Never Connected

CHRIS BRYANT DESCRIBES AND ANALYSES AN INGENIOUS AND RADICAL APPROACH TO AVOIDING MAINS POLLUTION EFFECTS

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The past 20 years or so has seen plenty of discussion about the risks of electrical pollution causing electro-hypersensitivity (EHS), whose symptoms include nausea, headaches, chronic fatigue, chronic pain, tinnitus and rashes. TV programs have discussed how electric fields can give you cancer, and some claim that cordless phones make people sick. A few consultants recommend that people who are sensitive shouldn't use cordless phones, and in extreme cases should also get rid of dimmer switches, 'energy-efficient' fluorescent bulbs, halogen lights and every other radio frequency noise-generating device. Here in the UK, the government seems inclined to dismiss all this as scaremongering, but Scandinavia apparently takes EHS very seriously. Norway has a cellphone free beach, and Sweden treats EHS as a disability, and is building an EHS-friendly village.

While electromagnetic noise might possibly make a few people ill, there's no denying that it's making our hi-fi systems sick. Although many dispute the effects on human beings, there's no arguing with the observation that this pollution can seriously harm electronics, and to this end governments have introduced legislation and directives to prevent unwanted electronic noise pollution emissions. Just as important, they have to ensure that all sensitive equipment is protected from noise interference. Noise is basically any unwanted signal, and recent times have seen a huge rise in airwave use for increasingly diverse activities (mobile phones, wi-fi, etc).

Electronic Noise

Unwanted noise has always be a problem for electronics. Some is generated in the components themselves, and once a circuit with appropriate noise levels has been developed, the designer must then try to stop unwanted noise from outside getting in, or from the inside getting out. However, government legislated standards to which all equipment must comply obviously have nothing to do with our sensitivities to changes in hi-fi performance.

The two main sources of noise that attack hi-fi equipment (and therefore require defence measures) are airborne radio frequency (RF) interference (incessant and ever increasing), and noise on the mains. Almost all equipment that draws power from the mains supply is also capable of generating noise, and this seeps back through the house wiring to pollute other equipment. Traditional mains transformer power supplies are bad enough at producing noise, but switch-mode power supplies are becoming increasingly popular, so mains noise gets steadily worse. Recently the spectre of broadband network distribution via the mains has become a reality, raising the spectre of things deteriorating even further.

Protection problems

The protection of our equipment from these assaults has become increasingly important, but unfortunately the protection itself can be yet another destroyer of fidelity. Like everything in hi-fi, compromises must be made: the more protection that is put into equipment to stop noise and interference, the more the likelihood that this extra filtering will itself reduce the fidelity of the equipment.

Long-term tests have shown that on those occasions when the equipment is relatively interference free, then it always sounds better without protection. However, when unwanted noise starts infiltrating equipment, then it doesn't function correctly without protection. Having the facility to switch it in and out might seem a clever solution, but then switch contacts don't sound particularly good either, so what you gain on one hand you may lose on the other. Back to compromise.

These noises could really become the bane of the audiophile's life. Notice how much better your hi-fi sounds very late at night when those down the street have switched off noise-generating televisions and computers, and local electronic background noise drops. (Good to unplug all those plug top supplies as well.) Even in a 24-hour city like London, once the witching hour has passed, systems bloom into delicacy and realism unsuspected during the day.

To combat this malaise, several small manufacturers have produced battery powered pre-amplifiers, but these devices required much thought and regimentation to get maximum performance. The batteries had to be charged when not in use, and unplugged from the mains when used. Ultimately most people just couldn't be bothered – the performance gain didn't seem enough to warrant the trouble.

With mainstream equipment, specialist mains cables and spur wiring techniques can improve things, and the best mains isolators do help but tend to be expensive and bulky (see HIFICRITIC Vol1 No.5). As

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technology advances, less than great minds find new ways of polluting the mains and airwaves with more noise, and governments remain entirely indifferent to our plight. We now know the problem, and its up to designers to come up with solutions that will rid us of the noise while at the same time leaving our high fidelity reproduction undamaged.

The cure?

Along comes a possible cure, or at least some form of barrier protection. It's an idea that immediately makes you wonder why it hasn't been thought of before, because it's so obviously simple it might just work. Creator Richard George has a patent pending on a device he has called *Never Connected* (*NC*), which tries to stop noise entering through the mains. The design principle is to do exactly what the name implies – disconnect the equipment from mains noise, while maintaining its ability to draw power from it. That sounds like a contradiction in terms, but this simple yet effective circuitry goes some way towards doing just that. In effect the circuit attempts to isolate the mains supply from the internal circuitry, and not only does it reduce noise getting in, but it also reduces noise getting out and back into the mains.

How it works

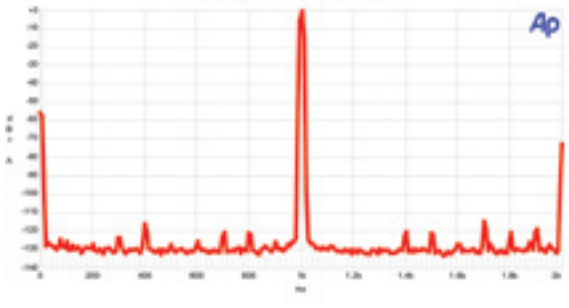
A standard high quality power supply consists of a transformer, which provides the correct AC voltage, and a diode bridge, which is used to charge a capacitor to provide a DC supply for the electronic circuits used within a product. When the supply is working, the diode only conducts for a fraction of the 50 Hz cycle (known as the conduction angle), depending on the design of the supply and the current drawn from it. An *NC* supply consists of two separate power supplies fitted in series – the first is entirely conventional, while the second, which is connected directly to the active circuitry, is a supply capacitor connected to the first *via* a switch.

The working principle is as follows. During the period the diode is conducting and charging the main supply capacitor, a signal is sent to switch off an FET inserted into the supply path to a second reservoir capacitor. This disconnects the second supply and the subsequent circuitry from the mains during the noisy diode conduction period. The second capacitor is only ever charged from the first through the FET when the diode is not conducting, so the active circuitry is never connected to the noisy mains. Rectifier diodes themselves produce noise as they switch on and off, so providing the 'FET off' period extends beyond this noisy switching time then this noise should also be blocked. However, *NC* does not stop the diode switching noise getting into the mains supply, so it's not quite perfect.

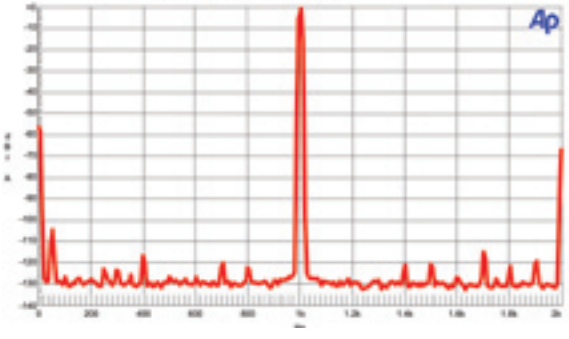
Early days

Some years ago George's company Fenson supplied me several early samples, which I used in various applications. In low power circuits they always managed to wring out a little extra performance, no matter what regulators or circuits follow. From CD players to pre-amplifiers they offered obvious improvements. Experimentation showed that incorporating the *NC*

ASTINTrew At3500 1kHz full level Jitter



ASTINTrew At3500 +NC 1kHz full level



boards with the shortest possible connections brought the best results, so the use of an external power supply was abandoned. Now a new version is available which is claimed to offer improved performance. It now comes with a low noise discrete regulator, and was supplied as a standalone power supply unit.

The technology appears to have limits, however, and as soon as you start drawing significant power (ie anything over about 500mA) the advantages are reduced and dynamics seem to suffer. In its current form it's definitely limited to low power applications.

The new Never Connected

As a technology showpiece, Fenson supplied two AstinTrew *AT3500* CD players. One was standard; the second was modified so that both the digital and main analogue circuits could be powered from two external *NC* supplies. (The valve output buffer stage and display still used the CD player's original, permanently connected supply.) Three mains cables are therefore required, and experience suggests one common mains connection might have given better results, though this should still easily show any benefits provided by this latest *NC* version.

Both units were run in continuously for a couple of days to ensure they were nicely warmed up. It would be unfair to comment on the *AT3500*'s performance, as there's no space here to review the CD players individually, so I'm just going to discuss the differences between the samples.

I was also hoping to measure some noise level or spurious artefact differences between the two players, and I spent several hours in the lab. In the event both versions had very low noise floors, low jitter and no noteworthy spuriae. I did manage to detect one difference - the *NC*-equipped player had a slightly larger hum component – beyond that, no change (see graphs).

Listening tests

However, the listening tests proved interesting and the difference between these two units was substantial, and the *NC* supplied player was simply better everywhere, giving a very significant 20% overall improvement. Bass sounded cleaner, apparently more powerful and better defined, with more impact, better structure, improved tune playing ability and dynamics. Midrange had better focus, more realistic tonality and dynamics, and just generally sounded more like a real sound. The treble had less grain, greater definition and extra air and sparkle. The soundstage was more solid with greater depth; focus was far tighter, and the whole illusion more realistic.

With an *NC* equipped component the choice of mains cables ought to be irrelevant. But in trying to cover all the angles I couldn't resist trying a change. Change the cable - change the sound. Put in a good mains cable, and the result is a better sound. This suggests that the 'never connected' barrier doesn't completely bar what lurks on the mains: it obviously helps, and helps a lot, but doesn't as yet give total isolation.

Conclusions

This simple but effective invention definitely helps with some of the problems associated with noise on the mains. In low power circuits it really can give a substantial performance improvement over conventional supplies. It appears equally competent with digital or analogue loads, and providing the current draw isn't too great, can be wholeheartedly welcomed. Even though the extra complexity and doubling of the supply capacitor count does significantly increase costs, the technology definitely deserves recommendation on the basis of its ability to improve sound quality. Obviously, future availability to most enthusiasts will be limited by those manufacturers prepared to incorporate it into their designs; in the meantime if you want a piece of equipment with *NC* supply, it has to be a retrofit. Alternatively, you could move to Sweden.

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