feature | keeping your studio quiet

keep it hushed up

REDUCING UNWANTED BACKGROUND NOISE IN THE STUDIO

Hums and buzzes in your signal path are not the only cause of noise problems in the studio. The mechanical noise emitted by some equipment can be equally disruptive -- but, as **Martin Walker** explains, you don't have to suffer in (lack of) silence.

As more and more of us move over to 20-bit and 24-bit recording systems, lowering the acoustic noise floor in our studios becomes just as important as optimising the gain structure of our mixers and keeping electrical noise at bay. After all, however high the quality of a recorded signal, you will only be able to monitor it properly if the dynamic range of your control room is just as wide. Many people monitor at sensible levels of 100dBA (at a distance of 1 metre) or less, but since the recommended background noise level for an office is around 40dBA, this would reduce the effective dynamic range to just 60dB!

Some fundamentals, such as air-conditioning, are best dealt with by a professional who knows the options, since they are an integral part of professional studio design. Other aspects of noise pollution, however, are caused by the cooling fans that inhabit not only most computers, but also many power amps and other pieces of studio gear. Add to this combined airflow the throbbing and clicking of hard drives, a host of buzzing and humming transformers, sympathetic rattles and buzzes from racks, radiators and other furniture, and you soon move beyond the mildly annoying to the mildly headache-inducing.

The easiest and best solution for professional studios is to source quiet equipment in the first place, by choosing power amps without fans, and buying computers (especially where PCs are concerned) from specialist music dealers who have plenty of experience of sourcing hard drives that are quiet as well as fast. However, even if you are already landed with equipment that throbs, whines, and buzzes, it is possible to reduce such noises in most cases, and sometimes eradicate them altogether. The DIY approach often costs relatively little, but the small amount of time it takes can reap dividends where unwanted
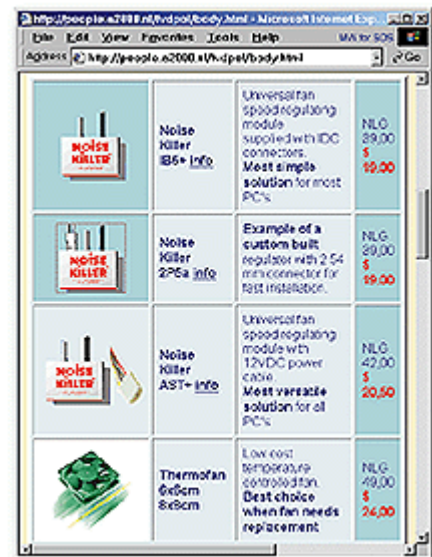
noise is concerned.

Most of the tweaks I'm going to discuss are easy to implement, but a few do involve a small amount of soldering, and you should always take great care when modifying any electrical equipment. If in doubt get a dealer or technician to make the modification for you, otherwise you may void any guarantee that your equipment is under. Having got those warnings out of the way, let's get silencing!

Your Biggest Fan

The best way to quieten your studio is to deal with the noisiest item first; once this is dealt with, the next one to treat will become obvious. Fans are nearly always the main source of unwanted noise in a studio, and are found in four main places -- computer power supplies, mounted on computer processor heatsinks, in external SCSI CD-ROM and hard-drive cases, and in high-powered amplifiers. The computer power supply is often the worst offender, because it normally has a large 80mm fan which shifts a lot of air, whereas those used inside amplifiers, rack gear and on CPUs are smaller (60mm or 40mm models are common). These smaller fans emit higher-pitched noise and are normally less objectionable, although you occasionally find fans as small as 20mm (often in CD-ROM drives) that are quite piercing!

The simplest solution would seem to be to exchange the noisiest fan for one with better aerodynamics and quieter bearings; most existing fans built in to both computers and amplifiers are designed with low cost rather than low noise in mind. However, although some manufacturers and suppliers do quote noise figures (in dBA), it can still be difficult to determine whether a particular fan model will be any less noisy than the existing one, and many people have found this approach to be very hit-and-miss.

Cool, Calm And Connected

A better solution from the musician's point of view is to provide the fans with a variable speed control to reduce their noise level. The majority of fans installed by default are fixed-speed devices that run flat out all the time: the fan is designed to provide enough airflow to cool the device in the worst possible conditions (in the middle of summer in the Sahara desert). Most of the time a much lower (and therefore quieter) speed would be sufficient.

Variable-speed fans use a tiny thermistor sensor to monitor the current temperature and hence regulate the fan speed, rotating only as fast as they have to to keep the processor, computer or amplifier within safe temperature limits. In normal conditions, therefore, they will exhibit considerably lower noise levels than fixed-speed fans.

The easiest way to add temperature-controlled cooling is to leave the existing fan in situ and add a controller to it. One such is Microstorm's Noise Killer, a tiny encapsulated circuit (26 x 40 x 12mm) that you stick, using a self-adhesive pad, at a suitable spot in the fan airflow, and then connect in series with your existing fan leads. No soldering is needed (the connections clamp over the existing wires), and the suppliers claim that you can fit one in 15 minutes with a screwdriver and a pair of pliers. I've used an older version for several years, and its two advantages are low cost (about £14) and that you can fit it to any size of fan: mine is currently silencing the high-pitched whine from a 1-inch fan in an external SCSI drive.

The temperature sensor should obviously be mounted close to the device being cooled for

optimum temperature monitoring. For a computer PSU, simply placing the sensor in the airflow of the fan should be sufficient; in other cases, you could directly mount it on an amplifier or processor heatsink.

If you prefer, you can replace the entire noisy fan for a better-quality one with variable-speed temperature control built in. Papst, for example, offer a range of Variofans through electronic component distributors (one UK supplier is Electrospeed). Price depends on size, but should be between £15 and £18. Two or three wires will need soldering onto the original fan connector, but this should not be beyond the capabilities of most DIY enthusiasts.

More Power To Your Elbow

Power amps often generate more heat than computers, and downgrading the fan-cooling arrangements might eventually result in blown output devices if you aren't careful. It is therefore particularly important when fitting temperature control to fans inside an amplifier that the temperature sensor is placed in a position where it is monitoring the maximum temperature. Some amplifier designs have fans mounted at the front of the rack case, to pull cold air past the hotter heatsinks further back, so mounting the sensor near the fan won't reflect the temperature of the amplifier at all. If you are at all unsure, leave amplifier cooling tweaks to those with knowledge and experience.

At the more ambitious end of things, some may find themselves with an entire rack full of power amps, valve-based effects and other heat-generating, fan-containing gear. In this case, the Smooth Cooler from Moth Marketing may be of interest; this is an external controller box (15 x 10 x 6cm) capable of running up to 1 Amp's worth of fans. After mounting the thermistor probe at the hottest spot in the entire rack (such as on an amplifier heatsink), you can use it to control the speed of a dozen or more extractor fans. LED indicators display Power, Spin (to confirm that the fans are still rotating), Max (indicating that the fans are already running flat out, and further cooling measures may be needed), and Alert (tripped when the thermistor reaches a preset temperature, normally 75 degrees Centigrade). It's pricey at £75, but a DIY kit version is available for £50.

Transforming The Noise

If and when you have minimised the fan and hard-drive noise from your studio you will be left with comparative silence. It is at this point, however, that many musicians discover other, previously unnoticed sounds. Many transformers used in mains power supplies buzz a little due to loose laminations, and once they are mounted in a case the problem often gets a lot worse, as whole sections of the case throb in sympathy. This is a particular problem when large unsupported areas such as top plates are close to (or touching) the top of the transformer.

A simple remedy is to open up the case and stick on a damping pad to stop the panel vibrating, but an even cheaper option is to place a thin piece or sheet of neoprene (or even a small strip of draft excluder) between the transformer and top plate, and then bolt the case together again, making sure that the neoprene is under a small amount of compression. Damping pads can be successfully employed wherever any unsupported panel is vibrating in sympathy, such as in keyboards, rack units, or even radiators and other furniture. Try a sinewave sweep and listen for frequencies that 'set things off' to discover the culprits -- if placing the palm of your hand on a panel cures the problem then so will a pad of damping material.

Quieter Processing

Although the fans used to cool computer CPUs tend to make far less noise than most others, many people are still tempted to buy the replacement processor heatsink/fan combinations advertised on many web sites. However, the vast majority of these are designed for serious 'overclockers' who want to run their processors way beyond the

manufacturer's recommended speed. Since this always results in lots more heat being generated, solutions nearly always involve adding more fans, and some processor coolers now have anything up to three of them mounted on the heatsink. This sort of system is obviously likely to be worse, rather than better, from the noise standpoint. One notable exception is the range of SuperSilent CPU Coolers from German company Noise Control, whose fans rotate at significantly lower speeds. I installed one of these on my Pentium II processor, and it proved so quiet it was difficult to tell whether the fan was even running!

Many modern computers use processor fans with a third wire: most of them still run at maximum speed (and noise level) all the time, but the rotation speed of the fan can be monitored externally by the BIOS to check that it is still working. This is to ensure that your expensive processor isn't rapidly approaching heat failure due to a failed fan. You may sometimes lose this facility when replacing the fan, but not with the Noise Killer: the new variable rotation speed will still be displayed by the BIOS.

However, one sure way to reduce noise is to replace the current processor heatsink/fan with a larger fanless heatsink, if you have enough space inside your computer case. Such heatsinks include the Pikes Peak 2 from CG consultants. A little caution is needed, since you are relying solely on the heatsink and airflow produced by the remaining PSU fan to cool your expensive processor. I couldn't fit a Pikes Peak 2 in my own PC, because it's only available for the newer SECC2 package processors, but it seems a good solution for processors that run reasonably cool in the first place.

The Case For The Defence

Sadly, most computer cases are made of fairly flimsy sheet metal about 1mm thick, and are designed primarily to support a variety of internal components and keep in radio interference, rather than provide any noise reduction. They can even add to the overall noise, since many of the panels have large unsupported areas that can (and do) vibrate in sympathy with the cooling fans and hard drives. The 'rattling case' phenomenon also occurs with external devices such as SCSI hard drives and CD-ROMs. Once you have fitted slower, quieter fans, the main cause of case vibration is hard drives -- and there are steps you can take to minimise it.

Power Amps Without Fans

As Gwynn Robinson wrote in November '99's 'Sounding Off', finding high-power amplifiers without fans can be difficult. However, they can be found, and in any case, not all of those with fans are particularly noisy. One easy way to bypass the problem altogether is to opt for active speakers, since these not only incorporate their own power amps, but have no fans.

Fans are also extremely rare on hi-fi power amps, which instead rely on large heat sinks and plenty of air flow (although this precludes fitting them in a rack). 'Studio' power amps available with silent convection cooling (ie. without fans) include the Samson Servo models up to the 500 (275 Watts per channel into 4 (omega)), and the more upmarket Crown K Series (up to 475 Watts per channel). I can personally vouch for the quietness of Smartlight Studio series amps (available from Smart Sound Direct at up to 550 Watts per channel),

You can choose quiet drives in the first place -- just as with fans, some are far noisier than others. Once again, finding this information in a form suitable for comparing different models can be tricky. You could buy your computer system from a knowledgeable music dealer to take advantage of their bulk buying and testing of the most suitable fast yet quiet drives. Feedback from other users on forums like our own at www.sospubs.co.uk is also useful, and you could also check out www.storagereview.com, a web site that includes basic information about relative noise levels in its reviews of hard drives.

Thankfully there are also several ways to reduce existing hard-drive noise at source. The SilentDrive is a sleeve lined in acoustic foam that slips over the entire drive -- I have

since their fan noise never rises above a whisper and stops when the music does.

one of these in my own PC, and it really does make a big reduction in drive noise. The heat generated by the drive is removed by large internal aluminium plates that pass though slots in the sleeve, but unfortunately there is a limit to how much heat can be safely extracted in this way. For this reason only drives up to 5400rpm can be 'sleeved', since faster ones would be likely to overheat and have a shorter life. However, many people still have 5400rpm drives (mine is solely used for data backup), and the SilentDrive works extremely well for these.

Another approach has been taken by Noise Control, whose NoVibes drive mountings are very much like microphone shockmounts. The drive sits in a web of rubber supports in such a way that its mechanical vibrations don't pass into the computer casing. Noise Control sent me various NoVibes mountings to try out. The EIDE model is the simplest, providing basic shock-proof mounting for a single drive, while the SCSI Papst version adds a Papst fan to cool faster 10,000rpm drives, and the SCSI Radial adds a radial fan, which has the advantage of redirecting the hot airflow through 90 degrees away from the drive. All worked well, the fans were extremely quiet, and the mountings made a worthwhile reduction in drive noise.

Nearly all 3.5-inch drives will fit into either a SilentDrive sleeve or a NoVibes mounting, but the sleeve or mounting then needs to be mounted in a 5.25-inch drive bay. Most computer cases should have a couple of such bays spare, but do check that you have space before getting out your credit card.

An Absorbing Problem
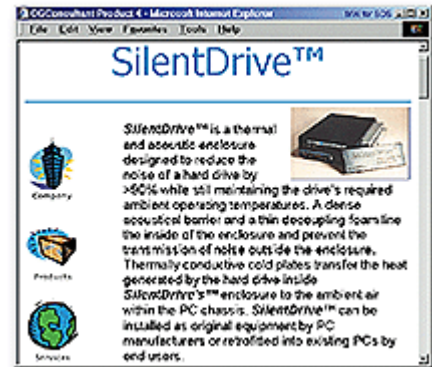
The other way of dealing with case-borne noise is from the outside, by silencing the case rather than the components within. There are two main approaches to this -- damping and sound absorption. Damping will alter the sound of a resonant panel from a ping to a thud, and can significantly reduce noise transmitted by both fans and hard drives. However, to reduce the noise still further you can completely cover the inside of the case with a suitable damping material, which will reduce noise levels in exactly the same way as traditional soundproofing does in the rest of your studio.

Purpose-designed self-adhesive damping sheets (often used to reduce structural noise in cars) are available for computer and audio use in two types from Russ Andrews. The cheaper black pads are 2mm thick, and come in sheets 160mm by 250mm at just £4 each. The EAR pads, at £11.90 each, are only 1mm thick and of composite construction with an outer aluminium skin. This version provides extra RF shielding, is considerably lighter, and will fit in places where the black pads are just too bulky.

Most computer owners will probably need three or four of the black pads. You could simply stick a pad in the middle of each large unsupported panel to stop ringing or other case noise, but for the most effective noise reduction, you should completely line the inside of the case side panels where your hard drives are positioned. This will not only stop the case from vibrating, but also significantly cut down transmitted noise from the drives.

The Overall Solution

By paying attention to fans, hard drives, and case vibrations, you should be able to reduce the acoustic noise in your studio from a roar to a whisper. However, there will still be some noise left after this acoustic treatment: if you want to reduce this still further, you will need

additional soundproofing, and this always involves adding more mass.

To further reduce computer noise, you could replace your existing computer case with a purpose-designed one with thicker walls, and possibly also lined with acoustic damping material (a few specialist companies, such as Noise Control, make such cases). You could instead add the mass of an intervening panel or wall by moving your computer further away into a cupboard or even another room, and then using a keyboard/mouse/monitor extension lead. These have recently come down in price, and cables of up to 10 metres long are quite feasible, although video quality may suffer slightly unless you buy the very best quality.

You could also build a small cabinet to house the entire computer and line it with acoustic foam. If the dimensions are a little larger than those of the computer, you could place external SCSI drives inside as well. Some form of hinged door at the front will be needed to let you get at the floppy and CD-ROM drives, and cooling is also important, since a sealed enclosure is a sure way to encourage overheating and possible component failure. I certainly know some musicians who simply 'open the door' between takes to let the heat out, but this is not an ideal long-term solution. Ideally, you need some ventilation holes in the front to let cool air in, and a large opening at the back to let warm air out. Many flatpack cabinets only have hardboard panels at the rear, so it would be easy to modify one of these. If the rear of the cabinet is facing a wall or desk, a further sheet of acoustic foam (or even a towel or tapestry) draped over this will stop any remaining fan noise being reflected back in your direction. 📧

Contacts

CG Consultant BV (Netherlands)
ATX Power Supplies fitted with thermally-regulated fans.
Pikes Peak 2 Passive Cooler.
SilentDrive hard disk sleeve.

T +31 (0)180 399 357.
E rienv@worldonline.nl
W www.silentsystems.com

Electrospeed (UK)
Papst Variofans.
Papst 60mm Variofan Model 612GI for PC processors (stock number 28-43579H) £15.15.
Papst 80mm Variofan Model 8412GV for power supplies (stock number 28-910337B) £18.48.

T +44 (0)1703 644555.
W www.electrospeed.com

Microstorm Elektronica (Netherlands)
Noise Killer fan silencer (models between £13 and £15).

E mstorm@wxs.nl

W people.a2000.nl/fvdpol/body.html

Moth Marketing (UK)

Smooth Cooler fan silencer.
Fully built-in case £75, DIY circuit board and components £50.

T +44 (0)1234 741152.

E hfn.accessories@mcmail.com

W www.hi-fi-accessories-club.mcmail.com

Noise Control (Germany)

ATX Power Supplies fitted with thermally-regulated fans.
Computer cases with silent PSU (also available with sound absorption lining).
NoVibes hard-drive mountings (models between £12 and £22).
SuperSilent CPU Coolers (models between £14 and £20).

E info@noisecontrol.de

W www.noisecontrol.de

Russ Andrews (UK)

Sound-deadening pads.
Black SD pad: (part number 32-108) £4.00.
EAR SD pad: (part number 32-139) £11.90.

T 0800 373467.

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All prices mentioned include VAT.

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