



FreeSpace® DS 16S FreeSpace® DS 16SE



Product Specifications

Frequency Range	90 Hz – 16 kHz ± 3 dB
Long Term Power Handling	16 watts continuous
Sensitivity	84 dB-SPL @ 1W/1m (pink noise)
Impedance	70/100V or 8 Ohm
Maximum Acoustic Output	96 dB-SPL @ 1m (pink noise) 102 dB-SPL peak @ 1m (pink noise)
Dispersion	170° x 160° (H x V)

Overview

This application note covers the basic concepts for the application of the FreeSpace DS 16S and SE loudspeakers in business music systems.

The FreeSpace DS 16S and SE loudspeakers are ideally suited to background music and paging applications with mounting heights between 8 and 20ft (2.4 to 6.1m). Compared to other loudspeakers, the 2.25 inch driver used in the FreeSpace DS 16S and SE provides more consistent coverage in low and medium mounting height applications. The FreeSpace DS 16S and SE loudspeaker is compatible with 70V, 100V and low impedance amplifiers and is capable of delivering up to 88 dB_{SPL} in a typical application with a 14ft (4.2m) mounting 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 speaker layout using the FreeSpace DS 16S and DS SE loudspeakers.

Design Guidelines

When creating a design that uses the FreeSpace DS 16S and SE loudspeakers, you should consider the following:

- The FreeSpace DS 16S and SE are ideally suited to background music applications. If your customer requirements are for a foreground music system, you should consider the FreeSpace DS 100SE loudspeakers.
- Recommended mounting height for the FreeSpace DS 16S and SE loudspeakers is between 8 and 20ft (2.4 and 6.1m).
- Provide at least 20ft (6.1m) of space between adjacent loudspeakers for typical applications.
- Generally, the FreeSpace DS 16S and SE should be pitched downward between 5° and 30°.
- Maximum SPL for a typical application is between 85 and 90 dB_{SPL}.
- Always add 25% headroom to your amplifier to accommodate various types of program material.

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Design Worksheet

Use the following worksheet to create a design using the FreeSpace DS 16S and SE 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 DS 16 loudspeaker will meet your loudness requirement.

- On the chart below, locate the loudspeaker mounting height for this design.
- Draw a line down to the desired maximum SPL.
- Draw a horizontal line across the chart at your desired SPL level.
- All of the loudspeakers listed below the line will meet your loudness requirement.

		Maximum Continuous Output Level											
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	
LOUDSPEAKER	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		

STEP 3 Confirm that the FreeSpace DS 16 loudspeaker 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 loudspeaker 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.

FreeSpace® DS 16S FreeSpace® DS 16SE



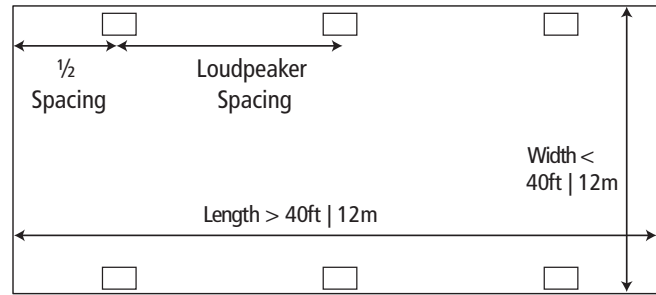
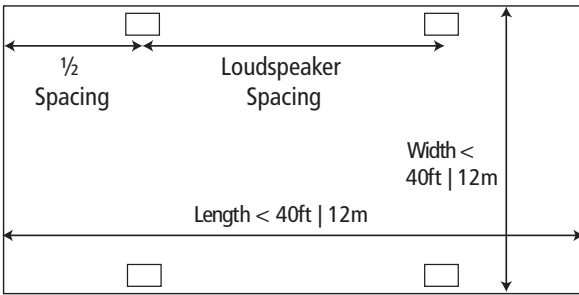
STEP 4 Using your sketch of the room, create a loudspeaker layout using a Loudspeaker Spacing from the table below that meets your coverage requirement.

Coverage	Loudspeaker Spacing Distance
Premium	25ft 7.5m
Standard	30ft 9.0m
Minimum	35ft 10.5m

A. In room is less than 40ft (12m), wide place one FreeSpace DS 16S/SE ½ the Loudspeaker Spacing distance in from each corner of the room.

OR

B. When the room length exceeds 40ft (12m), add additional FreeSpace DS 16S/SE loudspeakers using the required loudspeaker spacing distance.



STEP 5 Calculate the required amplifier size. Use the Tap Chart below to determine which loudspeaker tap is required for this design.

- Locate the loudspeaker mounting height for this design.
- Draw a line down to the desired maximum SPL.
- Draw a horizontal line across the chart to read the required loudspeaker tap.

Mount Height	m	2.4	3.0	3.6	4.2	4.8	5.5	6.1	
	ft	8	10	12	14	16	18	20	
T A P	1	78	77	77	76	75	74	73	dB _{SPL}
	2	81	80	80	79	78	77	76	
	4	84	83	83	82	81	80	79	
	8	87	86	86	85	84	83	82	
	16	90	89	89	88	87	86	85	

D. Calculate the required amplifier power:

E. Calculate the required amplifier size:

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

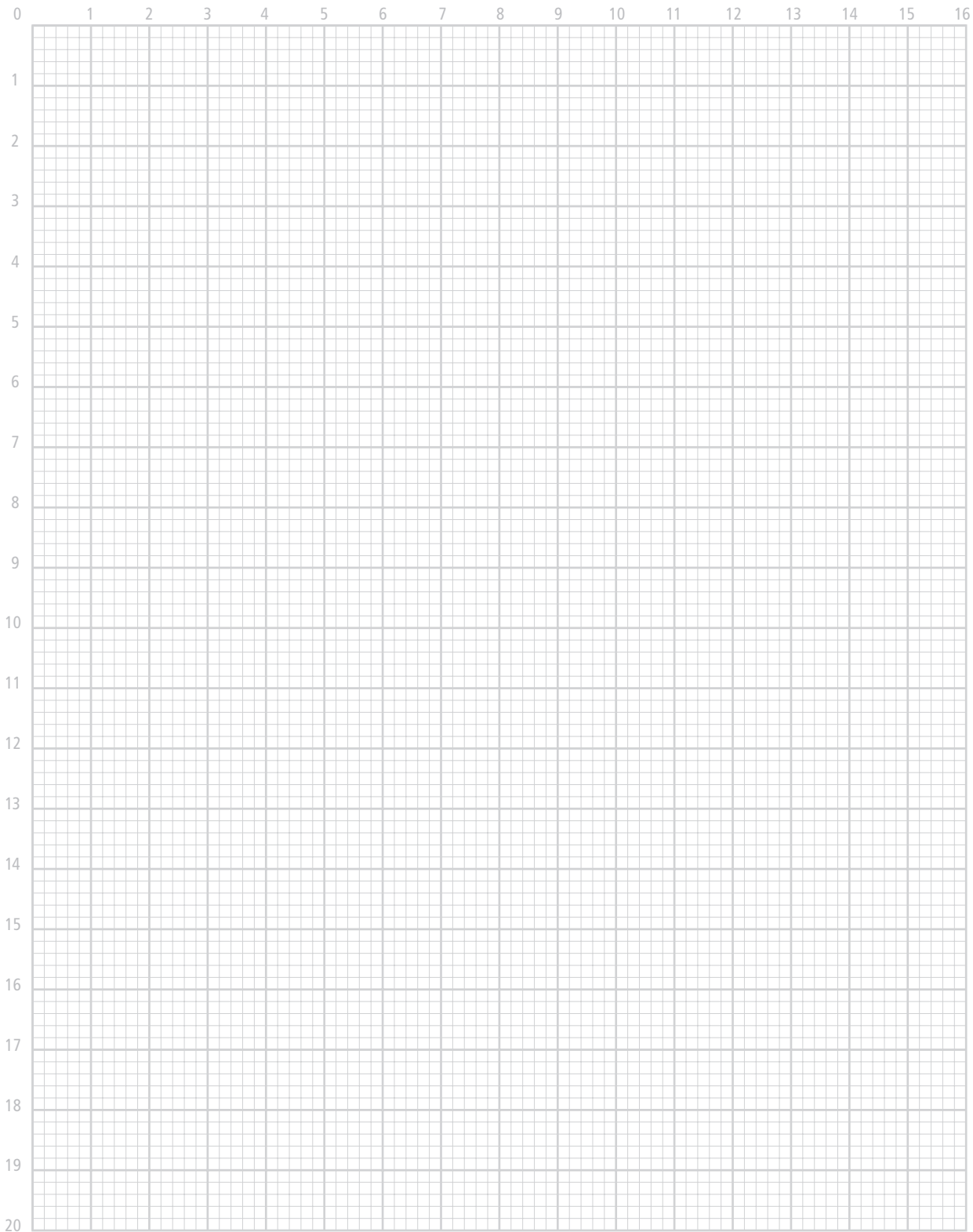
Number of Loudspeakers Required Loudspeaker Tap Power Required

$$\underline{\hspace{2cm}} \times 1.25 = \underline{\hspace{2cm}}$$

Power Required Headroom Amplifier Size

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DESIGN GUIDE



Project Name: _____

Contact: _____ Date: _____



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