

# BOSE PowerMatch™ Configurable Professional Amplifier

Bose PowerMatch™ PM8500 is a configurable professional power amplifier delivering concert sound quality for fixed-installation sound reinforcement systems. The Bose PM8500 incorporates numerous proprietary technologies to deliver class-leading power, efficiency, sound quality, and reliability.



## Concert Quality Sound

The PowerMatch™ amplifier, enabled by proprietary Bose technologies, delivers the same level of performance regardless of output level; the result is the best possible frequency response, low THD and widest possible signal to noise, at all listening levels.

## Configurability

Unique in the industry, each PowerMatch™ amplifier is a fully digital amplifier whose output channels are capable of being configured for operation as a single channel, dual channels in voltage bridge or current share mode, or as four channels operating together in current share plus voltage bridge mode to deliver a wide range of power options.

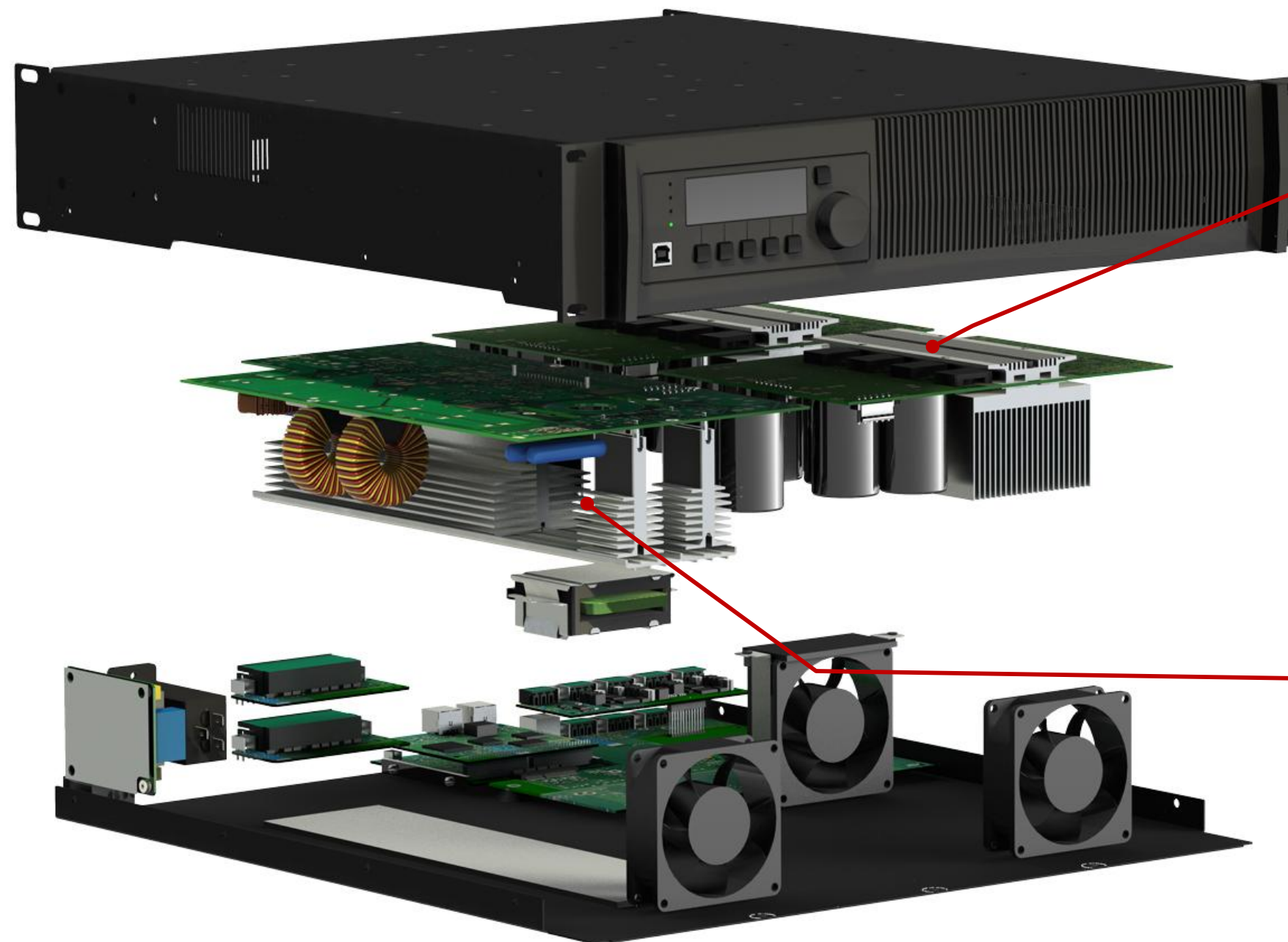
## Reliability and Efficiency

The PM8500 technology foundation is rooted in 20 years experience in building rugged and reliable Class-D amplifiers for the automotive industry.

Leveraging advanced technologies from the power industry and thermodynamic modeling tools, the PM8500 is designed to exceed industry reliability standards while being one of the most energy efficient professional amplifiers available.

# Concert Quality Sound For Fixed Installations

The PowerMatch™ amplifier, enabled by proprietary Bose technologies, delivers the same level of performance regardless of output level; the result is the best possible frequency response, low THD and widest possible signal to noise, at all listening levels.



## PowerMatch™ Class D Amplifier

New, proprietary design combines Class-D efficiency with a dual-feedback circuit to continuously monitor and control both the current and voltage of the output devices. This combination provides sound quality and reliability equal to the best Class-AB designs, with Class-D efficiency.

## PeakBank™ Power Supply

A regenerative 4-quadrant power supply with fast-tracking PFC is the key to high power with high efficiency, while providing the peak burst power needed for superior transient response and ample current reserve for bass impact.

# Configurability

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## Optimized Loudspeaker Processing

Integrated digital signal processing provides loudspeaker EQ, crossover, delay, and limiting. When used with RoomMatch™ and other Bose loudspeakers, the presets provide the same level of optimized protection limiting as self-powered loudspeakers.

## QuadBridge™ Output Mode

Outputs can be configured for single, bridge, or quad bridge operation, which allows 4kW of power to be allocated between 2 to 8 channels.

These software-selectable configurations range from 8 channels at 500 watts, 4 channels at 1000 watts, 2 channels at 2000 watts, or mixed combinations. Bridge and QuadBridge modes can drive either low-impedance or 70V/100V loads

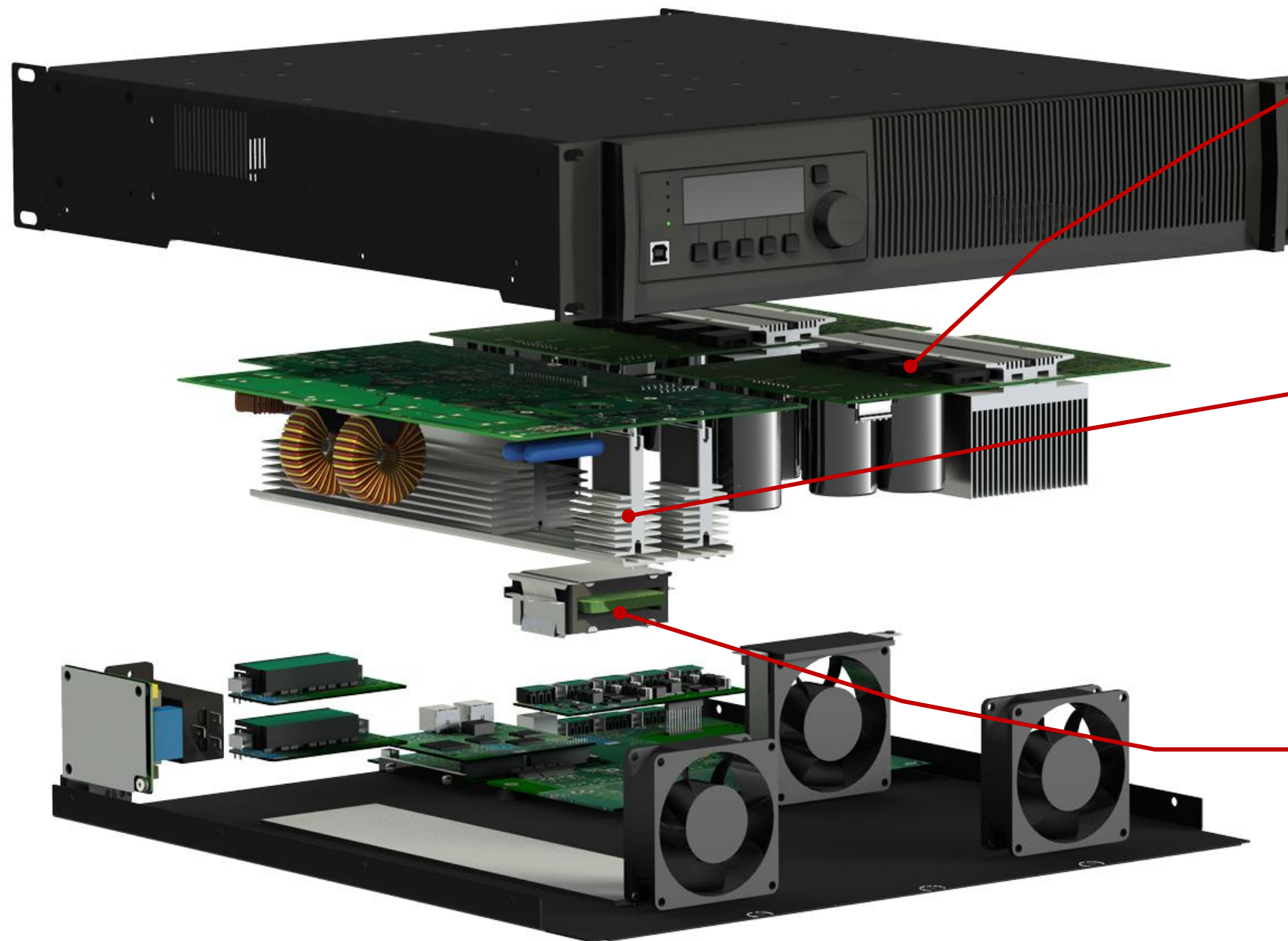
## Configured Using ControlSpace® Designer Software

All models have USB for Bose ControlSpace® software setup and configuration, in addition to the front-panel LCD user interface. Network versions can be integrated into larger ControlSpace systems.



# Audio Performance, Reliability and Efficiency

Leveraging advanced technologies from the power industry, thermodynamic modeling tools and 20 years of experience in building rugged, reliable Class-D amplifiers for the automotive industry, the PM8500 is designed to exceed industry reliability standards while being one of the most energy efficient professional amplifiers available.



## 4000 Watts from a Single Household AC Circuit

The new PeakBank™ Power Supply with Power Factor Correction and 4-Quadrant operation allow the PM8500 to deliver up to 4000 Watts burst power from a single 120V/20A AC mains circuit.

## Technology Choice: Efficiency

The combination of the new PowerMatch™ Class D amplification with the PeakBank™ Power Supply deliver one of the most efficient amplifiers on the marketplace, with a conversion efficiency greater than 75%.

## Technology Choice: Reliability

Careful component selection, thermodynamic modeling tools, and 20 years of experience in the design and manufacture of rugged, reliable Class-D amplifiers for the automotive industry result in a new class of amplifier to meet the demands of today's applications.

# PowerMatch™ Class D Amplifier

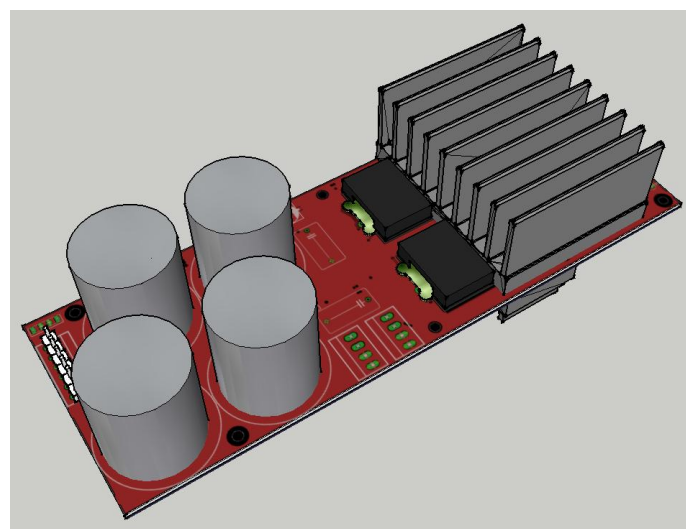
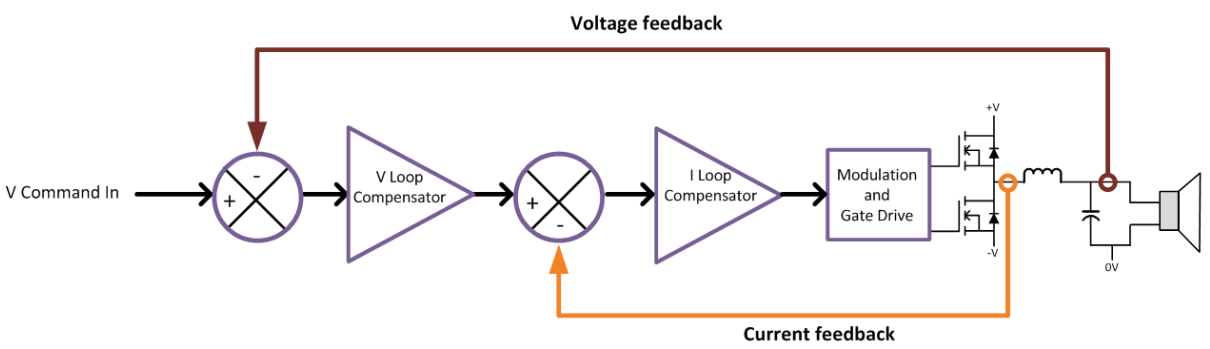
New, proprietary design combines Class-D efficiency with a dual-feedback circuit that continuously monitors and controls both the current and voltage of the output devices. This combination provides sound quality and reliability equal to the best Class-AB designs, with Class-D efficiency.

## Dual Feedback Loop Circuitry

At the heart of the PowerMatch Class D Amplifier is the proprietary Dual Feedback Loop design which provides real time command control of the output voltage and current.

This unique circuitry creates an amplifier topology that will never exceed its rated voltage or current output capabilities. This not only improves reliability, but enables the unique Configurable Channel Pair Topology used in both the Current Sharing and the QuadBridge™ output modes.

Dual Feedback Loop Design



## Configurable Channel Pair Topology

Each pair of amplifier channels within the PM8500 amplifier utilizes a unique configurable channel pair topology which allows them to be configured for independent, Voltage bridging or Current Sharing operation.

Multiple channel pairs can be combined in a unique QuadBridge™ Output mode to deliver the power of four amplifier channels to a single load.

Configuration	Rated Power Per Channel								Total Power
Mono	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	4000 W
Voltage Bridging	1000W @ 4Ω		1000W @ 4Ω		1000W @ 4Ω		1000W @ 4Ω		4000 W
Current Sharing	1000W @ 2Ω		1000W @ 2Ω		1000W @ 2Ω		1000W @ 2Ω		4000 W
QuadBridge™	2000W @ 4Ω				2000W @ 4Ω				4000 W
Mixed	1000W @ 2Ω	1000W @ 70/100V	300W @ 8W	300W @ 8W	500W @ 4W	500W @ 4W			

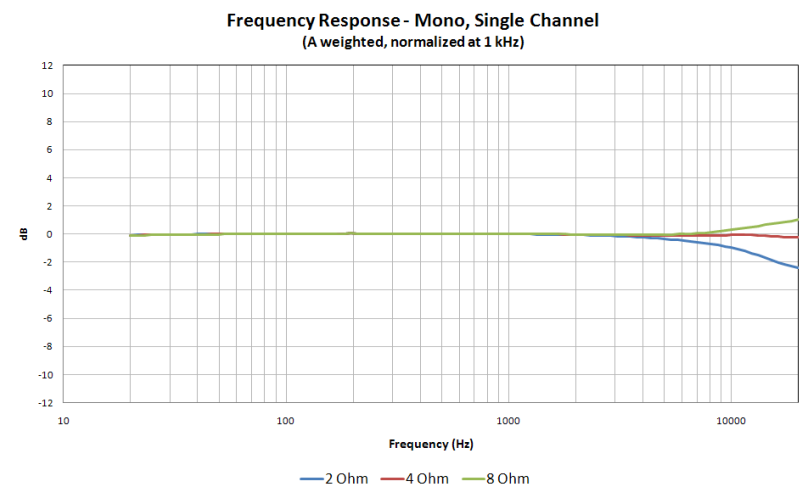
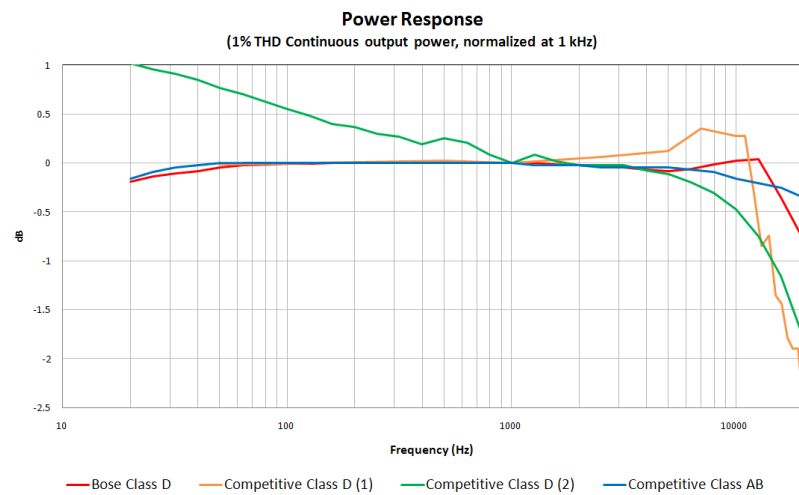
# Class AB Performance from a Class D Amplifier

The new PowerMatch™ Class D amplifier delivers Class AB performance in the areas of frequency response, THD+N, dynamic range and power response. In addition it delivers class leading continuous and burst output power capacity

## The Same Response At All SPL Levels

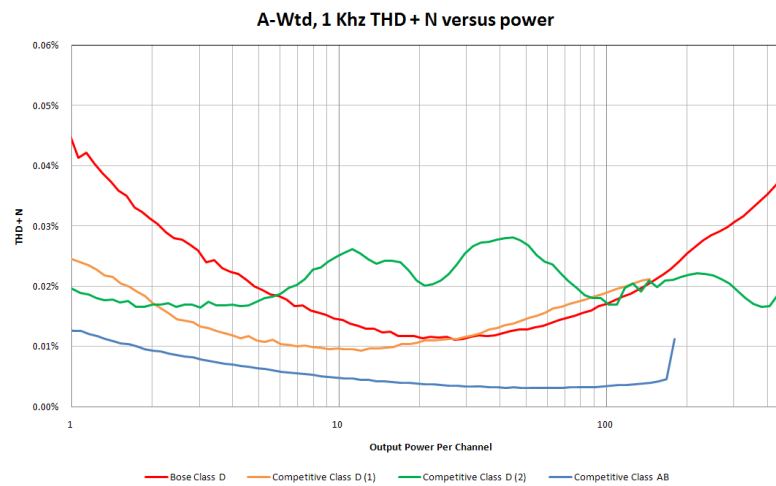
Unlike Class AB, many Class D amplifiers typically do not have a wide Power Response, nor do they deliver the same frequency response under varying load and power levels.

These problems are solved in the the PowerMatch amplifier. The PM8500 has the widest Power Response in its class, and it has a linear response, meaning the frequency response is the same at all output levels.



## Quiet Enough for A Concert Hall

Two key specifications in power electronics are Dynamic Range and THD+N. These two are considered a good indicator of audio quality. A high Dynamic Range means you will not hear operating noise during quiet passages in the program material, while THD+N is a good indicator of how accurately the amplifier will reproduce the program material.



The chart above shows the THD+N performance of the PM8500 as compared to competitive Class AB and Class D amplifiers.

## Dynamic Range

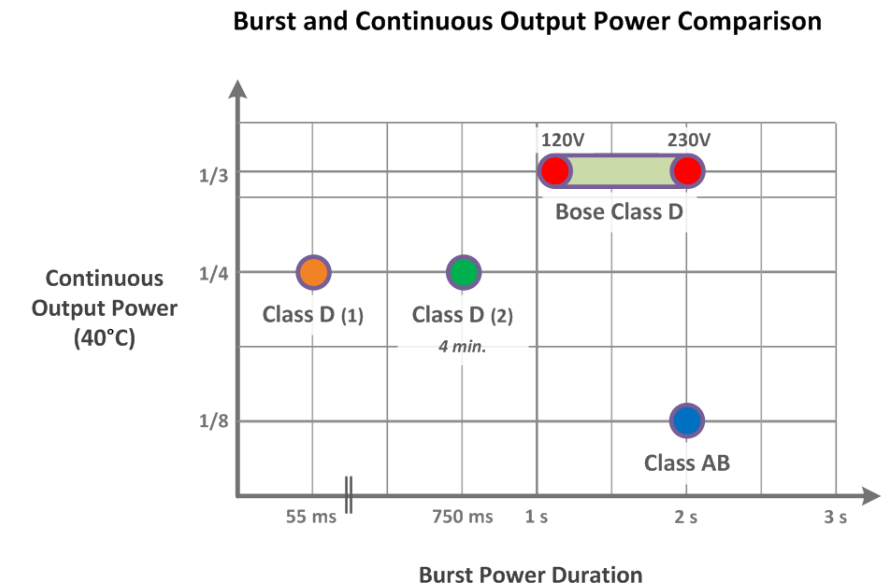
Dynamic Range in dB at rated power		
130W 8ch Class AB	500W 8ch Class D	500W 8ch PM8500
120	102	103

Note that the Dynamic Range performance of the PM8500 amplifier includes its integrated digital signal processing. The other ratings are only the amplifier.

## Power Enough For Transients

Amplifiers are typically rated on their continuous output power level. While this rating is important, of equal importance is its ability to have enough power in reserve to handle transients in program material.

The PM8500 delivers best in class performance for both continuous output power and short term burst power. The PM8500 is capable of higher continuous power levels than Class AB, and can sustain longer peak operation than most Class D amplifiers.



The chart above simultaneously compares the continuous output power and burst power duration for the PM8500 and three other multi-channel amplifiers. Note that both the PM8500's burst power output capability and continuous output capability are greater than any of the competitors.

NOTE: The PM8500's burst power capability is greater/longer when operating with a 230 VAC mains circuit.



# PeakBank™ Power Supply

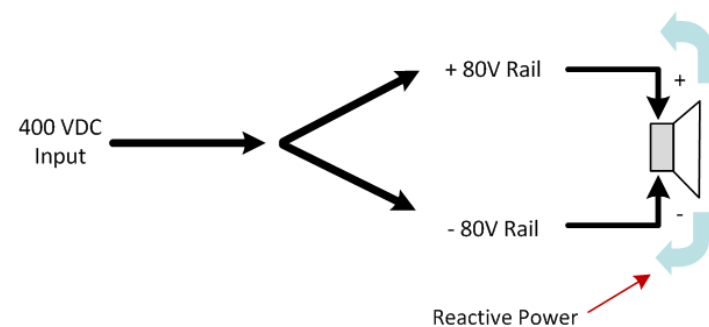
A Regenerative 4-quadrant power supply with fast-tracking PFC is the key to high power with high efficiency, while improving the peak burst power for superior transient response and current reserve for bass impact.

## Regenerative 4-Quadrant Operation

The PeakBank power supply dynamically allocates the voltage and current to where it is needed within the power supply resulting in a highly efficient use of AC Mains power.

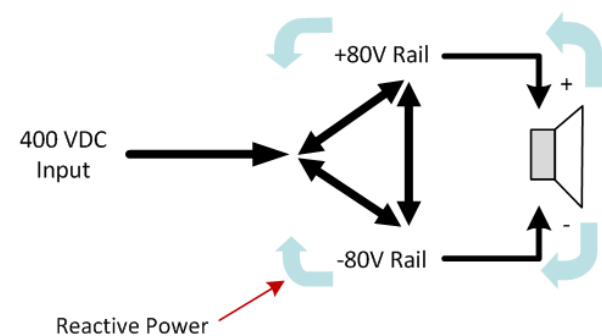
Adapted from the power supply industry this unique design recycles the reactive power generated by the loudspeaker, and surplus voltage and current within the supply itself to meet the varying voltage and current demands of the loudspeaker load.

### Conventional Switching Supply



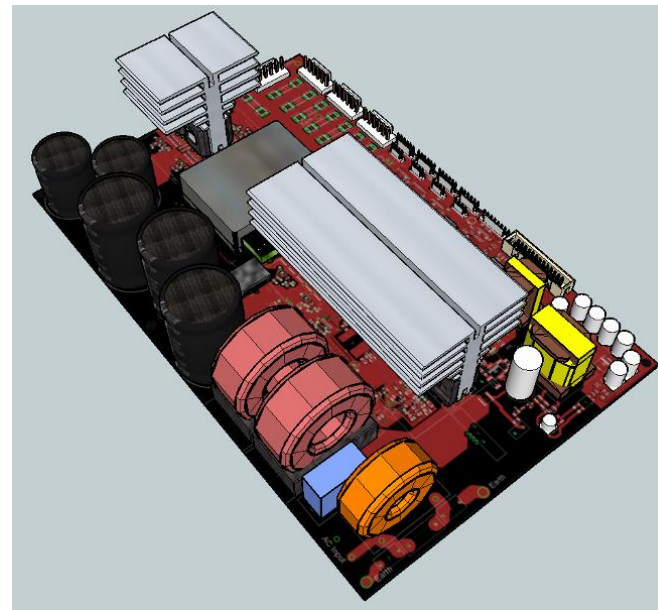
In a conventional switching power supply each voltage rail operates independently. If one rail requires additional voltage or current it can only be drawn from the main DC voltage input. In this design reactive power flowing back from the loudspeaker has no place to go. With highly reactive loads, like subwoofers, this can result in an audible artifact known as "rail pumping".

### 4-Quadrant Switching Supply



In a 4-Quadrant switching power supply voltage and current can be immediately applied to the voltage rails from either the opposite voltage rail, or from the DC voltage input. The result is a highly efficient design reducing the voltage and current draw from the AC Mains.

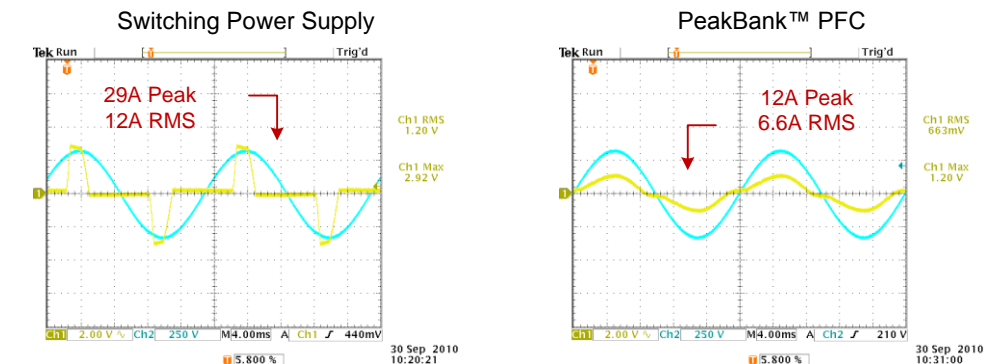
In this design reactive power flowing back from the loudspeaker is recycled, further reducing voltage and current demand. The result is an inherently "stiff" power supply which delivers outstanding low frequency performance.



## Fast-Tracking Power Factor Correction (PFC)

Power Factor Correction provides the benefit of minimizing current draw from the AC Mains, which results in an overall savings in the cost to run the equipment. The problem with conventional Power Factor Correction is that it does not respond quickly when the demand for power suddenly increases. A conventional PFC will save on energy costs, but at the expense of transient response.

The new proprietary Fast-Tracking PFC solves this problem. With this new technology the PeakBank power supply is able to meet the transient response demands of today's program material, while maintaining efficiency. The result is a highly efficient power supply, and an amplifier that delivers outstanding transient response.



The two graphs above compare the current draw of the PeakBank PFC to a competitive 500 Watt amplifier using a switching power supply. Notice that the current draw is about 2x that of the PeakBank supply when the units are driven at 1/3 power.

The result is that the PeakBank supply with PFC will draw half as much power from the line, and does not require large breakers for the equivalent amplifier power.



In this comparison we look at the amplifiers ability to meet the peak power demands for a 100 Hz transient. In each case the amplifier is driving all output channels simultaneously using a 4 Ohm load on each output. The measurement duration is 3 seconds.

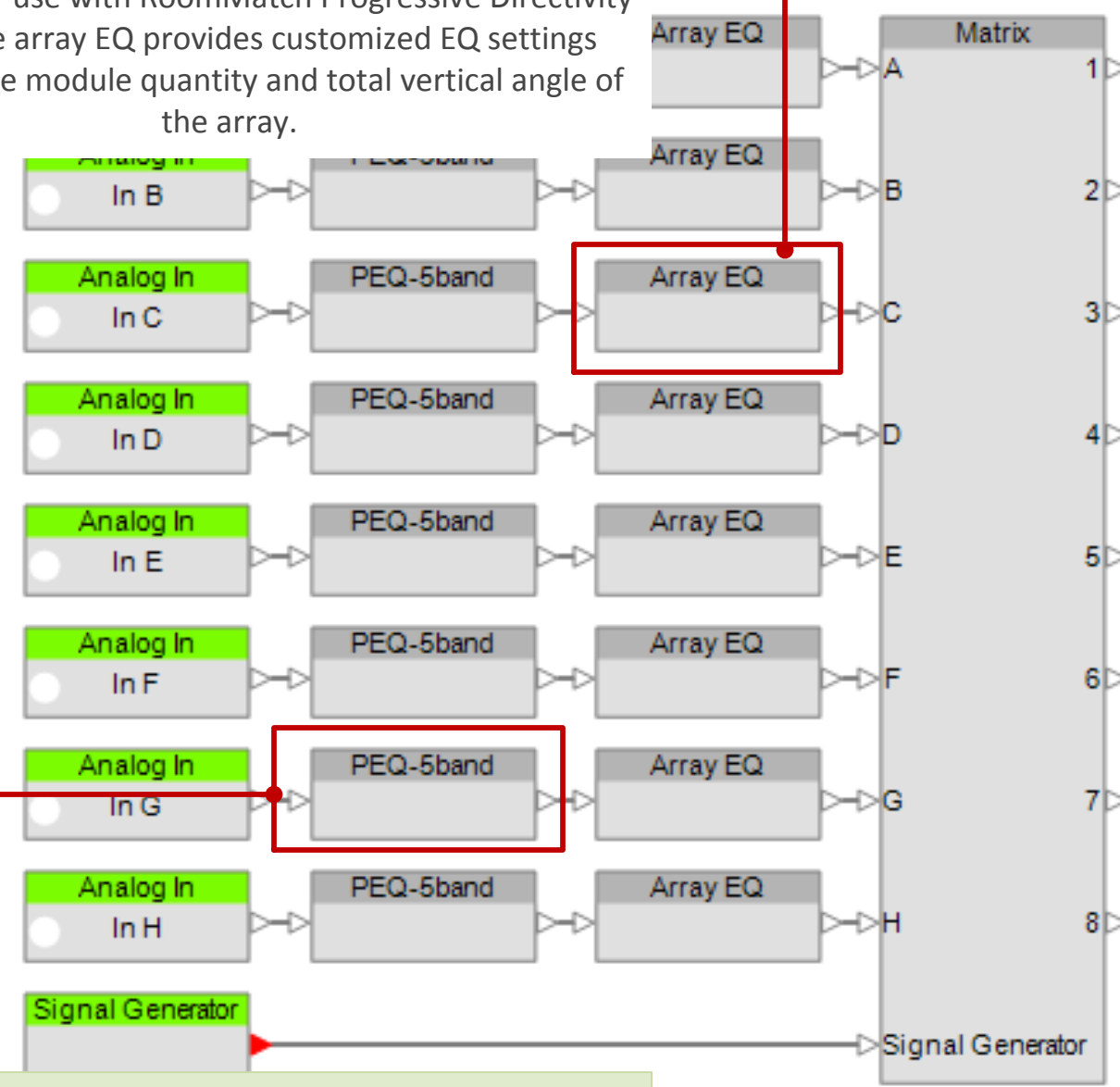
You will notice that the voltage rail sags immediately when the transient occurs, and does not recover, dropping the effective power by about 1.5 dB. The PowerMatch amplifier, on the right, does not exhibit this problem and can easily drive the transient to full power.

# Optimized Loudspeaker Processing

Integrated digital signal processing provides loudspeaker EQ, crossover, delay, and limiting. When used with RoomMatch™ and other Bose loudspeakers, the presets provide the same level of optimized protection limiting as self-powered loudspeakers.

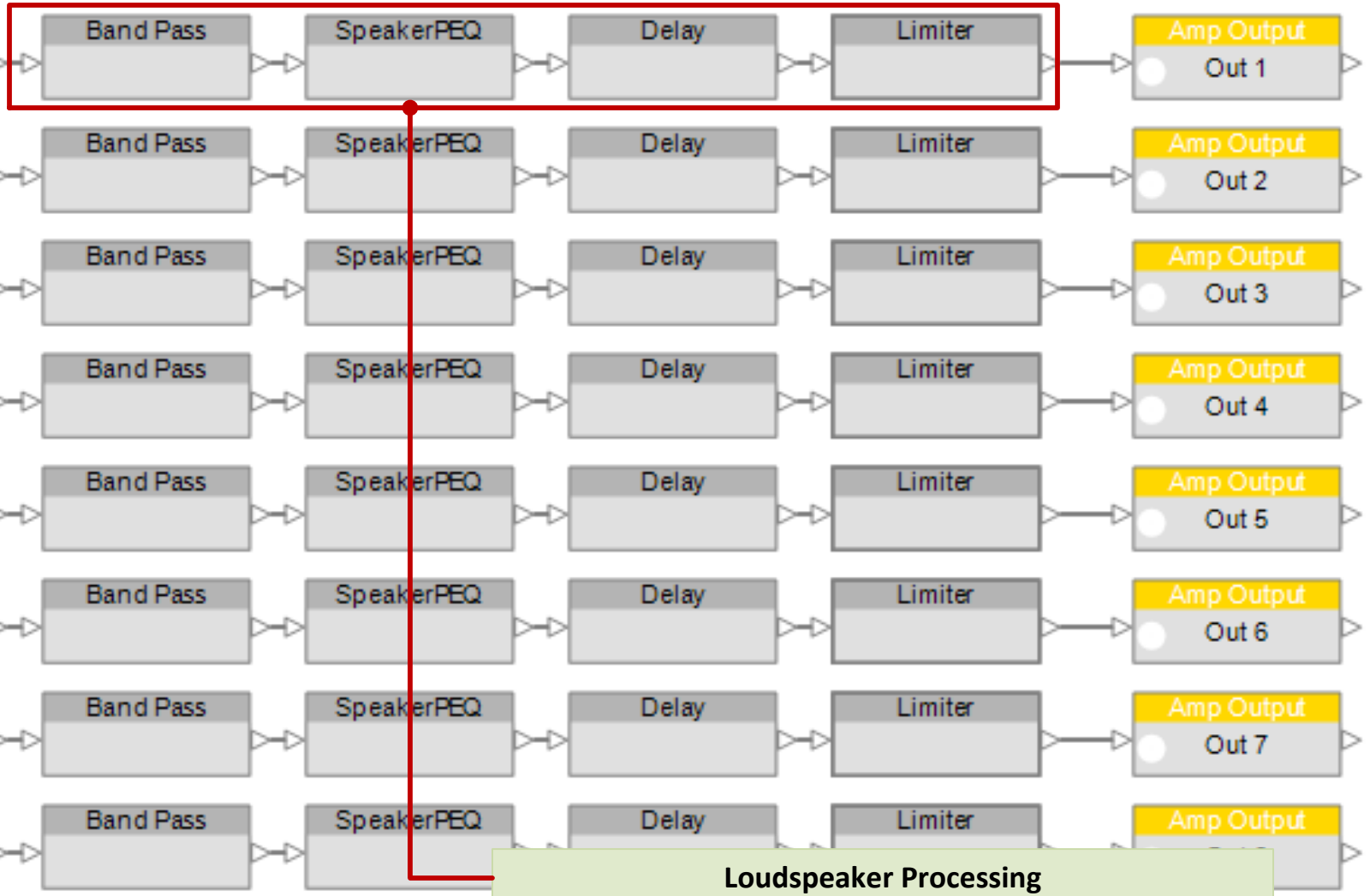
### RoomMatch Array Equalization

Designed for use with RoomMatch Progressive Directivity Arrays the array EQ provides customized EQ settings based on the module quantity and total vertical angle of the array.



### 5-Band House EQ

For smaller systems that may require only one or two PowerMatch amplifiers a 5-Band parametric EQ is available as a house EQ.



### Loudspeaker Processing

Each output signal processing chain includes a fully functional loudspeaker processing section including band-pass, 9-band parametric EQ, delay, and peak and RMS protection limiter. When using presets for Bose loudspeakers the settings are optimized to deliver the same level of protection and performance as a powered loudspeaker.



# QuadBridge™ Output Mode

Outputs can be configured for single, bridge, or quad bridge operation, which allows 4kW of power to be allocated between 2 to 8 channels. These software-selectable configurations range from 8 channels at 500 watts, 4 channels at 1000 watts, 2 channels at 2000 watts, or mixed combinations. Dual or quad modes can drive either low-impedance or 70V/100V loads

### One Amplifier, Multiple Power Configurations

The PM8500 is capable of handling a wide range of power levels and load types. This unique configurability allows a single amplifier to accommodate a wide range of applications within the Engineered Sound marketplace.

### Performance Independent of Configuration

The unique combination of technologies within the PowerMatch amplifier deliver the same level of performance, regardless of configuration.

### Supported Loads and Power Ratings

<b>Mono</b>	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	500W @ 4Ω	
<b>Voltage Bridging</b>	1000W @ 4Ω		1000W @ 4Ω		1000W @ 4Ω		1000W @ 4Ω	
<b>Current Sharing</b>	1000W @ 2Ω		1000W @ 2Ω		1000W @ 2Ω		1000W @ 2Ω	
<b>QuadBridge™</b>	2000W @ 4Ω				2000W @ 4Ω			
<b>Mixed</b>	1000W @ 2Ω	1000W @ 70/100V	300W @ 8Ω	300W @ 8Ω	500W @ 4Ω	500W @ 4Ω		

Performance data here

# ControlSpace® Designer Software v3.0

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## Front Panel Control

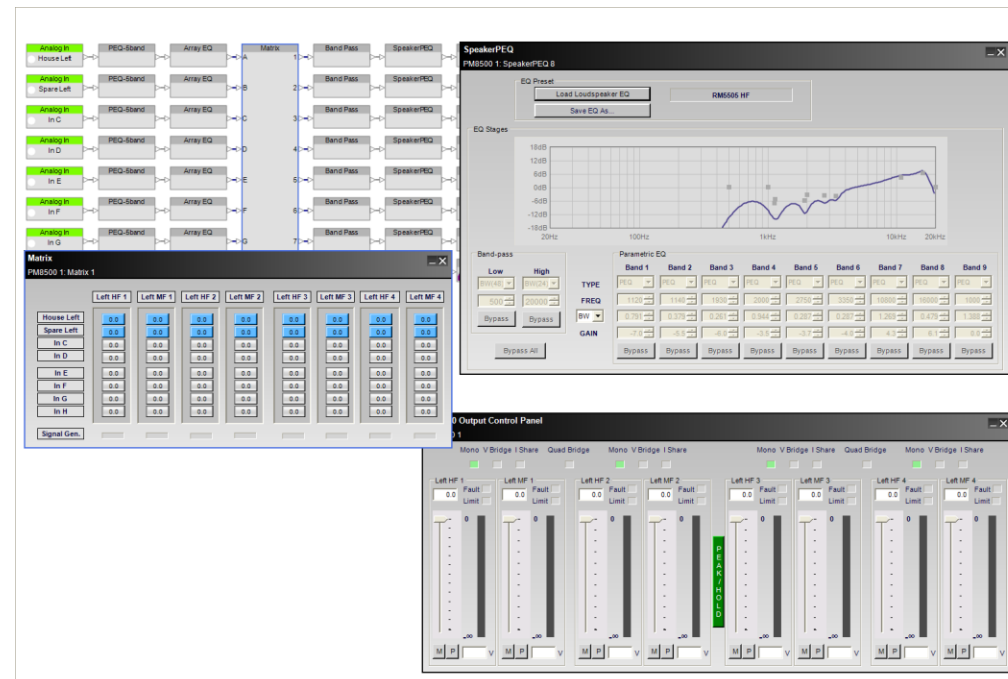
Many configuration and processing functions are available through the front panel interface.



## Configuration Using ControlSpace Designer Software

From within the ControlSpace Designer software all signal processing functions are accessible, as well as the parameters for amplifier output configuration.

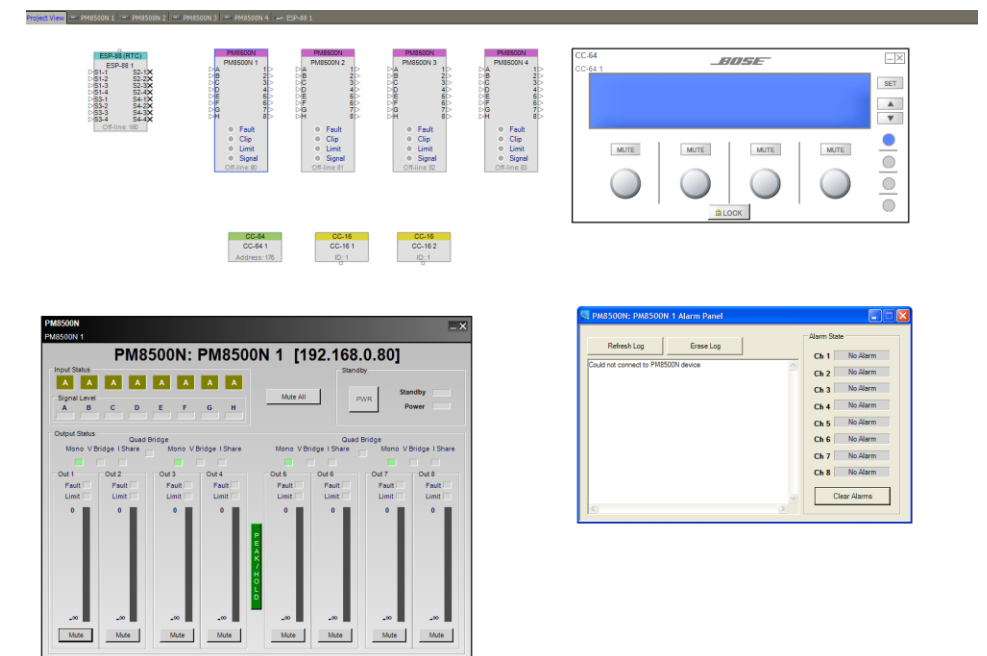
Using the USB port you can quickly set up one a PM8500 amplifier. Simply apply the pre-designed configuration to the hardware and it is ready for operation.



## Advanced Features Only for Networked Systems

In larger, networked systems use the ControlSpace Designer software to configure system power-on states, control programming and the creation of system presets.

Once the system is operational protect system settings using password protection, and leave the system operator with the ability to monitor system operation and fault conditions.

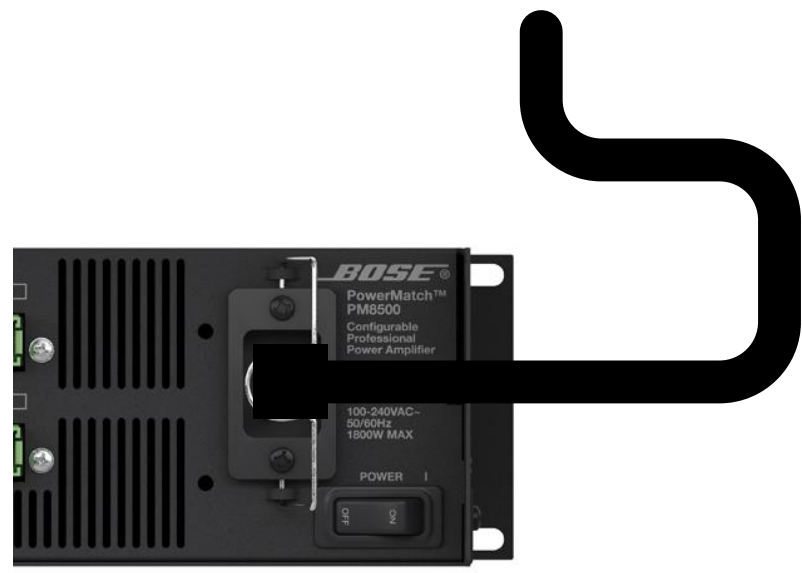
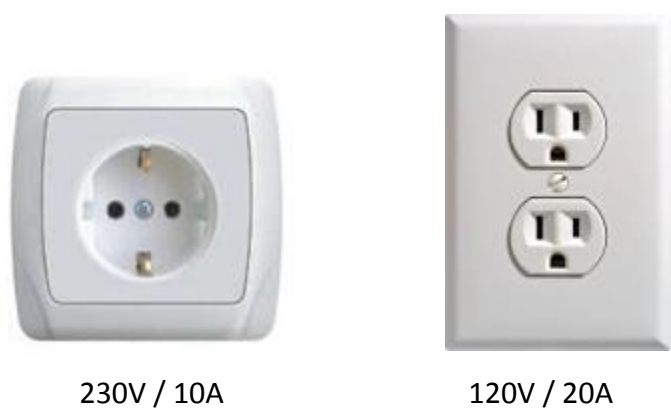


# 4000 Watts from a Single Household AC Mains Circuit

The PM8500 delivers 4 kW rated power from a single household-type AC mains outlet, with greater than 75% conversion efficiency.

## Standard AC Mains Wiring

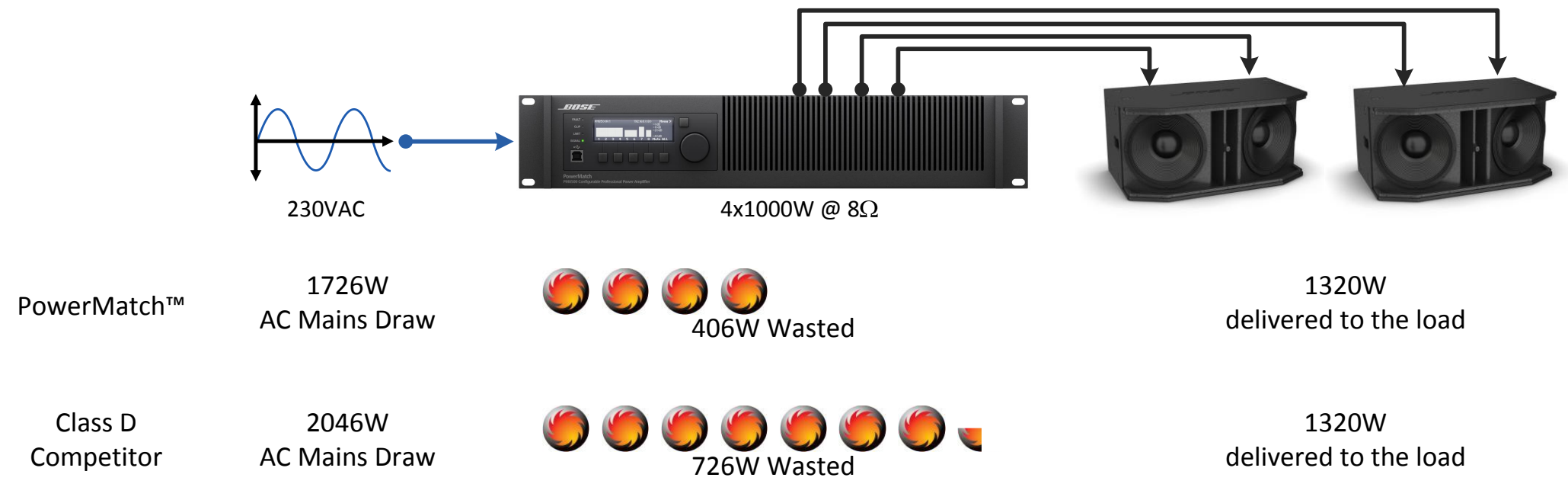
The unique combination of technologies within the PowerMatch amplifier uses power so efficiently that each amplifier only requires a single circuit – of the size you typically find in a home.



## Conversion Efficiency - Explained

Efficiency is a measure of how well an amplifier generates output power relative the amount of power it consumes for its operation. An ideal amplifier would generate 1W of power for every 1W of power consumed from the AC Mains. In the past amplifiers were at best 30 to 50% efficient; meaning they generated 0.5W of power for 1W of power consumed. When an amplifier is inefficient the “lost” power is radiated as heat, resulting in increased cooling costs for large systems.

The PowerMatch amplifiers have a conversion efficiency of greater than 75%, as measured with a 1kHz sine wave at 1/3 rated power. As a result you will have reduced electrical operation costs, and reduced cooling costs for large systems when PowerMatch amplifiers are used.



The above diagram compares a Gonzo amplifier running at 1/3 rated power to a competitive Class D amplifier. Each amplifier is capable of delivering 1320 Watts to the load, but the competitive amplifier requires an additional 320 Watts of electrical mains power to achieve the same output power. While some manufacturers claim to have an efficiency of greater than 90% they are only referring to the efficiency of the Class D amplifier stage, not the total conversion efficiency, which typically is much lower.



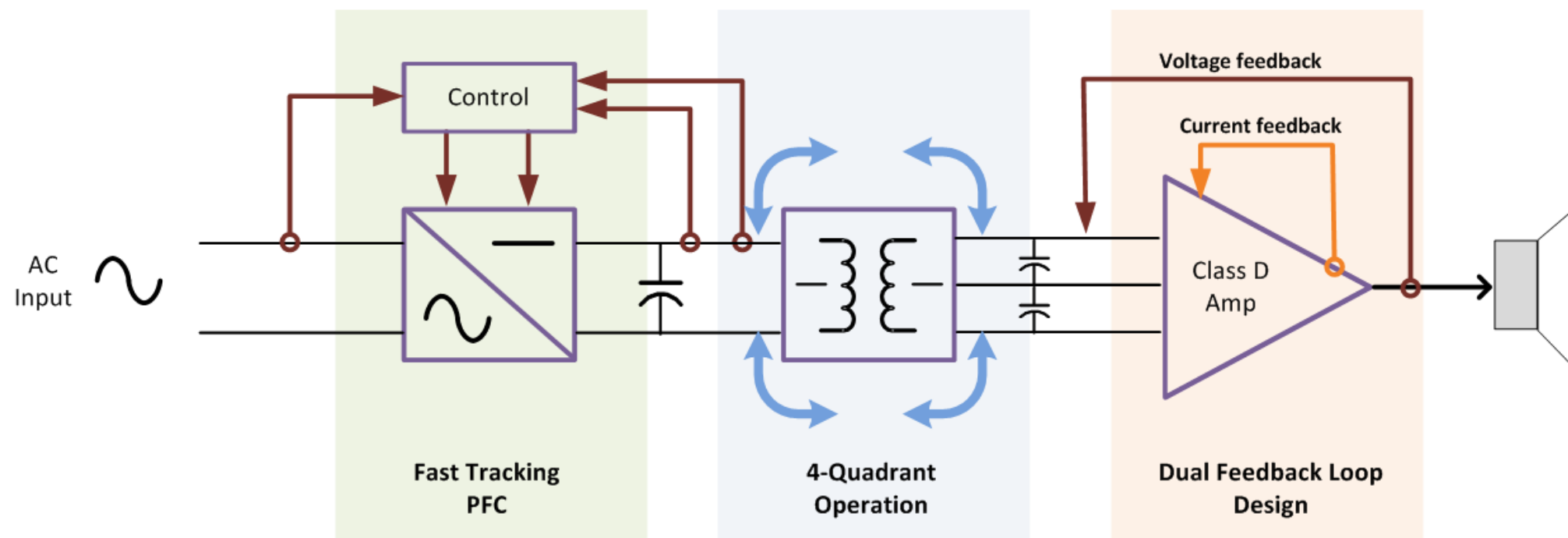
# Technology Choices: Efficiency

The combination of the new PowerMatch™ Class D amplification with the PeakBank™ Power Supply deliver one of the most efficient amplifiers on the marketplace, with a conversion efficiency greater than 75%.

## Adapting Technologies for the Professional Market

Achieving 75% efficiency for a high-power, multi-channel professional amplifier cannot be achieved using one single technology. The PowerMatch amplifiers employ technologies from within the amplifier marketplace, Class D, and couple them with technologies from other industries, 4 Quadrant power supplies to deliver the most efficient amplifier in its class.

The three key technologies, Dual Feedback Loop, 4 Quadrant Power Supply, and Power Factor Correction, were not “plug and play”, and required additional research and engineering to adapt them to the professional amplifier marketplace. When integrated together they combine to deliver outstanding audio performance, increased reliability and energy efficiency.



This new to the industry combination of technologies is a patent-pending design available only from Bose Corporation. When you wish to specify the highest level of both performance and efficiency there is no substitution for the PowerMatch™ amplifiers.

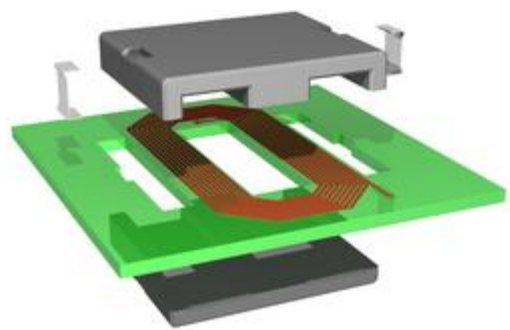
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Careful component selection, thermodynamic modeling tools, and 20 years of experience in the design and manufacture of rugged, reliable Class-D amplifiers for the automotive industry result in a new class of amplifier to meet the demands of today's applications.

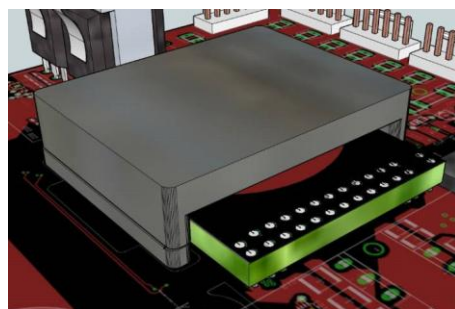
## Planar Magnetics Transformer

One of the unique technology choices within the PowerMatch amplifier is that of Planar Magnetics transformers. Originally developed for the power supply industry, this technology has been adapted for use in the PowerMatch amplifier.

Planar Magnetics transformers offer increased reliability as the transformer windings are part of circuit board – a highly repeatable process. The windings are surrounded by the metal core which has openings for airflow, increasing efficiency. Lastly, it is possible to create very high power transformers in a small form factor.



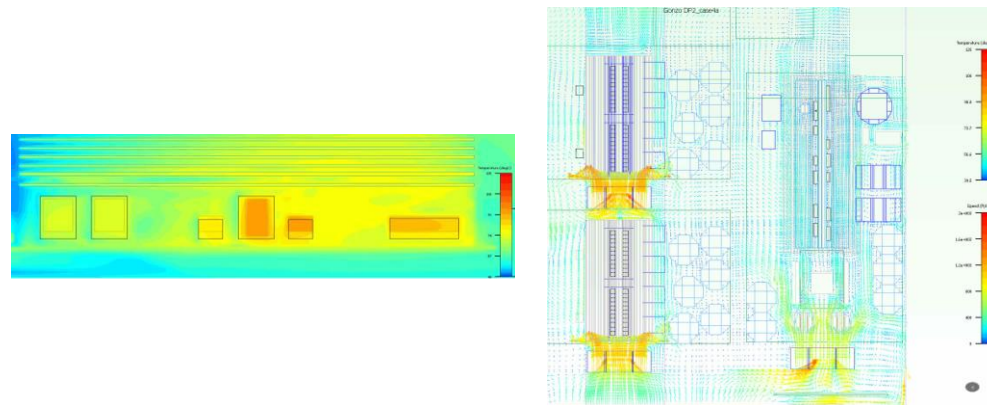
Sample of planar magnetics transformer.



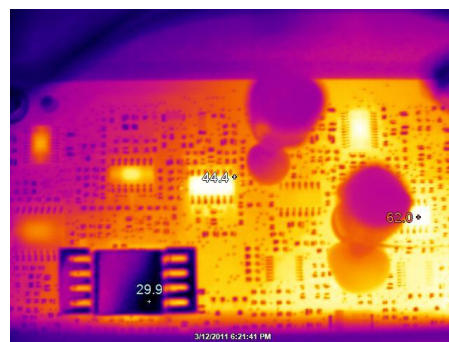
PowerMatch™ 4 kW planar magnetics transformer.

## Airflow Modeling

Providing adequate cooling for a high power multi-channel amplifier is a key to providing a highly reliable product. Utilizing advanced modeling tools detailed airflow models were developed to optimize fan and vent placement. Using these simulations the design was optimized, before the first prototypes were constructed.



The images above are from the thermal modeling tools used in the design of the PowerMatch amplifier. The image on the left is an thermal model of one of the amplifier components, while the image on the right represents the final airflow model of the amplifier.

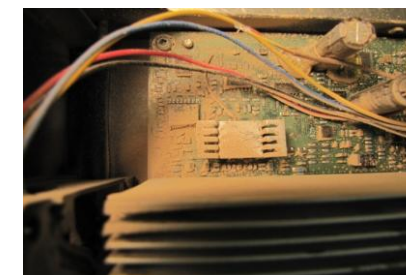


Once amplifier assemblies are complete the thermal models are verified using infrared imaging.

## Rugged Class-D Amplification

Bose Corporation has over 20 years experience in the design of Class D amplification for the automotive industry. Shock, vibration, dust and dirt are just a few of the “adverse conditions” encountered.

While this body of experience has informed the design used for the PowerMatch amplifiers we have nonetheless subjected the PowerMatch amplifiers to extremes of temperature, humidity and air quality. You can be assured if it is in the environment where you install professional amplifiers that we have tested it.



Accelerated dust accumulation – 22 years of dust shown.



Accelerated dust accumulation – 22 years of dust shown.



High temperature operation testing.



Drop testing

Category & Positioning  
(Introduction)

**Bose PowerMatch™ configurable professional amplifier**

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Key Benefits

**Concert quality sound**

The PowerMatch™ amplifier, enabled by Bose patented technologies, optimizes frequency response and minimizes distortion regardless of output level; resulting in the best possible frequency response, low THD and widest possible dynamic range.

**Configurability**

Unique in the industry, The PowerMatch™ amplifier is a full digital amplifier capable of being configured as a single module, dual module in bridge or parallel mode, or as four modules in bridged plus parallel mode.

**Reliability and Efficiency**

Leveraging advanced technologies from the Power Industry and thermodynamic modeling tools, the PM8500 is designed to exceed industry reliability standards while being one of the most energy efficient professional amplifiers available.

Primry Features

**PowerMatch™ Class D Amplifier**

New, patent-applied design combines Class-D efficiency with a dual-feedback circuit that continuously monitors and controls both the current and voltage of the output devices. This combination provides sound quality and reliability equal to the best Class-AB designs, with Class-D efficiency

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**8x500W from a Single Household AC Mains Circuit**

The PM8500 delivers 4kW rated power from a single household-type AC mains outlet, with greater than 75% conversion efficiency.

**PeakBank™ Power Supply**

Regenerative 4-quadrant power supply with fast-tracking PFC is the key to high power with high efficiency, while improving the peak burst power for superior transient response and current reserve for bass impact.

**Optimized Loudspeaker Processing**

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**Configured using ControlSpace™ Designer Software**

All models have USB for Bose ControlSpace® software setup and configuration, in addition to the front-panel LCD user interface.

**Technology Choice: Reliability**

Careful component selection, thermodynamic modeling tools, and 20 years of experience in the design and manufacture of rugged, reliable Class-D amplifiers for the automotive industry result in a new class of amplifier to meet the demands of today's applications.

Secondary Features & Enabling Technologies

**THD+N Performance**

**Dynamic Range Performance**

**4-quadrant power supply operation**

**Fast PFC**

**Configurable Channel Pair Topology (VI Loop)**

**Processing Specific to Bose Loudspeakers**

**Load Sweep**

**Alarm Logging & System Monitoring**

**Networked Systems**



# Fast-Tracking Power Factor Correction – Competitive Data

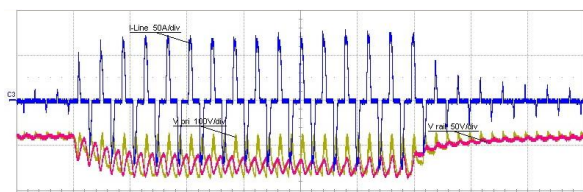
The following data represents measurements performed by Bose Corporation during our product evaluation and competitive benchmarking analysis. The purpose of this data is to demonstrate the performance differences between various technologies, and to compare the performance of PowerMatch amplifiers to their competitors.

## AC Current Draw

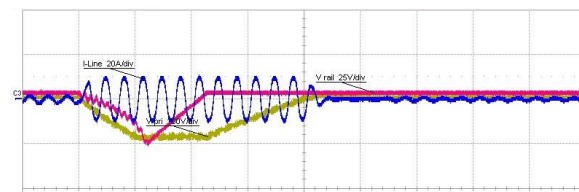
Efficient drawing current from the AC mains supply has three primary benefits: reduced electrical operating costs, improved immunity to low voltage conditions, and reduced circuit breaker requirements for equipment.

With linear and switching power supplies the current is only drawn at the peak of the voltage waveform. If the AC line voltage sags less current is available to equipment, in the case of an amplifier that means less power. In addition as the amplifier power increases it requires more current, increasing circuit breaker requirements. This is why a 120V/30A circuit is typically required for today’s high power amplifiers.

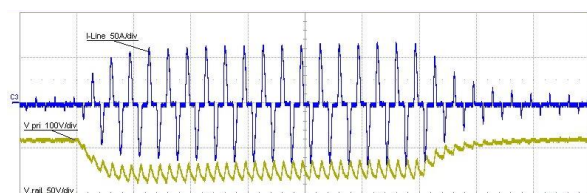
The following data shows the AC current draw for a QSC CX168, Lab Gruppen C20:8, PowerSoft Q4002, Dynacord DSA 8805, and a PowerMatch amplifier.



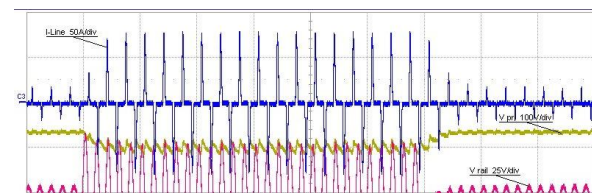
Dynacord (230V)



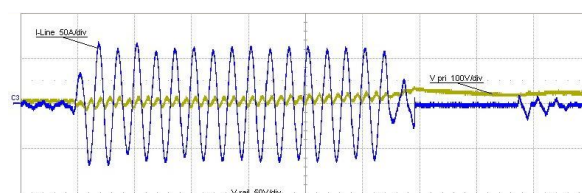
Lab Gruppen



PowerSoft



QSC



PowerMatch

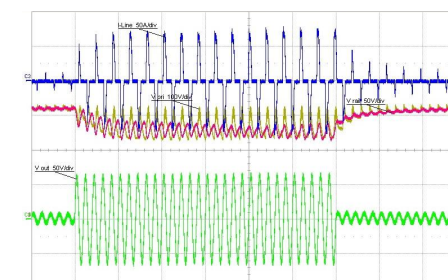
## Bass Response

An amplifier’s ability to accurately reproduce bass energy is largely determined by its ability to quickly draw current from the AC mains supply, to handle transients, and the regulation, or “stiffness” of the power supplies voltage rails.

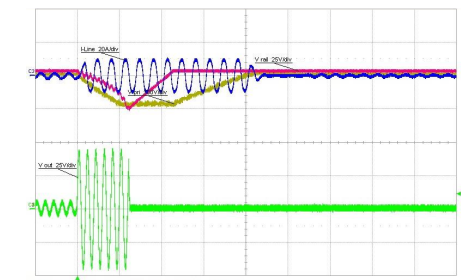
If the amplifier cannot quickly draw current from the AC mains supply, and maintain the current draw over the duration of the transient, bass impact will be lacking. By the time it can react, and obtain the current it needs the transient has passed.

A subwoofer is a very “power hungry” loudspeaker; it gets this power by drawing current from the amplifier. To deliver the desired power to the loudspeaker the amplifier’s voltage must be constant, any drop, or sag, results in reduced power at the loudspeaker.

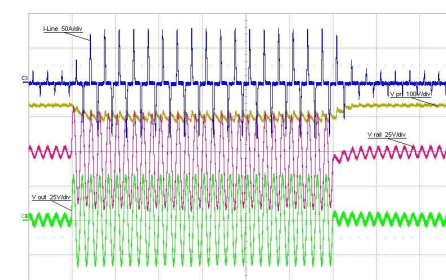
The following data shows the transient response for a QSC CX168, Lab Gruppen C20:8, PowerSoft Q4002, Dynacord DSA 8805, and a PowerMatch amplifier.



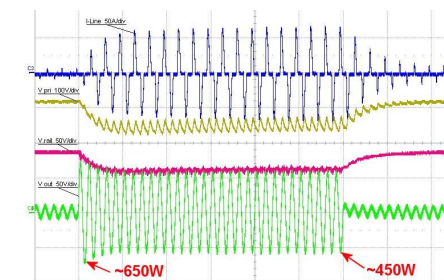
Dynacord (230V)



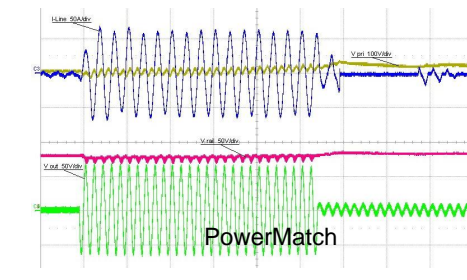
Lab Gruppen



QSC



PowerSoft



PowerMatch