CARVER

PROFESSIONAL

MODEL PM-100
Magnetic-Field Power Amplifier

Owner's Manual

IMPORTANT NOTICE
Please read carefully!

This amplifier was originally manufactured by Carver Corporation. There are references contained within this manual to addresses and telephone numbers that should no longer be used to obtain technical support or factory service.

For any assistance with this product please contact:

Carver Professional
A Division of Phoenix Gold International, Inc.
9300 North Decatur
Portland, Oregon 97203
Tel. 503.978.3344
Fax 503.978.3302

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1. Introduction

Congratulations on the purchase of your professional PM-100 Amplifier. It represents the latest technology in Carver's patented Magnetic Field Power Supply. This efficient supply, coupled with a unique amplifier design, provide you with the very best in performance. Because of the specially-designed protection systems, you can be assured your valuable speakers and amplifier will be protected.

Its lightweight and rugged construction makes it ideal for touring and permanent installations. We are proud of our track record for excellent performance and proven reliability. The high quality standards Carver products provide are the quality that our customers have come to expect.

Bob Carver

About This Manual

The manual is divided into the following sections:

Section	Description
Introduction	Introduces the PM-100 and describes the manual and the notational conventions used in the manual.
Special Features	Describes the features that make the PM-100 unique and lists the specifications.
Front and Rear Panel Features	Describes every knob, button, switch, and connector on the front and rear panels of the PM-100.
Installation	Covers all aspects of installation: mechanical, electrical, and thermal.
Technical Information	Describes the PM-100's circuit design. Includes procedures for changing the polarity of the XLR input connector and the AC power mains voltage. The schematic diagram can be found here.
In Case of Difficulty	Describes what to do when the PM-100 won't operate.
Warranty Information	Tells what to do when you need to contact the factory for repair or repair parts.

Notational Conventions

Several notational conventions are used in this manual. Some paragraphs may use **Note**, **Caution**, or **Warning** as a heading. These headings have the following meaning:

Convention	Description
Note	Identifies information that needs extra emphasis. A Note generally supplies extra information to help you use the amplifier better.
Caution	Identifies information that if not heeded, may cause damage to the amplifier or other equipment in your system.
Warning	Identifies information that if ignored, may be hazardous to your health or that of others.

In addition, typefaces and capitalization are used to identify certain words. These situations are:

CAPITALS	Controls, switches or other markings on the amplifier chassis.
Boldface	Strong emphasis.
Italic	Emphasis.

2. Special Features

The PM-100 has several design features that set it apart from the competition:

- ❒ Patented Magnetic Field Amplifier circuitry[1]
- ❒ Series and Parallel bridging
- ❒ Clipping eliminator circuitry
- ❒ Protection circuitry

Magnetic Field Amplifiers

A Carver Magnetic Field Amplifier is the synergism of a highly-efficient, multiple-rail power amplifier and a highly-efficient regulated power supply. Using regulated power supplies for audio amplifiers is nothing new; the difference in the PM-100 is in the power transformer and how it is driven.

Conventional amplifiers require the power transformer to be energized 100% of the time that the amplifier is in use. A magnetic field amplifier's power transformer is inside of a voltage regulator's feedback loop; it is only fully on when needed for full power output. At all other times, the power transformer operates only enough to keep the main filter capacitors charged to plus and minus 53 volts. This allows a considerable reduction in the size and weight of the power transformer; two of the principal reasons for the small size and light weight of the PM-100.

The amplifier circuitry uses a dual-rail power supply design. This design minimizes the voltage dropped across each of the output transistors, minimizing their heat dissipation. In turn, reducing the heat dissipation allows reducing the size and bulk of the heat sinks used to transfer this heat to the surrounding air.

This combination of a magnetic field power supply and a high-efficiency output stage yields an amplifier with a high power to weight ratio.

Series and Parallel Bridging

An unusual and useful feature of the PM-100 is its bridging capability. Bridging takes two forms: series and parallel.

Series bridging requires that the internal amplifier inputs be 180 degrees out-of-phase with each other, and that the load be connected *across* the outputs of the two amplifiers. Typically, this results in twice the rated (per-channel) power into twice the rated impedance. Most modern solid-state amplifiers have this capability. The PM-100 delivers 330 watts into 8 ohms in series bridging mode.

Parallel bridging connects both amplifier outputs in parallel to drive a single load. This results in twice the power into one-half the rated impedance (based on a single-channel). The PM-100 delivers 320 watts into 2 ohms in parallel bridging mode.

Direct 70V Output Capability

In series bridging mode, the PM-100 can produce sufficient output voltage to drive 70-volt distribution systems without using a step-up transformer at the amplifier. The amplifier can deliver 150-watts to the 70-volt system. Transformers are still required at each loudspeaker (as is the case with all 70-volt systems.

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1 US Patent 4,218,660

Clipping Eliminator

In addition to sounding ugly, clipped waveforms kill loudspeakers. This fact of life is made more true by the practice of using large amplifiers for increased headroom. When an amplifier clips, the output waveform contains large amounts of harmonics which extend both above and *below* the fundamental frequency. This can be potentially destructive to any high-frequency driver

The clipping eliminator works by sensing any amplifier clipping and reducing the input signal level to limit the distortion in the output signal to less than one percent THD with up to 8 dB of overdrive. The action is similar to that of a limiter. The clipping eliminator is sensitive to clipping regardless of cause: excessive input drive, power line sag, low load impedances, etc.

Protection Circuitry

The PM-100 has specially designed protection circuitry that protects the amplifier from abnormal load conditions, as well as protecting the load from an abnormal amplifier. The amplifier includes the following protective measures:

- ❒ Input RFI filtering.
- ❒ Power line filtering.
- ❒ Load protection from excessive low-frequency or DC output.
- ❒ Amplifier protection from sustained current limiting caused by severe overdrive or abnormally low load impedances.
- ❒ Thermal overload protection.

The top two yellow LED indicators in the output display are illuminated when any of the protection circuits is activated, when the amplifier clips, or when the clipping-eliminator circuit is activated.

Specifications

Power Output	FTC	EIA
8 ohms, both ch driven	110W	125W
4 ohms, both ch driven	150W	170W
2 ohms, both ch driven	180W	210W
8 ohms series mono	300W	330W
16 ohms series mono	240W	280W
70V series mono	150W	150W
8 ohms parallel mono	135W	145W
4 ohms parallel mono	200W	240W
2 ohms parallel mono	280W	320W

Note: FTC ratings based on 20-20kHz bandwidth, 0.5% THD.

Specification	Value
Frequency Bandwidth	-3, +0 dB, 4Hz-70kHz
IM Distortion (SMPTE)	Less than 0.1%
Gain	26 dB
Input Sensitivity (full output)	1.5V RMS, +5.74 dBu
Input Impedance	30 Kilohms balanced, 15 Kilohms unbalanced
Input Overload	+15 dBu
Slew Rate	25 V/uSec
Damping Factor	200 @ 1 KHz
Output Noise (A weighted)	-95 dB, ref 28V output
EMI/RFI Noise Filtering	0.15-30 MHz normal mode and common mode
Inputs (balanced, differential)	XLR, 1/4 inch tip-ring-sleeve phone jack, barrier strip terminals
Dimensions (HWD inches)	1.75 x 19 x 13.25, 1U rack space.
Weight	13 pounds
Power Requirements	120 V, 50-60 Hz, 840 Watts or 240 V, 50-60 Hz, 420 Watts

3. Front and Rear Panel Features

Front Panel

The following paragraphs describe the controls, switches, jacks, and displays found on the front panel of the PM-100. Refer to Figure 1.

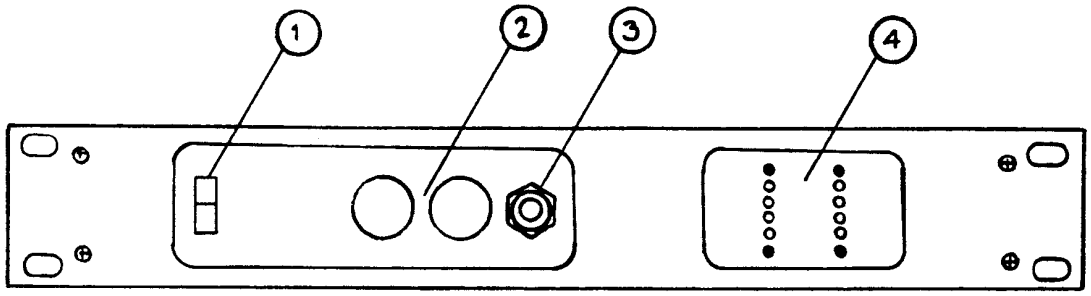

Figure 1. Front Panel Features

1. POWER switch.

2. LEFT and RIGHT level Controls. 11-step attenuators that adjust the relative output level of the PM-100. The amount of attenuation corresponds to the front-panel marking, in dB.

3. PHONES jack. A tip-ring-sleeve jack intended for use with stereo headphones. The tip connection of the jack connects to the left amplifier channel.

4. LED Output Status Display. 6 LEDs (per channel) indicating the status of the amplifier. The bottom, green LEDs indicate power-on. The four, red LEDs indicate the output power level of the amplifier in dB relative to maximum output. The top, yellow LEDs indicate the onset of clipping or the activation of either the clipping-eliminator circuitry (if the clipping-eliminator switch is depressed). The yellow LEDs also indicate activation of the amplifier's protection circuits.

Rear Panel

The following paragraphs describe the various rear panel features of the PM-100. Refer to Figure 2.

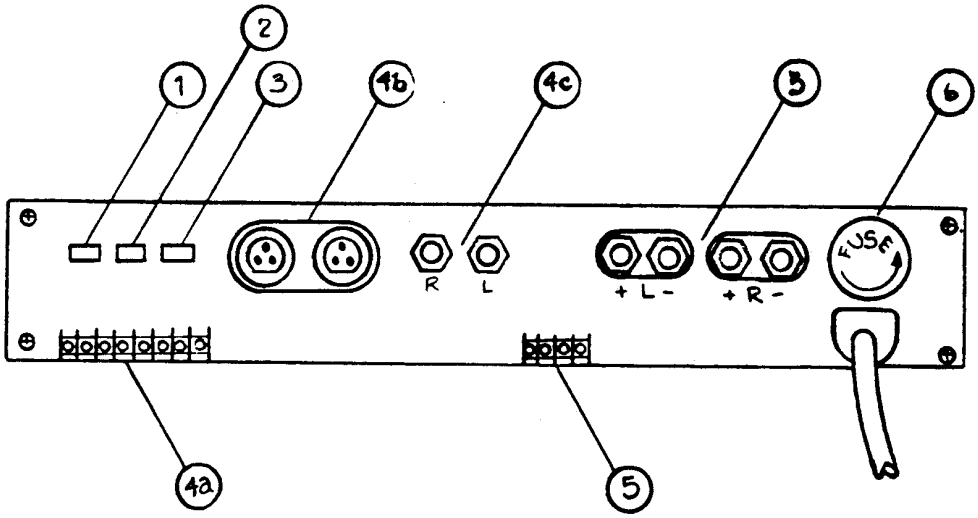

Figure 2. Rear Panel Features

1. PUSH PARALLEL MONO. Pressing this switch sets the PM-100 for parallel mono operation. This mode is best suited for low impedance loads (4 ohms or less).

2. PUSH SERIES MONO. Pressing this switch sets the PM-100 for series mono operation. Use this mode for 8 ohm or greater loads, and for 70 V direct operation.

3. PUSH CLIPPING ELIMINATOR. Pressing this switch turns on the clipping eliminator circuit. In this mode, the amplifier output remains undistorted even when overdriven by up to 8 dB.

4. INPUTS. Barrier strip terminals (4a), female XLR connectors (4b) and 1/4 inch tip-ring-sleeve phone jacks (4c). These are the input connectors for the amplifier.

5. AMPLIFIER/CHASSIS. Removing this jumper isolates the amplifier's power supply ground from the amplifier chassis. This may be necessary to eliminate ground loops in some systems. The amplifier chassis is always connected to the safety ground (line plug ground or green wire) of the power cord.

6. LEFT/RIGHT. 5-way binding posts used to connect the loudspeakers to the amplifier outputs. The red terminal is the signal connection, the black terminal is the signal return connection.

7. FUSE. AC power line fuse for the PM-100. Use only type MDQ7, 7 ampere slow-blow. Repeated fuse blowing is a sign of internal distress. Have an authorized Carver service technician repair the amplifier.

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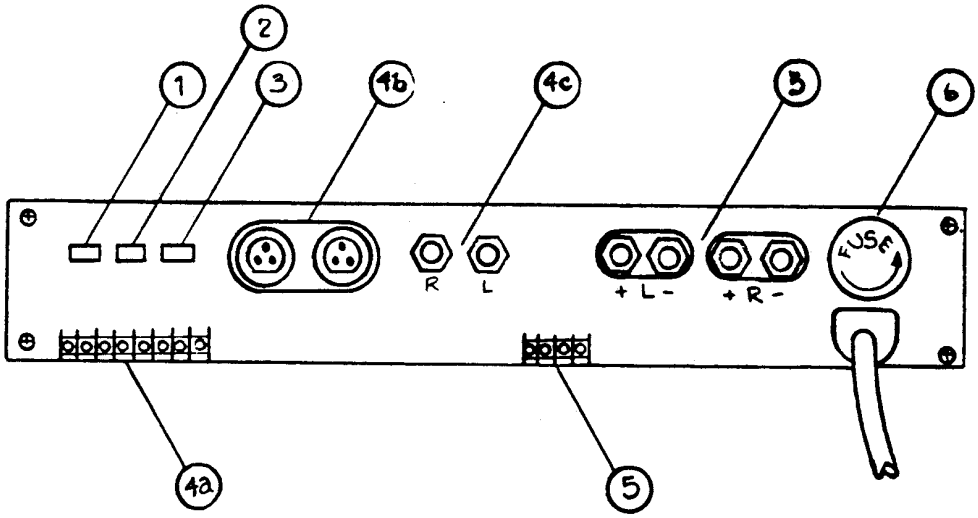

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Line Voltage Conversion

Caution

The line voltage conversion process requires soldering and the services of a competent technician. The conversion procedure is described in Section 5 of this manual.

Magnetic Flux Leakage Considerations

The PM-100 may be mounted without regard to any magnetic flux leakage (within reason). We recommend using a bit of common sense: it's not a good idea to mount *any* power amplifier near a microphone input transformer.

I/O Wiring

The PM-100 has three types of input connections (in order of reliability): screw terminals, XLR female, and 1/4 inch tip-ring-sleeve phone jack. Use the connector most appropriate to your installation. For fixed installations, we recommend using the screw terminals with a suitable crimp-on lug attached to the wire.

In addition, a ground system strap allows isolating the amplifier circuit ground from the AC line safety ground (green wire). Isolating the grounds may be necessary in some installations to break a ground loop.

XLR Connector Polarity (Pin 2 vs Pin 3)

There are two conventions for wiring XLR-type connectors. The PM-100's XLR connector may be strapped for either the American convention (pin 3 hot) or the DIN/ISO convention (pin 2 hot). The amplifier is supplied with the jumpers configured for pin 3 hot. Note: the XLR connector strapping does not affect the polarity of the phone jack or the screw terminals. All input connectors are connected in parallel; you can parallel the amplifier inputs by patching an unused input connector to its counterpart on the other channel.

Note

The XLR connector strapping procedure is described in Section 5 of this manual.

Output Connector Wiring

For stereo or parallel mono operation, use the red and black binding posts associated with each channel (see Figure 3). In parallel mono operation, the output binding posts are paralleled; do not connect loads to each set of terminals. Pick a set, and use it and it only (to avoid confusion later on).

For series mono operation, use both red binding posts (see Figure 4). The left-channel red post is the '*hot*' side (non-inverting) and the right-channel red post is the '*low*' side (inverting).

In either case, ensure that the total load impedance is not lower than that listed in the specifications for the mode of operation that you have selected.

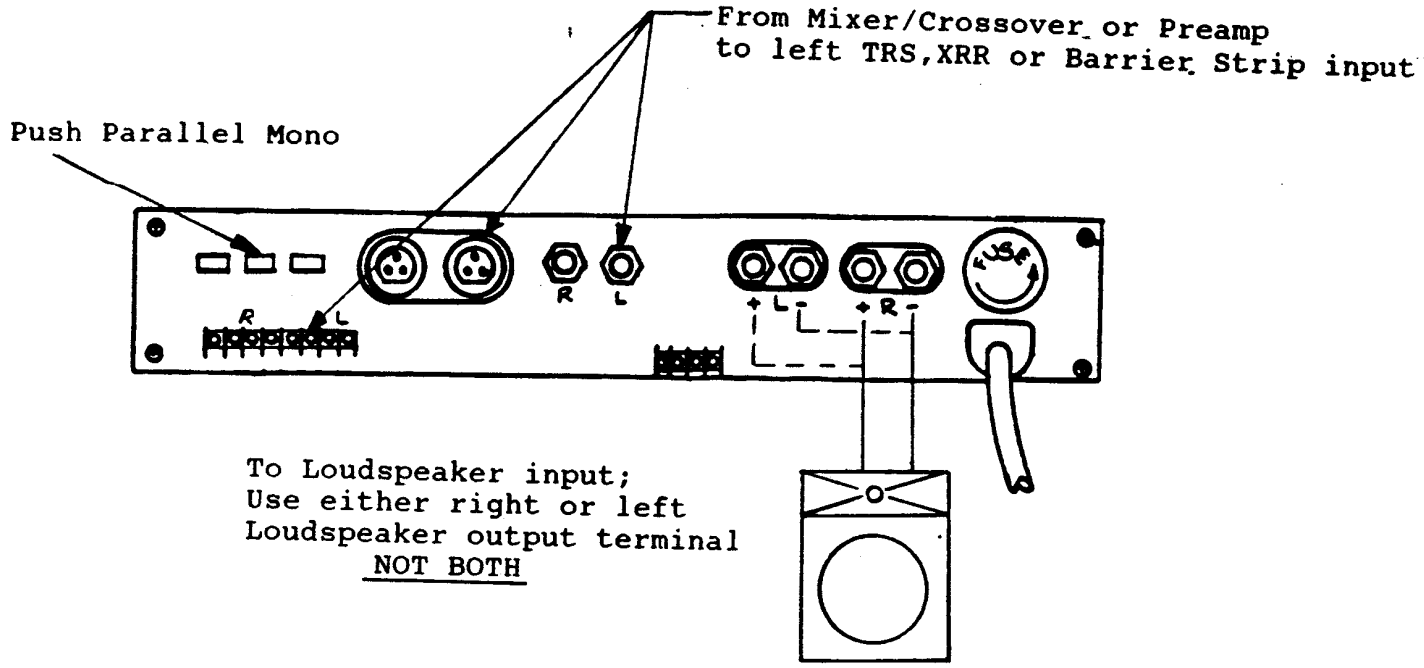

Figure 3. Parallel Mono Operation

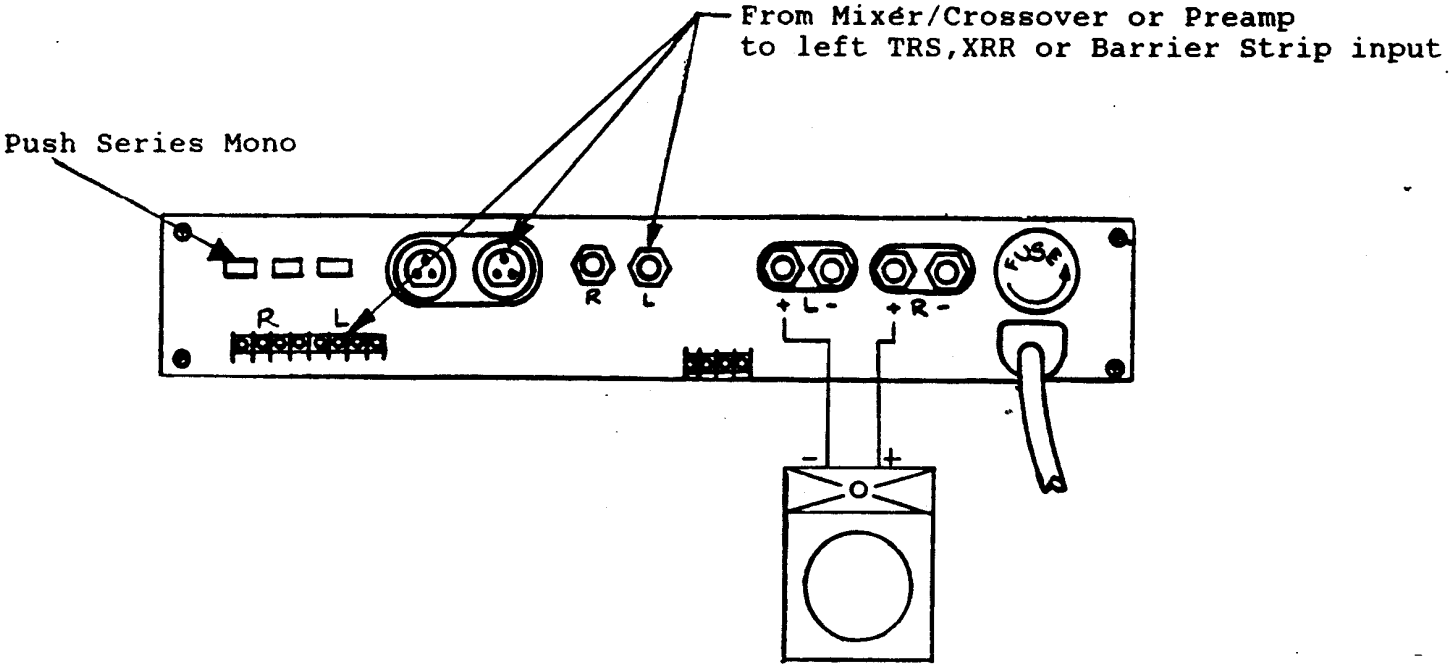

Figure 4. Series Mono Operation

Ground Lift Strap

The ground lift strap is located on the rear chassis of the amplifier, near the speaker output binding posts. To break the link between the amplifier's circuit ground and the amplifier chassis, remove the metal link that connects the two terminals.

Warning

For safety reasons, do not separate the ground systems unless absolutely necessary.

Switch Settings

The PM-100 has a number of switches on the rear panel that control various aspects of its operation.

Bridging Operation

Two switches, located on the rear panel of the PM-100, select the bridging mode for the amplifier. The following table shows the possibilities:

Mode	Series Mono switch	Parallel Mono switch
stereo	out	out
parallel mono	out	in
series mono	in	out

For stereo operation, use the INPUT connectors and OUTPUT connectors associated with each channel.

For parallel mono operation, use the LEFT INPUT connector and either OUTPUT connector. The red binding post is the signal connection, the black binding post is the common connection.

For series mono operation, use the LEFT INPUT connector, and both red OUTPUT connections. The LEFT output is the signal (non-inverting) connection, the RIGHT output is the common (inverting) connection.

Note

In series mono operation, the output connections are actually a balanced output configuration. This means that neither output terminal may be grounded (both are '*hot*').

Clipping Eliminator

The CLIPPING ELIMINATOR switch turns on the anti-clipping feature of the PM-100. When the switch is pressed, input signals that are large enough to drive the amplifier output past clipping are reduced enough to keep the amplifier from clipping. The clipping eliminator circuit keeps the amplifier output below one percent THD at up to 8 dB of overdrive.

Note

If the input LEVEL control(s) are turned down far enough, a sufficiently large input signal could drive the input differential amplifier into clipping. Another possibility is that the mixer, equalizer, etc. that is driving the amplifier may not have sufficient output to overcome the loss introduced by the setting of the input LEVEL control(s). The CLIPPING ELIMINATOR switch has no effect on this cause of clipping.

Using the PM-100

Once the amplifier has been installed and wired into your system, you are ready to use it. Here are some tips to help you get the most from your PM-100.

- ❒ Check the switch settings on the rear panel. Be sure that the mono-mode switches conform to the actual mode that you want.
- ❒ Use the clipping-eliminator feature. It helps save your loudspeakers from damage.
- ❒ Be sure that the input LEVEL controls are set sufficiently high to allow the preceding device in your system to drive the amplifier to full output. For most installations, the LEVEL controls are set wide open.
- ❒ When you power the system up for the first time (out of the cartons), it's a good idea to start with all of the amplifier level controls **off**, then advance them slowly, one at a time, so that you can determine that each amplifier channel is operating normally.
- ❒ Once you have established settings, it is a good idea to mark them down, on paper, on pieces of tape, or sticky-dots attached to the amplifier's front panel.
- ❒ In bi-amplified (all multi-amp) systems, it is a good idea to start with the low-frequency amplifiers turned off or down, and to check each frequency range from highest to lowest to ensure that the proper loudspeaker components are reproducing it.
- ❒ You can use the PHONES jack to quickly check the amplifier during operation. Simply plug in a pair of headphones to listen to the amplifier output.

Protection LEDs Illuminated

The protection LEDs respond to sustained clipping, overheating, current limiting, DC or sustained very-low-frequency output, or activation of the clipping-eliminator (if the clipping-eliminator switch is depressed).

- ☐ Check speaker cables for shorts.
- ☐ Are the speakers okay?
- ☐ Has the amplifier overheated.
- ☐ Are you driving the amplifier into sustained clipping?