

Modular Grounding and Patching

The 9700series modules use a four-circuit dc power scheme with dual-dc supplies, one with a positive polarity dc and the other a negative polarity dc, and two grounds. The two grounds originate from a single point on the power source, but run out to the modules over separate wires with one reserved for audio signals and the other for all the other stuff like power supply filter capacitors and toggling circuits which have currents associated with them that can be heard as hum, buzz, ticks and clicks.

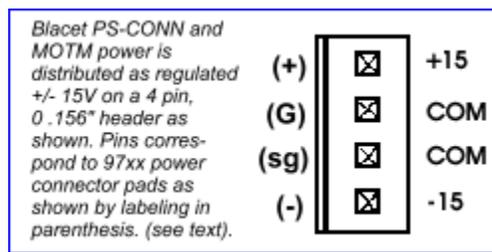
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Below are two references to this four-circuit power scheme from the PAiA website.

From: <http://www.paia.com/ProdArticles/9700faq.htm>

I have a really hefty bi-polar 15V regulated power supply. Can I use it with 97xx modules?

You sure can. You may need to change connectors to ones compatible with the supply you're using. For example, if using a Blacet Research PS-CONN distribution board you will probably want to get some .156 connector housings and pins from Blacet. When using +/-15V regulated supplies always short out isolating resistors R1 and R2 on the 97xx board. Be very careful not to interchange (G) and (sg) on any 97xx modules as this corruption of the module's Star Ground system will guarantee "noise". If the power supply has only a single ground, run separate wires from the (G) and (sg) of each 97xx module back to this single ground



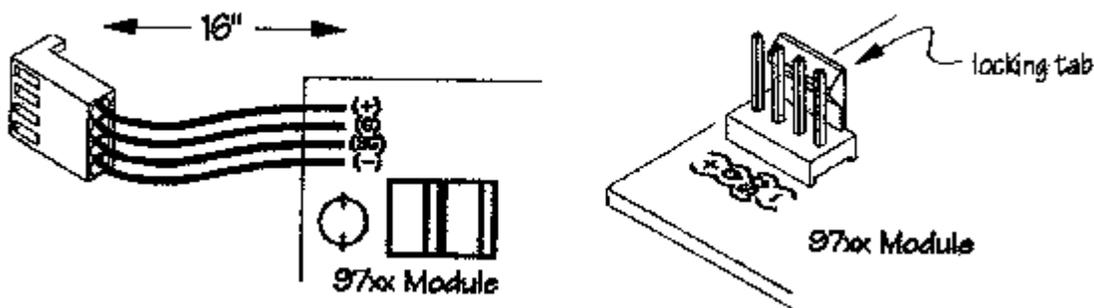
From: http://www.paia.com/ProdArticles/9700_chronicles.htm

The 9770U Power Wing is a zero-space power supply for systems that do not have a midi2cv8 or other power source. In the 9700 series, power is distributed as unregulated bipolar 18VDC to the modules which have local voltage regulation where needed. Signal ground and power grounds are separate lines for star grounding.

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Power connector kits are provided in the FR accessory kits associated with the 9710, 9720, and 9730 modules and are comprised of cable, terminal, and cover assemblies which solder to the module and a 0.1" four-pin header matching the cable end which solders on the preceding module in a P9700S or other FR-7 chassis. The 9700 MIDI2CV8 is the power source in the P9700S. The header for it is provided in the module to its right, (the 9720 in a P9700S). Note too, the locking tab for the MIDI2CV8 is towards the rear edge of the board which is different than the other modules in the system. Systems without the MIDI2CV8 can use the FR-PWP, a special rack-ear for the FR-7 for mounting a 9770series power supply without occupying any of the ten single spaces of the FR-7.

The following illustrations are examples of the 9790 power connector cable and header kit (FR accessory kit items).



Since all the modules are connected to a circuit-common/ground, it is only necessary to use a single, signal carrying wire to patch from module to module in a system.

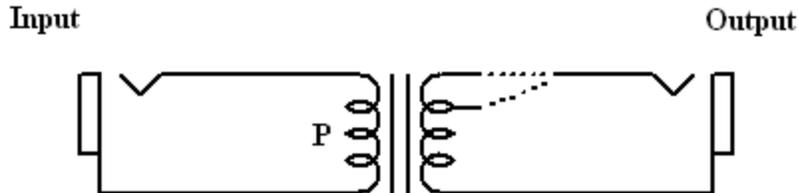
The PAiA 9791 Patch Cord kit included with the P9700S uses a flexible rubber test lead cable and miniature phone plugs for patches within the system. Patches to or from the system require a two conductor cable so that the separate pieces of equipment work as one and shielded cable is provided for this with the shield wire completing the ground circuit. The 9791 instruction sheet contains details about the patch cords and the way the use of single conductor patch cords avoid creating multiple ground circuits between the modules: They're joined at the supply, then at their input and output connectors. Loops like this aren't likely to be such a problem with a modular synthesizer's audio frequency signals and their relatively strong, 10v range, signals as they might be with post-audio or weaker, mic-level signals. And, with the normalization scheme of the P9700S and many usual patches already made within the multi-function modules, the number of patch cords is minimized. So it is OK to use pre-made two-conductor cables, and chances are, trouble from a poorly constructed patch cable are more likely than ground-loops made with module to module patches. Ground loops that occur when the wall-outlet safety ground is a path combined with an audio cable ground path is really more likely to be a source of ticks, clicks, or hum and these can be most easily prevented using a transformer to isolate separate device's audio grounds (example follows).

A consideration when shopping for plugs for cords, or pre-made cords, is that the module connectors are close together, so consider the diameter of the plugs and look for slim bodied types. Not all plugs are made to exacting specifications either. I have one that doesn't make contact if it is pushed completely into the socket, I'm always having to remember the reason there's no sound is because this one needs to be pulled back out a mm so it makes proper contact. Also, there are patch points on the 9700 modular expect the plug to be mono or tip-sleeve TS type which shorts the Ring contact of a tip-ring-sleeve TRS connector to the grounded sleeve. "Stereo" plugs would not do the job. On the other hand, the MIDI2CV8 module has TRS sockets so both voltages (CVs or Triggers) and Open Collector Transistor circuits are available from the single output. A P9700S does not utilize any of the o.c. circuits on the connector rings though, and, plugging a "mono" TS plug into these is OK. The transistors then only try to switch ground to ground....a loop, but only microscopic, and not a concern.

A benefit of making single conductor cables is that two-way or three-way cables can be made. One plug could have two or three wires on it to carry the Pitch or Gate or Pulse triggers to multiple modules. The lengths can be specific too, for a tidier look—if that's possible or desired in a modular set-up!

The following diagram is an example of an adapter which works to both a) lower the 10v signal levels from a 9700system to a more normal -10 to 0 dBv signal level (the expected level in an unbalanced, line-level input, and b) isolate the system, or other devices where this might be needed, and prevent ground loops formed by combinations of audio connection grounds and wall-outlet safety grounds. It uses a TM019 miniature audio transformer with connectors soldered to each side. If you make one and build it into a metal box, isolate one of the connectors so it doesn't contact the box and complete the ground circuit between the devices.

**High Level Synthesizer
to Line-level (-10 to 0 dBv)
Attenuator/Isolator**



**Mouser TM019
Miniature Audio Transformer**

**select secondary winding end or tap
for more or less signal level**

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Learn more about ground loops and see links for Rane's excellent information and solutions here:

[http://en.wikipedia.org/wiki/Ground_loop_\(electricity\)](http://en.wikipedia.org/wiki/Ground_loop_(electricity))

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Older 2720 and 4700 series PAiA modulars used different cables for the audio and control patches.

The patch cords for the modules consisted of 1/8" mini phone plugs for the audio cables and pin plugs for the control voltages/triggers and flexible, rubberized test lead cable for the patch cords.

The pin plugs aren't as readily available as the 1/8" phone plugs, but Mouser 800-346-6873 has them (stk #530-105-0302-1) but they describe them as tip plugs. Mouser has the rubberized test cable too. Solid, 14ga insulated wire with about an inch stripped off at each end can be used for the cv patches. Since everything in the 2720 or 4700 series systems is on the same power supply, they already have a common ground, so the cables need only be a single conductor wire. When patching to the external equipment, one cord will need to be patched between a ground-circuit pin jack on the synthesizer and the other device ground to establish a common ground between them.

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This next page is the instruction sheet included with the 9791 Patch Cord kit included in the P9700S.

PAiA 9791 Patch Cords

The material supplied may be used to make patch cords of lengths that are useful to you. A recommended distribution is:

- 6 ea. 6" patch cords
- 4 ea. 12" patch cords
- 2 ea. 18" patch cords.
- 1 ea. 4ft. I/O cord.

Patch cords are made using the flexible test-lead. Note that no connections will be made between the grounds of the plugs on either end.

High signal levels and low driving impedances of the 9700 series make patch cord shielding unnecessary AND if shielded cords are used the shield should not connect to the plug grounds at both ends. One end should always float. Shielded cords between modules can violate the 9700 series star ground provisions and lead to ground loops and noise.

The I/O cord makes connections between modules and outboard equipment such as a mixing board or amp. The RG-174/U coaxial cable should be used for this cord. One end should terminate in a 1/8" Phone Plug and the other end in a larger 1/4" Phone Plug. The Co-ax shield should connect to the plug ground on both ends as shown in the illustration below.

9791 patch cord set packing list

- 25 1/8" phone plugs
- 1 1/4" phone plug
- 10 ft flex test lead
- 4 ft RG-174U co-axial cable

