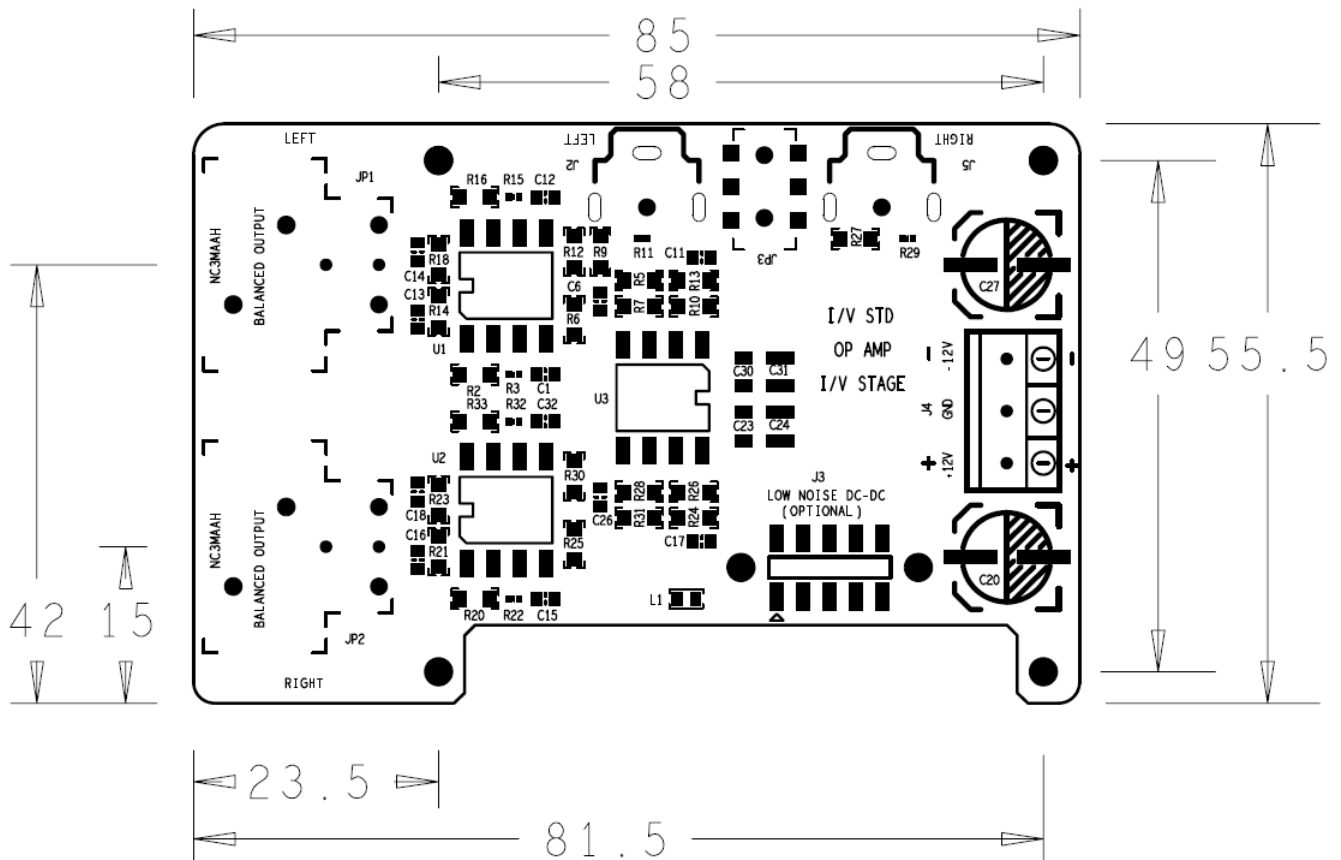# I/V STD user's guide

By Ian Jin, Dec 30, 2018 Ver. 1.0a

A. Highlighted Features

- Standard three OP amplifiers I/V stage.

- Has single end output, balanced output and headphone output.

- Works directly with Ian's ES9038Q3M dual mono DAC HAT and ES9028Q2M DAC HAT.

- With external power supply connector and optional internal DC-DC board socket.

- DIY friendly. OP amplifiers can easily be upgraded through the 8-PIN IC sockets.

B. Layout and Dimensions (in mm)

C. Getting start

1. Plug I/V STD on top of ES9028Q2M or ES9038Q2M Dual Mono DAC HAT. Make sure I/V connector J1 is fit properly.

2. Connect the dual rail analog power supply to the power terminal block J4. +-12V would be recommended.

3. Connect amplifier cable to RCA output J2 and J5, or XLR output JP1 and JP2.

4. Or connect high impendence headphone to 3.5 audio output JP3.

5. Power on system as usual.

6. Enjoy the music.

D. Connectors

J4: DC power input

A dual rail DC power supply must be connected to this 3-pin 5.0mm terminal for the I/V STD to operate. Voltage range can be $\pm 5V$ to $\pm 15V$ according to the on-board OP amplifiers. Low noise linear power supply is good for this I/V STD. LifePO4 battery power supply or ultra capacitor power supply would be preferred for best possible sound quality. Generally use a supply that provides 100mA as a minimum.

J2, J5: Single end output in RCA socket

J2 is for left channel and J5 is for right channel. 0dB output level will be 2V RMS.

J1, J2: Balanced output in XLR connector

J1 is for left channel and J2 is for right channel. 0dB output level will be 4V RMS. J1 and J2 were not assembled by default. To use balanced output, Neutrik XLR connectors are needed to be assembled to both J1 and J2. The P/N of the Neutrik XLR connector is NC3MAAH.

J1 I/V connector

This 10PIN 2.54 I/V connector must be connected to the raw balanced output of ESS DAC to operate.

PIN number	Descriptions
1	NC
2	Pi5V
3	L+, Left positive current input
4	L-, Left negative current input
5	GND
6	GND
7	R+, Right positive current input
8	R-, Right negative current input
9	3.3V ACVV for ESS DAC HAT
10	NC

JP3: 3.5mm audio connector for headphone

High impendence (200ohm or higher) headphone can be connected to this connector. OPA1622 OP amplifier would be highly recommended to replace U3 for headphone applications.

J3: Optional DC-DC board connector

It is possible to have the dual analog power rails converted from RPi 5V by a DC-DC convertor. External power input J4 must be un-connected if DC-DC convertor board is used.

PIN number	Descriptions
1	NC
2	Pi5V
3	NC
4	GND output
5	5V input
6	NC
7	NC
8	GND output
9	GND input
10	NC

E. Ways to improve sound quality

Replace with higher grade op amplifiers

Sound quality can be improved right away by replacing the pre-installed op amplifiers with higher grade ones.
OPA1622 would be recommended for U3. OPA1612 is also tested with good result to replace U1 and U2. Discrete op amplifiers are also worth to try. Please choose the most suitable op amplifier or amplifier combination according to personal preference.

Upgrade to better power supply

Higher grade power supply can improve sound quality significantly. Low noise linear analog power supply would be good to go. LiFePO4 battery power or ultra capacitor power is also highly recommended. Different people may prefer the sound of different power supply. Please choose the best suitable one according to personal preference.

Use the balanced output

Generally, balanced output has lower noise and higher dynamic range than the single end output. It was tested the balanced output of this I/V STD brings better sound quality then the SE output. And most high-end amplifiers also use XLR as input. So, for better sound quality, please use the balanced out as possible as you can.
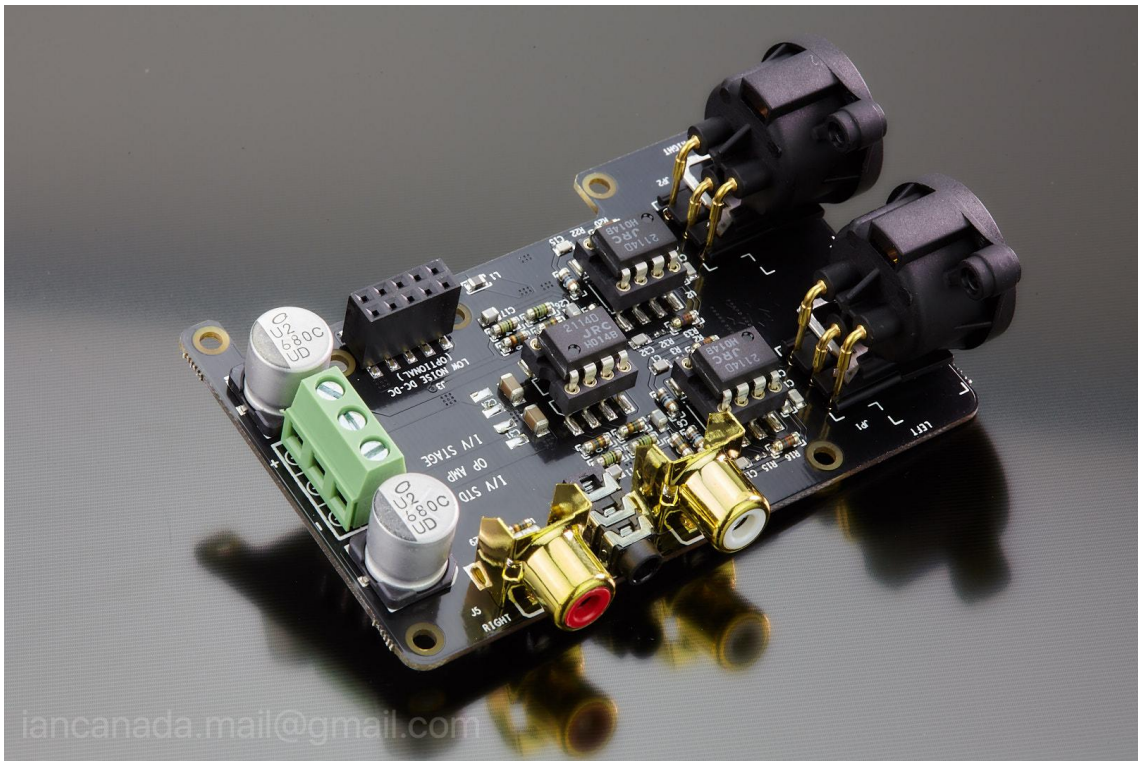
F. Schematics

G. I/V std pictures

1. I/V STD

2. I/V STD with XLR connectors assembled

3. I/V STD works with Raspberry Pi, ESS DAC HAT and ESS controller