TECHNICAL INFORMATION

- Product Selection Guidelines
- Code of Practice
- Battery Calculation & IP Rating Guidelines
- Technical Terms
- Speaker & Cabling Guidelines

DISCLAIMER

The information provided is derived from various sources and deemed accurate at the time of publication but is subject to change without notice. Amperes Electronics Sdn Bhd is not liable for any errors or consequences arising from the use of this data. Technical specifications may be updated to reflect technological improvements.

PRODUCT SELECTION GUIDELINES

Product outline drawings are available for download on each product page.

Product selection guidelines for choosing Amperes products based on **system scale, budget and compliance with fire department and local building regulations.**

Amperes offers a wide range of models that can be mixed and matched to suit different needs. To help consultants, system integrators, facility managers in selecting the right products, we've created simple guidelines grouped into 5 categories - from basic PA systems to complex IP-based setups. Each group includes variations based on project size and optional features.

Sample drawings are provided for easy reference and can be downloaded from our website by scanning the QR code below.

Need help with system design? Our technical team is ready to assist upon request.

System Category

Basic PA

Ideal for small, cost-effective BGM and paging systems with less than 6 zones, standalone and no fire code requirements.

Applications: Restaurants, conference rooms, retail shops, small warehouses, mosque (surau), small parking complex, small industrial facilities

Conventional Analogue PA

Ideal for paging and BGM setups with up to 12 zones, fire code compliant, and a single paging point.

Applications: Office buildings, industrial facilities, hypermarkets, mosque (surau), educational institutions, boutique hotels, police or fire stations, healthcare facilities

Conventional Digital PA

Supports up to 250 zones, suitable for single or multi-building fire code compliant setups.

Applications: Office towers, mixed development projects, universities and colleges, hotels or resorts, army camps, transport hubs, fire stations, healthcare facilities, shopping centers

Ethernet / IP-based PA

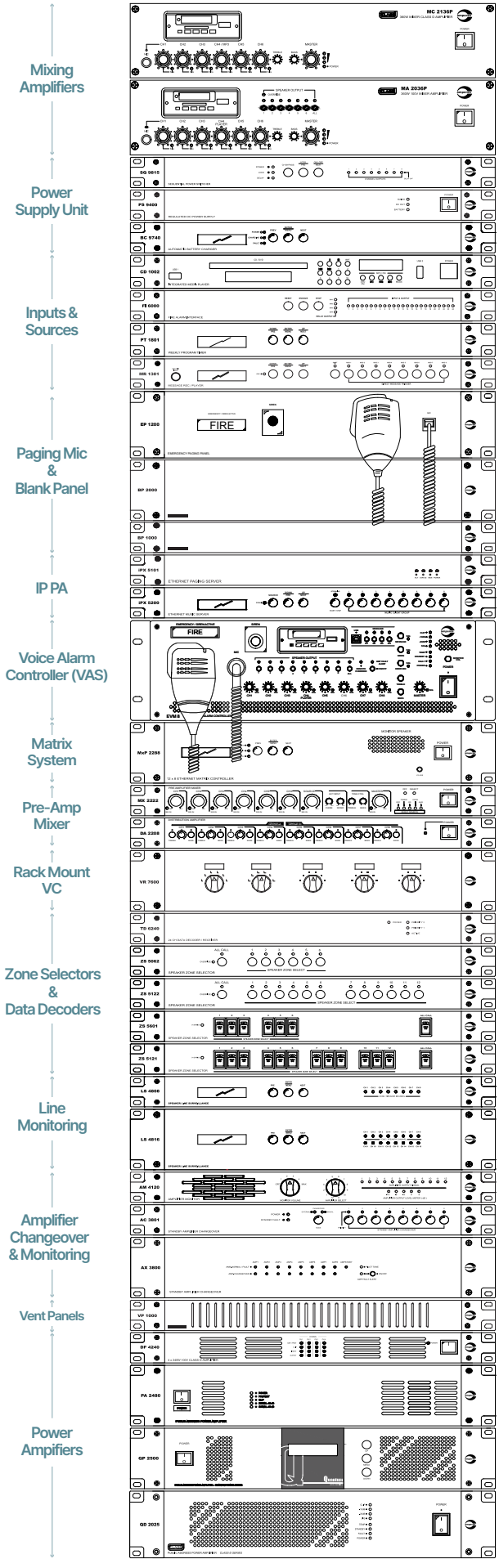
Medium to large decentralized systems with up to 250 zones, using IPX System or E2VIS for up to 2000 zones for simplified cabling and expansion.

Applications: Office towers, mixed development projects, universities and colleges, hotels or resorts, army camps, transport hubs, leisure parks, healthcare facilities

Matrix System

Flexible small-to-medium systems for uninterrupted paging, with full or semi-matrix audio configuration.

Applications: Office towers, mixed development projects, universities and colleges, hotels or resorts, clubhouses, residential developments, transport hubs



Applicable Standards for Commercial PA System Design

The following standards are commonly used in the design and implementation of PA and Voice Alarm systems:

- **BS 5839 Part 8** - Code of practice for the design, installation, commissioning and maintenance of voice alarm systems.
- **EN54 Part 16** - Requirements for Voice Alarm Control and Indicating Equipment.
- **EN54 Part 24** - Requirements for the design and construction of loudspeakers.
- **SS546 : 2022** - Emergency Voice Communication system in buildings (Singapore)

CE Markings:
Most Amperes pro ducts are CE-certified by independent third-party labs, compliant with **IEC 61000-3-2, EN 55032, EN 61000-3-3, EN 55035, EN IEC 62368.**

ⓘ NOTE ON USAGE

As a Code of Practice, this standard provides **guidance and recommendations**; it should not be cited as a specification. Users should take care to ensure that all claims of compliance are accurate and not misleading.

The extracts provided are **partial**, simplified references highlighting Amperes components relevant to these requirements. For full details, please refer to the complete standards.

The Need for A Voice Alarm System (VAS)

Studies show that people **respond more quickly to voice messages than to bells, sounders, or text notifications.** Clear voice instructions help reduce delays during emergencies by guiding occupants on how to react.

The points below are simplified extracts from BS 5839 Part 8, along with relevant Amperes products that can meet the stated requirements. This guide highlights only the key areas and does not replace the full standard. For complete details, please refer to the official publication.

Scope	Brief	Compatibility with Amperes
Types of Voice Alarm Systems	VAS falls under categories such as: • **Type V1:** Auto evacuation • **Type V2:** Live emergency messages • **Type V3:** Zonal live emergency messages • **Type V4:** Manual controls • **Type V5:** Engineered / customized systems	Amperes offers various components that can be mixed and matched to support all categories of VAS applications.
Design of System	System design depends on requirements such as: • Coverage area • Minimum sound pressure level • Speech intelligibility • Standby power duration • Cable parameters	Consult our technical team for optimal system design and cost-effective solutions.
Fire Alarm & VAS Interface	Define how the Fire Alarm System (FAS) links with the PA / VAS, including triggering methods and communication paths.	Compatible models include: **Amperes FI6000 MK II, MR1301 MK II, EP1200** Fire alarm activation will automatically trigger alarm tones or messages, including manual bypass if required.
Fault Monitoring	Faults must be reported within 100 seconds from the occurrence on any component or transmission path.	Amperes fault-monitoring components include: • **LS4808 / LS4816** - Speaker line monitoring units • **AX3800 MK II** - Amplifier changeover unit • **BC9740** - Battery charger • iPX modules monitored via **iPX5101** Network Controller or **PMX Software**

ⓘ **NOTE**

This information continues on page 86 ⟶

CODE OF PRACTICE

Continued from page 85

Scope	Brief	Compatibility with Amperes
Loudspeaker Zones	Emergency speaker zones should correspond to fire detection zones.	Speaker zoning can be easily organized using **Amperes ZS Series** speaker zone selectors.
Loudspeaker & Intelligible Coverage	Selection depends on speaker type, quantity, location, acoustic and environmental conditions, ambient noise, coverage area, and sound quality needs.	Amperes offers a full range of speakers — from ceiling to horn types — suitable for emergency paging, BGM, and high-quality audio. EN54-24 options and fire-rated enclosures are also available where required.
Power Amplifiers	Requirement of reliable amplifiers: • Frequency response of at least 200 Hz – 8 kHz • Standby changeover for faulty units	Compatible models include: • **Amperes QP / QD / PA / DP Series** of amplifiers • **Amperes AX3800 MK II** amplifier changeover unit
Ambient Noise Sensing (ANS)	Uses ambient noise detection to automatically adjust output volume for better intelligibility (optional feature).	Auto Volume Controller adjusts volume based on noise levels in a zone. Ie: **Amperes iAV7905**
Emergency Microphones	States the requirements for emergency paging mics: • Frequency response of 200 Hz - 5 kHz • Low distortion • Highest priority override • Only one emergency mic is active at a time	Compatible models include: **Amperes EP1200** (Conventional) / **iEP1200** (IP system) Both emergency paging panels include built-in siren tone generator, indicators, and message inputs.
Emergency Message	Specifies the requirement of pre-recorded emergency messages with minimum standards on frequency response, SNR, THD, and use of reliable non-mechanical storage media.	Compatible models include: **Amperes MR1301 MK II** The EVAC message player has a memory bank of over 500 hours and easily adaptable to most installation. Multilingual sample messages are available for download.
Priority of Messages	Message priority levels classifications: 1. Emergency microphones 2. EVAC pre-recorded messages / broadcast 3. Other pre-recorded messages / broadcast 4. Non-emergency messages / broadcast	Amperes system are designed with a built-in message priority structure with the emergency paging panel being the highest. When the Fire Alarm System (FAS) is activated, users can then manage and assign the priority level of all other messages accordingly. Compatible models include: **Amperes FI6000 MK II, MR1301 MK II, , EP1200**
Networked Large Systems	Applicable to networked systems with separate VACIE or individual setups linked to a central system. It highlights the importance of reliable communication links and the ability for each system to operate independently if a fault occurs in either the system or the communication line.	Amperes iPX Ethernet IP PA systems can function independently even if the main communication line to the sub-rack fails.
Power Supplies	Defines the requirements for mains and backup power, including standby duration, operation time, and proper indicators/labels. Refer to Pg.88 for back up battery calculations.	The battery charger includes charging-status indicators and built-in protections that help extend battery life, such as low-battery warning and automatic disconnection. Compatible model: **Amperes BC9740 Battery Charger**

Other parts of the standards include the following:

Other than previously mentioned standards, the following standards are also used in the design and implementation of PA and Voice Alarm systems:

- Placement and accessibility of VACIE
- Cabling of speaker circuit and its safety requirements
- Electrical safety precautions to VAS equipment
- Responsibility of installer, practices and workmanship
- Inspection and testing of wiring
- Commissioning and handover procedures including documentation and certification
- Acceptance and verification of installed system
- Maintenance of the system including user responsibility

ⓘ ABBREVIATIONS

VAS - Voice Alarm System
VACIE - Voice Alarm Control and Indicating Equipment
FAS - Fire Alarm System

Recommended Message Sequence

Broadcasting of alert or evacuation messages should follow the sequence shown below. Messages can be **customized to suit local needs, including language preferences.** In some cases, coded messages may be used to quietly alert staff of potential emergencies to avoid causing public panic.

Attention Drawing Signal	Brief Silence	Message Type: Alert / Evacuate		Brief Silence
Non-speech signal in 500 Hz to 1 kHz		**Alert Message (Pre-Evacuation)** " May I have your attention, please? " " A fire has been reported in the building. " " Please remain calm and await further instructions. " ⓘ To be used when notifying occupants of a potential emergency, before evacuation is confirmed.	**Evacuate Message (Confirmed Evacuation)** " Attention please. Attention please. " " A fire has been reported in the building. " " Please leave the building immediately using the nearest exit. " ⓘ To be used when immediate evacuation is required.	

2 to 10 secs → 1 second → **Message:** Less than 30s
Alert: More than 45s each → 2 to 5 secs

Repeated until manually silenced:
Each at interval <3 min

*The period of silence may depend on Reverberation Time (RTs) of the area.

Source: BSI Publication

Choosing the Right Installer

It is important that competent and well-trained personnel are involved in the design, installation, testing, and commissioning of the system to prevent errors and ensure proper performance.

Amperes is ready to support you from the design stage through installation completion. We also provide installation assistance through our certified installers and maintenance partners.

For more information, please contact us at **info@ampereselectronics.com**

BATTERY CALCULATION & IP RATING GUIDELINES

Calculate Backup Battery Capacity

For most commercial installations, local authorities require the PA system to **continue operating even during a power failure.** Backup power can be supplied either through the building's standby generator or a dedicated battery backup system.

The standby battery capacity must meet one of the following requirements:

Building with A Backup Generator

The battery must support system operation for at least 6 hours, after which it must still be able to run evacuation broadcasts in all zones for at least 30 minutes.

Building without A Backup Generator

The battery must support system operation for at least 24 hours, followed by at least 30 minutes of evacuation broadcast capability.

Calculation of Minimum Battery Capacity:

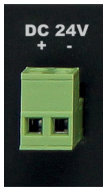
$$Cmin = 1.25 [(T1 \times I1) + D (I2 \times T2)] Ah$$

Cmin – Min. required battery capacity (new) at a 20-hour discharge rate at 20°C, in Ah
1.25 – Aging factor allowing 5% per year for 4 years
T1 – Battery standby period (hours)
T2 – Alarm operation period (hours, e.g., 0.5 hour or 30 minutes)
I1 – Battery standby load (in amperes)
I2 – Battery alarm load (in amperes)
D – Battery de-rating factor (typically 1.75 to account for battery inefficiency under

Example:
A system with full load of 50A and standby current at 2A would require minimum battery capacity of:
Cmin = 1.25 [(24 x 2) + 1.75 (50 x 0.5)]
= 114.7 Ah

Source: BS 5839-1: 2013: Annex D

Correct Way to Power Equipment with 24V DC Power Source



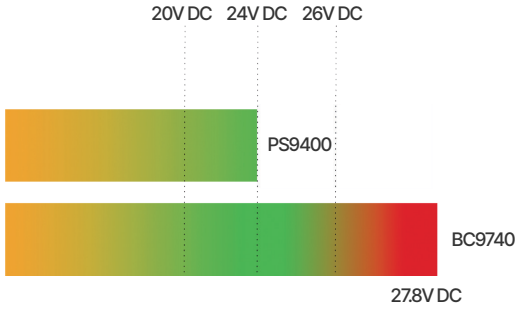
It is a common misconception that using a battery charger to power 24V DC equipment can help reduce costs. However, this is **unsafe and not recommended.**

Battery chargers typically output higher and unstable voltages, which can **exceed the allowable ±10% voltage** tolerance of most equipment.

This can:

- Stress the internal power regulation circuits
- Shorten the equipment's lifespan
- Generate excessive heat
- Potentially cause damage or failure

Battery charger output usually ranges between 27V to 28V DC, which is above the safe limit for most 24V devices. In comparison, a properly regulated 24V DC power supply (such as **Amperes PS9400**) provides stable and safe voltage for continuous operation. Therefore, always use a suitable regulated 24V DC power supply unit instead of a battery charger.



The chart compares the typical output voltage of a 24V DC regulated power supply and a 24V DC battery charger. Most equipment operates safely within the green voltage range. Since battery chargers often output higher voltage (e.g., 27.8V DC), they should not be used as the main power source.

IP (Ingress Protection) Ratings

1st Digit (Protection from Solid Object)		2nd Digit (Protection from Liquid)	
0	No protection	0	No protection
1	Solid object of up to 50mm and above	1	Vertically falling water drops
2	Solid object of up to 12mm and above	2	Water spray with 15° verticle angle
3	Solid object of up to 2.5mm and above	3	Water spray with 60° verticle angle
4	Solid object of up to 1mm and above	4	Water spray with full all direction with allowance
5	Dust with no harmful deposits	5	Low pressure water jet from all direction
6	Full protection from dust	6	High pressure water jet from all direction
		7	Temporary immersion in water
		8	Long immersion in water
		9	High-pressure, high-temperature water jets

The IP (Ingress Protection) rating system is an international standard by IEC 60529 to define the **level of protection electrical enclosures offer against the intrusion of solid objects (like dust) and liquids (like water).**

An IP rating typically consists of two digits:

- **First digit** (ranging from 0 to 6) indicates the level of protection against solid particles.
- **Second digit** (ranging from 0 to 9) indicates protection against moisture.

ⓘ NOTE ON USAGE

This rating system is essential in determining a product's suitability for different environments, especially for outdoor, industrial, or wet-area installations in Amperes Public Address (PA) systems.

IP65

TECHNICAL TERMS

General Terms Used In PA Systems

Root Mean Square (RMS)

The effective value of an AC voltage. It is equal to 0.707 of the peak voltage of a constant sine wave.

Impedance (Ω, symbol Z)

The total resistance to AC current in a circuit containing inductance and capacitance (e.g., speakers and microphones). Impedance varies by frequency and is usually rated at Ω @ 1 kHz.

Speaker circuit impedance must be measured using an impedance meter, not a standard multimeter.

Sensitivity

The minimum input signal required to produce a fixed output level.

- **Microphones (mV / Pa):** Output in mV produced by a 94 dB sound pressure.
- **Speakers (dB, 1W @ 1m):** Sound output in dB produced by 1W of power at 1m distance.
- **Amplifiers (dBu or V):** Input signal required for the amplifier to reach its rated

Signal-to-Noise Ratio (S/N Ratio)

Measured in dB. It is the ratio of useful signal to background noise at the same point. Measured at 1 kHz with 1V input. A higher S/N ratio indicates better clarity.

Decibels (dB)

A logarithmic unit used to compare two levels such as voltage, power, or sound pressure. Common uses include:

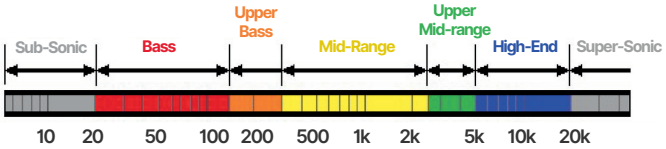
- **dB SPL** - Sound Pressure Level
- **dBV** - Relative to 1V
- **dBu** - Relative to 0.775V

Total Harmonic Distortion (THD)

Expressed in percent (%), indicates the amount of unwanted harmonics added by equipment. Lower THD means clearer audio.

Frequency Response

The diagram below shows how well equipment reproduces audio across the frequency range (typically 20 Hz - 20 kHz). Often measured at 1 kHz, with output variation within ±3 dB.



Balanced Signal

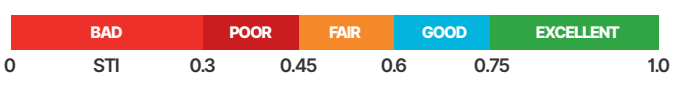
A balanced signal uses three conductors — Hot, Cold, and Ground/Shield — providing better immunity against external noise. It is the preferred option for long-distance audio cabling due to its stability and reduced interference.

Unbalanced Signal

An unbalanced signal uses only two conductors — Hot and Ground/Shield. It is suitable for short-distance cabling but more prone to noise and interference.

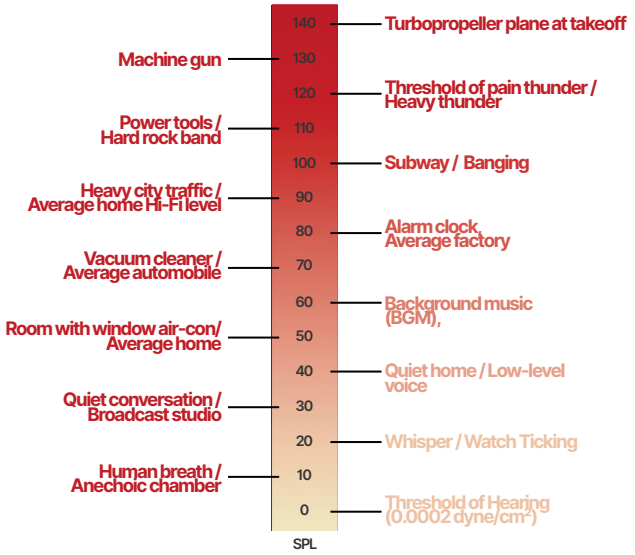
Speech Transmission Index (STI)

STI measures speech intelligibility by sending a test signal from the source and capturing the result at the listening area. The score ranges from 0 to 1.



Sound Pressure Level (SPL)

Sound Pressure Level (SPL) measures loudness relative to the threshold of human hearing at 20 µPa. Because loudness varies with frequency, SPL is expressed in decibels (dB SPL), typically using RMS values. Refer to the SPL chart for common real-world examples.



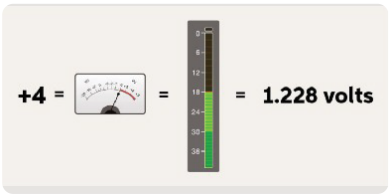
Audio Levels

In professional audio, line level is commonly referred to as +4 dBu, which indicates how much the signal is above or below the reference level of 0.775V. **+4 dBu = 1.228V (rms)**

Meanwhile, semi-professional and consumer levels differ:

- Semi-professional is typically 0 dBV = 1V (rms)
- Consumer line level is typically -10 dBV (~0.32V)

The reference of 0.775V rms is used because it produces 1 mW (0 dBV) across a 600-ohm load. **($P = V^2 / R$).**



dBV	Voltage (V)
+20 dBV	10 Volts
0 dBv	1 Volt
-20 dBv	0.1 Volt
-40 dBv	0.01 Volt
-60 dBv	0.001 Volt
-80 dBv	0.0001 Volt

Terms Related to Speaker Power

Audio Levels — Also known as **RMS power.** It refers to the continuous power a speaker can handle, calculated using the RMS values of voltage and current.

Program Power — Sometimes called **Music Power**. It is typically twice the Average (RMS) Power and is used as a guideline for selecting a suitable amplifier rating.

Peak Power — The maximum instantaneous power a speaker can handle at a given moment, usually during short bursts.

SPEAKER & CABLING GUIDELINES

Sound Pressure Level (SPL) of Speakers

From a speaker's technical datasheet, SPL is usually stated as something like 90 dB @ 1 kHz / 1W / 1m, meaning the speaker produces 90 dB at 1 kHz when driven with 1 watt at 1 meter distance. Some datasheets also list SPL at other frequencies, typically 4 kHz, 8 kHz, or 12 kHz.

There is a direct relationship between the rated SPL and the distance from the speaker, as well as the power applied to the driver.

SPL (dB) to Distance

A speaker's SPL drops by 6 dB every time the distance from the source doubles.
Formula: **SPL drop = 20 log D** (D = distance in meters)

Distance (D)	2	4	8	10	15	20	30	40	50	60	80	100
dB Loss	6	12	18	20	23.5	26	29.5	32	34	35.6	38	40

SPL (dB) to Power

SPL increases by 3 dB every time amplifier power doubles.
Formula: **SPL = 10 log W** (W = power input)

Power (W)	1	2	4	8	10	15	20	30	40	50	80	100
dB Gain	0	3	6	9	10	11.8	13	14.8	16	17	29	30

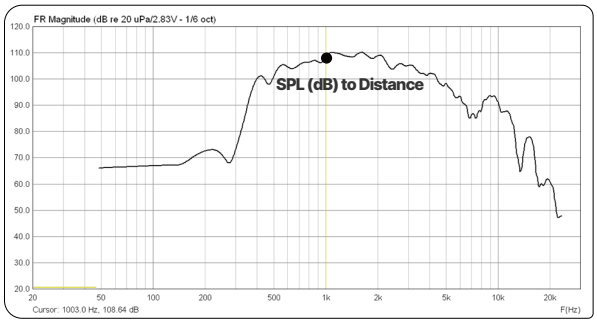
How to Determine SPL at Any Distance

A speaker is rated 90 dB @ 1W / 1m at 1 kHz, powered at 10W and measured at 20 m away:

SPL (d) = {SPL rated + 10 log W} – 20 log D

- Rated SPL = 90 dB
- Power increase = 10 log 10 = 10 dB
- Distance loss = 20 log 20 = 26 dB

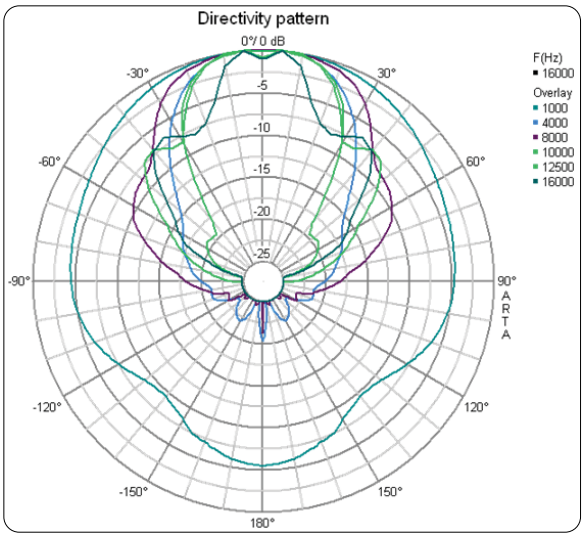
SPL = (90 + 10) – 26 = 74 dB



Frequency Response Chart

The chart (left) shows the frequency response of a speaker from 20 Hz to 20 kHz with 1W of power applied to the driver and measured at 1 meter.

From this curve, the SPL reference value at 1 kHz can be identified. The speaker's frequency response is typically determined by marking the range within ±3 dB from the 1 kHz reference point, although some manufacturers may specify a wider tolerance such as ±6 dB.



Polar Chart

**Polar chart of a speaker may be half or full polar.*

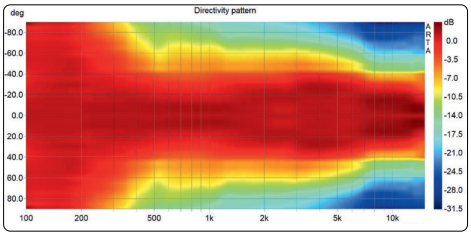
A polar chart shows the **dispersion angle of a speaker at different frequencies.** It is normally generated in a speaker test room or anechoic chamber by powering the speaker with 1W, measuring the output with a calibrated microphone, and capturing readings at various horizontal or vertical angles.

A standard polar chart displays horizontal dispersion. Vertical dispersion can also be measured using the same method when required.

The dispersion angle helps determine:

- how far the sound spreads,
- how many speakers are needed for an area,
- the correct mounting height,
- the required power tap, and
- the expected SPL coverage

A colored heat-map version of the polar chart may also be used to show **SPL intensity vs. dispersion angle** across different frequencies for easier visual interpretation.



Speaker datasheets are available for download on each product page.

SPEAKER & CABLING GUIDELINES

Positioning of Speakers

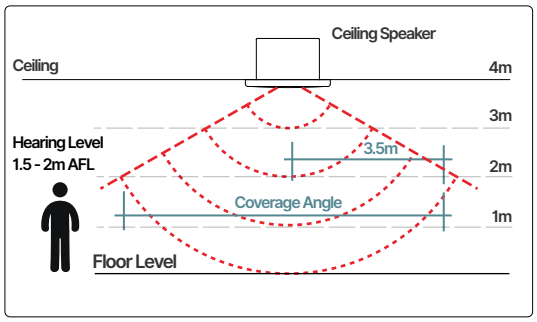
The criteria for determining the number of speakers required in an installation include:

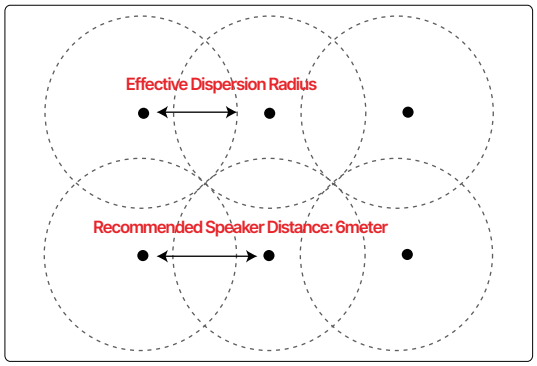
1. **Ceiling height**
2. **Acoustic conditions** of the environment
3. **Speaker type**, such as dispersion angle and SPL level
4. **Application**, e.g., factory, office, or shopping mall

To ensure clear audibility, the speaker's sound level should be **6 - 10 dB above the background noise.**

If the speaker's power is 3W, the SPL at 2m (at 1 kHz) is approximately 93 dB.
With music content, the average SPL is typically 3 dB lower, resulting in about 89 dB - a comfortable level for shopping malls.

Based on this, the coverage area can be estimated. For example, a typical coverage radius of around 3.5 m gives a coverage diameter of 7 m, or roughly 38 m². From this value, the required number of speakers can be determined by dividing the total area by the coverage area per speaker.





Speaker Cabling in 100V Line System

**Refer to the manufacturer's datasheet for more accurate information.*

Cables used in PA installations are subject to losses, similar to electrical wiring. The percentage of loss is affected by factors such as **cable size, length, conductor material, input voltage, load, and temperature.**

The first table shows a typical loss chart based on cable size (using copper conductors in single-phase systems).

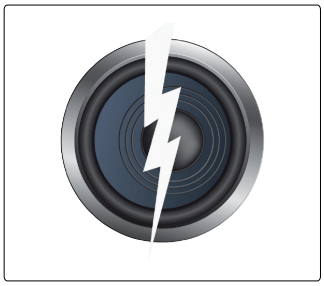
This second table shows the approximate permissible cable length for a specified signal loss in 100V line speaker installations.

dB loss due to cable loss :

Formula:
dB = 20 log (voltate ratio V2/V1)

Cable Gauge AWG	Conductor Size (mm sq)	Impedance Ohm / 1000 ft	Lengths in Meter for 0.5 dB Power Drop (Approx 81% at Load)				
			500W Load 20 Ohm	300W Load 33 Ohm	200W Load 50 Ohm	100W Load 100 Ohm	50W Load 200 Ohm
10	5.26	1	190	320	490	990	1990
11	4.17	1.26	150	260	390	780	1580
12	3.31	1.59	120	200	310	620	1250
13	2.62	2	90	160	240	490	990
14	2.08	2.53	75	130	190	390	780
15	1.65	3.18	60	100	150	310	620
16	1.31	4.02	45	70	110	240	480
17	1.04	5.06	35	60	90	170	390
18	0.82	6.39	26	50	70	150	370

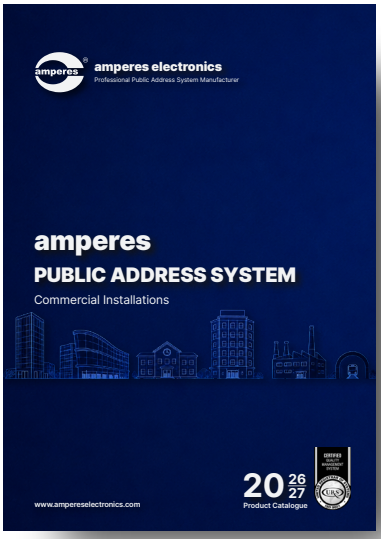
Cable Size	125W Power		250W		500W	
	1 dB Loss	3 dB Loss	1 dB Loss	3 dB Loss	1 dB Loss	3 dB Loss
10	1727	6045	862	3017	429	1502
12	1087	3805	542	1897	270	945
14	683	2391	341	1194	170	595
16	430	1505	215	753	107	375
18	269	942	134	469	67	235
Total Impedance	800 Ohm		400 Ohm		200 Ohm	



Possible Causes of Speaker Damage

Speakers can be damaged during operation **due to excessive power delivery** at certain frequencies or natural events such as lightning strikes. To prevent damage and prolong the lifespan of the speakers, consider the following:

- Avoid sending excessive input power to the speakers.
- Ensure the audio signal stays within the speaker's rated frequency band (e.g., avoid sub-bass on non-subwoofer speakers)
- **Prevent amplifier clipping:** ensure the amplifier's power rating matches or exceeds the total speaker load.
- Use amplifiers with DC output protection and, preferably, built-in high-pass and low-pass filters.



2026/2027 Product Catalogue
Public Address System

Due to our policy of continuous product improvement, Amperes Electronics Sdn. Bhd. reserves the right to modify specifications, features, and artwork without prior notice.

Every effort has been made to ensure the accuracy of the information contained in this catalogue at the time of printing. However, minor errors or omissions may occur unintentionally. Should you require any clarification, please do not hesitate to contact us. Amperes Electronics shall not be held liable for any claims arising from printing errors.

Related materials such as engineering specifications, instruction manuals, product drawings, data sheets, software updates, soft copy catalogue and certificates are available for download on our website.

Models not listed in this catalogue edition are either discontinued or newly developed products pending official launch at the time of printing.

For further information, please contact your nearest distributor or email us directly.

The "**amperes**" logo is a registered trademark of Amperes Electronics Sdn. Bhd.

AMPERES ELECTRONICS SDN. BHD.
Professional Public Address (PA) System Manufacturer
Co. No: 200001006420 (509025-X)

www.ampereselectronics.com
info@ampereselectronics.com

Find us on