AUDIO BASICS

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Unfortunately, DAT is Going One-Bit Too!

One of my clients recently sent me the data sheets on several new Sony DAT (Digital Audio Tape) recorders. Inasmuch as Sony has discontinued the sale of the free standing PCM units in the USA (such as my PCM501ES processor that uses any old video recorder as the record and playback source for high quality digital tapes) my client wondered how close the newest and greatest DAT machines came to the older PCM units.

Unfortunately, they don't come close at all. Each model described has gone to 1-bit converters. It appears that the clock frequency might be higher (24 MHz instead of 11 MHz as in 1-bit CD players) but still far too slow. This will provide about 2400 samples per cycle at 10 KHz of the 65000 samples per cycle available on a CD at this frequency – about 4% of the information. Of course with noise shaping and averaging the DAT will measure just fine – just what you wanted.

It appears that you might very well be better off with a simple Hi-Fi VCR for home recording if you want better quality than analog cassette. If you purchase a Hi-Fi VCR with an audio level display and if it has adjustable audio volume - balance record controls (the built-in automatic record level controls can be switched off) then you can simply hook the VCR to your audio system as if it was a stereo audio cassette recorder and make surprisingly musical and quiet audio tapes – six hours at a crack – with no serial copy schemes to get in your way.

Speaking of audio tape recording anti-copy schemes, royalties, and digital recording, you should read Wayne Green's editorial in the most recent issue of *CD Review*. He suggests that the proposed tape and recorder tax – royalty scheme and serial copy guard will be just another way to send more money to corporate Japan. He says small US recording companies won't benefit and that the consumer will lose. You better take a look at what he has to say.

The Objective vs. Subjective Controversy, A Fresh Viewpoint

My daughter, Vanessa Van Alstine, is tirelessly working her way towards a Master of Science Degree in Electrical Engineering. A hard earned Mathematics Degree from Carleton College is already in her portfolio. She plans to end up as that rare commodity – an engineer who is grounded in the arts and literature too. As a member of the Audio Engineering Society she has noticed the unfortunate polarization between the engineering community and the audiophile community when it comes to describing and evaluating the performance of high fidelity equipment. The following are her timely and interesting preliminary observations about the problem.

In recent years, there has been a growing confrontation between the audio objectivists and subjectivists. This split has been discussed recently in the audio press, including *Stereophile*. The objectivists are people behind the "all audio amps sound the same" movement, believing that if you can't measure a phenomenon, it simply doesn't exist. The subjectivists listen to equipment to make their judgments about how it behaves. They care not how the piece measures, but only how it sounds. After all, they might argue, "Who cares what the numbers are - do you plan to listen to it, or just pin the specification

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sheet to the wall and look at that?"

Proponents of the two viewpoints come into confrontation time and time again and rarely have a kind word for members of the other camp. The objectivists are considered by the subjectivists to be a bunch of heartless, soulless technocrats in lab coats who wouldn't know good sound, or good music, if it came up and bit them in the butt. The subjectivists are thought to be a bunch of mystic golden ears, charlatans selling snake oil, or fringe lunatics. They wax purple prose about details that don't exist, inventing tales about magic cables, and sweetness and warmth of the sound. The skirmishes between the two mind-sets have been growing louder, more bitter and more public in the last several years.

At an Audio Engineering Society (the professional society for engineers and academics involved in audio design and research) conference last year, one of the sessions was about "magic cables" and, in the process, the validity of listening tests. There was a panel discussion and demonstration with some members of the audio press and a general society audience. The idea was to determine if audiophiles (read: subjectivists) could really hear any differences between cables – or to see if there really was any audible differences between cables. Unfortunately, the testers provided absolutely terrible conditions for critical listening, and no good judgments could be made. Whether the cables had different "sounds" or not, the test conditions were so bad you could never tell. Because in this particular test, under very unfortunate conditions, all cables sounded the same, the tester then attempted to harangue the audience into rejecting the entire idea of a listening test as a decision making tool on the basis that in that demo they could not reliably hear any differences between trials. What the session really showed most was that the objectivists gave no serious consideration to the subjectivists. The objectivists would not even give them enough of a benefit to set up decent, feasible conditions for critical listening, because they thought that, well, you can either hear a difference or you can't. So put out and perform *now!* This incident has served only to cause more misunderstanding and resentment, rather than opening a rational forum for discussing the merits of the different approaches.

It looks like the problem is one of ears versus numbers. What do you choose to believe, what you hear, or what you see on a test bench? The way the current camps are set up, there is very little room for a middle ground. Ears or numbers, it's that simple. Do you buy equipment that you think sounds good or something that tests well? It's hard to decide.

The high end world is notorious about changing its mind about what sounds good. The underground magazines often publish reviews of a piece that is top rated for its sonic quality, but too soon thereafter some other piece sounds even better and the first one is judged to not have been that good after all. Or they can decide that piece A is really wonderful. Then later that this new piece B just beats out A in every way. A few years later another company comes out with brand C, and it just does everything better than B. Well, 10 years down the line, some reviewer hauls his old piece A out of the closet and compares it to the latest and greatest brand G. He decides that A was just really a superior product compared to G. That's nice, except that G was better then F, which was better than D, and so on back down to A. Every step in the chain was an improvement over the previous, but the very first step ended up beating out the last. This has actually happened with the original Dyna Pas-3 being piece A. Indeed, the high end world is no stranger to these very comparisons. Without tests and measurements, they

could very well end up on an Escher stairway of logical steps, leading around and around in little circles forever.

The supposed subjective experts can't keep straight what sounds good and what doesn't. Besides, who knows what good sound is? How do you decide? Maybe it is easier to just look at the specification sheets. That gives a nice clean set of numbers that you can compare and contrast, and use to make a decision. Numbers are numbers, so you don't have to rely on your own listening judgment. You have data to back up a decision. But even the most mundane car radio, boom box, or plastic discount house rack system offers impressive specifications. The industry calls these "mid-fi" components and no serious listener would consider them able to reproduce music adequately; they are designed to sell on styling, price, and features, not on musical fidelity. The measurements don't give a handle on whether something sounds good or not, so of what use are they? It's starting to look as if there is just no getting around it, and all you can do is join one camp or the other and wade into the fracas with fists held high.

B*ut, the problem really is not one of ears versus numbers. The fact this whole argument exists at all indicates that the current measurement and evaluation system is deeply flawed. Science is supposed to describe the physical world and help us try to understand it. A good indication of understanding is being able to make predictions. If a theorem or scientific law is useful, or in some sense "true," it allows us to make decent predictions about our surroundings. Test procedures were developed to serve, not to enslave. Successful test methods should help to predict and confirm knowledge we had guessed at or sensed.*

The current split between believe-the-ears and believe-the-numbers indicates that we are measuring the wrong things. Yes, the current tests are measuring physical parameters, but are they the right ones? It seems that what we are currently testing for is not useful in letting us make good predictions about the subjective behavior of the equipment. You could measure the number of grains of sand at the beach, but that alone won't tell you if it's a good place to vacation. The problem isn't ears good, numbers bad, or, if you prefer, ears bad numbers good, but that the bench tests and the listening tests are giving us different information that do not correlate.

The solution is to develop a set of tests and measurements that work with our judgments and subjective evaluations, rather than fighting against them, or making decisions on pointless numbers. We need accountability between the human judgment and the "objective" repeatable measurable set of hard data. It's not numbers versus ears, but both working to make a critical judgment.

So how do we do this? What do we want the tests to do? There should be correlation between the objective and subjective tests. The testing conditions should confirm our judgments about equipment. One expects good sounding equipment to have good measurements, and bad sounding equipment to have bad measurements. Then we have the predictability we expect of useful tests and good science. Of course, the definitions of "good" and "bad" sounding can be and still are hotly debated. When we thoroughly understand what equipment is doing and how the circuit performance relates to perceived musical fidelity, it will be easier to test for the physical parameters of the circuit that affect the performance. We are not to that level of understanding yet, and so we still aren't certain what the tests should be. We have not found complete sets of test conditions that agree with our other judgments about a piece, or the current objective-subjective war would not be going on.

But there are steps that can be taken now to get closer to agreement between electrical and audible performance. We could take the current testing structure, and move many of the conditions from easy to measure but absolutely unrealistic to something that more closely models actual use. That is, instead of making the measurements to be easy to check in lab, but having nothing to do with actual music playing conditions, we need to find test parameters that are still uniform and repeatable, but more closely model use. That should be a step in the right direction. All other things being equal, the closer the measurements are to actual use conditions, the better they should conform with our other judgments, such as listening tests.

As an example of the artificial measurement procedures, we can look at one of the conditions for testing audio amplifiers. The test signal used is an audio frequency sine wave. Can't get an easier signal to look at, can you? Easy to generate, easy to look at, easy to make your measurements. Besides, if you put in a sine wave, but the amplifier under test does strange things to it internally and then filters the wave form again at the end (as the low pass filter formed by the input to the current amplifier section of many audio power amplifiers does), you still get a sine wave at the output. Because you are looking at the amplifier as a black box, you won't see the distortion. In many cases, even if a circuit has a great deal of nonlinearities, after filtering, you still get a good looking sine wave back out. A sine wave is a wonderful test signal to show that something works because you can often mess it up and then recover it again - it is a special case. A sine wave is a bad choice for a critical audio test signal because a multitude of problems in the circuit can be hidden. A piece will measure wonderfully with low distortion on the sine wave but on music it could drive you to tears if it has other problems the sine wave test does not reveal.

A more complex waveform, such as a square wave, would serve much better as a critical test signal. Square wave outputs are available on nearly every good signal generator, so they are still easy to use with standard test equipment. After internal distortion and filtering by the circuit under test, a square wave will show distortion at the output – especially if the output load contains reactive elements, that the sine wave will not to the same extent. Simply changing the test signal will make a difference in how a unit tests. The square wave measurements will probably agree more closely with listening tests. If you test with the square wave in the first place, you will see the higher, and more realistic distortion levels in the test results, indicating that there will be problems in the audible performance. A square wave test will show thermal problems much more quickly too, and as an inference, it can help spotlight poor high frequency stability. It has been noted, but not yet documented, that designs with marginal high frequency stability tend to overheat much more quickly under high power square wave testing than absolutely stable designs do.

When the test signal standard is improved so that it actually shows the presence of a bad design or improperly operating unit in the testing procedure, that should predict unpleasant behavior on music. The "hard" data should agree with the other judgments and the specification becomes meaningful again. We can now use it to predict the performance of a piece of equipment with some accuracy. The ears-number argument is resolved, because both descriptions point towards the same knowledge. This is only one of

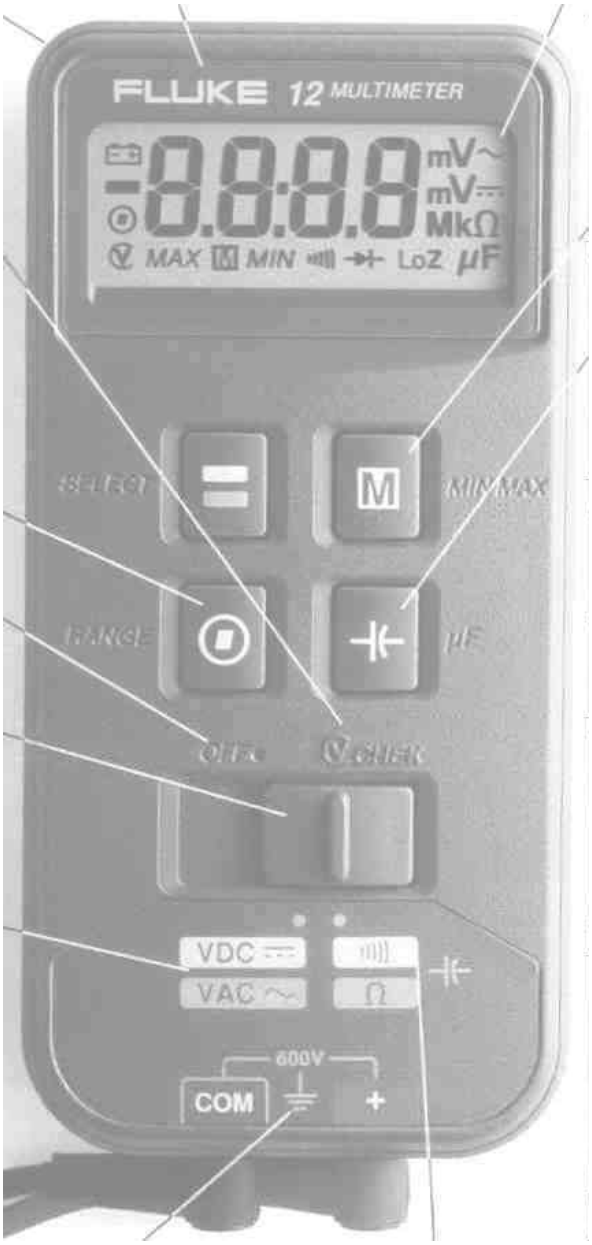
many reforms that need to be made in the way that we are testing equipment now. The entire approach to measuring audio equipment performance needs to be scrutinized to see if the tests serve to give us good information about the performance of the equipment when it is being used, or if they are trying to hide poor performance behind misleading specifications. Easy tests may make the specification sheet look impressive, but they serve only the manufacturer. The consumer is not helped by having happy numbers that don't give meaningful data.

There will of course be problems changing any of the testing conditions, and having them accepted by the rest of the community. Testing and standards is one of the most conservative areas of engineering and there will be opposition to any changes. In addition to professional inertia, manufacturers would be loathe to put out equipment with bad numbers - "good" numbers sell. Pathetic sounding harsh receivers with wonderful specifications still sell really well. If more effort is spent comparing numbers and worrying about distortion than listening to the music, the equipment doesn't seem to serve its function very well anyway. It tends to end up sitting around not getting played, and the consumer loses out. Perhaps a rating system that does provide useful prediction of actual performance will assist in choosing good equipment in the first place and is worth working towards. More realistic testing will help consumers avoid the disheartening process of buying equipment they end up not being happy with as they become subjectively more aware of its now undocumented distortions.

In the end, both objective and subjective approaches are important in evaluating equipment. In the absence of listening to equipment, you can end up loving a set of specifications that give terrible music performance. In the absence of having some technical background and having some data about what a circuit is doing, it is easy to short term make a bad judgment and like the sound of a piece that is doing nasty non-linear things, and regretting it badly later. Both approaches are needed to make good decisions about equipment, making sure that it not only sounds pleasant, but also has a chance of working linearly. The problem is that when a piece of equipment does not work well, as all too many in the marketplace now do, the sets of data do not give us the same answers. We don't know whether to believe the ears or the test bench when the two don't agree.

The solution is not to choose between either the ears or the numbers for decision making, but to look at the assumptions made in the current testing, remembering that valid tests ought to help confirm judgments made with other data and help us to predict performance. Often the tests were made to be easy and quick to do, and easy to repeat, or to give impressive numbers because manufacturers know that will help sales. The test conditions were not designed to examine equipment under realistic use conditions, or anything like them, and thus are not valid in helping us make decision about the equipment under use conditions. The test procedures need to be rewritten to give us useful data about the equipment in the way we will be using it, not necessarily the way that is simplest to measure. Once the bench numbers give useful data, we don't have to fight over whether one should be an audio subjectivist or objectivist, but we will know that both mind-sets give useful information, and that the judgments made corroborate rather than contradict one another.

Vanessa Van Alstine



The Fluke 10, 11, & 12 Multimeters. Only $89.95 – You Should Own One!

This is the best value we have seen yet in a precision multimeter – only $89.95 for a tool that measures everything from continuity to capacitance (everything except current) at essentially 1% accuracy. It even has a unique "V Chek" (idiot mode) for troubleshooting. If you can afford the price of a premium set of interconnect cables, you can afford to own this very useful and easy to read digital meter.

The V Chek mode will determine continuity/ohms. If voltage is present it will automatically change modes to measure AC or DC volts, whichever is detected. Auto-ranging is standard, but you can switch this off.

It measures capacitor values from .001µF (1000 pF) to 9999µF. Use it for matching speaker crossovers from channel to channel. You might discover that capacitors paired channel to channel, each of the correct value, actually makes your system sound and image better than randomly selected premium priced "good sounding" capacitors.

The meter's Min/Max capability can help you find intermittent problems. It can record highs and lows and "time stamp" them when they occur. It can capture opens or shorts as brief as 250µS.

It has an audible continuity checker (simply listen for the beep) so that you do not need to watch the display while looking for some problems.

It has a sleep mode that saves the battery if you forget to turn it off.

The Model 10 costs $69.95. It provides AC volts, DC volts, Ohms, Continuity, and Diode tests.

The Model 11 is $79.95 and in addition to the basic functions provides the V Chek mode and capacitance measurements and a bit better accuracy.

The Model 12 is $89.95 and adds the Min/Max and Time Stamp functions along with continuity capture. We suggest you go for this one! It has a two year warranty. In our experience Fluke test instruments (made in USA) are very rugged and reliable.

We don't sell Fluke products, they are available from many professional electronic distributors nationally.

We buy our Fluke instruments from Gopher Electronics Company, 222 E. Little Canada Road, St. Paul, MN 55117 (phone 612-490-4900) (ask for Tammy). They will probably sell one to you too. If you don't own a good meter there is no excuse to not get one now – the price performance ratio just got better than ever.

Used Equipment

Super Pas Three Vacuum Tube Preamplifier. This is a one-owner unit built new in our shop in March, 1988. It has gold jacks and a silver AVA Super Pas Three faceplate. We will check it out, make sure the tubes are good and the circuits are perfect and provide it with a 6 month parts and labor warranty for $295.00 plus $10.00 shipping in the continental USA. This unit isn't here yet (its a Super Pas Four trade-up) so give us a chance to get it, test it, and put it into the best possible shape for you before shipping.

This is the only used piece available this month. Everything else is sold. Why don't you trade-up now. Call us, your old AVA equipment may be worth more and will sell faster than you would expect.

Frank and Darlene Van Alstine