# User's Guide

## RME
### INTELLIGENT AUDIO SOLUTIONS

# ADI-2 *FS*

**The Analog Tool with Digital Spice**

**SyncAlign**

**SyncCheck**

**Intelligent Clock Control**

**SteadyClock *FS***

Hi-Precision 24 Bit / 192 kHz
2-Channel AD / DA-Converter
AES / SPDIF / ADAT Interface
High Power² Headphone Output
Advanced Feature Set

**adat®**
OPTICAL    AES/EBU

192 kHz / 24 Bit Interface

**Contents**

## 1. Introduction

With the ADI-2 FS, RME introduces the successor to the renowned ADI-2. Although the ADI-2 FS has been completely redesigned – for example with the complete analog input stage of the award-winning ADI-2 Pro - it still has the same, easy operation and I/Os as its predecessor. During its development some useful improvements were also added. The step-less adjustment of the rear output level can be activated directly on the front instead of internal jumpers. The new ANA option, which realizes an analog bypass from the analog input to the analog output, gives the ADI-2 FS a cornucopia of applications beyond AD and DA conversion. And naturally the ADI-2 FS comes with RME's latest SteadyClock.

Mute relays on XLR and Phones Out and four times the output power at the headphone output with only 0.1 ohm output impedance make the ADI-2 FS, among other things, an ideal, low-priced supplement to all RME interfaces up to the ADI-2 Pro. The ADI-2 FS provides these devices with two additional analog inputs and outputs and an additional headphone output.

The ADI-2 FS is a high quality, yet highly flexible and universally applicable tool. Advanced circuit technology combined with latest integrated circuits result in a unique and outstanding device, meeting highest quality standards. The ADI-2 FS will excite you even after many years of operation. The ADI-2 FS works as:

- AD/DA converter in professional studio quality
- Powerful headphone amplifier with analog and digital input
- Multi-format converter (AES, SPDIF, ADAT) with monitoring
- SPDIF/ADAT playback system
- Analog impedance converter
- Analog level adaptation
- Analog balanced converter (unbalanced to balanced)
- Analog distribution amp

## 2. Supplied Contents

Please check that your ADI-2 FS package contains each of the following:

- ADI-2 FS
- User's guide
- External switched power supply, lockable connector, DC 12 V 24 W
- Power cord

## 3. Brief Description and Characteristics

The ADI-2 FS is a 2-channel analog to digital and digital to analog converter in a half-rack (9.5") enclosure of 1 U height. Latest 24 bit / 192 kHz converters offer 120 dBA dynamic range. This value is not only printed in the brochure – it is what the unit achieves in real-world operation.

The servo-balanced analog inputs and dedicated balanced and unbalanced outputs are fitted with both XLR and 1/4" TRS/TS jacks. The unit's analog input stage uses a fully balanced and DC-coupled circuit design, for highest phase accuracy at lowest roll-off.

The Hi-Power² headphone output provides reference sound. The digital inputs and outputs are available as SPDIF coaxial (AES/EBU compatible), SPDIF optical and ADAT optical.

To maintain the full dynamic range within the best operating level, RME's ADI-2 FS includes electronic switches, which give control over input and output level via two keys from the front plate, for a perfect adaptation to the levels +4 dBu, +13 dBu and +19 dBu. Two compact level meters provide 6 LEDs each. Multiple brightness stages and peak hold functionality make reading and adjusting input levels easy and convenient.

The ADI-2 FS provides all sample rates between 32 kHz and 192 kHz. The unique Intelligent Clock Control technology (ICC) offers a flexible operation with internal clock and the digital input signals. Furthermore, RME's SteadyClock technology guarantees exceptional performance in all clock modes. Thanks to a highly efficient jitter suppression, the AD- and DA-conversion always operates on highest sonic level, being completely independent from the quality of the incoming clock signal.

## 4. Power Supply

In order to make operating the ADI-2 FS as flexible as possible, the unit has a universal DC input socket, accepting voltages from 6 Volts* up to 15 Volts. An internal switching regulator of the latest technology with high efficiency (> 90%) prevents internal hum noise by operating above audible frequencies. Internally this regulator feeds further high.efficiency switching regulators and super low-noise linear regulators. Therefore the ADI-2 FS achieves its technical specs even with less optimal power supplies. Or in other words: the choice of power supply is not critical.

Still the unit includes a high-quality switching power supply, 12 V / 2 A, which not only accepts any mains voltage between 100 V and 240 V (usable world-wide), but is also fully regulated against voltage fluctuations and suppresses line noise. Additionally it only weights 150 g in spite of its high power of 24 Watts.

The DC input of the ADI-2 FS also allows for the use of a rechargeable lead-battery or LiPo instead of a power supply, for completely independent mobile operation and ground isolation. A matching connection cable (power jack to terminals 6.3 mm) is available from RME. Special power banks in the range of 10,000 mAh and up can be found equipped with a 12 V output. These offer a perfect solution for mobility as well as ground isolated operation, for small money.

* The highly efficient, internal switching power supply actually enables operation of the ADI-2 FS from 6 Volts. When used with batteries or rechargeable batteries, but also with other power supplies (e.g. 9 Volts), there is a very low switch-off threshold and thus high operational reliability. In continuous operation, however, the typical operating voltage should not fall below 9 volts. An overvoltage fuse is activated if the operating voltage exceeds 15 Volts. Since the fuse may be destroyed, input voltages higher than 15 Volts must be avoided.

## 5. First Usage - Quick Start

Connect the TRS-jacks or the XLR connectors with the analog signal source. Change the input sensitivity by pressing ANALOG INPUT - LEVEL until the input level is sufficient to avoid noisy operation. Also try to achieve an optimum input level by adjusting the source itself. Raise the source's output level until the yellow –3 LEDs light up.

The analog line inputs of the ADI-2 FS can be used with signals from +4 dBu up to +19 dBu. The electronic input stage is built in a servo-balanced design which handles monaural and stereo jacks correctly. When used unbalanced it automatically corrects the gain by 6 dB.

The digital output of the ADI-2 FS can be used as SPDIF, AES/EBU and ADAT optical source. The button DIG OUT determines the current format:

* ADAT: The optical TOSLINK output operates in ADAT mode. Included support for S/MUX4 enables sample rates up to 192 kHz. The coaxial output continues to send out SPDIF.
* PRO: The output signal carries the Channel Status Professional. The physical output level at the RCA connector is raised, making the signal compatible to AES/EBU. The same signal is found at the optical output.
* CON: The output signal carries the Channel Status Consumer. The physical output level at the RCA connector is lowered. The same signal is found at the optical output.

On the analog playback side (the DA side), simply choose the desired digital input by pressing DIG IN. The analog output level is set by pressing ANALOG OUTPUT - LEVEL.

The output signal of the DA-converter is also available on the front, in the same quality as on the rear. The level can be changed in a stepless way using the VOL pot. This output is both powerful and has a very low output impedance to connect and enjoy even insensitive headphones.

The button ANALOG INPUT - LEVEL offers a fourth state (DIG). This state activates a digital pass-through mode with analog monitoring (DA-converter), with the AD-converter not in use. The level meters show the audio level of the digital input signal.

The button ANALOG OUTPUT - LEVEL offers a fourth state (ANA). This state activates an analog loop-through mode with digital monitoring (AD-converter), with the DA-converter not in use.

The button ANALOG OUTPUT - LEVEL also offers the option of switching the VOL knob into the rear output signal path, for variable adjustment of the rear output level. This is done by pressing and holding the button for 2 seconds. The active function is visualized by dimmed OUTPUT LEVEL LEDs.

The ADI-2 FS stores all current settings and automatically activates them when the device is turned on.

Transferring digital data into a computer is best done using RME's digital audio interfaces. These interfaces for PCI, PCI Express, USB and Thunderbolt come with drivers for all popular operating systems, and are highly respected worldwide.

# 6. Inputs and Outputs

## 6.1 Line In XLR / TRS

The ADI-2 FS has two analog line inputs that can operate with levels up to +19 dBu. The electronic input stage uses a servo balanced design which handles unbalanced (TS jacks) and balanced signals (TRS / XLR) correctly, automatically adjusting the level reference.

> **!** *When using unbalanced cables with the **XLR inputs**, pin 3 of the XLR jack should be connected to ground. Otherwise noise may occur, caused by the unconnected negative input of the balanced input.*

To use the inputs as unbalanced RCA: simply insert a standard TS male to RCA female adapter. Now any RCA / Cinch cable can be easily used with the ADI-2 FS.

One of the main issues when working with an AD-converter is to maintain the full dynamic range within the best operating level. Therefore the ADI-2 Pro internally uses hi-quality electronic switches, which allow for a perfect adaptation to the four most often used levels +4 dBu, +13 dBu and +19 dBu.

**Level Meter**

The 2-channel level meter with 6 LEDs each offers a useful display and check of input level and overloads. The LEDs make use of different brightness for different levels, so levels in between are easy to read out. This technology allows the ADI-2 FS to visualize a range of –80 dBFS up to –3 dBFS using only 5 LEDs.

The red OVR LED lights up dimmed at -2 dBFS, more bright at –1 dBFS. Reaching 0 dBFS it is fully lit. A peak hold function of one second ensures better visualization whenever the highest level is reached.

The table shows the level definition of the Level Meter, based on 0 dBFS. The actual input level in dBu can be calculated by adding the offset caused by the current choice of Input Level. Set to +19 dBu add 19 dB, at +4 dBu a value of 4 dB has to be added.

| LED | Dim | Medium | Bright |
|-----|-----|--------|--------|
| OVR | -2 | -1 | 0 |
| -3 dB | -5 | -4 | -3 |
| -6 dB | -8 | x | -6 |
| -12 dB | -24 | -18 | -12 |
| -30 dB | -45 | x | -30 |
| -60 dB | -80 | x | -60 |

## 6.2 Line Out XLR

The ADI-2 FS has two balanced, short circuit protected, low impedance line outputs, available as XLR jacks on the rear of the unit.

> **!** *The **XLR line outputs** do not operate servo balanced! When connecting unbalanced equipment, make sure pin 3 of the XLR output is not connected. A connection to ground might cause a decreased THD (higher distortion) and increased power consumption!*

To maintain an optimum level for devices connected to the analog outputs and to maximize the signal to noise ratio, the ADI-2 FS internally uses hi-quality electronic switches, which allow for a hardware-based adaptation to the maximum levels +4 dBu, +13 dBu and +19 dBu. For a variable control via the VOL pot see chapter 6.4.

## 6.3 Line Out TRS

The ADI-2 FS has two unbalanced analog outputs that provide levels up to +19 dBu. The short circuit protected, low impedance line outputs are available as 1/4" TRS jacks on the back of the unit. Contact R (ring) is connected to ground by a 100 Ohm resistor, which also allows the use of virtual balanced connections.

Both TRS outputs deliver the same signals and output levels as the XLR outputs.

## 6.4 Variable Output Level

The ADI-2 FS includes an option to control the output level of the rear Line outputs via the VOL pot. In this mode the current output level setting (+4/+13/+19) stays active, optimizing the pot adjustment path and enabling an offset between Phones and Line outputs.

This mode is activated and deactivated by pushing the ANALOG OUPUT – LEVEL button for 2 seconds. The LED of the currently active Output Level will light up dimmed, and in full brightness again after deactivation.
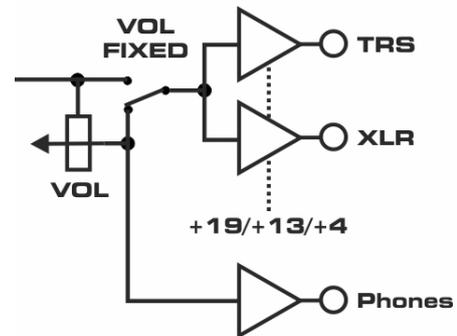
## 6.5 Phones

The PHONES output on the front offers the same outstanding technical specifications as the rear outputs (e.g. 120 dBA SNR), thus can be used as high quality Line output as well. Chapter 13, Connector Pinouts, shows the required adapter cable 1 x TRS to 2 x TS, often referred to as *insert cable*.

The level of the headphone output is changed in a stepless way using the VOL pot. The special High-Power² output design is not only of a very low impedance type (0.1 Ohms), but also offers high headroom at up to +19 dBu (6.9 Vrms) maximum output level.

For low impedance headphones, the Phones output provides twice as much power as previous High Power headphone outputs. For example, for 32 Ohms load 0.7 Watts are available per channel. The ADI-2 FS uses the driver technology of the ADI-2 Pro, offering very low distortion (THD) until it reaches clipping level.

## 6.6 Digital Inputs

The ADI-2 FS has a coaxial and an optical digital input.

The button DIG IN selects the active input.

The digital input format is detected automatically. Be it AES, SPDIF or ADAT, further settings at the ADI-2 FS are not required. In case of ADAT optical only channels 1 and 2 are processed, channels 3 to 8 are ignored.

To receive signals in AES/EBU format, an adapter cable is required. Pins 2 and 3 of a female XLR plug are connected individually to the two pins of a phono plug. The cable shielding is only connected to pin 1 of the XLR - not to the phono plug.
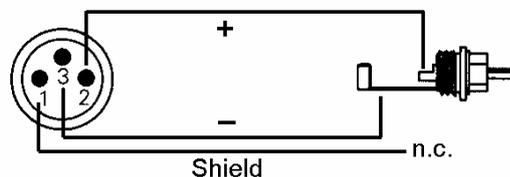
The ground-free design with transformer in the coaxial input offers full compatibility to AES/EBU along with perfect hum rejection.

The ADAT optical input of the ADI-2 FS is fully compatible with all ADAT optical outputs. RME's unsurpassed Bitclock PLL prevents clicks and drop outs even in extreme varipitch operation, and guarantees a fast and low jitter lock to the digital input signal. A usual TOSLINK cable is sufficient for connection.

**SPDIF Double/Quad Speed**
Both the coaxial and optical input support all sample rates between 32 and 192 kHz directly. They operate in the so called Single Wire mode.

**ADAT Double/Quad Speed**
At sample rates above 48 kHz (Double/Quad Speed) ADAT uses *Sample Multiplexing* (S/MUX) to be able to operate at up to 192 kHz. The data of the channels 1 and 2 will be transmitted using channels 1/2 and 3/4 (S/MUX), or channels 1 to 8 (S/MUX4). The ADI-2 FS can receive and recombine data into 2 channels from all S/MUX compatible devices at up to 192 kHz, naturally including all RME devices with ADAT I/Os.

**Emphasis**
The ADI-2 FS DA-converter supports Emphasis. This control information, only found in SPDIF/AES signals, causes the converter to reduce treble. (Note: this technology was used in the early days of digital audio, and is no longer used since years).

> *The button ANALOG INPUT - LEVEL offer s a fourth state (DIG). In this mode the ADI-2 FS operates as Insert DA-converter. The level meter show the audio level of the digital input signal, which is passed-through internally to the digital outputs.*

## 6.7 Digital Outputs

The ADI-2 has a coaxial and an optical digital output. The button DIG OUT determines the current format:

* ADAT: The optical TOSLINK output operates in ADAT mode. Included support for S/MUX4 enables sample rates up to 192 kHz. The coaxial output continues to send out SPDIF.
* PRO: The output signal carries the Channel Status Professional. The physical output level at the RCA connector is raised, making the signal compatible to AES/EBU. The same signal is found at the optical output.
* CON: The output signal carries the Channel Status Consumer. The physical output level at the RCA connector is lowered. The same signal is found at the optical output.

In SPDIF/AES mode, identical signals are available at both the optical and the coaxial output. Therefore up to two devices can be connected, sending the same data to two different devices.

To send signals in AES/EBU format, an adapter cable is required. Pins 2 and 3 of a female XLR plug are connected individually to the two pins of a phono plug. The cable shielding is only connected to pin 1 of the XLR - not to the phono plug.
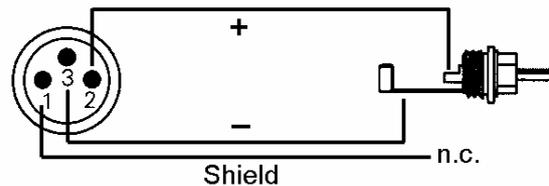
The ADAT optical output of the ADI-2 FS is fully compatible to all ADAT optical inputs. A usual TOSLINK cable is sufficient for connection.

### SPDIF Double/Quad Speed
Both the coaxial and optical output support all sample rates between 32 and 192 kHz directly. They operate in the so called Single Wire mode.

### ADAT Double/Quad Speed
At sample rates above 48 kHz (Double Speed) ADAT uses *Sample Multiplexing* (S/MUX) to be able to operate at up to 192 kHz. The data of the channels 1 and 2 will be transmitted using channels 1/2 and 3/4 (S/MUX) or 1 to 8 (S/MUX4). All devices compatible to S/MUX can receive and recombine the ADI-2 FS data into two channels of up to 192 kHz, naturally including all RME devices with ADAT I/Os.

# 7. Clock Section

The ADI-2 FS clock section is easy to use and easy to understand. It enables a flexible operation of the AD- and DA-converter with internal clock or the digital input signals. A clear display of the lock and sync state further improves the clock section's usability. Note: The chosen clock state is valid for both AD- and DA-conversion simultaneously.

The key DIG IN determines both the digital input being used for the DA-converter (coaxial or optical) and the external clock source, in case CLOCK – DIG IN has been selected. The lock state of the ADI-2 FS is indicated by a blinking (error) or constantly lit (Ok) DIG IN LED (COAX, OPT).

In order to avoid a disturbing continuous flashing of the selected input in Master mode (internal clock) when the digital input signal is missing, the input selection is visualized by a constant but dimmed LED. If an input signal is present but not synchronous, this is indicated by the CLOCK LED flashing.

Using external clock, the ADI-2 FS shows the range of the input signal's sample rate via the CLOCK LEDs. An external SPDIF or AES signal in Double or Quad Speed will cause the DS or QS LED to light up. With ADAT the input sample rate is always Single Speed. The real sample rate (Double or Quad Speed) therefore has to be set up manually by the user (push the CLOCK button so that either DS or QS light up).

| QS | INP |
|----|-----|
| DS | 48 |
| 32 → 44.1 | |

| QS | INP |
|----|-----|
| DS | 96 |
| 64 → 88.1 | |

| QS | INP |
|----|-----|
| DS | 192 |
| 128 → 176.4 | |

| QS | INP |
|----|-----|
| DS | 48 |
| 32 | 44.1 |

**Key CLOCK**
This key sets the sample rate of the ADI-2 FS, the unit will then be in clock mode master. However, with DIG IN selected (INP in the picture to the right), the sample rate of the present digital input signal will be used as clock reference. The device then turns into clock mode slave.

Each push on the key CLOCK raises the sample frequency. When reaching the setting 48 kHz the DS LED lights up. The chosen frequency is now multiplied with a factor of 2. When reaching 48 kHz (now 96 kHz) again, the QS LED lights up. The chosen frequency is now multiplied with a factor of 4. When reaching 48 kHz (now 192 kHz) again, the DIG IN LED lights up, then DIG IN DS, then DIG IN QS. Next the sample rate is back to 32 kHz and the scheme starts from the beginning.
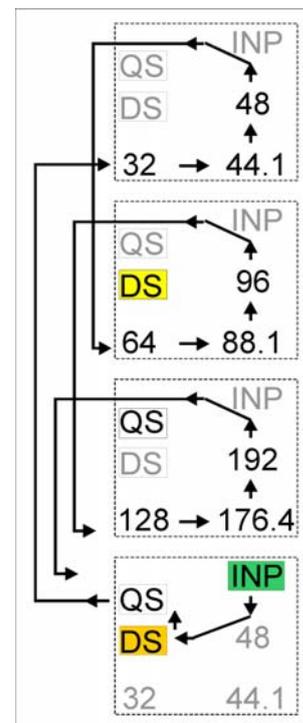
In case of SPDIF the incoming signal defines the status DS and QS. A manual selection is only necessary with ADAT. If an ADAT input signal is present, CLOCK also runs through DIG IN DS and DIG IN QS after DIG IN (INP).

**Clock mode D/A Internal**
Clocking the DA-converter from the internal clock requires a synchronous operation of the attached device. To guarantee this the external device connected to the ADI-2 FS has to synchronize itself to the ADI's clock via its SPDIF or ADAT output.

The ADI-2 FS has to be master, all attached devices slave. To prevent clicks caused by imperfect or even no synchronisation, a special method called *SyncCheck* compares the synchronicity of the incoming data with the internal clock of the ADI-2 FS. The current state is indicated by a blinking (error) or constantly lit (Ok) CLOCK LED.

! *Only one device can be master in a digital system! When the ADI-2 FS operates with internal clock, all other devices have to be slave.*

## 8. Digital loop-through (DIG)

The ANALOG INPUT - LEVEL button offers a fourth position, *DIG*. In this state the ADI-2 FS works in digital loop-through mode with analog DA monitoring. The AD converter is not in use. The level meters show the audio level of the digital input signal.

Since the digital input signal appears simultaneously on both digital outputs, DIG enables the ADI-2 FS to be used as format converter and distributor. For example, an ADAT input signal can be simultaneously sent out as SPDIF coaxial and SPDIF optical. An SPDIF signal can be converted converted into ADAT, but at the same time sent out as SPDIF again. With this type of digital inserting, the signal is completely recreated by the ADI-2 FS in a bit-accurate manner, and freed from jitter by its SteadyClock FS. A use as a signal refresher for cable extension is one of its many possible applications.

In all these cases, the DA converter remains active, allowing the digital signal to be played back and monitored locally.

## 9. Analog loop-through (ANA)

The ANALOG OUTPUT - LEVEL button provides a fourth position, *ANA*. In this state the ADI-2 FS operates in analog loop-through mode with digital monitoring (AD-converter). The DA-converter is not in use. The block diagram in Chapter 13 shows how mode ANA works. The analog input signal is not passed directly between the input jack and the output jack, but travels through the entire analog input and output stage. Only the AD- and DA-conversion is bypassed.

The analog input and output stages of the ADI-2 FS (in fact of all RME devices) have significantly better technical data than the AD- and DA-converters used. With barely measurable distortion, very low noise and extremely wide frequency response, passing through these stages can by no means be seen as a degradation of the analog signal. Instead, the advantages of active loop-through far outweigh the insignificant drawbacks, as the servo-balanced input stage with level adjustment, the multiple balanced and unbalanced output stages with level adjustment, and the headphone output with its own volume adjustment are all active now, turning the ADI-2 FS into various, useful tools:

• Analog impedance converter
• Analog level adaptation
• Analog balancer (unbalanced to balanced and vice versa)
• Analog distribution amplifier

The new option ANA which implements an analog bypass from the analog input to the analog output, gives the ADI-2 FS a cornucopia of possible uses. For example, if ANALOG INPUT - LEVEL is set to +4 dBu and ANALOG OUTPUT - LEVEL is set to +19 dBu, the ADI-2 FS amplifies the analog input signal by 15 dB. At the same time, it sends it out electronically separated to three different outputs.

Since in this mode the analog output is no longer connected to the DAC, the entire analog headroom is available, with a maximum output level of +22 dBu (balanced). Even the input can now be fed undistorted with up to +22 dBu. ANALOG INPUT set to +19 dBu and ANALOG OUTPUT set to +4 dBu attenuate such a signal by 15 dB.

Additionally the AD-converter is also active and usable. As long as one does not exceed +19 dBu input level, the analog signal can also be picked up digitally and undistorted.

Activation: Press the key ANALOG OUTPUT - LEVEL several times until no LED lights up. After one second, the ANA mode is activated and the LED lights up. To deactivate, select the ANA mode again and wait one second.

# 10. Technical Specifications

## 10.1 Analog

**AD**
- Signal to Noise ratio (SNR) @ +19 dBu: 117 dB RMS unweighted, 121 dBA
- Frequency response @ 44.1 kHz, -0.1 dB: 5 Hz – 20.5 kHz
- Frequency response @ 96 kHz, -0.5 dB: 3 Hz – 45.5 kHz
- Frequency response @ 192 kHz, -1 dB: 2 Hz – 92.7 kHz
- THD @ -1 dBFS: -114 dB, 0.00015 %
- THD+N @ -1 dBFS: -112 dB, 0.00025 %
- Channel separation: > 110 dB
- Max Input Level AD: +19 dBu
- Input: XLR or 1/4" TRS, electronically balanced
- Input impedance balanced: 36 kOhm, unbalanced: 18 kOhm
- Input sensitivity switchable: +4 dBu, +13 dBu, +19 dBu @ 0 dBFS

**DA**
- Signal to Noise ratio (SNR): 117 dB RMS unweighted, 120 dBA
- Frequency response @ 44.1 kHz, -0.1 dB: 10 Hz – 20.2 kHz
- Frequency response @ 96 kHz, -0.5 dB: 5 Hz – 44.9 kHz
- Frequency response @ 192 kHz, -1 dB: 3 Hz – 88 kHz
- THD @ -1 dBFS: -112 dB, 0.00025 %
- THD+N @ -1 dBFS: -110 dB, 0.00032 %
- THD @ -3 dBFS: -116 dB, 0.00016 %
- Channel separation: > 110 dB
- Max Output Level DA: +19 dBu
- Output: XLR balanced, 1/4" TRS unbalanced/balanced
- Output impedance: XLR balanced 150 Ohm, TS unbalanced 100 Ohm
- Output level switchable: +4 dBu, +13 dBu, +19 dBu @ 0 dBFS

**DA - Phones**
- as DA, except:
- Output: 6.3 mm stereo TRS, unbalanced
- Output impedance: 0.1 Ohm
- Output level at 0 dBFS, load 100 Ohm or up: +19 dBu (6.9 Vrms)
- Max power 32 Ohm load: 0.7 W per channel (0.01% THD, +16 dBu, 4.9 Vrms)
- THD 32 Ohm load @ +15 dBu: -110 dB, 0.0003 %

**Mode ANA (Analog In to Analog Out)**
- Signal to Noise ratio (SNR) @ +19 dBu: 123 dB RMS unweighted, 126 dBA
- Signal to Noise ratio (SNR) @ +13 dBu: 119 dB RMS unweighted, 122 dBA
- Signal to Noise ratio (SNR) @ +4 dBu: 112 dB RMS unweighted, 115 dBA
- Frequency response -0.5 dB: 1 Hz – 120 kHz
- THD+N @ +19 dBu: -116 dB, 0.00016%
- Channel separation: > 120 dB
- Maximum input / output level: +22 dBu

## 10.2 Digital

- Clocks: Internal, ADAT In, SPDIF In
- Jitter suppression of external clocks: > 50 dB (2.4 kHz)
- Effective clock jitter influence on AD and DA conversion: near zero
- PLL ensures zero dropout, even at more than 100 ns jitter
- Digital Bitclock PLL for trouble-free varispeed ADAT operation
- Supported sample rates with external clocking (SPDIF): 28 kHz up to 200 kHz
- Supported sample rates with external clocking (ADAT): 40 kHz up to 49 kHz
- Internal clocks: 32 kHz, 44.1 kHz, 48 kHz, 64 kHz, 88.2 kHz, 96 kHz, 176,8 kHz, 192 kHz

## 10.3 Digital I/O

- Digital input coaxial ground-free transformer coupled
- Formats: optical (TOSLINK), RCA (SPDIF, AES/EBU compatible)
- Format Consumer SPDIF according to IEC 60958
- Format Professional according to AES3-1992 Amendment 4

**SPDIF coaxial**
- RCA, according to IEC 60958
- High-sensitivity input stage RCA: < 0.2 Vpp input level
- Output voltage RCA Consumer 0.7 V, Professional 1.4 V
- Single Wire mode, sample rate 28 kHz up to 200 kHz

**SPDIF optical**
- 1 x optical, according to IEC 60958
- Sample rate 28 kHz up to 200 kHz

**ADAT**
- TOSLINK
- Standard: 8 channels 24 bit, up to 48 kHz
- Double Speed (S/MUX): 4 channels 24 bit 96 kHz
- Quad Speed (S/MUX4) : 2 channels 24 bit 192 kHz

## 10.4 General

- Included power supply: external switching PSU, 100 - 240 V AC, 2 A, 24 Watts
- Idle power consumption: 5,2 W (430 mA @ 12V)
- Max. power consumption: 10 Watts (830 mA @ 12 V)
- Dimensions (WxHxD): 215 x 44 x 130 mm (8.5" x 1.73" x 5.1")
- Weight: 900 g ( 2.0 lbs)
- Temperature range: +5° up to +50° Celsius (41° F up to 122°F)
- Relative humidity: < 75%, non condensing

# 11. Technical Background

## 11.1 Noise level in DS / QS Mode

The outstanding signal to noise ratio of the ADI-2 FS can be verified even without expensive test equipment, by using the record level meters of various software. When activating the DS and QS mode, the displayed noise level will rise from -117 dB to -110 dB at 96 kHz, and –89 dB at 192 kHz. This is not a failure. This kind of measurement measures the noise of the whole frequency range, at 96 kHz from 0 Hz to 48 kHz (RMS unweighted), at 192 kHz even from 0 Hz to 96 kHz.

When limiting the measured area to 22 kHz (audio bandpass, weighted) the value would be -117 dB again. This can be verified even with RME's DIGICheck. Although a dBA weighted value does not include such a strong bandwidth limitation as from an audio bandpass, the displayed value of –108 dB is nearly identical to the one at 48 kHz.



The reason for this behaviour is the noise shaping technology of the analog to digital converters. They move all noise and distortion to the in-audible higher frequency range, above 24 kHz. That's how they achieve their outstanding performance and sonic clarity. Therefore the noise is slightly increased in the ultrasound area. High-frequent noise has a high energy. Add the doubled (quadrupled) bandwidth, and a wideband measurement will show a significant drop in SNR, while the human ear will notice absolutely no change in the audible noise floor.

## 11.2 SteadyClock FS

RME's SteadyClock technology guarantees an excellent performance in all clock modes. Its highly efficient jitter suppression refreshes and cleans up any clock signal.

Usually a clock section consists of an analog PLL for external synchronization and several quartz oscillators for internal synchronization. SteadyClock requires one quartz only, using a frequency not equalling digital audio. Modern circuit designs like hi-speed digital synthesizer, digital PLL, 1 GHz sample rate and analog filtering allow RME to realize a completely newly developed clock technology, right within the FPGA at lowest costs. The clock's performance exceeds even professional expectations. Despite its remarkable features, SteadyClock reacts quite fast compared to other techniques. It locks in fractions of a second to the input signal, follows even extreme varipitch changes with phase accuracy, and locks directly within a range of 28 kHz up to 200 kHz.

The further improved SteadyClock FS technology offers even lower self-jitter, and uses a low phase noise quartz with jitter in the range of femtoseconds. Thanks to the highly efficient jitter suppression, the AD- and DA-conversion always operates on highest sonic level, being completely independent from the quality of the incoming clock signal.

SteadyClock has been originally developed to gain a stable and clean clock from the heavily jittery MADI data signal (MADI includes around 80 ns of jitter). Using the input sources of the ADI-2 FS, SPDIF, ADAT or AES, you'll most probably never experience such high jitter values. But SteadyClock would handle these easily.

# 12. Controls and Connectors

**Front**



**The front** of the ADI-2 FS has 5 buttons, a volume potentiometer, a headphone output via stereo TRS jack and 31 LEDs.

**Rear**
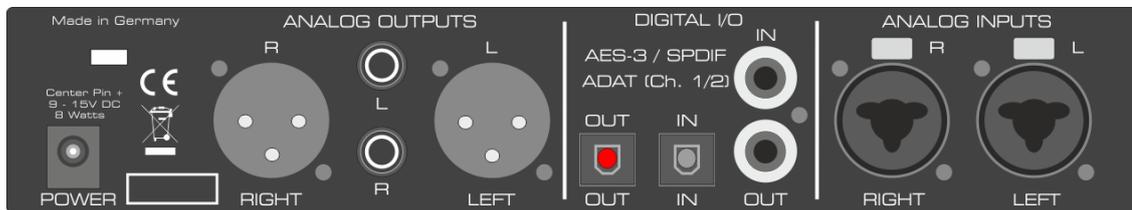


**The rear panel** of the ADI-2 FS features 2 servo-balanced analog inputs via XLR/jack combo jacks, 2 TS jacks as unbalanced outputs, 2 XLR jacks as balanced outputs, SPDIF I/O via TOSLINK optical and RCA coaxial, and a lockable power supply jack.

**Optical I/O** (TOSLINK): The device automatically detects whether a signal is present in SPDIF or ADAT format. The optical output can operate in SPDIF or ADAT mode after switching via DIG OUT. Please note that in ADAT format only channels 1/2 are accessible. However, SMUX and SMUX4 (up to 192 kHz) are supported.

**Socket for power supply**. This jack supports lockable plugs, such as those of the supplied RME power supply. After inserting the plug, carefully rotate it 90° for locking.

## 13. Connector Pinouts

### XLR jacks of analog input / output

The XLR connectors are wired according to international standards:

1 = GND (shield)
2 = + (hot)
3 = - (cold)

### TRS jacks of analog input / output

The stereo ¼" TRS jacks are wired according to international standards:

Tip = + (hot)
Ring = – (cold)
Sleeve = GND

The servo-balanced input circuitry allows to use monaural TS jacks (unbalanced) with no loss in level. This is the same as when using a TRS-jack with ring connected to ground.

The jack sockets of the two outputs are unbalanced, but realized as TRS. Since the contact R is connected to ground with 100 Ohm, virtual balanced connections to these sockets are also possible.

### TRS Phones jack

The analog monitor output on the front is accessible through a stereo ¼" TRS jack. This allows a direct connection of headphones. In case the output should operate as Line output, an adapter TRS plug to RCA phono plugs, or TRS plug to TS plugs is required.
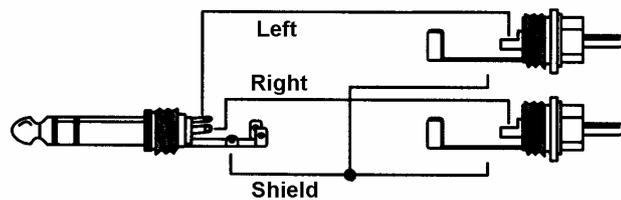
The pin assignment follows international standards. The left channel is connected to the tip, the right channel to the ring of the TRS jack/plug.
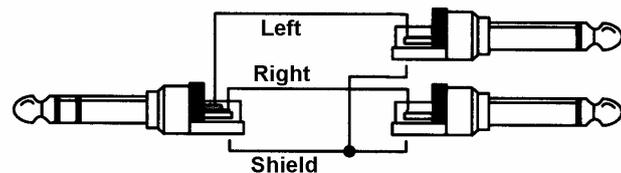
### Cinch / RCA

By a simple adapter mono 6.35 mm to RCA (also called Phono and Cinch). The adapters are plugged into the rear inputs and outputs - done. Now the existing RCA cables can be used with the ADI-2 FS.

Cables with mono 6.35 mm on one side and RCA on the other also exist, and work perfectly.

# 14. Block diagram
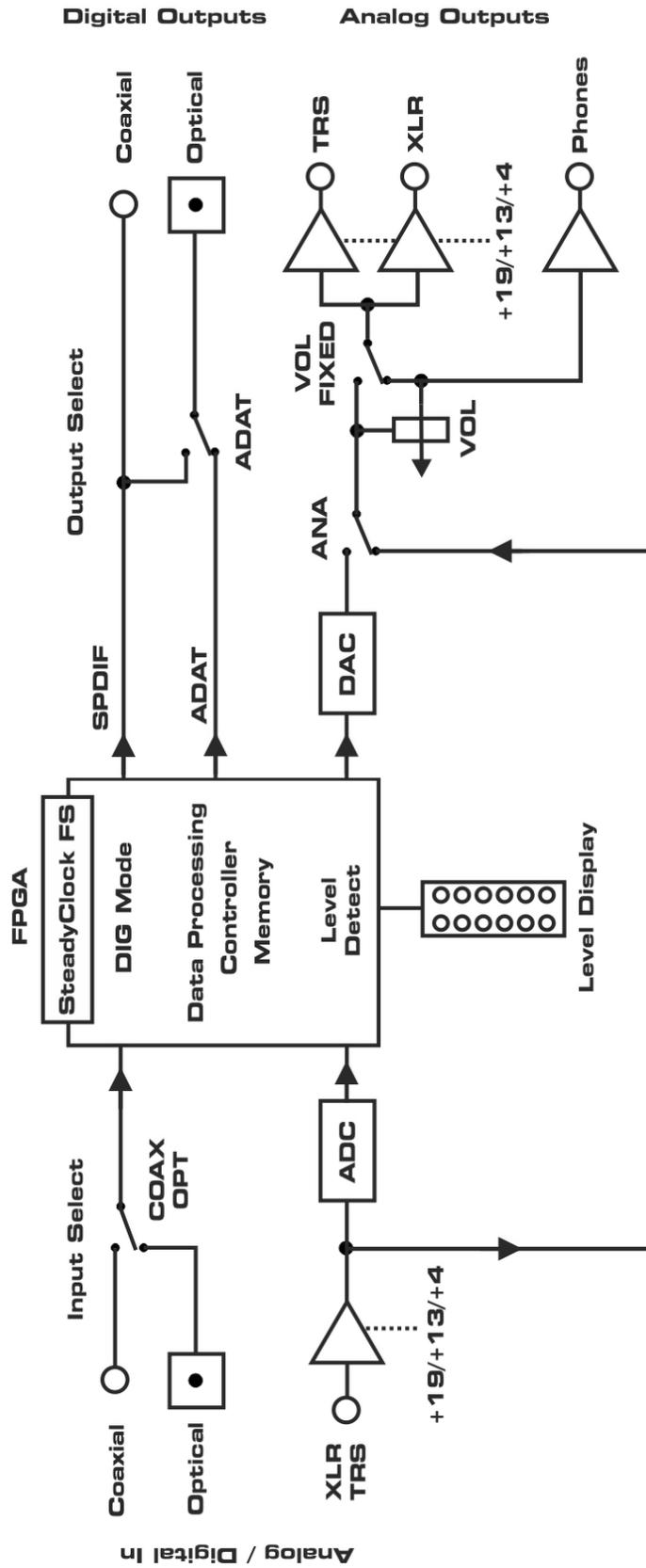
## 15. Accessories

There are several items available for the ADI-2 FS:

**Part Number    Description**

NT-RME-2          Power supply for ADI-2 Pro. Robust and light-weight switching power supply, 100 V-240 V AC, 12 V 2 A DC. Lockable DC connector.

RM-19-X          19" Rack Adapter, mounted on the sides of the ADI-2 Pro

Unirack          Universal rackmount adapter (tub for two 9.5" devices)

AUTOK            Cable for connection to car lighter socket

AKKUK            Cable for battery operation (6.3 mm flat connectors)


Optical cables for SPDIF and ADAT operation:

OK0100PRO    Optical cable, TOSLINK, 1 m (3.3 ft)
OK0200PRO    Optical cable, TOSLINK, 2 m (6.6 ft)
OK0300PRO    Optical cable, TOSLINK, 3 m (9.9 ft)
OK0500PRO    Optical cable, TOSLINK, 5 m (16.4 ft)
OK1000PRO    Optical cable, TOSLINK, 10 m (33 ft)


## 16. Warranty

Each individual ADI-2 FS undergoes comprehensive quality control and a complete test before shipping. The usage of high grade components should guarantee a long and trouble-free operation of the unit.

If you suspect that your product is faulty, please contact your local retailer. Do not open the device by yourself as it may get damaged. It has been sealed with tamper-evident material, and your warranty is void if those seals have been damaged.

Audio AG grants a limited manufacturer warranty of 6 months from the day of invoice showing the date of sale. The length of the warranty period is different per country. Please contact your local distributor for extended warranty information and service. Note that each country may have regional specific warranty implications.

In any case warranty does not cover damage caused by improper installation or maltreatment - replacement or repair in such cases can only be carried out at the owner's expense.

No warranty service is provided when the product is not returned to the local distributor in the region where the product had been originally shipped.

Audio AG does not accept claims for damages of any kind, especially consequential damage. Liability is limited to the value of the ADI-2 FS. The general terms of business drawn up by Audio AG apply at all times.

## 17. Appendix

RME news and further information on our products can be found on our website:

http://www.rme-audio.com

Distributor:
Audio AG, Am Pfanderling 60, D-85778 Haimhausen, Tel.: (49) 08133 / 918170

Manufacturer:
IMM electronics GmbH, Leipziger Str. 32, D-09648 Mittweida

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## 18. Declaration of Conformity

**CE**
This device has been tested and found to comply with the limits of the European Council Directive on the approximation of the laws of the member states relating to electromagnetic compatibility according to RL2014/30/EU, and European Low Voltage Directive RL2014/35/EU.

**FCC**
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

> Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Responsible Party in USA:
Synthax United States, 6600 NW 16th Street, Suite 10, Ft Lauderdale, FL 33313
T.:754.206.4220

Trade Name: RME, Model Number: ADI-2 FS

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

- Consult the dealer or an experienced radio/TV technician for help.

**RoHS**
This product has been soldered lead-free and fulfils the requirements of the RoHS directive RL2011/65/EU.

## Note on Disposal

According to the guide line RL2012/19EU (WEEE – Directive on Waste Electrical and Electronic Equipment), valid for all european countries, this product has to be recycled at the end of its lifetime.

In case a disposal of electronic waste is not possible, the recycling can also be done by IMM eletronics GmbH.

For this the device has to be sent **free to the door** to:

> IMM electronics GmbH
> Leipziger Straße 32
> D-09648 Mittweida
> Germany

Shipments not prepaid will be rejected and returned on the original sender's costs.