

The Ground Sound Active Solution Assembly Guide

Features

- Digital Crossover
- High performance Class AB amplifiers
- Highly Integrated Power Supply
- Automatically On/Off via signal sensing
- Very Quick Soft Start - fuse saver
- Silent Design Toroidal Transformer
- Free XOverWizard software for DCN23
- Optical isolated USB interface
- 48 or 180 biquads total processing power
- Very Low overall Noise and Distortion
- Regulated Supply for the Digital Crossover
- High current capability Supply for the amps

Applications

- High-End Active Loudspeakers
- Active Studio Monitors
- High Performance Surround Loudspeakers
- Active Subwoofers

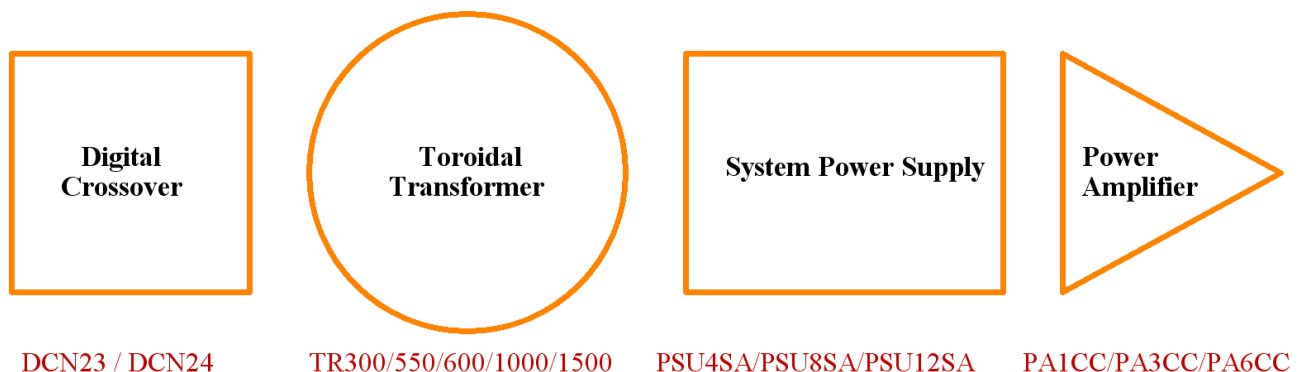
Description

The Ground Sound Active Solution is our way of make a highly integrated dedicated amplifier system, very flexible and capable yet very easy to use both at setup and daily life. The digital crossover gives you the flexibility and speed of changes to setup, that you don't have in a passive crossover yet very high quality sound beyond the quality you can obtain from a passive crossover and even analogue will not be comparable. The system power supplies give you fuse saving soft start, automatically power ON/OFF with signal sensing, dedicated regulated low voltage supplies and low ESR amplifier capacitor bank.

This guide describes in general terms how to assemble the modules with wires etc. There are multiple choices of all the types of components of the system – the choice depends highly on the individual loudspeaker application and choice of drivers.

The solution can either be built like a “Coolback” or in a separate external “Chassis”. Examples of the different ways of mechanical implementation can be found on our web site.

Choice of Modules for the Ground Sound Active Loudspeaker Solution:



Links to the modules:

Digital Crossovers

<http://www.groundsound.com/dcn23.php>
<http://www.groundsound.com/dcn24.php>

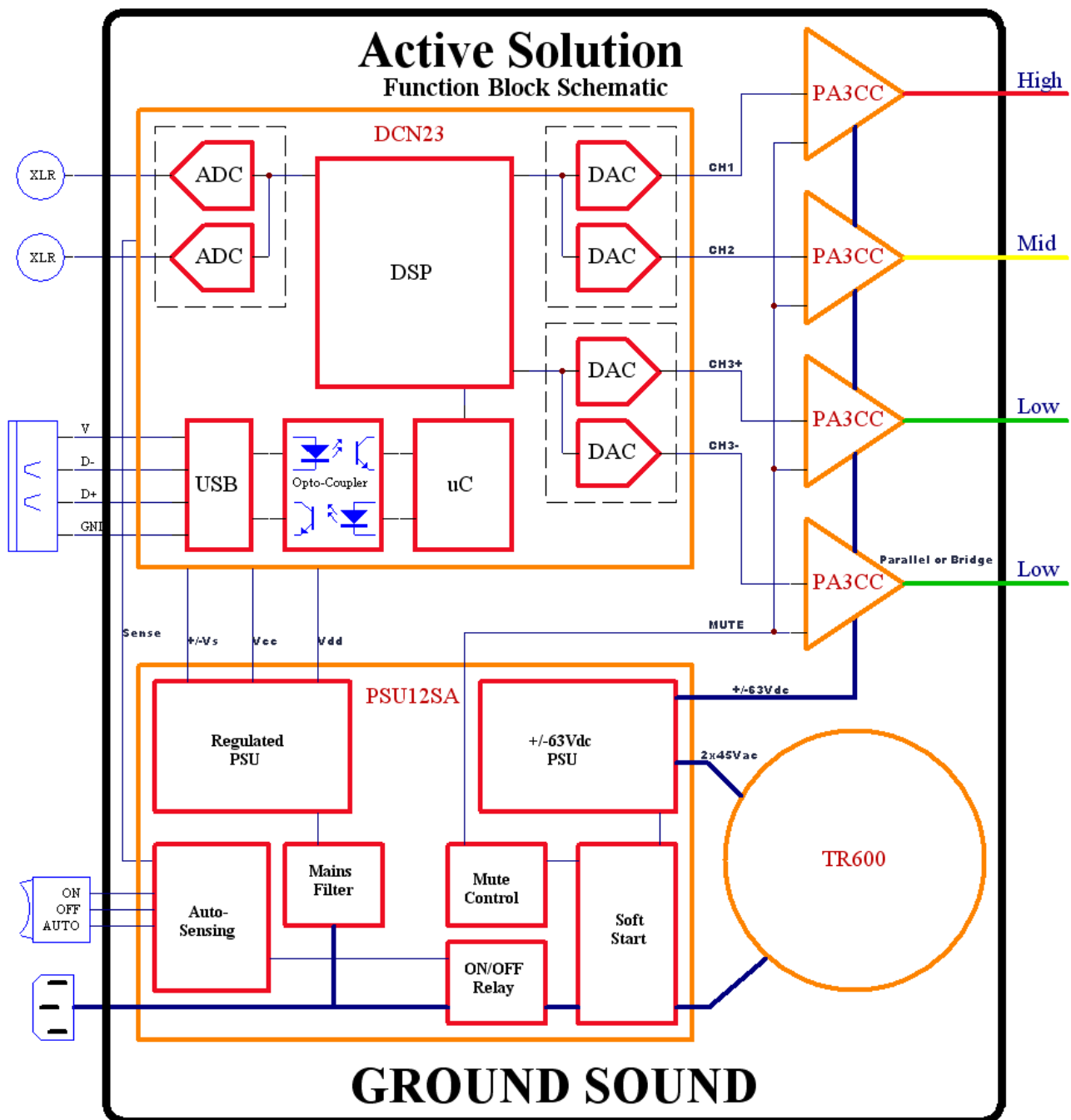
Power Supplies

<http://www.groundsound.com/psu4sa.php>
<http://www.groundsound.com/psu12sa.php>

Power Amplifiers

<http://www.groundsound.com/pa1cc.php>
<http://www.groundsound.com/pa3cc.php>
<http://www.groundsound.com/pa6cc.php>

Functional Block Schematic of the “Ground Sound Active Solution:



This is only an example - the choice of modules could also have been DCN24, PSU12SA, 4 pcs PA6CC and TR1500 or DCN23, PSU4SA, 2 x PA1CC and TR300. The principle of the system is the same whatever it is very high power or a lower power implementation.

Planning and assembly:

An active amplifier system like this Ground Sound Active Solution can be a little overwhelming project to most DIY people, but if you read this assembly guide thoroughly through one time maybe twice you will be able to plan and assembly the system. By reading this assembly guide you also get a better understanding how you can design the system and plan how the individual modules can be placed and what is important to do and to avoid. To ease the assembly we also encourage you to use the guide while you are assembling the system.

Mechanical Layout:

When you plan the mechanical design it is recommended that you have these considerations in mind. Don't place DCN23/24 right next to the Power Transformer. Don't place DCN23/24 right next to the transformer of PSU4SA/PSU12SA. Plan the mechanical design so that the input wires not pass too close to the transformers either. It's wise to place the input connector some distance from the Power Transformer. It's wise to mount the amplifier modules so that the input of the amplifier is some distance from the Power Transformer. It is wise to avoid having mains power wires placed too near low voltages wires or over the DCN23/24 board or audio connectors. If you have to place low voltage wires along the mains power wires it is recommended/required that you put the mains wires in an additional isolation hose/heat-shrinkable tube.



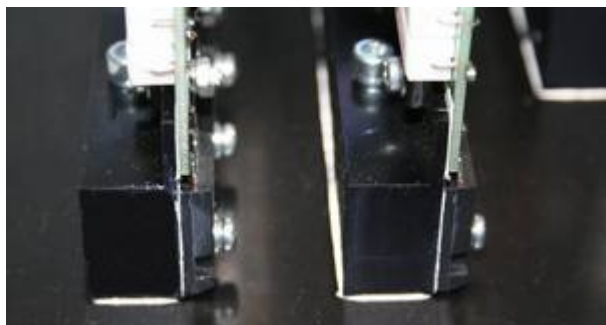
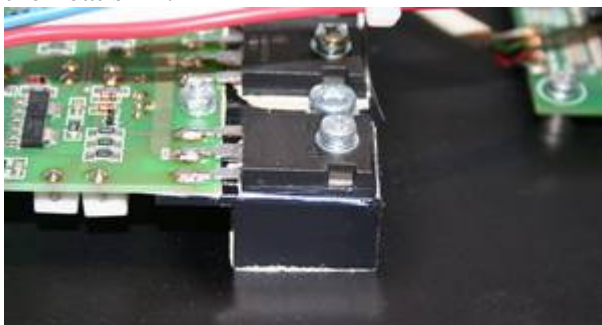
You have to make sure that there is enough distance between the bottom of the PSU4SA/PSU12SA board and the chassis; this will normally be fulfilled as the bridge rectifier makes a distance of 10mm. If the PSU isn't mounted on a plane surface it is recommended that you make sure that the regulations basic isolation distance of 2mm or reforced isolation distance of 4mm are kept. Use basic isolation distance for grounded systems and reforced isolation distance for not grounded systems. When you make the mechanical layout you should try to place the modules so that you get a "natural" flow of wires and reasonable short wiring.

A sensible mechanical layout will prevent noise, heat / stability issues and hum – so it is important.

Mechanical Assembly Information:

Earth screw of PSU4SA/PSU12SA has to have good electrical contact to Chassis/aluminium plate. If the Chassis/aluminium plate is anodized sand or scrape the anodized surface away to make a good electrical connection. See picture above – screw right next to the green/yellow mains earth wire. The distance tube will make an excellent contact if the anodized surface is removed.

The **Amplifier module** has two mounting options either parallel to the heat sink or right angle to the heat sink:



Remember to put **Thermal Paste** between the amplifier profile and the heat sink. You can use a small paint brush with good result. It is also advisable to put Thermal Paste between the bridge rectifier on PSU4SA/PSU12SA and the chassis plate. The amplifiers have 2, 3 or 4 pcs 4mm holes for mounting, please see the individual modules manuals for more information.

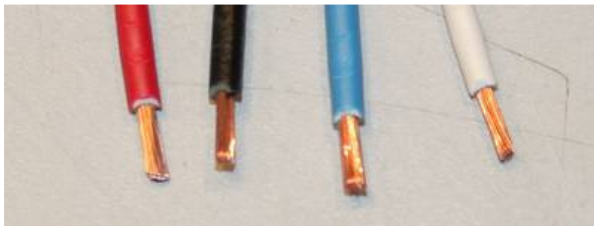
The amplifier modules will dissipate heat and this heat has to be transferred to the surrounding air. The heat sink size and shape depends highly on the total system power and the load. Quite often it's

enough with a large 10-15mm thick aluminium sheet or a normal heat sink. Our amplifier modules are low biased and therefore the idle power dissipation is rather low. In this general assembly guide we can't give a specific answer which size has low enough thermal resistance, but you often can use much smaller heat sinks than you think without any risk of shot down under normal conditions.

The **Power Transformer** shall be mounted in a very secure way and if you use our transformers you shall use an 8mm bolt, plain washer, spring washer and nut or tapped hole in the chassis/plate. Remember to put the supplied rubber isolating washer between transformer and chassis/plate.

Soldering and tools:

When you are assembling this system it is very important that you use a very good soldering iron. If the soldering joints aren't heated properly you will for sure get problems later on. It is important to put tin solder on both pad and the stripped wire end before making the actual connection. Use a high temperature on the soldering iron approximately 420°C for shorter time. Fast heating up and fast out = less heat where it doesn't belong. This will ensure best connection and avoiding melting of plastic cover. Proper tools are 80% of the job!



Wiring the system:

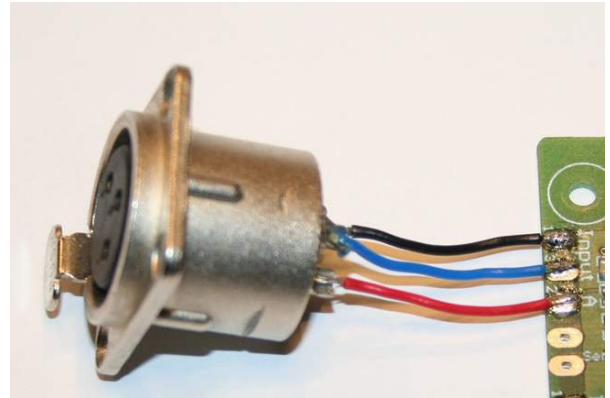
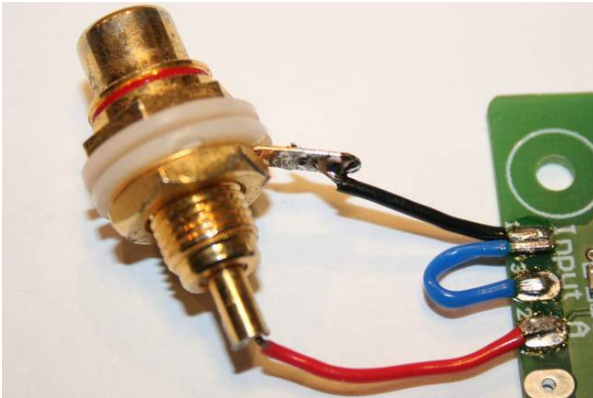
Wiring the system will be described in general terms and pictures are also included to give a visual understanding. It is also recommendable to read the manuals of individual modules, which will give you a deeper insight in function and connections.



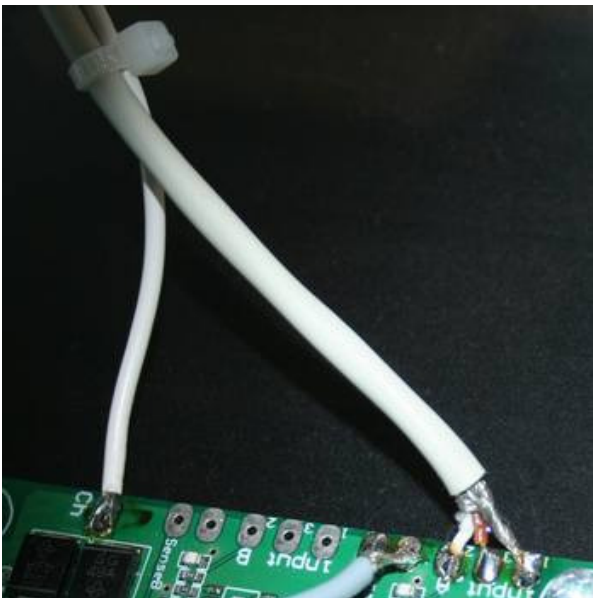
Recommended wire thickness and colours:

| Name | Thickness | Colour | Connection | Note |
|--------|---------------------|--------------|---|----------------|
| MUTE | 0,2mm ² | Purple | Mute control for power amp | |
| Vdd | 0,2mm ² | Yellow | Linear regulated 3,3V refer DGND | |
| DGND | 0,2mm ² | Black | Digital ground, digital circuit supply | |
| Vcc | 0,2mm ² | Brown | Linear regulated 5V refer GND | |
| -Vs | 0,2mm ² | Blue | Linear regulated -11,65V refer GND | |
| +Vs | 0,2mm ² | Red | Linear regulated +11,65V refer GND | |
| CONST | 0,2mm ² | Orange | +12V output for operation switch | |
| SELECT | 0,2mm ² | Grey | Input selector for operation switch | |
| AUTO | 0,2mm ² | Green | Auto-sensing output for operation switch | |
| St.By | 0,2mm ² | Red | StandBy/AC LED anode | Optional |
| common | 0,2mm ² | Blue | pad between ON & AC is common cathode | Optional |
| ON | 0,2mm ² | Green | ON LED anode | Optional |
| | | | | |
| AGND | 0,75mm ² | White | System ground for DCN23/24 | |
| CH | 0,75mm ² | White | Ground lift wire between DCN23/24 and Chassis | Close to input |
| GND | 1mm ² | Black | Power ground for amplifiers | Multiple wires |
| +V | 1mm ² | Red | Positive rail voltage for amplifiers | Multiple wires |
| -V | 1mm ² | Blue | Negative rail voltage for amplifiers | Multiple wires |
| | | | | |
| EARTH | 1,5mm ² | Green/Yellow | Mains Earth | |
| L | 1,5mm ² | Black | Mains Live | |
| N | 1,5mm ² | Blue | Mains Neutral | |
| N | - | Orange | Power Transformer Neutral * Primary side | |
| TR | - | White | Power Transformer Live * Primary side | Switched |
| | | | | |
| GND | - | Red&Brown | Power Transformer secondary CT entry | Two wires |
| AC1 | - | Green | Power Transformer * First Secondary | |
| AC2 | - | Blue | Power Transformer * Second Secondary | |
| | | | | |
| CH.1 | Shielded | Red | DCN CH.1 out to Power Amplifier | E.G. tweeter |
| CH.2 | Shielded | White | DCN CH.2 out to Power Amplifier | E.G mid |
| CH.3 | Shielded | Blue | DCN CH.3+/3 out to Power Amplifier | E.G bass |
| CH.4 | Shielded | Grey | DCN CH.3-/4 out to Power Amplifier | E.G sub-woofer |
| SENSE | Shielded | Grey | Signal Auto-Sensing | |
| | | | | |
| Input | Shielded | * | Depends high on connector type and distance | Single wires |
| USB | USB wire | * | Cable with USB B male connector | |

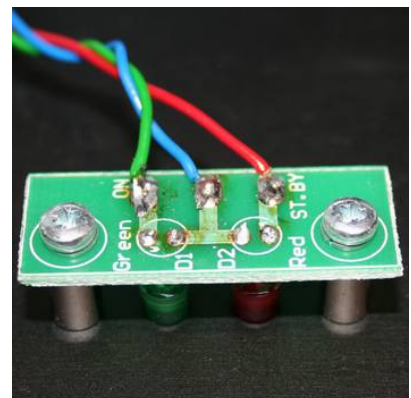
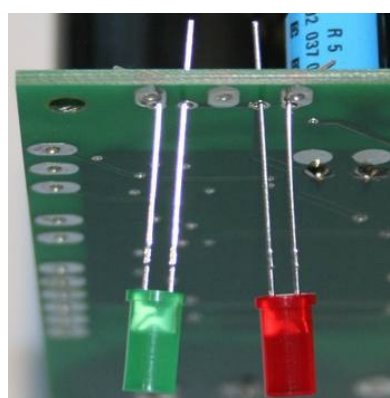
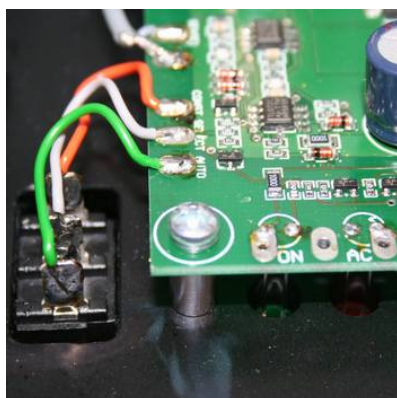
The **input** wiring to DCN23/24 depends upon the connector and the distance. If the distance is very short from connector to DCN23/24 input pads it should be sufficient to use ordinary 0,2mm² wire or else shielded cable. The shielded cable will have to have one inner core for unbalanced RCA connector and two inner cores for balanced female XLR. When the unbalanced RCA is used remember to short inverted input (pad3) to AGND (pad1) and the RCA has to be an isolated type (like the one on the picture) to avoid ground loops. If only one input channel is used it's recommended to short both pad 2 and 3 to AGND (pad1) of the unused input.



The **CH** pad on DCN23/24 is actually the ground lifted connection of the system which should be wired to chassis metal very near (RCA) or on the input connector (the Neutrik XLR connector has a soldering tag for this purpose).



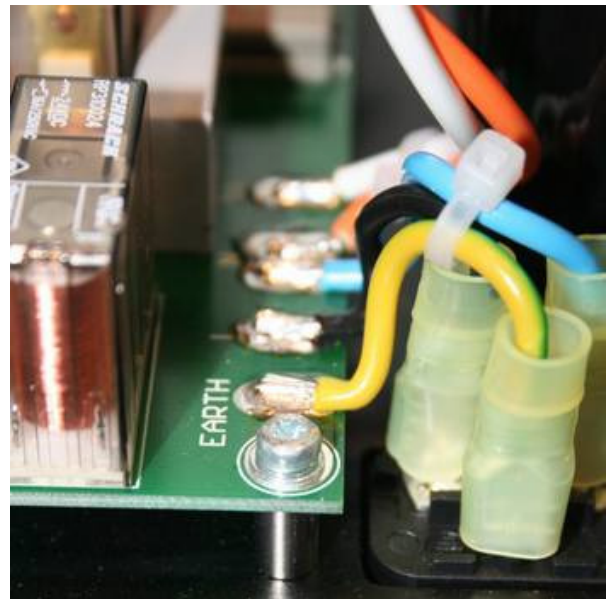
The **Function Switch** for AUTO-OFF-ON on PSU4SA/PSA12SA wire will be sufficiently wired with 0,2mm². This is a low current wire and it's no problem with 1m wires, if it is desired. Example: Mounting on front panel.



The **LEDs** indicating ON and Stand By can be mounted either direct in the PSU board or with 0,2mm² wires off the board. Place LEDs with the longest lead in pad signed A – anode. The anode can also be identified as the smallest metal in the plastic housing.

The **mains** power wiring can be done in three ways, either three separate wires with an additional isolation hose/heat-shrinkable tube (see picture above) or simply a three lead mains cable or if the wires will be very short like the pictures shows on the right.

Notice that regulations requires basis isolation distance of 2mm if chassis is connected to Earth via mains cable and if **not** connected to Earth then reinforced isolation distance of 4mm is required. It is also recommended/required that all mains wires are double secured. E.g. two wires that are connected to a mains IEC inlet are secured with additional cable tie. You shall connect PSU4SA/PSU12SA mains pads direct to the power mains inlet connector. The mains wires should be between $0,75\text{mm}^2$ and $1,5\text{mm}^2$. The Earth pad are (green/yellow wire) on the left / closest to the mounting screw. Make sure that the Earth pad/screw has good electrical connection to the chassis metal. The Live is second pad (black or brown wire) and neutral (blue wire) connects on the third pad. The Earth wire is not mandatory, but strongly recommended.



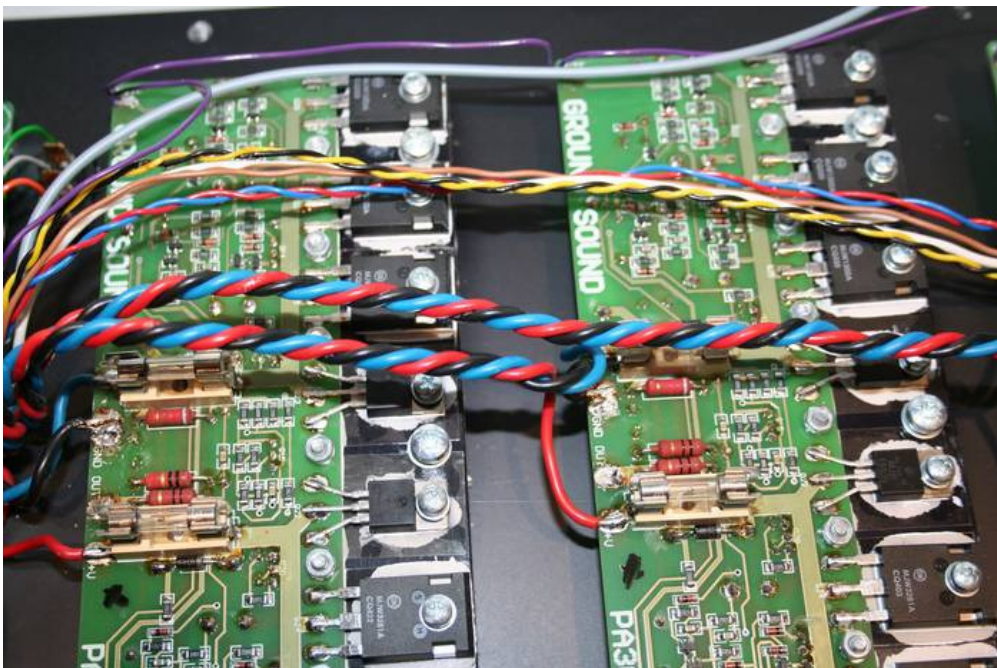
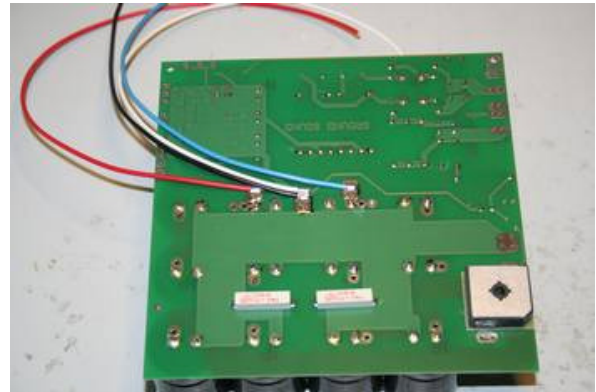
Fuses on PSU4SA/PSU12SA are found on each side of the low voltage supplies mains filter. The low voltage power supply's fuse is closest to the board edge and it shall be a slow blow 100mAT fuse for 230Vac and 200mAT for 115Vac (115Vac only on PSU12SA). The high power supply fuse sits between mains filter and soft start resistors. Its value depends on the VA rating of the Power Transformer. PSU4SA will normally be supplied with 4AT (TR300) and PSU12SA with 6,3AT (TR600).



The Low Voltage Supply on PSU12SA has two options of Mains Voltage selection: 230Vac and 115Vac.

The **Rail Voltage** wires for the Power Amplifier modules have to be soldered to the bottom of PSU4SA/PSU12SA before the power supply can be mounted. The **white AGND** wire also has to be soldered to the bottom of the power supply. All wires should be between 0,75-1,5mm² - it isn't necessary with thicker wires, but it is highly recommended to twist the rail wires for each amplifier module. This will decrease cross talk and increase EMC immunity. The AGND wire supplies analogue system ground to DCN23/24.

Use red wire for +V amplifier rail, blue for – V and black for amplifier power ground.

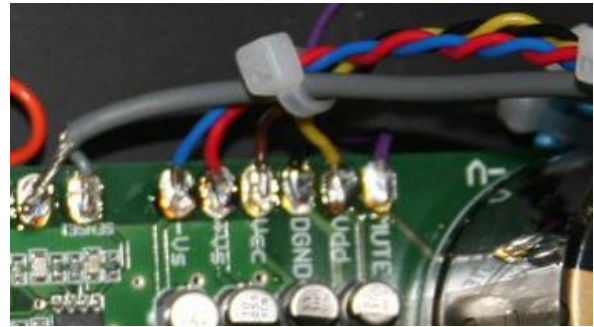


You can make a “**highway**” of cables/wires over the amplifier modules without any degrading effect to the performance of the active solution. Don't forget the recommendation to twist wires for higher immunity to negative influence. The “highway” gives you a more mechanical stable wiring system. At page 4 you can see the finished “highway” with cable ties.

The **Sense** wire feeds a buffered input signal to the PSU auto start circuit and the signal is noise sensitive. Therefore the wire has to be a shielded cable of relative good quality (this connection isn't in the audio path).

The **DCN23/24 outputs** to amplifier input has to be wired with good quality shielded low power signal cable with one inner core. Take extra care when you strip this kind of cable, so that no single core makes a short. Avoid melting the plastic covers - possible shortening the signal. This is a very likely potential fault.

The **Regulated Supplies** (-Vs, +Vs, Vcc, AGND, Vdd and DGND) for DCN23/24 will be sufficiently wired with 0,2mm² wire. It is recommended to twist the -Vs/+Vs pair and Vdd/DGND pair.

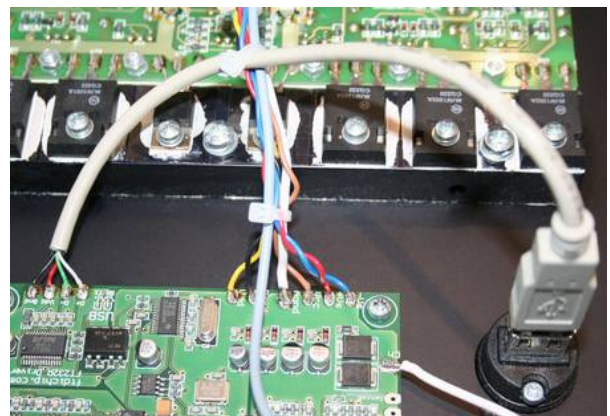


The **Muting** control wire to amplifier modules has to be daisy chained from PSU to first module to second module etc. Mute wire will be sufficiently wired with 0,2mm².

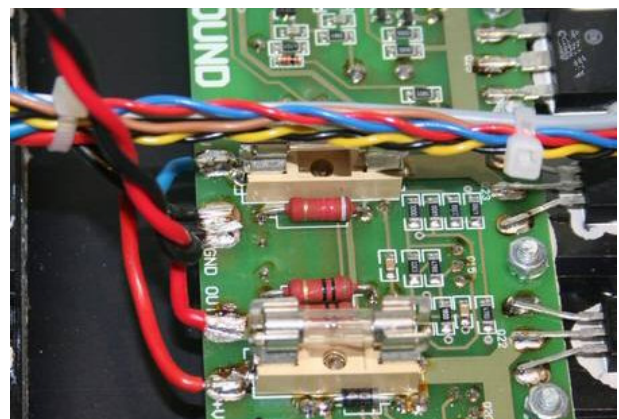


The **USB** connection has four pads labelled D+, D-, Vdd and GND. This part of the circuitry is isolated from the rest of the board. An opto-coupler transfer data from the PC powered part to the μ C. The board is designed with pads instead of a USB B connector for flexibility and mounting options. The chassis connector could be a Neutrik NAUSB or NAUSB-B or a USB B connector on a small printed PCB or simply a wire with a USB A connector. Be careful to connect red wire to Vdd and black wire to Gnd. Normally white wire connects to D+ and green wire to D-. The shield isn't connected on the DCN23 board, there is no need. Please notice that D+ and D- have to be swooped when using a

NAUSB connector as it swoops the two inside the connector. If you get a pop-up window with the text "USB Device Not Recognized" when connecting the USB to the PC you simply have to swoop D+ and D-

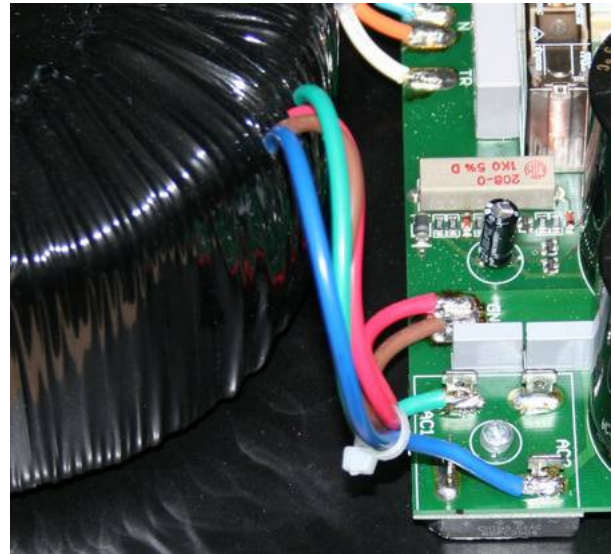


The **Amplifier output** can be wired with the same type and thickness as the rail voltage supply. It is also highly recommendable to twist the wires from the amplifier output to prevent influence to more sensitive cables like low level signals.



If you use a Ground Sound **Power Transformer** you get a transformer with “correct” placement of both primary and secondary side wires. The primary side wires (white and yellow) have to be connected to the live soft start controlled pad TR and the common neutral mains pad N.

The secondary side wires has to be soldered and it can be a little challenge to solder the secondary wires to the bridge rectifier of PSU4SA especially if the PSU has been mounted to chassis before soldering these wires – make sure that you supply enough heat to both wire and bridge terminal.



The Active Solution can be made as an internal “plate amplifier” or as an external chassis like this:



Remarks and Revision history

Ground Sound reserves the rights to make alterations without prior notice.

Please notice that Ground Sound will not be held responsible for any property damage. It's assumed that the customer is aware of the danger of high voltage and takes the necessary precautions to avoid personal injury and fully understands the consequence of dealing with high voltage.

Revision A: 2009-06-03