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Introduction

AmpConnect ISC™ makes loudspeaker and microphone testing simpler AND more cost-effective. It replaces a sound card, an impedance box, amplifier, microphone power supply and digital I/O card with one simple USB controlled piece of hardware. AmpConnect ISC provides all the necessary calibration, voltage, & current signals to perform acoustic and electronic tests such as frequency response, sensitivity, distortion, and impedance. It can also drive sound sources (e.g. mouth simulators) for testing microphones. This reduces operator error as multiple hardware items are replaced by a single rugged, rack mountable unit. The only connections required are a USB cable to the computer and cables to your device under test and test microphone. AmpConnect ISC is fully controllable via SoundCheck which means that adjustments of parameters such as gain can be included in test sequences. AmpConnect ISC is easy to calibrate, easy to setup and is more immune to noise due to minimized connections. AmpConnect ISC can route/select all test signals, and contains an integral power amplifier to drive the device under test (or mouth simulator). Two selectable internal reference resistances to measure device impedance offer much simpler impedance measurements than conventional methods. No additional external equipment is required to realize a complete acoustic test platform for a wide range of devices – simply connect your device to AmpConnect ISC and SoundCheck, and start testing.

Control

AmpConnect ISC can be controlled either using the switches on the front-panel, or remotely via a USB connected PC. This makes it equally suitable for use as a standalone device (e.g., in a lab or during production line setup), or with a PC on a production line. An eight-bit digital I/O port provides digital control and/or status monitoring of external devices for operator feedback, test fixture control, etc.

Connection

AmpConnect ISC™ features an Internal Sound Card and requires only a USB cable to interface with SoundCheck.

Two user-selectable inputs enable 2 measurements to be made simultaneously. In the case of a loudspeaker test, this may be an acoustic signal and an electrical signal such as impedance, or for headphones two acoustical signals simultaneously. In the case of a microphone test a reference microphone may be measured at the same time as the microphone under test for comparison purposes.

Two sets of output connections for the devices under test, either of which can be selected as the active output, permit one test to be performed while simultaneously setting up a test on the other output to increase production line testing throughput. A headphone output on the front may be used for testing headphones or monitoring input signals.

Two separate inputs allow the output from an external electrical test signal (typically the output of a measurement microphone) to be routed through and selected by AmpConnect ISC and communicated to SoundCheck. This frees the operator from having to handle external signal switching during testing. Both inputs provide voltage and IEPE bias, supporting transducers requiring either type of powering. The bias can be removed to allow direct connection to a microphone power supply or preamplifier.

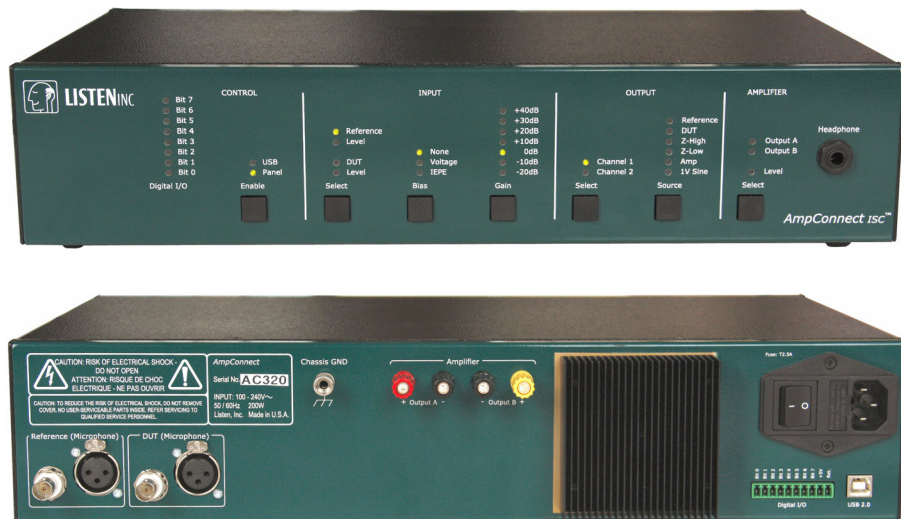
The amplitude of signals can be adjusted for maximum dynamic range without the need for external amplifiers or attenuators. Both the reference input signal and the signal from the device under test, can be attenuated by 10 or 20 dB, or amplified by 0, 10, 20, 30, or 40 dB before being output to SoundCheck.

Simplicity and ease of use has been carried through to the user display, with three-color LEDs on the front panel (as well as a signal to the computer via the USB) to provide a clear visual signal to the user that the reference, device-under-test, and power amplifier levels are operating within maximum dynamic range.

Key Features

Combines the functionality of:

- Sound Card
- Microphone power supply
- Impedance Sense Resistor Interface
- Power Amplifier (Mono)
- Signal Router
- Digital I/O
- Headphone Output



All in a 2 rack space package.

Simplicity

- Consolidates test equipment and eliminates excess cabling, greatly simplifying setup and reducing connectivity errors
- Much simpler calibration without having to change any cables

Integration

- Can be controlled directly from SoundCheck® via USB or through front panel controls

Protection & Durability

- Designed to operate in demanding production environments

Speed

- Dual amplifier outputs allows the operator to test one speaker while loading another
- Signal routing and switching can be stored in a SoundCheck sequence to simplify test setup

Test Setup Comparison

Conventional Test Setup

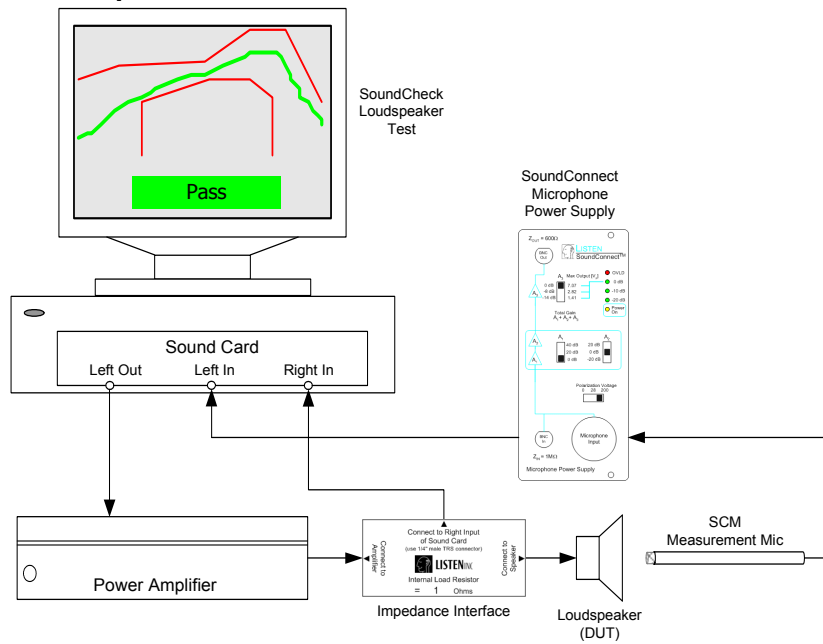


Figure 1-1: Conventional loudspeaker test setup

AmpConnect ISC Test Setup

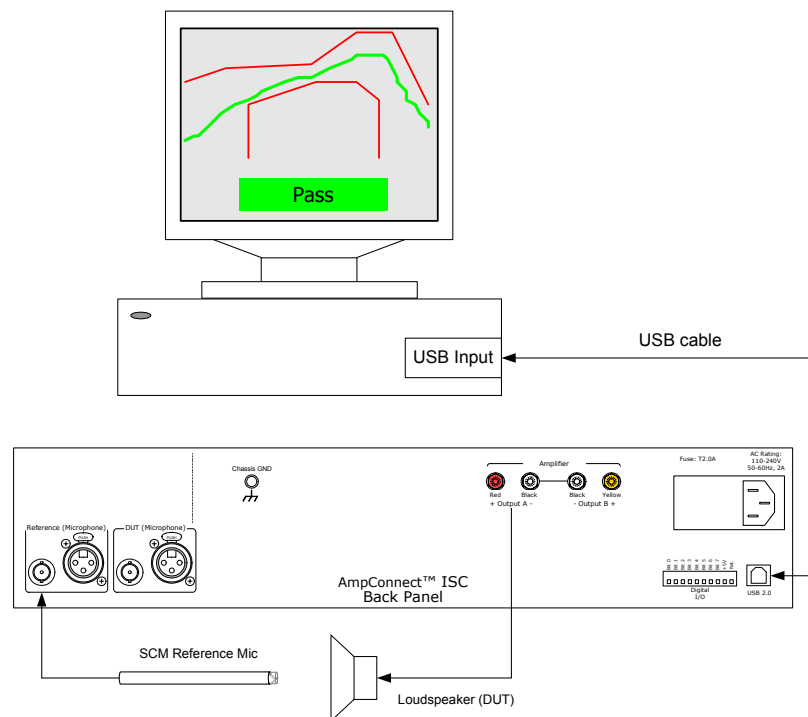


Figure 1-2: AmpConnect ISC simplifies the setup

Two Speaker Test Setup

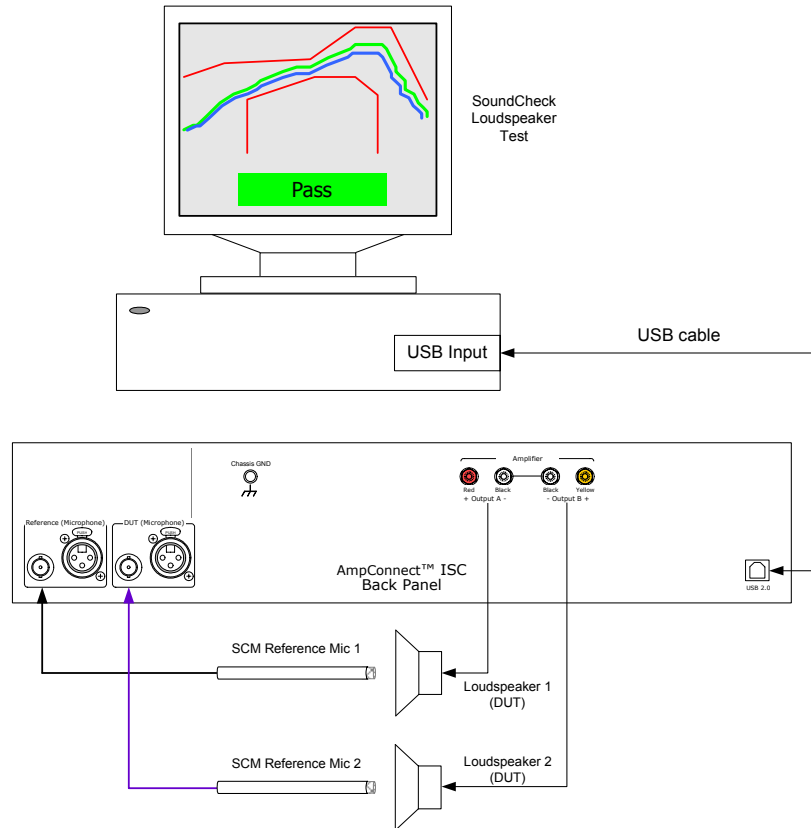


Figure 1-3: Example of two speaker test setup

Installation

Requirements

- SoundCheck 10.11 minimum (or SoundCheck ONE) is required in order to control AmpConnect ISC™ via USB
- The SoundCheck computer must have an available USB 2.0 connection

Note: It is recommended that AmpConnect ISC be mounted in a ventilated rack mount enclosure for proper cooling.

Software Installation

Important! Make sure the SoundCheck USB hardware key is not connected to the computer. If it is connected while installing AmpConnect ISC or SoundCheck, the hardware key could be destroyed.

Important! Do not unplug the hardware key while SoundCheck is running. Doing so could destroy the hardware key.

Before connecting AmpConnect ISC to a USB port of your SoundCheck System, SoundCheck must be installed. The AmpConnect ISC driver installation is part of the SoundCheck software install process.

AmpConnect ISC requires Microsoft .NET Framework 2.0 sp1 (or later). The installation process will check to see if .NET Framework is installed. If not, the following screen will appear prompting you to install the required application.

Note: An internet connect is required in order to download the Microsoft application. If the SoundCheck system does not have internet access, the NET framework installer can be download on a different PC and then copied to the system manually.



Once the installation has finished, you can connect AmpConnect ISC to your SoundCheck system using the USB cable provided.

Windows will indicate that new hardware has been found, which shows that the driver has been successfully installed. This may be displayed as "AmpConnect ISC" or as "New HID Device".



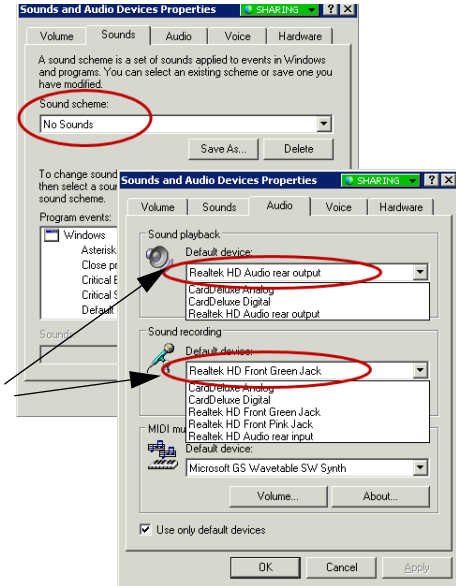
Audio Device System Settings

The following settings are recommended to prevent Windows systems sounds from inadvertently playing through a device under test or artificial mouth. Some system sounds are capable of damaging some transducers.

Windows XP Audio Devices

1. In the Control Panel select Sounds and Audio devices.
2. Select the Sounds tab and set the Sound scheme to “No Sounds”.
3. Under the Audio tab, check to make sure that the sound card that is to be used with SoundCheck is available.

Note: The mother board sound card should be set as the default play and record device. This will help prevent any “stray” system sounds from being played through the SoundCheck audio device.

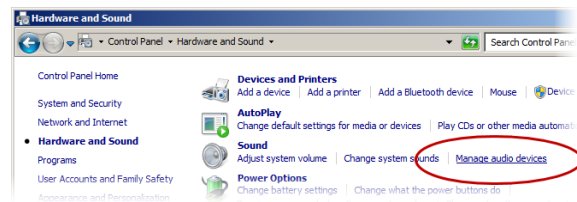


Windows 7 Audio Devices

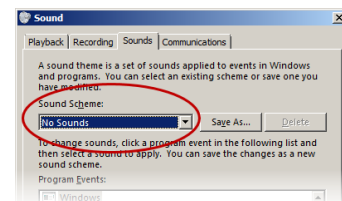
1. Click **Start** and then select Hardware and Sound



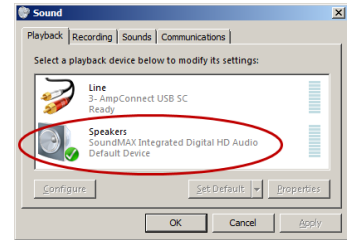
2. Click **Mange Audio Devices**



3. Click the **Sounds tab** and set the default scheme to No Sounds

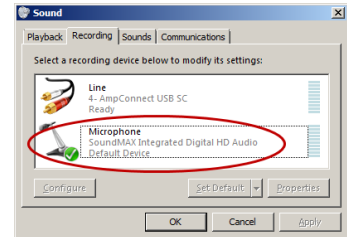


4. Select the **Playback tab** and set the default device to the motherboard sound card



5. Select the Recording tab and set the default device to the motherboard sound card

6. Click OK and close the remaining Control Panel windows



page intentionally left blank

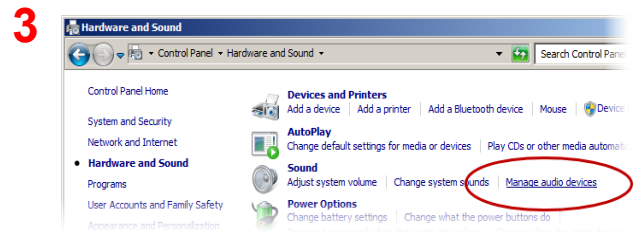
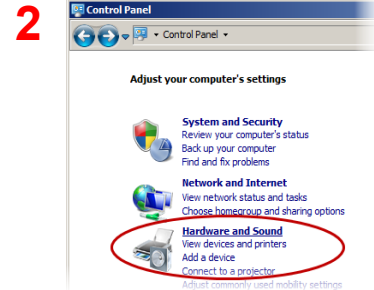
Hardware and Calibration

AmpConnect ISC acts as a complete audio interface for test and measurement with SoundCheck software. The Hardware Step in a SoundCheck sequence must be setup for use with AmpConnect.

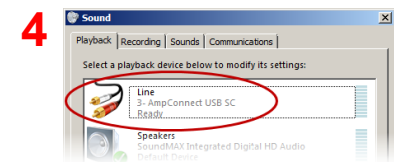
Important! Windows 7 users must first set the sampling rate for AmpConnect in the Windows Control Panel. SoundCheck must be closed when making these changes.

AmpConnect Setup in Windows 7 Only

1. Click **Start** and then select **Control Panel**.
2. Select **Hardware and Sound**
3. Next, under **Sound** select **Manage Audio Devices**

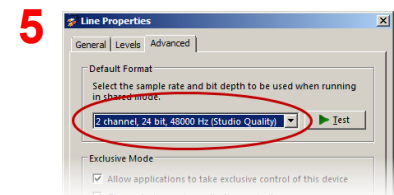


4. Under **Playback Tab** double click on **Line - Amp Connect USB SC**



Important! Windows 7 will set the sample rate of the AmpConnect sound card to 48kHz, by default.

5. Under **Advanced** select **44.1kHz** or **48kHz**. This step and the Hardware Step in Sound Check must use the same sampling rate. Click **OK**.
6. Under **Recording Tab** repeat the process from Steps 3 and 4. The sampling rate must match what was used in Playback.
7. Close the remaining Control panel windows.



AmpConnect Setup in Windows XP

- If the AmpConnect Internal Sound Card **INPUT** does not appear to receive signal, please set the SoundCheck Hardware Step to 48kHz sampling rate and 16 bit Bit Depth.
- Windows XP has an issue with USB audio that may require these changes.
- The AmpConnect Internal Sound Card will only function at 24 bit, ignoring the 16 bit setting.

Hardware Editor

Important! This section is for use with the full version of SoundCheck. The hardware editor in SoundCheck ONE is preset for use with AmpConnect ISC. The features noted are only available in the full version of SoundCheck.

In SoundCheck, open the AmpConnect Self Test sequence.

When running the AmpConnect Self Test sequence for the first time, SoundCheck will show a message:

Select **Re-link** to connect to the new AmpConnect ISC unit.

The next prompt indicates that AmpConnect ISC should be re-calibrated. Click **OK** to continue.

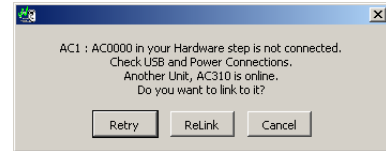


Figure 3-1: ReLink Notice

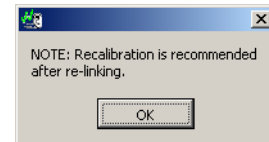


Figure 3-2: Recalibration Notice

Hardware Configuration

In order to control AmpConnect ISC from a SoundCheck sequence, it must be Enabled in the Hardware Editor.

- **Enable** - Select to allow control of AmpConnect ISC(s) in the sequence
- **Add** - Opens a selection window which allows the user to select a connected AmpConnect ISC. Select "User Defined" to add a unit that will be connected to the system at a later time.
- **Remove** - Highlight an AmpConnect ISC in the editor list and click this to remove it from the list.
- **Edit Serial #** - allows the user to put the proper serial number in for a unit that would be on a different production line. This is normally used for sequence development and editing when working on another workstation.
- **Rename** - Change the Device ID field to a unique name. The example in [Figure 3-3](#) shows the Device IDs of the two AmpConnect ISCs have been changed to: Wfr12 and Twr12, to indicate what they are used for.

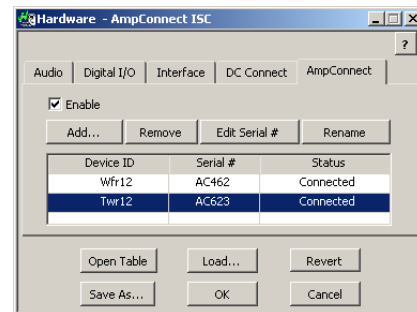


Figure 3-3: AmpConnect Setup

Hardware Table

Open the Hardware Step in the SoundCheck sequence.

Click **Open Table**.

- Windows 7 users must use the sampling rate values set in the Windows 7 Control Panel. See [AmpConnect Setup in Windows 7 Only on page 9](#).
- Due to Windows XP USB audio issues, XP users should see [AmpConnect Setup in Windows XP on page 9](#).
- Normally, Windows XP users do not need to set the sampling rate in Windows. It is controlled from SoundCheck exclusively.
- The latency should be set to **1500** as shown in [Figure 3-5](#).

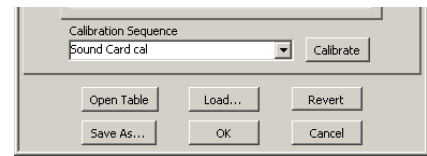


Figure 3-4: Open Table View

Input Channels									
Channel Name	Driver	Device Name	Select Ch	Vp	Analog/Digital	Sampling Rate	Alias Freq	Bit Depth	Latency
L	WDM/MME	AmpConnect USB SC	L	10	Analog	48000 Hz	22800 Hz	16 bit	1500
R	WDM/MME	AmpConnect USB SC	R	10	Analog	48000 Hz	22800 Hz	16 bit	1500

Output Channels									
Channel Name	Driver	Device Name	Select Ch	Vp	Analog/Digital	Sampling Rate	Alias Freq	Bit Depth	
L	WDM/MME	AmpConnect USB SC	L	1.5	Analog	48000 Hz	22800 Hz	16 bit	
R	WDM/MME	AmpConnect USB SC	R	1.5	Analog	48000 Hz	22800 Hz	16 bit	

Figure 3-5: Hardware Table View - Windows XP

Click **OK** to close the Table View.

Select **Save As** on the Hardware Editor to save the new values in the sequence. If the user needs to run the self test sequence again, the hardware values will already be set. These values will also be used if SoundCheck is in SC ONE mode.

AmpConnect ISC Hardware Step

The AmpConnect ISC Hardware Step is included in the default steps with SoundCheck 10.x and higher. This step is preset with the Inputs and Outputs that would normally be used in SoundCheck sequence. The Calibration Step that is associated with this step in a sequence will also require calibration, as shown in the following examples.

Input Channels									
Channel Name	Driver	Device Name	Select Ch	Vp	Analog/Digital	Sampling Rate	Alias Freq	Bit Depth	Latency
Reference	WDM/MME	AmpConnect USB SC	L	10	Analog	48000 Hz	22800 Hz	16 bit	1500
DUT	WDM/MME	AmpConnect USB SC	R	10	Analog	48000 Hz	22800 Hz	16 bit	1500

Output Channels									
Channel Name	Driver	Device Name	Select Ch	Vp	Analog/Digital	Sampling Rate	Alias Freq	Bit Depth	
AmpConnect amp	WDM/MME	AmpConnect USB SC	L	1.5	Analog	48000 Hz	22800 Hz	16 bit	
Left Headphone	WDM/MME	AmpConnect USB SC	L	1.5	Analog	48000 Hz	22800 Hz	16 bit	
Right Headphone	WDM/MME	AmpConnect USB SC	R	1.5	Analog	48000 Hz	22800 Hz	16 bit	

Figure 3-6: AmpConnect ISC Hardware Table View

Amplifier Calibration

The mono power amplifier in AmpConnect ISC can be calibrated for use in a SoundCheck sequence. Since the mono amp is switched to Outputs A or B, only one output needs to be calibrated.

AmpConnect ISC Settings

The Front Panel of AmpConnect ISC must be set as shown in [Figure 3-7](#).

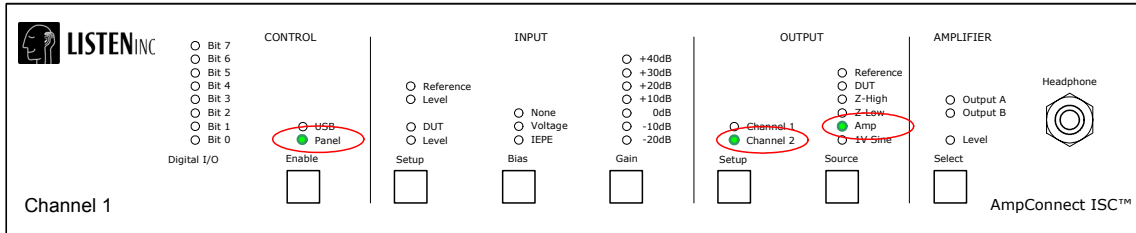


Figure 3-7: Front Panel Settings

- Panel is selected
- Ref and DUT Inputs - Bias and Gain settings not applicable
- Output - select Channel 2 then select Amp. This routes the amp through a 20dB attenuator to internal sound card input Channel 2.
- Amplifier output should be Off (since it is internally connected to sound card input 2) or disconnect any external load.

Important! The Sensitivity of the DUT channel in the Calibration Step of the SoundCheck sequence must be Unity Gain (0 dB).

SoundCheck Calibration Step

1. In SoundCheck, open the test sequence that will be used for the Device Under Test. (Do not open the Amplifier Calibration sequence.) In this example, the Loudspeaker Complete Test sequence is used.
2. Open the Calibration Step and select **Table View**.
3. Note that the output channel “**Amp ch 1**” is set to use the input channel “**L**” for calibration. See Input Channel line 1 in [Figure 3-8](#).
4. The sensitivity of this channel is set to Unity Gain or 0 dB.

The screenshot shows the 'Signal Channel Table' window with two sections: 'Input Channels' and 'Output Channels'. The 'Input Channels' table has columns: Signal Channel, Calibrated Device, Sens, Sens Unit, Sens (dB), Sens (Hz), Phys Unit, dB Ref, HW Channel, Calibration Sequence, Calibrate, and Last Cal Date. The 'Output Channels' table has columns: Signal Channel, Calibrated Device, Sens, Sens Unit, Sens (dB), Sens (Hz), Phys Unit, dB Ref, HW Channel, Calibration Sequence, Input Channel, Calibrate, and Last Cal Date. A red arrow points from the 'L' row in the Input Channels table to the 'Amp ch 1' row in the Output Channels table. The 'Sens (dB)' value for 'Amp ch 1' is circled in red.

Input Channels											
Signal Channel	Calibrated Device	Sens	Sens Unit	Sens (dB)	Sens (Hz)	Phys Unit	dB Ref	HW Channel	Calibration Sequence	Calibrate	Last Cal Date
L	unity cal (Read only)-in.c	1	V/V	0.0	1k	V	1	L	Microphone Calibration	Calibrate	
R	unity cal (Read only)-in.c	1	V/V	0.0	1k	V	1	R	Microphone Calibration	Calibrate	
Reference Mic	SCM 2 Mic.dat	20m	V/Pa	-34.0	1k	Pa	20u	L	Microphone Calibration	Calibrate	

Output Channels												
Signal Channel	Calibrated Device	Sens	Sens Unit	Sens (dB)	Sens (Hz)	Phys Unit	dB Ref	HW Channel	Calibration Sequence	Input Channel	Calibrate	Last Cal Date
L	Crown Amp- L.dat	20.9	V/V	26.4	1k	V	1	L	Amplifier Calibration	L	Calibrate	10/10
Amp ch 1	AmpConnect - L.dat	20.9	V/V	26.4	1k	V	1	L	Amplifier Calibration	L	Calibrate	10/10

Figure 3-8: Calibration Step Table View

5. Click **Calibrate** on output row three to start the calibration sequence. This will measure the sensitivity (gain) and frequency response of the power amp.
6. The measured sensitivity of the amplifier is automatically entered in the output sensitivity field.
7. The sensitivity will be approximately 6.4dB. This is due to the amplifier being routed through the internal 20 dB attenuator. Add 20 dB to this value to get the total amplifier gain.
8. If the measured sensitivity fails, make sure the Input Sensitivity of the SoundCheck Calibration Step is 0dB (Unity Gain) and try calibrating again.

For more troubleshooting information, go to <http://www.listeninc.com> and click **Support**.

Microphone Calibration

The REF and/or DUT microphone inputs should be calibrated when using either as an input for a reference microphone.

This procedure allows the user to check a reference microphone's sensitivity against the microphone manufacturer's specifications.

1. Open the *Calibration Editor* and select the Input tab. The **Calibration Sequence** should be set to **Microphone**.
2. Click **Calibrate**.
3. Select your calibrator model # from the pull-down menu or select **Other Calibrator** and enter the acoustic calibrator's reference level and frequency.
 - The microphone calibrator's reference level should be indicated in its specifications as a given dB SPL value (relative to 20 μ Pa) at a reference frequency.
 - e.g., for the Brüel & Kjær Type 4231 Acoustic Calibrator:
 - Sound Pressure Level: 94.00 dB \pm 0.20 dB
 - Frequency: 1000 Hz \pm 0.1%

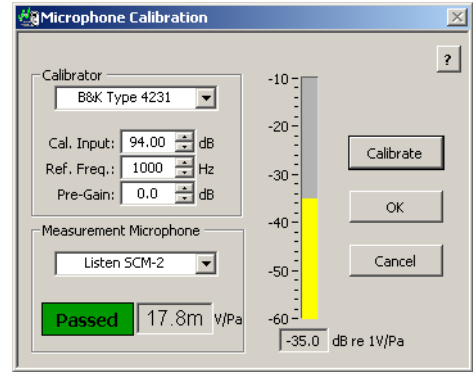


Figure 3-9: Microphone Calibration

Note: When choosing **Other Mic** under Measurement Microphone, the sensitivity check will always indicate PASS, as long as the sensitivity is above 1mV/Pa. Since SoundCheck does not have the sensitivity listed in the look-up table, the final Pass/Fail verdict must be left up to the operator. Please refer to the manufacturer's specifications to confirm that the measured sensitivity is within appropriate limits.

4. Note the gain or attenuation value, in dB, from the AmpConnect ISC channel settings that the reference microphone is connected to. Enter this value in the **Pre-Gain** numeric field of the Calibration Step.
5. Select the measurement microphone model number from the pull-down menu. If the microphone is not listed in the pull-down menu, choose **Other Mic**.
6. Place the acoustic calibrator on the reference microphone and click **Calibrate** to measure its sensitivity.
 - The measured sensitivity of the reference microphone is displayed under **Measured Sensitivity** in mV/Pa after clicking **Calibrate**. If the measured sensitivity is outside the manufacturer's specifications, a flashing FAILED message will appear. Check first to see if the connections are correct or if the calibrator is turned on before assuming something is wrong with the microphone.
 - The FAILED message can also appear if the Calibrator's frequency is not correct. If a Reference Frequency of 1000Hz is entered, but the Calibrator's actual frequency is 1008Hz, the Calibration may Fail. To verify the Calibrator's frequency, use the *Spectrum Analyzer* under the **Operate** menu.
 - The meter on the right side indicates the corresponding dB level relative to 1 Volt per Pascal. If it varies by a few tenths of a dB from the last calibration measurement, do not be alarmed, this is normal. If it varies by more than 1 dB or failed the sensitivity test, the microphone checked by a qualified calibration lab.

Front Panel Functions

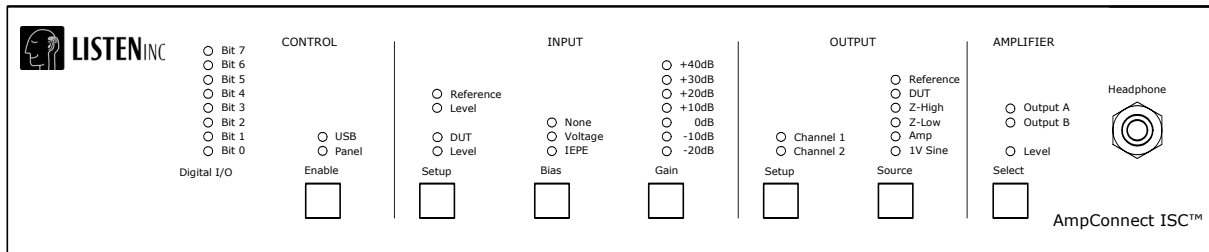


Figure 4-1: Front Panel

AmpConnect ISC™ can be used as a stand-alone test and measurement interface. It can also be controlled by SoundCheck using Message Steps in a test sequence. The front panel LEDs show the settings for input and output channels as well as signal level and signal state.

Headphone Output

A headphone output on the front may be used for testing headphones or monitoring input signals. This is a separate stereo amplifier and can be switched to monitor the internal sound card outputs or internal sound card inputs. Please refer to [Block Diagram on page 35](#) for more information.

Control

Enable

The Enable button toggles between USB and Front Panel control. The USB and Panel LEDs indicate which is selected.

- **USB** allows SoundCheck to control the operation of AmpConnect ISC
 - AmpConnect ISC will automatically enable **USB** control as soon as it is connected to the SoundCheck computer via USB
 - AmpConnect ISC will return to Panel control if the SoundCheck computer shuts down
- **Panel** allows AmpConnect ISC to function as a standalone interface (This is disabled when USB is selected in a SoundCheck sequence step.)
 - When **Panel** is disabled, the front panel is locked out, protecting the unit from accidental changes during testing. This feature may be activated from a step, however, it is not a requirement.
- **USB** and **Panel** control can be simultaneously enabled if desired

Panel Control

Important! The default power up state is user defined. Thirty seconds after the front panel settings have been changed, the new settings are stored and will be used as the **new default state** the next time the unit is powered on.

The initial power up default settings from Listen, Inc., are those most commonly used for loudspeaker testing:

- **Digital I/O:** all Bits are Low (LEDs off). (Digital I/O is not available when used as a stand-alone interface)
- **Input Reference:** Mic Bias set to Voltage with +20dB of gain
- **Input DUT:** Not selected since it is not used in for loudspeaker testing [DUT default settings]
- **Output Channel 1:** Reference Mic
- **Output Channel 2:** Z-Low
- **Amplifier:** Output routed to Output A

USB Control

- USB control of front panel functions through a SoundCheck sequence step
- When USB is selected in a SoundCheck sequence step, the Front Panel controls are disabled to prevent accidental changes

Digital I/O

- 8 bits of digital I/O that can be written and read directly in SoundCheck
- Used to control relay boards and switches, e.g. footswitch for Start and Stop
- Communicate with PLCs in automated production lines
- Receive TTL signals from other test equipment

Digital I/O States

- Bits can be used as either input or output. The state of the Bit is indicated by the LEDs:
 - LED off - Bit is low
 - LED on - Bit is high

Note: The Digital I/O function can only be used when AmpConnect ISC is controlled by SoundCheck through USB.

Input

The Setup button toggles between Reference input and DUT input. Separate settings and signal routing can be made for each. The settings for Reference and DUT are independent of each other.

When the Reference or DUT inputs are routed to Output 1 or 2, the level indicators show the signal state of the OUTPUTS that these inputs are assigned to. This is to insure that the input of the internal sound card is not overloaded or underloaded (low signal level that is too close to the noise floor of the system). Refer to your sound card manual to see what overload level is appropriate.

Reference

Level - Monitors the signal level and state of the **Output Channel** that the **Reference Input** has been routed to, after applying gain. (All values are nominal)

- Green indicates level is > -40dBV
- Yellow indicates level is > +4dBu
- Red indicates level is > +13dBu
- If an input channel is not assigned to an output channel, the LED is off

DUT (Device under test)

Level - Monitors the signal level and state of the **Output Channel** that the **DUT Input** has been routed to, after applying gain. (All values are nominal)

- Green indicates level is > -40dBV
- Yellow indicates level is > +4dBu
- Red indicates level is > +13dBu
- If an input channel is not assigned to an output channel, the LED is off

Bias

- **None**: for microphones or electronics that do not require power
- **Voltage**: provides bias to SCM microphones and electret condensers
- **IEPE**: provides constant current bias for pre-polarized reference microphones

Note: When testing pro audio condenser or ribbon microphones, use an external power supply. AmpConnect Bias voltage should be Off when connecting an external supply to an AmpConnect XLR input. Testing microphones that need 48V phantom power requires an external phantom power supply.

Gain

- Gain is variable in steps from -20dB to +40 dB
- Input gains are independently variable

Output

AmpConnect ISC™ features two configurable outputs to the internal sound card. The user can choose which signals are routed to each from the Front Panel or via USB control. Settings for Channels 1 and 2 are independent of each other.

Any of the following source signals can be routed to Output Channel 1 or 2:

- **Z-High:** The voltage across a 1 Ohm current sense resistor (for loudspeaker impedance test)
 - output signal is 1 Volt/Amp
 - An alternate resistor value is available as a factory installed option from Listen, Inc.
- **Z-Low:** The voltage across a 0.1 Ohm current sense resistor (for loudspeaker impedance test)
 - output signal is 100 mVolt/Amp
 - fixed value - cannot be changed
- **Amp:** the output voltage of the power amplifier, attenuated by 20 dB (x 0.1)
 - The output of the power amp can be routed to a signal out when calibrating the amp
 - Only one output at a time may use this source. If it is already selected, it will be skipped.
 - Output Impedance: Actively minimized to nearly 0 Ohms
- **Reference (Microphone) Input:** signal from the Reference microphone input
- **DUT (Microphone) Input:** signal from the DUT microphone input
- **1V Sine:** a reference 1 Volt, 1 kHz sine
 - constant signal generated by AmpConnect ISC
 - can be sent to either output in order to test sound card connections and settings
 - cannot be routed to amplifier output
- **Quiet:** Output channel is defeated (All source LEDs are set to **Off**). If AmpConnect ISC is accidentally disconnected from USB or if the computer is shut off, AmpConnect ISC will automatically switch to **Quiet**. The power amplifier outputs are also set to **Off**. This is to minimize transients. Re-enable the channel outputs and power amp outputs by re-selecting them.

Amplifier

- Single input, mono amplifier with a fixed gain of 26 dB
- Amplifier output can be routed to Output A, Output B or both simultaneously
- Output impedance is always actively minimized to nearly 0 Ohms, even as sense resistors are selected. The damping factor of the amplifier/speaker combination remains unchanged regardless of the sense resistor setting.
- If the power amp output current exceeds 5.7A peak, the power amp level indicator will flash red. The amplifier outputs are disabled until the user presses the **Amplifier - Select** button.

Level

- Monitors the peak signal level and state of the amplifier output (All values are nominal)
 - Green indicates level is > -14dBVout (corresponds to -40dBVin)
 - Yellow indicates level is > 12Vpeak (about 6dB before clipping)
 - Red indicates level is > 17Vpeak (about 3dB before clipping)

Rear Panel Connections

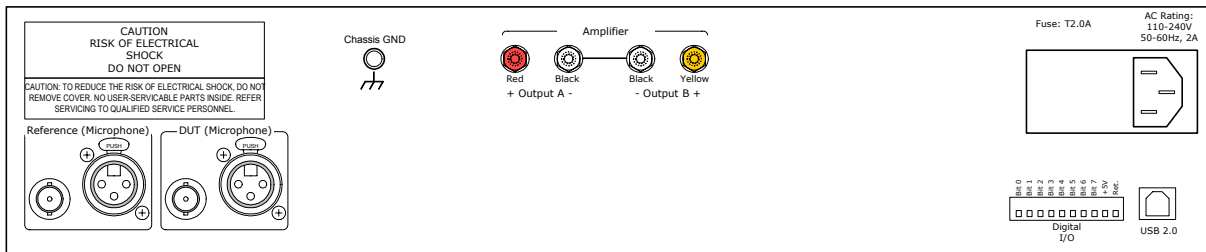


Figure 5-1: Rear Panel

Important! XLR and BNC connections on an **input** should not be used simultaneously.

Reference (Microphone) Input

This is typically used for connecting a Reference Microphone.

- Balanced XLR female and Single Ended BNC connectors, wired in parallel
- -3dB low frequency roll off point is 7 Hz (nominal)
- Bias voltage is across Pin 2 & 3 of XLR connector, and the center pin & shell of the BNC connector
 - When Voltage or IEPE Bias is selected, the BNC shell and XLR Pin 3 are internally connected to signal ground. This makes the input Single Ended.
- Voltage = 10 V (nominal) (Adjustable: Please refer to Internal Connections for more information)
- IEPE = 10mA (nominal)
- Input impedance - 100k ohm (nominal)

BNC vs. XLR internal wiring

- XLR & BNC inputs are differential, as long as the Bias is set to None. When Bias is set to Voltage or IEPE, they become single ended.
- XLR pin 1 is chassis ground
- XLR pin 2 is signal high (+), BNC center is signal high (+)
- XLR pin 3 is signal low (-), BNC case is signal low (-)

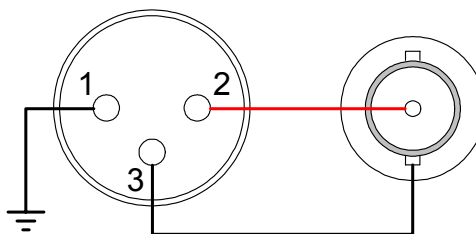


Figure 5-2: XLR / BNC Inputs

DUT (Microphone) Input

This connection can be used for connecting a “Device Under Test” Microphone. This connection is used typically for microphone testing.

- Features are the same as the Reference Input

Note: In cases where a DC Bias Voltage could damage a mic or power supply, e.g.: pro audio condenser or ribbon microphones, use an external power supply. AmpConnect Bias voltage should be **OFF**. Testing microphones that need 48V phantom power requires an external phantom power supply.

Amplifier

The internal sound card Left Output is directly connected to the mono power amplifier input.

Amplifier Output A

Connects to a transducer via the binding post connectors.

Note: There is only one, mono power amp channel in AmpConnect ISC. This amp channel can be switched to either Output A, Output B or A + B.

Amplifier Output B

Connects to a second transducer via the binding post connectors.

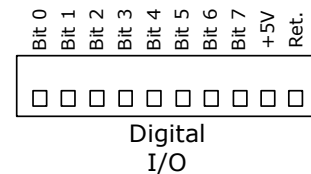
Digital I/O

Phoenix style connector

- Requires a Phoenix plug, part number: 1803659, in order to wire to external devices. (optional part, available from Listen, Inc.)

Pin out: (for wiring examples see [Digital I/O Connections on page 31](#).)

- Bit 0 thru 7 - Lines can be used as outputs to control external devices, or as inputs to receive switching signals from external devices.
 - Input Bit max voltage is 5.5V DC
- +5V - Provides a +5V DC voltage as reference or power for Bits
 - Self resetting fuse set at 80 mA
- Ret. - Digital I/O signal ground (at same potential as chassis ground)



USB

Connect to SoundCheck computer for USB control and audio.

The settings in AmpConnect ISC can be changed through a Message Step in a SoundCheck test sequence. See [Create Message Step on page 21](#) for more information.

USB Control Via SoundCheck

AmpConnect ISC is fully controllable via SoundCheck which means that adjustments of parameters such as gain can be included in test sequences. All Front Panel settings can be changed via USB during the run of a test sequence. An eight-bit digital I/O port provides digital control and/or status monitoring of external devices for operator feedback, test fixture control, etc. Digital I/O is only accessed by USB through SoundCheck. The following example shows how to use a Message Step in SoundCheck to control AmpConnect ISC. (AmpConnect ISC must be enabled in the Hardware Step. See [Hardware Configuration on page 10.](#))

Note: In SoundCheck ONE, the user does not have access to creating a new Message Step. Only the settings in the existing step can be changed. SoundCheck ONE users should skip to [AmpConnect Message Step on page 22.](#)

Create Message Step

Open the SoundCheck sequence editor and select the Message Step category on the left hand menu.

Under **Step** select **New**.

Enter "**AmpConnect Step 1**" for the Message Step name and click **OK**.

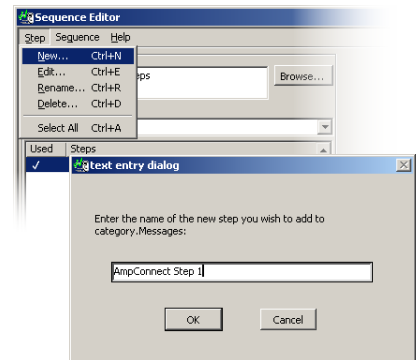


Figure 6-1: Create Message Step

Insert the new AmpConnect Message Step at the top of the sequence. When the sequence runs, this step will set the AmpConnect options for its first use in the sequence.

Other AmpConnect Steps may appear in the sequence with different settings. These steps should be named to identify the function of the step. This will make later sequence editing and trouble shooting easier.

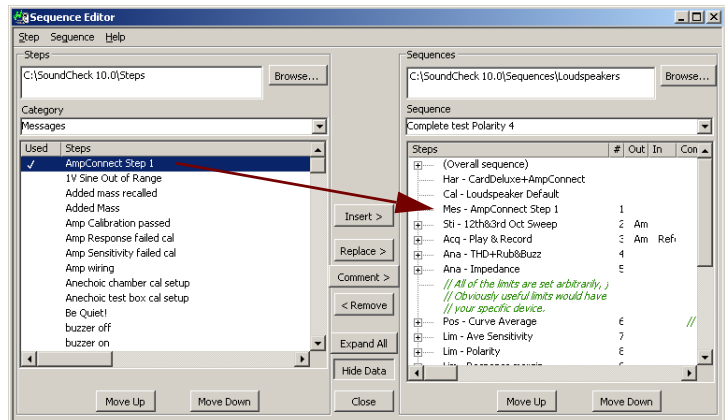


Figure 6-2: Message Step in Sequence

Note: AmpConnect settings can be changed during the run of a test sequence. This will require individual Message Steps at various points in the sequence. Only the Device ID field is **Sequence-specific** (Blue Field). Changes to this item will appear only in the sequence being edited. All other items are Step-Specific (Black Fields). Changes to these fields will appear in all sequences that use this step. See **Sequence-specific** in the Sequence Editor Chapter of the main SoundCheck manual.

AmpConnect Message Step

Open the AmpConnect Message Step from the Active Sequence in the right hand section of the editor, as shown in [Figure 6-2](#).

Message Title - This is the text that will be in the top of the step window as it is run.

Message - The example in [Figure 6-3](#) shows that the Message Step is set to AmpConnect.

Device ID - The user can select which AmpConnect is should be used, if multiple AmpConnects are on the system. This is a **Sequence-specific** (Blue Field).

Configure AmpConnect - Set the front panel settings of AmpConnect (see below)

Settings - The user selects the **Pass/Fail** state the step will yield in the Results section of the Memory List.

Wait - Allows the user to set a time period for the step to pause the run of the sequence. This allows for “switch closure times” associated with external devices connected to the Digital IO of AmpConnect.

Apply - Click Apply to switch AmpConnect ISC to the new settings from **Configure AmpConnect** without having to run the sequence. This is useful for testing the settings.

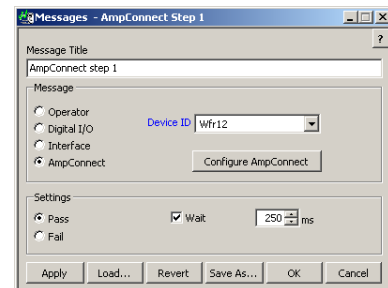


Figure 6-3: AmpConnect Settings

Note: SoundCheck ONE users will only have access to the default AmpConnect Step. To modify the settings, click on **Setup** from the SoundCheck ONE main screen. Then click on **AmpConnect** as shown in [Figure 6-4](#).

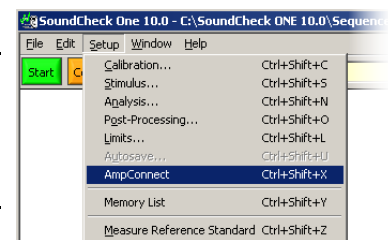


Figure 6-4: SC ONE AmpConnect Step

Configure AmpConnect

Click on **Configure AmpConnect** to set the front panel settings of AmpConnect ISC.

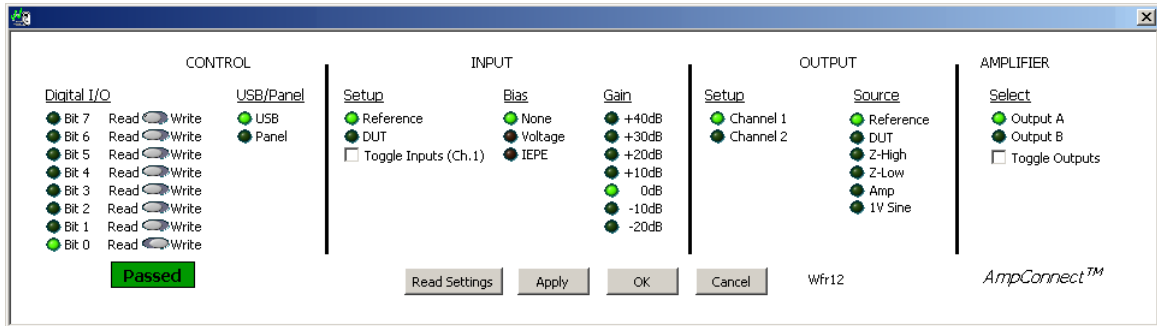


Figure 6-5: AmpConnect ISC Message Step

Read Settings - Allows the user to update the settings of the Message Step by Reading the current settings of the AmpConnect ISC Front Panel.

Apply - Click to send new settings to AmpConnect ISC.

OK - Accept changes and close configuration window.

Cancel - Disregard changes and close configuration window.

The standard front panel controls are explained in [Front Panel Functions on page 15](#).

In addition to the standard front panel controls, **Configure AmpConnect** also includes the following:

Control - Digital I/O (must be set to USB)

- Bit 0 thru 7: Shows the state that the Bit expects to see when set to Read. If the actual state of the input agrees with the setting, the step result will be “Pass”. If it does not agree, the result will be “Fail”. When set to write, this is the state that the Bit will change to when the Message Step runs in the sequence.

Toggle Inputs/Toggle Outputs

The Toggle control can be used to switch the Microphone Input and Amplifier Output as a test sequence runs in **Continuous** or Loop operation. This can be used to test a loudspeaker on one test fixture while setting up a different speaker on another fixture. (The fixtures and test microphones should be identical.)

- Toggle Inputs (Ch.1): Switches so that on the first pass of the sequence, Channel 1 uses the Reference Microphone Input and the second pass uses the DUT Microphone Input. (Output section.) This works on **Channel 1 only**.
- Toggle Outputs: Switches so that the first pass of the sequence uses Amplifier Output A and the second pass uses Amplifier Output B.

Bias on DUT channel

This allows the user to change the Bias settings on the DUT input channel.

Custom Step Conversion

SoundCheck 9 users will need to upgrade to SoundCheck 10.x to control AmpConnect ISC. The Custom Step from SoundCheck 9 will need to be re-created as a Message Step in SoundCheck 10.x.

Please use the following procedure.

1. Open the AmpConnect Custom Step(s) in SoundCheck 9.
2. Write down the settings for the step. (See [User Setup Notes on page 30](#) for a blank front panel drawing, which makes notation of settings easier.)
3. In SoundCheck 10, configure the Hardware Step for AmpConnect. See **AmpConnect** in the Hardware Chapter of the main SoundCheck manual.
4. Make a new Message Step in SoundCheck 10 and enter the settings from the front panel notation.
5. SoundCheck 10 will not open AmpConnect Custom Steps.

Sequence Example

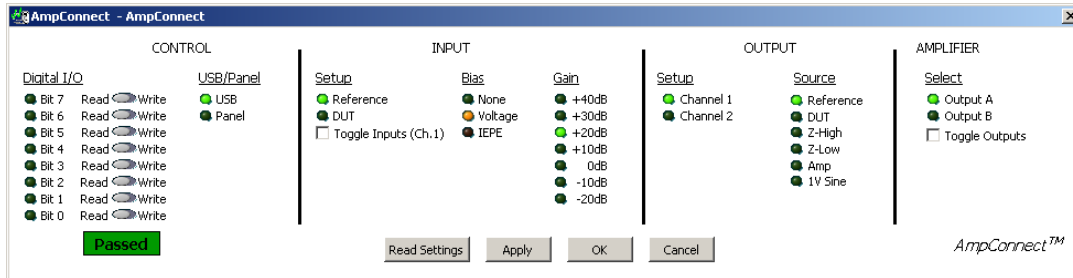


Figure 6-6: Channel 1 Settings

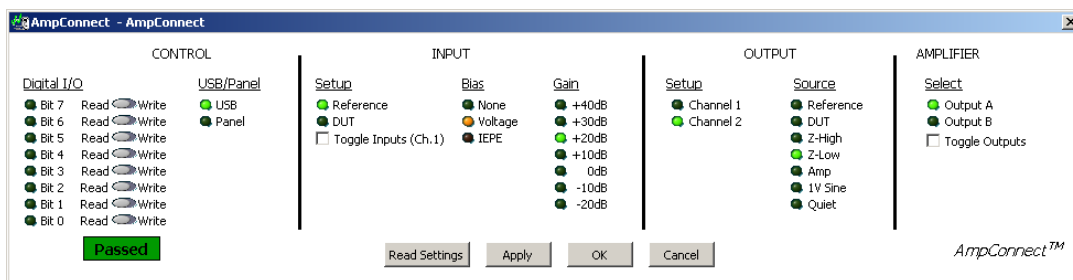


Figure 6-7: Channel 2 Settings

The Loudspeaker Impedance Test Sequence will require the settings as shown in [Figure 6-6](#). (Refer to the **Single Loudspeaker Test** section of the SoundCheck ONE manual for wiring suggestions.)

- Control is set to USB. This disables the front panel controls.
- Input Section - Reference Mic is set to use Voltage and a Gain of +20dB.
- Output Section - The Reference Mic is routed to Output Channel 1.
- Amplifier output is set to Output A

In addition, [Figure 6-7](#) shows the settings for Output Channel 2:

- The signal from the Z-Low sense resistor is set to Output Channel 2. This is used for the Impedance measurement input in the SoundCheck sequence.

Click **Apply** to send settings to the AmpConnect ISC unit. This allows the user to check the settings without having to run the sequence. Note that the software Control Panel for AmpConnect ISC may not show the changes. Check the settings on the Front Panel of the actual unit.

When the sequence runs, AmpConnect ISC will automatically change to these settings.

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Connection Procedures

Single Loudspeaker Test

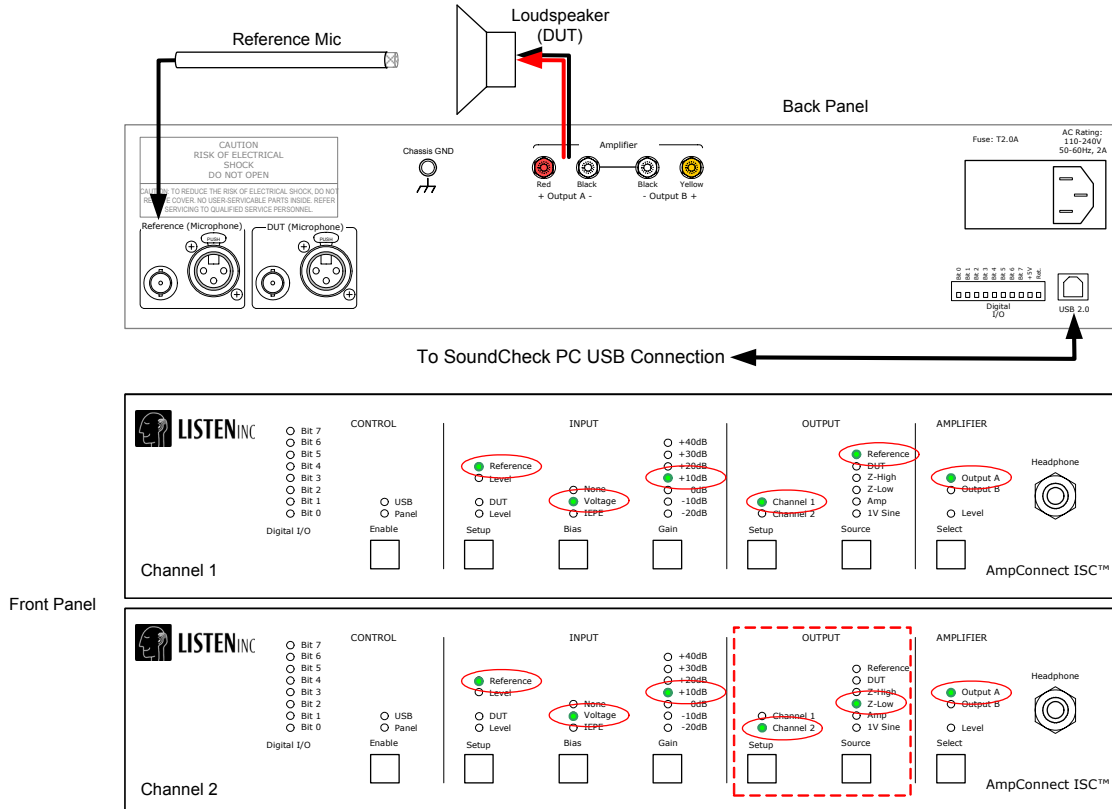


Figure 7-1: Single Loudspeaker Test Layout

The Single Loudspeaker test as shown in [Figure 7-1](#) shows AmpConnect ISC with the following settings:

- Reference Mic output set to Channel 1
- Bias set to Voltage
- Reference gain set to +10 dB (DUT input not used)
- Amplifier output set to Output A
- Z-Low sense resistor output set to Channel 2

Two Loudspeaker Test

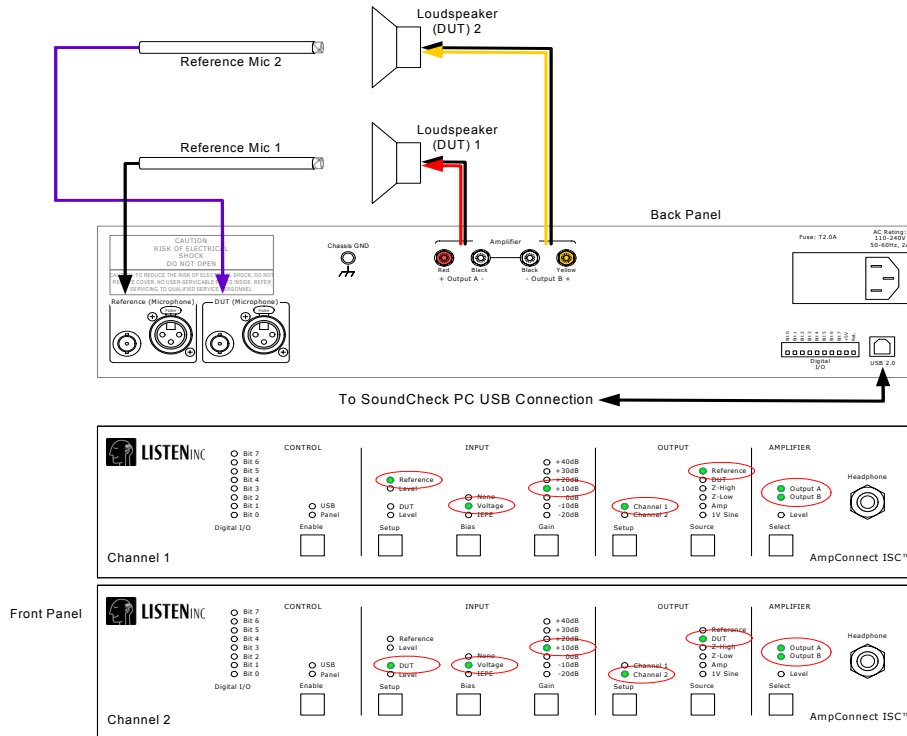


Figure 7-2: Two Loudspeaker Test Layout

Figure 7-2 shows AmpConnect ISC setup to test two loudspeakers simultaneously. (This does not include impedance measurement.)

- Reference Mic 1 output set to Channel 1
- Bias set to Voltage
- Reference gain set to +10 dB
- DUT Mic (Reference Mic 2) output set to Channel 2
- Bias set to Voltage
- DUT gain set to +10 dB
- Amplifier output set to Output A and B

Important! Connecting two loudspeakers in parallel to one amplifier output reduces the impedance of the load, e.g., 8 Ohms in parallel with 8 Ohms equals 4 Ohms.

When testing speaker loads between 3 and 4 Ohms, one of the Output Channels must be set to Z-High so that the 1 Ohm sense resistor will increase the load as seen by AmpConnect ISC.

This will reduce AmpConnect ISC's output power proportionately by the ratio of the reference resistor divided by the "**loudspeaker plus reference resistor**" impedance, (e.g.: a 3 Ohm loudspeaker with a 1 Ohm reference resistor will reduce the power output by $\frac{1}{4} \times 60$ watts = 15 Watts, leaving 45 Watts available to drive the load). Also, because of AmpConnect ISC's extra dissipated power internally, its upper operating temperature limit may be lowered.

Microphone Test

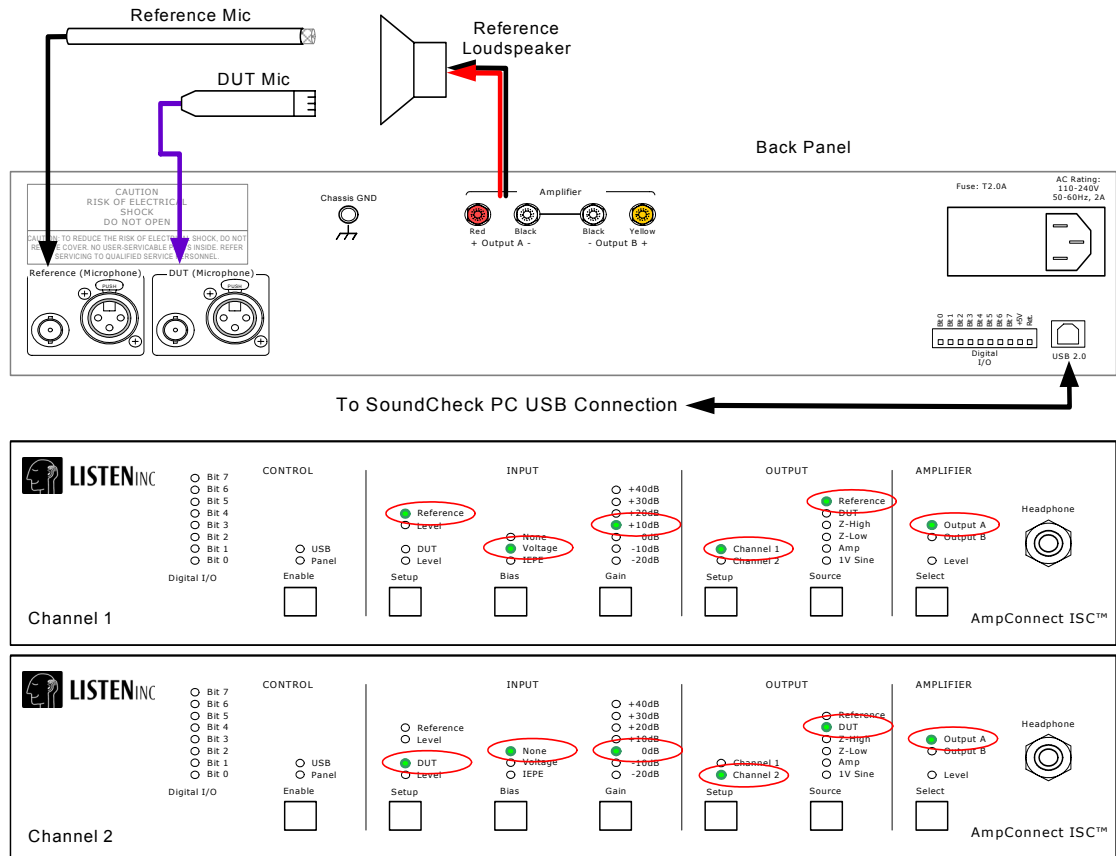


Figure 7-3: Microphone Test Layout

The Microphone test setup in [Figure 7-3](#) shows how AmpConnect ISC is setup with a DUT Mic.

- Reference Mic output set to Channel 1
 - Bias set to Voltage
 - Gain set to +10dB
- DUT Mic output set to Channel 2
 - Bias should be set to the requirement of the DUT Mic (See note below)

Note: When testing pro audio condenser or ribbon microphones, use an external power supply. AmpConnect Bias voltage should be Off when connecting an external supply to an AmpConnect XLR input. Testing microphones that need 48V phantom power requires an external phantom power supply.

- Gain set to 0dB
- Amplifier output set to Output A

Digital I/O Connections

Digital I/O settings are made in an AmpConnect Message Step used in a SoundCheck test sequence. When the Bit Light is **On**, the Bit is set **High**. When **Off**, the Bit is set **Low**. The Read/Write state of the Bit determines if it is an Output or an Input. (See General Rules below.)

Important! Individual AmpConnect Message Steps are required in a SoundCheck sequence to perform various Digital I/O operations. All settings in the AmpConnect Message Step are Blue Fields (Sequence Specific), so that multiple instances of a step can be used in a sequence. Each step can have different settings including different Bit configurations.

Sequence-specific Definition

Step attributes can be **Sequence-specific** (local). These attributes are marked with a blue colored font (blue field). Changes to these attributes only appear in the sequence they are saved in. (See **Sequence Editor** in the main SoundCheck Manual for more information.)

Note: Access to Digital I/O control is not available in SoundCheck ONE.

General rules

- Bits are at ground when set Low (LED Off)
- Bits are at +5V when set High (LED On)
- This corresponds to the Front Panel LEDs and software control settings
- Bits set to **Read** will act as Inputs
 - The setting of the Bit indicates the state that you expect to read. That state is then used in a comparison with what is actually read to produce the Pass/Fail result for the step.
 - If the Bit is selected in the Message Step (LED On), the step expects that Bit of AmpConnect ISC to be pulled High at the time the sequence runs in order to produce a Pass result. If the Bit is Low, the step result will be Fail.
- Bits set to **Write** will act as Outputs
- The Pass/Fail state of a step with a Bit set to **Read** is determined at the time the step is executed in the sequence.
 - If any Bit set to Read disagrees with the actual status of the Input, the step will issue a FAIL verdict. This is then used by the Step Configuration for sequence logic. See **Step Configuration** in the main SoundCheck Manual for more information.
 - If all Bits set to Read Agree with the actual status of the Input, the step will issue a PASS verdict.
- Lines for Bits 0 thru 7 have an internal 470 Ohm resistor in series with each
- When set to Read (configured as an input), the Bit is pulled high through an internal 100K resistor

Output: Bit set to Write

When using the Digital I/O Bits as outputs the example in [Figure 7-4](#) shows two possible wiring configurations.

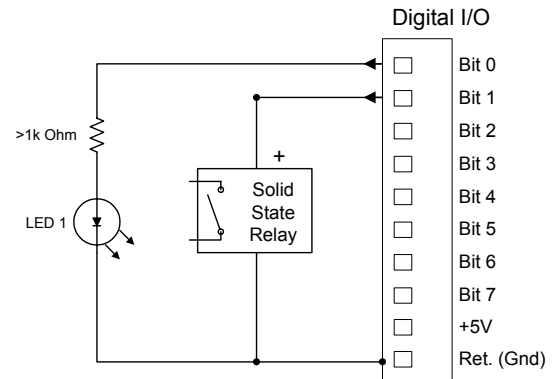


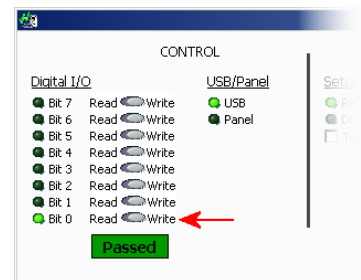
Figure 7-4: Bits 0 & 1 used as outputs

Bit 0 Example

When the step is executed in a sequence, an external LED (or other device) is turned on according to the settings in the software control panel:

- Bit 0 is set to Write (Output)
- Bit 0 is set to High (LED On)

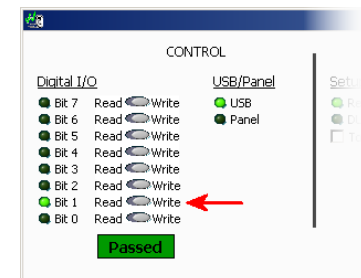
A resistor of at least 1k Ohm should be put in series with the LED, wired as indicated in [Figure 7-4](#). When the step is executed in the sequence, Bit 0 is set High and 5VDC is applied to the LED.



Bit 1 Example

- Bit 1 is set to Write (Output)
- Bit 1 is set to High (LED On)

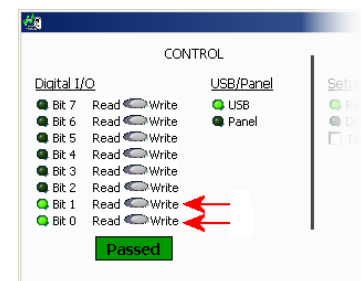
This activates an external Solid State Relay as shown in [Figure 7-4](#). When Bit 1 is set High by the AmpConnect Message Step, 5VDC is applied to the relay input.



Two different AmpConnect steps can be run in the sequence to perform the operations shown in the two previous examples independently.

A single AmpConnect step can also be created to perform both operations simultaneously.

- Both Bit 0 and 1 set to Write (Output)
- Bit 0 and 1 set to High (LEDs On)



Input: Bit set to Read

When set to **Read** (configured as an input), the Bit is pulled high through an internal 100K resistor. Users may want to use external pull-up resistors to increase noise immunity or pull-down resistors to force the input low, as shown in [Figure 7-6](#).

External Switch Examples

The DIO input of AmpConnect ISC can read external switch closures into a SoundCheck test sequence.

Normally Closed Switch

Bit 4 Example - High when switch is depressed

[Figure 7-5](#) shows a Normally Closed switch wired across Bit 4 and Ret.

In this configuration, when the switch is open (footswitch depressed), the AmpConnect ISC Input will be pulled **High**.

When the switch is closed (footswitch not depressed), the Input will return to **Low**.

The AmpConnect Message Step will compare the actual status of the Input to the setting for Bit 4 and issue a verdict.

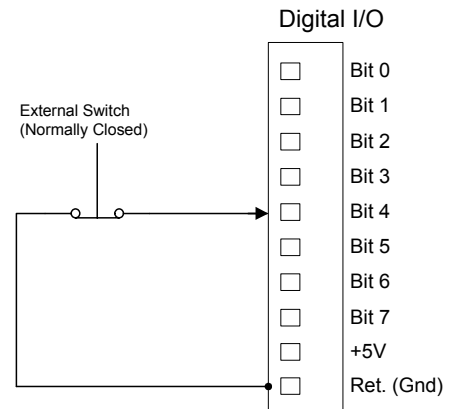


Figure 7-5: Bit 4 - Normally High

Normally Open Switch

Bit 4 Example - High when switch is depressed

In [Figure 7-6](#) a Normally Open switch is wired across Bit 4 and +5V.

A 2.2k Ohm resistor is also wired across Bit 4 and Ret.

In this configuration, when the switch is open, the AmpConnect ISC Input will be pulled **Low**. When the switch is closed, the Input will return to **High**.

The AmpConnect Message Step will compare the actual status of the Input to the setting for Bit 4 and issue a verdict.

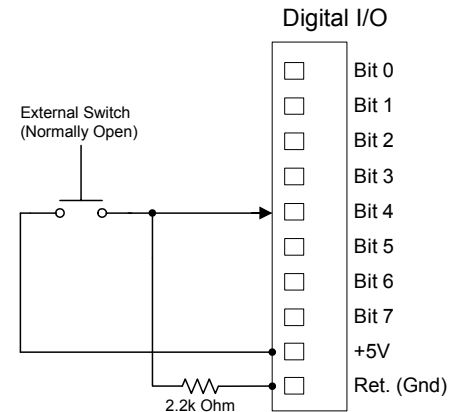


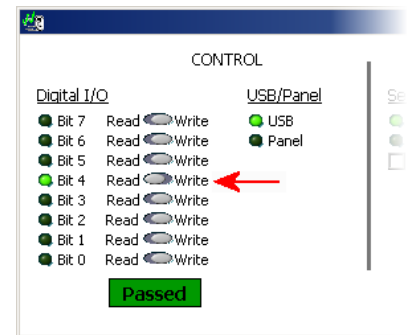
Figure 7-6: Bit 4 forced Low

When the AmpConnect Message Step is executed in the sequence, it will Read the actual status of the Input and compare it to the setting of Bit 4.

- Bit 4 is set to Read (Input)
- Bit 4 is set to High (LED On)

If the setting disagrees with the actual status of the Input, the step will issue a FAIL verdict. This is then used by the Step Configuration for sequence logic. See [Step Configuration](#) in the main SoundCheck Manual for more information.

If the setting agrees with the actual status of the Input, the step will issue a PASS verdict.



Bit 5 Example - TTL Input

SoundCheck may also need to receive a TTL signal from an external device such as a Production Line Controller.

Figure 7-7 shows the output of such a device connected across Bit 5 and Ret.

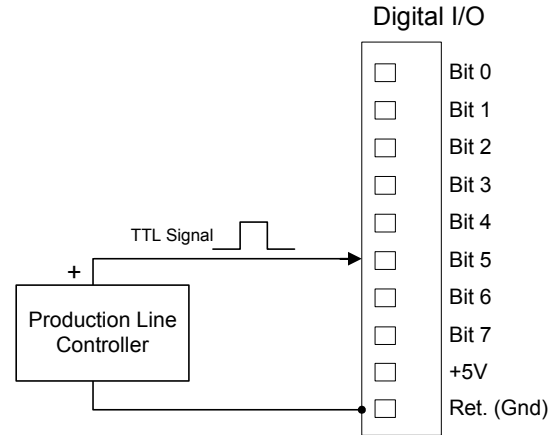


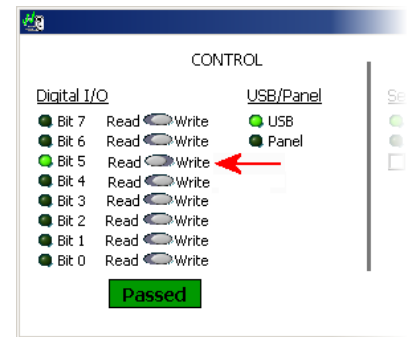
Figure 7-7: Bit 5 - Normal Logic Input

When the AmpConnect Message Step is executed in the sequence, it will Read the actual status of the Input and compare it to the setting of Bit 5.

- Bit 5 is set to Read (Input)
- Bit 5 is set to High (LED On)

If the setting disagrees with the actual status of the Input, the step will issue a FAIL verdict. This is then used by the Step Configuration for sequence logic. See **Step Configuration** in the main SoundCheck Manual for more information.

If the setting agrees with the actual status of the Input, the step will issue a PASS verdict.



AmpConnect ISC Block Diagram

Block Diagram

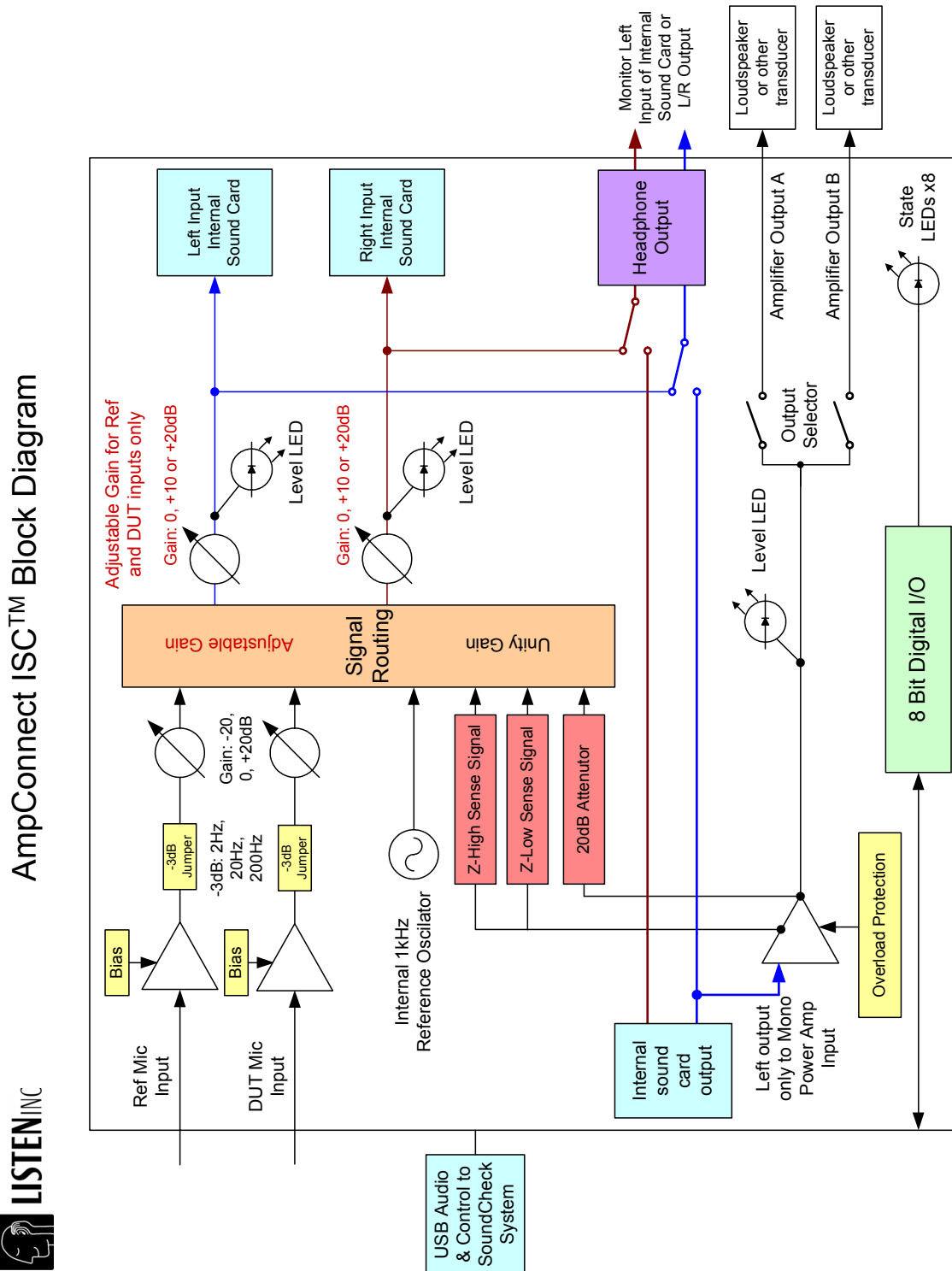


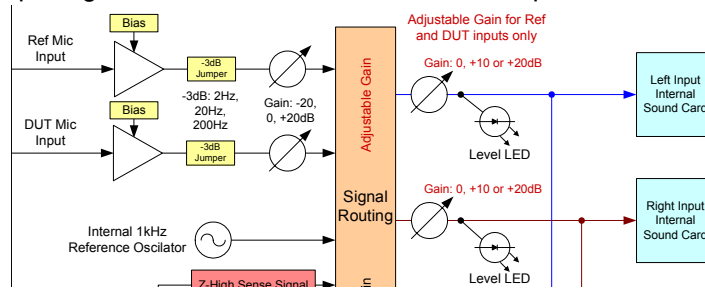
Figure 8-1: AmpConnect ISC Block Diagram

Listen, Inc. 580 Harrison Ave. Suite 2A, Boston, MA 02118 • Tel: (617) 556-4104 • Fax: (617) 556-4145 • www.listeninc.com • © Copyright 2009-2011

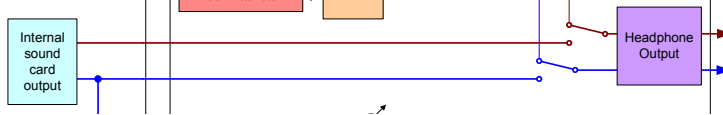
Block Diagram Explanations

Signal routing controlled from AmpConnect ISC front panel or from SoundCheck Message Step.

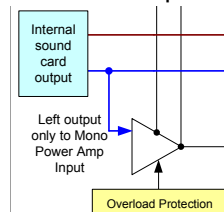
- Ref and DUT Input signals routed to Internal Sound Card inputs



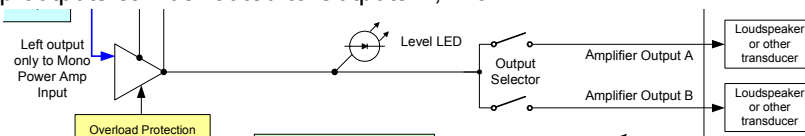
- Adjustable Gain after routing for Ref and DUT inputs only
- Internal 1kHz Reference Oscillator can be routed to Internal Sound Card inputs
- Internal Sound Card L + R outputs can be routed to stereo Headphone output



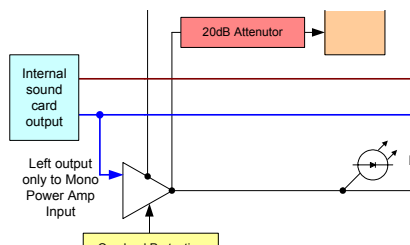
- Only the Left channel of Internal Sound Card Output is routed to input of mono power amplifier



- Power amp outputs can be routed to Outputs A, B or A + B



- Power amp can be internally routed through 20 dB attenuator, to internal sound card inputs for calibration or monitoring



- All signals that can be routed to Internal Sound Card inputs can also be routed to stereo Headphone output for signal monitoring

Internal Jumper Settings

Important! Only the noted jumpers and potentiometers should be adjusted. Other internal settings should not be changed! These are set at the factory and should only be changed with instruction from Listen, Inc.

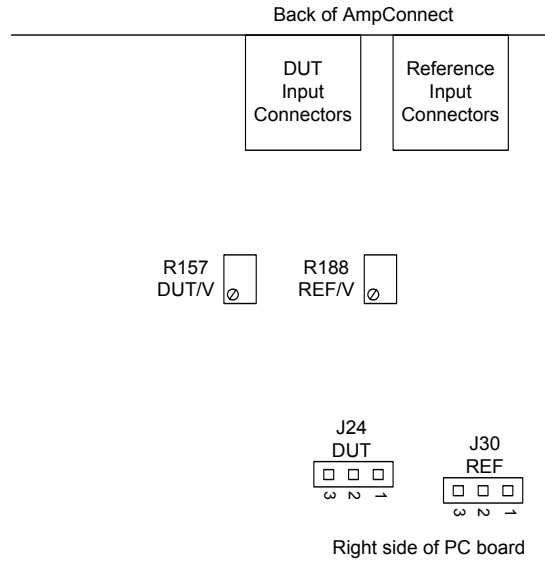


Figure 8-2: Internal Adjustments

Bias Voltage

The Bias Voltage of the Reference and DUT Inputs can be adjusted. See [Figure 8-2](#).

R188 - Reference Bias Potentiometer

R157 - DUT Bias Potentiometer

Default: 10 V DC

Range: 500mV to 12 V DC

Measure voltage across BNC connector or Pins 2 and 3 of XLR connector

IEPE Voltage is not adjustable

3dB Down Point

The 3dB Down Point of the Reference (J30) and DUT (J24) Inputs can be set. See [Figure 8-2](#).

2 Hz - No Jumper (Default)

20 Hz - Jumper across 1 and 2

200 Hz - Jumper across 2 and 3

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Specifications

Nominal values

Power Amplifier

- Continuous Output Power: 60W RMS into 4 Ohms, 47W RMS into 8 Ohms
- Frequency Response: -3dB at 4 Hz & 90 kHz
- THD at 60W, 4 Ohms: 0.019% at 1 kHz
- Internal Voltage Gain: +26.4dB, +/-0.1dB at 1 kHz
- Attenuator: -20.0dB +/-0.2dB at 1 kHz
- Gain from Amp In to Ch1/2 with Amp as Source: +6.4dB +/-0.23dB at 1 kHz
- Output Impedance: Actively minimized to nearly 0 Ohms (see [Amplifier on page 18](#))
- Minimum Load: 4 Ohms, combination of test load and impedance sense load

Loudspeaker Current Measurement

- Z-High = $1V/A$ +/-1%
- Z-Low = $100mV/A$ +/-1%

Reference & DUT Inputs

- Gain: -20dB to +40dB in 10dB steps
- Maximum input at -20dB: 100V RMS
- Maximum input at +40dB: 100mV RMS
- Frequency Response: -3dB at 20 Hz & 150 kHz;
- IEPE Bias: 10mA, 20VDC (max)
- ECM / Electret Bias: 500mV - 12 VDC (via internal trim pot) through 2.2k Ohm

Soundcard

- Channel 1 and 2 tolerances (to the PC via internal sound card): +/- 0.4dB for gains -20dB, 0dB, +20dB, +/-0.2dB for gains -10dB, +10dB, +30dB, +40dB (at 1 kHz)
- 2 Channels, inputs and outputs
- Supports up to 48 kHz sample rate and 24 bits
- Input Dynamic Range: 110 dB typical
- Output Dynamic Range: 114 dB typical
- Input/Output Coupling: AC
- Amplitude Flatness: 20 - 20 kHz \pm 0.25 dB
- THD @ 1 kHz: 0.001% typical
- Crosstalk @ 1 kHz: -110 dB
- Phase Linearity: \pm 5 degrees

Digital I/O

- 8 Bit; any Bit may be configured for input or output
- Outputs: +5V/GND 10mA (max) each
- Note: USB required for Digital I/O operation

Internal Sine Generator

- Output Level: 0 dBV (1V RMS) +/- 0.1dB
- Output Frequency: 1 kHz +/- 1Hz

USB 2.0 Interface

- Internal Sound Card provides audio in/out to PC
- All front panel functions USB controllable
- Front panel can be locked out via USB
- Outputs automatically disabled upon USB disconnect or PC shutdown

Physical

- Without rack mounting flanges: 17 in. wide, 2-Unit (3-1/2 in.) high, 11 in. deep
- Weight: 7 lbs (3.2kgm) approx.
- Power: 85 - 264VAC 50/60 Hz, 150 Watts (max)

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Contact Information

Contact the Listen office at 617-556-4104, Monday thru Friday, between 9 AM and 5 PM EST.
or email:

Sales - sales@listeninc.com

Technical Support - support@listeninc.com

Useful links

Listen Website: www.listeninc.com/

User Forum: www.listeninc.com/community/

FAQ page can be found at: www.listeninc.com/community/

Download the latest versions of manuals, drivers and sequences from the support section of the Listen website.

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