
CARVER

MODEL M400

OWNER'S MANUAL

INTRODUCTION

Thank you for choosing the Carver Magnetic Field Amplifier. We are particularly proud of this instrument and would like you to know why.

Your Magnetic Field Amplifier is a superb performer. Judged against conventional amplifier standards, the M-400 is second to none; its sound quality is smooth, sweet, and absolutely accurate. It can deliver more than 200 watts RMS per channel into an 8 ohm loudspeaker or **500 watts** into a single mono loudspeaker! It can deliver this power from 20kHz all the way down to 1Hz with distortion that is so low that it can be accurately measured by only the most advanced laboratory test equipment. Closed-loop frequency response extends from below 1Hz to beyond 250,000 Hz.

Judged by the standards of its new technology the M-400 stands in a class by itself. Most obvious is its compact size and weight. The magnetic field technology that makes this possible yields performance advantages that go far beyond that of conventional amplifiers.

The M-400 is remarkably efficient; considerably more efficient than conventional amplifiers. Its power supply can momentarily "assign" power as required: Unused power from one chan-

SPECIFICATIONS

Power Output:	201 watts RMS per channel into 8 ohms from 20Hz to 20kHz with no more than .05% total harmonic distortion.
Power at Clipping:	250 watts RMS per channel into 8 ohms at 1kHz. 300 watts RMS per channel into 4 ohms at 1kHz. 500 watts RMS per channel into 8 ohms at 1kHz.
Noise:	Greater than 100dB down, IHF A weighted. Harmonically related commutation noise is equal to or less than non-linear distortion components, IHF A weighted.
Intermodulation Distortion:	.05% SMPTE
Transient Intermodulation Distortion:	Unmeasurable
Frequency Bandwidth:	+0 - 3dB 1Hz - 250kHz at 1 watt, excluding filter.
Slew factor:	Greater than 200
Input Filter:	+0 - 3 dB below 40kHz
Output Filter:	+0 - 3 dB, 0Hz - 40kHz
Display Tracking:	\pm 1 LED Digit
Display Ballistics:	Peak responding, 1 millisecond attack, .5 second decay.

speakers are working in unison rather than opposing each other. Each speaker has + and — connections normally indicated by a red terminal or “8” for + and a black terminal, “0” or “Common” for —. Each should be connected the same way to the M-400. This is facilitated by the markings on speaker cable; lamp cord generally has a small ridge on one conductor’s insulation. Other wire may use silver and copper colored wires for the conductors.

To audibly check phasing, wait until after you’ve completed all the hookup and operating instructions. At that time, you may play music rich in bass frequencies and switch between mono and stereo on your preamp. When you are standing midway between the speakers you can identify an out of phase hookup by a weakening of bass when mono is selected. If phasing is correct the bass is unchanged. To correct, simply reverse the leads for **one** speaker.

Notice

Do not connect any of the speaker terminals from the M-400 to each other — either at the amplifier or at the loudspeaker. Make certain no stray strands of exposed wire are touching between terminals.

COMMON GROUND SPEAKER SWITCHING SYSTEMS

NOTE: READ THE FOLLOWING CAREFULLY.

Certain kinds of common ground systems **may** be used. Certain other kinds **may not** be used.

The multiple switching systems used in high-fidelity salons **may not** be used because one of two unacceptable conditions would result:

(1) One channel shorted to ground . . . OR

(2) One channel out of phase with respect to the other. The preceding occurs because other, conventional amplifiers are always included in the system.

A common ground switching system properly installed in a home **may** be used. You will have to connect the common ground wire to the black terminal marked "chassis", and the two outside terminals (one black, one red) become the "hot" signal leads and may then be routed through any switching system of your choice. (The red terminal marked "chassis" remains unused.) At this point, there is no electrical conflict in terms of ground or signal leads, however, in order to preserve phase integrity, the wires that connect to each **left** speaker in the system must be reversed 180°.

MONO HOOKUP

The M-400 can be used as an immensely powerful single channel amplifier without use of any special bridging adaptor. Again refer to the back panel illustration. You will need to feed both input jacks with identical signals from a "Y" connector. The speaker leads must be connected to the two outer terminals **only**. The two inner terminals are left unconnected. The + wire goes to the red (non-inverting), the — wire to the black (inverting).

The resulting output power is 500 watts RMS into 8 ohms.

POWER

The M-400 is designed to be connected to the convenience outlet on your preamp. If required, use only a heavy duty extension cord to minimize power loss.

Do not switch power on and off with loud music playing. Accessory outlets should be rated at no less than 500W.

OPERATION

Before plugging in the AC line and turning on power, double check input and speaker connections. Never change any connections with the AC cord of the M-400 plugged in. The resulting transient may blow a fuse or may permanently damage loudspeakers.

LED DISPLAY

The display serves two functions. First, it serves as a VU level indicator.

The display also functions as an indication of fault. The display will strobe (blink) twice per second at random with a brightness approximately 1/3 normal. This indicates possible short circuit in a speaker connection or severe overloading. The strobing of the display will last from 1 second to as long as several minutes, depending upon the fault. When proper operation is restored, the display reverts to its power indication status.

FUSES

The main fuse is selected to protect the M-400 from damage without sacrificing its ability to recreate dynamic range. If the fuse blows, investigate, then replace only with the same value, AGC 15. Use of a larger fuse can result in serious damage and will void the warranty.

Very few loudspeakers can handle the full power of the M-400 for more than a brief time period, such as a musical crescendo. Yet, its unclipped, undistorted output is less hazardous than the waveform of a smaller amplifier's clipped output. We strongly recommend separate fusing as per the speaker manufacturer's

recommendations; your dealer should be consulted. Naturally, Carver Corporation cannot be responsible for damage to loudspeakers connected to the M-400.

OPERATING TEMPERATURE

Under normal conditions your M-400 operates with cool efficiency, with huge reserves for voltage and power dynamic headroom. However, even though it is extremely efficient, the M-400 will still generate some heat when called upon to produce extremely high power and will heat up and cool down more rapidly than a conventional amplifier. This shorter thermal time constant is the result of the reduced mass of the M-400 — 1/6 that of conventional amplifiers.

This is because there is less material bulk to absorb and build up heat.

Under sustained high power operation, it is normal for this small chassis to dissipate internally generated heat and may be quite warm to the touch. This will not harm the internal components, however, as they are all rated for safe operation under far more extreme ranges than they encounter in the M-400.

Nevertheless, you must provide good ventilation around and

beneath the M-400 so air can enter underneath and exit out its back and sides. Avoid placing on a pile carpet that can impede air flow.

CARE OF THE M-400

Never short circuit the output terminals of the M-400. Take care when connecting the speakers that the speaker wires do not touch each other at the terminals on the amp or on the speaker.

Protect your amplifier from moisture and excessive dust.

Avoid dropping your amplifier.

Never replace fuse with one other than the specified rating.

The anodized front panel and knobs may be cleaned with a soft cloth and diluted ammonia to remove fingerprints and film buildup. Never use detergents or abrasives.

If you suspect a problem, try some simple troubleshooting first. Frequently, a problem lies elsewhere in the system or even the hookup cables. If one channel of the M-400 does not respond, turn off the power and reverse the input cords. If the other channel is inoperative, then you know the problem is not in the M-400. Check speaker hookups.

REPAIR

If the problem still exists contact your Carver Corporation dealer or the factory. We may suggest some further troubleshooting hints. If the amplifier does require service, bring it to your dealer in its original carton. If you must return it directly to us, call or write to advise us before shipping. Refer to your Carver Corporation Warranty for details.

In no case should anyone other than the factory or its designated service station disassemble or attempt repairs to the M-400. We want to inspect for cause and to assure proper future operation.

PROTECTION MECHANISMS

The M-400 protection mechanisms differ substantially from others. The power supply is "smart" in that it is digitally controlled by a miniature computer. Other power supplies lack a logic input and are not controlled. However, the Magnetic Field power supply is by its very nature controllable by computer generated logic commands. It therefore has the ability to respond

to the commands of a computer with high "artificial intelligence." This intelligence operates for a number of beneficial results. Inputs to the computer allow computation of voice coil temperature for **each** driver in multi-driver speaker system. When the computer identifies excessive voice coil heat or excessive acceleration stresses, it commands the M-400 power supply to shut down temporarily. If it recognizes that excessive clipping has caused excessive high frequency energy that could damage the tweeter, it will likewise shut down the amplifier and the LED display will blink randomly as a warning. If you persist in operation with continued clipping, the M-400 computer will shut down longer before restoring operation to allow sufficient cooling time for the tweeter voice coil. Beyond this, the computer will recognize your carelessness and shut off the M-400 for up to 90 seconds while blinking the display as a reprimand and reminder of the cost of tweeter replacement.

Beyond this, the computer intelligence will protect from low frequency transients without interfering with low frequency music. Even a 20 millisecond 400 watt pulse cannot confuse it and there is no "current limiting" sonic distortion.

SPECIAL NOTE

A phenomenon called "magnetostriction" causes the magnetic field coil inside of the M-400 to emit a nearly inaudible, soft "motorboating" or "putt-putt" sound at a 60 Hz rate. If this sound is audible more than a few feet from the unit in your installation, the **rubber shock mounts**, tightened snugly at the factory for transport, may be loosened **two** or **three** complete turns. They are located on the bottom of the unit, and may be identified by four rubber washers located under four Philips bolts. Use caution **not** to completely remove the bolts; loosen only two or three turns. The sound caused by magnetostriction diminishes after the amplifier has "warmed up".

As with any powerful amplifier, care should be exercised not to place the unit too close to other high sensitivity electronic instruments in order to avoid unwanted hum pickup. At least three feet is adequate for most installations.

TECHNICAL INFORMATION — BENCH TESTING

The Carver M-400 Magnetic Field Amplifier utilizes technology that requires test procedures markedly different than for conventional amplifiers. Failure to observe these differences may

abuse the amplifier and result in measurement error. The following are the differences:

1. The left channel output "hot" is connected to the black (—) terminal because there is an internal 180° phase relationship between the two channels. This is done for the following reasons:
 - A. It allows the amplifier to utilize its power supply in push-pull fashion facilitating the availability of power reserves as needed for either channel.
 - B. It allows single channel high power operation without need for a phase inverting "bridging adaptor."

Since the ground for the left channel is connected to the red speaker terminal, exercise care not to attach the grounding system of the test equipment to the black hot output of the left channel amplifier.

2. The input AC line **current** is in quadrature phase with the input AC line **voltage**. The input power is thus the product of the **in phase** voltage component and **in phase** current component.

When input current begins to flow, the line voltage will drop, causing the "input" AC waveform to distort. Accurate measurement of the M-400 depends on a sufficiently

“stiff” AC supply. The 60Hz AC line distortion must be below I.H.F. specification.

Most of us have used only peak responding AC line monitors or “slow” thermal RMS responding line monitors and they are simply inadequate for the task. Inspect the diagrams below:

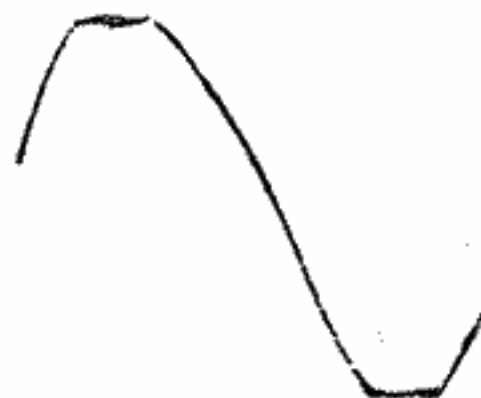
Conventional Amplifier

no load
120 V.
60 Hz



Undisturbed waveform. Average responding voltmeter and peak responding voltmeter read identically and correctly.

full load
120 V
60 Hz



Waveform peaks clipped at 90° by pulsating current flow. Average responding voltmeter reads too high. Peak responding voltmeter reads correctly.

Magnetic Field Amplifier

no load
120 V
60 Hz



Same as conventional amplifier.

full load
120 V
60 Hz



Waveform **sides** clipped at 180° by pulsating current flow. Average responding meters read too high. Only a meter that reads peaks at 180° can read correctly.

If you lack a “stiff” AC line supply or line distortion measuring method, you may use this rough approximation for determining a correction factor: $K = 1.15$.

V peak responding = $K \times V$ r.m.s. responding. The correction factor K will vary between roughly 1 and 1.15 depending on stiffness of the AC line.

3. THD measurements must separate the non-linear distortion products from the thermal noise and commutation noise products of the M-400 power supply. At low levels a spectrum analyzer must be used because a standard THD instrument cannot distinguish between distortion products and noise.

At high levels, a phase meter must be used at the output of the conventional THD instrument. This is to account

for commutation noise products that are harmonically related to the non-linear distortion components, but are in quadrature phase with them. Without the phase meter, small but observable measurement errors will result.

An approximate alternative is to use an IHF "A" weighting network at the input to the standard THD instrument.

We wish you many hours of musical enjoyment. If you should have questions or comments, please write to:

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