Chris Gaunt

The man behind the technology at UK digital broadcast console manufacturer Calrec discusses the implementation of multichannel, imparting character, progress in display technology and high performance sports cars.

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CHRIS GAUNT HAS SPENT his entire working life in the audio industry with his interest stretching back to 'doing the sound' for dramas while at school and a Saturday job in a hifi shop where he was introduced to the wonders of the Quad Electrostatic. He studied Electronic Engineering at university and developed skills in organising a range of social events, which sometimes included setting up the lighting and sound. After graduating he installed and serviced sound equipment in the ballrooms and nightclubs of the MECCA group before joining Calrec as the test department supervisor in 1978, where he worked on the J-Series, L-Series and M-Series broadcast consoles and moved from testing into system design and project management. He was one of the driving forces behind Calrec's UA8000 music console, project managing the design and build, and taking responsibility for all schematics and backplane design, and even installed the first desk at Abba's Polar Studios.

Following the purchase of Calrec by AMS in 1986, Chris spent more than ten years with AMS in several roles and contributed significantly to its digital console projects before rejoining Calrec in 1998 after it had spun off again on its own. He has overseen the development of Calrec's entire range of digital desks and is responsible for the continued development

of the Alpha, Sigma and Zeta System Plus range of consoles. He is also involved in Standards activities with the AES, IEC and SMPTE while his other passions include cricket, photography and folk music.

What is special about Calrec products?
They sound great, are reliable, easy to use and designed specifically for live production environments.

Calrec mixing consoles are ideal in a high pressure, live broadcast environment; controls are easy to identify and fast to operate and the surface gives an immediate and comprehensive display of all settings. Physically the consoles are light, have narrow fader widths, high input headroom and low noise, all of which are still so very important for broadcasters.

Low current consumption ensures a cool control surface for operator comfort and helps to make the desks extremely reliable. They also have unique redundancy features and power systems, which ensure that they will stay on air.

Because we only make mixing consoles for the broadcast market the design is optimised around those requirements; this technology is then used to make a range of similar products suitable for the different broadcast applications and different budgets.

By comparison, many of our competitors have to compromise the design of a product so they can sell a 'postproduction', or a 'film' or a 'broadcast' version of their console. The scale of their presence and their level of expertise in each market will determine how suitable their 'broadcast' offering is. Demands from other sectors of the market often mean that they only have a limited broadcast product range.

What are the specific demands of a broadcast worksurface and how does it differ from other worksurfaces?
Broadcast audio operators are very demanding creatures! In a live environment they are under such pressure that they need the console to tell them everything they need to know instantly.

It is vital that monitoring and metering systems enable the operator to see, or hear, virtually any input, output, channel, group, etc at a glance, and to be able to easily and quickly reconfigure these systems for different programmes.

The operator also needs feedback of control positions and input source selection, for an increasingly large number of channels.

Fader widths have to be narrow so that an operator can control 4 or 5 faders with one hand, and so that 72 faders can be fitted across the width of a standard OB truck. Because the operator wishes to remain in the ideal monitoring position, it is vital that all the important controls (i.e. all the controls!) are easily reached or accessed from a central position. This will be more important as surround operation becomes the norm.

In addition, an operator may be sitting over the console for many hours so it is essential that the surface is cool and that displays are very visible and have a long life.

From your standpoint, what are the absolute strengths of analogue technology against digital?
Actually there are very few, and there are less as digital technology improves. However, one clear advantage that an analogue desk enjoys is that there is no single point of failure that can result in loss of programme, which is why Calrec has designed its digital products with redundant features that give a similar level of security.

How do you impart 'character' and 'sound' to a digital desk?
A good audio designer can use DSP to shape the sound in any way they want, which is one of the benefits of working with DSP engines. So the problem of how to impart 'character' and 'sound' to a digital desk isn't really a problem at all. The real problem is the same as it has always been, which is that the characteristic of a 'sound' is very subjective.

We go to great lengths to ensure that the desks faithfully reproduce the incoming signals with the absolute minimum of distortion and colouration. The characteristics of the sound of the EQ and Dynamics are based on many years of experience with analogue consoles such as the UA8000, and are chosen to help the operator find the desired sound or effect with a minimum of control adjustment.

A key component in any such desk is the digitally controlled microphone preamplifier. Here we have more than 25 years of experience with digitally controlled analogue consoles, which has enabled us to achieve high headroom with low distortion and noise, together with low current consumption and high packing density.

Some suggest that the capabilities of most digital processing cores are now largely similar and what differentiates them is the implementation, do you agree?
Well, I would define the core as the result of the

implementation. It is not difficult to buy a chip that will do the job, but how the chips are used does make all the difference.

The way in which fixed and floating point processing is implemented in the different parts of the signal path and the allocation of noise and headroom bits are bound to affect the quality of the sound and the ease of operation in a live broadcast environment. Consoles designed for other purposes can be made cheaper by using fewer headroom bits, for example.

For the architecture, there are a number of philosophies, the most common of which utilises a quantity of DSP cards on a TDM backplane. The DSP cards are characterised by their programming. Here, the size and capacity of the backplane is the main limitation to the size and complexity of the design. We use a second backplane in our largest design, the Alpha. This helps us provide the flexibility of routing, etc, demanded by broadcasters. If a desk is small and simple enough it could be designed without the need for the backplane at all, greatly reducing the cost.

What is often overlooked is that while DSP devices such as the SHARC are excellent at EQ and Dynamics processing, they are not very efficient at the mixing consoles main job, i.e. mixing and routing. Calrec was one of the first companies to offer the routing and mixing of all channels and groups to all of the buses all the time, when many manufacturers relied on a certain diversity factor to limit the total number of mix nodes.

What are the difficulties associated with the implementation of multichannel in a desk?

Currently broadcasters use up to 96 stereo and 34 mono channels on our Alpha 100 console i.e. 226 mono channel equivalents. It's safe to assume that many of those 96 stereo channels will need to handle 5.1 inputs before long, requiring 400-plus mono channel equivalent signal paths. These large numbers of channel requirements have been seen in the film industry but at a price way above what a broadcaster could afford to pay. The difficulty any manufacturer will have is to provide them at a price not much higher than currently paid for stereo. Now consider moving to 96kHz and you double it up to 800-plus mono 48kHz channel equivalents. The above mentioned problems of mix node processing imply very large data rates.

So we need to improve the processing speed of our products by a factor of at least four in the next few years, at no extra cost to the customer.

Also, in broadcast applications, there can be problems with incoming signals so Calrec provides the ability to spill out the legs of a surround signal to allow adjustments to be made to individual components. This spills the surround signal to 2 x stereo (for LR and LsRs) and 2 x mono (for Centre and LFE) legs.

The advantage of using two stereo legs for the LR and LsRs rather than four monos are that it gives faster operation when the signals need to be adjusted separately from the surround channel. In addition, it ensures that during adjustment, the overall balance of the surround channel is not upset e.g. by adjusting the EQ of L and then R. It also allows adjustment of

the front and rear width of the surround signal, which is not possible if they are treated as mono legs.

When working with a large number of surround channels it is essential to be able to meter each and every sub channel of each incoming signal simultaneously. We already have a freely configurable, full-colour screen-based metering system that provides 6-channel metering of all channel inputs and all surround outputs simultaneously. The monitoring system also provides full surround monitoring of all inputs and outputs.

'Custom' was a term strongly associated with analogue broadcast products, how relevant is it now?

The digital console has in fact, made customisation easier. Calrec uses a system of identical single cable connections to each control panel, which can therefore be laid out exactly as the customer wishes. The desk frame is such that custom panels, for use with external devices for example, can easily be incorporated.

However, there is still a requirement for a degree of further customisation, which is something that Calrec has always been in a strong position to provide. As over 95% of the product is designed and produced in house, we have excellent control of all aspects of its configuration.

Also, the company has made significant investments in engineering, surface mount and test equipment over the last few years. This kind of continued investment continues to provide us with a unique ability to offer fully customised solutions.

How do you make a cheaper desk?

It is quite simple — by compromising on facilities or performance, but all customers are quite rightly demanding more of both!

The cost of a console is a three-way compromise between up-front development cost, future flexibility and performance. If more investment is made in the original design then manufactured cost will be lower, but this higher design cost now has to be recovered from sales, which may be difficult to increase in a relatively small market — therefore the cost may not be significantly reduced.

The audio industry's fortunes are largely dictated by the device manufacturers who continue to produce faster and higher density parts, with greater performance/pound ratios. Display technology is developing at a rapid pace to meet the demands of mobile phone users, PDAs and personal DVD players. Lower cost, highly visible displays will dramatically improve the options of console surface designers.

Where are we in the evolution of the digital console? Are we building our own tools and making fires or have we only just crawled out of the swamp? What will herald the next evolutionary step?

I'd say we're way beyond making fires — it's more like we're turning out high performance sports cars. We haven't designed the warp drive yet though!

Digital consoles can do all you need a console to do, and they can be as reliable as you need them to be. In fact, they do much more than their analogue ancestors, not least with the likes of setup memories and memorised patching. More importantly, they are reliable enough for users to be confident in them. This cultural change in users is a good benchmark for where we are.

At Calrec we can quickly incorporate the absolute latest technologies available and we are continually exploring new methods in software generation and reliability. As devices get faster, eventually the hardware will become an irrelevance and all programming will be done in high level languages.

As the processing elements of digital consoles become a commodity, the focus of attention will be very much on ergonomics and sound quality. The Calrec 'Hydra' audio network, which is used to connect consoles together to share sources and destinations, uses deterministic Gigabit Ethernet technology that ensures forward development (10G is already available) and industry standard compatibility. The benefits of this are real now, in the form of cheaper installation costs and more efficient use of studio resources, and will increase over time as 10G becomes available at lower cost. The bandwidth this offers will allow significant change and cost reduction in the way signals are routed in large-scale applications. ■