

SU XXI. Transformer free Phonograph Preamplifier for MM, or MC cartridges. Unique design from Nikolay Suhov.

1. Constant loop gain for no THD both @ LF and HF,
2. No coupling capacitors at all, MC-like sound with MM cartridge thanks to
3. aperiodic non-resonant HF correction with lowest input capacitance.

Thanks to that, the unwanted resonance of the input circuit is shifted far into the ultrasound region and does not manifest itself in the audio range, and the input resistor R1 can be increased to 150 kOhm, thus forming a "passive cooling", which reduces the input noise current in SQRT $(150 \text{ kOhm} / 47 \text{ kOhm}) = 1.78$ times compared to typical $R_{in} = 47 \text{ kOhm}$.

4. At the front end uses a matched pair of Dual, ultra-low noise, low-gate-current audio N-channel JFET - the latest JFE2140 from Texas Instrument. It's allow to achieve a record IEC-A weighted signal-to-noise ratio of 85 dBA relative to a standard 5 mV@1 kHz input level with an attached 0.5 H+ MM head equivalent. 1 kOhm

5. and THD less, then 0.00006% with fantastic overload capacity (64 mV@1 kHz < 0.0007%).

6. The frequency response exactly corresponds to the Enhanced RIAA not with three, as usual, but with five-time constants, in addition to 75 + 318 + 3180 μs , a Neumann pole compensator and a rumble-reducing 7950 μs - IEC 98 Amendment are also implemented.

7. Double differential stages scheme : high PSRR, but stabilized bipolar $\pm(15-18)\text{V}$ power supply with low ripple is required

Discussion here: <http://surl.li/Inteb>

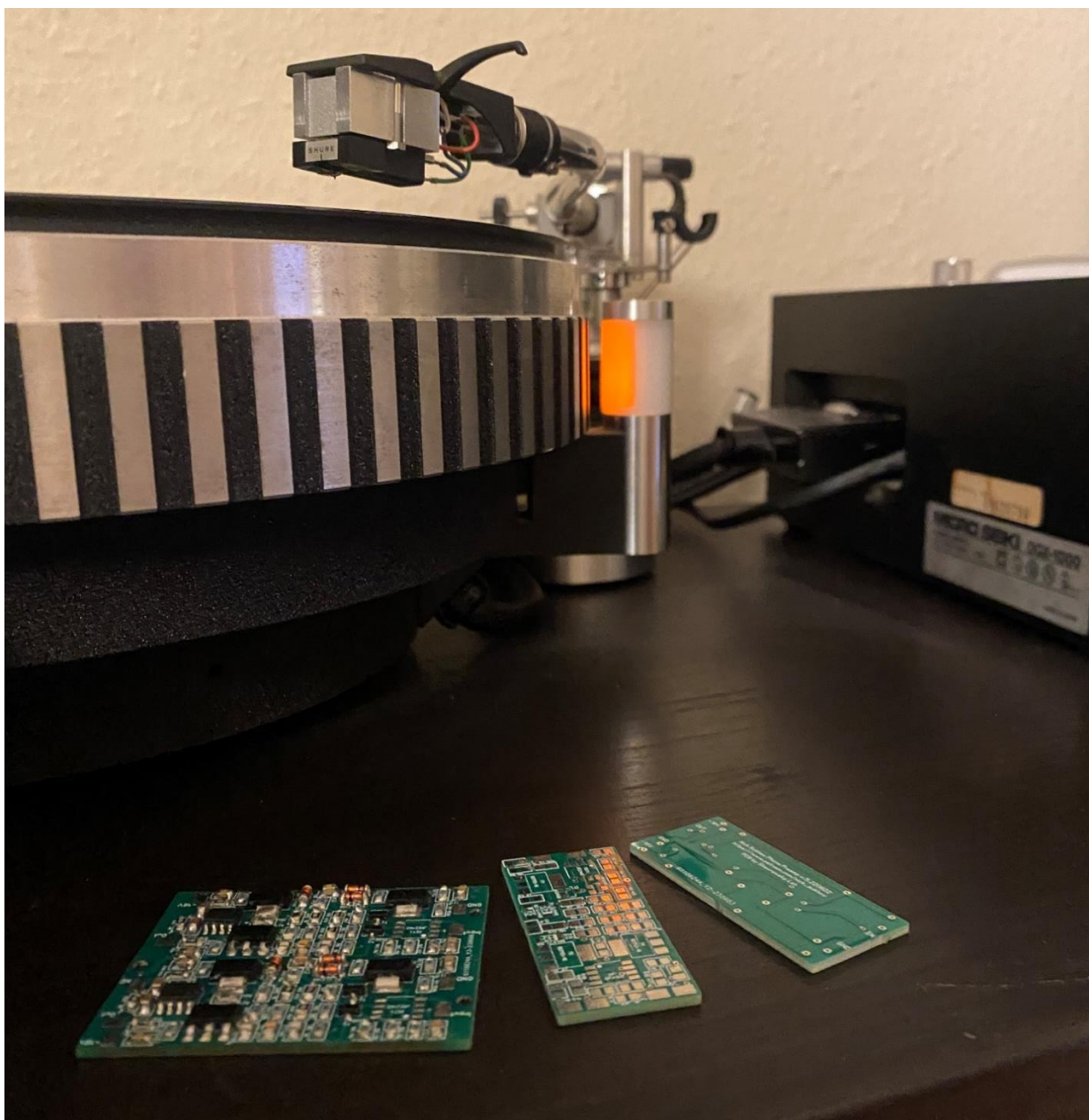
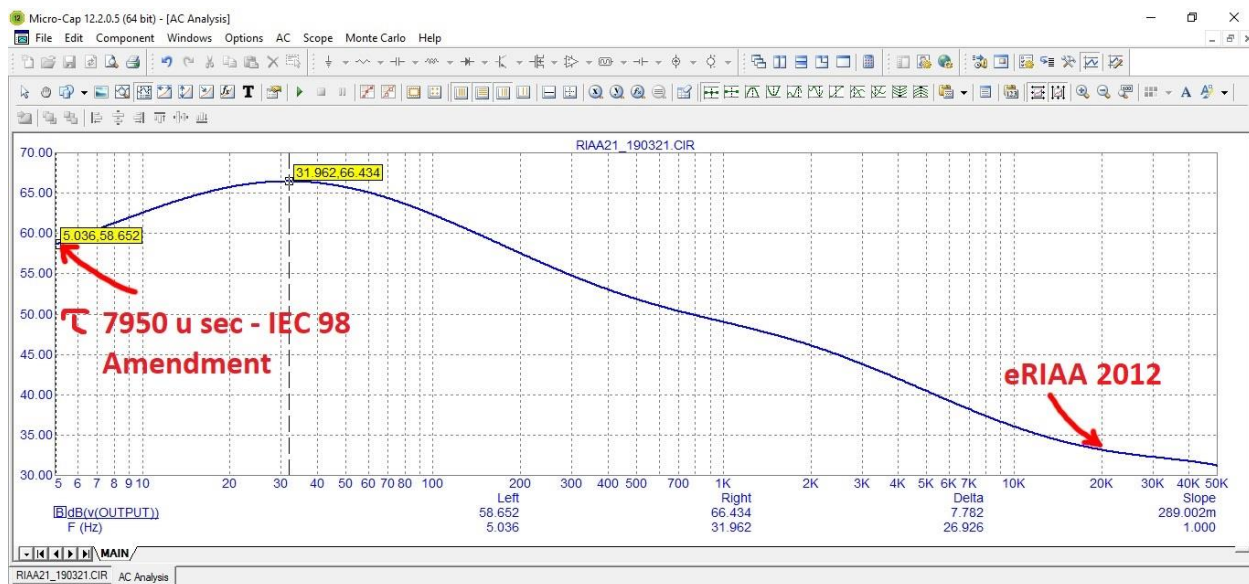
<u>MM</u>	<u>MC</u>
<i>Frequency range: 1 Hz - 45 kHz</i> <i>Ku at 1 kHz: 49 dB</i> <i>Rated output voltage: 1.4V</i> <i>Signal to noise ratio: >85 dBA</i> <i>THD: <0.00006%</i>	<i>Frequency range: 1 Hz - 45 kHz</i> <i>Ku at 1 kHz: 68 dB</i> <i>Rated output voltage: 1.4V</i> <i>Signal to noise ratio: >73.9 dBA</i> <i>THD: <0.0004%</i>

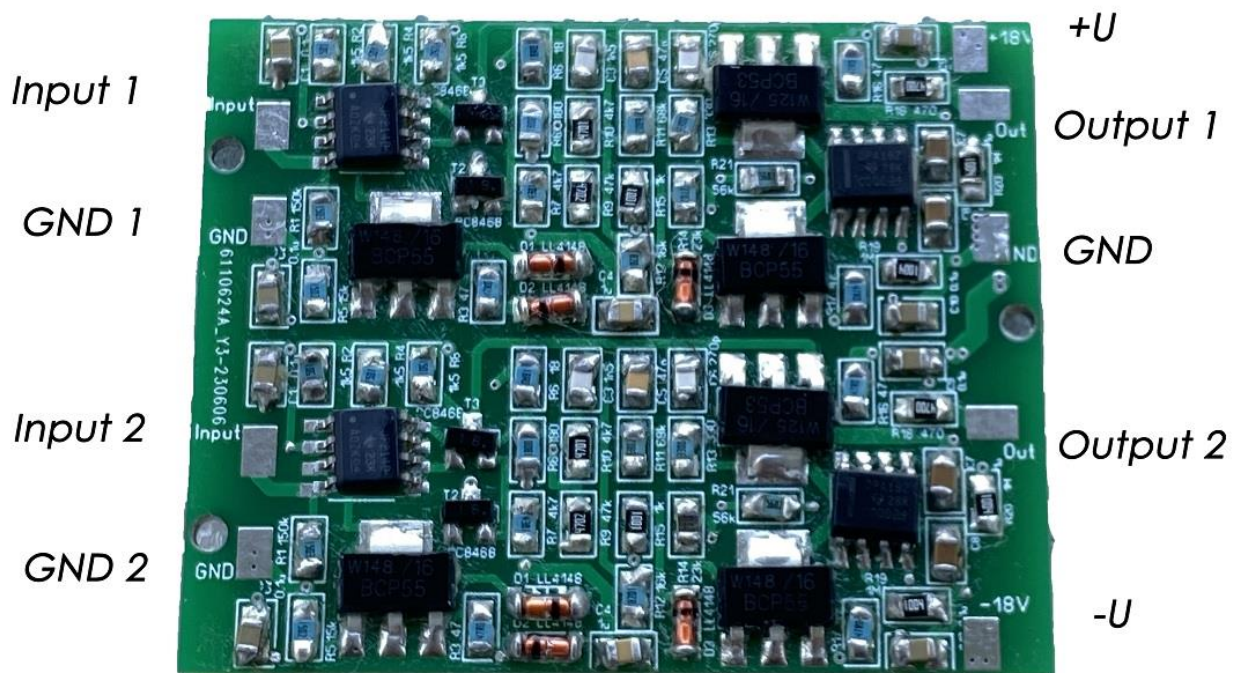
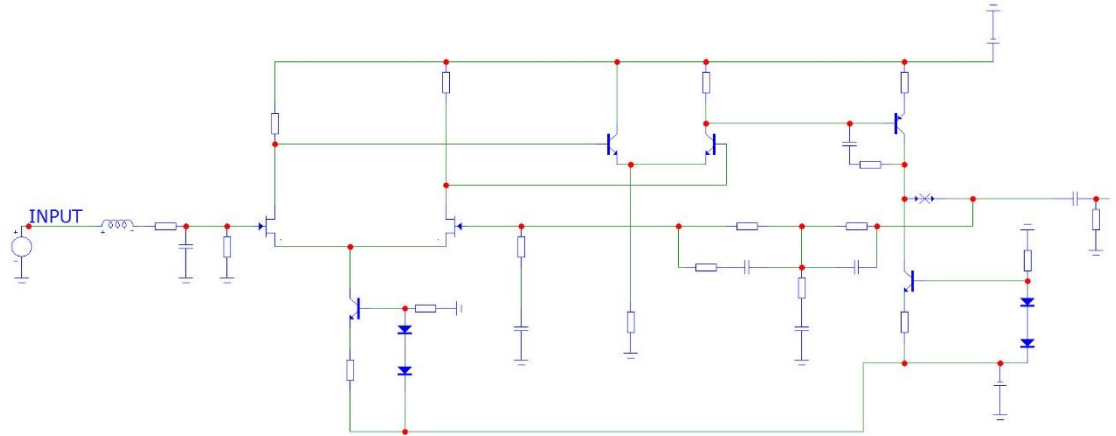
In order for the parameters of phono stages to be compared with each other, they must strictly comply with the regulations established in particular by IEC 61938. In this case, the input of the device should not be short-circuited, but should be loaded onto the equivalent - for MM this is a circuit consisting of inductance 500 mH, in series with a 1 kOhm resistor and a capacitance of 125 pF connected in parallel to them. For MC - 10 Ohms. The nominal input signal level for the MM is 5 mV, for the MC - 0.3 mV. Noise parameters must be A-weighted.

Competitors: Van den Hul The Grail SE+ - \$24,995.00

<https://www.artisanfidelity.com/phonostages/d2smxodran713ryz2pqal9ioq8vk23?fbclid=IwAR1Jrnnlle-i76J4dreLwsb-6yt0laXcP-cew3hMk6WJPLT3aDTjqzfXGmo>

Accuphase c47 <https://www.accuphase.com/model/c-47.html>





To implement the aperiodic correction invented by Sukhov, the input capacitance is minimized in the circuit (the input stage in the common feedback loop and its input capacitance is not multiplied, but is equal to a trivial single gate-drain capacitance), i.e. the resonance of the input circuit is shifted far into ultrasound, which made it possible to increase R_{in} from 47 to 150 kOhm and reduce the noise by almost 2 times, actually by 5 dB (a kind of "passive cooling"), and at the same time provide better transparency at high frequencies, because the blockage of a standard LC circuit at frequencies above the resonant one no longer distorts the sound. This is what the one of user mentioned "With aperiodic correction, the sound is more intelligible, realistic, it's like wiping fogged glasses."

- the used not resonant, but aperiodic HF correction also makes it possible to avoid the procedure of selecting the input capacitance for each specific type of pickup head, as well as to expand the frequency response at frequencies above 15 kHz due to the elimination of the usual sharp blockage of the frequency response with a slope of up to 12 dB/octave above the resonance frequency. Aperiodic correction is implemented by reducing the input capacitance to the limit (in this case, to 14 pF - the gate capacitance of the input field-effect transistor). In this case, the unwanted resonance of the input circuit is shifted far into the ultrasound region and does not manifest itself in the audio range, and the input resistor R1 can be increased to 150 kOhm, thus forming a "passive cooling", which reduces the input noise current in $SQRT(150\text{ kOhm} / 47\text{ kOhm}) = 1.78$ times compared to typical $R_{in} = 47\text{ kOhm}$.

- thanks to the general negative feedback, covering the input stage, THD at a standard input voltage of 5 mV does not exceed 0.000056%. At the same time, the overall negative feedback minimizes Miller's input capacitance to the

theoretical limit (gate capacitance of the input transistor), allowing the use of JFE2140 transistors that are optimal in terms of noise minimization (with spectral density of intrinsic noise $e_n=0.9 \text{ nV/SQRTHz}$).

- a unique (high-precision up to coverage of the general negative feedback) output stage operates in class A mode and, due to the load on the frequency response correction chain R9-R12C3-C5, when the general negative feedback is closed, it provides a unique "passive-active" principle of frequency response formation, in which, despite the very deep frequency response correction from +20 dB at low frequencies to -20 dB at high frequencies, an almost constant depth of feedback (constant loop gain) is provided in the entire sound range, which favorably affects both the accuracy of observing the standard frequency response and the potential stability of the circuit. With a closed loop of the general negative feedback, the output resistance of the circuit at the common point of the T4T5 collectors does not exceed 20 ohms, and, taking into account the resistor R18 that cuts off the capacitive load, at the output of the entire device does not exceed 500 ohms. We note in particular that in the vast majority of other competing circuits with outputs to an op-amp or emitter followers, such a constant loop gain principle is not implemented.

- the use of an integrating comparator (DCservo) on the op-amp OP1 provided a zero output (no more than $\pm 5 \text{ } \mu\text{V}$) for a constant voltage without using the usual electrolytic capacitors that introduce specific "ionic" distortions into the sound. ORA192 is used as an op amp - the most modern product of electronic technology based on eTrim technology with field effect transistors at the input and a uniquely low zero offset of no more than $5 \text{ } \mu\text{V}$.

- the nominal output voltage of the Su-XXI corrector is 1.4 V (K_u at a frequency of 1 kHz is 49 dB) versus 0.3 V (typical K_u of competitors at a frequency of 1 kHz is 35...40 dB). This means that Sukhov's vinyl proofreader can be connected to the input of modern power amplifier with a typical sensitivity of 1 to 1.5 V without an additional linear preamplifier, reducing the length of the path and reducing additional noise and distortion to a minimum.

