Positive Feedback Is Not Always Good News

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POWERING INTELLIGIBILITY

We all like to receive some positive feedback, a pat on the back, a compliment, some recognition for the work we have done or for something we have achieved. However, In the audio world, things are quite different, positive feedback can lead to instability, and too much positive feedback can cause catastrophic system failure; consider pushing a child on a swing, each push is in synch with the motion of the swing requiring relatively little effort yet the child swings higher and higher . If the positive feedback continues, the system becomes unstable and eventually it breaks down ending in tears.

Audio systems are similar and grown men do cry! With an open microphone near a speaker, the output from the speaker is fed back into the system pushing the output higher and higher eventually the system self oscillates and a loud screech emanates from the speaker. If corrective action is not taken, the amplifier and possibly the speaker will self destruct.

To recover from this situation, the operator can move the microphone further away from the speaker, turn the sensitivity down on the microphone, turn the volume down on the amplifier driving the speaker, filter the oscillating frequency, a combination of these or switch the system off and start again.

Every audio system will have a point at which it becomes unstable and self oscillates. A systems integrator needs to understand where this point is and to try and maximise the dynamic range to give the best system performance.

Induction loop systems are no different except when they self oscillate it all happens in silence and invariably goes undetected until it is too late since the feedback mechanism is magnetic.

Causes of Feedback

1) A dynamic microphone is being used inside the induction loop

Dynamic microphones use a magnetic pickup.

To reduce the susceptibility to feedback:

Use a dynamic microphone with better shielding.

Only use the microphone outside the loop and if necessary add a cancelation loop to this section.

Use a Super Loop system.

Reduce the output of the loop system (turn the current down).

Reduce the sensitivity of the microphone (turn the input gain down).

Limit the bandwidth of the loop input signal using DSP or other filtering techniques.

Use a combination of the above.

To avoid the Issue of feedback:

Do not use a dynamic microphone.

Use a condenser microphone or other type of microphone that does not use a magnetic transducer.

Finding the stability threshold for the loop system

The combined input and output settings at which the system begins to self oscillate is the stability threshold. To determine these points either the input level or the output level should be set to the desired position with the other control being adjusted from zero until the threshold is reached.

We suggest you set up the input level as specified in the amplifier documentation and then adjust the loop current from zero, observing the field strength generated. Increasing the current should cause the field strength to increase. If the field strength suddenly drops by 6dB the amplifier is self oscillating and the 2nd stage of the AGC has been activated. You will need to back the controls off or turn the system off to reset . An oscilloscope connected across the loop terminals (it must not be grounded) can be used to observe and measure the oscillation frequencies.

For a Super Loop system, you will need to adjust both master and slave. Start with both outputs set to zero, adjust the master whilst monitoring for feedback and if it is not reached, adjust the slave. You will need to monitor both master and slave outputs as either could begin to self oscillate

Is the system self oscillating?

It is often very difficult to tell whether the system is self-oscillating until it is too late. To check a system:

Set the field strength generated by the system to 0dB at the desired height using test signals from an independent source. Now connect the live feed and check the output level.

2) An electric guitar is being used inside an induction loop

An electric guitar uses a magnetic pick -up coil to detect the vibrating strings.

To reduce the susceptibility to feedback:

Only use the electric guitar outside the loop and if necessary add a cancelation loop to this section.

Use an SLS system.

Reduce the output of the loop system (turn the current down).

Reduce the sensitivity of the guitar pick up coil

Limit the bandwidth of the loop input signal using DSP or other filtering techniques.

Use a combination of the above.

To avoid the Issue of feedback:

Do not use an electric guitar where an induction loop system is being operated.

3) The Loop or loop feed cable is parallel and in close proximity to the low signal input cables

The high current in the loop and feed cable creates a magnetic field (as intended). This magnetic field will induce currents into adjacent conductors. If the conductors are carrying input signals eg. microphone signals then the output is being coupled back into the input; positive feedback.

Has the field strength dropped by approximately 6dB?

Keep quiet so there is no input to the microphone.

Does the audio input LED stay on?

Do the drive current LED's stay on?

The above are all indications that the system is unstable and self oscillating. The system should be turned off to avoid damage and remedial action to prevent or reduce susceptibility to self oscillation as described should be taken.

The Univox loop listener uses a peak detector so it can easily be used to check the field strength level of live signals. With test signals you would expect to see the green led lit indicating that the field strength is at least 0dB. When you connect the live signal you would expect the green LED to flicker on the peaks of the signal with the orange LED flickering occasionally too. If neither LED flickers, the field strength has dropped to below -6dB.

To reduce the susceptibility to feedback:

Increase the separation distance between the cables (at least 30cm separation between cables should be maintained).

Reduce the distance over which the cables run parallel to each other.

Use twisted pair loop feed cables (star quad configured loop feed cables are best).

Use balanced connections for high common mode rejection.

Reduce the output of the loop system (turn the current down).

Reduce the level of the input signal (turn the input down).

Limit the bandwidth of the loop input signal using DSP or other filtering techniques. (5kHz knee point or 4kHz if the system is only being used for speech) .

Modify the loop Amplifier. The manufacturer my be able to suggest some modifications to the amplifier to reduce feedback sensitivity. These modifications may cause other instability issues and therefore must be applied with caution.

Use a combination of the above.

To avoid the Issue of feedback:

Do not run loop cables in parallel with input cables. (They may cross at right angles).

Damage to induction loop amplifiers caused by positive feedback is not covered under warranty. It is the responsibility of the installer to ensure that the system is stable.