

STEREOPHONIC HIGH FIDELITY BY PILOT

OPERATING INSTRUCTION MANUAL

for the

PILOT 654

STEREOPHONIC RECEIVER

PILOT RADIO CORPORATION

37-06 36th Street, Long Island City, N.Y.

FOUNDED 1919

92-202

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The instrument you have purchased is the result of years of engineering research in sound reproduction. A combination of many skills went into its design and manufacture. The more you know about its operation and functions, the more useful you will find it. The 654 is a precision electronic instrument. The more familiar you become with its operation, the easier it will become, for you, to derive the maximum listening pleasure it has been designed to deliver.

Should any technical question arise that is not covered in this manual, personalized assistance is available to you, by writing or telephoning:

Systems Engineering Manager  
Pilot Radio Corporation  
37-06 36th Street  
Long Island City 1, New York

Stillwell 4-5454

I.

GENERAL DESCRIPTION

The Pilot 654 is a complete, all-in-one Stereophonic Receiver. It combines on one chassis -- individual tuners for FM and AM, a stereophonic control center and a 44 watt stereophonic amplifier.

With the 654 you can:

1. Receive monophonic FM or AM broadcasts, FM-AM stereocasts, and, with an external multiplex adapter, FM Multiplex stereo broadcasts.
2. Play monophonic or stereophonic records.
3. Play monophonic or stereophonic tape.
4. Record monophonic or stereophonic sound on tape.

II.

P A C K I N G   L I S T

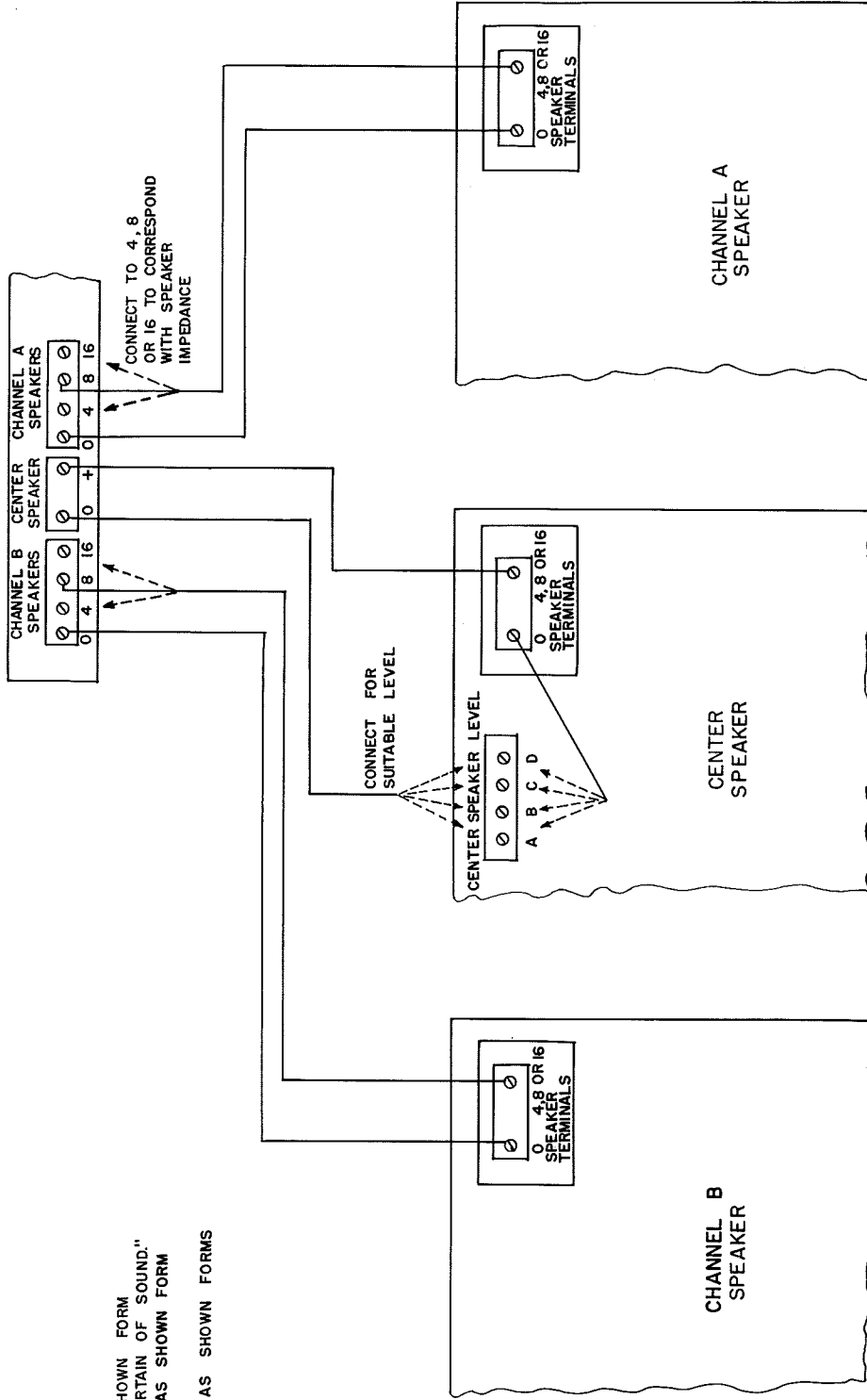
The following items are packed with each instrument:

- 1 - Warranty Card (to be filled out and mailed within 10 days of purchase).
- 1 - Set of custom mounting templates.
- 4 - Chassis mounting screws and washers.
- 4 - Frame mounting screws and washers.
- 1 - Speaker Level Adjustment Panel.
- 1 - 6" lead for Speaker Level Adjustment Panel.
- 1 - Folded dipole FM antenna.

I N S T A L L A T I O N

The 654 is designed and engineered to operate in its own attractively styled enclosure. It can, however, be custom installed in almost any kind of cabinet. For specific instructions and requirements, see section titled CUSTOM INSTALLATION.

PILOT  
 "STEREO PLUS" "CURTAIN OF SOUND"



THREE SPEAKERS AS SHOWN FORM  
 "STEREO PLUS" "CURTAIN OF SOUND."  
 TWO OUTER SPEAKERS AS SHOWN FORM  
 REGULAR STEREO.  
 ONE CENTER SPEAKER AS SHOWN FORMS  
 MONOPHONIC.

PILOT RADIO CORPORATION LONG ISLAND CITY, NEW YORK	
DATE 9-16-60	APP BY HBA
CKD BY Scl/A.	
SPEAKER CONNECTIONS	
DWG NO.	95-204

III.

C O N N E C T I N G   T H E   654  
F O R   O P E R A T I O N

CAUTION!    THE POWER LINE CORD MUST BE PLUGGED INTO  
A 105-120 VOLT 60 CYCLE AC LINE ONLY!

SPEAKER CONNECTIONS:

Most stereo systems employ two speakers. The 654 Stereo Receiver, however, can accomodate more elaborate systems requiring three speakers, such as Pilot's "Curtain-of-Sound". It can also be used to power a single speaker in another room. This speaker will reproduce monaurally, the sum of both channels of stereophonic program material.

For two speaker stereophonic operation, connect the left speaker to the speaker terminals on the rear of the 654 designated Channel A. One lead of the pair is connected to "0" and the second to either 4, 8 or 16, to correspond with the impedance of your speaker. In most instances, at least one terminal on the speaker will be identified; usually it will be the numbered terminal (4, 8 or 16). This numbered terminal should be connected to the corresponding terminal on the 654.

If your speaker terminals are not marked, refer to the paragraph on speaker phasing, found in the rear of this manual. First, however, complete all connections and read the operating instructions.

Similarly, the right speaker is connected to the terminal strip designated Channel B.

The terminals designated CENTER SPEAKER are designed to power a third speaker in a stereophonic system or a monophonic speaker in another room. Occasionally, because of room decor or size, the two speakers in a stereo system are widely spaced. Such speaker set-ups tend to develop a zone of silence in the center area. A third speaker, placed in the center, can eliminate this hole-in-the-middle.

In a three speaker stereo system the center speaker should operate at a somewhat lower volume than the Channel A or B speakers. If the volume is too high, the center speaker will predominate and decrease the stereo effect. If too low, it will not fill the hole-in-the-middle.

The correct volume for the center speaker is at a point between these two extremes.



To use a third speaker, connect a lead from the 654 Center Speaker terminal marked / to the numbered (4, 8 or 16) terminal of the speaker. Connect a second lead from the 654 Center Speaker terminal marked "0" to the SPEAKER LEVEL ADJUSTMENT PANEL terminal A. Connect the 6" lead between terminal D of the SPEAKER LEVEL ADJUSTMENT PANEL and the remaining speaker terminal. The volume of the third speaker is adjustable, however, it is recommended that you complete all connections and read the operating instructions before you make this adjustment.

Connected as described above, the third speaker will deliver minimum volume.

To increase the volume, shift the leads on the CENTER SPEAKER LEVEL ADJUSTMENT PANEL in the following order:

A and D - Minimum Volume

B and D

C and D

A and C

A and B

B and C

A and A - Maximum Volume

Special wood screws have been provided to mount the  
SPEAKER LEVEL ADJUSTMENT PANEL to the back of the  
center speaker cabinet.

If the third speaker is to be used in another room,  
you may elect not to use the SPEAKER LEVEL ADJUST-  
MENT PANEL. You would then make all connections  
directly to the 654.

## TUNER CONNECTIONS

Input and Output connections for all tuner stereophonic and monophonic functions have been made internally and tuners will be ready to operate after antenna connections are made.

FM Tuner Antenna Connections - The type of antenna you should use is determined by your location in relation to the stations you wish to receive. Actually, the 654 is ready to operate when it is removed from the shipping carton. It is equipped with a line cord FM antenna. The power line should be stretched to its full length. In many areas, this antenna will be sufficient. The folded dipole may improve reception in some areas. An outdoor antenna, mounted as high as possible, will greatly extend the range of reception. The line cord antenna is built-in. The 300 ohm lead-in from an outdoor antenna or the terminals of the folded dipole should be connected to the D1 and D2 terminals of the antenna strip on the back of the 654. If either of these are used, the one lead from the line cord antenna should be detached and allowed to hang free.

AM Tuner Antenna Connections - The 654 is equipped with a built-in, rotatable, ferrite core antenna. To rotate, remove the red screw on the support bracket and rotate gently. Replace the screw for future reclamping. This antenna will provide good reception in all but the most unfavorable locations.

If an outdoor antenna is used, it should be connected to the AM terminal on the antenna strip.

Multiplex Adapter Connections - No FCC official standards for FM Multiplex stereo broadcasting have as yet been formulated. Therefore, few commercial Multiplex Adapters are available. For specific connections, you will have to consult the instructions included with any Adapter you purchase.

You will need the following information in order to connect the Adapter: The Channel B Multiplex Output jack carries both the normal FM signal plus any other signal, such as that used for Multiplex FM stereo, transmitted on the same channel. Adapters that require only one input jack should be connected to this output. Some adapters may require two input jacks. These should be connected to Channel A and B Multiplex Output jacks.

RECORD CHANGER, TURNTABLE OR TAPE TRANSPORT CONNECTIONS:

The 654, as bought, can accommodate only one of the above at a time. By changing plugs or with external switching facilities, it can accommodate all three.

The 654 PHONO input is designed for signals from a magnetic cartridge or tape head. If you plan to use a ceramic cartridge, one designed specifically for connection to magnetic inputs is recommended.

Stereophonic Equipment Connections - The two cables from the signal source should be plugged into the 654 Channel A and B PHONO input jacks. These cables are usually labeled by the manufacturer and should be plugged into the corresponding inputs on the 654 A into A, B into B/

Monophonic Equipment Connections - The cable from the sound source is plugged into the 654 Channel A PHONO input jack.

TAPE RECORDER CONNECTIONS:

Recording Connections - Plug the two signal input cables of a stereophonic recorder, into the 654

Channel A and B Tape Output jacks. For monophonic recorder, plug the signal input cable into the 654 channel A Tape Output jack.

Playback Connections - Plug the two signal output cables from a stereophonic recorder into the corresponding 654 channel A and B Tape Input jacks. A on the recorder into A on the 654, and, B into B. For operating with a monophonic recorder, the signal output cable is plugged into the 654 channel A Tape Input jack.

IV.

D E S C R I P T I O N

of

O P E R A T I N G   C O N T R O L S

Before you attempt to operate your instrument, read and familiarize yourself with the control names and functions.

FM TUNING - Station selector for FM reception.

MASTER VOLUME - Adjusts both channels simultaneously.

STEREO BALANCE - Used to equalize the output of the two stereo speakers. Rotation to the right decreases the volume of the left speaker. Similarly, rotation to the left decreases the right.

BASS & TREBLE - Used to adjust the relative balance of bass and treble. Clockwise rotation boosts effect.

INPUT SELECTOR - Used to select the desired program source.

AM TUNING - Station selector for AM reception.

POWER SWITCH - Used to turn 654 on and off. Also controls power to the convenience outlet.

When the 654 is used with a Pilot RC-1, RC-2, or RC-3 record changer, the record changer can shut off both itself and the 654 after the last record has completed play. To accomplish this, set the power switch to the OFF/AUTO position. With the switch so set, control of power is transferred to the record changer power switch, and the entire system will be turned on when the record changer motor is started and off when the motor stops.

**LOUDNESS** - Provides compensation for listening at low volume when switch is set to IN. Compensation gradually decreases as the VOLUME control is advanced beyond the 12 o'clock setting.

**AM PHASE** - Used only for FM-AM stereocasts. Described under operating instructions.

**RUMBLE FILTER** - When set to IN, this control will reduce rumble. Control is operable for all inputs.

**SCRATCH FILTER** - When set to IN, this control will reduce scratch noise. Control is operable for all inputs.

**TAPE MONITOR** - Allows you to hear the signal you've recorded on tape a fraction of a second after it has been recorded. Used for comparison between recorded signal and original source. This switch must always be in the OUT position when you are not monitoring.



V.

O P E R A T I N G  
I N S T R U C T I O N S

TO OPERATE TUNERS:

The electronic eye tuning indicator located in the center of the 654 face dial, serves for all radio tuning functions. Minimum width between the two bars of light indicates correct tuning for that station.

FM Monophonic Operation - Set the INPUT SELECTOR to FM and tune desired station with the FM TUNING control.

AM Monophonic Operation - Set the INPUT SELECTOR to AM and tune the desired station with the AM TUNING control.

FM-AM Stereophonic Operation - First, tune the FM portion of the broadcast. Move the INPUT SELECTOR and tune the AM portion of the broadcast. Finally, set the INPUT SELECTOR to FM-AM. During a voice announcement on an FM-AM stereocast, adjust the BALANCE control until the apparent source of sound is midway between speakers. If such adjustment cannot seem to be made, move the AM Phase switch and try to adjust again. Once the adjustment is made, the phase will be correct for that particular broadcast. At times other than during

reception of an FM-AM stereocast, switch may be left in either position. It will have no effect on other signal sources.

TO OPERATE WITH A RECORD CHANGER, TURNTABLE OR TAPE TRANSPORT:

RIAA equalization is automatic when the INPUT SELECTOR is set to either PHONO position. This equalization is correct for all stereo records and most 33-1/3 and 45 rpm records. To adjust the equalization for playback from a tape transport, set the BASS control to approximately 4 o'clock.

With Stereophonic Equipment - Set the INPUT SELECTOR

to PHONO STEREO and start your equipment. Note! When monophonic program material is played on a record changer or turntable with a stereophonic cartridge, the 654 INPUT SELECTOR may be set in either PHONO position. However, setting it to PHONO MONO may result in some reduction of record noise.

With Monophonic Equipment - Set the INPUT SELECTOR

to PHONO MONO and start your equipment.

TO OPERATE WITH A TAPE RECORDER:

Recording - The 654 Tape Output jacks are always live and delivering any signal passing through the amplifier. In order to record, therefore, all that is necessary is to turn on the recorder. The signal fed it by the 654 is unaffected by VOLUME, BALANCE, LOUDNESS or tone control adjustments.

Playback - Set the INPUT SELECTOR to either TAPE STEREO or TAPE MONO depending on whether you are using a stereophonic or monophonic recorder.

Tape Monitoring - It is always possible to listen to the material as it is being recorded. Simply adjust the 654 VOLUME, TONE and STEREO BALANCE controls. These adjustments will effect only the signal being fed to your speakers. The signal being fed to the recorder will exactly match the original. Some recorders are equipped with a separate head and pre-amplifier for monitoring during the recording process. When such a recorder is used with the 654, the TAPE MONITOR switch makes possible instantaneous comparison between the original program material and the sound being recorded on the tape. When the switch is set

to OUT, your speakers reproduce the original program material. When set to IN, the speakers reproduce the sound on the tape a fraction of a second after it has been recorded. For a valid comparison, the speaker volume at either switch setting should be the same. You can accomplish this equalization as follows: First, set the TAPE MONITOR switch to OUT and using the 654 VOLUME Control, adjust the desired volume. Move the TAPE MONITOR to IN and using the output level control on your recorder, adjust the monitoring volume to the same level. Move the TAPE MONITOR from IN to OUT to IN, making any minor adjustments with the recorder level control until the speaker volume remains constant regardless of the position of the TAPE MONITOR switch.

CAUTION! The TAPE MONITOR switch must always be set to OUT when not being used for monitoring. If switch is set to IN during any other function your speakers will not operate.

VI.

C U S T O M

I N S T A L L A T I O N

By virtue of its compactness, the 654 is ideal for a great variety of Custom Installations. In any installation the 654 must be mounted horizontally.

Although the 654 generates relatively little heat, certain precautions must be taken to prevent overheating and allow for sufficient ventilation. The compartment into which you mount the 654 should meet the following specifications:

1. A minimum of 3/4" of air space should be allowed to each side of the component and 2" to the top.
2. The rear of the compartment housing the 654 must be left completely open.
3. There are two possible methods of allowing ventilating air to flow freely under the chassis.
  - (a) Block the 654 at least one inch off the floor of its custom compartment.
  - (b) Make the floor cut out on the 654 mounting board, as specified on the mounting template, packed with the instrument. In order for this cut out to provide effective ventilation,

it must open either to outside air or into a compartment that has access to open air. This compartment may contain a record changer, however, it should not contain any heat source such as a tape recorder with its own amplifiers. The access to free air must be at least 15 square inches.

When used in custom installations, the 654 must be used without its enclosure. Remove enclosure as follows:

1. Remove all control knobs by pulling off shafts.
2. Remove 2 screws located at bottom edge of each side.
3. Slide enclosure, complete with faceplate, forwards until it clears control shafts, then, lift.

You are now ready to complete your custom mounting.

1. Using the Front Mounting Template provided with the instrument, locate and make the front panel cutouts.

2. Unfasten the faceplate and frame from the enclosure by removing the 7 screws visible from the

underside. Also remove the 3 screws attaching the filler strip as they will be needed if you ever wish to remount the 654 in its own enclosure.

NOTE! The faceplate is cemented to the frame and should not be separated from it.

3. Fasten frame and faceplate to the front panel using the screws and washers provided, BUT do not tighten. For panels thicker than 1/4", either counter bore from the rear or use longer screws.

4. Mount the 654 in position using the screws and washers provided.

5. Center the front panel with the faceplate loosely attached over the control shafts. Position. Holding the faceplate in place, remove the front panel assembly from over shafts and tighten screws securing the faceplate.

6. Mount front panel and replace control knobs.

VII.

O T H E R   A P P L I C A T I O N S  
O F   T H E   6 5 4

The 654 can be used to provide amplifications from several sound sources other than those already described. Cables from a TV set or an electronic organ can be plugged into the Channel A Tape Input. With the INPUT SELECTOR set to TAPE MONO, the 654 can be used to control these sound sources.



VIII.

TECHNICAL & SERVICE  
INFORMATION

INDIVIDUAL CHANNEL TONE ADJUSTMENTS

The 654 has ganged tone controls for simultaneous adjustment of both channels. Individual adjustment for each channel is easily available by disengaging the locking device as follows:

1. Remove the small outer knob by pulling forward gently, but firmly.
2. Remove the small locking disc.
3. Replace the small knob.

The small upper knob now controls channel B and the larger, channel A.

DISASSEMBLY OF UNIT FOR SERVICING OR TUBE REPLACEMENT

1. Remove all control knobs by pulling forward.
2. Remove 2 screws located at the bottom edge of each side.
3. Slide enclosure, complete with faceplate and frame, forward till it clears the control shafts, then, lift.

No further disassembly is necessary for tube replacement. For internal servicing, you can now remove the bottom plate.

### SPEAKER PHASING PROCEDURE

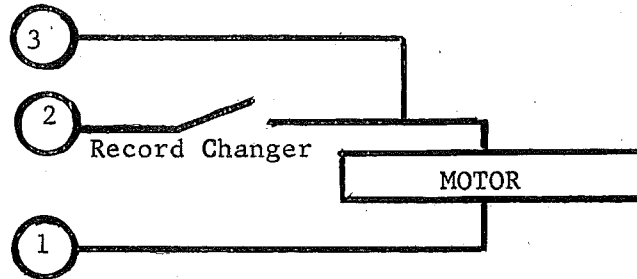
When the terminals on your speakers are not identified as to which tap is "0", it is necessary to establish correct phase by electrical means, as follows:

1. Tune to any FM station.
2. Adjust the balance control to a point where the apparent source of sound seems to be located midway between the speakers. If such a balance adjustment cannot be made, reverse the leads on one speaker and repeat the balancing adjustment.

### PILOT'S EXCLUSIVE AUTOMATIC SHUT-OFF

This exclusive feature can only be taken advantage of when the 654 is used with a Pilot model RC-1, RC-2 or RC-3 record changer. These record changers have, instead of the ordinary plug and power cord, a special cable and four pin plug and cables. This plug is inserted into the corresponding socket on the back of the 654.

### Plug Schematic



Wires 1 and 2 correspond to the original power cord wires. Wire 3 is connected to the motor side of the record changer power switch. These wires carry 117 volts AC and are suitably insulated for this purpose. They are twisted or taped together to avoid the possibility of hum. The pin numbers are molded into the plug for identification purposes.

### TECHNICAL ADJUSTMENTS

Adjustment Controls - Independent bias, DC Balance and Signal (AC) Balance controls are provided for each channel. Though easily reached for adjustment purposes, they are so located on the chassis as to make accidental movement virtually impossible. All six controls have been adjusted at the factory to reduce distortion to an absolute minimum over the entire audio frequency range.

### Bias and DC Balance Adjustment

When one or more output tubes are replaced, it is advisable to check Bias and DC Balance. Slight adjustments will correct for mismatch in output tubes and insure continued low distortion. In order to make these adjustments you will need a DC Voltmeter ( 0 to 3 volts or less ). The adjustment procedure is as follows:

1. Remove 5 pin shorting plug from test socket.
2. Connect the DC Voltmeter to pins 3 and 4 of the test socket.
3. Adjust Channel A DC Balance control for zero volt reading.
4. Disconnect Voltmeter from pins 3 and 4 and connect to pins 1 and 2.
5. Adjust Channel B DC Balance control for zero volts reading.
6. Connect the positive terminal of the Voltmeter to pin 3 and the negative terminal to chassis.
7. Adjust Channel A Bias control for 0.75 volts DC reading. (This voltage is the drop across a 20 ohm precision resistor when  $27\frac{1}{2}$  milli-amperes cathode current per output tube is flowing.)

8. Remove positive Voltmeter terminal from pin 3 and connect to pin 1.
9. Adjust Channel B Bias control for 0.75 volts DC reading.
10. Re-check DC Balance (Steps 2-5).
11. Replace shorting plug.

#### DISTORTION TESTING INFORMATION

Because of the low distortion of the 654, and its balanced to chassis ground output circuits, the test equipment used in measuring distortion must meet certain rigid requirements to insure accurate results. Following is a discussion of test equipment requirements and test procedure:

In making distortion measurements, the amplifier is fed by a signal generator and its output is measured by a distortion analyzer. Since the analyzer indicates the distortion of not just the amplifier, but the entire system...signal generator, amplifier and the analyzer itself...it is necessary to first make certain that the distortion of the test equipment is considerably lower than the distortion to be measured from the amplifier. An acceptable value for the residual distortion of the test equipment is 0.1%.

Most Intermodulation Distortion Test Sets combine the signal generator and analyzer on one chassis. If the chassis ground is common to the test signal output and the analyzer input, the input should not be connected directly across the 8 or 16 ohm terminals. Such connection will short circuit part of the output transformer secondary and result in a large measurement error.

For IM measurement, take the output voltage, regardless of load, from the ungrounded "0" terminal and the chassis grounded "4" terminal. The load should be connected across the appropriate output terminals. A Voltmeter with no grounded terminal should be connected across the load resistor.

#### DISTORTION MEASUREMENT PROCEDURE

In order to duplicate the factory distortion measurements for this instrument, the test equipment must meet the requirements as outlined in the preceding paragraphs and the following procedure must be adhered to:

1. Adjust the DC Balance and the Bias controls as outlined on pages 26 and 27.
2. Connect Harmonic Distortion measurement

equipment and drive the amplifier to full output at 1,000 cycles.

3. Adjust signal (AC) Balance control for minimum distortion. With this control, correctly set, the distortion waveform displayed on a scope will be mainly third order distortion.

4. Change input signal to low frequency and drive amplifier to full output. Make slight adjustment of DC Balance control to minimize distortion.

5. Change output signal to high frequency. Drive amplifier to full output and test distortion.

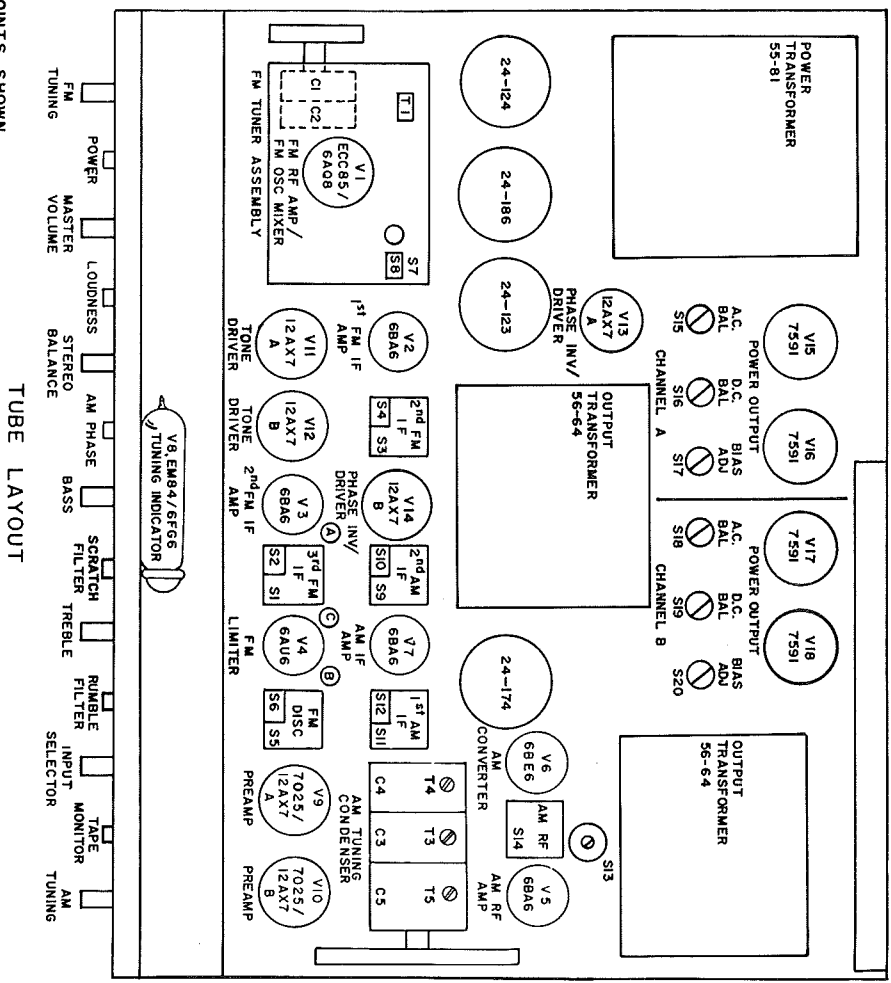
6. Connect SMPTE Intermodulation Distortion test equipment and drive the amplifier to full output.

7. Make a slight adjustment of the Bias control for minimum IM distortion and test.





ALIGNMENT POINTS SHOWN  
 BOXED IN, ARE LOCATED ON  
 UNDERSIDE OF CHASSIS



ALL DIMENSIONS UNLESS OTHERWISE SPECIFIED  
 MUST BE HELD TO A TOLERANCE OF  
 .005 INCHES  
 ATTENTION

PILOT RADIO CORPORATION  
 LONG ISLAND CITY, N. Y. U. S. A.  
 MODEL 654 TUBE LAYOUT  
 DATE: 9-19-60  
 DRAWN BY: JDA  
 CHECKED BY: JDA  
 APPROVED BY: JDA  
 PART NO: 95-205

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