It is fairly easy to calculate the *on axis* amount of power required to a speaker if we understand and apply a few basic principles.

Sensitivity

This rating given to all speakers indicates how efficient it is at converting power (wattage) into sound. This rating is expressed as
Sens dB= 1 watt / 1 meter.
Typical ratings are 90dB for 1 watt at 1 meter distance. What this implies is that if one watt of power is delivered to the speaker, the speaker will produce 90dB of sound pressure at a one
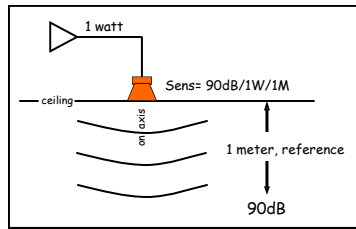
meter distance from the speaker. This distance is our *reference* distance. Of interest for ceiling speakers, the reference distance is approximately ½ meter distant from a person seated in an office with a typical ceiling height of 2.6 meters (8.5 feet). Therefore, in general, one or two watts is all that is needed in a *typical* office or training room scenario with a normal ceiling height of 8-9 feet.

Power Increase vs SPL

When we increase the power delivered to the speaker the amount of sound pressure, measured in dB, will also increase. The rate of increase for a standard speaker in free space is
3 dB for every doubling of power.
Our speaker above with a Sensitivity rating of
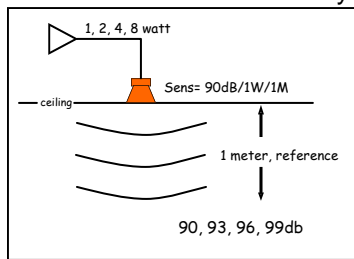
90dB=1W/1M, one watt would produce 90dB at reference. If we increase the wattage to 2 watts (doubled) our speaker would produce 93dB at reference. Doubling this again to 4 watts would produce 96dB at reference.

Loss of Sound Pressure over Distance

Our typical speaker above will have a perceived loss of sound pressure level as we move away from the speaker. For a free space environment this loss occurs at
6dB for every doubling of distance.
As an example, our speaker above is driven with 8 watts of power. Since the speaker has a sensitivity of
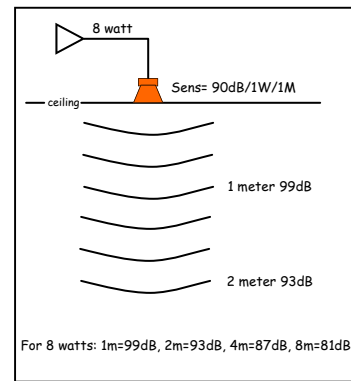
90dB/1W/1M, *at reference* this speaker will be producing 99dB.
So one meter away from the speaker (reference) there is 99dB of sound and as we double this reference distance away from the speaker, the sound pressure will decrease.
At 2 meters SPL= 93dB, 4 meters SPL=87dB, 8 meters SPL=81dB.

Typical Sound Levels

Busy traffic at 10 meters ~ 80-90dB
Office   ~ 50dB
Normal conversation   ~ 40-60dB

Having this information makes it relatively easy to estimate how much power is required per speaker for a given listening distance. No wasted amplifier power and no complicated math required.