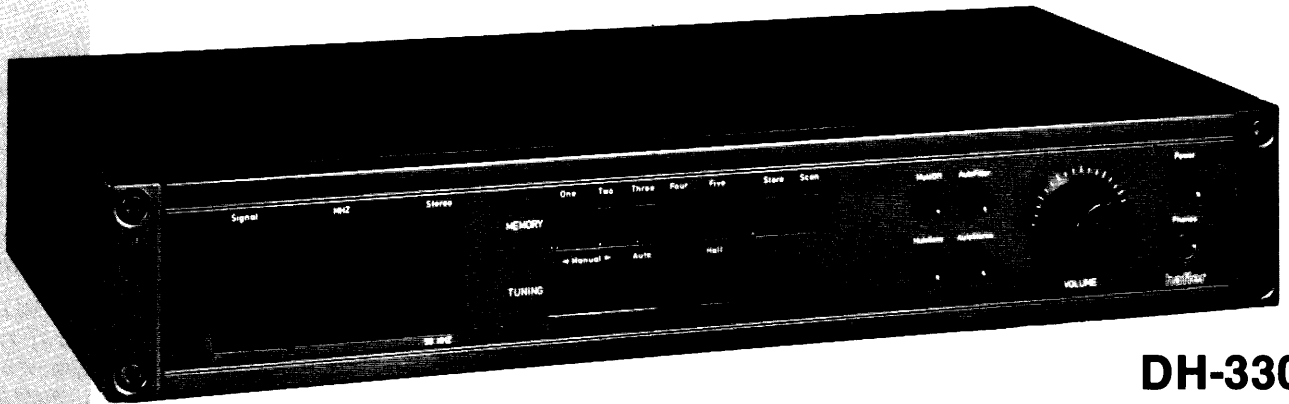


THE hafler FM TUNER



DH-330

INSTRUCTIONS for OPERATION and KIT ASSEMBLY

LM 092
\$3.00

THE DAVID HAFLER COMPANY
5910 Crescent Boulevard, Pennsauken, New Jersey 08109

Please refer to this
serial number in all communications
regarding this equipment.

SPECIFICATIONS

Useable Sensitivity: 11.3 dBf

50 dB Quieting Sensitivity: Mono: 17.2 dBf
Stereo: 37.2 dBf

Total Harmonic Distortion: @ 1 kHz, 100% Modulation: Mono: 0.1%
Stereo: 0.18%

Capture Ratio: 1.5 dB

Alternate Channel Selectivity: 60 dB

Stereo Separation: 1 kHz: 45 dB
10 kHz: 35 dB

Signal to Noise Ratio: Mono: 72 dB
Stereo: 68 dB

Dimensions: 17" W x 3" H x 8½" D

Net Weight: 9 lbs.

Shipping Weight: 11.5 lbs.

KIT BUILDERS PLEASE NOTE

Regulations issued by the Federal Communications Commission require that receivers operating above 30MHz (as do all FM tuners) meet certain maximum RF radiation limits. This Hafler DH-330 FM tuner will meet these requirements if it is constructed with the materials and components provided in this kit, and in strict accordance with the enclosed assembly instructions. To meet legal requirements it is necessary that you sign, date and attach to the back panel of the completed tuner the enclosed label indicating that you have assembled the tuner kit in accordance with the instructions.

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INTRODUCTION

The DH-330 is a perfect complement to Hafler amplifiers and preamplifiers in appearance, in performance, and in value. A quartz controlled, digitally synthesized tuning system provides fast, easy, precise station selection; a unique interference reduction circuit improves the reception; and its outstanding audio quality assures exact re-creation of the broadcast signal.

A Hafler-designed microprocessor highlights the advanced technology which makes finding a station on this tuner so quick, simple and sure. Exclusive Hafler programming of this computer system to complement the DH-330's features also makes possible the use of a non-volatile memory for easiest return to a chosen station. Even if the plug is pulled, the DH-330 retains its memory for years—long after the batteries would have failed.

Accurate tuning is a primary requirement in achieving lowest distortion reception. Simply having a digital display of the tuned frequency is no guarantee that a tuner is precisely centered on a station. The DH-330's phase locked loop local oscillator, which is referenced to a quartz crystal frequency standard, assures on-center drift-free tuning every time. With the convenience of a 5 station memory and 'Auto' tuning of the FM band, swift, sure tuning was never easier.

The Hafler designed 'AutoFilter' interference reduction circuitry is automatically activated when there is a need, yet functionally is completely out of the audio path when neither noise nor multipath problems interfere with good reception. When it senses noise or multipath effects, this unique system dynamically limits the high frequency separation and response in proportion to the amount of interference in the signal. The result is substantially less irritation or fatigue from less-than-perfect signals, and far more pleasurable listening from a wider variety of stations, both weak and strong, than you may have become accustomed to.

The Hafler name has been synonymous with audio quality for many years, and the DH-330 will meet your highest expectations. From the antenna input (for which a separate 75 ohm coaxial connector is provided for optimal matching), to the front panel audio output which has the requisite power to drive most headphones, the primary concern has been to achieve clear, undistorted reception. Particular attention has been devoted to the RF and IF stages, and to the interference reduction circuit. Other stages are significant chiefly in their refinement of proven concepts like the phase locked loop multiplex decoder. Our 'AutoFilter' system had as a first priority the certainty of no audio degradation when a normal interference-free signal is received.

The 'front end' utilizes a triple-tuned circuit between the RF stage and the mixer, in addition to a tuned antenna circuit. The RF stage and mixer semi-conductors are dual-gate MOSFETs which have superior signal handling capability and thus are able to provide better rejection of spurious signals. Utilizing the MOSFETs in conjunction with increased selectivity ahead of the mixer stage results in less likelihood of overload and intermodulation distortion. An additional dual gate MOSFET is used as a buffer between the mixer and the oscillator. This tends to prevent pulling of the oscillator by strong signal modulation. The end result is clearer reception of weaker signals which are very close in frequency to far stronger ones.

A delayed AGC circuit ensures that the system will be able to accommodate high level antenna inputs. The AGC circuit also keeps system distortion to a minimum over a wide range of input signal levels. The IF stages employ four ceramic filters to provide improved selectivity. They also have a flat group-delay characteristic and their superior phase linearity (uniform filter characteristic over a wider bandwidth) lowers the overall distortion.

It should be noted that any device like this which includes a microprocessor may be subject to disturbances from sharp voltage surges which may ride in on the power line. These can occur from nearby lightning strikes, among other causes. If you find that the memory locations are scrambled, for instance, this could be the cause. Then, simply re-program them. It is desirable to unplug the tuner if a severe thunderstorm is nearby, or if the tuner will be unused for an extended period—a precaution advised with any microprocessor-controlled equipment.

A simple 'T' shape dipole ribbon antenna has been supplied with your DH-330 to enable you to enjoy your music without delay. While this basic antenna will provide satisfactory reception in good locations (expect to be impressed with its quality—particularly when using the AutoFilter), it can't begin to show the full capabilities of this tuner. But, even the placement of a simple antenna like this one can materially affect the quality of reception. Some general information on antennas is provided later in this manual.

For operation outside of the USA, a different power transformer is available for mains voltages between 200 and 240 volts. In countries which broadcast with a 50 usec time constant, instead of the 75 usec standard for North America, the tuner's de-emphasis network can be changed to 50 usec by simply removing one capacitor on each channel — C-220 & C-220R.

INSTALLATION

Your tuner puts out very little heat, so it is not necessary to provide significant ventilation. The DH-330 may be stacked with other units which likewise need only modest air circulation.

Accompanying your tuner is a package containing a spare line fuse, a small 'L' shaped Allen wrench for the knob, a large Allen wrench for the front panel end caps, and a pair of audio connecting cables, as well as a pair of extended front panel end caps which enable the tuner to be mounted in a standard 19" equipment rack.

To install the rack mount end caps, first disconnect the power cord and signal cables. Place the tuner upside down on a protected surface such as a towel, and remove the two cover screws on each side of the bottom. Slide the cover back. Remove the end cap screws with the Allen wrench, and exchange the end caps—they slide outward. Replace the cap screws and nuts only finger tight at first. Check the alignment of the panel around the control buttons before tightening fully. Then replace and secure the cover.

Power Connections

Unless the tuner's shipping carton and its line cord are specially marked, all DH-330 tuners are supplied for 120 volt AC lines, as in the USA. For operation at other line voltages overseas, a different power transformer will be provided.

An accessory AC outlet is provided on the back panel. This outlet is 'live' whenever the tuner's power cord is plugged in. Note the 500 watt maximum rating for this outlet, which is the safe limit for this AC line cord.

Output Connections

A pair of standard shielded audio cables is supplied with the DH-330. These connect the Left and Right Output jacks on the back panel to the Tuner, Radio or FM-Mpx input of your control center.

The Phones jack on the front panel is an alternative output which has sufficient level to drive most headphones for private listening. A tape recorder could also be connected there. The back panel outputs are disconnected when a plug is inserted into the front panel jack. The jack is wired so that the left channel is the tip of the plug.

Antenna Connections

Provision is made for either 75 ohm or 300 ohm antenna inputs. The supplied folded dipole 'T' antenna connects to the 300 ohm screws. These are also used for other flat wire lead-ins. Where available, shielded 75 ohm coaxial cable (usually RG59 U) connects to the 75 ohm terminal, and is preferred in areas where interference is a problem. The ground terminal, which is the thumb screw to the side, is connected internally to the shield side of the 75 ohm input. With most antenna lead-ins, it is not used, but it is available for shielded 300 ohm lead-in, as well as to provide a means of grounding the tuner chassis, if desired.

OPERATION

Push the Power switch on, and the tuned frequency is indicated by the display. Unless this is a properly tuned station, no sound will be heard. **Initially**, depress all 4 round pushbutton switches, and set the volume control at about 12 o'clock. Press the 'Auto' button, and the tuner will tune to a station, and stop for 4 seconds, before continuing to the next station. Press the 'Halt' button when you come to a station you wish to listen to.

The volume control, which affects both the front and back panel outputs, will likely be fully advanced for most listening, and you will use the master volume control on your control preamplifier. You may wish to set it so that the tuner's output will match the level of other inputs to your preamp, such as Phono. Its primary use is to provide level control when headphones are connected to the front panel jack for private listening. The sensitivity of most headphones will enable comfortably loud listening levels when the volume control is fully advanced.

Signal Strength Indicator

This vertical row of 5 LEDs will be lighted only when a station is correctly tuned, even though a signal may be heard under other circumstances. Most stations in good reception locations will light all 5 LEDs, since the top indicator is lighted with 50 dBf input (about 150 microvolts at 75 ohms). The first (lowest) LED lights with a signal of approximately 11 dBf (2 microvolts) when the Mute Sensitivity switch is OUT, and at about 26 dBf when that button is IN. The signal strength indicator can therefore provide considerable help when adjusting an antenna on a weak signal.

Stereo Indicator

The Stereo LED will light only when a station is broadcasting a stereo signal, and when it is also being received in stereo. Thus it can only be illuminated when the AutoStereo button is IN.

50 kHz Indicator

This LED supplements the frequency readout in megahertz, indicating a half step higher than the numerical reading. It is not normally used in the USA, where all stations are assigned to frequencies at odd-numbered 100 kHz intervals, which the readout provides. In other countries, however, stations are also assigned to channels in 50 kHz steps, and this LED will then show correct tuning. It will flicker during the tuning action, but will not be lighted (in the USA) when a station is correctly tuned. In unusual cases, a particular station which is hard to receive may be deliberately mis-tuned in an effort to improve its reception with a quick tap on one of the manual tuning buttons, and then the 50 kHz LED will light. The signal strength LEDs will be dark, and the station can then be heard only when the 'Mute Off' button is IN.

Tuning Buttons

The 'Manual' buttons allow you to traverse the FM band either up or down in frequency. If a button is pressed quickly and released, this tuning will change in 50 kHz increments. If the button is held down, it will change frequency slowly for the first second, and then shift to a faster tuning speed to save time.

The 'Auto' button will tune upscale at an intermediate speed, stopping at each station for 4 seconds, and then cycle to the low end of the FM band to start over automatically. It will always tune up-scale unless specifically directed to search down-scale by pressing the left Manual button, and then 'Auto.'

The 'Halt' button locks onto the indicated frequency when a station has been selected in the 'Auto' mode, or in the 'Scan' mode. Pressing 'Halt' also assures that the station to which you were listening when the tuner was turned off will be locked in memory for immediate recall the next time the tuner is switched on.

Memory Buttons

Five stations may be placed in memory for instant access to a precisely tuned signal. Any frequency indicated in the window (including 50 kHz, if it is lighted) may be stored in memory by first pressing the 'Store' button, and then the appropriate memory location. Storing a new frequency automatically erases a previous entry. Any frequency can be stored in any location—they do not have to be in sequence. This tuner has a non-volatile memory, and needs no batteries to maintain stored frequencies for years, even in the event of a power line interruption.

The 'Scan' button cycles through the 5 preselected stations in numerical sequence, starting with memory ONE. It stops on each for 5 seconds. Pressing the 'Halt' button or one of the 5 memory buttons chooses the station.

Mute Off Switch

For most use, this button will likely remain OUT, so that audio muting is in effect for all tuning functions until the station is on-center. When it is IN, the audio signal is not muted when deliberately tuned off station, thus enabling fine tuning in 50 kHz increments with the Manual buttons. Even with this button IN, off-channel muting remains in effect when selecting from memory locations, or when in the scanning or auto-tuning modes, so that you are not annoyed with interstation noise. When this button is IN, the 'Mute Sens' switch is overridden, because the muting voltage is derived from the IF detector integrated circuit.

Mute Sensitivity Switch

When the 'Mute Sens' button is IN, weaker stations will be ignored, because the RF muting threshold is raised to 31 dBf. Thus the 'Auto' tuning mode would likely scan the dial in less time, as it would not stop on the weakest stations. When this button is IN, the signal level required to

light the first two LEDs on the signal strength meter is also raised. The first LED will then light at about 26 dBf, instead of 11 dBf.

AutoFilter Switch

This switch can normally be left IN, for the operation of this exclusive Hafler noise reduction circuit is automatic when engaged, and not detrimental to signals which do not evidence noise. When the signal has noise or multipath effects, this circuit automatically filters and blends the higher audio frequencies on a dynamic basis to provide clearer reception without 'pumping' or 'breathing.' With the switch OUT, the circuit is disengaged.

AutoStereo Switch

This button will invariably be left IN. In that mode, the tuner's operation is automatically switched from stereo to mono operation as called for by the broadcast. If this button is OUT, all reception will be monophonic. If a stereo broadcast is a very weak signal, the tuner will switch to mono below about 31 dBf (20 microvolts) to provide the most noise-free reception.

A WORD ABOUT ANTENNAS

You should remember that any tuner is no better than the signal at its antenna terminals. In difficult reception areas (whether center city or rural countryside) the quality of the antenna installation is of greater concern than differences between good tuners. The three primary determinants of antenna performance are: location, direction and height. When comparing different antenna designs, three other factors become important: gain, directivity, or pattern of reception, and front-to-back ratio.

The standard twinlead folded dipole 'T' antenna supplied with your DH-330 is convenient, and adequate for most locations where signals are relatively strong. This type of antenna has equal sensitivity in opposite directions, and maximum response (a 'figure 8') when facing broadside to (pointing at right angles from) the direction of the station's transmitter. 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 high up, extending the 'T.' It should not be attached to any metal surfaces, as these will tend to absorb the signal, and folding over the ribbon will have adverse effects. It is not uncommon, particularly in modern high-rise construction, where reinforced concrete interferes with radio reception, to find that a shift of even a foot or two may change reception noticeably.

The next step in possible improvement is a basic set of 'rabbit ears,' usually extended horizontally. Their advantage lies in rigidity combined with mobility, so that you can place these where the limp ribbon lead will not work. And, you can turn them to different directions easily.

ASSEMBLY INSTRUCTIONS

Selecting a roof-mounted antenna involves a number of choices which will probably best be solved by competent local advice—from someone who is knowledgeable about the particular reception problems you have to overcome. Sometimes it may be practical to use a single wide-band antenna design for both TV and FM, though best results are obtained from dedicated designs if the problems are severe. An antenna rotator may be advisable if the TV and FM towers are not in the same general compass direction. Or, if the signals come from opposite points of the compass, an antenna with a figure 8 pattern, or with a low front-to-back ratio may suffice. If the signal sources are not more than 60° apart, a pattern with a broad frontal lobe may avoid the need for a rotator. Omni-directional, or non-directional antennas are more subject to multipath effects, and offer no more gain, as a rule, than the folded dipole, though a roof mounting may afford better results than an indoor location.

In most urban locations, there is usually sufficient signal strength, but reflected signals are the big problem. So you don't need high gain, but you do want a high front-to-back ratio, and likely sharp directionality (especially with a rotator). In remote locations, gain is likely the most important criteria.

Some apartment house cable systems provide FM reception along with the TV channels, but others eliminate the FM band. Even where the FM signal is provided, you may find that the less demanding amplifier standards for satisfactory TV reception provide a poorer quality FM signal, compared with the DH-330's potential.

When it comes to choosing lead-in cable (from roof-mounted systems) there are three basic criteria: impedance matching, signal loss, and shielding. Since the DH-330 provides a direct 75 ohm input, we encourage your use of 75 ohm lead-in, with a matching antenna. The reasons: 75 ohm cable (usually RG59U) is shielded, so interference is reduced, and it is able to withstand the effects of weather quite well. The disadvantages: it is more expensive and has more signal loss than 300 ohm ribbon, and is harder to conceal. It also requires a balun, or matching transformer, if the antenna is the more common 300 ohm impedance.

While new twin lead has fairly low signal loss, the less expensive types are subject to weathering, and may need to be replaced after about 3 years in most localities. So don't blame the tuner when it may be the lead-in that needs replacing! Since ribbon lead has no shielding [special 300 ohm shielded cable is available, however], installers try to avoid long horizontal runs, stay away from metal surfaces such as gutters, and twist it once each foot to reduce interference pickup. You should, if possible, avoid chimney mounts, because the heat and contamination shortens antenna and lead-in life.

The DH-330 tuner is a versatile component with sophisticated circuitry which has been made remarkably easy to build by individuals with many years of experience in the design and engineering of the finest performing audio kits, and in the preparation of their manuals.

There are three basic rules for success in electronic kit building:

1. Read the instructions carefully, and follow them in order.
2. Make secure solder connections, which are bright and smooth.
3. Check your work carefully after each step.

Kit building should be fun, and we are certain you will find this to be so. Assembly will be faster and more enjoyable if you have someone help you by reading the steps aloud and selecting the required parts as you proceed. Fatigue increases the risk of error, so take a break rather than push to early completion. There are relatively few separate components in this design, to make it easy to pack everything away, if need be.

Your work area should have good lighting, the proper tools, and a place where the large pictorial diagram can be tacked to the wall within easy reach for checking. The tools should include:

1. A 40 to 60 watt pencil soldering iron with a 3/16" or smaller tip which reaches 700°F.
2. 60/40 (60% tin) ROSIN CORE solder, 1/16" diameter or smaller.
3. A damp sponge or cloth to wipe the hot tip of the iron.
4. A wire stripping tool for removing insulation. This can be a *single-edge* razor blade, but inexpensive stripping tools are safer, faster and easier.
5. A medium-blade screwdriver (about 1/4" wide).
6. A #1 or #2 Phillips head screwdriver.
7. Needle-nose pliers (a long, narrow tip).
8. Diagonal or side-cutting small pliers.
9. Large "gas" or "slip-joint" pliers.
10. A 1/4" "Spin-tite" nut driver may be helpful, but is not necessary.

Proper Soldering

There are four steps to making a good solder connection:

1. Make a good mechanical connection to hold the wire in position while heat and solder is applied.

2. Heat the *junction* of the wire and lug, or eyelet, with the bright, shiny tip of the iron.
3. After heating for a couple of seconds, apply solder to the junction. It should melt immediately and flow smoothly around both surfaces.
4. Allow the connection to cool undisturbed.

The general procedure is to use a hot iron for a short time to heat a connection, then add solder with the iron still in contact. Remove the solder once it flows, and then remove the iron. A cooler iron applied for a longer time is more likely to damage components, or lift the copper circuit pattern from the boards. A break in the etched circuit can be mended by simply soldering a small piece of wire across it. Do not allow much build-up of solder on the tip of the iron, or it may fall into adjacent circuitry.

Remember that the connection is made by the solder, not by mechanically attaching the wire to the terminal. Usually the wire is looped through the lug and crimped in place, but some prefer to just place it through the hole and rely on the stiffness of the wire to hold it while soldering. Circuit board hole connections, of course, are handled this way.

Good solder connections are *essential* for trouble-free, noise-free operation. A good solder joint does not require much solder around the conductors. Never "butter" partially melted solder on the joint, as it is useless. A good connection looks smooth and bright because the solder flows into every crevice when the parts are hot enough. The iron must have a bright, shiny tip to transfer heat easily to the junction. That's why the damp sponge should be used frequently to wipe the tip, and occasionally you must add a small amount of solder to the tip, too. If a connection is difficult to heat, "wet" the tip with a small blob of solder to provide a bigger contact surface to the joint. Once the solder flows around the conductors, any movement must be avoided for a few seconds to allow a good bond. When cool, check the connection by wiggling the wire. If in doubt, or if the connection is not shiny, re-heat the joint. Excess solder may be removed from a connection by heating it and allowing the solder to flow onto the iron, which is then wiped on the sponge.

ALL SOLDER USED MUST BE ROSIN CORE

Never use acid core solder or any separate flux in electronic work. Silver solder is also not suitable. If in doubt about unmarked solder, always obtain a fresh supply of rosin core solder. We recommend 60/40 for easiest use. Do not confuse it with 40/60, which is harder to melt.

When soldering to an eyelet or hole on the board, insert the wire from one side, and apply the iron to the other side, leaving some bare wire exposed so that you can see that the hole is then filled with solder for a secure bond. A round wooden toothpick is suggested so that you can heat

and clear the hole of solder if it hinders your inserting the wire. Some builders prefer to clear every hole first with a touch of the iron and toothpick. Others connect the wire by bringing it up to the center of the hole on top of the board, applying the iron from the bottom of the board, and pushing the lead in as the solder in the hole melts. If the wire has first been "tinned," usually no additional solder is necessary, but it is a good practice to push the wire through, and then back it up a bit, to be sure solder fills the hole. On both sides of the board, make certain a bright, shiny flow is evident from the wire onto the circuit pattern on the board.

"Tinning" refers to the process of applying a light coating of solder to the bared wire end. This keeps all the strands secured, and also makes a good connection easier. Simply touch the wire with the iron for a couple seconds, and apply solder. Allow the excess to flow away onto the iron. When properly done, the wire is uniformly bright, and no larger than before.

Wiring the Kit

If any components are unfamiliar to you, checking the pictorial diagram should quickly identify them. Or, the quantities, and the process of elimination as you check the parts list, will help. The pictorial diagram is necessarily distorted to some extent for clarity, so that you can trace every wire in a single overall view for verification as you work. You may wish to check off on the diagram as you solder each location.

To "prepare" a wire means to cut the designated amount from the length of that color, and strip about 1/4" of insulation from each end. The wire supplied in the kit is #22, so you can set adjustable wire-strippers accordingly. The transformer leads are #22, and the line cord is #18. Be careful that you do not nick the wire when you strip it (that can happen more easily if you do not use wire strippers) for that weakens it.

Whenever a connection is to be soldered, the instructions will so state, or indicate by the symbol (S). If more than one wire is to be soldered to the same point, they will be indicated by (S-2), (S-4), etc. If soldering is not called for, other connections have yet to be made to that terminal. They would be more difficult if the connection was already soldered. Every connection in the kit will be soldered when it is complete. After soldering a connection, it is best to clip off any excess lead length to minimize the possibility of a short circuit (as on switch lugs, where terminals are very close together), and for neatness.

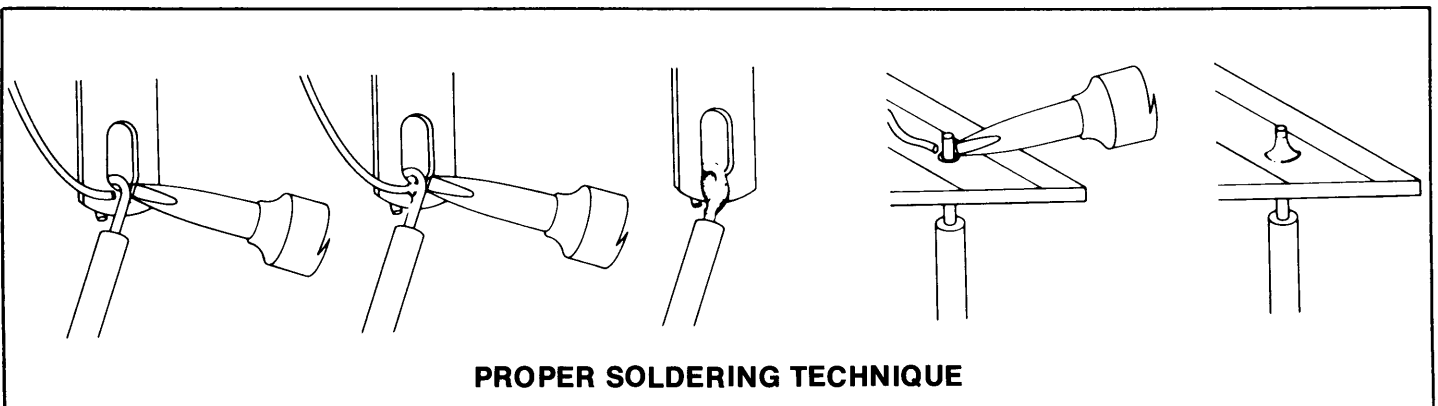
Handle the circuit boards carefully. They represent a major part of the kit cost. Take the time to be accurate and neat, and you can be sure that your completed tuner will meet the performance of a factory assembled unit, and can continue to perform properly for years to come. Check your work, and make sure the entire step has been completed before placing a check mark in the space provided, and continuing on to the next step.

CONSTRUCTION STEPS BEGIN ON PAGE 15

KIT PARTS LIST

Minor variations may sometimes be encountered in value or appearance. These will not affect performance.

	Part No.		Part No.
1 Chassis assembly including:		Wire	
1 Front panel	MS194	1 Antenna, folded dipole	WA036
1 Back Panel, charcoal	MS193	1 Line cord with plug	WA015
2 Side piece	MS189	1 Wire, White, #22, UL Listed	WS031
1 Front chassis rail	MS195	1 Wire, black, #22	
1 Rear chassis rail	MS197	1 Wire, green, #22	
1 PC-26 Assembly	KF347	1 Wire, orange, #22	
1 PC-27 assembly	KF348	1 Wire, red, #22	
1 Coaxial cable to antenna input	WA025	1 Wire, yellow, #22	
1 Coaxial cable, interconnect	WA026	2 Linear grommet, plastic, U-shape	HR127
1 Nut, volume control, M7 x .75	HK115		
1 Washer, volume control, M7	HW113	Hardware	
1 Transformer, power, domestic	TA131	1 Bracket, U-shape, phone jack	MS133
1 Chassis bottom plate	MS137	1 Coaxial connector, threaded, feed-through	XZ023
1 Cover, charcoal	MS138	3 Grommet, rubber, 3/4"	HR128
1 Front plate, extruded, charcoal	ME128	2 Grommet, rubber, 1/4"	HR163
1 PC-28 circuit board assembly, 2 pieces	KF349	2 Ground lug, internal tooth	HZ115
1 PC-24 circuit board	KF344	12 Lockwasher, #4	HW121
1 Knob, metal, charcoal	HD117	19 Nut, #4-40	HK111
2 End caps, standard, charcoal	MC111	5 Nut, #6-32	HK112
1 Label, serial number	LR015	1 Nut, #6, knurled, thumb	HK123
1 Label, signature, FCC required	LR039	4 Nut, #10-24 (2 installed)	HK113
Small Parts		1 Nut, 11/32", feed-through	HK126
1 Antenna balun coil	TA125	6 Screw, M3 x 4mm, [3/16"], black	HP111
1 Capacitor, .01 mfd, 1.4 KV, disc	CZ127	3 Screw, #4-40 x 3/16", bright	HA112
1 Resistor, 4.7 megohms, 1/2 watt	KZ019	13 Screw, #4-40 x 5/16", bright	HA113
Large Parts		3 Screw, #4-40 x 1/2", bright	HA135
1 AC outlet, convenience	XA015	4 Screw, #4-40 x 5/8", black	HP112
5 Pushbutton, switch, black	HD121	2 Screw, #4-40 x 7/8", bright	HA114
4 Foot, self-adhesive, square	HR134	1 Screw, #6-32 x 1/2", bright	HA116
1 Phone jack	XZ015	6 Screw, #6-32 x 1/2", black	HP113
1 Nut, phone jack	HK117	10 Screw, #6 sheet metal, self threading	HP138
1 Washer, flat, phone jack	HW119	4 Screw, #10-24 x 1", Allen head, cap (2 installed)	HP114
1 Switch assembly, dual	SA118	1 Screw, set, #8, knob	HP122
1 Switch, power	SL115	5 Standoff, threaded, 1/2"	HZ165
1 Terminal strip, 2 screw	XZ024	4 Standoff, threaded, 11/32"	HZ113
Accessories		3 Standoff, clear, 3/16"	HZ164
1 Audio cable pair	WA017	1 Strain relief, plastic	HR143
2 End caps, rack mount	MC112	1 Washer, flat, 11/32", feed-through	HW126
1 Fuse, spare, 3/16 ampere slo-blo	SF027	3 Wire tie, plastic	HR138
1 Wrench, 5/32" Allen, cap screw	HZ138		
1 Wrench, #8 Allen, set screw	HZ139	Lens Assembly	
		1 Lens, plastic	HR155
		4 Tape, double sided, paper backed	PP011
		1 Shield, fiber, black, die cut	PP029



COMPONENT VALUES FOR THE SCHEMATIC DIAGRAM

All resistors are 1/4 watt 5% carbon film unless otherwise noted.

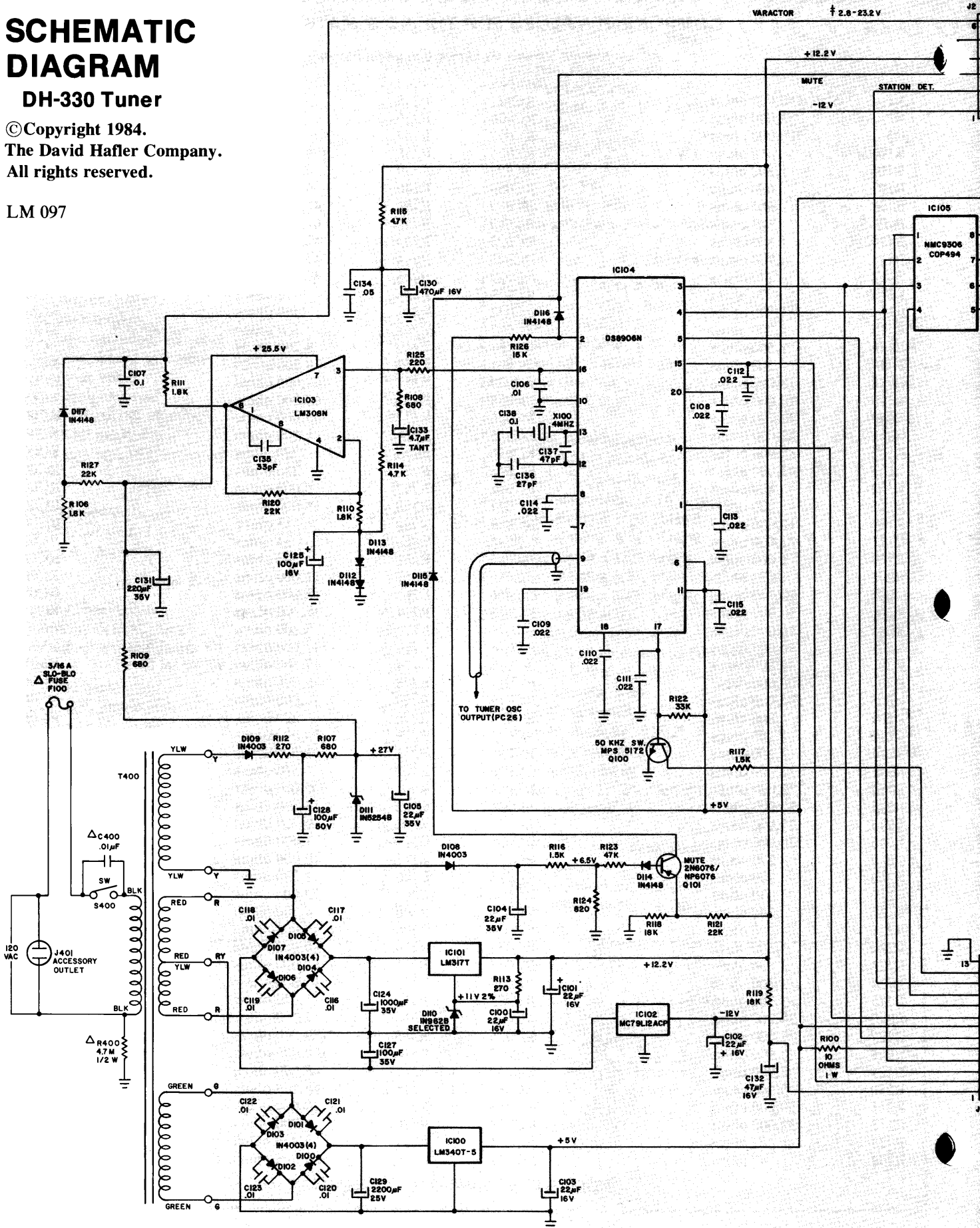
		Part No.			Part No.
R1	150,000 ohms	RC021	R235	47 ohms	RC039
R2	33,000 ohms	RC036	R236	47 ohms	RC039
R3	100,000 ohms	RC017	R237	470 ohms	RC041
R100	10 ohms, 1W	RZ021	R238	4,700 ohms	RC042
R106	1,800 ohms	RC023	R239	4,700 ohms	RC042
R107	680 ohms	RC059	R240	4,700 ohms	RC042
R108	680 ohms	RC059	R241	47,000 ohms	RC043
R109	680 ohms	RC059	R242	47,000 ohms	RC043
R110	1,800 ohms	RC023	R243	47,000 ohms	RC043
R111	1,800 ohms	RC023	R244	47,000 ohms	RC043
R112	270 ohms	RC029	R245	47,000 ohms	RC043
R113	270 ohms	RC029	R246	12 ohms	RC066
R114	4,700 ohms	RC042	R247	560 ohms	RC045
R115	4,700 ohms	RC042	R248	560 ohms	RC045
R116	1,500 ohms	RC061	R249	8,200 ohms	RC048
R117	1,500 ohms	RC061	R250	8,200 ohms	RC048
R118	18,000 ohms	RC058	R251	68,000 ohms	RC052
R119	18,000 ohms	RC058	R252	68,000 ohms	RC052
R120	22,000 ohms	RC026	R253	33,000 ohms	RC036
R121	22,000 ohms	RC026	R254	1,500 ohms	RC061
R122	33,000 ohms	RC036	R255	220 ohms	RC063
R123	47,000 ohms	RC043	R256	220 ohms	RC063
R124	820 ohms	RC062	R257	15,000 ohms	RC064
R125	220 ohms	RC063	R258	15,000 ohms	RC064
R126	15,000 ohms	RC064	R259	33 ohms	RC065
R127	22,000 ohms	RC026	R260	33 ohms	RC065
R200	1,000 ohms	RC015	R261	390 ohms	RC067
R201	1,000 ohms	RC015	R262	12,000 ohms	RC068
R202	10,000 ohms	RC016	R263	18,000 ohms	RC058
R203	10,000 ohms	RC016	R264	18,000 ohms	RC058
R204	10,000 ohms	RC016	R265	5,600 ohms	RC071
R205	10,000 ohms	RC016	R266	11,000 ohms, 1% metal film	RM024
R206	10,000 ohms	RC016	R267	47,500 ohms, 1% metal film	RM036
R207	100,000 ohms	RC017	R268	15,000 ohms	RC064
R208	120,000 ohms	RC019	R269	12,000 ohms	RC068
R209	1,800 ohms	RC023	R270	220 ohms	RC063
R210	2,200 ohms	RC025	R271	120,000 ohms	RC019
R211	2,200 ohms	RC025	R272	1,500 ohms	RC061
R212	22,000 ohms	RC026	R300	560 ohms	RC045
R213	22,000 ohms	RC026	R301	100,000 ohms	RC017
R214	22,000 ohms	RC026	R302	13,000 ohms	RC055
R215	22,000 ohms	RC026	R303	10,000 ohms	RC016
R216	220,000 ohms	RC027	R304	1,000 ohms	RC015
R217	270 ohms	RC029	R305	10,000 ohms	RC016
R218	330 ohms	RC034	R306	1,200 ohms	RC054
R219	330 ohms	RC034	R307	22,000 ohms	RC026
R220	330 ohms	RC034	R308	4,700 ohms	RC042
R221	330 ohms	RC034	R309	13,000 ohms	RC055
R220	3,300 ohms	RC035	R310	10,000 ohms	RC016
R223	3,300 ohms	RC035	R311	68,000 ohms	RC052
R224	3,300 ohms	RC035	R312	13,000 ohms	RC055
R225	3,300 ohms	RC035	R313	13,000 ohms	RC055
R226	33,000 ohms	RC036	R314	8,200 ohms	RC048
R227	33,000 ohms	RC036	R315	100,000 ohms	RC017
R228	3,900 ohms	RC037	R316	100,000 ohms	RC017
R229	3,900 ohms	RC037	R317	68,000 ohms	RC052
R230	3,900 ohms	RC037	R318	68,000 ohms	RC052
R231	39,000 ohms	RC038	R319	10,000 ohms	RC016
R232	39,000 ohms	RC038	R320	1,000 ohms	RC015
R233	82 ohms	RC053	R321	2,200 ohms	RC025
R234	47 ohms	RC039	R400	4.7 megohms, 10%, 1/2 W, carbon*	RZ019

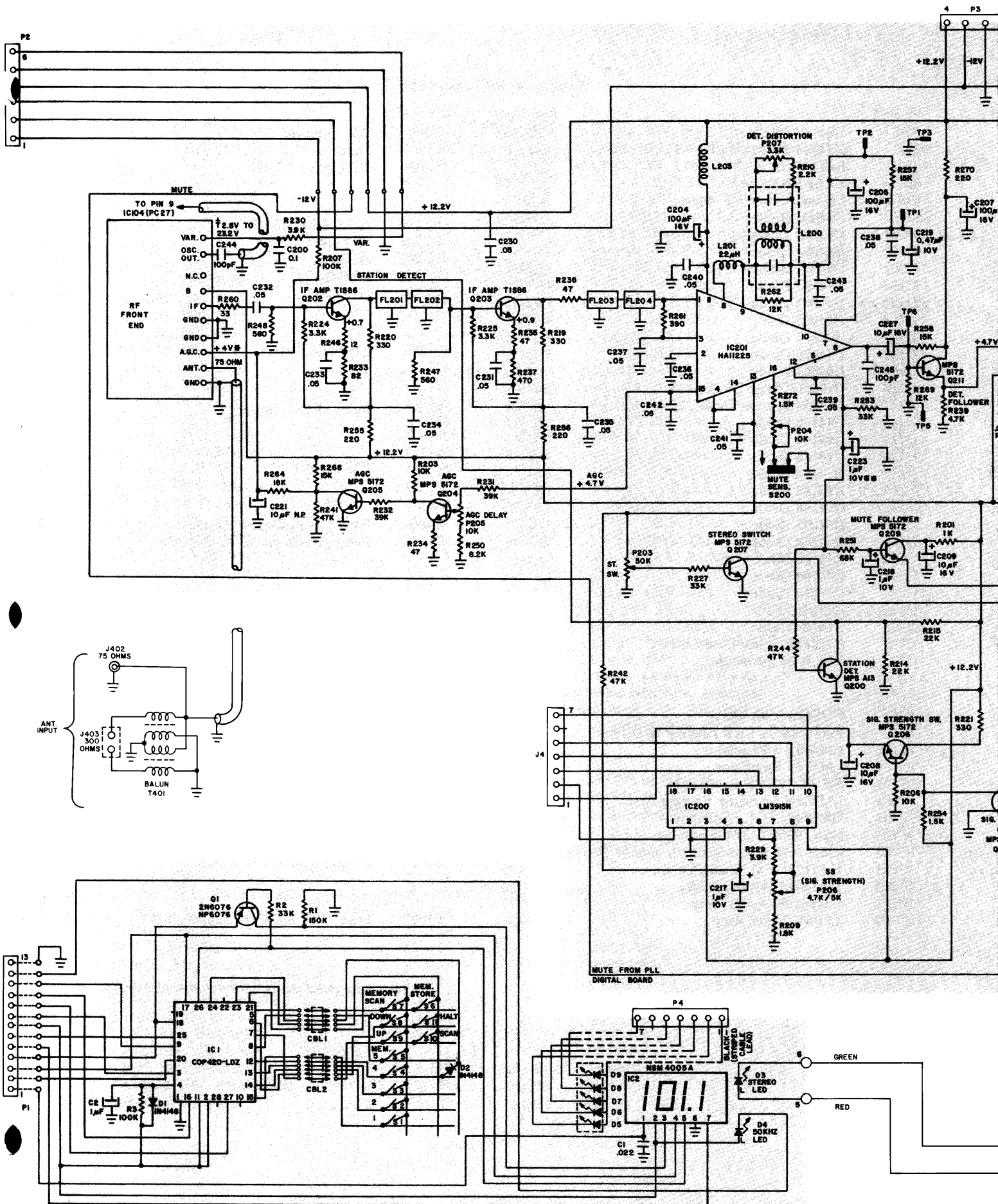
SCHEMATIC DIAGRAM

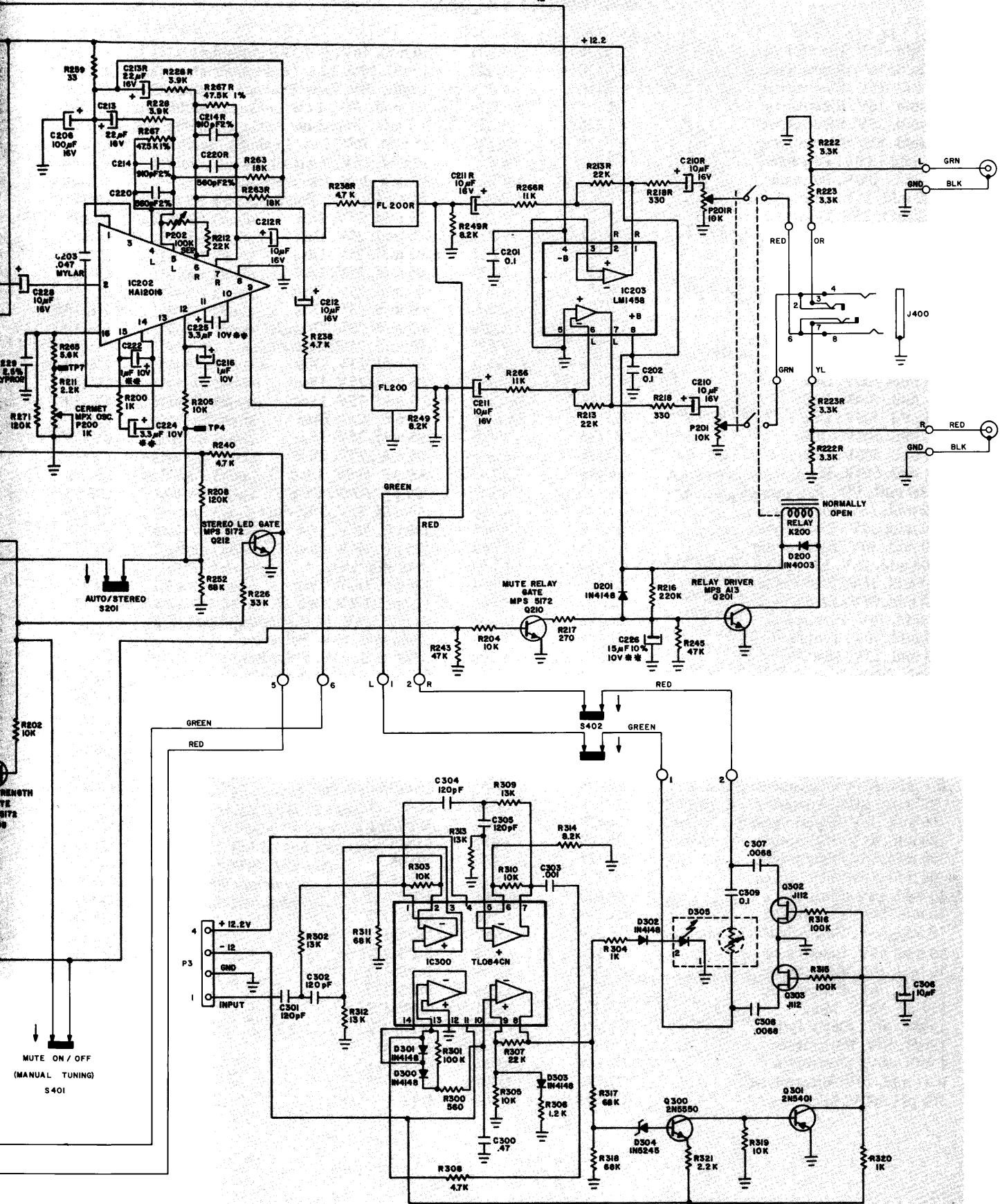
DH-330 Tuner

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LM 097







COMPONENT VALUES

	Part No.		Part No.		
C100	22 mfd, 16V, Electrolytic	CL136	C221	10 mfd, 16V, N.P. Electrolytic	CN115
C101	22 mfd, 16V, Electrolytic	CL136	C222	1 mfd, 10V, Low Leakage Electrolytic	CL144
C102	22 mfd, 16V, Electrolytic	CL136	C223	1 mfd, 10V, Low Leakage Electrolytic	CL144
C103	22 mfd, 16V, Electrolytic	CL136	C224	3.3 mfd, 10V, Low Leakage Electrolytic	CL145
C104	22 mfd, 35V, Electrolytic	CL138	C225	3.3 mfd, 10V, Low Leakage Electrolytic	CL145
C105	22 mfd, 35V, Electrolytic	CL138	C226	15 mfd, 10V, Low Leakage Electrolytic	CL146
C106	.01 mfd, 100V, Polyester	CE111	C227	10 mfd, 16V, Electrolytic	CL148
C107	0.1 mfd, 100V, Polyester	CE115	C228	10 mfd, 16V, Electrolytic	CL148
C108	.022 mfd, 25V, Disc	CZ121	C229	.001 mfd, 63V, Polypropylene	CP145
C109	.022 mfd, 25V, Disc	CZ121	C230	.05 mfd, 25V, Disc	CZ119
C110	.022 mfd, 25V, Disc	CZ121	C231	.05 mfd, 25V, Disc	CZ119
C111	.022 mfd, 25V, Disc	CZ121	C232	.05 mfd, 25V, Disc	CZ119
C112	.022 mfd, 25V, Disc	CZ121	C233	.05 mfd, 25V, Disc	CZ119
C113	.022 mfd, 25V, Disc	CZ121	C234	.05 mfd, 25V, Disc	CZ119
C114	.022 mfd, 25V, Disc	CZ121	C235	.05 mfd, 25V, Disc	CZ119
C115	.022 mfd, 25V, Disc	CZ121	C236	.05 mfd, 25V, Disc	CZ119
C116	.01 mfd, 500V, Disc	CZ126	C237	.05 mfd, 25V, Disc	CZ119
C117	.01 mfd, 500V, Disc	CZ126	C238	.05 mfd, 25V, Disc	CZ119
C118	.01 mfd, 500V, Disc	CZ126	C239	.05 mfd, 25V, Disc	CZ119
C119	.01 mfd, 500V, Disc	CZ126	C240	.05 mfd, 25V, Disc	CZ119
C120	.01 mfd, 500V, Disc	CZ126	C241	.05mfd, 25V, Disc	CZ119
C121	.01 mfd, 500V, Disc	CZ126	C242	.05 mfd, 25V, Disc	CZ119
C122	.01 mfd, 500V, Disc	CZ126	C243	.05 mfd, 25V, Disc	CZ119
C123	.01 mfd, 500V, Disc	CZ126	C244	100 pF, 500V, Disc	CZ123
C124	1,000 mfd, 35V, Electrolytic	CL116	C245	100 pF, 500V, Disc	CZ123
C125	100 mfd, 16V, Electrolytic	CL128	C300	.47 mfd, 63V, Polyester	CE125
C127	100 mfd, 35V, Electrolytic	CL134	C301	120 pF, 1KV, Disc	CZ117
C128	100 mfd, 50V, Electrolytic	CL135	C302	120 pF, 1KV, Disc	CZ117
C129	2200 mfd, 25V, Electrolytic	CL137	C303	.001 mfd, Disc	CZ118
C130	470 mfd, 16V, Electrolytic	CL139	C304	120 pF, 1KV, Disc	CZ117
C131	220 mfd, 35V, Electrolytic	CL141	C305	120 pF, 1KV, Disc	CZ117
C132	47 mfd, 16V, Electrolytic	CL142	C306	10 mfd, 16V, N.P. Electrolytic	CN115
C133	4.7 mfd, 10V, Tantalum	CL147	C307	.0068 mfd, 63V, Polyester	CE128
C134	.05 mfd, 25V, Disc	CZ119	C308	.0068 mfd, 63V, Polyester	CE128
C135	33 pF, 500V, Disc	CZ122	C309	0.1 mfd, 63V, Polyester	CE126
C136	27 pF, 500V, Disc	CZ124	C400	.01 mfd, 1.4KV, Disc*	CZ127
C137	47 pF, 500V, Disc	CZ125			
C138	0.1 mfd, 100V, Polyester	CE115			
C200	0.1 mfd, 100V, Polyester	CE115	Q1	2N6076 or NP6076	QP132
C201	0.1 mfd, 63V, Polyester	CE126	Q100	MPS5172	QN135
C202	0.1 mfd, 63V, Polyester	CE126	Q101	2N6076 or NP6076	QN132
C203	.047 mfd, 100V, Polyester	CE129	Q200	MPSA13	QN115
C204	100 mfd, 16V, Electrolytic	CL128	Q201	MPSA13	QN115
C205	100 mfd, 16V, Electrolytic	CL128	Q202	TIS86	QN134
C206	100 mfd, 16V, Electrolytic	CL128	Q203	TIS86	QN134
C207	100 mfd, 16V, Electrolytic	CL128	Q204	MPS5172	QN135
C208	10 mfd, 16V, Electrolytic	CL129	Q205	MPS5172	QN135
C209	10 mfd, 16V, Electrolytic	CL129	Q206	MPS5172	QN135
C210	10 mfd, 16V, Electrolytic	CL129	Q207	MPS5172	QN135
C211	10 mfd, 16V, Electrolytic	CL129	Q208	MPS5172	QN135
C212	10 mfd, 16V, Electrolytic	CL129	Q209	MPS5172	QN135
C213	22 mfd, 16V, Electrolytic	CL136	Q210	MPS5172	QN135
C214	910 pF, 100V, Mica	CM124	Q211	MPS5172	QN135
C216	1 mfd, 10V, Electrolytic	CL131	Q212	MPS5172	QN135
C217	1 mfd, 10V, Electrolytic	CL131	Q300	2N5550	QN128
C218	1 mfd, 10V, Electrolytic	CL131	Q301	2N5401	QP122
C219	0.47 mfd, 10V, Electrolytic	CL132	Q302	J112	QN131
C220	560 pF, 300V, Mica	CM125	Q303	J112	QN131

		Part No.			Part No.
D1	1N4148 Diode	QD116	L200	FM Detector Coil	TA128
D2	1N4148 Diode	QD116	L201	Detector Coil Fixed 22 uH	TA129
D3	LED, Red	QD114	L203	RF Choke 2.2 uH	TA132
D4	LED, Red	QD114			
D5-D9	LED Display, "S" Meter	AA123			
D100	1N4003 Diode	QD115	FL200	MPX Filter Block	AA118
D101	1N4003 Diode	QD115	FL201	IF Filter	ZA031
D102	1N4003 Diode	QD115	FL202	IF Filter	ZA031
D103	1N4003 Diode	QD115	FL203	IF Filter	ZA031
D104	1N4003 Diode	QD115	FL204	IF Filter	ZA031
D105	1N4003 Diode	QD115			
D106	1N4003 Diode	QD115			
D107	1N4003 Diode	QD115	X100	Crystal 4.0 mHz	ZA029
D108	1N4003 Diode	QD115			
D109	1N4003 Diode	QD115			
D110	1N962E Zener Diode, 11V	QD127			
D111	1N5254B Zener Diode, 27V	QD126	K200	Relay, Reed, Muting	SZ118
D112	1N4148 Diode	QD116			
D113	1N4148 Diode	QD116			
D114	1N4148 Diode	QD116		FM Front End	AA119
D115	1N4148 Diode	QD116			
D116	1N4148 Diode	QD116			
D117	1N4148 Diode	QD116			
D200	1N4003 Diode	QD115	T400	Power Transformer, Domestic	TA131
D201	1N4148 Diode	QD116	T401	FM Antenna Balun Transformer	TA125
D300	1N4148 Diode	QD116			
D301	1N4148 Diode	QD116			
D301	1N4148 Diode	QD116	P200	1,000 ohms trimpot	RP019
D302	1N4148 Diode	QD116	P201	10,000 ohms volume control	RP028
D303	1N4148 Diode	QD116	P202	100,000 ohms trimpot	RP031
D304	1N5245F Zener Diode, 15V	QD112	P203	50,000 ohms trimpot	RP032
D305	VTL5C2 Optocoupler	QD122	P204	10,000 ohms trimpot	RP033
			P205	10,000 ohms trimpot	RP033
			P206	4,700 ohms trimpot	RP034
			P207	3,300 ohms trimpot	RP035
IC1	COP420-LDZ Micro	QB135			
IC2	NSM 4005A LED Display w/Driver	AA117			
IC100	LM340T-5 Regulator	QB128			
IC101	LM317T Regulator	QB134	S1-S11	Switch, Keyboard	SZ116
IC102	MC79L12ACP Regulator	QB129	S200	Switch, MuteSens, DPDT	SA119
IC103	LM308N Varactor Voltage Amp	QB131	S201	Switch, AutoStereo, DPDT	SA119
IC104	DS8906N PLL Synthesizer	QB132	S400	Switch, AC Power, UL listed*	SL115
IC105	NMC 9306/COP494 Memory	QB133	S401	Switch, MuteOff, DPDT	SA118
IC200	LM3915N Signal Strength display Driver	QB124	S402	Switch, AutoFilter, DPDT	SA118
IC201	HA11225 FM IF and Detector	QB125			
IC202	HA12016 MPX Decoder	QB126			
IC203	LM1458N Audio Amp	QB127			
IC300	TL084CN OP Amp	QB121	F100	Fuse, 3/16 Ampere, Slo-Blo MDX	SFO27

*Replace with exact equivalent part for safety reasons.

COMPLETING YOUR DH-330

For safety in shipping, after the circuit boards in your tuner have been fully tested to confirm specifications, they have been assembled to the main chassis element. Some disassembly, such as removal of the back panel and the bottom plate, will be helpful as you proceed, and will be called for in the instructions. Before commencing assembly you should count each item and check off the quantity against the Kit Parts List, to enable you to differentiate similar parts, and to identify unfamiliar items. Hardware which need not be removed to complete the kit according to these instructions will not be listed in that Parts List.

Be careful not to confuse hardware which differs only slightly in size. Screws are measured from the underside of the head to the end of the threaded shaft. The #6 nuts can be separated from the similar-appearing #4 nuts by sliding them over a #4 (smaller size) screw. The larger #6 nut will clearly be loose. Screws are always installed from the outside of the chassis unless specifically directed otherwise. An egg carton will be helpful for sorting hardware.

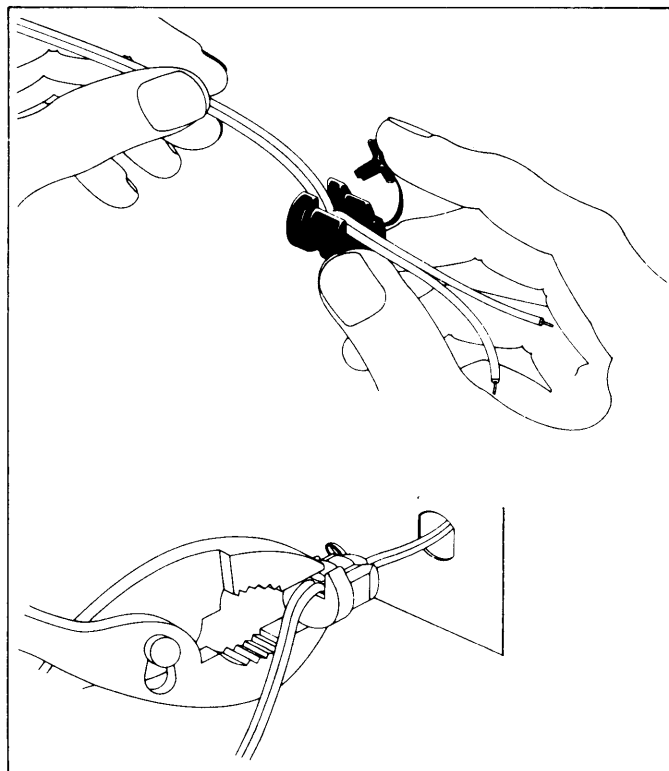
When handling the circuit boards, watch that component leads are not stressed by bending. Under no circumstances should the setting of any adjustable component on the boards be changed. Tuner alignment is a precise adjustment procedure, requiring extensive test equipment, and altering the setting of any item, even by a small amount, can destroy the excellent performance you have paid for.

When making connections to a circuit board hole, or eyelet, leave a little bare wire exposed, rather than push the insulation all the way up to the surface of the board. Then you can see if a good solder connection has been made to both sides of the board when you solder from the opposite side. Always clip off any excess bare wire stubs after soldering.

All references to left and right are made when the tuner is viewed from the top front, as shown in the Pictorial Diagram. Keep this diagram handy, so you can see wire directions, and connection locations.

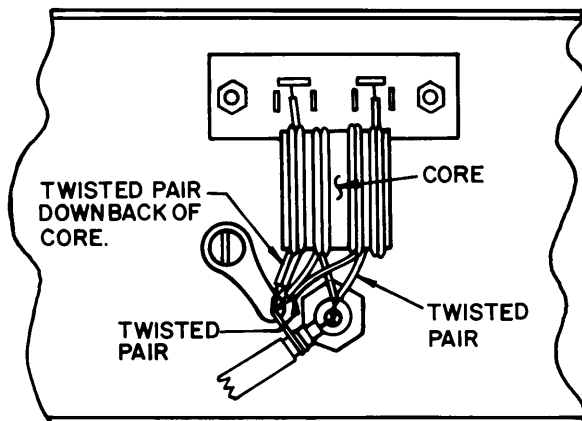
- 1 Remove the bottom plate, and separate the back panel assembly from the chassis. Count the hardware thus removed as part of the listed items. That list also includes the two cap screws and nuts which secure edges of the front panel. Set the cover, the bottom plate, the extruded front plate, the end caps, and the PC-28 circuit board aside.
- 2 Select the metal knob, the set screw, and the smaller L-shaped Allen wrench. Place the screw on the end of the wrench and thread it into the knob. Set the knob aside.
- 3 Select the AC outlet and the back panel assembly. Snap the outlet into the hole next to the transformer from the outside.
- 4 Select one of the ground lugs. Loosen the transformer mounting screw next to the AC outlet, and install the ground lug under the nut, pointing it towards the lower lug #2 of the AC outlet.

- 5 Select the two screw terminal strip and 2 of the 1/2" #6 black screws and nuts. Install the terminal strip on the **inside** of the back panel, with the lugs nearer the top of the panel.
- 6 Select the 75 ohm coaxial connector, its flat washer and nut. Install it from the outside so that its flat sides engage those of the mounting hole below the terminal strip.
- 7 Select the 1/2" bright-finished screw, the remaining ground lug, a #6 nut, and the round thumb nut. Place the ground lug on the screw so it is bent towards the screw head, and insert the screw from **inside** the back panel, next to the coaxial connector. Tighten the regular nut on the outside with the ground lug pointing towards the coaxial connector on the inside. Then add the thumb nut. Bend the ground lug up so that its tip is about 1/2" from the coaxial connector lug.
- 8 Select the AC line cord and the plastic strain relief. Make a sharp 'V' in the line cord by bending the cord back on itself 8" from the cut end. Install the strain relief as shown, with the smaller end of the strain relief nearest the cut end of the cord. Crimp the two halves of the strain relief around the wire at the 'V' with heavy pliers, to partially form it before insertion into the back panel hole AC on the left end. Then grip the larger diameter of the strain relief with the tips of the pliers, squeeze it tightly, and insert the end of the cord and the relief from the outside. With the cord horizontal, the flats on the relief mate with those of the hole. The relief snaps into position when fully inserted.



Separate the conductors of the line cord for about 1-1/2", and strip and tin the ends to secure all the strands.

- 9 Select the resistor (4.7 megohms—yellow/violet/green) and connect it midway between the ground lug on the transformer and the lower lug #2 of the AC outlet. Solder the ground lug. Cut off any excess lead length.
- 10 Prepare an 8-1/2" red wire and an 8-1/2" green wire. Select the PC-24 circuit board and connect the green wire to hole #1 at the bottom of the board from the front (components) side. Solder it on the back side. Connect the red wire to hole #2. (S). Keep these wires separated.
- 11 Prepare an 8" black wire and an 8" green wire. Twist these wires tightly together throughout their length (about 3 complete twists every 2 inches), and connect the green wire to hole #L on the right side of the board. (S). Connect the black wire to the nearest of the two adjacent holes labeled #G. (S).
- 12 Prepare a 7" red wire and a 7" black wire. Twist these wires tightly together, and connect the red wire to hole #R. (S). Connect the black wire to the remaining hole #G. (S).
- 13 Select the 4 threaded standoffs which are 11/32" long, the 4 black 5/8" #4 screws, four #4 nuts, and the PC-24 assembly. Tighten a standoff on each screw inserted on either side of the remaining back panel cutout for the outputs. Then secure the PC-24, placing the plug cable in the lower left corner.
- 14 Select the antenna transformer. Note that there are 2 pairs of twisted wires at one end, and 2 single wires and a single twisted pair at the other end. Fold the single twisted pair over the flat side of the core that does not have wires wrapped around it. That side of the core should face the back panel when installed. Follow the detail drawing of this transformer's connections, and connect each of the single wires at the top to one of the lugs on the



screw terminal strip. Solder each of these wires. Connect the folded twisted pair and one of the other pairs to the ground lug. Connect the remaining twisted pair to the protruding lug of the coaxial connector.

- 15 Connect one of the black transformer leads to AC outlet lower lug #2. Set the back panel assembly aside.
- 16 Select the main chassis, the dual switch assembly, and 4 of the shortest black Phillips head screws. Fasten the bracket of the already-installed dual push-button switch to the front panel. Install the other switch assembly above it, with the loop lugs at the top.
- 17 Select four 5/16" #4 screws and nuts. Install these in the open holes at the front and rear of PC-26 and PC-27 to complete the securing of the boards to the chassis rails. Check the tightness of the other bolts which had already been installed, including those attaching the back rail to the side pieces.
- 18 Select 2 sets of the same hardware and secure the front panel to the front chassis rail at the two central hole locations only. Leave the left holes open.
- 19 Select 3 of the 1/2" threaded standoffs, the 3 shortest (3/16") bright #4 screws, and three #4 lockwashers. Put a lockwasher on each screw first, and then insert the screws from the **inside** of the front panel in the 3 upper holes nearest the center. Tighten a standoff on each screw. It is best to keep these 3 standoffs as high on the panel as the holes permit. Set the chassis aside temporarily.
- 20 Select the phone jack, its flat washer and nut, and the U-shaped mounting bracket. The jack goes inside the 'U'. When you install the washer and nut on the outside, do not overtighten, as you may strip the plastic threads. With the front lug uppermost, note that the 6 lugs on the back are numbered counterclockwise, starting with #2 at the top. There are no lugs in the #1 and #5 positions.
- 21 Prepare a 2-1/4" black wire. Connect it to the separate front lug of the jack. (S).
- 22 Prepare a 2" green wire, but strip 1/2" from one end. Pass the longer bared end through lug #4, and connect it to lug #2. Solder both lugs.
- 23 Prepare a 2" red wire, but strip 1/2" from one end. Pass the longer end through lug #6, and connect it to lug #8. Solder both lugs.
- 24 Prepare a 1-1/4" orange wire and connect it to lug #3. (S).
- 25 Prepare a 1-1/4" yellow wire and connect it to lug #7. (S).
- 26 Select two 5/16" #4 screws and nuts, and install the phone jack assembly in the right front panel opening from the **outside**. All of the wires will connect to the top of the circuit board.

- 27 Connect the phone jack's orange wire to the hole #OR, just behind the jack. (S). Connect the yellow wire to the adjacent hole #YL. (S). Connect the black wire to the hole #GND on the edge of the board. (S). Connect the red wire to the hole #R (also labelled RED) to the left of the jack. (S). Connect the green wire to the hole #L (also GRN) to the left of the red wire. (S).
- 28 Select the 3 large rubber grommets. Install them in the side pieces, one next to the phone jack, and the others in each rear hole.
- 29 Select the two small rubber grommets. These go in the 3rd and 4th holes from the left end of the rear chassis rail. See pictorial diagram.
- 30 Prepare an 18" red wire and an 18" green wire. Twist these wires together throughout their length. Select the PC-28 circuit board. The two halves of this board are joined by flexible connectors to enable the sections to be mounted at different distances from the front panel. Connect the green wire to hole #6 at the top of the board, above the upper single red LED, from the back of the board. (S). Connect the red wire to the #5 hole below that LED. (S).
- 31 Select the two 7/8" long #4 screws, the two remaining 1/2" threaded standoffs, and two #4 lockwashers. Put the lockwashers on the screws first, and insert the screws from the front of the PC-28 switch board into the two lower holes. Tighten the standoffs on the back of the board.
- 32 Select the three 1/2" #4 screws, the 3 short standoffs which are not threaded, and three #4 nuts. Insert the screws through the display portion of the PC-28 board, then through the standoffs. Fasten the board to the front panel after the flexible connectors and wires have been pushed through the two large openings in the panel.
- 33 Select three 5/16" #4 screws, three #4 lockwashers, and two #4 nuts. Put a lockwasher on each screw first, and insert these in the upper holes of the PC-28 switch board, fastening it to the standoffs. Secure the lower bolts with the nuts. Excessive tightening of these is not required. If later adjustment of the position of this board is necessary to properly center the switches in the front panel, these 2 nuts, and the 3 screws above them on the inside of the panel must be loosened. Generally, keeping these bolts at the upper limit of the holes in the panel will be best.
- 34 Feed the long red and green twisted pair of wires down through the slot between the two circuit boards, under the front edge of PC-26 to the phone jack, and along the bottom of the right side piece. Connect the red wire to hole #5 in the rear corner of PC-26. (S). Connect the green wire to hole #6. (S).
- 35 Select the back panel assembly and four 1/2" black #6 screws and nuts. Attach the back panel to the sides.
- 36 Thread the AC line cord through the left rear grommet, and connect one lead to AC outlet bottom lug #2. (S-3). Connect the other lead to the outlet top lug #1.
- 37 Pass the remaining black transformer lead through the left small grommet in the rear chassis rail, and connect it to the hole #B in PC-27. (S).
- 38 Twist together the two yellow transformer leads, and push them through the hole in the rail next to the grommet. Shorten these leads if you choose, and connect one to each of the two holes #Y on PC-27 which are in front of the entrance hole. Solder each.
- 39 Twist together the two red, and the red/yellow transformer leads, and pass them through the second hole in the rail. Connect the red/yellow lead to the hole #RY on PC-27 in front of the grommets. (S). Connect each red lead to one of the holes #R near the side of the board. Solder each.
- 40 Twist the two green transformer leads together, and pass them through the first hole in the rail. Connect one lead to each of the holes #G along the side of the board towards the front. Solder each.
- 41 One length of shielded cable is connected at only one end to the underside of PC-26. Pass the other end through the hole in the rear rail below the gap between the two circuit boards. The outer shield has been terminated in a soldered single wire. Trim this wire to 3/8", and connect it to the ground lug in the center of the back panel. (S-5). Connect the center conductor of the cable to the lug of the coaxial connector. (S-3).
- 42 Pass the red and black pair of wires from PC-24 through the first hole from the right end of the rail, and connect the black wire to one of the two holes #BLK at the side of the board near the front. (S). Connect the red wire to the hole #RED in front of it. (S).
- 43 Pass the green and black pair of wires through the second hole in the rail, and connect the black wire to the second hole #BLK. (S). Connect the green wire to hole #GRN near the front of the board. (S).
- 44 Turn the chassis upright, and plug in the 3 flexible connector cables. The long one has a stripe which goes nearest the front panel. That plug has one pin intentionally missing.
- 45 Prepare a 3-3/4" yellow wire. Connect it to pushbutton switch MS lug #6. (S). Connect the other end to hole #4, to the right of the center of PC-26. (S).
- 46 Prepare a 3-1/2" yellow wire. Connect it to MS lug #5. (S). Connect the other end to hole #3 on PC-26. (S).

- 47 Prepare a 4-1/2" red wire, and connect it to switch AS lug #5. (S). Connect the other end to hole #2R located near the center of the right edge of PC-26. (S).
- 48 Prepare a 4" green wire, and connect it to switch AS lug #2. (S). Connect the other end to hole #L1. (S).
- 49 Select the red wire and the green wire from the back panel PC-24. Connect the red wire to AS lug #4. (S). Connect the green wire to AS lug #1. (S).
- 50 Prepare a 26" white wire and a 28" white wire. Starting with even ends, twist these lightly together (about 1 twist every 2 inches). From outside the right side piece, feed the even ends through the front grommet, and upwards past the outside of the phone jack about 2 inches. Feed the uneven ends through the rear grommet and along the outside of the rear rail, below the twisted pairs, and the single red and green wires. Connect the shorter white wire to the AC outlet upper lug #1. (S-2). Feed the longer white wire through the open grommet in the rear rail and connect it to the hole in the left rear corner of PC-27 that connects to the outer lug of the fuse clip. (S).
- 51 Select the power switch and the two remaining small black Philips head screws. Install the power switch above the phone jack with the lugs pointing up to the left. Bring the white wires over the switch and connect one white wire to each switch lug.
- 52 Select the .01 mfd disc capacitor. Trim its leads to 3/8", and connect one lead to each of the switch lugs. Solder the two wires on each lug. Place the capacitor down toward the board.
- 53 Select the metal knob, and install it fully on the control shaft, so that the set screw engages the flat on the shaft.
- 54 Select the black fiber shield, and punch out the segments. Place it over the PC-28 display board, and keep it up off the board to provide maximum shielding of stray illumination. Remove the clear protective covering over the number display, if it is present.
- 55 Select the plastic lens, the charcoal brown front plate extrusion, and the 4 strips of double sided tape. Remove one backing strip and install the tape along each inside edge of the large opening in the front plate. Once it has been firmly pressed into place, the second backing strip can be more easily removed, as the tape will stick to the metal. Clean both surfaces of the plastic lens, and press it into place.
- 56 Select the 5 plastic pushbuttons, and install them on the switch shafts. If one is not tight, a small piece of cellophane tape on one side of the shaft will secure it.
- 57 Select the 3 plastic wire ties. Thread one through the front pair of slots on the right side piece. Secure the red and green pair of the inside, as well as the white wires on the outside, by passing the tail of the tie through the head from the flat side. It locks automatically. Cut off the excess. The second tie secures the white pair at the fourth hole from the right end of the rear rail. The third ties together the transformer leads, the AC power cord, and the white wires on the right side of the power transformer.
- 58 Select the bottom plate, 6 sheet metal screws, and the 4 square feet. Move the AC line cord away from the screw hole below the transformer, and install the plate with its holes in the left rear corner. Place the self-adhesive feet in the corners.
- 59 Select a pair of end caps—either the standard ones, or those for rack mounting—and the front plate, along with the cap screws and nuts, and the large L-shape Allen wrench. The end caps slip into slots on the front plate. Remove the cap screws which have secured each end of the front panel, and with the other two sets, secure the end caps and front plate to the chassis. Check for clearance around each of the controls.
- Make sure the banks of square switch buttons are centered in the front plate cutouts. It may be necessary to shift the phone jack bracket if alignment is off, but the vertical setting of the front plate is determined largely by the bottom plate. The three screws and two nuts behind the switch circuit board can be loosened to provide a small adjustment.
- 60 Install the 2 long U-shape plastic grommets on the top edges of the front and back panels. Shake the unit to dislodge any wire clippings, etc. and check the following:
- There are no loose strands of line cord at the AC outlet.
 - There are no loose strands of shielding at the coaxial connector.
 - The connections on the phone jack are not touching.
 - There are no unsoldered connections.
 - The single red and green leads from PC-24 are kept apart, and above PC-26.
- 61 Slide on the cover from the rear, and secure it with the 4 sheet metal screws. Affix the serial number label to the bottom plate. You may wish to fasten the knob wrench to the bottom with tape.
- 62 **IMPORTANT.** Sign and date the FCC certification label. Peel off the backing and attach the label to the center of the back panel between the corner marks provided.

SERVICE POLICY AND LIMITED WARRANTY

The DH-330 Tuner has been carefully engineered to provide many years of use without requiring any maintenance or servicing.

Factory assembled units are subjected to many physical and electrical tests before shipment. The circuit board assemblies of kit units are similarly tested to meet performance specifications prior to packing. In spite of this, shipping damage does occur, a kit may not be assembled properly, or human error interferes, so service may be needed. The David Hafler Company provides complete service facilities at the factory to make any necessary repairs. Because many of the components in this refined design are not readily available through local sources, and the performance of the unit is likely to be compromised with "similar type" substitutions, we strongly recommend factory service, or obtaining the requisite parts from the factory.

It is the owner's responsibility to return or ship the unit freight prepaid to the factory service department and to provide insurance in transit. Units shipped freight collect will not be accepted. For units to be repaired under warranty, a copy of the dated bill of sale must accompany the unit.

Use the complete original carton and all packing material to ship your tuner. The kit packaging is designed to accommodate the completed unit. Enclose with the unit the following information:

1. Complete shipping address (Post Office box numbers are not acceptable, except for correspondence).
2. The serial number, if it is not on the unit.
3. Copy of dated bill of sale if repairs are to be made under warranty.
4. Description of the malfunction. If intermittent, be sure to indicate.
5. You may also wish to attach your address directly to the unit, or to the line cord.

All service work is guaranteed for 90 days.

Warranties apply to the original purchaser only. The warranty is void if the tuner has been modified without factory authorization; or if parts have been substituted which, in the factory's judgment, are not suitable; or if the tuner has been either physically or electrically abused, or used for some purpose for which it was neither designed nor intended. The warranty on the transformer is void if the leads have been cut too short for re-use.

Technical assistance to help you locate the source of a problem may be obtained by calling or writing the Technical Services Department. Phone (609) 662-6084 between 8

A.M. and 4:30 P.M., eastern time. It is helpful to know the serial number of the unit, and the results of any tests you have performed. However, this tuner is *not user serviceable*. This unit has been certified for compliance with FCC regulations limiting spurious RF radiation from a radio receiver only as it was aligned and tested at the factory. Thus, no adjustment should be made to any of the variable components on the circuit boards, without the extensive knowledge and test equipment which is required for circuit alignment. Only the most rudimentary component replacement may be undertaken otherwise. For the technician experienced in tuner alignment, details of the procedure and equipment required will be provided by the factory on request.

WARRANTY FOR KIT-BUILT UNITS

The parts in a DH-330 kit are warranted for a full year from the purchase date. If a defective component is found on a circuit board or in a kit, simply return the *individual* part to the factory prepaid together with the serial number and the date of purchase, and it will be replaced at no charge.

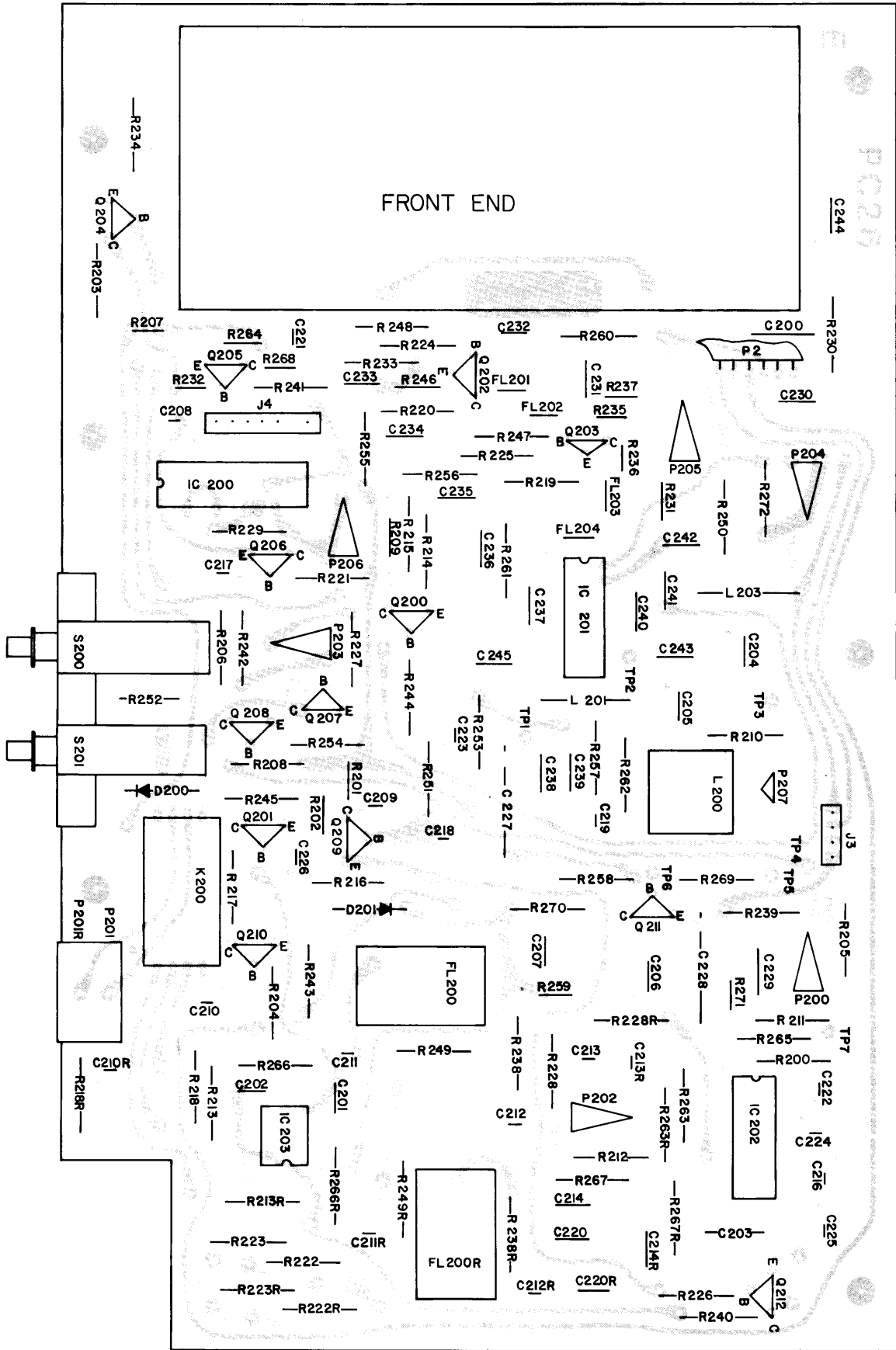
If you cannot locate what is wrong with your tuner, return it to the factory along with a copy of the dated bill of sale, and a check for \$35. If the cause of the problem is a defective part, the unit will be repaired and returned to you transportation prepaid, and your \$35 *less the shipping charges* will be returned to you. If the problem is found to be an error in your assembly of the tuner, the tuner will be put in proper working order, tested to be sure it is meeting specifications, and returned to you (freight prepaid within the continental U.S.). Excess shipping charges for expedited service, or overseas delivery are your responsibility. At the sole discretion of the factory service department, if the time required for diagnosis, repair and testing, and the nature of the malfunction warrants it, a portion of the submitted repair fee may be rebated.

This warranty is void if the kit has not been completely assembled or if other than rosin core solder has been used. Units assembled with acid core solder or paste flux will be returned unserviced.

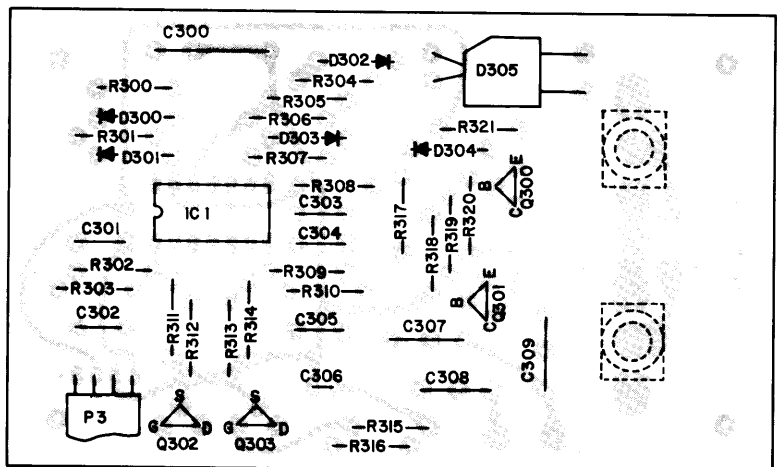
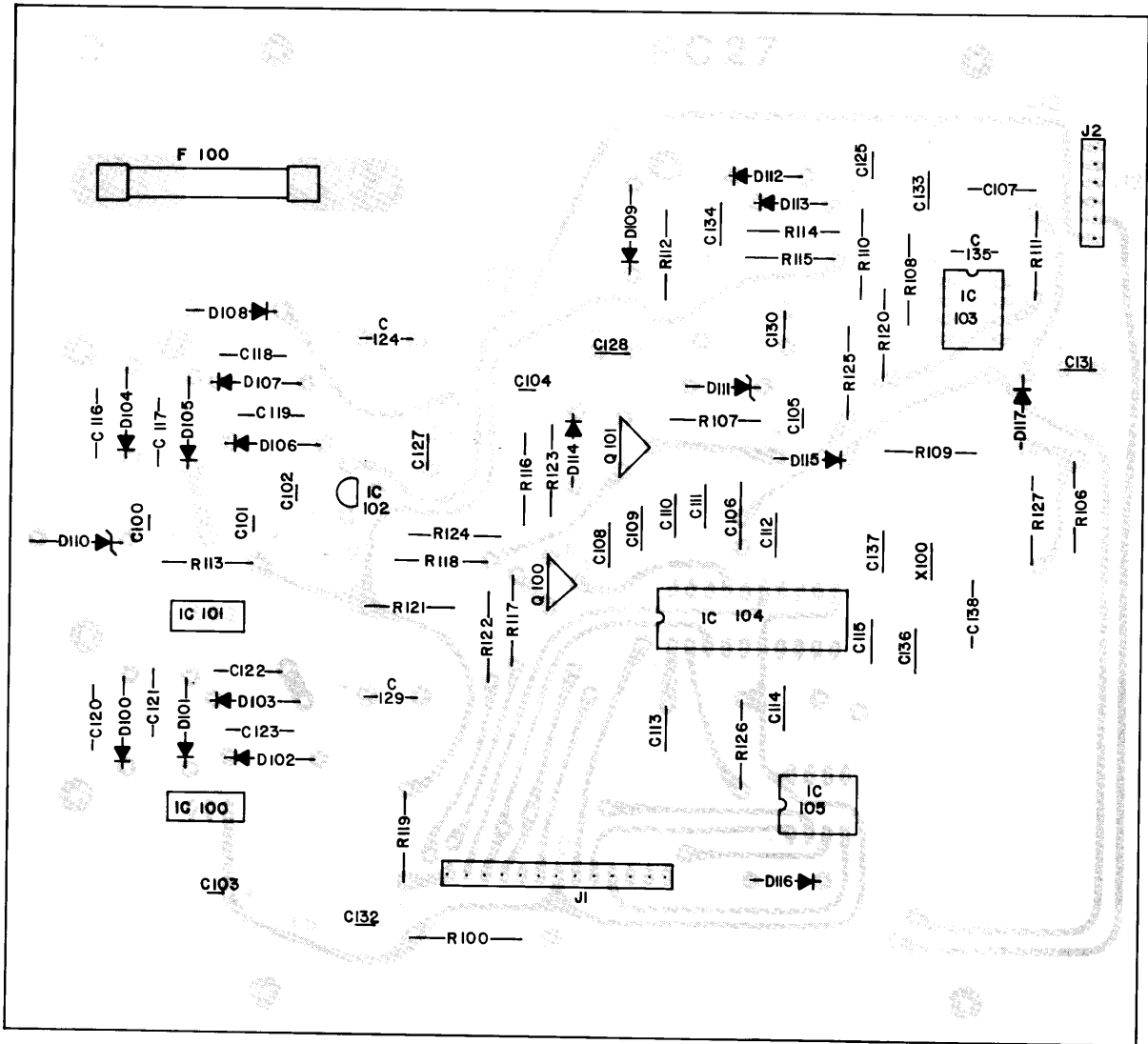
WARRANTY FOR FACTORY ASSEMBLED UNITS

The DH-330A is warranted for 3 full years from the purchase date including parts and labor and normal shipping costs from the factory to the owner within the continental U.S. The owner is responsible for returning the unit to the factory and must submit a copy of the dated bill of sale.

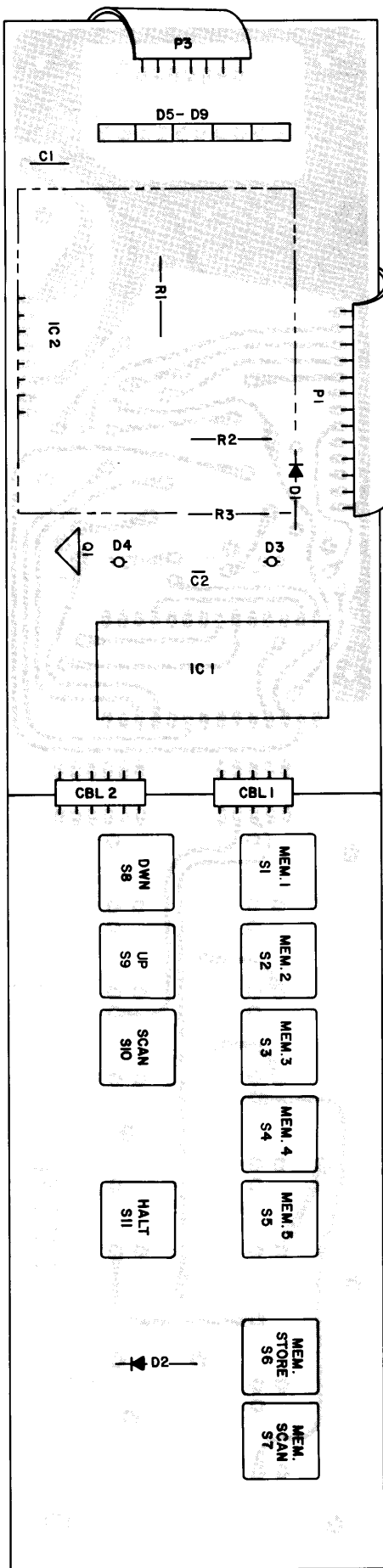
This warranty gives you specific legal rights. You may also have other rights which vary from state to state.



CIRCUIT BOARD COMPONENT IDENTIFICATION



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