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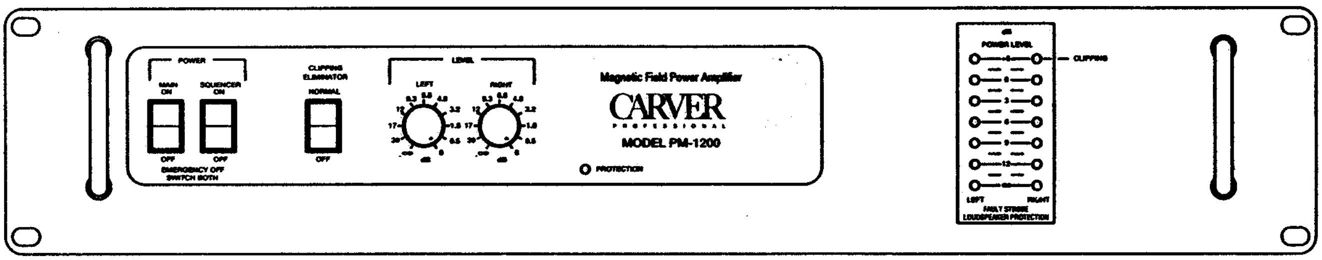

PM-1200
Magnetic Field Power Amplifier
Owner's Manual

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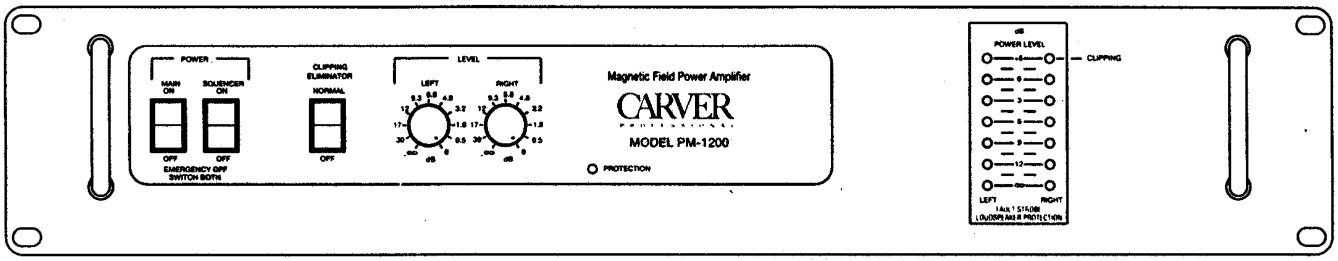

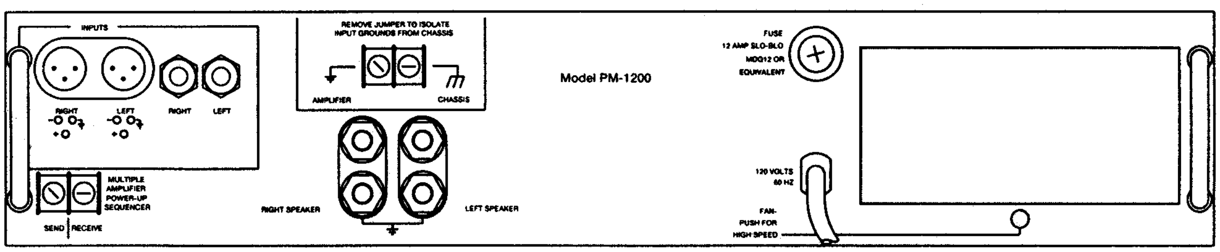

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1. Introduction

Congratulations on the purchase of your professional PM-1200 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 is the quality that our customers have come to expect.

Bob Carver

About This Manual

The manual is divided into the following sections:

Introduction. Introduces the PM-1200 and describes the manual and the notational conventions used in the manual.

Special Features. Describes the features that make the PM-1200 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-1200.

Installation. Covers all aspects of installation: mechanical, electrical, and thermal.

Theory of Operation. Describes the PM-1200's circuit design.

Service Information. Describes what to do when the PM-1200 won't operate.

Warranty Information. Tells what to do when you need to contact the factory for repair or repair parts.

Schematics.

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:

Note. Note identifies information that needs extra emphasis. A Note generally supplies extra information to help you use the amplifier better.

Caution. Caution identifies information that if not heeded, may cause damage to the amplifier or other equipment.

Warning. 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-1200 has several design features that set it apart from the competition:

- Patented Magnetic Field Amplifier circuitry
- Clipping eliminator
- Protection circuitry
- Power Sequencing 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 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 125 volts. This allows a considerable reduction in the size and weight of the power transformer, which are two of the principal reasons for the small size and light weight of the PM-1200.

The amplifier circuitry uses a triple-rail power supply design. This design minimizes the voltage dropped across each of the output transistors, which minimizes their heat dissipation. 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.

Stereo Direct 70V Output Capability

The PM-1200 has sufficient output voltage capability in stereo mode to drive 70-volt distribution systems without using a step-up transformer at the amplifier. The amplifier delivers 300-watts per channel to the 70-volt system. Transformers are still required at each loudspeaker (as is the case with all 70-volt systems. By re-calculating the tap power ratings on the step-down transformers used at the loudspeaker end, the PM-1200 can deliver additional power beyond 300 watts.

Clipping Eliminator

In addition to sounding bad, 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 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, lower load impedances, etc.

Protection Circuitry

The PM-1200 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 abnor mally low load impedances.
- Thermal overload protection. Activated when the amplifier chassis reaches 90 degrees Centigrade.

The red protect LED indicator on the front panel is illuminated when any of the protection circuits are activated. The two top yellow clipping LED's on the "ladder " display light when the amplifier clips, or when the clipping-eliminator circuit is activated.

Specifications

Power Output, FTC, 20-20kHz, 0.1% THD:

16 ohms, both ch driven	300
8 ohms, both ch driven	450
4 ohms, both ch driven	600
8 ohms mono bridge	1200W
16 ohms mono bridge	1000W

Frequency Bandwidth:
-3, +0 dB, 3Hz-80kHz

IM Distortion (SMPTE):
Less than 0.1%

Gain:
32 dB

Input Sensitivity (full output):
1.5V RMS

Input Impedance:
30 Kilohms balanced, 15 Kilohms unbalanced

Input Overload:
+19 dBu

Slew Rate:
25 V/uSec

Damping Factor:
200 @ 1 KHz

Output Noise (A weighted):
-115 dB, ref 450W output, A-weighted

Inputs (balanced, differential):
XLR, 1/4 inch tip-ring-sleeve

Power-up sequencing:
Barrier strip,
Receive accepts +5 to +15V to signal power on;
Send provides delayed +11.4V output to signal on next unit

Output::
5-way binding posts

Dimensions (HWD inches):
3.5 x 19 x 10.19, 2U rack space

Weight::
21 pounds

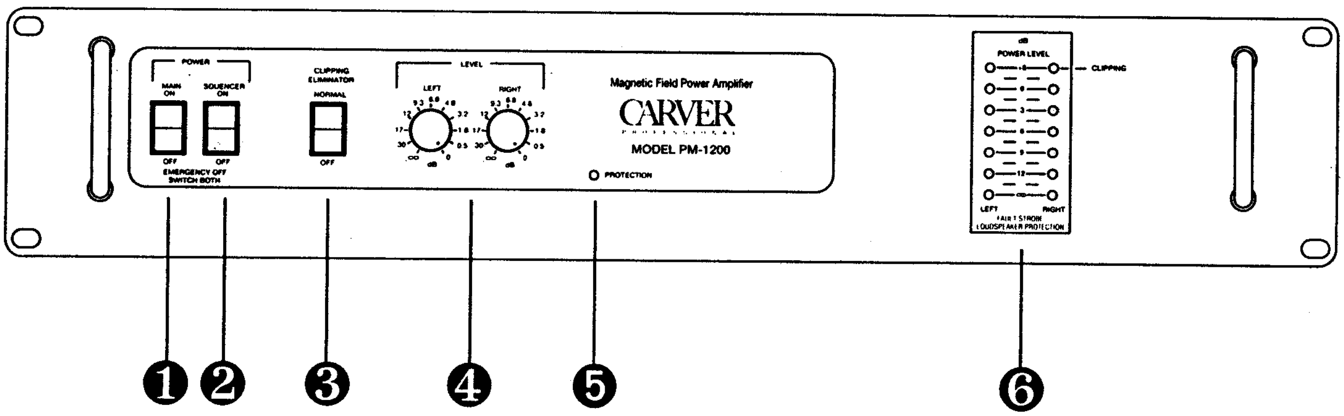
Power Requirements:
120 V, 60 Hz, 12A, 1500 Watts
230 V, 50 Hz, 6.25A, 1500 Watts

Note

Carver Corporation reserves the right to improve its products at any time. Therefore, specifications are subject to change without notice.

3. Front and Rear Panel Features

Figure 1



Front Panel

The following paragraphs describe the controls, switches, jacks, and displays found on the front panel of the PM-1200. Refer to Figure 1.

1. POWER switch. Local power switch. Use this switch when you are not using the remote power-up sequencer feature. Having the sequencing switch on will not affect turning on the amplifier with this switch; it will, however, not allow the amplifier to be turned off unless both switches are off. If the POWER switch is turned off, with the sequencing switch still on, the amplifier will remain on.

2. SEQUENCER switch. Rocker switch that enables remote power-up sequencing. The amplifier's POWER switch should be set to the OFF position when using this feature.

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. LEFT and RIGHT level Controls. 11-step attenuators that adjust the relative output level of the PM-1200. The amount of attenuation corresponds to the front-panel marking, in dB.

5. PROTECTION LED. A red LED that illuminates during fault conditions within the amplifier. This condition may be caused by improper or faulty load wiring. A fault condition causes this LED to light, and a soft popping sound will come from the speakers. Check all wiring, especially the speaker wiring, and the amplifier temperature.

6. Output Status Display. 7 LED's (per channel) indicating the status of the amplifier. The bottom, green LEDs indicate power-on. The five, red LEDs indicate the output power level of the amplifier in dB relative to maximum output. The top, yellow LED's indicate the onset of clipping or the activation of either the clipping-eliminator circuitry (if the clipping-eliminator switch is depressed).

Rear Panel

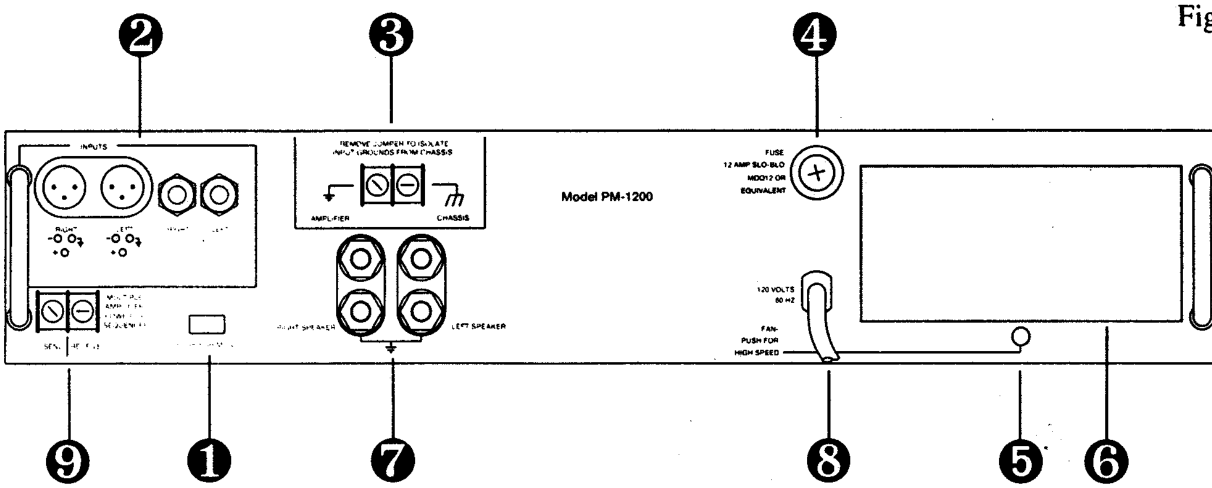
The following paragraphs describe the various rear panel features of the PM-1200. Refer to Figure 2.

1. PUSH MONO. Pressing this switch sets the PM-1200 for bridged mono operation. Use this mode for 8 ohm or greater loads.

2. INPUTS. Each channel has parallel connected female XLR connectors (2a) and 1/4 inch tip-ring-sleeve phone jacks (2b). These are the input connectors for the amplifier. Since the jacks are connected in parallel, the remaining jack can be used as an output when daisy-chaining several amplifier inputs.

3. 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. With the jumper removed, the amplifier's circuit ground is connected to the amplifier's chassis ground via a 27-kilohm resistor in parallel with a 0.1-mfd capacitor.

Figure 2



4. FUSE. AC power line fuse for the PM-1200. *Use only one of the following fuses for 120-volt models of the PM-1200*:

Bussman MDQ 12-amp
Little Fuse 3AB 12-amp
Schurter SPT (001.2535) 12.5-amp

For 230-volt models of the PM-1200 use:

Bussman MDQ 6.25-amp
Little Fuse 3AB 6.25-amp
Schurter SPT (001.2532) 6.3-amp

Repeated fuse blowing is a sign of internal distress. Have an authorized Carver service technician examine the amplifier.

5. QUIET/NORMALswitch. Push switch that controls the idle speed of the fan. Use the quiet position in applications that require low acoustic noise output.

6. FAN FILTER. Expanded foam filter that keeps dust and airborne debris out of the amplifier's cooling system. The filter should be washed whenever it shows signs of dust buildup. It is not a good idea to operate the amplifier without the filter in place. Replacement filters can be ordered from Carver; part number 000753.

7. LEFT/RIGHT SPEAKER OUTPUT. 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. The black terminals are internally connected together.

8. Power Cord.

9. SEND/RECEIVE Barrier strip. Barrier strip terminals used to link multiple amplifiers for sequenced turn-on. Connect the SEND connection of the first amplifier to the RECEIVE connection of the second PM-1200. Connect the SEND connection of the second amplifier to the RECEIVE connection of the third power amplifier, and so on.

4. Installation

The PM-1200 may be used free-standing or installed inside a rack enclosure. Installation consists of the actual mechanical installation, and the electrical and thermal considerations needed. The remaining paragraphs in this section describe the procedure.

Mechanical Considerations

The PM-1200 requires two rack spaces (3.5 inches). The amplifier requires 10.19 inches depth inside the rack. Be sure to secure the unit mechanically using four screws. It is a good idea to use flat-washers with the screws to prevent marring the front panel. Be sure that there is sufficient air space at the sides of the amplifier for airflow around the heat sinks.

Rear support for road applications

If the PM-1200 is rack-mounted, and the rack transported, it is good practice to provide mechanical support for the rear of the amplifier. This could take the form of a shelf across the rear of the amplifier, or brackets that engage the rear of the unit. This practice is recommended for all rack-mounted electronic instruments; especially those that are large, heavy, or mechanically deep. Brackets are available from the factory, part number 000754.

Thermal Considerations

When the PM-1200 is used free-standing, there are no thermal considerations to be made. If the PM-1200 is rack mounted, ensure that adequate ventilation exists in front of and behind the amplifier. When several amplifiers are mounted together in a rack, you may need to provide air inlets from the outside of the rack. The PM-1200 brings cold air in from the rear and exhausts it through the front.

PM-1200s may be stacked directly on top of each other without spacer panels. If the amplifier is used with other amplifiers, ensure that the other amplifier's heat output doesn't become part of the PM-1200's cold air supply (or vice versa).

The amplifier's cooling system uses a foam filter that must be cleaned periodically to remove any accumulated dust and dirt. A warm solution of mildly soapy water works fine. Be sure that the filter is completely dry before reinstalling it on the amplifier. Replacement filters may be obtained from Carver; part number 000753.

AC Power Considerations

The PM-1200 operates from 120 VAC 60 Hz. Ensure that the amplifier is plugged into an outlet capable of supplying correct voltage and enough current to allow full-power operation of all the amplifiers plugged into it. The PM-1200 requires 2500W at full power output into 4 ohms.

Magnetic Flux Leakage Considerations

The PM-1200 may be mounted without regard to any magnetic flux leakage (within reason). We do 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-1200 has two types of input connections (in order of reliability): XLR female, and 1/4 inch tip-ring-sleeve phone jack. Use the connector most appropriate to your installation.

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. This is infinitely preferable to breaking the ground pin off the power cord.

XLR connector polarity (Pin 2 vs Pin 3)

There are two conventions for wiring XLR-type connectors: DIN (pin 2 hot) and American (pin 3 hot). The PM-1200's XLR connector uses the American wiring convention (pin 3 hot). However, the PM-1200 may also be internally re-wired for pin 2 hot+ by a qualified Carver technician.

Note that the pin 3 of the XLR connector corresponds to the tip connection on the TRS phone jack. 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.

Output Connector Wiring

For 2-channel operation, use the red and black binding posts associated with each channel.

For bridged mono operation, use both red binding posts. 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.

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 In most cases, the PM-1200 operates best (lowest noise) with the linking installed.

Warning

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

Switch Settings

The PM-1200 has one switch on the rear panel that controls bridging operation.

Bridging Operation

This switch, located on the rear panel of the PM-1200 selects the operating mode for the amplifier. For stereo operation, use the INPUT connectors and OUTPUT connectors associated with each channel. The bridging switch should be in the OUT position.

For bridged mono operation, use both the LEFT and RIGHT INPUT connectors, and both red OUTPUT connections. Connect the two amplifier inputs in parallel by patching the remaining input jack to its counterpart on the other channel. Depress the bridging switch using a small screwdriver or other tool. The LEFT output is the signal (non-inverting) connection, the RIGHT output is the common (inverting) connection.

Note

Be sure to set both of the input level controls to the exact same setting for equal power distribution per channel.

Note

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

Caution

We do not recommend using phone plugs for speaker connections, especially with a bridged-mono amplifier. If you must use phone plugs for speaker cables, beware! When connected to a bridged-mono amplifier, the shell of the plug is 'hot' and could cause a nasty surprise if it comes in contact with something or someone that is grounded. At a minimum, insulate the shell of the plug with shrink sleeving.

WARNING

At clipping, the PM1200's peak output voltage at EACH of the output terminals approaches 125 volts (250 volts peak across both terminals). While this isn't quite what comes out of a wall outlet, the voltage and current levels are similar enough to be accorded the same degree of respect (it CAN be lethal). Class 1 (UL) wiring should be used.

Clipping Eliminator

The CLIPPING ELIMINATOR switch turns on the anti-clipping feature of the PM-1200. 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 out of 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 can drive the input differential amplifier into clipping. Another possibility is that the mixer, equalizer, etc. 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 these causes of clipping.

Power Sequencer

The Sequencer allows remote turn-on (and off) of any number of PM-1200 amplifiers. In multiple amplifier applications, the power-on for each amplifier is delayed by 10 to 15 seconds. Doing this allows powering up an entire rack of amplifiers without the turn-on surge actuating the circuit breaker. Basically, the Sequencer can perform two functions:

1. You can remotely power-up a PM-1200 from the mixing position or other location. *However the PM-1200 MUST be turned OFF at the unit.*

2. You can "soft start" multiple amplifier arrays employing more than one PM-1200. This is particularly handy for larger sound reinforcement and stage monitoring systems using many PM-1200's.

The sequencer works with the SEQUENCER switch on and the POWER switch off. A small dc control voltage (5-15V dc, 2-4 mA) presented to the Receive terminal located on the rear panel turns the amplifier on. The control voltage can be supplied by the first amplifier in the rack, or it can originate from a remote power supply (user-supplied).

Turn the amplifier off by switching the Sequencer switch off at the amplifier.

Using the PM-1200

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 it.

- Check the switch settings on the rear panel. Be sure that the bridging switch conforms to the actual mode that you want.
- If you are not using the sequencer, ensure that the SEQUENCER switch is set to OFF.
- Use the clipping-eliminator feature. It works. It saves loudspeakers.
- Be sure that the input LEVEL controls are set sufficiently high to allow the preceding device to drive the amplifier to full output. For most installations, this is 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, either on paper, or 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.

Using the PM-1200 to drive 70V Distribution Systems

The PM-1200 has sufficient output voltage capability in stereo mode to drive 70-volt distribution systems without using a step-up transformer at the amplifier. In this configuration, the PM-1200 delivers 300-watts per channel to the 70-volt system. As with all 70-volt systems, transformers are still required at each loudspeaker.

A 300-watt, 70-volt distribution system has an intrinsic impedance of about 16 ohms. Since the PM-1200 can drive lower impedance loads, additional power is available if we lower the nominal distribution line voltage to the maximum that the PM-1200 can deliver into a stated load impedance. The price for doing this is having to calculate the new transformer tap values at the new line voltage.

The PM-1200 can deliver 400 watts into an 8-ohm impedance (60V line voltage), and 600 watts into a 4-ohm impedance (49V line voltage). Since watts are proportional to the square of the voltage, compute the correction factor by taking the ratio of the square of the line voltages. Then multiply each tap value by this correction factor.

For example, a transformer has taps at 10W, 5W, and 2.5W when used in a 70.7 volt distribution. What are its new tap values when used with a PM1200, and an 8-ohm minimum amplifier load?

1. Compute correction factor K:
   $K = 60^2 / 70.7^2$
   $K = .7202$
2. Apply to tap value:
   marked power * K = new power
   10W * .7202 = 7.202W
   5W * .7202 = 3.6011W
   2.5W * .7202 = 1.805W

When used in a 60V distribution system, this transformer's tap values are 7.2W, 3.6W and 1.8W. Note that the 3 dB power relationship between each tap still holds true. Similarly, maximum amplifier loading occurs when the sum of the NEW tap values equals the amplifier's output power.

5. Technical Information

Theory of Operation

This section discusses the theory of operation of the PM-1200. Refer to the schematic diagrams presented later in this section. Opamps used in the circuitry use the following notation: IC1(7). This means op-amp IC1, whose output appears on pin 7. Unless otherwise noted, this discussion centers around the left-channel circuitry. The right-channel circuitry is essentially identical.

Low Level Circuitry

Input signals enter the circuit via the rear-panel XLR connector, tip-ring-sleeve (TRS) phone jack. The right-channel input circuit includes a phase-reverse switch that is used for mono-bridge operation. IC1(7) is configured as a differential amplifier with a gain of 1.47 driving the left-channel level control. On the amplifier board, R1, R2, and OC1 form an attenuator whose loss is dependent on the resistance of OC1, a LED-LDR module. The drive for the LED portion of OC1 comes from the clipping eliminator circuitry, which will be discussed later on.

The PM-1200 may be configured to operate as a conventional 2-channel, dual-mono amplifier or a single-channel, mono amplifier with high-voltage output. The operational mode is determined by mono-bridge switch SW1. For now, assume that SW1 is set for 2-channel, dual-mono (stereo) operation.

Power Amplifier Circuitry

The PM-1200 uses the patented Carver Magnetic-Field power amplifier circuitry. This innovative circuit uses the combination of a smart power supply and a highly linear, triple-rail power amplifier circuit.

IC1(6) is the input stage, providing differential inputs for input and feedback connections as well as most of the open-loop voltage gain of the circuit. The output of IC1(6) drives Q14 and Q15, operating as common-emitter amplifiers which level-shift the drive signal, provide voltage amplification, and couple it to common-emitter amplifiers Q13 and Q20. Q14, Q15, Q13, and Q20 provide additional voltage gain, which when combined with the voltage gain of the input op-amp is sufficient to swing the input signal between the +125 and -125 volt power supply rails. Q16 and Q17 are connected as a NPN-PNP conjugate pair and used as a VBE multiplier for bias control. Q16 is thermally connected to the output transistors and together with Q17 provides bias stabilization over a wide temperature range. Overall negative feedback from the output stage via R59 and R93 sets the closed-loop gain at 33 (30.36 dB).

Up to now, the amplifier circuitry has been fairly conventional. From this point on, there is a marked departure from convention. The PM-1200 uses a triple-stacked output stage, with each stage having access to its own power supply. Each level of the output stage turns on only when needed, which keeps the power dissipation of the output stage at a minimum. Start at the middle/output of the amplifier.

Ignore the negative-going portion of the output stage for now. The positive-going portion of the output stage is comprised of an emitter-follower driver (Q8) and a series-connected output stage (Q7, Q6/Q24). The negative-going portion of the output stage is exactly complementary to the positive-going portion: an emitter follower PNP driver (Q3) and a series-connected output stage (Q4, Q5/Q25).

The innermost pair, that is the output transistor pair whose emitters are closest to the output (load) terminals (Q6/Q24, Q5/Q25), are driven from the opposite sides of the VBE multiplier (Q16/Q17). The circuit looks suspiciously like a full-complementary amplifier. It is exactly that. Diodes D15-D17 and D31 level-shift the drive signal to the requirements of the innermost output transistors while Q23 is a local VBE multiplier to limit the maximum voltage difference between the output transistor bases.

Q18 operates as a VI limiter, sensing the voltage drop across emitter resistor, R49, and reducing the drive signal to the output stage under overload conditions. Q19 operates in similar fashion for the negative-portion of the output stage. Q26 senses current limiting in the negative half of the output stage and passes this signal to the power supply as a shutdown signal. C30 causes Q26 to also turn on in the presence of large high-frequency signals.

Q7, the middle output transistor receives its drive via D14. When the drive signal exceeds 36V + 2 diode drops, Q7 begins to turn on and supplies additional voltage output capability via the intermediate 76V power supply. When this occurs, D13 disconnects the 36V supply from the amplifier. The same is true for the negative half of the amplifier (Q4, D25, D24). We now have an amplifier capable of swinging the load from approximately +76V to -76V (minus saturation drops, of course).

Now consider the outermost pairs of output transistors (Q9/Q10 and Q1/Q2). These transistors are driven (via Q12/Q11 and Q21/Q22) from the positive and negative sides of the VBE multiplier (Q16/Q17) via zener diodes D34 and D35, which level shift the output signal by the zener voltage towards the 125V power supply rail. As long as the peak AC output voltage remains below the zener voltage, Q12 and Q121 do not conduct. Once the AC output signal exceeds the zener voltage, the outermost output transistors begin to conduct. Diodes D12 and D23 are commutator diodes that disconnect the output stage from the 76V power supply whenever the voltage at the connection point between Q10 and Q7 exceeds 76V. Under high-frequency conditions, C10 and C20 provide phase lead for the outermost output transistors, ensuring that they can "stay ahead" of the audio signal.

Under small-signal conditions, the innermost pair of transistors does all the work. As the signal level grows larger and larger, the middle pair of transistors assumes part of the burden. At the highest signal levels, the outermost pair of transistors assumes the remainder of the burden of providing a high-voltage output signal to the load. This three-stage approach minimizes the voltage across each of the output devices which also minimizes the power dissipation required. Without this approach, the output transistors would be required to support the entire power supply voltage under small-signal conditions and the "unused" portion of the power supply voltage would be turned into heat.

Anti Clipping Circuit

The amplifier's input operational amplifier, IC1(6), also drives a bridge rectifier (D1 through D4). The output of the rectifier drives the LED portion of OC1 (don't confuse this with OC1 in the power supply). IC1(6) is inside of the overall feedback loop, thus the signal voltage at this point is quite low, unless the feedback loop loses control (such as at clipping). Under these conditions, the output of the bridge rectifier is sufficient to illuminate the LED in OC1, which reduces the resistance of the resistor portion of OC1 which reduces the drive signal to the amplifier. The net result is a moderately fast compressor that is activated by amplifier clipping.

Magnetic Field Power Supply

The main power supply for the PM-1200 is a triple-voltage design which provides no-load voltages of plus and minus 125, 76, and 36 volts DC. Triac TR1 drives the primary of the magnetic-field power transformer. TR1 operates as a phase controlled switch; its gate signal depends on the signal supplied to opto-isolator OC1, which isolates the drive circuitry from the AC power line. Diode bridge D1 through D4 provide steering for the phototransistor in OC1, allowing the triac to fire on both alternations of the power line. The phototransistor, resistors R4, R3, and R2, capacitors C3 and C2, and diac DC-1 make up a phase-shift firing circuit that fires the triac earlier or later in the AC cycle depending on the phototransistor's conduction. When the LED in OC1 is OFF, the triac conducts earliest in the AC cycle: the power supply is operating at maximum output.

Emitter-followers Q5 and Q6 drive the LED portion of opto-isolator OC1. Their base drive is derived from the positive and negative 122 supplies and the positive and negative 43 volt supplies. RP1 sets the LED current, which in turn sets the no-load (idle) voltage of the power supplies. Under signal conditions, the 122 and 43 volt supplies will rise and fall as determined by signal/load demands. This changes the LED current, which in turn tells the triac what to do (more LED current, less triac current). This effectively keeps the various supplies at or near their no-load values.

Q2 and Q3 operate as a differential amplifier whose input is the logical OR of the various fault-detection systems. Q4 inverts the output of the diff-amp, and references it to the 75V power supply. If Q2 is turned on, Q4 pulls additional LED current through the optoisolator LED and shuts the power supply down.

DC Fault Protection

IC1(3) is a differential amplifier whose inputs are the amplifier outputs, severely low-pass filtered. The low-pass filtering prevents the circuit from operating on anything but DC output from the amplifier channels. The gains of the two inputs are different to ensure circuit operation if opposite halves of the amplifier decide to fail at the same time. If IC2(3) is negative-going, D5, R53, and D6 couple the signal to Q3's base, which results in Q4 turning on (via Q2). If IC2(3) is positive-going, D4 couples this signal to Q2's base, again turning on Q4, which disables the power supply.

Short Circuit/Low Impedance Load Protection

Q1's input is the output of each channel's protection sense transistors (Q26). If the protection transistors are triggered (low impedance load, output terminals shorted, high-frequency overload, etc.), Q1's collector goes positive. C22 provides a small time lag to allow momentary overloads to pass. When Q1 is triggered, its output drives Q2, which again disables the power supply via Q4.

Overvoltage Protection

IC1(12) is connected as a comparator. Its inputs are: 6V, derived from the 12V regulator, and 5.17V which is derived from the 125V supply via voltage divider R1, R2, and R59. If the 125V supply should exceed 141 volts, IC1(12) triggers, driving Q2 and Q4, again disabling the power supply.

Display Circuit

The clipping indicators are driven by transistors Q9, Q12 (left), Q10, and Q11 (right) located on the regulator PCB.. Each pair of transistors drives one of the LEDs. The signal for the clipping indicators comes from the main amplifier boards from IC1(6) via voltage divider R97/R12. This is the same signal that operates the anti-clipping opto-isolator. D17 half-wave rectifies the negative-going portion of the signal and drives Q9, which is a switch. C15 and R45 establish the time constant of the clipping indicator. When Q9 turns on, Q12 turns on as well, illuminating the LED (located on the display PCB).

The display driver circuit comprised of IC1(4,3,12,10) and IC2(12,3,4,10) is basically a ladder comparator driving LEDs with a twist. Assume that the signal at IC1 pin 2 is zero volts and ignore R23 and D4 for now. R12 and R13 are a voltage divider that establishes a reference voltage for the comparators (four per channel). The comparators compare their input signal against the voltages established by the tapped voltage divider made up of R21, R19, R17, and R24. The left channel LEDs are in the following sequence (lowest to highest): D11 (green), D10 (red), D9 (red), D8 (red), D7 (red), D6 (red), D5 (yellow).

The display board receives a positive-going half-wave rectified and smoothed signal from the input PCB. With the input signal at zero volts, all of the comparator outputs are at -12 volts. None of the LEDs (D26-D10) have any voltage across them; all are extinguished. IC1(4)'s output is high; all of the other comparator's outputs are low. As the input signal rises, it crosses, in sequence, the thresholds established at each of the four comparators. First IC1(3) fires; its output goes high, and D10 illuminates. Next IC1(12) fires, its output goes high; D10 extinguishes (no net voltage across it) and D9 illuminates. Finally IC1(10) fires; D9 extinguishes, and (this is the twist) D4/R23 supply current to the bottom of the R117, R19, and R21 voltage divider, which inverts the relationship of the comparators to each other.

When IC1(10) fires, the current through R23 reverses the sequence of the voltages that establish the thresholds for the three comparators. This allows the same comparators to perform double-duty. The new thresholds leave IC1(10) high, IC1(4) low, IC1(12) and IC1(3) low and D8 on. D6 and D7 are off. As the input signal rises further, IC1(12) fires, extinguishing D8 and illuminating D7. Next, IC1(3) fires, extinguishing D7 and illuminating D6. Finally IC1(4) fires, extinguishing D6. The last LED is the clipping indicator, D5.

6. In Case of Difficulty

If the PM-1200 fails to operate, here is a checklist of things to check before contacting an Authorized Carver Service Center (or the factory).

No lights, no sound

✓ Is the amplifier plugged in?
✓ Is the outlet live?
✓ Is the fuse okay?
✓ Is the power switch set to ON?

Low Output or No Output

✓ Are the input LEVEL controls set to their normal settings?
✓ Move the input connections to another amplifier that you know is working to verify that it is not a source problem.
✓ Check the speaker connections. Be sure that there are no small strands of wire touching similar strands coming from the other wire in the cable. If you use banana plugs, be sure that the setscrew in the plug is securely tightened.
✓ Are the speakers okay?
✓ If you are using bridged-mono mode, have you depressed the bridged-mono switch?
n Is the power line voltage dropping excessively when the amplifier is driven hard? Use a voltmeter to find out.

7. Warranty Information

Note:

✍ **Fill out and mail the WARRANTY REGISTRATION CARD which is enclosed in a separate envelope with the CARVER LIMITED WARRANTY.**

If your CARVER product should require service, we suggest you contact the Dealer from whom you purchased your unit. Should the Dealer be unable to take care of your needs, you may contact CARVER Service Department by phoning (206) 775-6245, or by writing to us at the Factory address given below. We will then direct you to one of our National network of factory trained and authorized Warranty Service Centers, or give you detailed instructions on returning the product to us for prompt appropriate action.

We suggest you read the LIMITED WARRANTY completely to fully understand what your warranty/service coverage is, and the duration. You must promptly complete and return the WARRANTY REGISTRATION CARD to validate your LIMITED WARRANTY.

If you should have questions or comments, please write to the Factory address given below. Please include the model and serial number of your Carver product, your complete address, and a daytime phone number.

Service Manual

A Service Manual including full schematics is available from the Carver Service Department.

Factory Address

Carver Corporation
Service Department
P.O. Box 1237
Lynnwood Washington, 98046
(206) 775-6245

Version 1.1

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