

# The What, How, and Why of Input Monitor Feedback

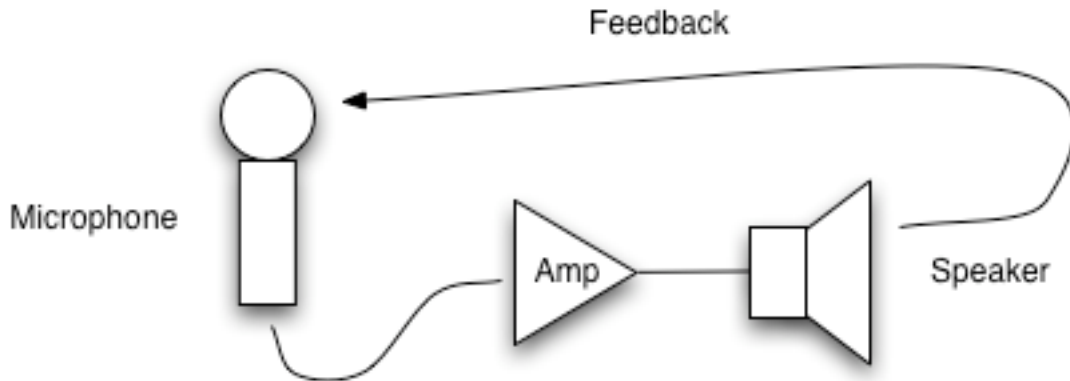
This document explains why feedback occurs when using input monitoring and how to avoid it.

Practically speaking, feedback will occur on any electronically amplified sound system whenever the gains are turned up high enough. This document will explain why feedback occurs and some of the measures that can be used to avoid it. **Care should always be taken to avoid setting gains high enough to cause feedback.**

## What is Acoustic Feedback?

*The reverberation of sound waves from a loudspeaker to a preceding part of an audio system, such as to the microphone, in such a manner as to reinforce, and distort, the original input.*

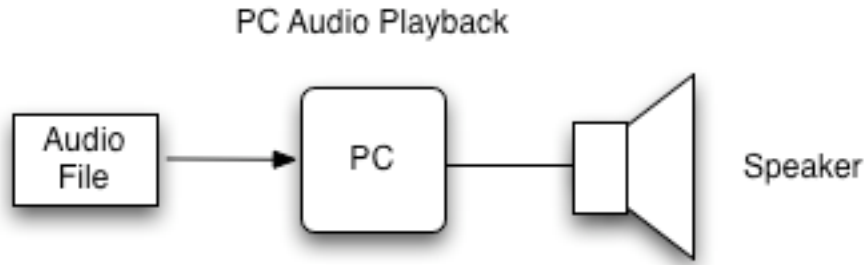
Acoustic feedback occurs in electronically amplified sound systems when enough of the sound coming from the speakers is received by the input microphone so as to be equal to or more than the original input.



In order for feedback to occur there must be a *path* all the way from the input microphone through the output speakers and back again to the input microphone. This is referred to as a *closed loop*.

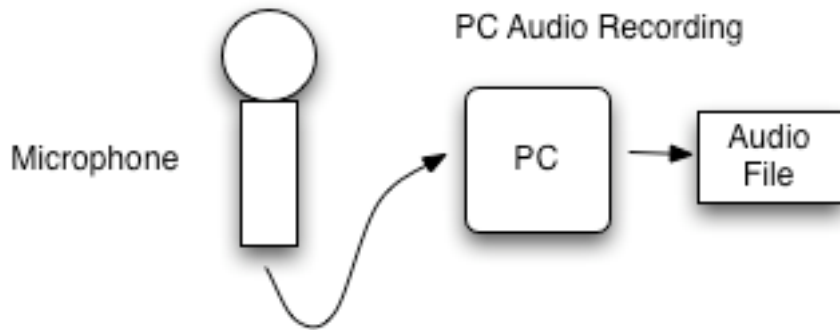
## PC Audio Playback

In a simple PC audio playback scenario feedback cannot occur because there is no input. The audio being played is coming from a file residing on the PC's disk or memory.



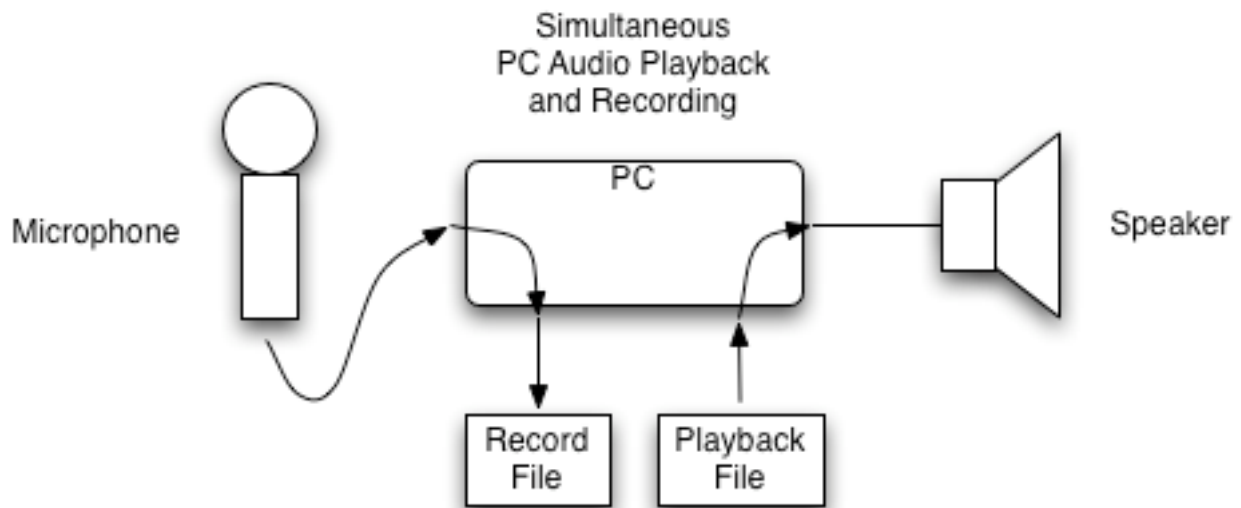
## PC Audio Recording

Likewise in a simple PC audio recording scenario feedback cannot occur because there is no output of the sound. The audio being recorded goes directly to a file residing on the PC's disk or memory.



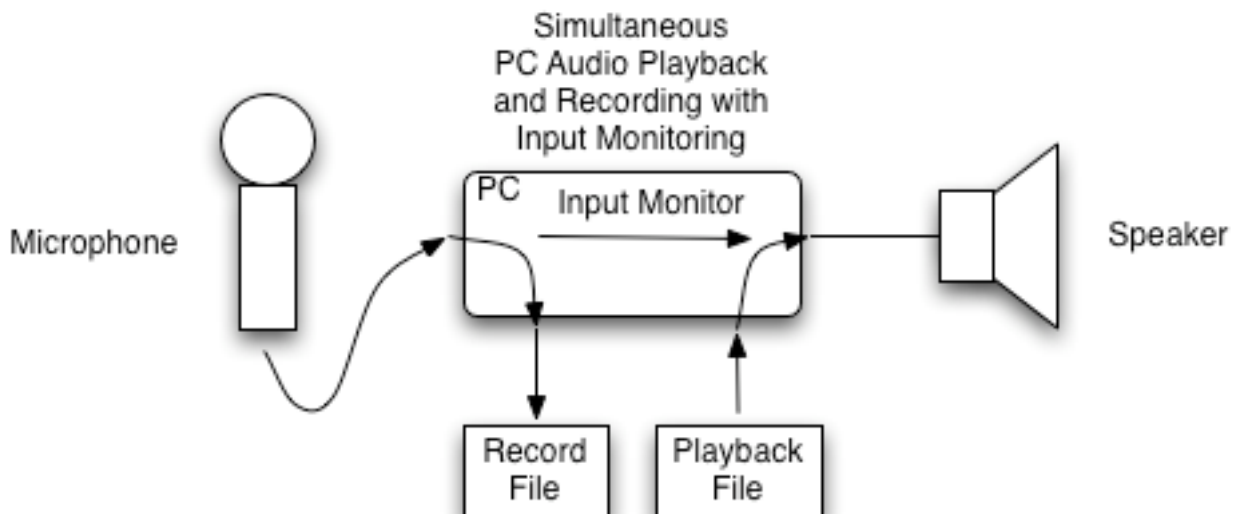
## Simultaneous PC Audio Recording and Playback

It is possible to record and playback at the same time. There is thus both an input and an output. But feedback cannot occur in this case because there is no path from the input microphone to the output speakers. Thus the closed loop path necessary for feedback to occur is not possible.



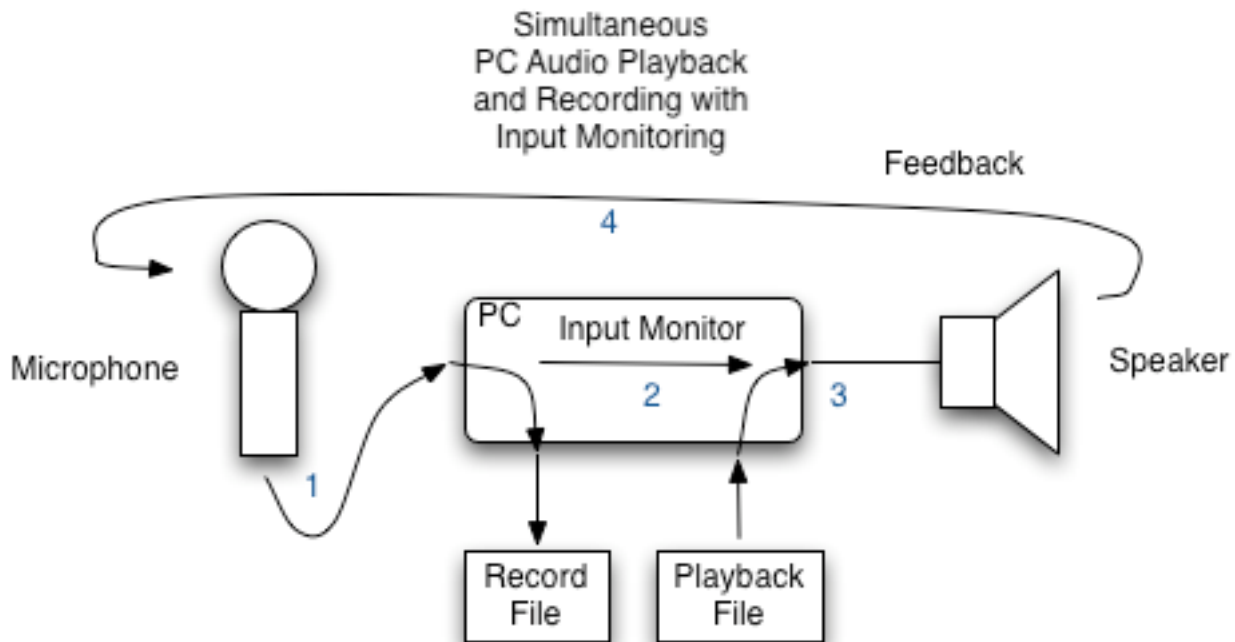
## PC Audio Recording and Playback with Input Monitoring

The possibility for feedback occurs in the record and playback scenario when some of the input is passed to the output. This is a common scenario in Karaoke type applications where the singer would like to hear what is being sung into the microphone. This is referred to as *input monitoring*.



## PC Audio Input Monitoring Feedback

Since there is now a closed loop, feedback will occur when enough of the sound coming from the speakers is received by the input microphone so as to be equal to or greater than the original input.



There are 4 main pieces of the closed loop path as indicated by the numbers in the above diagram. Each numbered piece contributes to the overall gain of the closed loop.

1. Input Microphone  
The gain of this piece is determined by the gain of the particular microphone being used. It is also affected by the microphone gain control provided by the PC audio subsystem.
2. Input Monitor  
The gain of this piece is determined by the input monitor control used to adjust how much of the input is heard in the output speakers.
3. Speakers  
The types of speakers and the volume controls determine the gain of the speakers piece.
4. Acoustic Path  
This is the path through the air or possibly through the PC case between the output speakers and the input microphone. Microphone and speaker placement and the physical environment affect the gain of this piece.

## How is input monitor feedback avoided?

Feedback is avoided by keeping the gain of all 4 pieces below that level at which feedback occurs. When feedback occurs, it can be eliminated by reducing any gain of any or all of the 4 pieces.

## What is the best way to avoid feedback?

Eliminating or reducing the acoustic path (#4) is the best way to avoid feedback. The following lists ways that this can be accomplished:

- Careful placement of the microphone and the speakers. For example, do not place the microphone directly in front of the speakers.
- In laptop systems, be careful to sonically decouple the internal speakers from the internal microphone. This includes both the path through air as well as the transmission path through the PC's case.
- Use headphones instead of speakers to completely eliminate the acoustic feedback path.
- Avoid placement of the microphone and speakers near a reflective wall in such a way the sound can bounce off of it from the speakers to the microphone.

## What about adjusting gains?

Yes, the gain controls of each section inside the PC can be reduced to eliminate feedback. In particular, the input monitor gain should be kept at a reasonable level. Reducing gain though should be done after performing the steps described above. As mentioned earlier, care should always be taken to avoid setting gains high enough to cause feedback.

## Can software be used to reduce feedback?

Yes. Feedback tends to occur at a particular frequency. IDT's software 10-band EQ can be used to reduce the gain for just the particular frequency band at which feedback is occurring.

## Does the type of microphone affect feedback?

Yes. There are many types of microphones. Some microphones are *directional* which means that they be pointed at the desired source of the input and will help reduce the amount of sound picked up from other directions.

Another attractive option for voice input is the use of a headset. The microphone is placed near the person's mouth providing a higher gain to what is being spoken or sung, allowing other gains to be like the microphone gain itself to be reduced. This lowers the overall loop gain without sacrificing the level of the input signal.

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