



speco technologies  
**COMMERCIAL**  
*audio guide*

## COMMERCIAL audio overview

### What is a 70 Volt Sound System & what is it used for?

A 70 Volt Sound System is comprised of amplifiers, speakers with transformers, microphones, volume controls, a telephone system interface and an assortment of wires used as connections. It is generally used for commercial sound applications where there is a necessity for electronically amplifying and distributing sound for the functions of paging, playing music and/or pre-recorded messages to a commercial environment.

### What are the components that make up a 70 Volt Sound System?

• **Centralized Amplifier:** The central unit of a 70 Volt System is the amplifier that amplifies the sound signal to be distributed to pre-established speakers or paging horn loudspeakers.

There are power amplifiers, which are rack-mountable and have no external controls, and packaged amplifiers, which have pre-amp features such as volume controls, bass and treble controls, etc., that are built into the amplifier to make it a pre-amplifier and amplifier all in one unit.



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Amplifiers have many diverse features and many input and output connections. They can feature XLR MIC Connectors or MIC terminal strip connections, auxiliary/RCA inputs for music sources, and 600 ohm telephone inputs.

Most commercial amplifiers have speaker outputs for 4/8/16 ohms and 70V systems. Most Speco Technologies amplifiers offer a 'Music on Hold' output feature to allow customers on hold to hear music or prerecorded advertising.

• **Speakers:** There are several different types of speakers including in-ceiling, in-wall, baffle and flush-mount cone speakers or horn loudspeakers.

Optimal speaker selection for each installation can depend on the application the speaker is needed for. It can also depend upon the area that is needed to be covered, the ambient noise level of the environment, whether the application for the speaker will be foreground/background music or voice, and whether the speaker will be used indoor or outdoor.

For commercial applications in a 70 Volt System, the speaker must have a transformer mounted on it to be used.

• **Transformers:** The transformers that are used on 70 Volt System speakers are step-down transformers that convert the high-voltage/low-current coming from the amplifier to the low-voltage/high-current signal that makes the speaker work.

Each transformer usually has multiple wattage taps so that each speaker can be individually set as to how much wattage will enter the speaker, and, because of this, how loud each speaker will be. The benefits of using transformers are listed on the next page.



MHL-5S

Transformers can be sold individually to be mounted on a speaker or premounted already on a speaker.

• **Phone System Interface Device:** These systems are used to connect a phone system to the speaker system via the amplifier for paging purposes.

• **Microphones:** Located in the front end of the system to receive the delivered sound, microphones are low impedance devices that require a shielded cable so as to not to interfere with the amplifier or speaker wires.

• **Wires:** Generally speaking, speaker wire is determined by the length of the run and wattage utilized:

For wire runs less than 50 ft. and 50 Watts of power or less use 16 wire gauge.

For wire runs more than 50 ft. or over 50 Watts of power use 14 gauge wire.

• **Volume Controls/Attenuators:** Allows adjustment of volume to speakers.

## What are the Benefits of Using a 70 Volt Sound System?

- A 70 Volt System uses a basis of high voltage to result in a lower current when distributing power to a sound system. Since **Power equals Voltage times Current**, a higher voltage will result in a lower current needed to arrive at a desired power load. This prevents long runs of wire from getting overheated by not having excessive, wasted current. **This makes 70 Volt Systems very energy efficient.**

Many municipalities in America actually require the use of 25 Volt transformers because the municipalities' electrical codes classify a 25 Volt system as low voltage, thus making it safer.

- Generally speaking, 70 Volt Systems are much **more cost efficient** than an 8 ohm speaker system when dealing with the volume installation of speakers.

- 70 Volt Systems are **easier to design** than 8 ohm speaker systems. The designer does not have to worry about keeping the impedance matched throughout their speaker system as they would on an 8 ohm based system. 70 Volt Systems can have their speakers daisy chained in parallel together without worry. Because 70 Volt speakers come with transformers, impedance is not an issue unless an extreme amount of speakers are installed together. (It is recommended to use multiple wire runs back to your amplifier as opposed to a single run.) This will make locating problems that occur easier to find by isolating it on individual small speaker runs where it can be quickly located.

Also it is an **easy calculation in determining the amount of wattage needed** by your amplifier. You will take the total wattage requirement of your 70 Volt speakers, or "load", and include a 20% safety buffer to the upside arriving at the minimum RMS wattage your amplifier should have.

- 70 Volt Systems **allow you to set the volume of each individual speaker** by letting you customized the wattage taps on the speakers for the specific volume needed in your specific sound area. The higher the wattage taps are set on individual speakers, the more power the speaker consumes, the louder the speaker will be.

The transformer on the speaker also serves as a safeguard to make sure individual speakers are not ruined by excessive wattage.



**P-30FACD**



**P-60FACC**

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# COMMERCIAL audio design

## Designing a 70 Volt System:

### 1) Which Type of 70V Speaker Should I Use?

**In-Ceiling Speakers** – Best utilized in 8, 10 & 12 ft. drop ceilings in professional environments with low noise levels. Great for background music and/or paging. Ceiling support brackets should be used with in-ceiling speakers.

**Wall Baffle Speakers** – Best utilized when the ceiling’s height is prohibitive to speaker placement and/or speakers can not be mounted on the ceiling.

**PA Horns** – Horns are usually utilized in loud environments when distinct, and powerful paging messages are needed or when large areas must be covered. In addition, most PA Horns are weatherproof and are used for outdoor applications such as loading docks and sports fields.

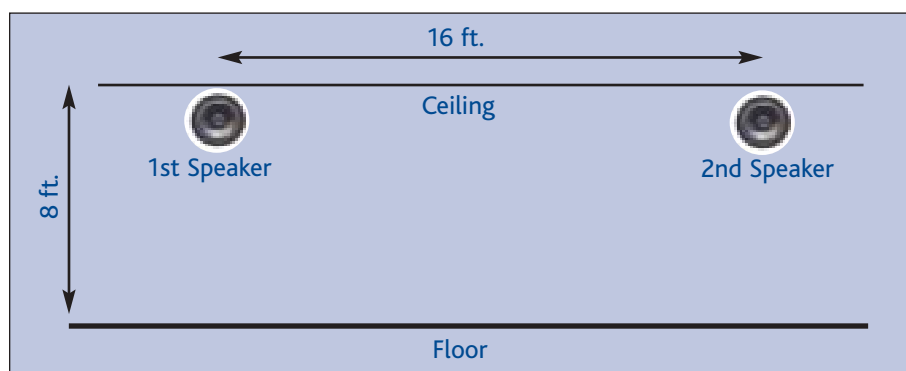
### 2) How Many Speakers Should I Use?

#### Determining Proper Use Quantity For In-Ceiling Speakers:

The industry standard for calculating the proper amount of in-ceiling speakers for a specific area is that you should have twice the space from the floor to the ceiling between the placement of each speaker on the ceiling, as shown in Diagram 1:

Diagram 1: Speaker Spacing on Ceilings

Ceiling Speakers Should be Spaced Apart at Twice the space of the Ceiling Height



For example, if your installation involves an 8 foot ceiling, then the speakers should be placed 16 feet apart on a square footage basis which equals 256 ft. of ceiling area covered. This leads to the following square area coverage chart for specific ceiling heights:

Speaker Square Footage Coverage for Ceiling Heights

|                 | Height of Ceiling | Spacing of Speakers<br>(Ceiling height x2 ) | Square feet coverage<br>per Speaker |
|-----------------|-------------------|---|-------------------------------------|
| 8 foot ceiling  | 8 ft.             | 16  | 16 x 16= 256 ft.                    |
| 10 foot ceiling | 10 ft.            | 20  | 20 x 20= 400 ft.                    |
| 12 foot ceiling | 12 ft.            | 24  | 24 x 24= 576 ft.                    |

As you will notice, lowering the ceiling height results in the less square footage coverage per speaker, or the more speakers you will need. This is due to there is less downward space for sound dispersion before it reaches the listener.

On the following page there is an easy reference chart for determining the correct number of speakers needed for a specific area to assure proper dispersion of sound.

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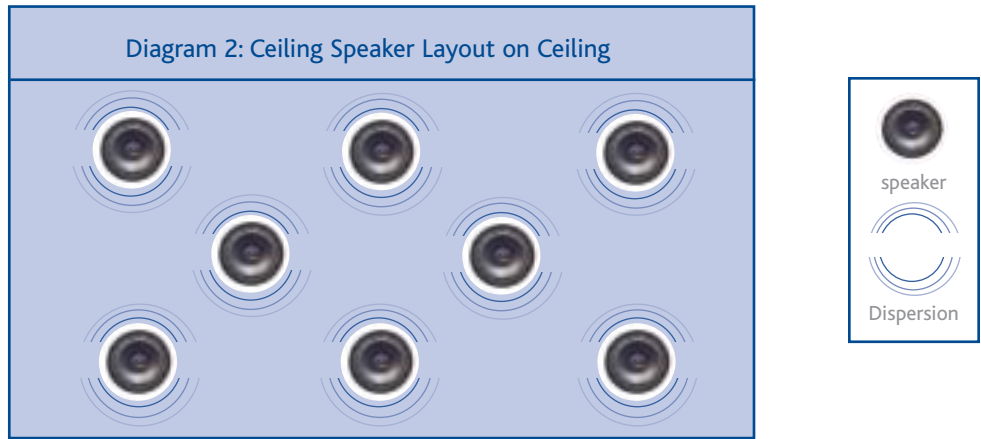
**Correct Number of In-Ceiling Speakers Needed for Proper Sound Dispersion in Room Areas**

|     |              | Length of Installment Room |    |    |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
|-----|--------------|----------------------------|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
|     |              | 10                         | 15 | 20 | 25 | 30 | 35 | 40 | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| 10  | 8' Ceilings  | 1                          | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 4  | 4  | 5  | 6  | 6   | 7   | 8   | 8   | 9   | 9   |
|     | 10' Ceilings | 1                          | 1  | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 5   | 6   | 6   | 7   | 7   | 8   |
|     | 12" Ceilings | 1                          | 1  | 1  | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 3  | 4  | 4   | 5   | 5   | 5   | 6   | 6   |
| 15  | 8' Ceilings  | 1                          | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 4  | 4  | 5  | 6  | 6   | 7   | 8   | 8   | 9   | 9   |
|     | 10' Ceilings | 1                          | 1  | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 5   | 6   | 6   | 7   | 7   | 8   |
|     | 12" Ceilings | 1                          | 1  | 1  | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 3  | 4  | 4   | 5   | 5   | 5   | 6   | 6   |
| 20  | 8' Ceilings  | 1                          | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 5  | 6  | 6  | 7  | 8   | 9   | 10  | 10  | 11  | 12  |
|     | 10' Ceilings | 1                          | 1  | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 5   | 6   | 6   | 7   | 7   | 8   |
|     | 12" Ceilings | 1                          | 1  | 1  | 1  | 1  | 2  | 2  | 2  | 2  | 3  | 3  | 4  | 4   | 4   | 4   | 5   | 5   | 5   |
| 25  | 8' Ceilings  | 2                          | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 9  | 10  | 11  | 12  | 13  | 14  | 15  |
|     | 10' Ceilings | 1                          | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 6   | 7   | 8   | 8   | 9   | 9   |
|     | 12" Ceilings | 1                          | 1  | 1  | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 3  | 4  | 4   | 5   | 5   | 6   | 6   | 7   |
| 30  | 8' Ceilings  | 2                          | 2  | 2  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 10 | 11 | 12  | 13  | 14  | 15  | 17  | 18  |
|     | 10' Ceilings | 2                          | 2  | 2  | 2  | 2  | 3  | 3  | 4  | 5  | 5  | 6  | 7  | 8   | 8   | 9   | 10  | 11  | 11  |
|     | 12" Ceilings | 1                          | 1  | 1  | 1  | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 5   | 6   | 6   | 7   | 7   | 8   |
| 35  | 8' Ceilings  | 2                          | 2  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 10 | 11 | 13 | 14  | 15  | 17  | 18  | 20  | 21  |
|     | 10' Ceilings | 2                          | 2  | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 11  | 11  | 12  | 13  |
|     | 12" Ceilings | 2                          | 2  | 2  | 2  | 2  | 2  | 2  | 3  | 4  | 4  | 5  | 5  | 6   | 7   | 7   | 8   | 9   | 9   |
| 40  | 8' Ceilings  | 2                          | 2  | 3  | 4  | 5  | 6  | 6  | 8  | 9  | 11 | 13 | 14 | 16  | 17  | 19  | 20  | 22  | 24  |
|     | 10' Ceilings | 2                          | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 9  | 10  | 11  | 12  | 13  | 14  | 15  |
|     | 12" Ceilings | 2                          | 2  | 2  | 2  | 2  | 2  | 3  | 3  | 4  | 5  | 6  | 6  | 7   | 8   | 8   | 9   | 10  | 10  |
| 50  | 8' Ceilings  | 3                          | 3  | 4  | 5  | 6  | 7  | 8  | 10 | 12 | 14 | 16 | 18 | 20  | 22  | 24  | 26  | 28  | 29  |
|     | 10' Ceilings | 3                          | 3  | 3  | 3  | 4  | 4  | 5  | 6  | 8  | 9  | 10 | 11 | 13  | 14  | 15  | 16  | 18  | 19  |
|     | 12" Ceilings | 2                          | 1  | 2  | 2  | 3  | 3  | 3  | 4  | 5  | 6  | 7  | 8  | 9   | 10  | 10  | 11  | 12  | 13  |
| 60  | 8' Ceilings  | 4                          | 4  | 5  | 6  | 7  | 8  | 9  | 12 | 14 | 17 | 19 | 21 | 24  | 26  | 28  | 31  | 33  | 35  |
|     | 10' Ceilings | 3                          | 3  | 3  | 4  | 5  | 5  | 6  | 8  | 9  | 11 | 12 | 14 | 15  | 17  | 18  | 20  | 21  | 23  |
|     | 12" Ceilings | 2                          | 2  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 7  | 8  | 9  | 10  | 11  | 13  | 14  | 15  | 16  |
| 70  | 8' Ceilings  | 4                          | 4  | 6  | 7  | 8  | 10 | 11 | 14 | 17 | 19 | 22 | 25 | 27  | 30  | 33  | 36  | 39  | 41  |
|     | 10' Ceilings | 4                          | 4  | 4  | 4  | 5  | 6  | 7  | 9  | 11 | 12 | 14 | 16 | 18  | 19  | 21  | 23  | 25  | 26  |
|     | 12" Ceilings | 3                          | 3  | 3  | 3  | 4  | 4  | 5  | 6  | 7  | 9  | 10 | 11 | 12  | 13  | 15  | 16  | 17  | 18  |
| 80  | 8' Ceilings  | 5                          | 5  | 6  | 8  | 10 | 11 | 13 | 16 | 19 | 22 | 25 | 28 | 31  | 35  | 38  | 41  | 44  | 47  |
|     | 10' Ceilings | 4                          | 4  | 4  | 5  | 6  | 7  | 8  | 10 | 12 | 14 | 16 | 18 | 20  | 22  | 24  | 26  | 28  | 30  |
|     | 12" Ceilings | 3                          | 3  | 3  | 3  | 4  | 5  | 6  | 7  | 8  | 10 | 11 | 13 | 14  | 15  | 17  | 18  | 19  | 21  |
| 90  | 8' Ceilings  | 6                          | 6  | 7  | 9  | 11 | 13 | 14 | 18 | 21 | 25 | 28 | 32 | 35  | 39  | 42  | 46  | 49  | 53  |
|     | 10' Ceilings | 5                          | 5  | 5  | 6  | 7  | 8  | 9  | 11 | 14 | 16 | 18 | 20 | 23  | 25  | 27  | 29  | 32  | 34  |
|     | 12" Ceilings | 4                          | 4  | 4  | 4  | 5  | 5  | 6  | 8  | 9  | 11 | 13 | 14 | 16  | 17  | 19  | 20  | 22  | 23  |
| 100 | 8' Ceilings  | 6                          | 6  | 8  | 10 | 12 | 14 | 16 | 20 | 24 | 27 | 31 | 35 | 39  | 43  | 47  | 51  | 55  | 59  |
|     | 10' Ceilings | 5                          | 5  | 5  | 6  | 8  | 9  | 10 | 13 | 15 | 18 | 20 | 23 | 25  | 28  | 30  | 33  | 35  | 38  |
|     | 12" Ceilings | 4                          | 4  | 4  | 4  | 5  | 6  | 7  | 9  | 10 | 12 | 14 | 16 | 17  | 19  | 21  | 23  | 24  | 26  |
| 110 | 8' Ceilings  | 7                          | 7  | 9  | 11 | 13 | 15 | 17 | 22 | 26 | 30 | 35 | 39 | 43  | 47  | 52  | 56  | 60  | 65  |
|     | 10' Ceilings | 6                          | 6  | 6  | 7  | 8  | 10 | 11 | 14 | 17 | 19 | 22 | 25 | 28  | 30  | 33  | 36  | 39  | 42  |
|     | 12" Ceilings | 5                          | 5  | 4  | 5  | 6  | 7  | 8  | 10 | 11 | 13 | 15 | 17 | 19  | 21  | 23  | 25  | 27  | 29  |
| 120 | 8' Ceilings  | 8                          | 8  | 10 | 12 | 14 | 17 | 19 | 24 | 28 | 33 | 38 | 42 | 47  | 52  | 56  | 61  | 66  | 70  |
|     | 10' Ceilings | 6                          | 6  | 6  | 8  | 9  | 11 | 12 | 15 | 18 | 21 | 24 | 27 | 30  | 33  | 36  | 39  | 42  | 45  |
|     | 12" Ceilings | 5                          | 5  | 4  | 5  | 6  | 7  | 8  | 10 | 13 | 15 | 17 | 19 | 21  | 23  | 25  | 27  | 29  | 31  |
| 130 | 8' Ceilings  | 8                          | 8  | 10 | 13 | 15 | 18 | 20 | 26 | 31 | 36 | 41 | 46 | 51  | 56  | 61  | 66  | 72  | 78  |
|     | 10' Ceilings | 7                          | 7  | 7  | 8  | 10 | 11 | 13 | 16 | 20 | 23 | 26 | 29 | 33  | 36  | 39  | 42  | 46  | 49  |
|     | 12" Ceilings | 5                          | 5  | 5  | 6  | 7  | 8  | 9  | 11 | 14 | 16 | 18 | 20 | 23  | 25  | 27  | 30  | 32  | 34  |
| 140 | 8' Ceilings  | 9                          | 9  | 11 | 14 | 17 | 20 | 22 | 28 | 33 | 39 | 44 | 49 | 55  | 60  | 66  | 72  | 77  | 82  |
|     | 10' Ceilings | 7                          | 7  | 7  | 9  | 11 | 12 | 14 | 18 | 21 | 25 | 28 | 32 | 35  | 39  | 42  | 46  | 49  | 53  |
|     | 12" Ceilings | 6                          | 6  | 5  | 6  | 7  | 9  | 10 | 12 | 15 | 17 | 19 | 22 | 24  | 27  | 29  | 32  | 34  | 37  |
| 150 | 8' Ceilings  | 9                          | 9  | 12 | 15 | 18 | 21 | 24 | 29 | 35 | 41 | 47 | 53 | 59  | 65  | 70  | 76  | 82  | 88  |
|     | 10' Ceilings | 8                          | 8  | 8  | 9  | 11 | 13 | 15 | 19 | 23 | 26 | 30 | 34 | 38  | 41  | 45  | 49  | 53  | 56  |
|     | 12" Ceilings | 6                          | 6  | 5  | 7  | 8  | 9  | 10 | 13 | 16 | 18 | 21 | 23 | 26  | 29  | 31  | 34  | 37  | 39  |

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Once the proper quantities of speakers are determined, the speakers should be set in the ceiling with an alternating pattern as shown in Diagram 2:

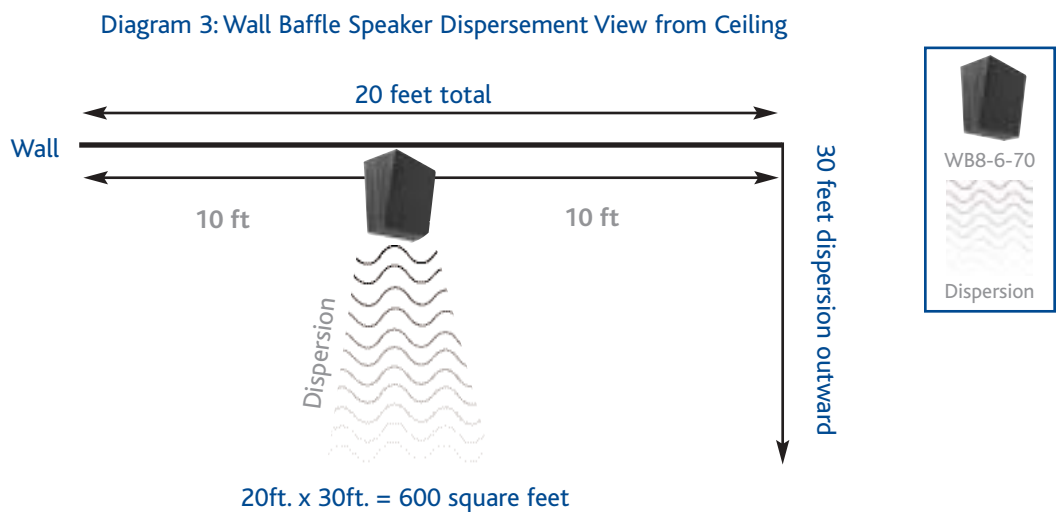


## Determining Proper Use Quantity For Wall Baffle Speakers:

The amount of Wall Baffle Speakers needed for an installation is an easy formula by taking the square footage of the area that needs coverage and dividing it by 600 square feet:

$$\text{Area of Square footage required} \div \text{Divided by } \% \text{ 600 Square Feet} = \text{Number of Wall Baffle Speakers Required}$$

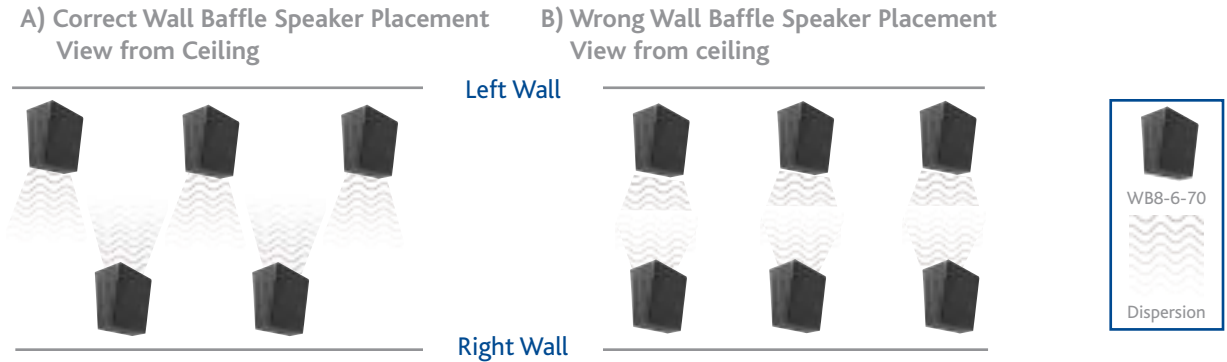
This 600 ft. is an average estimate and is arrived at by taking the usual side sound dispersement of a wall baffle speaker (10 ft. to each side), then considering the usual sound projection outward (30 ft. outward) as detailed by the Diagram 3:



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Wall Baffle Speakers should, whenever possible, always be pointed in the same direction. It is very important that if need arises to place wall baffle speakers on opposing walls to cover a large area of space that they are not positioned directly across from each other as shown in Diagram 4.

**Diagram 4: Correct and Incorrect Placement of Wall Baffle Speakers**



You can see in Scenario B) that there is an overlap of sound dispersion and distortion. With Scenario A) there is proper dispersion and the correct alignment.

**Determining Proper Quantity Use For PA Horn Speakers:**

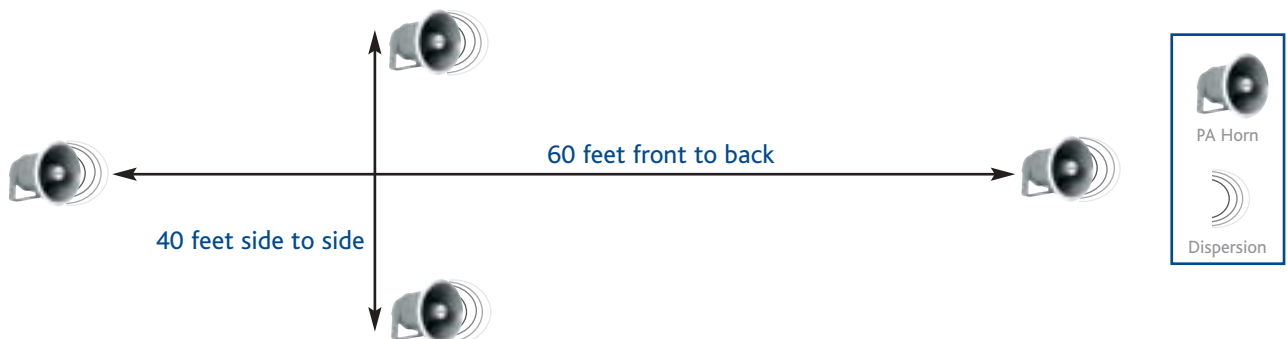
The correct number of PA Horn Speakers can be determined by the below chart by cross-referencing the square footage requirement and the type of noise environment.

**Desired Square Footage of Coverage (1,000 square ft.)**

| Environment           | dB Class | Example                      | 1 | 2 | 5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 45 | 50 | 55 | 60 | 65 | 70 | 75 | 80 | 85 | 90 | 95 | 100 | 125 | 150 | 200 | 225 | 250 | 300 |
|-----------------------|----------|------------------------------|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|
| Quiet Areas           | <70 dB   | Restaurant<br>Depart Store   | 1 | 1 | 1 | 1  | 2  | 3  | 3  | 4  | 4  | 5  | 6  | 6  | 7  | 8  | 8  | 9  | 9  | 10 | 11 | 11 | 12 | 13  | 16  | 19  | 25  | 28  | 31  | 38  |
| Noisy Areas           | 71-85 dB | Factory<br>Assembly Line     | 1 | 1 | 1 | 2  | 4  | 5  | 6  | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 23 | 24 | 25  | 31  | 38  | 50  | 56  | 63  | 75  |
| Extremely Noisy Areas | >85 dB   | Printing Press<br>Metal Shop | 1 | 1 | 3 | 5  | 8  | 10 | 13 | 15 | 18 | 20 | 23 | 25 | 28 | 30 | 33 | 35 | 38 | 40 | 43 | 45 | 48 | 50  | 63  | 75  | 100 | 113 | 125 | 150 |

PA Horns should be placed at a height of 15 feet and positioned at a 60 degree angle toward the ground. PA Horns should NEVER be positioned facing each other! In the case where multiple PA Horns are needed in a line, use what is known as a "diamond pattern" shown in Diagram 5.

**Diagram 5: Proper Placement of PA Horns in "Diamond Pattern"**



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### 3) What is the Purpose of a 70V transformer on a Speaker?

A 70V transformer attached to a speaker protects the speaker and only allows a certain wattage to pass through the transformer to activate the speaker depending on the sound requirement. The higher the wattage tap is set or wired, the louder the speaker will be. In addition, this transformer based system is very efficient on current and protects the system from getting overheated based on wasted power. Finally, a 70V transformer based system allows the installer to make a quick calculation for his required wattage needed for the system(See chart on page 9) because every speaker is individually set at a certain tap. The calculation requires adding all the taps requirement and adding an increase of a 20% as a safety buffer.

### 4) How do I wire a 70V Speaker?

Wiring a speaker with a 70 Volt transformer involves finding the correct colored wire extending from the transformer that corresponds with your desired wattage tap. Each colored wire's individual wattage tap should be marked on the transformer. Once the proper wire is found, connect it to the positive wire running from your amplifier. Then find the common wire extending from the transformer, usually black, and connect it with a wire running back towards the amplifier.

Some speakers have a transformer dial that makes the set up and selecting a desired wattage very easy by giving you one positive wire and one common wire for connections, then having you simply turn the transformer dial to the desired watt setting.



70V Transformer (T-7025/5)



Transformer Dial

### 5) Which Wattage Tap Should I Set My Speaker or Horn At?

The following chart shows a basic guideline for wattage tap setting. Please understand this is a very basic guideline and each case must be looked at individually as there are many factors that go into determining the best wattage tap settings per job.

## Basic Guideline to Select Wattage Tap Based on Sound Environment

| Noise Level   | Decibel                  | Examples         | Cone Speaker<br>Wattage Taps | PA Horns*<br>Wattage Taps |
|---------------|--------------------------|------------------|------------------------------|---------------------------|
| Low Noise     | 55dB -<br>64dB           | Doctor's Office  | 0.5                          |                           |
|               |                          | Department Store | 1                            |                           |
| Medium Noise  | 65db -<br>74dB           | Restaurant       | 2                            | 5                         |
|               |                          | Shipping Dep     | 5                            |                           |
| High Noise    | 75dB -<br>82dB -<br>84dB | Supermarket      | 5                            | 7.5                       |
|               |                          | Factory          | 7.5                          | 10                        |
|               |                          | Assembly Line    | 10                           | 15                        |
| Maximum Noise | 85dB+                    | Printing Press   |                              | 30                        |
|               |                          | Metal Shop       |                              | 40                        |

\*At an estimated 60 ft. of range

### 6) What Wattage Amplifier Do I Need?

Normally, to arrive at the needed requirement for an amplifier's wattage for a location, you will need to take the total sum of wattage you need when considering all the speakers and horns and their wattage taps they are set at, then you allow a 20 percent safety buffer to the upside. The work sheet, on the next page, will aid you in your calculation.

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## Determining Your Amplifier Needs for Sound Systems

- Step 1:** Fill out Wattage Tap Requirement Chart (to right) determining the number of speakers that will be used at each wattage tap for the amplifier.
- Step 2:** Multiply the number of speakers by each wattage tap to determine Total Wattage Requirement per Tap setting (See Ex A).
- Step 3:** Add all the figures in the shaded area to determine the total Wattage Requirement for the amplifier.
- Step 4:** Match total Wattage Requirement to the bottom chart "Recommended Amplifier Wattage Chart" to determine acceptable RMS Wattage your amplifier should have.
- Step 5:** Repeat this process for each amplifier system required.

## Wattage Tap Requirement Chart

|       | Set Wattage Taps |   | Number of Speakers at Set Tap | = | Total Wattage Requirement per Tap Setting |
|-------|------------------|---|-------------------------------|---|---|
| Ex A) | 5                | X | <u>10</u>                     | = | <u>50</u>                                 |
|       | 60               | X | _____                         | = |   |
|       | 30               | X | _____                         | = |   |
|       | 20               | X | _____                         | = |   |
|       | 15               | X | _____                         | = |   |
|       | 10               | X | _____                         | = |   |
|       | 7.5              | X | _____                         | = |   |
|       | 5                | X | _____                         | = |   |
|       | 4                | X | _____                         | = |   |
|       | 3.75             | X | _____                         | = |   |
|       | 2.5              | X | _____                         | = |   |
|       | 2                | X | _____                         | = |   |
|       | 1.50             | X | _____                         | = |   |
|       | 1.25             | X | _____                         | = |   |
|       | 1.00             | X | _____                         | = |   |
|       | 0.50             | X | _____                         | = |   |
|       | 0.25             | X | _____                         | = |   |
|       | 0.125            | X | _____                         | = |   |

Total Sum of Shaded Area Represents Total Wattage Requirement

## Recommended Amplifier Wattage Chart

|   | Acceptable Amplifier RMS Wattage |         |         |          |
|---|----------------------------------|---------|---------|----------|
|   | 15 Watt                          | 30 Watt | 60 Watt | 120 Watt |
| If Sum Wattage Total is 12 Watts or Less          | X                                | X       | X       | X        |
| If Sum Wattage Total is between 13 and 24 Watts   | X*                               | X       | X       | X        |
| If Sum Wattage Total is between 25 and 48 Watts   | X*                               | X*      | X       | X        |
| If Sum Wattage Total is between 49 and 96 Watts   | X*                               | X*      | X*      | X        |
| If Sum Wattage Total is between 97 and 204 Watts  | X*                               | X*      | X*      | X*       |
| If Sum Wattage Total is between 205 and 216 Watts |                                  | X*      | X*      | X*       |
| If Sum Wattage Total is between 217 and 240 Watts |                                  |         | X*      | X*       |
| If Sum Wattage Total is between 241 and 288 Watts |                                  |         |         | X*       |

\* RMS Amplifier used in conjunction with Speco Technologies' P-240A Power Booster Amp

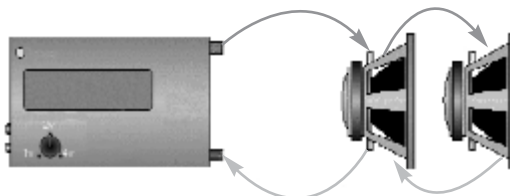
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## COMMERCIAL audio design

### 7) How Do I Wire a Commercial Run of Speakers?

Commercial Speakers should always be wired in a PARALLEL RUN, meaning the positive outbound connection of your amplifier or receiver should run to the positive terminal of your first speaker, then from that positive terminal you proceed with the wiring to the next speaker's positive terminal as detailed in the below Diagram 5. The return wiring goes from each common terminal to the next following speaker's on the return run's common terminal until you finish at the amplifier/receiver. Commercial Speaker wires should NEVER BE WIRED IN A SERIES RUN!

Diagram 5: Wiring Speakers in Parallel



Large runs with many speakers should be broken down into several runs from the amplifier. If one speaker stops working it is easier to locate the problem if you use shorter runs rather than one continuous run

Diagram 6: Proper Layout of Speaker Runs

Wrong Way to Wire a Row of Commercial Speakers: If one does not perform the whole row will not work, and each speaker must be checked individually



Correct Way to Wire Commercial Speakers. If one speaker does not perform, some speakers will work and problem will be easier to isolate.



### 8) What Wire Should I Use?

Generally speaking, speaker wire is determined by the length of the run and the wattage utilized:

- Wire runs less than 50 ft. and utilizing 50 Watts of power or less use 16 Gauge wire.
- Wire runs more than 50 ft. and/or over 50 Watts of power use 14 Gauge wire.

There are also other considerations such as UL listed, plenum rated, weatherproof, etc. when selecting your wire and line loss for length of speaker run.

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### Components of a 70 Volt Paging System:



P-60FACD

1) The Amplifier is the Central Component of a 70/25V System. It amplifies the sound source to be sent out to the speakers and connects the phone and auxiliary systems, in addition to the microphones, to the system.

2) The Phone System and Auxiliary Sound Sources are inputted and plugged into the amplifier through auxiliary inputs



WB8-6-70

5) Speaker wires run out of amplifiers through a volume control, if access to the volume control is needed in specific rooms, if not the volume is controlled centrally at the amplifier.

6) Speaker Wire Runs From the amplifier and connects to Wall Baffle, In-ceiling or PA Horn Speakers. Where sound is dispersed.

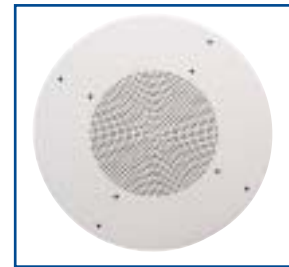


MCA-20

3) Mic Cables Connect the microphones to the Amplifier, usually by a XLR connectors.



WAT-35



G86TG



MHL-5S

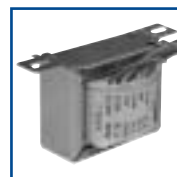


MW-200H



SPC-30RT

4) A Standard MIC or a wireless MIC is connected to the amplifier through a MIC cable, or XLR/screw terminal connectors.



T-7025/5

7) A transformer is mounted on each speaker above, controlling the wattage into the speaker.

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# Demystifying the Back of an Amplifier

Different Zones that 70V Wiring can go out to the speakers from. One positive terminal running to the speakers (marked "75V/25V"), One common ("COM") terminal that receives the speaker wire back from the speakers.

XLR Connectors that can receive plug ins from Male XLR Microphones Connectors.

An Auxiliary Input/ RCA connectors, that allows inputs from a CD Player or other sound source.

RCA Connector Outputs that allows sound to exit, and be recorded, into another device.



AC plug in for electrical cord.

Where fuse is kept. Can be replaced if blown.

Adjusts the volume of Music on Hold

Switch that allows MIC #1 to override music playing.

Inputs for AM & FM Radio antennas.

Adjusts the volume of paging system.

70 & 25 Volt Screw Terminals going out to the speakers, used if you do not want to separate into 4 zones above. Speaker Wire goes out through the "70V" or "25V" and returns through the "COM" terminal.

Accepts inputs from the telephone paging system so that you can page over the speaker system.

Screw Terminal Outputs to be used if the system is based on 8 ohms (residential), not 70V (commercial). You would connect the positive outgoing speaker wire to the proper ohm setting terminal and return the speaker wire through the "COM" terminal.

Music on Hold screw terminal outputs to the phone system that allow whatever sound/music that is being played through the amplifier to be heard by people/customers that are on hold.

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# AMP REFERENCE CHART

| Model Number | RMS Wattage | UL Listed | Inputs                        |                            |                     |                |                        |                            | Outputs |     |             |                      | Features    |                 |                            |           |                                       |                                    |               |
|--------------|-------------|-----------|-------------------------------|----------------------------|---------------------|----------------|------------------------|----------------------------|---------|-----|-------------|----------------------|-------------|-----------------|----------------------------|-----------|---------------------------------------|------------------------------------|---------------|
|              |             |           | Total Possible MIC/Aux Inputs | Total Possible Microphones | Mic Strip Terminals | XLR Connectors | Music/ RCA Jacks Pairs | Telephone Paging (600 ohm) | 70V     | 25V | 4/8/16 Ohms | Music on Hold Output | FM/AM Tuner | Muting Override | Auto-Reverse Cassette Deck | CD Player | Separate Front Bass & Treble Controls | Separate Front MIC Volume Controls | Master Volume |
| PBM-15       | 15          | X         | 2                             | 2                          | 2                   |                | 1                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  |               |
| PBM-30       | 30          | X         | 2                             | 2                          | 2                   |                | 1                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  |               |
| PBM-60       | 60          | X         | 3                             | 3                          | 3                   | 1              | 3                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  |               |
| PBM-120      | 120         | X         | 3                             | 3                          | 3                   | 1              | 3                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  |               |
| P-30FACC     | 30          | X         | 5                             | 4                          |                     | 4              | 1                      | X                          | X       | X   | X           | X                    | X           | X               | X                          |           | X                                     | X                                  | X             |
| P-30FACD     | 30          | X         | 5                             | 4                          |                     | 4              | 1                      | X                          | X       | X   | X           | X                    | X           | X               |                            | X         | X                                     | X                                  | X             |
| P-60FACC     | 60          | X         | 5                             | 4                          |                     | 4              | 1                      | X                          | X       | X   | X           | X                    | X           | X               | X                          |           | X                                     | X                                  | X             |
| P-60FACD     | 60          | X         | 5                             | 4                          |                     | 4              | 1                      | X                          | X       | X   | X           | X                    | X           | X               |                            | X         | X                                     | X                                  | X             |
| PMM-120A     | 120         | X         | 6                             | 6                          | 4                   | 4              | 3                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  | X             |
| PMM-60A      | 60          | X         | 6                             | 6                          | 4                   | 4              | 3                      | X                          | X       | X   | X           | X                    |             | X               |                            |           | X                                     | X                                  | X             |
| P-30A *      | 30          |           | 4                             | 2                          |                     | 2              | 2                      |                            | X       | X   | X           |                      |             | X               |                            |           |                                       |                                    | X             |
| P-30FA * #   | 30          |           | 3                             | 2                          | 2                   | 2              | 1                      | X                          | X       | X   | X           | X                    | X           | X               |                            |           | X                                     |                                    | X             |
| PAT-30 #     | 10          |           | 3                             | 2                          | 2                   |                | 1                      |                            | X       | X   | X           |                      |             |                 |                            |           |                                       |                                    |               |
| PAT-60 #     | 20          |           | 2                             | 2                          | 2                   |                | 2                      |                            | X       | X   | X           |                      |             |                 |                            |           |                                       |                                    |               |
| PAT-120 #    | 50          |           | 4                             | 4                          | 4                   |                | 3                      |                            | X       | X   | X           |                      |             |                 |                            | X         |                                       |                                    |               |
| P-240A *+    | 240         |           | 1                             |                            |                     |                | 1                      |                            | X       | X   | X           |                      |             |                 |                            |           |                                       |                                    | X             |
| PAT-20 ^     | 20          |           | 2                             | 1                          |                     |                | 1                      |                            |         |     | X           |                      |             |                 |                            |           |                                       |                                    | X             |
| PAT-25C ^    | 25          |           | 1                             | 1                          |                     |                | 1                      |                            |         |     | X           |                      |             |                 |                            |           |                                       |                                    |               |

\* 4/8 Ohm Output    ^ 8 Ohm- Mobile PA Amplifiers    + Power Booster Amp    # 1/4 MIC Plugs in lieu of Strip Terminal

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**5.1 System:** A designation describing a sound system incorporating 5 channels of sound/ speakers and one subwoofer.

**Amp:** The unit of measure used with an electric current.

**Amplifier:** An electronic component or device that takes low-level signals and recreates the signal with more power.

**Attenuators:** A device that reduces an amplified signal without distortion.

**Baffle:** A box-like structure that a speaker is placed into to enhance the bass sound of the speaker.

**Bass:** The lowest existing frequency range usually below 200 Hz.

**Bookshelf Speaker:** A small speaker which is designed to sit on a bookshelf or shelf.

**Capacitors:** An electrical device that store charges.

**Center Channel:** A third front audio channel that is usually used to enhance the clarity of dialog being heard within a sound system.

**Co-axial Speaker:** A type of speaker driver where the high frequency driver (the tweeter) is located inside a low or mid-frequency driver (the woofer).

**Crossover:** A component that splits up the frequency depending on ranges and directs them to certain drivers.

**Current:** The flow of electricity through a circuit as measured in amps.

**db Decibel:** A logarithmic scale measuring the intensity of the sound pressure level of a noise.

**Digital Surround Sound:** See definition for 5.1.

**Driver:** The cone-like component of a speaker that pushes back and forth to sound waves.

**Dual Voice Coil:** A speaker that accepts both right and left channels into one speaker providing full range sound in a smaller space than two speakers.

**Floor Standing Speaker:** A specific type of speaker enclosure with an acceptable level of sound height that stands directly on the floor.

**Frequency:** The number of repeating sound cycles in a given period, measured in hertz or kilohertz. Human hearing is usually 20Hz to 20KHz with the lower frequencies representing the bass and higher representing the treble.

**Grille:** An aesthetic front plate covering for speakers.

**Horn:** An element used to increase sound efficiency by placing the driver at the end of a megaphone-like structure.

**Hz (Hertz):** Number of cycles per second of sound waves used to measure frequency.

**Impedance:** The resistance to the flow of an electrical current as measured in ohms.

**kHz (Kilohertz):** One thousand sound cycles per second.

**Magnet:** A component of a speaker that uses electromagnets to create movement of the driver reproducing sound.

**Microphone:** A device used to create an electrical signal representative of the sound striking it to be heard over speakers.

**Midrange:** The middle band of audio frequencies between 150/200 Hz to between 1,000/2,000 Hz.

**Multimeter:** A device used to measure different electronic properties.

**Music on Hold Feature:** An amplifier output feature which allows callers on a phone system that are holding to hear music or supplied dialog.

**Ohm:** A measure of resistance in a circuit to an electric current.

**Outdoor Speaker:** A speaker that is weatherproof.

**Power Rating:** The maximum amount of power in watts that an amplifier can put out or a speaker can be driven with.

**RMS (Root Mean Square):** The average continuous power output an amplifier is capable of producing or a speaker is capable of receiving.

**Subwoofer:** A type of speaker used to reproduce the lowest portion of the frequency spectrum, usually 80Hz and below.

**Sensitivity or SPL:** A measure of the sound pressure level measured from a distance of one meter from a speaker when the speaker receives a 2.83-volt signal - -1 watt at 8 ohms.

**Shielded:** A term relating to specific speakers having their magnetic fields contained as to not harm video displays.

**Three-Way Speaker:** A speaker system containing three individual drivers covering three frequency bands.

**Transformer:** An important component of the power supply that pulls electricity from a source and then transforms it into power that can be used in electronic devices.

**Tweeter:** A speaker driver designed for receiving high frequencies usually above 2,000 Hz.

**Two-Way Speaker:** A speaker system with two individual drivers covering two frequency bands.

**Voice Coil:** A tightly wrapped coil of wire attached to a speaker driver's diaphragm and located near the stationary magnet.

**Watt:** A measurement of power obtained by multiplying current by voltage.

**Woofer:** A Speaker driver that handles low frequency signals.

**XLR Connector:** A plug connector usually at the end of a microphone wire that allows easy connection to an amplifier without the need to strip the wire to connect it to screw terminals.

## Speco Technologies Top Selling Commercial Items



30 or 60 Watt 4 Zone Amplifiers with AM/FM Tuner and CD Player  
**Item Codes:** P-30FACD, P-60FACD  
(Also available in cassette version)



15, 30, 60, 120 Watt RMS Contractor Series Amplifiers  
**Item Codes:** PBM-15, PBM-30, PBM-60 or PBM-120



Desktop MIC with XLR Connector  
**Item Code:** MHL-5S



70/25V MA Series ABS Plastic Enclosure Speakers  
**Item Codes:** SP-5MA/T, SP-6MA/T



70/25V Commercial Speakers  
**Item Codes:** G86TG, G86TCG (with Volume Control)



70/25V Nexus Contractor Series Metal Enclosed Speakers  
**Item Codes:** SP-4NXC/T, SP-5NXC/T, SP-6NXC/T



70/25V 30 Watt Weatherproof Horn  
**Item Code:** SPC-30RT



70/25 5.25" Outdoor Speakers  
**Item Codes:** SP-5AWD/T (Black), SP-5AWD/T-W (White)  
Available in 6.5" also



70/25V Rock Speakers  
**Item Code:** SP-RK65CB/T (Brown), SP-RK65CG/T (Granite)

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For more information contact us at:

Speco Technologies 200 New Highway, Amityville, NY 11701 Web: [www.specotech.com](http://www.specotech.com)  
Toll Free: 1-800-645-5516 In Metro NY: 631-957-8700 Fax: 631-957-9142 or 631-957-3880