

Millennia Design Philosophy

Millennia Music & Media began formally as a classical music recording engineering and production company. We have recorded nearly 1,000 symphonic orchestra sessions and a much larger number of chamber orchestras, small classical and jazz ensembles, soloists, and more. Millennia continues to engineer a significant number of location recordings each year; working with many of the [world's finest classical musicians](#).

Early on, we realized that most pro recording gear exhibited sonic colorations which limited our critical acoustic recording objectives. This general dissatisfaction with "off-the-shelf" recording products has inspired us to design our own uncompromised critical signal path. To assist our design efforts, we developed sensitive and repeatable laboratory methods to distinguish subtle sonic differences between small changes in circuit design.

Millennia employs a 40+ kHz analog listening environment in which critical audio circuits are scrutinized with live acoustic sources, including bell tree, voice, and cymbal. Sources are chosen for their complexity and difficulty — we've found that complex high frequency "partials" are the most difficult to reproduce accurately in audio circuits. We continually and alternately reference the original source in acoustic space while comparing it with a circuit under test. Each new circuit design or modification is compared with former designs:

- Where are the new shadings? Where are the timbre shifts?
- Is it more accurate, less accurate, or just different?
- In which part of the spectra are differences occurring?
- What are its dynamic characteristics (changes in timbre versus changes in level)?
- What changes to circuit might improve accuracy?

Each successive circuit is also objectively characterized on one of our Audio Precision *System One* and *Dual Domain* test machines. All parameters of distortion, noise, common mode rejection, etc., are measured and logged.

There's something we encounter again and again in our tests. Similarly measuring circuits (THD, noise, frequency response, etc.) often exhibit dramatically differing sonic signatures - especially in the critical upper frequencies. As such, specifications are a guide, but are not indicators of sonic performance. The only way to learn how an audio circuit really sounds is through first-hand critical listening.

Of course, even controlled listening tests are not without variables. Every element in a fixed reference chain adds its own personality. Over time, the engineer who comes to rely on this path learns to "listen through" *inherent* shadings and subtleties. We feel that our unique test environment has provided the tools to produce exceptionally accurate audio circuits.

Please call us directly if you would like to learn more about the specifics of our listening lab. We have recently expanding the lab into a dedicated 6,000 cu. ft. room with 9" thick concrete walls, isolated floor/wall/ceiling structures, and a carefully controlled ambient behavior. The prime structure was designed by acoustician George Newburn, formerly of "studio bau:ton" in Los Angeles and now Chief Acoustician at "Studio 440," an acoustics design and consulting firm (<http://www.studio440.com>).

Alas, lab listening tests go only so far. Which is why, when we arrive at a favorable design, the device is taken into the field for months (sometimes years) of real-world testing. New candidate circuits are employed during rehearsals and live sessions, where dynamic stability, imaging, and ambience retrieval can be auditioned later in our listening room.

When comparing audio circuits, especially mic preamps, take time to discover the personality of the design. Use complex radiators in comparison - continuously alternating your listening perspective between the circuit path and the actual source in real time acoustic space. Use a mono source when comparing timbre accuracy. You' ll begin to notice the "shadings" and nuance of different circuits. What at first sounds "more open" or "lively" is *very often* a euphonic coloration or subtle exaggeration in the upper partial frequencies and low-mid "warmth" region. It takes practice.

Listen especially to how a circuit performs at high dynamic levels. Very often, a good performing circuit at low to moderate operating levels will change character at high levels. This is especially true of transformer-coupled microphone preamplifiers, and those requiring attenuators (pads) to reduce input excursions.

As you' ll find, it' s often difficult to detect if a circuit is more musically accurate, or simply more colorful, lively, and "tweaked." There is a place in audio production for many kinds of preamp coloration; but for critical acoustic recording, musical accuracy is a requirement.

Which brings up an important point - not everybody desires accuracy. Audio circuits in use today can offer wonderful shades of coloration. Some of these audio devices are described variously as sounding "warm, in your face, round, euphonic, bigger than life, cutting, thick, soft, rich, bright, powerful" and so forth. And in pop music, these qualities are often essential tools for hit records. The Millennia HV-3 circuits do *not* offer these qualities, but micamps from many other fine manufacturers do. Millennia uses many of these other products for pop recording or special situations, including a wide assortment of "colorful" mic preamps from other manufacturers.

However, for those recordings where the room is correct, the instruments are beautiful, the players are first rate, and the music needs no further assistance, there is no substitute for accurate audio electronics. If it sounds luscious in acoustic space, Millennia Media electronics will simply not interfere. Assuming a fine electronics path overall, you will hear on speakers a presentation of music which your ears hear in acoustic space. At all dynamic levels. At all frequencies. With undisturbed acoustic complexity and subtlety.

TIPS ON SELECTING MICROPHONE PREAMPLIFIERS

Don't let anyone tell you that accuracy = sterility. If you do acoustic recording where your sources sound good (guitars, voice, percussion, acoustic ensembles, good room, great mics...), and there is no reason to mess with the source signatures, an accurate mic preamp will deliver the richness, depth, presence, air, ambience, and more of those *original* qualities you're looking to preserve, with nary a trace of electronic artifacts.

Be wary of the recent flurry of "textbook" designs using preamp function IC's, such as the Burr Brown INA-103 "transimpedance" amp, Analog Devices SSM-2017, and ultra-high speed video op-amp ICs. Video opamps are designed to carry video signals and are not optimized for audio. Certain *specifications* may be very good - especially "speed" (slew, transient impulse, and frequency response). But, as we've learned, specs rarely translate into sonic purity. This is especially true when applying video parts and "IC function modules" to critical audio. Listen *carefully* to upper partial frequencies and large dynamic excursions in such designs. For a revealing look at today's high gain technologies, see our non-technical [white paper](#) on the design of microphone preamplifier circuits.

Some other general design aspects to watch for when choosing an accurate mic preamps.

Transformer Coupling

While transformers offer better circuit protection and isolation than transformerless designs, they nevertheless present one additional layer of sonic personality. The best transformers are quite subtle at low to medium levels. Yet there is no transformer we've used which can rival the transparency of well-designed transformerless inputs — especially under higher dynamic range. Of course, sometimes transformers can offer a very desirable coloration. Some good examples are found in Rupert Neve's original ClassA designs (models 1073, 1272...) and a number of vintage and modern tube preamps. However, a transformer-coupled mic preamp, EQ, or any other signal path claiming "accuracy" should be approached with caution.

The Millennia HV-3 octal matched NPN discrete front end is protected by back-to-back zener diodes. With common care, the protection afforded is ample and authentically transparent. We have invested significant effort listening to AC coupling (phantom blocking) methods. Exotic poly caps and electrolytics (or lack of) do not necessarily translate into sonic reality. Our HV-series coupling method was painstakingly chosen as a matched set of very low impedance, high voltage electrolytics bypassed with polyethylene terephthalate film capacitors. In our final designs, we found nothing more dynamically stable and musically satisfying. When AC coupling is not required, such as when using ribbon or other dynamic microphones, all Millennia micamps can be acquired with an additional set of DC-coupled inputs.

Input and Output Headroom

Textbook mic preamp designs always require a pad (attenuator) at the input for hot mic signals. And there are very few micamps which can handle severe input levels without clipping. Millennia's HV-3 solid state micamp design is *entirely* balanced in a unique cross-coupled topology which *requires no padding* — input headroom is > +23 dBu. The Millennia mic preamp will simply not distort or overload even at extreme peak microphone levels.

Our unique approach to preamp design avoids the need for mic padding and the associated switch contacts and resistive dividers which can add another unnecessary layer of coloration and potential signal degradation. Moreover, Millennia' s output headroom is > +32 dBu, which is well over *twice* the reserve headroom capacity of common textbook mic preamp designs. The autosensing, DC-coupled, high current output stage is capable of balanced or unbalanced operation and provides effortless performance into very low impedances and very high capacitances.

The most severe test of a preamp output stage is driving long lengths of multicore "snake" cables (high capacitance) in a hostile (RF/EMI) environment. Does the preamp maintain its stability and neutrality under these conditions? Perhaps the most grueling test so far of Millennia' s preamp output stage came during Barbra Streisand' s live CD recording at Madison Square Garden. Sixteen channels of Millennia preamps drove nearly 1,000 feet of Belden multicore cable which was then transformer split to FOH, video truck, and multitrack recorders. Some of today' s leading engineers were on hand to handle the various feeds. The consensus was unanimous: the Millennia Media preamps sounded just as accurate in this harsh environment as in a controlled studio environment.

Design Philosophy

Often, designers will add phase reversal, ground lifts, and other utilities to their mic preamplifiers. Yet switch or relay contacts directly in the audio path can add another level of subtle audio shading and, over time, even the best switch and relay contacts will eventually degrade. For this reason, our HV-3B and HV-3D micamps avoid audio-path switch and relay contact closures whenever possible. On the infrequent occasion when such utility functions are required, we recommend that our customers carry a little collection of Switchcraft or Neutrik XLR "thru-tubes" which have these functions built-in.

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