Technical **Notes**

CXD and CXD-Q Series Amplifiers

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

We use 70-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 70-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 70-volt system is that the amplifier’s maximum output voltage, before it reaches clipping, is 70 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 70-volt RMS output voltage, an amplifier must be able to put out ±100 volts, because that is the peak value of a 70-volt RMS sine wave. This requires that the supply rails for the output section be at least ±100 volts as well. The CXD4.3, CXD4.5, CXD4.3Q, and CXD4.5Q all exceed that requirement and can therefore drive 70-volt lines on each individual channel.

The CXD4.2 and CXD4.2Q, however, have output section supply rails of about ±85 volts, slightly short of what is required for 70-volt operation. However, that is not the end of the story. While the CXD4.2 cannot fully drive any of its single channel outputs to 70 volts RMS, it can hit 60 volts. Therefore, in bridged

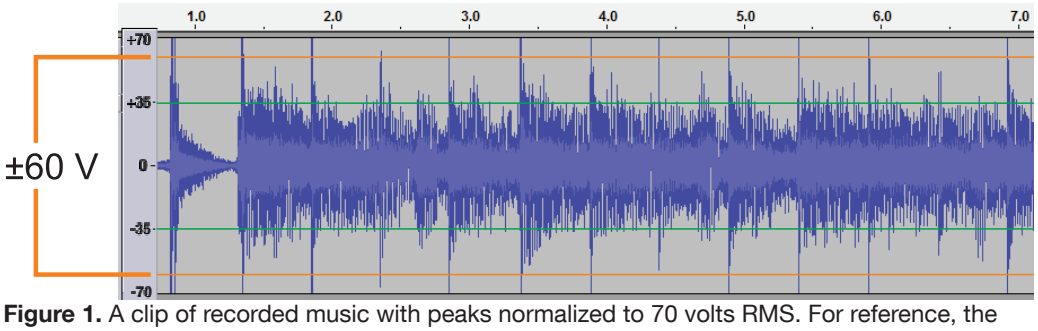

Figure 1. A clip of recorded music with peaks normalized to 70 volts RMS. For reference, the orange lines repesent the maximum output of a CXD4.2 or CXD4.2Q amplifier.

mono it is more than capable of driving 70- or even 100-volt lines fully.

A power amp, even one driving distributed lines, only puts out its maximum voltage at the very peaks of the audio signal. Therefore, a 70-volt amp's output, if it's set up properly, actually only rarely, if ever, hits 70 volts. The vast majority of the time the RMS output voltage is lower than even 35 volts. This is a characteristic of just about all audio program material, whether music or voice.

Figure 1 depicts the envelope of a clip of recorded music, normalized so its peaks hit 70 volts RMS. The orange lines represent the 60-volt RMS output limits of the CXD4.2 and CXD4.2Q. (The ratio of 60 volts to 70 volts is about 1.3 dB, which is a possibly discernible but still small difference.)

For reasons long forgotten, we select loudspeaker transformer power taps based on the maximum RMS voltage of the distributed line, typicall 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 might actually be higher than what you initially estimate; it might not even be important then whether the amp output reaches 60 volts instead of 70.

Summary

Here is a list of the ways to handle 70-volt lines with a CXD4.2 or CXD4.2Q.

Action	Why	Advantages	Disadvantages
Bridge a pair of channels	Doing so doubles the available output voltage, so the amplifier can easily drive a 70V line.	• No need to recalculate voltages, power taps, etc.	• It cuts the channel count in half.
Use the amp and loudspeaker transformers as they are	60 volts is only 1.3 dB less headroom than 70.	• The average sound levels can be maintained as with a 70-volt amp.	• Peaks might still clip the amp.
Select a higher transformer tap setting	Typically, the next higher tap setting delivers about 3 dB more power to the loudspeaker	• A 3 dB step more than makes up for a 1.3 dB reduction in maximum voltage.	• The higher tap lowers the loudspeaker's load impedance on the line; with multiple loudspeakers the cumulative effect might be stressful on the amp. • The transformer might already be at its highest tap.