[AN007]

Line-In Audio Interface

Version 2.0

8/28/2017

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2

v2.0

OVERVIEW

Line-level audio signals can broadcast to nearly all AND devices (except the IPSCM and ZONEC units, which do not offer access to the line-in signal). The line-in audio enables local amplification, playback on the device's own speaker(s), and/or broadcasting over a network via multicast addressing. Note that you cannot use the microphone input simultaneously with active playback or broadcast.

PHYSICAL INTERFACE

The following two wire cable will need to be built in order establish a physical connection between an AND device and the line-level input / audio source.

Line-In Audio Cable Build of Materials		
Manufacturer/Part #	**Qty**	**Description**
Molex 50-57-9002	1	Two-position .100" connector housing
Molex 16-02-1125	2	Gold finished female terminal connectors
Alpha Wire 1172C	1	22 AWG, 2-conductor, PVC insulated stranded wire, or similar
CUI SR-3501 or CUI SP-3501	1	3.5mm female jack or male plug connector

1. **Cable Assembly**
   a. Cut the appropriate length of cable (Alpha Wire 1172C) for the installation.

   b. Strip one end of the cable and crimp a female terminal connector (Molex 16-02-1125) to each wire, using a Molex crimper # 64016-0201.

   c. Slide the two female connectors into the connector housing (Molex 50-57-9002). The connector will snap into place when it is inserted properly.

   d. Strip the other end of the cable, and attach the red wire to terminal 2 (left channel audio) of the female jack and black wire to terminal 1 (ground) of the jack (CUI SR-3501). See Figures 1 and 2.

   e. If using the male plug (CUI SP-3501), attach the red wire to the tip terminal (left channel audio) and the black wire to the ground terminal.
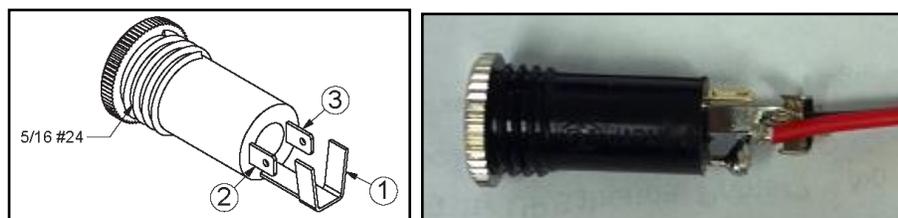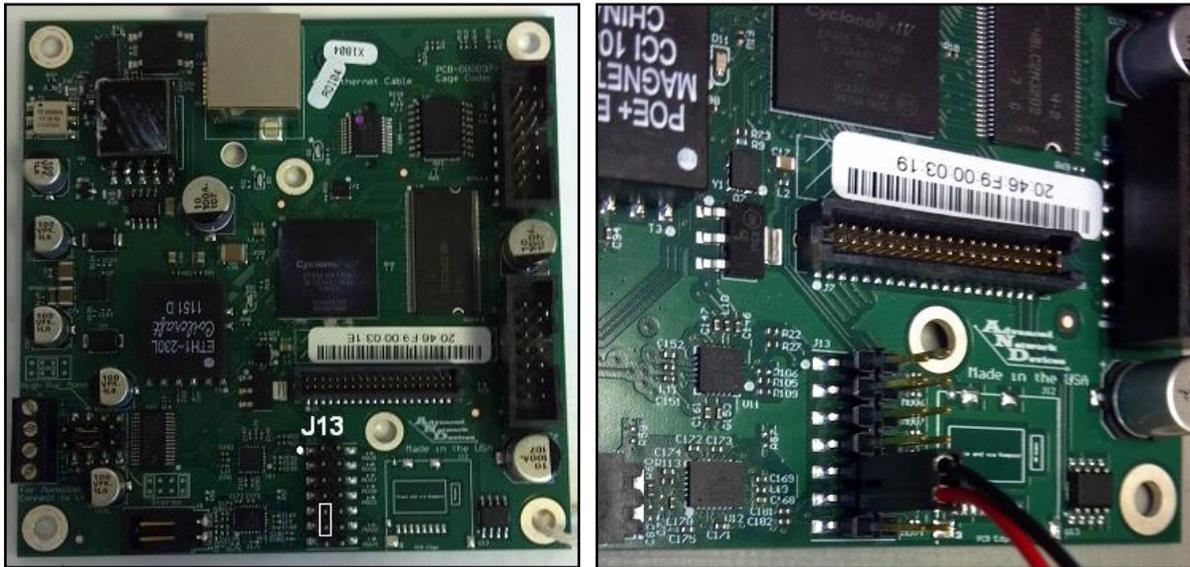

Figure 1 and 2 – 3.5mm Female Jack Connections

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3

v2.0

2. **AND Device Connections**
   Plug the two position .100" connector housing end of the cable onto pins 9 and 11 of the J13 header on the bottom edge of the square controller board in the device, as shown in Figures 3 and 4. The black wire (ground) goes to pin 9, and the red wire to pin 11.

Figures 3 and 4 – Connection to Controller Board

3. **External Audio Source**
   Connect the line out of the audio source into the 3.5 mm female jack or male plug cable assembly.

4. **Testing and Adjustment**
   a. Power on the AND device and the external audio source.

   b. Set the volume output of the audio source to 75% of the max volume.

   c. Set the Line-In volume and amplification to 5.0 using the configuration file.

      Or, to configure the audio with the device's web interface, select **Device Settings → Audio**. Within the Line-In Audio Settings table, set the Line-In Volume and Line-In Amplification Volume to 5.0.

   d. Reboot the speaker.

   e. Verify the audio can be heard at reasonable levels on the speaker. If it is too quiet or loud, adjust the volume settings accordingly.

WEB SERVER PARAMETERS

Parameters	Description
Device Settings → SIP	
Audio Source	Enables line-in as the audio source for SIP intercom calls, instead of the microphone.
Device Settings → Audio	
Line-In Volume	Sets the gain of line-in audio signal. *Range: 0.0 - 10.0*
Volume Modification via GPIO	Allows general purpose inputs 0 and 1 to turn the *Line-In Volume* level up or down, respectively, in 0.5 increments. This enables live changes to volume levels for background music and voice reinforcement amplification. Note that changes to the *Line-In Volume* made via GPIO are not saved when the device reboots. If the device also uses push buttons to initiate SIP calls, you still can use the *Push-to-Talk Alternate* settings to allow SIP call generation with a push and hold action (momentary press will actuate this line-in volume change).
Amplification Volume	Sets the local device playback volume of line-in audio signal (*Range: 0.0 – 10.0*). If set to 0, audio will not play back on the local device.
Filter	Modifies the sound characteristic of the line-in signal to reduce noise (*Range: 0 – 999).* Default = 0 (recommended)
Audio Detection Level	Internal level that the line-in signal must reach to broadcast, or to play back on the local device. Line-in local playback or broadcast stops below this level. Use this parameter to reduce network bandwidth and prevent undesired playback when line-in data is not present, or when the line input cable experiences a high noise floor. If set to 0, the local playback or broadcast will remain always on. *Range: 0 - 50*. A low value such as 2 or 3 normally serves as a good setting for most low-noise inputs. To help select a good level for a given device, you can verify when the device detects audio. Go to **Device Settings → Audio,** and use the *Microphone* settings in the Audio Settings section. For example: Level: mic (paused)=0.165 / linein=2.310, Boost=0.000, Detection mic=yes(0) / linein=no(3). Here current line-in level is 2.310, and the detection level is set to 3. Because the actual line-in level is less than the programmed detection level, the line-in audio will not play back at this time (line-in detection reports "no").
Quiet Detection Delay	Number of milliseconds the line-in audio signal must fall below the *Audio Detection Level* before the local playback or broadcast stops. If set to 0, the default value of 2000ms applies.
Broadcast Destination	Multicast address and port destination to which the device will broadcast the line-in audio (e.g., `232.9.10.11:23456)`. If not present, the line-in audio will only amplify and play back on the local device (provided line-in amplification volume holds a non-zero value). Any number of AND devices can listen to this multicast destination address via a permanent stream. For background music applications, you can set the permanent stream priority level to a very high level (99) to allow all other pages and activity to take precedence. The device generating the broadcast can also listen on its own permanent stream, useful for actuating features on the local device when receiving line-in data, based on message priorities (e.g., flashers).

Alternate Broadcast Destination	Multicast address and port destination to which the speaker will broadcast the line-in audio, if the selected general purpose input is active per the *External Activation* Alternate setting (e.g., `232.9.10.11:23456)`. Useful for emergency alerts that should broadcast to a larger zone, signified by the general purpose input activation.
Audio Quality	Normal or High. Use High for hi-fidelity music playback or voice applications. Use Normal for background music or when keeping network bandwidth to a minimum.
Packet Rate	Normal, Above Normal, or High. High applies to critical, low-latency applications, such as live voice amplification.
External Activation	If selected, the device will only allow line-in local playback or broadcast when the respective general purpose input activates. If selecting one of the Alternate cases, the line-in audio will playback or broadcast to the Broadcast Destination normally, and to the Alternate Broadcast Destination when the respective general purpose input activates.
Activate GPIO 0 During Amplification	If "Yes", general purpose output 0 will activate when the line-in local speaker playback is occurring. Useful for activating a paging amplifier only when receiving line-in audio.
Activate GPIO 1 During Amplification	If "Yes", general purpose output 1 will activate when the line-in local speaker playback is occurring. Useful for activating a paging amplifier only when receiving line-in audio.
Activate GPIO 0 When Line-In Active	If "Yes", general purpose output 0 will activate when the line-in local speaker playback or broadcast is occurring.
Activate GPIO 1 When Line-In Active	If "Yes", general purpose output 1 will activate when the line-in local speaker playback or broadcast is occurring.

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6

v2.0

LINE-IN PARAMETERS IN CONFIGURATION FILE (USING LINEIN TAG)

Configuration File Parameter	Correlation to web page settings	Value Range
volume	Line-In Volume	0.0 - 10.0
button_volume_mod_allowed	Volume Modification via GPIO	0 (no) or 1 (yes)
amplification_volume	Amplification Volume	0.0 - 10.0
filter	Filter	0 - 999
audio_detection	Audio Detection Level	0 - 50
quiet_detection_delay_ms	Quiet Detection Delay	0 - 10000
broadcast	Broadcast Destination	e.g., 10.10.7.250:23456
broadcast_alternate	Alternate Broadcast Destination	e.g., 10.10.7.250:23456
audio_quality	Audio Quality	"normal", "abovenormal", or "high"
packet_rate	Packet Rate	"normal" or "high"
external_activation	External Activation	"gpio0_gate", "gpio1_gate", "gpio0_alternate", or "gpio1_alternate"
gpio0_when_amp	Activate GPIO 0 During Amplification	0 (no) or 1 (yes)
gpio1_when_amp	Activate GPIO 1 During Amplification	0 (no) or 1 (yes)
gpio0_when_active	Activate GPIO 0 When Line-In Active	0 (no) or 1 (yes)
gpio1_when_active	Activate GPIO 1 When Line-In Active	0 (no) or 1 (yes)

EXAMPLE CONFIGURATION TAG SETTINGS

```
<LineIn
  volume="7.0"
  amplification_volume="7.0"
  audio_detection="2"
  audio_quality="high"
  packet_rate="high"
/>
```

VOICE REINFORCEMENT EXAMPLE

You can use the line-in capabilities of the AND device to provide live voice reinforcement. Connect a line-level output from the microphone system into the AND device line-in. Set the following values per the tables above using the device's web page interface, or via a configuration file, then reboot the device for the settings to take effect. Note that the recommended volume setting occurs when the orator can just barely hear their voice from the device.

Settings for playback on one device only:

Device with Line-In
• Volume = 7.0 (adjust as necessary) • Amplification Volume = 7.0 (adjust as necessary) • Audio Detection Level = 2 (adjust as necessary) • Audio Quality = High • Packet Rate = High

Configuration file settings:
<pre>\<LineIn
   volume="7.0"
   amplification_volume="7.0"
   audio_detection="2"
   audio_quality="high"
   packet_rate="high"
/></pre>

Settings for playback to more than one device:

Device with Line-In	Device Playing Back the Audio
• Volume = 7.0 (adjust as necessary) • Amplification Volume = 0 • Audio Detection Level = 2 (adjust as necessary) • Broadcast Destination = 232.1.2.4:23458 (choose an unused multicast address and port) • Audio Quality = High • Packet Rate = High	In the Permanent Streams table: • add a low latency multicast stream to match the one selected as the broadcast destination (e.g., 232.1.2.4:23458). • Set volume to 7 and adjust as needed.

Configuration file settings:
<pre>\<LineIn
   volume="7.0"
   amplification_volume="0"
   audio_detection="2"
   audio_quality="high"
   packet_rate="high"
   broadcast="232.1.2.4:23458"
/></pre>
	Configuration file settings:
	<pre>\<PermanentStreams>
	  \<Channel stream="232.1.2.4"
	port="23458" priority="99"
	latency="low" volume="7.000" />
	\</PermanentStreams></pre>