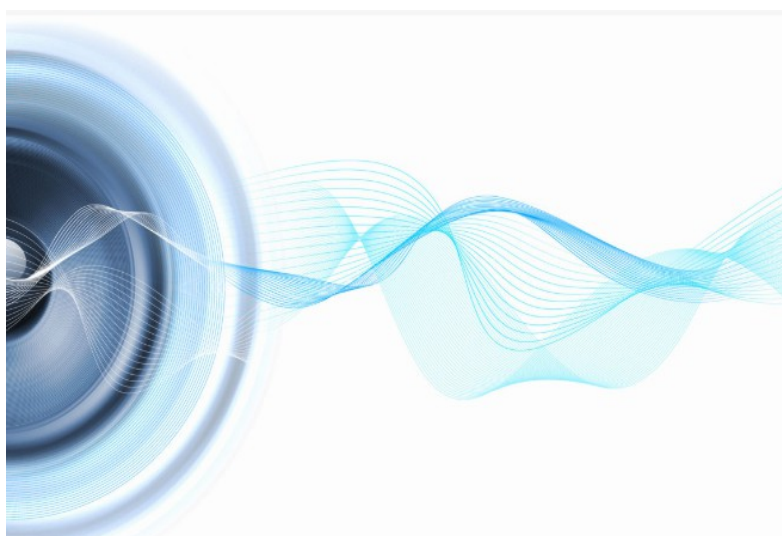


PA/VA EN54

LDA Acoustic considerations



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INDEX

1.INTRODUCTION.....	3
2.SOUND PRESSURE LEVEL (SPL).....	4
2.1.SPL Increase.....	4
2.2.SPL Atenuation.....	4
3.HIGH IMPEDANCE SPEAKER LINE.....	5
4.ACOUSTIC CONSIDERATIONS FOR THE PROPOSED SPEAKERS.....	5
4.1. Ceiling speaker CH-42TN.....	5
4.2. Ceiling speaker DS-60TN.....	7
4.3. Ceiling speaker SC-95TN.....	8
4.4. Horn speaker PS-30TN.....	10
4.5. Projection speaker PCM-20TN.....	11
4.6. Column speaker CI-225TN.....	12
4.7. Column speaker CI-825TN.....	14
5.DISTANCE BETWEEN SPEAKERS.....	16
6.CONCLUSIONS.....	16

1. INTRODUCTION

The aim of this document is to provide basic guidance on acoustic considerations of the system.

The following concepts will be described:

- Sound Pressure Level (SPL).
 - SPL increase.
 - SPL attenuation.
- Speaker connections.
 - High impedance speaker line.
 - Digital speaker line.

Then we will apply these concepts to the types of speakers proposed for the project:

- Ceiling speaker CH-42TN (6W).
- Ceiling speaker DS-60TN (6W).
- Ceiling speaker SC-95TN (24W).
- Unidirectional project speaker PCM-20TN (20W).
- Horn speaker PS-30TN (15W).
- Column speaker CI-225TN (20W).
- Column speaker CI-825TN (40W).

2. SOUND PRESSURE LEVEL (SPL)

Sound pressure level (spl) or sound level is a logarithmic measure of the effective sound pressure of a sound relative to a reference value. It is measured in decibels (dB) above a standard reference level. The standard reference sound pressure in air or other gases is 20 μ Pa, which is usually considered the threshold of human hearing (at 1kHz).

$$SPL(dB) = 20 \log \frac{P}{P_{ref}}$$

Where P_{ref} is the reference sound pressure and P is the sound pressure being measured. That is, each time the power is doubled, sound pressure level increases by 3 dB.

2.1. SPL Increase.

The SPL increase is the logarithmic ratio (expressed in dB) between the input power supplied to a certain speaker and a reference power.

$$SPL = 10 \log (P_2 / P_1)$$

Where “ P_1 ” is the reference power (in the case of speakers is usually taken as 1 W) and “ P_2 ” is the power supplied.

2.2. SPL Attenuation.

When a sound is emitted from a speaker, the sound is spread over space in the form of a sphere, so the sound pressure level is inversely proportional to the square of the distance. That is each time the distance is doubled the sound pressure level is attenuated by 6dB.

$$SPL = 20 \log (r_2 / r_1)$$

Where “ r_1 ” is the reference distance (in the case of speakers is usually taken as 1m) and “ r_2 ” is the distance at which we are calculating the attenuation.

In the particular case of linear sources those in the propagation is cylindrical (eg. Speaker columns)

the sound pressure level is attenuated by 3 dB each time we double the distance from the source.

3. HIGH IMPEDANCE SPEAKER LINE

High impedance speaker line are also called 70/100 V speaker line and are often used in public and large venues. The following table provides the maximum cable length in meters for different impedances and cable section.

The Type of cable used is copper twisted pair. The values shown may be used as a guide but it's the responsibility of the installer to make the final calculations appropriate to each case. The table shows the output power of typical amplification channels, using 100V rms lines.

Power (W)	0,82 mm ²	1,04 mm ²	1,65 mm ²	2,08 mm ²	2,63 mm ²	3,65 mm ²	4,15 mm ²	5,27 mm ²	6,62 mm ²	8,35 mm ²
60 W	200	255	405	510	645	810	1020	1300	1625	2050
120 W	100	130	200	255	320	405	510	645	810	1025
240 W	50	65	100	130	160	200	255	320	405	510
480 W	25	35	50	65	80	100	130	160	200	255

4. ACOUSTIC CONSIDERATIONS FOR THE PROPOSED SPEAKERS

4.1. Ceiling speaker CH-42TN

The EN 54-24 ceiling loudspeaker CH-42TN is designed for flush in suspended ceiling and ideal for an even sound distribution. The loudspeaker has a built-in protection to ensure that, in the event of a fire, damage to the loudspeaker does not result in failure of the loudspeaker circuit which is connected. In this way, system integrity is maintained and ensuring loudspeakers connected in the same circuit in other areas can still be used to inform people of the situation.



Features of CH-42TN :

- The loudspeaker can be easily installed by using the mounting spring attached.
- Fire dome is mounted in the speaker using the sliding brackets and the wing nuts.
- Equipped with thermal fuse and heat-resistant, high-temperature wiring
- Compliance with EN54 part 24.
- The loudspeaker is available with or without capacitor.

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (6W,1m)	SPL (6W,3m)	SPL (6W,5m)	SPL (6W,10m)
92 dB	100 dB	91dB	86 dB	79 dB

In this graph you can see the fall of dB according to the distance:



4.2. Ceiling speaker DS-60TN

DS-60TN is a high-performance 6W voice alarm cabinet loudspeaker. It provides a broad frequency response range, low distortion and high sound pressure level for accurate and intelligible broadcast of evacuation messages and high quality sound reproduction. It's ideal for sound distribution in various types of commercial buildings. Its low-profile, white color design blends easily with most interiors in localities such as hotels, conference rooms, cinemas, factories and exhibitions.



This voice alarm outdoor column loudspeaker complies with BS 5859 part 8 and EN 54 part 24.

Features of DS-60TN:

- Intelligible voice and superior sound reproduction
- Robust metal enclosure
- Harmonious with all indoor decoration
- Simple power setting
- Easy installation
- Complies with EN 54-24 standard
- Available with or without capacitor (part number without "C")

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (6W,1m)	SPL (6W,3m)	SPL (6W,5m)	SPL (6W,10m)
91 dB	99 dB	90 dB	85 dB	78 dB

In this graph you can see the fall of dB according to the distance:



4.3. Ceiling speaker SC-95TN

The SC-95TN is a high performance 24W coaxial ceiling loudspeaker. Its broad frequency range, low distortion, and high sound pressure level ensures the delivery of intelligible voice and excellent sound. The stylish low profile and white color design allows it to blend easily with most applications, such as hotels, shopping malls, conference rooms and exhibition halls.



This coaxial ceiling loudspeaker is EN54-24 certified, what ensures that, in the event of a fire, damage to the loudspeaker does not result in failure of the loudspeaker circuit which is connected.

Features of the SC-95TN :

- Intelligible voice and excellent sound reproduction
- Easy blending with any decorations

- Robust metal case with fireproof dome
- Simple power setting and wiring
- It is EN54-24 certified

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (24W,1m)	SPL (24W,3m)	SPL (24W,5m)	SPL (24W,13m)
91 dB	103 dB	93 dB	89 dB	81 dB

In this graph you can see the fall of dB according to the distance:



4.4. Horn speaker PS-30TN

The LDA PS-30TN is an horn speaker certified in accordance to EN 54-24, designed to cover big areas due to its high sensitivity and directivity.

It is made of ABS. For a increased protection, the loudspeaker is equipped with built in ceramic terminal and a thermal fuse. The power taps are 15W/ 10W/ 5W/ 8 Ω @100V or low impedance 8 Ohms.



It can be installed in outdoor in wet applications or indoor providing reliable performance over wide temperature and humidity ranges.

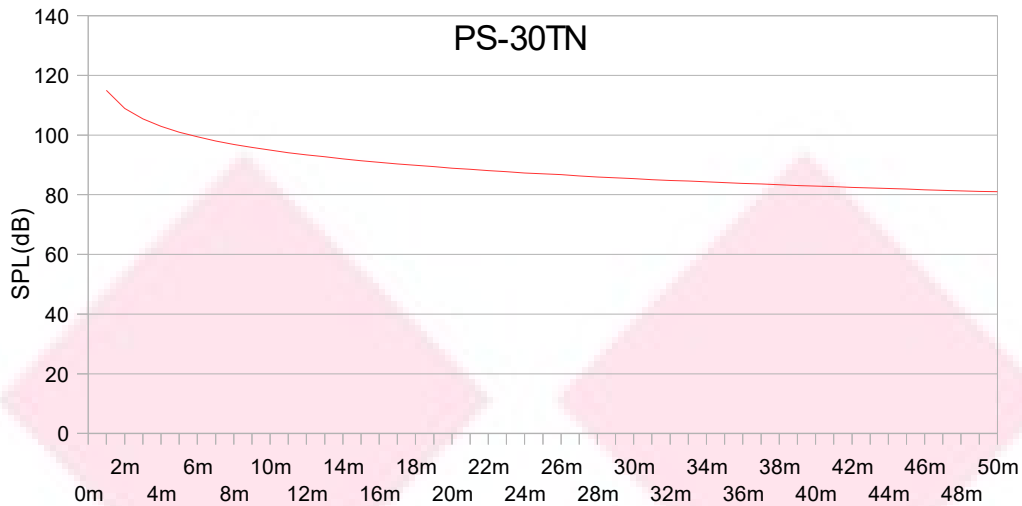
Features of PS-30TNE:

- Horn speaker made in ABS with UV protection.
- Power tap selector (70/100V lines).
- Bracket with U shape made of stainless steel.
- High sensitivity: 105dB (1W, 1m).

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (15W,1m)	SPL (15W,15m)	SPL (15W,20m)	SPL (15W,50m)
105 dB	115 dB	93 dB	89 dB	81 dB

In this graph you can see the fall of dB according to the distance:



4.5. Projection speaker PCM-20TN

The PCM-20T is a projection speaker designed for 70/100V lines. It is destined for big surfaces due to its high sensitivity and directivity. The enclosure is made of aluminum and stainless steel and has an anti-vandal wire connector. The power taps are 20/10/5/2.5W @ 70/100V lines or low impedance (8").

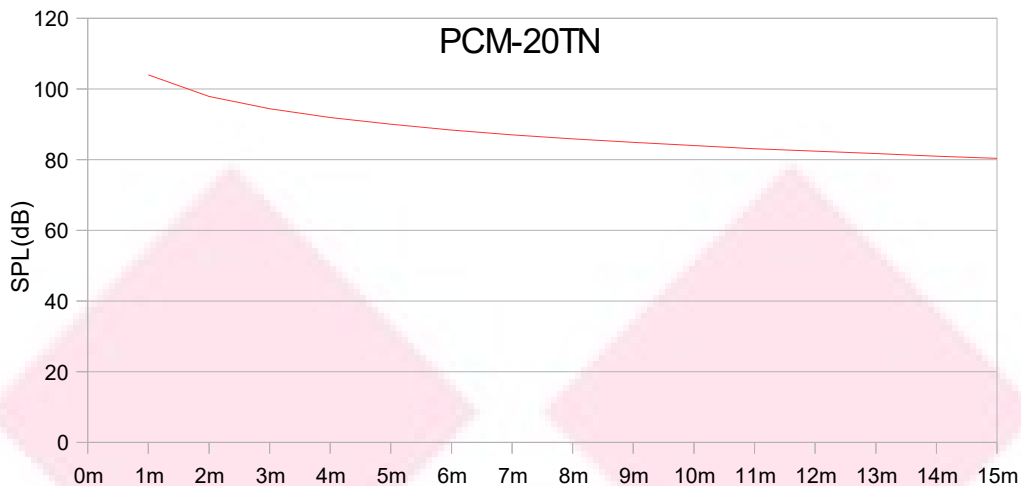


The features of the speaker allows it to cover the audio needs in mediums venues such as car parks, railway stations, sport stadiums or inside/ outside swimming pools.

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (20W,1m)	SPL (20W,8m)	SPL (20W,15m)
91 dB	104 dB	86 dB	81 dB

In this graph you can see the fall of dB according to the distance:



4.6. Column speaker CI-225TN

LDA CI225-TN is a high-performance 20W voice alarm column loudspeaker for indoor or outdoor use and it is EN 54-24 certified. It provides a broad frequency response range, low distortion and high sound pressure level for accurate and intelligible broadcast of evacuation messages and high quality sound reproduction.

Its low-profile, white color design blends easily with most interiors in locations such as hotels, conference rooms, cinemas, theme parks, factories and exhibitions.



Features of the CI-225TN:

- EN 54-24 certified.
- Intelligible voice and superior sound reproduction.
- Robust aluminum housing.
- Includes universal swivel bracket for easy angle adjustment.
- Able to be switched between 100V and 70V.

- Adapts to extreme environment.
- IP66 compliant.

The following table contains SPL values as defined in the previous sections:

SPL (1W,1m)	SPL (20W,1m)	SPL (20W,8m)	SPL (20W,15m)
92 dB	103 dB	85 dB	79 dB

In this graph you can see the fall of dB according to the distance:



4.7. Column speaker CI-825TN

LDA CI-825TN is a high-performance 40W voice alarm column loudspeaker for outdoor use. It provides a broad frequency response range, low distortion and high sound pressure level for accurate and intelligible broadcast of evacuation messages and high quality sound reproduction.



Its low-profile, white color design blends easily with most interiors in locations such as hotels, conference rooms, cinemas, theme parks, factories and exhibitions.

This voice alarm outdoor column loudspeaker complies with EN 54-24.

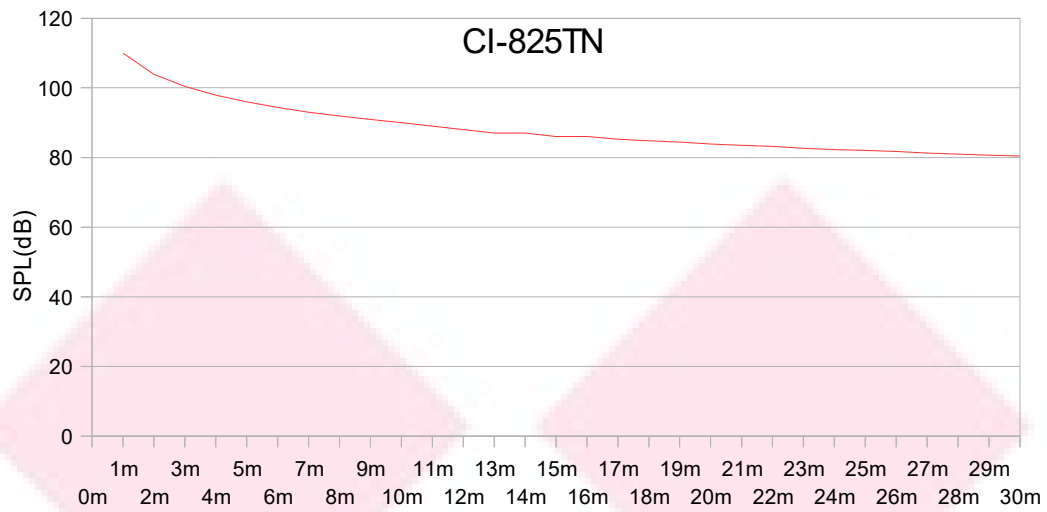
Features of the CI-225TN:

- EN 54-24 Certified
- 40W / 20W / 10W / 5W @ 100V or 20W / 10W / 5W / 2,5W @ 70V
- Intelligible voice and superior sound reproduction
- Robust aluminum housing
- Supplied with universal swivel bracket for easy angle adjustment
- Adapts to extreme environment
- IP66 certified

The following table contains SPL values as defined in the previous sections:

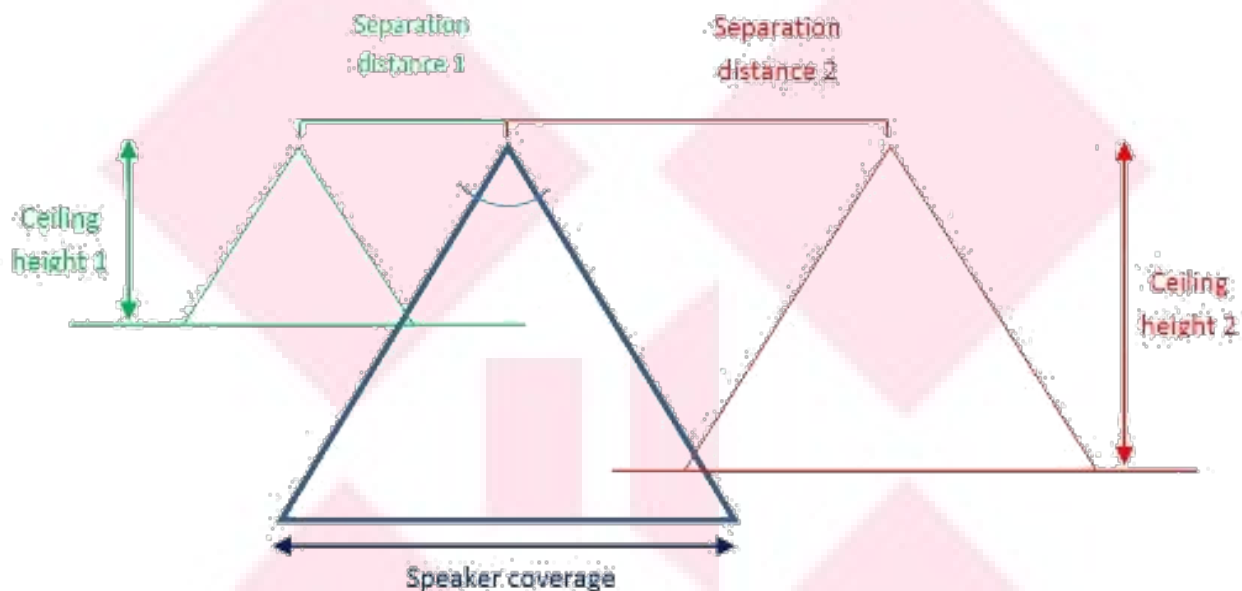
SPL (1W,1m)	SPL (40W,1m)	SPL (40W,15m)	SPL (40W,20m)	SPL (40W,30m)
94 dB	110 dB	87 dB	84 dB	81 dB

In this graph you can see the fall of dB according to the distance:



5. DISTANCE BETWEEN SPEAKERS

The dispersion of the speakers is proportional to the height they are located, therefore the coverage depends on the height of the ceiling and the average height of human ear. The separation between the speakers will be in accordance with this height as we can see in the following diagram:



6. CONCLUSIONS

We have carried out this study with EN54 certified loudspeakers which are the requirements that the loudspeakers must meet with regard to their acoustic and constructive characteristics.

This calculation of distances according to the characteristics of the loudspeakers in a theoretical system according to the formula used. Always perform an acoustic study will be the most accurate and you can get more information like the STI (Intelligibility Transmission Index).

For more information, please contact your company or the support department.