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KLEI™ Harmony (Bullet) Plug TECHNICAL SUMMARY

**Advancing the art and science of the Bullet plug
Keith Louis Eichmann (KL) proudly introduces
the next generation Bullet plug design**

The KLEI Harmony (Bullet) plug takes the highly acclaimed Eichmann Bullet Plug to a new level of performance and sophistication. In 2000, the Bullet plug set the industry on fire by offering radical improvements to the venerable RCA plug both in design and performance, and as a result the Bullet plug received worldwide acclaim.

The Harmony plug offers new materials and design enhancements, ie. new and superior technology and architecture. The KLEI Harmony (Bullet) plug, which can be considered the true and next generation Bullet plug design, extends and builds on its superiority over the Bullet plug (introduced in 2000), variations and enhancements of the Bullet plug, and traditional RCA designs. It represents a wholesale rethinking of the RCA connector introduced over eighty years ago by The Radio Corporation of America (RCA).



So why is the word Bullet now included in the KLEI Harmony Plug name, ie KLEI Harmony (Bullet) plug? This to inform, and advise, that Keith Louis Eichmann (KL) is the inventor and designer of the both the Bullet plug and the Harmony plug. We consider the Harmony plug the new and highly upgraded next generation Bullet plug design.

FOREWORD: Many have endeavoured and failed to understand the new and superior technology and architecture that has been utilised in the Harmony plug. Unfortunately – due to frustrations and gross misunderstanding(s) of the proprietary Harmony plug technology and architecture – misleading, false, and even defamatory information has been posted on various forms of media, ie websites, forums, etc.

We believe that all KLEI products are quality products and are well manufactured. The technology and architecture – ie forming, layering, and manufacturing processes – is proprietary and therefore will always have some mystery surrounding them. Customers often/frequently ask:

- How do KLEI products achieve such astonishingly high levels of performance when they look and appear so simple?
 - Our answer is that it is all in the art, that simple is best and less is more, hence the Bullet plug (introduced in 2000) and now the next generation Bullet plug design, the Harmony plug (introduced in 2014).
- A customer(s) who assumed that the Harmony plugs are simply silver plated, published misleading, false, and defamatory information on various media, insinuating that KLEI are not honest with customers.
 - We would like to assure customers that we conduct our business with utmost integrity and advise everyone to refer to the following sections, which details that proprietary and superior Mathematical Modelling is utilised to control and determine the required metallurgy, forming, layering, and manufacturing processes.
- Why are KLEI technologies and manufacturing processes proprietary?
 - Our reply is that of course our technologies and manufacturing process we use are proprietary. Electrically, sonically, and mechanically, we believe that KLEI products perform as indicated on the KLEI website, and we have used trademarked™ names to indicate our beliefs and impressions. We are happy to discuss the sonic performance of all KLEI products, but, by necessity, we will not be revealing proprietary aspects of KLEI products, ie how they work and/or how they are made. To do so, would allow our special and superior technology to be taken and used by others. Some manufacturers are very good and quick to copy superior technologies and manufacturing processes.

History

Looking to take his effort to the next level, Keith Louis formed KLEI (Keith Louis Eichmann Innovations) in 2013, and committed himself to improving the Bullet plug and to create an RCA connector with superior conductivity, enhanced signal integrity, and higher resolution. Since the RCA jack is so widely used – connecting virtually every component in an audio/video chain and linking entire systems through a network of interfaces – any improvement in its performance would be significant, especially over that of the Bullet plug and its variants.

To recap – a first evaluation of the traditional RCA jack showed obvious metallurgical shortcomings. Most connectors, even those marketed as “deluxe” upmarket RCA jacks, are made from nickel and gold plated brass or phosphor bronze with a conductivity rating typically less than 50% IACS (International Annealed Copper Standard) and often less than less than 28% IACS. As a comparison, the high purity copper used in the vast majority of interconnect cables has a conductivity rating of 100% IACS. Because of this low conductivity and the use of three disparate metals, it is our contention that standard RCA jacks – even expensive, flashy ones – compromise electron/energy flow and diminish the performance of the components they connect.

Nickel is added to the brass or phosphor bronze substrate solely to provide the jewel-like appearance that makes expensive connectors look expensive. While achieving the desired appearance, this comes at a cost–degraded sound or poorer picture quality, as electrons flow through three dissimilar metals with differing electrical and conductive properties.

Conductivity

Metal conductivity in IACS percentages, referenced to copper at 100%, are as follows

- Silver – >105%
- Copper – >100%
- Silver (Machinable) – 92.5% ~ 96%
- Tellurium Copper (Machinable) – 90% ~ 95%
- Gold – 65 ~ 75%
- Aluminium – 60 ~ 65%
- Bronze – 15 ~ 48%
- Beryllium (low/high copper content) – 17% ~ 43%
- Rhodium – 35% ~ 38%
- Brass (low/high copper content) – 25% ~ 37%
- Tungsten – 31%
- Nickel – 24%
- Palladium – 16%
- Platinum – 16%
- Tin – 15%

The Harmony plug pins are formed using proprietary high conductivity metallurgical process, with the resulting conductivity being >101% IACS to even >106% IACS. This provides over 360% greater conductivity than the gold-plated brass connectors used in the vast majority of deluxe RCA jacks. Proven metallurgical choices at KLEI result in better signal transfer, and electron/energy flow, that is consistent with the highest quality interconnect cables.

Traditional connectors impose a serious compromise to conductivity at the transfer point, component to component. KLEI's proprietary high conductivity forming processes eliminate the nickel/gold plating typically used as the third metal in a confusing composite in these standard RCA jacks.

The company's processes are controlled and supported via proprietary mathematical modelling, which creates an architectural and metallurgical relationship between the ground and signal pins. This provides a noticeable *sonic* improvement, when compared to other RCA plugs, and from Harmony plug model to Harmony plug model. The metal complement, mass, and other critical parameters, are derived via KL's signal to ground mathematical formulae.

Extrapolation, testing, and modeling indicate that our IACS percentages are equivalent, and even superior, to pure (solid) annealed copper (>=100% IACS), even pure (solid) annealed silver (>=105% IACS). They are noticeably superior to KL's previous copper and silver Bullet plugs. While the metallurgical understandings are significant, paramount, and crucial, the second observation regarding the traditional RCA jack turned out to be ground-breaking. It related to a problem, overlooked for decades, that is intrinsic to the RCA connector's design – something as fundamental as the architecture of the connector itself.

Architecture

The RCA ground collar, which in traditional designs encircles the signal pin, acts as a conductor that transfers electrons/energy from multiple directions along its surfaces. It is prone to small out-of-control turbulences called eddy currents. These turbulences are nothing less than chaos, exacerbated by the non specific point of ground in the RCA jack's design, especially since an entire surface encircling the centre pin forms the electrical ground. Capacitive reactance and micro-arcing are additional artifacts of this architecture.

The Harmony plug design addresses these issues and offers an elegant – and arguably major – redesign to the RCA jack, and in itself is fundamental but extensive. As with the Bullet plug, rather than encircle the centre conductor pin with a formed metal collar as ground, we opted for a single point ground contact similar to star earthing (grounding) in high-end electronics. Our new design, featuring single point ground connection and optimised shape, mass and thickness of the conductive elements, eliminates every vestige of eddy current turbulence, capacitive reactance, and micro-arcing.

We believe this approach solves a series of problems that collectively degrade audio/video performance and that do so in an additive manner. The importance of this innovation and redesign cannot be overstated. Its ramifications extend to every RCA interface in which high quality signal transfer is an issue. Extensive listening and critical comparisons played a major role in the evolution of the design, confirming at every juncture the audibility of properly applied science in even the area of RCA connection.

The Harmony plug, the next generation Bullet plug design, is the sonic culmination of KL's proprietary signal to ground formulae as applied to the architectural and metallurgical relationship between the signal and ground conductors.

In summary, KLEI's Harmony (Bullet) Plugs represent a further innovation and a totally refined approach to RCA connection. Its innovations and refinements include:

1. The conductive pins incorporate highly conductive materials, such as copper and silver
2. KL's proprietary mathematical modelling optimises mass, thickness, and composition of the conductive pins, resulting in enhanced electron flow
3. The conductive pins are arranged to maintain a consistent maximum distance from each other which further improves capacitive and inductive reactance effects and minimizes cross-talk EMF effects that occur in all other RCA plugs. This allows for significantly higher characteristic impedance, than conventional RCA plugs, and makes the Harmony plug an ideal connector for digital Interconnects requiring RCA connectivity in either 50, 75, or 110 Ohm impedances and low jitter
4. The conductive pins are now much stronger and allow for small and large conductor wires to be soldered to them
5. Further rejection of the idea of using a formed metal collar to encircle the centre pin and serve as the reference to ground, which eliminates co-axial inductive reactances
6. Single point star grounding, instead, to eliminate eddy current distortions, capacitive and inductive reactance, and micro-arcing
7. The ground pin includes thread teeth to star ground a conductive housing
8. Addition of an anti-short shield
9. The head assembly jaw structure has been redesigned and improved to allow an easy snap-like connection to an RCA socket, but still ensuring an ultimate connection
10. The housing assembly uses 2 screws to secure the cable sheath to the Harmony Plug housing
11. An extremely high temperature melting point polymer, with excellent electrical and mechanical characteristics, has been used

Standard RCA connectors	KLEI™Harmony (Bullet) Plugs
Gold plated brass or phosphor bronze with a conductivity rating of often less than 28% IACS (International Annealed Copper Standard).	Contact pins formed using proprietary high conductivity metallurgical processes, provides ultra-high conductivity (>101% IACS and even >106% IACS). Provides over 360% greater conductivity than gold plated brass binding posts.
Solid signal pin. Metal collar completely encircling pin as electrical ground. Total thickness and mass not optimised for signal integrity. Sound quality and electron flow compromised.	Hollow signal pin of ideal thickness and mass Provides a superior electron movement/current flow, and minimises skin effect issues. The result is a cleaner, more open sound, with even further detail.
Heavy plating of gold over a nickel substrate. This is often a cause of poor sound quality as electrons flow through 3 dissimilar metals with differing electrical and conductive properties.	Metallurgy process minimizes oxidation.
Ground collar surrounding centre pin has co-axial inductive reactance effects, which have detrimental effect on electron flow. Eddy current turbulences created as a result of non specific ground contact. Loss of signal integrity due to capacitive and inductive reactances and micro-arcing. Provides a plug with poor and reduced signal transfer resolution.	Patented single point ground pin, with easy connection, and a single point conductive Housing ground. Eliminates eddy-current turbulences, co-axial inductive reactance, capacitive reactance, and micro-arcing. Provides a plug that is linear to over 150KHz, which allows excellent sound and video signal quality, signal integrity, electron flow, and extremely high signal transfer resolution.



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