A SIMPLE GUIDE TO LOUDSPEAKER TECHNOLOGY

The answers to the most commonly asked questions on loudspeakers.

Terminology

dB Decibel	The units of how loud something is
W Watts	A measurement of power – same as for cookers, light bulbs, heaters etc
Hz Hertz	One Hz means backwards and forwards once in one second. Thus, a loudspeaker which is radiating 50Hz is moving in and out 50 times a second
SPL Sound Pressure Level	Technical term for "how loud!" (Measured in dB)

Decibels (dB): General Information

The dB scale is used when referring to how loud something is. 0dB is regarded as the threshold of hearing and 110dB is when it starts to hurt!

Double the power = 3dB increase in SPL

Power (in Watts) is related to dB in the following way: For every 3dB increase in SPL you will need to double how much power is sent to your loudspeaker.

At low power levels, for example 5 Watts to 10 Watts, this is not a problem; however, to get the same increase at high levels may require you to go from 1000W to 2000W for the listener to be aware of the same increase in sound level.

To the average ear	3dB is just a noticeable increase 10dB is twice as loud

Typical SPL's

Intolerable

140dB	30m (at the side of the runway) from a military aircraft at take off!
130dB	Pneumatic drill at the operator's position
120dB	Ships engine room at full speed Peak level in bunker at PLASA was 126dB

Very Noisy

110dB	Automatic Punch Press at the operator's position Average Nightclub level playing mainstream dance music
100dB	Platform of Underground station at rush hour with a train arriving/leaving
90dB	Heavy lorries at 6m distance Health and Safety upper limit for noise in an average working day

Noisy

80dB	Kerbside of busy street
70dB	Loud radio in average domestic room
60dB	Restaurant/Department Store

Quiet

50dB	Conversational speech at 1m. General Office noise
40dB	Residential area at night. Whispered conversation at 1m

Very Quiet

<30dB	Background in TV and recording studios

Loudspeakers – Some definitions

Power Handling

This is probably the most commonly asked and quoted specification. How many Watts a speaker uses is often regarded as the best way of assessing how loud it will be. However, the keyword here is *uses*. A car engine can use a lot of petrol (Watts) without moving the car very quickly. In the same way, a speaker can use a lot of Watts without being very loud!

Sensitivity

This parameter tells how much sound you will get per Watt. To continue the above analogy this is the “mpg” rating of the loudspeakers. The higher, the better.

Speakers are rated in terms of how loud they will be when 1 Watt is fed to them. This loudness is measured at a distance of 1 metre from the speaker.

Thus, if a speaker is rated as 99dB 1W/1m then you know that if you put 1 Watt in, at 1 metre distance you will hear 99dB.

Note: This is significantly more than a speaker rated at 96dB 1W/1m, because you will then need twice as much power to generate the same sound level. (See Decibels: General Information)

Power Compression

The Watts that are not turned into sound get transformed into heat. This heat increases the electrical resistance of the speaker, making it harder for the amplifier to drive. The harder you drive the speaker, the more heat is generated.

To return to the motoring analogy: This is the “aerodynamics of the speaker”: The faster you drive, the more wind resistance there is. Thus, *even more* power is required to make up for this. The lower the power compression figure is, the better.

Dispersion

Horn loaded loudspeakers do not radiate sound in all directions. They radiate a much greater proportion of this sound within a "dispersion angle". This angle is affected by the design of the horn and can vary quite dramatically from one model to another.

They are quoted in the following manner; 90^o x 50^o (HxV) or something similar. This refers to the angles, horizontal and vertical from which you can move away from "straight out" and still hear the sound properly. 90^o is a right angle, thus the quoted speaker will cover all areas when mounted in a corner within a 50^o vertical (up & down) plane.

Frequency Response

The frequencies covered by the loudspeaker. They are measured in Hz. The human ear can hear from 20Hz to 20000Hz to varying degrees of sensitivity. The average "shot to pieces" DJ/Rock 'n' Roller ear, probably only manages up to 15000Hz.

SOME BASIC CALCULATIONS

Watts – dB increase: How many dB increase for full power input **relative to 1 Watt**

Watts	1	50	75	100	150	200	300	350	600	800	1200**W**
dB	0	+17	+19	+20	+22	+23	+25	+25.5	+28	+29	+31**dB**

Maximum Sound Output To calculate the maximum SPL available from a loudspeaker

Max SPL = SENSITIVITY + dB at Full Power – Power Compression at Full Power

Sensitivity and power compression are found from the specification sheet. dB at full power can be found from the table above. If you cannot find the power compression figure then quote "excluding power compression" and omit it from the calculation.

Example: Max SPL at 1m = 99 +25.5 = 124.5dB (*excluding power compression*)

Effect of Distance: To calculate the level at a distance from the speaker **relative to 1m:**

Distance	1	3	5	7	10	15	20	30	50**m**
dB	0	-9.5	-14	-17	-20	-23.5	-26	-29.5	-34**dB**

This can be taken off the figure at 1m to give the level at any of the above distances.

Example: Max SPL at 15m: 124.5 – 23.5 = 101dB (*excluding power compression*)

NOTE: This does not account for any meteorological changes such as temperature, humidity or wind direction. However, it provides a good rule of thumb for indoor work.