S O U N D P R O J E C T S

GENERAL INFO
AND
OPERATION MANUAL
FOR
SPX SERIES™

SOUND PROJECTS
Karperweg 16
1317 SN Almere
The Netherlands
Phone +31 (0)36 53 94 570
Fax +31 (0)36 53 00 578

Contents

All the important notes regarding proper operation of the product and potential danger or damage to either the user or the equipment, are highlighted in light grey

Line-array basics

What is a line-array?

A line-array is a sound system made up out of a group of identical, omni-directional radiating elements oriented in a tightly spaced, straight line. If this line is long enough compared to the wavelength the elements behave acoustically as if it were a single source. The basics of this principle are employed in today's vertical line-array systems.
Because of the physical dimensions of conventional HF compression-drivers it is impossible to meet the criteria of tight spacing of the sources for the frequency bandwidth it operates. To solve this most line-array systems use waveguides to convert the circular wave front emerging from a HF drivers exit to a rectangular plane enabling multiple sources to be tightly spaced. Furthermore the wave front emerging from the waveguide should have tight vertical dispersion in order to avoid unwanted interference. The way this is achieved largely determines the vertical performance of the line-array system at the HF bandwidth.
Line-arrays behaviour differs in some respects remarkably from conventional systems. The greatest benefit of a line-array is that, when properly designed, the acoustical power of many cabinets can be combined without the unwanted interference that conventional systems show. Furthermore its vertical directivity can be adapted to closely fit the venue.

Vertical directivity of a line-array versus a conventional system

While conventional system will almost inevitably cause harmful interference when using more than one system, a well-designed line-array has the advantage of better acoustic energy distribution towards the projected area. Although it's a misconception that with a line-array no interference will occur, due to it's tight spacing of the omni-directional MF and LF sources most of the cancellations occur outside the projected area. In fact it is the 'wanted' interference that creates the 'bullet-shape' often seen in simulation software.
The vertical directivity of the MFs and LFs can be altered within limits by curving the shape of the array. Due to the HF waveguide's tight vertical dispersion, necessary for proper functioning of the array, curving the array is also bound to outer limits so it doesn't create harmful areas of hotspots and poor HF coverage. The angles of the HF-waveguides in the Dreamline™ have been configured for optimised performance in relation with the MF/LF-drivers.

Vertical directivity of low frequencies versus array size

The previously described 'bullet-shape', as a rule of thumb, applies for wavelengths equal to or smaller than the vertical array sizes. For a wavelength equal to the array length the vertical dispersion will approximately be 90-degrees. For the frequencies below this frequency, hence longer wavelengths, it will gradually turn into an omni-directional source. Therefore, vertical directivity control and maximum SPL of the low and low-mid frequencies greatly benefit from a larger array size.

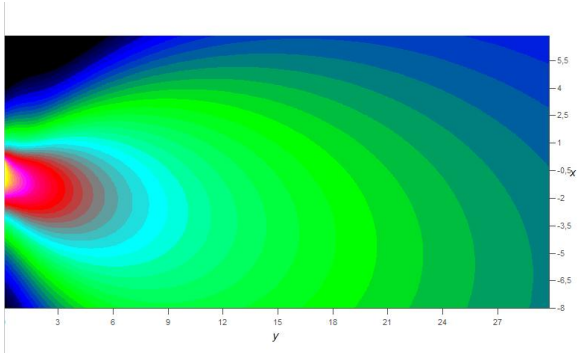


Fig.1 Typical characteristic of a 2 meter array at 170 Hz.

Basic set-up principles

With respect to the horizontal coverage characteristics any SPX system is similar to a conventional constant directivity (CD) horn/system. When more horizontal coverage is needed than the horizontal dispersion of one line-array some basic rules apply explained later in this chapter. The main variable to which a line-array has to be adapted is the vertical coverage.

Establishing proper vertical coverage

The first step in the configuration process is to get the venue parameters and listeners positions right. It may seem logical but a good preparation is the main time-saver in setting up any audio-system. Once these parameters, such as distances to first and last listener positions and flying height, are known prediction software such as SPArC™ can easily be employed to configure the best flying position.

In general, flying a system higher will bring a more even loudness throughout the audience, and flying at a lower position will get more loudness at the front listener positions. The highest horn unit in the SPX array should be aimed at the furthest listening position. In many cases it might even be preferred to aim just a little above this position.
When a line array is flown it is most logical to configure from top to bottom (far coverage to near coverage). Therefore it might not always be possible to point the bottom array element to the nearest listener position to be fed by the line-array (e.g. due to limited number of array elements). Additional front fill is then necessary. Another situation where front fill is preferred is when the array is flying relatively high to the first listeners position. In order to avoid 'elevator-music' coming from above, front fills placed at stage height will place the sound image downward for the front of the audience.
When a line array is ground stacked it is more logic to configure the array from bottom to top. Additional front fill can still be used, however often not necessary.

Horizontal coverage

In some cases it might be necessary to use more than one array per side in order to achieve more horizontal coverage or to be used as in-fills. An important rule applies when this situation occurs. Instead of placing an array directly besides the first one the proper approach would be 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: the first main cancellation is shifted lower in frequency (example, 28 Hz for 2 arrays of the same size, spaced 6 metres) and tends to be masked or filled in by room reverberation; 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.

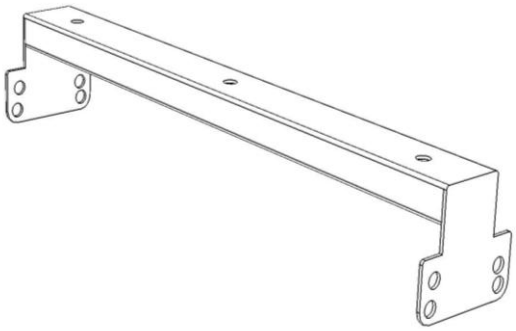
Quick reference set-up guide

Carefully read this section before suspending the SPX system

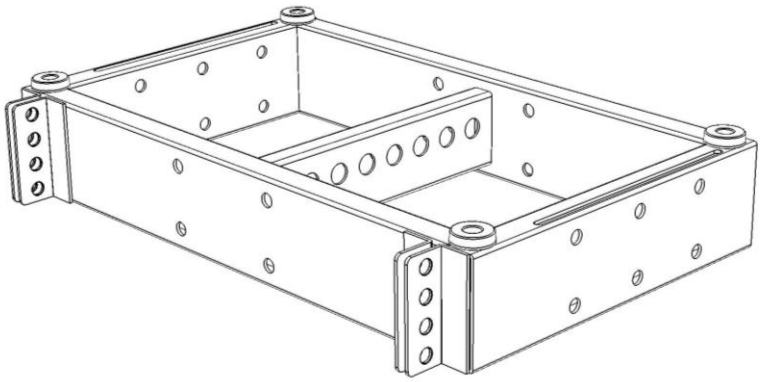
Note! The SPX flying system has been designed according to most international guidelines for overhead suspension. However, local safety legislation may be applicable and it is the responsibility of the installer to apply these safety guidelines.

SPX flying system components

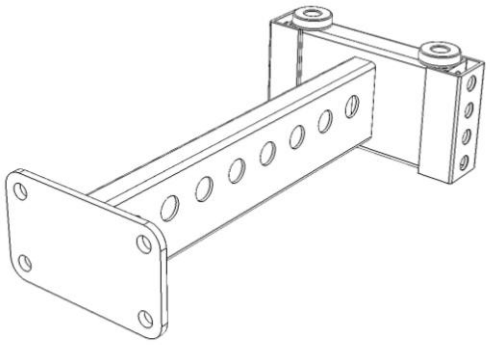
SPX Mounting Bracket
for single cabinet use



SPX Basic Flyingframe
for use up to 6 cabinets

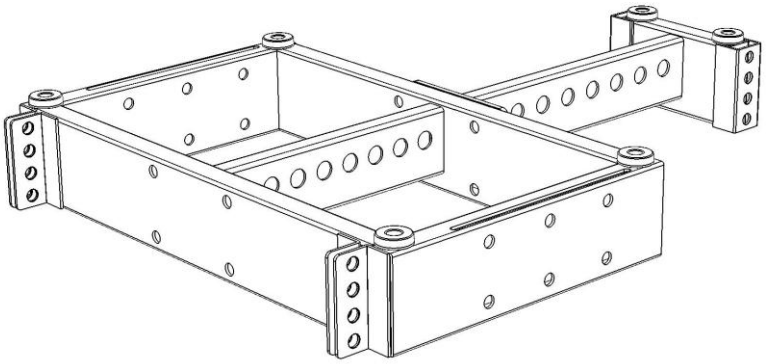


SPX Flyingframe Extender
For use up to 6 cabinets – configuration dependant



SPX Flyingframe assembly

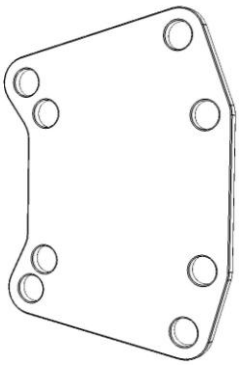
for flying up to 6 cabinets or
groundstacking up to 4 cabinets
for flying below or on top of SP18/SP2-10 bassbins



Consult the Guideline to maximum amount of cabinets on page 15 when preparing the design of an SPX line-array using the SPX flying frame with the flying frame extender.

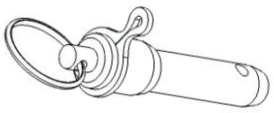
SPX Connector (2 per cabinet)

Cabinet interconnect



Quick Release Pin (8 per cabinet)

Connector fixes

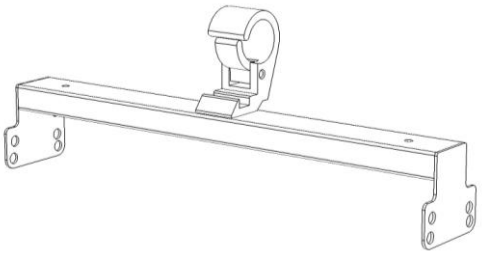


Using the SPX Mounting Bracket

The SPX mounting bracket is designed for use with a single cabinet when using the middle fixing hole or 2 cabinets when using the two outer fixing holes.
When used in static fixed installation situations, where no overhead situations are present the bracket can be used for up to 4 cabinets (using the 2 outer fixing holes).
All items for cabinet fixture are included. Various ways to connect the bracket to wall, ceiling or construction are applicable. Items for this purpose are optional.

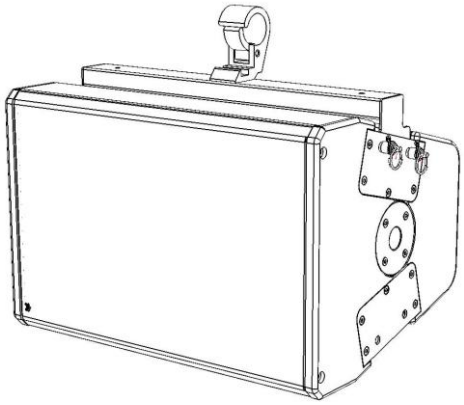
Step 1

When using a clamp or other device connect the clamp to the bracket. Connect safety slings to the left and right hole on top of the bracket if deemed necessary.



Step 2

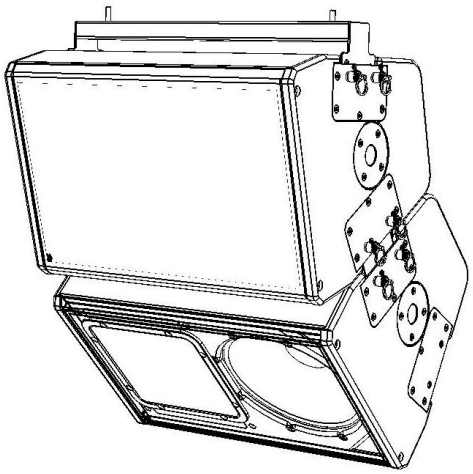
Once the mounting bracket is prepared for its intended purpose, the cabinet may be fixed to the bracket using the Quick Release Pins. There are three angles possible: parallel to bracket or tilted 10 or 15 degrees downwards.

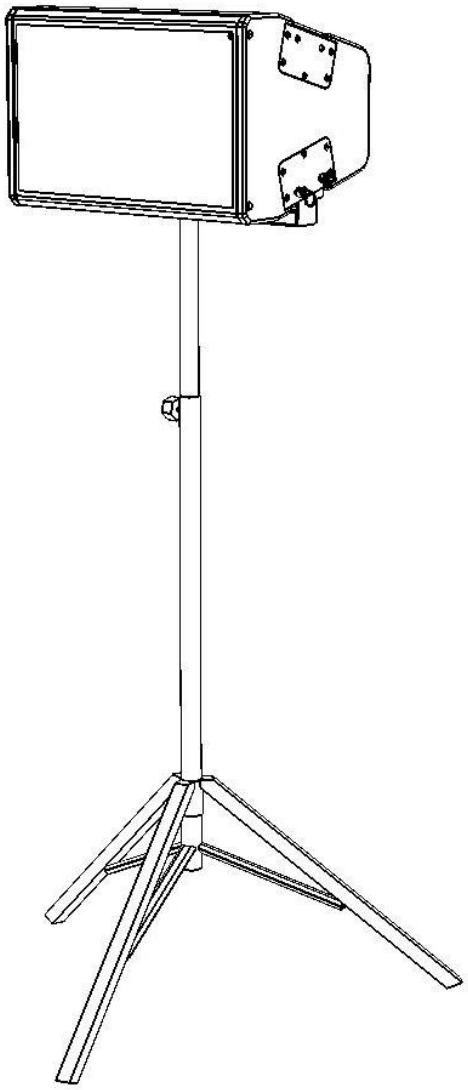


Step 3

ONLY applicable when using two or more fixing holes!

Connect a second cabinet by means of two connector plates and 8 quick release pins.





SPX-65 on a tripod using the SPX Mounting bracket

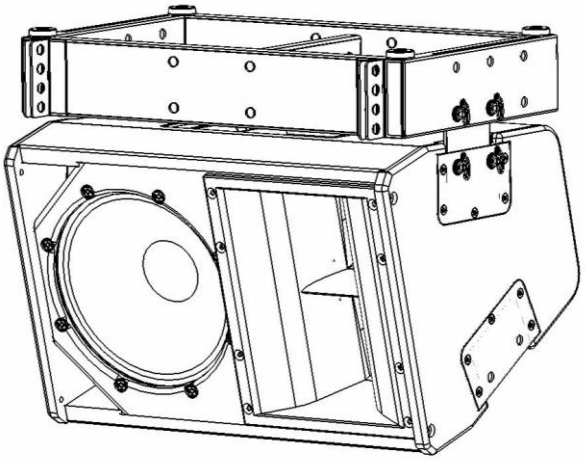
Safety Note: For direct fixes to walls or ceilings ALWAYS use two or more fixtures suitable for the applicable underground! Consult local rigging legislation regarding overhead suspension.

5 simple steps to rig your SPX array

Safety Note:
The maximum amount of cabinets to be hoisted by the SPX flying frame is dependent on the configuration of the intended setup. Due to momentum critical forces on connectors will increase fast when the lifting point is shifted backwards. Consult table on page xxx to avoid overload situations!

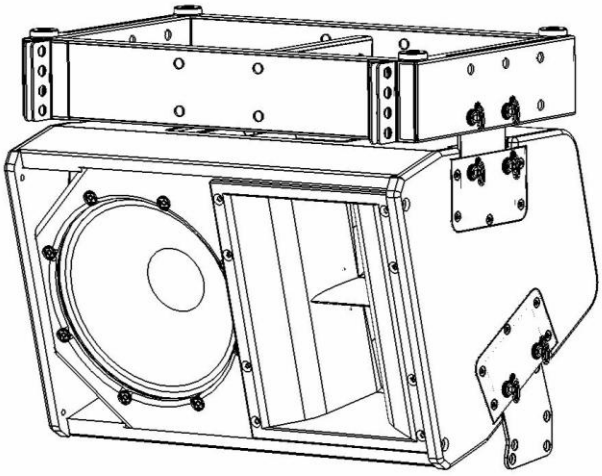
Step 1

When using the Flying frame extender, start with assembling the extender to the flying frame. Then connect the flying frame to the first cabinet in line with the connectors and Quick Release Pins and attach the hoist at the corresponding hole.



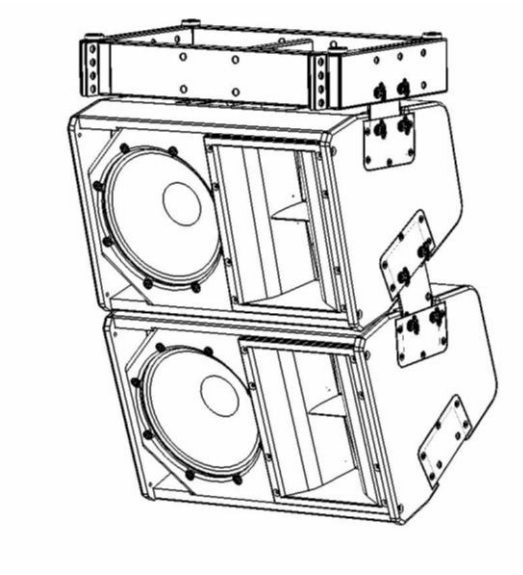
Step 2

Lift the frame and cabinet to approximately head-high position to enable attachment of the next cabinet. Start with attaching the two connectors at the cabinet in the array using the Quick Release Pins.



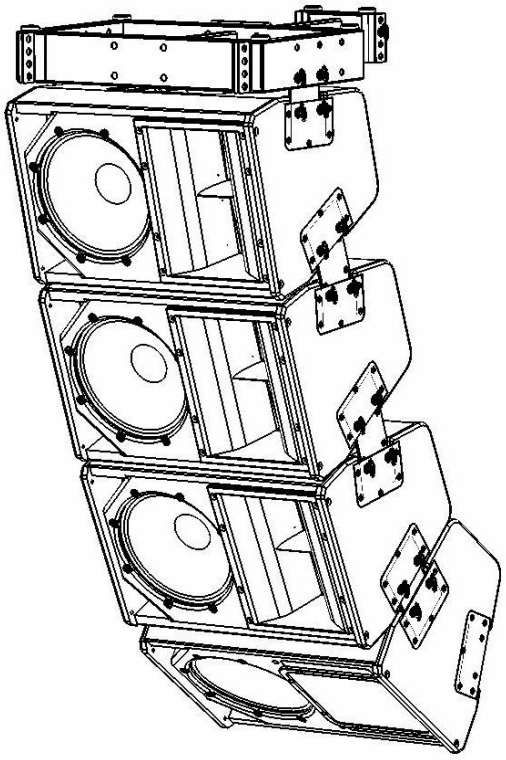
Step 3

Now lift the adjacent cabinet with one person a side and attach it to the extending connectors using two QRPs per side.



Step 4

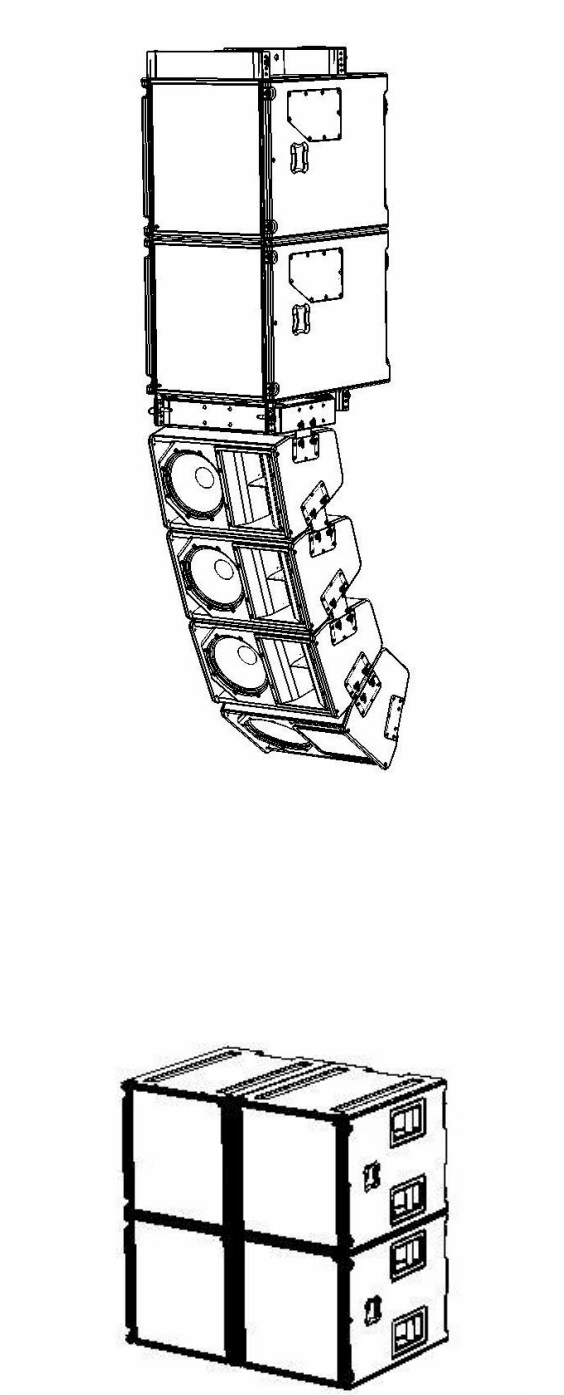
Connect audio and mains power cabels and repeat step 2 thru 4 for all cabinets in the array.



Step 5

Connect audio and power cables and lift the SPX array to the desired height. Guide the cables and fix them to avoid extensive pulling forces at the connectors.

Setup examples



Typical system setup consisting of 3 SPX-65s, 1 SPX-60 (downfill), 2 SP210s and 4 SP18s

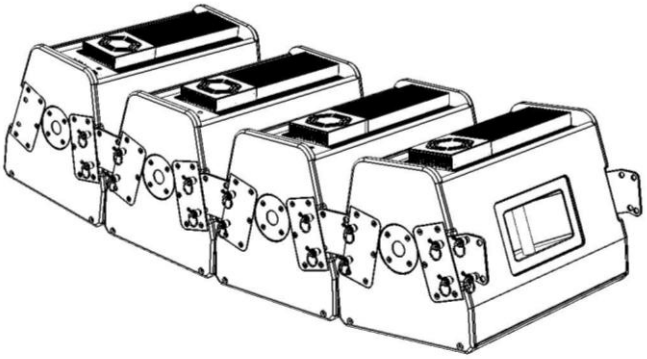
Ground-stacking an SPX array

Note: Always use an SPX flying frame with extender to stack an array of SPX cabinets. When stacking on top of a cluster of bassbins it is highly recommended to secure the flying frame with connectors to the bassbin.

Up to 4 cabinets can be groundstacked by means of the SPX frame with extender. Setup can be done either by placing cabinets one by one on top of each other or by pre-assembling the array on the floor and tipping the complete cluster including frame. The latter is explained below.

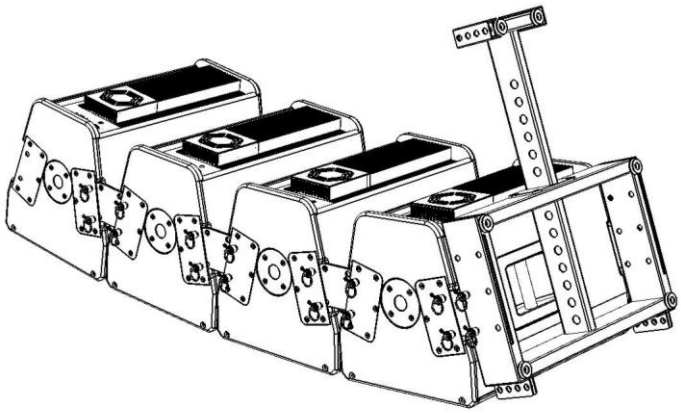
Step 1

Pre-assembly the array of cabinets on the floor with the angles between cabinets as needed.



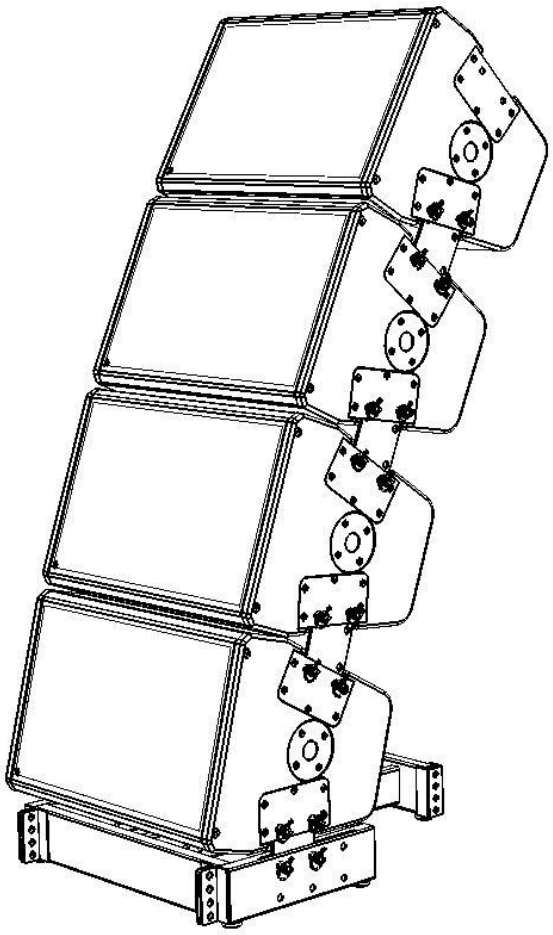
Step 2

Attach the flying frame including extender at the intended angel.



Step 3

Lift the complete ground stack array in an upright position.

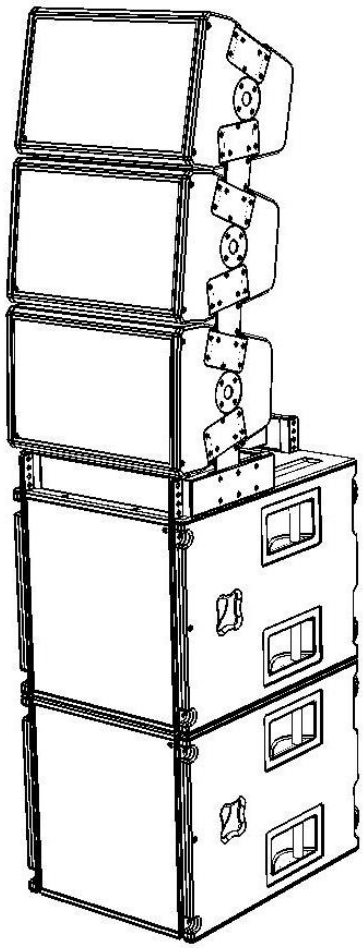


Typical groundstack setup consisting of 4 SPX-65s on a flying frame.

Note: the maximum amount of cabinets is largely depending on local circumstances such as ground-stability, weather influences (e.g. wind) and array shape. Always check groundstack stability physically and if necessary grant stability using stabilizing lines.

Groundstacking on top of Bassbins

When making a ground stack on top of a bassbin cluster it is highly recommended to use fixing connectors between the bassbin and the SPX flying frame.



Typical groundstack setup consisting of 3 SPX-65s and 2 SP18s

Additional Safety Guidelines

Before suspending the SPX system be sure you apply the following general safety guidelines.

- Standards for flying and rigging are local not universal, therefore it is important for the user to contact appropriate regulatory agencies concerning relevant standards for specific applications.
- Before suspending any system, always inspect all components of the rigging system for deformation, corrosion, and damaged or missing parts that could reduce strength and safety of the rigging system.
- Use only load rated hardware.
- Never exceed maximum load ratings at any time.
- Consult a licensed physical engineer if you are unsure how to proceed.
- It is advisable to consult and engage a qualified rigger when making decisions related to purchase, set-up and use of any equipment and technique that will be used to suspend any temporary loudspeaker system above areas that will be occupied by persons.
- Never tilt the array by pushing or pulling the array at the enclosures itself! The flyingframe is equipped and designed to be used both as lifting point and tilting point.

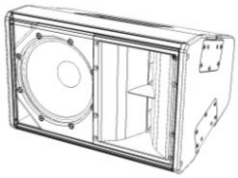
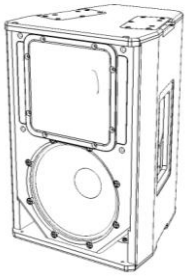
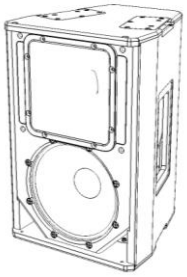
Maintenance

Minimum requirements for inspection of flying hardware:

- Control all rigging hardware on deformations, irregularities and missing or loose parts before every use. (User)
- Inspect all items at least once a year. (Qualified rigging personnel)
- Approval testing by Certified Body every two years. (Official agency)

Like any high performance tool your Sound Projects system needs regular maintenance.
Check all bolts and nuts of your audio systems at least once a year!
Clean fan-grill, foam-grill and cabinet openings with vacuum cleaner and compressed air to remove excessive dust. Frequency depending on local circumstances.

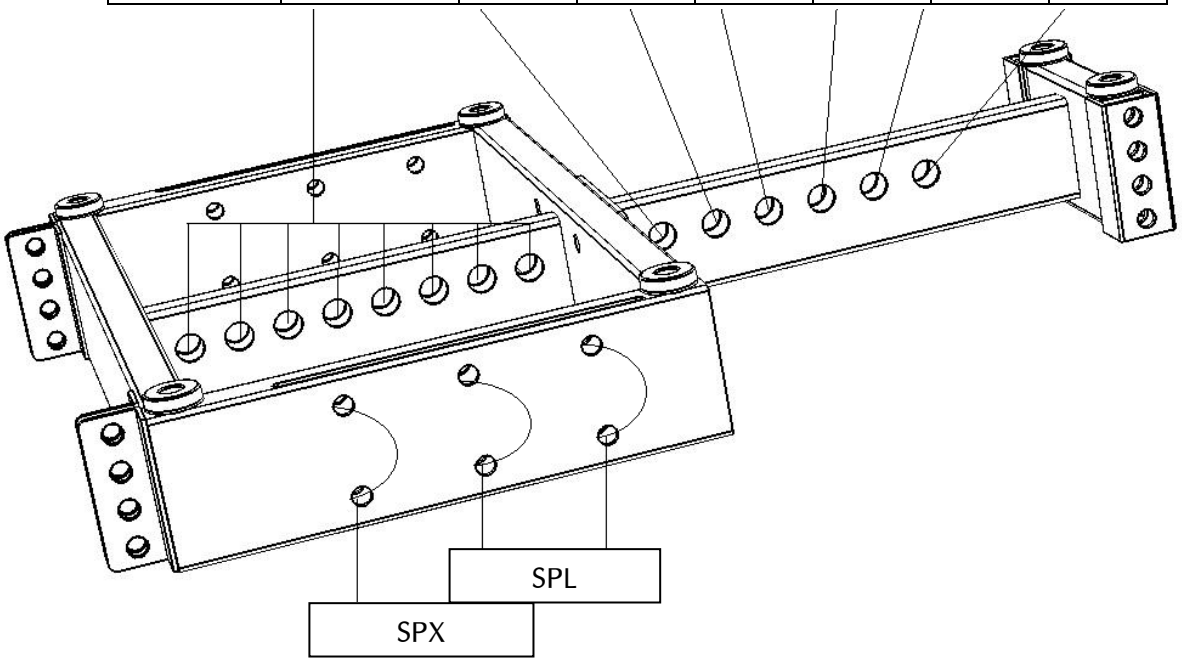
SPX Specsheet

Model:	SPX-65	SPX-60	SPX-90
			
Acoustical specifications:			
Max. peak SPL @1m: (crest factor 2 (6 dB))	133dB	134dB	134dB
Freq. response:	60 Hz -20kHz	60 Hz -20kHz	60 Hz -20kHz
Coverage angle:	65H x 15V	60H x 40V rotatable	90H x 60V rotatable
Electrical specifications:			
- Drivers:	12″/ 2 x 1″	12″ / 1.4″	12″ / 1.4″
Transient output:	1000W	1000W	1000W
Amplifier(s):	MA1000™ technology		
Crossover 4th order:	1000 Hz	1000 Hz	1000 Hz
Lowpass 4th order:	60 Hz	60 Hz	60 Hz
Protection:			
	D.A.L.C. (Double AudioLogic Control) Fast double driver-relais turn on/off Transient (soft power-up) DC-voltage short-circuit		
LED indication:	power-on/signal/protect		
Input impedance:	20 kOhms balanced, 10 kOhms unbalanced		
Output impedance:	hard-wired to input		
Protection threshold:	+4dBU		
Mains voltage:	230V (other on request)		
Mains frequency:	50/60 Hz		
Power cons. Idle:	< 50VA		
RMS Full load:	300VA		
Additional data:			
Cabinet construction:	crossgrain laminated multiplex		
Finish:	Nano Armor PU Coating		
Size WxHxD (mm):	395x600x405 trapezoid		
Rigging points:	integrated SPX flypoints recessed pole-mount adapter		
Audio connectors:	IEC XLR-3 in/out		
Main connectors:	powercon in, powercon out		
Max. operating temp.:	-10 to 40 C ambient		
Weight:	32kg	32kg	32kg

Additional information about SPX Series can be found on our website: www.soundprojects.com

Guideline to maximum amount of cabinets

MODEL	MAXIMUM NUMBER OF CABINETS *						
SPX	6	6	6	5	4	4	4
SPL	6	6	6	6	5	4	4



**Flying frame should be positioned horizontally*

ALWAYS consult Sound Projects' proprietary acoustic prediction software SPArC™ (downloadable at www.soundprojects.com) to determine the maximum amount of cabinets at specific situations. The angle of the flying frame influences the forces on the flying hardware.

Note: The maximum amount of cabinet as described in the table above are calculated with double the design factor as described in the 'Guidelines for Machinery' making it suitable for overhead suspension in most European communities. (e.g. NPR 8020)

Declaration of Conformity

Almere, 1 October 2010

DECLARATION OF CONFORMITY

SOUND PROJECTS, hereafter referred to as the manufacturer, declares that the SPX rigging system and its rigging hardware as supplied by the manufacturer are produced and, when provided with certificate, tested conform CE norms as described in the Guidelines for Machinery appendix 2A.

SOUND PROJECTS
Karperweg 16
1317 SN Almere
The Netherlands