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PREFACE

The Introduction to last year's volume (1967–68 Models) was included to explain why that volume, and the previous one (1966–67 Models), had departed slightly from the traditional style of the series. In a similar manner here, space has been provided to describe the additional changes that have been made in this volume.

There are now five main sections, one dealing with Recent Developments and the other four containing servicing data. Each of the data sections is preceded by a sub-title page which shows the nature of its content, and acknowledgement to the manufacturers concerned in that section.

Included in the Recent Developments section is an article on Colour Television Test Equipment, and a general description of an EVR System, which may have a great impact in fields of mass communication.

Colour Television has continued to grow, and the section devoted to it has been expanded, both to embrace new receivers and follow-up material for the receivers featured last year. Again it has been found necessary to "split" many colour television receiver diagrams across a number of pages. Consideration was given to a larger page size, but this would have caused an abrupt departure from the "handy size" and destroyed the recognisable continuity of the series. A study of the different receivers reveals that colour television receiver circuitry still varies considerably among models, though most manufacturers are following specific design lines. Hybrid receivers, it seems, are the most favoured, only one manufacturer having a fully transistorised model available.

The section headed "Radio Servicing" contains information covering Radiograms, Record Players, etc., as previously, subject to one change outlined in the paragraph following. The former is obviously the larger section and, although it is impossible (without extensive enlargement and price increase) to cover all models produced by all manufacturers, many new makes have been included. It is intended to maintain continuity as far as possible and models not included (provided adequate information is available) will be featured, together with the later models, in next year's volume.

Tape Recorders have now been given their own section and sub-title page. With the aid of the Contents List and Index, the user should be able to find information on tape recorders much more quickly than hitherto.

Monochrome Television Receiver data is contained in the last section, as previously, away from the data on colour television receivers to prevent confusion between them.

In general, the changes in this and the last two volumes have been made to cope with the situation in the Radio Trade, which has been much altered by the advent of colour television. Overall, the format and policy of these books remains unchanged.
We express our gratitude to all the manufacturers and agents who have co-operated with us in the preparation of this volume. Their co-operation, together with the assistance received from S.E.R.T., R.T.E.B. and R.T.R.A., has proved invaluable.

It is gratifying to record that, in order to deal with an increasing demand for their many services, the S.E.R.T. and R.T.E.B. have moved into larger accommodation at Faraday House, 8–10 Charing Cross Road, London, W.C.2. Increased interest, further requirements for adequate training and examination of servicing personnel, together with the necessity for improved courses of instruction have been main factors responsible for their expansion.

It is hoped that regular users of these volumes will find that the quality of the series has been maintained, irrespective of the alterations. Improved methods of production have resulted in a further increase in the number of pages without materially affecting the costs and subsequently the consumer.

J.H.
DEVELOPMENTS IN
ELECTRONIC VIDEO RECORDING AND REPRODUCTION

Reports in the Press have given some prominence to a radically new audio-visual system called EVR—Electronic Video Recording, which represents a technological development expected to have a substantial impact in the field of home entertainment and in education.

The EVR system makes it possible for the first time to show on a conventional television receiver, in the home or classroom, pre-recorded programming from ciné film and video tape. It combines optics and electron-physics technology to produce, inexpensively and in large quantities, cartridges containing video and audio information. The system is the result of many years of intensive research and development by the American CBS laboratories. Demonstrations there have shown that a great deal more pictorial and sound information can be stored on the EVR cartridge than is possible on a reel of magnetic tape of the same diameter, and at a much lower cost than with conventional ciné or magnetic-tape techniques. EVR cartridges are capable of carrying up to one hour of black-and-white programming or one half-hour of colour.

There are three main stages in the system:

Pre-recording: An electronic process transfers any film or video taped programme to a special 8-75-mm unperforated thin photographic film.

Cartridge: The film is contained in a cartridge 7 inches in diameter by \( \frac{1}{4} \) inch thick.

Reproduction: The cartridge is inserted into the player where it is automatically threaded, played, rewound and ejected. The player, which is roughly the size of a domestic tape recorder, is attached to the aerial socket of

![Diagram of EVR system](image)

**Fig. 1.** EVR electron beam recorder takes programme material from TV camera, magnetic tape or ciné film to generate an EVR master, in colour or black-and-white.
the television set. The EVR film moves at a speed of 5 inches a second, and one of its great advantages is that it can be stopped at will and a single frame shown. It also makes possible the display of film strips or ciné films on one and the same machine.

It is emphasised that the player is not a video tape recorder and that the film cartridges it plays will be made only in processing laboratories designed for the purpose. As yet there is no indication that there is any possibility for the recording process becoming available to the general public for use in a similar manner to that of magnetic recording. Demonstration of EVR equipment in this country is to be expected shortly and preliminary reports suggest that cartridges and players will be available in the spring of 1969.

**Fig. 2.** One 20-minute programme can be printed in approximately 30 seconds by EVR high speed multiple printer, which generates multiple EVR film cartridges from the EVR master.

**Fig. 3.** Electro-optical transducer in EVR player “reads” the EVR cartridge, which is reproduced on a TV receiver. The RF signal is carried through the aerial terminals.
DEVELOPMENTS IN
RADIO RECEIVERS 1968–69

Radio design continues to follow conventional patterns during the period covered by this book, but a significant modification is the replacement of dry-battery supplies in low-power models by mains-derived H.T. through transformer and full-wave contact-cooled rectifier. An increase in the number of designs incorporating AF and IF modules will be encountered by the service engineer, the only external circuitry under the control of the designer being the RF and oscillator tuned circuits and power supplies. It is emphasised that due to the advent of micro-techniques and thin-film resistor modules within these units, the possibility of servicing faulty items becomes remote and the repair of receivers of this type will necessitate a complete replacement.

Car Radios

The versatility of many portable receivers has been improved to make them more suitable for operation as a car radio. When operating on an external aerial, an external/internal switch disconnects the ferrite rod aerial windings and replaces them with well-screened aerial tuned circuits within the receiver fed by a screened down lead. This results in improved immunity from ignition interference and overcomes the directional properties of the ferrite rod which gives poor sensitivity when screened by the car body.

Stereo Multiplex Reception

Stereo multiplex decoders are featured as standard design in a number of current models, and a beacon light, operated from the 19 kc/s. pilot tone, is incorporated. In the Dynatron circuit the sensitivity of the beacon is adjusted so that it will only operate when an adequate signal for channel separation is present at the input to the receiver.

Capacitance Diode Tuning

A number of receivers incorporate bandspread tuning. Control is effected by means of a potentiometer connected to a reverse-biased diode in the local oscillator circuit. The small capacitance swing introduced by the diode limits the range of the oscillator fine tuning and only becomes effective at the high frequency end of the Medium Waveband. Such a circuit is featured in Philips models and is termed “Fine Focus” tuning. In this the diode rectifies the oscillator voltage appearing across the tuned circuit and the inverse voltage at the anode is set by the potentiometer tuning control (See Philips model 13RL360 in this volume).

The application of this method of tuning would appear attractive at
V.H.F./F.M. frequencies and is frequently to be found in A.F.C. circuits of such receivers. The disadvantage is that large swings of frequency at the oscillator would result in changes of gain across the band due to the R.F. stages remaining fixed tuned. A novel method of overcoming this is introduced in the Bang and Olufsen “Beolit 500” F.M. receiver. The conventional two-gang capacitor has been replaced by two BA 110 vari-cap diodes and five separate tuning potentiometers, all of which cover the entire F.M. band from 87.5 to 108 Mc/s. The control voltage is obtained from a separate battery in order to avoid interaction with the other stages of the receiver. Both the oscillator and R.F. collector circuits are tuned, and the same diodes receive A.F.C. bias from the discriminator. See Beolit 500 in this volume.
DEVELOPMENTS IN
COLOUR TELEVISION TEST EQUIPMENT

The test equipment described in this article, together with the normal
range of equipment to be found in a service department, should enable the
technician to install and service colour television receivers.

Crosshatch Generator

The crosshatch generator should have the following facilities: dual-
standard preferably covering Bands 3, 4 and 5 to avoid re-tuning of the
receiver; crosshatch for dynamic convergence; dot pattern for static con-
vergence; grey scale for checking and adjusting grey scale tracking and a
blank white synchronised raster to facilitate purity adjustments. The static
convergence magnets can be adjusted on a crosshatch pattern, but because of
the radial movement of the electron beams, a dot pattern makes adjustment
easier. Grey scale tracking can be carried out by de-tuning the receiver to
remove the colour burst or by switching to a monochrome picture. Purity
can be adjusted by removing the input signal and advancing the brightness
control, but, due to noise and difficulty on some receivers of obtaining
sufficient brightness, this method is not satisfactory.

Degaussing Coil

Although colour receivers incorporate an automatic degaussing circuit for
the shadow mask and cathode ray tube mountings, an external degaussing
coil is required to demagnetise the chassis and surrounding metal-work.

A suitable coil may be made by winding 800-1200 turns of 31 s.w.g.
enamelled copper wire on a 15-inch diameter former. When the coil has
been wound, the ends can be terminated in flexible insulated wires about 1 ft
long; the coil should then be insulated by wrapping it in PVC insulating
tape. The “half lap” method should be used so that all parts of the coil
are covered by two layers of tape. For greater safety, another layer of tape
should be added.

A wooden handle should then be fitted across the diameter of the coil
former. A switch of the push-button type (double-pole) and rated at 3
amps 240 volts a.c., should be mounted on the coil former. The switch
must be of the biased-off type so that the coil is energised only when the
switch is being pressed.

The coil should be connected to a convenient length of good quality twin
mains lead and the lead should be fixed to the wooden handle so that rough
usage will not make the coil dangerous.

This degaussing coil is not intended for long periods of continuous use
and it will become very warm if energised for more than a minute or two at
a time.

II
E.H.T. Meter

An e.h.t. meter with a minimum 30 kV. f.s.d. is essential during installation and maintenance. To obtain equal standards of grey scale, focus and convergence on 625-line and 405-line systems, the e.h.t. voltage must remain constant between the two systems.

A separate e.h.t. meter is more accurate, convenient and safer to use than an e.h.t. adaptor for use with the normal multirange meters. An important requirement of any instrument used is that it does not draw an excessive current from the e.h.t. circuits.

The source impedance of colour receiver e.h.t. circuits is much lower than the black-and-white e.h.t. circuits. The current consumed is about 1·25 mA at 24 kV representing 30 watts of power. For this reason no chances or risks should be taken. It is most important that no attempts be made to draw sparks from any part of the e.h.t. supply, either to an insulated screw-driver or to the chassis.

As in monochrome receivers the cathode ray tube inside and outside surfaces are coated to form a capacitor for e.h.t. smoothing and it is essential to discharge the tube before beginning service work. A lead may be made up consisting of 2 ft. of e.h.t. cable terminated at one end in a standard e.h.t. cavity connector fitted with a plastic insulating cap and the other in a crocodile clip. To discharge the tube, connect the crocodile clip to the tube magnetic shield, remove the e.h.t. connector from the tube cavity and replace it with the e.h.t. connector on the prepared lead. The shorting lead should be left in position until the receiver is ready for operation. The rapid discharge of the tube may cause the shadow mask to become magnetised.

Warning: The e.h.t. is stabilised by a shunt regulating circuit usually using a PD500 valve (or equivalent). This valve emits X-radiation when operating and for that reason it is housed in a compartment of heavy-gauge steel. With these metal screens in place, it is safe to work in the vicinity of the valve, but under no circumstances must the receivers be operated with any of the metal screens removed.

Colour Bar Generator

This instrument, though not essential, is useful when no colour transmissions are available. Its facilities enable adjustments to be made to the delay line, circuitry, demodulator and checks on the performance of the reference oscillator.

Cathode Ray Oscilloscope

The oscilloscope, preferably a double-beam, is essential for fault-finding and setting up, especially in the decoder section. The "Y" amplifier response must be level from d.c. to 6 Mc/s, and the timebase should be of the triggered type with a sweep speed of up to 1 microsecond/centimeter. The scope should be used with a high-impedance probe, which can be adjusted to compensate for the inductance and capacitance of the test leads, otherwise distortion of waveforms or, in some cases, damping of the circuit under test is likely to occur.
COLOUR TELEVISIÓN SERVICING

ACKNOWLEDGEMENTS

British Radio Corporation Ltd.
Combined Electronic Services Ltd
Rank Bush Murphy Ltd.
Radio Rentals Ltd.
General Description: This series of dual-standard colour television receivers is described in the 1967–68 volume, pages 30 to 55. This volume contains a short history of modifications and some other additional information. The models in the series are: 701/T, 701/W, 701/WP, 702/T 702/WP, 703, 704 and 707.

History of Modifications:

1. The U.H.F. tuners originally employed Fairchild transistors Tr1 (BF161UA) and Tr2 (BF161UB). Later production tuners employ Mullard transistors Tr1 (BF180) and Tr2 (BF181). Tuners with Mullard transistors operate from a supply of +14 volts, and a dropper R9 is included in series with the feed from the +25-volt line. R9 (1.5k) is mounted on top of the tuner.

2. Test-point 11 (see I.F. panel) used to be TP6. When this change was made, TP6 was moved to the previously unnumbered pin close to the original TP6 pin.

3. The original A.G.C. circuit did not have a weak/strong system of taps, as it has now that a resistor R103 (100k) and a flying lead have been added to the circuit.

4. R80 was originally 560 ohms but was increased to 680 ohms to prevent over-running of the pentode section of V13. R80 was later restored to its original value of 560 ohms, see 5.

5. R607 (2.2k) was originally 1.6k, and a resistor R104 (10k) was added across C609. These changes were made to reduce the H.T. at the V.H.F. tuner to about 180 volts, on 405, and 210 volts on 625. The modification also reduced the screen potential of V13 so that R80 was returned to its original value. R607, R104 and C608 are mounted on a tag strip on the right-hand side of the I.F. panel cradle. C139 (2200 pF.) was added to decouple the H.T. of the V.H.F. tuner at R.F. This capacitor is not shown on the circuit diagram, but it exists on the I.F. panel, just above the slider switch and to one side of the link.

6. R79 (on which L42 is wound) was originally 27k, but was changed to 5.6k to reduce the 6 Mc/s. output from the vision detector to Tr8. This reduces patterning during colour reception which is caused by a beat frequency of about 1.5 Mc/s. between 6 Mc/s. sound carrier and 4.43 Mc/s. chrominance sub-carrier.

7. R357 (8.2k) in the top connection of the brightness control was originally 10k. Due to the need to compensate for production spreads, R357 may be 8.2k or 10k.

8. C309 (4700 pF.) and R348 (180 ohms) were not present in the luminance circuit of early receivers. They constitute an anti-smear circuit and improve results, particularly on 625 reception. Full D.C. restoration was used in the grid circuit of V5b but the present D.C. restorer is tapped down the grid leak. The modification reduces changes in brightness when
switching between line standards, and between V.H.F. signals of differing strengths.

9. In early receivers, the D.C. component of the chrominance signals was re-inserted by clamping on the grids of the amplifiers V7a, V7b and V8a. The level of blanking pulse at the outputs was adjusted by means of a potentiometer between H.T. line and chassis. The 1M grid leaks were returned to a potentiometer across the H.T. line. Variation of the potentiometer varied the amplitudes of the blanking pulses at the outputs, but because of the matrixing for (G–Y) all outputs were not equally affected. The background colour was therefore changed. In the latest circuit, clamping is removed from the grids, and variation of the amplitude of the pulses at the output is achieved by altering the amplitude of the pulses fed into the grid circuits. R331 is provided to set the pulses at the (G–Y) output to the same amplitude as those at the (R–Y) and (B–Y) outputs when the (G–Y) matrixing has been set correctly. The grey-scale tracking can therefore be set more accurately than in the original circuit. The D.C. clamping is maintained by D.C. restorer diodes at the colour difference outputs, but for correct biasing of the output amplifiers, the grid leaks are now returned to the +20-volt line.

10. Tr31 (OC75) in the colour killer circuit was originally an OC81.

11. C232 (640 μF.) was originally 500 μF., and C312 (32 μF.) was added across C310. The modification overcame a tendency towards magenta-green shading on the picture, from left to right, during colour reception. The effect was particularly noticeable on Test Card F.

12. Sub-carrier radiation proved to be too high for good performance on Channel 1. A diagonal beat pattern was produced on the screen. R230 was 6.8k and is now 5.6k. R231 (15k) was originally connected to the +20-volt line, but is now connected to collector of Tr23 to apply some negative feedback. R237 was 8.2k and is now 10k. C265 and C315 were added and C227 (0.1 μF.) was removed from its position across R239.

13. The addition of D25, R314 and C307 made the saturation control work more smoothly.

14. C230 was a ceramic type but was changed to a polystyrene type to reduce the effect of temperature on background.

15. C304 (5 μF.) was 4 μF. C236 (5 μF.) was 1.6 μF. C237 (5 μF.) was 1.6 μF.

16. The original circuit did not include taps X, Y and Z for the anodes of the D.C. restorers V9a, V9b and V10a. These taps were provided to cater for the variations in C.R.T. grid bases. C311 was added to prevent a radiation which showed up as patterning on Channel 5.

17. C310 was added to provide additional decoupling of the +20-volt line.

18. The input circuit of Tr27 was altered to increase the 6 Mc/s. rejection and to reduce the response at higher video frequencies. L212 (27 + 30 s.w.g.) was (20 + 26 s.w.g.). C246 (180 pF.) was 390 pF. L211 (35 + Litz) was (50 + Litz). R269 (1k) was 1.5k. C260 added across L211 (680 pF. inside can).
19. L418 and L419 were employed in the horizontal convergence circuits to apply both positive and negative tilts.

20. Tr34 replaced two OA10 diodes. This modification also caused a change in the wiring of the red and green line convergence coils. Convergence coils made for use with early chassis will not work with late chassis unless the red and two brown leads on the red line convergence coils are transposed.

21. D33 and D34 have been replaced by Tr35, (AD162). This is a similar connection to Tr34. R526 (8-2 ohms) was 6-8 ohms.

22. R346 (47k) and C308 (10 pF.) have been added in series across P16 and P20. R150 and C615 have been removed.

23. R370, R371, R372, R373, R374, R375, R376, R377, R378 and R379 were added to reduce the effects of flash-over in the C.R.T.

24. D31 and D32, were changed from type OA81 to type BA144.

25. To prevent lock-out on 405, R463 was changed, and a capacitor (C440) and a resistor (R461) was added. This modification was later found to give rise to bent verticals. Therefore, C440 and R461 were removed, and R463 was restored to its old value. To overcome lock-out on 405, R473 was made 820 ohms and not 1000 ohms.

26. In some receivers, C477 and C478 are replaced by a single 82-pF capacitor.

27. R432 (33k) has been added in series with the lead from C414/R434 to the background controls. This resistor removes the third harmonic of the line pulse.

28. For H.T. rectification, some receivers use two BY100 diodes, and others employ a single 1N5054 diode.

29. The present pin-cushion transducer is Mullard AT4041/05. The earlier version was AT4041/03. A resistor R442 (22k) is used to damp the unused winding of the AT4041/05. It reduces distortion in the corners of the picture.

30. In present receivers, thermistor N600 is soldered to tags on R601 so that it remains at the correct distance of 0.25 in. from R601. In early receivers, N600 was soldered to a tag-strip and the wires bent so that N600 was in the correct position relative to R601. If N600 is wrongly positioned, variations in purity occur in sympathy with the beat frequency between the mains supply and the frame timebase.

31. The diameter of the system switch armature has been reduced from 0.375 in. to 0.345 in. to prevent the armature from jamming in the solenoid.

32. An 820k resistor has been added to the C.R.T. base panel between pin 14 (heater) and the end of R374 on the back plate (the end remote from pin 2 on C.R.T.).

33. F1 is now 2A anti-surge and not 3A.

Cathode Ray Tube: All models are fitted with a 25-in. C.R.T. A63-11X Mullard, or A63-13X R.C.A., or A63-16X R.C.A.

Colour Faults: See table on facing page.
## BAIRD

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Background suddenly becomes dark</td>
<td>EB91 D.C. restoration diodes V9 or V10 damaged by flashover in C.R.T.</td>
<td>Replace faulty EB91 and introduce flash-over protection, if not already present</td>
</tr>
<tr>
<td>Background goes green, and receiver</td>
<td>Reference oscillator (Tr223) stopped. Intermittent faults often</td>
<td>Replace faulty diode or capacitor</td>
</tr>
<tr>
<td>does not produce colour</td>
<td>caused by diode D23 (BA102), or polystyrene capacitors C221, C222,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C223, C219</td>
<td></td>
</tr>
<tr>
<td>Colour bars appear to be desaturated at</td>
<td>C273, 50 μF. electrolytic, is disconnected or O.C.</td>
<td></td>
</tr>
<tr>
<td>the left-hand side of the screen, and</td>
<td></td>
<td></td>
</tr>
<tr>
<td>over-saturated at the right-hand side.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Background is magenta on left and green on</td>
<td></td>
<td></td>
</tr>
<tr>
<td>right</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hanover bars to red, orange and magenta</td>
<td>O90 diodes D26, D27 out of balance</td>
<td>Replace both diodes (with a matched pair)</td>
</tr>
<tr>
<td>colours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very weak colour</td>
<td>Leads from inverter L214/L215 S.C.</td>
<td>Sleeve as appropriate</td>
</tr>
<tr>
<td>Weak (R-Y) signal; no (R-Y) signal</td>
<td>Leads from inverter transformer L216/L217 S.C.</td>
<td>Sleeve as appropriate</td>
</tr>
<tr>
<td>Vertical band of incorrect colour on right</td>
<td>PAL switching operation taking place during the active line period</td>
<td>Check that burst gating control R249 is sufficiently far advanced, and</td>
</tr>
<tr>
<td>or left side of picture—showing on red and</td>
<td></td>
<td>if necessary, re-set L216A and L216B</td>
</tr>
<tr>
<td>cyan areas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reference oscillator will not lock—</td>
<td>BA915 diodes D22, D22 out of balance</td>
<td>Replace faulty diode and re-set A.P.C. loop</td>
</tr>
<tr>
<td>impossible to obtain +6 volts on TPr8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Erratic locking of reference oscillator,</td>
<td>O90, D20, burst gating pulse</td>
<td>Replace D20</td>
</tr>
<tr>
<td>and erratic operation of 7.8 kc/s, switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>circuit—both affected by operation of</td>
<td></td>
<td></td>
</tr>
<tr>
<td>contrast control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No colour—poor luminance performance</td>
<td>Case of Tr33 touching emitter re-sistor R221</td>
<td>Move Tr33 so that its case cannot touch R221</td>
</tr>
<tr>
<td>+50-volt line reads about +5 volts</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Convergence Faults:

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Cause</th>
<th>Cure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insufficient range on horizontal R/G controls</td>
<td>OA10 diodes D35, D36 (early models) or AC128 transistor Tr34 (late models) S.C.</td>
<td>Replace faulty diodes or transistor</td>
</tr>
<tr>
<td>R/G out of convergence at edges of picture</td>
<td>1. OA10 diodes D35, D36 (early models) or AC128 transistor Tr34 (late models) O.C.</td>
<td>Replace faulty diode or transistor</td>
</tr>
<tr>
<td></td>
<td>2. R317 or R324 5 ohms R/G amp. control O.C.</td>
<td>Replace faulty control</td>
</tr>
<tr>
<td>Blue horizontal lines displaced from R, G,</td>
<td>OA10 diodes D33, D34 (early models) or transistor Tr35, AD162 (late models) S.C.</td>
<td>Replace faulty diodes or transistor</td>
</tr>
<tr>
<td>by about 1⁄2 in.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermittent variation in horizontal</td>
<td>System switch on convergence panel out of adjustment. This may be</td>
<td>Re-set switch, or replace S4, as appropriate</td>
</tr>
<tr>
<td>convergence</td>
<td>due to a weak toggle action in S4</td>
<td></td>
</tr>
<tr>
<td>Range of blue width control insufficient</td>
<td>Blue lateral magnet not correctly positioned over focus electrodes in</td>
<td>Correct position of magnet; reverse connections; or remove and replace</td>
</tr>
<tr>
<td>to achieve convergence at edges</td>
<td>C.R.T.; or connections of blue lateral magnet reversed; or magnet</td>
<td>magnet correctly</td>
</tr>
<tr>
<td></td>
<td>fitted back-to-front</td>
<td></td>
</tr>
<tr>
<td>R/G amp. does not move R relative to G, but</td>
<td>Incorrectly wired convergence coils — coils wired to suit early</td>
<td>Transpose the red and two brown leads on the line tags of the red</td>
</tr>
<tr>
<td>moves both R and G sideways</td>
<td>convergence circuits having R/G tilt potentiometers</td>
<td>convergence coil</td>
</tr>
<tr>
<td>R/G amp. and R/G tilt pots. do not move R</td>
<td>Incorrectly wired convergence coils — coils wired to suit later</td>
<td>Transpose the red and two brown leads on the line tags of the red</td>
</tr>
<tr>
<td>relative to G</td>
<td>convergence circuit having R/G tilt inductors</td>
<td>convergence coil</td>
</tr>
</tbody>
</table>

I7
General Description: The 2000 Series is designed for the reception of colour and monochrome pictures on 625-lines and monochrome pictures on 405-lines. Modular construction has been used to simplify the technique of servicing. All the major circuits are mounted on printed board sub-assemblies which slide into the main chassis frame, automatically making most of their connections as they are pushed home. The integrated tuner is also connected by plugs and sockets.

Warning: The receiver must not be connected to D.C. mains supplies. 
Note: All general pre-set adjustments should be made with the receiver set to a V.H.F. channel unless otherwise stated.

A.C. Mains Connection: The receiver is fitted with a 3-core mains lead which should be connected to a suitable 3-pin plug. Before connecting to the mains supply ensure that the plug-in links on the mains transformer are connected to the appropriate taps. In addition to the 200-volt, 220-volt, 240-volt taps a 0–10-volt tap is provided. Used in combination these taps cover 200–250 volts in 10-volt steps. It is important that the mains voltage taps are adjusted correctly for correct operation of the H.T. regulator and colour tube.

Aerials: Separate aerials are recommended for V.H.F. and U.H.F. The V.H.F. aerial should be a combined Bands I and III type. A wide band with U.H.F. aerial should be selected to ensure satisfactory reception of the colour sub-carrier. It should be carefully sited for best signal-
strength with freedom from ghosting. If combined V.H.F.–U.H.F. aerials are used, priority of positioning should be given to the U.H.F. array. The U.H.F. and V.H.F. aerials should be fed to the receiver with separate 75-ohm coaxial cables, and in accordance with R.T.R.A. recommendations the outer braiding of the feeders should be properly earthed. It should be noted that the aerial sockets on the colour receiver are wired to connect the outer of the cable direct to chassis which, when using a three-pin mains plug, is at mains earth potential.

**Fuses:** A 2-amp delay type fuse is incorporated in the mains input circuit. Fusible resistors are incorporated in the solenoid circuits and in the various H.T. lines—see Fusible Resistors.

**Electronic Trip:** An electronic trip circuit is incorporated in the 52–55-volt supply to the Line Timebase board and automatically cuts off this supply in the presence of voltage surges which might otherwise cause damage. The supply is normally restored by switching off the receiver for about 30 sec. If the picture fails to appear after switching on again, check for a fault condition.

**Contrast:** Independent 405 and 625 controls are provided for V.H.F. and U.H.F. reception. 625 Contrast adjustments should be made with the Colour control at minimum.

**625 Horizontal Hold:** Push in the spring-loaded control to break sync, and rotate to obtain a floating but resolved picture. Release the control and the picture should lock.

**405 Horizontal Hold:** The sync. breaking facility of the 625-Horizontal Hold should be used when adjusting the 405-Horizontal Hold.
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**Fusible Resistors:** R1 in the main H.T. supply to the E.H.T. Generator. R5 in the general 30-volt supply to Tuner, I.F. and Video boards, etc. R6 in the H.T. supply to the Chrominance circuits. R16 in series with I.F. system switch solenoid, R17 in series with Convergence board system switch solenoid, and R18 in series with the Line Timebase system switch solenoid. The solenoids are fed from the 240-volt winding on the mains transformer. R20 in the 270-volt smoothing circuit feeds the Video output collectors, partially supplies the E.H.T. Generator, and supplies the 68-volt reference for the Regulator. The fusible links may be resoldered to make contact after eliminating any overload condition.

![Diagram of receiver with labels for R6, R5, R16, R17, R18, R20.]

**(H111) INSTALLATION ADJUSTMENTS—25-INCH RECEIVER**

**Pre-set Push-Button Fine Tuning:** With the selector button depressed pull the button outwards against the spring pressure while rotating to tune in the required channel. Clockwise rotation increases the frequency.

**V.H.F. Channels:** Tuning adjustment should be made as soon as possible after switch-on from cold. The button should be adjusted to a point which is mid-way between the position where sound on vision occurs and the position where degradation of picture quality sets in. If the adjustment must be made when the receiver has been switched on for a considerable time, then select a tuning point which is closer to the onset of picture degradation. When all available V.H.F. channels have been adjusted, as described, select each channel in turn to check that button latching has been correct during the initial adjustment.

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U.H.F. Channels: Because of the critical nature of tuning-in a colour transmission, automatic frequency control (A.F.C.) is employed on U.H.F channels. In order to fully utilise the benefit of the A.F.C. system it is essential that the U.H.F. buttons are tuned to the middle of the "pull-in" range.

The following simple procedure for tuning to the centre of the "pull-in" range must be made within 20 minutes of switch-on from cold. A D.C volt-meter, such as an Avometer Model 8 on 100-volt range, should be connected positive to pin 16 (top rear corner of I.F. board) and negative to chassis. (i) Adjust button for picture and sound. (ii) Turn the button slowly clockwise until the picture shows patterning but does not break-up. (iii) Turn button slowly anti-clockwise until meter indicates 13 volts approximately.

After all available U.H.F. channels have been adjusted, re-select each channel in turn to check that button latching has been correct during initial adjustments.

Push-Button Band Changing: With the exception of the top button which tunes the U.H.F. band only, all other buttons can be adjusted to tune over any band. When changing the position of one of the selectors, ensure that the associated button is not depressed and that the locating pip locks securely in the correct hole. The 405/625 switching is operated by a coil spring and washer fitted over each U.H.F. push-button spindle. If it is required to change a push-button from 405 to 625 operation, a spring and washer must be fitted to the associated push-button spindle. Conversely, if it is required to change a button from 625 to 405 operation, then the spring and washer must be removed from the associated spindle. To remove or fit
(Hi13) Push-button Band Changing

a spring washer, pull off the push-button while gripping the spindle with pliers to avoid damage to the nylon spindle stop and remove the spring retaining circlip. When re-fitting the circlip ensure that it fits into the slot nearest the push-button end, and grip spindle when replacing button.

V.H.F. Wired Distribution Systems: With the exception of the top button which tunes the U.H.F. bands only, all other push-buttons can be adjusted to tune over V.H.F. Band I or Band III. For 625-line operation at V.H.F., simply adjust the band selector of the bottom U.H.F. button. This can be done without removing the tuner from the cabinet. It is important that the button is not depressed while this adjustment is made. If existing V.H.F. buttons are required to operate on 625-lines, additional springs and washers are necessary and are obtainable from Service depots.

Picture Size Adjustments: The height control should be adjusted so that the castellations at top and bottom of Test Card D are partially excluded and the width control set up for the best formation of the circle in the centre. The width control must not be set up for excessive overscan otherwise the line H.T. regulator may be overrun causing hum bars.

Line Linearity: The adjustable core has a square hole which accepts a non-magnetic trimming tool one-tenth of an inch wide. Adjust in conjunction with the width control while observing a test card to correctly proportion the picture.

Frame Linearity: Adjust in conjunction with the height control for a correctly proportioned picture.

Note: If a large change in the height adjustment is made it will be necessary to check the vertical balance adjustment as follows: (1) Adjust height and frame linearity. (2) Readjust height. (3) Adjust vertical balance for 24-volt D.C. at Test Point 3 on frame and sound board. (4) Readjust height.

Picture Squaring: To square up the picture with the mask slacken off the clamp screw securing the deflection coils housing and rotate the complete assembly as necessary. Before retightening the screw ensure that the housing is hard up against the flare of the tube neck. Finally check the purity adjustments.

Picture Centering: First check the line-hold adjustments and then, if necessary, adjust the line-shift and frame-shift pre-sets to centre the picture.

Magnetic Field Effects: The receivers leave the factory with all the colour tube adjustments set-up in a normal magnetic environment in such a
way that the receivers do not favour any particular orientation. Receivers set-up under these conditions should provide satisfactory pictures on installation without further adjustments for purity. It must be stressed however, that colour receivers are nevertheless susceptible to magnetic fields caused by large ferrous objects such as boilers, radiators, pre-stressed concrete beams and steel-framed buildings which could alter the normal field pattern to a degree that would make purity and static convergence adjustments necessary during installation. Generally, the vast majority of dwellings are of traditional construction and will normally be free of these effects.

**Automatic Degaussing:** A built-in degaussing coil effectively neutralises all but the most severe magnetism in the colour tube and surrounding shield due to changes in working position, or magnetism induced into the colour tube caused by a magnetic device being brought near to the faceplate. The automatic degaussing circuit operates whenever the set is switched on or when a change in line-system is made during push-button selection. Should the receiver become magnetised during a transmission, all that is necessary is to select another channel which involves a line-system change and allow approximately ten seconds for the degaussing process to take place before re-selecting the original channel.

**Manual Degaussing:** In an isolated case of severe magnetisation such as might be induced during transit by a large electric motor, e.g. a fork-lift truck or an electric train, a stronger degaussing field will be required and an external coil connected to the mains supply will be necessary.

**Coil Details:** A suitable 1900 ampere-turn degaussing coil for intermittent use may be made up of 800 turns of 24 S.W.G. enamelled copper wire, wound on a 12-inch diameter mandrel. This should be double-wrapped with Empire or PVC tape for insulation and connected to approximately five yards of suitable cable. Such a coil will provide a localised field of 75 gauss measured half-inch from the exterior of the winding.

**Procedure:** Connect coil to the A.C. mains supply—the receiver need not be switched off. Move the coil slowly about the faceplate of the C.R.T. and over the top, bottom and sides of the cabinet—never over the back. One minute is quite long enough to cure any isolated case of induced magnetism. Finish with the coil over the centre of the screen and withdraw it slowly to a distance of at least eight feet before disconnecting it from the mains supply. In a service department or showroom, this also means eight feet from any other colour receiver whether operating or not.

The external degaussing coil may also be used to neutralise the field disturbance produced by ferrous objects such as radiators located near the receiver, although good installation practice should ensure that, whenever possible, the receiver is positioned well away from such objects.

**Static Convergence and Purity:** A preliminary adjustment, for static convergence will be necessary before purity is adjusted due to both adjustments being to some extent interdependent. Withdraw the convergence board from its mounting and fit into chassis lugs in vertical position with controls facing towards front of receiver. Manually degauss the receiver
COLOUR TELEVISION SERVICING

and set-up all normal black-and-white adjustments affecting picture size, shape, position, linearity, etc. Allow the receiver to warm up with brightness control advanced to a high brilliance level for approximately 20 minutes before commencing adjustments. Select a 625-line channel. Connect a 405–625-line cross-hatch dot generator to receiver aerial sockets.

Note: When possible use a widely-spaced dot or cross-hatch pattern to avoid error of converging with the wrong dot. If a closely-spaced dot pattern must be used, make preliminary coarse convergence adjustments on broadcast picture before using pattern generator.

Static Convergence Adjustment: Red, green, and blue beam switches and 405 blue and R.G. clamp adjustments are located on the convergence board as shown below. All other adjustments are located on the tube neck assembly. Switch off the blue beam and rotate the red and green magnets on the convergence yoke to obtain convergence where the centre vertical and centre horizontal lines of the cross-hatch intersect at the centre of the screen. Switch on the blue beam, rotate the blue magnet on the convergence yoke and rotate the tube containing the blue lateral magnets on the neck to converge blue with red and green at the centre of the screen. Switch to a 405-line channel and if necessary adjust the clamps for blue and R.G. reconvergence.

Purity Adjustment: Switch off the green and blue beams leaving a red screen. Slacken the locking nuts securing the deflection yoke and slide the yoke backwards in its housing to the limit of its travel. Rotate both purity ring magnets relative to each other to obtain a uniform red patch at the screen centre. Slide the deflection yoke forward while observing the entire screen area until a position is found which gives an optimum overall red screen. Secure the yoke in this position. Check the blue and green fields for overall purity. Repeat the static convergence and purity adjustments until three clear fields are obtained.

Grey Scale Tracking (Set White): The ability of the colour receiver to produce a true white picture is dependent upon the grey-scale tracking adjustments. The complete adjustment procedure should only become necessary after replacing the C.R.T., frame timebase and sound board, video board or convergence board; or if it is suspected that the tracking adjustments have been disturbed. Generally, any slight coloration which cannot be removed by adjustment of the tint control (overall red or blue) or the green A1 potentiometer (overall purple or green) may be satisfactorily cleared by trimming the video gain pre-sets and/or the video bias pre-sets as described in the complete procedure.

Dynamic Convergence Adjustments: Dynamic convergence adjustments should only be attempted after purity, static convergence and grey-scale tracking adjustments have been made. It will be necessary to recheck and, if necessary, readjust static convergence after each adjustment during the dynamic convergence procedure which is shown for simplicity in illustrative form. The illustration shows the location of the controls, the area of the screen affected by each control and the necessary sequence of adjustments.
(H114) C.R.T. Neck Assembly
When following the sequence it should be noted that some controls—particularly those affecting the same axis—are to some extent interdependent and should therefore be adjusted in a complementary manner.

The following points should be noted if difficulty is experienced in obtaining dynamic blue lateral convergence. 1. For the adjustments to have maximum effect the blue lateral assembly should be as close as possible to the convergence yoke. 2. If convergence cannot be obtained within the limits of the adjustments, reverse SKT17 (on convergence board) and repeat the adjustments. 3. Where the left- and right-hand blue verticals are horizontally displaced by unequal amounts, unplug the socket and rotate the convergence yoke slightly to achieve equal separations and then replace SKT17. 4. In some receivers dynamic blue lateral correction is unnecessary and the blue lateral may then be left disconnected (in later production a “parking” pin is provided on the board for this purpose).


Main Chassis: The main chassis frame is mounted on four cabinet brackets. With the convergence board in its normal position, the four mounting nuts may be slackened to enable the chassis to be drawn back out of the cabinet along the brackets until the mounting studs engage with the slots at the ends. The mounting nuts should then be tightened. With the chassis in this servicing position, access to the interior of the receiver is improved and the copper sides of most printed boards exposed. The cabinet
may be turned on to its side for access to bottom boards. In 19-inch receivers a “parking” position for the power regulator board is provided to allow access to the component side of the chrominance board.

**Printed Board Removal:** Similar type connectors are colour-coded for easy identification. Before separating plug and socket connectors or floating edge-connectors, note the orientation of the associated cableforms so that similar routing may be employed when replacing. The 8KV pulse lead to the tripler must always be dressed carefully to avoid direct contact with any metalwork. When removing printed boards ensure that the board retainers do not interfere with the copper sides during withdrawal—the retainers are slotted to provide sufficient clearance without completely removing the screw. However, it is advisable to completely remove the retainers securing the vertically mounted boards to avoid accidental damage. Ensure that the insulator fitted over the copper side of the convergence board in 19-inch receivers is refitted when replacing the board.

**Note:** Ensure that the receiver is switched off before removing or inserting printed boards or disconnecting plugs and sockets.
COLOUR TELEVISION SERVICING

Plug and Socket Connectors: When removing a socket from the printed board plug pins, the socket may be rocked longways to ease removal. Do not rock sideways and see the information given for edge-connectors.

Floating Edge-Connectors: A similar technique to that described for plug and socket connectors is recommended when freeing floating edge-connectors. If the connector is very tight, insert a wide bladed screwdriver between the end lug of the connector and the board, and turn the blade. The following boards employ floating edge-connectors, and the removal procedure is as follows:

Automatic Degaussing: Remove edge-connector EC1, separate plug and socket connector PLG18-SKT18 in the leads to the degauss coils and release board from four spring-clips.

Power Supply Regulator (including Heat-Sink): 25-inch Receivers: Pull off edge-connector EC11 and release the complete assembly by removing four screws securing the heat-sink in the chassis. 19-inch Receivers: Pull off the edge-connector EC11, slacken two fixing screws in keyhole slots and withdraw the assembly by disengaging the heat-sink locating lugs from slots in the mounting brackets.

Convergence: Remove three edge-connectors EC2A–B–C and disconnect SKT14, SKT15, SKT16 and SKT17. Remove two board retainers and withdraw board from two edge clips.

Fixed Edge-Connectors: An extractor tab is fitted at the outer end of each board employing a fixed edge-connector to facilitate removal and replacement. A screwdriver inserted through the hole in the tab should be used against the chassis to lever a board out of its edge-connector. A similar technique should be employed by inserting the blade through the hole in the chassis rail when inserting this type of board to ensure that board and edge-connector are fully engaged. All the following boards employ fixed edge-connectors and the removal procedure is as follows:

Power Supply: Release sub-chassis retainer and withdraw.

I.F.: Disconnect SKT2, SKT3 and SKT4, also SKT7 on the video board. Release I.F. board retainer and withdraw.
**COLOUR TELEVISION SERVICING**

*Video:* Disconnect SKT7 and SKT8, also SKT9 on the chrominance board. Release the video board retainer and withdraw. See Note 1.

*Chrominance:* Disconnect SKT9 and SKT10. Release board retainer and withdraw. See Note 1.

**Note 1.** On 19-inch receivers the power supply regulator must be removed first.

*Frame Timebase and Sound:* Release board retainer and withdraw.

*Line Timebase:* Disconnect SKT11 on E.H.T. generator board, and SKT16 on convergence board. Release the line timebase board retainer and withdraw.


**Removal of Additional Assemblies**

* Loudspeaker: * Unplug two connectors from the speech coil tags and remove four PVC end caps to release the loudspeaker.

*Mains Transformer:* Disconnect SKT5 and SKT6 from the transformer. Remove four 2BA nuts and washers and withdraw the complete assembly from the mounting studs.

*Convergence Yoke: Type A:* The yoke engages with the circular channel at the rear of the deflector coils housing. Pull off the spark protection board assembly. Slacken the blue lateral assembly clamp and withdraw from the neck. Slacken the convergence yoke retaining screw. Turn the convergence yoke in an anti-clockwise direction and withdraw. *Type B:* Pull off the spark protection board assembly. Slacken the blue lateral assembly clamp and withdraw the blue lateral assembly and convergence yoke. When refitting ensure that the yoke is close up against the deflector coils and that no leads are trapped between assemblies.

*Tripler Assembly:* Unplug SKT12 from E.H.T. Generator board and SKT19 from focus assembly. Slacken locking nut to release tripler assembly from tube shield and unplug the assembly from E.H.T. cavity socket.

*Integrated Tuner Unit:* Remove screw to release aerial socket panel from cabinet. Disconnect SKT2 from I.F. board and disconnect PLG1/SKT1 in tuner cableform. Remove two brass nuts to release tuner from cabinet.

*Chassis Removal:* Withdraw chassis to servicing position. Pull off front control knobs and release front controls mounting panels, also release auxiliary controls panel from rear of cabinet. Unplug the following: 1. Floating connectors PLG1/SKT1 in tuner cableform and PLG18/SKT18 in degaussing coil leads. 2. Two mains transformer connectors SKT5 and SKT6 on transformer. 3. Loudspeaker amp.-connectors on loudspeaker. 4. Tuner I.F. coaxial lead SKT2 on I.F. board. 5. E.H.T. lead SKT19 on focus control assembly and E.H.T. lead SKT12 on E.H.T. transformer. 6. Cathode feed connector SKT8 on video board. 7. Four connectors SKT14–17 and edge-connector EC2B on convergence board to free tube neck assembly. 8. Two earthing leads on C.R.T. shield to spark
BRC

protection board and one earthing lead on C.R.T. shield to E.H.T. board. One earthing lead on deflector coils housing (Type B C.R.T. neck assembly only).

9. Spark protection board assembly from C.R.T.

(H119) INTERCONNECTIONS WIRING—2000 SERIES

31
Slacken the chassis mounting nuts. The chassis may now be lifted free of the cabinet.

**C.R.T. Replacement:** Colour Tube Types: 25-inch CTA2550/A63-11X; 19-inch CTA1950/A49-11X.

Remove the chassis assembly. Release the locking nut securing the E.H.T. tripler assembly and detach the assembly from the E.H.T. cavity socket. Slacken the blue lateral clamp and withdraw the assembly from the
tube neck. Slacken the deflection unit housing clamp and withdraw the complete assembly, including the convergence yoke and purity magnets, from the tube neck.

Place the cabinet face downwards on a clean padded surface—if possible rest the cabinet on two edge supports so that it is possible to visually check the new tube during fitting for registration within the mask.

Remove the four corner nuts securing the tube magnetic shield and withdraw the shield. With the shield withdrawn remove four nuts and washers securing the tube mounting brackets. Carefully remove the tube—do not lift by the neck.

Spin down the four knurled nuts on the tube mounting studs and insert the new tube so that it sits on the mask with the E.H.T. cavity socket towards the top of the cabinet. Adjust the tube until it appears central in the mask opening. Retract the knurled nuts under the tube brackets until they touch the brackets and just take the weight of the tube off the mask.

Refit the tube fixing washers (one elongated and one plain washer over each stud) and nuts followed by the tube shield and the tube shield fixing nuts. Refit the tube neck assembly with the red coding mark on the Type A deflection housing towards the top of the cabinet (the word TOP is printed on Type B assemblies). Replace the E.H.T. tripler assembly. Refit the chassis ensuring that all connections are correctly made.

Check and adjust where necessary in the following order: static convergence, picture squaring, purity, picture size, picture shift, grey-scale tracking and dynamic convergence.

(H121) ALTERNATIVE COMPONENT DETAILS

68-69  33  B
Interconnection Details (Frame Timebase and Sound):

EC6
1. 42 volts H.T. from convergence EC2C/12
2. To convergence EC2C/2
3. To vertical hold
4. Sync. in from video EC8/11
5. Frame earth to chassis
6. Frame scan earth return from convergence EC2C/1
7. 270 volts from power regulator EC11/9
8. D.C. bias to C.R.T. grids (30 volts approx.)
(H127b) Frame Timebase and Sound (Continued)

9. 220-volt line pulse from line time-base EC5/22
10. 55 volts from power regulator EC11/18
11. 66 volts from power supply EC10/20
12. 30 volts from junction block EC3/3
13. To loudspeaker live side
14. To vertical hold
15. 33 volts from power regulator EC11/11
16. Audio earth return to chassis
17. Earth for volume control feed
18. Audio input from volume control
(H124a) INTEGRATED TUNER (PART)
(H124b) Integrated Tuner (Continued)
COLOUR TELEVISION SERVICING

(H125a) I.F. AMPLIFIER (PART)

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(H125b) I.F. Amplifier (Part)
(H125d) I.F. AMPLIFIER (CONTINUED)
COLOUR TELEVISION SERVICING

DC VOLTAGES

- WITH COLOUR RECEPTION
- WITH BLACK/WHITE RECEPTION
- WITH SET WHITE SWITCH ON (FRAME COLLAPSED)

![Circuit Diagram]

NOTE: V17, V17(E5024), AND V18, V18(E5036) MUST BE USED IN TRIPLETS OF THE SAME COLOUR CODE

(H126a) VIDEO TYPE 135 (PART)

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(H126b) Video Type 135 (Continued)
COLOUR TELEVISION SERVICING

Interconnection Details (Integrated Tuner):

PLG1/SKT1—on flying leads
1. I.F. board EC9/14
2. I.F. board EC9/12
3. Junction block EC3/17
4. Junction block EC3/2 and top end of contrast network
5. I.F. board EC9/13
6. I.F. board EC9/15
7. I.F. board EC9/17
8. I.F. board EC9/16
10. Not used
11. Not used
12. Junction block EC3/15 and Auto-degauss EC1/1

SKT2—on flying co-axial lead
1. Inner
2. Screen

Interconnection Details (I.F. Amplifier):

EC9
1. Slider of 405 contrast control
2. Slider of 625 contrast control
3. Junction block EC3/14
4. Junction block EC3/10
5. Chassis earth
6. Not used
7. Power supply EC10/10
8. Not used
9. Chrominance EC7/2
10. Junction block EC3/5
11. Video EC8/1
12. SKT1/2
13. SKT1/5 x Tuner connector
14. SKT1/1
15. To tuner via SKT1/6
16. To tuner via SKT1/8
17. To tuner via SKT1/7
18. Convergence EC2C/10

PLG2—pins on board
1. Inner
2. Screen

Interconnection Details (Video Type 135):

EC8
1. I.F. board EC9/11
2. Power regulator EC11/8
3. Tint control
4. Line timebase EC5/10
5. Tint control
6. Junction block EC3/4
7. Not used
8. Not used
9. Brightness potential from convergence EC2C/8 (Video reference line with set white switch operated)
10. Line timebase EC5/18 via sync. switch on 625 horizontal hold control
11. Frame timebase and sound EC6/4
12. Power regulator EC11/16
13. Chrominance EC7/3—Bias in 4.4 MHz rejector switch
14. Chassis earth

PLG3—pins on board
1. Inner
2. Screen

PLG4—pins on board
1. Inner
2. Screen

SKT7—on flying co-axial lead
1. Inner
2. Screen

PLG7—pins on board
1. Luminance in from I.F. board
2. SKT7

PLG8—pins on board
1. Green Composite signals to C.R.T.
2. Red cathodes via SKT8 and
3. Blue spark protection board

SKT9—on flying leads
1. R-Y in from chrominance
2. Earth for R-Y and B-Y inputs
3. A.C. return for colour difference inputs
4. B-Y from chrominance
Interconnection Details (Line Timebase):

EC5
1. and 2. Not used
4. Chassis earth
5. Power regulator EC11/7
7. Boost H.T. to A1 potentiometers, convergence EC2A/1
8. Top of 405 horizontal hold control
9. Top of 625 horizontal hold
10. 30-volt line pulse out to video EC8/4
11. 30-volt line pulse out to chrominance EC7/8
12. Switched supply to 405 width pot. divider, power regulator EC11/6
13. Width switch supply in from power regulator EC11/14
14. Power supply EC10/12 (A.C. circuit)
15. Switched supply to 625 width pot. divider, power regulator EC11/4
16. Switched supply to E.H.T. generator EC4/4
17. Slider of 405 horizontal hold
18. Sync. input from video EC8/10 (via switch)
19. Slider of 625 horizontal hold
20. 52–55 volts to junction block EC3/1
21. 220-volt line pulse to convergence EC2A/2
22. 220-volt line pulse to frame time-base and sound board EC6/9
COLOUR TELEVISION SERVICING

(H128b) LINE TIMEBASE (PART)

SKT11—on flying leads
1. Line drive to E.H.T. generator
2. Switched supply to E.H.T. generator
3. Voltage in from E.H.T. generator

SKT16—on flying leads
1. Line scan out via convergence
2. Line D.C. shift return from convergence
3. Line scan coils earth to convergence
**Interconnection Details (E.H.T. Generator):**

**EC4**
1. Power supply EC10/19
2. Power supply EC10/18—earth return via R3 (2 ohms) on power supply
4. Line timebase EC5/16
5. Chassis earth

**PLG11—pins on board**
1. Line drive from E.H.T. board
2. To E.H.T. switch line timebase
3. (S1F)

**PLG12—SKT12—press-stud on transformer**
E.H.T. feed to tripler

**PLG13—pins on board**
1. 66 volts from focus panel
2. E.H.T. earth to focus panel
3. Feedback reference in from focus panel

**PLG19—pins on panel (numbers moulded on Focus cover)**
2. Power regulator EC11/13
3. Linked to (2) in socket
4. Focus potentiometer feed from tripler

*See diagram on next page.*
COLOR TELEVISION SERVICING

Interconnection Details (Power Supply):

**EC10**
1. Chassis earth
2. Junction block EC3/18
3. Junction block EC3/21
4. Power regulator EC10/10
5. Power regulator EC11/17
6. C.R.T. pin 1 via spark protection board
7. Power regulator EC11/15
8. Mains transformer via SKT6/3
9. Mains transformer via SKT6/4
10. I.F. board EC9/7
11. Convergence EC2A/3
12. Line timebase EC5/14
13. Power regulator EC11/1
14. Chrominance EC7/5
15. Junction block EC3/6
16. Power regulator EC11/5
17. Brightness control
18. E.H.T. generator EC4/2
19. E.H.T. generator EC4/1
20. Frame timebase and sound EC6/11
21. Mains transformer via SKT6/1
22. Mains transformer via SKT6/2

**PLG6**—pins on transformer
1. Power supply EC10/21
2. Power supply EC10/22
3. Power supply EC10/8
4. Power supply EC10/9
5. Live mains in via On/Off switch
6. Not used

**JUNCTION BLOCK**

**EC3**—the following contacts are linked on the copper pattern: 2–7, 8–11, 12–15, 17–19 and 20–22:
1. Line timebase EC5/20
2. To top ends of contrast controls and to tuner via SKT1/4
3. Frame timebase and sound EC6/12
4. Video EC8/6
5. I.F. board EC9/10
6. Power supply EC10/15
7. Convergence EC2C/14
8. Convergence EC2A/5
9. Line timebase EC5/3
10. I.F. board EC9/4
11. Auto-degauss board EC1/5 and to tuner via SKT1/9
12. Convergence EC2A/4
13. Line timebase EC5/6
14. I.F. board EC9/3
15. Auto-degauss board EC1/1 and to tuner via SKT1/12
16. Chassis earth
17. Tuner via SKT1/3
18. Power supply EC10/2
19. Mains transformer via SKT5/1
20. Auto-degauss board EC1/9
21. Power supply EC10/3
22. Mains transformer via SKT5/2

**MAINS TRANSFORMER**

**PLG5**—pins on transformer
1. Junction block EC3/19
2. Junction block EC3/22
3. Neutral mains in via On/Off switch
4. Chassis earth
5. C.R.T. pin 14
6. C.R.T. pin 1

**EC11**—on flying leads
1. Power supply EC10/13
2. Not used
3. Chassis earth
4. Line timebase EC5/15
5. Power supply EC10/16
6. Line timebase EC5/12
7. Line timebase EC5/5
8. Video EC8/2
9. Frame and sound EC6/7
10. Power supply EC10/4

11. Frame timebase and sound EC6/15
12. Convergence EC2C/11, then via switch to frame timebase and sound EC6/1
13. PLG19 on focus panel, then to E.H.T. generator PLG13/1
14. Line timebase EC5/13
15. Power supply EC10/7
16. Video EC8/12
17. Power supply EC10/5
18. Frame timebase and sound EC6/10
(H131) Power Supply Regulator
COLOUR TELEVISION SERVICING

Above: (H132a) Chrominance Type 131 (Part)
Right: (H132b) Chrominance Type 131 (Continued)
Interconnection Details (Chrominance Type x31):

**EC7**
1. To chassis
2. A.C.C. to I.F. board EC9/9
3. Bias to video EC8/13
4. Earth return for colour control
5. 30 volts from power supply EC10/14
6. To colour control, live end
7. Not used
8. 30-volt pulse in from line timebase EC5/11
9. To chassis

**PLG9**—pins on board
1. R-Y to video
2. Screens joined for R-Y and B-Y to video
3. A.C. return for colour difference outputs
4. B-Y to Video

**PLG10**—pins on board
1. Inner Chrominance in on SKT10 through main cableform and
2. Screen SKT3 on I.F. board
(H133a) Convergence Type 132 (Part)
(H133b) Convergence Type 132 (continued)
**Interconnection Details (Convergence Type 132):**

<table>
<thead>
<tr>
<th>EC2A—on flying leads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Line timebase EC5/7</td>
<td>1. Power regulator EC11/12</td>
</tr>
<tr>
<td>2. 220-volt line pulse in from line timebase EC5/21</td>
<td>12. Frame timebase and sound EC6/1</td>
</tr>
<tr>
<td>6. Not used</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EC2B—on flying leads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1—9. Waveforms out to convergence yoke</td>
<td>1—9. Waveforms out to convergence yoke</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EC2C—on flying leads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frame timebase and sound EC6/6 (frame earth)</td>
<td>1. Line scan in from line timebase</td>
</tr>
<tr>
<td>2. Frame timebase and sound EC6/2 (frame scan)</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. C.R.T. pin 5</td>
<td>3. Line earth—line timebase board</td>
</tr>
<tr>
<td>4. C.R.T. pin 4</td>
<td></td>
</tr>
<tr>
<td>5. C.R.T. pin 13</td>
<td></td>
</tr>
<tr>
<td>6. Chassis earth</td>
<td></td>
</tr>
<tr>
<td>7. Not used</td>
<td></td>
</tr>
<tr>
<td>8. Video EC8/9</td>
<td></td>
</tr>
<tr>
<td>9. Brightness control slider</td>
<td></td>
</tr>
<tr>
<td>12. Frame deflector coils earthy ends</td>
<td></td>
</tr>
<tr>
<td>13. Chassis earth</td>
<td></td>
</tr>
<tr>
<td>14. Junction block EC3/7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLG14—pins on board</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Frame deflector coils earthy ends</td>
<td>1. Lines scan in from line timebase</td>
</tr>
<tr>
<td>2. Not used</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. Frame scan out to frame deflector coils</td>
<td>3. Line earth—line timebase board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLG15—pins on board</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Line scan out to line deflector coils</td>
<td>1. Line scan in from line timebase</td>
</tr>
<tr>
<td>2. Line deflector coils earthy ends</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. Not used</td>
<td>3. Line earth—line timebase board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLG16—pins on board</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Line scan in from line timebase</td>
<td>1. Line scan in from line timebase</td>
</tr>
<tr>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. Line earth—line timebase board</td>
<td>3. Line earth—line timebase board</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PLG17—pins on board (socket is reversible)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Line earth out to blue lateral yoke coils</td>
<td>1. Lines scan in from line timebase</td>
</tr>
<tr>
<td>2. Not used</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. Correction waveform out to blue lateral yoke coils</td>
<td>3. Line earth—line timebase board</td>
</tr>
</tbody>
</table>

**Interconnection Details (Spark Protection Board):**

<table>
<thead>
<tr>
<th>SKT8—on flying leads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Green</td>
<td>1. Lines scan in from line timebase</td>
</tr>
<tr>
<td>2. Red &amp; Cathode feeds in from video</td>
<td>2. Line D.C. shift return for shift circuit on line timebase board</td>
</tr>
<tr>
<td>3. Blue</td>
<td>3. Line earth—line timebase board</td>
</tr>
</tbody>
</table>

**Note:** All other spark protection board connections are fed via the main cableform to the terminals indicated on the circuit diagram.

**Interconnection Details (Auto-Degauss):**

<table>
<thead>
<tr>
<th>EC1—on flying leads</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Joined on copper pattern with contact 1 out to tuner via SKT12/12</td>
<td>1. Linked on plug side, out to degauss coil</td>
</tr>
<tr>
<td>2. and also to junction block EC3/15</td>
<td>2. and also to junction block EC3/15</td>
</tr>
<tr>
<td>3.</td>
<td>3. A.C. return from degauss coil</td>
</tr>
<tr>
<td>4.</td>
<td></td>
</tr>
<tr>
<td>5. Joined on copper pattern with contact 5 out to tuner via SKT15/12</td>
<td></td>
</tr>
<tr>
<td>6. and also to junction block EC3/15</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td></td>
</tr>
</tbody>
</table>
(H134) Spark Protection and Auto-degauss
Circuit Diagram Notes

D.C. Voltages: Figures in rectangles are D.C. voltages which were taken on a nominal 240-volt input using the 240-volt tap. E.H.T. was measured with an electrostatic meter at minimum brightness; all other voltages with an Avometer Model 8. In general the receiver was set up for normal reception with a locked picture. The figures for the chrominance circuit were taken during colour reception and those for the E.H.T. generator were taken with respect to E.H.T. earth which is 2 ohms above chassis. Note also the following conditions when measuring E.H.T. generator voltages: Receiver set to a 625-line channel during test-card transmission. E.H.T. and beam current limiter checked for correct setting. Red and blue guns switched off and brightness control adjusted for average current of 600 μA. measured by inserting meter in series with green cathode lead—the lead may be unplugged at the C.R.T. base connector.

Before taking any voltage readings check that the two main taps are ad-
justed for the local supplies. Check and if necessary adjust set 55 volts for this figure at TP1 on the power regulator board. A tolerance of ±5 per cent. should be allowed for the 30-volt stabilised and 66-volt stabilised lines. Variations of up to 20 per cent. on the other supplies do not necessarily indicate fault conditions.

**Oscillograms:** Each set of oscillograms is lettered to correspond with the appropriate circuit diagram. Those for the frame timebase and sound board were taken at frame frequency all others at line frequency. Voltage

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(H137) **LINE TIMEBASE WAVEFORMS**

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COLOUR TELEVISION SERVICING

figures given with the oscillograms represent peak-to-peak values measured via a probe having an input capacitance of 8 pF. in parallel with 10 MΩ.

**Board Identification:** The type number is normally printed on the component side adjacent to the extractor tab and also etched on the copper side; prefix or suffix letters can be ignored.

**Complete Dynamic Convergence:** 1. Before attempting the complete procedure given in the dynamic convergence diagram, see the information given in dynamic convergence adjustments. 2. Static convergence should be checked after each adjustment given in the dynamic convergence diagram. 3. The 405 and 625 blue lateral dynamic adjustments will have no effect when SKT17 is in the parked position. 4. After completing the complete procedure, check convergence overall and adjust where necessary.

(H138) CHROMINANCE WAVEFORMS

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(H139) DYNAMIC CONVERGENCE DIAGRAM
Complete Grey-scale Tracking: Before attempting the following adjustments, see Grey-scale tracking (set white).

The following sequence of adjustments ensures a black and white picture free from coloration. An Avometer 8 (or equivalent) is required for D.C. voltage measurements. Locations of meter test connections are shown in the grey-scale diagram. The convergence board should be withdrawn and mounted in the cabinet clips. The setting-up procedure should be carried out with the receiver switched to a 625-line channel, preferably with a black and white transmission.

1. Set tint control to centre of range and turn A1 potentiometers to minimum. Connect meter (250 volt D.C. range) with positive to TP2 and negative to the red, green and blue video output loads in turn, adjusting each video bias pre-set for minimum reading. Set the three video gain pre-sets to mid positions. 2. Operate set white switch to collapse frame. Connect meter positive to TP1 and negative to chassis. Adjust video reference pre-set for +9·5 volts. 3. Connect meter as in operation 1, and adjust each video bias pre-set for +90 volts. 4. Connect meter positive to pin 12 on the tube base connector with negative to chassis and adjust C.R.T. grid bias potentiometer for +30 volts. 5. Slowly advance each A1 potentiometer until the three colours are just visible on the screen (see note below), the three A1 beam switches may be operated to turn the beams on and off for comparisons. 6. With all beams switched on, operate the set white switch to restore the frame. Adjust contrast and brilliance controls for a
typical black and white picture (ideally a test card). If necessary, readjust video gain pre-sets to improve highlights and trim the A1 potentiometers to remove any tinting in the shadows.

Note; Re 5. above, if any of the horizontal lines fail to appear with the A1 potentiometers at maximum: (a) Leave A1 potentiometers corresponding to absent colours at maximum. (b) Set A1 potentiometers controlling visible lines to minimum. (c) Advance C.R.T. grid bias potentiometer until the previously absent colours are just visible. (d) Set all A1 potentiometers to minimum and repeat 5.

Replacement Modules: All replacement modules are pre-aligned and adjusted before despatch, but the setting-up and checking adjustments should be made after fitting to the receiver.

1. Adjust pre-set fine tuning.
2. Set 55 volts. With the receiver adjusted for normal reception connect an Avometer, on the 100-volt D.C. range, to TP1 on the power supply regulator board and adjust set 55 volts on the same board.
3. Check width. Independent 405 and 625 width pre-sets are located on the power supply regulator board.
4. Check E.H.T. Without removing the tube anode cap, connect an E.H.T. meter to the C.R.T. anode by means of a probe which permits contact to be made underneath the cap. Switch on the receiver and with a locked picture turn the brightness to minimum. Adjust, if necessary, set E.H.T. (E.H.T. generator board) for 24 kV.
5. Beam current limiter. With the picture adjusted for normal contrast unplug the green cathode lead at the C.R.T. base and connect a meter (1 mA. range) in series with the cathode with the meter positive to the C.R.T. base. Switch off the red and blue beams (beam switches on convergence board).

Select a U.H.F. channel and turn the brightness control to maximum. Adjust the beam current limiter (power supply board) for a reading of 800 μA.
6. Check video reference. With a U.H.F. channel selected connect an Avometer to TP1 on the video board. Operate the set white switch (convergence board) to collapse the frame. The meter should read 9-5 volts, otherwise adjust video reference pre-set (convergence board) for this figure.
7. Check C.R.T. grid bias. This pre-set is located on the frame timebase and sound board and should be adjusted for a reading of 30 volts D.C. at TP1 (frame and sound board). However, if grey-scale performance is unsatisfactory, a slightly different setting may be necessary.
8. Check contrast. Independent controls are provided for V.H.F. and U.H.F. operation.
9. Check line linearity.
10. Check line shift. Adjust to centre picture horizontally.
11. Check frame shift. Adjust to centre picture vertically.
13. Check frame linearity.

15. Check purity and convergence.

16. Check automatic chrominance (A.C.C.). Select a colour transmission, turn colour control to minimum (no colour) and adjust the brightness and contrast controls for a satisfactory black and white picture.

Connect an Avometer Model 8, on 10 volt D.C. range, to the luminance out terminal on the I.F. board and readjust the contrast control for a reading of 6.5 volts. Then transfer the Avometer (10 volt D.C. range) to the
A.C.C. checkpoint on the chrominance board, and adjust A.C.C. pre-set (R48) for a reading of 3.4 volts.

17. Check grey-scale tracking.

18. Check auto-degauss. No adjustments are necessary when replacing the board. The degaussing action can be observed as a momentary period of coloration accompanied by raster distortion immediately following a channel change between systems. A recycling time of 3 to 5 minutes must be allowed before re-selecting the original system in order to observe the second degaussing effect in the opposite direction.
BUSH Models CTV25 and CTV167

General Description: Dual-standard hybrid colour television receivers. Valves are used in line timebase, field timebase, colour difference amplifiers and luminance output stage. Transistors are used in all other stages.

Installation: The following check list should be used for guidance when installing the receiver. It is assumed that the receiver has already been carefully checked in accordance with the setting-up procedure on pages 98–102.

Warning: Any mains adjustment should be carried out before the receiver is installed as adjustment entails the removal of the Power Unit.

1. Select a suitable position for the receiver in the customer's room so that the screen is shielded from direct light from lamps or windows. If possible do not position the receiver close to any large metal object such as a hot water radiator, etc., since stray magnetic fields may disturb the purity and convergence.

2. Remove the cabinet back and connect the receiver to the mains supply. Observe the usual live chassis precautions. Switch on the receiver, allow a warm up period not less than 10 minutes before making any adjustments.

3. Check purity by looking at the R.G. and B. fields in turn and carry out the following degaussing procedure if required. Connect a degaussing coil
to the mains supply, and degauss the complete receiver including the shadow mask and chassis. Remove the degaussing coil at least 10 feet from the vicinity of the receiver before switching the coil off. If the purity is still unsatisfactory adjust the purity ring magnets for a pure red field, then check the purity of the green and blue fields.

4. Connect both aerials and check that all the local stations are received satisfactorily and all buttons are tuned correctly. Adjust the brightness control 9RV25, and the 405 and 625 pre-set contrast controls for a correct picture. The local/distant control 2RV2 may need adjustment if a noisy picture or cross modulation is observed. Note: An aerial satisfactory for monochrome reception may not be entirely suitable for the reception of colour transmissions due to multipath reception, ghosting, insufficient bandwidth, etc. This may have little effect on monochrome reception but may produce any of the following symptoms on a colour transmission—colour distortion, grain on colour, weak colour irrespective of the setting of the colour control. Under these conditions adjustment to or resiting of the aerial system may be needed.

5. Switch the receiver to a 625 colour transmission and set the colour control to the centre of its travel then adjust the pre-set Auto Chroma gain Control 5RV4, for a correctly saturated colour picture.

6. Connect a signal generator (to the aerial input) modulated with a suitable cross hatch convergence grid pattern, set to the 625-line standard. Set the brightness control so that the raster is visible. Adjust radial and lateral static convergence magnets required. Check dynamic convergence. Repeat purity adjustments if a large static convergence error is corrected.

(H95) Block Diagram

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7. Switch signal generator (modulated with a suitable cross hatch grid pattern), and receiver to the alternative standard and check purity, static and dynamic convergence.

8. Replace receiver back, re-connect aerials and instruct the customer in the operation of the receiver, particularly the slight tuning adjustment that may be required for the best results on colour transmissions.

**Control Adjustments:** The following equipment will be required if all the adjustments outlined below are carried out:

(a) Pattern Generator—(Monochrome)—R.F. output on 405 and 625, with a suitable sync. and blanking. Alternatively a test transmission may be employed.

(b) Cross Hatch Pattern Generator—R.F. output on 405 and 625.

(c) Colour Bar Generator—R.F. output on 625, or test transmission.

(d) Isolation Transformer—500 watt rating (suitable for high peak currents).

(e) E.H.T. Meter—30 kV.

(f) A.V.O. Meter Model 8.

(g) Oscilloscope—wideband 0 to 6 MHz.

(h) Degaussing Coil—separate coil for external use.

Reference to the controls and their functions are listed in the following table.
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<td>Field linearity top</td>
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<td>Horizontal dynamic convergence</td>
<td>405</td>
<td>6RV1, 6TC1</td>
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<tr>
<td>R.G. and B.</td>
<td>405</td>
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<td></td>
<td>9RV5, 9RV14, 9RV17</td>
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<td>Subcarrier reference</td>
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<td>Generator</td>
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<td>V. channel sync.</td>
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<td></td>
</tr>
<tr>
<td>Grey scale adjustment</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mains Adjustment: The receiver as supplied is suitable for a 240-volt A.C. supply. To operate the receiver on a mains supply other than 240 volt A.C., remove the power unit from the cabinet and adjust it for the required voltage in accordance with accompanying diagram.

1. Remove the two screws securing the colour chassis (I.F. unit decoder audio unit, A.C.C. unit and Luminance colour diff. unit) to the cabinet (rear rail of colour chassis).
2. Unclip the system switch operating cable from the I.F. unit switch.
3. Disconnect the tuner unit power input and signal connection Z9 from the I.F. unit.
4. Withdraw the colour chassis as far as possible.
5. Disconnect the three connectors Z1, Z10 and Z11 from the power unit and remove the three screws securing it to the cabinet.

Degaussing: The receiver will only need degaussing using a separate degaussing coil if the purity has been disturbed due to external magnetic fields magnetising the screen or adjacent chassis. The automatic degaussing circuits incorporated in the receiver will normally take care of any magnetic effects induced into the screen but occasionally degaussing using an external coil may be required. To ascertain if the purity has been disturbed and degaussing using a separate degaussing coil is required, carry out the following procedure:

1. Turn the brightness control up until the raster is visible.
2. Switch off the green and blue guns and observe the red field, this should be pure (not showing any other colour) over the entire screen-use a low power magnifier to check that only the red phosphor dots are illuminated.
3. If the red field is found impure (i.e. showing other colours with red) and the automatic degaussing does not improve the conditions, carry out the following degaussing procedure using a separate degaussing coil.
4. Connect the degaussing coil to the mains supply, switch off the receiver and pass the coil over the screen and metal work several times, then withdraw the coil some (10 feet) distance from the receiver before switching it off.
5. Check the purity of the green and blue fields in turn by switching the
appropriate guns and check that each field is not contaminated by other colours.

Note 1: If impurity still persists carry out the purity adjustment procedure.

Note 2: So that the automatic degaussing circuit may work, the receiver must be switched on from cold, i.e. the control P.T.C. Thermistor 8TH2 should be at room temperature.

Push-Button, Band, System and Channel Selection: To alter the band or transmission system to which any particular button is set, proceed as follows:

1. Remove the tuner unit from the cabinet by withdrawing plug Z9, (power and I.F. signal) from the I.F. unit, the plug Z10 (Micro-switch to P.U.) from the power unit, then disconnect the braided chassis lead between the T.U. and the I.F. unit and withdraw the T.U. from the cabinet.

2. The information stamped on the Key Plate (illustrated), will indicate the band covered and the transmission system set for that button.

3. Withdraw the Key Plate from the slot under the push-button spindle that it is required to reset.

4. Insert the new Key Plate into the slot, correct side up. The button can be tuned over the band and will operate on the transmission system indicated on the upper face of the Key Plate.

5. Replace the T.U. in the cabinet and tune the button to the channel required.

Note: The T.U. is normally supplied with the following Key Plates:

Side 1: U.H.F. Bands 4/5 system 625; V.H.F. Band 1 system 405; V.H.F. Band 3 system 625.

Side 2: V.H.F. Band 3 system 405 (Four fitted to the unit); V.H.F. Band 1 system 625 (Two fitted to the unit); U.H.F. Band 4/5 system 405 (One supplied as spare).

Tuning Range (as despatched from the factory): Push-buttons 1 and 2, Bands 4 and 5, Channels 21 to 68, 625 system; Push-buttons 3 and 4, Band 3,
**Channels 6 to 13, 405 system; Push-buttons 5 and 6, Band 1, Channels 1 to 5, 405 system.**

**Tuning Procedure:**

1. Press in the button that requires tuning then allow it to return to its normal position.
2. Withdraw the button slightly, then turn the button until the receiver is tuned correctly for satisfactory picture and sound.
3. On colour programmes a slight readjustment to the tuning may be necessary so that the colour picture is received free from any interference pattern and with the maximum colour saturation. The correct tuning point is where the sound interference pattern just disappears from the colour picture.

**A.C.G. and Local/Distant Controls:** All these controls are located on the I.F. Unit. They are 2RV4, 2RV5 and 2RV2.
   1. Set the brightness control so that the raster is just below visibility.
   2. Select a 405 channel and adjust the 405 pre-set A.G.C. control 2RV5, for a correctly contrasted picture, making any slight adjustment to the brightness, control 9RV25, that may be necessary.
   3. Select a 625 channel and adjust the 625 pre-set A.G.C. control 2RV4, as for item 2.
4. If cross modulation or a noisy picture is obtained on either channel adjust the local/distant control 2RV2 for freedom from cross-mod and the best signal to noise result.

**Line Controls (3L1 and 3TC1):** Both line frequency controls 3L1, 625 and 3TC1, 405 are located on the scan generator chassis at the rear. Adjust as follows:
   1. Select a 625 channel, and remove the sync. input socket Z15 from the plug on the scan unit chassis. Set the brightness control 9RV25 for a visible picture.
   2. Adjust the core of 3L1 to approximately the correct frequency (picture just sliding horizontally).
   3. Select a 405 channel and adjust 3TC1 for the correct frequency as in item 2, then replace sync. input socket Z15.

**Field Control (3RV7):** The field frequency control 3RV7 is located on the rear of the scan generator chassis.

**Line Drive and E.H.T. Controls:** The line drive controls 3RV1 (405), 3RV2 (625) and the E.H.T. control 3RV6, are located on the right-hand side (rear view) of the scan generator chassis. Before making any adjustments that affect the line output stage it is advisable to check that the maximum cathode current in 3V3 (PL505) is not exceeded. Details of this check appear in the appropriate section under Convergence Procedure.

1. Connect an E.H.T. meter (30 kV. range) between the chassis and the picture tube E.H.T. connection, and an A.V.O. Meter Model 8 (2·5 volts D.C. range) between the chassis and pin 1 of 3V6 PD 500, i.e. across the cathode resistor 3R29.
COLOUR TELEVISION SERVICING

2. Select a 625 channel. Set the E.H.T. control 3RV6 and the 625 line drive control 3RV2 to approximately 75 per cent. of maximum. Adjust the 625 line width control 3L13 (located on side of timebase chassis) for a nominal scan then turn the brightness control 9RV25 to minimum.

3. Adjust the E.H.T. control 3RV6 and the 625 line drive control 3RV2 to give an E.H.T. voltage of approximately 24 kV. and a cathode current of 1.2 mA. (1.2 volts D.C. on A.V.O.) in the cathode resistor 3R29 of 3V6 PD500, E.H.T. regulator valve.

4. Connect A.V.O. Meter Model 8 (2500 volts D.C. range) between chassis and the boosted boost line (i.e. the junction of the capacitor 0.01, 3C38 and the rectifier BY100 3D4), and record the voltage obtained which should be approximately 1.25 kV.

5. Select a 405 channel. Set the 405 line drive control 3RV1 to approximately 75 per cent. of maximum and the 405 line width control 3L14 (located on the side of the timebase chassis), for a nominal scan. Turn the brightness control 9RV25 to minimum. Then adjust the 405 line drive control 3RV1 so that the boosted boost and E.H.T. voltages are similar to that obtained on the 625 channel. Note: The final setting of the 405 line drive control 3RV1 is governed by the requirement of equalising the boosted boost voltage and the E.H.T. voltage on the 405 and 625 systems.

**Line Width Controls (3L13 and 3L14):** The scan amplitude adjustment forms part of the line drive and E.H.T. adjustments. 3L13 (625) and 3L14 (405) are located on the right-hand side (rear view) of the timebase chassis.

**Field Height (9RV13):** The field height control 9RV13 is located on the convergence panel.

1. With a 405 or 625 channel selected, set the brightness control 9RV25 for a satisfactory brightness level, and check that the picture displayed on the screen is correctly locked, then adjust the field height control for a nominal scan amplitude.

**Line and Field Linearity (3L15, 9RV7 and 9RV2):** The linearity control 3L15 is located on the scan coil connector panel (left-hand side of timebase chassis) and the field linearity controls 9RV7 and 9RV2 on the convergence panel.

1. Select a 405 or 625 channel. Adjust the brightness control 9RV25 for a satisfactory brightness level, and check that the picture displayed on the screen is correctly locked, then adjust the line and field linearity controls for optimum linearity. Finally re-check, line width, drive and E.H.T.

**Focus Controls (3RV5 and 3RV4):** The focus controls 3RV5, 625; and 3RV4, 405; are located on the right-hand side (rear view) of the timebase chassis.

1. Select a 625 channel (viewing a high brightness picture, e.g. test card). Set the brightness control 9RV25 for the correct level and check that the display is correctly locked.

2. Adjust the 625 focus control 3RV5 for a correctly focused picture.

3. Switch to a 405 channel and under similar conditions to that for the 625 channel, adjust the 405 focus control 3RV4 for a correctly focused picture.
Picture Squaring: The picture squaring (scan yoke) adjustment is located on the C.R.T. neck.

1. Select a 405 or 625 channel. Set the brightness control for a satisfactory brightness level. Check that the display is correctly locked.

2. Slacken the scan yoke assembly clamp screw (one screw) and rotate the complete scan assembly until the vertical and horizontal lines in the test pattern are correct. It is important to maintain the scan yoke assembly in contact with the flare of the C.R.T.

As the convergence yoke is secured to the rear of the scan yoke assembly (a lockable bayonet fitting is used) adjustment to the scan yoke assembly will also effect the position of the convergence yoke, thus making some adjustments to the convergence necessary. A following section describes such adjustments.

(H97) Circuit Diagram—V.H.F. Tuner

Picture Shift: The picture shift controls 3RV3, (horizontal shift) and 3RV8 (vertical shift) are located on the right-hand side of the timebase chassis. Adjust the horizontal shift 3RV3 and vertical shift 3RV8 controls to centre the picture in the display area. Check horizontal shift on alternative system and make a compromise adjustment if required.

Pin-Cushion Corrector (3L19): The pin-cushion corrector 3L19 is located on the left-hand side of the timebase chassis. See further procedure on page 79.
Circuit Diagram Modifications:

1. Resistor 5R29 is changed to 680 ohms (Section M. V Detector).
2. A 33p capacitor is added between the junction of 2L32, 2L31, 2C60 and 2C61, 2C62, 2R50, etc., in the sound I.F. amplifier.
3. On some models the Thermistor 9TH1, and shunt resistor 9R21 is located in a different position to that shown in the circuit diagram. They are connected between the tag 7 of coil 9L28, and the bottom of resistor 9R23, also tag 3, of coil 9L27, and tag 4 of coil 9L28, are joined, and the junction taken to the slider of 9RV27. See also Circuit Diagram Notes with diagram on page 94.
(H100b) CIRCUIT DIAGRAM—I.F. STAGES, ETC. (PART)

H100b
(H100c) Circuit Diagram—I.F. Stages, etc. (Continued)
1. Select a 625 channel. Set the brightness control for a satisfactory brightness level. Check that the display is correctly locked. Adjust the core of the pin-cushion correction coil 3L19 so that any bowing at the top border of the picture is symmetrical.

2. Switch to a 405 channel and make a compromise adjustment to 3L19 if necessary.

3rd Harmonic Tuning (3L12 and 3L11): The 3rd harmonic tuning coils 3L12 on 405 and 3L11 on 625 are located inside the screened compartment of the timebase chassis. They are adjusted when the line-transformer is assembled and normally should not need adjustment. If, however, readjustment is required, carry out the following procedure:

1. Select a 625 channel, and set the brightness control $RV_{25}$ for a visible picture. Check the line and field frequency then black out the C.R.T. with the brightness control or the Ai C.R.T. gun switches.

2. Connect a 30 kV. E.H.T. meter between the chassis and the 25 kV. C.R.T. supply, and an A.V.O. Meter Model 8 (2.5 volt D.C. range) between the chassis and pin 1 of 3V6 PD500, i.e. across the cathode resistor $R_{29}$.

3. Adjust the core of 3L11, 625 harmonic tuning for maximum E.H.T. volts and maximum current in the cathode resistor $R_{29}$.

4. Switch to a 405 channel, and repeat settings as in item 1, then adjust the core of 3L12 405 harmonic tuning for maximum E.H.T. volts and...
maximum current in the cathode resistor 3R29. **Note:** It will be necessary to carry out operation 7 line drive and E.H.T. adjustment after readjusting the 3rd harmonic tuning.

**Sub-Carrier Reference Generator:** The sub-carrier generator controls 6RV1, 6TC1 and tuning adjustments 6L10/11 and 6L8/9 are located on the luminance/colour difference panel.

1. Select a 625 channel (colour signal). Set the brightness control 9RV25 for a satisfactory brightness level. Check that the line and field frequencies are correct. Then position the Colour control 9RV28 halfway. Override the colour killer circuit by connecting an 18 kΩ resistor between TP.P2, and TP.P3, and turn 6TC1 halfway. Connect TP.E3 to TP.E2.

2. Connect the C.R.O. to TP.E4. Adjust the sub-carrier oscillator output coil 6L10/11 for maximum output.

3. Transfer the C.R.O. to TP.G1, (any one of the colour difference amplifier outputs) and adjust 6TC1 the sub-carrier oscillator trimmer for zero beat on the C.R.O., i.e. colours just running through on the screen of the C.R.T. **Use a non metallic tool.** Remove connection between TP.E3 and TP.E2.


**V. Channel Synchronism:** The V. channel sync. control 5RV3 is located on the decoder panel and the tuned coil 6L12 on the luminance colour difference panel.

1. Select a 625 channel (colour signal). Set the brightness control 9RV25, for the correct level. Override the colour killer circuit by connecting an 18 kΩ resistor between TP.P2, and TP.P3.

2. Turn the V. channel sync. control 5RV3, fully clockwise (view from rear of receiver). If the picture has incorrect colours, interrupt the signal until the picture has the correct colours. Disconnect the 18 kΩ resistor TP.P2, and TP.P3.

3. Connect the C.R.O. (switched to D.C.) between chassis and TP.P3 and adjust coil 6L12 for maximum D.C. volts output on the C.R.O. Remove C.R.O. from the test points.

4. Interrupt the signal until the picture has incorrect colours, i.e. wrong V. channel sync., then turn the V. channel sync. control 5RV3, slowly back (counter-clockwise) until the correct synchronism is obtained, i.e. correct colours in the picture. **Do not turn the control beyond the point at which correct V. channel sync. is satisfactory, with either a weak or interrupted signal.**

**Purity Adjustment:** The controls associated with the purity adjustments consist of the purity ring magnet, scan coil yoke and the static convergence magnets, and are all located on the C.R.T. neck. The red, green and blue A1 gun switches 9S1a, b and c, are mounted on the convergence panel.
**BUSH**

*Note:* The term purity as applied to the shadow mask tube means the correct position of each of the electron beams as they approach the holes in the shadow mask when each beam should fall on the appropriate phosphor dot. The correction is made by means of the purity ring magnet, prior to the process of scan deflection.

1. Carry out the complete degaussing procedure.
2. Switch on the receiver and allow it ten minutes to warm up. Switch to a 625 channel and apply R.F. signal generator modulated with a cross hatch pattern to the aerial input. Adjust the input level and the brightness control 9RV25 so that the cross hatch pattern is visible.
3. Adjust the red, green and blue radial static magnets to minimum field, i.e. yellow dot on magnet to rear, Switch off blue gun by means of switch 9S1a, and viewing centre of screen only, adjust red and green radial static magnet to overlay—red and green line (produce yellow) then switch on blue gun and adjust blue radial and lateral static magnets to overlay (view centre of screen only) blue line on yellow (produces white). Only a rough adjustment is required at this stage.

If possible, switch off the cross hatch pattern leaving only a synchronised raster.

(H78) Purify Diagram

4. Loosen the four wing nuts securing the scan coils in the scan assembly cradle.
5. Switch off the green and blue guns using the A1 gun switch 9S1a and b. Turn the purity ring magnet to a minimum field, i.e. align the slots in the plastic rings for minimum field.
6. Adjust the purity ring magnets, by increasing the field strength a small amount at a time then rotating the complete purity magnet assembly around the neck of the C.R.T., repeating the field adjustments and rotating the assembly until the red area is central on the C.R.T. screen. See accompanying diagram.
7. Move the scan coils forward or backwards on the C.R.T. neck until a full pure red field is obtained over the entire screen, then tighten the four scan coil clamp screws.
8. Switch off the red gun and switch on the green and blue guns in turn and check that the green and blue fields are satisfactorily pure. *Note:* If the red, green and blue fields are not satisfactorily pure repeat the procedure carefully.

**Convergence:** The controls associated with the convergence adjustments are located on the convergence panel and the scan assembly cradle fitted to the C.R.T. neck.
1. Static Convergence

Red
Green
Blue
Blue

Radial convergence static magnets (one for each gun) located on the convergence coil yoke mounted on the rear of the scan yoke assembly.

Lateral convergence static magnet assembly located on the C.R.T. neck to the rear of the scan coil assembly.

2. Dynamic Convergence

Employing the following controls:

Field Derived

9RV6 Amp. 9RV1 Tilt 9RV16 Diff. 9RV12 Amp. 9RV11 Tilt

Vertical Red/Green

Line Derived 625

9RV19 Amp. 9RV20 Tilt 9RV21 Diff. 9RV22 Amp. 9RV18 Tilt

Horizontal Red/Green

9L9 Shape 9L5/6 Width

Horizontal Blue

Located on the convergence panel

Line Derived 405

9RV3 Amp. 9RV8 Tilt 9RV9 Diff. 9RV15 Amp. 9RV10 Tilt

Horizontal Red/Green

9L7 Shape 9L3/4 Width

Horizontal Blue

3. Scan Coil Balance Controls

9RV27 Vertical Scan Coil Balance 9L21 Horizontal Scan Coil Balance

Located on the scan assy. cradle

4. Warning: Carefully read the following comments before making any convergence adjustments.

(a) Check that the picture width, height, linearity, focus centering, squaring, are correct.

(b) Check that the receiver purity is satisfactory looking at the red, green and blue field in turn. Note: If large convergence errors are present it may not be possible to obtain a satisfactory purity on all fields. The remedy is to make a rough static and dynamic convergence adjustment followed by the purity adjustment.
(c) Carry out degaussing if any impurity exists.

(d) If significant errors are present it is preferable to make two sets of purity and convergence adjustments, a rough and a final adjustment. This is to reduce the effects of interaction between convergence and purity.

(e) Check that the E.H.T. and boosted boost voltages are similar between the 405 and 625 line standards.

(f) In the following convergence information, adjustments are only made looking along the centre horizontal line and down the centre vertical line and at intersections with them. No adjustments can be made observing the corners of the picture.

(g) Since dynamic convergence adjustments will cause changes in static convergence, it will be found necessary to readjust the static convergence from time to time during the setting-up procedure.

(h) If there is a static error of the red, green or blue lines (centre screen area) the correct dynamic convergence adjustment requires that the red, green or blue should be parallel so that correcting the static error will then overlay the red, green or blue lines to give correct convergence.

**Convergence Procedure:**

1. Select a 625 channel. Connect an R.F. generator (modulated with a cross hatch pattern) to the aerial input of the receiver. Tune for a satisfactory pattern and adjust the brightness control 9RV25 for a raster with cross hatch lines.

   ![Convergence Diagrams](image)

   (H79) Static Convergence Diagrams

2. Adjust the red, green and blue radial static magnets so that the yellow dot marked on the magnets is turned to the rear, i.e. minimum field.

3. Adjust the red and green radial static magnets to overlay the red and green lines, then adjust the blue radial and lateral static magnets to overlay the blue line on the yellow.

4. Pre-set the controls as follows:

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<tr>
<th>Control</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>9RV6</td>
<td>Red/green amp.</td>
</tr>
<tr>
<td>9RV1</td>
<td>Red/green tilt</td>
</tr>
<tr>
<td>9RV16</td>
<td>Red/green diff.</td>
</tr>
<tr>
<td>9RV12</td>
<td>Blue amp.</td>
</tr>
<tr>
<td>9RV11</td>
<td>Blue tilt</td>
</tr>
<tr>
<td>9RV27</td>
<td>Balance</td>
</tr>
<tr>
<td></td>
<td>Adjust to maximum counter-clockwise</td>
</tr>
<tr>
<td></td>
<td>Adjust to centre of travel</td>
</tr>
<tr>
<td></td>
<td>Adjust to maximum counter-clockwise</td>
</tr>
<tr>
<td></td>
<td>Adjust to centre of travel</td>
</tr>
<tr>
<td></td>
<td>No pre-set position given</td>
</tr>
</tbody>
</table>

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COLOUR TELEVISION SERVICING

5. Switch the blue gun A1, switch 9S1A to “Off”.
6. Adjust the red/green vertical amp. control 9RV6—to straighten the centre vertical red and green lines.
7. Adjust the red/green vertical tilt control 9RV1—to prevent the centre vertical red, green lines from crossing over each other.
8. Repeat items 6 and 7 as often as required.

9. Adjust the red/green vertical diff. control 9RV16—to make the red, green horizontal lines intersecting the vertical red, green lines equally spaced or coincident from top to bottom. Note: If unable to equalise the spacing at top and bottom adjust the vertical scan coil balance control 9RV27, then readjust 9RV16.
10. Adjust red and green radial static magnets—to overlay the red and green lines (yellow line resulting), view centre of screen only.
11. Switch blue A1 gun switch 9S1a—to On. View red, green and blue rasters. Adjust blue vertical amp. control 9RV12 and blue vert. tilt control 9RV11—so that the blue horizontal intersections with the centre vertical line are equally spaced with respect to the horizontal yellow line.

Note: Make a rough adjustment first, then switch the blue gun A1 switch 9S1a,—to Off. Check that the red and green static convergence is correct and adjust if necessary, then switch the blue gun A1 switch—to On, and adjust the blue radial and lateral static magnets to overlay the blue line on the yellow line (view centre of screen). Then repeat adjustments to 9RV12 and 9RV11 as above.
12. Repeat items 5 to 11 if required.
13. Pre-set controls as follows: 9RV19 Amp.—Adjust to fully counterclockwise. 9RV20 Tilt. and 9RV21 Diff.—Adjust to centre of travel.

![Adjust 9RV16](image1)

![Adjust 9RV16](image2)

![Adjust 9RV20](image3)

![Adjust 9RV21](image4)

(H82) Dynamic Convergence Diagrams—3

14. Switch the blue gun A1, switch 9S1a—to Off. Adjust the red/green horizontal amp. control 9RV19 for most equal spacing of the vertical red/green lines at the intersections with the horizontal red/green lines.

![Adjust 9RV12](image5)

![Adjust 9RV12](image6)

![Adjust 9RV27](image7)

![Adjust 9RV27](image8)

(H83) Dynamic Convergence Diagrams—4

15. View as in item 14, if the spacing of the red/green lines is unequal right across the screen—Adjust red/green horizontal tilt control 9RV20.
16. View along the centre horizontal red/green lines. Adjust the red/green horizontal diff. control 9RV21—to make the red/green horizontal lines parallel.

*Note 16/I:* If after optimum adjustment 16 the red and green horizontal lines cross over—Adjust the horizontal scan coil balance control 9L21—to correct skewing of the red versus green horizontal lines.

17. Repeat operations 14, 15 and 16 as necessary.

18. Adjust the red/green radial static convergence magnets—to overlay the red horizontal line on the green horizontal line (produce yellow).

19. Pre-set controls as follows: 9RV22 Amp.—Adjust to fully clockwise; 9RV18 Tilt—Adjust to centre of travel; 9L9 Shape—No pre-set position given; 9L5/6 Width—No pre-set position given.

![Dynamic Convergence Diagrams](H84)

20. Switch the blue gun A1, switch 9S1a—to On. Adjust the blue horizontal amp. control 9RV22—to make the blue horizontal line as near as possible parallel with the yellow line.

21. If the blue horizontal line cannot be made parallel with the yellow horizontal line both left and right of centre—Adjust the blue horizontal tilt control 9RV18.

*Note 21/I:* If a wave either side of centre of the blue horizontal line is seen or if there is a blue droop at the extreme left or right—Adjust the blue shape control 9L9.

*Note 21/2:* If 9L9 is adjusted too far it will be found that there will be insufficient range of adjustment on 9RV22.

22. Check red, green and blue radial and blue lateral static convergence (centre of screen) and adjust if necessary.

23. View red, green and blue rasters. View along horizontal centre line.
at the intersections with it. If the blue vertical lines overlay the yellow lines (white produced) no adjustment is required. If the blue vertical lines are either inside (blue narrow) or outside (blue wide) the vertical yellow lines proceed as follows: Adjust blue width coil 9L5/6—to overlay the blue vertical line on the yellow vertical line, withdraw core to increase width, screw in core to decrease width. (Do not withdraw the core further than the outermost coil.) If with the core in the outermost position blue width is still insufficient disconnect one of the supply leads to the blue width coil on blue lateral assembly and insulate the end of the lead.

_H85_ Dynamic Convergence Diagrams—6

_H86_ Dynamic Convergence Diagrams—7

**Note 23/I:** View centre horizontal line. If there is a linearity difference between the vertical blue lines with respect to the vertical yellow lines, slacken the clamp screw securing the convergence yoke to the scan assembly cradle and rotate very slightly to correct this error, then re-tighten the clamp screw. The adjustment will have some effect on all other convergence adjustments.
COLOUR TELEVISION SERVICING

24. Check red, green and blue radial and blue lateral static convergence (centre of screen) and reset if necessary.

25. Pre-set controls as follows: 9RV3 Amp.—Adjust control to fully counter-clockwise. 9RV8 Tilt and 9RV9 Diff.—Adjust controls to centre of travel.

26. Select a 405 channel. Switch the cross hatch generator to 405. Tune the receiver for a satisfactory pattern and adjust the brightness control 9RV25 for a raster with the cross hatch lines visible.

![Dynamic Convergence Diagrams](image)

27. Carry out operations 14, 15 and 16 but using the 405 red/green horizontal controls instead of the 625 red/green horizontal controls, as follows: Use the red/green horizontal amp. 9RV3 in place of 9RV19. Use the red/green horizontal tilt 9RV8 in place of 9RV20. Use the red/green horizontal diff. 9RV9 in place of 9RV21.

*Note 16/1: does not apply.*

*Note 27/1:* The correct dynamic convergence on 405 should give the appropriate static convergence provided the 625 convergence adjustments have been correctly carried out. However, slight compromise adjustments may be required in dynamic convergence but should never be permitted with static convergence.

*Note 27/2:* Two focus controls are provided 3RV5, 625; and 3RV4, 405; and adjustments to these may give rise to static convergence errors before a serious change in focus occurs. Therefore if there is a difference in static convergence between the 405 and 625 line standards the setting of the focus controls should be checked.
BUSH

28. Pre-set controls as follows: 9RV15 Amp.—Adjust to fully counter-clockwise; 9RV10 Tilt—Adjust to centre of travel; 9L7 Shape and 9L3/4 Width—No pre-set position given.

29. Carry out operations 20, 21 and 23, including Notes 21/1, 21/2 but using the 405 blue horizontal convergence controls as follows: Use blue horizontal amp. control 9RV15 in place of 9RV22. Use blue horizontal tilt control 9RV10 in place of 9RV18. Use blue horizontal shape control 9L7 in place of 9L9. Use blue horizontal width control 9L3/4 in place of 9L5/6.

**Important**: Line Output Stage 3V3, PL505. Cathode Current.
On completion of operation 7 or any adjustment affecting the line output stage conditions, it is advisable to ascertain that the maximum recommended cathode current in 3V3 PL505 is not exceeded. Check as follows:

2. Set control 3RV3 to the centre of its travel.

(H89) LAY-OUT OF POWER UNIT AND C.R.T. BASE
3. Note the voltage across 3RV3, which should be as follows: 405 system, 4 volt maximum; 625 system, 4.3 volt maximum.

**Grey Scale Adjustment:** To produce a satisfactory grey scale two sets of adjustments must be made. First, the cut-off potentials of each of the three guns must be set to the required value. This is carried out by varying the C.R.T. A1 voltages, the controls being A1 voltage controls 9RV5,
9RV14 and 9RV17 (low lights only) and the luminance drive controls 9RV23 and 9RV24 (high lights only). The controls are situated on the convergence panel and C.R.T. base panel respectively. Second, the drives to the guns must be set to the required ratio by means of the drive controls on the
tube base. Normally the red gun has fixed drive at maximum level, the other two being adjustable. If necessary the connections can be changed to permit the red drive to be varied.

(H93) Lay-out of Timebase and E.H.T. Unit and Scan and Convergence Assembly

Note: Width controls (405/625) repositioned at side of timebase unit.
**Method:** Carry out the procedure in subdued lighting conditions.

1. Select a 625 channel, apply no signal input.
2. Set the Luminance Drive controls 9RV23 and 9RV24, to maximum (slider to anode of luminance output valve 6V1 anode).
3. Connect an A.V.O. Meter Model 8 across 9RV23, use on 10 volt D.C. range.
4. Adjust the brightness control for zero volts D.C. on the A.V.O.
5. Adjust the C.R.T. Ai voltage controls 9RV17, 9RV14 and 9RV5 to black out the rasters, then readjust each control in turn to just illuminate each raster—taking care that the dim raster (low lights) is neutral grey. See Note 5/1.
6. Apply a 625 monochrome signal (test pattern if possible) and adjust the luminance drive controls 9RV23 and 9RV24 for a correct neutral raster in the high lights.

   If any colour tint shows in the low lights a slight adjustment to the red and/or blue Ai voltage controls 9RV17 or 9RV5 may be made to correct it. Do not readjust the green Ai voltage control 9RV14. See Note 6/1.
7. Select a 405 channel, and apply a monochrome signal (test pattern if possible). Check that the grey scale is satisfactory. If there should be a significant change, check that the boost voltage does not differ between standards.

   **Note 5/1:** If it is not possible to raise all three rasters, cut the link across 6R40, should it be impossible to black out any of the rasters replace the link across 6R40. Resistor 6R40 is located to the left of 6V4.

   **Note 6/1:** If with the best adjustments of the luminance drive controls the high lights still show a red tint, change the red gun cathode leads with the (green or blue gun cathode) which ever is set to maximum.

<table>
<thead>
<tr>
<th>Tint</th>
<th>Low lights—Ai adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Decrease red</td>
</tr>
<tr>
<td>Green</td>
<td>Increase red and blue</td>
</tr>
<tr>
<td>Blue</td>
<td>Decrease blue</td>
</tr>
<tr>
<td>Cyan (blue/green)</td>
<td>Increase red</td>
</tr>
<tr>
<td>Magenta (red/blue)</td>
<td>Decrease red and blue</td>
</tr>
<tr>
<td>Yellow</td>
<td>Increase blue</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tint</th>
<th>High lights—Luminance drive adjustment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Increase green and blue drive or if one is at max., interchange red cathode lead with one set at maximum</td>
</tr>
<tr>
<td>Green</td>
<td>Decrease green drive</td>
</tr>
<tr>
<td>Blue</td>
<td>Decrease blue drive</td>
</tr>
<tr>
<td>Cyan</td>
<td>Decrease green and blue drive</td>
</tr>
<tr>
<td>Magenta</td>
<td>Increase green drive or if at max., interchange green and red gun cathode leads and readjust</td>
</tr>
<tr>
<td>Yellow</td>
<td>Increase blue drive or if at max. interchange blue and red gun cathode leads and readjust</td>
</tr>
</tbody>
</table>
Circuit Diagram Notes:

1. Sections of the circuit diagram are identified with letters, e.g. “P" chroma amplifier, delay line and matrix.
2. The double reference associated with each circuit section is intended as tracking guidance for that section, e.g. section “P" chroma amplifier
delay line, etc., letters "P4", "B3" signify, that the base of Transistor 5VT2, "P4", is connected to "B3", of section "B", the colour killer amplifier.

3. The reference "Z" is used to identify the plugs and sockets.

*Note:* Attention is drawn to Circuit Modifications, listed on page 76.
(H102a) Circuit Diagram—Line Timebase, Etc. (Part)

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(H102b) Circuit Diagram—Line Timebase, Etc. (CONTINUED)
**Setting Up Procedure:** The items listed 1–8 below should be checked before the receiver is transferred to the customer. For items 3 and 4, a test pattern generator may be employed or a test card transmission may be used as an alternative. For items 6 and 7, a cross hatch pattern generator (R.F. output) will be required. If any of the items in the check list require adjustment, see the appropriate item under control adjustments. With the exception of the push-button setting, tuning, brightness, colour and volume controls, pre-set contrast and local/distant controls, the remaining controls will not require attention unless they have been accidentally disturbed or components or valves associated with them have been replaced.

1. Remove the receiver back. Check that all the valves and plugs are
firmed seated in their holders. Adjust the mains input tappings on the power unit to agree with the customer's mains supply. Note: The receiver as supplied is suitable for a 240 volts A.C. supply only. If the receiver is modified for operation on voltages other than 240 volt A.C. this should be noted on the rear of the cabinet back.

2. Connect the receiver to the mains supply, chassis to neutral. If an isolating transformer is used it should rate at 500 watts. Check that with the receiver connected to the isolating transformer the voltage waveform is not effected by the high peak current demand of the receiver.

3. Select a channel, set the brightness and volume controls, check push-button tuning horizontal hold, (line freq.) and vertical hold, (field freq.).
COLOUR TELEVISION SERVICING

(H99) COMPONENT DETAILS
100
Set 405 and 625 pre-set contrast controls, and local/distant control, finally checking all channel buttons and tuning.

**Warning:** Do not make unnecessary adjustments to the following controls as they will have some effect on the convergence and purity which would then have to be corrected.

4. Check the width, height, linearity, vertical and horizontal centering, squaring of the picture in the mask aperture and focus on both 405 and 625 system.

5. With no signal input applied. Check the purity on 625 and 405 by looking at red, green and blue fields in turn and carry out the normal de-gaussing procedure if required.

6. With input signal from cross hatch pattern generator (405 and 625). Check the static convergence at the centre of tube screen on 625 and adjust red, green and blue static magnets if required. Switch to 405 and check that static convergence is satisfactory.

7. Check the vertical and horizontal convergence on 625 then switch to 405 and repeat check. The vertical convergence is checked on the centre vertical line on the screen and at the horizontal intersections with it. The
horizontal convergence is checked on the horizontal centre line across the screen and at vertical intersections with it.

8. Apply a monochrome test pattern on 405. Adjust brightness control for a correct picture. Check that a neutral grey is obtained in the low and high light areas, switch to 625 and check for a similar grey scale balance.

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**MURPHY Models CV2510 and CV2511**

**General Description:** These two models are similar to the CTV25 and CTV167 Bush models, already described in this volume.
PHILIPS

Models “G6 Chassis”
and Type G25K500

General Description: Service data given in the 1967–68 volume was provisional. Various production changes have taken place and the following list of modifications should be used in conjunction with this information, to bring it up-to-date.

1. R5053 changed in value from 47 kΩ to 100 kΩ.
2. R1078 changed in value from 47 kΩ to 100 kΩ.
3. R1059 changed in value from 15 ohms to 22 ohms. (On some receivers, 2 × 47 ohms resistors are fitted.)
4. C5021 changed in value from 1K5 pF. to 330K pF.
5. C2040 changed in value from 16 μF. to 40 μF.
6. R7221 changed in value from 100 kΩ to 220 kΩ.
7. L2635 is added in lead to the base of T2144.
8. C2610 (330 pF.) is added from L2620/T2615 to chassis inside can assy.
9. R1166 (1 MΩ-pre-set contrast adj.) added in parallel with R1068.
10. C1009 changed in value from 0.1 μF. to 330K pF.
11. R1085 changed in value from 6K8 ohms to 1K2 ohms.
12. R4132 changed in value from 4K7 ohms to 2K2 ohms.
13. C4059 changed in value from 2 × 470 pF. to 1K pF.
14. R2646 (220 ohms) added in lead to L2643/2644, mounted inside can assy.
15. FS1156 changed to Bulgin or Belling-Lee type 1-amp. fuse.
16. C1038 (2.5 μF.) connected from R1073 line circuit side, to chassis. (On some receivers a 12.5 μF. capacitor is fitted.)

Models G25K501, G25K502 and ST2500 have a different loudspeaker fitted.

18. R1734–47 kΩ added from L1731/R1259 to L1731 centre tap. R1735–47 kΩ added from L1732/R1264 to L1732 centre tap. R1736–47 kΩ added from L1733 centre tap to unused end.
19. R1242 changed in value from 82 ohms to 47 ohms.
20. C1206 changed in value from 56O kF. to 39O kF.
21. R1275 deleted from the convergence box and the junction of L1637/L1638 connected direct to the chassis line. Two resistors R1097 and R1098–33 ohms are fitted in each lead joining the main chassis solenoid switch to the convergence solenoid switch. They are mounted across the tag strip behind the fuse panel on the main chassis.
22. R5040 and R5041 changed in value from 470 kΩ to 220 kΩ.
23. R2081 should be joined to the centre contact of the switch and not to the end contact as shown on the main circuit diagram.
24. X1295, X1296 and X1297 changed from OA9 to BA148.
25. FS1106 changed to 1-25 amp.
26. C1038 (2.5 μF.) connected from R1073 line circuit side to chassis. (On some chassis a 12.5 μF. is fitted.)
27. R1734–47 kΩ added from L1731/R1259 to L1731 centre tap. R1735–
47 kΩ added from L1732/R1264 to L1732 centre tap. R1736–47 kΩ
added from L1733 centre tap to unused end.
28. R1275 deleted from the convergence box and the junction of L1637/
L1638 connected direct to the chassis line. Two resistors R1097 and
R1098–33 ohms are fitted in each lead joining the main chassis solenoid
switch to the convergence solenoid switch. They are mounted across
the tag strip behind the fuse panel on the main chassis.
29. R1275 changed in value from 470 kΩ to 220 kΩ.
30. R2122 changed in value from 33 kΩ to 220 kΩ.
31. X1295, X1296 and X1297 changed from OA9 to BA148.
32. R1282 changed in value from 390 kΩ to 220 kΩ.
33. On some receivers, C2053 may be fitted on the print side of the I.F.
panel.
34. On the I.F. panel drawing, the lead from L2711/2712 should read
C4007—not C4077.
35. R2122 changed in value from 33 kΩ to 220 kΩ. R2123 deleted and
C2060 fitted in its place—220 K pF capacitor.
36. C2051 removed and reconnected across R2134; changed in value from
82 pF to 56 pF.
37. On some chassis the following changes occur together: C7074, R7230,
R7247 and R1091 (tint control) are deleted. R7229 changed in value
from 56 ohms to 82 ohms. R7246 changed in value from 47 ohms to
82 ohms.
38. C5014 may be either 35 pF or 42 pF. C5015 may be either 1·5 μF.
or 2·2 μF.
Important. The boost voltage setting for a line output transformer
incorporating the above values of C5014 should be 600 volts (625-line) and
570 volts (405-line).
39. R4075 changed in value from 150 kΩ to 130 kΩ.

STELLA Model ST2500

General Description: This model is electrically similar to Philips G6
Chassis, information for which is given on the previous page of this volume.
RADIO SERVICING

ACKNOWLEDGEMENTS

Alba (Radio and Television) Ltd.
Bosch Ltd.
British Radio Corporation Ltd.
Combined Electronic Services Limited
C.R.T.S. Ltd.
Dansette Products Ltd.
Debenhams Electrical Co. Ltd.
Denham & Morley Ltd.
Decca Radio & Television
Dynaport Radio & T.V. Ltd.
Dynatron Radio Ltd.
Eddystone Radio Ltd.
Elizabethan Electronics Ltd.
Fidelity Radio Ltd.

Hacker Radio Ltd.
Highgate Acoustics
Klinger Controls Ltd.
Monogram Electrical Company
Perdio Products Ltd.
Philco International Ltd.
Radio & Allied (Holdings) Ltd.
Radiomobile Ltd.
Rank Bush Murphy Ltd.
Roberts Radio Co. Ltd.
R.T.S. Ltd.
Sanyo Service & Sales
Sharp Sales & Service
Transervice Ltd.
ALBA  Model 339

General Description: Six-transistor-per-channel, mains-operated, stereophonic record player.

Dismantling: Pull off four control knobs. Remove bottom cover. Remove two, 4BA nuts fixing bottom of chassis to partition. Lift out chassis. When replacing chassis make sure location studs enter holes in control panel.

Access to Panel Copper Side: Remove four screws holding base plate to control bracket. Remove two screws holding panel to base plate. The panel together with control bracket may then be hinged open revealing copper side but leaving the power transistors screwed to base plate.

Power Transistors: When replacing TR5/TR6 or TR11/12 a matched pair must be used. The transistor case is insulated from the chassis by a mica washer and two plastic bushes. When replacing a transistor make sure the mica washer is not damaged. Apply heat sink compound to both sides of washer and screw down transistor evenly to make good thermal contact. Check that case is insulated from chassis.

Adjustments: Adjust VR4/VR9 to eliminate crossover distortion checking that TR5/TR11 collector current is not greater than 15 mA. If this current is greater than 15 mA modify to latest circuit.

Gain Measurements: All the following taken with balance set for equal outputs per channel at 10 kHz. and ¼ volume 5 ohms resistance load. With volume at max. and tone controls at mid position. For 2 volts r.m.s. output at 1 kHz. either channel. With P.U. disc and generator applied to P.U. lead 22 mV. r.m.s.

With generator applied via 12 kΩ in series with 0.1 μF. to: TR3/TR9 collector—3 volts r.m.s.; TR3/TR9 base (neg. side C10/C32)—140 mV./r.m.s.; TR2/TR8 collector (transistor case)—4.2 volts r.m.s.; TR1/TR7 collector (transistor case)—70 mV. r.m.s.

Response: With generator applied to P.U. lead.

Half Volume Response: Set base and treble for level response at max. volume then reduce volume control so that 260 mV. r.m.s. input gives 2 volts r.m.s. output at 1 kHz. The relative output at 100 Hz. should be +8 dB., and at 10 kHz. +3.5 dB.

Tone Control Variation: Set tone controls in mid position and volume at max. Relative to an input to give 2 volts r.m.s. output at 1 kHz. At 100 Hz. the range of bass control should be dB. At 10 kHz. the range of treble control should be 20 dB.

Spare Parts

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Item</th>
<th>Part No.</th>
<th>Item</th>
<th>Part No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottom cover</td>
<td>14224</td>
<td>Tr1</td>
<td>14130</td>
<td>VR2, 7</td>
<td>14320</td>
</tr>
<tr>
<td>Control knob</td>
<td>13860/P</td>
<td>Rectifier</td>
<td>14135</td>
<td>VR3, 8</td>
<td>14318</td>
</tr>
<tr>
<td>Escutcheon</td>
<td>14277</td>
<td>S1, 2</td>
<td>14322</td>
<td>VR5</td>
<td>11615</td>
</tr>
<tr>
<td>Speaker</td>
<td>14281</td>
<td>S3</td>
<td>14323</td>
<td>VR4/9</td>
<td>14118</td>
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<tr>
<td>Tweeter</td>
<td>14282</td>
<td>VR1, 6</td>
<td>14320</td>
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</tr>
</tbody>
</table>
On later models LB and RB are returned to chassis by separate 3000μF capacitors.
ALBA

Model 535

General Description: Seven-transistor, long- and medium-wave portable receiver. The receiver uses two modules that require specialised servicing facilities. In the event of a fault unsolder the leads and return the module to the manufacturer.

Dismantling: Pull off knobs. Pull cord off pointer. Remove three 4BA nuts holding chassis. Lift out chassis. When replacing, push cord on to pointer set at 2000 m. with gang closed.

Alignment: For alignment out of cabinet—attach paper clip to cord, line up to start with gang closed and use holes in top edge of chassis as shown. 470 kHz., adjust 4 cores on I.F. module for max. O/P; M.W. 600 kHz., 500 m. adjust L3 and L1; B/S. 1500 kHz., 200 m. adjust TC4 and TC3; M.W. 1500 kHz., 200 m. adjust TC2 and TC1; L.W. 200 kHz., 1500 m. adjust L2.

Sensitivity: With signal applied via 0·1 μF. to I.F. module pin 5. 470 kHz. 4 μV., 1 MHz. 1·5 μV. for 50-mW. output.
ALBA

Model 838

Alignment: Connect output meter across speaker. Adjust volume control for maximum. Adjust generator connected as below to restrict O/P to 5 mW.
Repeat each operation for optimum results. Oscillator is tuned at extreme end of each band.

Above: (F76a) Circuit Diagram—Model 838 (Part)
Right: (F76b) Circuit Diagram—Model 838 (Continued)
<table>
<thead>
<tr>
<th>Stage</th>
<th>Generator</th>
<th>Frequency</th>
<th>Adjust for max. O/P</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.F.T.S.</td>
<td>Across VC 1 via 0.1 μF.</td>
<td>470 kc/s.</td>
<td>T3, T2, T1</td>
</tr>
<tr>
<td>M.W.</td>
<td>Connect to radiation loop</td>
<td>520 kc/s.</td>
<td>L4, CT4</td>
</tr>
<tr>
<td></td>
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<td>1650 kc/s.</td>
<td>L7</td>
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<tr>
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<td>600 kc/s.</td>
<td>CT1</td>
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<td>1400 kc/s.</td>
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<td>340 kc/s.</td>
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<td>Connect to radiation loop</td>
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<td>18.5 Mc/s.</td>
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<td>6.5 Mc/s.</td>
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</tr>
<tr>
<td>S.W.</td>
<td>Connect to radiation loop</td>
<td>17 Mc/s.</td>
<td></td>
</tr>
</tbody>
</table>

I.I.T.S.
**RADIO SERVICING**

**BEOLIT Model 500 (Type 1101)**

**General Description:** An eleven-transistor radio for F.M. reception with station selection effected by push-button. Fitted with telescopic aerial and sockets for extension speaker and gramophone/tape recorder.

**Batteries:** 9 volts (6 × 1.5 volts). Quiescent current 26 mA. 22.5 volts. 15 amps.

**Sensitivity Measurements and Alignment Procedure:**

<table>
<thead>
<tr>
<th>Range</th>
<th>Potentiometer setting</th>
<th>R.F. Connection</th>
<th>Oscillograph connection</th>
<th>Frequency</th>
<th>Remarks</th>
<th>Sensitivity</th>
<th>Output</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L.F. Circuits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>Point A through 0.1 µF.</td>
<td>A.F. 121 collector (14) (see lay-out drawing)</td>
<td>As above</td>
<td>10.7 Mc/s.</td>
<td>A.F.C. out; max. treble</td>
<td>Through diode probe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>Aerial connector socket</td>
<td>As above</td>
<td>As above</td>
<td>10.7 Mc/s.</td>
<td>As above</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Oscillator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>108 Mc/s.</td>
<td>As above</td>
<td>As above</td>
<td>108 Mc/s.</td>
<td>As above</td>
<td>Core 3</td>
<td>Potentiometer 13</td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>87.5 Mc/s.</td>
<td>As above</td>
<td>As above</td>
<td>87.5 Mc/s.</td>
<td>As above</td>
<td>Core 2</td>
<td>for max. gain</td>
<td></td>
</tr>
<tr>
<td><strong>R.F. Circuits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>89 Mc/s.</td>
<td>As above</td>
<td>As above</td>
<td>89 Mc/s.</td>
<td>As above</td>
<td>Do not adjust core 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Detector</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>As above</td>
<td>Point 15 (see lay-out drawing)</td>
<td>10.7 Mc/s.</td>
<td>Without diode</td>
<td>With noise impulses</td>
<td>Cores 11, 12 for max. gain and symmetrical curve, and best noise suppression</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sensitivities**

<table>
<thead>
<tr>
<th>Range</th>
<th>Potentiometer setting</th>
<th>R.F. Connection</th>
<th>Oscillograph connection</th>
<th>Frequency</th>
<th>Remarks</th>
<th>Sensitivity</th>
<th>Output</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Button 1</td>
<td>Point A through 0.1 µF.</td>
<td>Point B through 0.2 µF.</td>
<td>10.7 Mc/s.</td>
<td>Unsolder tuner (320 pF, No. 54 in diagram)</td>
<td>15 µV.</td>
<td>50 mW.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>Point C through 0.1 µF.</td>
<td>Aerial connector socket</td>
<td>10.7 Mc/s.</td>
<td>10.7 Mc/s.</td>
<td>100 µV.</td>
<td>50 mW.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>91 Mc/s.</td>
<td>Aerial connector socket</td>
<td>91 Mc/s.</td>
<td>91 Mc/s.</td>
<td>1.5 mV.</td>
<td>50 mW.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>91 Mc/s.</td>
<td>Aerial connector socket</td>
<td>91 Mc/s.</td>
<td>91 Mc/s.</td>
<td>2.24 µV.</td>
<td>500 mW.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Button 1</td>
<td>91 Mc/s.</td>
<td>Aerial connector socket</td>
<td>91 Mc/s.</td>
<td>91 Mc/s.</td>
<td>3.55 µV.</td>
<td>20 dB signal/noise ratio</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* L.F. Alignment: Sweep Generator: Frequency Swing approx. 1 Mc/s.

II4
RADIO SERVICING

BLAUPUNKT

Model 13922

General Description: Stereo console radiogram for A.C. mains 110 volts and 220–250 volts 50 c/s.


Alignment (Preparation): Turn in tuning capacitor and set dial pointer to calibration mark on A.M. dial. Set tone controls to treble and bass, tone button to HI–FI, S.W. bandspread to 0 and volume control to maximum. Connect multimeter to output transformer secondary channel 2, and work at 0·38 volts (25 mW.).

Alignment (A.M. I.F.): Connect signal generator via 0·01 μF. to control grid of V872. Align according to alignment table. Connect signal generator via dummy aerial (see diagram) to aerial jack to align I.F. wave trap, tune to minimum. In order to measure sensitivities, connect signal generator via 0·01 μF. to control grids of V872 and V873 respectively.
### Alignment Table

<table>
<thead>
<tr>
<th>Band</th>
<th>Signal generator to:</th>
<th>Frequency</th>
<th>Set</th>
<th>Adjustments</th>
<th>A.M. and A.F. sensitivity for 25 mW output; F.M. 4 volt ratio detector voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z.F./I.F. (A.M.)</td>
<td>G 1 ECH 81 (3) (1)</td>
<td>460 kHz/kc.</td>
<td>M.W.</td>
<td>L787, L786, L784, L783 max. L796 min.</td>
<td>from G 1 EAF 801: R.F. 12 mV. approx. 15 µV. from G 1 ECH 81: approx. 15 µV.</td>
</tr>
<tr>
<td>S.W.</td>
<td>(1)</td>
<td>6.25 MHz/Mc.</td>
<td>S.W.</td>
<td>48 m.</td>
<td>from G 1 ECH 81: R.F. 20 µV. approx. 15 µV.</td>
</tr>
<tr>
<td>M.W.</td>
<td>(1)</td>
<td>546 kHz/kc.</td>
<td>M.W.</td>
<td>16.6 m.</td>
<td>20 µV.</td>
</tr>
<tr>
<td>L.W.</td>
<td>(1)</td>
<td>1500 kHz/kc.</td>
<td>L.W.</td>
<td>1600 kHz/kc.</td>
<td>10 µV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>160 kHz/kc.</td>
<td>L.W.</td>
<td>350 kHz/kc.</td>
<td>15 µV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>350 kHz/kc.</td>
<td>L.W.</td>
<td>1500 kHz/kc.</td>
<td>10 µV.</td>
</tr>
<tr>
<td>L.W.</td>
<td>Coupling coil</td>
<td>1500 kHz/kc.</td>
<td>L.W. and F-ANT.</td>
<td>1500 kHz/kc.</td>
<td>C710 adjust for maximum</td>
</tr>
<tr>
<td>Z.F./I.F. (F.M.)</td>
<td>(4)</td>
<td>350 kHz/kc.</td>
<td>V.H.F.</td>
<td>350 kHz/kc.</td>
<td>C711 max. from G 1 EAF 801: appr. 80 mV. from G 1 ECH 81: appr. 1.7 mV.</td>
</tr>
<tr>
<td>F.M. N.F./A.F.</td>
<td>A.F. generator</td>
<td>94.5 MHz/Mc.</td>
<td>V.H.F. + Stereo</td>
<td>94.5 MHz/Mc.</td>
<td>C913 C907 max. Channel 2 &lt;6 µV. from G 1 E(C)L 86: 390 mV. from G 1 E(C)L 86: 200 kΩ: 42 mV.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1600 Hz/c.</td>
<td>V.H.F.</td>
<td>104 MHz/Mc.</td>
<td>Channel 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>V.H.F.</td>
<td>350 kHz/kc.</td>
<td>Channel 1</td>
</tr>
</tbody>
</table>

**Notes:**
- G 1 EAF 801: R.F. 12 mV.
- G 1 ECH 81: approx. 15 µV.
- Ferrite antenna L899 adjust for maximum C712 max.
- L900 adjust for maximum C711 max.
- Oscillator Intermed. circ. C913 C907 max. Channel 2 <6 µV.
- Channel 1
Alignment (A.M. R.F.): Connect signal generator via dummy aerial to aerial jack and proceed according to alignment table.

Alignment (A.M. R.F. Ferrite Aerial): Connect signal generator to a coupling coil (20 turns, 2-36 inches dia.) and put coil close to ferrite rod. Increase signal generator output to obtain a useful reading on output meter and proceed according to alignment table.

Alignment (F.M. I.F.): The ratio detector voltage should be nearly 4 volts, measured between point 5 and ground (see circuit diagram). Connect F.M. signal generator (modulated) to slotted metal cylinder which is slid on V871, up to the upper edges of the plates. Turn out core of L791. Adjust L790-L911 for maximum on output meter. Increase ratio detector reading to 10 volts and adjust L791 for maximum reading at ratio detector.
(H159) Switch Diagram—Model 13922

Shown in position: VHF

Switch contact H159

(H155b) Circuit Diagram—Model 13922 (Part)

119
ALIGNMENT (F.M. R.F.): Set signal generator to 94'5 Mc/s. Tune in signal and set pointer to 94'5 Mc/s. on dial. Adjust C907 to maximum. Align C913 only if the frequency band is displaced.

Audio: The A.F. sensitivities from TA jack depend on the position of the balance control.

Oscillator Voltages: S.W. 4-5 to 10 volts. M.W. 5-12 volts. L.W. 5-13 volts. All voltages measured with V.T.V.M. at point 7. V.H.F. 1.5-3 volts measured with V.T.V.M. at point 8 (see circuit diagram).

Controls: B is bass control, E is balance control, L is volume control and S is treble control (see circuit diagram).


(H155c) Circuit Diagram—Model 13922 (Part)
(H157) Power Supply (Left); (H158) Loudspeaker Diagram (Right)

(H155d) Circuit Diagram—Model 13022 (Continued)
RADIO SERVICING

(H156) HEATER DIAGRAM

To output transformers

110-245V~

To output transformer

To output transformer

To RR

To RR

H156

(H160) VALVE VOLTAGES—MODEL 13922

(ECC 85) V871

106 V/4.2 mA

(180V/10.6 mA)

6.3V/435mA

(ECH 81) V872

204 V/2.2 mA

(178V/17.1 mA)

6.3V/300mA

(EAF 801) V873

192 V/11.6 mA

(185V/10.7 mA)

6.3V/200mA

(EM 87) V874

218 V/8.8 mA

(180V/8.8 mA)

6.3V/300mA

(V875/V876)

(H160) DRIVE CORD—MODEL 13922

FM+SW-bandspread

Ferrite antenna

AM

(H166)

122
**General Description:** Battery-operated portable receivers incorporating seven transistors and one crystal diode. The receivers have coverage of the long and medium wavebands, while an additional range provides electrical bandspread of the high frequency end of the medium waveband. At the top of the cabinet are the tuning scale and receiver controls, comprising three push-buttons and two edge-operated control knobs. Cabinet back detachable for battery replacement.

**Controls:** Top L to R: Three push-buttons selecting L.W., M.W., B.S., Volume On/Off, Tuning.

**Wavebands:** L.W. band: 1070–1900 m. (280 to 158 kc/s.) M.W. band: 187–570 m. (1605 to 525 kc/s.) B.S. band: 187–210 m. (1605 to 1430 kc/s.).

**Intermediate Frequency:** 470 kc/s., oscillator high with respect to signal frequency.

**Aerial:** An internal ferrite rod aerial is fitted serving the three ranges, and a socket is provided at the side of the receiver for use with a car aerial.

**Automatic Gain Control:** One controlled stage.

**Battery and Consumption:** One 9-volt PP7 or U.K. equivalent. Consumption is 14 mA. quiescent (at 18°C) and 18 mA. at average listening level.

**Audio Output:** 500 mW.

**Loudspeaker:** 5½ in. x 2½ in. elliptical. Impedance 15 ohms. Flux density 9500 lines per square centimetre.

**Transistors:** Mullard Type, VT1 AF117 mixer/oscillator; VT2 AF117 I.F. amplifier; VT3 AF117 I.F. amplifier; VT4 OC71 audio amplifier; VT5 OC81D or AC128 driver stage; VT6 and VT7 OC81 (or AC128) push-pull output matched pair.
**RADIO SERVICING**

**Crystal Diode:** D1 OA90 detector.

**Earpiece Socket:** A socket is provided at the side of the receiver into which may be plugged an earpiece of 20–1000 ohms impedance. Alternatively, this socket may be used with an external loudspeaker of 15 ohms, or for tape recording provided that the recorder has an input impedance of not less than 15 ohms.

**Removing the Chassis:** Place the cabinet face downwards, remove the detachable back, then remove the battery. Unscrew the four 4BA cheese-head screws securing the chassis to the cabinet (one screw to each corner of the chassis). Lift out the chassis to the extent of the aerial and loudspeaker leads. Unsolder the leads if total removal of the chassis is required.

**Replacement:** Replace by reversing the above procedure.

---

**Circuit Diagram—Model TR146 (Part)**

(F3a)
Alignment Procedure: Preliminary Notes: Equipment required: 
(a) An A.M. signal generator to cover 158 kc/s – 1605 kc/s. 
(b) An output wattmeter with a range 0 – 500 mW. to match 15 ohms impedance. 
(c) A non-metallic trimming tool for adjusting the iron dust cores and R.F. trimmers. 
(d) A 0.1 µF. capacitor for I.F. injection purposes, a 10 pF. capacitor for injecting R.F. calibration signals into the aerial socket, and an 8·2k resistor for temporarily desensitising the receiver under conditions of interference. The I.F. and R.F. alignment may be carried out after removing the back of the cabinet. Connect the output meter to the receiver by means of the earpiece socket and a suitable plug.

Warning: If the output meter is connected in parallel with the loudspeaker care must be exercised to ensure that the power output is not allowed
to rise to a level high enough to damage the output transistors (not greater than 75 mW.).

The signal generator should be switched on about 15 minutes before commencing the alignment. Set the volume control to maximum, and maintain the output at 50 mW. by adjusting the input signal each time a trimming adjustment is made (20 mW. if the loudspeaker is left in circuit).

**I.F. Alignment:** Switch the receiver to the medium waveband and set the tuning pointer to about 300 m. Set the signal generator to 470 kc/s., modulated 30 per cent. at 400 c/s. Connect the output via a 0.1 µF. isolating capacitor to the base of VT1 (junction of R2 and R3), the chassis connection being the return point for the signal. Align IFT3, IFT2 and IFT1, in that order, for maximum audio output. Align each transformer once only.
R.F. Alignment: Note: Ensure that the tuning pointer is in line with the datum dot at the low frequency end of the tuning scale when the tuning gang is fully meshed.

Oscillator Circuits: The signal generator should be connected to the aerial socket via a 10-pF capacitor. Under conditions of interference, the receiver may be temporarily desensitised by connecting an 8-2k resistor between the junction of R6 and R13, and chassis.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Sig. gen. frequency (mod. 30% 400 c./s.)</th>
<th>Tuning pointer setting</th>
<th>Adjust for maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>500 m.</td>
<td>L10/11/12 CT4</td>
</tr>
<tr>
<td>2</td>
<td>M.W.</td>
<td>1500 kc/s.</td>
<td>200 m.</td>
<td></td>
</tr>
</tbody>
</table>

Repeat operations 1 and 2 and check calibration.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Sig. gen. frequency (mod. 30% 400 c./s.)</th>
<th>Tuning pointer setting</th>
<th>Adjust for maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>L.W.</td>
<td>214 kc/s.</td>
<td>1400 m.</td>
<td>CT5</td>
</tr>
<tr>
<td>4</td>
<td>B.S.</td>
<td>1439 kc/s.</td>
<td>208 m.</td>
<td>CT3</td>
</tr>
</tbody>
</table>

Aerial Circuits: The signal generator should be coupled to the receiver by a loop of insulated wire placed about 3 ft. from the cabinet and with its plane at right-angles to the ferrite rod aerial.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Sig. gen. frequency (mod. 30% 400 c./s.)</th>
<th>Tuning pointer setting</th>
<th>Adjust for maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>500 m.</td>
<td>Adjusting ring* CT2</td>
</tr>
<tr>
<td>2</td>
<td>M.W.</td>
<td>1500 kc/s.</td>
<td>200 m.</td>
<td></td>
</tr>
</tbody>
</table>

Repeat operations 1 and 2 for optimum gain at both points.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Sig. gen. frequency (mod. 30% 400 c./s.)</th>
<th>Tuning pointer setting</th>
<th>Adjust for maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>L.W.</td>
<td>214 kc/s.</td>
<td>1400 m.</td>
<td>No adjustment CT1</td>
</tr>
<tr>
<td>4</td>
<td>B.S.</td>
<td>1439 kc/s.</td>
<td>200 m.</td>
<td></td>
</tr>
</tbody>
</table>

* See ferrite aerial connections.

Replacement of Drive Cord: To replace the drive cord, first remove the chassis from the cabinet as described in the dismantling procedure. Set the tuning capacitor to maximum, then remove the two Philips head screws securing the scale backing plate and lift clear. Remove the twin scale pointer assembly and fit the replacement drive cord in accordance with the diagram. Replace the scale pointer assembly and backing plate ensuring that the left hand pointer is in line with the datum dot at the low frequency end of the scale with the tuning gang fully-meshed.

Modifications: On some models VT5-7 are type AC 128, and R8 on later models is 820 ohms, ±10 per cent. 0·2 W.
**DANSETTE**  

**General Description:** Six-transistor portable radio. Power output 600 mW. Wavebands: L.W. 1200–2000 m; M.W. 180–500 m. The internal aerial is of the ferrite rod type. A socket is provided for an external aerial on the right side of the instrument and on the left side are two sockets; the lower is the earphone socket and directly above is the tape output socket. Signals are fed from the aerial to the base of the frequency changer stage (AF117), which produces its own oscillation by means of feedback from collector to emitter. Tracking of the aerial and oscillator is obtained by using a tuning capacitor with shaped oscillator vanes.

The intermediate frequency is extracted from the collector of the first AF117 transistor by the first I.F. transformer. The I.F. amplifier uses two AF117 transistors operating in grounded emitter circuits. The third I.F. transformer is connected to an OA70 detector diode which provides an audio output and a D.C. output. The D.C. is fed back to control the operating current of the first I.F. transistor, so providing A.G.C.

The selected signal is fed via the volume control to the base of the L.F. amplifying transistor (OC81D) and the amplified audio signals are transformer coupled to matched pair of OC81 transistors, which form the output stage.

The output transistors are connected in a common emitter, class "B", push–pull circuit. A push–pull output transformer terminates the output with a 3-ohm loudspeaker wired to the secondary.

**Alignment Instructions—Apparatus Required:** (1) A signal generator covering long and medium waves. (2) A sensitive D.C. volt-meter measuring 0–2.5 volts (to be connected across the volume control). (3) A radiator loop (a suitable loop consists of 0.25 m. with a series resistor of 430 ohms, situated about 0.6 m. from ferrite aerial). For all I.F. measurements connect a 0.5 µF. capacitor and an 820-ohm resistor in series with the generator direct.

**I.F. Alignment:** (1) Connect the signal generator to the base of the second I.F. transistor (TR3), set the generator to 470 kc/s. and adjust T3 for maximum output. (2) Transfer the signal generator to the base of the first I.F. transistor (TR2) and adjust T2 for maximum output. (3) Connect the generator to the base of the oscillator transistor (TR1) and adjust T1 for maximum output. (4) With the generator connected as in (3), the receiver switched to M.W. and the tuning capacitor set to maximum capacity, set the generator to 540 kc/s. Adjust the oscillator coil for maximum output. (5) Set the tuning capacitor to minimum capacity, reset the generator to 1640 kc/s. and adjust TC2 for maximum output. (6) Repeat (4) and (5) till no further improvement can be achieved.

**Aerial Alignment:** (1) Connect the loop to the generator termination, and set the generator to 600 kc/s. Tune the receiver to 500 m. on the scale.
and adjust the M.W. aerial coil for maximum output. (2) Set the generator to 1300 kc/s., tune the receiver to 230 m. and adjust TC1 for maximum output. (3) Switch to L.W. Set the generator to 220 kc/s. Tune the receiver to 1360 m. and adjust the L.W. aerial coil for maximum output.

DANSETTE

“Stereophon”

General Description: Five-transistors-per-channel stereophonic record player. Power output 2-4 watts per channel. Frequency response level from 40 c/s. to 10 kc/s. B.S.R. Monarch record unit fitted with a Ronette “105” pickup cartridge. Supply 210-250 volts A.C. only.

Circuit Description: Audio signals obtained from the pickup are fed to two preamplifiers. The output stages are class B push-pull circuits, designed to provide a common-emitter drive for the output transistors. The collector loads of the driver transistors are tapped, the tapping points being capacitively coupled to the mid-points of the output stages. The mid-point voltages are stabilised by providing D.C. feedback to the bases of the driver transistors, 1000 ohm. pre-set resistors being used to accommodate component tolerances and transistor spreads. These pre-set resistors also provide A.C. feedback, thus reducing any distortion originating in the output stages.

An n-p-n transistor and a p-n-p transistor in each channel are directly coupled to form the preamplifiers. Negative feedback is applied from the emitters of the OC75 transistors to the bases of the AC127 transistors.

The ganged bass boost controls operate by reducing this feedback at low frequencies. Ganged passive treble cut controls are also provided at the inputs.

The thermistors stabilise the quiescent current of the output stages, the 100-ohm pre-set resistors being used to set up the initial currents.

Audio Adjustment Procedure: Note: Normally no audio adjustment will be necessary. The following instructions apply only when driver or output transistors have been changed. (1) Switch the record player on. (2) Set the balance control fully to the channel being adjusted. (3) Disconnect the lead connecting the collector of the AC128 output transistor concerned from the junction of the negative supply line. Connect an ammeter in series and adjust the 100-ohm pre-set resistor on that channel to 18 mA. (no-signal). (4) Connect a power output meter to the respective L.S. (right or left hand) (15 ohms input impedance). Connect an Oscilloscope between the 250 μF. capacitor (positive side) and earth. Connect the
audio signal to the tape socket. (For pin connections see under Tape Recording.) (5) Set an audio signal to 1 kc/s. approximately. (6) With 460 mV. input, the power out should be 2·3 watts approximately. (7) Adjust the 1000 ohm. pre-set resistor concerned for a symmetrical sinewave at 2·3 watts output.
DANSETTE

"Hendon"

General Description: This model is electrically similar to the Dorchester, information for which is given elsewhere in this volume.

DANSETTE

"Supreme"

General Description: Five-transistor mains-operated record player. Power output 3 1/2 watts undistorted. Frequency response level from 40 c/s. to 10 kc/s. B.S.R. record player unit with "Ful-Fi" TC8 M cartridge.

Circuit Description: Audio signals obtained from the pickup are fed to a preamplifier. The output stage is a class B push–pull circuit, designed to provide a common-emitter drive for the output transistors. The collector load of the driver transistor is tapped, the tapping point being capacitively coupled to the mid-point of the output stage. The mid-point voltage is stabilised by providing D.C. feedback to the base of the driver transistor, a 1000-ohm pre-set resistor being used to accommodate component tolerances and transistor spreads. The pre-set resistor also provides A.C. feedback, thus reducing any distortion originating in the output stage.

An n-p-n transistor and a p-n-p transistor are directly coupled to form the preamplifier. Negative feedback is applied from the emitter of TR2 to the base of TR1.

The bass boost control operates by reducing this feedback at low frequencies. A passive treble cut control is also provided at the input.

The thermistor stabilises the quiescent current of the output stage, the 100-ohms pre-set resistor being used to set up the initial current.

Audio Adjustment Procedure: Note: Normally no audio adjustment will be necessary. The following instructions apply only when the driver or output transistors have been changed. (1) Switch the record player on. (2) Disconnect the lead connecting the 40 μF. capacitor to the junction of the two 2 2-ohm resistors. Connect an ammeter in series (test point H.T.) adjust the 100-ohm pre-set resistor to 18 mA. maximum current (no-signal). (3) Connect the power output meter to the "L.S." socket (15 ohms input impedance). Connect an Oscilloscope between the 250 μF. capacitor (negative side) and earth. Connect the audio signal to the tape socket. (4) Set the audio signal to 1 kc/s. approximately. (5) With 460 mV. input, the power out should be 2 3 watts approximately. (6) Adjust the 100-ohm pre-set resistor for a symmetrical sinewave at 2 3 watts output.
(F74) CIRCUIT DIAGRAM—DANSETTE “SUPREME”
DANSETTE

General Description: The Dansette “Herald” Portable Transistor Radio uses a superheterodyne circuit. The internal aerial is of the ferrite rod type. A socket is provided for an external aerial on the right-hand side of the instrument and on the left-hand side are two sockets; the lower is the earphone socket and directly above is the tape output socket. Signals are fed from the aerial to the input of the R.F./I.F. module. Tracking of the aerial and the oscillator within the module is obtained by using a tuning capacitor with shaped oscillator vanes.

The audio output from the module is fed via the volume control to the base of the A.F. amplifier transistor (OC81D) and the amplified audio signals are transformer coupled to matched pair of OC81 transistors, which form the output stage.

The output transistors are connected in a common emitter, class “B”, push–pull circuit. A push–pull output transformer terminates the output with a 3-ohm loudspeaker wired to the secondary.

Alignment Instructions—Apparatus Required: (1) A signal generator covering the long and medium wavebands. (2) A sensitive D.C. volt-meter measuring 0-2.5 volts (to be connected across the volume control). (3) A radiator loop (a suitable loop consists of 3 turns of copper wire wound on a diameter of 0.25 m. with a series resistor of 430 ohms, situated about 0.6 m. from ferrite aerial).

R.F. Alignment: (1) Connect the signal generator to the common tag of the coupling winding of the M.W. aerial coil (normally wired with a white coloured lead to the wave change switch) via a 0.5 µF. capacitor in series with an 820-ohm resistor. (2) With the receiver switched to M.W. and the tuning capacitor set to 550 m., set the signal generator to 546 kc/s. Adjust the unsealed adjustable core in the module for maximum output. (3) Set the tuning capacitor to 200 m., reset the generator to 1500 kc/s, and adjust T.C.2 for maximum output. (4) Repeat (2) and (3) till no further improvement can be achieved.

Aerial Alignment: (1) Connect the loop to the generator termination and set the generator to 600 kc/s. Tune the receiver till the maximum signal is received from the generator (500 m. on the tuning scale), and adjust the M.W. aerial coil for maximum output. (2) Set the generator to 1420 kc/s., tune the receiver till the maximum signal is received from the generator (approximately 210 m. on the tuning scale), and adjust T.C.1 for maximum output. (3) Repeat (1) and (2) till no further improvement can be achieved. (4) Switch the receiver to L.W.. Set the generator to 200 kc/s. Tune the receiver to 1500 m. and adjust the L.W. aerial coil for maximum output.

N.B. No I.F. alignment is required.
**General Description:** Stereo radiogram with four wavebands. Auto-changer, AT6 Mk. II Garrard automatic turntable with manual control. Pickup, Deram stereo transcription cartridge with high-compliance diamond stylus for both stereo and microgroove records. A 78 r.p.m. head available as extra. Stylus, Deram Diamond/s coding blue. 200–250 volts A.C. mains.

**Wavebands:** L.W. 1112–2069 m. M.W. 182–586 m. S.W. 16–8–51 m. V.H.F. 87·5–101 Mc/s.

**Alignment (Equipment):** Either power meter or A.C. volt-meter. A.M. signal generator (140 kc/s.–18·5 Mc/s.). F.M. signal generator (10·7 Mc/s. and 87–101 Mc/s.).

**Alignment (Notes):** During all tests a load of 15 ohms must be across each output (speaker or dummy). The power meter (or A.C. volt-meter) should be connected to the output of one audio amplifier. The volume control should be set to max. and the tone controls to min. The sig. gen. output should be adjusted to maintain 1 watt output. The sig. gen. earthy lead must be taken to an earth point as close as possible to the signal injection point.
DECCA

Alignment (A.M. I.F.): Depress M.W. button and fully close tuning gang. Disconnect wire from tap on M.W. aerial coil and inject 472 kc/s. signal into free end of wire via 0.01 μF. capacitor. Adjust cores of L14/15; L18/19 and L22 in this sequence for maximum output, keeping generator output as low as possible. Check and readjust if necessary. Replace wire to M.W. coil.

(H68) COMPONENT LOCATIONS—MAIN CHASSIS

Alignment (F.M. I.F.): Depress F.M. button and with gang fully closed inject a 10-7 mc/s. at 25 kc/s. deviation into base of TR2 via 0.01 μF. capacitor. Adjust cores of L5/6; L7/8; L16/17; L20/21; L23/24 in this sequence for maximum output, keeping generator output as low as possible. Check and readjust if necessary. Switch generator to A.M. position. Adjust VR1 for minimum output.
Alignment (M.W.): Inject signal via M.W. aerial lead (in series with 4700 ohms). Depress M.W. button. Set generator to 525 kc/s and with gang fully closed, adjust L26 for maximum output. Set generator to 1620 kc/s and with gang fully open, adjust C41 for maximum output. Repeat two above operations until no improvement can be made.

Set generator to 600 kc/s and with receiver tuned to this (500 m.) adjust L.9 for maximum output. Set generator to 1500 kc/s and with receiver tuned to this (200 m.) adjust C24 for maximum output.

Repeat two above operations until no improvement can be made.

Alignment (L.W.): Inject signal as for M.W. Depress L.W. button. Set generator to 145 kc/s and with gang fully closed adjust C43 for maximum output. Set generator to 170 kc/s and with receiver tuned to 1275 m. adjust L.9 for maximum output. Set generator to 240 kc/s and with re-
receiver tuned to 1800 m. adjust C24 for maximum output. Repeat the last two operations until no improvement can be made. Note: It will be necessary to re-check M.W. aerial alignment if L.W. aerial has been re-set.

Alignment (S.W.): Depress S.W. button. Inject signal into S.W. external aerial wire via 4.7 kΩ resistor.

Set generator to 5.85 Mc/s. and with gang fully closed adjust L25 for maximum output. Set generator to 18.3 Mc/s. and with gang fully closed adjust C39 for maximum output. Repeat two above operations until no improvement can be made. Set generator to 6.4 Mc/s. with receiver tuned to this and adjust L12 for maximum output. Set generator to 14 Mc/s. and with receiver tuned to this adjust C26 for maximum output. Repeat two above operations until no improvement can be made.

Alignment (F.M. R.F.): Depress F.M. button, but before commencing
alignment check that the F.M. tuner cover is fitted correctly. Set the generator to 87.5 Mc/s. Inject signal into external F.M. aerial lead and with gang fully closed, adjust L4 for maximum output. With gang open set generator to 101 Mc/s. and adjust C11 for maximum output. Repeat two above operations until no improvement can be made. Set generator to 90 Mc/s. and with receiver tuned to this, adjust L2 for maximum output. Set generator to 99 Mc/s. and with receiver tuned to this, adjust C5 for maximum output. Repeat two above operations until no improvement can be made. Set generator to 95 Mc/s. and with receiver tuned to this, adjust L1 for maximum output.

**Decoder Alignment (Equipment):** Double-beam oscilloscope and signal generator capable of composite signal on A.F. and R.F.

**Decoder Alignment (Procedure):**
1. Connect oscilloscope through 0.01 μF. to collector of TR27. With
(H71d) CIRCUIT DIAGRAM—727 (CONTINUED)

stereo generator adjusted for 50 mV. output and 19 kc/s. pilot tone, the generator is connected via C302. Tune T11 for maximum output approx. 2 mV. RMS.

2. Connect oscilloscope through 0.01 μF. to collector of TR28 and tune T12 for maximum output, i.e. approx. 6 mV, still keeping the input on C302.

3. Connect oscilloscope through 0.01 μF. to collector of TR29 and with stereo generator still at 19 kc/s. pilot tone, tune frequency doubling circuit to 38 kc/s., i.e. T13 for maximum output (6 mV).

4. With one beam of the oscilloscope on C1 and the other on C2 with a composite signal injected into C302 (with either left or right channel depressed on generator) the crosstalk can be observed on C1 or C2 by adjusting VR2 for minimum output.

5. Now connect signal generator to aerial input. With generator switched to R.F., tune the set into the appropriate frequency. With the oscilloscope leads connected to the speaker terminals final crosstalk can be adjusted by VR2.
RADIO SERVICING

**Loudspeakers:** Each channel has one 8-in. (15 ohms) and one 3-in. (15 ohms). Crossover point is 2500 c/s. External loudspeakers can be connected and these should have an impedance of 15 ohms. The following plugs are recommended—Hirschmann LS7 or LS8. Lumberg S34, S304 or S304N. The former can be obtained from Neoflex Ltd. and the latter from Super Electronics Ltd. The plug wiring is shown in the appropriate diagram. In one position the internal speakers are left on and in the other position (180° reversal) the internal speakers are muted.

![Diagram of Loudspeaker Plug](H65)

**Stereo Earphones:** The impedance should not be below 150 ohms. The plug is a standard Aerial Pressings RA 1826. If required, the plugs mentioned in the paragraph on loudspeakers, may also be used.

**Aerials:** Internal ferrite rod aerials are provided for M.W., L.W. and S.W. reception. In areas of weak signal strength an external aerial can be plugged into the M.W. aerial socket. Similarly an internal aerial is provided for V.H.F. reception, but an external aerial can be used. When an external V.H.F. aerial is used the internal aerial plug must be disconnected.

![Diagram of Transistors](H64)
### DECCA

**Voltage Readings:**

Pre-amplifier—Readings with respect to chassis

<table>
<thead>
<tr>
<th>Transistor</th>
<th>Collector</th>
<th>Base</th>
<th>Emitter</th>
</tr>
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<tbody>
<tr>
<td>TR11/21</td>
<td>6-1</td>
<td>0-3</td>
<td>3-4</td>
</tr>
<tr>
<td>TR12/22</td>
<td>7-7</td>
<td>1-3</td>
<td>2-3</td>
</tr>
<tr>
<td>TR13/23</td>
<td></td>
<td>1-8</td>
<td>3-4</td>
</tr>
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Power Amplifier—Readings with respect to positive tag...C401

<table>
<thead>
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<th>Transistor</th>
<th>Collector</th>
<th>Base</th>
<th>Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR14/24</td>
<td>5-7</td>
<td>3-0</td>
<td>3-3</td>
</tr>
<tr>
<td>TR15/25</td>
<td>18-0</td>
<td>1-4</td>
<td>1-3</td>
</tr>
<tr>
<td>TR17/27</td>
<td>22-5</td>
<td>1-1</td>
<td>0-8</td>
</tr>
<tr>
<td>TR16/26</td>
<td>44-5</td>
<td>23-0</td>
<td>22-5</td>
</tr>
</tbody>
</table>

Radio Unit—Readings with respect to chassis

<table>
<thead>
<tr>
<th>Transistor</th>
<th>Collector</th>
<th>Base</th>
<th>Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR1</td>
<td>0-2</td>
<td>8-7</td>
<td>8-8</td>
</tr>
<tr>
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<tr>
<td>TR3</td>
<td>0-2</td>
<td>5-3</td>
<td>5-9</td>
</tr>
<tr>
<td>TR4</td>
<td>0-2</td>
<td>6-7</td>
<td>7-0</td>
</tr>
<tr>
<td>TR5</td>
<td>3-0</td>
<td>7-6</td>
<td>8-2</td>
</tr>
<tr>
<td>TR6</td>
<td>2-7</td>
<td>7-5</td>
<td>8-1</td>
</tr>
<tr>
<td>TR7</td>
<td>0-6</td>
<td>7-5</td>
<td>7-8</td>
</tr>
</tbody>
</table>

**Transistor Replacement:** When soldering transistor connections, it is essential to use a heat sink (preferably reasonably sized pliers). If excessive heat is transmitted to the transistors, it could easily cause serious damage and transistors should not be subjected to a temperature above 60°F. It is also important to realise that the electric soldering iron should be earthed, irons often have a very slight leak and the resultant current can often damage a new transistor.
DEFIANT Model A503

**General Description:** Battery-operated portable receiver incorporating seven transistors and one crystal diode. The receiver has coverage of the long and medium wavebands, while an additional range provides electrical bandspread of the high frequency end of the medium waveband. At the top of the cabinet is the four part tuning scale which is also integral with the control panel. Controls comprise three push-buttons for waveband selection and two edge-operated control knobs, one for Volume and On/Off, the other for tuning. Cabinet back detachable for battery replacement.

**Wavebands:**
- L.W. band: 1070–1900 m. (280 to 158 kc/s.);
- M.W. band: 187–570 m. (1605–525 kc/s.);
- B.S. band: 187–210 m. (1605 to 1430 kc/s.).

---

**Notes:**
1. Voltages shown are negative with respect to chassis and measured with AVO No. 8 under no signal conditions and with volume control set to zero.
2. All values of resistance in ohms and all values of capacitance in mF unless otherwise stated.

* When alternative Dynaudio manufactured IF transformers are used values of capacitors marked thus become 250V.
**DEFIANT**

**Intermediate Frequency:** 470 kc/s., oscillator high with respect to signal frequency.

**Aerial:** An internal ferrite rod aerial is fitted serving the three ranges, and a socket is provided at the side of the receiver for use with a car aerial.

**Automatic Gain Control:** One controlled stage.

**Battery and Consumption:** One 9-volt PP7 or U.K. equivalent. Consumption is 12 mA. quiescent and 17 mA. at average listening level.

**Audio Output:** 500 mW.

**Loudspeaker:** 5½ in. × 3 in. elliptical. Impedance 15 ohms. Flux density 9500 lines per square centimetre.

**Transistors:** Mullard Type: VT1 AF117 mixer/oscillator; VT2 AF117 I.F. amplifier; VT3 AF117 I.F. amplifier; VT4 OC71 audio amplifier;

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**Circuit Diagram—Model A503 (Continued)**

(F6b)
VT5 OC81D or AC128 driver stage; VT6 and VT7, OC81 (or AC128). Push–pull output matched pair.

Crystal Diode: D1 OA90 detector.

Earpiece Socket: A socket is provided at the side of the receiver into which may be plugged an earpiece of 200–1000 ohms impedance. Alternatively, this socket may be used with an external loudspeaker of 15 ohms, or for tape recording provided that the recorder has an input impedance of not less than 15 ohms.

Removing the Chassis: Place the cabinet face downwards, remove the detachable back, then remove the battery. Unscrew the four 4BA cheese-head screws securing the chassis to the cabinet (one screw to each corner of the chassis). Lift out the chassis to the extent of the aerial and loudspeaker leads. Unsolder the leads if total removal of the chassis required.

Replacement: Replace by reversing the above procedure.

Alignment Procedure: Preliminary Notes: Equipment required: (a) An A.M. signal generator to cover 158 kc/s–1605 kc/s. (b) An output wattmeter with a range 0–500 mW. to match 15 ohms impedance. (c) A non-metallic trimming tool for adjusting the iron dust cores and R.F. trimmers. (d) A 0·1 μF. capacitor for I.F. injection purposes, a 10 pF. capacitor for injecting R.F. calibration signals into the aerial socket and an 8·2k resistor for temporarily desensitising the receiver under conditions of interference. The I.F. and R.F. alignment may be carried out after removing the back of the cabinet. Connect the output meter to the receiver by means of the earpiece socket and a suitable plug.

Warning: If the output meter is connected in parallel with the loudspeaker care must be exercised to ensure that the power output is not allowed to rise to a level high enough to damage the output transistors (not greater than 75 mW.).

The signal generator should be switched on about 15 minutes before commencing the alignment. Set the volume control to maximum, and maintain the output at 50 mW. by adjusting the input signal each time a trimming adjustment is made (20 mW. if the loudspeaker is left in circuit).

I.F. Alignment: Switch the receiver to the medium waveband and set the tuning pointer to about 300 m. Set the signal generator to 470 kc/s., modulated 30 per cent. at 400 c/s. Connect the output via a 0·1 μF. isolating capacitor to the base of VT1 (junction of R2 and R3), the chassis connection being the return point for the signal. Align IFT3, IFT2 and IFT1, in that order, for maximum audio output. Align each transformer once only.

R.F. Alignment: Note: Ensure that the tuning pointer is in line with the datum dot at the low frequency end of the tuning scale when the tuning gang is fully meshed.

Oscillator Circuits: The signal generator should be connected to the aerial socket via a 10-pF. capacitor. Under conditions of interference, the receiver may be temporarily desensitised by connecting an 8·2k resistor between the junction of R6 and R13, and chassis.
### Operation Waveband | Sig. gen. frequency (mod. 30% 400 c/s.) | Tuning pointer setting | Adjust for maximum output
--- | --- | --- | ---
1 | M.W. | 600 kc/s. | 500 m. | L10/11/12 CT4
2 | M.W. | 1500 kc/s. | 200 m. | CT5
3 | L.W. | 214 kc/s. | 1400 m. | CT4
4 | B.S. | 1439 kc/s. | 208 m. | CT3

**Aerial Circuits:** The signal generator should be coupled to the receiver by a loop of insulated wire placed about 3 ft. from the cabinet and with its plane at right-angles to the ferrite rod aerial.

### Operation Waveband | Sig. gen. frequency (mod. 30% 400 c/s.) | Tuning pointer setting | Adjust for maximum output
--- | --- | --- | ---
1 | M.W. | 600 kc/s. | 500 m. | Adjusting ring CT2
2 | M.W. | 1500 kc/s. | 200 m. | CT2
3 | L.W. | 214 kc/s. | 1400 m. | No adjustment CT1
4 | B.S. | 1500 kc/s. | 200 m. | CT1

* See ferrite aerial connections.
Replacement of Drive Cord: To replace the drive cord, first remove the chassis from the cabinet as described in the dismantling procedure. Set the tuning capacitor to maximum, then remove the two Phillips head screws securing the scale backing plate and lift clear. Remove the twin scale pointer assembly and fit the replacement drive cord in accordance with the diagram.

Replace the scale pointer assembly and backing plate ensuring that the left-hand pointer is in line with the datum dot at the low frequency end of the scale with the tuning gang fully-meshed.

Modifications: On some models VT5-7 are type AC 128 and R8 on later models is 82 ohms ± 10 per cent. 0.2W.

General Description: This SRX24 series of tuner amplifiers is used in the following Dynatron models: SRX24-TRV16, TRV17, HFC3A and HFC3M: SRX24A-RG46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56 and 57; SRX24B-HFC4.

All chassis are electrically similar but differ mechanically as follows:
SRX24 has a horizontal scale and fixed A.M. bands "Ferrite" aerial.
SRX24A has a horizontal scale and a rotable A.M. bands "Ferrite" aerial.
SRX24B has a vertical scale and a fixed A.M. bands "Ferrite" aerial.

The chassis are further subdivided into "20" series and "25" series by the use of alternative mains transformers. "20" series: RG46, 47, 51, 56, HFC4, TRV16; "25" series: RG48, 49, 50, 52, 53, 54, 55, 57, HFC3A, HFC3M, TRV17.

With the exception of RG55, all models fitted with record player units use the Sonotone 9TAHC cartridge with diamond L.P. stylus. Model RG55 is fitted with a Pickering V15/AC-1 magnetic cartridge with diamond stylus. TRV16 and TRV17 have a pickup socket provided on the rear socket panel to accept either a Piezo or Magnetic cartridge. Frequency compensation is to R.I.A.A. curve and is automatically applied for each type of cartridge depending on the manner in which the plug is wired.

Audio Amplifier Section: The circuit diagram shows the L.H. channel only since the R.H. channel is identical. VT1 is an equalised P.U. pre-amp. stage with sensitivity suitable for magnetic cartridges of medium output (5 mV. will fully drive the amplifier). Piezo cartridges must have a series resistor of the order of 100 kΩ to give cartridge constant velocity output.

Note: Realignment of the decoder circuits should NOT be attempted unless complete encoding equipment is available.

(W3) PRINTED PANEL—R.F., I.F. DECODER STAGES

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Removal of SRX24 Series Chassis From Cabinets

RG46, 47, 48, 49, 50, 53, 54 and 56: 1. Remove cross-head screws from front edge and rear of control panel facia. 2. Remove external plugs from sockets panel. Lift up front edge of facia to expose chassis and remove leads to gram motor, interior lamp, pickup, loudspeaker and mains transformer. 3. Feed mains lead through aperture at rear of cabinet and withdraw facia and chassis together.
**DYNATRON**

**RG51, 55 and 57:** 1. Remove sockets section panel from rear of cabinet after removing external plugs. 2. Remove mains transformer plug lead and disconnect loudspeaker leads. Release sockets panel from its mounting studs. Remove cross-head screws from top of facia and smaller screws from rear of facia edge. Lift up facia and chassis complete and remove leads to gram motor, interior light and pickup. Withdraw facia and chassis with sockets panel up through cabinet.

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(W1b) Circuit Diagram Tuner Amplifier—Model SRX24 (Continued)

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HFC3A and M, TRV16, TRV17: 1. Remove base of cabinet and release four nuts holding main chassis to front of cabinet, also two nuts holding sockets panel. 2. (a) HFC3. Release plugs connecting gram motor, pickup and mains transformer. (b) TRV16. Release loudspeaker leads and mains transformer plug lead. (c) TRV17 Release mains transformer plug lead.
DYNATRON

**HFC4:** 1. Remove base of cabinet and release plug leads for gram motor, interior lamp, loudspeakers and mains transformer. 2. Remove two nuts holding sockets panel to cabinet. 3. Remove screws holding facia panel in position, lift up facia and withdraw complete assembly through top of cabinet.

**Main Chassis:** To work on underside of audio print panel, release the three special studs securing board and lift up panel by hinging on the cable form immediately behind the control potentiometers (front of chassis).

To work on underside of receiver print panel, release four special studs securing board and unsolder leads to ferrite aerial and tuning gang so that the board may be lifted and hinged on the cable form at front of chassis.

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**DYNATRON Models TP30, TP31 and TP32**

**General Description:** The "Jewel" model TP30 is a seven-transistor battery-operated portable radio receiver covering the long and medium wavebands. Sockets for car aerial and earphone are incorporated. The "Sapphire" models TP31 and TP32 incorporate the additional features of a short waveband with a telescopic aerial, and a tape-recording socket.

**Batteries:** 2 × 9 volts (PP7 or equivalent). Loudspeaker 25 ohms.
Chassis Removal

Model TP30: Remove rear cover. Disconnect battery and speaker leads. Remove all control knobs to free dial scale and expose the two 4BA nuts holding top chassis. Remove nuts to free chassis. Remove wood-screw holding bottom printed panel chassis to floor of cabinet, and slide out panel to rear.

Models TP31, TP32: Remove rear cover. Disconnect the battery and
speaker leads, also the leads to earphone, tape and car aerial sockets, and telescopic aerial. Remove all control knobs to free dial scale and expose the two 4BA nuts holding top chassis. Remove nuts to free chassis. Remove left-hand battery bracket, and wood screw holding bottom printed panel chassis to floor of cabinet, and slide out panel to rear.

**Alignment: I.F.:** Inject 470 kc/s. across L4. Adjust L13, 12, 11, 10 and 9 for maximum output.
**R.F.:** Check that the pointer travels symmetrically within the scale aperture between the limits of the gang travel. Set up a standard loop aerial with its axis parallel to the receiver aerial and about 2 ft. away for M.W. and L.W. For S.W. feed signal through dummy aerial to aerial socket.

**Models TP31, TP32 only:** Switch to S.W. and feed in a signal at 6 Mc/s. Adjust S.W. oscillator coil and aerial coil turns for maximum output. Close aerial trimmer VC1A and feed in a signal at 15 Mc/s., adjust oscillator.
trimmer VC2A for second peak. Adjust aerial trimmer VC1A for maximum output, reducing capacity until oscillator goes off tune then increase capacity to a point where it comes back to tune.

All Models: 1. Switch to M.W. and tune receiver to I.F. end of scale. Feed in a signal at 540 kc/s. Adjust L8 core for maximum output. 2. Tune receiver to H.F. end of scale. Feed in a signal at 1640 kc/s. Adjust VC2A for maximum output model TP30, VC5 for maximum output TP31, TP32.
3. Repeat 1 and 2 until no further improvement can be made. 4. Switch to L.W. and tune to Radio 2 programme. Feed in a signal at 200 kc/s. and adjust VC4 for maximum output. 5. Switch to M.W., feed in a signal at 600 kc/s., tune in on receiver. Adjust L3 for maximum, and peak with VC6. 6. Feed in a signal at 1300 kc/s., tune in on receiver. Adjust VC1A for maximum output. 7. Repeat 5 and 6 until no further improvement can be made. 8. Switch to L.W. Feed in a signal at 160 kc/s., tune in on receiver. Adjust L1 on rod for maximum output. 9. Feed in a signal at 260 kc/s., tune in on receiver. Adjust VC3 for maximum output. 10. Repeat 8 and 9 until no further improvement can be made. 11. Check the calibration on M.W. adjusting position of pointer on drive cord to minimise residual errors.
General Description: Fully transistorised A.M./F.M. receiver with power derived from battery or mains. Facilities for tape recorder, record player and private listening. Battery six 1.5 volts dry cells (type U2). Speaker 8 ohms.


Alignment: Figures quoted for sensitivity, etc., in the instructions that follow are based on the assumption that new batteries are in use. Test equipment required: Signal generator(s) covering the two intermediate frequencies (465 kc/s. and 10.7 Mc/s.), the A.M. range (150 kc/s.-22 Mc/s.) and the F.M. band 88-108 Mc/s. Output meter matched to 8 ohms with plug to mate with telephone socket.
EDDYSTONE

Trimming tools: Miniature insulated screwdriver with \( \frac{1}{16} \) in. blade (length 2 in. maximum), small metal-tipped insulated screwdriver and a Neosid HSi hexagonal core adjuster.

When aligning either I.F. channel, the four screws which retain the two angle strips on which the I.F. board is mounted should be removed. The board can then be re-mounted at right-angles to its normal position using two screws only. All dust cores will then be accessible and there is no need to unsolder connections to the board.

465 kc/s. Stages: Stand the receiver on one end to allow connection of the generator output lead to the Range 5 mixer coil L11 (see underside view of receiver). The generator should be arranged to provide a 50-ohm source and the earth lead can be clipped to the screen adjacent to the coil. Disable the local oscillator by shorting out the forward section of the tuning gang (C48) and then plug the output meter into the telephone socket. The speaker is automatically disconnected on insertion of the plug and the meter if matched to 8 ohms will read the true output power. Switch on the
generator, allow it adequate time to stabilise against drift and then set the
receiver controls as follows: Range Switch, Range 5; Volume, Maximum;
Tuning, 350 kc/s.; Tone, Fully clockwise. Tune the generator to 465 kc/s.
(with modulation 30 per cent. at 400 c/s.) and then set the attenuator to give a
reading of approximately 50 mW. on the output meter. Peak the cores in
IFT1, IFT2 and IFT3 for maximum output, setting all cores to the “outer”
peak. Re-check each adjustment several times to ensure accurate alignment
and then set the attenuator for an output reading of 50 mW. Input should
be of the order 4 µV. If the I.F. sensitivity is lower than this figure, check
the A.F. sensitivity by introducing an audio generator across RV3. At
1000 c/s. an input of 5 mV. should give an output of 50 mW. Disconnect
the generator(s) and remove the shorting link from C48 on completion of the
alignment.

10-7 Mc/s. Stages: N.B.: The 10-7 Mc/s. I.F. Transformer L21/L22 is
not aligned with the other 10-7 Mc/s. circuits. It forms part of the F.M.
tuner unit and is adjusted when aligning this unit later in the alignment
procedure.

Switch on the generator, allow adequate time to stabilise against drift and
set all receiver controls as for 465 kc/s. alignment except the range switch
which should be at F.M. Short out the one discriminator diode D4 and con-
nect the output meter to the telephone socket as before. Tune the generator
to 10-7 Mc/s., adjust for 30 per cent. modulation at 400 c/s. and then connect
its output lead to tag 16 at the right-hand end of the I.F. board. The
adjacent tag 17 can be used as an earthing point.

Peak the cores in the 10-7 Mc/s. transformers IFT4, IFT5 and IFT6
on their “outer” peak for maximum reading on the output meter. Remove
the short from D4 and adjust the secondary (top) core of IFT6 for minimum
signal.

I.F. sensitivity using an A.M. signal and with D4 shorted should be of the
order 30 µV. for 50 mW. output. RV1 can be adjusted if necessary to
achieve this figure.

R.F. Alignment: (Ranges 1–5): The first step in this part of the procedure
is a check on the overall calibration accuracy. Proceed as follows: Standard-
ise the generator calibration against a reliable frequency standard and connect
its output lead to the “At” socket and “earth.” The shorting plug should
be in position between “AE” and “earth.” Select Range 1 and tune the
generator and receiver to each megacycle point in turn noting the degree of
error present. Errors should not exceed 1 per cent. (i.e. 180 kc/s. at 18
Mc/s., 90 kc/s. at 9 Mc/s., etc.). Repeat on Range 2 and then select Range 3.
Checks should be made at 500 kc/s. intervals on this range followed by checks
at 100 kc/s. intervals on Ranges 4 and 5.

Oscillator adjustments should not be touched unless errors of greater
than 1 per cent. are detected. If realignment is found to be necessary, carry
out normal tracking procedure using trimmers at the high frequency end
of the band and cores at the low frequency end. Each adjustment must be
Repeated several times to ensure accurate alignment. Alignment frequencies and adjustments are listed in the table which follows:

<table>
<thead>
<tr>
<th>Range</th>
<th>Frequency</th>
<th>Trimmer</th>
<th>Frequency</th>
<th>Core</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20.0 Mc/s.</td>
<td>C39</td>
<td>8.6 Mc/s.</td>
<td>L12</td>
</tr>
<tr>
<td>2</td>
<td>8.0 Mc/s.</td>
<td>C40</td>
<td>3.6 Mc/s.</td>
<td>L13</td>
</tr>
<tr>
<td>3</td>
<td>3.5 Mc/s.</td>
<td>C41</td>
<td>1.5 Mc/s.</td>
<td>L14</td>
</tr>
<tr>
<td>4</td>
<td>1400 kc/s.</td>
<td>C42</td>
<td>550 kc/s.</td>
<td>L15</td>
</tr>
<tr>
<td>5</td>
<td>330 kc/s.</td>
<td>C43</td>
<td>160 kc/s.</td>
<td>L16</td>
</tr>
</tbody>
</table>

Alignment of the R.F. (Aerial) and Mixer circuits can now be commenced. The generator is connected to "A1" and "earth" as before but must now be adjusted to match the receiver input impedance (75 ohms) for Ranges 1/3 and 400 ohms for Ranges 4/5. The output meter is connected as for I.F. alignment. Adjustments are made at the same frequencies used for oscillator alignment but using the adjustments listed in the following table. Care should be taken to ensure that the aerial circuits are set for best s/n ratio.

<table>
<thead>
<tr>
<th>Range</th>
<th>Trimmer</th>
<th>Core</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Aerial</td>
</tr>
<tr>
<td>1</td>
<td>20.0 Mc/s.</td>
<td>C3</td>
</tr>
<tr>
<td>2</td>
<td>8.0 Mc/s.</td>
<td>C4</td>
</tr>
<tr>
<td>3</td>
<td>3.5 Mc/s.</td>
<td>C5</td>
</tr>
<tr>
<td>4</td>
<td>1400 kc/s.</td>
<td>C6</td>
</tr>
<tr>
<td>5</td>
<td>330 kc/s.</td>
<td>C7</td>
</tr>
</tbody>
</table>

On completion of these adjustments, select 550 kc/s. on Range 4, tune the generator to 465 kc/s. and increase its level until an indication is obtained on the output meter. Adjust the I.F. rejector coil L1 for minimum signal.

**F.M. Alignment:** Alignment of the F.M. tuner unit is most conveniently carried out by using an A.M. signal and with D4 shorted out as in alignment of the 10.7 Mc/s. stages. The generator is required only to establish the accuracy of the dial calibration, all other adjustments being made on noise to avoid the need for continual re-tuning of the generator to cope with pulling of the receiver oscillator which occurs when either the input or output circuits of the mixer transistor are re-tuned.

The calibration check should be carried out at 100 Mc/s. with the generator connected either to the F.M. coaxial socket or to "A2" and "earth". Oscillator trimmer C106 should be adjusted to nullify any error which may be present. Now switch off the generator and adjust C99, L21 and L22 for maximum noise output. Re-check C106 setting at 100 Mc/s. and then carry out a sensitivity check at this frequency. A figure of the order 10 µV. should be obtained for 50 mW. output. Finally, tune the generator to 10.7 Mc/s. and adjust the I.F. rejector L17 for minimum signal output. Disconnect the short across D4 before putting the set back into its case.

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Drive Cord: In the instructions that follow, right-hand and left-hand are as viewed from rear of set.

1. Remove the existing cord and set the tuning gang to full mesh.
2. Tie a double knot in one end of the replacement cord and feed the cord through the hole provided in the left-hand drive pulley with the knot on the inside of the rim. The hole should lie at approximately "4 o'clock".
3. Wind approximately one and a half turns anti-clockwise round the drive pulley and then pass the cord under and over the left-hand guide pulley.
4. Pass the cord across the dial from left to right and then, while holding the free end of the cord in tension, rotate the tuning control to fully unmesh the tuning gang. This operation will wind just over three complete turns of cord on to the left-hand drive pulley and tension must now be maintained to prevent the cord from slipping out of the pulley groove.
5. Pass the cord clockwise round the jockey pulley (right-hand side of the receiver) and then back across to the right-hand drive pulley. Feed the cord into the pulley groove and then through the hole in the rim (hole lies at about "10 o'clock"). Increase the tension on the cord until the outer rim of the jockey pulley takes up a position level with the nearest edge of the panel handle retaining screw. Mark the cord with a pencil at the point where the retaining knot must be tied.
6. Free the cord from the jockey pulley and while maintaining tension, draw the cord through the hole in the right-hand drive pulley until it tightens on the left-hand guide pulley.
7. Tie a double knot at the position marked in (5) above and then cut off the surplus cord. Feed the cord back through the hole and replace in position round the jockey pulley.
8. Set the tuning gang to full mesh and slide the pointer to "o" on the logging scale. Attach the pointer to the cord (when viewed from above the
cord should pass under the two outer prongs at the rear of the pointer carrier) and then check the drive for free normal operation.

**Aerials for Use on Ranges 1–5:** The type of aerial used with the EB35 receiver will depend to a large extent on the permanency of the installation. Reasonable results may be obtained in a temporary installation with a relatively short length of wire located indoors. Some 15–20 ft. of insulated wire run round the picture rail will provide reception from all long and medium wave stations serving the area; many of the high-powered short-wave stations should also be audible at good strength. Such an aerial is of course relatively inefficient and it should be realised that signals are received only because of the high receiver sensitivity.

An outside aerial is strongly recommended for a permanent installation, permitting reception from a greater number of stations with a lower level of background noise. A suitable aerial could take the form of some 30–60 ft. of insulated wire strung between two insulators and located as high as conveniently possible. It should be kept well away from local obstructions (especially those of metallic construction). The down-lead can be taken from either end or from any point along the length of the horizontal top and should be run well clear of house guttering, etc., to avoid any loss in the available signal voltage. Soldered joints should be used where connections are needed.

Aerials of the types so far described are known broadly as “single-wire” or unbalanced aerials and are connected to socket “A1”. The socket marked “AE” should be linked to the “earth” terminal using the special shorting plug supplied. Improved results may be obtained when the wire length is less than 15 feet if the “A2” socket is used for the aerial connection. “A2” should also be used for connecting short rod aerials when a longer aerial is not available as for example when using the receiver in a vehicle.

For serious short-wave reception a further improvement can be obtained if a balanced aerial is employed. One type which falls in this category and involves no difficult constructional problems is the dipole aerial. This takes the form of a letter “T” in appearance, the horizontal portion being the aerial proper and the vertical section the downlead or feeder. Any wire of adequate strength (either insulated or bare) can be used for the top while the feeder can be any good quality twisted flex suitable for outside use (e.g., plastic covered). Special feeder cables are manufactured for this specific application but these are more expensive and offer little in the way of advantage for a normal domestic installation. They can of course be employed if the user so wishes.

For general short-wave reception the overall length of the horizontal portion should be of the order 50–60 ft., the wire being broken at the centre with each lead connected separately to the feeder cable. An insulator is used at this point to facilitate connection and provide mechanical support for the feeder. The length of the feeder is of minor importance and little attention need be paid to its actual positioning. The aerial proper should be erected
as high as conveniently possible using insulators for supporting the two ends of the wire.

If attention is centred in one specific short-wave broadcast band, performance can be optimised at this frequency by cutting the aerial to a predetermined length. Overall lengths for the main broadcast bands are as follows: 49 m.: 76 ft., 31 m.: 48 ft., 25 m.: 39 ft., 19 m.: 30 ft., 16 m.: 26 ft., 13 m.: 21 ft. Overall lengths (in feet) for other bands can be calculated by dividing 468 by the frequency in megacycles.

When using a twisted flex feeder of the type described above one feeder wire is connected to the "A1" socket and the other to the "AE" socket. The special shorting plug is removed and can be stored in the "A2" socket to avoid loss. The same connections are employed when using a standard flat twin transmission line. Coaxial feeders are unbalanced and are connected as follows. Braid to "earth" terminal, inner wire to "A1", shorting plug in position between "AE" and "earth" terminal. On the lower frequencies the dipole can be operated as a single-wire aerial by strapping together both the feeder wires and connecting to the "A1" socket. This will give greater signal pick-up and increase the versatility of the aerial.

In some cases it will be found that reception can be improved if an earth connection is made to the "earth" terminal. One benefit is a reduction of locally generated electrical interference especially when listening on the lower frequencies in the tuning range. The earth lead should be as short and direct as possible connected to a water pipe or an external earth rod.

Aerials for F.M. Reception: In the case of a permanent installation it will usually be found best to employ an outside aerial except when the receiver is situated very close to the transmitting station. A wide variety of commercial designs are available, but one should be selected of a type which is most suited to local conditions. Such an aerial will have a coaxial feeder which should be terminated with the plug supplied and connected to the "F.M." aerial socket.

For F.M. reception in regions of high signal strength an indoor aerial will usually suffice. The simplest type of indoor aerial takes the form of a short piece of insulated wire some 4–6 ft. in length connected to the "A2" socket. Its position will have quite a marked effect on reception and some experimentation is called for if optimum results are to be achieved.

Greater signal pick-up and reduced background noise are features of the dipole aerial already referred to in connection with A.M. reception on the short-wave bands. A dipole suitable for receiving F.M. signals in the V.H.F. band is relatively small and can be conveniently made from a length of ordinary twisted flex. Unravel some 30 in. at one end and straighten the two wires to form a horizontal top with an overall length of approximately 60 in. Tape the flex to prevent further unravelling. The remainder of the lead will serve as the feeder; one wire being connected to the "A2" socket and the other to the "earth" terminal.

As with the single-wire aerial, various positions should be tried for best
results and it may be found convenient to tape the aerial proper to a short length of bamboo cane to facilitate handling the wire which should be kept in a horizontal plane. Once the best position has been determined, the wire can be removed from the cane and tacked to a picture rail or otherwise retained in an unobtrusive location.

Use of the F.M. Attenuator: In some installations it may be found that too strong a signal is picked up by the aerial, especially when this is an outdoor type located only a few miles from the broadcast station. Excessive signal input to the receiver will be indicated by distorted output and a tendency for the station to remain in tune when the tuning is off-set from the correct tuning point. If this effect is noticed, it can be eliminated by removing the aerial plug from the set, plugging it instead into the attenuator and connecting this to the “F.M.” aerial socket.

Batteries: To fit the batteries, first unscrew the two knurled screws which retain the battery box at the rear of the receiver. Carefully remove the box and free it from the receiver proper by disengaging the battery connector. Lay the box on a flat surface and take off the inner cover. Arrange the batteries in two groups of three and then slide them into the battery troughs.

Dial Bulbs: Faulty bulbs can be changed by levering the holders free from the rubber mounting grommets at the extreme ends of the dial. Replacements should be of the L.E.S. type with a rating of 6 volts at 50 mA.

Mains Operation: The receiver can be operated directly from all standard A.C. mains supplies by fitting a Power Unit Type 924 in place of the battery container. The P.U. gives an output of 9 volts and has the same physical size and fixing arrangements as the normal battery box.
Removing the Cabinet

1. Remove the battery container by unscrewing the two knurled retaining screws and disengaging the battery connector.
2. Remove the four cabinet retaining screws located at the rear.
3. Free the cabinet from the panel by applying pressure with the fingers between the rear inner edge of the cabinet and the ends of the strip which supports the I.F. printed board near the top of the cabinet.
4. Slide the cabinet away from the panel.

Circuit Modifications:

1. Two reverse-connected diodes (DD006) have been added to the aerial input. The two diodes should be referred to as D6 and D7—they are connected directly across the Ai and AE sockets. See circuit diagram model EB36 in this volume.
2. C68 is 1 μF.
3. R27 is 1500 ohms.
4. Loudspeaker is 8 ohms.
5. IFT3 secondary winding is not tuned by dust core.
6. TR9 and TR11 are Mullard AC128.

EKCO Model PT302

General Description: This receiver is electrically similar to the Pye Model 1369 described elsewhere in this volume.

EKCO Model PT304

General Description: This receiver is electrically similar to the Pye Model 1372 described elsewhere in this volume.

EKCO Model PT305

General Description: This receiver is electrically similar to the Pye Model 1373 described elsewhere in this volume.

EKCO Models PT300, PT447

General Description: These models are electrically similar to the Pye Model 1370 described in the 1966–67 volume.
General Description: A six-transistor, M.W./L.W. pocket radio, with outlet socket for earphone (40 ohms).

Battery: 9 volts. PP3 or equivalent. Quiescent current 6–8 mA.

To Remove Chassis: The back cover is a close tolerance fit and is simply prised from the case, a thumb nail slot at the base of the cabinet being provided to facilitate removal. Remove battery. To release the interior panel, undo the three chassis fixing screws. Unsolder loudspeaker and earphone leads. To remove loudspeaker, undo the two screws clamping it in.

Trimming Procedure

<table>
<thead>
<tr>
<th>Apply signal as below:</th>
<th>Set receiver controls to:</th>
<th>Adjustment in order for maximum output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 470 kc/s. across L1 with 0·1 µF. capacitor in each lead</td>
<td>M.W. Low frequency end</td>
<td>Cores of T3, T2 and T1</td>
</tr>
<tr>
<td>2. 600 kc/s. to rod aerial via search coil at 11 in. from centre of rod</td>
<td>M.W. 500 metres</td>
<td>Core of L5 and position of L2 on rod</td>
</tr>
<tr>
<td>3. As 2, but 1500 kc/s.</td>
<td>M.W. 200 metres</td>
<td>Trimmers C6 and C1</td>
</tr>
<tr>
<td>4. Repeat 2 and 3 until calibration is correct</td>
<td>Seal L2 with polystyrene dope</td>
<td></td>
</tr>
<tr>
<td>5. As 2, but 214 kc/s.</td>
<td>L.W. 1400 metres</td>
<td>Trimmer C8 and position of L4 on rod</td>
</tr>
<tr>
<td>6. Seal L4 with polystyrene dope</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
(W32b) CIRCUIT DIAGRAM—MODEL PTP301 (CONTINUED)
(H9a) CIRCUIT DIAGRAM—ELIZABETHAN MODEL LZ3 (PART)
ELIZABETHAN

Model LZ3

General Description: Car radio incorporating Mullard R.F./I.F. amplifier module type LP.1166.

Module: The module is pre-aligned during manufacture and no further adjustments are necessary (or recommended) and no attempt should be made to open the sealed case.

Permeability Tuner: This unit is also accurately pre-aligned and the only operations required are specified in the paragraphs dealing with alignment.

M.W. Alignment: Select M.W. and tune receiver to high frequency end of band. Set signal generator to 1620 kc/s, and connect via 80 pF. capacitor to the aerial socket. Adjust TC2 for signal and TC1 for max.


(H9b) Circuit Diagram—Model LZ3 (Continued)

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RADIO SERVICING

A.F. Stages: The audio signal appears across the volume control VC1. A tape recorder socket is connected to the slider (on later models to the junction with Module pin 8). Increase the level of the injected signal until the output waveform (when viewed on a scope) just distorts, then adjust VC2 for symmetrical clipping.

Dismantling: Remove the control knobs, decorative nuts, tuning scale and silver bezel. Remove the Phillips-head screws from the top, bottom and sides of the case. Access to the component side of the printed circuit board and to the components on the rear panel can now be gained. Should it be necessary to work on the print side of the board carefully bend the metal tabs which secure the top and bottom edges of the board to the front panel.

Circuit Modifications: C9 is connected to module pins 3 and 4 on some models. C16 is sometimes omitted. C15 is taken to slider of VC1 on some models.
**General Description:** Car radio, employing six transistors and two diodes, for operation on a 12-volt positive or negative ground supply. The polarity is selected by a two pole changeover switch.

**I.F. Alignment:** Connect signal generator across R18—use blocking capacitor. Set generator frequency to 472 kc/s. and adjust I.F. T2 and I.F. T1 for max.

**M.W. Alignment:** Connect signal generator, via 80 pF. capacitor, to aerial socket. Tune receiver to high frequency end of band and select M.W. Set generator to 1260 kc/s. and adjust TC2 and TC1 for max. Check sensitivity at 1260 kc/s., 1500 kc/s. and 600 kc/s.

**L.W. Alignment:** Connect signal generator as for M.W. Select L.W. and tune receiver to 1500 m. Inject 200 kc/s. and adjust L7 for signal. Inject 230 kc/s., tune in receiver and adjust L4 and L2 for max. Check sensitivity at 230 kc/s.
Radio Servicing

Alignment Notes: The output of the receiver must be kept below 800 mV. during alignment, to prevent A.G.C. action.

Sensitivity: M.W. and L.W. 6-5 µV. average, 12 µV. max. I.F. 30 µV.
All sensitivities given for 50 mW. into 3 ohms.

TR5: Inject a signal as for L.W. alignment (230 kc/s.), and with a C.R.O. (continued opposite)

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H11a

All voltage readings taken with avoB on 25V range
All resistors x5 watts 10% unless otherwise stated.

(H11a) Circuit Diagram—Model LZ7 (Part)

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Model LZ15

General Description: Car radio, employing six transistors and two diodes, for operation on a 12-volt positive or negative ground supply.


M.W. Alignment: Pull out the button of a M.W. selector. Tune to high frequency end of band and fully depress the button. Connect signal generator, via 80 pF. capacitor, to aerial socket. Inject 1625 kc/s. Adjust TC3 for signal and TC1 and TC2 for max. Check sensitivity at 1625 kc/s., 1260 kc/s., 1500 kc/s. and 600 kc/s.

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across output, adjust VR2 for symmetrical waveform clipping (signal input must be increased until waveform just clips).

**Dismantling:** Remove control knobs, decorative nuts, tuning scale and silver bezel. Remove the Phillips-head screws from top, bottom and sides of case. Access to both sides of the printed board can now be obtained.

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**alignment:** Select L.W. (button) and tune receiver to 1500 m. Connect signal generator as for M.W. Inject 200 kc/s. and adjust L7 for signal. Inject 230 kc/s. and adjust L4 and L2 for max. Check sensitivity at 200 kc/s. and 230 kc/s.

**Alignment Notes:** The output of the receiver must not be allowed to exceed 800 mV., to prevent A.G.C. action.

**Sensitivity:** M.W. and L.W. 2 to 6 µV. I.F. 30 µV. A.F., 50 mV. (input to volume control). All sensitivities given for 50 mW. output except A.F. sensitivity which is given for 1·5 watts output.

**Dismantling:** Remove control knobs, decorative nuts, plastic trims and silver bezels. Remove Phillips-head screws from top and sides of case. Access to the printed side of the circuit boards can now be obtained. For
access to components on audio board, unsolder link wires, slacken volume control lock-nut and pivot small board on volume control shaft. For access to components on R.F. board. Unsolder connections on TC1 and aerial feeder. Unsolder lead from C4 at the earth tag. Remove three screws holding push-button unit to case bottom plate. The complete chassis may now be lifted and turned over. TC1, C4 and aerial feeder may now be re-connected with jumper leads for functional testing.

Pre-Selector Unit: There are five push-buttons, four for medium waves and one for long wave. To obtain a M.W. station, select any button except the right-hand one and pull it out to its full extent. Tune in the
required station with the right-hand control knob. When the station is tuned in, push in the button as far as it will go and then allow it to return to its normal position. Repeat this procedure with the other three M.W. buttons. Setting up the L.W. station is done in a similar manner. Once set up, pressing each button will tune in the selected station. Manual tuning can be carried out normally on M.W., but when manual tuning is required on L.W. the L.W. button must be depressed.

Warning: The unit must not be dismantled and the setting of the coil tuning slugs must not be altered.
(H14) COMPONENT LOCATIONS—MODEL LZ15
**FERGUSON**

**FERGUSON Model 3010**

**General Description:** Record player with 2.5 watts output. Changer, BSR UA25 four-speed automatic. Cartridge, type XiH with turnover styli ST5. Speaker, elliptical 3 ohms. A.C. mains 230-250 volts, 50 c/s.

**Dismantling (Changer and Amplifier):** 1. Remove ventilation panel from inside cabinet (two screws). Take out five screws and cup washers along the edges of the motor board. Unscrew transit screws to secure changer chassis and lift the motor board by the left-hand transit screw. The board can now be rested on its rear edge diagonally across the cabinet floor.

2. The amplifier chassis is secured to the inside of the cabinet by two 4BA screws which locate the top right-hand and bottom left-hand corners. Before removing, pull off two control knobs and remove nuts and washers to free chassis.

3. To separate the assemblies, unsolder the pickup leads and motor board earth lead from the amplifier tag panel and pull off loudspeaker tag connections. Note the respective positions and colour coding to facilitate reassembly.

**Dismantling (Speaker):** Remove ventilation panel from underside of cabinet, also the ventilation panel inside cabinet. Remove loudspeaker (four nuts), detach push-on connectors to speaker tags and note colour coding for ease of reassembly.

**Dismantling (Push-Button Catch):** With access from underside of cabinet after removing loudspeaker, ease out pressure spring from latch to expose top centre fixing screw. Remove two nuts and washers to release the push-button catch.

**Push-Button Catch Adjustment:** To prevent “buzz” occurring at the push-button catch, the latch pin should fit firmly into the latch plate when the lid is closed. Adjustment of the pin can be made by screwing it slightly

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(H224) Circuit Diagram—Model 3010

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in or out of the lid assembly. It is important that the pin is not shortened too much, otherwise difficulty will be found in engaging with the latch plate when the lid is closed.

**Styli Replacement:** The styli assembly may be pulled free with the indicator in the 78 position. The indicator of the replacement assembly must be similarly positioned before pressing into its locations. Always ensure that the styli arm is fitted correctly in the V-shaped slot.

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**FERGUSON Model 3020**

**General Description:** This model is similar to the Ultra Model 6018 described in this volume.

**Record Changer:** Garrard 3000 L.M. with Acos GP94–1 cartridge and turnover styli.

**Speaker:** Elliptical 8 ohms with 2·5 in. tweeter.

**Cartridge Replacement:** Ease forward the small plastic block at front of head to release cartridge. Then detach plugs from pins at rear of cartridge noting colour coding.

**Stylus Replacement:** Select L.P. stylus and prise out of selector lever assembly. Position replacement assembly with the tongue on top and press to engage with selector lever assembly. Ensure that the stylus arm is engaged within the V-shaped fork of the cartridge.

**Note:** T1 is replaced by motor winding L1 in this model—see Component Locations Diagram Ultra Model 6018. The layout of the controls is also illustrated in that diagram.
General Description: A.M./F.M. radio receiver with over 1 watt output. Aerials; ferrite rod, permeability input coil and telescopic rod. Sockets; car aerial, private listening and tape recorder (20k). Speaker; elliptical 25 ohms. Battery, 9 volts PP9.


(H247a) Circuit Diagram—Model 3152 (Part)
Alignment (General): A signal from a suitable generator 30 per cent. amplitude modulated by an A.F. signal is required for circuit alignment. Tuning indication is best obtained either with an output meter having an impedance of 25 ohms connected across the L.S. speech coil tags (with the loudspeaker disconnected)—printed board tags 22 and 24 are convenient connections—or a Model 8 Avometer, set to the 2.5-volt A.C. range, connected in parallel with the loudspeaker.

Throughout alignment the signal input level to the receiver should be adjusted to maintain the audio output at approximately 50 mW. with the bass, treble and volume controls set at maximum to avoid alignment error due to A.G.C. action.

(H247b) Circuit Diagram—Model 3152 (Part)
FERGUSON

Alignment (A.M. I.F.): Depress M.W. button and turn gang to maximum capacitance. Apply a 475 kHz modulated signal through a 0.1 μF capacitor across C24 (tags 8 and 9) aerial section of tuning gang. Adjust L41/42, L35/36, L33/34, L25/26, and L23/24 in that order for maximum output. Repeat in the same order until no further improvement is obtainable.

Alignment (A.M. R.F.): With gang at maximum capacitance, check that cursor coincides with set zero pip at left-hand end of scale window. Slide cursor along drive cord to correct any error in calibration. M.W. must be aligned first. Signals should be injected via a loop loosely coupled to the ferrite rod aerial with the CAR button in the "off" position. For S.W.
alignment the telescopic aerial lead should be disconnected and signals injected to the lead via a 7-10 pF. capacitor.

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kHz</td>
<td>500 metres</td>
<td>L18, L15</td>
</tr>
<tr>
<td>M.W.</td>
<td>1500 kHz</td>
<td>200 metres</td>
<td>C39, C23</td>
</tr>
<tr>
<td>L.W.</td>
<td>220 kHz</td>
<td>Cal. marker</td>
<td>C49, L13</td>
</tr>
<tr>
<td>S.W.</td>
<td>6.7 MHz</td>
<td>Pad marker</td>
<td>L22, L11</td>
</tr>
<tr>
<td>S.W.</td>
<td>15.8 MHz</td>
<td>Trim marker</td>
<td>C43, C22</td>
</tr>
</tbody>
</table>

Notes: Adjust L15 and L13 by sliding coil along ferrite rod. Pulling should be countered by rocking the gang when tuning C22.

Alignment (Car Aerial Tuner): M.W.: Depress M.W. and CAR buttons and set M.W. car aerial trim (L10) adjusting screw (cam follower) so that an equal amount of thread appears at each end of its moulded support. With gang fully closed, check that slot in rear face of drive cam is in line with cam follower. Set receiver to 500 metre mark on scale and inject 600 kHz signal into car aerial socket via dummy load comprising an 18-pF. capacitor in series with signal generator output, followed by a 60-pF. shunt capacitor. Adjust C18 for maximum output.

L.W.: Depress L.W. and CAR buttons and set receiver to calibration marker on L.W. scale. Inject 220 kHz and adjust L9 for maximum output.

Alignment (F.M./I.F.): Depress F.M. button and inject 10.7 MHz (25 kHz deviation) signal, via a blocking capacitor to tag 12 and chassis line (tag 13) on F.M. board. Peak L39/40, L37/38, L31/32, L29/30 and L27/28 for maximum output. Switch signal generator to A.M. (30 per cent. modulation) and adjust L39/40 for minimum output. (A.M. rejection.) Repeat adjustments as necessary for maximum F.M. output and minimum A.M. output.

Alignment (F.M./R.F.): Ensure that, when tuning capacitor is set to maximum capacitance, cursor coincides with the marker at left-hand side of
RADIO SERVICING

V.H.F. scale. Slide cursor along drive cord to correct any error in calibration. Depress F.M. and CAR buttons and connect F.M. signal generator across car aerial socket.

<table>
<thead>
<tr>
<th>Inject (MHz)</th>
<th>Cursor position (MHz)</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>94 MHz</td>
<td>94 MHz</td>
<td>L4, L3</td>
</tr>
<tr>
<td>96 MHz</td>
<td>96 MHz</td>
<td>L7, L8</td>
</tr>
</tbody>
</table>

**Installation (C18):** This adjustment is accessible after withdrawing the battery from the battery compartment adjacent to the aerial socket, within the limits of the connecting leads. Plug in car aerial feeder, select M.W. and depress CAR button. Tune receiver to any weak station at the middle of wave range and peak C18. Check that peak occurs within four turns of maximum capacitance.

**Dismantling:** Take off battery covers, disconnect and remove batteries. Pull off tuning and volume control knobs. Remove six self-tapping screws from centre panel in base of cabinet, then take out two threaded bolts from speaker baffle securing complete assembly to front grille. Unsolder six leads from tag panel fitted to cabinet moulding (note colour code for re-assembly), then unsolder speaker grille earthing lead from car aerial socket panel. The complete assembly can now be eased from the cabinet.

To expose component side of printed board take out four screws (two large and two small) securing speaker baffle to metal brackets on printed board assembly. The loudspeaker baffle can now be lifted clear within the limit of the connecting leads.

When refitting receiver assembly into the cabinet ensure that two studs on the scale backing plate locate with two stand-off pillars on the scale frame assembly.

**Note (W7):** The diode (W7) is biased by VT8 collector current and acts as a variable resistance which is sensitive to voltage and temperature variations. The voltage developed across W7 equals the sum of the nominal output transistor (VT9 and VT10) base/emitter voltages and so determines the correct quiescent operating conditions. During low ambient temperature conditions the resistance of W7 increases thus compensating for the falling current of the output transistors. This effect also takes place in the event of a falling battery voltage. The diode W7 also assists thermal stability at high temperatures and opposes high current drain from the battery.

**Note (VT9 and VT10):** Components VT9 and VT10 are fitted into a “heat sink” and a coating of silicone grease has been given to each to assist thermal conductivity. It is important that when replacing these transistors a coating of similar grease is applied in order to maintain the cooling action. Heat Sink Compound DP2633, or Anti-Tracking Grease MS4, is suitable.
FERGUSON

**Model 3156**

**General Description:** This model is similar to the Ferguson 3156T.

**Notes:** The push-button tone control is not used. S6A/B is used to switch in a scale lamp and is connected between tags 34 and 35. C81 is 100 pF. and C87 is omitted.

---

FERGUSON

**Model 3156T**

**General Description:** V.H.F./F.M. and A.M. radio receiver with over 1 watt output. Aerials, ferrite rod (A.M.) and telescopic rod (F.M.). Speaker, elliptical 25 ohms. Sockets, Car aerial, Tape (20k) and Private listening (15-100 ohms). Battery, 9 volt PP9.

**Wavebands:** L.W. 268-148 kHz. M.W. 1579-530 kHz. S.W. 18-8-6 MHz. V.H.F. 101-87 MHz.

Alignment (General): A signal from a suitable generator, 30 per cent. amplitude modulated by an A.F. signal is required for circuit alignment. Tuning indication is best obtained either with an output meter having an impedance of 25 ohms and connected in place of the loudspeaker or a Model 8 Avometer, set to the 2.5 volt A.C. range, connected in parallel with the loudspeaker.

Throughout alignment the signal input level to the receiver should be adjusted to maintain the audio output at approximately 50 mW. with the volume control set at maximum in order to avoid alignment error due to A.G.C. action.
Alignment (A.M. I.F.): Depress M.W. button and turn gang to maximum. Apply a 475 kHz modulated signal through a 0.1 μF capacitor into S5A contact 2. Adjust L40/41, L31, L28/29, L25 and L22/23 in that order for maximum output.
FERGUSON

Repeat in the same order until no further improvement is obtainable.

**Alignment (A.M. R.F.):** With gang at maximum, check that cursor coincides with the "zero" pips at right-hand end of scale. Slide cursor along drive cord to correct any error in calibration. M.W. must be aligned.

---

(H243b) Circuit Diagram—Model 3156T (Part)

68-69 193 G
first. Medium- and long-wave signals should be injected via a loop loosely coupled to the ferrite rod aerial. For S.W. alignment, unclip lead from telescopic aerial and inject signals into the lead via a 20 pF capacitor.

(H243c) Circuit Diagram—Model 3156T (Continued)

Note: The Sections (a) and (b) have been enlarged in proportion to (c) to illustrate the finer detail areas.

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kHz</td>
<td>500 m. calibration</td>
<td>L18, L12</td>
</tr>
<tr>
<td></td>
<td>1500 kHz</td>
<td>200 m. calibration</td>
<td>C39, C30</td>
</tr>
<tr>
<td>L.W.</td>
<td>220 kHz</td>
<td>L.W. calibration</td>
<td>C41, L13</td>
</tr>
<tr>
<td>S.W.</td>
<td>6.77 MHz</td>
<td>6.77 MHz calibration</td>
<td>L21, L14</td>
</tr>
<tr>
<td></td>
<td>15.45 MHz</td>
<td>15.45 MHz calibration</td>
<td>C38, C32</td>
</tr>
</tbody>
</table>

Notes: 1. Adjust L12 by sliding ring along ferrite rod. 2. Adjust L13 by sliding former along ferrite rod.

Alignment (F.M. I.F.): Depress F.M. button. Inject 10 MHz (25 kHz deviation) signal, via a 0.1 µF blocking capacitor, to S5A contact 2 and peak L36/37, L34/35, L32/33 and L26/27 for maximum output. Switch signal generator to A.M. (30 per cent. modulation) and adjust L38/39 for minimum output (A.M. rejection).

Alignment (F.M. R.F.): Inject signals into telescopic rod.
### Alignment (Car Aerial): The Car Aerial Circuits are aligned with A.M. signals, 30 per cent. modulated injected to the Car Aerial Socket via a dummy load comprising an 18-pF. capacitor in series with signal generator output, followed by a 60-pF. shunt capacitor. The "Car" button must be depressed in conjunction with the appropriate waveband button, make settings and adjustments as shown in the table.

### Circuit Description (F.M.): The signal is applied via tuned input transformer circuit L1, C1; L2, C3 and C4 to the emitter of VT1. The collector circuit of VT1 is tuned by L3, C8, C9 and C10. This stage operates as a grounded base R.F. amplifier feeding via C14 into the emitter of grounded base oscillator and mixer transistor VT2. The collector of VT2 is loaded by L6, L7 and tuned by series capacitors C21, C22. C19 provides coupling into the oscillator circuit (L5, C11, C12 and C13). L4 and C17 form a 10-7 MHz F.M. I.F. rejector with C16 acting as an input phase corrector at oscillator frequencies.

The 10.7 MHz I.F. output developed across L7 is fed via the potential divider C21/C22, switch S5A contacts 2 and 3 and C45, to the base of VT4 which operates as an I.F. amplifier.

### Circuit Description (A.M.): Medium- and long-wave windings and coupling coil L11 on the ferrite rod are selected by switches S2B contacts 1, 2 and 3 while short-wave signals are received by the telescopic aerial and coupled by S4B, contacts 2 and 3 and C33 to the tuned input transformer L14/15. C31, the aerial section of the tuning gang, is switched for S.W. tuning by S4A contacts 2 and 3. A.M. signals are fed via S5A, contacts 1 and 2 and C45 into the base of A.M. mixer transistor VT4. VT1 and VT2 are rendered inoperative when contacts 8 and 9 of switch S5B open to disconnect their emitter and bias voltages from the negative rail.

### Circuit Diagram Notes: All voltages were measured with an Avometer 8 and are with respect to the positive supply line of each transistor except where otherwise shown. Ringed figures indicate printed board tag connections. D.C. resistance readings are shown against inductors where these are greater than 1 ohm. The circuit diagram shown covers Model 3156T Sch. B receivers. On Sch. A receivers, C87 is 390 pF. and is connected between S6A/B contacts 2 and junction of R42, C81 and C83. Contacts 3 of S6A/B are connected to collector of VT7.

### Table

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Tune to</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.M.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>88 MHz</td>
<td>88 MHz calibration</td>
<td>L5, L3</td>
<td></td>
</tr>
<tr>
<td>96 MHz</td>
<td>96 MHz calibration</td>
<td>C12, C9</td>
<td></td>
</tr>
<tr>
<td>91 MHz</td>
<td>91 MHz</td>
<td>L6, L7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Tune to</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>600 kHz</td>
<td>500M Marker</td>
<td>L9</td>
<td></td>
</tr>
<tr>
<td>1500 kHz</td>
<td>200M Marker</td>
<td>C25</td>
<td></td>
</tr>
<tr>
<td>220 kHz</td>
<td>1400M Marker</td>
<td>L10</td>
<td></td>
</tr>
</tbody>
</table>
**FERGUSON**

**FERGUSON**

**Model 3160**

**General Description:** F.M./A.M. radio receiver with 200 mW. output. Aerials: ferrite rod and telescopic rod. Sockets, two for private listening. Speaker, round 8 ohms. Batteries, four 1.5 volt HP7. Accessories; earpiece in leather purse and carrying strap extension.

**Wavebands:**
- M.W. 1605–535 kHz
- L.W. 300–150 kHz
- V.H.F. 108–87 MHz

---

**Alignment (General):** A signal from a suitable generator, 30 per cent amplitude modulated by an A.F. signal is required for circuit alignment. Tuning indication is best obtained either with an output meter having an impedance of 8 ohms and connected in place of the loudspeaker or a Model 8 Avometer, set to the 10 volt A.C. range, connected in parallel with the loudspeaker.

Throughout alignment the signal level to the receiver should be adjusted to maintain an audio output at approximately 50 mW., with the volume control set at maximum, to avoid alignment error due to A.G.C. action.

**Alignment (A.M. I.F.):** Switch to M.W. and turn gang to maximum capacitance. Apply a 455 kHz modulated signal via a 0.1 μF. capacitor across C19, aerial section of gang. Adjust L28/29, L22/23 and L16/17 in that order for maximum output. Repeat in same order until no further improvement results.

**Alignment (A.M. R.F.):** With gang at maximum capacitance check that cursor is aligned across the top of the vertical lines on scale. M.W. must be aligned first. Medium- and long-wave signals should be injected via a loop loosely coupled to the ferrite rod aerial.

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kHz</td>
<td>6</td>
<td>L13, L6/7, C29, C20</td>
</tr>
<tr>
<td></td>
<td>1500 kHz</td>
<td>Midway between 14 and 16</td>
<td>C34, C22</td>
</tr>
<tr>
<td>L.W.</td>
<td>190 kHz</td>
<td>19</td>
<td>L19, L8/9</td>
</tr>
<tr>
<td></td>
<td>280 kHz</td>
<td>28</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Adjust L6/7 and L8/9 by sliding former along ferrite rod.

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Alignment (F.M. I.F.): Switch to F.M. Inject 10.7 MHz signal 25 kHz deviation via 0.1 μF capacitor to the junction of R4/L4 (clip signal input lead to the top of R4). Adjust L24/25, L20/21, L14/15 and L10/11 for maximum output. Switch signal generator to A.M.; 10.7 MHz, 30 per cent. modulated and adjust L26/27 for minimum output (A.M. rejection). Repeat adjustments as necessary to obtain maximum output and accurate calibration.
FERGUSON

Circuit Diagram Notes: Figures in rectangles indicate voltages measured with an Avometer 8, with respect to positive chassis. D.C. resistance readings are shown against inductors where these are 0.5 ohms or greater. Ringed figures indicate printed board tag connections.
(H255) COMPONENT LAY-OUT—Model 3160
FERGUSON


<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.M.</td>
<td>94 MHz</td>
<td>94</td>
<td>C17, C8</td>
</tr>
</tbody>
</table>

Circuit Description (F.M.): The signal is applied via the coupling capacitor C2 from the V.H.F./F.M. tuned circuit L2/C3. The collector of VT2 is loaded by L10 and tuned by C16. C13 provides the feedback into the emitter of VT2, L4 and C11 forming a 10.7 MHz rejector with C10 acting as an input phase corrector at oscillator frequencies. The 10.7 MHz oscillator output is fed via C35 to VT4 base which operates as the 1st F.M. I.F. amplifier.

Circuit Description (A.M.): Medium- and long-wave windings are selected by switch S2 and S7 respectively and fed via L7 or L9 via S3 to VT3 the A.M. oscillator-mixer. M.W. and L.W. oscillators are selected by S5 and S8; the selected oscillator output being fed direct to A.M. I.F.T1 and coupled to VT5 base by L17. VT1 and VT2 are rendered inoperative when S1 disconnects their emitter and bias voltages from the battery positive line.

Circuit Description (A.F.): Audio signals from the V.H.F./F.M. and A.M. channels are selected by S4 and fed to VT7 base via C57 and R30. The amplified signals are then passed to VT8 the audio driver stage and then transformer coupled into bases of VT9 and VT10 the push–pull output stage. S9 switches C60, the fixed tone correction into circuit from VT7 collector. Negative feedback operates between VT7 collector and base through R31 and C59. X1 with R39 form the base bias potentiometer network for VT9 and VT10. During low ambient temperature conditions the resistance of X1 increases thus compensating for falling current of the output transistors. This effect also takes place in the event of falling battery voltage. Thermistor X1 also assists thermal stability at high temperature and opposes high current drain from the battery.

Dismantling: To obtain access to the printed circuit board, remove two screws in the cabinet back. Insert thumb nail in the slot in the cabinet base and gently hinge open within the limit of the battery connecting leads. To release the cabinet back, unsolder the battery leads, noting connections for reassembly. To release the printed circuit board assembly, pull off tuning and volume control knobs, then pull out plug connection to telescopic aerial. Take out four self-tapping screws, one of which is located in the lower limb of the wavechange switch bracket assembly, then remove the hexagonal brass pillar located near the switch assembly and take out threaded screw and washers at extreme right-hand corner of printed board. The printed circuit board can now be lifted clear within the limit of the loudspeaker connecting leads. Unsolder these leads to completely free the printed circuit board, noting colour coding for correct reassembly.

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Drive Cord Replacement: Remove printed circuit board, then take out three screws securing scale to its mounting assemblies. Lift off scale to expose drive cord assembly. Approximately 14 in. of Nylon braided cord will be required.

---

FERGUSON

__Model 3338__

**General Description:** This model is similar to the Ultra Model 6322 described in this volume. Changer, BSR UA15 with BSR C1 cartridge.

**Note:** The component locations diagram does not show pickup matching components R83, R84, R85 and C87, C88. These components are mounted on a tag strip fitted to the underside of the record changer.

---

FERGUSON

__Model 3340__

**General Description:** This model is similar to the Ferguson Model 3348 see below, but it employs a Garrard 3000 L.M. record changer with a Sonotone 9TAHC cartridge and a L.P. stylus type 9T1.

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FERGUSON

__Model 3348__

**General Description:** This model is similar to the Marconiphone Model 4322 described in this volume.

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FERGUSON

__Model 3334__

**General Description:** This model is similar to the Ultra Model 6324 described later in this volume, apart from presentation and the number of wavebands covered.

**FIDELITY**

**FERRANTI**

**Model 1141**

**General Description:** This model is electrically similar to the Pye Model 1370 described in the 1966-67 volume.

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**FERRANTI**

**Model 5501**

**General Description:** This receiver is electrically similar to the Pye Model 1372 described elsewhere in this volume.

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**FERRANTI**

**Model 5503**

**General Description:** This receiver is electrically similar to the Pye Model 1373 described elsewhere in this volume.

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**FIDELITY**

**Comet**

**General Description:** Portable receiver with 500 mV. output. Speaker, round 10 ohms. Battery, 9 volts.

**Wavebands:** S.W. 6-14·5 Mc/s. M.W. 188-555 m. B.S. 188-211 m. L.W. 1200-2000 m.

**Alignment (General):** To obtain access to the cores and trimmers, it is necessary to remove the front panel assembly, see Dismantling. The template (see appropriate diagram) may be used to mark the alignment points on the pointer rail noting that the diagram is half-size. The L.H. pointer is used for M.W. and B.S. and the R.H. pointer for L.W. and S.W. Before alignment check that the L.H. pointer lines up with mark 1 when the gang is fully in. Use a coupling loop when the R.F. adjustments are made.

**Alignment (I.F.):** Connect a suitable output meter across the speaker tags via an isolating capacitor. Connect signal generator across the aerial section of the tuning gang (mauve and black leads). Turn the volume control to maximum clockwise. It is preferable, though not essential, to short out

(H356) TEMPLATE FOR ALIGNMENT MARKER POSITIONS (SHOWN EXACTLY HALF SIZE)
the tuned winding L13 (this may be achieved without further dismantling by bridging R8). Press the M.W. button and with tuning gang at maximum capacitance inject a modulated signal of 470 kc/s. and trim the cores of IFT3, IFT2 and IFT1, in that order, for maximum output. Repeat these adjustments with reduced signal input. Remove s/c from oscillator circuit.

**Alignment (B.S.):** Press B.S. button. Tune receiver to B.S. Luxembourg (L.H. pointer to calibration mark 3) and inject into loop a signal of 1440 kc/s. Trim the core of oscillator coil L13 for maximum output.

**Alignment (M.W.):** Press the M.W. button. Tune the receiver to 500 m. (L.H. pointer to calibration mark 2) and inject signal of 600 kc/s. Adjust aerial coil L3/4, by sliding it along the ferrite rod, for maximum output. Retune receiver to M.W. Luxembourg (L.H. pointer to calibration mark 4), inject signal of 1440 kc/s. and adjust aerial trimmer TC1 for maximum output. Repeat for optimum results.

**Alignment (L.W.):** Press the L.W. button. Tune the receiver to long wave 1500 m. position (R.H. pointer to calibration mark 7) and adjust oscillator trimmer TC2 for maximum output of the B.B.C. broadcast signal. Retune receiver to Allouis (R.H. pointer to calibration mark 5) and adjust aerial coil L5/6, by sliding it along the ferrite rod, for maximum output of Allouis broadcast signal.
Alignment (S.W.): Transfer signal generator output from transmitting loop to the S.W. telescopic aerial. Press the S.W. button and tune receiver to 9 Mc/s. (R.H. pointer to calibration mark 6). Inject signal of 9 Mc/s. and trim the core of oscillator coil L10, then the aerial coil L1/2, for maximum output.

Voltage Table: The voltage readings given in the table are negative with respect to chassis. They were taken with a 20,000 ohms/volt-meter under no signal conditions.

<table>
<thead>
<tr>
<th>Reference</th>
<th>Base</th>
<th>Emitter</th>
<th>Collector</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR1</td>
<td>0.75</td>
<td>0.6</td>
<td>5.7</td>
</tr>
<tr>
<td>TR2</td>
<td>0.9</td>
<td>0.7</td>
<td>6.0</td>
</tr>
<tr>
<td>TR3</td>
<td>1.0</td>
<td>0.7</td>
<td>5.75</td>
</tr>
<tr>
<td>TR4</td>
<td>4.0</td>
<td>4.2</td>
<td>0.15</td>
</tr>
<tr>
<td>TR5</td>
<td>0.15</td>
<td>—</td>
<td>4.5</td>
</tr>
<tr>
<td>TR6</td>
<td>4.7</td>
<td>4.6</td>
<td>9.0</td>
</tr>
<tr>
<td>TR7</td>
<td>4.5</td>
<td>4.6</td>
<td>—</td>
</tr>
</tbody>
</table>

Dismantling: Pull off the two front control knobs. Take off battery compartment cover and remove battery. Remove the Phillips-head screw
from top right-hand corner of battery compartment and remove the two long Phillips-head screws from back of cabinet.

The front panel assembly may then be removed by hinging it forward from the top, to the extent of the speaker leads (which may be unplugged), providing access to the component side of the printed circuit board.

For further dismantling, remove the five Phillips screws securing the circuit board and pointer rail moulding to the cabinet. Pull through the battery leads and connector. The complete assembly may then be removed by easing it out from the base of the circuit board, unplugging the lead to the telescopic aerial when board is raised.

When, reassembling, insert the chassis into the case top-first, easing the push-buttons into their slots from the top corner first. When replacing the front panel, first locate the three lugs into the slots provided in the case bottom.
General Description: Portable receiver with 500 mW. power output. Speaker, elliptical 10 ohms. Battery, 9 volts.


Alignment (General): To obtain access to coils and trimmers, remove chassis as described under Dismantling. Use the template (see appropriate diagram) to mark off calibration points on pointer rail, noting that the diagram is exactly half-size. The L.H. pointer is used for M.W. and the R.H. pointer for L.W. and B.S. Check that the L.H. pointer lines up with mark 1 when the gang is fully in.

![Alignment Marker Positions Diagram](H351)


Alignment (R.F.): Inject signal via a loop placed near to, and coaxial with, the ferrite rod. B.S. Press B.S. button. Tune to Luxembourg (R.H. pointer to mark 5). Inject 1440 kc/s. and trim L8 (red core) for maximum output. M.W. Press M.W. button. Tune to 500 m. (L.H. pointer to mark 2). Inject 600 kc/s. and adjust L2/3 (by sliding along rod) for maximum output. Retune to mark 3 (M.W. Luxembourg). Inject

![Drive Cord Diagram](H352)
RADIO SERVICING

1440 kc/s. and adjust TC1 for maximum output. L.W. Press L.W. button. Tune R.H. pointer to mark 6 and adjust TC2 for maximum output of B.B.C. Radio 2. Retune to mark 4 and adjust L4/5 (by sliding along rod) for maximum output of Allouis signal.

Dismantling: To remove cabinet back, take out the two slotted screws, (continued opposite)

(H350a) Circuit Diagram—Model Rad 11 (Part)

Note: The wavechange switch is shown in M.W. Position.

G.E.C. Model G832

General Description: Three waveband mains/battery portable radio receiver covering long, medium and a bandspread portion of the medium waveband, incorporating eight transistors and a diode. Features include silicon transistors in R.F. and I.F. stages with a transformerless complementary push–pull output stage with temperature compensation, an output in excess of 1 watt, separate car aerial input circuits on all bands.


Aerial: Internal ferrite rod covering all bands. A socket is also provided to allow the connection of a car aerial.

Output Sockets: A socket is provided for feeding into an earphone or...
then pull the fabric tab. This will give access to the tin dip side of the circuit board. For further dismantling, pull off tuning knob, unclip speaker tags, remove the two long-headed hexagon nuts (and their washers). The complete chassis may then be withdrawn from the case.

(H350b) Circuit Diagram—Model Rad 11 (Continued)

external loudspeaker. A second socket is provided for feeding the input of a tape recorder.

**Loudspeaker**: High flux elliptical 8 in. $\times$ 5 in., 20 ohms impedance.

**Power Output**: 1.5 watts maximum.

**Battery Supply**: 18 volts provided by two PP9’s or equivalent.

**Consumption**: 14 mA. quiescent.

**Intermediate Frequency**: 470 kc/s.

**Semiconductors**: TR1 BF195 Mixer/A.G.C.; TR2 BF195 Oscillator; TR3 BF194 1st I.F. amplifier; TR4 BF194 2nd I.F. amplifier; TR5 AC127 Audio Preamplifier; TR6 AC128 Audio driver; TR7 AC127 and TR8 AC128 Complementary p/p output: D1 OA90 Detector diode.

**Thermistor**: VA1040 Temperature stabilising.

**Mains Power Unit**: This assembly is in addition to batteries, and enables the receiver to be operated from a 200–250-volt A.C. mains supply.

**Dismantling**: For access to batteries, turn fastener on the end of the battery compartment cover in bottom of cabinet. This will release the cover.
When replacing, ensure that correct polarity of batteries is observed, turn fastener until it locks, indicated by a click.

To remove back of cabinet, undo the three Phillips screws in bottom of the cabinet, draw back off at an angle of about 15°, thus providing access to the component side of the printed circuit board, and to all the cores and trimmers so that alignment may be carried out without further dismantling.

Secondary calibration markers in the form of solid triangles are provided on the scale. Primary calibration markers are provided on the scale back moulding.

To remove the circuit board, gang and scale back moulding from the cabinet, remove all control knobs, unsolder speaker leads and connecting leads to the power unit, undo the two cheese-headed screws holding the
power unit chassis to the cabinet front. These are situated between the chassis and the cabinet side.

Withdraw the power unit. Remove the three cheese-head screws from the scale back moulding. Remove the hexagonal headed self tapping screw from the bottom of the circuit board. Carefully draw the assembly out away from the scale. It is then possible to examine or service the drive cord, gain access to the primary calibration markers or the sockets, etc.

**Alignment Procedure:** *Equipment Required:*

1. An output meter (20 ohms impedance, 0–100 mW.). The output during alignment should not exceed 50 mW.
(F45) The Circuit Board and Wiring Taken from it to the Aerial Coils, Power Supplies and Sockets. The Board is Viewed from the Tin Dipside with Components as seen through the Board. Wiring in Broken Line Represents Printed Connections on the Component Side of the Board
2. A signal generator (low impedance output), amplitude modulated to 30 per cent. covering long, medium and bandspread bands.
3. Suitable insulated trimming tools.
4. Dummy aerial unit.

Notes:
1. Before commencing alignment, check that the pointer lines up with calibration mark 1 with the tuning gang fully closed (i.e. max. capacity).
2. For I.F. alignment (operations 1 and 2 in the alignment table) the signal generator is connected to the base of TR1 by a 0.1 \( \mu \)F capacitor.
3. For R.F. alignment (operations 3 to 8 in the alignment table) the signal generator is connected via a dummy aerial to the car aerial socket, and the car switch depressed.
4. For R.F. alignment (operations 9 to 12 in the alignment table) the output from the signal generator should be fed into a transmitting coil placed 6 in. from the ferrite rod and the car switch released. A suitable coil can be made with approximately 14 turns of 18 s.w.g. enamelled copper wire wound on a 1-in. former and spaced to a length of 1-1\( \frac{1}{4} \) in.

<table>
<thead>
<tr>
<th>Op.</th>
<th>Set pointer to alignment mark</th>
<th>Waveband</th>
<th>Signal gen. frequency</th>
<th>Adjust for max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gang closed</td>
<td>M.W.</td>
<td>470 kc/s.</td>
<td>L13, L12, L8</td>
</tr>
<tr>
<td>2</td>
<td>Repeat operation 1.</td>
<td>M.W.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Car switch depressed

| 3   | 2                              | M.W.     | 600 kc/s.             | L10 (oscillator coil)  |
| 4   | 6                              | M.W.     | 1439 kc/s.            | L4 (car aerial coil)   |
| 5   | 5                              | L.W.     | 220 kc/s.             | TC6 (oscillator trimmer)|
| 6   | 4 Approx. (tune to signal)     | M.W.     | 908 kc/s.             | TC3 (car aerial trimmer)|
| 7   | Leave as tuned in Operation 7  | B.S.     | 1439 kc/s.            | TC4 (oscillator trimmer)|

Car switch released

| 9   | 2 Approx. (tune to signal)     | M.W.     | 600 kc/s.             | L1 (rod aerial coil)   |
| 10  | 6 Approx. (tune to signal)     | M.W.     | 1439 kc/s.            | TC1 (rod aerial trimmer)|
| 11  | 5 Approx. (tune to signal)     | L.W.     | 220 kc/s.             | L3 (rod aerial coil)   |
| 12  | 4 Approx. (tune to signal)     | B.S.     | 1439 kc/s.            | TC2 (rod aerial trimmer)|

5. The alignment points referred to in the alignment table are raised pips on the lower edge of the front face of the scale back moulding.
6. All cores should be tuned to the outer position.
7. Adjustment of \( L1 \) and \( L3 \) where mentioned in the alignment procedure, is achieved by sliding the appropriate coil along the ferrite rod.
8. After alignment, the aerial coils should be resealed.

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G.E.C.

Model G827

General Description: This receiver is similar to the model D527 described on page 188 in the 1966–67 volume.
G.E.C. Model G983

**General Description:** Five-waveband A.M.–F.M. stereo radiogram, incorporating a four-speed automatic record player, five transistors, six diodes and five valves.

**Wavebands:**
- **Long Wave:** 158–270 kc/s. (1120–1900 m.).
- **Medium Wave:** 540–1500 kc/s. (200–555 m.).
- **M.W./Bandspread:** 1420–1700 kc/s. (180–211 m.).
- **Short Wave:** 5.7–16.5 Mc/s. (18–53 m.).
- **V.H.F./F.M.:** 87–108.5 Mc/s.

**Aerials:**
- A.M. (internal): Ferrite rod.
- F.M. (internal): Dipole.
- F.M. (external): 75 ohm unbalanced dipole.

**Loudspeakers:** Two 8 in. × 5 in. wide-range high-flux loudspeakers, 3 ohms impedance. Provision is made for external speakers with internal/external switching.

**Power Output:** Audio power output is 4 watts per channel; 8 watts total.

**Tape Output Socket:** Provision is made for the monitored recording of radio programmes and mono or stereo gramophone records; mono or stereo tape recordings may also be played back via the audio amplifiers. All connections are made by means of a 5-pin DIN plug.

**Intermediate Frequencies:**
- A.M. 470 kc/s.;
- F.M. 10–7 Mc/s.

**Record Player Unit:** A Balfour four-speed auto-changer is fitted, with a Ronette 105S cartridge having a diamond stylus in the L.P. position.

**Mains Input:** 200–250 volts, 50/60 c/s A.C. only.

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Diagram: Pointer assy comprising: Carriage P31766, Pointer P30270, Sleeve P75050

4 Pulleys 2

4 Pulleys 2

Tension spring P46499

2.5 turns anti-clockwise round drive pulley

2.5 turns anti-clockwise from point 'X' terminating at tension spring

1/4 turn anti-clockwise from tension spring

Tension spring P46499

(F25) Drive Cord
detector diodes (F.M. only). D_{13}, OA90; Detector (A.M. only). D_{11}, OA79; A.G.C. (F.M. only).

**Valves:** V_{31}, ECC83; Audio pre-amplifier. V_{32}, ECC83; Audio amplifier and driver. V_{33}, EL84; Audio power output. V_{34}, EL84; Audio power output. V_{41}, EZ81; Power rectifier.

**Dismantling:** Access to all components is obtained by removal of the
(F31c) Circuit Diagram—Model G983 (Continued)

power pack and/or the main chassis. Remove the back panel. The power pack can then be removed after unplugging the octal plug from the main chassis and unscrewing the fixing screws. Removal of the rear fixing screws will enable the main chassis to be moved to the rear, free of its front fixing lugs. Before lifting out the chassis disconnect pickup lead by unplugging the 3-pin connector from the I.F. panel, and disconnect mains indicator
lamp leads and gram compartment lamp leads by unplugging the A.M.P. connectors from the push-button switch panel.

**Alignment Procedure:** Check that with the gang capacitor fully closed, the scale pointer coincides with the extreme low frequency end of the scale (logging scale at 100). A 3-ohm loudspeaker or dummy load must at all times be connected across each pair of output terminals. Damage to the output valves may result if the output terminals are left open-circuited. It is important that all cores are tuned to the first peak from the outer ends of the coils.

**A.M. Alignment:** Connect an A.C. volt-meter across one loudspeaker or dummy load. Reference level is 0·8 volts (200 mW.). As the circuits are brought into alignment, the signal input should be reduced so that the output does not exceed the reference level. Set the volume control at maximum, the treble control at minimum and the bass and balance controls in the mid-position. Switch receiver to M.W. and set gang capacitor at maximum. Feed a 470 kc/s. signal to TR11 base via a 0·01 μF. capacitor. Adjust L127, L123, L122, L119, L118 in that order, for maximum output. Connect the signal generator via a dummy aerial to the A.M. aerial and earth socket.

**A.M. Alignment Table:**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Tuning scale</th>
<th>Logging scale</th>
<th>Frequency</th>
<th>Signal level</th>
<th>Adjust for max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M.W.</td>
<td>500 m.</td>
<td>77</td>
<td>600 kc/s.</td>
<td>6 μV.</td>
<td>L115 and L105</td>
</tr>
<tr>
<td>2</td>
<td>M.W.</td>
<td>H.F. end</td>
<td>0</td>
<td>1500 kc/s.</td>
<td>6 μV.</td>
<td>TC105 and TC103</td>
</tr>
<tr>
<td>3</td>
<td>M.W.</td>
<td></td>
<td></td>
<td>Repeat 1 and 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>M.W.B.S.</td>
<td>&quot;300&quot; on M.W. scale</td>
<td>25</td>
<td>1500 kc/s.</td>
<td>3 μV.</td>
<td>TC107 and TC101</td>
</tr>
<tr>
<td>5</td>
<td>L.W.</td>
<td>1360 m.</td>
<td>31</td>
<td>220 kc/s.</td>
<td>25 μV.</td>
<td>TC106 and L107</td>
</tr>
<tr>
<td>6</td>
<td>S.W.</td>
<td>6·5 Mc/s.</td>
<td>72</td>
<td>6·5 Mc/s.</td>
<td>25 μV.</td>
<td>L112 and L103</td>
</tr>
<tr>
<td>7</td>
<td>S.W.</td>
<td>15 Mc/s.</td>
<td>6</td>
<td>15 Mc/s.</td>
<td>25 μV.</td>
<td>TC104 and TC102</td>
</tr>
<tr>
<td>8</td>
<td>S.W.</td>
<td></td>
<td></td>
<td>Repeat 6 and 7.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:** A trimming tool made of insulating material must be used for the adjustment of all aerial trimmers and the B.S. oscillator trimmer. L105 and L107, on the ferrite rod, should be adjusted by sliding the coils along the rod. L103, on the ferrite rod, should be adjusted by altering the spacing of the turns. Care must be taken to avoid hand capacitance effects. TC102 must be adjusted to the peak which occurs with the trimmer furthest in.

**F.M. Alignment:** The A.F.C. button must be **out** during F.M. alignment.

**Sweep Frequency Method:** It is strongly recommended that the F.M./I.F. tuned circuits are aligned using a wobulator set to a deviation of approx. ±300 kc/s. about a centre frequency of 10·7 Mc/s. displaying the I.F. response and ratio detector curves on an oscilloscope.

Connect the wobulator signal output to the base of TR11 via a 0·01 μF. capacitor. Connect the oscilloscope diode probe to test point TP11 (i.e. free end of R121, 100 kΩ resistor). Detune the secondary of IFT5 (L126)
by unscrewing the dust core so that it protrudes approx. \( \frac{\sqrt{2}}{4} \) in. from the top of the coil former.

Adjust L124, L121, L120, L117 and L116 in that order for maximum amplitude and symmetry about 10-7 Mc/s.

Transfer wobbulator signal output to SC6 (positive supply point) on tuner, via a 0.01 \( \mu F \) capacitor, earthy lead to Sc1. Adjust L6 for maximum amplitude and symmetry about 10-7 Mc/s.

Connect oscilloscope direct input (i.e. without diode probe) to PC103. Screw in core of L126 and adjust for most symmetrical "S" curve about 10-7 Mc/s.

**Spot Frequency Method:** This method should be used if a wobbulator and display equipment are not available. Connect a volt-meter of not less than 50 k\( \Omega \) resistance across C145. Feed a 10-7 Mc/s. unmodulated signal to the base of TR11 via a 0.01 \( \mu F \) capacitor. Detune the secondary of IFT5 (L126) by unscrewing the dust core so that it protrudes approx. \( \frac{\sqrt{2}}{4} \) in. from the top of the coil former. Detune L6 by unscrewing its core.

Adjust L124, L121, L120, L117 and L116 in that order, for maximum reading, adjusting the input signal to keep the output voltage at approx. 0.5 volt.

Feed a 10-7 Mc/s. signal to SC6 (positive supply point) on tuner, via a 0.01 \( \mu F \) capacitor, earthy lead to SC1. Adjust L6 for maximum output.

Connect a 100 \( \mu A \) meter between the junction of R127/R128 (PC103) and the junction of R131/C150, the negative to PC103. Adjust L126 by screwing in the dust core. As the core is screwed in, the current will first increase, then decrease to zero, and reverse. The correct setting is for zero meter reading.

**R.F. Alignment:** Connect an F.M. signal generator to the F.M. aerial socket. Set scale pointer to 88. Inject an 88 Mc/s. signal and adjust the core of L5 to tune in the signal, then adjust the core of L3 for maximum output.

Set pointer on 108. Inject a 108 Mc/s. signal and adjust TC1 to tune in the signal. Repeat the oscillator adjustment at 88 Mc/s. and then again at 108 Mc/s. This procedure may have to be repeated a number of times until correct calibration is obtained.

Input level should be 2.5 \( \mu V \) for a reading of 0.8 volts.
**General Description:** This receiver is a battery-operated transistor portable covering M.W. and L.W. broadcast bands. Provision for car operation has been made including extra screened aerial coils and S.W. filters on the car aerial input sockets. The ferrite rod aerial can be switched out of circuit. Cabinet dimensions are designed to suit most glove compartments and dashboard tray configurations.

**Features:**
1. Auxiliary tape recorder or personal earphone socket.
2. Car aerial socket with screened aerial coils and S.W. filter.
3. Temperature and voltage compensation in amplifier circuit.
4. Push-button, wave change, tone control and car operation switches.
5. Elliptical speaker 25 ohms.
6. Two PP9 batteries, quiescent current 19 mA. approx.
7. Ferrite rod for portable use with two screened coils for car operation.
Radio Servicing


Removal from Case: With front facing forward, open the back by placing hands on the sides and easing the back by pressing the top of the back away with the thumbs. Disconnect batteries and remove. Remove 5-pin plug from amplifier and remove green/black connections to aerial socket. Remove clamps fixing chassis to cabinet interior. Remove domes covering handle securing screws by gentlylevering off. Take out handle fixing screws and remove handle. Remove amplifier which is secured by 4BA nuts. Unplug blue/black wire from earphone socket. To remove speaker, unplug speaker leads. The speaker is fixed with 4 x 4BA nuts. (Take care in replacing—not to over-tighten.) Remove grille and baffle (fixed by 4 x 4BA nuts).

Push-Button Switch: This component is of rigid design and should give little trouble. In the event of replacement being necessary, considerable care must be taken in removing the switch to avoid damage to the printed circuit board. It is necessary to remove all the solder from the connecting pins before attempting to take the switch out. This operation is facilitated by the use of a solder “sucker”.

It is very important to position the new switch correctly on the printed board and a spacing jig consisting of a small piece of 16-gauge aluminium or brass giving a clearance of \( \frac{1}{16} \) in. will ensure that sufficient spacing is left between the body of the switch and the circuit board.

Ferrite Rod: Replacement must always be followed by R.F. realignment, an important feature of which is correct positioning of the coils on the ferrite rod. The correct position of the M.W. coil is such that the tags of the coil are in the physical centre of the rod, i.e. 4 in. from the end.

I.F. Transformers: When any I.F. transformer is replaced, I.F. realignment will be necessary. The I.F. transformers are aligned visually in the factory and therefore should not just simply be peaked for maximum output. Instability is likely to result if the circuits are peak tuned.

Speaker: Extreme care must be observed when replacing the speaker to avoid damaging the cone.

Static Voltages: All voltages measured with Avometer 8—with respect to H.T. negative rail. Supply 18 volts H.T. rail 7.7 volts.

<table>
<thead>
<tr>
<th>Tuner</th>
<th>( T_1 ) volts</th>
<th>( T_2 ) volts</th>
<th>( T_3 ) volts</th>
<th>( T_4 ) volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
<td>7.7</td>
</tr>
<tr>
<td>B</td>
<td>1.05</td>
<td>1.0</td>
<td>1.0</td>
<td>1.85</td>
</tr>
<tr>
<td>E</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td>1.55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Amplifier</th>
<th>( TR_1 )</th>
<th>( TR_2 )</th>
<th>( TR_3 )</th>
<th>( TR_4 )</th>
<th>( TR_5 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vce</td>
<td>7.1</td>
<td>9.0</td>
<td>0.3</td>
<td>9.1</td>
<td>8.9</td>
</tr>
<tr>
<td>Veb</td>
<td>4.7</td>
<td>8.75</td>
<td>0.125</td>
<td>9.0</td>
<td>8.72</td>
</tr>
<tr>
<td>Vbe</td>
<td>0.625</td>
<td>0.175</td>
<td>0.175</td>
<td>0.15</td>
<td>0.15</td>
</tr>
<tr>
<td>Ic</td>
<td>0.58 mA.</td>
<td>7.1 mA.</td>
<td>—</td>
<td>4 mA.</td>
<td>4.25 mA.</td>
</tr>
</tbody>
</table>

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Quiescent Current and Mid-Point Voltage: 1. Connect a 25–30-ohm output meter to the output of the amplifier, having first disconnected the speaker. 2. Short-circuit the input of the amplifier to Earth. 3. Connect a 0–10 Ma. D.C. meter between points of test link, having first cut link.
4. Connect 0·10-volt D.C. volt-meter between the junction of R14/R15 and Earth (—ve to Earth). 5. Connect 18 volt supply. 6. Adjust RV2 to give a quiescent current reading of 4 Ma. Also adjust RV1 to give a mid-point voltage reading of 8·85 volts. Readjust RV2 and RV1 to give a balanced reading of 4 Ma. and 8·85 volts respectively as necessary.

**Stabilisation:** With conditions as for Quiescent Current and Mid-point Voltage: 1. Reduce supply volts to 12 volts. 2. Read fall in quiescent current reading—this should be 2·4 minimum. 3. Switch off supply and resolder test link. Seal RV2.

**Sensitivity:** 1. Connect output meter and C.R.O. across speaker ter-
minals. 2. Inject a signal at 1000 c/s. from audio generator to input of amplifier to produce 1 watt undistorted output. The input signal required to produce this output should be 30 millivolts ±1 dB.

*Note:* Some uneven clipping of the waveform near the rated power output may be noticed, if so, adjust RV1 slightly to produce even clipping.

**Frequency Response:** With conditions as for Sensitivity, reduce input to produce an output of 100 mV. Then keeping input voltage constant: 100 c/s. (plus 5 dB), 1000 c/s. (0 dB) and 6000 c/s. (plus 4 dB). Limits plus or minus 2 dB.

**Stability:** Remove input and speaker load (30 ohms). With C.R.O. 68–69 225
H363 (Circuit Diagram of A.F. Stages—Model RP33)
Hacker

connected across speaker terminals there should be no oscillation visible on trace.

Noise: With output meter (25–30 ohms) connected in place of speaker, load input with 47k ohm resistor. Noise level should be greater than —60 dB on 1 watt. Quiescent current 14 mA. maximum.

Alignment (I.F.): Switch to M.W. with Auto button up. Connect C.R.O. and millivoltmeter across volume control (VR1). Connect sweep generator (via 0.1 μF.) across gang (GC1). Keep input signal low to avoid A.G.C. action. Adjust L6, L7 and L8 for a symmetrical shape having a bandwidth of 6 kc/s. at 3 dB down. Remove sweep generator and replace by R.F. generator. The sensitivity should be 25 μV. for an output of 25 mV.

1. Inject a signal of 660 kc/s. and with the pointer set to 500 m., adjust L5 and L1 in turn for maximum output.
2. Inject a signal of 1500 kc/s. and with the pointer set to 200 m. adjust TC5 and TC4 for maximum output.
3. Repeat 1 and 2 until no further improvement can be made.
4. Switch receiver to L.W. Auto.
5. Inject a signal of 200 kc/s. and with the pointer set to 1500 m., adjust TC6 for maximum output.
6. Inject a signal of 174 kc/s. and tune in receiver, adjust L2 for maximum output.
7. Inject a signal of 260 kc/s. and tune in receiver, adjust TC1 for maximum output.
8. Check sensitivity. The following inputs should be sufficient to produce 25 mV. across RV1. 600 kc/s. (10 μV.), 1500 kc/s. (20 μV.), 174 kc/s. (20 μV.) and 260 kc/s. (15 μV.).
9. Disconnect dummy aerial and feed R.F. signals via loop. Switch to M.W. with Auto button in up position.
10. Inject a signal of 600 kc/s. via the loop and adjust the small winding of L3 on the rod for maximum output.

*Note:* The tags on the major winding of L3 must be in the centre of the 8-in. aerial rod.

11. Inject a signal of 1500 kc/s. via loop, tune in receiver and adjust TC2 for maximum output.
12. Repeat until no further improvements can be made.
13. Switch receiver to L.W. Inject via loop, a signal of 174 kc/s., tune in receiver and adjust L4 on the rod for maximum.
14. Inject via the loop, a signal of 260 kc/s., tune in receiver and adjust TC3 for maximum output.
15. Check sensitivity. With loop at 24 ins. the following inputs should be sufficient to produce 25 mV. across RV1. 600 kc/s. (15 mV.), 1500 kc/s. (15 mV.), 174 kc/s. (10 mV.) and 260 kc/s. (8 mV.).

**Drive Cord:** Tape cord temporarily to chassis in position X with spring in position drawn. Proceed round pulley A to pulleys B and C and wind 4 turns on to drum E in anti-clockwise direction on end of drum nearest to chassis. Carry cord through slot in drum centre flange and wind on 1 turn. Then proceed to pulley D releasing taped cord. Pointer should then be positioned as shown before checking calibration.

**Modifications:**
1. The first few receivers used the old LFK4 package of transistors in the amplifier. TR1 (BC108), TR2 (OC81), TR3 (AC127), TR4 (AC127) and TR5 (OC81).
   *Note:* TR1 not in package.

   Later receivers use the new LFK4 package, TR1 (BC108), TR2 (AC128), TR3 (AC127), TR4 (AC127) and TR5 (AC128).
   *Note:* TR1 not in package.

2. L8 (3rd I.F.T.) was changed to include screen plate in order to reduce tendency to instability at L.F. end of M.W. band with new batteries.
3. A resistor (3kΩ) has been added between primary collector top of L8 (3rd. I.F.T.) and E, on some models only.

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**General Description:** The "Gondolier" model GP42 is an A.C. mains-operated transportable record reproducer with 7 watts push–pull output and the Garrard 3000 record changer. The record reproducer is stereo adaptable and a speaker amplifier unit, AL42 of similar construction is available. The following service information is equally correct for both equipments.

**Features:**
1. Wide range elliptical loudspeaker with 15 ohms voice coil.
2. Ample power reserve. 7 watts.
3. Independent bass and treble controls.
4. Either Garrard model 3000 or SP25 (single player).
5. Illuminated controls externally situated.
6. Socket for radio and tape play back utilising internal amplifier and speaker.
7. Switched socket for external hi-fi speaker (15 ohms) or tape recorder.
8. Quick action securing device for transit of free floating record changer.
9. Transformer isolated from the...
mains, completely safe. External equipment such as tape recorder, etc., may be added without fear of shock.

**Note:** The model 3000 Garrard unit is not adaptable for 60-c/s supply.

**Pickup:** Acos GP96/1 turnover stylus. LP/Stereo frequency response 30 c/s to 15 kc/s. separation better than minus 15 dBs at 1000 c/s.

**Installation:** Ensure that the mains voltage adjustment is correct for the supply from which it is to be used. Access to the voltage adjustment panel is obtained by removing the plate at the rear of the case. Wherever possible a 3-pin mains plug should be used with the green lead connected to the earth pin. If a 2-pin plug must be used, reverse the plug connections for minimum hum with the volume control advanced towards maximum. Loosen transit screws fully before use. Check stylus pressure and adjust if necessary to 5–6 grammes, measured with a pressure gauge.

**Stereophonic Reproduction:** Setting up for stereophonic reproduction is very simple. Couple the two units by the co-axial lead supplied, i.e. from

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(H367b) CIRCUIT DIAGRAM—MODEL GP42 (CONTINUED)
the stereo output of the GP42 to the input socket of the AL42. Each unit has independent volume controls. These must be set to approximately the same level on each unit. The calibrated tone control panel will help the operator to determine the positions of the volume, treble and bass controls. If, however, the treble or bass controls are adjusted on one unit to suit various makes of records, the corresponding changes must be made on the other unit. To help obtain a balance between the two units, it is advisable to play an ordinary monophonic record and to adjust the volume controls on each unit so that the apparent sound is "moved" to the centre of the two units. This system enables the operator to adjust the two units for optimum reproduction in stereophonic sound.


![H368 Sockets](image)

**Removal (Motor Board and Changer):** Remove four fixing screws located on the motor board. Lift motor board and unplug motor supply (a 3-pin plug located on the amplifier chassis) and the four pickup slip-on tags. The motor board can now be completely withdrawn. To remove auto changer from motor board, it is necessary to depress auto changer to the motor board, to release the pressure on the two locking clips situated on the underside of the board. Twist clips to an upright position and withdraw auto changer. For assembly reverse procedure.

*Note:* Pickup connecting leads must be reconnected in the same order as when they were removed and in the same position. Incorrect positioning of the leads could result in excessive hum and if they are pulled too tight they can cause acoustic feedback.

**Removal (Amplifier):** Unplug all existing plugs on the amplifier. These plugs cannot be interchanged hence there is no danger of a wrong connection being made when re-assembling. Remove the fixing clamp situated on the right-hand side of the chassis, two 4BA nuts located at the top and a fixing screw near the mains transformer. Unfasten insuloid clip to free mains lead. Withdraw amplifier. For assembly reverse procedure.

**Removal (Tone Control Unit):** Remove top panel by undoing five fixing screws. Disconnect slip-on leads from switched socket panel and earth to speaker chassis. Undo fixing clamp. Unfasten plastic strap to free mains cable. Withdraw tone control unit. For assembly reverse procedure.
RADIO SERVICING

Removal (Speaker): Remove slip-on tags. Note connections. Undo four nuts securing speaker and withdraw speaker.

Removal (Switched Socket Assembly): Undo four woodscrews, plastic strap and withdraw. For assembly reverse procedure.

Removal (Amplifier Unit AL42): Take back cover off and undo 2 × amplifier fixing bolts located on the crossbar and the dog clamp on both sides of the chassis. Unplug mains switching connecting plug and T/C input plugs. Remove slip-on tags to L/S and lift amplifier out over the bar. Speaker and T/C removal as on GP42. For assembly reverse procedure.

Sensitivity: Remove the tone control and short out the feedback lines on the 4-pin socket, pins 2 and 3. Connect a wattmeter (15 ohms impedance) and C.R.O. to the secondary of output transformer, having disconnected L.S. Inject 1000 c/s. into grid of V1a, 250 mV. for 6 watts output.

Frequency Response: With conditions as for Sensitivity, reduce input signal to give an output of 1 watt at 1000 c/s. 30 c/s. (0 dB), 1000 c/s. (0 dB) and 20 kc/s. (0 dB). Limits plus or minus 1 dB.

Hum and Noise: With conditions as for Frequency Response, remove input source and with grid open the hum and noise should be approximately minus 60 dB.

Sensitivity through Tone Control Unit: With conditions as for Sensitivity. Plug in the tone control unit and remove the shorting link from the feedback line. Turn volume, treble controls to maximum, bass minimum and connect the switched socket panel to amplifier tone control. Connect wattmeter and oscilloscope to secondary of output transformer. Inject a 1000 c/s. signal source from A.F.G. into the radio socket. Adjust the input to give 6 watts output. Input required 400 mV.

Frequency Response of Tone Controls: With conditions as for Frequency Response, reduce the input at 1000 c/s. to give an output of 100 mW. 70 c/s. (bass max. plus 9 dB, bass min. o dB). 1000 c/s. (Level o dB). 10,000 c/s. (Treble max. plus 3 dB, Treble min. minus 16 dB).

<table>
<thead>
<tr>
<th>Static Voltage</th>
<th>Avo 8 volts</th>
<th>Range volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mains in</td>
<td>245</td>
<td>1000 A.C.</td>
</tr>
<tr>
<td>Secondary</td>
<td>250–0–250</td>
<td>1000 A.C.</td>
</tr>
<tr>
<td>Heater 2 to V3</td>
<td>6.3</td>
<td>10 A.C.</td>
</tr>
<tr>
<td>Heater 2 to V1 and lamp</td>
<td>6.3</td>
<td>10 A.C.</td>
</tr>
<tr>
<td>H.T.1 C12</td>
<td>260</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>H.T.2 C11</td>
<td>250</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>H.T.3 C8</td>
<td>240</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>V1a pin 9 anode</td>
<td>145</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>V2a pin 9 anode</td>
<td>145</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>V1b pin 6 anode</td>
<td>260</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>V2b pin 6 anode</td>
<td>260</td>
<td>1000 D.C.</td>
</tr>
<tr>
<td>V1a pin 2 cathode</td>
<td>1.3</td>
<td>10 D.C.</td>
</tr>
<tr>
<td>V2a pin 2 cathode</td>
<td>1.2</td>
<td>10 D.C.</td>
</tr>
<tr>
<td>V1b pin 7 cathode</td>
<td>7.8</td>
<td>10 D.C.</td>
</tr>
<tr>
<td>V2b pin 7 cathode</td>
<td>7.8</td>
<td>10 D.C.</td>
</tr>
</tbody>
</table>

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**General Description:** Battery-operated, portable transistorised record reproducer with an output power of 1-2 watts. Garrard record player unit SRP12. Pickup, ERC Compact D–HC. Speaker, elliptical 25 ohms. Batteries, $3 \times $PP9, or $18 \times $U2 (if fitted with alternative battery containers and retaining panel).

**Access for Servicing Amplifier and Motor:** 1. Access to the batteries is obtained by removing the back which is held in place by two turn buckle screws (turn clockwise). One PP9 battery drives the motor and the remaining two batteries (in series) feed the amplifier.

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(H361) Component Locations—Model GP19
2. To obtain access to the amplifier or motor, it is necessary to remove the screws securing the motor board to the cabinet, taking care not to lose the cup washers, the motor board may now be lifted up. To remove the amplifier chassis, remove batteries and battery shelf from rear of case. Unplug the On/Off switch leads from the motor board and pickup leads, making note of the pickup connections so that they may be replaced in the same order. The motor board can now be removed entirely. Remove the sloping wooden panel which conceals the speaker, by taking out the securing screws at each side. Disconnect the speaker. Remove the three wood screws holding the amplifier in position. Remove leads from cleat. It is now possible to remove the amplifier.

3. If the speaker is removed for any reason, make sure when replacing, to tighten nuts alternatively a little at a time and avoid over-tightening which could distort the cone.

(H360a) Circuit Diagram—Model GP19 (Part)
**Hacker**

**Static Voltages:** The voltages given below were measured with a voltmeter of 20,000 ohms per volt:

<table>
<thead>
<tr>
<th>Collector volts</th>
<th>Base volts</th>
<th>Emitter volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TR1 +ve terminal to junction of R5/R4</td>
<td>4.0</td>
<td>1.5</td>
</tr>
<tr>
<td>TR2 +ve terminal to junction of R10/R8</td>
<td>3.2</td>
<td>0.625</td>
</tr>
<tr>
<td>TR3 +ve terminal to HT+</td>
<td>0.15</td>
<td>6.4</td>
</tr>
<tr>
<td>TR4 +ve terminal to HT+</td>
<td>9.1</td>
<td>0.15</td>
</tr>
<tr>
<td>TR5 -ve terminal to Earth</td>
<td>18</td>
<td>9.4</td>
</tr>
<tr>
<td>TR6 +ve terminal to HT+</td>
<td>18.0</td>
<td>9.1</td>
</tr>
</tbody>
</table>

**Quiescent Current and Mid-Point Voltage Setting:** With speaker or output meter connected: 1. Short-circuit amplifier input by a link between Pin No. 4 and 5 of SK1, or set volume control to minimum. 2. Connect

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(H360b) Circuit Diagram—Model GP19 (Continued)
Radio Servicing

a 0·10 mA. meter between the test link terminals (having first cut the wire link). 3. Connect a 1-10-volt meter between the mid-point voltage test point, which is the junction of R19, R20 and Earth (negative to Earth). 4. Connect batteries. 5. Adjust RV4 to give a quiescent current of 4 mA. Also adjust RV3 to give a mid-point voltage reading of 8·85 volts. Readjust as necessary, seal RV4. Switch off supply. Remove meters. Replace link and remove short-circuit from input.

**Warning:** It is important at all times to avoid short-circuiting the speaker leads as this will result in damage to the output transistors.

**Amplifier Sensitivity:** With bass and treble controls set to minimum:
1. Connect oscilloscope and output meter (22-30 ohms impedance) to the output transistors of the amplifier. 2. Inject a signal at 1000 c.p.s. from the audio generator to the top of the volume control, to produce 1·2 watts undistorted output as indicated on the oscilloscope. Sensitivity for 1·2 watts output—25 mV. (22-ohm load); Sensitivity for 1·1 watts output—20 mV. (30-ohm load). 3. If uneven clipping of the waveform occurs near the rated power output, adjust RV3 slightly to produce even clipping. 4. Limits of sensitivity tests plus or minus 1 dB. 5. Audio generator 600 ohms output.

**Frequency Response:** With conditions the same as for Amplifier Sensitivity, reduce audio generator output to produce an output of 100 mW. Then the following results should be obtained: 1000 c/s. (0 dB), 100 c/s. (—1 dB) and 10 kc/s. (—4 dB). Limits plus or minus 2 dB.

**Tone Control:** With conditions the same as for Frequency Response keep the reference frequency of 1000 c/s., and reduce input to produce an output of 10 mW.: 1. Change the generator frequency to 50 c/s. and rotate the bass control to maximum. The change from minimum to maximum should produce a change in output of 13 dB. Return bass control to minimum. 2. Change the generator frequency to 10 kc/s. and rotate the treble control to maximum. The change from minimum to maximum should produce a change in output of +14 dB. 3. Limits in both tests plus or minus 3 dB.

**Stability:** With no input to the amplifier but with the output meter or speaker connected, connect oscilloscope to output terminals and note that no oscillations are visible in the trace.

**Noise:** With output meter connected, turn treble, bass and volume controls to maximum and noise level should only just be noticeable on 5 mW. range, i.e. —50 dB on 1 watt.

**Battery Consumption:** Amplifier quiescent current is 15 mA. approx. Motor current at 33 r.p.m. is 40 mA. approx. Motor current at 78 r.p.m. is 60 mA. approx. Note that any extra load on motor will increase motor current.

**Pickup Stylus Pressure:** Use pressure gauge when adjusting screw at base of pickup pivot. Pressure 6·5–7 gm.
H.M.V. Model 2026

General Description: This model is similar to the H.M.V. Model 2328 described in this volume.

Notes: Model 2026 is not fitted with V.H.F./F.M. radio. Regarding the component locations diagrams for Model 2328, the F.M. printed board and SKT2/P2 do not exist in Model 2026.

H.M.V. Model 2030

General Description: This model is similar to the Ultra Model 6018 described in this volume.

Chassis Removal: Remove ventilation panel (two screws) from record changer compartment and take out screw from each end of escutcheon plate. Slip a thin card between escutcheon plate and cabinet sides to protect the leathercloth when removing or replacing chassis. To free escutcheon plate ease up at front to free it from slot in cabinet and slide it back to clear control knobs. From top of chassis, unplug socket leads, taking careful note for correct reconnection.

Changer Removal: Unfasten ventilation panel and remove four screws and cup washers to release motor board. Withdraw and lift motor board on to its side. Unfasten mains lead cleat, disconnect plug connections from tag strip on underside of record changer (note colour coding to ensure correct reconnection) and also unplug lead connections to socket panel after taking note of appropriate connections. Unsolder motor leads from On/Off switch on amplifier chassis. The record changer assembly may now be lifted clear of the cabinet.

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H.M.V. Model 2150

**General Description:** Radio receiver with 500 mW. output. Aerials, ferrite rod for A.M. and telescopic rod for F.M. Speaker, round 35 ohms. Sockets, car aerial and personal listening which may also be used for feeding a tape recorder. Battery, two 9 volt DT6.


**Alignment (General):** A signal from a suitable generator, 30 per cent. amplitude modulated by an A.F. signal is required for circuit alignment. Tuning indication is best obtained either with an output meter having an impedance of 35 ohms and connected in place of the loudspeaker or a Model 8 Avometer, set to the 2-5-volt A.C. range, connected in parallel with the loudspeaker. Throughout alignment the signal input level to the receiver should be adjusted to maintain the audio output at approximately 50 mW. with the volume control set at maximum in order to avoid alignment error due to A.G.C. action.

![Diagram of Drive Cord Assembly](image)

**H222) Drive Cord—Model 2150**
(Shown with Tuning Gang fully closed)

**Alignment (A.M. I.F.):** Select M.W. and turn gang to maximum capacitance. Apply a 475 kc/s. modulated signal through a 0.1 μF. capacitor between tags 18 and chassis line tag 16. Adjust L26/27, L24/25, L20/21 and L18/19 in that order for maximum output.

**Alignment (A.M. R.F.):** With gang at maximum, check that cursor coincides with the "zero" pip at left-hand end of each scale. Slide cursor along drive cord to correct any error in calibration. M.W. must be aligned first. Medium and Long wave signals should be injected via a loop loosely coupled to the ferrite rod aerial.

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>Centre of 500 m.</td>
<td>L13, L5</td>
</tr>
<tr>
<td></td>
<td>1500 kc/s.</td>
<td>Centre of 200 m.</td>
<td>C25, C8</td>
</tr>
<tr>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>L.W. calibration marker</td>
<td>C29, L6</td>
</tr>
</tbody>
</table>

*Note: Adjust L5 by sliding ring along ferrite rod. Adjust L6 by sliding coil former along ferrite rod. Repeat adjustments as necessary to obtain accurate calibration.*

**Alignment (F.M. I.F.):** Select F.M. Inject 10-7 Mc/s. (25 kc/s. devia-
tion) signal, via a 0.1 µF. blocking capacitor, between F.M. I.F. injection point (lower tag on R6) and chassis line (tag 16) and peak L30/31, L28/29, L22/23, L16/17 and L11/12 for maximum output. Switch signal generator to A.M. (30 per cent. modulation) and adjust L30/31 for minimum output (A.M. rejection).

**Alignment (F.M. R.F.):** Inject F.M. R.F. signals into telescopic aerial lead with aerial disconnected.

<table>
<thead>
<tr>
<th>Range</th>
<th>Inject</th>
<th>Tune to centre of</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.M.</td>
<td>88 Mc/s.</td>
<td>88 Mc/s. calibration</td>
<td>L9, L8</td>
</tr>
<tr>
<td></td>
<td>96 Mc/s.</td>
<td>96 Mc/s. calibration</td>
<td>C18, C11</td>
</tr>
<tr>
<td></td>
<td>92 Mc/s.</td>
<td>92 Mc/s. calibration</td>
<td>L12</td>
</tr>
</tbody>
</table>

*Note:* Adjust L9 by slightly opening or closing coil turns.

**Circuit Diagram Notes:** All voltages were measured with a 20,000-ohm volt-meter and are with respect to the positive supply line of each transistor except where otherwise shown. Ringed figures indicate printed board tag connection points. D.C. resistance readings are shown against inductors where these are 1 ohm or greater.

**Circuit Description (F.M.):** The telescopic aerial applies F.M. signals via tuned input transformer circuit L2, C1 and L3, C3 to the emitter of VT1. The collector circuit of VT1 is tuned by L8, C10, C11 and C14. This stage operates as a grounded base R.F. amplifier feeding via R4, C12 into the emitter of grounded base oscillator and mixer transistor VT2. The collector of VT2 is loaded by L11–L12 and tuned by series capacitors C30,
(H223b) Circuit Diagram—Model 2150 (Continued)
C31. C17 provides coupling into the oscillator circuit L9, C15, C18 and C21 with C16 providing feedback into the emitter of VT2. L10 and C19 form a 10-7 MHz F.M. I.F. rejector with C20 acting as an input phase corrector at oscillator frequencies.

A portion of the 10-7 MHz I.F. output developed across L12 is tapped by means of the potential divider C30/C31 and fed via switch S3A, contacts 2 and 3, to the base of VT3 which operates as an I.F. amplifier when the receiver is switched to F.M.

**Circuit Description (A.M.):** Medium- or long-wave windings and base coupling coil L7 on the ferrite rod are selected by switch S2A and coupled by switch S3A, contacts 1 and 2, to the base of A.M. mixer transistor VT3. VT1 and VT2 are rendered inoperative when contacts 2 and 3 of switch S3B open to disconnect their emitter and bias voltages from the positive rail.

The load presented by F.M. transistors VT1 and VT2 is replaced by R10 in order to maintain an unchanged supply voltage to the I.F. and audio stages when the receiver is switched for A.M. operation.

**Circuit Description (W6):** The diode (W6) is biased by VT7 collector current and acts as a variable resistance which is sensitive to voltage and temperature variations. The voltage developed across W6 equals the sum of the nominal output transistor (VT8 and VT9) base/emitter voltages and so determines the correct quiescent operating conditions. During low ambient temperature conditions the resistance of W6 increases thus compensating for the falling current of the output transistors. This effect also takes place in the event of a falling battery voltage. The diode W6 also assists thermal stability at high temperatures and opposes high current drain from the battery.

**Access For Service:** 1. Insert and twist coin in slots in cabinet base to release cabinet back cover. 2. Take out battery, pull off volume and tuning control knobs (note felt washers and plastic inserts) then remove countersunk screw securing telescopic aerial and connecting lead to cabinet base. 3. Withdraw telescopic aerial from insulating tube, release battery and loudspeaker leads from cable clip, unsolder cabinet top trim earthing lead from right-hand side of L.W. aerial coil former, then take out two screws at lower edge of printed board. Note positions of insulating washers. 4. The printed board assembly may now be lifted out within limit of loudspeaker leads and turned over for access to drive cord and copper side of printed board. 5. When reassembling, ensure that insulator is correctly located over loudspeaker tag panel and do not omit to refit telescopic aerial rod insulator tube.

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### H.M.V. Model 2322

**General Description:** This model is similar to the Ferguson Model 3334 described in this volume.
**H.M.V.**

**Model 2328**

**General Description:** Stereomaster radiogram with 14 watts output (7 watts per channel). Turntable; Garrard Autochanger 3000 with low mass Cartridge; Sonotone 9TAHC with diamond L.P. stylus, stereo balanced by pre-set control. Speakers; two round (10 ohms) and two tweeters (10 ohms). Sockets; Record and playback (100k), Radio or tuner (20k), 200–250 volts A.C. 50 c/s.

**Amplifier Controls:** Calibrated Volume (Mains On/Off); Calibrated Bass; Calibrated Treble; Stereo/Mono Selector; Gram-Tape-Radio Selector.

**Integral Tuner Unit:** Push-button tuning for three F.M. programmes. A.F.C.; Internal dipole with provision for external aerial connection (75 ohms); A.F.C. On/Off control; Home, Light and Third push-buttons (each button tuneable over range 87·5–101 Mc/s.).

![Printed Board](H262)

**Chassis Removal:** Unscrew transit screws fully anti-clockwise to lock auto-mechanism then turn cabinet on its side taking precautions to protect the surface.

Remove cabinet base cover (16 screws) then unplug F.M. aerial lead. Detach ventilation panel (three screws) from turntable compartment and pull off stereogram control knobs. Turn cabinet on its front, take out chassis board fixing screws (two short ones from the control panel end and two longer ones from the lower rail) then slide out chassis board assembly within limit of leads taking care not to lose rubber bush located between indicator lamp recess and chassis board.

For complete separation from cabinet, unsolder pickup and loudspeaker leads (note for reassembly the lead colour to each tag), disconnect motor leads from mains transformer and detach mains lead clamp from cabinet back.
**Record Changer Removal:** Detach ventilation panel from turntable compartment. Take off cabinet base cover. Disconnect motor leads from mains transformer and, taking note of connections, unsolder pickup cable from tag strip mounted on automechanism baseplate. With transit screws turned fully in, pivot clips on transit screws to enable them to pass through motor board, then lift changer out of cabinet.

*Note:* If the gramophone is to be operated with the cabinet base cover removed, it is essential to keep the volume level well attenuated otherwise damage to the high compliance speaker cones may result.

**Stylus Replacement:** A special diamond L.P. stylus is fitted to the pickup cartridge for minimum record wear at a stylus pressure of 2 to 3 g.

On some turntable units, to examine the stylus, it is necessary to turn aside a flexible pickup lift restrictor at the rear of the pickup arm. To remove the styli, turn the indicator flag to its mid position, and then by pulling the indicator gently outwards, the complete styli assembly may be withdrawn. The indicator of the replacement assembly must be similarly placed in the mid position before attempting to press the assembly into its location.

**Stylus Pressure:** To adjust stylus pressure (pickup weight), turn the knurled nut on the underside of the pickup arm clockwise to decrease or counter-clockwise to increase pressure.

**Audio Check:** The following tests should be made via the pickup leads for each channel. Connect output lead from audio generator (switched to 800 c/s.) to pickup leads, and output leads to output meter; plug in, switch on.

1. Set volume, bass and treble controls to maximum; switch to stereo.
2. Sensitivity for 5 watts per channel undistorted is 57 mV. approximately.
3. Turn bass and treble controls to minimum. Sensitivity for 5 watts per
channel undistorted is 120 mV. 4. Sensitivity for 500 mW. per channel is 37 mV. 5. Balance between channels should be within 2dB's. 6. Switch generator to 100 c/s. and check operation of Bass control, i.e. boost and cut, note that outputs at any setting of the control should be within 2dB of each other. 7. Switch generator to 10 kc/s. and check operation of treble control, i.e. boost and cut: note that output at any setting of the control should be within 2dB of each other.

**Audio Check:** The following tests should be made via the tape socket for each channel. Connect generator (switched to 800 c/s.) to Tape socket. Sensitivity from this socket for 500 mW. output is 10 mV.

1. Check that outputs are within 2dB of each other. 2. Switch to mono, check that outputs are similar.

**Note:** A pre-set balance control is incorporated for P.U. balance only and is set during manufacture. It will not require readjustment unless a replacement cartridge is fitted. The two audio boards are also matched at the factory to within 2dB.

**Alignment (General):** Remove chassis as described. Connect an output meter adjusted for 10 ohms impedance in place of L.H. or R.H. loud-speakers, or a 20,000-ohm meter set to a suitable A.C. voltage range between tags 109 and 111.

To ensure satisfactory operation of A.F.C. it is essential to ensure that the discriminator is adjusted to a balanced condition. This is achieved by measuring voltage between junction of R40–R41 and chassis line (tag 15). As this voltage will swing alternately positive and negative, a centre-zero meter (25–0–25 μA.) with a series 22 kΩ resistor produces a satisfactory movement. The meter should read 0 volts on completion of alignment. An Avo Model 8 on the 50 μA. D.C. range with series 22 kΩ resistor will also suffice but is not so convenient for following the voltage swing and zero reading.

**Alignment (I.F.): I.F. Circuits:**

Inject a 10–7 Mc/s. signal (25 kc/s. deviation) via 30 pF. capacitor to junction of R12–C15, with generator earth lead connected to "earthy" end of R10. Switch off A.F.C. Detune L3 by unscrewing core 2–3 turns. Peak L21 and L17/18 for maximum audio output.

*If D.C. meter does not read zero, a slight adjustment of L21 should be made to produce this condition.*

If L21 was readjusted, re-peak L17/18 and then L15, L13, L11, L9 and L7 for maximum output.

*If D.C. meter has moved off zero, correct with L21 and repeat this operation.*

Complete I.F. alignment with input of approximately 100 μV. reducing volume control setting to retain output at approximately 500 mW. Maximum output should now occur with D.C. = 0 and coincide with minimum noise or A.M. modulation. A check of balanced alignment may be made by swinging generator frequency either side of 10–7 Mc/s. when D.C. meter should show a similar deflection to positive and negative.
(H260a) Circuit Diagram—Model 2328 (Part)

Circuit Diagram Notes: All voltages were measured with an Avometer 8, and are with respect to the positive line appropriate to each transistor except where otherwise stated. Ringed figures denote printed board connecting points.
(H260c) Circuit Diagram—Model 2328 (Continued)
Alignment (R.F.): R.F. Circuits:

Retain D.C. meter connection as for I.F. alignment. Apply 87.5 Mc/s signal (25 kc/s. deviation) to aerial terminals. Select a tuning push-button and turn to L.F. end of band (i.e. bottom of scale).

Tune oscillator coil L4 for maximum output: zero reading on the D.C. meter will indicate correct tuning point. Change input frequency to 94 Mc/s. or any suitable frequency avoiding an interfering station. Tune push-button tuning control to this frequency for maximum output and peak R.F. coil L3 for maximum output. During this peaking operation a slight "pulling" of the oscillator may occur shown by the D.C. meter moving off zero; this should be corrected by the push-button tuning control and L3 then peaked for maximum output. During final alignment, input level should be approximately 10 µV. and the volume control adjusted for a convenient output level.

Circuit Description: The R.F. and oscillator sections follow conventional transistor tuner circuitry except that in both the R.F. and oscillator tuned circuits a variable capacitance diode provides the variable capacity tuning element. The voltage across these diodes, and thereby the capacitance, is varied by means of one of the tuner potentiometers R174, R175 or R716 which together with R177 and R7 form a potentiometer network across the D.C. supply lines. This variable voltage is applied to each diode tuned circuit via R6 and R8. This facility of tuning by voltage variation is further utilized for the application of A.F.C. (Automatic Frequency Control). Any out of balance voltage due to mis-tuning is fed via R16 and then to each circuit via R5 and R9 of such polarity as to correct tuning. This correction voltage is shorted out by S4 in the A.F.C. off position.

A.G.C. is applied to the R.F. amplifier via R15 and is derived from W3 in VT3 collector circuit. R44 is required to provide a base voltage suitable for the operation of transistors of varying parameters.

W6 is a Zener diode providing a stabilised supply voltage.

The output from the pickup is preamplified by low-noise silicon planar transistors VT151 and VT152. The amplified output is fed via the Radio-Tape-Gram Selector switch to audio amplifier VT101 of left- and right-hand channels. R161 across the audio amplifier input is adjusted for optimum pickup stereo balance, and the stereo-mono switch across R161 effectively parallels the left- and right-hand audio channel inputs for mono reproduction.

Separate Bass and Treble tone controls and a loudness-type Volume control are incorporated in the interstage coupling of audio amplifiers VT101 and VT102. C177-R164 are connected to a tapped volume control R166 so that additional bass boost is applied as volume is reduced. The output of VT102 is applied to the audio driver stage VT103. Stabilising diodes W101 and W102 are series connected in the collector circuit and feed into the complementary push-pull driver comprising n-p-n and p-n-p transistors VT104 and VT105.

D.C. coupling is used to the p-n-p output transistors VT106 and VT107.
H.M.V.

operating in push–pull and balanced by variable resistor R113 in VT103 emitter circuit. The output transistors are mounted in a large heat sink together with the two stabilising diodes. The diodes are included in the heat sink so that any temperature changes are immediately transferred to the diodes to ensure effective compensation. Overall negative feedback is applied to the base of audio driver VT103 from the push–pull power output stage via R114. C108, in parallel with R114, is incorporated in the loop for phase correction.

The audio outputs are fed to the loudspeaker system of each channel which consists of a sealed enclosure containing a specially developed side-mounted bass speaker featuring a large ceramic magnet and a rolled cone surround. The enclosure permits the maximum movement of the cone while avoiding “doubling” or “trebling” at low frequencies. A capacitive cross-over to a 3½-in. forward facing tweeter unit completes the system on each channel and combined with the bass speaker provides an even response over the whole range of audible frequencies.

A fully isolated mains transformer and full-wave rectifier provides a 30-volt line voltage supply to the amplifier circuits and includes a protective fuse incorporated in the negative rail.
K.B. "CHIEFTAIN" Model KR023

General Description: This receiver is similar to the K.B. model KR022 (Commodore), see facing page, apart from the R.F. Module RMM21 which does not incorporate separate coils, or push-button switching for car operation.

Component Details—Model KR023
K.B. “COMMODORE” Model KR022

**General Description:** This receiver is similar to the R.G.D. model RR222 (Rambler), described in the 1967–68 volume.

K.B. Models KG041 and KG042

**General Description:** These models employ the S.T.C. Chassis GC10 and GC11 described in this volume.

**Dismantling (Chassis):** 1. Ensure that the radiogram mains lead is disconnected from the mains supply. 2. Remove the circular knobs from the horizontal controls. 3. Unclip the control panel fascia; the hole sur-
rounding the tuning control spindle is elongated to facilitate this action. The small light bulbs may now be replaced easily if necessary. 4. Remove the longer of the two back panels. 5. Disconnect all plugs from the back of the chassis and also the A.M.P. connectors on the indicator bulb socket. Ensure the A.M.P. plugs do not short together. 6. Unplug the cartridge lead from the changer tag strip. 7. Unfasten the mains lead at the P-clip on the cabinet base by the mains lead slot in the cabinet back. 8. Remove the screw from the counterbored hole at the back of the cabinet. 9. Remove the screw from the right-hand side of the changer compartment. 10. Remove the two Phillips screws to the right of the card mask that fits over the control spindles. If the mains lead is unhindered, the chassis should now be free to be lifted vertically out of the cabinet.

Dismantling (Changer): 1. Remove the radiogram mains plug from the mains supply. 2. Remove the longer of the two cabinet backs. 3. Pull out the changer mains plug from the chassis. 4. Unplug the changer cartridge lead from the changer tag strip. 5. Set the transit screw clips on the changer vertical and, ensuring the mains lead is free to move, lift the changer vertically from the cabinet.

Note: When re-connecting the cartridge lead ensure the A.M.P. “Faston” lugs are terminated with the red lead to the tag with the red wire, the black lead to the tag with the white wire, and the screen to the centre tag.

Dismantling (Loudspeaker): 1. Disconnect the radiogram from the mains supply. 2. Remove the appropriate back panel of the cabinet. 3. Unplug the A.M.P. lugs from the speaker terminals. Ensure the lugs do not present a short-circuit to the output stages of the audio module. 4. Unscrew the nuts on the built-in speaker fixing bolts and pull the speaker off from these bolts.

Note 1: The lead with the red stripe should be reconnected to the lug marked with a red dot or +ve sign and the all black lead to the lug marked with a black dot or —ve sign.

Note 2: When refitting the speaker be careful not to puncture the cone with the built-in bolts.

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K.B. Model KP036

General Description: Record player with 3 watts output (Mk. 1 chassis) or 3.5 Watts output (Mk. 2 chassis). The chassis can be easily distinguished as the Mk. 1 has two tag strips, whereas the Mk. 2 has only one tag strip.

Circuit Description (Mk. 1): The transistor amplifier uses a low noise pre-amplifier stage TX1, incorporating feedback R3 C3 to provide capacitive loading for the cartridge. The output voltage developed across R4 is fed
via the volume and tone control network to the pre-driver TX2 and then on to the driver TX3. TX3 has D.C. feedback applied through R19 enabling the biasing condition of the driver to be adjusted by R18 for optimum performance. The output stage consists of two transistors TX4 and TX5 operating in complementary symmetry. They function in the common emitter mode due to the A.C. referencing action of C12. The changer motor has an 18.6 volt secondary which is used to supply the indicator lamp and to drive the 24 volt D.C. rail by bridge rectification.

**Circuit Description (Mk. 2):** The signal from the cartridge passes first to the bass control which functions by resistively loading the capacitive source. The treble control cuts high frequencies when the slider is towards the end of the control connected to R4. The signal then passes via the volume control R5 to the input of TX1 which has a high impedance. The amplified signal then passes to TX2 and thence to the complementary symmetry output. D.C. and A.C. feedback is applied via R13 and R11 from the output to the emitter of TX1. A large amount of feedback is applied to
eliminate the need for any adjustment for correct working conditions. The A.C. feedback is controlled by the networks C6, R12 and C5, R10.

The output stage consists of two transistors TX3 and TX4 operating in complementary symmetry. They function in common emitter mode due to the fact that R15 is connected to the live terminal of the load. The changer motor has an 18.6 volt secondary which is used to supply the indicator lamp and drive the 24 volt D.C. rail by half wave rectification.

Note: This amplifier has a negative H.T. rail.

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Bias Adjustment (Mk. 1): Disconnect the cartridge from the input and with volume, bass and treble set at maximum, use the following procedure:
Set the present resistor R18 to the centre of its travel. Apply a 1 kc/s.
sine wave signal to pin 5 of tape socket. Replace the loudspeaker by a
15-ohm 3-watt resistor, and connect an oscilloscope across it. Increase the
input signal until clipping of the output waveform occurs and then adjust
R18 for symmetrical clipping.

(H33b) Circuit Diagram—Chassis Mk. 1 (Continued)
**Dismantling:** Unscrew the three plastic screws on the back cover and remove. The two chrome screws on the control panel should then be removed and the control panel lifted clear of the cabinet, and placed upside-down over the position from which it was withdrawn, to enable servicing.

**Stylus Replacement:** Turn the stylus flag to the L.P. position, that is turnover flag pointing towards the centre of turntable when looking downwards on to the pickup arm. Then pivot pickup arm upwards so it is at 90° to turntable. If the pickup cartridge is viewed from the underside a plastic tube coded with a blue strip will be observed. The fingernail should be inserted under the lip on the front of this tube and gently ease the tube complete with metal stylus arm away from the flag moulding until it is an angle of approximately 45°. The stylus may then be removed with fore-
finger and thumb. To replace, reverse this procedure ensuring that the coded plastic tube is fitted securely, and the rear end is in contact with the turnover flag proper. Make certain that the metal stylus is firmly located in the V-shaped groove of the drive pocket.

Semiconductor Complement:

Mk. 1
BC109
BC113
AC176
AC176 NPN
AC128 PNP
LT120 (bridge)

Mk. 2
Pre-amplifier
BC154
Pre-driver
BC107
Driver
AC176
Push-Pull Output
AC128
H225L/9004—Rectifier.

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**General Description:** This model is similar to the Klinger Model KC24 described in this volume. The letter M indicates that a dynamic pickup is used.
**General Description:** Compact stereo HI-FI system consisting of a player unit and two identical loudspeakers. Power output 5 watts per channel. Power supply 200-250 volts A.C. 50 c/s.

**Record Changer:** Garrard model 3000 equipped with lightweight arm, ceramic cartridge and diamond stylus.

**Loudspeakers:** Bookshelf size acoustically designed speaker system enclosures contain separate bass and tweeter speakers with a crossover network. Impedance 8–16 ohms.

**Amplifiers:** Two closely matched, 5 watt, 7-transistor amplifiers independently constructed on modular circuit boards.

**Dismantling:** Place player unit upside down and remove base board. Disconnect motor and pickup, remove nut on one side and long nut on other side to withdraw entire front assembly from the two bolts anchored in front of cabinet. The two amplifiers are constructed on plug-in boards. Each amplifier board has nine pins which plug into a valveholder near centre of chassis. A retaining strip on a spring ensures that the boards remain in the valveholders. On the outer ends each board has a bracket fixed to chassis with a selfthreading screw.

To remove a board, release tension on the retaining strip and swing board out sufficiently to unplug. The valveholders pivot on their fixing points. The four soldered connections on each board are shown in the diagram. Note that the heat sinks on outer ends of each board are at collector potential of power transistors. Care must be taken to avoid contact with chassis when power is on, as this could destroy the transistors.

**Notes:** The loudspeakers are sealed units. In the event of failure they should be returned to the makers. In case of a fault involving semiconductors on the boards, contact the makers for a replacement board in exchange for faulty one.

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**Diagram:**

![Diagram of Amplifier Board - Soldered Connections](image)

*(H280) Amplifier Board — Soldered Connections*
**KLINGER**

**Controls:**
1. On/Off.  
2. Radio/Gram.  
3. Stereo/Mono.  
4. Volume.  
5. Balance. In its central position the volume from each speaker is the same. The control varies the relative volume from the two speakers. In the extreme positions one speaker or the other is silenced.  
7. Treble.

*chassis fixings

*Muting Switch

**Model KC24**

**General Description:** This model is similar to the Klinger Model KC23 previously described in this volume. However, this model employs the Garrard SP25 playing deck and a separate compensated preamplifier.

**Table of Components:**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>10 mF.</td>
<td>6 volts</td>
<td>R3</td>
<td>2K7</td>
</tr>
<tr>
<td>C2</td>
<td>25 mF.</td>
<td>10 volts</td>
<td>R4</td>
<td>10k</td>
</tr>
<tr>
<td>C3</td>
<td>64 mF.</td>
<td>4 volts</td>
<td>R5</td>
<td>220 ohms</td>
</tr>
<tr>
<td>C4</td>
<td>0.015 mF.</td>
<td>10 volts</td>
<td>R6</td>
<td>4K7</td>
</tr>
<tr>
<td>C5</td>
<td>0.047 mF.</td>
<td>4 volts</td>
<td>R7</td>
<td>100k</td>
</tr>
<tr>
<td>C6</td>
<td>250 mF.</td>
<td>16 volts</td>
<td>R8</td>
<td>150k</td>
</tr>
<tr>
<td>C7</td>
<td>220 pF.</td>
<td>4 volts</td>
<td>R9</td>
<td>4K7</td>
</tr>
<tr>
<td>C8</td>
<td>16 mF.</td>
<td>16 volts</td>
<td>R10</td>
<td>2K7</td>
</tr>
<tr>
<td>C9</td>
<td>125 mF.</td>
<td>16 volts</td>
<td>R11</td>
<td>6K8</td>
</tr>
<tr>
<td>R1</td>
<td>150k</td>
<td>VT1</td>
<td>BC109</td>
<td></td>
</tr>
<tr>
<td>R2</td>
<td>22k</td>
<td>VT2</td>
<td>BC108</td>
<td></td>
</tr>
</tbody>
</table>
KLINGER

Model KC26

General Description: Hi-fi stereo amplifier with power output of 13 watts per channel. Speaker Matching, 8–16 ohms from transformerless output stages. Power supply, 200–250 volts A.C. 50–60 c/s.

Input Selector Control: Push-button interlocked. 1. P.U.1. For magnetic (dynamic) pickups. Stereo or mono. 2. P.U.2. For crystal or ceramic pickups. Stereo or mono. 3. Radio. For stereo or mono tuners. 4. Tape. For replay from monitor or speaker outlet on tape recorder, or tape preamplifier. 5. Auxiliary. For high output crystal pickups or other signal source.
**Bass Control**: Precision ganged—continuously variable. Boost 14 db at 40 Hz. Cut 15 db at 40 Hz. Indicated centre position for level response.

**Treble Control**: Precision ganged—continuously variable. Boost 12 db at 14 kHz. Cut 18 db at 14 kHz. Indicated centre position for level response.

**Balance Control**: Single knob adjustable for correct balance between channels from zero to maximum power. Calibrated centre zero setting.

**Volume Control**: Precision ganged for both channels—continuously variable.

**High Filter Control**: Rotary three position, cutting 10 db at 7 kHz, 10 db at 10 kHz, and "out". Used to reduce or eliminate scratch from records, or whistles and interference on radio.

**Low Filter Control**: Push-button 18 db cut at 50 Hz. Used to reduce or eliminate turntable rumble, or other low frequency interference.

**Mode Switch Control**: Four position: 1. Power off. 2. Stereo. 3. Stereo reverse (reversing left and right channels). 4. Mono. Left channel input feeding both outputs.

**Input Sensitivities**:

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Matching</th>
<th>Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickup 1</td>
<td>3.5 mV.</td>
<td>47 kΩ</td>
</tr>
<tr>
<td>Pickup 2</td>
<td>2 mV.</td>
<td>47 kΩ</td>
</tr>
<tr>
<td>Radio</td>
<td>100 mV.</td>
<td>220 kΩ</td>
</tr>
<tr>
<td>Tape</td>
<td>100 mV.</td>
<td>220 kΩ</td>
</tr>
<tr>
<td>Auxiliary</td>
<td>250 mV.</td>
<td>430 kΩ</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R.I.A.A. compensated for magnetic (dynamic) pickups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>R.I.A.A. compensated for ceramic pickups</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flat (for high-output crystal pickups or other high level programme sources)</td>
</tr>
</tbody>
</table>

**Circuit Diagram Notes**: C3 may be 0.47 μF. An extra capacitor 680 pF, is connected between base of TR3 and junction C11/C14. Set RV5 for symmetrical clipping on full drive. Voltage on emitter of TR5 should read 1.4 volts. Figures set in squares denote numbering of connections on printed circuit board. The manufacturer reserves the right to alter circuit diagram without notice.
Service: To simplify service, the modular sub-units are available separately or as replacements. The three principal units are: (a) Input Selector Switch with PC boards and wire to tails complete with diagram of connections and colour code. (b) Preamplifier circuit boards Ref. 1010/25. (c) Complete Power amplifier module with power transistors and speaker terminals. Detach faulty unit by removal of two screws at rear of amplifier and four connections.

A.C. Outlets: Two 2-pin sockets (U.S.A. standard) are provided at the rear of the amplifier. These are convenient power sources for gramophone motor, tuner or tape unit. The power from these sockets is not fused. One of the sockets is controlled by the on/off switch of the amplifier.

Input Connections: The inputs are standard international co-axial (phono) sockets. Screened cables must be used, whereby the screening forms the only “earth” connection between the amplifier and other equipment. Multiple earthing may introduce hum and instability.
KLINGER

General Description: This model is similar to the Klinger Model KC23 described in this volume. However, this model employs the Garrard AT60 playing deck and a separate compensated preamplifier (see Klinger Model KC24 in this volume).
**MARCONIPHONE**

**Model 4020**


**Valves:** V1 (10P18/UL84) and V2 (U381/UY85).

**Access for Service:** Secure the record changer by means of the transit screws. Remove the ventilation panel from inside cabinet (two screws). Take out screws around edge of motor board then pull it forward to clear securing slot. Lift from left-hand side and place on its rear edge diagonally across cabinet floor. The amplifier chassis is secured to the control panel by three nuts (two on Model 6008) before removing, pull off control knobs then take off nuts to release chassis.

To separate the assemblies unsolder from the tag panel all leads to the motor board. Note the respective connections and colour coding to facilitate reassembly. In Model 6008 the output transformer is fitted on the loudspeaker, the leads connecting this to the amplifier tag panel must also be disconnected.

**Circuit Diagram:** Note that the D.C. voltages were measured with an Avometer 8, with a mains input of 240 volts.
**MARCONIPHONE**

**MARCONIPHONE**

**Model 4140**

**General Description:** A.M. radio receiver with 600 mW. output. Aerials; ferrite rod and telescopic rod. Sockets; car aerial and earphone (15 ohms). Speaker, round 35 ohms. Batteries, two 9 volt PP7.


**Alignment (General):** Remove cabinet back cover only, then connect an output meter, set to 35 ohms impedance, in place of loudspeaker via jack plug connection to J1. Alternatively, connect a Model 8 Avometer (10 volt A.C. range) across speech coil via tags 12 and 13 on printed board.

**Set volume control to maximum but, during alignment, adjust signal generator output level to maintain receiver output at 50 mW.**

**Alignment (I.F.):** Switch receiver to medium waveband and turn gang to maximum capacitance. Apply a 475 kc/s. (30 per cent. modulated) signal, via a 0-1-μF. blocking capacitor, across C2 (aerial section of gang)

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**Use 32" Length of Nylon Braided Cord**

**Drive Cord—Model 4140**

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(H249) COMPONENT LOCATIONS—MODEL 4140

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(H251) DRIVE CORD—MODEL 4140

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then adjust IFT₃, IFT₂ and IFT₁ (in that order) for maximum output. Repeat until no further improvement results.

Alignment (R.F.): Inject M.W. and L.W. signals, via a loop loosely coupled to the ferrite rod aerial. On S.W. extend telescopic aerial and place signal generator lead nearby to provide a loose coupling. Check that cursor travel is central in scale window, i.e. the gap between cursor and edge of window is equal at both ends.

<table>
<thead>
<tr>
<th>Wave range</th>
<th>Signal generator</th>
<th>Tune to</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medium</td>
<td>600 kc/s.</td>
<td>500 m.</td>
<td>L₁₁, L₄</td>
</tr>
<tr>
<td>Bandspread</td>
<td>1500 kc/s.</td>
<td>200 m.</td>
<td>C₂₁</td>
</tr>
<tr>
<td>Medium</td>
<td>1500 kc/s.</td>
<td>Max. output at 200 m.</td>
<td>C₆</td>
</tr>
<tr>
<td>Bandspread</td>
<td>1500 kc/s.</td>
<td>200 m.</td>
<td>C₃</td>
</tr>
</tbody>
</table>

Repeat as necessary for accurate calibration and maximum output.

| Long             | 200 kc/s.        | 1500 m.          | C₁₈, L₅ |
| Short            | 7 Mc/s.          | 7 Mc/s.          | L₇, L₁  |
| Short            | 16 Mc/s.         | 16 Mc/s.         | C₁₃, C₉ |

Repeat as necessary for accurate calibration and maximum output.
(H250b) Circuit Diagram—Model 4140 (Continued)

Notes: Adjust L4 by sliding ring along ferrite rod. Adjust L5 by sliding former along ferrite rod. Pulling should be countered by rocking the gang when tuning C9.

Balance Adjustment (R14): VT6 and VT7 are balanced by R14. The output waveform should be viewed on an oscilloscope at maximum output, and R14 adjusted for symmetrical clipping.

Heat Sink Components: Whenever transistors (sleeved or unsleeved types) are used in heat sinks it is essential for the preservation of a low thermal resistance that there should be no air-space between the outside surface of the transistor and the inside of the heat sink. In the case of small transistors in cylindrical encapsulation, this air-space must be filled by the application of a suitable heat conducting grease and the transistor pushed fully into its sink. Although the heat sink grease is applied during-production it must always be reapplied by the engineer when replacing a transistor during servicing.

Heat Sink Compound DP2623, or Anti-Tracking Grease MS4, is suitable.
Circuit Diagram Notes: Figures in rectangles indicate voltages measured with an Avometer, between positive line of each transistor and point shown. D.C. resistance readings are shown against inductors where these are 1 ohm or greater. Ringed figures show printed board tag connections.

Dismantling: Slide open battery cover, then disconnect and take out batteries. Complete access to the printed board may be gained by removing the cabinet back cover which is retained by three countersunk screws in the cabinet base. For access to the drive cord and the copper side of the printed board, pull off control knobs and unsolder lead on telescopic aerial. Take out five screws and washers securing printed board, then unsolder leads on loudspeaker tag panel. The printed board may then be lifted out without further disconnection.

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MARCONIPHONE Model 4142

General Description: This receiver is similar to the Ultra Model 6146 described in this volume.

MARCONIPHONE Model 4322

General Description: Stereogram with an output of 2 watts continuous tone per channel. Record changer; B.S.R. Superslim UA15 with B.S.R. C1 cartridge and stylus type ST3. Aerials; ferrite rod for A.M. and internal dipole for F.M. Sockets; A.M. aerial, F.M. dipole and tape input and output. 200–250 volts A.C. 50 c/s.


Alignment (General): Remove chassis. Connect an output meter adjusted for 15-ohm impedance in place of L.H. or R.H. loudspeaker or a 20,000-ohm volt-meter set to a suitable A.C. voltage range across the L.H. or R.H. loudspeaker sockets. Zero, trim and pad markers are provided on the scale diffuser.

Circuit Diagram Notes: Voltage measurements shown in rectangles were taken relative to the positive rail of each transistor (except where otherwise indicated) with a 20,000-ohm volt-meter, and with a mains input of 245 volts. D.C. resistance readings are shown against inductors where these are 1 ohm or greater. When a stereo decoder unit Type SD2 is plugged into socket SKT5, the wire links A, B and C are cut where shown.
Alignment (A.M. I.F.): Switch receiver to M.W.: turn gang to maximum capacitance position and volume control fully clockwise. Inject a 475 kc/s., 30 per cent. modulated, signal via a 0.1 µF. capacitor between contact 5 of
switch S5A and chassis, then peak L29, L25, L22, and L21 for maximum output, adjusting signal input level as required to maintain an output level of 200 mW.
RADIO SERVICING

(H272c) Circuit Diagram—Model 4322 (Continued)

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MARCONIPHONE

**Alignment (A.M. R.F.):** Align M.W. first. 30 per cent. modulated signal should be injected at A.M. aerial/earth socket (SKT2) via a 30-pF. series capacitor. With the tuning gang at maximum, check that the cursor coincides with the zero marker on the scale diffuser.

<table>
<thead>
<tr>
<th>Range</th>
<th>Frequency</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>M.W. pad marker</td>
<td>L15, L10</td>
</tr>
<tr>
<td>L.W.</td>
<td>1400 kc/s.</td>
<td>M.W. trim marker</td>
<td>C32, C20</td>
</tr>
<tr>
<td>S.W.</td>
<td>220 kc/s.</td>
<td>L.W. 220 kc/s. marker</td>
<td>C36, L9</td>
</tr>
<tr>
<td></td>
<td>6-7 Mc/s.</td>
<td>M.W. pad marker</td>
<td>L19, L12</td>
</tr>
<tr>
<td></td>
<td>15-8 Mc/s.</td>
<td>M.W. trim marker</td>
<td>C30, C25</td>
</tr>
</tbody>
</table>

**Notes:** Adjust L10 by sliding ring along ferrite rod. Adjust L9 by sliding former along ferrite rod.

**Alignment (F.M. L.F.):** Use a signal generator providing Band II coverage, also 10-7 Mc/s. A.M. (30 per cent. modulated) and 10-7 Mc/s. F.M. signals (25 kc/s. deviation) at an impedance of 75 ohms.

Switch to V.H.F., and allow the receiver and test equipment to warm up for about 10 min.; set volume control 90 deg. back from maximum with treble and bass controls set to the midway position. Inject 10-7 Mc/s. F.M. signal between tag 7 and chassis, then adjust L31, L32, L27 and L23 for maximum output.

**Notes:** Tune L31 and L32 to outer peak with cores protruding from top of coil can.

**Alignment (A.M. Rejection):** Switch signal generator to 10-7 Mc/s. A.M. and tune L32 for minimum output (this should be a sharply defined dip in output). Switch signal generator to 10-7 Mc/s. F.M. and check that F.M. output has been retained. If maximum A.M. rejection does not coincide with maximum F.M. output, L32 should be tuned for maximum rejection at the expense of a slight reduction in F.M. output. Reset signal generator to 100 μV. F.M. output and recheck operations 1, 2 and 3 using volume control to maintain the output level at 500 mW.

**Alignment (F.M. R.F.):** Check that the cursor coincides with the “zero” marker on the scale diffuser when the gang is fully closed. Tune receiver to F.M. 94 Mc/s. marker on scale diffuser. Inject 94 Mc/s. F.M. signal into F.M. aerial socket (SKT1) and adjust L5, L3 and L6 for maximum output. Repeat as necessary for correct calibration.

**Pickup Balance:** R44 is a pre-set control which balances the left-hand and right-hand outputs from the pre-amplifier and, normally, will require adjustment only if the pickup cartridge is replaced.

**Audio Check:** Connect a 15-ohm impedance output meter in place of each loudspeaker. Alternatively, examine output waveform on an oscilloscope connected between tag 29 (or tag 26 for LH channel) and chassis. Switch to gram and turn both treble and bass controls fully clockwise, then connect audio oscillator between tags 22 and 18. Inject a 15-20 mV. 800 c/s. signal and note output; for a correctly functioning amplifier this

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should be clean, unclipped and approximately 2 watts. Transfer input to tags 17 and 18 and similarly check other amplifier.

**Tone Control Check:** With test conditions as for the audio amplifier check, volume control at maximum and tone controls set to the midway position, reduce input of 800 c/s. signal to produce 200 mW. output: this will require an input of approximately 5 mV. Back off volume control 20 db, i.e. increase input 20 db and adjust volume control to reduce output to original level. Inject an 80 c/s. audio signal and turn bass control from minimum to maximum: this should produce a variation of 12 db in output level. Inject an 8 kc/s. audio signal and turn treble control from minimum to maximum: this should produce a variation of 18 db. in output level.

**Chassis Removal:** Pull off rotary control knobs, best done by using a length of stout cord as a "puller". Disconnect F.M. aerial plug and remove back cover. Pull out A.M. aerial and F.M. aerial plugs from chassis then release tape recorder and aerial sockets panel from cabinet. Release mains lead clamp, then detach connections from chassis (mains transformer, pickup and loudspeaker). When removing loudspeaker socket connection from printed board, pull outward only to avoid breaking soldered connections on copper side of board. Remove 2BA nut and washers or 2BA bolt from chassis fixing lug located centrally at rear of chassis. The chassis assembly may now be pulled clear of front locating studs and manoeuvred clear of cabinet.

**Record Changer Removal:** Take out screws, swivel turnclips, and unplug F.M. and A.M. leads to release back covers. Unplug pickup and mains transformer connections from radio chassis, remove two 4BA nuts and shake-proof washers securing mains transformer to cabinet floor, and (in Models 2338, 3348 and 4322 only) take out sliding shelf beneath record changer. With record changer transit screws turned fully clockwise, pivot clips on lower end of transit screws to enable them to pass through motor board, then lift record changer and mains transformer clear of cabinet.
**General Description:** A three-band push-button portable radio receiver covering long, medium and short wavebands and incorporating a bandspread section of the medium waveband centred on Radio Luxembourg. Circuit features include seven transistors, one diode and a complementary transformerless push-pull audio circuit, with negative feedback and temperature stabilisation.

**Waveband Coverage:**
- **Long Wave:** 150–260 kc/s. (2000–1155 m.).
- **Medium Wave:** 540–1500 kc/s. (555–200 m.).
- **Short Wave:** 5·7–10·3 Mc/s. (49, 41 and 31 mb).

**Aerial:** Internal ferrite rod covering all bands. A seven section telescopic aerial is incorporated to improve short-wave performance. Socket also provided to allow connection to car aerial.

**Output Socket:** A socket is provided for feeding into an earphone, extension speaker or tape recorder. Insertion of a jack plug automatically mutes the internal loudspeaker.

- **Loudspeaker:** High flux 4½ in. diameter, 25 ohms impedance.
- **Power Output:** 250 mW. maximum.
- **Battery Supply:** 9 volts: Ever Ready PP7, Vidor VT7 or equivalent.
- **Consumption:** 11 mA. quiescent.
- **Intermediate Frequency:** 470 kc/s.

**Semiconductors:**
- AF115 Self-oscillating mixer.
- AF117 1st I.F. amplifier.
- AF117 2nd I.F. amplifier.
- AC127 Audio pre-amplifier.
- AC128 Audio driver.
- AC128 and AC127 Complementary push-pull output.
- OA90 Detector diode.

(F38) Location of Alignment Components

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Thermistor: VA1034 Temperature stabilising.

Dismantling: Remove back cover (two Phillips-head screws). Disconnect the lead to telescopic aerial. The chassis is held in position by four screws. To release chassis, slide the car aerial and output sockets out of their slots, remove tuning and volume control knob; (pull off) and remove chassis fixing screws.

Should it be necessary to replace the wave-change switch, it should be noted that the position of this switch is critical and, if misplaced, push-buttons will not centre in the escutcheon. When fitting the new switch, the free end of the pins protruding through the printed circuit board must measure \( \frac{7}{8} \) in. from the top of the pins to the face of the board.
Alignment Procedure: Equipment Required:

1. An output meter (25-ohm impedance, 0–100 mW.). The output during alignment should not exceed 50 mW.
2. A signal generator (low impedance output), amplitude modulated to 30 per cent, covering long, medium and short wave bands.
3. Suitable insulated trimming tools.

Notes:

1. Before commencing alignment, check that the pointer coincides with the alignment mark 1 when the gang is fully open.
2. For I.F. alignment (operations 1 and 2 in the alignment table) the signal generator is connected to the base of Tri via a 0.01 μF. capacitor.
3. For R.F. alignment (operations 3–11 in the alignment table) the output from the signal generator should be fed into a transmitting coil placed 6 in. from the ferrite rod. A suitable coil can be made with approximately 14 turns of 18 s.w.g. enamelled copper wire wound on a 1-in. former and spaced to a length of 1 to 1 1/4 in.
(F41) The circuit board employs plated circuit technique with printed wiring on both sides. The diagram above shows the board as viewed from the tin dip side, with components as seen through the board. Wiring shown in broken line represents printed connections on the component side of the board. The printed circuit (PC) connections are also identified on the circuit diagram.
4. The alignment points referred to in the alignment table are marked on the scale back plate.
5. All cores should be turned to the outer position.
6. Adjustment of L2 and L3/L4, where mentioned in the alignment procedure, is achieved by sliding the appropriate coil along the ferrite rod.
7. Adjustment of L6 is achieved by altering the spacing of the turns.
8. After alignment, the aerial coils should be resealed.

N.B.: The short-wave section of this receiver is restricted and covers the 31, 41 and 49 meter bands only. No oscillator tuning adjustment is provided, and in steps 9 and 10 the appropriate signal should be injected and the signal tuned in before the aerial adjustments are made.

Alignment Table:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Set pointer to alignment mark</th>
<th>Waveband</th>
<th>Signal gen. frequency</th>
<th>Adjust for maximum output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Gang fully closed</td>
<td>M.W.</td>
<td>470 kc/s.</td>
<td>L14, L12, L7</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>L11</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>L3/L4</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>M.W.</td>
<td>1440 kc/s.</td>
<td>TC3 and TC5</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>M.W.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Repeat operations 3, 4 and 5</td>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>L2</td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>B.S.</td>
<td>1500 kc/s.</td>
<td>TC4 and TC1</td>
</tr>
<tr>
<td>8</td>
<td>3</td>
<td>S.W.</td>
<td>6.0 Mc/s.</td>
<td>L6</td>
</tr>
<tr>
<td>9</td>
<td>49 m. band</td>
<td>S.W.</td>
<td>9.5 Mc/s.</td>
<td>TC2</td>
</tr>
<tr>
<td>10</td>
<td>31 m. band</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Repeat operations 9 and 10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(F104a) Circuit Diagram—Model UKC 1570 (Part)

**Circuit Diagram Notes:** 1. S3 used with clock on clock sets. 2. S3 used with R36 on non-clock sets. 3. Unless otherwise noted. Capacitors more than 1 = μF. Capacitors less than 1 = mF. Resistors ½ watt K = 1000. 4. Voltages are positive with respect to B—under no signal conditions and volume control min. 5. Replace transistors with type shown. 6. Switch S1 shown in F.M. position.
(F103) Drive Cord—Model UKC 1570

Alignment: See tables overleaf.

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Alignment:

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal Generator</th>
<th>Generator setting</th>
<th>Tuning gang</th>
<th>V.T.V.M. connection</th>
<th>Adjustment</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Couple output to emitter of TR2 through a 3 M.M.F. ceramic capacitor. Couple gnd. to tuning gang</td>
<td>10-7 Mc. A.M. modulated 80 per cent. or less</td>
<td>Set gang at highest frequency</td>
<td>TR8 emitter and gnd. in series with a 22k resistor and a 0-05 M.F. series capacitor</td>
<td>T5, T3, T2, T7 for maximum gain</td>
<td>Keep generator output level as low as possible. Sr in F.M. and A.F.C. switch in F.M. position.</td>
</tr>
<tr>
<td>2</td>
<td>Same</td>
<td>Same</td>
<td>Top side of volume control</td>
<td>Same</td>
<td>Same</td>
<td>Same</td>
</tr>
<tr>
<td>3</td>
<td>Couple output and gnd. to F.M. antenna term</td>
<td>108-5 Mc. Unmodulated</td>
<td>Same</td>
<td>Same</td>
<td>Adjust CrB and CrC for best null in noise level</td>
<td>If F.M. modulation is available, make all adjustments for maximum gain. Use weakest possible signal.</td>
</tr>
<tr>
<td>4</td>
<td>Same</td>
<td>87-75 Mc. Unmodulated</td>
<td>Set gang at lowest frequency</td>
<td>Same</td>
<td>Adjust L2 and L4 for best null in noise level</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Recheck Steps 3 and 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A.M. Alignment

<table>
<thead>
<tr>
<th>Step</th>
<th>Signal generator</th>
<th>Generator setting</th>
<th>Tuning gang</th>
<th>Connect scope or output meter</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radiate output to L5</td>
<td>455 kc. modulated 400 cycles at 30 per cent.</td>
<td>Set gang to highest frequency</td>
<td>Voice coil</td>
<td>T4, T6, T9 for maximum</td>
</tr>
<tr>
<td>2</td>
<td>Repeat Step 1</td>
<td>1630 kc.</td>
<td>Same</td>
<td>Voice coil</td>
<td>Oscillator trimmer CrF for maximum</td>
</tr>
<tr>
<td>3</td>
<td>Radiate output to L5</td>
<td>580 kc.</td>
<td>580 kc.</td>
<td>Voice coil</td>
<td>A.M. Oscillator L6 while rocking gang</td>
</tr>
<tr>
<td>4</td>
<td>Same</td>
<td>1400 kc.</td>
<td>1400 kc.</td>
<td>Voice coil</td>
<td>Peak antenna trimmer CrE while rocking gang</td>
</tr>
<tr>
<td>5</td>
<td>Same</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Repeat Steps 1 through 5 as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NATIONAL PANASONIC

Model R-47

General Description: Ten-transistor, four-waveband portable receiver. Wavebands M.W. 525-1605 kc/s.; S.W.1 6-4-5 Mc/s.; S.W.2 4-5-7 Mc/s.; S.W.3 12-26.1 Mc/s. Power output 0.5 watts undistorted up to watt maximum. Intermediate frequency 455 kc/s.

The Mechanical I.F. Filter: The mechanical filter employed as the 1st I.F. transformer of this superheterodyne receiver is the H-type electromechanical I.F. filter. The filter consists of an input transducer, a resonant mechanical section (comprised of elinvers and coupling rod). Two ceramic films, as a function of the input and output transducer, are mounted by silver solder on both sides of the elinvers shown. The input and output transducers serve only as electro to mechanical coupling and do not affect the selectivity characteristics, which are determined by the dimensions of the elinvers and the coupling rod. An electrical signal applied to the input terminal is converted into a mechanical vibration at the input transducer
by means of piezoelectric effect of the ceramic film. This mechanical vibration travels through the resonant mechanical section to the output transducer where it is converted by means of piezoelectric effect to an electrical signal which appears at the output terminal. By employing the mechanical filter the selectivity is improved more than 10 times and the bandwidth more than twice compared with the usual I.F. transformer. The frequency characteristic of the mechanical filter is permanent and no adjustment is possible. The filter is enclosed in a hermetically sealed case.

**Circuit Diagram Notes:**
1. S₁, S₄: Band selector switch in “M.W.” position. 2. S₅: Dial light switch in “OFF” position. 3. S₆: Power source switch in “OFF” position. 4. Measured voltages for TR₁ ~ TR₁₀ are from transistor terminal to bias line. 5. The value of resistance marked with * is standard and it may be changed by the characteristics of transistors. *R₂₁ = 330 kΩ, 220 kΩ or 150 kΩ. 6. D.C. voltage measurements are taken with circuit tester (10 kΩ/V). 7. Capital letters (M, K, J, P) in the circuit diagram show allowable tolerance of capacitors as follows: M = ±20%; K = ±10%; J = ±5%; P = ±100%, ±0%. 8. Tolerance of all resistors is ±10%. 9. Battery current; No signal 12 ~ 20 mA. Maximum output 150 ~ 190 mA.
(F52a) Circuit Diagram—Model R-470 (Part)
NATIONAL PANASONIC

2SB173
PRE Amp.

2SB173
1st AF Amp.

2SB171
3rd AF Amp.

2SB178×2
Power Amp.

(F52b) CIRCUIT DIAGRAM—MODEL R-470 (CONTINUED)

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RADIO SERVICING

<table>
<thead>
<tr>
<th>S₄ (SW₃)</th>
<th>S₃ (SW₂)</th>
<th>S₂ (SW₁)</th>
<th>S₁ (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 100 190 280</td>
<td>10 100 190 280</td>
<td>10 100 190 280</td>
<td>10 100 190 280</td>
</tr>
<tr>
<td>20 110 200 290</td>
<td>20 110 200 290</td>
<td>20 110 200 290</td>
<td>20 110 200 290</td>
</tr>
<tr>
<td>30 120 210 300</td>
<td>30 120 210 300</td>
<td>30 120 210 300</td>
<td>30 120 210 300</td>
</tr>
<tr>
<td>40 130 220 310</td>
<td>40 130 220 310</td>
<td>40 130 220 310</td>
<td>40 130 220 310</td>
</tr>
<tr>
<td>50 140 230 320</td>
<td>50 140 230 320</td>
<td>50 140 230 320</td>
<td>50 140 230 320</td>
</tr>
<tr>
<td>60 150 240 330</td>
<td>60 150 240 330</td>
<td>60 150 240 330</td>
<td>60 150 240 330</td>
</tr>
<tr>
<td>70 160 250 340</td>
<td>70 160 250 340</td>
<td>70 160 250 340</td>
<td>70 160 250 340</td>
</tr>
<tr>
<td>80 170 260 350</td>
<td>80 170 260 350</td>
<td>80 170 260 350</td>
<td>80 170 260 350</td>
</tr>
<tr>
<td>90 180 270 360</td>
<td>90 180 270 360</td>
<td>90 180 270 360</td>
<td>90 180 270 360</td>
</tr>
</tbody>
</table>

(F52c) Band Selector Switch—Model R-470

NATIONAL PANASONIC  Model RF-621L


Dismantling: Remove the back cover, four red chassis mounting screws and the heat sink mounting screw. To remove the chassis, unsolder the loudspeaker leads.

Alignment

A.M.: Connect several turns of wire across the signal generator output. I.F. 470 kc/s. Adjust T8, T5 and T3 for maximum output. L.W. 150 kc/s.—L9 (osc. coil), L8 (aerial coil); 300 kc/s.—C31 (osc. trimmer), C23 (aerial trimmer). M.W. 550 kc/s.—L10 (osc. coil), L7 (aerial coil); 1500 kc/s.—C35 (osc. trimmer), C22 (aerial trimmer).
F.M. I.F. and Detector Alignment with Oscilloscope

Oscilloscope: Set sweep selector of oscilloscope to "External Sweep". Apply 60-c/s. sweep signal from sweep generator to horizontal input terminals of oscilloscope.

Equipment Required: Signal generator that provides 10.7 Mc/s. marker. Sweep generator that provides 10.7 Mc/s. centre frequency and 400 kc/s. sweep width. Set band selector switch to F.M. Set volume control to minimum.

Note: Unsolder lead between test point PT3 and point (A) before alignment and resolder it after alignment.

<table>
<thead>
<tr>
<th>Sweep generator coupling</th>
<th>Signal generator coupling</th>
<th>Radio dial setting</th>
<th>Indicator</th>
<th>Adjust</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-0.01 μF. to point TP2, Common to Chassis</td>
<td>0-0.01 μF. to point TP2, Common to Chassis</td>
<td>100 Mc/s.</td>
<td>Connect vert. Amp. of scope to point TP3, Common to chassis</td>
<td>T4 (3rd I.F.T.)</td>
<td>Adjust for maximum amplitude and symmetrical curve</td>
</tr>
<tr>
<td>0-0.01 μF. to point TP2, Common to Chassis</td>
<td>0-0.01 μF. to point TP2, Common to Chassis</td>
<td>100 Mc/s.</td>
<td>Connect vert. Amp. of scope to point TP4, Common to chassis</td>
<td>T6 (4th I.F.T.)</td>
<td>Adjust T6 for maximum amplitude and proper linearity between +100 kc/s. markers. Adjust T7 so that 10.7 Mc/s. marker appears at the centre. (Refer to illustration F49)</td>
</tr>
</tbody>
</table>

Note: When aligning the Ratio Detector circuit, (Fig. F49) waveform may be inverted.

F.M. R.F. Alignment: Output of signal generator should be no higher than necessary to obtain an output reading. Set volume control to maximum. Set band selector switch to F.M.

<table>
<thead>
<tr>
<th>Signal generator coupling</th>
<th>Signal Generator frequency</th>
<th>Radio dial setting</th>
<th>Indicator</th>
<th>Adjust</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Connect to Point TP4 through F.M. Dummy antenna, Common to chassis</td>
<td>90 Mc/s. (400 c/s. Mod.)</td>
<td>90 Mc/s.</td>
<td>Output meter across earphone jack</td>
<td>L6 (F.M. Osc. coil)</td>
<td>Adjust for maximum output</td>
</tr>
<tr>
<td>(2) Connect to Point TP4 through F.M. Dummy antenna, Common to chassis</td>
<td>106 Mc/s. (400 c/s. Mod.)</td>
<td>106 Mc/s.</td>
<td>Output meter across earphone jack</td>
<td>C8 (F.M. Ant. trimmer)</td>
<td>Adjust for maximum output. Repeat steps (1) and (2)</td>
</tr>
</tbody>
</table>

Note: As three output responses will be present, proper tuning is the centre frequency.
Circuit Diagram Notes:  1. S1–1 ~ S1–6: Band selector switch in "F.M." position.  2. S2: Power source switch in "OFF" position.  3. D.C. voltages measurements are taken with circuit tester (10 kΩ/V) from negative terminal of battery.  
 misconception . . . F.M. position ( ) . . . M.W. position.  4. Capital letters
(J, K, M, P, C) in the circuit diagram shows allowable tolerances of resistors and capacitors as follows: $J = \pm 5\%$, $K = \pm 10\%$, $M = \pm 20\%$, $P = +100\%$, $C = \pm 0.25 \text{ pF}$. 5. Battery current: No signal F.M. M.W. 17 mA. Maximum output F.M. M.W. 130 mA. 7. All resistor values in ohms ($K = 1000 \text{ ohms}$). 8. All capacitor values in micro-farads.
**PERDIO**  
**Model PR.40 (Knightsbridge FM)**

**General Description:** The Knightsbridge F.M. is a nine-transistor, eight-diode portable radio receiver. This version (PR.40) covers extended L.W., M.W. and V.H.F./F.M. bands. All versions are fitted with a tone control, record socket, and external antenna socket. The S.W. versions (PR.47 and PR.48) have a bandspread control for use on A.M. reception.

**A.M.:** The self oscillating mixer transistor is fed from a ferrite rod antenna or from an external antenna via separate screened input coils. A separate oscillator tuned circuit is used for each waveband.
RADIO SERVICING

Three single tuned I.F. transformers couple the two grounded emitter I.F. amplifiers, and the crystal detector. The first I.F. amplifier is A.G.C. controlled by bias derived from the detector output.

The demodulated signal is fed via the volume control to the first A.F. amplifier which is directly coupled to the second A.F. transistor the output of which is used to drive a pair of output transistors in push–pull. This circuit is stabilised against falling battery voltage, and is temperature compensated.

F.M.: The self-oscillating mixer transistor is fed from a V.H.F. R.F. amplifier, which is coupled to the antenna system via a matching transformer.

Three double tuned I.F. transformers, and a ratio detector couple the three grounded emitter I.F. amplifiers. The R.F. amplifier is A.G.C. controlled by bias derived from the secondary of the third I.F. transformer. The ratio detector output is then fed to the A.F. amplifier as for A.M. A D.C. output from the ratio detector is fed back to the oscillator, for the automatic frequency control.

Controls: Volume with on–off switch, edge control at lower right-hand side of cabinet. Tone, edge control at lower right side of cabinet. Tuning, edge control at top of cabinet, right-hand side. Wavechange, edge control at top of cabinet, central. Antenna switch, slide action at top of cabinet left-hand side, selecting internal or external antenna circuits. A.F.C. switch, slide action at top of cabinet right-hand side, switching A.F.C. in or out.

Wavebands: Band 1 L.W. 150 kc/s–385 kc/s. (2000 m–780 m.). Band
VOLTAGES SHOWN ENCIRCLED ARE APPROXIMATE

Tuner Circuit Diagram—V.H.F.

2 M.W. 525 kc/s.—1620 kc/s. (570 m.—185 m.). Band 3 V.H.F./F.M. 87'5 Mc/s.—108 Mc/s. (3'43 m.—2'78 m.).

In addition to individual scales for each band a logging scale is provided, and the V.H.F. scale is marked in channels. The moulded pointer has a travel of approx. 8½ in., and a cord-drive system is used, with a 7'6:1 reduction on the tuning gang.

Aerial: The receiver has an 8-in. ferrite rod antenna for use on band 1 and band 2, and a 35-in. whip antenna (flexible joint) for band 3 reception. An external antenna socket is provided, and is intended for use with a screened car antenna. On bands 1 and 2, this socket feeds the signal to a screened filter, and screened tuned coils, thus greatly reducing ignition interference, and obviating the directional properties of the ferrite rod which is switched out of circuit. On band 3 the socket feeds direct to the matching transformer in the V.H.F. tuner, and has an input impedance of 75 ohms.


Sound Output: Power output is 1 watt. A low-level high-impedance A.F. output via a five pin DIN socket derived from the detector load, and independent of the volume control setting, is provided for feeding into a tape recorder.

Loudspeaker: 8 in. × 5 in. elliptical. Impedance 15 ohms. Flux density 8000 lines.

Batteries: 9 volts.

Consumption: Approx. 30 mA. at a reasonable listening level.

Dismantling: Remove cabinet back by taking out the two fixing screws. This will expose the component sides of the circuit boards and provide access.
Radio Servicing

to all coil cores and trimmers required for alignment purposes. The receiver consists of two sub-assemblies, an R.F. panel and an I.F.–A.F. panel. To remove both assemblies complete, disconnect both battery plugs, unplug the two speaker leads and speaker frame lead on the I.F.–A.F. panel, and antenna lead on the R.F. panel, pull out last section of whip antenna. Remove the four PK screws in the corners of the I.F.–A.F. panel and the two on the R.F. panel, lift the whole assembly towards the top of the cabinet and withdraw from the bottom, taking care not to damage the volume control knob, finally unplug the external antenna leads. To separate the I.F.–A.F. panel from the R.F. panel, unplug the thirteen coloured flying leads from the I.F.–A.F. panel unsolder C2 at one end and remove the four PK screws marked "B".

Drive Cord: To replace a drive cord, a length of 3 in. of 245–001 drive cord is required. First remove the tuning scale by taking out the four fixing screws. Then pull off the tuning control knob. Form a tight loop in the replacement drive cord and push it through the slot in the drum and locate around the centre boss, moistening the cord slightly if necessary to facilitate the operation. Replace the tuning knob and proceed to route the cord as shown in the diagram noting the relative positions of the tuning gang, scale pointer and tension spring. The V.H.F. cord drive is best fitted when the gang is in the fully opened position, fit cord over pulley assembly, wrap one turn around drive in an anti-clockwise direction, then pass through slot so that eyelet engages firmly.

Alignment Procedure: Equipment Required: (1) Signal generator with a frequency coverage of 150 kc/s. to 1620 kc/s., 10 Mc/s. to 11 Mc/s. and 87 Mc/s. to 110 Mc/s., with suitable modulation for both A.M. and F.M., a "sweeping" circuit should also be available for F.M. alignment. (2) Display equipment suitable for use with the signal generator for F.M. alignment. (3) An output meter of 15 ohms impedance, or a suitable A.C. volt-meter. (4) Antenna pad for aligning the external antenna circuit. (5) Suitable non-ferrous trimming tools for adjusting oscillator, R.F., and I.F. circuits.

Audio Bias Adjustment: To set the audio bias potentiometer RV4, proceed as follows. With no signal applied and the volume control at minimum, insert current meter at test link, tag (14) on I.F.–A.F. board, that is, between the H.T. line and pin 2 of AFT2. Adjust RV4 so that a steady
current of 8.5 mA. flows through the meter. Remove meter, and replace test link.

Note: Before further alignment, set volume control to maximum, tone control to minimum treble cut, and use lowest signal from generator consistent with reasonable output, say 50 mW, this avoids A.G.C. action.

I.F. Alignment (A.M.) Spot Frequency Method: Switch receiver to band 2, and turn gang to its fully meshed position; check that pointer coincides with the zero mark on logging scale. Set signal generator to 468 kc/s., modulated to 30 per cent, and connect signal between chassis and the I.F. input tag (3) on I.F.–A.F. board after removing lead from R.F. board. Connect output meter across the loudspeaker tags 15 and 16. Adjust cores of A.M./I.F. 1, 2 and 3 for maximum output, reducing the level of input signal as the circuits come into alignment.

I.F. Alignment (F.M.) Sweep Method: Switch receiver to band 3. Set the signal generator to 10.7 Mc/s. and switch on sweeping circuit, connect signal between chassis, and I.F. input tag (3) on I.F.–A.F. board after removing lead from R.F. board. Connect display equipment between chassis, and output of ratio detector tag (12). Adjust cores of F.M./I.F. 2, 3 and 4 for maximum output together with a response curve reducing the level of input signal as the circuits come into alignment.

Adjustment of A.M. Rejection on F.M.: Proceed as for F.M. I.F. alignment, after this alignment has been concluded, increase input level by approx. 20 dB, reducing display equipment sensitivity accordingly. Switch 30 per cent. of A.M. on to swept I.F. signal and adjust RV3 for minimum A.M. output at centre point of response curve.

R.F. Alignment (A.M.): The signal generator should be loosely coupled to the receiver by means of a transmitting loop, placed adjacent to, and co-axially with the ferrite rod antenna assembly. The screened external antenna coils are aligned with the signal generator coupled to the external antenna socket.

Band 1 (Long Wave): (1) Switch receiver to band 1 and antenna switch to INT. (2) Set generator and receiver to 165 kc/s. (3) Adjust L.W.
oscillator coil L6 and L.W. antenna coil L2 for maximum output. (4) Switch to ext. and adjust L.W. external antenna L4 for maximum output. (5) Switch to intr. and reset generator and receiver to 370 kc/s., adjust L.W. oscillator trimmer C15 and L.W. antenna trimmer CT1 for maximum output. (6) Switch to ext. and adjust L.W. external antenna trimmer CT3 for maximum output. (7) Repeat above procedure until no further improvement can be obtained, finishing at the higher frequency 370 kc/s.

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**PERDIO Model PR.43 “Mini 77”**

**General Description:** Battery-operated seven-transistor radio receiver covering medium and long wavebands. The set contains an I.F. module comprising all that is normally in the I.F. strip of a M.W./L.W. transistor receiver from the base of the mixer to the output of the diode.

**Controls:** Wavechange switch is on the right-hand side of cabinet. The tuning knob is at the top of the cabinet and the volume control is on the left-hand side.

**Wavebands:** M.W. 184–570 m. (1635–525 kc/s.); L.W. 1090–1940 m. (275–155 kc/s).

**Aerial:** Internal ferrite rod aerial is used on both wavebands.

**Intermediate Frequency:** 470 kc/s.
PERDIO

Battery: Two 9-volt batteries are used in parallel. Suitable types include: PP3; T6003; DT3.

Consumption: Approximately 20 mA. at a reasonable listening level.

Sound Output: 100 mW. at 5 per cent. total distortion.

Loudspeaker: Flux density 7000 lines per sq. cm. Impedance 60 ohms.

Transistors: AF127 mixer; AF127 1st I.F. amplifier; AF127 2nd I.F. amplifier; OC71 1st A.F. amplifier; OC81D Driver; OC81 and OC127

Complementary push-pull output Crystal diode oA91 detector.

Chassis Removal: The back is secured with a coin slot screw, when this is undone the back may be removed by turning a small coin in the slot on the underside of the cabinet. Disconnect battery, remove the 6BA hexagonal spacer and the board fixing screw, the board may then be taken out of the cabinet by lifting the left-hand side first, allowing the volume control knob to clear its aperture.

Alignment Procedure: Equipment Required—(1) A signal generator with a frequency coverage of at least 155—1670 kc/s. with suitable modulation.
(2) Output power meter 60-ohm impedance or volt-meter to read 0–2 volts A.C. across speech coil. (3) Trimming tool suitable for adjusting I.F. and oscillator coils, 10BA trimming tool for L.W. oscillator trimmer.
(4) Volt-meter to read 0–10 volts D.C.

Before alignment set the volume control to maximum and use the lowest signal from the generator consistent with reasonable output from the set, say 50 mW. or 1.7 volts A.C. across the speech coil. This avoids A.G.C. action.

I.F. Alignment: Switch the receiver to M.W. Set the gang to approximately 1 Mc/s. Set the signal generator to 470 kc/s. and connect to pin 1 of the I.F. module. Align each I.F.T. for maximum output with either the output meter connected in place of the speaker or with the volt-meter connected across the speaker.

R.F. Alignment: For R.F. alignment the signal generator should be loosely coupled to the set by a loop of insulated wire placed at a convenient distance from the set. The loop should be orientated for maximum pickup.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Waveband</th>
<th>Generator</th>
<th>Receiver</th>
<th>Adjust for max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>M.W.</td>
<td>525 kc/s.</td>
<td>Gang closed</td>
<td>Osc. coil</td>
</tr>
<tr>
<td>2</td>
<td>M.W.</td>
<td>1670 kc/s.</td>
<td>Gang open</td>
<td>CT4 (&quot;O&quot; on gang)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat operations 1 and 2.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>600 kc/s.</td>
<td>M.W. aerial coil</td>
</tr>
<tr>
<td>4</td>
<td>M.W.</td>
<td>1450 kc/s.</td>
<td>1450 kc/s.</td>
<td>CT2 (&quot;A&quot; on gang)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat operations 3 and 4.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>L.W.</td>
<td>155 kc/s.</td>
<td>Gang closed</td>
<td>CT3</td>
</tr>
<tr>
<td>6</td>
<td>L.W.</td>
<td>175 kc/s.</td>
<td>175 kc/s.</td>
<td>L.W. aerial coil</td>
</tr>
<tr>
<td>7</td>
<td>L.W.</td>
<td>260 kc/s.</td>
<td>260 kc/s.</td>
<td>CT1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Repeat operations 6 and 7 and check operations 3 and 4.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

When the oscillator is set up on L.W. the aerial should be detuned by 305
PHILCO

placing a ferrite rod next to the L.W. aerial coil. This stops the aerial circuit pulling the oscillator off tune.

**Circuit Voltages:** Circuit voltages are measured with respect to common positive line under “no-signal” conditions.

<table>
<thead>
<tr>
<th></th>
<th>VT1 volts</th>
<th>VT2 volts</th>
<th>VT3 volts</th>
<th>VT4 volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emitter</td>
<td>0.94</td>
<td>0.56</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Base</td>
<td>1.1</td>
<td>0.74</td>
<td>5.0</td>
<td>4.7</td>
</tr>
<tr>
<td>Collector</td>
<td>3.6</td>
<td>4.7</td>
<td>9.0</td>
<td>0</td>
</tr>
</tbody>
</table>

Voltage on pin 5 of I.F. module is —7 volts.
Quiescent current = 10 mA. ± 2 mA.

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**PHILCO**

**Model PT914**

**General Description:** Thirteen transistors, five diodes and one thermistor in a superhet F.M./A.M. receiver. Wavebands: F.M. 88 Mc/s.-108 Mc/s.; M.W. 528-1630 kc/s.; L.W. 145-410 kc/s.; S.W.1 1650 kc/s.-4.3 Mc/s.; S.W.2. 3.7-10.3 Mc/s.; S.W.3. 9.7-18.4 Mc/s. Loudspeaker 4 x 6 inches, 8 ohms impedance.

**Dismantling:** Open battery cover and remove batteries. Remove two nuts and screws holding aerial terminal panel to cabinet. Remove two screws holding chassis to angle brackets located inside bottom of cabinet (angle brackets are attached between chassis and bottom of cabinet). Remove two handle mounting screws at top of cabinet. Slide chassis part way out of cabinet and remove two nuts holding earphone and external power jack to cabinet. Unsolder lead to aerial then slide chassis completely from cabinet.
A.M. Alignment: Allow test equipment 15 minutes to warm up and stabilise. Set band switch of receiver as indicated on chart. Set volume control to maximum. Connect an 8-ohm resistor across an earphone plug and insert plug into earphone jack (J1). Connect V.T.V.M. or Oscilloscope across the 8-ohm resistor for an output indicator. Connect A.M. Signal Generator (30 per cent. modulation) as indicated on chart; keep generator output as low as possible to avoid A.G.C. action.
(F93b) Circuit Diagram—Model PT914 (Continued)

**Note: Alignment Charts** (For both A.M. and F.M.) are given on the following page.

**F.M. Alignment:** Set band switch of receiver to F.M. position. Connect F.M. (±75 kc. deviation) signal generator as indicated on chart. Connect A.M. (30 per cent. modulation) signal generator as indicated in Step 3 only. Keep signal generator output as low as possible to avoid overload.
### Alignment (A.M.)

<table>
<thead>
<tr>
<th>Step</th>
<th>Connection to radio</th>
<th>Dial setting</th>
<th>Dial setting</th>
<th>Special instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use radiating loop</td>
<td>455 kc.</td>
<td>Tuning gang</td>
<td>Set band switch to &quot;A.M.&quot;. Adjust coils for max. output</td>
<td>L11, L9, L7 and L6</td>
</tr>
<tr>
<td></td>
<td>(see Note 1)</td>
<td></td>
<td>fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Repeat Step 1 until no further improvement is obtained</td>
<td>528 kc.</td>
<td>Tuning gang fully closed</td>
<td>Adjust coils and trimmers indicated for max. output</td>
<td>VC4-C</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1</td>
<td>1630 kc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Same as Step 1</td>
<td>1400 kc.</td>
<td>Tuning gang fully open</td>
<td>Adjust coils and trimmers indicated for max. output</td>
<td>VC3-A</td>
</tr>
<tr>
<td>5</td>
<td>Repeat Step 3 through 6 until no further improvement is obtained</td>
<td>600 kc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Same as Step 1</td>
<td>145 kc.</td>
<td>Tuning gang fully closed</td>
<td>Set band switch to &quot;L.W.&quot; Adjust coils and trimmers indicated for max. output</td>
<td>L17</td>
</tr>
<tr>
<td>7</td>
<td>Repeat Step 8 through Step 11 until no further improvement is obtained</td>
<td>410 kc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>VC4-A</td>
</tr>
<tr>
<td>13</td>
<td>Connect to &quot;S.W.&quot; on ext. ant. panel</td>
<td>165 kc.</td>
<td>Tuning gang fully closed</td>
<td>Adjust coils and trimmers indicated for max. output</td>
<td>VC3-B</td>
</tr>
<tr>
<td>14</td>
<td>Same as Step 13</td>
<td>4.7 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>E2</td>
</tr>
<tr>
<td>15</td>
<td>Repeat Step 13 through Step 16 until no further improvement is obtained</td>
<td>2.0 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Same as Step 13</td>
<td>3.7 Mc.</td>
<td>Tuning gang fully closed</td>
<td>Set band switch to &quot;S.W.r&quot;. Adjust coils and trimmers indicated for max. output</td>
<td>L18</td>
</tr>
<tr>
<td>19</td>
<td>Repeat Step 18 through Step 21 until no further improvement is obtained</td>
<td>10.3 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Same as Step 13</td>
<td>184 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Repeat Step 23 through Step 26 until no further improvement is obtained</td>
<td>16 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Repeat Step 23 through Step 26 until no further improvement is obtained</td>
<td>10 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Radiating loop is made of 6 to 8 turns of insulated wire in a 6-inch diameter. Connect to generator terminals and place about 12 inches from radio.

### Alignment (F.M.)

<table>
<thead>
<tr>
<th>Step</th>
<th>Connection to radio</th>
<th>Dial setting</th>
<th>Dial setting</th>
<th>Special Instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>To F.M. terminals on external ant. panel</td>
<td>10.7 Mc.</td>
<td>Tuning gang fully open</td>
<td>Adjust coils for max. output in order</td>
<td>L8, L5, L3, L4, and L16A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Repeat Step 1 until no further improvement is obtained</td>
<td>10.7 Mc. A.M.</td>
<td>Tuning gang fully open</td>
<td>Adjustment for minimum output</td>
<td>L10-B</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1</td>
<td>88 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>L13</td>
</tr>
<tr>
<td>4</td>
<td>Same as Step 1</td>
<td>108 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>VC6</td>
</tr>
<tr>
<td>5</td>
<td>Repeat Step 4 through Step 7 until no further improvement is obtained</td>
<td>108 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>VC8</td>
</tr>
<tr>
<td>7</td>
<td>Repeat Step 4 through Step 7 until no further improvement is obtained</td>
<td>90 Mc.</td>
<td>Tuning gang fully open</td>
<td></td>
<td>L1 and L2</td>
</tr>
</tbody>
</table>

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Dismantling: Remove cross-recess screw from bottom of rod aerial and slide rod up out of cabinet to clear chassis. Remove four cross-recess screws holding panel to cabinet. Carefully remove chassis by lifting right side first to clear recessed control knobs. Speaker and earphone jack may remain in cabinet while servicing.

A.M. Alignment: Allow test equipment 15 minutes to warm up and

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(F92a) Circuit Diagram—Model QT91 (Part)
stabilise. Set slide-switch to A.M. position. Insert earphone plug paralleled with a 32-ohm resistor into the earphone jack, Jr. Connect V.T.V.M. across the 32-ohm resistor. Connect generator leads as indicated in chart. Keep generator output as low as possible to avoid A.G.C. action. Set volume control to maximum. See alignment chart at top of next page.

**F.M. Alignment:** Refer to A.M. alignment preliminary instructions. Set slide-switch to F.M. position. See lower alignment chart on facing page.
### PHILCO Alignment Charts: (Top) A.M. and (Lower) F.M.

<table>
<thead>
<tr>
<th>Step</th>
<th>Connection to radio</th>
<th>Dial setting</th>
<th>Dial setting</th>
<th>Special instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Radiating loop</td>
<td>455 kc.</td>
<td>Tuning gang fully open</td>
<td>Adjust for max. output in order given</td>
<td>T9, T6, T4</td>
</tr>
<tr>
<td>2</td>
<td>Same as Step 1</td>
<td>510 kc.</td>
<td>Tuning gang fully closed</td>
<td>Adjust for max. output</td>
<td>T2</td>
</tr>
<tr>
<td>3</td>
<td>Same as Step 1</td>
<td>1650 kc.</td>
<td>Tuning gang fully open</td>
<td>Adjust for max. output</td>
<td>VC1D</td>
</tr>
<tr>
<td>4</td>
<td>Repeat Steps 2 and 3 until no further improvement is obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Same as Step 1</td>
<td>600 kc.</td>
<td>600 kc.</td>
<td>Adjust for max. output by sliding ant. coil on core</td>
<td>Et</td>
</tr>
<tr>
<td>6</td>
<td>Same as Step 1</td>
<td>1400 kc.</td>
<td>1400 kc.</td>
<td>Adjust for max. output</td>
<td>VC1C</td>
</tr>
<tr>
<td>7</td>
<td>Repeat Steps 5 and 6 until no further improvement is obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Signal generator

<table>
<thead>
<tr>
<th>Step</th>
<th>Connection to radio</th>
<th>Dial setting</th>
<th>Dial setting</th>
<th>Special instructions</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Emitter of Q2</td>
<td>10-7 Mc.</td>
<td>Tuning gang fully open</td>
<td>Adjust for maximum output in order given</td>
<td>T7, T5, T3 and T1</td>
</tr>
<tr>
<td>2</td>
<td>Same as Step 1</td>
<td>10-7 Mc.</td>
<td>Tuning gang fully open</td>
<td>Adjust for maximum output</td>
<td>T8</td>
</tr>
<tr>
<td>3</td>
<td>Repeat Steps 1 and 2 until no further improvement is obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Use radiating loop</td>
<td>86-2 Mc.</td>
<td>Tuning gang fully closed</td>
<td>Adjust for maximum output</td>
<td>L5</td>
</tr>
<tr>
<td>5</td>
<td>Same as Step 4</td>
<td>108-8 Mc.</td>
<td>Tuning gang fully open</td>
<td>Adjust for maximum output</td>
<td>VC1B</td>
</tr>
<tr>
<td>6</td>
<td>Repeat Steps 4 and 5 until no further improvement is obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Same as Step 4</td>
<td>87 Mc.</td>
<td>87 Mc.</td>
<td>Adjust for maximum output</td>
<td>L3 (see note below)</td>
</tr>
<tr>
<td>8</td>
<td>Same as Step 4</td>
<td>108 Mc.</td>
<td>108 Mc.</td>
<td>Adjust for maximum output</td>
<td>VC1 (see note below)</td>
</tr>
<tr>
<td>9</td>
<td>Repeat Steps 7 and 8 until no further improvement is obtained</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** When tracking is off, adjust L3 and VC1A and keep the tuning correct by adjusting VC1B. Osc. frequency varies slightly if L3 and VC1A are adjusted.

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![Diagram](https://i.imgur.com/3Q2Uo.png)

**Note:** When tracking is off, adjust L3 and VC1A and keep the tuning correct by adjusting VC1B. Osc. frequency varies slightly if L3 and VC1A are adjusted.

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![F91 Drive Cord—Model QT91](https://i.imgur.com/3Q2Uo.png)
**General Description:** The EL1998 mains supply unit enables battery-operated equipment to be used from an A.C. mains supply. It is designed to operate with a mains input of 220–240 volts A.C. 50–60 c/s, and can be adjusted for use with 110–127 volts A.C. by changing one connection of the mains lead and replacing the 50 mA. fuse FS1 with the 100 mA. fuse supplied.

(W62) **COMPONENT LAY-OUT (1ST VERSION)—MODEL EL1998**
Above: (W63) Circuit Diagram—Model EL1998 (1st Version)

Right: (W63) Alternative Mains Transformer for 1st Version
Top: (W64) Circuit Diagram—Model EL1998 (2nd Version)

Note: In some versions, the output lead is wired direct to the unit, Skt. 1 being omitted. In these cases, an adaptor is supplied instead of the second output lead, enabling the output to be applied to either a ROKA or 5-pin DIN socket.
PHILIPS

The unit has a stabilised output, which can be switched to 7.4 volts or 9 volts D.C. as required. It may be used in conjunction with various recorders, record players, etc., as listed below: Philips—EL3300, EL3301, EL3301T, EL3302, EL3583, EL3586, N4200, AG4100, AG4127, 22GF227, L6X38T; Cossor—CR1621; Stella—ST471, ST472, ST474.

In addition to the version of the EL1998 mains supply unit described, there are two other versions, (a) and (b), each with mains transformers with separate 220-volt and 240-volt tappings.

Details of these variations are as follows: (a) Employs the printed panel as given, but with an additional connection point included for 220 volts. A different mains transformer, with a 220-volt tapping, is used. (b) Employs a different printed panel and mains transformer.

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PHILIPS

Model EL3787A

**General Description:** Three-stage transistor preamplifier which can be used with any of the mono tape recorders listed below to provide the following facilities: 1. Playback of pre-recorded stereo tapes at 3 inches and 7½ inches per second (an external main mono/stereo amplifier and L.S. are required). 2. Synchronous recording/Duoplay, i.e. monitoring the playback of one track while recording a synchronised programme on another (headphones required). Both recordings may be subsequently played back together by the recorder in the “PAR” track selector position. 3. Multiplex, i.e. copying (with attenuation) from one track to another and simultaneously mixing an additional microphone input with headphones and lead.

The following recorders are suitable for use with this equipment: Philips: EL3553A, EL3556A, EL3558A, EL3573A, EL3576A, EL3578A. Stella: ST462, ST463.

Operating voltage 22 volts. D.C. at 8 mA. Sensitivity 260 µV. into 3 kΩ for 1 volt output across 20 kΩ.

**Electrical Adjustments:** If the preamplifier is to be operated without a recorder, a 22-volt D.C. supply is required, connected to PLG1 as follows: Positive—pin 2; Negative—pin 5; Join pins 2 and 4 together.

- **R16:** Switch to “Stereo 3¼ in. per second” and connect a 100-ohm resistor between pins 1 and 2 on PLG1. Connect an A.C. millivolt-meter (1-volt range) between pins 3 and 2, SKT2 and apply a 1 kHz signal via 100 kΩ resistor to pin 1 of PLG1. Adjust generator output for a meter reading of exactly 650 mV. then, without changing the generator output, reset the frequency to 14 kHz. and adjust R16 for a meter reading of 650 mV.

- **R24:** With the generator, input divider and A.C. millivolt-meter connected as given above for R16, apply a 60 Hz. signal at 22 mV. and adjust R24 for a meter reading of 400 mV.

- **R21:** Connect a D.C. volt-meter (10-volt range) between the collector and emitter of T3 then adjust R21 for a meter reading of 7.3 volts.

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Pins 2 & 4 must be connected together when making tests with a separate power supply.

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Metal chassis.

Common positive line.

S11: Playback 7 1/2 ins.
S12: Playback 3 1/4 ins.
M/D: Mute/play/Dualplay.

All voltages taken with respect to chassis, using a 100 KΩ/voltmeter.
No audio input.

Plug and sockets viewed on solder lugs.

Switches close only for functions indicated.

(W66) CIRCUIT Diagram—Model EL3787A
PHILIPS Model F5G53AT "Studio Ten"

General Description: Mains operated, all transistor, A.M./F.M. radiogram, incorporating two audio channels for reproduction of stereophonic disc and tape recordings and an automatic record changer. Provision also for connection of an F.M. stereo decoder for reception of F.M. stereo broadcasts.

A 5 pin DIN socket is fitted for the connection of a tape recorder to playback mono/stereo tape recordings through the audio amplifier. The same socket (different plug connections) is used for the tape recording of mono/stereo disc records or a mono radio programme. Stereo radio programmes may also be tape recorded when the F.M. stereo decoder is fitted and stereo transmissions are available. Extension loudspeaker sockets are

(W68a) CIRCUIT DIAGRAM R.F./I.F. STAGES—MODEL F5G53AT (PART)
PHILIPS

provided for the connection of external speakers of 15 ohms impedance. The record changer is a 4-speed, mono/stereo, type GC150 autochanger.

**Warning:** Care must be taken not to short-circuit the loudspeakers as this may damage the output transistors. Damage may also result if the impedance of the external speakers is less than the recommended value.

**A.F. Adjustments**

**Setting Up Procedure:** Switch to "Gram." and turn volume controls (inner and outer knobs) to minimum. Connect a D.C. volt-meter between the junction of R41/R42/R43 and the +ve tag of C69 and adjust R37 (R.H. channel) to obtain a meter reading equal to half the voltage measured across C69. Transfer the meter —ve connection to the junction of R57/R58/R59 and adjust R53 (L.H. channel) to obtain the same meter reading. A convenient point for the connection of the meter to the junction of R41/R42/R43

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(W68b) CIRCUIT DIAGRAM R.F./I.F. STAGES—MODEL F5G53AT (CONTINUED)
RADIO SERVICING

is the —ve (top) connection of C56, and for the junction of R57/R58/R59, the —ve (top) connection of C68.

Collector Current Setting: Switch to "Gram." and turn volume controls (inner and outer knobs) to minimum. Connect a D.C. milliammeter in series with the collectors of each pair of output transistors in turn. Test points "B" and "C" are provided for this purpose in the form of soldered tags—"B" adjacent to R39 for T7/T8 and "C" adjacent to R55 for T12/T13. Adjust R38 (R.H. channel) and R54 (L.H. channel) to obtain a quiescent current of 6 mA. on each channel.

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PHILIPS

Capacitors pF. (Continued)

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<th>C45</th>
<th>12,000</th>
<th>C65</th>
<th>4 μF.</th>
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<td>91</td>
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</tr>
<tr>
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<td>200</td>
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</tr>
<tr>
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<td>2,200</td>
<td>C50</td>
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<tr>
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<td>C51</td>
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<td>C71</td>
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<tr>
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<td>C52</td>
<td>0.33 μF.</td>
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</tr>
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<td>4 μF.</td>
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<tr>
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<td>4,700</td>
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<tr>
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<td>250 μF.</td>
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</tr>
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<td>C37</td>
<td>200</td>
<td>C58</td>
<td>4 μF.</td>
<td>C78</td>
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</tr>
<tr>
<td>C38</td>
<td>82</td>
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<td>64 μF.</td>
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</tr>
<tr>
<td>C39</td>
<td>82</td>
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<tr>
<td>C40</td>
<td>20,000</td>
<td>C61</td>
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<td>C81</td>
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<tr>
<td>C41</td>
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<td>C62</td>
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<tr>
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(W68d) CIRCUIT DIAGRAM A.F. STAGES—MODEL F5G53AT (CONTINUED)
### Capacitors pF. (Continued)

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<td>C306</td>
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<td>C307</td>
<td>6</td>
</tr>
<tr>
<td>C308</td>
<td>4</td>
</tr>
<tr>
<td>C309</td>
<td>470</td>
</tr>
<tr>
<td>C310</td>
<td>10</td>
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<td>C318</td>
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### List of Resistors Ω

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<th>Value</th>
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<td>R3</td>
<td>1,000</td>
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<tr>
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<td>R5</td>
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<tr>
<td>R6</td>
<td>0.12M</td>
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<tr>
<td>R7</td>
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<td>R11</td>
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<tr>
<td>R12</td>
<td>220</td>
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<td>R13</td>
<td>180</td>
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<tr>
<td>R14</td>
<td>0.22M</td>
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<td>R15</td>
<td>4,700</td>
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<td>R53</td>
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<td>R55</td>
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<tr>
<td>R100</td>
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</tr>
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*Fitted some sets only. † Some sets 47,000/82,000. † Some sets 22.
General Description: A mains-powered transistor record-player, comprising a single transistor (BC108) preamplifier and 4 watt power amplifier module. A 5 pin DIN socket is provided for making tape recordings or for
RADIO SERVICING

(W83) CIRCUIT DIAGRAM—MODEL 13GF810
feeding in an audio signal for amplification. An extension speaker socket allows for the connection of an external speaker of 12 ohms impedance.

**Warning:** The output transistors will be damaged if the speaker is short-circuited or an external speaker of lower impedance than that recommended is connected.

**Uncasing:** Disconnect from supply. Remove two screws and the fibreboard panel at the side of the autochanger. Undo one screw under the cabinet at the control panel end and five screws securing the motorboard. Slide the motorboard together with the amplifier compartment out from the cabinet.

**Amplifier:** The module LP1162 is a factory tested unit. For servicing this should be returned intact to the manufacturer.

**Resistors:**

<table>
<thead>
<tr>
<th>Value Ω</th>
<th>Wattage</th>
<th>Tolerance %</th>
<th>Value Ω</th>
<th>Wattage</th>
<th>Tolerance %</th>
</tr>
</thead>
<tbody>
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<td>10</td>
<td></td>
<td>R10 56k</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>R2 470k</td>
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<td></td>
<td>R11 820</td>
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<td>R3 470k</td>
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<td>R12 33k</td>
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<td>R13 68k</td>
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<td>10</td>
<td></td>
<td>R14 Wire wound 39</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>R6 27k</td>
<td>10</td>
<td></td>
<td>R15 120</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>R7 High stability 320k</td>
<td>10</td>
<td>R16 Treble 200 log law</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R8 1M</td>
<td>10</td>
<td>R17 Volume 250 log law</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R9 High stability 10k</td>
<td>5</td>
<td>R18 Bass 500 log law</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**PHILIPS**

**Model 22GF100**

**General Description:** Battery-operated, three-speed, portable record player with the loudspeaker housed in the detachable lid. Provision is made for operation from a mains supply unit. Transistors T5 and T6 provide motor speed stabilisation. Speed adjustment is effected by R16. Stylus pressure 4–6 gms.

**Batteries:** 9 volts (6 × 1½ volts). U2 or equivalent.

**Uncasing:** Release cabinet lid by sliding the two side catches forward towards the carrying handle. Lift off turntable mat, release spring and remove turntable. Remove battery cover and the batteries, then withdraw the three screws and raise top plate, captive only by battery and loudspeaker connecting leads. Both the printed circuit and the motor assembly (located on underside of top plate) are now accessible.

To obtain access to loudspeaker, remove grille (held by four screws inside lid) then release the four screws and clips securing the rim of the loudspeaker assembly. The assembly may now be lifted from the top of the lid.
**General Description:** This receiver/amplifier chassis is basically similar to that fitted to Philips Model F5G53, information for which is given elsewhere in this volume. Additional facilities incorporated in the 13RB561 include a built-in stereo decoder, a meter type tuning indicator and four loudspeakers arranged in two pairs of speaker and tweeter.

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**PHILIPS Model 13RL161 “Popmaster 161”**

**General Description:** This portable receiver is electrically similar to Philips Model L1G41T, for which information was given in the 1964–65 volume.
PHILIPS Model I3RL265 “Popmaster 265”

**General Description:** A M.W. and L.W. battery-operated portable radio receiver employing micro-technique and special thin film resistor modules. The extremely economical circuit, using 6 transistors and one crystal diode, is powered by four penlight batteries which are housed in a separate compartment accessible through the sliding panel in the base. An earphone socket is provided, the internal loudspeaker being automatically silenced when the earphone plug is inserted.

*Note:* Later production models use an alternative printed circuit panel utilising conventional carbon resistors; these models are suffixed as follows, /05X with blue case and /05B with grey case. Both versions are electrically identical. The circuit used in this receiver is identical to that used in Philips Model 13RS261, featured in this volume, less mains power supply unit, and reference should be made to that diagram. The two versions of construction are given: Type /00—Module; Type /05 Conventional.

(W80) Tuning Drive—'Popmaster' 265

33°
Note: A low impedance meter should not be used when measuring voltages and resistances, since excessive current flowing through the delicate resistor modules will damage them.
**PHILIPS**

**Dismantling**: Remove the sliding battery cover and take out batteries and foam pad. Release the screw located at each end of the battery compartment, and gently separate the two halves of the case. Ease the station scale from its locating lugs on the front case and remove for safe keeping the carrying strap fixing studs, case clamping brackets and the battery link. The component side of the printed panel is now accessible. To gain access to the print side of the panel and the tuning drive assembly, remove the two screws securing the bracket and pulley assembly to the front case, then release the two screws and fibre washers securing the printed panel. The printed panel complete with ferroceptor aerial and tuning drive assembly can now be lifted from the case, captive only by the earphone and loudspeaker connecting leads which may now be unsoldered.

**Alignment**: Use alignment procedure given for Philips Model 13RS261.

---

**PHILIPS**

**Model 13RL360**

**General Description**: A six-transistor, M.W./L.W. portable receiver. Sockets are provided for the connection of a car aerial socket, earphone and tape recorder. A feature of the circuit is a fine tuning control employing a capacitance diode operated by a potentiometer.

**Dismantling**

**Removing the Cabinet**: Place receiver face downwards on a soft cloth, release the two captive retaining screws in the cabinet backplate, then lift off backplate. Remove the battery; the wooden cabinet is now held only by the four corner screws.

**Removing the Chassis**: To detach the chassis from the front moulding, remove the two large screws securing the socket plate assembly, also the two chassis screws, one of which is situated next to the tuning gang and the other near the Station Focus control mounting plate. Pull off the four control knobs, unsolder the speaker leads and withdraw the chassis.

**Releasing the Panel**: To gain access to the underside of the panel, release the two fixing screws and withdraw the panel from the slots in the rod aerial rubber mounting brackets. To release the panel further, unsolder C32 from the underside and R31 from its tag near the Station Focus control. The panel can now be removed.

**R23 Adjustment**: This resistor controls the amount of current drawn by T5/T6 under quiescent conditions. Normally, adjustment will only be required if T5/T6 or any associated components are replaced. To measure the combined collector current, remove the shorting link on the panel near the output transformer. Connect a 0–10 mA. meter between the link tags, turn volume control to minimum, switch receiver on and ensure that the
battery voltage is at least 8.5 volts. Observe the ambient temperature near the panel and adjust R23 to give a meter reading according to the table given below.

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Collector current setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>18°C (64.4°F)</td>
<td>4.5 mA.</td>
</tr>
<tr>
<td>22°C (71.3°F)</td>
<td>5 mA.</td>
</tr>
<tr>
<td>26°C (78.4°F)</td>
<td>5.5 mA.</td>
</tr>
</tbody>
</table>

All voltages taken with respect to battery positive, using a 100KΩ/volt meter. No signal input. Negative earth. Battery voltage 9 volts.

Wavechange switch shown in M.W. position viewed on solder contacts.

(W72) CIRCUIT DIAGRAM—MODEL 13RL360
PHILIPS

Model 13RS261

General Description: Mains-operated clock radio featuring a radio/buzzer alarm, the radio being switched on first, the buzzer sounding approximately 10 minutes later. Also featured is an automatic "sleep control" which can be set to switch off the radio at a predetermined time of up to 60 minutes. The radio consists of a micro-technique chassis employing six transistors, two diodes and a rectifier, to provide reception on the long and medium wavebands. Mains supply 200–240 volts, 50 c/s.

Note: MR1 is a S.T.C. Type S7 Rectifier. For similar component lay-out see Model 13RL265/05.

Dismantling

Removing the Cabinet Rear: Place receiver face downwards on a soft cloth, remove the two retaining screws from the rear of the cabinet, which can then be carefully lifted away to the extent of the loudspeaker connecting leads. To detach rear section completely, the loudspeaker leads must be disconnected. The component side of the printed panel, the power supply and the clock assembly are then readily accessible.

Releasing the Printed Panel: Release the three panel securing screws, two at the top adjacent to the ferrite rod and one at the bottom on the paxolin panel. The panel and ferrite rod assembly can now be lifted from the front moulding, giving access to print side of the panel and drive cord assembly.
RADIO SERVICING

Releasing the Power Supply Panel: Remove the three retaining screws, one at the top adjacent to the volume control and two at the bottom near the mains transformer. The metal panel now can be lifted from the front panel.


(W77) TRIM PLAN—MODEL 13RS261

PORTADYNE Models RG400, RG1000

General Description: These A.M. Radio/Stereograms incorporate a five-valve chassis, electrically similar to that used in Model SRG 26, which information was given in the 1963–64 volume.

PORTADYNE Models RP17, RP20

General Description: Record players incorporating a two-valve (UCL 82, UY 85) amplifier for use on A.C. mains. Caution: Live chassis.
PORTADYNE

Model 3B2

General Description: Three-waveband transistor portable receiver, incorporating I.F. and A.F. modules. Provided with telescopic aerial, car aerial socket and earphone socket.

(W118) Drive Cord—Model 3B2

339
PYE Models 1369 and 1371

General Description: An eight-transistor portable radio for reception of L.W. and M.W., with bandspread at the high frequency end of the M.W. fitted with telescopic aerial and earphone socket. Early versions of Model 1369 contain a 5-pF. capacitor in position C32 and the bandspread range covers from 185-225 metres. Later models use a 12-pF. capacitor and cover 185-255 metres on the bandspread range. All 1371 receivers have a 5-pF. capacitor.
Note: All resistors in OHMS unless stated otherwise.
All capacitors in μF unless stated otherwise.
Voltages negative with respect to chassis, using AVO 8,20,000 OPV.
Wavechange switch in L.W. position.
"L1" and telescopic aerial not fitted to PT302 or 1371.
AE socket not fitted to 1371.

(W29a) Circuit Diagram—Models 1369 and 1371 (Part)

Batteries: U7 or equivalent (4 × 1½ volts). Quiescent current: 8 mA.

To Remove Chassis: Release screw, insert coin into slot at base of cabinet and twist to remove back cover. Unclip the battery leads from container. Unsolder the leads to aerial and earpiece sockets. Remove the four chassis fixing screws and aerial input pillar.

Trimming Procedure (Table continued on next page)

<table>
<thead>
<tr>
<th>Apply signal as below:</th>
<th>Set receiver controls to:</th>
<th>Adjust in order for maximum output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 470 kc/s. to junction S1B/C6 with 0.1-μF capacitor in each lead</td>
<td>Low frequency end of M.W. Volume control at maximum</td>
<td>Cores of T3, T2 and T1</td>
</tr>
</tbody>
</table>

342
2. 600 kc/s. mod. 30 per cent. at 1000 c/s. to rod aerial via standard loop at 15 in. from centre of rod

3. As 2, but 1500 kc/s.

4. Repeat 2 and 3 until calibration is correct. Seal position of L2 with polystyrene dope

5. As 3, but 200 kc/s.

6. Seal with polystyrene dope

7. As 2, but 1389 (or 1215) kc/s.

---

Note: In the event of any adjustment being made to the M.W. circuits, the L.W. and M.B. circuits must also be realigned.

‡ Dependent upon coverage of bandspread.
**General Description:** An eight-transistor portable radio for reception of M.W., L.W. and F.M. transmissions. Fitted with telescopic aerial and car aerial socket, with provision for connection to a tape recorder.

**Batteries:** U11 or equivalent (6 × 1 1/2 volts). Consumption A.M. 18 mA., F.M. 22 mA.
## Trimming Procedure (A.M.)

<table>
<thead>
<tr>
<th>Apply a 30% modulated signal as below:</th>
<th>Set receiver controls as follows:</th>
<th>Adjust in order for maximum output:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 470 kHz via dummy aerial to S3 (pin 8)</td>
<td>M.W. button depressed. Low frequency end of band. Volume and tone controls at maximum Check that pointer is aligned with datum marks at low frequency end of scale</td>
<td>Cores of T2, T4 and T6</td>
</tr>
<tr>
<td>2. 600 kHz via dummy aerial to external aerial socket</td>
<td>M.W. button depressed. 500 metres M.W. button depressed. 200 metres</td>
<td>Core of L12 and position of L11 on ferrite rod Trimmers C27 and C21</td>
</tr>
<tr>
<td>3. As (2), but 1500 kHz</td>
<td></td>
<td>Seal position of L11 on rod, also trimmers C27 and C21</td>
</tr>
<tr>
<td>4. Repeat (a) and (3) until calibration and tracking is correct. also trimmers C27 and C21</td>
<td></td>
<td>Trimmer C22 and position of L9 on rod. Seal L9</td>
</tr>
<tr>
<td>5. As (a), but 214 kHz</td>
<td>L.W. button depressed. 1400 metres</td>
<td></td>
</tr>
</tbody>
</table>

## Trimming Procedure (F.M.)

<table>
<thead>
<tr>
<th>Apply signal, input terminated 75 ohms as follows:</th>
<th>Set receiver controls as below:</th>
<th>Adjust in order for maximum output: (unless otherwise stated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 10-7 MHz ± 22kHz deviation, to external aerial socket</td>
<td>F.M. button depressed. Approx. 92 MHz. Volume and tone controls at maximum</td>
<td>Cores of T1, T3, T5, L5 and L6 Repeat until no improvement can be obtained Core of T5 secondary for minimum output Cores of T1, T3 and T5 primary Cores of L3 and L7</td>
</tr>
<tr>
<td>2. As (1), but switch to A.M. modulation</td>
<td>As (1)</td>
<td>Trimmers C4 and C16</td>
</tr>
<tr>
<td>3. As (1)</td>
<td>As (1)</td>
<td></td>
</tr>
<tr>
<td>4. As (1), but 92 MHz ± 12kHz deviation</td>
<td>As (1)</td>
<td></td>
</tr>
<tr>
<td>5. As (1), but 102 MHz</td>
<td>As (1), but 102 MHz</td>
<td></td>
</tr>
<tr>
<td>6. Repeat (4) and (5) until calibration and tracking is correct.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**NYLON DRIVE CORD—EXTENSION LONG**

**W36**

(W36) DRIVE CORD—MODEL 1372

**W37**

(W37) V.H.F. TUNER PANEL—MODEL 1372

346
General Description: A seven-transistor M.W./L.W. portable receiver. A special feature of this model is the inclusion of a screened R.F. amplifier stage for use when the receiver is operated from a car aerial. When S4 button is pressed, R.F. signals are amplified by VT7 which is connected as an emitter follower and matched into the first tuned stage via L2.

Batteries: U11 or equivalent (6 × 1½ volts). Consumption 18 mA.

Below: (W39a) Circuit Diagram—Model 1373 (Part)

Right: (W39b) Circuit Diagram—Model 1373 (Continued)
Trimming Procedure

Apply a 30% modulated signal as below:

1. 470 kHz via dummy aerial to S3 (pin 8)

2. 600 kHz via dummy aerial to external aerial socket

3. As (2), but 1500 kHz

4. Repeat (2) and (3) until calibration and tracking is correct, also trimmers C9 and C3

5. As (2), but 214 kHz

Set receiver controls as follows:

1. M.W. button depressed. Low frequency end of band
   Volume and tone controls at maximum
   Check that pointer is aligned with datum marks at low frequency end of scale

2. M.W. button depressed. 500 metres

3. M.W. button depressed. 200 metres

Adjust in order for maximum output:

1. Cores of T1, T2 and T3

2. Core of L5 and position of L4 on ferrite rod
   Trimmers C9 and C3

3. Seal position of L2 on rod, also trimmers C9 and C3

4. Seal position of L2 on rod, Seal L2

5. Seal position of L2 on rod. Seal L2

Note - Collector connected to can
Above: (W41) Drive Cord—Model 1373
Right: (W42) Printed Panel R.F. Stage
General Description: Six-transistor, two-waveband A.M. car radio. Earth polarity change-over switch. Loudspeaker output impedance 3.5 ohms.

Circuit Alignment Data

Output Transistor Current Adjustment: (This adjustment must be made after transistor replacement.) Disconnect battery lead and insert an ammeter (1 amp range) into circuit, ensure pilot lamp is illuminated. Adjust slider resistor RV2 for 900 mA at 14.5 volts input. Check current after 15 minutes' operation.
**RADIOMOBILE**

**I.F. Alignment:** M.W. and L.W. models—470 kc/s. M.W. only models—456 kc/s. Apply the appropriate I.F. signal modulated 30 per cent. at 400 c/s. to the aerial input socket via the standard dummy load. Switch to M.W. and set pointer to 350 m. Tune to maximum output: Secondary I.F.T.2 (top tuning core); Primary I.F.T.2 (bottom tuning core); Secondary I.F.T.1 (top tuning core); Primary I.F.T.1 (bottom tuning core). Repeat until no further improvement in gain can be made.

(F87b) **Circuit Diagram—Model 70X (Continued)**

**M.W. Alignment:** Switch the M.W. pointer to the calibration mark at left of scale. Inject signal 1620 kc/s. (185 m.) and peak CV3, CV2, CV1. Check alignment at 1100 kc/s. (272.7 m.) and 600 kc/s. (550 m.). Gain figure should be better or equal to that obtained in previous operation.

*Note:* The tuner unit is factory pre-aligned, coils L2, L4, L7, should not be disturbed during alignment procedure.

To Replace Drive Cord: With tuning spindle fully anti-clockwise, i.e. tuning cores fully withdrawn, restring drive cord as shown in illustration, passing the loose end through loop and knotting the cord. Check pointer calibration.
R.G.D. Models RG241 and RG242

**General Description:** These models employ the S.T.C. Chassis GC10 and GC11 which are suitably described later in this volume on page 377 to 390.

**Dismantling:** This procedure is similar to that given for K.B. models KG041 and KG042 previously described on pages 255 and 256 of this volume.

R.G.D. Model RP236

**General Description:** This model employs the S.T.C. Chassis PC10 and PC11, and is similar to the K.B. model KP036 described on page 256 of this volume.

R.G.D. “ROVER” Model RR221

**General Description:** This model, apart from presentation, is similar to the “Cobra” radio receiver (KR021) described on page 239 of the 1967–68 volume.

R.G.D. “RAPIER” Model RR223

**General Description:** This model is similar in most respects to the model RR222 (Rambler) described on pages 326 to 331 of the 1967–68 volume.

The R.F. Module RMM21 employed in this receiver is similar to that employed in the K.B. model KR023 (Chieftain) described previously, on pages 254 and 255 of this volume.
ROBERTS R600

**General Description:** F.M./A.M. portable receiver employing eleven transistors and five diodes. Miniature jack socket for earpiece and car-type aerial socket for external aerials. Speaker, elliptical 5 ohms. Battery, 9 volts.

**Wavebands:** L.W. 150–265 kHz. M.W. 530–1620 kHz. V.H.F. 87.5–108 MHz.

**Adjustments:** The following adjustments are carried out with 9 volts measured across C24. (1) Connect a volt-meter between junction of TR5 and TR6 emitters and positive supply, and with volume at minimum, adjust RV2 to give 4.7 volts. (2) Connect a milliammeter in black flex link (LK) under printed circuit board, and adjust RV3 to give an output stage quiescent current of 3.5 mA. at 20°C. Allow one minute and recheck the figure. (3) Observing a sine-wave output on an oscilloscope, adjust RV2 for symmetry at onset of clipping.

**Alignment:** The I.F. transformers have been accurately aligned by the manufacturers and no attempt should be made to realign them. If a fault develops in the I.F. amplifier or the F.M. tuner, the complete unit should be removed and returned to the Roberts’ Radio Co. Ltd. for replacement. R.F.A.M. Rotate tuning control fully anti-clockwise and check that pointer coincides with the high wavelength end of the tuning scale. Inject signal via a coupling coil. Output should be kept low to avoid A.G.C. action. M.W. 1500 KHz. Adjust A.M. osc. and Aerial for max. 560 KHz. Adjust A.M. osc. coil and L2 for max. L.W. 263 KHz. Adjust CV1 and CV2 for max. 158 KHz. Adjust L3 for max. F.M. Switch off A.F.C. (button...
(H28) CIRCUIT DIAGRAM—R600
ROBERTS


Dismantling: Remove battery. Remove two screws securing chassis to case and one screw retaining telescopic aerial. Disconnect speaker leads. Remove complete chassis from the top of the case.
SANYO

General Description: Two-waveband seven-transistor portable radio-gram. Wavebands M.W. 187-550 m., L.W. 850-2,000 m. Maximum output power 700 mW. Current consumption, maximum 170 mA. (radio), 210 mA. (gram.).

Alignment: Apply volt-meter across the L.S. Volume control at maxi-
SANYO

Output of signal generator should be no higher than necessary to obtain output reading in order to avoid the effects of A.G.C.

**I.F. Alignment:** 470 kc/s.–T₃, T₂ and T₁.


(F21b) CIRCUIT DIAGRAM—Model G-1120E (Continued)

Alignment: Apply volt-meter across the loudspeaker. Volume control at maximum. Output of signal generator should be not higher than necessary to obtain proper output reading in order to avoid the effects of A.G.C.

I.F. Alignment: 470 kc/s. – T3, T2 and T1.

M.W./R.F. Alignment: 577 m. – L3; 182 m. – M.W. osc. trim Ct 2. Repeat. 500 m. – L1; 214 m. – M.W. aerial trim Ct 1. Repeat.

L.W./R.F. Alignment: 1141 m. – L.W. osc. trim Ct 3; 1875 m. – L2. Repeat.

Transistors:

TR-1 . . . 2SA 321
TR-2 . . . 2SA 203
TR-3 . . . 2SA 202
TR-4 . . . 2SB 186
TR-5 . . . 2SB 187
TR-6 . . . 2SB 187

Diode:

D-1 . . . 1S 188
(F24) CIRCUIT DIAGRAM—SANYO MODEL 6L-714E
SHARP

**SHARP**

**Model BXH-16L**

**General Description:** An eight-transistor portable radio for reception of L.W. and M.W. An external aerial is used for L.W.

**Batteries:** 6 volts (4 x 1½-volt cells). Quiescent current 13 mA.

**Dismantling:** Remove back and batteries. Remove three screws located on the printed circuit board.

**Alignment:** I.F. 455 kc/s. (I.F.T. 3, 2, 1); M.W. 520 kc/s. (L3), 1680 kc/s. (C4), 600 kc/s. (L1), 1400 kc/s. (C3); L.W. 145 kc/s. (L4), 385 kc/s. (C6), 180 kc/s. (L2), 350 kc/s. (C5).

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(W43a) CIRCUIT DIAGRAM—MODEL BXH-16L (PART)
**SOBELL**

**Model S327**

**General Description:** This receiver is similar to the model D527 described on page 188 in the 1966–67 volume.

366
**General Description:** Ten-transistor A.M./F.M. Portable receiver covering L.W., M.W. and V.H.F. Bands and incorporating a separate switched car aerial input circuit for the A.M. Bands. Silicon Planar transistors are used in the permeability V.H.F. tuner, throughout the R.F./I.F. circuits and in the audio pre-amplifier, resulting in high uniform sensitivity and good signal-to-noise figures. A ferrite rod internal aerial is used for signal pickup on A.M. and a 30-in. multi-position telescopic aerial is provided for F.M. reception.

Detected signals are fed into a four-stage audio amplifier which includes a temperature stabilised complementary push–pull output circuit and negative feed-back over three stages.


**Aerials:** Internal ferrite rod covering L.W., M.W. (An aerial socket provides for the connection of a car aerial.) Telescopic aerial for V.H.F./F.M. reception.

**Tape Output Socket:** A socket provides a signal source of 30 kΩ impedance for making tape recordings, which is unaffected by the setting of the volume control.

**Loudspeaker:** 4-in. round, 10-ohm impedance.

**Intermediate Frequencies:** 470 kc/s. and 10·7 Mc/s.

**Power Output:** 600 mW. undistorted.
Battery Supply: 9 volts. PP7 or equivalent.
Battery Consumption: 14 mA. quiescent (A.M.); 18 mA. quiescent (F.M.).
Wavechange switching shown in the F.M. position. All voltages were measured with respect to positive ground with a 20,000 \( \Omega/V \) testmeter on the 10-volt range. Starts of coils are indicated with a dot.


**Dismantling:** Slide off battery cover to obtain access to battery. In replacing battery, ensure that correct polarity is observed.

To remove back of cabinet, undo the two 4BA Phillips-head screws at bottom edge, tilt open at approximately 15 deg., and slide downwards to
release the telescopic aerial from aperture in scale. Slide out the tape output socket to fully open the back cover. This provides access to the component side of the printed-circuit board.

To dismantle the printed-circuit board from the cabinet, pull off control knobs, slide out ear-phone and tape recording sockets, remove the two 4BA screws securing the chassis, tilt out the bottom edge and remove in a downward direction.

Alignment Procedure: A.M. Alignment—Equipment Required:
1. An output meter (10 ohms impedance, 0–100 mW.). The output during alignment should not exceed 50 mW.
2. A signal generator (Low impedance output), amplitude modulated to 30 per cent. covering long and medium wavebands.
3. Suitable non magnetic trimming tools.
4. Dummy aerial unit.

![Diagram](F34-DUMMY_CAR_AERIAL)

Notes:
1. Before commencing alignment, check that the pointers line up with calibration marks 1 and 4 with the tuning gang fully closed (i.e. maximum capacitance).
2. For I.F. alignment (operations 1 and 2 in the alignment table) the signal generator is connected to the base of TR3 by a 0.01 μF. capacitor.
3. For R.F. alignment (operations 3 to 5 in the alignment table) the signal generator is connected via a dummy aerial to the car aerial socket, and the CAR switch depressed.
4. For R.F. alignment (operations 6 and 9 in the alignment table) the output from the signal generator should be fed into a transmitting coil placed 6 in. from the ferrite rod, and the car switch released. A suitable coil can be made with approximately 14 turns of 18 s.w.g. enamelled copper wire wound on a 1-in. former and spaced to a length of 1 1/4 in.
5. The alignment points referred to in the alignment table are raised marks on the scale back moulding.
6. All cores should be tuned to the outer position.
7. Adjustment of L12 and L13 where mentioned in the alignment procedure, is achieved by sliding the appropriate coil along the ferrite rod.
8. After alignment, the aerial coils should be resealed.
(F35) The Circuit Board and Wiring Taken from it to the Aerial Coils

The board is viewed from the tin dip side with components as seen through the board. Wiring in broken line represents printed connections on the component side of the board.
Alignment Table:

<table>
<thead>
<tr>
<th>Operation</th>
<th>Set pointer to alignment mark</th>
<th>Waveband</th>
<th>Signal gen. frequency</th>
<th>Adjust for max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Car switch depressed</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Gang closed</td>
<td>M.W.</td>
<td>470 kc/s.</td>
<td>L18, L21, L25/26</td>
</tr>
<tr>
<td>2</td>
<td>Repeat Operation 1.</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>L9/10/11 (Oscillator coil) L14/15 (Car aerial coil)</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>M.W.</td>
<td>1439 kc/s.</td>
<td>C25 (Oscillator trimmer) C46 (Car aerial trimmer)</td>
</tr>
<tr>
<td>4</td>
<td>Repeat Operations 3 and 4.</td>
<td>L.W.</td>
<td>220 kc/s.</td>
<td></td>
</tr>
<tr>
<td><strong>Car switch released</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>2 Approx.*</td>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>L12 (Rod aerial coil)</td>
</tr>
<tr>
<td>7</td>
<td>3 Approx.*</td>
<td>M.W.</td>
<td>1439 kc/s.</td>
<td>C63 (Rod aerial trimmer)</td>
</tr>
<tr>
<td>8</td>
<td>Repeat Operations 6 and 7.</td>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>C19 (Oscillator trimmer) L13 (Rod aerial coil)</td>
</tr>
</tbody>
</table>

* Tune to signal.

**F.M. Alignment—I.F. Circuits:** It is strongly recommended that the F.M. I.F. tuned circuits are aligned using a wobbulator set to a deviation of ±300 kc/s. about a carrier frequency of 10.7 Mc/s., displaying the I.F. curve and ratio detector curve on an oscilloscope.

Inject the signal from the wobbulator to the base of TR3 via a 0.01 μF capacitor. Detune the secondary, L23, of the ratio detector transformer by unscrewing the dust core so that it protrudes approximately 1/8 in. from the top of the coil former. Connect the oscilloscope "diode input" to the free end of R47, a 100 kΩ resistor. Adjust I.F.T.'s L22, L19, L20, and L16, L17, in that order, for maximum amplitude and symmetry about 10.7 Mc/s.

Transfer the signal input across L3. Adjust L6 and L7 for maximum amplitude and symmetry about 10.7 Mc/s. Connect oscilloscope "direct input" to the junction of R24 and R25. Screw in the core of L23 and adjust for "S" curve with linear portion symmetrical about 10.7 Mc/s.

**R.F. Circuits:**

Connect F.M. signal generator to F.M. aerial input (SC1) and tuner cover. Set pointer to Mark 5 (88 Mc/s.) mark. Adjust oscillator coil L5 and R.F. coil L3 with 88 Mc/s. signal input. Further calibration marks are provided at 6 (93 Mc/s.) and 8 (108 Mc/s.). These are for checking purpose only.

**N.B.:** A trimming tool made of non-magnetic material must be used for these adjustments. **Final adjustment of ratio detector transformer:** Feed in signal of 93 Mc/s. at 2.5 μV. level. Tune receiver for maximum output. Switch signal generator to A.M. and readjust L23 for minimum output (not more than 1/4 turn of core).
**Model 4F-53L**

**General Description:** An eight-transistor A.M./F.M. portable radio, with telescopic aerial for F.M. reception and jack sockets for the connection of a multiplex stereo adaptor, tape recorder and earphone. Batteries: 9 volts (6 $\times$ 1½ volts). Quiescent current, 10 mA. approx.

**R.F. Alignment Details:** See page 375 for table, under the second section of the circuit diagram.

**Transistors:**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>X101</td>
<td>2SA455</td>
<td>X203</td>
</tr>
<tr>
<td>X102</td>
<td>2SA455</td>
<td>X204</td>
</tr>
<tr>
<td>X201</td>
<td>2SC403</td>
<td>X205</td>
</tr>
<tr>
<td>X202</td>
<td>2SC403</td>
<td>X206</td>
</tr>
</tbody>
</table>

(W123) F.M. Tuner Lay-out—Model 4F-53L
RADIO SERVICING

(W121a) CIRCUIT DIAGRAM—MODEL 4F-53L (PART)

(W124) DRIVE CORD—MODEL 4F-53L
R.F. Alignment:

<table>
<thead>
<tr>
<th>Adj. item</th>
<th>SSG freq.</th>
<th>Receiver dial setting</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>coverage</td>
<td>105.5 Mc.</td>
<td>Fully left</td>
<td>Coil (L104)</td>
</tr>
<tr>
<td></td>
<td>105.5 Mc.</td>
<td>Tune to 105.5 Mc. signal</td>
<td>Trimmer (C1-4)</td>
</tr>
<tr>
<td>M.W. Frequency</td>
<td>520 kc. †</td>
<td>Fully left</td>
<td>M.W. osc.</td>
</tr>
<tr>
<td>coverage</td>
<td>1680 kc. †</td>
<td>Fully right</td>
<td>Coil (L202)</td>
</tr>
<tr>
<td>M.W. Tracking</td>
<td>620 kc. †</td>
<td>Tune to 620 kc. signal</td>
<td>M.W. osc.</td>
</tr>
<tr>
<td></td>
<td>1400 kc. †</td>
<td>Tune to 1400 kc. signal</td>
<td>Trimmer (C2-4)</td>
</tr>
<tr>
<td>L.W. Frequency</td>
<td>260 kc. †</td>
<td>Fully right</td>
<td>M.W. ant.</td>
</tr>
<tr>
<td>coverage</td>
<td>200 kc. †</td>
<td>Tune to 200 kc. signal</td>
<td>L.W. osc.</td>
</tr>
<tr>
<td>L.W. Tracking</td>
<td></td>
<td></td>
<td>Trimmer (C211)</td>
</tr>
</tbody>
</table>

* 400 c/s. ± 22.5 kc. F.M.
† 1000 c/s. 30 per cent. A.M.
General Description: These chassis differ only in their power output. The GC10 gives 3 watts per channel and the GC11 gives 7 watts per channel. Radiograms fitted with these chassis are suitable for the reproduction of stereophonic records, and the reception of L.W., M.W., S.W. and V.H.F./F.M. signals. A stereo decoder plug-in unit type GDK1 is available as an optional extra for the reception of stereo radio transmissions.


Circuit Description (A.M.): The long-wave and medium-wave aerial coils are wound on the ferrite rod, the short-wave aerial being wound on a dust cored former and connected to the internal antennae on switching. The medium wave coil is tuned by Cr3 and Cr4. On long wave the medium wave primary is shorted out and the long-wave aerial coil tuned by Cr3, Cr4 and Cr5. On short-wave the aerial coil Lr1 is series fed via Cr1 and tuned by Cr2 and Cr3. On medium and long wave the aerial is bottom capacity coupled via Cr6.

The tuned signal selected is fed via Cr7 to the base of TXr1 which is operated as a mixer. The heterodyne voltage is derived from TXr2.

The short-wave oscillator coils Lr12 and Lr14 are tuned by Cr24 and Cr27. On medium wave the oscillator coils Lr11 and Lr13 are tuned by Cr25, Cr26 and Cr27, while the long wave is tuned by adding Cr49 and Cr21 in shunt.

(H40) Wiring Diagram of GC10 and GC11

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RADIO SERVICING

The I.F. signal is selected by Lr7, and Lr10 and further amplification occurs at TXr3 which has the 2nd A.M. I.F. transformer in its collector circuit comprised of Lr15 and Lr18. Lr18 feeds the A.M. detector TXr4 which is connected via the filter Cr44, Rr28 and Cr47, and switching circuitry to the audio amplifiers.

Circuit Description (F.M.): TXt1 and TXt2 comprise a transistor tuner operating over the frequency range 86–101 MHz.

Signals are coupled to the emitter of TXt1 by the aerial input transformer Lt1 and Lt2. The tuned circuit, Lt3, Ct6, Ct8 and the ganged capacitor Ct9, selects the required frequency, and the signal is coupled via Ct7 to the emitter of the F.M. mixer TXt2. The oscillator tuning inductance is Lt5. Lt6 and Lt7 form the first F.M./I.F. transformer and are tuned to 107 MHz. The output coil Lt7 is coupled to the input of TXr1, via the capacity tap Ct19 and Ct20. Signals at 107 MHz are selected by Lr8 and Lr9 (2nd F.M./I.F. transformer) before being passed to TXr3 and the ratio detector Lr16–Lr17. The balanced detector (two 1N 542's) feeds the signal to the audio amplifiers.
**Circuit Description (Gram.):** In the Gram position the outputs from the cartridge are directly coupled to the base of TXa1 on each channel which has a stage gain of less than unity, due to the capacitive feedback provided by Ra2 and Ca1, which capacitively loads the cartridge. This allows the high cartridge impedance to be matched to the input impedance of the transistor.

The output from TXa1 is fed via the volume control and tone control network to the pre-driver TXa2, and after amplification is fed to TXa3 which is used to drive the output stage.

The output stage comprises two transistors TXa4 and TXa5 operating in complementary symmetry, the output voltage being developed at the junction of Ra17 and Ra18, and applied to the loudspeaker via Ca9. Ra15 forms a feedback loop to the base of TXa3 providing adjustable biasing of the output and driver stages by means of Ra14. On the GC11, Ra13 provides an adjustment of the output stage quiescent current.

**Alignment (Equipment):** Realignment should not be necessary unless a coil or the tuner is replaced. It should not be attempted without all the necessary equipment. The following equipment will be required:

1. Output power meter covering the range 50 mW. - 10 watts at impedances of 6 and 15 ohms or an A.C. valve volt-meter to read 1 mV. and 50 mV.

(H39) Chassis View of GC11

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2. A.M. signal generator covering the frequency range 175 KHz to 15 MHz, modulated to a depth of 30 per cent. at 400 Hz.
3. F.M. signal generator covering the frequency range 10 MHz–100 MHz, with variable deviation and A.M. facility, modulation frequency 1 KHz.
4. Sweep generator 10–7 MHz and 94 MHz.
5. Oscilloscope.

Alignment (A.M.):
1. Set tuning pointer to datum (gang closed).
2. Rotate tone controls fully clockwise and balance control to its central position.
3. Adjust the volume control to position 5 if an output power meter is to be used to measure the output signal, or to position 0, if a valve volt-meter is to be used.
4. Connect the output power meter in place of the L.H. loudspeaker and disconnect the R.H. loudspeaker.
5. Do not apply a dummy load to the R.H. channel output. Do not short-circuit either output under any circumstances.
6. If a valve volt-meter is employed, connect its input to the junction of Rr28 (10 kΩ) and Cr48 (3900 pF.).
7. During alignment adjust the input signal level to keep the output at approximately 50 mV. or 50 mW.
8. Apply a 470 KHz signal (modulated to a depth of 30 per cent. at 400 Hz) to pin E2 on the band switch.
10. Align the A.M./I.F. transformers in the following order Lr18, Lr15, Lr10, Lr7.
11. After alignment the —3dB bandwidth should be 7 KHz ±0.5 KHz and the response at ±9 KHz off tune should be —20 dB ±3 dB.

Applying a signal to aerial input socket via a standard dummy aerial.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Input frequency</th>
<th>Waveband</th>
<th>Gang or pointer position</th>
<th>Adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>600 KHz</td>
<td>M.W.</td>
<td>1\frac{1}{2} in. from datum</td>
<td>M.W. Osc. coil Lr13</td>
</tr>
<tr>
<td>2</td>
<td>1500 KHz</td>
<td>M.W.</td>
<td>8\frac{1}{4} in. from datum</td>
<td>M.W. Osc. trimmer Cr26</td>
</tr>
<tr>
<td>3</td>
<td>1500 KHz</td>
<td>M.W.</td>
<td>8\frac{1}{4} in. from datum</td>
<td>M.W. Osc. trimmer Cr26</td>
</tr>
<tr>
<td>4</td>
<td>175 KHz</td>
<td>L.W.</td>
<td>3\frac{1}{4} in. from datum</td>
<td>L.W. Osc. trimmer Cr49</td>
</tr>
<tr>
<td>5</td>
<td>175 KHz</td>
<td>L.W.</td>
<td>3\frac{1}{4} in. from datum</td>
<td>L.W. Osc. trimmer Cr49</td>
</tr>
<tr>
<td>6</td>
<td>6 MHz</td>
<td>S.W.</td>
<td>3\frac{1}{4} in. from datum</td>
<td>S.W. Osc. coil Lr14</td>
</tr>
<tr>
<td>7</td>
<td>15 MHz</td>
<td>S.W.</td>
<td>8\frac{1}{4} in. from datum</td>
<td>S.W. Osc. trimmer Cr24</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>Repeat operations 8, 9, as necessary</td>
</tr>
</tbody>
</table>
Alignment (F.M./I.F.):

1. Press F.M. button and tune to 94 MHz unless interference is present on this frequency, in which case employ 92-5 MHz wherever 94 MHz is mentioned below. If a valve volt-meter is used, transfer its input to pin D8 of bandswitch.

2. During alignment adjust the input signal to keep the output at approximately 50 mW. or 20 mV.

3. Apply input signal at 10-7 MHz deviated 22·5 kHz to pin E2 on the bandswitch.


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5. Align the F.M./I.F. transformers in the following order: Lr16, Lr17, Lr9, Lr8, when aligning Lr17, choose the tuning point giving greater inductance (core further in).

6. Repeat alignment in the following (different) order Lr17, Lr16, Lr9, Lr8.

7. Using the sweep generator, display the S-curve and check for linearity and symmetry.

**Alignment (A.M. Rejection):**

1. Return to the signal-generator input signal set to give 50 mW. (or 20 mV.) output and change modulation to 30 per cent. A.M.
2. Retune generator slightly for minimum response (the adjustment required should not exceed 20 KHz).
3. The output should fall by more than 30 dB.
CAPACITORS Cr3, C19, C115, Cr27 ARE GANGED TOGETHER.

ALL SWITCHES SHOWN IN MEDIUM WAVE POSITION

VIEW FROM COPPER SIDE

MEDIUM & LONG WAVE AERIAL COILS

(Viewed from tagged end)

F.M. COILS (Underside view)

A.M. COILS (Underside view)

TRANSISTOR BASE CONNECTIONS

(H43d) Circuit Diagram GC10 (Part)

(H43g) Circuit Diagram GC10 (Continued)
Alignment (F.M. Tuner):
1. Apply 94 MHz signal at 22.5 KHz deviation to F.M. aerial terminals.
2. Align in the following order: Lt5, Lt7, Lt6, Lt3.
3. Do not repeat, if alignment is not satisfactory unscrew the cores of Lt7 and Lt6 and repeat alignment.

Audio Adjustments: Adjustment is provided for symmetry by Ra14. Quiescent current adjustment is provided by Ra13 on GC11 only. No
1. Voltages with M.W. button pressed except where stated.
2. Unless otherwise stated all resistors 10 per cent. ½W and all capacitors 10 per cent.

Adjustment for Quiescent current is provided on GC10 chassis audio modules. An output power meter is essential, full scale readings of 5 watts at 15 ohms for GC10 chassis and 10 watts at 6 ohms for GC11 chassis.

Apply an input signal either to tape socket, or receiver circuit and connect the required power meter (5 watts f.s.d. or 10 watts f.s.d.) and an oscilloscope to the output of the module required.

Adjust the input to obtain: 2·6 watts for GMA20 (i.e. GC11 chassis);
S.T.C.

1.0 watts for GMA11 (GC10 chassis) and allow 10 min. to reach thermal equilibrium.

Increase input until output is just clipped and adjust RA14 (in both cases) for symmetrical clipping. Remove input signal and allow 10 min. for cooling. On GMA20 (GC11 chassis) remove link adjacent to contact 10 on this audio module and insert a milliammeter. Adjust current to 10 mA, by means of Ra13. Replace link and seal both Ra13 and Ra14.

When drive drum turned fully clockwise and in position shown proceed as follows:

1. Connect end "X" of cord to hook P and pass cord clockwise round drive drum.

---

**Diagram Description:**

- **Pillar 'B':** Drive drum is connected to this pillar.
- **Pillar 'D':** Drive spindle is crimped to cord.
- **Drive Cord:** The cord is passed through the pillars as described in the text.

**Textual Diagram:**

```
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```

**Diagram Note:**

(H37) Drive Cord

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3. Put two turns clockwise on drive drum and connect end "Y" to hook Q.
4. Connect pointer as shown and line up with asterisk adjacent to F.M. on scale plate when gang is fully closed.

**STANDARD Model SR-Q771FL**

**General Description:** A.M./F.M. radio receiver employing nine transistors, five diodes and one thermistor. Battery 6 volts. Speaker 8 ohms. Power output 250 mW. undistorted.


(H24a) Circuit Diagram—SR-Q771FL (Part)
### Transistor

<table>
<thead>
<tr>
<th>Transistor</th>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1</td>
<td>2SA235</td>
<td>F.M. R.F. Amplifier</td>
</tr>
<tr>
<td>Q2</td>
<td>2SA235</td>
<td>F.M. Converter</td>
</tr>
<tr>
<td>Q3</td>
<td>2SA234</td>
<td>F.M. I.F. Amplifier</td>
</tr>
<tr>
<td>Q6</td>
<td>2SA234</td>
<td>A.M. Converter</td>
</tr>
<tr>
<td>Q7</td>
<td>2SA234</td>
<td>F.M. I.F. Amplifier</td>
</tr>
<tr>
<td>Q11</td>
<td>2SB75</td>
<td>A.M. I.F. Amplifier</td>
</tr>
<tr>
<td>Q12</td>
<td>2SB77</td>
<td>A.F. Amplifier</td>
</tr>
<tr>
<td>Q13</td>
<td>2SB77</td>
<td>Power Amplifier</td>
</tr>
<tr>
<td>Q14</td>
<td>2SD77</td>
<td>Power Amplifier</td>
</tr>
</tbody>
</table>

### Diode

<table>
<thead>
<tr>
<th>Diode</th>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q4</td>
<td>IN34A</td>
<td>Osc. Compensator</td>
</tr>
<tr>
<td>Q5</td>
<td>IN34A</td>
<td>A.G.C. Compensator</td>
</tr>
<tr>
<td>Q8</td>
<td>IN34A</td>
<td>F.M. Detector</td>
</tr>
<tr>
<td>Q9</td>
<td>IN34A</td>
<td>F.M. Detector</td>
</tr>
<tr>
<td>Q10</td>
<td>IN34A</td>
<td>A.M. Detector</td>
</tr>
</tbody>
</table>

### Thermistor

<table>
<thead>
<tr>
<th>Thermistor</th>
<th>Type</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q15</td>
<td>D-1E</td>
<td>Temp. Compensator</td>
</tr>
</tbody>
</table>

---

**CIRCUIT DIAGRAM**

1. All Resistance values in Ohm, \( \times 1000 \)
2. All Capacitance values in microfarad, \( \times 10^{-6} \)
3. Voltage measured from common negative wiring at no signal. \( V \) voltage (V), \( I \) current (mA)
4. Specifications subject to change without notice

(H24b) CIRCUIT DIAGRAM—SR-Q771FL (CONTINUED)
(H25b) Component Locations—SR-Q771FL (Continued)
STELLA Model ST335AT

General Description: This radiogram is electrically similar to the Philips Model FG53AT "Studio Ten" information for which is given elsewhere in this volume.

STELLA Model ST438T

General Description: A seven-transistor portable receiver which incorporates a bandspread waveband in addition to Long and Medium Wavebands. Sockets are provided for a car aerial and earphone (8 ohms).

Batteries: $4 \times 1\frac{1}{2}$ volts (U11 or equivalent). Consumption 11–15 mA.

Dismantling: Remove the spring loaded battery compartment and lay the receiver, face downwards, on a soft protective surface. Release the two retaining screws and lift off the cabinet rear. Remove the screw situated in the volume control compartment and the screw adjacent to the wavechange switch assembly. The chassis can now be lifted from the cabinet front, captive only by the loudspeaker and earphone/aerial connecting leads which may now be unsoldered.

Adjustment of R21: This resistor controls the quiescent current drawn by T6/T7, and since the A.F. amplifier stages of the receiver are D.C. coupled it is advisable to check, and if necessary adjust, this current value after any servicing has been carried out on the A.F. amplifier stages. To measure the current, remove the link from T5 collector to T7 base, and insert a 0–10 mA. meter. Turn the volume control to minimum and adjust R21 for a meter reading of 3 mA. Disconnect the meter and replace the shorting link.

(W51) Drive Cord—Model ST438T

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### (W52) Trim Plan—Model ST438T

**Alignment Table**

<table>
<thead>
<tr>
<th>Switch to:</th>
<th>Set gang to:</th>
<th>Injection point</th>
<th>Sig. gen. frequency</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I.F. Alignment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.W.</td>
<td>Minimum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>470 kHz.</td>
<td>L1 max. output</td>
</tr>
<tr>
<td>M.W.</td>
<td>Minimum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>472 kHz.</td>
<td>L18 max. output</td>
</tr>
<tr>
<td>M.W.</td>
<td>Minimum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>468 kHz.</td>
<td>L15 max. output</td>
</tr>
<tr>
<td><strong>M.W. Oscillator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M.W.</td>
<td>Maximum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>540 kHz.</td>
<td>L9 max. output</td>
</tr>
<tr>
<td>M.W.</td>
<td>Minimum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>1545 kHz.</td>
<td>C16 max. output</td>
</tr>
<tr>
<td><strong>L.W. Oscillator</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L.W.</td>
<td>Maximum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>148 kHz.</td>
<td>C10 max. output</td>
</tr>
</tbody>
</table>

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(W50a) CIRCUIT DIAGRAM—MODEL ST438T (PART)

<table>
<thead>
<tr>
<th>Switch to:</th>
<th>Set gang to:</th>
<th>Injection point</th>
<th>Sig. gen. frequency</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.W.</td>
<td>Maximum</td>
<td>Aerial side of C7 via a 470 kpf. cap.</td>
<td>1395 kHz.</td>
<td>L26 max. output</td>
</tr>
<tr>
<td>B.W.</td>
<td>Minimum</td>
<td>C13 max. output</td>
<td>1645 kHz.</td>
<td>C13 max. output</td>
</tr>
<tr>
<td>Repeat as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B.W. Oscillator

M.W. Aerial

<table>
<thead>
<tr>
<th>M.W.</th>
<th>600 kHz.</th>
<th>Via coupling loop</th>
<th>600 kHz.</th>
<th>L3/4 max. output</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>1500 kHz.</td>
<td>Via coupling loop</td>
<td>1500 kHz.</td>
<td>C6 max. output</td>
</tr>
<tr>
<td>Repeat as necessary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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STELLA

Switch to: | Set gang to: | Injection point | Sig. gen. frequency | Adjust
---|---|---|---|---
**L.W. Aerial**
L.W. | 190 kHz. | Via coupling loop | 190 kHz. | L1/2 max. output

**B.W. Aerial**
B.W. | 1645 kHz. | Via coupling loop | 1654 kHz. | C4 max. output

(W50b) Circuit Diagram—Model ST438T (continued)
General Description: A nine-transistor, three-waveband A.M./F.M. portable radio. A telescopic aerial is used for F.M. and switchable tone control is provided at the rear of the receiver. Sockets are provided for connection of a car aerial, earphone and extension loudspeaker (3 ohms).

Dismantling: Place receiver face down on a protected surface, release the "clip-in" battery cover and withdraw batteries. Undo two screws at bottom of receiver, also unscrew two ornamental screws at each side of case. The rear cover can now be removed.

Note: When re-assembling, ensure that the metal lip on the rear half of the case engages under the metal scale trim, to obtain a proper fit at the top.

(W54a) Circuit Diagram—Model ST6143 (Part)
**STELLA**

**Removing the Battery Holder:** To remove battery holder from chassis, unscrew the two countersunk screws at each end of holder. Unsolder the red and black wires from their tags, also the lead to the telescopic aerial connecting plate. Withdraw battery holder from chassis.

**Releasing the R.F.-I.F. Panel:** After removing battery holder and turning the gang to max. capacity (pointer to 550 m.), remove the six cheesehead screws securing panel to chassis, but before removing, attach a piece of adhesive tape to the tuning drum to hold the drive cord in place. Then ease drum assembly off the gang spindle and stick it to the case side with adhesive tape. As the panel is removed, gently lever the wavechange knob off its spindle. To detach the panel completely from the chassis, it is necessary to unsolder the leads from the tag strip on top of the detector screening can and the Ext. aerial socket lead from L11.
**RADIO SERVICING**

**Releasing the A.F. Panel:** Unsolder the three leads from the left-hand edge of the A.F. panel, unscrew the two screws retaining the panel, one by the output sockets and the other in the bottom right hand corner, after which the panel can be removed. To detach the panel completely from the chassis, unsolder the grey L.S. lead from its tag and the two leads at the top edge of the A.F. panel.

![Diagram of A.F. panel](image)

(W55) **Drive Cord—Model ST6143**

**R10 Adjustment:** Connect a valve volt-meter across R12, and with no signal input, adjust R10 to give a reading of 0.4 volt.

*Note:* This adjustment only applies where R10 is a pre-set pot. In some sets it is a 120 kΩ fixed resistor.

**R39 Adjustment:** This resistor controls the amount of current drawn by T8/T9 under quiescent conditions. Normally, adjustment will only be required if T8/T9 are replaced. To measure the combined collector current, remove the shorting link on the print adjacent to C71. Connect a 0–10 mA. meter between the print lands, turn volume control to minimum, switch receiver on and ensure that the battery voltage is at least 5.5 volts. Adjust R39 for a reading of 3 mA., disconnect meter and replace shorting link.

![Diagram of R10 and R39](image)
### Alignment Table

<table>
<thead>
<tr>
<th>Switch to:</th>
<th>Gang to:</th>
<th>Gen. freq. 30% mod.</th>
<th>Apply to:</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>Max.</td>
<td>470 kHz.</td>
<td>T3 base via 39 kpf.</td>
<td>L38/39</td>
</tr>
<tr>
<td>M.W.</td>
<td>Pointer to 530 m.</td>
<td>570 kHz.</td>
<td>T3 base via 39 kpf.</td>
<td>L36/37</td>
</tr>
<tr>
<td>M.W.</td>
<td>Pointer to 194 m.</td>
<td>1550 kHz.</td>
<td>T3 base via 39 kpf.</td>
<td>L35/34</td>
</tr>
<tr>
<td>L.W.</td>
<td>Pointer to 1200 m.</td>
<td>250 kHz.</td>
<td>T3 base via 39 kpf.</td>
<td>L15-17</td>
</tr>
<tr>
<td>M.W.</td>
<td>Pointer to 530 m.</td>
<td>570 kHz.</td>
<td>Via loop</td>
<td>C8</td>
</tr>
<tr>
<td>M.W.</td>
<td>Pointer to 194 m.</td>
<td>1550 kHz.</td>
<td>Via loop</td>
<td>C30</td>
</tr>
<tr>
<td>L.W.</td>
<td>Pointer to 1760 m.</td>
<td>170 kHz.</td>
<td>Via loop</td>
<td>Adj. position</td>
</tr>
<tr>
<td>L.W.</td>
<td>Pointer to 1200 m.</td>
<td>250 kHz.</td>
<td>Via loop</td>
<td>L9/L10</td>
</tr>
<tr>
<td>F.M.</td>
<td>Max.</td>
<td>10.7 MHz.</td>
<td>T4 base via 47 kpf.</td>
<td>C7</td>
</tr>
<tr>
<td>F.M.</td>
<td>Max.</td>
<td>10.7 MHz.</td>
<td>T4 base via 47 kpf.</td>
<td>C25</td>
</tr>
<tr>
<td>F.M.</td>
<td>Pointer to 90 MHz.</td>
<td>90 MHz.</td>
<td>T1 coll. via 47 kpf.</td>
<td>L25/27</td>
</tr>
<tr>
<td>F.M.</td>
<td>Pointer to 100 MHz.</td>
<td>100 MHz.</td>
<td>Tele. aerial via 1500 pF.</td>
<td>L28/29</td>
</tr>
<tr>
<td>F.M.</td>
<td>Pointer to 90 MHz.</td>
<td>90 MHz.</td>
<td>Tele. aerial via 1500 pF.</td>
<td>L30/31</td>
</tr>
<tr>
<td>F.M.</td>
<td>Pointer to 100 MHz.</td>
<td>100 MHz.</td>
<td>Tele. aerial via 1500 pF.</td>
<td>L22/24</td>
</tr>
</tbody>
</table>

### STELLA Model ST7005

**General Description:** This portable transistor radio is electrically similar to the Philips Model 13RL360 described on pages 333 to 335 of this volume.

### STEREOSOUND Models SS.16 and TA.2

**General Description:** Five-transistor, eight-watt complementary push-pull amplifier. Circuit features include direct coupling, negative feedback and low impedance loudspeaker. On TA.2, R.21, C.16 are omitted and TR3 emitter is earthed. On certain models a 6.8 kΩ resistor may be connected across C.14 to reduce the bass response.
RADIO SERVICING

(F100a) Circuit Diagram—Stereosound SS.16 and TA.2 (Part)

<table>
<thead>
<tr>
<th>TR Voltages</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS.16 8 watt</td>
</tr>
<tr>
<td>Collector volts</td>
</tr>
<tr>
<td>TR1</td>
</tr>
<tr>
<td>TR2</td>
</tr>
<tr>
<td>TR3</td>
</tr>
<tr>
<td>TR4</td>
</tr>
<tr>
<td>TR5</td>
</tr>
</tbody>
</table>

Quiescent current at collector of TR.5, 22 Ma. (SS.16), 20 Ma. (TA.2). All voltages with respect to chassis, measured with Avo Model 8. In Mono models the balance control is omitted. In stereo models two amplifier channels are used, controlled by dual treble, bass and volume controls.
STEREOSOUND

Model TR.5

General Description: Five-transistor complementary Class B push–pull record-player amplifier. Circuit features include direct coupling, negative feedback, treble and bass controls.
(F99) (Top) Component Lay-out—Stereosound SS.16 and TA.2

(F101) (Bottom) Component Locations—Stereosound TR.5
Above: (F101a) Circuit Diagram—Stereosound TR.5 (Part)

Below: (F101b) Circuit Diagram—Stereosound TR.5 (Continued)

All voltages are negative with respect to chassis.
ULTRA Model 6008

General Description: This model is similar to the Marconiphone Model 4020 described in this volume.

ULTRA Model 6016

General Description: This model is similar to the Ultra Model 6008 described above.

Note: The positions of R1 and R5 are reversed—see Component Locations Diagram on page 270, as for Model 6008.

ULTRA Model 6018

General Description: Record player with 5 watts output. Changer, B.S.R. UA15 Superslim. Cartridge, B.S.R. C1 with turnover stylus ST3. Speaker, elliptical 8 ohms. A.C. mains 200–250 volts 50 c/s. Sockets, microphone and radio inputs, stereo output (L.H. channel) and tape recording output.

Circuit Diagram Notes: Figures in rectangles are voltage readings taken with an Avometer 8, and are with respect to the positive line unless otherwise indicated. Ringed figures indicate printed board tag connections. J1 is shown in the monophonic position.

Stylus Replacement: Turn indicator flag to L.P. position. Press down and forward (gently) to release styli assembly. After replacement, ensure that stylus arm is engaged within the V-shaped fork of cartridge.

Cartridge Replacement: Ease forward the spring clip at front of head to release cartridge. Then detach plugs from pins at rear of cartridge, noting colour coding.

Chassis Removal: Fully unscrew transit screws to lock record changer to motor board then turn cabinet on to its left-hand side taking precautions to protect the surface. Take out six plastic screws to release cabinet base cover: these screws can be refitted by pushing them in.

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Above: (H229a) Circuit Diagram—Model 6018 (Part)
Below: (H229b) Circuit Diagram—Model 6018 (Continued)
Unplug pickup connections from tag strip on underside of record changer (taking note of colour coding to ensure correct reconnection) and unfasten cleats securing pickup and mains leads. Also, unclip neon indicator lamp and unplug leads from loudspeaker tags. Restore cabinet to its normal position then take out screw from each end of amplifier control panel. The control panel and chassis assembly may now be lifted out within limit of mains transformer leads. Unsolder these leads for complete removal of the control panel and chassis assembly.

**Changer Removal:** Remove cabinet base cover and unplug pickup leads (see Chassis Removal) then unsolder motor leads from mains transformer. Turn transit screws fully clockwise then prise up locking tongue of each transit clip and slide the latter off the bottom end of the transit screw. Remove flat washers from transit screws and lift record changer out of the cabinet.
General Description: A.M. radio receiver with 300 mW. output. Aerials; ferrite rod and telescopic rod. Sockets; car aerial and earphone (or tape recorder). Speaker, round 15 ohms. Battery, 9 volts PP6.


Alignment (General): Connect an output meter, set to 15 ohms impedance, in place of loudspeaker. Alternatively, connect a Model 8 Avometer (on 10-volt A.C. range) across speech coil. Set volume control to maximum but, during alignment, adjust signal generator output level to maintain receiver output at 50 mW.

Alignment (I.F.): Switch receiver to M.W. and turn gang to maximum capacitance. Apply a 475 kc/s. (30 per cent. modulated) signal, via a 0.1 µF. blocking capacitor, across C3 (aerial section of gang) then adjust IFT3, IFT2 and IFT1 (in that order) for maximum output.

Alignment (R.F.): Inject M.W. and L.W. signals via a loop loosely coupled to ferrite rod aerial. Align in following order.

<table>
<thead>
<tr>
<th>Range</th>
<th>Sig. gen.</th>
<th>Tune to</th>
<th>Adjust (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>525 kc/s.</td>
<td>Signal</td>
<td>L8 (M.W. osc. pad)</td>
</tr>
<tr>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>Signal</td>
<td>L2 (M.W. aer. pad)</td>
</tr>
<tr>
<td>M.W.</td>
<td>1500 kc/s.</td>
<td>Signal</td>
<td>C2 (M.W. aer. trim)</td>
</tr>
<tr>
<td>L.W.</td>
<td>148 kc/s.</td>
<td>Signal</td>
<td>C15 (L.W. osc. trim)</td>
</tr>
<tr>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>Signal</td>
<td>L3 (L.W. aer. pad)</td>
</tr>
</tbody>
</table>

Note: Adjust L2 and L3 by sliding coil former along ferrite rod.

Alignment (S.W.): Extend telescopic aerial and place signal generator lead nearby to provide a loose coupling.

<table>
<thead>
<tr>
<th>Range</th>
<th>Sig. gen.</th>
<th>Tune to</th>
<th>Adjust (max.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.W.</td>
<td>5.9 Mc/s.</td>
<td>Gang closed</td>
<td>L1 L (S.W. osc. pad)</td>
</tr>
<tr>
<td>S.W.</td>
<td>17 Mc/s.</td>
<td>Gang open</td>
<td>C9 (S.W. osc. trim)</td>
</tr>
<tr>
<td>S.W.</td>
<td>677 Mc/s.</td>
<td>Signal</td>
<td>L4 (S.W. aer. pad)</td>
</tr>
<tr>
<td>S.W.</td>
<td>1545 Mc/s.</td>
<td>Signal</td>
<td>C5 (S.W. aer. trim)</td>
</tr>
</tbody>
</table>

Circuit Diagram Notes: Figures in rectangles indicate voltages measured with an Avometer 8, between positive line and point shown except where otherwise indicated. D.C. resistances are shown against inductors where these are greater than one ohm. Ringed figures show printed board tag connections.

Balance Adjustment: Output transistors VT6 and VT7 are series connected across the 9-volt battery supply and to ensure a balanced supply voltage to each, an adjustment R13 is incorporated in emitter circuit of VT4.
Adjustment of this resistor sets emitter potential and hence collector potential of VT4. It will, therefore, determine the base potential of driver VT5 which is directly coupled to VT4. This bias decides collector potential of VT5 which in turn controls base voltages of VT6 and VT7.

Correct balance is obtained when potential of VT6/VT7 emitter junction is 5 volts with respect to positive line. The discrepancy from half-battery voltage is due to the emitter bias voltage developed across R17 which determines limit of negative signal excursion before bottoming of VT5 takes place.

An alternative method of balancing operating voltages of VT6 and VT7 is by visual observation, on an oscilloscope, of output waveform at maximum output when adjustment should be made for symmetry of both waveform and clipping at high outputs.

**Complementary Power Output Stage:** p-n-p and n-p-n type transistors are used in conjunction with a stabilising diode to provide a transformerless power stage giving an audio output of 300 mW.
The audio signal developed across volume control R12 is applied via coupling capacitor C25 to the base of audio amplifier transistor VT4. The amplified signal appearing at the collector of VT4 is directly coupled to the base of driver transistor VT5. The output from VT5 simultaneously drives the bases of both output transistors VT6 and VT7. During positive half-cycles of the signal, n-p-n transistor (VT7) conducts, resulting in a fall in collector/emitter voltage of VT7. During negative half-cycles of the signal p-n-p transistor (VT6) conducts, resulting in an increase in collector/emitter voltage of VT7. The loudspeaker is fed via C30 and J1.

VT5 collector load R19 is returned to the “live” side of the loudspeaker and, as this point is coupled to the emitters of VT6 and VT7 through C30, the input signal to the output stage is virtually applied between base and emitter of both VT6 and VT7.

The diode is biased by VT5 collector current and acts as a variable resistance which is sensitive to voltage and temperature variations. The resistance value of W2 is small compared with R19 and the voltage developed
across W2 equals the sum of the nominal output transistor (VT6 and VT7) base/emitter voltages and so determines the correct quiescent operating conditions. During low ambient temperature conditions the resistance of W2 increases thus compensating for falling current of the output transistors. This effect also takes place in the event of falling battery voltage. The diode W2 also assists thermal stability at high temperatures and opposes high current drain from the battery.

**Dismantling:** Slide the battery cover downwards to release it and remove the battery. Unscrew the handle fixing studs to free the back cover. For access to the copper side of the printed board, pull off the tuning knob then gently prise up the lower end of the board which is clipped into moulded lugs on the case.

(H252) Component Locations — Model 6146

**ULTRA Model 6158T**

**General Description:** This model is similar to the model Ferguson 3156T described in this volume.
ULTRA

Model 6322

General Description: Stereogram featuring twenty transistors and four diodes, in a mains powered cool chassis. Power output, 2 watts continuous tone per channel. Aerials; rotatable ferrite rod and internal dipole. Speakers, two elliptical 15 ohms. Sockets; A.M. aerial, F.M. dipole and tape input and output. 200–250 volts A.C. 50 c/s. Power consumption; radio 20 watts and gram 35 watts.


Alignment (General): Remove chassis as described. Connect an output meter adjusted for 15 ohm impedance in place of L.H. or R.H. loudspeaker or a 20,000–ohm volt-meter set to a suitable A.C. voltage range across the L.H. or R.H. loudspeaker sockets. Zero, trim and pad markers are provided on the scale diffuser.

Alignment (A.M. I.F.): Switch receiver to M.W.: turn gang to maximum capacitance position and volume control fully clockwise. Inject a 475 kc/s., 30 per cent. modulated, signal via a 0·1 µF. capacitor between contact 5 of switch S5B and chassis, then peak L29, L25, L22 and L21 for maximum output, adjusting signal input level as required to maintain an output level of 200 mW.

Alignment (A.M. R.F.): Align M.W. first. 30 per cent. modulated signals should be injected in A.M. aerial/earth socket (SKT2) via a 30 pF. series capacitor. With the tuning gang at maximum, check that the cursor coincides with the zero marker on the scale diffuser.

<table>
<thead>
<tr>
<th>Range</th>
<th>Frequency</th>
<th>Cursor position</th>
<th>Adjust</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.W.</td>
<td>600 kc/s.</td>
<td>M.W. pad marker</td>
<td>L15, L10</td>
</tr>
<tr>
<td></td>
<td>1400 kc/s.</td>
<td>M.W. trim marker</td>
<td>C32, C20</td>
</tr>
<tr>
<td>L.W.</td>
<td>220 kc/s.</td>
<td>L.W. 220 kc/s. marker</td>
<td>C36, L9</td>
</tr>
<tr>
<td>S.W.</td>
<td>6·7 Mc/s.</td>
<td>M.W. pad marker</td>
<td>L19, L12</td>
</tr>
<tr>
<td></td>
<td>15·8 Mc/s.</td>
<td>M.W. trim marker</td>
<td>C30, C25</td>
</tr>
</tbody>
</table>

Notes: Adjust L10 by sliding ring along ferrite rod. Adjust L9 by sliding former along ferrite rod.

Alignment (F.M. I.F.): Use a signal generator providing Band II coverage, also 10·7 Mc/s. A.M. (30 per cent. modulated) and 10·7 Mc/s. F.M. signals (25 kc/s. deviation) at an impedance of 75 ohms. Switch to V.H.F., and allow the receiver and test equipment to warm up for about 10 min.; set volume control 90 deg. back from maximum with treble and bass controls set to the midway position. Inject 10·7 Mc/s. F.M. signal between tag 7 and chassis, then adjust L31, L32, L27 and L23 for maximum output.

Note: Tune L31 and L32 to outer peak, the cores should be protruding from top of coil can.

Alignment (A.M. Rejection): (a) Switch signal generator to 10·7
ULTRA

Mc/s. A.M. and tune L32 for minimum output (this should be a sharply
defined dip in output). (b) Switch signal generator to 10·7 Mc/s. F.M. and
check that F.M. output has been retained. If maximum A.M. rejection
does not coincide with maximum F.M. output, L32 should be tuned for
maximum rejection at the expense of a slight reduction in F.M. output.

Reset signal generator to 100 µV. F.M. output and recheck operations 1, 2
and 3 using volume control to maintain the output level at 500 mW.

Alignment (F.M. R.F.): Check that the cursor coincides with the “zero”
marker on the scale diffuser when the gang is fully closed. Tune receiver to
F.M. 94 Mc/s. marker on scale diffuser. Inject 94 Mc/s. F.M. signal into
F.M. aerial socket (SKT1) and adjust L5, L3 and L6 for maximum output.
Repeat as necessary for correct calibration.

A.F. Circuit Description: VT9 and VT10 form conventional audio
amplifying stages incorporating treble and bass control circuits. VT11 is an
audio driver stage with a transistor (connected as a stabilising diode) series
connected, in its collector lead and feeding into the complementary output
stage which uses p-n-p and n-p-n transistors (VT12 and VT13) respectively.
The left-hand channel, comprising VT14-18 and stabilising diode W6,
operates in a similar manner.

R44 is a pre-set control which balances the left-hand and right-hand
outputs from the preamplifier and, normally, will require adjustment only
if the pickup cartridge is replaced.

VT7-10, VT14 and VT15 are silicon planar transistors. Replacements
should be obtained direct from the usual suppliers.

A.F. Check: Connect a 15-ohm impedance output meter in place of each
loudspeaker. Alternatively, examine output waveform on an oscilloscope
connected between tag 29 (or tag 26 for L.H. channel) and chassis. Switch
to gram and turn both treble and bass controls fully clockwise, then connect
audio oscillator between tags 22 and 18. Inject a 15-20 mV. 800 c/s. signal
and note output: for a correctly functioning amplifier this should be clean,
unclipped and approximately 2 watts. Transfer input to tags 17 and 18 and
similarly check other amplifier.

Tone Control Check: With test conditions as for the audio amplifier
check, volume control at maximum and tone controls set to the midway
position, reduce input of 800 c/s. signal to produce 200 mW. output: this
will require an input of approximately 5 mV. Back off volume control
20 dB, i.e. increase input 20 dB and adjust volume control to reduce output
to original level. Inject an 80 c/s. audio signal and turn bass control from
minimum to maximum: this should produce a variation of 12 dB in output
level. Inject an 8 kc/s. audio signal and turn treble control from minimum
to maximum: this should produce a variation of 18 dB in output level.

Chassis Removal: Pull off rotary control knobs. Remove back cover.
Release mains lead clamp. Detach mains transformer, pickup and speaker
connections from chassis. Pull outward only when removing speaker socket
connection from printed board. Remove 4BA nut, washer and SP washer
from stud passing through chassis fixing lug located centrally at rear of
RADIO SERVICING

(H265a) CIRCUIT DIAGRAM—MODEL 6322 (PART)

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ULTRA

(H265b) Circuit Diagram—Model 6322 (Part)

VOLTAGE

MEASURED WITH 6475 VOLTAGE INPUT
TB 538 CONTACT 4 OR HV
ZERO SIGNAL 6441
100 µV
1 mV

H265b

68–69
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ULTRA

chassis. Now pull chassis clear of front locating studs and take it out through rear of cabinet. Take care to avoid scraping scale with control spindles.

**Record Changer Removal:** Take out five screws and unplug F.M. and A.M. leads to release back cover. Unplug pickup and mains transformer connections from radio chassis, then remove two 4BA nuts and washers securing mains transformer to cabinet shelf. With changer transit screws fully clockwise, pivot clips on lower end of transit screws, then lift changer and mains transformer clear.

**Record Changer:** Garrard 3000 L.M. with Sonotone 9TAHC cartridge and diamond L.P. stylus.

**Circuit Diagram Notes:** Voltages shown in rectangles were taken relative to positive chassis line (except where otherwise indicated), with an Avometer 8, and a mains input of 245 volts. D.C. resistances are shown against inductors where these are 1 ohm or greater. Ringed figures indicate printed board tag connections.

**Note (Component Locations):** In a few receivers contacts 4, 5 and 6 of switch S2A are used instead of contacts 1, 2 and 3 of switch S2B. Also, in these receivers the value of C5 and C14 is 15 pF.

![Circuit Diagram](image)

(H267) Drive Cord—Model 6322

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ULTRA

**Model 6324**

**General Description:** Stereogram similar in most respects to the Ultra Model 6322 also described in this volume. This model features eighteen transistors and four diodes in a mains powered cool chassis. The power output, loudspeakers, aerials, sockets, drive cord, wavebands and mains voltage range identical to Model 6322.

**Record Changer:** Balfour Princess with Sonotone 19-T1 cartridge, or, B.S.R. UA15SS with Sonotone 20-T1 cartridge.

**Servicing:** Alignment, A.F. circuit description and check, tone control check, circuit diagram notes and component locations are as Model 6322.

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(H268b) Circuit Diagram—Model 6324 (Part)

ULTRA

1st FM-AM IF AMP AM MIXER AF11B

2nd FM-AM IF AMP AF11B

AM DETECTOR OA10

FM RATIO DETECTOR 2X0A90

VOLTAGE V
PLEASHER WITH 725 AM INPUT
TO 510 CONTACT C 0-50 M8
220V ➔90V 100mA 100V 0-30V
1W 0-25W

TO GRAM MOTOR

TOTAL CURRENT
000 MAV AM 10mA

SUPPLY RECTIFIER

2 X 12V 150IJ

PU PRE-AMPLIFIER

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(H268c) Circuit Diagram—Model 6324 (Continued)
**ULTRA Model 6330**

**General Description:** This model is similar to the Marconiphone Model 4322 described in this volume.

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**UNITRA Figaro Special**

**General Description:** A.M. radio receiver with an apparent output power of 1 VA. A.C. mains 220/240 volts 50 c/s.


**Alignment:** Always begin with medium wave.

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(H145) Drive Cord—Figaro Special

IFT-1  IFT-2

1-st and 2-nd IF Transformer

Tr2

Louder Speaker Transformer

Tr1

Auto Transformer

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UNITRA

(H147a) Circuit Diagram—Figaro Special (Part)

(H148) Component Locations—Figaro Special
(H147b) CIRCUIT DIAGRAM—FIGARO SPECIAL (CONTINUED)

**Tuning of:**  | **Wave switch** | **Dial indicator** | **H.F. signal on aerial jack by 100 pF.** | **Measuring frequency** | **Tune**
---|---|---|---|---|---
I.F.-transformers I.F.-eliminator | M.W. | 550 m. | 465 kc/s. | | L6 L7 L6 L5 (max. output) L1 (minimum output) L4 L10 C7 C18 L3 L5 L9 L3 L2 Maximum output C6 C3
Long waves | L.W. | 175 kc/s. | 175 kc/s. 600 kc/s. 1400 kc/s. | 600 kc/s. 1400 kc/s. | L4 L10 C7 C18
Medium waves | M.W. | 600 kc/s. | 600 kc/s. | 600 kc/s. 1400 kc/s. | L3 L5 L9 L3 L2 Maximum output C6 C3
Short waves | S.W. | 6 Mc/s. | 6 Mc/s. 11.8 Mc/s. | 6 Mc/s. 11.8 Mc/s. | L4 L10 C7 C18

**WORLD RADIO**

**Model 125X**

**General Description:** This model is electrically similar to Radiomobile Model 70X, information for which is given elsewhere in this volume.

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ACKNOWLEDGEMENTS

A.E.G. (Great Britain) Ltd.
Alba (Radio and Television) Ltd.
B. Adler and Sons (Radio) Ltd.
British Radio Corporation Ltd.
Combined Electronic Services Ltd.
Denham and Morley Ltd.
Dynatron Radio Ltd.
Grundig (Great Britain) Ltd.
Highgate Acoustics.
Monogram Electric Company.
Radiomobile Ltd.
Robuk Electrical Industries Ltd.
Sanyo Service and Sales.
Sharp Sales and Service.
Transervice Ltd.
Van Der Molen Ltd.
General Description: Transistorised tape recorder, capstan drive, two-speed, dual track. Power source, 6 volt battery or 117 volt 50/60 c/s. A.C. mains. Speaker, elliptical 8 ohms. Power output 800 mW. max.
AIWA

Power source for TP-730H, 110-125 volt 50/60 c/s. and 220-240 volt 50/60 c/s.

Dismantling: To remove back lid: Take out four setscrews and pull A.C. input jack down and out. Remove two setscrews securing selector switch—TP-730H only. To remove chassis assembly: Remove five setscrews and one bind screw. Remove two setscrews from switch holder,
(H16) COMPONENT LOCATIONS—TP-730, TP-730S AND TP-730H
AIWA

and one setscrew from volume holder. Unsolder lead wires from battery terminal plate. Turn over case and remove four jacks AUX. EXT. MIC. and REMOTE.

(H15) ADJUSTABLE PARTS—TP-730, TP-730S AND TP-730H

AIWA

Model TP-1004

General Description: Portable stereo cassette tape recorder, capstan drive, four track. Power source, 6-volt battery, interchangeable A.C. 110–220 volts 50 c/s.

Dismantling: To remove back lid: Take out five setscrews and move A.C. jack out of groove. To take out chassis assembly: Remove five screws securing chassis assembly and stud securing back lid. Remove one setscrew in side of case. Pull off four control knobs. Remove nuts on headphone and speaker jacks.

Cleaning: When surface of Recording/Playback head slit is dirty, contact between tape and the head slit becomes improper, resulting in insufficient output. Failure to erase may also occur.

Wipe the slit surface clean, using a soft piece of cloth moistened with alcohol or carbon tetrachloride. The slit is so narrow that ample care should be taken in cleaning.
(H18a) COMPONENT LOCATIONS—TP-1004 (PART)
TAPE RECORDER SERVICING

VOLUME CONTROL

TONE CONTROL

RIGHT CHANNEL AMPLIFIER.

(H19a) CIRCUIT DIAGRAM—TP-1004 (PART)

434
H19b) Circuit Diagram—TP-1004 (Continued)

435
General Description: Four-track stereo (transistorised) tape recorder. Power source (1) 6 volt battery (2) A.C. plug-in 110–125 volts 50/60 c/s. (3) A.C. plug-in 220–240 volts 50/60 c/s.
AIWA

**Dismantling:** Similar to that given for model TP-730 described in this volume, but, in removing back lid note that the nut securing the **RIGHT** speaker must be removed.

*Note:* The "adjustable parts" diagram given for the TP-730, also applies to the TP-1014.

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(H20b) **CIRCUIT DIAGRAM—TP-1014EH** (CONTINUED)

437
(H22) COMPONENT LOCATIONS—TP-1014EH AND TP-1014H
AIWA

(Circuit Diagram—TP-1014H (Part)
ALBA

Model R19

**General Description:** Eight-transistor portable tape recorder. Power output 450 mW. undistorted, 800 mW. maximum. A.C. record bias and D.C. erase bias. Frequency response 100–6000 c/s. at 3\(\frac{3}{8}\) in./sec. and 100–3000 c/s. at 1\(\frac{1}{2}\) in./sec.

**Warning:** When installing or adjusting Head angle all tools used must be non magnetic, otherwise parts located near the tape may become magnetised, causing static.
NOTE: C.C.T. SHOWN IN PLAY POSITION.

S1 - S6 RECORDING SWITCH
S7 SWITCH ON AT RECORD AND PLAY
S8 SWITCH ON ATREWIND AND FAST FORWARD
S9 POWER SWITCH "SWITCH OFF AT STOP"

(F85a) CIRCUIT DIAGRAM—MODEL R19 (PART)
TAPE RECORDER SERVICING

F85b

PREFIX S ON R5 IS 5⅞.
UNMARKED R5 10Ω.
VOLTAGES TAKEN WITH A.V.O. 6, RELATIVE TO BATT.+
NO SIGNAL INPUT. 240V MAINS.
ON DUAL VOLTAGE FIGURES
UPPER IS PLAYBACK, LOWER IS RECORD.
ADJUST VR3 FOR 96MV ACROSS R26.
ADJUST VR4 FOR 4V ACROSS MOTOR.

(F85b) CIRCUIT DIAGRAM—MODEL R19 (CONTINUED)

442
**DYNATRON**

**Model STRi**

**General Description:** A fully transistorised, three speed (7\(\frac{1}{2}\), 3\(\frac{3}{4}\), 1 in./sec.), four-track, stereo tape recorder with facilities for transferring recordings between tracks 1 and 3. Only the right-hand channel is shown. The left-hand channel uses an identical circuit. For use on 200–240-volt A.C. mains. The Modified Output Stage and Voltage Data is shown on the section of the Circuit Diagram 7c.

**Dismantling**

**To Remove Head Cover:** 1. Slide off the speed selector knob (remove lock screw if fitted in end of knob). 2. Remove the two fixing screws at the top of the head cover. 3. Take off the cover. Follow reverse sequence when assembling.

**To Remove Main Cover:** 1. Remove head cover as above. 2. Remove the volume and selector knobs. 3. Remove five counter-sunk screws in the cover. 4. Remove the two smaller cheese-head screws in the cover. 5. Take off the main cover. Follow reverse sequence when assembling taking care that the main cover is not held off by displaced wires etc., or tape reels may foul cover.

(W10) (Above) Component Lay-out—Record/Replay Amplifiers—Model STRi

(W12) (Left) Component Lay-out—Oscillator—Model STRi

443
TAPE RECORDER SERVICING

To Remove Complete Machine from Case: 1. Remove covers as above. 2. Locate and remove four cheese-head 4BA screws securing deck plate to case. One will be found at each rear corner of deck plate, another adjacent to the counter and the fourth is reached through an aperture in the meter mounting plate. 3. Lift complete machine from case and, if necessary, disconnect loudspeaker leads. When reassembling take care not to trap any wiring associated with selector switch.

To Remove Amplifier Print Panels: 1. Remove instrument from case. 2. Temporarily remove counter drive belt. 3. Loosen socket head set screw securing speed change lever to equalisation switch shaft and lift off bush from shaft. 4. Carefully withdraw completely the equalisation switch shaft. 5. Unsolder two link wires from top print panel and connector strip. 6. Remove tie strap from amplifier panel support plates. 7. Carefully ease off the connector strip from the top print panel and then withdraw the panel from the support plate guides in a direction parallel to the main deck plate. 8. Unsolder link wires on lower print panel as detailed above and withdraw in similar fashion. It is important that the rotors of the equalisation switch wafers are not moved or alignment difficulty will appear on reassembly. Also preserve and replace any insulating material fitted to prevent frame of Ti contacting support plate.

Lubrication: All main bearings are of the oil retaining type and rarely need lubricating. If it does become necessary a SPOT of oil can be applied to bearings of motor, capstan, pressure roller, intermediate drive wheel, reel hubs and drive belt pulley bearings. Use only a fine grade oil and at all costs avoid excessive use of the oil can. Any surplus oil should be removed with a clean rag. As a general rule, do not oil unless really necessary.

(W11) COMPONENT LAY-OUT—POWER AND O/P STAGES—MODEL STR1

444
(W7a) Circuit Diagram—Model STR1 (Part)

445
TAPE RECORDER SERVICING

(W7b) (Below) CIRCUIT DIAGRAM—MODEL STRi (PART)

(W7c) (Right) CIRCUIT DIAGRAM—MODEL STRi (CONTINUED)
General Description: Two-speed, two-track battery/mains tape recorder with 800 mW. output. Heads; standard half-track, one erase and one record/play. Speeds; 3:75 in./sec. and 1:875 in./sec. Counter, three digits press-button reset. Moving coil meter for record level and battery
indicator. Input Sockets; Microphone (low-level) and Radio (high-level).
High-level monitor output socket (8 ohms). Battery, six 1.5-volt cells (HP2 or equivalent). A.C. mains 220–240-volt 50 Hz.

**Battery Check:** The condition of the batteries may be checked when the Battery/Mains switch is set to Battery. Depress the PLAY, FWD orREW key. If the batteries are good the needle of the Indicator will move into the

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(H239b) Circuit Diagram—Model 3234 (Continued)
blue area, but the needle will remain in the red area if the batteries are weak.

**Automatic Level Control (ALC):** This facility is suitable for speech only. With the ALC switch on, the Record Level (Volume) control and meter are inoperative.

**Speed Changing:** Pull off head housing. Rotate knurled cap (on top of capstan spindle) clockwise to remove sleeve. Fit sleeve on to speed compensation switch spindle adjacent to left-hand tape guide. Turn cap anti-clockwise to secure. This retains sleeve and operates speed compensation circuit.

**Dismantling (Tape Deck and Printed Board):** Remove battery compartment cover and extract batteries. Remove four screws (from underside of case) and withdraw deck and amplifier assembly. Slacken screw to release printed board retaining bracket, and hinge out printed board. When returning printed board to normal position, ensure that the slide switch linkage is re-engaged.

**Dismantling (Top Cover):** Unscrew (clockwise) knurled screw and remove pinch wheel. Remove six screws from underside of deck to release complete top cover assembly—the screws are colour stained for easy identification.

**Cleaning and Lubrication:** Petrol or carbon-tetrachloride should be avoided. A soft cloth (dampened with methylated spirits) should be used to clean the drive surfaces and head faces. Pressure pad and clutch pad

(H234) Brake Mechanism

45°
surfaces should be kept clean and fluffy. Only the slightest amount of oil should be applied to the bearing surfaces, and care must be taken to ensure that the oil does not reach the drive surfaces.

**Brake Mechanism:** See diagram H234. Adjust tension of spring (1) so that the Operating Plate is in close contact with the key levers. Check for 1–2 mm. clearance between operating plate and brake shoe lever also between brake shoe lever and link lever. Check condition of take-up spool brake shoe material and renew if necessary. Increase tension of spring (2) if braking is insufficient on supply spool.

**Pinch Wheel:** See diagram H235. Adjust effective length of actuating rod for minimum clearance of 1 mm. at point shown with recorder in the 1½ in./sec. mode (i.e. capstan sleeve removed and Play key depressed). Pressure of pinch wheel against capstan set by spring (3) with capstan sleeve removed should be 350 ± 50 grams.

**Back Tension:** See diagram H236. A lightly loaded brake pad provides the necessary back tension by retarding the supply spool carrier during record, play or forward wind. The correct pressure set by spring (4) of the brake shoe against the spool carrier base is 5–7 grams.

**Take-Up and Forward Wind:** See diagram H237. The drive to the take-up spool carrier is transmitted from the spool carrier drive pulley through a felt clutch ring fitted under the spool carrier. A spring plate and coil
spring mounted under the drive pulley presses the pulley upwards to maintain sufficient drive contact with the spool carrier. This pressure is increased to provide extra torque on forward wind by a sliding plate which raises the spring plate.

In the event of poor take-up or insufficient torque on forward wind, check for oil-stained clutch washer, weak pressure of idler against drive pulley, or insufficient upwards thrust under drive pulley. If the upwards thrust is insufficient, bend the sliding plate slightly to raise the spring plate.

**Head Adjustment:** See diagram H238. Provision is made on the head mountings for both vertical (height) and horizontal (azimuth) adjustment. For optimum results use a pre-recorded standard tape with 5 KHz signal and adjust the play/record head for maximum reading on an audio output meter. Adjust the erase head for optimum erasure of a high-level recording.

**Record Level Meter Calibration:** With the record and play keys depressed and the ALC switch at OFF set the volume control to maximum. Connect a 1 KHz signal from an audio generator via an attenuator to the microphone terminals. Set the audio generator for 1 volt output and adjust the attenuator for −71 db signal at microphone terminals (approximately 300 µV.). Adjust R40 so that the meter needle registers at the junction of the blue and red sections of the scale.

**Bias Level Adjustment:** Connect a valve millivolt-meter across R4 and with the machine in the Record mode adjust R13 for a reading of 7 mV.

**Demagnetisation:** The normal precautions and procedure apply.

**Circuit Diagram Notes:** Figures in rectangles represent D.C. voltages measured with respect to positive chassis line. They were taken with an Avometer 8 during A.C. mains operation. Inductors have the D.C. resistance of their windings given where they exceed 1 ohm.
FERGUSON

Model 3216

General Description: This tape recorder is similar to the Ferguson Model 3214 described in the 1967–68 volume.

FERGUSON

Model 3230

General Description: This tape recorder is similar to the Ferguson Model 3214 described in the 1967–68 volume.
GRUNDIG Models TK120, TK125, TK140, TK145

General Description: The mechanical construction of this series of mains-operated tape recorders is almost identical. Model TK120 is a twin-track machine. Model TK140 is a four-track version of the TK120. Model TK125 is a twin-track machine. Model TK145 is a four-track version of the TK125.

Models TK125, TK140 and TK145 incorporate a digital position indicator and "end-of-tape" stop mechanism.
Dismantling: Most components are accessible after removal of the top deck and the base. The top deck is held by five screws. Before this can be finally removed the selector switch knob must be pulled off. The magic eye is clipped to the top deck.

Note: Never remove the four sealed screws holding the sound channel assembly mounting plate.

The base is held by four screws and the mains lead is taken through an opening in the storage compartment. To obtain access to the printed circuit,
first remove the top deck and base. Remove the lever bracket by tilting towards the centre of the machine until one lug is free. Now move the bracket towards the printed circuit panel to free the second lug and then unhook the return spring. Free both sides of the printed circuit from its mounting studs and lift out. Reassemble in reverse order.
GRUNDIG

To change the two drive belts, remove the lower flywheel bearing, clean the lower flywheel spindle and pulley with a lint-free cloth and lift both drive belts through the chassis cut-out over the spindle. Remove the belts through the top of the machine. Engage the flywheel bearing in the chassis guide holes when reassembling.

(W113b) CIRCUIT DIAGRAM—MODEL TK145 (CONTINUED)
TAPE RECORDER SERVICING

Before completing the reassembly, switch on the recorder briefly to reposition the magic eye. The recording button, control knobs and connecting socket are re-positioned automatically by the refitting of the top deck.

**H.F. Bias Setting:** To measure H.F. signals, use a capacitive potential divider, having a ratio of 1000:1, so that the voltage levels are read on the millivolt range of the meter (Grundig type VST24). Variable controls and trimmers should be set to their mid-position before adjustment. The H.F. bias frequency is 52-58 kHz. Next check the erase and record current as follows:

**TK120:** Adjust R31 for 41 volts measured across erase head and C20 to provide 82 volts across record head.

**TK125:** Adjust C2 for 82 volts across record head. The reading across the erase head should then be 33-36 volts.

**TK140:** Adjust R31 for not less than 9 volts across either erase head system. Then adjust C20 for a mean voltage level depending upon the colour code of the record head: Red-red = 53 volts; White-white = 63 volts; Black-black = 73 volts; Red-white = 58 volts; White-black = 68 volts.

**TK145:** Adjust C2 for a mean reading depending upon the colour code of the record head: Red-red = 53 volts; White-white = 63 volts; Black-black = 73 volts; Red-white = 58 volts; Red-black = 68 volts. The reading across the erase heads must then be between 10-12 volts.

Trick recording must not change the H.F. bias reading by more than +15 per cent. (TK125-TK145 only).

Where a valve volt-meter is not available approximate readings can be obtained across the heads with an Avo. 8.

<table>
<thead>
<tr>
<th>Model</th>
<th>A.C. range volts</th>
<th>Record bias volts</th>
<th>Erase volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>TK120</td>
<td>100</td>
<td>60</td>
<td>55</td>
</tr>
<tr>
<td>TK125</td>
<td>100</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>TK140</td>
<td>25</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>TK145</td>
<td>25</td>
<td>20</td>
<td>6</td>
</tr>
</tbody>
</table>
**General Description:** Ten-transistor, two-track, magazine-loading tape recorder. Frequency response 50–8000 c/s, at –6 dB. Power output 1·8 watts. Input socket for radio and microphone about 0·3 mV., 10 kΩ impedance. Output jack for radio 700 mV., 700 ohms, external loudspeaker 5 ohms or an earphone 5 ohms. Power supply 110 volts or 220 volts, 50 or 60 c/s., consumption 6 volts/amp. Battery supply 5 mono cells of 1·5 volts.

**The Quiescent D.C. Current of the Output Stage:** Adjust the D.C. current of the output stage with the potentiometer R59 to be 8 mA. This is equivalent to 8 mV. over R38/1 ohm. Hereupon, the output stage will be loaded at the output transformer with 4·7 ohms and then be checked with an oscilloscope at full load equivalent to 2·9 volts on 4·7 ohms at 1 kc/s. An overlapping fault in the output sine wave of the output transistors can be corrected by readjusting the D.C. initial current. The quiescent current for correctly paired output transistors may be 6 mA. min. and 10 mA. max.

<table>
<thead>
<tr>
<th>Measuring point</th>
<th>D.C. voltage to earth</th>
<th>Playback level at 1 kc/s. applied on 1 ohm in the cold wire of the head</th>
<th>Record level at 1 kc/s. applied on 5 kΩ series resistance in the microphone jack, R55 opened</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>560 mV.</td>
<td>0·3 mV.</td>
<td>0·2 mV.</td>
</tr>
<tr>
<td>C1</td>
<td>1·6 volts</td>
<td>12 mV.</td>
<td>8 mV.</td>
</tr>
<tr>
<td>B2</td>
<td>765 mV.</td>
<td>12 mV.</td>
<td>8 mV.</td>
</tr>
<tr>
<td>E2</td>
<td>113 mV.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C2</td>
<td>1·7 volts</td>
<td>7·5 mV.</td>
<td>8·1 mV.</td>
</tr>
<tr>
<td>V2</td>
<td>4·2 volts</td>
<td>520 mV.</td>
<td>530 mV.</td>
</tr>
<tr>
<td>E3</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C4</td>
<td>7·3 volts</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>E4</td>
<td>1·1 volts</td>
<td>520 mV.</td>
<td>530 mV.</td>
</tr>
<tr>
<td>B5</td>
<td>1·5 volts</td>
<td>57 mV.</td>
<td>57 mV.</td>
</tr>
<tr>
<td>E5</td>
<td>1·3 volts</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>C5</td>
<td>6 volts</td>
<td>460 mV.</td>
<td>460 mV.</td>
</tr>
<tr>
<td>B6</td>
<td>×150 mV.</td>
<td>190 mV.</td>
<td>190 mV.</td>
</tr>
<tr>
<td>B7</td>
<td>×150 mV.</td>
<td>190 mV.</td>
<td>100 mV.</td>
</tr>
<tr>
<td>C6</td>
<td>×7·5 volts</td>
<td>5·2 volts</td>
<td>5·2 mV.</td>
</tr>
<tr>
<td>C7</td>
<td>×7·5 volts</td>
<td>5·2 volts</td>
<td>—</td>
</tr>
<tr>
<td>E6/7</td>
<td>×10 mV.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>V1(E10)</td>
<td>adjusted with R59</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**Motor Noise:** The distortion of the motor is to be measured at the radio output socket after laying on an empty magazine. Use a valve volt-meter able to measure dB and peak values with electric ear characteristic. Set
the valve voltmeter for measuring peak values and in the slow acting position. The noise level of the motor with this measurement may not exceed 10 mV.

**Drive Noise:** At normal playback operation, the drive noise of the set, measured when driven from a battery, is ≤ 40 phons. The measurement is taken at 10 cm. over the record/play head.
(F102b) CIRCUIT DIAGRAM—MODEL OPTACORD 450 (CONTINUED)
MARCONIPHONE Model 4216

General Description: Tape recorder employing Tape Deck Thorn type DB42. Output power 3 watts. Digital type position indicator. Input Sockets; Microphone (1.5 mV. into 10M), Radio (1.5 volts into 68k), and Pickup (75 mV. into 3.3M). Output Sockets; Radio (500 mV. at 22k), and External speaker (3 watts at 3 ohms). Power supply 200–250 volts, A.C. 50 c/s.

Note: 1. When the output socket for the external speaker is used, the internal speaker is automatically muted. 2. See page 383 of 1967–68 volume for Thorn type DB42 tape deck.

Heater Balance: The humdinger (R26) has been set during manufacture and should not be altered unless a valve change is made. If readjustment becomes necessary the procedure given below must be carefully followed. While setting the adjustment, the chassis must be electrostatically screened particularly around V1.

Take off the tape spools and set the instrument to “Record” with the tone control set to minimum and record level control at maximum. Connect a sensitive valve volt-meter between the junction of C10/C11 and chassis. Place a shorting lead across R20 to prevent the oscillator functioning and plug in a screened dummy microphone connector with a 1000-pF. capacitor strapped across pins 4 and 5. Allow the machine to warm up for 10 minutes, then adjust R26 for minimum reading on the valve volt-meter (approximately 50 mV.).
**Demagnetisation:** It is important that there is no residual magnetism in the heads or the capstan spindle. This condition, which may arise if magnetised objects are brought near these components or if an ohmmeter is connected to the head windings, leads to an increase in background noise on play. Suitable instruments for providing a demagnetising field are available from a number of manufacturers.

**Head Adjustment:** Provision is made on the head mounting for horizontal adjustment (azimuth) of the record/play head. Adjustment becomes necessary only when the manufacturer’s setting has been disturbed. The head can be “rocked” on its mounting by making adjustments to the two mounting screws, one of which is fitted with a compression spring. To readjust, play back a standard azimuth tape with an output meter connected. Adjust the record/play head for maximum output using the volume control to keep the output level as low as possible. Avoid overtightening the mounting screws as this may cause distortion of the head mounting.

**Dismantling (Top Cover):** To gain access to the tape deck for routine cleaning, pull off the control knobs and moulded head cover, then remove seven screws securing the moulded top cover.

**Dismantling (Chassis):** Having removed control knobs and covers, remove two screws from each side of the mechanism top plate. Remove socket cover and then two screws securing storage compartment backing to the main chassis. The complete assembly (less loudspeaker) can now be lifted from cabinet. To disconnect loudspeaker pull the connecting leads from the speaker tags.

**Dismantling (Printed Circuit Board):** To obtain access to components located behind S1a–f, the printed board can be released from its mounting. Take out two small self-tapping screws securing the switch lever bracket to the main chassis and release a spring clip fitting into a slot at the other end of the printed board. The assembly can now be eased away from the main chassis.

**Component Locations:** V3, R24 SKT1, S2 and S6/7 are located on the tape deck top plate. Accurate positioning of the switch lever bracket on the printed board is necessary for correct switch operation. Where the bracket has been removed, the following procedure should be followed for refitting. With printed board in position on the base plate and screws “A” and “B” slackened, adjust the printed board relative to the switch lever so that the switch lever arm just touches the baseplate; the screw holes in the printed board are oversize to allow for adjustment. Finally, tighten screws “A” and “B”.

### MARCONIPHONE Model 4212

**General Description:** This tape recorder is similar to the Marconiphone Model 4210 described in the 1967–68 volume.
General Description: Capstan cartridge tape recorder for portable operation. VU meter for record level set, and remote control jack for an external footswitch. Power supply, five 1.5-volt cells.

Circuit Diagram Notes: Si shown in record position. Unless otherwise noted, capacitors more than 1 are in pF and capacitors less than 1 are in μF. All resistors are 1/8 watt.

Voltages: All voltages (given with respect to ground) measured with 20k/V. meter. Voltages marked with an asterisk taken in Record position. Voltages not marked with an asterisk taken in Play position.
Lubrication: The mechanical parts are factory coated with a thin coat of light grease and should not necessarily require further lubrication. If a light grease is applied, use caution not to get any grease on the record and erase heads, other head unit components, tape reel compartments or selector switch.

Dismantling: To open the cabinet, remove screws from the cabinet back. To remove the component circuit board, remove the two screws holding it to the transport. To remove cabinet front, remove two side screws and two screws inside located at speaker end of transport.
**General Description:** Solid state four transistor battery portable tape recorder. Power output 700 mW., D.C. bias and erase. Frequency response 150–6000 c/s. at 3/4 in./sec. and 150–4000 c/s. at 1 1/4 in./sec. Monitor output impedance 8 ohms. Erase current should be within the range 5.5–11.5 mA.

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**NOTE:**

1. S1–1→S1–6..Record/Playback Selector Switch (Shown in Playback position)
2. S2 Amplifier Power Switch (ON in Record and playback modes only)
3. S3 Motor Power Switch (ON in FF. and Rewind modes only)
4. S4 Power Switch (OFF in Stop mode only)
5. Resistors are 1/4 Watt unless specified otherwise. K = 1,000,000, M = 1,000,000,000.
6. Capacitors are microfarad (µF) unless specified otherwise. PF = Micro-microfarads.
7. Values indicated in [] are DC to chassis ground with no signal applied.
8. The upper values should be measured during playback and the lower values during recording.

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**(F58a) Circuit Diagram—Model RQ-113S (Part)**

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Maintenance: The tape recorder does not generally require oiling, but on repair just one or two drops of oil may be applied to the capstan, pressure roller and rewind pulley bearings, and also the reel table spindles and the guide pulleys. All traces of oil should be removed afterwards from surfaces of capstan and pressure roller, or the tape may slip and cause damage. The motor bearings require no oiling during the lifetime of the motor and should bearings or armature shaft show excessive wear, replace motor.
Cleaning: A soft cloth moistened with alcohol may be used to wipe dirt from the record/playback and erase heads, the surface of the pressure roller and the surface coming into contact with the belt.

Continuity: Magnetisation of the heads may result if continuity of heads is measured with an ohmmeter, and if such check is necessary, heads should be demagnetised afterwards. The magnetised head can be neutralised by use of a standard demagnetisation tool, the tip of which should not be used through the pad, but should be thin enough to fit between pressure pad and head. A piece of cellulose tape on the tip prevents metal to metal contact. After demagnetisation, slowly remove tool from vicinity before turning off current.

Pressure Roller Tension: 1. Load the tape as in the case of playback, and set the tape recorder in record or playback mode.
   2. Hang a loop of twine on the pressure roller shaft and hook the spring scale on the other end of the loop.
   3. Pull the spring scale in the direction of a line connecting the centres of the capstan and pressure roller shaft. Slowly increase the pull and read the scale at a point where the tape stops moving.
   4. The standard pressure of the Pressure Roller Shaft should be:

   $\frac{1}{2}$ in./sec. . . . between 7.8 and 12.0 ozs. (220 and 340 g.)
   $\frac{3}{4}$ in./sec. . . . between 11.2 and 15.6 ozs. (320 and 440 g.)

Adjustment: Adjust the pressure roller spring to the standard pressure.

Winding Torque for Playback: 1. Make a loop at the end of a fully loaded 3-inch reel of tape, fasten the looped end with splicing tape, and put the reel on the takeup reel table.
   2. Hook the tension gauge in the loop and pull out about 6 inches of the tape end.
   3. Set the recorder in playback mode, and pull tension gauge in direction of winding, keeping pace with the moving tape until the reading of the tension gauge remains constant, then take the reading. Repeat this several times and take the average to determine the correct torque.
   4. The above test should be made with 3-inch tape reel fully loaded.
   5. The standard torque should be:

   between 0.63 and 1.08 ozs. (between 18 and 30 g.).

Adjustment: Adjust torque with the friction spring on the takeup reel table. If torque is too strong, loosen friction spring, if too weak tighten it. If the friction washer gets oily clean it immediately to prevent slip. If tension of takeup belt is weakened, winding torque drops.
**General Description:** Six transistor battery portable tape recorder. Power output 500 mW. (700 mW. maximum). 30 kc/s. A.C. bias with D.C. erase. Frequency response 120–7000 c/s at 3 in./sec. and 120–4000 c/s at 1 in./sec. Input impedance: microphone 2-7 kΩ; auxiliary 100 kΩ. Extension loudspeaker impedance 8 ohms.

**Adjustments:** Pressure Roller Shaft tension should be 5.6–7.8 ozs. at 1 in./sec. and 5.3–7.4 ozs. at 3 in./sec. Winding torque 0.28–0.42 ozs.

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**NOTE:**
1. S1-1 ~ S1-5 ... Record/Playback Selector Switch (Shown in Playback position).
2. S2 ...... Amplifier Switch (ON in Record and Playback modes only).
3. S3 ...... Power Switch (OFF in Stop mode only).
4. S4 ...... ON in F.F and Rewind mode only.
5. S5 ...... 1 ... Sound Monitor. 2 ... OFF. 3 ... AGC-ON.
6. S6 ...... Recording Switch (ON in Record mode only).
7. R21 and R25 ... Values to be determined by gain characteristic of TR4 and TR5.
8. Resistors are 1/4 watt unless specified otherwise. K=1,000Ω, M=megohms.
9. Capacitors are microfarad (μF) unless specified otherwise. P=picofarads.
10. Values indicated in ( ) are DC to chassis ground with no signal applied.
11. The upper values should be measured during playback and the lower values during recording.

(F56a) CIRCUIT DIAGRAM—MODEL RQ-153S (PART)
Tape pad pressure 0.53–1.1 ozs.

**Record Bias Current:** Place a 100-ohm resistor in the earthy lead of the record/playback head. Using a valve volt-meter check that the voltage across the 100-ohm resistor is 0.065–0.11 volts. If the voltage is not within the above range, correct by adjusting T3. The frequency must be in the range of 25–35 kc/s.

**Erase Current:** Connect a D.C. milliammeter in the earthy lead of the erase head. Erase current should be 5.35–7.5 mA.

**Maintenance and Cleaning:** The procedures for Model RQ-113S (in this volume) apply.
**General Description:** Seven-transistor battery portable tape recorder. Power output 700 mV. Tape speed 1/2 in./sec. Frequency response 120–6000 c/s. Bias and erase frequencies 35 kc/s. Microphone input impedance 2 kΩ. Line output 20 kΩ.

**Adjustments:** Pressure roller: Set the recorder in the Playback position and attach a short length of string on to the frame of the pressure roller assembly. Suspend a spring scale on the other end of the string and pull the spring scale at right angles to the frame. When the pressure roller comes off the capstan the spring scale should be indicating 5.45–6.5 oz. (155–185 g.). To adjust the roller pressure change the position of the roller spring. Record Bias Current: Connect a valve volt-meter between chassis and the earthy side of the record head. Set the recorder in the record mode keeping the record level at zero. The bias voltage indicated by the VVM should be 23–28 mV. This voltage can be obtained by adjusting the variable inductor T3.

**Resistors**

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, 10, 13</td>
<td>Carbon resistor</td>
<td>39 kΩ ± W.</td>
</tr>
<tr>
<td>R2, 8</td>
<td>Carbon resistor</td>
<td>56 kΩ ± W.</td>
</tr>
<tr>
<td>R3, 28</td>
<td>Carbon resistor</td>
<td>10 kΩ ± W.</td>
</tr>
<tr>
<td>R4</td>
<td>Carbon resistor</td>
<td>4.7 kΩ ± W.</td>
</tr>
<tr>
<td>R5</td>
<td>Carbon resistor</td>
<td>2.2 kΩ ± W.</td>
</tr>
<tr>
<td>R6</td>
<td>Carbon resistor</td>
<td>22 kΩ ± W.</td>
</tr>
<tr>
<td>R7</td>
<td>Carbon resistor</td>
<td>15 kΩ ± W.</td>
</tr>
<tr>
<td>R9, 27</td>
<td>Carbon resistor</td>
<td>1.8 kΩ ± W.</td>
</tr>
<tr>
<td>R11, 32</td>
<td>Carbon resistor</td>
<td>1 kΩ ± W.</td>
</tr>
<tr>
<td>R12</td>
<td>Carbon resistor</td>
<td>56 kΩ ± W.</td>
</tr>
<tr>
<td>R14</td>
<td>Carbon resistor</td>
<td>33 kΩ ± W.</td>
</tr>
<tr>
<td>R15, 35</td>
<td>Carbon resistor</td>
<td>82 kΩ ± W.</td>
</tr>
<tr>
<td>R16</td>
<td>Carbon resistor</td>
<td>2.7 kΩ ± W.</td>
</tr>
<tr>
<td>R17, 25</td>
<td>Carbon resistor</td>
<td>68 kΩ ± W.</td>
</tr>
<tr>
<td>R18</td>
<td>Carbon resistor</td>
<td>820 Ω ± W.</td>
</tr>
<tr>
<td>R19</td>
<td>Carbon resistor</td>
<td>470 Ω ± W.</td>
</tr>
<tr>
<td>R20</td>
<td>Carbon resistor</td>
<td>18 kΩ ± W.</td>
</tr>
<tr>
<td>R21</td>
<td>Carbon resistor</td>
<td>2.2 kΩ ± W.</td>
</tr>
<tr>
<td>R23</td>
<td>Carbon resistor</td>
<td>330 Ω ± W.</td>
</tr>
<tr>
<td>R24</td>
<td>Carbon resistor</td>
<td>680 Ω ± W.</td>
</tr>
<tr>
<td>R26</td>
<td>Carbon resistor</td>
<td>1.5 kΩ ± W.</td>
</tr>
<tr>
<td>R29</td>
<td>Carbon resistor</td>
<td>150 Ω ± W.</td>
</tr>
<tr>
<td>R30</td>
<td>Carbon resistor</td>
<td>47 Ω ± W.</td>
</tr>
<tr>
<td>R31</td>
<td>Carbon resistor</td>
<td>10 Ω ± W.</td>
</tr>
<tr>
<td>R33</td>
<td>Carbon resistor</td>
<td>21 kΩ ± W.</td>
</tr>
<tr>
<td>R34</td>
<td>Carbon resistor</td>
<td>4.7 Ω ± W.</td>
</tr>
<tr>
<td>R36</td>
<td>Carbon resistor</td>
<td>270 Ω ± W.</td>
</tr>
</tbody>
</table>

**Variable Resistors**

<table>
<thead>
<tr>
<th>VR1, VR2</th>
<th>Volume control</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>20 kΩ-A</td>
</tr>
</tbody>
</table>

473
Capacitors

Ref. No. | Description
--- | ---
C1, 3, 5, 7, 14, 16, 24 | Electrolytic capacitor 3 μF.
C2, 6, 13, 18 | Electrolytic capacitor 40 μF.
C4, 8, 17 | Electrolytic capacitor 30 μF.
C9 | Polystyrene capacitor 0.001 μF.
C10 | Mylar capacitor 0.039 μF.
C11, 25 | Mylar capacitor 0.1 μF.

NOTE:
1. S1-1~S1-13...Record/Playback Selector Switch (Shown in Playback position)
2. S2 ...............Power Switch (Shown in Playback position)
3. Resistors are 1/4 Watt unless specified otherwise.
   K=1,000Ω M=megohms.
4. Capacitors are microfarad (μF) unless specified otherwise.
   P=picofarads.
5. Values indicated in [ ] are DC to chassis ground with no signal applied.

(F54a) CIRCUIT DIAGRAM—MODEL RQ-3001S (PART)
NATIONAL

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>C12</td>
<td>Mylar capacitor</td>
<td>0.047 μF</td>
</tr>
<tr>
<td>C15</td>
<td>Electrolytic capacitor</td>
<td>200 μF</td>
</tr>
<tr>
<td>C19</td>
<td>Polystyrene capacitor</td>
<td>0.0039 μF</td>
</tr>
<tr>
<td>C20</td>
<td>Mylar capacitor</td>
<td>0.012 μF</td>
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<tr>
<td>C21</td>
<td>Polystyrene capacitor</td>
<td>0.0022 μF</td>
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<td>C22</td>
<td>Polystyrene capacitor</td>
<td>820 pF</td>
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<tr>
<td>C23</td>
<td>Mylar capacitor</td>
<td>0.056 μF</td>
</tr>
<tr>
<td>C26</td>
<td>Electrolytic capacitor</td>
<td>500 μF</td>
</tr>
</tbody>
</table>

2SB 345 (Tr5, Tr6) 2 - 2SB 324

(F54b) CIRCUIT DIAGRAM—MODEL RQ-3001S (CONTINUED)

475
RADIONETTE

RADIOMOBILE  Model CTR 101

General Description: This model is electrically similar to World Radio Model TRC1, information for which is given elsewhere in this volume.

RADIONETTE  Battery Eliminator Type E2

General Description: Stabilised battery eliminator with an internal resistance of 0.9 ohms (9 volts at 400 mA.).

Note: see also MULTICORDER (following).

(H27) Circuit Diagram—Type E2

Components: R1 (2.2k), R2 (25k), R3 (3.3k), R4 (3.9k), R5 (10k), C1 (200 μF./10 volts), C2 (1000 μF./12 volts) and C3 (125 μF./16 volts).

Output: Maximum current 400 mA. Voltage 6, 7.5 or 9 volts D.C. Note that R2 is adjusted for an output of 9.8 volts at 20 mA.

RADIONETTE  Multicorder

General Description: Tape recorder employing seven transistors and two diodes. Tape speeds, 1.875 in./sec. and 3.75 in./sec. Total playing time, 12.8 hours, using all four tracks at the lower speed. Speaker 4 ohms.
Tape Recorder Servicing

Power supply, 9-volt battery or mains adaptor. Digital type tape indicator. Bias oscillator, 66·6 kHz (kc/s.).

Note: See previous page for battery eliminator type E2.

Recording Indicator: During recording the instrument indicates between 2 and 3 with peaks reaching 6. During playback and fast rewind the total current consumption is shown on the instrument’s lower dial. During fast forward wind the battery voltage is indicated on the instrument’s upper dial.

Circuit Notes: The circuit diagram applies to models with serial numbers of 5000 and above. Components marked with an asterisk have been subject to changes.

(H26a) Circuit Diagram—Multicorder (Part)

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RADIONETTE

Electrical Adjustments: The oscillator trap L1 should be tuned for a minimum A.C. voltage across C31, track 1. The bias current to the playing head is adjusted by means of C30, it is read as an A.C. voltage (of 10 mV.) across R2. The recording indicator reading is adjusted by means of P5 on fast forward wind, and by means of P4 on fast rewind.

Dismantling: Remove control knobs (setscrews), lift off track lever and pull out top cover. Take out four screws in bottom, remove batteries, unsolder loudspeaker wires and lift out chassis. Loosen screw on motor clip and remove motor. To lift printed board out of locking slots, remove the locking key and then ease the side brackets to free the printed board.

(H26b) CIRCUIT DIAGRAM—MULTICORDER (CONTINUED)
ROBUK

Model 4/44

General Description: Five-valve, mains-operated tape recorder.

Sockets: Extension Loudspeaker, Monitor, Output Microphone and Gram inputs.

Valves: V1 (ECC83), V2 (ECL82), V3 (EZ80), V4 (EL84) and V5 (EM84). Note: WX6 is a germanium diode.

Components:

<table>
<thead>
<tr>
<th>R1</th>
<th>470k</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2</td>
<td>180k</td>
</tr>
<tr>
<td>R3</td>
<td>47k</td>
</tr>
<tr>
<td>R4</td>
<td>220k</td>
</tr>
<tr>
<td>R5</td>
<td>220k</td>
</tr>
<tr>
<td>R6</td>
<td>47k</td>
</tr>
<tr>
<td>R7</td>
<td>180k</td>
</tr>
<tr>
<td>R8</td>
<td>33k</td>
</tr>
<tr>
<td>R9</td>
<td>100k</td>
</tr>
<tr>
<td>R10</td>
<td>47k</td>
</tr>
<tr>
<td>R11</td>
<td>47k</td>
</tr>
<tr>
<td>R12</td>
<td>39k</td>
</tr>
<tr>
<td>R13</td>
<td>100k</td>
</tr>
<tr>
<td>R14</td>
<td>1.5k</td>
</tr>
<tr>
<td>R15</td>
<td>47k</td>
</tr>
<tr>
<td>R16</td>
<td>100k</td>
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<tr>
<td>R17</td>
<td>47k</td>
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<td>R18</td>
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<td>R20</td>
<td>10k</td>
</tr>
<tr>
<td>R21</td>
<td>150k</td>
</tr>
<tr>
<td>R22</td>
<td>820k</td>
</tr>
<tr>
<td>R23</td>
<td>680 ohm 1 Watt</td>
</tr>
<tr>
<td>R24</td>
<td>250 ohm 2 Watt</td>
</tr>
<tr>
<td>R25</td>
<td>10k</td>
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<tr>
<td>R26</td>
<td>100k</td>
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<td>R27</td>
<td>1.5k</td>
</tr>
<tr>
<td>R28</td>
<td>2.3 Meg</td>
</tr>
<tr>
<td>R29</td>
<td>47k</td>
</tr>
<tr>
<td>R30</td>
<td>39k</td>
</tr>
<tr>
<td>R31</td>
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<tr>
<td>R32</td>
<td>100 ohm</td>
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<tr>
<td>R33</td>
<td>100 ohm</td>
</tr>
<tr>
<td>R34</td>
<td>100 ohm</td>
</tr>
<tr>
<td>R35</td>
<td>1.0k W/W</td>
</tr>
</tbody>
</table>

Note: All fixed resistors have a tolerance of 20 per cent. except R2 which is 5 per cent.

C1  8 + 8 + 8 mF. Electrolytic
C2  25 mF. 25 V Electrolytic
C3  0.05 mF. + Earthing tag
C4  0.05 mF.
C5  10,000 pF.
C6  5,000 pF.
C7  2,500 pF.
C8  1,000 pF. or 500 pF.
C9  500 pF.
C10 0.04 mF.
C11 0.01 mF.
C12 50 + 50 mF. 375 V Electrolytic
C13 2,500 pF.
C14 250 pF.
C15 500k Log + Earth mic.
C16 500k + Earth gram.
C17 1 Meg tone
C18 Monitor
C19 Double pole switch

VR1 500k Log + Earth mic.
VR2 500k + Earth gram.
VR3 1 Meg tone
VR4 500k Monitor
S1/S2 Double pole switch

VR1 500k Log + Earth mic.
Robuk Model 5/54

General Description: Three-speed, two- or four-track tape recorder. Five valve push-pull amplifier gives 5-watt output. Equalisation to C.C.I.R. specification. Wow and flutter less than 0.2 per cent. at 7\(\frac{1}{2}\) in./sec. and 0.3 per cent. at 3\(\frac{1}{2}\) in./sec. Frequency response 40–15,000 c/s. ±3 dB at 7\(\frac{1}{2}\) in./sec.

Valves: V1 (ECC83), V2 (ECL82), V3 (ECL82), V4 (EL84) and V5 (EM84).

Diodes: D1 (OA81) and D2 (BY105).

Components:

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>68k</td>
</tr>
<tr>
<td>R2</td>
<td>180k H.S.</td>
</tr>
<tr>
<td>R3</td>
<td>4.7k</td>
</tr>
<tr>
<td>R4</td>
<td>220k</td>
</tr>
<tr>
<td>R5</td>
<td>10k</td>
</tr>
<tr>
<td>R6</td>
<td>220k</td>
</tr>
<tr>
<td>R7</td>
<td>10k</td>
</tr>
<tr>
<td>R8</td>
<td>3.3k</td>
</tr>
<tr>
<td>R9</td>
<td>470k</td>
</tr>
<tr>
<td>R10</td>
<td>270k</td>
</tr>
<tr>
<td>R11</td>
<td>220k</td>
</tr>
<tr>
<td>R12</td>
<td>39k</td>
</tr>
<tr>
<td>R13</td>
<td>100k</td>
</tr>
<tr>
<td>R14</td>
<td>4.7k</td>
</tr>
<tr>
<td>R15</td>
<td>270k</td>
</tr>
<tr>
<td>R16</td>
<td>150k</td>
</tr>
<tr>
<td>R23</td>
<td>12 Meg.</td>
</tr>
<tr>
<td>R25</td>
<td>250 ohm</td>
</tr>
<tr>
<td>R26</td>
<td>560 ohm</td>
</tr>
<tr>
<td>R27</td>
<td>390 ohm</td>
</tr>
<tr>
<td>R28</td>
<td>100k</td>
</tr>
<tr>
<td>R29</td>
<td>1.5k</td>
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<tr>
<td>R30</td>
<td>39k</td>
</tr>
<tr>
<td>R31</td>
<td>3.3M ohm</td>
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<tr>
<td>R32</td>
<td>470k</td>
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<td>R34</td>
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</tr>
<tr>
<td>R35</td>
<td>100 ohm</td>
</tr>
<tr>
<td>R36</td>
<td>1k W.W.</td>
</tr>
<tr>
<td>R37</td>
<td>180k</td>
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<tr>
<td>R38</td>
<td>33k</td>
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<tr>
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<td>10M ohm</td>
</tr>
<tr>
<td>R40</td>
<td>33k</td>
</tr>
<tr>
<td>R41</td>
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<td>R43</td>
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<td>R44</td>
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<td>R45</td>
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</tr>
<tr>
<td>R46</td>
<td>100k</td>
</tr>
<tr>
<td>C1</td>
<td>8 mF. 275V Wkg.</td>
</tr>
<tr>
<td>C2</td>
<td>8 mF. 275V Wkg.</td>
</tr>
<tr>
<td>C3</td>
<td>8 mF. 275V Wkg.</td>
</tr>
<tr>
<td>C4</td>
<td>25 mF. 25V Wkg.</td>
</tr>
<tr>
<td>C5</td>
<td>0.05 350V Wkg.</td>
</tr>
<tr>
<td>C6</td>
<td>0.05 350V Wkg.</td>
</tr>
<tr>
<td>C7</td>
<td>5,000 pF.</td>
</tr>
<tr>
<td>C8</td>
<td>6,800 pF.</td>
</tr>
<tr>
<td>C9</td>
<td>15,000 pF.</td>
</tr>
<tr>
<td>C10</td>
<td>5,000 pF.</td>
</tr>
<tr>
<td>C11</td>
<td>10,000 pF.</td>
</tr>
<tr>
<td>C12</td>
<td>500 pF.</td>
</tr>
<tr>
<td>C13</td>
<td>0.05</td>
</tr>
<tr>
<td>C14</td>
<td>1,000 pF.</td>
</tr>
<tr>
<td>C15</td>
<td>3,300 pF.</td>
</tr>
<tr>
<td>C16</td>
<td>2,000 pF.</td>
</tr>
<tr>
<td>VR1</td>
<td>250k ohm Log</td>
</tr>
<tr>
<td>VR2</td>
<td>250k ohm Log</td>
</tr>
<tr>
<td>VR3</td>
<td>1M ohm Log</td>
</tr>
<tr>
<td>VR4</td>
<td>500k ohm Log (D.P. Switch)</td>
</tr>
<tr>
<td>T1</td>
<td>Mains Tran.</td>
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<tr>
<td>T2</td>
<td>O.P.T.</td>
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<tr>
<td>L1</td>
<td>osc. coil</td>
</tr>
<tr>
<td>L2</td>
<td></td>
</tr>
</tbody>
</table>

482
SANYO Model MR-130

General Description: Two track portable A.C./D.C. tape recorder. Power supply 115/230 volts 50–60 c/s. A.C. or six 1½-volt batteries. Power consumption 8 watts. Tape speeds: $3\frac{3}{4}$ in./sec. or $1\frac{3}{8}$ in./sec. Output power 1 watt (undistorted 800 mW.). Frequency response 100–7000 c/s. at $3\frac{3}{4}$ in./sec. and 100–4000 c/s. at $1\frac{3}{8}$ in./sec. Microphone input 20 kΩ. Extension loudspeaker impedance 8 ohms.

(F17a) Circuit Diagram—Model MR-130 (Part)

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**SANYO**

**Dismantling:** To remove the amplifier and mechanism from the cabinet. Unscrew the pinch roller mounting screw in a counter-clockwise direction and remove. Pull the pinch roller upwards and remove. Pull the head-cover and take it out. Place tape recorder upside down and remove four (+) screws by rotating counter-clockwise. Remove the back lid. Remove all 6 (+) screws coated with red paint by turning them counter-clockwise. The amplifier and mechanism can now be taken out of the cabinet.

**Bias Current Adjustment:** Adjust VR3 so that 7 mV. is measured by a valve volt-meter across R42.

(F17b) Circuit Diagram—Model MR-130 (Continued)
TAPE RECORDER SERVICING

Record/Play Head Azimuth Adjustment: Use a pre-recorded tape (5000 c/s.) and adjust the record/play head for maximum output. Erase head current 14 mA. (5 volts across erase head).

Voltage and Current Chart

<table>
<thead>
<tr>
<th>Point</th>
<th>Playback</th>
<th>Recording</th>
<th>Tester range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr-7 C</td>
<td>(V)</td>
<td>8.0 (V)</td>
<td>25 (V)</td>
</tr>
<tr>
<td>Tr-4 C</td>
<td>7.0 (V)</td>
<td>6.8 (V)</td>
<td>25 (V)</td>
</tr>
<tr>
<td>Tr-3 C</td>
<td>5.4 (V)</td>
<td>6.2 (V)</td>
<td>25 (V)</td>
</tr>
<tr>
<td>Tr-2 C</td>
<td>2.3 (V)</td>
<td>2.4 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-1 C</td>
<td>2.1 (V)</td>
<td>2.3 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-7 E</td>
<td></td>
<td>1.0 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-4 E</td>
<td></td>
<td>1.9 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-3 E</td>
<td></td>
<td>1.7 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-2 E</td>
<td></td>
<td>1.5 (V)</td>
<td>10 (V)</td>
</tr>
<tr>
<td>Tr-1 E</td>
<td></td>
<td>2.0 (V)</td>
<td>10 (V)</td>
</tr>
</tbody>
</table>

|          |          | 100 (mA)  |
| Tr-1 E   | 460 (μA.)| 380 (μA.) |
| Tr-2 E   | 410 (μA.)| 370 (μA.) |
| Tr-3 E   | 560 (μA.)| 740 (μA.) |
| Tr-4 E   | 2.2 (mA.)| 2.1 (mA.) |
| Tr-7 E   | 42.5 (mA.)| 42.5 (mA.)|
General Description: Model RD-505 is a two speed, two-track monaural tape recorder designed to operate as a portable. It incorporates solid
state electronic circuitry and will operate using either an internal 9-volt battery supply or connected to a conventional 240, 220, 200, 110 volts, 50/60 cycle power outlet. Automatic level control switch is provided for

2SB-75  2SB-156 x2

(W45b) Circuit Diagram—Model RD505 (Continued) 488
an automatic recording level control. Jacks are provided for connecting an external speaker or earphone and for recording directly from an external source, such as a radio or pickup. The microphone supplied with this recorder is equipped with a remote control switch.

**Record Bias:** Connect a 100-ohm resistor in series with the earthy end of the Record/Playback head. Connect a valve volt-meter across the resistor and adjust T3 for 100 mV.

**Erase Current:** Connect a D.C. ammeter in series with the earthy end of the erase head. The current should exceed 7 mA.

**Cabinet Removal:** Remove the tape reel cover, the tape reels and the head cover.

*Note:* At this point the tape heads are accessible for cleaning. Remove the volume control and tone control knobs, then fast forward and function selector knobs from the cabinet top. Remove the cabinet top retaining screw that is located under the function selector knob. The battery compartment and batteries should now be removed. Next take out the accessory compartment cover and the six bottom retaining screws. Remove cabinet bottom. Separate the jack mounting plate from the cabinet top and remove the four chassis retaining screws. Remove the battery terminal leadwire from the cabinet top. Remove speaker holder and take speaker out of cabinet top, which now separates from the chassis and associated circuitry.

*Note:* At this point, the printed circuit board assembly and mechanism are accessible for servicing.

---

**SHARP**  
**Model RD706**

**General Description:** The Model RD-706 is a two-track three-speed monaural tape recorder that operates in a vertical and horizontal position. It incorporates solid state electronic circuitry and will operate on a conventional (120 volt, 60 c/s) (240, 220, 200, 110 volt, 50/60 cycles) power outlet. Jacks are provided for connecting an external speaker, and for recording directly from an external source, such as radio or pickup. The unit includes a sound monitor switch with built-in speaker.

**Record Bias:** Connect a 100-ohm resistor in series with the earthy end of the Record/Playback head. Connect a valve volt-meter across the resistor and adjust C30 for 100 mV.

**Erase Voltage:** Connect a 1-ohm resistor in series with the earthy end of the erase head. Connect a valve volt-meter across the resistor. The reading should be approx. 25 mV.

**Mechanism Assembly Removal:** Remove all control and selector knobs and head cover. Remove the five screws retaining the reel panel and the two screws retaining the deck cover. Take off the reel panel and the
deck cover. **Caution:** The counter belt of the tape counter at the back of the reel panel should be removed when taking out the reel panel and deck cover. Next unplug the speaker lead tip. Remove the two screws retaining
SHARP

the handle, and the four screws retaining the bottom legs and cabinet to the mechanism chassis. Remove the two screws retaining the back legs and cabinet mechanism chassis at the rear.
(H152) Circuit Diagram—Model SR-100

Note: Voltage values shown on the circuit diagram were measured with a VTVM under no-signal conditions. Voltages shown in parentheses are for switch in record position.
STANDARD

Model SR-100

General Description: Portable cassette tape recorder with 400-mW. power output. Tape speed 4.75 cm./sec. Battery 9 volts. Current Consumption: See table below.

<table>
<thead>
<tr>
<th>Playing</th>
<th>Amplifier</th>
<th>Motor</th>
<th>Actual value (AMP + motor)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No-signal</td>
<td>15 ~ 25 mA.</td>
<td>80 ~ 130 mA.</td>
<td>95 ~ 155 mA.</td>
</tr>
<tr>
<td>Max. output</td>
<td>130 mA.</td>
<td>80 ~ 130 mA.</td>
<td>210 ~ 250 mA.</td>
</tr>
<tr>
<td>Recording</td>
<td>50 mA.</td>
<td>80 ~ 130 mA.</td>
<td>160 ~ 180 mA.</td>
</tr>
<tr>
<td>Fast winding</td>
<td>—</td>
<td>70 ~ 130 mA.</td>
<td>—</td>
</tr>
</tbody>
</table>

(H151) Block Diagram—Model SR-100

STANDARD

Model SR-300

General Description: Transistorised tape recorder with 800-mW. power output. Tape speeds 9.5 and 4.75 cm./sec. Battery 9 volts. Recording Level: The best recording is made when the level lamp goes on and off continuously. Batteries: The level lamp acts as an indicator of battery voltage. When the lamp goes almost out, the batteries should be changed.
(H154) CIRCUIT DIAGRAM—MODEL SR-300

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STDARD

(H153) BLOCK DIAGRAM—MODEL SR-300
**General Description:** A four-track, four-speed, mains-operated monophonic tape recorder employing both semiconductors and valves in a printed circuit amplifier. Low noise, high input impedance $n-p-n$ type transistors are used in all low-level stages of the pre-amplifier which feeds an all-valve...
main amplifier having separate bass and treble tone controls and a push–pull output stage. Provision is made for operation as a microphone or P.U./radio amplifier and, when used in conjunction with the Philips EL3787/00A pre-amplifier, etc., stereo playback, multiplay or duoplay is also possible.

Adjustments: R34 Adjustment, Recording Indicator Sensitivity—Switch recorder on (any speed), depress the record (red) key only and place
the track selector in the "1-4" position. Connect an A.C. millivolt-meter to MP1 and apply a generator source of 1 kc/s. to tag 1 on Skt1. Adjust generator level and/or microphone level (R18) for a meter reading of exactly 15 mV. Set R34 so that the fluorescent segments just meet the red band.
R44 and R45 Adjustment, Recording Bias Level: Switch to Record at 3½ in./sec. and connect an A.C. millivolt-meter to MP1. Place the track selector in the “1-4” position and adjust R44 for a meter reading of 58 mV. Transfer the meter to MP2, switch to the “2-3” track position and adjust R45 for the same reading.

L2 Adjustment, Oscillator Frequency Control: The bias/erase oscillator frequency should be 52 kc/s. ±10 per cent. This may be determined by measuring the voltage developed between the junction K2-K102 and chassis with a valve volt-meter. Adjust the core of L2 for a reading of 14.5 volts A.C. which should occur when the core is almost fully in.
**General Description:** Model M200: A two-track mains-operated tape recorder employing six transistors. Model M201: Employs a similar chassis with switching for four-track operation.

**AC 150 green**  **AC 122 violet**  **AC 122 violet**

---

**Diagram Instructions:**

- **e** Radio and Phono socket
- **b** Microphone socket
- **c** Record / playback head
- **d** Earphone socket
- **e** Battery power and level meter
- **f** On / off-switch S 8
- **g** Erase head
- **h** External loudspeaker socket 3.5 ... 8Ω
- **i** Loudspeaker-switch S 7
- **j** Marked switch position: Loudspeaker ON
- **k** Volume control
- **l** Voltage selector S 9
- **m** Tonal control
- **n** Recording / playback switch S 1, S 101
- **o** Switch position shown: playback
- **p** Playback switch S 1
- **q** Switch position shown: playback

(W119a) **Circuit Diagram—Model Magnetophon 200 (Part)**

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TELEFUNKEN

Bias and Erase Oscillator: T105 operates as oscillator transistor in the cording setting. The oscillator circuit is single-ended with inductive feedback. The capacitor C132 in conjunction with one winding of the oscillator coil L102 constitutes the frequency-determining resonant circuit which is tuned to 85 kc/s. with the help of the screw core of the coil. If it is

(W119b) Circuit Diagram—Model Magnetophon 200 (Continued)
necessary to retune the oscillator frequency, make sure that the erase head is connected. The R.F. bias required for the recording process is fed to the record/playback head via C11/12 or C21/22 respectively.

Adjusting the Parallel-tuned Trap, Coil L101: This trap serves for suppressing R.F. bias injection into the amplifier circuit. Readjustment of the trap is necessary when oscillator circuit components or the erase head have been replaced. For such readjustments, connect the VTVM in parallel with capacitor C108 and switch the tape recorder to "recording". Then adjust the iron core of coil L101 for minimum voltage across C108.

Setting the Resting Current of the Output Stage: The resting current of the driver and output stage is set to 24 mA. in the absence of an A.F. signal. After any repairs to this stage have been carried out, first of all reset to this current value before applying an A.F. signal to the stage. For this purpose it is necessary to break the negative line running to the amplifier plate and to interpose the current meter. Switch the tape recorder to playback with the volume control turned right back to zero. Then adjust the resting current with the potentiometer R143.

**ULTRA**

**Model 6212**

**General Description:** This tape recorder is similar to the Ultra Model 6206 described in the 1967–68 volume.
VAN DER MOLEN

General Description: Stereo cassette unit with internal speaker of 15 ohms impedance.


Notes: Only the CH.1 amplifier is shown in the circuit diagram. CH.2. is similar to CH.1., but the transistors TR1–6 become TR10–15. SKT.1. is 3 Pin Din and SKT.2. is 5 Pin Din. S3 is Record Interlock.

(H23a) CIRCUIT DIAGRAM—MODEL SONIC EIGHT (PART)

503
4 way interconnecting cable

4 pin plug rear view

4 pin socket front view

Power unit in detachable speaker cabinet

(H23b) Circuit Diagram—Model Sonic Eight (Continued)
**General Description:** Ten-transistor tape recorder. Loudspeaker output impedance 8 ohms. Battery supply 7.5 volts.

**Variable resistor** | **Value**
--- | ---
R51 | 20k
R53 | 10k
R54 | 220 Ω

**Transistor** | **Type**
--- | ---
TS1 | AC125
TS2 | AC125
TS3 | AC125
TS4 | AC126
TS5 | AC126
TS6 | AC128
TS7 | AC127
TS8 | AC125
TS9 | AC127
TS10 | AC128
Switch SK4 shown in 'Record' position

(F88) Circuit Diagram—Model TRC1
ACKNOWLEDGEMENTS

British Radio Corporation Ltd.
Combined Electronic Services Ltd.
C.R.T.S. Ltd.
Decca Ltd.
Dynatron Radio Ltd.
R.T.S. Ltd.
General Description: Dual-standard television chassis similar (in some respects) to the Thorn 950 Mk. II Series described on page 509 in the 1967-68 volume.

A.C. Mains Connection: Before connecting to the mains supply ensure that the flylead to the mains transformer is connected to the appropriate voltage tag as shown on the indicator flap. The flylead is provided with a "push-on" tag connector. The black wire in the mains lead is connected to chassis when the receiver is switched on. Connect to mains so that the chassis is at neutral; the use of a non-reversible mains plug is recommended. The receiver may be operated on non-synchronous supplies.

Fuses: A 1.5 amp cartridge type is fitted in the supply to the mains transformer. If replacement becomes necessary, a fuse of the same type and rating should be used. Additional protection is provided by a fusible resistor link in the receiver H.T. line. A second fusible resistor link separately protects the switch operating solenoid. It should be noted that if this link is fused the supply to the transformer is also disconnected. The fusible links may be resoldered to make contact after eliminating any overload condition.

Line-Hold Controls: Independent controls are provided for each line standard. Pictures may be displaced to one side of the screen or split into two after locking-in. Careful readjustment of the appropriate line-hold control should centre the picture within the screen area. The correct adjustment is obtained when the picture is centred and free from any foldover effect.
R413: This is a factory adjustment and should not normally require attention. To readjust, select a V.H.F. transmission, short-circuit the top end of R44 (sync. separator grid-leak) to chassis, and adjust the 405 line-hold control for an almost stationary picture. Remove the short-circuit and check that the picture breaks up when the control is rotated in either direction from the stationary position. If necessary adjust the pre-set line-hold control (on flywheel unit) to achieve this condition. Renew the short-circuit and select a U.H.F. band. Tune to signal and adjust the 625 line-hold control in the same manner, but do not disturb the setting of the pre-set line-hold control. Remove short-circuit.

Picture Squaring: To square-up the picture with the mask, slacken off the clamp securing the deflector coils assembly on the neck of the tube. Then, keeping the coils as far forward as possible while at the same time ensuring that the position of the linearity sleeve relative to the deflector coils remains unaltered, carefully rotate the complete assembly as required.

Pin-Cushion Correction Magnets: These magnets are mounted on flexible brass strips attached to the deflection unit. To remove curvature from the edges of the picture, the positions of the magnets should be adjusted by bending the mounting strips.

Picture Size: The height control should be adjusted so that the castellations at top and bottom of Test Card C are partially excluded and the width control set up for the best formation of the circle in the centre. The adjustments should be made on a low brilliance setting. The width control must not be set up for excessive over-scan, otherwise the E.H.T. may rise beyond the maximum permissible voltage.

The line linearity correction sleeve must be positioned so that the locating lug is directly opposite the tube anode connector with the moulded ring 3 mm. from the edge of the deflector coils moulding. Where over- or under-scan cannot be corrected by the width control with the linearity sleeve set to its correct distance, then the sleeve may be readjusted within the tolerance limits 0–4 mm. The deflector coils clamp should be slackened before adjusting.

Frame Linearity: Two frame linearity adjustments are provided; one controlling the overall linearity and the other affecting only the top of the picture. The latter should not be disturbed unless non-linearity is apparent at the top of the frame, in which event it should be set to the middle of its range while overall linearity is adjusted by means of the main control. The "top" adjustment may then be varied, if necessary, to correct the top of the picture.

Picture Position: The shift control is mounted at the rear of the deflector coils assembly. The picture can be moved in any direction by rotating both control rings together around the neck of the tube. The position of the rings relative to one another alters the extent of the picture movement. (See also Line-Hold Controls.)

Ratio Detector Balance (625): This is a factory adjustment and should not normally require attention. To readjust, set control for minimum

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“buzz” from the loudspeaker with the receiver correctly tuned to a 625-line U.H.F. transmission.

**Push-Button Fine Tuning:** With the selector button depressed, the spring-loaded outer sleeve can be further depressed to allow the inner shaft to be rotated. Avoid pressing in on the button when tuning as this will alter the effect of the adjustment.

**Push-Button Band Changing:** With the exception of the top button which tunes the U.H.F. band only, all the other buttons can be adjusted to tune over any band. The band selectors are shown in Diagram 1. When changing the position of one of the selectors, ensure that the associated button is not depressed and that the locating pip locks securely in the correct hole. The 405/625 switching is determined by the positions of circlips on the push-button spindles, see Diagram 2. Two locating slots are provided on each push-button spindle, the one nearest the tuner metalwork for 625 and the one nearest the push-button knob for 405. Fit the circlip into the appropriate slot.

![Diagram 1](H214)

**V.H.F. Wired Distribution Working:** If it is required to operate the receiver on 625 lines at V.H.F., all that is necessary is to move the circlip on the appropriate V.H.F. button to the 625 position, and if necessary set the associated band selector to the required V.H.F. Band. (See Push-Button Band Changing.)

**Harmonic Suppression Filter:** 1. This filter is normally tuned to 194 Mc/s. to suppress the 5th harmonic of the 625-line vision I.F., which might cause interference on receivers which are in close proximity and operating on Channel 9. Alternatively the filter may be readjusted to 209 Mc/s. to suppress self-generated I.F. harmonic interference received on Channel 12. The adjustment (L14) is located in the vision detector coil assembly. Set the fine tuning control for maximum interference and adjust L14 for maximum suppression.

**Wire-Wrap Tags:** If these connections are replaced during service, do not attempt to wrap the wires but use normal soldered joints.

**Alignment (Equipment):** 1. An A.M. signal generator 75 ohms output impedance capable of being modulated at audio frequencies. 2. A wob-
B.R.C.

bulator providing a 30–45 Mc/s. sweep and preferably incorporating a display unit or alternatively a separate oscilloscope may be used for display purposes.

3. A video output meter. This may be a Model 8 Avometer, used on its 100-volt D.C. range. 4. An output meter for the 6 Mc/s. F.M. I.F. amplifier. This may be a Model 8 Avometer, used on its 10-volt D.C. range. 5. A suitably calibrated, audio output meter. 6. Resistors and capacitors to provide suitable terminations for test equipment.

**Alignment (Procedure):** Suitable connecting points for test equipment are shown in the alignment diagrams. When two tuning cores are located in same former, tune to the outer peak in each case; select the peak nearest chassis or printed board for single core formers. The input signal level should be adjusted during alignment to maintain the video output meter reading at about 70 volts on V.H.F., and 50 volts on U.H.F. The audio output should not be allowed to exceed 50 mW. *Note:* L17 and L18 are adjusted during factory alignment on special test gear to ensure optimum transient response and therefore it is advisable not to disturb these adjustments. Harmonic suppression coil L14 is normally tuned to 194 Mc/s. to suppress 625 vision I.F. fifth harmonics.

**Alignment (Rejector and 405 Sound I.F.):** Connect shorting links as shown in the Alignment Diagram. Connect equipment to the points shown in Alignment Diagram.

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(H215) **Wobulator Diagrams.** *Key Numbers on Diagrams are included for Easy Reference to Text*
Unmodulated Input Signals

<table>
<thead>
<tr>
<th>Adjust</th>
<th>Mc/s.</th>
<th>Video output</th>
</tr>
</thead>
<tbody>
<tr>
<td>L0</td>
<td>38.15</td>
<td>Minimum</td>
</tr>
<tr>
<td>L8</td>
<td>41.5</td>
<td>Minimum</td>
</tr>
<tr>
<td>L6</td>
<td>33.15</td>
<td>Minimum</td>
</tr>
<tr>
<td>L2</td>
<td>39.05</td>
<td>Minimum</td>
</tr>
</tbody>
</table>

Modulated Input Signals

<table>
<thead>
<tr>
<th>Adjust</th>
<th>Mc/s.</th>
<th>Audio output</th>
</tr>
</thead>
<tbody>
<tr>
<td>L45</td>
<td>34.65</td>
<td>Minimum</td>
</tr>
<tr>
<td>L26</td>
<td>38.25</td>
<td>Maximum</td>
</tr>
<tr>
<td>L29</td>
<td>38.25</td>
<td>Maximum</td>
</tr>
<tr>
<td>L28</td>
<td>38.25</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

Alignment (Tuner To Link Unit Coils): With the test equipment set up as for Rejector and 405 Sound I.F., remove the shorting link from junction L229–C255 and transfer sig. gen. to Tuner Test Point 1. Return all push-buttons to the out position. (1) Signal generator to 39.7 Mc/s. and adjust L220 for maximum. (2) Signal generator to 33.2 Mc/s. and adjust L229 for maximum. Disconnect test equipment and links.


1(a) Terminate the wobbulator output with a 75-ohm resistor and connect via a 1000-pF. capacitor to V2 grid T.P. (see alignment diagram). Connect the input of the display unit to pin 8 of V3 (R32 end cap provides a convenient connection) via a 1 kΩ resistor decoupled by a 1000-pF. capacitor. Switch wobbulator range to cover 30–45 Mc/s. If the wobbulator does not incorporate a marker generator, the A.M. signal generator may be used for this purpose provided that the calibration is known to be accurate.

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B.R.C.

Adjust L11/L13 and L12 for response shape as shown in 1a on accompanying diagram. (b) Switch to U.H.F. and check that response shape is as shown in 1b. If the vision carrier is not within the tolerance limits, L11/L13 and L12 should be slightly readjusted to obtain the best compromise between the 405 and 625 response shapes. Finally, check that vision carrier remains within the specified limits on both line systems.

2(a) Transfer the wobbulator output to pin 2 of V1 (V1 grid T.P.) and reduce the R.F. output of the wobbulator to maintain a similar size trace as before. Switch to U.H.F. Adjust L5 and L10 for a response shape as shown in 2a on accompanying diagram. (b) Switch to Channel 2. Check that response shape is as shown in 2b. If the vision carrier is not within the tolerance limits, readjust L5 and L10 for best compromise ensuring that the vision carrier remains within the specified limits on both line systems.

3(a) Transfer wobbulator to Test Point Z. Place shorting link between junction L229-C255 and chassis. Select U.H.F. band and adjust L3 and L231 for shape shown in 3a on accompanying diagram. (b) Select a V.H.F. band and check that shape is as shown in 3b. If vision carrier is not within
(H217a) Chassis Left-hand Side Panel

(H217b) Chassis Right-hand Side Panel
tolerance limits readjust $L_3$ and $L_{231}$ for best compromise. Ensure that vision carrier remains within the specified limits on both line systems. Remove shorting link.

**Alignment (6 Mc/s. F.M. I.F.):** Select U.H.F. band. Connect output meter (on 10-volt D.C. range) across $R_{81}$. Inject 6 Mc/s. unmodulated signal at $V_{3A}$ grid ($R_{32}$ end cap provides a convenient connection).

During alignment adjust the signal generator input to maintain the meter reading at 5 volts approximately. Adjust the following for maximum output: $L_{21}$, $L_{22}$, $L_{27}$ and $L_{31}$. Disconnect the output meter from across $R_{81}$ and connect two equal resistors of about 100 kΩ each, in series across $R_{81}$. Switch the meter to its 50-μA range and connect it between the

(H219) CIRCUIT DIAGRAM—INTEGRATED V.H.F./U.H.F. TUNER AND LINK UNIT

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junction of these resistors and the junction of R72–C65 (a suitable tag is provided on the printed board for the latter connection). Adjust L32 for zero meter reading between positive and negative swings. Disconnect the resistors and remove the meter.

**A.G.C. Level Adjustment (R225):** Under normal circumstances it should not be necessary to disturb the setting of R225. In the absence of suitable test gear tune the receiver to a strong V.H.F. signal and adjust R225 for minimum cross-modulation. This usually occurs at a position slightly clockwise of centre.

**Circuit Notes:** Apart from the integrated tuner and link unit, contrast and A.G.C. networks the circuits are basically similar to those in the Thorn 950 Mk. II Series.

**Flywheel Sync. Unit:** See Thorn 950 Mk. II Series.

**Pentode Type Flywheel Sync.:** See Thorn 950 Mk. II Series.

**Access For Service:** See Thorn 950 Mk. II Series.

**Cathode Ray Tube Notes:** See Thorn 950 Mk. II Series.

**Circuit Diagram Notes:** The following differences to the circuit diagram may be found in some receivers: C33–33 pF., C73–0.01 μF., C107–20 pF., R41–5.6 kΩ, R44–680 kΩ. In some receivers the Flywheel Unit D.C. Amplifier is connected as a pentode with the following component differences: R51–68 kΩ; R55–100 kΩ; R406–180 kΩ; R408–68 kΩ; R409–39 kΩ; R411–47 kΩ.

Figures in rectangles are D.C. voltage measurements. They were taken on a mains input of 240 volts A.C. with the controls set for normal operation. Timebase measurements were taken with the oscillators locked, all other measurements were taken under “no-signal” conditions. E.H.T. was measured with an electrostatic meter at minimum brilliance. These readings may be considered as typical but it is stressed that they are provided for guidance only and that variations of 10 to 20 per cent. do not necessarily indicate fault conditions.

Ringed figures indicate connecting points on the component side of the printed board.

The spark gaps shown in the main circuit diagram are formed in the copperwork of the printed board and provide a “low resistance” path to earth for any high voltage flashover which might occur in the C.R.T.

Whenever possible, D.C. resistances are given for inductors which have a resistance of 1 ohm or more.

The oscillograms show peak-to-peak voltage values. They were measured via a probe of 8 pF. in parallel with 10 MΩ. (A), (B), (D), (E), (F) and (M) were taken at 405-line frequency. (C), (G), (H), (J) and (K) were taken at field frequency. Note that (K) was taken with the field oscillator rendered inoperative by earthing grid of V6B.

**Printed Board Servicing Aids:** Printed wiring between components and general circuit information (including circuit references) is printed in white on the component side of the printed board.
TELEVISION SERVICING

VISION & SOUND IF AMP 6F 29 (EP483)

IF INPUT

CIRCUIT DIAGRAM—MAIN CHASSIS-970 SERIES (PART)

H220a

(H220a) CIRCUIT DIAGRAM—MAIN CHASSIS-970 SERIES (PART)

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(H220b) CIRCUIT DIAGRAM—MAIN CHASSIS—970 SERIES (PART)

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(H220c) Circuit Diagram—Main Chassis—970 Series (Continued)
B.R.C.

External connections to wire-wrap tags numbered to correspond with circuit diagram are also shown. White lines on the copper side of the board, with circuit references, indicate soldering points for individual components. Lines which are marked with the letter J indicate wire jumpers. Solder connections to valve bases are numbered to facilitate pin identification.

---

B.R.C. 1400 Series Tuners and Chassis

**General Description:** Dual-standard television receiver chassis used with V.H.F. tuner type 1516 and U.H.F. tuner types T4 and T8.

**A.C. Mains Connection:** The black wire in the mains lead is connected to chassis when the receiver is switched on. Connect to mains so that the chassis is at neutral; a non-reversible mains plug is recommended.

**Fuses:** A fusible resistor link protects the switch operating solenoid. It should be noted that if this link is fused the supply to the receiver is also disconnected.

**Local-Distant Control (V.H.F. only):** In strong signal areas the control should be used to remove cross modulation effects. These effects show up as bars on the picture changing in sympathy with the sound, or as a buzz from the loudspeaker varying with picture content. In weak signal areas the control should be adjusted for minimum noise on the picture.

**Contrast Controls:** Independent controls are provided for V.H.F. and U.H.F. reception.

**Picture Squaring:** Slacken off the clamp securing deflector coils, then rotate complete assembly as required. Note that the coils must be kept as far forward as possible and the linearity sleeve must retain its position with respect to the coils.

**Pin-Cushion Correction Magnets:** To remove curvature from the edges of the picture, the positions of the magnets should be adjusted by bending the mounting strips.

**Picture Size:** The height and width adjustments should be made on a low brilliance setting. The width must not be made excessive, in order to prevent the E.H.T. exceeding the maximum permissible voltage.

**Line Linearity:** The correction sleeve must be set with the moulded ring 3 mm. from the edge of the deflector coils moulding. Tolerance limits 0 to 4 mm. Note that the deflector coils clamp should be slackened before adjusting.

**Field Linearity:** Two frame linearity adjustments are provided; one controlling the overall linearity and the other affecting only the top of the picture. The latter should not be disturbed unless non-linearity is apparent at the top of the frame, in which event it should be set to the middle of its
range while overall linearity is adjusted by means of the main control. The “top” adjustment may then be varied, if necessary, to correct the top of the picture.

**Picture Position:** The shift control is mounted at the rear of the deflector coils assembly. The picture can be moved in any direction by rotating both control rings together around the neck of the tube. The position of the rings relative to one another alters the extent of the picture movement.

**Ratio Detector Balance:** This is a factory adjustment and should not normally require attention. To readjust, set control for minimum “buzz” from the loudspeaker with the receiver correctly tuned to a 625-line U.H.F. transmission.

**U.H.F. Tuner:** The unit may be continuously tuned through Bands IV and V and is fitted with either push-button or rotary channel selection depending on individual receiver presentation. Where push-button selection is employed the buttons may each be pre-set to any channel.

**Warning (U.H.F. Tuner Unit):** No servicing adjustments of an electrical nature should be attempted on this unit. If the unit develops an electrical fault, the complete assembly should be sent to the nearest Service Depot.

**V.H.F. Tuner:** Each Band 1 and Band 3 biscuit is numbered to indicate the channel to which it is tuned. The number is preceded by the letter C. An additional biscuit (marked U.H.F.) adapts the R.F. and Mixer stages to function as an I.F. pre-amp. during U.H.F. reception. A common biscuit (numbered C23) is employed for channels 12 and 13.

**Wire-Wrap Tags:** If these connections are replaced during service, do not attempt to wrap the wires but use normal soldered joints.

**Alignment Notes:** 1. All other possible causes of poor response or low gain should be checked before realigning the circuits. 2. Equipment required: (a) A.M. signal generator of 75 ohms output impedance. (b) Video output meter—or Model 8 Avo. (c) Output meter—or Model 8 Avo. (d) 4:5-volt grid bias battery. (e) Various small components

![Diagram](image-url)
B.R.C.

—see text. 3. When two cores are located in the same former, tune to outer peak in each case. 4. Select the peak nearest printed board for single core formers. 5. The signal input should be adjusted to maintain a video output reading of 120 volts on V.H.F. 6. On U.H.F. the signal input should be set to maintain a video output reading of 80 volts except for the 33·15 MHz rejector when the output reading should be 50 volts. 7. The audio output should never exceed 50 mW. 8. L18 should not be disturbed.

Rejector and 405 Sound I.F.: Turn the local/distant control fully anti-clockwise, and contrast and volume controls fully clockwise. Connect apparatus as shown in alignment diagram. Use Table 1. Then connect 4·5-volt battery as in alignment diagram and use Table 2.

Vision I.F.: After the rejector and 405 sound I.F. circuits have been set up, the audio output meter should be removed. Then switch receiver to U.H.F. and short TP3 to TP4. The damping components (330 ohms and 1000 pF.) should be connected in series (with short leads) between the earth conductor and the damping points specified in Table 3.

Table 1. Unmodulated Input Signals

<table>
<thead>
<tr>
<th>Select</th>
<th>Adjust</th>
<th>MHz</th>
<th>Video output</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.H.F. Channel 2</td>
<td>L7</td>
<td>38·15</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>L2</td>
<td>41·5</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>L3</td>
<td>39·65</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>L6</td>
<td>33·15</td>
<td>Minimum</td>
</tr>
<tr>
<td>U.H.F.</td>
<td>L1</td>
<td>33·15</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

Table 2. Modulated Input Signals (A.M.)

<table>
<thead>
<tr>
<th>Select</th>
<th>Adjust</th>
<th>MHz</th>
<th>Video output</th>
</tr>
</thead>
<tbody>
<tr>
<td>V.H.F. Channel 2</td>
<td>L23</td>
<td>38·15</td>
<td>Minimum</td>
</tr>
<tr>
<td></td>
<td>L25</td>
<td>38·15</td>
<td>Maximum</td>
</tr>
<tr>
<td></td>
<td>L26</td>
<td>38·15</td>
<td>Maximum</td>
</tr>
</tbody>
</table>

Table 3

<table>
<thead>
<tr>
<th>Adjust</th>
<th>MHz</th>
<th>Damping point</th>
<th>Video output</th>
</tr>
</thead>
<tbody>
<tr>
<td>L10</td>
<td>36·5</td>
<td>V₄A anode</td>
<td>Minimum</td>
</tr>
<tr>
<td>L9</td>
<td>38·3</td>
<td>—</td>
<td>Minimum</td>
</tr>
<tr>
<td>L8</td>
<td>37·3</td>
<td>V₃ anode</td>
<td>Minimum</td>
</tr>
<tr>
<td>L5</td>
<td>38·2</td>
<td>TP₂</td>
<td>Minimum</td>
</tr>
<tr>
<td>L209</td>
<td>37·4</td>
<td>V₃ grid</td>
<td>Minimum</td>
</tr>
<tr>
<td>L₄</td>
<td>35·1</td>
<td>Tag 1</td>
<td>Minimum</td>
</tr>
</tbody>
</table>

and chassis. 2. During alignment adjust the signal generator input to maintain the meter reading at 5 volts approximately. Adjust the following for maximum output: L24, L27, L28, L20 and L21. 3. Disconnect the output meter from across R88 and connect two equal resistors of about 100 kΩ each in series across R88. Switch the meter to its 50 μA range and connect it between the junction of these resistors and the junction of R81–C70 (pin 1 of L28 coil base is suitable for the latter connection). Adjust L28 for zero meter reading between positive and negative swings. Disconnect the resistors and remove the meter.

**V.H.F. Tuner Oscillator Adjustment:** Connect aerial, select appropriate channel and turn fine tuning to the middle of its range. Tune in transmission with L206.

![Alignment Diagram](H202)

(Circuit Diagram Notes: 1. The diagrams shown are of the Schedule B chassis. The Schedule A chassis differed in that R90, C128, T.P1–5 and Tags 43 and 44 (the latter incorrectly shown as Tag 42 in diagram) were not fitted. Also in some Schedule A chassis R69 was 360k, R102 was 1k and C89 was 0.1 μF. 2. Later production chassis are designated Schedule C. They incorporate a fusible resistor in the HT2 positive rail. When this is fitted R137 becomes 126 ohms and the line-hold controls are taken directly to C123. 3. Figures in rectangles are D.C. voltages. All were taken on a mains input of 240 volts A.C. using the 240–250-volt tap. E.H.T.)
B.R.C.

was measured with an electrostatic meter and all other voltages with an Avometer Model 8. The readings are typical but variations of up to 20 per cent. do not necessarily indicate fault conditions. 4. If the D.C. resistance of an inductor is greater than 1 ohm, its value is given in the circuit diagram.

5. Ringed figures indicate connecting points on the component side of the printed board.

| Circuit Description (Tuners): | The V.H.F. tuner employs a frame-grid triode R.F. amplifier followed by a triode-pentode oscillator and mixer, the R.F. and mixer stages being A.G.C. controlled. The R.F. amplifier V1 and the pentode section of V2 also function as an I.F. amplifier during 625-line U.H.F. reception, the I.F. output from the U.H.F. tuner being applied to the grid circuit of V1. The switching circuit is contained on a special turret biscuit.

The U.H.F. tuner employs two high frequency transistors, AF139, AF186 or AF239 (R.F. amplifier) and AF139 (self-oscillating mixer) connected in grounded-base configuration. The \( \frac{1}{4} \)-wave lecher lines L352,
L353 and L356 are end-capacity tuned by a three-gang capacitor providing complete coverage of Bands IV and V. A low voltage supply, derived from the receiver H.T. line, is fed to the emitter/base resistance networks while the chassis and collectors are maintained at relative negative potential.

**Circuit Description (Solenoid):** The main chassis circuit includes dual-standard I.F. and line timebase stages, the necessary changeover between systems being achieved by a solenoid actuated slide switch S2A–M.

When the "U" position is selected on the V.H.F. turret control the selector stud (at the rear of the tuner) moves S3 to the "U" position to energise S2 solenoid, winding L29, which in turn moves the slide switch S2A–M to the 625 position. The switching is arranged so that the solenoid is only energised momentarily—the movement of the slide switch automatically breaks the solenoid circuit at S2A. When the turret control is returned to a V.H.F. channel the operation is reversed, another solenoid winding (L30) being employed to return the slide switch to the 405 position. A fusible resistor link (R123) protects the solenoid against overload. If this link fuses, the supply to the receiver (via Fr) will also be disconnected.

**Circuit Description (V.H.F. 405 Operation):** The vision-sound I.F. from the V.H.F. tuner is fed via adjacent channel sound rejector L1 and Channel 1 rejector L2 to vision-sound I.F. amplifier V3 which is grid tuned by L4, with adjacent channel vision rejection provided by L3–C12.
(H205a) CIRCUIT DIAGRAM, MAIN CHASSIS—MODEL 1400 SERIES (PART)
V3 anode circuit is tuned by L5, and L23 is the sound I.F. “take-off” coil. The anode-grid circuit between V3 and V4A incorporates adjacent channel sound rejector L6-C19; and sound I.F. rejector L7, C22 and C23. V4A grid is tuned by L8.

The vision I.F. is amplified by V4A and bottom inductively coupled to vision detector W4. The video signal is fed in the correct modulation sense by S2H and C34 to V5 grid. R30, W2 and C32 form the overload circuit. W2 conducts when the D.C. component of the rectified signal exceeds the A.G.C. line voltage to supplement the A.G.C. bias on very strong signals. The amplified video signal is then fed to the C.R.T. cathode via L22 and C39, the D.C. reference level being provided by potential divider R119-R120. V5 output is also applied to sync. separator V6A via R44 and C40. A mean-level A.G.C. voltage is derived from V6A grid circuit and applied to I.F. amplifier V3 and to the V.H.F. tuner via a pre-set delay R11.

(H206) Oscillograms. A, B, D, E and F at 405-Line Frequency. C, G, H and J at Field Frequency. Voltages given are Peak-to-Peak Values Measured via a Probe of 8 pF. in Parallel with 10M
The 38.15 MHz sound I.F. at V₃ anode is inductively coupled by L₂₃ to sound I.F. amplifier V₇ and detected by W₇ in the secondary of the anode transformer (L₂₅—L₂₆). The rectified output, developed across potential divider R₈₅—R₈₆, is applied to V₇ as A.G.C. bias. The audio signal developed across R₈₅—R₈₆ is fed via switch S₂₉ and C₇₉ to the audio amplifier V₈.

**Circuit Description (Audio Amplifier):** V₈A audio amplifier provides limiting action to impulsive interference by the self-bias time constant C₇₉—R₉₁ in the grid circuit; the delay time being determined by the time constant C₇₈—R₉₂ in the anode circuit. To preserve the efficiency of this stage, limiting action must take place before the volume control circuit and for this reason the volume control R₉₃ is included in the coupling to the output stage V₈B.

**Circuit Description (U.H.F. 625 Operation):** The I.F. output from the U.H.F. tuner is applied to grid of V₁ (in V.H.F. tuner) which, together with V₂B, functions as an I.F. preamplifier. The output from V₂B anode is applied to V₃ grid circuit, L₄ being the common I.F. grid coil. L₆—C₁₇ in V₃ anode circuit form a sound rejector to reduce sound level.

The combined vision-sound I.F. is further amplified by V₄A and detected by W₅. The polarity of the diode circuit is switched by S₂₉ to provide an output in the correct modulation sense. R₃₀, W₂ and C₃₂ form an overload circuit. W₂ conducts when the D.C. component of the rectified signal exceeds the A.G.C. line voltage to supplement the A.G.C. bias on very strong signals. The rectified video signal containing the F.M. intercarrier beat frequency (6 MHz) is coupled by switch S₂₉ to V₅ (video amplifier) grid via C₃₄. S₂J switches in L₁₈ the detector compensation coil.

A 6 MHz tuned circuit L₂₀—C₃₅ in V₅ anode circuit selects the F.M. intercarrier which is taken off the sound I.F. amplifier through C₃₆. Any residual 6 MHz signals are rejected by L₂₁—C₃₈ ensuring that the intercarrier signals are isolated from the C.R.T. cathode.

The 6 MHz sound I.F. is amplified by V₇. S₂D modifies the screen circuit to reduce the screen voltage, the necessary limiter action being provided by V₇ grid current. The output from V₇ is transformer fed to W₈ and W₉ operating in a ratio detector circuit. The tertiary voltage is taken from the junction of C₆₆—C₆₇ in series which shunt tune L₂₇ the primary of the transformer. The voltage is injected into the secondary L₂₈ at the centre-tap formed by tuning capacitors C₆₈—C₆₉. Ratio detector balance is adjusted for optimum A.M. rejection by pre-set R₈₇. C₇₆ is the stabilising capacitor, with R₈₈ as the detector load. R₈₁ and C₇₀ provide de-emphasis and the audio signal is switched to V₈A grid by S₂₉.

**Circuit Description (Line Timebase):** Sync. pulses are taken from V₆A anode to the flywheel discriminator via integrating network R₅₀—C₄₄ and coupling capacitor C₄₃.

A reference pulse, taken from winding ED on the L.O.T. (Tag 28), is fed to the discriminator via integrating network R₅₆—C₄₂ and shaper C₄₈. The discriminator formed by W₅—W₆, develops a negative or positive
voltage depending on whether the reference pulse lags or leads the sync. pulse. The resultant D.C. voltage is amplified by $V_{4B}$ and applied as a control voltage to grid of line oscillator $V_{6B}$.

The discharge rate of oscillator grid components $C_{53} \text{--} R_{69}$ is influenced by a network which incorporates the horizontal hold controls. The settings of the horizontal hold controls affect the anode voltage of $V_{4B}$.

The appropriate horizontal hold control is selected for 405- or 625-line operation by $S_{2F}$. $S_{2K}$ selects the line charging capacitance for either system. Width stabilisation is provided by voltage dependent resistor $Z_{4}$ in the grid of line output stage ($V_{10}$), while the scan and linearity are equalised for 405-625 operation by $S_{2L}$ and $M$.

**Circuit Description (E.H.T. Trebler. 20 kV.):** A pulse derived from the anode circuit of the line valve $V_{10}$ is applied to the rectifiers and voltage-trebler circuit formed by $W_{12A} \text{--} E$ and $C_{109} \text{--} C_{112}$. The basic principle is that of a Cockcroft Walton multiplier. To avoid earth connections in the circuit the aquadag coating of the C.R.T. is used as a reservoir capacitor which charges up through series capacitors $C_{109}$ and $C_{111}$.

**Circuit Description (Field Timebase):** $V_{9A}$ and $V_{9B}$ are connected in a multivibrator oscillator circuit, the pentode section also functioning as the output stage. $V_{9A}$ anode is fed from the boost H.T. supply. The increase in voltage from this supply on 625 is counteracted by $S_{2K}$ connecting $R_{72}$ to earth from the boost H.T. line. Voltage dependent resistor $Z_{2}$ across the boost H.T. line stabilises the height. The pulses from the sync. separator are fed via $C_{91}$ to $V_{9A}$ cathode. $C_{90}$ is the frame charging capacitor with pulse shaping performed by $C_{94} \text{--} C_{97} \text{--} R_{109}$.

A linearising network including pre-set controls $R_{116}$ and $R_{118}$ is connected from the anode of $V_{9B}$. Voltage dependent resistor $Z_{3}$ across the primary of $T_{3}$ limits the frame flyback peak voltage, and $C_{99}$ across the secondary bypasses any line frequency high harmonics induced through the deflector coils. Frame amplitude is stabilised by temperature dependent resistor $X_{1}$ in series with the frame scan coils, to maintain constant resistance despite temperature changes. Damping resistors $R_{126} \text{--} R_{127}$ reduce ringing induced by the line flyback. $V_{9B}$ grid bias is derived from a tapping on the heater chain.

**Circuit Description (Heater Chain):** The heater supply is fed with pulses due to series diode $W_{10}$. It is connected so as to provide a pulsating D.C. supply negative with respect to chassis to enable a voltage to be tapped from the heater chain, smoothed and applied to $V_{9B}$ (frame output) as grid bias. Should $W_{10}$ fail by going short-circuit, loss of $V_{9B}$ grid bias would provide a visual indication of the fault by the timebase not locking. Without this precautionary circuit, heater current could rise without noticeably affecting receiver performance.

Due to the presence of diode $W_{10}$ in the heater chain, current or voltage measurements should be made with a moving-iron or hot-wire instrument for accurate results.

**Heater Chain Notes:** Voltage and current measurements of the valvè-
TELEVISION SERVICING

heater chain must be made with a moving iron or hot-wire type of meter to obtain normal R.M.S. readings.

An average value reading instrument, such as an Avometer will not indicate correct value voltage or current due to the series rectifier in the heater chain. The indicated heater current would be approximately 0.19 amps on the D.C. range, and the voltage across a 6.3 volt heater would be indicated as approximately 4 volts.

**Heater Current Adjustment:** A shorting link (tags 32 and 33) is provided for use when operating the receiver on mains supplies consistently less than 220 volts.

**Cathode Ray Tube Notes:** The notes on this topic are similar to those given for the Thorn 950 Mk. II Series, which is described on page 509 in the 1967-68 volume.

Access for Service: The printed circuit board has been designed with standardised mounting facilities for easy access and removal. To gain access to the component side of the printed circuit board, take out the two screws securing the printed board assembly to the two metal brackets at the right-hand side of the cabinet. The printed board can now be hinged open to expose the components or lifted off the hinge pivots, as shown, when opened out sufficiently to line up with the bracket to release the interlock.

The receiver can be operated with the board hinged open providing the usual safety precautions are exercised regarding high voltages.

The line output transformer assembly is secured to the heat-sink by two screws. Extreme care should be exercised when removing or resoldering the connecting leads to the tags on the transformer.

Use a small, low consumption iron and do not bear down on the tags heavily or apply the bit for longer than is necessary to produce sound joints.

Short-circuiting the E.H.T. supply should be avoided. After a number of short-circuits the rectifiers are affected to some extent and their working
life may be shortened. These items carry a twelve-month guarantee and replacements are available as a complete sub-assembly (Part No. 6M3-034) from Service Depots.

The complete tray unclips from the transformer but in some cases it will be necessary to first release a PVC strap—which has been added for transit purposes.

**Splined Knob Fixing:** The V.H.F. and U.H.F. channel selector spindles are fitted with insulating sleeves to ensure that metal parts are not exposed when the knobs are removed. The knobs are a friction fit on the sleeve assembly; the splined portion of the sleeve accepts the fine tuning control (V.H.F. spindle) or the channel indicator ring (U.H.F. spindle).

To refit the U.H.F. indicator, first tune spindle to a known channel, then push on indicator ring in a position to indicate the appropriate number. The splined sleeve feature ensures precise calibration.

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**V.H.F. Tuner Removal:** Remove the turret knob to reach the fixing screw. After removing the screw, unlatch the tuner from the nylon moulding. The mounting position of the tuner and nylon moulding varies with receiver presentation.

**V.H.F. Wired Distribution System Working:** In addition to being suitable for adjacent channel operation of officially allocated Bands I and III V.H.F. frequencies receivers incorporating the 1400 Series Chassis can also be quickly modified for 625-line operation at V.H.F. The removable turret coil biscuits can be moved in position or substituted if necessary. The U.H.F. tuner, when fitted, may be removed or left in position as required.

The following changes should be made: Remove push-on connector from Tag 43 located near main electrolytic and transfer fly-lead to link Tag
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43 with Tag 44, this maintains H.T. to the V.H.F. oscillator through R90 (1 kΩ) with the receiver switched to either system.

Replace the turret “ U ” biscuit with a suitable 625 V.H.F. segment.

When more than one 625-line channel is required, additional selector studs must be inserted in the appropriate holes in the moulded cam at the rear of the tuner. Selector studs may be obtained from the nearest Service Depot by quoting Part No. 56357. Information regarding special coil biscuits can also be obtained.

Tags 43 and 44 (including R90) are not fitted to Schedule A chassis. With receivers fitted with these chassis it will be necessary to solder a 1 kΩ, \( \frac{1}{2} \) watt, 10 per cent. resistor across switch S2B, see circuit diagram.

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B.R.C. Models 2643 and 3649

**General Description:** These two 16-in. models employ a chassis assembly which is similar to the Thorn 980 Series Chassis, except that the contrast, brilliance, volume and on/off controls are separately mounted in the cabinet.

*Note:* The Thorn 980 Series Chassis is described on page 502 in the 1967–68 volume.

**Service Details:**
1. To remove the turret knob assembly, select channel 3, rotate fine tuner to expose grub screw in aperture (A). Slacken grub screw and pull off knob assembly. The grub screw which secures the off/on volume knob is accessible through aperture (B) when the knob is in the off position.
2. To release the tuner unit remove two screws (C) and unlatch the tuner from the cabinet bracket.
3. The printed board assembly is mounted on a metal chassis which is secured to the cabinet base. Remove two nuts (D), release cableform from cleat (E) and withdraw the board assembly. The frame output earth lead is looped and sleeved for length adjustment and should be shortened again when refitting the board assembly.

*Note:* A brass strip is used to bond the tuner to the printed board assembly and a 1000 pF. (BS415) is connected between the tuner mounting and the adjacent tube mounting bracket. The aquadag coating on the tube is connected through the earthing spring and lead to chassis but the tube mounting assembly is isolated from general chassis by a 2.2 MΩ static discharge resistor. Ensure that these connections are correctly made when refitting.

**C.R.T. Details:**
1. The replacement tube must be a similar type (CME1602/A40–12W/S). This is supplied complete with safety band and mounting lugs.
2. To obtain removal clearance for the tube it is necessary to remove the printed board assembly, tuner unit, aerial panel and loudspeaker assembly.
3. To avoid any possibility of direct contact between the tube mounting and chassis metalwork, insulating strips are fitted over the two lower tube mounting lugs and an insulating patch is fitted to the tube.
behind the tuner unit. Ensure that the insulators are refitted with the replacement tube.

4. The mask is secured by four nuts which are accessible with the tube removed.

**Modifications:** See circuit diagram Thorn 980 Series. The following differences to the circuit diagram may be found in later production receivers: R85-470 kΩ (Part No. 8A32); 470 kΩ resistor (Part No. 8A32) added in series with R85 and the junction of these resistors connected to chassis via a 0.1 μF. capacitor (Part No. 8M51); 100 kΩ (Part No. 1A68) added between junction C54/R71 and chassis.

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**General Description:** Apart from presentation items, Model 4618 is otherwise identical to the group of receivers using the Thorn 980 Series Tuners and Chassis, described on page 502 in the 1967–68 volume.

**C.R.T.:** Mazda Rimband CME 1201/A31–18 W. 12 in.

**Modifications:**
1. See circuit diagram Thorn 980 Series. The following differences to the circuit diagram may be found in later production receivers: R85-470 kΩ (Part No. 8A32); 470 kΩ resistor (Part No. 8A32) added in series with R85 and the junction of these resistors connected to chassis via a 0.1 μF. capacitor (Part No. 8M51); 100 kΩ (Part No. 1A68) added between junction C54/R71 and chassis.
2. In some early production 12-in. receivers R114, R115 and R116 may be mounted on a tag strip instead of being fixed to the printed board.
DECCA Schools Receiver

**General Description:** Dual-standard television receiver incorporating the Professional Standard Chassis. Power consumption 100 watts.

**System Switching:** This is achieved by using a solenoid in conjunction with a micro-switch on the tuner and actuated by the appropriate channel selection button giving automatic changeover from 625 to 405. It is also possible to provide a V.H.F. channel operating on the 625 system.

**Video Amplifier:** Will provide not less than 120-volt P-P of drive with an input of 1-volt P-P from the video detector. D.C. coupled to the tube cathode to eliminate caption "streaking" associated with the normal practice of partial D.C. coupling.

**Amplified A.G.C. System:** The gated A.G.C. system operates during the back porch (Black Level) following the line pulse and will therefore produce a voltage independent of the video information. Lock-out or blocking of the A.G.C. system is prevented by the use of D.C. coupling to the video detector so that the amplifier may respond to peak white video in the absence of gating pulses. Thus the system reverts to a form of mean level A.G.C. under abnormal operating conditions. The A.G.C. has a total compression of not less than 80dB with a dynamic range of not less than 40dB.

**Sound Output:** The sound output is a class B push–pull amplifier using complementary output and driver stages with negative feedback giving a total harmonic distortion better than 5 per cent. and a maximum power output of 3 watts. A continuously variable tone control has been included in the specification.
Separate Mains Switch: A separate on–off mains switch has been provided to enable the volume control to be pre-set at any level. As the sound stage is transistorised the sound appears immediately the receiver is switched on.

Valves: ECL80 (Line pulse discriminator); ECC82 (Line oscillator); PL504 (Line output); PY800 (Boost diode); DY87 (E.H.T. rectifier); 30PL14 (Frame oscillator/output); EF80 (Sync. separator).

Transistors and Diodes: BF163 (First vision I.F. amplifier A.G.C. controlled); BF163 (Second vision I.F. amplifier); BF159 (Final vision I.F. amplifier); BF154 (Video phase splitter); BC118 (Video driver); BD119 (Video amplifier); BC113 (Signal sampler); P346A (Gate); BC116 (Mean
level override amplifier); BC116 (A.G.C. amplifier); BF163 (First sound I.F. amplifier A.G.C. controlled); BF159 (Final sound I.F. amplifier); BC118 (A.G.C. amplifier and audio amplifier); BC135 (Audio pre-driver);
BC136 and BC137 (Complementary drivers). $2 \times$ BC138 (Push-pull output stage).
SFD104 (Video detector); BA130 (38-15 Mc/s. A.M. sound detector);
BA130 (Sound interference limiter); BA130 (Vision I.F. A.G.C. delay diode); BA130 (Tuner A.G.C. delay diode); BA129 (Vision interference limiter); BA129 (Vision A.G.C. delay diode). 2 × BA130 (F.M. sound.
(H72d) DP TV. I.F. CIRCUIT DIAGRAM (CONTINUED)

discriminator). $3 \times \text{BA130}$ (Bias diodes for audio drivers). $12V7$ (Video driver H.T. stabiliser).
Note: In the Transistor Voltages Table all the readings are positive with respect to chassis. The readings were taken with Avo Model 8, 405 opera-
tion, contrast control at maximum with zero signal input. Voltages are nominal and may vary with transistor spreads. (See Table, next page.)

68-69  545
### Transistor Voltages Table:

<table>
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<th>Transistor</th>
<th>Emitter</th>
<th>Base</th>
<th>Collector</th>
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<tr>
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<td>P346A</td>
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</tr>
<tr>
<td>TR209</td>
<td>BC116</td>
<td>17.5</td>
<td>17</td>
</tr>
<tr>
<td>TR210</td>
<td>BC116</td>
<td>20</td>
<td>17.5</td>
</tr>
<tr>
<td>TR211</td>
<td>BF163</td>
<td>0.4</td>
<td>1.1</td>
</tr>
<tr>
<td>TR212</td>
<td>BF159</td>
<td>1.8</td>
<td>2.5</td>
</tr>
<tr>
<td>TR213</td>
<td>BC118</td>
<td>1.3</td>
<td>1.7</td>
</tr>
<tr>
<td>TR214</td>
<td>BC135</td>
<td>0.2</td>
<td>0.85</td>
</tr>
<tr>
<td>TR215</td>
<td>BC137</td>
<td>10</td>
<td>9.5</td>
</tr>
<tr>
<td>TR216</td>
<td>BC136</td>
<td>11</td>
<td>11.5</td>
</tr>
<tr>
<td>TR217</td>
<td>BC138</td>
<td>10.5</td>
<td>11</td>
</tr>
<tr>
<td>TR218</td>
<td>BC138</td>
<td>0</td>
<td>0.5</td>
</tr>
</tbody>
</table>
**General Description:** This series of television receivers incorporate a hybrid circuit using transistors in the R.F., I.F. and first A.F. stages and valves in the video, line, frame and sound output stages. Model TV95 uses manual station selection, the remainder being fitted with a motorised unit operated by push-button or remote control. This chassis is designed for use from an A.C. supply of 200/250 volts. Under no circumstances connect to a D.C. supply or serious damage will result.

**Notes on Adjustment of Controls**

* Set Width (625 and 405): Ensure first that the horizontal linearity adjustment has been correctly carried out. Adjust appropriate line system slider control commencing from minimum scan and advancing to the point where scan ceases to increase. Move slider in reverse direction to the correct amplitude setting.

**Vertical Scan Equalising:**
1. Ascertain which line system has the highest boost voltage (SW4G–c).
2. Plug fly-lead (frame oscillator feed) on to the appropriate tag for the system with the highest boost voltage, i.e. tag 50 (625) or tag 49 (405).

**Focus:** Optimum focus is obtained by connecting the blue jumper lead from pin 4 of the C.R. tube to the appropriate tag on the spark protection card assembly.

† **Pre-set Contrast (625 and 405):** These controls should be set so that the D.C. volts developed across R20, with an input signal greater than 1 mV., are 1·8 volts (405) and 2·9 volts (625). Slight readjustment should then be made as necessary to give equal contrasts on both systems.

* It is recommended that 30 minutes heating up on normal operation be allowed before making amplitude or linearity adjustments. If not, then the amplitude controls should be adjusted to give a small additional vertical and horizontal overscan to that for correct setting.
† This control is factory pre-set and will not normally require adjustment.
TELEVISION SERVICING

Note: Cross-modulation problems on strong signals may result if the control settings are too high.

Bowden Cable: When it becomes necessary to detach the tuner from the chassis, the cable should be disconnected at the tuner end, by prising the outer and inner from their retaining brackets. In either case, do NOT disturb the cable adjuster screw on the chassis. In the unlikely event of a replacement cable being required, however, proceed as follows: 1. Remove faulty cable and fit replacement to tuner. 2. With tuner and timebase system switch in “405” position (tuner cable retainer “open” and timebase switch plate “lowered”), slacken off cable adjuster screw and hook inner cable into hole “A”. 3. Fit outer cable to adjuster bracket and tighten screw.

Note: In the illustration, the switch plate is shown in the “raised” (625) position.

![Diagram of Sound Output Unit](W23)

![Diagram of Bowden Cable](W24)

Automatic Gain Control: With the receiver set for maximum gain and a weak signal applied, the A.G.C. transistor (VT5) is operating in a fully bottomed state (i.e. conducting heavily), thus causing its collector to become negative with respect to chassis.

Under these conditions, D4 is conducting and appears as a short-circuit transferring any change in VT5 collector volts to the base of VT1, the first I.F. amplifier, while D3 is cut off. As the signal strength is increased, or the setting of the pre-set contrast control is made more negative, the current passing through VT5 will decrease, causing its collector and also the base of VT1 to become less negative, thus reducing the stage gain.

When the collector of VT5 reaches a predetermined voltage, D3 will conduct and D4 will become cut off. Under these conditions, the gain of the I.F. amplifier stage is fixed at some low value, while D3 conducting is
(W21a) Chassis Rear View
(W21b) Chassis View (Lowered Position)

549
effectively a short-circuit and now transfers the A.G.C. voltage to the base of
the R.F. transistor (VT1 in the tuner).
The A.G.C. to the R.F. stage is therefore delayed in order to give optimum
signal to noise performance.

The pre-set contrast control provides a manually controlled voltage which
determines the A.G.C. operating point, and the A.G.C. voltage is therefore
the summation of the signal and manual control voltages.

Tuner and Line System Adjustments

Band and Line System Selection: When despatched from the factory,
the Dynatron Rotary and Motorised Tuners are "set" so that the two
B.B.C.1 positions can only be tuned to channels 1–5 (405); the two I.T.A.
positions to channels 6–13 (405); and the two B.B.C.2 positions to channels
21–68 (625).

In any instance where it is required to change the above combination, this
is achieved quite simply by rearranging the position of the system screws
(which determine the line system); and/or rotating through 180 deg. or
removing one of the cam buttons (which determine the band coverage).

Three combinations are illustrated, these being: A As despatched from
the factory, B B.B.C.1 converted to Band I (625), C I.T.A. converted to
Band III (625).

---

**Diagram:**

A

B

C

---

W28a

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In Fig. W28a the Rotary Tuner channel selector knob is viewed with the I.T.A. position having a small index spot below the “T” at top centre, and the two cams in the same relative position, viewed from rear and front respectively. In Fig. W28b the Motorised Tuner cams are in a corresponding position (as will be seen from the index holes), but the direction of rotation is reversed and they are viewed from the front and rear respectively. Thus, in order to change A to either B or C, one of the screws placed in alternate order behind the cam (system screw “A”) or in front of the cam (system screw “B”) must be removed and re-fitted as shown. The cam buttons remain unaltered in both cases. If it should be required to alter the band range, which is selected by the bottom centre cam button, this button should be: (a) in the low (inner) position for Band I, (b) removed for Band III, (c) in the high (outer) position for Bands IV and V.

This is shown by the following examples: (i) to convert a B.B.C. I position to Band III, remove button 3 or 6 and “park” in square hole adjacent to fine tuner spindle; (ii) to convert an I.T.A. position to Band I, insert an additional button in either 1 or 4, in “low” position; (iii) to convert a B.B.C. 2 position to Band I 625 (or Band III 625), pull-out button 2 or 5, rotate through 180 deg. and replace in “low” position (or pull-out button 2 or 5, and “park”).

Warning: In any instance where the position of a system screw has been changed and either channel selector or system switch is removed with the Bowden cable disconnected, care must be taken to ensure that both selector and switch are returned to their original positions before re-connecting the cable. Otherwise, it is possible for the mechanism to become jammed.

Fine Tuning: After carrying out any of the above adjustments, the required programme can be obtained by rotating the fine tuner fully clockwise and then turning back approximately the number of turns indicated in the table following.
TELEVISION SERVICING

<table>
<thead>
<tr>
<th>Channel No.</th>
<th>No. of turns anti-clockwise from stop</th>
<th>Channel No.</th>
<th>No. of turns anti-clockwise from stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>6½</td>
<td>25</td>
<td>2½</td>
</tr>
<tr>
<td>3</td>
<td>9½</td>
<td>30</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>34</td>
<td>5½</td>
</tr>
<tr>
<td>5</td>
<td>18½</td>
<td>39</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>9½</td>
<td>40</td>
<td>7½</td>
</tr>
<tr>
<td>7</td>
<td>10½</td>
<td>45</td>
<td>9½</td>
</tr>
<tr>
<td>8</td>
<td>11½</td>
<td>50</td>
<td>11½</td>
</tr>
<tr>
<td>9</td>
<td>13</td>
<td>55</td>
<td>13½</td>
</tr>
<tr>
<td>10</td>
<td>14½</td>
<td>60</td>
<td>15½</td>
</tr>
<tr>
<td>11</td>
<td>15½</td>
<td>65</td>
<td>17½</td>
</tr>
<tr>
<td>12</td>
<td>16½</td>
<td>68</td>
<td>18½</td>
</tr>
<tr>
<td>13</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Transistor Voltage Data

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Collector</th>
<th>Base</th>
<th>Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT1</td>
<td>6‘75 (8‘7)</td>
<td>15‘4</td>
<td>16‘1 (13‘4)</td>
</tr>
<tr>
<td>VT2</td>
<td>0</td>
<td>13‘9</td>
<td>14‘7</td>
</tr>
<tr>
<td>VT3</td>
<td>0</td>
<td>14‘4</td>
<td>15‘2</td>
</tr>
<tr>
<td>VT4</td>
<td>9‘0 (3‘0)</td>
<td>9‘3</td>
<td>10‘4 (15‘25)</td>
</tr>
<tr>
<td>VT5</td>
<td>17‘5 (3‘15)</td>
<td>16‘74</td>
<td>17‘6 (17‘75)</td>
</tr>
<tr>
<td>VT6</td>
<td>0</td>
<td>14‘25</td>
<td>15‘5</td>
</tr>
<tr>
<td>VT7</td>
<td>0‘5</td>
<td>14‘0</td>
<td>14‘7</td>
</tr>
</tbody>
</table>

Pin “D” 12‘0 (3‘4)
Pin “E” 12‘9 (4‘3)
Pin “F” 18‘0

All the above voltage readings are negative with respect to chassis and taken with AVO model 8, no-signal input, SW2 in "405" position with pre-set contrast at maximum gain. Readings in brackets are those which differ when the pre-set contrast is set for minimum gain.

Circuit Variations: During the early stages of production a certain number of component values were changed. The current values only are shown on the circuits and the original values are listed below for information: R6—1K5; R112—47K; R113—50K; C110—270 pF.; R140—120K; R141—22K; R146—1K.

Voltage and Waveform Analysis Conditions: 1. With signal input, volume control at minimum all other controls set for normal operation.
2. Volt-meter sensitivity 20,000 Ω/v Avometer Model No. 8. Electrostatic volt-meter used for E.H.T. voltages. 3. Waveforms taken with Cossor 1035 Mk. 2 oscilloscope E.H.T. voltage at zero beam current. All voltage readings taken with receiver on 240 V.A.C. Voltages shown in brackets are for 405-line operation.

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(W13a) CIRCUIT DIAGRAM WITH VOLTAGE AND WAVEFORM ANALYSIS—MODEL TV95 (PART)

625-Line System: Switches in position "a" as illustrated.
405-Line System: Switches in position "b".

---
- I.F. printed panel limits
- T.B. printed panel limits.
(W13b) Circuit Diagram with Voltage and Waveform Analysis—Model TV95 (Part)

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(W13c) CIRCUIT DIAGRAM WITH VOLTAGE AND WAVEFORM ANALYSIS—MODEL TV95 (CONTINUED) In later models C75 is 0.1 µF. R156 is 560k.
(W17) Modifications for Power Supplies—Models TV96–100

Centre right: (W18) Modifications for Brightness Circuit

(W15) Sound Output Unit
A 47k resistor is added between V 15 socket (pin 6) and chassis in later models.
Circuit Notes: All resistors \( \frac{1}{2} \) W 10 per cent, unless otherwise stated. All capacitors \( 350 \geq 20 \) per cent, unless otherwise stated. All potentiometers linear unless otherwise stated. SW2 A—G ganged to SW4 A—K and mechanically coupled to tuner channel selector. C66—C67—C86—C101 in one container. R66—R69 on same former. SW1 ganged to R84.
EKCO  Models T500, T510, T511, T512, T513, TC501 and TC502

**General Description:** These models are electrically similar to the Pye '67 Chassis. Reference should be made to this information which is given elsewhere in this volume.

**Cathode Ray Tube Type Variations**
- **T510, T511:** 19 in. A47-14W; 23 in. A59-15W.
- **T512, T513:** 19 in. A47/26W or C47/10R; 23 in. A59/23W or C59/10R.

FERGUSON  Model 3646

**General Description:** This model employs tuners and chassis adapted from the B.R.C. 1400 Series described in this volume.
- **V.H.F. Tuner:** Type 1516.
- **U.H.F. Tuner:** Type T8.
- **C.R.T.:** 19 in. Rimguard. CME 1907/A47-25W/S.
- **Dismantling:** Remove cabinet back (5 screws). Release chassis from right-hand mounting brackets (2 screws). The chassis can be hinged open or lifted off its hinges for complete accessibility as described in the 1400 Series.

FERRANTI  Models T1164, T1165, TC1157, TC1159, TC1160 and TC1163

**General Description:** These models are electronically similar to the Pye '67 Chassis. Reference should be made to this information which is given elsewhere in this volume.

**Cathode Ray Tube Variations:** 19 in. A47-14W; 23 in. A59-15W; 25 in. A65-11W.
H.M.V.

Model 2631

**General Description:** 1. Model 2631 employs a special 20 kV. version of the 950 Series "TV only" chassis. 2. A modified jellypot line output transformer is fitted, together with a rectifier assembly which functions as a voltage trebler to provide 20 kV. of E.H.T. 3. A pulse derived from the anode circuit of the line output valve V11 is applied to the rectifier and voltage trebler circuit formed by W11a-e and C127-C130. The basic principle is that of a Cockcroft Walton multiplier. To avoid earth connections in the circuit the aquadag coating of the C.R.T. is used as a reservoir capacitor which charges up through series capacitors C129 and C127. 4. The frame output transformer is especially wound to provide the extra scanning power required. Component differences are detailed below.

**Note:** The Thorn 950 Series is described on page 482 in the 1966-67 volume.

**Component Differences:** The following differences should be observed when reading the 950 Series data: 1. C95 from 25 pF. to 11 pF., 350 volts, Part No. 5M92. 2. C97 from 300 pF. to 450 pF., Part No. 1M19. 3. C115 and L39 deleted, also the C.R.T. grid screen is not fitted. 4. C127-C130, 500 pF., 8 kV., added, part of E.H.T. trebler circuit. 5. C131, 220 pF., 5 per cent., 8 kV., shunt capacitor added, Part No. 6M24. 6. R112 from 360 ohm to 270 ohm, Part No. 9A49. 7. R126 from 220 kΩ to 470 kΩ, Part No. 9A50. 8. T3, Frame output transformer, Part No. oD3-012. 9. T4, Line output transformer, Part No. oD4-043. 10. W11A-E, Selenium E.H.T. rectifier assembly and part of E.H.T. trebler circuit. 11. Main printed board assembly, Part No. oV6-045/12. 12. Flywheel printed board assembly, Part No. oV6-0831/1.

Items 4 and 10 have regard to the Complete tray assembly, Part No. oM3-700.

V.H.F. Tuner: Type 1700.

U.H.F. Tuner: Type UHFT4.


H.M.V.

Model 2636

**General Description:** This model employs tuners and chassis adapted from the B.R.C. 970 Series which is described in this volume.
**H.M.V.**

**Model 2637**

**General Description:** This model employs tuners and chassis adapted from the Thorn 950 Mk. II Series described on page 509 in the 1967–68 volume.

- **V.H.F. Tuner:** Type 1500.
- **U.H.F. Tuner:** Type 050.
- **C.R.T. Assembly:** 23 in. C.R.T. CME2303/AW59–91. PVC implosion guard (pre-stretched).

**Dismantling:** Remove cabinet back (two screws). Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.

---

**H.M.V.**

**Model 2639**

**General Description:** This receiver employs tuners and chassis adapted from the B.R.C. 1400 Series described in this volume.

- **V.H.F. Tuner:** Type 1516.
- **U.H.F. Tuner:** Type T8.
- **C.R.T.:** 19 in. Rimguard CME 1907/A47–25W/S.

**Dismantling:** Remove cabinet back (6 screws). Release chassis from right-hand mounting brackets (2 screws). The chassis can be hinged open or lifted off its hinges for complete accessibility as described in the 1400 Series.

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**K.B.**

**Models KVO13, KVI13, KVO14 and KVI14**

**General Description:** All these models employ the S.T.C. Chassis type VC4 described in the 1967–68 volume.

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**K.B.**

**Models KVO24, KVO25, KVI24 and KVI25**

**General Description:** All these models employ the S.T.C. Chassis VC51 and VC51/1 described in this volume.
MARCONIPHONE

MARCONIPHONE

Model 4615

General Description: This receiver employs tuners and chassis adapted from the Thorn 950 Mk. II Series described on page 509 in the 1967-68 volume.

V.H.F. Tuner: Type 1500.
U.H.F. Turner: Type 050.


Dismantling: Remove cabinet back (two screws). Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.

MARCONIPHONE

Model 4619

General Description: This model is fitted with a chassis basically similar to the 950 Mk. II Series except for the following modifications (see note below): Mechanically operated system switch, mains dropper power supply circuit with series diode rectifier in the heater supply. Also in later production chassis the frame output (V8B) is negatively biased from the heater line at the junction on the C.R.T. and V7 heaters. Under this arrangement, failure of the heater diode will be indicated by loss of vertical hold. A shorting link is provided for the outer section of the mains dropper (R150) for operation on A.C. mains supplies below 220 volts.

Note: To identify later production chassis, check for absence of C89 and R112, the bias components for V8B—see 1967-68 volume page 509.

V.H.F. Tuner: Type 1500.
U.H.F. Tuner: Type 050.

C.R.T. Assembly: 19 in. C.R.T. Rimguard Mk. II. CME-1907/A47-25W/S.

Dismantling: Remove cabinet back (two screws). Disengage system switch link by lifting off spring. Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.
Philips Models GI9T21OA, GI9T2IIA, G23T21OA and G23T2IIA

General Description: These receivers are dual standard 405/625-line, printed circuit hybrid models employing eleven transistors and seven semiconductor diodes in the tuner and I.F. amplifiers and nine valves and two semiconductor rectifiers in the time bases, output stages and power supplies. The integrated V.H.F./U.H.F. tuner is operated by six push-buttons which can be set to select any channel on 405- or 625-lines. The system switch is solenoid operated and is actuated by a micro-switch on the tuner. To facilitate servicing the chassis is located on two spigots in the base of the cabinet and is secured by a single fixing screw at the top. The connecting leads are sufficiently long to enable the receiver to be operated with the chassis withdrawn from the cabinet and socket connectors are fitted to the tuner and deflection coils.

Circuit Protectors:

<table>
<thead>
<tr>
<th>Fuses</th>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS1551</td>
<td>Thermal</td>
<td>Main H.T. supply</td>
</tr>
<tr>
<td>FS1571</td>
<td>1.5A</td>
<td>Mains supply</td>
</tr>
<tr>
<td>FS1572</td>
<td>1.0A</td>
<td>Solenoid switching</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drop-off resistors</th>
<th>Value</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>R4036</td>
<td>560 ohms</td>
<td>Field output stage</td>
</tr>
<tr>
<td>R4037</td>
<td>560 ohms</td>
<td></td>
</tr>
<tr>
<td>R4050</td>
<td>1800 ohms</td>
<td>Video output stage</td>
</tr>
<tr>
<td>R4051</td>
<td>1800 ohms</td>
<td></td>
</tr>
<tr>
<td>R4052</td>
<td>100 ohms</td>
<td>Audio output stage</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Safety resistors</th>
<th>Value</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1547</td>
<td>1000 ohms</td>
<td>Audio amplifier H.T. supply</td>
</tr>
<tr>
<td>R2145</td>
<td>2200 ohms</td>
<td>Line oscillator H.T. supply</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Spark gap</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>SG1560</td>
<td>C.R.T. base connector</td>
</tr>
<tr>
<td>E.H.T.</td>
<td>18 kV. stabilised</td>
</tr>
</tbody>
</table>

Specially Mounted Components: The following information relates to the replacement of certain components; it is very important that the methods described below are followed.

Safety Resistors R1547 and R2145: Safety resistors R1547 and R2145 are designed to act as fuses when their rated dissipation is exceeded. In the event of a fault causing either of these resistors to become open circuit it must be replaced with the correct type and in the case of R2145 spaced approximately ½ in. away from the panel by crimping the connecting wires.
Ballast Resistors: During manufacture, a high melting point solder is employed on all connections to the power supply ballast resistors R1542/R1543 and R1541/R1544/R1545. It is most important that this grade of solder (e.g. Ersin Cosmol Alloy) is used with a high temperature iron if these components are replaced, and that the component connection tags are positioned horizontally and point towards the rear of the receiver.

NOTE: In sets fitted with vision detector unit code no. 3113108, 21940, L2682 is omitted and R2662 and C2650 are replaced by R2125 and C2040. For circuit and print details see provisional service manual AES-641.
**PHILIPS**

**Thermal Fuse:** A thermal fuse (FS1551) in the form of a wire spring is soldered adjacent to R1542 on the H.T. supply ballast resistor. Excessive heat dissipation will cause the solder to melt and the fuse will spring free. The spring must be refitted using "60/40" solder.

**Drop-off Resistors:** R4036, R4037, R4050, R4051 and R4052 are spaced from the printed panel on stand-off solder tags. Should one of these resistors

(W84b) Circuit Diagram (Part)

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overheat for any reason, such as an inter-electrode short-circuit occurring in a valve, the solder on the tags will melt, allowing the component to fall away. This provides a degree of protection to the printed panels and other circuitry. Replacements should be made with Dubilier type BTA 1W resistors, using ordinary "60/40" resin cored solder. The resistors must be mounted on the underside of the soldered tags, with the connecting wires placed straight under the tags and not wrapped around them.

\[ \text{WB4c) Circuit Diagram (Part) 568} \]
**Receiver Notes**

**Warning:** Integrated Tuner: Service engineers are advised not to attempt to service the integrated tuner, push-button assembly and A.G.C. panel. Tuner assemblies requiring service should be returned complete with all connecting leads, except those to the micro-switch, to C.E.S. Ltd.

**Special Trimming Tool:** A special star-shaped trimming tool is necessary for the alignment of the tuner I.F. coil. This tool is available as part of...
TELEVISION SERVICING

(W84e) Circuit Diagram—Models G19T210A, G19T211A, G23T210A, G23T211A

(CONTINUED)
PHILIPS

the trimming tool kit 800/TX and engineers are advised that attempts to adjust this core with non-standard tools may result in damage to the core.

Adjustments

**Tuner Push-Buttons:** Depress the appropriate push-button for the band and system being used until it locks in, then without further pressure, slowly rotate to tune in the desired channel. The tuner switching can be set for any combination of band and system in the following way. With all the push-buttons in the unlatched position, depress the appropriate plastic knob at the rear of the tuner and rotate until the arrow on the rear of the knob lines up with the required band and system. A label which is attached to the rear of the tuner will assist in this setting-up procedure.

**Release of Tuner Push-Buttons:** In the event that the six push-buttons have been accidently pressed in simultaneously, they may be released by pressing in the third button from the top (B.B.C.2) still further.

**Line-Hold Pre-set (R2155):** A pre-set line-hold control is provided to balance the setting of the main line-hold control for both systems. To
adjust, switch to 625-lines and lock the picture using the main hold control, then switch to 405 lines and lock the picture by adjusting R2155.

**Line Stabilisation/Width (R2170, R2171):** Great care must be taken when making this adjustment as high voltages exist at this point.

Correct adjustment of the 405- and 625-line stabilising controls automatically sets the picture width. Lock the raster and turn the brightness control to minimum. Connect a high impedance D.C. volt-meter between the boost test point (junction of R2165/R2175, indicated by a red disc) and chassis. Adjust R2170 and R2171 accurately to give a meter reading of 930 volts on 625 and 405 line respectively.

**Tuner A.G.C. Control (R3485):** R3485 is adjusted in the factory and its setting should not be altered. If, however, it has been disturbed, proceed

---

### Coil Resistances

<table>
<thead>
<tr>
<th>№</th>
<th>Value (n)</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>L5020</td>
<td>&lt;1</td>
<td>A-B</td>
</tr>
<tr>
<td>L5021</td>
<td>&lt;1</td>
<td>B-C</td>
</tr>
<tr>
<td>L5022</td>
<td>1</td>
<td>D-E</td>
</tr>
<tr>
<td>L5023</td>
<td>2-8</td>
<td>E-F</td>
</tr>
<tr>
<td>L5024</td>
<td>3-8</td>
<td>G-H</td>
</tr>
<tr>
<td>L5025</td>
<td>25</td>
<td>H-J</td>
</tr>
<tr>
<td>L5026</td>
<td>6-7</td>
<td>J-K</td>
</tr>
<tr>
<td>L5027</td>
<td>370</td>
<td>K-L</td>
</tr>
<tr>
<td>L5028</td>
<td>&lt;1</td>
<td>M-N</td>
</tr>
</tbody>
</table>

---

(W92) **Line Output Transformer**

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as follows: Switch the tuner to any blank channel. Connect a variable D.C. supply to the junction of X2192 and R2118 and adjust its output to 3.8 volts. Connect a high impedance volt-meter across R3482 and adjust R3485 to give a reading of 3.5 volts.

Voltage waveforms peak to peak taken on Philips PM3230 oscilloscope using high impedance probe.
TELEVISION SERVICING

PYE Models 48, 49, 53, 60 and 61 ('67 Chassis)

General Description: These models incorporate the Pye "Group '67 Chassis", which employs the "Multi-band" silicon tuner and separate I.F. panel. The circuit is designed for use on an A.C. supply of 200/250 volts. Note: Some early models are suitable for 210/250-volt operation only (see inset at left-hand side of circuit diagram). Under no circumstances connect to a D.C. supply or serious damage will result.

Circuit Notes and Component Variations

Models 60 and 61: 19 in. A47/26W or C47/10R; 23 in. A59/23W or C59/10R.

During the early stages of production a certain number of component values were changed. The current values only are shown on the circuit, and the original values are listed for information: R5-2K2 (fixed); R13-4K7; R14-1K; R24-560Ω; R36-1K; R44-820Ω; C40-47 pF.; C74-0.01 μF.; R6A- not fitted.

In addition, Link "A" in the base of the 1st. Vision I.F. (VT1) has now been moved to the opposite side of C7. It is in fact a double link, connecting C7 separately to the junctions C4/C6 and L2B/R4.

Three further changes which do not appear on the circuit are being made, as follows: R103 (470Ω) rating raised to 3W. R112 and R113 (Vertical hold control) increased to 10k. In later models the following component values apply: R6 1k 2; R140 100k; R141 18k; R146 10k; R156 560k 1W; C110 470 pF. Mica. In some chassis VT7 may be type BF 185.

Adjustments: The Horizontal Linearity control (L32) is located on the front of the timebase panel. Adjust the round magnet up or down the former until the first 30 per cent. of scan is equal to the last 30 per cent. of scan.

* Set Width (625 and 405): Ensure first that the horizontal linearity adjustment has been correctly carried out. Adjust appropriate line system slider control commencing from minimum scan and advancing to the point where scan ceases to increase. Move slider in reverse direction to the correct amplitude setting.

Vertical Scan Equalising: 1. Ascertain which line system has the highest boost voltage (SW4G c). 2. Plug fly-lead (frame oscillator feed) on to the appropriate tag for the system with the highest boost voltage, i.e. tag 50 (625) or tag 49 (405). 3. Equalise frame scans with pre-set control R157.

* It is recommended that 30 minutes heating up on normal operation be allowed before making amplitude or linearity adjustments. If not, then the amplitude controls should be adjusted to give a small additional vertical and horizontal overscan to that for correct setting.

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**Picture Centring:** Picture centring is effected by the two magnets (M1, M2) situated on the rear of the deflector coils. Rotate the magnets independently until the picture is correctly positioned on the screen.

**Focus:** Optimum focus is obtained by connecting the blue jumper lead from pin 4 of the C.R. tube to the appropriate tag on the Spark Protection Card Assy.

* **Pre-set Contrast (625 and 405):** These controls should be set so that the D.C. volts developed across R20, with an input signal greater than 1 mV., are 1.8 volts (405) and 2.9 volts (625). Slight readjustment should then be made as necessary to give equal contrasts on both systems.

**Note:** Cross-modulation problems on strong signals may result if the control settings are too high.

**Mechanical Data:** After switching the receiver off, the final anode connected on the glass bulb of the C.R. tube should be short-circuited to chassis before any work is carried out.

---

**To Lower Chassis:** Remove back cover. Remove the two top chassis fixing screws. The chassis may now be lowered to the horizontal position to enable normal service to be carried out.

**Chassis Removal:** Raise the chassis (approximately to the halfway position) until the slots in the cabinet hinge brackets permit the chassis to be withdrawn. If it should be desired to completely detach the chassis, e.g. for cabinet replacement, it will be necessary to remove the front control panel, unplug or unsolder deflector coils, disconnect the tuner 3-pin plug sockets and the C.R. tube; also the blue and red leads on the sound output transformer.

**L.O.P.T. Assembly Removal:** Lower chassis. Unplug E.H.T. cavity connector, the two valve top cap connectors and fly-leads from L.O.P.T. to terminating posts on timebase panel. Remove the self-tapping screw and washer and carefully withdraw L.O.P.T., at the same time releasing the E.H.T. lead retaining grommet.

**L.O.P.T. Assembly Replacement:** Reverse above procedures, ensuring that the coloured leads to the timebase panel are replaced as follows: White—V22 T.C., Black—V21 T.C., Brown—Pin 55, Blue—Pin 57, Orange—Pin 58, Green—Pin 59, Yellow—Pin 60, Red (inc. C121)—Pin 64.

* This control is factory pre-set and will not normally require adjustment.
To Disconnect C.R. Tube: Lower chassis. Release aquadag earthing strap and disconnect spark protection card assembly. Pull off E.H.T. cavity connector and C.R.T. base connector; also unplug or unsolder deflector coils.
To Detach I.F. Panel: Remove 4-pin and two 3-pin plug sockets. Slacken the two Philips self-tapping screws on the right-hand side and carefully disengage system switch link.

Bowden Cable: When it becomes necessary to detach the tuner from the

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chassis, the method used will depend on whether the cable outer is (a) clamped to the cable adjuster bracket on the chassis, or (b) simply held in position by a spring clip.

In the case of (a) the cable should be detached at the tuner end, by prising
the outer from its retaining bracket (or removing two s/t. screws on retainer bracket). For (b) the cable should be detached at the chassis end, by releasing the spring clip, slackening the s/t. screw holding the cable inner retainer, pushing it aside and then unhooking the inner cable from the switch plate.

(W110) D.C. Resistance and Connections of Windings
In either case, do NOT disturb the cable adjuster bracket screw on the chassis, which is sealed with a blob of red paint.

In the unlikely event of a replacement cable being required, however, proceed as follows: 1. Remove faulty cable and fit replacement to tuner. 2. With tuner and timebase system switch in "405" position, slacken off cable adjuster bracket screw and hook inner cable into hole "A" (push-button tuners) or into hole "B" (rotary tuners). 3. Fit outer cable to cable adjuster bracket and tighten screw; then replace cable inner retainer.

Circuit Diagram Notes

Voltage and Waveform Analysis Conditions: With signal input, volume control at minimum all other controls set for normal operation. Voltmeter sensitivity 20,000 Ω/v Avometer model No. 8. Electrostatic volt-meter used for E.H.T. voltages. Waveforms taken with Cossor 1035 Mk. 2. Oscilloscope E.H.T. voltage at zero beam current. All voltage readings taken with receiver on 240 v.a.c. Voltages shown in brackets are for 405-line operation.


Circuit Notes: All resistors $\frac{1}{4}$ W. 10 per cent. unless otherwise stated. All capacitors 350 volts $\geq$ 20 per cent. unless otherwise stated. All potentiometers linear unless otherwise stated. SW2 A–G ganged to SW4 A–K and mechanically coupled to tuner channel selector. C66–C67–C86–C101 in one container. R66–R69 on same former. SW1 ganged to R84.

Frame Equalisation: Ascertain the system with the highest boost voltage (SW4Gc) plug ply-lead (frame osc. feed) on to the appropriate tag for the system with the highest boost voltage i.e. tag 50 (625), tag 49 (405). Equalise frame scans with pre-set control R157.

Transistor Voltage Data

<table>
<thead>
<tr>
<th>Code No.</th>
<th>Collector</th>
<th>Base</th>
<th>Emitter</th>
</tr>
</thead>
<tbody>
<tr>
<td>VT1</td>
<td>6.75</td>
<td>15.4</td>
<td>16.1</td>
</tr>
<tr>
<td>VT2</td>
<td>0</td>
<td>13.9</td>
<td>14.7</td>
</tr>
<tr>
<td>VT3</td>
<td>0</td>
<td>14.4</td>
<td>15.2</td>
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<tr>
<td>VT4</td>
<td>9.0</td>
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<td>10.4</td>
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<td>VT5</td>
<td>17.5</td>
<td>16.74</td>
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<td>0</td>
<td>14.25</td>
<td>15.5</td>
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<tr>
<td>VT7</td>
<td>0.5</td>
<td>14.0</td>
<td>14.7</td>
</tr>
<tr>
<td>Pin &quot;D&quot;</td>
<td></td>
<td>12.0</td>
<td>(3.4)</td>
</tr>
<tr>
<td>Pin &quot;E&quot;</td>
<td></td>
<td>12.9</td>
<td>(4.3)</td>
</tr>
<tr>
<td>Pin &quot;F&quot;</td>
<td></td>
<td>18.0</td>
<td></td>
</tr>
</tbody>
</table>

All the above voltage readings are negative with respect to chassis and taken with AVO model 8, no signal input, SW2 in "405" position with pre-set contrast at maximum gain. Readings in brackets are those which differ when the pre-set contrast is set for minimum gain.
(W105) “Multi-band” Tuner Circuit Diagram
In early panels coded 'V', 'VA', 'V8' & 'VC' certain variations applied; these included—
C78 fitted to copper side
C81 mounted on panel
C116A and R155A mounted on chassis side member

(W107) TIMEBASE PANEL
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(W108) I.F. PANEL DETAILS

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Above: (W109a) Chassis Rear View—Pye '67 Chassis

Below: (W109b) Chassis View (Lowered Position)
R.G.D. Models RV213, RV313, RV214 and RV314

**General Description:** All these models employ the S.T.C. Chassis type VC4 described in the 1967-68 volume.

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R.G.D. Models RV224, RV225 and RV235

**General Description:** All these models employ the S.T.C. Chassis VC51 and VC51/1 described in the following pages.

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S.T.C. Television Chassis Type VC51

**General Description:** Dual-standard chassis supplied with or without U.H.F. tuner. Similar to VC4 chassis described in the 1967-68 volume.

The V.H.F. tuner is a conventional type giving 13 positions. The coils are loaded in non-sequential order to give adjacent Band I and Band III positions in most areas. Each pair of aerial and oscillator coils in the V.H.F. tuner are mounted on a single biscuit, and are easily exchanged after first removing the tuner unit cover plate. The V.H.F. tuner valves are PC97 (Neutrode R.F. Amplifier) and PCF805 (Mixer Oscillator). H.T. supplies for the U.H.F. tuner are obtained from a plug and socket mounted on the side of the V.H.F. tuner.

The I.F. output from the U.H.F. unit is also connected to this plug and socket and applies the signal to the grid of the mixer section of the PCF805 (V.H.F. Tuner) via a balanced bridge which prevents interaction between the two circuits. This arrangement gives satisfactory U.H.F. operation irrespective of the position of the V.H.F. Channel Selector, and provides an additional stage of I.F. amplification on U.H.F. and enables selection of U.H.F. signals to be combined with the system switch.

When the system switch is in the 405-line position the H.T. supply to the U.H.F. tuner is disconnected, and when the switch is in the 625 position, H.T. supply is connected to the U.H.F. tuner and disconnected from the neutrode amplifier and oscillator section of PCF805 in the V.H.F. tuner leaving the pentode section of this valve in operation as on I.F. amplifier.

**A.G.C. Pre-set:** R77 should be adjusted for an optimum position where all obtainable channels are received at the lowest noise level attainable without introducing intermodulation.
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**PT.NO.8/533 MAINS TAPPING ADJUSTMENTS**

<table>
<thead>
<tr>
<th>Supply Voltage</th>
<th>Red Lead</th>
<th>Brown Lead</th>
<th>White Lead</th>
</tr>
</thead>
<tbody>
<tr>
<td>240v</td>
<td>A</td>
<td>H</td>
<td>E</td>
</tr>
<tr>
<td>210v</td>
<td>B</td>
<td>G</td>
<td>E</td>
</tr>
</tbody>
</table>

**DEFFLECTOR COIL LEAD CONNECTIONS**

- White
- Polythene
- Black
- Brown

**DEFLECTOR COIL PLASTIC MOULDING**

- Copper in Linearity Sleeve
- Specified Gap 1.5 mm.

**(H48) LAY-OUT OF CONTROLS**

**Width**: Separate width adjustment is provided for 405 and 625 systems by means of their respective pre-sets R154 and R153.

**Linearity**: Vertical linearity is achieved by two pre-sets, R96 controlling the top of the raster, and R93 the bottom. Horizontal linearity is achieved by sliding the paper sleeve, incorporating a shorted turn along the tube neck, and then readjusting the width controls.

**Focus**: Focus is obtained by varying the voltage applied to the third anode of the tube by means of R157.

**U.H.F. To V.H.F. Translation**: To modify this chassis to operate in the V.H.F. bands when switched to 625-line standards it is necessary to ensure that the H.T. supply remains connected to the neutrode amplifier and oscillator section of the V.H.F. tuner. This can easily be carried out by linking section S.9 of the system switch. It may also be necessary to fit a wide band biscuit to cover the appropriate V.H.F. band, and these are available from the spares department. When ordering it is essential to quote the vision and sound frequencies of the translated signal. The U.H.F. tuner should be rendered inoperative by disconnecting the socket from the side of the V.H.F. tuner.

**(H49) LINE LINEARITY DIAGRAM**
Circuit Description (Common I.F. Amp.): Coupling between the tuner unit and the common I.F. amplifier stage is achieved by means of a band pass filter consisting of a coil in the anode of V2 and L32 in the grid circuit of V5, the degree of coupling being determined by the capacity to chassis of the screened lead connecting the tuner to the amplifier together with C33. Also between the tuner unit and V5 is located an adjacent channel trap (C31, C32, L31) tuned to reject 41.5 Mc/s. which is the adjacent sound carrier for the 625 system. The basic interstage coupling between V5 and V6 is achieved by a double tuned circuit L34 and L39. Band defining filters are then selected by the system switch as follows:

405 System: 1. Rejector circuit 38.15 Mc/s., the accompanying sound frequency L36, C43, C47. 2. Rejector circuit 39.65 Mc/s., the adjacent vision carrier L37, C48. 3. Rejector circuit 33.15 Mc/s., the adjacent sound carrier L40, C50, C51. These three circuits limit the response of the I.F. signal on 405-line system to a bandwidth of 3 Mc/s. before passing to the grid of V6.

Left: (H51) I.F. Coil Assembly Viewed from Underside of Chassis
Right: (H52) Discriminator Transformer Viewed from Underside of Chassis
**TELEVISION SERVICING**

**625 System:** Trap circuit 33.5 Mc/s., the accompanying sound frequency L35, C42, C45. All these defining filters are switched into circuit by contacts S2 and S3 of the system switch. The remaining tuned circuit in the I.F. amplifier is the single tuned circuit in the anode of V6 (L41, L42) which feeds direct to the detector diode.

**Circuit Description (Detector and Video Amp.):** The detector circuit is of conventional design using a CG64H germanium diode, but as on the 625-line system, negative modulation is used as opposed to positive modulation for 405-lines, it is necessary to switch the polarity of the detector, this is achieved by contacts S5 and S6 on the system switch. On 625-lines the grid of the video amplifier V7 is A.C. coupled, but on 405-lines is directly coupled to the vision detector, from which it derives the positive drive.

This necessitates increasing the cathode bias on 405-lines and is achieved by switch S11 and R55, additional to the normal bias from R54. Trap circuits are also employed in the video amplifier anode and cathode circuits to reject the difference frequency beat that occurs on the detector. L49 and C65 for 405-lines rejecting at 3.5 Mc/s., and L48 and C67 on 625-lines rejecting at 6.0 Mc/s. The video signal is A.C. coupled from the video amplifier anode to the cathode of the cathode-ray tube.

**Circuit Description (405-Line Sound):** The signal is fed through a common I.F. amplifier and the output is taken via C38 at 38.15 Mc/s., the voltage being developed across the tuned circuit L54, C86, and applied to the grid of V10. The grid of this valve is supplied with A.G.C. the negative
voltage being derived from the detector diode and fed via R109. In the anode circuit of V10 is the double tuned circuit L59, L60, together with the OA81 germanium diode detector. The detector signal is fed via a noise limiter diode and C102, back through the F.M. discriminator and then on to the volume control and is then applied to the conventional two stage L.F. amplifier (V11 PCL86) with fixed tone correction (C106) applied to the grid of the pentode.

**Circuit Description (625-Line Sound):** On the 625-line transmission the sound carrier is frequency modulated (F.M.) and the method used to derive the sound I.F. is known as the intercarrier system. This is achieved by permitting a small proportion of the sound carrier at I.F. frequency (33.5 Mc/s.) to pass through the vision I.F. amplifier, on reaching the vision...
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detector stage the diode acting as a form of mixer produces through the mixing of the vision and sound carriers, a difference frequency of 6 Mc/s. which carries the F.M. sound modulation and the A.M. vision modulation. These signals are then fed to the video stage and the 6 Mc/s. F.M./I.F. signal is developed across L48 and C67 and fed via C63 to the tuned circuit L55 together with the capacity of the screened cable and the valve input capacity. The voltage developed across the tuned circuit is passed to the grid of V10 via C88 and S1. In the anode circuit of V10 is the discriminator tuned circuit L56 incorporating a ratio detector. The amplitude modulation is removed in the F.M. detector circuit by means of the normal limiting action of the ratio detector. The audio signal is fed via R113 to the volume control, the return path being via the A.M. noise limiter D4 and the A.M. detector load R108, the audio then continues on to the L.F. amplifier.

Circuit Description (Sync. Separator): The sync. separator uses the pentode section of a PCF80 (V8) in a conventional sync. limiter circuit. The vertical sync. pulse is fed via a cathode driven vertical sync. amplifier PCL84 (V7) to the grid of the vertical scan oscillator. The line synchronising

(H56) V.H.F. TUNER—Top View

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A — TOP CAP OF VI3
B — CI31 (VIOLET)
C — JUNCTION OF CI35 AND R139 (WHITE)
D — TOP CAP OF VI4
E — HORIZONTAL DEFLECTOR COILS (POLYTHENE)
F — CI33 (POLYTHENE)
G — JUNCTION OF CI34 AND R156 (ORANGE)

Connections to Line Output Transformer

Deflector Coil Connections

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pulses are fed via C71 to the “two-diode” A.F.C. circuit comprising 2 × OA81.

Circuit Description (A.F.C. Circuit): The line sync. pulses are clamped by the diode OA81 (D7) to a variable potential which serves as the common line hold control. Reference pulses from the line output transformer, suitably attenuated, are D.C. restored by diode OA81 (D8) to produce the controlling potential which is filtered and fed to the control grid of the horizontal oscillator. The degree of D.C. restoration of the reference pulse is determined by the gating action of the respective pulses applied to the anode and cathode of D8.

Circuit Description (Line Oscillator): The horizontal oscillator is a sine wave generator oscillating between the control grid and screen grid of the pentode section of the PCF802. The nominal frequency is determined by the tuned circuit of L63, the required capacity being selected by switch S14. Small changes of the frequency are determined by the degree of conduction of the triode section of the PCF802 which is connected as a capacitative reactance valve in parallel with the coil L63. The grid of this triode has the filtered control voltage from the A.F.C. circuit connected to it. The anode circuit of the pentode section has a switched pulse shaping circuit and is A.C. coupled by C126 to the grid of the horizontal output valve (V14, PL36).

Circuit Description (Line Deflection Circuit): In a stabilised line deflection circuit the performance is practically unaffected by mains variations and spread or deviation of the line output valve. In the circuit, advantage is taken of the rectifying action resulting from the curvature of the characteristic of a V.D.R. in order to derive a negative bias for the line output valve (PL36) from the amplitude of the flyback pulse. From the slider of the appropriate width pre-set, via R148 and R149, a direct current flows through the V.D.R. which fixes the working point of the latter. On this direct current is superimposed a pulsating current which is derived from the flyback pulse via C133. Due to the presence of R142 and the coupling capacitor C126, the resulting pulsating voltage across the V.D.R. is converted into a direct voltage which controls the bias of the line output valve. The direct voltage is determined by the mean value of the voltage across the V.D.R. which is highly dependent on the amplitude of the flyback pulse.

Circuit Description (Vertical Scanning): A cathode coupled multivibrator is used as a vertical oscillator and employs the triode sections of V8 and V9. The pentode section of V9 is used as the frame output amplifier and correct linearity is ensured by R93 and R96 in the coupling circuit. The vertical deflector coils are connected in series and a thermistor is placed in series with the deflectors to ensure the stability of height and linearity with temperature changes.

Circuit Description (Power Supply): A silicon diode is used to supply the H.T. line and a capacitor (C144) is wired in parallel with the diode to prevent build up of any high reverse voltage across the diode due to high
S.T.C.
voltage pulses on the H.T. line or mains supply. On the VC51/1 chassis, two thermistors (VA1015 R164) and (VA1015 R172) are connected in series with the heater chain to protect the dial lamps from current surge when the set is switched on. A mains dropping resistance provides facilities for operating between 210 and 240 volts.

Coil and Transformer Data: All the coils and transformers not included in the following table, have a resistance less than 1 ohm.

<table>
<thead>
<tr>
<th>Circuit Ref. No.</th>
<th>Function</th>
<th>Approximate ohms</th>
</tr>
</thead>
<tbody>
<tr>
<td>L42</td>
<td>Vision detector secondary</td>
<td>450</td>
</tr>
<tr>
<td>L60</td>
<td>Sound detector secondary</td>
<td>8k</td>
</tr>
<tr>
<td>L46</td>
<td>Video anode peaking inductance</td>
<td>5.5</td>
</tr>
<tr>
<td>L47</td>
<td>Video anode peaking inductance</td>
<td>4</td>
</tr>
<tr>
<td>L48</td>
<td>6 Mc/s. sound take-off (625)</td>
<td>1.8</td>
</tr>
<tr>
<td>L63</td>
<td>Line oscillator transformer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>280</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>55</td>
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<tr>
<td>L64</td>
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</tr>
<tr>
<td></td>
<td>Primary</td>
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<tr>
<td>L66</td>
<td>E.H.T. overwind</td>
<td>65</td>
</tr>
<tr>
<td>L67</td>
<td>Line deflector coils (in parallel)</td>
<td>7.5</td>
</tr>
<tr>
<td>J69, 70</td>
<td>Frame output transformer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Primary</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td>3.5</td>
</tr>
<tr>
<td>L50</td>
<td>Frame deflector coils (in series)</td>
<td>7.5</td>
</tr>
<tr>
<td>L51</td>
<td>Frame deflector coils (in series) + thermistor</td>
<td>11</td>
</tr>
<tr>
<td>L52, 53</td>
<td>Audio output transformer primary</td>
<td>450</td>
</tr>
</tbody>
</table>

Alignment (Notes): Under normal working conditions the I.F. circuits of this instrument are unlikely to need realignment. With the exception of cases where the I.F. stages are known to have been tampered with or a new I.F. coil fitted, realignment of I.F. stages should not be attempted until a thorough investigation has been carried out covering other possible causes for low gain or poor picture quality, such as: (a) inefficient aerial systems; (b) low gain tuner units; (c) A.G.C. faults; (d) faulty diode filter coil or diode detector; (e) defective video stage.

Alignment (Equipment Required): (a) Signal generator covering the frequency range 32 to 42 Mc/s. (b) A valve volt-meter capable of operating up to 6 Mc/s. (c) Wattmeter for audio measurements with an impedance of 3 ohms. (d) High impedance volt-meter for sound A.G.C. voltage measurements. (e) A.M./F.M. signal generator covering the frequency range 5 to 7 Mc/s. (f) A sweep generator covering the range 32 to 42 Mc/s., together with display equipment. (g) A biasing potential of 3 volts.

Item (f) is not essential, but is desirable if optimum results are to be obtained. Connect the volt-meter (d) across the vision diode load resistor R47
TELEVISION SERVICING

Waveforms—Taken on a 543A Tektronix Oscilloscope

(2.7 kΩ) operate at about 1 volt during alignment. The wattmeter should be connected in place of the loudspeaker and the signal generator should be connected to the valve (V2) as illustrated in the appropriate diagram.

**Dust Cores:** The dust cores of the I.F. coils on the receiver chassis should be unscrewed until just protruding from the base of the cans. In the case of cans containing two cores, the top one should be unscrewed until just protruding from the top of the can. The cores of the I.F. coils on the tuner should not be detuned.

**Alignment (Procedure):** Before commencing alignment the receiver should have been switched on for at least five minutes. 3 volts negative bias should be applied to the vision A.G.C. line at the junction of R35 and C39 (1000 pF.).

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**Alignment (Response Curves):** Connect a sweep generator (f) in place of the signal generator. Connect the display unit between the video ampli-
(H57) System Switch—Shown in 405-Line Position

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The maximumifier grid (Pin 8 of V7) and chassis. Apply a battery bias potential of -3 volts to the vision I.F. A.G.C. line. The system switch should be in the 405-line position. Check that the response of the vision I.F. agrees with the requirements of the curve shown in the appropriate diagram. Slight adjustment of L41, L42 and L42 may be necessary to achieve this response. The system switch should next be changed to the 625-line position and the response curve checked against that shown in the appropriate diagram. Slight adjustment of L38 and V.H.F. tuner I.F. may be necessary to achieve this response.

Alignment (F.M. Sound): Connect the volt-meter (d) between the wiper of the A.M. balance control (R111) and chassis. This point can be obtained by inserting a probe through hole in top of discriminator can that is available for A.M. balance control adjustment. The signal generator (e) output lead should be connected between the video amplifier grid (pin 8 of V7) and chassis. The generator must have the correct terminating resistance connected across the end of its output lead. 1. Inject an unmodulated signal of 6 Mc/s. and adjust L48 (Sound take-off coil—625) L55 (1st Sound I.F., top core) L56 (Discriminator transformer, bottom core) in that order for maximum meter deflection.

Note: L48 must be reset when receiver is operating on picture.

2. Remove meter, connect wattmeter (c) to sound output transformer secondary, and apply ±16 kc/s. deviation F.M. to signal generator. Adjust L57/L58 (Discriminator transformer, top core) for maximum audio output, setting signal input to provide a maximum output of 500 mW., volume control set at maximum. An alternative method of aligning L57/L58 is as follows: Remove meter and connect wattmeter as above. Connect high impedance Volt-meter (d) (Avometer Model 8, 2-5 volts range) to audio output point of discriminator transformer (R113). Adjust L57/L58 for zero voltage output. Remove volt-meter, apply ±16 kc/s. deviation and adjust signal input to provide an output of 500 mW., volume control set at maximum. 3. Change modulation of signal generator to 30 per cent. A.M. and adjust balance control R111 (Discriminator transformer top) for minimum audio output.

Alignment (Final): The receiver should have been switched on for at least five minutes before this alignment is started. The system switch should be in the 405-line position. A sweep generator should be connected to the aerial socket of the receiver. The display unit should be connected to the grid of the video amplifier (Pin 8 of V7). On each V.H.F. channel used the local oscillator should be adjusted so that the sound carrier marker pip appears in the bottom of the sound trap. The vision carrier should be between 5 and 7 dB down on the overall response. If a sweep generator is not available one generator tuned to the sound frequency of the channel under test should be connected to the aerial terminals and a 38-15 Mc/s. signal injected into the sound I.F. from another generator. The oscillator should be adjusted for an audible beat in a loudspeaker connected to the output.
The response and sensitivity of the receiver should be checked on all tuner positions and should appear as the I.F. response shown in the appropriate diagram, except that the vision and sound carriers will bear the frequency of the channel under test. Slight I.F. coil adjustment is permitted to

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achieve optimum results in all channels. The response may be slightly double humped, a maximum peak to valley ratio of 1 dB being permissible.

**Cathode Trap (Video):** 1. Connect valve volt-meter \((b)\) to the junction of \(L_{46}\) and \(L_{47}\) in the video stage. 2. Inject a 3.5 Mc/s. signal into the grid
of the video stage (Pin 8, V7). System Switch on 405. 3. Adjust L49 for minimum reading on the volt-meter.

Anode Trap (Video): The 3.5 Mc/s. trap can be satisfactorily aligned on 405-line picture transmission, by detuning the receiver by means of the fine tuner control, and then adjusting L49 until the 3.5 Mc/s. beat pattern (the fine dot structure) disappears. Similarly L48 may be adjusted on a 625-line picture transmission.

Line Oscillator (Setting Up Procedure): A biasing potential of 3 volts positive is required and stationary test cards of both 405 and 625 systems are necessary. 1. Switch to the 625 position. 2. Short circuit the A.F.C. circuit by connecting the junction of D7 and C109 (0.01 μF.) to pin 9 of V12 (PCF802). Connect volt-meter (d) between pin 9 of V12 and chassis. Set line-hold control so that 3 volts is indicated on meter. 3. Adjust the dust core of L63/L64 (line oscillator transformer) until a stationary picture is obtained. 4. Switch to the 405 position and check the 3-volt bias voltage. Adjust the trimming condenser C113 until a stationary picture is obtained. 5. Remove short-circuit across the A.F.C. circuit. 6. Seal the head of the screw and the washer to the trimmer blade by a neat blob of distrene or other suitable material to prevent movement after setting. 7. Adjust the common line-hold control R126 to place the movement of the picture in the centre of the pull-in range. When R126 is rotated either fully clockwise or fully anti-clockwise it may be necessary to switch the systems switch to 625 then back to 405 to disturb synchronism.

Warning: Under no circumstances should adjustment or repairs be attempted on the U.H.F. tuners, neither should the cover plate be removed for inspection.

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**STELLA**

**Model ST1100**

**General Description:** This all-transistor portable television receiver is electrically similar to the Philips Model 11TG190AT, information for which is given in the 1967-68 volume.

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**ULTRA**

**Model 6645**

**General Description:** This model employs tuners and chassis adapted from the B.R.C. 970 Series which is described in this volume.
ULTRA Model 6642

**General Description:** This model employs tuners and chassis adapted from the Thorn 950 Mk. II Series described on page 509 in the 1967–68 volume.

- **V.H.F. Tuner:** Type 1500.
- **U.H.F. Tuner:** Type 050.
- **C.R.T. Assembly:** 19 in. C.R.T. CME 1908. PVC implosion guard (pre-stretched).

**Dismantling:** Remove cabinet back (two screws). Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.

---

ULTRA Model 6643

**General Description:** This model employs tuners and chassis adapted from the Thorn 950 Mk. II Series described on page 509 in the 1967–68 volume.

- **V.H.F. Tuner:** Type 1500.
- **U.H.F. Tuner:** Type 050.
- **C.R.T. Assembly:** 23 in. C.R.T. CME2303/AW59–91. PVC implosion guard (pre-stretched).

**Dismantling:** Remove cabinet back (three screws). Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.

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ULTRA Model 6647

**General Description:** This model employs tuners and chassis adapted from the Thorn 950 Mk. II Series described on page 509 in the 1967–68 volume.

- **V.H.F. Tuner:** Type 1500.
- **U.H.F. Tuner:** Type 050.

**Dismantling:** Remove cabinet back (four screws). Remove two brass nuts securing the chassis to the slotted mounting brackets. Disengage the chassis mounting studs from the slots and withdraw the chassis from the cabinet within the limits of the interconnecting leads.
ULTRA Model 6646

General Description: This 16-in. model employs tuners and chassis adapted from the Thorn 950 Series and the Thorn 16-in. Portable, both described in the 1966-67 volume.

Note: Chassis fitted to Model 6646 incorporates a modified power supply circuit and may be identified by the presence of a tubular dropper resistor mounted to the chassis top member.


Access For Service: 1. The cabinet back cover is secured by five screws; three at the top and two at the base of the cover. When the screws are removed, the back cover may be detached and swung to one side with the aerial panel leads still connected. To disconnect the back cover completely, remove two screws securing the aerial panel to the back cover. 2. Access to the line output stage is facilitated by removing the metal screen. Remove two screws and detach the screen from its rear clip fixing. 3. The pre-set controls mounting panel (Frame Lin. and Height) can easily be detached from the chassis (one screw fixing). 4. The heat deflector (fitted under the sound output stage) can also be removed for access (one screw).
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