FreeSpace® DS 40F

Product Specifications

Frequency Range	80 Hz – 16 kHz (-3 dB)
Long Term Power Handling	40 watts continuous
Sensitivity	87 dB-SPL @ 1W/1m (pink noise)
Impedance	70/100V or 8 Ohm
Maximum Acoustic Output	103 dB-SPL @ 1m (pink noise) 109 dB-SPL peak @ 1m (pink noise)
Dispersion	125° conical

DESIGN GUIDE

Overview

This application note covers the basic concepts for the application of the FreeSpace DS 40F loudspeakers in business music systems.

The FreeSpace DS 40SE loudspeakers are ideally suited to background music, foreground music and paging applications with mounting heights between 8 and 26ft (2.4 to 8.0m). The system incorporates a single 4.5 inch driver in a ported enclosure which may be pendant mounted or installed flush, in drop tile or solid ceilings. The FreeSpace DS 40F loudspeakers are compatible with 70V, 100V and low impedance amplifiers and are capable of delivering up to 101 dB_{SPL} in a typical application with a 12ft (3.6m) 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 40F loudspeakers.

Design Guidelines

When creating a design that uses the FreeSpace DS 40F loudspeakers, you should consider the following:

- The FreeSpace DS 40F loudspeakers are ideally suited to background music, foreground music and paging applications.
- Recommended mounting height for the FreeSpace DS 40F is between 8 and 26ft (2.4 and 8.0m).
- Maximum SPL for a typical application is between 91 and 106 dB_{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 DS 40F 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 40F loudspeaker 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. Any loudspeaker exceeding the loudness requirement may be used in this design.

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					dB_{SPL}
	360P-II		94	93	92	90	89	88	87					
	FreeSpace 3		96	95	95	94	93							
	DS 40SE		97	96	96	95	94	93	92	91	91	90		
	DS 100SE		98	97	97	96	95	94	93	92	92	91	89	
	203		98	97	97	96	95							
	Model 16		101	97	94	91	90							
	DS 40F		106	103	101	98	97	95	94	93	92	91		
	DS100F				102	99	98	96	95	94	93	92	89	

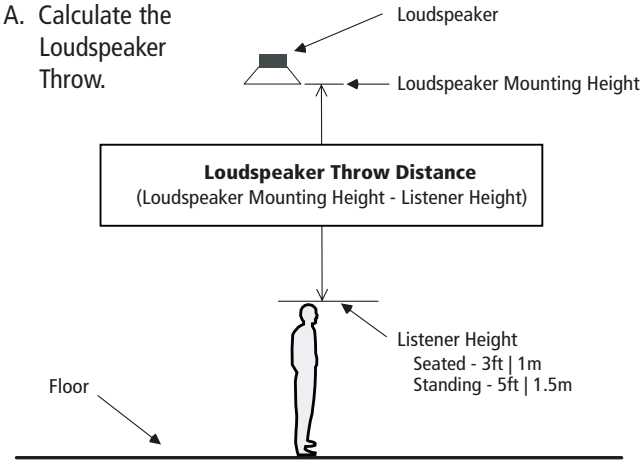
STEP 3 Confirm that the FreeSpace DS 40F loudspeaker will meet your Response Requirement.

Vocal Range	Full Range	Extended Range
DS 16S & SE	203	FreeSpace 3
DS 16F	360P-II	Any vocal range loudspeaker combined with a FreeSpace 3 bass module.
DS 40F	DS 100SE	
DS 40SE	DS 100F	

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, follow the steps below to create a layout with the Loudspeaker Spacing that meets your Coverage Requirement.

A. Calculate the Loudspeaker Throw.



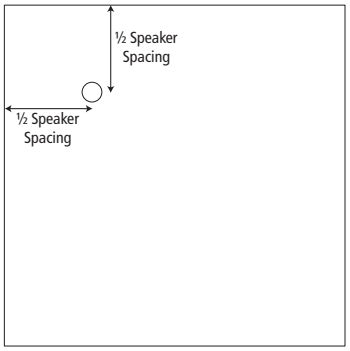
B. Calculate the Loudspeaker Spacing distance by multiplying the Loudspeaker Throw Distance by the Coverage Multiplier.

Coverage	Multiplier
Premium	2.0
Standard	2.5
Minimum	3.0

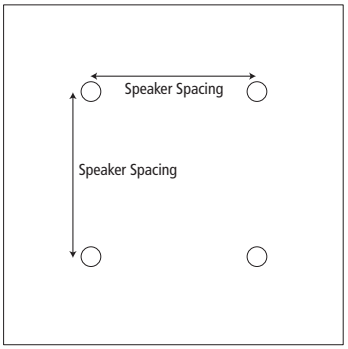
Loudspeaker Throw Distance x Coverage Multiplier = Loudspeaker Spacing

_____ 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 Calculate the required amplifier size. Use the Tap Chart at right to determine which loudspeaker tap is required for this design.

A. 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 to read the required loudspeaker tap.

DS 40F												
Mount Height	m	2.4	3.0	3.6	4.2	4.8	5.5	6.1	6.7	7.3	8.0	
	ft	8	10	12	14	16	18	20	22	24	26	
TAP	2.5	94	91	89	86	85	83	82	81	80	79	dB_{SPL}
	5	97	94	92	89	88	86	85	84	83	82	
	10	100	97	95	92	91	89	88	87	86	85	
	20	103	100	98	95	94	92	91	90	89	88	
	40	106	103	101	98	97	95	94	93	92	91	

Note: 2.5 Watt tap is not available for 100V operation.

D. Calculate the required amplifier power:

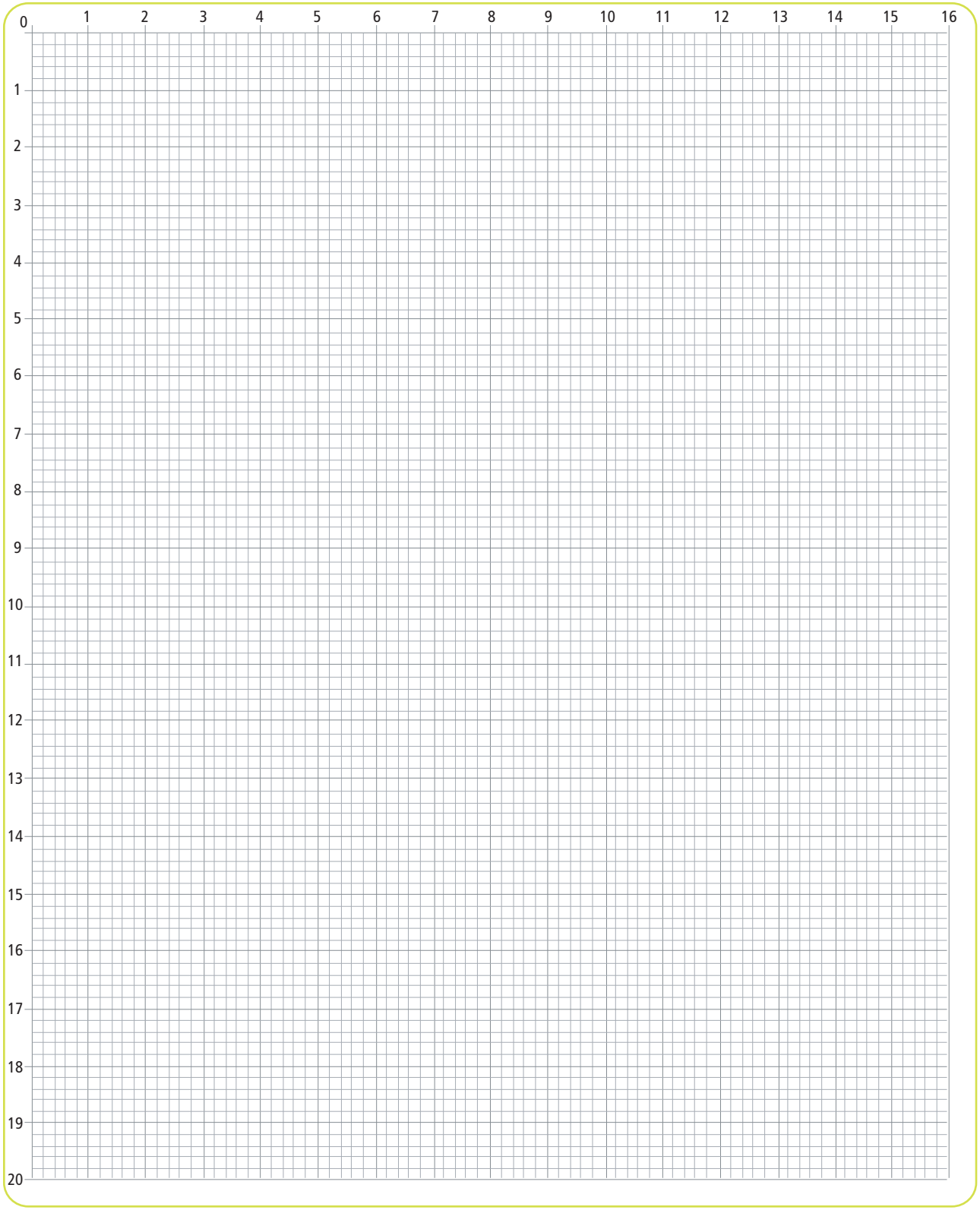
_____ x _____ = _____

Number of Loudspeakers Required Loudspeaker Tap Power Required

E. Calculate the required amplifier size:

_____ x 1.25 = _____

Power Required Headroom Amplifier Size



Contact: _____ Date: _____

Project Name: _____

1. The first loudspeaker is placed at a distance of half the Loudspeaker Spacing distance from any corner of the room.

2. Remaining loudspeakers are laid out using a square grid pattern and are spaced using the Loudspeaker Spacing distance.

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