Audial

A-LINK Specifications

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Audial D/A converters released in 2021 employ serial PCM interface as external digital audio connection, using the HDMI connector. The interface can carry either I2S or simultaneous data protocol, both originally defined by Philips.

This document specifies electrical properties for this connection, from now on referred to as A-link. Other manufacturers are free and welcome to adopt it.

CONNECTOR PINOUT

A-link uses a standard HDMI (A) connector, with the following pinout. Connections shown in bold are required for stereo operation, while the others either add more features, or increase the functionality to multichannel operation, so it can carry up to eight channels by I2S, or up to four by simultaneous data protocol.

Pin	125	Philips sim. data
1	DATA	DATA L
2	GND	GND
3	DATA N or DATA 3	DATA LN or DATA 3
4	ВСК	ВСК
5	GND	GND
6	N/C	N/C
7	ws	LE
8	GND	GND
9	N/C	N/C
10	DATA 2	DATA R
11	GND	GND
12	DATA 4	DATA RN or DATA 4
13	N/C	N/C
14	МСК	N/C
15	N/C	N/C
16	N/C	N/C
17	GND	GND
18	N/C	N/C
19	MCK-R	MCK-R
Shield	GND	GND

The shown pinout applies to the receiving device. At the source, pins 6 and 9, and pins 3 and 12 if unused, can be grounded.

DATA channels may be provided or omitted, to fit the particular unit features.

Generally, two-channel connections should carry the DATA at pin 1 (I2S), or pins 1 and 10 (simultaneous data). For instance, although Audial S5 PCM output is the 3rd and 4th channel from its USB input, this data is carried by pins 1 and 10, and not pins 3 and 12. This is because this output is meant for use with (another) stereo, and not with a multichannel D/A converter.

Optionally, this link can include a master clock signal. One path is reserved for the master clock sent from the source to the DAC (MCK), often required for sigma/delta DACs, and the other is a "backward" path, from the DAC to the source (MCK-R), so the DAC can act as a master device.

These master clock signals and their frequencies, especially MCK-R, are application-specific, and if they are included, it is recommended to make them on-off switchable.

Please also note that the initial specifications for this link specified the ground at pin 19, and consequently this pin at S5 and AYA 5 is grounded.

ELECTRICAL SPECIFICATIONS

The interface operates with, for most devices native, TTL / CMOS voltages.

The receiving device is **3.3 V nominal**, up to 5 V tolerant. The low-level maximum voltage is 1V, and the high-level minimum voltage is 2.3 V. The input is not terminated and acts as a high impedance point.

The source output high-level is 3 V (typically). In the S5 and AYA 5, the output includes a 100 Ohm series resistor at each signal, which protects it from short.

This also matches the proposed impedance of the HDMI cable, however the impedance matching between the source, the interface, and the receiver is not critical, and hence it is not deemed as necessary at this time.

The HDMI cable used here should be as short as possible, preferably not longer than 50 cm, with the lowest possible ground conductors resistance, to minimize ground bounce. Capacitance should be also as low as possible, preferably below 50 pF from pins 1, (3,) 4, 7, and 10 (and 12) to the ground. The capacitance above 150 pF may cut into the required bandwidth.

These capacitances are specified to ensure reliable operation up to 384 kHz for Philips simultaneous data protocol (32-bit frame), and up to 192 kHz for I2S (64-bit frame).

In addition, if the master clock, usually equal to 128xFs or 256xFs, is sent by this connection, for the MCK and MCK-R pins (14 and 19) a capacitance below 50 pF is not only preferred but also necessary.

If higher bandwidth is required, it is recommended to set the source output impedance lower.

For connections using master clock signals, a cable employing the fifth internal shielded pair for pins 14 and 19 (HDMI Ethernet channel) is highly recommended.

GROUNDING

In the S5 DAC, all the ground pins, at both sides of this connection, are connected directly to their respective stages ground planes.

OTHER SERIAL PCM PROTOCOLS

Even though Audial specifies this connection to carry Philips 12S or simultaneous data protocol, the proposed scheme can also work for other serial audio PCM protocols, such as right justified or left justified, or even more specific protocols such as signed magnitude, whether time-multiplexed or not, as it practically provides and specifies all the necessary lines for those other protocols too.

It is assumed that the source device and the DAC must always use the same protocol.

DSD

This interface can adapt for DSD connections relatively straightforwardly, still taking into account required signals and frequencies.

Detailed specifications for DSD may be added in another revision of this interface.

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