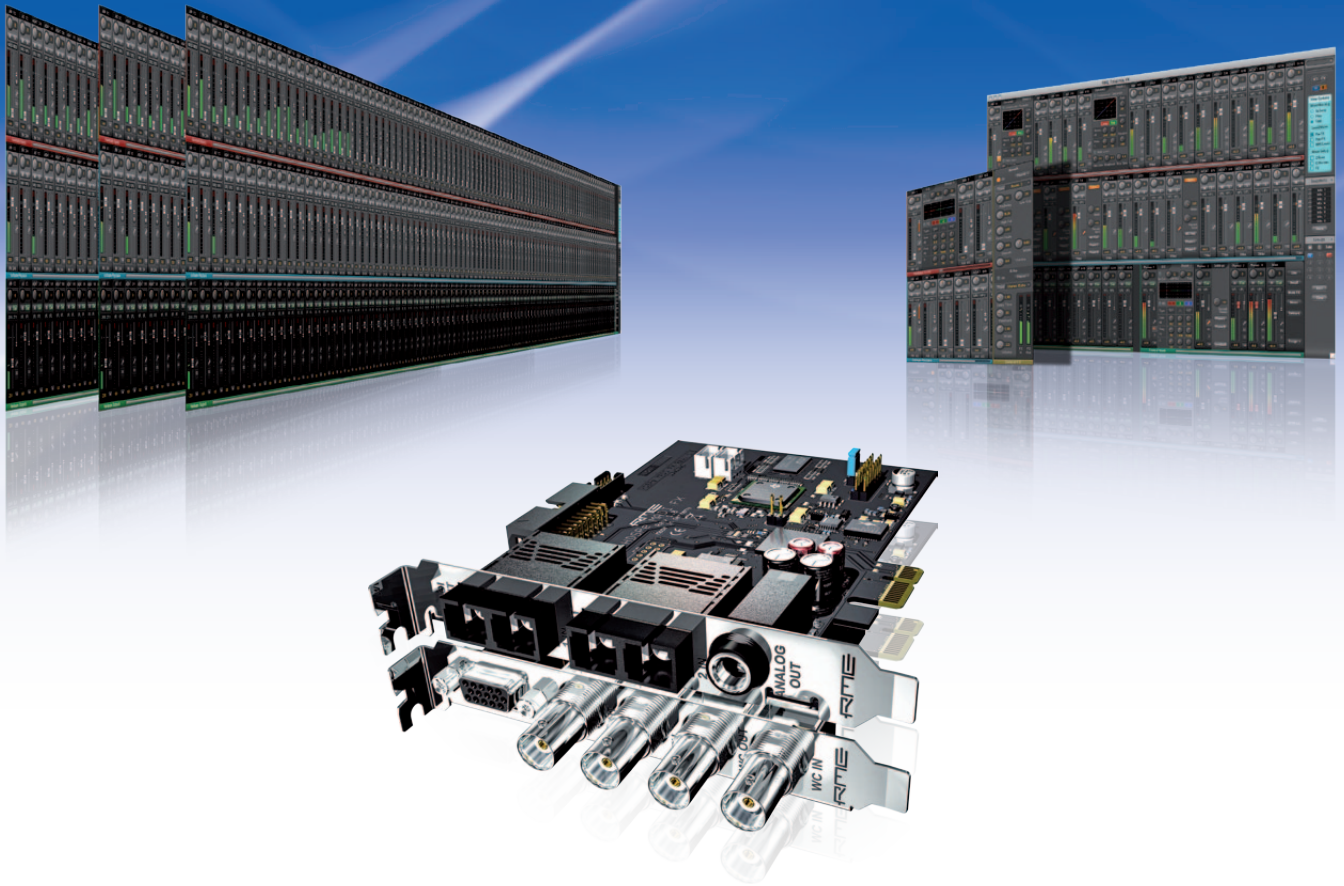


390 Channels
Plus effects.



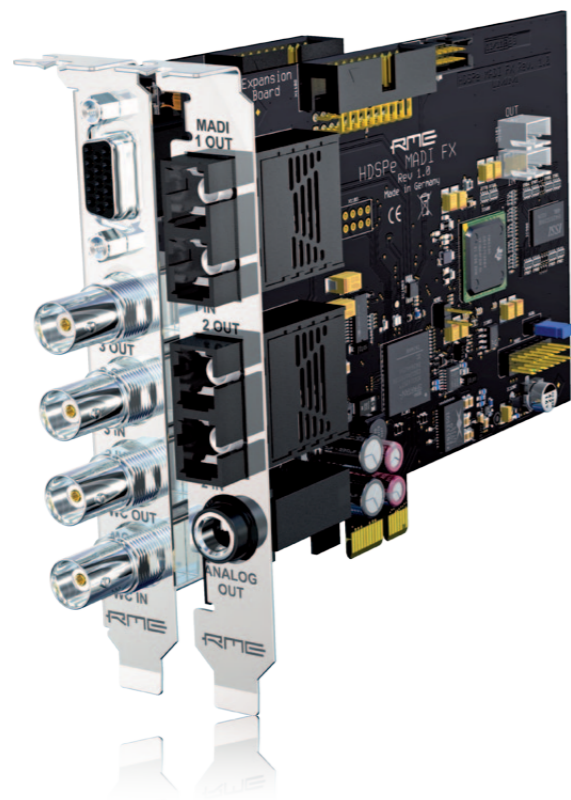
HDSPe **MADI FX**

RME

MADI TECH

Overview

390-Channel 192 kHz Triple MADI PCI Express Interface



Connectivity

- 194 input + 196 output channels = 390 channels
- TotalMix FX with 192 kHz effects engine
- 3 x MADI I/O (2 x optical + 1 x coaxial)
- AES/EBU I/O (via breakout cable)
- Stereo analog out (for monitoring)
- Word clock I/O
- 3 x virtual MIDI I/O over MADI
- 1 x MIDI I/O via breakout cable

The HDSPe MADI FX marks a new milestone both in the history of audio interface cards in the past two decades and within the long series of outstanding RME devices. Never before has such a high-performance multi-channel audio system existed.

The HDSPe MADI FX features 390 audio channels! Three MADI I/Os - two optical and one coaxial - are accompanied by one AES/EBU I/O and one analog monitoring output. To complete the feature set, a Word Clock connection and four MIDI I/Os were added. The complete technology and connectivity are highly integrated into the smallest possible amount of space - typical for RME. Only one PCIe slot is required on the motherboard, plus one free slot opening on the case.

To guarantee RME's unique low latency performance with such a huge amount of audio channels, the HDSPe MADI FX introduces a newly developed modular Hammerfall Pro Audio Core. The high-tech core will process three times as many channels as the channel count of the previous MADI flagship, while actually reducing the system load and enabling ultra-low latencies down to 32 samples on modern computers.

A sophisticated new efficiency technology will automatically deactivate currently unused channels, so that they require no processing power or bandwidth. A simple stereo playback will not require any more performance than from a standard stereo audio card - despite the use of a professional multi-channel system with almost 400 channels.

The new core technology is accompanied by a special version of TotalMix FX, which allows using the enormous channel count in an efficient and practical manner. The addition of numerous performance optimizations ensures that the 4096-channel mixer of the MADI FX responds just as smoothly as its 1800-channel counterpart in the Fireface UFX. A new and faster DSP allows for a greater number of EQs and compressors.

An innovative new layout of TotalMix enables ergonomic handling of the enormous number of channels. A special option makes it possible to visually hide unused channels. Complete "Hide setups" can be saved at any time, and switched with a simple mouse click, for example between the channel view of the drum mix and the full band setup.

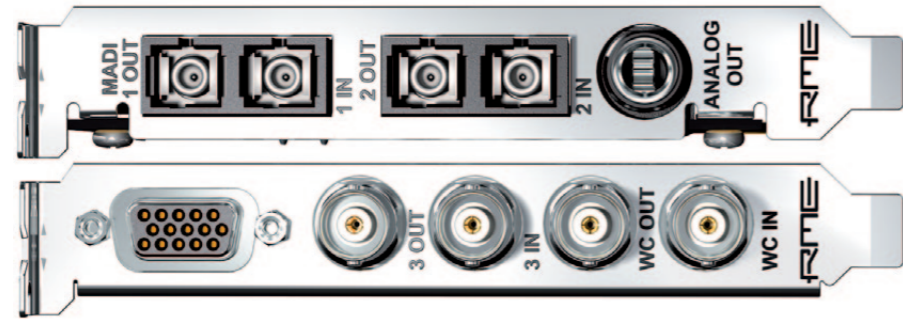
The 192 kHz RME effects engine allows latency-free monitoring with numerous effects like EQs, Compressors, Reverb, and Echo rendered directly on the hardware of the card, independent from the DAW software in use.

The integrated TotalMix matrix conveniently allows the use of the card as powerful MADI router. Unlike most other router solutions, each channel can be routed individually - even with separate level settings for each routing. The unparalleled flexibility of TotalMix can turn the most exotic applications into practical reality.

RME's unique Seamless Redundancy Operation uses the cards' 3 MADI receivers to provide professional users with state-of-the-art fail safe operation. The audio data is not interrupted when switching to another input - and the card can use not only one, but two more sources for redundancy. In SRO mode the card operates as single MADI input device, recording up to 64 channels. As soon as the current input fails the audio data received from one of the other two inputs is used. No relocking and synchronization to a different clock source is required, and the interruption caused by the external failure is minimized to a few samples.

The card also features SteadyClock, RME's active jitter suppression and the unique professional meter and analysis toolbox DIGiCheck - including EBU R128 metering - as well as nearly identical operation of the card under Windows and Mac OS.

Inputs + Outputs



3 x MADI I/O

The MADI FX provides two optical and one coaxial MADI I/O*.

Thus a total of 192 inputs and 192 outputs are simultaneously available in MADI format (at 44.1 and 48 kHz). At 96 kHz there are 96/96, and at 192 kHz an impressive 48/48 inputs and outputs can be used.

The HDSP MADI FX provides a sufficient amount of audio channels for every conceivable project, and enough reserve to grow with future needs. In general, two optical MADI-I/Os are adequate to implement a major studio or live setup with long cable lengths. The additional coaxial MADI I/O provides maximum flexibility and provides in-the-box conversion between both formats.

* The optical connectors are SC industry standard, in multi-mode technology. The coaxial MADI I/O is configured as 75 ohm BNC.

Analog Monitoring Output

The HDSPe MADI FX provides an analog stereo output in reference quality with RME's proven low-latency converter technology. The output is ideally suited for high- and low-impedance headphones.

Thanks to the powerful monitoring features of TotalMix, any input channel, recorded tracks, or complex sub-mixes can be selected for listening. An advanced Cue function allows each of the 98 possible stereo sub-mixes to be monitored with just a single mouse click.

AES/EBU I/O

An audio interface which is limited to MADI I/Os needs expensive multichannel converters to perform a conversion to other digital formats or even a simple sync connection. Those who work with MADI usually have also AES/EBU devices in use and would like to connect them easily to their DAW.

Therefore the HDSPe MADI FX provides a digital I/O in the professional AES/EBU format. This allows the connection of a simple AD/DA converter (e. g. RME's ADI-2 for example) to get a 2nd monitoring output, or to create a talkback setup. Even the connection of an external digital effects unit without a costly external MADI to AES/EBU interface can be realized easily.

The AES/EBU I/O can also be used for synchronization, e. g. with Steinberg's synchronizer and clock device, the Nuendo Sync Station.

MIDI integration and remote control

The HDSPe MADI provides four MIDI I/Os:

- 1 x external via breakout cable
- 3 x internal as virtual MIDI ports - one for each MADI I/O

RME MADI devices will not only transmit 64 audio channels with a single connection, but also regular MIDI signals. The HDSPe MADI FX is no exception: each MADI I/O owns a virtual MIDI I/O in the operating system that can be addressed by any MIDI program.

MIDI signals will be transmitted invisibly through the same lines and distances as the MADI data. At the other end of the MADI cable, the MIDI signals can be played back from RME MADI devices via a standard MIDI DIN port.

MIDI over MADI also allows remote control of all RME MADI devices, including monitoring and configuring a device's complete status. This outstanding feature makes MADI transmission across large distances practically usable, with host computers and devices far from each other - for example, FOH and stage.

All units can be programmed with their own ID, allowing independent remote control of multiple devices via a single MIDI channel.

RME provides a free Windows and Mac software to control all RME MADI devices. This "MIDI Remote" can use any existing MIDI port within the system to remotely control and monitor all connected devices. The software provides both a front-panel like operation and an extended Matrix display.

Wordclock I/O

A word clock I/O with switchable termination completes the connectivity of the MADI FX card.

While most MADI-based devices require an additional word clock or AES/EBU line, the MADI FX card uses SteadyClock to extract the reference clock directly from the MADI signal, while reducing possible jitter to a minimum, making long-distance connections even more convenient.

The word clock input processes signals automatically in single, double or quad speed.

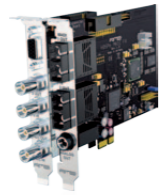
Available channel numbers with different Sample Rates:

Sample Rate	Analog	AES/EBU	MADI	Total In/Out
44.1/48 kHz	0/2	2/2	192/192	194/196
88.2/96 kHz	0/2	2/2	96/96	98/102
176.4/192 kHz	0/2	2/2	48/48	50/52

MADI . Made by RME

ADAT on Steroids?

Example . Digital Multicore



HDSPe MADI FX
390-Channel PCI Express Card
with optical
and coaxial MADI I/Os



optical cables
2 x 64 channels . up to 2000 m



ADI-6432
64-Channel bidirectional
AES/EBU frontend

The MADI protocol (= Multichannel Audio Digital Interface) audio transmission of up to 64 channels over a single cable. The digital MADI audio format is no mystery, it is based on the common professional AES/EBU standard. Technically it's simple: 32 AES/EBU signals are transmitted within one optical or coaxial cable with the multiplex method.

Optical MADI cables are not only inexpensive, but offer a considerable advantage: While coaxial cables allow distances of up to 100 meters, it is possible to cover distances of up to 2000 meters with optical fibers – an impossible venture with traditional analog multicores. The optical interface is also more interesting for its complete galvanic separation.

Another key advantage of MADI - compared to ADAT, TDIF or AES/EBU - is the possibility to cascade external devices easily. Analog converters, microphone preamps and converters to/from AES/EBU or ADAT can be combined in a single MADI line. A thin, optical double-cable for signals and remote control connects the DAW computer to the equipment rack in the recording room or on stage - in both directions. The rack-devices itself were connected in series with short, centimeter-long MADI cables. For example: with 64 input channels it's easily possible to create a studio or stage with a combination of 24 mic preamps plus further 24 channels of AD converters. And there are still 16 channels available for additional analog or digital inputs.

MADI shows its strengths especially in networked production houses with many recording suites, classical orchestra recordings or broadcast audio setups of large outdoor sports and other live events. But even in small music studios, where the distances from the main DAW to the recording room or the equipment room can easily reach more than 15 m, MADI leaves AES/EBU or ADAT cabling far behind.

But there is more: RME MADI products not only transmit 64 audio channels with a single line, but also embed MIDI and RS232 signals "invisibly" into the data stream. All RME MADI-based devices can be directly remote controlled from the main computer – via the same MADI cable.

RME MADI interfaces

All the tools.



8-Channel 192 kHz MADI <-> AES/EBU converter



64-Channel 192 kHz MADI <-> AES converter (AES-id version available)



8-Channel 192 kHz AES/EBU . ADAT . MADI <-> AD/DA converter



64-Channel 192 kHz ADAT <-> MADI converter (8 x ADAT to MADI and back!)

TotalMix FX

Built-in high-end hardware mixer



The center piece of the MADI PCI Express platform is TotalMix FX, the DSP-based hardware mixer, comparable to high-end digital consoles in its complex functionality. With its UFX counterpart, complete live gigs have already been mixed directly inside the interface, replacing standard digital FOH mixing consoles. Thanks to the higher channel count and the additional routing options the HDSP MADI FX goes even further.

Digital Zero Latency Effects

The HDSPe MADI FX provides the same 192 kHz effects engine as the Fireface UFX and UCX.

To supply the sheer amount of nearly 400 channels with as much as possible high-quality effects, the DSP algorithm's efficiency was further improved and a more powerful FPGA of the latest generation was selected. These performance improvements ensure that the 4096-channel mixer reacts just as smoothly as those on other RME interfaces with significantly fewer channels.

Every input and output channel comes with a luxury feature set, comparable to a full-scale digital console. The effects per channel include 3-band parametric EQ, adjustable Low Cut, Auto Level, Compressor, Expander, MS Processing and phase reversal. The Reverb and Echo effects unit is available for all channels by way of a stereo send and return bus. The HDSPe MADI FX easily surpasses the competition by offering all these effects even at 192 kHz operation.

The complete effects section not only adds a lot of flexibility to the recording chain, but makes latency burdened software dispensable. TotalMix can easily replace any external mixer, e. g. to create different latency-free monitoring mixes with EQ and Reverb for the main studio monitors and the headphone of the vocalist(s) in the recording room.

The FX-DSP uses an automatic overload surveillance. As soon as no effect can be added to the fully loaded DSP, the TotalMix surface will clearly signal this condition. When changing to higher sample rates all effects that exceed the DSP's performance were automatically deactivated - the DSP will never be overloaded. This also prevents any possible damage to loudspeakers due to distortion.

Furthermore, the DSP hardware calculates RMS and Peak levels for all level meters, so there is zero CPU load on the host.

The Hide feature

To keep an overview of 390 channels in live and studio situations, where not all channels will need to be visible at all times, TotalMix FX provides a new form of channel management.

Although the software has featured a sophisticated multi-window technique from the start, which can display several views of the mixer at the same time, channel rows of 196 channels need a special user interface design. For example, a mixdown of channels 1, 2, and 191/192 at the same time would need a constant scrolling back and forth, and these channels would be never visible within one view.

All these and other limitations are eliminated with the new Hide technology. Any channel can be hidden from the surface. Hide setups can be stored and loaded anytime.

An example: on channels 73-85 are all signals of a drum set, on channels 110-114 represent some electronically generated drum sounds. The Hide feature will enable the user to remove all the other channels from the view, and display just the entire drum mix with a simple mouse click. Channels 110-114 seamlessly connect to channel 85 - all in one window - creating a perfect overview with optimal operation.

Hide also allows removal of channels for a connected MIDI remote control. Remotes with few faders can thus control any individual selection of the existing 196 channels - without the need of further switching.

Flexible Routing with professional Matrix view

All 194 inputs and 196 playback channels can be routed and mixed to 196 physical outputs completely freely. This impressive feature culminates in the most powerful router/mixer ever implemented on an audio card, and allows much more than a usage as pure computer I/O unit. Examples are:

- MADI optical patchbay and router
- MADI coaxial/optical or vice versa converter and splitter
- MADI redistributor, patchbay and router

The MADI FX can be turned into a freely programmable and very comfortable MADI router for complete live and studio setups. Compared to hardware routers, the sophisticated TotalMix channel matrix not only offers a superior user interface with unmatched clarity, it also enables lightning-quick changes and the creation of routings and setups with a few mouse clicks.

Monitoring Controller

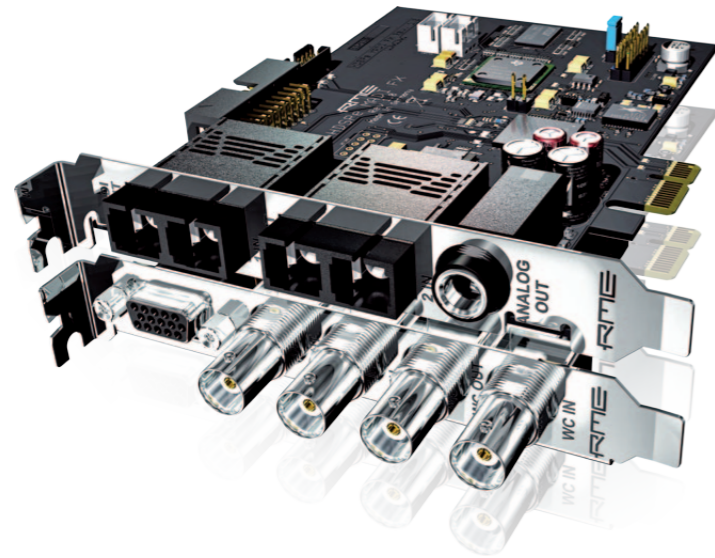
TotalMix provides a complete arsenal of all the functions needed to control the monitoring of modern in-the-box studio or live mixing sessions.

Among these, there is Dim, source selection, monitor switching, integrated talkback, a flexible cue setup, mute and mute FX, mono, speaker B switching and much more.

TotalMix Remote Control

The main functions of TotalMix can be remote controlled via MIDI with any Mackie Control compatible controller. Additionally TotalMix can be also remote controlled by Apple's iPad via Mackie Control emulator apps, standard MIDI commands, and OSC (TouchOSC, Lemur). This realizes a comfortable wireless remote control of TotalMix key parameters.

Additional Features



SteadyClock . RME's unique jitter suppression technology guarantees perfect sound quality throughout, making the device completely independent from the quality of external clock signals. Due to the highly efficient jitter reduction, the DA converter operates independently from the quality of the external clock signal, as if they are working with internal clock all the time. Moreover, a clean signal with minimal jitter is available on all digital outputs.

SteadyClock allows the HDSPe MADI FX to control the sample rate freely on its own. The settings dialog includes a direct choice of the video and audio world's most often used sample rates.

ICC . Intelligent Clock Control not only displays every clock status, but will also retain the last valid input sample rate in case of failure of the external source. Other renowned RME technologies like SyncCheck offer a quick detection of clock problems.

DIGICheck . The card comes with RME's unique software tool box for metering, testing, measuring and analyzing digital audio streams. On Mac OS X provides unique functions and features of the spectral analysis of the data calculated in hardware level right through to sophisticated multi-channel level meter. On Windows, an additional multi-track recorder and the display of playback data from an audio software are also available.

Specifications

1-Lane PCI Express Endpoint device (no PCI Express to PCI Bridge), revision 1.1.

2.5 Gbps line speed

Packet-based full-duplex communication (up to 500 MB/s transfer rate)

All settings changeable in real-time

Automatic and intelligent master/slave clock control

Sync sources: MADI coaxial, MADI optical, AES/EBU, word clock, internal

Varipitch: by input signal or word clock

Sample rates: 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, 176.4 kHz, 192 kHz, variable (Sync/word clock)

Sample rate range: MADI: 32 kHz - 96 kHz, word clock: 27 kHz - 200 kHz

Jitter: < 1 ns, internal and all inputs

Jitter sensitivity: PLL operates even at 100 ns Jitter without problems

Input: MADI optical, MADI coaxial (BNC), 2 x MIDI, word clock (BNC)

Output: MADI optical, MADI coaxial (BNC), 2 x MIDI, word clock (BNC), stereo analog line/phones

Input word clock: BNC, Signal Adaptation Circuit (functional from 1.2 Vpp input signal), switchable termination

Output word clock: BNC, low-impedance driver stage, 4 Vpp into 75 Ohms, short-circuit-proof

MIDI input and output: via one 5-pin DIN jack

Stereo Monitor Output (Phones)

- Signal-to-Noise (DR): 110 dB RMS unweighted, 113 dBA @ 44.1 kHz
- Channel separation: > 100 dB
- Output: 6.3 mm TRS
- Output impedance: 75 Ohm
- Output level at 0 dBFS: +13 dBu