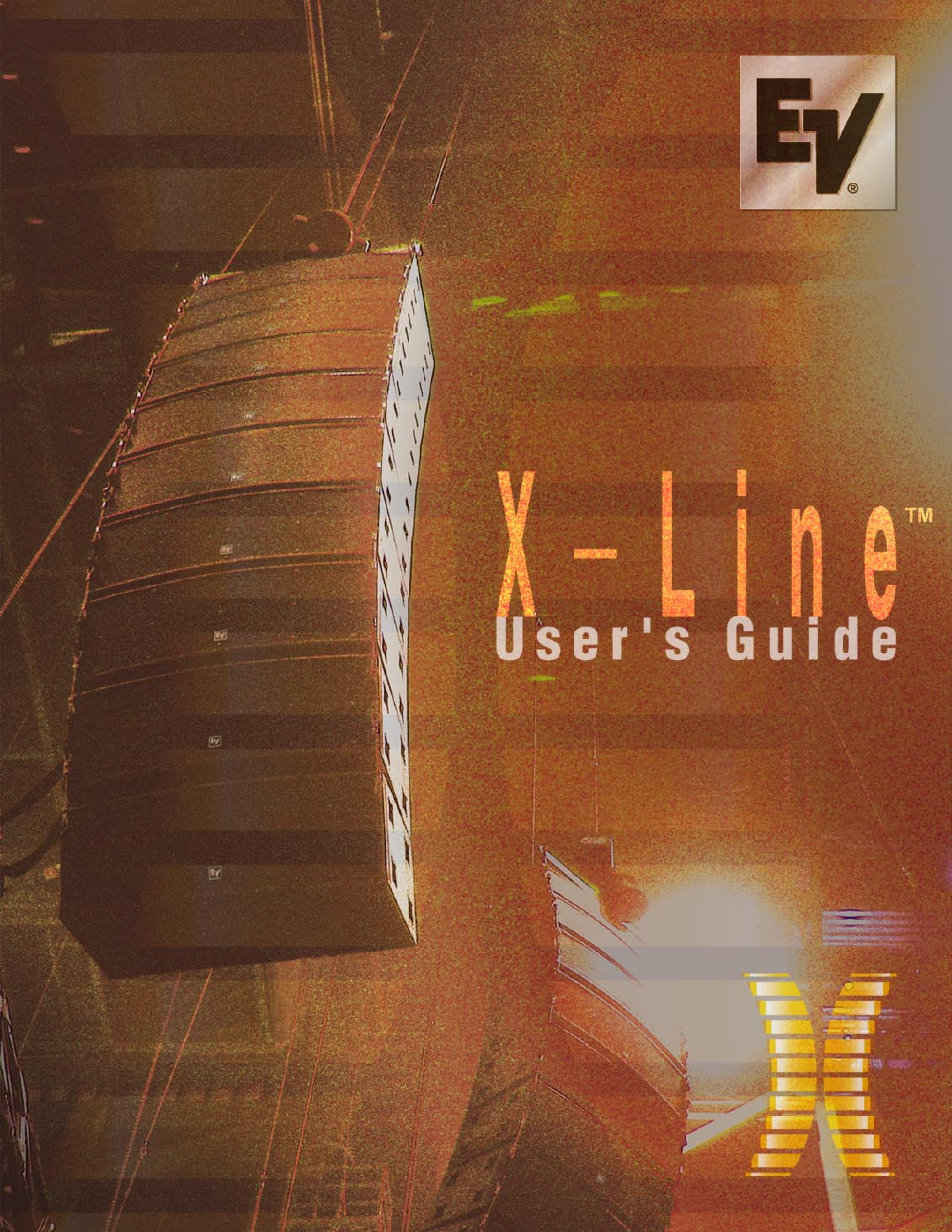
X-Line™
User's Guide



X-Line™ System 1

The Electro-Voice X-Line™ is a fully configurable linear sound reinforcement system. It is designed to allow one-person rigging while exhibiting both flat-front long-throw and curved-front arc segment—or **J**-box—orientations. X-Line™, Electro-Voice's realization of that classic **J** orientation, maximizes vertical-plane wave summing and eliminates the physical gaps between the rectangular enclosures at the **J** portion of the hang. Because such gaps separate the high-frequency radiating planes and result in non-coherent summing when the wavelengths are shorter than the spacings between rectangular enclosures, the X-Line™ simply provides cleaner sound.

Four application-specific enclosures—Xvls, Xvlt, Xfil, and Xsub—compose the EV X-Line™ system. Each represents a no-compromise approach that recognizes the extreme performance requirements and level-independent integrity demanded not just by line arrays, but also by many other contemporary sound reinforcement designs.

Primary Enclosures: Xvls and Xvlt

In the two primary enclosures—the Xvls and Xvlt—the transducer components are identical, but the directional specifications differ. The Xvls, a fully rectangular cabinet with a horizontal included angle of 90 degrees (see Figure 1-1), is designed for the upper or very long throw portions of the X-Line™ system. The rectangular design allows up to four Xvls cabinets at once to be dropped onto the X-Line™ **R**-dolly and raised or lowered in a single cell (see Figure 1-2). The easy dolly loading and cabinet geometry make possible not only very rapid venue load-in and load-out, but also one-person aiming of individual cabinets.

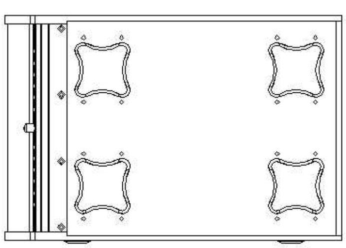


Figure 1-1 Xvls (side view)

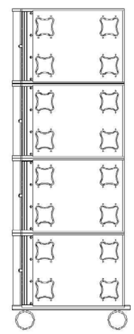


Figure 1-2 Xvls on dolly (side view)

The vertically trapezoidal Xvlt (see Figure 1-3), with its 120-degree vertical included angle, is used in the **J**—or "fishhook"—portion of the X-Line™ array (see Figure 1-4 on the next page). The five-degree included angle on both top and bottom of the cabinet also allows the Xvlt to be assembled into multi-box arc segment arrays (see Figure 1-5 on the next page), which are excellent for medium-format venues such as theaters or corporate events.

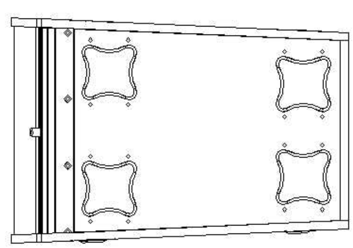


Figure 1-3 Xvlt (side view)

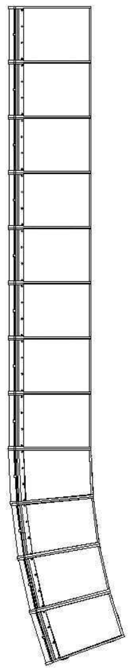


Figure 1-4 Xvls/Xvlt array

Figure 1-5 Xvlt array

The Xvls and Xvlt can both be configured in large-format arrays, either with several like enclosures or in combination with each other. Such configurations can combine long-throw vertical-plane wave segments (from the Xvls) with arc-segment portions (from the Xvlt). The sample 12-box array shown in Figure 1-4 effectively combines both rectangular and trapezoidal enclosures.

There are two major advantages to the X-Line™ multi-enclosure approach. The first is that the top eight enclosures can be lowered in two groups and left rigged, even during transportation, as shown in Figure 1-4. Only two dollies are needed for all eight top enclosures. The complete array shown in Figure 1-4, for example, requires only six dollies for total load-in and load-out. The second major advantage is that all top eight enclosures can be landed and re-aimed without the need for derigging, aiming, and re-rigging.

In a combined array, the Xvls cabinet's rated horizontal included angle of 90 degrees superbly fulfills long-throw needs. The Xvlt enclosure's rated horizontal included angle of 120 degrees makes it ideal for the shorter throw/wider coverage angles demanded from the **J** portion of the array. Thus, the Xvls/Xvlt combination supplies an ideal variable horizontal angle that minimizes reflections in enclosed spaces and maximizes throw for outdoor applications.

The Xvlt enclosure, with its horizontal included angle of 120 degrees, may also be used in an all-Xvlt array when extremely wide horizontal coverage is needed. This is the case in four- to eight-box vertical arrays used for very large performing arts venues, large churches, or other spaces where short throw but very wide coverage is necessary.

Downfill Enclosure: Xfil

The Xfil is a unique design intended to provide high-level coherent output below the "Christmas tree" portion of the main hang (see p. 10). Figure 1-6 shows the need for down-array ("under-array") coverage. The Xfil enclosure's 120-degree horizontal included angle and vertically asymmetric driver configuration provide complete down-fill coverage but still conform with the rest of the system to maintain full line-array integrity.

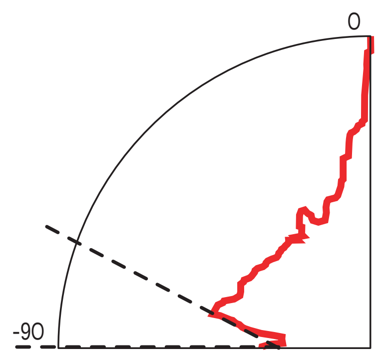


Figure 1-6 Dotted lines show where Xfil supplies coverage closest to the stage

Subwoofer Enclosure: Xsub

The Xsub enclosure, which completes the X-Line™ system, is a true sub-deep bass system designed for high-level extended low-frequency output. Its enclosure footprint is identical to that of other X-Line™ enclosures (49.000" × 29.115"). The Xsub is available either in non-flying configuration or fully outfitted with a front track and a unique backbone rigging system (all other X-Line™ cabinets are available in flying configuration only). The rigging option allows Xsubs to be flown next to the main Xvls/Xvlt hang as shown in Figure 1-7 (see next page).

The configuration illustrated in Figure 1-7 preserves the full line array of the main stack, and in fact improves extended low-frequency horizontal control if the entire main array is in bass/sub-bass overlap mode.

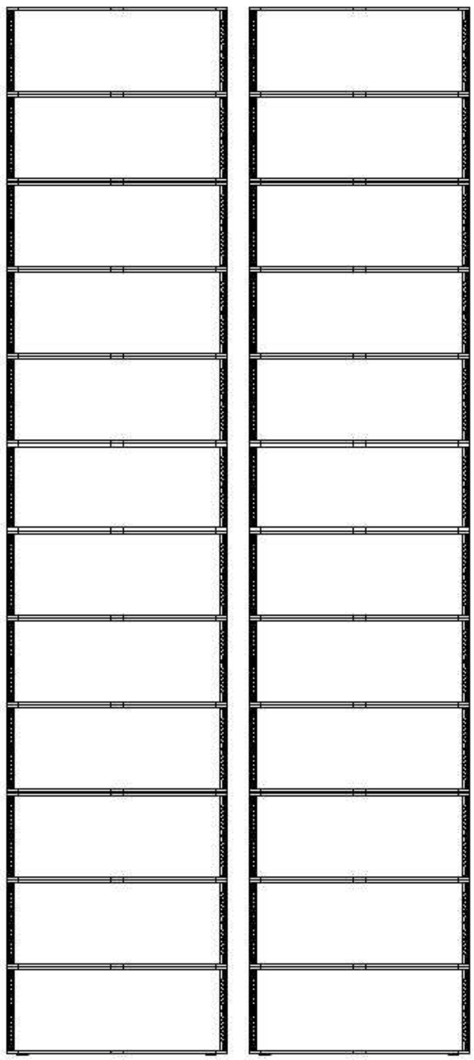


Figure 1-7 Full X-Line array: 12 Xsub; 12 Xvls/Xvlt

X-Line™ Transportation Configurations

Each X-Line™ enclosure is 49.000 inches (1244.6 mm) wide × 29.115 inches (740.4 mm) deep × 19.500 inches (495.3 mm) high.

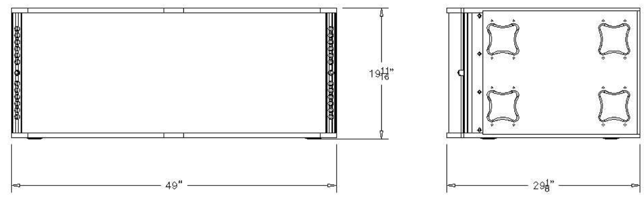


Figure 1-8 Xvls and Xsub

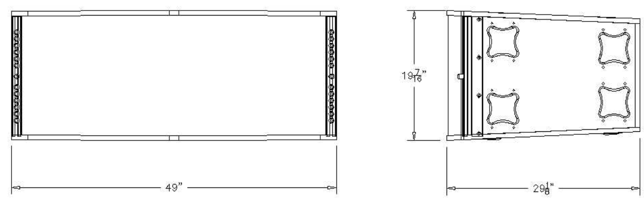


Figure 1-9 Xvlt and Xfil

Three possible trailer packing configurations, which take advantage of the optimal packing dimensions, are shown in Figures 1-10, 1-11, and 1-12.

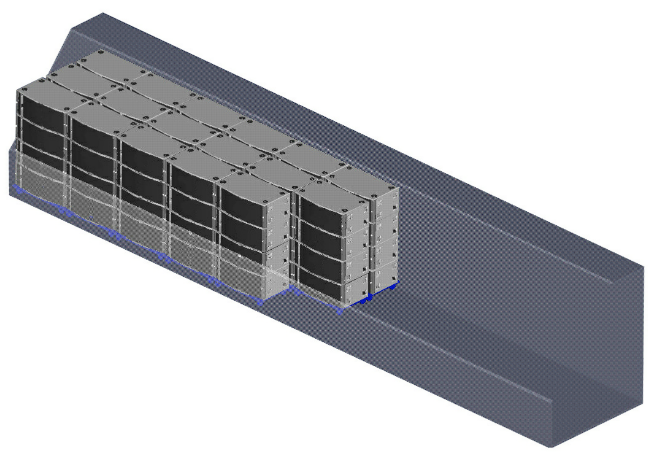


Figure 1-10 Bottom dollies: 3 columns × 4 rows = 12 cabinets in 49“ of trailer length

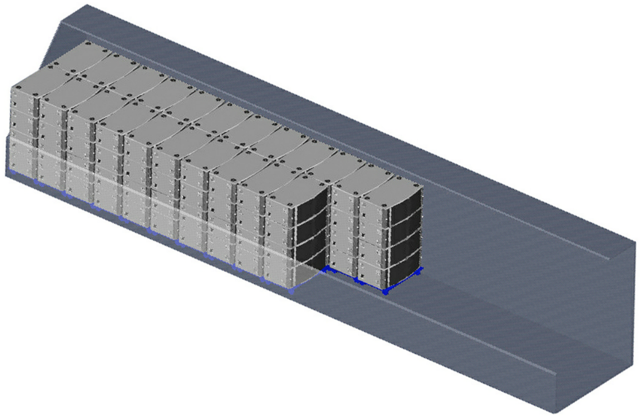


Figure 1-11 Bottom dollies: 2 columns × 4 rows = 8 cabinets in 33“ of trailer length

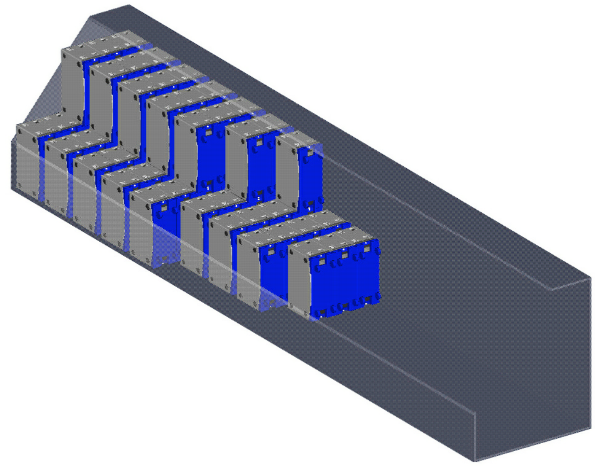


Figure 1-12 Front dollies: 5 columns × 2 rows = 10 cabinets in 33“ of trailer length

Components 2

The Xvls and Xvlt use newly developed components and time-synchronized wave guides. All X-Line™ acoustical and mechanical circuits employ EV's exclusive Ring Mode Decoupling (RMD™) to ensure sonic character that does not degrade with increasing power levels. The application of RMD™ technologies to all enclosures and transducer components controls—or damps—each of the mechanical and acoustical resonant modes found in loudspeaker systems. Aggressive control of these resonant modes not only yields level-independent fidelity, but also produces substantially more upfront tonal character that is free from the typical ringing—or time-domain distortions—found in most high-level sound reinforcement systems.

High-Frequency Components

All high-frequency sections in the X-Line™ system use EV's newly developed ND5A compression driver. The ND5A brings substantially improved time-domain response and a cleaner, less colored upper vocal performance. While two ND5A drivers are used in the Xfil, each full-range enclosure contains three ND5As coupled to the Hydra™, EV's exclusive vertical plane wave generator (see Figure 2-1; also Figure 3-7 on p. 11). The Hydra™ combines two acoustical alignment techniques that ensure uniform phase over the entire vertical plane of the wave guide. Accurate vertical wave front geometry[1] produces excellent far-field summing.

The very uniform amplitude response of the Hydra™ correlates with those of conventional wave guides or diffraction slot devices. The excellent high-frequency summing experienced with X-Line™ enclosures results from their superior phase response (and consequently the superior group delay).

Single-enclosure, three-driver configurations that use conventional wave guide devices, or horns have excellent amplitude response, but the phase response is extremely non-uniform. Sonically, this conventional approach results in poor summing in the vertical plane with numerous peaks and dips in the response (practically, this manifests as substantial variation in tonal character when walking front to back in a venue). The vertical plane-wave generator technology of the Hydra™ ensures extremely smooth, lobe-free sound fields. The three ND5A drivers and Hydra™ plane-wave generators couple to a 90-degree (120 degrees for Xvlt and Xfil) included-angle horizontal wave guide designed to produce exceptional stereo imaging, even at very high frequencies.

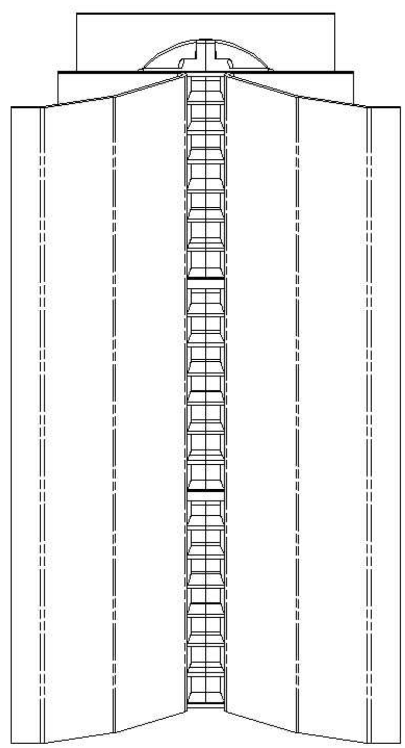


Figure 2-1 High-frequency section: Three Hydra™ plane-wave generators

[1]The high-frequency wave front is planar in its vertical orientation; see p. 11.

Mid-bass components

Modern line array systems employ an axially symmetric configuration with the high-frequency system between two mid-bass drivers (see Figure 2-2). This typical configuration's acoustical symmetry about the center line of the enclosure produces identical responses on either side of the system in the horizontal plane. However, as demonstrated in the ArrayShow®[2] representation in Figure 2-3, horizontal spacing of mid-bass drivers always generates an off-axis null.

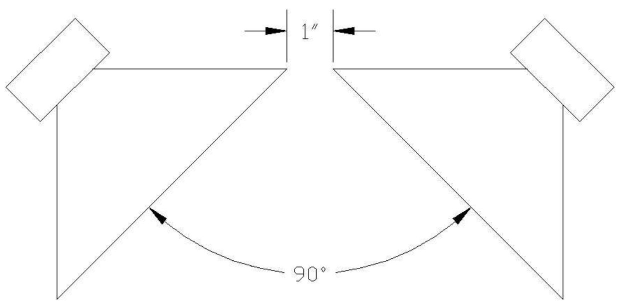


Figure 2-2 Conventional midbass configuration (top view)

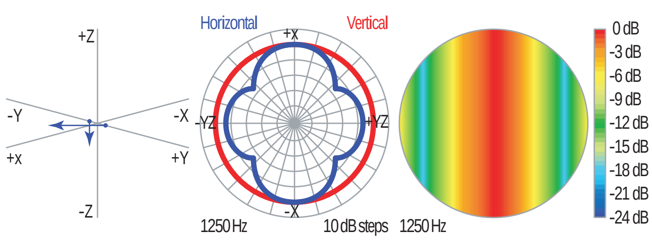


Figure 2-3 Horizontal spacing of midbass drivers generates off-axis null

[2]ArrayShow® is EV's proprietary software for mapping speaker response. To download your own copy of this freeware program, go to:
http://www.electrovoice.com/Old_Site/htdocs/html/indexsarsho.html
and scroll to the bottom of the screen to access the download link.

All ArrayShow® models are based on the physical relationships of sources radiating specific wavelengths. These relationships derive from physical laws of nature and are shown to illustrate actual acoustical results.

The example in Figure 2-3 assumes a very typical 1250 Hz crossover. This horizontal spacing may be treated as a two-element horizontal array. The null for a spacing of seven inches (20.3 cm) at the reference crossover point is approximately –15 dB at about 40 degrees in the horizontal axis. Because this null falls within the nominal rated coverage, it compromises coverage uniformly both onstage and offstage.

While designing the X-Line® mid bass, EV engineers recognized the performance limitations of the conventional design approach. These limitations include not only tonal-balance degradation in the mid frequencies (vocals) but also loss of control due to inability to maintain the low mid-bass directionality. To remedy this, the X-Line™ places the high-frequency section (ND5A drivers and Hydra™ vertical plane-wave generators and wave guides) to the onstage side of the enclosure. This keeps the critical mid-bass response unaltered by the horizontal-array effect of separated mid-bass drivers (see Figure 2-4). The high-frequency section, when placed to an onstage position, produces exceptional stereo imaging, and the mid-bass polar response—particularly in the stereo field—will be free from the polar lobing shown in Figure 2-3.

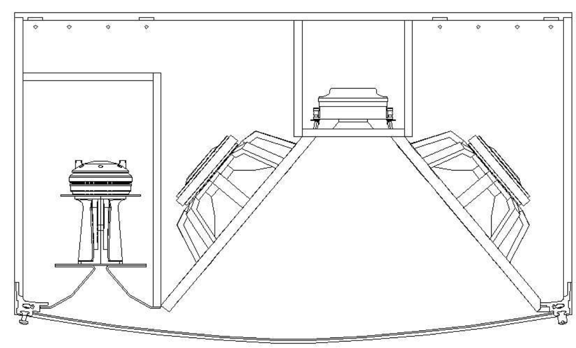


Figure 2-4 Xvls/Xvlt midbass driver configuration (top view)

The large-format mid-bass mouth, with its unobstructed area, offers extended horizontal pattern control. The X-Line™ uses such a mid-bass mouth width, and is illustrated in Figure 2-5.

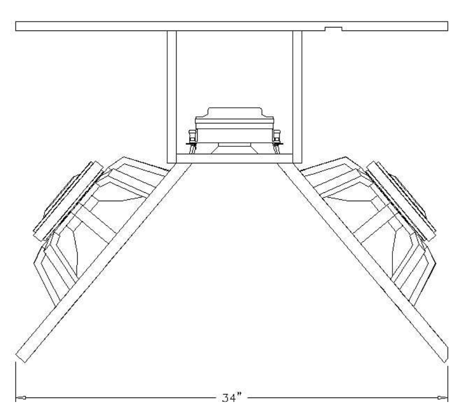


Figure 2-5 Xvls/Xvlt midbass mouth width (top view)

The wider the mouth width, the lower the frequency at which the system can maintain horizontal polar control. Such polar control is critical for minimizing unwanted reflected energy in a venue. Hence, the X-Line™ mid-bass configuration increases direct-to-reverberant ratios, particularly in the vocal fundamental range.

Figure 2-6 shows a horizontal polar pattern and its loss of control at 250 Hz (a typical bass to mid-bass crossover frequency) for a mid-bass array with a small mouth width. Note that the horizontal spacing of seven inches exhibits virtually no horizontal control.

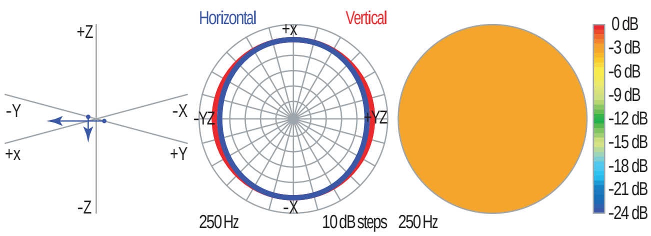


Figure 2-6 Midbass array with small mouth width

Figure 2-7 shows a mid-bass response at the same frequency (250 Hz) but with a spacing more compatible to the radiated wavelength (note the superior horizontal control). Such polar control is critical for maintaining wide bandwidth power response.

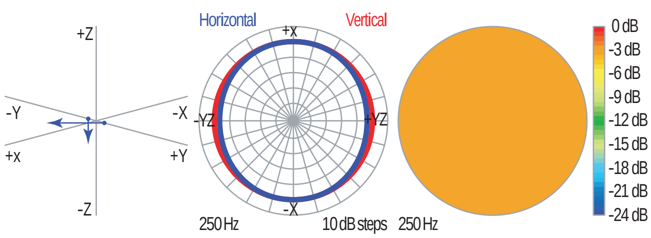


Figure 2-7 Midbass array with mouth width related to radiated frequency

The mid-bass horn's ability to control the horizontal pattern is directly related to its mouth width. The equation

$$\frac{1 \times 10^6}{(\text{horizontal angle [in degrees]}) \times (\text{mouth width [in inches]})}$$

predicts the lowest approximate control frequency. By this formula, a 13-inch mouth width produces a control frequency of 855 Hz in the horizontal pattern. The Xvls and Xvlt have a horizontal mouth width of approximately 34 inches that produces a relative control to 327 Hz (Xvls). Such a substantial improvement in horizontal control is a key performance advantage for the X-Line™ system.

Low-Frequency Components

The low-frequency section of the Xvls and the Xvlt uses a new version of the EVX-155 bass driver, the EVX-155P (P stands for "plate"). Two bass drivers are mounted on the portion of the mid-bass horn that is farthest inside the cabinet (see Figure 2-5 above).

EVX-155P drivers use a lightweight but rigid honeycomb-laminate acoustic cavity cover that eliminates the acoustic discontinuity of common driver cones. This not only negates the cavity resonance produced by drivers without the plate, but it also eliminates the cross-sectional area discontinuity that is present in other line array designs.

Figure 2-8 shows how the EVX-155P eliminates the area discontinuity. If the shaded area is not flat, it not only produces a volume but also alters the horizontal radiation pattern. Figure 2-8 illustrates the correct geometry. The X-Line™ approach prevents both the resonant modes and horizontal radiation errors exhibited by drivers like the one illustrated in Figure 2-9 (see next page).

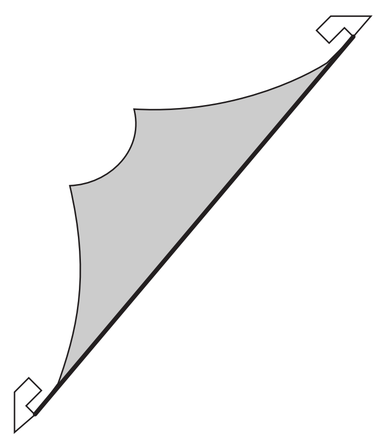


Figure 2-8 EVX-155P driver with plate (cross section)

The low crossover frequency ensures excellent transient detail from the low-frequency drivers. The EVX-155P drivers produce high level output to 40Hz because of their very high continuous power handling and peak excursion capability.

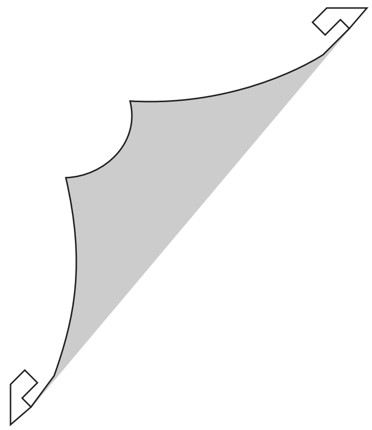


Figure 2-9 15" driver without plate (cross section)

Subwoofer Components

The Xsub's direct radiating design uses two 18-inch EVX-180B sub drivers with excellent excursion performance. The unique magnet structure design—which is also employed in the EXV-155P driver—ensures world-class power compression performance.

Linear Arrays 3

The X-Line™ system offers a wide variety of array configurations. The X-Line™'s design philosophy recognizes that many existing design approaches compromise the performance or rigging options of other systems. Naturally, the X-Line's most important design priority is to preserve the system's acoustical performance. However, although a three-box design approach (main, down fill, and sub enclosures) seemed attractive at first, the complications of field rigging and hang aiming ease suggested the need for both rectangular and trapezoidal geometrics for the main enclosures.

The array configurations suggested in this chapter are based on fundamental physical relationships between array height and radiated wavelengths. A single-directional X-Line™ enclosure (Xvls, Xvlt, or Xfil) cannot be used alone because of its extremely tight vertical radiation pattern, particularly at high frequencies. It is extremely important to recognize that vertical line arrays should not rated conventionally, in terms of vertical dispersion. The front-to-back venue coverage of a line array should be evaluated over the entire 0-degree to –90-degree quadrant of its polar response, not over the vertical included-angle rating used for conventional sound reinforcement devices (see p. 10 below).

Linear Arrays—General Theory

From a theoretical standpoint, the first step in constructing a linear array begins with a simple—or point—source. A simple source is a spherical shape, the radius of which varies with time, thus producing variations in sound pressure at some distance from the source. A point source is simply a hypothetical version of a spherical source that is very small compared to the wavelengths it generates. If these conditions are met, radiation is always omnidirectional, and the wave fronts are always spherical.

The logical second step in constructing a linear array to introduce a second point source at a distance **X** from the first source, where **X** is much, much less than the radiated wavelength, or lambda (λ). If $X \ll \lambda$, then the two point sources **A** and **B** generate double the sound pressure of a single point source, while still maintaining the directivity of a single point source. Figure 3-1 illustrates such a configuration.

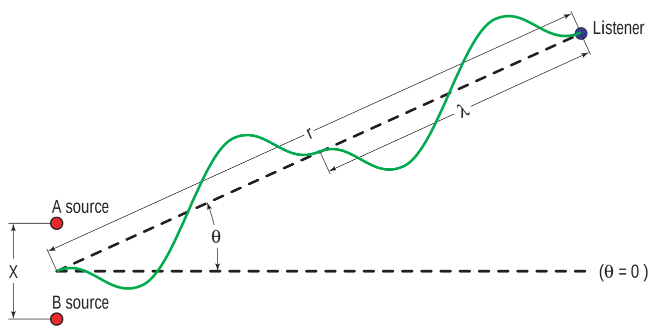


Figure 3-1 If $X \ll \lambda$, then sources A and B generate twice the sound pressure with single-point directivity.

If, as Figure 3-1 suggests, the two sources are separated by **X** and the listener is a distance **r** away from them, the sources add to produce—depending upon the listener's angle (θ) off the 0-degree axis and the sound wavelengths—a new sound pressure. If the wavelength (λ) is long compared to the spacing (**X**) of the sources, the pressure doubles as expected. As the wavelengths decrease and the frequency increases, the sound pressure will increase on axis, but the off-axis response becomes a series of pressure peaks and dips. Their amplitude and angular location are also functions of the comparative sizes of **X** and the wavelengths being produced.

The third logical step in constructing a line array is to add sources to the two shown in Figure 3-1. Although a two-source can be construed as a very basic line array—and it does functions as one—a more typical approach is the one in Figure 3-2. Here, many simple sources are introduced, and their spacing is such that any wavelength is always long compared to the spacing. The theoretical continuous line source assumes an infinite number of sources with essentially no space at all between them. The classic theoretical example is a infinitely long vibrating string.

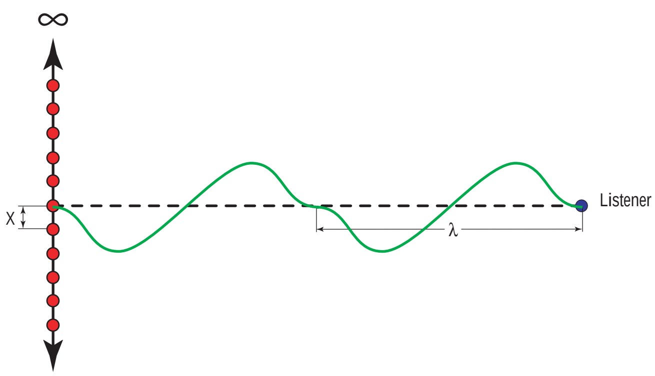


Figure 3-2 Ideal line source: X is always much, much less than λ.

Note that point sources do not exist in practice. Real sources are always directional at some frequencies and non-directional at others. This is why the total directivity of a long array must equal the product of the directivity produced by the array itself and the directivity of the individual devices in the array.

The 22-inch line array analyzed in the ArrayShow® reading in Figure 3-3 is roughly ten times longer than the wavelength of approximately 1.3 inches, or 10 kHz. Such an array may be scaled to a length of 220 inches (18.3 ft.) and a wavelength of 13 inches, roughly one kHz.[1]

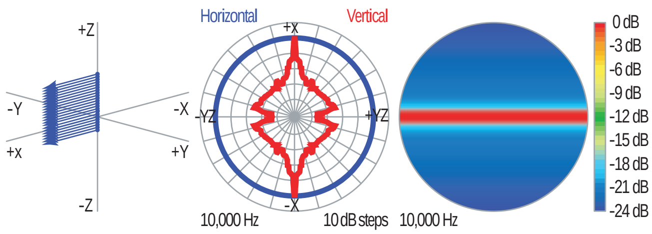


Figure 3-3 22-inch line array at 1.3" wavelength.

Figure 3-4 shows the fourth quadrant of the polar response of such a 220-inch-long array. The response reveals several very important details about the array. First, it is obvious that the classical understanding of vertical directivity is inadequate to describe the array's directivity. According to Figure 3-4, the classically defined included vertical dispersion angle is approximately 2 degrees to 3 degrees. A more appropriate and useful definition of the array's vertical response derives from the shape of the entire vertical response, from the 0-degree axis of the array (which projects to the back of the venue) to –90 degrees (which project to the front of the venue, directly under the system).

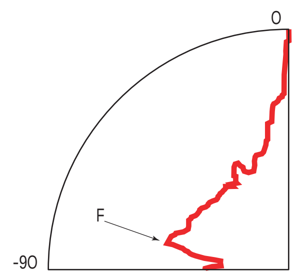


Figure 3-4 Fourth-quadrant response of a 220" line array

The shape of the array's vertical response as shown in Figure 3-4 can be likened to that of a Christmas tree. If the line source is aimed (0 degrees) to the back of a listening area, then the vertical response of the system follows a slope defined by the profile of the Christmas tree. The highest sound pressure level occurs along the 0-degree axis. As a listener walks from the back of the venue (the 0-degree axis) toward the front of the venue (approaching the –90-degree axis) the sound pressure level decreases. Point **F** represents that portion of the line array where it becomes necessary to use the Xfil enclosure to fill in the bottom portion of the Christmas tree. In a perfect example, the decreasing SPL would match the decreasing distance from the source. The result would be uniform and constant sound pressure level from the front of the venue to the back of the venue.

A second important detail revealed by Figure 3-4 are the minor—but nevertheless significant—lobing errors. These peaks and dips result from the multiple arrival times of the wavefronts generated by the array's spherical sources. As the wavelengths from a real array—that is, with finite element spacing—become short compared to the element spacing, the small peaks and dips become large and very audible. As long as the generated wavefronts are shaped like segments of a sphere, the summing or evenness from the front to the back of a venue will be compromised.

[1]This arithmetic may be scaled to describe taller arrays at lower frequencies.

Because the physical dimensions of an array's transducers affect the interactions between the soundwaves they produce, locating the exact crossover points in an array is critical to minimizing the adverse effects of such interaction. Again, this is most important when the wavelengths become comparable to or shorter than the space between elements. In the X-Line™ system—as with most line arrays—the low/midbass and midbass/high crossover points are chosen to ensure that the spacing between all the elements (not just the high-frequency elements) is reasonably small compared to the crossover frequency (in other words, that the wavelengths remain long compared to the wavelengths of the crossover frequencies).

However, this issue is more difficult to resolve in the high frequencies, since the wavelengths—which range from 10.8 inches (1250 Hz, or roughly the mid/high crossover point) to 0.84 inches (16 Khz, the high-frequency limit of the system—become very small relative to the spacing of the elements that produce them. The problem arises of regulating the high frequencies so that interference errors do not occur; the solution is to provide, in the vertical pattern, a wavefront that is planar rather than spherical.

Plane Waves

A plane wave differs from a spherical wave in that along any given spatial plane—or "slice of space"—a plane wave has the same phase and amplitude over the entire surface of that plane (see Figure 3-5). A spherical wave, on the other hand, has a non-constant amplitude and phase over that same slice of space (see Figure 3-6). In practice, this comparision reveals substantially better summing for the planar wave shape, particularly when the wavelengths are short compared to the driver spacing. This superior summing audibly results in a far more uniform sound field with limited interference.

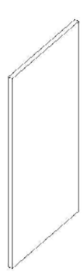


Figure 3-5 Plane wave

Figure 3-6 Spherical wave

Hydra™ Plane Wave Generator

X-Line™ enclosures (except the Xsub) use the Hydra™ device to produce a plane-wave condition along the vertical axis. The Hydra™ guarantees equal arrival times by fully equalizing the path lengths over the entire length of the vertical portion of the device. In a large-scale vertical array, the multiple Hydra™ plane-wave generators (36 drivers and 36 Hydra™ per 12-box hang) produce a line length of 234 inches. The resulting acoustic length is 275 times that of a wavelength at 16Khz, which is the upper frequency limit of the ND5A high-frequency driver. Thus, the X-Line™ system satisfies the requirement for single-point directivity, that the line source must be long compared to the radiated wavelengths.

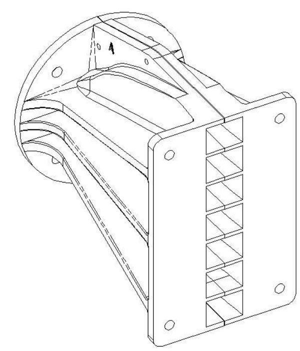


Figure 3-7 Hydra™ plane-wave generator

Line Array Height and Intercept Frequency

A vertical line array's ability to maintain a line source in terms of controlling both the front-to-back ratio of sound pressure and the lobing errors is a function of array height. Simply put, the number of enclosures determines the low-frequency limit of the array.[2]

This limit is relative to the array's ability to control the vertical portion of the low-frequency radiation pattern. For any given number of enclosures, as the ratio of wavelength to system height becomes less than 4 or 5, the main lobe begins to widen and lobing errors begin to increase. Tables 1 and 2 show the approximate cut-off frequency when the array

[2]The term "low-frequency limit" refers here to the limit of an array's vertical control. It should not be confused with the system's low-frequency response limit.

height becomes less than an appropriate multiple of the wavelength. The table clearly shows that the longer the array, the lower the low-frequency limit beyond which control becomes difficult.

The question "What minimum number of boxes is required?" thus should be phrased: "What low-frequency intercept point is desired?" Although there is no simple answer, an eight-box vertical array provides good vocal control, while a 12-box array will provide excellent, full-bandwidth vocal control. The tables in Figure 3-8 and Figure 3-9 indicate low-frequency control intercepts for configurations ranging from four boxes to 14 boxes. As the number of boxes increases, the low-frequency limit decreases. A low-frequency limit of 200Hz is an excellent control over an extremely wide bandwidth.

Configuration	Line Array	Height ÷ 5	Cutoff Frequency
4 boxes	78"	15.6"	870 Hz
6 boxes	117"	23.4"	580 Hz
8 boxes	156"	31.2"	435 Hz
10 boxes	195"	39.0"	348 Hz
12 boxes	234"	46.8"	290 Hz
14 boxes	273"	54.6"	248.6 Hz

Figure 3-8 Use 5 as multiple for array (line) control

Configuration	Line Array	Height ÷ 5	Cutoff Frequency
4 boxes	78"	19.5"	696 Hz
6 boxes	117"	29.25"	464 Hz
8 boxes	156"	39.0"	348 Hz
10 boxes	195"	48.75"	278 Hz
12 boxes	234"	58.5"	232 Hz
14 boxes	273"	68.25"	199 Hz

Figure 3-9 Use 4 as multiple for array (line) control

Bass Arrays: Ground Stacked vs. Flown

A conventional subwoofer ground stack doubles the radiated acoustic power as long as the wavelengths are much longer than the spacing between the subwoofer cabinets and the reflecting surface (the ground). Certainly this is the case when two subs are stacked vertically but remain on the ground (see Figure 3-10).

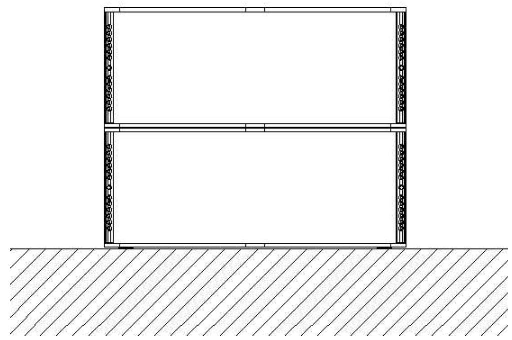


Figure 3-10 Ground-stacked subwoofers

A ground stack of four Xsubs reaches 58 inches above the ground and essentially still maintains the loading presented by the reflecting boundary (the ground). However, if either stack is placed on a 48-inch (4 ft.) stage (increasing the spacing to 106-inch [8.8 ft.]), it loses loading.Under these conditions, the ground stack's 3dB gain reduces by a small amount due to the distance between the stack to the ground. Ground stacking is thus a proven method to generate a doubling of acoustic power without the need for increased electrical input. Note that elevating the ground stack above ear level, even though it somewhat compromises ground loading, can improve overall system bass because of the crowd absorption associated with a true ground stack.

The Xsub is also available with full rigging, making possible large-scale vertical arrays at lower frequencies. The sound of these arrays benefits from the increased directivity index (DI) associated with the directional control offered when the array height becomes comparable to the radiated wavelengths. A ground stack of four Xsub enclosures offers an acoustic advantage in radiated power over a flown Xsub bass array until the flown array reaches a certain height. For example, a three-high, three-wide Xsub ground stack provides greater acoustic output than a flown array until the flown array includes at least 14 subs. In a typical 12-high flown Xsub array, the acoustic output is approximately 1dB less than that of a three-high, four-wide ground stack (see Figure 3-11 on the next page).

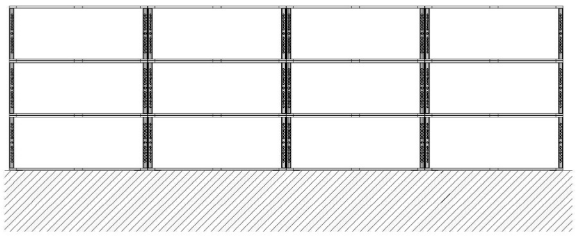


Figure 3-11 Three-high, four-wide stack

Flying bass arrays, on the other hand, offer other performance advantages. If the trim height (a function of venue length) is sufficient, the flying bass array can provide even more low-frequency coverage from the front to the back of the venue. Figure 3-12 illustrates this concept.[3]

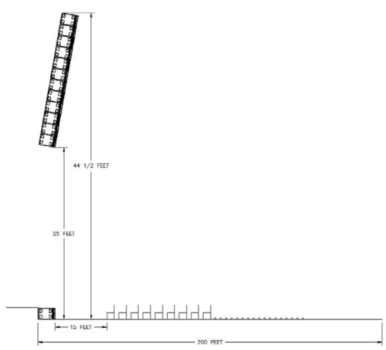


Figure 3-12 Coverage from a flown bass array (note: not drawn to scale)

This example assumes that a ground stack low-frequency output has been normalized to 0 dB (that is, to a reference of whatever very loud low-frequency level is desired at the first audience position). The ground stack's low-frequency output reduces by 22.5 dB at the back of the venue, 200 feet away. The ground stack level, then, varies by 22.5 dB from the front of the venue to the back of the venue (this variation relates purely to a 6 dB loss for every doubling of distance).

By contrast, a 14-box flown Xsub array offers not only SPL levels comparable to those of a ground stack (due to the increase in SPL associated with increased Q), but also substantially more even audience coverage. The variation in front-to-back coverage of the 14-box array shown in Figure 3-13 is just five dB.

[3]This theoretical example is designed solely to illustrate the concept of front-to-back coverage. Any resemblance to a real venue is accidental.

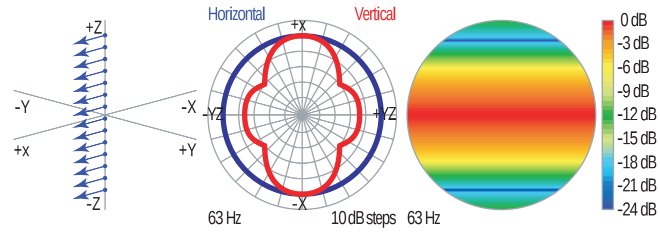


Figure 3-13 14-box Xsub array: 5 dB variation in SPL front-to-back

Another benefit of flying the bass array next to the main array is that signal alignment between the two stacks is extremely accurate. Conventional combinations of flown main arrays with ground-stacked subwoofers can be signal-aligned (time-aligned) at only one point in a venue because of the physical separation between the main and subwoofer systems. Flying the arrays closely together allows easy time-aligning for the entire venue. This is especially important when the crossover points of the low-frequency and subwoofer systems are overlapped. The EVX-155P drivers in the Xvls and Xvlt operate from the low/mid crossover point at 220 Hz down to 40 Hz, while the EVX-180B drivers in the Xsub operate from 80 Hz down to 32 Hz. Thus the two drivers overlap in the 80 Hz to 40 Hz range.

Line Arrays and the Major Acoustical Lobe

Vertical line arrays should be viewed as a single acoustic radiating device, not as a collection of individual sources. Each individual source interacts with adjacent sources to produce an overall polar response. The resulting polar response will exhibit a principal acoustic lobe, also called a principal directional characteristic. This is why the X-Line™ (or any line array, for that matter) should be aimed onto an audience area with an understanding of the location and direction of the entire system's directional characteristics, not the directional characteristics of the individual enclosures.

Figure 3-14 shows a 12-box Xvls hang that is completely flat. This simplest and most straightforward array will produce the most planar wavefronts. (The geometry of the lobe shown in Figure 3-14 is approximated for ease of viewing. The actual acoustic lobe would certainly appear different in detail, but the principle illustrated is the same.) It is very important to note that the 0dB reference (maximum SPL) is centered about the geometric center of the vertical array.

The reference line labeled "Aiming Laser" refers to the common practice of using lasers to aim vertical line arrays. Note that if the laser mounted on the top enclosure of an array were aimed at the back seat of a venue, a large portion at the rear of the venue would experience a rapid fall-off of broadband SPL.

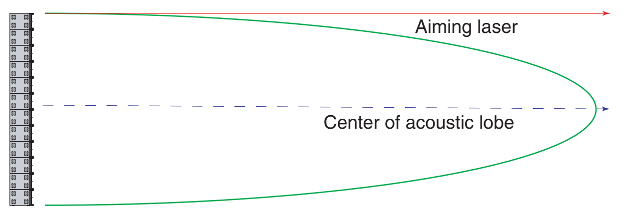


Figure 3-14 Flat-front Xvls array (12 enclosures)

Figure 3-15 illustrates how the major lobe and the aiming laser can be tilted to achieve aiming of this flat-front array. Note that, as in Figure 3-14, the laser in no way predicts even front-to-back coverage. A completely flat-front array is rarely used due to SPL distribution requirements. It is shown here because it represents the archetypical attempt to generate plane waves.

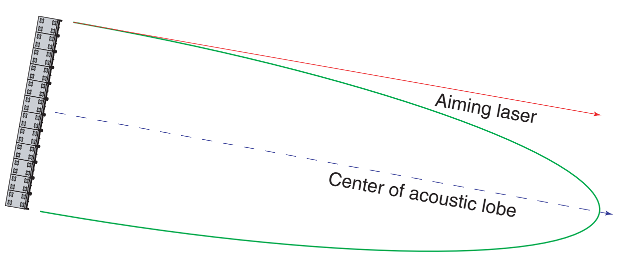


Figure 3-15 Tilted flat-front Xvls array (12 enclosures)

Figure 3-16, a very common configuration, illustrates six enclosures in a planar arrangement at the top of the array and six enclosures arranged into the **J** portion of the hang to produce more even front-to-back coverage in the first third to half of the venue. The aiming laser is again used to reference the back of the listening space (note that the aiming error between the laser and the acoustical center of the lobe still exists, as in the previous examples). The dashed red lobe illustrates the direction of the major lobe for the top six enclosures alone. When the **J** portion is added to the array, it steers the major lobe down so that the aiming error is even greater than with a flat array. Almost all line-array configurations with some degree of curvature exhibit an increase in downward tilt of the major lobe. (For a 12-box array like the one in Figure 3-16, the typical steering tilt is between three and ten degrees below the laser indication).

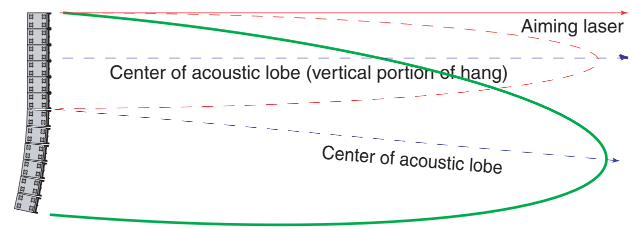


Figure 3-16 J-front Xvls array (12 enclosures)

This aiming error must be understood and overcome in order to achieve proper audience coverage. While enclosures can be aimed individually to effect uniform coverage throughout a venue, the shape of the major lobe will be determined by the overall line geometry. Figure 3-17 is an excellent example. The top enclosure is aimed horizontally, and each of the other enclosures is angled uniformly with equal spacing between boxes, thus bringing the array's shape to resemble an archery bow. The center of the acoustic lobe is aimed by the array in exactly the way an arrow would be aimed with a bow. In this case, the aiming laser would provide a very inaccurate prediction of SPL coverage.

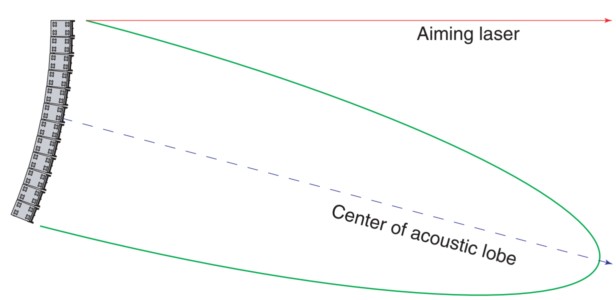


Figure 3-17 Curved-front Xvls array (12 enclosures)

The critical issues demonstrated by the four examples above are that each enclosure always influences the steering of adjacent enclosures and that the direction of the major acoustical lobe is greatly affected by the overall line geometry.

Electro-Voice's proprietary ArrayShow® software is very helpful in providing data and resulting aiming information for selected array configurations. To download your own copy of this freeware program, go to:

http://www.electrovoice.com/Old_Site/htdocs/html/indexsarsho.html

and scroll to the bottom of the screen to access the download link.

4 Rigging

Rigging Overview

The X-Line™ loudspeaker systems have been designed to construct acoustic line arrays. Acoustic line arrays typically consist of independent columns of loudspeaker systems. Additional columns are sometimes added to cover different seating sections of a venue. Unlike cluster systems, when multiple arrays are used, they are physically separated to minimize the acoustic overlap. This simplifies the rigging system.

The rigging system for a column of X-Line™ loudspeakers consists of a grid at the top with a column of loudspeakers suspended underneath. There are two pickup points on the grid, one at the front and one at the back. The two grid pickup points are in line and are adjustable front-to-back to help distribute the loads between the two points. For smaller arrays (8 boxes or less), two one-ton hoist motors are recommended. For larger arrays (more than 8 boxes), two two-ton hoist motors are recommended. Two one-ton hoist motors can be used; however, the front-to-back distribution of the weight becomes much more critical than with two-ton hoists.

The X-Line™ loudspeaker enclosures have a hinged rigging system. The rear of the enclosures are hinged at the back corners using rigging hardware specially designed for the X-Line™ system. Adjustable rigging straps are installed at the front of the enclosure that allow the space between the front corners to be adjusted; hence, adjusting the relative angle between the enclosures.

Enclosure Rigging Hardware

The X-Line™ loudspeaker systems have rigging at both the front and rear of the enclosures as shown in Figure 1 (see p. 18). The rear rigging consists of four pieces of track that run side to side. Two pieces of track are at the top and two pieces are at the bottom. Special hinges are installed into these tracks to attach one enclosure to another. Internal to the enclosure are four aluminum bars that run top to bottom between the rigging tracks to minimize the stress on the wooden enclosures.

At the front of the X-Line™ enclosures are two aluminum extrusions with tracks that run top to bottom. Rigging straps may be attached at different positions along the track, effectively adjusting the space between enclosures at the front.

External Rigging Hardware

The X-Line™ loudspeaker systems use separate pieces of rigging hardware, shown in Figure 2 (see p. 18), to link one enclosure to another or to attach the top enclosure to the grid. To attach one enclosure to another, two Xvhl linking hinges are used at the back and two Xvsl linking straps are used at the front. A column of loudspeakers with rigging is shown in Figure 3 (see p. 18).

The Xvhl linking hinges are solid hinges that allow the enclosures to hinge at their adjacent rear corners. The Xvsl linking straps consist of two special fittings connected by a chain. The fittings on the linking straps can be installed at different positions along the enclosure front rigging track. By attaching the straps at different positions, the amount of space between the enclosures can be adjusted in 1° increments.

The Xvhg grid hinges are flexible hinges that secure the rear of the top enclosure to the grid. The Xvsg grid straps are just like the Xvsl linking straps, with the exception that they are shorter.

Special Safety Notes

Rear Hinge Safety Note

Both the Xvhg grid hinges and Xvhl linking hinges must be installed in the enclosures so that, when locked in position, the base of the hinge is located in the track at the outside of the enclosure with the locking knobs toward the center as shown in Figure 3. If the hinges are installed backwards, the structural strength is significantly decreased and an unsafe condition will exist. Before suspending any X-Line™ enclosure overhead, the operator must always check to make sure that the hinges are installed in the correct orientation and that the locking pins are fully engaged in the track.

Front Strap Safety Note

Before suspending any X-Line™ enclosure overhead, the operator must always check to make sure that the Xvsg and Xvsl front strap fittings are securely installed in the track and that the fitting locking pins are fully engaged in the track.

Adjusting Vertical Angles of Enclosures

The vertical angle of an enclosure may be adjusted relative to the enclosure immediately above by the choice of the attachment position of the Xvsl front linking straps in the enclosure track. The locating holes in the enclosure rigging track are spaced 1.00 inches apart. Moving the attachment position one hole results in a 2° change in the enclosure vertical angle. A 1° angle adjustment is possible, however.

The chain on the Xvsl linking strap is secured to the fittings on each end with a pin through a hole on each fitting. Note that there are two holes on each fitting labeled "A" and "B". These two holes offer two attachment points that change the length of the linking strap assembly. When the chain is connected in the "B-B" position, the Xvsl linking strap is 0.500 inches longer than when connected in the "A-A" position. This 0.500-inch change in length results in a 1° angle adjustment. Thus, by adjusting the length of the Xvsl linking straps and their attachment position on the enclosure front track, the relative angles between boxes can be adjusted in 1° increments. When used with the "A-A" length, even-numbered angles result (0°, 2°, 4°, 6°, etc.) when changing the attachment position of the linking strap along the track, while odd-numbered angles result (1°, 3°, 5°, 7°, etc.) when used with the "B-B" length.

When planning angle adjustments between boxes, the shape of the enclosure must be taken into account. Two rectangular enclosures (either Xvls or Xsub) can be pulled up tight with their sides parallel, leaving a 0° relative angle between the enclosures (that is, both are facing straight ahead). When two trapezoidal enclosures (Xvlt only) are pulled up tight with their sides parallel, a 5° relative angle exists between the enclosures (because the enclosure shape is a 5° wedge). When a trapezoidal enclosure (Xvlt) and rectangular enclosure (either Xvls or Xsub) are pulled up tight with their sides parallel, a 3° relative angle exists between the enclosures.

To facilitate array design, Table 1 (see p. 21) shows all of the possible combinations of rigging attachment locations and linking strap lengths.

Rigging an Array Using Boxes with Dollies

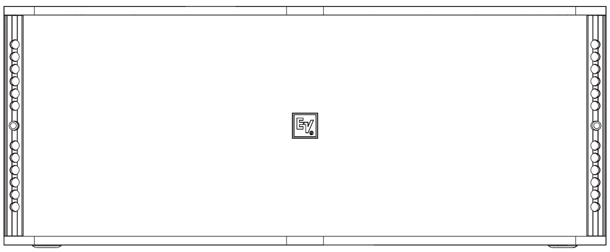
Two dollies are available for transporting the X-Line™ loudspeaker systems. The actual array rigging technique will vary depending on which dolly is used.

A bottom dolly can be used with the rectangular loudspeaker enclosures (either Xvls or Xsub). Up to four loudspeaker systems can be stacked on top of a single bottom dolly. The loudspeakers all are sitting upright, just like they would be arrayed. These dollies have sufficient clearance to allow the enclosures to travel with both the front and rear rigging hardware attached to the loudspeaker systems. This makes rigging set up and tear down extremely easy because the loudspeaker enclosures can be moved in blocks of four units. Figure 4 (see p. 18) illustrates the technique used to construct a loudspeaker array with enclosures transported on bottom dollies. The bottom dolly cannot be used with trapezoidal enclosures (Xvlt).

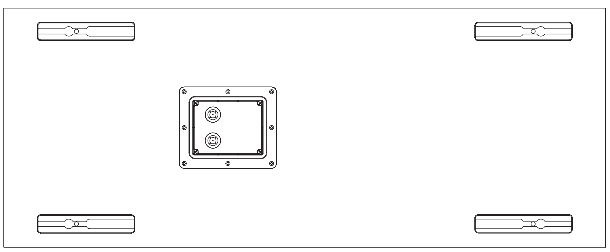
A front dolly can be used with either the rectangular enclosures (Xvls or Xsub) or trapezoidal enclosures (Xvlt). The front dolly attaches to the front of a single loudspeaker system covering the grille and the enclosure front rigging track. This dolly allows the ease of moving one loudspeaker enclosure at a time; however, the rigging cannot remain attached to the enclosure during transport. Figure 5 (see p. 20) illustrates the technique used to construct a loudspeaker array with enclosures transported on front dollies.

Because most arrays typically require more rectangular Xvls and Xsub systems than trapezoidal Xvlt systems, it would be common in large-scale touring situations for the rectangular boxes to be transported on bottom dollies and trapezoidal boxes to be transported on front dollies. Thus, both rigging techniques may be employed in the same array.

Figure 5-1: X-Line™ Enclosures



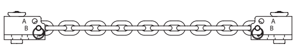
X-Line™ enclosure front showing rigging hardware



X-Line™ enclosure rear showing rigging hardware

Figure 5-2: X-Line™ External Rigging Hardware

“A-A” Xvsl linking strap

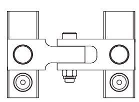


“B-B ” Xvsl linking strap

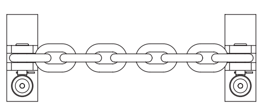
The **Xvsl front linking strap** is used to link one box to another. Two are required for each box.

The Xvsl front rigging strap may be adjusted for two different lengths. There are two holes in the fittings labeled "A" and "B". The chain is secured to the fitting by a pin inserted into one of those holes. To change the length of the rigging strap, remove the circular cotter pin, and pull it out of the fitting and chain. Next, move the pin and chain to the new hole and install the circular cotter pin.

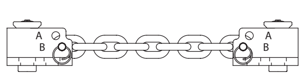
With the chain secured in the "A-A" positions, the vertical angles of the boxes may be adjusted for even angles (0°, 2°, 4°, 6°, etc.). With the chain secured in the "B-B" positions, the vertical angles of the boxes may be adjusted for odd angles (1°, 3°, 5°, 7°, etc.).



The **Xvhl rear linking hinge** is used for linking two boxes together. Two are required for each box.

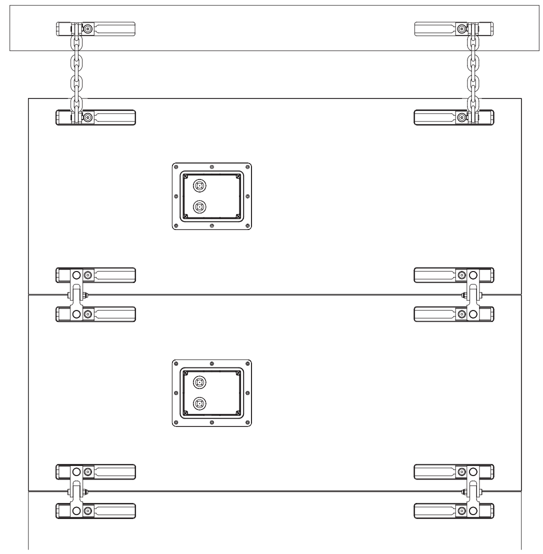


The **Xvhg rear grid hinge** is used for securing the top box to the grid. Two are required for each box.



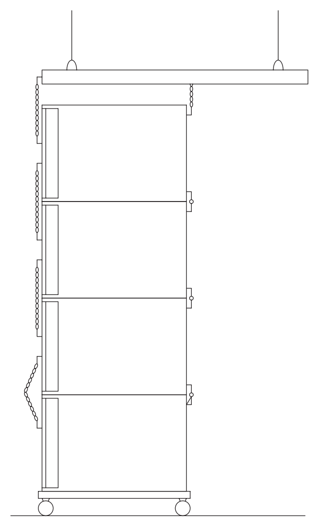
The **Xvsg front grid strap** is used for securing the top box to the grid. Two are required for each box. There is no reason to adjust the length of this strap.

Figure 5-3: Attaching Rigging Hardware to Boxes

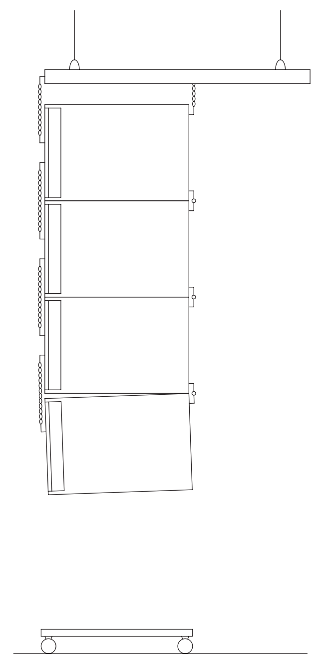


Important Safety Note: Both the grid and linking hinges must be installed as shown with the hinge at the outside edge of the track and the locating knobs towards the center. Installing the hinges backwards will result in significantly reduced structural strength.

Figure 5-4: Rigging an Array Using Boxes with Bottom Dollies

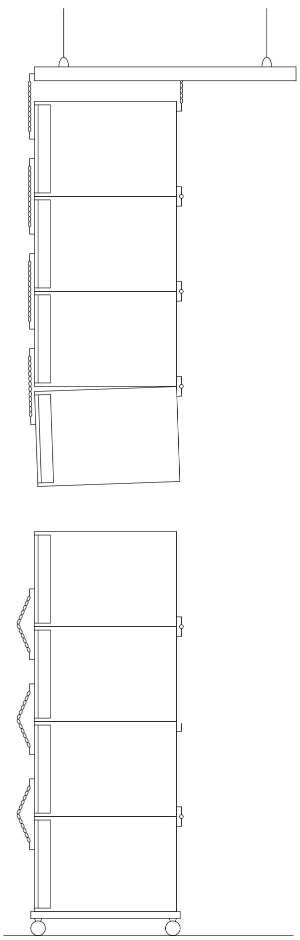


Step 1: Roll stack of boxes into position and attach the top box to the grid using two grid straps at the front and two grid hinges at the rear. Attach rigging chain at the front to achieve the desired vertical angles.

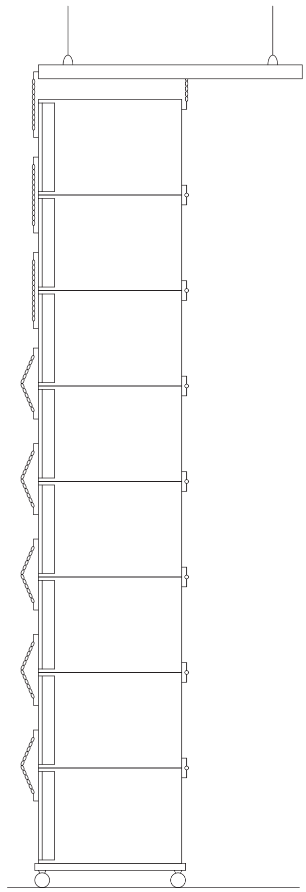


Step 2: Lift the boxes off the dolly.

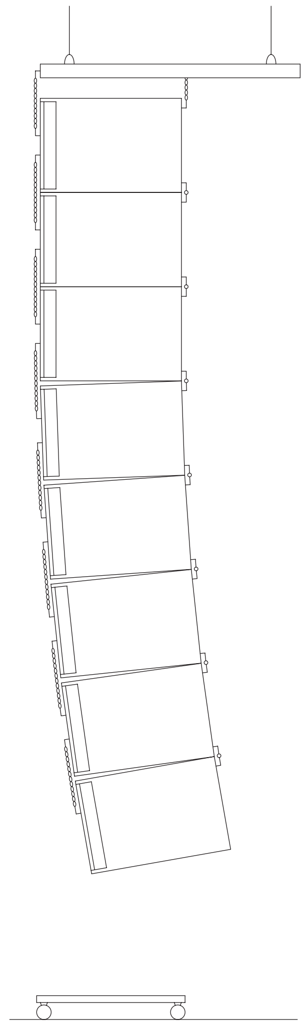
Figure 5-4 (continued)



Step 3: Roll another stack of boxes into position under the suspended array. Attach rigging chain at the front to achieve the desired vertical angles for the next stack.

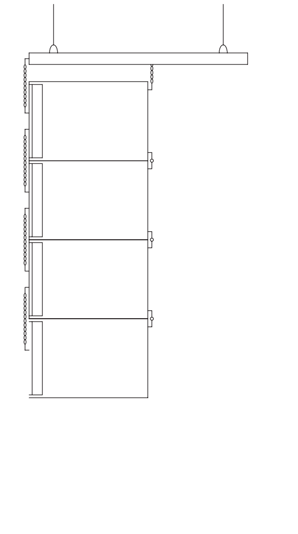


Step 4: Land the suspended array on top of the next stack. Attach the rear hinges between the two stacks. Attach rigging chain at the front between the two stacks to achieve the desired vertical angles.

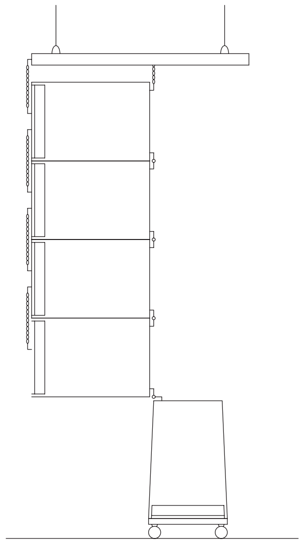


Step 5: Lift the entire array of boxes. Repeat Steps 3 and 4 as necessary.

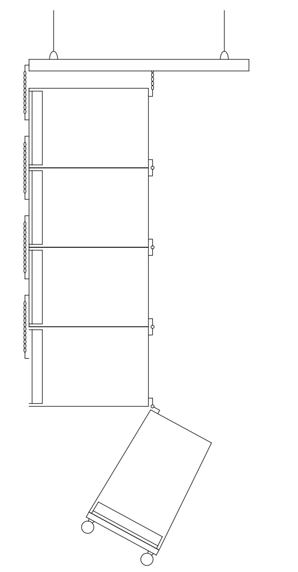
Figure 5-5: Rigging an Array Using Boxes with Front Dollies



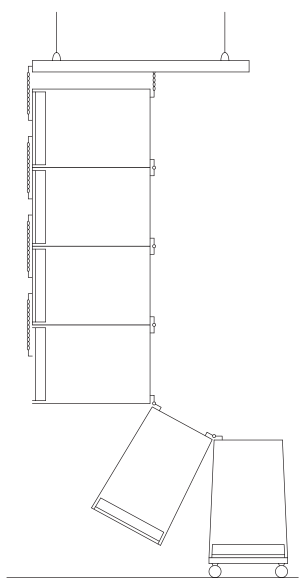
Step 1: Attach one or more boxes to the grid using two grid straps at the front and two grid hinges at the rear. Lift the array.



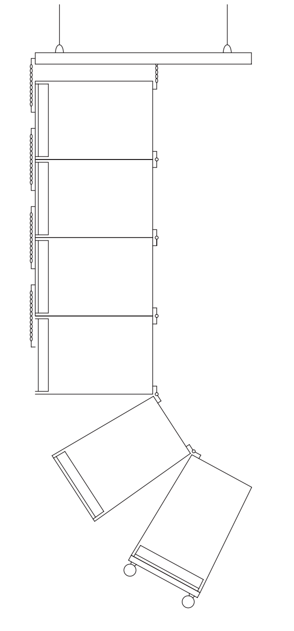
Step 2: Roll one box on a front dolly into position and lower the array to align the bottom box with the box on the front dolly. Install rear hinges one at a time. To ease installation boxes must be held parallel. Lift suspended box or dolly box as necessary to facilitate hinge installation.



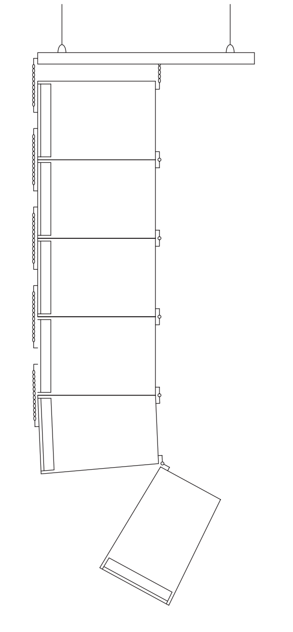
Step 3: Remove dolly pin and lift array.



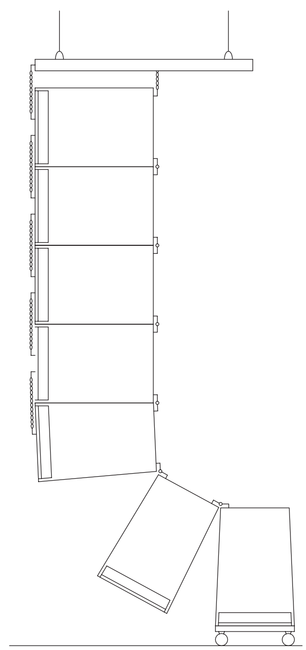
Step 4: Roll the next box on a front dolly into position. Lower the array and install the two rear hinges between the bottom array box and the dolly box as in Step 3.



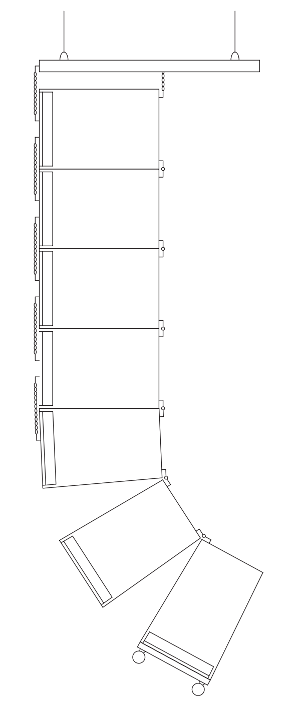
Step 5: Remove the dolly pin and lift the array.



Step 6: Swing the next-to-bottom box up and attach the two grid straps at the front to the box above.

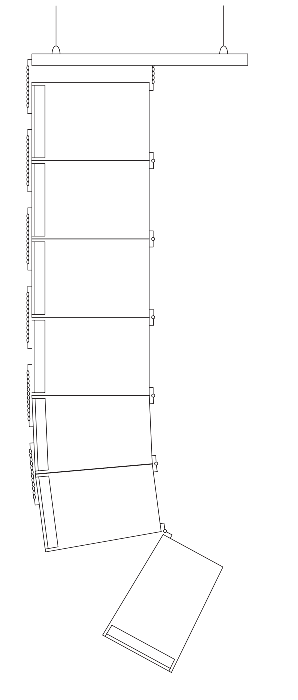


Step 7: Roll another box with a front dolly into position and lower the array to align the bottom box in the array with the box with the front dolly. Install the two rear hinges and two front straps as described in Step 2.

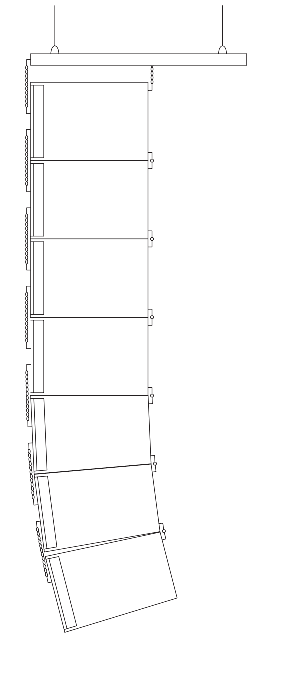


Step 8: Remove the dolly pin and lift the array.

Figure 5-4 (continued)



Step 9: Swing the next-to-bottom box up and attach the two grid straps at the front to the box above. Repeat Steps 7, 8 and 9 as necessary to build the array.



Step 10: Swing the bottom box up and attach the two grid straps at the front to the box above.

Table 5-1: Adjusting Angles Between Boxes Using Xvsl Rigging Straps

Angle Between Boxes	Front Strap Chain Position	Holes Showing in Front of Rigging
0°	A-A	0
1°	B-B	0
2°	A-A	1
3°	B-B	1
4°	A-A	2
5°	B-B	2
6°	A-A	3
7°	B-B	3

Rectangular Box (Xvls or Xsub) to Rectangular Box (Xvls or Xsub)

Angle Between Boxes	Front Strap Chain Position	Holes Showing in Front of Rigging
3°	B-B	0
4°	A-A	1
5°	B-B	1
6°	A-A	2
7°	B-B	2
8°	A-A	3
9°	B-B	3
10°	A-A	4

Rectangular Box (Xvls or Xsub) to Trapezoidal Box (Xvlt)

Angle Between Boxes	Front Strap Chain Position	Holes Showing in Front of Rigging
5°	B-B	0
6°	A-A	1
7°	B-B	1
8°	A-A	2
9°	B-B	2
10°	A-A	3

Trapezoidal Box (Xvlt) to Trapezoidal Box (Xvlt)

5 Parameters

The X-Line™ system parameters in this chapter are best understood in three distinct groups: crossover settings and signal delay; equalization; and system dynamics.

Crossover Settings

Crossover settings and associated signal delays for the X-Line™ system have been established to insure that the wavelengths at crossover are always longer than the specific device spacing (see Chapter 3, p. 11). These processor settings insure controlled and lobe-free operation near the crossover point.

The low-to-mid crossover should be set to 220 Hz (the wavelength at this frequency is approximately 61.2 inches/1.56 meters). Although a crossover slope of 48 dB per octave is preferred, a crossover slope of 24 dB per octave may also be used. The mid-to-high-frequency crossover should be 1000 Hz (the wavelength is approximately 13.5 inches/.34 meters). Again, either 48-dB-per-octave or 24-dB-per-octave crossover slopes may be used, but the 48-dB-per-octave slope is preferred. All crossover filters should be of the Linkwitz-Riley type.

Signal Delay

A low-pass (high-cut) filter is set to 16 KHz to limit ultrasonic material. The low-frequency response of the full-range enclosures (Xvls, Xvlt, Xfil) is set to 50 Hz (a 50-Hz, 24-dB-per-octave Butterworth is used). This frequency may be lowered to 40 Hz if subwoofers (Xsub) are not being used. When subwoofers are not used, 5.0 milliseconds of signal delay may be removed from each pass of the system to reduce latency.

Particular attention should be paid to signal delay when an X-Line™ full-range hang is used in overlap mode. The additional 5.0 milliseconds of signal delay is necessary to offset goup delay effects associated with the low-pass filters. The low-pass filter used in the Xsub is set to 80 Hz, while the low-pass filter associated with the low-frequency drivers in the full-range enclosures is 220 Hz. This difference in delay associated with the two different corner frequencies necessitates the additional 5.0-millisecond delay between the subwoofers (set to 0.0 milliseconds) and the full-range enclosures (set to 5.0 milliseconds). The delay is required whether the subwoofers are flown or ground stacked. Of course, physical misalignment of ground-stacked subwoofers will require more or less delay, depending on whether they are physically located in front of the main hang (more delay needed) or behind the main hang (less delay needed).

Equalization

All commercially available loudspeaker processors offer both pre- and post-crossover equalization capabilities. The post-crossover equalization has been established to provide the most linear and musical starting point. Changes in system geometry and venue acoustics will necessitate modifications to system equalization.

It is recommended that all user equalization take place in the pre-crossover domain. Use extreme caution while establishing system equalization for the X-Line™ system (or any other system).

The X-Line™ system's response is very time-coherent, especially in the midrange (the critical vocal fundamental range). Electrical filters introduce time-domain distortion (ringing). The amount of ringing is directly proportional to the filter Q (bandwidth). The higher the Q, the higher the degree of induced ringing. These induced ringing modes can be audible and are typically encountered when a user is analyzer driven to achieve flat frequency response. Such users usually (and mistakenly) employ high-Q boosts or cuts to achieve excellent amplitude linearity at the cost of introducing significant time-domain distortion.

System Dynamics

Post-crossover compressors and limiters allow X-Line™ users to achieve an optimal ratio of system dynamics to system protection. Obviously, thresholds can be raised to the point where the compressors and limiters alike are essentially out of circuit. An out-of-circuit threshold enables maximum system dynamic range. In such a case, system protection is handled only by the FOH engineer. Of course, this requires that the FOH engineer be extremely knowledgeable regarding the X-Line™'s dynamic capabilities.

Electro-Voice® recommends the use of the compression and limiter parameters listed in the the charts below because they provide extremely high system dynamics while introducing enough system protection. Electro-Voice® also strongly recommends that the system processor use independent post-crossovers and limiters. Each output should provide band-dependent system protection. Many loudspeaker processors use post-crossover limiters only. Post-filter limiters, although not as desirable as compressors and limiters used together, can also increase system protection.

Amplifiers

Electro-Voice® recommends the use of high-quality professional amplifiers with 90-volt power supply rails (minimum). Amplifier class (A/B, H, and so on) determines varying degrees of additional dynamic headroom. Electro-Voice® recommends the EV P3000 or its equivalent (90-volt power supply rails and 130-volt to 142-volt peak dynamic headroom [with a duty cycle that is average-frequency dependent]).

Because peak-output capability can vary between amplifier types and design approaches and cause peak excursion overload in the drivers, Electro-Voice® strongly recommends using the dynamics settings charted below.

Parameter Instructions

The output EQ and signal delays have been carefully chosen to ensure that the acoustic outputs of the Xvls, Xvlt, and Xfil loudspeakers all have the same magnitude and phase response. This acoustic matching is necessary for correct acoustic summation for line-array performance. This requires that the MB and HF sections of the Xvls, Xvlt and Xfil loudspeakers all have unique drive signals. However, they may all share the same LF drive signal. Attempting to share MB and HF drive signals between different loudspeaker systems will alter the time/phase alignment, deteriorating the line-array acoustic performance.

When making EQ or signal-delay changes to compensate for array geometry or room acoustics, all changes must be made in the full-range input sections, not at the outputs. Attempting to change EQ or signal delay in the outputs may alter the time/phase alignment, deteriorating the line-array acoustic performance.

These tables indicate that a signal delay is required at the inputs of the Xvls, Xvlt and Xfil full-range systems, but not the Xsub subwoofer. This delay is necessary to achieve time alignment between the subwoofers and the full-range systems. The indicated signal delay assumes that the full-range systems are physically located right next to the subwoofer systems. If the full-range systems are physically separated from the full-range systems, that input signal delay must be adjusted. If the subwoofers are closer to the audience than the full-range systems, less delay is required. If the full-range systems are closer to the audience than the subwoofers, more delay is required.

The output compressors/limiters are used for loudspeaker protection. The thresholds shown in the tables are specifically for use with the EV P3000 amplifiers with the “0-dB for Rated Output” gain setting (for which the gain is 39 dB). If amplifiers with different gain are used (or if the gain of the P3000 amplifiers is altered), the thresholds must be readjusted. There are cells in the table labeled “Amp @ Thresh (Vrms).” The compressor/limiter thresholds should be adjusted so that gain reduction turns on when these indicated voltages appear at the amplifier outputs. These compressor/limiter settings provide a compromise between maximized acoustic output with minimized loudspeaker failures. As such, these settings will reduce the possibility of damage to the loudspeakers, but will not eliminate failures if driven excessively hard. If additional loudspeaker protection is desired to further reduce the possiblity of loudspeaker failures, the thresholds should be turned down to a lower level.

Not all controllers have enough outputs to drive an entire X-Line system. Eight are required for a complete system. As such, multiple controllers may have to be used to get the correct number of output drive signals. These tables simply indicate the input and output signal processing requirements. When using multiple controllers, it is the responsibility of the system designer to choose appropriate input and output asignments.

Table of Parameters for KT DN9848

	Enclosure	Xvls/Xvlt	Xfil	Xsub		Xsub	Xxxx	Xfil	Xfil	Xvlt	Xvlt	Xvls	Xvls
Assign	**Frequency Band**	**Input**	**Input**	**Input**		**SUB**			**LF**	**MB**	**HF**	**MB**	**HF**
	Connector	**A**	**B**	**C**	**D**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Main	Input Routing					C	A	B	B	A	A	A	A
	Digital Gain (dB)	+0.0 dB	+0.0 dB	+0.0 dB		+0.0 dB	-0.7 dB			+0.0 dB	+0.0 dB	+0.0 dB	+0.0 dB
	Signal Delay (mSec)	5.000 mS	5.000 mS	0.000 mS		0.000 mS	0.250 mS			0.396 mS	0.464 mS	0.000 mS	0.318 mS
	Polarity (Norm/Inv)					Norm	Norm			Norm	Norm	Norm	Norm
Crossover	HP Frequency (Hz)					32.6 Hz	50 Hz			220 Hz	1250 Hz	220 Hz	1250 Hz
	HP Resp (Type, dB/Oct)					But24	But24			LR24	LR24	LR24	LR24
	HP Q (-) or Boost (dB)												
	LP Frequency (Hz)					80 Hz	220 Hz			1250 Hz	16000 Hz	1250 Hz	16000 Hz
	LP Resp (Type, dB/Oct)					LR24	LR24			LR24	But24	LR24	But24
	LP Q (-) or Boost (dB)												
EQ Filter Block (PEQ filter width specified in both Bandwidth and Q)	Filter 1 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 1 Freq. (Hz)					45.4 Hz	50 Hz			591 Hz	1130 Hz	572 Hz	1000 Hz
	Filter 1 Gain (dB)					+3.0 dB	+3.0 dB			-5.7 dB	-10.9 dB	-6.8 dB	-11.5 dB
	Filter 1 BW (Oct)					0.50 Oct	0.90 Oct			1.20 Oct	1.20 Oct	1.00 Oct	1.50 Oct
	Filter 1 Q (Q)					2.87 Q	1.58 Q			1.17 Q	1.17 Q	1.41 Q	0.92 Q
	Filter 1 Slope (dB/Oct)												
	Filter 2 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 2 Freq. (Hz)					305 Hz	165 Hz			1550 Hz	3050 Hz	936 Hz	2270 Hz
	Filter 2 Gain (dB)					-4.0 dB	-2.0 dB			-4.7 dB	-7.0 dB	-5.8 dB	-7.0 dB
	Filter 2 BW (Oct)					1.00 Oct	0.50 Oct			1.20 Oct	1.50 Oct	1.00 Oct	2.00 Oct
	Filter 2 Q (Q)					1.41 Q	2.87 Q			1.17 Q	0.92 Q	1.41 Q	0.67 Q
	Filter 2 Slope (dB/Oct)												
	Filter 3 Type						PEQ				PEQ		PEQ
	Filter 3 Freq. (Hz)						572 Hz				15000 Hz		15000 Hz
	Filter 3 Gain (dB)						-8.0 dB				+11.3 dB		+11.0 dB
	Filter 3 BW (Oct)						0.30 Oct				0.70 Oct		0.70 Oct
	Filter 3 Q (Q)						4.80 Q				2.04 Q		2.04 Q
	Filter 3 Slope (dB/Oct)												
	Filter 4 Type										PEQ		PEQ
	Filter 4 Freq. (Hz)										1820 Hz		1820 Hz
	Filter 4 Gain (dB)										-3.0 dB		-3.0 dB
	Filter 4 BW (Oct)										0.30 Oct		0.20 Oct
	Filter 4 Q (Q)										4.80 Q		7.21 Q
	Filter 4 Slope (dB/Oct)												
	Filter 5 Type										PEQ		PEQ
	Filter 5 Freq. (Hz)										2420 Hz		2540 Hz
	Filter 5 Gain (dB)										-4.0 dB		-3.0 dB
	Filter 5 BW (Oct)										0.20 Oct		0.20 Oct
	Filter 5 Q (Q)										7.21 Q		7.21 Q
	Filter 5 Slope (dB/Oct)												
	Filter 6 Type												
	Filter 6 Freq. (Hz)												
	Filter 6 Gain (dB)												
	Filter 6 BW (Oct)												
	Filter 6 Q (Q)												
	Filter 6 Slope (dB/Oct)												
Compressor	Comp. Thresh. (dBu)					+0.0 dBu	+0.0 dBu			+0.0 dBu	+0.0 dBu	+0.0 dBu	+0.0 dBu
	Amp Out @ Thresh (Vrms)					69.3 V	69.3 V			69.3 V	69.3 V	69.3 V	69.3 V
	Comp. Ratio (X:1)					3:1	3:1			3:1	3:1	3:1	3:1
	Knee (Hard/Soft)					Hard	Hard			Hard	Hard	Hard	Hard
	Comp. Attack (mS)					10.00 mS	10.00 mS			8.00 mS	0.50 mS	8.00 mS	0.50 mS
	Comp. Release (mS)					200 mS	200 mS			150 mS	100 mS	150 mS	100 mS
Limiter	Limiter Thresh (dBu)					+2.0 dBu	+2.0 dBu			+2.0 dBu	+2.0 dBu	+2.0 dBu	+2.0 dBu
	Amp Out @ Thresh (Vrms)					87.2 V	87.2 V			87.2 V	87.2 V	87.2 V	87.2 V
	Knee (Hard/Soft)					Hard	Hard			Hard	Hard	Hard	Hard
	Limiter Release (mS)					20 mS	20 mS			5 mS	1 mS	5 mS	1 mS

Table of Parameters for EV Dx38

Section	Enclosure	Xvls/Xvlt	Xfil	Xsub		Xsub	Xxxx	Xfil	Xfil	Xvlt	Xvlt	Xvls	Xvls
Assign	Frequency Band	Input	Input	Input		SUB			LF	MB	HF	MB	HF
Assign	Connector	A	B	C	D	1	2	3	4	5	6	7	8
Main	Input Routing					C	A	B	B	A	A	A	A
Main	Digital Gain (dB)	+0.0 dB	+0.0 dB	+0.0 dB		+0.0 dB	+0.8 dB			-0.5 dB	+0.0 dB	-0.5 dB	+0.0 dB
Main	Signal Delay (mS)	5.000 mS	5.000 mS	0.000 mS		0.000 mS	0.260 mS			0.375 mS	0.469 mS	0.000 mS	0.312 mS
Main	Polarity (Norm/Inv)					Norm	Norm			Norm	Norm	Norm	Norm
Crossover	HP Frequency (Hz)					32.6Hz	50Hz			220Hz	1250Hz	220Hz	1250Hz
Crossover	HP Resp (Type, dB/Oct)					But24	But24			LR24	LR24	LR24	LR24
Crossover	HP Q (-) or Boost (dB)												
Crossover	LP Frequency (Hz)					80 Hz	220 Hz			1250 Hz	16000 Hz	1250 Hz	16000 Hz
Crossover	LP Resp (Type, dB/Oct)					LR24	LR24			LR24	But24	LR24	But24
Crossover	LP Q (-) or Boost (dB)												
EQ Filter Block (PEQ filter width specified in both Bandwidth and Q)	Filter 1Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 1Freq. (Hz)					45.4 Hz	56 Hz			600 Hz	912 Hz	553 Hz	936 Hz
	Filter 1Gain (dB)					+3.0 dB	+3.0 dB			-3.0 dB	-12.0 dB	-5.0 dB	-12.0 dB
	Filter 1BW (Oct)					0.50 Oct	1.27 Oct			1.08 Oct	1.92 Oct	0.90 Oct	2.00 Oct
	Filter 1 Q (Q)					2.87 Q	1.10 Q			1.30 Q	0.70 Q	1.58 Q	0.67 Q
	Filter 1Slope (dB/Oct)												
	Filter 2Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 2Freq. (Hz)					305 Hz	164 Hz			1560 Hz	3100 Hz	909 Hz	2850 Hz
	Filter 2Gain (dB)					-4.0 dB	-2.0 dB			-5.0 dB	-5.0 dB	-5.0 dB	-5.0 dB
	Filter 2BW (Oct)					1.00 Oct	0.51 Oct			2.54 Oct	1.70 Oct	0.90 Oct	2.50 Oct
	Filter 2 Q (Q)					1.41 Q	2.80 Q			0.50 Q	0.80 Q	1.58 Q	0.51 Q
	Filter 2Slope (dB/Oct)												
	Filter 3Type						PEQ				PEQ		PEQ
	Filter 3Freq. (Hz)						580 Hz				14800 Hz		15000 Hz
	Filter 3Gain (dB)						-8.0 dB				+11.0 dB		+11.0 dB
	Filter 3BW (Oct)						0.29 Oct				0.71 Oct		0.70 Oct
	Filter 3 Q (Q)						5.00 Q				2.00 Q		2.04 Q
	Filter 3Slope (dB/Oct)												
	Filter 4Type	PEQ									PEQ		PEQ
	Filter 4Freq. (Hz)	1820 Hz									2540 Hz		2540 Hz
	Filter 4Gain (dB)	-3.0 dB									-4.5 dB		-3.0 dB
	Filter 4BW (Oct)	0.20 Oct									0.20 Oct		0.20 Oct
	Filter 4 Q (Q)	7.21 Q									7.21 Q		7.21 Q
	Filter 4Slope (dB/Oct)												
Compressor	Comp. Thresh. (dBu)					+0.0 dBu	+0.0 dBu			+0.0 dBu	+0.0 dBu	+0.0 dBu	+0.0 dBu
Compressor	Amp Out @Thresh (Vrms)					69.3 V	69.3 V			69.3 V	69.3 V	69.3 V	69.3 V
Compressor	Comp. Ratio (X:1)					3:1	3:1			3:1	3:1	3:1	3:1
Compressor	Comp. Attack (mS)					10.00 mS	10.00 mS			8.00 mS	1.00 mS	8.00 mS	1.00 mS
Compressor	Comp. Release (mS)					200 mS	200 mS			150 mS	100 mS	150 mS	100 mS
Limiter	Limiter Thresh (dBu)					+2.0 dBu	+2.0 dBu			+2.0 dBu	+2.0 dBu	+2.0 dBu	+2.0 dBu
Limiter	Amp Out @Thresh (Vrms)					87.2 V	87.2 V			87.2 V	87.2 V	87.2 V	87.2 V
Limiter	Limiter Release (mS)					50 mS	50 mS			50 mS	50 mS	50 mS	50 mS

Notes for All Tables of Parameters

ONLY use the input EQ to make adjustments for system EQ and room EQ. DO NOT adjust output EQ, filters and delays because this will compromise line array performance.

The output compressors and limiters are used for loudspeaker protection. The thresholds shown are calibrated for EV P3000 power amplifiers, which have a gain of 39 dB (as shipped from the factory with the 0 dBu for full power gain settings). If amplifiers with a different gain are used, the thresholds should be adjusted so that the gain reduction turns on at the indicated amplifier output voltages.

The Xvls, Xvlt & Xfil all share the same drive signal, denoted in the tables as “Xxxx LF.”

Table of Parameters for BSS FDS-366

Section	Enclosure	Xvls/Xvlt	Xfil	Xsub		Xsub	Xxxx	Xfil	Xfil	Xvlt	Xvlt	Xvls	Xvls
Assign	Frequency Band	Input	Input	Input		SUB			LF	MB	HF	MB	HF
	Connector	A	B	C	D	1	2	3	4	5	6	7	8
Main	Input Routing					C	A	B	B	A	A	A	A
	Digital Gain (dB)	+0.0 dB	+0.0 dB	+0.0 dB		+0.0 dB	+0.0 dB			+0.0 dB	+0.0 dB	+0.0 dB	+0.0 dB
	Signal Delay (mS)	5.000 mS	5.000 mS	0.000 mS		0.000 mS	0.000 mS			0.958 mS	1.125 mS	0.563 mS	0.958 mS
	Polarity (Norm/Inv)					Norm	Norm			Norm	Norm	Norm	Norm
Crossover	HP Frequency (Hz)					32.6 Hz	49 Hz			225 Hz	1230 Hz	225 Hz	1230 Hz
	HP Resp (Type, dB/Oct)					But24	But24			LR24	LR24	LR24	LR24
	HP Q (-) or Boost (dB)												
	LP Frequency (Hz)					80 Hz	225 Hz			1230 Hz	16000 Hz	1230 Hz	16000 Hz
	LP Resp (Type, dB/Oct)					LR24	LR24			LR24	But24	LR24	But24
	LP Q (-) or Boost (dB)												
EQ Filter Block (PEQ filter width specified in both Bandwidth and Q)	Filter 1 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 1 Freq. (Hz)					45.4 Hz	50.8 Hz			574 Hz	1190 Hz	554 Hz	1110 Hz
	Filter 1 Gain (dB)					+3.0 dB	+2.8 dB			-5.4 dB	-13.6 dB	-6.2 dB	-15.0 dB
	Filter 1 BW (Oct)					0.50 Oct	0.60 Oct			0.95 Oct	1.80 Oct	0.85 Oct	1.35 Oct
	Filter 1 Q (Q)					2.87 Q	2.39 Q			1.49 Q	0.75 Q	1.67 Q	1.03 Q
	Filter 1 Slope (dB/Oct)												
	Filter 2 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 2 Freq. (Hz)					305 Hz	159 Hz			1370 Hz	3610 Hz	901 Hz	3030 Hz
	Filter 2 Gain (dB)					-4.0 dB	-2.4 dB			-4.4 dB	-2.4 dB	-6.4 dB	-3.2 dB
	Filter 2 BW (Oct)					1.00 Oct	0.50 Oct			1.25 Oct	0.80 Oct	0.90 Oct	2.00 Oct
	Filter 2 Q (Q)					1.41 Q	2.87 Q			1.12 Q	1.78 Q	1.58 Q	0.67 Q
	Filter 2 Slope (dB/Oct)												
	Filter 3 Type						PEQ				PEQ		PEQ
	Filter 3 Freq. (Hz)						500 Hz				14900 Hz		14900 Hz
	Filter 3 Gain (dB)						-9.0 dB				+11.8 dB		+11.8 dB
	Filter 3 BW (Oct)						0.50 Oct				0.60 Oct		0.60 Oct
	Filter 3 Q (Q)						2.87 Q				2.39 Q		2.39 Q
	Filter 3 Slope (dB/Oct)												
	Filter 4 Type										PEQ		PEQ
	Filter 4 Freq. (Hz)										1800 Hz		1800 Hz
	Filter 4 Gain (dB)										-2.8 dB		-3.4 dB
	Filter 4 BW (Oct)										0.20 Oct		0.20 Oct
	Filter 4 Q (Q)										7.21 Q		7.21 Q
	Filter 4 Slope (dB/Oct)												
	Filter 5 Type										PEQ		PEQ
	Filter 5 Freq. (Hz)										2460 Hz		2550 Hz
	Filter 5 Gain (dB)										-4.6 dB		-4.0 dB
	Filter 5 BW (Oct)										0.20 Oct		0.20 Oct
	Filter 5 Q (Q)										7.21 Q		7.21 Q
	Filter 5 Slope (dB/Oct)												
	Filter 6 Type												
	Filter 6 Freq. (Hz)												
	Filter 6 Gain (dB)												
	Filter 6 BW (Oct)												
	Filter 6 Q (Q)												
	Filter 6 Slope (dB/Oct)												
Limiter	Limiter Thresh (dBu)					+2.0 dBu	+2.0 dBu			+2.0 dBu	+1.0 dBu	+2.0 dBu	+1.0 dBu
	Amp Out @ Thresh (Vrms)					87.2 V	87.2 V			87.2 V	77.7 V	87.2 V	77.7 V
	Limiter Attack (mS)					Fast	Fast			Fast	Fast	Fast	Fast
	Limiter Release (mS)					Slow	Slow			Med	Fast	Med	Fast

Table of Parameters for XTA DP226

Assign	Enclosure	Xvls/Xvlt	Xfil	Xsub		Xsub	Xxxx	Xfil	Xfil	Xvlt	Xvlt	Xvls	Xvls
	Frequency Band	Input	Input	Input		SUB			LF	MB	HF	MB	HF
	Connector	A	B	C	D	1	2	3	4	5	6	7	8
Main	Input Routing					C	A	B	B	A	A	A	A
	Digital Gain (dB)	+0.0 dB	+0.0 dB	+0.0 dB		+1.5 dB	+0.0 dB			+0.0 dB	+0.0 dB	+0.0 dB	+0.0 dB
	Signal Delay (mSec)	5.000 mS	5.000 mS	0.000 mS		0.000 mS	0.198 mS			0.388 mS	0.477 mS	0.000 mS	0.323 mS
	Polarity (Norm/Inv)					Norm	Norm			Norm	Norm	Norm	Norm
Crossover	HP Frequency (Hz)					32.4 Hz	50.6 Hz			223 Hz	1240 Hz	223 Hz	1240 Hz
	HP Resp (Type,dB/Oct)					But24	But24			LR24	LR24	LR24	LR24
	HP Q (-) or Boost (dB)												
	LP Frequency (Hz)					80.3 Hz	223 Hz			1240 Hz	16000 Hz	1240 Hz	16000 Hz
	LP Resp (Type,dB/Oct)					LR24	LR24			LR24	But24	LR24	But24
	LP Q (-) or Boost (dB)												
EQ Filter Block (PEQ filter width specified in both Bandwidth and Q)	Filter 1 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 1 Freq. (Hz)					45.1 Hz	50.6 Hz			583 Hz	1120 Hz	551 Hz	1100 Hz
	Filter 1 Gain (dB)					+3.0 dB	+1.5 dB			-5.9 dB	-13.0 dB	-6.6 dB	-15.2 dB
	Filter 1 BW (Oct)					0.50 Oct	0.63 Oct			0.75 Oct	1.33 Oct	0.67 Oct	1.19 Oct
	Filter 1 Q (Q)					2.87 Q	2.27 Q			1.90 Q	1.04 Q	2.14 Q	1.18 Q
	Filter 1 Slope (dB/Oct)												
	Filter 2 Type					PEQ	PEQ			PEQ	PEQ	PEQ	PEQ
	Filter 2 Freq. (Hz)					303 Hz	154 Hz			1390 Hz	3850 Hz	926 Hz	3560 Hz
	Filter 2 Gain (dB)					-4.0 dB	-2.5 dB			-4.3 dB	-3.3 dB	-6.3 dB	-2.1 dB
	Filter 2 BW (Oct)					1.00 Oct	0.50 Oct			0.79 Oct	1.00 Oct	0.67 Oct	2.00 Oct
	Filter 2 Q (Q)					1.41 Q	2.87 Q			1.79 Q	1.41 Q	2.14 Q	0.67 Q
	Filter 2 Slope (dB/Oct)												
	Filter 3 Type						PEQ				PEQ		PEQ
	Filter 3 Freq. (Hz)						572 Hz				15700 Hz		15400 Hz
	Filter 3 Gain (dB)						-9.0 dB				+10.6 dB		+11.0 dB
	Filter 3 BW (Oct)						0.33 Oct				0.47 Oct		0.47 Oct
	Filter 3 Q (Q)						4.31 Q				3.04 Q		3.04 Q
	Filter 3 Slope (dB/Oct)												
	Filter 4 Type										PEQ		PEQ
	Filter 4 Freq. (Hz)										1780 Hz		1820 Hz
	Filter 4 Gain (dB)										-3.0 dB		-3.4 dB
	Filter 4 BW (Oct)										0.21 Oct		0.20 Oct
	Filter 4 Q (Q)										6.86 Q		7.27 Q
	Filter 4 Slope (dB/Oct)												
	Filter 5 Type										PEQ		PEQ
	Filter 5 Freq. (Hz)										2470 Hz		2570 Hz
	Filter 5 Gain (dB)										-4.5 dB		-3.8 dB
	Filter 5 BW (Oct)										0.19 Oct		0.17 Oct
	Filter 5 Q (Q)										7.70 Q		8.64 Q
	Filter 5 Slope (dB/Oct)												
	Filter 6 Type												
	Filter 6 Freq. (Hz)												
	Filter 6 Gain (dB)												
	Filter 6 BW (Oct)												
	Filter 6 Q (Q)												
	Filter 6 Slope (dB/Oct)												
Limiter	Limiter Thresh (dBu)					+2.0 dBu	+2.0 dBu			+2.0 dBu	+1.0 dBu	+2.0 dBu	+1.0 dBu
	Amp Out @ Thresh (Vrms)					87.2 V	87.2 V			87.2 V	77.7 V	87.2 V	77.7 V
	Limiter Attack (mSec)					0.30 mS	0.30 mS			0.30 mS	0.30 mS	0.30 mS	0.30 mS
	Limiter Release (x Attack)					32x	32x			16x	4x	16x	4x

6 Specifications

Xvls (Full-Range)

Speaker Description

Part Number	301034-000
LF Section and Components	Two EVX-155 Plate 15-inch woofers in a vented box enclosure
MB Section and Components	Two ND08 8-inch neodymium 8-inch midbass drivers on a 90-degree horn
HF Section and Components	Three ND6 3-inch-diameter titanium diaphragm compression drivers on a 90-degree horn
System Configuration	Three-way full-range
Powering Configuration	Triamp only
Recommended Active High-Pass Frequency (12-dB/octave minimum)	50 Hz
Recommended Active Crossover Frequencies (24-dB/octave typical)	220/1000 Hz
Cabinet Type (shape)	Rectangular
Enclosure Materials	13-ply birch plywood with structural aluminum reinforcement
Finish	Black textured epoxy paint
Connectors	Two Neutrik Speakon ® NL8 8-pin connectors
Suspension Hardware	Proprietary hinge hardware at rear, proprietary track hardware at front
Grille	14 GA steel with foam backing
Options	
Accessories	Xvhl rear linking hinge, two per box (two included) Xvsl front linking chain, two per box (two included) Xvhg rear grid hinge, two per column Xvsg front grid chain, two per column Xvhp rear pickup hinge, two per box Xvsp front pickup chain, two per box X-Line grid (from ATM Flyware) Bottom dolly to stack four boxes high (from R&R Cases) Front dolly to go on front of individual box (from R&R Cases)

XvIs (continued)

Speaker Characteristics

Frequency Response	
+/–3 dB	50–15000 Hz
–10 dB	40–16000 Hz
Axial Sensitivity	
SPL, 1 Watt @ 1m, LF	101 dB
SPL, 1 Watt @ 1m, MB	105 dB
SPL, 1 Watt @ 1m, HF	111 dB
Impedance	
Sections (LF/MB/HF)	Two 8.0/8.0/5.3 Ohms
Power Handling	
LF	
Long-Term EIA	1200 Watts
Short-term peak	4800 Watts
MB	
Long-Term EIA	600 Watts
Short-term peak	2400 Watts
HF	
Long-Term AES	225 Watts
Short-term peak	900 Watts
Calculated Maximum SPL Output	
LF	
Long-Term	132 dB
Peak	138 dB
MB	
Long-Term	133 dB
Peak	139 dB
HF	
Long-Term	135 dB
Peak	141 dB
Nominal Coverage Angle	
Horizontal (–6 dB)	90 degrees
Vertical (–6 dB)	5 degrees
Dimensions	
Height at front	19.46 inches/494.3 mm
Height at back	19.46 inches/494.3 mm
Width	49.00 inches/1244.6 mm
Depth	29.15 inches/740.4 mm
Trapezoid Angle	0 degrees per side
Weights	
Net Weight	257 lbs/117 kg
Shipping Weight	269 lbs/122 kg

Xvlt (Full-Range)

Speaker Description

Part Number	301035-000
LF Section and Components	Two EVX-155 Plate 15-inch woofers in a vented box enclosure
MB Section and Components	Two ND08 8-inch neodymium 8-inch midbass drivers on a 90-degree horn
HF Section and Components	Three ND6 3-inch-diameter titanium diaphragm compression drivers on a 90-degree horn
System Configuration	3-way full-range
Powering Configuration	Triamp only
Recommended Active High-Pass Frequency (12-dB/octave minimum)	50 Hz
Recommended Active Crossover Frequencies (24-dB/octave typical)	220/1000 Hz
Cabinet Type (shape)	Vertically trapezoidal
Enclosure Materials	13-ply birch plywood with structural aluminum reinforcement
Finish	Black textured epoxy paint
Connectors	Two Neutrik Speakon® NL8 8-pin connectors
Suspension Hardware	Proprietary hinge hardware at rear, proprietary track hardware at front
Grille	14 GA steel with foam backing
Options	
Accessories	Xvhl rear linking hinge, two per box (two included)
	Xvsl front linking chain, two per box (two included)
	Xvhg rear grid hinge, two per column
	Xvsg front grid chain, two per column
	Xvhp rear pickup hinge, two per box
	Xvsp front pickup chain, two per box
	X-Line grid (from ATM Flyware)
	Bottom dolly to stack four boxes high (from R&R Cases)
	Front dolly to go on front of individual box (from R&R Cases)

Xvlt (continued)

Speaker Characteristics

Frequency Response	
+/–3 dB	50–15000 Hz
–10 dB	40–16000 Hz
Axial Sensitivity	
SPL, 1 Watt @ 1m, LF	101 dB
SPL, 1 Watt @ 1m, MB	105 dB
SPL, 1 Watt @ 1m, HF	111 dB
Impedance	
Sections (LF/MB/HF)	Two 8.0/8.0/5.3 Ohms
Power Handling	
LF	
Long-Term EIA	1200 Watts
Short-term peak	4800 Watts
MB	
Long-Term EIA	600 Watts
Short-term peak	2400 Watts
HF	
Long-Term AES	225 Watts
Short-term peak	900 Watts
Calculated Maximum SPL Output	
LF	
Long-Term	132 dB
Peak	138 dB
MB	
Long-Term	133 dB
Peak	139 dB
HF	
Long-Term	135 dB
Peak	141 dB
Nominal Coverage Angle	
Horizontal (–6 dB)	120 degrees
Vertical (–6 dB)	9 degrees
Dimensions	
Height at front	19.46 inches/494.3 mm
Height at back	16.92 inches/429.7 mm
Width	49.00 inches/1244.6 mm
Depth	29.15 inches/740.4 mm
Trapezoid Angle	2.5 degrees per side
Weights	
Net Weight	253 lb/115 kg
Shipping Weight	265 lb/120 kg

Xsub (Subwoofer)

Speaker Description

Part Number	301036-000
Components and Loading	Two EVX-180B 18-inch woofers in a vented-box enclosure
System Configuration	Subwoofer
Powering Configuration	Active subwoofer
Recommended Active High-Pass Frequency (12-dB/octave minimum)	33 Hz
Recommended Active Crossover Frequency (24-dB/octave typical)	80 Hz
Cabinet Type (shape)	Rectangular
Enclosure Materials	13-ply birch plywood with structural aluminum reinforcement
Finish	Black textured epoxy paint
Connectors	Two Neutrik Speakon® NL8 8-pin connectors
Suspension Hardware	Proprietary hinge hardware at rear,proprietary track hardware at front
Grille	14 GA steel with foam backing
Options	Non-flying
Accessories	Xvhl rear linking hinge, two per box (two included)
	Xvsl front linking chain, two per box (two included)
	Xvhg rear grid hinge, two per column
	Xvsg front grid chain, two per column
	Xvhp rear pickup hinge, two per box
	Xvsp front pickup chain, two per box
	X-Line grid (from ATM Flyware)
	Bottom dolly to stack four boxes high (from R&R Cases)
	Front dolly to go on front of individual box (from R&R Cases)

Xsub (continued)

Speaker Characteristics

Frequency Response	
+/–3 dB	40–400 Hz
–10 dB	35–500 Hz
Axial Sensitivity	
SPL, 1 Watt @ 1m, half-space	103 dB
SPL, 1 Watt @ 1m, full-space	100 dB
Impedance	Two 8 Ohms
Power Handling	
Long-Term EIA	1200 Watts
Short-Term peak	4800 Watts
Calculated Maximum SPL Output	
Half-space	
Long-Term	134 dB
Peak	140 dB
Full-space	
Long-Term	131 dB
Peak	137 dB
Nominal Coverage Angle	
Horizontal (–6 dB)	200 degrees
Vertical (–6 dB)	325 degrees
Dimensions	
Height at front	19.46 inches/494.3 mm
Height at back	19.46 inches/494.3 mm
Width	49.00 inches/1244.6 mm
Depth	29.15 inches/740.4 mm
Trapezoid Angle	0 degrees per side
Weights	
Net Weight	202 lbs/92 kg
Shipping Weight	214 lbs/97 kg