JBL STUDIO MONITORS

Design Theory

JBL studio monitors reflect the very latest developments in acoustic engineering. They provide the accuracy, durability, and versatility required in professional installations—with substantial extra capacity available to deal with the unexpected.

Because all artistic judgments of recordings are made subjectively through studio monitor loudspeakers, the quality of the monitors is of vital importance to the recording process. Data and experience acquired through a long and intimate involvement with the recording industry have provided JBL with a thorough knowledge of the requirements for a quality studio monitor. Every JBL model is designed to these criteria.

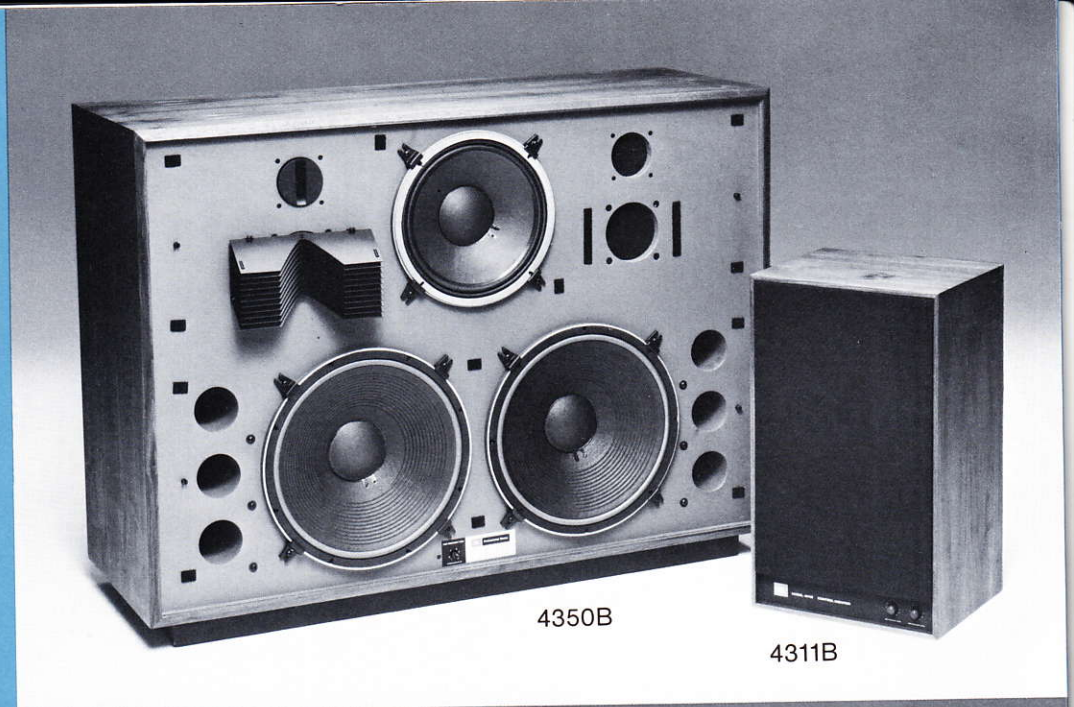
Wide Bandwidth. JBL monitors have the widest possible bandwidth, while retaining sufficient sensitivity to be practical in use. Good low frequency response is necessary for the engineer to accurately gauge the bass content of the music; extended high frequency response ensures accurate reproduction of the harmonics that give each instrument its distinctive timbre.

Flat Frequency Response. The frequency response of a JBL monitor is flat as well as wide. The engineer can add equalization to adapt the monitor to a particular environment (or personal taste); however, equalization should not be considered as a substitute for loudspeaker quality.

High Power Handling Capability. To accurately reproduce the dynamic range of music, and to withstand the strenuous demands of the studio environment, JBL monitors are built to accommodate massive power input. Because reserve amplifier headroom is also important, JBL monitors combine high sensitivity with this power handling capacity.

High SPL Capability. JBL studio monitors achieve high sound pressure levels with low distortion, to ensure that valid analytical evaluations of musical material may be made. The SPL capabilities of all JBL monitors are sufficient for their intended applications.

Wide Dispersion Angle. Uniform response through a wide, specified dispersion angle must be maintained. If this angle is too narrow or the response is not uniform, the studio engineer may have his working area greatly restricted; in addition, imaging may be unstable, and proper physical location of the monitors will be difficult to achieve.



4301B Broadcast Monitor 2-way

JBL's smallest monitor is designed primarily for the broadcast control room and edit booth, and has achieved wide acceptance in home studios, remote recording and quality control areas. Smooth, wide range response and low distortion are obtained from 200 mm (8 in) low frequency and 36 mm (1.4 in) high frequency loudspeakers. A high frequency level control is provided on the front baffle. Available in oiled walnut with dark blue grille.

4301BE Broadcast Monitor 2-way

The 4301BE includes a built-in power amplifier of extremely high quality, allowing direct connection to a control board. Because the loudspeaker requires no external amplifier, it is ideal for use wherever space is at a premium. The amplifier has been designed specifically for the 4301BE, can be driven to rated output with only 0.5 V input, and is fully protected against overdrive conditions. The 4301BE is otherwise physically and acoustically identical to the 4301B, and is also available in oiled walnut with a dark blue grille.

4311B Control Monitor 3-way

A compact loudspeaker system designed for control rooms and other applications where space is restricted, the 4311B utilizes 300 mm (12 in) low frequency, 130 mm (5 in) midrange and 36 mm (1.4 in) high frequency loudspeakers. Front panel controls, below the grille, permit convenient adjustment of midrange and high frequency levels. Available in textured gray or oiled walnut with black grille.

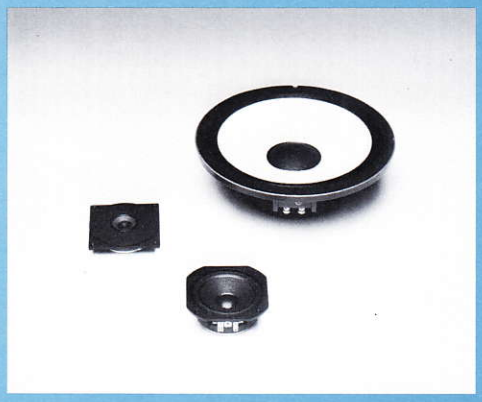
4313B Control Monitor 3-way

Setting new performance standards for compact monitors, the JBL 4313B delivers smooth, low distortion, wide-band sound reproduction. It is ideal for control rooms, small studios, mixdown facilities, or other similar applications. The system utilizes a 250 mm (10 in) low frequency loudspeaker, 130 mm (5 in) midrange loudspeaker, and 25 mm (1 in) high frequency dome radiator mounted in a vertical array to provide the widest possible dispersion, excellent stereo imaging and spatial accuracy. The 4313B is available in oiled walnut with dark blue grille.

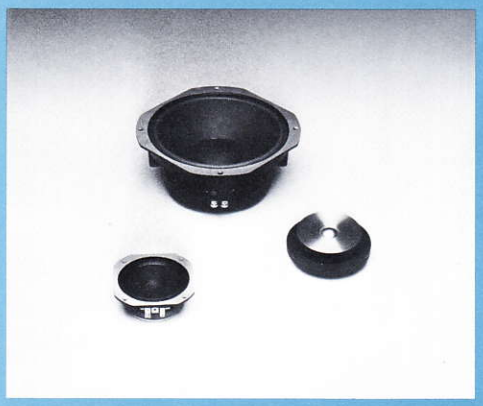
4315B Compact Studio Monitor 4-way

Exhibiting exceptionally smooth, wide-band reproduction, clarity, superior transient response and controlled dispersion, the 4315B is similar in sound character to the larger studio monitors. It is recommended whenever the high SPL of the larger systems is not required or where space is limited. The system consists of 300 mm (12 in) low frequency, 200 mm (8 in) midrange, 130 mm (5 in) high frequency loudspeakers and an ultra-high frequency transducer. The 4315B can be positioned with the high frequency units at the top or bottom when vertical, or at the left or right when horizontal, to optimize high frequency coverage. Eye bolts can be inserted on the back to suspend the system. It is available in textured gray with black grille, or oiled walnut with dark blue grille.

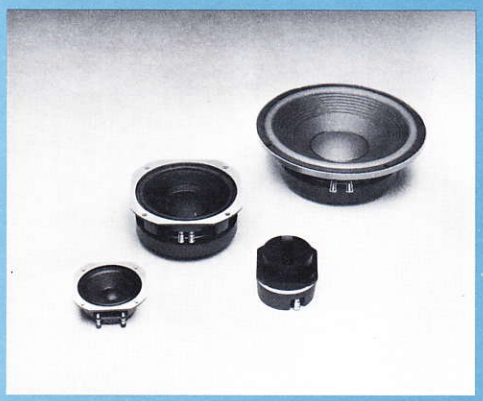
4301B Components



4311B Components



4313B Components



4315B Components

4331B Studio Monitor 2-way

A refinement of the classic JBL studio monitor, the 4331B utilizes a recently developed 380 mm (15 in) low frequency loudspeaker having extended bass response and greater accuracy, plus a wide range high frequency compression driver with horn/lens assembly. The frequency dividing network can be switched for conventional, passive operation or for bi-amplification. The enclosure contains steel bracing that will accept eye bolts for horizontal or vertical suspension. It is available in textured gray with black grille or oiled walnut with dark blue grille.

4331B Components

4333B Studio Monitor 3-way

An expansion of the two-way system of the 4331B featuring an ultra-high frequency transducer that extends system bandwidth to 20 kHz, ±3 dB. The frequency dividing network is switchable for conventional, passive operation or for bi-amplification. The enclosure design and options are identical to those of the 4331B.

4333B Components

4343B Studio Monitor 4-way

JBL's most sophisticated medium-sized monitor, the 4343B utilizes 380 mm (15 in) low frequency and 250 mm (10 in) midrange loudspeakers, a high frequency compression driver with horn/lens assembly, and an ultra-high frequency transducer.
The monitor exhibits exceptional clarity, transient response and low distortion, and is intended for control room and mastering applications. The frequency dividing network can be switched for conventional, passive operation or to allow bi-amplification. Rigidly constructed of 25 mm (1 in) and 19 mm (¾ in) stock, the enclosure has provision for mirror image mounting of midrange and high frequency components. An internal steel brace will accept eye bolts for horizontal or vertical suspension. Textured gray with black grille or oiled walnut with dark blue grille.

4343B Components

4350B Studio Monitor 4-way

JBL's largest monitor, the 4350B represents the ultimate in high acoustic output, broad bandwidth, definition and efficiency. Designed for bi-amplification, the system consists of two 380 mm (15 in) low frequency loudspeakers, a 300 mm (12 in) midrange loudspeaker, a high frequency compression driver with horn and acoustic lens, and an ultra-high frequency transducer. The enclosure allows mirror image mounting of high frequency components for optimum source localization. The bottom panel is finished and the base is removable to facilitate inverted suspension by eye bolts anchored to an internal steel support. Available in textured gray with black grilles or oiled walnut with dark blue grilles.

4350B Components

Design Procedures

Since JBL designs each monitor for a specific application, interacting parameters in addition to those above must be considered. Each JBL monitor represents the optimum balance for its particular purpose.

The design work begins with the low frequency loudspeaker. JBL engineers seek the smoothest possible response, maximum bandwidth and lowest distortion consistent with the intended application. Larger drivers generally have greater efficiency; smaller drivers can maintain the same bandwidth, but with reduced efficiency and output level.

Next comes the choice of drivers to cover the remaining bandwidth. Two-way systems can be adequate if flat response to 20 kHz is not required. To cover the full audible range effectively, a system must be at least a three-way design, and a four-way system offers greater advantages: more detailed reproduction, wider dispersion with a more uniform power response, lower intermodulation distortion, and greater phase accuracy.

If transducers with the required characteristics are not available, a totally new transducer will be built specifically for this purpose.

The greatest challenge in studio monitor design is achieving a smooth blending of the acoustical outputs of the various transducers. Using computer technology, JBL engineers first design a crossover network for theoretically ideal transducers, then connect it to the actual drivers in use. The network is then modified until the smoothest possible results are obtained.

Every JBL studio monitor loudspeaker system is the product of extensive development and testing. Each is as ideal for its intended application as present technology permits.

Cover photos courtesy of, top to bottom: Capitol Records Studios, Hollywood, California; Criteria Studios, Miami, Florida; KHJ Radio, Hollywood, California. Photo this page by EMI Pathé-Marconi, France.

Intended Applications

JBL provides complete specifications on all studio monitors. These specifications are derived from actual production units. The tests are conducted in acoustically neutral "hemispherical free-field" conditions. Any significant deviations from these results can thus be attributed to the acoustics of the control room and the manner in which the loudspeaker systems are mounted.

While JBL endorses no specific control room design, certain characteristics of the interface between the room and the loudspeaker system must be taken into account in order to achieve the desired performance.

JBL monitors may be operated in either the horizontal or vertical position, but vertical mounting will provide the best stereo imaging. Imaging will also be improved by installing the monitors symmetrically in a symmetrical room, because the left and right reflections will be identical. The larger monitors permit the user to arrange the drivers in either a left-hand or right-hand configuration to facilitate symmetrical placement.

For the smoothest response, JBL monitors should be mounted with the baffle surfaces flush with the wall. If this is not possible, the monitors should be mounted against the wall. Other mounting locations, such as away from a wall or at the intersection of room surfaces, cause uneven bass response.

The choice of a monitor should be based on the expected maximum SPL to be achieved in the room. Adequate amplifier power should be provided to allow full transient impact, and to minimize the risk of damage to the high frequency transducers. JBL recommends a minimum of 3 dB of amplifier headroom.

The larger monitors may be switched for bi-amplification by the user; all necessary protection components are built in. JBL recommends 12 dB/octave Butterworth active dividing networks (such as a JBL 5233 or 5234, with appropriate crossover cards) when the monitors are switched for bi-amplification.

JBL studio monitor crossover networks employ continuously variable attenuators to control driver level. The controls are marked in decibels, with 0 dB referenced to flat system response measured in a hemispherical free field. Because of wide variations in room acoustics, JBL recommends user experimentation, adjusting the controls for best balance and best center monaural image.

New Magnetic Structure

JBL's studio monitors now feature low-frequency drivers with brand new magnetic structures, incorporating a ferrite magnet. Ferrite magnets have many desirable characteristics, but these have been overshadowed in conventional designs by unacceptably high (by JBL standards) levels of second harmonic distortion. However, after two years of concentrated research, JBL engineers have developed an assembly that solves the distortion problem.

One key to the new JBL design is the Symmetrical Field Geometry (SFG). Accurate reproduction of the audio signal requires that the cone and voice coil move in or out with equal facility. This does not happen in conventional designs because the magnetic field around the voice coil gap is not symmetrical; such designs generate large amounts of second harmonic distortion. JBL's new SFG design greatly reduces this distortion by creating a symmetrical magnetic field on both sides of the gap.

Another problem with conventional ferrite structures is flux modulation. As the voice coil moves in the gap in a conventional ferrite design, the electrical field produced by the coil (from the audio signal) modulates the flux in the magnetic structure. This in turn affects cone movement and generates from 3% to 5% second harmonic distortion above 100 Hz. JBL engineers found an ingenious solution – the Flux Stabilizing Ring, an aluminum ring surrounding the pole piece. This minimizes flux modulation and thereby reduces second harmonic distortion in the mid-bass to 0.1% or less.

The low frequency reproduction of these drivers is not only powerful, but clean, exhibiting the depth and transparency needed for accurate low frequency reproduction.

	Frequency Response (±3 dB)	Power Capacity[2] (Continuous Sine Wave)	Nominal Impedance	Sensitivity[1] 1 W, 1 m (3.3 ft)	Crossover Frequencies[3]	Enclosure Volume	Exterior Dimensions (Height x Width x Depth)	Net Weight
4301B	45 Hz-15 kHz	15 W	8 Ω	88 dB SPL	2.5 kHz	30 litres 1 ft³	483 mm x 306 mm x 211 mm 19 in x 12 1/16 in x 11 1/4 in	12.7 kg 28 lb
4301BE Loudspeaker, Amplified[4]	45 Hz-15 kHz	—	—	—	2.5 kHz	30 litres 1 ft³	483 mm x 306 mm x 211 mm 19 in x 12 1/16 in x 11 1/4 in	14 kg 31 lb
4311B	45 Hz-15 kHz	40W	8 Ω	91 dB SPL	1.5 kHz, 6 kHz	40 litres 1.5 ft³	597 mm x 362 mm x 298 mm 23 1/2 in x 14 1/4 in x 11 3/4 in	20 kg 46 lb
4313B	40 Hz-18 kHz	40 W	8 Ω	89 dB SPL	1 kHz, 4 kHz	34 litres 1.2 ft³	597 mm x 362 mm x 252 mm 23 1/2 in x 14 1/4 in x 9 15/16 in	21 kg 47 lb
4315B	35 Hz-20 kHz	60 W	8 Ω	89 dB SPL	400 Hz, 2 kHz, 8 kHz	90 litres 3.2 ft³	854 mm x 521 mm x 327 mm 33 5/8 in x 20 1/2 in x 12 7/8 in	47.6 kg 105 lb
4350B	30 Hz-20 kHz	200 W below 250 Hz 100 W above 250 Hz	4 Ω below 250 Hz 8 Ω above 250 Hz	95.5 dB SPL	250 Hz, 1.1 kHz, 9 kHz	270 litres 9.5 ft³	889 mm x 121 mm x 508 mm 35 in x 47 5/8 in x 20 in	118 kg 261 lb
4331B	35 Hz-15 kHz	75 W	8 Ω	93 dB SPL	800 Hz	156 litres 5.5 ft³	778 mm x 619 mm x 514 mm 30 5/8 in x 24 3/8 in x 20 1/2 in	58.5 kg 129 lb
4333B	35 Hz-20 kHz	75 W	8 Ω	93 dB SPL	800 Hz, 8.5 kHz	156 litres 5.5 ft³	778 mm x 619 mm x 514 mm 30 5/8 in x 24 3/8 in x 20 1/2 in	60 kg 133 lb
4343B	35 Hz-20 kHz	75 W	8 Ω	93 dB SPL	300 Hz, 1.25 kHz, 9.5 kHz	156 litres 5.5 ft³	1051 mm x 635 mm x 435 mm 41 3/8 x 25 in x 17 1/8 in	83.9 kg 185 lb

1. Sensitivity measured with an input averaged from 500 Hz to 2.5 kHz, with controls set for flattest response.

2. When bi-amplified, the 4331B and 4333B are rated at 75 W below 800 Hz and 30 W above 800 Hz. The 4343B is rated at 75 W below 300 Hz and 75 W above 300 Hz.

3. The lowest crossover frequency specified refers to operational characteristics with the network set for conventional, passive operation and is also the recommended crossover frequency for bi-amplification.

4. The 4301BE has a built-in power amplifier with the following specifications: Sensitivity 0.5 V; Power Output 10 W continuous sine wave; THD at rated output 0.05% or less; THD at 1 W 0.02% or less; Signal/Noise Ratio (at rated output) better than 90 dB.

JBL continually engages in research related to product improvement. New materials, production methods, and design refinements are introduced into existing products without notice as a routine expression of that philosophy. For this reason, any current JBL product may differ in some respect from its published description, but will always equal or exceed the original design specifications unless otherwise stated.

Professional Division

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