HD-AUD-IO
HDMI 2.0 Audio Inserter & Extractor

Table of Contents

1.0 Introduction

The Hall Research HD-AUD-IO is an all-in-one HDMI audio manager capable of extracting audio from (de-embedding) and inserting audio into (embedding) an HDMI video signal. The product also provides EDID management features.

The product provides one HDMI input with a corresponding HDMI output. The HDMI input audio signal simultaneously extracts to both 2-channel L/R analog and Digital SPDIF (TOSLINK).

The product provides two audio inputs (analog and digital). Users can select which audio to embed in the HDMI output. It can be the same as the original HDMI audio (pass-thru), SPDIF digital, or 3.5mm L/R analog.

Advanced EDID management allows users to control the video portion as well as the audio part of the EDID. The EDID presented to the video source connected to the HDMI input can pass from the downstream device or emulate an EDID from internal memory. The device can also "Learn" the EDID connected to its HDMI output.

The product has a video bandwidth of 18 Gbps and supports resolutions up to 4K @ 60 Hz 4:4:4 with HDR. It supports HDCP 2.2 as well as HDCP 1.4 if needed.

The device has the ability to generate and output a blank HDMI signal with audio embedded even if there is no HDMI input; often referred to as "HDMI Audio Bridging". This is a convenient means to distribute audio only signals over an HDMI network.

The HD-AUD-IO has a configurable digital input terminal that can mute the audio and/or video.
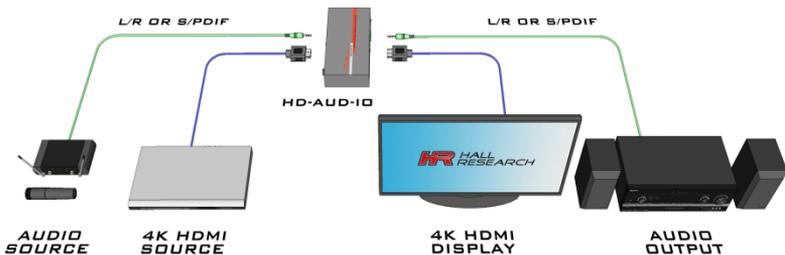
Typical Connection Diagram

Features

- Supports 4K/60 4:4:4, HDR, HDCP 2.2 & 1.4
- 18 Gbps bandwidth for compatibility with both HDMI 1.4 and 2.0b
- Supports multi-channel digital and 2-channel analog audio
- Extracts both LR analog and digital audio embedded in the HDMI input
- Embeds either LR analog or digital audio into the HDMI output
- Generates HDMI output with embedded audio with no HDMI input
- EDID management
- Can pass-thru or emulate EDID
- RS-232 controllable
- Configurable digital input for muting audio and/or video

2.0 Package Contents

HD-AUD-IO

(1) Model HD-AUD-IO
(2) Rack mounting brackets
(1) 4 position terminal block
(1) 5 Volt power supply with locking connector
(4) Power supply plug universal adapters
(1) Web documentation card

3.0 Setup

Installation

- *Optionally,* connect an HDMI source to the <u>HDMI IN</u> connector. Note that a source is NOT required to embed audio onto the HDMI output. If there is no HDMI source signal, the HDMI Output will be a 640x480 black screen.
- *Optionally,* connect an HDMI compatible sink to the <u>HDMI OUT</u> connector. A sink is not required to extract the HDMI Input Audio.
- *Optionally,* connect the <u>SPDIF OUT</u> audio output to a compatible audio device.
- *Optionally,* connect the <u>L/R OUT</u> analog audio output to a compatible device (e.g., headphones, assistive listening devices).
- *Optionally,* connect the audio to embed to the <u>SPDIF IN</u> and/or <u>L/R IN</u> connector(s).
- *Optionally,* Connect the <u>TX, RX and GND</u> contacts on the **Control** terminal strip to a compatible controller (e.g., PC or RS-232 controller).
- *Optionally,* Connect the <u>DI</u> contact on the **Control** terminal strip to a compatible normally open dry contact. This can be configured to mute the audio and/or video. Factory default is to mute the audio output. (Closed = MUTE)
- *Optionally,* use the included rack mount brackets and hardware. The brackets are configurable for different mounting orientations.
- Connect the included power supply to the 5V DC connector.

4.0 Connector and Indicator Functions
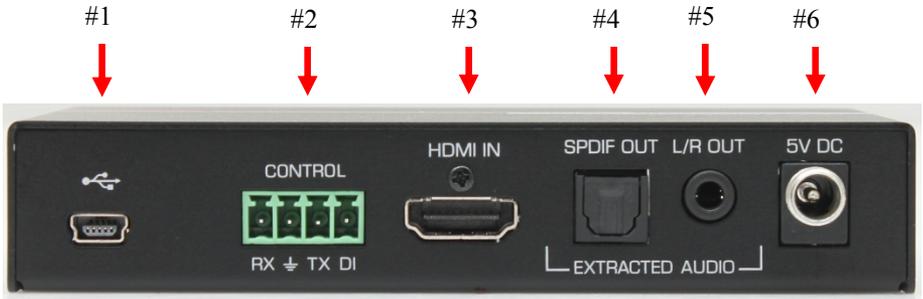
1)   Mini-USB Port
    a.   Used by Windows GUI and to update system firmware.
2)   CONTROL Terminal Strip -
    a.   RX, GND and TX - RS-232 Port
            i.   Connect to an external RS-232 controller to control the HD-AUD-IO.
    b.   Digital Input
            i.   Connect to an external control for system output muting control based on the configured 'Digital Input Action'.
3)   HDMI IN
    a.   Connect to a compatible HDMI Source
4)   EXTRACTED AUDIO - SPDIF Out
    a.   Connect to other compatible digital audio equipment.
5)   EXTRACTED AUDIO - L/R Out
    a.   Connect to other compatible line-level audio equipment.
6)   5V DC
    a.   Connect to the included power supply.
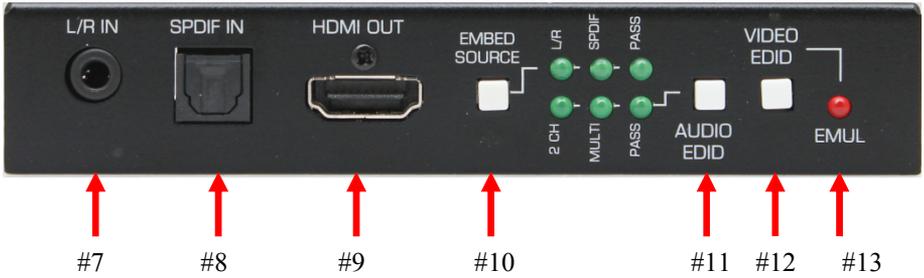
7) AUDIO TO EMBED - L/R IN
   a. Connect to compatible line-level audio source
8) AUDIO to EMBED - SPDIF IN
   a. Connect to compatible digital audio source
9) HDMI OUT
   a. Connect to a compatible HDMI SINK
10) EMBED SOURCE Button and LEDs
   a. **L/R** - Audio on HDMI OUT connector comes from L/R IN connector
   b. **SPDIF** - Audio on HDMI OUT connector comes from SPDIF IN connector
   c. **Pass** - Audio on HDMI OUT connector comes from HDMI IN connector
11) AUDIO EDID Button and LEDs
   a. **2 CH** - Alters EDID to include only 2CH audio settings
   b. **Multi** - Alters EDID to include only Mult-Channel audio settings
   c. **Pass** - Pass EDID to source from SINK
12) VIDEO EDID Button
   a. Single button press - Toggle between EMULATED and PASSTHRU EDID modes
   b. 1 Blink - HOLD FOR 3 SECS - LEARN EDID
   c. 2 Blinks -HOLD FOR 7 SECS - FACTORY DEFAULT
13) VIDEO EDID LED
   a. OFF = PASS-THRU EDID
   b. ON = EMULATED EDID
   c. This LED blinks when VIDEO EDID button is pressed AND HELD to show function selected when button is released.

14) <u>EDID Handling</u>

   a. With no SINK attached to the HDMI OUT connector, the EDID presented to the SOURCE will be emulated from the current EDID stored in the system.

5.0 RS-232 commands

- The following table lists the available RS-232 commands:
  - A single carriage return character (hex 0x0D) terminates each command.
  - Invalid input, space and linefeed characters (hex 0x0A) are ignored.
- RS-232 communication on the RS-232 terminal strip is:
  - **115200 bps, 8 Bit, No Parity, 1 Stop bit.**
- <CR> symbols in the table below refer to a single carriage return character (0x0D)
- "Invalid Command" is sent in response to invalid RS-232 commands
- Other possible responses
  - "ERR1" - Internal I2C error
  - "ERR2" - TX HPD read error
  - "ERR3" - Chip Signature error

Command	Response	Function and Example
FW	FWx.y<CR>	Returns the firmware version. FW1.1<CR> -- X and Y represent the firmware version numbers. (V1.1)
CVx	CVx<CR>	Sets/Returns the current HDMI Output video status CV?<CR> -- Returns the current HDMI Output video status CV1<CR> -- HDMI Output video is ON CV0<CR> -- HDMI Output video is OFF
DI	DIx<CR>	Returns Digital Input Status DI1<CR> -- Digital Input terminal is not grounded. DI0<CR> -- Digital Input terminal is grounded.
DIAx	DIAx<CR>	Sets/Returns Digital Input Action DIA?<CR> – Returns current Digital Input Action DIA3<CR> -- HDMI Output Audio is muted when digital input is grounded. (Factory Default) Where 'x' is one of the following: 0 -- No Action 1 -- Mute HDMI Output Video and Audio 2 -- Mute HDMI Output Video 3 -- Mute HDMI Output Audio 4 -- Mute Both External SPDIF and L/R Outputs 5 -- Mute External LR Output 6 -- Mute External SPDIF Output
ESx	ESx<CR>	Sets/Returns the current EDID setting ES?<CR> -- Returns the current EDID setting ES1<CR>-- Pass-Thru EDID (Factory Default) ES0<CR> -- Emulated EDID
EL	EL OK<CR> EL ERR<CR>	Learns the connected SINK to the selected EDID (LR or Multi) EL OK<CR> -- The EDID learning process was completed EL ERR<CR> -- The EDID learning process was not completed. Failures can occur from: No SINK attached Attempting to learn while in EMULATED EDID mode Attempting to learn while in AUDIO EDID Pass-Thru mode
FD	FD<CR>	Resets device to Factory Defaults Unit will reboot

Command	Response	Function and Example
HDI	HDIx<CR>	Returns HDMI Input HDCP status HDI?<CR> -- Returns the current HDMI Input HDCP Status HDI2<CR> -- HDMI Input is HDCP 2.2 encrypted HDI1<CR> -- HDMI Input is HDCP 1.4 encrypted HDI0<CR> -- HDMI Input is not encrypted
HDOx	HDOx<CR>	Returns the HDMI Output HDCP Mode HDO?<CR> – Returns the current HDMI Output Mode
HI	HIx<CR>	Returns HDMI Input +5V Status. HI1<CR> -- Source +5V connected. HI0<CR> -- Source +5V disconnected.
HO	HOx	Returns HDMI Output HPD Status. HO1<CR> -- Sink HPD connected. HO0<CR> -- Sink HPD disconnected.
IAx	IAx<CR>	Sets/Returns the current Audio EDID Source IA?<CR> – Returns the current Audio EDID Source IA2<CR> -- L/R IA1<CR> -- Multi-Channel IA0<CR> -- Pass-Thru (Factory Default)
MUTx	MUTx<CR>	Sets/Returns the current muting state MUT?<CR> -- Returns the current muting status Where 'x' is one of the following: 0 -- No Muting (Factory Default) 1 -- Mute HDMI Output Video and Audio 2 -- Mute HDMI Output Video 3 -- Mute HDMI Output Audio 4 -- Mute Both External SPDIF and L/R Outputs 5 -- Mute External LR Output 6 -- Mute External SPDIF Output
OAx	OAx<CR>	Sets/Returns the current HDMI Output Audio status OA?<CR> – Returns the current HDMI Output Audio Status OA1<CR> -- HDMI Output Audio is ON (Factory Default) OA0<CR> -- HDMI Output Audio is OFF
SAx	SAx<CR>	Sets/Returns the current Embed Audio Source SA?<CR> – Returns the current Embed Audio Source SA2<CR> -- L/R SA1<CR> -- Multi-Channel SA0<CR> -- Pass-Thru (Factory Default)
ST		Returns the current system status ST<CR> -- Returns the current system status
UPGRADE	One Moment...<CR> Run Firmware Upgrade tool now<CR>	Used to place system into the firmware upgrade mode.

6.0 Windows Graphical User Interface

The HD-AUD-IO is controllable via free Windows® based software available from the Hall Research website at:

http://hallresearch.com/page/products/HD-AUD-IO

1.1. Software Installation Prerequisites
- A PC with Windows XP® OS or later
- USB port
- Microsoft® .NET Framework 2.0 or later (most recent OS including Windows 8 and later include this software and no action is required). If the .NET Framework 2.0 or later is not installed on your PC, the Microsoft™ website has free downloads available.

1.2. Software Installation
If an earlier version of this particular software was previously installed, UNINSTALL the program first from either the Add/Remove Programs section of the control panel or by running the previous installation's SETUP.EXE and selecting "remove application".

- Install the software by executing the SETUP.EXE program from the installation source directory
- Accept the default settings, but if you want to specify a particular installation directory other than the default, you may do so.
- Once the HD-AUD-IO software installation has completed, either click the desktop icon or navigate the Start Menu to
    Start -> Programs -> Hall Research -> HD-AUD-IO

1.3. General
In most installations the use of the software GUI is not required as most functions can be performed using the front panel buttons on the product.

You can use the software to export EDID files from the device.
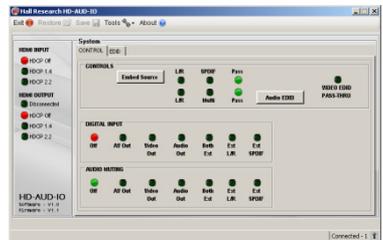
It is possible to connect more than one HD-AUD-IO to the PC (using several USB ports of the PC). The same software GUI detects all connected devices and allows control from the same application.

1.4. USB Device Detection

The HD-AUD-IO software uses standard Windows® drivers, which automatically configure the USB port after connection and do not require the installation of any special USB drivers.

The first time you connect the HD-AUD-IO to the PC, you may experience a short delay and a windows notification pop-up message may display.

1.4.1. The software GUI scans the HD-AUD-IO settings continuously in real-time, all changes to the system are reflected in the software GUI.

1.4.2. If no HD-AUD-IO device is attached to the system, the on-screen fields are disabled (grayed out).
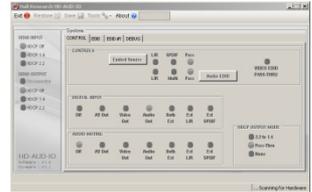
The new device detection and driver auto installation typically only occurs once. Thereafter, devices that are reconnected detect with no delay or message.

1.4.3. Only one instance of the software GUI can run at a time. Executing the application more than once will result in a warning message.

1.5. Tool Bar Menu

1.5.1. EXIT

Exits the application

1.5.2. TOOLS

Factory Defaults
Restore the device to factory default settings.
The user must confirm the action.

Export EDID
Save the currently selected EDID as a 256-byte binary file.

Firmware Update
Allows users to field upgrade the device application firmware. Application firmware that does not support this function will disable this option.
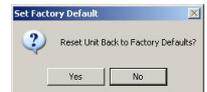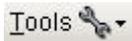
ABOUT
Displays screen with software versions, website link, legal disclaimer and copyright information.
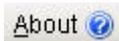
1.6. Status Bar

The bottom bar of the screen shows the current USB status as follows:

"Scanning for Hardware…"
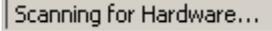
> Scanning for Hardware…

The GUI software is looking for HD-AUD-IO devices.
The screen controls are disabled until a HD-AUD-IO device attaches.

"Connected – XX"

> Connected - 1

Where XX is the number of HD-AUD-IO devices connected to the PC.

1.7. Controls

Embed Source
This button selects which audio source to embed; either 3.5mm L/R IN, SPDIF IN or HDMI IN.

Audio EDID
This button selects how the EDID is altered; either L/R (2 Channel), Multi (Multi-Channel) or Pass-Thru from the HDMI output.

Video EDID Emulate/Pass-Thru
Pressing this button quickly selects whether the EDID given to the source is from a previously stored EDID or from the HDMI OUT display.

Press and hold the button for more than 3 seconds. After the LED blinks once, release the button to LEARN the EDID connected to the HDMI OUT connector. If there is an error learning the EDID, the VIDEO EDID LED will blink 10 times.

Press and hold the button for more than 7 seconds. After the LED blinks twice, release the button to factory default the device.

1.8. Digital Input

This area controls and shows the desired mute setting which occurs when the DI (digital input) terminal connects to ground.

The indicator will be 'RED' when the DI is un-grounded and 'GREEN' when the DI input connects to ground.

The factory default setting is to mute only the HDMI audio output. Click the desired setting to change the factory default.

Setting	Functionality
OFF	No muting occurs
AV Out	Both HDMI Audio and VIDEO are muted
Video Out	Only HDMI Video is muted
Audio Out	Only HDMI Audio is muted
Both Ext	Both L/R Out and SPDIF Out are muted
Ext L/R	Only L/R Out is muted
Ext SPDIF	Only SPDIF Out is muted

1.9. Audio Muting

This area controls and shows the current system muting state. This setting can be different from the setting above for when the Digital Input.

For example,
With 'Audio Muting' set for AV Out and the Digital Input setting is OFF. When the Digital Input terminal connects to ground, the Audio and Video muting turns off.

7.0 Troubleshooting

If you are experiencing problems getting the system to work properly, please use the following troubleshooting suggestions.

- Ensure that all connections to the device are solid. Loose connections are the number one cause of issues.
- Try resetting the system by unplugging BOTH the power supply and HDMI IN connectors, waiting 5 seconds and plugging them back in.
  - o The front panel LEDs cycle several times at power up; after ~15 seconds, audio and video should be passing through the device.
- Try restoring factory defaults using the front panel VIDEO EDID button (hold for 7 seconds) or via RS-232 command.
- Cycle the EDID mode with the front panel VIDEO EDID button.

Contacting Hall Research

If you determine that the HD-AUD-IO is malfunctioning, do not attempt to repair the unit yourself.

Instead, contact Hall Research Technical Support at 714-641-6607. To return the unit to Hall Research you must first get a Return Authorization (RMA) number. Package the unit carefully, if returning. We recommend that you use the original container.

8.0 Specifications

Video

Standards	DVI (single link)	
	HDMI 1.4 and HDMI 2.0b video specifications including 12 bit color depth, 3D video	
	HDCP 2.2	
Connectors	**HD-AUD-IO**	
	(1) HDMI Input	
	(1) HDMI Output	
Resolutions	DVI signal	VGA (640x480) thru WUXGA (1920x1200)
	HDTV signal	480p through 4K 60 Hz 4:4:4

Audio

Formats	LPCM 2CH Audio (32, 44.1 and 48 KHz sample rate)
	Digital Audio multi-channel 2.1, 5.1, 7.1

Other Signals

RS-232	(1) RX, TX and GND on Terminal Strip
	RS-232 Baud Rate: 115200, N, 8, 1
Digital Input	Dry Contact, connect to ground to trigger configured action

General

Power Supply	100 VAC to 240 VAC, 47-63 Hz, External; 5 VDC 1.0 ADC	
Temp/humidity	Storage: -40 to +158 °F (-40 to +70 °C) / 10% to 90%, non-condensing	
	Operating: +32 to +122 °F (0 to +50 °C) / 10% to 90%, non-condensing	
Current Draw	@5 VDC - 85 mADC (typical), 200 mADC (fully loaded)	
Cooling	Convection	
Enclosure type	Metal (Steel)	
Dimensions		
Model	0.9" H x 4.47" W x 2.53" D	
	(23 mm H x 114 mm W x 64 mm D)	
Shipping	4.0" H x 10.0" W x 8" D	
	(101.6 mm H x 254 mm W x 203.2 mm D)	
Product weight	Model Only	HD-AUD-IO - 0.5 lb (0.227 Kg)
	Shipping	HD-AUD-IO - 1.6 lb (0.726 Kg)
Safety	CE	
EMI/EMC	CE, FCC Class A	
MTBF	90,000 hours (estimate)	
Warranty	3 years parts and labor	

Specifications are subject to change without notice

HALL RESEARCH

1163 Warner Ave., Tustin, CA 92780
Ph: (714)641-6607