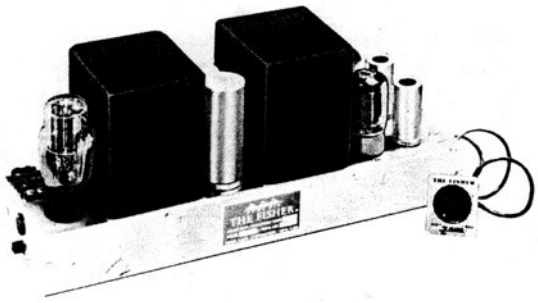
THE FISHER®

AUDIO AMPLIFIER

INSTALLATION AND
OPERATING INSTRUCTIONS



MODEL 70-AZ

WITH Z-MATIC PAT. PEND.

PRICE: $1.00

FISHER RADIO CORPORATION · NEW YORK

THE FISHER

AUDIO AMPLIFIER · Model 70-AZ

GENERAL INFORMATION

THE FISHER Audio Amplifier, Model 70-AZ, will meet the requirements of the most exacting user. Complete fidelity of reproduction and absence of listener fatigue are a direct result of the extremely low harmonic and intermodulation distortion at all power levels, as well as excellent transient response, wide frequency range and good linearity. Hum and noise are virtually non-measurable, thus allowing operation at all listening levels without the distraction of extraneous noise. The great reserve power handling capacity of the Model 70-AZ makes it capable of reproducing the complete dynamic range even of a full symphony orchestra. All components in this compact unit have been selected for long life and installed with maximum accessibility in mind, for easy servicing.

THE FISHER Z-MATIC CONTROL

The loudspeaker system has long been recognized as one of the most important limiting factors in the faithful reproduction of high fidelity sound. Where a loudspeaker bears the typical specification — "Voice Coil Impedance: 16 ohms" — it should be noted that this specification really applies only to a *limited portion* of the total frequency range. The reason is that a speaker voice coil impedance actually varies quite markedly, and according to the particular point of the audible spectrum involved. Thus, a typical 12" speaker rated at 15 ohms actually has that 15-ohm impedance at 400 cycles. At 35 cycles the voice coil impedance could be anywhere from 60 to 90 ohms, and at 10,000 cycles from 30 to 50 ohms. See Figure 8.

The steep rise in voice coil impedance in the 40-to-100-cycle region is particularly serious, for it is exactly in this portion of the audible spectrum that we need a good impedance match between voice coil and amplifier in order to reproduce with full richness such instruments as the tympanum, bass viol, cello, organ, and the bottom octave of the piano. And the steep rise in voice coil impedance at the high end decreases treble response.

All typical amplifiers of better quality built today have not taken the above impedance matching problem into account. Thus, although the electrical characteristics of the signal up to the voice coil may have a uniform response, this is promptly affected by the impedance variations of the loudspeaker system. Although the VOLTAGE delivered to the loudspeaker remains constant regardless of frequency, the POWER absorbed by the loudspeaker will *not* be constant because it is a function of both voltage *and* load resistance.

As an example, let us assume that a 440-cycle tone (Middle A on the piano) is introduced to the loudspeaker. At this frequency the voice coil impedance is actually 16 ohms, as specified by the speaker manufacturer. Let us assume further that the voltage reaching the voice coil is 4 volts. Under these conditions electrical power will be 1 watt. Let us now attempt to reproduce an organ tone 3 octaves *lower* (55 cps) and of *equal* intensity. The impedance of the loudspeaker at this frequency would in this case be about 64 ohms (and in many cases loudspeakers have even higher voice coil impedances as one approaches their resonant frequency.) Inasmuch as power, for a constant voltage, varies inversely with the load impedance, the result is that only *¼ of 1 watt* of power will actually be absorbed and utilized by the speaker on the aforementioned organ tone.

It therefore follows that the ideal goal is to produce an amplifier containing special circuits that recognize the non-uniform impedance of loudspeakers and provide the means of eliminating this inherent mismatch. We are proud to announce that this long-sought-after goal has now been reached in FISHER Amplifiers. These special circuits are what comprise THE FISHER Z-Matic Control.

THE FISHER Z-Matic circuits will not only supply *constant* power to a loudspeaker *regardless* of its load impedance but, further, will at the mere turn of a control knob provide *additional* compensation to balance the deficiencies of the loudspeaker or its enclosure.

WHAT THE FISHER Z-MATIC CONTROL DOES

The unusual circuitry of THE FISHER Z-Matic Control *automatically* corrects the impedance mismatch condition described earlier. The Z-Matic Control is continuously variable and can be set at any desired point to suit the requirements of the particular program being reproduced, as affected by the existing speaker system, speaker enclosure — in fact, the entire electrical and acoustical system. See Figure 9.

The Z-Matic Control *automatically* makes the corrections for varying load impedance *to the exact degree desired by the user* to meet his particular acoustic and environmental conditions. The results are truly revolutionary and thrilling to hear, for Z-Matic opens a wide, new door on high fidelity sound reproduction.

IMPORTANT NOTE: THE FISHER Z-Matic Control does what an ordinary Bass Tone Control, or Loudness Balance Control, *cannot* do. The Z-Matic Control restores to full intensity only *those* tonal frequencies that suffered attenuation because of speaker system characteristics. For this reason, no "barrel" bass is created. Proof of this desirable achievement is instantly apparent on listening to the male speaking voice, the most usual source of "barrel" bass.

THE FISHER Model 70-AZ may be used directly with an FM-AM tuner, such as THE FISHER Model 70-RT, a crystal phonograph cartridge or any other device which is capable of producing a one-volt signal. Where magnetic phonograph cartridges, microphones or similar low-level devices are employed, pre-amplification is necessary. Especially suited to these latter applications is THE FISHER Master Audio Control, Series 50-C, available as a companion unit to THE FISHER Audio Amplifier, Model 70-AZ.

The Model 70-AZ has four separate feedback loops, resulting in low internal impedance, extremely low distortion and excellent transient response. Two type 5881-tubes, connected as tetrodes, are employed in the power stage. The unique cathode and screen feedback circuit offers all the advantages of triode performance, together with efficiency of tetrodes. The carefully designed output transformer consists of fifteen interleaved windings in conjunction with a grain-oriented steel core, assuring the finest results.

INSTALLATION

Since THE FISHER Model 70-AZ is designed for use as a basic amplifier it can be installed wherever there is adequate ventilation. Once properly installed and adjusted, access to its controls will not be required for normal operation of the equipment. Chassis mounting dimensions are shown in FIGURE 6. THE FISHER Model 70-AZ power line cord should be connected to an auxiliary AC receptacle working off a master switch. Thus the amplifier is turned on together with the tuner or preamplifier used. THE FISHER Model 70-AZ requires 170 watts at 105-125 volts, 50-60 cycles AC.

The Z-Matic Control and Cable Assembly will be found packed in the top "filler" of the amplifier carton. The 4-prong connection plug should be installed in the proper receptacle on the amplifier chassis.

1. Note that the middle terminal of the three speaker terminals on the amplifier has been discontinued. Connect the loudspeaker leads to the two remaining terminals (these are labeled "8 or 16" and "Gnd".) The latter ground must not be used as part of the basic ground of the entire electrical system.
2. To select the proper nominal matching impedance for the speaker system being used, set the impedance switch correctly.
3. The Z-Matic Control shaft can be mounted on your main control panel by drilling a ⅜" hole therein.
4. Remove all the elements from the Z-Matic Control shaft, except the final hex-nut. Insert the Control in the panel from the rear, and adjust the aforementioned hex-nut so that sufficient threads protrude past the front surface to accommodate the Z-Matic designation plate as well as the remaining hex-nut. Before tightening, mount the Control knob on the shaft, turn it to the left as far as it will go, and then rotate the portion of the Control on the rear of the panel so that the white dot on the knob falls at the corresponding "min" dot on the designation plate. Now remove the knob, tighten the final hex-nut and slip the knob back on again.

INPUT CONNECTION

Connection to the INPUT of the Model 70-AZ is made by means of a standard RETMA phono plug supplied with the equipment. If the signal source is approximately one volt, the LEVEL ADJUSTMENT control should be rotated fully clockwise. For signal sources in excess of one volt, turn the LEVEL ADJUSTMENT correspondingly lower (counter-clockwise) depending on the maximum voltage of the signal source. When using THE FISHER Master Audio Control as a preamplifier, set the LEVEL ADJUSTMENT of the Model 70-AZ to maximum (clockwise.)

HOW TO ACHIEVE MAXIMUM ENJOYMENT OF THE FISHER Z-MATIC CONTROL

When the Z-Matic Control is set at minimum, the amplifier will operate in the conventional manner, producing constant voltage regardless of load.

Let us now arbitrarily set the Control with the dot at the top. In this vicinity constant power will be fed to the loudspeaker regardless of variations in speaker impedance. High quality speaker systems with good, overall efficiency will perform best when the Control is in this position.

Where optimum speaker systems and speaker enclosures are not available, the acoustic shortcomings of the system can be overcome in great measure by rotating the Z-Matic Control toward maximum, according to the needs of the situation. Any rotation past the top position produces increasing multiplication of the electrical factors necessary to overcome the deficiencies of the speaker system and speaker enclosure.

The Z-Matic effect will, of course, be most apparent in the maximum position (full), in many cases, represents the closest approach to truly uniform response in terms of *audible power*, which is after all the ultimate criterion.

It should be noted that the three positions described were arbitrary, for the purposes of the discussion. There are an infinite number of intermediate positions available, according to your tastes and needs. May we suggest that you experiment with the Control to familiarize yourself with its tremendous possibilities for increasing the enjoyment of your equipment.

IMPORTANT NOTE: With some speakers, rotating the Z-MATIC Control may result in an over-all volume change. This condition is caused by a slight mismatch between speaker and amplifier. (A nominal 16-ohm voice coil may not be exactly 16 ohms at mid-frequencies.) As long as the change in volume is not severe, the Z-Matic circuit will operate effectively.

PHASE INVERTER BALANCE ADJUSTMENT

The phase inverter balance adjustment potentiometer R-6, is inside the side apron of the chassis. This potentiometer has been carefully pre-set at our factory. Adjustment is required only when components in the phase inverter circuit are replaced and should never be attempted unless a low distortion audio generator, and a wave analyzer or distortion analyzer, are available. If this adjustment becomes necessary, proceed as follows:

1. Connect the audio generator to the amplifier INPUT.
2. Disconnect the speaker and connect a 16-ohm, 20 watt resistor to "GND" and "8 or 16".
3. Switch IMPEDANCE SELECTOR to "16".
4. Rotate Z-MATIC Control fully counterclockwise.
5. Connect the wave analyzer or distortion analyzer across the 16-ohm resistor.
6. Set the audio generator to 1000 cycles and adjust the attenuator so that the amplifier produces 20 watts output (17.85 volts RMS) across the 16-ohm resistor.
7. Tune the wave analyzer to the second harmonic of 1000 cycles, or, if a distortion analyzer is used, tune it for minimum reading at 1000 cycles.
8. With extreme care adjust the phase inverter balance control for minimum distortion.

TECHNICAL SPECIFICATIONS

HIGH OUTPUT, with less than ½% distortion at 25 watts (less than 0.15% at 20 watts; less than 0.05% at 10 watts.) INTERMODULATION DISTORTION less than ½% at 20 watts and less than 0.2% at 10 watts; see FIGURE 1. FREQUENCY RESPONSE is uniform within 0.1 db from 20-20,000 cycles and is within 1 db from 10-50,000 cycles; see FIGURE 3. POWER OUTPUT is constant within 1 db at 25 watts from 15-35,000 cycles; see FIGURE 5. HUM AND NOISE level is better than 95 db below full output. INTERNAL IMPEDANCE with Z-MATIC Control counterclockwise is 0.61 ohms for 16-ohm operation, giving a damping factor of 26. PHASE SHIFT is less than 15° at 20 cycles and less than 18° at 20,000 cycles; see FIGURE 2. A schematic diagram is shown in FIGURE 7. LINEARITY RESPONSE (input versus output) is plotted in FIGURE 4.

GENERAL SPECIFICATIONS

The entire amplifier and power supply are built on one compact, steel chassis, thus simplifying installation. Handsome, professional styling includes black, baked enamel transformer cases. TUBE COMPLEMENT: 1-12AT7, 1-12AU7, 2-5881, 1-5V4G. OUTPUT IMPEDANCES: 8 or 16 ohms. Instantly accessible fuse. SIZE: 4⅛" deep, 14¾" wide, 6⅛" high. SHIPPING WEIGHT: 21½ pounds.

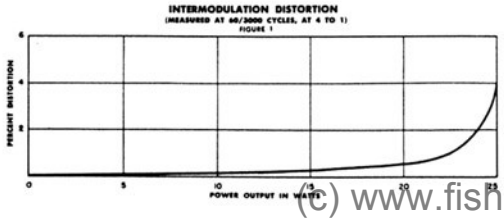
AT YOUR SERVICE

It is the constant desire of Fisher Radio Corporation to have your FISHER equipment give you its best possible performance. Toward that objective, we solicit your correspondence on any special problems that may arise. After you have had an opportunity to familiarize yourself with THE FISHER equipment you purchased, we would appreciate your letting us know how it is meeting your requirements.

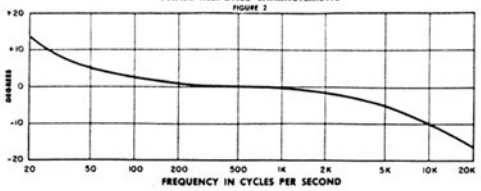
SPECIAL NOTE: To maintain your equipment at peak performance, may we suggest that you avail yourself of the facilities and factory trained personnel at our Service Department.

FISHER RADIO CORPORATION
21-21 Forty-fourth Drive
Long Island City 1, N. Y.

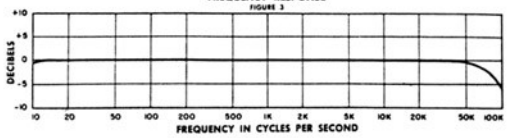
INTERMODULATION DISTORTION
(MEASURED AT 60/3000 CYCLES, AT 4 TO 1)
FIGURE 1



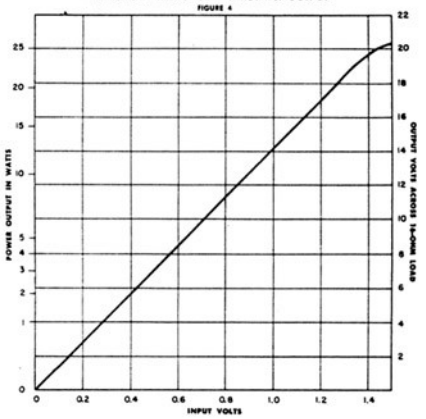
PHASE RESPONSE CHARACTERISTIC
FIGURE 2



FREQUENCY RESPONSE
FIGURE 3



LINEARITY RESPONSE — INPUT VS. OUTPUT
FIGURE 4



POWER RESPONSE
(MEASURED AT 50 AND 25 WATTS OUTPUT)
FIGURE 5

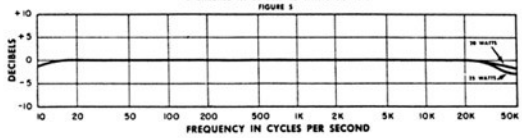


FIGURE 8. TYPICAL IMPEDANCE CURVE — 12" SPEAKER

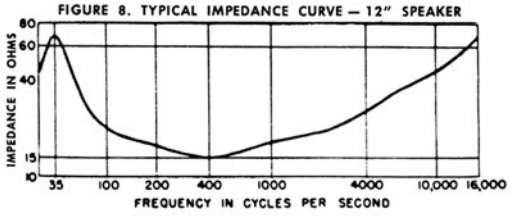
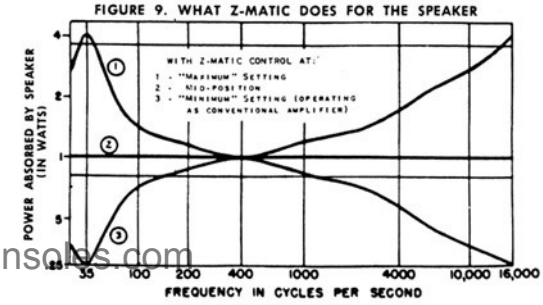


FIGURE 9. WHAT Z-MATIC DOES FOR THE SPEAKER



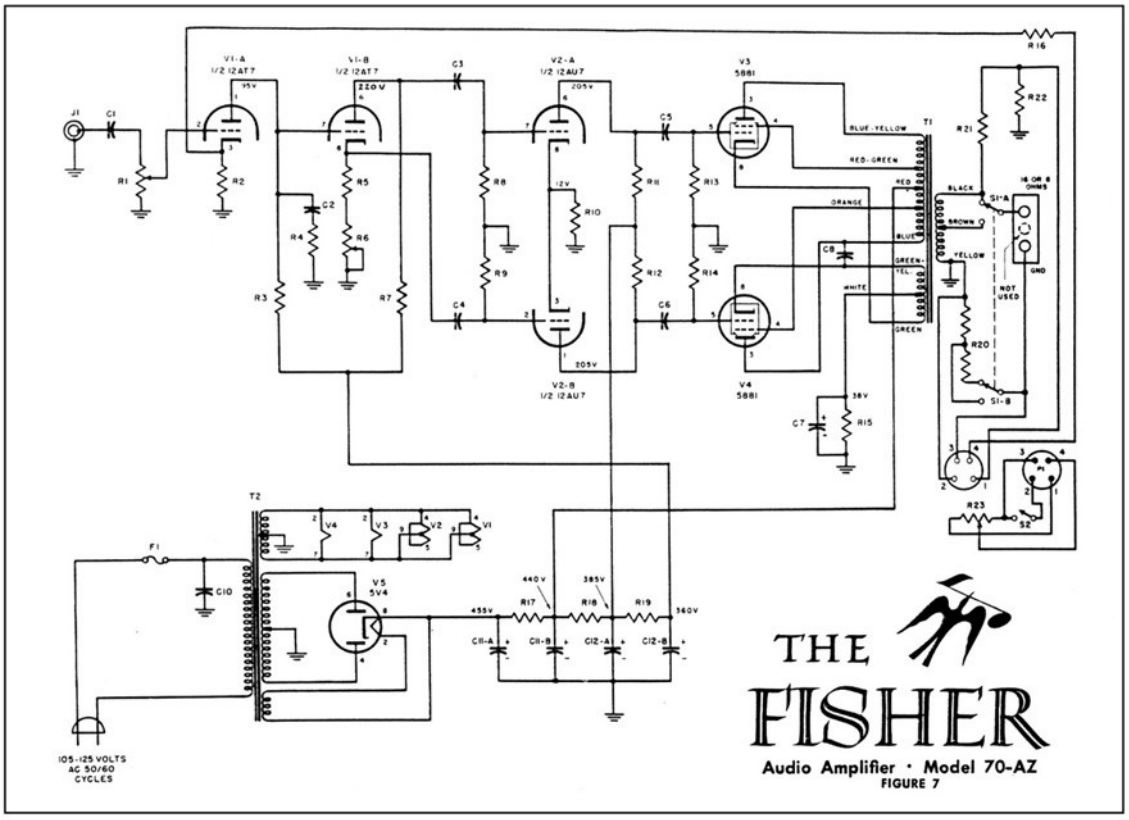


FIGURE 7

PARTS DESCRIPTION LIST

SYMBOL	DESCRIPTION	PART No.
C-1	Capacitor: .22 mfd; 200 V	C-68P224V2
C-2	Capacitor, Ceramic: 82 mmfd, 10%; 500 V	C-3310
C-3, C-4	Capacitor: .022 mfd; 400 V	C-68P223M4
C-5, C-6	Capacitor: .1 mfd; 400 V	C-68P104M4
C-7	Capacitor, Electrolytic: 50 mfd; 50 V	C-508-115
C-8	Capacitor, Ceramic: 500 mmfd; 1500 V	C-508-122
C-10	Capacitor: .01 mfd; 600 V	C-2747
C-11A, B	Capacitor, Electrolytic: Each section 40 mfd; 500 V	C-522-114
C-12A, B	Capacitor, Electrolytic: Each section 40 mfd; 450 V	C-1798
P-1	Plug: 4 Male Contacts	P-1657
R-1	Potentiometer, Composition: 500,000 ohms	R-2815-9
R-2	Resistor, Composition: 1500 ohms, 10%; ½ W	RC-20BF152K
R-3	Resistor, Composition: 220,000 ohms, 10%; ½ W	RC-20BF224K
R-4	Resistor, Composition: 10,000 ohms, 10%; ½ W	RC-20BF103K
R-5	Resistor, Composition: 68,000 ohms, 10%; ½ W	RC-20BF683K
R-6	Potentiometer, Composition: 50,000 ohms	R-50000-5

SYMBOL	DESCRIPTION	PART No.
R-7	Resistor, Composition: 100,000 ohms, 10%; ½ W	RC-20BF104K
R-8, R-9	Resistor, Composition: 470,000 ohms, 10%; ½ W	RC-20BF474K
R-10	Resistor, Composition: 4700 ohms, 10%; ½ W	RC-20BF472K
R-11, R-12	Resistor, Composition: 150,000 ohms, 10%; ½ W	RC-20BF154K
R-13, R-14	Resistor, Composition: 470,000 ohms, 10%; ½ W	RC-20BF474K
R-15	Resistor, Wirewound: 350 ohms, 10%; 10 W	R-508-121
R-16	Resistor, Composition: 2200 ohms, 10%; ½ W	RC-20BF222K
R-17	Resistor, Composition: 100 ohms, 10%; 5 W	R-508-120
R-18, R-19	Resistor, Composition: 10,000 ohms, 10%; ½ W	RC-20BF103K
R-20	Resistor, Wirewound: 2 ohms, tapped at 1 ohm	R-522-118
R-21	Resistor, Composition: 2200 ohms, 10%; ½ W	RC20BF222K
R-22	Resistor, Composition: 330 ohms, 10%; ½ W	RC20BF331K
R-23	Potentiometer, Composition: 1000 ohms	R-537-121
S-1	Switch, Slide: DPDT	S-505-117
S-2	Switch, SPST; part of R-23	R-537-121
T-1	Transformer, Output	T-508-116
T-2	Transformer, Power	T-508-117

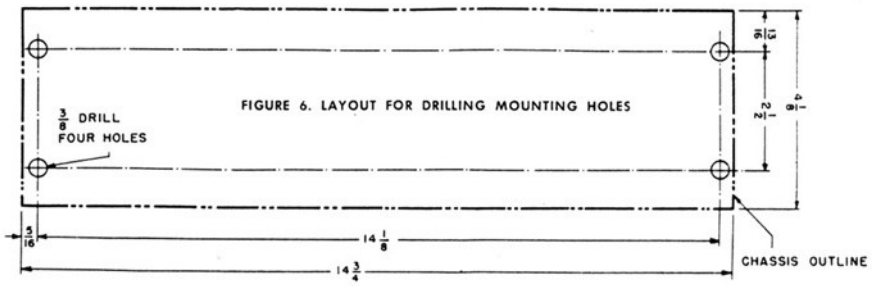


FIGURE 6. LAYOUT FOR DRILLING MOUNTING HOLES