



Beeps, Bongs, Bangs, And Buzzers..... Which Sound Device Is Right For Your Application? By Windsor Waits & Mike Ward

These days, it seems that we are constantly being alerted with everything from beeps to buzzers. Personal Computers, virtually all types of home appliances, cars, farm implements, golf carts, medical equipment, instrumentation, and smoke and carbon monoxide detectors. These all contain audible alarm devices which notify us of events warranted by the manufacturer.

But what types of alarms are available? And how does a manufacturer decide what specific alarm is best suited for their particular application?

First of all, there are many different kinds of audible alarms out there which can create a myriad of continuous and intermittent sounds. Two of the most popular technologies used in audible alarms are piezo-ceramic transducers and electro-magnetic type technology. Both of these audible alarm technologies have two primary components: 1) A base material mounted within a sound chamber. 2) A drive circuit which supplies an output that is applied to the base material causing deflections.

The deflections of the base materials, in turn, cause variations in the air pressure within the sound chamber and create the audible sound. Different base materials mounted in various sized sound chambers (with specifically designed drive circuits) create the variances in the audible alarms.

Why Different Sounds Are Different

To discover the operational differences between electro-magnetic and piezo-ceramic transducers, let's return to the design process of each and then determine how each device will vary the sound. The first operational difference between the two devices exists in how the base material is made to deflect.

The electro-magnetic device creates the deflection by applying an oscillating voltage to a coil that, during the positive half cycle, pushes away or deflects the thin base material which is mounted on top of the magnet. The base material is then brought to its original position during the magnetic half cycle by a magnetic field. Thus, the base material vibrates at the frequency of the applied signal, causing vibrations in air pressure, or sound.

Piezo-ceramic devices deflect with the application of an oscillating voltage. The piezo crystal is mounted to a metal base within a sound chamber. The drive circuitry supplies an oscillating signal to the crystal which causes it to deflect. As previously mentioned, the deflections of the piezo cause changes in the air pressure within the sound chamber, creating the audible sound. The sound output will be at the frequency of the oscillating signal supplied by the drive circuit. No electro-magnetic or RF noise is created with piezo devices.

The popular Mallory Sonalert® is a good example of a piezo-ceramic audible alarm. It is simple to operate because it is self-contained, with the drive circuitry supplied within the device. In addition, it is effectively sealed for use in harsh environments. Models are available which operate at various voltages ranging from 1 VDC to 250 VAC.

Which is the right device for you? It depends entirely on your application and the sound you anticipate it will take to accomplish your objective.

Selecting A Sound

When an equipment manufacturer decides that an audible alarm device is required in a product and contacts the alarm manufacturer, a number of criteria should be considered prior to beginning the electrical and mechanical design:

- **What type of product is the alarm device to be used in and who is the audience that will be impacted?** Will the application be consumer, industrial, emergency, etc., and who will use it? Nailing down all the facts in advance will help determine what sort of sounds should be considered.
- **Should the tone be continuous or intermittent?** Intermittent tones are generally more discernible than continuous tones.
- **What is the magnitude of sound required to perform the expected task?** Most devices are available in loud, medium, or soft sounds. The sound level selected should match the application and the surrounding environment. Care should be taken to make certain the device's tone doesn't melt into the background noise and not be heard.
- **Will the product be operating under emergency conditions?** If the product is responsible for signifying an emergency, you will probably want it to emit a loud, very discernible, audible alarm.
- **What type of actuation signal will be available?** Audible alarms must be supplied with an actuating signal. However, most manufacturers of various types of audible alarms can supply devices which are actuated by anything from low voltage DC signals to AC voltages up to 250 VAC.
- **Does the immediate environment present any constraints as far as the type of sound or sound level is concerned?** Will the sound present an annoyance or impair the work of people or equipment in close proximity to the device?
- **Will other alarm devices be operating in close proximity?** Consideration should be given to ensure that the tone the device is generating doesn't get confused with other devices. An example of this problem occurring is in hospitals where other alarm devices that produce similar sounds could well be in close proximity.

Each of these questions is important and must be answered in advance. So, there's a lot of work to be done before you can zero in on the type of device best suited to handle your specific application.

The Right Sound Level

Most audible alarm devices are available in a large range of sound levels. As mentioned earlier, the challenge is to determine which of these best suits your product application.

The loudness of sound heard depends upon, among other things, the hearing sensitivity of the listener, the frequency of the sound, the distance to the listener, the density and humidity of the air, the design of the sound signal, and the voltage applied.

One of the most popular Mallory Sonalert sounds is the continuous tone operating at 2900 Hz. Other audible sounds are created by varying the oscillating signal. Fast pulses, slow pulses, short pulses, warbles, chimes, and chirps are readily available options to the Mallory Sonalert. The magnitude of the sound in this piezo-ceramic device is controlled by the drive circuit and the amount of power it applies to the piezo crystal, the size of the crystal, and the size of the sound chamber.

Something important to keep in mind when comparing the dB output of different sound devices is that the distance from the device where the measurement was taken must be consistent. For distances shorter than 50 meters, sound pressure drops approximately 6 dB each time the distance traveled is

doubled. Variations as much as ± 8 dB may occur inside a room or around large objects, such as buildings, due to echo cancellation and reinforcement effects.

Mallory Sonalert standard measurements documented in technical literature are made at a distance of two feet in an anechoic chamber.

When Size Is a Consideration

Electro-magnetic devices, which create deflections in the base material via a magnetic field, can be made smaller than piezo-ceramic devices, and are frequently employed in small or miniature consumer devices. One drawback of these products is that they do not create as much audible output and are not as capable of creating as many different types of continuous and intermittent sounds. However, depending on the application, this may not be a negative.

The Mallory Sonalert MSR Series is a piezo-ceramic product which was developed to combine a smaller size (23mm Dia. x 10.5mm Hgt.) with a high audible output. Like the standard-sized Mallory Sonalert, it is a self contained piezo device.

Mountings and More

The mounting of the audible alarm device is usually not a problem. Panel mount devices are available with various types of terminal or wire terminations. All of the smaller devices are mounted on PCB's. One consideration that is frequently overlooked when mounting audible alarm devices, especially the smaller PCB ones, is that the sound can be attenuated by surrounding devices. Audible alarms are tuned devices and large mass devices mounted close to them can change the audible characteristics of the device.

Naturally, there are going to be times when a standard product just isn't right for your application. This isn't a problem as most manufacturers of sound devices - electro-mechanical and piezo ceramic alike - can customize their products to meet special requirements.

Take the Mallory Sonalert, for example. Special mounting brackets can be attached, very unusual audible sounds can be created with a piezo crystal, and custom drive circuitry and special terminations and/or wires can be incorporated. In addition, the external electronics that the end user would otherwise provide to turn the Sonalert on and off have been successfully incorporated into the Sonalert housing, resulting in cost savings.

Conclusions

What's the answer to your search for the right audible alarm device? Sorry, but there is no one answer...no single device is right for every application. There are just too many variables to be considered. But with the wide range of available products and sounds, you're certain to find a device that will compliment your product and its application.

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