Signal Chain Optimization

Mixer Gain Structure

From Course 100 training, you are now familiar with the signal chain and the purpose of each component. The mixer is the "cockpit" of the sound system. All user interaction and control takes place here. Mixing is artistic control bounded by technical limits. To fully utilize the mixer, a proper gain structure must be established. As important as that is, it is the exception to see a mixer that is setup properly and operating at its full potential.

In this lesson I present a logical, orderly and defensible way of setting up the mixer, one that is based on achieving two results:

1. The mixer's faders are in their proper range of operation.
2. The mixer's output is line level, and its meter(s) indicate this.

It is important to note that a mixer still "works" if neither of these conditions are met. It just isn't operating at its full potential. Since getting it there doesn't cost any extra, we might as well do so.

Video topics

1. Introduction
2. Dynamic Range
3. Signal-To-Noise Ratio
4. Mixer Stages
5. The Objective
6. The Main Meter
7. The One-Channel Mixer 8. The Multi-Channel Mixer 9. Summing Room
10. Digital Mixers
11. Conclusion

System Gain Structure

Now that the mixer's gain structure has been established, the system gain structure can be addressed. We are back to the signal chain again, assuring that each component is operating at its optimum level. A good system gain structure has two objectives:

1. No component is clipping the signal.
2. The residual noise is as low as possible.

Achieving this can be simple for some systems, but there are some conditions that can complicate it. I'll start simple and then handle the special cases.

Video topics

Signal Chain Optimization

1. Introduction
2. Signal Processing
3. Expected Levels
4. Finding Unity Gain
5. Quickie Gain Structure 6. Some Audio History
7. An Ideal Case
8. Peak Room Wars
9. An Analogy
10. Sizing A Pad
11. The Amplifier

Setting Amplifier Levels

Amplifiers are usually designed to work with a broad range of applications, including both consumer and professional systems. Since these systems have different operating levels, the required amplifier sensitivity and gain will be different for each. Nearly all amplifiers have level controls, and many have gain/sensitivity switches to adapt the amplifier to the drive signal level from the preceding component. In this lesson we'll look at why these settings are there, and how to set them for optimal amplifier performance.

Video topics

1. Introduction
2. What Is An Amplifier?
3. Voltage Gain
4. Amplifier Stages And Controls 5. Gain Selection
6. Playback Level Method I
7. Playback Level Method II
8. How NOT To Do It
9. The Over-Driven Input
10. Amplifier Specifications
11. Digital Audio
12. What Input Sensitivity?

Loudspeaker Power Ratings

The most abused rating in all of audio is the loudspeaker power rating. Few end users understand what it is or what it means, and yet it often profoundly influences the buying decision for many systems. This pressures manufacturers to come up with ways to publish larger ratings, making it impossible to make meaningful comparisons between products.

In this lesson I will describe how the rating originates. This reveals how to use the rating to determine the required amplifier size and how to know when your loudspeaker is "maxed out" when commissioning the system.

Video topics

Signal Chain Optimization

1. It's A System
2. Power Rating - Introduction 3. Loudspeaker Efficiency
4. Loudspeaker Sensitivity
5. What Voltage?
6. Loudspeaker Impedance
7. Rated Impedance
8. Voltage Transfer
9. Peak VS RMS Voltage
10. Power Rating Details
11. Noise Spectrum
12. When Less Is More
13. Calculating Voltage
14. Amplifier Monitoring
15. Conclusion

Amplifier Power Ratings

In the last lesson I showed how loudspeakers get their power ratings. The next logical step is to examine how this influences the selection of an appropriate power amplifier. This is the longest lesson in the course, and includes topics that are relevant to other areas of audio. I've divided it into several sub-topics.

1. An overview of how amplifiers interact with loads (loudspeakers).

2. The fundamentals of waveform types, including those used to rate power amplifiers.

3. A demonstration and some exercises on sizing amplifiers for various loudspeakers and applications.

The lesson includes a Windows software calculator that you may download, install, and use in your design work.

The content of the loudspeaker and amplifier "power lessons" is the result of many years of investigation, experimentation and refinement. I am hopeful that they serve you in helping unravel this confusing area of sound reinforcement.

Video topics

1. Introduction
2. What Is Power?
3. Amplifier Loading & Power 4. Amplifier Power as a Level

5. Signal Power
6. Crest Factor
7. A Reference Waveform
8. Amplifier Current

Signal Chain Optimization

9. The Continuous Sine Test 10. The Sine Burst
11. The Noise Test
12. The Output Matrix
13. The Complete Picture 14. Amplifier Class
15. The Low-Z Amplifier
16. The High-Z Amplifier
17. “Constant-Voltage”
18. Idealized Voltage Source 19. Real World Sources
20. “Constant-Power”
21. Multi-channel Amplifiers 22. Current Sharing
23. The IO Matrix
24. Level Differences
25. Conclusion

Amplifier Calculations

Several scenarios so you can test your understanding.

Wire Gauge Selection

At this point in the course you have learned how to size an amplifier for a loudspeaker based on several different criteria. The final step is to connect the amplifier to the loudspeaker. While most any cable will “pass the signal” there is a minimum required wire gauge to prevent excessive line loss. I’ll present a quick overview of the physics, and then show how to use the CAFViewer Low-Z and High-Z calculators to do the math.

Video Topics

1. Overview
2. Wire Resistance
3. Wire Gauge Calculations
4. Examples (Click on "Examples" link in course outline) 5. Conclusion