# iAudioInterface
# User Guide

# STUDIO SIX DIGITAL LLC

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# Quick Start

iAudioInterface is a combination audio line input, line output, headphone amp, and microphone input device for iPod touch.

## Hardware Requirements

iAudioInterface is designed to work with any model iPod touch running OS 3.0 or later. If you plug it into an iPhone, you will get a message asking you to turn on airplane mode. If you do continue to use iAudioInterface with an iPhone, we recommend that you use airplane mode to reduce audio interference.

## Installation and Setup

To install iAudioInterface, plug it into the dock connector of any model iPod touch. Make sure that you hear both latches click so that you know you have a firm connection. Some third-party plastic outer cases have smaller openings for dock connector cables, so make sure that the case does not interfere with the iAudioInterface connector, and that the connector is making solid contact with the dock connector.

After plugging iAudioInterface in, allow 3 seconds for the accessory to become active before starting AudioTools, or it may not be available.

Note that it is possible for the iPod touch to find the accessory, but not be fully functional if the connector is not fully seated.

## App Installation

If you do not have the AudioTools app installed, when you connect iAudioInterface to your device a prompt will appear, and you will be asked if you want to install AudioTools. This behavior is normal and is a feature of the iPod touch platform OS. Although AudioTools is not required to use iAudioInterface, it is recommended.

## Calibration

You can use iAudioInterface right out of the box, but for more accurate results see our calibration section below for information on how to calibrate your iAudioInterface.

## *Default Configuration*

As shipped, iAudioInterface is in the following configuration, which is used in apps other than AudioTools:

- Mono Line Input, microphone input enabled
- Line input gain range -70dBu to +8dBu
- Stereo (headphone) output
- Output level control enabled

These settings can be changed in the AudioTools app, see below for more information.

# Block Diagram

**iAudioInterface Block Diagram**

from iPod Line Outputs

Output Level Control

Line Input Gain Select

Right Input

Input Source Select

Output Level Control Enable

to iPod Line Inputs

Left Input

Balanced / Stereo Output Select

Right Output

Line Output

Left Output

Mic Gain Select

Mic Input

Balanced / Mic Input Select

Line Input
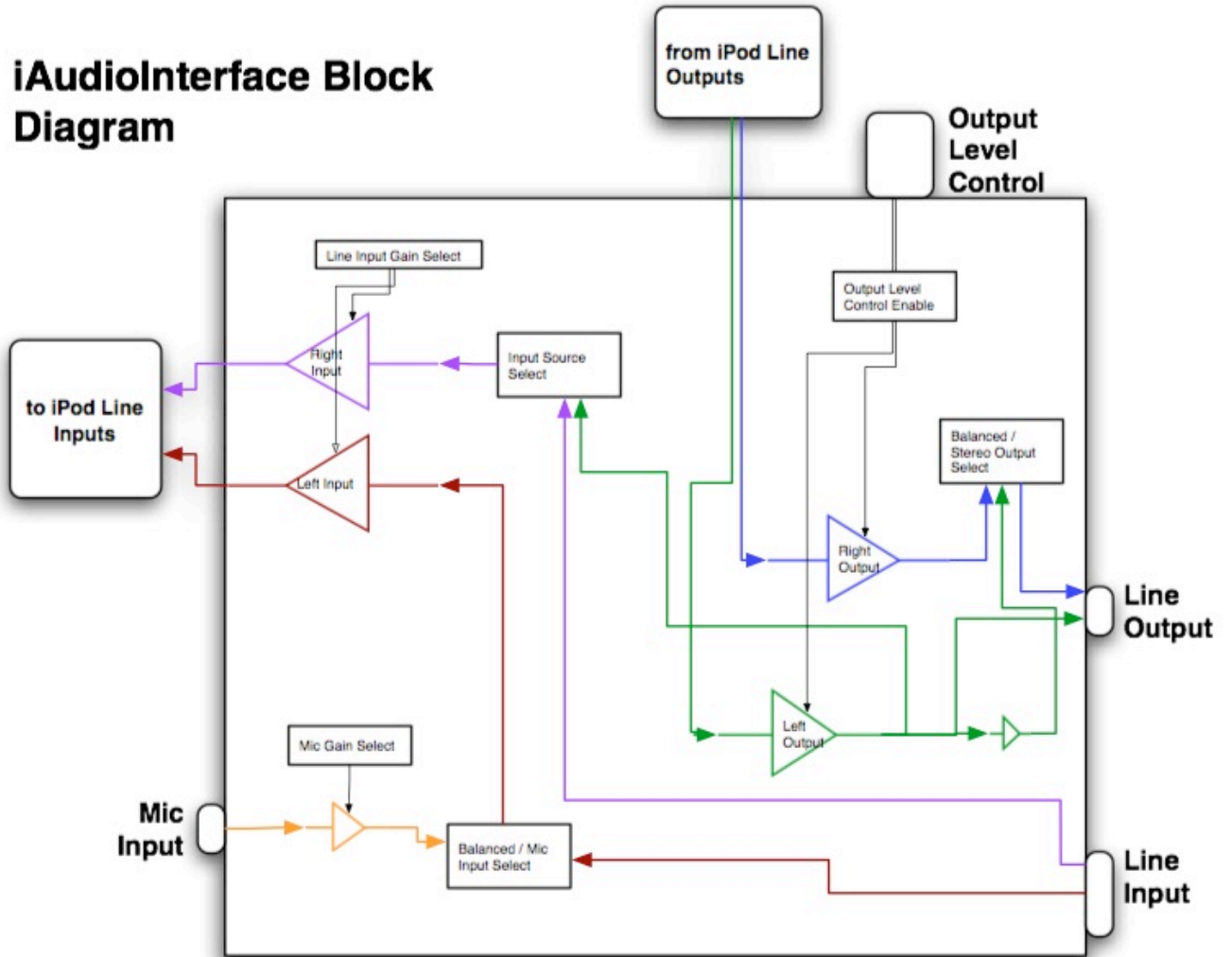
**Legend**

Right Output Signal

Left Output Signal

Right Input Signal

Left Output Signal

Microphone Signal

Control Signals

# Connections



## *Configurations*

iAudioInterface may be setup in a number of ways depending on your needs. The input and output can be mono or stereo, the output level control can be enabled or disabled, and there are several available gain ranges for the inputs. It is also possible to internally connect the right input to the line output, in order to monitor the output level directly.

While you are running AudioTools, all of these settings are controlled to set up iAudioInterface appropriately for the function or test that AudioTools is currently running.

When you are using iAudioInterface with another app, you can still control its configuration.

To select the settings that you want to be in effect when you are using iAudioInterface with another app, start AudioTools and go to the Settings->Configuration screen. When you exit AudioTools, these settings will be stored in non-volatile memory in iAudioInterface, so even if you unplug it or power down your iPod touch, the settings will be available when you next use iAudioInterface.

Note that the every time you exit AudioTools, iAudioInterface will be set to the configuration stored on the General->Configuration screen.

## *Line Input*

The line input connector is a ¼" TRS connector, which may be setup as a stereo unbalanced line input, or a mono balanced line input capable of handling -90dBu to +40dBu in three ranges. **Make sure that you first select the correct input range before connecting a high-level input to this connector.**

This input is configured as a mono balanced line input by default. In AudioTools it is possible to switch this connector to a stereo unbalanced connector. In stereo mode, the microphone input is disabled. To set this mode, go to the Settings->Configuration page, and enable stereo or mono input.

The line input supports three ranges, -90 dBu to -10dBu, -70dBu to +8 dBu, and -35 dBu to +40 dBu. These input ranges are available whether or not you are in stereo mode.

## Line Output

The output connector is configured as a stereo headphone jack by default. For example, if you play music from your device, you will hear the music in stereo.

When the AudioTools app is running, in most situations, the output connector is configured as a true balanced line output. The maximum output level is approximately +12 dBu in balanced mode.

## Output Level Control

The level control may be used to set the output level in either mode, headphone output or line output.

The output level control is enabled by default, but AudioTools will enable it during use for most functions. Some functions will disable it to get repeatable readings.

You can control whether or not the level control is enabled once you leave AudioTools by setting a preference on the Settings Menu->Configuration page.

## Clip Indicators

iAudioInterface will normally indicate clipping (level greater than the input is capable of measuring correctly) by a red "clipping" indicator on the screen. In some cases where the input level is much greater than the current level range, the clipping indicator may not be seen. If you are using auto-ranging, iAudioInterface will always select the best range for the measurement.



## Microphone

The microphone connector should only be used with the supplied iAudioInterface microphone. You may connect the microphone directly to the chassis, or connect it remotely it from the chassis using a shielded, balanced ¼" male to female cable. We recommend not exceeding 25', but longer runs

may be possible with some loss of high-frequency content, and the possibility of picking up some noise, depending on the environmental conditions.

The microphone supports two ranges, 30 dB to 100 dB SPL, and 50 dB to 130 dB SPL.

## USB

The USB mini-jack allows you to charge the attached iPod touch, and sync the device to iTunes. You can also use any standard USB power supply or battery to obtain longer run times than the internal iPod touch battery may allow.

## Dock connector cable

The dock connector cable is used to attach iAudioInterface to your device. Connect it only to an iPod touch. The cable should be connected to the device before starting AudioTools. Never use any dock-extender cable, as these are not approved by Apple .

## Power Options

iAudioInterface is always powered directly from your iPod touch. Since it uses less than 100ma under all situations, and often much less, it will not significantly effect battery life. When not in active use, which is any time that you are not in AudioTools or otherwise using the audio inputs and outputs, power consumption is minimal and will not reduce battery life of your device.

To get longer battery life, you can connect any source of USB power to the USB mini jack on iAudioInterface. This can be from a computer, a USB AC power adapter, or one of the available USB battery power sources. The USB power is routed directly to the iPod touch, which in turn powers iAudioInterface.

By connecting external power to the USB mini jack on iAudioInterface, you can extend the run time of the device to match your needs.

# AudioTools App

iAudioInterface is designed to work with the Studio Six Digital app "AudioTools", which is available for download on the iTunes app store. When used with AudioTools, all of the features of iAudioInterface, such as multiple gain ranges and output configuration, are available. When used with any other app, iAudioInterface operates in the configuration specified on the Settings->Configuration Settings screen of AudioTools.

This manual will not cover the AudioTools app in detail, but it will discuss ways in which AudioTools interacts with iAudioInterface.

## *iAudioInterface Modules*

When iAudioInterface is connected to an iPod touch running AudioTools, additional modules become available. Some of these modules are available as optional in-app purchases.

## *Acoustic Analysis and SPL Functions*

These functions use the input source selected and gain range settings on the Settings menu, Microphone Setup module. The currently active input source is always shown on the screen. You may see labels like "`iAI Mic Low Range`" or "`iAI Line Mid Range`".

## *Line Level Functions*

These functions are available from the Line Level menu.

### Level Meter

Level meter can measure the level on the mono balanced line input connector, or the level that is present on the balanced line output connector. The switch in the upper right corner selects the source of the measurement.

You can select the input gain range, or allow iAudioInterface to auto-range. You can also select the units that you would like to see the results in.

The bottom part of the screen controls the output. You can turn on the generator, select the desired waveform, and for sine and square waves, the frequency. If you need more specialized signals, see the Generator function on the Utility menu.

## THD+n

You can measure Total Harmonic Distortion + noise (THD+n) with iAudioInterface. To do this, the app will generate one of several octave-band sine waves, which are routed to the device under test (DUT). The output of the DUT is then routed back to line input of iAudioInterface.

To measure the lowest possible distortion, the output level must be set close to the upper range of the middle line input range, 8 dBu. Make sure that you keep the input level as close as possible to this level when you route the signal through an external device.

If you are generating a signal yourself, make sure it is exactly the frequency that THD+n is set to, and that the level is as close as possible to +8dBu, as shown on the input level meter.

The app then subtracts the fundamental sine wave, and the resulting signal is compared to the full input signal. The result is the THD+n.

For best results, and to measure the lowest possible THD+n, use the middle line input range if possible. You may select the other ranges, but the minimum distortion that you can measure will be greater than can be read using the middle level.

## Impedance Meter and Impedance Sweep

To measure impedance, you need a special cable. This cable is a ¼" TRS cable with the tip and ring brought out to test leads, and the ground not connected (open). **You must use only this cable configuration with the impedance test functions.** This cable is plugged into the line output connector. The test leads are then connected across the load, and the generator is turned on. The app then computes the impedance of the load and displays the equivalent wattage for the selected voltage source.

The output of iAudioInterface is fixed in impedance testing. Before you set up for impedance testing you must calibrate the impedance test. To do this, go to the impedance setup function, which you can reach from either impedance test by tapping the wrench icon or pressing Setup.

Now turn on the generator, and clip the impedance test lead together (0 ohms). Wait 10 seconds for the reading to stabilize, and tap the Minimum button.

Next, leaving the generator running, disconnect the clip leads (maximum resistance), wait 10 seconds for the reading to stabilize, and tap the Maximum button. Calibration is now complete and you may use the function.

# Calibration

Since the calibration values are stored in your device (iPod touch), you must calibrate iAudioInterface to any device to which it is attached. Although you can use iAudioInterface without calibrating it, you will get the most accurate results if you calibrate it.

There are two levels of calibration that you can do. The first level is to enter the calibration values included with iAudioInterface into the calibration screens of AudioTools, and the next level is to trim your iPod touch using a piece of external equipment, to get the most accurate possible results.

You can also manually calibrate each input and output, if you have access to a variety of test and calibration equipment. This will provide slightly more accurate results.

We also provide factory calibration service of your complete setup. This service requires that you send us your iPod touch along with iAudioInterface so that we can do the calibration of the complete system. You will receive a calibration certificate from us along with a copy of the calibration values for your device. See our website for the cost for this service and for more details.

## *Basic Calibration*

To get accurate results from your iAudioInterface, you should enter the calibration values from your Calibration Card into AudioTools, for each device with which you plan to use AudioTools. These values are generic, in that they can be used with any model of iPod touch.

### Microphone Calibration

Connect iAudioInterface to your device, and start the AudioTools app. Now go to the Settings menu, Microphone Setup function. The Input Sources screen appears.

Select the iAI Mic, by tapping the blue disclosure triangle. (The other selections apply to other microphone calibrations that you may wish to store).

Select Low Range (darker). Enter the "**Microphone Low Range Trim Value**" from the Calibration Card into the Trim field, by tapping the field. Tap Done when complete.

Now select High Range (darker). Enter the "**Microphone High Range Trim Value**" from the Calibration Card into the Trim field, by tapping the field. Tap Done when complete.

### Line Input Calibration

Connect iAudioInterface to your device, and start the AudioTools app. Now go to the Settings menu, Line Input Setup function.

Select Low Range (darker). Enter the "**Line Input Low Range Trim Value**" into the Trim field, by tapping the field. Tap Done when complete.

Select Mid Range (darker). Enter the "**Line Input Mid Range Trim Value**" from the Calibration Card into the Trim field, by tapping the field. Tap Done when complete.

Select High Range (darker). Enter the "**Line Input High Range Trim Value**" from the Calibration Card into the Trim field, by tapping the field. Tap Done when complete.

### Line Output Calibration

Connect iAudioInterface to your device, and start the AudioTools app. Now go to the Settings menu, Line Output Setup function.

Enter the "**Line Output Trim Value**" from the Calibration Card into the Trim field, by tapping the field. Tap Done when complete.

If you wish, you can also define a reference level. For example, if you wish to define 0.0 dBu as your reference level, turn on the Generator Output, and turn on Set Reference Level. Now, adjust the slider until your reference level appears in the Output Level dBu field. This level is now stored, and can be activated on the Line Input menu, Level function, by turning on the Output Reference Level switch.

## *Advanced Calibration*

Each iPod touch has a slightly different input sensitivity and output gain. To get the most accurate results, you should enter an overall trim value, which will be added to all of the calibration values. To obtain the value for your device, you will need one of the following:

- Microphone calibrator
- Calibrated RMS dB or voltage level meter
- Calibrated generator

Depending on which item you have, follow these instructions.

### Microphone Calibrator

Connect the microphone calibrator to the supplied microphone. Go to the Settings menu, Microphone Setup function to bring up the Input Source screen. Select iAI Mic by tapping the blue disclosure triangle.

Normally you will select Low Range, when using a typical 94dB calibrator.

Now turn on the calibrator, and adjust the iPod Trim field until the dB reading shows the output level of your calibrator.

Exit the function and you are done. The calibration trim value is added to all other calibration values.

### Calibrated Level Meter

Connect the calibrated level meter to the line output, and go to the Line Output Setup function on the Settings menu.

Turn on the generator, and read the level on the level meter. Adjust the iPod Trim field until the reading on the level meter matches the dB reading on the screen. Make sure that your meter is set to read dBu, and that it can handle +12 dBu.

Exit the function and you are done. The calibration trim value is applied to all factors.

## Manual Calibration

To manually calibrate any field, connect a reference source, tap the dB field, and enter the source level.

## Typical iPhone and iPod touch Trim Levels

We have found that there are typical values for iPod trim levels that seem to be consistent between devices. Please realize that this may not be true for your model, but it may be worth using these figures if you do not have access to any other method of calibration.

Although iAudioInterface is not intended to be used with an iPhone, we have included iPhone calibration numbers as a courtesy for any users who decide to use an iPhone with this device.

Enter this value on any iPhone / iPod Trim dB field, for example on the Settings menu, Line Input Setup page.

| | | |
|---|---|---|
| iPhone | (first generation) | 3.80 dB |
| iPhone 3G | | 3.80 dB |
| iPhone 3Gs | | 1.15 dB |
| iPod touch | (first generation) | 0.00 dB |
| iPod touch | (second generation) | 0.00 dB |
| iPod touch | (third generation) | 0.00 dB |

## Using Your Own Microphone

You can use your own microphone, as long as you can supply a signal to the line input of iAudioInterface. You may need your own phantom power supply, or microphone preamp. To calibrate your microphone, you will need a microphone calibrator.

Attach the microphone calibrator to your microphone, and connect your microphone preamp output to iAudioInterface line input. Select the Microphone Setup function on the Settings menu. The Input Sources page will appear.

AudioTools supports storing multiple calibration settings, so that you can easily switch between several mics.

Initially, there is one external mic setting, labeled 'iAI Line Input". You can use this field for your first external microphone. To add another calibration setting, tap the "+" button.

For any calibration setting, tap the blue disclosure triangle to bring up the settings page.

Turn on the microphone calibrator, and tap the dB field. Now enter the value of the calibrated level that your calibrator produces. Tap Done and you are finished. You may also rename the microphone, or enter a description for the mic. Tap the "Input Source" button to return to the list of stored calibrations.

From any acoustic function, the setup page for that function will show a button labeled "Input Source" or just "Input". Tapping this button will bring up the Input Source screen. You can tap any cell to select the stored gain settings for that source, and you can also select the gain range.

Note that if your external preamp has a gain control, you must always set it to the position that you used when you originally calibrated that mic.

# Specifications

## *Microphone*

+30 dB SPL to +130 dB SPL, +/- 3dB typical.

## *Line Input*

Noise floor to clipping, -90 dBu to +40 dBu.
Frequency response 20-20kHz +0.0 -0.10.
Distortion (lowest THD+n that can be read) 0.007%.

## *Line Output*

Maximum +12 dBu.
0.009% THD+n at +8.00 dBu output level.

## *Headphone Amplifier*

Suitable for driving 150 ohm headphones.

# Support

See our website for the most up-to-date information about our products.

www.studiosixdigital.com

support@studiosixdigital.com

# Warranty

Studio Six Digital LLC (Manufacturer) warrants the Products, so far as the same are of its own manufacture, against defects in material and workmanship under the normal use and service for which they were designed, for a period of one (1) year after date of shipment. Manufacturer's obligation under this warranty being limited, at its option, however, to the replacement or repair of a part or parts determined by it to be defective. All necessary packing and transportation costs for return of the goods to be paid by sender. The Products must be returned in appropriate packaging, comparable to that used in the original package by Manufacturer. All replacement or required goods will be returned to sender by like means at Manufacturer's expense.  Manufacturer shall under no circumstances be liable for any special, indirect or consequential damages owing to failure of the Products. MANUFACTURER MAKES NO WARRANTY OF FITNESS OR MERCHANTABILITY AND NO OTHER WARRANTY, ORAL OR WRITTEN, EXPRESS OR IMPLIED, EXCEPT AS SPECIFICALLY SET FORTH HEREIN.

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