

BeStar®

Product Training Overview

- Fundamental Aspects of Acoustics
- Different Kinds of Buzzers

BeStar® Product Overview

- How to find the right component

Fundamental Aspects of Acoustics

Some General Points

- A tone is the result of a mechanical vibration that will be transmitted through the motion of molecules.
- The vibration is a reciprocating motion of a given frequency and amplitude.
- The sound level depends on the amplitude of the vibrations.
- The pitch of tone depends on the frequency of the vibrations.

Fundamental Aspects of Acoustics

Some General Points

- The sound level changes itself with the distance between the sound source and the hearing position.
- Our ear is able to notice a difference regarding the sound level only if the sound level is doubled or reduced by half.
- Sound pressure is measured in Decibels (dB)
- dB is not a physical value
- The human ear is able to hear frequencies between 16-20000Hz

Fundamental Aspects of Acoustics

Physical Properties of a Sound

A sound is consisting of following 4 factors:

- **Loudness** (intensity of a sound), also called **Sound Pressure Level (SPL)**
- **Pitch** (highness/ lowness of a sound)
- **Harmonics** (a factor affecting tone color)
- **Mode** (characteristics varying with time)

Fundamental Aspects of Acoustics

Loudness

The SPL (sound output) is expressed in dB (decibel) the physical value is Pascal (Pa):

0dB = minimum audible intensity of a sound

0dB = 0,00002 Pa

140dB = maximum intensity of a sound that an human can receive

140dB = 200 Pa

Interesting Fact: The minimum pressure difference that can be heard by a human is around +/- 3dB

Loudness Relationships to Distance

SPL decreases by 10dB

If the distance (D) changes from 10 cm to 30cm also from 30cm to 1m

| | | | | | | | | | | |
|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|
| D | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 | 1m |
| SPL | 90 | 84 | 80 | 78 | 76 | 74 | 70 | 72 | 71 | 70dB |

SPL decreases by 6 dB.....If distance is doubled!

Fundamental Aspects of Acoustics

Pitch

- The pitch is the psychological property of sound characterized by highness or lowness depending on frequency.
- The pitch becomes higher as the frequency increases.
- The frequency is expressed in Hertz (Hz).

Fundamental Aspects of Acoustics Harmonics

- When e.g. a violin is playing an „A“ note (440 Hz) a series of sounds called harmonics are generated simultaneously.
- The magnitude and the existence of the harmonics give an effect to the tone color.



Product Training Overview

Fundamental Aspects of Acoustics Mode

The sound of a piano and a violin are not similar even if they have the same pitch and the same sound pressure level.

Different Kinds of Buzzers

Different Types of Acoustic Components

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graph TD; A[Different Types of Acoustic Components] --> B[Static Systems]; A --> C[Dynamic Systems]; A --> D[Mechanical Systems];
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Static Systems

Dynamic Systems

Mechanical Systems

Different Kinds of Buzzers

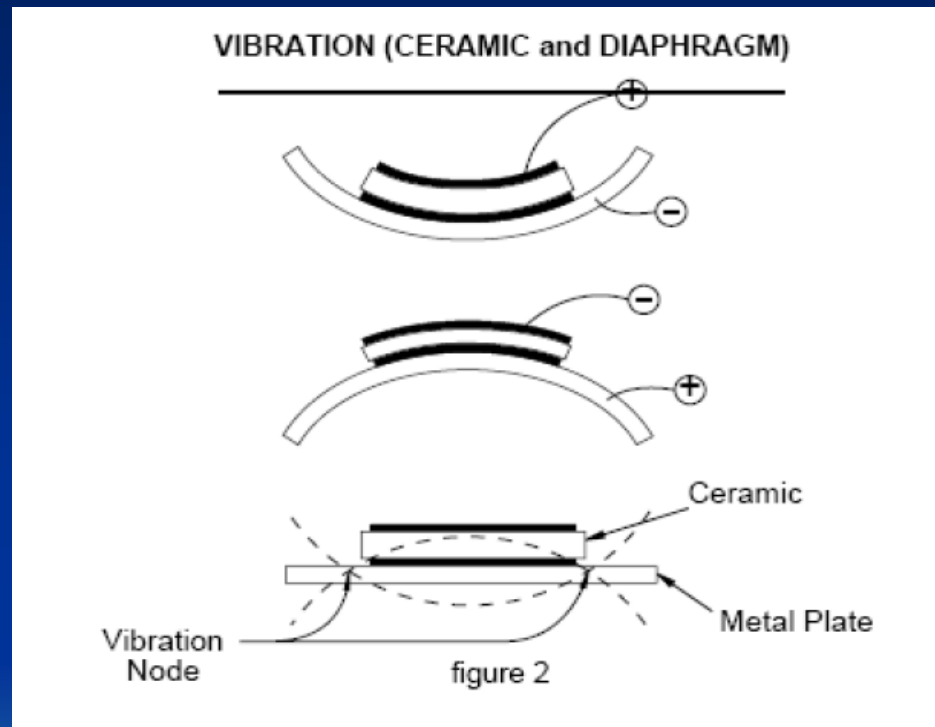
Static Systems

Piezo Electric Buzzers have a relatively simple construction:

- A piezoelectric ceramic disk is placed on a metal plate (diaphragm).
- By applying AC voltage to the electrodes the ceramic disk expands and shrinks according to the polarity of the voltage.
- Continuous application of AC voltage causes a vibration of the disk and generates a noise.

Different Kinds of Buzzers

Static Systems



Piezo Disc Operating Principles

Different Kinds of Buzzers

Static Systems

Advantages:

- low power consumption
- wide operating voltage range
- low profile
- low cost

Disadvantages:

- restricted sound quality
- restriction in reducing the diameter
- very narrow frequency range

Different Kinds of Buzzers Dynamic Systems

- The dynamic buzzer has a construction that is quite similar to a dynamic speaker of an audio system.
- The frequency range of a dynamic buzzer is not so wide as the range of a dynamic speaker.

Working Principle:

The diaphragm to which a magnet piece with a fixed polarity is bonded is placed above an iron core. A coil is wound around this core that is positioned below the center of the speaker diaphragm. When current flows through the coil the top of the iron core will be magnetized. The diaphragm will be attracted or repulsed when its fixed polarity is opposite or same as that of the iron core.

This repeated movement of the diaphragm will produce the sound.

Different Kinds of Buzzers Dynamic Systems

Advantages:

- Wider frequency range (as compared to piezo discs)
- Able to produce relatively low frequencies even with small housing dimensions.

Disadvantages:

- Higher power consumption
- Higher cost than piezo of similar dimensions

Different Kinds of Buzzers Mechanical Systems

Working Principle:

- An electromagnet will cause an up and down movement of the striker when current is flowing through the coil.
- Due to this fact the striker will hit the diaphragm and produces a sound.

Functionally similar to a drum

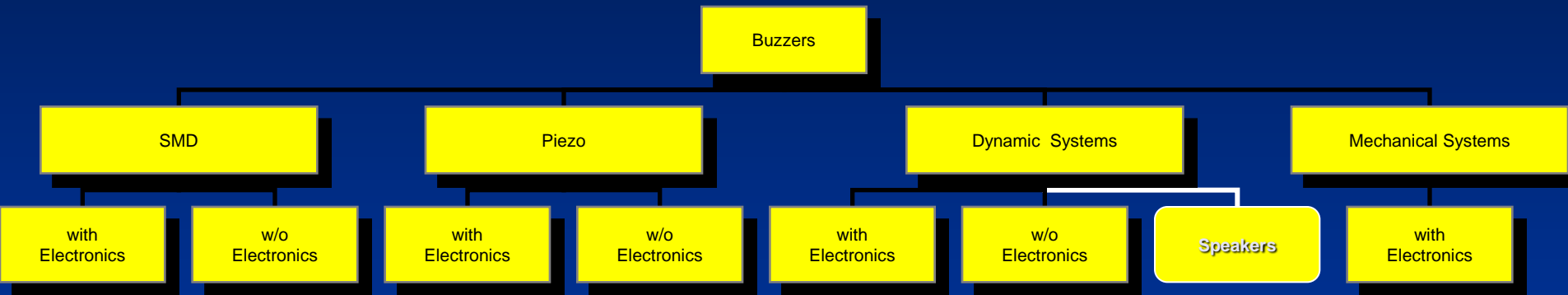
Different Kinds of Buzzers Mechanical Systems

Advantages:

- Low current consumption
- Able to produce low frequency tones.

Disadvantages:

- Size
- Reliability
- “Old Fashioned” snaring sound
- Monotone



How to find the right component

- There are many customers who are not able to describe their needs.
- The main questions from the customer can for the most part be answered by understanding the previous training
- Here next are some examples question regarding key product/program characteristics.

How to find the right component

Type of sound required

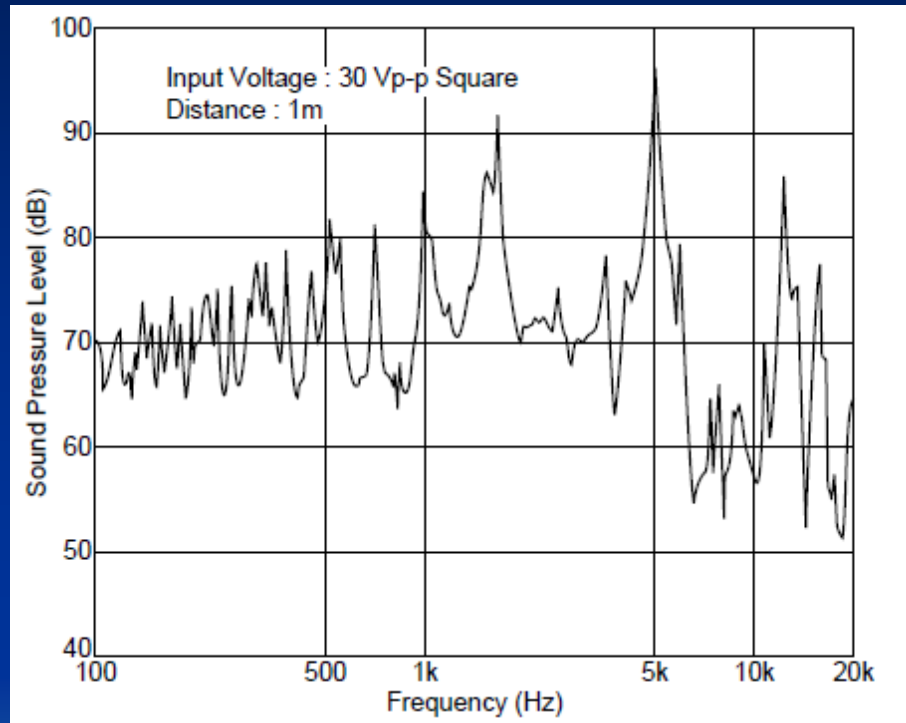
- Simple tone alerts
- Music or Voice Quality
- Very Loud, Sirens or Alarms

Other important considerations:

- Program Quantity/Target cost range
- With or without an oscillator (self or non self drive)
- Sound Pressure Level over distance
- Voltage and Current consumption
- Frequency range required
- Size or available space
- Kind of contact: surface mount, pins, leaded, connector
- Operating Temperature range

How to find the right component

Frequency Response



■ Freq. Response (Square Wave 30Vp-p, 1m)

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Product Training Overview

How to find the right component

Now let's go over the catalog!

Thank you for your interest in BeStar®

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