

EICO

maintenance manual



Classic Series 



Eico Electronic Instrument Co. Inc., 3300 Northern Boulevard, Long Island City 1, N. Y.

Specifications

IHFM usable sensitivity: 3uv (30db quieting), 1.5uv for 20db quieting. Sensitivity for phase locking (synchronization) in stereo: 3uv. Full limiting sensitivity: 10uv. IF bandwidth: 280kc at 6db points. Audio bandwidth at FM detector: Flat to 53kc discounting pre-emphasis. IHFM signal-to-noise ratio: 55db. IHFM harmonic distortion: 0.6%. Stereo harmonic distortion: Less than 1.5%. IHFM capture ratio: 3db. Channel separation: 30db (at 1kc). Power Requirements: 120V, 60 cps; 55 watts. Size (HWD): 5-5/8" x 15-7/8" x 11-5/8".

Maintenance

general

This unit does not depend upon special tube selection for proper operation. Any tube may be replaced without necessitating re-alignment or re-adjustment provided the replacement is a type specified for the particular socket. All tube types used are available nationally, but may be obtained directly from EICO as well.

The completed kit wired correctly does NOT require alignment. The FM "FRONT-END", the FM IF strip, and the coils in the stereodemodulator section are factory pre-aligned. Presuming that the wiring is entirely correct, that none of the pre-set adjustments have been changed, and that no parts have been damaged in the course of constructing the kit, the completed kit should operate in a satisfactory manner without any alignment adjustments. Use the service alignment procedures on completed kits only if there is definite indication of misalignment, and after checking that wiring is entirely correct and that there are no damaged or defective parts. On factory-wired units and completed kits that have been performing properly, use the service alignment procedures only after trouble-shooting by voltage and resistance measurements, visual inspection for defective parts or wiring faults, and tube substitution.

sensitivity adjustment for completed kits

Connecting cable from the Front-End lugs No. 12-11 to IF Strip lugs No. 4-3 represents part of the tuning capacity for the secondary of IF transformer T1 included in the Front-End. As the cable capacity may vary slightly from unit to unit, a small improvement in sensitivity may possibly be achieved by slight adjustment of top slug A10 of T1 (see page 12). With the tuner connected to an antenna and the MODE switch set at MONO, tune to one of the more weakly received stations. Mark the slot position of the A10 slug for reference, and then use an insulated aligning tool only to turn the A10 slug CLOCKWISE (IN) ONLY, NO MORE THAN ONE TURN, while observing the tuning eye for a lessening gap to indicate improved sensitivity. In most cases, a slight improvement in sensitivity will be obtained even if the tuning eye does not show it clearly. Only if a worsening of sensitivity is noted would it be advisable to reset the A10 slug to its original position.

trouble-shooting

A. ADDITIONAL TROUBLE-SHOOTING PROCEDURES FOR DEFECTIVE NEWLY-COMPLETED KITS

If the newly-completed kit does not operate properly, do not neglect the following checking procedures which usually correct 90% of the difficulties that may be encountered.

I. Inspection.

a. To catch any wiring errors, check the entire wiring, step-by-step, against the wiring instructions and the wiring diagrams. If possible, have a friend go over the wiring with you. Often, a person is unable to detect his own errors because he misunderstands an instruction.

b. Check that all connections are properly soldered. There should be no unsoldered connections or cold solder connections. A cold solder connection is due to insufficient heating, and is evidenced by a dull lump of solder on the connection, rather than clear indication that the solder has flowed freely over and formed a shiny coating on the terminal and all the wires connecting to it. If a connection appears uncertain, reheat it to obtain the result just described, using a small amount of additional solder.

c. Check for accidental shorts between terminals that are not connected together.

d. Check the insulation on crossing leads. The insulation should not be melted away enough to cause crossing leads to short to each other.

e. Check shielded leads for shorts between the shield and the inner conductor due to melted inner insulation or a shield strand touching the inner conductor or connecting lug.

f. Check for wrong tube placement, or accidental shorting of leads or parts to the bottom plate; also blown fuse, or line cord plug making improper contact in outlet.

II. Measurements & Testing.

a. Check all d-c operating voltages and power supply a-c voltages with a VTVM or 20,000 Ω /V VOM.

b. An ohmmeter may be used for continuity testing or resistance measurements with the unit disconnected from the a-c power line and filter capacitors discharged.

c. A signal tracer may be used to check all signal paths.

III. Specific Problems.

a. Hum: Check solder connections to ground on filter capacitors, etc.; check lead dress (keep signal leads away from filaments and other power transformer leads); check for ground connections not as specified in the construction steps and figures, or an accidental ground connection to the wrong point on the chassis; check for a defective tube or filter capacitor; check for tube shield not making electrical contact to base.

b. Distortion on mono and/or stereo, inadequate or no separation: See specific symptoms in trouble-shooting section.

B. GENERAL TROUBLE-SHOOTING PROCEDURES

I. Power Supply Trouble-shooting Chart.

SYMPTOM	CAUSE	REMEDY
Fuse blows with V11 out of socket.	Short in T9	Replace
Fuse blows only with V11 in socket.	Defective V11. Shorted C2	Replace

Tube filament not lit.	Open tube filament. Open connection from appropriate filament winding of T9	Replace or Repair
DC voltage at V11 cathode (pin 3) incorrect as specified below:		
a) No voltage	Defective V11. C2 shorted internally or externally. Open connection to T9 h. v. sec. center tap	Replace Repair or Replace Repair or Replace
b) High voltage	Open lead from C2-C, open R1 or R2.	Repair or Replace
c) Low voltage	Short in B+ wiring. C2-A open or shorted Defective V11	Repair Replace Replace
Excessive hum	C2 open	Replace

II. Mono Operation Trouble-Shooting.

In the following procedures, it is assumed that the trouble has not been found to be in the power supply.

Connect an appropriate 300 Ω FM antenna to the ANT. terminals of the tuner, and the tuner outputs to a stereo amplifier and stereo speakers. Turn the tuner and the associated equipment on and allow a few minutes warm-up.

Set the FM MODE switch to MONO and the associated amplifier loudness and balance controls to mid-rotation. Tune to any local station (mono or stereo). If sound and tuning eye indication is satisfactory, proceed to the stereo demodulator checks. If there is no sound, but satisfactory tuning eye indication, this indicates that the Front-End RF & oscillator stages (V1), the first three IF stages (V2, V3, V4), and the tuning indicator (V7) are functioning, and the trouble lies between V5 and the output (V5, V6, V10 and associated component, switch S2, etc.).

In case of difficulty in mono operation, we suggest a process of elimination applied to the following items.

1. Associated amplifier and connecting cables.
2. Audio stages (V10) of the tuner and associated switching (FM MODE switch S2), cables and components.
3. IF Board Assembly (V2, V3, V4, V5, V6).
4. Front-End (V1).
5. Tuning eye indicator (V7).

Procedures recommended for each check are detailed below.

1. Associated Amplifier and Cables: Disconnect cables from tuner audio outputs. Touch disconnected cable ends with tip of screwdriver. Buzzing noise should be audible if cables and amplifier are o. k.

2. Audio Stages (V10) and S2: Touch tip of screwdriver to lug 8 (de-emphasized mono output) of IF strip. Buzzing noise should be heard from both speakers. If not, check V10, S2, and associated components and wiring. (Lug 8 of IF strip is used as test point to include continuity check of wiring to S2 and V10).
3. If the test in paragraph (2) above is satisfactory, it shows the trouble to be in the Front-End or IF strip. You can then determine quickly whether the Front-End or the IF strip is at fault. Disconnect lug 3 of the IF strip and touch lug 3 with the end of a screwdriver. If a buzzing noise is heard from the speaker, the IF strip is most likely o.k. and the trouble is in the Front-End.
4. If trouble, from paragraph (3) above, is indicated in the Front-End, check tube V1. Then examine the Front-End solder lugs for cold solder joints (resolder with fresh solder) or shorts between the outer braid and inner conductor of shielded lead connections. Next proceed to voltage measurements according to the chart. If the measurements do not indicate that the trouble lies in the B+ or filament supply or in the connections to the front-end, and a check proves tube V1 to be o.k., then the Front-End is defective and must be replaced. DO NOT attempt to service the Front-End.
5. If trouble, from paragraph (3) above, is indicated in the IF strip, then replace each of the 6AU6 tubes V2, V3, V4, and V5 in turn with the 6AU6 tube used as V9. After each replacement, allow the tubes to warm up and then repeat the screwdriver test described in paragraph (3) above. If replacement of the 6AU6 tubes does not restore operation, check the 6AL5 tube V6. If all the tubes prove o.k., make a careful visual check of the board for cold solder joints at the numbered solder lugs (resolder with fresh solder) or shorts between the outer braid and inner conductor of shielded lead connections. Then proceed to voltage measurement as described in the chart. If the trouble is localized to a component on the board, then there are two possibilities. If the unit is within the guarantee period, return the IF strip (less tubes) to EICO for replacement. DO NOT attempt to repair it unless you are quite skillful, and even then only within the limitations to be described. Any damage done the board in an unskillful attempt to repair it will automatically void the EICO guarantee. If the unit is out of guarantee and you are adequately skillful, you may attempt to make the repair if the defective component is an accessible resistor, capacitor, or filament lead choke. If an IF transformer is defective, which is very unlikely, there is no possibility of repair or replacement and individual IF transformers for replacement are not available. In the latter case, the entire IF strip (less tubes) must be replaced.
6. If sound on mono is satisfactory, but the tuning eye indicator does not perform properly, check voltages on the V7 socket according to the chart, (use readings for TUNING position of INDICATOR switch) and continuity from lug 10 of IF strip through INDICATOR switch S1 to pin 1 of V7. If satisfactory, check V7 by substitution.

III. Stereo Demodulator Trouble-Shooting.

Do not check stereo performance or the stereo demodulator section until you are thoroughly satisfied that mono performance is normal. A tuner that does not perform properly on mono cannot operate normally on stereo.

If listening quality and functioning of the tuner is normal on mono, but unsatisfactory on stereo, the trouble is probably in the stereo demodulator section, provided that an adequate FM antenna system is in use for receiving FM stereo properly in the particular location for a particular station or stations. Certainly a station that is poorly or marginally received at the MONO mode can only be received likewise or worse on the STEREO mode. In any case, background noise in the STEREO mode will be at least 9db over that in the MONO mode for the same

station due to the wider bandwidth employed. If any stereo station is received well, poor stereo performance on the other stereo stations is probably due to an inadequate antenna system. Do not tamper with the alignment of the stereo demodulator section unless there is clear indication that re-alignment is necessary.

To check the tuner on stereo, set the FM MODE switch to STEREO. Tune accurately to an FM stereo station known to be broadcasting stereo at the time. Press the INDICATOR switch down to the STEREO CHECK position and observe the tuning indicator. If a stereo program is in progress, the 19kc pilot signal, which is part of the stereo broadcast signal, should cause the upper and lower bars of the tuning indicator to close and even overlap slightly to form an extra bright center line. If this occurs, then V8A and V9 in the stereo demodulator section are functioning, as well as the INDICATOR switch S1 and the circuitry associated with V7. If not, check V8 and V9 by substitution, continuity between lug 9 on the IF board and lug 1 in the MX board, continuity between lug 7 on the MX board and the contact in switch S1, continuity between switch S1 and pin 1 of V7, and proper operation of S1. If the trouble is not uncovered, proceed to voltage checks according to the chart on the V8 and V9 sockets, and on the V7 socket using the readings for the STEREO CHECK position of the INDICATOR switch. Follow this by checking individual components on the MX board associated with V8A and V9, including coil T6, or those associated with V7 if trouble is indicated there.

If the indication at STEREO CHECK is proper, and stereo sound is absent or exhibits poor separation, or poor separation and severe distortion on all stereo stations, then the trouble may lie in the circuitry including and associated with V8B, coils T7 and T8, CR1, CR2, PC3, PC4, or in the interdependent alignment of coils L1, T6, T7, and T8. (See block and V9 sockets according to the chart should be made, followed by individual component and continuity checks. If no trouble is found, then misalignment is a good possibility, and should be performed by the procedures given in the Service Alignment of the Stereo Demodulator section with the required instruments.

If the required instruments are not available, a touch-up stereo demodulator alignment may be attempted without instruments. There are four coils in the stereo demodulator (MX) circuit: 67kc trap L1, 19kc filter T6, 19kc oscillator T7, and 38kc transformer T8. All have been factory pre-set. In this procedure, the adjustments for coils L1 and T6 are assumed correct and left untouched, as they are considered the least critical. All adjustments are made during a stereo program transmission with the FM MODE switch set to STEREO, after having obtained normal sound in the MONO mode on the same station. Use an insulated hex wrench alignment tool (such as G.C. Electronics #8606), making sure to use the end of the wrench which has a shoulder to prevent inserting the tool too far. If there is poor or no separation and beat-note distortion (may be severe low-pitched grinding noise or higher pitched fluttering tone), adjust slug A13 of coil T7 by turning it slowly up to approximately 90 degrees in the direction which causes the beat-note to drop in frequency and finally become inaudible (zero-beat). Continue past this point until the beat-note reappears, and then center the slug between the points at which the beat-note becomes audible. If the only problem is poor or no separation, adjust slug A14 of coil T8 (controls phase of 38kc re-inserted sub-carrier) slowly up to one full turn in either direction until maximum separation is achieved. This may be done best, if the stereo station broadcasts commercials on only one channel, so that the adjustment can be made for minimum sound in the unused channel. Remember that both the A13 and A14 adjustments were originally correctly made at the factory, and should only require slight adjustment.

Coil L1, and the .003 uf capacitor connected in parallel with it, comprise a 67kc trap intended to suppress interference from store-casting on the 67kc sub-carrier frequency prescribed by the FCC for FM stereo stations. This is factory-aligned and it is unlikely that misalignment would occur. Evidence of misalignment would be a faint high-pitched whistle on a stereo station known to be store-casting. (Check with the station if you are not sure). If this occurs, locate the L1 slug adjustment A15 and adjust until the whistle becomes inaudible.

NOTE that, in general, defective components on the MX board may be replaced. However, coils T6, T7, and T8 are all soldered to the board at many points, and only a highly skilled person with proper tools will be able to remove a coil successfully. Should the trouble prove to be a defective coil, we suggest that the MX board (less tubes) be sent to the EICO factory for repair. Please note that if one of the diodes CR1 or CR2 is replaced, take special care to avoid overheating the replacement diode in soldering.

circuit description

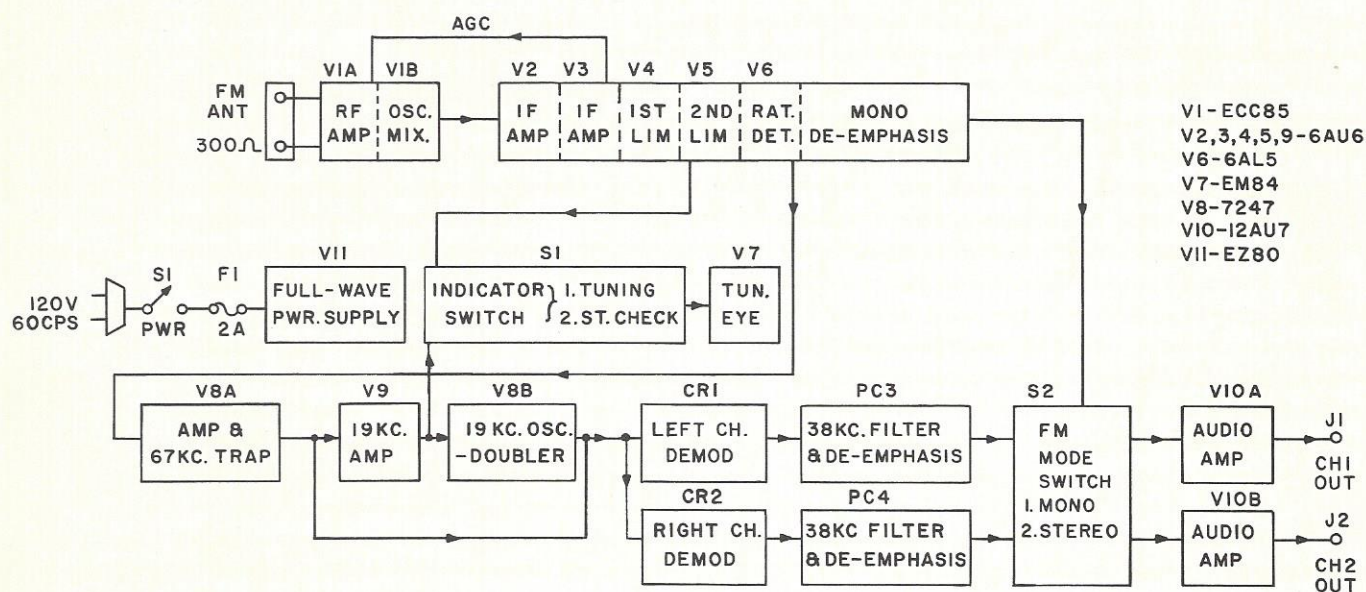
The desired FM signal, whether stereo or mono, is selected by the tuning circuit in the front end assembly. Here, the signal is mixed with the local oscillator frequency, resulting in a signal swept 75 kilocycles on either side of a 10.7 megacycle center frequency. This IF frequency is amplified and limited by V2, V3, V4 and V5. It is finally detected by V6, the ratio detector. The output in the monaural case is strictly an audio signal with components to 15kc; in the stereo case, a more complex signal appears at the output containing main channel components up to 15kc, a 19kc pilot carrier, and an amplitude-modulated 38kc carrier (suppressed) with components up to 53kc.

The composite stereo signal, as received from the ratio detector, is amplified by V8A. In the cathode circuit of this stage is a 67kc trap to eliminate interference from subscription background music services on the 67kc sub-carrier frequency authorized for stereo stations. One output of V8A is the amplified composite stereo signal, and the other is the amplified and isolated 19kc pilot signal developed across 19kc coil T6. The 19kc pilot signal is further amplified by the 19kc oscillator-doubler stage V8B, with 19kc oscillator coil T7 in the grid circuit and 38kc doubler coil T8 in the plate circuit. The synchronized 38kc output of T8 is passively added in R14 and other circuit impedances to the composite stereo signal from V8A to form a signal having one envelope that is the left-channel audio signal and the other envelope that is the right-channel audio signal. This signal is peak detected in both directions separately by the diode detector circuits associated with diodes CR1 and CR2, respectively, to obtain the left and right channel audio signals. Networks PC3 and PC4 each integrate the functions of a 38kc re-inserted sub-carrier filter and a standard de-emphasis network for the left and right channel audio signals respectively. The left and right channel signals are fed to voltage amplifier stages V10A and V10B respectively, the outputs of which appear at jacks J1 (CH 1) and J2 (CH 2) respectively.

The above described operation is obtained on a stereo broadcast with the INDICATOR switch S1 set at TUNING (and the FM MODE switch S2 set at STEREO). Tuning indication is obtained in both the STEREO AND MONO positions of the FM MODE switch by signal at the grid of the last IF stage V6 fed to the grid of the tuning eye V7. When the INDICATOR switch S1 is held down at the STEREO CHECK position (FM MODE switch remaining at STEREO), S1A switches the grid of the tuning eye to the output of 19kc amplifier V9, S1C shunts R9 with R8 to raise the tuning eye B+ operating voltage, S1D disables the 19kc oscillator-doubler stage V8B, and S1B opens the composite stereo signal path as well as grounding the input to the mixing and detection circuits. As a result, the multiplex circuit is disabled and no signal is fed to the output voltage amplifier stages V10A & B at the STEREO CHECK position (presuming the FM MODE switch is set at STEREO).

At the MONO position of the FM MODE switch S2, the 19kc oscillator-doubler stage V8B is disabled and the composite stereo signal output of V8A shorted to ground by S2C; in addition, the inputs of V10A and V10B are both switched by S2A and S2B respectively to the ratio detector output through the mono de-emphasis network on the FM IF PC board.

Block Diagram



dial cord re-stringing & dial setting procedures

If there is indication of drive or pulley slippage due to a loose set screw, use procedure B only. If the dial cord is re-strung or replace, use procedures A & B.

A. DIAL CORD RE-STRINGING (Turning Directions Below Refer to Rear View)

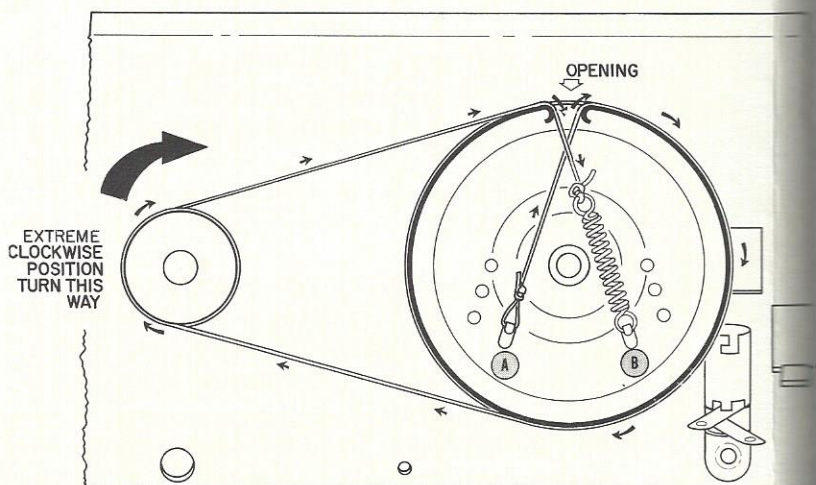
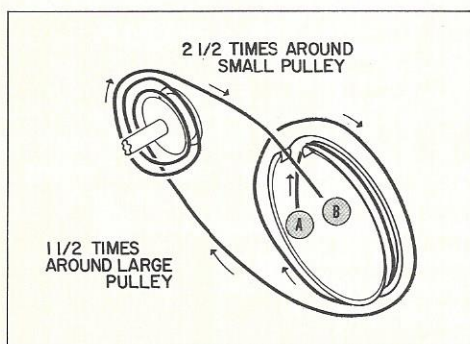
GENERAL INFORMATION: Remove sub-panel cover. Position the chassis as shown in the drawing looking in at the rear of the sub-panel. Dip one end of the dial cord in some nail lacquer or shellac to prevent fraying.

1. () Make a loop knot on one end of the dial cord.
2. () Place the point of a pencil into the loop. Stretch the dial cord taut. Mark off EXACTLY 35 inches.
3. () Tie the dial cord at the 35" mark, to one end of the spring. Make a double knot.
4. () Loosen the set screw of the LARGE PULLEY and rotate it until the opening on the rim is facing up, as shown. Then re-tighten the screw making sure beforehand that the LARGE PULLEY is IN LINE with the SMALL PULLEY and not touching either the drive bracket or the chassis flange.
5. () Turn the SMALL PULLEY on the FM FRONT END to the extreme counter-clockwise position (all the way to the left), as indicated by the arrow in the figure.
6. () Catch the looped end of the dial cord at point "A" on the LARGE PULLEY.
7. () Feed the end of the cord with the spring through the opening on the rim. Wind the cord around the LARGE PULLEY 1-1/2 turns, coming off at the bottom of the pulley.
8. () Feed the spring end of the dial cord under the SMALL PULLEY, and wind the dial cord around the SMALL PULLEY 2-1/2 turns, coming off at the top of the pulley.

9. () Feed the spring through the opening of the LARGE PULLEY once more. Hold the SMALL PULLEY so that it doesn't rotate and hook the open end of the spring to point "B".
10. () If the dial cord is of the proper length and all the instructions have been followed correctly, then the spring should have to be stretched partially open* to hook onto point "A" and thus make the dial cord taut. If the spring can hook on to point "B" without stretching enough to obtain moderate tension, or would have to be stretched beyond its elastic limit to hook on, then the dial cord length must be corrected. Do this by untieing the double knot in the dial cord on the end of the spring, and either lengthening or shortening the dial cord as required before re-making the double knot. Place some nail lacquer or shellac on the knot for permanence.

*Length of spring closed is approximately $7/8$ inch. Stretch approximately to $1-3/8$ inches.

Dial Cord Re-stringing



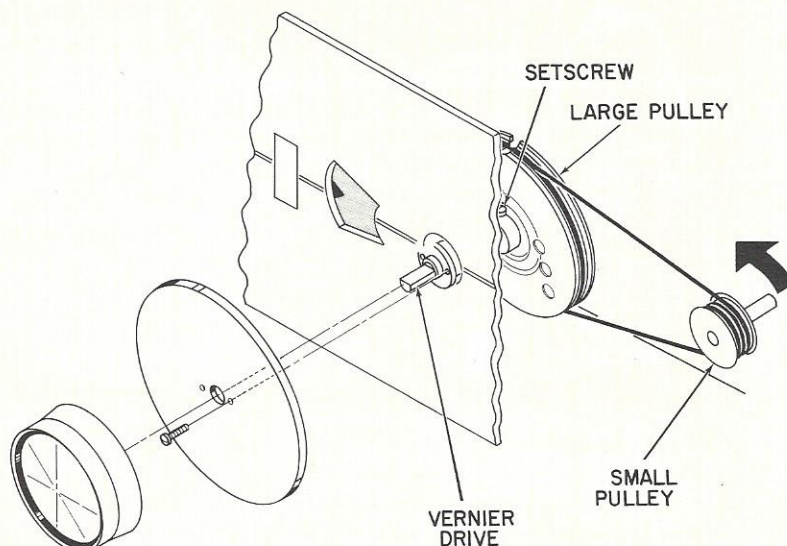
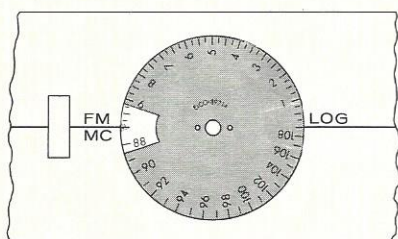
B. DIAL SETTING PROCEDURE (Turning Directions Below Refer to Front View)

1. () Loosen the set screw on the LARGE PULLEY. Rotate and hold the SMALL PULLEY to the extreme counter-clockwise position (all the way to the left), as indicated by the arrow.
2. () While holding the SMALL PULLEY, turn the tuning knob so that 10 on the logging scale (last dial mark on logging scale) is directly over the apex (tip) of the triangle on the WHITE WINDOW. See the detail drawing of the plastic dial.
3. () FIRMLY RE-TIGHTEN the set screw on the LARGE PULLEY, making certain that none of the parts previously adjusted move. As a precautionary measure to prevent slippage, FIRMLY RE-TIGHTEN the other set screws (two on the vernier drive and one on the SMALL PULLEY).

service alignment of the FM front-end & IF strip

1. The following alignment procedures are for servicing purposes only. They should be undertaken only if there is definite indication of misalignment. Please note that the kit is factory pre-aligned and does not require any alignment. Therefore, it is suggested that you check the wiring and components first for a possible error before attempting to align.

Dial Setting Procedure



2. These are the only permissible alignment procedures, and EICO takes no responsibility for the performance of the unit if these procedures are deviated from in any way. The alignment procedure requires a sweep generator and marker oscillator or an FM signal generator, a scope, and a VTVM. Do not attempt to align either section unless you have the required instruments and the skills to do it properly. Use the alignment chart below for the proper procedure.

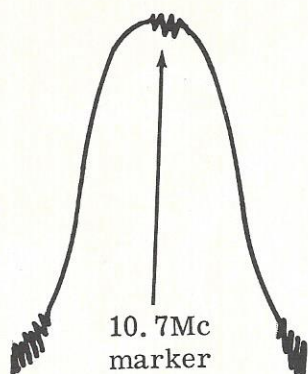
3. The desired IF response curve is very close to symmetrical and is to be achieved at a low level. When using a sweep signal generator, marker oscillator, and scope for alignment, proceed as instructed in the chart, and inject the marker intermittently at first. The purpose of this is to adjust the marker level to a value that will just make it visible, but not high enough to significantly change the IF response display as it appears without any marker injected. If this is not done, you may easily obtain misleading results due to the fact the actual IF response is being suppressed by excessive marker amplitude. See the following page. It may also be due to use of ordinary audio cable for scope connection instead of low-loss cable as specified.

4. It may be that the injected 10.7MC marker will be found slightly off center. This must not be interpreted as misalignment. Please note that alignment for minimum distortion does not necessarily produce coincidence of the 10.7Mc marker with the exact center of the IF response curve.

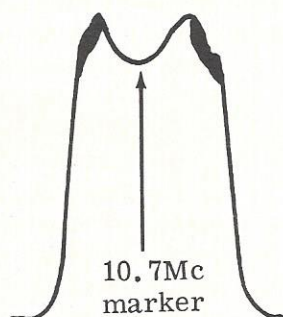
5. Furthermore, please note that FM Front-End and IF Strip have been factory aligned for best performance on weak signals, which is the only truly practical procedure. The distortion level specified is the distortion level obtained with this alignment procedure. It is also a fact that alignment with minimum distortion as the objective produces a distortion level only very slightly lower, and is very much more difficult and complicated to perform. We therefore DO NOT recommend any other alignment procedure than the one prescribed.

6. If dial calibration is in error in the same direction at both the high and low frequency ends of the dial, tune in a station from 88 to 100mc* by the tuning eye. Loosen the set screw on the large pulley bushing, and hold the large pulley in position while turning the tuning knob until the station frequency reads correctly on the dial. Then firmly re-tighten the large pulley set screw. If dial calibration is slightly off at the high frequency end of the dial, first tune in a station from 104 to 106mc. Then turn the tuning knob until the station frequency is read correctly on the dial. Now adjust oscillator trimmer A11 on the front end slowly first clockwise up to approximately one turn. If there is no improvement, return to the original position and turn counter-clockwise up to approximately one turn. Somewhere in this range the correct tuning-in point should be found.

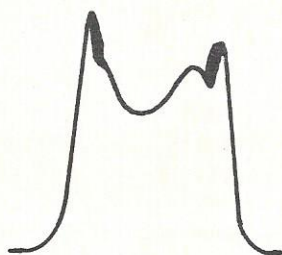
*In this region the large pulley set screw is accessible from the top.



(a) Symmetrical response with low input signal.



(b) Response with input signal increased by 20db.



(c) Input same as in (b); response suppressed due to excessive marker.

Control Settings:

1. FM MODE switch at MONO
2. INDICATOR switch at TUNING
3. POWER switch to ON and allow 15 minutes warm-up for the tuner and test equipment.















FM-IF ALIGNMENT USING SWEEP		
Step No.	Input Thru	Connect Sweep Sig. "HOT" lead to:*
1	.01uf cap. or direct	point $\triangle A$ (pin #1 of tube V5). Accessible underside of the chassis
2	.01uf cap. or direct	point $\triangle B$ (solder on IF board)
3	Wrap a loop of hook-up wire around Tube V1 on Front End	Loop

*(Always connect ground lead to ground point nearest to the point being connected.)

ALIGNMENT WITH FM			
Step No.	Input	Connect FM Sig. Gen. Thru 300 Ω Termination to:	FM Sig. or 1kc M
1	300 Ω Antenna	point $\triangle C$ (antenna terminals)	90Mc or 1kc M





1. For these alignment procedures, use an insulated alignment tool. Use the end of the tool that has a shoulder.
2. In making slug adjustments, turn the slug back and forth slowly and carefully; only a very small adjustment. If you turn any slug more than one full turn, you are probably compensating for the longitudinal grooves in the alignment tool clearly visible when inserted. In this way you will know how far you are turning the slug to its original position.

P GENERATOR-MARKER OSCILLATOR & SCOPE (See Notes Below)

Gen.	Sweep Sig. Gen. Freq.	Tuner Dial Setting	Connect Scope to:	Adjust	Notes
f 6AU6 ble from assis.	10.7mc, 1mc sweep	no interfer- ence & no signal point	point  (solder pt. #9 on IF board). Use low loss cable RG58 or RG178	  bottom slug of T5 for symmetry of "S" curve & 10.7mc marker approx. at center of crossover line.  top slug of T5 for max. amplitude and symmetry of "S" curve.	Set sweep gen. output for maxi- mum. Apply marker for checking peak-to-peak separa- tion (approx. 1Mc).
point #3	10.7Mc, 280kc sweep	108Mc or no interference & no signal point	point  on IF board (pin #6 of tube V5)	     and  bot- tom and top slugs of IF transformers T4, T3, and T2 for sym- metry with 10.7Mc marker approximately at the center of IF response.	Set sweep gen. output to -40db from max. Apply marker at low-level only, otherwise IF response on scope may be suppressed due to excessive marker.
	10.7Mc, 280kc sweep	no interfer- ence & no signal point	point 	 &  IF transformer T1 slugs on the Front-End for symmetry and max. output with 10.7Mc marker approximately at center of IF re- sponse.	Due to loose coupling, increase output of sweep generator.

ear the "HOT" lead connection).

MOD. SIGNAL GENERATOR

Gen. 400 c/s mod. 100%	Tuner Dial Setting	Connect Scope To:	Adjust	Notes
no interfer- ence signal point	90Mc or no interference & no signal point	point  (solder point #8 on IF board)	 thru  (PRI & Sec adjustments on all IF transformers T1 thru T5) for max. signal output, (approximately 0.8V) at point 	Choose spot on the dial where there is no interference and no signal. Apply 10uV RF signal 100% mod. to antenna terminals. With IF trans- former slightly under-coupled, optimum adjustment is possible on peak tuning, observing sine waveform on scope.

ent tool such as G.C. Electronics 8606 nylon hex wrench for
r to prevent inserting the tool too far and adjusting the opposite slug.

lowly over a narrow-range of ± 90 degrees maximum. For accurate
adjustment is required to reach the right point. If you have to turn
sating for a defective component or even a wiring fault. Mark one
th a pencil and note the marked groove position when the tool is
g the slug from its original position and also be able to return the

service alignment of the stereo demod circuit

NOTE: The following alignment procedures are for servicing purposes only. Audio, multiplex, and FM signal generators (or a combination instrument) are required in addition to a 'scope. Stereo demodulator alignment involves coils T6, T7, T8, and 67kc trap coil L1. All slug adjustments can be made from the top using an insulated alignment tool such as G. C. Electronics #8606 nylon hex wrench. The adjustment of L1 must always precede the adjustments of T6, T7, and T8. IMPORTANT: Note that stereo demodulator alignment can be done only after the tuner has been aligned and functioning properly on mono. Kit builders please note that the stereo demodulator coils are supplied factory pre-aligned, and that no alignment is needed unless there is definite indication of misalignment. In the case that the required test equipment is not available, touch-up alignment procedures that require no instruments are given in the trouble-shooting procedures.

A. Adjustment of 67kc Trap (L1).

Connect audio generator to pt. 1 on PC2 MX board. Set generator to 67kc, 1 volt rms output. Set INDICATOR switch to STEREO CHECK position and FM MODE switch to STEREO. Connect 'scope or VTVM to TB3-2 (lug 2 on terminal board TB3 called out in chassis view) and set A15 slug (L1) for minimum output.

B. FM Signal Generator, MX Signal Generator, & Tuner Set-up for Stereo Demodulator Alignment.

1. Connect Multiplex Generator and FM Signal Generator (or a combination instrument) to ANT. input terminals as per Fig. 0. If the audio generator is external, set it at 1000 cps and adjust output to the level specified for the Multiplex Signal Generator.

2. Set Multiplex Generator for left channel signal only.

3. Set FM Signal Generator for 75kc deviation at some frequency between 98 and 100mc (off any local station).

4. Set tuner to FM signal generator frequency.

C. Stereo Demodulator Alignment.

1. Connect 'scope to CH 1 output jack J1 and observe output.

2. Connect 'scope to CH 2 output jack J2 and observe output.

3. Normally, J1 should be the left channel output and J2 the right channel output. If there is an estimated 10:1 or better amplitude difference (separation) between the J1 and J2 outputs, even if J2 is apparently the left channel output and J1 the right channel output the way the stereo demodulator is now aligned, then the stereo demodulator is either correctly aligned or close to correctly aligned as it is. To check this, set the Multiplex generator for right channel output only, and compare the J1 and J2 signal outputs again. If separation is significantly poorer in one channel than in the other, adjust A14 (T8) slightly for a compromise which yields approximately equal separation (symmetry). Alignment in these circumstances is now completed.

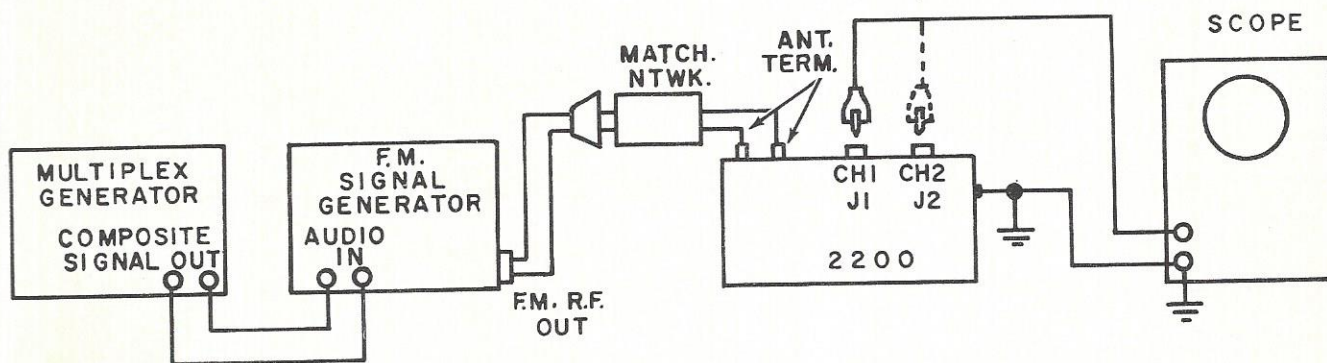
4. If steps 1 and 2 show separation to be poor, set the Multiplex generator to left channel output only, reconnect the 'scope to the CH 1 output jack J1, and proceed to the following steps:

5. Adjust A13 (T7) for maximum output from J1.

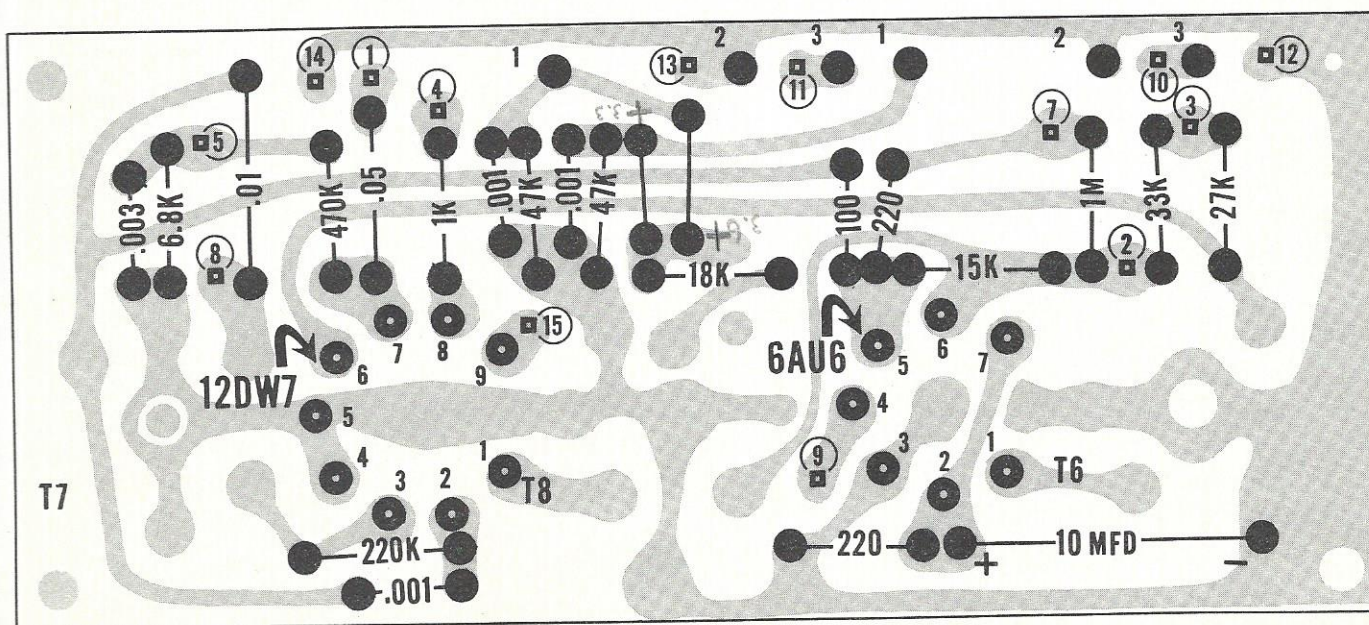
6. Adjust A14 (T8) for maximum output from J1.
7. Connect 'scope to CH 2 output jack J2.
8. Adjust A12 (T6) for minimum output from J2 (maximum separation).
9. Re-touch A14 (T8) for minimum output from J2 (maximum separation).
10. Re-set Multiplex Generator for right channel signal only.
11. Observe right channel output signal from CH 2 output jack J2, and then reconnect 'scope to CH 1 output jack J2 to check for minimum output (maximum separation).
12. If separation is significantly poorer in one channel as compared to the others, re-adjust A12 (T6) and/or A14 (T8) for a compromise which yields approximately equal separation.

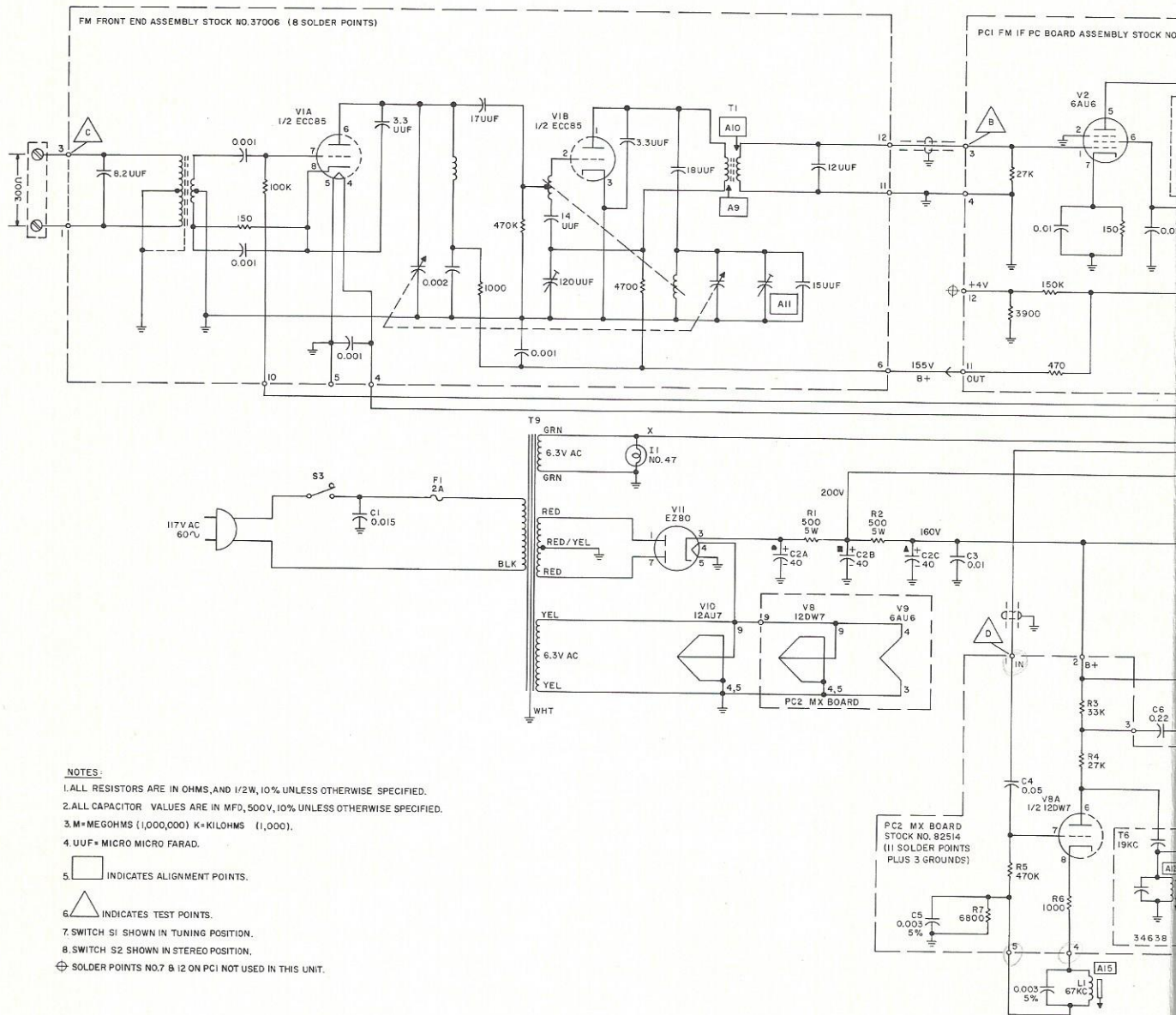
NOTE: If two 'scopes (or a dual trace 'scope) are available, connect one 'scope to each output to facilitate the alignment work.

Stereo Demod Alignment Block Diagram



MX Board





Schematic D

82511 (12 SOLDER POINTS)

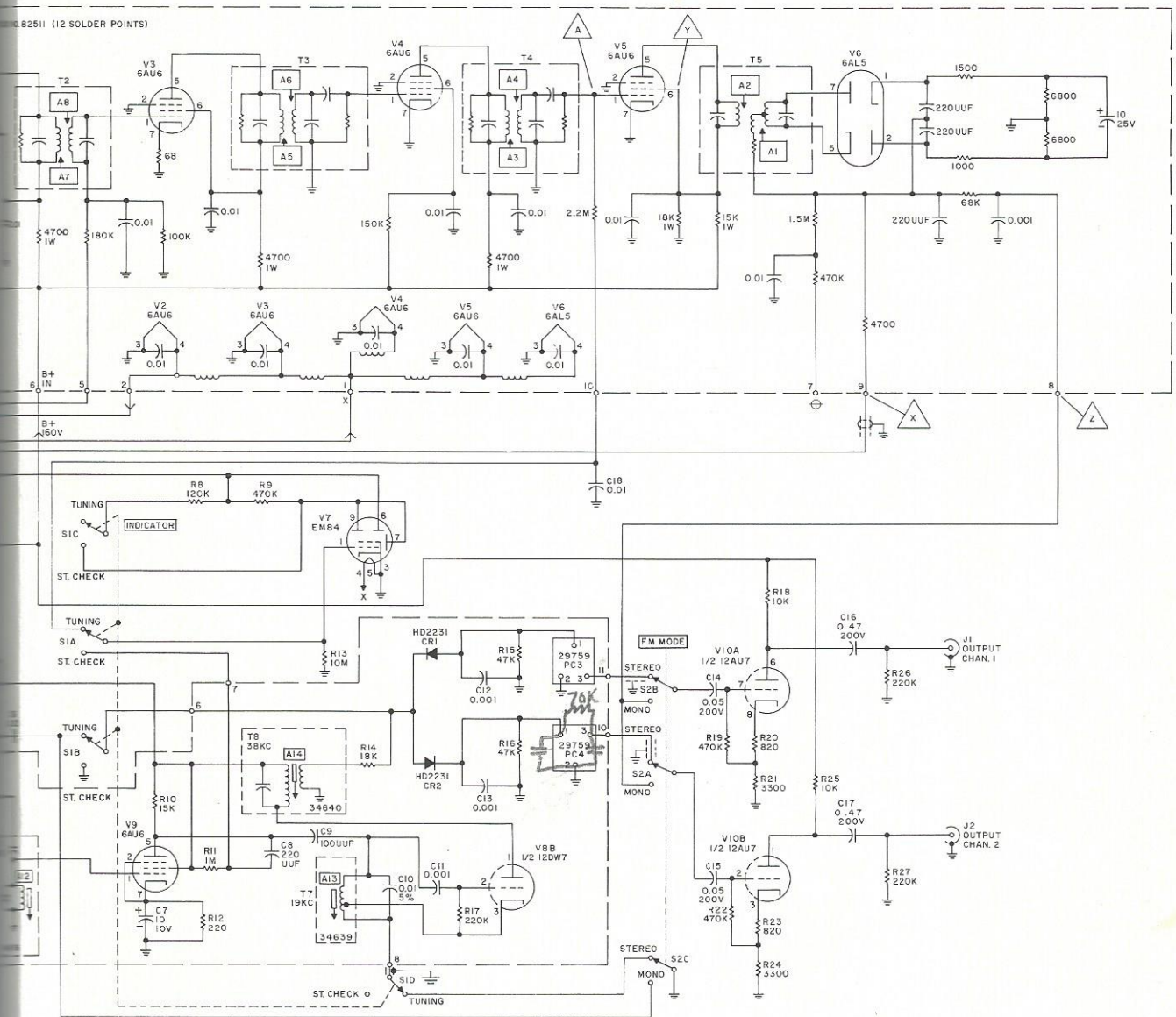


Diagram for 2200

Replacement Parts List

SYM. NO.	STOCK#	DESCRIPTION
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CAPACITORS

C1	20078	molded, .015uf, 10%, 600V
C2	24017	elec., 2 x 40uf, 350V, 40uf, 250V
C3, 18	22519	disc, .01uf, 10%, 500V
C4, 14, 15	20061	mylar, .05uf, 200V, 10%
C5	22564	disc, .003uf, 5%, 500V
C6	20030	molded, .22uf, 10%, 400V
C7	23024	elec., 10uf, 10V
C8	22552	disc, 220uuf, 10%, 1000V
C9	22509	disc, 100uuf, 10%, 500V
C10	20079	poly, .01uf, 5%, 125V
C11, 12, 13	22555	disc, .001uf, 10%, 1000V
C16, 17	20057	mylar, .47uf, 200V, 20%

PRINTED CIRCUITS

PC1	82511	printed circuit board, FM IF assembly
PC2	82514	printed circuit board, MX
PC3, PC4	29759	printed circuit, 38kc filter

RESISTORS

ALL RESISTORS ARE 1/2 WATT, 10% UNLESS OTHERWISE SPECIFIED

R1, 2	14500	500Ω, 5 watt, 10%, wire wound
R3	10426	33KΩ
R4	10451	27KΩ
R5, 9, 19, 22	10431	470KΩ
R6	10432	1000Ω
R7	10421	6800Ω
R8	10444	120KΩ
R10	10416	15KΩ
R11	10407	1MΩ
R12	10546	220Ω
R13	10402	10MΩ
R14	10453	18KΩ
R15, 16	10428	47KΩ
R17, 26, 27	10417	220KΩ
R18, 25	10400	10KΩ
R20, 23	10456	820Ω
R21, 24	10420	3.3KΩ

SOCKETS

XV7, 10, 11	97025	9 pin - pre-riveted
XV8	97071	9 pin for PC, w/89709 ground strap
XV9	97055	7 pin for PC, w/89709 ground strap

SYM. NO.	STOCK#	DESCRIPTION
<u>SWITCHES</u>		
S1	62020	slide, 4PDT with spring - pre-riveted
S2	62024	slide, 4PDT
S3	64005	push on - push off
<u>TERMINAL STRIPS</u>		
TB1	54000	1 post left - pre-riveted
TB2	54063	3 post, 1 right double mount - pre-riveted
TB3	54048	2 post, double mount - pre-riveted
TB4, 7	54001	1 post right - pre-riveted
TB5	54004	2 post with ground - pre-riveted
TB6	54513	terminal board, 2 post - pre-riveted
TB8	54059	2 post double mount right ground-pre-riveted
<u>TRANSFORMERS</u>		
T6	34638	coil, 19kc
T7	34639	coil, 19kc
T8	34640	coil, 38kc
T9	30071	power transformer - premounted
<u>TUBES</u>		
V1	90049	ECC85/6AQ8
V2, 3, 4, 5, 9	90020	EF94/6AU6
V6	90017	EB91/6AL5
V7	90058	EM84/6FG6
V8	90061	12DW/7247
V10	90033	ECC82/12AU7
V11	90069	EZ80/6V4
<u>HARDWARE</u>		
40019		nut, Tinnerman, 6-32 (2) - console mtg.
41024		screw, set, 8-32 x 1/4" (2) - drive assembly
41038		screw, 6-32 x 1-3/4" Rd. (2) - console mtg.
41069		screw, set, 6-32 x 1/8", (2) - drive assembly
41089		screw, 6-32 x 3/16" (3) - FM front end mtg.
41095		screw, 2-56 x 1/4" (2) - plastic dial mtg.
41097		screw, 6-32 x 5/16", brown (2) - front panel mtg.
43006		lug, No. 4 (3) - PC2
46017		foot, plastic (4)
47004		spring (1)

SYM. NO.

STOCK#

DESCRIPTION

SHEET METAL

80140	panel, front
81370	bottom plate
81372	chassis
81378	shield, front
81379	sub-panel, front
81962	front end bracket, back
81963	front end bracket, front

WIRE

57006	line cord, brown UL approved (1)
58416	cable, RG174/U, black (2 ft.)
58446	cable, RG174/U, green (2 ft.)
58447	cable, RG174/U, grey (2 ft.)
58449	cable, RG174/U, brown (18 in.)
58450	cable, RG174/U, yellow (18 in.)

MISCELLANEOUS

CR1, 2	95006	diode, germanium, HD2231
F1	91000	fuse, 2 Ampere
I1	92017	bulb, No. 47 AF (frosted)
J1-2	50011	output jack, dual, w/50012 insulator - pre-riveted
L1	33001	coil assembly for 67kc
XF1	97800	fuseholder
XI1	97712	pilot light assembly - pre-riveted
	37006	front end FM tuner (1)
	53081	knob, tuning (1)
	59307	felt cushion (2)
	59310	plastic foam, light blocking (1)
	66130	manual, operating (1)
	66141	manual, maintenance (1)
	66383	manual, construction steps (1)
		manual, construction figures (1)
	81175	clamp, plastic (3)
	82009	extension shaft, short (1)
	82102	strain relief (1)
	83007	window, white (1)
	83008	window, blue (2)
	83010	indicator, plastic bar (1)
	84001	drive vernier 1:6 (1)
	86503	pulley, 3" (1)
	89283	label, tube layout (1)
	89596	dial cord (40 inches)
	89627	glue, capsule (1)
	89693	pulley, 1" plastic (1)
	89714	dial, plastic (1)
	97305	shield for 9 pin tube (1)
	97309	shield for 7 pin tube (1)

MODEL 2200 KIT PACKING LIST

BOX MARKED "FIG. 1, 3, 4, 5 & 6"			
	DESCRIPTION	STOCK NO.	AMOUNT
"Fig. 1" (Contained Loose Within Box)	✓ switch, on-off	64005	1
	✓ shaft, extension*	82009	1
	✓ vernier drive	84001	1
	✓ pulley, large	86503	1
	✓ bulb, No. 47AF (frosted)	92017	1
"Fig. 3" Envelope	✓ resistor, 120KΩ, 1/2W, 10% (brown, red, yellow, silver)	10444	1
	✓ capacitor, mylar, .05ufd, 200V, 10%	20061	2
"Fig. 4" Bag	✓ coil, 19kc	34638	1
	✓ coil, 19kc	34639	1
	✓ coil, 38kc	34640	1
	✓ socket, 9 pin for PC2	X2200E	1
	✓ socket, 7 pin for PC2	X2200F	1
"Fig. 5" Envelope	✓ resistor, 1MΩ, 1/2 watt, 10% (brown, black, green, silver)	10407	1
	✓ resistor, 15KΩ, 1/2 watt, 10% (brown, green, orange, silver)	10416	1
	✓ resistor, 220KΩ, 1/2 watt, 10% (red, red, yellow, silver)	10417	1
	✓ resistor, 6800Ω, 1/2 watt, 10% (blue, grey, red, silver)	10421	1
	✓ resistor, 33KΩ, 1/2 watt, 10% (orange, orange, orange, silver)	10426	1
	✓ resistor, 47KΩ, 1/2 watt, 10% (yellow, violet, orange, silver)	10428	2
	✓ resistor, 470KΩ, 1/2 watt, 10% (yellow, violet, yellow, silver)	10431	1
	✓ resistor, 1000Ω, 1/2 watt, 10% (brown, black, red, silver)	10432	1
	✓ resistor, 27KΩ, 1/2 watt, 10% (red, violet, orange, silver)	10451	1
	✓ resistor, 18KΩ, 1/2 watt, 10% (brown, grey, orange, silver)	10453	1
	✓ resistor, 220Ω, 1/2 watt, 5% (red, red, brown, gold)	10546	1
	✓ capacitor, mylar, .05ufd, 200V, 10%	20061	1
	✓ capacitor, poly, .01ufd, 125V, 5%	20079	1
"Fig. 6" Envelope	✓ capacitor, disc, 100uuf, 500V, 10%	22509	1
	✓ capacitor, disc, 220uuf, 1KV, 10%	22552	1
	✓ capacitor, disc, .001ufd, 1KV, 10%	22555	3
	✓ capacitor, disc, .003ufd, 500V, 5%	22564	1
	✓ capacitor, elec., 10ufd, 10V	23024	1
	✓ printed circuit, 38kc filter	29759	2
	✓ diode	95006	2
BOX MARKED "FIG. 7, 10, & 11"			
"Fig. 7" (Contained loose within box)	✓ capacitor, elec., can	24017	1
	✓ coil, assembly, 67kc	33001	1
	✓ line cord, brown, UL Approved	57006	1
	✓ foam, plastic	59310	1
	✓ clamp, plastic cable	81175	3
	✓ bracket, back for FM Tuner	81962	1
	✓ bracket, front for FM Tuner	81963	1
	✓ strain relief for line cord	82102	1
	✓ pulley, plastic	89693	1
	✓ fuseholder	97800	1
"Fig. 10" Envelope	✓ resistor, 10KΩ, 1/2 watt, 10% (brown, black, orange, silver)	10400	2
	✓ resistor, 10MΩ, 1/2 watt, 10% (brown, black, green, silver)	10402	1
	✓ resistor, 220KΩ, 1/2 watt, 10% (red, red, yellow, silver)	10417	2
	✓ resistor, 3300Ω, 1/2 watt, 10% (orange, orange, red, silver)	10420	2
	✓ resistor, 470KΩ, 1/2 watt, 10% (yellow, violet, yellow, silver)	10431	3
	✓ resistor, 820Ω, 1/2 watt, 10% (grey, red, brown, silver)	10456	2
	✓ resistor, 500Ω, 5 watt, 10%	14500	2
	✓ capacitor, molded, .22ufd, 400V, 10%	20030	1
	✓ capacitor, mylar, .47ufd, 200V, 20%	20057	2
	✓ capacitor, molded, .015ufd, 600V, 10% *	20078	1
	✓ capacitor, disc, .01ufd, 500V, 10%	22519	2
"Fig. 11" Envelope	✓ spring, dial cord	47004	1
	✓ dial cord, 40 inches	89596	1
BOX MARKED "FIG. 12 & 13"			
	✓ foot, plastic	46017	4

"Fig. 12"
Bag

✓felt, cushion	59307	2
✓indicator, plastic bar	83010	1
✓glue capsule	89627	1

"Fig. 13"
(Contained
loose within
box)

✓tube, 6AL5	90017	1
✓tube, 6AU6	90020	5

BOX MARKED "FIG. 13"

✓label, tube layout	89283	1
✓tube, 12AU7	90033	1
✓tube, EM84	90058	1
✓tube, 12DW7	90061	1
✓tube, EZ80	90069	1
✓fuse, 2 Amp	91000	1
✓shield, tube 9 pin	97305	1
✓shield, tube, 7 pin	97309	1

BOX MARKED "HARDWARE & WIRE"

"Wire"
(Contained
loose within
box)

✓wire, hook-up (black, brown, red, orange, yellow, green, blue, violet, grey, white, tubing and bare)		
✓wire, black & white, cotton	58036	12"
✓cable, 300Ω twin lead	58402	12"
✓cable, RG174/U, black	58416	24"
✓cable, RG174/U, green <i>white *</i>	58446	24"
✓cable, RG174/U, grey	58447	24"
✓cable, RG174/U, red	58448	24"
✓cable, RG174/U, brown	58449	18"
✓cable, RG174/U, yellow	58450	18"

"No. 4
Hardware"
Envelope

✓nut, hex, No. 4-40	40007	6
✓screw, No. 4-40 x 1/4	41016	18
✓washer, lock, No. 4	42007	6
✓lug, No. 4	43006	3

"No. 6
Hardware"
Envelope

✓nut, hex, No. 6-32	40000	3
✓nut, Tinnerman, No. 6-32	40019	2
✓screw, No. 6-32 x 1/2	41008	3
✓screw, No. 6 x 1/4, self tapping	41035	20
✓screw, set, No. 6-32 x 1/8	41069	2
✓screw, No. 6-32 x 3/16	41089	3
✓screw, No. 6-32 x 5/16, brown	41097	2
✓washer, lock, No. 6	42002	3
✓washer, flat, No. 6	42005	3

"Miscellaneous
Hardware"
Envelope

✓nut, hex, 1/2"	40016	1
✓screw, set, No. 8-32 x 1/4	41024	2
✓screw, No. 2-56 x 1/4	41095	2
✓washer, rubber, 1/2"	42029	1

"Installation
Hardware"
Envelope

✓screw, No. 6-32 x 1-3/4, Rd. Hd.	41038	2
✓washer, flat, No. 6	42005	2

BOX MARKED "PC2"

✓printed circuit board	82514	1
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MISCELLANEOUS

✓panel w/window	X2200A	1
✓sub-panel, pre-riveted	X2200B	1
✓chassis, pre-riveted w/transformer	X2200D	1
✓tuner, FM Front End w/ECC85 tube	37006	1
✓knob, tuning	53081	1
✓bottom plate	81370	1
✓shield, front	81378	1
✓printed circuit, FM IF	82511	1
✓dial, plastic	89714	1
✓manual, operating	66130	1
✓manual, maintenance	66141	1
✓manual, construction (steps)	66383	1
✓manual, construction (figures)	66383	1

