WestminsterLab

“Without music, life would be a mistake.”

Friedrich Nietzsche

THE ORIGIN

We believe Life is Music, an incredible
and tremendous gift of its existence.

May everyone be joyful with music, with life.

With our passion, we are eager to
reveal the totality and beauty of the
original, the gift of its existence.

It is the art of bridging science
and human hearts, and beyond that,
the harmony and balance in between.

Let everyone experience music as it is.

METICULOUS

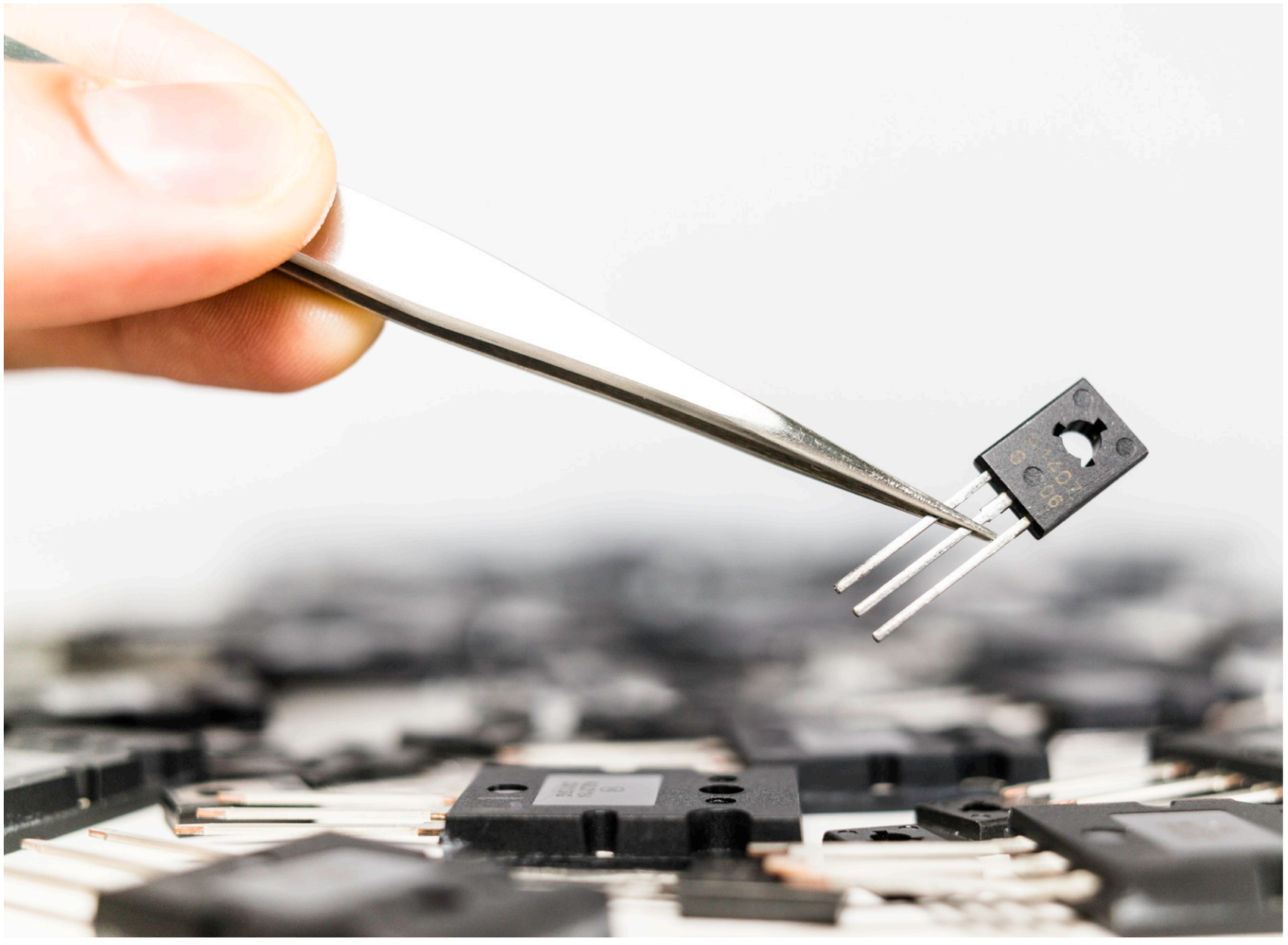
REPEAT & TESTING APPROACHES

We research many of the products and brands in the market and investigate their merits and demerits. We put their theories to their limits and through extensive field experiments, we improve upon it by fusing our ideas.

To ensure that the results will not be limited by the blind spots of any particular methods, numerous testing approaches are taken, including fine tuning of the circuit, repeated computer simulation, real-life performance assessments and various auditions.

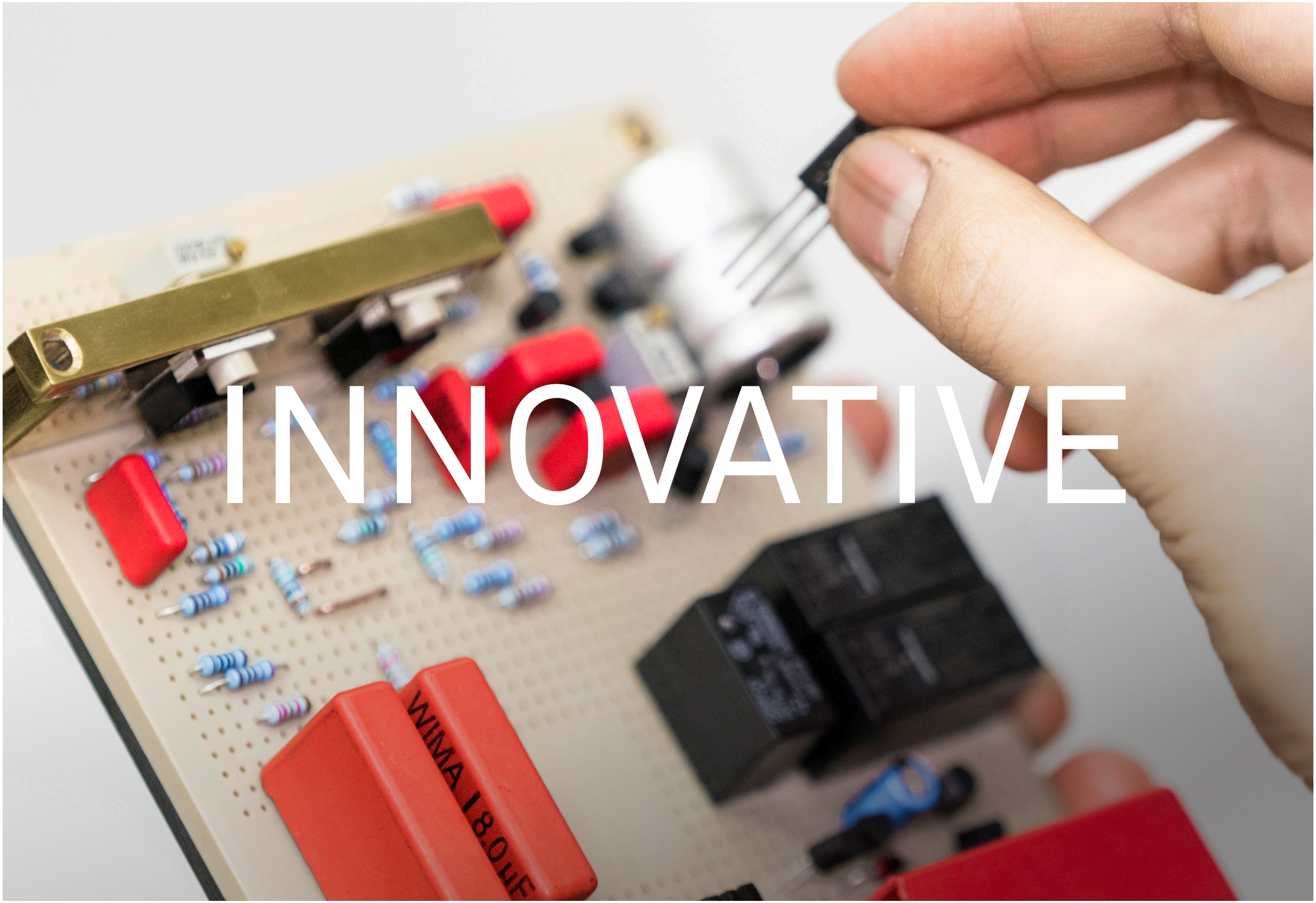
Conclusions and results are refined and challenged over and over to push the boundaries of quality further to the best each time.

SCRUPULOUS



THE BEST CANDIDATE

Components are precisely selected from a wide variety range, including different models, packages, sizes, manufacturers, origins and technologies. They are carefully chosen by both performance analysis and listening experiences.


INNOVATIVE
WIMA 18.0µF

CRAFTING THE CIRCUITRY

Printed circuit board (PCB) is standard in the industry for its simpleness and low cost.

One of the fatal drawbacks of PCB is its impure electric transmission route. Signals from a component have to pass through a soldering point, a soldering pad, a thin flat copper layer, a soldering pad and finally to a soldering point before reaching the next component.

In order to tackle this fatal disadvantage, we have come up with a solution where all the components are now hold on a machined engineered plastic PEEK chassis, which provides excellent dielectric and structural properties.

Components are now directly connected and soldered with each other without intermediate disturbance, which establishes much purer and cleaner transmission of signals and power.

This innovative and revolutionary solution requires a new soldering procedure, demanding a whole new level of care, devotion and detailing.

FASTIDIOUS

DETAILS

The intensive use of carbon fibre is due to its advantages over other materials - low resonance, rigid, tough, stable, and the property of rejecting unwanted interference.

Titanium screws are used for their high yield and tensile strength and stability over corrosion and temperature changes. These two adoptions can provide a more stable environment for amplification.

The precisely machined brass grounding spikes minimise the vibrations transmitted to the amplifier from the environment , maintaining the perfect working condition for the semiconductor. Furthermore, the height of the spikes can be tuned individually to ensure perfect levelling.


WestminsterLab

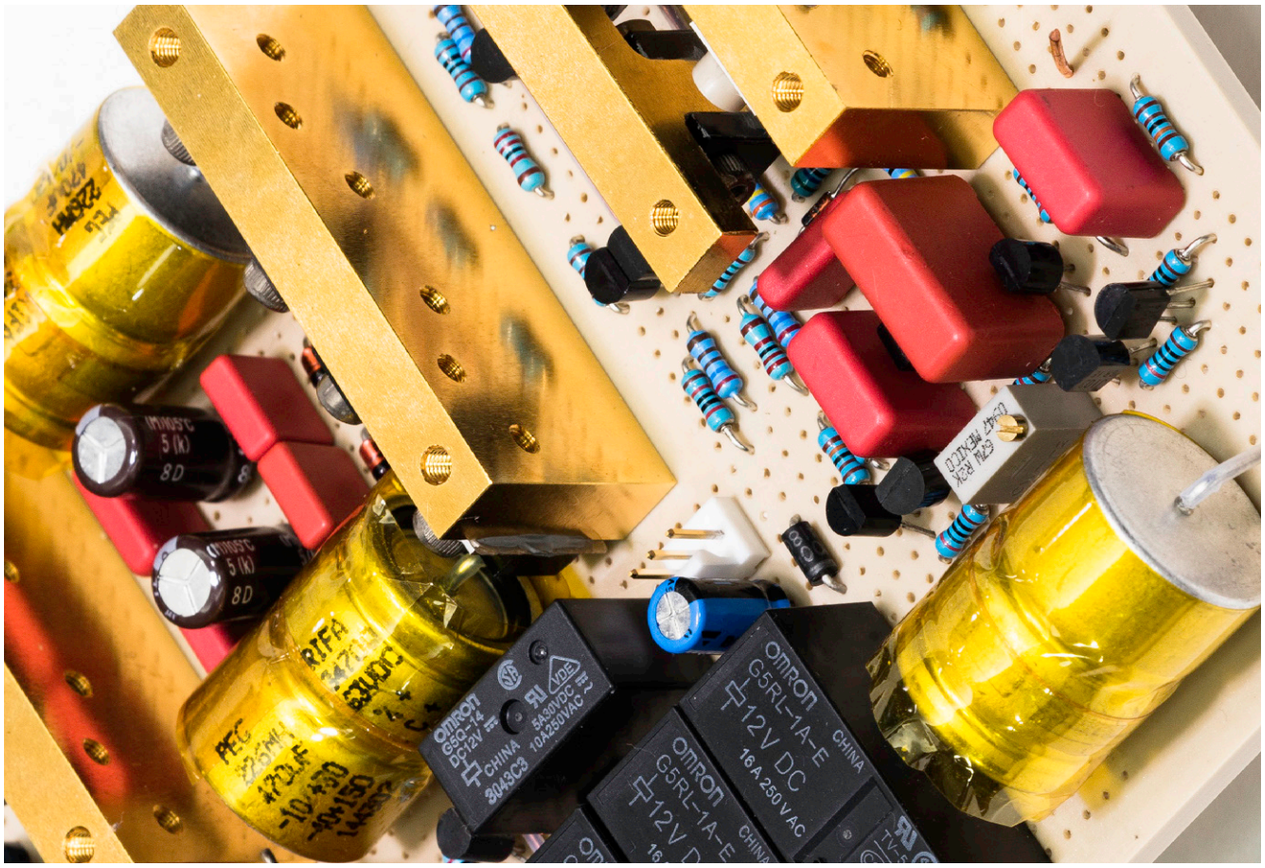
“Nothing works without details. They are everything, the baseline of quality.”

Dieter Rams

UNUM

MONO AMPLIFIER


estminsterLab


omron
G5RL-1A-E
12V DC
16A 250VAC
CHINA
omron
G6O-14
DC12V
CHINA
5A30VDC
10A250VAC
3043C3
RIFA
PEG
225MH
470µF
-10+50
105°C
5 (k)
8D


PUSH

UNUM

Power
200 watts @ 8Ω
400 watts @ 4Ω
800 watts @ 2Ω

Frequency Response
5 Hz to 75 kHz, -1 dB
10Hz to 40 kHz, ±0.1 dB

Distortion
(95 watts @ 8Ω)
<0.1% @ 1 kHz

Signal-to-Noise Ratio
103 dB, unweighed

Input
1 balanced XLR input

Output
1 balanced XLR output

Input Impedance
200 kΩ

Output Impedance
0.0100Ω

Dimensions
W232 x H72 x D501 mm

Weight
19KG

UNUM - Edition

Power (True RMS)
220 watts @ 8Ω
440 watts @ 4Ω
880 watts @ 2Ω

Frequency Response
5 Hz to 75 kHz, -1 dB
10Hz to 40 kHz, ±0.1 dB

Distortion
(95 watts @ 8Ω)
<0.1% @ 1 kHz

Signal-to-Noise Ratio
105 dB, unweighed

Input
1 balanced XLR input

Output
1 balanced XLR output

Input Impedance
200 kΩ

Output Impedance
0.0095Ω

Dimensions
W232 x H72 x D501 mm

Weight
22KG

CABLES

BNC

Standard length:
1M-5M, every 0.5M

Standard Plugs:
Neutrik NBNC75B

Ultra Plugs:
OYAIDE SLSB

Impedance:
75ohm

SPDIF

Standard length:
1M-5M, every 0.5M

Standard Plugs:
Furutech FP110G

Ultra Plugs:
OYAIDE SLSC

Impedance:
75ohm

USB

Standard length:
1M-5M, every 0.5M

Standard Plugs:
USB A to USB B

Ultra Plugs:
Gold plated USB A
to gold plated USB B

Compatible
with USB2.0

AES

Standard length:
1M-5M, every 0.5M

Standard Plugs:
Neutrik NC3FXX-B
to Neutrik NC3MXX-B

Ultra Plugs:
Neutrik NC3FXX-HE
to Neutrik NC3MXX-HE

Impedance:
110ohm

RCA

Standard length:
1M-5M, every 0.5M

Standard Plugs:
Furutech FP101G

Ultra Plugs:
Furutech FP110G

XLR

Standard length:
1M-3.5M, every 0.5M

Standard Plugs:
Neutrik NC3FXX-B
to Neutrik NC3MXX-B

Ultra Plugs:
Neutrik NC3FXX-HE
to Neutrik NC3MXX-HE

Power

Standard length:
1.5M-4.5M, every 0.5M

Standard/Ultra Plugs:
Furutech FI11M-G
to Furutech FI11-G

Speaker cable

Standard length:
2M-6M, every 0.5M

Standard Plugs:
Furutech FP218G

Ultra Plugs:
Furutech FT211G

Option for carbon fibre sleeve available for all cables.
Please enquire for custom length and plugs.

ENGINEERING THE AMPLIFIER

WestminsterLab Mono Amplifier Technical Design White Paper

Engineering the amplifier

The development of the amplifier is kindled by the ambition of producing pure and clean transmission of both signals and power, and reproducing the essence of the original signal sources as total as possible.

Approaches

When designing the circuit, not only do we perform endless computer simulation, but also countless real-live performance assessments and ceaseless auditions. Over dependence on one approach may blind many possibilities for improvements.

For instance, focusing solely on low distortion of the circuit may sacrifice listening experience. And in this particular example, apparatus and computer simulation can give you a measurement of distortion but not listening experience. Hence, it is necessary to come up with multiple methodologies to cover the blind spots.

Point to Point Connections

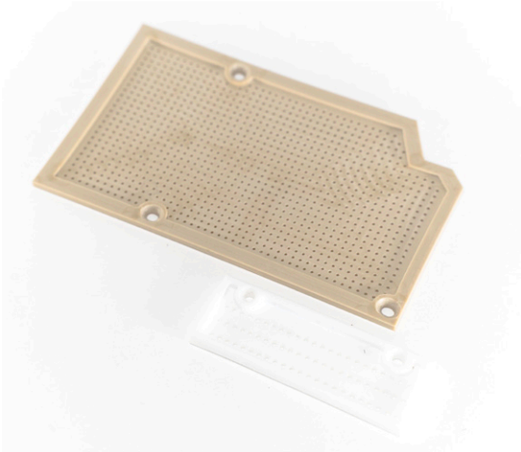
The most common solution of building circuitry is by using a printed circuit board (PCB). As we investigate in this standard solution of the industry, we discover that it is impossible to maintain purity during transmission, because of the indirect connections between components. Signals from a component has to first pass through a soldering point, a soldering pad, a thin flat copper layer, a soldering pad, and finally to another soldering point again before reaching the next. This imperfect contact keeps recurring throughout the whole circuitry and reduces the purity of the transmission.

The adhesive part which bonds the copper layer to the glass fibre board and the protective coating on the copper layer are inevitable due to the manufacturing process of PCB, which provide a poor environment for the transmission of signals.

The quality of the copper of the conduction layer, in terms of purity and crystal structure, cannot be determined and, by our findings, its profile lowers the quality of signal and power transmission.

To achieve the purest and cleanest transmission, we decide not to use PCB. We start considering if we use the usual approach of valve amplifier, components are too far apart and a lot of connection wires are needed. If we directly connect components together, for the small size of solid-state components, it will be an impossible and unsafe work. We finally decide to go for a circuit board which can hold components, giving structural strength and possibility to work on.

We immediately think of PTFE as an alternative, which is famous for its outstanding dielectric property and high stability over environment changes. But we find that it is too soft in nature which causes structural problems when it comes to a larger piece. To solve this problem, we finally come to PEEK, a much more expensive engineered plastic. PEEK is very stable over environment changes and provides excellent dielectric properties. With its hardness and stiffness, it gives a superior condition for amplification.



As a result, all components are attached onto the PEEK circuit board and connected directly to each other without intermediate disturbance, reserving the quality of the original signal. Many soldering points are reduced than before. In our auditions, this approach gives much better purity as well as clean and direct sound. But as a big drawback of the solution, extra days of intensive works to build the circuit by labour and quality check are needed.

Fasteners and Bracing Materials

We then investigate fasteners and bracing materials. It is common to use metal or stainless steel but we raise a big question. We pay attention to the magnetising effect and eddy current. When a signal or current goes through a metal plate, the electric field will generate a magnetic field within the metal and this potential energy affects back to the signal. In our test this magnetic field generates a blur and unclear effect to the sound.

To further increase rigidity and stability of the whole, we decide to go for Titanium screws, in which the yield and tensile strength is higher than common stainless steel screws. Besides, titanium is more environmentally stable than stainless steel. As a result, amplification is under a much more stable environment.

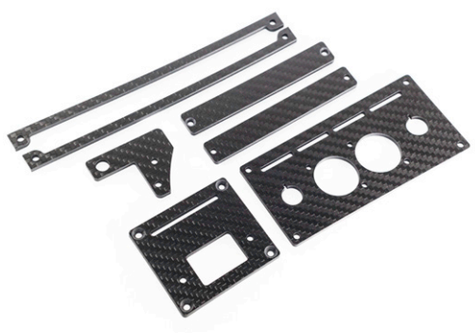
Similarly, for fastening transistors, whenever metal screws are used, it gives a less clear, pure and direct sound after testing several metal screws. What materials can be used if metals cannot be used? No metals. Yet, it has to be strong enough to firmly hold the transistors. Even usual plastic screws cannot do. So we finally make screws with PEEK. As mentioned above, PEEK is hard, stiff and stable with excellent dielectric property, which is perfectly suitable in this application.

As we consider the eddy current on metals, we decide to adopt PEEK screws for the screw terminal capacitors, which solve the issue of eddy current when metal screws are used.

Shielding

Another problem about metal is that it actually absorbs radio interferences from the environment and these interferences then convert to electrical noise and magnetic disturbance which affect the whole system, giving a blur and noisy background.

Therefore, we adopt an extensive use of carbon fibre as shielding materials for both amplifier and cables, instead of the usual copper or aluminium braids and foils, which does not generate any magnetic fields, and amazingly, it rejects interferences without absorption in nature. It also provides a very high stability over environment changes and extreme rigidity which gives low resonance and vibrations.



Daisy Chain

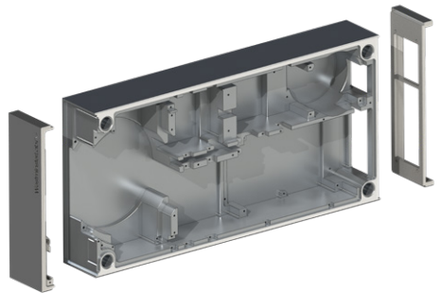
We understand that the best solution for a speaker system is one amplifier drives only one speaker unit, in which impedance change and power handling will be much better. We consider that some pre-amplifiers with only one output that cannot connect two or more power amplifiers, or not designed to drive more power amplifiers as input impedance would curtail the original in half. We design a special by-pass for connection to the next power amplifier. With this design users can use several power amplifiers with most of the pre-amplifiers in the market.

Transformer

Toroidal transformers are widely used in the industry. It is efficient and very easy to source. For transformers we raise two considerations. When we designed the amplifier, we hope to make it smaller and thinner in size so users can easily place two or more amplifiers on the rack and stack. Even not considering power quality, neither EI type, R type nor normal toroidal type transformers can be fit inside such small case, with footprint and height limitation. Second consideration is power quality. The O type transformer used in our amplifier provides even higher efficiency than usual toroidal, and a cleaner, purer, faster power due to its different iron core design. O type transformer is simply smaller and better.

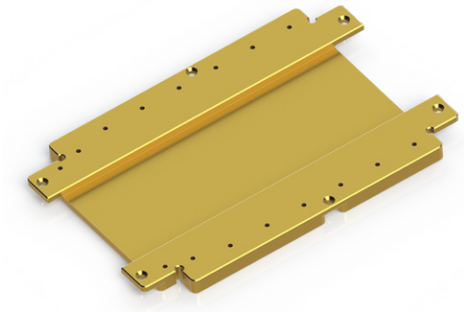
Unibody Construction

As said above, we consider much about the stability and rigidity of the whole amplifier. This is because under a stable environment, signals and power can go through a more stable, undisturbed flow. For that, the chassis must be very stable and rigid with very low resonance and vibration. Moreover, wherever there is a joint, there is a possibility of vibration. So as to minimize vibration, we doubtlessly decide to machine the chassis from a 30kg block of 6082 aluminium, which is then machined down to 8kg. The complex structure inside the chassis is designed to allow each component to have its bespoke mounting point on the chassis if possible.



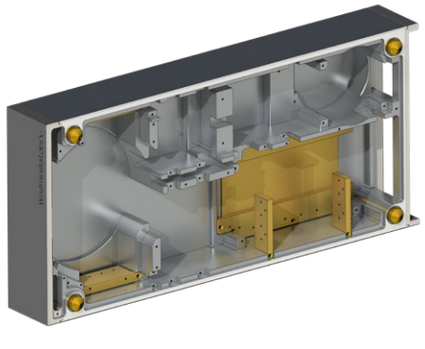
Unified Thermal Core

We figure out an improving room when we are installing the power transistors. In the original design the transistors are directly mounted onto the one-piece aluminium chassis. What inspire us is the improvement of the evenness of heat produced by the power transistors. The reason is, the evenness of the power transistors' temperature contributes closer conditions changes between these transistors and the amplification, providing a much more stable environment. Therefore, we change our design by first mounting the power transistors onto a single piece of copper for both PNP and NPN channels, and then mounting this piece of copper onto the aluminium chassis. The result is excellent. Temperature of these transistors come closer and the output sound is more stable and dynamic.



Conclusion

This is the whole process we engineer the mono amplifier and for certain we will continue exploring the best. Hope all the users enjoy our products and experience music as it is.



ENGINEERING THE CONNECTIONS

WestminsterLab Audio Interconnects Technical Design White Paper

Engineering the connections

With the same goal to retain the amplifier with pure and clean signals and power, we start developing cables. We first start from the basic, stranded conductors and solid conductors. In our testing results it is very clear that solid conductors can provide cleaner and clearer sound.

Solid Core Conduction

The advantage of stranded one maybe the flexibility of the cable. But, on the other hand, the problem of stranded conductors is that its structure generates Straying Electric Current which flies between the conductors. When a current flows through one conductor, it may jump into another conductor repeatedly rather than fluently flowing from start to end. Many electrons create a turbulence in the cable which causes incidental sound and distortion.

Material Investigation

Then we investigate into conductor materials which are a very crucial part of a cable. We research and test different materials, including but not only, very high purity copper, silver, gold, silver-gold alloy, precious metals plated copper and silver. Yet distortion of signals is still quite obvious like, uneven frequency transition, loss of density and grainy sound. Higher frequencies tend to flow on the outer part of the conductor rather than the inner part. To refine this result, we polish the surface of the conductors, resulting in less distortion at high frequencies.

We then change our aspect to the “smaller” world - the crystal structure and atomic arrangement. In the market, single crystal copper and silver are available and they are able to solve the grainy sound and density problem. As crystal is continuous and unbroken with no grain boundaries that, electrons don’t need to “jump” or “jump” less from one crystal to another. Currents can flow more smoothly and so as the signals. Then we go further trying to change the atomic arrangement by common temperature treatment. The result is good. Sounds are clearer and purer.

But one downside is that, no matter usual copper, silver or that with single crystal, their material sound signatures are heavy and dense. It is where the terms - “copper sound” and “silver sound” come.

Bespoke Conductors

Therefore, we are clear that several points need to be achieved - solid core, no material sound signatures, no grain boundaries, surface polish and temperature treatment. To achieve all these, we develop our own conductors with self-formulated temperature treatment. We name it as Autria Alloy. However, as long as the conductor is exposed to the air, the surface will oxidise and it causes distortion at high frequencies and dull the sound. We try to protect the surface by enamelling the alloy. The surface is protected and the result is positive. We further investigate the surface coating and introduce the black coating which outperforms the usual enamel. To further improve dielectric property, each individual conductor is then carefully inserted into a PTFE tube by hand.

Structures

It is well known that simple twist of a pair or pairs of wires can reduce crosstalk - RFI and EMI. According to Mr Alexander Graham Bell, “The several circuits are composed each of two wires--a direct and a return wire--forming a metallic circuit. Inductive disturbance in the telephone and in other electrical instruments connected with a metallic circuit when the later is placed in the neighbourhood of other electrical circuits arises from the unequal inductive effect of the later upon the two wires, for it is obvious that if the direct and return wire were affected equally the current generated in one would neutralize and destroy that created in the other. The disturbance can be avoided by placing the two wires in the same inductive relation to the disturbing currents, or, other conditions being the same, by placing them at equal distance from said circuits.”

Well it does not mean that it must be better to twist the pair. Twisting a pair brings demerits like higher capacitance and inductance to the cables, and by twisting, a longer conductor is needed to maintain the effective length of the whole cable, increasing the whole resistance. So we decide to go for a deep test about twisting or not. The result we get is that, an untwisted pair easily picks up noise around the environment which causes a noisy background and distorted signals. Then we test twisted pair and it really gives a cleaner and darker background. The reason is, without twisting, a magnetic field generated by the current flowing in the signal conductor causes an unwanted current to flow in the paired conductor. After twisted, the crosstalk between wires is cancelled when an interfering signal is applied equally to both sides of a twisted-pair wire. Therefore, an induced magnetic field or current will be minimized. However, the effect of capacitance is quite obvious. The sound is a little duller and slower.

Vari-Twist

The next question will be - how much or at what angle should the pair be twisted. The angle must be enough to reduce interference yet a big angle will generate a bigger capacitance. These two factors need to be balanced. In our tests, it seems that a single angle can hardly balance these two, as a single angle gives a particular resonance to a particular frequency range. It may be good for a single frequency signal like digital. But it may not be good for multi-frequency analogue signals in which your music actually is. To solve this, there should be different angles. It is very amazing that we finally come to our self-formulated Vari-Twist. Vari-Twist, as how it names, twists the signal pair to our formulated varying angle throughout the whole cable. The capacitance of the cable keeps changing to minimize the resonance with particular frequency yet interference and magnetic field are still minimized.

Shielding

In the market, the common solutions are foil shielding and braided shielding. Some go for tube shielding to shield conductors by a metal tube, achieving 100% shielding. Materials used are common tin, aluminium, copper, silver plated copper and nickel plated copper. But in our tests, as long as metal is used, rather than rejecting, interferences are absorbed and fed back to the system, although most of them are considered as “grounded”. These radio-wave changes to electricity and magnetic field to affect the whole system, which gives a blur and noisy background. This finding is the same as in the mono amplifier. Moreover, as long as there is current flowing through the conductors, the flowing current generates a magnetic field which is absorbed by the metal shielding and feedback to the system, resulting in dull, contracting and tight sound.
In final conclusion, we adopt carbon fibre sleeve for shielding, which will not be affected by any magnetic field and amazingly rejects interferences without absorption in nature. It also provides very high stability over environment changes. Considering users may like the white appearance of cables, carbon fibre sleeve is optional.

Conclusion

This is the whole process we engineer the cables and for sure we will continue exploring the best. Hope all the users enjoy our products and experience music as it is.

PHILOSOPHY OF ALL

“The truth was a mirror in the hands of God. It fell, and broke into pieces. Everybody took a piece of it, and they looked at it and thought they had the truth.” — Rumi

We long for the whole, the complete. The complete experience of music.

One may ask for a single or few segments of music experience - details, treble, bass, stages, clarity, low distortion or emotions. As life is - good or bad, born or die, laugh or cry, up or down, war or peace, love or hate. One may choose either side.

We are not choosing any one, as a result the whole reveals itself.

We invite you to come into this new dimension of music experience. In this dimension words are totally futile. We are not going to nor able to describe the enigma. We invite you to experience.

At this time you are not listening to music. You experience music as it is.

“There are lovers content with longing. I’m not one of them.” — Rumi

Experience music as it is.

THE LAST QUESTION

We hope this brochure can satisfy most of the wonders you may encounter. The very last question that we deliberately leave unanswered is your own feeling to the sound expression that we offer. It can only be answered through self engagement and experience in our products.

If you have any inquiries or interests in our latest products and updates, please don't hesitate to contact us via email. We are honoured to hear from you.

Very blessing from WestminsterLab

www.westminsterlab.com