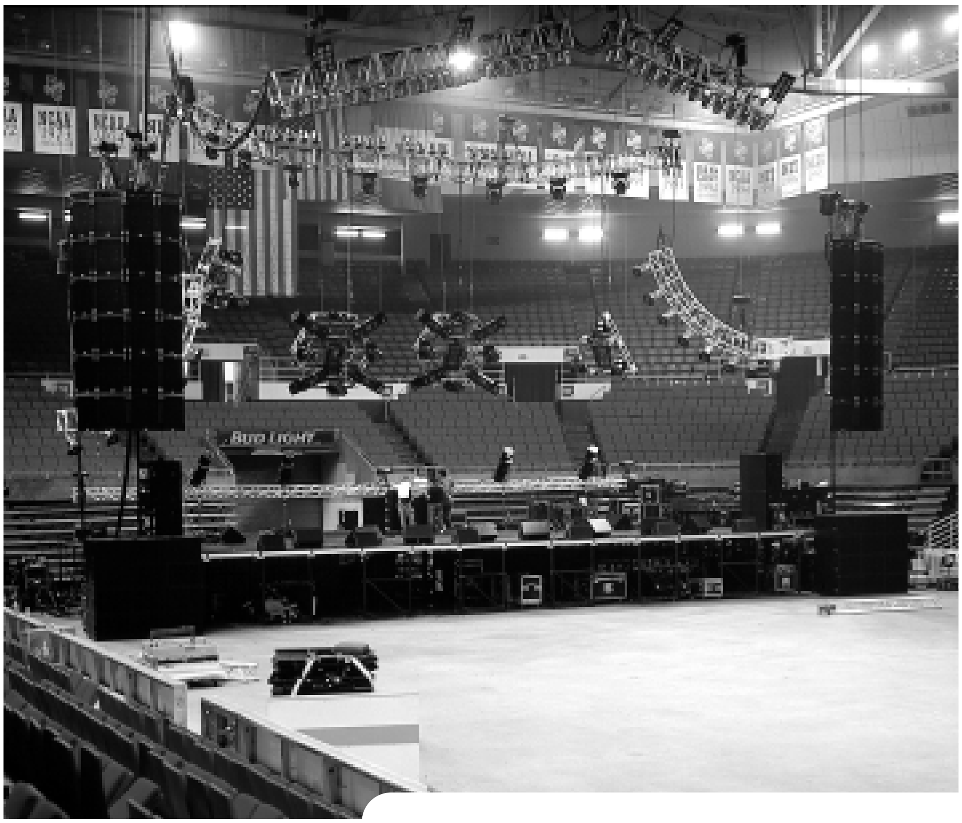
EAW's KF700 Series

Touring Usage Guide

The Laws of Physics | *The Art of Listening*

EASTERN ACOUSTIC WORKS


BUD LIGHT

EAW's KF700 Series

Touring Usage Guide

Since its inception, EAW has combined market feedback with top-level engineering to produce a range of utility-driven tools that address the needs of the touring sound market. Over the last few years, EAW Engineering has worked steadily to find techniques that allow typical users to create loudspeaker arrays that act as a single unit. Developing and integrating the various loudspeaker modules in the KF850, KF860 and KF900 Series has led us to new ways of looking at array building that provide even coverage throughout large venues.

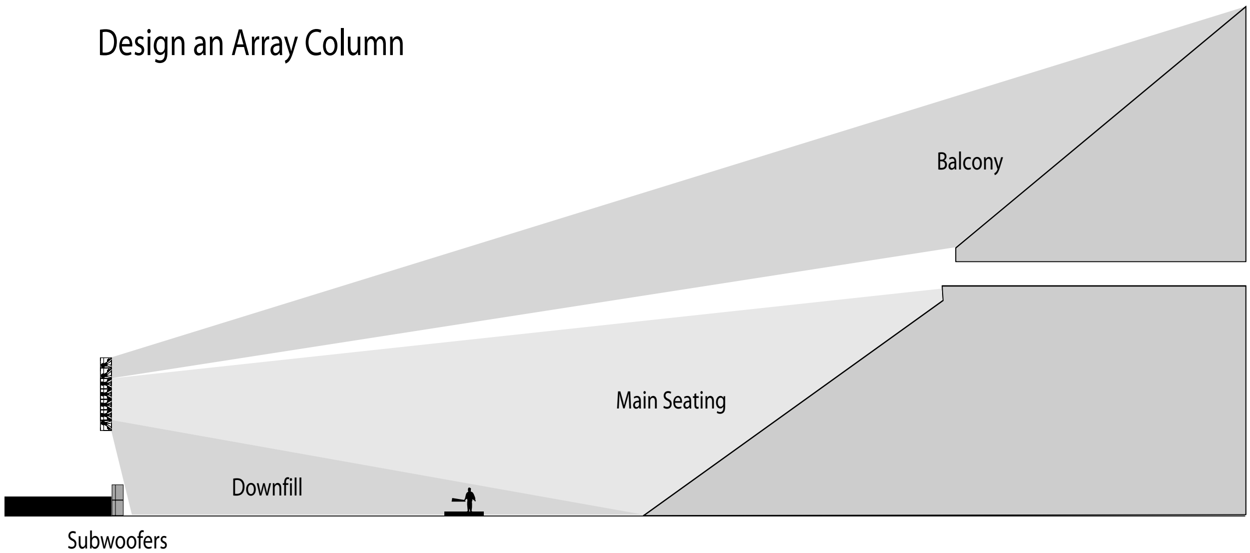
These years of R & D have resulted in the logical, step-by-step array-building process contained within this Guide. While we focus here on KF700 Series arrays, the basic approach applies to these other EAW array-oriented products.

I – The Five Basic Steps of Array Building

Venue sizes and styles vary dramatically. It is not uncommon for a concert tour to play a 1,000 seat club, a 3,000 seat theater and an 8,000 seat arena on successive nights. Creating the right array for each venue is vital to maintaining consistency and establishing a true continuum of success. Our experience has led us to develop a five step approach to designing the appropriate array for any venue.

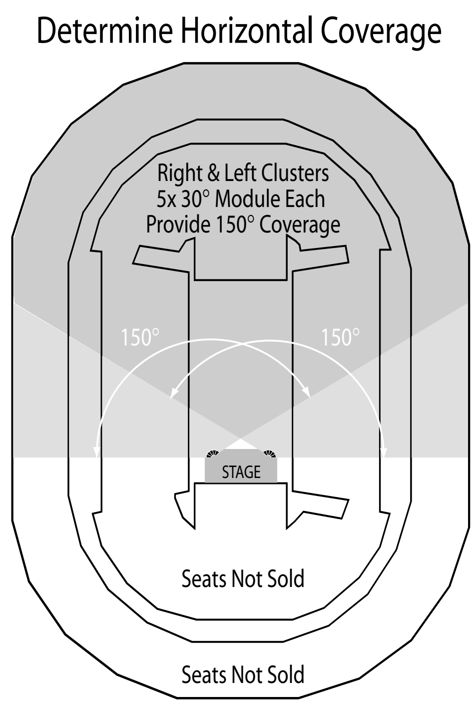
1 DESIGN ARRAY COLUMNS

Design a single array column that will address each vertical audience zone in a cross-section running from the stage through the center of the venue to the rear-most seat. Be sure to factor in the array trim height. To seamlessly cover each vertical zone (front, middle, rear, balcony, etc.) requires that the system engineer properly apply the various array modules in his/her arsenal including subwoofers. This is the primary key to delivering a uniform response to the entire venue.



2 DETERMINE HORIZONTAL COVERAGE

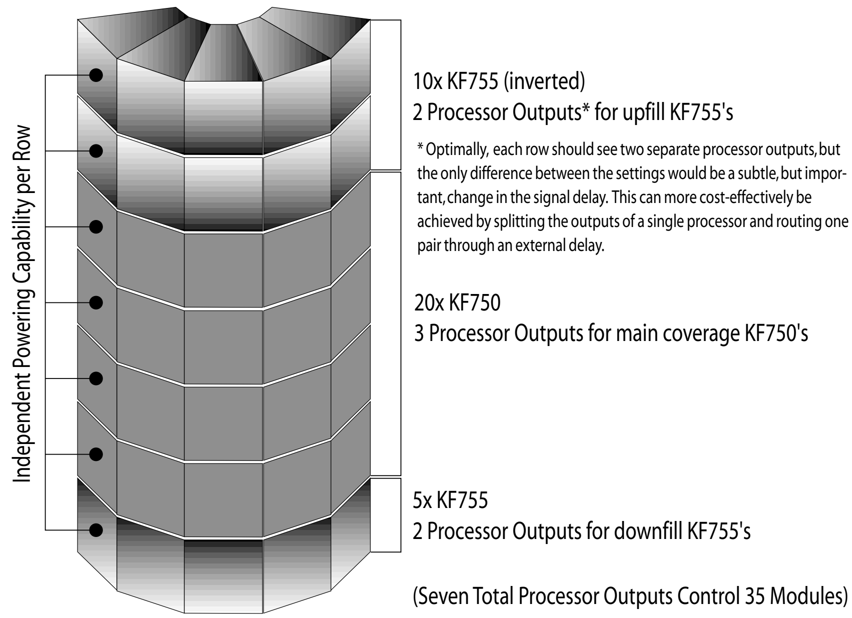
The horizontal coverage angle of any venue can be readily determined through inspection of its plan view. Once the horizontal coverage requirement has been determined, calculate the number of columns required to thoroughly address the entire venue based on each column's horizontal coverage pattern.



3 IMPLEMENT SIGNAL PROCESSING

Module-specific array processing, currently supported by most digital platforms, allows the user to address coverage of each vertical audience zone independently (i.e. separate settings for long throw, main coverage and downfill array modules). This usually does not require a separate processor channel for each row.

Powering and Processing for a Large KF700 Series Array



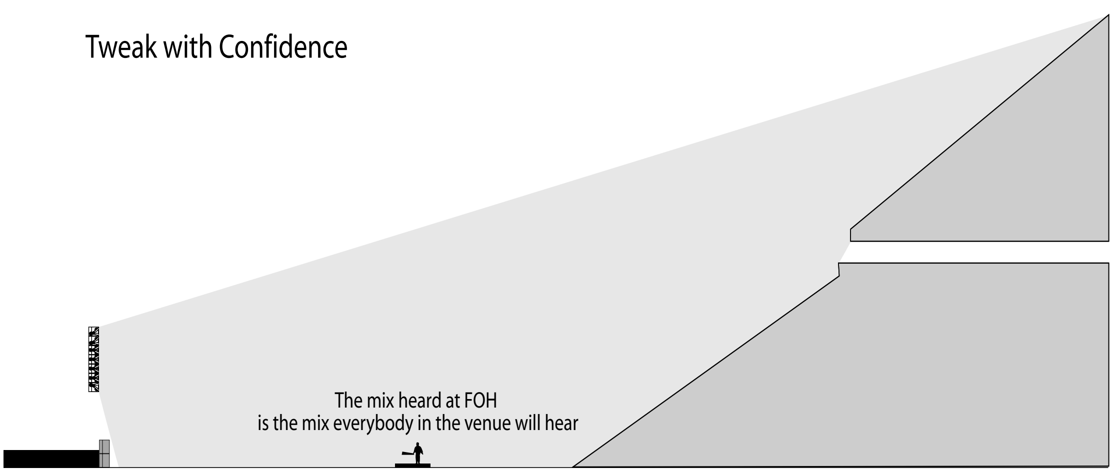
4 APPLY ARRAY SHADING (AS3D™)

AS3D array shading is a technique EAW Engineering developed to minimize destructive interaction between array modules and produce even coverage in three-space (three dimensions). AS3D requires that the array amplification be zoned in horizontal rows to permit implementation of subtle bandwidth and row dependent amplifier adjustments. Array shading has a dramatic impact on the consistency of tonality throughout the venue.

5 TWEAK

That is, adjust EQ to suit your taste. The first four steps of array building should provide the user with uniform coverage throughout the venue such that he can set EQ at the mix position with full confidence that each adjustment has the same impact throughout the venue.

Tweak with Confidence



II – KF700 Series Array Philosophy

Since we set out to develop the KF700 Series for ease of use, we insisted that arrays designed to cover any venue could be flown quickly, easily, and safely as a dead hung cluster. Such a system would save the user both time and money while providing his/her client with an acoustically consistent and aesthetically pleasing cluster.

To further enhance utility, the KF700 Series uses a multi-axial approach that creates compact modules that provide the high "Q" pattern control associated with much larger devices. Combined with the tightly packed, dead-hung nature of the cluster, this allows for maximum coupling of array elements, providing tremendous output capability through the low and mid frequency subsections of the array.

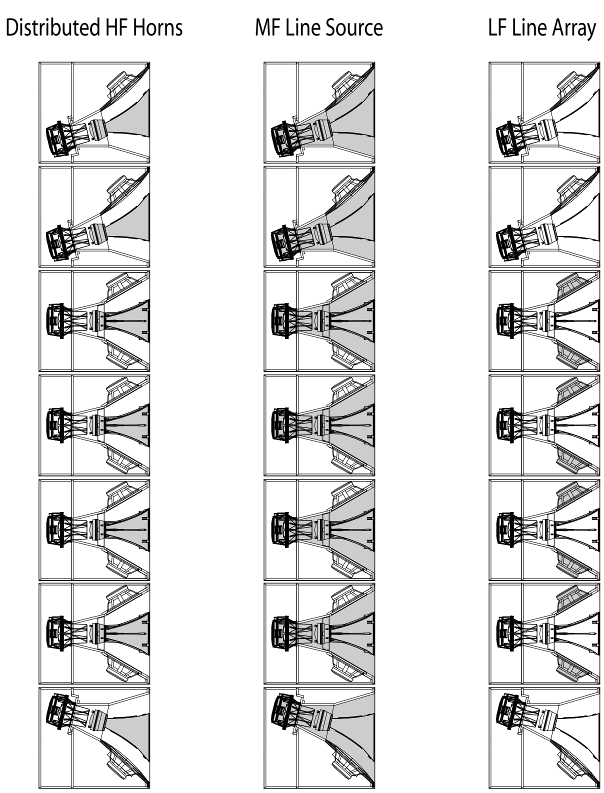
Finally, KF700 Series arrays will provide uniform coverage with relatively simplistic processing. We have developed AS3D array shading to enhance array control and coverage without requiring additional DSP units.

THE GOLDEN RULES

Both our experience and user feedback has led us to develop two Golden Rules for KF700 Series usage. Following these rules will not guarantee success. However, not following them will definitely compromise array performance.

1 Never let an audience member see a handle on a module in their primary cluster. (It is alright if someone seated house-right sees a handle on the house-left cluster). The KF700 Series loudspeakers provide a 30∞ horizontal pattern that drops off very rapidly outside of this nominal angle. Since the physical angle of the enclosure is also 30∞, if you can see the handle, you are out of the pattern. The difference in performance will be audible.

2 Provide separate processing for each row of KF755's. Using multiple rows of KF755's allows KF700 Series arrays to work in a number of challenging venues, but each row of KF755's must be processed independently in order to achieve proper integration. (N. B. This requires only two channels of output per row in large arrays in which the KF750's alone produce sufficient LF response.)



III – Building Arrays: Bandwidth by Bandwidth

The soon-to-be-released KF700 Series Owner's Manual provides information regarding the fundamental design attributes of the modules within the series. These systems are designed to exhibit predictable behavior when arrayed, but it is important to realize that array behavior is not the same as module behavior. In fact, when arrayed, the individual devices within a module combine with their counterparts in adjacent modules to achieve a different level of performance that must be addressed as a system. It is vital to understand the nature of this device cooperation in order to consistently build and ultimately tune these high performance clusters.

LOW FREQUENCY LINE ARRAYS

The low frequency components within an individual KF750 array module behave as a tuned dipolar array, but in a large format cluster the low frequency devices couple to behave as a line array (a column of closely spaced devices). These LF line arrays provide tremendous output along the primary axis of a dead hung cluster, and their coverage pattern mimics the contours of most venues. As a result, the LF subsection requires little adjustment except incremental level attenuation as additional modules are employed.

MID FREQUENCY LINE SOURCES

The mid frequency horn in a KF700 Series module occupies the full frontal dimensions of the enclosure. As a result, adjacent modules (including KF755's) couple to behave as a true line source that exhibits increased directivity with increased size, providing high levels of pattern control throughout the operating bandwidth. Projection of lower mid frequency information is also improved to the point that low/mid energy in the long throw may need to be attenuated to provide more spatial consistency.

The impulse response of a line source is most notably influenced by the edge events. That is, an impulse response measurement reveals two distinct upper mid frequency arrivals coming from the physical edges of the line source (i.e. the top of the top module and the bottom of the bottom module). Thus at an observation point beneath the cluster the first measured arrival comes from the lower line source edge while the second, noticeably later, arrival comes from the topmost edge. These multiple arrivals in turn produce comb filtering in the front rows of a typical venue which, fortunately, can be eliminated with appropriate AS3D array shading .

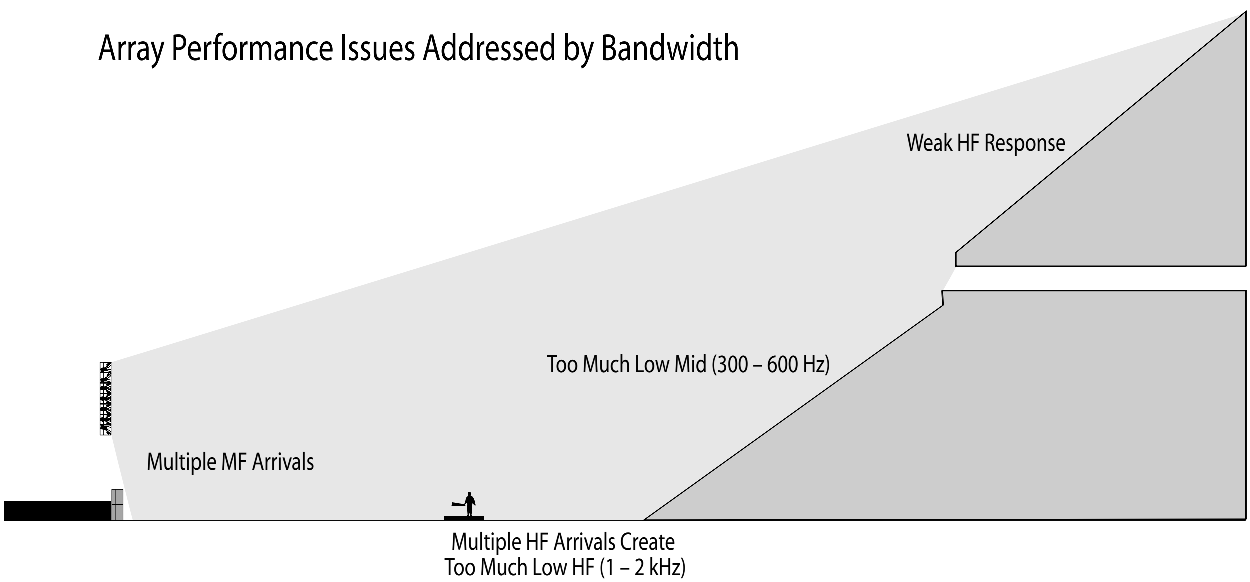
HIGH FREQUENCY DISTRIBUTED SOURCES

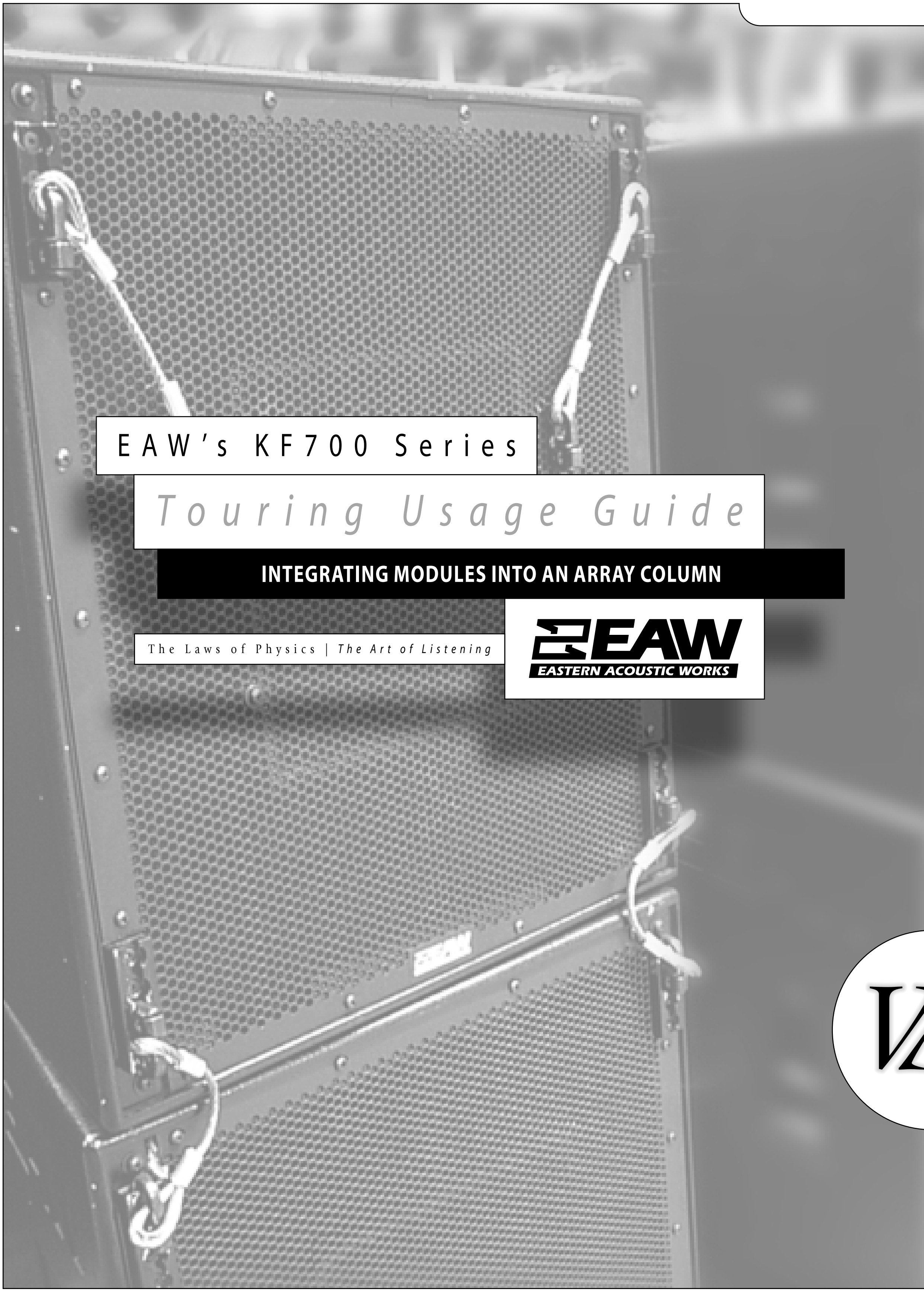
The high frequency horns in a KF700 Series array are not prone to coupling as they are physically separated and behave as distributed sources much like the behavior of KF850 arrays.

When using KF755's as down/front fill loudspeakers, the mix position is typically provided with high frequency output from the KF755's as well as multiple rows of KF750's. If the arrivals from the KF755's and the next row of KF750's are near one another in level, the bottom of the high frequency operating range becomes dominant at front-of-house position. However, implementing appropriate AS3D array shading will eliminate this build up of 1kHz to 2kHz energy at FOH.

In long throw applications, the air's absorption of HF energy significantly impacts response as the distance from the source increases. Techniques will be discussed later in this Guide that allow the user to address this specific issue.

Array Performance Issues Addressed by Bandwidth





EAW's KF700 Series

Touring Usage Guide

INTEGRATING MODULES INTO AN ARRAY COLUMN

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EASTERN ACOUSTIC WORKS

VA⁴

I – Using KF750's for Primary Coverage

As discussed in Section 1, array columns are created based on a venue's cross-section. Naturally, the overall depth of the venue will govern the number of KF750's in the column with larger venues requiring more KF750's per column. For basic guidelines on the quantity of KF750's required per column in specific venue types, see Section 4.

II – Using KF755's for Downfill Coverage

When clusters are flown, most venues require downfill in order to effectively cover the front of the audience. Since the KF755 uses an asymmetrical multi-axial design, it will provide downfill coverage from a deadhung array. Properly integrating KF755 downfill modules with appropriate processing and AS3D techniques will provide even coverage to the front of the venue without creating interference issues in the transition area between KF755 and KF750 coverage.

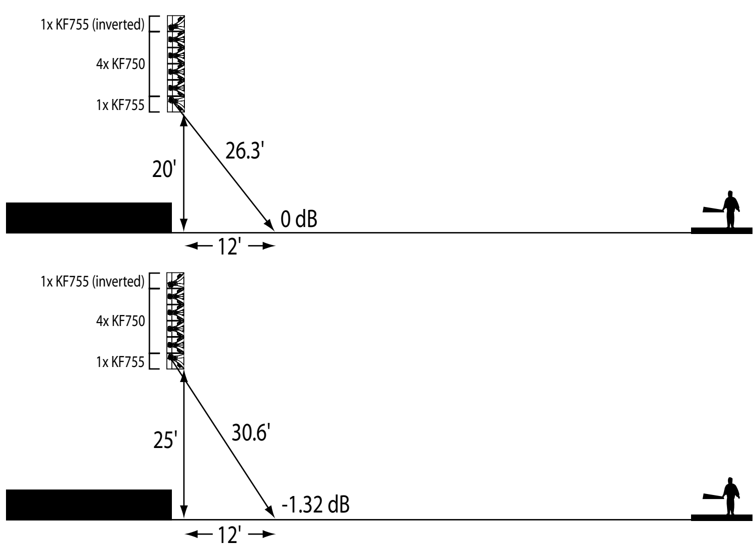
Dedicated downfill module processor settings* allow users to integrate KF755's into a KF750 cluster without modifying the KF750 processing. The unconventional settings that result will make a KF755 sound tonally unbalanced when listened to in the absence of a KF750 array above. This is entirely intentional and provides for tonally transparent transition from downfill coverage to the primary cluster.

IIa – Adjusting KF755 System Gain and System Delay

As the user moves from venue to venue, (s)he need adjust only two critical KF755 parameters: system gain and system delay, both of which vary with trim height and number of KF750's per column.

Default KF755 gains are set for given KF750 quantities in the standard array processing. This gain however, must be adjusted as trim height varies. If the cluster is flown higher than the default setting's assumptions, the KF755 gain must be increased to compensate for increased throw and vice versa.

Adding downfill gain to compensate for additional trim height



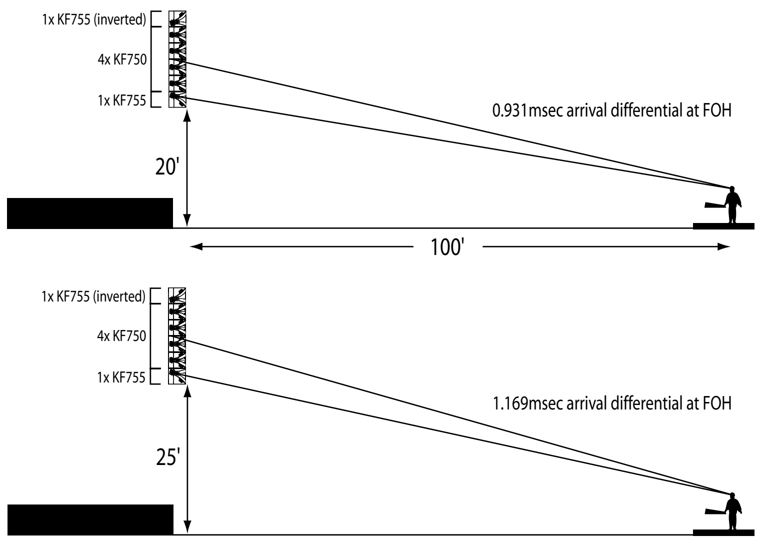
4.3' difference in throw results in 1.32 dB less output in the nearfield
Add 1.32 dB additional downfill gain to compensate for 5' increased trimheight

* *Processor settings will be released in text format as part of the Touring Usage Guide.*

Default processor settings delay the KF755's back to the acoustic origin of the KF750 column. As more KF750's are used per cluster, the apparent origin of the column moves upward and increased KF755 system delay is added with each row of KF750's.

Default processor settings apply system delay to KF755 downfill modules based upon assumed typical trim heights and FOH locations as described in Section 4. If FOH is atypically close, this delay should be increased. If FOH is atypically distant, the system delay should be reduced.

Adding downfill delay to compensate for additional trim height



1.169 msec - 0.931 msec = 0.238 msec
Therefore add 0.238msec of additional downfill delay to compensate for 5' of increased trim height

All default delay settings are configured to allow users to fine-tune delay at FOH. Downfill delay and gain can be simply adjusted and tuned by ear. Coherent summation is a very audible phenomenon. Acoustical analysis systems, such as SIA-SMAART, aid in the ability to fine tune these parameters. If FOH location and trim height are typical and appropriate processing is being utilized, then KF755 integration should be as simple as powering up.

III – Using SB750's

Virtually all pro audio applications require sub bass reinforcement and a ratio of at least one SB750 per every two KF700 array modules is the rule of thumb. The SB750 offers users the flexibility of stacking subwoofers on the ground or flying them with the array. Users can insert flown subs as rows above and/or below the main array, or in columns along the off-stage side of the main array. (Inserting flown subwoofers directly withing the main array is not recommended.) Each location has benefits and trade-offs. Most venues require a combination of locations for optimal performance. In all cases, the subwoofers must be timed for coherent arrival in order to achieve appropriate summation throughout a venue.

IIIa – Groundstacking SB750's

Many users will choose to use SB750's in a traditional groundstacked configuration. In addition to providing even sub bass coverage throughout a venue, this technique also provides maximum sub bass impact in the front rows, a quality many fans have come to expect in high-energy live music performances.

The SB750 has the same footprint as the other KF700 array modules, creating attractive clusters when all loudspeakers are groundstacked. It also features a stacking pad that keys into the enclosure above it, providing a safer groundstacked configuration. All groundstacked modules should also be connected with fly hardware. Sound system designers should note that an SB750 measures nearly 4-ft in height, so that most applications will only allow a two-high stack of subs on the deck.

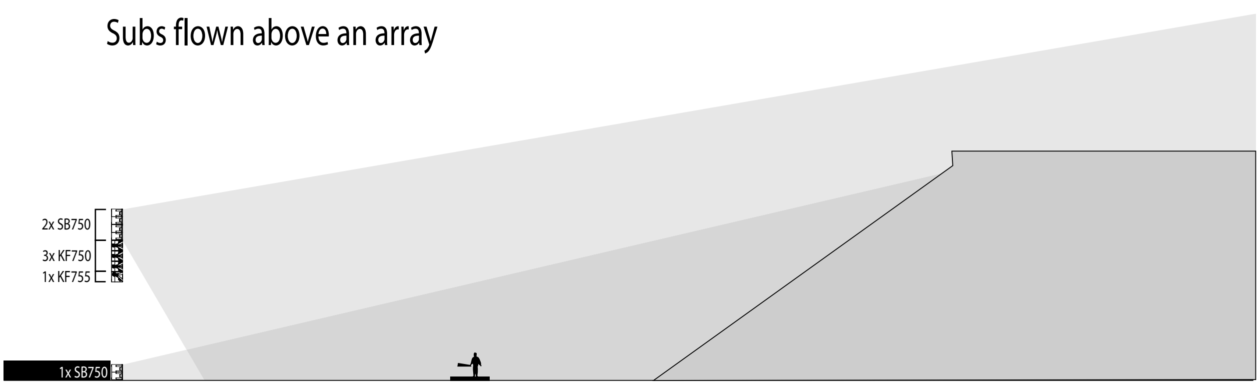
IIIb – Flying SB750's

Flying subwoofers, while unconventional, offers the designer a variety of advantages. Sightlines to performers are completely unobstructed providing a better experience to more concert-goers. But the greatest benefit of flying SB750's lies in the ability to create dipolar arrays† of subwoofer devices, providing vertical pattern control within the subwoofer pass band. This added control increases projection and apparent impact at great distances. Additional processing also allows for subwoofer beam steering.

Unlike conventional ground stacked subwoofers, flown subwoofers lose the increased output benefit provided by coupling to the floor. This loss of overall output could be a detriment if too few subwoofers are utilized with a given performer.

Since KF700 Series arrays are zoned in rows to allow for AS3D® implementation, flown SB750 modules are most effectively deployed in rows either above or below the array.

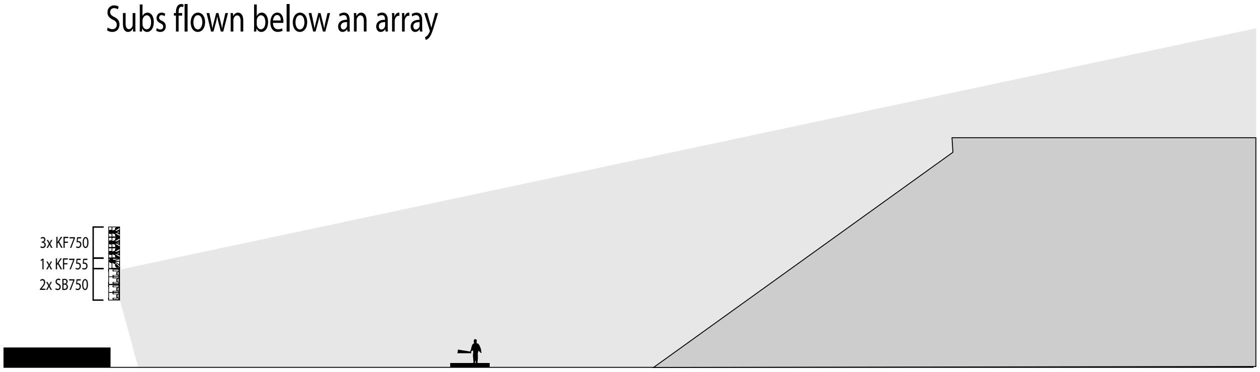
When multiple rows of SB750's are placed at the top of an array, they provide significant subwoofer projection and good overall vertical coverage but lack the near field impact associated with ground-stacked subwoofers. This configuration requires additional stacked subwoofers to provide the impact associated with near field seating, but the number of modules on the deck is greatly reduced.



† *For more information on Dipolar Array Technology, visit the Technology Section of EAW's website:*
www.eaw.com/pages/TechSupport/Technologies/NewConcepts/TDA.html

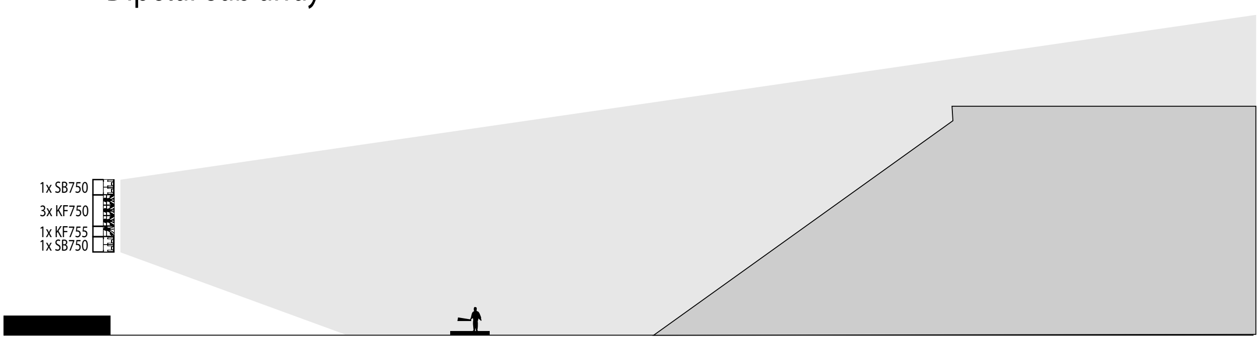
Multiple rows of SB750's can also be flown from the bottom of the array. These subwoofers provide both the coverage and impact associated with ground stacking with minimal sightline interference. However, flying the entire array out to the desired height for optimal front fill coverage may place the rows of SB750's too low for some venues and associated staging.

Subs flown below an array



Flying subwoofers at both the top and bottom of an array allows for the creation of a dipolar array, providing significant pattern control through the sub bass passband. A dipolar array results when direct radiating devices are spaced such that their center-to-center distance is equivalent to one half wavelength within the operating bandwidth.

Dipolar sub array

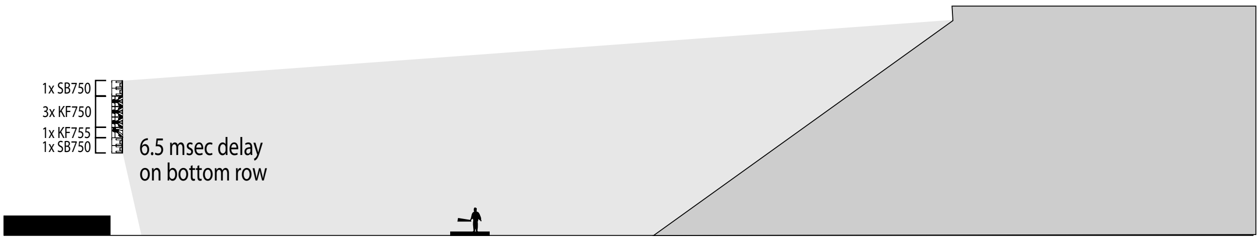


Sub frequencies have very long wavelengths. As a result, dipolar subwoofer arrays are not typically possible. However, by flying SB750's both at the top and the bottom of a KF700 Series array, dipolar array can be created, providing pattern control as low as 40Hz.

This configuration is not generally recommended when more than four rows of KF700 Series modules are being used in the full range array because the dipolar array grows too large and pattern control becomes excessive in the upper sub bass range with pronounced lobes above and below the cluster. This limits the ability to project sub frequency information upward to the far reaches of the venue, significantly reduces the subwoofer output in the front rows of the venue and reduces gain before feedback from mics onstage.

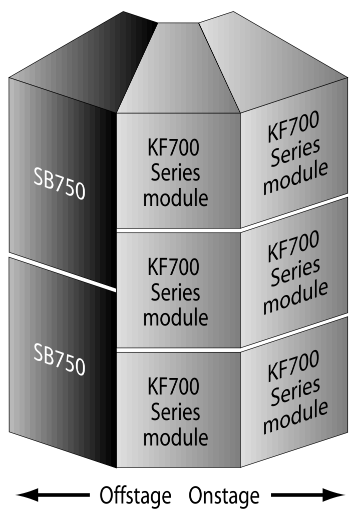
When SB750's are used above and below four rows of KF700 modules, the slight near field attenuation can be addressed by adding delay to the bottom rows of SB750, in essence steering the subwoofer lobe to the desired location. In a small to medium arena, 6.5msec of delay on the bottom row of SB750's forces the greatest subwoofer output to FOH while providing tremendous impact in the near field and still covering the back of the venue.

Dipolar sub array w/ beam steering



In some venues a column of flown subwoofers is appropriate. As stated previously, two-high flown subwoofer columns are the same height as three-high KF700 array module columns. These two-high subwoofer columns can be used in smaller venues and flown on the offstage side of the cluster, close to the venue wall. This configuration will provide similar performance to flown rows while once again maintaining clear sightlines. Again, SB750 columns should not be inserted between KF700 columns.

Flying subs as a column



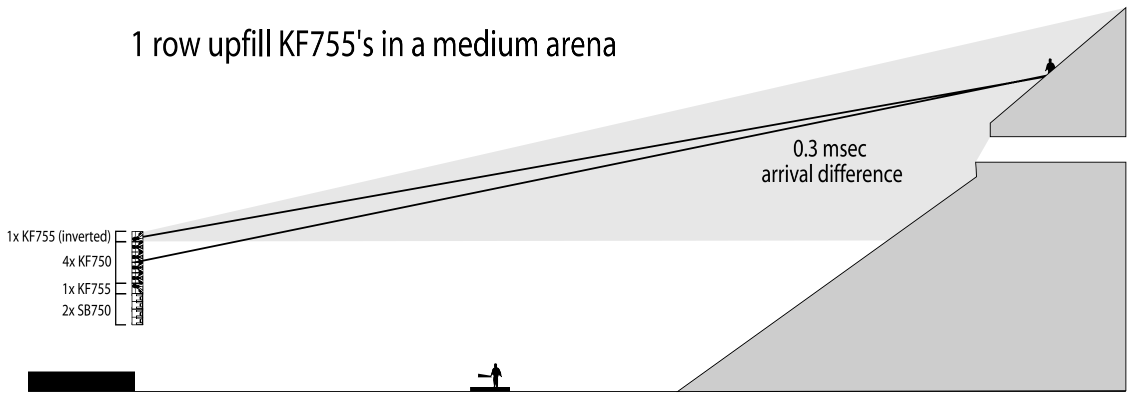
IV – Using KF755's for Upfill Coverage

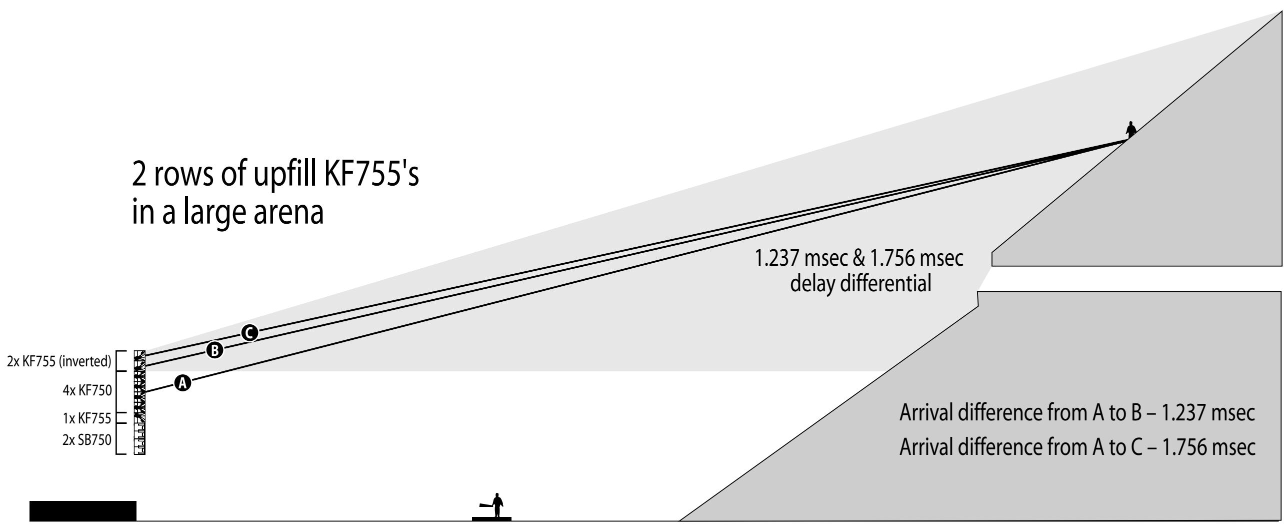
Many larger venues (medium and large arenas) require upfill in order to reach the farthest seating. This seating not only requires increased output to overcome inverse square loss relative to the cluster, but also requires significant high frequency emphasis in order to overcome the attenuation caused by air absorption. KF755's are designed such that when inverted and processed independently as long throw elements, they meet both criteria.

It should be noted that the KF755, though commonly thought of as a dedicated downfill module, is a very high Q device. It exhibits the same pattern control as a KF750, but utilizes asymmetrical horns to project this coverage at an angle relative to the front of the enclosure. Consequently, KF755's can readily double as long throw elements.

Much like the downfill processing, KF755 upfill processing allows for the integration of KF755's into a KF750 cluster without modifying the KF750 processing. Once again this results in some unconventional processing. The main KF750 array provides more than adequate LF information and projection to the upper seating, and the upfill merely provides the information that is missing. Therefore only two channels of processing are required for optimal upfill integration. In default upfill settings, the KF755 upfill modules are high passed at 350Hz and provided with high frequency equalization to counteract air absorption in typical venues.

In medium (13,000 seat) arenas, a single row of inverted KF755's is adequate to provide appropriate upfill projection. In larger arenas (18,000+), two inverted rows are more appropriate to provide upfill at 300 feet. In either case, the upfill modules must be delayed so as to sum with the energy from KF750 column.

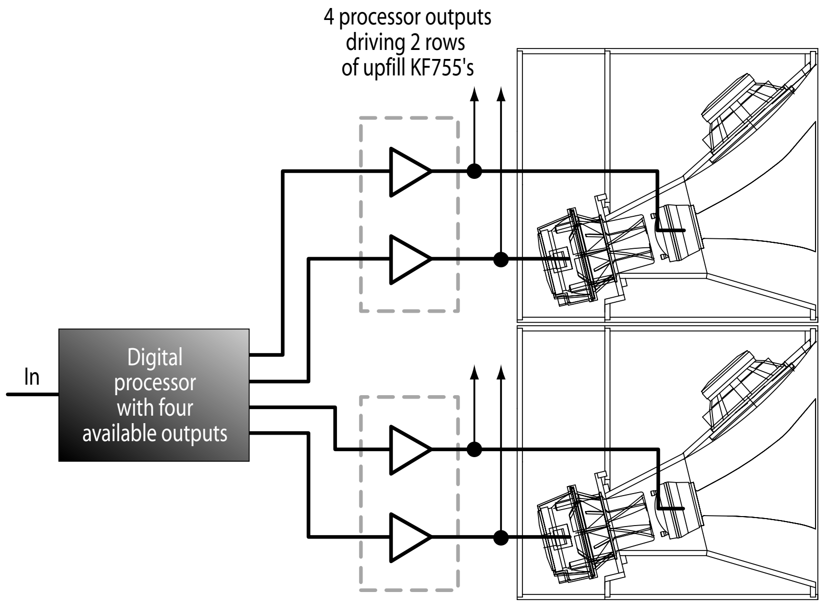


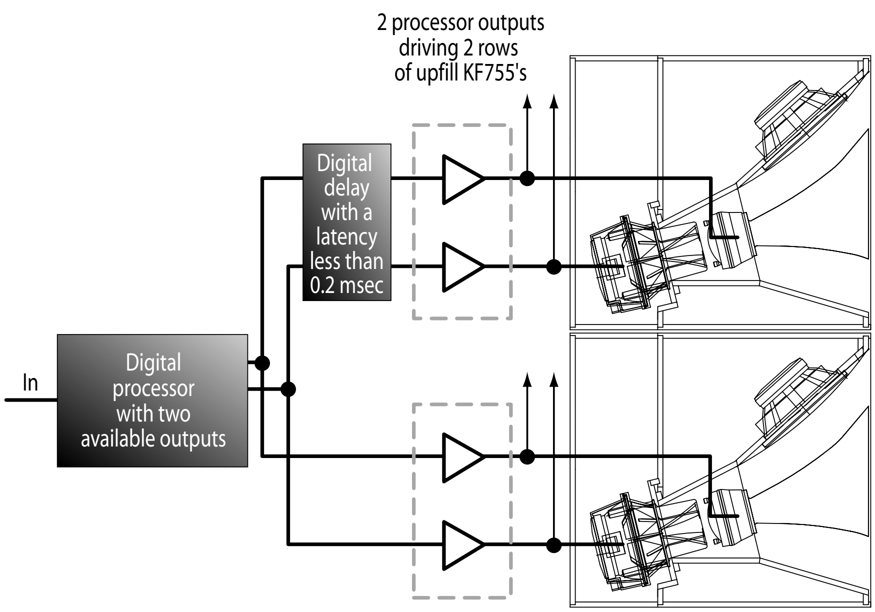


Default processor settings apply system delay to KF755 upfill modules based upon assumed typical balcony locations and throws as described in Section 4. Acoustical analysis systems, such as SIA-SMAART, aid in the ability to fine tune these parameters. If, however, balcony position and throw distances are typical and appropriate processing is being utilized, then KF755 upfill integration should be readily achieved through the use of default settings.

Each row of inverted KF755's requires two processing outputs with each row seeing different delay settings so as to sum coherently in the balcony. Thus two rows of inverted KF755's require four processing outputs. However, another approach eliminates two of the four.

The main upfill processing (crossovers, equalization, device delay) is the same for each upfill row. Only the system delay changes. As a result, two fully processed outputs can be used to tune the upfill. These outputs would then feed a delay line providing four outputs: two with more delay for the top row, and two with less for the second row. A delay unit must be carefully chosen such that the latency delay through the unit does not exceed the desired delay for the second row of upfill.

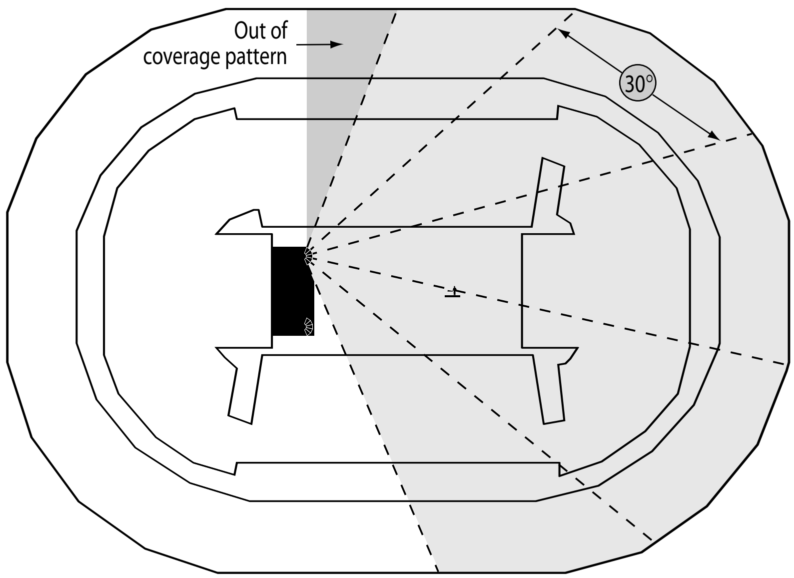




V – Determine Horizontal Coverage

This fundamental step is actually quite simple. With the KF700 Series, this coverage must be narrowed to the most appropriate multiple of 30° (90°, 120°, 150°, etc.). Dividing this required coverage by 30° yields the required number of array columns.

When determining horizontal coverage, it is important to remember the “visible handle” rule of thumb. Because the KF700 Series pattern edge exhibits dramatic attenuation, the clusters can be flown much closer to on-stage without the feedback problems associated with conventional arrays. This allows the mixer to take greater advantage of the KF700 Series stereo separation. It is possible to observe stereophonic information while seated directly in front of one of the primary clusters.



One side shown for illustration purposes

EAW's KF700 Series

Touring Usage Guide

AS3D™ (ARRAY SHADING IN THREE DIMENSIONS)

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INSTALLMENT 3: AS3D™ (ARRAY SHADING IN THREE DIMENSIONS)

1 – Overview

The primary goal of an arrayed loudspeaker system is consistency. The FOH engineer needs to know with confidence that the tonality present at the mix position is the same throughout the venue. With any array of devices, interactions are present that can create inconsistencies throughout a performance space. The KF700 Series was designed to minimize these effects, but also to isolate those that remain and develop simple tools that resolve these issues without the introduction of complex processing. As discussed in Part 2 of this guide, dedicated down fill, primary, and up fill processing are the first steps in this optimization. AS3D™ array shading is the next.

2 – Vertical Array Shading

The key to consistency of coverage when dead hanging KF700 Series product is zoning the array amplification in rows. This allows the user to adjust the gain for each row to optimize performance.

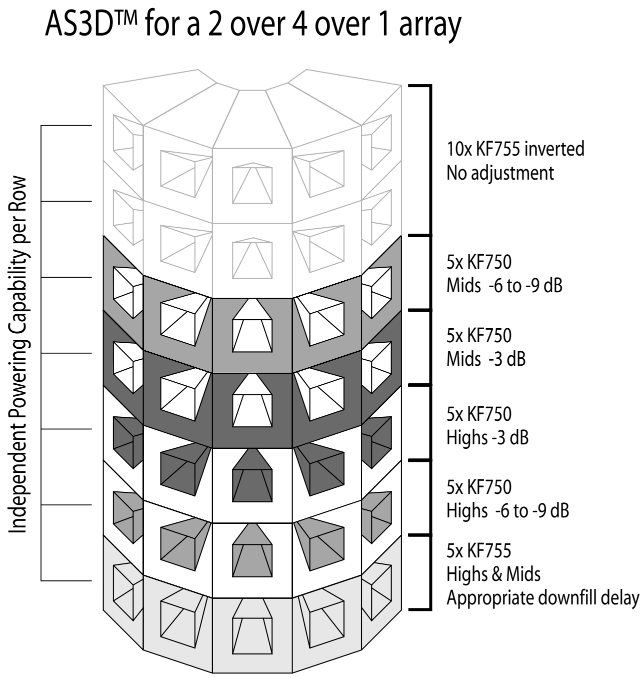

***Figure 1** shows the appropriate AS3D settings for maximizing coherence of this specific array which we use to illustrate the effectiveness of AS3D in the remainder of this section.*

Please note that the addition of upfill rows does not affect the primary and downfill response.

Except for the downfill delay,all these adjustments can be implemented by adjusting amplifiers that have been zoned by rows.

Vertical Array Shading in the Mid Frequencies

As discussed in Part 1, an array's mid frequency impulse response is governed by two distinct arrivals that are directly linked to the ends of the line source. If the array is short, these arrivals occur close together. In larger arrays, the arrivals are further apart.

These dual arrivals create problems in areas that lie off of the primary array axis (like the nearfield). In the far field the arrivals sum coherently. In either case, attenuating the mid frequency devices at the top of the cluster softens the second arrival, virtually eliminating any harmful interaction in the front of the venue. Depending on the size of the array, one or more rows of mid frequency devices will be turned down using simple amplifier adjustments, improving the consistency of mid frequency coverage.

This simple technique provides the added benefit of softening the projection of the dominant low/mid lobe. This spatial smoothing results from introducing asymmetry to the mid frequency line source drive signals. As a result, the shading adjustment tempers the low/mid output in the far field, providing extremely consistent mid-range coverage throughout any venue.

The dramatic impact of this array shading can be readily demonstrated by creating a model of array performance using EAW's Phased PointSource Technology optimization and modeling program, F-Chart*. These complex frequency response charts predict array performance at a variety of listening positions. For the sake of legibility, only three locations are shown (0°, -10°, -20°). These locations are illustrated in Figure 2.

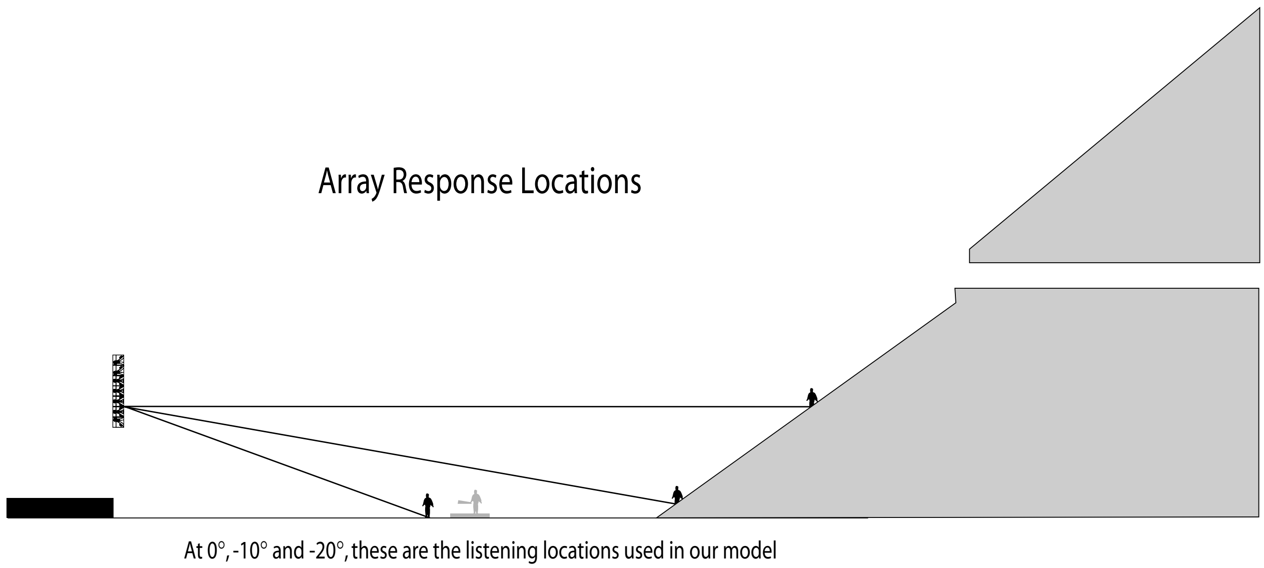

Figure 2

Please note that the data presented below are based on a computer model of how a line source behaves as described in such acoustical texts as Beranek and Olsen. Before building the full array model, EAW engineers created a preliminary model of a single KF750 midrange device and then performed extensive measurements of an actual KF750 to confirm the model's accuracy. Thus while these graphs do not represent actual array measurements, they are based on measured data.

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* *For more information of PPST, visit the following URL at our website:*
http://www.eaw.com/pages/TechSupport/Technologies/NewConcepts/PPST.html

AS3D™ array shading techniques and their effects on the mid frequency response of a 4 over 1 KF700 Series array

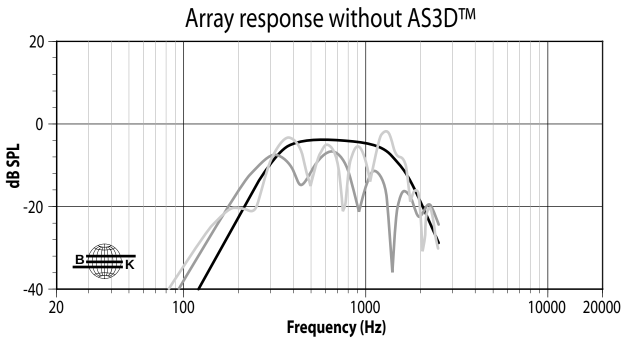


Figure 3

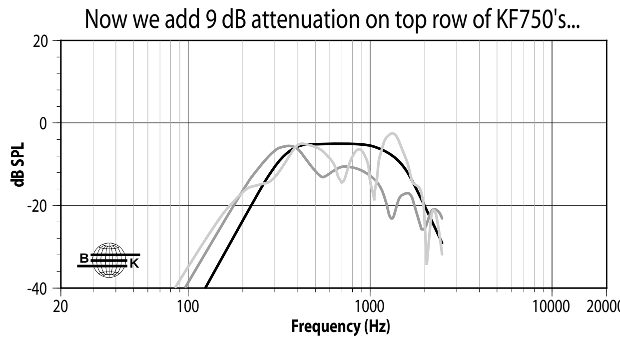


Figure 4

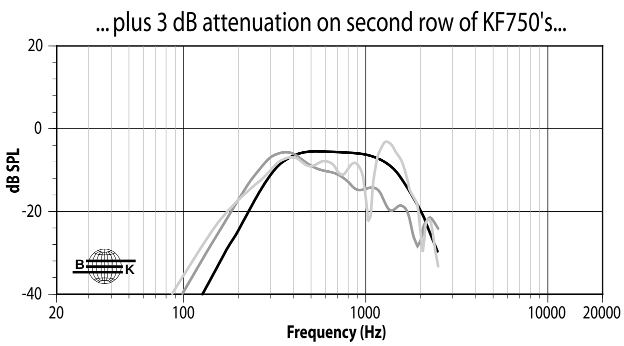


Figure 5

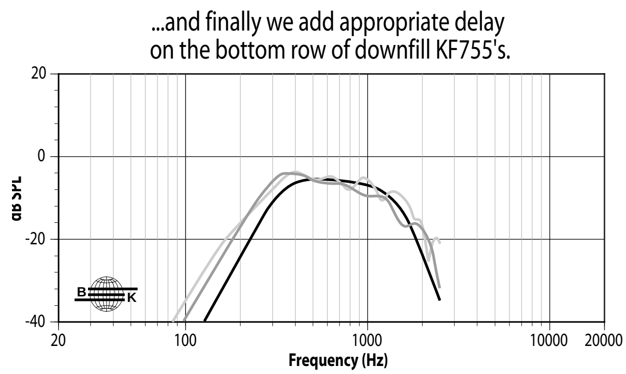


Figure 6

0 degrees — -10 degrees — -20 degrees

(in the vertical plane)

The first chart (Fig. 3), showing array performance with no processing or equalization, predicts significant comb filtering at most locations with the best summation at the far field. The next two charts (Figs. 4 and 5), show how performance improves when the top row of KF750's is attenuated 9 dB and the next row down is attenuated 3 dB. The final chart (Fig. 6), depicts final array performance when appropriate delay is added to the bottom row of downfill KF755's. Note that overall output decreases only marginally while overall performance improves dramatically.

Vertical Array Shading in the High Frequencies

The high frequency response at FOH is governed by both the KF755 and KF750 horn arrivals. For best performance, the KF755 must be allowed to dominate. By simply shading the KF750 high frequency devices in the row above the KF755's, the build up of energy between 1kHz and 2kHz is eliminated as demonstrated in Figure 7 below. Note that this response is generated by the same computer model referenced above.

By implementing these simple techniques, effective and extremely consistent array performance can be provided using the simple dead hung array. These subtle adjustments are also achieved without a requirement for additional processing. In fact, short of overall low frequency level adjustment, KF700 Series arrays can be utilized and optimized by making minor adjustments to a few amplifier channels night in and night out in varying venues.

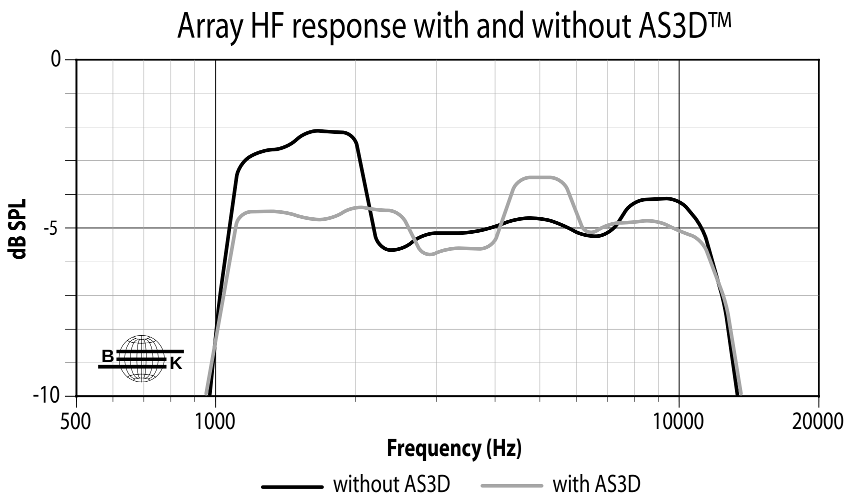


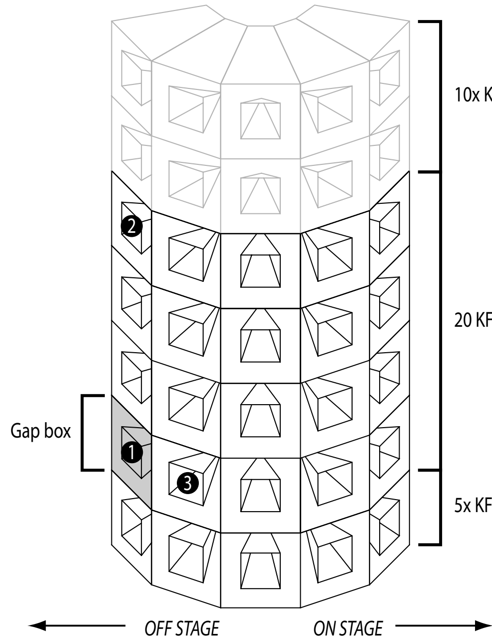
Figure 7

3 – Horizontal Array Shading

The only issue that remains is how to adjust level in the horizontal plane to account for throw distance differential when the array is zoned in rows. The answer is quite simple.

Many venues require no horizontal array shading as throw distances should be relatively consistent. However, in venues that are particularly long or particularly narrow, output levels on the short throw sides may become excessive. This can be addressed in two ways depending on the situation. Neither method requires additional processor adjustments.

Adjusting for excessive level in short throw sections



For excessive level in short throw areas of a venue, turn off the gap box (1) for some attenuation (1.5 dB in this case).
For greater attenuation, also turn off the top box (2).
For a wider area of attenuated coverage, also turn off the gap box in the next column (3)

Figure 8

The first approach is appropriate when an array is already hung and listening tests show short throw levels to be excessive. In this case, the user simply unplugs the KF750 that lies directly above the KF755 and points in the direction where decreased output is desired. We have dubbed this array module the gap box. Unplugging the gap box has little impact on the vertical performance of the individual array column; it merely decreases the output of the array in that direction of radiation.

When even greater output reduction is required a second level of horizontal tapering can be achieved by unplugging the top KF750 in the column that addresses the direction of interest. Eliminating both the gap box and the top box in an individual column not only reduces the output of the column even more, it also expands that column's vertical coverage to more adequately address the increased vertical angle associated with closer proximity to the array. In an extreme situation, increase the horizontal area of attenuated coverage by unplugging the gap box in the second column in.

The second, more complex approach works best when the designer knows beforehand, either through experience or calculation, that short throw levels in a particular venue will be excessive. In this case, amplification should be zoned such that the problematic column can be controlled as a unit with the rest of the array remaining zoned in rows as discussed above. This column can then be attenuated with far greater precision to suit the specific needs of the situation.

VA4

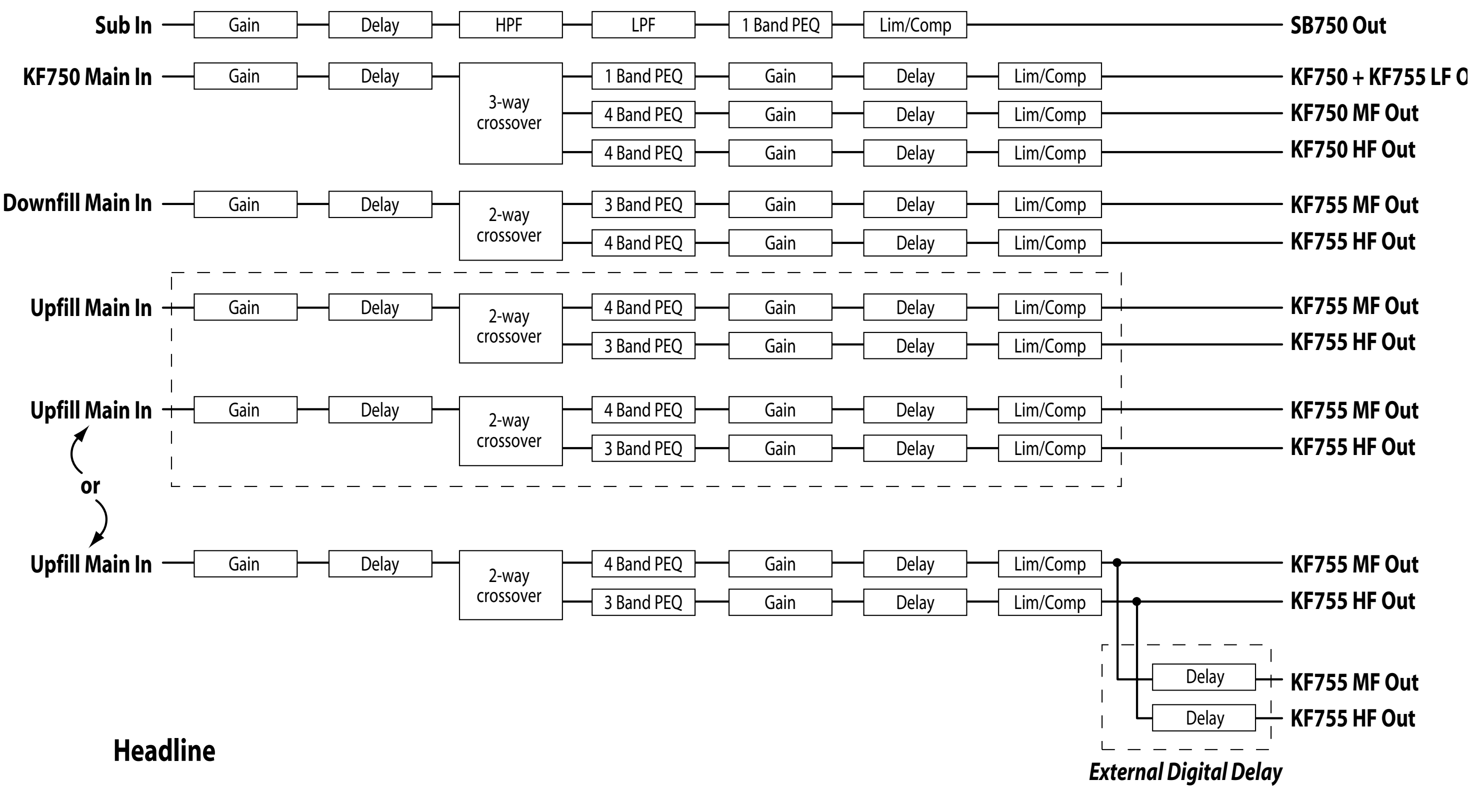
EAW's KF700 Series

Touring Usage Guide

DSP SETTINGS

The Laws of Physics | *The Art of Listening*

EAW EASTERN ACOUSTIC WORKS



Headline

Copy Single row of KF750's recommended for: small to medium nightclubs with no balcony
Use One-Over-One KF750 DSP Settings

1 KF750 over 1 KF755
KF750 DSP SETTINGS

Assumed Trim Height: 20 ft.
Assumed Distance to FOH: 50 ft.

INPUT

DELAY	0.000msec

LF

GAIN	+6.5dB				
DELAY	1.896msec				
HPF	40.9Hz	24dB Butterworth			
LPF	170Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	152Hz	-6.5dB	4.8	2.92	0.21

MF

GAIN	-1.5dB				
DELAY	0.000msec				
HPF	177Hz	24dB Link/Riley			
LPF	1k39Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	1k19Hz	+4.5dB	1.1	1.54	0.91
EQ2	520Hz	-4.5dB	4.8	3.30	0.21
EQ3	1k00Hz	-4.5dB	5.7	3.92	0.18
EQ4	218Hz	-1.0dB	2.0	1.41	0.50

HF

GAIN	+0.0dB				
DELAY	1.102msec				
HPF	1k47Hz	24dB Link/Riley			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	10k7Hz	+12.5dB	3.0	3.28	0.48
EQ2	2k62Hz	-6.0dB	1.8	1.23	0.56
EQ3	6k73Hz	-3.0dB	6.0	4.17	0.17

KF755 DSP SETTINGS

LF (take signal from KF750 LF)

INPUT

DELAY	0.514msec
GAIN	-6.0dB

MF

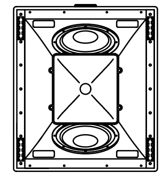
GAIN	-3.5dB				
DELAY	0.000msec				
HPF	354Hz	24dB Link/Riley			
LPF	1k14Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	500Hz	-8.5dB	2.2	0.99	0.52
EQ2	874Hz	-5.5dB	10	6.84	0.10
EQ3	1k26Hz	-3.5dB	3.6	2.49	0.28

HF

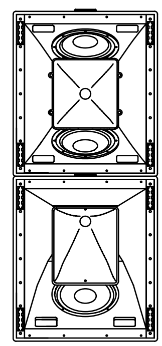
GAIN	-2.0dB				
DELAY	1.102msec				
HPF	1k68Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	11k3Hz	+9.0dB	2.1	2.41	0.57
EQ2	5k99Hz	-7.0dB	9.0	5.10	0.12
EQ3	2k33Hz	-9.5dB	1.8	0.69	0.68
EQ4	3k92Hz	-6.0dB	5.0	3.41	0.20

Single row of KF750's recommended for:
> small to medium nightclubs with no balcony

Use One-Over-One KF750 DSP Settings



One-Over-One Configuration recommended for:
theaters and performing arts centers where arrays may be flown



Downfill delay for this configuration is based on the trim height and distance to FOH listed above. For more information on adjusting gain and delay to account for different venue geometries, see Section 2 of this Guide.

***** *Q, Bandwith and USP-2Q all define the width of the EQ curve. Different DSP units use different nomenclature to define this parameter. If you are unsure which to use, contact the DSP manufacturer.*

2 KF750 over 1 KF755
KF750 DSP SETTINGS

Assumed Trim Height: 20 ft.
Assumed Distance to FOH: 60 ft.

INPUT

DELAY	0.000msec

LF

GAIN	+2.5dB				
DELAY	1.896msec				
HPF	40.9Hz	24dB Butterworth			
LPF	170Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	152Hz	-6.5dB	4.8	2.92	0.21

MF

GAIN	-0.5dB				
DELAY	0.000msec				
HPF	177Hz	24dB Link/Riley			
LPF	1k62Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	1k19Hz	+4.5dB	1.1	1.54	0.91
EQ2	520Hz	-4.5dB	4.8	3.30	0.21
EQ3	1k00Hz	-4.5dB	4.2	2.89	0.24

HF

GAIN	+0.0dB				
DELAY	1.102msec				
HPF	1k68Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	10k7Hz	+12.5dB	3.0	3.28	0.48
EQ2	2k57Hz	-6.0dB	2.0	1.36	0.50
EQ3	6k73Hz	-3.0dB	6.0	4.17	0.17

KF755 DSP SETTINGS

LF (take signal from KF750 LF)

INPUT

DELAY	0.712msec
GAIN	-6.0dB

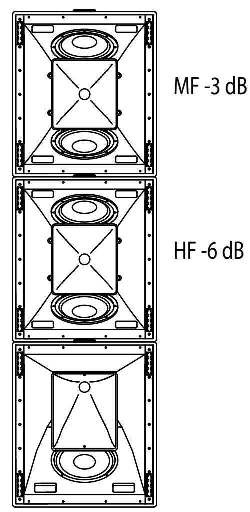
MF

GAIN	-3.5dB				
DELAY	0.000msec				
HPF	354Hz	24dB Link/Riley			
LPF	1k47Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	490Hz	-8.0dB	2.1	1.02	0.53
EQ2	874Hz	-5.5dB	10	6.84	0.10
EQ3	1k26Hz	-3.5dB	3.6	2.49	0.28

HF

GAIN	-2.0dB				
DELAY	1.102msec				
HPF	1k96Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	11k3Hz	+9.0dB	1.8	2.07	0.66
EQ2	5k99Hz	-8.0dB	9.0	4.38	0.12
EQ3	2k33Hz	-10.5	1.8	0.58	0.72
EQ4	3k92Hz	-6.0dB	5.0	3.41	0.20

Two-Over-One Configuration recommended for:
> large theaters and performing arts centers where arrays may be flown



Downfill delay for this configuration is based on the trim height and distance to FOH listed above. For more information on adjusting gain and delay to account for different venue geometries, see Section 2 of this Guide.

***** *Q, Bandwith and USP-2Q all define the width of the EQ curve. Different DSP units use different nomenclature to define this parameter. If you are unsure which to use, contact the DSP manufacturer.*

3
1

3 KF750 over 1 KF755
KF750 DSP SETTINGS

Assumed Trim Height: 20 ft.
Assumed Distance to FOH: 80 ft.

INPUT

DELAY	0.000msec				

LF

GAIN	+1.5dB				
DELAY	1.896msec				
HPF	40.9Hz	24dB Butterworth			
LPF	170Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	152Hz	-6.5dB	4.8	2.92	0.21

MF

GAIN	-1.5dB				
DELAY	0.000msec				
HPF	173Hz	24dB Link/Riley			
LPF	1k62Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	1k17Hz	+4.0dB	1.1	1.54	0.91
EQ2	520Hz	-4.0dB	4.8	3.32	0.21

HF

GAIN	+0.0dB				
DELAY	1.102msec				
HPF	1k75Hz	24dB Link/Riley			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	10k7Hz	+12.5dB	3.0	3.28	0.48
EQ2	2k77Hz	-7.0dB	2.1	1.19	0.50
EQ3	6k73Hz	-5.0dB	6.0	4.12	0.17
EQ4	5k14Hz	+1.5dB	4.2	5.95	0.24

KF755 DSP SETTINGS

LF (LF is muted)

INPUT

DELAY	0.859msec				
GAIN	0.0dB				

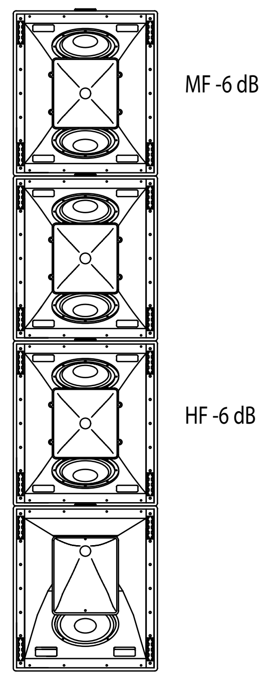
MF

GAIN	-3.5dB				
DELAY	0.000msec				
HPF	354Hz	24dB Link/Riley			
LPF	1k47Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	490Hz	-8.0dB	2.1	1.02	0.53
EQ2	874Hz	-5.5dB	10	6.84	0.10
EQ3	1k26Hz	-3.5dB	3.6	2.49	0.28

HF

GAIN	-2.0dB				
DELAY	1.102msec				
HPF	1k96Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	11k3Hz	+9.0dB	1.7	1.95	0.70
EQ2	5k99Hz	-8.0dB	12	5.84	0.09
EQ3	2k33Hz	-11.0dB	1.8	0.54	0.74
EQ4	3k92Hz	-6.0dB	5.0	3.41	0.20

Three-Over-One Configuration recommended for:
> pavilion (shed)
> small to medium arena (one row of upfill KF755's may also be required)



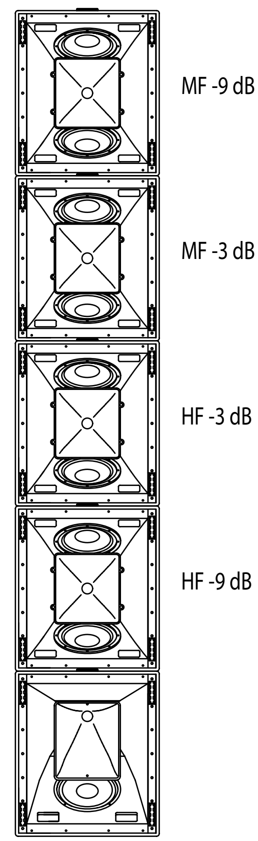
Downfill delay for this configuration is based on the trim height and distance to FOH listed above. For more information on adjusting gain and delay to account for different venue geometries, see Section 2 of this Guide.

***** *Q, Bandwith and USP-2Q all define the width of the EQ curve. Different DSP units use different nomenclature to define this parameter. If you are unsure which to use, contact the DSP manufacturer.*

4 KF750 over 1 KF755
KF750 DSP SETTINGS

Assumed Trim Height: 20 ft.
Assumed Distance to FOH: 100 ft.

Four-Over-One Configuration recommended for:
- > large pavilion
- > large arena (one or two rows of upfill KF755's may be required)



INPUT

DELAY	0.000msec

LF

GAIN	+1.5dB				
DELAY	1.896msec				
HPF	40.9Hz	24dB Butterworth			
LPF	170Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	152Hz	-6.5dB	4.8	2.92	0.21

MF

GAIN	-1.5dB				
DELAY	0.000msec				
HPF	173Hz	24dB Link/Riley			
LPF	1k62Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	1k19Hz	+4.5dB	1.1	1.54	0.91
EQ2	520Hz	-4.5dB	4.8	3.30	0.21
EQ3	1k00Hz	-4.5dB	4.2	2.89	0.24
EQ4	218Hz	-1.0dB	2.0	1.41	0.50

HF

GAIN	+0.0dB				
DELAY	1.102msec				
HPF	1k68Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	10k7Hz	+12.5dB	3.0	3.28	0.48
EQ2	2k57Hz	-6.0dB	2.0	1.36	0.50
EQ3	6k73Hz	-3.0dB	6.0	4.17	0.17

KF755 DSP SETTINGS

LF (LF is muted)

INPUT

DELAY	0.931msec
GAIN	0.0dB

MF

GAIN	-3.5dB				
DELAY	0.000msec				
HPF	354Hz	24dB Link/Riley			
LPF	1k47Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	490Hz	-8.0dB	2.1	1.02	0.53
EQ2	874Hz	-5.5dB	10	6.84	0.10
EQ3	1k26Hz	-3.5dB	3.6	2.49	0.28

HF

GAIN	-2.0dB				
DELAY	1.102msec				
HPF	1k96Hz	24dB Butterworth			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	11k3Hz	+6.0dB	1.8	2.50	0.56
EQ2	5k99Hz	-8.0dB	10	4.87	0.11
EQ3	2k33Hz	-10.5	1.8	0.58	0.72
EQ4	3k92Hz	-6.0dB	5.0	3.41	0.20

Downfill delay for this configuration is based on the trim height and distance to FOH listed above. For more information on adjusting gain and delay to account for different venue geometries, see Section 2 of this Guide.

*** *Q, Bandwith and USP-2Q all define the width of the EQ curve. Different DSP units use different nomenclature to define this parameter. If you are unsure which to use, contact the DSP manufacturer.*

KF755 UP FILL (1 or 2 modules)
KF755 DSP SETTINGS

LF (LF is muted)

INPUT

When only 1 row of upfill is used (theater or small arena)

DELAY	0.300msec
GAIN	0.0dB

When 2 rows of upfill are used (large arena)

Top Up Fill Module

DELAY	1.237msec
GAIN	-5.0dB

Second Up Fill Module

DELAY	1.756msec
GAIN	-5.0dB

MF

GAIN	-1.5dB				
DELAY	0.000msec				
HPF	195Hz	24dB Butterworth			
LPF	1k44Hz	24dB Butterworth			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	1k19Hz	+4.5dB	1.1	1.54	0.91
EQ2	520Hz	-3.0dB	2.4	1.67	0.42
EQ3	841Hz	-3.0dB	3.4	2.36	0.29
EQ4	218Hz	-1.0dB	2.0	1.41	0.50

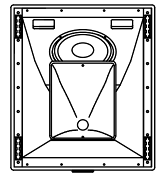
HF

GAIN	0.0dB				
DELAY	0.646msec				
HPF	1k56Hz	24dB Link/Riley			
LPF	22k0Hz	24dB Link/Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	10k7Hz	+12.5dB	3.0	3.28	0.48
EQ2	2k88Hz	-13.0dB	3.8	0.80	0.39
EQ3	4k94Hz	-2.0dB	8.5	5.95	0.12

One Row of Upfill KF755's recommended for:

> theater where arrays cannot be flown

> medium arenas where the balcony is above the level of the array

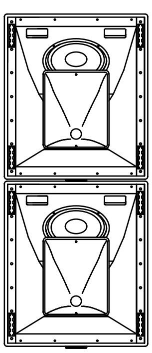


The delay of a single row of KF755 upfill modules is calibrated to meet the acoustic origin of an array comprising 3-high KF750's over a single KF755 downfill module (Three-Over-One Configuration).

When used with smaller arrays, the delay should be decreased. When used with larger arrays, the delay should be increased.

Gain adjustment for a single row of upfill KF755 modules is based on a throw distance of 235 ft. to the midpoint of the balcony. If a given venue's throw is longer, gain should be increased and vice versa for a shorter throw.

See Section 2 of this Guide for more details on adjusting these parameters.



Two rows of Upfill KF755's recommended for:

> large arenas where the balcony is above the level of the array

The delays for two rows of KF755 upfill modules are calibrated to meet the acoustic origin of an array comprising 4-high KF750's over a single KF755 downfill module (Four-Over-One Configuration).

When used with smaller arrays, the delays should be decreased. When used with larger arrays, the delays should be increased.

Gain adjustments for two rows of upfill KF755 modules are based on a throw distance of 300 ft. to the midpoint of the balcony. If a given venue's throw is longer, gain should be increased and vice versa for a shorter throw.

See Section 2 of this Guide for more details on adjusting these parameters.

SB750 DSP SETTINGS

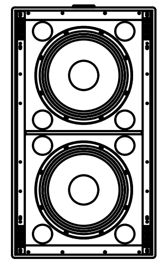
LF

GAIN	+6.0dB				
DELAY	0.000msec				
HPF	35.14Hz	24dB Bessel			
LPF	93.09Hz	24dB Linkwitz-Riley			
PEQ	**Frequency**	**Boost/Cut**	**Q***	**USP-2 Q***	**Bandwidth***
EQ1	30Hz	+6.0dB	3.3	4.59	0.30

SB750 Subwoofers recommended for:

> all applications at a ratio of 1 subwoofer for every 2 full range modules

Subwoofer processor parameters require only minor adjustment depending on how they are deployed. Please see Section 2 of this Guide for more information on flying or groundstacking SB750 subwoofers.



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EUROPE: EAW International Ltd., ***tel:*** +44 1494 539090 ***fax:*** +44 1494 539091