Easy Design™ Guide

What is Easy Design?

1 Select the correct type of speaker for the job *(see chart below)*

2 Find the number of speakers needed *(see charts on pages 6-8)*

3 Select the amplifier for the system *(see page 9)*

Armed with just 3 pieces of information, you can quickly create a bill of material for speaker paging jobs. Bogen's Easy Design line of products was created specifically to make the design process easier and less time consuming for the installer.

You supply some basic pieces of information – type of application, dimensions of the area to be covered, ambient noise level, and ceiling height*. Then, a few simple and direct charts will immediately provide you with the best type of speaker to use, the number of speakers needed, and the amplifier size required for the job.

* *Not all dimensions needed for all speaker types. Refer to section 2 for specific dimensions needed for each speaker.*

Each speaker in the Easy Design line is designed with a single power tap and a volume control. Any paging system you create using the Easy Design products will be flexible, robust, and powerful. If noise levels increase in the future, just turn up the volume controls on the speakers – the amplifier will not overload!

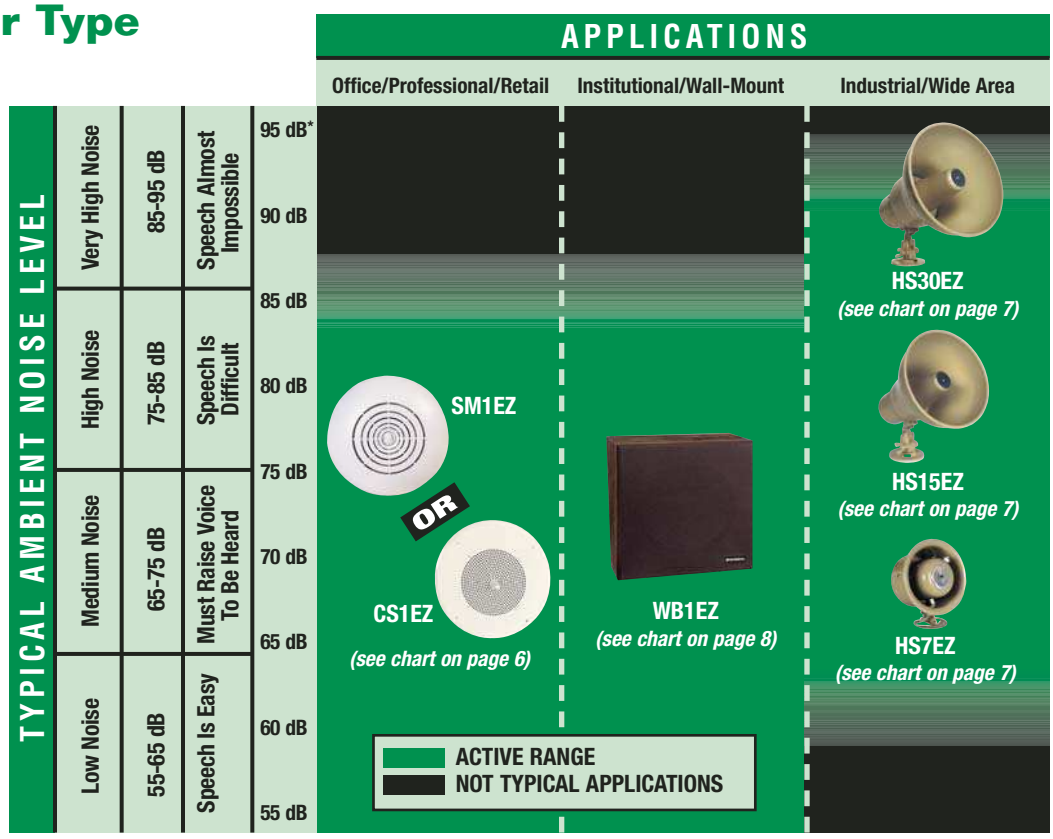
You get all the benefits of a 70V central-amplified system – full power capability, high-quality sound and performance, 2-wire installation, long speaker runs, flexibility in amplifier location, no distributed power supplies – and now, super simple system design (we've eliminated the multiple power taps). Easy Design speakers have the high-quality and reliability you expect from Bogen.

1 Select Speaker Type

- Determine the **ambient noise level** of the area in which the speakers will be installed.
- Select the **type of environment** in which the speakers will be installed.
- Crisscross these two characteristics on the chart to determine the **speaker(s) best suited** for the area.

Examples:

- A typical waiting room's ambient noise level is 60 dB and is considered a professional working environment. Crisscross these two characteristics and you can easily determine that the CS1EZ or SM1EZ ceiling speaker is the best speaker for the job.
- The ambient noise level in a machine shop in an industrial area is 90 dB. By referring to the chart, you will find that the HS30EZ horn loudspeaker is best suited for this environment.



*For applications over 100 dB, contact Bogen for assistance.

For applications with mixed noise levels, such as a location with quiet waiting rooms, medium noise level office areas, and very noisy manufacturing, select an appropriate speaker type for each different area.

Once you have selected the speaker type(s), the next step is to determine how many speakers you will need to cover the area sufficiently.

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Easy Design™ Guide (cont.)

2 Determine the Number of Speakers Needed

CS1EZ Ceiling Speaker
SM1EZ Surface-Mount Ceiling Speaker

Use this chart to determine the number of CS1EZ Ceiling Speakers and/or SM1EZ Surface-Mount Ceiling Speakers a particular installation will require, based on the dimensions of the area and the ceiling height.

RED for 8' Ceiling
BLUE for 10' Ceiling
GREEN for 12' Ceiling

Look Up SHORTER Dimension Of Area On This Side ↓ / Look Up LONGER Dimension Of Area On This Side →	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
20	1	2	3	4	5	6	6	7	8	9	10	10	11	12	13	13	14	15	16
	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10
	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7
30		4	5	6	7	8	10	11	12	13	14	15	17	18	19	20	21	22	24
		2	3	4	5	5	6	7	8	8	9	10	11	11	12	13	14	14	15
		2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	11
40			6	8	9	11	13	14	16	17	19	20	22	24	25	27	28	30	31
			4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
			3	4	4	5	6	6	7	8	8	9	10	11	11	12	13	13	14
50				10	12	14	16	18	20	22	24	26	28	29	32	33	35	37	39
				6	8	9	10	11	13	14	15	16	18	19	20	21	23	24	25
				4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	17
60					14	17	19	21	24	26	28	31	33	35	38	40	42	45	47
					9	11	12	14	15	17	18	20	21	23	24	26	27	29	30
					6	7	8	9	11	12	13	14	15	16	17	18	19	20	21
70						19	22	25	27	30	33	36	39	41	44	47	50	52	55
						12	14	16	18	19	21	23	25	26	28	30	32	33	35
						9	10	11	12	13	15	16	17	18	20	21	22	23	24
80							25	28	31	35	38	41	44	47	50	54	56	60	63
							16	18	20	22	24	26	28	30	32	34	36	38	40
							11	13	14	15	17	18	20	21	22	24	25	27	28
90								32	35	39	42	46	49	53	56	60	64	67	70
								20	23	25	27	29	32	34	36	38	41	43	45
								14	16	17	19	20	22	24	25	27	28	30	31
100									39	43	47	51	55	59	62	67	71	74	78
									25	28	30	33	35	38	40	43	45	47	50
									17	19	21	23	24	26	28	30	31	33	35
110										47	52	56	60	65	69	74	78	82	86
										30	33	36	39	42	44	47	50	52	55
										21	23	25	27	29	31	33	35	36	38
120											56	61	66	70	75	80	85	90	94
											36	39	42	45	48	51	54	57	60
											25	27	29	31	33	36	38	40	42
130												66	72	76	82	87	92	97	103
												42	46	49	52	56	59	62	66
												30	32	34	36	38	41	43	45
140													77	82	88	93	99	105	110
													49	53	56	60	63	67	70
													34	37	39	41	44	46	49
150														88	94	100	106	112	118
														56	60	64	68	72	76
														39	42	45	47	50	52
160															100	107	114	120	125
															64	68	72	76	80
															45	47	50	53	56
170																114	120	127	133
																72	76	81	85
																50	53	56	59
180																	128	134	142
																	81	88	90
																	56	60	63
190																		142	150
																		90	96
																		63	66
200																			156
																			100
																			70

Ceiling Speakers (CS1EZ, SM1EZ)

- Obtain the length, width, and ceiling height of the area.
- Look up where the **length** and **width** of the area meet on the chart.
- You will find three color-coded numbers. Use the **red** number for 8 ft. ceilings, **blue** for 10 ft. ceilings, and **green** for 12 ft. ceilings. The color-coded number that corresponds to the area's **ceiling height** is the general number of speakers the installation requires.

The **minimum amplifier power** needed (in watts) is equal to the total number of CS1EZ or SM1EZ speakers required in the area for uniform coverage.

Amplifier Power (min.) = Number of CS1EZ or SM1EZ Speakers

Example:

An office area, using CS1EZ ceiling speakers (or SM1EZ surface-mount ceiling speakers), is 100 feet long by 70 feet wide by 10 feet high. Crisscross the length (100 feet) and width (70 feet) on the chart. You will find three color-coded numbers – 27, 18, and 12. Since blue numbers are used for ceiling heights of 10 feet, 18 is the recommended quantity of CS1EZ speakers needed for this application. This number – 18 – is also the minimum amplifier power needed (in watts) for this area.

27
18

NOW, TURN TO PAGE 9 TO SELECT AMPLIFIER.

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Horn Loudspeakers (HS7EZ, HS15EZ, HS30EZ)

- Obtain the **square footage** of the area to be covered and its ambient noise level.
- Where the area's square footage intersects the area's **ambient noise level**, you will find two numbers.

The number in **blue** is the typical **number of horn loudspeakers** the installation requires. Additional speakers may be needed in areas that have obstructions, like shelving, that block sound dispersion.

The number in **red** is the **minimum amplifier power** needed (in watts) for the installation.

Amplifier Power (min.) = Number in Red

Example:

A factory has 35,000 square feet of open area and an average ambient noise level of 80 dB. Thus, it will require HS15EZ horn loudspeakers. Using the chart for the HS15EZ speaker, crisscross the square footage and the ambient noise level. The number of horn loudspeakers needed with an installation is shown in blue and the minimum amplifier power for this number of speakers is shown in red. As you can see, 6 speakers are needed for this application and the minimum amplifier power needed is 90 watts.

HS7EZ Horn Loudspeaker

Use this chart to determine the number of HS7EZ Horn Loudspeakers a particular installation will require, based on the size of the area and the ambient noise level of the environment.

HORN QTY. & MIN. POWER (WATTS) BASED ON AMBIENT NOISE		SIZE OF AREA TO BE COVERED (THOUSANDS OF SQUARE FEET)																			
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
55–65 dB Low Noise – speech is easy	HORNS	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10
	POWER	8	8	15	15	23	23	30	30	38	38	45	45	53	53	60	60	68	68	75	75
65–75 dB Medium Noise – must raise voice to be heard	HORNS	1	2	3	4	5	5	6	7	8	9	10	10	11	12	13	14	15	15	16	17
	POWER	8	15	23	30	38	38	45	53	60	68	75	75	83	90	98	105	113	113	120	128

The # in **blue** is the # of speakers.

The # in red is the minimum amplifier power required.

NOW, TURN TO PAGE 9 TO SELECT AMPLIFIER.

HS15EZ Horn Loudspeaker

Use this chart to determine the number of HS15EZ Horn Loudspeakers a particular installation will require, based on the size of the area and the ambient noise level of the environment.

HORN QTY. & MIN. POWER (WATTS) BASED ON AMBIENT NOISE		SIZE OF AREA TO BE COVERED (THOUSANDS OF SQUARE FEET)																			
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
75–85 dB High Noise – speech is difficult	HORNS	1	2	3	4	5	5	6	7	8	9	10	10	11	12	13	14	15	15	16	17
	POWER	15	30	45	60	75	75	90	105	120	135	150	150	165	180	195	210	225	225	240	255
85–95 dB Very High Noise – speech almost impossible	HORNS	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40
	POWER	30	60	90	120	150	180	210	240	270	300	330	360	390	420	450	480	510	540	570	600

The # in **blue** is the # of speakers.

The # in red is the minimum amplifier power required.

NOW, TURN TO PAGE 9 TO SELECT AMPLIFIER.

HS30EZ Horn Loudspeaker

Use this chart to determine the number of HS30EZ Horn Loudspeakers a particular installation will require, based on the size of the area and the ambient noise level of the environment.

For Applications over 100 dB, Contact Bogen for Assistance.

HORN QTY. & MIN. POWER (WATTS) BASED ON AMBIENT NOISE		SIZE OF AREA TO BE COVERED (THOUSANDS OF SQUARE FEET)																			
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
85–95 dB Very High Noise – speech almost impossible	HORNS	1	2	3	4	6	7	8	9	10	11	12	13	14	16	17	18	19	20	21	22
	POWER	30	60	90	120	180	210	240	270	300	330	360	390	420	480	510	540	570	600	630	660

The # in **blue** is the # of speakers.

The # in red is the minimum amplifier power required.

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Easy Design™ Guide (cont.)

2 Determine the Number of Speakers Needed (cont.)

WB1EZ Wall Baffle Speaker

Use this chart to determine the number of WB1EZ Speakers a particular installation will require, based on the dimensions of the area.

Look Up SHORTER Dimension Of Area On This Side ↓ / Look Up LONGER Dimension Of Area On This Side →	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200
20	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	6
30	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	
40	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13		
50	4	5	6	7	8	8	9	10	11	12	12	13	14	15	16	17			
60	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20				
70	8	9	11	12	13	14	15	16	18	19	20	21	22	23					
80	11	12	13	15	16	17	19	20	21	23	24	25	27						
90	14	15	16	18	20	21	23	24	26	27	28	30							
100	17	18	20	22	23	25	27	28	30	32	33								
110	20	22	24	26	28	29	31	33	35	37									
120	24	26	28	30	32	34	36	38	40										
130	28	30	33	35	37	39	42	44											
140	33	35	37	40	42	45	47												
150	33	40	43	45	48	50													
160	43	45	48	51	52														
170	48	52	54	56															
180	54	58	60																
190	60	64																	
200	66																		

Wall Baffle Speaker (WB1EZ)

- Obtain the **length** and **width** of the area.
- Where the length and width of the area crisscross on the chart, you will find the typical **number of speakers** the installation requires.

The **minimum amplifier power** needed (in watts) is equal to the total number of WB1EZ speakers required in the area for uniform coverage.

Amplifier Power (min.) = Number of WB1EZ Speakers

Example:

An area's dimensions are 150 ft. long by 110 ft. wide. Crisscross these two dimensions on the chart and you will find that 28 WB1EZ wall baffle speakers are needed for this application. This number – 28 – is also the minimum amplifier power needed (in watts) for this area.

Mixed Speaker Type Applications

For applications with more than one type of speaker:

- Determine the number of speakers and the minimum amplifier power needed for each type of speaker separately.
- Add together the minimum amplifier power needed for each type of speaker to obtain the **minimum amplifier power** needed for the **entire application**.

Example:

An application requires 10 SM1EZ surface-mount ceiling speakers (minimum amplifier power needed is 10 watts), 5 HS15EZ horn loudspeakers (minimum amplifier power needed is 75 watts), and 10 WB1EZ wall baffle speakers (minimum amplifier power needed is 10 watts). Add together the minimum amplifier power needed for each type of speaker: 10 watts + 75 watts + 10 watts. The sum is 95 watts. This is the minimum amplifier power needed (in watts) for the entire application.

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3 Select an Amplifier

Once you determine the number of speakers and the minimum amplifier power for the installation, you are ready to select the system amplifier. A 70V paging amplifier is very easy to select.

- Locate amplifiers on the chart that have a **wattage equal to or higher** than the minimum amplifier power of your application. (Amplifiers with power capacities greater than this number will not damage the speakers. The extra power available is simply not used.)
- Determine the **amplifier features** needed for the application (see the *Site Survey Check List* on page 56 and the *Glossary of Amplifier Features* on page 57).
- Using the chart on page 66, **find an amplifier** that offers these features. As long as the wattage of the selected amplifier is equal to or higher than the minimum amplifier power, the amplifier will work well for the application.

If you think the application's system may need to expand in the future (this is often the case with new constructions and relocating companies), you may want to select an amplifier with a greater power capacity now.

Example:

An application requiring 18 CS1EZ Ceiling Speakers requires a minimum amplifier power of 18 watts, so an amplifier with a power rating of 18 watts minimum is needed. Now, look at the chart on page 66 to determine which amplifiers provide the necessary wattage to drive the speakers as well as provide the amplifier features that are most appropriate for the installation. Since the minimum wattage needed is 18, the amplifier with the lowest power usable for this installation is 20 watts (model C20). However, if the C20 does not have the features required for the application, such as bass and treble controls, you can select any amplifier of greater wattage that offers the specific features. For instance, you might select the TPU35B or C35. Both of these amplifiers have a higher wattage than the application's minimum amplifier power needed and provide the desired features because they have bass and treble controls. Either of these amplifiers will work well for this application. Plus, there is room to expand the system on a 35W or higher amplifier without the need to purchase an additional amplifier in the future.

The Amplifier Features Chart outlines the features and power ratings of Bogen amplifiers that can be used for a variety of application needs. For complete chart, see page 66.

A POWER
Locate a power rating that is higher than the application requires (allowing for future system expansion).

B FEATURES
Find the amplifier features that the application requires.

Amplifier Power Rating/ Channel	Model Numbers	Amp Channels	Input Types					Signal Processing						Music Muting							Mounting			Page Number
			Tel Input* 600-ohm Balanced	Mic Inputs* Lo-Z Balanced	Aux Inputs* Hi-Z Unbalanced	Balanced Inputs Hi-Z	Modular Inputs	Aphex Aural Exciter	Loudness Contour	ALC	EQ	Bass/Treble	Tone Control	Variable Mute	Auto Mute	Manual Mute	MDH Output	Night Ringer	Remote Volume	Output Meter	Wall Mount	Shelf Mount	Rack Mount	
1.5W	GA2	1			1																			26
6W	GA6A	1		1	1								●									●		26
10W	C10	1	1	2 (1)	0 (1)								●		●	●						●	●	26
10W	C10MOH	1	1	2 (1)	0 (1)								●		●	●	●					●	●	26
15W	TPU15A	1	1		1					●			●		●			●				●		30
20W	C20	1	1	2 (1)	0 (1)								●		●	●						●	●	26
20W	C20MOH	1	1	2 (1)	0 (1)								●		●	●	●					●	●	26
35W	C35	1	1	2 (1)	1 (2)							●			●	●							●	26
35W	GS35	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●				●	25
35W	TPU35B	1	1	1	1			●		●		●		●	●	●		●			●			30
35W	V35	1	●	●	●	●	8			●	●	●		●	●	●			●	●		●	●	22
60W	BPA60	1			●																	●	●	29
60W	C60				1 (2)										●							●	●	26

C MODEL NUMBER
Select the amplifier model(s) best suited for your application.

D REFERENCE PAGE
Turn to the page number indicated for more information about the product you need.

COMPLETE CHART ON PAGE 66

Easy Design™ Is Easy!

That's all it takes to design a robust, high-quality paging system with Bogen's Easy Design line.

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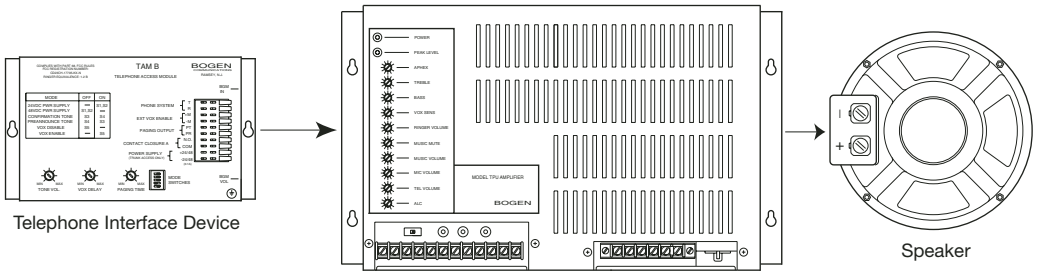
What Is A 70V System?

70V Paging Systems consist of:

• **A Centralized Amplifier** which offers a variety of features to enhance voice and music reproduction as well as easy system expansion.

• **Speakers** that connect with a simple 2-wire installation because the power is supplied from the centralized amplifier.

• **An Interface Device** that connects the paging system to the telephone system. (Depending on the telephone system and amplifier, an interface device may not be needed.)



Why Use 70V Outputs?

Low Currents Allow Long Runs

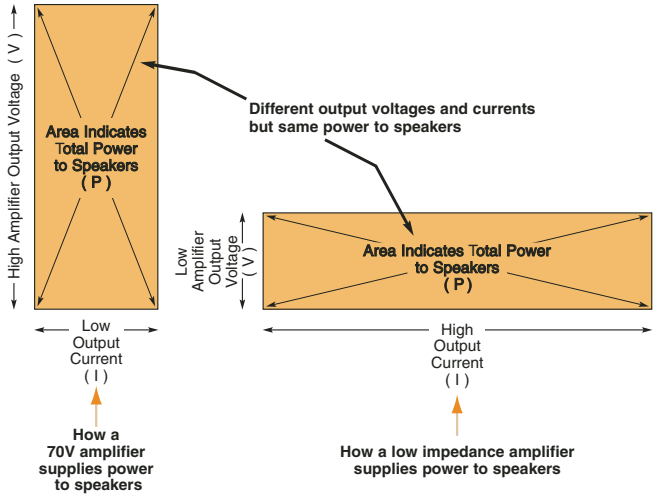
Why do distributed sound systems use centralized amplifiers with 70V output signals? Because 70V systems can handle extremely long lengths of wire to connect the speakers to the amplifier, and they can power a large number of speakers in each system.

When sending power signals over long distances, it is important to minimize the amount of current flowing in the wire. High currents allow too much power, or electrical energy, to be wasted in wires in the form of heat.

The power provided to a load (for example, a speaker) is equal to the voltage multiplied by the current.

P = V x I
(Power) (Voltage) (Current)

Therefore, to reduce the amount of power wasted in wires (and thus, to reduce heat), increase the voltage and decrease the current. This is where 70V systems come in – they use a higher voltage and a lower current, thus reducing the amount of electrical energy wasted in wires without generating heat in wires. By decreasing the current by a factor of two, the power loss in the wire drops 4 times.



Easy To Control Speaker Power Draw

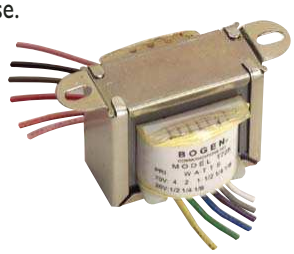
The output of a central paging amplifier is designed to limit the maximum output voltage that can be supplied to the speakers. This maximum output voltage remains the same regardless of the amplifier's power capacity. Because the output voltage is limited, speaker manufacturers can design products that consume a specific amount of power from the amplifier. This is beneficial in two ways.

First, the speakers will not consume more power than they are designed for; so, they cannot blow out from using an amplifier that's too powerful. Second, since each speaker's power consumption is known, the correct amplifier power for the paging system is simply the total power drawn by all the speakers.

What Makes A 70V Speaker?

Step-Down Transformer

70V paging speakers have a step-down transformer, which is used to convert the high-voltage/low-current amplifier signal of the central paging amplifier to the low-voltage/high-current signal that speakers use.



Taps

The primary side of the step-down transformer (the side that connects to the amplifier) has a number of connections (called taps or power taps) that can be used to select the peak power the speaker will consume from the amplifier.

Why Taps?

The selection of the power tap has an effect on both the amplifier power needed for the system and the volume of the speaker. The more power a speaker consumes, the louder the sound from the speaker. By tapping speakers for lower power in quiet areas and for higher power in noisier areas, the sound level of the paging system can be controlled and balanced.

It is important that speakers be tapped correctly for the area that they will be used in. Setting all the speakers for the same power regardless of the amount of noise in different areas will cause balance problems. If the amplifier is adjusted to produce adequate paging levels in the noisy areas, the paging levels in the quiet areas will be too loud or vice versa. Selecting the proper tap setting is not difficult, but it does require knowing the level of ambient noise in different areas. (See *Sound Pressure Levels Chart* on page 65.)

Of course, the best way to determine how effectively a system covers an area is to test it. Never install a paging system and leave the site without testing it. Sound adjustments or additional speakers may be needed. Some paging equipment, such as Bogen's PCM2000, include a test tone that is sent to all speakers in the system so installers can check the system installation. For other systems, the installer can have pages made while the installer walks the area to listen for appropriate sound levels and uniform coverage of the system to find out if and where adjustments need to be made, and to make sure that all speakers are properly connected.

Easy Design™ Without Taps

To make designing paging systems as easy as possible, Bogen offers a line of Easy Design™ speakers. These speakers do not require tapping and allow for on-the-fly adjustment of speaker paging levels. All the information that is needed to design a complete system are the dimensions of the different paging areas and the type of environment. With this basic information, you can use the Easy Design speaker line to quickly design a robust, professional, and powerful paging system. (See pages 3-9 for more information.)

Other Speakers

Low Impedance

Low impedance speakers are designed to be located close to the amplifier and require large amounts of current at relatively low voltages. This type of speaker cannot be used with the 70V outputs of central paging amplifiers because it does not have the necessary step-down transformer. However, many Bogen paging amplifiers do provide outputs compatible with low impedance speakers. Low impedance speakers are also very limited as to the number of speakers that can be connected to the amplifier. If too many speakers (sometimes as few as 4) are added, the amplifier will quickly overload.

25V Special Installations

Paging speakers with step-down transformers sometimes have provisions to be used with amplifier outputs that provide 25V signals instead of 70V. The operation of these speakers and the way that they are applied in paging systems are identical to 70V speakers. The reason for the lower voltage is based on certain types of installations where the use of the lower 25V amplifier output signal is preferred.

Amplified Speakers

Amplified speakers have a self-contained amplifier in each speaker with just enough capacity to power the speaker to its rated output level. These speakers require 4 wires to be connected to each speaker – 2 wires for the DC power that the internal amplifier consumes and 2 wires to carry the low level signal that is to be amplified. Amplified speakers operate off of 24V power supplies. Depending on the number of speakers or distance between speakers, several power supplies may need to be positioned at different locations throughout the paging area. Amplified speakers also require the use of an input controller that conditions the input signals for the system so that they are compatible with the requirements of the amplified speakers.

70V Centralized Paging Amplifiers

Benefits of Using 70V Centralized Paging Amplifiers

Centralized amplifiers are extremely compact and comprehensive pieces of electronics because they provide:

• **Multiple Features** – They include provisions for numerous input styles for different music and paging sources, multiple output types, and various tone and level control features.

• **2-Wire Installation** – One of the most convenient aspects of centralized amplifier systems is the simple 2-wire connection to all the paging speakers. And accidentally reversing the speaker wire connections is not harmful to the electronics and typically has little or no effect on system operation.

• **One Package Amplifier** – This single piece of equipment contains all the electronics needed for a basic paging system, making it quick and easy to install as well as more reliable. Centralized amplifiers, unlike amplified speakers, contain all the various circuits needed for paging – signal conditioning, amplification, power supplies, and heat control – built into one package. All these items are designed to work together as a single piece of equipment and provide clean, smooth audio power to the speakers. You get exactly what you need – without having to research and price out the different electronics components required for amplified speaker systems.

• **Full Power** – Centralized amplifiers are designed to deliver their full-rated power to the paging system. All the electrical components are designed to meet the published full power output specifications.

Amplifier Output Types

70V Output

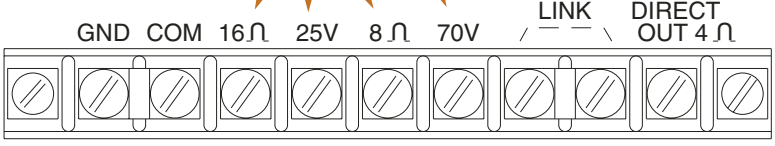
A 70V output is available on Bogen amplifiers and is the primary type of output for paging systems. A step-up output transformer in the amplifier provides the high 70V output signal. All speakers with step-down transformers (rated for 70V systems) are connected to this output.

Other Output Types (25V, 16- and 8-ohm)

There are a number of other standard speaker impedances that Bogen amplifiers can be connected to. These outputs provide the correct speaker signal levels for different configurations of low impedance speakers. The lower voltage, 25V, output is provided on many Bogen amplifiers for use in paging installations that require a speaker voltage of less than 70V to meet building code requirements.

Direct Output

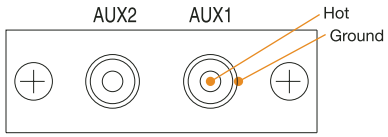
Direct outputs are used with low impedance speakers. These outputs have an exceptional low frequency (bass) response, providing the fuller sound that low impedance speakers can reproduce. Certain Bogen amplifiers, designed for general purpose sound reinforcement applications, include this feature which allows the step-up output transformer to be bypassed for direct connection to the power amplifier's output.



Amplifier Input Types

Auxiliary Input (AUX)

The Auxiliary input is the most common type of input used in paging. This input is designed to connect to most music sources, such as a CD player or tuner. Usually the connector for such an input is a Phono jack (also called an RCA jack). It connects to other equipment using standard audio cables.



Phono (RCA) Input Jacks

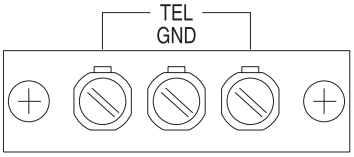
The Aux input has an outer connection that is directly connected to the equipment's ground and a center connection that is the "hot" input. Aux inputs, sometimes referred to as Hi-Z or high impedance inputs, have a high input impedance so that they won't put too much of a load on the source equipment's output. This type of input is "unbalanced". You must use shielded cable with this type of input in order to avoid getting noise induced into the system.

Normally, connections between source equipment and the amplifier's Aux input should not be too long, about 6 feet. The problem with long connections is that the cable acts like an antenna, picking up any electrical noise in the area. The longer the cable, the more noise that is picked up.

Telephone Input (TEL)

The Tel Input is so named because it was designed to be compatible with page port outputs of telephone systems. The Tel input is a 600-ohm transformer-coupled input that:

- matches the impedance of the telephone port to provide proper interfacing
- electrically isolates the amplifier from the PBX or Key System
- provides a balanced input with a great deal of noise immunity



Telephone Input Screw Terminals

Bogen's Tel inputs do not have to be shielded, but it is always a good idea to provide more noise immunity (normally a ground terminal is available on the input for the shield connection). Higher noise immunity allows the amplifier to be located much farther away from the source equipment than what an unbalanced input will allow.

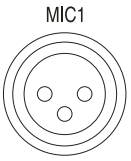
The input transformer is not designed to pass loop current from a telephone line. Any time you want to connect to a telephone station or trunk port, you will need to use a telephone interface module like the TAMB, which converts the telephone signal into a "dry" audio signal compatible with the amplifier's Tel input.

Microphone Input (MIC)

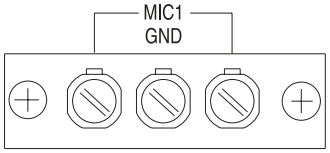
The traditional paging amplifier input is the Microphone input. Mic inputs were the primary announcement source until connection to the telephone system became possible. Mic inputs are still used in public address applications today.

When connected properly, a microphone can be hundreds of feet away from the amplifier and still provide clear, quiet audio.

Mic inputs are the most sensitive of all the amplifier inputs and tend to pick up the stray electrical noise in an area. To combat the noise pickup problem, Mic inputs are balanced. Just like Tel inputs, the balancing of the input provides a high level of noise immunity. Mic inputs are also made to have a fairly low input impedance, which makes it difficult for electrical noise to get induced. The low impedance effectively keeps down noise, which makes its signal level smaller.



Balanced Microphone "XLR" Type Connector



Balanced Microphone Screw Terminals

Microphone cable is always shielded. The input requires 3 connections – two for the balanced signal and one for the shield ground. You can reverse the balanced signal leads and the system will still work properly. However, if you mis-wire the ground connections, the amplifier can become unstable and start to oscillate. When this occurs, the amplifier may heat up enough to cause its protection circuits to shut it down or it may produce very distorted sound.

Site Survey

Designing a system and determining an installation's requirements are quite simple. After you set up your first system, the steps will appear logical and soon the process will become routine.

Before you begin designing or quoting a job, you will need some basic information regarding the site and the end-user's needs. Use the *Site Survey Check List* below to ensure that you collect all the information you will need to complete the design of the paging system. When you have completed the check list, refer to the *Easy Design™ Guide* (pages 5-9), or the multi-tap design section (continue on page 58), to create a bill of material for the equipment you need for the installation's sound system.

Tools Needed

You will need to bring the following tools with you when you visit the installation site:

- measuring wheel/tape measure
- sound pressure meter
- calculator
- Bogen Products catalog
- Photocopies of *Site Survey Check List* (this page)

Obtain a copy of the floor plan, or create sketches of any areas that may require special design considerations (high shelving, speaker mounting locations, exposed beams, amplifier location, etc.).

A successful paging system depends on more than just understanding the physical requirements of the installation site, it also depends on knowing which special paging features the user will benefit from and use on a daily basis. These include zone paging, tone controls, night ringer, feedback elimination, ambient noise sensors, multiple inputs, etc.

Site Survey Check List

Photocopy, Print from the Web, or Order in Packs of 25

This *Site Survey Check List* will help to determine the paging system equipment needed for installations. Photocopy this page and bring it with you when you visit installation sites. You may need several copies of this chart for each installation.

Section I – *System Needs* concerns the requirements of the entire installation.

Section II – *Specific Area Needs* concerns specific areas within the installation.

I. *SYSTEM NEEDS*

Note: Installations that contain areas with different style environments or sound levels may require Section II to be filled out separately for each area. Be sure to make enough photocopies of this page for this purpose.

a. **What Type of Telephone Port Will Be Available for Connection to the Paging System?** *(see page 64)*
❑ Loop Start ❑ Ground Start
❑ Page Port ❑ Analog Station Port
❑ Other: _____

b. **How Many MIC Inputs Needed?** _____ *(see page 55)*

c. **How Many AUX Inputs Needed?** _____ *(see page 55)*

d. **Is Zone Paging Required?** ❑ Yes ❑ No *(see pages 34-36)*
If yes, how many zones: _____

e. **Is Talk Back Required?** ❑ Yes ❑ No *(see page 39)*
If yes, in individual zones? ❑ Yes ❑ No *(see pages 34-35)*
If yes, system-wide (no zones)? ❑ Yes ❑ No *(see page 39)*

f. **Is Group Paging Required?** ❑ Yes ❑ No *(see pages 34-36)*

g. **Are Time Tones Needed to Signal Shift Changes?**
❑ Yes ❑ No *(see page 38)*

h. **How Can the Amplifier Be Mounted?**
❑ Rack ❑ Wall ❑ Shelf

i. **Amplifier Features Needed** *(refer to Glossary on page 57 for description of features):*
❑ Aphex™ Aural Exciter ❑ Variable Loudness Contour Control
❑ Automatic Level Control (ALC) ❑ Graphic Equalizer
❑ Bass & Treble Controls ❑ Variable Mute
❑ Automatic Mute ❑ Manual Mute
❑ MOH Output ❑ Night Ringer

II. *SPECIFIC AREA NEEDS*

a. **Area Name/Description:** _____

b. **Area Dimensions:**
Length _____ ft. Width _____ ft.
Square Footage _____ sq. ft. Ceiling Height _____ ft.

c. **Ambient Noise Level:** _____ dB
(to estimate, see chart on page 65)

d. **Will There Be Large Changes in Ambient Noise Levels in the Area?** ❑ Yes ❑ No *(see page 38)*
If yes, note range: _____ dB to _____ dB

e. **Environment:**
❑ Office/Professional/Retail Store ❑ Factory/Industrial
❑ Institutional/Remote Public Area ❑ Warehouse
❑ Aisles created by high storage racks ❑ Hallways
❑ Cafeteria/Break Room ❑ Auditorium
❑ Loading Docks/Outdoor Areas ❑ Other: _____

f. **Where Will the Speakers Be Placed?**
❑ Indoors ❑ Outdoors

g. **How Can the Speakers Be Mounted?**
❑ Suspended/Drop Ceiling* ❑ Wall**
❑ Beams, Columns, Other Structures ❑ Ground

** Make note of any changes in surfaces or positions for actual speaker mounting.*
*** Make note of any changes in wall angles, surfaces, or height.*

h. **Are Volume Controls Mounted on Each Speaker Needed?**
❑ Yes ❑ No

i. **Are Wall-Mounted Attenuators Needed for Area's Volume Control?** ❑ Yes ❑ No *(see page 20)*

j. **Is Feedback Elimination Equipment Needed?** ❑ Yes ❑ No *(see page 39)*

k. **Is Background Music Needed?** ❑ Yes ❑ No
If yes, BGM source: *(see pages 41-43)*
❑ Tuner
❑ Tape Player/Tuners
• Antenna Available for tuners? ❑ Yes ❑ No
❑ CD Player ❑ Other: _____

Glossary Of Amplifier Features

ALC (Automatic Level Control)
Automatically adjusts the amplifier's output level to ensure a consistent paging level. ALC keeps loud voices from booming out of the paging system's speakers and allows people with weak voices to be clearly heard. It also enhances intelligibility in difficult acoustic environments.

Aphex® Aural Exciter
Regenerates the high-frequency harmonics lost during the amplification process through the handsets and speakers, and adds them back to the audio signal. This results in increased intelligibility and presence, greater perceived loudness (without increasing power), and reduced listener fatigue.

Automatic Mute
An audio-activated (VOX) circuit detects a page announcement and automatically mutes background music during a page. This feature typically includes a VOX sensitivity control (see VOX Sensitivity) to prevent paging line noise from muting the background music accidentally.

AUX Inputs (See page 55.)

Back-Slope™ AC Voltage Stabilization
Assures consistent performance and reliability by regulating the proper amount of AC energy to the amplifier's power toroid, as AC line voltages rise and fall (up to 10%), thus maintaining maximum performance. This also prevents damage to the amplifier over varying line voltages and load conditions.

Bass & Treble Controls
Separate bass and treble controls allow greater control of the high and low frequency response of the paging system. High or low frequencies can be cut or boosted to enhance intelligibility or to make the system sound more natural.

Clipping
A form of distortion caused by cutting off the peaks of audio signals. Clipping usually occurs in the amplifier when its input signal is too large or when the voltage rails of the amplifier's power supply cannot deliver the necessary voltage to the amplifier's output.

Cross-Talk
Unwanted coupling of one audio channel into another, or when some portion of a signal from a music source that you are not listening to leaks into the circuit of the source that you are listening to.

Distortion
Inexact reproduction of an audio signal.

Equalizer
Boosts or cuts specific audio frequency bands to smooth out system response or eliminate acoustical feedback (squealing). Improves intelligibility, restores naturalness of sound, and increases usable power. Slide controls adjust amount of cut or boost in each frequency band and create a graphical representation of the system frequency response.

Frequency Response
How consistently the signal is produced over a given range of frequency. Usually expressed as a specific range (45 Hz to 17 kHz, for example) and combined with a plus/minus decibel figure (±) indicating how much variation, in the amount of output signal, the device may introduce over that range of frequencies. The audible range is considered to be 20 Hz - 20 kHz.

Gain
Amount of signal amplification, usually expressed in decibels. The relative change in voltage, current, or power to the same reference voltage, current, or power, from input signal to output signal.

Limiter
A circuit that restricts the maximum level of a signal.

Manual Mute
External contacts can control the muting of music or auxiliary inputs.

MIC Inputs (See page 55.)

MOH Output
Provides music or message program to telephone callers placed on hold. Only the signal applied to the Aux input (typically background music) is amplified and sent to the MOH outputs (no paging announcements are heard). MOH outputs have their own output level control. (See page 26.)

Night Ringer
Triggered by an external contact closure or by 90V ring signal from the telephone line, the night ringer mutes background music and sends an electronic tone through the paging system's speakers. It functions as an after-hours night bell, to alert personnel working late of incoming calls, or to signal security guards. (See page 39.)

Power MOSFET Circuitry
Type of transistor technology that provides superior performance and reliability in power amplifiers.

Sensitivity
The minimum input required to reach a specific output level.

Signal-to-Noise (S/N)
The ratio, usually expressed in dB, between the equipment's noise floor (the minimum noise level produced by the equipment itself) and the desired signal.

Switch-Selectable Input
Select one of two different input types for an input channel. For example, a Mic/Tel switch-selectable input can act as either a microphone input or a telephone input depending on the needs of the application.

TEL Inputs (See page 55.)

Tone Control
Subtly enhances audio output by boosting or cutting the high frequency response to make the output sharper (more intelligible) or more natural.

Variable Loudness Contour Control
Follows the psychoacoustic curves of hearing and enhances the low and high frequency response to increase the fullness of music usually lost at low volume.

Variable Mute
Controls the amount of background music that is heard during a page. The level can be adjusted from no suppression of the background music to full suppression (no background music) during page announcements. After the page has finished, the music gradually returns.

VOX Sensitivity
Allows adjustment of the threshold of audio activity necessary to automatically mute background music. Adjusts the trip level so that noise on the paging input will not falsely mute the background music. VOX-threshold sensitivity can be adjusted so only real signals are picked up.

Specifying Equipment

Determine Speaker Types

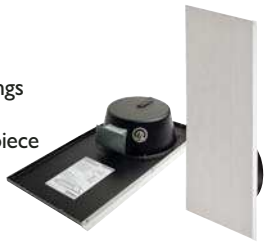
CEILING SPEAKERS

Recessed Ceiling Speakers

- Pre-assembled for faster installation in suspended ceilings
- For paging and background music on 25V and 70V systems
- Single-tap *(page 4)* or multi-tap models *(page 10)*

Easy Install® Surface-Mount Speakers

- Installs in seconds; use in suspended ceilings
- Surface mount; no need to cut ceiling tiles
- For paging and background music on 70V systems
- Single-tap or multi-tap models *(page 3)*



Drop-In Ceiling Speaker

- Installs fast and easy in suspended ceilings
- For voice and paging reinforcement
- Integral support rail attached for one-piece installation
- For 25V and 70V systems *(page 12)*

High-Fidelity Ceiling Speaker

- Use in suspended or hard-surfaced ceilings
- Quality hi-fi audio from coaxial drive; for music and speech
- Large back can and dual vents provide deep bass response
- For 16-ohm, 70V & 100V systems *(page 2)*

NEAR® Orbit Ceiling Speaker

- Use in suspended or hard-surfaced ceilings
- Coaxial NEAR metal-alloy driver technology for excellent quality music and speech reproduction
- Wide frequency response and dispersion
- For 16-ohm, 70V & 100V systems *(page 16)*

PENDANT SPEAKERS

NEAR® Orbit Pendant Speakers

- For use in open areas; large cabinet volume and dual vents for exceptional bass
- Secure mounting from above
- Coaxial NEAR metal-alloy driver technology for excellent quality music and speech reproduction
- For 16-ohm, 70V & 100V systems *(page 17)*

HORN LOUDSPEAKERS

Horn Speakers

- For large coverage areas and noisy environments, indoors or outdoors
- For paging and voice reproduction
- Weatherproof for all types of environments
- Single-tap *(page 4)* or multi-tap models *(page 13)*
- For 8-ohm, 25V, 70V, or 100V systems

CABINET SPEAKERS

NEAR® A-Series Speakers

- Fully-sealed cabinet for indoor or outdoor applications
- High-precision, high-performance sound
- Weatherproof durability; rugged construction withstands all environmental conditions
- NEAR metal-alloy driver technology
- For 8-ohm and 70V systems *(page 18)*

FG-Series

- For indoor wall-mount applications
- Delivers high-quality foreground audio and background music
- For 8-ohm and 70V systems
- 2-way speakers (woofer/tweeter) *(page 15)*

Wall Baffle Speakers

- Pre-assembled for fast and easy wall-mount installation
- For paging and background music
- Simulated walnut-finished wooden enclosure with black grille cloth
- Single-tap *(page 4)* and multi-tap models for 25V and 70V systems *(page 12)*

Sound Columns

- For indoor installations with large coverage areas
- Highly directed sound projection for speech or background music
- For 8-ohm systems *(page 15)*
- Simulated walnut cabinet with black grille

LANDSCAPE SPEAKERS

NEAR® Rock Speakers

- For landscaped outdoor environments
- Completely weatherproof
- NEAR metal-alloy driver technology in a heavy, rugged, realistic looking rock enclosure
- For 8-ohm and 70V systems
- Sandstone or granite finish; vertical or horizontal orientation *(page 19)*

REMOTE CALL SPEAKERS

Vandal-Resistant Speakers

- For speech communication in locations subject to damage and destruction
- Four layers of defense include steel guards and water-resistant cone
- Available with unbreakable metal call-button
- For 8-ohm or 25V systems *(page 20)*

BOGEN® PHONE OR FAX YOUR ORDER, TOLL-FREE! TEL: 1-800-999-2809 • FAX: 1-800-999-9016

Determining Quantities

1 Determining Quantities

Figuring out how many speakers you need for your application is simple. Basically, you only need the dimensions of the area in which the paging system will be installed.

- For Bogen's Easy Design™ line speakers, refer to the charts on pages 6-8.
- For speakers with multiple tap settings, refer to this section for information.

CEILING SPEAKERS

Models CSD1X2, SM4T, S86/S810T725PG8W and variations.

To determine the number of ceiling speakers your installation requires, simply divide the area's total square footage by the speaker coverage as indicated in this chart.

Ceiling Height (ft.)	Coverage (sq. ft.)
8	250
10	400
12	580
14	780

Total Area (Sq. ft.) ÷ Speaker Coverage = # of Speakers

WALL BAFFLE SPEAKERS

Models WBS8/S810T725 & variations.

To determine the number of wall baffle speakers your installation requires, simply divide the area's total square footage by 600 square feet.

Coverage is 600 sq. ft. per speaker

Total Area (Sq. ft.) ÷ 600 Sq. ft. = # of Speakers

HORN LOUDSPEAKERS

Models SPT5A/15A/30A.

To determine the number of horn loudspeakers your installation requires, simply divide the area's total square footage by the speaker coverage as indicated in the chart below.

See chart below

Total Area (Sq. ft.) ÷ Speaker Coverage = # of Speakers

2 Determining Taps

To determine tap settings, use the appropriate chart.

Recommended Ceiling Speaker Tap Settings

Ambient Noise Range	Ceiling Height (ft.)			
	8	10	12	14
Low Noise (55 dB-65 dB)	1/2W* 1/4W+	1/2W* 1/4W+	1W	1W
Medium Noise (65 dB-75 dB)	1W* 1/2W+	1W* 1/2W+	2W	4W
High Noise (75 dB-85 dB)	4W			
Very High Noise (85 dB-95 dB)				

*SM4T Tap Settings +S86/S810 Tap Settings

Recommended Wall Baffle Tap Settings

Ambient Noise Range	Tap Setting
Low Noise (55 dB-65 dB)	1W
Medium Noise (65 dB-75 dB)	4W
High Noise (75 dB-85 dB)	
Very High Noise (85 dB-95 dB)	

Recommended Horn Tap Settings

	Ambient Noise Range	Speaker Power Taps (Watts)	Coverage (sq. ft.)
SPT5A	Low Noise (55 dB-65 dB)	1.25W	6,500
	Medium Noise (65 dB-75 dB)	7.5W	6,500
SPT15A	Medium Noise (65 dB-75 dB)	.9W	7,000
	High Noise (75 dB-85 dB)	3.8W	6,500
	Very High Noise (85 dB-95 dB)	15W	2,500
SPT30A	High Noise (75 dB-85 dB)	3.8W	7,000
	Very High Noise (85 dB-95 dB)	30W	5,500

3 Determining Amplifier Power

To determine the total power your installation will require, simply multiply the number of speakers by the tap wattage.

Total Speakers × **Tap Wattage** = **Minimum Amplifier Power**

Amplifier Selection

Once you know the minimum amplifier power your system requires, refer to the *Amplifier Selection Charts* on pages 66-67.

To assist with selection of amplifier features, refer to the *Glossary of Amplifier Features* on page 57.

Speaker Layout

The layout of the speakers should be planned before installation begins. The spacing of the speakers can be adjusted so that the speakers are evenly spaced in a row. Some adjustments may need to be made due to sound obstructions that may be in the area such as high shelving, cubicle walls, etc.

Ceiling Speakers

Layout starts in one corner of the area. The first speaker should be positioned from each wall a distance approximately equal to the ceiling height of the room (dimension A).

The next speaker in row 1 should be spaced a distance approximately equal to twice the height of the ceiling (dimension B). Each additional speaker in the row should use this same spacing.

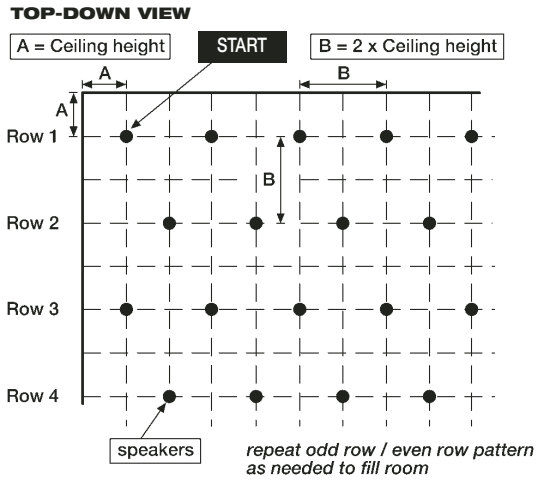
Row 2 starts at twice the ceiling height distance from row 1 (B) and twice the ceiling height (B) from the wall. The other speakers in this row are also spaced at twice the ceiling height.

Row 3 is again spaced at twice the ceiling height (B) from the previous row. The first speaker starting this row is positioned at one ceiling height distance (A) from the wall (similar to row 1).

Continue this pattern of alternating rows until the room is covered.

The spacing of the speakers can be adjusted so that the speakers are evenly spaced in a row and aesthetically pleasing.

Ceiling Speaker Layout



Horn Loudspeakers

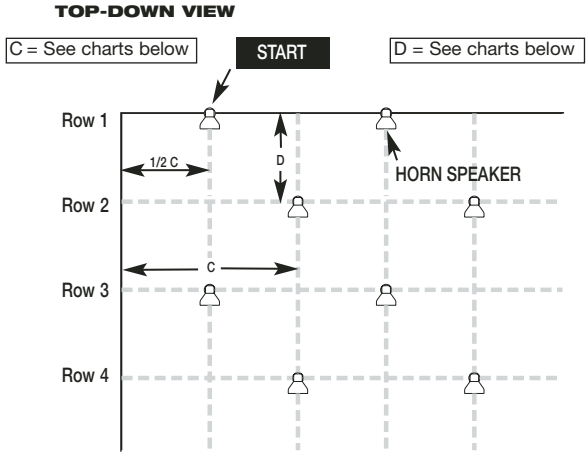
Desired mounting height, barring obstructions, is 15 to 20 feet, with the speakers angled downward toward the listening area and facing in the same direction. Follow the diagram for the layout of the horn speakers while using the charts below to define the lettered dimensions for each specific speaker.

Begin in one corner of the area. The first speaker in Row 1 is positioned a distance equivalent to (1/2C). The next speaker in Row 1 should be a distance equivalent to (C) from the first speaker. Each additional speaker in the row should use this same spacing. Row 2 starts at the indicated ceiling height distance (D) from the wall. Using the diagram as a guide, fill in the remaining rows in this same alternating pattern until the entire area is appropriately covered.

For areas that include high shelving or corridors, speakers should be installed so that they project down the aisles between the shelves or down through the corridors.

The spacing of the speakers can be adjusted so that the speakers are evenly spaced in a row.

Horn Speaker Layout



NOTE: Each environment is unique. This layout plan is general in nature and may not be applicable for every installation.

	Ambient Noise Range	C	D	Volume Setting
HS7EZ	Low Noise (55 dB-65 dB)	120 ft.	80 ft.	1/2 Rotation
	Medium Noise (65 dB-75 dB)	100 ft.	60 ft.	Full Clockwise
HS15EZ	High Noise (75 dB-85 dB)	100 ft.	60 ft.	1/2 Rotation
	Very High Noise (85 dB-95 dB)	65 ft.	40 ft.	Full Clockwise
HS30EZ	Very High Noise (85 dB-95 dB)	90 ft.	55 ft.	Full Clockwise

	Ambient Noise Range	Speaker Power Taps (Watts)	C	D
SPT5A	Low Noise (55 dB-65 dB)	1.25W	100 ft.	65 ft.
	Medium Noise (65 dB-75 dB)	7.5W	100 ft.	65 ft.
SPT15A	Medium Noise (65 dB-75 dB)	.9W	105 ft.	67 ft.
	High Noise (75 dB-85 dB)	3.8W	100 ft.	65 ft.
	Very High Noise (85 dB-95 dB)	15W	63 ft.	40 ft.
SPT30A	High Noise (75 dB-85 dB)	3.8W	103 ft.	68 ft.
	Very High Noise (85 dB-95 dB)	30W	97 ft.	57 ft.

Wall Baffle Speakers

The layout of the speakers should be planned prior to installation. Because wall baffle speakers are designed to project forward, it is best to aim them in the same direction, as this provides for both greater coverage and clarity. You can use the building's roof pillars or other available supports for mounting the wall baffles. In some cases, it may be necessary to mount the wall baffles on opposing walls. In these cases, the speakers will project sound in opposing directions.

Ambient Noise Range	Tap Setting
Low Noise (55 dB - 65 dB)	1W
Medium Noise (65 dB - 75 dB)	4W
High Noise (75 dB - 85 dB)	
Very High Noise (85 dB - 95 dB)	

• *Hallway/Room*

Wall baffle speakers work well with rooms and hallways that are 20' to 60' wide. Layout starts at one end of the hallway or room. The first speaker should be installed 10' from the end of the hallway or room. The next speaker on that wall should be installed 20' from the first speaker, as should any additional speakers required to cover the length of the hallway or room.

The first speaker on the opposing wall should be installed 20' from the end of the hallway or room, thereby staggering the speakers. Each additional speaker should also be installed 20' apart from the previous one. (See Figure 1.)

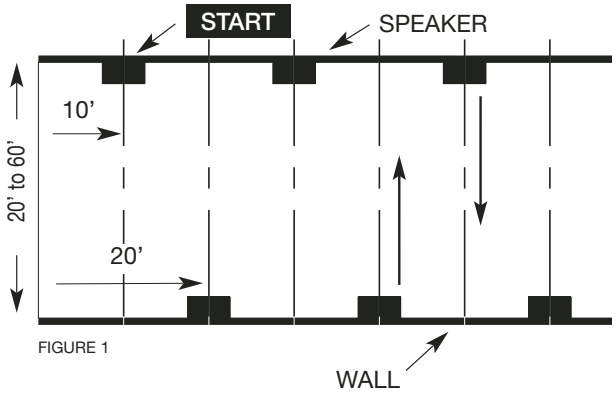


FIGURE 1

• *Open Area*

The number of speakers needed to cover an open area and the layout of those speakers is contingent upon the availability of suitable mounting points in the area to be covered.

Layout starts in one corner of the room. The first speaker should be installed 10' from the corner of the room with each additional speaker in the first row installed in increments of 20' from the first. Based on Figure 2, install the next row of speakers 30' from the first row and 20' from the wall with increments of 20' between each speaker. The third row would follow the example of the first and each additional row would continue this pattern of alternating rows until the whole area is covered.

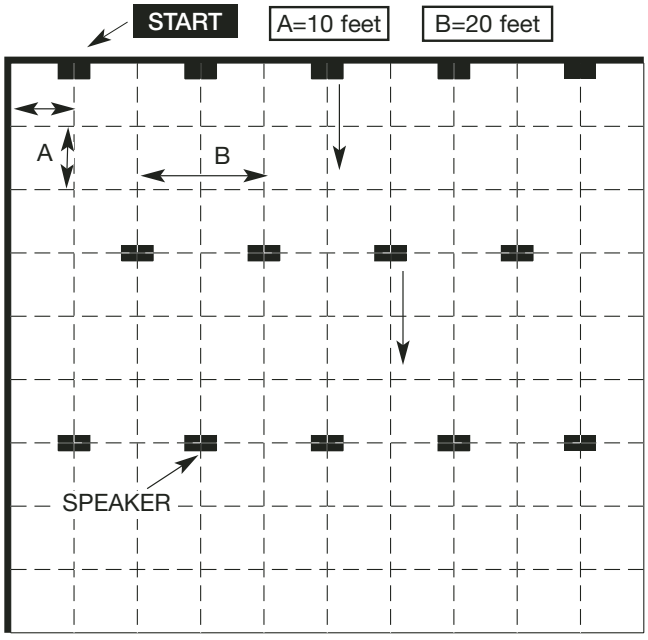


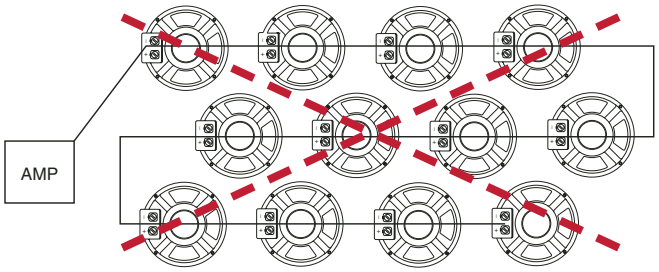
FIGURE 2

Speaker Wiring

Speaker Wiring Patterns

Because a great number of speakers and long distances can be accommodated by 70V paging systems, the manner in which the speakers are wired is of interest. Deciding on how to wire the speakers depends on whether separate zones of speakers are needed, how many lines back to the amplifier is reasonable, and how easy it will be to troubleshoot the system in the future.

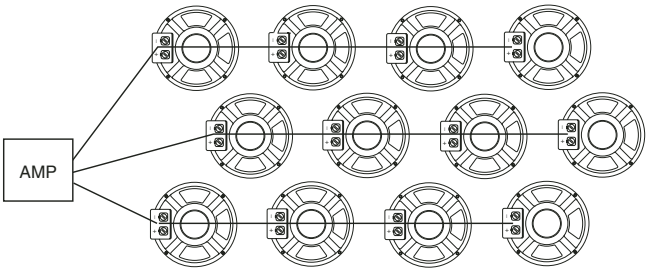
How you wire a speaker system may require some tradeoffs. The simplest way is to parallel all the speakers on one very long run of wire. This approach leads to some problems. First, the amount of power lost in a long run of wire may not allow the required amount of power to get to the farthest speakers. Second, if there should be a short on the wire run, it would take down the entire run. In order to locate it, you would need to disconnect each speaker until the failed one is found.



Single wire Run (Not Recommended)

Multiple Wire Runs

A more practical approach is to wire each row of speakers in an area together and run a lead wire from this row back to the amplifier. The objective is not to have so many speakers daisy-chained together that it makes troubleshooting impossible. Wire runs can be connected separately to determine where the problem is.



Multiple Wire Runs (Preferred)

Wire Loss

Once you have an idea of how many speakers are to be wired together, estimate how long the wire run will be from the first to the last speaker in each row. Include the lead-in wire length from the amplifier to the first speaker in each row in your overall run length. For each row, sum up the speaker power and cable lengths.

Then, refer to the *Wire Loss Chart* to ensure that the wire gauge is sufficient to support the power and cable length desired. It may be necessary to increase the wire gauge or split the speaker loads to shorten the wire run lengths if they exceed the chart maximums.

Wire Loss Chart

(10% of Power Lost in Wire)

Wire Gauge	Load Power Per Wire Run (Watts)						
	5	10	15	30	50	100	200
16	10,000	7000	4600	2300	1400	700	350
18	9000	4500	2800	1400	830	415	205
20	5500	2700	1800	900	540	270	135
22	3400	1700	1100	550	330	115	60
24	2100	1000	700	350	210	105	50
	Maximum Wire Run Cable Length (ft.)						

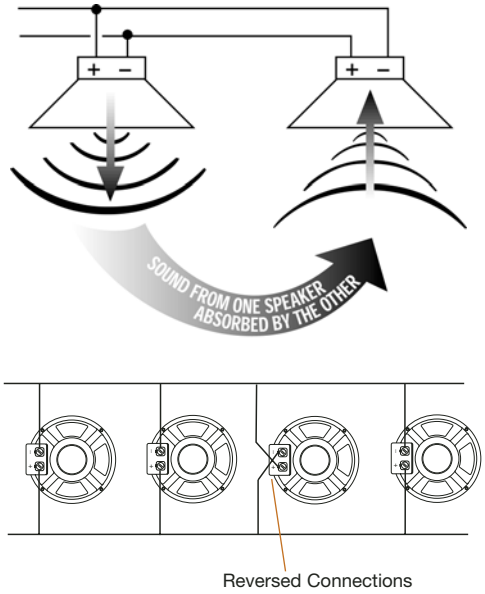
Speaker Phasing

As the voltage on a speaker changes from plus to minus, the speaker cone moves from pushing out to pulling in. If you reverse the polarity, the speaker responds in the opposite manner.

If a speaker is pushing out and an adjacent speaker is pulling in, some of the pressure caused by the speaker pushing out will be absorbed by the speaker pulling in. These two speakers are out of phase.

In a paging system, all the speakers should be in phase so that they all push out at the same time. Out of phase speakers operate perfectly well and will not cause any harm to a paging system, but will tend to diminish the bass response in the area around the out of phase speaker.

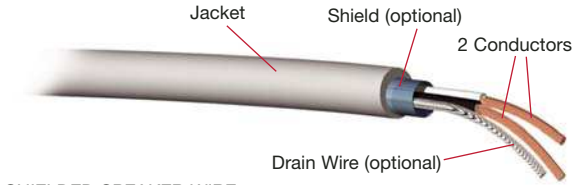
The important thing is to wire all the same polarity (+ or -) connections together. This will ensure that the speakers in the system all work in unison. All paging speaker connections have a polarity indicator. It may be a color code, plus (+) and minus (-) symbols, or a red dot.



Wire Types

Speaker Wire

The speaker wire best suited for paging systems is 2 conductors in a jacket. The gauge of the conductors varies depending on the installation. In many instances, a shielded version of the speaker wire is used. The shield can be useful to help protect the conductors from receiving electrical interference from other electrical equipment in the area. The shield is particularly useful when speakers are to be used as microphones in talk back applications (see page 39 for more information on talk back).



SHIELDED SPEAKER WIRE

Shielded Cable

Shielded cable refers to any conductor, or conductors, wrapped in an electrically conductive shield. The two types of cable most prevalent for audio installations are:

• *Single Conductor Shielded Cable*

Single conductor shielded cable is used to connect external equipment to the unbalanced Aux inputs of amplifiers. The center conductor carries the signal source and the shield carries the ground between the amplifier and external equipment. In addition to completing the ground return between the electrical equipment, the cable provides a large amount of noise and interference protection for the center conductor. The most common connector for this type of cable is the Phono connector (a.k.a. the RCA connector).

The connector's center pin connects to the internal conductor and the skirt around the connector's perimeter connects to the shield of the cable.

SINGLE CONDUCTOR SHIELDED CABLE

• *Two Conductor Shielded Cable*

Two conductor shielded cable is typically used with balanced microphones. Two internal conductors are required for the low impedance balanced microphones used in paging systems. The shield is wrapped around these conductors and provides the same protection against electrical interference and noise as single conductor cable. Balanced microphone inputs provide a ground connection point for the shield. Without the ground connection, the shield would be ineffective. Some microphones with push-to-talk switches require two more conductors to carry the switch closure back to the amplifier. In this cable, the conductors for the switch closure are not wrapped in the shield but rather carried in the cable jacket outside of the shield. The most popular types of connectors for microphone cable are screw terminals and XLR connectors.

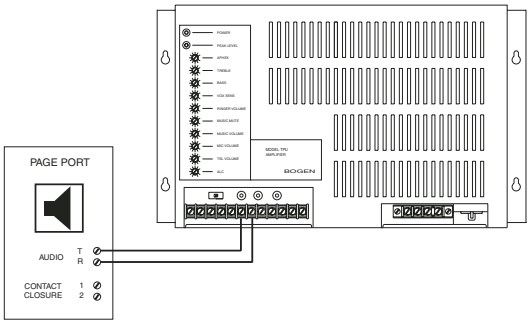
TWO CONDUCTOR SHIELDED CABLE
(BALANCED MIC CABLE)

Telephone Interfaces

The most common way to make announcements over a paging system is through the telephone system. It is a convenient and readily available live input source. However, audio and telephone technologies are different. This sometimes makes it necessary to use an adapter to link the two systems together.

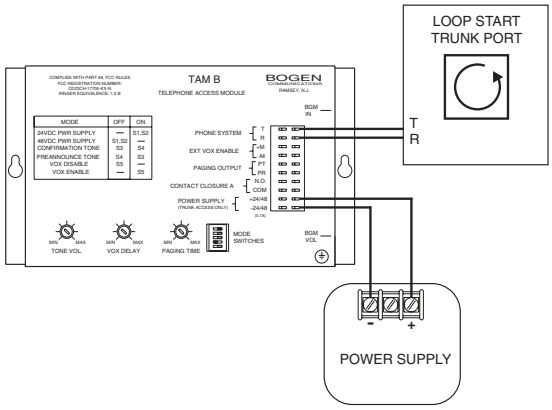
There are many types of telephone ports possible in telephone switches. The four types presented here – Page Port, Loop Start trunk, Ground Start trunk, and Analog ring up station – are the only ones Bogen recommends as interfaces to telephone systems. Other port types and specifically digital station ports are not suitable for connection to amplifiers and interface devices.

Page Ports



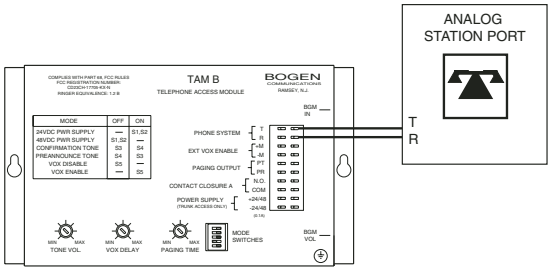
- Dedicated audio output available standard on most telephone systems
- Can be connected directly to the input of most amplifers
- Traditionally a 600-ohm dry audio signal and a normally open control contact closure
- Control contacts, if available, activate during a page and typically control the muting of background music
- Some page ports provide only an audio pair, which requires that audio equipment have voice-activated (VOX) functions such as background music muting
- Paging ports are not always bi-directional like telephone lines (bi-directionality is necessary when including talk back capability in a paging system)
- Not all paging ports will produce DTMF tones which are necessary when using zone paging equipment

Loop And Ground Start



- The Loop start, or CO port, is the most popular type of paging interface to use when a page port is not available or suitable
- A Ground start trunk uses loop current but employs a request and acknowlegment hand shake for making the initial connection
- An interface device is necessary when connecting a trunk to an amplifier
- When paging, an interface adapter detects the off-hook condition of the trunk and connects the amplifier to the trunk port through signal conditioning electronics
- When the trunk is released, the adapter detects the on-hook condition and immediately disconnects the amplifier from the trunk
- Trunk interface adapters require a power supply to provide talk-battery and loop current to the trunk port
- A pop at the end of a page is typically present due to the large change in telephone line voltage between on and off hook conditions

Analog Station



- An analog station allows interfacing when neither a paging port nor a trunk port is available
- Analog ring-up interfacing requires a more sophisticated interface than other methods
- The interface must detect a high voltage ring signal and answer the call to start the page
- To determine when to disconnect the page, typically two system timers are used — one that limits the maximum length of the page to ensure disconnection, the other senses audio activity and disconnects after a preset length of silence
- Many telephone switches now provide calling party control (CPC) signal, which indicates to the interface that the caller has disconnected; Bogen interfaces disconnect immediately upon detecting a CPC signal

Sound Pressure Levels Chart

Typical Ambient Noise Level			Typical Environments	
				95 dB
Very High Noise	85-95 dB	Speech Almost Impossible	Construction Site Loud Machine Shop Noisy Manufacturing Printing Shop	
				85 dB
High Noise	75-85 dB	Speech is Difficult	Assembly Line Crowded Bus/Transit Waiting Area Machine Shop Printing Shop Shipping/Warehouse Supermarket (Peak Time) Very Noisy Restaurant/Bar	
				75 dB
Medium Noise	65-75 dB	Must Raise Voice to be Heard	Bank/Public Area Department Store Noisy Office Restaurant/Bar Supermarket Transportation Waiting Room	
				65 dB
Low Noise	55-65 dB	Speech is Easy	Conversational Speech Doctor's Office Hospital Hotel Lobby Quiet Office Very Quiet Restaurant/Bar	
				55 dB

AMPLIFIER FEATURES CHART

Amplifier Power Rating/ Channel	Model Numbers	Amp Channels	Input Types					Signal Processing						Music Muting			MOH Output	Night Ringer	Remote Volume	Output Meter	Mounting			Page Number
			Tel Input* 600-ohm Balanced	Mic Inputs* Lo-Z Balanced	Aux Inputs* Hi-Z Unbalanced	Balanced Inputs Hi-Z	Modular Inputs	Aphex Aural Exciter	Loudness Contour	ALC	EQ	Bass/Treble	Tone Control	Variable Mute	Auto Mute	Manual Mute					Wall Mount	Shelf Mount	Rack Mount	
1.5W	GA2	1			1																●	●		26
6W	GA6A	1		1	1								●									●		26
10W	C10	1	1	2 (1)	0 (1)								●		●	●					Ⓚ	●	Ⓚ	26
10W	C10MOH	1	1	2 (1)	0 (1)								●		●	●	●				Ⓚ	●	Ⓚ	26
15W	TPU15A	1	1		1					●			●		●			⊠			●			30
20W	C20	1	1	2 (1)	0 (1)								●		●	●					Ⓚ	●	Ⓚ	26
20W	C20MOH	1	1	2 (1)	0 (1)								●		●	●	●				Ⓚ	●	Ⓚ	26
35W	C35	1	1	2 (1)	1 (2)							●			●	●						●	Ⓚ	26
35W	GS35	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●			●	Ⓚ	25
35W	TPU35B	1	1	1	1			●		●		●		●	●	●		●			●		Ⓚ	30
35W	V35	1	●	●	●	●	8			●	●	●		●	●				●	●		●	Ⓚ	22
60W	BPA60	1			◐																	●	Ⓚ	29
60W	C60	1	1	2 (1)	1 (2)							●			●	●						●	Ⓚ	26
60W	GS60	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●			●	Ⓚ	25
60W	TPU60B	1	1	1	1			●		●		●		●	●	●		●			●		Ⓚ	30
60W	V60	1	●	●	●	●	8			●	●	●		●	●				●	●		●	Ⓚ	22
100W	C100	1	1	2 (1)	1 (2)							●			●	●						●	Ⓚ	26
100W	GS100	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●			●	Ⓚ	25
100W/60W/20W	PM3180	3	0 (1)	2 (1)	4					●		●		●	●	●			●	●		●	Ⓚ	31
100W	TPU100B	1	1	1	1			●		●		●		●	●	●		●			●		Ⓚ	30
100W	V100	1	●	●	●	●	8			●	●	●		●	●				●	●		●	Ⓚ	22
100W	WV100	1	●	●	●	●	8			●	●	●		●	●				●	●	Ⓚ			24
125W	HTA125A	1			◐																	●	●	29
150W	GS150	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●			●	Ⓚ	25
150W	V150	1	●	●	●	●	8			●	●	●		●	●				●	●		●	Ⓚ	22
150W	WV150	1	●	●	●	●	8			●	●	●		●	●				●	●	Ⓚ			24
250W	GS250	1	0 (1)	6 (4)	1 (2)			●	●	●	●			●	●	●			●			●	Ⓚ	25
250W	HTA250A	1			◐																	●	●	29
250W	MT250D	1			◐																	●	●	29
250W	TPU250	1	1	1				●		●		●		●	●	●		●			●		●	30
250W	V250	1	●	●	●	●	8			●	●	●		●	●				●	●		●	Ⓚ	22
250W	WV250	1	●	●	●	●	8			●	●	●		●	●				●	●	Ⓚ			24
300/600W	M300	2/1	●	●	●	2†	2			●				●	●							●	●	27
300W	X300	2				2																●	●	28
450/900W	M450	2/1	●	●	●	2†	2			●				●	●							●	●	27
450W	X450	2				2																●	●	28
600/1200W	M600	2/1	●	●	●	2†	2			●				●	●							●	●	27
600W	X600	2				2																●	●	28

● Feature Included

● Features determined by type of module installed

◐ Balanced input available with accessory plug-in transformer (TL100 or TL600)

Ⓚ Accessory kit required for mounting

⊠ Contact closure activation only

* Some inputs are switch selectable. The number in parentheses shows the maximum number of inputs when switched.

† BAL2S balanced input module included standard; uses one modular input bay.

Specifications subject to change without notice.

AMPLIFIER SPECS CHART

Model Numbers	Output Power (/Channel)	Channels	Frequency Response*	Distortion**	Speaker Outputs	AC Line Draw***	Dimensions	Product Weight
BPA60	60W	1	50 Hz to 15 kHz	2% Max	8-ohm/25V, 16-ohm, 25VCT, 70V	180W	15-1/4" W x 3-1/2" H x 8-1/4" D	17 lb.
C10	10W	1	70 Hz to 16 kHz	1% Max	70V, 25V, 16-ohm, 8-ohm, 4-ohm	38W	11-3/8" W x 2-7/8" H x 7-3/8" D	5 lb.
C10MOH	10W	1	70 Hz to 16 kHz	1% Max	70V, 25V, 16-ohm, 8-ohm, 4-ohm	38W	11-3/8" W x 2-7/8" H x 7-3/8" D	5 lb.
C20	20W	1	70 Hz to 16 kHz	1% Max	70V, 25V, 16-ohm, 8-ohm, 4-ohm	50W	11-3/8" W x 2-7/8" H x 7-3/8" D	6 lb.
C20MOH	20W	1	70 Hz to 16 kHz	1% Max	70V, 25V, 16-ohm, 8-ohm, 4-ohm	50W	11-3/8" W x 2-7/8" H x 7-3/8" D	6 lb.
C35	35W	1	70 Hz to 16 kHz - Transformer; 20 Hz to 20 kHz - Direct	1% Max	70V, 25V, 16-ohm, 4-ohm direct	85W	14-1/2" W x 3-3/4" H x 11" D	16 lb.
C60	60W	1	70 Hz to 16 kHz - Transformer; 20 Hz to 20 kHz - Direct	1% Max	70V, 25V, 16-ohm, 4-ohm direct	148W	14-1/2" W x 3-3/4" H x 11" D	18 lb.
C100	100W	1	70 Hz to 16 kHz - Transformer; 20 Hz to 20 kHz - Direct	1% Max	70V, 25V, 16-ohm, 4-ohm direct	220W	14-1/2" W x 3-3/4" H x 11" D	20 lb.
GA2	1.5W	1	200 Hz to 15 kHz	2% Max	8- & 600-ohm	4W	5-1/2" W x 4-1/8" H x 2-1/4" D	2 lb.
GA6A	6W	1	30 Hz to 12 kHz	2% Max	70V, 25V, 8-ohm	16W	8-1/2" W x 2-3/4" H x 6" D	5 lb.
GS35	35W	1	65 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% Max	70V, 25V, 25VCT, 8-ohm, 4-ohm direct	0.9A	16-1/2" W x 3-1/2" H x 13-1/2" D	17 lb.
GS60	60W	1	65 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% Max	70V, 25V, 25VCT, 8-ohm, 4-ohm direct	1.3A	16-1/2" W x 3-1/2" H x 13-1/2" D	20 lb.
GS100	100W	1	65 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% Max	70V, 25V, 25VCT, 8-ohm, 4-ohm direct	2.2A	16-1/2" W x 3-1/2" H x 13-1/2" D	23 lb.
GS150	150W	1	65 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% Max	70V, 25V, 25VCT, 8-ohm, 4-ohm direct	3.0A	16-1/2" W x 3-1/2" H x 13-1/2" D	29 lb.
GS250	250W	1	65 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% Max	70V, 25V, 25VCT, 8-ohm, 4-ohm direct	5.0A	16-1/2" W x 3-1/2" H x 13-1/2" D	30 lb.
HTA125A	125W	1	20 Hz to 20 kHz	0.5% Max	70V, 25VCT, 25V, 8-ohm, 4-ohm	260W	19" W x 5-1/4" H x 11" D	36 lb.
HTA250A	250W	1	20 Hz to 20 kHz	0.5% Max	70V, 25VCT, 25V, 8-ohm, 4-ohm	520W	19" W x 5-1/4" H x 11" D	50 lb.
M300	300/600W	2 or 1	20 Hz to 20 kHz	0.5% Max	4- to 8-ohm (2 channel mode); 70V (1 channel mode)	12A	17" W x 3-1/2" H x 18-1/2"D (not including brackets)	41 lb.
M450	450/900W	2 or 1	20 Hz to 20 kHz	0.5% Max	4- to 8-ohm (2 channel mode); 70V (1 channel mode)	15A	17" W x 3-1/2" H x 18-1/2"D (not including brackets)	44 lb.
M600	600/1200W	2 or 1	20 Hz to 20 kHz	0.5% Max	4- to 8-ohm (2 channel mode); 70V (1 channel mode)	20A	17" W x 3-1/2" H x 18-1/2"D (not including brackets)	46 lb.
MT250D	250W	1	20 Hz to 20 kHz	2% Max	100V, 70V, 25V, 12.5V, 8-ohm	650W	19" W x 13" H x 5-1/4" D	57 lb.
PM3180	100W 60W 20W	3	70 Hz to 20 kHz - Trans (Amp 1 & 2); 70 Hz to 15 kHz - Trans (Amp 3); 20 Hz to 20 kHz - Direct (Amp 1 & 2); 20 Hz to 15 kHz - Direct (Amp 3)	0.5% - Amp 1&2; 1% - Amp 3 (Max)	70V, 25V, 8-ohm, 4-ohm direct	430W	17" W x 5-1/2" H x 12-1/2" D	38 lb.
TPU15A	15W	1	70 Hz to 12 kHz	2% Max	70V, 25V, 8-ohm	48W	11" W x 2-3/4" H x 2-3/8" D	4 lb.
TPU35B	35W	1	70 Hz to 15 kHz	1% Max	70V, 25V, 25VCT, 16-ohm	0.7A	14-1/4" W x 8-3/8" H x 3-5/8" D	13 lb.
TPU60B	60W	1	70 Hz to 15 kHz	1% Max	70V, 25V, 25VCT, 16-ohm	1.5A	14-1/4" W x 8-3/8" H x 3-5/8" D	15 lb.
TPU100B	100W	1	70 Hz to 15 kHz	1% Max	70V, 25V, 25VCT, 16-ohm	2A	14-1/4" W x 8-3/8" H x 3-5/8" D	18 lb.
TPU250	250W	1	70 Hz to 15 kHz	1% Max	70V, 25V	5A	19" W x 10-1/2" H x 3-7/8" D	30 lb.
V35	35W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	0.6A	16-1/2" W x 3-1/2" H x 12" D	24 lb.
V60	60W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	1.3A	16-1/2" W x 3-1/2" H x 12" D	28 lb.
V100	100W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	2.0A	16-1/2" W x 3-1/2" H x 12" D	32 lb.
V150	150W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	3.5A	16-1/2" W x 3-1/2" H x 12" D	35 lb.
V250	250W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	5.5A	16-1/2" W x 3-1/2" H x 12" D	40 lb.
WV100	100W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	2.0A	14-1/8" W x 21" H	27 lb.
WV150	150W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	3.5A	14-1/8" W x 21" H	29 lb.
WV250	250W	1	45 Hz to 20 kHz - Transformer; 20 Hz to 20 kHz - Direct	0.5% - Transformer; 0.1% - Direct (Max)	70V, 25V, 8-ohm, 4-ohm direct	5.5A	14-1/8" W x 21" H	28 lb.
X300	300W	2	20 Hz to 20 kHz	0.5% Max	70V direct	12A	17" W x 3-1/2" H x 18-1/4"D (not including brackets)	41 lb.
X450	450W	2	20 Hz to 20 kHz	0.5% Max	70V direct	15A	17" W x 3-1/2" H x 18-1/4"D (not including brackets)	44 lb.
X600	600W	2	20 Hz to 20 kHz	0.5% Max	70V direct	20A	17" W x 3-1/2" H x 18-1/4"D (not including brackets)	46 lb.

*@ -2dB FRP Transformer output; @ FRP for Direct outputs

** Bandwidth limited to frequency response

*** FRP @ 120V AC line voltage

Specifications subject to change without notice.

Product Accessories

	Model #	Accessory Description	Associated Model(s)	Dimensions	Prod. Wt.	Page #
AMPLIFIERS	GSRVC	Remote Volume Control	Gold Seal Amps	2-3/4" W x 4-1/2" H x 1-3/8" D	1 lb.	25
	GSTRC	Gold Seal Security Cover	Gold Seal Amps	14-3/4" W x 3-1/2" H x 1" D	1 lb.	25
	PVSC	Power Vector Security Cover	V-Series Amps	15-1/2" W x 3-1/8" H x 1/2" D	1 lb.	22
	RVCP	Remote Volume Control	V- & WV-Series Amps	1-3/4" W x 4" H	1 lb.	22, 24
	TL100	1:1 Ratio Plug-In Transformer	BPA60/HTA125A/HTA250A/MT250D	1" dia. x 1-1/4" D	1 lb.	29
	TL600	Plug-In: 600 ohms Transformer	BPA60/HTA125A/HTA250A/MT250D	1" dia. x 1-1/4" D	1 lb.	29

	Model #	Accessory Description	Associated Model(s)	Dimensions	Prod. Wt.	Page #
MOUNTING KITS	BBF	Back Box for Flush Mounting	WV-Series	14-1/2" W x 24-3/4" H x 3-7/8" D	12 lb.	24
	BBS	Back Box for Surface Mounting	WV-Series	16-1/4" W x 26-3/4" H x 3-7/8" D	16 lb.	24
	BC1	Beam Clamp	Horn Loudspeakers	2-1/8" W x 2" H x 3/4" D	1 lb.	4, 13, 14
	CK10	Cable Kit	HFCS1/OCS1/OPS1	10 feet long	1 lb.	2, 16, 17
	FGSM (W)	Swivel Mount	FG15/FG20S/FG30	4-1/8" W x 4" H x 5-1/2" D	1 lb.	15
	GSRPK	Rack Kit	Gold Seal Series Amps	1-1/4" W x 3-1/2" H x 10-1/4" D	2 lb.	25
	RK78	Rack Panel Kit	CR100A	19" W x 3-1/2" H x 7" D	3 lb.	43
	RMPWMK3	Remote Panel Mounting Kit	PM3000/PM3180	9-1/8" W x 4-3/4" H x 3/4" D	1 lb.	31
	RPK35B	Rack Panel Kit	C10/C20 (MOH)/CAM2	19" W x 3-1/2" H x 6-1/2" D	3 lb.	26, 33
	RPK46A	Rack Mount Kit	TP30D	2-1/4" W x 1-3/4" H x 4-1/4" D	1 lb.	41
	RPK47	Rack Mount Kit	RM350D	3-1/2" W x 3-1/2" H x 2-7/8" D	1 lb.	42
	RPK50	Rack Mount Kit	C35/C60/C100	2-1/2" W x 3-1/2" H x 2-1/8" D	1 lb.	26
	RPK53	Rack Mount Kit	BPA60	2" W x 3-1/2" H x 1" D	1 lb.	29
	RPK79	Rack Mount Kit	PM3000/PM3180	1" W x 5-1/4" H x 3-1/2" D	1 lb.	31
	RPK82	Rack Mount Kit	TPU35B/60B/100B	3" W x 8-3/4" H	1 lb.	30
	RPK84	Rack Mount Kit	PCM2000	7" W x 8" H	2 lb.	35
	RPK86	Rear Rack Support Brackets	M-Class/Black Max Amplifiers	3-3/4" W x 3-1/2" H	1 lb.	27, 28
	RPK87	Rack Mount Kit	V-Series	1" W x 3-1/2" H x 3-3/4" D	1 lb.	22
	SMTB	Tile Bridge for Easy Install Speakers	SM1EZ/SM4T	4-3/8" W x 1-1/4" H x 23-3/4" D	5 lb.*	3
	TBCR	Tile Bridge Support Ring	HFCS1/OCS1	17" W x 1-1/8" H x 24" D	2 lb.	2, 16
	WMAD	Door for WV-Series Amps	WV-Series	16-1/4" W x 26-3/4" H x 1" D	9 lb.	24
	WMK1	Wall Mounting Kit	C10/C20 (MOH)/CAM2	14-1/2" W x 16" H x 4" D	10 lb.	26, 33

	Model #	Accessory Description	Associated Model(s)	Dimensions	Prod. Wt.	Page #
PAGING/INTERCOM	2518	18-Gauge Connector	PI35A/SI35A	5/8" W x 1/4" H x 3/4" D	1 lb.	48
	2520	20-Gauge Connector	PI35A/SI35A	5/8" W x 1/4" H x 3/4" D	1 lb.	48
	2522	22-Gauge Connector	PI35A/SI35A	5/8" W x 1/4" H x 3/4" D	1 lb.	48
	CA10A	Call-In Switch	PI35A/SI35A	2-3/4" W x 4-1/2" H x 2" D	1 lb.	48
	CA11A	Call Privacy Switch	PI35A/SI35A	2-3/4" W x 4-1/2" H x 1-3/4" D	1 lb.	48
	CA17	Call-In Switch	PI35A/SI35A	2-3/4" W x 4-1/2" H x 1" D	1 lb.	48
	PCMPS2	12V DC/1.5A Power Supply	PCM2000	2-5/8" W x 3-3/8" H x 2-3/4" D	1 lb.	35
	SBA225	25-Key Station Panel Selector	SI35A	19" W x 1-3/4" H x 1-1/4" D	2 lb.	48
	SCR25A	Call-In Module	SBA225/SI35A	16-3/4" W x 1-1/4" H x 4" D	2 lb.	48
	TB10A	Paging Adapter	TP-AP Series	4-3/4" W x 1-7/8" H x 6-3/8" D	2 lb.	49
	TL156	Insertion Tool	PI35A/SI35A	2" W x 3-1/4" H x 1" D	1 lb.	48
	TWK351	2-Wire Call-In Adapter Kit	PI35A/SI35A	5-1/2" W x 4" H x 2-1/4" D	2 lb.	48

	Model #	Accessory Description	Associated Model(s)	Dimensions	Prod. Wt.	Page #
MISC.	AFDS2	Automatic Failure Detector Sensor	Amplifiers	19" W x 3-1/2" H x 7-1/2" D	8 lb.	--
	ASTB4	Electrical Cover	A-Series	2-7/8" W x 1-7/8" H x 2-3/16" D	1 lb.	18
	MRCA3	Mono 3 ft. RCA Cable	Music & Input Sources	3 feet long	1 lb.	--
	MRCA6	Mono 6 ft. RCA Cable	Music & Input Sources	6 feet long	1 lb.	--
	SRCA6	Stereo 6 ft. RCA Cable	Music & Input Sources	6 feet long	1 lb.	--
	VHSK	V-Hub Security Kit	V-Hub	6 feet long	1 lb.	51

*Weight based on 5 per pack