

tuned to tomorrow...



INSTRUCTION BOOK FOR

The National *Horizon 20* TWENTY WATT AMPLIFIER

The latest in audio engineering techniques, plus careful attention to design details, make the Horizon 20 an instrument unparalleled for superb performance and operating efficiency. Its excellent characteristics are due, in large measure, to the unique output stage in which the coupling between the output tubes is unity, independent of the output transformer. This permits the use of high efficiency class AB₁ operation without the impulse distortion commonly associated with conventional circuits which rely upon the output transformer for coupling between the tubes. Unity coupling has the additional advantage of requiring a

far lower impedance ratio between the output tubes and the load with attendant reduction in leakage inductance and increased power bandwidth.

In addition to its superlative performance, the National Horizon 20 incorporates the unique plug-in facility for the accommodation of the Horizon 5 Preamplifier - Control Unit. This feature alone exemplifies the advanced design of the National high fidelity line resulting in optimum flexibility of installation and operation. The following specifications indicate some of the other outstanding features of the Horizon 20.

Please use this manual. It has been prepared with the prime purpose of enabling the user to obtain full satisfaction from this product.

NATIONAL COMPANY, INC.,



MALDEN & MELROSE, MASS.

FEATURES

HARMONIC DISTORTION: 0.3% at rated output of 20 watts, 0.6% at 25 watts.

INTERMODULATION DISTORTION: 1% at 20 watts, measured with 400 cps. and 7 kc. at a ratio of 4:1.

FREQUENCY RESPONSE: ± 0.1 db from 20 cps. to 20 kc. ± 1 db from 10 cps. to 100 kc.

POWER RESPONSE AT 20 WATTS: ± 0.15 db from 20 cps. to 20 kc. ± 1 db from 10 cps. to 60 kc.

HUM AND NOISE: 80 db below 20 watts output.

SENSITIVITY: 1.6 volts for 20 watts output.

OUTPUT IMPEDANCE: 8 and 16 ohms nominal.

INPUT IMPEDANCE: 500,000 ohms.

INPUT LEVEL CONTROL: accommodates a wide range of input signal levels.

RUMBLE FILTER: built in to minimize turntable rumble and noise.

ACCESSORY OUTLET: 117 volt AC, 3 amp. convenience outlet for energizing associated equipment.

PREAMP COMPARTMENT: contains multiconnector wired to associated rear-panel jacks to convert the Horizon 20 to a single-unit equipment when the Horizon 5 preamp is plugged in.

POWER INPUT: 117 VAC, 50-60 cps, 1 amp, 110 watts.

PREPARING TO OPERATE

Examine the amplifier immediately after unpacking to make certain that no apparent damage has been incurred during shipment. A cardboard pad is placed around the tubes to protect them in transit. This must be removed. To do so it is necessary to remove the cabinet. Since the Horizon 20 has no operating controls, it may be installed in any convenient location so long as there will be a free circulation of air to allow ventilation. The above would hold true when the Horizon 5 preamp is used with the amplifier, provided that the preamp is located at a point remote from the amplifier.

When the National Horizon 5 preamp is plugged into the Horizon 20, the unit must be installed with control accessibility in mind. The attractive overall appearance of the amplifier makes it well suited for use on a table top, shelf or any convenient location. Once the input, power and speaker connections have been made, the Horizon 20 with the Horizon 5 preamp becomes a versatile control center for the custom high fidelity installation. If it is desired to make this combination part of a custom installation, refer to the paragraph on Cabinet Installation.

ELECTRICAL CONNECTIONS

All the input and output connections of the Horizon 20 amplifier are located on the back drop of the chassis. See Figure 1. Connections to the various jacks and terminals should be made in the following manner:

1. HORIZON 20 AMPLIFIER WITHOUT HORIZON 5 PREAMP

PWR. AMP. INPUT: The output of the National Criterion or similar AM-FM tuner or the output of a preamp other than the Horizon 5 is connected to this jack. Single conductor shielded cable must be used, the length dictated by the recommendations accompanying the particular equipment. Associated equipment should have an output level of 1.6 volts or more. All other jacks are unused.

SPEAKER OUTPUT: A high fidelity loudspeaker system having an impedance of either 8 or 16 ohms may be connected to these terminals. The terminal marked G is the common connection and may be grounded if desired. Shielded cable is not required for speaker connections and the length is not critical. Number 18 wire (size of ordinary lamp cord), or larger, is recommended.

117V 3A OUTLET: This convenience outlet is supplied for the purpose of providing input voltage

for other units of the system as desired. It is energized when the amplifier is plugged into the 117-volt line.

2. HORIZON 20 AMPLIFIER WITH HORIZON 5 PREAMP

PWR. AMP. INPUT: When the Horizon 5 preamp is used with the Horizon 20, either plugged into the unit or connected by means of an interconnecting cable, the Pwr. Amp. Input jack is not used. The interconnecting cable complete with mating connectors may be procured in either 4 or 15-foot lengths.

When the interconnecting cable is used, remove one of the thumbscrews from the preamp compartment cover plate and thread the screw into the tapped hole at the right edge of the preamp compartment. This must be done in order to close the interlock switch.

TV INPUT: Any TV tuner having an output of 1.6 volts or more may be connected to this jack. This jack will also accommodate the standard high-level ceramic or crystal type phono pickup. Shielded cable must be used.

TAPE PLAYBACK INPUT: A tape reproducing unit may be connected to this jack, or any piece of

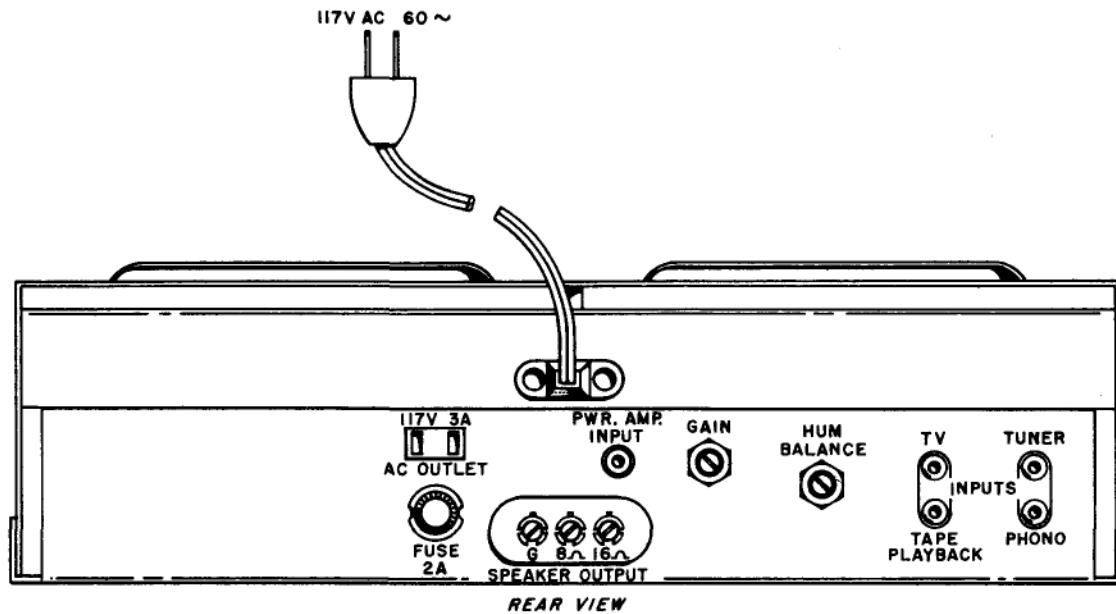


Figure 1. Electrical Connections

audio equipment having an output of approximately 1.6 volts. This jack will also accommodate the ceramic or crystal pickup.

TUNER INPUT: The National Criterion AM-FM tuner or any high quality tuner may be connected at this point. When the Criterion is used, the four-foot length of audio interconnecting cable may be used. If another tuner is employed, the cable used should be of the single-conductor shielded type. The length must be determined by the instructions accompanying the tuner. Cables in excess of the recommended length may cause serious attenuation of the higher

frequencies.

PHONO INPUT: This jack accommodates all types of high fidelity low-level phono pickup cartridges. Shielded cable of the type and length recommended by the pickup manufacturer should be used. A slide switch is incorporated in the Horizon 5 to select the proper circuitry for either the 10 mv. or 30 mv. type of cartridge. (See instruction manual supplied with the Horizon 5 preamp).

SPEAKER OUTPUT AND 117V, 3A OUTLET: The instructions given in paragraph 1. also apply when the preamp is used.

OPERATING INSTRUCTIONS

When the Horizon 20 amplifier is used without the preamp installed there are no operational controls to be adjusted. The line cord should be plugged into a 117-volt source that will be switched with some other unit of the high fidelity installation. No ON-OFF switch is provided on the amplifier since it may be installed in an inaccessible location.

If the Horizon 5 preamp is installed in the preamp compartment of the amplifier or connected to the am-

plifier by means of the interconnecting cable; all the operational functions of the amplifier-preamp combination are handled at the control panel of the preamp. This includes the ON-OFF switch, program Selector switch, Loudness-Volume control, Bass and Treble controls and the full range of phono equalization selection. The function of these controls, together with instructions for their proper adjustment, is described in the Horizon 5 instruction manual.

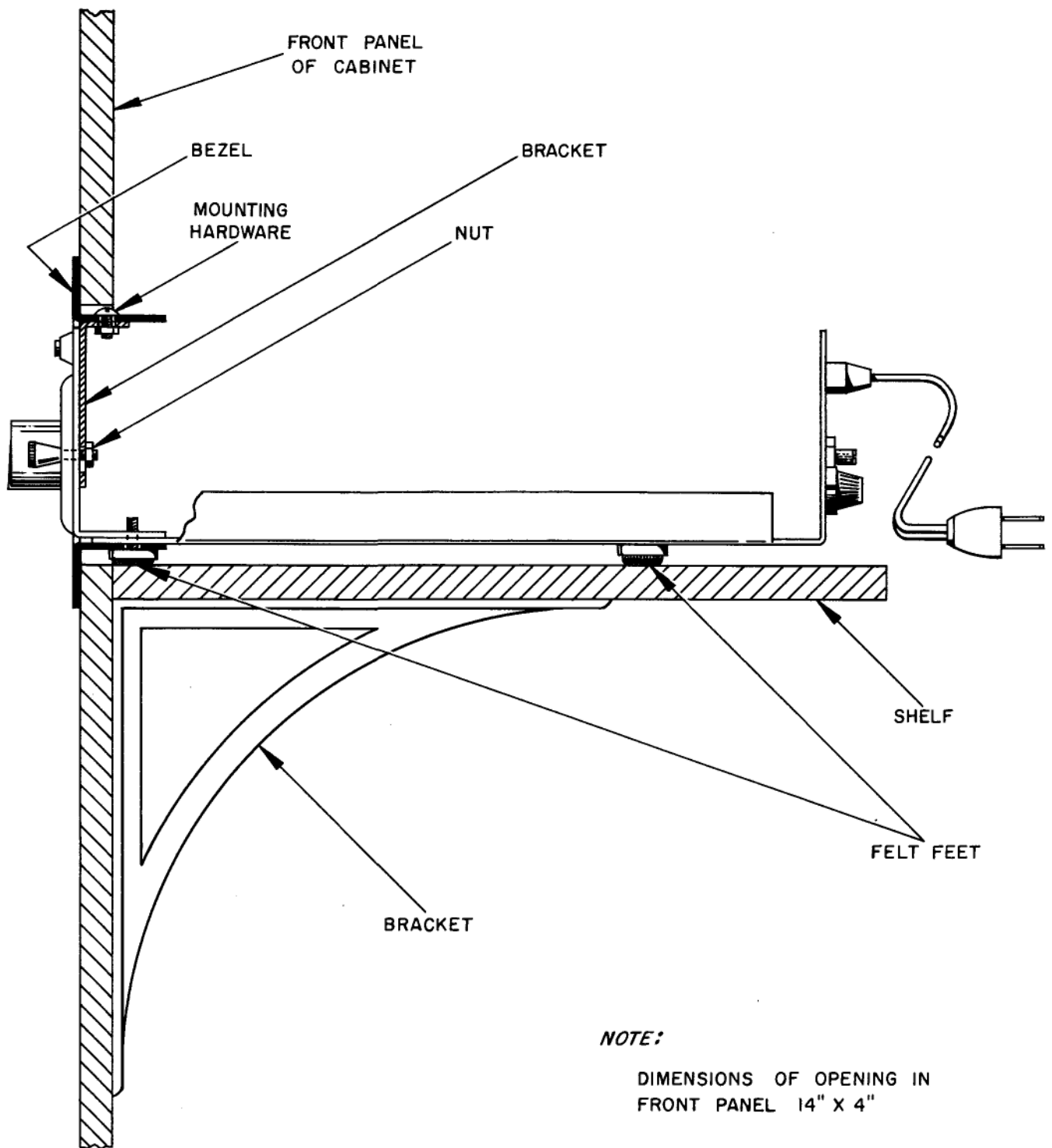


Figure 2. Custom Cabinet Installation

CABINET INSTALLATION

If desired, the Horizon 20 Amplifier may be mounted in a wooden cabinet as part of the custom installation. This requires a shelf and cutout as illustrated in Figure 2. Locate the 14 by 4 inch horizontal cutout, making certain that it is square with the sides of the cabinet. Prime consideration should be given to the location in regard to accessibility of controls and sufficient clearance between the top of the amplifier and the inside of the cabinet top to allow ventilation. A 12 by 15 inch shelf must be installed within the cabinet, with its top surface flush with the bottom edge of the cutout. This should be made of stock at least 1/2 inch thick and supported by shelf mounting brackets sufficiently rigid to maintain the weight of the Horizon 20.

Remove the metal dust cover from the amplifier as

described in the following paragraph. Before placing the amplifier in the cabinet it must be equipped with the ornamental bezel. This bezel may be procured from your National dealer along with the necessary brackets, mounting hardware and A.C. line cord. The bezel has two mounting holes on the top flange and three holes on the bottom flange. The top flange is secured using the brackets, screws, washers and nuts supplied with the bezel. The bottom flange is secured by first withdrawing the two felt feet and self-tapping screw at the front of the amplifier and then replacing them through the flange.

Slide the Horizon 20 through the cutout until the bezel meets the front of the cabinet. The weight of the amplifier is sufficient to hold the unit in the cabinet.

REMOVAL FROM CASE

The Horizon 20 amplifier is enclosed in a ventilated protective metal dust cover equipped with a safety interlock. The cover must be removed to gain access to the tubes and/or components. To do so, remove the two hex-head screws at the front corners of the bottom plate and remove the two Phillips-head screws

at the ends of the rear drop of the dust cover. Slide the cover straight back far enough to disengage the interlock plug and then lift the cover from the amplifier. This process is reversed when replacing the dust cover. Use care in engaging the interlock to prevent distortion of the plug.

HUM BALANCE ADJUSTMENT

The hum balancing adjustment has been made at the factory for satisfactory performance of the power amplifier itself but may require readjustment after the input equipment (Horizon 5 preamp etc.) has been connected. To accomplish this, turn on the equipment and turn the loudness or volume control of the preamp

to maximum. Any tone controls, such as the Bass and Treble controls of the Horizon 5, should be set at the Flat position. With no signal input, adjust the Hum Balance control on the rear chassis drop of the Horizon 20 for minimum hum from the loudspeaker.

GAIN ADJUSTMENT

The Gain control at the back of the chassis requires no adjustment when the Horizon 5 preamp is used with the amplifier. It is always left at the maximum clockwise position (full gain).

When the Horizon 20 is used without a preamp, the Gain control is adjusted to set a limit of maximum volume level as follows:

Set the volume control of the device connected to the amplifier at maximum. Set the Gain control of the amplifier to provide the maximum volume for the specific installation. Make this adjustment using program material with a high audio level. Thereafter the level is controlled by the volume control on the associated device.

TABLE 1. TUBE SOCKET VOLTAGES

CONDITIONS

All voltages measured between tube pin and chassis except as noted.

VTVM used for all measurements.

117 VAC, 60 cycle input.

No input signal.

Tolerance $\pm 10\%$.

TUBE	PIN								
	1	2	3	4	5	6	7	8	9
V1	140	0	1.5	32*	32*	250	**	-270	32*
V2	0	32#	380	380	-26	-26	32#	5	--
V3	0	32#	380	380	-35	-35	32#	0	--
V4	NC	400##	117V tie point	350AC	NC	350AC	5	400##	--

*6.3 AC between pins 4 or 5 and 9.

** -3.6 between pins 7 and 8.

#6.3 AC between pins 2 and 7.

##5 AC between pins 2 and 8.

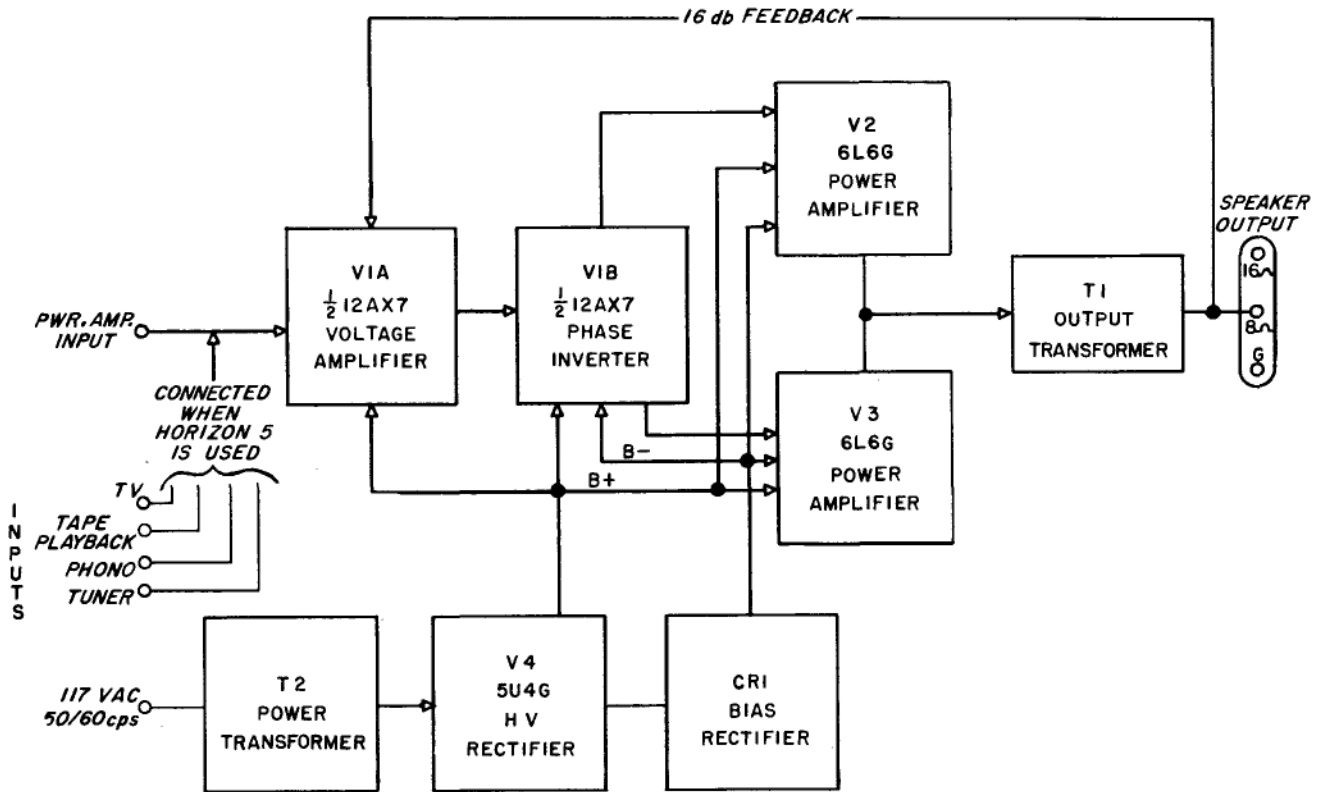


Figure 3. Functional Block Diagram

PARTS LIST

SYMBOL	DESCRIPTION	NATIONAL CO. DRAWING NO.
CR1	Selenium Rectifier	T657-1
E1	Dummy Panel	T671-2
E2	Terminal Panel, speaker connection	E259-6
J1	Phono-jack, single, Cinch Mfg. Co. type 8171	T458-1
J2	Receptacle, A.C. Alden Products type 402ACE	T452-1
J3	Receptacle, A.C. power cord interlock; Cords Ltd., Inc. type CC-2	L283-1
J4	Phono-jack, double, Cinch Mfg. Co. type 8113	T579-1
J5	Jack, 16 contacts, Amphenol type 26-4200-16S modified	T448-1
J6	Phono-jack, double, Cinch Mfg. Co. type 8113	T579-1
L1	Filter Choke, 1.5 hy, 200 ma, Stancor type C2327	T685-1
P1	Dummy Plug	SB:2800
R3	Variable, 500,000 ohms, C taper, IRC type RQ13-133	T013-1
R19	Variable, 1,000 ohms, A taper, IRC type RQ11-108	T013-5
SW1	Switch, interlock	T755-1
T1	Output Transformer, two primary windings	T665-1
T2	Power Transformer, primary 117 v AC, 60 cycles; secondaries 360-0-360 v at 120 ma, 5 v at 3 amps, 6.3 v at 3.5 amps	T658-1
W1	Power Cord, 2 conductor, interlock; Phalo Plastics type CSR-606RTV or equivalent	A10927
XF1	Fuseholder, Littlefuse type 34201	E510-1

Standard Form Warranty

Adopted by the Radio Manufacturers Association, Inc.

This equipment is warranted to be free from defective material and workmanship and repair or replacement will be made of any part which under normal installation, use and service discloses defect, provided the unit is delivered by the owner to the manufacturer or through the authorized radio dealer or wholesaler from whom purchased, intact, for examination, with all transportation charges prepaid to the factory, within ninety days from the date of sale to original purchaser, and provided that such examination discloses in the manufacturer's judgment that it is thus defective.

This warranty does not extend to any radio products which have been subjected to misuse, neglect, accident, incorrect wiring, improper installation, or to use in violation of instructions furnished by the manufacturer, nor extend to units which have been repaired or altered outside of the factory, nor to cases where the serial number thereof has been removed, defaced or changed, nor to accessories used therewith of other manufacture.

Any part of a unit approved for remedy or exchange hereunder will be remedied or exchanged by the authorized radio dealer or wholesaler without charge to the owner.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for the manufacturer any other liability in connection with the sale of their radio products.

National Company, Inc. reserves the right to make any change in design or to make add' on to, or improvements in, its products without imposing any obligations upon itself to install them in its products previously manufactured.

