QSC

AET Application Engineering Team

Technical **Notes**

CXD and CXD-Q Series Amplifiers

100-volt lines and the CXD4.2 / CXD4.2Q

We use 100-volt distributed lines to create sound systems, usually with multiple loudspeakers, in a greatly versatile and technically predictable way. A key but often misunderstood element of a 100-volt system, though, is that despite the common misnomer “constant voltage,” the signal on it is still a fully formed audio signal produced by an amplifier; what makes it a 100-volt system is that the amplifier’s maximum output voltage, before it reaches clipping, is 100 volts RMS.

To start, let’s establish that the term “power amplifier,” which has been with us in audio about as long as there has been electronic reproduction of sound, is actually a misnomer. What we call a “power amplifier” is actually a voltage amplifier, which multiplies its output signal by multiplying the input signal voltage. Therefore, most of this discussion will be about voltage, not power (i.e., watts).

To fully support a 100-volt RMS output voltage, an amplifier must be able to put out ±141 volts, because that is the peak value of a 100-volt RMS sine wave. This requires that the supply rails for the output section be about ±141 volts or higher as well. The CXD4.3, CXD4.5, CXD4.3Q, and CXD4.5Q all meet or exceed that requirement and can therefore drive 100-volt lines on each individual channel.

The CXD4.2 and CXD4.2Q, however, have output section supply rails of about ±85 volts, definitely short of what is required for 100-volt operation.

Figure 1 depicts the envelope of a clip of recorded music, normalized so its peaks hit 100 volts RMS. The orange

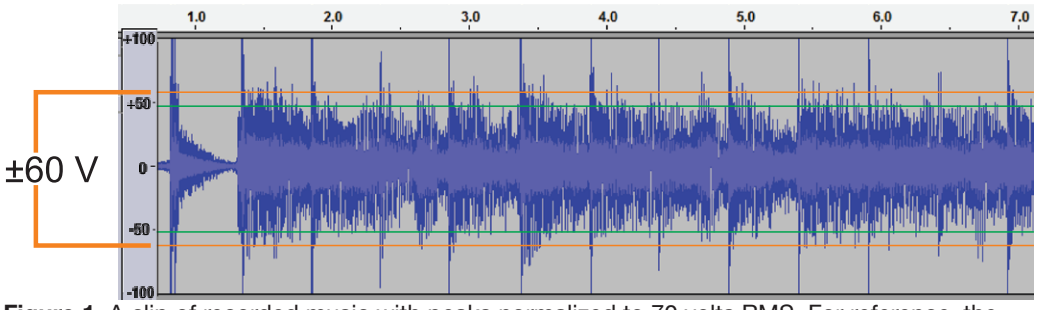

Figure 1. A clip of recorded music with peaks normalized to 70 volts RMS. For reference, the orange lines repesent the maximum output of a CXD4.2 or CXD4.2Q amplifier.

lines represent the 60-volt RMS output limits of a single channel of the CXD4.2 or CXD4.2Q. It's clear that many of the peaks and transients would get chopped off if you tried to use one of these amps in this manner.

However, that is not the end of the story. While the CXD4.2 cannot fully drive any of its single channel outputs to 100 volts RMS, its 60-volt capabilty means that by bridging a pair of its channels it is capable of driving 100-volt lines fully. The only real downside is that it takes away an additional available amp channel.

Notes on power tap selection

A power amp, even one driving distributed lines, only puts out its maximum voltage at the very peaks of the audio signal. Therefore, a 100-volt amp's output, if it's set up properly, actually only rarely, if ever, hits 100 volts. The vast majority of the time the RMS output voltage is lower than even 50 volts. This is a characteristic of just about all audio program material, whether music or voice.

For reasons long forgotten, we select loudspeaker transformer power taps based on the maximum RMS voltage of the distributed line, typically 70 and 100 volts. A typical selection of taps might be something like 30, 15, 7.5, and 3.8 watts; each represents a 3 dB increase or decrease from the next. If you base your soundfield calculations strictly on these values, however, the resulting sound levels may be disappointing because the average level of the audio signal will be considerably lower, typically by about 9 or 10 dB or more. Therefore, the correct transformer tap for the situation might actually be higher than what you initially estimate.

Summary

Here is how to handle 100-volt lines with a CXD4.2 or CXD4.2Q.

Action	Why
Bridge a pair of channels	Doing so doubles the available output voltage, so the amplifier can easily drive a 100V line.