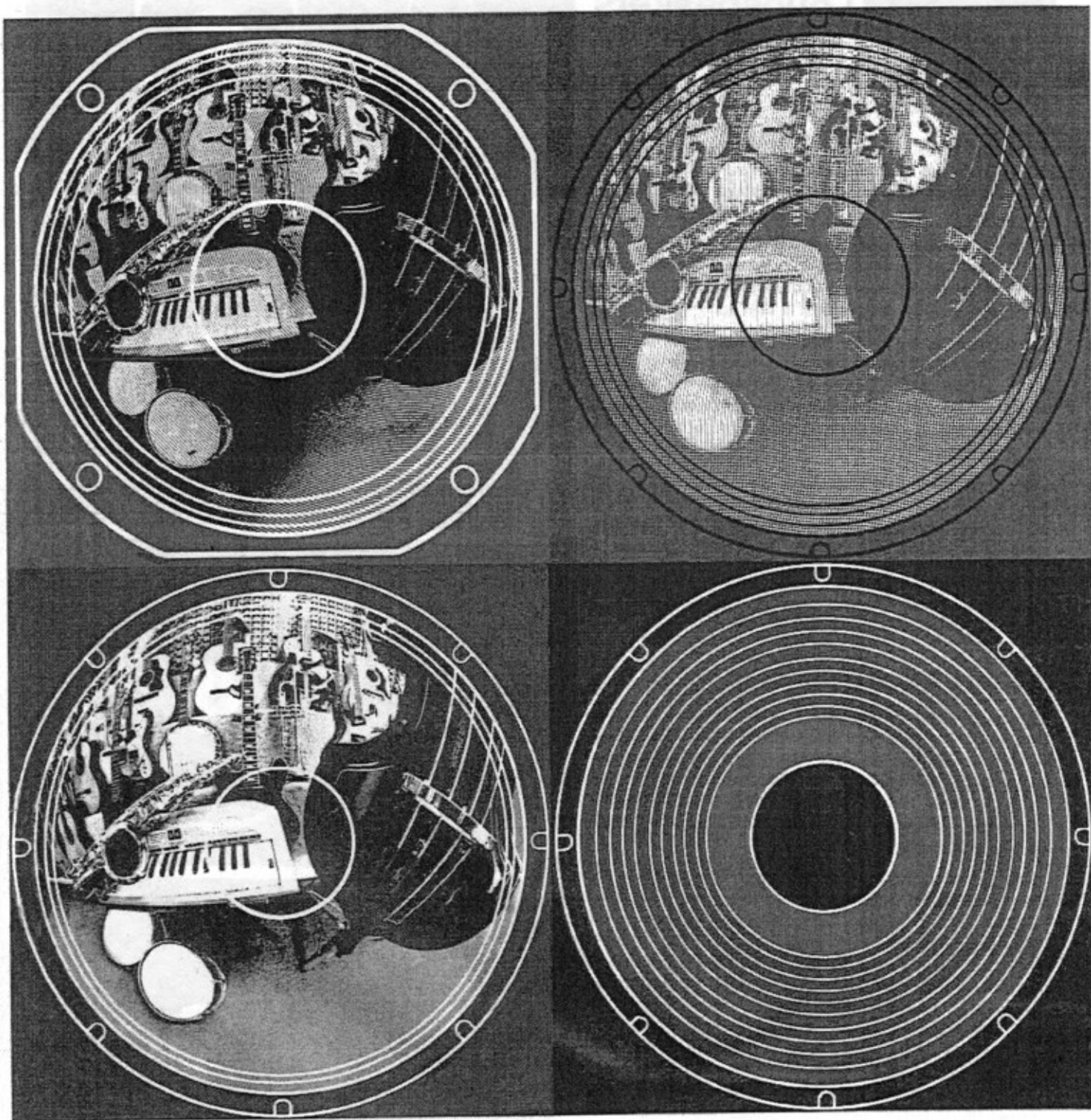


Musical Instrument Loudspeakers



JBL

JBL

Musical Instrument Loudspeakers

The hungry embrace of a driving bass guitar rhythm. A heavy lead guitar run that weaves itself around the diminished seventh cry of an electronic organ. The sawtoothed call of a melody played on fuzz. Intricate instrumental harmonies that speak languages a new generation understands. Music that says what has to be said.

These are the sounds of now. These are the sounds that today's musician uses to tell his message. These are the sounds of technology molded into an art form. An art form that was born in the awareness of a new age.

The musician of today has at his fingertips more command over the sound of his instrument than ever before in history. At the touch of a switch, he can change the tone, the timbre, the actual characteristic of any given note. With the turn of a dial, he can shape sound energy to suit his every artistic purpose.

Now loudspeakers have been made specifically for the musician. Loudspeakers that will reproduce the signal he creates with verbatim accuracy. Loudspeakers that let him hear everything his instrument has to offer.

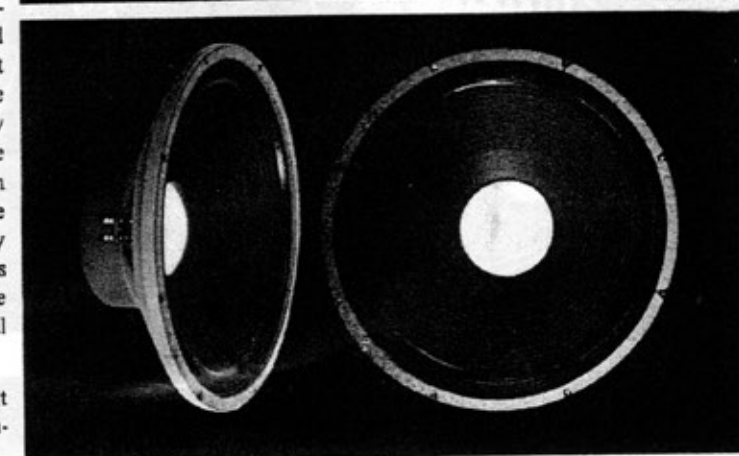
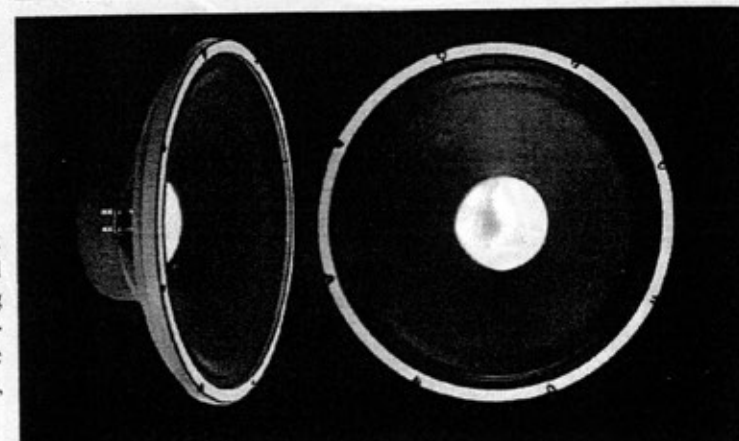
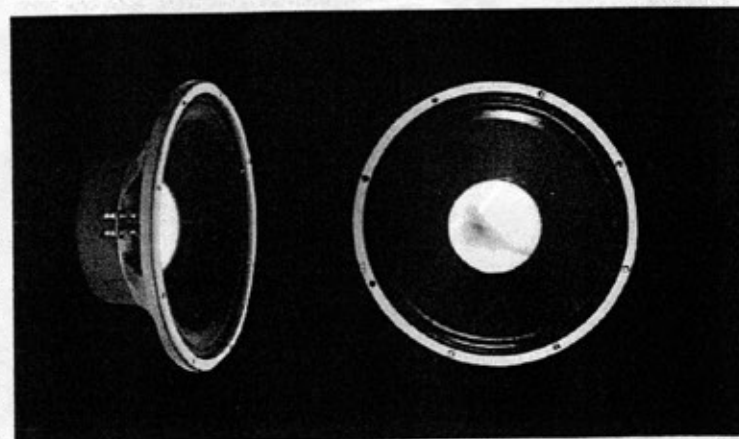
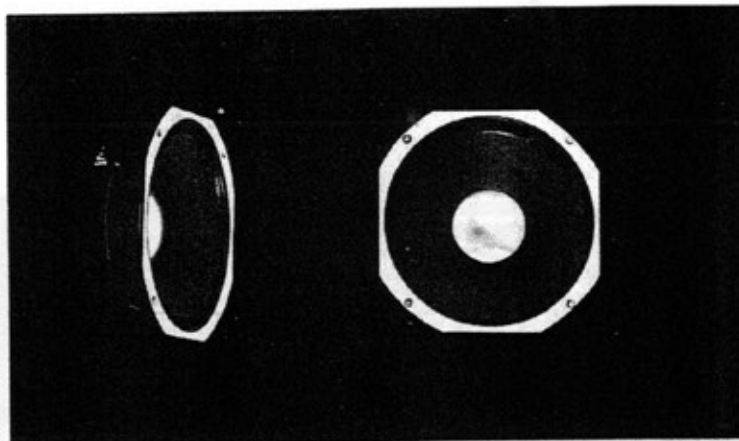
They are known as JBL MUSICAL INSTRUMENT LOUDSPEAKERS, designed and crafted by the Professionals in Sound, JAMES B. LANSING SOUND, INC.

PRECISION JBL CRAFTSMANSHIP

The requirements for making a perfect musical instrument loudspeaker are complex and exacting. Only JBL Musical Instrument Loudspeakers meet these requirements. Engineering and assembly specifications are followed with incredible exactitude to bring you an altogether new breed of electronic instrument reproducers... unquestionably the finest available, both in performance and reliability.

Each part of a JBL Musical Instrument Loudspeaker is carefully machined and hand-assembled. Each unit is tested and retested throughout every stage of assembly, assuring that JBL's demanding production specifications are met before the unit is released. Each loudspeaker is virtually custom-made by master craftsmen who take sincere pride in their work. These are some of the reasons JBL offers this unique warranty with every JBL Musical Instrument Loudspeaker: "Because we believe that a fine musical instrument loudspeaker, like any fine musical instrument, should last a lifetime, JBL will, at its option, repair this product free of charge during its entire normal life if factory inspection discloses a defect in original workmanship or material."

It takes a lot of confidence to offer a warranty like that. At JBL, that confidence is built into every JBL Musical Instrument Loudspeaker.



D110F.... A 10" loudspeaker manufactured by JBL expressly for use with electronic musical instruments. Absorbs more power and delivers more sound output than any other 10" loudspeaker made. The D110F can be used in single or multiple configurations for a wide variety of sound amplification needs. Because of its dynamic presence in the midrange, it is also an excellent choice for sound reinforcement applications. Directly interchangeable with any standard 10" musical instrument loudspeaker.

D120F.... A massively constructed 12" full range loudspeaker with an eleven pound magnetic assembly. Features greater power handling ability than most 15" units. Low frequency performance that really satisfies; dramatic midrange reproduction, the heart of the sound spectrum; sparkling highs that cut through with vibrant clarity. The D120F replaces any standard 12" musical instrument loudspeaker for improved performance and power capacity.

D130F.... Ruggedly built to withstand intense performance conditions, the total sound of the D130F is unapproachable by any other 15" musical instrument loudspeaker. Accepted as a standard of excellence by professional musicians throughout the world. The clean, spacious reproduction of the D130F makes it ideal for lead and rhythm instruments. Where space permits, the D130F is preferable to smaller units because of its larger cone area and greater sound output in the low frequency region.

D140F.... This 15" behemoth is capable of delivering thunderous bass fundamentals without breakup or distortion. Designed specifically for the bass guitarist or organist, the D140F combines a specially-designed cone and voice coil with a mighty magnetic assembly. Greater efficiency and power handling capacity than any other bass musical instrument loudspeaker on the market. The low frequency characteristic of the D140F is crisp, solid and accurate, never contributing coloration of its own to mask the waveform supplied by the instrument itself.

DYNAMIC ASSEMBLY

JBL Musical Instrument Loudspeakers use massive magnetic structures cast from a special high magnetic conductance alloy. All of the energy supplied by the heavy Alnico V magnet in each unit is directed to the one place where it contributes most to performance — the voice coil gap. Wasteful stray fields are positive indications of lost magnetic energy, and they are simply non-existent in JBL Musical Instrument Loudspeakers. This can be easily verified by holding a small metal object to the rear of a JBL magnetic assembly and noting that virtually no attraction occurs.

Edgewound ribbon voice coils are another unique feature found on every JBL Musical Instrument Loudspeaker. By using ribbon wire wound on its edge, efficiency is raised, range is greatly increased and the speaker is able to handle tremendous momentary overloads without damage. Edgewinding is the most costly and time-consuming method of constructing a voice coil...but it is by far the best. That is why they are made that way at JBL.

The cones of JBL Musical Instrument Loudspeakers are made of material carefully calculated for optimum mass, density and stiffness. A specially treated compliance is affixed to the outer edge of each cone and then cemented to a rigid cast aluminum loudspeaker frame, permitting the cone assembly to undergo long excursions with perfect linearity.

The centerdome in each JBL Musical Instrument Loudspeaker is made of dural aluminum alloy, precisely drawn to shape by hydropneumatic pressure. Attached directly to the voice coil, the centerdome produces highs that are crisp and brilliant. Slides and complex runs are cleaner, more spacious. Each note has all the bite and body needed for even the most demanding compositions.

The end result of the exacting techniques and demanding production tolerances used by JBL is a series of musical instrument loudspeakers that provides unparalleled accuracy. Loudspeakers that put out exactly what the musician puts in.

JBL Musical Instrument Loudspeakers don't make great musicians. But they do make great musicians sound as great as they really are.

ENCLOSURE REQUIREMENTS

JBL Musical Instrument Loudspeakers are designed to be used in enclosures as small as 3.5 cubic feet internal volume. However, cabinets with 4.5 cubic feet or more will assure optimum low frequency performance and power handling. For detailed instructions on proper enclosure construction for JBL Musical Instrument Loudspeakers, write to JBL's Technical Service Department and request a copy of JBL publication CF707. Please enclose 50¢ in coin to cover the cost of printing and handling.

This comprehensive enclosure construction manual covers such topics as materials, bracing, porting, acoustical padding and includes drawings and measurements of typical enclosures. For those concerned with getting the best possible performance from their instrument, this booklet is invaluable.

SPECIFICATIONS

	D110F	D120F	D130F	D140F
Nominal Diameter	10 inches	12 inches	15 inches	15 inches
Magnetic structure	6 pounds	11 pounds	11 pounds	11 pounds
Impedance	8 ohms	8 ohms	8 ohms	8 ohms
Power Capacity**	100 watts	100 watts	100 watts	150 watts
Voice coil diameter	3 inches	4 inches	4 inches	4 inches
Voice coil material	Edgewound Aluminum Ribbon	Edgewound Aluminum Ribbon	Edgewound Aluminum Ribbon	Edgewound Copper Ribbon
Flux density	10,200 Gauss	12,000 Gauss	12,000 Gauss	11,500 Gauss
Total Flux	170,000 Maxwells	275,000 Maxwells	275,000 Maxwells	260,000 Maxwells
Depth	4-1/4"	4-5/8"	5-11/16"	5-9/16"
Shipping Weight	8.75 lbs	10.25 lbs	14.75 lbs	17.25 lbs
Baffle hole dia.				
rear mounting	8-3/4"	11-1/16"	13-1/2"	13-1/2"
front mounting	9"	11-1/16"	*14-1/4"	*14-1/4"

POWER CAPACITY**

The power capacity of any loudspeaker is dependent on a number of variable factors, such as enclosure loading, the quality of the signal being generated by the amplifier, special effects that the loudspeaker is asked to create and the frequency range being reproduced. The rated power capacity of JBL Musical Instrument Loudspeakers refers to the amount of continuous program material the speaker can absorb under recommended conditions without damage. Their peak power capacities are considerably greater. For example, instantaneous peaks may reach many times the average power level, and such peaks will be faithfully reproduced by JBL Musical Instrument Loudspeakers.

The incomparable power capacity of JBL Musical Instrument Loudspeakers is the result of advanced engineering and space age technology. Each edgewound ribbon coil is backed by a coil form made of material that is virtually indestructible. This material is insensitive to climatic changes, highly heat resistant, retains its shape ten times better than standard voice coil paper and provides unequalled sound transmission. The coil, coil form, cone and spider are "super-cured" on intricate devices specially designed and built by JBL. Exotic compounds and adhesives are used to bond the component parts of the cone assembly together by this exclusive JBL time-cycled curing process.

Because of the unique materials and manufacturing processes used only by JBL, a JBL Musical Instrument Loudspeaker is more dependable under a wider variety of performance conditions than any other musical instrument loudspeaker on the current market. This simply means that the musician can really get into his act without worrying about blowing his speaker in the middle of a performance.

JBL Musical Instrument Loudspeakers are built to take it.

*If these units are installed from the front of the baffle panel, an MA15 kit is required. MA15 kits may be ordered directly from JBL at a cost of \$3.90 per kit (one required for each front-mounted 15" speaker). Please enclose your check or money order for the full amount with your request.

NEED SPECIAL HELP?

In most instances, JBL Musical Instrument Loudspeakers will be used to replace existing loudspeakers in standard amplifier cabinets. However, these fine units are also adaptable for special installations to meet specific needs. For example, a professional musician may want a very small, high quality extension speaker for monitoring. Or an organist may want to build a large speaker system to bring out the full potential of his instrument. Or a group may wish to put together an effective sound reinforcement system for vocal and miked instrument amplification.

JBL wants to help. For this reason, we maintain a staff of technical experts who will be happy to supply additional information and assistance on the proper use of JBL Musical Instrument Loudspeakers. If you have any questions or problems, please feel free to write directly to: Technical Service Department, James B. Lansing Sound, Inc., 3249 Casitas Avenue, Los Angeles, California 90039. A full description of your requirements will assure a complete and accurate response to your inquiry.

SBF1 Printed in U.S.A. 3/70



James B. Lansing Sound, Inc. 3249 Casitas Ave., Los Angeles, Calif. 90039

Technical Note

Danger: Low Power

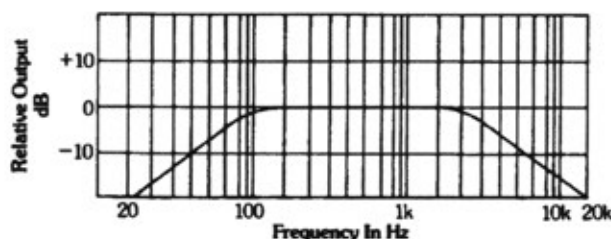
Too Little Amplifier Power Can Produce Too Much

We occasionally hear of JBL owners who damage the high frequency components of their loudspeaker systems using amplifiers that are rated at less—rather than more—power output than recommended. Understandably, they often find it difficult to comprehend how such an amplifier can actually burn out JBL components when they have been told, by our dealers and in our literature, that JBL loudspeakers can handle large amounts of power and will also deliver big sound with relatively little input power. These statements are true, provided the amplifier is not overdriven. To understand this more clearly, it is necessary to understand the nature of music as it relates to amplifier power and distortion.

First, The Nature Of Music

Not all musical notes are created equal. There is much more power in the lower registers of music than in the midrange and treble regions. If we examine the accompanying graph, we can see that the energy content of treble frequencies is typically 10 to 20 dB less than bass and midrange frequencies. Therefore, even if we allow for 10-dB peaks in high frequency program material, which is common, the high frequency driver of a system will be called upon to handle only about one-tenth the power that the low and mid frequency components must sustain.

This natural distribution of musical energy works to our advantage. It means, for example, that a loudspeaker system capable of handling 100 watts should have a high frequency unit capable of handling 10 watts. Thus, if the high frequency unit is designed to handle 20 watts of power (characteristic of many JBL systems), we are building a 100% safety factor into the high frequency unit. The result is that the capabilities of the components of a loudspeaker system parallel the natural energy distribution of music.



Energy distribution of typical recorded orchestral music. Rock and electronic music follow the same general contour.

Now, Let's Look At The Nature Of Amplifier Power

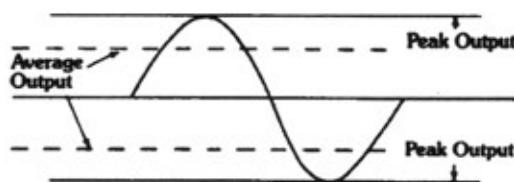
The power output specification of an amplifier is not absolute. Under certain operating conditions, such as when the volume control is set too high or when the input signal is too great, the amplifier can exceed its published output. The power output of an amplifier is rated with reference to a given level of total harmonic distortion (THD). If required to produce more power, the amplifier will do so, but at considerably greater distortion levels. For example, an amplifier rated at 10 watts (20 to 20,000 Hz into an 8-ohm load) at no more than 0.5% THD could be overdriven to produce 20 watts of output power to the loudspeakers. Under these same adverse conditions, an amplifier rated at 20 watts could deliver 40 watts to the loudspeakers; a 35-watt amplifier could deliver 70 watts and a 50-watt amplifier could be overdriven to deliver 100 watts. This distorted output could very well be in the treble region, as we shall soon see.

Here's The Killer: Distortion Generally Affects High Frequency Drivers

The additional power generated by overdriving the amplifier is rich in harmonics (distortion). These harmonics can be particularly dangerous to high frequency drivers. Harmonics are higher frequency multiples of the original signal; therefore, the high frequency component of a loudspeaker system must bear the brunt of the distortion—even though the original signal may have been generated by a bass guitar.

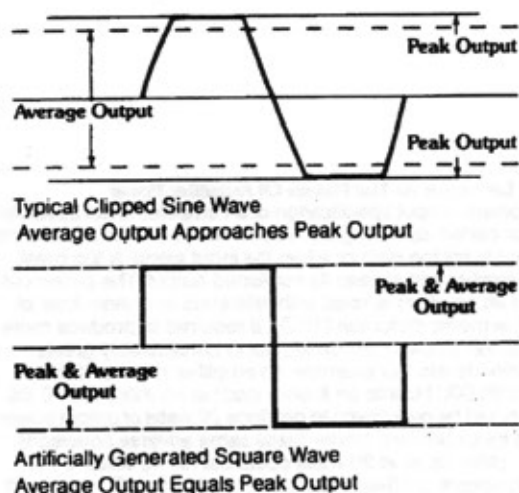
Here's What It Looks Like On A 'Scope

When a sine wave test signal (a signal consisting of a fundamental frequency without overtones or harmonics) is displayed on the screen of an oscilloscope, its top and bottom extremes will exhibit normally rounded contours. Average output power is one-half the peak output power. When an amplifier is overdriven, the contours are "clipped" off, producing a near square wave, having flat areas at the top and bottom limits, in which the average power approaches the



Typical Sine Wave
Peak Output 2 Times Average Output

peak power. When this occurs, up to twice the amplifier's rated output can be delivered to the high frequency driver, which may not be capable of handling the abnormal load. A higher powered amplifier, however, can generate the required power levels without clipping, allowing the loudspeaker system to receive program material containing a normal distribution of energy levels. Under these conditions, damage to the high frequency driver is most unlikely.



What Can The User Do?

There are no hard and fast rules. Very few amplifiers have meters that are capable of accurately indicating when an amplifier is being overdriven to the point that it could damage loudspeakers. Even the volume control position is not a clue — half rotation often produces considerably more or less than 50% of an amplifier's power. There are no absolutes. We wish there were.

However, we can offer a few guidelines:

1. *Purchase an amplifier that will provide more power than you will need.* Remember, a loudspeaker can require up to ten times the average power level for those instantaneous bursts of sonic power known as transients. If the amplifier has enough reserve power, transients will be clear and crisp. If not, the transients will be muddy or dull. When an amplifier runs out of undistorted power, it is forced to exceed its design capabilities, producing dangerous power levels rich in high frequency distortion.

2. *Do not drive the amplifier into clipping.* Clipping sounds something like a stylus mistracking, and generally occurs on loud passages when the system is played at loud volume levels. If clipping occurs regularly, turn down the volume level or install a larger amplifier that can deliver the required power without distortion.

3. *Do not make or break connections to the amplifier while it is operating.* Unplugging or inserting connectors into an amplifier, preamplifier or receiver while it is operating can produce momentary loud buzzes. Often, these buzzes occur at high power and can destroy loudspeaker voice coils very quickly.

4. *Practice audio precaution.* If your tape deck does not have tape lifters, it can produce squeals when in the fast-wind mode (either forward or backward) that can destroy high frequency drivers. Turning the volume down when fast-winding is a simple remedy. Also, turning down the volume whenever handling the phonograph tone arm is prudent. If a phonograph pickup is accidentally dropped on a record when the volume is turned up, the resulting thump could destroy the loudspeaker. Do not play the system loudly with excessive bass boost, which can easily cause the amplifier to be overdriven. Remember, a 3-dB increase in volume is just noticeable to the ear, but requires double the amplifier power, and many tone controls are capable of providing boost of 15 dB.

Summary

JBL loudspeaker systems are efficient; they will produce reasonable volume levels in a room of moderate size with very little amplifier power. However, if a small amplifier must be overdriven to obtain the desired volume levels in a listening room, thus generating high power and distortion levels, the user would be better advised to purchase a larger amplifier capable of producing the required power with negligible distortion. In any case, an amplifier should be selected with an output power rating that is greater than the maximum power that will be used. This margin of reserve power will ensure that the amplifier will not attempt to deliver more power than its design allows. The net result will be distortion-free sound reproduction and virtually unlimited loudspeaker life.

JBL

Speaker Power Requirements

Answers To Some Often Asked Questions

1. What do terms like "peak," "instantaneous power," "music power," and "program power" mean?

Basically, these terms describe, in one way or another, the time-varying nature of music and the electrical power required to reproduce it. A 150-watt light bulb presents a constant 150-watt load to an electrical power source when it is on. By contrast, a 150-watt audio amplifier will only *rarely* be called upon to deliver its full output to a loudspeaker. Figure 1 illustrates the time-varying nature of music and the power which may be required to reproduce it.

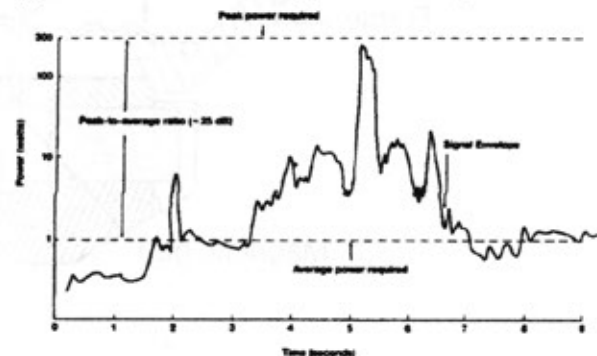
In the illustration, the term *peak power* is clearly defined as the maximum power required over the time interval shown. Average power represents the overall average power requirement for the time interval in question.

There are two points to be noted here: both peak and average power requirements are very dependent on the nature of the program signal, and the peak-to-average ratio can vary considerably from one kind of program to another.

Strictly speaking, the term *instantaneous power* refers to any very short-term power requirement, and normally it is associated with the maximum power which the program signal may require. Such terms as *music power* and *program power* are not rigorously defined, but may be thought of essentially as variations of average power.

In the figure, the program envelope is plotted against time along the horizontal axis for a typical loudspeaker system rated for use with a 300-watt amplifier. Note that most of the time the power requirements are quite low; only occasional momentary peaks will require full system output. The ratio in decibels calculated from the two dashed lines is known as the peak factor of the signal. In this case, the ratio is about 25 dB, and that would be typical for classical music. For rock music, we would expect to see signal peak factors in the range of 8 to 10 dB.

Figure 1. Peak and Average Power Requirements



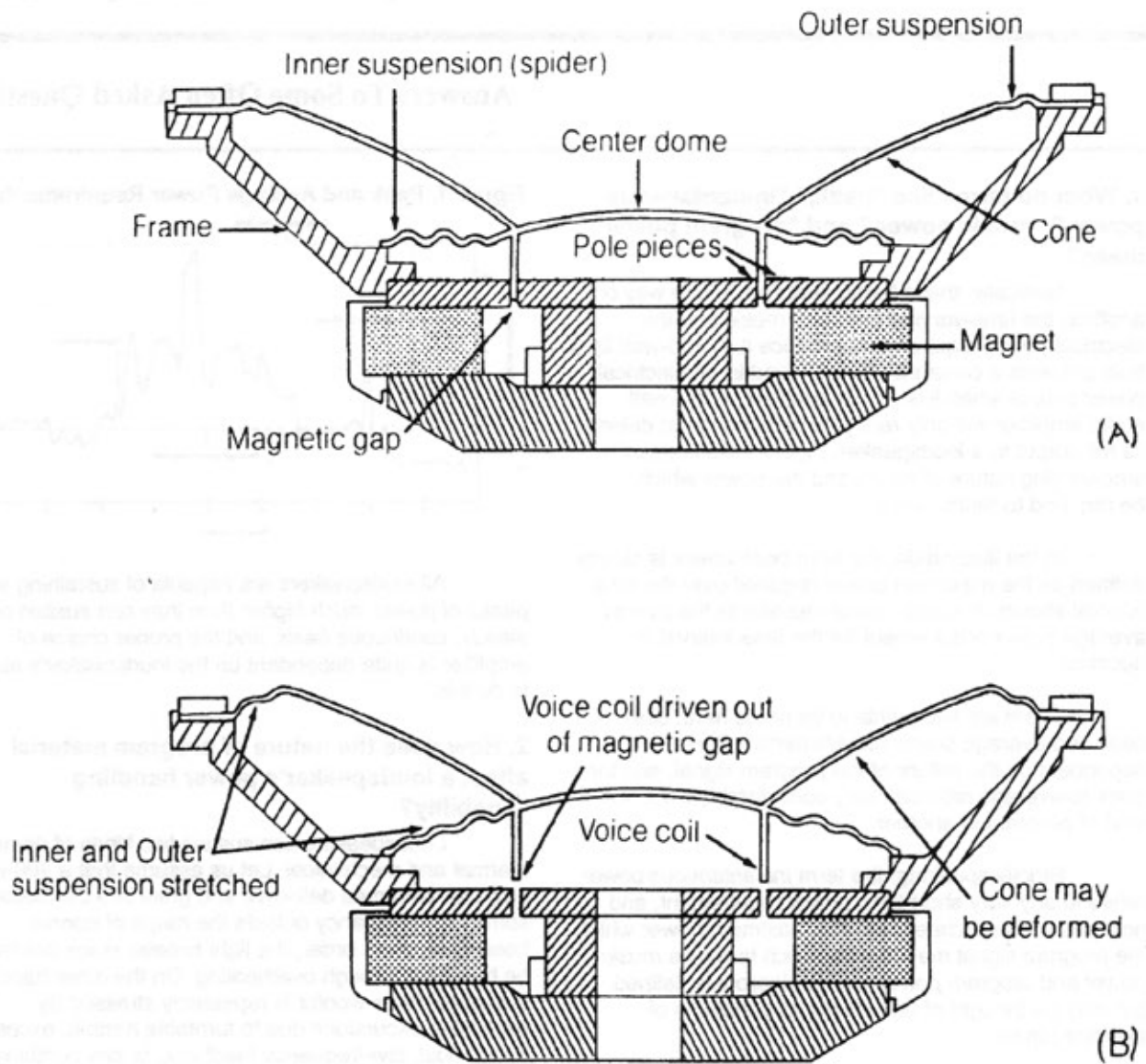
All loudspeakers are capable of sustaining short peaks of power *much higher than they can sustain on a steady, continuous basis*, and the proper choice of amplifier is quite dependent on the loudspeaker's ability to do this.

2. How does the nature of program material affect a loudspeaker's power handling capability?

Loudspeakers can sustain two kinds of damage, thermal and mechanical. Let us assume that a 100-watt amplifier becomes defective and goes into oscillation at some high frequency outside the range of normal hearing. In short order, the light tweeter voice coil may be burnt out through overheating. On the other hand, suppose that a woofer is repeatedly stressed by excessive excursions due to turntable rumble, excessive bass boost, low-frequency feedback, or any combination of these. After a while, the moving parts of the woofer will be so strained that possible misalignment of the voice coil and consequent rubbing could occur. In especially severe cases, the voice coil may be forced out of the gap and hang up on the pole piece, as shown in Figure 2.

The amounts of power required for this kind of damage may not be great at all, perhaps no more than 20 or 30 watts, if the signal is in the subsonic range. Good engineering practice requires some degree of high-pass filtering in professional systems to attenuate signals below the pass-band of the system.

Figure 2. Loudspeakers in Normal (A) and Overdriven (B) States

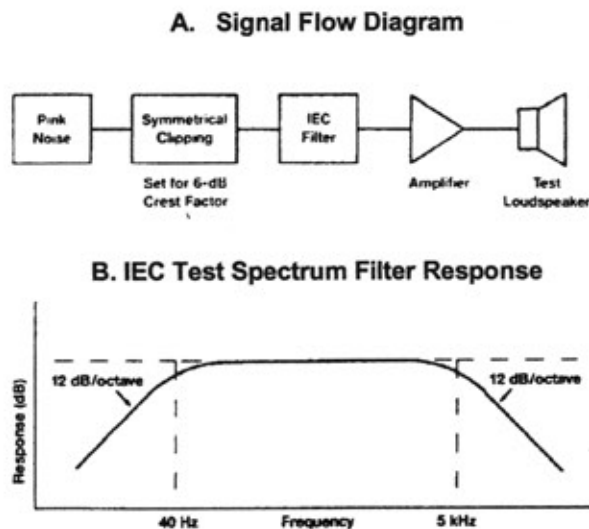


3. How are JBL Professional loudspeaker systems rated?

As we have seen, a loudspeaker can be damaged by both excessive voice coil heating and by over-excursion at low frequencies. Ideally, we would like to use a standard test signal which took both of these failure modes into account and which, at the same time, related sensibly to real-world application. Such a signal is described by the International Electrotechnical Commission (IEC) Standard number 268-5; it is a pink noise signal with a crest factor of 6 dB, filtered at 12 dB/octave below 40 Hz and above 5 kHz.

In establishing a meaningful power rating for a loudspeaker, a sufficiently large sample size of the model is subjected to the signal at power increments, and the rating is defined as that power which the sample can sustain for a period of 8 hours. Details of the testing method are shown in Figure 3.

Figure 3. IEC Power Measurement



We stated that the crest factor of the noise signal was 6 dB. We now explain this in more detail. Crest factor is related to peak factor and is a precise measure of the peak noise value as related to the average "heating capability" of the signal in the voice coil. A crest factor of 6 dB means that a given loudspeaker or transducer is being stressed by signals with four-times the power of the average signal. For instance, a loudspeaker rated at 150 watts by this testing method would have been stressed during its 8-hour test period by instantaneous power input of 600 watts. The test method relates so well to real-world conditions that JBL has adopted it for loudspeaker systems to the exclusion of all previous power ratings.

4. What about loudspeaker abuse in normal operation? Should there be any de-rating of systems to allow for this?

Yes. JBL defines the following three categories of loudspeaker application, each requiring an adjustment of the system's IEC rating:

A. For carefully monitored applications where peak transient capability must be maintained, a system should be powered with an amplifier capable of delivering twice its IEC rating. For example, a studio monitor system rated at 300 watts can be safely driven by an amplifier capable of 600 watts output.

Discussion: Careful monitoring is the key here. High quality music production today demands high peak factors in the recorded signal. Such peak signals are normally of such short duration that they hardly stress the system's components. Thus, the extra 3-dB margin (times two) of power will result in cleaner overall operation of the system, with less listening fatigue.

B. For routine application where high continuous, but non-distorted, output is likely to be encountered, a system should be powered with an amplifier capable of delivering the IEC rating of the system.

Discussion: This case describes the bulk of sound reinforcement activities. Such systems can often be inadvertently overdriven, or can go into feedback. When powered with an amplifier equal to their IEC rating, the user is guaranteed of safe operation.

C. For musical instrument application, where distorted (overdriven) output may be a musical requirement, the system should be powered with an amplifier capable of delivering only one-half of the IEC rating for the system.

Discussion: Much rock music is produced at full output with the amplifier well into clipping, and this is a matter of musical choice. When an amplifier capable of, say, 300 watts of undistorted sinewave output is driven well into clipping, its output power can approach 600 watts! So, Berating the system to one-half its IEC power will result in safe operation of the loudspeaker.

For a more detailed discussion of these topics, see JBL Technical Notes, Volume 1, Number 16.

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Frequently Asked Questions

Enclosures and Systems -- The Basics

- [What makes a good vented enclosure?](#)
- [Is it possible to get deep, punchy bass from a small enclosure?](#)
- [Will a bigger driver give me more bass from my enclosure?](#)
- [What does "tuning" of an enclosure or port mean?](#)
- [What are Balanced and Unbalanced Lines?](#)
- [What is a crossover network and what is "bi-amplification"?](#)
- [What are some advantages of bi-amplification?](#)
- [What are some disadvantages of bi-amplification?](#)
- [What if I want the best of both worlds?](#)

What makes a good vented enclosure? The basic purpose of any loudspeaker enclosure is to partition the front and rear of the driver's cone. This prevents the opposing air pressure changes produced by cone motion from combining and canceling. Vented enclosures allow the compressibility of the air inside the enclosure to work as a more active part of the "system" consisting of driver and enclosure. A low frequency loudspeaker enclosure should do absolutely nothing, that is, it should add no effects of its own -- no vibration, no tonality, no motion -- nothing to interfere with or absorb acoustic energy produced by the driver inside.

Is it possible to get deep, punchy bass from a small enclosure? Only if the driver selected is designed for "deep" bass operation in a small enclosure. Unfortunately, it's usually a relatively small driver that can work properly in a small enclosure. Since a small driver can only move a small amount of air, lower sound pressure levels (output) will result. In general, larger boxes with larger bass drivers produce more bass; smaller boxes produce less bass. "Deep" bass production simply requires that more air be moved.

Will a bigger driver give me more bass from my enclosure? An enclosure will not automatically produce more bass when a larger driver is installed; in fact, the opposite is often the result.

What does "tuning" of an enclosure or port mean? Have you ever blown over the top of a bottle and heard the note it produces? Have you ever changed that note by adding or pouring out liquid? A vented loudspeaker enclosure works under a similar principle. When liquid is added to or poured out of a bottle, its internal air volume is changed and the resonant note is raised or lowered. Enclosure tuning is affected by the ratio of air volume in the duct/port (equivalent to a bottle's bottleneck) to the enclosure's interior volume. Tuning of a loudspeaker enclosure is the result of manipulating the difference in effective air mass between the enclosure interior and the air in the duct. The bottle-like nature of a vented enclosure is known as a "Helmholtz Resonator". The vents/ducts in a vented enclosure work only over a narrow band of frequencies near the chosen tuned frequency, producing the same effect as when blowing across a bottleneck.

What are Balanced and Unbalanced Lines?

- A balanced line is a shielded, three-conductor system in which the two signal wires carry identical signals of opposite polarity. The third conductor (a braided or foil sheath around the two signal wires) acts only as a shield and does not carry an audio signal. Both signal wires will pick up any external electrical noise that gets past the shield. The receiving input will invert the polarity of one of the signals and combine it with the other. When the inverted noise is added to the non-inverted noise it is canceled. This is known as "common mode rejection". Note that both the output of the sending equipment and the input of the receiving equipment must be balanced in order for the line connecting them to be considered balanced.
- An unbalanced line is a two-wire system in which both the shield (ground wire) and the center conductor carry the audio signal. Unbalanced inputs and outputs are typically found in guitar amplification, effects processors and hi-fi and home theater systems. Unbalanced systems will perform acceptably as long as cable length is kept relatively short, the system is not subject to excessive RF noise, and the AC ground of the various system components is at the same potential.

What is a crossover network and what is

"bi-amplification"? A speaker system that uses high and low frequency drivers requires a crossover network. This network is an electronic circuit that acts as a sort of traffic cop, directing the high-frequency signals to the high-frequency drivers and the low-frequency signals to the low-frequency drivers. The crossover network may be placed *after* the amplifier and is usually mounted in the speaker cabinet. This is called a "passive" or "high-level" network (there are also passive "low-level" networks but these are uncommon and will mostly be found in older systems). On the other hand, the crossover network may be placed *before* the amplifiers. This is called an "active crossover" or "electronic crossover". Systems with active crossovers will have one amplifier (or amplifier channel) for the lows and a separate amplifier (or amplifier channel) for the highs. A system using an electronic crossover is said to be "bi-amplified" (2 separate amplifier channels) if it is a 2-way system or "tri-amplified" (3 separate amplifier channels) if it is a 3-way system.

What are some advantages of bi-amplification?

- A "high-level" (passive) crossover can degrade the audio signal from the amplifier and can reduce system sensitivity. By eliminating these components from the signal path, system performance can be improved. This statement is less true today than in the past due to improvements in passive crossover design.
- In extremely high-powered systems, a passive crossover can become quite expensive, large, and heavy.
- Subwoofers are intended to handle very low frequencies - usually below 150Hz. The inductors (a coil of wire sometimes wrapped around a metal core) needed to cross-over at these low frequencies are prohibitively large, heavy and expensive, even for moderately powered systems. Bi-amplification of subwoofers is usually a necessity.
- Active crossovers can be less expensive in large systems

consisting of many speaker boxes. If these multi-box systems used passive networks, a separate network would be needed for every enclosure. A single active crossover can feed power amplifiers for many speaker enclosures.

- Contemporary active crossovers (such as the JBL DSC260) can be extremely powerful signal processing devices that may incorporate advanced features, such as equalization, time/phase correction, individual band limiting and signal delays. By precisely tailoring the parameters of these crossover networks to the speaker system, it's possible to get the best possible performance from the speakers.
- Consider what happens when a very strong low-frequency signal such as a kick-drum drives an amplifier into clipping. The clipping creates harmonics. In a passive system, the crossover simply sends these harmonics to the high-frequency driver, where they will be quite audible. This is called "intermodulation distortion". In a bi-amplified system, only the low-frequency amplifier will be driven into clipping with a strong kick drum signal. The high frequency amplifier will continue to produce clean, undistorted power. As a result, the clipping distortion is less audible.

What are some disadvantages of bi-amplification?

- Bi-amplification is generally more expensive and requires more amplifiers. Also, electronic crossovers are typically more costly than the passive networks in the enclosures.
- A bi-amplified system is more complex, although properly fabricated electronics racks and cabling can simplify the set-up of a bi-amp'ed system. Some expertise is required to configure the system.
- There are more things to go wrong -- more components to fail, more connections to be accidentally disconnected or mis-connected and more controls to be incorrectly adjusted. Some improper connections (such as hooking the low-frequency amplifier output to a high-frequency driver) can destroy a driver.

What if I want the best of both worlds? One way to get the best of both worlds is with JBL's EON Series powered speakers. Since EON powered speakers are bi-amplified, they give you all the performance advantages of bi-amplification. On the other hand, since the power amplifiers are built-in, they are perfectly matched to the drivers and the cost is comparable to that of a similar *passive* speaker. EON powered speakers are faster and easier to set-up than a passive speaker and its amplifier.



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Technical Notes, Volume 1 Number 12B

Polarity Conventions of JBL Transducers and Systems

Introduction:

For most of JBL's existence, the company has designed many transducers and systems with a polarity convention opposite to the rest of the industry. The typical JBL transducer exhibited a backward motion of the cone when a positive-going signal was applied to the red input terminal, and this convention was normally carried over into systems.

This situation began to change when JBL first introduced systems intended primarily for musical instrument (MI) applications. Since these systems traditionally used 1/4" phone plugs for signal input, there was no easy way for the user to invert the input signal polarity. However, there was a need for JBL's MI products to be consistent with the rest of the industry, since there is considerable mixing and matching of systems of different manufacturers in the field.

As time has gone on, there have been many pressures, both internal and external, for JBL to convert over to the "positive-to-red" standard which is followed by the rest of the loudspeaker industry. Such a prospect has never been taken lightly, simply because no company has more functioning transducers in the professional field than JBL has. A sudden polarity change of JBL drivers would cause chaos in the field.

Nevertheless, JBL has decided to make an orderly transition to the positive-to-red standard, in accordance with the practice recommended by the AES, EIA, IEC, and other standards organizations. This will come about over the next few years, with polarity changes being effected only in new system and transducer models. That is to say, no current models will be changed to the new polarity convention during their remaining catalog life.

For this transition to be orderly, it is essential that all users of JBL products have access to a complete listing of polarity of current products and that all new and updated specification sheets carry a clear indication of polarity. This version of Technical Notes Volume 1 Number 12 will be the first of many that will spell out all polarity conventions. It will be reissued at relatively short intervals so that there will be a single source of information on all current JBL products. In addition, all low-frequency transducers which are of positive polarity will carry a small sticker which indicates this.

Terminology:

Positive systems: A system or transducer is said to be positive if a positive-going voltage applied to its red (non-black) input terminal caused a positive pressure at the output of the device. For cone transducers, the cone will move outward and can be easily seen. For compression drivers, a positive-going pressure can be measured at the driver's exit.

Many systems and transducers do not have color-coded input terminals, and in these cases one terminal is usually labeled with a + sign. Consistent with the positive standard, a positive-going signal at the positive terminal will result in outward motion of the cone.

In the case of systems with 1/4" phone plug inputs, a positive going voltage on the tip of the plug will cause outward motion of the low-frequency cone.

Negative systems: A system or transducer is said to be negative if a positive-going voltage applied to its red (non-black) input terminal causes a negative pressure at the output of the device.

JBL Systems and Transducers:

The following is a comprehensive listing of all current JBL systems and transducers by product category. Within each category, models are indicated as positive or negative.

SR Series; all models positive:

SR4704	SR4718
SR4715N	SR4725
SR4722	SR4732
SR4732	SR4732N
SR4735	SR4738

MR Series; all models positive:

MR802	MR805
MR812	MR815
MR818	MR822
MR825	MR826
MR835	MR838

Cabaret Series; all models positive:

4602B
4604B

Musical Instrument transducers:

The following models are negative:

E110-8	E120-8, -16
E130-8	E140-8
E155-4, -8	

The following models are positive:

M121-8
M151-8

Control Monitors; all models are positive:

4312AL, R	Control 1
Control Micro	Control 1AW/70
Control SB Micro	Control 5
Control 1 Plus	Control 10L, R
Control SB-1	
Control SB-5	
Control 12SR	

Studio Monitors:

The following models are negative:

4406	4408
4410L, R	4412L, R
4425L, R	4430L, R
4435L, R	

The following models are positive:

4206 4208

Compression Drivers; the following models are negative:

2402H	2404H
2405H	2426H, J
2427H, J	2446H, J
2450H, J	2485J

Cone Transducers; the following models are negative:

LE8T-H	2105H
2118H, J	2123H, J
2202H	2206H
2220H, J	2226H, J
2235H	2240G, H
2241G, H	2245H

Coaxial Transducers; the following models are positive:

2142H	2152H
2155H	

Industrial Products; all industrial products with spade lug attachment follow positive industry standards:

8110H	8120H
8130H	8140H
8110HT	8120HT
8130HT	8140HT

Sound Reinforcement and Theater Systems; the following models are negative:

4670C	4671A
4673A	4675B
4675B-2	4675B-4LF
4675B-8LF	4670C-HF
4675B-HF	

Loaded Low Frequency Systems; the following models are negative:

4646A	4647A
4648A	4648A-8
4648TH	

Subwoofer Systems:

The following models are negative:

4642	4642-4
4645	

The following TCB models produce a positive-going pressure at the output of the upper tuned chamber when a positive-going signal is applied to the red input terminal. (Strictly speaking, these systems do not fit either positive or negative polarity conventions):

4682	4685
4688	4688-4

Enclosed Utility Systems:

The following models are positive:

SLT-1	4612OK
8216A	8216AT

The following models are negative:

4660A	4671OKA
8330	

Wall Speaker Systems; all models are positive:

8305P2	8305P6
8305S6	8305MK6
8306P2	8306P6
8306S6	8306MK6

Concert Series; all models are accessed through multi-pin plugs which are harness-wired to power amplifiers. The overall polarity of the systems is positive, with a positive-going signal on Pin-2 at the input of the amplifiers causing a positive-going motion of the low frequency loudspeaker cones:

4802A	4805A
4825A	4828A
4842A	4845A
4850A	4851A
4852A	4853A
4870A	4871A
4872A	4873A

Architectural Series: These new loudspeaker systems can be configured in several ways, including standard input terminals as well as barrier strips. The poling convention for all models is positive.

Applications:

JBL has always recommended that absolute polarity standards be maintained throughout an audio system, from microphone input to loudspeaker output. Since most microphone and electronics manufacturers adhere to the "pin-2 hot" convention, this ensures that a positive-going signal at the input of a microphone will produce a positive-going signal at the non-ground output of a power amplifier. If JBL negative convention loudspeakers are used, the required polarity inversion should be made at the loudspeaker's input terminals themselves. **Note carefully: making the polarity inversion anywhere else in the system is an invitation to confusion.**

A few examples are presented. Many times, JBL negative convention screen loudspeakers are used with positive convention surround loudspeakers. Bi-amplification often compounds the problem. Figure 1 shows how such a system should be wired:

Figure 1.

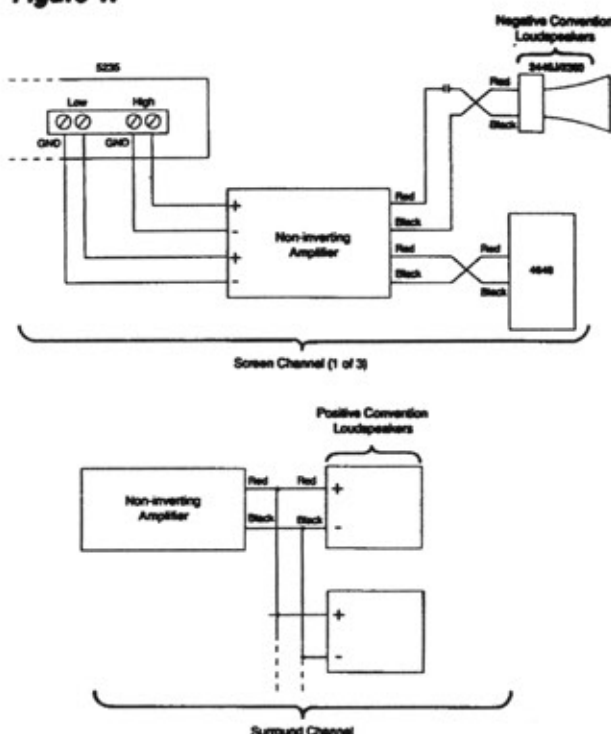


Figure 2 shows details of connecting a JBL 4670C in proper polarity. In this system, because of the short length of the high frequency horn, it is recommended that the HF section of the system be wired in opposite polarity with the LF section in order to get proper summation at the crossover point. Since the LF section of the system is inverted at the amplifier's output, it is obvious that the feed to the HF section must remain non-inverted.

Figure 2.

