What Gauge Speaker Cable Should I Use ?

by: Joe Ging, E.E.

<u>Note:</u> For very high quality and very high-powered low impedance speaker systems, locating the power amplifiers as close to the speakers as possible and using cable that is the largest gauge possible, can result in improved system frequency response and maximum sound pressure level. The wiring method just described, optimizes "Damping Factor" and other considerations, but this method is not practical for commercial / industrial paging, background music, and foreground music systems where the amplifier is typically located in a centralized location. For that reason, topics like "Damping Factor", are beyond the scope of this paper and only cable resistance and loss will be discussed.

Power Loss and Wire Length Table:

Speaker cable gauge selection is all about the power loss in the speaker cable that the system designer is willing to accept. Every speaker cable conductor has a resistance to current flow. The question is, how much power loss in the speaker cable is acceptable? For commercial/industrial paging, background music, and foreground music systems, Lowell Manufacturing recommends that a good "rule-of-thumb" is that speaker cable gauge be chosen so that less than 0.5dB of sound pressure loss (roughly 11% power loss) occurs as a result of loss in the speaker cable. The tables on page 2 can be used as a guide for the maximum distance from the amplifier that speakers can be placed for an approximate maximum 0.5dB loss in SPL (11% power loss) when using a particular wire gauge size with a given speaker load. Four separate tables are provided for 4, 8, or 16 ohm, 25V, 70.7V, and 100V speaker systems. Notice that the tables give the length of 2 wire copper cable, which means that the resistance in the sending conductor and the return conductor have both been taken into account. The tables are calibrated for the entire load to be at the maximum distance, but a good approximation for a string of speakers is to add up the total power load on that string of speakers and make sure that the total length of the string is not longer than the maximum length given in the table. With large loads and small gauge cable, the current in the cable can exceed the maximum allowed by the NEC (National Electrical Code). Notice in the lower right blackened section of the tables, the text "Not Recommended" indicates that the given power load for that gauge cable is not recommended by Lowell Manufacturing at any distance.

Low Impedance Speaker System Example:

Because of the low impedance of the voice coil of a 4Ω , 8Ω , or 16Ω speaker, a small amount of resistance in the speaker cable can eat up a large portion of the amplifier power. Cable distance should be kept as short as possible and cable gauge should be as large as possible for a low impedance speaker line to minimize the power lost. For an example using the "4-OHM, 8-OHM & 16-OHM" table on page 2: To install an 8 ohm speaker at a distance of 150 feet from the amplifier and not have a loss of more than 0.5dB (11% loss), 12 gauge speaker cable would be required.

25V, 70.7V, and 100V Speaker System Examples:

25V, 70V, and 100V speaker systems (by design) have reduced power loss in the speaker cable. When the sending voltage is increased, the current in the speaker cable is lower while delivering the same power to the speaker. Lower current means that less power is lost in the speaker cable. This is the same concept used by power utilities when they transmit AC power at very high voltages to reduce loss in the transmission lines. The voltage is then stepped down at the transformer outside of your house for your use. Note that separate tables are provided on page 2 for 25V, 70.7V, and 100V speaker lines.

Example: You design a system with a 70V string of speakers where adding up the power taps on all of the speakers totals 120 watts, and the total length of the speaker string is 260 feet. Looking at the 70.7V table on page 2, for a 125 watt load (always round your power up for the table), the allowable length for 16 gauge cable is 290 feet, so 16 gauge cable is sufficient. If that same system was a 100V system with a 120 watt load running in a string for 260 feet, looking at the 100V table on page 2 you would see that under the 125 watt load column, the allowable length of 18 gauge cable is is 360 feet, so 18 gauge cable is sufficient. In another example, for a 25V system with a total speaker load of 58 watts on a string that is 110 feet long, on the 25V table on page 2 you look at the 60 watt column, which says that 14 gauge cable can run 119 feet, so 14 gauge cable is sufficient. Note that a 25V system has much more loss in the cable than a 70V or a 100V system. The higher the system voltage, the lower is the loss in the cable.

Lowell Manufacturing Company • 100 Integram Drive • Pacific, Missouri 63069 U.S.A.					
Call: 800-325-9660	Fax: 636-257-6606	Click: www.lowellmfg.com	REV: 4-20-21		

4-OHM, 8-OHM, & 16-OHM SPEAKER LINES

2 WIRE COPPER SPEAKER CABLE LENGTHS FOR MAXIMUM 0.5dB LOSS IN SPL (11% POWER LOSS IN WATTS)

WIRE GAUGE	4 OHM SPEAKER LOAD	8 OHM SPEAKER LOAD	16 OHM SPEAKER LOAD	
10	120	240	480	
12	75	150	300	
14	50	100	200	
16	30	60	120	
18	20	40	80	
20	12.5	25	50	
22	8	16	32	

WIRE LENGTHS IN FEET

2 WIDE CORRER SREAKER CARLE LENGTHS FOR MAXIMUM A FOR LOSS IN SPL (119) ROWER LOSS IN WATTEN										
	7 5WL ood					125W Load	250WL oad		500W Load	
10	2 500	1 250	625	313	188	12377 Loau	23077 Load	400W Loau	34	
10	1.550	775	388	194	118	94	47	29	23	
14	950	475	238	119	75	56	28	18	14	
16	600	300	150	75	46	36	18	11		
18	375	188	94	47	29	23	11			
20	240	120	60	30	19	14				
22	150	75	38	19	12		Not R	lecomm	nended	
			WIR		HS IN FEI	ET				
						-				
	70.7 VOLT SPEAKER LINE									
2 WIRE 0		EAKER CABL	E LENGTHS	FOR MAXIN	IUM 0.5dB L	OSS IN SPL	(11% POWEI	R LOSS IN W	ATTS)	
WIRE GAUGE	7.5W Load	15W LOAD	30W LOAD	60W Load	100W Load	125W Load	250W Load	400W Load	500W Load	
10	20,000	10,000	5,000	2,500	1,500	1,100	550	365	275	
12	12,400	6,200	3,100	1,550	940	750	375	230	185	
14	7,600	3,800	1,900	950	600	450	225	140	110	
16	4,800	2,400	1,200	600	370	290	145	90		
18	3,000	1,500	750	375	230	180	90			
20	1,920	960	480	240	150	110	Not D) o o o m m	andad	
22	1,200	600	300	150	95		Not Recommended			
			WIR	E LENGT	HS IN FEI	ET				
			100 V			INF				
2 WIRE 0	COPPER SPE	EAKER CABL	E LENGTHS		UM 0.5dB L	OSS IN SPL	(11% POWEI	R LOSS IN W	ATTS)	
WIRE GAUGE	7.5W Load	15W LOAD	30W LOAD	60W Load	100W Load	125W Load	250W Load	400W Load	500W Load	
10	40,000	20,000	10,000	5,000	3,000	2,200	1,100	730	550	
12	24,800	12,400	6,200	3,100	1,880	1,500	750	460	370	
14	15,200	7,600	3,800	1,900	1,200	900	450	280	220	
16	9,600	4,800	2,400	1,200	740	580	290	180		
18	6,000	3,000	1,500	750	460	360	180			
20	3,840	1,920	960	480	300	220				
22	2,400	1,200	600	300	190		Not Recommended			

WIRE LENGTHS IN FEET

Lowell Manufacturing Company100 Integram DrivePacific, Missouri 63069 U.S.A.Call: 800-325-9660Fax: 636-257-6606Click: www.lowellmfg.com

Sheet: GSC Page 2 of 2 REV: 4-20-21