

OPERATING INSTRUCTIONS AND WARRANTY



THE FISHER[®]

400

STEREOPHONIC

FM Multiplex Receiver

PRICE \$1.00

WORLD LEADER IN STEREOPHONIC HIGH FIDELITY

CONGRATULATIONS!

With your purchase of a FISHER instrument you have completed a chain of events that began many months ago, in our research laboratories. For it is there that the basic concept of the equipment you have just acquired came into being—its appearance, its functions, its quality of performance, its convenience of use.

But the end step—your purchase—is merely a beginning. A door has now opened, for you and your family, on virtually unlimited years of musical enjoyment. Recognizing that one of the keys to pleasurable ownership is reliability, we have designed this instrument to give long and trouble-free service. In fact, instruments we made over twenty-seven years ago are still in use today.

Remember always that we want this equipment to give you the best performance of which it is capable. Should you at any time need our assistance toward that objective, please write me personally.

AN IMPORTANT SUGGESTION

Many hours have been spent by our engineers and technical writers to create this instruction book for your guidance and enjoyment. If you want the **most** out of your FISHER, there is only one way to obtain it. With the equipment before you, please read this booklet carefully. It will be time well spent!

Avery Fisher

Founder and President

FISHER FIRSTS — Milestones in the History of High Fidelity Reproduction.

- | | | | | | |
|------|--|------|--|------|--|
| 1937 | First high-fidelity sound systems featuring a beam-power amplifier, inverse feedback, acoustic speaker compartments (infinite baffle and bass reflex) and magnetic cartridges. | 1956 | First dual dynamic limiters in an FM tuner for home use. | 1961 | First complete receivers with Multiplex. |
| 1937 | First exclusively high fidelity TRF tuner, featuring broad-tuning 20,000 cycle fidelity. | 1956 | First Performance Monitor in a high quality amplifier for home use. | 1961 | First FM-Stereo-Multiplex tuners with STEREO BEAM. |
| 1937 | First two-unit high fidelity system with separate speaker enclosure. | 1956 | First FM-AM tuner with TWO meters. | 1961 | First loudspeaker system with frameless woofer cone, eliminating all parasitic resonance. |
| 1938 | First coaxial speaker system. | 1956 | First complete graphic response curve indicator for bass and treble. | 1961 | First internal switching system to permit immediate tape playback with use of all controls and switches. |
| 1938 | First high fidelity tuner with amplified AVC. | 1957 | First Golden Cascode FM Tuner. | 1962 | First simplified-operation Control-Amplifier, with infrequently used controls behind a front-panel cover, yet immediately accessible. |
| 1939 | First 3-Way Speaker in a high fidelity system. | 1957 | First MicroRay Tuning Indicator. | 1962 | First loudspeaker with eddy-current-damped voice coil. |
| 1939 | First Center-of-Channel Tuning indicator. | 1958 | First Stereophonic Radio-Phonograph with Magnetic Stereo Cartridge. | 1962 | First bass speaker with combined serrated-aluminum and fiber cone. |
| 1945 | First Preamplifier-Equalizer with selective phonograph equalization. | 1959 | First high-quality Stereo Remote Control System. | 1962 | First FM Tuner Kit with separate d'Arsonval meter for tuning and separate cathode ray stereo broadcast indicator (STEREO BEAM). |
| 1948 | First Dynamic Range Expander with feedback. | 1959 | First complete Stereophonic FM-AM Receiver (FM-AM tuner, audio control, 40-watt amplifier). | 1962 | First Stereophonic FM Tuner with TUNE-O-MATIC Motor Tuning. |
| 1949 | First FM-AM Tuner with variable AFC. | 1959 | First high-compliance plus high-efficiency free-piston speaker system. | 1962 | First Supersonic Wireless Remote Control in a high fidelity component. |
| 1952 | First 50-Watt, all triode amplifier. | 1960 | First to use MicroRay for FM tuning and as a Recording Audio Level Indicator. | 1963 | First to use 8417 tubes with unique cavity-anode design. |
| 1952 | First self-powered Master Audio Control. | 1960 | First complete stereo FM-AM receiver with 60-watt power amplifier and new 7591 output tubes. | 1963 | First power amplifier to use oscilloscope-type, frequency compensated input circuit. |
| 1953 | First self-powered electronic, sharp-cut-off filter system for high fidelity use. | 1960 | Smithsonian Institution, Washington, D.C. accepts for its collection America's first commercially manufactured high fidelity radio-phonograph, made by Avery Fisher in 1937. | 1963 | First amplifier kit with STRATABALANCE, visual dynamic balancing system. |
| 1953 | First Universal Horn-Type Speaker Enclosure for any room location and any speaker. | 1960 | First reverberation device, for use in high fidelity equipment—The Fisher Dynamic Spaceexpander. | 1964 | First multiplex adaptor with 'flywheel synchronization.' Closely approaches theoretical limit of noise rejection, and of all spurious responses. |
| 1953 | First FM-AM Receiver with a Cascode Front End. | 1960 | First stereo tuner with MicroTune. | 1964 | First AFC with strong locking on weak signals, with no pull-in from adjacent strong signals. |
| 1954 | First low-cost electronic Mixer-Fader. | 1960 | First FM tuner with six IF stages. | | |
| 1954 | First moderately-priced, professional FM Tuner with TWO meters. | 1960 | First FM tuner with five limiters. | | |
| 1955 | First Peak Power Indicator in high fidelity. | 1960 | First front panel antenna selector switch, 72-300 ohm, Local-Distant positions. | | |
| 1955 | First Master Audio Control Chassis with five-position mixing facilities. | 1961 | First Multiplex units with STEREO BEACON and automatic switching, mono to stereo. | | |
| 1955 | First correctly equalized, direct tape-head master audio controls and self-powered preamplifier. | | | | |
| 1956 | First to use Power Monitor in a home amplifier. | | | | |
| 1956 | First All-Transistorized Preamplifier-Equalizer. | | | | |



THE FISHER 400
STEREOPHONIC
FM Multiplex Receiver

YOUR NEW FISHER 400 incorporates on a single chassis a highly sensitive FM multiplex tuner, a Master Audio Control with a full complement of controls and features, and a dual-channel, 65-watt power amplifier with ample reserve power for full room volume with *any* pair of loudspeakers. Many new advances in the technology of music reproduction have been included in the 400 design. The front-end, for example, is of the new FISHER Golden Synchrode design, employing a specially developed RF amplifier tube combined with *three* tuned circuits for maximum selectivity, sensitivity and rejection of unwanted signals. Three wideband IF stages are used, followed by a ratio detector that is linear over an extremely wide range. The multiplex converter is the superior time-division type, utilizing two balanced diode bridges and a 38-kc synchronous oscillator acting together as electronic switches. This circuit reduces noise and distortion to the theoretical minimum and achieves the greatest possible stereo separation. The famous STEREO BEAM* indicator signals instantly whenever a station transmits a multiplex stereo program.

The audio section consists of several voltage amplifying stages followed by the power amplifier, utilizing four Novar-type 7868 beam-power pentodes in push-pull configuration for a full 65 watts of Music Power (IHFM standard).

Most important of all, however, is the craftsmanship and the painstaking care which go into each FISHER unit. You can be sure that your 400 has been checked and rechecked each step of

the way, and that it has met or exceeded stringent Laboratory Standards in each particular before leaving the factory. By purchasing a FISHER, you have assured yourself of many years of pleasurable and trouble-free music listening.

WHAT IS STEREOPHONIC SOUND?

STEREOPHONIC SOUND (STEREO) is a method of reproducing sound by means of two independent channels, left and right, so that a spatial feeling of direction and depth is recreated. It is the extension of high fidelity sound into three dimensions. In fact, it offers the closest approach to true high fidelity yet achieved because it comes closest to the ultimate aim of all high fidelity systems—a perfect recreation of the original live sounds. Thus, good stereophonic sound is high fidelity in the truest sense of the term.

This feeling of dimension is lost with monophonic (single channel) reproduction, because our ears help determine the relative position of separate instruments in an ensemble only if each hears a slightly different version of the sound, just as visual depth perception depends on the two separate, slightly different pictures received by the eyes. Merely using two or more speakers on a single amplifier does not solve the problem; it only spreads the single sound source without providing the all-important different "aural viewpoints."

True stereo sound, then, requires the use of two independent

*Patent Pending

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sound paths from the origin to your ears, kept separate at all times during recording, transmission and reception. This requires the use of two separate sets of recording amplifiers, a means of keeping the channels apart during recording and radio broadcasting, and finally, two independent amplifier and speaker systems in the home. In a stereo record, each wall of the groove contains a separate signal, and the stereo cartridge is designed to pick up each of these two channels separately. The new system of FM stereo broadcasting (known as "multiplex") utilizes a separate supersonic signal, in addition to the main signal. By combining these two signals in a multiplex converter, the original left and right channels are recovered. Stereo tape recordings are made by impressing the two channels on separate parallel tracks running along the length of the tape.

No attempt is made to keep the two channels completely separate. In a live performance, your left ear hears many of the sounds on your right, and vice versa. Thus, keeping the channels totally apart from the original recording session to the final playback in your home would result in an unnatural effect. But enough separation is maintained so that a definite feeling of direction occurs as you

listen to the reproduced sound. The result is a remarkably vivid illusion of great depth and spaciousness, such as is normally obtained only at a live performance.

INSTALLING THE 400

THE FISHER 400 operates on 105-120 volts, 50-60 cps (AC) only, and consumes 200 watts at full power output. Connecting the unit to other voltages or direct current (DC) may cause serious damage to the unit, and voids the warranty. Two auxiliary power outlets, which are controlled by the power switch on the Volume control, are provided on the rear panel for the connection of other components.

The 400 may be placed on a shelf, or installed in a custom cabinet or console of your choice. Should you desire a wood cabinet, the FISHER Model 30-U custom cabinet, especially designed for the 400, is available, in walnut or mahogany finish, from your dealer. If you decide to mount the 400 in a custom installation, please refer to the *Custom Mounting Instructions* section before proceeding with the installation, since certain precautions must be observed during installation. For open-shelf installation with or without the 30-U cabinet, leave a minimum of two inches of space on all three sides of the unit, and four inches of space above the tops of the output tubes (V13-V16), for ventilation. In addition, do not place the unit on soft or yielding material, since this could impede proper ventilation.

Loudspeakers

Placement of loudspeakers has a significant effect on the sound quality of a high fidelity system. Most speakers will give better results in the bass range when placed in a corner, although there are exceptions to this rule. Speakers should generally be placed along a wall in such a position that no large objects block the sound path between the speaker and the listening area. In a stereo system the speakers should be approximately equidistant from the listening area. As a rule-of-thumb, the distance between the speakers should be approximately two-thirds the distance separating the

speakers from the listening area. It has been found that the aural effect of stereophonic sound is enhanced when two identical speaker systems are used. Although these principles can serve as a general starting point in placing your loudspeakers, we strongly recommend that you experiment with several different arrangements before deciding on a final placement. The unpredictable effects resulting from furniture arrangement and irregularities in room dimensions may sometimes make unorthodox placement of the loudspeakers necessary.

After the initial location of the loudspeakers has been decided upon, make the following connections:

ONE SPEAKER: If you are using only one speaker, it should be connected to the LEFT SPKR terminals on the rear panel (marked SPKR and GND). (See Figure 1.) Use ordinary power cord, up to 50 feet in length, for these connections. For longer distances, use heavy-duty wire. The L (Left) impedance selector (marked IMP SELECTOR on the rear panel) is used to match the output impedance of the 400 to the impedance of your loudspeaker. The upper (L) wire protruding from the rear panel next to the IMP SELECTOR terminal strip should be connected to the terminal marked "4," "8," or "16," depending on the impedance of your loudspeaker. *Be sure to turn the Balance control fully counterclockwise before turning on your 400.* The Balance control should be kept in the maximum counterclockwise position until a speaker is attached to the RIGHT SPKR output terminals.

TWO SPEAKERS: In the normal stereo installation, the two speakers (one for the left channel and one for the right channel) are connected to the LEFT SPKR and RIGHT SPKR terminals. In each case, the terminal marked GND should be connected to the ground or common terminal (marked G, GND, C, COM, etc.) of your loudspeaker. This will assure correct phasing of your loudspeakers, causing them to "push" and "pull" in unison, rather than in opposition. Use ordinary power cord for distances up to 50 feet, heavy-duty power cord for longer distances. The L (upper) wire protruding from the rear panel should be connected to the upper

IMP SELECTOR terminal (either "4," "8," or "16") corresponding to the impedance of your loudspeaker. In the same manner, the R (lower) wire should be connected to the terminal on the lower IMP SELECTOR which corresponds to the impedance of your right channel loudspeaker.

THREE SPEAKERS: If you desire to connect a center channel speaker, in addition to the two ordinary channels, this can be done by using a separate monophonic amplifier. The CENTER CH OUTPUT jack should be connected to the input of the amplifier, using shielded audio cable. It is advisable to use an amplifier with an input level control so that you can adjust the volume of the center channel speaker to the desired level. The best stereo effect will generally be obtained if the center speaker is adjusted for approximately half the volume of the left and right speaker systems. Separate tone controls are not necessary, since the tone controls of the 400 will adjust all three speakers simultaneously. The shielded audio cable from the CENTER CH OUTPUT should not be longer than 10 feet. Use of longer cable will cause roll-off of the higher frequencies.

EXTENSION SPEAKER: If you wish to use the CENTER CH OUTPUT to provide a monophonic extension speaker in another room of your home, this can be done by using a separate monophonic power amplifier as indicated in the preceding paragraph. The shielded audio cable between the 400 and your additional monophonic power amplifier should not be longer than 10 feet, but the wire from additional amplifier to the speaker can generally be many times that length if heavy duty power cord is used.

Antenna

A folded dipole antenna is included with the 400. The two arms of this antenna should be horizontal and away from all large metal objects and electrical wiring for best results. After the antenna has been connected and the 400 put into operation, the dipole antenna should be rotated horizontally, to determine the

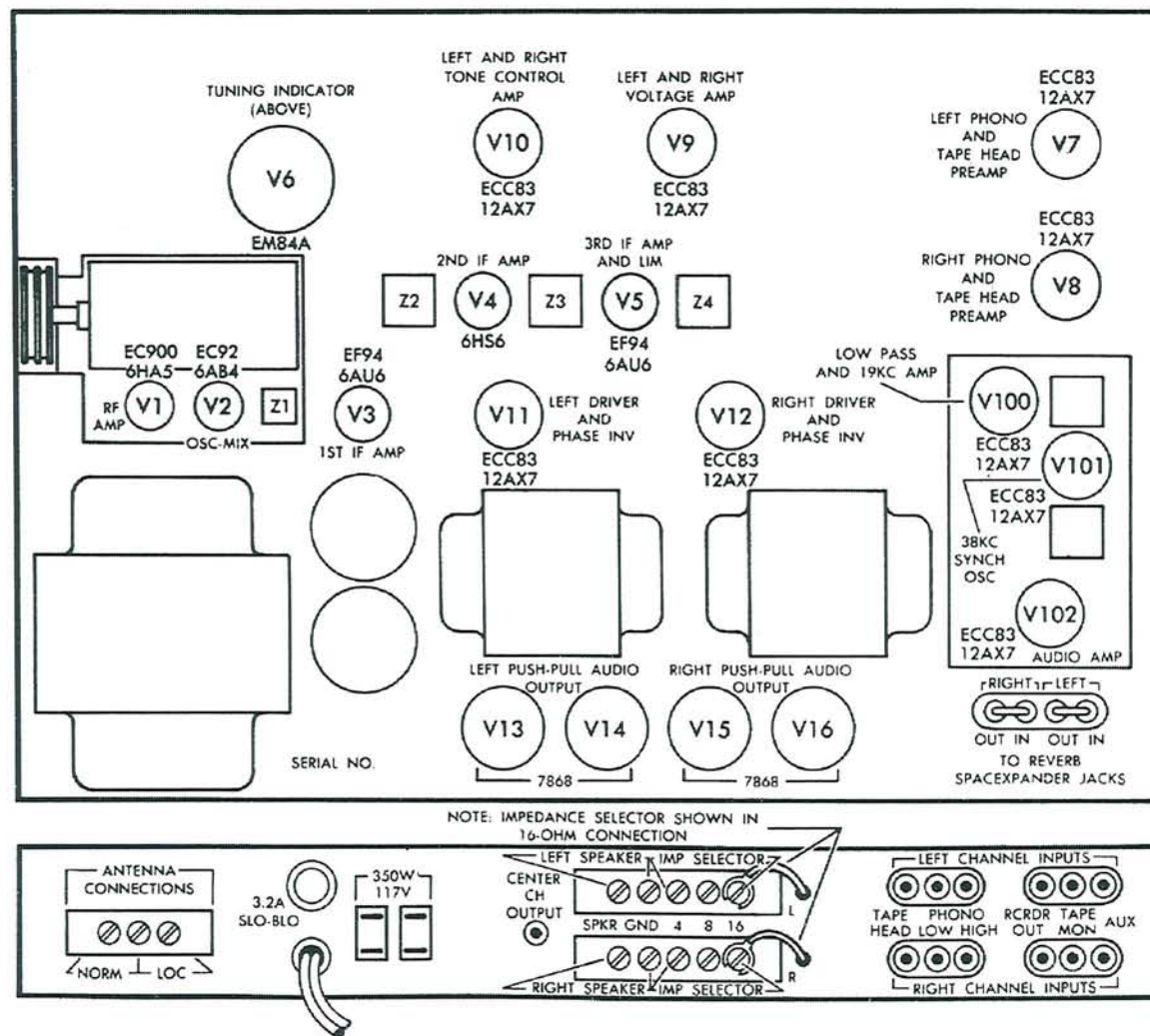


FIGURE 1.
Tube layout and rear panel of the 400.

orientation for best reception. In apartment buildings and other buildings using steel structural supports, reception can generally be improved by placing the antenna close to a window. If tacks or staples are used to fasten the antenna in place, be sure that they do not contact the two conductors running along each edge of the antenna wire and avoid fastening the antenna directly to a wall. Mount the antenna on strips of wood, which can then be fastened to the wall. In a strong signal area the antenna may be placed under a carpet, but as a general rule reception greatly improves as the height of the antenna is increased. The antenna should never be folded or coiled.

FM multiplex reception requires stronger signals to achieve the same low noise levels as you normally expect from ordinary monophonic programs. You may find, therefore, that placement of the antenna may have to be improved for good multiplex reception. In some cases, especially in fringe areas, an outdoor rooftop antenna or even a highly directional yagi type may be needed for multiplex reception, even though the indoor antenna suffices for monophonic transmissions. A directional antenna is also very effective in preventing multipath distortion, caused by the simultaneous reception of the direct signal from the FM station and one or more reflected and delayed signals, bounced off buildings or other large vertical surfaces.

CONNECTIONS: For best reception under most conditions, connect the FM dipole antenna or an external 300-ohm FM antenna to the NORM terminals on the terminal strip marked ANTENNA CONNECTIONS. If you find, after putting the 400 in operation, that strong local stations appear at several places along the band, change the connections to the LOC terminals. The LOC terminals attenuate the input signal, thus preventing overload distortion from very strong local stations. At the same time, however, they lower the over-all sensitivity of the receiver. Therefore, if you wish to receive some weak stations, use the NORM terminals for best results.

Record Players and Changers

Record players and changers using magnetic or ceramic phonograph cartridges can be played through the 400. The PHONO LOW input jacks are used for practically all types of magnetic cartridges, and the PHONO HIGH inputs are designed for very high output magnetic cartridges and all ceramic cartridges with adaptors for magnetic inputs. If you cannot ascertain which of the two leads from the record player is the Channel A (left) output and which is the Channel B (right) output, connect them to the 400 and listen for normal placement of the instruments on a symphonic stereo record. If the violin section appears to be located on the right, reverse the leads from the phonograph. (Special test records may also be obtained from your record dealer.)

NOTE: If you hear only weak and distorted sound, the two channels from your phono cartridge may be connected out-of-phase. To correct this condition, simply reverse the two leads from *one* channel of the cartridge.

Tape Recorders

Tape recorders can be connected to play through and to record from the 400. If the recorder has separate record and playback heads, the DIRECT TAPE MONITOR* system will permit you to listen to your tapes while they are being recorded, and to have the full use of all the audio control facilities of the 400 during ordinary playback of previously recorded tapes. Connections are as follows:

STEREOPHONIC TAPE RECORDER:

- 1-Connect the Channel A or Left output of the tape recorder to the Left Channel TAPE MON input jack.
- 2-Connect the Channel B or Right output of the tape recorder to the Right Channel TAPE MON input jack.
- 3-Connect the Channel A or Left input of the tape recorder to the Left Channel RCRDR OUT jack.
- 4-Connect the Channel B or Right input of the tape recorder to the Right Channel RCRDR OUT jack.

*Patent Pending

MONOPHONIC TAPE RECORDER:

- 1-Connect the input of the tape recorder to the Left Channel RCRDR OUT jack on the rear panel of the 400.
- 2-Connect the output of the tape recorder to both the Left and Right Channel TAPE MON jacks. You can obtain a "Y" connector from your dealer for this connection. This connection to both TAPE MON jacks is necessary for tape playback and monitoring through both speaker systems.

Tape Decks

A tape deck is the tape transport mechanism without the electronic preamplifiers found in tape recorders. Such tape decks may be played through the 400 by connecting the Channel A (or left) output on the tape deck to the jack on the 400 marked Left Channel TAPE HEAD. The Channel B (or right) output of the tape deck should be connected to the Right Channel TAPE HEAD jack on the 400. A monophonic tape deck should be connected to both TAPE HEAD jacks by using a "Y" connector, available from your dealer.

SPACEEXPANDER®

The FISHER SPACEEXPANDER, Model K-10, can be connected to the 400 by using the special SPACEEXPANDER jacks on the top of the chassis. Before installing the SPACEEXPANDER, remove the two jumper wires between the SPACEEXPANDER jacks but retain the jumpers for possible future use. *These jumpers must be inserted when the SPACEEXPANDER is not connected or the 400 will be completely inoperative.* Make the following connections to the SPACEEXPANDER:

- 1-LEFT TO REVERB OUT jack on the 400 to the Channel A OUTPUT jack on the SPACEEXPANDER.
- 2-RIGHT TO REVERB OUT jack on the 400 to the Channel B OUTPUT jack on the SPACEEXPANDER.
- 3-LEFT TO REVERB IN jack on the 400 to the Channel A INPUT jack on the SPACEEXPANDER.
- 4-RIGHT TO REVERB IN jack on the 400 to the Channel B INPUT jack on the SPACEEXPANDER.

System Grounding

The two terminals marked GND on the speaker terminal strips on the rear panel of the 400 are connected to the chassis and may be used to ground the motor and tone arm of your record player in order to reduce possible hum. The chassis ground of other components may also be connected to these terminals if desired.

TV Sound

Because television receivers differ widely in circuit design, it is advisable to consult your serviceman before attempting to connect the sound output of your TV set to the 400. However, once the method of connection has been determined, the cable from the TV set should be connected to both AUX input jacks. The sound portion of the TV program will be heard when the Selector is turned to the AUX-TAPE position. If you have a tape recorder already connected to the TAPE MON jacks, you should not use the AUX jacks since the two sets of jacks are electrically connected.

NOTE: The connection on the TV set should generally be made to the secondary of the audio output transformer.

OPERATING THE 400

YOUR 400 IS NOW ready for operation, but like any other fine piece of electronic equipment, it must be operated correctly in order to deliver its full capabilities. We urge you to read these instructions carefully in order to achieve optimum results.

1 Volume Control and Power Switch

The Volume control regulates the total volume of sound from both speakers. The AC Power switch is combined with this control and turns off the power to the 400 (and all other equipment connected to the auxiliary power outlets on the rear panel) at the extreme counterclockwise position. The Volume control changes the sound level from both channels equally, thus making it unnecessary to balance the channels each time you change the volume.

2 Selector Switch

The Selector switch determines which program source will be heard and selects the mono or stereo mode of operation. The positions perform the following functions:

TAPE HEAD: Selects a tape deck connected to the TAPE HEAD jacks and provides correct equalization for tapes played at a speed of $7\frac{1}{2}$ inches per second. When playing tapes at $3\frac{3}{4}$ inches per second, advance the treble control to the "three o'clock" position for correct equalization.

PHONO MONO: This position is used to listen to monophonic records on a record player or changer connected to the PHONO LOW or PHONO HIGH jacks on the rear panel. The two stereo channels of the record player are electrically connected, resulting in a more accurate reproduction of monophonic records and a great reduction in possible record noise resulting from vertical motion of the stylus.

PHONO STEREO: This position should be used for all stereophonic records on a player or changer connected to the PHONO LOW or HIGH jacks.

FM STEREO: This position is used for listening to all FM stereo multiplex programs of normal signal strength. With the Selector in this position, you can find a multiplex program by tuning across the band slowly. When you reach a station transmitting a stereo signal, the two bright bands at the edges of the STEREO BEAM indicator will come together at the center of the tube. Monophonic stations will merely cause a slight flickering of the two bands. Be sure to turn the Selector to the FM MONO position for monophonic FM programs, since the noise level is increased when listening to monophonic programs with the Selector at FM STEREO.

FM STEREO FILTER: Use this position for listening to a *stereophonic* program when the background noise level interferes with your enjoyment of the program. If this position does not remove the noise sufficiently, try the High Filter and the Treble control. In the event that these measures do not remove the noise, turn the Selector to

the FM MONO position for monophonic reception of the stereo program. Since the FM STEREO FILTER position locks the 400 in the stereo mode, be sure to return the Selector to FM MONO when listening to monophonic programs.

FM MONO: This position is designed to provide monophonic reception of FM programs. It is normally used when a station broadcasts a monophonic signal and may also be used to eliminate noise on very weak stereo programs.

AUX-TAPE: This position selects either a component connected to the AUX input jacks or a tape recorder connected to the TAPE MON jacks.

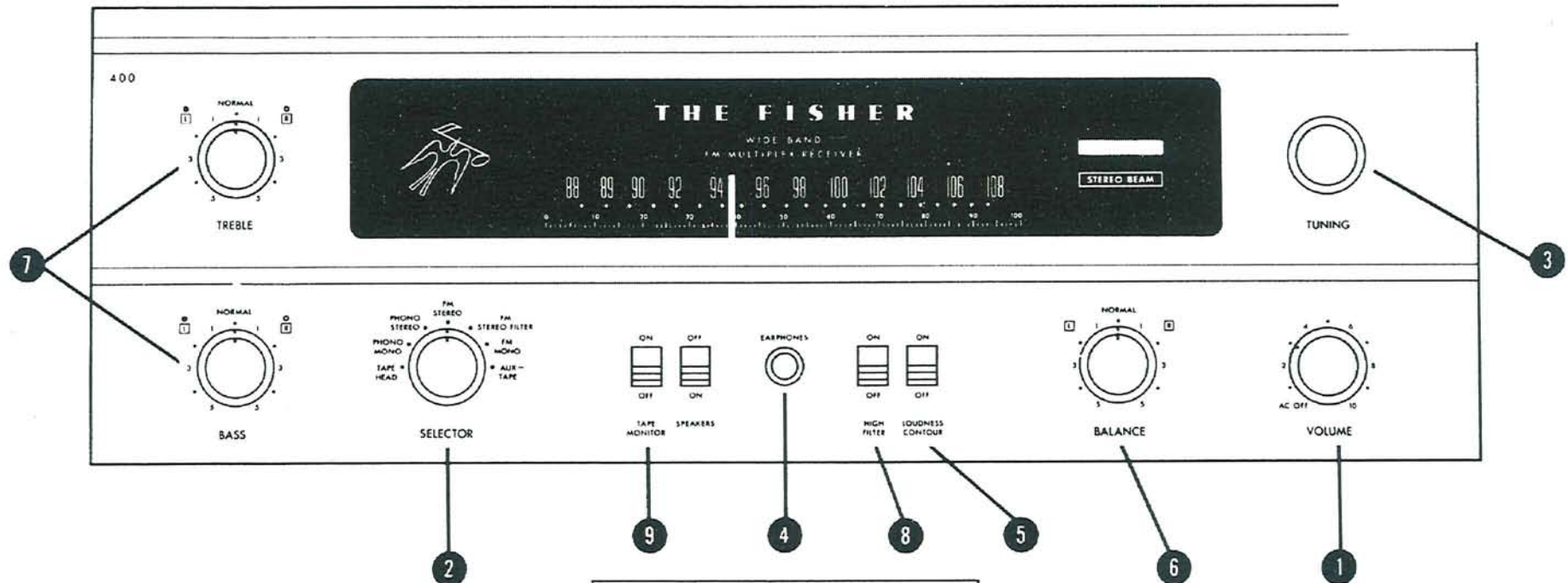
3 FM Tuning

The Tuning knob selects FM stations in the 88 to 108 megacycle band. The Tuning Indicator (which also acts as the STEREO BEAM with the Selector at FM STEREO) has a logarithmic response to the strength of broadcast signals; that is, it responds with greatest sensitivity to weak signals, and with less sensitivity to strong signals, thus guarding against overloading. Each station should be tuned for minimum width of the dark band in the center of the indicator. When this point is reached, optimum reception is assured. For your added convenience, a logging scale with linear divisions from 0 to 100 is included under the tuning dial. By making a note of the location of your favorite stations on this linear scale, you will be able to tune to them more quickly and accurately.

To find a multiplex program, place the Selector switch in the FM STEREO position and tune across the band until the two bright portions of the STEREO BEAM widen, indicating a multiplex program. For fine tuning, turn the Selector to FM MONO and turn the Tuning knob until the dark band on the indicator is narrowest. When this has been done, turn the Selector back to the FM STEREO position to receive the multiplex program stereophonically.

Due to the nature of the multiplex system, the noise level of a *monophonic* program will be somewhat higher when the Selector is turned to FM STEREO. For this reason, we recommend that you

FOR THE 'MAN IN A HURRY'



NOTE: Set all other switches and controls in the position shown.

BASS AND TREBLE CONTROLS:
To adjust the Left Channel use the inner knob; To adjust the Right Channel use the outer knob.

STEP 2

Set **SELECTOR** to the program source you wish to hear.

PHONO MONO or **PHONO STEREO** to listen to a monophonic or stereo record.

FM MONO or **FM STEREO** for a monophonic or stereo FM program.

AUX-TAPE for a tape recording.

STEP 1

Turn on power by turning **VOLUME** control slightly clockwise until it clicks. Adjust later for desired volume.

do not leave the Selector in the FM STEREO or FM STEREO FILTER positions when listening to a monophonic FM broadcast.

4 Earphones Jack and Speakers Switch

The Earphones jack is conveniently located at the center of the front panel. It will accept any standard stereo earphones plug. You can silence the speakers, for personal listening with the earphones alone, by placing the Speakers switch in the OFF position.

When using your earphones for the first time, turn the Volume control to minimum before connecting them and then turn up the volume slowly with the Speakers switch in the OFF position until you reach the earphone volume level you prefer. Then slide the Speakers switch to the ON position and compare the sound level from the speakers. This test will enable you to set the correct volume level for the earphones before plugging them in, thus avoiding possible damage caused by overloading them. To prevent accidental overloading of the earphones, we recommend that you disconnect them when listening to the speakers.

5 Loudness Contour Switch

The Loudness Contour switch is used to add compensation for the natural deficiency of the human ear in the extreme bass and treble ranges at low volumes. With this switch in the ON position, an increasing emphasis of low bass and high treble tones is added as the Volume control is turned counterclockwise, resulting in a more natural sound at low volumes.

6 Balance Control

This control is used to equalize the sound levels from both speaker systems to achieve the optimum stereo effect. If the left and right inputs are exactly balanced, you will hear equal sound levels from the left and right speakers with the control in the NORMAL position. If, however, there is an imbalance in the program levels, you can re-balance the sound levels by turning the Balance control either clockwise (to increase the sound level on the

right and decrease the sound level on the left) or counterclockwise (to increase the left and decrease the right). The Balance control is not a volume control since the same over-all volume is maintained as it is adjusted. With the Balance control fully counterclockwise, only the left speaker will be heard; with the control fully clockwise, only the right speaker will be in operation.

7 Bass and Treble Controls

The Bass controls increase or decrease the amount of bass tones heard in the sound output. With the Bass controls in the NORMAL position, the base tones will sound exactly as they were recorded at the program source. If you wish to increase the bass emphasis because of a bass deficiency in the record, tape or radio broadcast you have selected, simply turn the Bass controls clockwise. To decrease the prominence of the bass tones, turn the Bass controls counterclockwise. Normally, the Bass controls for left and right speaker systems rotate together, but if you wish to adjust the Bass separately for each channel, hold one of the knobs while turning the other.

The Treble controls adjust the intensity of the treble tone heard in the sound output. As with the Bass controls, the NORMAL position will result in the same degree of treble tone as exists in the program source. The relative amount of treble tone can be increased, resulting in a more brilliant and crisp sound, by turning the Treble controls clockwise; and it can be decreased, resulting in a more mellow and intimate tone, by turning the controls counterclockwise. The Treble controls may also be adjusted individually for each channel by holding one knob while rotating the other.

The center knob of each dual control adjusts the left channel; the outside ring adjusts the right channel. Excessive use of bass boost when playing records may result in acoustic feedback (a low rumbling sound) caused by the close proximity of your speakers to the record player.

8 High Filter

The High Filter is a sharp cut-off circuit designed to remove

do not leave the Selector in the FM STEREO or FM STEREO FILTER positions when listening to a monophonic FM broadcast.

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7 Bass and Treble Controls

The Bass controls increase or decrease the amount of bass tones heard in the sound output. With the Bass controls in the NORMAL position, the base tones will sound exactly as they were recorded at the program source. If you wish to increase the bass emphasis because of a bass deficiency in the record, tape or radio broadcast you have selected, simply turn the Bass controls clockwise. To decrease the prominence of the bass tones, turn the Bass controls counterclockwise. Normally, the Bass controls for left and right speaker systems rotate together, but if you wish to adjust the Bass separately for each channel, hold one of the knobs while turning the other.

The Treble controls adjust the intensity of the treble tone heard in the sound output. As with the Bass controls, the NORMAL position will result in the same degree of treble tone as exists in the program source. The relative amount of treble tone can be increased, resulting in a more brilliant and crisp sound, by turning the Treble controls clockwise; and it can be decreased, resulting in a more mellow and intimate tone, by turning the controls counterclockwise. The Treble controls may also be adjusted individually for each channel by holding one knob while rotating the other.

The center knob of each dual control adjusts the left channel; the outside ring adjusts the right channel. Excessive use of bass boost when playing records may result in acoustic feedback (a low rumbling sound) caused by the close proximity of your speakers to the record player.

8 High Filter

The High Filter is a sharp cut-off circuit designed to remove

annoying record scratch, hiss and other high frequency noise without dulling the treble portion of the musical program. It may also be used to eliminate noise on multiplex programs from very weak stations.

9 Tape Monitor Switch

This switch is used *only when making a recording with an instrument having separate record and playback heads*. At all other times it should be left in the OFF position. While the recording is being made, you can compare the quality of the tape with the original sound source by sliding the switch back and forth between ON (to hear the tape itself) and OFF (to hear the original sound source). The tape recording will not be affected by the operation of this switch or by the setting of the other controls (except the Selector switch). For playback of a previously recorded tape, use the AUX-TAPE position on the Selector switch.

CUSTOM MOUNTING INSTRUCTIONS

THE 400 Receiver may be mounted in a special custom cabinet, Model 30-U (walnut or mahogany), or it may be mounted in your own custom cabinet by following the directions and illustrations in this section. It is important to remember that adequate ventilation is absolutely essential for proper operation of the 400. The enclosure should therefore be open at the rear. Install the chassis above other heat-producing equipment.

The 400 is shipped with four plastic mounting feet attached to the bottom of the chassis. To install the 400 in a custom cabinet, these mounting feet must first be removed.

HORIZONTAL MOUNTING

Installation With Cleats

To provide adequate ventilation to the underside of the chassis, it is advisable to mount the 400 on wooden cleats which are fastened to the floor of the cabinet. For this installation, proceed as follows:

1—Obtain a strip of wood $\frac{3}{4}$ inch square and 23 $\frac{3}{4}$ inches long. Cut this strip in half to form two 11 $\frac{3}{4}$ -inch cleats.

2—Fasten the two cleats to the top of the mounting board with wood screws in the position shown in Figure 3. Screw heads should be flush with the top of the cleats. Then locate and drill four $\frac{1}{4}$ -inch holes through the mounting board and cleats as indicated.

3—Saw a cutout through the front panel of your cabinet to the dimensions shown in Figure 2. The distance between the top surface of the mounting board and the bottom of the cutout must be the same as the height of the cleats.

4—Insert the 400 chassis through the front of the panel cutout. Slide the chassis into the cabinet until the back of the control panel is tight against the panel of the cabinet.

5—Insert the four $1\frac{1}{2}$ -inch screws supplied in the accessories bag through the holes in the bottom of the mounting board and fasten the chassis into place.

Flush Installation

If the height of the custom cabinet will not permit you to mount the 400 by means of cleats, as described in the preceding section, the chassis may be mounted directly on the cabinet shelf. If the chassis is mounted in this way, however, it is essential that cutouts be made in the shelf as shown in Figure 3, and that the back of the cabinet remain completely open, in order to provide proper ventilation. For a flush-mounted installation, proceed as follows:

1—Locate and drill the four $\frac{1}{4}$ -inch holes in the bottom shelf of the custom cabinet as indicated in Figure 3.

2—Saw cutouts in the bottom shelf following the outlines shown in Figure 3. It is absolutely essential that these cutouts be made as indicated so that the necessary ventilation will be supplied to the 400 chassis.

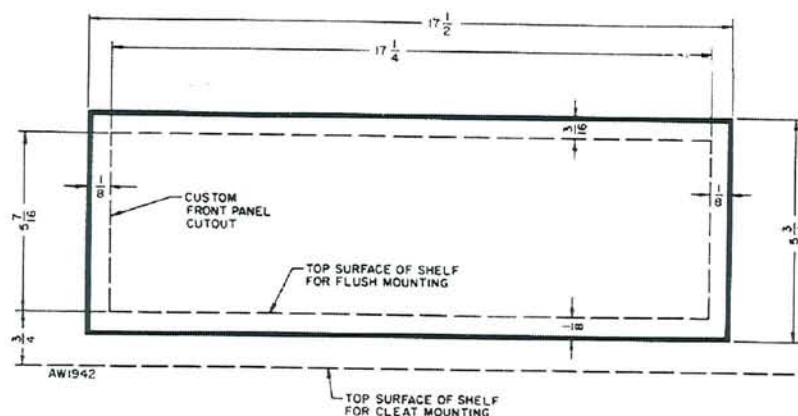


FIGURE 2. Front panel cutout.

3—Saw a rectangular cutout through the front panel of your custom cabinet to the dimensions shown in Figure 2. Note that the bottom of the cutout coincides with the top of the mounting shelf, since cleats are not used in this installation.

4—Insert the chassis through the custom cabinet front panel cutout. Slide the chassis in all the way so that the rear of the 400 control panel fits tightly against the front of the custom panel.

5—Fasten the chassis to the shelf by means of four mounting screws and flat washers. The screws are inserted from the underside of the shelf, through the holes and into the four mounting holes formerly used for attaching the plastic mounting feet. Use the four 1-inch screws and washers furnished in the accessories bag for this purpose.

VERTICAL MOUNTING

In order to mount your 400 vertically, the cabinet must have an open back, and the compartment in which the receiver is mounted must be sealed off from all other heat-producing equipment. In addition, you will need a fan capable of delivering a minimum of 25 cubic feet per minute. Follow the mounting procedure outlined below.

1—Determine the position in which you wish to mount the receiver. After checking beneath the top panel of the cabinet for any obstruction, make a cutout in the top panel, as shown in Figure 3.

2—Cut the mounting board shown in Figure 4 from a piece of $\frac{3}{4}$ -inch plywood. The width of the mounting board should be $\frac{1}{4}$ inch less than the inside width of the cabinet, to allow for the clearance of $\frac{1}{8}$ inch as shown in Figure 4. Make the cutouts (indicated as shaded areas) in Figure 4.

3—Cut two cleats approximately 12 inches long (cleats 1 and 2) from a piece of $\frac{3}{4}$ by $\frac{3}{4}$ -inch stock.

4—Cut two cleats approximately 16 inches long (cleats 3 and 4) from a piece of 1 by 1-inch stock.

5—Drill a $\frac{1}{4}$ -inch hole two inches from one end of cleats 1 and 2 (holes A and B.) Drill a second $\frac{1}{4}$ -inch hole (holes C and D) spaced 8 inches from the first hole on each cleat.

6—Drill $\frac{3}{16}$ -inch pilot holes in cleats 3 and 4, for the screws shown in Figure 4.

7—Mount cleats 3 and 4 on the inside of the cabinet, as shown in Figure 4. Drill $\frac{1}{16}$ -inch pilot holes in the cabinet for each screw, about $\frac{1}{4}$ inch deep.

8—Mount the fan in place, as shown in Figure 4. The axis of the fan should be pointed toward the spot on the mounting board marked 'X'. The fan must be no more than 4 inches away from the mounting board.

9—Remove the dress panel of the unit by pulling all knobs gently away from the panel, and loosening the two nuts which secure the dress panel to the control shafts. Fasten the 400 and cleats 1 and 2 to the mounting board with four 1 $\frac{3}{4}$ -inch 8-32 screws, and the four metal washers provided in the hardware bag.

10—Place the mounting board in the cabinet as shown, keeping it in place with two blocks of wood placed beneath it. Secure the dress

panel to the 400 with the nuts removed above, and replace the knobs.

11—With the dress panel flush against the top of the cabinet, secure the mounting board to cleats 3 and 4 as shown, using 1 $\frac{3}{4}$ -inch round-head #8 wood screws.

12—Plug the fan into one of the receptacles on the rear of the 400. If the fan has a switch, it should be left permanently in the ON position.

NOTE: The fan *must* be connected in such a manner as to *always be on whenever the receiver is on*. For this reason, only the receptacle on the rear of the 400 should be used to furnish power to the fan. The fan *must* blow the air toward the chassis.

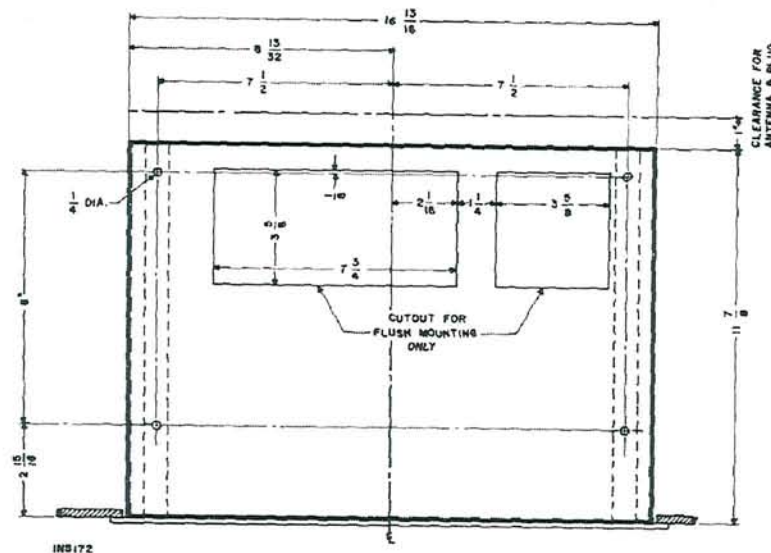


FIGURE 3. Top view of custom installation.

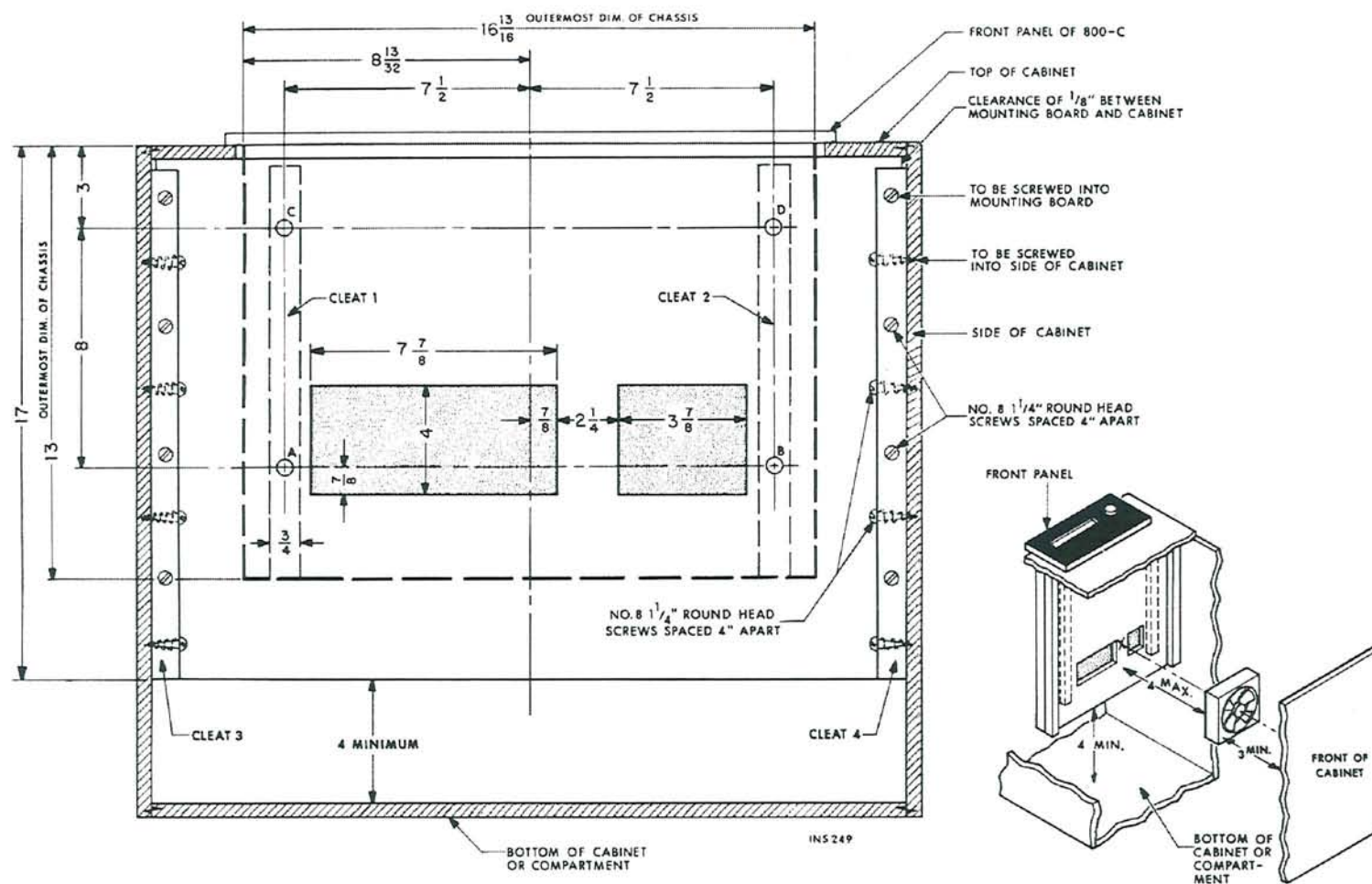


FIGURE 4. Side view of custom cabinet installation (vertical mounting)

TECHNICAL SPECIFICATIONS

THE FM TUNER:

IHFV Usable Sensitivity	1.8 microvolts
Selectivity (alternate channel)	60 db
Signal-to-noise-and-hum ratio (100% modulation)	70 db
IF Rejection (at 100 Mc.)	85
Spurious Response Rejection (at 100 Mc.)	90 db
Image Rejection (at 100 Mc.)	57 db
Capture Ratio (IHFV)	2.5 db
FM Harmonic Distortion (400 cps, 100% modulation)	0.5%
Calibration Accuracy	0.2%
FM Stereo Channel Separation (at 1 Kc)	35 db

THE AUDIO SECTION:

Music Power (IHFV, at 1 kc and 0.5% THD)	65 watts total
RMS Power (at 1 kc and 0.8% THD)	
One channel driven	30 watts
Both channels driven	50 watts
Intermodulation Distortion (60/7000 cps, 4:1)	
at 28 watts, each channel	0.8%
at 50 watts, both channels driven	0.8%

Frequency Response

Over-all	25-25,000 cps \pm 1 db
Power amplifier section	10-40,000 cps, +0, -2 db
Hum and Noise (below RMS rated output) AUX-TAPE input, Volume control at max.	80 db
Channel Separation (at 1 kc)	50 db
Bass Controls (total variation at 50 cps)	22 db
Treble Controls (total variation at 10 kc)	22 db
Fixed Subsonic Filter	12 db/octave below 18 cps
High Filter (-3 db at 5 kc)	12 db/octave above 6 kc
Input Sensitivity (for rated output)	
PHONO LOW	4.4 mV
PHONO HIGH	14 mV
TAPE HEAD	2.8 mV
AUX	280 mV
TAPE MON	
Tape Monitor Switch ON	1.15 V
Selector at AUX-TAPE	440 mV
Power Consumption (at 117 V)	
For 5 watts output power	160 watts (180 VA)
For rated RMS output power	200 watts (230 VA)

LOGGING CHART

[illegible]

NOTE: This chart may be used as a handy guide for quick tuning to the stations in your area.



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