

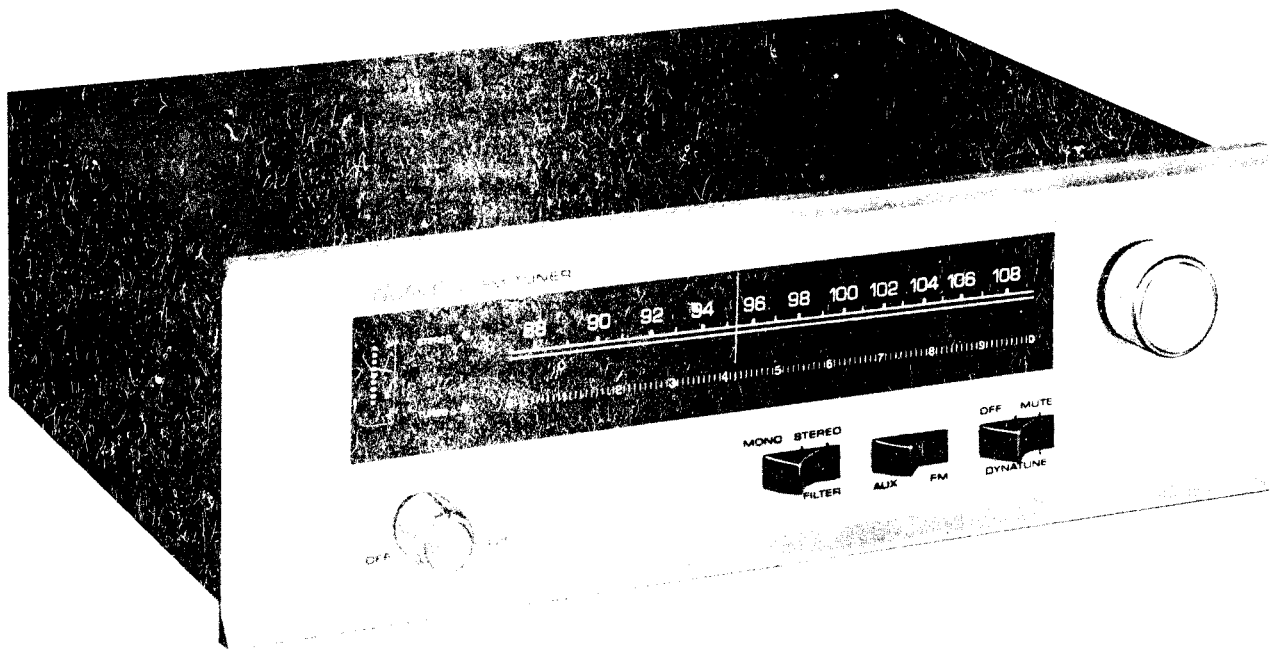
DYNACO

FM-5

SERIAL NUMBER

This number must be mentioned in all communications concerning this equipment.

INSTRUCTIONS FOR ASSEMBLY OPERATION



929122-1

DYNACO INC.

COLES ROAD & CAMDEN AVENUE / POST OFFICE BOX 88
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SPECIFICATIONS

IHF sensitivity (noise and distortion down 30 db @ 100% modulation):
1.75 μ v

Input required for 40 db S/N @ 100% modulation: 2.0 μ v.

Input required for 50 db S/N @ 100% modulation: 5.0 μ v.

Frequency response before de-emphasis: 30 Hz to 52 kHz, \pm 1 db.

De-emphasis time-constant: 75 μ sec.

Frequency Response: 20 Hz to 15 kHz \pm 1 dB

Harmonic distortion and IM distortion @ 100% modulation:

Mono - 0.5% (0.25% typical).

Stereo - 0.9% (0.5% typical).

Capture ratio: 1.5 db.

Muting threshold: 4 μ v.

Output @ 100% modulation: 2 volts.

Ultimate signal to noise ratio: 65 db @ 100% modulation.

Drift: less than 0.02%.

Selectivity: 65 db alternate channel.

AM suppression: 58 db.

Stereo switching threshold: 4 μ v.

Stereo separation: @ 1000 Hz, 40 db.

@ 50 Hz, 30 db.

@ 10 kHz, 30 db.

19 kHz and 38 kHz subcarrier suppression: 50 dB minimum

67 kHz SCA carrier suppression: 80 dB minimum.

Antenna input: 72 ohm unbalanced and 300 ohm balanced.

Gain from Auxiliary Input: 28 dB

Front panel controls: Power/Volume; Tuning; Circuit Mode (off, muting, muting and Dynatune™); Mono, Stereo Filter, Stereo; Output (FM, Auxiliary).

Dimensions: 13 1/2" x 9" x 4 1/4" High.

Shipping weight: 11 lbs.

Power consumption: 10 watts, 120V or 240V, 50/60 Hz AC.

THE FM-5 DYNATUNER

INTRODUCTION

The Dynaco FM-5 is the culmination of more than 6 years of Dynaco design research with the avowed goal of exemplary performance under a wide range of reception conditions at modest cost. Its compact size nonetheless provides a generous layout for easy kit construction and outstanding serviceability. In addition, an exceptional degree of flexibility has been designed into this tuner for future contingencies.

The availability of an auxiliary high level input through the tuner's volume control enables tape playback, for example, with just a power amplifier and speakers. Alternatively, an accessory phono preamp module, Model PPM-5, will be offered for the FM-5 so that the AUX position will accommodate a magnetic cartridge input. In the distant future, if a compatible system of 4-channel multiplexing is approved, it is possible that the power supply and space allocations will accommodate it, and the necessary audio outputs are available.

The primary consideration in the development of each new Dynaco product is exceptional performance. The FM-5 delivers this in full measure. The design considerations necessary to achieve a premium quality kit lead automatically to a distinctly superior factory assembled unit as well.

The determination of the best FM tuner design for maximum listening enjoyment is not one which can be made entirely in the laboratory, nor can it be fully defined by specifications. Extensive field testing is a vital part of tuner design. Reception conditions vary so greatly that certain characteristics which favor reception in some instances may prove a handicap under different circumstances. Side-by-side listening comparisons of the FM-5 with tuners several times its cost demonstrate the FM-5's ability to reject the pervasive effects of multipath dispersion on strong urban signals, as well as to clearly receive weak or distant signals without noise or interference. A tuner can, however, only process the signal it receives from its antenna. The proper antenna is thus a vital adjunct to your music system. A section of this manual gives some suggestions in this regard, but competent local advice which takes into account the particular location of the tuner will always be advantageous.

Vanishingly low distortion has always been a hallmark of any product bearing the Dynaco name. The FM-5 establishes new standards, not only for typical in-phase stereo measurements, but for signals of dissimilar phase characteristics as well. Coupled with outstanding phase integrity in a solid state tuner, this yields exemplary results with any of the matrix-type 4-Dimensional (sometimes incorrectly called 4-Channel) broadcasting systems now proposed, including the ingeniously simple DYNACQUAD™ system developed by Dynaco.

Any successful high performance audio kit design must concomitantly deliver unchanging results over extended use. This also implies assurance that the standards set by the factory assembled units are consistently reproducible when even a novice properly assembles the kit. The more than 15 year old Dynaco reputation for consistently meet-

ing conservative, detailed specifications is your best guarantee that the FM-5 will do just that. The two fiberglass etched circuit boards and the front end assembly (which contain all of the active circuitry) have been completely tested and aligned as a matched set for the kit, leaving nothing but their interconnection for the builder. The excellent specifications of the FM-5 are possible, and guaranteeable, unit to unit, lab model to production kit, because of the extraordinary uniformity which etched circuits provide, and the inherent stability of the circuit configuration.

The capability for the finest performance is of little value if it cannot be readily utilized in normal use. The consummate operating ease of the FM-5 is a case in point. You simply take your hand off the tuning knob as soon as the TUNED indicator is illuminated. The exclusive DYNATUNE™ circuit *automatically* fine-tunes the station. A stereo broadcast will *automatically* switch the tuner to stereo reception, and light the STEREO indicator too.

The FM-5 actually exceeds its own IHF specifications when it comes to listenable results. The IHF procedure for determining the distortion specification of a tuner allows readjustment of the source signal for the lowest measurable distortion. You the listener cannot do this. In the past you have had to rely on the uncertainty of "center of channel" meter systems, or on the even less precise signal strength maxima indications. The certainty of the DYNATUNE™ circuit automatically eliminates these variables, assuring reception with the lowest possible distortion. The DYNATUNE™ logic circuit senses the presence of the desired signal, together with the absence of noise, before it will switch on the audio. Then it *automatically* fine-tunes to the exact center of the FM channel (the minimum distortion point) in either mono or stereo. Such precise tuning is accomplished faster and more accurately than any other tuning system.

A clearly audible virtue of this design is the total elimination of switching transients in the operation of the muting function. And you have the convenience of interstation muting down to the levels of the weakest useable signals—in the vicinity of 4 microvolts! The result is absolute silence—or the station in correct tune. Only the FM-5 achieves this ultimate goal of a tuner. This refined muting circuit eliminates the possibility of damaging speakers or solid state amplifiers as a result of the low frequency "thumps" so common in the past with rapid dial manipulation. Yet so sophisticated is its operation that selectivity of adjacent channels is completely unaffected.

In urban locations where the FM-5's extreme sensitivity could have been a handicap, special care was taken in the design of the front end to accommodate extremely powerful signals without encroaching on adjacent weaker channels. The FM-5's suppression of spurious responses (cross-modulation) is notable among solid state tuners. Generous tolerance of overmodulation (an all-too-common broadcasting fault) yields low distortion signals in instances where others suffer.

Smooth flywheel action, a long uniformly spaced dial, and the most accessible and easiest to install dial stringing system ever, make the FM-5 a joy to use, and a breeze to construct. Only those who have built other tuners with similar dials can fully appreciate the latter.

The IF section utilizes two 4-pole ceramic filters for the optimum combination of alignment accuracy and stability, phase integrity and effective selectivity. The ideal selectivity curve is a 3-sided rectangle—unachievable in practice. Of the several approaches to this goal, the compromises in each must be weighed in the light of other criteria. The FM-5 demands an unusually high degree of alignment accuracy and stability to assure that prealigned circuit boards conform in all respects to a fully assembled unit when it has been aligned on completion. Too, the advent of DYNAQUAD™ and other similar matrix-type 4-Dimensional broadcasts demands an unusually high degree of phase linearity for maximum separation and low distortion reproduction. Such characteristics also lead naturally to better reception of even conventional stereo broadcasts. These goals tend to conflict with design criteria which favor the achievement of the most impressive figures for selectivity specifications. Indeed, some of the quoted selectivity figures are of dubious validity. Impressive figures can be obtained if phase linearity is ignored. The antenna becomes a much more significant factor where adjacent channel signals are possible, and alternate channel isolation is important.

Sensitivity—the most quoted tuner specification—is in fact of minimal concern for most users. The FM-5's specification of 1.75 microvolts closely approaches the accepted theoretical limit of signal strength, and yet retains great stability, notable spurious response rejection, and excellent AM (multipath) rejection. The steep limiting curve exemplified by the 50 db signal to noise ratio with only a 5 microvolt signal is of far greater significance than the IHF

sensitivity. A signal should have a signal to noise ratio of at least 40 db (which occurs at only 2 microvolts) to be of acceptable listening quality. At normal signal levels, the typical signal to noise figure is 65 db!

Exceptional filtering of the 19 kHz multiplex pilot carrier, the 38 kHz multiplex subcarrier and of the 67 kHz SCA carriers assures freedom from interference beats with tape recorder oscillators when recording off the air.

More than with any other audio product, FM tuner specifications need to be evaluated with a somewhat jaundiced eye, and an appreciation that individually impressive figures do not necessarily yield the best listening results in the real world. Foremost is the limitation that most tuners are designed to meet criteria established by measurements made in a specially shielded room. Such results are not necessarily transposable to your living room. Neither the previous FM-3 Dynatuner nor the FM-5 were based on shielded room evaluations. The FM-3 established an enviable reputation for outperforming numerous tuners of far greater cost having apparently better specifications on paper.

The FM-5 is a break with the kit design philosophy of its FM-3 predecessor. The FM-3 was designed from the ground up to be wholly self-aligned by the builder on completion. Because of that recognized success, Dynaco thoroughly pursued over many months the possibility of a similar design using transistors. The characteristics of solid state devices preclude this approach. Thus the FM-5 evolved as a concept of highly stable performance which could be honed to perfection when factory aligned as a set of 3 matched subassemblies, capable of being tested as a fully operational tuner. Thus no adjustment of any nature should be made short of *complete* alignment facilities. Solid state reliability makes such adjustment unlikely for the life of the tuner.

INSTALLATION AND OPERATING INSTRUCTIONS

The highly refined and distilled engineering of the FM-5 combines the performance of far more costly and complex FM multiplex tuners with the operating ease and simplicity which has been a Dynaco tradition. Exhaustive engineering research has replaced needless adjustments, controls and indicators with automated functioning, freeing the listener to enjoy the results.

Normal operation leaves all 3 switches depressed to the right. Once the power switch is rotated to the desired volume level, you need only tune until the TUNED indicator is illuminated at the desired station. It is as simple as that.

AC Line Connection

The tuner is normally wired for the U.S. standard 120 volt, 60 Hz AC line. Alternative wiring to accommodate 240 volt operation, with either 50 or 60 Hz, is described later in the manual. The typical AC connection will be to a switched outlet on the control center or amplifier. Thus the tuner's power switch (on the volume control) may be left "on" with the volume control adjusted for compatibility with other sources. The AC outlet on the back panel of the FM-5 is controlled by the front panel power switch. Thus if no separate control center is needed in the system, the power amplifier may be switched through this outlet, and the FM-5 plugged into the wall outlet.

Antenna Connections

Three screw terminals are provided on the back panel for either 300 ohm balanced, or 72 ohm unbalanced antenna systems. A twinlead folded dipole antenna is supplied with the tuner and will suffice for all but the most difficult signal areas. It should be connected to the two outer (300 ohm) screw terminals. A later section of this manual will give you suggestions for other antennas if conditions require such.

Output Connections

A pair of shielded cables is supplied with the FM-5. These should be connected from the AUDIO OUT tuner sockets to the FM-MPX, RADIO or TUNER inputs of the control center or amplifier. The output level of the FM-5 is adjusted by the front panel volume control. The nominal output level at maximum setting from a fully modulated signal is 2 volts. You can also connect the tuner to any basic power amplifier which has an input sensitivity of less than 2 volts for full output.

The TAPE OUT sockets also provide a variable output level which is adjustable by the front panel volume control. These may be connected to the line inputs of a tape recorder.

Auxiliary Input

The third pair of audio sockets provides an *input* connection which is switched on the front panel. This signal is available at both the AUDIO OUT and TAPE OUT sockets. This input provides a maximum of 28 dB gain and is controllable by the volume control.

Off / Volume Control

The power switch, which also controls the back panel AC outlet, is a part of the volume control. If the tuner is plugged into a switched AC outlet on the control center, the tuner's volume control will likely be left in the upper half of its range, where the tuner level will match the level of other inputs to the control amplifier.

Mono / Stereo Switch

In the MONO position all stations will be heard monophonically, and the stereo indicator will never light. This position may provide greater clarity in monophonic reception of *very* weak stereo broadcasts.

In the middle STEREO FILTER switch position, high frequency separation of stereo broadcasts is reduced, or blended, to improve the signal to noise ratio on weak stereo signals. In other respects, tuner operation is similar to the normal STEREO mode.

The normal position of this switch is the extreme right STEREO mode. The tuner switches automatically from mono to stereo operation, and lights the STEREO indicator whenever the tuned station is broadcasting the 19 kHz multiplex stereo pilot carrier signal. On rare occasions the station may forget to turn off the pilot carrier when they revert to mono broadcasting. In such a case, you will receive a mono broadcast even though the stereo indicator is lighted.

Without the pilot carrier, the tuner reverts to mono but the lowest noise will be obtained in the MONO position.

Off / Mute / Dynatune Switch

In the OFF position the muting circuitry and the automatic DYNATUNE circuitry is defeated. This permits extremely weak signals to be perceived, as there is no interstation noise suppression (muting). Tune for maximum vertical meter indication. The TUNED light will flicker on very weak signals of varying strength. For the reception of such signals it is best to operate in the MONO mode.

The middle switch position is preferred for normal operation with the highest tuning accuracy. The muting circuit eliminates all interstation noise. When the TUNED light comes on, let go of the tuning knob and switch to the extreme right DYNATUNE position. The automatic circuitry will then take over for precise tuning of the center of the channel for minimum distortion.

You may prefer to leave this switch in the DYNATUNE position most of the time, as this is the easiest method of operation. The proper tuning procedure here is to release the tuning knob as soon as the TUNED light indicates the desired station. "Fiddling" back and forth on the dial is not recommended with the switch in this position, for it may leave it on the "edge" of the correct zone. In such a case the automatic tuning circuitry may not be able to fully correct for lowest distortion reception.

AUX / FM Switch

The normal position is FM. The AUX position selects an alternate high level signal source, such as a tape playback amplifier, which is controlled by the tuner's volume control. In the AUX input mode, the tuner should be muted (off station) to avoid audio signal feed-through.

The inclusion of this switch and the additional output sockets on the back panel also provide contingency for future flexibility. An accessory phono preamp stage, Model PPM-5, will be offered for the FM-5, so that the AUX position will accommodate a magnetic cartridge input. In the distant future, if a system of 4-channel multiplexing is approved, it is possible that these provisions will accommodate it.

Signal Strength Meter

The meter circuit has been compensated to accurately show changes in signal strength at a very few microvolts, as well as those inordinately powerful signals above 30,000 microvolts. This can be of significant value in determining antenna orientation, or possibly the need for an attenuator for too strong a signal.

The operation of this meter circuit is such that normal signal levels will all indicate very similar levels near the center of the meter scale, even though they may vary over a wide range. Such signals do not normally present reception problems, and the meter is then unnecessary. Its circuit has been designed to be most meaningful when it can be most useful.

While a maximum meter indication will show the proper tuning zone, well within the Dynatune "window", it is possible that a minute reduction from the maximum meter indication may be observed as the Dynatune circuit takes over on signals strong enough to activate it, and the muting circuit. The Dynatune circuit enables far greater tuning precision than manual tuning with *any* meter system.

The Tuned and Stereo Indicator Lights

The TUNED indicator lights when you are on station. If the station is broadcasting in multiplex stereo, the STEREO light will also come on an instant later.

As the tuning dial approaches within 80 kHz of the station's broadcast frequency, the illumination of the TUNED light will indicate that the Dynatune circuit can take over. This will "lock on" that signal for the next 250 kHz. If the station is approached from the opposite direction, the same locking action will be observed in the reverse direction, starting again within 80 kHz of the broadcast frequency.

If the dial location is more than 80 kHz distant from the broadcast frequency, and the Dynatune switch is disengaged, the signal will be muted. To resume reception, the tuner will have to be re-tuned until the TUNED light is again illuminated.

Occasional lack of stereo separation when the STEREO indicator is lighted is possible if the station neglected to turn off its 19 kHz stereo pilot when broadcasting mono.

If either of these two lights flicker, it indicates exceedingly low signal strength (below 4 microvolts) or noise interference spikes of very high intensity. In such a case readjustment of the antenna for a better signal may be possible. Switching the muting switch "Off" may also prove useful.

Tuning a Station

The DYNATUNE™ circuit operates simultaneously with the muting circuit. If you wish to defeat muting, you cannot use DYNATUNE. While this circuit "locks in" a station well past the exact frequency as the tuning traverses the dial, selectivity between closely spaced stations is not impaired, and the recent station can be tuned easily from the opposite direction.

The simplest tuning procedure is to move the dial deliberately, and release it as soon as the "TUNED" indicator lights. Allow DYNATUNE to do the rest. If you move the dial rapidly, you will hear no sound, and the indicator will not light at all.

Installing Your FM-5

Your FM-5 generates very little heat. It is unnecessary to provide ventilation, even with continuous duty operation. The FM-5 may be mounted in any position in a cabinet, and if desired, it may be stacked with a Dynaco PAT-4 preamplifier. If it is used with the Dynaco SCA-80 or SCA-80Q amplifier, adequate ventilation must be provided for the amplifier.

For panel mounting, an accessory FM-5 bracket kit is available from Dynaco for \$2 postpaid. Please order please. A single rectangular cutout 13 1/2 by 3 1/2 inches is required in any panel up to one inch thick. Or, you can simply provide a shelf flush with the bottom of the opening. The rubber feet are not used in such mounting. In a cabinet which provides for "face up" mounting, the FM-5 can simply be supported in the cutout by its front panel.

CIRCUIT DESCRIPTION

The following brief explanation of the essential circuit features of the FM-5 may aid service personnel and the technically inclined hobbyist to understand the operation of this tuner. Those not interested in the technology may ignore this section.

Front End

The front end comprises a tuned RF input to an FET RF amplifier with interstage double tuning to the FET mixer. A transistor oscillator supplies the mixer. The last section of the four gang tuning capacitor tunes the oscillator. Circuit constants of the oscillator and mixer circuits have been adjusted to give uniform sensitivity over the entire FM band.

The AGC signal is picked up from the high side of the IF output, through a transistor amplifier, a double diode detector, and applied to the gate of the RF mix FET.

IF Amplifier—Limiter—Detector

The IC intermediate frequency amplifier is followed by a 4-pole ceramic filter, another IF amplifier, then another 4-pole ceramic filter and a high gain limiting amplifier. The IF gain is so high, and the limiting action so effective that limiting occurs on input noise alone. Phase shift in an FM signal corresponds to amplitude nonlinearity or distortion in an audio amplifier. Accordingly, these IF circuits were designed for minimum phase shift across the pass band. This approach maintains low distortion of the audio signal all the way down into the noise, and permits useful reception of very weak signals.

A high gain IC amplifier drives a ratio detector which provides an emitter follower audio output. The audio goes through a phase compensation network and a low pass filter with a 67 kHz notch for SCA carrier rejection and through the muting FET.

Multiplex

The IC multiplex circuit is a cross-coupled multiplier demodulator which provides additional 67 kHz rejection. A low pass filter with dual notch rejection for 19 kHz and 38 kHz is followed by the deemphasis network. With the FM-AUX switch on the front panel in the FM position, the audio passes through the volume control and an audio amplifier with 28 dB of gain. The output impedance of the audio amplifier is 1000 ohms, which permits very long connecting cables with low losses. The AUDIO and TAPE outputs are paralleled and the level of each is dependent on the setting of the volume control.

Meter

The audio meter circuit is specifically designed to reflect maximum differentiation of the weakest signals for optimum antenna orientation, while defining as well those signals which reach unusually high intensity. Meter feeds are obtained after the first 4-pole ceramic filter and after the limiting amplifier.

Muting

The audio muting action is controlled by a combined logic circuit which is fed by the detector output. It senses the detector's DC level, and switches off the audio (mutes) when the variation from center exceeds 80 kHz. It is also activated by a second signal which is the output of a 150 kHz high pass filter. Any interstation noise at this point is amplified, and its presence switches off the audio.

Dynatune

The automatic tuning logic circuit may be thought of as a highly amplified closed loop tracking circuit with a narrow "window". The detector's DC output is amplified by a high gain operational amplifier. This output is fed back to the front end through a limiter in what may be considered a servo loop. This signal controls the frequency of the oscillator, and is set for zero DC at the detector output. With proper factory alignment, the zero DC detector output can be assumed to be the preset minimum distortion point.

The output of the servo amplifier must be switched off, or it would lock on one signal all the time. The AFC "window" is controlled by the limiter independent of the muting action. When the DC level reaches a predetermined value at the detector output by the action of moving the dial, the muting logic circuit switches off the servo-loop before audible noise or distortion is observed. Only when the muting logic circuit perceives a lack of interstation noise will the audio (and the servo loop) be switched on again.

Indicator Lights

The "Tuned" light is switched by the output of the muting logic circuit. The "Stereo" light is actuated by the same circuit, plus the presence of the 19 kHz multiplex carrier. It has a longer time constant, however, to avoid any audible noise accompanying its operation.

Power Supply

The full wave bridge rectified supply includes zener diode (shunt) regulation on the negative side, and series transistor regulation on the positive side.

GETTING THE MOST FROM YOUR TUNER

The simple 300 ohm twinlead folded dipole antenna supplied with your FM-5 will be convenient to use. Because of the extreme sensitivity and excellent quieting characteristic of your Dynatuner, this antenna will be capable of meeting the requirements in many typical installations.

This folded dipole type of antenna has equal pickup from opposite directions, and has maximum response to a signal coming from right angles (broadside) to the top of the "T". Therefore best reception will be achieved when it faces toward (points 90° from) the direction of the station. While such an antenna can be placed under a rug, or simply dangled from the back of the tuner, better reception will usually be obtained when it is mounted higher up. It can be tacked to the back of a cabinet, taped along wooden bookshelves, pinned along the back of a sofa or even against a wall. It should not be attached to any metal surfaces (these will tend to "absorb" the signal) and it should not be folded over, for this will adversely affect reception.

If you find that reception is not satisfactory with the antenna supplied and an outside, roof-mounted antenna is not practical, you may be able to improve directionality by using an ordinary set of TV "rabbit ears" of the simplest form. These have the added virtue of mobility in difficult areas. They can be turned to effect maximum pickup from different directions or moved to avoid particular room interference effects. They usually work best when they are extended horizontally. Connect them to the outer 300 ohm antenna screw terminals.

With any indoor antenna, the building structure may reduce its performance. This is particularly true of steel reinforced concrete structures, which often shield antennae all too well. Similarly, furniture placement and the movement of people through the room can affect the reception of some signals. Often the simplest solution is to fasten the antenna to the outside of a window ledge, or to a board mounted outside the window. Be careful that the lead-in is not squeezed by the window. If necessary, the lead-in (the portion which has the connecting lugs) may be extended with similar type wire.

Roof-Mounted Antennae

By far the most satisfactory results from any quality stereo FM tuner will be obtained with a roof-mounted, directional antenna. The general rule of thumb is that if a television set requires an external antenna, so too will an FM tuner. The same effects you see as "ghosts" on television are apparent as multipath dispersion in stereo FM. Such effects are most common in cities where tall buildings provide many signal reflections, but trees and hills can also cause similar effects.

When selecting an antenna, competent advice from a local dealer who has experience with various systems, and knows the needs of your location, can be of great help. Here are some general tips which may assist you.

There are three criteria by which an antenna should be judged: gain, directionality and front-to-back ratio. Gain is the amount of signal amplification provided. Directionality refers to the sharpness of its acceptance pattern in selecting one compass direction, and minimizing signals from widely divergent compass points. The front-to-back

ratio is a separate element of directionality, in that it specifies the ability to reject a signal coming from the rear. Some highly directional antennae are capable of picking up signals from the rear almost as well as from the front, and thus have a low front-to-back ratio.

Yagi or log periodic antennae should be used, though they are more costly than the omni-directional (non-directional) designs. Non-directional antennae are more subject to multipath effects, and offer no more gain than the folded dipole, though the roof location may afford some improvement in reception of some signals.

In the city there is usually plenty of signal strength, but the reflections from surrounding buildings require good directionality and an excellent (high) front-to-back ratio for good stereo reception. Unfortunately, to obtain these, it is usually necessary to buy a high gain antenna. As a result you may find that you have such high signal intensities that some stations may come in at several points on the dial. These are known as images, or spurious responses, from which no tuner is immune. To overcome these, you can install an attenuator, or resistive network at the input terminals to "pad down" the signal. A type which can be switched out would enable you to pick up weak stations when desired. Write Dynaco for details.

For suburban locations, like those in "fringe areas", you need only consider gain if you are interested in receiving the maximum number of stations clearly. A strong local transmitter can impose special directional considerations, though.

If all of your stations are from one general direction, the antenna may be rigidly mounted facing that way. Or, if they are from two opposite directions, an antenna with reasonable gain and directivity, and a low front-to-back ratio may work well. However, if they are from many directions of the compass, you should use an antenna rotator.

If you are in a difficult reception area, you may find that changes in mast location, as well as its height, may effect improvements. In some cases, tilting the antenna off the horizontal is beneficial. Note that by far the most-used location is the least satisfactory: the chimney. Antennae are adversely affected by contamination, and heat affects the lead-in. A chimney supplies both in abundance.

The best antennae for FM use are cut specifically for the FM band, which lies between TV channels 6 and 7. Most television antennae also provide reasonable FM sensitivity, and these, with a single lead-in, can be used with a two-set coupler, or splitter, to provide slightly reduced signals to both FM and TV. Some television antenna systems actually reject the FM band. This may be the case in some apartment house distribution systems, though the more recent ones include FM as a rule.

If two antennae are mounted on the same mast, locate them at least 3 feet apart to minimize interference between them. Do not connect the terminals of one antenna to the terminals of a different antenna so as to use a single downlead. Always use separate lead-ins. This is quite a different matter from "stacking" or properly combining two similar antennas in close proximity to obtain a boosted more directional signal in extreme fringe locations.

Lead-In Wire

There are three basic criteria in selecting the appropriate lead-in: impedance matching (to avoid unnecessary signal loss), signal loss characteristic (expressed in db/100 feet), and shielding, or intrinsic resistance to interference.

There are two impedances of FM systems: 72 (or 75) ohms, and 300 ohms. The FM-5 provides for direct connection of either. The majority of antennae are designed for 300 ohm systems, but matching transformers, or baluns, may be used to convert from one antenna impedance to the other lead-in impedance with minimum signal loss. There are several types of 300 ohm lead-in, but only one 72 ohm in common use—coaxial shielded RG-59U. For extremely long runs, RG-11U is a lower loss equivalent.

RG-59U is used in many apartment house distribution systems and cable TV systems for it has relatively low signal loss and good life expectancy and very good shielding. It is fairly expensive and somewhat bulky, and the installation of connectors is a nuisance, but it is still preferred by many installers where interference, such as from motor vehicles, is a problem.

The most popular 300 ohm lead-in is the flat "ribbon" twinlead. It is the least expensive, has fairly low signal loss (at least when it is new), and low bulk, so it can be run (though with adverse effect on signal) under carpets and along walls with minimum unsightliness. Since it has no shielding, installers try to avoid horizontal runs as much as possible, stay away from metal surfaces like gutters and downspouts, and twist it about once each foot to reduce interference pickup. Twinlead is more subject than most to the effects of weather, and it should be replaced after about 3 years in most localities.

In fringe areas where maximum signal transmission is important, a special open wire 300 ohm twinlead uses plastic spacers to support the two conductors with a minimum of loss. It, too, has no shielding capability, and is affected by the elements. Weather resistance has been improved with some types of oval twinlead, both hollow and foam-filled, at the expense of considerable bulk and increased cost.

ASSEMBLY INSTRUCTIONS

Assembly of the FM-5 is exceptionally simple when compared to other kits. The preassembled etched circuit boards have saved you much of the work, and the assembly that remains is arranged in an open, uncluttered layout that makes wiring quick and easy. The construction time will be only a few hours, but it is best to work slowly and carefully rather than worry about the time.

Construction will be greatly simplified if you have someone help you by reading the steps aloud, selecting the required parts, and preparing the necessary wire lengths as you proceed.

When you unpack your kit, check off the components against the parts list at the back of the manual. You can identify unfamiliar parts by matching them to the pictorial diagram or photograph.

Have the proper tools at hand before starting assembly. You will need a pencil-type soldering iron of 30- to 60-watt rating with a small tip, long nosed pliers, diagonal cutting

The most recent variation is shielded 300 ohm cable. It is the most expensive, with moderate signal loss, and is the bulkiest of all. It is well shielded and has good life expectancy, so it is preferred by many installers in urban areas.

The right choice of antenna and lead-in can take maximum advantage of the FM-5's superior performance. The antenna system is a substantially greater factor than any tuner design characteristic in achieving good reception of weak signals. The Dynatuner's front end has such low noise that it is doubtful if any form of booster or antenna amplifier can provide a signal with any listenable improvement over that directly from the antenna.

The critical listener may well spend as much for the antenna system as for the FM-5, but such a combination will accomplish far more than a rudimentary antenna attached to tuners several times the cost of the FM-5.

OPERATION OUTSIDE THE UNITED STATES CONNECTIONS FOR 240 VOLT AC LINE

The power transformer supplied in the FM-5 may be connected for a 240 volt AC line as well as for the standard 120 volt AC line, which is how the transformer is wired unless this manual is stamped "240 volt". The transformer has dual primary windings. They are connected in parallel for 120 volts, and in series for 240 volts. The notes to steps 93 and 94 of the wiring instructions, and the diagram on the pictorial insert detail the 240 volt connections.

The $\frac{1}{10}$ ampere (100 ma) slo-blo fuse supplied with 120 volt wiring should be replaced with a $\frac{1}{16}$ ampere (62 ma) slo-blo fuse when the tuner is wired for 240 volt use.

The FM-5 is designed for use with either 50 Hz or 60 Hz current. Variations of line voltage up to 10% from nominal value will not affect performance.

The standard 75 μ sec FM de-emphasis time constant used in the United States is used in many other countries as well. If your location uses the alternative 50 μ sec de-emphasis (common in Europe), capacitors C-64 and C-65 on the PC-26 board should each be changed to .0056 mfd.

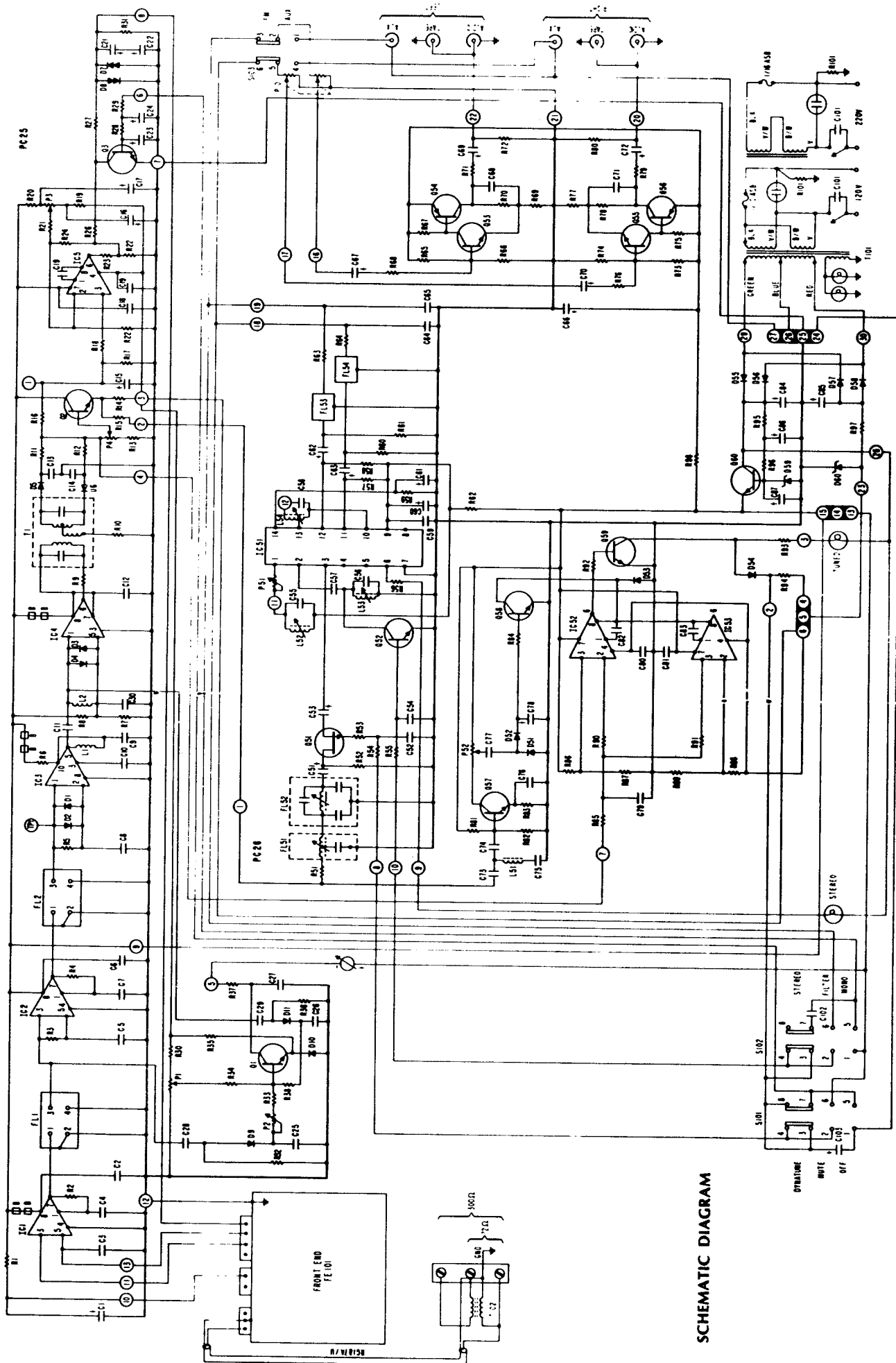
pliers, a medium-sized screwdriver, and 60/40 rosin core solder not larger than $\frac{1}{16}$ " diameter. You will also find a damp sponge or cloth helpful to wipe the tip of the iron clean periodically. An inexpensive wire stripping tool is helpful, but some people prefer a single-edged razor blade for removing the insulation.

A good solder connection does not require a large amount of solder around the joint. A well-made connection looks smooth and shiny because the solder flows into the joint when both parts are hot enough.

There are four steps to making a good solder connection:

1. Make a good mechanical connection.
2. Heat both parts with the tip of the iron at the junction.
3. Apply solder to the junction until it melts and flows.
4. Allow the connection to cool undisturbed.

ALL SOLDERING MUST BE DONE WITH A GOOD GRADE OF ROSIN CORE SOLDER.



SCHEMATIC DIAGRAM

PARTS LIST FOR SCHEMATIC DIAGRAM

All resistors are 1/4 watt, 10% tolerance unless otherwise indicated.

			PART #				PART #				PART #
R1	47 ohms		117470	R30	27,000 ohms		117273	R71	1,000 ohms		117102
R2	330 ohms, 5%		119331	R31	1 megohm, 5%		119105	R72	220,000 ohms		117224
R3	330 ohms, 5%		119331	R32	10,000 ohms, 5%		119103	R73	2.2 megohm, 5%		119225
R4	330 ohms, 5%		119331	R33	10,000 ohms, 5%		119103	R74	180,000 ohms, 5%		119184
R5	330 ohms, 5%		119331	R34	100,000 ohms		117104	R75	12,000 ohms, 5%		119123
R6	240 ohms		117241	R35	4,700 ohms, 5%		119472	R76	1,000 ohms		117102
R7	2,200 ohms		117222	R36	10,000 ohms, 5%		119103	R77	82 ohms, 5%		119820
R8	1,200 ohms		117122	R37	47,000 ohms		117473	R78	2,200 ohms, 5%		119222
R9	240 ohms		117241	R38	22,000 ohms, 5%		119223	R79	1,000 ohms		117102
R10	68 ohms		117680	R51	1,300 ohms, 5%		119132	R80	220,000 ohms		117224
R11	5,600 ohms, 5%		119562	R52	220,000 ohms		117224	R81	8,200 ohms, 5%		119822
R12	5,600 ohms, 5%		119562	R53	100,000 ohms		117104	R82	1,200 ohms, 5%		119122
R13	39,000 ohms		117393	R54	100,000 ohms		117104	R83	1,000 ohms, 5%		119102
R14	10,000 ohms, 5%		119103	R55	100,000 ohms		117104	R84	1,000 ohms		117102
R15	100 ohms		117101	R56	150 ohms		117151	R85	100,000 ohms		117104
R16	47,000 ohms		117473	R57	3,900 ohms, 5%		119392	R86	22,000 ohms, 5%		119223
R17	100,000 ohms		117104	R58	3,900 ohms, 5%		119392	R87	390 ohms, 5%		119391
R18	2,200 ohms		117222	R59	10,000 ohms, 5%		119103	R88	22,000 ohms, 5%		119223
R19	15,000 ohms		117153	R60	220,000 ohms		117224	R89	390 ohms, 5%		119391
R20	15,000 ohms		117153	R61	220,000 ohms		117224	R90	2,200 ohms		117222
R21	470,000 ohms		117474	R62	100 ohms		117101	R91	2,200 ohms		117222
R22	10,000 ohms, 5%		119103	R63	10,000 ohms, 5%		119103	R92	10,000 ohms		117103
R23	8,200 ohms		117822	R64	10,000 ohms, 5%		119103	R93	150 ohms		117151
R24	1 megohm, 5%		119105	R65	2.2 megohm, 5%		119225	R94	100,000 ohms		117104
R25	2,200 ohms, 5%		119222	R66	180,000 ohms, 5%		119184	R95	560 ohms		117561
R26	47,000 ohms		117473	R67	12,000 ohms, 5%		119123	R96	560 ohms		117561
R27	47,000 ohms		117473	R68	1,000 ohms		117102	R97	150 ohms, 5%, 1/2 watt		113151
R28	47,000 ohms		117473	R69	82 ohms, 5%		119820	R98	100 ohm		117101
R29	47,000 ohms		117473	R70	2,200 ohms, 5%		119222	R101	3.3 megohm, 1/2 watt		112335
<hr/>											
B	ferrite bead		417590	C74	560 pf, 100v., 5%		254561	IC1	IC LM703L		587010
C1	200 mfd, 15v.		283207	C75	.01 mfd, 100v., 5%		205103	IC2	IC LM703L		587010
C2	to			C76	.01 mfd, 100v., 20%		234103	IC3	IC CA3012		587012
C12	.01 mfd, 100v., 20%		234103	C77	.22 mfd, 100v., 10%		204224	IC4	IC LM3028		587028
C13	220 pf, 5%		245221	C78	1 mfd, 25v.		283105	IC5	IC LM301AH		587709
C14	220 pf, 5%		245221	C79	.47 mfd, 100v., 10%		260474	IC51	IC MC1307P/ μ A769		587307
C15	5 mfd, 15v.		283505	C80	.01 mfd, 100v., 20%		234103	IC52	IC LM301AH		587709
C16	1 mfd, 25v.		283105	C81	.01 mfd, 100v., 20%		234103	IC53	IC LM301AH		587709
C17	1 mfd, 25v.		283105	C82	.001 mfd, 100v., 10%		240102	L1	27 μ h choke		413027
C18	.01 mfd, 100v., 20%		234103	C83	.001 mfd, 100v., 10%		240102	L2	27 μ h choke		413027
C19	33 pf, NPO		247330	C84	500 mfd, 25v.		280507	L51	.43 mh coil		422431
C20	.01 mfd, 100v., 20%		234103	C85	500 mfd, 25v.		280507	L52	7 mh coil		422019
C21	33 mfd, 10v.		283336	C86	250 mfd, 25v.		280257	L53	7 mh coil		422019
C22	33 mfd, 10v.		283336	C87	5 mfd, 15v.		283505	L54	8 mh coil		422038
C23	1 mfd, 25v.		283105	C101	.02 mfd, 500v.		227203	P1	10,000 ohms trimpot		140103
C24	5 mfd, 15v.		283505	C102	.0082 mfd, 100v., 5%		264822	P2	22,000 ohms trimpot		140223
C25	.01 mfd, 100v., 20%		234103	C103	1 mfd, 15v.		283105	P3	4,700 ohms trimpot		140472
C26	.01 mfd, 100v., 20%		234103	D1	germanium diode		543541	P4	22,000 ohms trimpot		140223
C27	.01 mfd, 100v., 20%		234103	D2	germanium diode		543541	P51	470 ohms trimpot		140471
C28	5.6 pf, NPO		244050	D3	silicon diode		543148	P52	10,000 ohms trimpot		140103
C29	5.6 pf, NPO		244050	D4	silicon diode		543148	P101	volume control w/switch		180203
C30	.01 mfd, 100v., 20%		234103	D5	germanium diode		543541	Q1	transistor BC237A		577020
C31	5 mfd, 15v.		283505	D6	germanium diode		543541	Q2	transistor BC237A		577020
C32	.47 mfd, 100v., 10%		260474	D7	silicon dual diode		546361	Q3	transistor BC237A		577020
C33	5 mfd, 15v.		283505	D8	silicon dual diode		546361	Q51	FET 2N5462		597462
C34	.22 mfd, 100v., 10%		204224	D9	germanium diode		543541	Q52	transistor BC237A		577020
C35	.01 mfd, 33v., 5%		263103	D10	silicon diode		543148	Q53	transistor BC237A		577020
C36	.01 mfd, 33v., 5%		263103	D11	germanium diode		543541	Q54	transistor BC308B		567070
C37	.1 mfd, 100v., 10%		204104	D51	silicon diode		543148	Q55	transistor BC237A		577020
C38	.0022 mfd, 33v., 5%		263222	D52	silicon diode		543148	Q56	transistor BC308B		567070
C39	.01 mfd, 100v., 20%		234103	D53	silicon diode		543148	Q57	transistor BC237A		577020
C40	200 mfd, 15v.		283207	D54	germanium diode		543541	Q58	transistor BC237A		577020
C41	5 mfd, 15v.		283505	D55	silicon diode		544012	Q59	transistor BC237A		577020
C42	5 mfd, 15v.		283505	D56	silicon diode		544012	Q60	transistor D40D2		574001
C43	5 mfd, 15v.		283505	D57	silicon diode		544012	S101	DPTT rocker switch		337001
C44	.0082 mfd, 100v., 5%		264822	D58	silicon diode		544012	S102	DPTT rocker switch		337001
C45	.0082 mfd, 100v., 5%		264822	D59	zener diode		540014	S103	DPDT rocker switch		334006
C46	200 mfd, 15v.		283207	D60	zener diode		540113	T1	ratio detector		432022
C47	1 mfd, 25v.		283105	FE101	front end		553503	T101	power transformer		464122
C48	.001 mfd, 100v., 10%		240102	FL1	4-pole ceramic filter		505107	RF	balun		414022
C49	1 mfd, 25v.		283105	FL2	4-pole ceramic filter		505107				
C50	1 mfd, 25v.		283105	FL51	phase comp. filter		420122				
C51	.001 mfd, 100v., 10%		240102	FL52	67 kHz filter		420022				
C52	1 mfd, 25v.		283105	FL53	19 kHz filter		420100				
C53	360 pf, 100v., 5%		254361	FL54	19 kHz filter		420100				

PROFESSIONAL SERVICE ALIGNMENT

(FOR QUALIFIED PERSONNEL WITH THE PROPER EQUIPMENT ONLY)

There is no provision for any home alignment of the FM-5, and under no circumstances should any adjustments be made without the following service equipment:

1. Sound Technology 1000A FM alignment generator, or the equivalent, such as a Measurements Corporation Model 88 or 210A generator, plus a suitable multiplex generator with adjustable pilot level, and an accurate 67 kHz oscillator.
2. Oscilloscope—Hewlett Packard 130C or equivalent with its Diode Probe and a 10:1 Probe.
3. AC voltmeter with rms scale.
4. DC voltmeter, with 0.5 volt or less full scale; 10 megohms input impedance.
5. Intermodulation Analyzer.

Operate both the tuner and the instruments for at least 20 minutes prior to alignment.

IF Alignment

Locate a dial setting between stations. Switch the tuner to MONO, Dynatune OFF, and maximum volume. Tune the generator to the same frequency with 200 kHz deviation and a 3000 μ v output. Connect the diode probe to the scope vertical input, with a sensitivity of 10 mv/cm. Set the scope's horizontal external sensitivity for 1 v/cm, with the sweep ("external" or "horizontal") output of the generator connected to the horizontal input.

The diode probe connected to TP 1 of PC-25 will show tuning as a bandpass curve. Center the curve on the scope display with the tuning knob. The IF secondary, accessible through a hole in the front panel, is the *only* adjustment on the front end. Seek the best combination of symmetry and amplitude.

Detector

Reduce the sweep to 75 kHz, but be careful not to touch the tuning of either the generator or the FM-5. Connect the DC voltmeter (on its most sensitive scale) to the tuner chassis and to eyelet #4 on PC-25. Adjust the secondary (top) of the detector transformer T 1 for zero. Disconnect the diode probe. Switch the generator to external modulation and connect IM analyzer to it. The IM signal should be in a 1:1 ratio to allow for de-emphasis. Adjust the IM analyzer level for 100% modulation as indicated on the modulation meter. Connect the tuner output to the IM analyzer. Adjust the primary (bottom) of the detector transformer for minimum IM. Remove IM analyzer.

Audio Level

Maintain 3000 μ v signal level and switch to 400 Hz modulation. Adjust trimpot P 4 on PC-25 for 2 volts audio output from tuner with the volume control fully up.

Muting Threshold

Switch to MUTE, attenuate the generator output to 8 μ v (assuming the use of a 2:1 balun), and adjust trimpot P 52 on PC-26 until the audio just mutes off. Adjust trimpot P 52 until audio just comes on (actually 4 μ v).

Dynatune

Return the generator to 3000 μ v. Connect the DC probe to eyelet #1 on PC-25. Retune for zero if necessary. Then switch the mute switch to DYNATUNE. If the zero indication changes *at all*, adjust trimpot P 3 on PC-25 for zero.

67 kHz Filtering

From an external oscillator connect an *accurate* 67 kHz source to the external modulation input of the FM generator. Connect the 10:1 probe to the negative side (the top end) of C 51. While observing the 67 kHz on the scope, adjust filter FL 52 for minimum amplitude.

Multiplex

Switch to STEREO. Connect the stereo generator to the external input of the FM generator. Connect the 10:1 probe to the vertical input of the scope, and set the internal sweep to approximately 2 milliseconds/cm. Connect the probe to eyelet #11 on PC-26. Peak both the 19 kHz coils L 52 and L 53 for maximum vertical deflection. Go back and forth.

Reduce the pilot level on the multiplex generator to 5%. Adjust trimpot P 51 until the STEREO light goes out. Then adjust trimpot P 51 until the STEREO light just comes on. The STEREO light should come on at 5% of the total modulation. Return pilot level at generator to 10%. Move the probe to eyelet #12 on PC-26 and adjust the 38 kHz coil L 54 for maximum vertical deflection. Remove probe.

With 1 kHz modulation on the left channel only, observe the right channel output and adjust first the 38 kHz coil L 54 and then the 19 kHz coil L 53 for minimum indication (maximum separation). Compare left and right separation. Switch to 10 kHz modulation on the left channel and adjust filter FL 51 for minimum indication (maximum separation).

Meter Adjustment

Switch to MONO and decrease FM generator output to 10 μ v. Set trimpot P 1 on PC-25 for 25% meter deflection. Increase the FM output to 30,000 μ v. Set trimpot P 2 for full scale meter deflection.

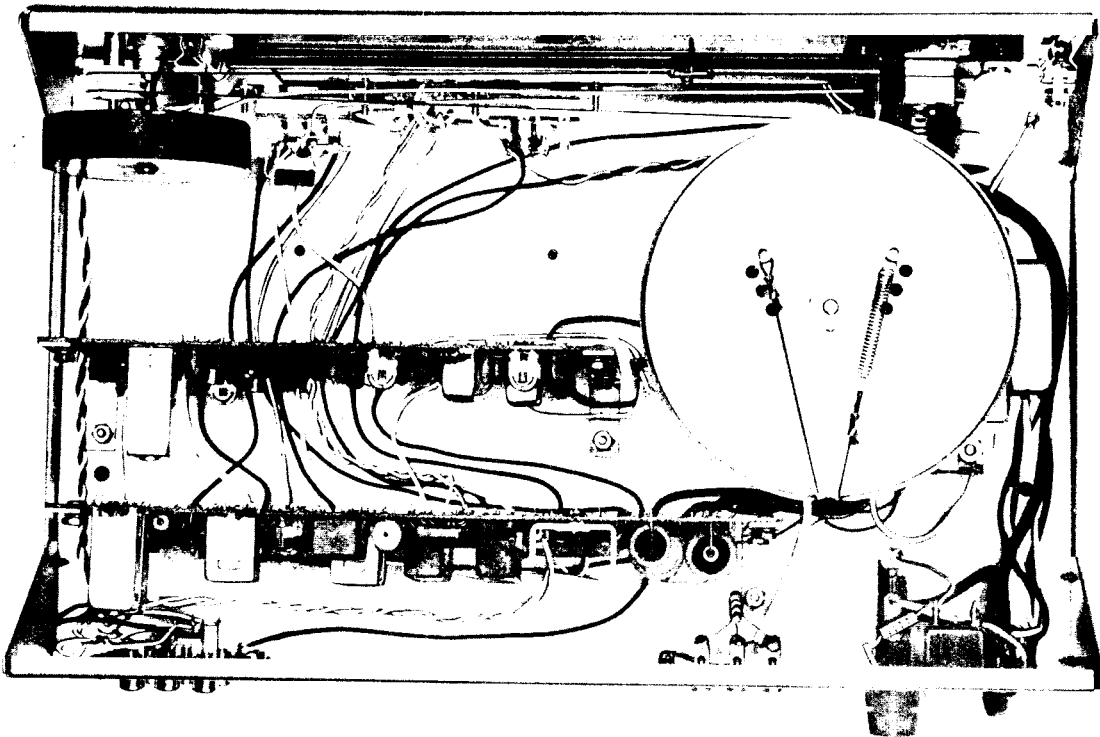
Service Note: The TUNED indicator lamp is a part of the muting circuit. If it is *shorted*, the audio will remain muted, even on a station. Switching the muting *off* will enable signal reception until the lamp is replaced. If the lamp is *open*, the muting circuit will not work and there will be noise between stations in all switch positions.

KIT PARTS LIST

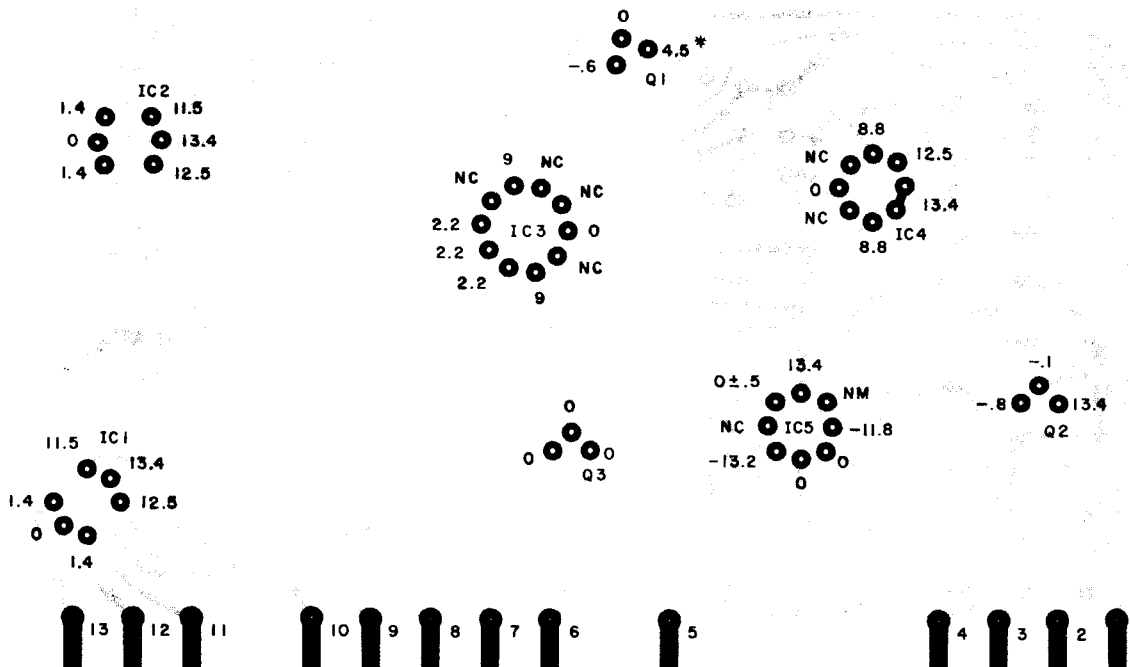
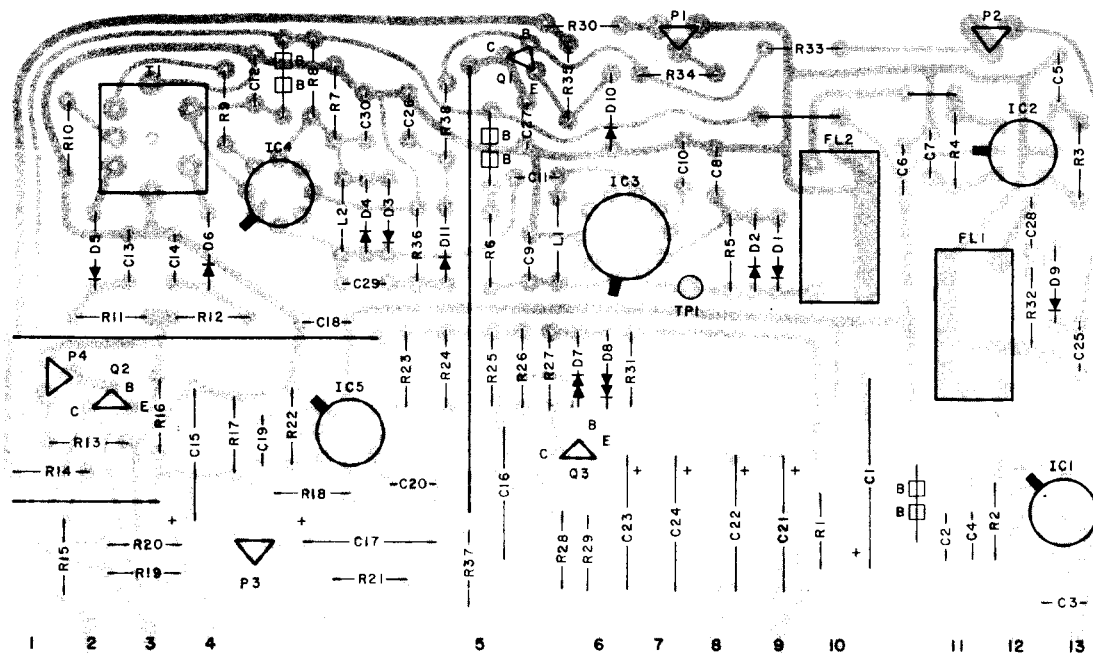
Parts of similar type which do not change performance will sometimes be included as a matter of expediency. This will account for slight variations in value and appearance.

	PART #	Hardware Envelope	PART #
1 Chassis bottom plate	711622	4 Foot, rubber	859001
1 Chassis front panel	711322	1 Fuse, 1/10 ampere slo-blo	342101
1 Chassis back panel	711222	1 Fuse, 1/10 amp. slo-blo pigtail (Canada only)	342102
1 Chassis sub-panel (black front)	711722	4 Ground lug	639308
1 Circuit board assembly, PC-25	957025	38 Lockwasher, #6	617305
1 Circuit board assembly, PC-26	957026	2 Lockwasher, 3/8"	617065
1 Cover	711022	29 Nut, hexagonal, #4-40	614245
1 Front End assembly	553503	6 Nut, hexagonal, #6-32	614355
1 Front plate—gold	769022	4 Nut, hexagonal, 3/8"	614065
1 Transformer, power	464122	4 Screw, machine, #4-40 x 3/4"	611205
1 Transformer, power (Canada only)	464123	29 Screw, machine, #4-40 x 1/4"	611245
		8 Screw, machine, #6-32 x 3/16"	611355
1 AC outlet	351001	3 Screw, self tapping, #6 blue	613345
1 Antenna	312316	17 Screw, sheet metal, #6	612339
1 Bracket, lamp holder	710122	5 Set screw, 3/16" Allen head	613834
1 Bracket, circuit board	710422	4 Spacer, tubular aluminum	660261
4 Bracket, audio connecting	321072	1 Strain relief, plastic	895001
2 Cable, audio connecting	320187	3 Washer, fiber	876022
1 Cable, coaxial shielded, 7"	844022	1 Wrench, Allen #5	968522
1 Dial plate, plastic	715022		
1 Flywheel	341001	<i>Small Parts Box</i>	
1 Fuse holder, with hardware	764185	1 antenna coil, balun, tubular	414022
1 Knob, small	764184	1 capacitor, .02 mfd disc ceramic	227203
1 Knob, large	808021	1 capacitor, .0082 mfd, 5% mylar	264822
1 Label, FCC certification	376022	1 capacitor, 1.0 mfd electrolytic	283105
2 Lamp holder, clip type	322092	1 dial cord assembly	890022
1 Line cord	717022	2 lamp, dial, tubular	526008
1 Pulley, tuning, 4" diameter	893002	1 lamp, indicator, blue & white leads	526112
1 Sleeving, large, 6"	395003	1 lamp, indicator, blue & red leads	526012
2 Socket strip, audio, 3 outputs	337001	2 lamp cover, blue plastic	834022
2 Switch, rocker, DPTT (8 lugs)	334006	1 meter	508022
1 Switch, rocker, DPDT (6 lugs)	373003	1 meter cover, black	711522
1 Terminal strip, 3 screw	372001	1 pointer, dial	737022
1 Terminal strip, 2 lug	180203	3 pulley, nylon	894022
1 Volume control with switch		2 pulley support, brass	733122
1 Wire, hookup, black		1 resistor, 3.3 megohm, 1/2 watt	112335
1 Wire, hookup, green		1 sleeving, insulating, small	893001
1 Wire, hookup, red		1 spring, dial cord	712122
1 Card, warranty		1 tuning shaft assembly	733022
1 Manual, instruction			

Do not remove the teflon tape from the angled flange of the sub-panel.



PC-25



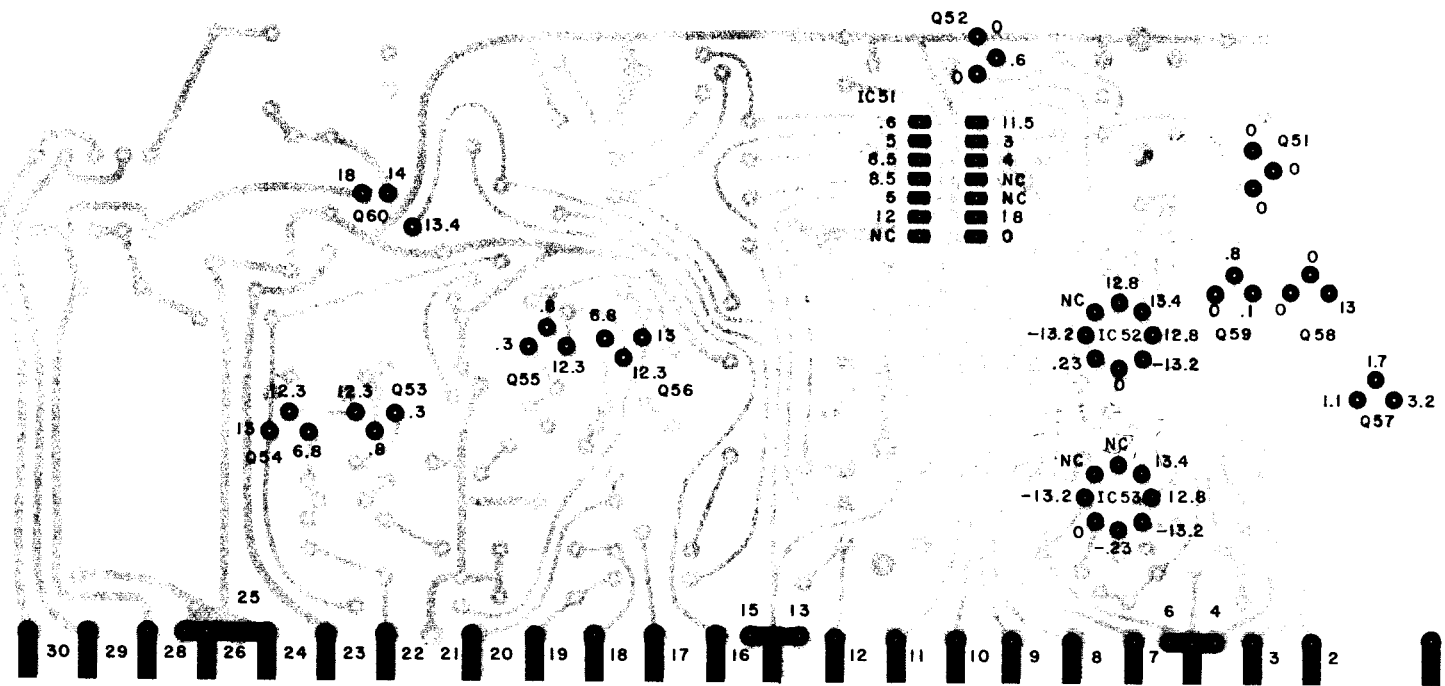
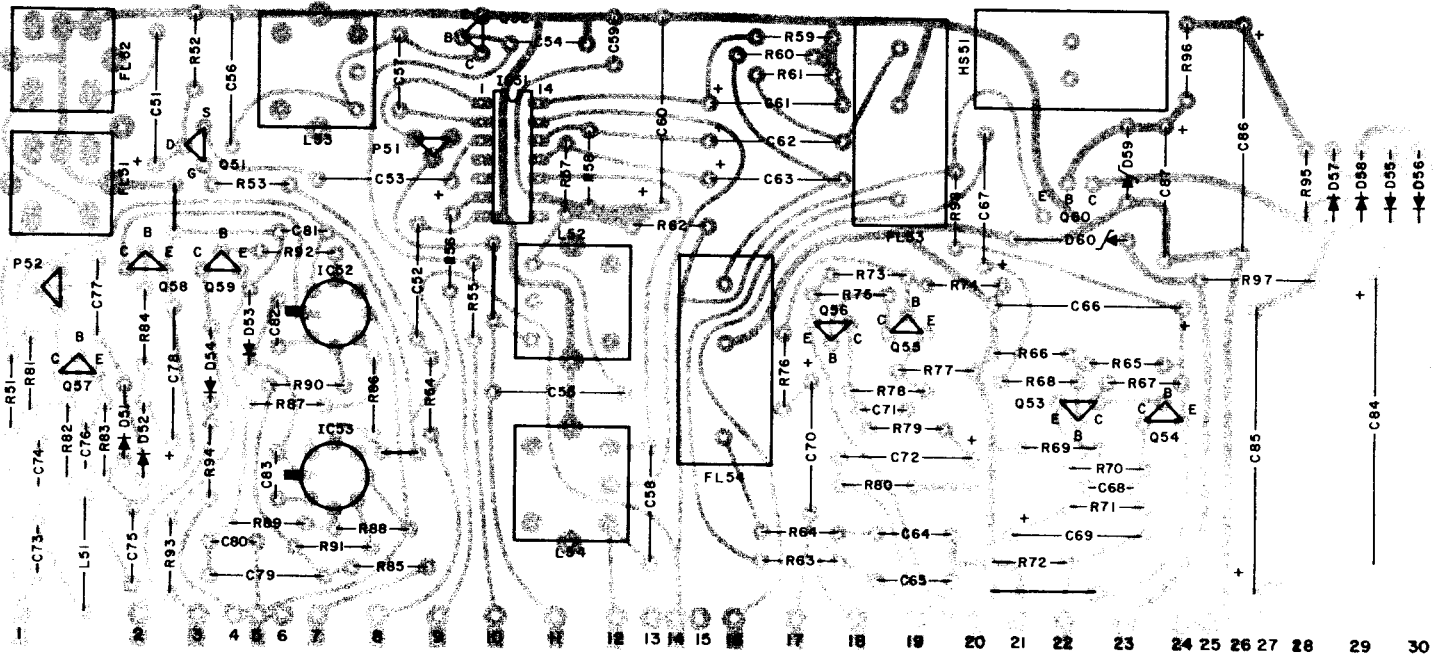
THIS VIEW IS OF THE CIRCUIT SIDE OF BOARD

VOLTAGE TEST POINTS

Measured with VTVM or TVM with at least 10 megohms input impedance. All measurements taken with a 1500 μ V input (unless otherwise noted), MONO mode, with muting switch in DYNATUNE. Chassis is ground reference. Be careful the meter does not short to adjacent circuit points or damage may result.

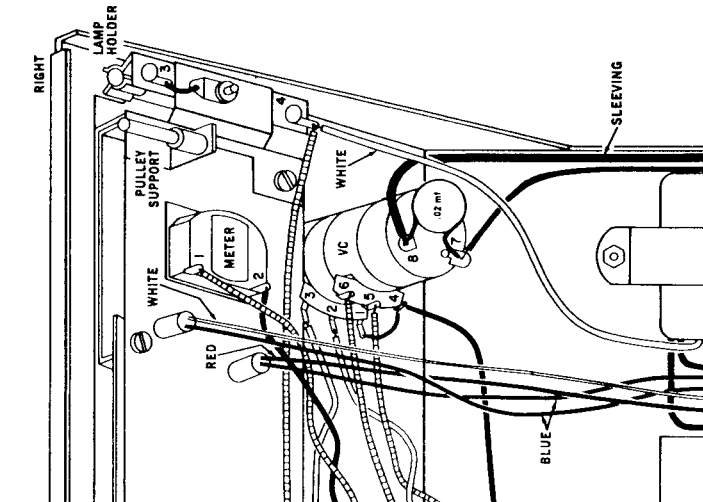
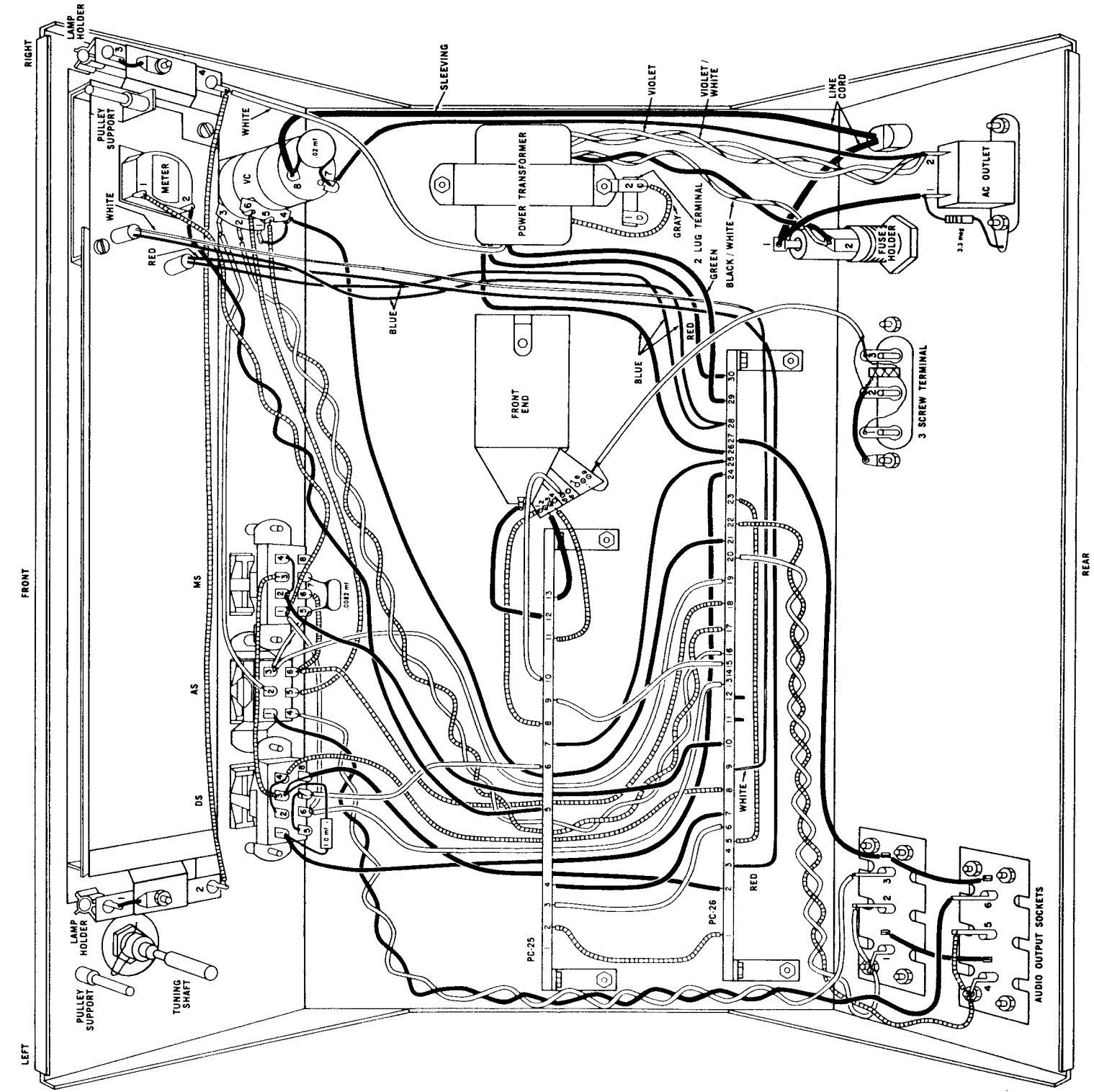
* @ full scale deflection of tuning meter
 NC = No Connection

NM = Not Measurable (no meaning)

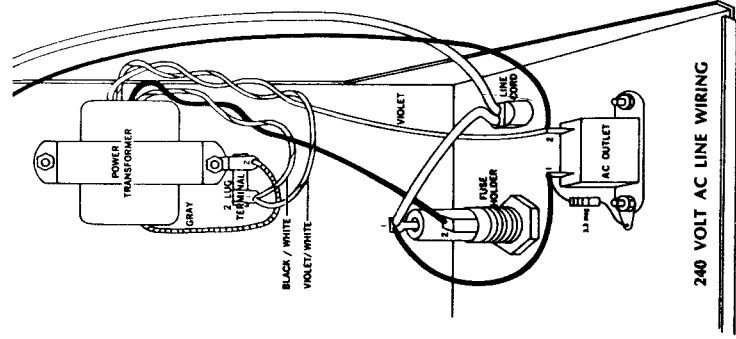


THIS VIEW IS OF THE CIRCUIT SIDE OF BOARD

FM-5 PICTORIAL DIAGRAM

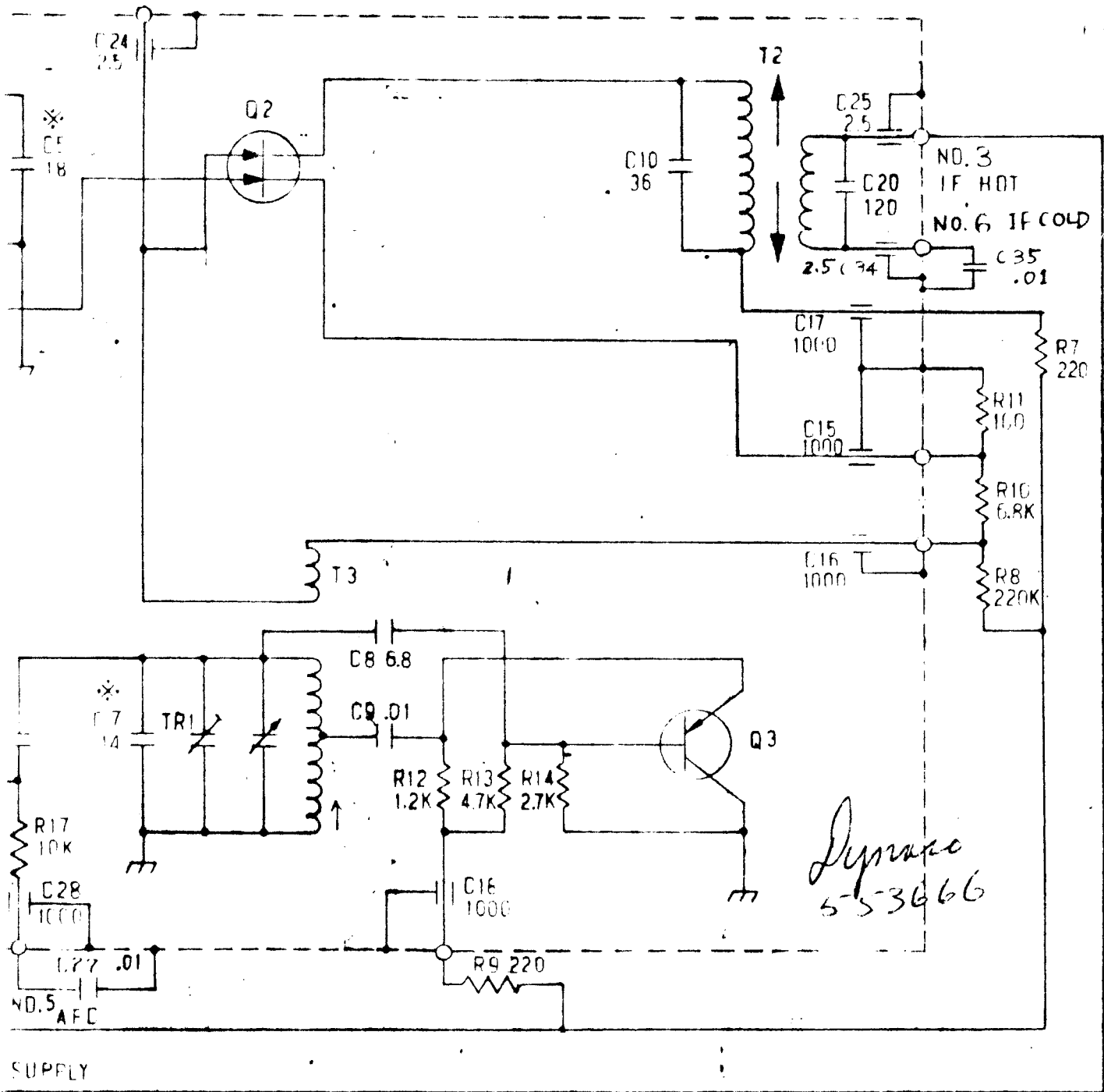


120 VOLT AC LINE WIRING
FOR UNITS OBTAINED IN CANADA



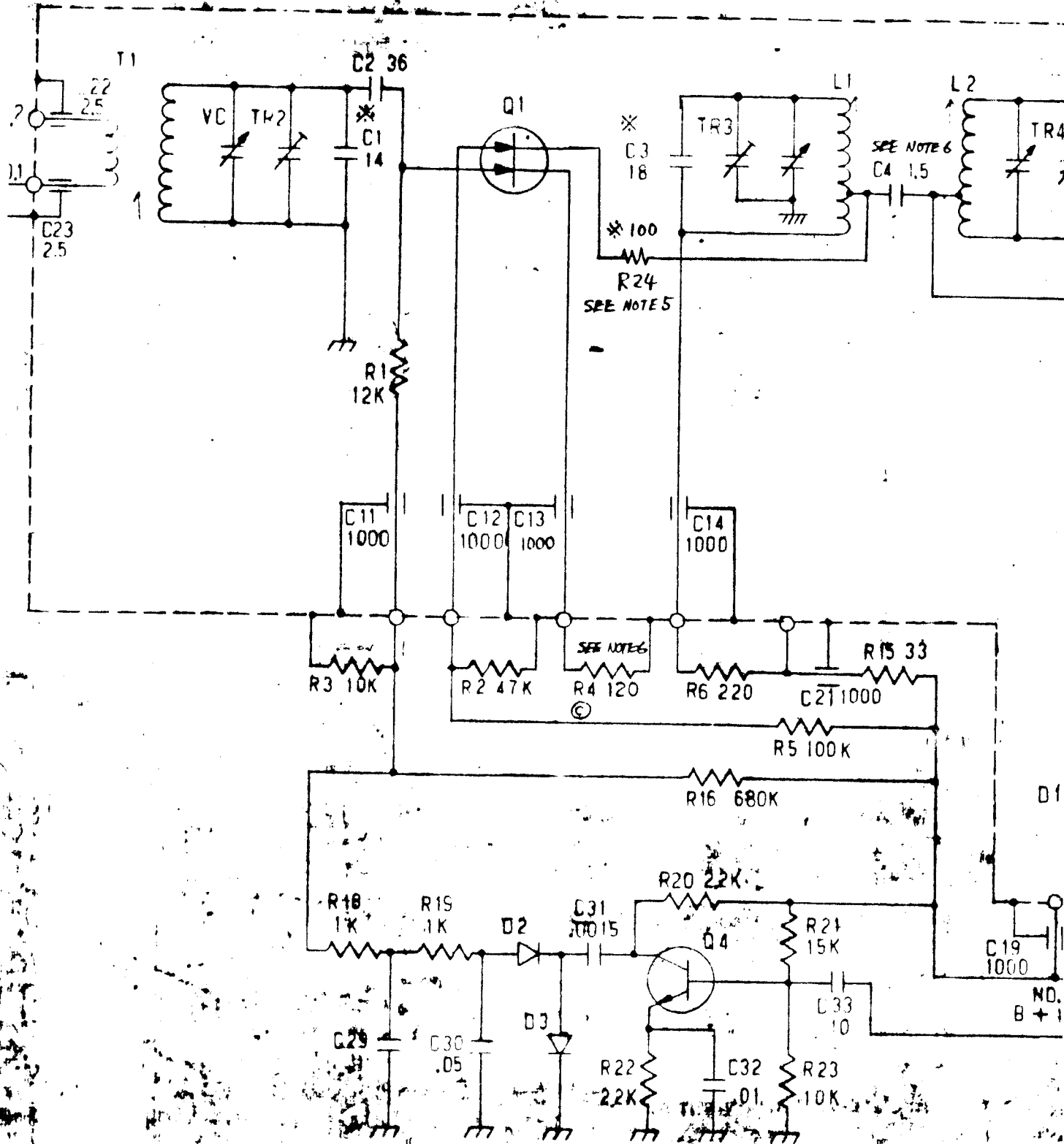
240 VOLT AC LINE WIRING

T.P



(A) ADDED C34 2.5P, ADDED C35 .01MFD, NO.6 AGC REMOVED, NO.6 IF COLD ADDED. 9-18-72 Tsujii
 (B) Q1 ~ L1 CKT CHANGED 10-19-72 (F) NOTE 6 3-8-73 CL
 (C) R4 120 WAS 150 11-16-72 K.Y
 (D) C6 22 PRT 10-19-73 E.T (E) R24 ADDED, NOTES, NOTES ADDED 11-21-73 E.T

TOLERANCES UNLESS OTHERWISE SPECIFIED				WALLER JAPAN K.K.	
DECIMALS	±TOL	FRACTIONS	±TOL	TOKOROZAWA SAITAMAKEN JAPAN	
X	.030	1/16	1/16	NAME 43SN5DF2-31 SCHEMATIC	
XX	.020	0 TO 24	1/32	SIGNATURE	
XXX	.010	ABOVE 24	1/64	DATE	
ANGULAR TOL ±4				FIRST USED IN ASSEMBLY	
DIMENSIONS IN INCHES UNLESS OTHERWISE SPECIFIED ON DRAWING				FIRST MADE FOR	
DO NOT SCALE DRAWING				DWG. NO	
				143204	
				SCALE	

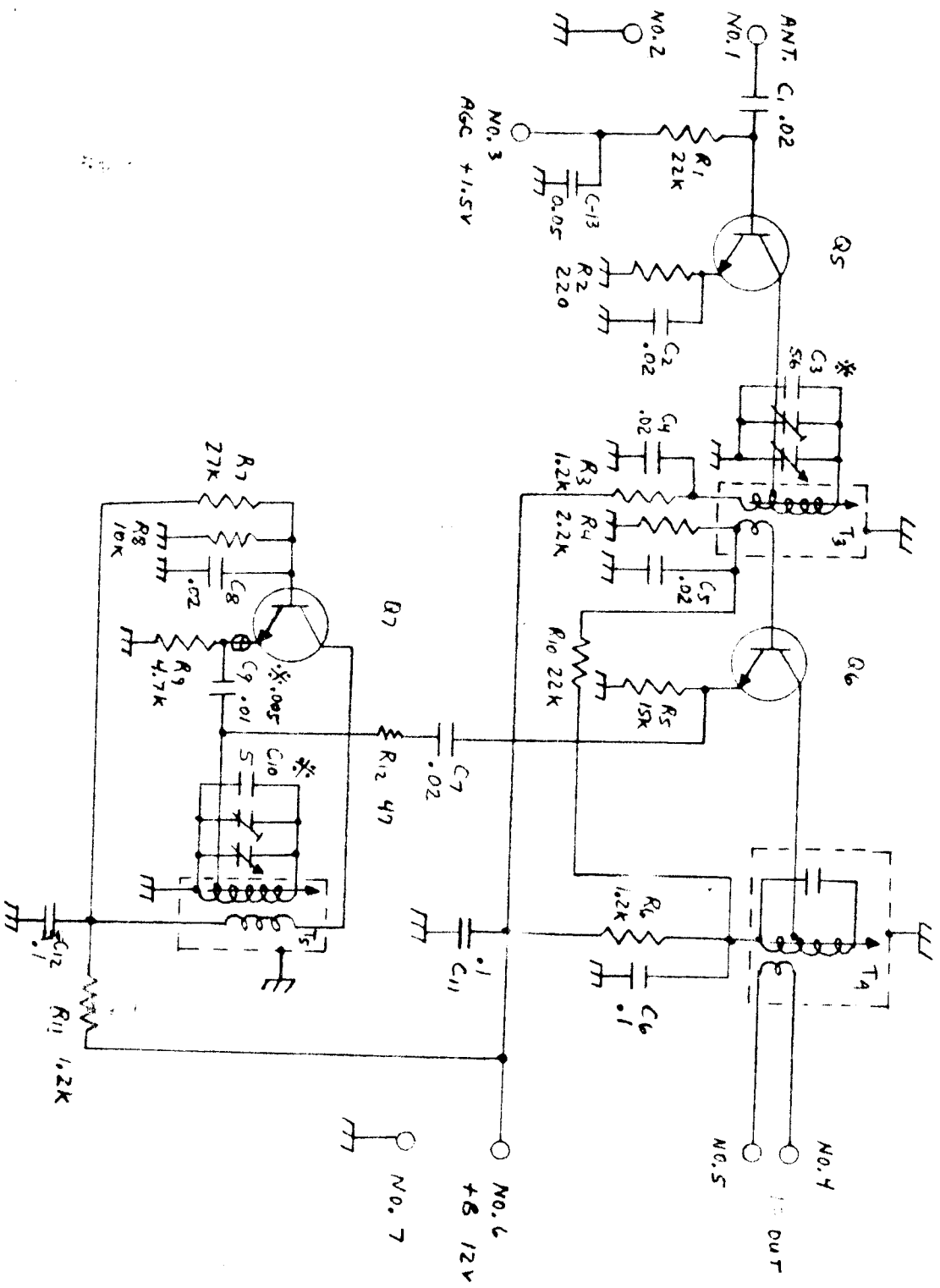


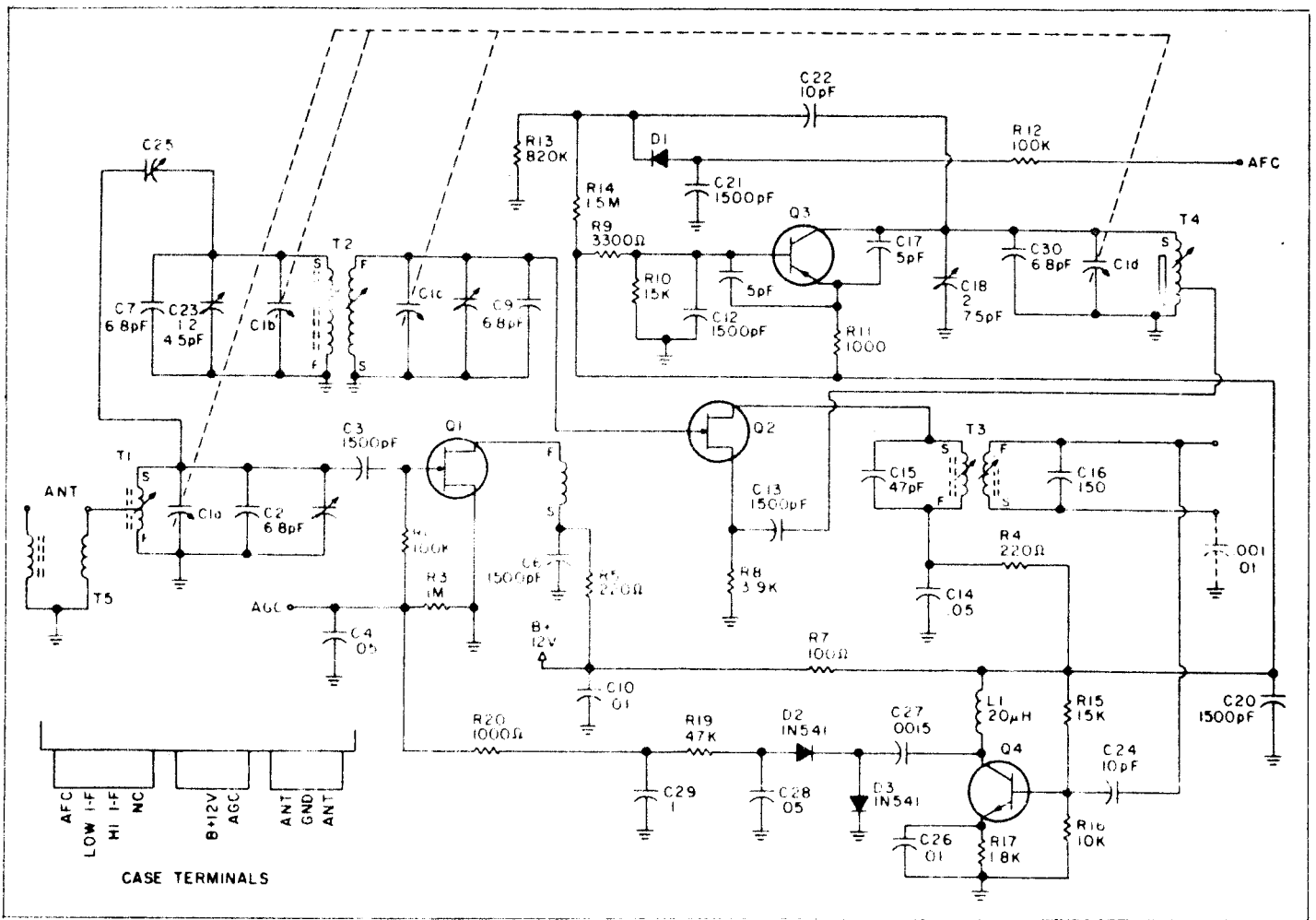
NOTES

1. ALL CAPACITANCE VALUES IN MMF EXCEPT DECIMAL VALUES IN MF.
2. ALL RESISTANCE VALUES IN OHMS.
3. Q1: 180693. (MOS FET) MADE BY RCA } OR { MEM 616 (MOS FET) MADE BY G.S.
 Q2: 180692. (MOS FET) MADE BY RCA } OR { MEM 617 (MOS FET) MADE BY G.S.
- Q3: SPS 2295
- Q4: 183017

4. VALUES SELECTED AT FACTORY AVERAGE VALUE SHOWN. *
 5. R24 IS REQUIRED ONLY WHEN Q1, MOS FETS ARE USED.
 6. R24 IS NOT REQUIRED WHEN Q4 IS MOS FET.

Dynaco AF6





The Audio Research SP-6 makes a return visit to our pages, this time in its revised SP-6A version on the facing page, and with a full parts listing below. Note the size of the coupling capacitors on both amplifier stages. We thank Tom Tutay for sharing the schematic (slightly marked up) with us. We also thank, again, William Z. Johnson of Audio Research Corp. of Minneapolis for permission to reprint the schematic.

Dynaco's FM-5 tuner has a front end which, on the schematic, is a black box. To our knowledge, the internal details of the front end have never been made public. Since the unit is no longer available, Robert Tucker kindly provided the known details of the unit with the thought that those who may want to repair it will more likely be able to do so with the information provided above. Unfortunately we do not know more about the individual components than is designated above. □

SP-6A PARTS LIST

COMPONENT	QUAN.	DESCRIPTION	VALUE	RATING	TOL.
V1-6	6	ECC83/12AX7A			
D1-8,13	9	1N4005			
D9-12	4	1N4006			
ZD1-17	17	1N5368B	47V	5W	5%
LED1,2	2	LED			
Q1	1	MJ413 Transistor			
Q2,3	2	MJ410 Transistor			
RV1	1	Balance Control	100K	LogTaper	10%
RV2	1	Gain Control	100K	LogTaper	10%
VR1	1	7824 Voltage Regulator	24V	1A	+1%
R1	2	Metal Film	49.9K	1/2W	1%
R2	2	Carbon Comp.	4.7K	1/2W	5%
R3	2	Wirewound	300K	2/10W	1%
R4,23	4	Metal Film	2.21K	1/2W	1%
R5,20,24	6	Carbon Comp.	470K	1/2W	5%
R6,25	2	Metal Film	1.2K	1/2W	2%
R7,22,26	6	Metal Film	301K	3/4W	1%
R8,27	4	Metal Film	100K	3/4W	1%
R9	2	Metal Film	1.82Meg	1/2W	1%
R10	2	Metal Film	100K	1/2W	1%
R11,19,14-17	10	Carbon Comp.	4.7K	1/4W	5%
R12,30	4	Carbon Comp.	470Ω	1/2W	5%
R13,29	4	Carbon Comp.	1Meg	1/2W	5%
R18	2	Carbon Comp.	470Ω	1/4W	5%
R21	2	Carbon Comp.	1.8K	1/2W	5%
R25	2	Metal Film	1.5K	1/2W	1%
R28	2	Metal Film	4.99K	1/2W	1%
R31	2	Metal Film	12.1K	1/2W	1%
R33	1	Carbon Comp.	10K	2W	5%
R34,35	2	Carbon Comp.	100K	2W	5%
R36	1	Carbon Comp.	100K	1/2W	10%
R39,41	2	Carbon Comp.	820Ω	1/2W	5%
R40	1	Carbon Comp.	1.8K	1W	5%
R42	1	Carbon Comp.	1K	1W	5%
R43	1	Carbon Comp.	10K	1W	10%
R44-46	3	Carbon Comp.	270Ω	2W	10%
R47,48	2	Carbon Comp.	8.2K	2W	5%
R49	1	Carbon Comp.	1K	1W	5%
R50	2	Carbon Comp.	15Meg	1/2W	5%
C1,2,8	6	Dipped Mica	20pF	500V	5%
C3	2	Metallized Mylar	47pF	400V	10%
C4,10	4	Metallized Mylar	15pF	200V	10%
C5	2	Dipped Mica	250pF	500V	2%
C6	2	Dipped Mica	750pF	500V	2%
C7	2	Metallized Mylar	1.0pF	100V	10%
C8,16,24-26	6	Metallized Mylar	.22uF	500V	10%
C11	1	Metallized Mylar	.01uF	1600V	10%
E12,13	2	Electrolytic	2x1500uF	50V	-10/+75%
C14,15	2	Electrolytic	300uF	300V	-10/+75%
C17	1	Electrolytic	2X75uF	475V	-10/+75%
C18-23	6	Electrolytic	200uF	450V	-10/+75%
C27	2	Dipped Mica	56pF	500V	5%
F1	1	SloBlo 120VAC (240VAC)	1/2A	250V	
T1	1	Transformer		1/4A	250V)
OT1-4	4	AC Receptacle			
SW1	1	Source Switch			
SW2,5	2	DPDT Gold Contact			
SW3	1	Mode Switch			
SW4	1	DPDT Silver Contact			
SW6	1	DPDT Silver Contact			
SW7,8	2	DPDT Silver Contact			
K1	1	Relay			
J1-16	16	Phono Jack			

8-1-84

Dear SCC,

Enclosed is my order for a Dynaco Rack Mount Adapter.

I am also enclosing ~~some~~ a pair of schematics that I've managed to locate for the AM/FM front-end module used in Dynaco's AFG tuner. One covers the FM circuit (different from FMS) and the other covers the AM board. These schematics are not in the AFG manual and I had to do quite a bit of writing and calling to finally locate the manufacturer and obtain the schematics. Why am I sending them to you? I hope they will be of some value to you - you may even want to sell copies of them. I'm even hoping that you would be willing to offer me a discount on the rack mount in return for these. Of course, since you didn't request the schematics, they are yours to use as you see fit with no obligation to give me anything. I'll leave it up to you.

A similar schematic for the FMS module was published in the Audio Amateur magazine #2/1980 (copy enclosed).

Thanks for your time,

Bill Goldie

1937 Byrd

Dearborn MI 48124

P.S. The AM board schematic was a poor copy and I had to retrace it. That's why it looks different.