

Hifisonix
X-Altra Mini //
Line Preamplifier

Updated 07 June 2023

See last slide for document release history

www.hifisonix.com

Andrew C. Russell

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Remote Control X-Altra Mini II

'Classic' X-Altra Mini II



WARNING DISCLAIMER

This project is intended for experienced DIY constructors.

This project involves wiring up mains voltages.

Do NOT attempt this project unless you are completely aware of the dangers of mains voltages and fully understand mains voltage wiring safety practises and conventions.

A wiring mistake can be lethal. Do not take any risks.

Seek professional advice if you are not sure.

Always adhere strictly to the electrical regulations in your country.

Introduction

- The *X-Altra Mini II* Line Level preamplifier is a full function preamp accepting 6 inputs (phono, CD, Tuner, DAC, Aux and Recorder) and providing two line level unbalanced outputs, a balanced line level output (one per channel) and a buffered record output
- The preamplifier is available in two versions: the 'Classic' which is a manual control implementation or a remote control version using the Apple TV Remote
- The preamplifier mechanical design is such that the user can use any volume control – typically this would be a Alps RK27 (motorized or unmotorized) or Goldpoint 10k or 20k audio log taper level control for a 'Classic', but any other suitable high quality level control could be used
- The preamp uses small PCB modules and extensive use of SMD components
- Because the preamp is modular, the functionality can be tailored to user requirements ranging from a basic unbalanced line level preamp through to a full feature preamp incorporating multiple outputs and a high performance class A headphone amplifier
- The X-Altra Mini II uses a Modushop Galaxy Maggiorato 1NGX388 80mm high housing with a machined and laser printed front plate designed to accept 50mm diameter knobs. [You can buy a housing for this preamplifier from Modushop](#)
- The rear panel consists of two stacked PCB's fully drilled, machined and silkscreened, saving the builder the trouble and expense of either making their own, or getting one professionally custom made

Construction Notes

- This is a *large, complex project* and will require very good SMD soldering and debug skills
- You need a good quality temperature controlled soldering iron with a needlepoint soldering tip, a pair of needlepoint tweezers and 0.5mm diameter solder. [See this video here for guidance](#)
- It is highly recommended that you only undertake this project if you have a scope and a signal generator; the addition of a sound card and suitable audio analyser software is even better so you can fully verify the performance of your build.
- There is a substantial amount of wiring between the modules and the wiring routing and dressing must follow those given later in the document in order to realise the measured performance on offer
- A full set of BOM's in Excel for all the modules is provided - see the hifisonix website [X-Altra Mini II webpage](#)
- A Selection of 48mm and 50 mm knobs is available at Mabel Audio (see BOM for link to vendor home page)

X-Altra Mini II - General Specifications (Full Feature Unit)

- Line level input impedance: 20k (builders can opt for 10k as well – note this will mean the worst case input impedance at the pot electrical centre position will be c. 5k on the 2V inputs). I do not recommend pot of > 50k because of the thermal noise penalty.
- Inputs: CD, DAC, AUX – 2V sensitivity into 6.7k Ω at max volume, approx. 10k Ω at mid level setting; Phono, Tuner, Record – 175mV into 20k Ω (see separate Phono Amp specifications)
- Line level gain: 5.7x (15 dB).
- Line level outputs: 1 x set main unbalanced via all discrete line level amp, 1 x set aux output unbalanced via OPA1641/2 JFET opamp stage, 1 set balanced via JFET OPA1642 opamp stage
- Nominal output: 1V RMS on unbalanced outputs for rated input levels; max output into 2k Ω is >11.5 V RMS; 2V RMS on balanced outputs for rated input levels
- 1 x buffered Record output (175mV for rated input levels) using OPA1642
- Distortion: Better than 10ppm 2V RMS output into 2k on any output; better than 20ppm into 2k at 8V RMS output
- Frequency Response; 3 Hz to 150 kHz -3dB
- Headphone amplifier: Class A at <20ppm distortion into 32 Ω at 13V pk~pk; better than 50ppm distortion at 22 V pk~pk into 32 Ω ; IMD (19+20 kHz) better than -100 dB 13V pk~pk into 32 Ω ; output power into 32 Ohms is 1.75W
- Power consumption: 110VAC or 220VAC nominal at 25 VA max

X-Altra Mini II - MC/MM Phono EQ Preamp

MM Input uses 2 x OPA1641 JFET Input opamp and all active EQ + 1 x OPA1642 buffer

- Input Impedance: 47k
- Gain: 42x (32dB); (gain reduced to 25x via jumper links when used with MC front end preamp)
- RIAA Conformance: typically +/-0.3 dB 20Hz to 20 kHz
- Noise floor*: Input shorted – better than -112 dBV RTO; with standard cartridge source (1350 Ω + 500mH L + 125pF); Signal to Noise Ratio ref 5mV input: -74 dB
- Overload margin (measured at output of MM amp): 34 dB; for 5mV input, 39 dB for 3mV input. The overload margin holds over the audio band from 20 Hz to 50 kHz
- Max phono stage output: ~11.5V RMS into 20k Ω
- Distortion (MC and MM): better than 50ppm at 1kHz up to 8V RMS output; typically 15ppm at 1V RMS output

MC Input stage uses a OPA1612 bipolar input dual opamp

- Input impedance: 150 Ω
- Gain: Jumper selectable for 11x or 21x
- Noise floor with input shorted: -86 dBV RTO (see measurements)
- Signal to Noise Ratio ref 500uV input: ~72 dB

*The nominal output of the X-Altra Mini II is 1V RMS – so the noise figures have been referenced to dBV RTO

X-Altra Mini II
Line Preamp

- Phono
- CD
- Tuner
- DAC
- Aux
- Recorder



Select Input



Headphones



Le

X-Altra Mini // Line Preamplifier - Configurations

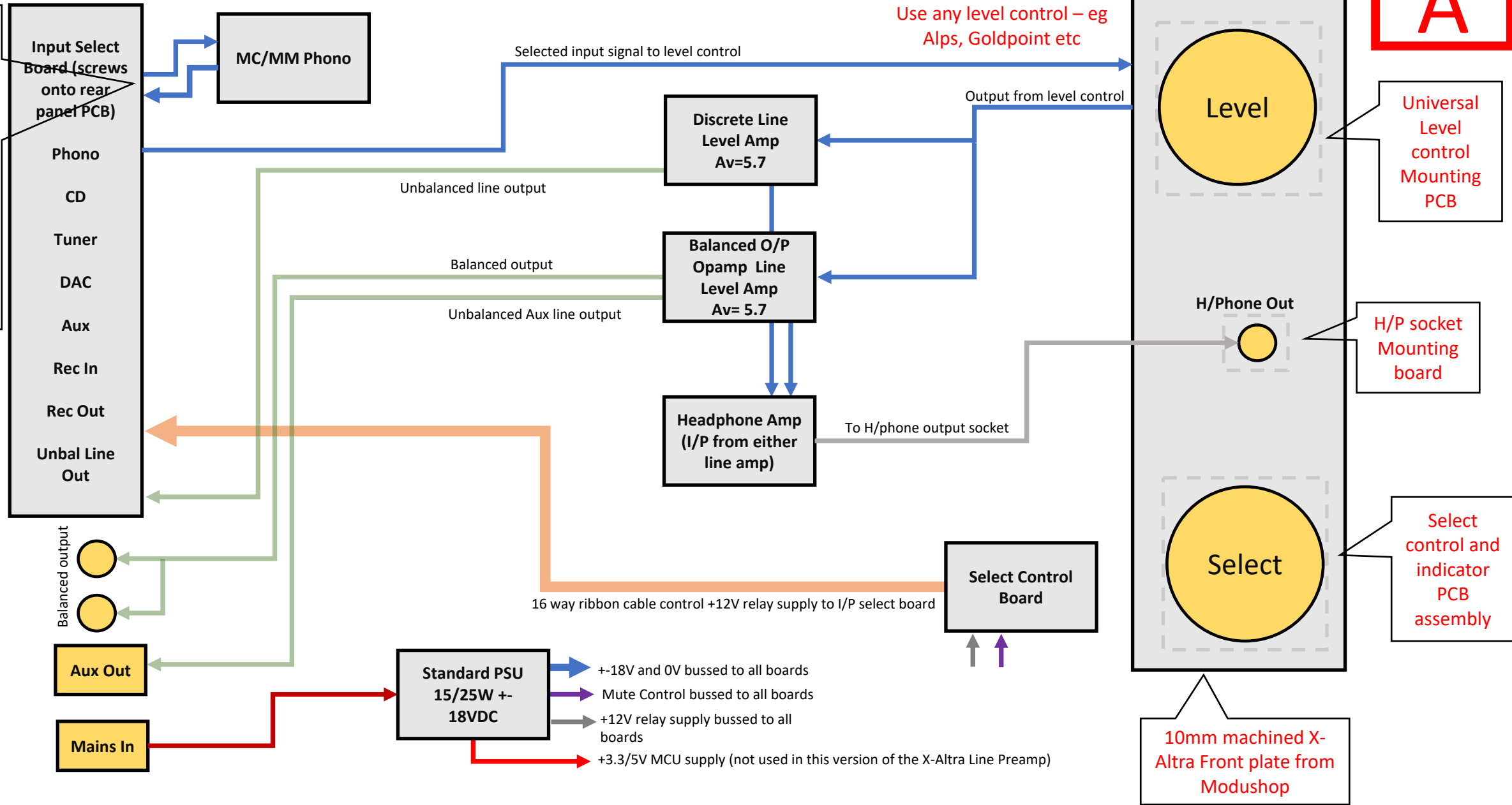
- Because the X-Altra Mini II Line Preamplifier is modular, there is a lot of scope to configure the preamp to your requirements
- The following pages give a few ideas
- See the Hifisonix Shop webpage for the X-Altra Mini II PCB sets prices
- You are free to buy the boards singly or in sets – you do not have to buy the suggested sets
- To upgrade any of the ‘Classic’ configurations on the following pages to full remote control using the Apple TV Remote, order the ‘Remote Control Upgrade’ in the [Hifisonix Shop](#)

Full Feature X-Altra Line Preamp Implementation



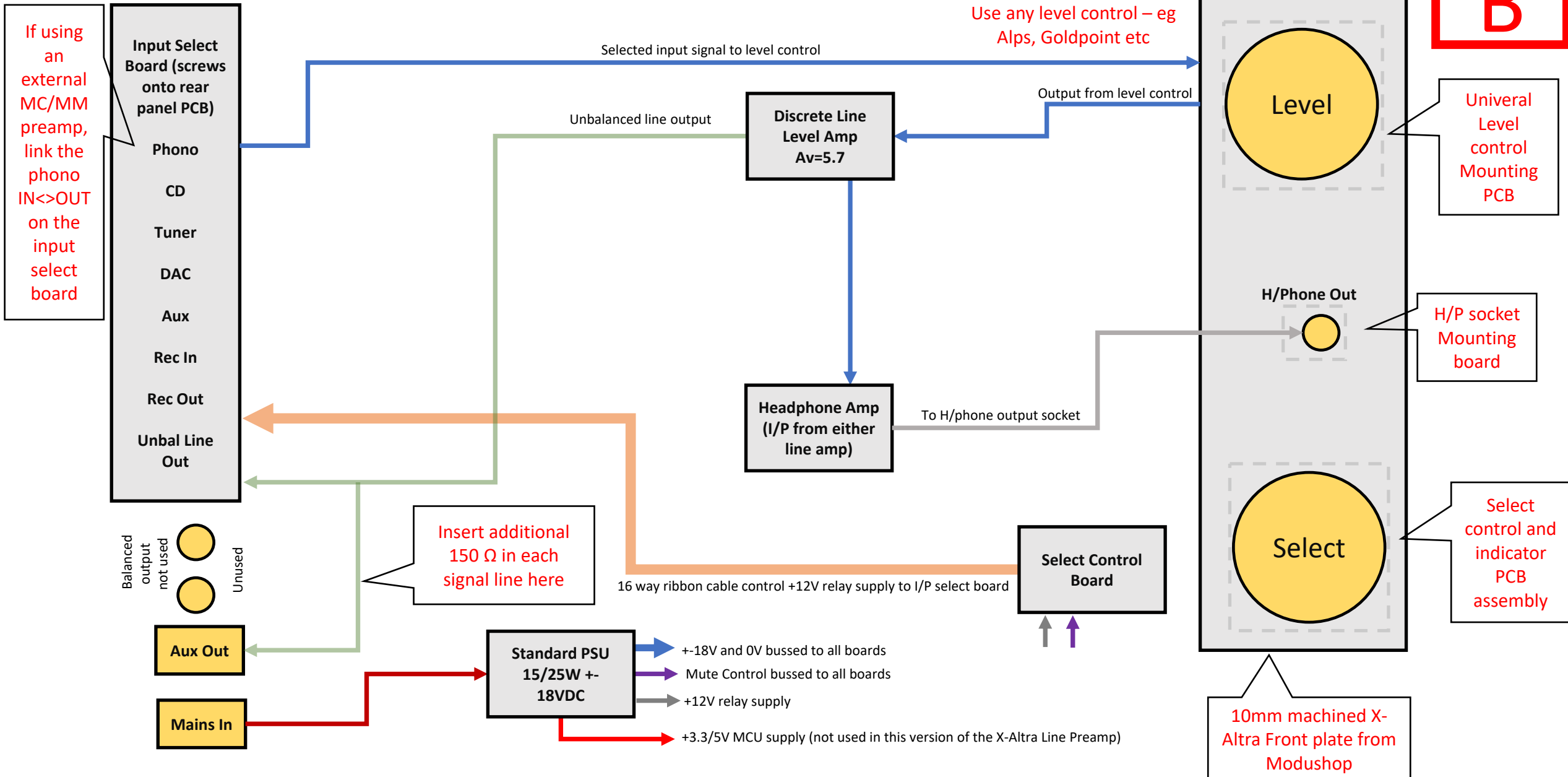
If using an external MC/MM preamp, link the phono IN<->OUT On the input select board

Use any level control – eg Alps, Goldpoint etc

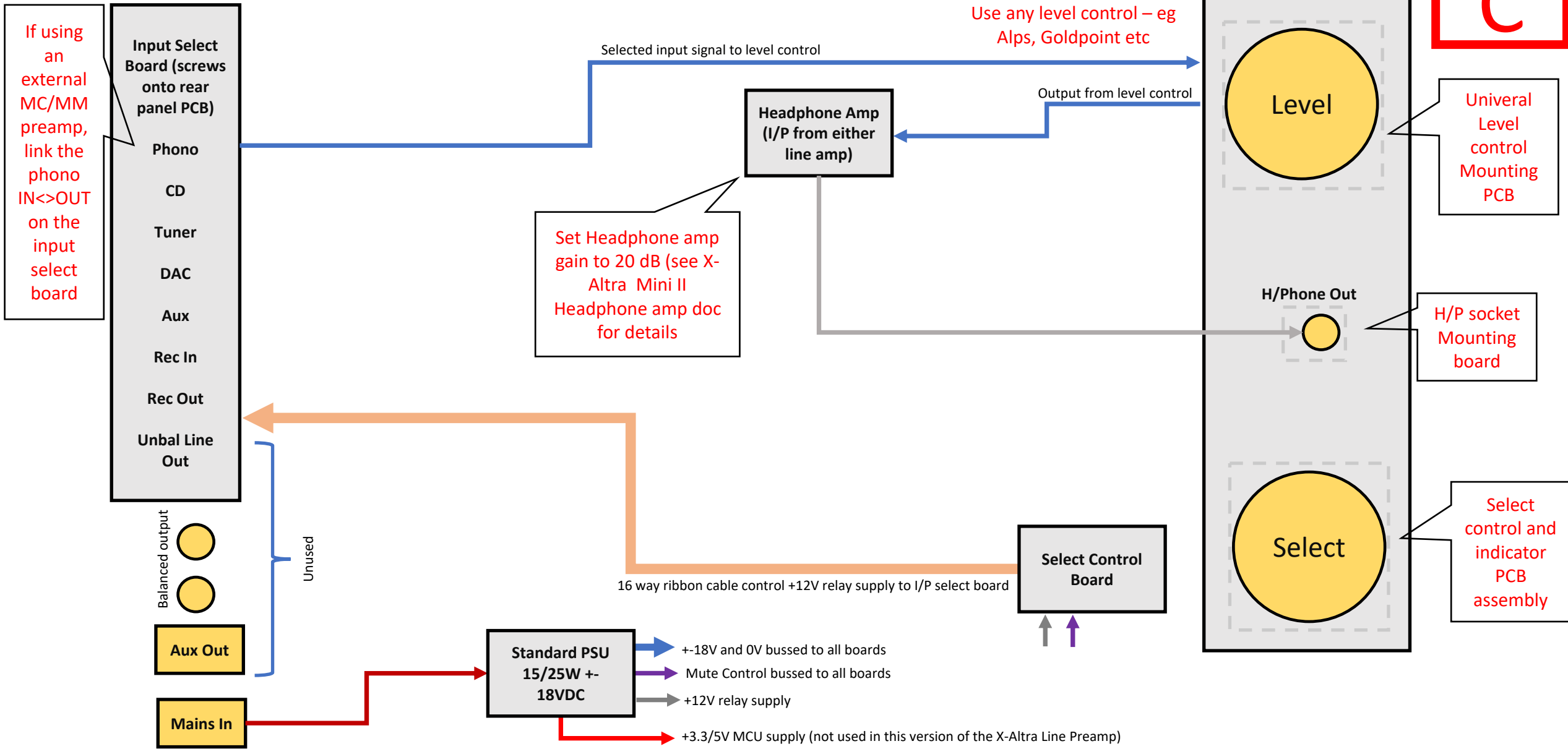
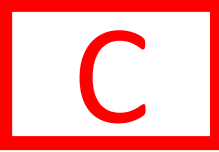


Minimalist X-Altra Line Preamp Implementation

B

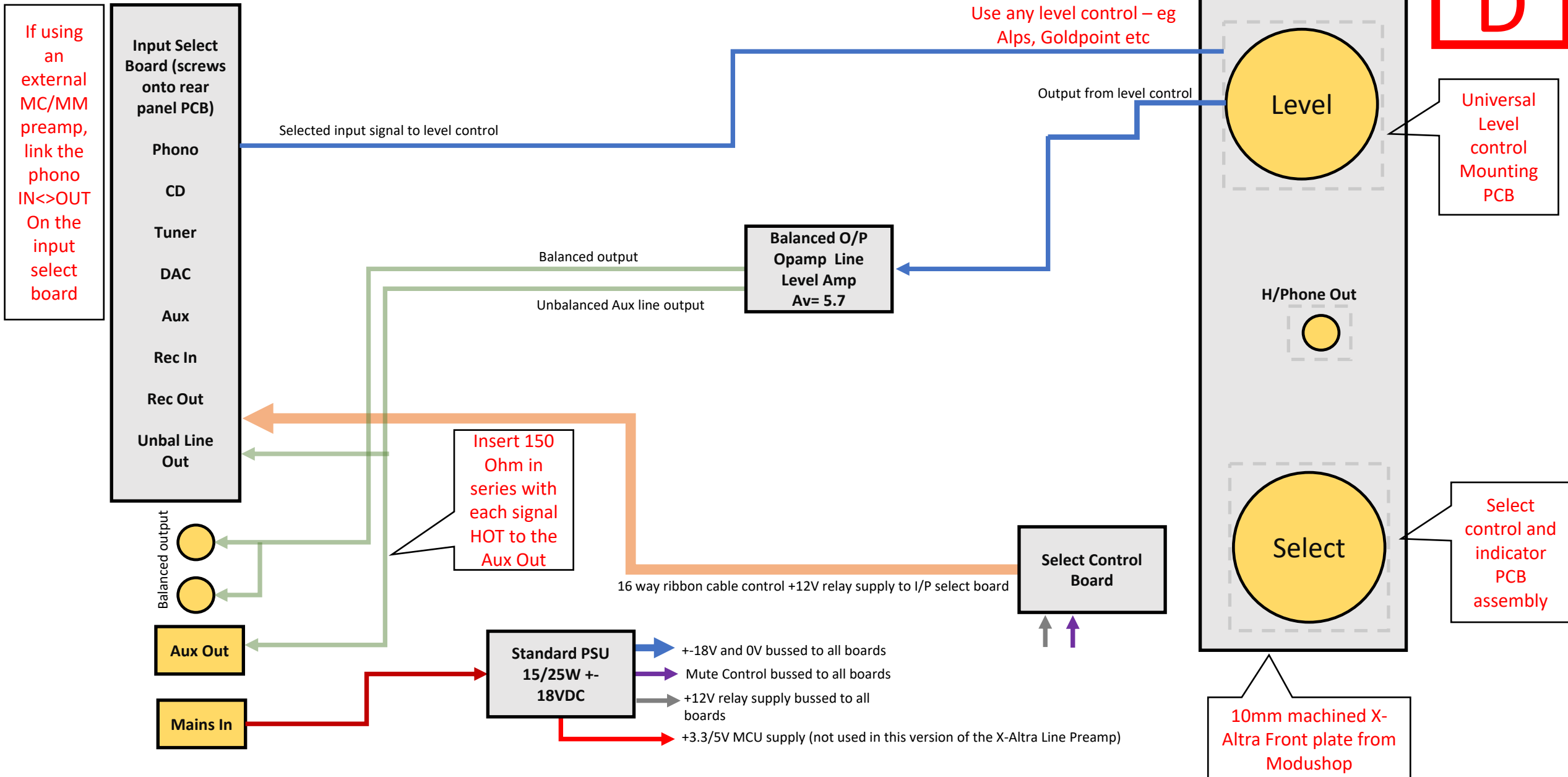


X-Altra Headphone Amp With Input Select



Full Feature X-Altra Line Preamp Implementation

D

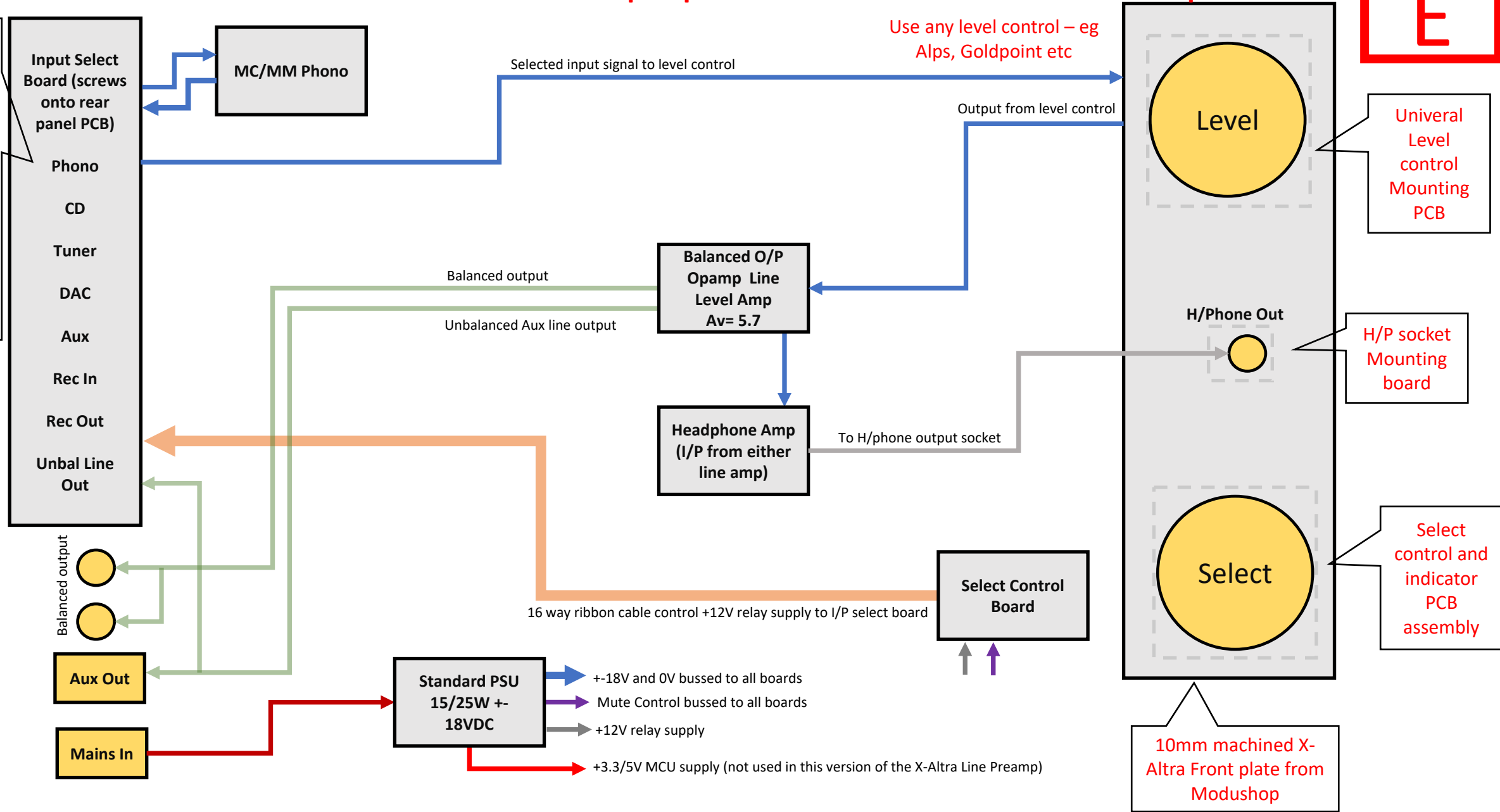


If using an external MC/MM preamp, link the phono IN<->OUT On the input select board

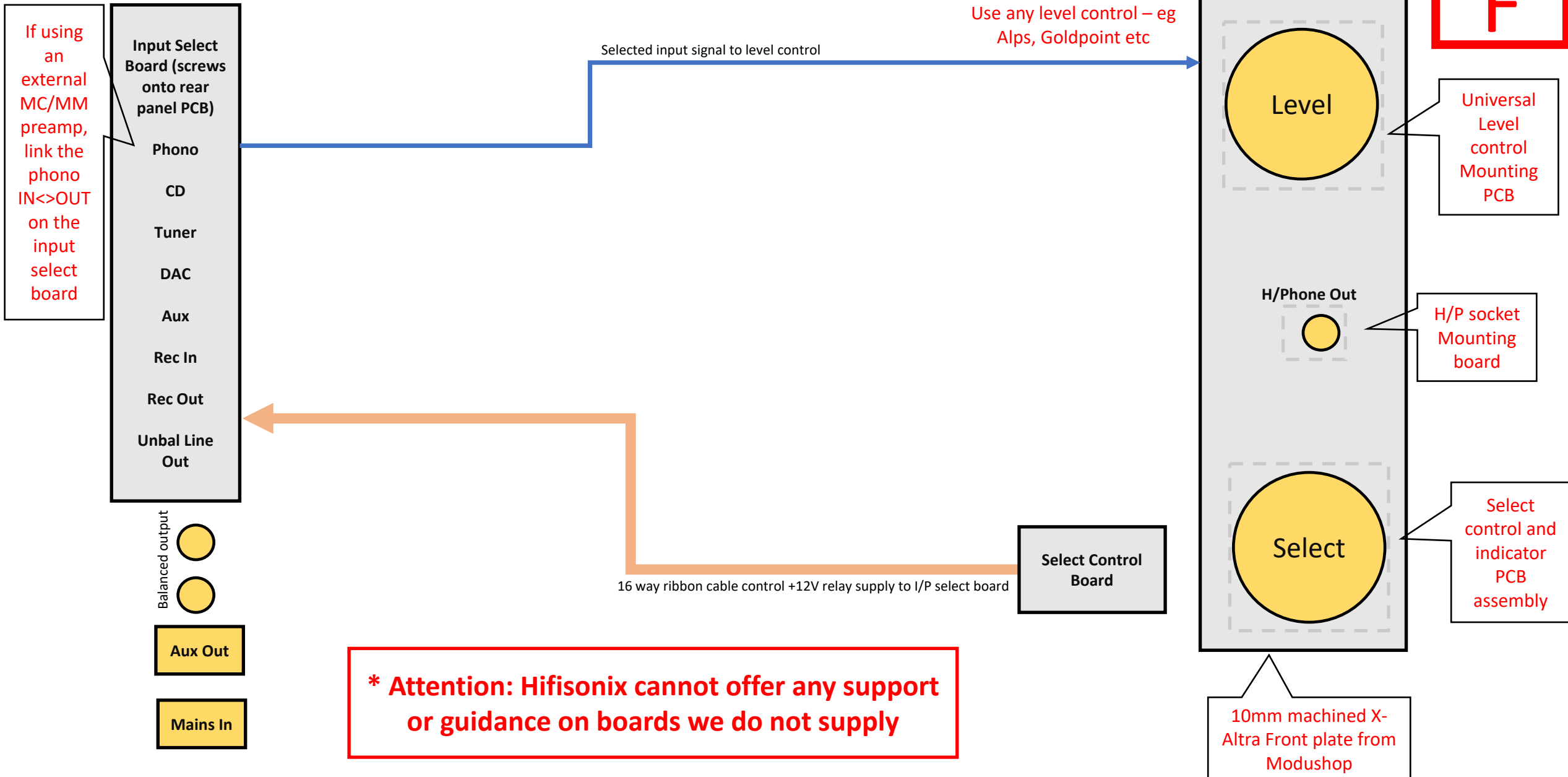
Basic Full X-Altra Line Preamp Implementation – But No Discrete Line Amp



If using an external MC/MM preamp, link the phono IN<->OUT on the input select board



Bare bones X-Altra Line Preamp - Input select only – you fit with your own amplifier and PSU boards*



If using an external MC/MM preamp, link the phono IN<>OUT on the input select board

Use any level control – eg Alps, Goldpoint etc

Selected input signal to level control

16 way ribbon cable control +12V relay supply to I/P select board

Universal Level control Mounting PCB

H/P socket Mounting board

Select control and indicator PCB assembly

10mm machined X-Altra Front plate from Modushop

*** Attention: Hifisonix cannot offer any support or guidance on boards we do not supply**



X-Altra Mini II General Construction Notes

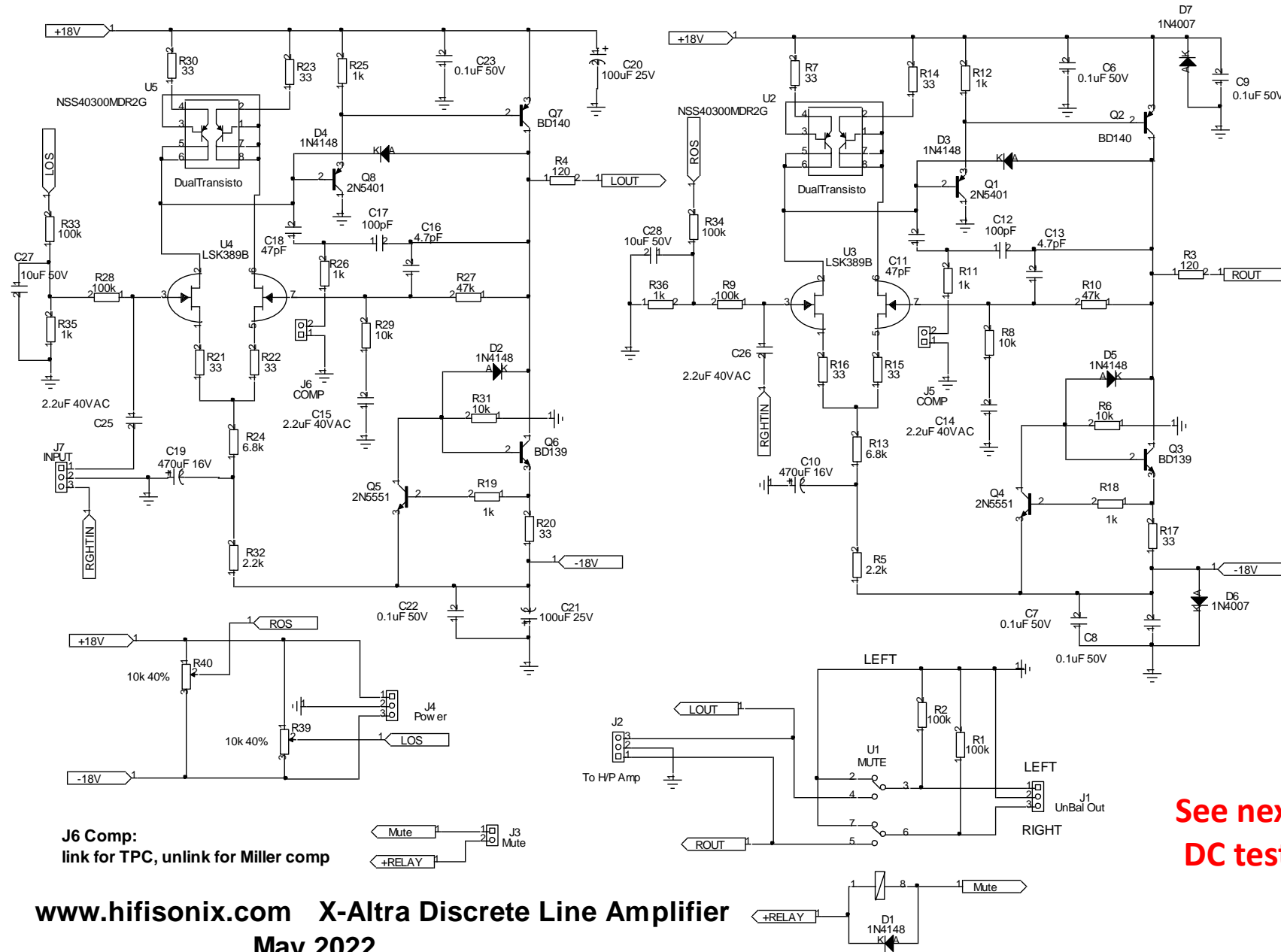
- Build the PSU first since you will need it to test the modules
- Build the input select PCB and the input control PCB next
- Assemble or buy an 45cm (18") 16 way ribbon cable
- Assemble the remaining modules as required for your implementation per the example configurations
- Before you begin mounting and wiring the modules into the housing, test every single module individually. DO NOT do the final assembly into the housing without first thoroughly testing each module separately. There is a lot of interconnect wiring and if you have to disassemble to fix faults, it will create a mess and ruin your good solder work
- Stick strictly to the wiring routing shown in order to keep loop areas to a minimum. The peak noise floor on the line level inputs is -128 dBV or better and this is only achievable with careful cable dressing

X-Altra Mini II Line Preamplifier

Module Schematics

www.hifisonix.com

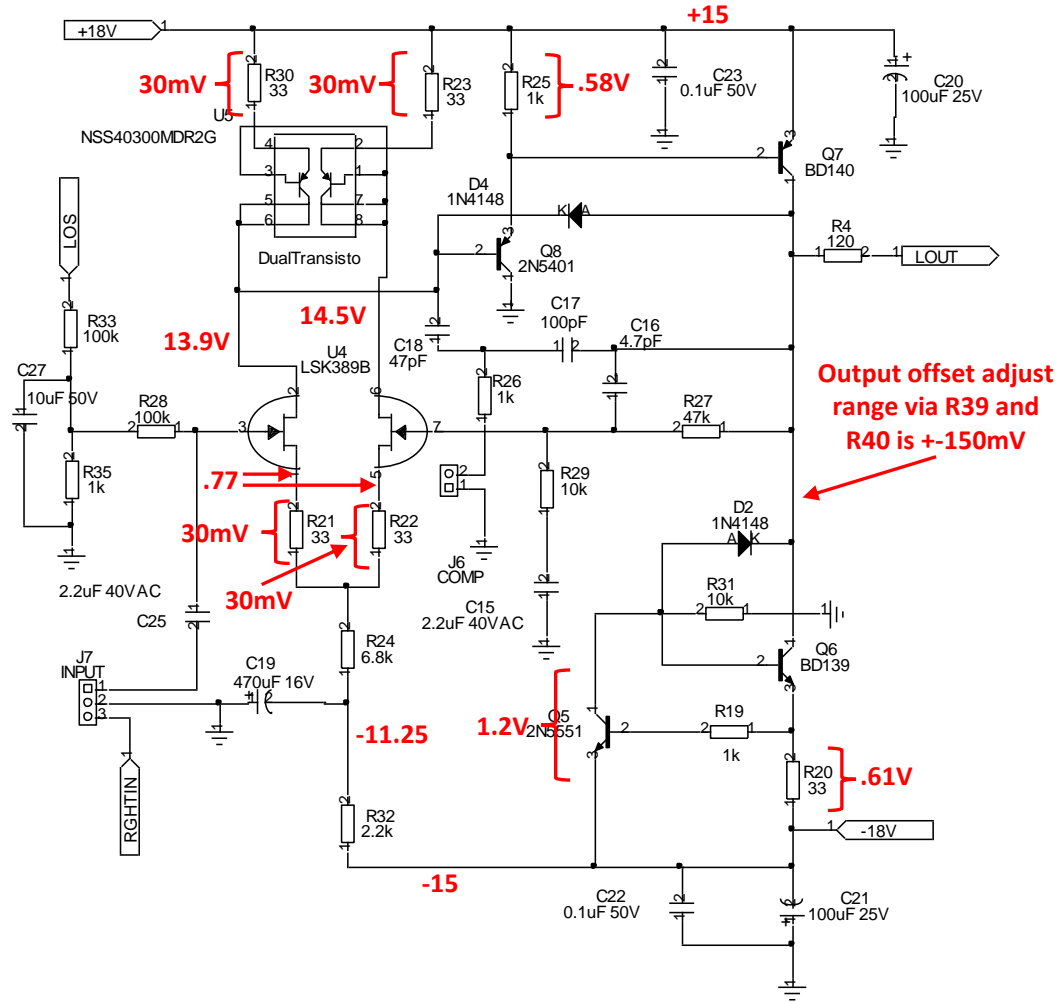
Discrete Line Amp



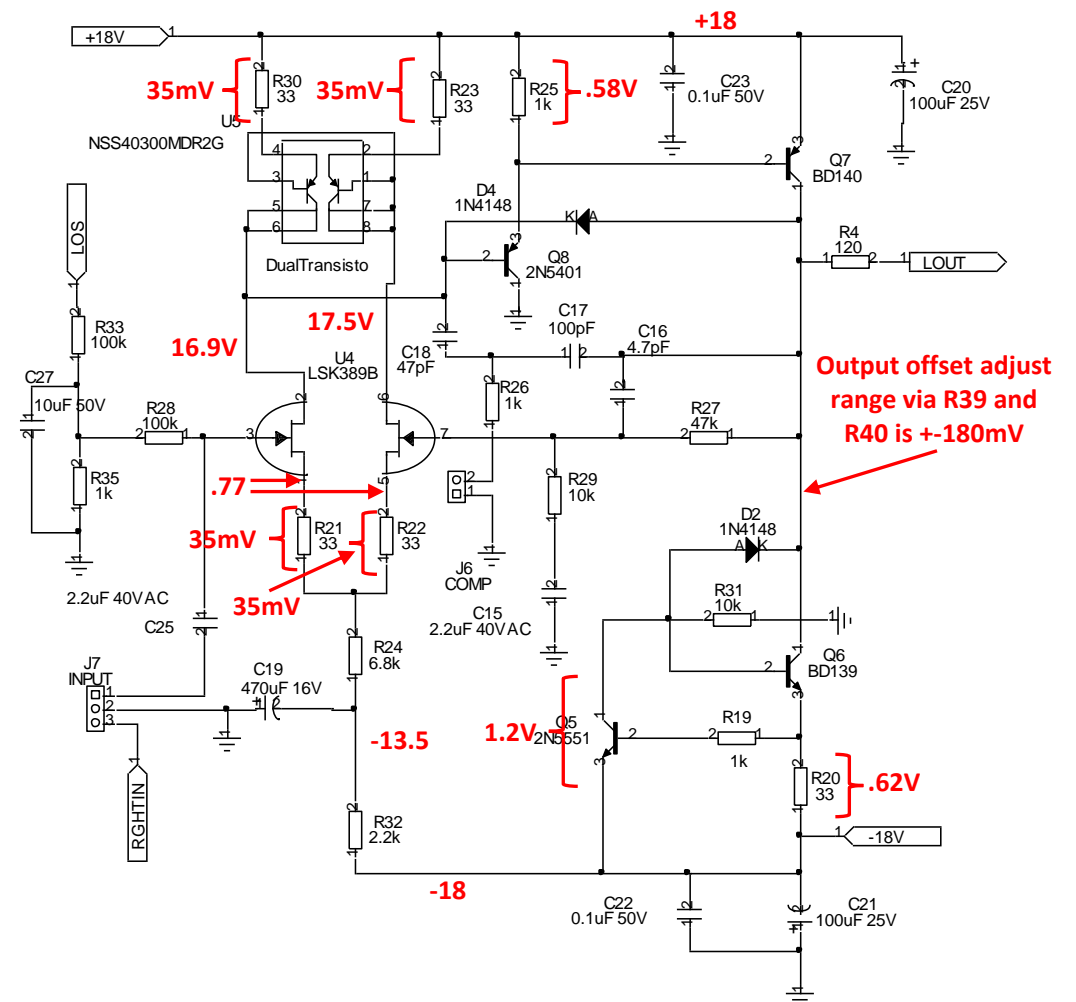
www.hifisonix.com X-Altra Discrete Line Amplifier
May 2022

See next slide for
DC test voltages

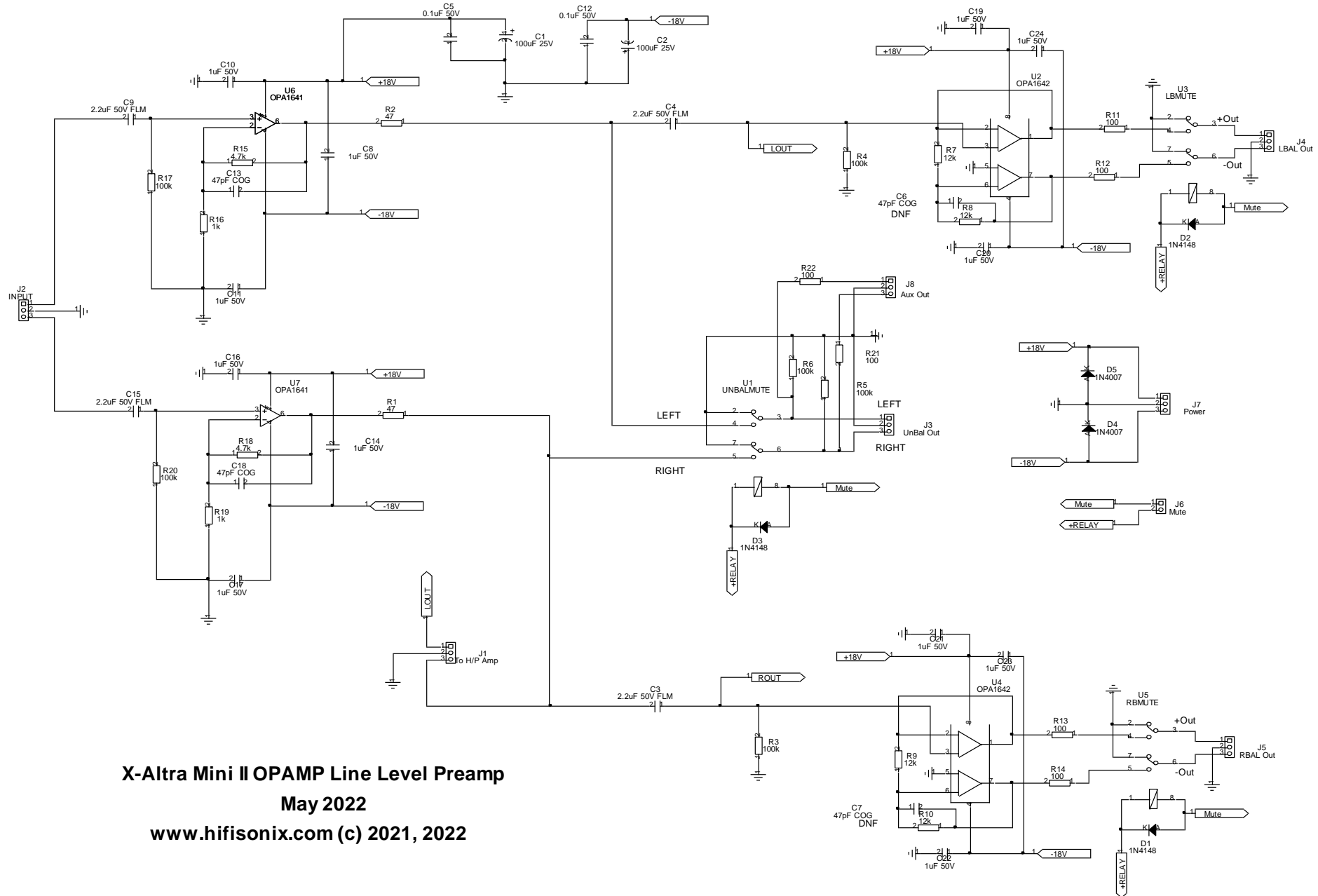
For +/-15V Supply Rails



For +/-18V Supply Rails as used with the Standard PSU



Balanced Line Level Amp

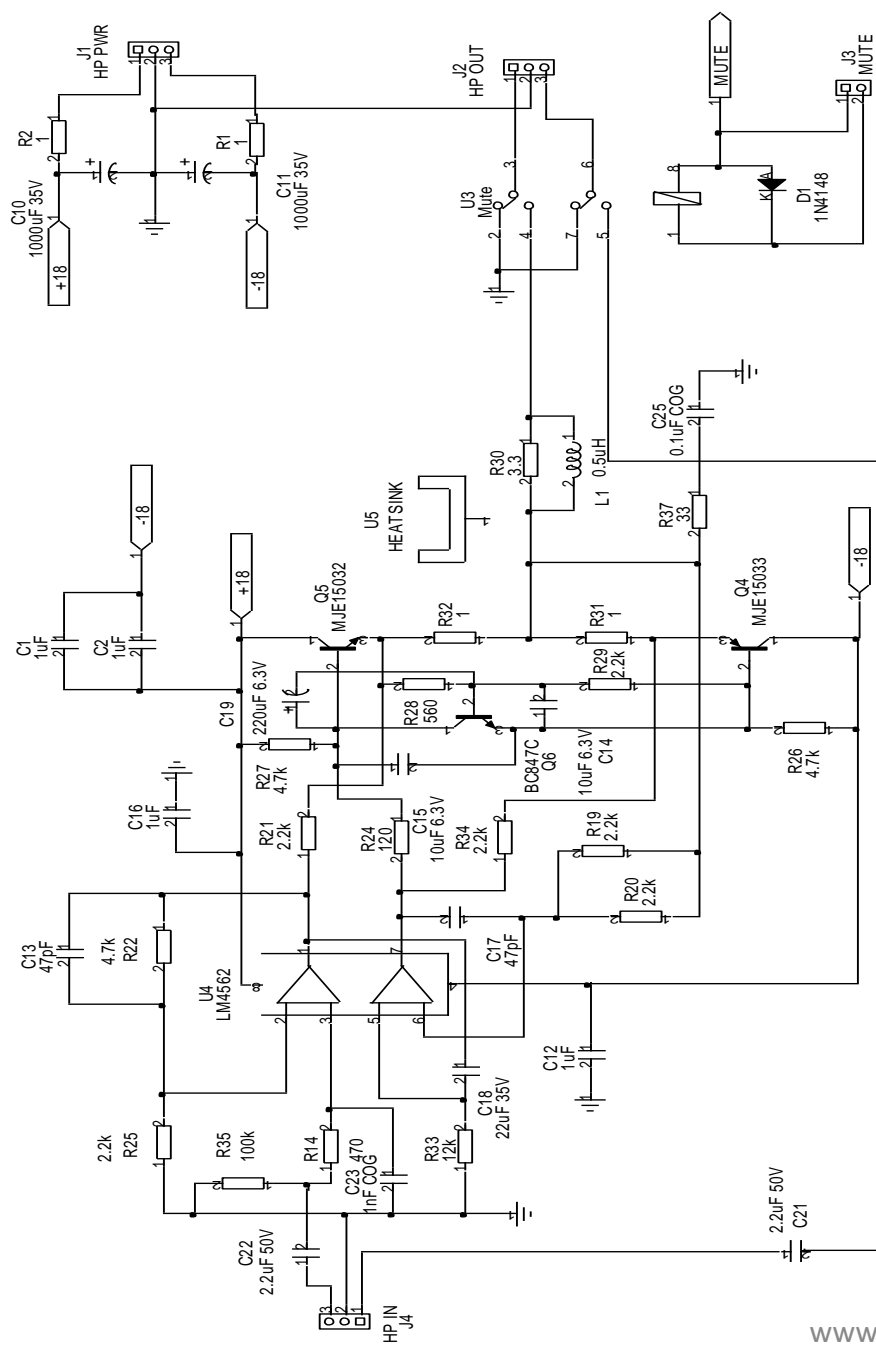


X-Altra Mini II OPAMP Line Level Preamp
May 2022
www.hifisonix.com (c) 2021, 2022

With the inputs shorted, the output voltage on all opamps must be 0.000V +-5mV

HPA-1 Class A Headphone Amplifier

6/7/2023

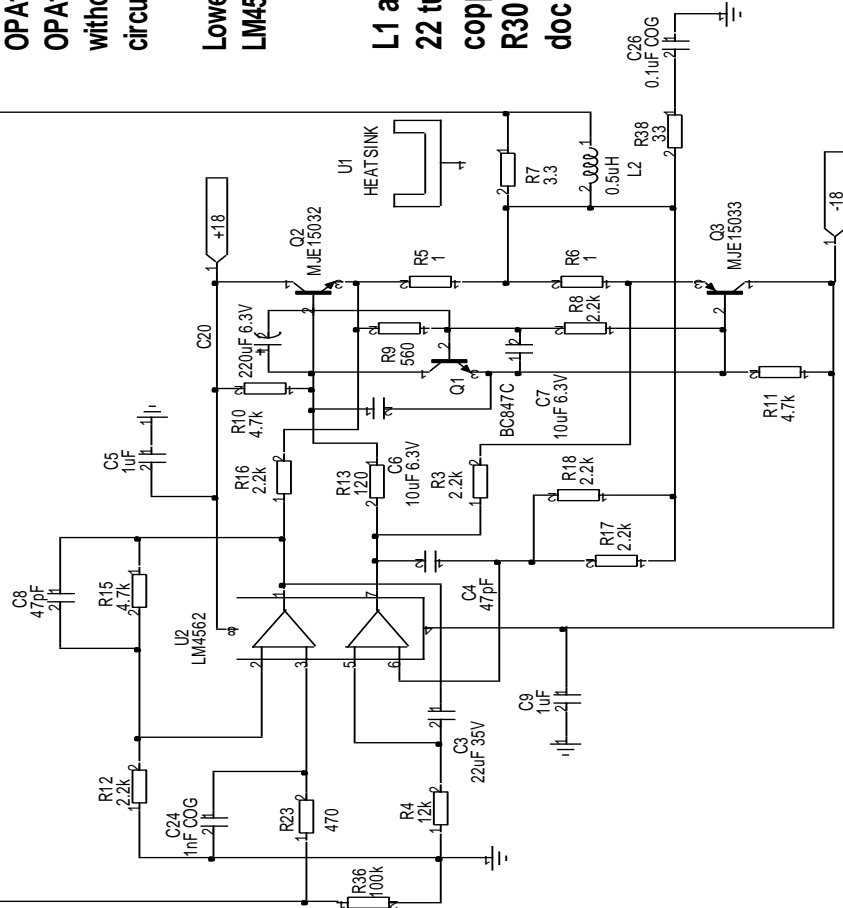


Notes

For U2 and U4, you can use
OPA1642,
OPA1652, TL072 or NE5532
 without
 circuit modification.

Lowest distortion is with
LM4562

L1 and L2 are OPTIONAL:
22 turns 0.5mm diameter
copper wire wound over
R30 and R7. See build
doc for details



www.hifisonix.com

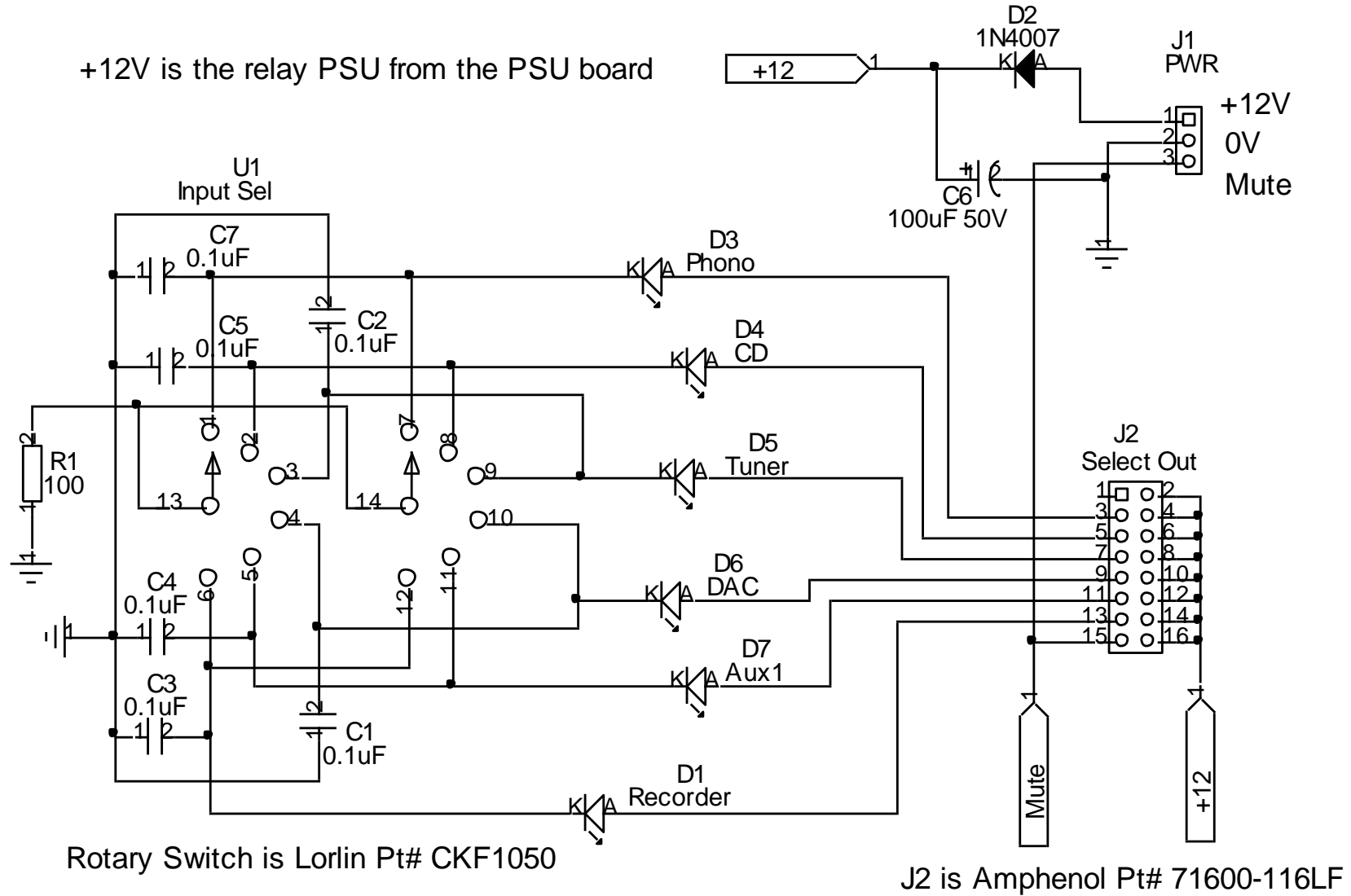
www.hifisonix.com

May 2022

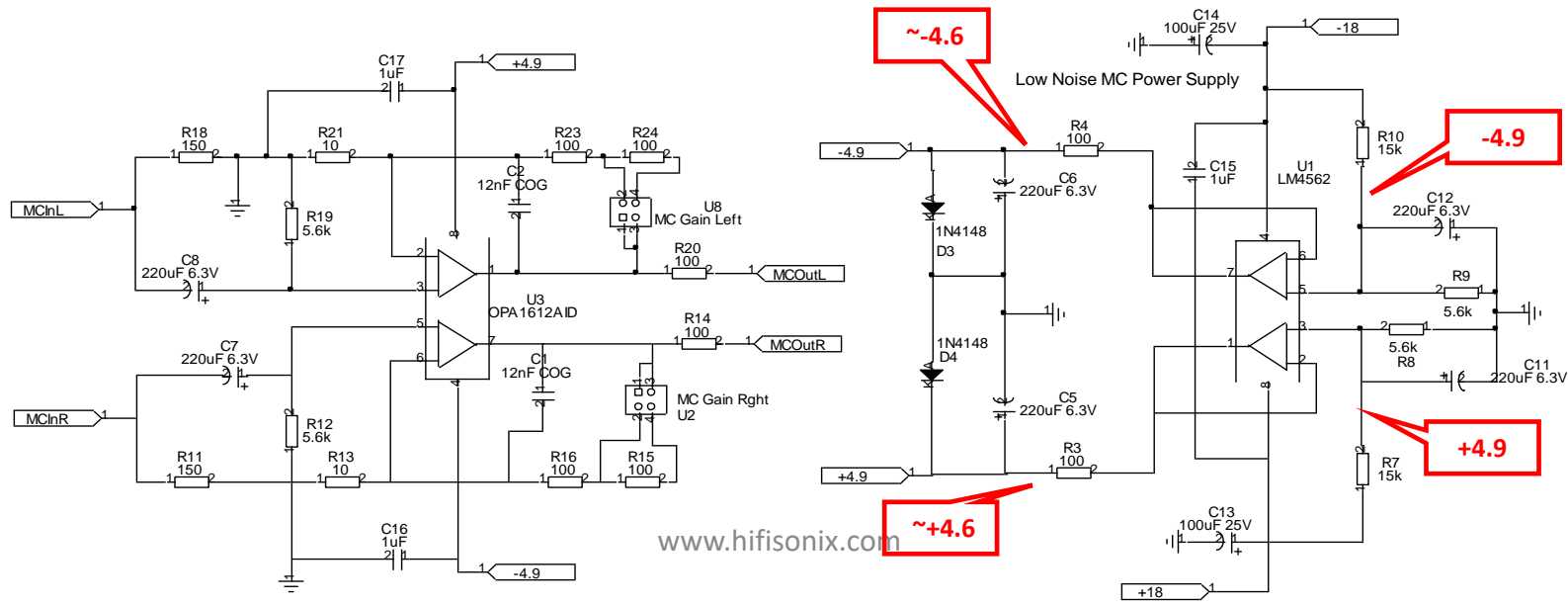
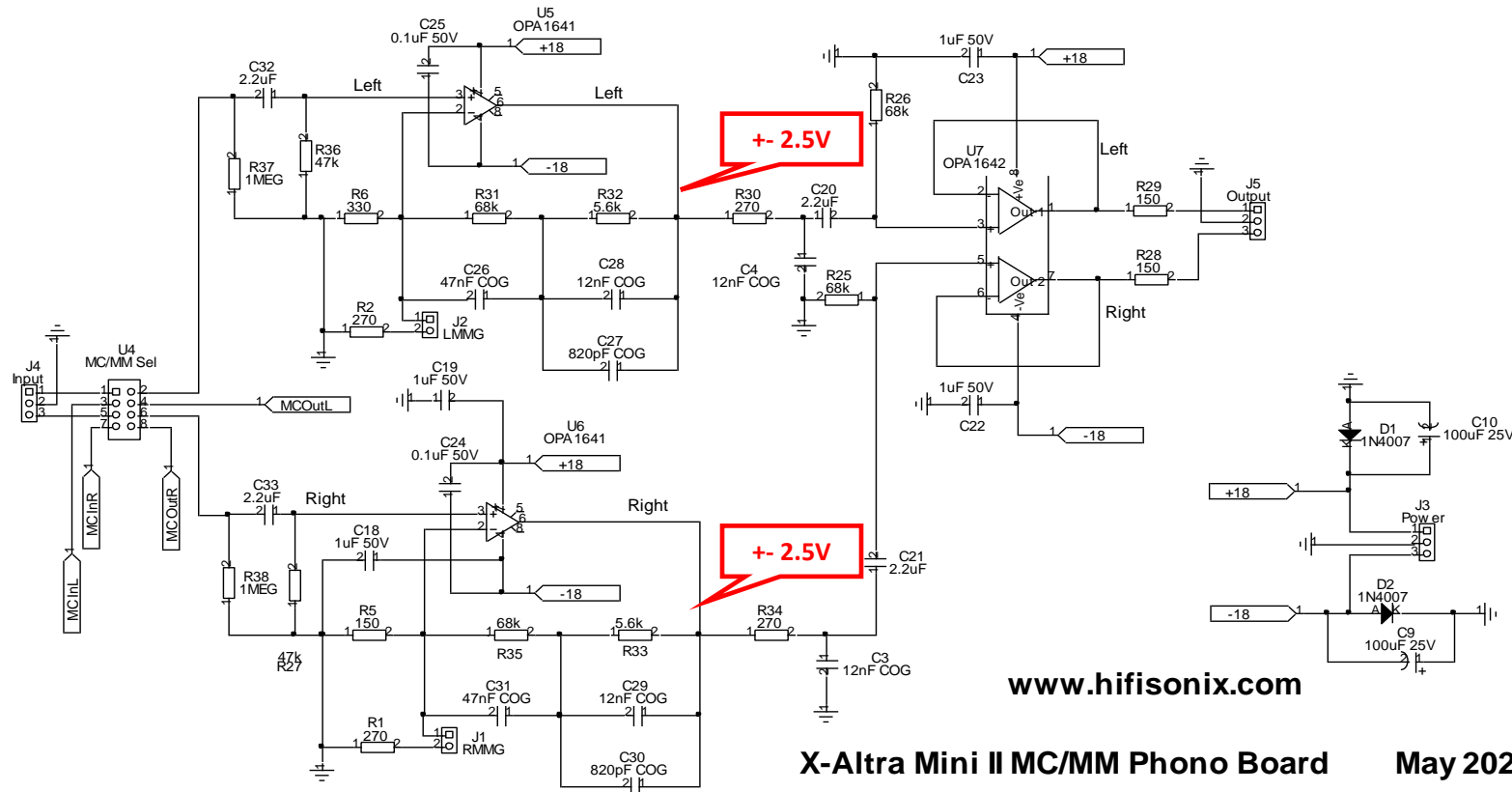
X-Alpha HPA-1 Class A Headphone Amplifier

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Input Select Control Board May 2022



MC/MM RIAA Phono EQ Preamp



With the inputs shorted, the output voltage on all opamps must be 0.000V +/-3.5mV except where noted

For MM Inputs:-

- Input signal routing: On U4, link 1-2 and 5-6
- Leave other positions on U4 open

- MM Gain setting (J1 and J2): Link J1 and J2 when using MM inputs

For MC Inputs:-

- Input signal routing: On U4, link 1-3 and 5-7; Link 2-4 and 6-8

MC Gain setting (U2 and U8)

- Link 1-2 for 11x or 3-4 for 21x
- Leave J1 and J2 OPEN when using MC inputs

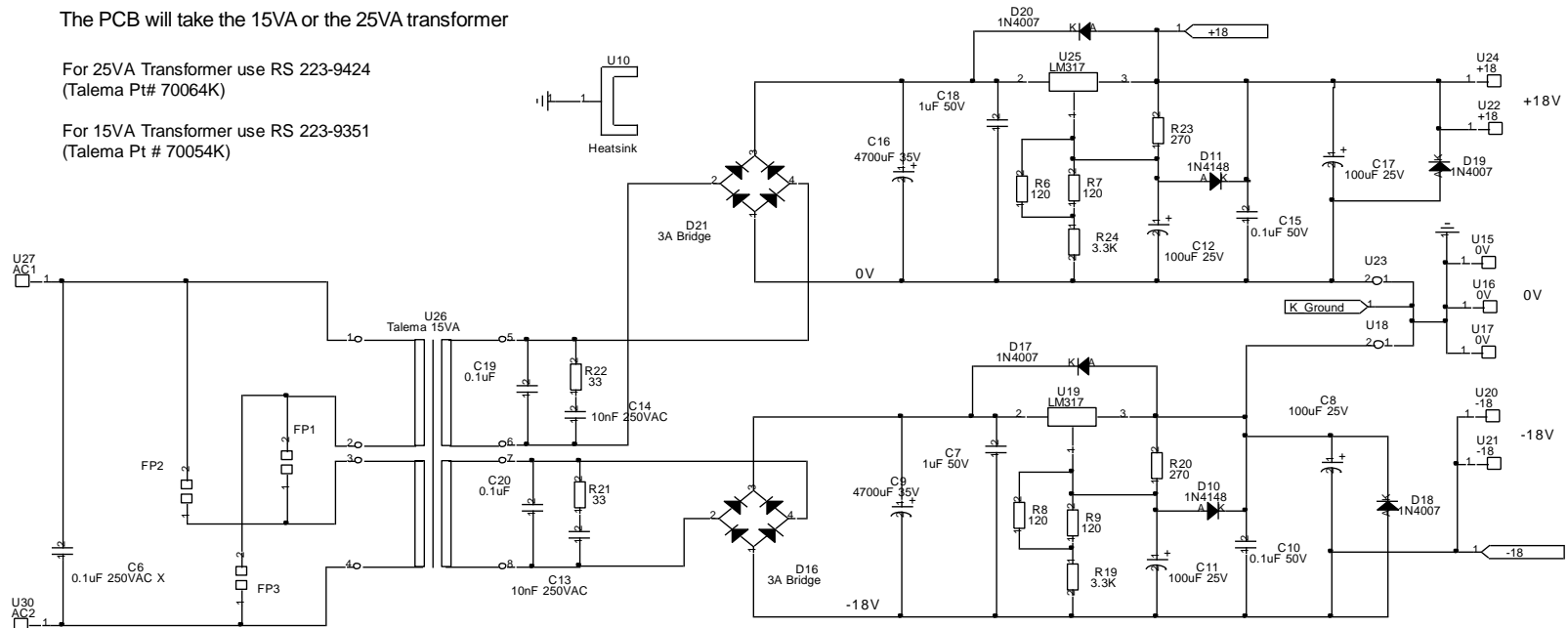
Hifisonix Standard PSU May 2022

The PCB will take the 15VA or the 25VA transformer

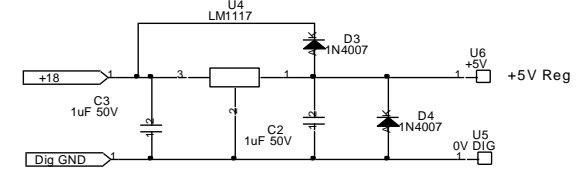
For 25VA Transformer use RS 223-9424 (Talema Pt# 70064K)

For 15VA Transformer use RS 223-9351 (Talema Pt # 70054K)

Low Noise 15/25W PSU



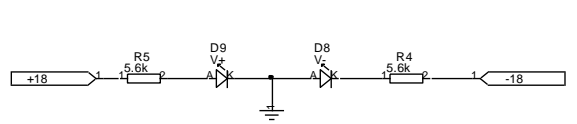
Microcontroller Power Supply



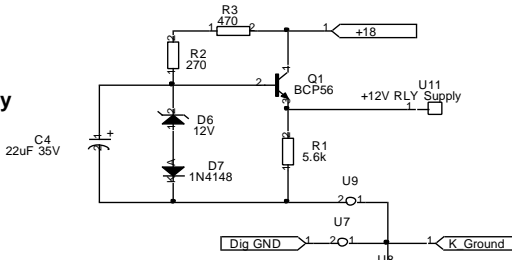
For the LM117 above, a 3.3 or 5V output part can be used:-

3.3V part use MSR 863-LM117MPX-33NOPB

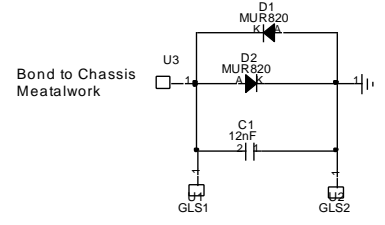
5V part use MSR 863-LM117MPX-50NOPB



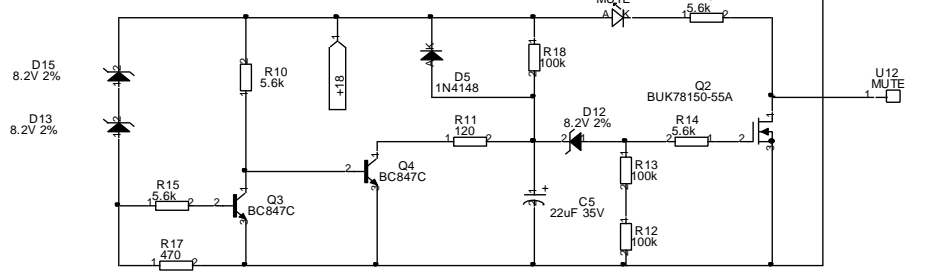
+12V Relay Power Supply



Ground Lifter



Mute Relay Controller



For boards shipped before 29th August 2022, use this circuit diagram

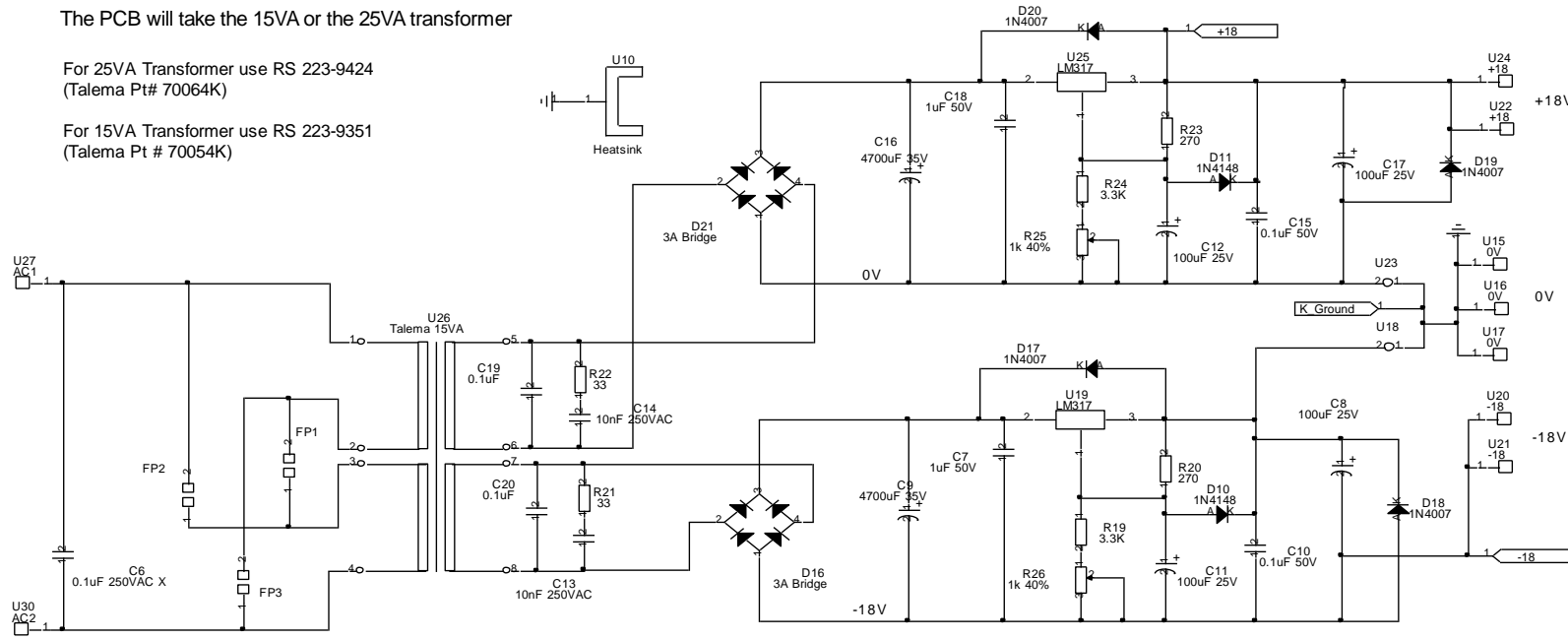
Hifisonix Standard PSU September 2022

The PCB will take the 15VA or the 25VA transformer

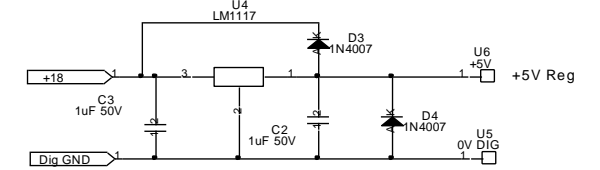
For 25VA Transformer use RS 223-9424 (Talema Pt# 70064K)

For 15VA Transformer use RS 223-9351 (Talema Pt # 70054K)

Low Noise 15/25W PSU



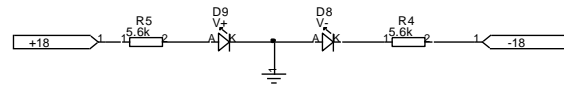
Microcontroller Power Supply



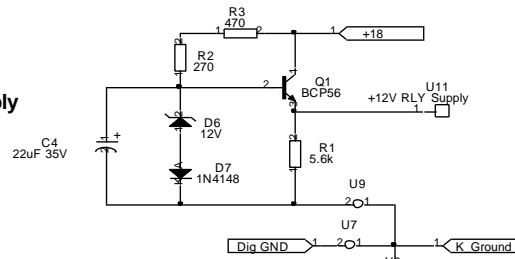
For the LM117 above, a 3.3 or 5V output part can be used:-

3.3V part use MSR 863-LM117MPX-33NOPB

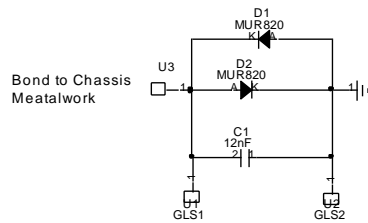
5V part use MSR 863-LM117MPX-50NOPB



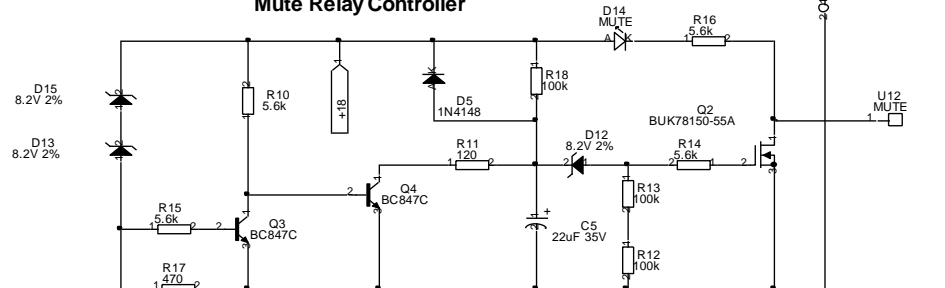
+12V Relay Power Supply



Ground Lifter

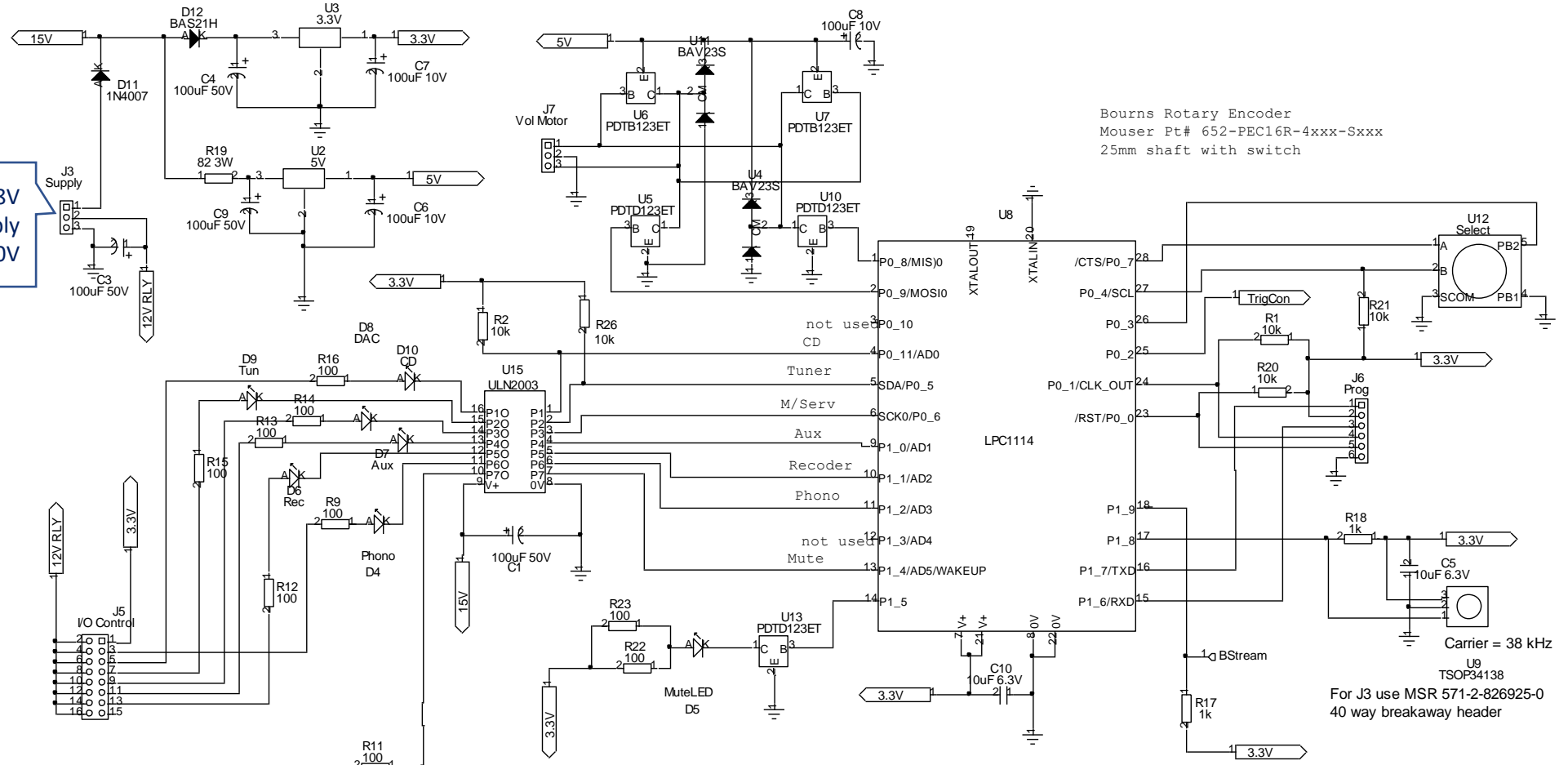


Mute Relay Controller



For boards shipped after 29th August 2022, use this circuit diagram

Pin 1 = +18V
Pin 2 = +12V relay Supply
Pin 3 = Digital 0V



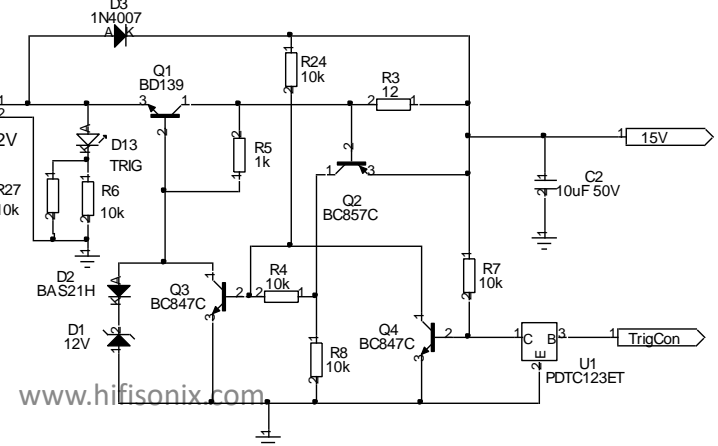
Bourns Rotary Encoder
Mouser Pt# 652-PEC16R-4xxx-Sxxx
25mm shaft with switch

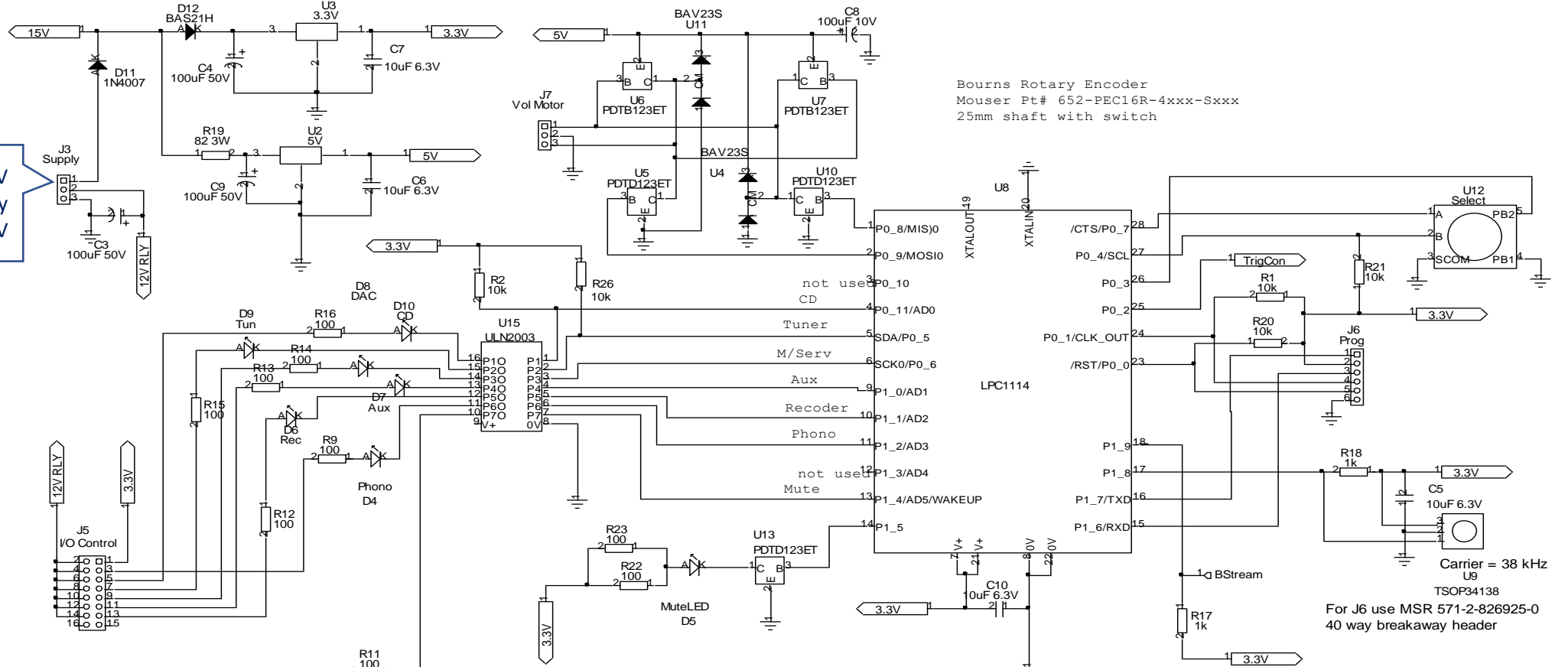
Carrier = 38 kHz
U9
TSOP34138
For J3 use MSR 571-2-826925-0
40 way breakaway header

X-altra Mini II Remote Control Select Board Aug 2022

Important note: To sync the Apple TV Remote with the X-altra Mini II, hold the Menu + Select button on the remote down for 6 seconds. You may have to repeat this 2-3 times to get the correct control codes up on the remote. Once paired, no further syncing is required.

+12V Trig
Max trigger current is ~40mA at 12V





Pin 1 = +18V
 Pin 2 = +12V relay Supply
 Pin 3 = Digital 0V

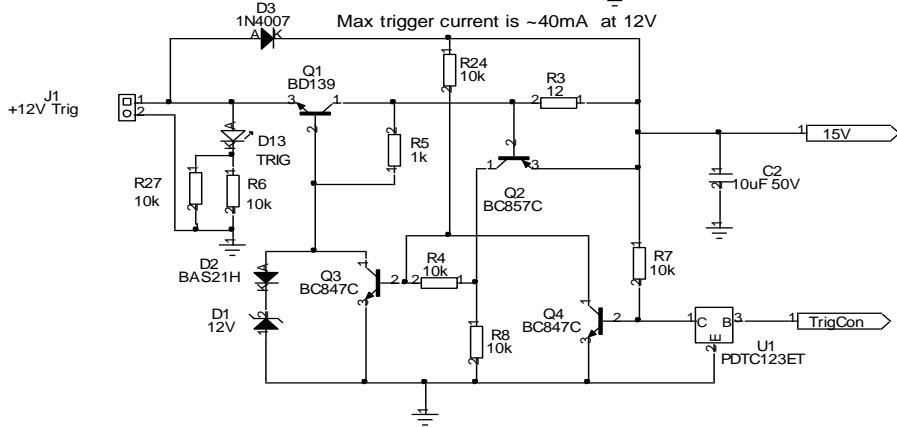
Bourns Rotary Encoder
 Mouser Pt# 652-PEC16R-4xxx-Sxxx
 25mm shaft with switch

Carrier = 38 kHz
 TSOP34138
 For J6 use MSR 571-2-826925-0
 40 way breakaway header

X-altra Mini II Remote Control Select Board April 2023

Important note: To sync the Apple TV Remote with the X-altra Mini II, hold the Menu + Select button on the remote down for 6 seconds. You may have to repeat this 2-3 times to get the correct control codes up on the remote. Once paired, no further syncing is required.

April 2023 update: Pin 16 on J5 disconnected from +12V to prevent blowing IC's on +3.3V if plugged in back-to-front



Max trigger current is ~40mA at 12V



T/T Ground

Aux Line Out

Right Bal Out

Left Bal Out

X-Altra Mini II Line Preamp
www.hifisonix.com
Ensure Unit is Always Earthed/Grounded

R L

Left

Right

Phono

CD

Tuner

DAC

Aux

Rec In

Rec Out

Line Out

Trigger

+12V 40mA
Reg=0V Tip +12

MADON
200mA

Hifisonix

X-Altra Mini II Line Preamplifier

Final Measurements
29 May 2022

www.hifisonix.com

Notes/Remarks on Measurements

- These measurements are for the completed full feature Manual X-Altra Mini II ([version A](#)) with all modules and PSU in the same Modushop Galaxy housing
- All measurements are in dBV unless otherwise stated
- In all measurements, the level control was set to maximum unless otherwise stated
- The measurements were conducted using a QuantAssylum QA401 Audio Analyser on 29th and 30th May 2022

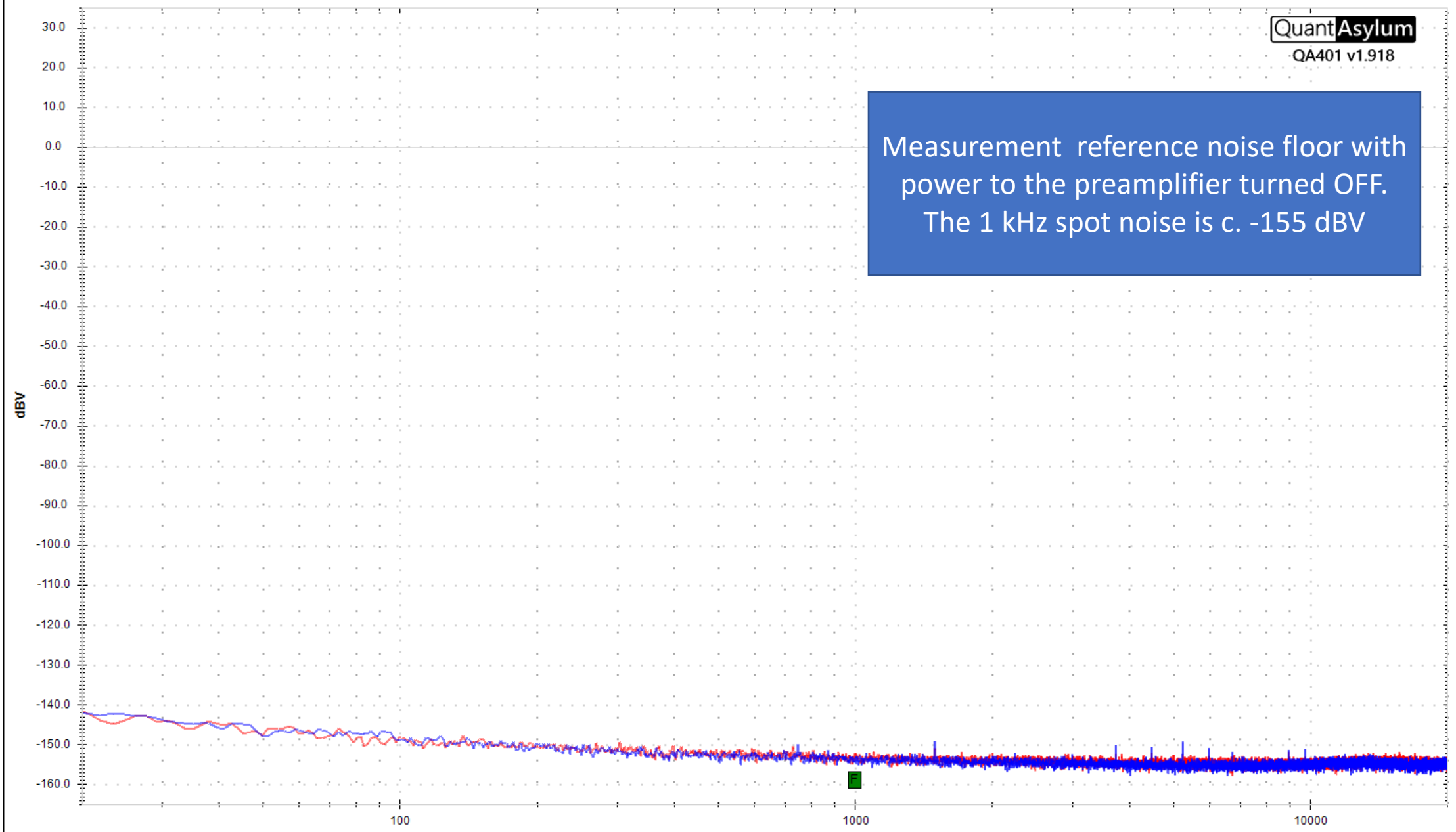
Andrew C. Russell

30 May 2022

FFT: 32k Meas Start: 20.0 Hz Peak L: -101.85 dBV Gen 1: 996.0937 Hz @ 3.0 dBV
Avg: 39 of 49 Meas Stop: 20.0 KHz Peak R: -109.71 dBV Gen 2: 3.000000 KHz @ -36.0 dBV
Res: 1.46 Hz Peak L: 8.084 uVrms
Fs: 48.0 KHz Peak R: 3.269 uVrms
Win: Hann THD L: -- dB/ --%
Weight: None THD R: -- dB/ --%

QuantAsylum
QA401 v1.918

Measurement reference noise floor with
power to the preamplifier turned OFF.
The 1 kHz spot noise is c. -155 dBV



FFT: 32k
Avg: 34 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

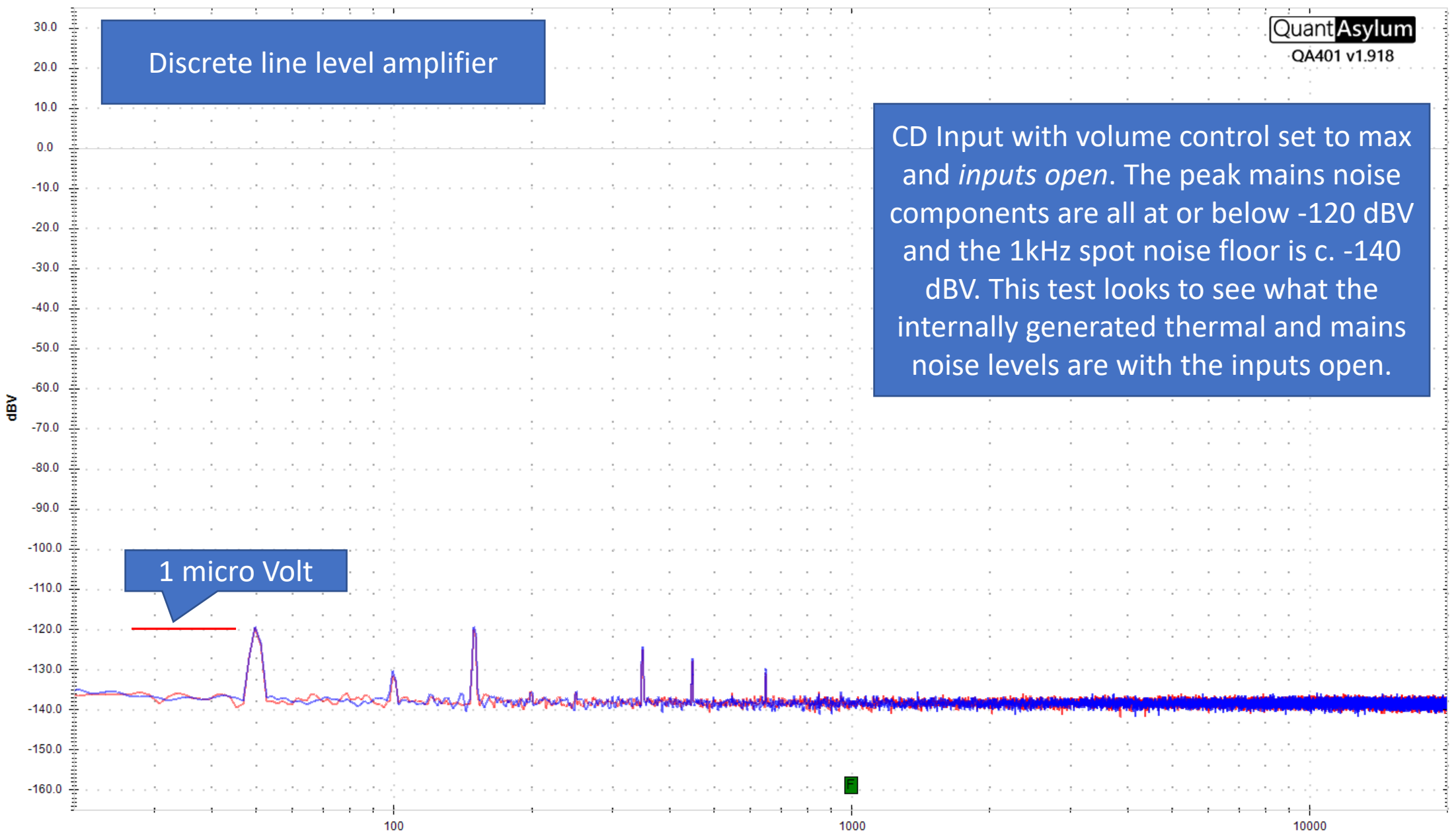
Peak L: -119.38 dBV
Peak R: -114.87 dBV
Peak L: 1.074 uVrms
Peak R: 1.804 uVrms
THD L: --- dB/ ---%
THD R: --- dB/ ---%

Gen 1: 996.0937 Hz @ 3.0 dBV
Gen 2: 3.000000 KHz @ -36.0 dBV

QuantAsylum
QA401 v1.918

Discrete line level amplifier

CD Input with volume control set to max and *inputs open*. The peak mains noise components are all at or below -120 dBV and the 1kHz spot noise floor is c. -140 dBV. This test looks to see what the internally generated thermal and mains noise levels are with the inputs open.



1 micro Volt

100

1000

10000

FFT: 32k
Avg: 49 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

Peak L: 0.84 dBV
Peak R: 0.85 dBV
Peak L: 1.101 Vrms
Peak R: 1.103 Vrms
THD L: -99.5 dB/ 0.00106%
THD R: -96.9 dB/ 0.00143%

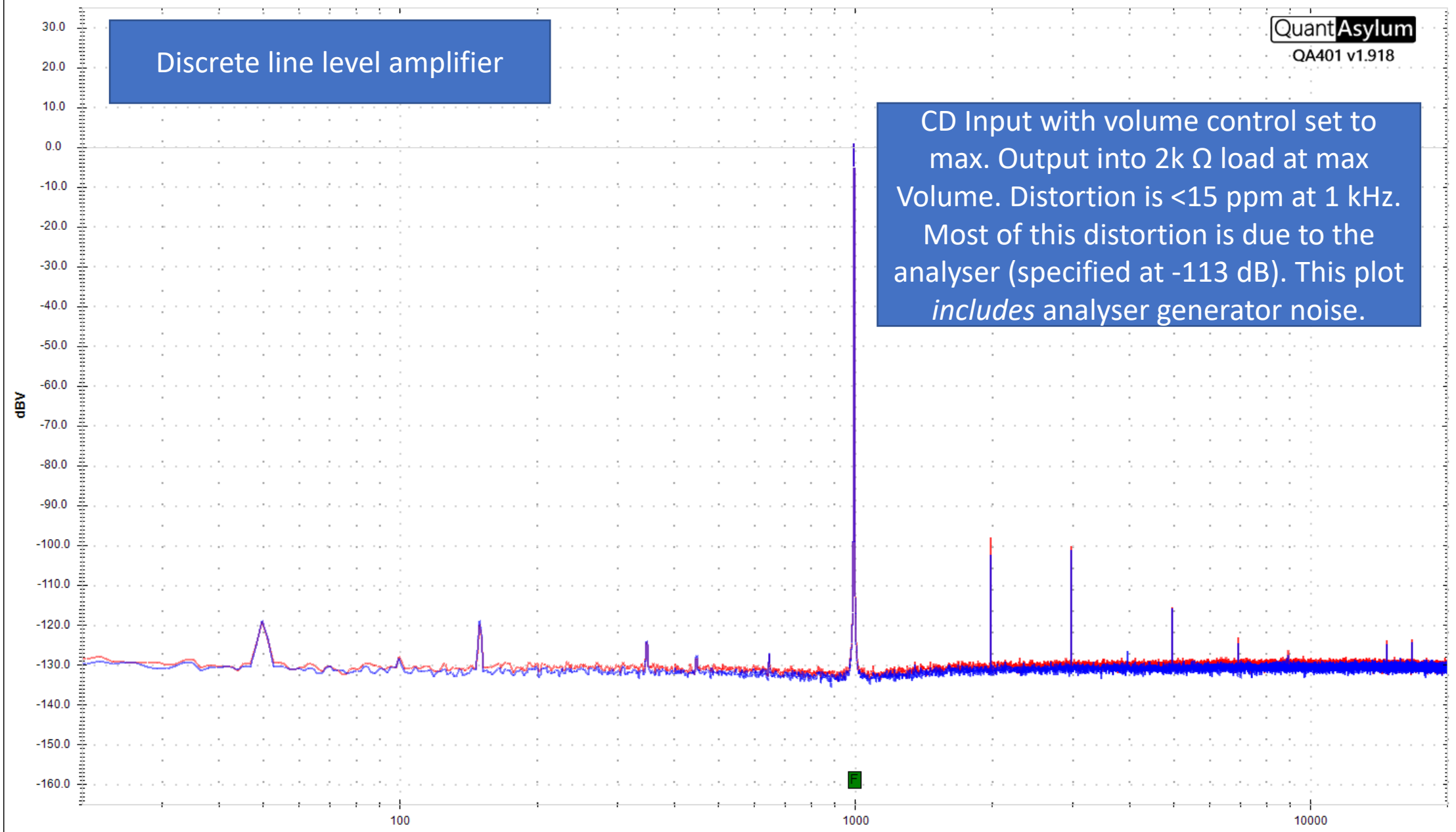
Gen 1: 996.0937 Hz @ 3.0 dBV
Gen 2: 3.000000 KHz @ -36.0 dBV

Phase L: 4.80 deg
Phase R: 4.77 deg
Delay L: 1.00 mSec
Delay R: 1.00 mSec
Gain L: -2.15 dB
Gain R: -2.14 dB

QuantAsylum
QA401 v1.918

Discrete line level amplifier

CD Input with volume control set to max. Output into 2k Ω load at max Volume. Distortion is <15 ppm at 1 kHz. Most of this distortion is due to the analyser (specified at -113 dB). This plot *includes* analyser generator noise.



FFT: 32k
Avg: 49 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

Peak L: 18.84 dBV
Peak R: 18.84 dBV
Peak L: 8.746 Vrms
Peak R: 8.749 Vrms
THD L: -102.3 dB/ 0.00076%
THD R: -101.5 dB/ 0.00084%

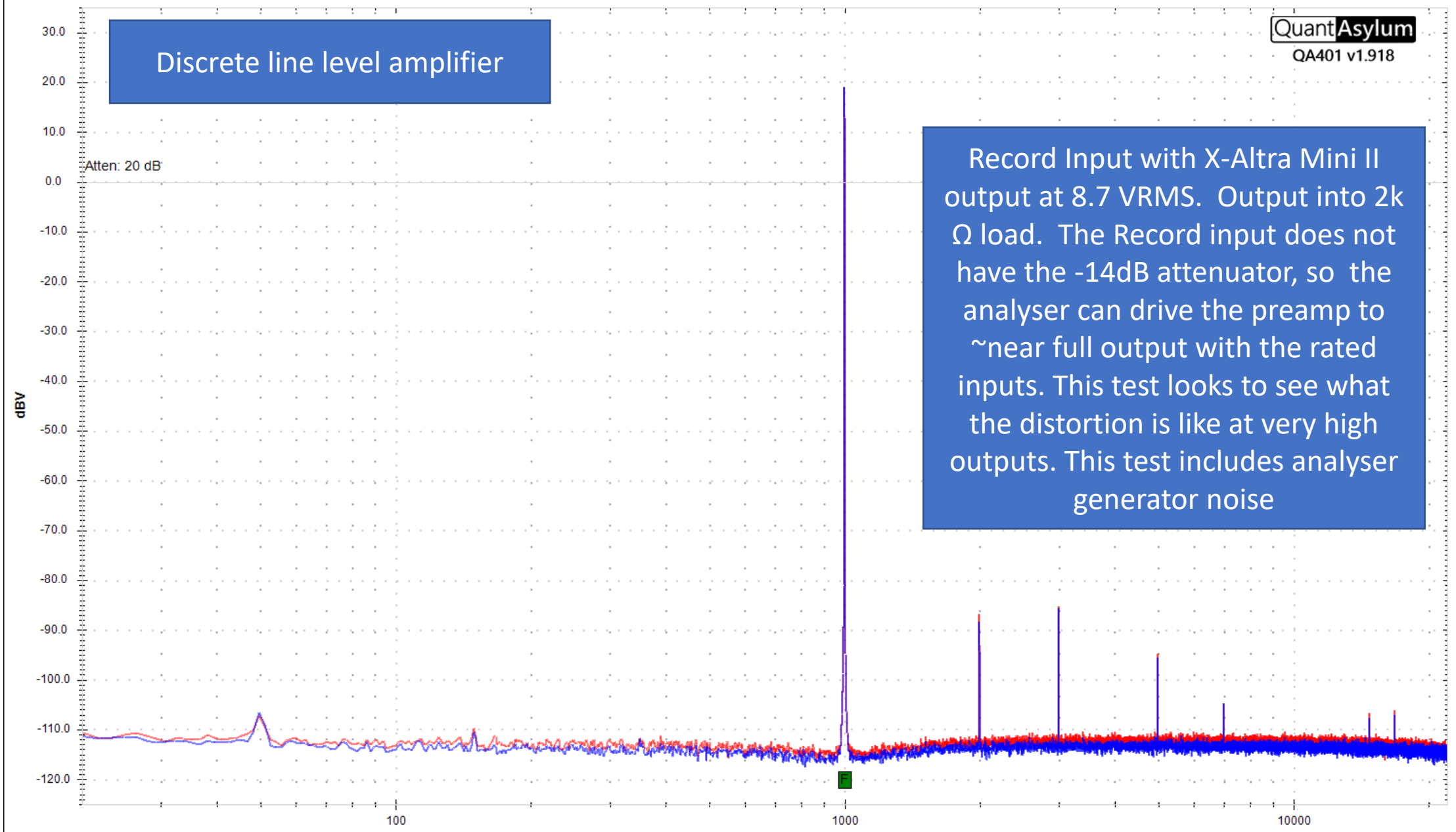
Gen 1: 1.000488 KHz @ 5.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

Phase L: 5.36 deg
Delay L: -3.8 uSec
Delay R: -3.7 uSec
Gain L: 13.85 dB
Gain R: 13.85 dB

QuantAsylum
QA401 v1.918

Discrete line level amplifier

Record Input with X-Altra Mini II output at 8.7 VRMS. Output into 2k Ω load. The Record input does not have the -14dB attenuator, so the analyser can drive the preamp to ~near full output with the rated inputs. This test looks to see what the distortion is like at very high outputs. This test includes analyser generator noise



FFT: 32k
Avg: 47 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

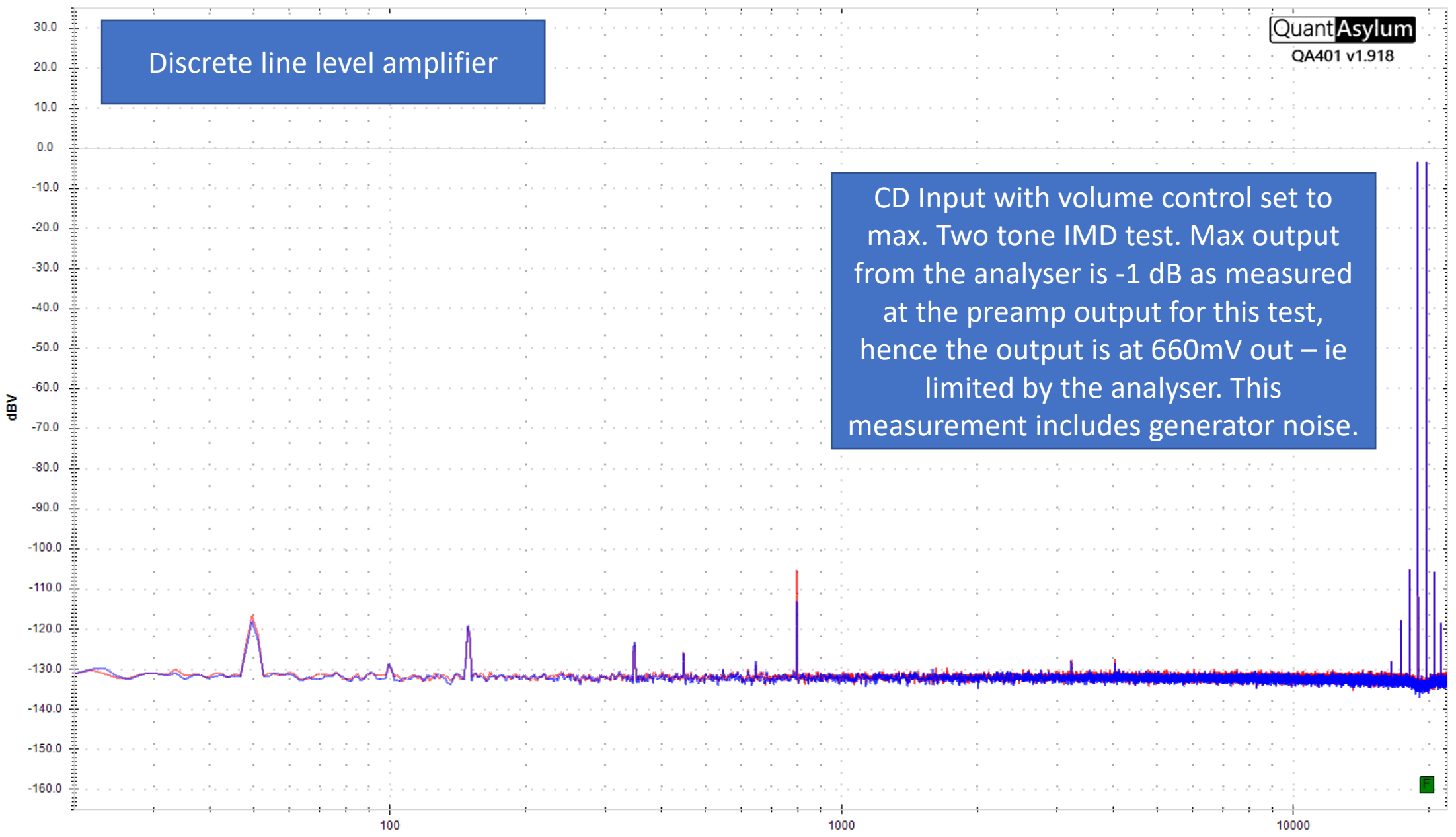
Peak L: -3.60 dBV
Peak R: -3.59 dBV
Peak L: 660.3 mVrms
Peak R: 661.0 mVrms
THD L: $-\infty$ dB/ 0.00000%
THD R: $-\infty$ dB/ 0.00000%

Gen 1: 19.80029 KHz @ -1.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

QuantAsylum
QA401 v1.918

Discrete line level amplifier

CD Input with volume control set to max. Two tone IMD test. Max output from the analyser is -1 dB as measured at the preamp output for this test, hence the output is at 660mV out – ie limited by the analyser. This measurement includes generator noise.



FFT: 32k
Avg: 28 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

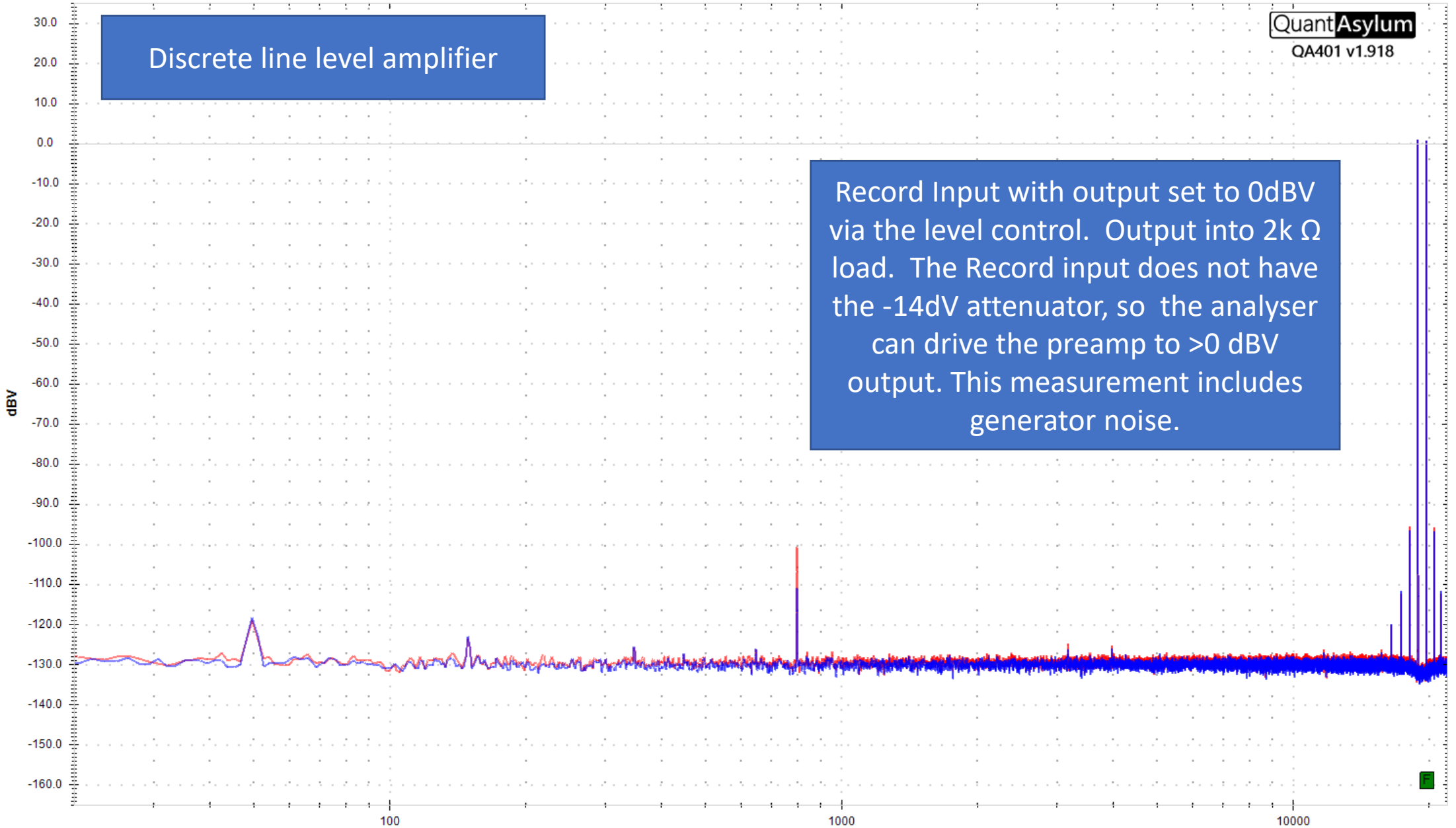
Peak L: 0.70 dBV
Peak R: 0.70 dBV
Peak L: 1.084 Vrms
Peak R: 1.083 Vrms
THD L: $-\infty$ dB/ 0.00000%
THD R: $-\infty$ dB/ 0.00000%

Gen 1: 19.80029 KHz @ -1.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

QuantAsylum
QA401 v1.918

Discrete line level amplifier

Record Input with output set to 0dBV via the level control. Output into 2k Ω load. The Record input does not have the -14dB attenuator, so the analyser can drive the preamp to >0 dBV output. This measurement includes generator noise.

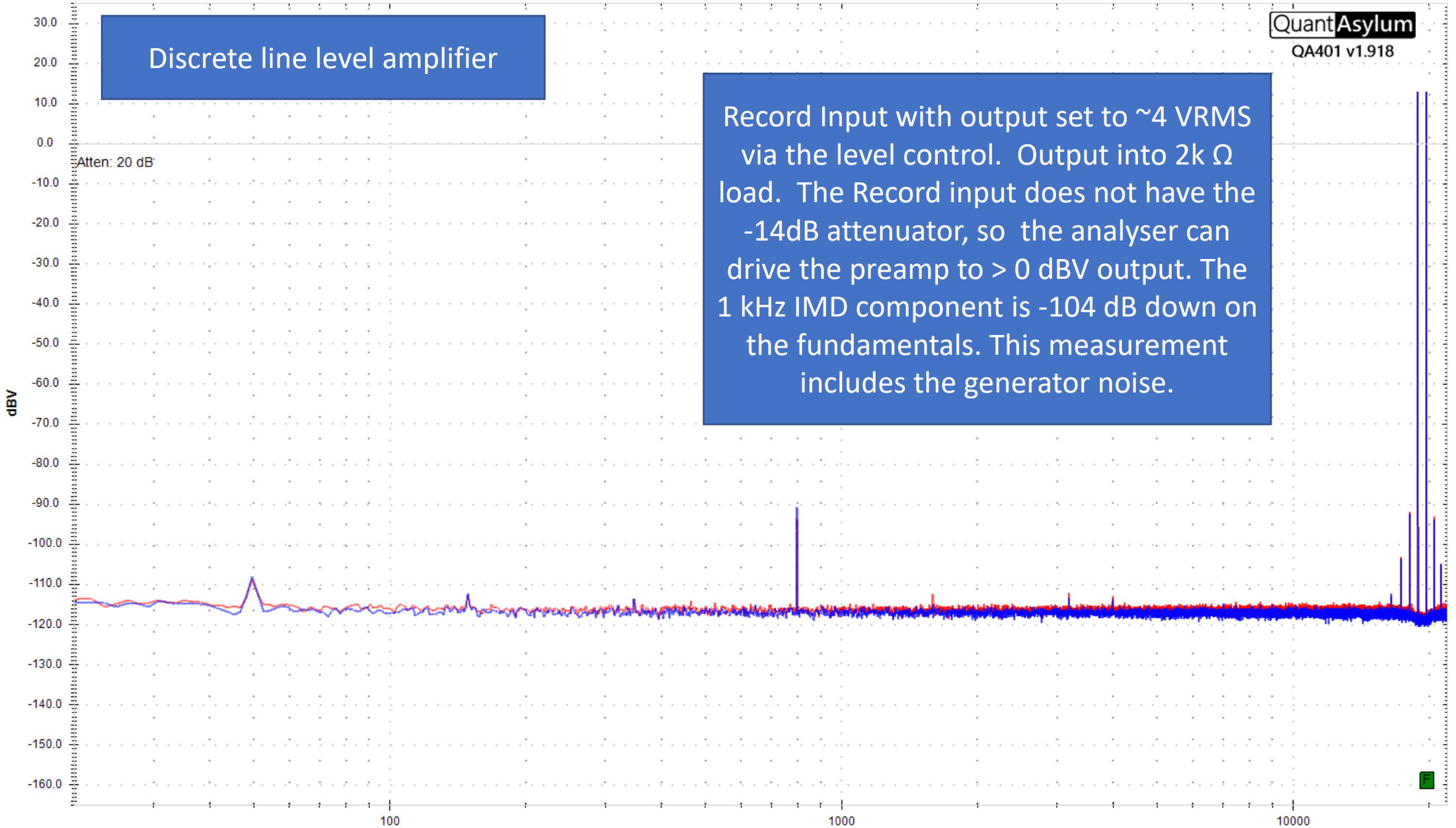


FFT: 32k Meas Start: 20.0 Hz Peak L: 12.69 dBV Gen 1: 19.80029 KHz @ -1.0 dBV
Avg: 49 of 49 Meas Stop: 20.0 KHz Peak R: 12.68 dBV Gen 2: 19.00048 KHz @ -1.0 dBV
Res: 1.46 Hz Peak L: 4.311 Vrms
Fs: 48.0 KHz Peak R: 4.307 Vrms
Win: Hann THD L: -∞ dB/ 0.00000%
Weight: None THD R: -∞ dB/ 0.00000%

Discrete line level amplifier

QuantAsylum
QA401 v1.918

Record Input with output set to ~4 VRMS via the level control. Output into 2k Ω load. The Record input does not have the -14dB attenuator, so the analyser can drive the preamp to > 0 dBV output. The 1 kHz IMD component is -104 dB down on the fundamentals. This measurement includes the generator noise.



FFT: 32k
Avg: 25 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

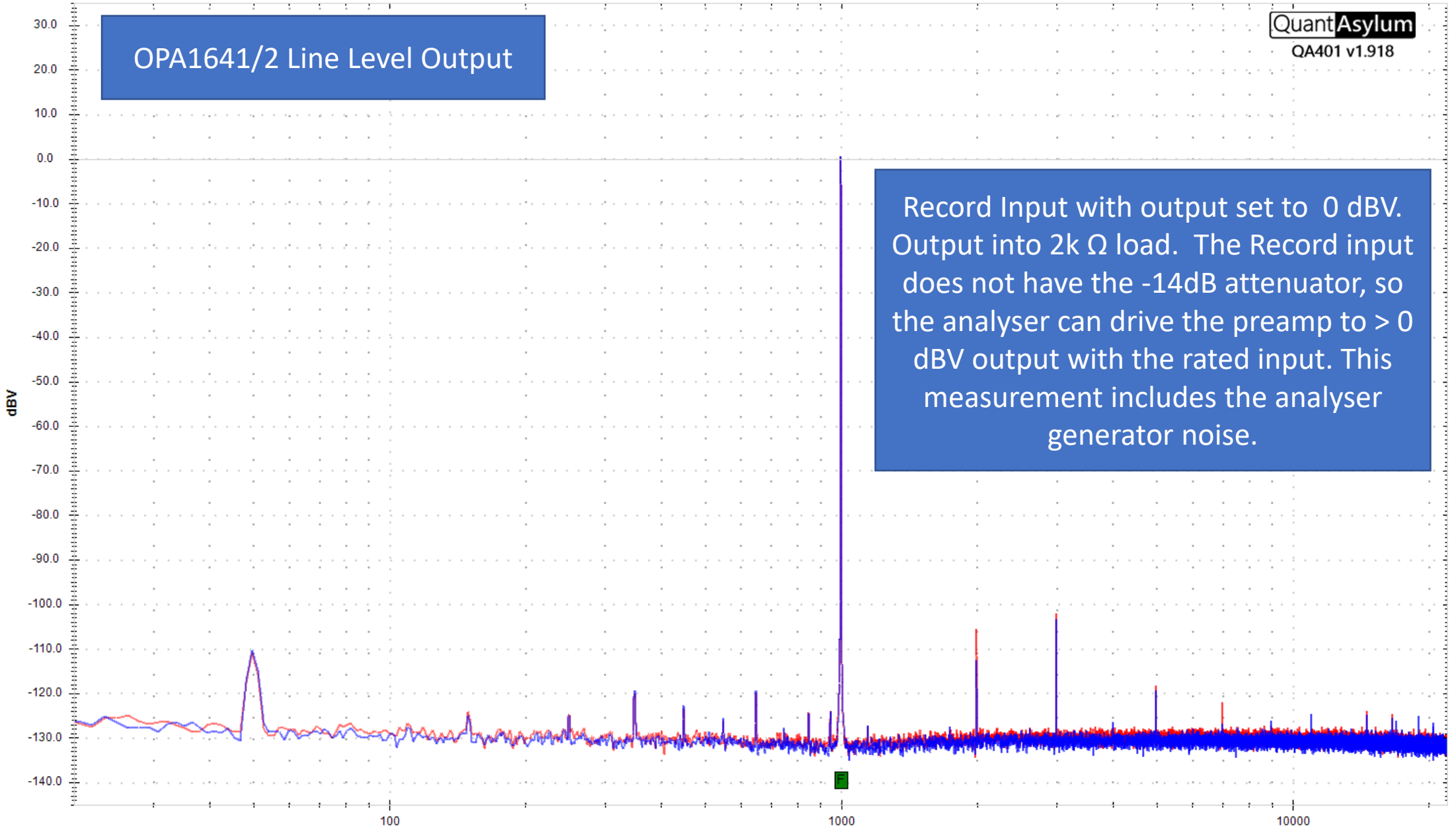
Peak L: 0.43 dBV
Peak R: 1.050 Vrms
THD L: -103.1 dB/ 0.00070%
THD R: -100.9 dB/ 0.00090%

Gen 1: 1.000488 KHz @ -13.5 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

Phase L: 4.96 deg
Delay L: -2.7 uSec
Gain L: 13.94 dB
Gain R: 13.94 dB

QuantAsylum
QA401 v1.918

OPA1641/2 Line Level Output



Record Input with output set to 0 dBV. Output into 2k Ω load. The Record input does not have the -14dB attenuator, so the analyser can drive the preamp to > 0 dBV output with the rated input. This measurement includes the analyser generator noise.

FFT: 32k
Avg: 38 of 49
Res: 1.46 Hz
Fs: 48.0 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz

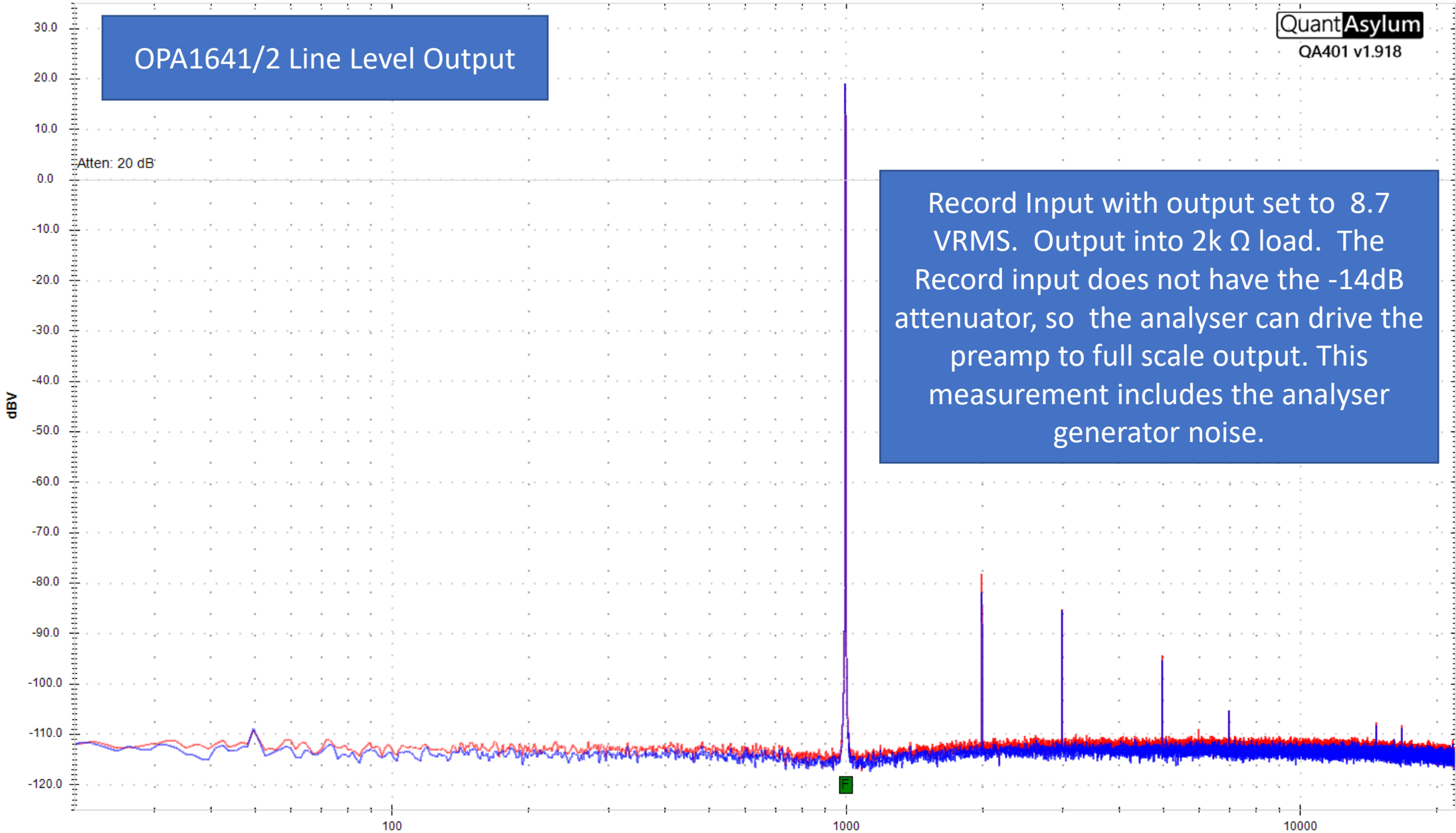
Peak L: 18.85 dBV
Peak R: 18.86 dBV
Peak L: 8.762 Vrms
Peak R: 8.768 Vrms
THD L: -99.1 dB/ 0.00110%
THD R: -96.2 dB/ 0.00155%

Gen 1: 1.000488 KHz @ 5.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

Phase L: 4.94 deg
Delay L: -2.6 uSec
Delay R: -2.6 uSec
Gain L: 13.86 dB
Gain R: 13.87 dB

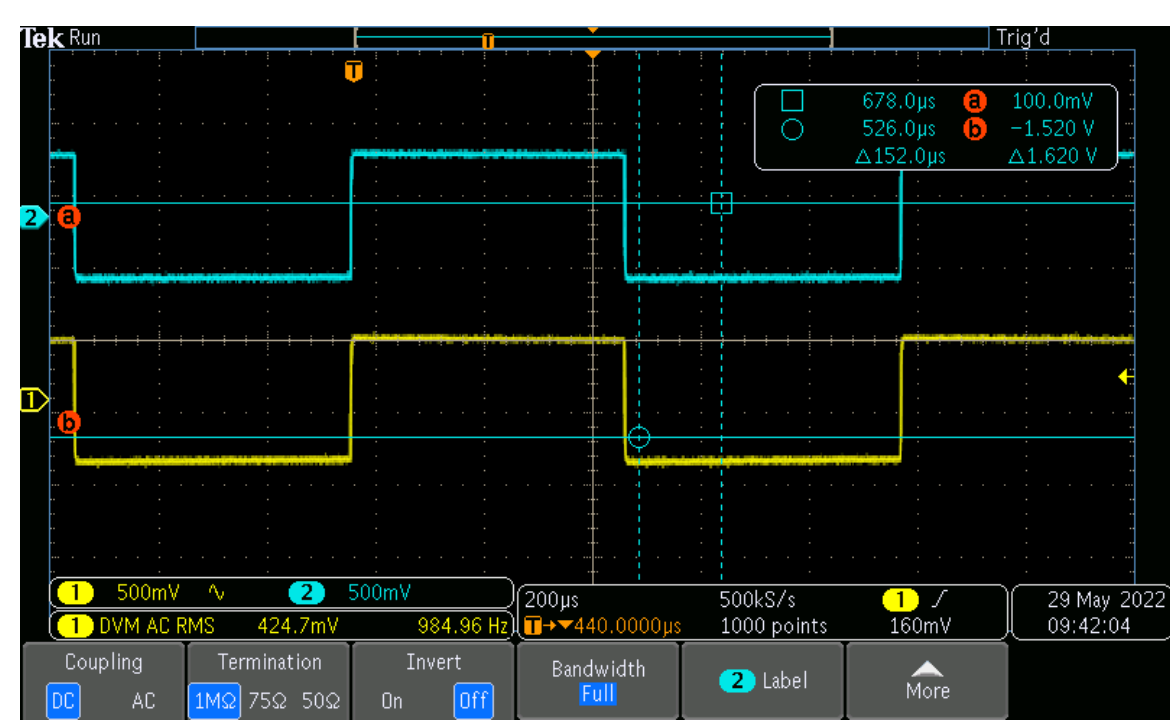
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QA401 v1.918

OPA1641/2 Line Level Output

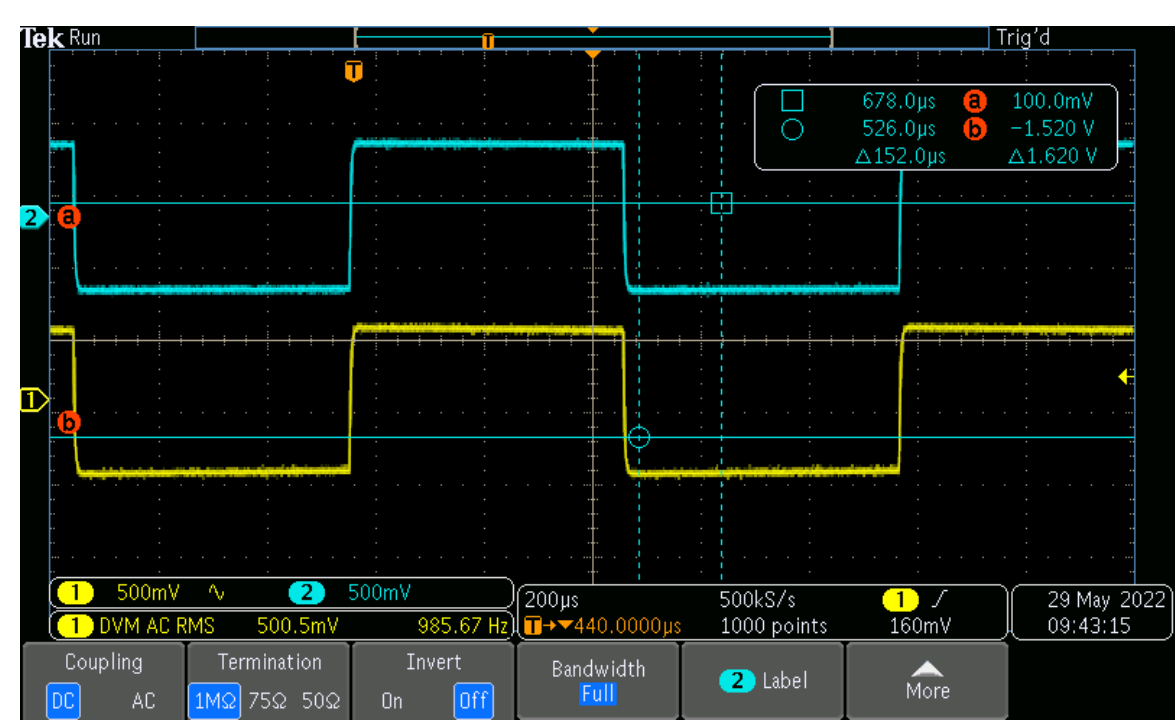


Record Input with output set to 8.7 VRMS. Output into 2k Ω load. The Record input does not have the -14dB attenuator, so the analyser can drive the preamp to full scale output. This measurement includes the analyser generator noise.

Atten: 20 dB



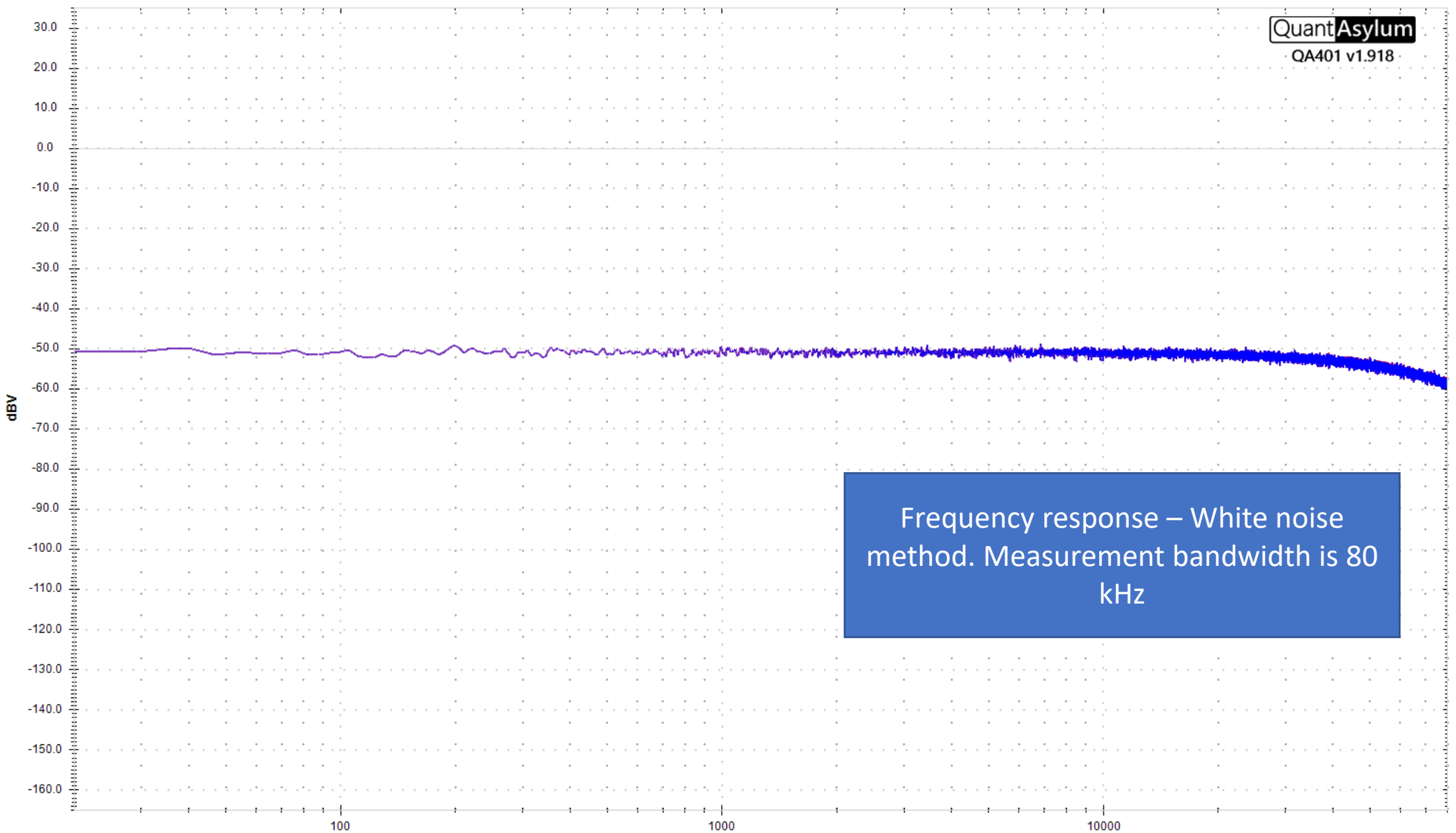
Preamp output with square wave injected into the Record input. There is no attenuator on the Record input



Preamp output with square wave injected into the CD input. There is a -14 dB attenuator on the CD input with $Z_{in} = 10k$ and $Z_o = c. 2k$

FFT: 32k Meas Start: 20.0 Hz Peak L: -49.04 dBV FR Gen: -40.0 dBV
Avg: 49 of 49 Meas Stop: 20.0 KHz Peak R: -49.03 dBV
Res: 5.85 Hz Peak L: 3.532 mVrms
Fs: 192 KHz Peak R: 3.534 mVrms
Win: Hann
Weight: None

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QA401 v1.918



Frequency response – White noise method. Measurement bandwidth is 80 kHz

FFT: 32k
Avg: 49 of 49
Res: 5.85 Hz
Fs: 192 KHz
Win: Hann
Weight: None

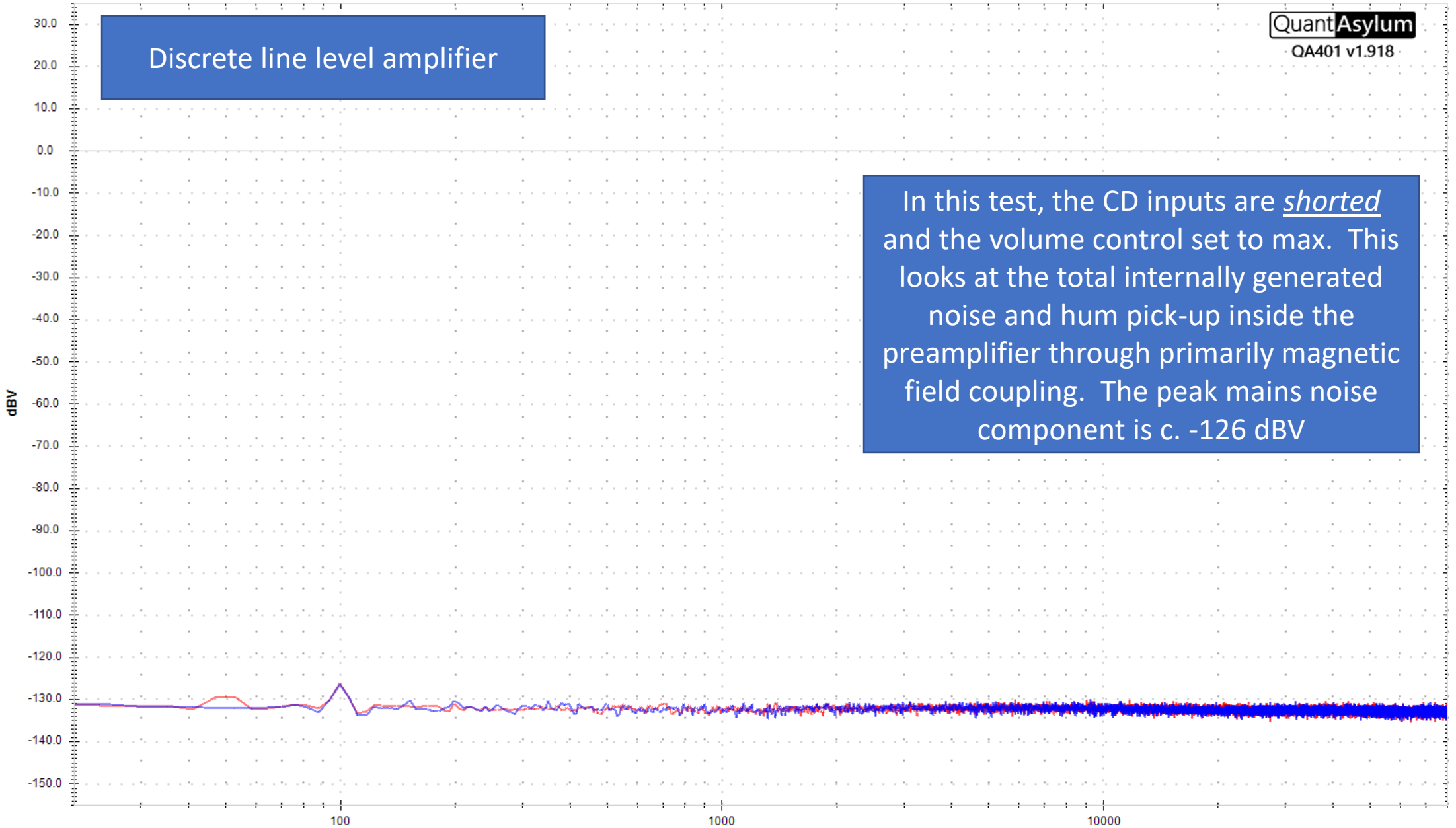
Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz
RMS L: 11.4 uV
RMS R: 11.5 uV

Peak L: -124.89 dBV
Peak R: -115.28 dBV
Peak L: 569.2 nVrms
Peak R: 1.722 uVrms

Gen 1: 1.001953 KHz @ 5.0 dBV
Gen 2: 19.00195 KHz @ -1.0 dBV

QuantAsylum
QA401 v1.918

Discrete line level amplifier



In this test, the CD inputs are shorted and the volume control set to max. This looks at the total internally generated noise and hum pick-up inside the preamplifier through primarily magnetic field coupling. The peak mains noise component is c. -126 dBV

FFT: 32k
Avg: 49 of 49
Res: 5.85 Hz
Fs: 192 KHz
Win: Hann
Weight: None

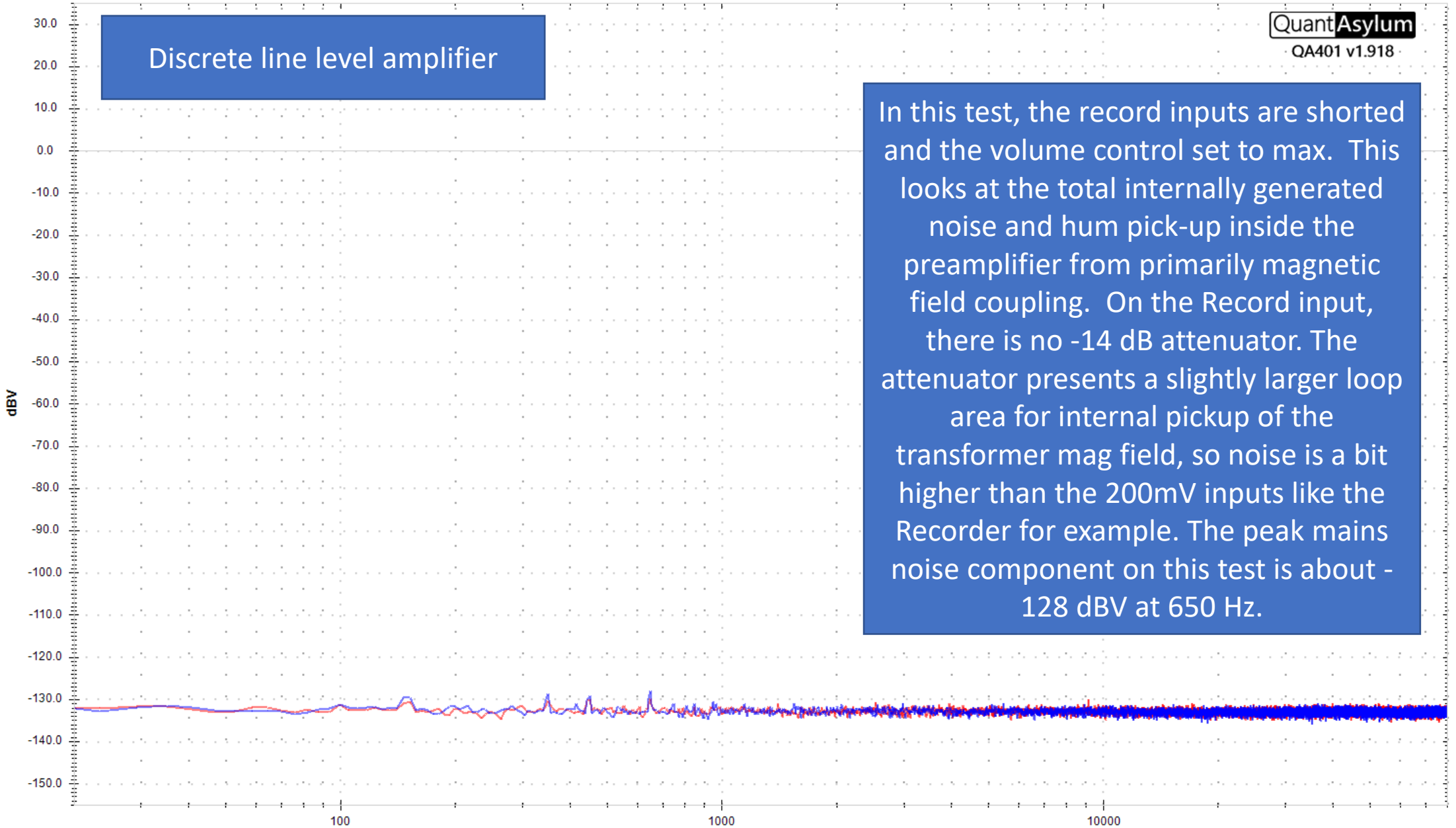
Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz
RMS L: 10.6 uV
RMS R: 10.7 uV

Peak L: -119.48 dBV
Peak R: -107.04 dBV
Peak L: 1.061 uVrms
Peak R: 4.446 uVrms

Gen 1: 1.001953 KHz @ 5.0 dBV
Gen 2: 19.00195 KHz @ -1.0 dBV

QuantAsylum
QA401 v1.918

Discrete line level amplifier



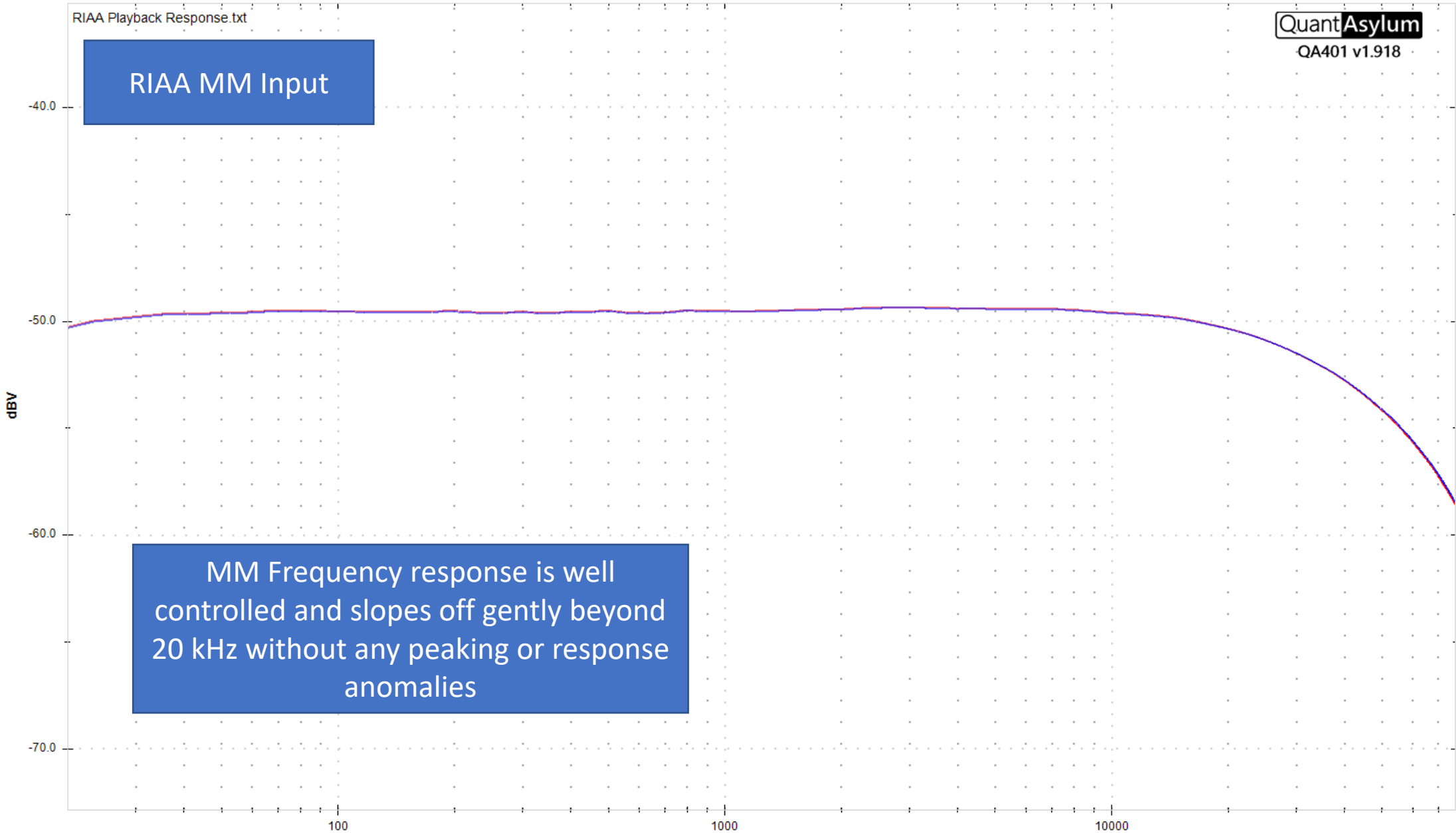
In this test, the record inputs are shorted and the volume control set to max. This looks at the total internally generated noise and hum pick-up inside the preamplifier from primarily magnetic field coupling. On the Record input, there is no -14 dB attenuator. The attenuator presents a slightly larger loop area for internal pickup of the transformer mag field, so noise is a bit higher than the 200mV inputs like the Recorder for example. The peak mains noise component on this test is about -128 dBV at 650 Hz.

FFT: 32k Meas Start: 20.0 Hz Peak L: -49.42 dBV FR Gen: 0.0 dBV
Avg: 49 of 49 Meas Stop: 20.0 KHz Peak R: -49.39 dBV
Res: 5.85 Hz Peak L: 3.382 mVrms
Fs: 192 KHz Peak R: 3.394 mVrms
Win: Hann
Weight: User

RIAA Playback Response.txt

QuantAsylum
QA401 v1.918

RIAA MM Input



MM Frequency response is well controlled and slopes off gently beyond 20 kHz without any peaking or response anomalies

FFT: 128k
Avg: 40 of 49
Res: 1.46 Hz
Fs: 192 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz
RMS L: 11.4 V
RMS R: 11.5 V

Peak L: 21.17 dBV
Peak R: 21.23 dBV
Peak L: 11.44 Vrms
Peak R: 11.52 Vrms

Gen 1: 1.000488 KHz @ -30.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

Phase L: -48.40 deg
Phase R: -48.45 deg
Delay L: 144 uSec
Delay R: 144 uSec
Gain L: 51.18 dB
Gain R: 51.24 dB

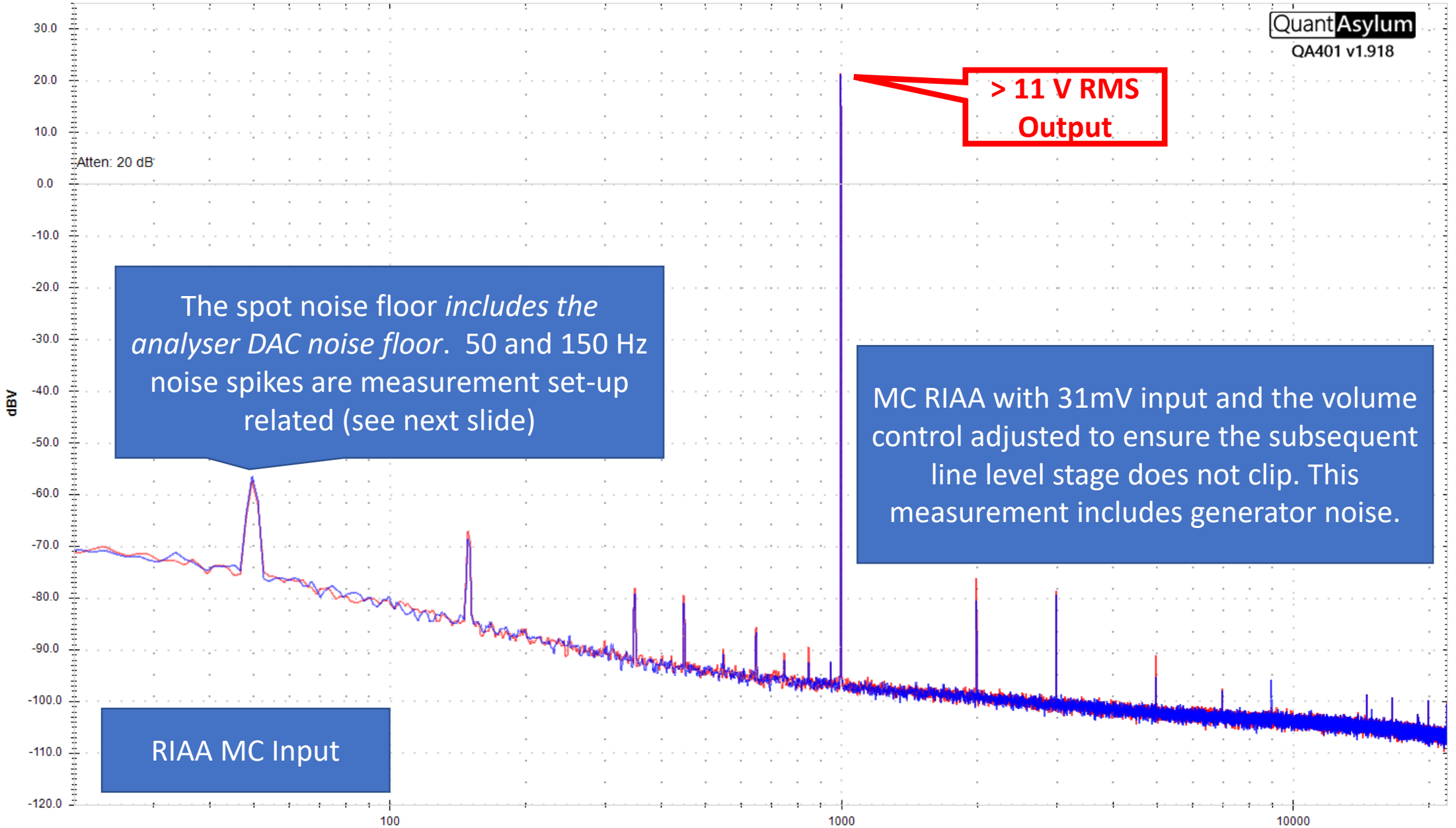
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> 11 V RMS
Output

The spot noise floor includes the analyser DAC noise floor. 50 and 150 Hz noise spikes are measurement set-up related (see next slide)

MC RIAA with 31mV input and the volume control adjusted to ensure the subsequent line level stage does not clip. This measurement includes generator noise.

RIAA MC Input



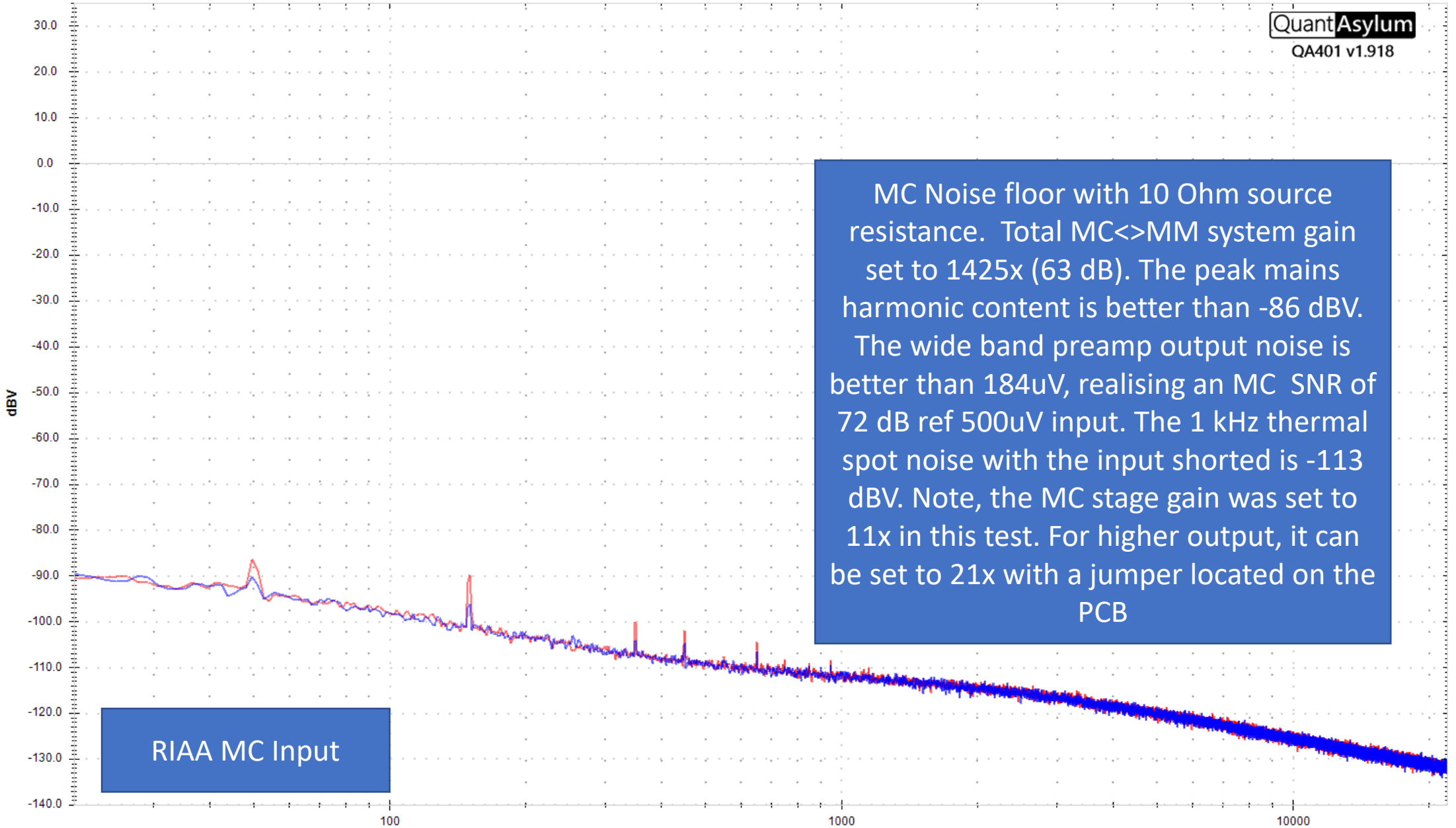
FFT: 128k
Avg: 49 of 49
Res: 1.46 Hz
Fs: 192 KHz
Win: Hann
Weight: None

Meas Start: 20.0 Hz
Meas Stop: 20.0 KHz
RMS L: 174 uV
RMS R: 183 uV

Peak L: -88.90 dBV
Peak R: -86.38 dBV
Peak L: 35.88 uVrms
Peak R: 47.94 uVrms

Gen 1: 1.000488 KHz @ -30.0 dBV
Gen 2: 19.00048 KHz @ -1.0 dBV

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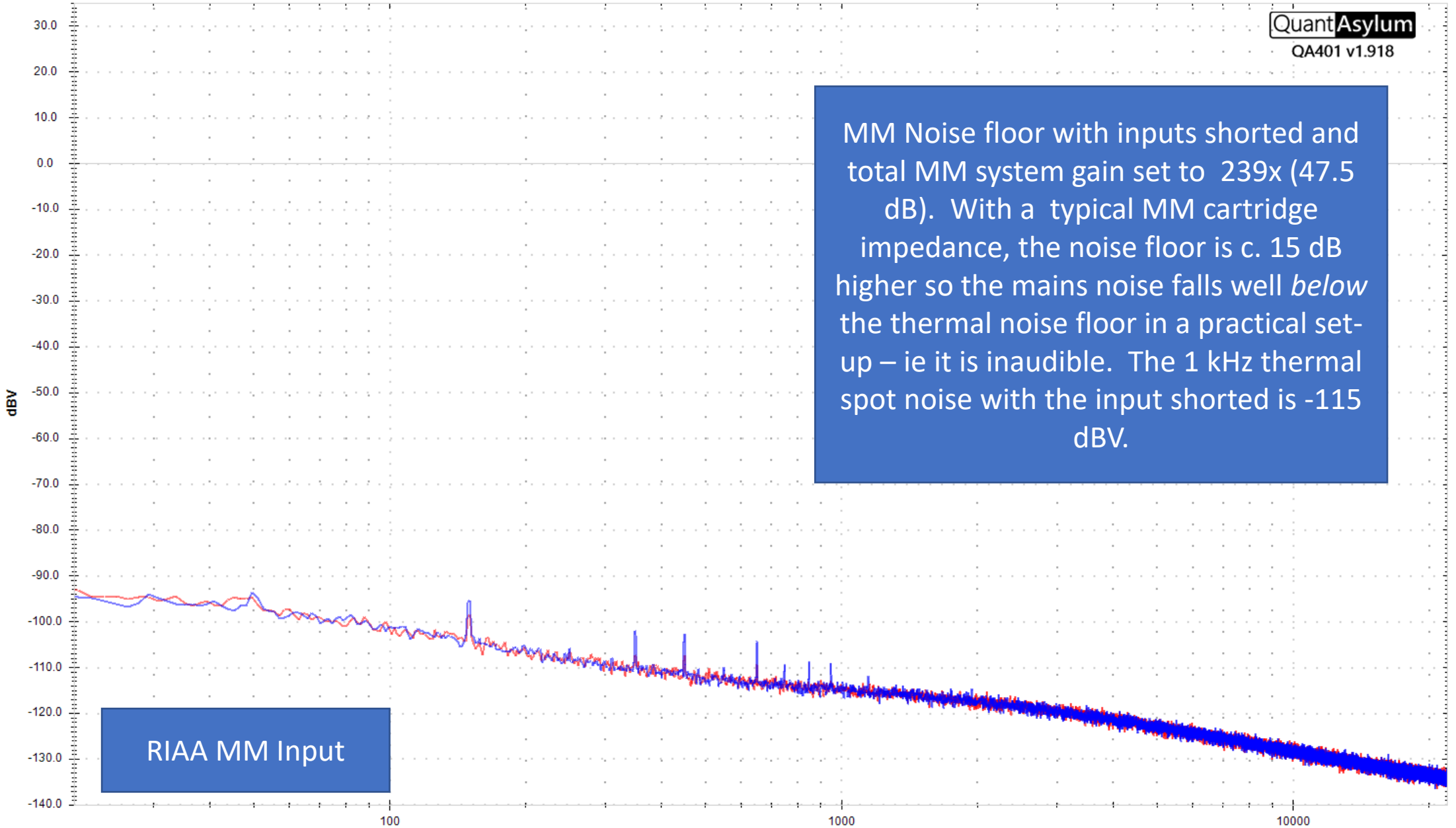
MC Noise floor with 10 Ohm source resistance. Total MC<>MM system gain set to 1425x (63 dB). The peak mains harmonic content is better than -86 dBV. The wide band preamp output noise is better than 184uV, realising an MC SNR of 72 dB ref 500uV input. The 1 kHz thermal spot noise with the input shorted is -113 dBV. Note, the MC stage gain was set to 11x in this test. For higher output, it can be set to 21x with a jumper located on the PCB

RIAA MC Input

FFT: 128k Meas Start: 20.0 Hz Peak L: -92.77 dBV Gen 1: 1.000488 KHz @ -30.0 dBV
Avg: 35 of 49 Meas Stop: 20.0 KHz Peak R: -92.89 dBV Gen 2: 19.00048 KHz @ -1.0 dBV
Res: 1.46 Hz RMS L: 120 uV Peak L: 22.98 uVrms
Fs: 192 KHz RMS R: 121 uV Peak R: 22.67 uVrms
Win: Hann
Weight: None

QuantAsylum
QA401 v1.918

MM Noise floor with inputs shorted and total MM system gain set to 239x (47.5 dB). With a typical MM cartridge impedance, the noise floor is c. 15 dB higher so the mains noise falls well *below* the thermal noise floor in a practical set-up – ie it is inaudible. The 1 kHz thermal spot noise with the input shorted is -115 dBV.



RIAA MM Input

*Part numbers for the
mounting hardware are
included in the BOM but
repeated on the following
slides for your
convenience*

Hifisonix

X-Altra Mini II Line Preamplifier

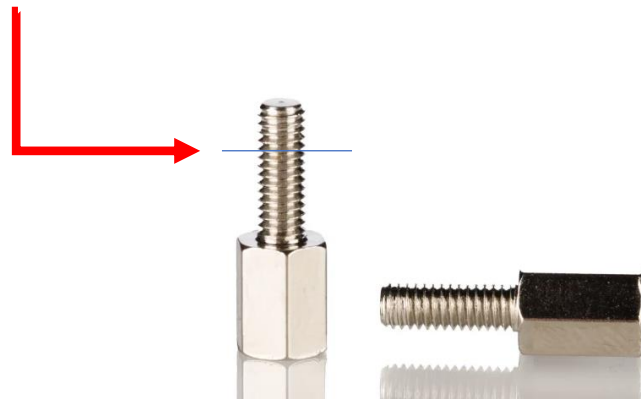
Mechanical and Assembly Notes

8th Nov 2022

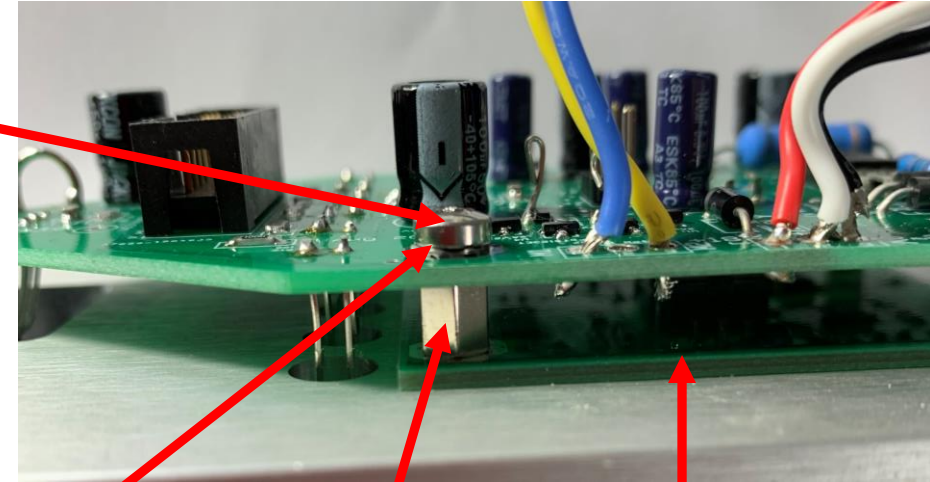
www.hifisonix.com

How to mount the Remote Control board to the front panel. If you are building a manual version of the preamp, see the next slide.

Attention: you will need to cut the bottom 3mm off the male thread on the hex brass stand-offs – as supplied they are too long and the standoff will not seat flush onto the Volume control Mounting board. I just used a pair of side cutters, but you can also saw it or file it down. Put a M3 nut fully on before this operation so that when you subsequently remove it, it de-burrs the thread. All PCB's are 1.6mm thick



4 off M3 x 6mm
Posidrive
machine screw

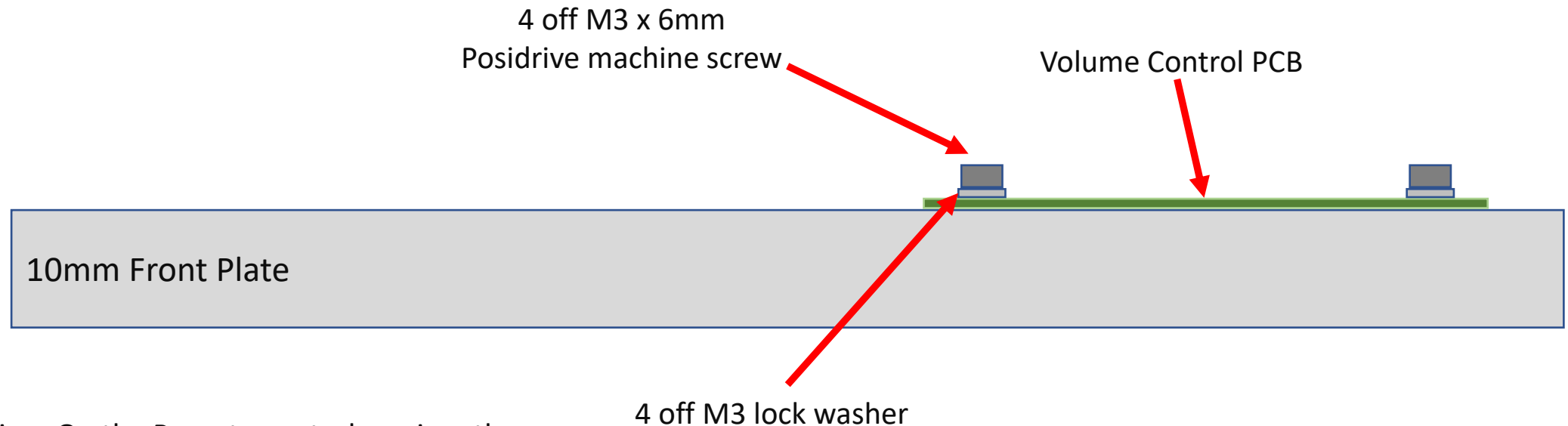


4 off M3 lock washer

4 off 6mm female to male
hex brass stand-off RS part
number 221-128

Volume Control Mtg PCB (used to
mount volume control and input
select or Remote Control Board) -
you need 2 to build a preamp

How to mount the Volume Control Mounting boards (one is used to mount the volume control and one is used for the input select switch or the Remote control Board)



Attention: On the Remote control version, the machine screws are replaced with 6mm hex brass stand-offs per the previous slide on the left hand side of the front panel (looking from the front).

You need 2 off volume control mounting boards to build the preamp. One is used to mount volume control and the other the input select or Remote Control Board

How to Mount the Headphone Socket to the Front Plate

2 off M3 x 5mm
Posidrive machine screw +
2 off M3 lock washer



To cover the wiring to the
socket, use 30mm heat
shrink as shown.

Attention: the headphone socket mounting
nut must be ordered separately. The Mouser
Pt# is NRJ-NUT-MS.

The Headphone socket Pt# is Mouser 568-
NRJ3HF-1

The headphone socket mounting PCB is
provided with the PCB set when you order
the PCB's from Hifisonix

When correctly mounted, the nose of the
headphone socket must stand c. 1mm
(1/25") proud of the front panel. This
ensures the headphone Jack plug can never
scrape against the front panel

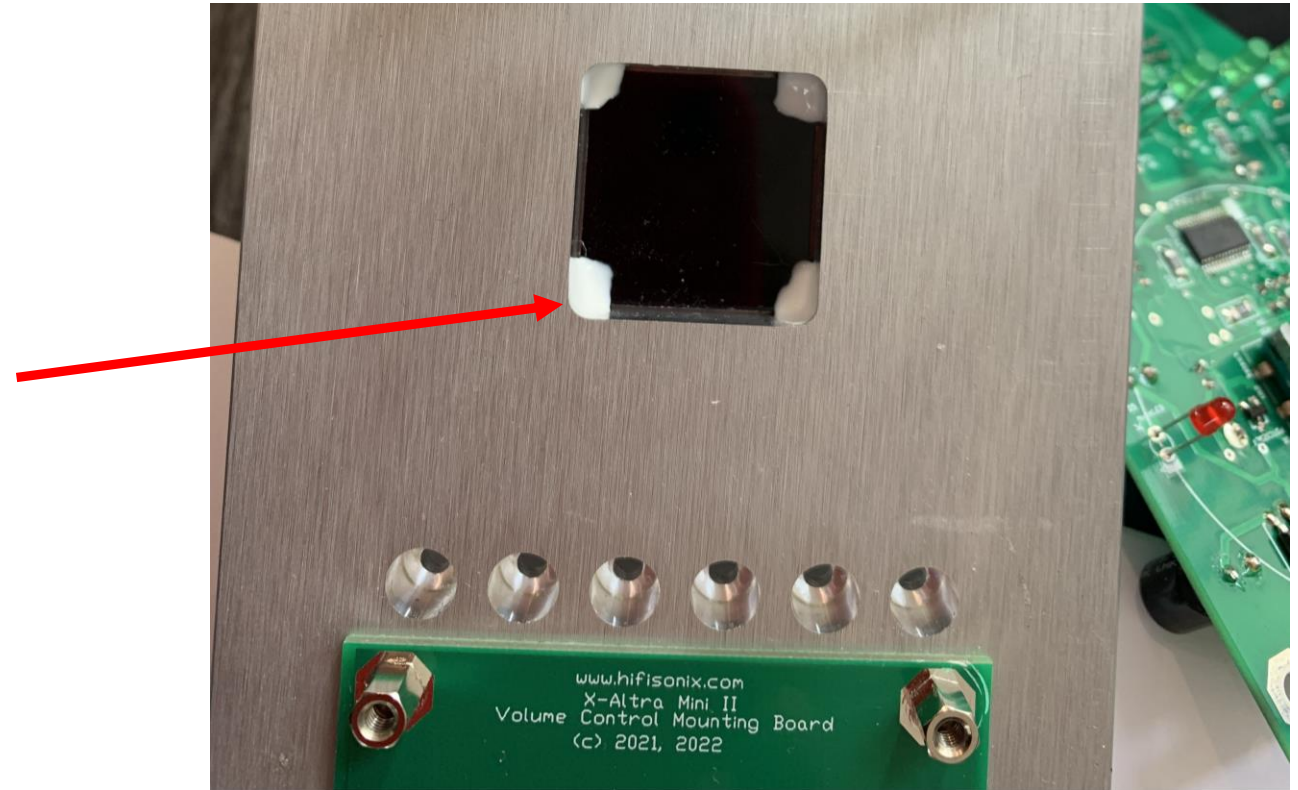
How to Mount the IR Plexiglas Window (Remote Control Version Only)

Press the window into the cavity from the rear.
Make sure it is fully seated – the front of the window will sit about 1mm back from the front of the faceplate.

Put 4 small drops of clear RTV or **viscous** adhesive in each corner.

Leave the front panel face down for a few hours to allow the adhesive to dry.

Do not use Gorilla glue or super glue. This type of adhesive will run out onto the front panel and completely ruin it!



Hifisonix
X-Altra Mini II Line Preamplifier

How to Wire-up your X-Altra Mini II

November 17 2022

www.hifisonix.com

Assembling your X-Altra Mini II Line Preamplifier

1. You will need 0.5mm² (20 AWG) multistrand silicone insulated wire with at least 7 or 8 different colours; a bag of 2.5mm wide cable ties; 4mm heat shrink to make off the screened cable – see next slide for some examples from Amazon
2. Test all the PCB's thoroughly . ***DO NOT begin mechanical assembly*** without fully testing of each and every board.
3. [Use the drilling template](#) to mark just one hole for each board from the drilling template and then use the actual PCB to mark off the remaining 3 mounting holes. Drill the holes out to 3.5mm and deburr.
4. The inter-module wiring up process will take place without the chassis side ears or top and bottom plates – just the base board and the front plate and rear panel sub-assemblies
5. First screw together the discrete line amplifier and the balanced line amplifier. The discrete line amplifier will go on the bottom and the balanced line amplifier on the top. Join the boards with 20mm female to male hex brass standoffs with the 10mm standoffs on the bottom side of the discrete line amplifier. The reason the balanced line amp is on top is it has quite a few connections going to it, so you want easy access to it later on in the wiring assembly process
6. Using 1mm tinned copper wire, solder the +, -, and 0V of the discrete line amplifier and the balanced line amplifier together. Do the same for the input side (the pins on each board line up over those of the other board). Next wire the mute relay connections together (so +12V to +12V and Mute to Mute) with short pieces of wire.
7. Now mount all the PCB's to the base board using 10mm hex female brass standoffs, M3 x 10mm machine screws and serrated washers.
8. Mount the input relay select board to the rear panel and assemble all the remaining connectors, Trigger socket, switched and fused mains IEC socket etc
9. Mount the input select board or the remote control board to the front panel; mount the headphone socket assembly
10. Mount the volume control board to the front panel and the volume control (usually an Alps RK27 and motorized if you are building the Remote Control version) – see the slide about mounting the Alps RK27 a bit further on
11. Place the front panel 100mm from the front edge of the baseboard face down so you have access to the PCB's mounted on it
12. Place the rear panel + input relay select assembly 100mm from the rear edge of the baseboard. See the next slide. You are now ready to start wiring up.
13. A lot of effort will go into tracking the module inter-wiring correctly to minimize loop areas in order to get the mains noise floor to at or below -128 dBV
14. In the slides that follow, we will step through the wiring process

Very important note: the wire connections to the front plate mounted PCB's and the rear panel + Input Relay select board must be long enough to stretch from the baseboard mounted PCB's – that's why they have to be placed and wired 100mm from the baseboard.



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18 AWG 30m £20.89	20 AWG 60m £17.09 prime	22 AWG 60m £14.49 prime	24 AWG 60m £13.19 prime	26 AWG 60m £12.34 prime
30 AWG 120m £12.77 (£0.21 / meter) prime				

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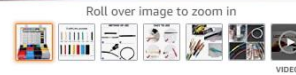
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100 x Female	100 x Female Insulated	100 x Male
--------------	------------------------	------------

Colour Name: Blue



Colour: Blue
 Gauge: 16.0
 Stud size: 6.3 month

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Dispatches from Amazon
 Sold by LED-Essential

Return policy: Returnable until Jan 31, 2023

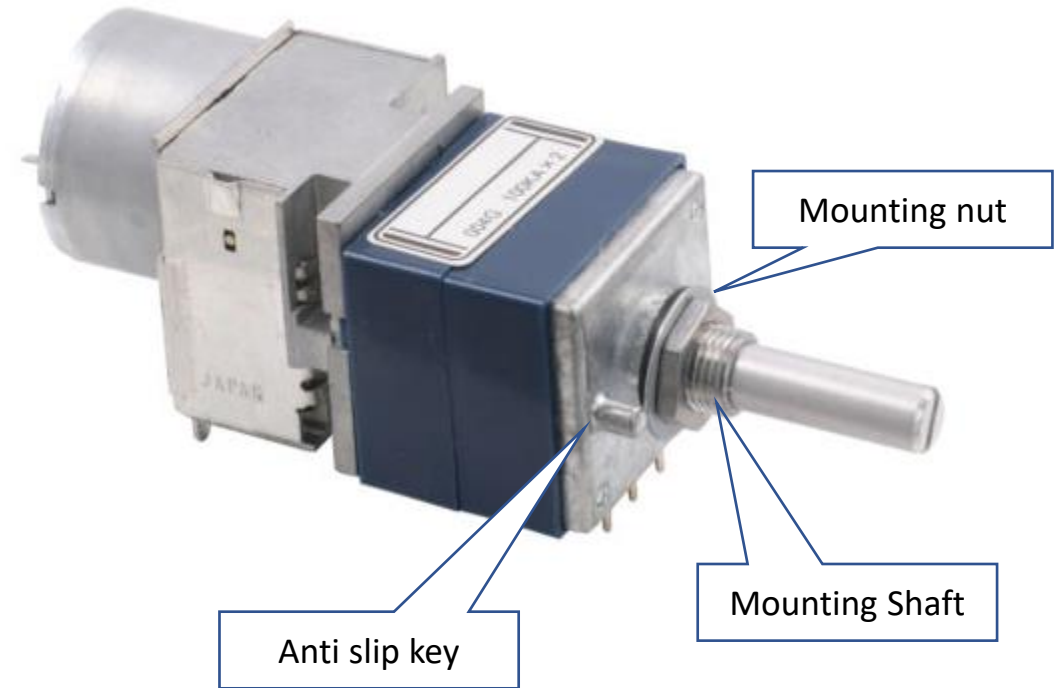
Add to List

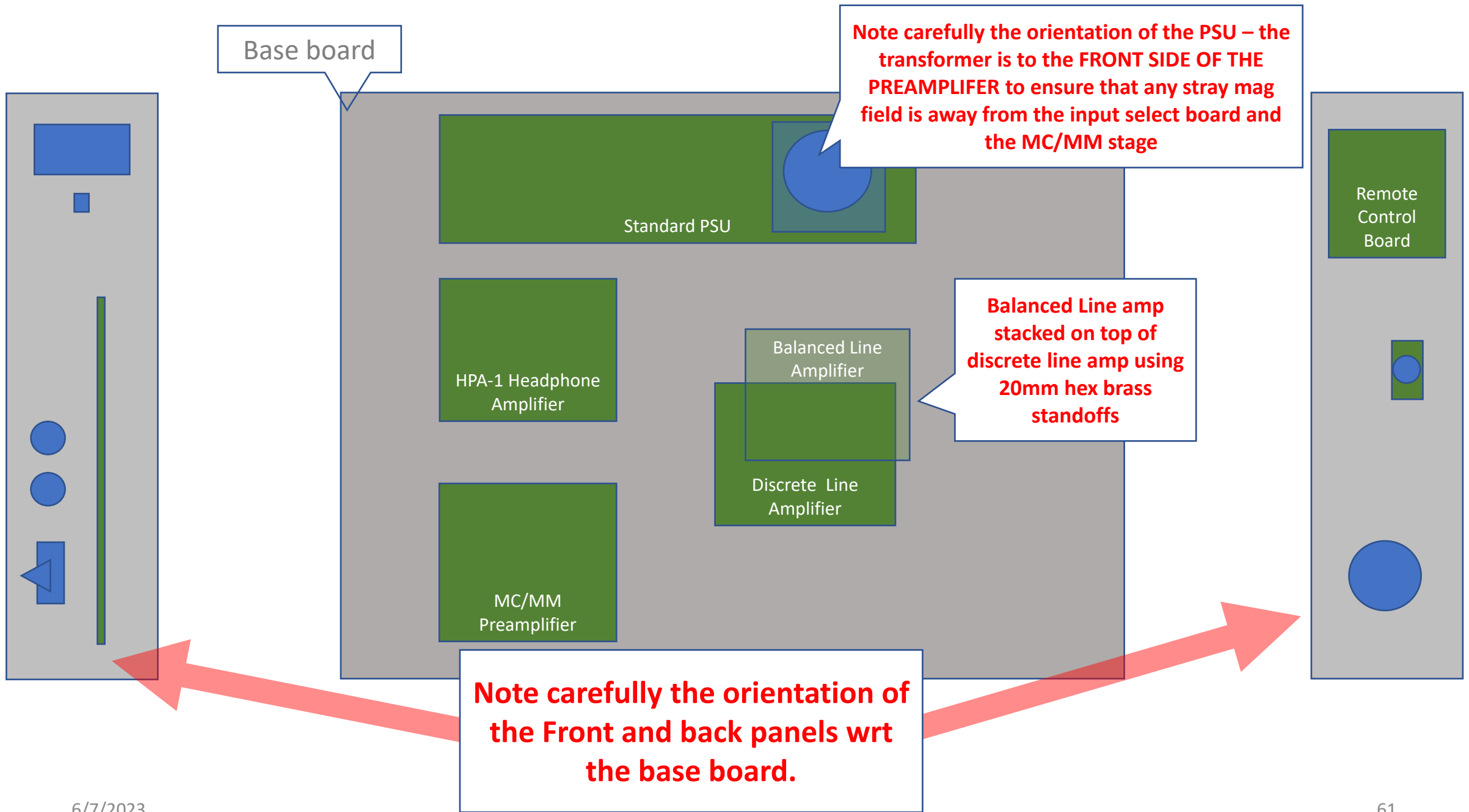
Attention: only use fully insulated spade connectors!

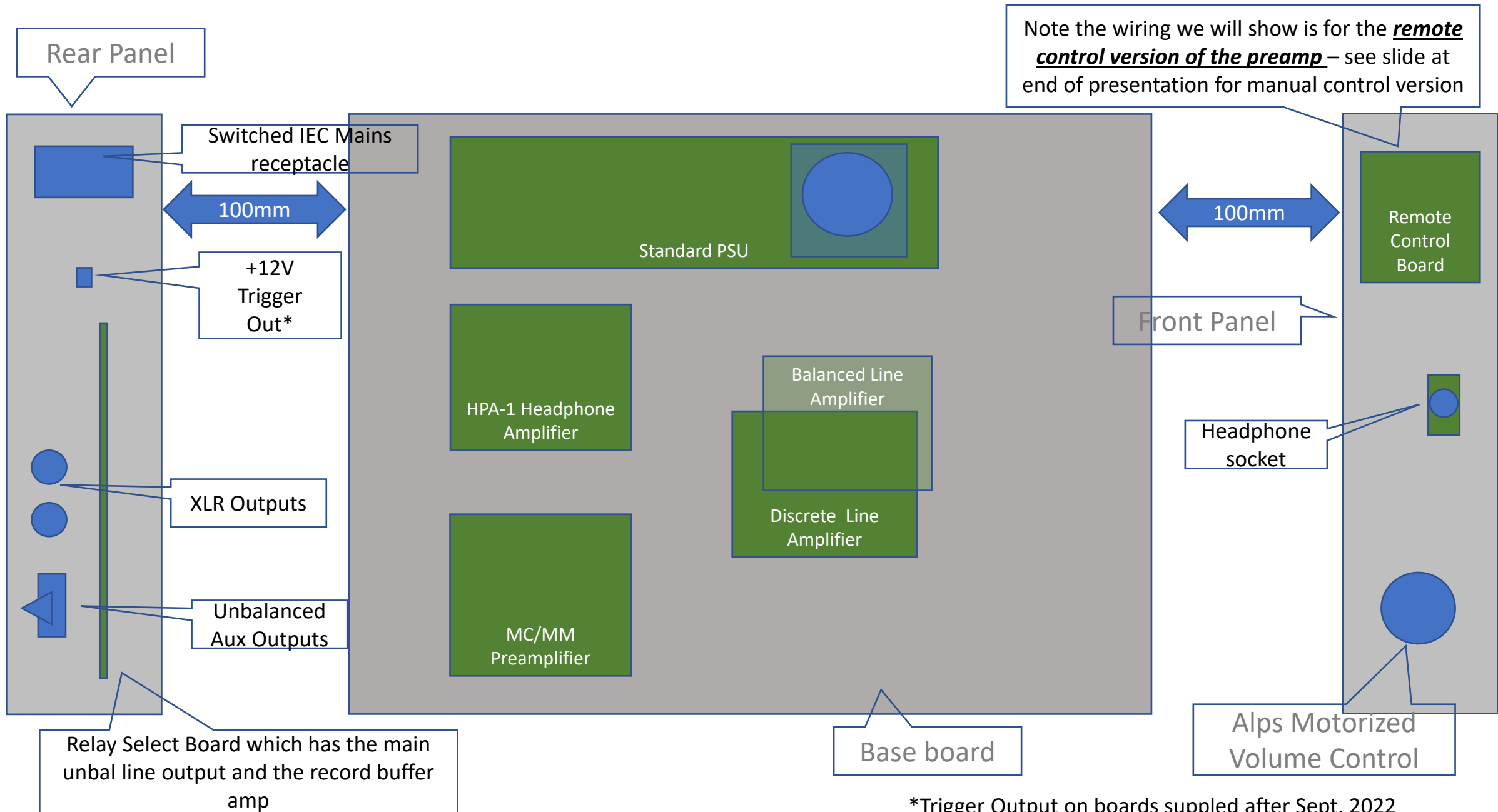
Examples of consumables required for wiring up the X-Altra Mini II from Amazon.

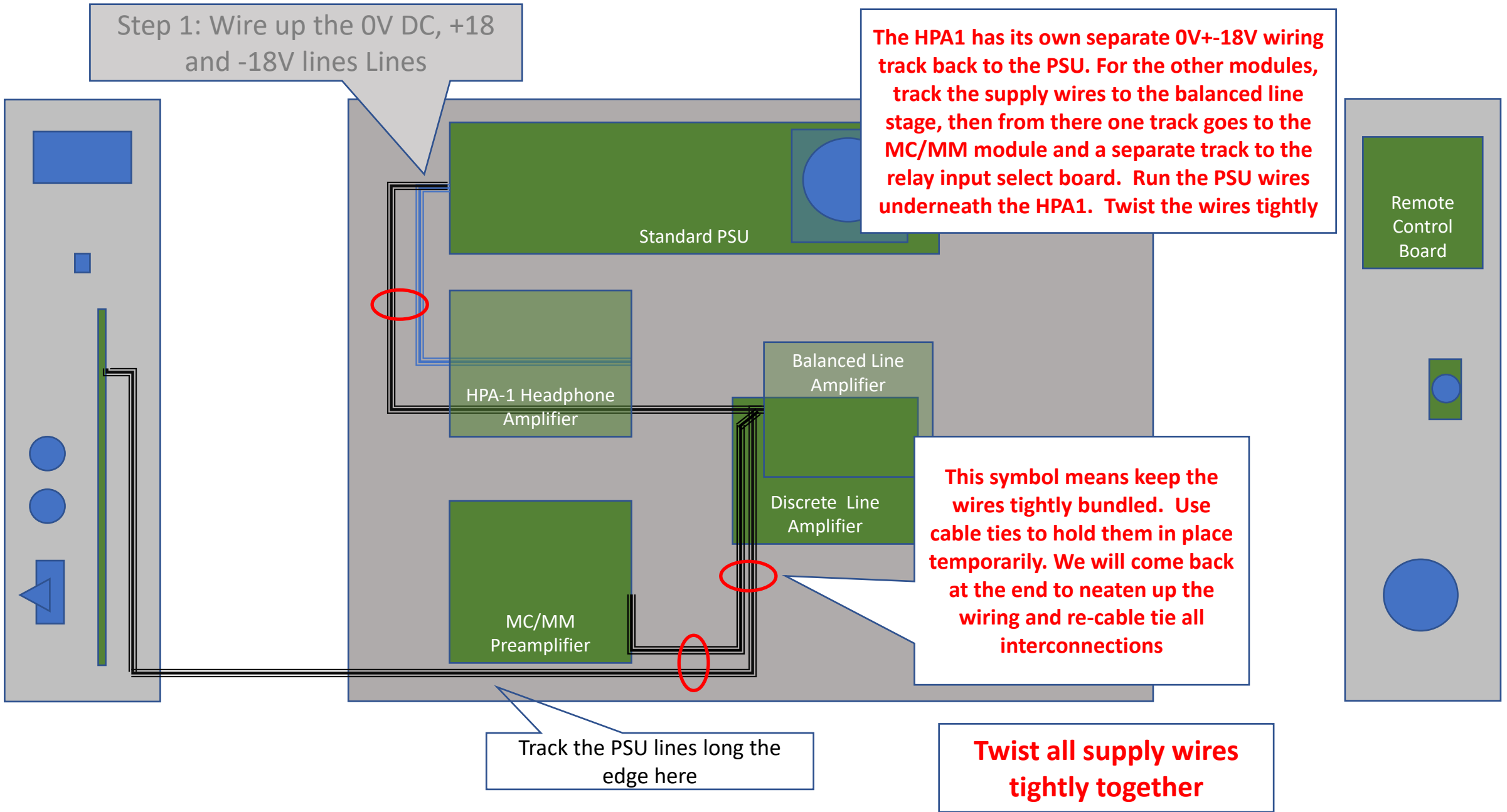
Mounting the Alps RK27 – important note

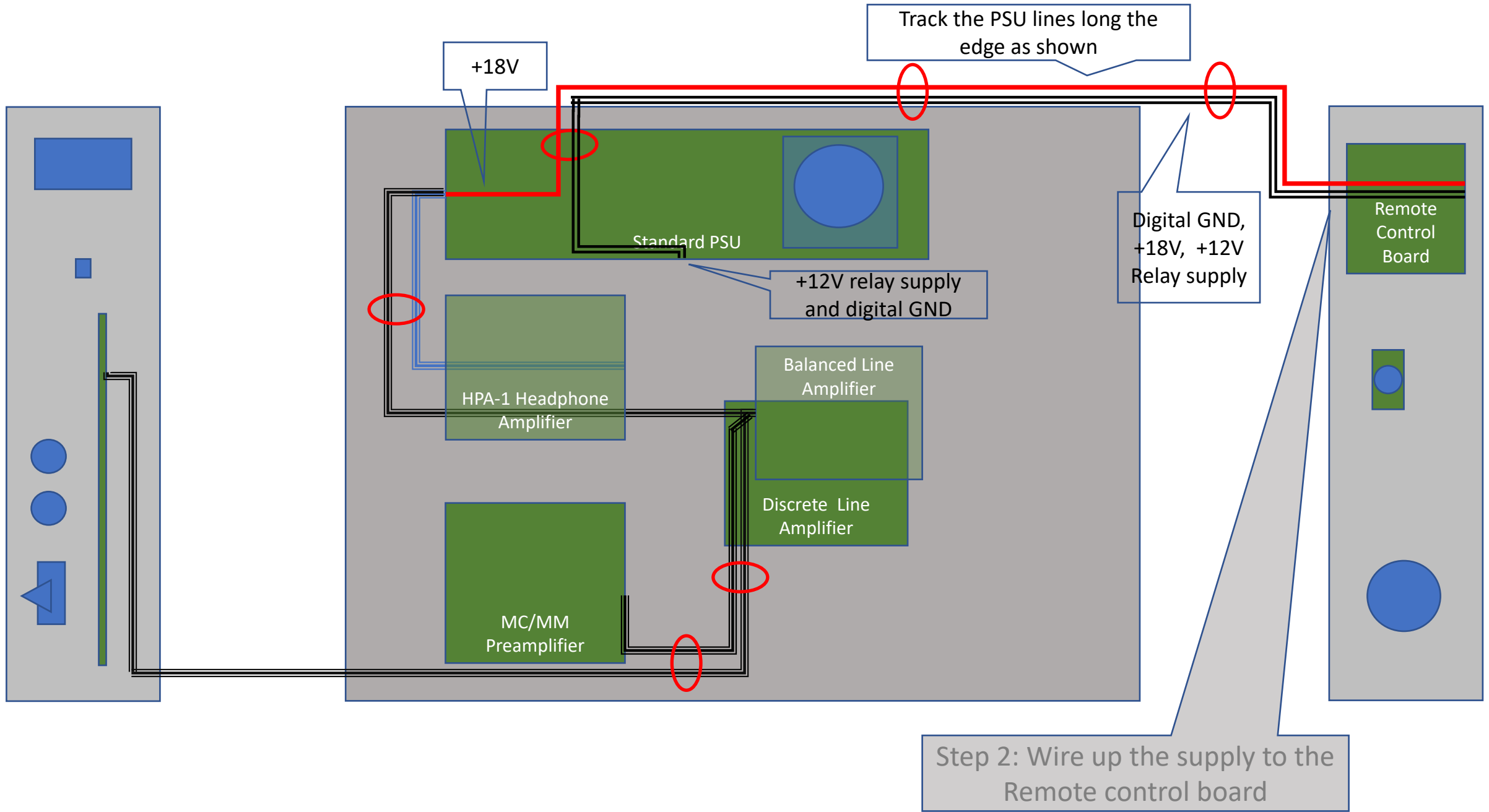
- If you overtighten the Alps mounting shaft nut, the motor will not be able to rotate the volume control wiper
- The mounting nut should be just *a little tighter than finger tight*.
- Once all debugging is completed, you can secure the mounting nut with a few dabs of *nail varnish* to it and the mounting shaft to ensure it does not come undone
- DO NOT use super glue or any other hard adhesive for this – you will not be able to undo the mounting nut if you have to remove the potentiometer for some reason in the future.

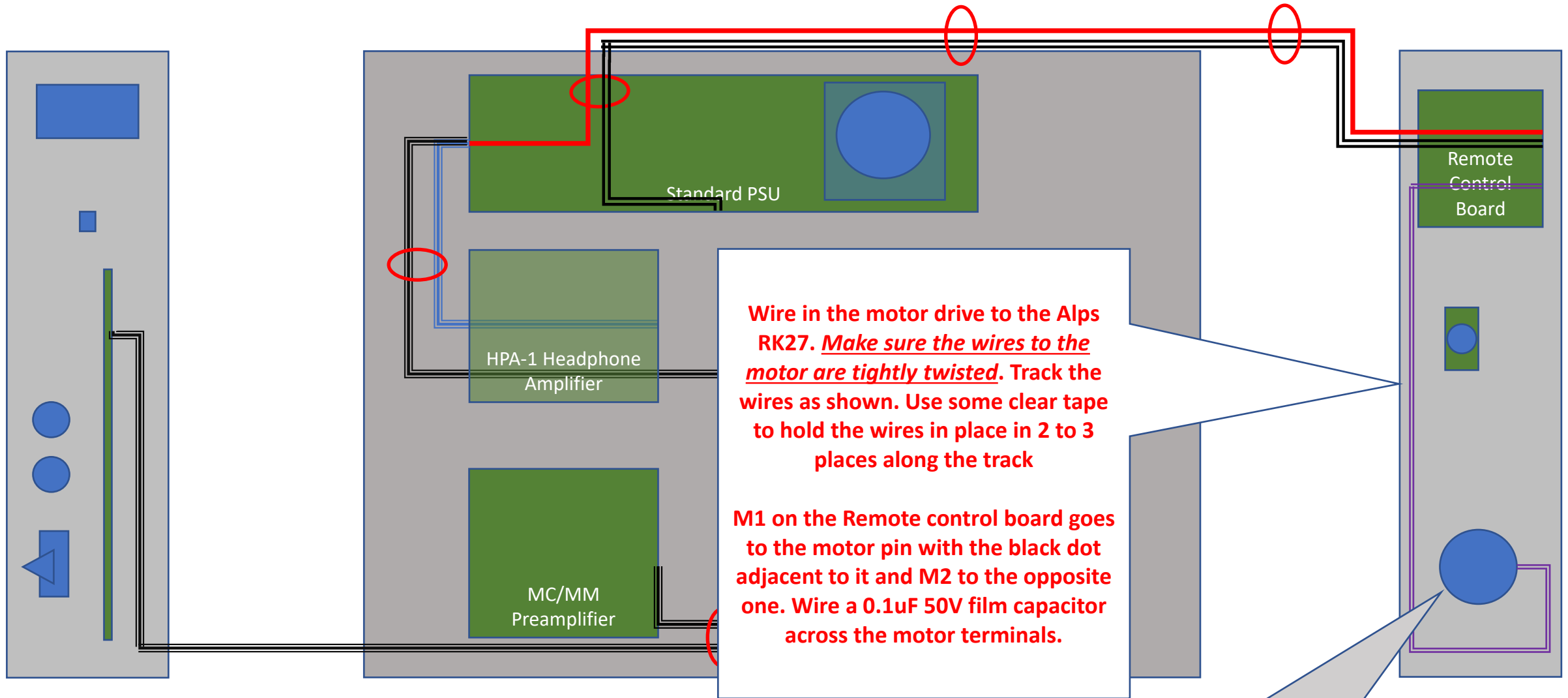










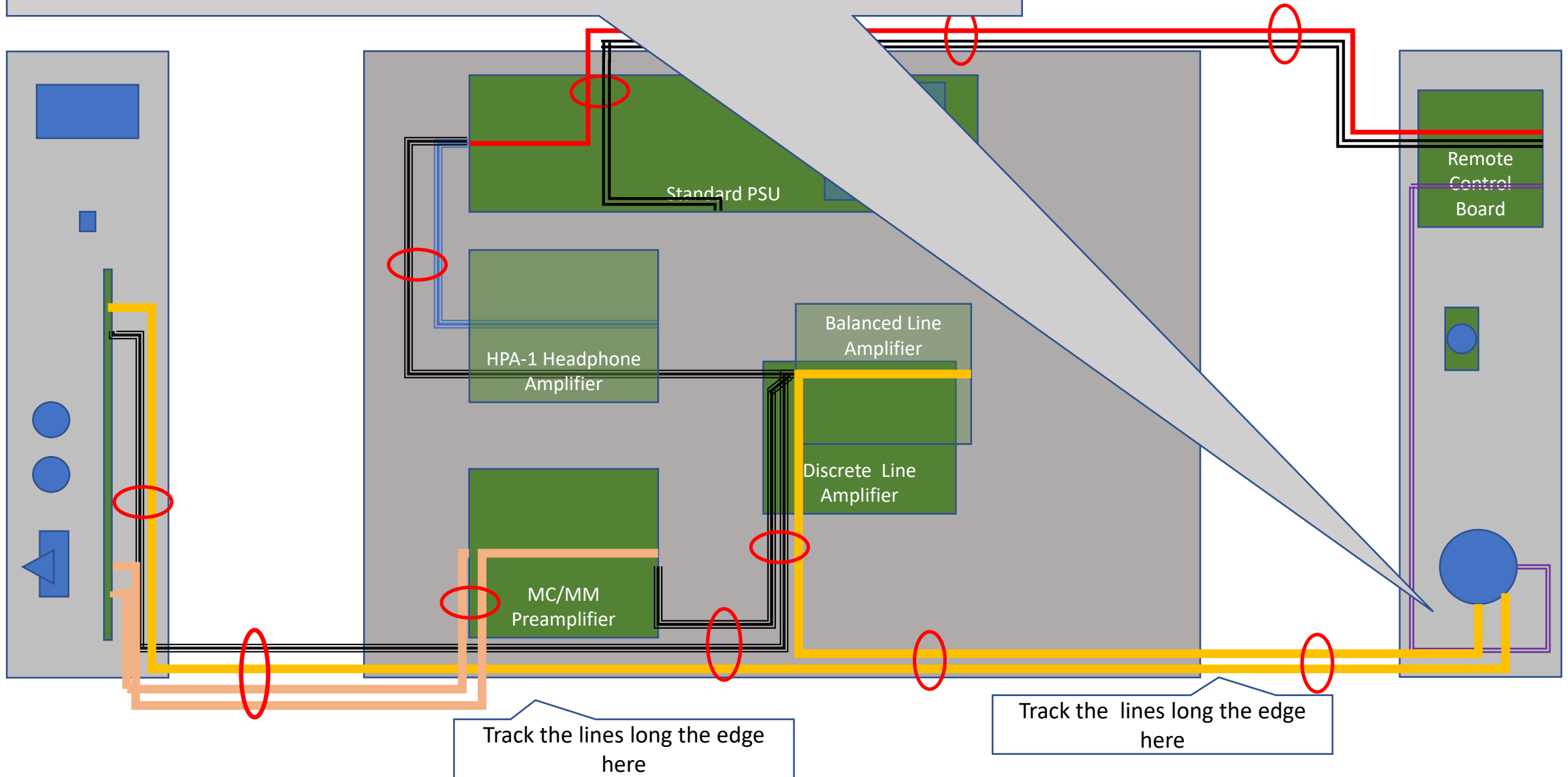


Wire in the motor drive to the Alps RK27. Make sure the wires to the motor are tightly twisted. Track the wires as shown. Use some clear tape to hold the wires in place in 2 to 3 places along the track

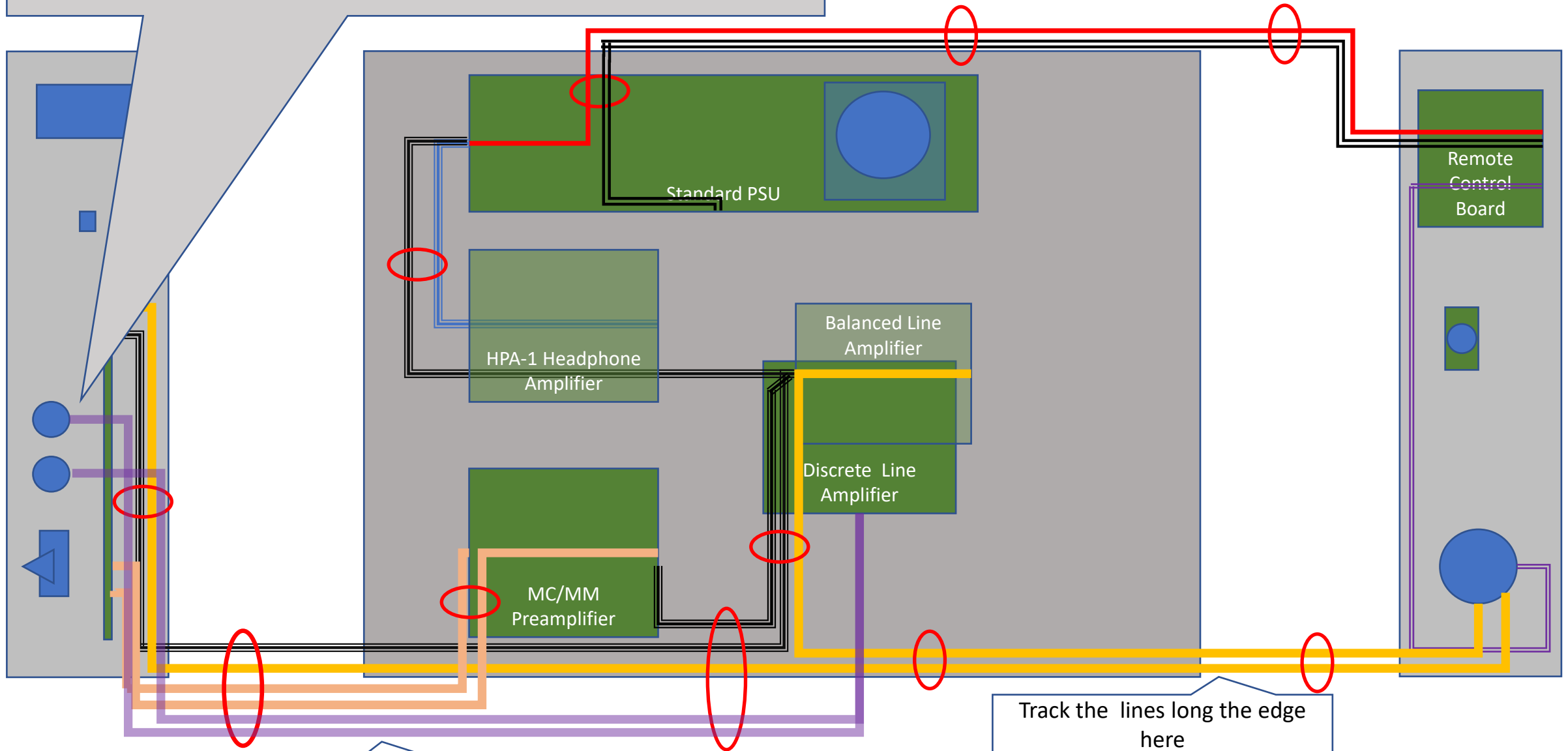
M1 on the Remote control board goes to the motor pin with the black dot adjacent to it and M2 to the opposite one. Wire a 0.1uF 50V film capacitor across the motor terminals.

Step 3: Wire up the motorized potentiometer drive signals

Step 4: Signal wiring to and from the volume control and MC/MM preamp

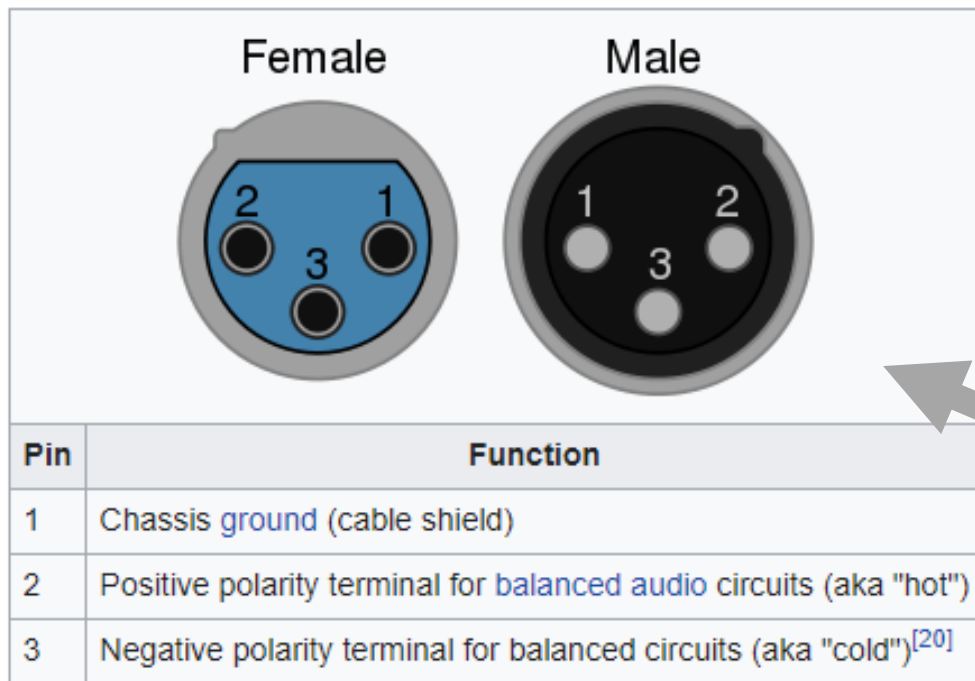


Step 5: Signal wiring to bal outputs – see next slide also



Track the lines long the edge here

Track the lines long the edge here

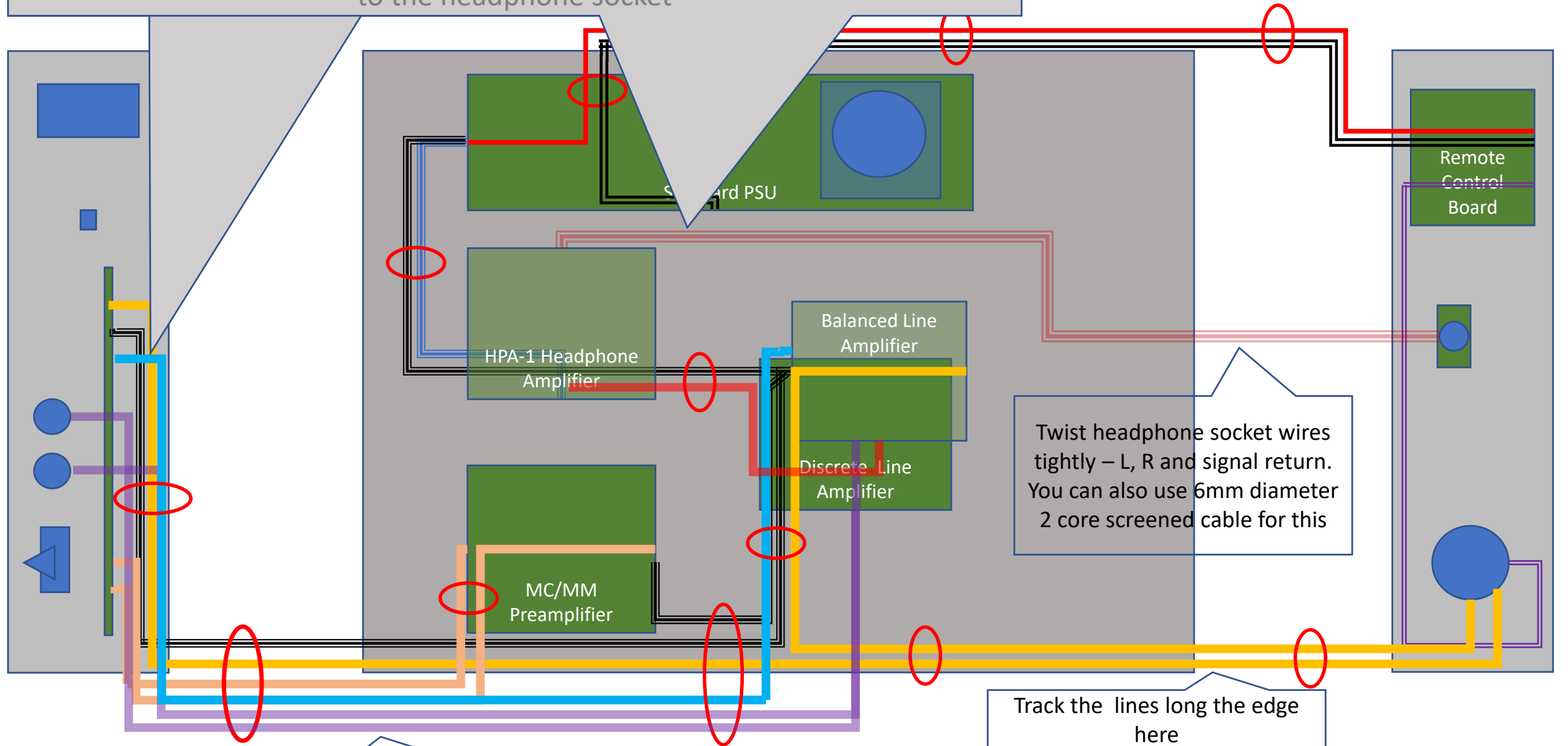


First, on the inside of the rear panel, neatly scrape away a small area (c. 1-2mm square) of solder mask next to the XLR connectors to expose the underlying copper.

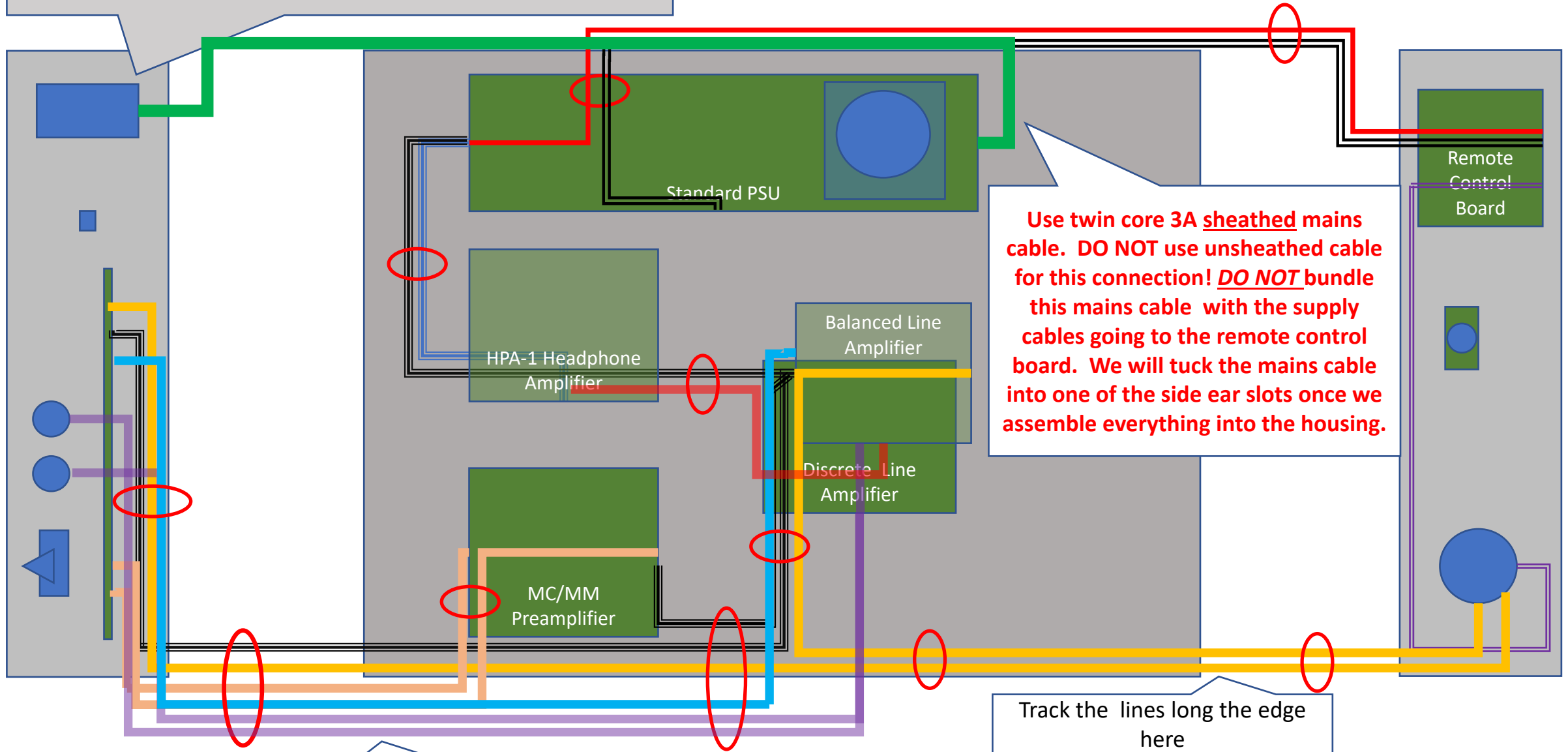
Join both pin 1's together. Solder a short piece of bare wire from one of the pin 1's to the scraped area. This step improves the RFI immunity of the XLR connections

These are the pin designations looking from the FRONT of the connector. Use single core screened cable for each channel from the balanced line amplifier board to the XLR receptacle. The screen (cold) goes to pin 3, the core goes to pin 2 (hot). Make sure the balanced screened cables track the other cables.

Step 6: Signal wiring to the unbal outputs, HPA-1 input and from HPA1 Output to the headphone socket



Step 7: wire up the PSU to the IEC receptacle

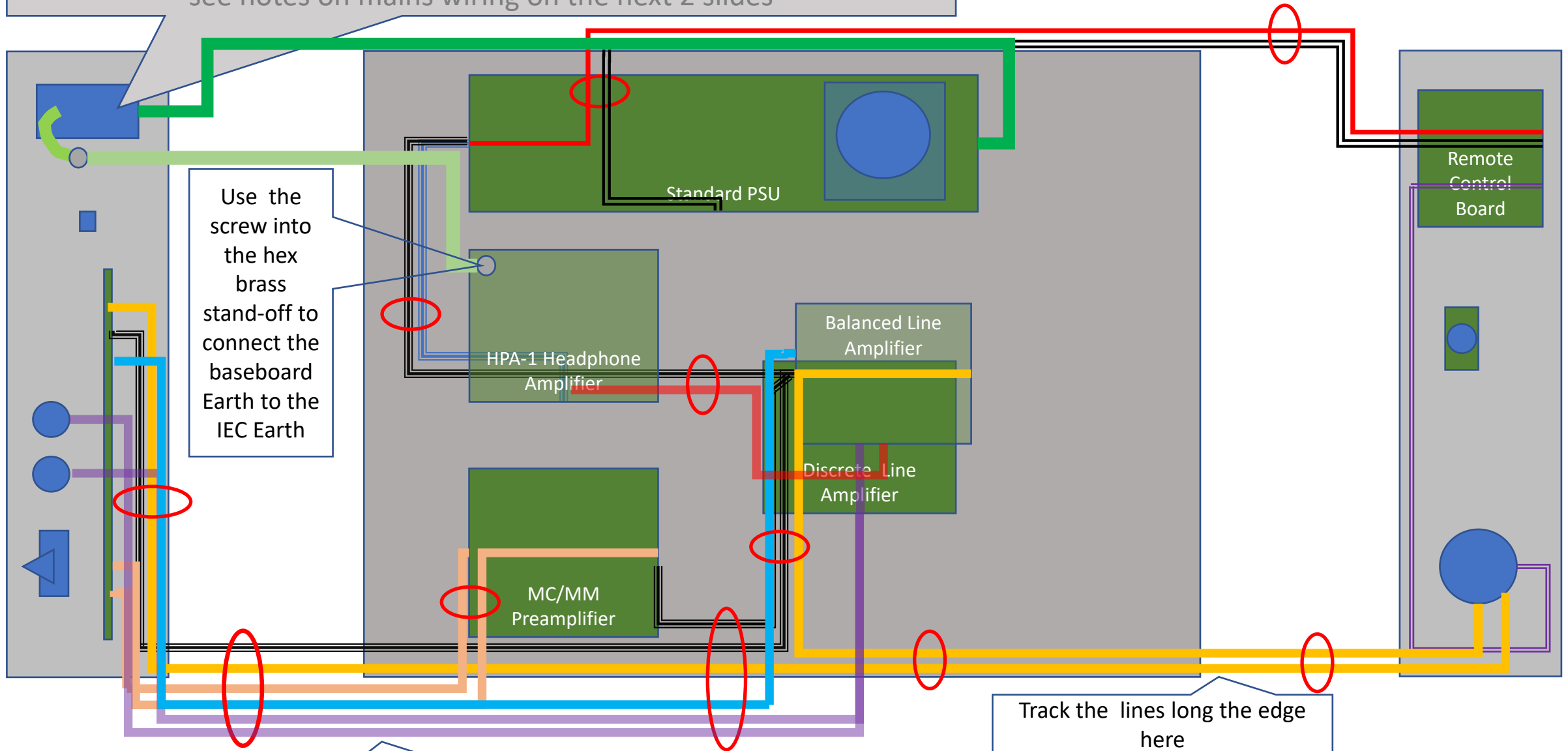


Use twin core 3A sheathed mains cable. DO NOT use unsheathed cable for this connection! DO NOT bundle this mains cable with the supply cables going to the remote control board. We will tuck the mains cable into one of the side ear slots once we assemble everything into the housing.

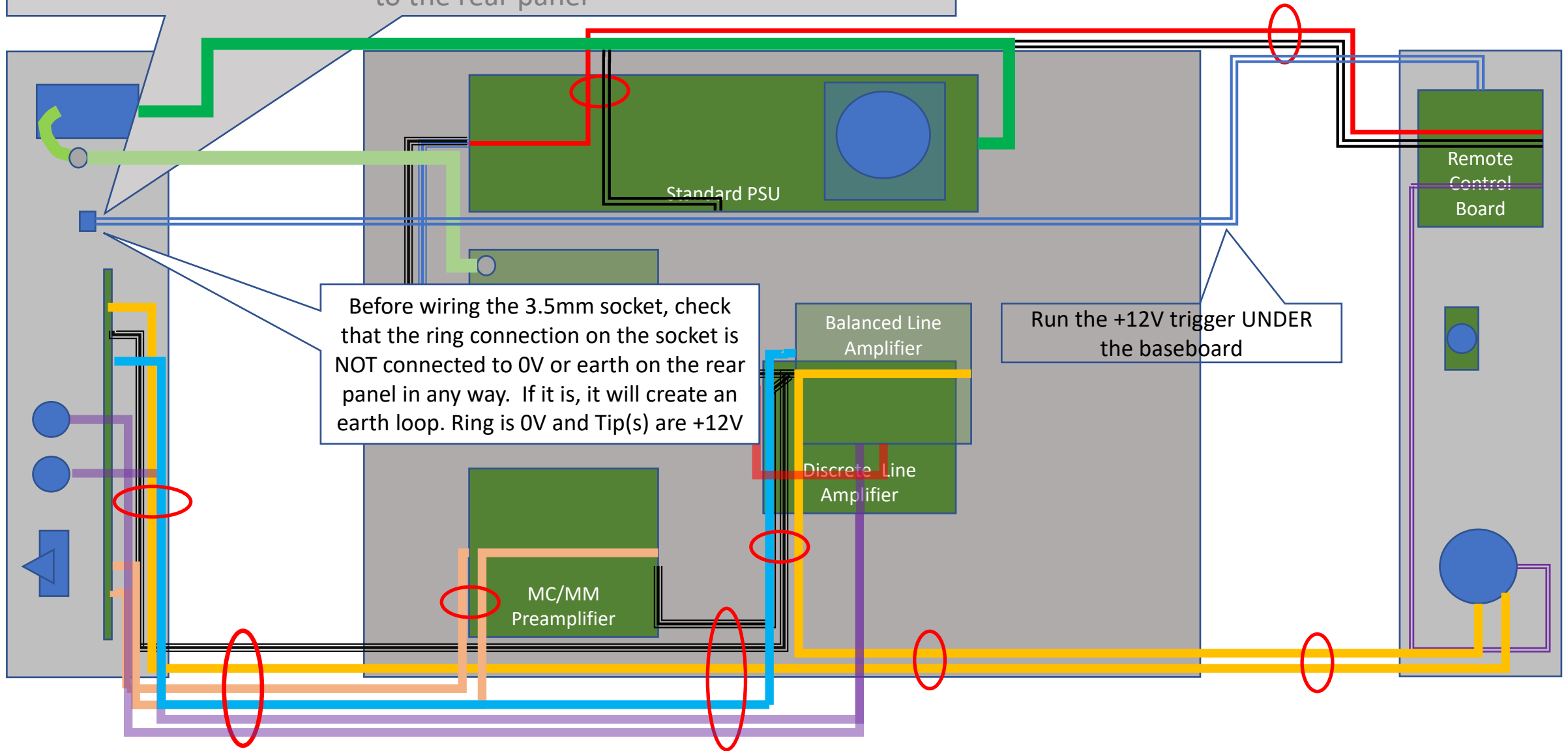
Track the lines long the edge here

Track the lines long the edge here

Step 8: The most important connection of all: the Earth (aka Ground) – see notes on mains wiring on the next 2 slides



Step 9: Wire in the +12V Trigger function from the remote control board to the rear panel



Important notes on mains wiring

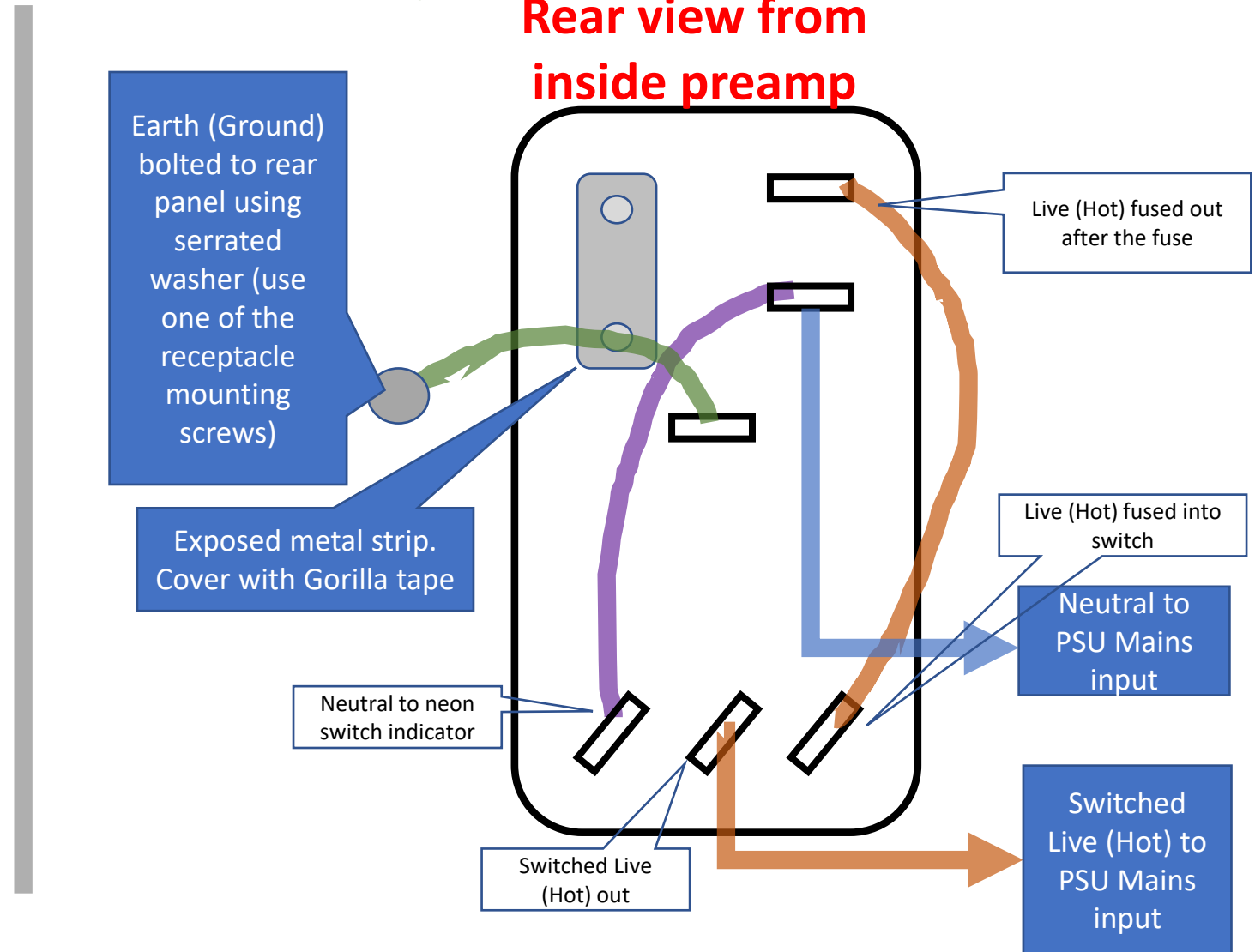
- Use only fully sheathed insulated 6.3mm push on tabs to connect the incoming mains to the PSU board. Under no circumstances use unsheathed, uninsulated push on tabs – see next slide
- On the IEC connector, use 10mm heat shrink to completely cover the soldered connections to the terminals. No metal connections must be exposed under any circumstances.
- Cover the exposed metal section (see next slide) of the IEC connector with a strip of Gorilla tape, or better still, use an IEC mains receptacle insulating boot
- For the Earth/Ground connection, use a short piece of thick wire (1-2 mm multistrand). Solder one end to the IEC EARTH tab and the other to a closed lug. Mount the lug to one of the IEC mounting screws with a serrated washer
- Connect the baseboard to the IEC Earth using a cable with closed lugs either end. Screw one end of the cable to the mounting screw on the HPA1 - use a serrated washer
- Use a meter to check that there is a solid connection between the IEC earth pin and the rear panel and the baseboard
- Insert a 5 x 20 200mA 'T' fuse into the IEC receptacle fuse drawer
- Use a meter on Ohms setting to check that there is no connection from either the main live (hot) or neutral to the rear panel with the IEC receptacle switch on both the ON and OFF position. Repeat this test but between Live and Neutral and make sure there are no shorts. Recheck that the baseboard has a solid connection to the IEC Earth (Ground) pin
- As a general guide, there must be no exposed mains connections anywhere inside the housing that can be easily touched with a small screw driver blade.
- If all ok, you can proceed to the next steps

Examples of sheathed, insulated spade connector



Push on spade connector is fully insulated/shrouded. **DO NOT** use uninsulated spade connectors

How to wire up the switched, fused IEC Mains Receptacle



Step 10 - Test the system

- Connect the preamp to a mains supply using a suitable mains cable from the IEC socket to the wall outlet and apply power. You should hear some relays click in after a few seconds
- Use your meter to make sure the $\pm 18V$ is present on the output of the PSU. If any of the supply wires are crossed, the associated supply line will be clamped to within $\pm 0.6V$ of ground and the associated regulator heatsink will quickly get hot
- Assuming the supplies at the PSU are ok, confirm they are all present on each of the PCB's
- Next check that the $+12V$ relay supply is present on the PSU and on the balanced line amplifier, HPA-, the discrete line amplifier and the remote control board
- Next, plug in the 16 way ribbon cable to the remote control board and the other end to the input relay select board. Run the ribbon cable UNDER the base board
- When you now rotate the input select dial, the associated input LED should illuminate and you will hear the selected input relay click in
- At this stage, it is recommended you sync your apple remote to the X-Altra Mini II (see here for how to do this)
- Check that all the functions on the remote work – select up and down, volume (make sure the potentiometer shaft rotates in the right direction – if not, reverse the wires on the motor), mute (ensure you can hear the relays click in and out and the RED LED at the 12 o'clock position on the Input Select dial illuminates) and power ON/OFF
- Plug a pair of headphones in apply an input signal and check that each input can be selected and the volume adjusted
- Assuming all is correct, we can move on to the next steps which it to mechanically assemble the preamp

Step 11 – Assemble the preamp housing and dress the cabling

- Begin by screwing one of the side ears to the front and back plates. Slot the base board into the lowest slot on that side, and then screw the other side ear into the front and back plates, slotting the baseboard into the corresponding opposite lowest slot.
- You can now screw into position the top plate of the housing.
- Connect a 100mm wire from the unused IEC receptacle mounting screw using a closed lug and serrated washer to the housing bottom plate, picking up a connection on the housing foot closest to the rear right hand corner. Use a serrated washer on the housing cover and check with a meter that you have a solid connection between the rear panel and the bottom housing cover. This step will improve the mains noise floor by 4~6 dB to around -128 dBV.
- Tack a piece of mylar film 150mm x 60mm onto the bottom housing cover over where the HPA-1 heatsinks are. This will prevent the heatsinks potentially shorting to the bottom cover which will cause a serious ground loop issue. Alternatively, you can use a strip of Gorilla tape like I did, but this does not look as neat.
- The final internal steps are to neaten up all the wiring by removing temporary cable ties and re cable tying all cabling tightly every 3-4 cm's, making sure that it is tracked neatly and along the edges of the housing as shown in the earlier slides.
- Slot the mains cable from the IEC connector to the PSU mains input terminals into one of the available slots along the side ear and use a clear tape to hold it in position along with 2 to 3 dabs of clear silicone RTV
- Finally, Screw the bottom housing cover in place, and flip the preamplifier over onto its feet. The assembly is now complete.
- As a final test, it is recommended you leave the preamp powered up for a few hours and then test each input and output (main unbal output, auxiliary output, balanced output, headphone output) using a source signal. Make sure the remote control is fully operational as well.

X-Altra Mini II - Document Update/Release History

- Initial Release – 14 June 2022
- Updated 24th July 2022 – added DC test voltages to amplifier boards
- 4th August 2022 – updated Standard PSU schematic. Output voltages are now adjusted with a trimmer
- 6th October 2022 – minor corrections to the Remote Control board circuit diagram
- 2nd Nov 2022 – some of the resistor values in the MC/MM circuit were incorrectly labelled. Now corrected. The BOM and Schematic resistor values take precedence when assembling the board
- 8th November 2022 – added mechanical assembly guidelines for the front plate
- 17th November 2022 – added wiring and assembly instructions
- 02 January 2023 – updated the build 'D' option. This is now a basic line level preamp sans phono amp, discrete line stage and Headphone amp.
- 07 June 2023 – updated MM/MC module schematic; updated associated BOM