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Technical Guide – Loudspeaker Sensitivity Explained

Loudspeaker Sensitivity, And Why It Is Important

Question: When is a 6w ceiling loudspeaker not a 6w ceiling loudspeaker?

Answer: When is only as loud as a 2w ceiling loudspeaker!

The above question and answer may seem a little strange, but it is true if we disregard some of the loudspeaker specification data, especially regarding efficiency or sensitivity.

When being asked to quote and suggest equipment for a sound system design, a customer will normally send plan drawings and a system requirement specification sheet. If the design and layout of the sound system has already been done, then the specification sheet may contain details of the number and type of loudspeakers required.

We may see a list like this:

Zone 1: 45 x 6w ceiling loudspeaker
Zone 2: 10 x 20w projection loudspeaker
Zone 3: 6 x 30w music cabinet loudspeaker

This list looks like it will be easy to provide pricing, however let the seller, buyer and end user beware as there is not enough information!

Compare the specification of the 2 ceiling speakers in the table below:

Model	TD06T	R06T
Type	6w 100v ceiling speaker 200mm overall diameter	6w 100v ceiling speaker 197mm overall diameter
Tappings	6/3/1.5/0.75w	6/3/1.5w
Sensitivity	91dB 1w/1m *	85dB 1w/1m *
Frequency response	90 Hz to 18 kHz (+/- 10dB)	80 Hz to 19 kHz (+/- 10dB)
List price	£ 25.70	£ 19.25

These loudspeakers appear quite similar in specification. They are both rated at 6w 100v and have an overall diameter of around 200mm. One also has a slightly better low frequency response than the other. However, the sensitivity figures are very different. Our list of loudspeakers from the project specification makes no mention of sensitivity but it is very important.

see next page…

What is sensitivity?

In basic terms loudspeaker sensitivity is a measure of input verses output, i.e. for an amount of amplifier input power, how much sound pressure level do I get out of the loudspeaker?

We need to also understand how sensitivity is expressed and its units of scale.

The sound pressure level (SPL) output of a loudspeaker is normally expressed in dB (decibels) and within its specification you will usually see its maximum output level and the sensitivity measured with a 1w input and at a 1m distance.

The scale of SPL is logarithmic, and for every additional 10dB you will effectively double the perceived volume level, so 90dB is twice as loud as 80dB, and four times as loud as 70dB.

To increase the SPL by 10dB would require 10 times the input power, so to achieve twice the volume level with a specific loudspeaker which is currently being fed with 10w would require an input power of 100w, not forgetting to consider whether the loudspeaker can handle this increase or not!

Looking back at the two ceiling loudspeaker models, we can see a 6dB difference between them meaning you will need considerably more power to achieve the desired SPL using the R06T model than the TD06T model. This would require an increase of 4 times the amplifier power, or it could mean that the TD06T model could be tapped down considerably saving money on high powered amplification systems.

However, There Is Always A But!

We are of course are at the mercy of the data published by manufacturers and must trust that what we read is correct, sometimes this is not always the case. The normal rule of thumb is that when something looks too good on a spec sheet, it normally is.

* For this document, we have assumed that the sensitivity of the loudspeakers shown in the example is consistent across the frequency and dispersion range. In the real world this is rarely the case and you should also consider frequency response and SPL in relation to dispersion, power compression, and many other things but hopefully you will now understand why sensitivity is an important factor.

Whilst designing a system, you should also consider the desired frequency response and coverage that is required, in addition to the sensitivity.