Focusrite Liquid Channel

It's been some time since a product has been so eagerly anticipated as Liquid and it's probably the most important piece Focusrite has ever produced. Not just because of the cutting edge technology it employs, says JON THORNTON, but because it is the most clearly defined response yet of an audio hardware manufacture to the shifting landscape in the world of the DAW and plug-in.

THE LIQUID CHANNEL applies the principle of digital convolution to replicate as faithfully as possible the sonic characteristics of any combination of front-end signal processing — in other words any possible permutation of microphone preamp and compressor that has ever been manufactured. The principle of convolution isn't particularly new. Simply put, if a known impulse is put into a system or audio device at a particular level (and ideally an impulse containing all frequencies), and the resulting output sampled, any difference between the sampled output and the original impulse will contain information about every nuance of that device's sonic behaviour.

This information can then be mathematically applied to another digital audio signal on a sample by sample basis, and the resulting output should be as if that audio signal had passed through the original device. While we've seen this principle applied recently to digital reverb units and plug-ins, it needed to be moved forward in a number of ways to really do justice to the non-linear and dynamic responses of devices like microphone preamps and compressors.

The first step here comes in the form of a perfect marriage between Sintefex and Focusrite, using a Sintefex developed process known as 'dynamic convolution'. This involves measuring and sampling a series of impulse responses at different levels from the peak level of the unit to its noise floor, and then applying these samples appropriately to incoming signals. Even that's not the end of the story though, as dynamic processors have the usual parameters of threshold, attack, release, etc. Rather than having a set of impulses sampled at every signal level and at every possible permutation of control setting, the behaviour of an individual compressor with regard to its detection and side chain functions is measured at different levels and settings, and this information glued together with the impulse responses to form what Focusrite refers to as a 'replica'.

This allows the convolution process to faithfully replicate the sonic characteristics of a device with regard to the frequency response, harmonic distortion, headroom, etc., but also to apply this information over time in a manner that mimics the time-based characteristics of the original device.

While this takes care of the replication of compressors, using this approach to reproduce the sound of microphone preamps introduces additional challenges — most notably the fact that there is an interaction between the microphone used and the characteristics of the analogue input stage that is loading it. Not only does this encompass a huge variety of different approaches taken over the years — electronic, transformer based and with variances in nominal input impedances — but also the interaction will be different with every microphone, making it difficult to replicate with convolution.

Focusrite's approach has been to design what it describes as 'the most flexible analogue front-end ever conceived'. A new custom wound transformer, designed to offer as little inherent colouration as possible, coupled with banks of relays switching capacitor and inductor combinations, and a specially developed electronic input stage mean that signal paths can be constructed that most closely match the impedance and operating principle of any classic mic pre. And then dynamic convolution takes care of the rest.

This (lengthy) introduction is important — it gives you some sense of the engineering and design challenges faced by the development team on a number of levels. Computationally, the approach demands an enormous amount of DSP; hence the use of multiple SHARC processors in each unit. And at an analogue level, there is clearly a need to develop one of the cleanest, purest and well engineered signal paths to provide the blankest sheet of paper possible for the switching matrixes and convolution process to work their magic on. In short, this 2U unit needs to impress.

It's certainly impressive enough when you first unpack it, and at 8.6kg a fair old weight. The polished chrome rack ears might not be to everybody's taste though. In true audio engineering style, it's straight round to the back panel, which reveals microphone and line level analogue inputs, a line level analogue output, and an AES-EBU digital I-O all on XLRs. BNC connectors are provided for TTL Word clock I-O and a pair of phonos and a USB port (more of which later) finish things up.

The front panel's most striking feature is the large number of rotary encoders that control most of the variable parameters of the unit and these are surrounded by a ring of LEDs that indicate relative position. The Liquid Channel's controls break down into five main sections.

Located at the left hand side are the majority of the controls associated with the analogue mic preamp stage. A rotary encoder adjusts the gain level, the range being determined by the input source select button immediately above it, which can be mic, line or digital. Mic and line level signals pass via this analogue front-end into an A-D convertor stage before having the convolution process applied — digital signals enter directly into the convolution engine.

An input bargraph meter shows the post-gain signal level being applied to this A-D stage, with an additional digital clip LED. Illuminated pushbuttons are also provided for Phantom power, phase reverse and a high pass filter — this is switchable in software between 75 and 120Hz. Moving along are a set of pushbuttons that select sample rate (all usual flavours between 44.1kHz and 192kHz) and clock source (external TTL, AES embedded or internal).

Passing over the centrally located LCD panel and controls for a second, we find the inclusion of a 3-band digital EQ. This is not convolved, but rather modeled loosely on the sound of a Focusrite ISA 110. Featuring high and low shelving bands (admittedly with typically digital wide ranges), and a peaking mid band with a switchable Q, the EQ section can be placed pre or post compression, or inserted in the sidechain of the selected compressor replica.

A data entry wheel and buttons for accessing system wide set-up menus occupy the far right hand side of the unit. There are also buttons for saving, recalling and naming user memories, of which there are 99. As all controls are 'soft', entire set-ups comprising particular combinations of preamp and compressor replicas with specific settings can be easily stored and recalled.

Returning to the central section, we find a two row back-lit LCD panel, which displays the names of the

currently loaded replicas, together with the parameter values for these, which are adjusted by a row of rotary encoders immediately below. Loading replicas is as easy as hitting the preamp select or compressor select buttons located at the top of the display, and then scrolling through the available replicas with the data wheel, pressing it to load. A replica does take several seconds to instate, which makes direct A/B comparisons between replicas a little hard. Compressor replicas have the usual controls of Threshold, Ratio, Attack, Release and Gain Make-up — although depending on the replica loaded, not all of these are available as the unit will display only the parameters and associated values of the original unit. This can be over-ridden, though, allowing access to controls or parameter values that may not be available on the original.

The preamp replicas have a single control, labelled harmonics. Adjusting this control allows a larger amount of 2nd, 3rd and 5th order harmonics to be added by the convolution process — the exact blend of which will be determined by the impulse responses of that particular replica. This has two benefits. First, it enables slight variations in sound that exist between different original units — often caused either by age or manufacturing variations — to be accounted for. Second, it allows the sound of the preamp to sound overdriven if desired without compromising the overall gain structure of the signal path.

I have to say at this point that the user interface of the Liquid Channel is simultaneously a triumph, and possibly its fatal flaw. It is excellent in terms of ease of use and remarkably intuitive — and the use of single function controls in most places helps no end. But despite this, and despite the nice tactile feedback from the rotary encoders, it never really seems to give the immediacy of interaction that the originals it replicates can. It's not a criticism of the design team, as there is clearly always going to be this compromise when making a unit this flexible, but nearly everyone who used the unit felt as if they were always operating it at a distance.

You can live with this though, as it sounds absolutely awesome. I have to admit to being sceptical about Focusrite's initial claims, but this is a remarkable machine. Fresh from the factory, the Liquid Channel comes loaded with 40 classic mic pre replicas and 40 classic compressor replicas — although Focusrite is continually making additional replicas available that can be downloaded to the unit (see sidebar). The replica

names give you enough of a clue as to what they are — in some cases its very obvious, in other cases a model number only is given, with no reference to the manufacturer. There are clearly some questions still around regarding intellectual property rights with regard to convolution technology, and Focusrite appears to be treading carefully here. Nevertheless, what is on offer is almost certainly in excess of what even the most ardent fan and collector of vintage outboard might possess. As I suspect most reviewers will do, I begged, stole and borrowed some of the original units to do an A/B comparison. Using a variety of microphones on original and replica preamps, there was no audible difference between the units. Using line level sources on the compressors, again, there was no discernible difference between original and replica.

As there were far more replicas on offer than original units I had access to, this exercise soon turned into an exploration of all the replicas on offer. Admittedly, the differences between some of the mic pre replicas are very subtle, even with a variety of microphone sources. Perversely, I liked the most neutral 'Flat Transformer' setting enormously — this is simply one of the most uncoloured and neutral mic preamplifier sounds I have come across. Moving to the compressor replicas reveals a lot more differentiation in character, although I struggled a little with gain structure when trying to get very hot and heavy compression from a line level source. This is perhaps why Focusrite has recently released a number of 'Hot' replicas. The more you use this box, the more you realise just how flexible and powerful a tool is at your disposal — almost too flexible as you could spend an entire session simply exploring options.

If there was a disappointment, it was in the digital EQ section. Although quite smooth sounding, it seemed to be a little too restrained in it sound. It's fine for gentle mastering applications but struggles with anything more aggressive.

Despite this and despite my reservations about the units' tactility, Liquid Channel is an enormous achievement and a real milestone in audio processing. The original devices it replicates will (I hope) never be replaced — but we can't all have access to them or, indeed, afford them. And in a straight battle between the Liquid Channel and the plug-in market there is really no contest — expect to see it becoming a standard studio fixture. My order is already in... ■

Liquid Control

Liquid Control is a software application that allows remote control of a Liquid channel via its USB port, and also gives users the ability to manage the contents of their Liquid Channel. Replicas, user memories, or the entire contents of the machine can be backed up or restored to Mac or PC. Additional replicas, available from the Focusrite website, can also be loaded into the unit.

The software installed without problem on my G4 Powerbook, and the process of archiving and restoring or adding new replicas is exceptionally straightforward. However, you are limited to having a maximum of 40 compressor or preamp replicas resident in the machine at one time, which means deleting some of the factory loaded replicas to install new ones. Given the relatively small size of the replica files, this does seem a little mean in this iPod age.

Up to eight Liquid channels can be controlled at once by separate USB cables or by using the digital linking units together. Remote control is straightforward and bi-directional — while the Liquid Channel responds very quickly to Liquid Control the software display tends to update a little sluggishly if a control is altered on the unit itself.

PROS	Awesome sound and performance; flexibility and expandability; very intuitive; Session Saver is a great feature; Liquid Control makes file management very simple.
CONS	Digital EQ perhaps a little too restrained; never quite as tactile as the originals; could burn up a lot of session time!

Other good stuff

Although the Liquid Channel is single channel only, multiple units can be slaved together using the Digital Link Bus. This uses phono cables to link pairs of units, which can then work as a stereo linked device. More than two units can also be linked with multiple units slaved from a master unit for multichannel applications.

An easy to overlook, but incredibly useful feature, is the Session Saver function. Once armed, this monitors input level to the A-D stage and output level. If the input level is in danger of approaching clipping, the system will automatically lower the input gain by an appropriate amount. Similarly, if the output level is approaching clipping but the input stage is clean the gain make-up level is dropped. Once you use this feature, you'll never want to disable it — it works extremely well in those situations where signal levels are hot and is so much better than a post-compressor peak limiter.