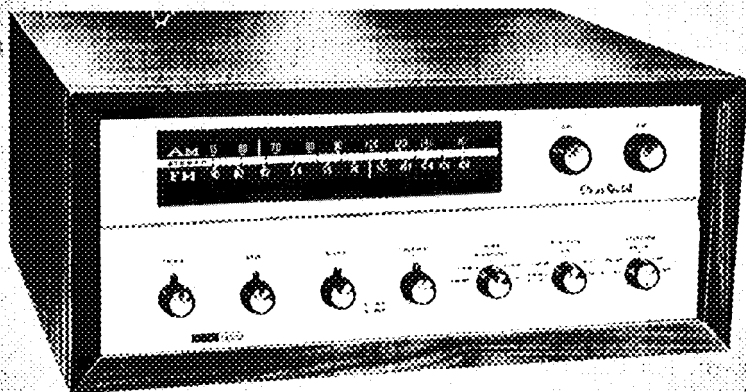


harman kardon



Stereo Recital

Model TA224

INTEGRATED STEREOPHONIC RECEIVER

INSTRUCTIONAL MANUAL

It is essential you read this instruction booklet carefully before installing your Stereo Recital. You have invested in a fine high fidelity stereophonic control center into which many important and excellent engineering developments have been incorporated. Each is necessary for the proper operation of your system.

This instruction booklet has been written in simple non-technical language. If you will take time to read it first before doing anything else, you will find it an easy task to install and operate your new Model TA224 stereophonic receiver. **KEEP THIS BOOKLET AVAILABLE AT ALL TIMES FOR IT CONTAINS INDISPENSABLE TECHNICAL AND SERVICE INFORMATION.**



This is the Harman-Kardon Stereo Symbol. It is your assurance of superb stereo performance.

GENERAL DESCRIPTION

The Stereo Recital, Model TA224, is by far the most versatile instrument ever designed. It may be used in any of the following ways:

- 1—Monophonic AM or FM receiver.
- 2—Stereophonic Simulcast AM-FM Receiver.
- 3—Stereophonic FM Multiplex Receiver when used with a multiplex adapter.
- 4—Stereophonic Preamplifier-Amplifier for playback of records and tapes.

UNPACKING

After removing the Stereo Recital from the shipping carton, inspect it carefully for signs of transit damage. The unit was subjected to many inspections and tests at the factory prior to final packing, and it therefore should be in perfect condition. If damage is visible, notify your dealer at once. If the instrument was shipped to you, notify the transportation company without delay.

Check the contents of the carton and folds of the packing material carefully before discarding it. The package should contain the following items:

- 1 Stereo Recital, Model TA224.
- 1 Instruction Booklet
- 1 Mounting Template and Mounting Instructions
- 1 Warranty Card
- 1 Package of Hardware for cabinet installation

WARRANTY POLICY

We urge you to completely fill in your warranty card and mail it to the factory without delay to protect your rights under warranty. The warranty cards are carefully filed for reference and should you require information on the use of this high fidelity unit, or repair service, we will be able to identify your set and reply quickly.

NOTE: It is necessary to receive factory authorization before returning a set for warranty repair either to the factory or to an authorized station. Repairs are to be returned on an Express Prepaid basis. A letter describing the exact difficulty must be enclosed with the unit.

WARRANTY

We warrant each Model TA224 to be free from defects in material and workmanship under normal use and service, and in accordance with the conditions herein below set forth, for a period of 1 year from date of delivery to the original purchaser, and agree to replace or repair any part or parts, with the exception of tubes which are under the manufacturer's 90 day warranty, returned to us within said 1 year, with transportation prepaid and which our examination shall disclose to our satisfaction to have been thus defective. This warranty does not include free labor, nor is it applicable to any instrument which shall have been repaired or altered in any way so as in our judgment to affect its stability or reliability nor which has been subject to neglect, misuse, abuse, negligence or accident nor which has had the serial number altered, effaced, or removed. Neither shall this warranty apply to any instrument which has been connected otherwise than in accordance with instructions furnished by us.

This warranty is expressly in lieu of all other warranties, express or implied, and of all other obligations or liability on our part, and we neither assume nor authorize any representative or other person to assume for us any other liability in connection with the sale of this instrument.

CONTROL CENTER**INSTALLATION PROCEDURE****Ventilation:**

The unit is well ventilated in itself, but sufficient space must be allowed around it to permit proper air flow. Install the Stereo Recital in a manner to allow for unrestricted circulation. Do not place books or other objects on the cage or cabinet or in the immediate vicinity of the instrument. Reducing the air flow will result in sharply reduced component and tube life. Allow at least 4 inches above the unit when custom installing into a cabinet. Refer to mounting instruction sheet for cabinet installation procedure.

Power Requirements:

Plug the AC line cord into any outlet furnishing 117 volts, 50 or 60 cycles AC current. The voltage may vary between 105 and 125 volts. A 1 amp AC convenience receptacle is located on the rear panel of the receiver and is controlled by the ON/OFF switch on the front panel.

Connecting the Speakers:

Your two speakers should be identical if possible to obtain optimum results. Experts agree that a perfectly matched system offers the best stereophonic reproduction. The speakers should be preferably placed along the same wall approximately 8 to 15 feet apart depending upon room size and furniture placement. It may be necessary to experiment with speaker placement until best results are obtained.

Use any type wire to connect your speakers to the Stereo Recital. Lamp cord ("zip cord") is excellent and may be easily dressed around the molding for an inconspicuous and neat installation. Do not drive the staples or tacks through the center of the wire for this will short out the two sections and will decrease the overall volume or short out the speakers entirely. It is permissible to use approximately 100 feet of speaker connecting wire for each speaker without loss of volume.

Connect one length of lamp cord to your left speaker and attach the other end to the screw terminals on the LEFT SPEAKER output strip. Connect one wire to the "G" terminal and the other wire to either the "8" or "16" ohm screw depending upon the nominal impedance rating of your speaker. (Impedance ratings are usually listed on the rear of the speaker or on the shipping carton.) Similarly connect another length of lamp cord to your right speaker and attach the other end to the RIGHT SPEAKER output strip. Connect one wire to "G" and the other wire to either "8" or "16" as previously discussed. Carefully dress the speaker leads away from audio input cables and power lines. Keep the wiring neat and be sure there are no frayed edges touching the chassis or other terminals.

Speaker Phasing:

When more than one speaker is used in any music reproducing system they must be connected in such a way as to aid each other, rather than to work against each other. Since two speakers must be used for stereo reproduction, this

caution applies. Checking for phase, and correcting if necessary, is quite simple, and is done at the time of installation of the system.

Play a record with readily apparent bass tones. Listen carefully to the strength and clarity of the bass. Now reverse the connections of *one* of the speakers. If the bass notes are now louder and clearer, the speakers are now correctly phased. If the bass seems weaker, the original connection was correct.

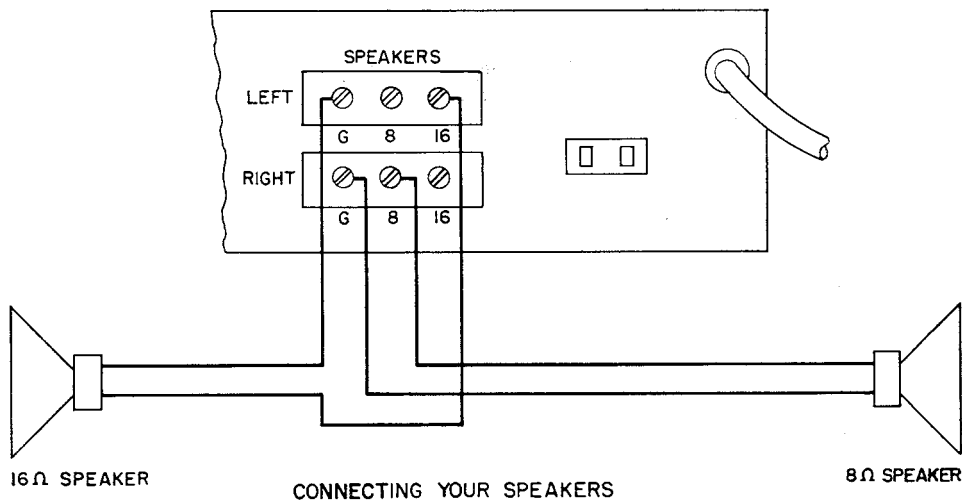


DIAGRAM A

Connecting The FM Antenna:

Due to the exceptionally high FM sensitivity of the TA224, the 48" piece of wire supplied with the unit will be sufficient antenna for all but the most difficult locations. One end of this wire should be stripped of insulation and attached to the rear screw terminal marked FM on the Antenna Terminal strip located on the rear of the chassis. The other end of this wire should be extended horizontally along the cabinet or table. Horizontal placement of the antenna wire provides proper polarization for optimum reception.

If an outdoor antenna is required to "reach" for distant stations, use a folded dipole or Yagi specifically cut for the FM band. A homemade 300 ohm "T" type antenna is not satisfactory and should not be used as a substitute for the 48" piece of wire supplied with the set. The "T" type antenna has a tendency to pick up extraneous noise.

TV antennas are at times satisfactory but may have a tendency to introduce ignition noise and other interference into the tuner circuit. They are not recommended except under unavoidable circumstances. Usually better results can be obtained with the 48" piece of wire.

When using an outdoor antenna, attach the 300 ohm lead-in wire (twisting it 4-5 times for each running foot) to the antenna terminals on the rear of the TA224 marked FM and G.

Connecting The AM Antenna:

The AM loopstick antenna on the rear of the TA224 chassis comprises all the antenna required for normal signal areas. In more remote locations an addi-

tional outdoor antenna may be necessary. This should consist of a single wire, as long as is reasonably practical. It must be kept away from large metal objects, power lines or electrical machinery to insure reception without extraneous noise. Attach the external antenna to the rear terminal strip marked AM.

Connecting Your Stereo Record Player:

A stereophonic cartridge uses two output plugs. Provision has been made on the Stereo Recital to accommodate any of the three types of phonograph pickups available on the market.

MAGNETIC CARTRIDGE: Connect your magnetic stereo cartridge to the LEFT and RIGHT PHONO LO input receptacles located on the rear of the receiver chassis.

CERAMIC CARTRIDGE: Connect the two outputs of your ceramic cartridge to the LEFT and RIGHT PHONO HI input receptacles on the rear of the chassis. Note: There are several stereo ceramic cartridges available that must be connected to the PHONO LO input receptacles instead of the usual high level (PHONO HI) inputs. Follow the cartridge manufacturer's recommendations.

CRYSTAL CARTRIDGE: Connect the two outputs of your stereo crystal cartridge to the LEFT and RIGHT PHONO HI input receptacles.

Connecting A Monophonic Record Player:

A monophonic record player uses one connecting plug. If you are using a low output magnetic cartridge connect it to either the LEFT or RIGHT PHONO LO input receptacle.

IMPORTANT: When the TA224 is used only for monophonic operation (and stereo is to be added at some later date) it is essential that both speaker output terminals are terminated into speakers or into a speaker and resistive load. For example, if you have only one speaker, attach it to the Left Speaker Output connections and connect an 8 or 16 ohm 25 watt wirewound resistor to the Right Speaker Output connections. This will assure proper loading of the output stage and will prevent damage to the output tubes. A more satisfactory solution would be to connect an additional speaker for monophonic listening instead of the 8 or 16 ohm resistor. Refer to Diagram B.

Connecting Your Stereo Tape Deck:

A stereophonic tape deck utilizes two playback heads usually contained in one head assembly. Each head has its own output plug. Connect both plugs to the LEFT and RIGHT TAPE HD input receptacles located on the rear panel.

Connecting Your Monophonic Tape Deck:

Attach the shielded lead from the monophonic tape head to either the LEFT or RIGHT TAPE HD input.

Connecting Your Stereo Tape Recorder:

Since most stereophonic tape recorders have their own preamplifiers, it is not desirable to connect the output of the recorder into the low level PHONO LO inputs. This could result in overloading of the input stage and cause distortion. Connect one tape recorder output cable to the LEFT AUX input and the other output lead to the RIGHT AUX input.

These connections will enable you to play back your stereo tapes. To make a stereo recording connect your recorder as follows:

Connect the left input of your tape recorder to the TA224 LEFT TAPE OUT receptacle. Similarly connect the right input of your recorder to the RIGHT TAPE OUT receptacle located on the rear panel. This will enable you to make a stereophonic recording with the proper recording equalization as determined by your recorder, while simultaneously monitoring the program with the proper tone control, contour and loudness setting.

The recording level from the TA224 TAPE OUT receptacles is approximately 1 volt and is unaffected by the tone and loudness controls to assure a "flat" recording signal.

Connecting Your Monophonic Tape Recorder:

When using a monophonic tape recorder with the TA224, connect the recorder output to either the LEFT or RIGHT AUX input receptacle. This will enable you to play back your monophonic tapes. If your tape recorder is a stereo playback-monophonic record, connect the output as described in the previous paragraph, but connect the input as described below.

Connect the input of your monophonic tape recorder to either the LEFT or RIGHT TAPE OUT receptacle on the rear of the TA224 chassis. This will enable you to make a monophonic tape recording with the proper equalization as determined by your recorder, while simultaneously monitoring the program with the proper tone control, contour and loudness setting.

The program material you wish to record is selected by the FUNCTION SELECTOR and TUNER SELECTOR on the front panel. To record a radio program, set the FUNCTION SELECTOR to "TUNER" and the TUNER SELECTOR to either FM, FM-AFC, AM-FM or AM. To tape monophonic records, set the TUNER SELECTOR to "OFF" and the FUNCTION SELECTOR to PHONO HI-LO. If you are using a stereo cartridge (and you are making a monophonic recording), set the MODE switch to "MONOPHONIC". If you are using a monophonic cartridge, set the MODE switch to RIGHT or LEFT relating to the input receptacle used.

Connecting An External Self-Powered Multiplex Adapter:

In those localities where FM multiplex broadcasting is available, connect the adapter to the two MULTI IN input receptacles located on the rear panel. FM program material for the adapter is supplied from the output receptacle labeled MULTI OUT. Follow the instructions supplied with the adapter for complete hookup information.

OPERATING THE MODEL TA224 AS AN INTEGRATED RECEIVER

Every control on a well designed and honestly considered high fidelity instrument has a specific useful function related to each of the other controls. A brief explanatory note on the relationship of the various front panel controls will doubtless prove useful in organizing and clarifying them for you.

Bass and Treble Tone Controls:

The BASS and TREBLE tone controls on the TA224 provide the full range of tonal adjustment necessary for stereo high fidelity listening. The tone control

range is considerable and can adequately adjust the low and high frequencies in accordance with your listening preference, speaker characteristics and room acoustics.

You will note that the BASS and TREBLE controls each have two knobs, one in front of the other. The front knob controls the right channel and the rear knob controls the left channel. These two knobs are separate to facilitate operation.

If the two channels require different tone control settings, due perhaps to differences in speakers or room acoustics, the two BASS knobs may be adjusted independently to balance the differences, and from then adjusted simultaneously by grasping both knobs at the same time.

The two TREBLE controls can be similarly adjusted.

Loudness/Balance Control:

The BALANCE control on this amplifier utilizes the concentric LOUDNESS controls to balance the channels. This assures accurate tracking and ease of operation.

To operate, turn both Loudness Controls to zero to attain mechanical alignment. Grasp both controls and rotate clockwise until desired listening level is achieved. If your system is not in perfect balance, rotate the inner control either to the right or left while holding the outer control in place. This will provide proper stereo balance.

Mode Switch:

The MODE switch is incorporated to select between the various modes of operation which may be desired for monophonic and stereophonic reproduction. This switch offers FIVE positions of operation. STEREO REVERSE, STEREO, MONOPHONIC, RIGHT and LEFT.

At this writing, most newly recorded stereophonic discs follow the established industry standard, so that your left speaker will reproduce the program as picked up by the left recording microphone when the MODE switch is in the STEREO position. However, this is not necessarily so for older recordings. While one label may present the orchestra with the bass section on the right and the violins on the left, another recording company may reverse this procedure. Some of us prefer to listen to a symphony orchestra in the same relative orientation as in the concert hall. The REVERSE position on the MODE switch serves to reverse the apparent locations of instruments in an orchestra to duplicate the original setting where necessary.

For those who do not have matched speakers for stereophonic reproduction, the REVERSE position on the MODE switch serves an additional purpose. In "Ping-Pong" stereo recordings, the bass is sometimes favored on one side, while the higher frequencies may appear on the other channel. By experimenting with the MODE switch it is possible to channel the low frequencies through the speaker system having the best bass response. Merely throw the MODE switch back and forth between REVERSE and STEREO until the low frequencies are reproduced by the speaker system with the better low frequency response.

The STEREO position on the MODE switch maintains the Left-Right relationship for properly made records.

When you desire to play a monophonic record utilizing your stereo cartridge, the MODE switch should be set to the MONOPHONIC position. This position combines the left and right sections of the stereophonic cartridge and cancels vertical rumble and distortion.

Setting the MODE switch to RIGHT when the Stereo Recital is set for stereo reproduction allows any program material being fed into the right input receptacles to be reproduced by both speakers simultaneously. If you are listening to a stereo disc and the MODE switch is set to RIGHT, only the right channel of the recording will appear at the speakers. Setting the MODE switch to LEFT allows all program material being fed into the left input receptacle to be reproduced by both speakers simultaneously.

When using a monophonic cartridge with the TA224, the MODE switch must be properly set to correspond with the input used. If your monophonic cartridge is connected to the LEFT PHONO LO input, then the MODE switch must be set to the LEFT position to activate the left preamplifier. Similarly if your monophonic magnetic cartridge is connected to the RIGHT PHONO LO input, the MODE switch must be set to the RIGHT position to activate the right preamplifier.

To play the AM or FM tuner monophonically, set the FUNCTION SELECTOR switch to "TUNER" and the TUNER SELECTOR to either "FM, FM-AFC or AM" and turn the MODE switch to "MONOPHONIC". To play the tuner stereophonically, set the FUNCTION SELECTOR to "TUNER" and the TUNER SELECTOR to "AM-FM". Turn the MODE switch to "STEREO" or "REVERSE".

FUNCTION SELECTOR SWITCH:

The FUNCTION SELECTOR selects the desired type of program source and has five switching positions. PHONO/HI-LO selects your phonograph for playback. TAPE HD selects your tape deck for playback with the standard NARTB playback curve. AUX selects the high level inputs when connected to your tape recorder or other auxiliary equipment. MULTI selects the two multiplex input jacks on the rear panel. TUNER activates the TUNER SELECTOR switch.

Tuner Selector Switch:

This switch selects the tuner portion of the receiver for operation. It will not operate unless the FUNCTION SELECTOR is in the "TUNER" position.

FM selects the FM tuner for operation. FM-AFC selects the FM tuner for operation but with the addition of automatic frequency control. The operation of this circuit will be discussed in a later paragraph. AM-FM selects both AM and FM tuners for simulcast stereo reception. AM selects the AM tuner for operation. Turn the TUNER SELECTOR to "OFF" when the tuner is not in use.

FM-AFC:

FM broadcasting, by its very nature, eliminates almost all natural and man-made static. However, the characteristics of FM which makes this possible also causes problems in tuning. The TA224 incorporates a special electronic circuit known as Automatic Frequency Control that overcomes these problems and insures proper tuning even if the manual tuning is not accurately done. Therefore AFC always keeps the station in the center of the channel and eliminates distortion caused by inaccurate tuning.

In order to take maximum advantage of the benefits of AFC, it is suggested that fine tuning be done with the Tuner Selector Switch in the FM position. When the switch is then turned to the FM-AFC position the AFC will improve this careful tuning by a factor of 10 to 1. This procedure is especially recommended when a weak station is being tuned on a channel adjacent to a stronger one. This will prevent the AFC from reaching for the more powerful signal and skipping over the weaker one. If the weaker station is tuned in without the AFC, when the AFC is applied it will lock it in permanently.

Blend Control:

This control is used to introduce a controlled amount of crosstalk between the two channels to fill in the hole in the middle found in certain stereo program material.

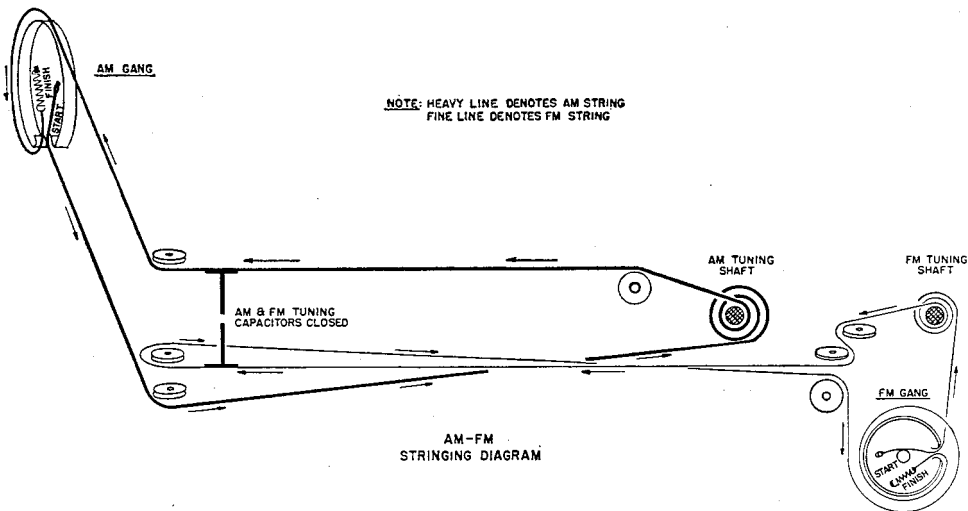
Rotate the BLEND knob clockwise to engage the control. When set to the extreme clockwise position the result will be monophonic. (A + B)

Power On/Off Switch:

The ON/OFF switch is located in the TREBLE control knob furthest from the panel. To turn the set on, rotate the TREBLE control knob in a clockwise position.

AM and FM Tuning Controls:

These controls are located on the front panel and are used to tune for AM or FM stations. For simulcast AM-FM stereo reception, it is necessary to tune the AM and FM sections separately.



MAINTENANCE AND REPAIRS

Hum and Noise:

In any high fidelity installation, hum may be caused by the interconnection of a record player, tuner and amplifier, as a result of the cables and different grounds. If hum is experienced with the TA224, disconnect everything but the speakers from the receiver. If hum persists, reverse the AC line cord. Also perform the balancing adjustments outlined in a later paragraph. Plug in the record player and if hum appears, reverse the record player power plug and connect a single lead from the record player chassis to a good ground point on the chassis of the TA224. Connect your other devices in this manner. CAUTION: Hum may be also induced by defective connecting cables or by running these cables too close to a strong AC field.

Output Tube Balancing Controls:

There are two OUTPUT TUBE BALANCING CONTROLS located on the top of the chassis near the output tubes. These controls are factory adjusted and should not be touched unless tubes are changed. If adjustment is necessary follow the procedure listed below.

1. Set the LOUDNESS CONTROL to minimum.
2. Slowly rotate each BALANCING CONTROL for minimum hum.
3. If the hum level is not readily apparent, set the control to the mid-position.
4. For absolute accuracy use an IM analyzer and set for lowest IM distortion.

Replacing Output Tubes:

It is permissible to replace the 7408 output tubes of this receiver with 6V6GT's. This may cause a slight power loss and a slight increase in intermodulation distortion.

Fuse:

This receiver is fused in the AC primary with a 4 amp-MTH fuse. It is located underneath the chassis near the line cord. Replace if necessary, only with the same size used.

Tube Checking and Service:

It is recommended to test the tubes of this receiver every twelve months in order to insure optimum performance. When a tube is changed in the tuner portion, it may be necessary to have the instrument recalibrated and realigned.

If this instrument should not perform properly during the first year after date of purchase, contact the factory for instructions. DO NOT have it repaired locally without first contacting Harman-Kardon for advice. The factory has many authorized warranty service stations in the United States, and for the station nearest you, please write or call our Customer Service Department, Harman-Kardon, Inc. 520 Main Street, Westbury, L. I., New York. Be sure to include the model and serial number of the unit. A brief description of your other components is often of help in answering your questions.

USING THE MODEL TA224 AS AN INTEGRATED STEREOPHONIC

CONTROL CENTER

INSTALLATION PROCEDURE

Ventilation:

The unit is well ventilated in itself, but sufficient space must be allowed around it to permit proper air flow. Install the Stereo Recital in a manner to allow for unrestricted circulation. Do not place books or other objects on the cage or cabinet or in the immediate vicinity of the instrument. Reducing the air flow will result in sharply reduced component and tube life. Allow at least 4 inches above the unit when custom installing into a cabinet. Refer to mounting instruction sheet for cabinet installation procedure.

Power Requirements:

Plug the AC line cord into any outlet furnishing 117 volts, 50 or 60 cycles AC current. The voltage may vary between 105 and 125 volts. A 1 amp AC convenience receptacle is located on the rear panel of the receiver and is controlled by the ON/OFF switch on the front panel.

Connecting the Speakers:

Your two speakers should be identical if possible to obtain optimum results. Experts agree that a perfectly matched system offers the best stereophonic reproduction. The speakers should be preferably placed along the same wall approximately 8 to 15 feet apart depending upon room size and furniture placement. It may be necessary to experiment with speaker placement until best results are obtained.

Use any type wire to connect your speakers to the Stereo Recital. Lamp cord ("zip cord") is excellent and may be easily dressed around the molding for an inconspicuous and neat installation. Do not drive the staples or tacks through the center of the wire for this will short out the two sections and will decrease the overall volume or short out the speakers entirely. It is permissible to use approximately 100 feet of speaker connecting wire for each speaker without loss of volume.

Connect one length of lamp cord to your left speaker and attach the other end to the screw terminals on the LEFT SPEAKER output strip. Connect one wire to the "G" terminal and the other wire to either the "8" or "16" ohm screw depending upon the nominal impedance rating of your speaker. (Impedance ratings are usually listed on the rear of the speaker or on the shipping carton.) Similarly connect another length of lamp cord to your right speaker and attach the other end to the RIGHT SPEAKER output strip. Connect one wire to "G" and the other wire to either "8" or "16" as previously discussed. Carefully dress the speaker leads away from audio input cables and power lines. Keep the wiring neat and be sure there are no frayed edges touching the chassis or other terminals.

Connecting Your Speaker For Monophonic Operation:

Connect your speaker to either the LEFT or RIGHT SPEAKER output strip according to its impedance rating. Connect an 8 or 16 ohm 25 watt wirewound resistor to the remaining SPEAKER output strip.

This precaution loads the unused channel and prevents damage to the output stage of the receiver. Please refer to diagram B

Speaker Phasing:

When more than one speaker is used in any music reproducing system they must be connected in such a way as to aid each other, rather than to work against each other. Since two speakers must be used for stereo reproduction, this caution applies. Checking for phase, and correcting if necessary, is quite simple, and is done at the time of installation of the system.

Play a record with readily apparent bass tones. Listen carefully to the strength and clarity of the bass. Now reverse the connections of *one* of the speakers. If the bass notes are now louder and clearer, the speakers are now correctly phased. If the bass seems weaker, the original connection was correct.

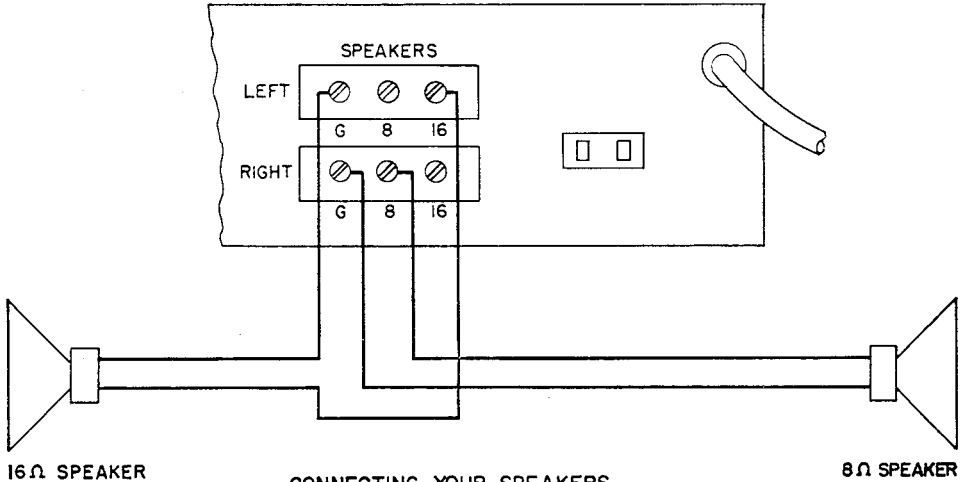


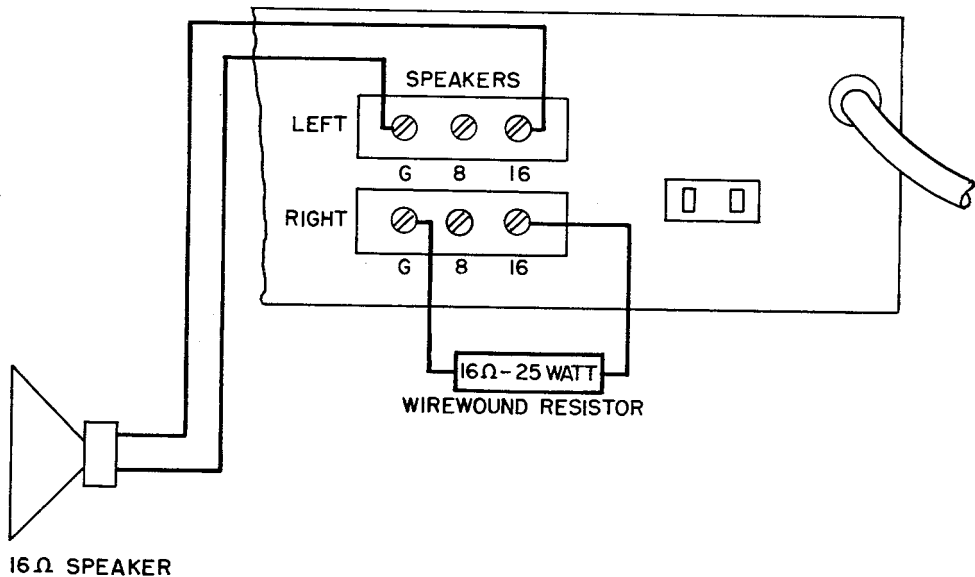
DIAGRAM A

IMPORTANT: When the TA224 is used only for monophonic operation (and stereo is to be added at some later date) it is essential that both speaker output terminals are terminated into speakers or into a speaker and resistive load. For example, if you have only one speaker, attach it to the Left Speaker Output connections and connect an 8 or 16 ohm 25 watt wirewound resistor to the Right Speaker Output connections. This will assure proper loading of the output stage and will prevent damage to the output tubes. A more satisfactory solution would be to connect an additional speaker for monophonic listening instead of the 8 or 16 ohm resistor. Refer to Diagram B.

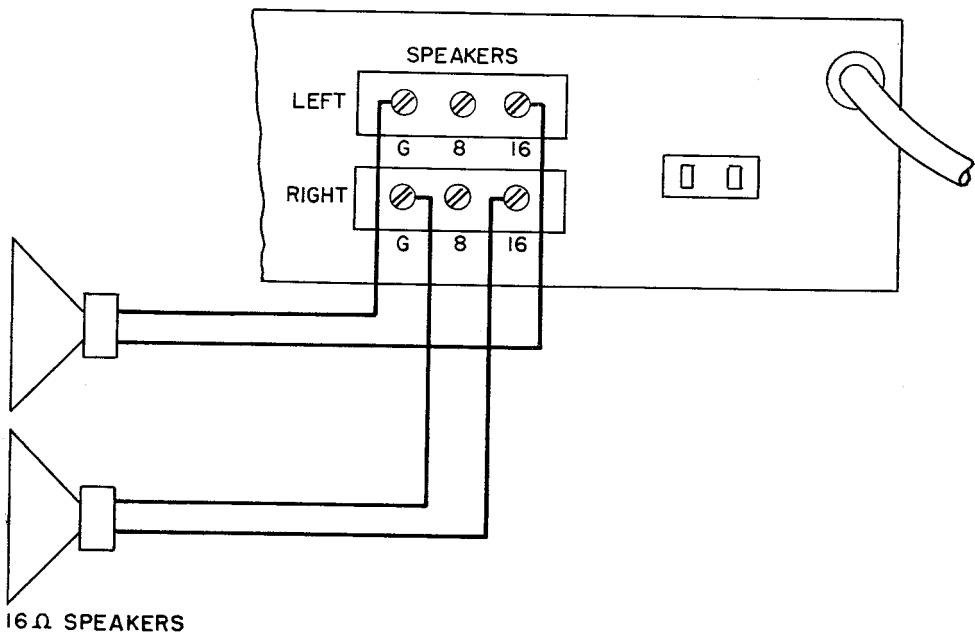
Connecting The FM Antenna:

Due to the exceptionally high FM sensitivity of the TA224, the 48" piece of wire supplied with the unit will be sufficient antenna for all but the most difficult locations. One end of this wire should be stripped of insulation and attached to the rear screw terminal marked FM on the Antenna Terminal strip located on the rear of the chassis. The other end of this wire should be extended horizontally along the cabinet or table. Horizontal placement of the antenna wire provides proper polarization for optimum reception.

If an outdoor antenna is required to "reach" for distant stations, use a folded



ONE SOLUTION FOR MONOPHONIC INSTALLATION



BEST SOLUTION FOR MONOPHONIC INSTALLATION

player and if hum appears, reverse the record player power plug and connect a single lead from the record player chassis to a good ground point on the chassis of the TA224. Connect your other devices in this manner. CAUTION: Hum may be also induced by defective connecting cables or by running these cables too close to a strong AC field.

Hum Balance:

A HUM BALANCE potentiometer is located on top of the chassis directly behind the 7408 output tubes.

Set the Function Selector to the Auxiliary position and disconnect any equipment connected to the Auxiliary input receptacles. Turn the Volume control to maximum. Slowly rotate the HUM BALANCE potentiometer until the hum disappears or is at its lowest level. This control may be set anywhere within its rotation to obtain minimum hum.

Output Tube Balancing Controls:

There are two OUTPUT TUBE BALANCING CONTROLS located on the top of the chassis near the output tubes. These controls are factory adjusted and should not be touched unless tubes are changed. If adjustment is necessary follow the procedure listed below.

1. Set the LOUDNESS CONTROL to minimum.
2. Slowly rotate each BALANCING CONTROL for minimum hum.
3. If the hum level is not readily apparent, set the control to the mid-position.
4. For absolute accuracy use an IM analyzer and set for lowest IM distortion.

Replacing Output Tubes:

It is permissible to replace the 7408 output tubes of this receiver with 6V6GT's. This may cause a slight power loss and a slight increase in intermodulation distortion.

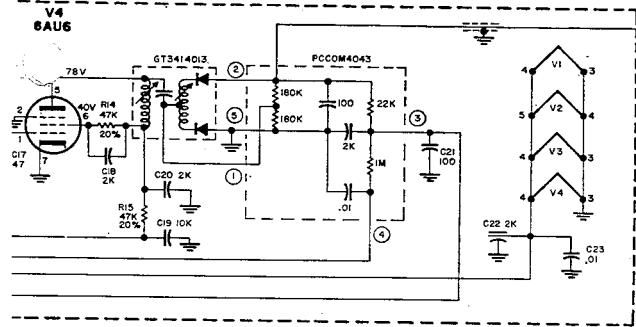
Fuse:

This receiver is fused in the AC primary with a 4 amp-MTH fuse. It is located on top of the chassis. Replace if necessary, only with the same size used.

Tube Checking and Service:

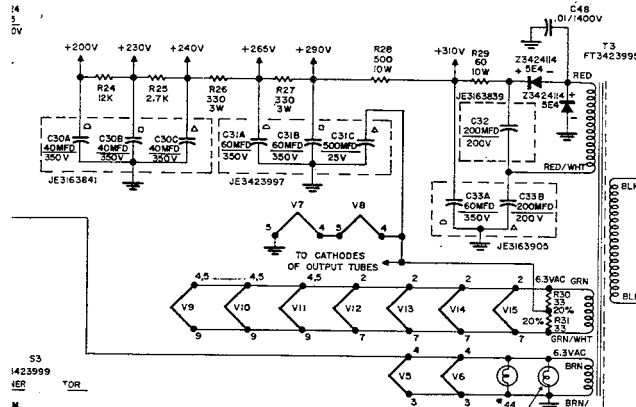
It is recommended to test the tubes of this receiver every twelve months in order to insure optimum performance. When a tube is changed in the tuner portion, it may be necessary to have the instrument recalibrated and realigned.

If this instrument should not perform properly during the first year after date of purchase, contact the factory for instructions. DO NOT have it repaired locally without first contacting Harman-Kardon for advice. The factory has many authorized warranty service stations in the United States, and for the station nearest you, please write or call our Customer Service Department, Harman-Kardon, Inc. Plainview, L. I., New York. Be sure to include the model and serial number of the unit. A brief description of your other components is often of help in answering your questions.



RESISTANCE CHART

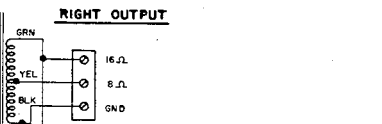
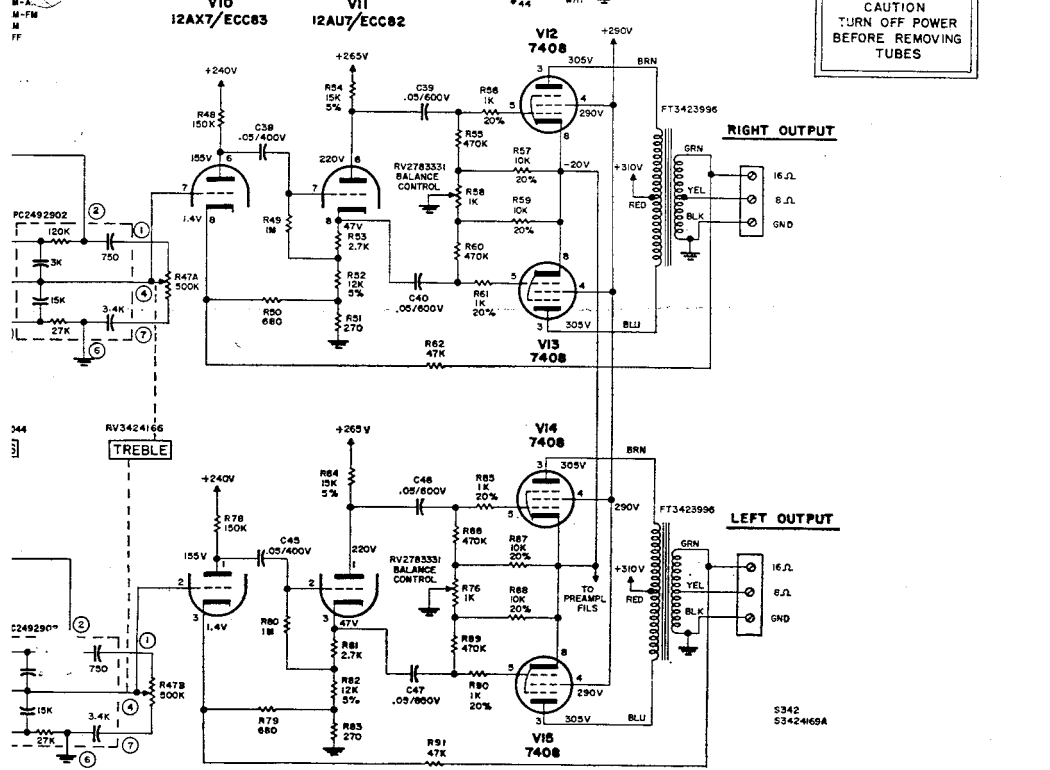
TUBE	1	2	3	4	5	6	7	8	9
V1 6CY5	0	68	—	—	—	—	68	—	—
V2 EF184	220	100K	220	—	—	0	—	—	—
V3 6AU6	470K	0	—	—	—	0	—	—	—
V4 6AU6	100K	0	—	—	—	0	—	—	—
V5 6BE6	22K	.3	0	—	—	100K	—	—	—
V6 6BA6	0	0	—	—	—	100K	.150	—	—
V7 12AX7	—	3.3M	0	—	—	—	10K	1800	—
V8 12AX7	—	3.3M	0	—	—	—	10K	1800	—
V9 12AX7	—	200K	330	—	—	—	200K	330	—
V10 12AX7	—	—	850	—	—	—	—	850	—
V11 12AU7	—	1M	15K	—	—	—	60K	1M	15K
V12 7408	—	—	—	—	—	500K	500K	—	—
V13 7408	—	—	—	—	—	500K	500K	—	—
V14 7408	—	—	—	—	—	500K	500K	—	—
V15 7408	—	—	—	—	—	500K	500K	—	—



VOLTAGE AND RESISTANCE READINGS — LOUDNESS MAX C.W
 TREBLE & BASS FLAT
 BLEND MAX CCW
 FUNCTION AM/FM POS.
 MODE STEREO/NORMAL POS.
 TUNER SELECTOR AM/FM POS.

NOTES:
 UNLESS OTHERWISE SHOWN
 ALL RESISTORS 1/2 WATT ± 10%
 ALL CAPACITOR VALUES WITH DECIMAL
 TO BE PAPER IN MFD.
 ALL CAPACITOR VALUES WITHOUT
 DECIMAL TO BE GENERAL PURPOSE
 CERAMICS 500VDC IN MMF.
 ALL VOLTAGES ARE DC
 ALL RESISTANCES ARE IN OHMS
 ALL SELECTOR SWITCHES ARE
 SHOWN IN POSITION *

CAUTION
 TURN OFF POWER
 BEFORE REMOVING
 TUBES



S342
 53424168A

TAB24

FM CARTRIDGE ALIGNMENT PROCEDURE

STEP	FUNCTION SWITCH SETTING	SIG. GENERATOR INPUT		SIGNAL INPUT POINT	OUTPUT INDICATOR	CONNECT INDICATOR TO	DIAL SETTING	ADJUST	OUTPUT INDICATION
		FREQ	MOD						
1.	FM	10.7 MC	60 CPS 300KC DEV.	COUPLE INTO TUBE SHIELD OF EF184	SCOPE	JUNCTION OF 47UUF FEED THRU CAPACITOR TO 100K RESISTOR OF 3d IF XFMR (TOP CHASSIS)	—	1st, 2nd & 3rd FM IF XFMR	MAX GAIN AND SYMMETRY
2.	FM	10.7 MC	SAME	SAME AS STEP 1	SCOPE	FM OUTPUT OF TUNER	—	DISC. PRIMARY	MAX GAIN
3.	FM	10.7 MC	SAME	SAME AS STEP 1	SCOPE	SAME AS STEP 2	—	SECONDARY DISC.	SYMMETRY OF "S" PATTERN
4.	FM	106 MC	SAME	ANT TERM	SCOPE	SAME AS STEP 2	106 MC	106 MC OSC & RF TRIMMER	MAX OUTPUT
5.	FM	90 MC	SAME	SAME AS STEP 4	SCOPE	SAME AS STEP 2	90 MC	90 MC OSC & RF COIL	MAX OUTPUT

AM ALIGNMENT PROCEDURE

STEP	FUNCTION SWITCH SETTING	SIGNAL GENERATOR		SIGNAL INPUT POINT	OUTPUT INDICATOR	CONNECT INDICATOR TO	DIAL SETTING	ADJUST	OUTPUT INDICATION
		FREQ	MOD						
1.	AM	455 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1600 KC	1st AND 2nd I.F. TRANS.	MAX. OUTPUT
2.	AM	1400 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1400 KC	OSC & RF TRIMMERS	MAX. OUTPUT
3.	AM	600 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	OUTPUT TUNER AM	600 KC	OSC & RF TRIMMERS	MAX. OUTPUT
4.	AM	1400 KC	REPEAT STEP #2						

AM ALIGNMENT PROCEDURE

STEP	FUNCTION SWITCH SETTING	SIGNAL GENERATOR		SIGNAL INPUT POINT	OUTPUT INDICATOR	CONNECT INDICATOR TO	DIAL SETTING	ADJUST	OUTPUT INDICATION
		FREQ	MOD						
1.	AM	455 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1600 KC	1st AND 2nd I.F. TRANS.	MAX. OUTPUT
2.	AM	1400 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1400 KC	OSC & RF TRIMMERS	MAX. OUTPUT
3.	AM	600 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	OUTPUT TUNER AM	600 KC	OSC & COIL LOOPSTICK	MAX. OUTPUT
4.	AM	1400 KC	REPEAT STEP #2						

REPLACEMENT PARTS LIST

Part No.	Description	Price
HC24625	AC Convenience Outlet .....	.20
HC33901	Fuse Holder (With Cap) .....	.35
ZCOM3299	Fuse, 4 Amp (Buss Type MTH4) .....	.15
FT3423995	Transformer, Power	17.50
FT3423996	Transformer, Output	7.00
JE3423997	Electrolytic Capacitor	3.75
JE3163839	Electrolytic Capacitor	2.60
JE3163905	Electrolytic Capacitor	3.50
JE3163841	Electrolytic Capacitor	3.00
JE3584255	Electrolytic Capacitor .....	.70
RVCOM2569	DC Balance Pot, Output Tube Circuit .....	.60
RV3424251	Blend Control	2.00
ER3424247	Mode Selector Switch	1.10
ER3424246	Function Selector Switch	3.15
ER3424242	Tuner Selector Switch	1.10
RV3424589	Bass Control, Dual	2.15
RV3424589	Treble Control, Dual, w/AC on-off Sw.	2.60
RV3424588	Volume Control, Dual	2.15
GL3484026	AM Osc Coil .....	.65
GTCOM4152	1st AM-IF Transformer	1.30
GT3425028	2nd AM-IF Transformer	1.30
GL3424083	AM Loopstick Antenna	2.40
P481329	Tuning Ring for AM Loopstick .....	.10
P3424089	Dial Glass	1.25
KBCOM3429	Panel Lamp, Type #44 .....	.20
P3424093	Dial Pointer .....	.40
PC3824700	PC Plate, Equalization .....	.75
PC2492902	PC Plate, Tone Control .....	.90
Z3424114	Silicon Rectifier, 400 P. I. V.	2.90
PC781599	PC Plate, AM Det. Filter .....	.35
B3424605	Escutcheon (Specify Color)	12.00
PCOM3602	Knob, Rear Concentric .....	.25
PCOM3603	Knob, Front Concentric .....	.25
PCOM3601	Knob .....	.25
RVCOM2569	Hum Balance .....	.60

harman

kardon

Stereo Recital

MODEL TA224

INTEGRATED STEREOPHONIC RECEIVER

INSTRUCTIONAL MANUAL

It is essential you read this instruction booklet carefully before installing your Stereo Recital. You have invested in a fine high fidelity stereophonic control center into which many important and excellent engineering developments have been incorporated. Each is necessary for the proper operation of your system.

This instruction booklet has been written in simple non-technical language. If you will take time to read it first before doing anything else, you will find it an easy task to install and operate your new Model TA224 stereophonic receiver. **KEEP THIS BOOKLET AVAILABLE AT ALL TIMES FOR IT CONTAINS INDISPENSABLE TECHNICAL AND SERVICE INFORMATION.**



*This is the Harman-Kardon Stereo Symbol.
It is your assurance of superb stereo performance.*

GENERAL DESCRIPTION

The Stereo Recital, Model TA224, is by far the most versatile instrument ever designed. It may be used in any of the following ways:

- 1—Monophonic AM or FM receiver.
- 2—Stereophonic Simulcast AM-FM Receiver.
- 3—Stereophonic FM Multiplex Receiver when used with a multiplex adapter.
- 4—Stereophonic Preamplifier-Amplifier for playback of records and tapes.

UNPACKING

After removing the Stereo Recital from the shipping carton, inspect it carefully for signs of transit damage. The unit was subjected to many inspections and tests at the factory prior to final packing, and it therefore should be in perfect condition. If damage is visible, notify your dealer at once. If the instrument was shipped to you, notify the transportation company without delay.

Check the contents of the carton and folds of the packing material carefully before discarding it. The package should contain the following items:

- 1 Stereo Recital, Model TA224.
- 1 Instruction Booklet
- 1 Mounting Template and Mounting Instructions
- 1 Warranty Card
- 1 Package of Hardware for cabinet installation

WARRANTY POLICY

We urge you to completely fill in your warranty card and mail it to the factory without delay to protect your rights under warranty. The warranty cards are carefully filed for reference and should you require information on the use of this high fidelity unit, or repair service, we will be able to identify your set and reply quickly.

NOTE: It is necessary to receive factory authorization before returning a set for warranty repair either to the factory or to an authorized station. Repairs are to be returned on an Express Prepaid basis. A letter describing the exact difficulty must be enclosed with the unit.

WARRANTY

We warrant each Model TA224 to be free from defects in material and workmanship under normal use and service, and in accordance with the conditions herein below set forth, for a period of 1 year from date of delivery to the original purchaser, and agree to replace or repair any part or parts, with the exception of tubes which are under the manufacturer's 90 day warranty, returned to us within said 1 year, with transportation prepaid and which our examination shall disclose to our satisfaction to have been thus defective. This warranty does not include free labor, nor is it applicable to any instrument which shall have been repaired or altered in any way so as in our judgment to affect its stability or reliability nor which has been subject to neglect, misuse, abuse, negligence or accident nor which has had the serial number altered, effaced, or removed. Neither shall this warranty apply to any instrument which has been connected otherwise than in accordance with instructions furnished by us.

This warranty is expressly in lieu of all other warranties, express or implied, and of all other obligations or liability on our part, and we neither assume nor authorize any representative or other person to assume for us any other liability in connection with the sale of this instrument.

USING THE MODEL TA224 AS AN INTEGRATED STEREOPHONIC CONTROL CENTER

INSTALLATION PROCEDURE

Ventilation:

The unit is well ventilated in itself, but sufficient space must be allowed around it to permit proper air flow. Install the Stereo Recital in a manner to allow for unrestricted circulation. Do not place books or other objects on the cage or cabinet or in the immediate vicinity of the instrument. Reducing the air flow will result in sharply reduced component and tube life. Allow at least 4 inches above the unit when custom installing into a cabinet. Refer to mounting instruction sheet for cabinet installation procedure.

Power Requirements:

Plug the AC line cord into any outlet furnishing 117 volts, 50 or 60 cycles AC current. The voltage may vary between 105 and 125 volts. A 1 amp AC convenience receptacle is located on the rear panel of the receiver and is controlled by the ON/OFF switch on the front panel.

Connecting the Speakers:

Your two speakers should be identical if possible to obtain optimum results. Experts agree that a perfectly matched system offers the best stereophonic reproduction. The speakers should be preferably placed along the same wall approximately 8 to 15 feet apart depending upon room size and furniture placement. It may be necessary to experiment with speaker placement until best results are obtained.

Use any type wire to connect your speakers to the Stereo Recital. Lamp cord ("zip cord") is excellent and may be easily dressed around the molding for an inconspicuous and neat installation. Do not drive the staples or tacks through the center of the wire for this will short out the two sections and will decrease the overall volume or short out the speakers entirely. It is permissible to use approximately 100 feet of speaker connecting wire for each speaker without loss of volume.

Connect one length of lamp cord to your left speaker and attach the other end to the screw terminals on the LEFT SPEAKER output strip. Connect one wire to the "G" terminal and the other wire to either the "8" or "16" ohm screw depending upon the nominal impedance rating of your speaker. (Impedance ratings are usually listed on the rear of the speaker or on the shipping carton.) Similarly connect another length of lamp cord to your right speaker and attach the other end to the RIGHT SPEAKER output strip. Connect one wire to "G" and the other wire to either "8" or "16" as previously discussed. Carefully dress the speaker leads away from audio input cables and power lines. Keep the wiring neat and be sure there are no frayed edges touching the chassis or other terminals.

Speaker Phasing:

When more than one speaker is used in any music reproducing system they must be connected in such a way as to aid each other, rather than to work against each other. Since two speakers must be used for stereo reproduction, this

caution applies. Checking for phase, and correcting if necessary, is quite simple, and is done at the time of installation of the system.

Play a record with readily apparent bass tones. Listen carefully to the strength and clarity of the bass. Now reverse the connections of *one* of the speakers. If the bass notes are now louder and clearer, the speakers are now correctly phased. If the bass seems weaker, the original connection was correct.

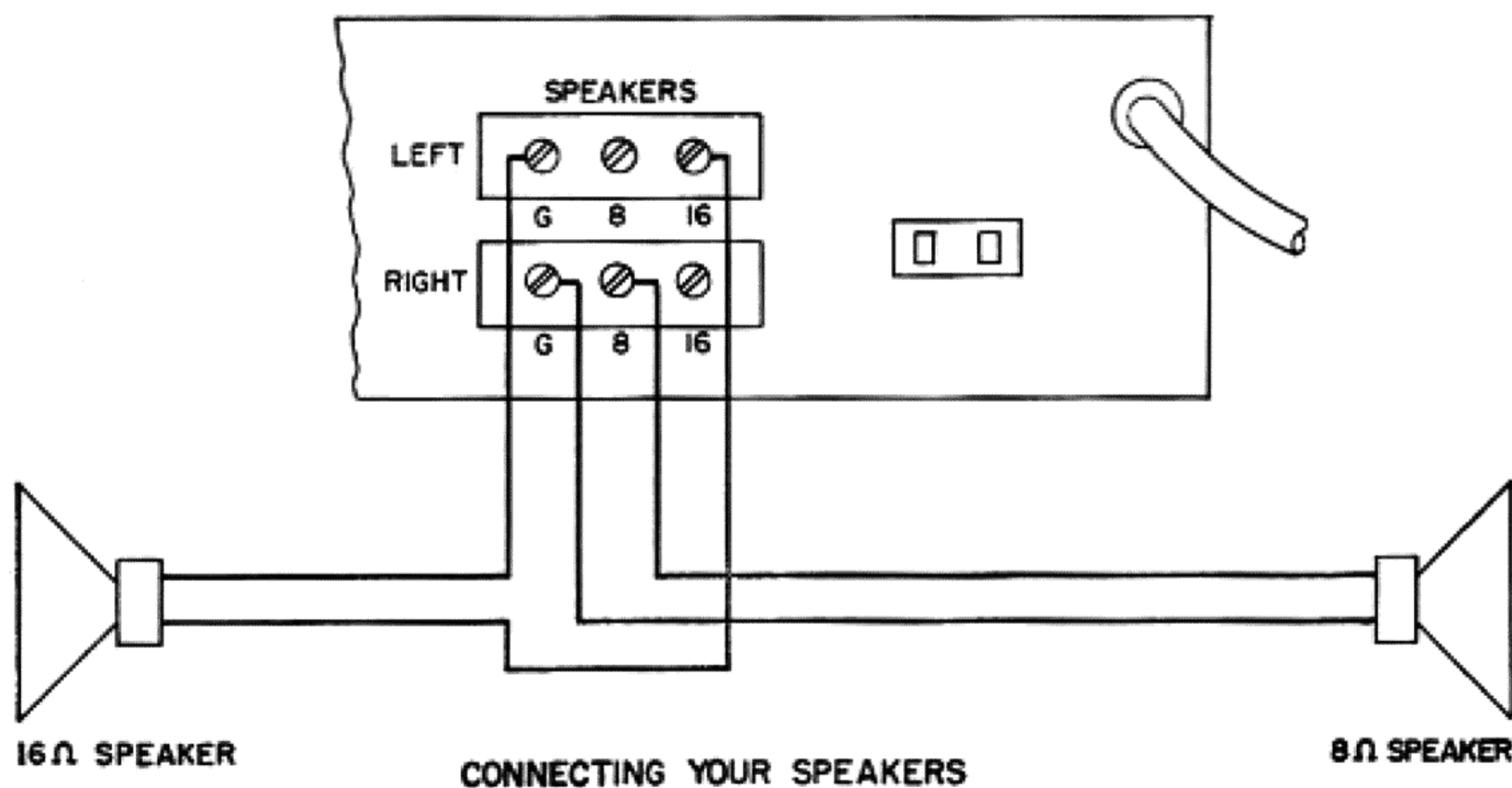


DIAGRAM A

IMPORTANT: When the TA224 is used only for monophonic operation (and stereo is to be added at some later date) it is essential that both speaker output terminals are terminated into speakers or into a speaker and resistive load. For example, if you have only one speaker, attach it to the Left Speaker Output connections and connect an 8 or 16 ohm 25 watt wirewound resistor to the Right Speaker Output connections. This will assure proper loading of the output stage and will prevent damage to the output tubes. A more satisfactory solution would be to connect an additional speaker for monophonic listening instead of the 8 or 16 ohm resistor. Refer to Diagram B.

Connecting The FM Antenna:

Due to the exceptionally high FM sensitivity of the TA224, the 48" piece of wire supplied with the unit will be sufficient antenna for all but the most difficult locations. One end of this wire should be stripped of insulation and attached to the rear screw terminal marked FM on the Antenna Terminal strip located on the rear of the chassis. The other end of this wire should be extended horizontally along the cabinet or table. Horizontal placement of the antenna wire provides proper polarization for optimum reception.

If an outdoor antenna is required to "reach" for distant stations, use a folded dipole or Yagi specifically cut for the FM band. A homemade 300 ohm "T" type antenna is not satisfactory and should not be used as a substitute for the 48" piece of wire supplied with the set. The "T" type antenna has a tendency to pick up extraneous noise.

TV antennas are at times satisfactory but may have a tendency to introduce ignition noise and other interference into the tuner circuit. They are not recom-

mended except under unavoidable circumstances. Usually better results can be obtained with the 48" piece of wire.

When using an outdoor antenna, attach the 300 ohm lead-in wire (twisting it 4-5 times for each running foot) to the antenna terminals on the rear of the TA224 marked FM and G.

Connecting The AM Antenna:

The AM loopstick antenna on the rear of the TA224 chassis comprises all the antenna required for normal signal areas. In more remote locations an additional outdoor antenna may be necessary. This should consist of a single wire, as long as is reasonably practical. It must be kept away from large metal objects, power lines or electrical machinery to insure reception without extraneous noise. Attach the external antenna to the rear terminal strip marked AM.

Connecting Your Stereo Record Player:

A stereophonic cartridge uses two output plugs. Provision has been made on the Stereo Recital to accommodate any of the three types of phonograph pickups available on the market.

MAGNETIC CARTRIDGE: Connect your magnetic stereo cartridge to the LEFT and RIGHT PHONO LO input receptacles located on the rear of the receiver chassis.

CERAMIC CARTRIDGE: Connect the two outputs of your ceramic cartridge to the LEFT and RIGHT PHONO HI input receptacles on the rear of the chassis. Note: There are several stereo ceramic cartridges available that must be connected to the PHONO LO input receptacles instead of the usual high level (PHONO HI) inputs. Follow the cartridge manufacturer's recommendations.

CRYSTAL CARTRIDGE: Connect the two outputs of your stereo crystal cartridge to the LEFT and RIGHT PHONO HI input receptacles.

Connecting A Monophonic Record Player:

A monophonic record player uses one connecting plug. If you are using a low output magnetic cartridge connect it to either the LEFT or RIGHT PHONO LO input receptacle.

Connecting Your Stereo Tape Deck:

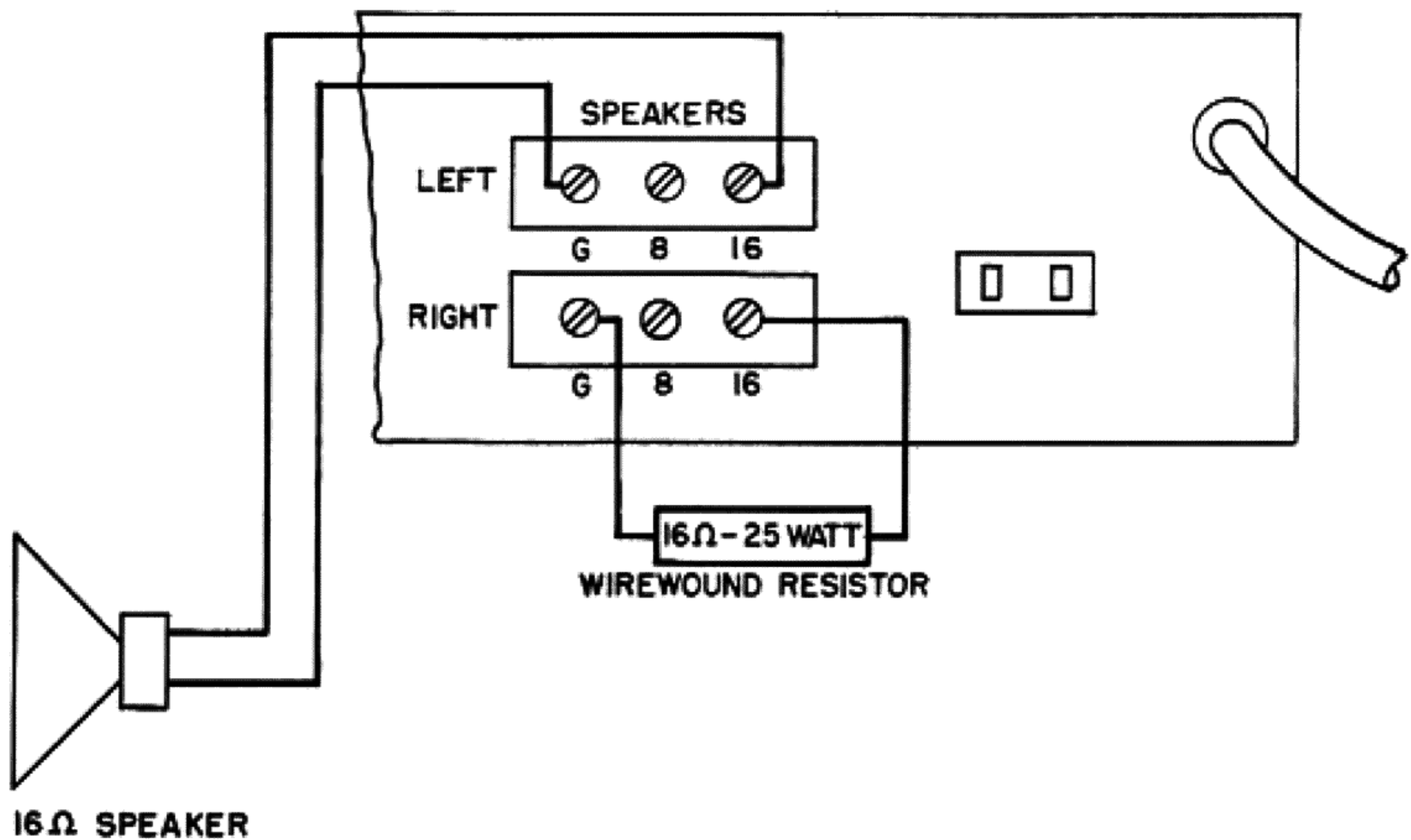
A stereophonic tape deck utilizes two playback heads usually contained in one head assembly. Each head has its own output plug. Connect both plugs to the LEFT and RIGHT TAPE HD input receptacles located on the rear panel.

Connecting Your Monophonic Tape Deck:

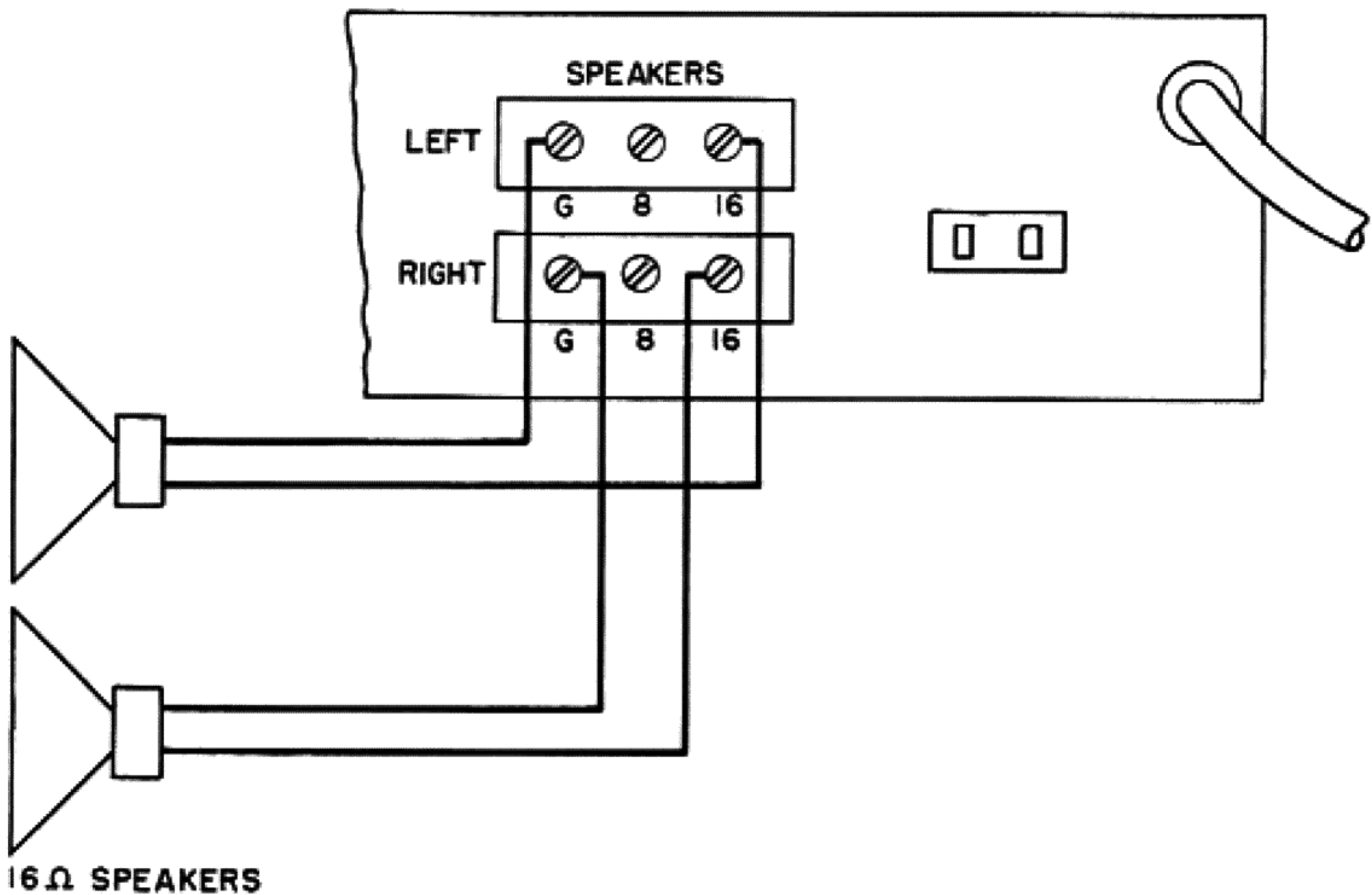
Attach the shielded lead from the monophonic tape head to either the LEFT or RIGHT TAPE HD input.

Connecting Your Stereo Tape Recorder:

Since most stereophonic tape recorders have their own preamplifiers, it is not desirable to connect the output of the recorder into the low level PHONO LO inputs. This could result in overloading of the input stage and cause distortion. Connect one tape recorder output cable to the LEFT AUX input and the other output lead to the RIGHT AUX input.



ONE SOLUTION FOR MONOPHONIC INSTALLATION



BEST SOLUTION FOR MONOPHONIC INSTALLATION

DIAGRAM B

These connections will enable you to play back your stereo tapes. To make a stereo recording connect your recorder as follows:

Connect the left input of your tape recorder to the TA224 LEFT TAPE OUT receptacle. Similarly connect the right input of your recorder to the RIGHT TAPE OUT receptacle located on the rear panel. This will enable you to make a stereophonic recording with the proper recording equalization as determined by your recorder, while simultaneously monitoring the program with the proper tone control, contour and loudness setting.

The recording level from the TA224 TAPE OUT receptacles is approximately 1 volt and is unaffected by the tone and loudness controls to assure a "flat" recording signal.

Connecting Your Monophonic Tape Recorder:

When using a monophonic tape recorder with the TA224, connect the recorder output to either the LEFT or RIGHT AUX input receptacle. This will enable you to play back your monophonic tapes. If your tape recorder is a stereo playback-monophonic record, connect the output as described in the previous paragraph, but connect the input as described below.

Connect the input of your monophonic tape recorder to either the LEFT or RIGHT TAPE OUT receptacle on the rear of the TA224 chassis. This will enable you to make a monophonic tape recording with the proper equalization as determined by your recorder, while simultaneously monitoring the program with the proper tone control, contour and loudness setting.

The program material you wish to record is selected by the FUNCTION SELECTOR and TUNER SELECTOR on the front panel. To record a radio program, set the FUNCTION SELECTOR to "TUNER" and the TUNER SELECTOR to either FM, FM-AFC, AM-FM or AM. To tape monophonic records, set the TUNER SELECTOR to "OFF" and the FUNCTION SELECTOR to PHONO HI-LO. If you are using a stereo cartridge (and you are making a monophonic recording), set the MODE switch to "MONOPHONIC" If you are using a monophonic cartridge, set the MODE switch to RIGHT or LEFT relating to the input receptacle used.

Connecting An External Self-Powered Multiplex Adapter:

In those localities where FM multiplex broadcasting is available, connect the adapter to the two MULTI IN input receptacles located on the rear panel. FM program material for the adapter is supplied from the output receptacle labeled MULTI OUT. Follow the instructions supplied with the adapter for complete hookup information.

OPERATING THE MODEL TA224 AS AN INTEGRATED RECEIVER

Every control on a well designed and honestly considered high fidelity instrument has a specific useful function related to each of the other controls. A brief explanatory note on the relationship of the various front panel controls will doubtless prove useful in organizing and clarifying them for you.

Bass and Treble Tone Controls:

The BASS and TREBLE tone controls on the TA224 provide the full range of tonal adjustment necessary for stereo high fidelity listening. The tone control

range is considerable and can adequately adjust the low and high frequencies in accordance with your listening preference, speaker characteristics and room acoustics.

You will note that the BASS and TREBLE controls each have two knobs, one in front of the other. The front knob controls the right channel and the rear knob controls the left channel. These two knobs are separate to facilitate operation.

If the two channels require different tone control settings, due perhaps to differences in speakers or room acoustics, the two BASS knobs may be adjusted independently to balance the differences, and from then adjusted simultaneously by grasping both knobs at the same time.

The two TREBLE controls can be similarly adjusted.

Loudness/Balance Control:

The BALANCE control on this amplifier utilizes the concentric LOUDNESS controls to balance the channels. This assures accurate tracking and ease of operation.

To operate, turn both Loudness Controls to zero to attain mechanical alignment. Grasp both controls and rotate clockwise until desired listening level is achieved. If your system is not in perfect balance, rotate the inner control either to the right or left while holding the outer control in place. This will provide proper stereo balance.

Mode Switch:

The MODE switch is incorporated to select between the various modes of operation which may be desired for monophonic and stereophonic reproduction. This switch offers FIVE positions of operation. STEREO REVERSE, STEREO, MONOPHONIC, RIGHT and LEFT.

At this writing, most newly recorded stereophonic discs follow the established industry standard, so that your left speaker will reproduce the program as picked up by the left recording microphone when the MODE switch is in the STEREO position. However, this is not necessarily so for older recordings. While one label may present the orchestra with the bass section on the right and the violins on the left, another recording company may reverse this procedure. Some of us prefer to listen to a symphony orchestra in the same relative orientation as in the concert hall. The REVERSE position on the MODE switch serves to reverse the apparent locations of instruments in an orchestra to duplicate the original setting where necessary.

For those who do not have matched speakers for stereophonic reproduction, the REVERSE position on the MODE switch serves an additional purpose. In "Ping-Pong" stereo recordings, the bass is sometimes favored on one side, while the higher frequencies may appear on the other channel. By experimenting with the MODE switch it is possible to channel the low frequencies through the speaker system having the best bass response. Merely throw the MODE switch back and forth between REVERSE and STEREO until the low frequencies are reproduced by the speaker system with the better low frequency response.

The STEREO position on the MODE switch maintains the Left-Right relationship for properly made records.

When you desire to play a monophonic record utilizing your stereo cartridge, the **MODE** switch should be set to the **MONOPHONIC** position. This position combines the left and right sections of the stereophonic cartridge and cancels vertical rumble and distortion.

Setting the **MODE** switch to **RIGHT** when the Stereo Recital is set for stereo reproduction allows any program material being fed into the right input receptacles to be reproduced by both speakers simultaneously. If you are listening to a stereo disc and the **MODE** switch is set to **RIGHT**, only the right channel of the recording will appear at the speakers. Setting the **MODE** switch to **LEFT** allows all program material being fed into the left input receptacle to be reproduced by both speakers simultaneously.

When using a monophonic cartridge with the TA224, the **MODE** switch must be properly set to correspond with the input used. If your monophonic cartridge is connected to the **LEFT PHONO LO** input, then the **MODE** switch must be set to the **LEFT** position to activate the left preamplifier. Similarly if your monophonic magnetic cartridge is connected to the **RIGHT PHONO LO** input, the **MODE** switch must be set to the **RIGHT** position to activate the right preamplifier.

To play the AM or FM tuner monophonically, set the **FUNCTION SELECTOR** switch to "TUNER" and the **TUNER SELECTOR** to either "FM, FM-AFC or AM" and turn the **MODE** switch to "MONOPHONIC". To play the tuner stereophonically, set the **FUNCTION SELECTOR** to "TUNER" and the **TUNER SELECTOR** to "AM-FM". Turn the **MODE** switch to "STEREO" or "REVERSE".

Function Selector Switch:

The **FUNCTION SELECTOR** selects the desired type of program source and has five switching positions. **PHONO/HI-LO** selects your phonograph for playback. **TAPE HD** selects your tape deck for playback with the standard NARTB playback curve. **AUX** selects the high level inputs when connected to your tape recorder or other auxiliary equipment. **MULTI** selects the two multiplex input jacks on the rear panel. **TUNER** activates the **TUNER SELECTOR** switch.

Tuner Selector Switch:

This switch selects the tuner portion of the receiver for operation. It will not operate unless the **FUNCTION SELECTOR** is in the "TUNER" position.

FM selects the FM tuner for operation. **FM-AFC** selects the FM tuner for operation but with the addition of automatic frequency control. The operation of this circuit will be discussed in a later paragraph. **AM-FM** selects both AM and FM tuners for simulcast stereo reception. **AM** selects the AM tuner for operation. Turn the **TUNER SELECTOR** to "OFF" when the tuner is not in use.

FM-AFC:

FM broadcasting, by its very nature, eliminates almost all natural and man-made static. However, the characteristics of FM which makes this possible also causes problems in tuning. The TA224 incorporates a special electronic circuit known as Automatic Frequency Control that overcomes these problems and insures proper tuning even if the manual tuning is not accurately done. Therefore AFC always keeps the station in the center of the channel and eliminates distortion caused by inaccurate tuning.

In order to take maximum advantage of the benefits of AFC, it is suggested that fine tuning be done with the Tuner Selector Switch in the FM position. When the switch is then turned to the FM-AFC position the AFC will improve this careful tuning by a factor of 10 to 1. This procedure is especially recommended when a weak station is being tuned on a channel adjacent to a stronger one. This will prevent the AFC from reaching for the more powerful signal and skipping over the weaker one. If the weaker station is tuned in without the AFC, when the AFC is applied it will lock it in permanently.

Blend Control:

This control is used to introduce a controlled amount of crosstalk between the two channels to fill in the hole in the middle found in certain stereo program material.

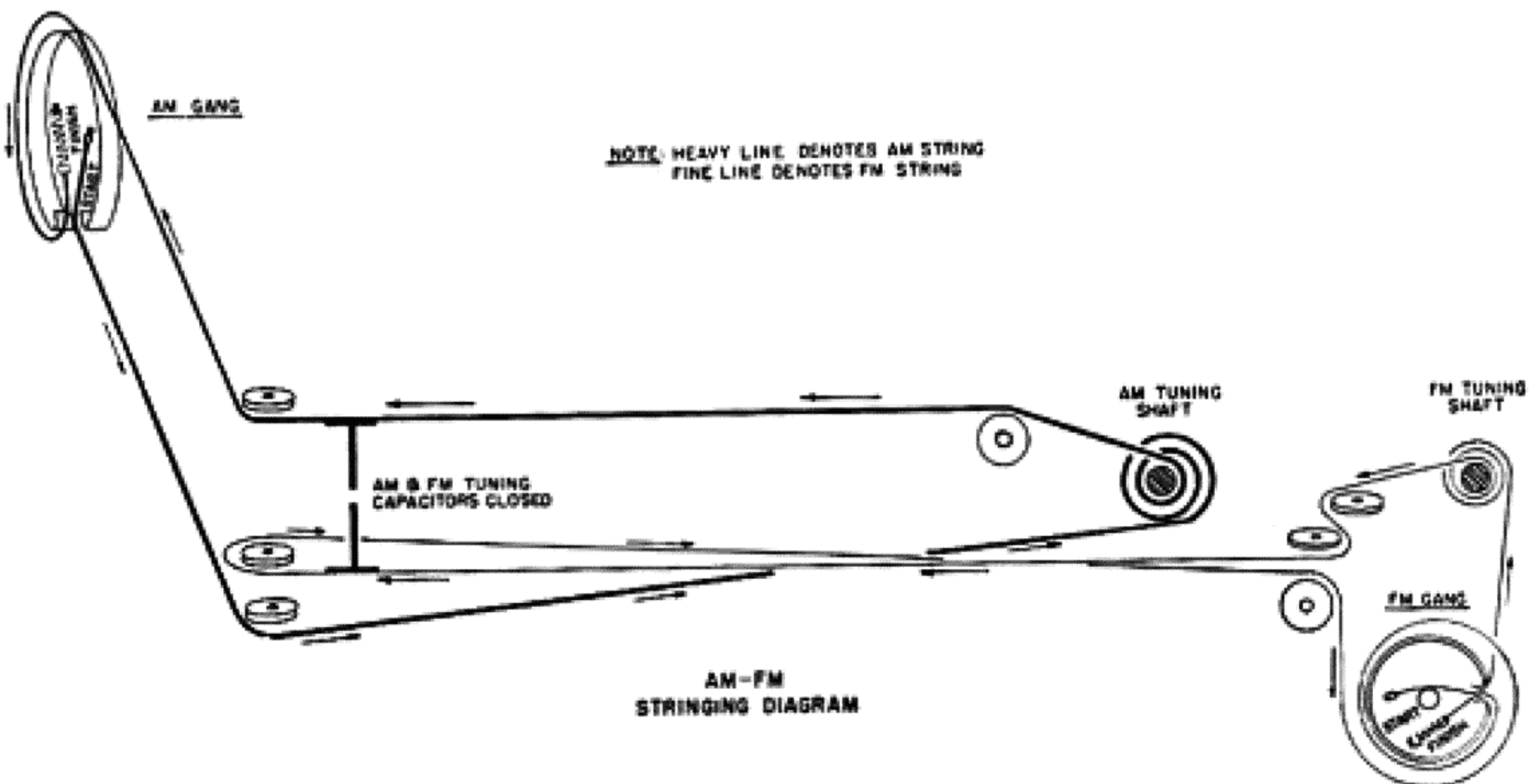
Rotate the BLEND knob clockwise to engage the control. When set to the extreme clockwise position the result will be monophonic. (A + B)

Power On/Off Switch:

Depress the red push button power ON/OFF switch to turn the set on. Depress the button again to turn the set off.

AM and FM Tuning Controls:

These controls are located on the front panel and are used to tune for AM or FM stations. For simulcast AM-FM stereo reception, it is necessary to tune the AM and FM sections separately.



MAINTENANCE AND REPAIRS

Hum and Noise:

In any high fidelity installation, hum may be caused by the interconnection of a record player, tuner and amplifier, as a result of the cables and different grounds. If hum is experienced with the TA224, disconnect everything but the speakers from the receiver. If hum persists, reverse the AC line cord. Also perform the balancing adjustments outlined in a later paragraph. Plug in the record player and if hum appears, reverse the record player power plug and connect a single lead from the record player chassis to a good ground point on the chassis of the TA224. Connect your other devices in this manner. CAUTION: Hum may be also induced by defective connecting cables or by running these cables too close to a strong AC field.

Output Tube Balancing Controls:

There are two OUTPUT TUBE BALANCING CONTROLS located on the top of the chassis near the output tubes. These controls are factory adjusted and should not be touched unless tubes are changed. If adjustment is necessary follow the procedure listed below.

1. Set the LOUDNESS CONTROL to minimum.
2. Slowly rotate each BALANCING CONTROL for minimum hum.
3. If the hum level is not readily apparent, set the control to the mid-position.
4. For absolute accuracy use an IM analyzer and set for lowest IM distortion.

Replacing Output Tubes:

It is permissible to replace the 7408 output tubes of this receiver with 6V6GT's. This may cause a slight power loss and a slight increase in intermodulation distortion.

Fuse:

This receiver is fused in the AC primary with a 4 amp-MTH fuse. It is located underneath the chassis near the line cord. Replace if necessary, only with the same size used.

Tube Checking and Service:

It is recommended to test the tubes of this receiver every twelve months in order to insure optimum performance. When a tube is changed in the tuner portion, it may be necessary to have the instrument recalibrated and realigned.

If this instrument should not perform properly during the first year after date of purchase, contact the factory for instructions. DO NOT have it repaired locally without first contacting Harman-Kardon for advice. The factory has many authorized warranty service stations in the United States, and for the station nearest you, please write or call our Customer Service Department, Harman-Kardon, Inc. 520 Main Street, Westbury, L. I., New York. Be sure to include the model and serial number of the unit. A brief description of your other components is often of help in answering your questions.

AM ALIGNMENT PROCEDURE

STEP	FUNCTION SWITCH SETTING	SIGNAL GENERATOR		SIGNAL INPUT POINT	OUTPUT INDICATOR	CONNECT INDICATOR TO	DIAL SETTING	ADJUST	OUTPUT INDICATION
		FREQ	MOD						
1.	AM	455 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1600 KC	1st AND 2nd I.F. TRANS.	MAX. OUTPUT
2.	AM	1400 KC	30% AM	AM ANT. TERM.	AC-VTVM OR SCOPE	TUNER OUTPUT AM	1400 KC	OSC & RF TRIMMERS	MAX. OUTPUT
3.	AM	600 KC	30% AM	AM ANT. TERM	AC-VTVM OR SCOPE	OUTPUT TUNER AM	600 KC	OSC & COIL LOOPSTICK	MAX. OUTPUT
4.	AM	1400 KC	REPEAT STEP #2						

REPLACEMENT PARTS LIST

Part No.	Description	Price
HC33901	AC Convenience Outlet .....	.20
P1142116	Fuse Holder (With Cap) .....	.35
ZCOM3299	Fuse, 4 Amp (Buss Type MTH4) .....	.15
FT3423995	Transformer, Power	17.50
FT3423996	Transformer, Output	7.00
JE3423997	Electrolytic Condenser	3.75
JE3163839	Electrolytic Condenser	2.60
JE3163905	Electrolytic Condenser	3.50
JE3163841	Electrolytic Condenser	3.00
JE3584255	Electrolytic Condenser .....	.70
RV2783331	DC Balance Pot, Output Tube Circuit .....	.60
RV3424251	Blend Control	2.00
ER3424247	Mode Selector Switch	1.10
ER3424246	Function Selector Switch	3.15
ER3424242	Tuner Selector Switch	1.10
RV3424589	Bass Control, Dual	2.15
RV3424589	Treble Control, Dual, w/AC on-off Sw.	2.60
RV3424588	Volume Control, Dual	2.15
GL3484026	AM Osc Coil .....	.65
GTCOM4152	1st AM-IF Transformer	1.30
GTCOM4153	2nd AM-IF Transformer	1.30
GL3424083	AM Loopstick Antenna	2.40
P481329	Tuning Ring for AM Loopstick .....	.10
P3424089	Dial Glass	1.25
KBCOM3429	Panel Lamp, Type #44 .....	.20
P3424093	Dial Pointer .....	.40
PCCOM4151	PC Plate, Equalization .....	.75
PC2492902	PC Plate, Tone Control .....	.90
Z3424114	Silicon Rectifier, 400 P. I. V.	2.90
PC781599	PC Plate, AM Det. Filter .....	.35
Z2923361	Diode, AM Detector .....	.90
B3424605	Escutcheon (Specify Color)	12.00
PCOM3602	Knob, Rear Concentric .....	.25
PCOM3603	Knob, Front Concentric .....	.25
PCOM3601	Knob .....	.25

W24711	FM Wire Antenna, 48" .....	.20
Z3414150	AFC Diode	1.85
Z3414016	Discr. Diode (Order matched pairs) .....	.90
KB3634243	AFC Neon V.R. Tube .....	.30
GL3634212	FM-IF Coil .....	.55
GT3634213	1st FM-IF Transformer	1.40
GT3634214	2nd FM-IF Transformer	1.40
GT3634385	FM Discriminator Transformer	3.05
GL3634393	FM Antenna Choke (.24 uh) .....	.20
GL3634392	FM-RF Plate Choke .....	.30
PC3634227	PC Plate, FM Discriminator	1.05
PC3634228	PC Plate, Condistor .....	.45
PC3634229	PC Plate, Condistor .....	.30
KQ6-16SC	Shelf Mtg. Screw, #6/1" (Set of 4) .....	.10
KW6-SC	Shelf Mtg. Flatwasher #6 (Set of 4) .....	.05
L3424099	Instruction Book	1.00

FM CARTRIDGE ALIGNMENT PROCEDURE

STEP	FUNCTION SWITCH SETTING	SIG. GENERATOR INPUT		SIGNAL INPUT POINT	OUTPUT INDICATOR	CONNECT INDICATOR TO	DIAL SETTING	ADJUST	OUTPUT INDICATION
		FREQ	MOD						
1.	FM	10.7 MC	60 CPS 300KC DEV.	COUPLE INTO TUBE SHIELD OF ECF80	SCOPE	JUNCTION OF 47UUF FEED THRU CAPACITOR TO 100K RESISTOR OF 3d IF XFMR (TOP CHASSIS)	—	1st, 2nd & 3rd FM IF XFMR	MAX GAIN AND SYMMETRY
2.	FM	10.7 MC	SAME	SAME AS STEP 1	SCOPE	FM OUTPUT OF TUNER	—	DISC. PRIMARY	MAX GAIN
3.	FM	10.7 MC	SAME	SAME AS STEP 1	SCOPE	SAME AS STEP 2	—	SECONDARY DISC.	SYMMETRY OF "S" PATTERN
4.	FM	106 MC	SAME	ANT TERM	SCOPE	SAME AS STEP 2	106 MC	106 MC OSC & RF TRIMMER	MAX OUTPUT
5.	FM	90 MC	SAME	SAME AS STEP 4	SCOPE	SAME AS STEP 2	90 MC	90 MC OSC & RF COIL	MAX OUTPUT

SPECIFICATIONS

FM

Circuit:

Low noise front end consisting of a shaded grid low noise RF amplifier, followed by wide band, transitionally coupled IF stages. Armstrong circuit with pentode limiter, wide band Foster-Seeley discriminator and Automatic Frequency control.

Sensitivity:

2.5 microvolts for 20 db quieting.
3.5 microvolts for 30 db quieting.

SPECIFICATIONS (Continued)

Capture Ratio:	7 db.
Selectivity:	240 KC bandwidth: 6 db down.
Discriminator Peak to Peak Separation:	0.4 megacycles.
Frequency Range:	88-108 megacycles.
Drift:	±5 KC Maximum.
Image Rejection:	35 db.
IF Rejection:	60 db.
Antenna Input:	300 ohms.
Distortion:	Lower than 1% (IHF M).
Frequency Response:	±0.75 db 30-15,000 c.p.s. including standard 75 microsecond de-emphasis.
Hum Level:	60 db below 100% modulation.
Output Level:	1.5 for 100% modulation. 0.5V for 30% modulation.

AM

Circuit:	Low noise high gain pentagrid converter, wide band IF stage and a high perveance detector with quick action AVC. High pick up sensitivity resulting from the use of a special litz wire high-Q ferrite loopstick.
Sensitivity:	120 microvolts per meter. Terminal sensitivity 15 microvolts.
Selectivity:	8 KC bandwidth: 6 db down.
Frequency Range:	530-1640 KC.
Image Rejection:	30 db.
IF Rejection:	30 db.
Distortion:	1% harmonic.
Hum Level:	45 db below 80% modulation.

AUDIO

Circuit:	Four 7408 beam pentodes in self-biased push-pull circuit.
Power Output:	30 watts music waveform (15 watts per channel).
Output Impedance:	8 & 16 ohms.
Frequency Response:	±0.5 db 15-30,000 c.p.s. at normal listening level.
Minimum Volume Hum:	75 db below 10 watts.
High Level Hum:	70 db below 10 watts (0.5 volt input reference).
Low Level Hum:	60 db below 10 watts (1 mv. input reference).
Tone Control Range:	±8 db at 50 and 10,000 c.p.s.
Input Levels:	Auxiliary: 400 mv. Phono (mag): 2 mv. at 1 KC (Will not overload with input level below 180 mv.) Tape: 1 mv. at 250 c.p.s.
Tape Output Level:	1 volt per channel unmodified by volume and tone controls.
Record Equalization:	RIAA.
Tape Equalization:	NARTB 7½ IPS.
Special Feature:	New Blend Control to eliminate "hole-in-the-middle" effect.