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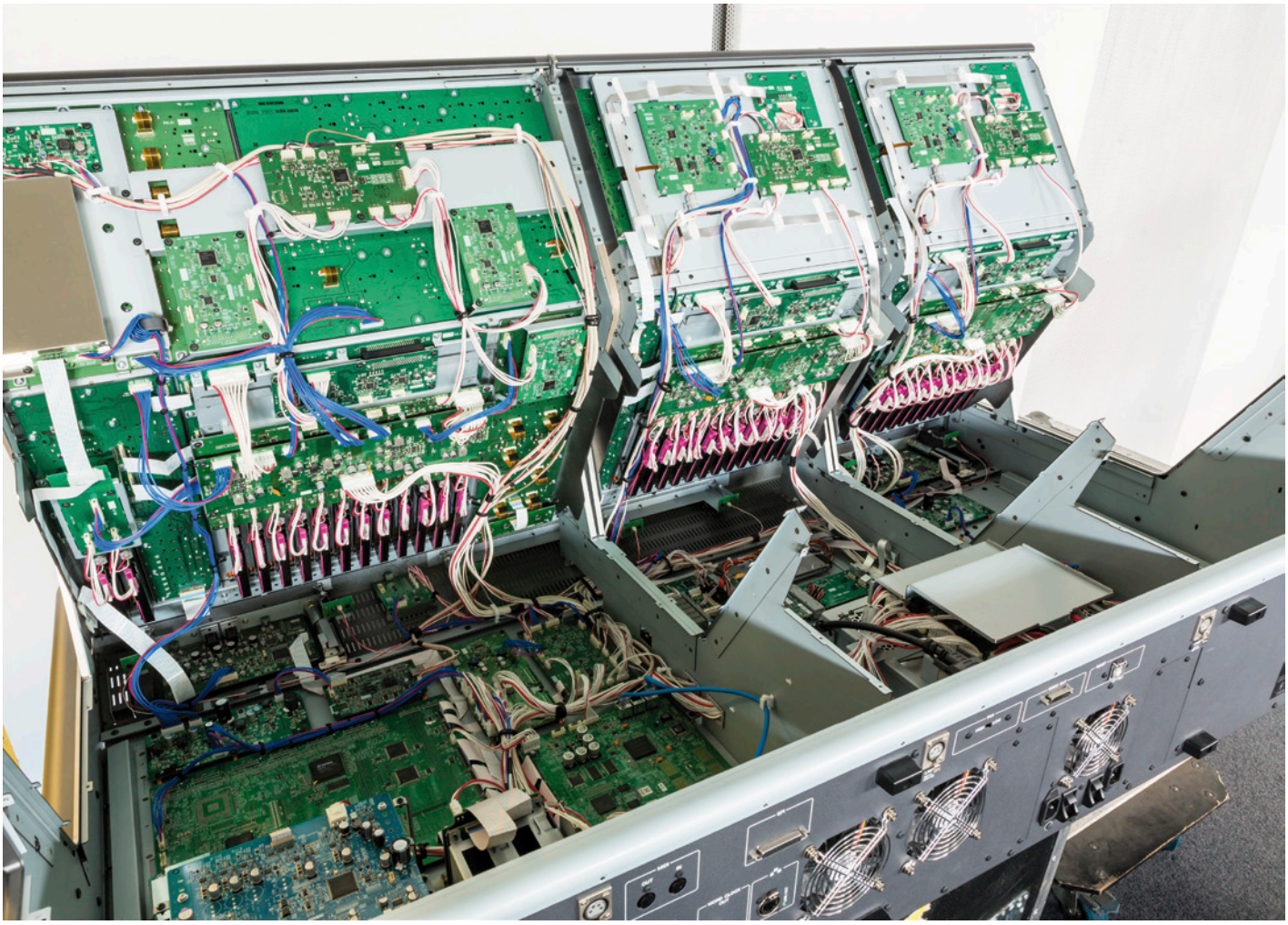
MODERN VINTAGE LIVE SOUND

A CLOSE-UP LOOK AT THE YAMAHA RIVAGE PM10 DIGITAL LIVE SOUND CONSOLE

Sometimes opportunity falls simply into your lap. When a friend from Hamburg asked me last year if I would join him in June 2018 for Germany's only Foo Fighters concert, I couldn't have guessed that this rather leisurely event would directly coincide with a review happening at the same time. As a long-time Foos fan the concert certainly was a special experience for me personally, but it was also extraordinary for the Tonmeister in me. The audience of 60,000 people at the Hamburg trotting track were treated with arguably the best live sound I'd ever heard. Punchy, transparent, clear, and nuanced. But yet with the sonic thrust you'd expect from a true rock band. Impressive. It so happened I found out later that the concert was mixed on the very desk I was going to review within the next few days.



Quite obviously the sound isn't shaped by the mixing desk alone, but it rather is created by the human being operating it and his team (presuming that the band delivers as well). Unfortunately the Foo Fighters' front-of-house engineer Bryan Worthen was unavailable due to the short notice, because we would have otherwise added his comments to the review. But it is clear without a doubt that an audio engineer may only put his talents to good use if the equipment is up to par; thus closing the loop right back to the mixing console. Only if all the pieces work together seamlessly something truly exceptional can come to be - as was the case on that one night in Hamburg.

The Studio Magazin isn't exactly predestined for showcasing a traditional live sound console. Firstly, it's not our standard repertoire, and secondly our expertise is by now somewhat limited in this field. Live sound is truly an independent field of work with highly specialised colleagues. Even so, we decided to take on the Rivage PM10 for a close-up review, because there's much more to it than it being "just a live desk". There's a lot of technology derived from the studio world under the hood. Specifically this manifests itself in various plug-ins emulating the sound of iconic studio processors and tape machines. Beyond that, Yamaha takes an exciting step in the front end design by emulating Rupert Neve Designs' "SILK" transformer inputs introduced with the Portico series. Since we've already reviewed several Rupert Neve products with the original analog circuitry we were able to make direct comparisons. So this review will show how well Yamaha can approximate the Neve sound and reveal if the Rivage PM10 is also suited for studio use. Or, and arguably more intriguing, how well it is possible to take sounds from the studio to the live stage. Surely this will prove to be quite interesting for readers of the Studio Magazin.

Overview

A complete Rivage PM10 system consists of three components. The processing core DSP-R10 is the functional center of the console. This is the central hub where all audio signals are combined and processed. The core can process up to 144 input channels, 72 mix busses, 36 matrix inputs and two stereo outputs. In addition to the fixed standard processing in every channel, plug-in modules can be assigned as inserts. In this case, the required DSP

resources have to be made available for the inserts. These DSP slots are not only necessary due to the finite DSP processing resources, but also because dedicated paths to and from the DSP need to be instantiated internally first. A method well known from UAD processing cards or other DSP systems. The plug-ins available as inserts are mostly based on Yamaha's Virtual Circuitry Modeling (VCM) technology emulating analogue circuits down to all the particularities of the individual components. For example, the PM10 offers models of various vintage Neve compressors and equalisers loosely based on their original counterparts from the 1960s, 70ies, and 80ies. On top of that there are Portico emulations and models of classic compressors and multi-effects units (such as the Eventide H3000 or the TC Electronic VSS4). But there is also a tape machine emulation with four models, which we will touch on in more detail later. VCM is further used to model the Rupert Neve Designs Silk circuitry in the input stage. The input and output modules in the stage racks are independent from the processing core. Users can choose between two types with a distinct difference: only the "native" Rivage racks called RPio are equipped with their own DSPs on the input cards (RY16-ML-SILK). These modules are further deployed for the eight local analog inputs of the control surface, the so-called Omni inputs. This is because the processing of the Silk input stages always takes place right at the physical analogue inputs. Consequently, the signal has already been processed by the Silk effect once it is passed on to the processing core - including the high pass filter and trim level. Any post-processing with Silk is not possible as it is unavailable in the plug-in racks. The big advantage of this approach is that the sonic "upgrade" of the Silk processing is then inherent for all the members of the network. Whether that's front-of-house, the monitor console, or the multi-track recording in the OB truck. The downside is, however, that there is no "neutral" recording and that Silk cannot be applied for any digital inputs or returns from the DAW. The fact that Silk has already been part of the processing also has to be kept in mind when doing a virtual soundcheck. We will lay out the details of Silk further down.

The Rivage PM10 deploys a proprietary digital audio network protocol called Twinlane to transmit the high channel count. Dante and other standard interfaces are certainly also supported as alternatives. Yamaha developed Twinlane at a time when Dante could not yet handle the high number of channels with the required latency. Alternatively to the current RPios it is also possible to use existing stage racks from Yamaha's Rio series used for the smaller CL series consoles with Dante interfacing. Those are not equipped with Silk though, which means that this feature will be inaccessible. The third and most obvious component of the Rivage system is the control surface. It is currently available in two sizes: the CS-R10 with 38 faders or the CS-R10-S with 26 faders. The size of the control surface is independent from the above-mentioned processing power of the DSP engine. The latter of which could in fact be exclusively controlled by the software editor of the StageMix app, although that would hardly make sense. Yamaha presented the smaller sibling, the Rivage PM7, designed for smaller events and installations with existing, pre-configured wiring at this year's Prolight+Sound show. This console offers the exact same control surface as the PM10, but the processing core is built into the console housing. The capabilities of the PM7 are only slightly less powerful than those of the PM10. Processing power has been reduced to supporting 120 channels, 60 busses, and 24 matrix sources, for example. The smaller, more compact system is then comprised of just the console and the stage racks, but the limitations of the

Silk technology persist. The PM7 can only provide Silk in combination with the RPio input stages.

Transformers + Silk

Rupert Neve's Silk circuitry is an analogue effect initially introduced with the Portico series by his current company RND (Rupert Neve Designs). In its first generation there was only one flavour of the effect, which has since merged into the blue option in the latest, switchable version of the circuit. Engaging the Silk function reduces the feedback in the transformer changing the available headroom and driving the transformer into saturation. There is also a slight change in frequency response which is derived from popular Rupert Neve designs from the 1970s. This processing results in a subtle signal compression with an emphasis in the lower mids. The signal saturates sooner in the low frequency domain, gains in weight and is "rounded off" in the best possible sense. Silk blue is well suited to boost somewhat lackluster signals and push them into the acoustical spotlight. Upon reading these sonic descriptions one might come to wonder why Rupert Neve might have chosen the colour blue instead of red to associate with such a method of "warming up" the signal. But there is an explanation: the association does in fact come from the blue and red labels marking a component in the circuitry, and does not originate from our more traditional associations with warmth or heat. Starting with Portico II Silk was expanded by adding a second, red-labelled sonic flavour. This is characterised by a different harmonics spectrum and emphasises the upper mids and highs in the saturation. This causes a pleasant shift in presence that can make dull signals more exciting and helps with highlighting them in a mix. A pleasing sheen is added to the signal. The ability to adjust the intensity of Silk by means of a texture pot was also added with the Portico II in Neve's design. Yamaha has attempted to emulate all the characteristics of the entire circuitry. This in turn means that engaging Silk also adds the transformer emulation. Without Silk the input stage does without any modification of the signal post conversion, apart from the high-pass filter and the M/S decoder.

Silk measurements

In our measurements we didn't want to consider assessing the entire mixing console, but instead focused on the input stages. So our APx555 was connected with two inputs of the RPio in the analogue domain, while the return was sent digitally via AES3. To ascertain the status quo we first determined the technical performance of the neutral input stage. The maximum input level in line mode is +24 dBu. The maximum analog gain was measured at almost exactly 65 dB. The input noise with no gain was measured at -112.96 dBFS RMS unweighted (20 Hz to 20 kHz). Increasing the gain to its maximum value the noise rises to -84.1 dBFS RMS unweighted (20 Hz to 20 kHz). These values constitute the maximum available dynamic range per channel. Since Silk is added after the converter, the noise values remain unchanged when engaging the effect. Alternative quasi-peak measurements according to ITU-R BS.468-4 show the expected difference of about 11 dB. The impeccable noise spectrum is shown in figure 1. Figure 2 shows the amplitude and phase frequency response curves of the neutral input stage. It's also important to have a look at the THD performance since this is exactly what Silk manipulates. Figure 3 shows the curve of the THD as a function of input level measured at 1 kHz and minimum input gain. The response curves at other frequencies are not significantly different as shown by the THD performance as a function of frequency and at -3 dBFS input level, as shown in figure 4. The console inputs overall are characterised by very low distortion and the noise performance is very good. These are ideal prerequisites to serve as the foundation for creative processing. Engaging Silk makes immediately obvious a change in amplitude frequency response. Figure 5 shows the curves for both flavours where the colours of the traces correspond with

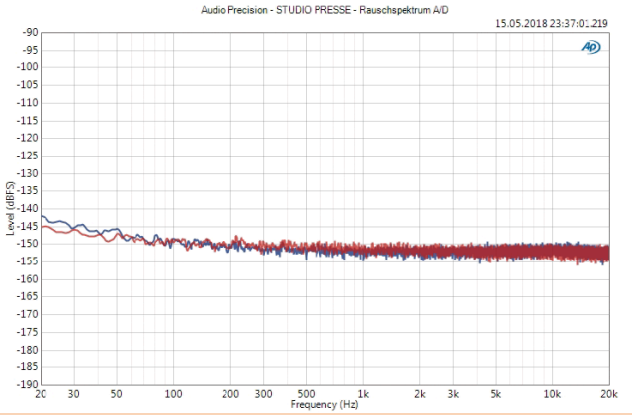


Figure 1: Impeccable noise spectrum of the neutral input stage

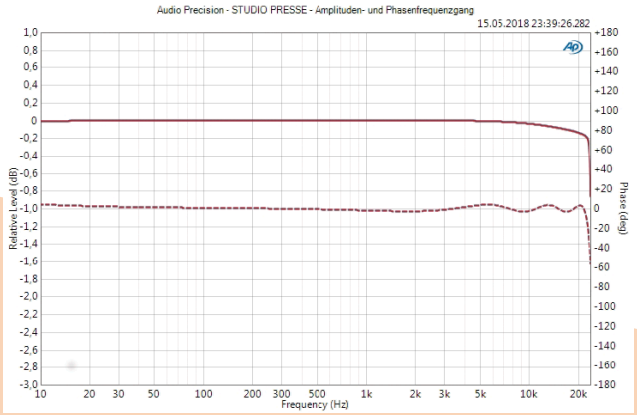


Figure 2: Amplitude (solid) and phase (dashed) frequency response of the neutral input stage

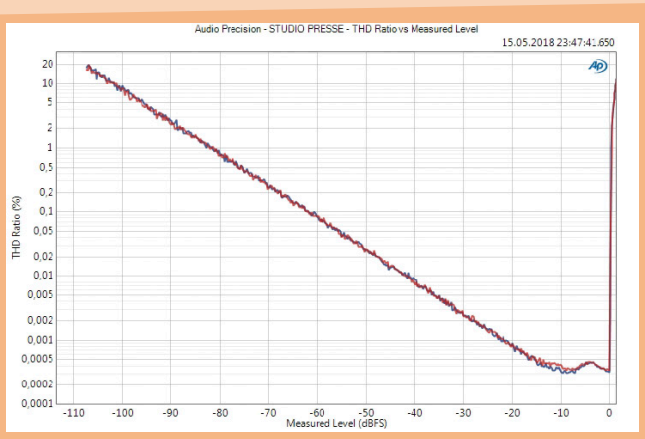


Figure 3: THD as a function of input level, no effects

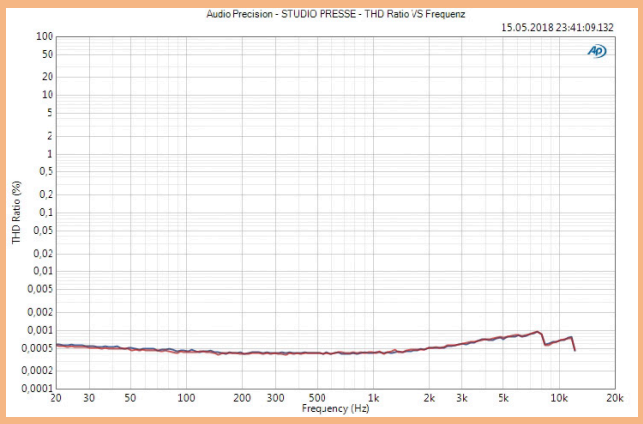


Figure 4: THD as a function of frequency, no effects, -3 dBFS level

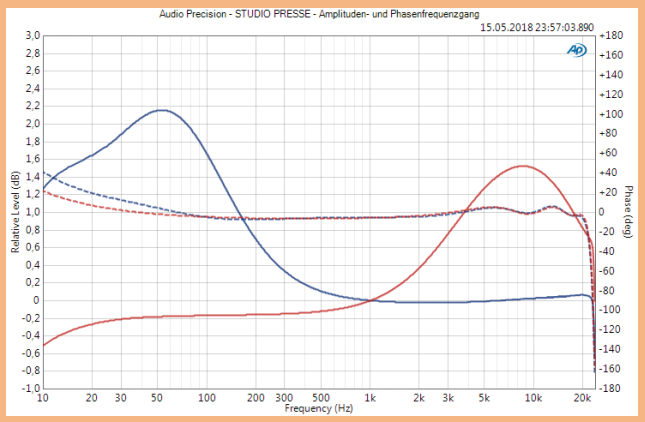


Figure 5: Amplitude (solid) and phase (dashed) frequency response of Silk blue and red transformer emulations

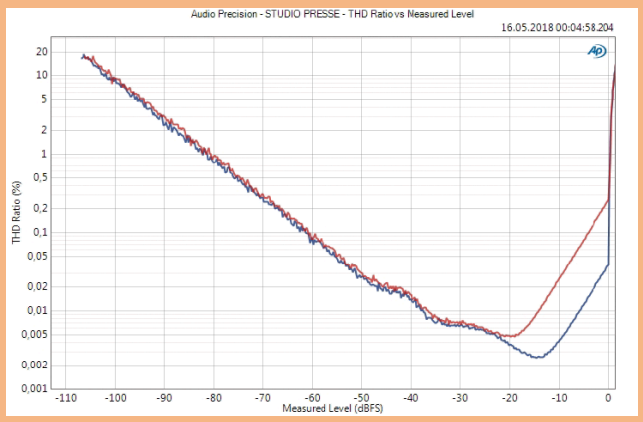


Figure 6: THD as a function of input level, Silk blue and red

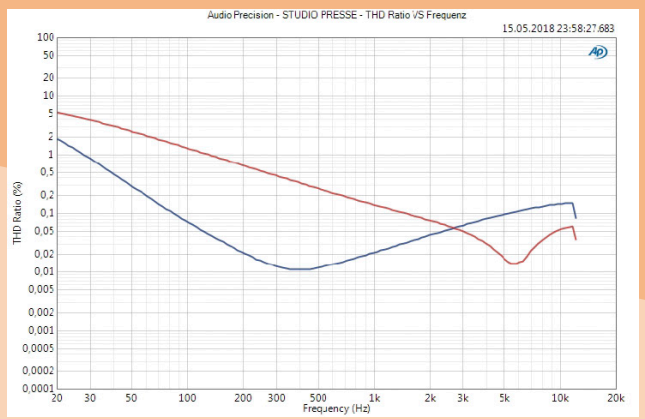


Figure 7: THD as a function of frequency, Silk blue and red

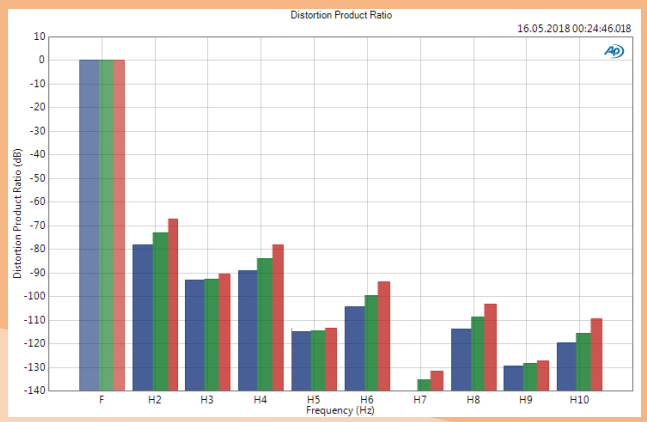


Figure 8: THD spectrum Silk blue Yamaha, fully counterclockwise (blue), 12 o'clock (green), and fully clockwise (red)

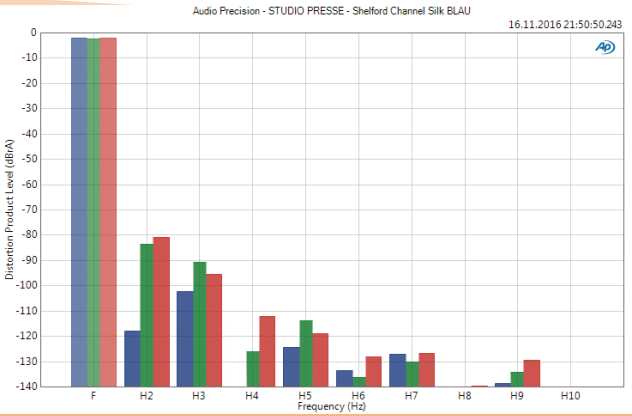


Figure 9: THD spectrum Silk blue Neve Shelford Channel, fully counterclockwise (blue), 12 o'clock (green), and fully clockwise (red)

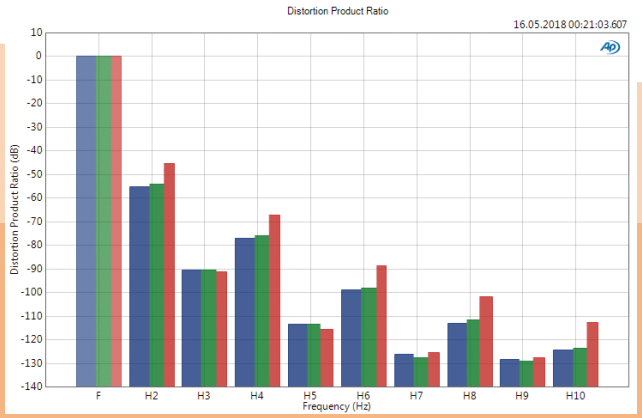


Figure 10: THD spectrum Silk red Yamaha, fully counterclockwise (blue), 12 o'clock (green), and fully clockwise (red)

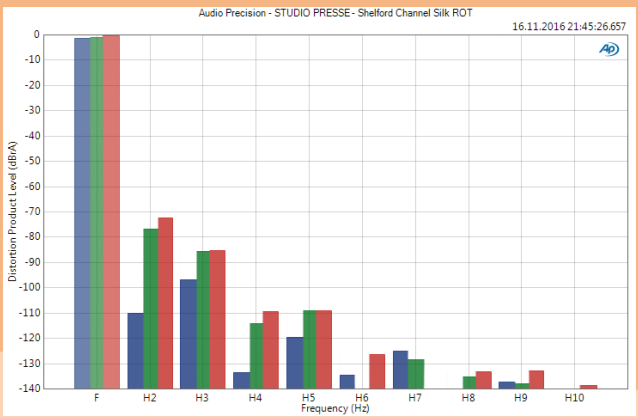


Figure 11: THD spectrum Silk red Neve Shelford Channel, fully counterclockwise (blue), 12 o'clock (green), and fully clockwise (red)

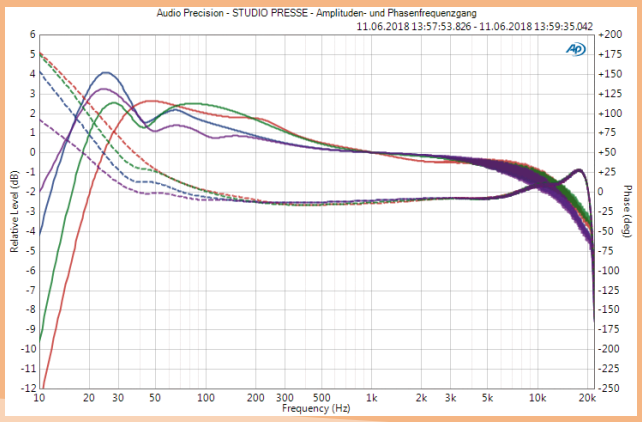


Figure 12: Amplitude (solid) and phase (dashed) frequency response Opendeck, Swiss 85 (blue), Swiss 78 (red), Swiss 70 (green) and American 70 (purple)

the silk settings. The response of the THD also shifts as expected. Figure 6 illustrates very well how the added THD dominates the clipping characteristics of the converter by several magnitudes. As such the THD is by no means static, but rather changes as a function of frequency quite significantly. The behaviour of both colour variations at -3 dBFS level is shown in figure 7. In these cases the texture control was set to 8 out of 10. This is not an exaggerated setting because the emulation, just like its original prototype, only yields a significantly audible effect beyond its half-way point (12 o'clock setting). It's a favourable coincidence that we measured the Rupert Neve Shelford Channel in similar conditions back a while. So the THD spectra of the Silk implementations in the Shelford Channel and in Yamaha's PM10 can for the most part be directly compared.

All measurements were carried out with three texture settings at the counterclockwise extreme (blue), 12 o'clock (green), and clockwise extreme (red). Let's start with the Yamaha Silk blue in figure 8 and the corresponding comparison with the Shelford Channel in figure 9. The absolute characteristics are certainly comparable, but the spectral compositions show a few differences. Silk red shows a similar behaviour in figure 10 compared with Rupert Neve in figure 11. As a general rule, Yamaha seems to achieve an even stronger discrimination between red and blue than Rupert Neve himself. This may be due to the circumstance that the effects of the simulation can naturally be better controlled than the behaviour of analogue components - particularly a complex one like a transformer.
It definitely becomes evident that Yamaha has gone to great lengths with the emulation, because the dynamic behaviour as a function of frequency and level is quite detailed hinting towards a significant development and processing effort. Whether or not the emulation fully hits the mark cannot be concluded with complete confidence, because we don't know which silk circuitry served as the prototype for the modelling.

Silk hands-on and sound

For a fair contest of the sound quality we didn't just process isolated signals, but we decided to treat three multitrack projects with Silk. These projects were then mixed just by means of level balance and panning. Sound sources were both recordings of acoustic instruments as well as purely digital signals. This resulted in a diverse mix

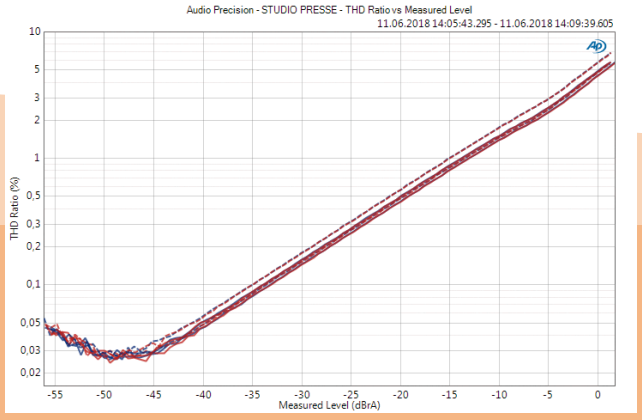


Figure 13: THD ratio as a function of input level, all models

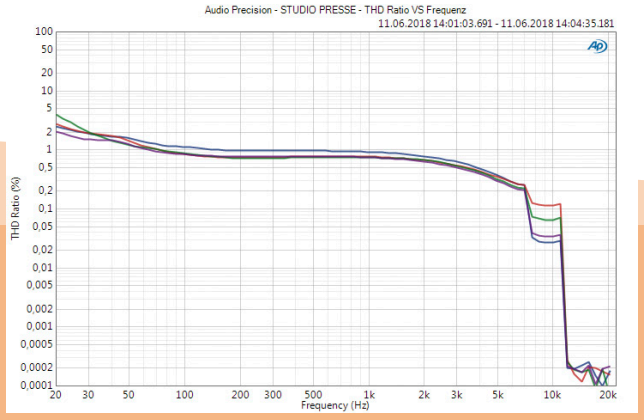


Diagramm 14: THD Ratio über die Frequenz bei -20 dBFS Aussteuerung, Swiss 85 (blau), Swiss 78 (rot), Swiss 70 (grün) und American 70 (lila)

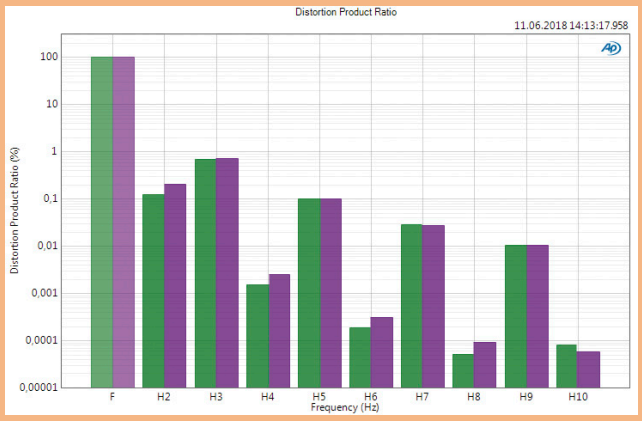


Figure 15: THD spectrum at -20 dBFS level, Swiss 70 (green) and American 70 (purple)

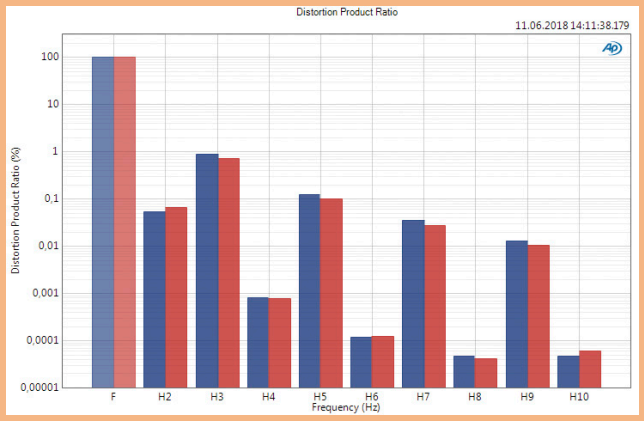
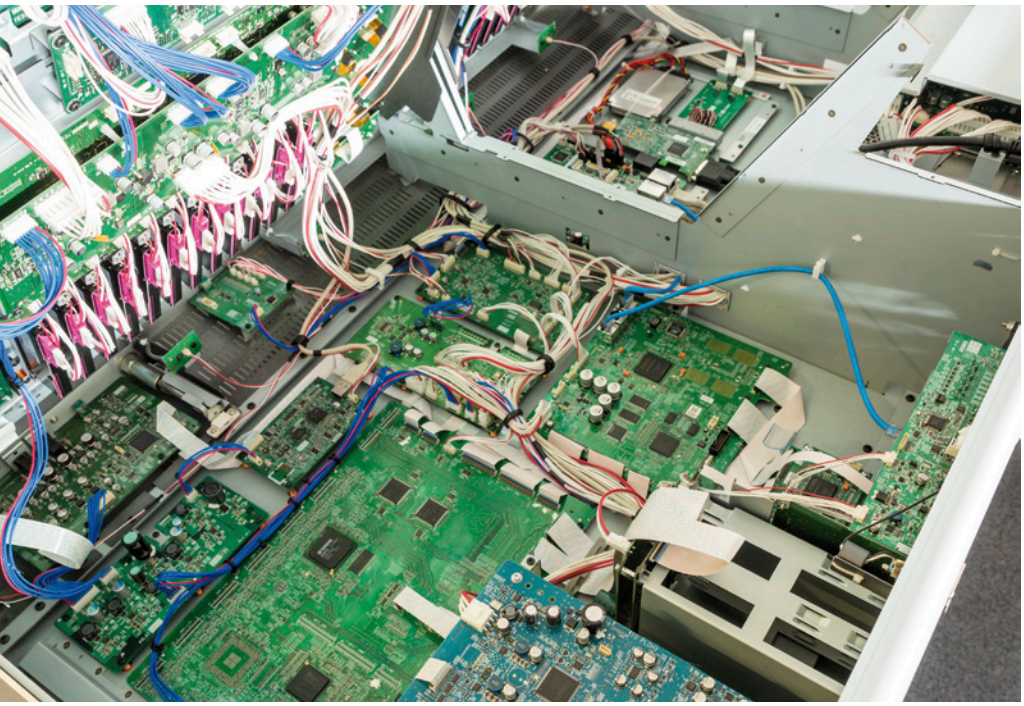


Figure 16: THD spectrum at -20 dBFS level, Swiss 85 (blue), Swiss 78 (red)

of representative signals that were all available in their original state (but sent via the neutral converters), as well with as both Silk red and Silk blue processing. We first tried to mix these signals as “single-origin”, i.e. just the neutral, the red, and the blue signals among each other. This immediately revealed the characteristic differences. While the original sources sounded thin and flat by comparison, the red signals showed a clear emphasis in the lower highs, a presence, that just became too much in the sum of all channels. This is similar, albeit not as drastic, as an exciter effect that falls short when exaggerated. We didn’t expect anything different since it’s really not advisable to treat all sources with the exact same concept. Using a sensible mix of sources with all three versions however yielded an ideal situation. The individual instruments immediately position themselves in the acoustical background, the middle or in the front. This automatically creates a very transparent depth in the sense of the front-back localisation. The emulation also succeeds in recreating the typical 3D effect of analogue processing. A default use of Silk is not advisable, but at the end of our mixing experiments it became clear that it worked and added to the signals much more often than not. An individual signal processed with Silk never sounded unpleasant or artificially over-processed. In other words, using Silk never causes any real harm down the road, but it should still be used judiciously (where would this rule not apply?). Even if one ends up wishing to have used a different effect intensity in hindsight, small EQ adjustments can typically remedy a potential over-emphasis. Obviously such corrective EQ is incapable of removing the additional harmonics, but it can in fact take their edge off. What remains is a rich, beautiful signal that is a pleasure to mix. This is in fact another sign of quality as bad processing typically can’t be repaired after the fact. At the end of the day we have to conclude that signals processed with Silk are simply easier to mix than the neutral input signals. Since we deliberately refrained from additional sound processing we suppose that a controlled use of Silk will require less work and effort to achieve a good mix.

Tape machine emulation Opendeck

As mentioned earlier, the Rivage PM10 also offers the possibility of inserting a tape simulation in a channel or buss. This current version of Yamaha’s so-called Opendeck is also available as a VST plug-in from Steinberg. We decided to discuss this special plug-in as well, because it is in some ways an unusual



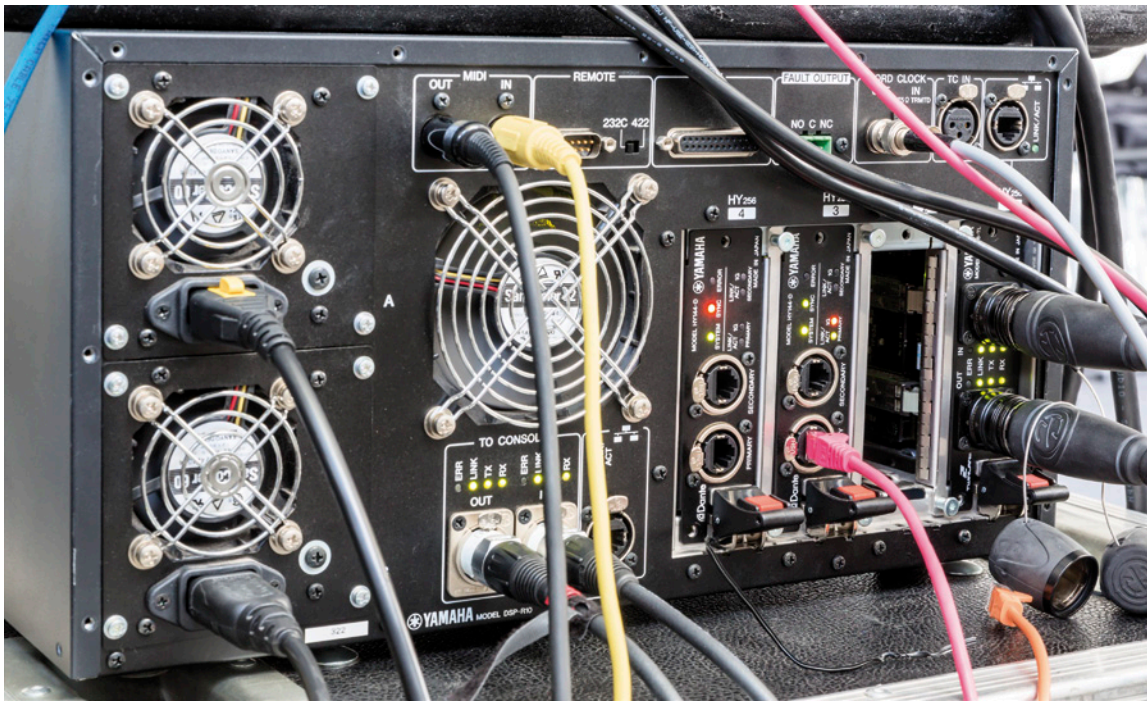
feature for a live console. It is also loosely associated with the type of processing as Silk and it fits right in line with our series of tape machine emulation reviews we've already written. The plug-in can be set to four different tape machines with scrambled titles. Presumably, the following machines are referred to by these names: Swiss 70 is probably based on Studer's A80, Swiss 80 may have been modelled after the A800, and Swiss 85 may draw its inspiration from the closely related A812 and A820 machines. In addition, there is an American 70 model, which may be based on the Ampex ATR-102 - at least the design of the rotary controls resembles this model. But, as our measurements will show, these parallels should not be taken to literally and it makes more sense to view the effect as an autonomous feature. Models can be independently selected for record and playback as if one would track to tape with one machine and play it back with another. All the settings track across the range of models and are comprised of record and playback level, a coarse frequency response adjustment for the highs and lows, a bias control, the choice between an old and a new tape, as well as two different tape speeds.

Measurements Opendeck

This leads us to our measurements of Yamaha's Opendeck plug-in then. For this purpose the mixing console was connected to our Audio Precision via AES3 without any conversion. We had a look at Yamaha's default presets for the different models. To begin, we examined the amplitude and phase frequency response curves, because these reveal the first and most important difference between the models. Figure 12 illustrates the rather significant differences between the four emulations. The absolute boost in the low frequency domain can be up to 4 dB and, consequently, is immediately audible when engaging the plug-in. Equally noticeable are the differences between the various models. However, it appears that the emulation does not discriminate between the models in any other area. The result of the THD measurement as a function of input level is shown in Figure 13. This graphic shows that the THD behaviour is based on a predominantly static model that doesn't change from one emulation to the next; a suspicion that is further confirmed when examining figure 14. Here, we document the THD response as a function of frequency, a criteria that would be drastically variable for the original tape machines. The emulation however again is characterised by a more constant response that doesn't change with the different types. As a whole, Opendeck stays a little flat and doesn't match the emulation depth of Silk. Figures 15 and 16 demonstrate this once again by means of the harmonics spectra, which wouldn't be as similar for the original tape machines as they are shown here for the emulation.

Opendeck hands-on and sound

Even though the technical results of the measurements have revealed that Opendeck, presumably due to resource constraints, hasn't been designed as detailed as one possibly would have wished, it still sounds surprisingly good. In our hands-on review we ran several mixes and individual signals through the four models and the sonic results were by and large very convincing. It's important to pay close attention to level-matching to avoid being fooled by a slight



difference in loudness. Consequently, the level compensation option should be engaged. If this is taken care of, Opendeck impresses as a subtle but truly pleasant effect. Particularly positive is how it treats transients. Any hard or excessively steep signal slopes present in the original will be rounded off by the plug-in, accompanied by a reduction in "annoyance factor" of such signals. Extremely transient hits on an acoustic guitar, commonly encountered with piezo pickups, are leveled out in a very musical fashion. There's also a subtle compression and increased density. Some caution is advisable when it comes to the increase in level at low frequencies. It makes sense to instantiate Opendeck at the beginning of a session and to mix "into" the plug-in. This avoids an over-emphasis in the lows and a cluttered mix. As a whole, Opendeck left a great impression on us, although we wouldn't use it without hesitation like Silk. Opendeck doesn't quite match the glue and compression of a real tape machine. A conclusion we've so far had to draw for all tape emulations. Even in Yamaha's case the fact remains that the signal path from head to tape back to the head cannot be fully replicated.

Conclusions

In our review the console was able to strikingly prove its strengths. We did of course go into much more detail than this review might make it appear. The overall sound quality is very high, but with just a few tweaks it can be elevated much beyond the neutral sound of other digital consoles or workstations. Rupert Neve's certified Silk input stage is the biggest contributor to that, lending a beautiful character to every signal that rarely becomes too much. For a lot of applications, we might even go as far to say the most, Silk is an upgrade that you quickly can't live without. This is because a Silk processed signal fits better in a mix, creates a bigger differentiation from other signals, and can be put into the spotlight with a bit more treatment. In other words, the mix just falls into place a lot easier and quicker. This is an attribute many will recognize from big analogue desks and it's one of the reasons why certain manufacturers are still particularly revered today. The big disadvantage of the concept lies in the fact that Silk can't be added to digital signals retroactively. This leaves you with the classic concept of "recording with colour, mixing in a neutral way". It is very clear that whoever works with the PM10 or gets to enjoy the results of the efforts on the console (e.g. for multi-track mixing) will be very pleased. The sound quality is truly terrific and makes life easier for everybody involved. It's a superb mixing console that could in fact easily prove its worth in the studio. But what's certain is that it provides an exceptional solution to bring the studio sound to the live stage.