Version 2.0
November 2001

dV-DOSC®
dV-SUB
OPERATOR MANUAL

FOREWORD

This manual is intended for sound engineers who are responsible for the set-up, operation and maintenance of L-ACOUSTICS® dV-DOSC™ systems. It is also intended to provide interested sound designers, consultants and installers with the information they require regarding the fundamental principles of Wavefront Sculpture Technology® and how these principles are embodied within the dV-DOSC sound reinforcement system. dV-DOSC specifications, installation procedures and general guidelines for sound design are also discussed in this document.

MANUAL ORGANIZATION

- The Introduction gives a brief presentation of the dV-DOSC system and presents the fundamentals of Wavefront Sculpture Technology
- Chapter 1 introduces the elements of the dV-DOSC system.
- Chapter 2 describes dV-DOSC array performance and coverage prediction.
- Chapter 3 discusses elements of sound design and suggested array configurations.
- Chapter 4 gives detailed procedures for stacking and flying dV-DOSC.
- Chapter 5 lists recommended installation and maintenance tools.
- Chapter 6 gives specifications for elements of the dV-DOSC system.
- Finally, the Appendices elaborate on several technical aspects.

TABLE OF CONTENTS

0. INTRODUCTION 8

0.1 WAVEFRONT SCULPTURE TECHNOLOGY™ FUNDAMENTALS 8
The Sound Reinforcement Problem 8
Wavefront Sculpture Principles 9
First V-DOSC, Now dV-DOSC 10
Summary of dV-DOSC Applications 14

0.2 TRAINING AND QUALIFICATIONS 15
THE QUALIFIED V-DOSC TECHNICIAN (QVT) 15
THE CERTIFIED V-DOSC ENGINEER (CVE) 15

1. ELEMENTS OF THE dV-DOSC SYSTEM 16

1.1 dV-DOSC SYSTEM COMPONENTS 19

1.2 dV-DOSC ENCLOSURE DESCRIPTION 23

1.3 dV-DOSC FLYING SYSTEM 23

1.4 dV-DOSC AMPLIFIER RACKS 26

1.5 POWERING dV-DOSC 31

1.6 dV-SUB ENCLOSURE DESCRIPTION 34

1.7 dV-SUB FLYING SYSTEM 35

1.8 POWERING dV-SUB 37

1.9 dV-DOSC CONTROL 38
(a) General Guidelines Regarding System Protection 38
(b) Preset Policy 38
(c) General Description of dV-DOSC Presets 39
(d) BSS FDS 355 VERSION 6 0801 PRESETS 41
(e) BSS FDS 366 VERSION 6 0801 PRESETS 42
(f) XTA DP224 VERSION 6 0801 PRESETS 43
(g) XTA DP226 VERSION 6 0801 PRESETS 44

1.7 CONTROL SIGNAL DISTRIBUTION 45

1.8 CO 24 CONTROL OUTPUT PANEL 46

1.9 MD 24 MULTI DISTRO PANEL 47

1.10 CD12 CONTROL DISTRO PANEL 48

2. dV-DOSC ARRAY SPECIFICATIONS 51

2.1 ISOCONTOUR IN THE HORIZONTAL PLANE 51
Horizontal Directivity of a dV-DOSC Array 51
Effective Coverage in the Horizontal Plane 51

2.2 WAVEFRONT SCULPTURE IN THE VERTICAL PLANE 52
Flat dV-DOSC Array 52
Convex Curvature dV-DOSC Array 52
Constant Curvature dV-DOSC Array 52
Variable Curvature dV-DOSC Array 53
Concave Curvature dV-DOSC Array 53

2.3 COVERAGE PREDICTIONS USING THE ARRAY 2000 SPREADSHEET 53

CUTVIEW SHEETS (ARRAY1, ARRAY2, dV-ARRAY1, dV-ARRAY2) 54
a) Input Data 54
b) Optimization Procedure 56
c) Output Data 56

SIMULATING dV-DOSC DOWNFILL 58
SIMULATING dV-DOSC UPFILL 58
dV-DOSC PICK POINT UTILITY 59

H-ISOCONTOUR SHEET 59
a) Input Data 59
b) Optimization Procedure 60
c) Output Data 60

ARRAY 2000 SPREADSHEET CALCULATION EXAMPLES 61

3. ELEMENTS OF SOUND DESIGN 63

3.1 MULTIPLE ARRAY CONCEPTS 63
Reducing Array Interaction 63
Achieving Optimum Coverage 63

3.2 STACKED OR FLOWN? 64
Stacking Guidelines 64
Flying Guidelines 65

3.3 SUBWOOFERS 66
General Guidelines for the Use of Subwoofers 66
Split Left/Right Ground Stacked Subwoofers 66
Flown Subwoofers 67
Central Location, Ground Stacked 68

3-WAY PRESETS FOR dV-DOSC AND SB218 SUBWOOFERS 68

3-WAY PRESETS FOR dV-DOSC AND dV-SUB SUBWOOFERS 68

4-WAY PRESETS FOR dV-DOSC AND dV-SUB OR SB218 SUBWOOFERS 70

4. INSTALLATION PROCEDURES 71

4.1 STACKED SYSTEMS 71
Stacking dV-DOSC Standalone 71
Safety Rules 72
Stacking on top of V-DOSC 77
Stacking on top of SB218 Subwoofers 80
Stacking dV-SUB Subwoofers 84
Stacking dV-DOSC on top of dV-SUBS 87
Procedure 1: Stacking without dV-BUMP 87
Procedure 2: Stacking with dV-BUMP 90

4.2 FLOWN SYSTEMS 92
Standalone Flying with dV-BUMP 92
Trim and Angle Adjustments 99
Flying under V-DOSC with dV-DOWN 101
Flying dV-SUB Standalone 105
Flying dV-DOSC Under dV-SUB (3+1 configuration) 108
Flying dV-DOSC Under dV-SUB (larger configurations) 112
Procedure 1 (2 dV-SUB + 6 dV-DOSC) 112
Procedure 2 (larger configurations) 113

SAFETY RULES 119

5. MAINTENANCE AND INSTALLATION TOOLS 121

5.1 RECOMMENDED MAINTENANCE PROCEDURES 121

5.2 RECOMMENDED MAINTENANCE TOOLS 121

5.3 SPARE PARTS 122

5.4 RECOMMENDED INSTALLATION TOOLS 123

6. SPECIFICATIONS 124

6.1 dV-DOSC ELEMENT SPECIFICATIONS 124

6.2 dV-SUB SPECIFICATIONS 127

APPENDIX 1: How Does dV-DOSC Behave With Respect To WST Criteria 129

APPENDIX 2: How Does the DOSC Waveguide Work? 130

LIST OF FIGURES

Figure 1: Wavefield interference for a conventional system compared to a sculptured dV-DOSC wavefield 9
Figure 2: Wavefront Sculpture Technology Criteria 10
Figure 3a: System Block Diagram 17
Figure 3b: Example System Configuration 18
Figure 4: dV-DOSC and Accessories 22
Figure 5: dV-DOSC Element - Front and Rear Views 23
Figure 6: dV-ANGLE P1 and P2 angle values 24
Figure 7: dV-BUMP 25
Figure 8: dV-DOWN 25
Figure 9: V-DOSC AMP RACK RK12-4 26
Figure 10: PAD 04 (4 amplifiers per rack) 27
Figure 11: RK12-2M and RK12-2S Master and Slave Racks 29
Figure 12: PAD 02 (2 amplifiers per rack) 29
Figure 13: Connecting dV-DOSC to L-ACOUSTICS RK12-4 33
Figure 14: dV-SUB 34
Figure 15: dV-ANGLESS sub-to-sub angle bar 35
Figure 16: dV-ANGLESDP and dVANGLESD hole definitions 35
Figure 17: Illustration of dV-SUB rigging configurations 37
Figure 18: CO24 Control Output Panel 46
Figure 19: MD24 Multi Distro Panel 47
Figure 20: CD 12 Control Distro Panel 48
Figure 21: System Architecture using RK12-2M Master Rack and RK12-4 50
Figure 22: Defining Cutview Dimensions 54
Figure 23: Parameters for the ROOM DIM Utility Sheet in ARRAY 55
Figure 24: Optimizing Array Element Focus By Adjusting For Equal Spacing 56
Figure 25: Physical dV-DOSC Rigging Parameters for ARRAY 57
Figure 26a: ARRAY 2000 spreadsheet calculation example (LCR dV-DOSC system) 61
Figure 26b: Simulating dV-DOSC under V-DOSC 62
Figure 26c: Simulating dV-DOSC on top of V-DOSC 62
Figure 27: Recommended Installation Tools 123
Figure 28: dV-DOSC Element – Line Drawing 125
Figure 28: dV-SUB Line Drawing 127
Figure 30: Front view of dV-DOSC array and vertically stacked DOSC waveguides 129
Figure 31: DOSC Waveguide – Internal Section 130

LIST OF TABLES

Table 1: PAD04 Amp Panel Wiring Chart 28
Table 2: PAD02 Amp Panel Wiring Chart 30

Table 3: Power Handling versus HP Filter Characteristics for dV-DOSC LF 31
Table 4: Load, RMS and Peak Power Ratings for dV-DOSC..... 31
Table 5: Recommended Amplifier Power Ratings for 100 Hz LR24 HPF..... 32
Table 6: L-ACOUSTICS LA 24 MLS Settings for use with dV-DOSC..... 32
Table 7: L-ACOUSTICS LA 48 MLS Settings for use with dV-DOSC..... 32
Tables 8, 9: Maximum rated dV-SUB / dV-DOSC combinations..... 36
Table 10: Recommended Power and Amplifier Power Ratings for dV-SUB..... 37
Table 11: BSS FDS 355 Presets 41
Table 12: BSS FDS 366 Presets 42
Table 13 : XTA DP224 Presets..... 43
Table 14: XTA DP226 Presets..... 44
Table 15: Pick Point Reference Chart (1 dV-SUB + 3 dV-DOSC).....109
Table 16: Recommended Maintenance Tools 121
Table 17: dV-DOSC weight per number of cabinets.....126

0. INTRODUCTION

The small "d" in dV-DOSC refers to the mathematical terminology for the derivative function since dV-DOSC is a derivative of V-DOSC. dV-DOSC provides the same benefits of Wavefront Sculpture Technology as V-DOSC except in a much smaller format.

We hope this manual will help you to appreciate why and to understand the basic principles behind how the dV-DOSC system works. Understanding these principles will help you to optimally use dV-DOSC and dV-SUB in sound design – whether for touring or fixed installation. Understanding the concepts behind dV-DOSC and Wavefront Sculpture Technology are just as important as learning the many operational details related in this manual – the more you understand the big picture, the more effectively you will use the system.

As you will see, dV-DOSC is a complete system approach – starting from the basic question of how to effectively couple sound sources then including all aspects of sound design, performance prediction, system installation, rigging, cabling, signal distribution, digital control and tuning. This turnkey system approach allows for accurate and predictable results, however, in order to achieve the best results you need to understand the concepts behind how the system works.

Apart from sound quality, the system design approach and ergonomics, there are many benefits to dV-DOSC. Many of you readers are already aware of these benefits; otherwise they will become apparent throughout the course of this manual.

0.1 WAVEFRONT SCULPTURE TECHNOLOGY™ FUNDAMENTALS

The Sound Reinforcement Problem

The trend in sound reinforcement has been to increase both the actual SPL during concerts and the size of the audience to be covered. This leads to an increased number of loudspeakers since more powerful single loudspeakers would reach such sizes and weights that their transport, handling and installation would simply not be feasible.

In practice, conventional loudspeakers are assembled in a fan-shaped array following the angle determined by the horizontal directivity of each enclosure in an attempt to reduce overlapping zones that cause destructive interference. With this type of arrangement, the optimum clarity available in one direction can only be provided by the individual enclosure facing in this direction. Attempts at “flattening the array” in order to achieve greater throw and higher sound pressure levels results in severe interference in an uncontrolled way, affecting coverage, directivity control, intelligibility and overall sound quality. Even when arrayed according to specification (always an "optimum" compromise), the sound waves radiated by individual loudspeakers do not couple coherently thus the conventional system approach is fundamentally flawed. Furthermore, the chaotic sound fields created by interfering sound sources waste acoustic energy, thus requiring more power than a single, coherent source would in order to achieve the same sound pressure level.

To illustrate this, consider what happens when we throw pebbles in the water. If we throw one pebble into the water, we can see circular waves expanding from the place where it disturbed the surface. If we throw a handful of pebbles, we observe a chaotic wavefield. If we throw a larger stone, with total size and weight equivalent to the handful of pebbles then we see a circular wave as was obtained with the single pebble, except now with much larger amplitude. If all of the individual pebbles of the handful could be glued together, this would provide the same effect as the larger stone...

This illustrates the thinking behind dV-DOSC and V-DOSC: if we can build a single sound source from a number of individual speakers that can be separated for transport and handling, then we have achieved our goal, i.e., to provide a totally coherent, predictable wavefield.

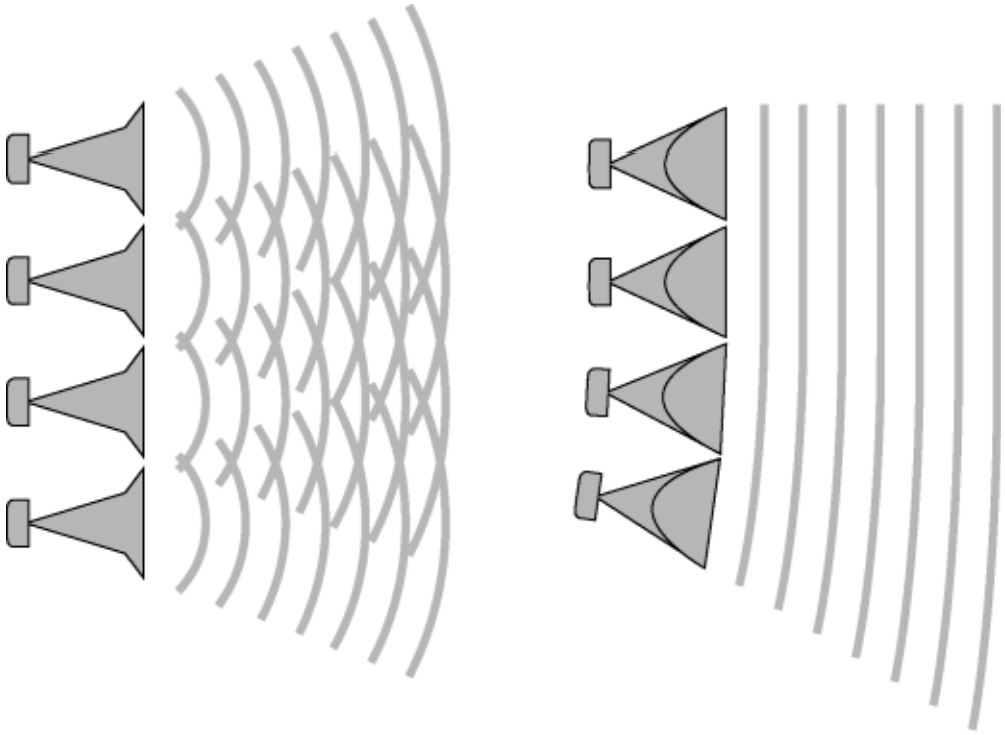

Figure 1: Wavefield interference for a conventional sound reinforcement system compared to a sculptured dV-DOSC wavefield

Wavefront Sculpture Principles

As early as 1988, a preliminary system named "Incremental" had proven the feasibility of V-DOSC and dV-DOSC. From this experimental concept, theoretical research was undertaken by Professor Marcel Urban and Dr. Christian Heil. The results of this research were presented at the 92nd AES convention in Vienna, March 1992 (preprint n°3269).

The theory that was developed defines the acoustic coupling conditions required for effectively arraying individual sound sources. Relevant parameters include: wavelength, the shape of each source, the surface area of each source and the relative source separation.

In brief, the coupling conditions can be summarized as follows:

An assembly of individual sound sources arrayed with regular separation between the sources on a plane or curved continuous surface is equivalent to a single sound source having the same dimensions as the total assembly if one of the two following conditions is fulfilled:

1) Shape: The wavefronts generated by the individual sources are planar and the combined surface area of the sources fills at least 80% of the total target surface area.

2) Frequency: The step or source separation, defined as the distance between the acoustic centers of the individual sources, is smaller than half the wavelength over the bandwidth of operation.

These two criteria form the basis of Wavefront Sculpture Technology™ (referred to as WST throughout this text). For further information, more detailed theory is presented in Appendix 3.

Additional WST Criteria were developed for the AES preprint entitled "Wavefront Sculpture Technology" that was prepared for the 111th Convention, NYC, Sept 2001 (preprint n°5488). The first two WST Criteria were re-derived based on an intuitive approach using Fresnel analysis and in addition it was shown that:

3) The deviation from a flat wavefront must be less than $\lambda/4$ at the highest operating frequency (this corresponds to less than 5 mm curvature at 16 kHz)

4) For curved arrays, enclosure tilt angles should vary in inverse proportion to the listener distance (geometrically this is equivalent to shaping variable curvature arrays to provide equal spacing of individual element impact zones)

5) Limits exist given the vertical size of each enclosure and the relative tilt angles that are allowed between enclosures.

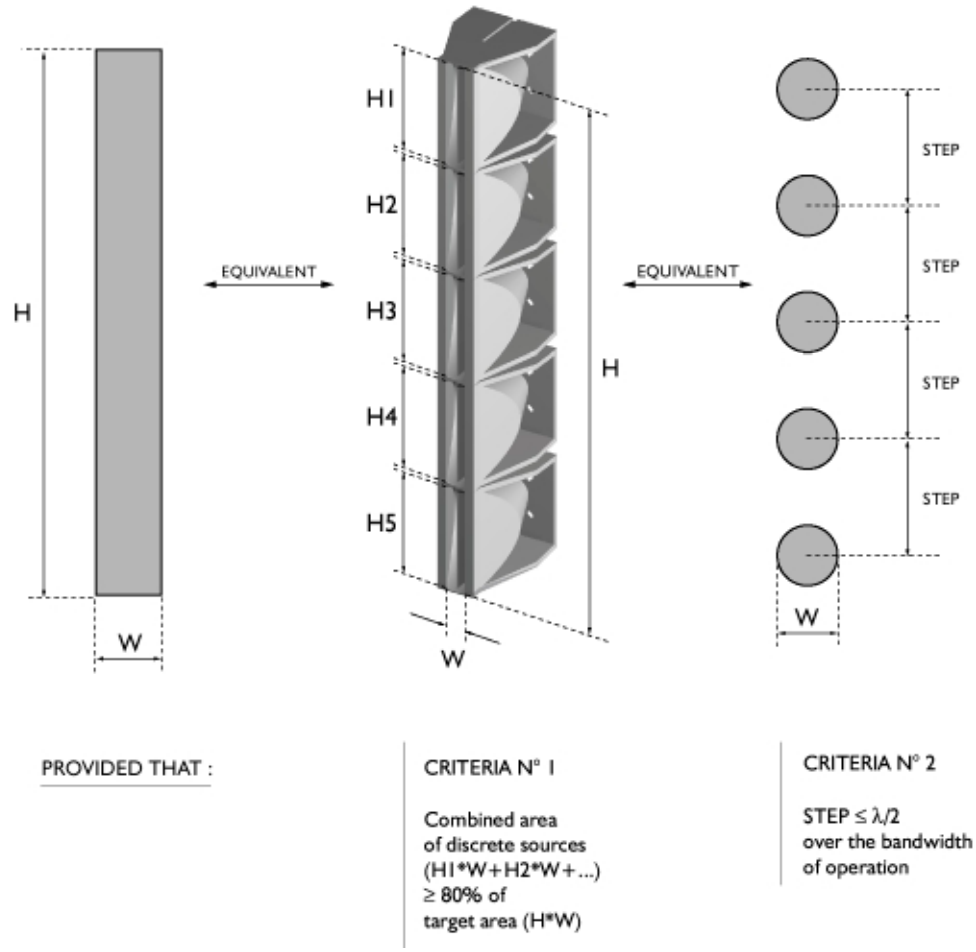

Figure 2: Wavefront Sculpture Technology Criteria

First V-DOSC, Now dV-DOSC

V-DOSC is the first system that functions according to the principles of Wavefront Sculpture Technology. DOSC stands for "Diffuseur d'Onde Sonore Cylindrique" – in english this means Cylindrical Sound Wave Generator. The "V" in V-DOSC refers to the V-shaped acoustic lens configuration employed for the mid and high frequency sections. As stated above, dV-DOSC can be considered a derivative of V-DOSC since it performs according to the same principles except in a smaller format.

An important design objective for dV-DOSC was to provide expanded horizontal and vertical coverage and this has been achieved in two ways - first, the V-shaped acoustic lens section for the low section (that also acts as a waveguide for the high section) has been engineered to provide 120 degree horizontal coverage in comparison with the 90 degree coverage of V-DOSC. Secondly, the innovative construction of dV-DOSC employs minimum thickness top and bottom aluminum plates and the rigging system pivots around the front points of the enclosures - these two features bring the openings of the individual DOSC waveguides (one per enclosure) as close together as possible, allowing dV-DOSC to be used up to a maximum of 7.5 degrees between each enclosure while still satisfying the greater than 80% fill WST criterion. By comparison, V-DOSC enclosures can be arrayed up to a maximum of 5 degrees between elements.

dV-DOSC enclosure trapezoidal angles have been engineered so that 7.5 degrees per enclosure is obtained for tightly wrapped arrays. Starting from a tightly wrapped array (7.5 degrees between cabinets) the backs of the dV-DOSC enclosures can be progressively opened up using dV-ANGLEP1 or dV-ANGLEP2 rear angle bars by selecting various hole positions to produce variable curvature arrays. A flat array is obtained using the maximum extension hole position on dV-ANGLEP1 for all enclosures. Array curvature obtained using dV-ANGLEP is described as convex and the array shape corresponds to the positive curvature that we are familiar with.

If dV-ANGLEN rear angle bars are selected, concave or negative curvature arrays can be constructed (to visualize a negative curvature array, just think of a satellite dish). A flat array is obtained using the minimum hole position on dV-ANGLEN and the array becomes progressively concave as hole positions with greater spacing are selected. Experimentation into the use of negative curvature arrays is ongoing and it is thought that such arrays will be highly useful for longthrow applications and for acoustic holography effects where it is possible to create a virtual acoustic source by focussing sound at a defined location in space. The sound will then appear to emanate from a focal line - not from the array itself - allowing for interesting sound design possibilities. Alternatively, dV-ANGLEN can be used to provide negative tilt for a dV-DOSC array when dV-DOSC is stacked on top of subwoofers.

Just as for V-DOSC, dV-DOSC was designed as a system consisting of identical, vertically-arrayable elements. Individual transducers are physically arranged within each enclosure so as to meet WST criteria, frequency-band by frequency-band, when the enclosures are arrayed together. Each element radiates a flat isophasic (constant phase) wavefront, allowing the overall assembly of multiple elements to produce a single extended sound source. Since the angle of separation between adjacent elements is adjustable, the wavefront can be shaped by physically shaping the array. Through successful coupling over the entire audio frequency range, dV-DOSC produces a consistent wavefront over a large area with little variation in frequency response and sound pressure level.

The heart of the dV-DOSC system is the internationally patented[1] DOSC waveguide. Essentially, the DOSC waveguide permits fulfilment of the first condition of WST for frequencies higher than 800 Hz, i.e., the wavefronts generated by individual DOSC waveguides are planar and their combined surface area accounts for at least 80% of the total surface area. For conventional horn-loaded systems, coherent summation is simply not possible at higher frequencies since the wavelength becomes progressively smaller than the physical separation between horn and driver assemblies and neither of the two WST criteria can be satisfied. As a result, interference occurs throughout most of the high frequency section's operating bandwidth for a conventional system.

By comparison, a dV-DOSC array is a full-spectrum, coherent loudspeaker system even for the highest frequencies. As with any speaker system, interference does occur for the case of dV-DOSC, however, the main difference is that within the defined coverage region the interference is constructive, while outside of the defined wavefield it is destructive.

dV-DOSC elements are vertically arrayed in columns. Since elements of the array couple coherently, the enclosures are physically smaller and fewer cabinets are required in comparison with conventional systems. This makes dV-DOSC very cost effective for touring sound applications where transport space and handling time means money. These properties also make dV-DOSC highly effective for fixed installation where compact size combined with predictable coverage is important.

One of the key benefits of WST is the predictability of the wavefront's shape. Horizontally, the entire dV-DOSC array has the same directivity as a single element (120°). Vertically, the coverage is determined by the number of vertically arrayed elements and the specified angle of separation between them. Given this predictability, vertical coverage can be optimized to match specific audience area geometries. A quick, user-friendly CAD spreadsheet helps the operator to determine how to focus the wavefield so that tonal balance and sound pressure levels are evenly distributed throughout the listening area. Using this program, array design can be conveniently performed on a case-by-case basis to optimize coverage for each venue according to the specific audience layout.

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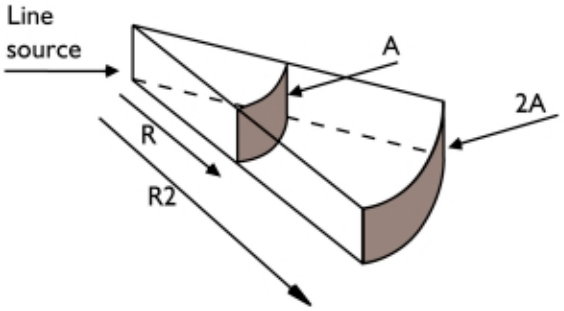
[1] ***The DOSC waveguide is registered under European patent n°0331566 and North American patent n°5163167. Please see Appendix 2 for a description of the DOSC waveguide.***

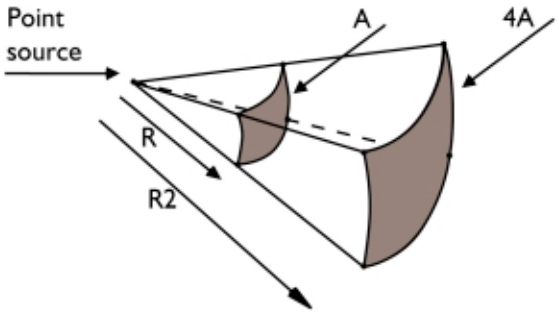
The configuration of transducers in a dV-DOSC element is symmetrical with respect to the plane of propagation of the wave, i.e., the plane bisecting the horizontal coverage angle. High frequency transducers are located in the middle and low frequency transducers are located on both sides of the high section. Such a configuration is described as having COPLANAR SYMMETRY.

Coplanar symmetry is the cylindrical domain equivalent of the coaxial arrangement for individual (spherical) sources. Essentially, coplanar symmetry allows for homogeneous coverage of the sound field at any listening angle over the dV-DOSC array's 120° horizontal coverage window. Coplanar symmetry also eliminates off-axis acoustic cancellations at crossover points so that polar lobing is not an issue. Psychoacoustically, coplanar symmetry is largely responsible for the exceptional imaging properties that are characteristic of dV-DOSC when used in stereo (Left / Right) configurations.

Apart from coverage precision and predictability, another significant benefit of dV-DOSC is the fact that the system effectively extends the near field region at higher frequencies. For flat dV-DOSC arrays, this results in a 3 dB reduction in SPL with doubling of distance as opposed to the 6 dB reduction that is typical of conventional systems. This property arises due to the physics of cylindrical waves versus spherical waves (see the figure below).



Cylindrical Wave
- Expands in horizontal dimension only
- At 2R, surface area increases 2 times
⟶ 3 dB attenuation



Spherical Wave
- Expands horizontally and vertically
- At 2R, surface area increases 4 times
⟶ 6 dB attenuation

This means that dV-DOSC should not be evaluated in terms of the classical "$ / kilowatt"-ratio, i.e., due to it's ability to perform Wavefront Sculpture, dV-DOSC has different attenuation properties than conventional systems. Comparing SPL predictions according to standard calculations is not meaningful since dV-DOSC produces a combination of cylindrical and spherical wavefront propagation that must be evaluated using specific calculations.

Aside: This is one of the reasons why EASE and CATT-Acoustic modelling data was not available for dV-DOSC, V-DOSC and ARCS in the past (whereas data was provided for the coaxial MTD products manufactured by L-ACOUSTICS). Custom modelling for WST-based system simulation has recently been completed for the EASE and CATT-Acoustic room acoustics modelling packages.

When curved dV-DOSC arrays are employed there is a combination of cylindrical and spherical propagation. This combined propagation, together with the actual shape of the audience geometry allows the wavefield to be focused so that tonal balance and sound pressure levels are evenly distributed throughout the listening area. Although pure cylindrical wave propagation is not always in effect, 3 dB reduction with distance can still be obtained along with extension of the nearfield by

correctly focussing the system on the audience - this is the benefit of WST and also the reason why correct focus of the system on the audience area is so important.

Psychoacoustically, nearfield extension allows one to walk a considerable distance from a dV-DOSC system with only a small difference in SPL due to the system's unconventional attenuation rate. Effectively, more of the audience experiences nearfield listening, enjoying higher fidelity, improved stereo imaging and exceptional clarity. Subjectively, the loudspeakers seem much closer and the sound is "in your face". Image localization is towards the action on stage - not the loudspeaker arrays. Practically, this extension of the nearfield means that extreme sound pressure levels are not required close to the system in order to provide acceptable SPLs further back in the audience - this is a highly desirable property that results in reduced potential for hearing loss for both audiences and engineers.

Nearfield extension, combined with the precision and predictability of dV-DOSC coverage is also effective in "pushing back" the critical distance in highly reverberant spaces (critical distance is defined as the distance where the energy of the direct sound is equal to the reverberant energy). In many situations, it is extremely important to keep energy off the roof, for example in arenas or outdoor amphitheatres. If we can excite less room reverberation and focus more energy on the audience, we can effectively move back the critical distance in a given room. Given the well-defined vertical coverage of dV-DOSC, the benefits of WST become immediately obvious in comparison with conventional systems when working in difficult rooms.

Finally, another benefit of WST is the high degree of SPL rejection that is obtained outside of the defined wavefield. Nominally as high as 20 dB, this permits the installation of a dV-DOSC array behind or above microphones with exceptionally high feedback immunity. Basically, if you can see the bottom of the bottom enclosure of the array, you are outside of the coverage pattern (actually, you are 3.75 degrees outside the coverage pattern – more on this later!). Monitor engineers also enjoy working with dV-DOSC FOH systems since there is very little backwave on stage - even at lower frequencies due to the coplanar symmetric arrangement and vertical line array configuration of the mid/low section. High SPL rejection outside of the defined coverage region also makes dV-DOSC an excellent solution in situations where environmental noise control is an issue, for example, in situations where outdoor amphitheatres are located close to residential areas.

The accuracy, flexibility and predictability inherent in WST and the dV-DOSC approach to sound reinforcement opens up many new horizons for sound design.

Summary of dV-DOSC Applications

As a full range two-way system, dV-DOSC can be used for speech reinforcement in corporate applications, houses-of-worship, television or theatrical productions. In some situations, dV-DOSC can also be used for limited bandwidth musical reinforcement (note: for extended bandwidth sound reinforcement, the use of subwoofers is recommended). Another possibility is the use of dV-DOSC in A/B systems for theatre. The compact profile of dV-DOSC is ideal for such installations where visually unobtrusive sound design is an important issue and a small enclosure is required.

dV-DOSC is also well suited to large scale fixed installations such as multiple distributed arrays for stadium and arena sound reinforcement. For these applications, the generous 120 degree horizontal pattern combined with the seamless transition between short to long throw zones obtained using Wavefront Sculpture principles allows the sound designer to achieve excellent intelligibility and cost effective coverage even under difficult, highly reverberant acoustic conditions.

When combined with subwoofers for extended bandwidth applications, dV-DOSC can be used as a front-of-house system for small, medium and large venues. For these applications, the 120 horizontal coverage pattern provides excellent stereo imaging in the standard left-right format while the flexibility provided by Wavefront Sculpture allows the sound designer to cover virtually any room geometry. The compact size of dV-DOSC also opens up the possibility for adding a center cluster for LCR reproduction and depending on room geometry, dV-DOSC can be used exclusively for all LCR channels or as a center cluster in conjunction with ARCS or V-DOSC Left / Right systems.

For touring applications, dV-DOSC can be used as a downfill enclosure for flying under V-DOSC arrays and as a long-throw or upfill extension of the system when stacked on top of the V-DOSC flying bumper. Other applications include flown dV-DOSC arrays for center cluster, offstage fill or stacked stereo front fill. When operated in conjunction with subwoofers, dV-DOSC can be used for flown or stacked monitor side fill and also for drum monitor applications in either horizontal or vertical orientations.

Given all these possibilities, that is why the "dV" in dV-DOSC stands for "definitely Versatile".

0.2 TRAINING AND QUALIFICATIONS

V-DOSC and dV-DOSC are innovative systems which are based on a completely new approach to sound reinforcement. These systems can provide fully predictable results to the extent that no other existing system is capable of. However, achieving the desired results requires following a rigorous procedure which may at first seem unusual to some sound designers and engineers. Hopefully, most of you will embrace this new technology and approach dV-DOSC with an open mind, excited by the many new possibilities that such a system makes available.

However, it can be "hard to teach an old dog new tricks". For those of you in this category, the first step to take is to forget your experience with other systems, overcome your biases and forget all the tricks you have learned from past experience. Try to accept that THIS SYSTEM BEHAVES DIFFERENTLY! V-DOSC and dV-DOSC cannot be left in the hands of someone who has no experience with the system - even if that person has great skills and experience with respect to other systems. A dV-DOSC operator needs specific training and there are two levels of qualification:

THE QUALIFIED V-DOSC TECHNICIAN (QVT)

The responsibilities of a Qualified V-DOSC Technician are: equipment preparation, system design using ARRAY software (on-site measurements or from architectural plans), system installation (rigging, assembly, cabling, system focus, preset selection and drive rack configuration), system testing/tuning and assisting the FOH mix engineer. The QVT is a sound technician with demonstrated ability who has been chosen for his or her technical expertise by a given V-DOSC Network service provider. To be included in the official list that is distributed to members of the V-DOSC Network, the QVT has to meet the following criteria:

- Must be recommended by a recognized CVE or official representative of the V-DOSC Network
- Must have participated in V-DOSC training sessions on theory and rigging.

THE CERTIFIED V-DOSC ENGINEER (CVE)

The higher level of qualification is termed "Certified V-DOSC Engineer" or CVE. In addition to satisfying the mission statement for Qualified V-DOSC Technicians (see above) the CVE has further expertise in the areas of: sound design and system measurement as well as extensive real world experience with V-DOSC. The CVE has comprehensive theoretical understanding of all Wavefront Sculpture Technology based systems (including V-DOSC, ARCS and dV-DOSC) with a full grasp of the operating theories and principles behind the system. The CVE is capable of recommending and endorsing QVTs along with supervising the QVTs during their apprenticeship period towards becoming a full CVE. In some cases, CVEs may also conduct V-DOSC training sessions.

To be included in the official CVE list that is distributed to members of the V-DOSC Network, the operator has to meet the following criteria:

- Must be recommended by a recognized CVE or official representative of the V-DOSC Network
- Must have participated in V-DOSC training sessions on theory and rigging
- Must be known and certified by an official representative of L-ACOUSTICS.

The Qualified V-DOSC Technician and Certified V-DOSC Engineer are important representatives of the V-DOSC Network. While the V-DOSC Network provides the V-DOSC system on a rental basis, it is the QVT or CVE who accompanies the system at each installation to ensure that performance is optimal. We hope that you carefully follow the guidelines presented in this manual - it is in everyone's best interest that V-DOSC and dV-DOSC are deployed correctly and optimally in the field.

NOTE: L-ACOUSTICS provides QVT training seminars in North America, Europe and at the factory in France (please contact L-ACOUSTICS for the latest training schedule). In some cases, training can be provided on site.

1. ELEMENTS OF THE dV-DOSC SYSTEM

dV-DOSC is a complete, self-contained sound reinforcement system consisting of loudspeaker enclosures, amplifier racks, flying hardware, dedicated signal processing, packaging, cables and connectors. dV-DOSC system elements have been carefully selected by L-ACOUSTICS for their specific quality and long term reliability. Together, the elements of the system form a Universal Standard for dV-DOSC.

The benefits of the dV-DOSC standard include:

- Total compatibility between V-DOSC and dV-DOSC partners for cross rental purposes.
- Long term, common experience shared by all Certified V-DOSC Engineers and QVTs.
- Very flexible packaging which is not dedicated to one specific application.
- High standards of quality control ensuring that system performance is consistent for all Network Partners world-wide resulting in enhanced end user confidence.

The dV-DOSC system does not include chain motors, mains distribution or external handling gear, nor does it include upstream signal mixing and processing equipment. In general terms, the dV-DOSC system is capable of producing sound from a line-level signal in any concert situation.

A general system block diagram is presented below to provide an overview of system connection and signal flow. This is followed by identification of the individual components of the system and more detailed descriptions.

Please note that the multiconductor connector for system drive remains open for the user to define although L-ACOUSTICS does supply a specific connector type for turnkey systems (Whirlwind MASS W6 - 84 pin). L-ACOUSTICS recognizes the fact that multiconductor snakes and connectors represent a significant investment and many users already have their own internal standard that they must adhere to. Therefore, this part of the Universal Standard remains flexible.

However, other elements that must remain standard in order to ensure compatibility include: multiconductor line assignments; crossover presets and channel assignments; amplifier rack connectors for speaker connection; amplifier rack connectors and channel assignments for signal distribution. L-ACOUSTICS specifies only approved amplifiers, digital processors and processor presets for use with dV-DOSC.

NOTE: dV-DOSC systems that do not comply with the standards outlined in this manual are considered non-approved by L-ACOUSTICS. For the case of custom, non-standard systems, L-ACOUSTICS does not accept responsibility for misuse or misoperation and in extreme cases the product warranty may be void. L-ACOUSTICS encourages all users to comply with the recommended standard as closely as possible.

General System Block Diagram

A general block diagram representation of V-DOSC and dV-DOSC system components, cabling and signal flow is given in Figure 3. Please refer to this for a general overview of the system.

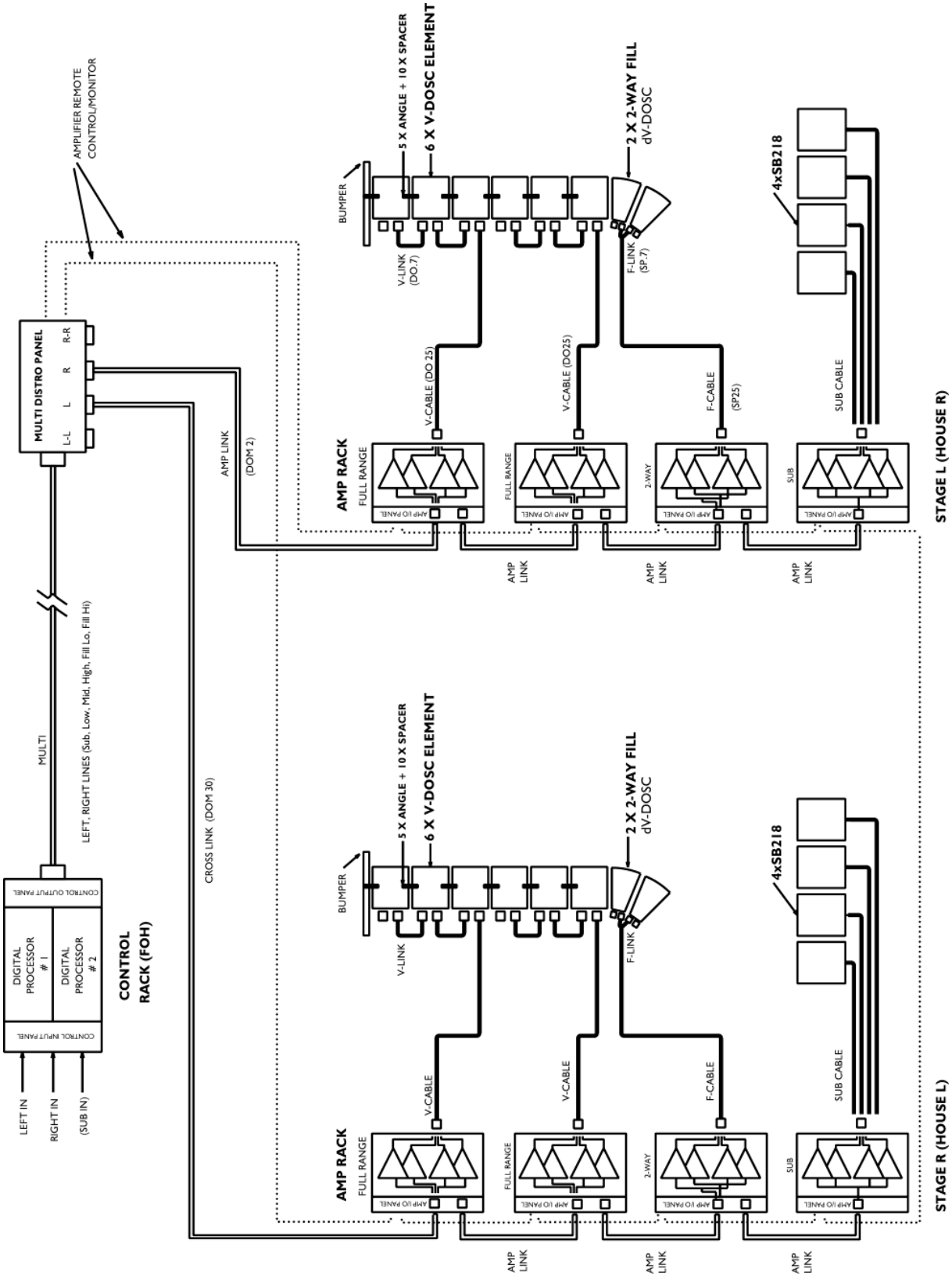


Figure 3a: System Block Diagram

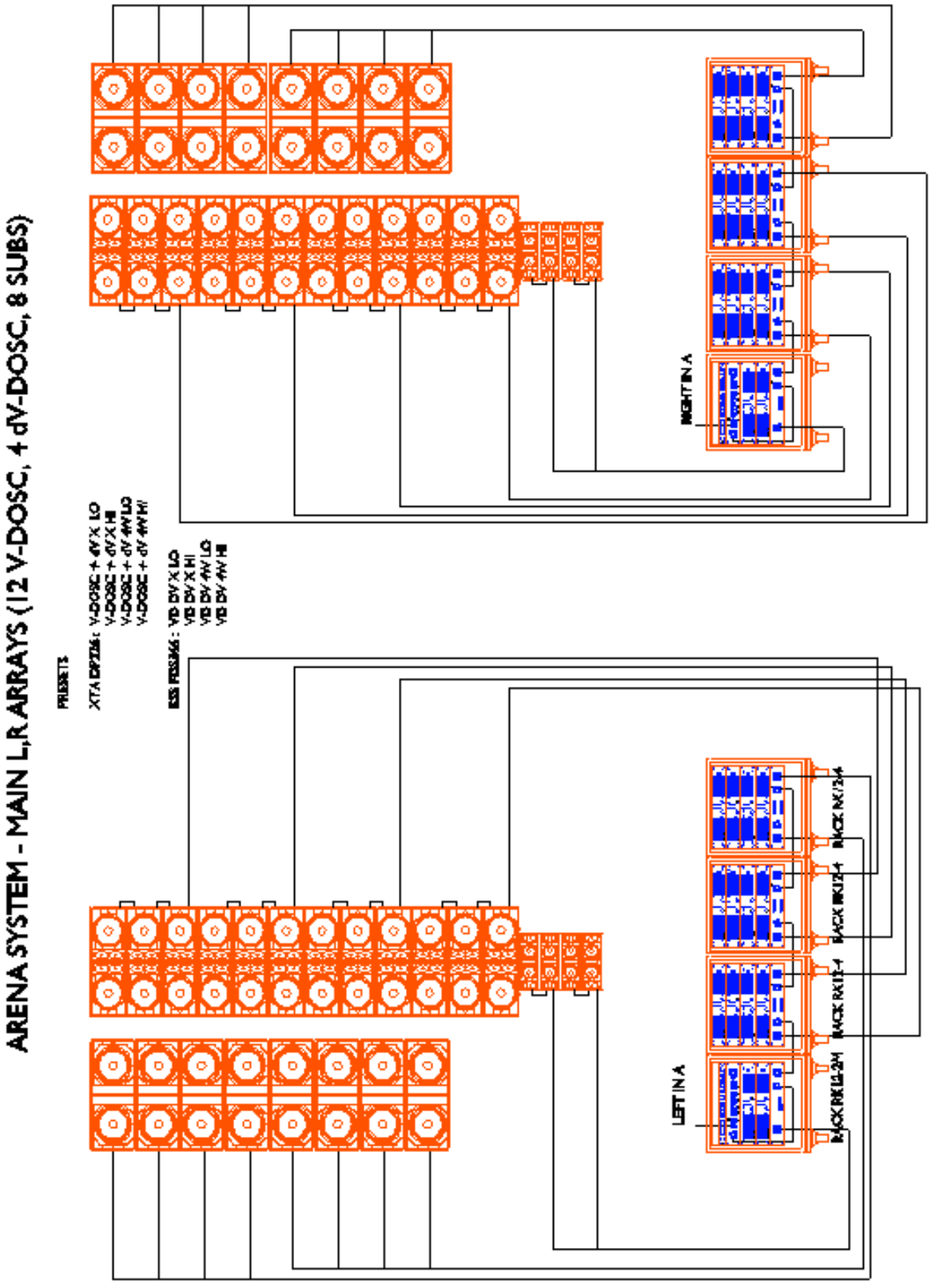


Figure 3b: Example System Configuration

1.1 dV-DOSC SYSTEM COMPONENTS

(1) **dV-DOSC**
Active 2-way loudspeaker enclosure, meeting Wavefront Sculpture Technology criteria, with coplanar symmetric arrangement of loudspeaker components

(2) **dV-SUB**
Companion subwoofer for dV-DOSC with three 15-inch components mounted in a vented bandpass configuration.

RIGGING

(3) **dV-BUMP**
Flying bumper for rigging dV-DOSC and/or dV-SUB. When combined with the V-DOSC BUMPER, can be used as a stacking platform or for rigging dV-DOSC on top of V-DOSC

(4) **dV-DOWN**
Pair of flying bars for rigging dV-DOSC underneath V-DOSC

(5) **dV-PIN25**
Locking quick release pin (25 mm grip length) for physically interconnecting dV-DOSC or dV-SUB enclosures. Six dV-PIN25 are required per 2 dV-DOSC enclosures along with 2 dV-ANGLE (P1 or P2) bars.

(6) **dV-PIN 81**
Locking quick release pin (81 mm grip length) for physically connecting dV-DOSC to dV-DOWN

(7) **dV-ANGLEP1, dV-ANGLEP2**
Rear angle bar used to form convex (positive curvature) arrays. Available angles include:
P1: 0, 2, 3.75, 5.5, 7.5 degrees
P2: 1, 3, 4.5, 6.5 degrees

(8) **dV-ANGLEN**
Rear angle bar used to form concave (negative curvature) arrays or for downwards tilt of stacked dV-DOSC systems. Available angles include: 0, -2, -3.75, -5.5 and -7.5 degrees

(9) **dV-ANGLESS**
Front and rear angle bar used to rig dV-SUB to dV-SUB (i.e., SS=sub to sub)

(10) **dV-ANGLESD**
Front angle bar used to rig dV-DOSC to dV-SUB (i.e., SD=sub to dV) or dV-SUB to dV-BUMP

(11) **dV-ANGLESDP**
Rear angle bar used to rig dV-DOSC to dV-SUB (i.e., SDP=sub to dV, positive tilt). Available angles include: 0, 1.75, 3.75 degrees.

(12) **FLIGHT-dV**
Flight case for transport of three dV-DOSC enclosures

(13) **dV-SUBPLA**
Dolley board for dV-SUB

(14) **dV-SUBCOV**
Protective cover for dV-SUB

CABLING

(15) **SUB CABLE (DOSUB)**
Subwoofer loudspeaker cable, 5 m (16 ft) length, with male 8 pin CA-COM connector and four Speakon connectors (for connecting 4x dV-SUB or 4x SB218 subwoofers to amplifier racks)

(16) **SUB EXTENSION CABLE (DO10P)**
Subwoofer extension cable ,10 m length for use with DOSUB

(17) **SP.7**
Loudspeaker cable, 0.7 m length, four conductor (4 mm^2 cross sectional area per conductor) terminated in locking Speakon connectors. Used for parallel linking of dV-DOSC enclosures

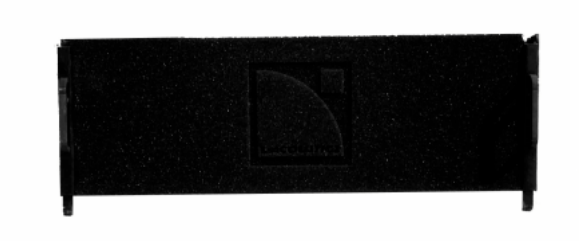
(18) **SP7**
Loudspeaker cable, 7 m length, four conductor (4 mm^2 cross sectional area per conductor) terminated in locking Speakon connectors

(19) **SP25**
Loudspeaker cable, 25 m length, four conductor (4 mm^2 cross sectional area per conductor) terminated in locking Speakon connectors

(20) **DOFILL**
CA-COM (8 pin male barrel) to dual locking Speakon adaptor, 3 m length. For use with V-DOSC cables DO7 and DO25 for breakout and connection at the loudspeaker end

(21) **DO2W**
CA-COM (8 pin male - barrel plus coupling ring) to dual locking Speakon adaptor, 3 m length. For breakout at the amplifier rack and connection via two CC4FP and two standard Speakon cables SP7 or SP25

(22) **CC4FP**
Speakon to speakon adaptor (female-female)



dV-DOSC



dV-DOWN



dV-PIN25



dV-PIN81



dV-ANGLEP1

(0, 2, 3.75, 5.5, 7.5 deg)



dV-ANGLEP2

(1, 3, 4.5, 6.5 deg)



dV-BUMP



dV-ANGLEN

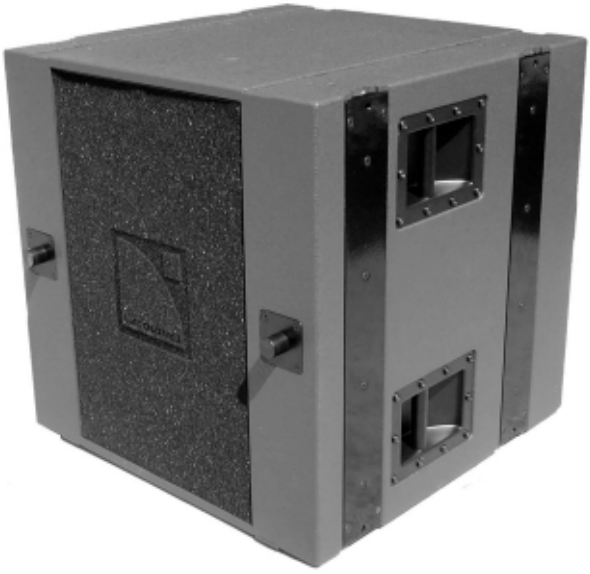
(0, -2, -3.75, -5.5, -7.5 degrees)



FLIGHT-dV



FLIGHT-dV



dV-SUB



dV-ANGLESS



dV-ANGLESD



dV-ANGLESDP



SUB CABLE DOSUB



SUB EXTENSION DO10P



SP.7



SP7



SP25



DOFILL



DO2W



CC4FP

Figure 4: dV-DOSC and Accessories (not to scale)

1.2 dV-DOSC ENCLOSURE DESCRIPTION



Figure 5: dV-DOSC Element - Front and Rear Views

dV-DOSC contains two 8" loudspeakers (connected in parallel) and a 1.4" exit compression driver mounted on a custom DOSC waveguide. The 8" loudspeakers are individually rated at 16 ohms and connected in parallel to provide a nominal impedance of 8 ohms. The nominal operating bandwidth for the 8" section is 100 Hz to 800 Hz. A surface coating is applied to the composite cellulose fibre cone body and all metal parts are corrosion-treated to ensure weather resistant protection. Other features include: rugged kevlar dustcap, 2" diameter edgewound copper voice on a polyimide former, high excursion/reduced fatigue suspension and a compact, high flux density magnetic system.

Nominal impedance for the high section is 8 ohms and the compression driver employed in dV-DOSC features a 1.4" exit, titanium diaphragm, 3" diameter edgewound aluminum voice coil and a lightweight neodymium magnet. These features combine to provide high sensitivity and power handling with low distortion over the entire operating bandwidth (800 - 18k Hz). A removable rear panel allows access to the compression driver for servicing the diaphragm.

Each dV-DOSC element is provided with two Speakon connector sockets for direct connection and paralleling of up to three enclosures. Elements are paralleled using SP.7 loudspeaker cables (0.7 m length). Direct connection of elements to the AMP RACK is made using SP7 or SP25 (7 m or 25 m length, as required) in conjunction with the DO2W adapter and two CC4F. Alternatively, connection can be made using standard V-DOSC cables (DO7 or DO25) and the DOFILL adapter (8 pin male CA-COM barrel to dual speakon breakout).

The bandwidth of dV-DOSC is 100 Hz to 18 kHz. For extended bandwidth applications, the addition of dV-SUB or SB218 subwoofers is recommended in order to extend the response to 25Hz and increase the available headroom in the extreme low frequency range.

1.3 dV-DOSC FLYING SYSTEM

Flying a dV-DOSC array is easy, fast and secure since the trapezoidal shape of the enclosure and integral rigging plates allow for efficient stacking, transport and handling. dV-DOSC features a unique flying system where rear mounted angle bars are used to control the angle between enclosures, i.e., cabinets pivot about the front mount points and selecting the desired hole on the rear angle bars adjusts the angle between enclosures. When dV-ANGLE P1 or P2 bars are used, convex (positive curvature) arrays can be constructed ranging from flat up to a maximum of 7.5 degrees between cabinets in increments of approximately 1 degree. When dV-ANGLEN bars are used, concave (negative curvature) arrays can be constructed ranging from flat up to a maximum of minus 7.5 degrees between cabinets in increments of approximately 1.75 degrees.

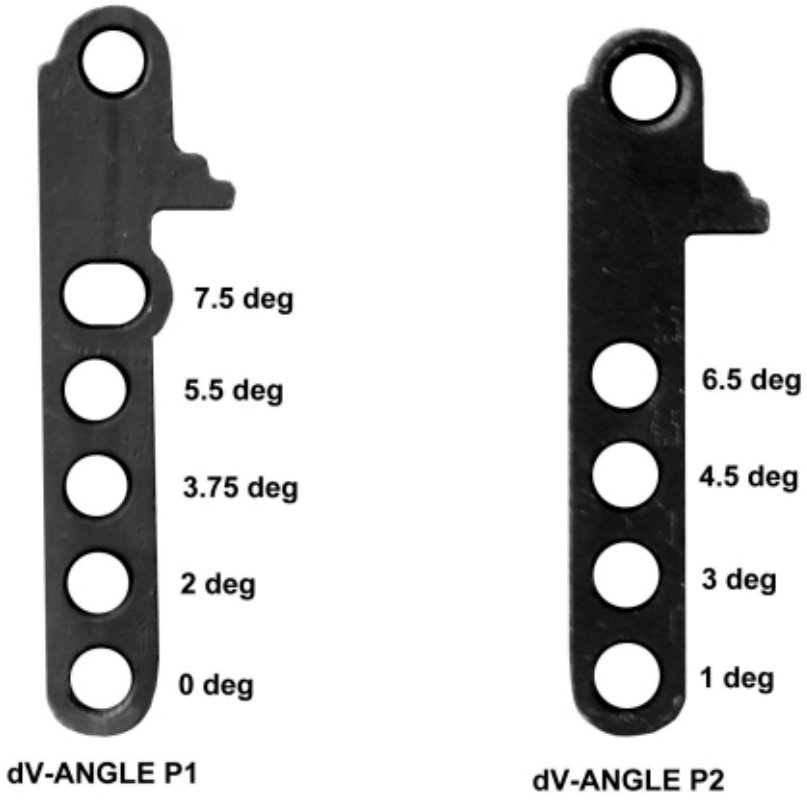


Figure 6: dV-ANGLE P1 and P2 angle values

The dV-BUMP flying bumper can be used for rigging dV-DOSC standalone or for a variety of stacking applications. For standalone flying, there are 8 pick point holes available on the central spreader bar section of dV-BUMP for single point hangs (pick point hole numbering is 1-8 from front to rear). An extension bar can be added to dV-BUMP to provide an additional 8 pick points for single point hangs (pick point hole numbering is 9-16 from front to rear) or to allow for 2 point hangs with front and rear motors similar to the manner in which V-DOSC is flown (note: the front motor controls array trim height while the rear motor controls array tilt and focus - this is due to the fact that the dV-DOSC rigging system pivots around the front, not the rear as is the case for V-DOSC).

For a tightly wrapped array of 12 dV-DOSC, 90 degrees vertical coverage is obtained. For this case, when the rear-most point on the extension bar is used for a single point hang, the 90 degree coverage runs from parallel to the floor to perpendicular to the floor.

Note: For single point hangs, array tilt angles obtained will depend on the size and shape of the array since these factors alter the center of gravity of the overall flown system.

dV-BUMP also allows for three different stacking options:

1) stacking platform with variable tilt adjustment for stacked dV-DOSC applications;

2) stacking platform for rigging dV-DOSC on top of V-DOSC;

3) stacking platform for rigging dV-DOSC on top of SB218 or dV-SUB subwoofers.

Note: Options 1) and 2) are achieved by mechanically connecting dV-BUMP to the V-DOSC BUMPER.



Figure 7: dV-BUMP

Maximum recommended flown configurations are summarized as follows:

dV-BUMP ONLY
(SINGLE POINT HANG FROM CENTRAL SPREADER BAR POINTS)
- maximum 24 dV-DOSC elements

dV-BUMP + EXTENSION BAR
(SINGLE POINT HANG FROM REAR EXTENSION BAR POINTS)
- maximum 12 dV-DOSC elements

dV-BUMP + EXTENSION BAR
(2 POINT HANG FROM dV-BUMP FRONT POINT AND EXTENSION BAR REAR POINT)
- maximum 12 dV-DOSC elements



Figure 8: dV-DOWN

With dV-DOWN, up to a maximum of 6 dV-DOSC can be flown underneath V-DOSC for downfill applications. Three dV-DOSC are equivalent to the weight of one V-DOSC, therefore maximum cabinet combinations include: 15 V-DOSC plus 3 dV-DOSC or 14 V-DOSC plus 6 dV-DOSC.

1.4 dV-DOSC AMPLIFIER RACKS

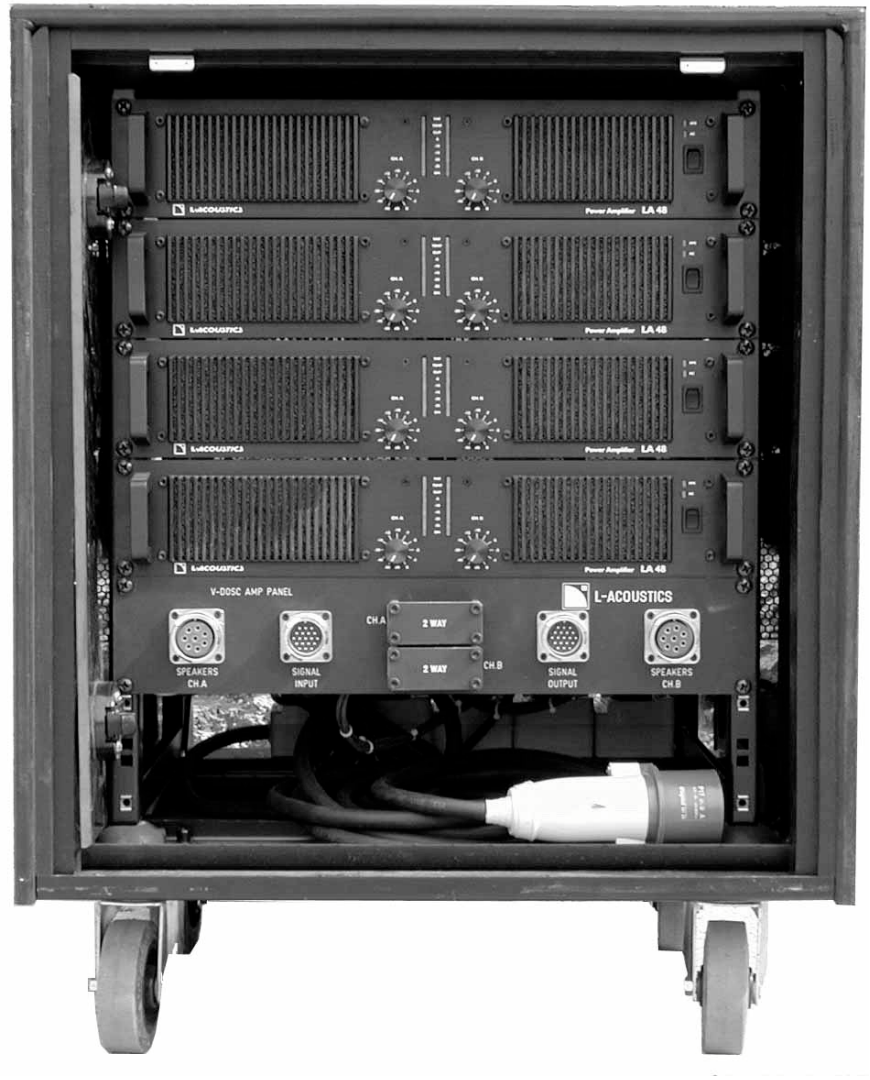


Figure 9: L-ACOUSTICS AMP RACK RK12-4

The standard L-ACOUSTICS RK12-4 amplifier rack is twelve rack units high and contains four L-ACOUSTICS LA 48 amplifiers. Overall external dimensions are 77 cm high (including casters) x 61 cm wide x 58 cm deep (30.3 x 26.4 x 22.9 inches). Clearance from the front rack rail to the front of the rack is 9.5 cm (3.7 in). Clearance from the rear rack rail to the rear of the rack is 6 cm (2.4 in). The depth from front to rear rack rails is 42.5 cm (16.7 in) and the depth from front rack rail to the rear support points for the LA 48 amplifier is 39 cm (15.35 in). Due to the switch mode power supply technology employed in the L-ACOUSTICS LA 48, the rack weighs only 98 kg (216 lbs)!

Using the COMB connectors located on the Amp Panel (PAD04), the rack can be configured so that A and B channels are independent. Depending on how the rack is to be configured 2-WAY, 3-WAY or SUB COMB connectors are selected. The COMB connectors route the desired input lines from the 19 pin CA-COM connector via internal XLR breakouts to the appropriate amplifier inputs for A and B channels, respectively. Using separate COMB connectors for both channels, it is possible to assign the A channels and the B channels independently. Therefore, half an amplifier rack can power up to 3 V-DOSC (6 total), 4 SB218 or 4 dV-SUB subwoofers (8 total) or 6 dV-DOSC (12 total).

In terms of construction, the amplifier rack is made of a lightweight aluminum space frame with heavy duty bracing, internal shock mounting, standard rack rails and provision for rear support of amplifiers. Clear, unbreakable polycarbonate (lexan) front and rear doors allow the user to see how the racks are configured and can be conveniently stored in the sides of the rack during use (note: for ventilation purposes, front and rear doors must always be removed during operation). A high impact

resistant polyethylene cover provides protection for the rack during transport so that no external case is required. Four recessed Aeroquip flytrack sections are mounted on both sides of the amplifier rack for flying applications.

There are recesses in the top cover of each rack that allow racks to be stacked on top of each other with the castors still attached. It is also possible to remove the casters on one amplifier rack, place it on top of a second amp rack and then mechanically bolt the two racks together. Overall the L-ACOUSTICS amplifier rack provides an extremely efficient package in terms of power versus size and weight while at the same time maintaining flexibility for smaller scale and distributed system applications.

NOTE: As installed in RK12-4, all L-ACOUSTICS LA 48 amplifiers are rear supported. Rear support of L-ACOUSTICS LA amplifiesr is strongly recommended for all portable or touring sound applications.

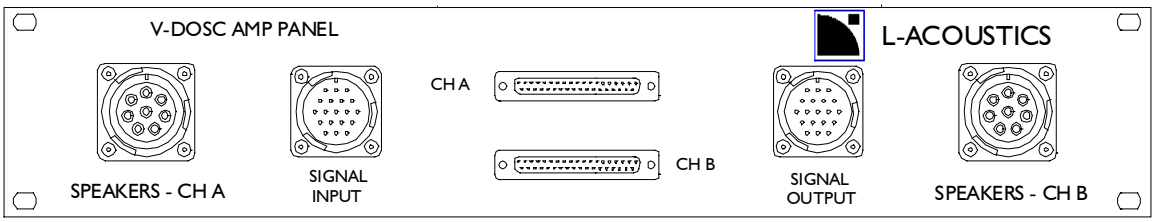


Figure 10: PAD 04 (4 amplifiers per rack)

The PAD04 panel is intended for 4 amplifier-per-rack packaging and allows for connection of loudspeakers, input signal and output signal loop through. The panel has dual 8 pin female CA-COM connectors for loudspeaker connection and two male 19 pin CA-COM connectors for input signal connection (using either AMP LINK or CROSS LINK cables) and for jumping to subsequent amp racks (using AMP LINK cables). Ch A and Ch B COMB connectors allow the rack to be configured for either 2-way, 3-way or SUB operating modes.

Internally, two sets of 4X male XLR fanouts connect the input signal from the 37-pin Dsub connector via the COMB connector on PAD04 to the amplifier inputs. For the CA-COM connector, lines 5 and 6 are always assigned to 2-way fill (high and low, respectively). Line 4 is reserved for subwoofer drive while lines 1, 2 and 3 are for V-DOSC high, mid and low, respectively. For complete details regarding CA-COM line assignments, PAD04 wiring and COMB connector wiring, please refer to the table below.

In 3-way mode, 8 pin loudspeaker CA-COM pinouts for channels A and B are as follows:

A/B = V-DOSC LOW AMP#3 +/-

C/D = V-DOSC LOW AMP#4 +/-

E/F = V-DOSC MID AMP#2 +/-

G/H = V-DOSC HIGH AMP#1 +/-

In 2-way mode, 8 pin loudspeaker CA-COM pinouts for channels A and B are as follows:

A/B = HF AMP#3 +/-

C/D = LF AMP#4 +/-

G/H = HF AMP#1 +/-

E/F = LF AMP#2 +/- .

Either DOFILL or DO2W adapters are used to convert from 8 pin CA-COM to dual Speakon connectors. Individual Speakon pinouts are : +1/-1 = dV-DOSC LF +/- ; +2/-2 = dV-DOSC HF +/- .

Table 1: PAD04 Amp Panel Wiring Chart

PAD 04 COMB/PANEL/AMPLIFIER WIRING + CHANNEL ASSIGNMENTS

CA COM 19 WIRING

LINE IN	SIGNAL	CHANNEL	SUB D-37
A	gnd		14
B	+	(HF)	15
C	-		16
D	gnd		17
E	+	(MF)	18
F	-		19
G	gnd		20
H	+	(LF)	21
J	-		22
K	gnd		23
L	+	(SUB)	24
M	-		25
N	gnd		26
P	+	(HF-FILL)	27
R	-		28
S	gnd		29
T	+	(LF-FILL)	30
U	-		31

COMB WIRING

3-WAY	SUB	2-WAY
14	23	26
15	24	27
16	25	28
17	23	29
18	24	30
19	25	31
20	23	26
21	24	27
22	25	28
20	23	29
21	24	30
22	25	31

CHANNEL A SUB D-37 TO AMPLIFIER TO SPEAKER CONNECTOR WIRING

SUB D-37 A	SIGNAL	XLR COLOR	XLR PIN	AMP CH	AMP OUT	SPEAKON COLOR	CACOMB A
1	gnd		1				
2	+	BROWN	2	LA 48 (1)	1+	BLUE	G
3	-	AMP1 CH A	3	CH A	1-	AMP1 CH A	H
4	gnd		1				
5	+	VIOLET	2	LA 48 (2)	1+	GREEN	E
6	-	AMP2 CH A	3	CH A	1-	AMP2 CH A	F
7	gnd		1				
8	+	WHITE	2	LA 48 (3)	1+	RED	A
9	-	AMP3 CH A	3	CH A	1-	AMP3 CH A	B
10	gnd		1				
11	+	ORANGE	2	LA 48 (4)	1+	YELLOW	C
12	-	AMP4 CH A	3	CH A	1-	AMP4 CH A	D

AMP CHANNEL ASSIGNMENT

3-WAY	SUB	2-WAY
HI A	SUB A	HF FILL A
MID A	SUB A	LF FILL A
LOW1 A	SUB A	HF FILL A
LOW2 A	SUB A	LF FILL A

COMB WIRING

3-WAY	SUB	2-WAY
14	23	26
15	24	27
16	25	28
17	23	29
18	24	30
19	25	31
20	23	26
21	24	27
22	25	28
20	23	29
21	24	30
22	25	31

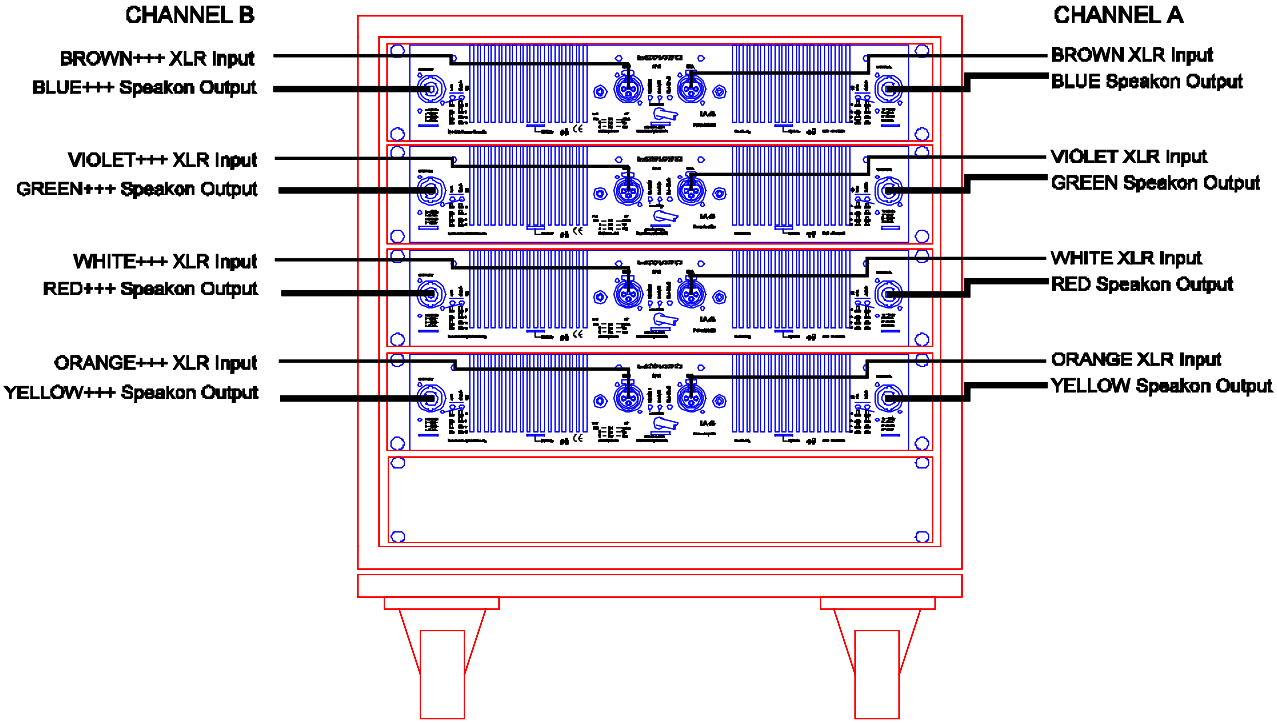
CHANNEL B SUB D-37 TO AMPLIFIER TO SPEAKER CONNECTOR WIRING

SUB D-37 B	SIGNAL	XLR COLOR	XLR PIN	AMP CH	AMP OUT	SPEAKON COLOR	CACOMB B
1	gnd	BROWN	1			BLUE	
2	+	+++	2	LA 48 (1)	1+	+++	G
3	-	AMP1 CH B	3	CH B	1-	AMP1 CH B	H
4	gnd	VIOLET	1			GREEN	
5	+	+++	2	LA 48 (2)	1+	+++	E
6	-	AMP2 CH B	3	CH B	1-	AMP2 CH B	F
7	gnd	WHITE	1			RED	
8	+	+++	2	LA 48 (3)	1+	+++	A
9	-	AMP3 CH B	3	CH B	1-	AMP3 CH B	B
10	gnd	ORANGE	1			YELLOW	
11	+	+++	2	LA 48 (4)	1+	+++	C
12	-	AMP4 CH B	3	CH B	1-	AMP4 CH B	D

AMP CHANNEL ASSIGNMENT

3-WAY	SUB	2-WAY
HI B	SUB B	HF FILL B
MID B	SUB B	LF FILL B
LOW1 B	SUB B	HF FILL B
LOW2 B	SUB B	LF FILL B

RK12 Amplifier Rack Wiring Diagram for PAD04



L-ACOUSTICS RK12-2M and RK12-2S are examples of two-amplifier-per-rack packaging. RK12-2M includes a digital processor plus CD12 Control Distribution Panel and can act as a standalone master rack. RK12-2S contains 2 amplifiers (plus storage drawer) and acts as a slave rack.



RK12-2M Master Rack

RK12-2S Slave Rack

Figure 11: RK12-2M and RK12-2S Master and Slave Racks

For RK12-2M and RK12-2S, amplifier rack panel PAD02 is employed. With two LA 48 amplifiers per rack, up to 3+3 dV-DOSC can be powered whereas two LA 24 are suitable for powering up to 2+2 dV-DOSC. Just as for PADO4, PADO2 allows for connection of loudspeakers, input signal and output signal loop through. The panel has a single 8 pin female CA-COM connector for loudspeaker connection and two male 19 pin CA-COM connectors for input signal connection (using either AMP LINK or CROSS LINK cables) and for jumping to subsequent amp racks (using AMP LINK cables). COMB connectors allow the user to reconfigure the AMP RACK for either 2-way, 3-way or SUB operating modes.

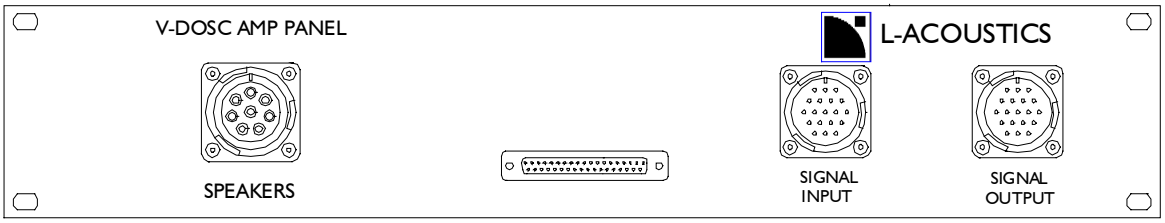


Figure 12: PAD 02 (2 amplifiers per rack)

Internally, a set of 4X male XLR fanouts connect the input signal from the COMB connector on PAD02 to the amplifier inputs. For the CA-COM connector, lines 5 and 6 are always assigned to 2-way fill (high and low, respectively). Line 4 is reserved for subwoofer drive while lines 1, 2 and 3 are for V-DOSC high, mid and low, respectively.

In 2-way mode, 8 pin loudspeaker CA-COM pinouts are as follows:

A/B = HF (Top Amplifier, Channel A +/-)

C/D = LF (Bottom Amplifier Channel A +/-)

G/H = HF (Top Amplifier Channel B +/-)

E/F = LF (Bottom Amplifier Channel B+/-).

Either DOFILL or DO2W adapters are used to convert from 8 pin CA-COM to dual Speakon connectors. Individual Speakon pinouts are : +1/-1 = dV-DOSC LF +/- ; +2/-2 = dV-DOSC HF +/- .

Table 2: PAD02 Amp Panel Wiring Chart

PAD 02 COMB/PANEL/AMPLIFIER WIRING + CHANNEL ASSIGNMENTS

CA COM 19 WIRING

LINE IN	SIGNAL	CHANNEL	SUB D-37
A	gnd		14
B	+	(HF)	15
C	-		16
D	gnd		17
E	+	(MF)	18
F	-		19
G	gnd		20
H	+	(LF)	21
J	-		22
K	gnd		23
L	+	(SUB)	24
M	-		25
N	gnd		26
P	+	(HF-FILL)	27
R	-		28
S	gnd		29
T	+	(LF-FILL)	30
U	-		31

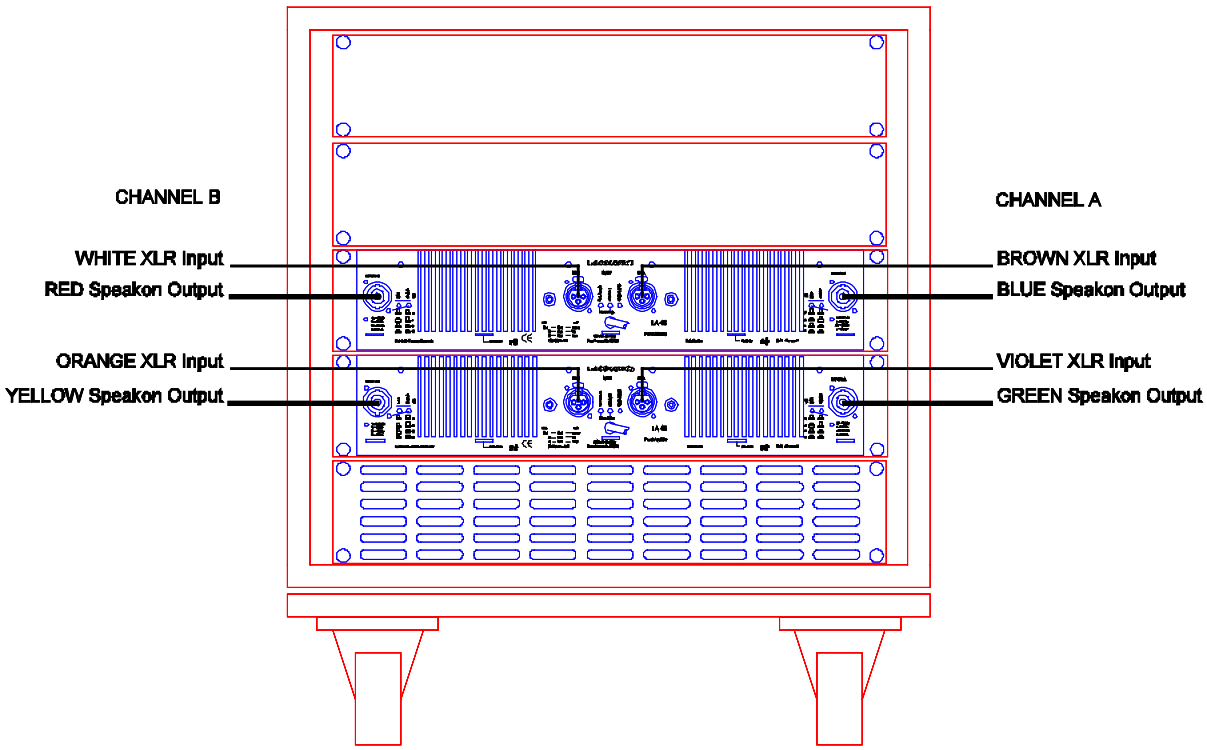
COMB WIRING

3-WAY	SUB	2-WAY
14	23	26
15	24	27
16	25	28
17	23	29
18	24	30
19	25	31
20	23	26
21	24	27
22	25	28
20	23	29
21	24	30
22	25	31

CHANNEL A SUB D-37 TO AMPLIFIER TO SPEAKER CONNECTOR WIRING — AMP CHANNEL ASSIGNMENT

SUB D-37 A	SIGNAL	XLR COLOR	XLR PIN	AMP CH	AMP OUT	SPEAKON COLOR	CACOM8	3-WAY	SUB	2-WAY
1	gnd		1							
2	+	BROWN	2	LA 48 (1)	1+	BLUE	G	HI	SUB	HF FILL A
3	-	AMP 1 CH A	3	CH A	1-	AMP 1 CH A	H			
4	gnd		1							
5	+	VIOLET	2	LA 48 (2)	1+	GREEN	E	MID	SUB	LF FILL A
6	-	AMP 2 CH A	3	CH A	1-	AMP 2 CH A	F			
7	gnd		1							
8	+	WHITE	2	LA 48 (1)	1+	RED	A	LOW1	SUB	HF FILL B
9	-	AMP 1 CH B	3	CH B	1-	AMP 1 CH B	B			
10	gnd		1							
11	+	ORANGE	2	LA 48 (2)	1+	YELLOW	C	LOW2	SUB	LF FILL B
12	-	AMP 2 CH B	3	CH B	1-	AMP 2 CH B	D			

RK12-2 Amplifier Rack Wiring Diagram for PAD02



1.5 POWERING dV-DOSC

As stated above, one L-ACOUSTICS RK12-4 rack can power up to 6 V-DOSC, 8 dV-SUB or SB218 subwoofers or 12 dV-DOSC. If both A and B sides of the rack are configured in 2-way mode and we consider the amplifiers as numbered 1 through 4 (from top to bottom as they appear in the rack) nominal impedance loads and amplifier channel assignments when powering 4 dV-DOSC cabinets are:

- 1 x 8 ohms on high-frequency channel (amplifiers # 1, 3 – Channels A / B).
- 1 x 8 ohms on low-frequency channel (amplifiers # 2, 4 – Channel A / B)

The power rating for the dV-DOSC low section is dependent on the selected high pass filter frequency and slope. Selection of highpass filtering parameters will depend on the intended application for dV-DOSC, i.e., whether dV-DOSC is used with subwoofers, standalone (fullrange) or flown under V-DOSC for downfill applications.

Given a maximum excursion of +/- 4 mm for the low frequency component, Table 3 summarizes the power ratings for the low section as a function of high pass filtering characteristics:

Table 3: Power Handling versus HP Filter Characteristics for the dV-DOSC LF Section

HPF frequency	FILTER TYPE	Vrms	Wrms	Wpeak
75	Bessel 12	29.0	105	421
75	Butterworth 12	32.0	128	512
75	LR 24	40.0	200	800
100	Bessel 12	40.0	200	800
100	Butterworth 12	44.0	242	968
100	**LR 24**	**50.0**	**313**	**1250**
125	Bessel 12	49.0	300	1201
125	Butterworth 12	54.0	365	1458
125	LR 24	60.0	450	1800

Specifying a 100 Hz Linkwitz Riley (LR24) high pass filter frequency as standard, multiple cabinet impedance loads and power ratings are summarized in Table 4.

Table 4: Load, RMS and Peak Power Ratings for dV-DOSC (100 Hz LR24 HPF for the LF section)

	One dV-DOSC			Two dV-DOSC			Three dV-DOSC		
Section	Load (ohms)	RMS (W)	Peak (W)	Load (ohms)	RMS (W)	Peak (W)	Load (ohms)	RMS (W)	Peak (W)
LOW	8	300	1200	4	600	2400	2.8	900	3600
HIGH	8	75	300	4	150	600	2.8	225	900

According to standard L-ACOUSTICS specification practice, minimum amplifier power output ratings are defined as twice the RMS power rating for the low section and equal to the peak power rating for the high section. Recommended power amplifier ratings are therefore given in Table 5.

NOTE: L-ACOUSTICS specifies amplifiers with 32 dB gain as standard.

Table 5: Recommended Amplifier Power Ratings for 100 Hz LR24 HPF

Load (ohms)	HF Section POWER RATING (gain = 32 dB)	LF Section POWER RATING (gain = 32 dB)
8	> 300 W	> 600 W
4	> 600 W	> 1200 W
2.8	> 900 W	> 1800 W

Tables 6 and 7 give a cross reference of L-ACOUSTICS LA 24 and LA 48 amplifier power ratings and MLS switch settings for powering dV-DOSC. In general terms, the LA 24 is suitable for powering up to 2 dV-DOSC while the LA 48 is recommended for powering 3 enclosures in parallel. For system protection via power matching, recommended MLS switch settings are indicated in bold italics and bold for the low and high sections, respectively. For touring applications (i.e., with skilled operators) LA 24 and LA 48 amplifiers can be operated with MLS switches in the 0 dB position, however, for fixed installations it is recommended that the MLS switch settings tabulated in Tables 6 and 7 be used.

Table 6: L-ACOUSTICS LA 24 MLS Settings for use with dV-DOSC

		MLS SWITCH SETTING			
LOAD	CONFIGURATION	-5 dB	-4 dB HF	-2 dB	0 dB LF
8 ohms	Stereo (2 channel)	300	**350**	650	***1000***
4 ohms	Stereo (2 channel)	570	**680**	1100	***1400***
2.8 ohms	Stereo (2 channel)	880	**1025**	1300	***1400***

(Recommended settings in BOLD for HF, BOLD/ITALICS for LF)

Table 7: L-ACOUSTICS LA 48 MLS Settings for use with dV-DOSC

		MLS SWITCH SETTING			
LOAD	CONFIGURATION	-5 dB HF	-4 dB	-2 dB LF	0 dB
8 ohms	stereo (2 channel)	**430**	520	***820***	1300
4 ohms	stereo (2 channel)	**830**	1000	***1600***	2100
2.8 ohms	stereo (2 channel)	**1380**	1660	***2000***	2250

(Recommended settings in BOLD for HF, BOLD/ITALICS for LF)

Cabling options for connecting to either RK12-2 or RK12-4 are shown below:



Breakout at the loudspeaker end:

2-WAY COMB connector

V-DOSC Cable DO7 or DO25

DOFILL Adapter



Breakout at the amplifier rack:

2-WAY COMB connector

DO2W Adapter

CC4FP Speakon Barrel Extension (2)

Speakon Cable SP7 or SP25 (2)

Figure 13: Connecting dV-DOSC to L-ACOUSTICS RK12-4

1.6 dV-SUB ENCLOSURE DESCRIPTION

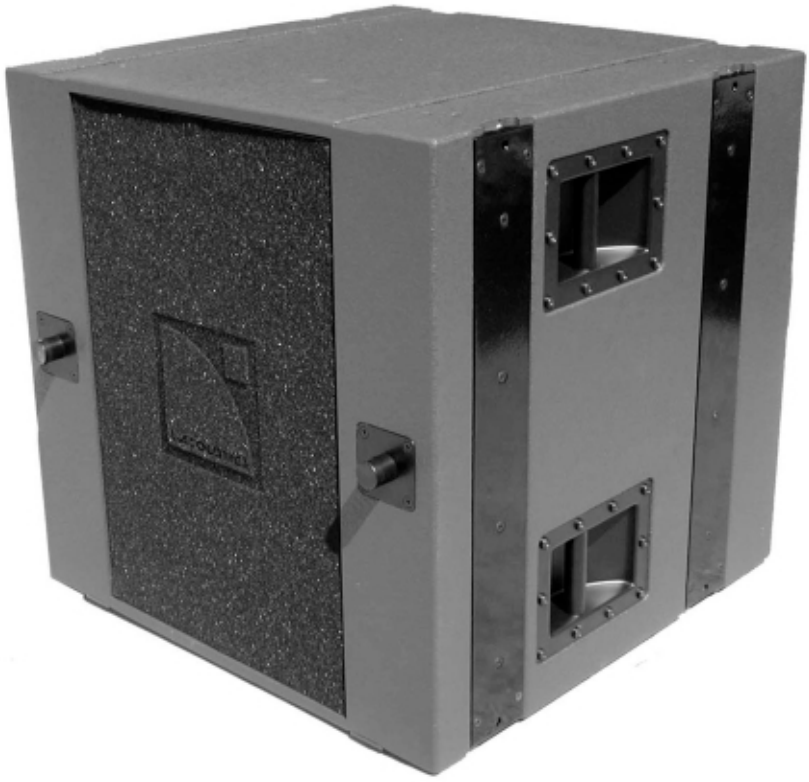


Figure 14: dV-SUB

dV-SUB contains three 15" loudspeakers mounted in a vented bandpass configuration. Individual 15" loudspeakers are rated at 8 ohms and connected in parallel to provide a nominal impedance of 2.7 ohms.

Note: the two side firing 15" components are wired internally in polarity opposition so that a positive signal causes cone movement in the same direction for all components, i.e., a positive pulse causes all 15" components to pressurize the central chamber, resulting in positive polarity as measured acoustically. When servicing 15" components, 1:1 correspondence in terms of wiring should be followed, i.e., red lead -> red terminal, black lead -> black terminal since the polarity inversion for the side 15" components is taken care of at the input terminal (not at the speakers).

dV-SUB operating bandwidth is 40 Hz to 200 Hz with a useable bandwidth of 35 to 200 Hz measured under half space loading conditions. Recommended crossover filtering is 80 - 200 Hz 4th order Linkwitz-Riley lowpass filtering (depending on the preset type) and 30 Hz 4th order Linkwitz-Riley highpass filtering. The 15" components employed in dV-SUB feature front and rear treatment of the cone body and all metal parts are corrosion-treated to ensure weather resistant protection. Other features include: high strength/low fatigue surround, 3" edgewound copper ribbon voice coil, die cast aluminum basket, massive vented magnet structure and high thermal capacity.

A single Speakon connector socket is provided for connection to the amplifier in order to avoid paralleling of multiple enclosures and subsequent reductions in overall load impedance. dV-SUB cabling is compatible with all existing SB218 subwoofer cabling (as part of the V-DOSC standard) and sub cable DOSUB (8 pin CACOM to 4 x Speakon) with, or without, sub extension DO10P can be used for connecting dV-SUB to L-ACOUSTICS RK12-4 or RK12-2 amplifier racks.

1.7 dV-SUB FLYING SYSTEM

dV-SUB features two sets of recessed side panels on each side of the enclosure that are used in conjunction with three different types of angle bar for rigging purposes. dV-ANGLESS angle bars are used for rigging sub-to-sub in flown or stacked applications. Four dV-ANGLESS are required per two cabinets along with 8 dV-PIN25.



Figure 15: dV-ANGLESS sub-to-sub angle bar

Two other sets of angle bars are provided for attaching dV-SUB to either dV-DOSC or dV-BUMP: dV-ANGLESD and dV-ANGLESDP. For attachment to dV-BUMP, 4 x dV-ANGLESD should be used along with 8 x dV-PIN25. For stacking dV-DOSC directly on top of dV-SUB or when flying dV-DOSC underneath dV-SUB, 2 x dV-ANGLESD are used for attachment of the front dV-DOSC points and 2 x dV-ANGLESDP are used for attachment of the rear dV-DOSC points along with 8 dV-PIN25.

Note: dV-ANGLESS and dV-ANGLESDP have two different holes for connection to the dV-SUB depending on whether dV-DOSC is to be stacked on top of dV-SUB or flown underneath. The closest hole is for stacked applications while the further hole is for flown applications - the need for different attachment points is due to the requirement for physical clearance for the dV-SUB stacking runners when dV-DOSC is flown underneath.

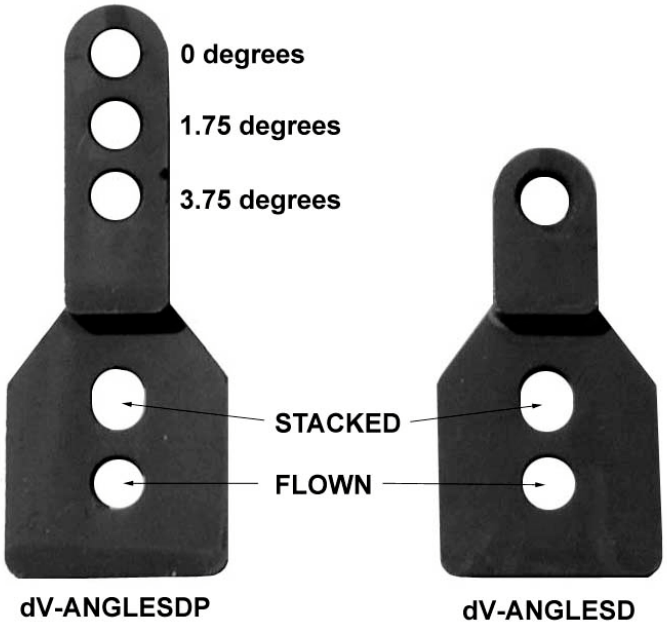


Figure 16: dV-ANGLESDP and dVANGLESD angle bars

Note: the thickness of the dV-ANGLESS, dV-ANGLESD and dV-ANGLESDP is different than that of dV-ANGLEP1 or P2 in order to account for the increased mass of the dV-SUB. Use of separate angle bars for dV-SUB is necessary for safety factor reasons. Always install dV-ANGLESD and dV-ANGLESDP with the fat part of the bar oriented towards the center of the dV-SUB on both sides.

dV-SUB rigging is compatible with dV-BUMP and the rigging system is rated for up to 6 dV-SUB deep. When flown 6 deep, the overall weight of the system is 552 kg (1217 lbs). Pick point hole number #5 on the central spreader bar of dV-BUMP will produce a dead hang (nominal zero degrees).

When flying combined dV-DOSC and dV-SUB arrays in a single column, dV-SUB is always flown on top. Under no circumstances should dV-SUB be flown beneath dV-DOSC. Maximum rated combinations are summarized in the following tables:

Table 8: Maximum rated dV-SUB / dV-DOSC combinations - dV-DOSC flown below dV-SUB
Single point hang from rear extension bar (holes 9-16)
OR
2-point hang from dV-BUMP front point (hole 0) + extension bar rear point (hole 16)

dV-SUB	0	1	2	3	4	5	6
dV-DOSC	12	6	4	1	0	0	0
Total weight	414 kg 912 lbs	290 kg 639 lbs	316 kg 697 lbs	309 kg 681 lbs	368 kg 811 lbs	460 kg 1014 lbs	552 kg 1217 lbs

Table 9: Maximum rated dV-SUB / dV-DOSC combinations - dV-DOSC flown below dV-SUB
Single point hang from central spreader bar (holes 1-8)

dV-SUB	0	1	2	3	4	5	6	6
dV-DOSC	24	9	8	7	6	4	1	0
Total weight	786 kg 1732 lbs	389 kg 858 lbs	448 kg 988 lbs	507 kg 1118 lbs	566 kg 1248 lbs	592 kg 1305 lbs	585 kg 1290 lbs	552 kg 1217 lbs

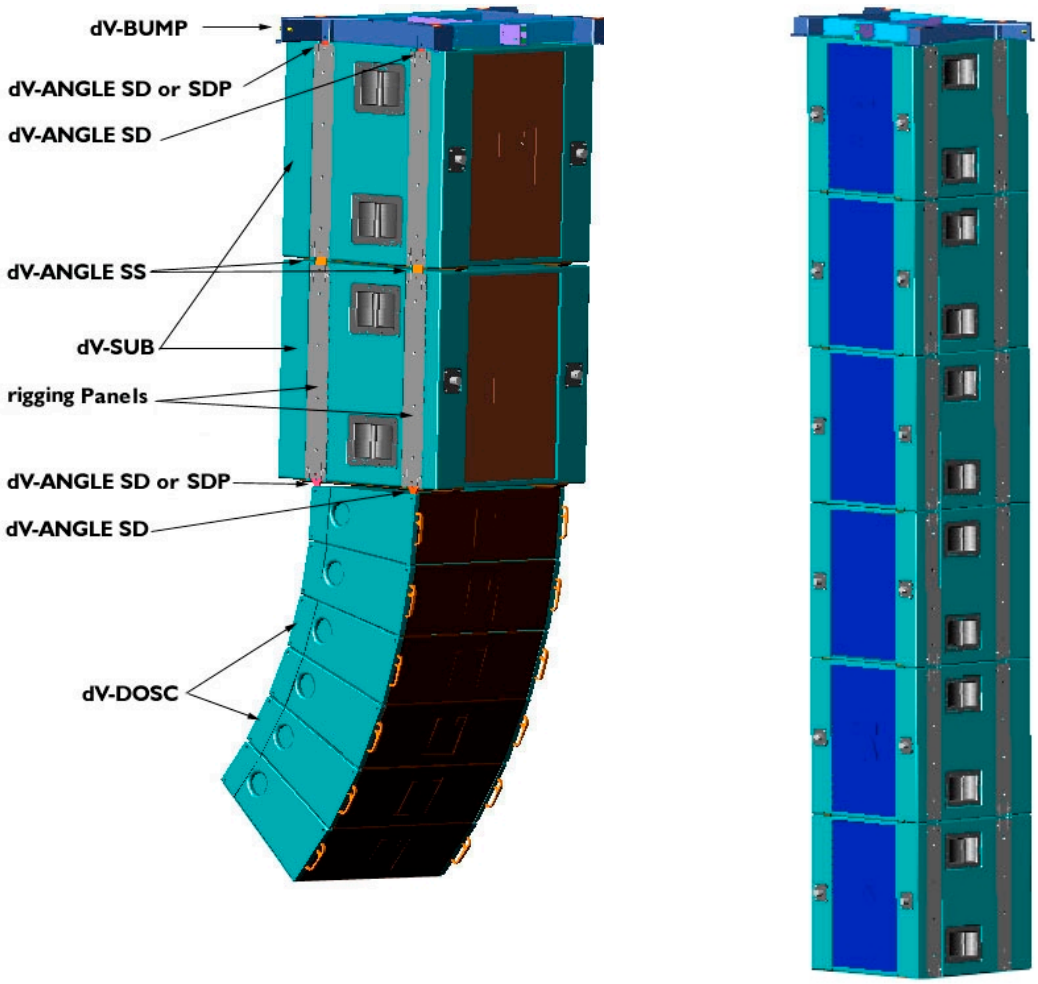


Figure 17: Illustration of dV-SUB rigging configurations

1.8 POWERING dV-SUB

One L-ACOUSTICS RK12-4 rack can power up to 8 dV-SUB where one dV-SUB is driven per amplifier channel (RK12-2 can power 4 dV-SUBs). The power rating for dV-SUB is 57 Vrms long term (pink noise with a crest factor of 6 dB) which corresponds to 1200 Wrms and 4800 Wpeak power handling. According to standard L-ACOUSTICS specification practice, minimum amplifier power ratings are defined as twice the RMS power rating, leading to the recommended power amplifier specification of 2400 W into 2.7 ohms. Since the L-ACOUSTICS LA 48 delivers 2250 W (nominal) and 2600 W (peak) into 2.7 ohms, this makes it an excellent choice for powering dV-SUB. Amplifier power ratings are summarized below:

Table 10: Recommended Power and Amplifier Power Ratings for dV-SUB (EIA 1 kHz @ 1% THD)

LOAD (ohms)	REC'D POWER	LA 48 nominal	LA 48 peak	CROWN MA5000	CROWN MA5002	QSC 6.0
2.7	2400	2250	2600	*2250*	*2250*	*2900*

1.9 dV-DOSC CONTROL

Four digital signal processing units are currently supported and specified by L-ACOUSTICS for controlling the dV-DOSC system: XTA DP 226, DP 224 and BSS FDS 355 (Omnidrive Compact), FDS 366 (Omnidrive Compact Plus).

XTA or BSS processors are supplied with proprietary presets that are intended for specific array configurations. Since the XTA DP 226 is a 2 input by 6 output unit, the DP224 is 2 x 4, the BSS FDS 355 is 3 x 5 and the FDS 366 is 3 x 6, exact internal wiring of your FOH drive rack and digital processor channel assignments will vary depending on the selected processor and preset. Various operating modes, processor channel assignments and MULTI line assignments are described in detail below for the various processors. Carefully consider your flexibility requirements before selecting the number and type of processors to specify.

NOTE: Whichever processor is used, MULTI line assignments must remain standard to allow for system compatibility. Failure to follow MULTI standards may result in damage to speaker components of the V-DOSC system.

ALWAYS REFER TO THE PRESET DESCRIPTION SHEET FOR YOUR PROCESSOR WHEN SELECTING PRESETS AND CONFIGURING THE DRIVE RACK.

(a) General Guidelines Regarding System Protection

As supplied by L-ACOUSTICS, limit thresholds for all dV-DOSC presets for both XTA and BSS processors are set at +7 dBu (100 Hz HPF) or +5 dBu (75 Hz HPF) for the low section and +4 dBu for the high section. These limit thresholds are set based on the power handling specifications of each section. In addition to crossover limiters, amplifier power ratings must be correctly matched to loudspeaker's power handling capabilities and amplifiers must have 32 dB gain. For L-ACOUSTICS LA 24 and LA 48 amplifiers please refer to tables 6 and 7 to determine the correct MLS switch settings required for power matching.

When further system protection is desirable, low and high section limit thresholds can be reduced up to an additional 3 dB below the initial values (i.e., +4 / +2 dBu for the low section, +1 dBu for the high section). Exact settings will depend on individual engineer preferences and the type of music or application which, in turn, determines how hard the system is being operated and how much headroom is desired.

(b) Preset Policy

dV-DOSC and V-DOSC presets are provided as a reference for all Qualified V-DOSC Technicians and Certified V-DOSC Engineers. According to L-ACOUSTICS policy, key parameters are software protected and preset data is not freely communicated in order to preserve quality control, confidentiality and to maintain the integrity of L-ACOUSTICS system presets.

A lot of engineering and real world testing goes into determining optimum dV-DOSC presets – detailed polar measurements and weighted spatial averaging are used to determine component equalization, crossover points and crossover filter slopes, for example. As a result, dV-DOSC presets give the user an optimum starting point – system tuning should be done using band attenuation, accurate subwoofer time alignment and system equalization – not by altering crossover presets for the following reason:

Without proper instrumentation and spatial averaging, adjustments made at one location (e.g. the mix position) are not optimum at all other locations within the defined coverage region of the system. When made by ear, such adjustments are often misguided – the user may be in a local room mode (low frequency pressure maximum or minimum) and/or may be hearing a cancellation or addition due to crossover misalignment that sounds good at that specific location but what about all others? Meanwhile, the same result could have been achieved while preserving the power response of the system (and satisfaction of WST criteria) by using the correct crossover preset and a simple equalization cut or correct time alignment of subwoofers …

The bottom line is that making sure that dV-DOSC is used properly is in **everyone's** best interest and it is up to the Qualified V-DOSC Technician and Certified V-DOSC Engineer to maintain quality control standards. Quality control starts with good sound design, proper array design, accurate installation, correct preset selection and a solid methodology for system tuning. Restricting access to presets is in no way meant to restrict the creative process – on the contrary, the overall systems approach is intended to enhance it by ensuring quality control and repeatability.

In practice, all OEM presets are distributed to end users via PCMCIA Card or are downloadable from www.l-acoustics.com so that the presets remain software protected. Presets and preset updates are available directly from L-ACOUSTICS headquarters in France or from Cox Audio Engineering in the U.S. L-ACOUSTICS maintains a library of stock presets for both XTA and BSS processors to support approved amplifiers for a variety of operating modes and cabinet combinations. Custom presets are available on a special order basis and there is a standard price per preset in order to cover custom engineering costs.

c) General Description of dV-DOSC Presets

Similar to V-DOSC, dV-DOSC presets are provided in LO and HI versions with differing amounts of HF shelving equalization. In general, LO presets are flat (smooth) while HI presets have an additional 3 dB of shelving eq (bright).

2-way dV-DOSC stereo presets offer the choice between two high pass filters for the low section and two shelving eqs for the high section. For dV-DOSC 2W 100 (XTA) or DV2W (BSS) presets, a 100 Hz, 24 dB/octave slope HPF is applied to the low section and the limit threshold is set at +7 dBu. For dV-DOSC 2W 75 (XTA) or DV2WX (BSS) presets, a 75 Hz 12 dB/octave slope HPF is applied to the low section and the limit threshold is set at +5 dBu. For either of these presets, LO (smooth) or HI (bright) versions are provided with differing amounts of shelving eq for the high frequency section.

For V-DOSC plus dV-DOSC presets (for example, V-DOSC+dV X LO/HI or V-DOSC + dV 4W LO/HI for XTA; VD DV X LO/HI or VD DV 4W LO/HI for BSS), dV-DOSC is preattenuated by 4 dB for downfill applications where dV-DOSC is flown underneath V-DOSC. dV-DOSC high pass filtering is set at 100 Hz and LO or HI shelving eq corresponds to the equivalent shelving eq that is applied to V-DOSC. For BSS processors, dV-DOSC downfill enclosures can be driven with the same signal as the main V-DOSC arrays by selecting source input A (instead of B as is standard). For the XTA DP226, a fixed 4+2 configuration is used so that V-DOSC is driven off input A and dV-DOSC off input B (an input Y adapter, i.e., 1x female XLR to 2x male XLR, can be used to apply the same signal to both A and B channels to simplify console output matrix routing).

Note: For V-DOSC presets that include dV-DOSC processing, if dV-DOSC is used with V-DOSC for upfill applications or as a separate fill array, the 4 dB preattenuation that is built in to the V-DOSC + dV-DOSC presets for downfill applications may not be desirable and should be accounted for by varying the B input gain or the dV-DOSC LF and HF section output gains.

Note: For 4+2 XTA configurations where V-DOSC is driven off input A and dV-DOSC off input B, if you apply predelay to the V-DOSC arrays, make sure you apply the same predelay to the dV-DOSC arrays when dV-DOSC is used for downfill.

3-way presets are provided for dV-DOSC plus dV-SUB with a variety of crossover points available between dV-SUB and the dV-DOSC low section (80, 120 and 200 Hz). The 80 Hz crossover point is intended for applications where dV-SUB and dV-DOSC are physically separated (eg. ground stacked subwoofers with flown dV-DOSC system). The 120 Hz crossover point is considered optimal in terms of power bandwidth for both dV-SUB and the dV-DOSC low section. The 200 Hz crossover point allows the dV-SUB to function as a combination sub/low enclosure and also provides an operating bandwidth that corresponds to that of the V-DOSC low section.

Note: For a ratio of 3:1 dV-DOSC:dV-SUB low frequency extension is provided that results in the same spectral balance as V-DOSC (without subwoofers). For additional low frequency impact, a 1.5:1 dV-DOSC:dV-SUB ratio is recommended (eg; 3:2, 6:4, 9:6, 12:8).

3-way presets are also provided for dV-DOSC plus L-ACOUSTICS SB115 (single 15") and SB218 (dual 18") subwoofers. Two types of presets are provided for each subwoofer: 3W (100 Hz HPF for dV-DOSC) and 3WX (80 Hz HPF for dV-DOSC). The 3W preset is intended for applications where subwoofers are flown closely coupled to the dV-DOSC array as an extension of the system, whereas 3WX presets are intended for applications where subwoofers are ground stacked, separate from the flown dV-DOSC arrays. SB115 3-way presets are optimized for a 3:2 dV-DOSC:SB115 cabinet ratio, while SB218 3-way presets are optimized for a 2:1 ratio.

Note: For XTA 224 and 226, the number of OEM memories is limited to 40 total. Additional presets such as dV 3W 200 dV-SUB LO/HI, dV 3W SB115, dV 3WX SB115, dV 3WX SB218 are available in the XTA Audiocore .xbl file.

4-way presets are provided for flown dV-DOSC + dV-SUB arrays when used in conjunction with ground stacked dV-SUB or SB218 subwoofers. A 1.5:1 dV-DOSC:Subwoofer ratio is recommended (for example: 3 dV-DOSC, 1 dV-SUB flown, 1 dV-SUB ground stacked) and separate processing is provided for the flown versus ground stacked subwoofers.

For example, the dV 4W dV-SUB LO/HI preset has the following output channel assignments:

Output 1	dV-SUB ground stacked	(input A)
Output 2	dV-SUB flown	(input A)
Output 3	dV-DOSC low section	(input A)
Output 4	dV-DOSC high section	(input A)
Output 5	fullrange	(input A)
Output 6	dV-SUB ground stacked	(input B)

Output 6 can be used for auxiliary sub drive via input B.

Note: For 4W presets, the crossover frequency between the flown dV-SUB and dV-DOSC low section is 120 Hz to optimize the power bandwidth for both sections. The overall operating bandwidth for the flown dV-SUB is 30 Hz – 120 Hz while the operating bandwidth for ground stacked subs (dV-SUB or SB218) is 30-80 Hz. Depending on how ground stacked subs are processed, due to the overlap of the operating bandwidths for flown vs ground stacked (30-120 vs 30-80) the 180 degree phase shift due to the 80 Hz low pass filter may have to be compensated for by inverting the polarity of the ground stacked subwoofers. For the standard preset, polarity for output channels 1 and 6 is positive – experiment with polarity during tuning and time alignment to get the best result.

Version 6 preset names and descriptions for BSS 355, 366 and XTA 224, 226 processors are given below. Full details of channel assignments and user adjustable parameters are provided in the Preset Description sheets that are distributed with PCMCIA cards. Alternatively, preset data along with preset description sheets can be downloaded from www.l-acoustics.com.

d) BSS FDS 355 VERSION 6 0801 PRESETS

BSS FDS 355 VERSION V6 0801 PRESETS

PRESET NAME	PGM TYPE	Mem	OUT 1 (Source)	OUT 2 (Source)	OUT 3 (Source)	OUT 4 (Source)	OUT 5 (Source)
USER		1					
VD X LO	4(A)+1(B)	2	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
VD X HI	4(A)+1(B)	3	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
VD 4W LO	4(A)+1(B)	4	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
VD 4W HI	4(A)+1(B)	5	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
VD DV X LO	3(A)+2(B)	6	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV X HI	3(A)+2(B)	7	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV 4W LO	3(A)+2(B)	8	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV 4W HI	3(A)+2(B)	9	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD ARC X LO	3(A)+2(B)	10	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC X HI	3(A)+2(B)	11	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC 4WL	3(A)+2(B)	12	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC 4WH	3(A)+2(B)	13	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD FR X LO	3(A)+2(B)	14	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR X HI	3(A)+2(B)	15	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR 4WL	3(A)+2(B)	16	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR 4WH	3(A)+2(B)	17	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
DV 2W LO	mono+2(A)+2(B)	18	SUM (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 2W HI	mono+2(A)+2(B)	19	SUM (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 2WX LO	mono+2(A)+2(B)	20	SUM (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 2WX HI	mono+2(A)+2(B)	21	SUM (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 200 L	mono+2(A)+2(B)	22	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 200 H	mono+2(A)+2(B)	23	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 120 L	mono+2(A)+2(B)	24	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 120 H	mono+2(A)+2(B)	25	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 80 L	mono+2(A)+2(B)	26	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 80 H	mono+2(A)+2(B)	27	MONO dV-SUB (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W SB L	mono+2(A)+2(B)	28	MONO SB218 (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W SB H	mono+2(A)+2(B)	29	MONO SB218 (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3WX SB L	mono+2(A)+2(B)	30	MONO SB218 (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3WX SB H	mono+2(A)+2(B)	31	MONO SB218 (A+B)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 4W DVS L	4(A)+1(B)	32	dV-SUB ground (A)	dV-SUB flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB ground (B)
DV 4W DVS H	4(A)+1(B)	33	dV-SUB ground (A)	dV-SUB flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB ground (B)
DV 4W SB L	4(A)+1(B)	34	SB218 ground (A)	dV-SUB flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 ground (B)
DV 4W SB H	4(A)+1(B)	35	SB218 ground (A)	dV-SUB flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 ground (B)
ARCS 2W LO	mono+2(A)+2(B)	36	SUM (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARCS 2W HI	mono+2(A)+2(B)	37	SUM (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARC 3W SB L	mono+2(A)+2(B)	38	MONO SB218 (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARC 3W SB H	mono+2(A)+2(B)	39	MONO SB218 (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARC 3W DV L	mono+2(A)+2(B)	40	MONO dV-SUB (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARC 3W DV H	mono+2(A)+2(B)	41	MONO dV-SUB (A+B)	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
SUB ARC	5-WAY (A)	42	DELAY 1 (A)	DELAY 2 (A)	DELAY 3 (A)	DELAY 4 (A)	DELAY 5 (A)

Table 11: BSS FDS 355 Presets

e) BSS FDS 366 VERSION 6 0801 PRESETS

BSS FDS 366 VERSION V6 0801 PRESETS

PRESET NAME	PGM TYPE	Mem	OUT 1 (Source)	OUT 2 (Source)	OUT 3 (Source)	OUT 4 (Source)	OUT 5 (Source)	OUT 6 (Source)
USER	3(A)+3(B)	1						
VD X LO	5(A)+1(B)	2	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
VD X HI	5(A)+1(B)	3	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
VD 4W LO	5(A)+1(B)	4	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
VD 4W HI	5(A)+1(B)	5	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
VD DV X LO	4(A)+2(B)	6	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV X HI	4(A)+2(B)	7	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV 4W LO	4(A)+2(B)	8	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD DV 4W HI	4(A)+2(B)	9	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
VD ARC X LO	4(A)+2(B)	10	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC X HI	4(A)+2(B)	11	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC 4W L	4(A)+2(B)	12	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD ARC 4W H	4(A)+2(B)	13	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
VD FR X LO	4(A)+2(B)	14	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR X HI	4(A)+2(B)	15	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR 4W LO	4(A)+2(B)	16	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD FR 4W HI	4(A)+2(B)	17	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULLRANGE (B)	FULLRANGE (B)
VD 3W LO	3(A)+3(B)	18	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
VD 3W HI	3(A)+3(B)	19	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
VD 3WX LO	3(A)+3(B)	20	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
VD 3WX HI	3(A)+3(B)	21	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
DV 2W LO	2(A)+2(B)+2(C)	22	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	dV-DOSC LO (C)	dV-DOSC HI (C)
DV 2W HI	2(A)+2(B)+2(C)	23	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	dV-DOSC LO (C)	dV-DOSC HI (C)
DV 2WX LO	2(A)+2(B)+2(C)	24	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	dV-DOSC LO (C)	dV-DOSC HI (C)
DV 2WX HI	2(A)+2(B)+2(C)	25	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	dV-DOSC LO (C)	dV-DOSC HI (C)
DV 3W 200 L	3(A)+3(B)	26	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 200 H	3(A)+3(B)	27	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 120 L	3(A)+3(B)	28	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 120 H	3(A)+3(B)	29	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 80 L	3(A)+3(B)	30	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W 80 H	3(A)+3(B)	31	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W SB L	3(A)+3(B)	32	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3W SB H	3(A)+3(B)	33	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3WX SB L	3(A)+3(B)	34	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 3WX SB H	3(A)+3(B)	35	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
DV 4W DVS L	5(A)+1(B)	36	dV-SUB ftawn (A)	dV-SUB ftawn (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	dV-SUB ground (B)
DV 4W DVS H	5(A)+1(B)	37	dV-SUB ground (A)	dV-SUB ftawn (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	dV-SUB ground (B)
DV 4W SB L	5(A)+1(B)	38	SB218 ground (A)	dV-SUB ftawn (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	SB218 ground (B)
DV 4W SB H	5(A)+1(B)	39	SB218 ground (A)	dV-SUB ftawn (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	SB218 ground (B)
ARCS 2W LO	2(A)+2(B)+2(C)	40	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)	ARCS LO (C)	ARCS HI (C)
ARCS 2W HI	2(A)+2(B)+2(C)	41	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)	ARCS LO (C)	ARCS HI (C)
ARC 3W SB L	3(A)+3(B)	42	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)	ARCS LO (B)	ARCS HI (B)
ARC 3W SB H	3(A)+3(B)	43	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)	ARCS LO (B)	ARCS HI (B)
ARC 3W DV L	3(A)+3(B)	44	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)	ARCS LO (B)	ARCS HI (B)
ARC 3W DV H	3(A)+3(B)	45	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)	ARCS LO (B)	ARCS HI (B)
SUB ARC	6-way (A)	46	SB218 SUB (A) T1	SB218 SUB (A) T2	SB218 SUB (A) T3	SB218 SUB (A) T4	SB218 SUB (A) T5	SB218 SUB (A) T6

Table 12: BSS FDS 366 Presets

f) XTA DP224 VERSION 6 0801 PRESETS

XTA DP 224 VERSION V6 0801 PRESETS

PRESET NAME	PGM TYPE	MEM	OUT 1 (Source)	OUT 2 (Source)	OUT 3 (Source)	OUT 4 (Source)
V-DOSC X LO	4-way (A)	10	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)
V-DOSC X HI	4-way (A)	11	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)
V-DOSC 4W LO	4-way (A)	12	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)
V-DOSC 4W HI	4-way (A)	13	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)
V-DOSC X LO AUX	3-way (A) + SUB (B)	14	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
V-DOSC X HI AUX	3-way (A) + SUB (B)	15	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
V-DOSC 4W LO AUX	3-way (A) + SUB (B)	16	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
V-DOSC 4W HI AUX	3-way (A) + SUB (B)	17	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	SUB (B)
dV-DOSC 2W 100 LO	2-way (A) + 2-way(B)	18	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV-DOSC 2W 100 HI	2-way (A) + 2-way(B)	19	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV-DOSC 2W 75 LO	2-way (A) + 2-way(B)	20	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV-DOSC 2W 75 HI	2-way (A) + 2-way(B)	21	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W 200 dVS LO	3-way (A) + SUB (B)	22	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W 200 dVS HI	3-way (A) + SUB (B)	23	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W 120 dVS LO	3-way (A) + SUB (B)	24	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W 120 dVS HI	3-way (A) + SUB (B)	25	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W 80 dVS LO	3-way (A) + SUB (B)	26	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W 80 dVS HI	3-way (A) + SUB (B)	27	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)
dV 3W SB2 18 LO	3-way (A) + SUB (B)	28	SB218 (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 (B)
dV 3W SB2 18 HI	3-way (A) + SUB (B)	29	SB218 (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 (B)
dV 3WX SB2 18 LO	3-way (A) + SUB (B)	30	SB218 (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 (B)
dV 3WX SB2 18 HI	3-way (A) + SUB (B)	31	SB218 (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 (B)
dV 4W dV-SUB LO	4-way (A)	32	dV-SUB Ground (A)	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)
dV 4W dV-SUB HI	4-way (A)	33	dV-SUB Ground (A)	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)
dV 4W SB2 18 LO	4-way (A)	34	SB218 Ground (A)	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)
dV 4W SB2 18 HI	4-way (A)	35	SB218 Ground (A)	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)
dV dVS LO dVS AUX	3-way (A) + SUB (B)	36	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)	dV-SUB Ground (B)
dV dVS HI dVS AUX	3-way (A) + SUB (B)	37	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)	dV-SUB Ground (B)
dV dVS LO SB AUX	3-way (A) + SUB (B)	38	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)	SB218 Ground (B)
dV dVS HI SB AUX	3-way (A) + SUB (B)	39	dV-SUB Flown (A)	dV-DOSC LOW (A)	dV-DOSC HIGH (A)	SB218 Ground (B)
ARCS 2W LO	2-way (A) + 2-way(B)	40	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARCS 2W HI	2-way (A) + 2-way(B)	41	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)
ARCS 3W SB218 LO	3-way (A) + SUB (B)	42	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)
ARCS 3W SB218 HI	3-way (A) + SUB (B)	43	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)
ARCS 3W dVSUB LO	3-way (A) + SUB (B)	44	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)
ARCS 3W dVSUB HI	3-way (A) + SUB (B)	45	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)
115FM 2W	2-way (A) + 2-way(B)	46	115FM LO (A)	115FM HI (A)	115FM LO (B)	115FM HI (B)
115FM 2WX	2-way (A) + 2-way(B)	47	115FM LO (A)	115FM HI (A)	115FM LO (B)	115FM HI (B)
115FM 3W SB218	3-way (A) + SUB (B)	48	SB218 SUB (A)	115FM LO (A)	115FM HI (A)	SB218 SUB (B)

Table 13 : XTA DP224 Presets

g) XTA DP226 VERSION 6 0801 PRESETS

XTA DP226 VERSION V6 0801 PRESETS

PRESET NAME	PGM TYPE	MEM	OUT 1 (Source)	OUT 2 (Source)	OUT 3 (Source)	OUT 4 (Source)	OUT 5 (Source)	OUT 6 (Source)
V-DOSC X LO	5-way (A) + 1 (B)	10	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
V-DOSC X HI	5-way (A) + 1 (B)	11	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
V-DOSC 4W LO	5-way (A) + 1 (B)	12	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
V-DOSC 4W HI	5-way (A) + 1 (B)	13	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	FULL (A)	SUB (B)
V-DOSC+dV X LO	4-way (A) + 2 (B)	14	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
V-DOSC+dV X HI	4-way (A) + 2 (B)	15	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
V-DOSC+dV 4W LO	4-way (A) + 2 (B)	16	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
V-DOSC+dV 4W HI	4-way (A) + 2 (B)	17	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)
V-DOSC+ARCS X LO	4-way (A) + 2 (B)	18	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
V-DOSC+ARCS X HI	4-way (A) + 2 (B)	19	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
V-DOSC+ARCS 4W LO	4-way (A) + 2 (B)	20	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
V-DOSC+ARCS 4W HI	4-way (A) + 2 (B)	21	SB218 SUB (A)	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (B)	ARCS HI (B)
V-DOSC+dV LOAUX	5-way (A) + 1 (B)	22	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SUB (B)
V-DOSC+dV HIAUX	5-way (A) + 1 (B)	23	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SUB (B)
V-DOSC+ARCS LOAUX	5-way (A) + 1 (B)	24	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (A)	ARCS HI (A)	SUB (B)
V-DOSC+ARCS HIAUX	5-way (A) + 1 (B)	25	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	ARCS LO (A)	ARCS HI (A)	SUB (B)
V-DOSC 3W LO	3-way stereo	26	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
V-DOSC 3W HI	3-way stereo	27	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
V-DOSC 3WX LO	3-way stereo	28	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
V-DOSC 3WX HI	3-way stereo	29	V-DOSC LO (A)	V-DOSC MID (A)	V-DOSC HI (A)	V-DOSC LO (B)	V-DOSC MID (B)	V-DOSC HI (B)
dV-DOSC 2W 100 LO	2-way stereo + mono sum (5/6)	30	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	FULL (A+B)	FULL (A+B)
dV-DOSC 2W 100 HI	2-way stereo + mono sum (5/6)	31	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	FULL (A+B)	FULL (A+B)
dV-DOSC 2W 75 LO	2-way stereo + mono sum (5/6)	32	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	FULL (A+B)	FULL (A+B)
dV-DOSC 2W 75 HI	2-way stereo + mono sum (5/6)	33	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-DOSC LO (B)	dV-DOSC HI (B)	FULL (A+B)	FULL (A+B)
dV 3W 120 dVS LO	3-way stereo	34	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W 120 dVS HI	3-way stereo	35	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W 80 dVS LO	3-way stereo	36	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W 80 dVS HI	3-way stereo	37	dV-SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	dV-SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W SB218 LO	3-way stereo	38	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 3W SB218 HI	3-way stereo	39	SB218 SUB (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	SB218 SUB (B)	dV-DOSC LO (B)	dV-DOSC HI (B)
dV 4W dV-SUB LO	5-way (A) + 1 (B)	40	dV-SUB Ground (A)	dV-SUB Flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	dV-SUB Ground (B)
dV 4W dV-SUB HI	5-way (A) + 1 (B)	41	dV-SUB Ground (A)	dV-SUB Flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	dV-SUB Ground (B)
dV 4W SB218 LO	5-way (A) + 1 (B)	42	SB218 Ground (A)	dV-SUB Flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	SB218 Ground (B)
dV 4W SB218 HI	5-way (A) + 1 (B)	43	SB218 Ground (A)	dV-SUB Flown (A)	dV-DOSC LO (A)	dV-DOSC HI (A)	FULL (A)	SB218 Ground (B)
ARCS 2W LO	2-way stereo + mono sum (5/6)	44	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)	FULL (A+B)	FULL (A+B)
ARCS 2W HI	2-way stereo + mono sum (5/6)	45	ARCS LO (A)	ARCS HI (A)	ARCS LO (B)	ARCS HI (B)	FULL (A+B)	FULL (A+B)
ARCS 3W SB218 LO	3-way stereo	46	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)	ARCS LO (B)	ARCS HI (B)
ARCS 3W SB218 HI	3-way stereo	47	SB218 SUB (A)	ARCS LO (A)	ARCS HI (A)	SB218 SUB (B)	ARCS LO (B)	ARCS HI (B)
ARCS 3W dVSUB LO	3-way stereo	48	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)	ARCS LO (B)	ARCS HI (B)
ARCS 3W dVSUB HI	3-way stereo	49	dV-SUB SUB (A)	ARCS LO (A)	ARCS HI (A)	dV-SUB SUB (B)	ARCS LO (B)	ARCS HI (B)

Table 14: XTA DP226 Presets

1.7 CONTROL SIGNAL DISTRIBUTION

The control signal distribution architecture adopted for V-DOSC and dV-DOSC allows maximum flexibility while providing a scaleable approach that can be used for small, medium and large systems. Let's consider a large system application in detail since small and medium systems will adhere to the same MULTI line assignment standards and are considered as subsets of the large scale setup.

A large scale system typically consists of: main Left (L) and Right (R) V-DOSC arrays and Left-Left (L-L), Right-Right (R-R) offstage fill arrays. Each of the four V-DOSC arrays can have associated 2-way dV-DOSC downfill enclosures and SB218 subwoofers therefore requiring 6 channels per array: 3 for V-DOSC, 2 for dV-DOSC and 1 for subwoofers.

Discrete drive for all 4 arrays allows maximum flexibility for time alignment, separate array equalization and stereo imaging (for example, using console matrix sends and panning R channel program to the L-L array and L channel program to the R-R array can provide stereo imaging on a larger scale). Since there are 4 arrays and 6 channels per array, control signal distribution requires 24 channels total. Three lines per channel (+ve, -ve, ground) and additional lines for future amplifier remote control account for selection of the 84-pin Whirlwind MASS W6 connector as the suggested standard multipin connector for control signal distribution. Similarly, 6 channels per array (18 lines total) account for the selection of the 19-pin CA-COM connector.

The CO 24 Control Output panel is used for assigning crossover outputs to the MC2875 multicore drive snake which runs from the control rack at the front-of-house mix position to the stage. Note: since the MASS W6 connector is "hermaphroditic", MC2875 drive snakes (standard 75 metre length) can be conveniently extended for longer cable runs. At the stage end, the MD 24 Multi Distribution panel allows breakout from the multicore and subsequent connection to the appropriate amplifier racks for L-L, L, R and R-R arrays. COMB connectors allow individual amplifier racks to be configured for driving dV-DOSC, V-DOSC, subwoofers (or other 2-way fill enclosures such as ARCS provided that the correct preset has been selected).

1.8 CO 24 CONTROL OUTPUT PANEL

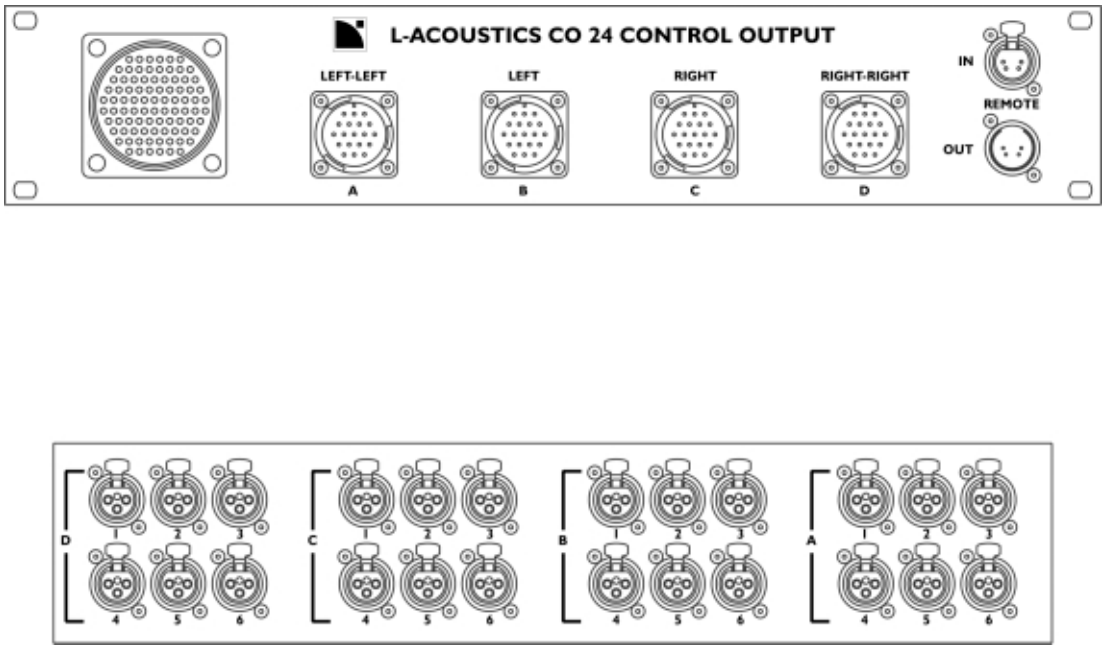


Figure 18: CO24 Control Output Panel

Digital signal processor outputs are assigned to MULTI return lines via the CO 24 CONTROL OUTPUT panel. Internally, XLR outputs are patched from the digital processor to the 24x female XLR patch bay on the internal side of the CONTROL OUTPUT panel. The convention for CO 24 channel assignments for A, B, C, D is: Channel 1 = Sub; Channel 2 = V-DOSC Low; Channel 3 = V-DOSC Mid; Channel 4 = V-DOSC High; Channel 5 = dV-DOSC Low; Channel 6 = dV-DOSC High. Always refer to the preset description table (supplied with PCMCIA cards) to determine correct channel assignments for digital processor outputs. For detailed information on multicore line assignments, please refer to the tables in the appendices of the V-DOSC manual.

All MULTI lines are paralleled with the Left-Left, Left, Right, Right-Right (A, B, C, D) CA-COM connectors located on the front panel of CO 24. These individual CA-COM connectors can be used in situations where CONTROL RACKS are located onstage (eliminating the need for a MULTI DISTRO panel) or when it is desirable to run separate drive snakes to remotely located AMP RACKS For example, in some cases, amplifier racks may be located at delay towers behind the FOH location and separate snake runs required. In smaller venues, a pair of DOM30 cross link cables (with LINK EXTEND DOMP adaptors if necessary) can be run directly from the CA-COM connectors on CO24 and used for system drive instead of the MC2875 multicore. In addition, the availability of individual CA-COM connectors allows a LINK BREAKOUT cable (DOMM) to be connected to these outputs for testing purposes.

For amplifier remote control/monitoring, inputs and outputs are assigned directly to the appropriate MULTI lines. The exact connector type will depend on the model of amplifier selected and the number of required lines will depend on specific amplifier requirements.

1.9 MD 24 MULTI DISTRO PANEL

As seen in the system block diagram of Figure 3, a MULTI DISTRO panel is required onstage for distribution of MULTI return snake lines from the FOH mix position. A single MULTI DISTRO panel is required – typically, the MULTI DISTRO panel is packaged separately and located either stage left or stage right depending on physical constraints regarding snake runs (alternatively, this panel can be mounted in the AMP RACK that is first in line for patching purposes).

An AMP LINK cable is run from the MULTI DISTRO panel to the appropriate CA-COM connector of the first AMP RACK, e.g., CA-COM B (LEFT) if the AMP RACK is located stage right. AMP LINK cables are then used to connect all subsequent stage right amplifiers so that all receive LEFT channel drive lines (including subwoofer amp racks which are configured using the SUB COMB connector and dV-DOSC amp racks using the 2-WAY connector as described above).

A CROSS LINK cable is then used to distribute LEFT array lines from the MULTI DISTRO panel cross stage to the stage left amplifiers. These racks are connected in the same way using AMP LINK cables. Separating left and right signal distribution lines is an effective way to avoid potential ground loop problems.

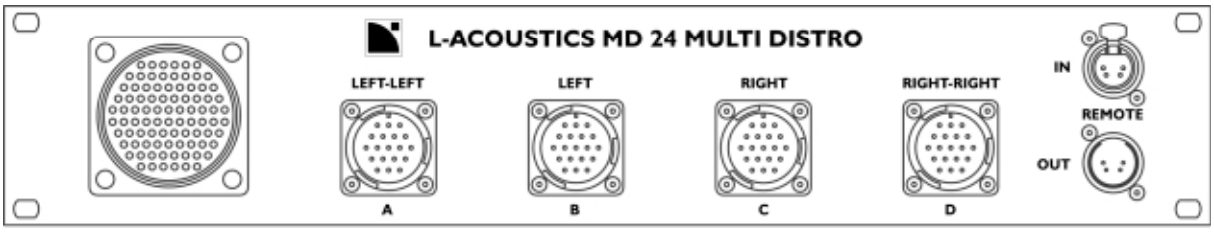


Figure 19: MD24 Multi Distro Panel

1.10 CD12 CONTROL DISTRO PANEL

As an alternative to the traditional "crossovers-in-a-drive rack-at-FOH" approach described above, the CD 12 Control Distribution panel is available for applications where the digital processor is mounted in the amplifier rack (such as the RK12-2M master rack). A multicore drive snake is not required allowing the user to send up to 4 channels from the FOH mix position, for example, left and right program, aux signal for subwoofer drive (optional), RS485 remote control (optional).

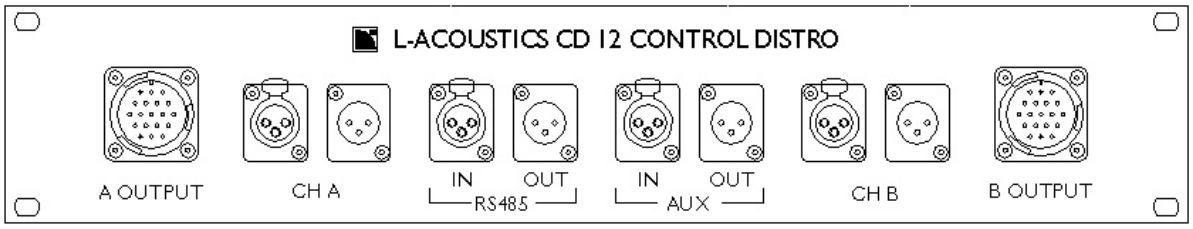


Figure 20: CD 12 Control Distro Panel

For a 3-way stereo applications (dV-DOSC plus subwoofers), patch the left/right program inputs to the Ch A and Ch B XLR inputs. The male XLR tails on the reverse side of CD12 are then patched to the corresponding A and B crossover inputs.

Referring to the channel assignment table for XTA DP226 presets, crossover outputs are then patched as follows:

STEREO 3-WAY MODE

Crossover Output	Crossover Channel Assignment	CD 12 Female XLR Tail
1	Ch A SUB	CA-COM A SUB
2	Ch A LOW	CA-COM A 2-WAY FILL LOW
3	Ch A HIGH	CA-COM A 2-WAY FILL HIGH
4	Ch B SUB	CA-COM B SUB
5	Ch B LOW	CA-COM B 2-WAY FILL LOW
6	Ch B HIGH	CA-COM B 2-WAY FILL HIGH

The A OUTPUT CA-COM is patched from CD12 to the SIGNAL INPUT CA-COM of the PAD02 AMP PANEL in RK12-2M using an AMP LINK cable. The B OUTPUT CA-COM is then patched from CD12 to the PAD02 SIGNAL INPUT CA-COM in RK12-2S using a CROSS LINK cable to get to the other side of the stage. Finally, 2-WAY and SUB COMB connectors are selected for the amplifier racks powering subwoofers and dV-DOSC as required.

When using dV-DOSC with V-DOSC in 4-way + 2 mode, patch the V-DOSC and dV-DOSC program inputs to the Ch A and Ch B XLR inputs (use this approach if you want to run dV-DOSC off a separate matrix send using the Ch B input). Alternatively, use the parallel loop through connector to jump from the Ch A input XLR to the Channel B input on CD12 if you want to send the same input signal to V-DOSC and dV-DOSC. The male XLR tails on the reverse side of CD12 are then patched to the corresponding A and B crossover inputs. CA-COM A only is used and the following channel assignments apply:

4-WAY + 2 MODE

Crossover Output	Crossover Channel Assignment	CD 12 Female XLR Tail
1	SUB	CA-COM A SUB
2	V-DOSC LOW	CA-COM A LOW
3	V-DOSC MID	CA-COM A MID
4	V-DOSC HIGH	CA-COM A HIGH
5	dV-DOSC LOW	CA-COM A 2-WAY FILL LOW
6	dV-DOSC HIGH	CA-COM A 2-WAY FILL HIGH

If separate sub drive is required, use the VDOSC+dV AUX presets (5-way+1). In this case, V-DOSC and dV-DOSC signal is applied to Ch A and sub drive (via a separate aux send) to Ch B.

5-WAY + 1 MODE

Crossover Output	Crossover Channel Assignment	CD 12 Female XLR Tail
1	V-DOSC LOW	CA-COM A LOW
2	V-DOSC MID	CA-COM A MID
3	V-DOSC HIGH	CA-COM A HIGH
4	dV-DOSC LOW	CA-COM A 2-WAY LOW
5	dV-DOSC HIGH	CA-COM A 2-WAY HIGH
6	SUB	CA-COM A SUB

NOTE: For all operating modes, do not forget to patch the Ch A CA-COM Output from CD12 to the SIGNAL INPUT CA-COM on PAD-02 using an AMP LINK cable (i.e., signal routing is not internal in the rack and external connection is required).

NOTE: Compared with the STEREO 3-WAY preset, for 4-WAY+2 and 5-WAY+1 presets, there is a 4 dB attenuation of dV-DOSC that is built-in to the preset, i.e., it is assumed that dV-DOSC is used for downfill under V-DOSC and this attenuation is required. Compensate for this attenuation using output level adjustments if dV-DOSC is being used in another application other than downfill.

IMPORTANT NOTE: Be careful when changing from 4-WAY+2 MODE to 5-WAY+1 MODE. Due to preset channel reassignments you must repatch the crossover outputs. If you do not do this it is possible to send SUB signal to the dV-DOSC HIGH section resulting in damage to the loudspeaker.

An example configuration is shown below to illustrate signal flow for a typical arena system using an RK12-2 master rack along with RK12-4 racks.

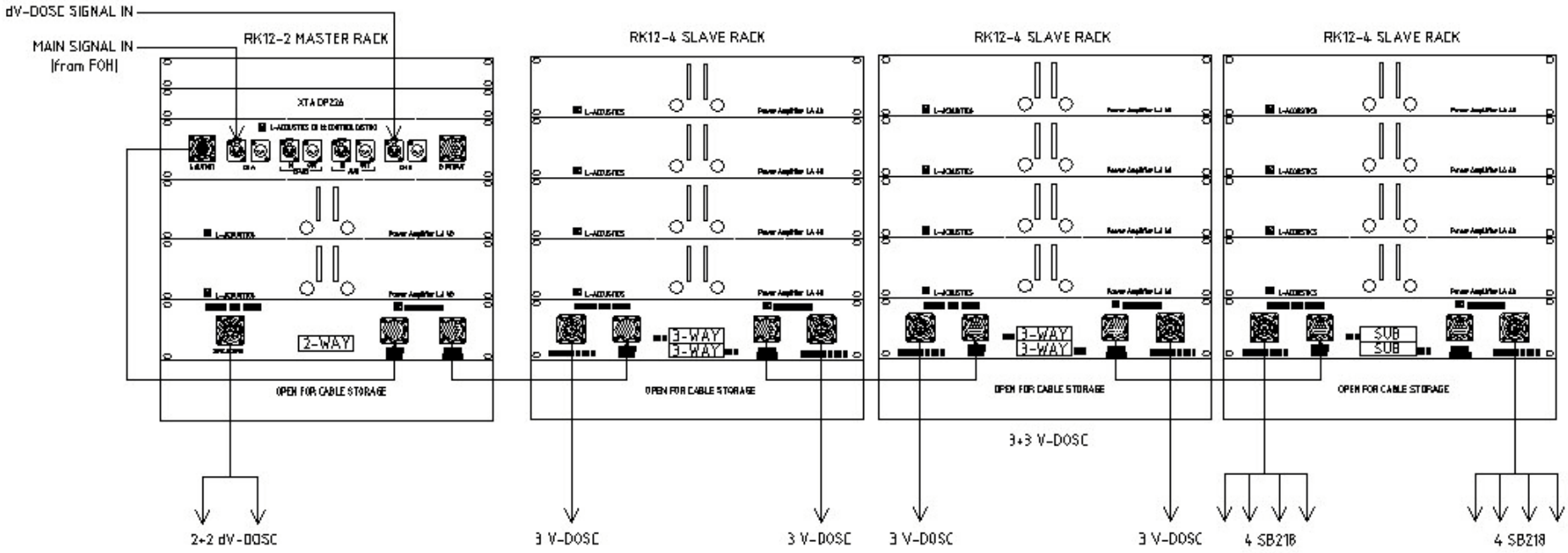


Figure 21: System Architecture using RK12-2M Master Rack and RK12-4

2. dV-DOSC ARRAY SPECIFICATIONS

2.1 ISOCONTOUR IN THE HORIZONTAL PLANE

Horizontal Directivity of a dV-DOSC Array

According to AES recommendations, directivity is specified over an angular window with no more than 6 dB deviation. For the case of dV-DOSC, the -6dB points are at +/- 60° off axis and the horizontal directivity pattern is strictly symmetrical with respect to the 0° axis - a direct consequence of coplanar symmetry. Horizontal directivity of a dV-DOSC array is independent of the number of arrayed elements and the vertical configuration of the array. Horizontal coverage for the entire array remains equal to the directivity of a single dV-DOSC element, i.e., 120° from 1k - 10k Hz.

To summarize, any dV-DOSC array has a constant horizontal coverage angle of 120° in the horizontal plane from 1000 to 10,000 Hz with -6dB points at +/- 60° off-axis.

Effective Coverage in the Horizontal Plane

In practice, strict adherence to polar specifications does not reflect the effective coverage of a sound system when it comes to the real world. Although a dV-DOSC array is in fact radiating 6 dB less at 60° off-axis, this is generally not acceptable for most sound engineers (and audiences). A SPL window of 3 dB is more acceptable for defining the coverage of a system with constant distance. For a dV-DOSC array of arbitrary height, the –3 dB coverage window is 100° from 1k to 10 k Hz.

For sound design purposes, we will use a concept that takes into account the relative distance from the array, at different angles, having the same SPL. These isobaric (constant SPL) curves, or isocontours, are obtained by re-formatting polar curves on a linear scale. The horizontal projection of the isocontour can then be used directly to predict the effective coverage of a dV-DOSC array in the horizontal plane. By overlaying the isocontour on the blueprints of a venue, the sound designer can adjust the main axis of the array to get the best results for a given audience layout.

The horizontal isocontour for dV-DOSC is averaged from 1-10 kHz since the directivity of the array remains constant over this frequency range. This also gives good consistency over what we call the clarity or intelligibility range. For lower frequencies, the isocontour is not preserved and becomes more omnidirectional as the directivity decreases at lower frequencies.

For simulation purposes, L-ACOUSTICS provides horizontal isocontour data (see sheet H-ISOCONTOUR in the ARRAY spreadsheet). For further details on how to use this data in array design please see Section 2.3.

2.2 WAVEFRONT SCULPTURE IN THE VERTICAL PLANE

Flat dV-DOSC Array

Flying or stacking dV-DOSC elements with zero degree angles between all enclosures produces a flat array. In this case, the whole array behaves acoustically like a vertically-oriented, flat, continuous, isophasic ribbon and radiates a CYLINDRICAL WAVEFIELD. The cylindrical wave expands in the horizontal dimension only and is defined by the section of a vertical cylinder over a predictable distance. The height of this section matches the height of the array (try to visualize a 120° cheese wedge). The overall vertical coverage angle of the array is equal to the angle defined by a line that is perpendicular to the front of the top enclosure of the array (referenced to the top of this enclosure) and a line that is perpendicular to the front of the bottom enclosure of the array (referenced to the bottom wall of this enclosure - not the trapezoidal angle of the cabinet).

According to the Fresnel description of wavefields, a cylindrical wavefield expands from a source over a certain distance then becomes a "classical" spherical wavefield. Detailed analysis shows that a flat
dV-DOSC array radiates a spherical wavefront at the lowest frequencies and a cylindrical wavefront at higher frequencies at any location within its coverage window. The boundary between the cylindrical wavefield and the spherical wavefield is both frequency and height dependent.

In spherical mode, the wavefront expands in two dimensions, thus producing a SPL attenuation of 6dB with doubling of distance. In cylindrical mode, the wavefront expands linearly with distance, thus producing only 3dB of attenuation when doubling the distance.

The net result is that at large distances, the tonal balance is progressively tilted by a HF enhancement since the dV-DOSC system is, in essence, more efficient at projecting HF energy than LF. This is an important benefit of the dV-DOSC system. With distance, this tilt in tonal balance is offset by air absorption at large distances in open air situations and by both building material absorption and air absorption indoors, resulting in tonally balanced sound over the largest audience area possible.

Since the flat array configuration maximizes energy and intelligibility with distance, it should mainly be used for long throw applications or in very reverberant rooms. It is also common to use a flat array section at the top of a variable curved array for maximum throw in arena and stadium installations.

Convex Curvature dV-DOSC Array

A convex or positive curvature dV-DOSC array (stacked or flown) is obtained by using dV-ANGLE P1 or P2 bars to provide the desired angle between each element. If the angle between two adjacent dV-DOSC elements is less than 7.5°, WST criteria are satisfied and the array behaves like a continuous, curved radiating ribbon. If the angle between elements exceeds 7.5°, WST criteria are no longer valid over the full audio frequency range. Practically, a larger angle produces neither desirable nor predictable results - elements radiate individually and the benefits of collective coupling are lost. That is why dV-ANGLE bars and the trapezoidal shape of the dV-DOSC enclosure itself allows up to 7.5° maximum angle between enclosures.

There are two types of convex curvature V-DOSC array: constant curvature and variable curvature. For the first case, the angle between all adjacent elements is constant while for the second case, it varies within the defined range of 0° to 7.5°.

Constant Curvature dV-DOSC Array

For a constant curvature array, the vertical directivity is nominally N x A° where N is the number of elements in the array and A° is the constant angle between each adjacent element. Therefore, a

curved array of 8 dV-DOSC elements can provide a maximum vertical coverage of 8 x 7.5° = 60° while still satisfying WST criteria.

The constant curvature array is the simplest type of convex curvature dV-DOSC array. This configuration should only be used for smaller sized arrays or when the geometry of the audience is unknown. Since an array of constant curvature radiates the same amount of energy in all directions over the nominal vertical coverage range (N x A°), this type of array is of practical use only when the entire audience is sitting at the same distance from the array.

However, in most venues, a dV-DOSC array will have to cover an audience sitting at varying distances from the array and a constant curvature array would produce excessive SPLs in the first rows compared to the remote audience. Therefore, a constant angular spacing between elements is generally not useful for most applications. If this configuration is used, the gain of the amplifiers powering the high frequency section of the lower dV-DOSC elements should be progressively reduced. However, such attenuation results in a global loss of energy.

Variable Curvature dV-DOSC Array

The ability of dV-DOSC to perform Wavefront Sculpture allows the designer to adapt the wavefront to suit specific audience requirements through the use of variable curvature arrays.

Since each dV-DOSC element produces a flat isophasic wavefront, it is possible to couple as many elements as is needed in one vertical sector in order to focus more energy in this direction. This is accomplished by reducing the angular spacing (A) between elements within this sector, or conversely by increasing interelement spacing (up to a maximum of 7.5°) in order to lower the SPL in another direction. This is the basic principle that allows energy to be more uniform throughout the audience.

Shaping the vertical isocontour is the key to Wavefront Sculpture Technology.

The ARRAY spreadsheet allows the designer to shape the vertical isocontour of a dV-DOSC array by displaying the results of various angular spacing selections (see Sheet CUTVIEW in the ARRAY spreadsheet).

Concave Curvature dV-DOSC Array

If dV-ANGLEN rear angle bars are selected, concave or negative curvature arrays can be constructed. A flat array is obtained using the minimum hole position on dV-ANGLEN and the array becomes progressively concave as hole positions with greater spacing are selected. Experimentation into the use of negative curvature arrays is ongoing and it is thought that such arrays will be useful for longthrow applications and for acoustic holography effects where it is possible to create a virtual acoustic source by focussing sound at a point in space. The sound will then appear to emanate from this focal line - not from the array itself - allowing for interesting sound design possibilities.

2.3 COVERAGE PREDICTIONS USING THE ARRAY 2000 SPREADSHEET

L-ACOUSTICS has developed a fast, easy-to-use prediction spreadsheet named ARRAY 2000. ARRAY 2000 operates under EXCEL and is available for both Windows and MacIntosh. The spreadsheet can predict coverage for flat, constant curvature and variable curvature arrays.

The first four worksheets represent vertical cut views (section elevations) of the audience in the xz plane and show the intersection of the vertical aiming direction of each element with the audience (impact zones). The direction of each element is calculated automatically according to the user-input angles. All angles are referenced with respect to the site angle of the top element which should be aimed at the rearmost part of the audience. These cutview sheets are used to shape the vertical isocontour of either V-DOSC or dV-DOSC arrays to match the audience area.

Note: Cutview sheets ARRAY1 and ARRAY2 are used to simulate V-DOSC arrays while Cutview sheets dVARRAY1 and dVARRAY2 are used for dV-DOSC. In addition, dVARRAY1 can be used to simulate dV-DOSC

used as downfill (under V-DOSC) while dVARRAY2 can be used to simulate dV-DOSC used as upfill/longthrow (on top of V-DOSC).

Note: For dV-DOSC, site angles are not referenced to the trapezoidal enclosure wall – they are referenced to a line that is perpendicular to the front of the enclosure at the middle of the enclosure. This is because dV-DOSC radiates a flat wavefront that is parallel to the front of the enclosure.

The H-ISOCONTOUR sheet displays the horizontal isocontour (see Section 2.1) of all defined arrays projected onto a plan view of the audience area in the xy plane.

The SUB ARC sheet is used to calculate delay taps based on the physical configuration of a given subwoofer array for electronic arc processing (see the V-DOSC manual for further details)

The ROOM DIM sheet can be used to help calculate xz cutview parameters based on room measurements.

The DATAcutview and DATAiso sheets are used for calculation purposes and should not be altered.

In general, all input data should be entered into the cells in black. Results are displayed in red.

CUTVIEW SHEETS (ARRAY1, ARRAY2, dV-ARRAY1, dV-ARRAY2)

a) Input Data

In AUDIENCE GEOMETRY cells, the designer enters the distances and elevations that define the audience area according to a section view along the main zero degree axis of the system. The origin of the x-axis is referenced to the downstage rigging point of the dV-DOSC BUMPER (hole 0) while the origin of the z-axis is referenced to floor level, i.e., the x-axis is distance or range along the desired array axis and the z-axis is height above floor level. A second cut-view can also be specified at an off-axis angle within the coverage pattern of the array. Typically the second cut-view is taken at 45° offstage for V-DOSC or 60° for dV-DOSC in order to confirm coverage throughout all portions of the audience. The "listening level" cell is the effective hearing level or ear height relative to floor level (1.2 metres for a seated audience, 2 metres for standing).

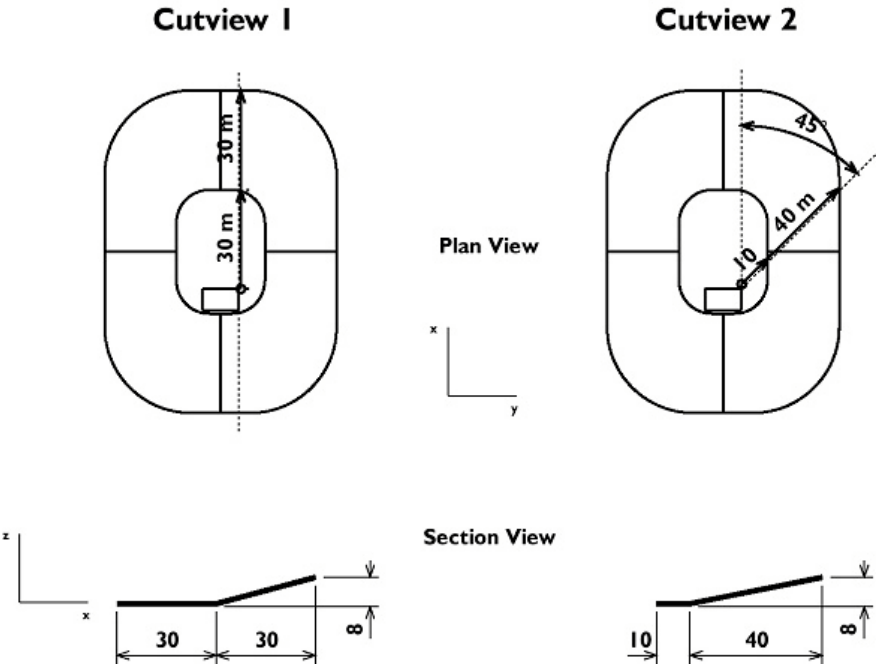


Figure 22: Defining Cutview Dimensions

Although detailed blueprints are not necessarily required, the more information that can be obtained on a venue for defining the audience geometry the better. Typically, plan and section views are available for most venues upon request. In situations where such documentation does not exist, there are a number of options: use a tape measure or laser range-finder on site to perform dimensional measurements. Alternatively, L-ACOUSTICS has had good results with the Bushnell Yardage Pro 600 for field measurements. Apart from being useful for defining room geometry, this tool can also be used for determining delay time settings during system tuning, for locating laser beams during array trim and angle adjustment (and even on the golf course on days off!). In some cases, tribune or balcony elevations can be determined by measuring individual step depth/height and then counting the number of steps to calculate the section depth/elevation.

The ROOM DIM sheet is provided in ARRAY 2000 to assist in calculating cutview data from room measurements (see Figure 23 for details).

Note: the calculation of elevation Z2 is susceptible to small errors in distance measurements and should always be verified with a tape measure whenever possible. Combined distance/angle measurements are typically more accurate than distance only measurements when calculating Z2.

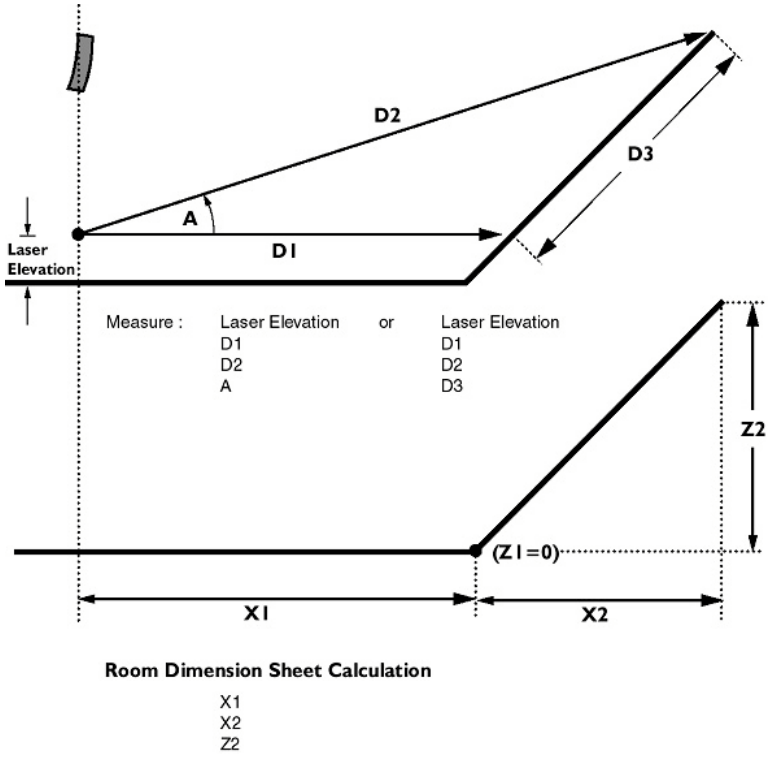


Figure 23: Parameters for the ROOM DIM Utility Sheet in ARRAY

In dV-DOSC ARRAY#1 or ARRAY#2 cells, the designer enters the number of dV-DOSC elements, the elevation of the bumper and the autofocus adjust angle. Normally, ARRAY 2000 automatically focuses the top element to the rear of the audience geometry that is defined in Cutview 1. Autofocus adjust can be used to adjust the overall focus of the array and DOES NOT CORRESPOND TO THE OFFSET ANGLE OF THE BUMPER.

The designer then chooses the angular spacing between elements from the available values (0°, 2°, 3.75°, 5.5°, 7.5° for dV-ANGLEP1 or 1°, 3°, 4.5°, 6.5° for dV-ANGLEP2). The red lines (beam display) show the aiming directions of all elements, where each line is aligned perpendicular to the middle of its respective enclosure. Note that the displayed top element corresponds to the BUMPER, not the first element of the dV-DOSC array. XZ cells can be used to enter additional room features such as balcony profiles, stage/proscenium details, FOH mix position, etc.

b) Optimization Procedure

The calculated beam display indicates the effective vertical coverage of the array above frequency F_1, where F_1 is defined as the low frequency limit of the clarity domain, i.e., above F_1 WST criteria are fully satisfied and cylindrical wave propagation applies. Intersection of beams with the audience (square blocks = impact zones) represents the dispersion of sound pressure level over the audience. The best results are achieved when the audience intersection points have equal spacing between them. In this case, the SPL decreases by 3 dB when doubling the distance (see Figure 24 for details).

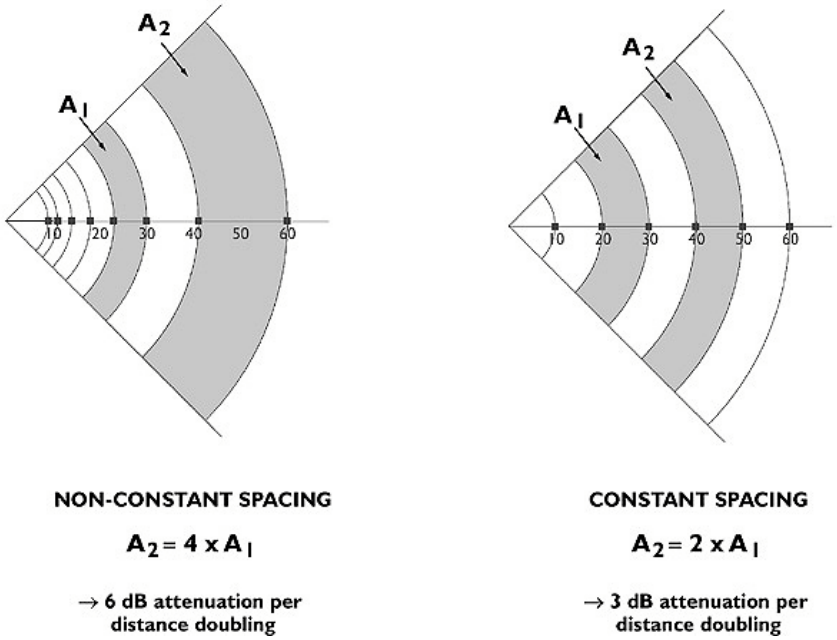


Figure 24: Optimizing Array Element Focus By Adjusting For Equal Spacing

Typically, optimum spacing and coverage is obtained iteratively by varying the height of the array and the element angles (#1 to next, #2 to next, etc). The designer manually performs the optimization by visually referring to the spacing between audience intersection points (impact zones) after making changes to the array. Once equal spacing has been achieved, the designer has successfully optimized the performance of the system by shaping the array's vertical isocontour to match the geometry of the audience. dV-ANGLE values, bottom element elevation, site angles for top and bottom elements and trim height parameters are then recorded and used for actual installation of the system.

c) Output Data

In the columns adjacent to where angle values are entered, the site angles (i.e., what you would measure if you put a digital inclinometer on #1, #2, etc elements) and the wavepath (throw distance) for each element are tabulated.

Note: The site angle for dV-DOSC element #1 is equal to the dV-BUMP site angle provided that a 3.75° angle bar is used at the rear to connect element #1 to the bumper. If a 3.75° angle bar is used, a laser and/or remote digital inclinometer can be mounted on the dV-BUMP to measure the focus of the top element.

Also tabulated are continuous A-weighted SPL estimates throughout the vertical coverage pattern of the array on an element-by-element basis. These dBA estimates are derived using a Fresnel-type calculation with a 2 kHz reference frequency for a +4 dBu nominal input signal level (17 dB of headroom remains). Since the dBA calculation considers discrete dV-DOSC elements (not sections of the continuous radiating line source array) the resolution of this calculation is not sufficient for the user to design for constant dBA throughout the audience area. Users are advised to refer to the visual spacing of impact zones and to use the dBA estimates as a guideline only.

In ARRAY GEOMETRICAL DATA cells, the physical dimensions of the array are displayed including: the Overall Depth of the Array (in the x dimension referenced to the downstage rigging point), the Overall Height of the Array (in the z dimension), and the Bottom Element Elevation (referenced to floor level). The bottom element elevation is used for flying the system and the Depth/Height information is useful to determine if the array will physically fit in a given space (scaffold bay, clearance to proscenium wall etc). Please see Figure 25 for further details.

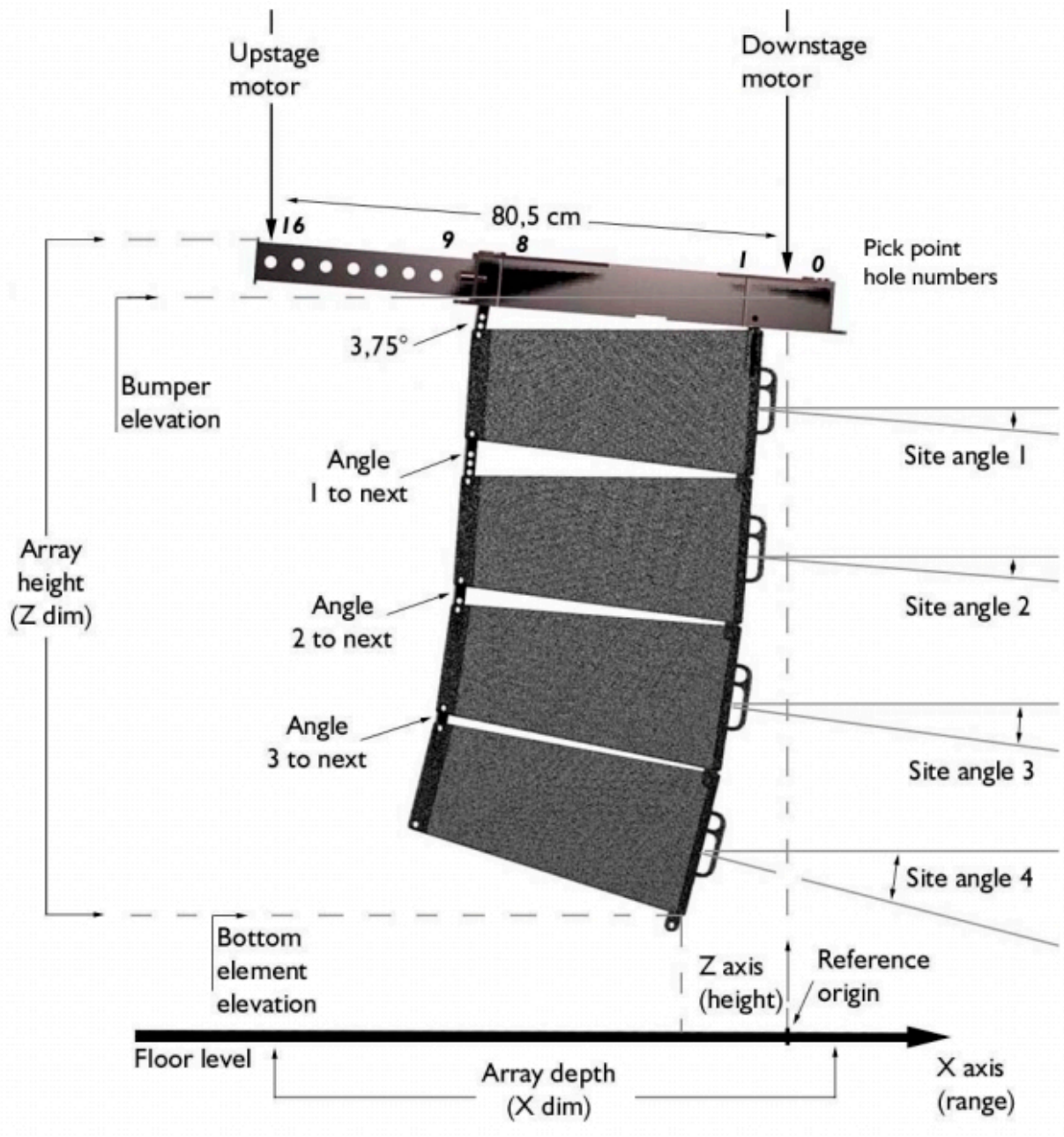


Figure 25: Physical dV-DOSC Rigging Parameters for ARRAY

ACOUSTICAL PREDICTION data gives the continuous unweighted SPL of the array referenced to 1 m and the unweighted SPL of the array at a selected distance (enter the distance in the black cell). This calculation is based on a 200 Hz reference frequency and correlates well with the unweighted SPL (as opposed to the A-weighted element-by-element SPL estimate). The peak unweighted SPL for a single array as well as an estimate of the peak unweighted SPL for 2 arrays is also given. Note that these unweighted SPL estimates do not include additional contributions due to subwoofers.

Vertical coverage of the array is calculated as the sum of all interelement angles. As discussed above, this coverage becomes effective at F_1, defined as the lowest frequency of the clarity domain. For all frequencies higher than F_1, the vertical coverage angle is controlled within the nominal vertical coverage angle. Above F_2, the vertical coverage angle perfectly matches the nominal value. Some beaming (vertical coverage narrowing) may occur at F_3, especially when the array is of constant curvature type.

MECHANICAL DATA gives the location of the center of gravity and overall weight of the flown dV-DOSC array. Offset distance, elevation and site angle values are also provided for applications where dV-DOSC is used with V-DOSC for downfill or upfill. When a V-DOSC array is defined in the ARRAY1sheet, dV-DOSC downfill or upfill simulation parameters are automatically calculated in the dV-ARRAY1 and dV-ARRAY2 sheets.

SIMULATING dV-DOSC DOWNFILL

The dV-ARRAY1 sheet is used to simulate downfill applications. The user should enter the parameters suggested in the MECHANICAL DATA cells into the appropriate cells in the dV-ARRAY1 sheet as follows:

1) Offset Distance (dV<V-DOSC) should be entered into the Offset Distance cell,
i.e., enter the value recommended in Cell T35 in Cell B36

2) Elevation (dV<V-DOSC) should be entered into the Bumper Elevation cell,
i.e., enter the value recommended in Cell T36 in Cell B38

3) With reference to Site Angle #1 (dV<V-DOSC) the Autofocus Adjust parameter should be adjusted so that "Site #1 to Next" corresponds to the recommended value,
i.e., enter the following in cell B39: – [original value in I24] – [recommended value in T37]

Note: When simulating dV-DOSC downfill or upfill using ARRAY there will appear to be a physical alignment offset with respect to V-DOSC. This is normal and is due to the different coordinate system references used for V-DOSC versus dV-DOSC since the rigging systems are rear-pivoting versus front-pivoting. Even though the display in ARRAY may appear incorrect, DOSC waveguides are physically aligned and the simulated coverage is correct.

SIMULATING dV-DOSC UPFILL

The dV-ARRAY2 sheet is used to simulate upfill applications. The user should first select the number of dV-DOSC elements and estimate the required angles between elements. The parameters suggested in the MECHANICAL DATA cells are then entered into the appropriate cells in the dV-ARRAY2 sheet as follows:

1) Offset Distance (dV>V-DOSC) should be entered into the Offset Distance cell,
i.e., enter the value recommended in Cell T35 in Cell B36

2) With reference to Bottom Elt Elevation dV>V-DOSC (cell T36) the Bumper Elevation (cell B38) should be adjusted so that Bottom Element Elevation (cell P26) corresponds to the recommended value,
i.e., change the value in cell B38 so that cell P26 = cell T36

3) Referring to the Bottom Elt Site Angle (dV>V-DOSC), the Autofocus Adjust parameter should be adjusted so that Site #N to Next (where N = the number of dV-DOSC upfill enclosures) corresponds to the recommended value
i.e., in cell B39 enter: – [original value for Site #N to Next] – [recommended value in T37]

Note: The recommended Bottom Elt Site Angle (dV>V-DOSC) in cell T37 corresponds to having the first dV-DOSC flat with respect to the top V-DOSC element (0 degree relative angle). To obtain a 0 degree relative angle, the 3.75 degree hole on dV-ANGLEP1 should be used. For upfill purposes, the 5.5 or 7.5 degree holes can be selected on dV-ANGLEP1. When using 5.5 or 7.5 degree holes, add 1.75 degrees or

3.75 degrees, respectively, to the recommended Bottom Elt Site Angle (dV>V-DOSC) given in cell T37. This is necessary to compensate for the 3.75 degree trapezoidal angle of the dV-DOSC enclosure.

dV-DOSC PICK POINT UTILITY

A pick point calculation utility is also included for single point dV-DOSC array hangs. Pick point holes are numbered 0 to 16 from front-to-rear on dV-BUMP. Hole 0 corresponds to the downstage motor point, holes 1-8 correspond to pick points on the central spreader bar and holes 9-16 correspond to pick points on the rear extension bar. The user simply varies the pick point number (from 0 to 16) and the bumper elevation while attempting to minimize the "Site angle deviation wrt target" value so that this value is as close to zero as possible. The user can then determine the appropriate pick point and whether the dV-BUMP extension bar is required or not.

Note: Always verify the actual, installed array tilt angle using an inclinometer. If a 3.75 degree angle is used between the top dV-DOSC and dV-BUMP, then the angle of dV-BUMP should correspond to 'Site #1 to Next" for the selected pick point.

H-ISOCONTOUR SHEET

The H-ISOCONTOUR sheet is used to check horizontal coverage by mapping a projection of the horizontal isocontour of the defined V-DOSC and dV-DOSC arrays onto the user-defined audience area. By matching horizontal coverage to the audience area, H-ISOCONTOUR can be used to check array placement and aiming as well as to determine whether offstage fill, front fill or center cluster arrays are required. Two audience areas can be defined and the coverage of up to four arrays displayed (2x V-DOSC, 2x dV-DOSC). Calculation assumptions include: 3 dB SPL reduction with doubling of distance (i.e., arrays have been designed for constant spacing using their respective Cutview sheets); doubling the number of cabinets adds 3 dB to the A-weighted SPL; anechoic or reflection-free conditions (direct sound only).

Note: At this time it is not possible to properly simulate the transition between the dV-DOSC to V-DOSC isocontours when dV-DOSC is used for downfill or upfill with V-DOSC.

a) Input Data

Just as for the Cutview sheets, user input data cells are in black and results are displayed in red.

To define a plan view of the audience area, the user inputs x (range) and y (distance off-center) coordinates in the Contour 1 and Contour 2 cells. As coordinates are entered, the display of the audience area is automatically updated and a mirror image drawing scheme is used so that only half the room needs to be defined. It is only necessary to define Contour 1, however, Contour 2 is useful to represent balconies, stage thrusts, proscenium opening, FOH location etc.

When V-DOSC and dV-DOSC arrays are defined (in ARRAY1,2 and dVARRAY1,2 Cutview sheets respectively), they are automatically displayed in the H-ISOCONTOUR sheet with the X Location of each array referenced to the defined Offset Distance taken from each arrays' respective Cutview sheet. The parameter "Isocontour at Distance (m)" refers to the throw distance for the top element of the respective array and is given relative to the defined Offset Distance.

The user then enters the "Console Output Signal (dBu)" for each array, i.e., output level of the mixing desk (typically 0 VU on the console meter = +4 dBu) and the Continuous A-weighted SPL is tabulated. This corresponds to the SPL that would be obtained along the isocontour of each array. The Console Output Signal can be increased to up to 11dBu for dV-DOSC, 17 dBu for V-DOSC - at this point the amount of headroom available in the system goes to zero and the user has an indication as to the peak A-weighted SPL that will be available along the isocontour. Further increases in the Console Output Signal will produce a CLIP indication reflecting amplifier clip.

The user can also define the y coordinates for each array (distance off center line) and the azimuth angle in degrees (i.e., aiming or panning angle of the array). Note: to simulate a center cluster, simply set "Y location" equal to zero.

b) Optimization Procedure

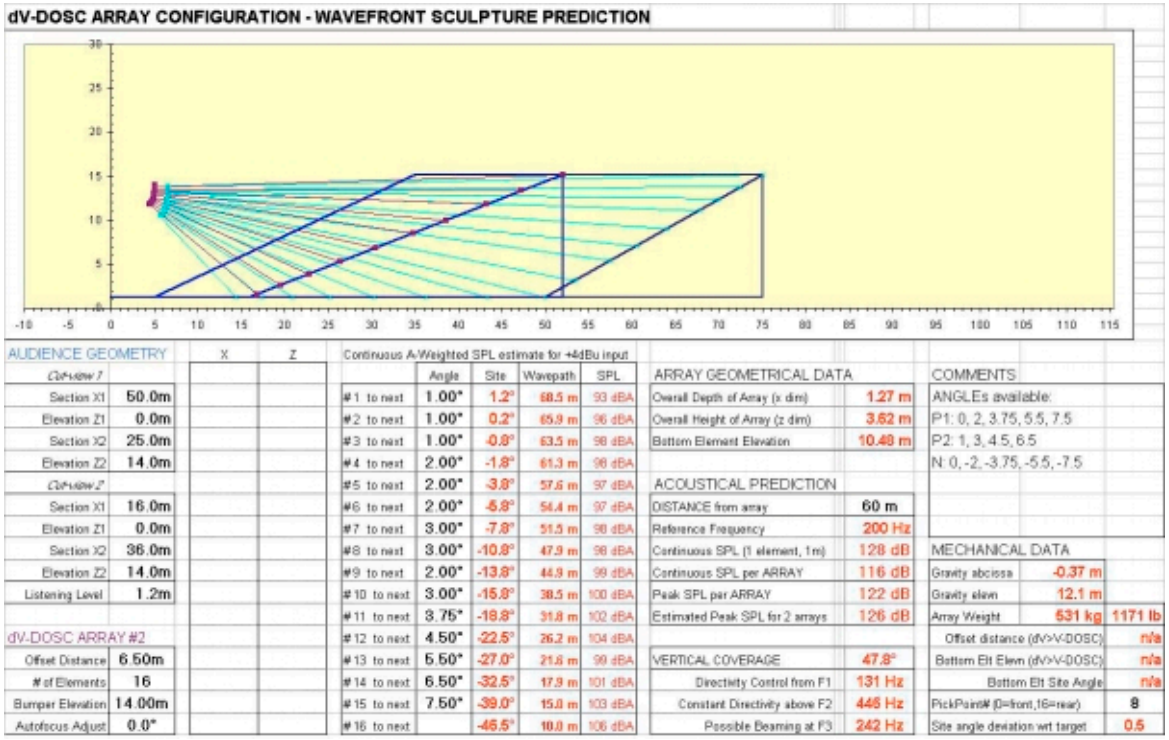
Typically, the optimization procedure begins by using the ARRAY1, ARRAY2, dV-ARRAY1 or dV-ARRAY2 Cutview sheets to determine the number of array elements for A1, A2, A3 and A4. H-ISOCONTOUR is then used for adjustment of array separation and panning angles in order to ensure adequate audience coverage at a desired A-weighted SPL and to match coverage to the audience area.

In some cases, when horizontal coverage is an important design issue, simulation can start with the H-ISOCONTOUR sheet first in order to predetermine the 0 and 45 degree axes prior to more detailed Cutview simulation.

c) Output Data

Output data is directly displayed as a projection of the horizontal isocontour on the defined audience area. The A-weighted SPL and amount of headroom in the system are given for each array. Note that the displayed ISOCONTOUR for each array is terminated in a line that is referenced to where coverage starts for the bottom element. Therefore, H-ISOCONTOUR gives a direct indication as to the areas where coverage is lacking and offstage fill, center fill or delay clusters are required. The overlap between L, R arrays also gives an indication as to which portions of the audience will experience stereo imaging.

ARRAY 2000 SPREADSHEET CALCULATION EXAMPLES



dV-DOSC ARRAY CONFIGURATION - WAVEFRONT SCULPTURE PREDICTION

AUDIENCE GEOMETRY		X	Z
Cut-view 1			
Section X1	50.0m		
Elevation Z1	0.0m		
Section X2	25.0m		
Elevation Z2	14.0m		
Cut-view 2			
Section X1	16.0m		
Elevation Z1	0.0m		
Section X2	36.0m		
Elevation Z2	14.0m		
Listening Level	1.2m		

dV-DOSC ARRAY #2	
Offset Distance	6.50m
# of Elements	16
Bumper Elevation	14.00m
Autofocus Adjust	0.0°

Continuous A-Weighted SPL estimate for +4dBu input

	Angle	Site	Wavepath	SPL
#1 to next	1.00°	1.2°	68.5 m	93 dBA
#2 to next	1.00°	0.2°	65.9 m	96 dBA
#3 to next	1.00°	-0.8°	63.5 m	98 dBA
#4 to next	2.00°	-1.8°	61.3 m	98 dBA
#5 to next	2.00°	-3.8°	57.6 m	97 dBA
#6 to next	2.00°	-5.8°	54.4 m	97 dBA
#7 to next	3.00°	-7.8°	51.5 m	98 dBA
#8 to next	3.00°	-10.8°	47.9 m	98 dBA
#9 to next	2.00°	-13.8°	44.9 m	99 dBA
#10 to next	3.00°	-15.8°	38.5 m	100 dBA
#11 to next	3.75°	-18.8°	31.8 m	102 dBA
#12 to next	4.50°	-22.5°	26.2 m	104 dBA
#13 to next	5.50°	-27.0°	21.6 m	99 dBA
#14 to next	6.50°	-32.5°	17.9 m	101 dBA
#15 to next	7.50°	-39.0°	15.0 m	103 dBA
#16 to next		-46.5°	10.0 m	106 dBA

ARRAY GEOMETRICAL DATA	
Overall Depth of Array (x dim)	1.27 m
Overall Height of Array (z dim)	3.62 m
Bottom Element Elevation	10.49 m

ACOUSTICAL PREDICTION	
DISTANCE from array	60 m
Reference Frequency	200 Hz
Continuous SPL (1 element, 1m)	128 dB
Continuous SPL per ARRAY	116 dB
Peak SPL per ARRAY	122 dB
Estimated Peak SPL for 2 arrays	126 dB
VERTICAL COVERAGE	47.8°
Directivity Control from F1	131 Hz
Constant Directivity above F2	445 Hz
Possible Beaming at F3	242 Hz

COMMENTS
ANGLEs available:
P1: 0, 2, 3.75, 5.5, 7.5
P2: 1, 3, 4.5, 6.5
N: 0, -2, -3.75, -5.5, -7.5

MECHANICAL DATA		
Gravity abciss	-0.37 m	
Gravity elevn	12.1 m	
Array Weight	531 kg	1171 lb
Offset distance (dV>V-DOSC)		n/a
Bottom Elt Elevn (dV>V-DOSC)		n/a
Bottom Elt Site Angle		n/a
PickPoint# (0=front,16=rear)		8
Site angle deviation wrt target		0.5

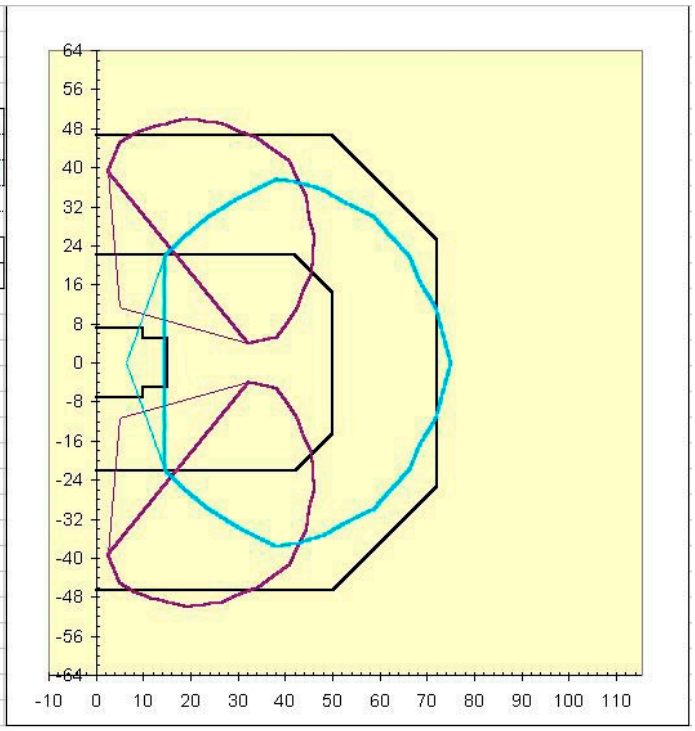
CUTVIEW SHEET

HORIZONTAL ISOCONTOUR

ARRAYS	A1	A2	A3	A4
Isocontour at distance (m)	0	0	47	69
Console output signal (dBu)	4	4	11	4
X location (m)	0	6.5	5	6.5
Y location (m)	0	0	11.2	0
Azimuth angle (deg)	0	0	40	0
Headroom (dB)	13	13	0	7
Cont A-weighted SPL (dBA)	######	######	100	93

AUDIENCE CONTOUR (meters)

CONTOUR 1		CONTOUR 2	
X	Y	X	Y
0.0	22.1	0.0	46.5
42.0	22.1	50.0	46.5
50.0	14.5	72.0	25.2
50.0	0.0	72.0	0.0
0.0	7.0		
10.0	7.0		
10.0	5.0		
15.0	5.0		
15.0	0.0		



HORIZONTAL ISOCONTOUR SHEET

Figure 26a: ARRAY 2000 spreadsheet calculation example (LCR dV-DOSC system)

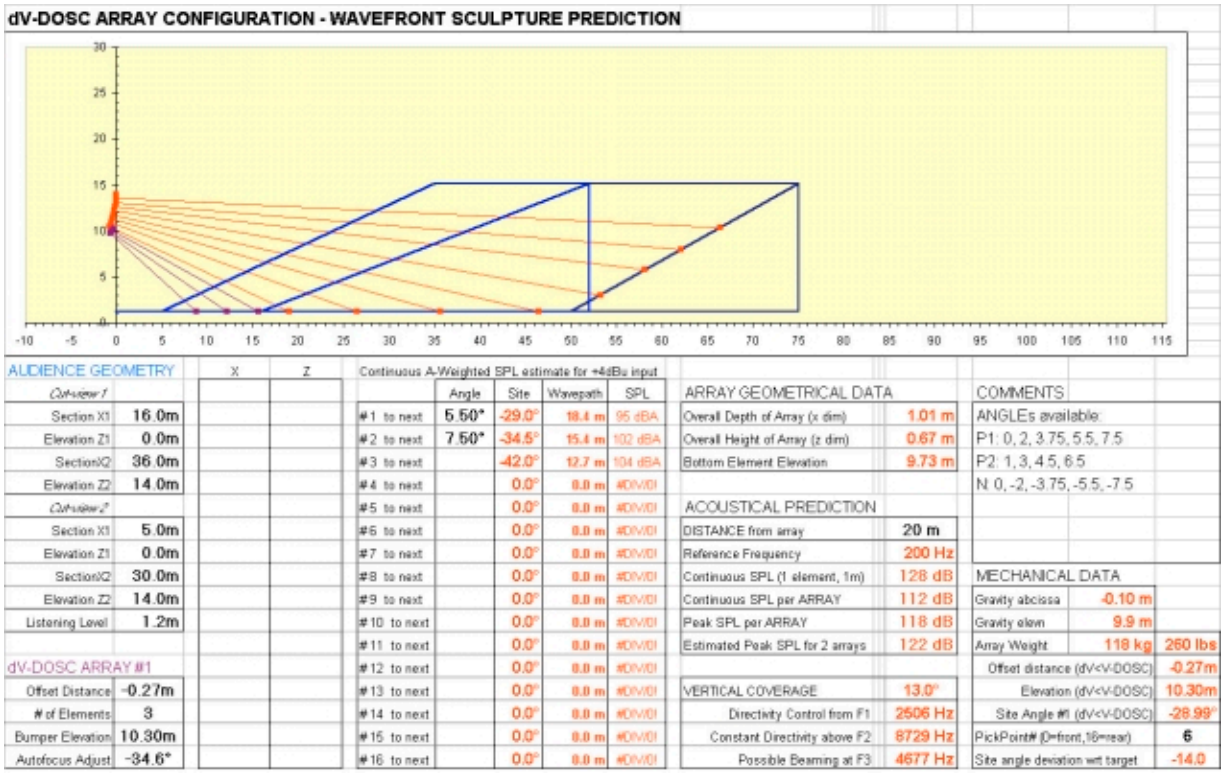


Figure 26b: Simulating dV-DOSC under V-DOSC

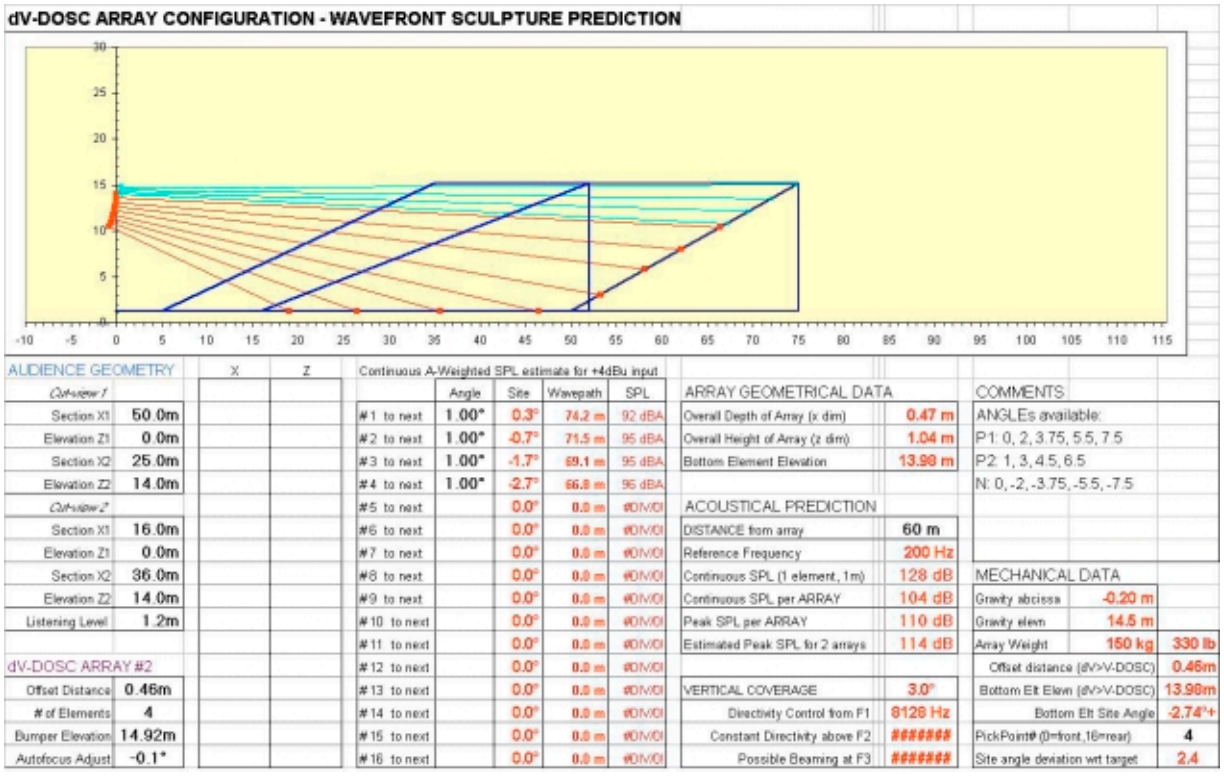


Figure 26c: Simulating dV-DOSC on top of V-DOSC

3. ELEMENTS OF SOUND DESIGN

3.1 MULTIPLE ARRAY CONCEPTS

Reducing Array Interaction

It is well known that the collective radiation of sound by a number of loudspeakers located close to each other results in interference that creates frequency-dependent directivity lobes. The only coherent way to couple loudspeakers is to meet Wavefront Sculpture Technology criteria, which, for the case of dV-DOSC is met in the vertical domain.

When the horizontal coverage of a dV-DOSC array (120° nominal, 100° effective) is not sufficient, the solution is not to place a second array directly beside the first one. The correct approach is to utilize a second array which is focused on another portion of the audience and spaced at least 6-7 meters (approximately 20 ft) away from the first array.

Given this separation, interference only occurs in the low frequency range and there are no audible intelligibility losses for two reasons: 1) the first main cancellation is shifted lower in frequency (example, 24 Hz for 2 arrays of the same size, spaced 7 metres) and tends to be masked or filled in by room reverberation; 2) by focussing the arrays at different panning angles, comb filtering interaction is lessened since their overlap region is reduced. In addition, the ear cannot resolve tightly spaced comb filtering notches at higher frequencies throughout the overlap region.

The array closest to the stage is usually the larger of the two arrays. This array is considered as the time reference and any other array is delayed with respect to it. This is valid for arrays fed with the same signal (in a stereo configuration, it is obvious that the left array is not delayed with respect to the right one or vice-versa).

Experience has shown that this is a very flexible approach that can cover any type of audience. An additional advantage of multiple arrays is improved resistance to wind effects in open-air situations. Another benefit is improved perception of stereo effects throughout the audience area – something which should not be limited to just the mix position (i.e., arrays can be run in cross-panned stereo with L-L (right), L (left), R (right) and R-R (left)).

Beyond the basic solution of coverage problems, multiple source arrays open up many possibilities for creating a spatial soundscape, thus providing a powerful tool for sound design and creativity.

Achieving Optimum Coverage

Using the isocontour drawn on a blueprint or the data provided in ARRAY 2000 (H-ISOCONTOUR), it is easy to achieve correct horizontal coverage for a complete system consisting of multiple V-DOSC and/or dV-DOSC arrays. Parameters for each array such as spatial coordinates, axial direction and output level are first chosen by the sound designer and entered in the ARRAY 2000 spreadsheet with respect to the basic geometry of the audience.

The displayed horizontal isocontours should overlap to a certain extent and cover the majority of the audience. The amount of overlap will depend on the tradeoffs between stereo perception and intelligibility. The remaining areas should be covered with fill speakers such as ARCS, MTD115a, MTD112, MTD108a or EX112 loudspeakers.

3.2 STACKED OR FLOWN?

Although flown systems are generally preferred by most sound engineers, there are good arguments to support both solutions. In many cases the answer is dictated by logistics that are venue-specific, i.e., sometimes it simply isn't possible to fly PA.

"Stacking" onstage lowers the perceived sound image to stage level which is beneficial in small venues. Stacking also offers more low frequency SPL due to enhanced floor coupling and since dV-DOSC has less SPL attenuation from the front to the back of the audience than traditional systems, this allows a stacked system to project further. In addition, for geometric reasons a stacked array can provide more extended vertical coverage than a flown one - this can be seen using the ARRAY 2000 spreadsheet. For these reasons, stacking makes sense in small configurations where only a few elements can optimize audience coverage.

"Flying" is the best solution to achieve uniform sound pressure level and even tonal balance over the entire audience provided that the number of elements arrayed is sufficient to provide the necessary front to rear coverage. Flying is also an excellent solution for sightline problems that commonly occur and provides better high frequency penetration into the audience with reduced shadowing effects. For flown configurations, additional speakers are added to cover center- or front-fill requirements and to help pull the localization image down towards the stage for the first 10-20 rows of the audience. Good candidates for this include ARCS stereo infill, distributed dV-DOSC apron fill or other front fill enclosures such as: MTD115a, MTD112, MTD108a or EX112 loudspeakers.

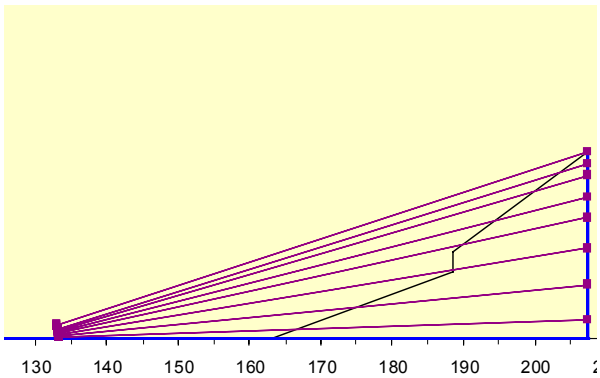
Stacking Guidelines

The stacking system is rated for a maximum of 12 dV-DOSC elements.

For this type of installation, the precise nature of dV-DOSC vertical coverage allows little margin for error. The designer must know if the audience is standing or seated - the bottom of the array should always be higher than the ears of the first rows of the audience and the lowest element tilted downwards. Note: for extended bandwidth applications, a vertical stack of 4 SB218 subwoofers provides a convenient stacking platform at a height of 2.2 m above ground level. Alternatively, 3 dV-SUBs provide a good stacking height (2.1 m above ground level).

If the bottom of the array is too low, the first rows receive too much SPL and audience members directly in front of the system behave as an acoustic screen for the following rows (shadowing). Ideally, the bottom of the array should be slightly above the audience (not lower than 2 m or 6.5 ft above floor level), with the lowest element tilted downwards as necessary.





A distributed, field level stacked system for stadium sound reinforcement.

Flying Guidelines

For single point hangs, the flying system is rated for a maximum of 24 dV-DOSC elements without the extension bar and 12 dV-DOSC elements with the extension bar.

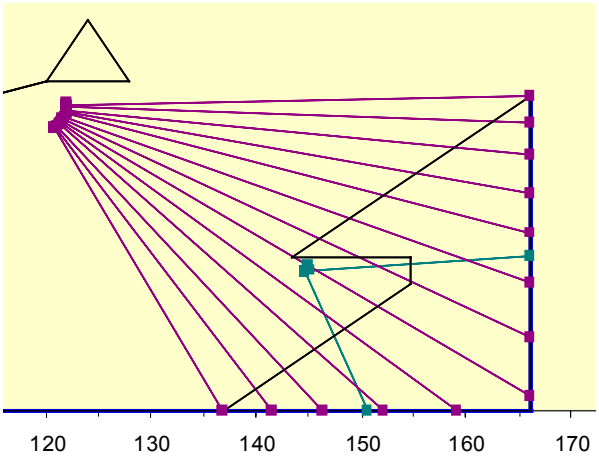
Particular attention must be paid to the height at which the array is flown when predicting the vertical coverage in ARRAY 2000 (Cutview). One will discover that in many cases it is easier to optimize coverage at a certain height versus any other height.

Note that the angular configuration of the array should not be adjusted by considering the on-axis cutview alone – always consider the audience geometry off the main axis, especially from 45° to 60° off-axis (on the shorter throw side). Be sure to check that you are not lacking in offstage coverage and require additional fill systems.

It is quite common to have venues where there are two sections of the audience area that have two different slopes. In this case, coverage of the areas which are close to the borderline must be determined carefully and dV-DOSC arrays should be focused differently on the two sections.

Finally, to effectively complete any dV-DOSC installation, either stacked or flown, the operator has to carefully verify by actual measurement that the parameters in ARRAY 2000 (Cutview) have been implemented correctly. Tools and procedures that are useful for this purpose are described in Chapter 5. Detailed flying and verification procedures are described in Chapter 4.





A flown, distributed dV-DOSC system for stadium sound reinforcement

3.3 SUBWOOFERS

Subwoofers are used to extend the frequency response of the dV-DOSC system down to 25-30 Hz and to increase the overall SPL without increasing the potential for audience hearing loss.

General Guidelines for the Use of Subwoofers

The number of subwoofers to be used depends on 3 parameters:

- Number of dV-DOSC Elements:

  The standard number of dV-SUB subwoofers recommended is a 3:1 ratio (dV-DOSC:dV-SUB)

  The standard number of SB218 subwoofers recommended is a 2:1 ratio (dV-DOSC:SB218)

- Type of Program Material:

  Standard subwoofer ratios are recommended for classical music or corporate events. For these applications, subwoofers act as a low frequency extension for dV-DOSC and provide approximately 6 dB of low frequency contour. In this case, the overall system functions as an extended bandwidth 3-way system.

  For more demanding rock music applications, a ratio of 1.5:1 (dV-DOSC:dV-SUB or SB218) is recommended to provide a more suitable low frequency contour (e.g., 3:2, 6:4, 9:6, 12:8).

- Type of Venue or Installation: In open-air, when subs are ground stacked the quantity remains standard. When flown, additional subwoofers are required. Indoors, at least one subwoofer is required per 7,500 m^3 volume.

Note: In terms of simple component count, 3 V-DOSC is the equivalent of 6 dV-DOSC and 2 dV-SUBs (6x15", 12xMF, 6xHF). Therefore, the standard ratio of 3:1 dV-DOSC:dV-SUB will provide the equivalent of V-DOSC standalone as a 3-way enclosure in terms of overall tonal balance and low frequency impact. For increased low frequency impact, additional subwoofers are required just as for V-DOSC. The standard V-DOSC ratio is 1.5:1 V-DOSC:SB218 and if we continue with the simple component count example above, this corresponds to 3 V-DOSC plus 2 SB218. Therefore we need to add 2 additional dV-SUBs to obtain the equivalent 4-way result, giving 6 dV-DOSC and 4 dV-SUB and the same 1.5:1 dV-DOSC:dV-SUB ratio.

Split Left/Right Ground Stacked Subwoofers

Subwoofers are usually installed on the floor, next to each other, to take advantage of the enhancement obtained due to floor coupling. When there is a physical separation between dV-DOSC and subwoofer arrays, it is well known that time alignment is only valid at one location and alignment requires some degree of compromise. When performing time alignment, always try to pick a measurement location that is representative for the majority of the audience.

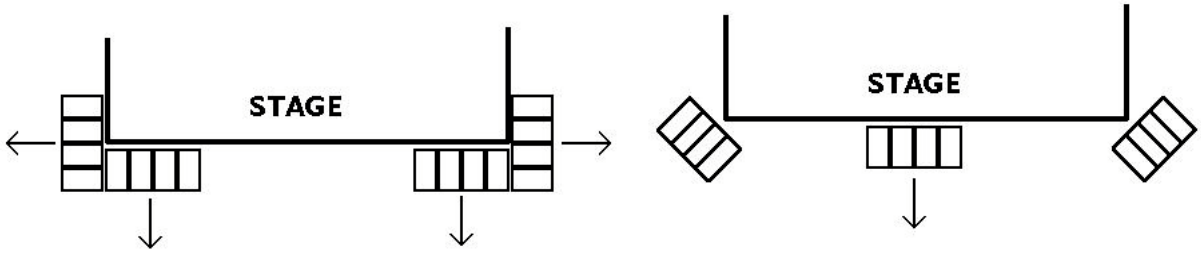
It is also well known that split left/right subwoofer stacks tend to produce a build-up of low frequency energy in the center and cancellations that vary with listener position due to path length difference cancellations between the split stacks. Techniques to overcome this center build-up include:

- Use split left/right vertical line arrays of subwoofers or else attempt to minimize the size of the left/right subwoofer arrays in terms of horizontal footprint.
- Physically (or electronically) arc the individual left/right subwoofer arrays or create an L-shaped array that wraps around the corner of the stage. This directs the individual main lobes of the left and right arrays offstage, thus reducing the center build-up created by their interaction.
- Use a center horizontal line array with electronic delay processing to broaden the horizontal directivity. This configuration also has the advantage of omnidirectional vertical directivity, making it a good solution for use indoors.

- Use a LCR sub array configuration with the L,R arrays oriented at 45 degrees offstage. This can give excellent results in terms of horizontal evenness provided that the same number of subs are used for L, C, and R systems.

NOTE: Always time align and check the polarity of the subwoofer section to optimize low frequency performance.

NOTE: For ground stacked subwoofer systems, typically an 80 Hz low pass filter is employed (with or without aux sub drive). Presets for use with the SB218 are dV 3WX SB218 L0/HI (XTA) and DV 3WX SB L/H (BSS). Presets for use with dV-SUB are dV 3W 80 dVS LO/HI (XTA) and DV 3W 80 L/H (BSS)



Flown Subwoofers

The benefits of flown subwoofers include:

- Improved low frequency summation when subs are flown close to the dV-DOSC arrays since the subwoofers act as an extension of the system
- Due to longer wavelengths at low frequencies, floor coupling is still obtained with flown subwoofers. Reductions due to lack of floor coupling are offset by reduced audience absorption plus the reduction of subwoofer energy for the first 20 metres is largely due to the vertical directivity that is introduced by vertically line arraying subs.
- Time alignment of subwoofers to the main left/right dV-DOSC arrays is greatly simplified since the physical path length difference problem of ground stacked subs versus flown dV-DOSC is no longer a factor that varies with listening position. Overall, this improves low frequency summation and coherency for the entire audience.
- Elimination of local low frequency buildup for the audience down front in the first few rows. Adding several ground stacked subs per side or a center line will provide sufficient low end impact for the first 20 metres
- Cleaner staging and better sightlines.

NOTE: When subwoofers are flown and closely coupled to the dV-DOSC array, presets for use with the SB218 are dV 3W SB218 L0/HI (XTA) and DV 3W SB L/H (BSS). Presets for use with dV-SUB are dV 3W 120 dVS LO/HI or dV 3W 200 dVS LO/HI (XTA) and DV 3W 120 L/H or DV 3W 200 L/H (BSS). The 80 Hz presets can also be used but the 120 Hz preset is considered optimal in terms of power bandwidth.

NOTE: 200 Hz presets should not be used for flown coplanar configurations (dV-SUB arrays flown on either side of the dV-DOSC array) since WST Criterion #2 will not be satisfied.

Central Location, Ground Stacked

This configuration optimizes the radiated energy. All subwoofers are acoustically coupled and the floor acts as a mirror that virtually doubles the number of subs. Given the same number of subs, the overall pressure obtained by ground stacking in this manner is simply not achievable in any other configuration.

The central ground stack solution is not devoid of shortcomings. Typically the problems are:

- Tonal balance has an exaggerated low boost for the closest members of the audience. Front fill speakers are necessary to compensate for this local buildup of low frequency energy.
- Low end can spill back onstage and cause feedback problems for the stage monitoring system
- Restricted projection due to audience absorption and modified thermal conditions (this problem is likely to occur with any ground stacked configuration)
- Mutual radiation pressure may wear the drivers located at the center of the array

For the central ground stacked configuration, the subwoofers are not acoustically coupled with the main dV-DOSC arrays. They are processed separately and fed with an independent signal from an auxiliary output.

NOTE: For central ground stacked subwoofer configurations, typically an 80 Hz low pass filter is employed along with aux sub drive. Presets for use with the SB218 are dV 3WX SB218 L0/HI (XTA) and DV 3WX SB L/H (BSS). Presets for use with dV-SUB are dV 3W 80 dVS LO/HI (XTA) and DV 3W 80 L/H (BSS)

If a center line of subwoofers is installed, horizontal directivity will narrow while the subwoofers will remain omnidirectional vertically. Electronic delay arc processing as described in the V-DOSC manual can help broaden the narrowing of the central lobe and improve overall coverage horizontally. Please consult the V-DOSC manual for further details.

3-WAY PRESETS FOR dV-DOSC AND SB218 SUBWOOFERS

Two types of presets are provided for the SB218: 3W (100 Hz HPF for dV-DOSC) and 3WX (80 Hz HPF for dV-DOSC). The 3W preset is intended for applications where subwoofers are flown close to the dV-DOSC array as an extension of the system or when SB218s are used as a stacking platform. The 3WX preset is intended for applications where subwoofers are ground stacked, separate from the flown dV-DOSC arrays. Both presets are optimized for a 2:1 dV-DOSC:SB218 cabinet ratio.

A dV-DOSC array is capable of radiating frequencies down to 100 Hz at high level with good directivity control. As seen previously in the "Powering dV-DOSC" section, a dV-DOSC array is typically high-pass filtered at 100 Hz and the limiter threshold set at 7 dBu for the low section in order to provide excursion protection for the 8" components. This is the case for 3W presets while for 3WX presets, the dV-DOSC low section is high pass filtered at 80 Hz and the limiter is set at 5 dBu. For 3WX presets, since there is no overlap in the effective operating bandwidths of sub and dV-DOSC low sections, the subwoofers can be operated with the same polarity in 3-way mode without phase problems due to the overlap of crossover frequencies.

3-WAY PRESETS FOR dV-DOSC AND dV-SUB SUBWOOFERS

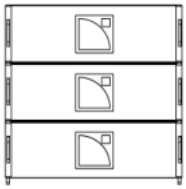
For dV-DOSC plus dV-SUB 3-way presets, a variety of crossover points between dV-SUB and the dV-DOSC low section (80, 120 and 200 Hz) are provided for different configurations. The 80 Hz crossover point is intended for applications where dV-SUB and dV-DOSC are physically separated (eg. ground stacked subwoofers with flown dV-DOSC system). The 120 Hz crossover point is considered optimal in terms of power bandwidth for both dV-SUB and the dV-DOSC low section and is intended for all closely coupled applications (closely coupled flown subwoofers or ground stacked systems). The 200 Hz crossover point allows the dV-SUB to function as a combination

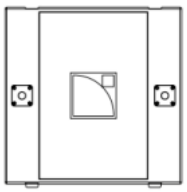
sub/low enclosure and also provides an operating bandwidth that corresponds to that of the V-DOSC low section. The 200 Hz crossover point is intended for closely coupled configurations except for coplanar flown configurations, i.e., when dV-SUB arrays are flown on both sides of a dV-DOSC array.

For flown configurations, the minimum spacing between the acoustic centers of dV-DOSC and dV-SUB arrays is 0.96 metres (i.e., the rigging point separation for single point hangs). For 80, 120 and 200 Hz crossover points, $\lambda/2$ is: 2.15 m, 1.4 m, 0.86 m, respectively. Therefore, all crossover points will satisfy WST Criterion #2 for the case of single, closely coupled arrays of dV-DOSC and dV-SUB. For flown coplanar systems, the spacing between acoustic centers of the 2 dV-SUB arrays becomes 1.92 metres, therefore the 200 Hz crossover preset should not be used.

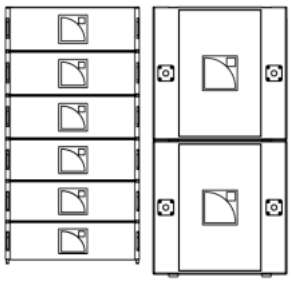
Note: For a ratio of 3:1 dV-DOSC:dV-SUB low frequency extension is provided that results in the same spectral balance as V-DOSC (without subwoofers). For additional low frequency impact, a 1.5:1 dV-DOSC:dV-SUB ratio is recommended (eg; 3:2, 6:4, 9:6, 12:8).

Note: For XTA 224 and 226, the number of OEM memories is limited to 40 total. Additional presets such as dV 3W 200 dV-SUB LO/HI, dV 3W SB115, dV 3WX SB115, dV 3WX SB218 are available in the XTA Audiocore .xbl file.





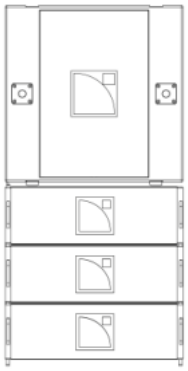
1) dV 3W 80 dVS LO/HI (XTA)
   dV 3W 80 L/H (BSS)



1) dV 3W 120 dVS LO/HI (XTA)
   dV 3W 120 L/H (BSS)

2) dV 3W 200 dVS LO/HI (XTA)
   dV 3W 200 L/H (BSS)

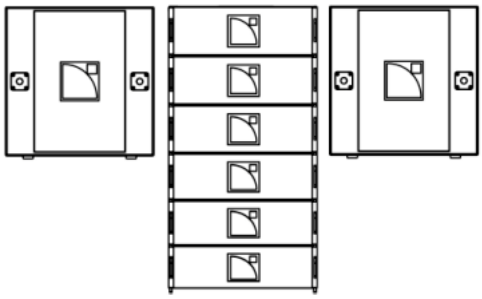
3) dV 3W 80 dVS LO/HI (XTA)
   dV 3W 80 L/H (BSS)



1) dV 3W 120 dVS LO/HI (XTA)
   dV 3W 120 L/H (BSS)

2) dV 3W 200 dVS LO/HI (XTA)
   dV 3W 200 L/H (BSS)

3) dV 3W 80 dVS LO/HI (XTA)
   dV 3W 80 L/H (BSS)



1) dV 3W 120 dVS LO/HI (XTA)
   dV 3W 120 L/H (BSS)

2) dV 3W 80 dVS LO/HI (XTA)
   dV 3W 80 L/H (BSS)

4-WAY PRESETS FOR dV-DOSC AND dV-SUB OR SB218 SUBWOOFERS

4-way presets are provided for flown dV-DOSC + dV-SUB arrays when used in conjunction with ground stacked dV-SUB or SB218 subwoofers. A 1.5:1 dV-DOSC:Subwoofer ratio is recommended (for example: 3 dV-DOSC, 1 dV-SUB flown, 1 dV-SUB ground stacked) and separate processing is provided for the flown versus ground stacked subwoofers.

For XTA DP226, the dV 4W dV-SUB LO/HI preset has the following output channel assignments:

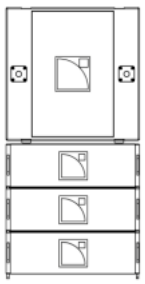
Output 1	dV-SUB ground stacked	(input A)
Output 2	dV-SUB flown	(input A)
Output 3	dV-DOSC low section	(input A)
Output 4	dV-DOSC high section	(input A)
Output 5	fullrange	(input A)
Output 6	dV-SUB ground stacked	(input B)

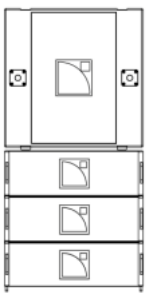
and the dV 4W SB218 LO/HI preset has the following output channel assignments:

Output 1	SB218 ground stacked	(input A)
Output 2	dV-SUB flown	(input A)
Output 3	dV-DOSC low section	(input A)
Output 4	dV-DOSC high section	(input A)
Output 5	fullrange	(input A)
Output 6	SB218 ground stacked	(input B)

For both examples, output 6 can be used for auxiliary sub drive via input B. The corresponding presets for BSS are named: DV 4W DVS L/H and DV 4W SB L/H.

Note: For 4W presets, the crossover frequency between the flown dV-SUB and dV-DOSC low section is 120 Hz to optimize the power bandwidth for both sections. The overall operating bandwidth for the flown dV-SUB is 30 Hz – 120 Hz while the operating bandwidth for ground stacked subs (dV-SUB or SB218) is 30-80 Hz. Depending on how ground stacked subs are processed (discrete aux drive or mixed drive, i.e., same signal sent to the flown and ground stacked subs), due to the overlap of the operating bandwidths for flown versus ground stacked (30-120 versus 30-80) the 180 degree phase shift due to the 80 Hz low pass filter may have to be compensated for by inverting the polarity of the ground stacked subwoofers. For the standard preset, polarity for output channels 1 and 6 is positive – experiment with polarity during tuning and time alignment to get the best result.







1) dV 4W dV-SUB LO/HI (XTA)
dV 4W DVS L/H (BSS)



1) dV 4W SB218 LO/HI (XTA)
dV 4W SB L/H (BSS)

4. INSTALLATION PROCEDURES

In the following sections, detailed installation procedures for stacking and flying dV-DOSC are presented. Please follow these procedures carefully and at all times remain safety-conscious.

4.1 STACKED SYSTEMS

Stacking dV-DOSC Standalone

For stability reasons, the maximum number of dV-DOSC elements that can be stacked is 12. In this case, each screwjack presents a load of 95 kg (210 lbs). The strength of the supporting floor should be carefully examined to determine if such a load can be supported - sheets of plywood or steel plates can be placed under individual screwjack feet in order to help distribute the load. For improved stability and load distribution, the front two screwjacks can be omitted and the two rear screwjacks only used for downwards tilt adjustment. For improved stability in outdoor situations, ratchet strap the dV-BUMP and V-DOSC bumper assembly to the stacking platform whenever possible.

Once the floor location for the stacked array has been determined, dV-BUMP is attached to the V-DOSC BUMPER by mating the two locating studs on dV-BUMP with the corresponding holes on the center cross bar section of the V-DOSC BUMPER (locating tabs are facing upwards so that dV-BUMP sits inside the V-DOSC bumper). A steel stud and dV-PIN81quick release pin is then used to mechanically secure dV-BUMP to the V-DOSC BUMPER at the central hole position along the front of the entire assembly.

Aim the stacking platform in the correct direction to provide the desired amount of array rotation on- or off-stage. Attach two screwjacks to the rear of the V-DOSC BUMPER by setting the height adjustment blocks on the two screwjacks to the minimum position then sliding these blocks into the locating slots on dV-BUMP (the front two screwjacks are optional when the array is to be tilted downwards).

Referring to the simulation results obtained in ARRAY, the screwjacks are then adjusted to provide the required vertical angle for the lowest element. NOTE: A digital inclinometer is useful for performing angle measurements. If this is not available, visually sight down dV-BUMP to ensure that the closest members of the audience will be covered.

In preparation to begin stacking, pre-attach dV-ANGLE P1 to the two rear mount points on dV-BUMP. Select the 3.75 degree hole (middle position) and pin dV-ANGLE P1 into position using dV-PIN25. As a reference, the ball end of dV-ANGLE P1 should always face outwards. By selecting the 3.75 degree hole, this sets dV-BUMP perpendicular to the face of the bottom cabinet and allows the site angle of dV-BUMP to serve as an aiming reference for correct focus.

Orienting dV-DOSC with the rigging tabs down (i.e., grille logo in the correct orientation), place the bottom enclosure on dV-BUMP by mating the front rigging tabs and rear locator slots with the locator slots and rear dV-ANGLE bars that were previously attached to dV-BUMP. Attach all four points using four dV-PIN25 (front first, rear last) to secure the bottom dV-DOSC to dV-BUMP. Verify the tilt angle for the first element and perform any required tilt adjustments using the rear screwjacks.

Note : Compensate for the 3.75 degree trapezoidal angle of dV-DOSC versus the actual site angle by using a 3.75 degree angle between the rear of the bottom enclosure and dV-BUMP.

The next step is to connect two more dV-ANGLE bars to the rear locator slots of the bottom dV-DOSC enclosure using two dV-PIN25. Pre-select the appropriate hole position to give the desired tilt angle for the second enclosure.

Note: As a reference for ANGLE bar orientation, the ball end of the angle bar should always be facing outwards (even when attaching to the dV-BUMP).

Place the second dV-DOSC on top of the bottom enclosure by mating the two front rigging posts on the second element and the dV-ANGLE bars that were previously mounted on the bottom element with the available locator slots. Attach the two front points using two dV-PIN25 to secure the second dV-DOSC element's front rigging tabs to the bottom element. Tilt the rear of the second enclosure to the desired angle and attach the second dV-DOSC to dV-ANGLE using two dV-PIN25.

The same procedures are followed for all other dV-DOSC elements of the array until stacking is completed.

The correct angle for the entire array is then obtained by fine adjustment of the dV-BUMP screwjacks. Focus of the top element can be checked by sight from behind the array - but you must compensate for the 3.75 degree trapezoidal angle of dV-DOSC since the wavefront is radiated parallel to the front of the cabinet (not perpendicular to the trap angle).

As a sighting guide, attach a dV-ANGLE bar at 3.75 degrees at the rear of the top enclosure and a second dV-ANGLE at 7.5 degrees at the front of the top enclosure. Visually lining up the tops of the two dV-ANGLE bars provides a sighting guide that is perpendicular to the front of the top element.

Looking from the rear of the array and sighting along the two dV-ANGLE bars, the tilt of the array should be aligned so as to cover the rearmost seats of the audience. Alternatively, from the highest section of audience area, if you can see the upper wall of the top dV-DOSC element, you are definitely out of the coverage pattern. More precise aiming can be accomplished by placing a laser pointer or similar device on the upper wall of the top enclosure (and compensating for the 3.75 degree trap angle). A similar visual check should also be made with respect to the lower wall of the bottom element of the array in order to ensure that the closest members of the audience are covered.

Connection of the array to the AMP RACKS can be performed as soon as stacking is completed. Remember to parallel a maximum of 3 dV-DOSC elements only.

Safety Rules

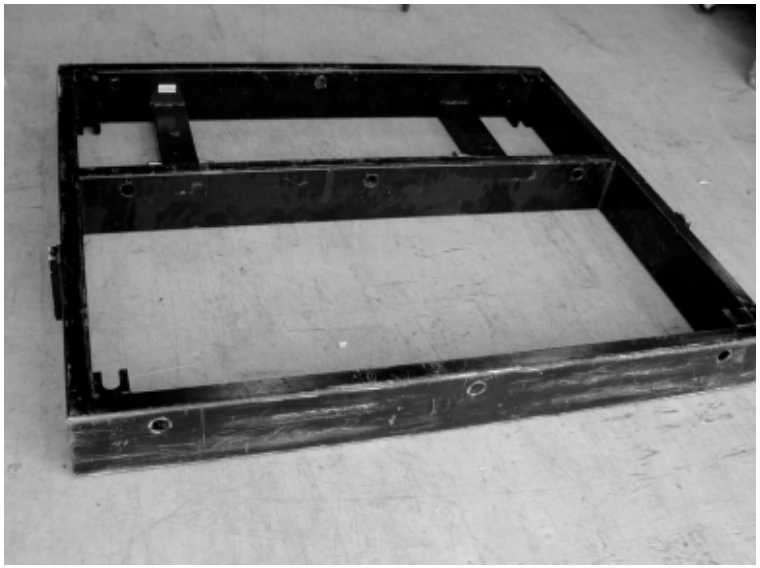
CAUTION: NO MORE THAN 12 dV-DOSC ELEMENTS SHOULD BE STACKED ON ONE BUMPER. INSTABILITY CAN OCCUR EITHER WHEN TILTING THE ARRAY OR UNDER HARD WIND CONDITIONS.

FOR STABILITY REASONS, THE dV-DOSC ARRAY MUST BE PHYSICALLY CONTAINED WITHIN THE VERTICAL FOOTPRINT OF THE V-DOSC BUMPER.

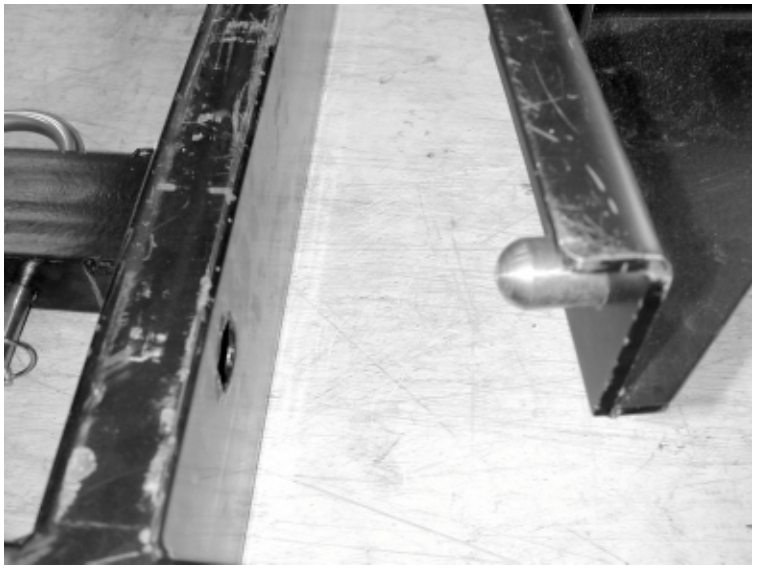
Always test the strength of the supporting floor - for 12 elements each screwjack can produce up to a 95.5 kg load (210 lbs). If necessary, use plywood sheets or steel plates under individual screwjack feet in order to help distribute the load.

Verify that all dV-DOSC elements are securely interconnected with dV-PIN25.

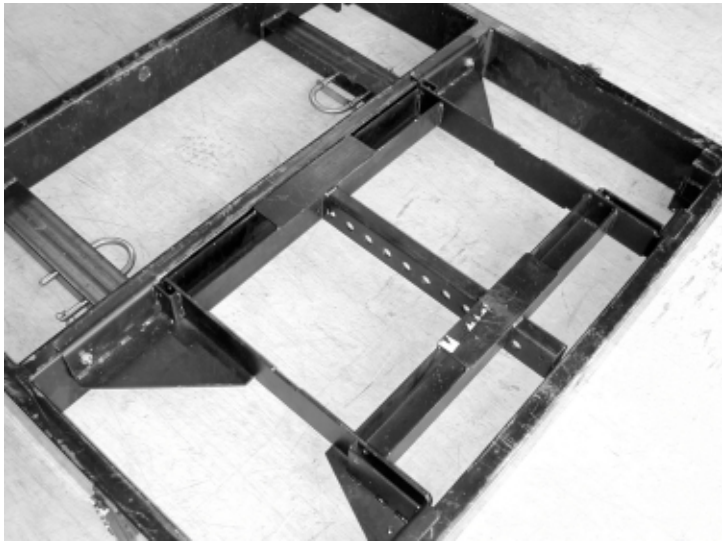
For improved stability in outdoor situations, ratchet strap the dV-BUMP and V-DOSC BUMPER assembly to the stacking platform whenever possible



(i) Place V-DOSC BUMP into position



(ii) dV-BUMP locator studs mate with holes on V-DOSC BUMP



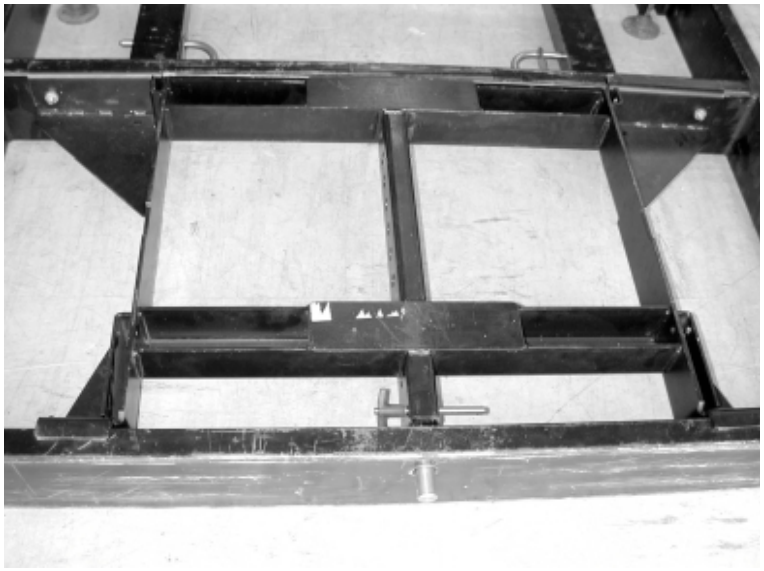
(iii) dV-BUMP mounted inside V-DOSC BUMP



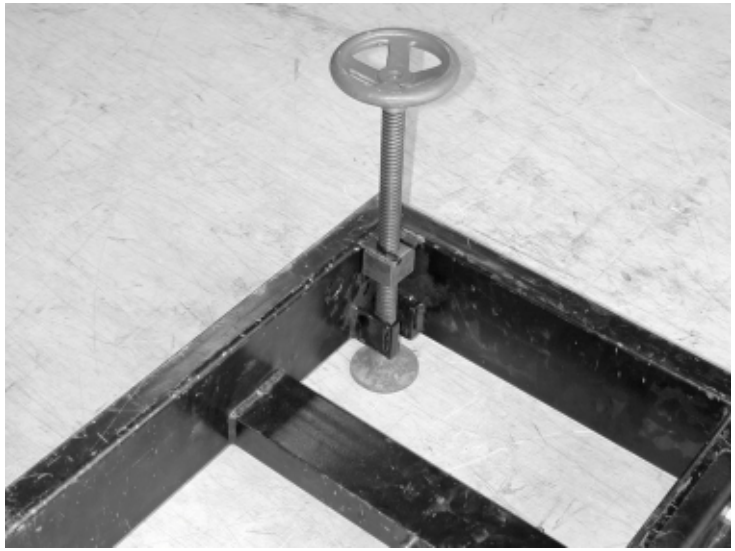
(iv) Insert locator pin



(v) Use dV-PIN81 to secure locator pin



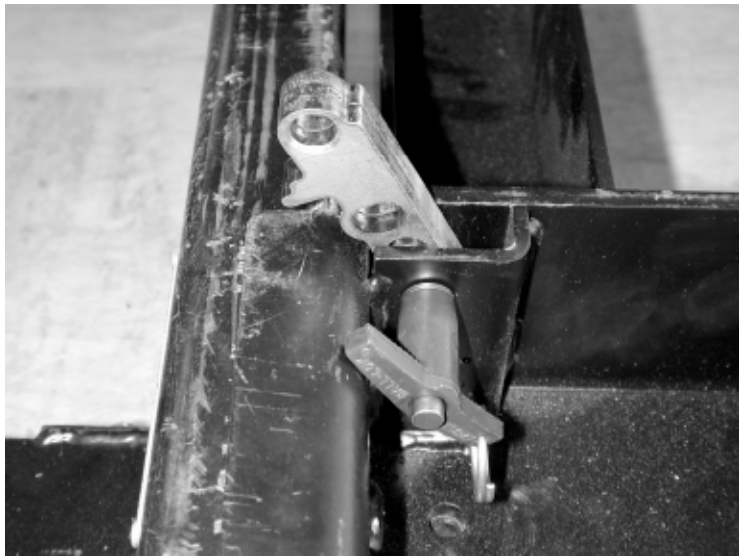
(vi) Overview of dV-BUMP secured to V-DOSC BUMP



(vii) Attach rear screwjacks to V-DOSC BUMP



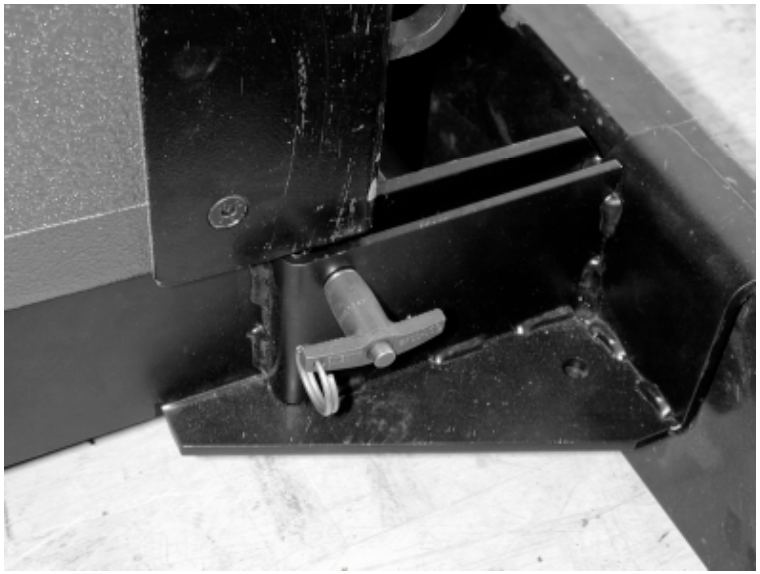
(viii) Select 3.75 deg (middle hole) for rear points on dV-BUMP



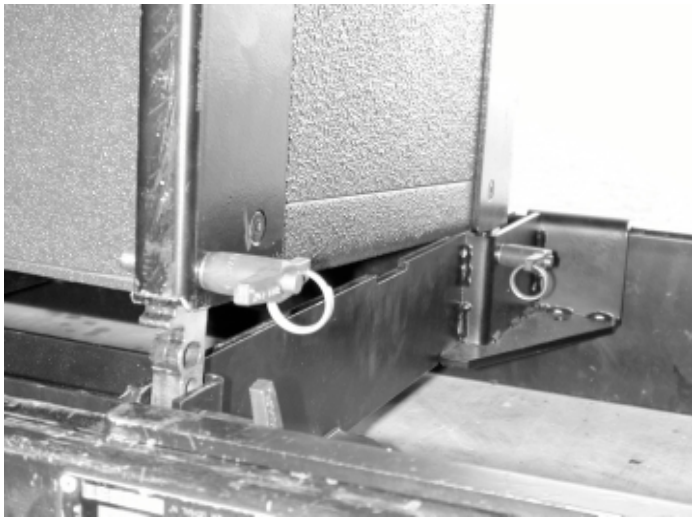
(ix) dV-ANGLE pre-attached in the 3.75 degree position



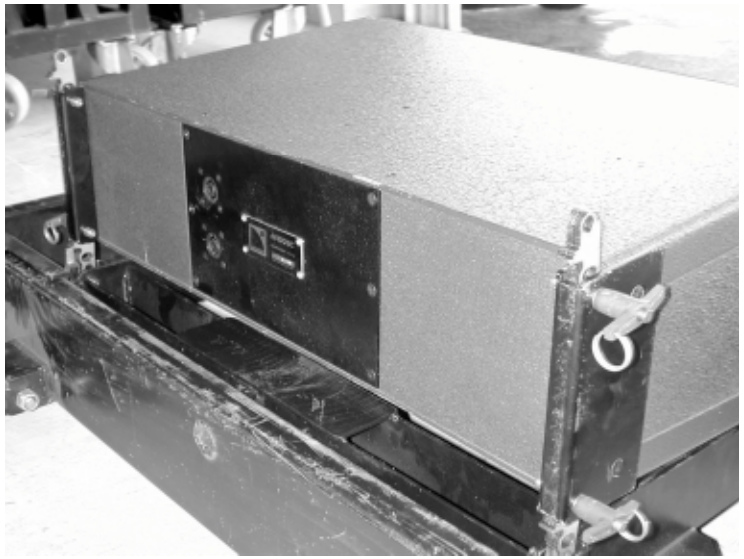
(x) Front rigging tabs mate with locator slots on dV-BUMP



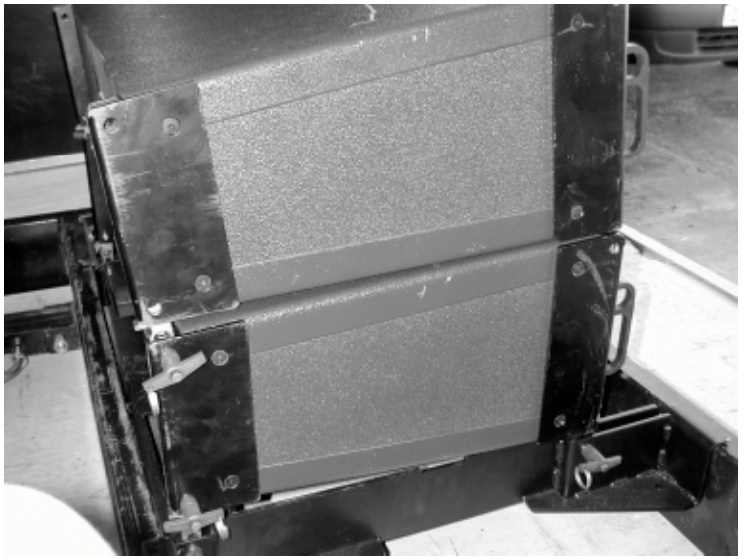
(xi) Pin front points first using dV-PIN25



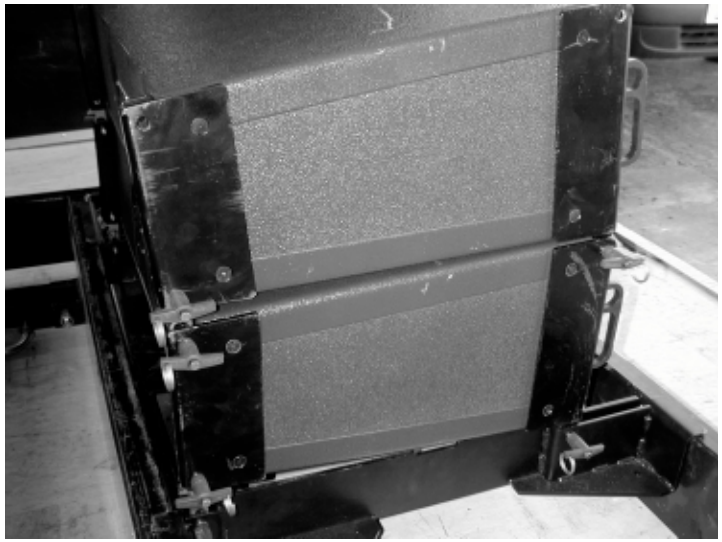
(xii) Then pin the rear points - note: by pre-selecting the angle, the tab on dV-ANGLEP1 acts as a stop when dV-DOSC is placed in position



(xiii) Pre-attach two more dV-ANGLE bars at desired angle



(xiv) Stack the second dV-DOSC enclosure



(xv) Pin front points first, rear points last using dV-PIN25



(xvi) Use dV-ANGLE at 3.75 (rear) and 7.5 (front) degree positions as a site for adjusting the focus of the stacked system

Stacking on top of V-DOSC

To fly dV-DOSC on top of V-DOSC, dV-BUMP is attached to the V-DOSC bumper to act as a stacking platform as in the standalone stacking procedures outlined above.

For stability reasons, the maximum number of dV-DOSC elements that can be stacked on top of V-DOSC is 6. Typically, allowable trim height and chain motor clearance issues will be the determining factors with respect to the number of cabinets that can be used.

Standard rigging procedures for V-DOSC are followed (please see the V-DOSC manual for complete details). For the front motor point, bridling should be performed using the outer points on the V-DOSC bumper in order to ensure that steel or motor chain does not interfere with the high frequency section of dV-DOSC once it is stacked on top of V-DOSC.

Once all standard V-DOSC flying preparations are complete, the first step is to raise the front motor so that the V-DOSC BUMPER rotates upwards to a horizontal position. If necessary take any slack out of the rear motor so that the V-DOSC BUMPER is securely supported in the horizontal position.

Attach dV-BUMP to the V-DOSC BUMPER by mating the two locating studs on dV-BUMP with the corresponding holes on the center cross bar section of the V-DOSC BUMPER (locating tabs are facing upwards so that dV-BUMP sits inside the V-DOSC bumper). A steel stud and dV-PIN81quick release pin are used to mechanically secure dV-BUMP to the V-DOSC BUMPER at the central hole position along the front of the entire assembly.

In preparation to begin stacking, pre-attach two dV-ANGLEP1 bars to the two rear mount points on dV-BUMP using two dV-PIN25. Selecting the 3.75 degree hole (middle position) will set the bottom dV-DOSC element parallel to the top V-DOSC element for long throw applications. For upfill applications, selecting the minimum 7.5 degree hole position (tightly wrapped) will provide 3.75 degrees tilt upwards with respect to the top V-DOSC element while selecting the 5.5 degree hole position will provide 1.75 degrees.

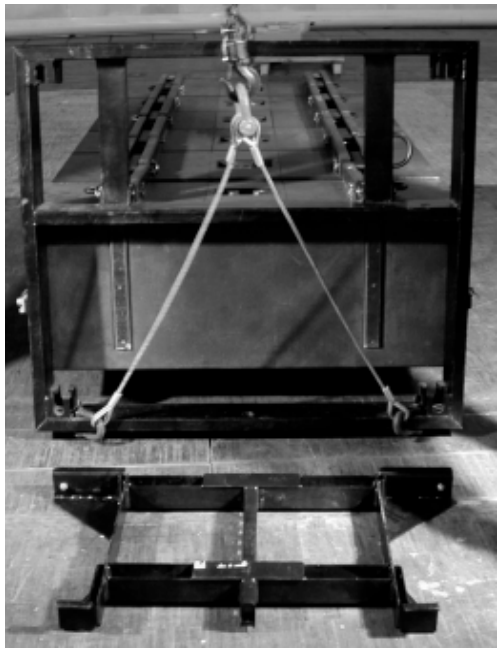
Orienting dV-DOSC with the rigging tabs down (grille logo in the correct orientation), place the first dV-DOSC on dV-BUMP by mating the front rigging tabs and rear locator slots with the locator slots and rear dV-ANGLE bars that were previously attached to dV-BUMP. Attach all four points using four dV-PIN25 (front first, rear last) to secure the bottom dV-DOSC to dV-BUMP.

The next step is to connect two dV-ANGLE (P1 or P2) bars to the rear locator slots of the bottom dV-DOSC enclosure using two dV-PIN25. Pre-select the appropriate hole position to give the desired tilt angle for the second enclosure. Note: As a reference for dV-ANGLE bar orientation, the ball end of the angle bar should always be facing outwards.

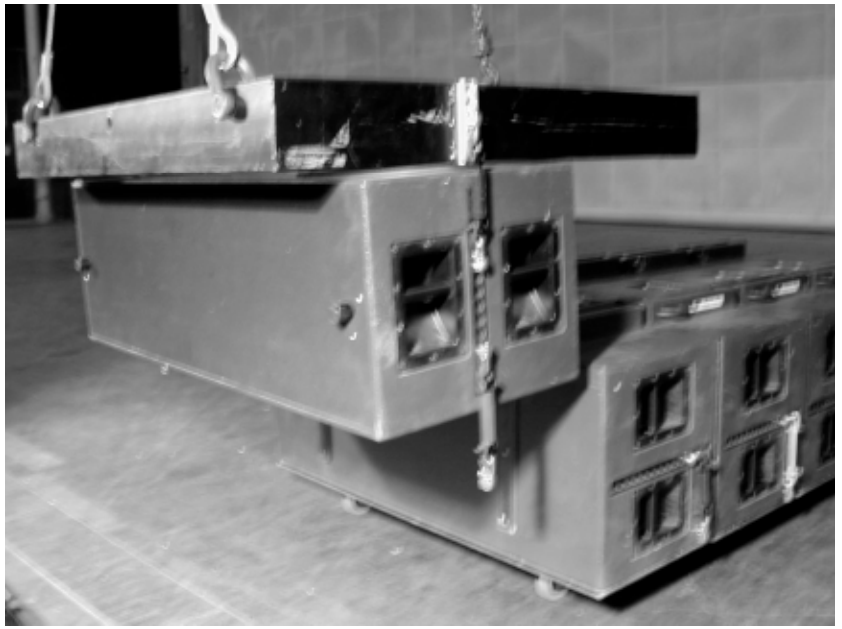
Place the second dV-DOSC on top of the bottom enclosure by mating the two front rigging posts on the second element and the dV-ANGLE bars that were previously mounted on the bottom element with the available locator slots. Attach the two front points using two dV-PIN25 to secure the second dV-DOSC element's front rigging posts to the bottom element. Tilt the rear of the second enclosure to the desired angle and attach the second dV-DOSC to dV-ANGLE using two dV-PIN25.

The same procedures are followed for all other dV-DOSC elements of the array until stacking is completed.

Connection of the array to the AMP RACKS can be performed as soon as stacking is completed. Remember to parallel a maximum of 3 dV-DOSC elements only.



(i) dV-BUMP and V-DOSC BUMPER



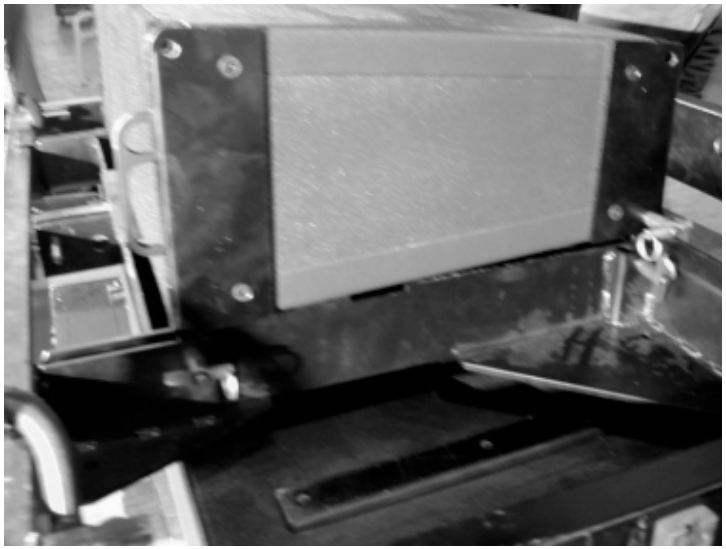
(ii) Raise and level the V-DOSC BUMPER



(iii) Place dV-BUMP inside V-DOSC BUMPER



(iv) Attach locator pin into position using dV-PIN81



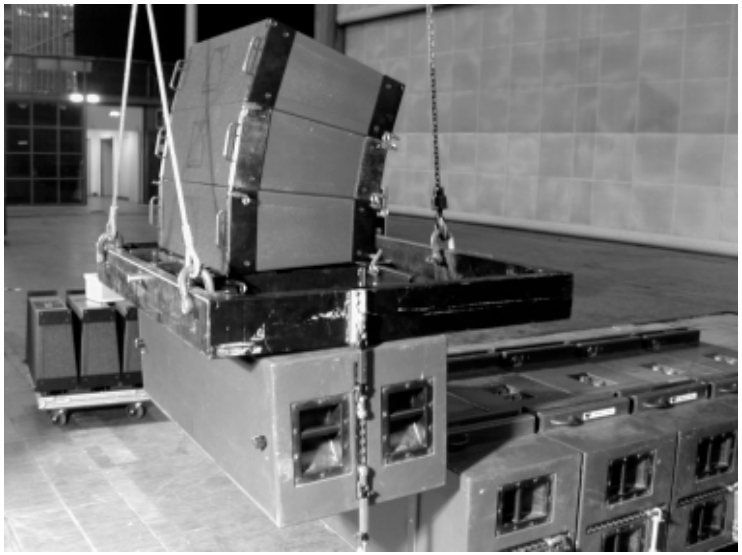
(v) Attach rear dV-ANGLE and mount the first element



(vi) Continue to build the stack



(vii) Note bridling arrangement in front



(viii) Entire system is now ready to fly

Stacking on top of SB218 Subwoofers

For this application, four circular pads are provided on dV-BUMP that mate with the stacking runner recesses on the top panel of the SB218 subwoofer. Side notches in dV-BUMP are also available that allow a ratchet strap to be used to secure dV-BUMP to the SB218 for added stability.

Start by building a stack of SB218 subwoofers. From ground level, stacking at least four SB218 enclosures high puts dV-DOSC at a good height so that the bottom cabinet will be angled down into the audience. Before stacking dV-DOSC, secure SB218 cabinets together using V-DOSC ANGLE straps between cabinets (and/or a ratchet strap running around the entire stack). Physically securing SB218s will provide extra stability during the dV-DOSC stacking procedure and will also prevent subs from "walking" during the show.

Place dV-BUMP into position on top of the upper SB218 by mating the pads with the stacking runner recesses. Attach two double stud to ring fittings in the fly track sections on the sides of the SB218. Run a ratchet strap between these fittings through the side notches on dV-BUMP to secure dV-BUMP to the top subwoofer. Tighten the ratchet strap securely but do not overtighten to the extent that flytrack sections or double stud fittings are damaged. Alternatively, a ratchet strap can be run around the entire subwoofer stack, including the dV-BUMP.

Pre-attach two dV-ANGLE bars at the rear points on dV-BUMP and select the desired tilt angle downwards. Note: dV-ANGLE N bars can be selected if greater than 3.75 degrees downwards tilt is required (this is provided by the 0 degree hole position on the dV-ANGLE P1 bar - note that the site angle is referenced perpendicular to the front of dV-DOSC and not the trap angle of the enclosure).

Orienting the first dV-DOSC enclosure with the rigging tabs down (grille logo in the correct orientation), place the enclosure on dV-BUMP by mating the front rigging tabs and rear locator slots with the locator slots and rear dV-ANGLE bars that were previously attached to dV-BUMP. Attach all four points using four dV-PIN25 (front first, rear last) to secure the bottom dV-DOSC to dV-BUMP.

The next step is to connect two more dV-ANGLE bars to the rear locator slots of the bottom dV-DOSC enclosure using two dV-PIN25. Pre-select the appropriate hole position to give the desired tilt angle for the second enclosure. Note: As a reference for ANGLE bar orientation, the ball end of the angle bar should always be facing outwards.

Place the second dV-DOSC on top of the bottom enclosure by mating the two front rigging posts on the second element and the dV-ANGLE bars that were previously mounted on the bottom element with the available locator slots. Attach the two front points using two dV-PIN25 to secure the second dV-DOSC element's front rigging posts to the bottom element. Tilt the rear of the second enclosure to the desired angle and attach the second dV-DOSC to dV-ANGLE using two dV-PIN25.

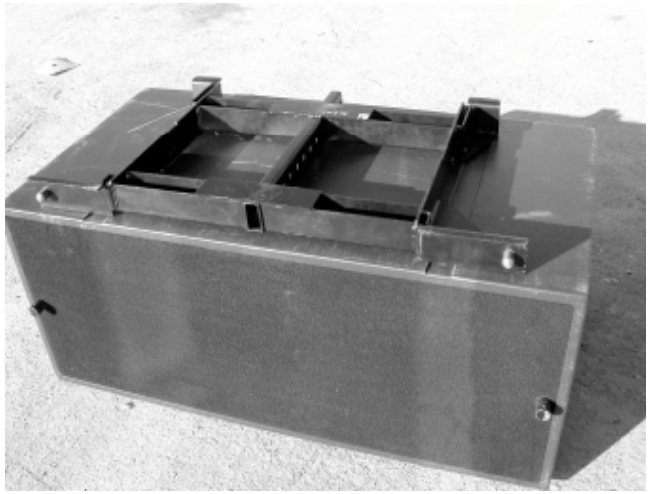
The same procedures are followed for all other dV-DOSC elements of the array until stacking is completed.



(i) Note circular discs on dV-BUMP



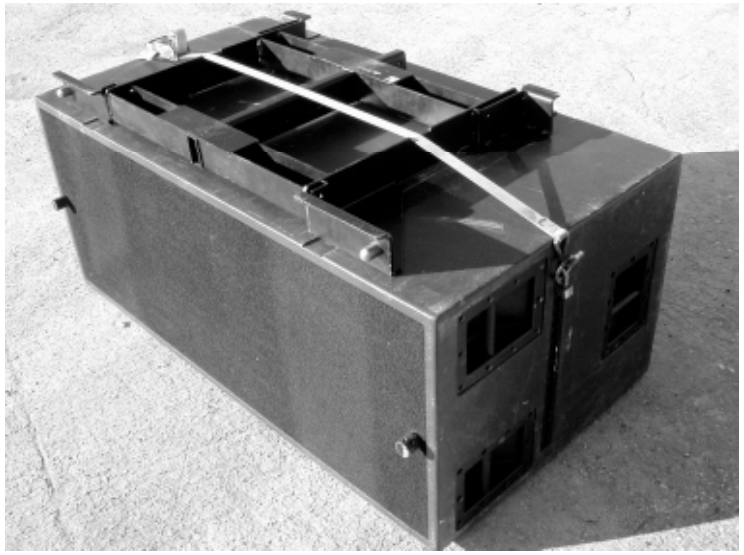
(ii) These mate with stacking runner recesses on SB218



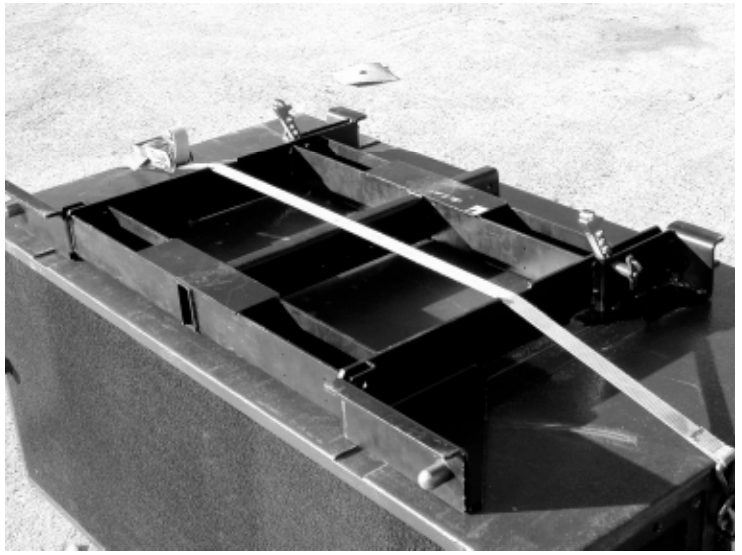
(iii) dV-BUMP placed into position



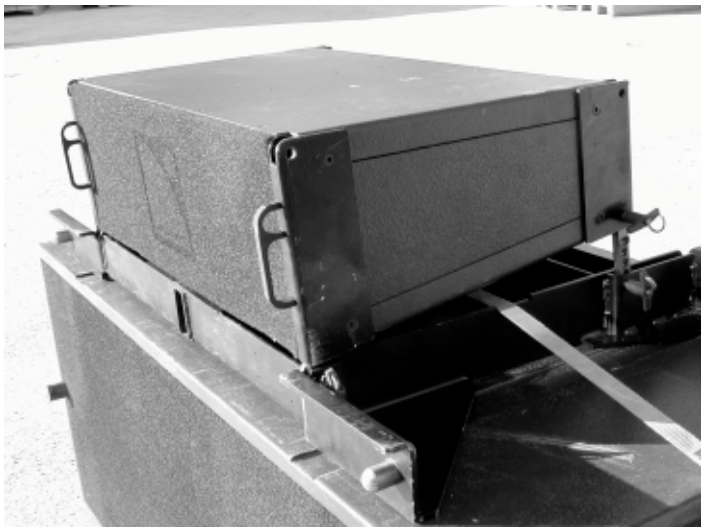
(iv) Double stud to ring fitting attached to SB218 flytrack (alternative: run a ratchet around the entire stack)



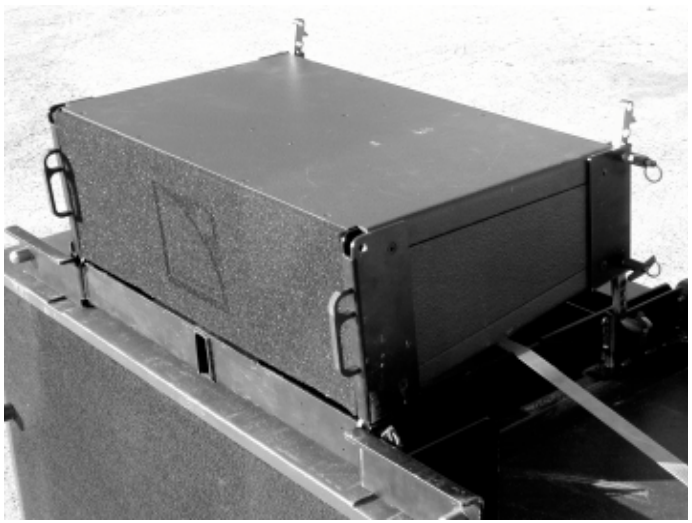
(v) Ratchet strap secures dV-BUMP to the SB218



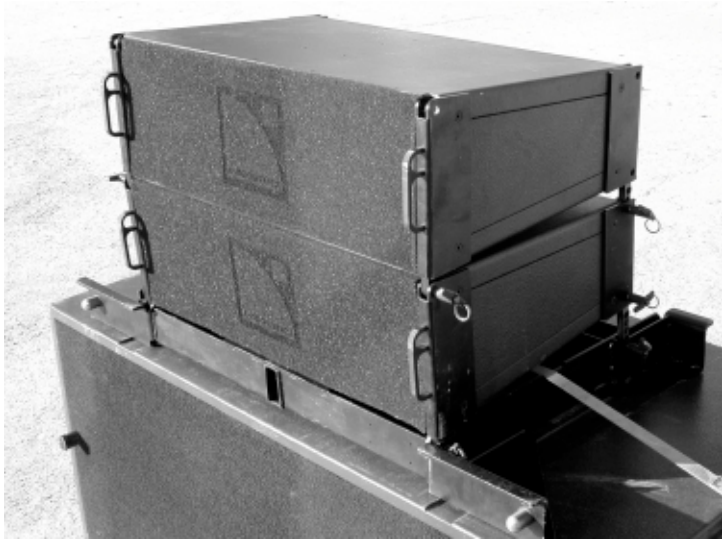
(vi) Rear dV-ANGLE pre-attached at desired angle



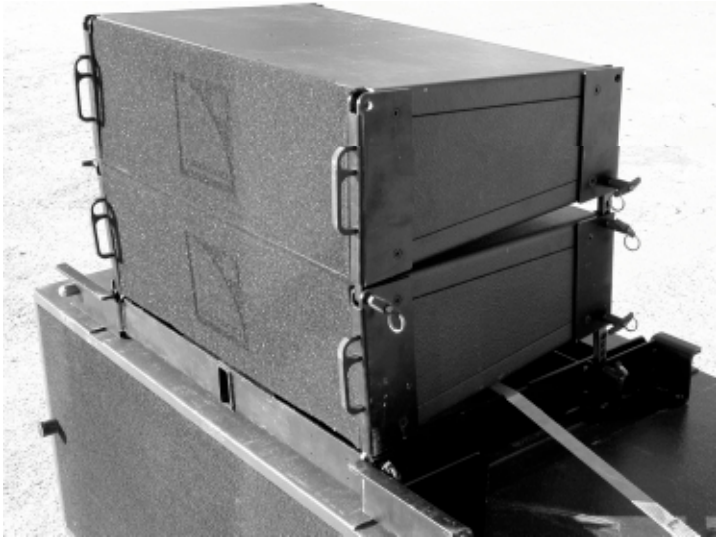
(vii) Bottom dV-DOSC mounted, attached using dV-PIN25



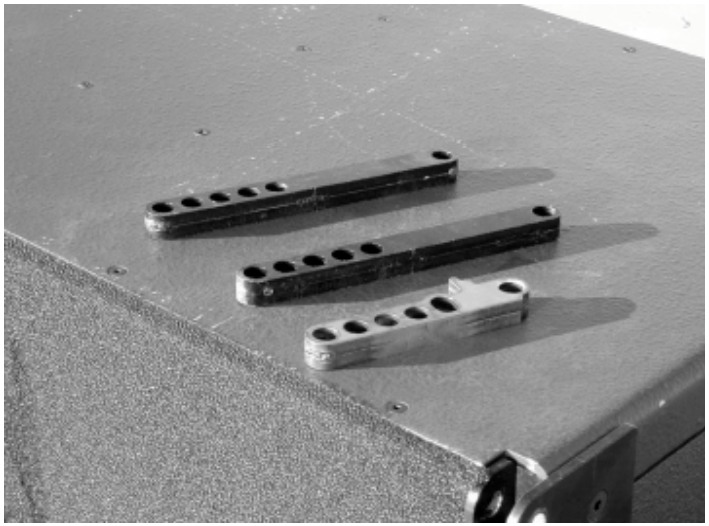
(viii) Pre-attach next set of dV-ANGLE



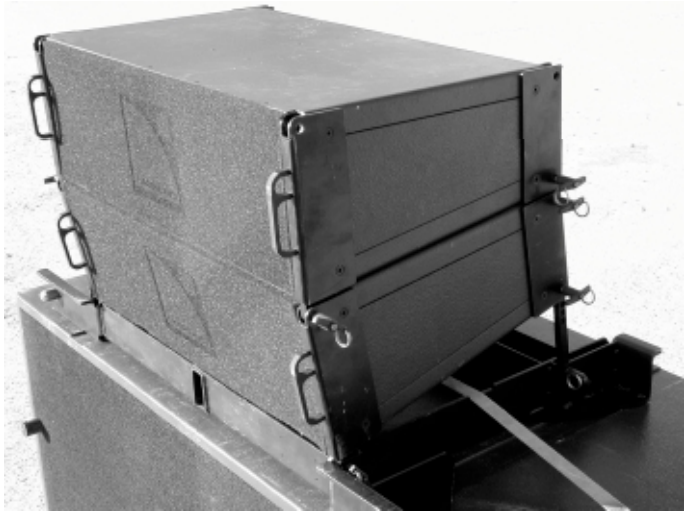
(ix) Second dV-DOSC placed into position



(x) then secured using dV-PIN25 (front first then rear)



(xi) Use dV-ANGLE N instead of dV-ANGLE P1…



(xii) for more downwards tilt

Stacking dV-SUB Subwoofers

When stacking dV-SUBs, the stacking runners on the bottom of enclosures mate with the recesses on the tops of adjacent enclosures while the stack is being built. For this application, there are two options for securing a stack of dV-SUBS: 1) use a ratchet strap around the entire stack or 2) use dV-ANGLESS (sub-to-sub) angle bars between adjacent dV-SUB enclosures. Either of these options is recommended, especially if dV-SUB will serve as a stacking platform for dV-DOSC (see the following section).

If dV-ANGLESS (sub-to-sub) angles are used, it is best to place the first enclosure in the desired stacking location and pre-attach four dV-ANGLESS using dV-PIN25 quick release pins to the second enclosure before stacking. If two people lift the second dV-SUB and crown the bottom front edge (once stacked), it is then possible to rotate/lower the dV-SUB into position by using the dV-ANGLESS as locators that mate with the slots on the dV-SUB rigging panels of the first enclosure.

Note: this procedure is recommended (as opposed to placing dV-ANGLESS on the first enclosure then lowering the second into position) since due to the weight of the second cabinet and the subsequent difficulty in lining up rigging slots with dV-ANGLESS, it is possible to damage the second enclosure's paint/finish.

For more details on stacking dV-SUBS using dV-ANGLESS, please refer to the following photo sequence:



Bottom dV-SUB in position, second dV-SUB with dV-ANGLESS pre-attached



Crown the bottom front edge of the second dV-SUB



Rotate/lower the second dV-SUB into position and position all four dV-ANGLESS in the corresponding slots of the bottom enclosure's rigging panels



Use 4 x dVPIN25 to attach the second enclosure to the bottom dV-SUB



Repeat the same procedure to stack 3 dV-SUBs high



The stack - secured using 8 dV-ANGLESS and 16 dVPIN25

Stacking dV-DOSC on top of dV-SUBS

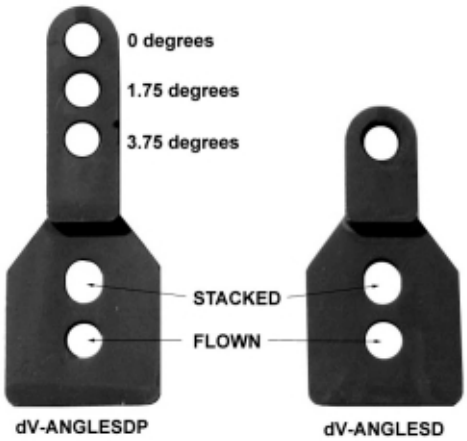
There are two options for stacking dV-DOSC: with, or without dV-BUMP.

Procedure 1: Stacking without dV-BUMP

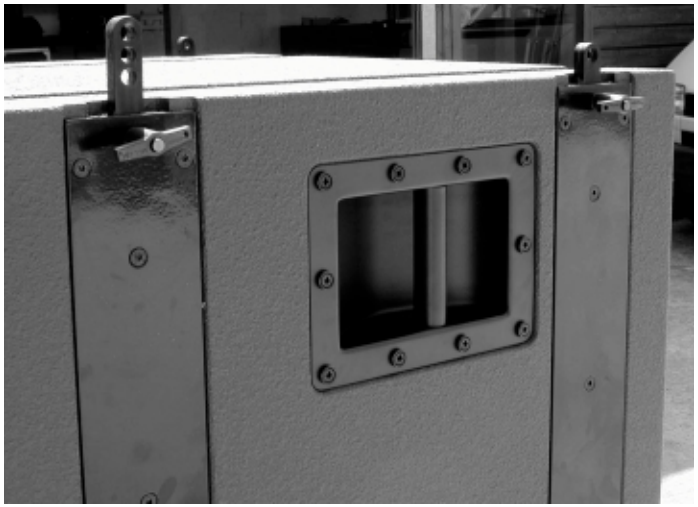
When stacking on stages or risers, reduced downwards tilt requirements for the stacked dV-DOSC system may allow for the direct installation of dV-DOSC on top of dV-SUB without use of dV-BUMP. Two dV-ANGLESD (sub to dV-DOSC) angles are used for the front attachment points and two dV-ANGLESDP (sub to dV, positive tilt) are used for the rear attachment points of the first dV-DOSC. The dV-ANGLESDP angle bar provides tilt angles of 0 (dV-DOSC flat with respect to dV-SUB-furthest hole position), 1.75 (intermediate) and 3.75 degrees (tightly wrapped - minimum hole position).

Before stacking dV-DOSC, build the dV-SUB stack and physically secure the enclosures using dV-ANGLESS angles between cabinets (and/or a ratchet strap around the entire stack). Physically securing dV-SUBs will provide extra stability during the dV-DOSC stacking procedure and will also prevent subs from moving during the show.

With reference to the photo sequence that follows, pre-attach 2 x dV-ANGLESD at the front of the top dV-SUB and 2 x dV-ANGLESDP at the rear using 4 x dV-PIN25. The closest holes on these angle bars are used for stacked applications and the "fat" part of the angle bars is oriented towards the center of dV-SUB in order to mate properly with the dV-DOSC rigging panels.



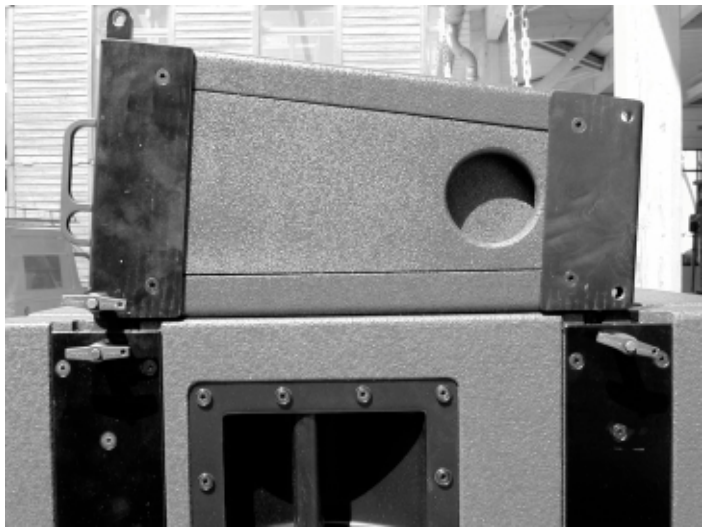
The first dV-DOSC is inverted and placed in position by mating the rigging recesses on the dV-DOSC rigging panels with the pre-attached dV-ANGLESD and dV-ANGLESDP angle bars. Secure the front two attachment points using 2 x dV-PIN25 then raise the dV-DOSC at the rear and select the desired tilt angle on dV-ANGLESDP (0, 1.75 or or 3.75 degrees), again securing the two rear points using 2 x dV-PIN25. Continue to build the stack by pre-attaching dV-ANGLE P1 or P2, pre-selecting the desired tilt angle and securing with dV-PIN25 before installing additional dV-DOSC enclosures.



(i) Pre-attach dV-ANGLESD (front) and dV-ANGLESDP (rear) to dV-SUB



(ii) Note: The "fat" part of dV-ANGLESD and dV-ANGLESDP is oriented towards the center of dV-SUB on both sides

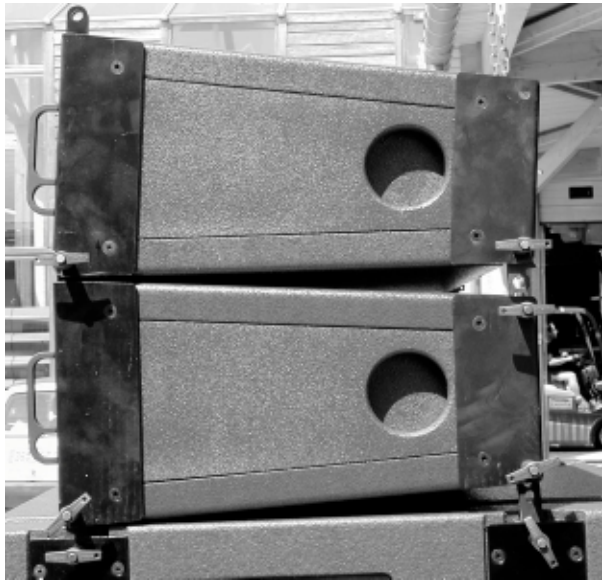


(iii) Place dV-DOSC in position (inverted) and secure the front 2 points

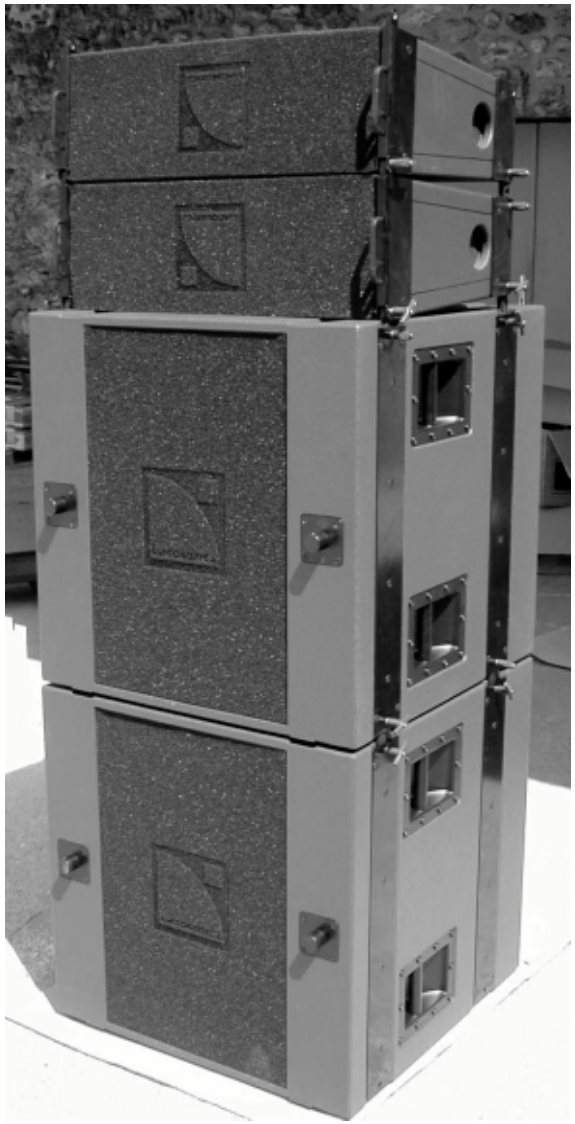


(iv) Lift dV-DOSC into position and secure with dV-PIN25





(v) Pre-select the angle / pre-attach dV-ANGLE P1 or P2 for the second dV-DOSC elements and continue to build the stack



(vi) The finished stack of dV-SUB and dV-DOSC

Procedure 2: Stacking with dV-BUMP

In this case, dV-BUMP is placed on top of the upper dV-SUB and serves as a stacking platform for dV-DOSC. dV-ANGLEN bars can be used for downwards tilt, and from ground level, stacking 3 dV-SUB enclosures high puts dV-DOSC at a good height so that the bottom cabinet will be angled down into the audience. Typically downwards tilt is necessary to reduce audience shadowing effects and to improve HF penetration into the audience.

Before stacking dV-DOSC, build the dV-SUB stack and physically secure the enclosures using dV-ANGLESS angles between cabinets (and/or a ratchet strap around the entire stack). Physically securing dV-SUBs will provide extra stability during the dV-DOSC stacking procedure and will also prevent subs from moving during the show.

Place dV-BUMP into position on top of the upper dV-SUB and secure in place using a ratchet strap around the entire stack.

Pre-attach two dV-ANGLE P1 or P2 bars at the rear points on dV-BUMP and select the desired tilt angle or, alternatively, use dV-ANGLE N bars if greater than 3.75 degrees downwards tilt is required

Orienting the first dV-DOSC enclosure with the rigging tabs down (grille logo in the correct orientation), place the enclosure on dV-BUMP by mating the front rigging tabs and rear locator slots with the locator slots and rear dV-ANGLE (P1, P2 or N) bars that were previously attached to dV-BUMP. Attach all four points using four dV-PIN25 (front pair first, rear pair last) to secure the bottom dV-DOSC to dV-BUMP.

The next step is to connect two more dV-ANGLE P1 or P2 bars to the rear locator slots of the bottom dV-DOSC enclosure using two dV-PIN25. Pre-select the appropriate hole position to give the desired tilt angle for the second enclosure.

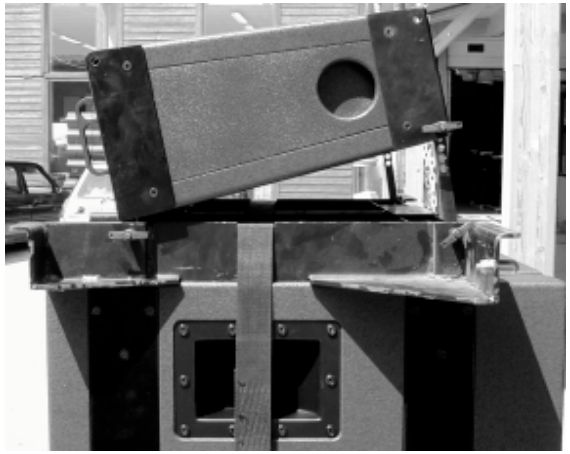
Note: As a reference for ANGLE bar orientation, the ball+tab end of the angle bar should always be facing outwards. The advantage of pre-selecting the angle is that the dV-ANGLE P1 or P2 acts as a stop when the next dV-DOSC enclosure is placed. This makes it easier to secure the rear points since less lifting is required.

Place the second dV-DOSC on top of the bottom dV-DOSC enclosure by mating the two front rigging posts on the second element and the dV-ANGLE bars that were previously mounted on the bottom element with the available locator slots. Attach the two front points using two dV-PIN25 to secure the second dV-DOSC element's front rigging posts to the bottom element. Tilt the rear of the second enclosure to the desired angle and attach the second dV-DOSC to dV-ANGLE using two dV-PIN25.

The same procedures are followed for all other dV-DOSC elements of the array until stacking is completed.



(i) dV-BUMP secured to dV-SUB stack using a ratchet strap. dV-ANGLEN preinstalled for rear attachment points



(ii) dV-DOSC installed - note how dV-ANGLEN provides downwards tilt



(iii) 3 high dV-SUB stack provides a good height as a stacking platform. With the bottom element tilted downwards, coverage starts from 2 metres onwards.



4.2 FLOWN SYSTEMS

Standalone Flying with dV-BUMP

Flying a dV-DOSC array is fast and easy. When properly prepared and organized, handling time can be significantly reduced in comparison with conventional systems. Installation is optimum when 2-3 people are available although it is possible for a single person to fly dV-DOSC.

Preliminary Preparations:

- All geometrical data for flying the array (i.e., trim height, bottom element elevation, inter-element angles) has been pre-calculated using ARRAY 2000 (CUTVIEW sheet dVARRAY1 or dVARRAY2)
- Two independent flying points are available, directly in line and with the desired pan angle for the array as determined using ARRAY 2000 (ISOCONTOUR sheet)
- Alternatively, a single point hang can be performed using the points available on the central spreader bar section of dV-BUMP or the rear extension bar
- Access is available beneath the flying points, i.e., a flat surface where it is possible to assemble dV-DOSC elements

Given the above conditions:

The first step is to unpack and organize all dV-DOSC elements and rigging hardware at the flying location. As a reference for cabinet orientation, the front grille logos should all be in the correct orientation and the bottom rigging tabs facing down once the system is flown.

Line up all dV-DOSC enclosures in their flight cases (3 per case). Mate the bottom rigging tabs from the first group of 3 cabinets with the top locator slots of the next group of cabinets. Repeat until all dV-DOSC flight cases are physically lined up.

Physically connect the fronts of all dV-DOSC enclosures by attaching the front points using dV-PIN25. The entire assembly will then be linked, similar to how V-DOSC is attached using rotating legs and U-pins (except the attachment points are at the front in this case).

Place dV-BUMP at the front of the array, oriented so that the dual locating studs are facing upwards (or rear extension bar upwards). If desired, attach the extension bar to dV-BUMP using an 18 mm shackle at pick point hole number 8 on the central spreader bar section. The extension bar allows the use of two motors for tilt adjustment or single point hangs of up to 12 elements from the 8 additional points available on the extension bar. Note: 12 elements, tightly wrapped at 7.5 degrees provide 90 degree coverage focussed from vertical to horizontal when the rearmost pick point of the extension bar is used. If the extension bar is not used, 8 pick point positions are available on the central spreader bar section of dV-BUMP for single point hangs and up to 24 dV-DOSC can be flown.

Pre-attach dV-ANGLE P1 at the 3.75 degree (middle hole) position to the two rear points on dV-BUMP using dV-PIN25. Pre-attach dV-ANGLE P1 at the 7.5 degree (smallest gap) position to the front points on dV-BUMP. As a reference, the ball/tab end of all four dV-ANGLE should be facing outwards.

Note : The 3.75 degree angle between the rear of the top enclosure and dV-BUMP is necessary to compensate for the 3.75 degree trapezoidal angle of dV-DOSC versus the actual site angle of the enclosure which is perpendicular to the front of the enclosure. Adding a 3.75 degree angle at the rear allows focus to be verified with a laser attached to dV-BUMP since this will be parallel to the site angle of the top element.

The next step is to attach dV-BUMP to the top element by mating the pre-attached dV-ANGLE bars to the locating slots of the top element. Use four dV-PIN25 to physically connect dV-BUMP to the top element.

Referring to the angle values that were pre-calculated for each element using ARRAY 2000, pre-attach pairs of dV-ANGLE bars at the rear of all dV-DOSC elements of the array (while they are still face down in their flight cases). Remember to keep the ball/tab end up and oriented towards the dV-BUMP as a reference. Be careful to select the correct angle for each element (generally, it is better if one person performs this operation to avoid mistakes). Note that pre-selecting angles will allow the dV-ANGLE tab to act as a stop while the array is being lifted, facilitating attachment using dV-PIN25.

Connect the rears of dV-DOSC elements in blocks of three (while they are still face down in their flight cases) by pulling the cabinets together at the rear and inserting dV-PIN25. This operation is facilitated by the fact that all fronts are pinned together and can pivot, plus all rear angles were pre-attached in the previous step.

Connect all elements to the AMP RACKS using the appropriate cables and adaptors (SP and DO2W or DO plus DOFILL) and SP.7 jumpers between elements for parallel operation. Long cable runs should be dressed and tied off to dV-BUMP for strain relief. Be careful not to connect more than 3 dV-DOSC enclosures in parallel.

Conduct a final inspection to make sure all cabling is correct, proper interelement angles have been selected and that all dV-PIN25 are in place and securely seated.

Connect the front and rear motors (or single motor) to dV-BUMP.

Slowly begin to raise the array. As the array lifts off, the rear gaps between blocks of 3 cabinets will close, allowing you to progressively pin the blocks together as system goes up.

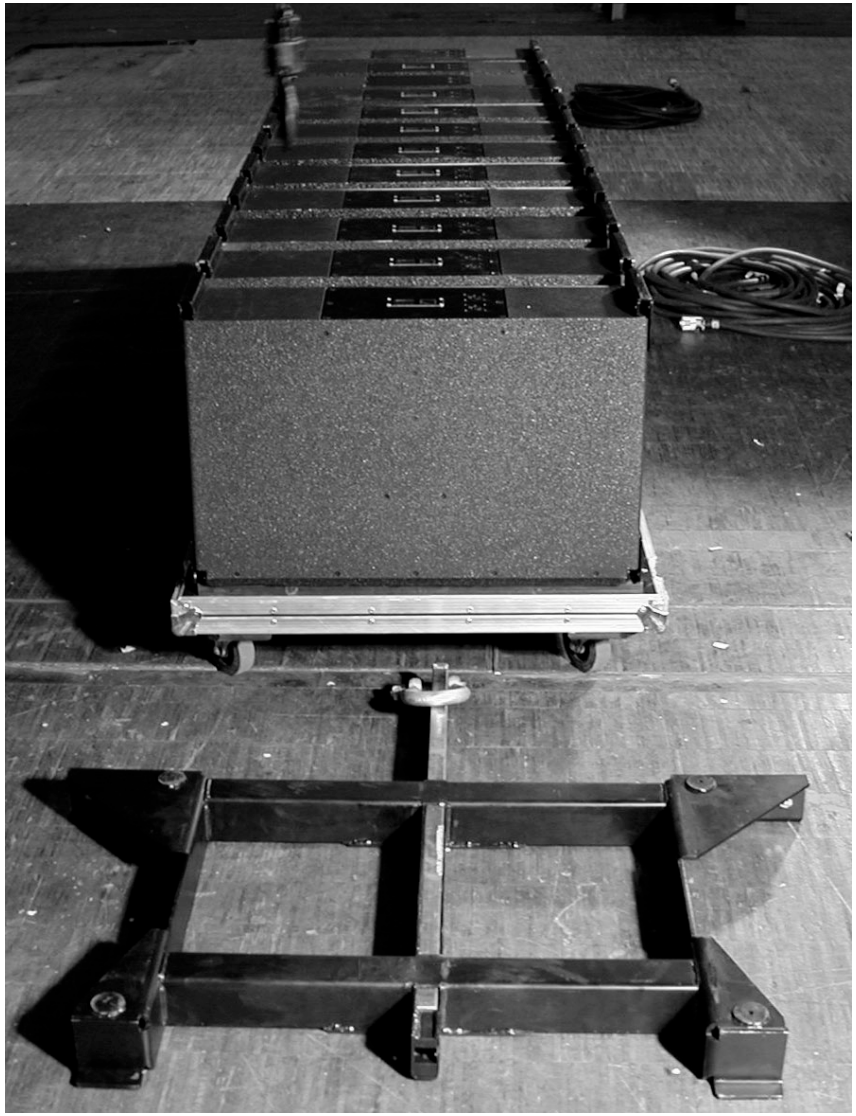
Be careful to steady the array as it lifts off the ground in order to prevent it from swinging. Gradually lift the array until it is freely floating in air. If you are doing a single point hang, use a digital inclinometer to verify that the tilt angle of the top element is correct before taking the array up to trim. If adjustment is required, lower the array and change the pick point until the desired tilt is obtained.

Attaching rear dV-ANGLE bars and shackles to the bottom element of the array then running a ratchet strap up to the single point hang location can provide an additional degree of tilt adjustment (down only) and also help to stabilize the array from spinning. The bottom two points can also be used for attaching tie lines.

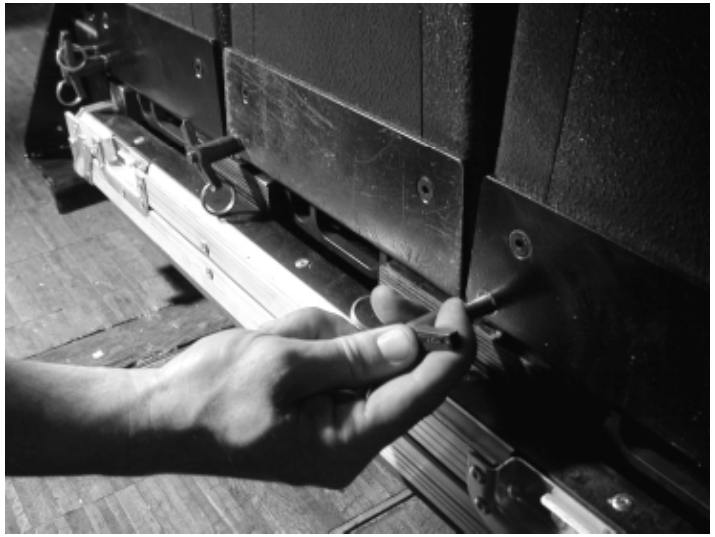
If you have 2 motors available, more detailed focus can be achieved by mounting a laser on top of dV-BUMP (provided that you have used a 3.75 degree angle for the rear of the top element so that dV-BUMP is parallel to the site angle).

Note: Since the rigging system for dV-DOSC is front pivoting, coordinates are referenced to the front of the top element and the bottom element elevation is referenced to the front of the bottom element. This means that when focussing a dV-DOSC array the front motor controls the trim height while the rear motor controls tilt. This is opposite to the case for V-DOSC since the rigging system is rear-pivoting.

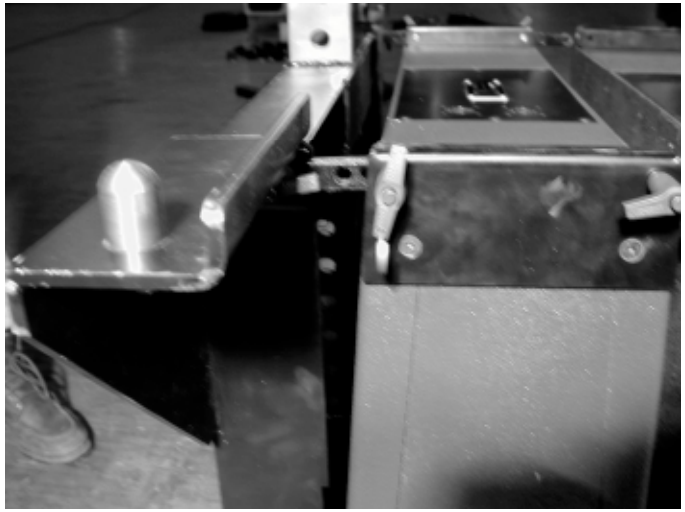
For demounting, lower the array and remove the front dV-PIN25 pins on the bottom three elements. Roll a FLIGHT-dV case into position and land the three elements face down in the case. Disconnect the rear dV-PINs of the third element and wheel the block of 3 out of the way for further hardware de-installation. Repeat this procedure in groups of three at a time.



(i) dV-DOSC lined up in FLIGHT-dV cases



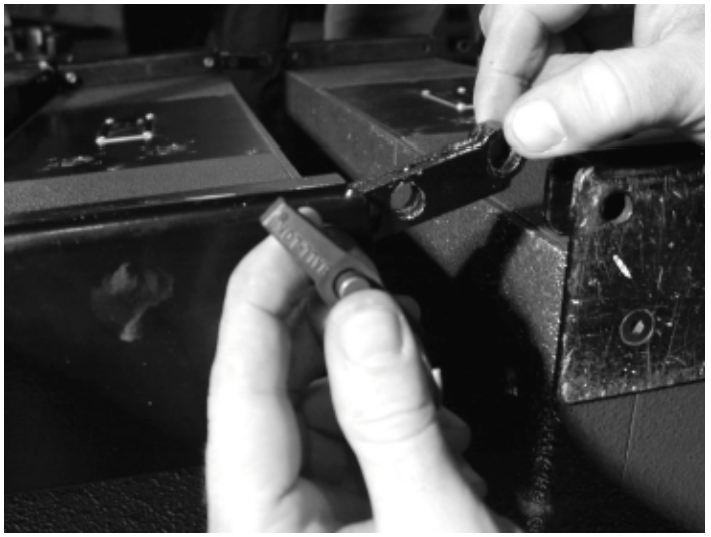
(ii) Pin the fronts of all dV-DOSC using dV-PIN25



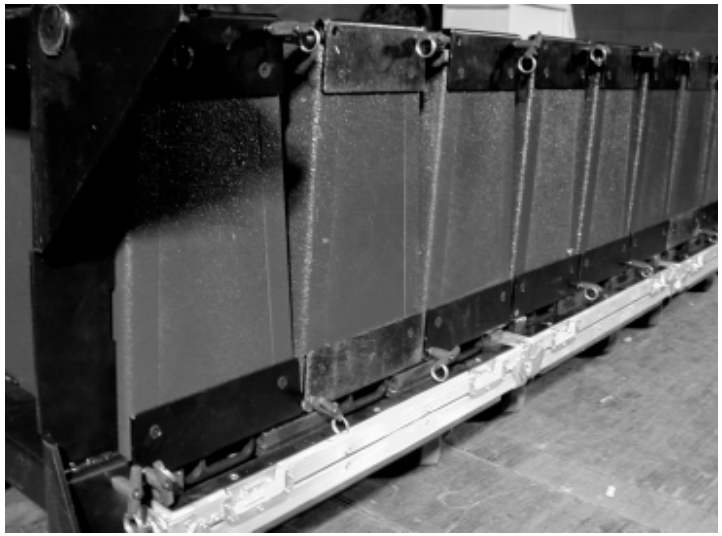
(iii) Use 3.75 degree for rear when attaching dV-BUMP



(iv) Pre-attach all rear dV-ANGLE (ball end up)



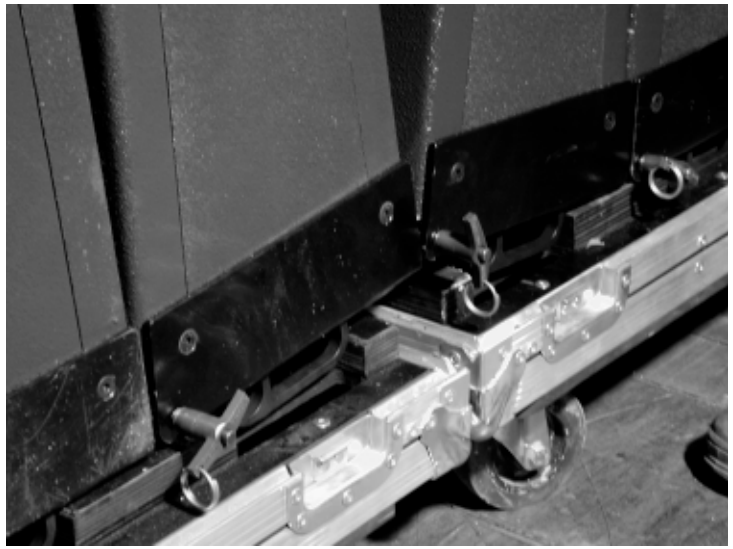
(v) Pre-select the desired angle



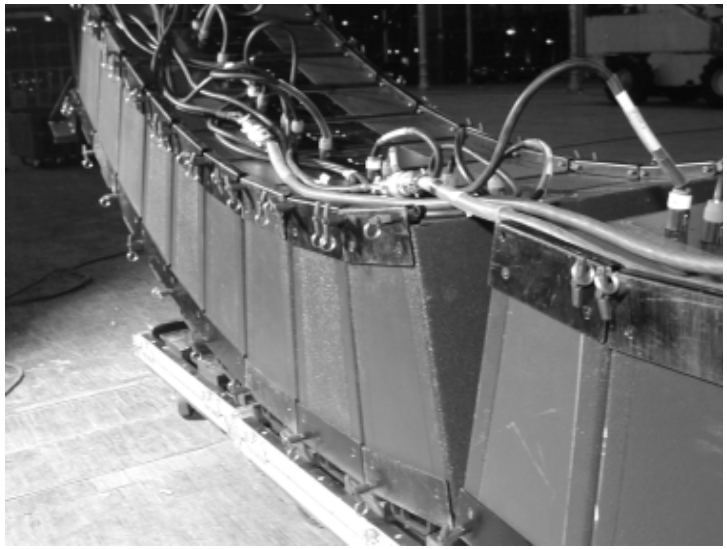
(vi) dV-BUMP attached, dV-ANGLE pre-attached



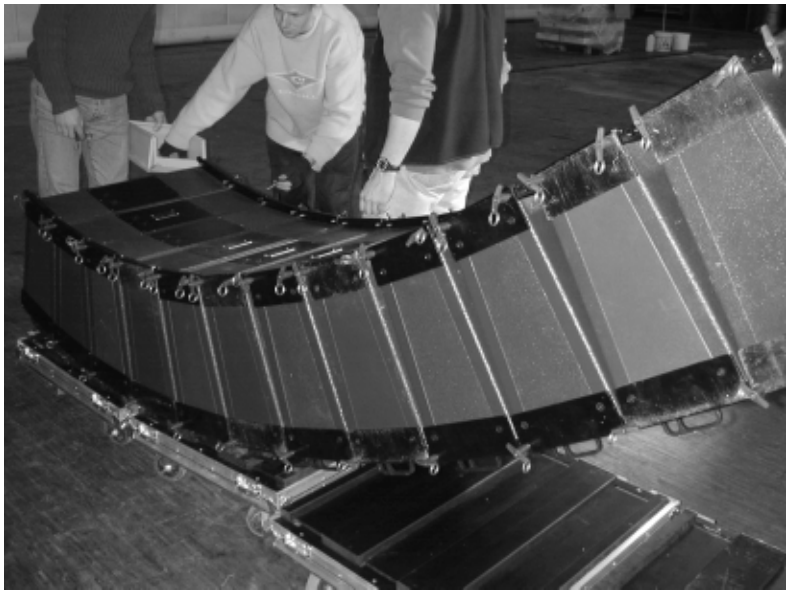
(vii) Connect dV-DOSC enclosures in groups of three

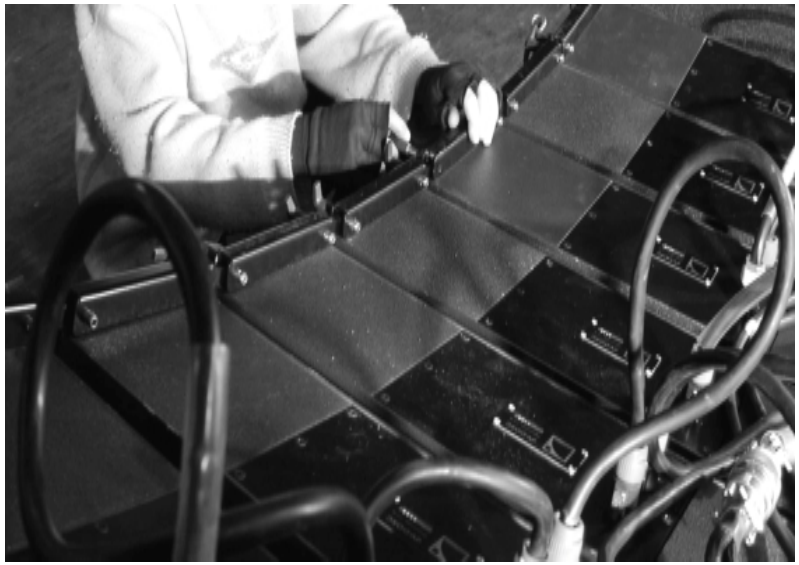


(viii) Lower detail between adjacent blocks of 3 dV-DOSC



(ix) As cabinets lift off …

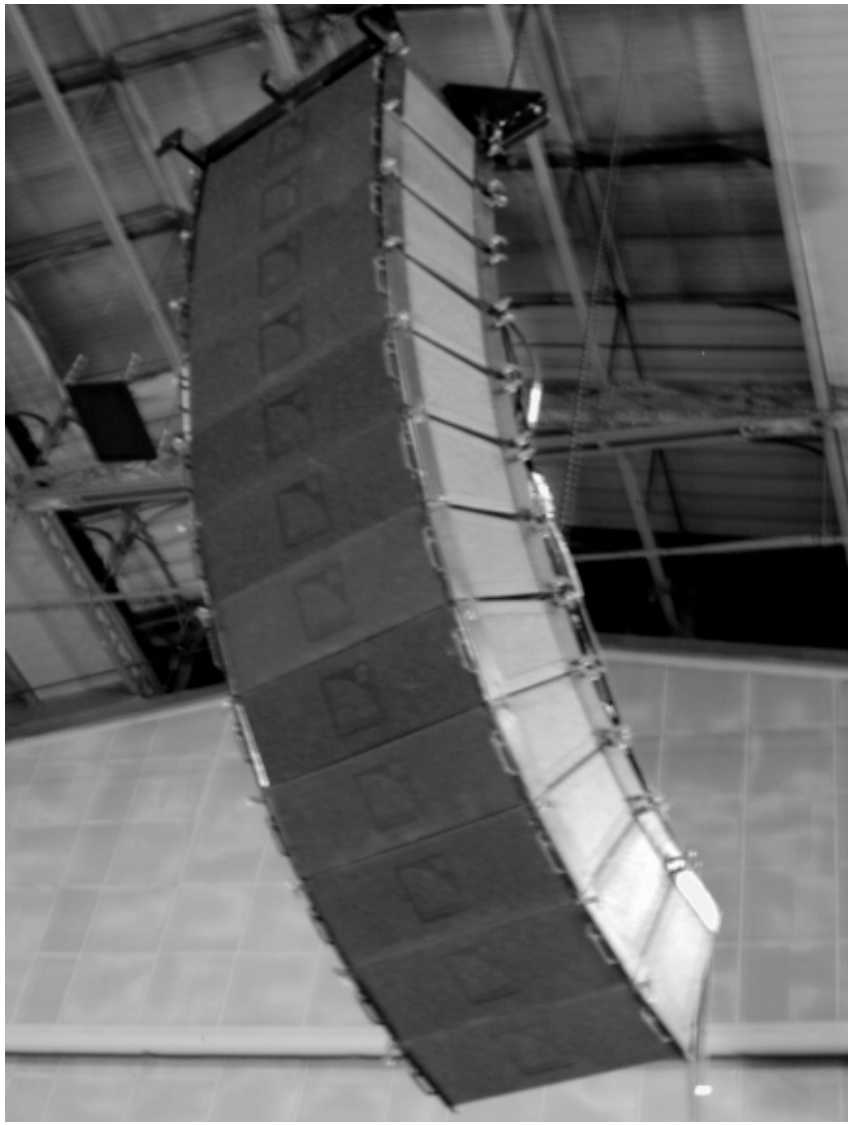




(x) Pin adjacent blocks of 3 together as the gaps close



(xi) Note: single point hang from spreader bar section on dV-BUMP



(xii) Front view of the flown array



(xiii) Single point hang from rear point on extension bar gives 90 degrees coverage with 12 dV-DOSC

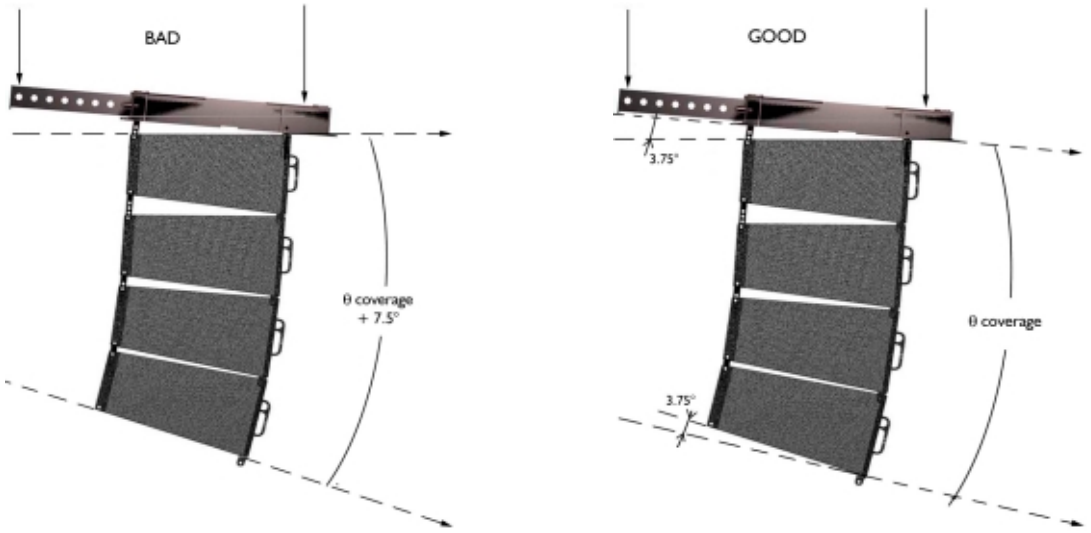


(xiv) 90 degrees vertical coverage running from parallel to vertical with respect to floor level

Trim and Angle Adjustments

At this point there are only two adjustments left - trim height of the array and tilt angle of the entire flown system. If two motors are used for standalone flying, the front motor is used to set the proper height of the whole array. Controlling the tilt angle is then performed by the relative action of the two chain-motors, i.e., once the proper height has been set the front motor is fixed and activating the rear motor only varies the tilt angle.

Note: For dV-DOSC, do not use the top and bottom of the cabinet as a visual reference (as for V-DOSC). The radiated wavefront is parallel to the front of the cabinet and is not defined by the trapezoidal enclosure walls. Adding a 3.75 degree angle at the rear of the top element allows dV-BUMP to be used as a site angle reference for the top element.



Depending on the tools available, there are a number of possible techniques for trimming and angling the array. For trim height measurement, one end of a tape measure can be fixed to the lower wall of the bottom dV-DOSC element at the front of the enclosure (by using some duct tape). The tape measure is then used to raise the array to the proper height (referenced to the floor) based on the bottom element elevation which was pre-calculated using ARRAY 2000. Once the array is at trim and focussed, the tape measure can be pulled free.

For angle adjustment, under dark conditions (indoors), a small flashlight can be attached at the junction between the top and the second elements. The final trim angle adjustment can then be checked from the rearmost seats of the audience: when the light can be seen through the small gap separating the first and the second elements, the angle of the array is correct.

A more precise technique for far field focus is to use a laser attached to dV-BUMP (provided that a 3.75 degree angle is used at the rear of the top dV-DOSC). Trim angle adjustments are then directly given by the focus of the laser on the audience (no walking to the back of the venue is required although a set of binoculars can be useful in locating the laser beam). Obviously, array focus using lasers is difficult to perform outdoors under daylight conditions.

For both alternatives, two pieces of light rope can be run from the floor, one over dV-BUMP and the other routed through a hole in dV-BUMP. Both lines attach to the Maglite or laser device in order to pull the instrument free then lower it after measurements have been performed (one string is a pull line, the other is used to lower the instrument). As a final check, mute mid and low channels and run pink noise through the system and listen to the high section coverage throughout the venue to verify that installation is correct.

Under daylight conditions (outdoors), the trim angle can be visually checked from the rearmost audience section. If the gap between the top and second elements is clearly visible then the focus is correct. At long distances, binoculars can help to visualize this gap and for final angle adjustments, a

pair of radios is useful while one person walks the room and visually inspects the array while a second person operates the motors. Alternatively, a digital inclinometer with remote display of array tilt angle (example: Lucas Control Systems Model 0256-01) can be placed on top of the array and used to set the array tilt equal to the value calculated for Site Angle #1 in ARRAY 2000.

Verifying coverage down front is more difficult since the trapezoidal angle of dV-DOSC cannot be used as a reference. If you can see the bottom of the bottom dV-DOSC you are definitely outside the coverage pattern (more so than for V-DOSC). Attaching an extra dV-ANGLE at the rear of the bottom cabinet at 3.75 degrees and using this as a site reference with the front rigging post can help avoid this problem.

Use the above described techniques to verify that L and R arrays are matched (plus L-L and R-R arrays, if installed). Walk to the back of the venue and by looking at the gaps between cabinets of each array, visually confirm that L and R are matched as you walk forwards toward the system.

Flying under V-DOSC with dV-DOWN

Typically, 3-4 dV-DOSC are recommended for flying under V-DOSC for downfill applications. The maximum number of dV-DOSC that can be flown under V-DOSC is 6. In most cases, dV-DOSC elements will be used at the maximum angle between cabinets, i.e., 7.5 degrees, and the enclosures will be tightly wrapped according to the trapezoidal angle of the enclosures.

Standard rigging procedures for V-DOSC are followed (please see the V-DOSC manual for complete details). Fly the V-DOSC array in the normal manner but do not connect the ANGLE straps of the bottom V-DOSC element. Flip down the rotating legs (balanciers) of the bottom V-DOSC element in preparation for attachment to dV-DOWN.

Remove the FLIGHT-dV case cover and wheel 3 dV-DOSC into position (face down). As a reference for cabinet orientation, the logos will be in the correct orientation and the bottom rigging tabs pointing down once the system is flown. Pin the fronts of all dV-DOSC together using dV-PIN25 (four required). Attach pairs of dV-DOWN flying bars to the top element using four dV-PIN81.

Pre-attach pairs of dV-ANGLE bars at the rear of all dV-DOSC elements of the array. Remember to keep the ball end of dV-ANGLE up as a reference and be careful to select the correct angle. Typically, for downfill applications the 7.5 degree position (minimum hole separation) will be selected to produce a tightly wrapped array for maximum vertical coverage.

Connect the rears of all 3 dV-DOSC elements while they are still face down in their flight cases by pulling the cabinets together at the rear and inserting dV-PIN25. This operation is facilitated by the fact that all fronts are pinned together and can pivot, plus all rear angles were pre-attached in the previous step.

Loosen the screwjacks on dV-BUMP so that they do not interfere while dV-DOWN is attached to the V-DOSC rotating legs. Do not tighten the screwjacks until the dV-DOSC array is floated above the ground. Since the angle strap for the bottom V-DOSC has not been attached, this helps to facilitate alignment of the holes on the rotating legs with the corresponding holes on dV-DOWN (when the holes are aligned, the V-DOSC rotating leg will be oriented vertically). Once aligned, attach both dV-DOWN to the V-DOSC rotating legs using two U-PINS. Install the locking safety pins on the U-PINS.

Proceed to raise the system. The dV-DOSC enclosures will automatically lift off from the flight case. Fly the system until dV-DOSC is floating above floor level.

At this point the angle straps for the bottom V-DOSC element can be connected, i.e., one person on either side can swing the bottom V-DOSC cabinet upwards and attach the angle strap on each side.

Once flown, there will be a gap between dV-DOSC and the bottom V-DOSC element. To remove this gap, the two dV-DOWN screwjacks are tightened to firmly secure dV-DOWN and the first dV-DOSC element to the V-DOSC enclosure, i.e., as the screwjacks are tightened, the underhung dV-DOSC array will swing upwards. Do not overtighten the screwjacks.

At this point, the system is ready to be taken up to trim and the installation completed by verifying trim height and focus. During de-installation, the procedure is reversed. Loosen the screwjacks, remove the front dV-PIN25, remove the bottom V-DOSC element angle straps and then land the dV-DOSC enclosures face down in their flight case as the system is lowered.



(i) Pre-attach dV-DOWN on either side of dV-DOSC



(ii) Use dV-PIN25 to connect front points of all dV-DOSC



(iii) Rotating leg on bottom V-DOSC flipped down, ANGLE strap not attached on bottom element



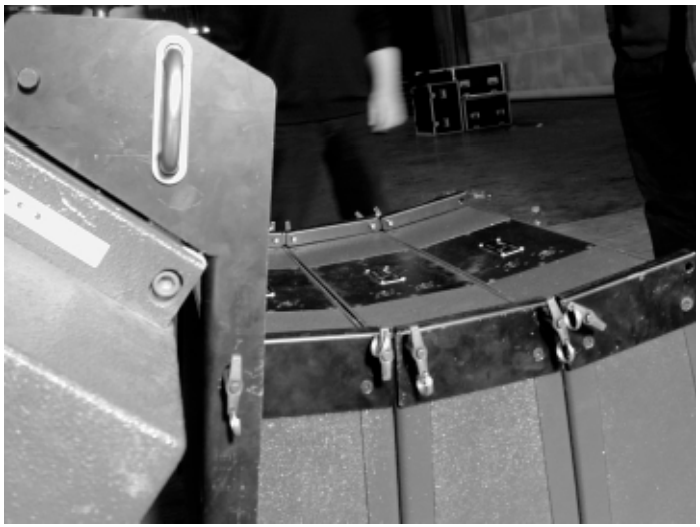
(iv) Align rotating leg with holes on dV-DOWN



(v) Attach dV-DOWN using U-PIN and locking safety



(vi) Preconnect all dV-ANGLE at the rear of dV-DOSC



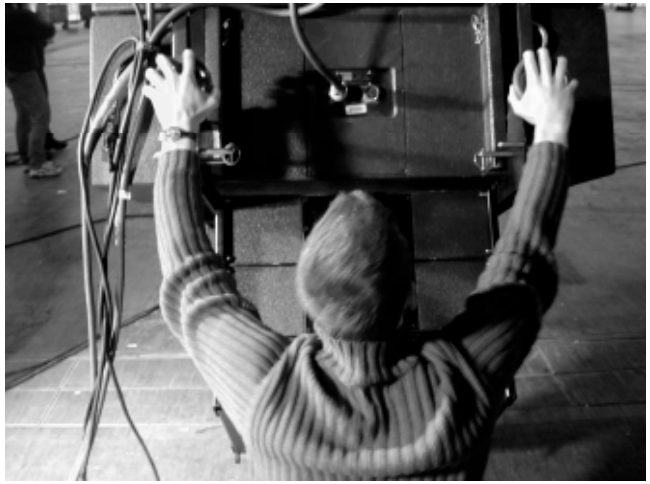
(vii) Pin all dV-DOSC at the rear using dV-PIN25



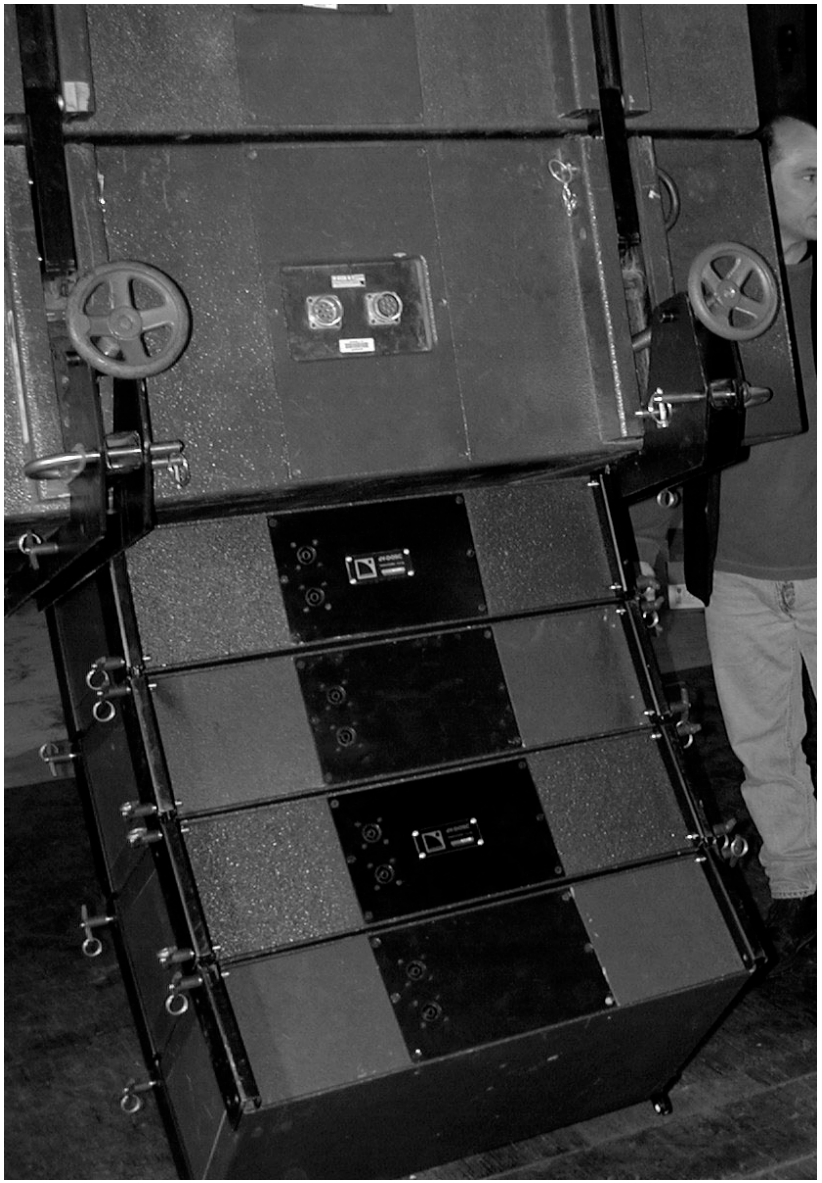
(viii) Connect ANGLE straps on bottom V-DOSC



(ix) Raise the ARRAY - note the gap



(x) Tighten screwjacks to remove this gap



(xi) dV-DOSC flown under V-DOSC

Flying dV-SUB Standalone

When flying dV-SUB standalone, up to 6 dV-SUBs deep can be flown from dV-BUMP (single or two point hang). Please refer to the photo sequence below in addition to the following description of dV-SUB rigging procedures.

To fly the system, the first dV-SUB enclosure is located at the rigging location and flipped onto it's stacking runners in the normal orientation. Four dV-ANGLESD are pre-attached to the dV-SUB using 4 x dV-PIN25, in preparation for attaching dV-BUMP. The "fat" part of the dV-ANGLESD is oriented towards the center of dV-SUB on both sides.

Note: Since there are no stacking runners on the top of dV-SUB, it is possible to select the stacked hole position on the dV-SUB end of dV-ANGLESD.

The next step is to place the dV-BUMP into position and secure using 4 x dV-PIN25.

Attach the motor to dV-BUMP using an 18 mm shackle.

Note: Hole number 5 (from the front) on the central spreader bar will produce a "dead hung" array (i.e., approximately zero degree tilt angle).

Raise the first dV-SUB enclosure off the ground with sufficient clearance to position the next dV-SUB enclosure underneath.

Pre-attach 4 x dV-ANGLESS to the second dV-SUB enclosure using 4 x dV-PIN25.

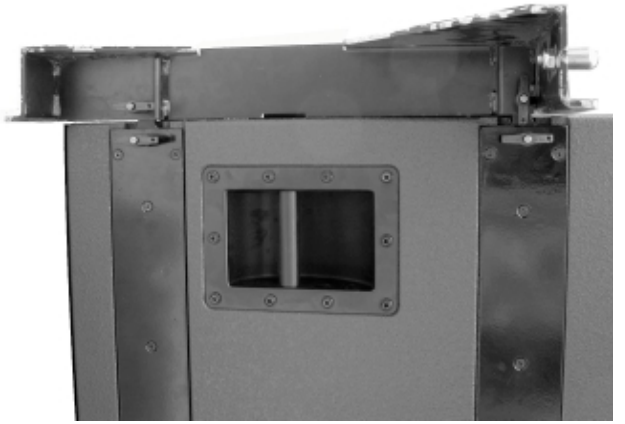
Slowly lower the first dV-SUB into position by mating the pre-attached dV-ANGLESS to the corresponding rigging slots on the first enclosure.

Secure the two dV-SUBs using 4 x dV-PIN25.

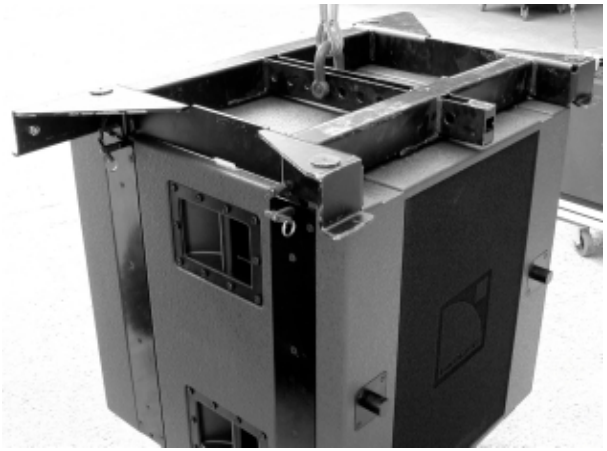
Repeat this procedure as the dV-SUB array is progressively flown.



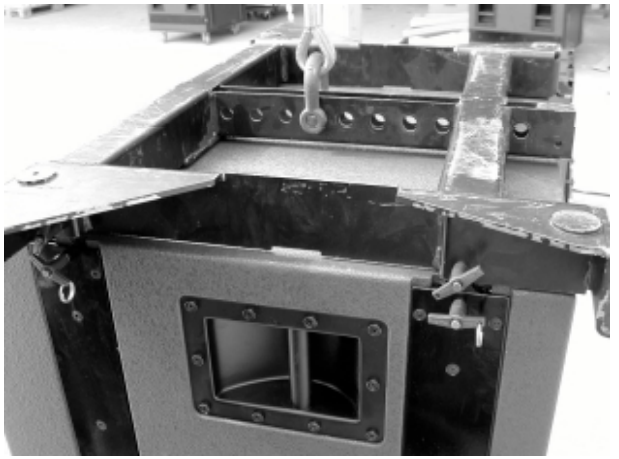
(i) dV-ANGLESD pre-attached - note that the stacked hole position has been selected and the "fat" part of the angle bar is oriented towards the center



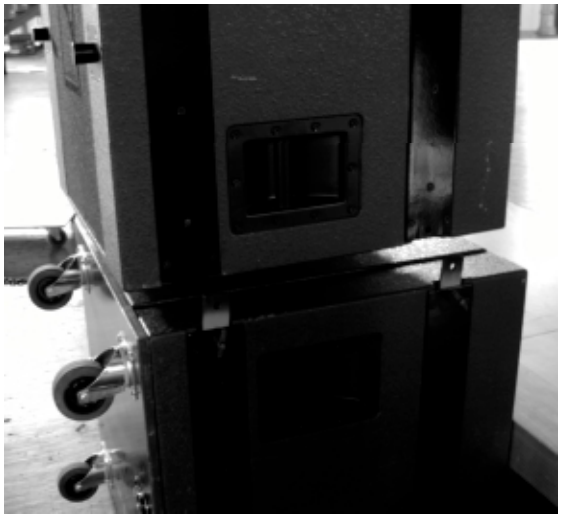
(ii) dV-BUMP placed into position and secured using 4 x dV-ANGLESD and 8 x dV-PIN25

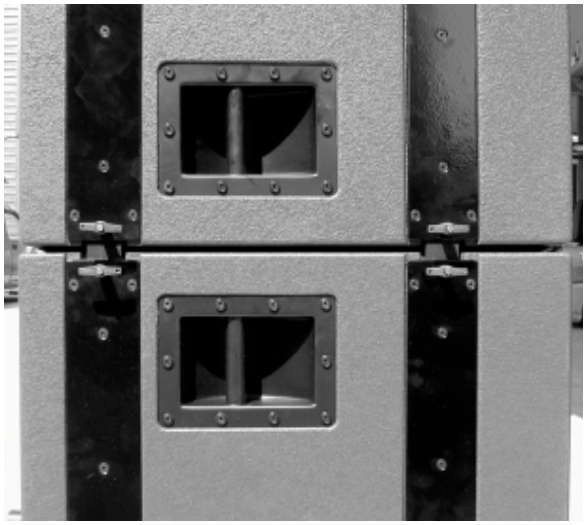


(iii) Float the first enclosure, pre-attach 4 x dV-ANGLESS, land on the second enclosure, secure using dV-PIN25 then repeat this procedure



(iv) Pick point hole #5 (from the front) on the central spreader bar section of dV-BUMP produces a dead hang (approx zero degree tilt)









Lower 1st dV-SUB into position and attach using 4 dV-PIN25

Flying dV-DOSC Under dV-SUB (3+1 configuration)

When rigging small configurations of dV-DOSC under a single dV-SUB (e.g., 1 dV-SUB with 3 dV-DOSC underneath), it is possible to fly the system in the same manner as dV-DOSC standalone, i.e., assemble the elements while they are face down on the ground and fly the system as a whole.

Note: For larger configurations with more than 3 dV-DOSC flown under multiple dV-SUBs, see the following section for rigging procedures.

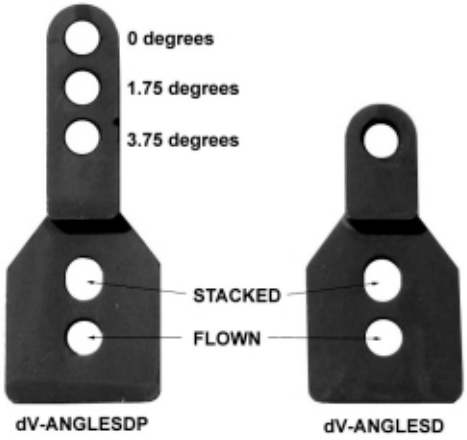
Please refer to the photo sequence below in addition to the following description:

To fly the system, the dV-SUB enclosure is located at the rigging location (face down on it's dolley board) and four dV-ANGLESD are pre-attached to the dV-SUB using 4 x dV-PIN25 (in preparation for attaching dV-BUMP). The "fat" part of the dV-ANGLESD is oriented towards the center of dV-SUB on both sides.

Note: Since there are no stacking runners on the top of dV-SUB, it is possible to select the stacked hole position on the dV-SUB end of dV-ANGLESD.

Place the dV-BUMP into position on the dV-SUB and secure using 4 x dV-PIN25. The dV-BUMP is oriented so that the dual locating studs are facing upwards (or rear extension bar upwards). If desired, attach the extension bar to dV-BUMP using an 18 mm shackle at pick point hole #8 on the central spreader bar section of dV-BUMP. The extension bar allows the use of two motors for tilt adjustment or single point hangs from the 8 additional points available on the extension bar. If the extension bar is not used, 8 pick point positions are available on the central spreader bar section of dV-BUMP for single point hangs.

Pre-attach 2 x dV-ANGLESD at the (bottom) front and 2 x dV-ANGLESDP at the (bottom) rear of the dV-SUB using 4 x dV-PIN25. Recall that the outermost holes on these angle bars are used for flown applications (to provide clearance for the stacking runners) and that the "fat" part of the angle bars is oriented towards the center of dV-SUB in order to mate properly with the dV-DOSC rigging panels.



Line up the 3 dV-DOSC enclosures in their flight case (3 per case) at the rigging location. Physically connect the fronts of all dV-DOSC enclosures by attaching the front points using pairs of dV-PIN25. The entire assembly will then be linked, similar to how V-DOSC is attached using rotating legs and U-pins (except the attachment points are at the front in this case).

Referring to the angle values that were pre-calculated for each element using ARRAY 2000, pre-attach pairs of dV-ANGLE bars at the rear of all dV-DOSC elements of the array (while they are still face down in their flight cases). Remember to keep the ball / tab end up as a reference and be careful to select the correct angle for each element (generally, it is better if one person performs this operation to avoid mistakes).

Connect the rears of the 3 dV-DOSC elements (while they are still face down in their flight cases) by pulling the cabinets together at the rear and inserting dV-PIN25. This operation is facilitated by the

fact that all fronts are pinned together and can pivot, plus all rear angles were pre-attached in the previous step.

Pre-connect the rear point only for the first dV-DOSC to the dV-SUB, i.e., use 2 x dV-PIN25 to secure dV-DOSC to the dV-ANGLESDP that was pre-attached at the (bottom) rear of dV-SUB

Note : Selecting the 0 degree angle on dV-ANGLESDP (between the rear of the top dV-DOSC enclosure and dV-SUB) is necessary to compensate for the 3.75 degree trapezoidal angle of dV-DOSC versus the actual site angle of the enclosure which is perpendicular to the front. Selecting the 0 degree angle allows focus to be verified visually or with a laser attached to the bottom of dV-SUB since this will then be referenced to the actual site angle of the top dV-DOSC element.

Connect all elements to the AMP RACKS using appropriate cables and adaptors (SP and DO2W or DO plus DOFILL) and SP.7 jumpers between elements for parallel operation. Long cable runs should be dressed and tied off to dV-BUMP for strain relief. Be careful not to connect more than 3 dV-DOSC enclosures in parallel.

Conduct a final inspection to make sure all cabling is correct, proper interelement angles have been selected and that all dV-PINs are in place and securely seated.

Connect the front and rear motors (or single motor) to dV-BUMP.

Slowly begin to raise the array. As the array lifts off, there will be a gap between the dV-SUB and dV-DOSC. One person on either side can lift/rotate the block of 3 dV-DOSC into position and then secure the front attachment points to dV-ANGLESD using 2 x dV-PIN25.

Be careful to steady the array as it lifts off the ground in order to prevent it from swinging. Gradually lift the array until it is freely floating in air. If you are doing a single point hang, use a digital inclinometer to verify that the tilt angle of the top element is correct before taking the array up to trim. If adjustment is required, lower the array and change the pick point until the desired tilt is obtained.

Table 15: EXAMPLE PICK POINT REFERENCE CHART

(1 dV-SUB, 3 dV-DOSC, 7.5 deg between all dV-DOSC)

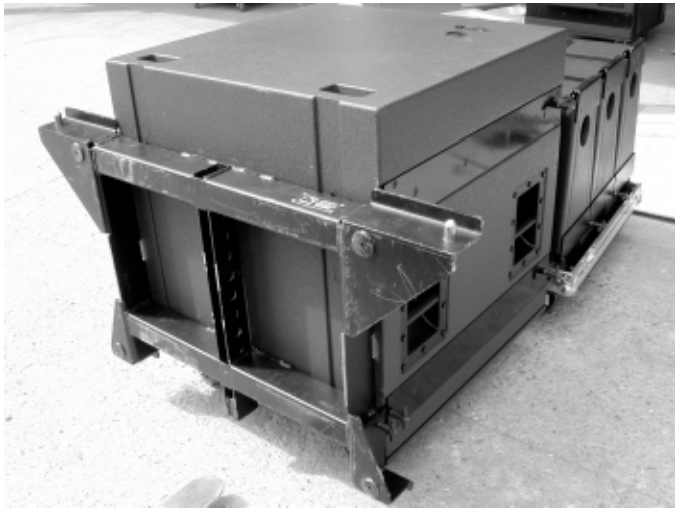
dV-BUMP Hole # (0=front, 16=rear) 1-> 8 = center 9 -> 16 = ext bar	**dV-BUMP Site Angle** (= top dV-DOSC site angle provided 3.75 deg selected between top dV-DOSC and dV-SUB)
1	+14.7 deg
2	+11.1 deg
3	+7.7 deg
4	+3.7 deg
5	+0.5 deg
6	-4.5 deg
7	-8.25 deg
8	-11.9 deg
9	-20.8 deg
10	-24.0 deg
11	-27.2 deg
12	-30.3 deg
13	-33.1 deg
14	-35.7 deg
15	-38.2 deg
16	-40.6 deg



(i) dV-ANGLESDP pre-attached to the rear of dV-SUB



(ii) dV-ANGLESD pre-attached to the front of dV-SUB



(iii) dV-BUMP attached to dV-SUB using 4 x dV-ANGLESD and 8 x dV-PIN25



(iv) dV-DOSC located behind the array



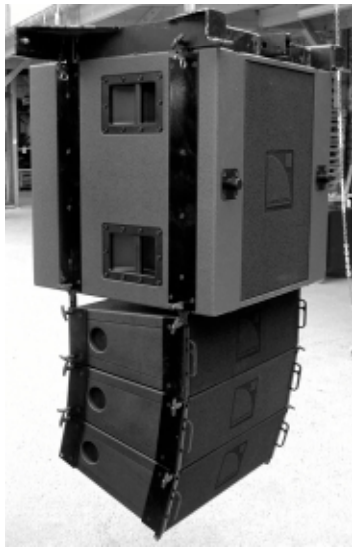
(v) Attach rear points only (dV-SUB to dV-DOSC)



(vi) Houston - we have liftoff…



(vii) Lift dV-DOSC into position, secure front points using 2 x dV-PIN25



(viii) The flown array

Flying dV-DOSC Under dV-SUB (larger configurations)

When rigging larger configurations of dV-DOSC under dV-SUB (e.g., 2 dV-SUB with 6 dV-DOSC underneath), there are 2 possible procedures: 1) fly the system in the same manner as dV-DOSC standalone, i.e., assemble the elements while they are face down on the ground and fly the system as a whole or 2) follow the dV-SUB standalone rigging procedure then fly dV-DOSC in blocks of three.

For both procedures, refer to the photo sequences below in addition to the following descriptions:

Procedure 1 (2 dV-SUB + 6 dV-DOSC)

The dV-SUB enclosures are located at the rigging location (face down on their dolley boards) and four dV-ANGLESD are pre-attached to the dV-SUB using 4 x dV-PIN25 (in preparation for attaching dV-BUMP). The "fat" part of the dV-ANGLESD is oriented towards the center of dV-SUB on both sides.

Note: Since there are no stacking runners on the top of dV-SUB, it is possible to select the stacked hole position on the dV-SUB end of dV-ANGLESD.

Place the dV-BUMP into position on the dV-SUB and secure using 4 x dV-PIN25. The dV-BUMP is oriented so that the dual locating studs are facing upwards (or rear extension bar upwards). If desired, attach the extension bar to dV-BUMP using an 18 mm shackle at pick point #8 on the central spreader bar section. The extension bar allows the use of two motors for tilt adjustment or single point hangs from the 8 additional points available on the extension bar. If the extension bar is not used, 8 pick point positions are available on the central spreader bar section of dV-BUMP for single point hangs.

Pre-attach 4 x dV-ANGLESS on the second dV-SUB enclosure (still face down on its dolley) then physically connect to the first dV-SUB using 8 x dV-PIN25 total.

Pre-attach 2 x dV-ANGLESD at the (bottom) front and 2 x dV-ANGLESDP at the (bottom) rear of the second dV-SUB using 4 x dV-PIN25. Recall that the outermost holes on these angle bars are used for flown applications (to provide clearance for the stacking runners) and that the "fat" part of the angle bars is oriented towards the center of dV-SUB in order to mate properly with the dV-DOSC rigging panels.

Line up all dV-DOSC enclosures in their flight cases (3 per case). Mate the bottom rigging tabs from the first group of 3 cabinets with the top locator slots of the next group of cabinets. Repeat until all dV-DOSC flight cases are physically lined up.

Physically connect the fronts of all dV-DOSC enclosures by attaching the front points using pairs of dV-PIN25. The entire assembly will then be linked, similar to how V-DOSC is attached using rotating legs and U-pins (except the attachment points are at the front in this case).

Referring to the angle values that were pre-calculated for each element using ARRAY 2000, pre-attach pairs of dV-ANGLE bars at the rear of all dV-DOSC elements of the array (while they are still face down in their flight cases). Remember to keep the ball / tab end up as a reference and be careful to select the correct angle for each element (generally, it is better if one person performs this operation to avoid mistakes).

Pre-connect the front and rear points for the first dV-DOSC to the dV-SUB, using 4 x dV-PIN25. Do not connect the rear of dV-DOSC #2 to #1 (this will be done as the system is flown). Do connect the rear of dV-DOSC #2 to #3.

Note : Selecting the 0 degree angle on dV-ANGLESDP (between the rear of the top dV-DOSC enclosure and dV-SUB) is necessary to compensate for the 3.75 degree trapezoidal angle of dV-DOSC versus the actual site angle of the enclosure which is perpendicular to the front. Selecting the 0 degree angle allows focus to be verified visually or with a laser attached to the bottom of dV-SUB since this will then be referenced to the actual site angle of the top dV-DOSC element.

Except for the first block of 3 dV-DOSC, connect the rears of all other dV-DOSC elements in blocks of three (while they are still face down in their flight cases) by pulling the cabinets together at the rear and inserting dV-PIN25. This operation is facilitated by the fact that all fronts are pinned together and can pivot, plus all rear angles were pre-attached.

Connect all elements to the AMP RACKS using appropriate cables and adaptors (SP and DO2W or DO plus DOFILL) and SP.7 jumpers between elements for parallel operation. Long cable runs should be dressed and tied off to dV-BUMP for strain relief. Be careful not to connect more than 3 dV-DOSC enclosures in parallel. Conduct a final inspection to make sure all cabling is correct, proper interelement angles have been selected and that all dV-PINs are in place and securely seated.

Connect the front and rear motors (or single motor) to dV-BUMP. Slowly begin to raise the array. As the array lifts off, the rear gaps between dV-DOSC #1 to #2 and then between blocks of 3 cabinets will automatically close, allowing you to progressively pin the blocks together as system goes up.

Be careful to steady the array as it lifts off the ground in order to prevent it from swinging. Gradually lift the array until it is freely floating in air. For single point hangs, use a digital inclinometer to verify that the tilt angle of the top element is correct before taking the array up to trim.

Procedure 2 (larger configurations)

For larger configurations it is best to follow the dV-SUB standalone rigging procedure (see above) and then fly dV-DOSC in blocks of 3 underneath the pre-flown dV-SUB array.

The first dV-SUB enclosure is located at the rigging location and flipped onto it's stacking runners in the normal orientation. Four dV-ANGLESD are pre-attached to the dV-SUB using 4 x dV-PIN25, in preparation for attaching dV-BUMP. The "fat" part of the dV-ANGLESD is oriented towards the center of dV-SUB on both sides and since there are no stacking runners on the top of dV-SUB, it is possible to select the stacked hole position on the dV-SUB end of dV-ANGLESD. The dV-BUMP is then placed in position and secured using 4 x dV-PIN25.

The chain motor is attached to dV-BUMP using an 18 mm shackle and the first dV-SUB enclosure is raised off the ground with sufficient clearance to position the next dV-SUB enclosure underneath.

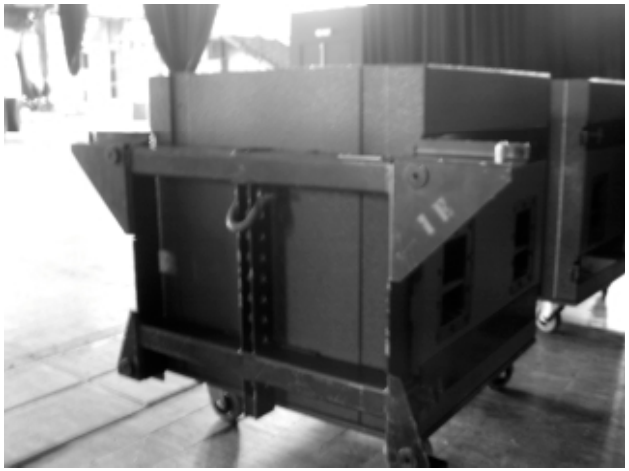
4 x dV-ANGLESS are pre-attached to the second dV-SUB enclosure (using 4 x dV-PIN25) and the first dV-SUB is slowly lowered into position by mating the pre-attached dV-ANGLESS to the corresponding rigging slots on the first enclosure. The two dV-SUBs are secured using 4 x dV-PIN25 and this procedure is repeated as the dV-SUB array is progressively flown.

Blocks of 3 dV-DOSC are then pre-assembled using the angles calculated in ARRAY. These blocks are then flipped out of their flight cases onto dV-SUB dolleys in order to position them under the dV-SUB array. Using dV-ANGLESD and dV-ANGLESDP for attachment of the first dV-DOSC, the dV-SUB array is lowered into position so that the front points can be attached. The system is then lifted and the first block of 3 dV-DOSC is raised/rotated into position and pinned at the rear. This procedure is then repeated for subsequent blocks of 3 dV-DOSC.

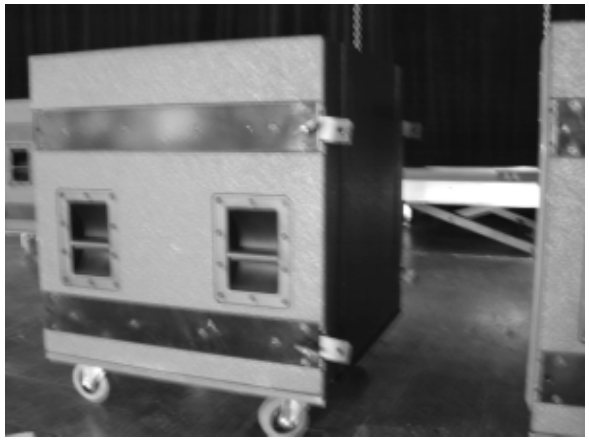
EXAMPLE PICK POINT REFERENCE CHART
(2 dV-SUB, 6 dV-DOSC, 7.5 deg between all dV-DOSC)

dV-BUMP Hole # (0=front, 16=rear) 1-> 8 = center 9 -> 16 = ext bar	dV-BUMP Site Angle (= top dV-DOSC site angle provided 3.75 deg selected between top dV-DOSC and dV-SUB)
1	+9.5 deg
2	+7.8 deg
3	+5.9 deg
4	+4.1 deg
5	+2.0 deg
6	0 deg
7	-1.9 deg
8	-4.1 deg

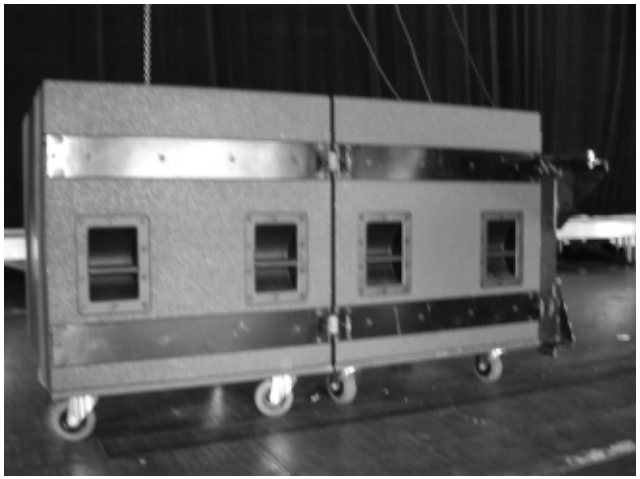
PROCEDURE 1



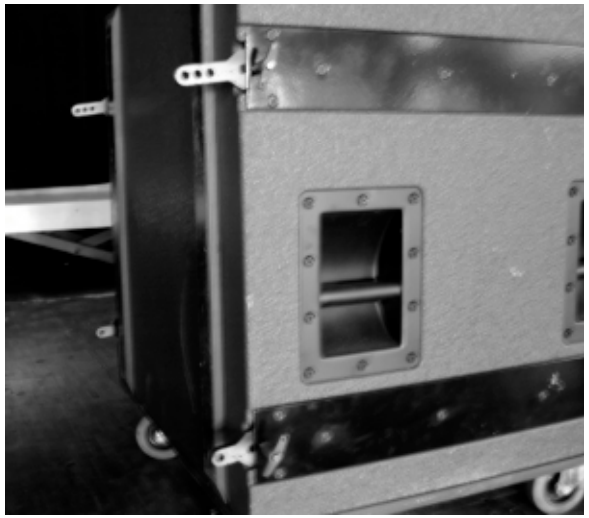
(i) dV-SUB with dV-BUMP attached using 4 x dV-ANGLESD and 8 dV-PIN25



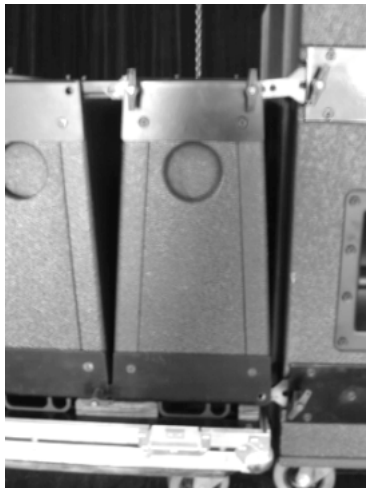
(ii) Second dV-SUB with 4 x dV-ANGLESS pre-attached



(iii) 2 x dV-SUB physically connected



(iV) dV-ANGLESD (front) and dV-ANGLESDP (rear) pre-attached



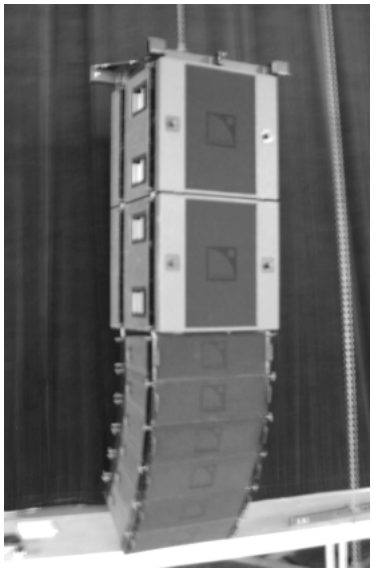
(v) Preconnect the first dV-DOSC to dV-SUB, front and rear.
(Do not attach the dV-DOSC #2 to dV-DOSC #1)



(vii) dV-DOSC #2 to #1 then blocks of 3 are attached as the array is raised

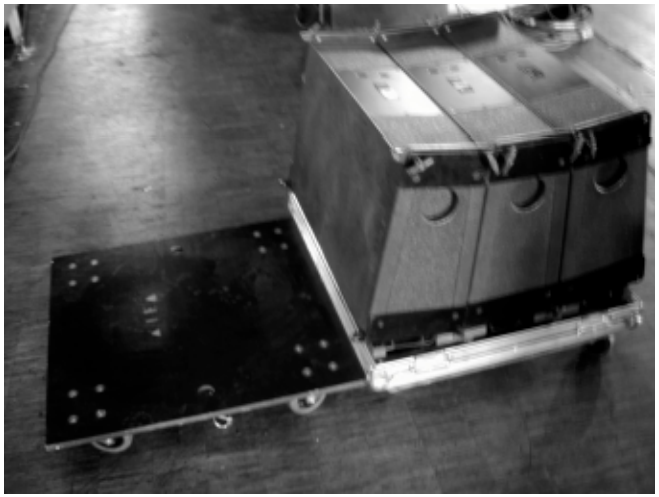


(vi) All dV-DOSC attached at front, in blocks of 3 at the rear
(except for dV-DOSC #1 to #2)



(viii) The flown system (2 dV-SUB + 6 dV-DOSC)

PROCEDURE 2



(i) dV-DOSC are pre-attached in blocks of 3



(ii) Flip dV-DOSC onto dV-SUB dolleys to position under the dV-SUB array

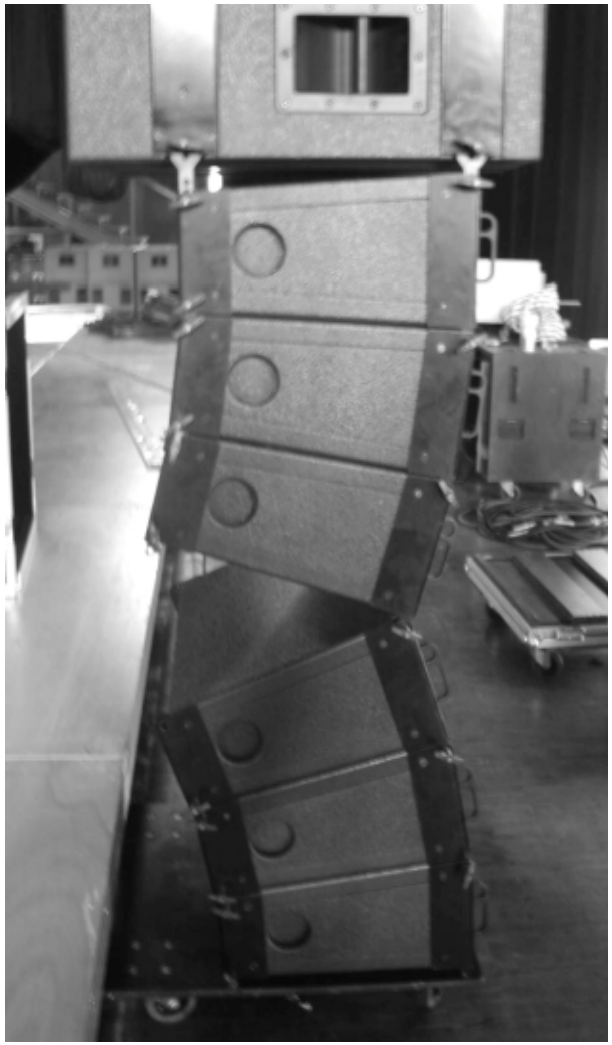


(iii) Standalone dV-SUB techniques (see above) are used to fly the dV-SUB array



(iv) dV-DOSC front point attachment using dV-ANGLESD. The array is then raised and the rear points attached using dV-ANGLESDP

PROCEDURE 2





(v) The procedure is repeated with subsequent blocks of 3 dV-DOSC

SAFETY RULES

CAUTION: PLEASE FOLLOW THE GUIDELINES BELOW WHEN FLYING dV-DOSC AND dV-SUB AND DO NOT EXCEED THESE GUIDELINES UNDER ANY CIRCUMSTANCES

dV-BUMP ONLY
(SINGLE POINT HANG FROM CENTRAL SPREADER BAR POINTS)
- maximum 24 dV-DOSC elements

dV-BUMP + EXTENSION BAR
(SINGLE POINT HANG FROM EXTENSION BAR POINTS)
- maximum 12 dV-DOSC elements

dV-BUMP + EXTENSION BAR
(2 POINT HANG FROM dV-BUMP FRONT POINT AND EXTENSION BAR REAR POINT)
- maximum 12 dV-DOSC elements

dV-DOSC FLOWN UNDER V-DOSC USING dV-DOWN
- maximum 6 dV-DOSC elements
- 15 V-DOSC + 3 dV-DOSC maximum
- 14 V-DOSC + 6 dV-DOSC maximum

GROUND STACKED dV-DOSC (STANDALONE)
- 12 maximum using dV-BUMP + V-DOSC BUMPER provided that the dV-DOSC array is physically contained within the vertical footprint of the V-DOSC BUMPER.

dV-DOSC STACKED ON TOP OF V-DOSC
- 6 maximum

Maximum rated dV-SUB / dV-DOSC combinations (dV-DOSC flown below dV-SUB)
Single point hang from rear extension bar
or
2-point hang from dV-BUMP front point + extension bar rear point

dV-SUB	0	1	2	3	4	5	6
dV-DOSC	12	6	4	1	0	0	0
Total weight	414 kg 912 lbs	290 kg 639 lbs	316 kg 697 lbs	309 kg 681 lbs	368 kg 811 lbs	460 kg 1014 lbs	552 kg 1217 lbs

Maximum rated dV-SUB / dV-DOSC combinations (dV-DOSC flown below dV-SUB)
Single point hang off central spreader bar

dV-SUB	0	1	2	3	4	5	6	6
dV-DOSC	24	9	8	7	6	4	1	0
Total weight	786 kg 1732 lbs	389 kg 858 lbs	448 kg 988 lbs	507 kg 1118 lbs	566 kg 1248 lbs	592 kg 1305 lbs	585 kg 1290 lbs	552 kg 1217 lbs

- All rigging should be performed by certified, trained rigging experts.

- Proper chain motor maintenance, installation and operation is absolutely necessary under all circumstances.
- If motors are exposed to outdoor weather conditions for any length of time, cover the motors in plastic to prevent them from getting wet.
- L-ACOUSTICS recommends the use of safeties at all times.
- When flying dV-DOSC and/or dV-SUB, determine the overall weight of the system to be flown and determine chain motor ratings accordingly.
- When dV-DOSC is flown on top of, or below V-DOSC account for the additional weight and adjust your chain motor ratings accordingly.
- Always be sure that the immediate area is clear of people and obstacles whenever raising or lowering the array.
- Announce (in a loud voice) whenever the array is being moved to get people's attention.
- Always look up while moving the array to be sure that movement remains unimpeded and to check cable tension.
- Once flown to trim and correctly angled, remove motor control cables so that the array cannot be tampered with by unauthorized people.

5. MAINTENANCE AND INSTALLATION TOOLS

5.1 RECOMMENDED MAINTENANCE PROCEDURES

Regular maintenance procedures (monthly) include:

component sweep (using sine wave generator or other suitable test system) and polarity check to ensure that all speakers and drivers are in good working order

cable continuity test

clean power amplifier filters

verify crossover presets are correct and up to date

Periodic maintenance procedures (every 6-12 months) include:

tighten high frequency diaphragm mounting fasteners

inspect all rigging components for wear and replace as necessary

inspect wiring harnesses, internal connections for all panels

Occasional (as necessary) maintenance procedures include:

refoam grilles

repaint cabinets

5.2 RECOMMENDED MAINTENANCE TOOLS

Table 16: Recommended Maintenance Tools

APPLICATION	dV-DOSC SERVICE TOOLS
As Required	#2 Phillips screwdriver
MF Speaker Mount	4 mm hex key
HF Diaphragm Mount	4 mm hex key
DOSC Waveguide Mount Bolt	10 mm socket

Miscellaneous Tools : adjustable pliers, rubber mallet, sidecutters, wire stripper, soldering iron, digital voltmeter (DVM), breakout cables for speaker testing (CA COM to banana leads).

5.3 SPARE PARTS

Speakers

dV-DOSC HF driver (complete)	HP BC22
dV-DOSC HF diaphragm	HS BC22
dV-DOSC 8" loudspeaker	HP PH81
dV-DOSC 8" recone kit	HS PH81
dV-SUB 15" loudspeaker	HP PH153
dV-SUB 15" recone kit	HS PH153

Connectors

Female Panel Mount Speaker Connector (8 conductor)	CC 8B EF
Male Panel Mount Speaker Connector (8 conductor)	CC 8B EM
Female Speaker Connector – Line (8 conductor)	CC 8B FF
Male Speaker Connector – Line (8 conductor)	CC 8B FM
Male Panel Mount Link Connector (19 conductor)	CC 19B EM
Female Link Connector – Line (19 conductor)	CC 19B FF
Speakon Connector – Line (4 conductor)	CC 4 F
Speakon Connector – Panel Mount (4 conductor)	CC 4 ER
COMB Connector	CC 25SUBDM

Accessories

25 mm grip length locking quick release pin	dV-PIN25
81 mm grip length locking quick release pin	dV-PIN81
Rear angle bar (0, 2, 3.75, 5.5, 7.5 degrees)	dV-ANGLEP1
Rear angle bar (1, 3, 4.5, 6.5 degrees)	dV-ANGLEP2
Rear angle bar (0, -2, -3.75, -5.5, -7.5 degrees)	dV-ANGLEN
dV-SUB to dV-SUB angle bar	dV-ANGLESS
dV-SUB to dV-DOSC angle bar	dV-ANGLESD
dV-SUB to dV-DOSC angle bar (0, 1.75, 3.75 deg)	dV-ANGLESDP
Equipped flying bumper	dV-BUMP
dV-BUMP shackle (18 mm)	CA-MAN 18
Equipped adaptors for rigging under V-DOSC	dV-DOWN
Transport case for 3 dV-DOSC	FLIGHTDV
Front foam replacement	CM dV-DOSC, CM dV-SUB
Front grille	MC GRdV-DOSC, MC GRdV-SUB

5.4 RECOMMENDED INSTALLATION TOOLS

- Inclinometer – Digital Protractor 3600 or Lucas Control Systems 02506-01 Remote
- Laser Rangefinder (Bushnell Yardage Pro 600 or Leica DISTO BASIC with tripod/inclinometer)
- Portable computer with Excel for running ARRAY
- Portable computer with MLSSA, SMAART or TEF 20 System
- Real Time Analyzer - DBX or Sound Technology RTA-1
- Polarity Checker - PC 80 MK 11 SCV Audio, BSS (or equivalent)
- Laser Level Device
- 2x 20 m (50 ft) tape measures



Figure 27: Recommended Installation Tools

6. SPECIFICATIONS

6.1 DV-DOSC ELEMENT SPECIFICATIONS

L-ACOUSTICS specifications are based on measurement procedures which produce unbiased results and allow for realistic performance prediction and simulation. Some of these specifications will appear conservative when compared with other manufacturer's specifications. Measurements are conducted under free field conditions and scaled to a 1 m reference distance unless otherwise specified.

Frequency response (+/-3 dB) 160 Hz - 18 kHz (single unit)
100 Hz - 18 kHz (coupled array)

Full system bandwidth with SB218 25 Hz - 18 kHz

Sensitivity (average SPL over component's rated bandwidth, equivalent to 2.83 Vrms at 1 metre)

MF	99 dB SPL	(100 - 800 Hz)
HF	109 dB SPL	(800 - 18k Hz)

Long Term Power Rating (100 Hz HPF for low section, pink noise with 6 dB crest factor)

MF	49 Vrms	300 Wrms	1200 Wpeak	8 ohms
HF	25 Vrms	75 Wrms	300 Wpeak	8 ohms

Horizontal Directivity 120° (-6 dB points, symmetrical about main axis)
100° (-3 dB points, symmetrical about main axis)

Vertical Directivity defined by the shape of the array

System Data	**Continuous SPL (flat array)**	**Continuous SPL (max curvature array)**
1 enclosure	128 dB	128 dB (vertical coverage not defined)
2 enclosures	134 dB	132 dB (15 degrees vertical coverage)
4 enclosures	140 dB	136 dB (30 degrees vertical coverage)

COMPONENTS

MF 2 x 8" weather resistant loudspeaker, 2" voice coil, bass-reflex loaded

HF 1 x 1.4" neodymium compression driver, patented DOSC waveguide

CONSTRUCTION

Material Baltic birch plywood, folded construction with aluminum top and bottom plates and metal reinforcement. Sealed, screwed cabinet construction. 3.75 degrees trapezoidal angle.

Finish Maroon-gray™

Grill Black epoxy-coated perforated steel, acoustically transparent foam

Features Integrated flying hardware and handles

Dimension (WxHxD): 695 mm x 257 mm (front) x 171 mm (rear) x 476 mm
(27.4 in x 10.1 in x 6.7 in x 18.7 in)

Weight: 31.8 kg (70.1 lbs)

Shipping Dimensions: 800 mm x 360 mm x 560 mm
(31.5 in x 14.2 in x 22 in)

Shipping Weight: 35 kg (77.2 lbs)

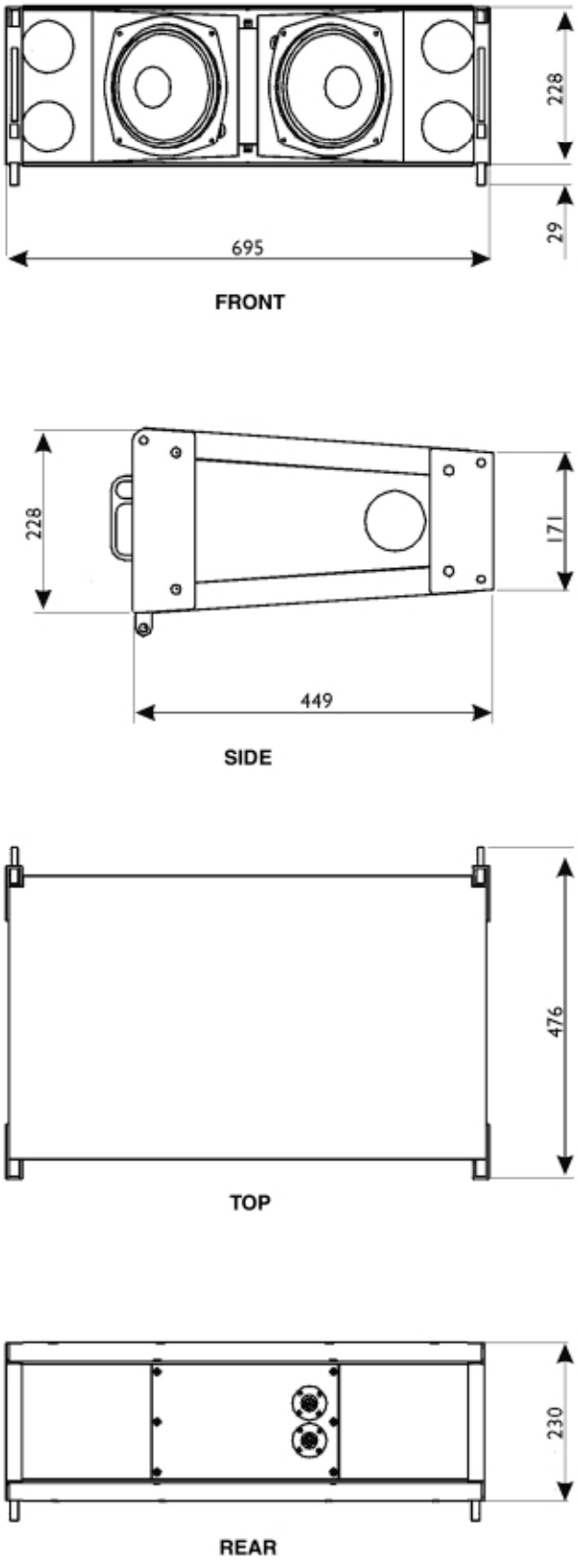


Figure 28: dV-DOSC Element – Line Drawing

Table 17: dV-DOSC weight per number of cabinets

Number of dV-DOSC Cabinets	Cabinet Weight (kg)	Cabinet Weight (lbs)
2	63.6	140.2
3	95.4	210.3
4	127.2	280.4
5	159.0	350.5
6	190.8	420.6
7	222.6	490.7
8	254.4	560.9
9	286.2	631.0
10	318.0	701.1
11	349.8	771.2
12	381.6	841.3
13	413.4	911.4
14	445.2	981.5
15	477.0	1051.6
16	508.8	1121.7
17	540.6	1191.8
18	572.4	1261.9
19	604.2	1332.0
20	636.0	1402.1
21	667.8	1472.2
22	699.6	1542.3
23	731.4	1612.4
24	763.2	1682.6

dV-DOWN

Net Weight: 18 kg (fully equipped including: 2 dV-DOWN, dV-PIN81, U-PINs)
Shipping dimensions: 405 x 785 x 145 mm
Shipping weight: 19.4 kg

dV-BUMP

Net Weight: 22.5 kg without extension bar (49.6 lbs)
32.0 kg with extension bar (70.5 lbs)
Shipping dimensions: 1062 x 608 x 85 mm
(41.8 x 23.9 x 3.35")

6.2 dV-SUB SPECIFICATIONS

L-ACOUSTICS specifications are based on measurement procedures which produce unbiased results and allow for realistic performance prediction and simulation. Some of these specifications will appear conservative when compared with other manufacturer's specifications. Measurements are conducted under freefield conditions and scaled to a 1 m reference distance unless otherwise specified.

Frequency response (+/-3 dB) 40 - 200 Hz

Usable bandwidth 35 - 200 Hz

Recommended Filtering 80 to 200 Hz (4th order low pass filter)
30 Hz (4th order high pass filter)

Sensitivity (average SPL over rated bandwidth, freefield conditions, without equalization, equiv to 2.83 Vrms at 1 metre)
104.5 dB SPL (40 - 200 Hz)

Long Term Power Rating (pink noise with 6 dB crest factor over rated bandwidth)			**Amplification**	**Impedance**
57 Vrms	1200 Wrms	4800 Wpeak	2400 W recommended	2.7 ohms

System Data	**SPL**	
1 enclosure	127 dB (rms)	133 dB (peak)
2 enclosures	133 dB (rms)	139 dB (peak)
4 enclosures	139 dB (rms)	145 dB (peak)

COMPONENTS

3 x 15" weather-resistant loudspeaker, 3" edgewound copper ribbon voice coil, vented bandpass loaded, die cast aluminum basket, massive vented magnet structure, high thermal capacity

CONSTRUCTION

Dimension (WxHxD): 695 mm x 708 mm x 695 mm
(27.4 in x 27.9 in x 27.4 in)

Weight: 93 kg (205 lbs)

Shipping Dimensions: (including dV-SUBPLA) 795 mm x 790 mm x 890 mm
(31.3 in x 31.1 in x 35 in)

Shipping Weight: 107 kg (235.9 lbs)

Connector 1x 4 pin Neutrik Speakon (1+/1-)

Material 24 mm Baltic birch plywood (sealed, screwed and rabbeted angles, internally braced)

Finish Maroon-gray™

Grill Black epoxy-coated perforated steel, acoustically transparent foam

Rigging Integral flying hardware and handles

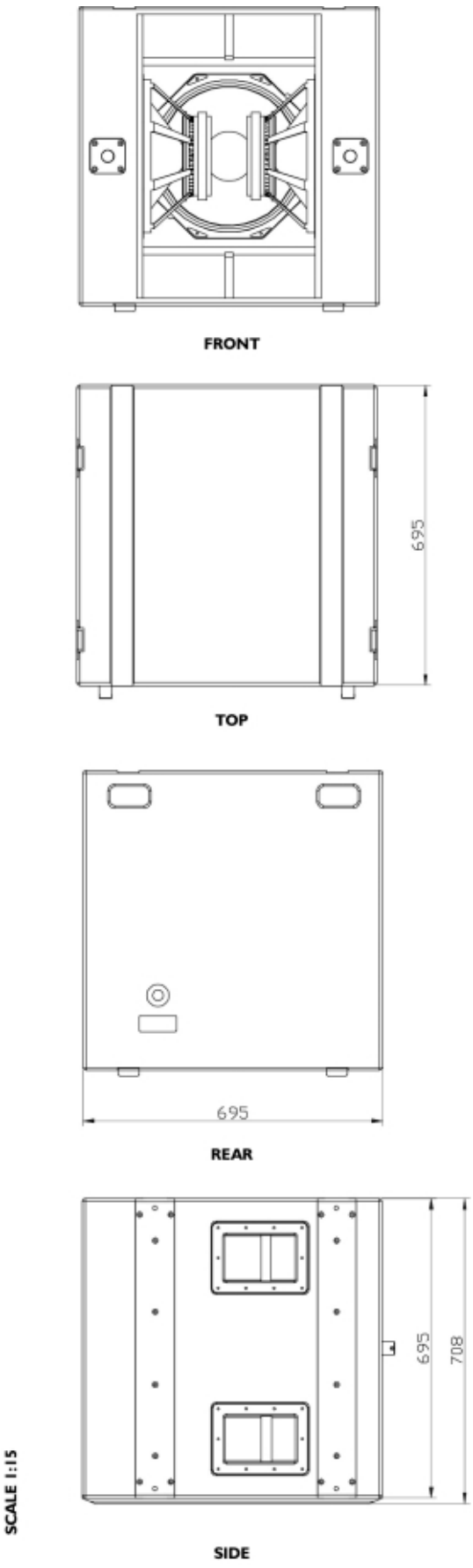


Figure 29: dV-SUB Line Drawing

APPENDIX 1:
HOW DOES dV-DOSC BEHAVE WITH RESPECT TO WST CRITERIA

The second Wavefront Sculpture Technology criterion: STEP < $\lambda/2$ over the frequency range of operation is fulfilled by a dV-DOSC array at low/mid frequencies.

With reference to Figure 30:

Acoustic centers between 8" speakers are separated by 25cm horizontally and 23 cm vertically. The 800 Hz crossover frequency utilitized for the low section corresponds to $\lambda/2$ = 21.5 cm so that WST criteria is satisfied over the majority of the 8" operating bandwidth.

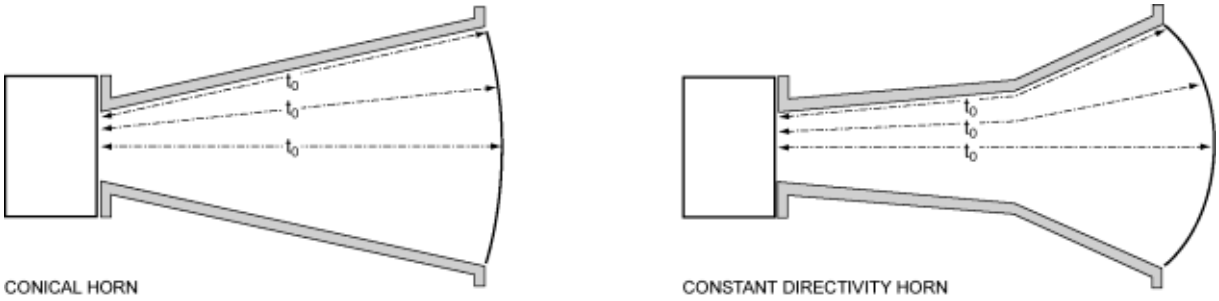


Figure 30: Front view of dV-DOSC array and vertically stacked DOSC waveguides

We have to fulfil the first WST criterion at higher frequencies since it is not possible to satisfy the second WST criterion, i.e., the wavelengths are too small to have the acoustic centers of adjacent components within $\lambda/2$. This is achieved by mounting a DOSC waveguide on the exit of each compression driver – this shapes the wavefront into a flat, rectangular constant phase source. Arraying DOSC waveguides and drivers then creates a flat isophasic ribbon that fulfils the first WST criterion (greater than 80% fill up to a maximum of 7.5 degrees between enclosures).

APPENDIX 2:
HOW DOES THE DOSC WAVEGUIDE WORK?

There is no mysticism surrounding the DOSC waveguide. It is simply the result of careful analysis of the wave path through the waveguide and the resulting wave-front shape.



With respect to the above figure, the wavefront emerging from a horn is the result of constant time arrivals for all possible wave paths radiated by the driver exit. The two examples shown produce curved wavefronts that obviously cannot meet the second WST criterion.

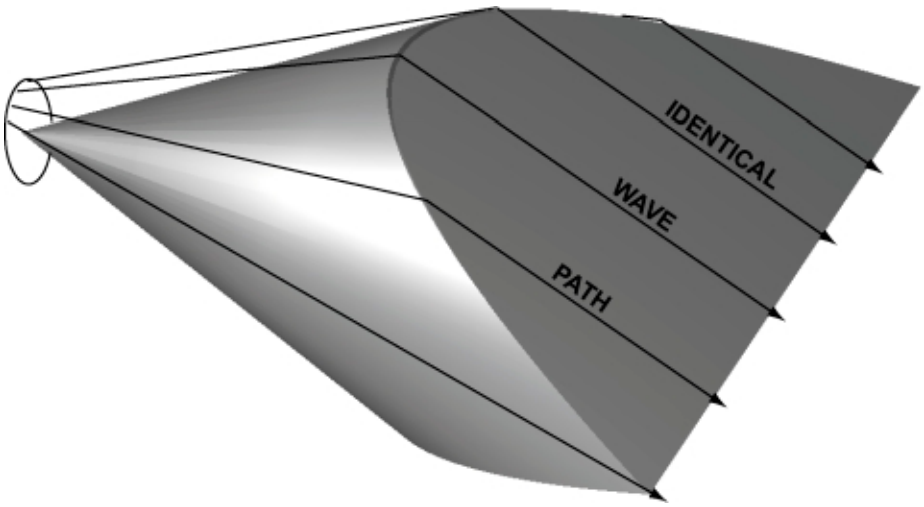


Figure 31: DOSC Waveguide – Internal Section

By comparison, the DOSC waveguide acts as a time alignment plug, delaying the arrival times of every possible wave path to be the same value at the rectangular exit of the device. The internal plug is a truncated conical piece that looks like a "tomahawk". This plug and its outer housing are precisely constructed according to specific ratios between depth, height and cone angle in order to produce the flat constant phase wavefront and tight manufacturing tolerances are obtained through the use of computer aided design and manufacturing (CAD/CAM) techniques. As shown in AES preprint 5488 "Wavefront Sculpture Technology", the deviation from a flat wavefront must be less than $\lambda/4$ at the highest operating frequency - this corresponds to less than 5 mm of curvature at 16 kHz and experiments have shown that the DOSC waveguide provides less than 4 mm of curvature.

DOSC waveguide technology is patented on an international basis.
(n°0331566 in Europe, n°5163167 in North America).