## Revision History

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<tr>
<th>Document No.</th>
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<tr>
<td>511-000838-01 Rev B</td>
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<td></td>
<td>Changed recommended Raspian OS on p. 12.</td>
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<td>Changed Cypress Siena driver link on p. 16.</td>
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<td>Step 2 in “Writing Raspian OS to microSD Card” on page 6.</td>
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<tr>
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<td>Initial release</td>
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Scope
This documentation provides step-by-step instructions on setting up the Synaptics AudioSmart™ 4-Mic Development Kit for Amazon AVS. The document covers how to make the necessary hardware connections, install the driver, flash the firmware (only when needed), configure the Raspberry Pi3 (RPi3), and set up the Amazon Alexa Voice Service (AVS).

Note: The Raspberry Pi2 (RPi2) can be configured for use. However, using the RPi2 requires additional time for building the SDK. This document assumes the developer is using an RPi3.

Target Audience
This document is intended for manufacturers and developers for creating Smart Home device prototypes that utilize the Synaptics AudioSmart 4-Mic Development Kit and the RPi3 (not provided with the kit) to offer an ideal Voice Control experience via Amazon's Alexa Voice Service.

References

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<tr>
<td>ALSA</td>
<td>The Advanced Linux Sound Architecture (ALSA) provides audio and MIDI functionality to the Linux operating system.</td>
<td><a href="http://www.alsa-project.org/main/index.php/Main_Page">http://www.alsa-project.org/main/index.php/Main_Page</a></td>
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<td>ASoC</td>
<td>ALSA system on Chip for I2S codecs</td>
<td><a href="http://www.alsa-project.org/main/index.php/ASoC">http://www.alsa-project.org/main/index.php/ASoC</a></td>
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<td>Sensory</td>
<td>Wake word engine plug-in for Raspberry Pi</td>
<td><a href="https://github.com/Sensory/alexa-rpi">https://github.com/Sensory/alexa-rpi</a></td>
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Definitions, Acronyms, and Abbreviations

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<tr>
<td>AVS</td>
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<td>GPIO</td>
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<td>I2C</td>
<td>Inter-Integrated Circuit</td>
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<td>RPi3</td>
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Overview

The Synaptics AudioSmart 4-Mic Development Kit for Amazon AVS contains the following:

- CX20924 EVK
- Microphone/LED module (positioned on top of the CX20924 when shipped)
- USB cable
- Cable assembly (colored wires)
- +5V power supply

Note:

- A Micro SD card with at least 8GB is required. A Micro SD card with 16GB is recommended.
- Powered speakers, RPi3, and micro SD card are all mandatory for the set up but are NOT included in the Synaptics AudioSmart 4-Mic Development Kit for Amazon AVS.

Proper speaker selection will enhance overall performance. Download External Loudspeaker Guidelines and Recommendation for Smart Speaker Applications (008DGR0x) document for additional info.

Figure 1: Development Kit Components
Figure 2: CX20924 EVK: Connections, Interfaces, and Devices
Microphone/LED Module

Figure 3: Microphone/LED Module: Four Digital Microphone Locations
Step-by-Step Setup Summary

Hardware Setup

Ensure that connections between the CX20924 EVK and the Microphone/LED module are already established. To set up the hardware connection between these two boards and the RPi3 (not provided with the kit) see "Connecting the EVK and Microphone/LED Module to the RPi3".

Connecting the EVK and Microphone/LED Module to the RPi3

Make the following hardware connections between the CX20924 EVK, the Microphone/LED module, and the RPi3 (connections between the CX20924 EVK, Microphone/LED module and cable assembly are already established).

1. Connect the cable assembly to the GPIO pins on the RPi3. Align the sticker labeled '1' with physical pin 1 on the RPi.

![Connecting Cable Assembly to RPi GPIO Pins](image)
2. Connect the output of the 4-mic processed signal.
   a. Use the USB cable to connect J4 on the CX20924 EVK to a USB port on the RPi.

![Figure 5: Connecting Output of 4-Mic Processed Signal](image1)

3. Connect the powered speakers to the LINEOUT port.
   a. Connect the 3.5mm jack from the powered speakers to J8 (labeled LINEOUT) on the CX20924 EVK.

![Figure 6: Connecting Powered Speakers to the LINEOUT Port](image2)
4. Using the HDMI and USB ports on the RPi3, connect the RPi3 to the monitor, keyboard, and mouse.

5. Connect the 5V supply to the J1 connector on the CX20924 EVK. Use the +5V power supply included with the kit to power the CX20924 EVK, Microphone/LED module, and the RPi3.

**Note:** Power to the RPi3 is provided from the CX20924 EVK and the Micro-USB power on the RPi3 is not used.

![Figure 7: Connecting 5V Power Supply to J1 Connector on the EVK](image1)

The unit should be mounted on top of the speakers, separated by a cushioned material such as putty or foam, to minimize vibrations from the speaker.

![Figure 8: DS20924 Mounted on Speaker](image2)
Software Setup

Writing Raspbian OS to the microSD Card

1. Format the SD card. This can be done by going to the 'Computer' folder and right clicking on the SD card. Click **Format...** to display the format options. When reformatting, confirm that the File system is FAT32 or FAT, as shown below.

![Format Options](image)


3. Unzip and write the downloaded image to the SD card using Win32DiskImager. This tool can be found at the following link: [https://sourceforge.net/projects/win32diskimager/](https://sourceforge.net/projects/win32diskimager/)

4. Run the Win32DiskImager to write the image to the SD card.

   - Browse to the subdirectory icon and select the image file.
   - Select the device drive in the **Device** drop down menu to write the Raspbian OS.
   - Click **Write** to write the image to the SD card.

5. After the image has finished writing, insert the microSD card into the RPi3.
Install, Configure, and build the SDK

1. Insert the microSD card with the Raspbian Stretch OS installed in the RPi3. See "Writing Raspbian OS to the microSD Card".

2. Power on the EVK using the included +5V supply.

3. When the desktop loads, establish a WLAN or LAN connection. If using a WLAN connection, click on the network icon and select the desired network.

4. Open a terminal and send the following command to get the files necessary for installing the SDK.

   $ git clone https://github.com/conexant/avs-device-sdk.git

   The following shows a screen with representative results:

   ![Git Clone Result]

5. Once the files are downloaded, go into the avs-device-sdk directory and run the install.sh script:

   $ cd avs-device-sdk/

   $ bash install.sh

6. Several screen prompts will follow. These screens enable you to acknowledge the Sensory license agreement. You will be asked to set your account credentials. Your account credentials can be found or created at the following: https://developer.amazon.com/edw/home.html. It is important that you write down the following account credential elements. These can also be copied and pasted into the user interface:

   a. ClientId: Type in the ClientId and press Enter.

   b. ClientSecret: Type in the ClientSecret and press Enter.

   c. ProductId: Type in the ProductId and press Enter.
Once the above Sensory license agreement items are entered, the following screen appears:

7. Select item 2 for 4-Mic EVK and press Enter.
   
   This starts the installation which will take several hours to finish.

8. When the setup is complete, you will see a message prompting you to open a browser and go to http://localhost:3000. When you navigate to the page, you will be asked to login with your Amazon account credentials. After logging in, you should see a page that appears like the following:

9. Once you have logged in to your Amazon account, you should see the following message in the terminal. You have completed the setup and are ready to run the sample application.
Running the Setup

Open a terminal and send the following command to run the sample app:

```
$ bash run.sh
```

When the sample app is ready to be used, you should see the following screen:

![Sample App Screen](image)

Verifying the Setup

Once the RPi3 is correctly configured and the hardware connections are established, the unit is ready to be run when all LEDs turn off.

- Say Alexa and three LEDs will point in the direction of the talker.
- When the command is being processed, blue LEDs will flash around the board.
- While the response is played out, the LEDs on the device will brighten and dim.
Installing the Cypress Siena USB-to-I2C Device Driver

A driver must be installed to enable the onboard Cypress Siena USB-to-I2C device. Once enabled, this device will allow the user to communicate with the CX20924 evaluation board over I2C. This is necessary to flash firmware.

1. Connect the Type A to Type B USB cable between your laptop and the CX20924 evaluation board to connector J2.
   
   a. This cable will interface to a Cypress USB-to-I2C control device, allowing you to control parameters of the CX20924 evaluation board using a Conexant GUI.
   
   b. This cable can also be used to flash new Firmware to the CX20924 evaluation board if needed (see “Flashing New Firmware” on page 18).

2. The Cypress Siena driver that enables USB-I2C communication between your laptop and the CX20924 evaluation board can be downloaded from:

   https://raw.githubusercontent.com/wiki/conexant/avs-device-sdk/assets/Conexant_Siena_Driver .rar

   a. Filename: Conexant_Siena_Driver .rar
   
   b. Extract the Conexant_Siena_Driver .rar file onto your laptop.

3. Run the Setup .exe file included in the Conexant_Siena_Driver folder as shown below:
4. When the following message appears. Click Yes.

In the Device Manager, you should shortly see **Conexant Siena USB Driver** appear under **Universal Serial Bus Controllers**.

The Cypress Siena device is now ready to use.
Flashing New Firmware

The CX20924 evaluation board comes pre-flashed with firmware (FW). The following instructions are only needed if a new FW version needs to be loaded.

1. Connect the standard USB cable to allow Cypress Siena USB-I2C control if not done already.

2. Firmware flashing on the CX20924 device is done from the laptop/PC through the onboard Cypress Siena CY7C68013A I2C-to-USB converter device going to the CX20924 and the SPI flash device.
   a. FW update system flow: Laptop/PC>Cypress CY7C68013A>CX20924>SPI Flash.
   b. A driver is required to use the Cypress Siena CY7C68013A device, so make sure you have previously installed the Cypress Siena CX7C68013A driver as described in "Installing the Cypress Siena USB-to-I2C Device Driver" on page 16.

The FW release package is stored in a folder named fcp. This folder contains a number of subfolders as shown below.

![Figure 9: Example FCP Folder](image)

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3. Open the **build** folder which contains the *.sfs* FW image file.

![Build Folder Contents](image)

**Figure 10: Build Folder Contents**

4. Double click on the **i2c_flash.exe** file. FW updating will begin, and the following window will appear.

![FW Update Window](image)

Wait for the green **PASS** message to appear, indicating that the FW was updated successfully. The FW upgrade should take less than 30 ms to complete.

5. Once the successful **PASS** message appears, close the window and cycle power on the board by unplugging and plugging back the power on the CX20924 evaluation board. The CX20924 device is ready to be used with the new updated FW.
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