

# TAS Interview

## Spectral's Richard Fryer & Keith Johnson



Keith Johnson



Richard Fryer

If high-end audio is a secret well kept from the general public, Spectral Audio is a secret well kept from the high end. This 33-year-old company doesn't pursue reviews, advertise, or promote its products in any way. It seems to relish this low profile, letting music lovers discover its products on their own. Spectral is also unique to the high end in the way it approaches research and development and product pricing, and in its concept that the components in an audio system are, in fact, one piece of engineering.

To gain some insight into this enigmatic company, Robert Harley sat down with Spectral's founder, Richard Fryer, and its chief designer, Keith Johnson, for an extended interview.

**Robert Harley:** Spectral is 33 years old now, making it one of the longest-lived high-end audio companies. Tell us about Spectral's core values, which to me seem to have remained unchanged over a very long time.

**Richard Fryer:** It's always been about revealing the beauty of music by making a system that is timeless, and using technology where it counts. Spectral was the end of a long line of investigation for me. Spectral was the last thing that I could do. Having been an audiophile building music systems since I was very young and working in high-end companies when I was in college, I gravitated towards the high-end specialty audio companies of the day, almost like a moth drawn to a flame. At a certain point you say, "I have to decide what to do with my life," and make decisions about where your education is taking you. I felt I had to challenge myself because I saw the future of music reproduction and I wanted to be part of it. I admired so many

people in the high-end business who were pioneers and I wanted to make my own contribution. At a certain point the high end became so time-consuming that I had to decide between a career as a psychologist, which is where my training was, and the music systems and musical appreciation that were instinctive for me.

Spectral has been a very personal endeavor. I looked for the sharpest, most innovative, most sensitive people that I could to associate with our company. I've tried to give them unconstrained resources with as few boundaries as possible, and with the highest standards to exceed.

I'm proud of the Spectral design team. I hope that I'm a facilitator for other talent. I'm not an engineer, but that's part of my strength. I know when people are good, and I like to bring people of great talent and insight together, and with their interaction come about new solutions.

**Spectral seems to have taken a different path than most high-end companies.**

**RF** We took a path that's different from other high-end companies because I'm not a business major. Spectral was to take many of the values that we learned from a great century of inventors and auteurs and cultural innovators, and in our case, invest them with our local capabilities in the Silicon Valley where Spectral is

located. Our contribution could be to utilize technologies and solutions and ideas that weren't uncommon in other areas, but that perhaps sometimes were overlooked or unappreciated, or were simply too new to be utilized for solutions in audio.

We didn't start up a business as a career vehicle or because we were going to starve. We did it because, almost like an artist's output, we couldn't *not* do it. It was essential to get this out, to have at it and try. But having seen other great products, I think that I had a sense for what classic group design was, and I was in awe of it. It's breathtaking when music products are done well and work well together. It taught me that the role of the music system always should be reverent and should be focused on supporting and presenting the work of the artist.

**Because we have given ourselves rather unrestrained capabilities in terms of resources and development cost, we have no justification for compromise.**

**Is that the idea behind the very long development times of Spectral products—introducing a product only when there's a real advancement?**

**RF** Absolutely. If a product or a system is designed very well and you develop it to a high level of refinement, other than change for the sake of change there may be nothing more that you can say on the subject for awhile. You can't make it better, you can

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only make it different. If you're trying to be true to the inner reality of the recording and the intentions of the artist, leave it alone. It's our responsibility to support the total fulfillment of that recording, never to modify or interpret it. In other words, the music system cannot be a musical instrument to any degree; it has to be a music reproducer. It's a tool. It has to be accurate.

And so this focus on accuracy—which is not always understood—is based on the broader idea of accuracy as truth. The musicality in an accurate music system comes from the recording and from the artist. It will never come from the hardware or the music system. For us to turn our back on the true nature of the recording and what was captured in that event puts us above the artist, and above those who have created this musical snapshot. We feel very strongly that that is absolutely not our role. Because we have given ourselves rather unrestrained capabilities in terms of resources and development cost, we have no justification for compromise. It's necessary in mid-fi—value is always a serious issue. But we have one goal, and that is reproducing the entire three-dimensional envelope of the event in the best way we possibly can with technology, and through that to bring people to music and share the tremendous gift that we've had living in this period of music.

There's an evangelistic side to Spectral, because we all have a responsibility in opening these doors that were opened for us. In that regard, our product simply can't be good enough. We are driven and obsessive because we have to be. We have the

experiences and the references to know what is right and wrong in sound reproduction and what is the road to the truth. We have to keep pushing ourselves for superior results.

**Related to that, the volume control in the DMC-3OSS preamplifier seems to be a good example of not accepting conventional technologies and instead finding different solutions. Perhaps you can talk about the technical side of the volume control as an example of your core philosophy.**

**Keith Johnson:** In making recordings, gain control is a very important part of the system, but it's also a major weakness. We've done a lot of listening with what we call "ultimate" [high-resolution digital] files and microphone feeds to figure out where the degradations occur. There are many ways of controlling volume, but most of them don't work very well. We tried for probably a good six months to make a DAC-based control. It would be very useful to have such a thing, but we never could really make it work at the standard that we'd already achieved in the rest of the circuit.

So we end up using a motorized rotary control. The reason for the motor is so we can place the control right at the business end of the analog electronics and not rely on trace lengths that can pick up noise or degradation. That's a proven technique over the years and we haven't found anything that's better.

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We've improved the volume control over the years, but the current version is probably the first in the audio industry. It uses a particular chemistry and metallurgy and polymers in a way that creates the ideal resistor that will last a very long time.

**RF** Spectral has experimented with attenuators as a fundamental point in preamplifier design ever since the 1970s. We've tried many, many attenuators over the years, and for us, cost is simply no object, because this point in the circuit path can never be good enough. It's very critical.

After using the best parts the industry had to offer, we decided to step out of the audio field and develop new technologies with people who had specialties in robotic-control elements and servo elements for avionics and high-reliability applications. Keith and the design team worked with them to develop a new resistive-element material that would work better. It comes down to knowing why the attenuator sounds the way it does, and it has a lot to do with the metallurgy, the contact science, and, in the case of the variable resistor, the element material itself. After a two-year, continuous process of development, we have a design that is totally superior. It's so costly that very probably no one else would ever use it, other than us.

But that's typical of a Spectral solution. After many, many years of development in unique materials, we have an outcome that fulfills our needs. It's very costly, but you don't put a price on the musical purity that can result from a solution like this.

Spectral rarely will for long accept a fundamental limitation in a component part that's holding back the overall design. It's antithetical to our thinking, and frankly, we're driven in a competitive sense to improve. If that means we have to work in the component-development area to do it, we will to the limit of our company's resources.

**Speaking of being competitive, Spectral doesn't seem to compare itself with other companies, but instead has this idealized goal of music reproduction by which you judge yourself.**

**RF** This is absolutely true. Part of that thinking is just the practical reality that when we started, today's high-end companies weren't with us yet, with a few exceptions—Bill Johnson's wonderful company [*Audio Research—Ed.*] was here, and Mark Levinson had finished his first design with John Curl. We were in pioneering areas where actually there was no peer review. In our case, no one had done a high-speed megahertz preamplifier before. We had to define that that was an engineering and technological goal. No one could tell us that this was a virtue. We basically had to define that for ourselves.

We don't have the ability to compare ourselves outside of ourselves, because our solutions are so internal and personal. Those solutions are driven by findings in high-technology industries such as microwave transmission and precision

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measurement. These are areas where questions are the norm and solutions can justify the considerable development time and expense.

We've had a tremendous luxury in not worrying about short-term profitability. It might take five years to redefine a basic platform for Spectral, like a new preamplifier, or, in the case of recent digital [*the SDR-4000 Pro—Ed.*], seven years of continuous development. I would leave it to others to decide if that was a wise investment of resources. But on a personal level, we could do nothing less, because as you listen to the results over the years, you have to ask, "Am I ready for this to represent our company, our team, our values, and our industry?" And if the answer isn't a resounding "yes," you just stop and continue the development. Many times we've been ready to bring a product out, but we listen to it and say, "Our work's not done yet."

The development can be very, very expensive, but if we're lucky, we have a tremendous, unanimous response from our dealers and our customers. We don't do this in a vacuum. We do it for the customers who want products done a certain way, with care, and on a small-build basis. They want the most searching research and highest standards that are possible.

There's no justification for mediocre high-end equipment. It's almost a sin—we look at it in a Calvinistic way. When a Spectral product is ready—not perfect, but when it meets our aesthetic and musical standards and we feel it's an ambassador for the artist and for the high end—then we'll release it. But the development doesn't stop there because it's not finished. As we learn, as we grow, as we experience, we see the light much more clearly.

**Spectral seems to have had the approach of letting audiophiles and music lovers find the company rather than promoting itself. Consequently, Spectral is a well-kept secret.**

**RF** I guess when you're on the inside you don't see it that way. Our point of view is the baseball cliché: "Build it and they will come." We felt that our personal values were universal enough that if we could please ourselves—we're our own worst critics when it comes to design and implementation—there would be enthusiasts who thought the way we do. That they would consider the investment in something that had been designed with real reverence for recordings and for the artists, that they would want that in their lives, too.

And for us, less is more. We felt very strongly that promotion of the products, to some extent, would probably need to be left to the performance of the products themselves. We talk less and we act more.

A better way of knowing about Spectral than my talking about it is to spend time with a Spectral system and decide for yourself if it speaks to you. The greatest contribution we can give to anyone's life is to bring them closer to this love that we all have for our music, whatever it may be.

**Spectral has strongly advocated the idea that a playback system is one piece of engineering that happens to be housed in different chassis. Consequently, you stress the complete system approach. Do you think the high-end industry has gone**

**down the wrong path with the prevalent paradigm of mixing and matching components?**

**RF** I don't think we ever felt we had any choice. We're not marketing people; we're not commercial. Our background in the test and measurement field, the computer field, and the recording field says that system integration is the way you arrive at precision. We're interested in tools that do their job to a very high level of refinement and accuracy, and this concept of accuracy has been corrupted generally in the last few decades.

It didn't always mean amusing, unmusical, or non-humanistic. When we say accuracy, we're coming from an engineering point of view as a concept. What we mean is linearity. What we mean is not adding anything to the process of amplification, and using transducers that are linear. And I think because the Spectral engineers and I have a respect for, and a background in, the precision-technology fields, we understand that this is not a bad thing. Very good engineering, coupled with insight into the mechanisms of why things sound the way they do, is very necessary if we're to have great music reproduction which will bring people to music.

**The musicality in an accurate music system comes from the recording and from the artist. It will never come from the hardware or the music system.**

In the technology fields, it's been axiomatic that in the finest test-and-measurement equipment, high-speed, fast-settling circuits had the highest resolution and were the most linear. Spectral has basically picked ideas and existing technologies from many trees of technology, and out of this comes an integrated approach to a system that is not dissimilar to microwave systems or radio systems or test-and-measurement systems. You have to look at all the parts, how they interact, and optimize their performance together. You don't practice mix-and-match and get uniformly great results.

In our case, we have uniform bandwidth and settling—basically the "baud rate" of information that is propagated through Spectral components has to be uniform, consistent, and unimpeded by differences in interfaces and circuit characteristics. To us that's axiomatic. We want to hear what's in these recordings. Everything. We want it all, and we want it uninterpreted for us.

**Keith, you have an unusual talent for correlating measured performance with specific sonic degradations. Can you talk about that approach?**

**KJ** I think that starts from when I was a kid who was very much interested in music, loved music, and started building things.

**I know that you built a cutting lathe when you were 12 years old and the recording medium was a piece of cardboard with shellac sprayed on it.**

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**KJ** Not long after that, in junior high school, I was designing my own amplifiers. I've always had an interest in building devices to enjoy music. That was just the way it was. Later I specialized in instrumentation to get a much more solid fundamental knowledge of how things worked. All through this development of making recording equipment, rebuilding microphones, sometimes building microphones from scratch, I realized that nothing's perfect. Something's not working the way one thinks it is working, and people like myself ask: "What is going on? There's something happening here that conventional knowledge isn't explaining?"

In designing microphone preamps I fairly quickly learned about high-speed circuits, and settling, and thermal tails, and issues that affect clarity and resolution. I built a variety of different architectures and topologies in amplifiers and subjected them to recording situations. Over the years the ones that worked the best have survived, and a lot of other circuits and approaches that might look very good to the eye didn't make it. Basically the current Spectral electronics are based on the surviving circuits, the ones that made it in recording sessions.

I'm always trying to figure out what is going on in the circuit. Why didn't this circuit work right when it should have? It measured very fine but it didn't sound quite right. So one gets into what might be called behavioral assessment and behavioral measurements. Most designers look at a circuit and say, "How can this possibly go wrong?" rather than saying, "How do I test it, and what do I look for?"

I look for ways of testing the circuit to make it behave in a way that correlates with what I heard. I devise a specific measurement approach or measurement technique to excite that behavior, and something might pop out. For example, I started very early using tone clusters for measurements because they resemble music in a way. They can be mathematically defined so that the test signal can be subtracted out by passive parts. If there's an error or an artifact, it will show up with very, very high sensitivity to what's going wrong.

When you discover the artifact, the question is whether we hear it. Is it something that we can see but is not really of great importance, or do we hear it? Many times fixing the system won't make any difference. The fix made it better but it didn't sound any better. It's the accumulation of these little errors that create a degradation that has a recognizable character. If our tests are right, we'll be able to clean up a problem that conventional measurement won't show.

These behavioral tests open up a whole new panorama of problems that we hadn't known about. The solution appears deceptively simple for the amount of work that went into it. A good example is the floating power in the SDR-4000. There are a large number of current-source shunt regulators in the machine. They are equivalent to batteries in their isolation from noise, but they work a whole lot better than batteries. It's as though each part of the machine is operating off its own power that magically isn't connected to anything. The beauty of this behavioral-

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analysis approach is that the solutions are often very simple and don't require a grotesque amount of hardware.

**I don't know another designer who bridges the gap between the theoretical and the experiential the way you do. Do you think that comes about from your recording experience and hearing live instruments, microphone feeds, and being able to recognize what those distortions are?**

**KJ** I think very much so. I've always had a vision of capturing a beautiful performance in a great space, the emotions and feelings of what's happening in the music, in a concert or a performance. These are rare events. They happen only one time. Once you record it, the only thing that remains is a shift in domains on a piece of magnetic tape or a hard drive. The frustration is to try to take what was there and make it happen again, and sometimes it does. On some of the high-resolution five-channel work I've gotten pretty close, where you can turn the lights out in the room, walk around the place and it's pretty close to what was happening in the performance. But that's an impractical type of system. It's not a kind of thing that somebody would want to buy and set up in his home. The room is built up around the system, and then its lifespan is very short because it gets taken apart to be experimented on in some other way.

**How has having access to the 176kHz/24-bit high-resolution files of your own recordings affected your design work on playback equipment?**

**KJ** It's affected it very, very much. The high-res files set a gold standard against which you can judge CD playback. I should mention that CD can be very good, indeed. We think, "Oh my gosh, it's 44.1kHz and 16 bits—how can that be even in the same league as something that's got ten times more information?" It turns out if one works a CD very, very well, with the proper noise-shaping system that is accurate to about 1 part per million, then the remaining difference between high resolution and the 44.1 is time dispersion. The other factors really are not that important. And the time dispersion can be partially corrected by doing group-delay corrections.

**Time dispersion, for the benefit of the readers, is a smearing of transient information that occurs in digital filters. High sampling rates relax the filter requirements so there's less of this spreading out of transient energy over time.**

**KJ** Exactly. That's exactly what happens, and it's very technical, but it's highly audible.

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### So a lot of the problems that we hear in CD playback are implementation issues rather than inherent limitations in the format?

**KJ** Absolutely. They're usually old ways of thinking. I'd say 90 percent of the problems are rooted in old ways of thinking. "I can make a better clock. I'll plug it in and it'll work." Or, "I can maybe put a vacuum tube in place of an op-amp and that's going to make it better." Or, "I'll use this DAC instead of that DAC because it works better." Unfortunately, none of those things address the real problems. One has to go far, far deeper into the system and do essentially what we've been doing, where we make a reasonably educated guess at what we want to do and then investigate. There's an awful lot of measurement and analysis work that goes into creating the best solution.

### Which is why the SDR-4000 took seven years to design.

**KJ** Right. There were some new technologies as the industry evolved, and we thought our older player wasn't up to the standard of what we could do. There are a lot of CDs out there, and some of them are pretty grungy. If the player's good, you can identify the artifacts and the brain has a chance of rejecting them. If the player doesn't have resolution then you have an overall confusion that forces the brain to work. The effort required doesn't let you listen on that ethereal plane, the meditative plane of music, because the brain is working, trying to sort out a bunch of problems.

## The goal of our design work is to keep the listener's mental effort down. The more information the ear has, the less the brain has to work to create the illusion of music and of being at the performance.

The goal of our design work in all the products, not just the CD player, is to keep the listener's mental effort down. One of the best ways of doing this is to not only have accuracy, but also provide an awful lot of information. The more information the ear has, the less the brain has to work to create the illusion of music and of being at the performance.

**RF** There was lack of understanding among our peers as to why we spent so much time on a CD player. Don't they understand that CD is now a heritage technology? This is where the music is. They dismiss it because many of the recordings are poor. I'm sorry, but there's musical history in there. Although we've gone past the CD, it was obvious to us that we needed to pull out all the stops and do an "Apollo program" to build the finest reproduction of 16-bit digital.

**KJ** My instinct is that ultimately high-resolution will be a coming media, but when and what form it's going to take is questionable.

I'm wearing a record company hat [Reference Recordings] because we're seeing this interest in it, and it does work. It's got something a little better, but in my experience it's not something that's going to bash you in the face as being different, unless you're using a converter that has taken into account what we have done in the SDR-4000.

We've been using the high-res file as the reference. We ended up doing strange things to make the CD as close to the high-res as we could. That, of course, benefits a lot of old recordings.

**RF** Because we're audiophiles there's a tendency to say to ourselves, "Think of the heaven we'd be in with this high-resolution file." But you have to continually put yourself back in the shoes of every-day music enthusiasts, where the recordings they love were made in any number of different ways, and many are compromised. What the public wants is great reproduction of *their* music. That's everything from the Stones and the Beatles to everything recorded in the 60s and 70s. It's all the stuff. We've tried to make a real contribution to keeping music alive by addressing issues that are relevant to music lovers and not just to audiophiles.

If we can bring about a more ideal conversion of this massive body of work, everybody wins. To me the heroic effort was sort of archeological—that is, to take a medium that's been beat around and abused and doesn't have a great reputation, certainly amongst us purists, and raise it up and discover the really noble performances.

**KJ** I have a monaural Joan Baez LP that's a gorgeous, beautiful recording of a great voice in its prime. If you listened to the CD years ago, it was like knitting needles in the ears. But if you listen to the same CD where the time-domain distortions have been reduced, you hear the LP in the CD. For 25 years we've learned not to expect from the CD what we hear in LP and analog tape. But when decoded correctly, it doesn't sound digital. It sounds old and vintage, but it's beautiful. That quality is on many recordings you wouldn't expect because you thought the CD had been so badly encoded. That's reversible to a degree.

### It seems as though Spectral products are underpriced relative to the amount of R&D that goes into them.

**RF** We've already been very blessed by economic success in some other fields and with other investments. To limit or compromise Spectral by the need to be financially successful doesn't suit our purposes.

When you consider what you're going to be known for—either when you're gone or what you are known for now—to say that it was more important to get to the bank first is just a cop out. We're better than that. With Spectral this is our opportunity as designers and music lovers to make a contribution, and we're stable enough financially that we can literally afford to do whatever we want.

It's very difficult today for a start-up company, particularly a specialty audio company, to survive at first. What we were able to do in the 70s and 80s, which was frankly very, very expensive research, today might almost be impossible for a young company. We did it while we could, and didn't ask the company to be profitable literally for years. We put tremendous financial resources into Spectral, and the payback for us was a set of

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technological building blocks and a knowledge base. That's what we bought for this tremendous investment in time and capital.

In our case, getting the technological breakthroughs, getting the performance advantage, and making the results is the company's goal, plain and simple. The financials have to be acceptable, but they're not the principal motivation. In addition, the Spectral customer to us is everything. They are the reason that we exist. They are the reason we can do what we do. Our clients are the ones who believe in our mission and have partnered with us on the solutions. We owe to them our very best work. We never lose sight of that.

### **I know that there's a long waiting time to buy a Spectral product. It is possible to increase production without compromising quality?**

**RF** No. The products are designed for a certain scale of production. To increase production significantly the designs would have to be dumbed down, and production streamlined and made simpler.

Keith and the design team do not focus on making things producible. Their engineering focus is on doing the design right and getting the performance. Spectral then has to find a way to build these instruments. It takes tremendous dedication and care to do that, and they can't be produced in quantity. There's no free lunch. These products are instrumentation, plain and simple. They're crafted by hand, slowly, with care and dedication. That's the only way that we know that it can be done. The ability to build thousands of units is impractical with this scale of design and engineering.

We have an optimum size for the company and its production output that gets us X number of units. The market for music products and instrumentation of this quality is vastly larger than Spectral can supply. There's no advantage really to building more, because the standards have to be loosened up, and that's not our principal goal. We could increase the price, but that only eliminates potential owners. We're not priced for what the market can bear. We're building strictly to a very small multiplier of the parts cost, which is very different than what's traditional in our industry.

The parts cost in a Spectral is a very substantial amount, larger than it is in traditional manufacturing. But the cost of research and development is not factored at all into the price of a Spectral product. In other words, when you buy a Spectral product, you are paying for the parts. We have a multiplier of three-to-one, and five-to-one is typical in the high-end industry. And rightly so. But with Spectral, the higher the price goes, the fewer music enthusiasts can consider it in their lives.

To us, that's antithetical to the people we want to serve. Those people could be us in another life; we could be the ones who couldn't afford Spectral.

It's very much to us like the musician who needs a great piano to become a great pianist. He should not be denied that instrument because there are economic limitations, and we believe the same is true for playback equipment. This is very fine instrumentation for the reproduction of music, and by placing financial hurdles in front of music enthusiasts, we really deny our own success. Therefore, a Spectral product is priced based on manufacturing cost without factoring in the multi-million-dollar research and development overhead. It's what we choose to do because it gives us the pleasure of knowing that these components are going to people who will use them hard and use them well. **TAS**

