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711A  
FM RECEIVER

NEW  
PLAYBACK  
SERIES

New Purchase Date  
Feb 20-68

OPERATING  
INSTRUCTIONS



Figure 1: The Altec 711A FM Receiver (in accessory Walnut Cabinet)

## Forward

Your new Altec 711A, the first all-silicon transistor FM Receiver, represents the maximum in fine sound reproduction. The 711A is evolved from Altec's extensive experience as the largest manufacturer of professional sound equipment and as the pioneer in transistor audio components. Your 711A was developed after years of extensive circuit evaluation and stringent testing by Altec engineers to provide you with years of listening pleasure.

Not only is the 711A an all solid-state device, but also — and even more important — it uses only *silicon* transistors; the most rugged and reliable transistors available.

Other outstanding features you will find in your 711A are:

- ... a full 100-watts of undistorted sound
- ... no transformers in any portion of the audio amplifiers
- ... a four-gang tuning condenser
- ... a fully neutralized IF (which uses high-gain silicon transistors)
- ... automatic stereo switching for FM Multiplex
- ... smooth, exact ball-bearing tuning
- ... a tuning meter for precise FM tuning

In essence, the 711A is THE FM Multiplex Receiver to meet all the requirements of the most exacting listener.



A Division of *LSV* Ling Altec, Inc.

1515 S. Manchester Ave., Anaheim, Calif.  
New York

40753-1

Price \$.56

Litho in USA C/P

10/65

# Specifications

## GENERAL

**Controls:** Multiplex Filter Switch  
Input Selector Control  
Tape Monitor Switch  
Low Cut Switch  
Stereo-Mono Switch  
Loud-Volume Switch  
Speakers-Remote Switch  
Dual Volume Controls (ganged)  
Dual Bass Controls (ganged)  
Dual Treble Controls (ganged)  
Power On-Off Switch  
FM Tuning Control

**Inputs:** FM Antenna (Distance and Local Terminals)  
Tape Monitor (Left and Right Channels)  
Extra (Left and Right Channels)  
Phono (Left and Right Channels)  
Tape Head (Left and Right Channels)

**Outputs:** Main Speakers (Left and Right Channels)  
Remote Speakers (Left and Right Channels)  
Center Channel Voltage Output  
Recorder Output (Left and Right Channels)  
AC Power Outlet (Switched)  
Headphone Jack

## TUNER

**Antenna:** Standard 300  $\Omega$  twin lead

**IHF Usable Sensitivity:** 2.2  $\mu\text{v}$

**Image Rejection:** > 65 db

**IF Rejection:** > 100 db

**Frequency Response:**  $\pm 1$  db from 20 to 20,000 cps

**Capture Ratio:** 2.5 db

**Antenna Radiation:** Within FCC requirements

**AGC:** Controls RF stage gain

**Tuning Indicator:** Meter

## MULTIPLEX

**Type:** Time division

**Separation:** 40 db

**Activation:** Automatic electronic gating by pilot signal

**Indication:** Signal lamp on front panel lights to indicate Multiplex transmission signal being received

## AMPLIFIER

**Power Output:** 100 watts total, IHF Standard at 0.5% THD, 4  $\Omega$  (50 watts per channel)  
70 watts total, IHF Standard at 0.25% THD, 8  $\Omega$  (35 watts per channel)

**Power Bandwidth:** 10 to 40,000 cps, IHF Standard

**Frequency Response:**  $\pm 1$  db from 10 to 100,000 cps

**Tone Control Range:**  $\pm 18$  db at 20 cps and 2,000 cps

**Low Cut Filter:** -6 db per octave below 30 cps

**Input Sensitivity:** (For 35 watts output at 1000 cps)  
Tape Monitor - 450 mv  
Tape Head - 2.2 mv  
Phono - 4.0 mv  
Extra - 450 mv

**Input Impedance:** Phono and Tape Head - 47,000  $\Omega$   
Tape Monitor - 250,000  $\Omega$   
Extra - 10,000  $\Omega$

**Load Impedance:** 4 to 16  $\Omega$

**Amplifier Protection:** Three 1-ampere circuit breakers

**Damping Factor:** 50

**Noise Level:** (Below 35 watts)  
Tape Monitor - 82 db  
Tape Head - 53 db  
Phono - 60 db  
Extra - 82 db

**Transistors:** 16 - 2N2712; 4 - 40461; 4 - 2N3055;  
2 - 36811 or TA2651; 2 - 40245; 1 - 40242;  
1 - 40243; 1 - 40244; 1 - 40246.

**Diodes:** 7 - 1N3754; 3 - 1N87A; 2 - 1N542;  
2 - A10B G.E.; 1 - LMZX 9.1A;  
1 - LMZX 12A.

**External Power:** One AC outlet controlled by master power switch

**Power Consumption:** Zero Signal Power - 20 watts  
Normal Operating Power - 55 watts

**Power Requirements:** 120 v, 60 cps

**Color:** Blue metal case with brushed gold panel

**Dimensions:** 5 $\frac{1}{2}$ " H x 16 $\frac{3}{4}$ " W x 12" D (including knobs)

**Weight:** 19 lb

**Accessory:** Altec 40728-1 Walnut Cabinet

## Description

The Altec 711A contains all the facilities necessary to create a complete "Music Center" in any home. It will receive FM — monophonic and Multiplex. It contains two complete amplifiers — preamplifiers and power amplifiers. The inputs, outputs, and controls provide for the addition of a record changer or turntable, a tape deck or tape machine, AM tuner, or other optional audio equipment as may be desired.

The FM circuitry features automatic all-electronic stereo switching which distributes regular FM and Multiplex signals to their proper channels. The tuning meter provides a visual means for precise, maximum strength FM tuning. An indicator light serves as a guide to the type of broadcast being received; lighting when the signal is being transmitted in Multiplex. The four-gang tuning condenser is integrated with the fully-neutralized IF which uses high-gain silicon transistors.

The unique design of the dual amplifier sections, which incorporate all-silicon transistors, has eliminated ALL audio transformers. Output transformers have been done away with and, more significant, the driver transformers have been eliminated to provide a true transformerless high quality stereo amplifier. Capable of 100 watts output (50 watts per channel), the 711A has infinitesimal distortion. Total harmonic distortion at 70 watts is only 0.25% (IFM Standard).

The 711A has all the necessary controls for maximum versatility. Dual, index-locked controls are friction-coupled for volume and

tonal adjustments. These controls may be adjusted independently for each channel or, by use of only one knob, the relative volume or tonal balance between channels may be maintained while the overall volume (or tone) is altered. Easy operating rocker switches control other functions such as power, remote speakers, tape monitoring, low cut filter, low volume compensation, stereo-monophonic mode, and the Multiplex filter.

Speaker connections permit the installation of a secondary stereo listening area remote from the main speakers. Also, a center channel output is available for use with an additional amplifier and loudspeaker in the patio or any other area where monophonic reproduction may be desired.

The 711A has three circuit breakers of the automatic reset type. In the event of a malfunction, one or more of these devices will turn off and on at intervals of a few seconds. Should this occur, turn the power switch OFF as soon as possible to avoid damage to other components. Necessary repairs should be made by qualified personnel.

The best safety device, however, is proper connections and correct operation of the 711A. In the pages which follow are instructions and suggestions for the use of the 711A. Read these carefully. Compliance with them will assure you of the utmost in listening enjoyment and the maximum of trouble-free performance of your 711A.

## Installation

### VENTILATION REQUIREMENTS

The performance of any solid-state device may be impaired by high temperatures. Such heat may result from a rise in the ambient (surrounding) temperature, or from heat generated by the device. Maximum performance, therefore, will not be obtained unless the unit is provided with proper ventilation.

The 711A is designed to incorporate the most effective means of dissipating heat from the transistors. The back panel serves as the major heat dispersion area. The 711A should not be placed in a location or installation which impedes the flow of air up and across the back panel.

The four plastic feet on the bottom of the 711A permit an adequate flow of air under the unit to the back panel when the unit is shelf mounted. However, other equipment which may emit

heat should be kept away from the unit. Do not place the 711A on top of, or closely adjacent to any heat producing unit.

### CUSTOM INSTALLATION (See Figure 2.)

When the 711A is installed in a custom cabinet, the top and bottom covers, which provide circuit shielding, should not be removed from the unit. The cut-out size of the panel should measure  $16\frac{1}{16}$ " wide (long) by  $4\frac{5}{8}$ " high, and the bottom of the cut-out should be flush with the shelf on which the 711A will rest. The shelf should be no deeper than the 711A chassis ( $10\frac{3}{4}$ " ), or should have slots provided at that point to permit air to flow past the back panel. If the custom cabinet is built with a back wall, make certain that provisions are made to permit air to escape above the back of the 711A.

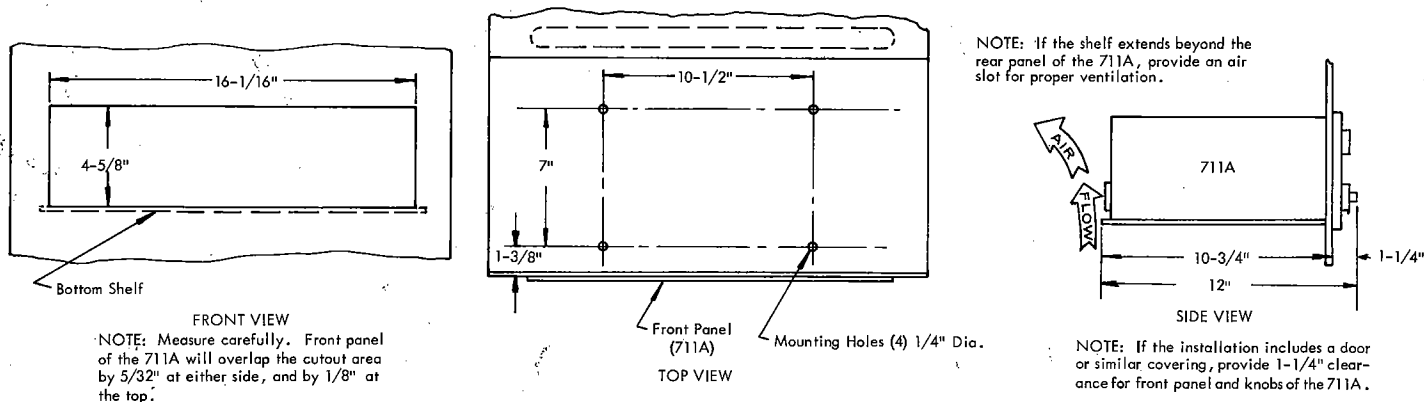


Figure 2: Custom Installation Drawings

To install the 711A, remove the four plastic feet and slide the unit into the cut-out. The brushed gold front panel will overlap the cut-out. If it is desired to secure the unit, the bottom shelf should be provided with four  $\frac{1}{4}$ " holes which will align with the holes for the screws which attach the plastic feet to the bottom of the 711A. The centers of two holes should be  $10\frac{1}{2}$ " apart and  $1\frac{3}{8}$ " from the front of the cut-out. The centers of the other two holes also should be  $10\frac{1}{2}$ " apart and 7" behind the centers of the first pair. A flat washer and 6-32 screw inserted from under the shelf through each hole will secure the 711A to the shelf. The length of the screws used will be determined by the thickness of the shelf and should not be more than  $\frac{1}{4}$ " longer than that thickness.

## WALNUT CABINET

The Altec 40728-1 Cabinet is an accessory item which may be used with the 711A. To install the unit in this hand-rubbed walnut enclosure:

- (1) Remove the four plastic feet from the bottom of the 711A by loosening the retaining screws.
- (2) Remove the screws from the retaining feet.
- (3) Slide the 711A into the walnut cabinet (from front to back).
- (4) Align the slots in the bottom of the walnut cabinet with the holes in the bottom of the 711A chassis.
- (5) Using the screws furnished with the walnut cabinet, replace the plastic feet.

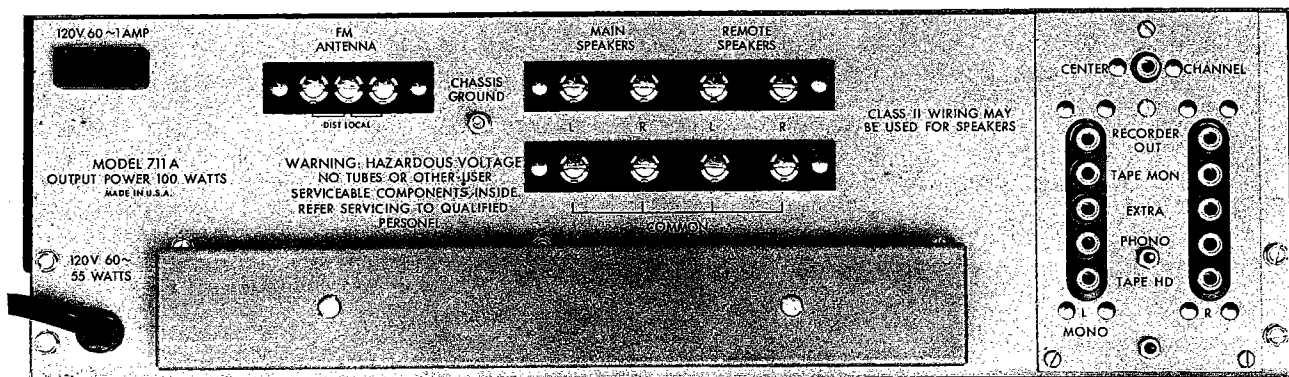


Figure 3: Rear View Showing Connections and Inputs

## Connections (See Figure 3.)

### AC POWER CONNECTIONS

The 711A operates from a 120-volt, 60-cycle ac source. In addition to the usual ac cord and plug, the 711A has an ac outlet on the rear of the unit which provides a connection to power auxiliary equipment such as a turntable, record changer, tape machine or deck, AM tuner or other audio components. This outlet is switched 'on' and 'off' by the master power switch on the front panel of the 711A.

### ANTENNA

A FM antenna should be connected to the FM ANTENNA terminals on the rear of the 711A. Provisions are made for connections for both LOCAL and DIST(ant) station reception. In areas where the FM signal is strong, the antenna should be connected to the terminals marked LOCAL. Where no FM stations are located nearby, use of the DIST terminals will provide greater sensitivity.

If FM reception — particularly Multiplex reception — has a high noise level (hiss) and low meter readings, the quality of the reception will be improved by transferring the antenna from the LOCAL to the DIST terminals. If there is evidence of overloading by nearby high-powered stations, the antenna should be transferred to the LOCAL terminals.

A dipole antenna, made of 300-ohm twin-lead, is furnished with the 711A. This antenna is designed for reception of strong local FM stations only. It may be placed on the back of a cabinet or

bookcase, attached to a wall, or, with the use of additional leads (300-ohm twin-lead), it may be concealed in the attic or other interior area.

For best results — especially for Multiplex reception — an outdoor antenna should be used. Optimum FM reception requires careful positioning of the antenna in regard to height and orientation to achieve satisfactory results. (Consult your local Altec High Fidelity distributor or local service man.)

**NOTE:** A separate FM antenna, correctly installed, is required for optimum performance. The 711A should NOT be connected to an antenna utilized by a television receiver unless a good quality coupler is used and the area has exceptionally good reception.

### INPUT CONNECTIONS

All input connections, plus those of the RECORDER OUT and the CENTER CHANNEL outputs, should be made with the standard low-capacitance shielded or coaxial cable (often referred to as 'phono cable'). Most audio components associated with a tuner-amplifier such as the 711A are supplied with the necessary connecting cables and plugs.

All stereo input connections should be made to the 'L' (left) and the 'R' (right) jacks in accordance with the designations on the inputs. Monophonic inputs should be made to the left jack only.

## Tape Monitor Input

The TAPE MON jacks are for the connection of a stereo or a monophonic tape machine (or recorder-player) which has self-contained preamplification and equalization facilities. Many tape machines use separate heads for recording and playback; an arrangement which permits monitoring directly from the tape while recording. With the input of the tape recorder connected to the RECORDER OUT jacks of the 711A, and the output of the tape recorder connected to the TAPE MON inputs, any program material received by the 711A may be recorded and the recorded signals monitored by use of the TAPE MON rocker switch. (See TAPE MON Switch operation, Page 7.)

## Phono Input

Turntables or record changers should be connected to the PHONO inputs. These inputs provide proper preamplification and equalization for magnetic phono cartridges and should be used for connection of low-level output components only.

NOTE: Record changers or turntables equipped with a ceramic or crystal cartridge require the use of a good phono adapter. (See your Altec High Fidelity distributor.)

## Tape Head Input

Tape decks having no electronics may be played through the 711A by connecting the tape deck outputs to the TAPE HEAD inputs. This type of machine cannot be used for recording or monitoring. Do not connect tape machines or other high-level input sources to the TAPE HEAD inputs.

## Extra Input

The EXTRA inputs may be used for the connection of any stereo or monophonic source which furnishes a high-level output signal. Such audio units as tape machines, AM tuners or television sound may be connected to these inputs.

## OUTPUT CONNECTIONS

### Recorder Out

The RECORDER OUT jacks provide a source of audio signal output from the 711A to the input jacks ('high level' or 'line') of a tape recorder. When connected, any program material selected

and amplified by the 711A may be recorded. The signal at the RECORDER OUT jacks is independent of the Volume, Bass and Treble controls of the 711A.

### Center Channel Out

The CENTER CHANNEL voltage output jack provides a monophonic audio signal (combined from both right and left channels) for driving an additional amplifier and loudspeaker system in a remote area. Volume, Bass and Treble controls on the 711A are bypassed so that these functions may be controlled at the remote amplifier.

## SPEAKER CONNECTIONS (See Figure 4.)

Output connections at the dual speaker terminal strips may be made with standard AC line ('zip' or 'class II'), or with special speaker wire. When using stranded wire, be sure to prevent any loose strands from shorting out to adjacent terminals or to the case of the unit.

### Main Speakers

Two terminal barrier strips, on the rear of the 711A, are marked for speaker connections. To connect the MAIN speakers, connect the speaker located on the listener's left to the terminals marked 'L', and the speaker to the listener's right to the 'R' terminals. To obtain proper phasing, make certain that the corresponding terminals of each speaker are connected to the corresponding terminals on the rear of the 711A. For example, the plus terminal of one speaker is connected to the top terminal. For proper phasing, the plus terminal of the other speaker also should be connected to the top terminal for that channel. Minus terminals of both speakers should be connected to the proper bottom (common) terminals. (See Phasing, Page 5.)

### Remote Speakers

The 711A has a second set of terminals (marked REMOTE) to permit connection of another pair of speakers. These speakers may be located in a second listening area where stereo reproduction is desired. Connections to the remote speakers should be made in the same manner as for the main speakers.

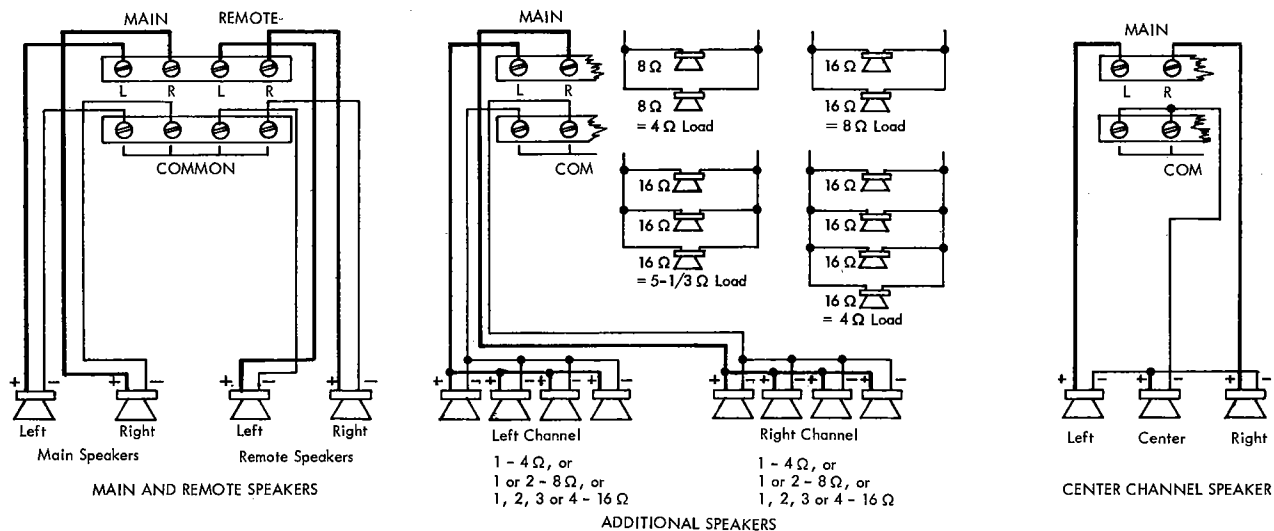


Figure 4: Speaker Connection Diagrams

### Third Channel Speaker (See Figure 4.)

A third (center) channel speaker, which receives the sum of the signals being fed to both the right and left channels, will prevent the "hole-in-the-middle" effect and will tend to offset conditions where extreme physical separation exists between the two speakers. If a third channel speaker is desired, it may be connected as indicated in Figure 4.

### Additional Speakers

In those installations where additional speakers are desired, they may be connected in parallel as indicated in Figure 4.

NOTE: Speaker load impedance should not be less than 4 ohms.

### SPEAKER PHASING

Proper phasing of all loudspeakers is essential. Incorrect phasing — when the polarity of one speaker is reversed — can cause unsatisfactory reproduction in both the stereo and monophonic modes. Bass notes will be attenuated and stereo sound will tend to jump back and forth between the speakers.

When properly phased, stereophonic program material will assume an added depth and spread of sound, and the various musical instruments will appear in their proper position as originally recorded. Monophonic material, properly phased, will appear as a single point source directly between the two loudspeaker systems.

If speaker connection instructions are followed, the speakers should be in phase. The phasing may be tested by reversing the connections to one speaker and listening to the resultant sound. Speakers in phase will have more volume at the same control setting than will speakers which are out of phase.

A visual test for proper phasing may be made in those installations where the loudspeaker cones are visible. Disconnect the speakers from 711A and connect the negative lead from a 1.5-volt dc dry cell battery to one terminal of one speaker. Use the positive lead to rapidly make and break connection to the other speaker terminal while observing the direction of travel of the speaker cone. If, for example, the cone travels forward each time the lead is applied, then test the terminals on the second speaker to deter-

mine which one will cause that cone to move forward also. For proper phasing, connect these two terminals to similarly marked speaker connection terminals on the 711A. That is, connect one to the top 'L' terminal and the other to the top 'R' terminal. The remaining speaker terminal lines then should be connected to the proper COMMON terminals.

### SPEAKER PLACEMENT

The correct placement of loudspeakers is important, regardless of the number of channels utilized, or if the reproduction is monophonic or stereo.

Stereophonic reproduction is dependent upon the time and intensity difference between separate output channels. Many single enclosures (so-called stereo consoles) provide too small a distance between speakers for good stereo reproduction. If, on the other hand, the distance between speakers is too great, there may be an apparent lack of sound between the speakers (the 'hole-in-the-middle' effect).

Optimum loudspeaker placement for the average listening room will be from 8 to 12 feet apart, measured between the centers of the speaker cabinets. The optimum listening area in front of the speakers will be from 1 to 2 times the amount of separation between the speakers. Therefore, the best overall sound quality will be obtained when the listener is seated from 8 to 24 feet in front of loudspeakers which are 8 to 12 feet apart.

### HEADSET CONNECTIONS

Any high-quality stereophonic headset may be plugged into the 711A for private listening. The headset should have an impedance of from 4 to 16 ohms. It may be left connected to the PHONES jack in the center of the lower front panel, or it may be inserted and removed as needed. The output to the headset jack is controlled by the SPEAKERS-REMOTE rocker switch on the front panel, and is sufficiently attenuated so as not to damage the headset diaphragms when switching from program material appearing on the speakers. Output to the headset may be obtained by placing the rocker switch in the REMOTE position.

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## Operation and Controls

### General

Knowledge of the function of each control knob and switch will enable the listener to enjoy the fine reproduction of which the 711A is capable. Correct use of the controls may make the difference between good and outstanding performance.

### POWER ON-OFF Switch

The POWER ON-OFF power switch, a rocker switch, is located at the extreme right side of the front panel. To turn the 711A on, press in the top section of the rocker switch.

### INPUT Selector Control

The INPUT selector control determines which input source, whether monophonic or stereo, is to be heard through the 711A. Each input position is indicated:

- TAPE HEAD — for playback of pre-recorded tapes from a tape deck which does not incorporate preamplification stages.
- PHONO — for use with magnetic cartridge turntables or record changers for the playback of monophonic or stereo discs.
- FM — for the reception of both regular and Multiplex FM radio transmission.
- EXTRA — for use with any other high-signal level output audio accessory.



Figure 5: Front Panel Showing Controls and Switches

## VOLUME Controls

The VOLUME control is a dual, ganged control with concentric knobs, one for each channel. The larger (outer) knob controls the left channel and the smaller (inner) knob controls the right channel. These controls are friction-coupled to permit the volume of both channels to be adjusted simultaneously by the rotation of either knob. Clockwise rotation increases the volume while counterclockwise rotation decreases it.

## BALANCE

If the balance of the loudspeakers is not correct, it may be altered by turning the volume control knob for one channel only. For example, if the left speaker channel is not as loud as the right channel speaker, hold the right channel control knob and increase the volume of the left channel until the speakers are in balance. The dual controls will remain friction-coupled at this setting, allowing the overall volume level to be altered while maintaining the proper speaker balance.

## BASS and TREBLE Controls (See Figure 6.)

The BASS and TREBLE controls are dual, ganged controls, also, permitting these functions to be altered simultaneously in both channels, or — by turning one knob in relation to the other — individually. The larger (outer) knobs control the left channel and the smaller (inner) knobs are for right channel adjustments.

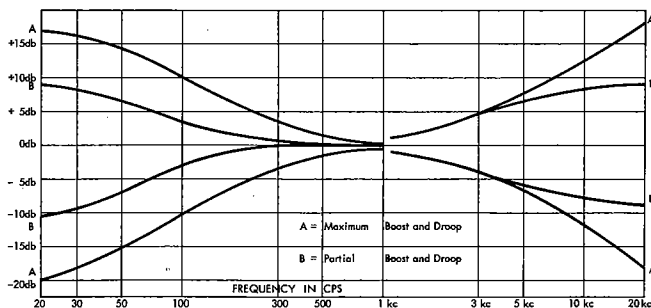


Figure 6: Tone Control Response Curves

For most program material, stereo or monophonic, the BASS and TREBLE controls may be left in the center (12 o'clock) position for a flat response. Clockwise rotation of these controls increases the bass or treble volume, while counterclockwise rotation decreases the volume level of the frequency extremes.

## ROCKER SWITCHES

In addition to the POWER ON-OFF switch, there are six other rocker switches located on the bottom half of the front panel. Each control has two positions and is marked in accordance with its function and position.

## MPX FILT Switch

The Multiplex filter switch is located at the extreme left side of the front panel and is marked MPX FILT. Some FM stations broadcast background music for markets, stores, restaurants and similar businesses simultaneously with the regular FM programs. This "SCA" programming, commonly known as 'store-casting', is frequency modulated on a 67 kc carrier and is transmitted together with the Multiplex signal. It is possible that the 'store-cast' program may interfere with the regular program and may be heard as 'warble' or 'birdie' sound in the background of a Multiplex program. Placing the MPX FILT switch in the on position introduces a high attenuation 67 kc filter into the circuit, eliminating 'store-casting' interference.

## TAPE MON Switch

To the right of the INPUT selector control is the TAPE MON rocker switch. When a tape recording is being made of program material being received by the 711A, the original signal may be compared to the tape recorded signal by placing the TAPE MON rocker switch in the on position. The sound heard through the loudspeakers will be directly from the tape as recorded a fraction of a second earlier. The TAPE MON switch has no effect on the input signal being recorded.

## TAPE MACHINES

A pre-recorded tape played back on a tape machine may be heard by placing the TAPE MON rocker switch in the on position. The position of the INPUT selector will not affect the tape recordings played back in this manner.

**NOTE:** Always move the TAPE MON to the OFF position following the completion of a monitoring or tape playback function. With this switch in the TAPE MON position, only input signals from the tape machine will be heard regardless of the position of the INPUT selector control.

## LOW CUT Switch

Placing this rocker switch in the LOW CUT position will attenuate the extreme low frequencies (usually below the bass tones recorded or transmitted in program material). The most common source of such unwanted noise is the 'rumble' found in some automatic record changers. The distraction of these low 'rumble' frequencies may be removed by the use of the LOW CUT switch.

## STEREO-MONO Switch

In the STEREO position, this rocker switch permits all stereophonic input sources to be amplified and controlled by both channels of the 711A. When listening to monophonic input sources, the switch should be placed in the MONO position to permit single-channel program material to be heard through all the loudspeakers connected to the unit. Use of the MONO position when playing monophonic recordings with a stereo car-

tridge will cancel the rumble and noise introduced by the vertical component of the monophonic record.

When playing a monophonic half- or quarter-track tape on a stereo tape machine, the MONO position will permit the desired single track ('left' or 'A') to be heard through all the speakers without interference from adjacent tape tracks.

The STEREO-MONO rocker switch should be in the STEREO position when tuning and listening to FM Multiplex broadcasts (see Tuning Procedures, Page 8).

## LOUD-VOL Switch

The human ear decreases in sensitivity at the low end of the audio frequency spectrum when program material is heard at reduced listening levels. When placed in the LOUD position, the LOUD-VOL switch will provide the required compensation up to nearly mid-position of the Volume control. Beyond this setting, the loudness compensation is automatically removed and the Volume control does not affect the frequency response. In the VOL position, there will be no compensation present regardless of the position of the Volume control.

## SPEAKERS-REMOTE Switch

When this switch is placed in the SPEAKERS position, the main speakers are connected to the amplifier output. In the REMOTE position, the main speakers are disconnected and the remote speakers and headphone jack are connected to the amplifier output.

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# FM Tuning Procedures

## MONOPHONIC

To tune the 711A for reception of FM monophonic transmissions,

- (1) Place the INPUT selector control in the FM position.
- (2) Place the STEREO-MONO rocker switch in the STEREO position. (The circuitry automatically selects and indicates the type of program. If the transmission is monophonic, the STEREO FM indicator at the right end of the tuning dial will not light. Should there be background noise with even a fairly strong signal, placing the switch in the MONO position will minimize the noise.)
- (3) Place the MPX FILT rocker switch in the OFF position.
- (4) Tune the desired station by rotating the tuning control knob on the upper right hand side of the front panel.
- (5) Check the tuning meter (upper left hand side of the front panel) for best tuning. The meter will show a maximum reading when the station is correctly tuned. A low maximum reading (of about 5 or 6) indicates a comparatively weak station and may or may not provide satisfactory reception.
- (6) Adjust the volume and tone controls to suit the individual preference.

## MULTIPLEX

To tune the 711A for reception of FM Multiplex transmissions,

- (1) Place the INPUT selector control in the FM position.
- (2) Place the STEREO-MONO rocker switch in the STEREO position.
- (3) Place the MPX FILT rocker switch in the OFF position. (After the station is tuned, if there are some 'birdies' in the background, place the rocker switch in the MPX FILT position.)
- (4) Tune the desired station by rotating the tuning control knob on the upper right hand side of the front panel. When a FM Multiplex transmission is received, the STEREO FM indicator at the right end of the tuning band will light.
- (5) Tune the station for a maximum reading on the meter (upper left hand side of the front panel).
- (6) Adjust the Volume and Tone controls to suit the individual preference.

**NOTE:** When tuning, the STEREO FM indicator may flick if the noise level between stations is sufficiently high. When the 711A is tuned correctly, the indicator will remain lighted during Multiplex transmission.

## Maintenance and Service

(For the Information of Qualified Service and Repair Personnel)

### General

The Altec 711A utilizes only carefully selected components and, under normal operating conditions, will provide outstanding performance for many years. The elimination of vacuum tubes removes virtually all periodic maintenance required. All switching components are of the self-wiping type for maximum length of service.

All service should be performed by a qualified Altec Service Representative. Your Altec dealer will be glad to furnish information regarding qualified service representatives in your area. Should a malfunction occur, output transistors may be checked with a transistor checker and other circuit components may be checked by the usual means after the actual operating voltages (as indicated on the schematic, Figure 10) have been determined with a VTVM. The Part List (Page 12) provides information regarding the value, tolerance, part number and, where needed, the part manufacturer of all replaceable parts.

### Top Cover Removal

To remove the top cover from the 711A, remove the four Phillips head screws (two at either end of the unit) and lift the cover off of the chassis.

### Bottom Cover Removal

To remove the bottom cover from the 711A, remove the six Phillips head screws (three at either end of the unit).

### Front Panel Removal

Should it be necessary to remove the front panel, remove the knobs from all controls by easing them off the control shafts. Remove the nuts from the control shafts of the four controls on the bottom section of the panel (INPUT, VOLUME, BASS and TREBLE), and slide the panel forward to remove it.

### Pilot Lamp Replacement

To replace either or both of the dial-illuminating pilot lamps (PL602-PL603), remove the front panel, then remove and replace the burned out lamp(s). Remove the shield(s) from the old lamp and install on the new lamp to direct the light into the end of the glass. Replace the front panel and knobs.

The meter illuminating pilot lamp (PL604) and the stereo pilot lamp (PL601) may be made accessible for replacement by removing the top cover. Pilot lamps PL602, PL603, and PL604 should last at least 5000 hours. The stereo lamp should last indefinitely.

### Selector Switch and Preamps Removal

To facilitate replacement of preamp components not accessible with the assembly in place:

- (1) Remove the front panel.
- (2) Remove the  $\frac{3}{8}$ " nut and washer from the switch bushing.
- (3) Disconnect the 10 wires equipped with push-on connectors from their respective terminals being careful to note the wire color code and locations.
- (4) Remove the three #4 sheet metal screws which hold the input panel to the rear panel.
- (5) Pull the assembly out of the hole in the rear panel.

### TRANSISTORS

Transistors are inherently long-life devices and normally should not require replacement in the life of the equipment. If it becomes apparent through systematic trouble-shooting that replacement is necessary, a few precautions must be observed.

#### PROTECTION

Transistors can be damaged by excessive heat. When removing or replacing a transistor soldered to the points or to an etched circuit board, use a small soldering iron with an  $\frac{1}{8}$ " diameter chisel tip.

Use small diameter, high tin content solder.

On etched circuit boards, use a toothpick inserted from the conductor side to clean out the holes before inserting the new transistor. High heat reduces conductor-to-board bonding. Pressure applied from the component side may cause the hole pad and conductor to be torn away from the board.

#### ORIENTATION

Transistors are packaged in various case sizes and types with various lead configurations. (See Figure 7 for typical packages.) Before removing a transistor from an etched circuit board or tie points, make a sketch of the orientation of the transistor leads with respect to the circuit board or tie points. Forming the leads on the new transistor to conform with the leads on the one being replaced also will aid in making proper connections.

Before removing small 'plug-in' transistors, note the position of the index tab with respect to the socket. Cut the leads on the new transistor to the required length and insert into the socket properly indexed.

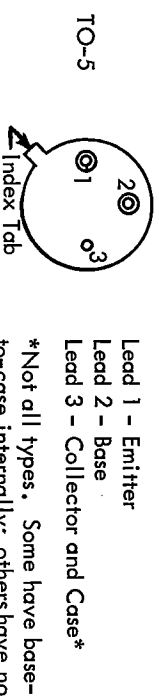
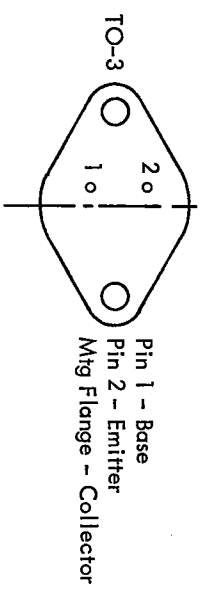
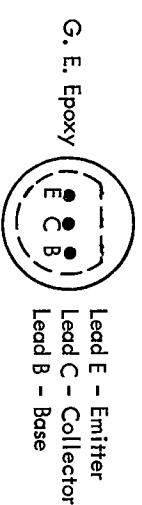
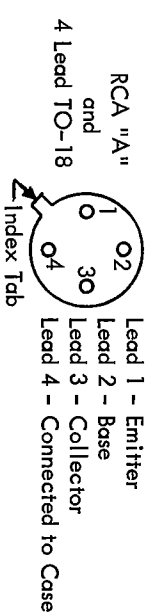


Figure 7: Transistor Packages, Bottom View of Lead or Pin Configuration



### POWER TRANSISTORS

When replacing power transistors, be sure that —

- (1) The mica insulator is not damaged,
- (2) No grit or metal particles are lodged between the transistor and the heat sink,
- (3) Both sides of mica insulator are covered with silicone grease or fluid,
- (4) Mounting screws are tight, and
- (5) The protective cover is in place.

### Transistor Testing

Transistors should be checked with a transistor tester. If one is not available, an ohmmeter may be used inasmuch as most transistor failures result in a collector-to-emitter short or open circuit. Remove the suspected transistor from the circuit. Connect the ohmmeter leads to the collector and the emitter (see Figure 7 for pin or lead configurations) and read on the low-ohm range. If the low reading is virtually the same when the ohmmeter connections are reversed, the transistor is shorted. If the ohmmeter (on high megohm range) shows no reading for both connections of the ohmmeter, the transistor is open.

### Servicing Etched Circuit Boards

Before removing or replacing components on etched circuit boards, read and observe the following precautions:

- (1) Use a small soldering iron with an  $\frac{1}{8}$ " diameter chisel tip, and use small diameter, high tin content solder.
- (2) Components may be removed by placing the soldering iron on the component lead on the conductor side of the board and pulling out the lead. Avoid overheating the conductor.
- (3) If the component is obviously faulty or damaged, clip the leads close to the component and then unsolder the leads from the board. Withdraw them from the component side.
- (4) Large components such as potentiometers and sockets may be removed by rotating the soldering iron from lead to lead and applying steady pressure to lift the part free. If the part is to be replaced with a new one, follow the procedure outlined in (3) above.
- (5) Since the conductor part of the etched circuit board is a metal-plated surface covered with solder, use care to avoid overheating and lifting the conductor from the board. A method for repair is to solder a section of good conducting wire along the damaged area.
- (6) Clear the solder from the circuit board holes before inserting the leads of the new component. Heat the solder in the hole, remove the iron and quickly insert a pointed non-metallic object (such as a toothpick) from the conductor side.
- (7) Shape the new component leads and clip them to the proper length. Insert the leads in the holes, observing the same polarity or orientation as that of the removed component. Apply heat and solder on the conductor side.

## ALIGNMENT INSTRUCTIONS

Alignment procedures are outlined in the tables below. Study these instructions before attempting alignment. The output of the signal generator should be no higher than necessary to obtain

output readings. With the tuning gang fully closed, set the dial pointer on "0" on the dial logging scale. Parts and test point locations are shown in Figures 8 and 9.

### 711A RECEIVER ALIGNMENT CHART — FM

Step	Signal Generator Coupling	Signal Generator Frequency	Tuning Dial Setting	Connect DC VTVM	Switch Settings	Adjust	Remarks
1	Connect signal generator to a 4 turn coil of #20 or #22 hook-up wire 1/4" I.D. Slide coil around transistor Q102	10.7 mc No modulation	Point of no interference	Test Point J201 Top side of IF crt board + lead to jack - lead to chassis 3v range	Selector: FM MPX FILT: OFF Tone controls: flat	Top & Bottom T101, T201, T202, T203	Adjust for maximum VTVM deflection. Keep Sig. Gen. input to give approx. 2 to 2.5 v reading on VTVM.
2	Hi side to LOCAL ant. Low side to chassis gnd.	90 mc No modulation	90 mc	(Same as Step 1)	(Same as Step 1)	L106	(Same as Step 1)
3	(Same as Step 2)	106 mc No modulation	106 mc	(Same as Step 1)	(Same as Step 1)	C119	Repeat steps 2 and 3 until these points are tracked.
4	(Same as Step 2)	90 mc 75 kc deviation 400 cps modulation (FM)	90 mc	(Same as Step 1)	(Same as Step 1)	L104, L103 L102	Adjust for maximum VTVM deflection and check for good sine wave 400 cps signal in output
5	(Same as Step 2)	106 mc 75 kc deviation 400 cps modulation (FM)	106 mc	(Same as Step 1)	(Same as Step 1)	C108, C103 C102	
6							Repeat steps 4 and 5 until no improvement is noted.

### 711A RECEIVER ALIGNMENT CHART — MULTIPLEX DEMODULATOR

Step	Signal Generator	Signal Generator Frequency	Signal Generator Coupling	AC VTVM Connect To	711A Switch Setting	Adjust	Remarks
1	Audio	67 kc	J202 Ground side to chassis	J301 ground side to chassis	Selector: FM Stereo: on MPX FILT: on	L301	Adjust for minimum reading on VTVM. Disconnect from J202
2	Multiplex generator with RF output	RF output with 19 kc pilot only	Hi side to LOCAL antenna terminals Lo to chassis	(Same as Step 1)	Same as above except MPX FILT is OFF.	T303 T302 T301	Accurately tune to MPX gen. frequency for max. tuning meter reading. Peak adjust T303, T302, T301 in that order for max. VTVM reading (approx. 1 v). Disconnect from J301.
3	(Same as Step 2)	RF output with right channel 100% modulated 1000 cps	(Same as Step 2)	711A RECORDER OUT "L"	(Same as Step 2)	T301 T303	Adjust T301 for minimum VTVM reading. Slightly readjust T303 for possible lower minimum.
4	(Same as Step 2)	RF output with left channel 100% modulated 1000 cps	(Same as Step 2)	711A RECORDER OUT "R"	(Same as Step 2)	T301 T303	Read VTVM and slightly readjust T301 and T303 for possible lower minimum. Re-check step 3. If more than 1 db higher than original reading, very slightly adjust T301 to correct.

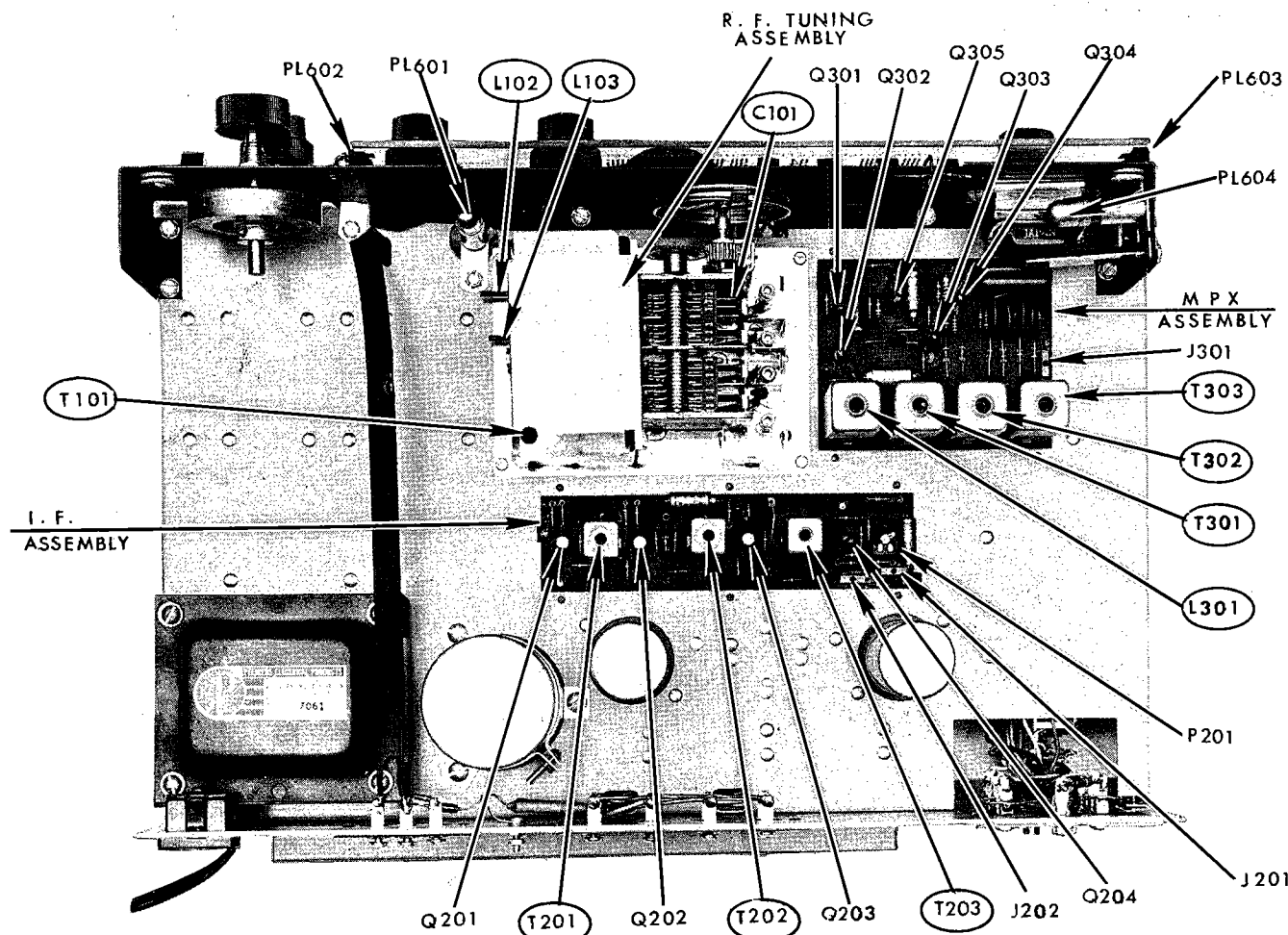


Figure 8: Parts Location, Top View (Test Points Circled)

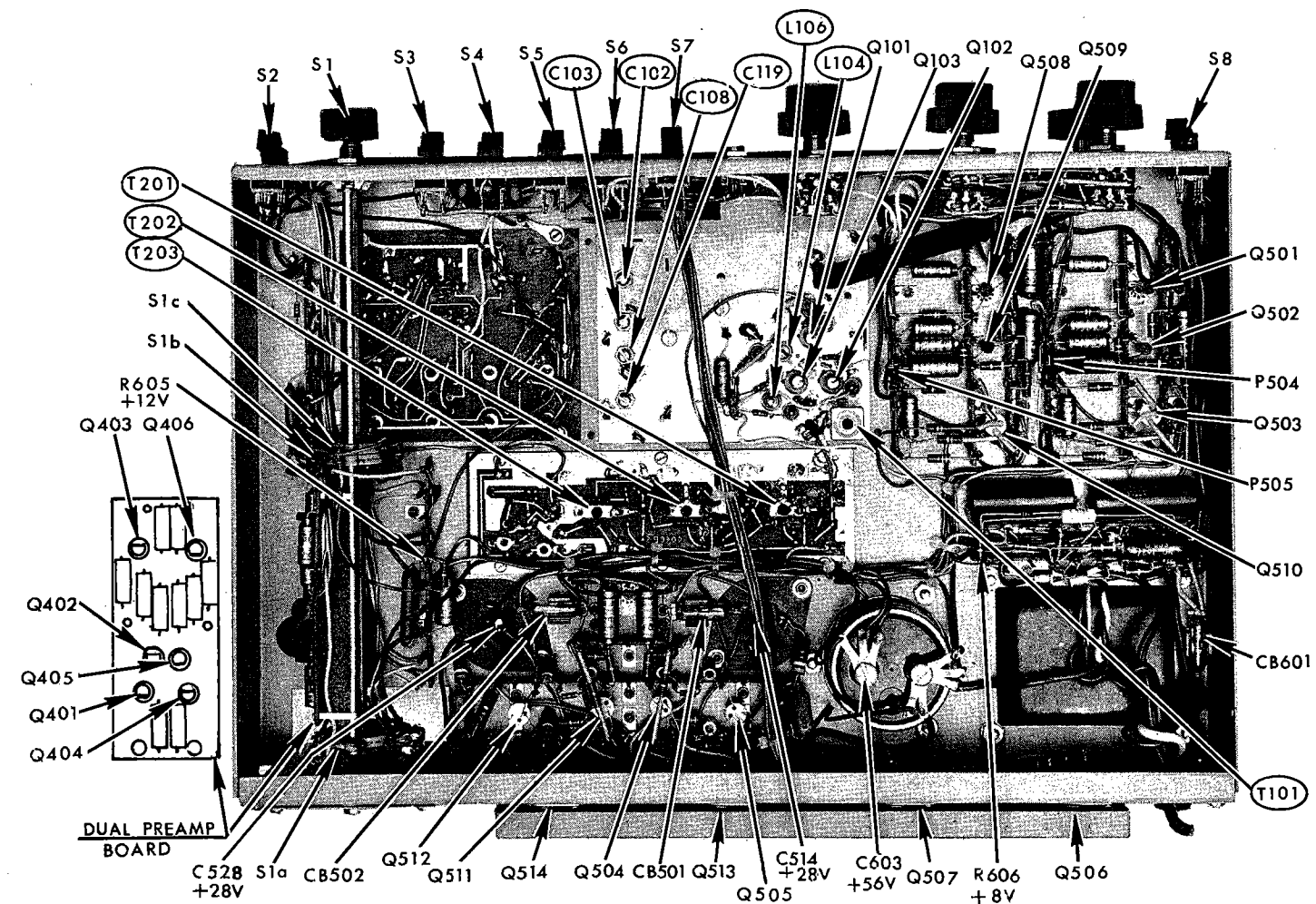
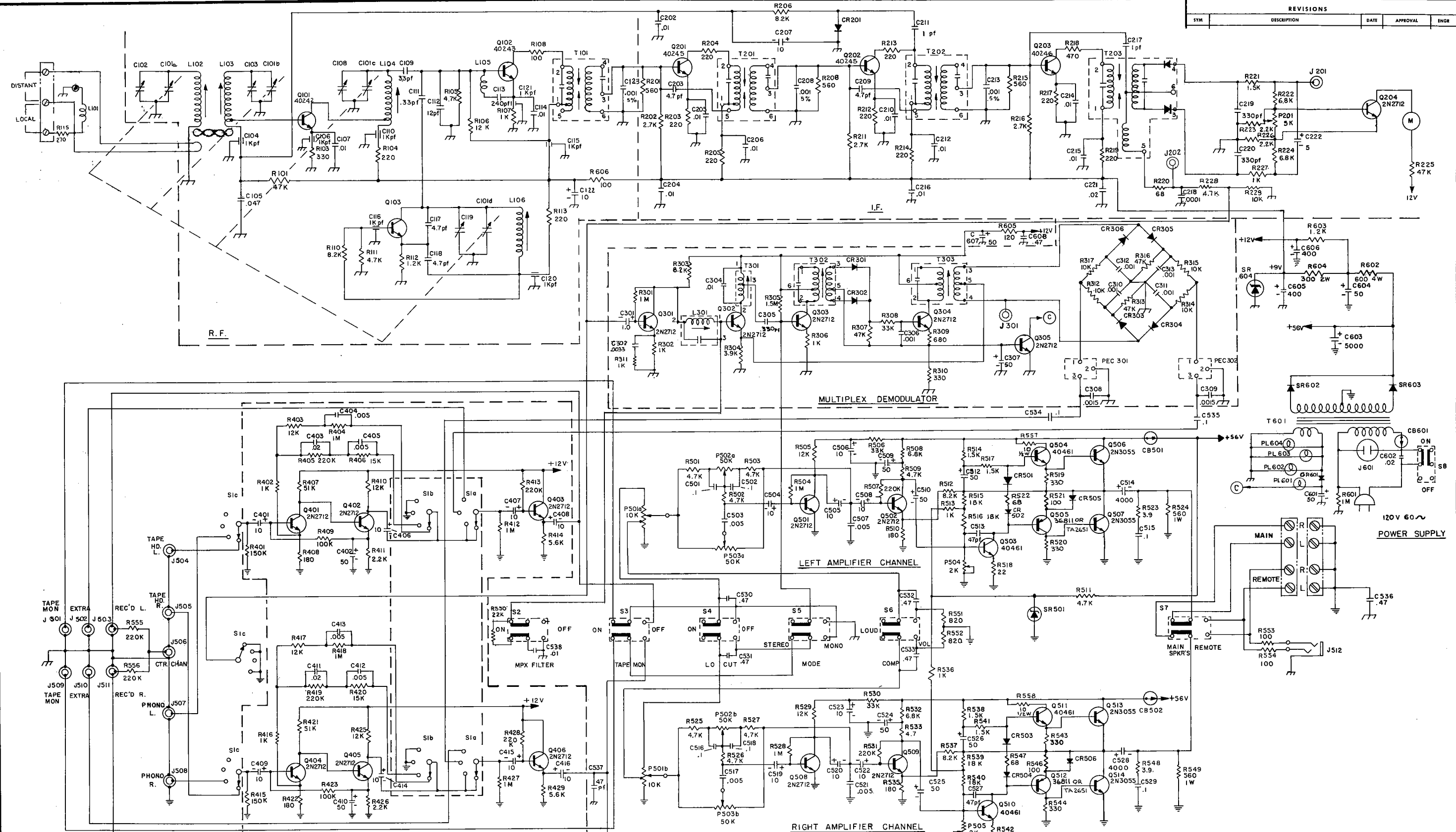


Figure 9: Parts Location, Bottom View (Test Points Circled)

REVISIONS				
SYM	DESCRIPTION	DATE	APPROVAL	ENGR



3  $\perp$  CIRCUIT GROUND,  $\perp$  CHASSIS GROUND  
 2 ALL CAPACITORS ARE IN MICROFARADS.  
 1. ALL RESISTORS ARE IN OHMS

NOTES:

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON FRAC. 2 PLACE DEC. 3 PLACE DEC.	ORIGINAL DATE OF DRAWING 4-21-65	 A subsidiary of Ling-Temco-Vought, Inc. ANAHEIM, CALIFORNIA
	DR. BY G. HOYT	
CHD.	ENGR.	<b>711A</b> NEXT ASSY USED ON APPLICATION
ENGR.	ENGR.	
SCALE NONE	CODE	SHEET 1 OF 1 D 8833-1

Figure 10: 711A Schematic

## Parts List

Reference Designator	Name and Description	Reference Designator	Name and Description	Reference Designator	Name and Description	Reference Designator	Name and Description
C101 a,b,c,d, C102, C103, C108	Condenser, tuning (Altec 14988-2) Condenser, trimmer, 1 to 7.5 pf (Centralab DA 1005-352)	C513, C527, C537	Condenser, 0.000047 mfd $\pm 10\%$ (Disc, Erie 831-U2M-470K)	PL601	Pilot lamp, 28 v, 40 ma (G.E. 1819)	R401, R415	Resistor, 150,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C104, C106 C105	Condenser, feed-thru, 1000 pf (AB FW5N-102W) Condenser, 0.047 mfd $\pm 10\%$ , 250 v (Met. Mylar® Comark)	C514, C528 C530, C531, C532, C533, C536	Condenser, 4000 mfd, 30 v (STM 10FT30HS 43) Condenser, 0.47 mfd $\pm 10\%$ , 250 v (Met. Mylar, Ducati)	PL602, PL603, PL604	Pilot lamp, 14 v, 0.2a (G.E. 1815)	R402, R416 R403, R410, R417, R425	Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 12,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C107, C114	Condenser, 0.01 mfd $+80\%$ , $-20\%$ , 100 v (Disc, Erie 805-X5V-103Z)	C538	Condenser, 0.01 mfd $+80\%$ , $-20\%$ , 100 v (Disc, Erie 805-X5V-103Z)	Q101	Transistor, (RCA 40242)	R404, R412, R418, R427	Resistor, 1.0 meg $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C109	Condenser, 3.3 pf, NPO (Disc, Erie 861-COGo-339C)	C601, C604, C607	Condenser, 50 mfd, 25 v (Ducati 12.37.33)	Q102	Transistor, (RCA 40243)	R405, R413, R419, R428	Resistor, 220,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C110, C115, C116, C120, C121	Condenser, feed-thru, 1000 pf (AB FU6D-102W)	C602	Condenser, 0.02 mfd $\pm 20\%$ , 500 v (Disc, Erie 841-X5V-203M)	Q103	Transistor, (RCA 40244)	R406, R420 R407, R421	Resistor, 15,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 51,000 $\Omega \pm 5\%$ , $\frac{1}{4}$ w
C111	Condenser, 0.33 pf $\pm 10\%$ (Stackpole Type GA)	C603	Condenser, 5000 mfd, 60 v (Callins 4-85 CL)	Q201, Q202 Q203	Transistor, (RCA 40245) Transistor, (RCA 40246)	R408, R422 R409, R423	Resistor, 180 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 100,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C112	Condenser, 12 pf, NPO (Disc, Erie 865-COGo-120K)	C605, C606 C608	Condenser, 400 mfd, 25 v (Ducati 12.17.151) Condenser, 0.47 mfd $\pm 10\%$ , 250 v (Met. Mylar, Ducati)	Q204	Transistor, 2N2712 (G.E.)	R411, R426 R414, R429	Resistor, 2200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 5600 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C113	Condenser, 0.00024 mfd $\pm 10\%$ (Disc, Erie 831-X5R-241K)	CB501, CB502, CB601	Circuit breaker, 1 amp (Sylvania MB 315)	Q301, Q302, Q303, Q304, Q305	Transistor, 2N2712 (G.E.)	R501, R502, R503, R509, R511, R525, R526, R527, R533	Resistor, 4700 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C117, C118	Condenser, 4.7 pf, N750 (Disc, Erie 835-024-U2JO-479D)	CR201	Diode, 1N87A (Sylvania)	Q401, Q402, Q403, Q404, Q405, Q406	Transistor, 2N2712 (G.E.)	R504, R528 R505, R529	Resistor, 1.0 meg $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 12,000 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C122	Condenser, 10 mfd, 25 v (Ducati 12.37.31)	CR301, CR302 CR303, CR304, CR305, CR306	Diode, 1N87A (Sylvania) Diode, 1N542, matched pair (Sylvania)	Q501, Q502, Q508, Q509 Q503, Q504, Q510, Q511 Q506, Q507, Q513, Q514 Q505, Q512	Transistor, 2N2712 (G.E.) Transistor (Altec 40461-1) Transistor, 2N3055 (R.C.A.) Transistor, TA2651 (R.C.A. or R.C.A. 36811)	R506, R530 R507, R531, R555, R556 R508, R532 R510, R535 R512, R537 R513, R536 R514, R517, R538, R541	Resistor, 33,000 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 220,000 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 6800 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 180 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 8200 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 1500 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C123	Condenser, 0.001 mfd $\pm 5\%$ (Disc, Erie 855-T3DO-102J)	CR601	Diode, rectifier 1N3754 (RCA)	R101	Resistor, 47,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R515, R516, R539, R540 R518, R542 R519, R520, R543, R544	Resistor, 18,000 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 22 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 330 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C202, C204, C205, C206, C210, C212, C214, C215, C216	Condenser, 0.01 mfd $+80\%$ , $-20\%$ , 100 v (Disc, Erie 805-X5V-103Z)	J201, J202	Jack, test, (G. C. #33-235-1)	R103	Resistor, 330 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R521, R546, R553, R554 R522, R547 R523, R548 R524, R549 R550	Resistor, 100 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 68 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 3.9 $\Omega \pm 10\%$ , $\frac{1}{2}$ w Resistor, 560 $\Omega \pm 10\%$ , 1 w Resistor, 22,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C203, C209 C207	Condenser, 4.7 pf, NPO (Disc, Erie 835-COGo-479D) Condenser, 10 mfd, 25 v (Ducati 12.37.31)	J301	Jack, test, (G. C. #33-235-1)	R106	Resistor, 12,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R551, R552 R557, R558	Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 820 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 1200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 270 $\Omega \pm 10\%$ , $\frac{1}{4}$ w
C208, C213	Condenser, 0.001 mfd $\pm 5\%$ (Disc, Erie 855-T3DO-102J)	J501, J502, J503, J504, J505, J507, J508, J509, J510, J511	Connector, phono, 5-jack (N.T.T. #355)	R107	Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R601	Resistor, 1.0 meg $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C211, C217	Condenser, 1.0 pf, NPO (Disc, Erie 861-COGo-109C)	J506	Jack, phono (N.T.T. #326)	R108	Resistor, 100 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R602	Resistor, 600 $\Omega \pm 10\%$ , 4 w (WW Tasho Co., Ltd.)
C218	Condenser, 0.0001 mfd $\pm 10\%$ (Disc, Erie 831-X5R-101K)	J512	Jack, headset, 2-circuit (Carter J6-3)	R110	Resistor, 8200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R603	Resistor, 1200 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C219, C220	Condenser, 0.00033 mfd $\pm 10\%$ (Disc, Erie 831-X5R-331K)	J601	Outlet, ac (Circle F438-L)	R112	Resistor, 1200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R604	Resistor, 300 $\Omega \pm 10\%$ , 2 w (WW Tasho Co., Ltd.)
C221	Condenser, 0.02 mfd $\pm 20\%$ , 500 v (Disc, Erie 841-X5V-203M)	L101, L105	Choke, RF, 1 microhenry (Jeffers 10200-107)	R115	Resistor, 270 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R605	Resistor, 120 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C222	Condenser, 5 mfd, 25 v (Ducati 12.37.30)	L102	Coil, Antenna (Altec 40477-2)	R201, R208, R215	Resistor, 560 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	R606	Resistor, 100 $\Omega \pm 10\%$ , $\frac{1}{2}$ w
C301	Condenser, 1 mfd, 3 v (Callins 1UPSS)	L103	Coil, RF (Altec 40479-2)	R202, R211, R216	Resistor, 2700 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	S1 a, b, c S2, S3, S4, S5, S6, S7, S8	Switch (Altec 40231-2) Switch, rocker, DPDT (U.I.D. #RSW322A)
C302	Condenser, 0.0033 mfd $\pm 5\%$ , 125 v (Dielectrics)	L104	Coil, Mixer (Altec 40475-3)	R203, R204, R205, R212, R213, R214, R217, R219	Resistor, 220 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	SR501	Diode, zener, 12 v $\pm 5\%$ , 2 w (Semcor LMZX12A)
C304	Condenser, 0.01 mfd $\pm 10\%$ , 125 v (Dielectrics)	L106	Coil, Oscillator (Altec 40478)	R206	Resistor, 8200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	SR602, SR603 SR604	Diode, rectifier (A10B G.E.) Diode, zener, 9.1 v $\pm 5\%$ , 2 w (Semcor LMZX9.1A)
C305	Condenser, 0.00033 mfd $\pm 10\%$ (Disc, Erie 831-X5R-331K)	M	Meter, tuning, 200 $\mu$ a (International Electronic Corp. H307)	R218	Resistor, 470 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T101	Transformer, IF, 10.7 mc (Altec 40491-2)
C306, C310, C311, C312, C313	Condenser, 0.001 mfd $\pm 10\%$ , 500 v (Disc, Erie 801-X5R-102K)	P201	Potentiometer, 5000 $\Omega$ (Nucleonic Components Type PA 10 B)	R220	Resistor, 68 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T201	Transformer, IF, 10.7 mc (Altec 40492-2)
C307	Condenser, 50 mfd, 6 v (Ducati 12.37.18)	P501	Potentiometer, dual, concentric, vol. (Altec 40291-2)	R221	Resistor, 1500 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T202	Transformer, IF, 10.7 mc (Altec 40493-2)
C308, C309	Condenser, 0.0015 mfd $\pm 10\%$ , 500 v (Disc, Erie 801-X5R-152K)	P502, P503 P504, P505	Potentiometer, dual, concentric, tone (Altec 40290-2) Potentiometer, 2000 $\Omega$ (Nucleonic Components Type PA 10 B)	R222, R224 R223, R226 R225 R227 R228 R229	Resistor, 6800 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 2200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 47,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 4700 $\Omega \pm 10\%$ , $\frac{1}{4}$ w Resistor, 10,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T203	Transformer, ratio det., 10.7 mc (Altec 40494-2)
C401, C406, C407, C408, C409, C414, V415, C416	Condenser, 10 mfd, 25 v (Ducati 12.37.31)	PEC301, PEC302	Filter, notch, 38 kc (Centralab YDD-146-01A4B)	R301	Resistor, 1.0 meg $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T301	Coil, 19 kc (Altec 40496-2)
C402, C410 C403, C411	Condenser, 50 mfd, 6 v (Ducati 12.37.18) Condenser, 0.02 mfd $\pm 20\%$ , 500 v (Disc, Erie 841-X5V-203M)			R302, R306, R311	Resistor, 1000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T302	Transformer, doubler (Altec 40497-2)
C404, C405, C412, C413	Condenser, 0.005 mfd $\pm 20\%$ , 500 v (Disc, Erie 801-X5V-502M)			R303	Resistor, 8200 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T303	Transformer, output, 38 kc (Altec 40498-2)
C501, C502, C515, C516, C518, C529, C534, C535	Condenser, 0.1 mfd $\pm 10\%$ , 200 or 250 v (Met. Mylar, Ducati)			R304	Resistor, 3900 $\Omega \pm 10\%$ , $\frac{1}{4}$ w	T601	Transformer, power (Altec 7061)
C503, C507, C517, C521	Condenser, 0.005 mfd $\pm 20\%$ , 500 v (Disc, Erie 801-X5V-502M)			R305	Resistor, 1.5 meg $\Omega \pm 10\%$ , $\frac{1}{4}$ w		
C504, C505, C506, C508, C519, C520, C522, C523	Condenser, 10 mfd, 25 v (Ducati 12.37.31)			R307, R313, R316	Resistor, 47,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w		
C509, C510, C512, C524, C525, C526	Condenser, 50 mfd, 25 v (Ducati 12.37.33)			R308	Resistor, 33,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w		
				R309	Resistor, 680 $\Omega \pm 10\%$ , $\frac{1}{4}$ w		
				R310	Resistor, 330 $\Omega \pm 10\%$ , $\frac{1}{4}$ w		
				R312, R314, R315, R317	Resistor, 10,000 $\Omega \pm 10\%$ , $\frac{1}{4}$ w		