**Electrical Characteristics**

**AVERAGE POWER RATINGS:**

- **Line Voltage:** 117 Volts A.C.
- **Tele:** 543 Watts
- **FM:** 223 Watts
- **AM:** 160 Watts
- **Phono:** 152 Watts

**CURRENT RATINGS:**

- **Tele:** 4.90 Amperes
- **FM:** 2.02 Amperes
- **AM:** 1.46 Amperes
- **Phono:** 1.43 Amperes

**AUDIO POWER OUTPUT:**

- 8 Watts undistorted

**RF FREQUENCY RANGE:**

- 44 to 216 MC continuous tuning covering 13 television channels and the FM band
- Input impedance: 72 OHMS

**Intermediate Frequencies:**

- **Television Video:** 26.4 MC
- **Television Audio:** 21.9 MC
- **AM Tuner:** 436 KC

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1.0 INTRODUCTION

1.1 DESCRIPTION OF SET.

The Model RA-101 is a complete home entertainment unit containing facilities for television, FM and AM reception. Included in the model is an automatic record changer.

The set appears in the following six different style cabinets: Westminster, Hampshire, Sherwood, Devonshire, Revere and Plymouth. The electrical circuits of all cabinet styles are similar. Differences between the model are in the type of record changer, size of cathode-ray tube and the size of the speaker used. The Westminster and Hampshire utilize a 20-inch diameter cathode-ray tube, a 15-inch speaker and a Webster Model 70 Record Changer. The other four models employ a 15-inch diameter cathode-ray tube, a 12-inch speaker and a Webster Model 56 Record Changer.

All cabinet styles contain the following chassis and sub-assemblies:

1. Audio amplifier chassis (containing the audio amplifier and its power supply).
2. Sweep chassis (containing sweep circuits, a power supply for low voltage and bias voltage for the sweep and RF-IF chassis, and the high-voltage supply for the cathode-ray tube).
2a. Sync stabilizer chassis (containing automatic frequency control circuit).
3. The RF-IF chassis (containing both sound and video IF circuits, video amplifier, RF input system).
4. The AM tuner chassis (containing the tuning unit for AM reception).

2.0 DESCRIPTION OF CIRCUITS

2.1 AUDIO AMPLIFIER CHASSIS.

The audio amplifier assembly contains its own power supply furnishing sufficient output to operate the entire audio system and sound IF of the RF tuner. The amplifier section itself contains four tubes, namely: two tubes, Type 6SN7, V1 and V2, and two tubes, Type 6V6, V3 and V4. The audio amplifier is resistance coupled. V1 is a dual triode with both sections connected as voltage amplifiers in cascade. The sound volume control is in the input circuit of the first stage. The tone control is connected in the plate circuit of the second half of V1. The first half of V2 is another voltage ampli-
The sweep chassis contains the power supply which furnishes both B+ and bias voltages to the sweep chassis and also to the video IF amplifier and the video amplifier on the RF-IF chassis. A negative voltage is also derived from this same power supply to furnish a negative bias voltage for both the sweep and RF-IF chassis. This low voltage power supply contains two 5U4G rectifiers, V9 and V10, each of which is operated as a half wave rectifier to result in full wave rectification. A time delay relay in this power supply prevents B+ from being available for about 30 seconds.

The sweep circuits on this chassis generate both the vertical and horizontal sweep voltages for the deflection yoke of the cathode-ray tube. A toggle switch on the chassis is available to shut off the high voltage at the convenience of the serviceman. The sweep circuits are used to generate deflection voltages which when applied to the cathode-ray tube will cause the electron beam to scan across the face of the tube. The sweeps must be synchronized to those at the transmitter, and for that purpose, synchronizing pulses transmitted with the video signal are used.

The sync pulses are obtained from the video channel on the RF-IF chassis and fed to V2, the sync amplifier. The output from V2 drives the circuits in the sync stabilizer chassis.

SYNC STABILIZER CHASSIS

Four stages comprise the sync stabilizer chassis. The signal from the sync amplifier is clipped by V1, the clipper stage on the sync stabilizer. The three other stages on the sync stabilizer chassis comprise the "automatic frequency control" circuit. The object of the "AFC" circuit is to obtain pulses for synchronization that are stable in frequency and phase and not affected by extraneous disturbances. The principle used is to originate the pulses by a local oscillator, whose frequency and phase are controlled by the incoming sync pulses. The oscillator output will then be used to pulse the sweep circuits.

The oscillator used is an electron coupled oscillator using a 6K6 tube. The oscillator is coupled to the phase discriminator by transformer coupling (T1). The sync pulses are fed to the center tap of the discriminator transformer from the clipper stage. With respect to the center tap, the sinusoidal oscillator output on the discriminator plates are 180 degrees out of phase. The pulse, being center fed, adds to both plates with the same polarity. When the oscillator frequency is in adjustment, the pulse rides the sine wave at the 180 degree point in its cycle. See Figure 7. During one-half the cycle, one section of the diode will conduct, and during the second half of the cycle, the other section of the diode will conduct. The output voltage across the diode load will be the same in magnitude throughout the cycle, since the magnitude of the voltage on each plate is equal during each diode's conduction period. If the oscillator frequency changes, the pulse will no longer ride the mid-point of the wave. See Figure 7. Now the pulse voltage adds to the sine wave voltage on one plate while it subtracts from the voltage on the other plate. Thus during the cycle, the magnitude of the output voltage will change. A bias of ~1.5 volts is applied to the cathode circuit of the diode. Since this voltage supply has no d-c return path to ground in the diode cathode circuit, no current will flow and the 1.5 volts will be applied equally to both cathodes. The output voltage of the diode stage will add or subtract from the ~1.5 volts. The ~1.5 volts are used to bias the "reactance tube" V4 through the diode lead.

There is, therefore, a d-c voltage that is constant for proper oscillator frequency, but changes when the oscillator frequency is not correct. The voltage is fed to the grid of the "reactance tube" (V4). Output from the oscillator is fed to the cathode of the reactance tube through C10, a .01 µf capacitor. This capacitor causes a phase shift of the signal. Depending upon the voltage on the grid of the reactance tube, the output...
impedance of the retrace tube will be of a certain inductive value. Changes in the oscillator frequency or phase with respect to the pulse frequency will cause different values of voltage on the retrace tube grid and therefore vary the inductive output impedance of the tube.

By coupling the retrace tube across the oscillator coil, the oscillator frequency will vary in such a manner as to correct its deviation from the proper value. The oscillator is thus synchronized to the pulse frequency.

There is a filter circuit between the discriminator and the retrace tube (C12, R17 and C17). Any stray pulses or disturbances are by-passed to ground by the filter, and therefore will not affect the operation of the sweeps. The oscillator output is a distorted sine wave which, when differentiated, will give a pulse output. The differentiating circuit used is C6, C7, R9 and R10.

The signal from the plate of the electroncoupled oscillator is then fed to the second half of V2, a Type 6SN7, which is connected as a driven sweep generator (sometimes called a sawtooth wave generator). The signal from the sweep generator is then fed to the grids of the horizontal deflection amplifiers, two tubes Type 807s. These tubes are V3 and V4, which operate in parallel to drive the horizontal output transformer T2. Because of the relatively high frequency components present in the horizontal sweep signal, it is necessary that the primary of this output transformer have relatively few turns compared to the vertical deflection amplifier in order to keep the distorted capacitance within the transformer to a minimum. Also, much more power must be delivered to the horizontal deflection coils due to greater energy losses. Thus it is necessary to supply more current and power to the horizontal output transformer than to the vertical.

The horizontal damping tube, V5, is a 6AS7. This tube is a dual triode which is connected across the output of the horizontal output transformer. The function of the horizontal damping tube is to eliminate the oscillation which occurs from an overshoot on the sawtooth voltage. The horizontal sweep signal is fed to the deflection yoke. Horizontal positioning is obtained by means of a potentiometer which injects a portion of the bias voltage into the secondary of the horizontal output transformer.

The vertical sync amplifier, V6, is a 6SJ7. This tube amplifies the vertical sync signal and transmits it to one of the windings of the vertical blocking oscillator transformer. The vertical blocking tube oscillator consists of one-half of V7, a Type 6SN7. This blocking tube oscillator triggers the sweep generator, which is the second half of V7. The vertical sweep signal from the sweep generator is fed to the vertical deflection amplifier which consists of another 6SN7 with both halves operating in parallel. The vertical deflection amplifier drives the primary of T4, the vertical output transformer. Because the vertical sweep operates at a low frequency of 60 cycles (distributed capacitance has much less effect than at 15,750 cycles), it is possible to use more turns of wire in T4 and thus obtain the same number of amperes turns as used in the horizontal output transformer, and drive the primary of T4 with less current. Thus, a 6SN7, operated in parallel, will furnish sufficient current as a deflection amplifier to operate the vertical output transformer. Vertical positioning is obtained by means of a potentiometer, which injects a portion of the bias voltage into the secondary of the vertical output transformer.

The beam control amplifier, V13, is also on the sweep chassis. This amplifier is a dual triode, Type 6SN7, which receives the signal from the vertical output transformer on one grid and a signal derived from the horizontal output on the other grid.

One-half of this tube is normally conducting and the other half is normally cut off. If either of the sweeps fail, the half of the dual triode which is conducting becomes non-conducting. Since the solenoid of the relay is connected in series with the plate of the normally conducting half of the tube, the relay contacts are allowed to open. The opening of these relay contacts applies a positive voltage to the cathode of the cathode-ray tube, thus cutting off the beam of the cathode-ray tube, and preventing a stationary bright spot or line from appearing on the screen if the sweep should fail.

**2.3 THE RF-IF CHASSIS.**

The RF tuning assembly is the complete input system for the Du Mont Teleset. It consists of three separate variable inductors (the Du Mont inputter) which cover the range of 44 to 216 megacycles without band-switching. In the Du Mont input system are the tubes V1, V2, and V9. V1 and V9 are type 6J6 tubes and V2 is a Type 6AK5; V1 is an RF stage. V9 is the local oscillator, and V2 is the mixer.

The output of the RF section is the intermediate frequency of the Teleset. This intermediate frequency differs, however, from the normal AM receiver in that it is a band of frequencies which contains both video and sound signals. The video and sound IF signals can be separated because they occur at different frequencies due to the fact that they were transmitted on separate carriers. 4.5 megacycles apart. The sound IF is separated from the video signals by means of a sound trap and is impressed on the grid of the first sound IF stage. The sound IF amplifier is a three-stage amplifier consisting of V3, V4 and V5, which utilize Type 6BA6 tubes. After passing through the sound IF amplifiers, the sound IF signal passes through the two limiter stages, V6 and V7, which are connected in cascade. These tubes remove amplitude modulation from the FM signal. The output of the second limiter is coupled to the discriminator tube by means of the discriminator transformer. The discriminator, V8, is a 6AL5. This is a typical discriminator circuit for removing the modulation from the intermediate frequency and is so tuned that its output is zero volts, at exactly 210 megacycles. The voltage output of the discriminator is a varying DC voltage whose magnitude is dependent upon the deviation of fre-
quency of the sound IF signal from the center value of 21.9 megacycles. The FM teletracking meter is connected to one of the cathodes of the discriminator and registers zero when the FM or television station being received is properly tuned. The output of the discriminator is the audio signal which is fed to the audio amplifier, which in turn drives the speaker.

The tuned circuit in the plate of the mixer tube, V2, is tuned to have a band pass between 21.5 and 26.4 megacycles.

![Figure 8. RF-IF Chassis](image)

The sound IF frequency is picked off prior to the tuned circuit and the video IF frequency passes through to the grid of V10, the first video IF amplifier. Two sound traps are located, one between the first and second video IF stages and the other between the second and third video IF stages. These sound traps prevent the sound IF signals from passing through the video IF amplifier and causing interfering patterns in the picture. In all there are five video IF stages in the Model RA-101. These five stages consist of V10, V11, V12, V13, and V14. All of these stages employ the same tube type, a 6AU6, with the exception of V14, which uses a 6AG7. The video IF stages utilize special coupling circuits to provide a band pass of 4 megacycles. The output of the fifth video IF stage feeds V19, the video detector. V19 is a 6AL5 which is connected as a half wave diode detector. The output of the video detector feeds the first video amplifier, V17, a 6AG7. V17 in turn feeds V16, a 6V6, connected as a cathode follower output. The output of V16 is coupled directly to the control grid of the cathode-ray tube. However, V15, the AC restorer and sync clipper is connected across the output.

The DC restorer and sync clipper consists of a single tube, V15, a 6AL5. One-half of this tube operates as the DC restorer and the other half as the sync clipper. The signal is taken from the plate of the sync clipper and fed to the sweep chassis as composite sync.

There are a number of other components also located on this chassis. These items are enumerated below:

1. The Contrast Control, which effectively is the same control on the video signal as the volume control on the audio signal, varies the output of the video IF amplifier by varying the negative bias voltage applied to the grids of the first two video IF amplifiers.

2. The Picture Brightness Control is located on this chassis. It is used to set the intensity level of the background of the picture.

3. Because the Picture Brightness Control is located on this chassis, it is also convenient to place the relays for the sweep failure protection circuit for the cathode-ray tube on this same chassis.

4. The Sound Volume Control is also located on this chassis to consolidate all controls on a single chassis, and is connected by cable to the audio chassis.

5. The motor for driving the pointer on the FM teletracking dial, the magnetic clutch, and the hand vernier tuning mechanism, all of which are used in conjunction with the inductuner, are also included on this chassis, thus consolidating all front panel controls on one chassis.

6. The Grid Drive Control—which adjusts the cathode-ray tube grid sensitivity.

2.4 THE AM TUNER CHASSIS.

AM tuner chassis, which is employed in the Model RA-101, consists essentially of four major sections. The RF amplifier is a tuned RF stage which feeds a 6SA7 converter. The 6SA7 serves the function of both oscillator and mixer to convert the RF signal to an intermediate frequency of 456 KC. This chassis contains one IF amplifier, a 6SK7, which in turn feeds a 6SN7. One-half of this tube acts as a diode detector and the other half as a cathode follower output. This chassis contains its own heater transformer but B+ is supplied to it from the audio chassis.

![Figure 10. AM Tuner](image)
2.5 THE TONE SELECTOR.

The Tone Selector is a separate assembly with five different RC circuits connected for varying the quality of the audio signal. This separate assembly is located directly behind the bezel for the teletext.

2.6 THE SERVICE SELECTOR.

The Service Selector is a push-button switch assembly which connects both AC and DC circuit voltages to the proper units depending upon the service selected, and switches the output of the three different chassis to the input of the audio amplifier.

2.7 RECORD CHANGER.

The Record Changer, as previously stated, is a Webster Model 70 in both the Westminster and Hampshire cabinet styles. In the Sherwood, Devonshire, Revere and Plymouth cabinet styles, the Webster Model 56 is used. The output of the record changer is fed to the audio amplifier chassis through the service selector switch. Since the output from the record changer does not have a flat frequency response, the high frequency end of the response curve must be attenuated. This attenuator and de-emphasizing circuit is an RC network which is placed in parallel with the signal from the record changer and is mounted on a bracket at the rear of the unit.

2.8 THE CATHODE-RAY TUBE ASSEMBLY.

The Cathode-ray Tube for the Westminster and Hampshire cabinet styles is the Du Mont Type 20BP4. It is mounted in a cradle which may be raised by a mechanical driving mechanism to place the tube in viewing position. The same tilt mechanism which is controlled by a switch on the lid, lowers the tube when it is not in use. The cathode-ray tube, its focusing coil, and its deflection yoke are all mounted in position so that they cannot shift in this cradle.

The cathode-ray tube used in the Sherwood, Devonshire, Revere, and Plymouth cabinet styles is the 15AP4. This tube is mounted in a fixed position in the cabinet and contains no tilt mechanism. The focusing coil and deflection yokes are fixed in their respective positions on the neck of the tube.

3.0 INSTALLATION

Installations, at the present state of the television art, are of the utmost importance. Customer satisfaction will depend entirely upon a well made installation. The best teletext manufactured is not capable of improving upon the signal presented to it by its antenna. The consumer is not technically educated enough to appreciate the difficulties involved in obtaining a clean picture in our urban areas. He will judge the television industry by the picture presented to him in his home. No amount of explanations or apologies will offset the unfavorable impression created by a noisy, blurry, jumpy picture.

Remember also, that a teletext purchaser will remain a teletext owner, only as long as he is able to enjoy the entertainment provided by the art. A rejected and returned teletext will not improve a dealer's net profit. It, therefore, is important for the service or installation man to bend every effort to make a good installation when a teletext is sold, not only for his own immediate profit, but also for the good of the art as a whole. The mortality will be high among servicemen attempting to profit from television installations. The field is complex and demanding of perfection. Only those who have firmly grasped and assimilated the necessary techniques and principles, will survive the competitive era now approaching. The following installation data is not complete. To be of value to a practicing serviceman it should be amplified by study and experimentation on his part.

3.1 THE PRESALE SURVEY.

When an installation is contemplated, make a complete survey before starting any permanent work. This will assure the prospective teletext owner of good reception before he buys. It will also enable the dealer to avoid a great deal of expense and trouble if conditions prove impossible at the proposed location.

To make a survey the following equipment is required:

1. A portable, sturdy television receiver.
2. A sectional mast or pole, which can be extended to 20 or 25 feet.
3. A portable antenna kit, which can be easily assembled into several simple directive arrays.
4. A set of tuned dipoles to receive each station and reject all others.
5. Lengths of co-axial and/or parallel lead-in equipped with connectors.
6. Lengths of A.C. power lines, equipped with connectors.

Select a temporary position for the antenna, bearing in mind the requirements for a clean signal. Connect the antenna to the receiver and examine the resulting picture.

If the picture is satisfactory on all stations available, orient the antenna for maximum signal strength and note the location so determined. A permanent installation may then be made.

Should the location prove to be poor, one or more picture defects will be evident. Various remedies should be applied until a clean picture results. A permanent installation can then be made. The advantages of the survey method should be self-evident. Trying out different antennas and antenna positions in permanent form is not only difficult but almost impossible.
3.2 ANTENNA AND LEAD-IN.

The antenna which is recommended for use with a Du Mont telester is known as the Congrove Antenna. This antenna has been designed for Du Mont telesters in accordance with Du Mont specifications. It is a wide band antenna so that it picks up almost equally well all signals between 44 and 216 megacycles. The impedance of the antenna is 72 ohms and the lead-in from this antenna to the set, therefore, must be made with 72 ohm cable. Thus the antenna and lead-in system is matched to the input impedance of the receiver which is also 72 ohms. Since the input system of the Du Mont telester is unbalanced, the inner conductor of the 72 ohm co-axial cable is connected to the input terminal and the shield is connected to ground.

3.3 REFLECTIONS.

Reflections are exactly what their name implies. Any surface which is at the correct angle to the transmitting and receiving points, will provide an additional, reflected, signal path.

This reflected signal will be accepted by the receiver, and will be presented on the viewing screen, along with the direct signal. However, there will be an appreciable time and phase difference between the two signals and they will not coincide on the viewing screen.

If the reflected signal is of equal or approximately equal amplitude to the direct signal, it will affect the synchronization stability (horizontal line displacement) of the receiver and may make it impossible to attain correct sweep synchronization. If the time difference is negligible or very small, no obvious ghost will be seen. However, it will be present, and will evidence itself by blurring the outlines of whatever picture is presented on the screen. Remember also that reflection conditions may change, with every change in atmospheric humidity, so that an erratic and unstable picture may result as the reflection strength changes. The usual reflection will appear on the screen as an offset, duplicate of the pattern being viewed. The amount of offset is proportional to the difference in signal path lengths.

The reflection problem can only be solved by proper selection of antennas and their orientation and directivity. The antenna must be directive enough to accept the direct signal from the desired transmitter. It must also discriminate against reflections received from different directions. It is frequently possible to achieve this result by rotating a single dipole. Usually, however, more antenna directivity must be used. This is accomplished by adding reflectors to the dipole or using a directive antenna such as the "V" or rhombic.

On occasion a complex type of ghost will be encountered due to multiple reflections. This may result in a reflection being received from the same direction as the direct signal, in which case, antenna directivity will not reduce the reflection.

The only recourse for this condition is to attenuate the composite signal until the reflection is below the noise level. The direct signal will probably still be strong enough to be usable. If not, nothing else can be done, except to tolerate it or to add a special antenna and the RF matching stage. If it is impossible to eliminate ghosts on all stations with a single antenna, multiple antennas with a switching arrangement or a matching amplifier can be used. Each antenna should be adjusted for best response on a single station.

3.4 NOISE.

Signal to noise ratio is dependent upon both the strength of the received signal and upon the level of the local noise. If the ratio is too low the picture will be unusable. High peak pulse noise also may trigger the sweep circuits and make the picture unusable.

If the signal is weak, normal atmospheric and set noise will be high enough in comparison to the signal to have the same effect as a high level of local noise.

If the local noise level is high, only an extremely strong signal will overcome it. In this type of situation only by removing the source of local noise will an acceptable picture result. Many types of apparatus will cause appreciable noise in a given locality. Electric motors, neon signs, automobiles, household appliances will all radiate interfering noises if too near the telester antenna.

Random noise, atmospheric or set, will evidence itself as light and dark spots in the picture. From a distance, the effect resembles a snow storm.

Pulsed type noise, from motors, automobiles, etc., will create streaks or "tear out" across the picture. This type of noise may also trigger the vertical sync circuits and cause the picture to skip a frame or so (roll up or down).

The noise problem may be attacked from two angles. One is to endeavor to increase the signal pickup while attenuating noise. Often this can be accomplished by using a high gain, directive antenna. Anything done to increase signal strength will raise the signal to noise ratio, shortening the lead-in, using lower loss lead-in, or elevating the antenna, are effective.

Moving the antenna out of the direct noise field, even at the expense of increasing lead-in strength, is often beneficial. If the signal strength is extremely low, recourse might be had to a long wire "V" or rhombic antenna .

In regard to signal strength level, remember: that beyond approximately 50 miles from the transmitter, receiving conditions will be very poor. If beyond "line of sight" from the transmitter, usually nothing much can be done to secure reliable reception; however, some installations have been known to work satisfactorily.

The second method of attack on the poor signal to noise ratio problem is to eliminate noise at its source. The source of local noise should be determined and remedies applied to reduce or eliminate it. Electric motors, diathermy, neon signs, elevators, household appliances are all susceptible to proper filtering, bonding or shielding.

3.5 INTERFERENCE AND FADING.

A variety of different types of signals will create visual interference on the viewing screen. Ultra short wave diathermy or harmonics of short wave diathermy apparatus will seriously interfere with good reception of the picture. The interference will appear as one or two dark bands moving slowly up or down the screen, if the signal is strong. A weak diathermy signal will appear as bands of cross hatch or herring bone, moving up and down the screen. If the diathermy is extremely strong, the sweeps will kill in on it instead of the picture. In this case a stationary type of interference will result, while the picture will move through the background. Harmonic or image signals of different services will also affect the picture. The type of interference seen will vary as the modulation on the interfering signal varies. Usually it will consist of alternate dark and light lines, moving vertically
or horizontally, changing in width, number, and speed, as the audio modulation on the interfering signal changes. An unmodulated carrier will cause a hazing bone or spotty type of interference all over the screen area.

Interference caused by signals from other television and FM stations at the image frequency of the teletext, can be eliminated with wave traps. A tuned circuit, resonating to the image frequency of the interfered with television station, will usually eliminate this type of interference. The trap can be a parallel circuit placed in series with the ungrounded side of the lead-in. Or, it can be a series circuit placed across the lead-in. All traps should be located as close as possible to the antenna terminals of the teletext. Traps will not be effective if interference is being received at the desired tele-station’s frequency. In such a case, the antenna, if directive, can be oriented to discriminate against the interference. Or, the combined interfering and desired signal can be attenuated until the interfering signal is too weak to cause trouble. This will, of course, be ineffective if the interference is as strong as, or stronger than, the desired signal. Harmonics of lower frequency services, diathermy, and other teletext local oscillators, will cause the types of interference mentioned above.

Fading will cause the picture to become alternately stronger and weaker. As the signal becomes stronger, the picture will lose detail and contrast, and become "soft," or "mushy." When the picture signal becomes weak, the picture seen will fade into the background noise. It will also lose synchronism and either skip a vertical frame or tear out horizontally.

Fading is normally the result of wave addition and subtraction between reflections and direct signals. Or, of varying propagation conditions due to reception beyond the reliable service area of a given transmitter. Nothing much can be done to eliminate this condition. Antenna gain and directivity will help. But if conditions at the receiving location are such that severe fading occurs, it usually must be tolerated.

### 4.0 MAINTENANCE AND ADJUSTMENT

#### 4.1 SAFETY PRECAUTIONS.

Before attempting any sort of servicing or adjustment it is imperative that the serviceman bear in mind certain safety precautions.

**HIGH VOLTAGE PRECAUTIONS**

1. The high voltage applied to the accelerating electrode is 12,000 volts and contact with it can cause severe burns or even DEATH.
2. Always turn OFF the high voltage switch on the sweep chassis before doing any work on this chassis.
3. Always turn OFF all power, and remove the power plug from wall receptacle before removing any chassis from the cabinet.
4. Always make adjustments with only one hand.
5. Always turn OFF all power before soldering or making connections.

**CATHODE-RAY TUBE PRECAUTIONS**

1. Do not bump the tube against hard objects.
2. Do not use tools near the tube.
3. Always wear safety goggles and gloves when handling the tube.
4. Always stand the tube on its face on a thick piece of felt in a protected place if it is removed from the cabinet.
5. Always replace a tube if it becomes scratched and return it to the factory for a pressure test.

#### 4.2 ADJUSTMENT OF CONTROLS.

Normal operating procedure should be followed. See operating instruction manual. If satisfactory results are not obtained, then further adjustments should be made as outlined below. If required results are still not obtained, a diagnosis should be made to locate the trouble.

### A. LOCATION OF CONTROLS

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<td>Transformer</td>
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</table>

All other controls are on the control panel and are marked.

### B. ADJUSTMENT OF CONTROLS

1. **Sensitivity Control Adjustment** (should not be touched except when cathode-ray tube is changed).
   a. Press the "Tele" button on the service selector switch.
   b. Increase brightness for raster appearance.
   c. Decrease brightness until raster just fades out.
2. **Hor. Phase** (should not be touched except when cathode-ray tube is changed).
   a. Check voltage on cathode of cathode-ray tube. If voltage is less than 45 volts, this adjustment is correct. If the voltage is greater than 45 volts, turn sensitivity control full clockwise, increase brightness until 45 volts are obtained and then turn sensitivity control for disappearance of raster.

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For test patterns see back of Manual
2. Turn up contrast control for image, and adjust the focus control in a clear picture.

3. If the picture is tilted, adjust the yoke on the neck of the cathode-ray tube. Loosen both top and bottom screws to turn yoke. Be certain that the set is turned off. Remember, contact with the high voltage may be lethal.

4. Increase brightness more than usual, and adjust vertical hold control if necessary.

5. When horizontal adjustment is necessary the following procedure should be followed:
   a. Turn the screwdriver adjustment (horizontal frequency adjustment on phase discriminator transformer) until the test pattern or picture comes into sync.
   b. Turn clockwise until the test pattern falls out of sync, then back off until it pulls in again. Note the position where “pull in” occurs.
   c. Continue rotating counterclockwise until the test pattern falls out of sync again. Then turn clockwise until it pulls in. Note the position of the control for this second pull in point.
   d. Set the adjustment halfway between the two “pull in” points.
   e. Adjust phase control for proper blanking and sync pulse, if necessary. Then readjust frequency as outlined above.
   f. Set the vertical linearity, size and positioning controls for a good pattern.
   g. Set the horizontal controls for good linearity, as well as for size and positioning.

**EFFECTS OF CONTROLS ON LINEARITY**

<table>
<thead>
<tr>
<th>Control</th>
<th>Effect on Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hor. linearity</td>
<td>Flattens and expands pattern on right side.</td>
</tr>
<tr>
<td>Hor. peaking</td>
<td>Flattens and expands both sides, but affects left side more.</td>
</tr>
<tr>
<td>Hor. damping</td>
<td>Flattens and expands left side of pattern.</td>
</tr>
<tr>
<td>Vert. linearity</td>
<td>Flattens and expands top side of pattern.</td>
</tr>
</tbody>
</table>

**4.3 TROUBLESHOOTING PROCEDURE.**

Although much information can be given for diagnosing trouble in the Telesets, the information is of a general nature. The nature, location and repair of troubles must be analyzed by the repairman. This necessitates a good working knowledge of the circuits of the sets, as well as an understanding of television principles. It behooves the repairman to study teleset circuits as well as outside information on television.

Before attempting to repair a set, a diagnosis should be made to determine in what channel or circuit there is trouble. Remember that in 99% of cases only one trouble develops at a time. It is only a waste of time and effort to indiscriminately test circuits of a set when trouble occurs. The method to follow is by use of logic and symptoms to localize the trouble before testing. When the troublesome circuit has been localized, a tube check should be made for faulty tubes. A few examples of proper reasoning are presented below.

Assume the following trouble is evident: No picture can be obtained, but sound is operating. First of all, it can be assumed that the Inputuner is operating correctly. If it wasn’t, the sound channel would not be operating. Turn the brightness control clockwise. If a raster appears, the sweep circuits must be operative. The trouble has been localized to the video channel. The repairman can now test the video channel.

If when the brightness control is advanced, no raster appears, the difficulty can be in either the sweep circuits or the high voltage power supply. A failure of either sweep circuit will cause excessive bias on the cathode-ray tube and cut it off. Check the voltage on the cathode of the cathode-ray tube. If it is excessive, a failure of sweep is indicated. If it is normal, a failure of high voltage is indicated. Thus, the trouble has been localized to either the sweep or high voltage circuits.

Another condition is that there is picture, but no sound. Check the action of the tuning meter. If it is operating correctly, the trouble is in the audio amplifier. If it is not, the trouble is in the sound IF channel. This assumption comes from the fact that the tuning meter operates from the sound discriminator. Again, it can be assumed that the Inputuner is operating correctly since the picture is being received.

![Figure 12(a). 6AK5 Adapter Tube](image)

If the receiver is completely dead (no picture, no sound), check the input power, input power cords and interlock (safety) switches. The antenna lead-in cable or the Inputuner may be bad. If these checks do not reveal the trouble, the low voltage power supply outputs should be checked. In case of Inputuner difficulties (aside from bad tubes), the entire unit should be removed and sent back to the factory.

If the sound channel is operating correctly, and the picture alone is distorted, an analysis can be made by merely viewing the screen of the cathode-ray tube. Such faults as too strong a signal, too weak a signal, outside interfering signals, excessive ripple, distortion and phase shift, can be viewed on the screen. Once recognized as specific faults, corrections can be made. The procedure to follow then is:

1. Analyze symptoms.
2. By reasoning, localize trouble to possible channels.
3. By tests, locate actual channel.
4. By further tests, find and correct trouble.

Normal signal tracing methods of testing is recommended for the audio amplifier and the sound channel. For the video channel, response curves can be checked by using a weibul-tor and an oscillograph. For the sweep channel, waveforms can be viewed and checked against those given in section 4.5.
4.4 REQUIRED TEST EQUIPMENT

VACUUM TUBE VOLTMETER—20,000 ohms-per-volt voltmeter with ranges approximately 0 to 5 V, 0 to 20 V, 0 to 100 V, 0 to 500 V.

CATHODE-RAY OSCILLOGRAPH—Du Mont Type 208-B recommended for 35-MHz alignment, and audio amplifier servicing. Du Mont Type 224-A or Type 241 for troubleshooting sweep chassis.

SIGNAL GENERATORS—

1. FM Signal Generator—This is a wobbulator-type signal generator whose center frequency ranges from 20 to 30 megacycles with a sweep width of ±5 megacycles (adjustable). The voltage output of this generator should be 0.1 volts.

2. RF Signal Generator—With modulation available, RF range from 20 megacycles to a minimum of 60 megacycles. The RF signal must be adjustable to within 10 kc with a calibrated attenuator on the output.

3. Audio Signal Generator (for Checking Audio Amplifiers).

TRAVELING DETECTOR—This is a crystal detector mounted in a probe assembly to enable IF stages to be aligned stage-by-stage. (See Figure 12b.)

6AK5 ADAPTER TUBE—See Figure 12a.

OPTIONAL TEST EQUIPMENT

VIDEO SWEEP GENERATOR—Output varies from 0 to 6 megacycles.

VOLTAGE CALIBRATOR—Du Mont Type 264-A recommended for use in measuring peak-to-peak voltages.

SQUARE WAVE GENERATOR—For servicing audio and video amplifiers.

4.5 SWEEP WAVEFORMS.

Sweep waveforms are given in Figure 16. Waveforms were taken with the following control settings:

- Line Voltage — 115 volts a-c
- Horizontal Damping Control—Full counterclockwise
- Horizontal Linearity — Full clockwise
- Horizontal Peaking — Full clockwise
- Vertical Linearity — Full counterclockwise
- Vertical Size — Full clockwise
- Horizontal Size — Full counterclockwise
- Vertical Hold — Set to lock picture
- Positioning Controls — Normal setting

5.0 CUSTOM MODEL

The circuits of the custom model are almost identical to all other RA-101 models. The chassis are mounted in a rack as can be seen in Figure 13. A 20-inch cathode-ray tube is mounted in a separate rack. Two 12-foot cables are provided for connecting the cathode-ray tube and the speaker to the chassis on the main rack. Cabling may be as long as 35 feet, depending upon individual requirements. No record player is included in this model.

5.1 INSTALLATION.

1. SELECT THE PLACE OF INSTALLATION TO CONFORM WITH THE FOLLOWING REQUIREMENTS AND LIMITATIONS.

(a) The cathode-ray tube should be placed so it may be viewed by the greatest number of people with a minimum rearrangement of the room furnishings.

(b) The cathode-ray tube should be placed sufficiently high so that its view is not obstructed by the normal movements of people in the room.

(c) The speaker should be placed sufficiently high to overcome interference from normal floor noise.

(d) The control panel should be convenient to authorized operating personnel, but out of reach of meddlers.

(e) The room or hall into which chassis rack and the cathode-ray tube mounting rack extend should be well ventilated and free from dust and fumes.

2. POWER REQUIREMENTS.

(a) The Custom Model Teleseer requires an A-C power source of 115 volts 60 cycles from which it draws approximately 5 amperes for Television operation.

(b) It is recommended, that power be supplied from a special power line direct from the meter.

3. WALL CUT-OUTS.

(a) The wall cut-out for the speaker is a circle 12-1/4 inches in diameter.

(b) The wall cut-out for the cathode-ray tube is a square 22-1/4 by 22-1/4 inches.

(c) The wall cut-out for the control panel is given in Figure 29.

(d) Note the special cut-out required for the control panel when the wall is greater than 2-1/2 inches thick. See Figure 29.

4. MOUNTING THE SPEAKER.

(a) Mount the speaker on its baffle (item 14).

Note

The speaker grill (item 15) may be mounted between the baffle and the speaker, or on the face of the baffle.

(b) Fasten the speaker and the baffle to either the front or the rear side of the wall as desired.

(c) If the baffle is fastened on the rear side of the wall, it will probably be desirable to mount the speaker grill on the front side of the wall over the speaker cut-out.

5. MOUNTING THE CATHODE-RAY TUBE.

(a) Remove the tube from its cradle and place it in a safe place.
Figure 13(a). Cathode-Ray Tube Mounting for Custom Model

**Note**

**EXERCISE EXTREME CARE IN HANDLING THE TUBE SO IT IS NOT SCRATCHED OR STRUCK.**

**DO NOT HOLD THE TUBE BY ITS NECK.**

(b) Mount the tube cradle through the wall from the front side with the rubber-padded, tube-support bracket on the bottom. Fasten the cradle securely to the wall through the flange.

(c) Replace the tube in its cradle from the front side of the wall so that the face of the tube is flush with and resting on the rubber-padded support bracket.

(d) Place the tube frame assembly in position and secure it with the 4 mounting screws.

(e) Place the tube socket on the tube base.

6. MOUNTING THE CHASSIS RACK.

(a) Remove the knobs from the controls on the front panel, taking care that the position of each is noted.

(b) Remove the screws which hold the metal panel (item 4) and remove this panel.

(c) Remove the tuning meter plug from its jack on the RF-IF chassis.

(d) Remove the screws which hold the bezel panel (item 5) and remove this panel.

(e) Set the rack in position behind the wall.

(f) Loosen the 4 set screws which hold the RF-IF chassis and slide the chassis forward until it is flush with the front side of the wall.

(g) Replace the bezel and metal panels on the front side of the wall.

(h) Replace the tuning meter plug in its jack on the RF-IF chassis.

Figure 13(b). Main Rack for Custom Model

(i) Replace the knobs on the controls on the front panel.

(j) Tighten the set screws to hold the RF-IF chassis securely in position.

(k) Fasten the rack to the floor with screws through the mounting holes in the base.

7. FINAL ADJUSTMENTS.

(a) Connect the high voltage lead to the cathode-ray tube.

(b) Connect the cable from the cathode-ray tube into its jack on the sweep chassis.

(c) Connect the cable from the speaker into its jack on the main chassis.

(d) Check to be sure the cables between the AM tuner and the RF chassis are connected to the audio amplifier.

(e) Check to be sure the cables to and from the Tone Selector are connected.

(f) Be sure the interlocks on the sweep chassis are closed.

(g) Plug in the A-C plug and make certain that each of the facilities is operating properly.

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Figure 14.

Installation Diagrams for Custom Model

LIST OF PARTS

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
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<td>2</td>
<td>Rack</td>
<td>10</td>
<td>A. C. Plug</td>
</tr>
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<td>3</td>
<td>Bezel Panel</td>
<td>11</td>
<td>Wall Thickness Adjustment</td>
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<tr>
<td>4</td>
<td>Metal Panel</td>
<td>12</td>
<td>Loop Antenna</td>
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<td>5</td>
<td>RF and IF Chassis</td>
<td>13</td>
<td>Intensifier Lead and Clip Assembly</td>
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<td>Modified for Custom Model</td>
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<td></td>
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<td>6</td>
<td>Bracket (A. C. Plug)</td>
<td>14</td>
<td>Sync. Chassis Assembly</td>
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<td>7</td>
<td>Audio Amplifier</td>
<td>15</td>
<td>Tuning Indicator</td>
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<td>8</td>
<td>Sweep Chassis</td>
<td>16</td>
<td>Tone Selector Assembly</td>
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<td>Modified for Custom Model</td>
<td>17</td>
<td>A. M. Tuner Assembly</td>
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<td></td>
<td>Model</td>
<td>18</td>
<td>Service Selector</td>
</tr>
</tbody>
</table>

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Figure 15.A
Oscillogram of the dual sound IF curve (untuned). This is the response curve appearing on the right of Figure 15-A after it has been expanded.

Figure 15.B
Oscillogram of the single sound IF curve, properly tuned sound IF curve with birde at 21.9 mc.

Figure 15.C
Oscillogram of Figure 15-B with birde at 21.9 mc.

Figure 15.D
Oscillogram showing the effect of too much birde.

Figure 15.E
Oscillogram showing a slight amount of overload caused by too much signal from the webulated signal generator.

Figure 15.F
Oscillogram showing excessive overload caused by too much signal from the webulated signal generator.

Figure 15.G
Oscillogram of overall sound IF response. (The improper alignment is due to the different amplitude of the signal now being applied to the grids of each stage.) (Birdie at 21.9 mc.)

Figure 15.H
Oscillogram showing a slight amount of overload caused by too much signal from the webulated signal generator.

Figure 15.I
Oscillogram showing excessive overload caused by too much signal from the webulated signal generator.

Figure 15.J
Double discriminator curve.

Figure 15.K
Single discriminator curve (expanded from double curve). Birdie at 21.9 mc.

Figure 15.L
Properly aligned discriminator curve. Birdie at 21.9 mc.

Figure 15.M

Figure 15.N
Same as Figure 15-M except that the sweep of the oscillograph has been expanded to obtain a single curve.

Figure 15.O
Same as Figure 15-M with 137 and 144 properly tuned (birdie at 36.4 mc.)

Figure 15. Alignment Waveforms
Figure 15-O
Video response curve showing excessive overloading due to too much signal applied to the stage from the webbulater signal generator.

Figure 15-P
Same as Figure 15-O except that the birdie is at 27.4 mc.

Figure 15-S
Video IF response curve: Webbulater to the grid of V13 and the traveling detector to the oscillograph at the plate of V16. L34 and L35 properly tuned (birdie at 26.4 mc).

Figure 15-T
Video IF response curve: Webbulater to the grid of V12 and the traveling detector to the oscillograph at the plate of V13. L31 and L32 properly tuned (birdie at 26.4 mc).

Figure 15-U
Sound trap much too low. Birdie at 21.9 mc.

Figure 15-V
Sound trap properly set. Birdie at 31.9 mc.

Figure 15-W
Sound trap slightly too high.

Figure 15-X
Video IF response curve: Webbulater to the grid of V11 and the traveling detector to the oscillograph at the plate of V12. L37 and L38 properly tuned (birdie at 26.4 mc).

Figure 15-Y
Sound trap too low.

Figure 15-Z
Sound trap properly adjusted.

Figure 15-XX
Sound trap too high.

Figure 15-A
Video IF response curve: Webbulater to the grid of V10 and the traveling detector to the oscillograph at the plate of V11. L34 and L35 properly tuned (birdie at 28.4 mc).

Figure 15-BC
Video IF response curve: Webbulater to the grid of V2 and the traveling detector to the oscillograph at the plate of V10. L5 and L6 properly tuned (birdie at 26.4 mc).

Figure 15-DD
Overall video IF response curve: Webbulater to the grid of V2 and the oscillograph to the cathode of V16. The birdie at 36.4 mc is 50% down on the curve.
### TABLE I
DATA FOR ALIGNMENT

#### SOUND CHANNEL

<table>
<thead>
<tr>
<th>To Adjust</th>
<th>Type of Input Signal Required</th>
<th>Connect Generator Leads Across</th>
<th>Connect Output Leads Across</th>
<th>Feed Output Leads Directly Into Oscillograph or Into Oscillograph Via Probe Detector</th>
<th>Adjust Cells to Conform to Fig. No.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z2</td>
<td>Wobbulator, RF Signal Generator</td>
<td>Pin 1, V3 and Chassis</td>
<td>Pin 5, V4 and Chassis</td>
<td>Probe Detector</td>
<td>15-E</td>
<td>RF Signal Generator Set at 21.9 mc to give birdie</td>
</tr>
<tr>
<td>Z3</td>
<td>Wobbulator, RF Signal Generator</td>
<td>Pin 1, V4 and Chassis</td>
<td>Pin 5, V5 and Chassis</td>
<td>Probe Detector</td>
<td>15-E</td>
<td>RF Signal Generator Set at 21.9 mc to give birdie</td>
</tr>
<tr>
<td>Z4</td>
<td>Wobbulator, RF Signal Generator</td>
<td>Pin 1, V5 and Chassis</td>
<td>R27</td>
<td>Direct</td>
<td>15-F</td>
<td>Connect 100 k resistor in series with oscillograph</td>
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<tr>
<td>Z2, Z3, Z4</td>
<td>Wobbulator, RF Signal Generator</td>
<td>Pin 1, V3 and Chassis</td>
<td>R27</td>
<td>Direct</td>
<td>15-G</td>
<td></td>
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<tr>
<td>Z5</td>
<td>Wobbulator, RF Signal Generator</td>
<td>Pin 1, V7 and Chassis</td>
<td>Pin 1, V8 and Chassis</td>
<td>Direct</td>
<td>15-L</td>
<td>Readjust Z4 and Z1 to obtain good response curve</td>
</tr>
</tbody>
</table>

#### VIDEO CHANNEL

| L37, L44  | Wobbulator, RF Signal Generator | Pin 4, V14 and Chassis | Pin 8, V16 and Chassis | Direct | 15-O | RF Signal Generator set at 26.4 mc |
| L34, L35  | Wobbulator, RF Signal Generator | Pin 1, V13 and Chassis | Pin 8, V14 and Chassis | Probe Detector | 15-S |
| L31       | Wobbulator, RF Signal Generator | Pin 1, V12 and Chassis | Pin 5, V13 and Chassis | Probe Detector | 15-T |
| L9        | Wobbulator, Signal Generator | Pin 1, V12 and Chassis | Pin 5, V13 and Chassis | Probe Detector | 15-V |
| L27, L28  | Wobbulator, RF Signal Generator | Pin 1, V11 and Chassis | Pin 5, V12 and Chassis | Probe Detector | 15-X |
| L26       | Wobbulator | Pin 1, V11 and Chassis | Pin 5, V12 and Chassis | Probe Detector | 15-Z |
| L24, L25  | Wobbulator, RF Signal Generator | Pin 1, V10 and Chassis | Pin 5, V11 and Chassis | Probe Detector | 15-BB |
| L5, L6    | Wobbulator, RF Signal Generator | Pin 1, 6AK5 Adapter (V2) and Chassis | Pin 5, V10 and Chassis | Probe Detector | 15-CC |
|           | Wobbulator | Pin 1, 6AK5 Adapter (V2) and Chassis | Pin 8, V16 and Chassis | Probe Detector | 15-DD |

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<table>
<thead>
<tr>
<th>Table No.</th>
<th>Tube Type</th>
<th>Function</th>
<th>Pin 1</th>
<th>Pin 2</th>
<th>Pin 3</th>
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<th>Pin 5</th>
<th>Pin 6</th>
<th>Pin 7</th>
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**TABLE 2**

D. C. voltages taken with no signal applied. These voltages should be regarded as only representative and not absolute. All measurements are taken with respect to ground.
Figure 20. Audio Amplifier Schematic

Figure 21. Sync Stabilizer Schematic

©John F. Rider
Figure 23. Service Selector Schematic

Figure 24. Tone Selector Schematic
### 6.0 ELECTRICAL PARTS LIST

#### DE-1949

**Type 7001-A**

<table>
<thead>
<tr>
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<th>Description</th>
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<td>Capacitor, fixed: ceramic; 1000 mfd; 100 V; ±10%</td>
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<td>3-1169</td>
<td>Capacitor, fixed: paper; wax; .1 mfd; 600 V; ±25%</td>
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</tr>
<tr>
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<td>CM3LA472K</td>
<td>Capacitor, fixed: mica; 4700 mfd; 500 V; ±10%</td>
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<td>Same as C4</td>
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<tr>
<td>C7</td>
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</tr>
<tr>
<td>C8</td>
<td>Same as C2</td>
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<td>C9</td>
<td>3-1162</td>
<td>Capacitor, fixed: electrolytic; 40; 40 mfd; 475 V</td>
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<td>3-1167</td>
<td>Capacitor, fixed: electrolytic; 8 mfd; 475 V</td>
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<td>3-1146</td>
<td>Capacitor, fixed: electrolytic; 500 mfd; 50 V</td>
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<td>3-1217</td>
<td>Capacitor, fixed: electrolytic; 90 mfd; 475 V</td>
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<td>F1</td>
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<td>Fuse, cartridge: 2 amp.</td>
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<td>9-274</td>
<td>Connector, female: 1 pin</td>
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<tr>
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<td>Choke, 6 by: 175 ma; 70 ohm—(DD-4535-D)</td>
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<tr>
<td>L2</td>
<td>21-330</td>
<td>Choke, 12 by: 76 ma—(DD-4533-D)</td>
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<td>9-335</td>
<td>Connector, male: 6 pin</td>
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<td>Resistor, fixed: composition; 1 megohm; 1/2 W; ±15%</td>
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<td>RC21BF190K</td>
<td>Resistor, fixed: composition; 1 K; 1/2 W; ±15%</td>
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<td>RC3BF432K</td>
<td>Resistor, fixed: composition: 56 K; 1 W; ±15%</td>
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<td>Resistor, fixed: composition: 10 mgswhm; 1/2 W; ±10%</td>
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<td>RC21BF502K</td>
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<td>Resistor, fixed: wire wound; 5 K; 10 W; ±5%</td>
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<td>R21</td>
<td>3-161</td>
<td>Resistor, fixed: wire wound: 256 ohm; 10 W; ±5%</td>
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<td>R22</td>
<td>4-268</td>
<td>Resistor, variable: wire wound: 1 K; 25 W; ±15%</td>
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#### 6.2 SWEEP CHASSIS ELECTRICAL PARTS LIST DE-1950

**Type 7002-A1**

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<td>3-1216</td>
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<td>1-1165</td>
<td>Capacitor, fixed: electrolytic; 4 mfd; 50 V; ±45, ±10%</td>
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<td>Capacitor, fixed: electrolytic; 8 mfd; 110 V; ±40, ±25%</td>
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<td>3-1189</td>
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<td>3-1207</td>
<td>Capacitor, fixed: paper; .008 mfd; 600 V; ±25%</td>
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<td>3-1199</td>
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<th>No.</th>
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<td>500 V</td>
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<td>Capacitor, variable: ceramic: 4-30 mfd; trimmer</td>
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6.3 RF Assembly Electrical Parts List DE-1955.

Type 7027-A1

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</tr>
<tr>
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<td>CM120471K</td>
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<td>500 V</td>
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<td>Capacitor, variable: ceramic: 4-30 mfd; trimmer</td>
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<tr>
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<td>CM120471K</td>
<td>Capacitor, variable: ceramic: 4-30 mfd; trimmer</td>
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</table>
C7 3-1214 Capacitor, variable: 25 mmfd; air
C8 1206 Capacitor, fixed: ceramic; 15 mmfd; ±1.5
mmfd.
C9 CMHCVT1K Capacitor, fixed: mica; 470 mmfd;
±10%; 600 V
C10 CMHCVT1K Capacitor, fixed: mica; 470 mmfd;
±10%; 600 V
C11 3-367 Capacitor, variable: ceramic; 4-39 mmfd;
trimmer
C12 3-1223 Capacitor, fixed: ceramic; 5 mmfd ±0.5
mmfd.
C14 3-1215 Capacitor, fixed: ceramic: 1 mmfd; ±29%
C14 CMHCVT1K Capacitor, fixed: mica; 476 mmfd; ±10%
500 V
C16 CMHCVT1K Capacitor, fixed: mica; 476 mmfd; ±10%
500 V
11 39-16 Lamp, incandescent: 6-8 V; 0.55 amp.
12 39-16 Lamp, incandescent: 6-8 V; 0.55 amp.
13 39-16 Lamp, incandescent: 6-8 V; 0.55 amp.
14 39-16 Lamp, incandescent: 6-8 V; 0.55 amp.
L1 See Wiring Diagram
L2A 21-357 Inductor, variable (3 gang Inductor)
L2B Part of L2A
L2C Part of L2A
L3 See Wiring Diagram
L5B 21A-11281 Coil, shaft
L5C See Wiring Diagram
L5D 34C-1710-101 Assembly, Magnetic Clutch Body
R1 2-957 Resistor, fixed: composition; 200 ohm:
±5%; 1/2 W
R2 2-948 Resistor, fixed: composition; 10,000 ohm:
±10%; 2 W
R4 2-956 Resistor, fixed: composition; 11,000 ohm:
±10%; 1/2 W
R6 2-1900 Resistor, fixed: composition; 1 megohm:
±10%; 1/2 W
R8 2-952 Resistor, fixed: composition; 47 ohm:
±10%; 1/2 W
R9 2-954 Resistor, fixed: composition; 220,000 ohm:
±10%; 1/2 W
R11 2-956 Resistor, fixed: composition; 12,000 ohm:
±10%; 1/2 W
R12 2-948 Resistor, fixed: composition; 10,000 ohm:
±10%; 1/2 W
R14 2-956 Resistor, fixed: composition; 15,000 ohm:
±10%; 1/2 W
S1 5-386 Switch, rotary jack
V1 25-436 Tube; electron; twin triode; miniature
type: Type 6J3
V1 25-6AK5 Tube; electron; H.P. amplifier pentode;
miniature type: Type 6AK5
V9 25-436 Tube, electron; twin triode; miniature
type: Type 6J3

6.4 IF ASSEMBLY ELECTRICAL PARTS LIST DE-1951.
Type 7003-A1
C11 CM381B103K Capacitor, fixed: mica; 16,000 mmfd; 300
V; ±25%
C12 Same as C11
C13 3-1227 Capacitor, fixed: ceramic; 1,000 mmfd;
±25%; High K
C14 3-1224 Capacitor, fixed: ceramic; 4.3 mmfd;
±25 mmfd.
C16 CM65C105F Capacitor, fixed: mica; 39 mmfd; 500 V;
±5%
C17 Same as C16
C18 Same as C11
C20 CM65R47M Capacitor, fixed: mica; 4700 mmfd; 500
V; ±10%
C21 Same as C11
C22 Same as C11
C24 Same as C20
C25 Same as C11
C26 Same as C20
C27 Same as C11
C28 Same as C20
C29 Same as C20
C30 Same as C20
C31 Same as C11
C32 3-1119 Capacitor, fixed: paper; 10,000 mmfd
680 V; ±25%
C34 Same as C11
C35 CM39BD416K Capacitor, fixed: mica; 17 mmfd 660 V;
±10%
C36 Same as C11
C37 Same as C11
C38 Same as C36
C39 Same as C36
C40 Same as C30
C41 CM35R471K Capacitor, fixed: mica; 470 mmfd 560 V;
±10%
C42 Same as C30
C43 Same as C30
C44 Same as C30
C46 Same as C30
C47 Same as C11
C48 Same as C11
C49 Same as C30
C50 Same as C30
C51 Same as C11
C52 Same as C11
C53 Same as C11
C54 Same as C11
C55 Same as C11
C56 Same as C11
C57 Same as C11
C58 Same as C11
C59 Same as C30
C60 Same as C30
C61 2-501 Capacitor, fixed: electrolytic: 10 mmfd; 10
V; −10% −20%
C62 Same as C11
C63 Same as C11
C64 Same as C11
C65 Same as C11
C66 Same as C11
C67 Same as C11
C68 Same as C11
C69 Same as C11
C70 Same as C11
C71 Same as C11
C72 Same as C11
C73 Same as C11
C74 Same as C11
C75 Same as C11
C76 Same as C11
C77 Same as C11
C78 3-1112 Capacitor, fixed: paper; 0.5 mmfd 660 V;
±25%
C79 3-1115 Capacitor, fixed: paper; 65 mmfd 660 V;
±25%
C80 Same as C18
C81 Same as C18
C82 Same as C20
C83 3-1164 Capacitor, fixed: electrolytic; four section
10-14-14-14 mmfd; 415 V; ±40 −10%
C84 Same as C32
C85 Same as C32
C86 Same as C32
C87 2-812 Capacitor, fixed: electrolytic; impedance
1.0 ohm at 60 cps; 3 V
C88 Same as C20
C89 Same as C20
C90 Same as C20
C91 Same as C20
C92 Part of C83
C93 Same as C20
C94 Part of C83
C95 2-1156 Capacitor, fixed: paper; 10,000 mmfd; 600
V; ±25%
C96 Same as C11
C97 10-750 Rectifier, selenium
F1 11-2 Fuse, cartridge: 1 ampere
J1 5-376 Connector, female: 1 pin
J2 9-334 Connector, female: 6 pin
J3 1-418 Connector, female: 2 pin
J4 10-244 Board, terminal: two terminal
K1 1-206 Relay, SPST

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6.5 TONE SELECTOR ELECTRICAL PARTS LIST
DE-1953.

**Type 7009-A1**

- **C1**: CM14B11K Capacitor, fixed: mica; 470 mmfd; 600 V; ±10%
- **C2**: CM14B12K Capacitor, fixed: mica; 47,000 mmfd; 60 V; ±10%
- **C3**: 12-157 Capacitor, fixed: paper; 0.02 mmfd; 680 V; ±20%
- **C4**: CM20A21K Capacitor, fixed: mica; 220 mmfd; 600 V; ±10%

**J1**: 9-276 Connector, female: 1 contact
**J2**: 9-276 Connector, female: 1 contact

**R1**: RC31BP141K Resistor, fixed: composition; 32,000 ohms; 1/2 W; ±10%
**R2**: RC31BP121K Resistor, fixed: composition; 22,000 ohms; 1/2 W; ±10%
**R3**: RC31BP181K Resistor, fixed: composition; 68K; 1/2 W; ±10%

**S1**: SC4103 Switch, push button; 5 position selector

6.6 SERVICE SELECTOR ELECTRICAL PARTS LIST
DE-1954.

**Type 7010-A1**

- **C1**: 8-319 Capacitor, fixed: paper; 0.5 mmfd; 200 V; ±5%

**J1**: 9-276 Connector, female: 1 contact; shielded
**J2**: 9-276 Connector, female: 1 contact
**J3**: 9-276 Connector, female: 1 contact

**P1**: 9-364 Connector, chassis: male; 8 pins

**S1**: SC4104 Switch, push button; 5 position

6.7 RECORD CHANGER ELECTRICAL LIST.

(DE-1958—Type 7007-A1)

- **C1**: 2-137 Capacitor, fixed: paper; 0.2 mmfd; 680 V

**P1**: 9-316 Connector, male: 2 prong

**R1**: RC31BP143K Resistor, fixed: composition; 47,000 ohms; 1/2 W; ±10%

**R1C1**: 69-3 Record Changer, intermix
**J2**: 35-0 Lamp, incandescent; 6 W; 110 V
**S3**: 5-322 Switch, sensitive; SPST, spring return, normally closed

(DE-1959—Issue 3—Type 7018-A1)

- **C1**: 3-1107 Capacitor, fixed: paper; 0.2 mmfd; 680 V
**J2**: 38-5 Lamp, incandescent; 6 watt; 110 V
**P1**: 9-340 Connector, male: 2 prong

**R1**: RC31BP471K Resistor, fixed: composition; 47,000 ohms; 1/2 W; ±10%
**R1C1**: 69-1 Record Changer, non-intermix

**S2**: 5-322 Switch, sensitive; SPST, spring return, normally closed

6.8 CATHODE-RAY TUBE AND OTHER CABINET MOUNTINGS ELECTRICAL PARTS LIST.

(DE-1952—Type 7008-A1)

**M1**: 36-739 Meter, 150 m.p.; zero center, dwgs. no. DD44468 with scale dwg. DD44468

(DE-1957—Issue 2—Type 7005-A1)

- **P1**: 11-34 Fuse, cartridge: 8 amp; 250 V
**P2**: 11-34 Same as P1

- **J1**: 46-6 Lamp, glow: neon; 115 V; 1/4 watt

**L1**: 21-C4892-101 Focus Coll Assembly
**L2**: 21-254 Inductor, fixed: deflection yoke

**S1**: 5-51 Switch, push; SPST
**S7**: Same as S1

(DE-1958—Issue 1—Type 7014-A1)

- **P1**: 11-34 Fuse, cartridge: 8 amp; 250 V
**P2**: 11-34 Same as P1

- **J1**: 46-6 Lamp, glow: neon; 115 V; 1/4 watt

**L1**: 21-C6892-101 Focus Coll Assembly
**L2**: 21-254 Inductor, fixed: deflection yokes

**S1**: 5-51 Switch, push; SPST

(DE-1961—Issue 3—Type 7017-A1)

- **L51**: 51-11 Speaker, Dynamic, 12"}

- **L51**: 30-761 Loudspeaker, 15"; Permanent Magnet Dynamic

- **(DE-1959—Issue 1—Types 7022-A1, A2, 7013-A1)

**B1**: 62-40 Motor, A.C.: series; 100 pound inches

- **P1**: 11-34 Fuse, cartridge: 1/2 amp; 250 V

- **P2**: 9-340 Connector, male: 2 prong

**S1**: 5-218 Switch, sensitive: SPST, normally open
**S4**: 5-217 Switch, sensitive: SPST, normally closed
**S4**: Same as S4

**S5**: 5-226 Switch, pull: SPDT; no off

**V1**: 25-120BP Tube, electron: type 209BS; cathode-ray

**(DE-1951—Issue 1—Types 7024-A1, A2, 7025-A1, A2, and 7026-A1, A2)

**V1**: 25-15AP Tube, electron: Type 15AP, cathode-ray
The most important difference between the RA-101A and the RA-101B is in the sweep chassis. In the RA-101A telesets, a cascade voltage doubler using a 60 cycle transformer was used. The output voltage from this supply was approximately 12 Kv.

In the RA-101B, an RF power supply is used to provide the necessary high voltage. The output voltage of this supply is usually set for approximately 17 Kv. This output voltage can be varied by adjusting Ch2.

Another change that is incorporated in the sweep chassis of the 101B is the use of a 6A15 in a time delay circuit. This in conjunction with relay K1, prevents the application of high surge voltages to the filter capacitors of the low voltage power supply.

In the audio amplifier used with the RA-101B an additional 10,000 ohm 20 watt resistor was added across C12, the 80 mfd. filter condenser in the power supply. This change was necessary to increase the focus current because of the higher voltage used for the cathode-ray tube.