GEMINI GROUNDING GUIDE

The GEMINI features an internal ground-plane noise reduction technology that uses patented NIC™ noise isolation chamber technology. This system provides a common grounding point for all components in the system and extends the GEMINI's internal ground-plane noise reduction capabilities to components external to the GEMINI. This significantly reduces chassis voltage differences between component chassis and may help to reduce potential ground loops.
~ Patent Number: US 8,658,892 ~

DOES CHASSIS GROUNDING REALLY MATTER?

The amount of noise that exists on the safety grounds and on the component chassis can significantly impair the performance of even the most expensive systems. The long runs of wire in the wall, the power cords and the chassis themselves can all act as antennas, picking up radio frequency signals and electrical interference in the environment. Although most people assume that ground implies ZERO, all power supply grounds and all chassis grounds in fact have some residual, measurable levels of noise. Using a power analyzer or oscilloscope will quickly reveal significant amounts of radio, television, microwave, Wi-Fi and cell phone interference pervading the grounding system.

NOTES: The GEMINI Ground System is a chassis grounding hub.
Unlike the ALTAIRA, it cannot be used as a signal ground hub.
The GEMINI ground hub may also be used in a more complex ground system that contains multiple interconnected hubs. (See ALTAIRA Ground System)

HISTORICAL GROUNDING PRACTICES

The subject of grounding can be confusing. There are many terminologies, such as earth ground, chassis ground, safety ground, circuit ground, signal ground, mains panel ground, ground rods, neutral ground, power supply ground, ground loops and more. It is not our intention to define or describe all of the technicalities associated with grounds — rather we will take a general and simplified approach so that the non-technical reader may understand the basics of grounding. These concepts and techniques are essential to optimizing and improving the performance of your home entertainment system.

Many of the best practices used in audio have come from the early days of the telecommunications industry. It was common practice to mount equipment in a metal rack. The equipment in the rack would be connected to a common grounding lug or terminal using braided ground conductors. Every electronic device had a dedicated grounding lug for this ground connection. This practice continues today in both the telecommunication and networking industries. Components of the era were commonly equipped with single-ended RCA jacks that are quite susceptible to ground currents which could result in audible hum and buzz. Connecting all equipment to a central ground point ensured electrical safety and eliminated voltage differences between component chassis that caused the ground loop problems.

With the advent of modern day, mass-market consumer audio products and plastic chassis, many components no longer include a ground terminal. The most common exceptions are turntables and phono-preamplifiers where ground terminals are required to prevent hum. Of course, turntables and phono-preamps are *legacy components* that have survived from an earlier generation of audio systems.

Although many components are no longer equipped with a dedicated chassis ground terminal, it is still advantageous to ground all of your equipment to a common grounding system. This reduces ground loop currents and the associated hum and noise problems. An external grounding system improves overall audio and video performance even if there are no obvious ground loops or hum.

GROUNDING TERMINOLOGIES

Earth-Ground System
The *earth-ground* system begins at the ground rod and includes the electrical panel grounds, in-wall AC ground wiring, socket or outlet ground pins, power cord ground wires and finally the metal chassis of each of the appliances or electronic device plugged into the AC power circuits.

Electrical Safety Ground
There are three conductors in modern household AC circuits: the line, the neutral and the *safety ground*. The safety ground wire provides an unbroken pathway from the appliance or electronic device through the in-wall wiring to the electrical panel's ground buss. Safety grounds primarily serve to prevent electrocution and electrical fire.

Chassis Grounds

The term *chassis ground* refers to the metal enclosure of an electronic component or appliance. The component has an internal wire that connects directly from the AC power cord or inlet (ground pin) to the metal chassis itself. In essence, the component's chassis is an extension of the safety ground. The NEC electrical code *requires* this connection and it is critical in preventing electrocution or a potential fire hazard in the event of an electrical fault.

For example, if a live wire were to come loose within an appliance and touch the metal case it could potentially electrocute someone that touches the appliance. The *safety ground* ensures that the current is diverted (shorted) back to the electrical panel causing the circuit breaker to open.

COMPONENT CHASSIS GROUNDING

Ideally, every component in the system should be connected to the GEMINI ground hub system. If every component manufacturer put a dedicated chassis ground terminal on the product, this would be simple. You would simply connect a ground cable from the GEMINI to the component's ground terminal. This would effectively make a low impedance connection from the GEMINI ground hub to the component's chassis.

Unfortunately, many audio components and most computer or digital devices do not have chassis ground terminals. Therefore, alternate methods of connection may be necessary. The *Component Continuity Tests* allow you to determine the best method to connect each component to a chassis grounding hub.

There are basically three possible methods. The first method is the aforementioned dedicated chassis ground terminal. If a component has a terminal then there is no need to do any of the Continuity Tests.

The second method is to locate a chassis screw on the component that has continuity to the component's ground pin within the AC power inlet connector. An ohm meter is used to measure the resistance from the inlet's ground pin and selected chassis screws. If a screw measures less than 1 ohm in resistance, then this screw can be used to connect one end of the grounding cable by using a very small, thin spade or ring terminal that slips under the screw.

The third, and last method, should be used if method one and two are not possible or impractical. Many signal connectors such as an RCA or XLR connector have a direct electrical connection to the component's chassis. An ohm meter is used to measure from the AC inlet ground pin to the signal connector's ground pin or barrel. If the reading is less than 1 ohm, that means you can use an unused connector as a chassis ground connection for that specific component.

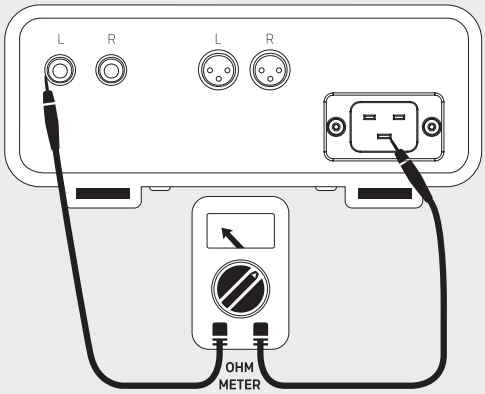
CONNECTIONS & TESTS

Some components have dedicated ground terminals, which makes it very easy to connect to the GEMINI ground terminals. However, many components do not have a dedicated ground terminal. An alternative method must be used to ground these components. One method is to use one of the component's chassis screws as a ground connection point. Another method would be to connect a ground cable to an *unused* signal connector (e.g., an RCA or XLR connector). A simple ohm meter is all that is required to perform the tests of the types of connections that can be safely used. The results of the tests will help identify which components can be grounded (some can't) and help determine which method is best for each component.

TEST PROCEDURE:
SIGNAL CONNECTOR GROUND CONTINUITY

1. Place one ohm meter lead on the AC inlet ground pin.
2. Place the other lead on the barrel of an RCA connector or the ground pin of an XLR connector.

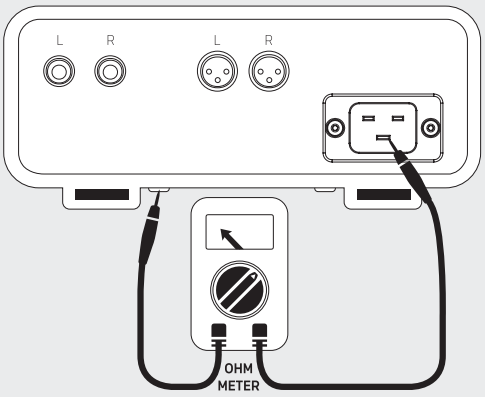
Result: If the ohm meter reads less than 1 ohm, that means that the chassis is connected to the earth-ground and that the chassis screw can be used as a connection point to the ground component.



TEST PROCEDURE:
CHASSIS GROUND CONTINUITY

1. Place one ohm meter lead on the AC inlet ground pin.
2. Place the other lead on a metal chassis screw.

Result: If the ohm meter reads less than 1 ohm, that means that the chassis is connected to the earth-ground and that the chassis screw can be used as a connection point to the ground component.



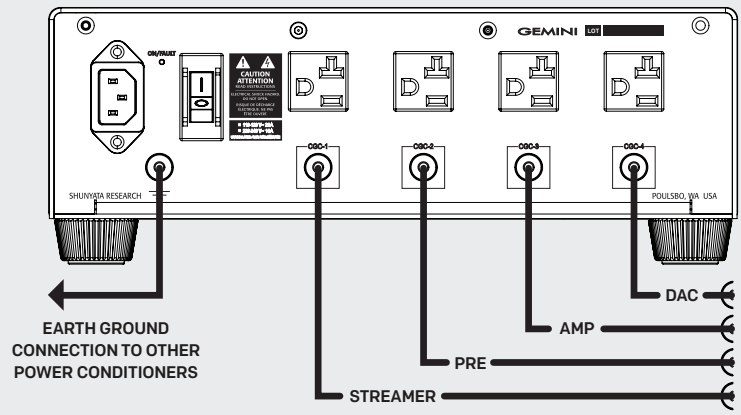
GEMINI GROUNDING GUIDE

While you can use any good quality wire to make the chassis ground connections, we recommend Shunyata Research's own CGC *(chassis grounding cables)* for best performance. It is preferable to use a large gauge wire of 12-10 gauge or larger for best results. Solid core wire is very stiff in large gauges, so it is easier to use a fine stranded wire or a ground braid since it is more flexible.

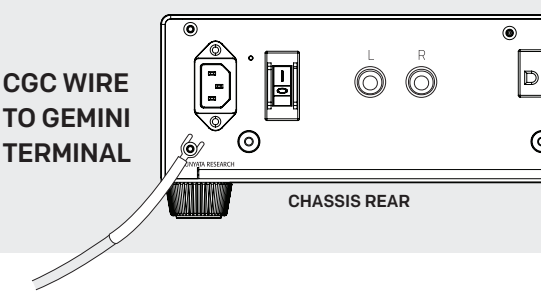
If your components include a dedicated ground terminal, the connection is straight-forward: connect one end of the ground wire to the component's ground terminal and the other end to a CGS terminal on the back of the GEMINI.

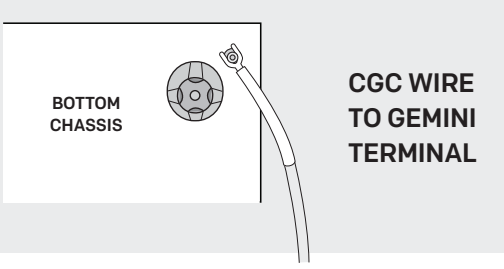
If a component does not have a dedicated ground terminal, you may use a ground wire with a small spade and attach it to one of the chassis screws on the bottom of the component.

CONNECTIONS



NOTE: Care must be taken to ensure that you are loosening an actual chassis screw and not a screw that holds some internal part in place. Refer to your component's service manual if possible. Only test and loosen chassis screws that are around the perimeter of the chassis case. DO NOT loosen any screws that are inside the perimeter of the bottom or base plate. DO NOT loosen any screws that may hold internal parts in place.





Shunyata Research makes ground cables that are attractive, perform well, and are inexpensive. We also make adapters called *Ground Tails* specifically designed to safely make ground connections to various connector types: RCA, XLR, BNC, USB, ethernet.

Check with Shunyata Research Customer Service or your dealer for more information.

~ WARNINGS ~
Just to be very clear — when referring to connections to an RCA or XLR channel,
we DO NOT mean that you connect a normal interconnect
to the component and the other end to a grounding hub.
This would *short out the signa*l and could *possibly damage the equipment*.

Do not make DIY grounding cables
unless you are absolutely sure that you know what you are doing!
We strongly recommend that you ONLY use grounding cables
specifically designed for the purpose.

Never connect a ground cable to a speaker's input terminals
or to an amplifier's output speaker terminals.

FAQ — FREQUENTLY ASKED QUESTIONS

What performance improvements can I expect from using the CGS?
The sonic improvements are often described as a reduction of background noise along with broader range of dynamics. The timing of dynamics can also improve, along with more dimensional and precise image placement. These improvements may be more obvious in some systems and more subtle in others. Our advice is try it and see what works best in your system.

Which components should I connect to the ground hub?
All components in the audio system may be connected to the CGS grounding system. Components that do not have a ground pin in the IEC power inlet may produce sound when not grounded. Additionally, you may connect metal equipment racks and anti-static mats if used in the system.

NOTE: Care must be taken to ensure that you are loosening an actual chassis screw
and not a screw that holds some internal part in place.
Refer to your component's service manual if possible.

I have an amplifier(s) connected to a separate dedicated line — should I connect them to the ground hub?
Generally speaking, you should try it. This may reduce ground loop problems and improve sound quality. However, connecting the ground on some amplifiers to the ground hub may produce no results or may degrade the sound quality. It is important to test each of the ground connections independently, one at a time.

If a component's power cord is connected to the GEMINI — do I need to run a ground wire to the ground terminals?
If a component is connected to the GEMINI with a power cord where the ground wire and AC plug pin are functional, the chassis of the component will be connected to the internal grounding system of the GEMINI through the power cord. You do not need to make another connection to the ground hub terminals. However, many components benefit from the additional chassis connection, especially if you are using common stock power cords. Try it and see if performance is improved.

If a component does not have a ground terminal, how do I make a connection to the chassis and CGS?
If your components include a dedicated ground terminal, the connection is straight-forward: connect one end of the ground wire to the component's ground terminal and the other end to a CGS terminal on the back of the GEMINI.

If a component does not have a dedicated ground terminal, you may use a ground wire with a small spade and attach it to one of the chassis screws on the bottom of the component.

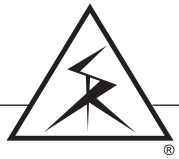
Are ground cables included with the GEMINI?
There are no ground wires included. There is no way to know how many components you might have and how far away the connections may be. Check with Shunyata Research Customer Service or your dealer for more information.

How many ground terminals can be connected to the ground system?
There are four terminals, but each terminal can accept multiple wires. However, each terminal can accept two ground cables, one terminated with a spade and the other with a banana. Therefore, the Model-4 can accommodate up to 8 ground cables and the Model-8 can accept up to 16 ground cables.

Is the GEMINI ground hub similar to Entreq or other grounding box products?
There are many *chassis grounding* and *signal grounding* products, and both types of products provide a common grounding point. However, the method of reducing ground noise varies by manufacturer. The GEMINI's chassis grounding system is unique and patented. However, it is compatible with most *chassis grounding* type products.

Can I use other manufacturers' ground cables?
Yes, any good cable or wire that has a low DC resistance and low impedance is suitable. Be sure that the ground cable has a very low resistance (less than .1 ohms per meter).

What is the best method to connect a turntable and a phono preamp?
It is usually best practice to connect the phono turntable ground wire to the phono preamp. Then, connect the ground terminal of the phono preamp to one of the GEMINI ground terminals.



SHUNYATA RESEARCH

26273 Twelve Trees Lane, Poulsbo, Washington 98370

360 598 9935 | www.shunyata.com

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