

HIGH FIDELITY FM TUNER

MODEL

HFT-90

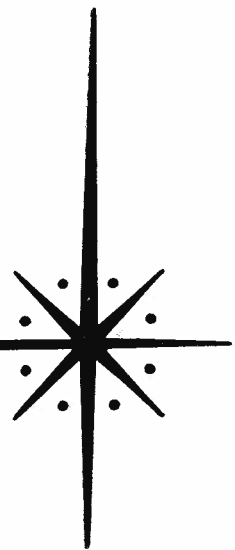


EICO

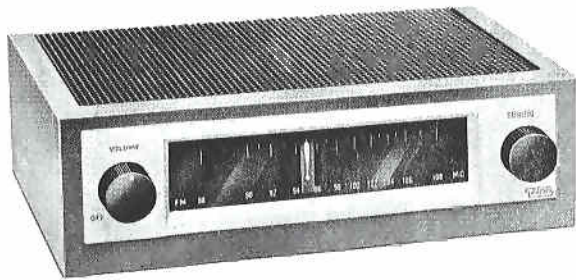
INSTRUCTION

MANUAL

HFT 90-4



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MODEL HFT 90 HIGH FIDELITY FM TUNER

general description

GENERAL

Among the most advanced of the FM tuner designs both electrically and mechanically, the EICO HFT-90 FM Tuner kit is equal to or surpasses wired tuners up to three times the price. It is the first kit to include an entirely pre-wired and pre-aligned "front end" (housed and completely shielded in a solid aluminum-zinc casting). This "front end" not only provides extremely high sensitivity and low noise, but is also entirely stable and guaranteed drift-free. Through the use of the most advanced circuitry and temperature compensated components, the need for AFC is completely eliminated and drift is less than 2 parts in 10,000 from cold start. This "front end" makes completely practical, even for a novice, the building of an FM tuner kit equal to really good factory-wired units.

Furthermore, the kit is supplied with the IF and Ratio Detector transformers pre-aligned in manufacture. Thus every tuned circuit in the tuner is pre-aligned and a completed tuner kit will give satisfactory reception without alignment providing that the indicated layout of components and wiring is followed.

SPECIFICATIONS

Sensitivity: 1.5 uv for 20 db quieting; 2.5 uv for 30 db quieting; full limiting from 25 uv.

Input: 300 ohms balanced.

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

IF Bandwidth: 260 kc at 6 db points.

Detector Characteristic: Peak separation of 600 kc. Linear bandwidth of 400 kc. Broadband ratio detector preceded by stabilized limiter stage.

Stability: Maximum drift of 20 kc from cold start. Stable after approximately one minute.

Radiation: Complete shielding of oscillator circuit and tube in preassembled "front end" minimizes radiation.

The HFT-90 is the first kit, also to include the DM-70 traveling tuning eye which travels along the side-rule dial as a luminous "exclamation point" indicator, contracting at the exact center of each broadcast channel. Having a sensitivity over six times greater than other kit tuners and equaling the most expensive wired tuners, the HFT-90 provides excellent reception even in fringe areas. Other performance features include fly-wheel tuning, automatic gain control, stabilized low limiting threshold for excellent performance from weaker signals, broad-band ratio detector for improved capture ratio and easier tuning, full-wave rectifier and heavy-filtering, and very low distortion plus flat frequency response for superb audio quality.

The HFT-90 utilizes a low-silhouette construction, utilizing a horizontal chassis to permit proper layout and component separation necessary for long component life and stability. The important construction aids include simplified dial cord arrangement pre-wired tuning eye assembly. Extremely flexible design permits easy console installation with adaptability to panel thicknesses up to 3/8 inch. Optional cabinet may also be used in console installation to provide additional shielding.

Output: Two provided; cathode follower and multiplex. Cathode follower permits use of up to 200 ft. of connecting cable. For 10 uv input with 75 kc deviation, an audio output 1.0 volt is obtained.

Hum: 60 db below 1 volt.

Controls: Tuning, Volume/Off.

Tubes: 1- ECC85/6AQ8 grounded grid r-f amplifier and reflex converter; 2- 6AU6 IF amplifiers; 1- 6AU6 IF amplifier/limiter; 1- 6AL5 dual diode detector; 1- DM70 tuning indicator; 1- 6C4 cathode follower output; 1- 6X4 full wave rectifier.

Power: 110-125 vac, 60 cps; 40 watts drain.

Size: HWD: 3 5/8", 12", 8 1/4"

Shipping Weight: 10 lbs.

mechanical installation

a) **HEAT DISSIPATION (VENTILATION):** In common with other electronic equipment, the HFT-90 produces considerable heat in normal operation. Unless continuous and adequate air flow is obtained around the heat producing elements, these elements will over-heat and their useful life will be greatly reduced.

Adequate ventilation will be provided if the tuner is installed in an open-back console provided that the top of the tuner is spaced at least two inches below any shelf mounted above it. If the cabinet is enclosed at the rear, provide several large holes or slots as low down and as high up in the cabinet back as possible. As an alternative, holes may be provided in the sides, bottom, or top of the cabinet. The important thing to remember is that effective ventilation requires provision for cool air to enter at the bottom and hot air to leave at the top.

If the tuner is not installed in a console, it may be situated on an open surface or on a shelf of a bookcase. Four rubber feet are also provided so that the tuner will not mar the surface of furniture on which it is placed.

If it is considered essential, because of space limitations to "stack" a matching amplifier such as the HF-12 with the tuner (not recommended for reasons described above), place the amplifier above the tuner since the amplifier produces substantially more heat and requires more ventilation.

b) **POSITION:** The specified absence of tuning drift can be fully assured only if the tuner is placed in an approximately horizontal position, which is therefore strongly recommended.

c) **EASY ACCESS TO CONTROLS:** Mount the tuner at a height which will permit easy manipulation of the controls. Amplifier controls should be located nearby.

d) **ACCESSABILITY TO PARTS:** Tubes are the most frequently replaced items in electronic equipment. If the tuner is installed in a console, sufficient space should be allotted to reach and remove any tube in the tuner. Furthermore, antenna and output terminals of the amplifier should be accessible to permit easy interchanging of system components for comparison. If antennas are strung around the back of the console in which the tuner is installed, arrange them so they will not interfere with access to the tuner.

d) **ACOUSTICAL ISOLATION:** If tuner and speaker are installed in the same cabinet (not recommended), provide sufficient separation to minimize mechanical speaker vibration reaching the tuner which may result in microphonics and howling. The minimum separation is about one foot. A baffle, usually the tuner mounting base, should be present between tuner and speaker. In extreme cases, it may be necessary to mount the tuner on sponge rubber pads.

CONSOLE MOUNTING

NOTE: The tuner may be installed in a console with or without "cover", consisting of two side pieces and a perforated slide-out top. Special side brackets are required and supplied for assembly purposes when the "cover" is not used. We recommend the use of the "cover" even in console mounting for the additional shielding and protection it provides. The thickness of the console panel may be up to 3/8".

a) Operations on console front panel preliminary to amplifier mounting: (1) Tape the panel template provided to the face of the console so that the top of the mounting surface line on the template is level with the top of the amplifier mounting shelf. (2) Use an awl or a nail to pierce the centers of the two 3/8" diameter holes for the controls, and the two small holes for mounting the control plate, to transfer their locations to the console panel beneath. (3) Use an awl or nail to mark the four corners of the rectangular tuning dial cut-out. (4) Remove the panel template and draw the dial cut-out with a pencil. (5) Drill only the holes for the panel controls (the two small holes which have been marked are for wood screws). (6) Now make the dial cut-out, which must be done accurately. It is recommended that the rough cut-out be made slightly undersize and then finished accurately and smoothly with a file. Then use the file to make a smoothly finished 45 degrees bevel on the lower edge of the cut-out sloping downward from the outside surface to the inside surface. The beveled surface must be smooth so that the wire going to the tuning eye socket will not catch or otherwise be obstructed when the tuning eye is moved along the dial.

b) Tuner mounting in console: (1) Pull off the control knobs. (2) Remove the four screws that fasten the bezel to the side pieces (or the special brackets if the tuner is supplied without "cover" and remove the bezel, which is not used in console mounting. (3) Remove the control plate, which is attached to the bezel by two screws and nuts. (These may be discarded since they are unsuitable for attaching the control plate to the console panel and two 4 X 3/8 wood screws have been supplied for this purpose.) (4) Fasten the control plate to the console panel with the 2 #4 X 3/8 wood screws. (5) If the rubber feet have been inserted in the bottom plate, remove them. (They may be pried out with a thin screwdriver.) (6) Place the unit on the mounting shelf and slide it forward until the front surface of the tuning dial rests against the turned-in edge of the dial cut-out in the control plate and the control shafts are centered in the holes. (7) With a sharp pencil, draw the outline of the side and rear bottom edges on the chassis shelf. As the bottom plate falls short of the full width by 3/16" on each side, draw new side edge lines 3/16" inside the original side edge lines. (8) Now take the chassis off the shelf. (9) Remove the 6 screws which fasten the bottom plate to the side pieces (or the special

side brackets). (10) Place the bottom plate exactly in the outline drawn on the shelf and mark the position of the center hole on the left side and the center hole on the right side. (11) Remove the bottom plate and drill each of the marked holes on the shelf to a diameter of 1/4". (12) Re-fasten the bottom plate to the side pieces (or the special side brackets), with the four of the six #8 X 3/8 screws previously removed, using the two holes at the rear and the two holes at the front of the side pieces (or special brackets).

(13) Replace the chassis on the shelf, positioning it exactly in the outline previously drawn, and push on the knobs. The knob with the indicator dot is for the VOLUME/OFF control. Make sure this dot agrees with the control position. (14) From the bottom side of the shelf insert a #8 X 1" screw, with a 1/2" flat washer against the head, through both the left and right side center holes. These screws engage the stamped nut over each hole on the side piece flanges (or special side brackets) and when tightened secure the chassis to the shelf.

electrical installation

FM ANTENNA

Any VHF 300 ohm TV antenna will serve very well as an antenna for the tuner. If the antenna is also being used with a tv set, it is advisable to use an inexpensive two-set coupler. If an antenna is to be installed for FM reception only, a 300 ohm FM antenna composed of a folded dipole and reflector is recommended. The best reception in extreme fringe areas will be achieved with an FM yagi antenna properly oriented for maximum sensitivity in the direction of the broadcasting station. The antenna in all cases is connected to the ANT. INPUT terminals on the rear chassis apron. Good results may be obtained inexpensively with an indoor dipole antenna fashioned from 300 ohm twin lead as shown below. Note that the length of the lead to the ANT. INPUT terminals is not critical. Any convenient length may be used.

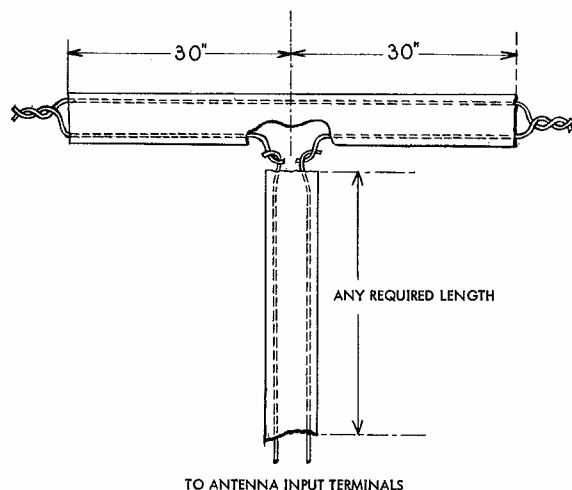


Fig. 1

POWER

Plug the line cord into any outlet supplying 117 volts, 60 cycle AC power. Variation of the line voltage from 105 to 125 volts is not critical, but it must be 50 or 60 cycles AC. This outlet may be a switched convenience outlet on an amplifier having controls and switching facilities if the convenience of having power to the tuner controlled by the ON-OFF switch on the amplifier is desired. On the other hand, if the tuner is being operated with a power amplifier having no controls itself, plug the line cord of the power amplifier into the convenience outlet at the back of the tuner (so that the amplifier will be turned on and off with the tuner) and plug the tuner line cord into a wall outlet.

AUDIO OUTPUT

A jack marked "AUDIO OUTPUT" will be found on the rear chassis apron. A low-capacity shielded cable of the shortest practical length possible should be used to connect this jack to the TUNER input jack of the amplifier. Such a cable with connectors may be purchased at an electrical supply store or made up from the desired length of cable and two RCA male phono connectors.

MULTIPLEX OUTPUT

A jack marked "MULTIPLEX OUTPUT" will be found on the rear chassis apron. At this output, the audio signal before de-emphasis is obtainable. This jack is provided for use if and when multiplex FM transmission for stereophonic FM broadcasting becomes a fact. At such time, EICO and other manufacturers will make available multiplex reception equipment which will make use of this output.

operation

The HFT-90 has only two controls, the TUNING control at the right which selects the station and the VOLUME/OFF control at the left which turns the tuner on and off and permits control of the audio output level (or volume). The traveling tuning-eye indicator shows at which frequency (or station) the tuner is set and also acts as a pilot. To turn the tuner on, rotate the VOLUME control clockwise from the AC OFF position. Allow a one minute warmup for

completely stable operation and then use the tuning control to set the tuner to the desired station. Correct tuning of each broadcast channel is indicated by maximum contraction of the luminous "exclamation point". A setting for the tuner volume control should be found and used consistently which produces the same average sound level with a given setting of the amplifier level and loudness controls that is obtained on phonograph from an average recording.

maintenance

OPERATING NOTES

Your tuner should require little service except for normal tube replacement. No substitutions for tube types used in this tuner is permissible. All tube types used are distributed nationally, but replacements can be obtained directly from EICO if desired.

If dial calibration seems to be in error, it can always be corrected by re-setting the position of the tuning-eye indicator carriage on the dial cord.

When connected properly, the hum originating in your HFT-90 tuner is inaudible. If the hum level is high due to defective components, alignment or installation, please check the following.

1. Check tubes V1 through V7 for excessive heater-cathode leakage or grid-cathode short.
2. Check C20 for value of capacity and leakage.
3. Check the dress of all the leads connected to the grids of all the tubes. Dress away from AC filament and power lines. Exercise special precautions with grid lead (pin 6) of V6.
4. Check alignment of T4.
5. Reverse AC plug in receptacle to determine position for minimum hum.
6. Run wire from tuner to amplifier chassis. Connect chassis of amplifier to ground (water or steam pipe).

To facilitate servicing, a VOLTAGE CHART and a RESISTANCE CHART is also provided as an aid in locating defective components.

ALIGNMENT PROCEDURE

1. Plug line cord into 117VAC, 60 cycle outlet. Rotate VOLUME control clockwise from AC OFF to turn tuner on and set at maximum clockwise position for full volume. Allow full 5 minutes warm-up time before starting alignment. Sweep generators and signal generators should be allowed to warm up a full half-hour before use to insure against drift during alignment.

2. Rotate TUNING control clockwise until tuning eye indicator is set at extreme right-hand end of dial (108 mc).

3. Check the voltages as given in the voltage chart using either a VTVM or a 20,000 ohms/volt VOM. All voltages are checked with a line voltage of 117VAC. If line voltage is actually 117VAC, all voltages should measure as stated within $\pm 15\%$. If line voltage is above or below 117VAC, then the discrepancy must be considered in interpreting the permissible variation in measured voltages. Note that voltages are measured under no-signal conditions. If voltages check out as given, proceed with alignment. NOTE: The visual alignment method, requiring a sweep generator and an oscilloscope, is of course preferred. If this equipment is not available however, very good results will normally be obtained by the simple signal generator method described also. Please read the whole procedure through very carefully before starting, including the IMPORTANT NOTE regarding the "front-end" (RF Tuning Assembly). Under no condition tamper with the setting of the RF SENSITIVITY TRIMMER or the OSCILLATOR TRACKING TRIMMER in the "front-end". Do not tamper with a seemingly defective "front-end" unit. Return it to EICO for repair or replacement.

SERVICE

If trouble develops in your instrument which you can not remedy yourself, write to our service department listing all possible indications that might be helpful. If desired you may return the instrument to our factory where it will be placed in operating condition for \$7.50 plus the cost of parts replaced due to their being damaged in the course of construction. NOTE: Before returning this unit, be sure all parts are securely mounted. Attach a tag to the instrument, giving your home address and the trouble with the unit. Pack very carefully in a rugged container, using sufficient packing material (cotton, shredded newspaper, or excelsior), to make the unit completely immovable within the container. The original shipping carton is satisfactory, providing the original inserts are used or sufficient packing material inserted to keep the instrument immovable. Ship by prepaid Railway Express, if possible, to Electronic Instrument Co., Inc., 33-00 Northern Blvd., Long Island City 1, New York. Return shipment will be made by express collect. Note that a carrier cannot be held liable for damages in transit if packing IN HIS OPINION, is insufficient.

FM VISUAL ALIGNMENT PROCEDURES FOR HFT-90 FM TUNER

EQUIPMENT REQUIRED: SWEEP GENERATOR & MARKER OSCILLATOR, OSCILLOSCOPE & VTVM or 20,000 Ω/V VOM




CONNECT SWEEP GEN.	SET SWEEP GEN. CENTER FREQ. (f _o) & MIN. SINE SWEEP TO	SET MARKER FREQ. TO	TUNER DIAL SETTING	CONNECT SCOPE & VTVM LEADS TO	ADJUST	REMARKS
Ground lead to chassis close to V4 pin 1. Hot lead to V4 pin 1 (pt. A)	10.7 mc (f _o) 600 kc sweep	10.7 mc	108 mc	point Δ and ground	T4 pri. (bottom) for symmetry of "S" curve. T4 sec. (top) for centering f _o marker	set sweep gen. output for approx. 0.3 rms ac volt out from Pt. X to chassis ground
Ground lead to chassis close to V3 pin 1. Hot lead to V3 pin 1 (pt. B)	10.7 mc (f _o) 260 kc sweep	10.7 mc	108 mc	point Δ and ground	T3 pri. (bottom) and T3 sec. (top) for symmetry of IF response curve about f _o marker and max. output.	a) Set sweep gen. output for approx. 0.4 rms ac volt out from pt. Y to chassis gnd. b) Always adjust for max. output with symmetry about f _o marker. Sacrifice additional output if it entails loss of symmetry.
Ground lead to chassis close to V2 pin 1. Hot lead to V2 pin 1 (pt. C)	10.7 mc (f _o) 260 kc sweep	10.7 mc	108 mc	point Δ and ground	T2 pri. (bottom) and T2 sec. (top) for symmetry of response curve about f _o marker and max. output	a) Set sweep gen. output for approx. 0.4 rms ac volt from out from pt. Y to chassis ground b) Always adjust for max. output with symmetry about f _o marker. Sacrifice additional output if it entails loss of symmetry.

IMPORTANT NOTE: "Front-end" is factory pre-aligned and no adjustment facility thereon should be tampered with. If there is definite indication that the "front-end" is misaligned, check the positions of the cores in IF transformer T1 located inside the "front-end". The T1 primary core can be seen on the bottom chassis surface of the "front-end" and the secondary core on the top chassis surface of the "front-end" (see Figs. 2 & 3) page 7. The T1 primary core should protrude approximately 1/32" from the coil form; the T2 secondary core should be neither "in" nor "out" of the coil form but flush with it. If these conditions do not exist closely as described, then it is permissible to adjust one or both of the cores to the described condition. Please note that the T1 core adjustments will normally have already been made at the factory. If a highly skilled, properly equipped person feels it necessary to make an absolutely exact adjustment of the T1 cores, he may do so on his own responsibility as described below. (EICO does not feel such an adjustment is normally necessary and takes no responsibility for any damage done to the "front-end" if this method of adjustment is undertaken.)

CONNECT SWEEP GEN.	SET SWEEP GEN. CENTER FREQ. (f _o) & MIN. SINE SWEEP TO	SET MARKER FREQ. TO	TUNER DIAL SETTING	CONNECT SCOPE & VTVM LEADS TO	ADJUST	REMARKS
Ground lead to chassis Hot lead to V1 pin 2 thru 5 mmf cap (short leads).	10.7 mc 260 kc sweep	10.7 mc	108 mc	point Δ and ground	T1 pri. (bottom) for symmetry; T1 sec. (top) for max. output	It is necessary to remove bottom plate of "front-end" in this operation to solder 5 mmf cap to V1 pin 2. Use small pin-point soldering iron only to avoid overheating components.

IF ALIGNMENT USING AM SIGNAL GENERATOR AND VTVM OR 20,000Ω/V VOM

EQUIPMENT REQUIRED: RF SIGNAL GENERATOR with or without amplitude modulation, VTVM or 20,000Ω/V VOM, OSCILLOSCOPE (optional)

CONNECT SIGNAL GENERATOR	TYPE OF SIGNAL	SET SIG. GEN. FREQ. TO	SET FM TUNER DIAL TO	CONNECT VTVM/VOM LEADS	ADJUST	REMARKS
Ground lead to chassis close to V4 pin 1. Hot lead to V4 pin 1 (pt. )	unmodulated	10.7 mc	108 mc	across C13 (observe polarity)	T4 pri. core (bottom) for max. dc voltage output.	Allow sig. gen. to warm up 1/2 hour before use. If sig. gen. is inexpensive type and/or frequency calibration is doubtful, shift frequency setting above and below 10.7 mc marking on dial to find setting at which the greatest maximum output across C13 is obtained with the T4 pri. (bottom) core adjustment. The sig. gen. frequency setting found in this manner should be taken as 10.7 mc throughout the entire alignment procedure. Note that if a small error in the intermediate frequency used for alignment is maintained constantly throughout the entire alignment procedure, performance will not be greatly affected except for a small shift in the dial calibration. If, however, there is any drift or change in the sig. gen. frequency setting from the time of the Ratio detector transformer alignment to the time of the IF transformers alignment, there will be a substantial increase in distortion as well as a loss of sensitivity.
Ground lead to chassis close to V4 pin 1. Hot lead to V4 pin 1 (pt. )	unmodulated or amplitude modulated	10.7 mc	108 mc	pt.  and ground	T4 sec. core (top) for a zero indication.	a) Set sig. gen. output to maximum (50 to 100 uv). b) If vtvm is used, set it to zero center on the 10 to 15 volts dc range. c) If 20,000Ω/V VOM is used, set the range selector at the 10 or 15 volts dc range and use the meter movement zero adjust screw to set the pointer off zero to the first major scale marking. The purpose of this is to permit observation of a negative indication on the meter. Reset the meter needle to the zero mark on the scale after this alignment step is completed. d) If an amplitude-modulated signal is used and an oscilloscope is connected to the audio output jack of the tuner, a finer adjustment can be made by setting the T4 sec. slug for minimum audio frequency output, corresponding to maximum a-m rejection.

RF SIGNAL GENERATOR ALIGNMENT METHOD
continued on page 7 of INSTRUCTION BOOK.

