



# PowerMatch® PM8500/8250/4500/4250

## Using Mono Mode (single channel) to Drive High Impedance Loudspeaker Loads

APPLICATION NOTE

### Introduction

On all PowerMatch configurable professional power amplifiers, Constant-Voltage (or "Hi-Z") operation is typically accomplished by using **V-Bridge** (2 channels bridged) or **Quad** modes (4 channels combined). Within these modes the appropriate configuration for 70V or 100V operation can be selected. However, some users have expressed a desire to use a single channel in **Mono** mode to drive 70V or 100V loudspeakers.

The capability to drive 70/100V distribution lines is possible as a derated use (referred to as "50V Mode" in this document) and requires additional consideration: *Each loudspeaker's maximum effective tap setting is now only 1/2 of the highest 70V tap* (see the *Background* section for more detail). The full amplifier rating of a single channel is still available. The following table (Figure 1) provides a comparison between **V-Bridge** and **Mono** modes to drive 70/100V distribution systems:

|                             | Single Channel "50V Mode"  | 70V Hi-Z                                | 100V Hi-Z                                |
|-----------------------------|--|---|--|
| Output Configuration:       | <b>Mono</b>  | <b>V-Bridge (70V)</b>                   | <b>V-Bridge (100V)</b>                   |
| Loudspeaker Tap Setting:    | 2X desired Wattage (70V input)<br>4X desired Wattage (100V input)              | Desired Wattage (using 70V input)       | Desired Wattage (using 100V input)       |
| Limiter Threshold Settings: | Must modify limiter settings:<br>Set to 50V <sub>RMS</sub> / 71V <sub>PK</sub> | 71V <sub>RMS</sub> / 100V <sub>PK</sub> | 100V <sub>RMS</sub> / 142V <sub>PK</sub> |
| Open Circuit Alarm:         | Recommend Disabled   | Automatically Disabled                  | Automatically Disabled                   |

Figure 1. Driving Hi-Z loudspeakers from a single PowerMatch amplifier channel

### Example:

A customer has a large area that he wants to cover with multiple Bose FreeSpace® DS 40 loudspeakers. Perhaps the customer created a design that requires 20 FreeSpace DS 40 loudspeakers tapped at 20W each. In this situation, he can use a single channel (**Mono** mode) of a PowerMatch PM4500 amplifier with the loudspeakers set to the **40 W/70 V** tap position. He will still have sufficient power from the PM4500 amplifier with the 20 speakers on the zone, because the effective loading will be **20 W** x 20 spkrs = 400 W. This is a good fit as the effective loading is less than the available 500 W of per-channel power from the PM4500.

### Special Considerations when setting up PowerMatch amplifiers for Mono Mode Constant-Voltage Use

- Using ControlSpace® Designer™ software (CSD), you can opt to select various PowerMatch fault conditions that could trigger the fault alarm (see help within CSD for details). Once an alarm condition is met, a contact closure on the amplifier activates and fault indicators on the amplifier front panel and in CSD light to alert you of a potential problem. One of the alarm conditions, *open circuit detection*, **should be deselected while using high impedance loads**. Because some Constant-Voltage installations have zones configured for very low power, a PowerMatch amplifier could detect a high impedance and misinterpret the circuit as an open circuit. For example, in a 100 volt system, a 1 watt load presents an impedance of 10 kΩ - too high to be measured by the amplifier's open circuit detector.
- When a PowerMatch amplifier is configured in **Mono** mode, selecting a FreeSpace loudspeaker assumes that the speaker's input is set to the 8 ohm direct input rather than the 70V or 100V input. Therefore, the limiter settings are adjusted to much lower peak and RMS levels to prevent the PowerMatch amplifier from overpowering the speaker. Note that the limiter settings in 70V mode are automatically set for 71V<sub>RMS</sub>/100V<sub>PK</sub> and 100V<sub>RMS</sub>/142V<sub>PK</sub> for 100V mode. In our special case of using **Mono** mode for 70/100V operation, those limits need to be manually re-adjusted to the default settings of 71V<sub>PK</sub> and 50V<sub>RMS</sub>. The workaround process is as follows:
  - Working in ControlSpace Designer software (v3.0+) with the amplifier configuration already set to **Mono** mode, double-click on the appropriate "SpeakerPEQ" block, then select the desired model from the "Load Loudspeaker EQ" button's list. Once the speaker file is loaded, all of the Bandpass, Speaker EQ and Limiter settings will be locked (see Figure 2).

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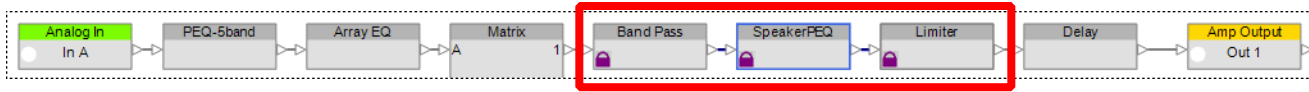


Figure 2. Locked Band Pass, SpeakerPEQ, and Limiter Parameters

- b. After choosing the correct model, use the "Save EQ As..." button to save a .seq file with a different filename, for example: "DS40F-50V\_mode.seq". This will unlock the previously locked settings (see Figure 3).

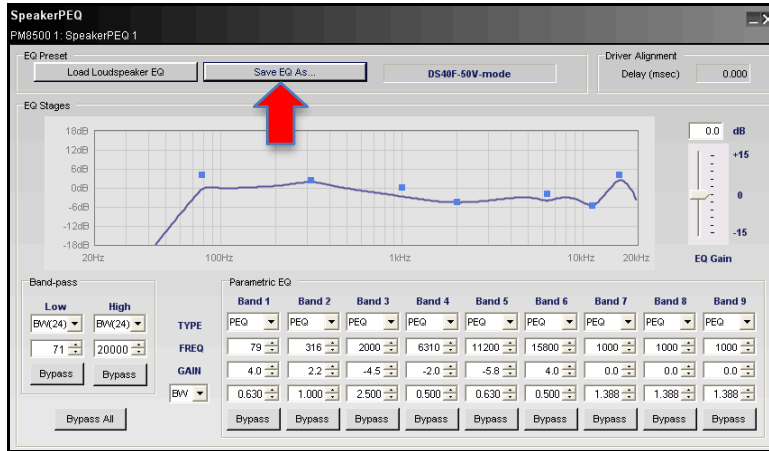


Figure 3. Using "Save EQ As..." to Unlock Settings

- c. Double-click on the appropriate Limiter block, and change the **V Peak and V RMS Threshold(V)** values to 71.0 and 50.0 respectively (see Figure 4).

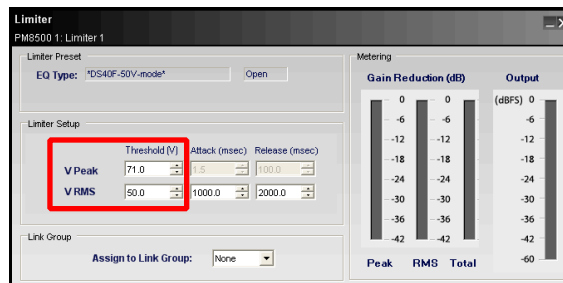


Figure 4. Changing the V Peak and V RMS values

- c. Repeat steps b. and c. for any other channels that you want to configure the same way. You can load and save speaker EQ's for different models, if appropriate, or copy & paste functions to copy settings to other channels.

## Background

Remember that "Constant-Voltage" is really a misnomer: A 70 volt system can be loosely defined as an amplifier that outputs about 70  $V_{RMS}$  maximum. This amplifier drives multiple transformer-coupled speakers that load the 70 volt line at a selected wattage. The voltage is not constant at all - it's audio. Any intelligible music or speech signal will generally result in a speaker's long-term power dissipation of 50% or less of the tap setting.

The simplest explanation of using a PowerMatch channel in **Mono** mode is that you now have a 50 volt system, as opposed to the more common 70V and 100V systems.  $Power = V^2/Z$  implies that whatever tap setting is used on the speaker (using the speaker's 70V input), the effective tap setting will be exactly  $\frac{1}{2}$  of the physical switch or jumper setting. Or, if using a speaker's 100V input, the effective tap setting will be exactly  $\frac{1}{4}$  of the switch setting. This effective tap setting, not the physical switch/jumper setting, should be used to determine the power load to the amplifier channel. In the case using **Mono** mode with a PM8500 or PM4500 amplifier, each channel offers 500 watt maximum while a PM8250 or PM4250 offers 250 watt maximum.



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