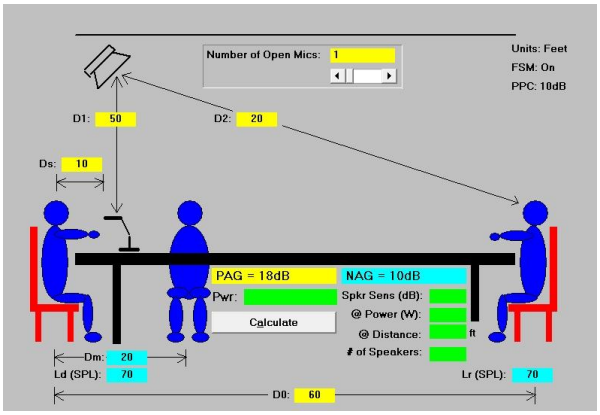
A CALCULATOR THAT PREDICTS GAIN-BEFORE-FEEDBACK

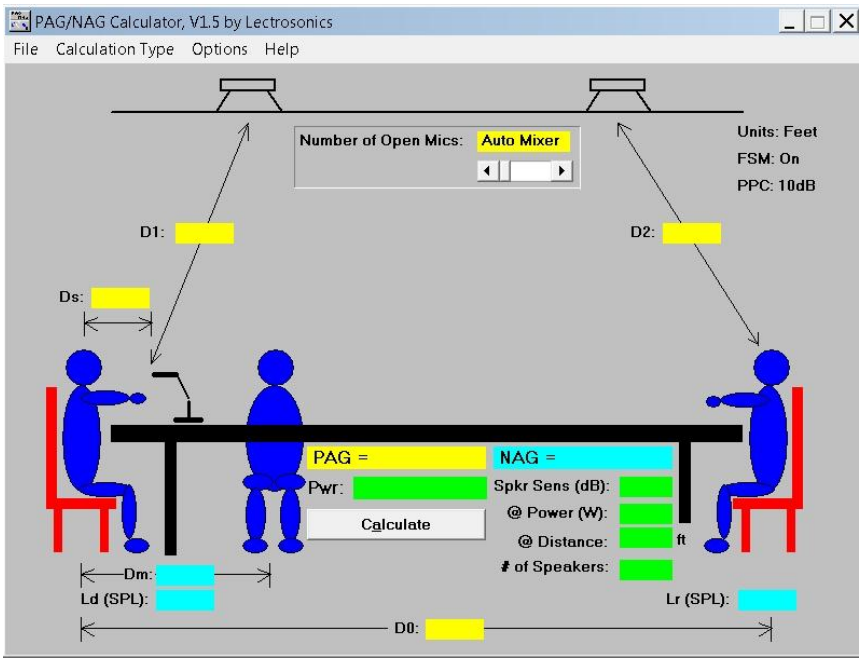


Here's a handy calculator that predicts how loud a sound system can get without running into feedback. You enter various distances related to the mic and speaker placement, and the calculator tells you how likely the system is to go into feedback.

You can download the calculator by pasting the link below into your web browser. It's the PAG/NAG Calculator v 1.5 by Lectrosonics.

http://cdn.shopify.com/s/files/1/0247/3799/files/GAINCALC.exe?1695

When the program opens, you see a microphone, a person talking into the mic, a loudspeaker, and a couple of audience members. You can enter various distances, then press the Calculate button to see the results.



First, under “Calculation Type” at the top, select “single speaker”. Under “Options” uncheck “calculation warnings”. Set the “Number of Open Mics” to 1. Set Dm to 20, set Ld to 70, and set Lr to 70.

Let’s define the terms used in the calculator:

PAG is Potential Acoustic Gain. That’s how much the sound system can amplify the speech.

NAG is Needed Acoustic Gain. That’s how much the sound system needs to amplify the speech so it can be heard easily.

We want to make PAG as big as possible, so the sound system will be loud without feedback.

The program solves these two equations:

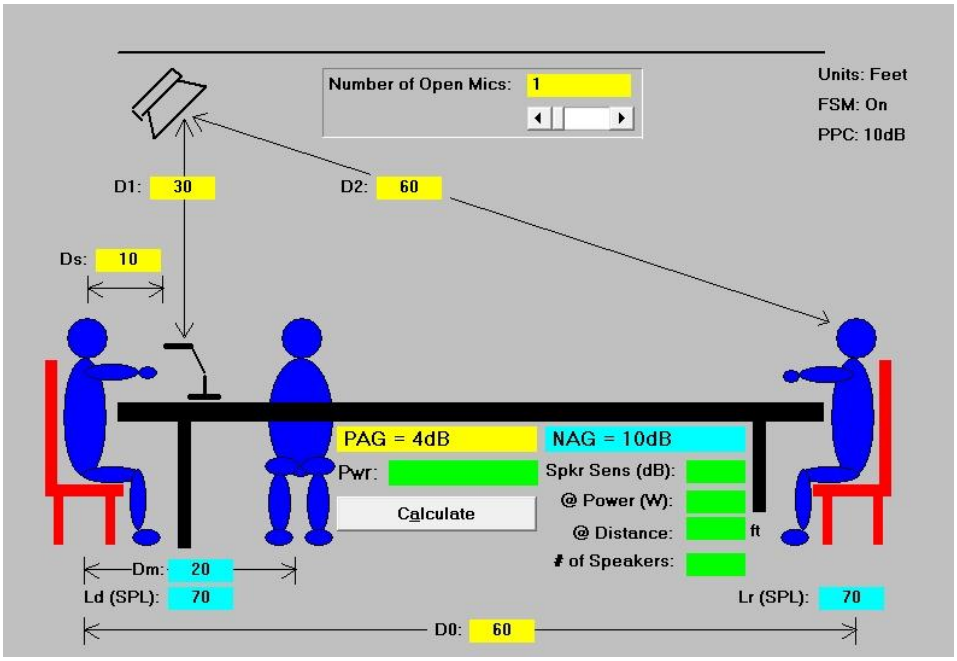
PAG = 20 log (D0 x D1)/(Ds x D2) **NAG = 20 log (D0/Dm)**

D0 is the distance from the talker to the farthest listener.
D1 is the distance from the mic to the loudspeaker.
Ds is the distance from the talker to the mic (typically 10 feet for a floor mic)
D2 is the distance from the loudspeaker to the farthest listener.
Dm is the distance from the talker to the nearest listener.

As the equation shows, PAG goes up (the system gets louder without feedback) when: D0 goes up, D1 goes up, Ds goes down and D2 goes down. We can’t control D0 (the distance from the talker to the farthest listener) or Ds (the talker-to-mic distance). But we can control the loudspeaker placement.

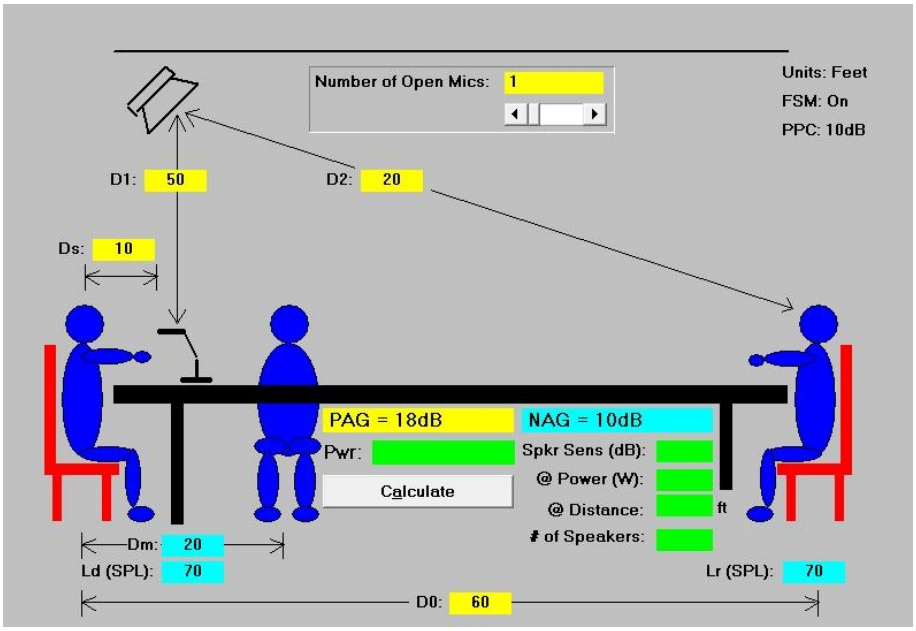
The farther the loudspeaker is from the mic, and the closer the loudspeaker is to the listener, the higher the PAG – the louder the system can get without feedback. That’s why I advise customers to place their loudspeakers far from the microphones and close to the audience.

Let’s try an example. Suppose the loudspeaker is 30 feet above the stage. The floor mic is 10 feet from the talker. The loudspeaker is 30 feet from the mic, the loudspeaker is 60 feet from the farthest listener, and the talker is 60 feet from the farthest listener. The screen capture below shows those figures in the yellow boxes.



The Needed Acoustic Gain to make speech heard adequately is 10 dB, but the system can provide a Potential Acoustic Gain of only 4 dB. It won't be loud at all. If you turn up the mic loud enough to hear the speech, the system will feed back. That's why I don't recommend using a loudspeaker over the stage. It's too close to the mic and too far from the audience.

Now suppose the loudspeaker is along a side wall, even with the third row of the audience. The loudspeaker is maybe 50 feet from the mic, and 20 feet from the farthest listener. In that case, the PAG is 18 dB – more than enough to provide adequately loud sound without feedback (see below).



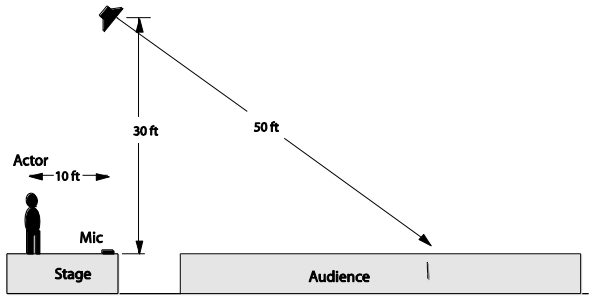
Under “Options” at the top is a selection called FSM or Feedback Stability Margin. To prevent the sound system from ringing, you want to operate it at 6 dB or more below the Potential Acoustic Gain. In other words, turn down the sound system 6 dB below the point of ringing. If the FSM option is checked, the calculation includes the Feedback Stability Margin, which is good practice.

The feedback calculator assumes that the microphone is omnidirectional. However, a Bartlett floor mic has a half-supercardioid polar pattern, so it provides several dB more gain-before-feedback than an omnidirectional mic would.

Have fun experimenting with the calculator.

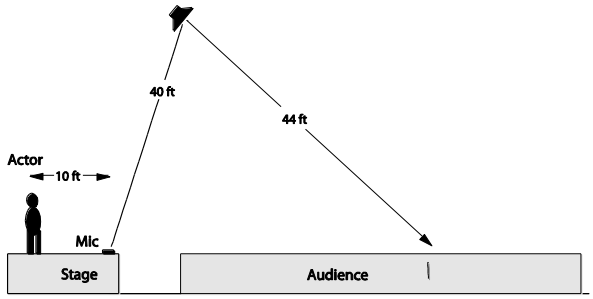
On the next page is a diagram which shows the Potential Acoustic Gain of four loudspeaker placements in a theater.

Potential Acoustic Gain (PAG) of Four Loudspeaker Placements in a Theater (HIgher PAG means less feedback)



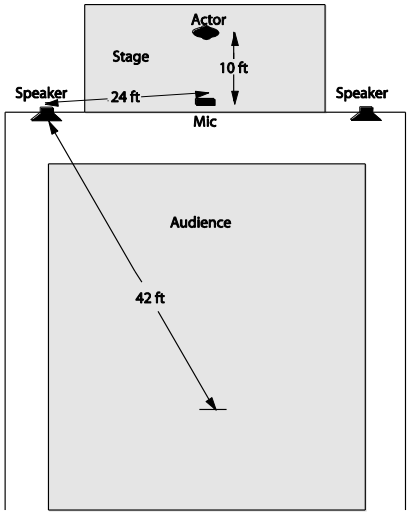
PAG = 4 dB

Rear sound rejection of mic increases PAG up to 6 dB.
Angling speaker away from mic increases PAG 0 to 6 dB depending on frequency.
(PAG can be up to 16 dB with this placement)



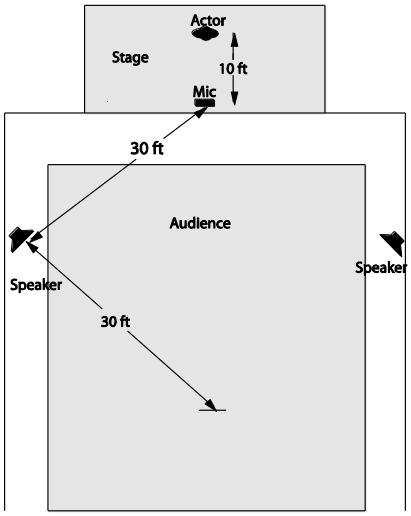
PAG = 8 dB

Rear sound rejection of mic increases PAG up to 8 dB.
Angling speaker away from mic increases PAG 0 to 7 dB depending on frequency.
(PAG can be up to 23 dB with this placement)



PAG = 4 dB

Rear sound rejection of mic increases PAG up to 10 dB.
Angling speaker away from mic increases PAG 0 to 10 dB depending on frequency.
(PAG can be up to 24 dB with this placement)



PAG = 9 dB

Rear sound rejection of mic increases PAG up to 12 dB.
Angling speaker away from mic increases PAG 0 to 10 dB depending on frequency.
(PAG can be up to 31 dB with this placement)

This setup provides the most gain before feedback.