FreeSpace® 3 Flush System

DESIGN GUIDE

Product Specifications

Frequency Range	50Hz – 16kHz ± 3dB
Long Term Power Handling	100 watts continuous (8 Ohm)
Sensitivity	82 dB-SPL @ 1W/1m (pink noise)
Impedance	6 Ohm
Maximum Acoustic Output	102 dB-SPL @ 1m (pink noise)
Dispersion	170° Conical (Satellite) Omni-directional (bass)

Overview

This application note covers the basic concepts for the use of the FreeSpace 3 system in business music applications.

The FreeSpace 3 system is ideally suited to background and foreground music applications with ceiling heights between 8 and 16ft (2.4 to 5m). The 2.25 inch driver used in the FreeSpace 3 system provides more consistent coverage in low ceiling applications, compared to other loudspeakers, and the Acoustimass® bass module provides deep, rich bass that appears to fill the room. The FreeSpace 3 system is compatible with 70V, 100V and 8 Ohm amplifiers, and is capable of delivering up to 95dB$_{SPL}$ in a typical application with a 12ft (3.5m), ceiling height.

All system designs begin with a set of requirements. The system requirements can be as simple as "it has to sound great," or as detailed as "it must have an output level of 100 dB$_{SPL}$". In either case, the challenge is to gather the right set of requirements and convert them into a set of design criteria to use in creating your design.

The three key requirements that you need to identify in order to deliver the right business music sound system are:

LOUDNESS What sound pressure level is required for this application?

RESPONSE What bandwidth is required for the type of program material that will be used?

COVERAGE How consistent must the sound be across the entire coverage area?

Each of these requirements can be easily converted into a specification that we can use to create our system design. If we understand the customer's needs in these three areas, we can deliver a design that will, at a minimum, meet their needs, and at best exceed their expectations.

For the purposes of this application note, we will assume that you are familiar with the system requirements for a business music system and are ready to focus on the creation of a loudspeaker layout using the FreeSpace 3 system.

Design Guidelines

When creating a design that uses the FreeSpace 3 system, you should consider the following:

- Recommended mounting height for Satellites is between 8 and 16ft (2.4 and 4.8m).
- One Satellite should always be placed near the bass module to further reduce localization.
- Do not place bass modules along the center line of the room; offset bass modules from the center line using a staggered layout.
- Maximum SPL for a typical application is between 85 and 90dB$_{SPL}$.
- Always add 25% headroom to your amplifier to accommodate various types of program material.

Design Worksheet

Use the following worksheet to create a design using the FreeSpace 3 surface mounted loudspeakers.

STEP 1 Using the graph paper on the last page, create a sketch or drawing of the room.

STEP 2 Confirm that the FreeSpace 3 System will meet your loudness requirement.

A. On the chart below, locate the loudspeaker mounting height for this design.

B. Draw a line down to the desired maximum SPL.

C. Draw a horizontal line across the chart at your desired SPL level.

D. All of the loudspeakers listed below the line will meet your loudness requirement.

Maximum Continuous Output Level

LOUDSPEAKER	Loudspeaker Mounting Height	m	2.4	3.0	3.6	4.2	4.8	5.5	6.1	6.7	7.3	8.0	10.0
		ft	8	10	12	14	16	18	20	22	24	26	32
	DS 16S / SE		90	89	89	88	87	86	85				
	360P-II		94	93	92	90	89	88	87				
	FreeSpace 3		96	95	95	94	93						
	Model 32SE		96	96	95	94	93	92	91	90			
	DS 100SE		98	97	97	96	95	94	93	92	92	91	89
	FreeSpace 203		98	97	97	96	95						
	DS 16F		99	97	94	91	90	88	87				
	102F		105	100	98	95	94	92	91	90	89	88	
	DS 100F		107	103	102	99	98	96	95	94	93	92	89
	Model 32		107	103	100	97	96	94	93	92	91	90	

dB_{SPL}

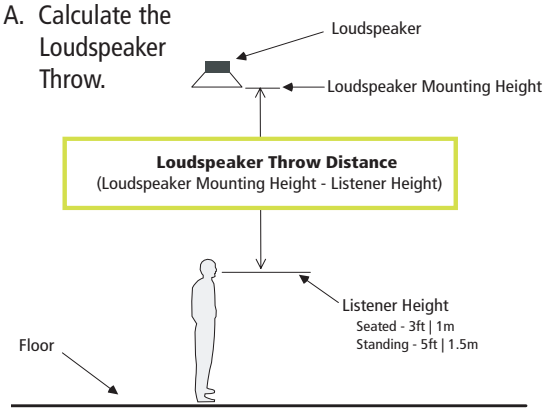
STEP 3 Confirm that the FreeSpace 3 System will meet your Response Requirement.

Vocal Range	Full Range	Extended Range
DS 16S & SE	203	FreeSpace 3
DS 16F	360P-II	
Model 32	DS 100SE	Any vocal range loud-speaker combined with a FreeSpace 3 bass module.
Model 32SE	DS 100F	
102F		

NOTE: If the loudspeaker that meets your response and loudness requirement does not meet your mounting needs select one that provides more bandwidth, and also meets your mounting needs.

STEP 4 Using your sketch of the room, create a layout with the Loudspeaker Spacing that meets your Coverage Requirement.

A. Calculate the Loudspeaker Throw.



B. Calculate the Loudspeaker Spacing distance by multiplying the Loudspeaker Throw Distance by the Coverage Multiplier.

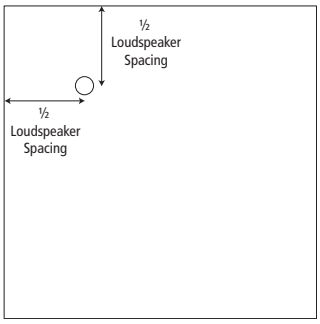
Coverage	Multiplier
Premium	2.0
Standard	2.5

Loudspeaker Throw Distance x Coverage Multiplier = Loudspeaker Spacing

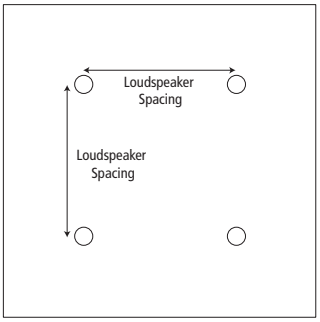
_____ x _____ = _____

(Loudspeaker Throw Distance) (Coverage Multiplier) (Loudspeaker Spacing)

C. Place the first loudspeaker at ½ the Loudspeaker Spacing distance from any corner of the room.



D. Remaining loudspeakers are arranged on a square grid pattern using the Loudspeaker Spacing distance.



STEP 5 Using your sketch of the room, create a Bass Loudspeaker Layout with the correct number of bass modules to meet your Coverage Requirement.

A. Determine the quantity of bass modules required for your system layout.

Coverage	Bass Required
Premium	Total Satellites / 2
Standard	Total Satellites / 4

B. Use the spacing guidelines below, determine the minimum spacing between two or more FreeSpace 3 bass modules.

Bass Module Spacing	FreeSpace 3 Bass Module Mounting Height			
	8ft | 2.5m	10ft | 3m	12ft | 3.5m	16ft | 4.8m
Min Spacing (ft)	20	25	30	35
Min Spacing (m)	6	7.5	9	11

STEP 6 Calculate the required amplifier size. Use the Tap Chart at below to determine which loudspeaker tap is required for this design.

FreeSpace 3 Flush System Tap Chart

Mount Height	m	2.4	3.0	3.6	4.2	4.8	
	ft	8	10	12	14	16	
TAP	25	87	86	86	85	84	dB_{SPL}
	50	90	89	89	88	87	
	100	93	92	92	91	90	
	200	96	95	95	94	93	

A. Locate the loudspeaker mounting height for this design.

B. Draw a line down to the desired maximum SPL.

C. Draw horizontally across the chart to read the required loudspeaker tap.

D. Calculate the required amplifier power:

_____ x _____ = _____

Number of Loudspeakers Required Loudspeaker Tap Power Required

E. Calculate the required amplifier size:

_____ x 1.25 = _____

Power Required Headroom Amplifier Size

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Project Name: _____

Contact: _____ Date: _____

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