What are the benefits and limitation of using Prepolarized microphones with CCP preamps vs. Externally polarized microphones with Traditional preamps?

We will explore the benefits and limitations of the CCP preamplifier and Prepolarized microphone technologies so it is possible to make a comparison with the performance of Traditional preamplifiers and Externally Polarized microphone capsules.

Figure 1. Possible connections between CCP/Traditional Preamplifiers and Externally polarized/Prepolarized microphone capsules.

Figure 14 shows the connection possibilities between Prepolarized and Externally polarized microphone capsules with CCP and Traditional preamplifiers. A traditional preamplifier can be used with both Prepolarized and externally polarized microphones. When a traditional preamplifier is used in combination with an externally polarized microphone, the polarization voltage for the microphone capsule will be provided by an external equipment via one of the pins in the preamplifier´s connector (Figure 11). This is the reason why a CCP preamplifier can ONLY work together with a Prepolarized microphone. The two wire CCP preamplifier system doesn´t offer the possibility of the extra pin needed for sending the polarization voltage needed for an externally polarized microphone capsule.

Prepolarized Microphones + CCP preamplifier benefits:

The above mentioned CCP two-wire system, that limits these preamps to be used only with Prepolarized microphone capsules, can be seen as the great advantage of CCP preamplifiers. Because this means that simple coaxial cables (typically with BNC, Microdot 10/32 or SMB connectors) can now be used instead of the more complex and expensive multi-wire cables used with the voltage driven Traditional preamplifier types. In the end, this will reduce the overall cost per channel of CCP systems.

CCP Preamplifiers sometimes cost less than Traditional ones. The Power supply for CCP preamplifiers is very simple and inexpensive, because there is no need for +200V polarization voltage for the microphone capsule and 120V supply for the preamplifier. This power supply for CCP preamplifiers (also known as CCP/IEPE/ICP/CCLD supply) can now be found built into the input channels of many data acquisition systems (DAQ). This means, that the microphone sets using CCP

preamplifiers can, under those conditions, be connected directly to the DAQ without the need of using any other external equipment (see Figure 15).

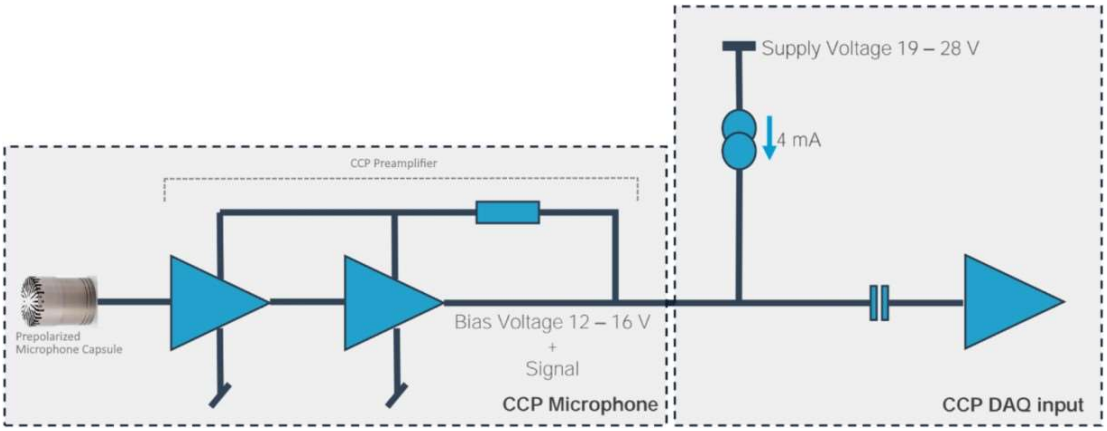

Figure 2. CCP microphone set connection layout including Prepolarized microphone capsule, preamplifier and DAQ input with built in CCP supply.

On the other hand, Traditional preamplifiers must be connected to a power module or an analyzer input which can supply, not only the preamplifier with power, but also +200 V polarization voltage if an externally polarized microphone capsule is used (see Figure 16).

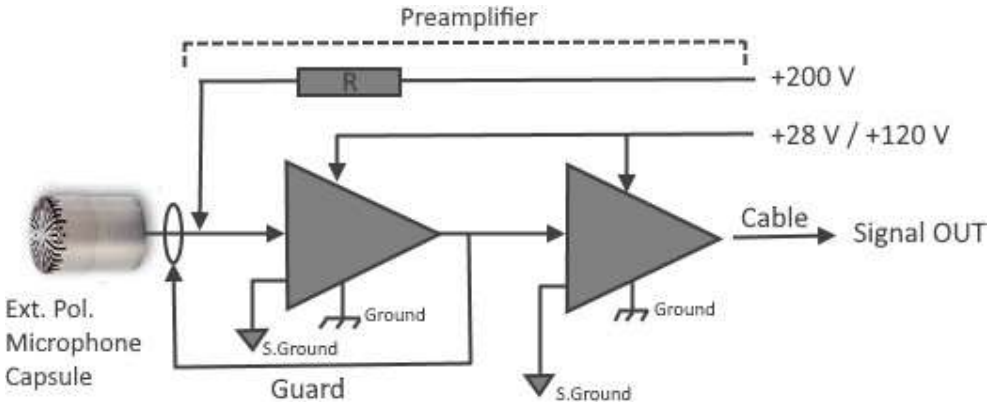

Figure 3. Traditional microphone set connection layout with Externally polarized microphone capsule.

Prepolarized microphones + CCP preamplifier limitations:

As mentioned above, CCP preamplifiers can only be used with Prepolarized microphones.

Dynamic range in CCP preamplifiers is also limited due to its smaller output voltage swing. This is due to the lower driving voltage of a constant-current source which limits the maximum output signal. Effectively, with only an 8-10 Vpeak swing, the upper limit of the amplitude range for the microphone + preamplifier pair is limited by the CCP preamplifier (rather than the microphone itself) by approximately 8-10 dB. Therefore, a ½" microphone with a sensitivity of 50 mV/Pa and an upper dynamic range limit of 146 dB, would now be limited to 138 dB when using a CCP preamplifier.

In comparison, a traditional preamplifier limit is set around 50 Vpeak when using a +/- 60V or +120V supply voltage. This way if we take the same case of the ½" microphone with 50 mV/Pa sensitivity,

with a traditional preamplifier it will be possible to reach the upper dynamic range limit of 146 dB (See Figure 17).

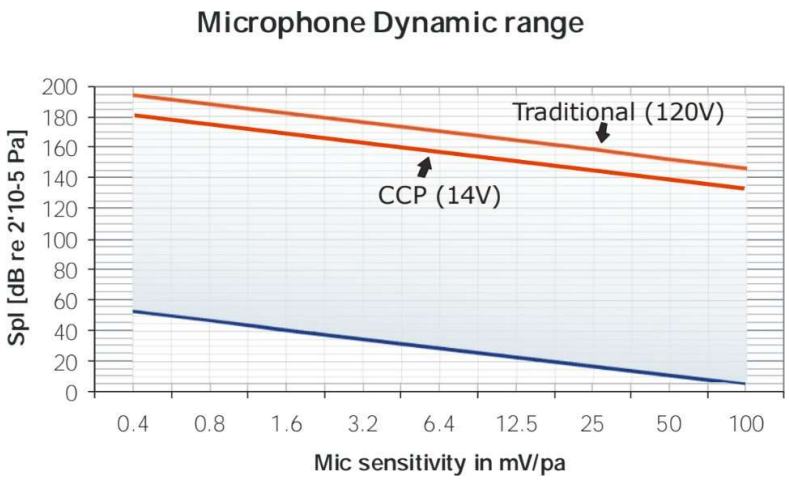

Figure 4. Comparison of upper dynamic range limits of the same microphone using a CCP vs Traditional preamplifier.

Lastly, Prepolarized microphone capsules are slightly more expensive than externally polarized microphones. This is due to the additional manufacturing required to apply the material that contains the electrical charge on the backplate and aging processes needed for adjusting the microphone's sensitivity. But overall, the cost savings of CCP significantly outweigh this.

The long term and high temperature stability of Prepolarized microphones are typically not as good as for externally polarized microphones. This is because the electrically charged layer of material (on the Prepolarized microphone´s backplate) can lose electrons over time or when exposed to temperatures above its operation range