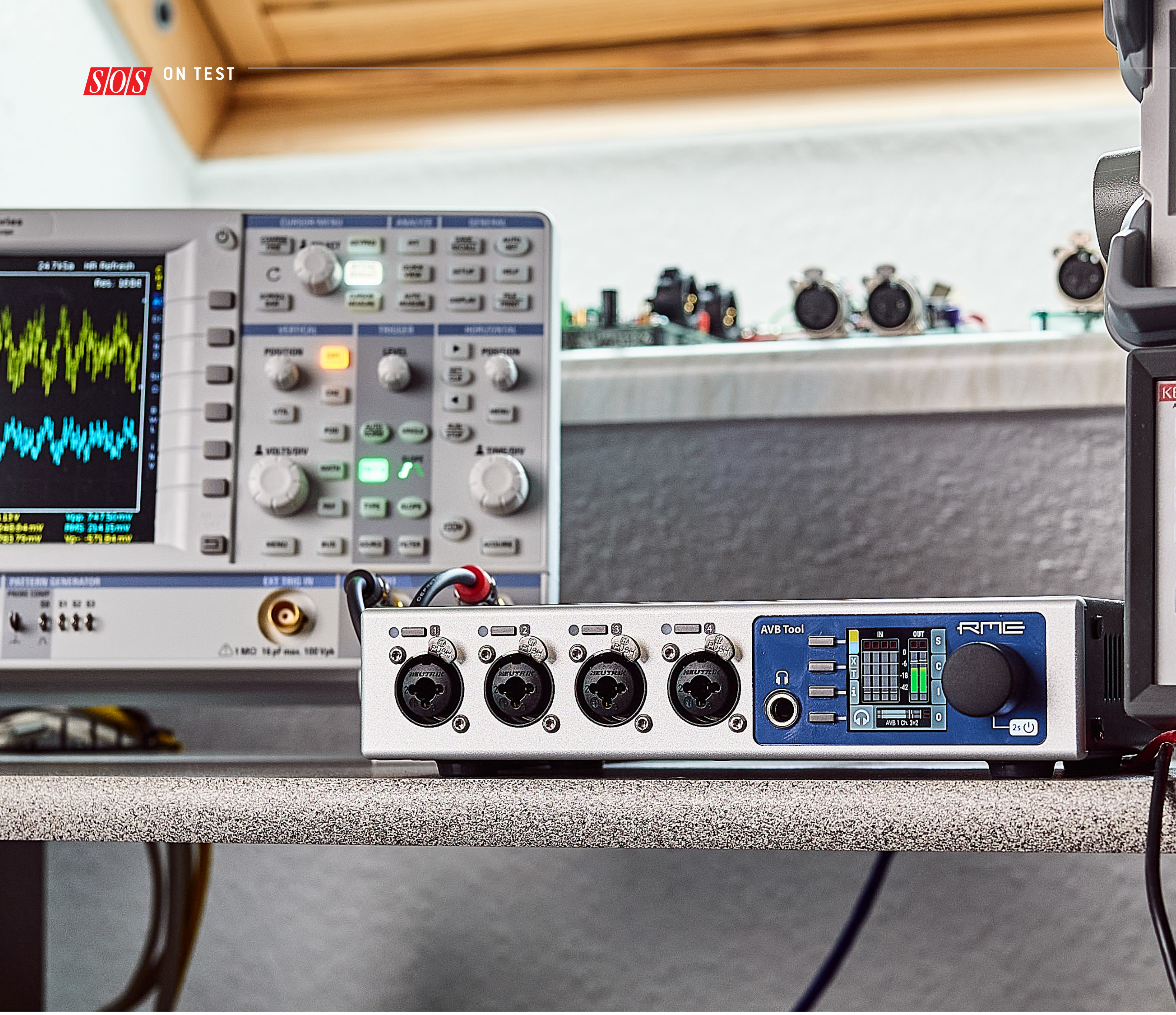


HUGH ROBJOHNS

RME AVB Tool & Digiface AVB

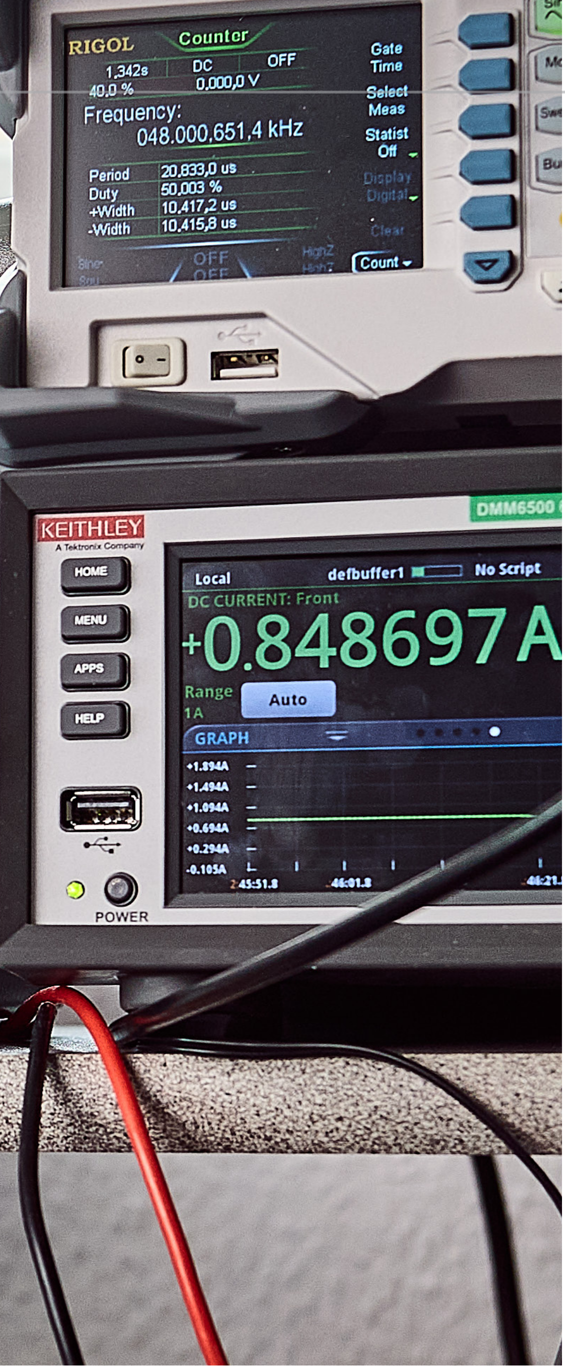
Networked Audio Interfaces

RME deliver affordable and reliable Audio over IP with two new boxes.

Audio over IP (AoIP) is becoming the standard way of transferring high numbers of audio channels between equipment and locations using low-cost Ethernet cabling and infrastructure, supplanting MADI as the large multi-channel interface of choice, particularly in the live-sound and broadcast worlds. However, most of the advanced AoIP formats — like Dante, Q-Lan, Livewire and Ravenna — are proprietary, and therefore inherently costly for both product manufacturers and end-users.

The AVB format, in contrast, is essentially built upon a collection of open-source extensions to the IEEE Ethernet standards, and that makes the format very attractive for product manufacturers and more cost-effective for small-scale installations. Although AVB is technically a 'Layer-2' system (along with the likes of CobraNet, SoundGrid, EtherSound and ACE), it shouldn't be thought of as inferior or the poor relation to Layer-3 systems like Dante and Ravenna. In RME's implementation, an AVB connection is capable of passing 128 separate audio channels in each direction; it supports standard, double and quad sample rates; and it guarantees a fixed network latency of typically just 2ms, although in smaller setups it can be configured to be as low as 0.3ms!

Recognising the growing interest in and practical attractiveness of the AVB format, RME have recently expanded their product



range with a number of new AVB-equipped interfaces. These latest AVB additions comprise the AVB Tool, the Digiface AVB, and the 12Mic preamp. The AVB Tool is a four-channel preamp with built-in AVB and MADI interfacing, and the ability to route signals between them. The Digiface AVB, like other Digiface units, is a simple digital interface, in this case providing a convenient means of connecting a computer to an AVB network to send and receive audio channels. It also serves as a controller to configure and manage signal routing across the network. Both of these products are reviewed here. The 12Mic is, as the name implies, a 12-channel mic preamp which is digitally controlled and features AVB, MADI and ADAT interfacing (you can read our review of it in next month's *SOS*). For completeness, RME also produce the M-32 Pro and M-1610 Pro multichannel A-D and D-A converters, which are also equipped with MADI and AVB interfaces.

Digiface AVB

The Digiface AVB sits in RME's product range alongside the Digiface Dante and Digiface USB (ADAT) interfaces, providing neat and simple digital-format computer audio interfacing. Mac owners might be wondering if the Digiface AVB is necessary given that Apple's latest Mac OS has included support for the AVB format via the computer's own Ethernet connections since El Capitan. However, there are currently some questions over this facility's compatibility, and AVB hasn't yet been integrated into the Windows OS. Consequently, RME's new Digiface AVB provides a universal, reliable and convenient AVB network connection for both platforms, hooking into the computer via USB 3.0. It is compatible with Mac OS 10.11 upwards and Windows 7 onwards, and comes with RME's legendary rock-solid drivers as well as TotalMix low-latency monitoring software for real-time signal mixing and routing, and the very handy Digicheck audio analysis utility software. Usefully, TotalMix can now be remote-controlled via any iOS device, Mac or PC on the same network, or via RME's own ARC USB hardware remote.

Physically, the Digiface AVB's grey and black folded-steel case measures just 112 x 26 x 83 mm and weighs only 300g — about the size and weight of a pack of playing cards! At the rear is a 'double-decker' USB 3.0 B-type socket for connection to the computer, and this is also the only means of powering the Digiface unit, drawing up to 400mA and consuming around 1.5W of power. A suitable 1.8-metre USB 3.0 (A-B) cable is supplied.

The front of the unit carries a single RJ45 socket for the AVB network connection (100Mb/s or 1Gb/s), a pair of BNCs for word-clock I/O (75Ω input termination is selectable through the configuration software), plus a quarter-inch TRS socket. This last connection is primarily intended for stereo headphone monitoring, but can also be used as dual unbalanced analogue line outputs, or even for sending control voltages to synthesizers (it is DC-coupled).

And that's it for the hardware. Hook up the USB and network connections and it's ready to go! Of course, the Digiface configuration and AVB Controller software both need to be pre-installed in the host computer, but that is taken care of with RME's usual efficiency. I used the AVB interface under both Windows 7 and 10 on different machines without any installation or setup difficulties. RME's current driver supports up to three of their interfaces being used simultaneously, provided they are all synchronised to the same clock. The Digiface AVB can be clocked either from its internal clock, the AVB network's established clock, or an external work-clock input, supporting all standard sample rates between 44.1 and 192 kHz.

The Digiface configuration software adjusts things like the ASIO buffer size (from 32 samples) and toggles the word-clock connector's input termination. There are also indicators to show the AVB network sample rate and clock source, and various other options for WDM devices, isochronous streaming over USB 3, and so forth. Once configured appropriately for the system, though, these settings would generally be left alone. Everything to do with network audio routing and related functions is taken care of within the AVB Controller software.

Fat Controller

RME's AVB Controller software is 'AVDECC-compliant' — meaning it can talk to other manufacturers' AVB equipment too — and must be running in the background whenever the Digiface AVB is being used, since it actively monitors »

RME AVB Tool & Digiface AVB

£1479 & £799

PROS

- 128 audio channels in each direction over a single Ethernet cable.
- Straightforward network configuration and management.
- AVB Tool provides a bridge between MADI and AVB environments.
- Excellent preamp quality and versatility.

CONS

- AVB-capable switches are essential.
- Another learning curve to climb!

SUMMARY

Networked audio is an attractive means of distributing high-channel-count audio between devices, and the open-source AVB format does so at lower cost than the leading proprietary systems. RME's support of the format enhances credibility, and the company's range of compatible products makes it a very practical and cost-effective alternative.

» and controls the network and any AVB devices attached to it. If the Digiface AVB is configured as the master device on the AVB network, the controller software is used to configure the clock sources and sample rates, and manage the connections of different Streams between source and destination devices.

There is also a facility to set the nominal network latency for each AVB device send-receive connection. The default AVB standard is 2ms, but that's a generous duration intended to accommodate a large 100Mb/s network with several hops between switches. In smaller and simpler systems, with 1Gb/s infrastructure, it is quite practical to operate the AVB network with much lower latencies, so the Digiface AVB controller software includes options for much lower network latencies down to 0.3ms. Just as with ASIO buffer settings, larger values increase reliability at the expense of overall system latency but, unlike ASIO buffers, if the setting is too low for the network infrastructure the audio Stream will fail completely, rather than issuing occasional splats! (See the 'AVB Networking' box.)

When used under ASIO at standard sample rates, the Digiface AVB is capable of passing up to 128 audio channels in each direction across the AVB network, and into and out of the computer for recording and playback. At double sample rates that channel count into/from the computer falls to 64, and then to 32 channels in each direction at quad rates.

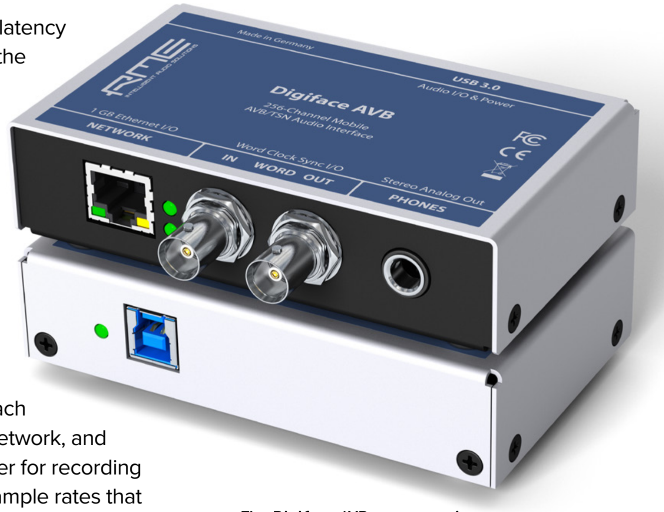
However, since the TotalMix software controls digital monitor mixing within the hardware of the interface itself, it can access all 128 AVB input and output channels at both single and double sample rates. At Quad rates, though, the hardware's limited DSP capability reduces the access to only 60 channels on the network itself.

There's not much to say about the Digiface AVB's technical performance since it is basically a bit-transparent format converter. However, the phones/line-output D-A converter has a dynamic range of 113dBA which is certainly more than good enough for high-quality headphone monitoring. The THD+N figure is 0.0017 percent, and a 0dBFS digital signal generates +9.5dBu at the unbalanced output socket. At full volume, 50mW of power is provided to each side of connected stereo headphones, which is quite generous.

AVB Tool

The AVB Tool is designed to insert and retrieve four channels of analogue audio into and out of an AVB network. It also has MADI connectivity and so can route and convert signals between the MADI and AVB domains.

Physically, the AVB Tool is a half-rack-sized module which shares its styling cues with other recent RME interfaces. Control and configuration of the unit is primarily through a small but crisp TFT colour display screen on the right-hand side, with an associated rotary encoder which also doubles up as the standby on/off button (if held for two seconds). Four soft buttons on the left select functions like



The Digiface AVB measures just 112 x 26 x 83 mm and includes an RJ45 port, a pair of BNC word-clock connectors, a headphone port and, round the back, a USB port for computer connection.

AVB Networking

At its simplest, an AVB network comprises one or more AVB-capable switches linking two or more AVB devices across a standard Ethernet network. However, AVB-capable switches are not 'nice-to-have' accessories here; they are essential core elements of any AVB system since only AVB-capable switches are able to reserve and manage the required data bandwidth across the network, prioritise the audio and other data packets appropriately, and transmit them in the designated precision time slots to avoid packet collisions — all things that are essential in guaranteeing the fixed network latency so critical to stable audio performance.

Audio data packets are categorised as either Class A or Class B, with Class A audio traffic being guaranteed a maximum network latency of just 2ms — assuming a maximum of seven hops between switches across the network (which would be a very large network!). Class B traffic has a guaranteed maximum latency of 50ms. Audio data can be in 24- or 32-bit integer or 32-bit floating-point formats, and the network can carry other related data such as MIDI, timecode and MPEG or SDI video.

AVB-capable switches are available from all the usual big IT suppliers like Netgear, Cisco, Extreme Networks, and others, but some audio companies are also now providing their own AVB Switches too, such as MOTU and PreSonus, for example.

RME's implementation of AVB networking complies fully with the MILAN standard. This is effectively a set of cooperative agreements over the implementation of AVB technology, including compatible media formats, clocking arrangements, and controller software, among many other aspects. MILAN ensures reliable interoperability between different brands of AVB equipment.

Up to 128 audio channels in each direction are supported in RME's AVB products, but to simplify the network management these channels are grouped together in up to 16 separate 'Streams', with each Stream carrying anything from one to 32 audio channels at a fixed sample rate. So, for example, there could be 16 eight-channel Streams, or four 32-channel Streams, or any other combination of different Stream sizes provided the total adds to 128 channels or fewer! A Stream generated by one device (the 'talker') can be received by any number of 'listener' devices — the required signal routing across the network being determined by the AVDECC Controller.

Three commonly used Stream coding formats are supported by most AVB audio devices. The AM824 format is the default, but the IEEE-based AAF format (also known as the AVTP format) is also employed as it's simpler with a slightly more efficient packet-coding technique. The third mode is the CRF (Clock Reference Format) Stream, which carries only clocking information.

The audio source or 'talker' device time-stamps each audio packet with its 'presentation time', which is the exact time it should be replayed by the receiver ('listener') device. This time stamp has nanosecond precision — which is impressive bearing in mind that a 48kHz sample period is 20,800ns! — and it is normally offset by 2ms from the packet creation time to allow a sufficient duration to transit the network before being replayed. Any packets which arrive at the 'listener' after the stamped 'presentation time' are discarded and the audio muted. So the decided network latency is effectively baked into each 'talker' device before the corresponding stream is connected to a 'listener', and is then guaranteed by all the listener devices. In small networks a lower latency value can be baked in, if appropriate.

phantom power, polarity inversion, meter resets and so on, with the appropriate tallies displayed on the left of the screen. There are just four menu pages, accessed via the encoder again, dealing with things like 'State' (general settings and preset configurations), Clocking, Inputs and Outputs. These functions can also be configured via a web browser either over the AVB network or via a USB 2.0 B-type port on the rear panel.

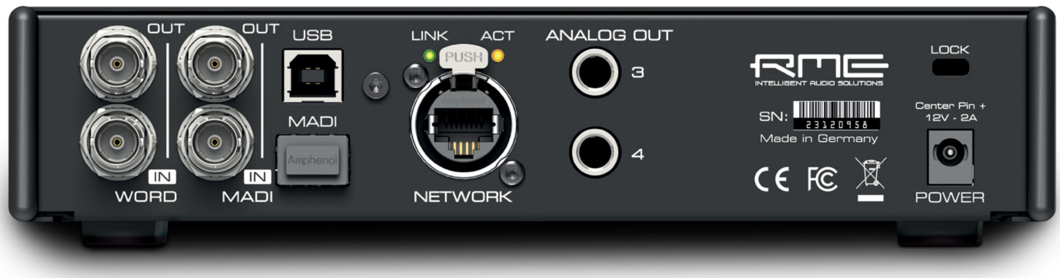
It is important to note that the AVB Tool does not contain an AVDECC controller, so it cannot recognise or control other devices on the AVB network itself. Instead, some other device with the required controller software must be present on the network — such as the Digiface AVB, or even just a computer with a network connection and the AVDECC software — to establish the network's clock source and sample rate, and to create audio Stream connections between devices.

"I have no doubt that networked audio, and AVB in particular, will become as commonplace as ADAT for project and professional installations alike."

To the left of the front panel are four versatile and high-quality analogue input channels, all with combi XLRs. The preamp and converter circuitry is exactly the same as that employed in the new 12Mic preamp, but is derived from the well-respected UFXII /UFX+ design. These four inputs accept mic, unbalanced instrument, or balanced line connections, with up to 75dB of gain available in 1dB increments for the XLR input, and a 42dB range for the TRS input. Channel gains can be linked, and phantom power is switchable on the XLR socket, while the TRS input can be configured with a high impedance (1MΩ) for instruments. There is no pad option because the XLR input can accommodate signals up to +18dBu (and the TRS input up to +21dBu).

My test-bench measurements using an Audio Precision system faired extremely well, with an AES17 dynamic range figure of 120.4dB (A-weighted), which is very good indeed, and on a par with the likes of Grace Design's M108 and the Apogee Symphony.

For anyone familiar with other RME products, setting up the input channels is straightforward using a small button above each input socket to access the channel's parameter on the TFT screen. A multicolour LED next to each button indicates the current status. For example, if phantom power is present it lights yellow, if the TRS input is selected it shows white, and it turns blue if the Hi-Z mode is active. The same LED also indicates signal level, changing from variable to solid bright green at -20dBFS, then to yellow at -5dBFS, and red at -1dBFS. So for most purposes the optimal signal level for recording would see a solid bright green most of the time, with occasional flicks to yellow on the highest transient peaks. »



At the back of the AVB Tool we find two pairs of BNC connections for word-clock and coaxial MADI I/O, a USB-B port for updates, a blanking plate for the optional SFP transceiver module, the all important RJ45 connector and a pair of quarter-inch analogue audio outputs.

One unusual design feature is that RME have chosen to change the A-D anti-aliasing filter response at different sample rates. At base rates the anti-alias filters are optimised for ultra-low latency while maintaining the widest possible audio bandwidth. In contrast, though, at double and quad rates the filtering is optimised instead to give the best impulse response with minimal ringing. This is achieved in part by implementing a gentle roll-off (rather than the usual brick wall) starting at just 25kHz for double sample rates, and from 32kHz for quad rates).

RME argue that the sonic benefit of the improved impulse response easily outweighs any practical relevance of the reduced ultrasonic bandwidth, and I'd agree! Not only is 25kHz far above the human hearing range, it's also above the natural roll-off of most microphones! However, for anyone wanting to use the AVB tool for scientific research involving ultrasonic sounds, a firmware modification is available from RME which implements more conventional anti-alias filtering to retain the full bandwidth associated with higher sample rates.

The AVB Tool provides four analogue outputs, arranged as a stereo headphone output on the front panel, and two servo-balanced line outputs on TRS sockets at the rear. The latter are configurable such that a 0dBFS digital signal generates analogue output levels of either +2dBV (+4dBu) or +19dBu, to suit connection with semi-pro or pro equipment, respectively. The headphone socket can also be used to deliver two unbalanced line outputs (+13dBu max), or it can be reconfigured as a single balanced output (+19dBu max).

Again, my test-bench measurements of the D-A stages impressed, with an AES17 dynamic range figure of 118dB (A-weighted), matching the UAD Apollo and Focusrite Forte's figures. Any or all input and output channels can be monitored at the headphone socket, of course, but there's also a momentary solo mode to check the four analogue input channels, which is very useful.

External word-clock in and out connections are provided on BNC sockets, and as mentioned earlier, the USB port is available for firmware updates and browser-based remote control options. Power is via a bayonet-locking coaxial plug from a supplied 12V DC line-lump (Class-2) power supply.

As shipped from the factory, digital I/O is available as both a single 1Gb/s EtherCON ruggedised RJ45 socket for an AVB network connection, and a pair of BNC connectors for coaxial MADI in and out. In addition, a blanking plug conceals a socket for a (cost-option) plug-in 125Mb/s SFP (Small Form-factor Pluggable) transceiver module, which enables MADI-over-fibre connections. Two different SFP modules are available providing either single-mode or multi-mode operation, both using standard LC optical connections. The multi-mode module is the most commonly used type, supporting optical fibres up to 2km in length, while the single-mode option allows for very much longer fibre connections — up to 20km! If installed, the SFP module can either be used to provide an additional 64 channels of MADI (matching the 128 channels available over AVB), or it can be configured to operate in concert with the coaxial MADI ports as a redundant pair connection for enhanced reliability in conveying 64 channels (at base sample rates).

Streaming

The AVB Tool supports eight Streams in either direction, with each Stream being configured within the unit to contain either 1-8, 12 (base and double sample rates), or 16 audio channels (base rates only). To simplify the initial setup, routing Preset 1 is set at the factory to send the four analogue inputs directly to MADI output channels 1-4, and also to four channels in each of the first two AVB Streams, with Stream 1 coded in the AAF format, and Stream 2 in the AM824 format. However, this preset can be overwritten if desired, and any other configuration created and saved.

The internal router allows any of the physical input channels (four analogue preamps, 128 MADI and 128 AVB) to be routed to any of the physical outputs (stereo headphone, stereo line, 128 MADI and 128 AVB).

In Use

RME's products have acquired a well-deserved reputation for reliability, ease of use and high quality, and the Digiface AVB and AVB Tool are no exceptions. I built a small AVB network with these two devices, plus the 12Mic preamp (which provided ADAT interfacing for my bench-testing), and an AVB-compliant switch to link them all together.

Setting the whole system up was remarkably straightforward and it didn't take very long to configure a stable system with 0.3ms latency. RME's AVDECC controller made it easy to set up the clocking arrangements and establish signal paths between devices, and I was very pleased with how quickly I was able to get everything up and running, after which it felt much the same as using any other RME interface.

The Digiface AVB box is really a case of 'fit and forget', although the associated Controller software is the beating heart of the whole system. The AVB Tool is a handy, compact interface to an AVB system with its four analogue inputs and outputs, and the preamps really are excellent — clean and quiet, with welcome versatility — and they are, again, easy to configure and control. But for many, its real power is its ability to serve as a bridge between MADI and AVB systems, with comprehensive routing capabilities.

I have no doubt that networked audio, and AVB in particular, will become as commonplace as ADAT for project and professional installations alike, and RME's first forays into the format create a very solid and practical foundation upon which to build.

£ AVB Tool £1479, Digiface AVB £799. Prices include VAT.
W www.synthax.co.uk
W www.rme-audio.de

Mix with the best!

"Besides the excellent interviews and fascinating, in-depth recording and mixing articles, I can always depend on Sound On Sound for complete, unbiased reviews of the latest pro-audio gear."

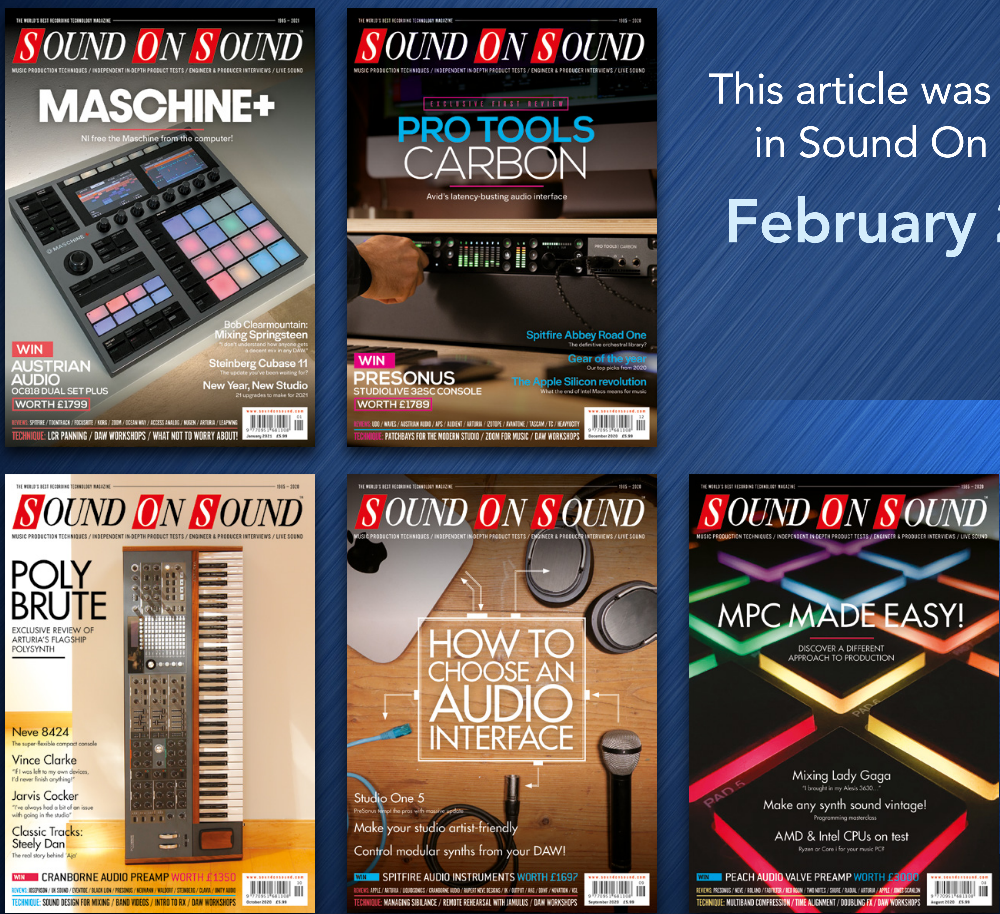
Bob Clearmountain, engineer, producer and mixer, Grammy Award winner (Bruce Springsteen, The Rolling Stones, Paul McCartney, INXS)

"As a professional I admire Sound On Sound as one of the most trusted and credible sources of inspiration and information."

Jack Joseph Puig, mixer, producer, Grammy Award winner (Rolling Stones, U2, Mary J Blige, Black Eyed Peas)

SOUND ON SOUND

The World's Best Recording Technology Magazine



This article was originally published in Sound On Sound magazine,

February 2021 edition

Available on the App Store

follow us on Twitter

find us on Facebook

go to the SOS YouTube channel

visit the SOS forum

Subscribe and Save Money!

Visit our subscriptions page at www.soundonsound.com/subscribe
for more information on the Sound On Sound App go to: www.soundonsound.com/app

Sound On Sound, Allia Business Centre, King's Hedges Road, Cambridge, CB4 2HY, United Kingdom
Email: subscribe@soundonsound.com **Tel:** +44 (0)1223 851658