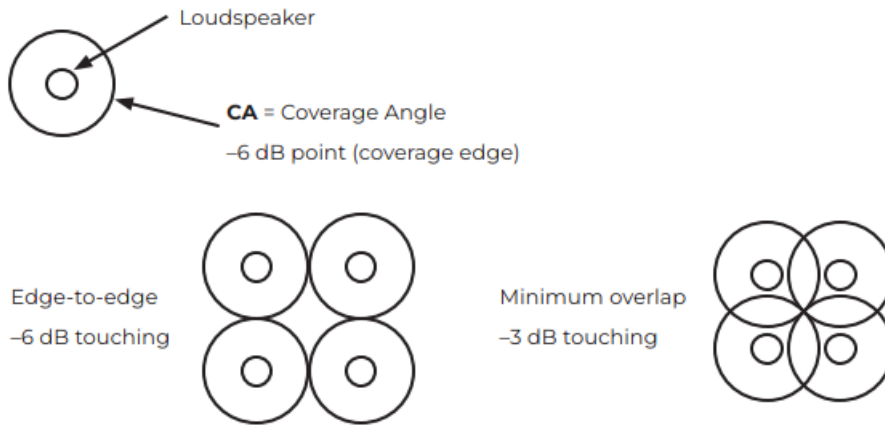


Determining Loudspeaker Quantity and Spacing

The goal is to evenly distribute loudspeakers in the room to provide consistent sound throughout. It may be helpful to sketch this out on paper. Start by creating a sketch layout of the room. Using your sketch of the room, follow the steps below to create a layout with the loudspeaker spacing that meets your coverage requirement.

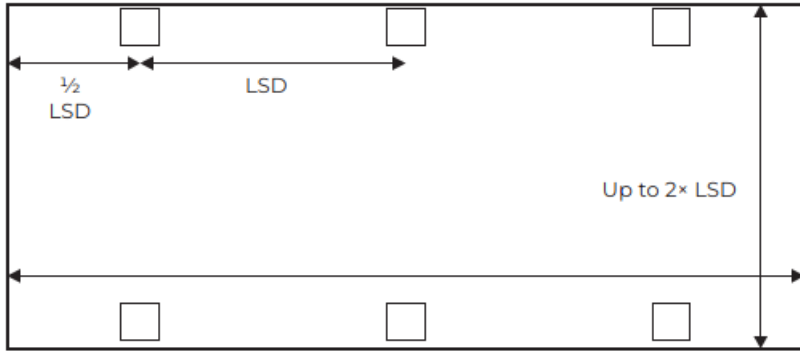
A. Calculate the Loudspeaker Spacing Distance (LSD)

Loudspeaker Spacing Distance (LSD)											
Mounting Height		Listener Position		Standing 5 ft 1.5 m				Sitting 3.5 ft 1 m			
ft	m	Recommended Downward Pitch	Density	FS2SE DM3SE FS4SE		DM5SE DM6SE DM8S		FS2SE DM3SE FS4SE		DM5SE DM6SE DM8S	
				ft	m	ft	m	ft	m	ft	m
8	2.4	0°	Edge-to-edge	15	5	16	5	24	7	22	7
			Minimum Overlap	10	3	10	3	16	5	14	4
			Center-to-center	8	2	7	2	9	3	12	4
10	3.0	0°	Edge-to-edge	26	8	24	7	32	10	32	10
			Minimum Overlap	18	5	16	5	22	7	20	6
			Center-to-center	13	4	11	3	15	5	16	5
12	3.7	-15°	Edge-to-edge	34	10	30	9	40	12	35	11
			Minimum Overlap	21	6	20	6	26	8	24	7
			Center-to-center	17	5	15	5	19	6	17	5
14	4.3	-15°	Edge-to-edge	42	13	38	12	46	14	43	13
			Minimum Overlap	28	9	24	7	29	9	30	9
			Center-to-center	21	6	17	5	23	7	23	7
15	4.6	-30°	Edge-to-edge	42	13	36	11	46	14	40	12
			Minimum Overlap	28	9	24	7	30	9	28	9
			Center-to-center	23	7	19	6	25	8	23	7
16	4.9	-30°	Edge-to-edge	46	14	40	12	50	15	46	14
			Minimum Overlap	28	9	28	9	32	10	30	9
			Center-to-center	23	7	21	6	25	8	25	8
18	5.5	-45°	Edge-to-edge	48	15	42	13	52	16	46	14
			Minimum Overlap	32	10	30	9	33	10	32	10
			Center-to-center	25	8	23	7	29	9	25	8
20	6.1	-45°	Edge-to-edge	52	16	48	15	55	18	52	16
			Minimum Overlap	33	10	34	10	39	12	36	11
			Center-to-center	27	8	28	9	32	10	29	9



Edge-to-edge coverage generally works well in fixed-location seating/standing scenarios and for installations on a tighter budget. It is appropriate for low-level background music. Center-to-center installations will have higher density and can accommodate people listening in many different positions and moving floor plans due to uniform coverage. They will also have fewer dead zones. If additional loudspeakers are required beyond what is included with the AudioPack Pro additional FS2SE loudspeakers can be added to the system, however, the loudspeakers will need to be set at a lower power level. For more precise results, and to adjust for obstructions, use a software design tool, such as Bose Professional Modeler, EASE, EASE Address, or EASE Evac.

Place the first loudspeaker at ½ LSD from any corner of the room. Continue to place loudspeakers along the wall at LSD. Supported room width can be up to 2× LSD, assuming loudspeakers are facing in from each opposing wall as shown.



The remaining loudspeakers are arranged on a square grid pattern using the LSD. After the last loudspeaker is placed, center the loudspeakers in that row to create new offset distances out from each corner, which may be unique from ½ LSD.

Calculate Loudspeaker Tap Values

The FreeSpace FS loudspeakers are compatible with 70-volt, 100-volt amplifiers like the IZA 190-HZ.

Use the Tap Charts to determine which loudspeaker tap is required for this design A. Locate the loudspeaker tap chart and find the column for mounting height for this design.

- B. Follow the column to the desired maximum SPL.
- C. Follow the row across the chart to determine the required loudspeaker tap.
- D. Calculate the required amplifier power:

$$\frac{\text{Number of Loudspeakers Required}}{\text{Required Loudspeaker Tap}} \times \text{Power Required} =$$

E. Calculate the required amplifier size:

$$\text{Power Required} \times \text{Headroom} \times 1.10 = \text{Amplifier Size}$$

FreeSpace FS2C Loudspeaker Amplifier Example	Maximum Loudspeakers at Higher Tap Settings	EQ Preset	Average SPL *
FreeSpace IZA 190-HZ	5 at 16W, 10 at 8W tap	FS2C/SE/P	87 dB at 16W, 84 dB at 8W

* 3 meter (10 foot) ceiling height room with edge-to-edge density, standing listener, 12 dB crest factor of pink noise/compressed music, direct-field, no room gain.

Tap Charts

Individual Loudspeaker Continuous Output Level

Note: The following tap charts assume standing ear height at 1.5 meters (5 feet) in minimum overlap spacing. Room reverberation could add as much as 4 dB system gain, which is not factored into the measurements. Designing without room gain will ensure you don't under-plan your design, and amp attenuation is possible at the job site if you exceed the average room SPL target during measurement. Values below 70 dB are omitted, select a higher tap.

FS2C

FS2C (standing listener height)														
Ceiling Height		m	2.4	2.7	3	3.7	4	4.3	5	5.5	6	6.7	8	9.8
		ft	8	9	10	12	13	14	16	18	20	22	26	32
TAP	1W		87	84	82	79	78	77	75	74	73	72	—	—
	2W		90	87	85	82	81	80	78	77	76	75	73	75
	4W		93	90	88	85	84	83	81	80	79	78	76	78
	8W		96	93	91	88	87	86	84	83	82	81	79	81
	16W		99	96	94	91	90	89	87	86	85	84	82	84
	8Ω		99	96	94	91	90	89	87	86	85	84	82	80
													dB-SPL	

Graph Paper

