

Drive-Thru Sound Levels

Some municipalities have adopted regulations aimed at controlling the acoustic noise levels in residential and (or) commercial areas. These regulations are of particular importance to drive-thru operators because the drive-thru is viewed as a source of noise. The noise originates both from the vehicles themselves and from the drive-thru communications system. This white paper addresses common questions related to sound from the communications system.

Note: Because every site is different and each municipality has its own regulations, HME is unable to make specific recommendations for compliance or give any assurance that any particular system configuration will comply with any given regulations. Statements made in this paper should be taken as general guidelines, but to ensure compliance, the site planner should retain the services of a qualified acoustic consultant equipped to make the necessary measurements.

In the drive-thru, the primary source of sound other than the vehicles is often the drive-thru communications system. Outbound audio includes the order taker's voice and any sound provided by the message repeater. The outbound audio is delivered by the speaker and must be loud enough to be clearly heard by the customer over the noise of the customer's vehicle, any local traffic and other ambient background noises in the area. However, if it is too loud, the sound can be objectionable to neighbors or even violate specific regulations.

HME base stations are equipped with a feature known as Automatic Volume Control or "AVC" which can be used to reduce the outbound sound pressure level based on ambient noise. When AVC is active, the outbound level is reduced to a level that is 15 dB above the ambient noise level at the speaker post microphone, but it **never** increases the level above what would be heard with AVC turned off. This feature can considerably reduce the SPL during quiet periods and may help in satisfying local requirements.

Sound levels are measured in units of dB SPL and usually include a frequency variable weight referred to as "A Weighting". For this reason, the units are frequently written as "dBA SPL" and that notation will be used throughout this paper. The sound pressure level from a speaker decreases as the distance away increases. However, it can be difficult to predict how much reduction will actually occur. For a single point sound source like an alarm bell hanging in air, the SPL drops approximately 6 dB every time the distance from the source doubles. Thus if one starts one foot away, the level will be 36 dB lower when one is 64 feet away. Unfortunately, speakers are neither single point sources nor are they hanging in air. Rather, speakers are mounted in a variety of different type enclosures. Further, the building, the ground and even other cars in proximity all effect the sound's direction and decay rate. All of this tends to make the sound more directional and the decay rate less predictable.

This paper provides some "typical" measurements taken outdoors under specific circumstances. These measurements can be used as a guide for what levels might occur in a drive-through installation. These measurements were taken using "pink noise", a type of noise frequently used for acoustic testing, at levels simulating the loudest speech expected from an order taker.

All typical measurements provided here were taken using the following equipment:

- Base station: HME ION IQ set to factory default levels
- Communicator: HME COM6000
- Speaker: HME SP10
- Speaker post: Texas Digital model 107150

Drive-Thru Sound Levels

Speaker box is approximately 50' from the northeast corner of the site plus, unlike the calculation underlined below, there will be a car and a masonry wall between the speaker box and the residential property.

The measurement environment was as follows:

- Asphalt parking lot 50 ft from any building
- Ambient background noise level: ~47 dBA SPL
- Nearest vehicle not part of measurement: 15 ft

Initial measurements were taken with AVC off, no vehicle in front of the speaker post, and no other obstructions within at least 100 ft of the speaker. These are not “normal” conditions for a drive-thru, but they do yield one worst-case measurement. Under these conditions, the sound pressure level 1 foot in front of the speaker is 90 dBA SPL. At 17 feet, it drops down to a normal conversational level of 66 dBA SPL, but does not drop to 60 dBA until a distance of 55 feet. Figure 1 shows the loudness contours for both 60 dBA and 66 dBA levels. Since the primary concern is noise abatement at a distance, higher level contours are not shown.

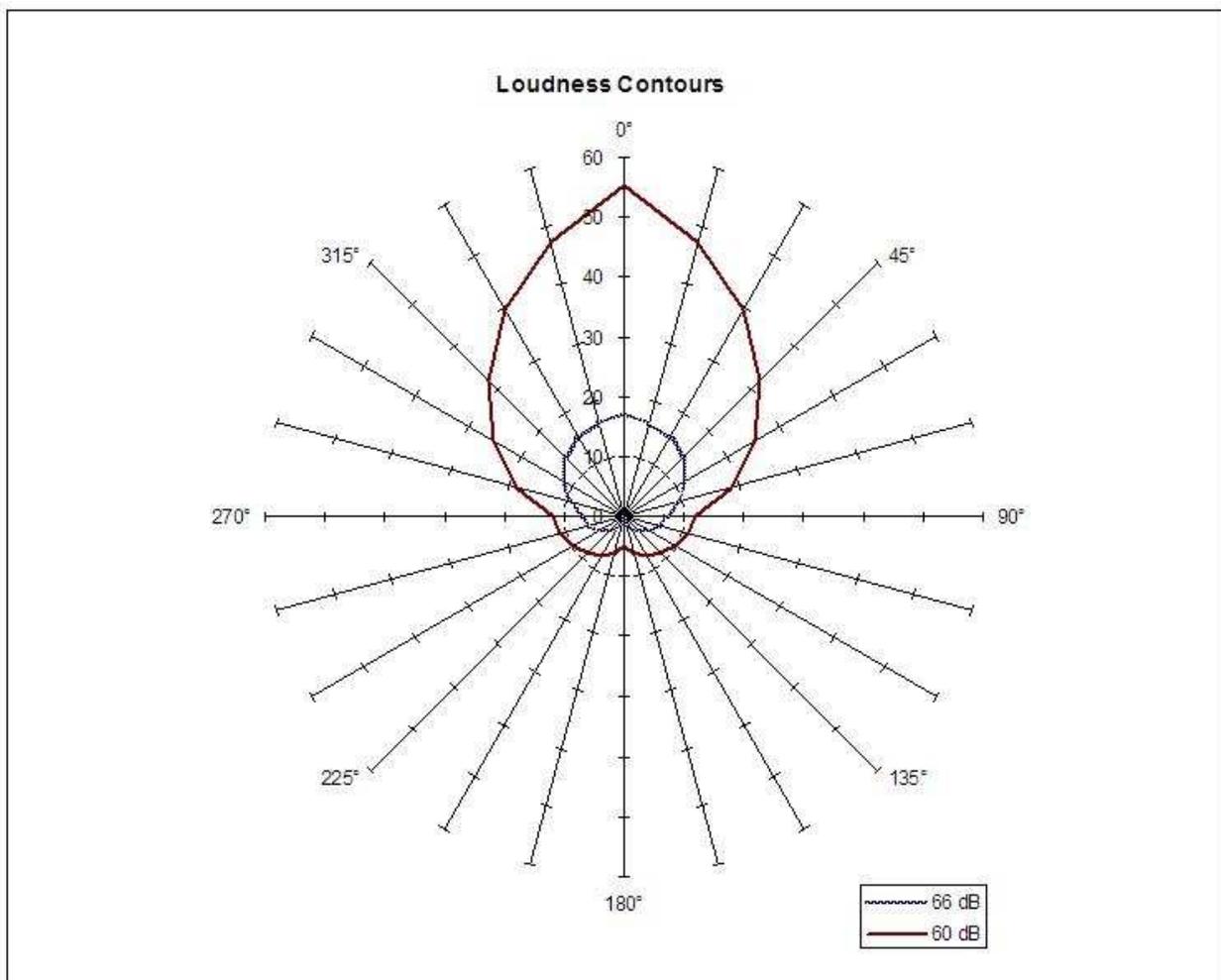


Figure 1 – SP10 SPL Contours

With a vehicle parked in front of the speaker, the shape of the contour changes dramatically and depends on many factors including the height, size, shape, and angle of the vehicle. Because of the tremendous differences in vehicles, positioning, and lane construction, HME cannot predict with any certainty the shape of the resulting SPL contours. However, generally, the shape flattens and the loudest sounds are found at angles to the front and rear of the vehicle with the front being louder.

Drive-Thru Sound Levels

Per our Technical Noise Report, the ambient noise level in this area of the site is 61 dBA meaning the speaker would go to 76 dBA. As in the case below, the SPL would be below the ambient noise level less than 20' away from the speaker.

AVC Operation

AVC measures the ambient noise level in the drive-thru and adjusts the outbound level down so that it is never more than 15 dB above the ambient noise level. This is particularly useful at night when there is less traffic on surrounding streets and fewer cars in the drive-thru. It may also be useful in situations where the regulations do not specify specific sound pressure levels, but use terms like “reasonable” or “sufficient”. Because AVC adjusts continuously, it ensures that the outbound level is high enough to be heard by the customer whatever the conditions may be.

As an example, if the ambient noise level is 47 dBA, AVC will adjust the outbound level to approximately 62 dBA at a position about 1 ft from the speaker. Given this condition, the SPL will be below the ambient noise level less than 20 ft away from the post.

Since AVC adjusts based on the noise level measured at the speaker post, a noisy vehicle will drive the outbound level up. Thus, the use of AVC will not guarantee that the SPL is below any particular level for all vehicles or conditions. However, it will keep the outbound level from becoming excessively loud.

Guidelines

HME cannot make specific recommendations, but here are some general things that can be done to minimize issues:

Do

- Place the speaker post where vehicles can get close to it. This allows the outbound level to be kept to a minimum.
- Use brick or concrete walls to isolate the installation from adjacent residences. These walls make good barriers, but must be high enough that sounds do not easily go over them.
- Adjust the outbound level to the minimum necessary to be clearly heard by customers
- Use AVC in situations where noise abatement is an issue to further reduce outbound levels during quiet periods.

Don't

- Face the speaker post toward busy streets. This increases the ambient noise level and makes it necessary to use higher outbound levels.
- Place the speaker post on a curve in the lane. Curves force vehicles to be further away from the post, which results in higher outbound level requirements and makes it difficult for order takers to hear customers.
- Face the speaker post or the drive-thru lane at adjacent residences. Remember that the highest sound levels are likely to be directly opposite the post and off the front of vehicles.
- Turn the outbound level up higher than necessary.
- Rely on vegetation to reduce sounds. Plants have rather limited impact on sound levels.

Memo**Re: Drive-Thru Sound Pressure Levels From the Menu Board or Speaker Post**

The sound pressure levels from the menu board or speaker post are as follows:

1. Sound pressure level (SPL) contours (A weighted) were measured on a typical HME SPP2 speaker post. The test condition was for pink noise set to 84 dBA at 1 foot in front of the speaker. All measurements were conducted outside with the speaker post placed 8 feet from a non-absorbing building wall and at an oblique angle to the wall. These measurements should not be construed to guarantee performance with any particular speaker post in any particular environment. They are typical results obtained under the conditions described above.
2. The SPL levels are presented for different distances from the speaker post:

Distance from the Speaker (Feet)	SPL (dBA)
1 foot	84 dBA
2 feet	78 dBA
4 feet	72 dBA
8 feet	66 dBA
16 feet	60 dBA
32 feet	54 dBA

3. The above levels are based on factory recommended operating levels, which are preset for HME components and represent the optimum level for drive-thru operations in the majority of the installations.

Also, HME incorporates automatic volume control (AVC) into many of our Systems. AVC will adjust the outbound volume based on the outdoor, ambient noise level. When ambient noise levels naturally decrease at night, AVC will reduce the outbound volume on the system. See below for example:

Distance from Outside Speaker	Decibel Level of standard system with 45 dB of outside noise <u>without</u> AVC	Decibel level of standard system with 45 dB of outside noise <u>with</u> AVC active
1 foot	84 dBA	60 dBA
2 feet	78 dBA	54 dBA
4 feet	72 dBA	48 dBA
8 feet	66 dBA	42 dBA
16 feet	60 dBA	36 dBA

If there are any further questions regarding this issue please contact HME customer service at 1-800-848-4468.

Thank you for your interest in HME's products.