ECHO
TEST + MEASUREMENT

ECHO AIO TEST SYSTEM

USER MANUAL

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revision 3, June 20, 2023

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Limited 3 Year Warranty

Echo warrants its products to be free of manufacturing defects for a period of three years from the date of purchase. Any product covered under a valid Echo new product warranty—where the damage is not caused by owner misuse or abuse (see Warranty Exclusions, below)—will be repaired or replaced by Echo free of charge. **Please see the full Echo Warranty Policy for more information.**

CE Compliant

RoHS Notice: Echo Digital Audio has conformed and this product conforms, where applicable, to the European Union's Directive 2002/95/EC on Restrictions of Hazardous Substances (RoHS) as well as the following sections of California law which refer to RoHS, namely sections 25214.10, 25214.10.2, and 58012, Health and Safety Code; Section 42475.2, Public Resources Code.

WEEE: As with the disposal of all old electrical and electronic equipment, this product is not to be treated as regular household waste. Instead, it shall be handed over to the applicable collection point for the recycling of electrical and electronic equipment.

Safety Instructions

1. Read Instructions—Be sure to read all the safety and operating instructions before operating this product.

2. Keep Instructions—The safety instructions and user manual should be kept for future reference.

3. Warnings—All warnings on your Echo AIO and in the user manual should be followed.

4. Follow Instructions—All operating and use instructions should be followed.

5. Moisture—Water and moisture are detrimental to the proper operation of the Echo AIO. Do not install or operate your Echo AIO near sources of water or moisture such as sinks, damp basements, leaky roofs, etc.

6. Heat—Your Echo AIO should be situated away from sources of heat such as heaters or radiators.

7. Power Sources—This unit should be operated only from a stable AC power source as indicated in this documentation or on the Echo AIO. A surge protector is recommended in areas that are subject to lightning or noise from industrial equipment such as that found on a factory floor.

8. Grounding—Precautions should be taken so that the grounding capabilities of the unit are not undermined. The Echo AIO is provided with a cord with an equipment grounding conductor and grounding plug. This plug must be plugged into an outlet that is properly installed and grounded in accordance with all local rules and ordinances. Do not modify the plug provided with the equipment. If the plug will not fit into your outlet, have a proper outlet installed by a qualified electrician.

9. Power Cord Protection—Power supply cords should be routed so that they are protected from damage. Pay particular attention to protecting the plugs, outlets, and the point at which the cord exits your Echo AIO.

10. Servicing—There are no user serviceable parts inside the Echo AIO. Do not attempt to service this unit yourself, as opening the case will expose you to hazardous voltage or other dangers, will void the calibration and void the warranty. All servicing should be referred to qualified service personnel.

NOTE: There are no user serviceable parts inside. Do not attempt to remove modules from the chassis. Doing so will void the warranty and calibration! Please contact your nearest authorized repair center for servicing.

Contents

1. Introduction

The Echo AIO Test System is a USB 2.0 compliant audio test platform compatible with ASIO and WASPI drivers on Windows computers and Core Audio on Macintosh (Mac) computers. When coupled with a computer running test software, AIO forms a complete system for testing digital and analog audio electronics and acoustics in consumer and professional products. Echo AIO products are ideally suited for a high-volume production environment where testing occurs on a continual basis.

Echo AIO combines the functionality of multiple pieces of test equipment into a single, integrated device for increased reliability at a reduced cost. In addition to audio testing, it has extensive capability to control measurement fixtures, simulate batteries for wearable products, and even measure environmental variables such as temperature, barometric pressure, and humidity, allowing baseline conditions to be established for factory production runs.

Figure 1 Echo AIO Test System (AIO-SA configuration)

The Echo AIO Test System is a modular design consisting of a chassis, an interface module with connections for a locking USB 2.0 cable and a locking power cable, and one or two modules selected from a variety of types for analog I/O, digital I/O, or control. The product name is based on the combination of installed modules (i.e.: AIO-SA has one AIO-S and one AIO-A module).

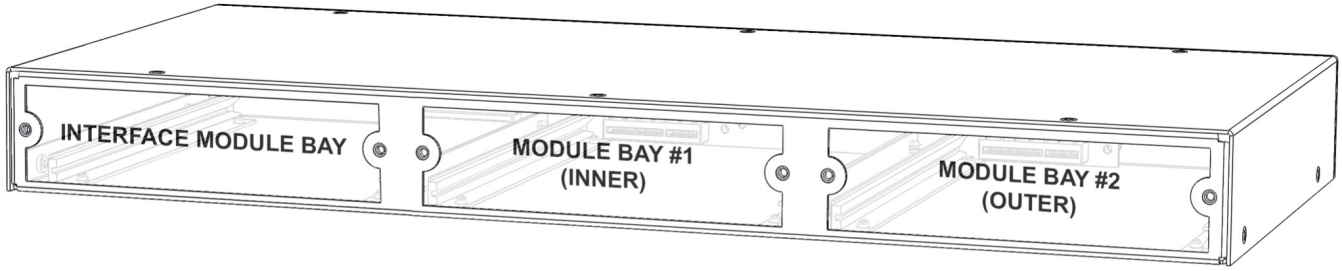

Figure 2 Rear panel

All Echo AIO products come from the factory in predetermined, fixed configurations. Attempting to change the factory configuration or swapping modules between chassis will cause the AIO to stop working properly and will void the calibration and the warranty! Products originally configured with a single module and an empty slot may be returned to a factory authorized service station at a later date to add a second module.

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2. Installation

Hardware

Connect the locking power cable supplied with the AIO to the locking IEC C14 power inlet. Both locking and non-locking cables may be used. For reliability, the AIO does not have a power switch. The blue LED on the front panel indicates when power is applied and the AIO is operating. The universal AC input accepts 90 – 264 VAC at 50 or 60 Hz. The AIO, equipment connected to the AIO, and the test computer must all be connected to the same surge-protected power strip.

Figure 3 Locking power cable

Connect the Type-B end of the supplied locking USB 2.0 “HI-SPEED” cable to the USB connector on the AIO, and the other end to the host computer. Both locking and non-locking cables may be used.

Figure 4 Locking USB cable

Echo Driver Software

For Windows computers, download the AIO Windows driver from the downloads section of the Echo website and run the installer. This will install the AIO control panel, the latest firmware, the ASIO driver, and the command-line application. Although the AIO will automatically be recognized on Windows 10 or 11 and can function using only Windows’ built-in WASAPI driver, we recommend installing the Echo software to add control panel functionality, firmware updates, and ASIO driver support. Most professional audio and test applications support ASIO. The driver will appear in your software as “ASIO Echo AIO”.

For MacIntosh computers, support for USB audio is part of the macOS and its audio component, Core Audio. The AIO is automatically detected whenever it is powered on and connected to a Mac USB port.

3rd Party Test and Measurement Software

The Echo AIO Test System may be used with a wide variety of 3rd party test and measurement software via the Echo AIO ASIO driver. Because ASIO is a digital interface, all levels are communicated between the hardware and software as digital values, and there's no inherent conversion to actual analog I/O values when using an analog interface. To properly do the conversion, the software needs to know the correct scaling factor, which defines the relationship between analog voltage and digital full-scale level (0 dBFS). The scaling factors for different types of inputs and outputs are typically different. For example, the scaling factor of a line-level output will be different than for a speaker output, because the maximum voltage of a speaker output is much greater.

Although scaling factors can be determined by experimentation using a calibrated voltage meter, we provide you with the correct scaling factors for our hardware, so that you can simply enter these values into the appropriate settings in the measurement software that you are using.

Table 1 Scaling factors

	Connector	Module	Scaling Factor
Outputs	Line (unbalanced)	AIO-L	8.0 V/FS
	Line (balanced)	AIO-L	16.0 V/FS
	Headphone	AIO-H	3.0 V/FS
	Amplifier/Speaker	AIO-A, -S	9.545 V/Fs
Inputs	Mic-Line	AIO-A, -H, -L, -S	161.6 mFS/V
	Headphone Impedance VMON	AIO-H	333.3 mFS/V
	Headphone Impedance IMON *	AIO-H	8.0 FS/V
	Speaker Impedance VMON	AIO-S	80.80 mFS/V
	Speaker Impedance IMON *	AIO-S	161.6 mFS/V

3. Hardware Configurations

The Echo AIO Test System is available in different hardware configurations (models) depending on the module type and position installed in the chassis. The product name is based on the combination of installed modules (i.e.: AIO-SA has one AIO-S and one AIO-A module). Common configurations are listed in the table below.

Table 2 Common AIO configurations

Model	Inner Module	Outer Module	Mic/Line Inputs	Line Outputs	Headphone Outputs	Amp Outputs	Impedance	Digital	5VDC & Battery Simulator	GPIO	PTH
AIO-A1	AIO-A		4			2					
AIO-A2	AIO-A	AIO-A	8			4					
AIO-AC	AIO-A	AIO-C	4			2			Y	8/8	Yes
AIO-AH	AIO-A	AIO-H	6		2		1				
AIO-AT	AIO-A	AIO-T	4			2		TDM 10/10			
AIO-C1		AIO-C							Y	8/8	Yes
AIO-H1	AIO-H		2		2		1				
AIO-H2	AIO-H	AIO-H	4		4		2				
AIO-L1	AIO-L		4	2							
AIO-L2	AIO-L	AIO-L	8	4							
AIO-LT	AIO-L	AIO-T	4	2				TDM 10/10			
AIO-S1	AIO-S		2			2	1				
AIO-S2	AIO-S	AIO-S	4			4	2				
AIO-SA	AIO-S	AIO-A	6			3	1				
AIO-SL	AIO-S	AIO-L	6	2		2	1				
AIO-T1		AIO-T						TDM 10/10			

Additional configurations are possible, as long as they follow the rules below. Check with your Echo dealer for availability.

a. Any combination of two analog audio modules (A, H, L or S) may be ordered, with either module in the inner or outer slot.
b. Any analog audio module (A, H, L or S) may be ordered for the inner slot, along with a C or T module in the outer slot.
c. For a single-module unit, the analog modules (A, H, L, or S) may be placed in either slot, while the C or T modules may only be placed in the outer slot.

Note that modules are not sold separately, except as part of an upgrade by an authorized dealer to convert a single-module chassis to a two-module chassis. Modules do not function as stand-alone devices. They must be installed in an AIO chassis to operate.

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4. Hardware Modules

Acoustic (AIO-A)

The Acoustic test module (AIO-A) is designed for making basic acoustic measurements of a device under test (DUT)—typically a speaker or driver. Ideal for use with measurement microphones, ear simulators, artificial heads, speakers, actuators, and mouth simulators. AIO-A maps to the audio driver as 4 input channels and 2 output channels.

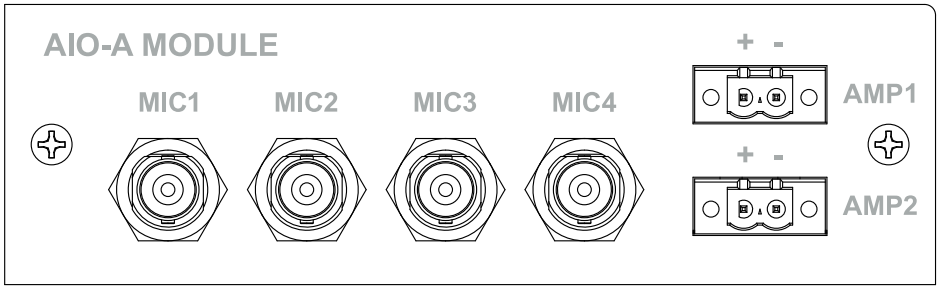

Figure 5 AIO-A module

Combo (AIO-C)

The Combo test module (AIO-C) is designed to provide non-audio connectivity and control options for driving various fixtures associated with acoustic measurements. It features 8 aux (GPIO) inputs and 8 aux (GPIO) outputs, a fixed 5 VDC 1 Amp power supply, a variable 5 VDC 1 Amp power supply (for battery simulation), and sensor inputs for temperature, humidity, and barometric pressure. The module does not map to the audio driver since it has no audio channels.

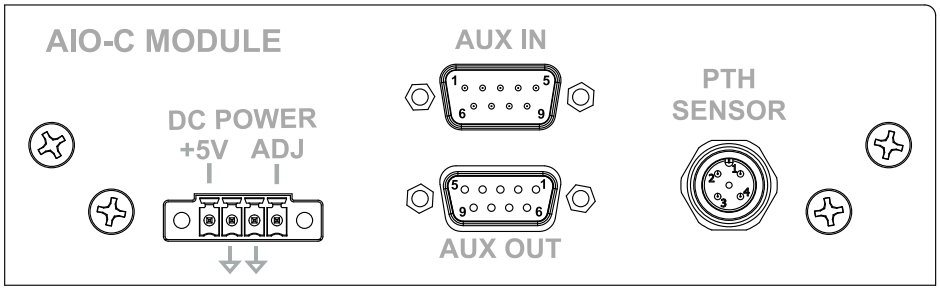

Figure 6 AIO-C module

Headphone (AIO-H)

The Headphone test module (AIO-H) is designed for making advanced acoustic and impedance measurements of a device under test (DUT)—typically wired headphones, headsets, earbuds, and hearing protection devices. It maps to the audio driver as 4 input channels and 2 output channels. Inputs 1 and 2 correspond to the front panel Mic/Line inputs. Input 3 connects across the remote voltage sense terminals + and - on the Euroblock connectors. Input 4 is wired across an internal current sense resistor in series with each output, for measuring impedance, and is not externally accessible. Inputs 3 and 4 are assigned to the L or R channel via a selector in the AIO control panel.

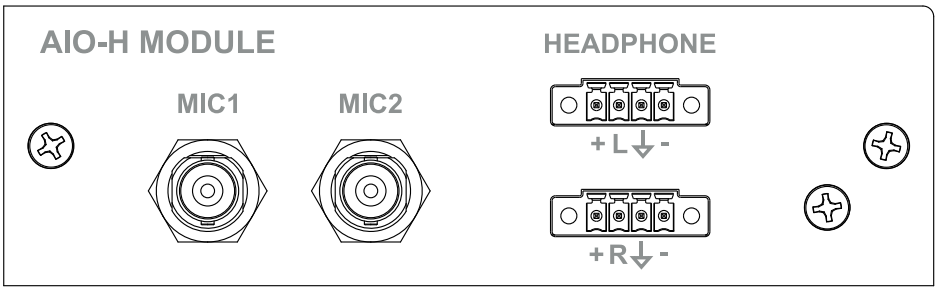

Figure 7 AIO-H module

Line (AIO-L)

The Line-level test module (AIO-L) is designed for making basic acoustic and electrical measurements of a device under test (DUT). It features balanced line outputs, which are useful both for interfacing to balanced audio devices, and for interfacing to single-ended devices where ground isolation is desired. It maps to the audio driver as 4 input channels and 2 output channels. The outputs may be connected in single-ended (unbalanced) mode by connecting to the + and ground terminals and leaving the – terminal floating (unconnected).

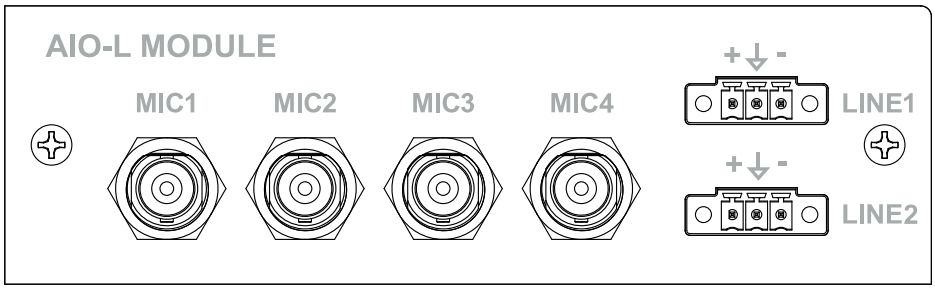

Figure 8 AIO-L module

Speaker (AIO-S)

The Speaker test module (AIO-S) is designed for making advanced acoustic and impedance measurements of a device under test (DUT)—typically a speaker or driver. Ideal for use with measurement microphones, ear simulators, artificial heads, speakers, actuators, and mouth simulators. It maps to the audio driver as 4 input channels and 2 output channels. Inputs 1 and 2 correspond to the front panel Mic/Line inputs. Input 3 connects to the remote voltage sense terminals V+ and V- on the SPKR Euroblock connector. Input 4 is wired across an internal 0.1 Ω current sense resistor in series with the SPKR output for measuring impedance and is not externally accessible.

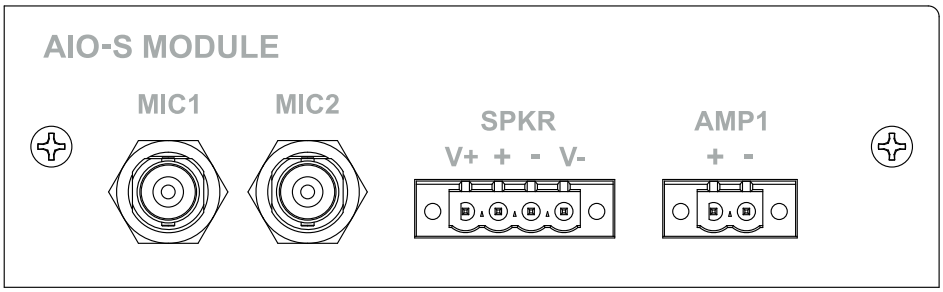

Figure 9 AIO-S module

TDM (AIO-T)

The TDM test module (AIO-T) provides a 10 channel TDM (Time-Division Multiplexed) interface for connection directly to audio converters or other ICs. The AIO-T Module maps to the audio driver as 10 input channels and 10 output channels. The module functions as a TDM master (MASTER mode), sourcing the clocks and synchronization signals or as a TDM slave (SLAVE mode) syncing all data and audio clocks to SCLK and SYNC. It supports 2 channel (I2S or DSP format), 4 channel, or 8 channel modes.

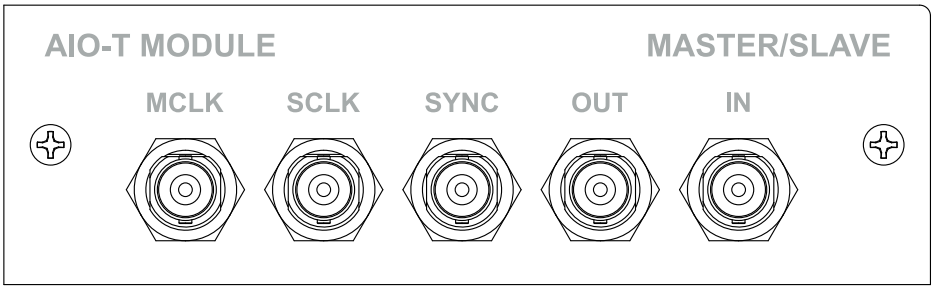

Figure 10 AIO-T module

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5. Analog I/O

Microphone/Line Inputs A H L S

Inputs with BNC connectors are available for connecting externally polarized or prepolarized constant current (CCP/IEPE/ICP, 4 mA) microphones, or unbalanced line-level inputs. Input gain, constant current supply, and TEDS reading are available at each input and are under software control via the AIO control panel.

The mic/line inputs are designed to accommodate a very wide range of input voltages, from extremely low-level dynamic microphones all the way to line level inputs. To cover such a wide range of voltages, three input gain levels (1x, 10x, and 100x) are available. The gain settings are individually adjustable for each channel. Keep in mind that setting the input gain higher will also amplify the noise floor, so the best practice is to use the lowest gain setting needed for a particular application. This will result in the best dynamic range for the measurements.

TEDS

Transducer Electronic Data Sheet (TEDS) is an industry standard (IEEE 1451) memory device attached to a microphone or other transducer, which stores transducer identification, calibration, correction data, and manufacturer-related information. It is commonly used in measurement microphones and other sensors to allow bypassing of the calibration step using external calibrators by providing the original factory calibrated sensitivity level. This level can be plugged into the audio analysis software and used directly. Note: Using the TEDS data does not take into account the effects of age, temperature, humidity and barometric pressure on the measurement microphone or sensor. Calibration using external calibrators will usually be more accurate and is the recommended best practice.

The AIO mic/line inputs can read TEDS data and return it to the AIO control panel. The TEDS levels can then be cut and pasted or manually entered into the audio analysis software.

Line-level Outputs L

The AIO-L module has two outputs with Euroblock connectors for connecting line-level devices. The outputs are differential with (+), (-), and ground connections.

Headphone Outputs H

Amplified outputs with Euroblock connectors are provided for driving headphones and earbuds. The Left and Right outputs are single-ended and share a common ground.

VMON Input (Input 3)

Voltage measured directly at the speaker terminals is monitored on input 3 of the AIO-H module using two wires connected from the headphone terminals directly to the (VL) and (VR) remote sense terminals on the connector. The left or right channel is selected via the AIO control panel. By connecting directly at the headphones, the voltage drop across the headphone wires does not affect the measurement. Please refer to Figure 11.

IMON Input (Input 4)

Precision current sense resistors are placed in series with the outputs. A voltage across these resistors is generated by the signal and is monitored using input 4 of the AIO-H module. The sense resistor voltage can be used to derive the current through the connected driver. The left or right channel is selected via the AIO control panel. There are no external connections to these current sense resistors or circuits. Please refer to Figure 11.

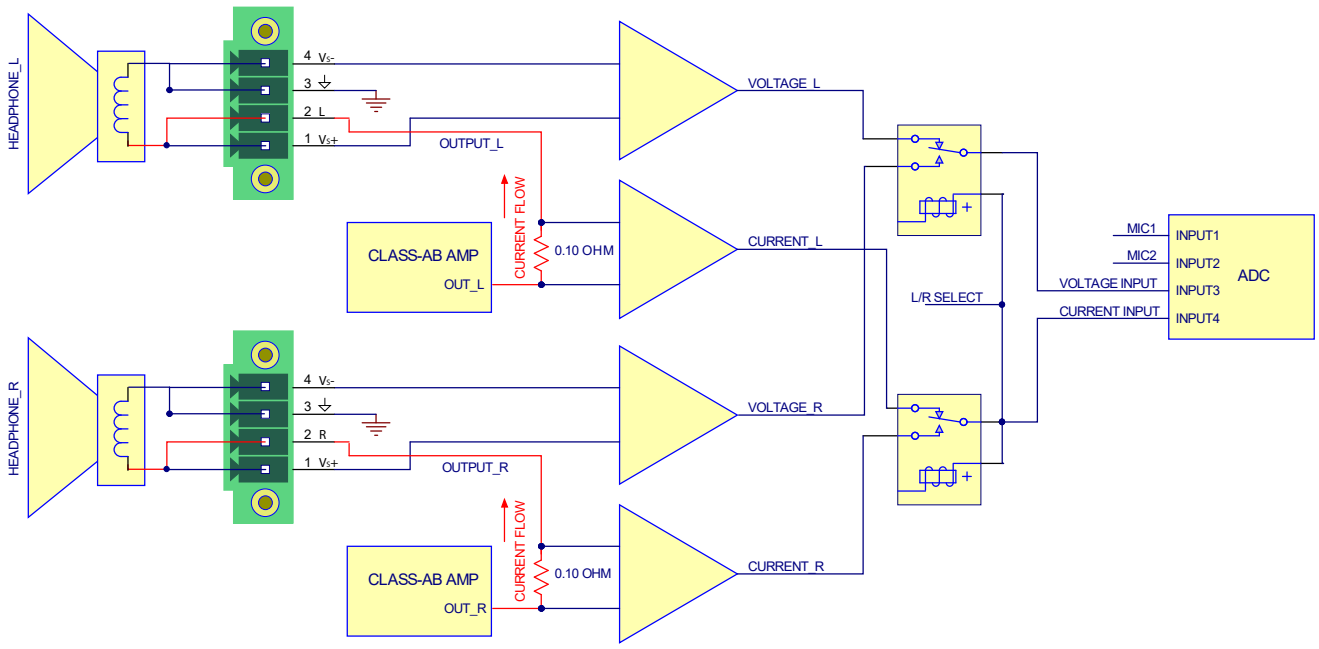

Figure 11 AIO-H module block diagram

Amplifier Outputs A S

Amplified (class D) outputs with Euroblock connectors are provided for driving speakers or other devices. The outputs are single ended with (+) and (-) connections and the speaker should be connected directly across them. Both the (+) and (-) outputs are biased at ~7.5V.

Note: Amplifier outputs are floating and not ground-referenced. Connecting a speaker or other low-impedance path from one of the outputs to ground will cause the amplifier to shut down. The amplifier will reset and resume normal operation after the fault is removed.

Outputs labeled as “SPKR” are the same as the “AMP” outputs, except that they also feature load-impedance measurement, facilitated by the two additional inputs described below.

VMON Input (Input 3)

Voltage measured directly at the speaker terminals is monitored on input 3 of the AIO-S module using two separate wires connected from the speaker terminals to the (V+) and (V-) terminals of the SPKR connector. By connecting directly at the speakers, the voltage drop across the speaker wires does not affect the measurement. Please refer to Figure 12.

IMON Input (Input 4)

A precision 0.1 Ω current sense resistor is placed in series with the + side of the SPKR output. A voltage across this resistor is generated when a load is connected across the + and - pins of the SPKR output and is monitored using input 4 of the AIO-S module. The sense resistor voltage can be used to derive the current through the connected speaker. There are no external connections to this current sense resistor or circuit. Please refer to Figure 12

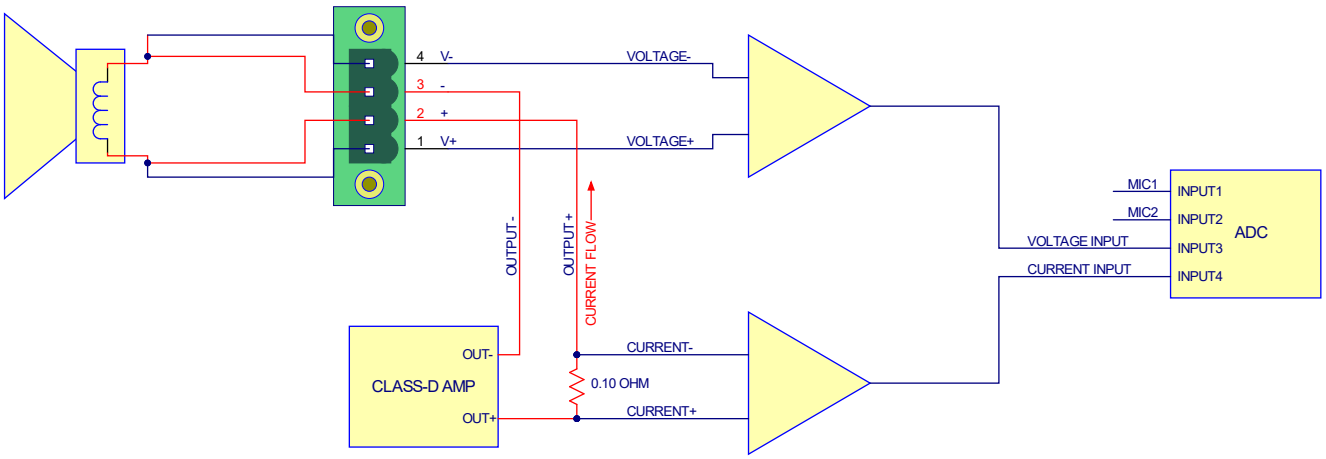

Figure 12 AIO-S module SPKR block diagram

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6. Digital I/O

TDM T

The AIO-T module provides up to 10 digital I/O channels through a TDM (Time-Division Multiplexed) interface, for connection directly to audio converters or other ICs.

The AIO-T has five BNC connectors. In MASTER mode, the connectors are configured as four outputs (MCLK, SCLK, SYNC, and OUT) and one input (IN). In SLAVE mode, the connectors are configured as two outputs (MCLK and OUT) and three inputs (IN, SCLK, and SYNC).

Connectors

MCLK: 24.576 MHz master clock output.

SCLK: Bit clock output (MASTER mode) or input (SLAVE mode). Polarity and bits per frame are programmable. SCLK may also be set to be disabled, outputting a constant “0” logic level.

SYNC: Frame synchronization output (MASTER mode) or input (SLAVE mode). Used to signal the start of an audio frame. Width, polarity, and phase relationship to the audio data are programmable.

OUT: Data output, can contain up to 10 channels of 24-bit audio.

IN: Data input, can contain up to 10 channels of 24-bit audio.

Logic Levels

I/O logic levels can set to either 1.8V or 3.3V via the AIO control panel, command line interface, or APIs.

Termination

Outputs are high-drive capability, with a series resistance of 50 Ω. Inputs have an input impedance of 10K Ω.

Configuration

The TDM interface may be programmed through the AIO control panel, command line interface, or APIs for number of channels, bits/sample, bits/frame, sync type (width, polarity, and placement), and clock polarity. The module always presents 10 channels of input and output to the audio driver, regardless of the number of active TDM channels. Unused channels are ignored.

Table 3 TDM Settings

Setting	Description
Clock direction	Clock sink mode: MCLK, SCLK, and SYNC are inputs Clock source mode: MCLK, SCLK, and SYNC are outputs
Bits per frame / bits per word	Determines the number of channels per frame. 256 bits/frame, 24 bits/word: 10 channels 256 bits/frame, 32 bits/word: 8 channels 128 bits/frame: 4 channels 64 bits/frame: 2 channels The bits/word setting has no effect for 128 bits/frame and 64 bits/frame.
Invert SCLK	Sets the polarity of SCLK. Not inverted: Data and FSYNC clock out on falling edge of SCLK Inverted: Data and FSYNC clock out on rising edge of SCLK
Advance output	Disabled: Audio output is aligned with audio input Enabled: Audio output is advanced the specified number of bits before the audio input
Delay FSYNC and INPUT by ½ bit	Delays FSYNC and audio input sampling by ½ bit
FSYNC position	Sets the position of the positive portion of FSYNC relative to the start of frame
FSYNC width	Sets the width of FSYNC in bits

7. Miscellaneous I/O

The AIO-C module is designed to provide non-audio connectivity and control options for driving various fixtures associated with acoustic measurements. It features 8 aux (GPIO) inputs and 8 aux (GPIO) outputs, a fixed 5V @ 1A DC power supply, a variable 5V@1A DC power supply (for battery simulation), and sensor inputs for temperature, humidity, and barometric pressure.

The AIO-C module does not map to the audio driver since it has no audio channels.

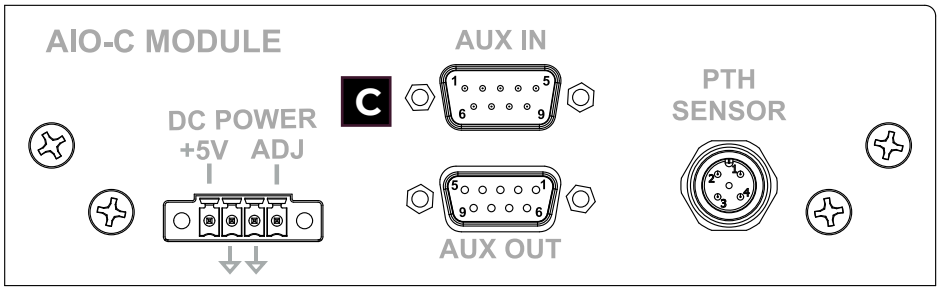


Figure 13 AIO-C module

5 VDC Fixed Power Supply

The fixed 5V DC @ 1A power supply is provided on the left two pins of the 4-pin DC Power Euroblock connector.

5 VDC Variable Power Supply (Battery Simulator) C

The variable 1A power supply is provided on the right two pins of the 4-pin DC Power Euroblock connector. The variable DC supply is primarily designed for battery simulation on portable devices and has an adjustable voltage output that ranges from 0.1 volts to 5 volts.

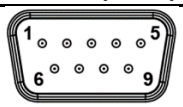
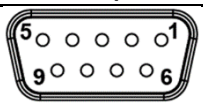
The supply features DC current measurement in four selectable ranges: 1250 ma, 125ma, 12.5ma, and 1.25ma, with a 1/4096 resolution. An overcurrent threshold may be set to turn off the supply if it is exceeded.

The DC current measurement settings and results can be viewed in the AIO control panel.

Aux (GPIO) C

The AIO-C module features 8 open drain TTL level (GPIO) outputs capable of sinking up to 250mA of current on a female 9 pin locking D-sub connector and 8 TTL level (GPIO) inputs on a male 9 pin locking D-sub connector. They allow sending and receiving switch closure information under program control for interfacing to other test or display devices. A simple application of this feature would be to illuminate a Pass/Fail light-bar based on test results.

Table 4 Aux I/O Pin-out

AUX IN (male)		AUX OUT (female)	
			
PIN	**FUNCTION**	**PIN**	**FUNCTION**
1	AUX In 1	1	AUX Out 1
2	AUX In 2	2	AUX Out 2
3	AUX In 3	3	AUX Out 3
4	AUX In 4	4	AUX Out 4
5	AUX In 5	5	AUX Out 5
6	AUX In 6	6	AUX Out 6
7	AUX In 7	7	AUX Out 7
8	AUX In 8	8	AUX Out 8
9	GND	9	GND

Environmental (Pressure, Temperature, Humidity) C

Since manufacturing factories rarely have sophisticated environmental control systems (quite often they have none at all), it is important to take baseline measurements of environmental conditions on the production line periodically before doing manufacturing runs on sensitive acoustic devices. Temperature, humidity, and barometric pressure can vary widely from day to day (or even hour to hour) and can have a significant impact on acoustic measurement accuracy.

The AIO-C module is unique in the world of audio testing devices by providing an interface for making these important baseline measurements. The sensor connects to the AIO-C module through a 4-pin locking M-12 connector. The measurement results can be viewed in the AIO control panel.

You may supply your own sensor(s), or order the PTH sensor as an optional accessory. Echo's PTH sensor is factory calibrated by the manufacturer of the sensor and no additional calibration is required. The sensor is mounted in a small weather-resistant plastic enclosure at the end of a 2m cable, so that can be placed away from local heat sources (power supplies, etc.).

Figure 14 PTH sensor

8. Control Panel

Overview

The control panel controls and monitors the following AIO hardware functions:

- Analog input and output gain
- Constant-current power to microphones
- TEDS data
- Level meters
- Firmware update
- WASAPI and ASIO driver settings
- Clock source and status
- Diagnostic logging and directory

When the control panel is opened, it will automatically detect the connected AIO hardware and display the corresponding tabs and options. The tabs and drop-down menus are described in the text that follows. If the control panel is not already installed, please see the *Echo* Driver Software section on page 3. **The control panel is for AIO hardware control only. It does not perform any audio analysis.**

Channels Tab

The Channels tab shows the input and output channels of the connected AIO test system. It allows levels to be monitored and configuration options, which vary depending on the type of module installed, to be set.

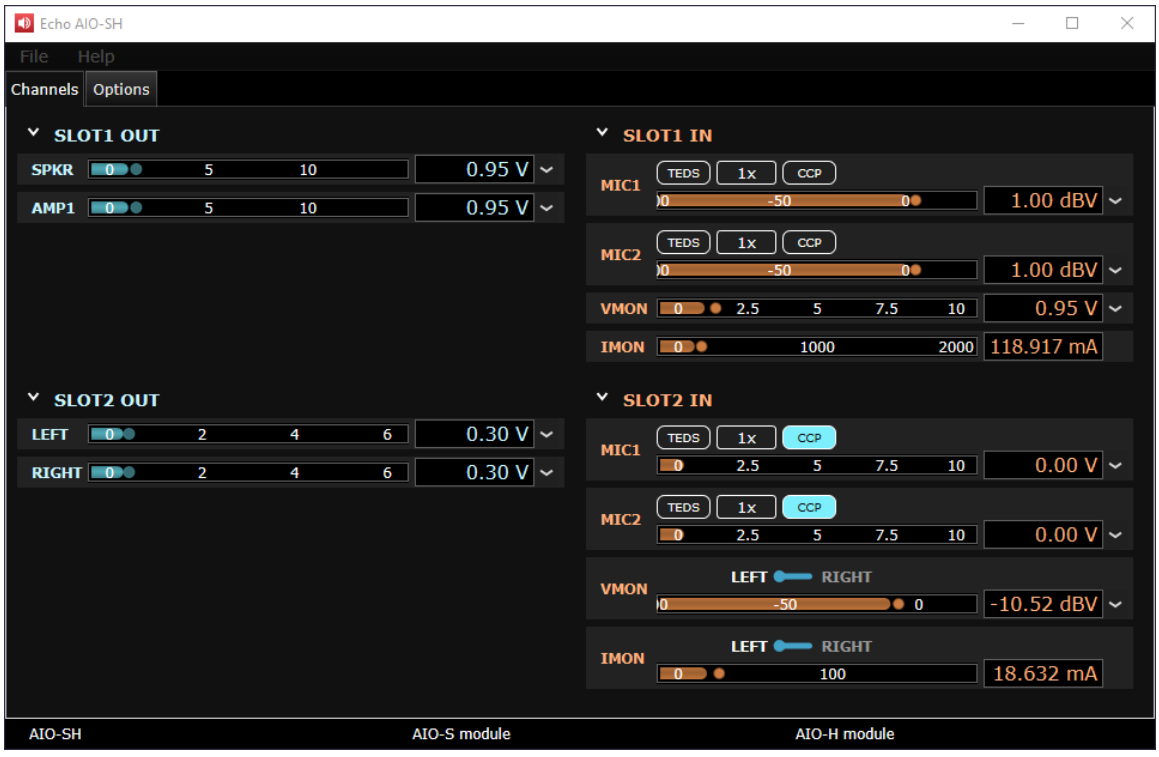


Figure 15 Channels tab (AIO-SH)

Outputs

The left side of the tab shows the output channels. The output level of each channel is displayed both on a horizontal bar graph (A) and numerically (B). Use the drop-down control to select the desired units (C). The appearance and features will vary depending on the AIO modules that are installed. Click the caret (D) to expand or condense the channel display for each module type. In the condensed view, only the bar-graphs are visible.

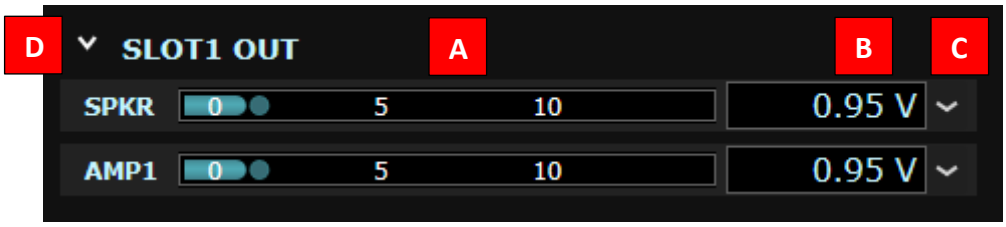


Figure 16 Output channels

Inputs

Input channels are similarly shown on the right side of the Channels tab. The input level of each channel is displayed both on a horizontal bar graph (A) and numerically (B). Use the drop-down control to select the desired units (C). The appearance and features will vary depending on the AIO modules that are installed. Mic/line inputs contain the following additional controls:

TEDS: Displays the TEDS (Transducer Electronic Data Sheet) information reported back from the attached microphone, if the microphone supports it (D). See the TEDS section below for more details.

Gain: Sets gain to 1x, 10x, or 100x to accommodate a wide range of signal levels (E).

CCP: Turns on the constant current supply (CCP/IEPE/ICP) to power prepolarized measurement microphones (F).

Click the caret (G) to expand or condense the channel display for each module type. In the condensed view, only the bar-graphs are visible.

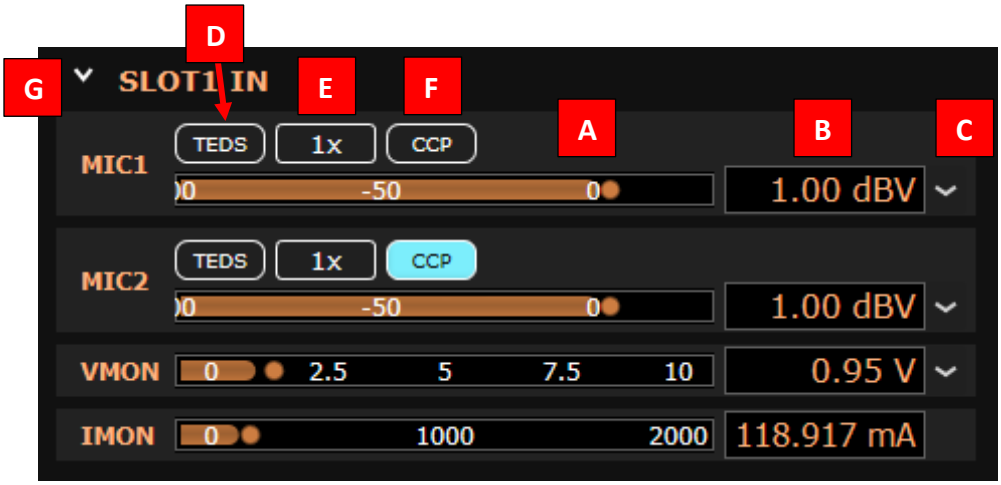


Figure 17 Input channels

TEDS

When the TEDS button is clicked, the TEDS data window will be displayed. If the attached microphone does not support TEDS, then a message “TEDS device not found” will be shown instead of the data.

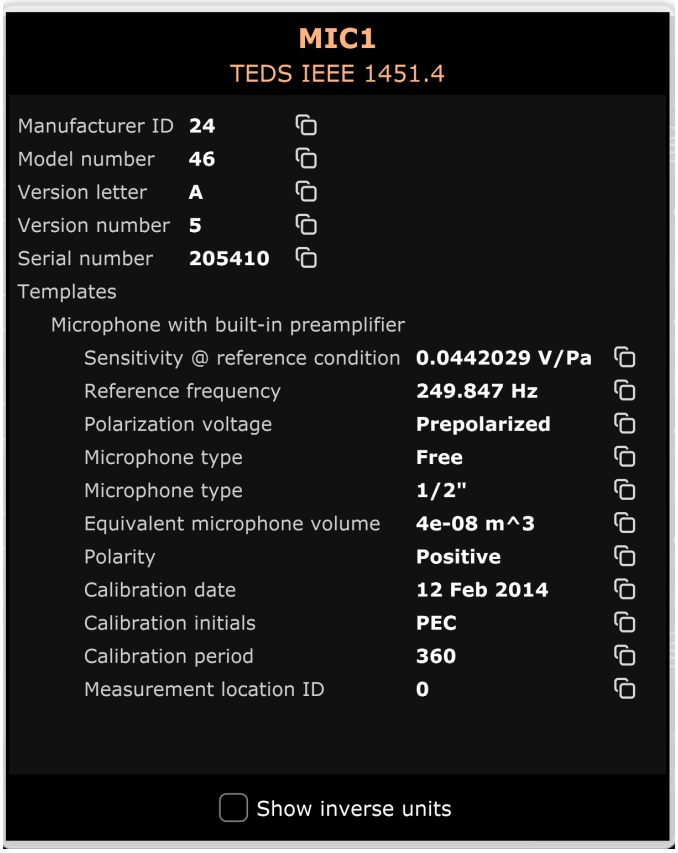


Figure 18 TEDS data window

TEDS data is not automatically transferred to the audio analysis software—it must be copied and pasted or manually entered into the appropriate field(s). Data may easily be copied by clicking the icon to the right of each line.

Sensitivity is displayed by default in units of Volt/Pascal. Some audio test software, such as Audio Precision’s APx500 Flex, requires the sensitivity data to be entered in units of Pascals/Volt (also called the “scaling factor”). Checking the “Show inverse units” checkbox at the bottom will switch the “Sensitivity @ reference condition” units to Pascals/Volt.

TDM Tab

The TDM tab is displayed if the AIO test system has an AIO-T module installed. For further details on the TDM tab settings, refer to the Digital I/O section on page 15.

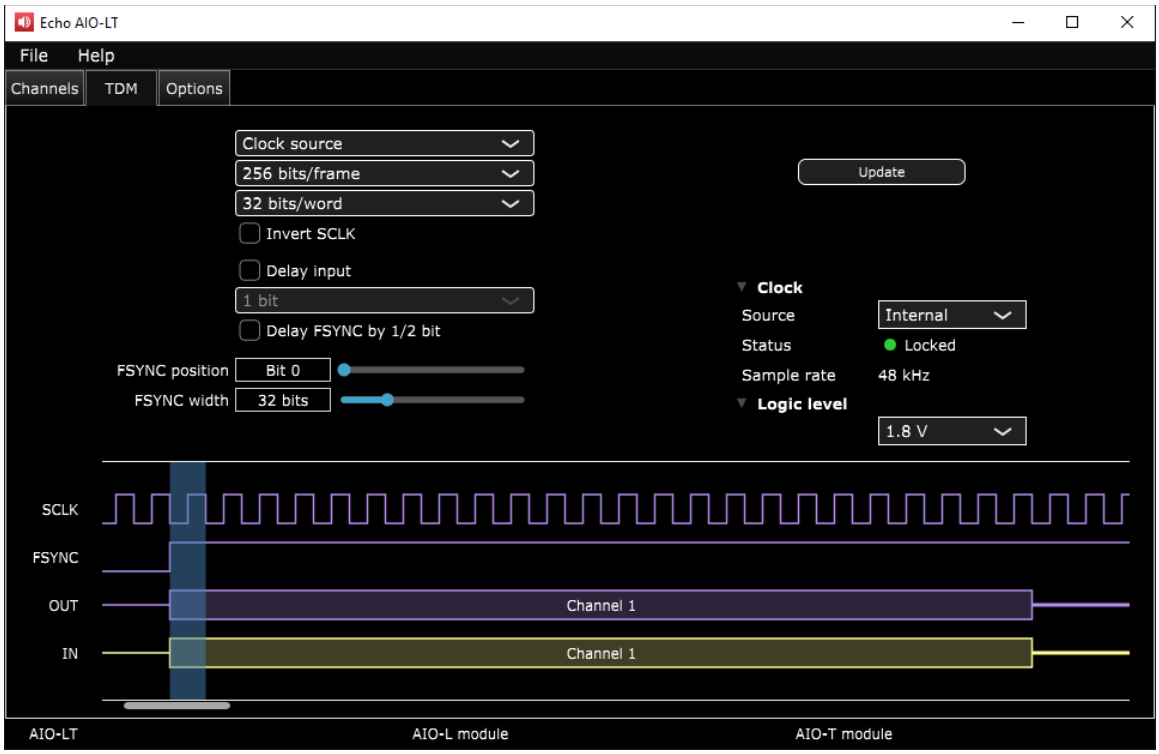


Figure 19 TDM tab

AIO-C Tab

The AIO-C tab appears if the AIO-C module is installed in the AIO test system. Its controls and indicators are described below. The module firmware revision and serial number are indicated in the lower right corner.

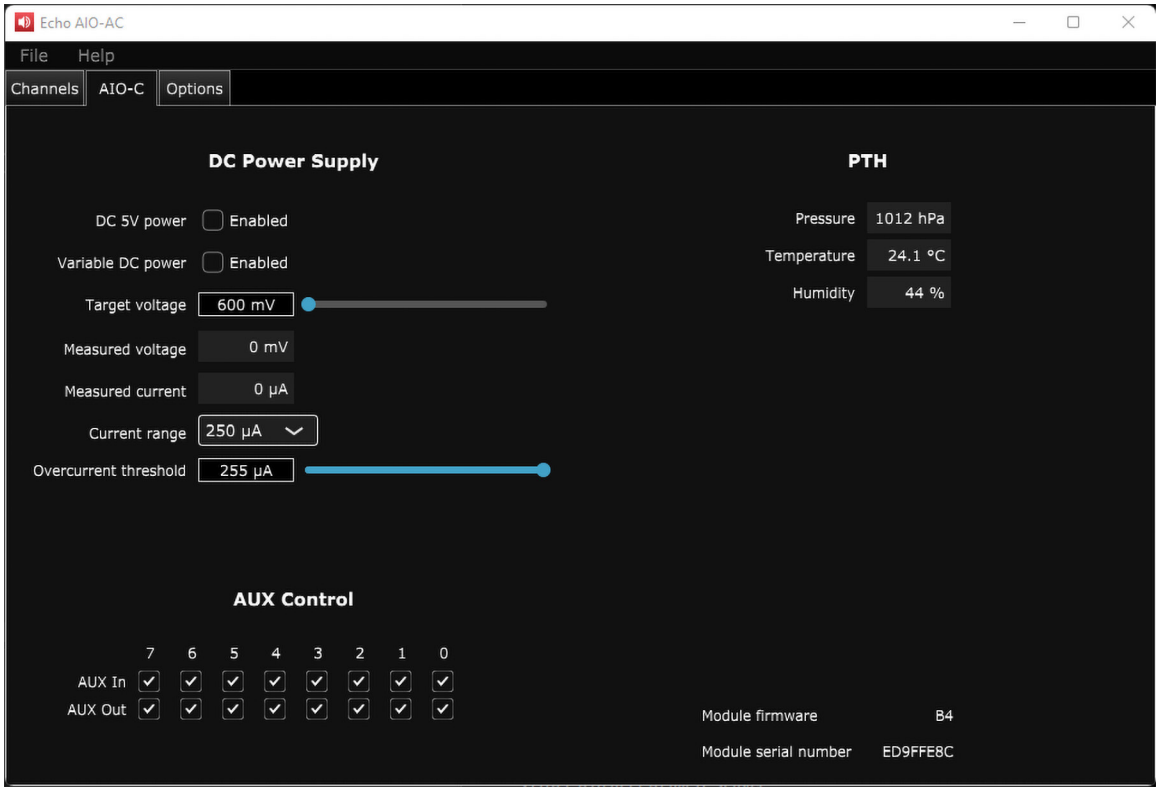


Figure 20 AIO-C tab

DC Power Supply

DC 5V power: Check the box to enable the 5 VDC power supply output.

Variable DC power: Check the box to enable the variable 5 VDC power supply/battery simulator output.

Target voltage: Type the desired output voltage level (or move the slider).

Measured voltage: Displays the voltage at the output of the variable DC power supply.

Measured current: Displays the load current being delivered by the variable DC power supply.

Current range: Sets the current range for setting the overcurrent threshold for the variable DC power supply.

Overcurrent threshold: Type the desired overcurrent threshold (or move the slider). If the threshold is exceeded, the variable DC power supply output will shut off.

Aux Control

AUX In: Indicators to show the state of the Aux In ports.

AUX Out: Controls to set the Aux Out ports to a True or False state.

PTH

Pressure, temperature, and humidity data readouts from the attached PTH sensor.

Options Tab

The Options tab contains information about the connected AIO test system and allows various configuration options to be set. Its controls and indicators are described below.

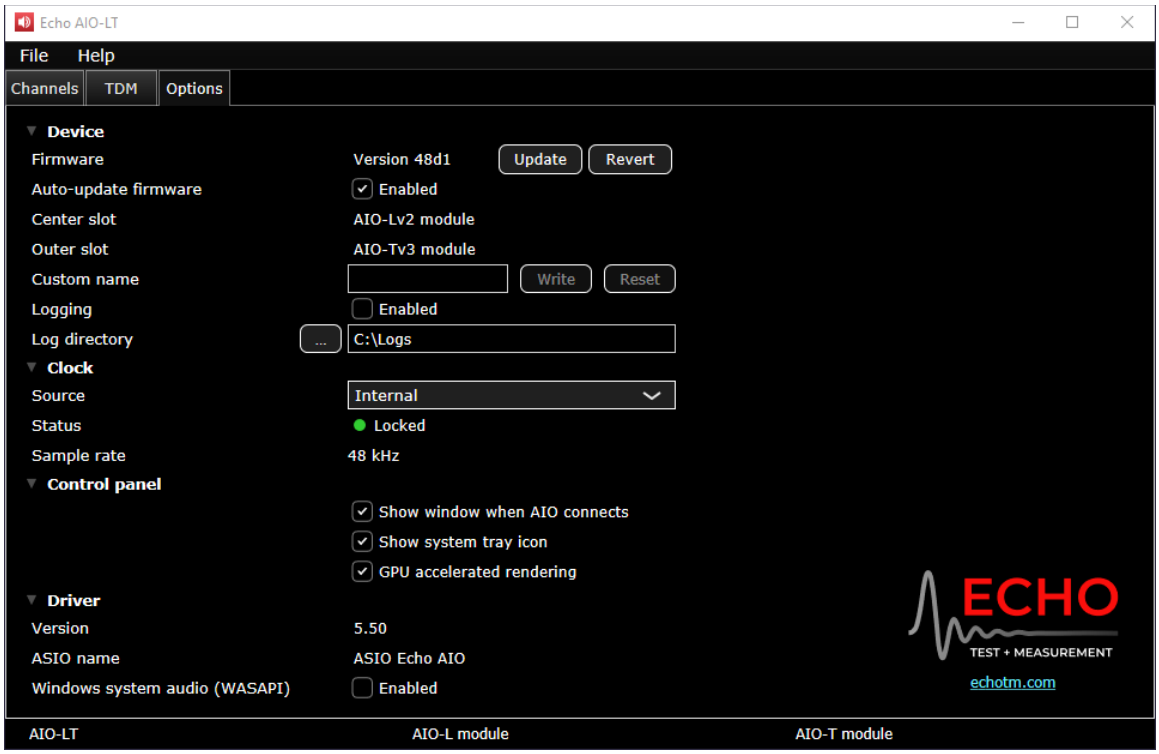


Figure 21 Options tab

Device

Firmware: Displays the current firmware version and allows you to manually update or revert to the factory supplied version.

Auto-update firmware: When checked, you will be prompted to update the firmware if the control panel includes a later version than is already installed.

Center slot: The AIO module detected in the center slot.

Outer slot: The AIO module detected in the outer slot.

Custom name: Allows you to set a custom USB device name for this AIO test system. This is primarily useful if you have multiple AIOs connected to a single computer. The device name is persistently stored in flash memory in the AIO.

Logging: Enables diagnostic logging. You typically do not need to enable logging unless requested by Echo support.

Log directory: Directory where the log file will be stored.

Clock

Source: Selects the clock source as Internal (the AIO's built-in crystal oscillator), USB (USB start-of-frame), or TDM (TDM module only).

Status: Shows if the clock source is locked (green indicator illuminated). If the clock is not locked, then the selected clock source is not valid.

Sample rate: Shows the ASIO clock rate selected in the measurement software.

Control Panel

Show window when AIO connects: Shows the control panel window when the AIO test system is connected.

Show system tray icon: Shows the control panel icon in the system tray when running.

GPU accelerated rendering: When checked, allows the GPU (graphics card) to offload from the CPU the task of redrawing of the control panel meters.

Driver

Version: Currently installed driver version.

ASIO name: Shows the name of the Echo ASIO driver as it will be displayed in the measurement software.

Windows system audio (WASPI): Enables the Windows WASAPI audio driver. Leave this unchecked unless you are running software that only supports WASAPI and does not support ASIO.

File Menu

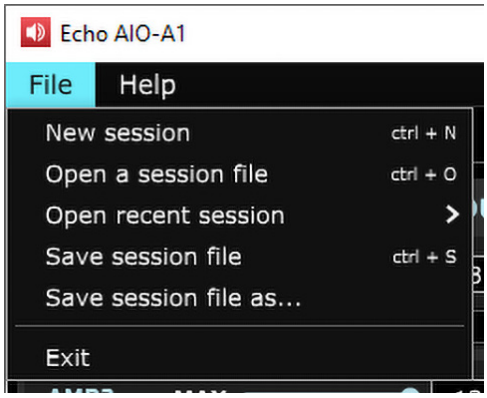


Figure 22 File menu

The File menu allows you to open and save sessions. An AIO session stores all the current hardware settings in a text file that can be used to reset the hardware to a previous state.

Additionally, the AIO command-line application can read session files, so you can fully configure the AIO, save the configuration as a session, and then later load all those settings using a single command-line call.

It is not usually necessary to directly edit the session file, as the easiest way to construct it is simply to set the control panel up as desired and then save the session. It can be, however, be easily edited in a text editor. The format is generally self-explanatory, however it is further described in the AIO Command-line Reference, which may be downloaded from the website.

Help Menu

The Help menu contains a single item: “About AIO Control Panel”. The “About” window shows the version number and build date of the currently installed control panel application.

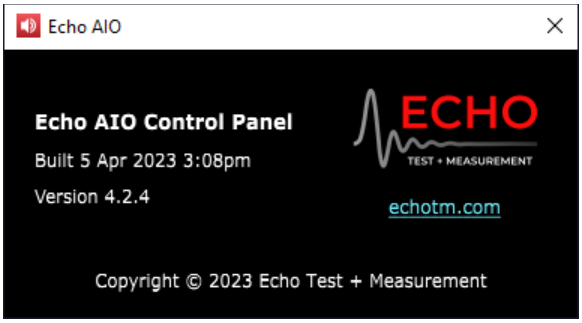


Figure 23 AIO “About” window

9. Programmatic Control

Command-line Application

The command-line application is primarily used for configuring an AIO test system from another application. This is especially useful if you want to automate setting up your AIO as part of your test sequence.

The AIO command-line app can also be used to control your AIO from the Windows command prompt or macOS terminal.

On Windows, the command-line application is installed when you install the Echo AIO Driver.

On macOS, no driver installation is necessary. Just copy the command-line application and the required EchoAIOInterface.dylib library to a folder on your hard drive.

Documentation of the command-line calls is available in a separate document, the AIO Command-line Reference, which may be downloaded from the Echo Test+Measurement website.

API

AIO includes a C library dll which makes it possible to control the AIO test system from a variety from your own code. For documentation, refer to the AIO API Reference, which may be downloaded from the Echo Test+Measurement website.

LabVIEW Driver

The AIO LabVIEW driver, which includes a package of Vis for controlling the AIO and retrieving data, is available for download from the Echo Test+Measurement website.

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10. Specifications

Data

Microphone / Line Inputs A H L S	
Input impedance:	1 MΩ
Input coupling:	AC
Input gain:	1x, 10x, and 100x
Voltage, full scale (1x gain):	8.75 Vpk (+15.8 dBV)
Voltage, maximum:	±15 Vpk
Frequency response:	±0.01 dB (10 Hz – 22 kHz) (48k SR) ±0.01 dB (10 Hz – 44 kHz (96k SR) ±1 dB (10 Hz – 86 kHz) (192k SR)
Input bandwidth (-3 dB @ 192k SR):	94 kHz
Dynamic range (20 kHz BW):	112 dB
THD+N (1x gain, 20 kHz BW):	< -105 dB (20 Hz – 20 kHz)
Noise, residual:	17 µV
IMD (SMPTE 4:1 @ full scale):	-95 dB
Crosstalk:	< -122 dB (20 Hz – 20 kHz)
Phase error:	< ±0.1° @ 20 kHz
Constant current supply:	CCP/IEPE/ICP, 4 mA
TEDS reader:	IEEE 1451.4 Class 1

Line Outputs L	
Output impedance:	102 Ω
Output coupling:	DC
Minimum load:	600 Ω
Voltage, maximum:	16 Vrms (+24 dBV) (bal) 8 Vrms (+18 dBV) (unbal)
DC offset, range:	±22.6 VDC (bal); ±11.3 VDC (unbal)
DC offset, residual:	< ±1.6 mV
Frequency response:	±0.01 dB (10 Hz – 21 kHz) (48k SR) ±0.01 dB (10 Hz – 43 kHz) (96k SR) ±1 dB (10 Hz – 75 kHz) (192k SR)
Output bandwidth (-3 dB @ 192k SR):	90 kHz
Dynamic range (20 kHz BW):	120 dB
THD+N (20 kHz BW):	< -102 dB (20 Hz – 20 kHz)
Noise, residual:	17 µV (bal), 8.5 µV (unbal)
IMD (SMPTE 4:1 @ full scale):	-101 dB
Crosstalk:	< -122 dB (20 Hz – 20 kHz)
Phase error:	< ±0.1° @ 20 kHz

Headphone Outputs H	
Output impedance:	350 mΩ
Output coupling:	DC
Load, minimum:	16 Ω
Voltage, maximum:	3 Vrms (+9.5 dBV) (≥ 32 Ω load)
Current, maximum:	125 mA
DC offset, range:	±4.24 VDC (≥ 32 Ω load) ±2.8 VDC (16 Ω load)
DC offset, residual:	< ±6 mV
Power output (20 Hz – 20 kHz, all channels driven):	281 mW @ < 0.0016% THD+N (32 Ω) 250 mW @ < 0.0019% THD+N (16 Ω)
Frequency response:	±0.01 dB (10 Hz – 21 kHz) (48k SR) ±0.01 dB (10 Hz – 43 kHz) (96k SR) ±1 dB (10 Hz – 75 kHz) (192k SR)
Output bandwidth (-3 dB @ 192k SR):	89 kHz
Dynamic range (20 kHz BW):	120 dB
Noise, residual:	2.8 µV
IMD (SMPTE 4:1):	< -82 dB (> 375 µW)
Crosstalk:	< -119 dB (20 Hz – 20 kHz)
Phase error:	< ±0.1° @ 20 kHz
Impedance measurement accuracy:	≤ 1% (20 Hz – 20 kHz)

Amplifier / Speaker Outputs A S	
Output impedance:	190 mΩ (amp), 290 mΩ (spkr)
Output coupling:	AC
Load, minimum:	4 Ω
Voltage, full scale:	9.475 Vrms (8 Ω load)
DC offset, residual:	< ±6 mV
Power output (20 Hz – 20 kHz, all channels driven):	10 W @ <0.2% THD+N (8 Ω load) 6 W @ <0.3% THD+N (4 Ω load)
Frequency response:	±0.2 dB (10 Hz – 20 kHz) (8 Ω load)
Output bandwidth (-3 dB @ 192k SR):	44 kHz
Dynamic range (20 kHz BW):	100 dB
Noise, residual:	100 µV
IMD (SMPTE 4:1):	< -53 dB (≥ 0.5 mW)
Crosstalk:	< -70 dB (20 Hz – 20 kHz)
Phase error:	< ±1.2° @ 20 kHz
Impedance measurement accuracy:	≤ 0.5% (20 Hz – 20 kHz)

TDM T	
Channels	2, 4, 8, or 10
Clock source	Internal or external
Bits per frame	64, 128, or 256
Bits per sample	24 or 32
Frame sync width	1 – 128 bits
Frame sync position	Bit 0 – 255
Sample rate	44.1k, 48k

GPIO C	
Inputs and outputs	8/8
Input level	TTL
Output type	Open drain, 250 mA max

Environmental Sensor (PTH) C	
Atmospheric pressure	260 to 1260 hPa absolute
Ambient temperature	-40 °C – 90 °C ±0.2°
Humidity	±1.5 % relative humidity

DC Power C	
Fixed DC power supply	5 VDC, 1 A max
Battery simulator, output	600mVDC – 5 VDC, 1 A max, with current measurement
Battery simulator, setting resolution	1 mV

General (all)	
Power:	90 – 264 VAC, 50/60 Hz, 60 W
Dimensions:	17.5” (44.4 cm) x 8.75” (22.2 cm) x 1.75” (4.4 cm)
Weight:	42.5 lbs (19.3 kg)

Graphs

Mic-Line Input

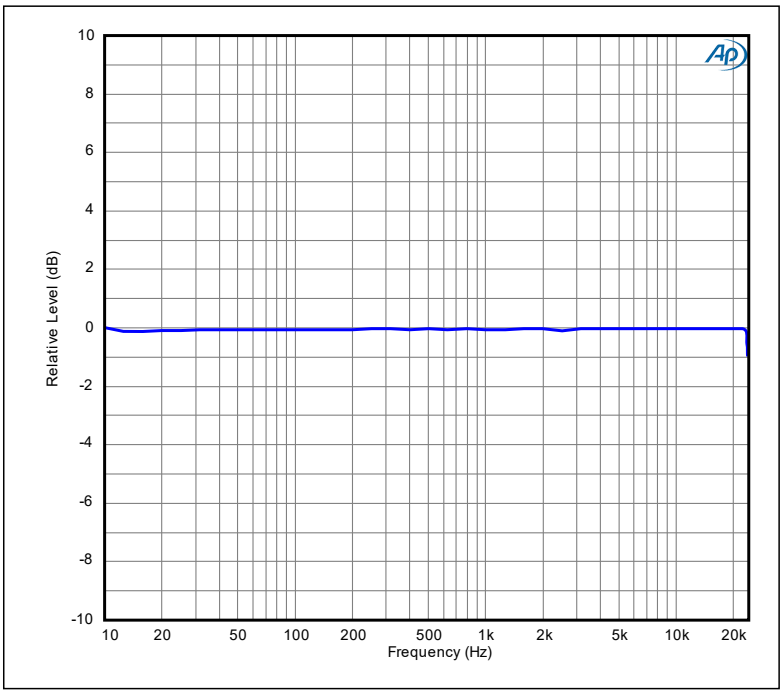

Figure 24 Frequency Response (48k SR)

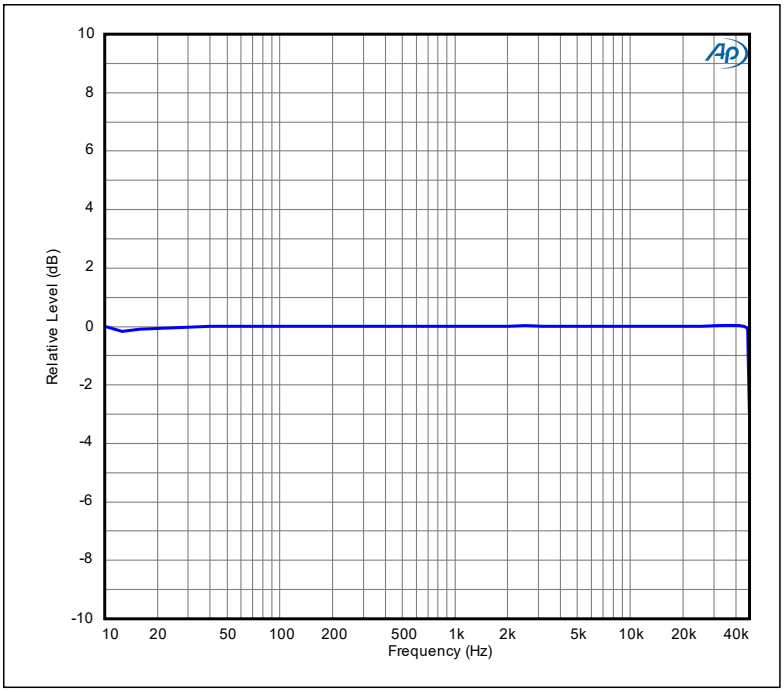

Figure 25 Frequency Response (96k SR)

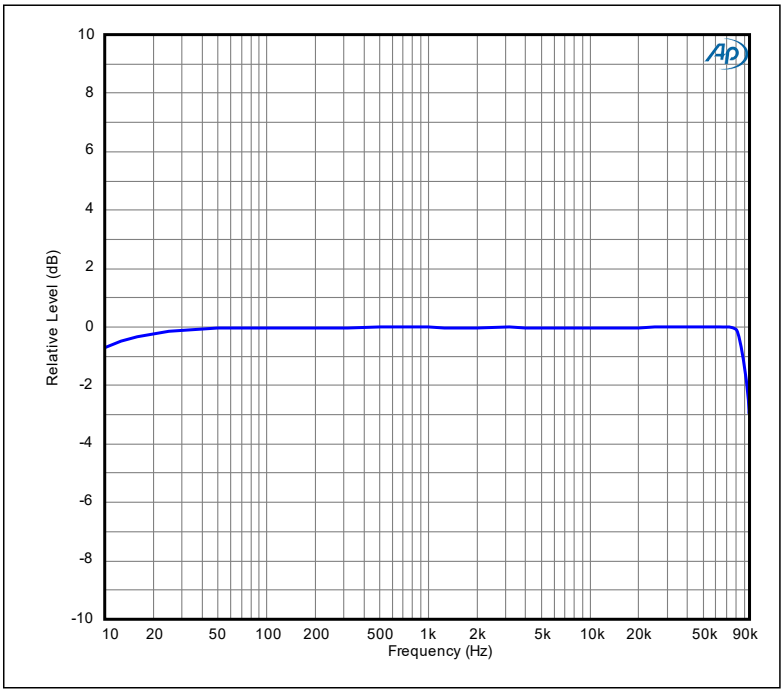

Figure 26 Frequency Response (192k SR)

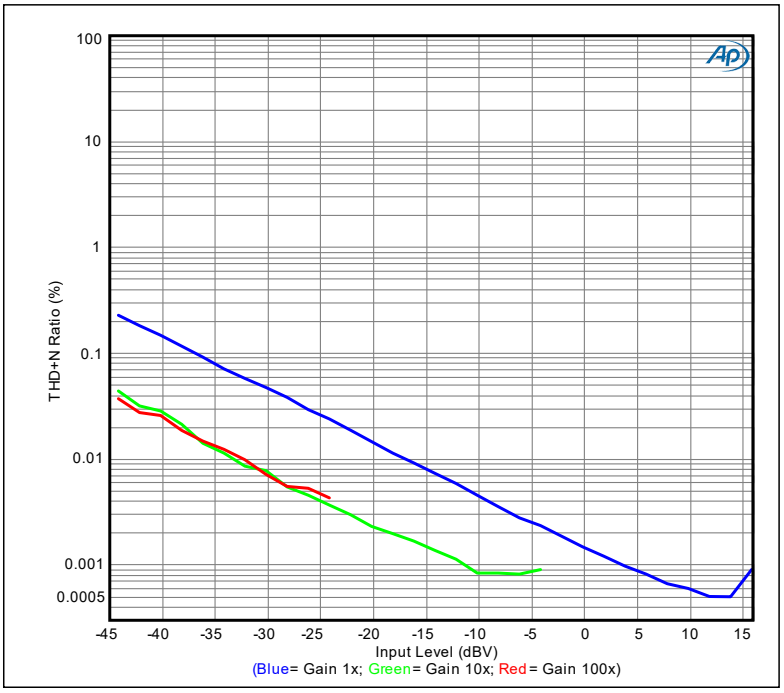

Figure 27 THD+N Ratio vs Input Level (48k SR)

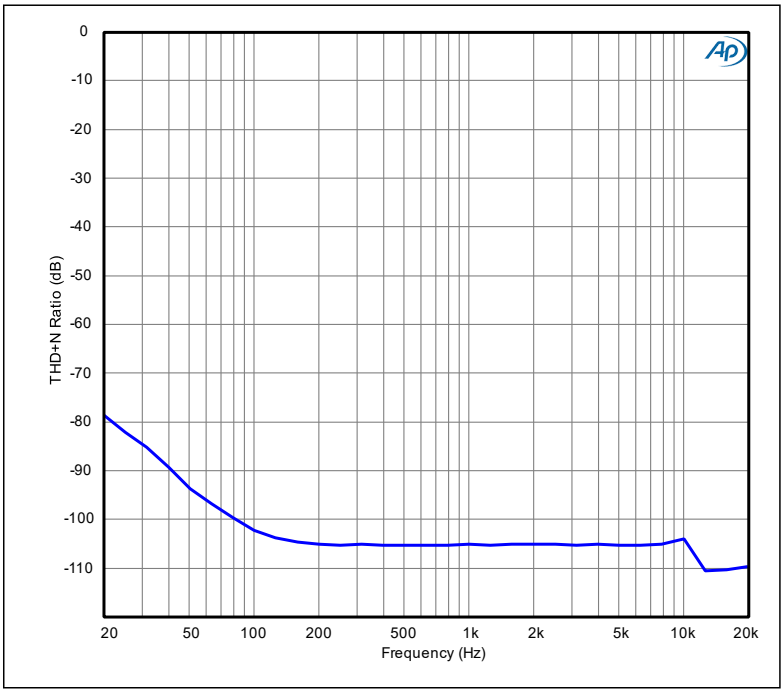

Figure 28 THD+N Ratio vs Frequency (48k SR)

Line Output

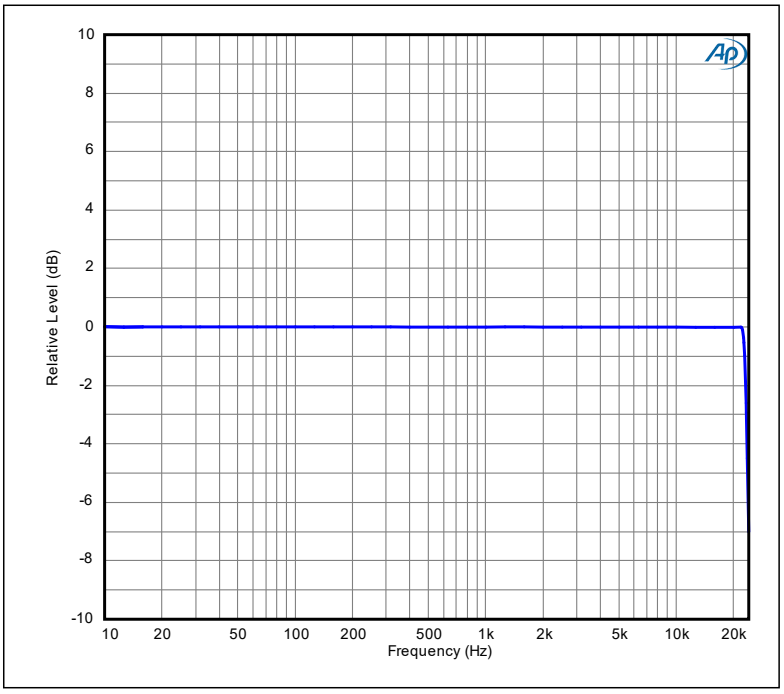

Figure 29 Frequency Response (48k SR)

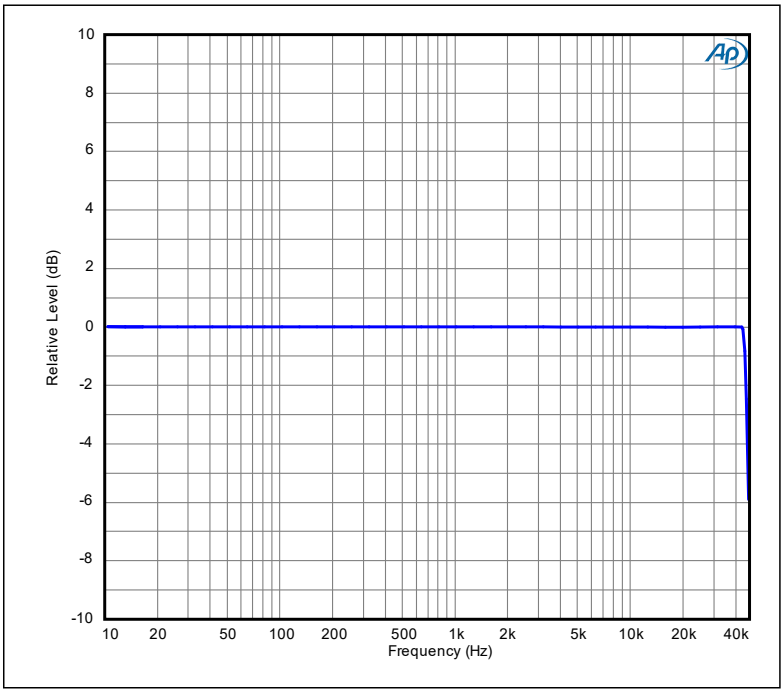

Figure 30 Frequency Response (96k SR)

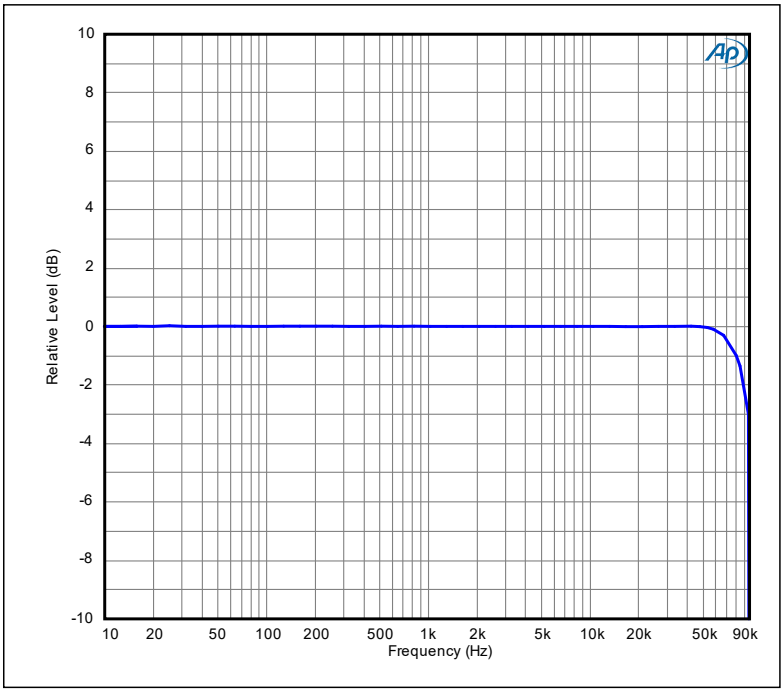

Figure 31 Frequency Response (192k SR)

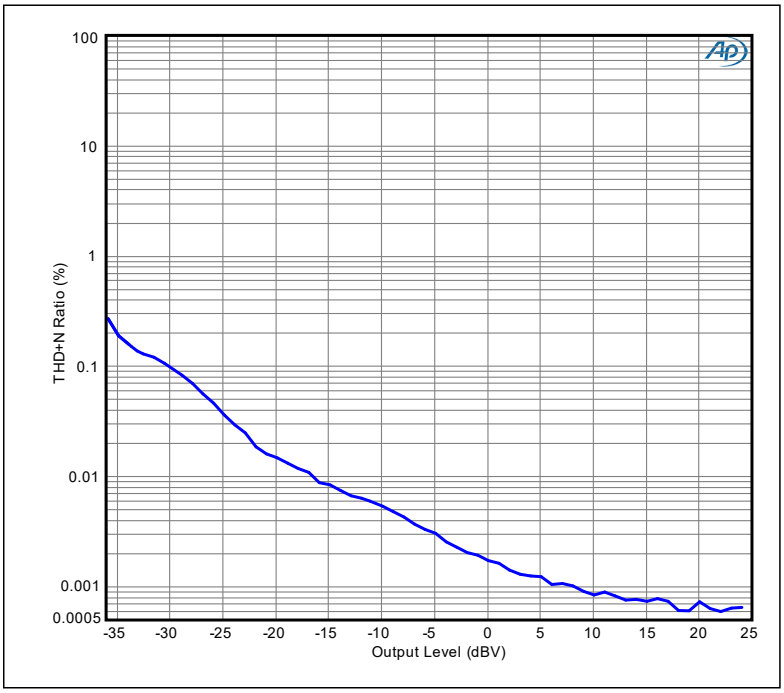

Figure 32 THD+N Ratio vs Output Level (48k SR)

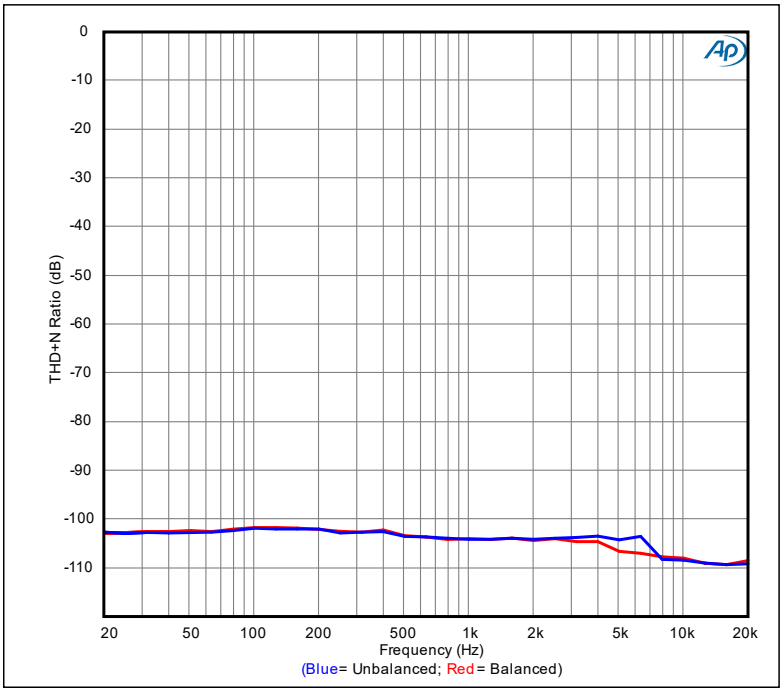

Figure 33 THD+N Ratio vs Frequency (48k SR)

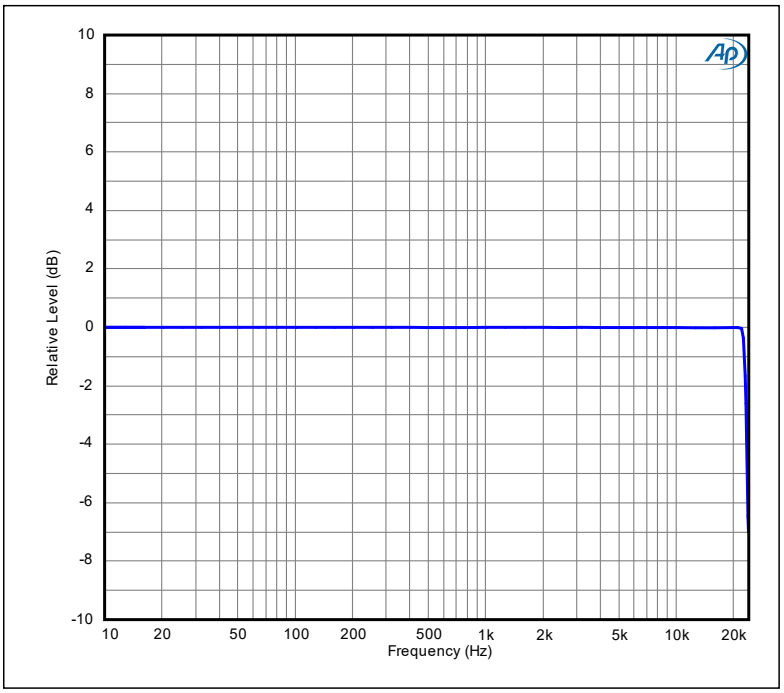

Figure 34 Frequency Response (48k SR)

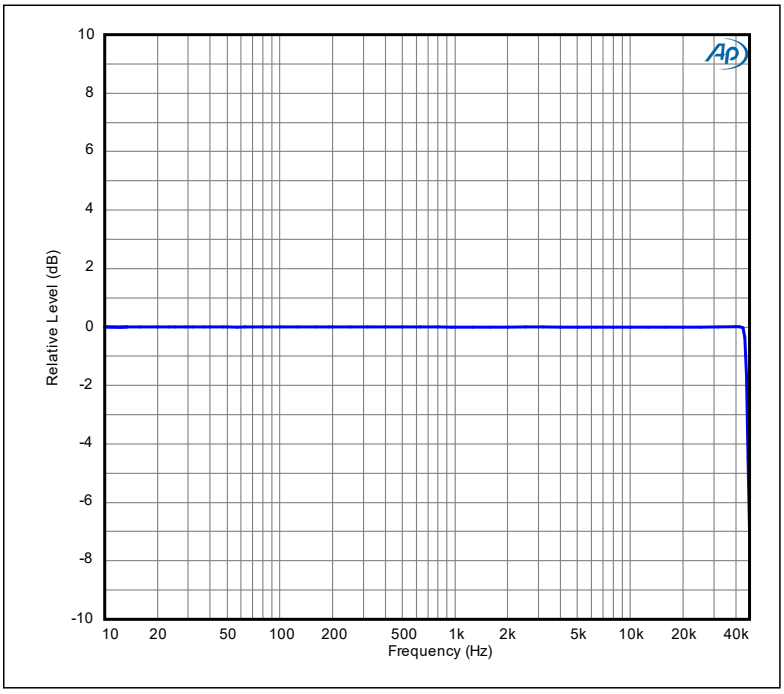

Figure 35 Frequency Response (96k SR)

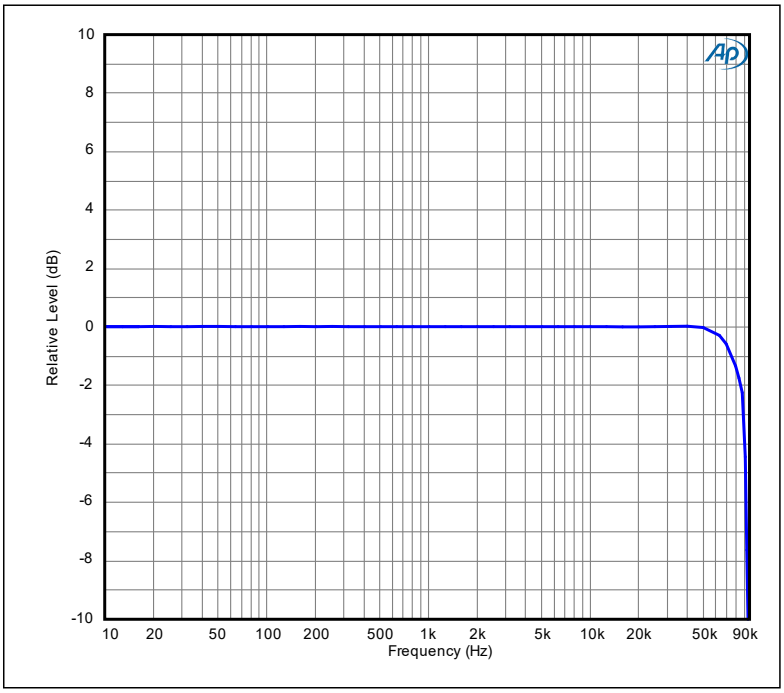

Figure 36 Frequency Response (192k SR)

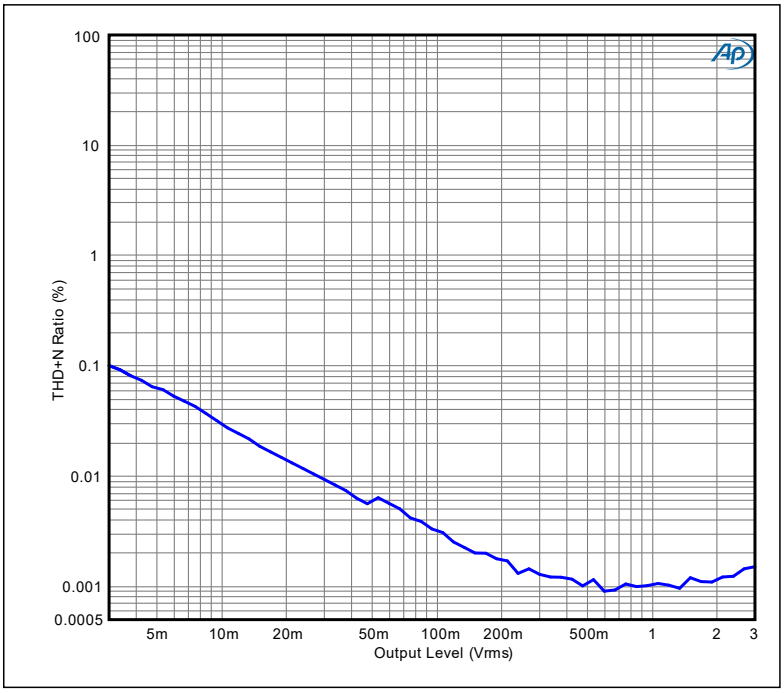

Figure 37 THD+N Ratio vs Output Level (48k SR)

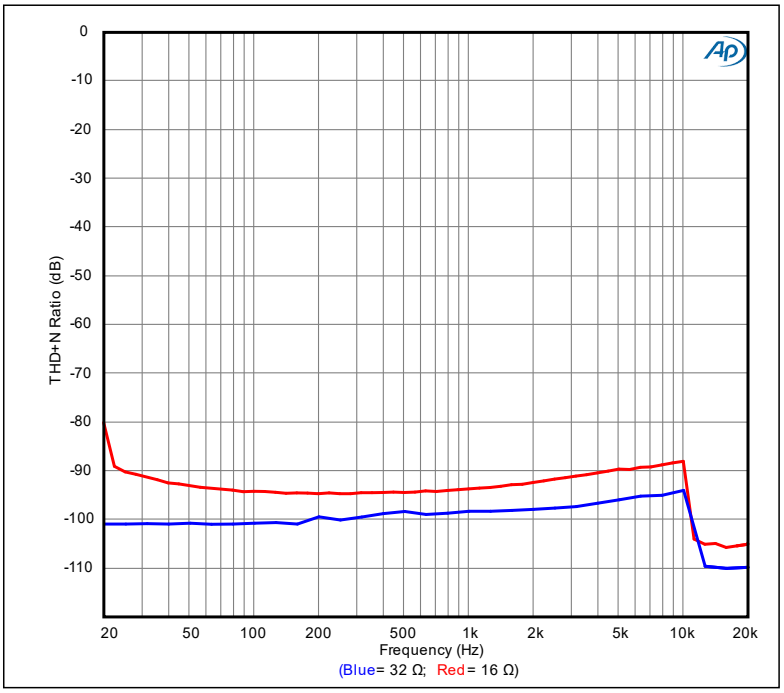

Figure 38 THD+N Ratio vs Frequency (48k SR)

Amplifier Output

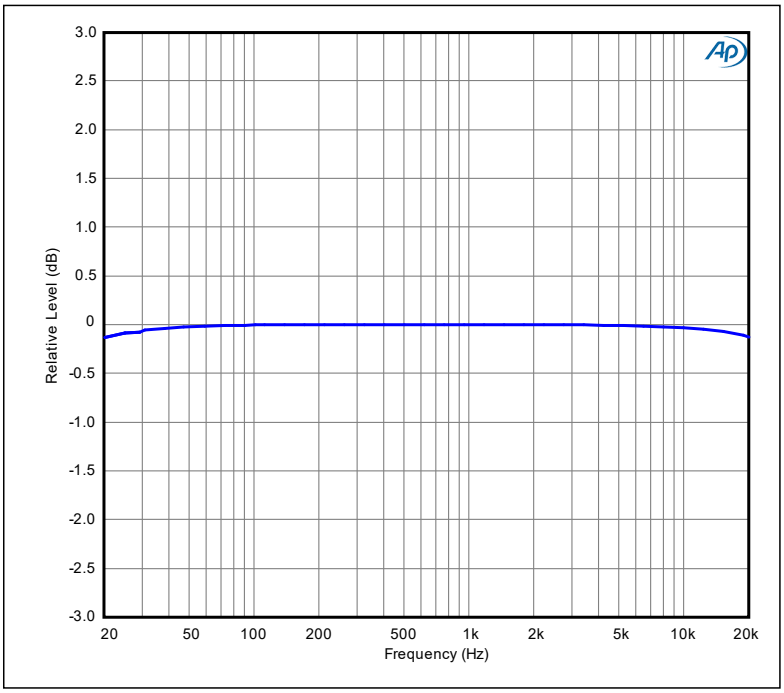

Figure 39 Frequency Response (48k SR) (8 Ω load)

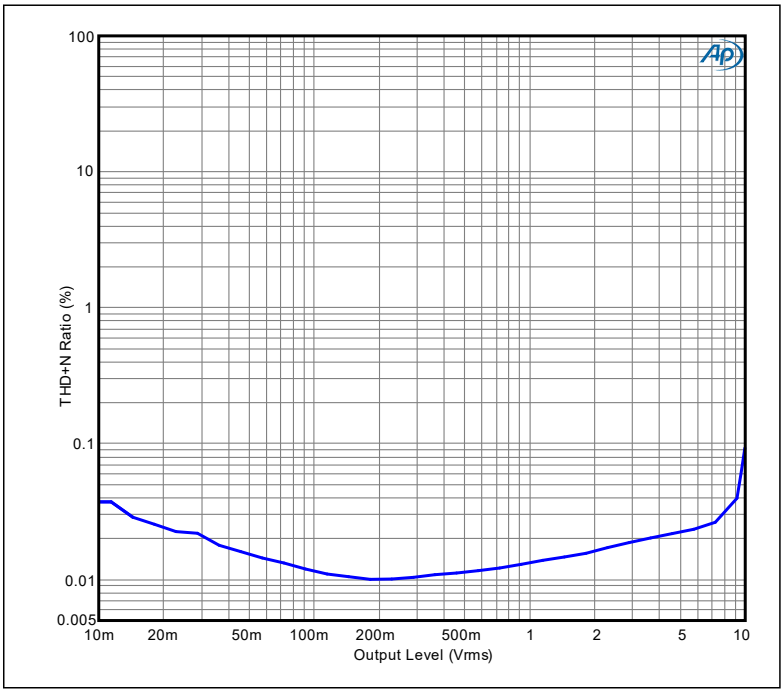

Figure 40 THD+N Ratio vs Output Level (48k SR) (8 Ω load)