Synaptics

ADVANCING
THE HUMAN
INTERFACE

Synaptics AudioSmart® 4-Mic Development Kit for Amazon AVS

511-000838-01 Rev C

Contents

List of Figures

List of Tables

1. Introduction

This document provides step-by-step introductions on setting up the Synaptics AudioSmart® 4-Mic Development Kit for Amazon™ AVS. The document describes 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.

1.1. Target Audience

This document is intended for manufacturers and developers for creating Smart Home device prototypes that use 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.

1.2. References

Table 1. References

Name	Description	Location
I²C	I²C Specification	http://www.nxp.com/documents/user_manual/UM10204.pdf
ACPI	Advance Configuration and Power Interface	http://www.acpi.info/DOWNLOADS/ACPIspec50.pdf
RPi3	An open source code single-board computer	https://www.raspberrypi.org/products/raspberry-pi-3-model-b/
ALSA	The Advanced Linux Sound Architecture (ALSA) provides audio and MIDI functionality to the Linux operating system.	http://www.alsa-project.org/main/index.php/Main_Page
ASoC	ALSA system on Chip for I²S codecs	http://www.alsa-project.org/main/index.php/ASoC
Sensory	Wake word engine plug-in for Raspberry Pi	https://github.com/Sensory/Alexa-rpi

1.3. Definitions, Acronyms, and Abbreviations

Table 2. Definitions

Term	Definition
AVS	Alexa Voice Service
DSDT	Differentiated System Description Table
GPIO	General-Purpose Input/Output
I²C	Inter-Integrated Circuit
RPi3	Raspberry Pi 3

2. Overview

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

- CX20924 evaluation kit (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 of at least 8 GB is required. A Micro SD card with 16 GB is recommended.
- Powered speakers, RPi3 board, 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 protection will enhance overall performance. See *External Loudspeaker Guidelines and Recommendations for Smart Speaker Applications* (PN: 507-000837-01) document for additional information.

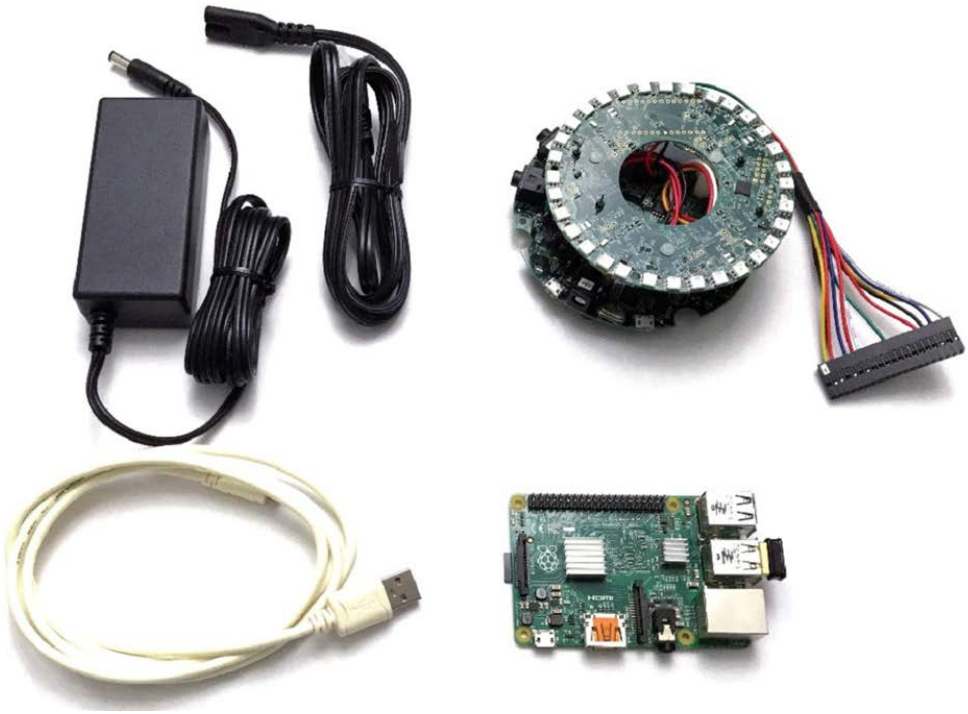


Figure 1. Development kit components

2.1. CX20924 EVK

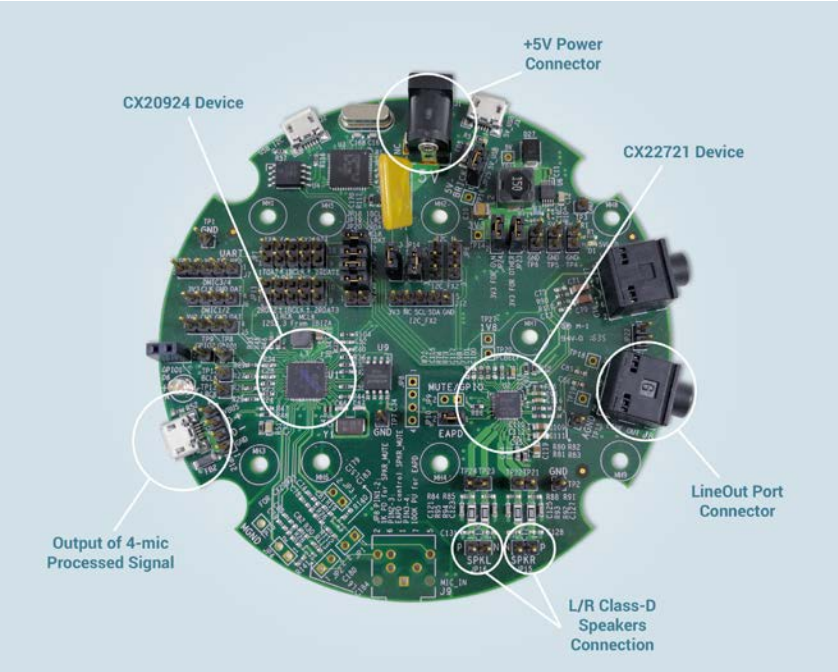


Figure 2. CX20924 EVK: connections, interfaces and devices

2.2. CX20924 Microphone/LED Module

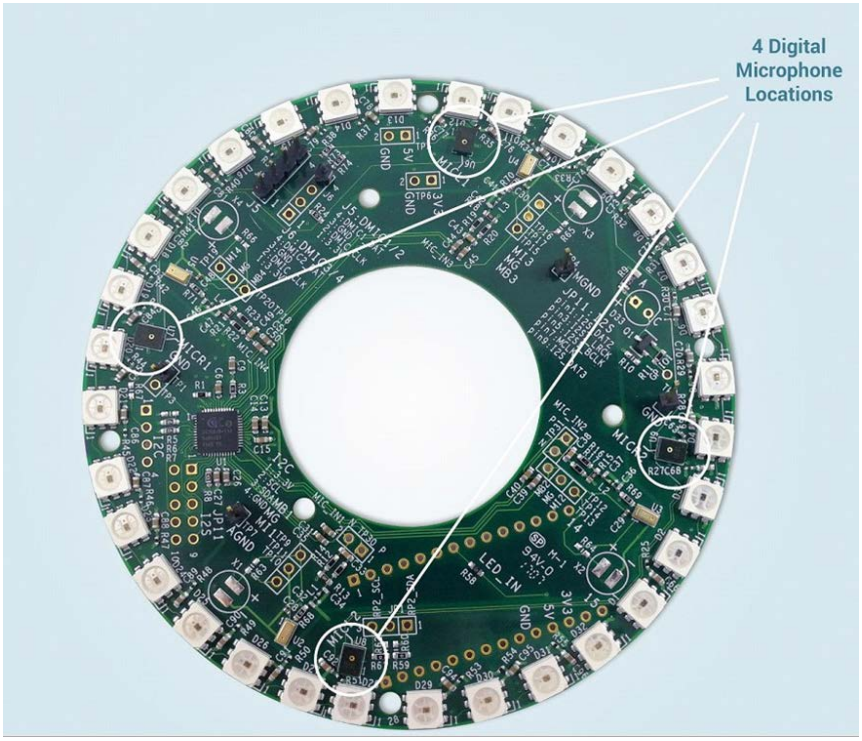


Figure 3. CX20924 Microphone/LED module: four digital microphone locations

3. Using the Development Kit

3.1. Hardware Setup

Ensure that connections between the CX20924 EVK and the Microphone/LED module are already established.

3.1.1. Connecting the EVK and Microphone/LED Module to the RPI3

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

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

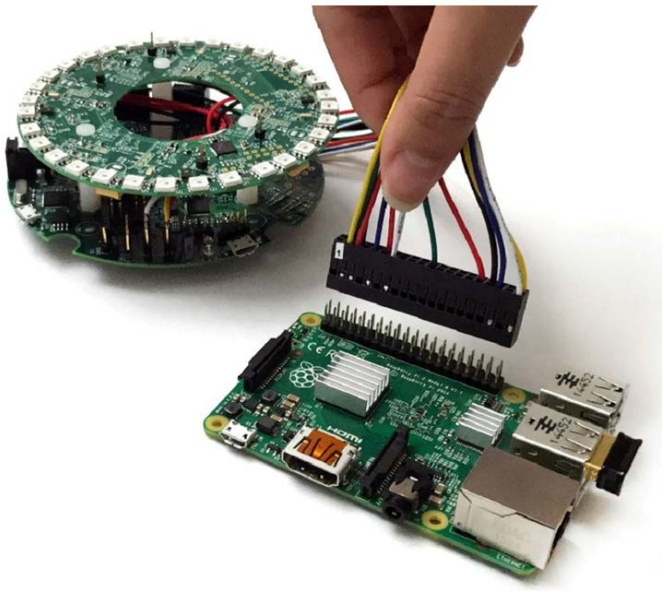


Figure 4. Connecting cable assembly to RPi3 GPIO pins

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 RPi3.

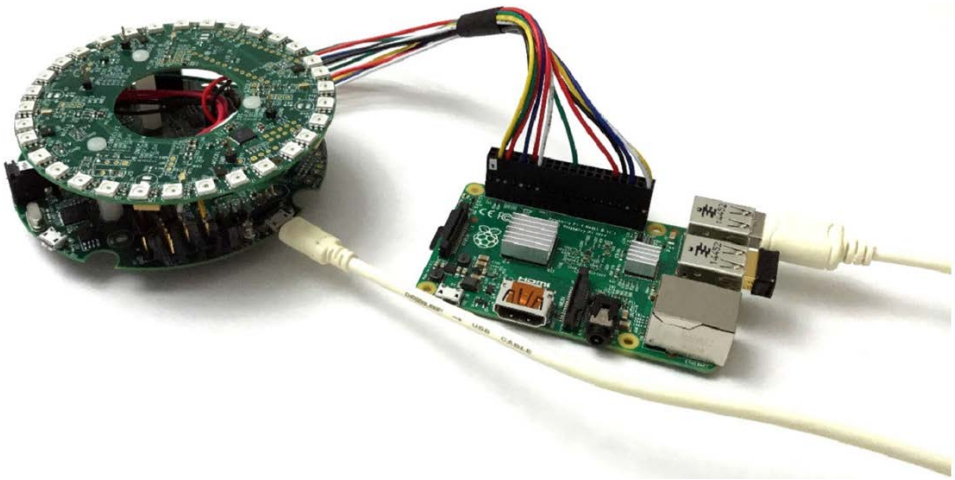


Figure 5. Connecting output of 4-mic processed signal

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.

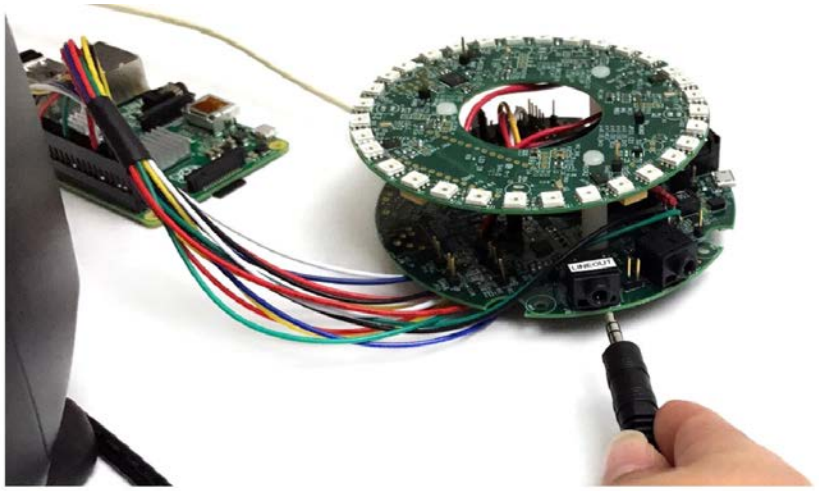


Figure 6. Connecting powered speakers to the LINEOUT port

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 by the CX20924 EVK. The Micro-USB power on the RPi3 is not used.

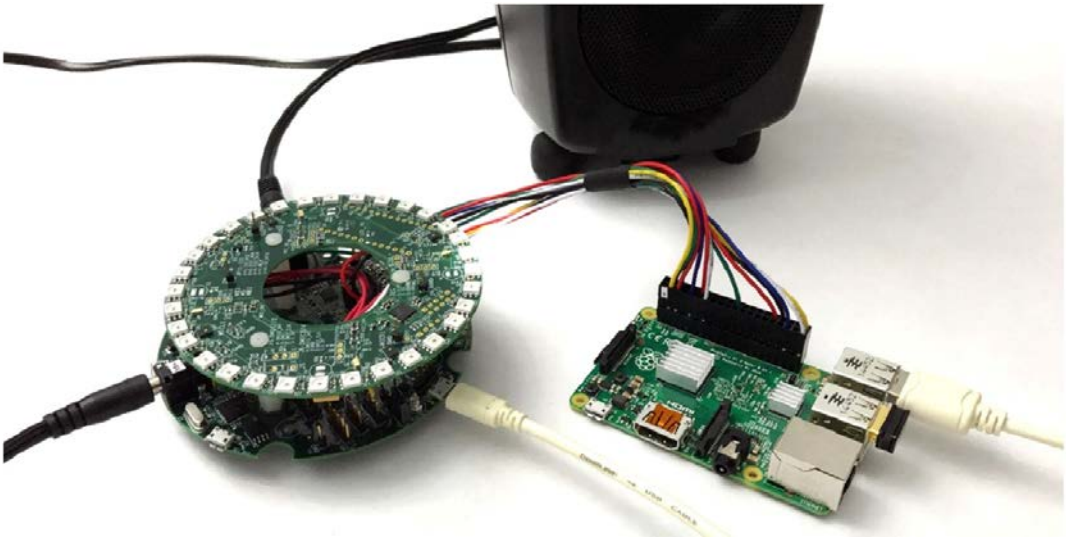


Figure 7. Connecting 5V power supply to J1 connector on the EVK

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.

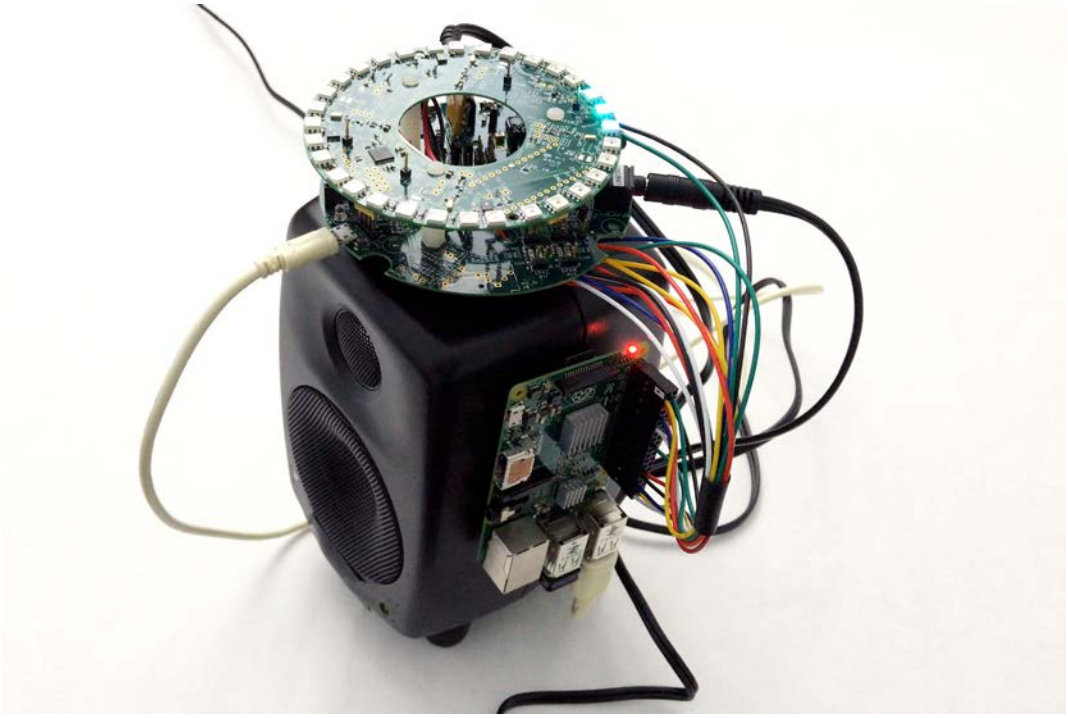
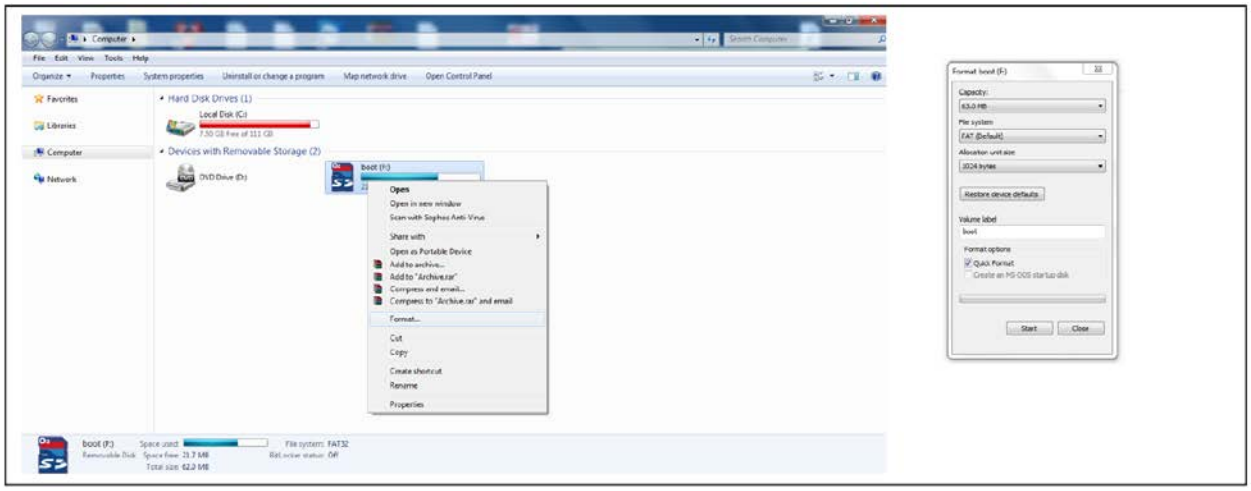


Figure 8. DS20924 mounted on speaker

3.2. Software Setup

3.2.1. *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.

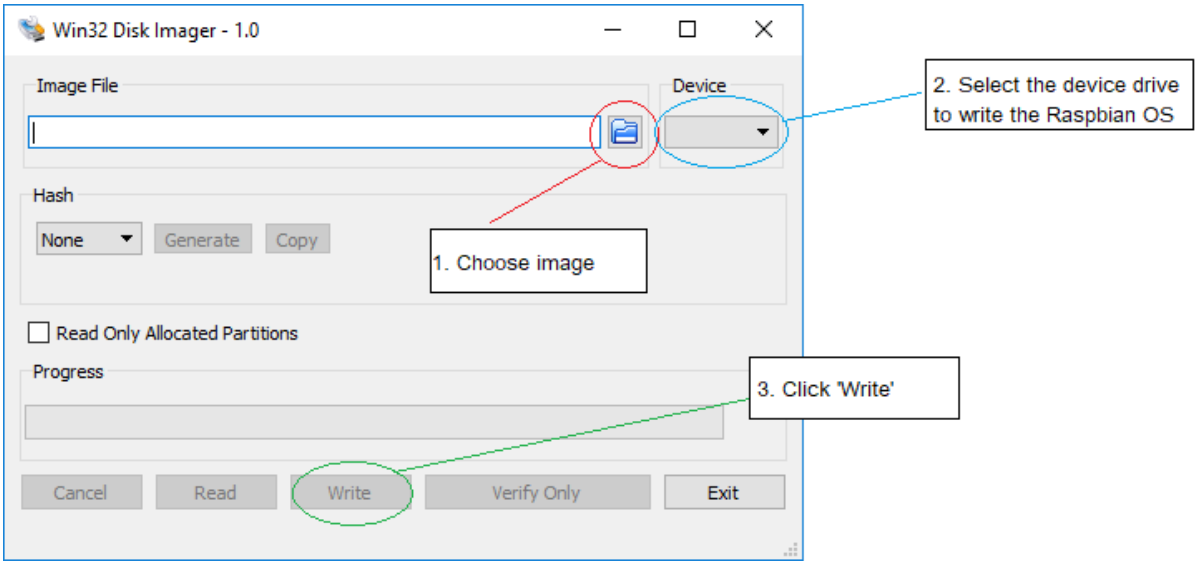


2. Download the Raspbian Stretch OS. The zip file is located at the following link:

   http://downloads.raspberrypi.org/raspbian/images/raspbian-2018-11-15/

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/

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.

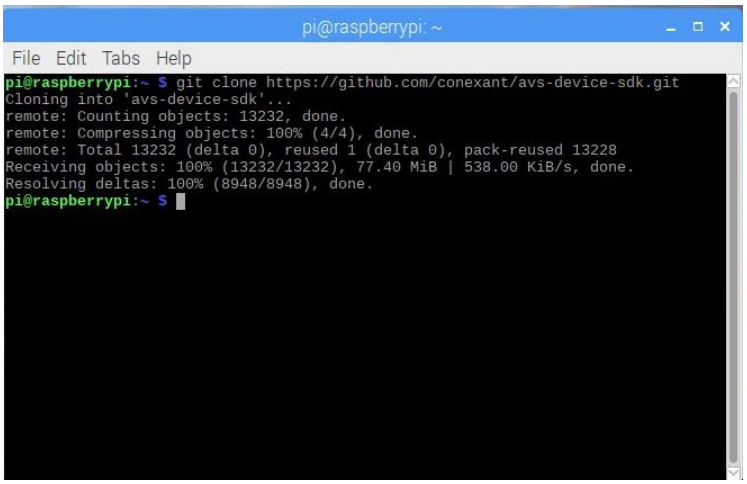
5. After the image has finished writing, insert the microSD card into the RPi3.

3.3. 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.
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:



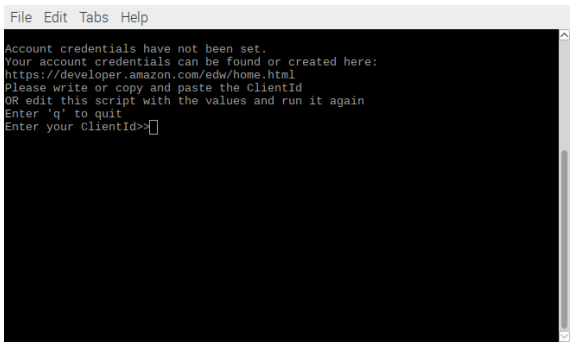
5. After the files are downloaded, go into the avs-device-sdk directory and run the install.sh script.

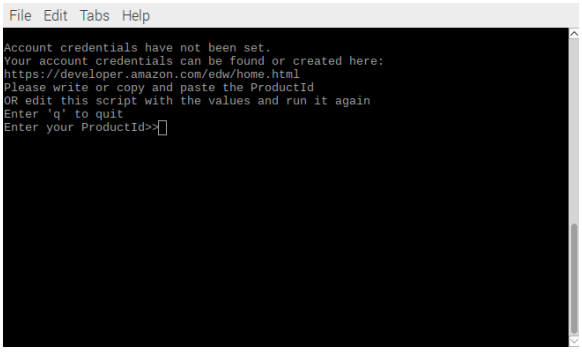
   ```
   $ cd avs-device-sdk
   ```

   ```
   $ bash install.sh
   ```

6. Several screen prompts will follow. You will need to provide your account credentials and answer several prompts. Depending on your answers to the prompts, you may need to acknowledge the Sensory license agreement.

Note: If you haven't already registered your device, you can do so at: https://developer.amazon.com/alexa/console/avs/home. To create a security profile, go to: https://github.com/alexa/avs-device-sdk/wiki/Create-Security-Profile for step-by-step instructions.

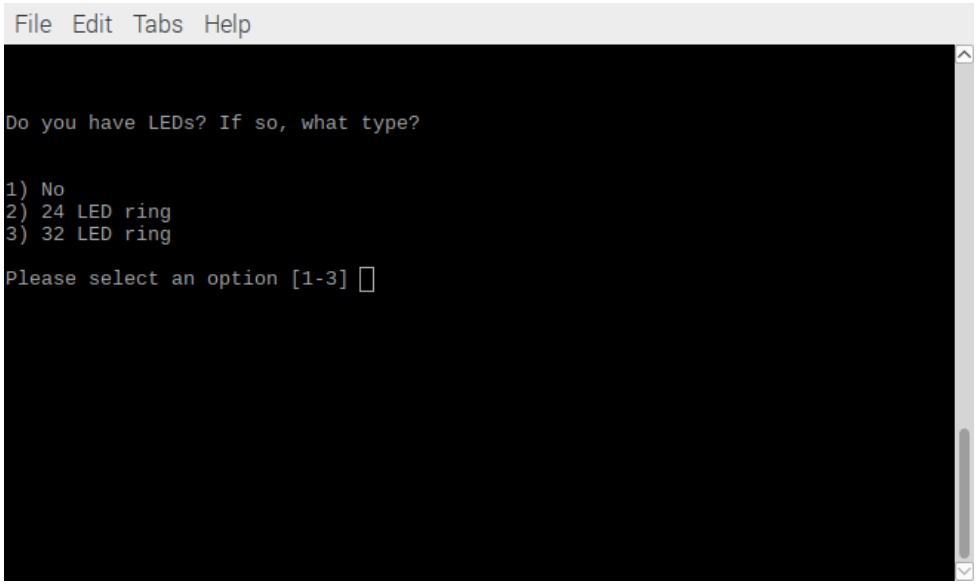




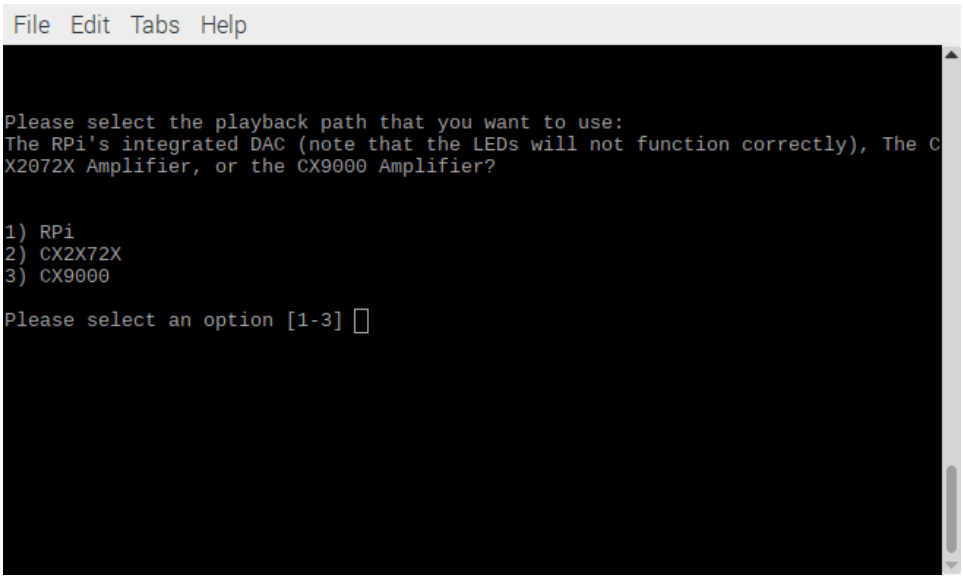
a. ClientId: Type in the ClientId and press **Enter**.

b. ProductId: Type in the ProductId and press **Enter**.

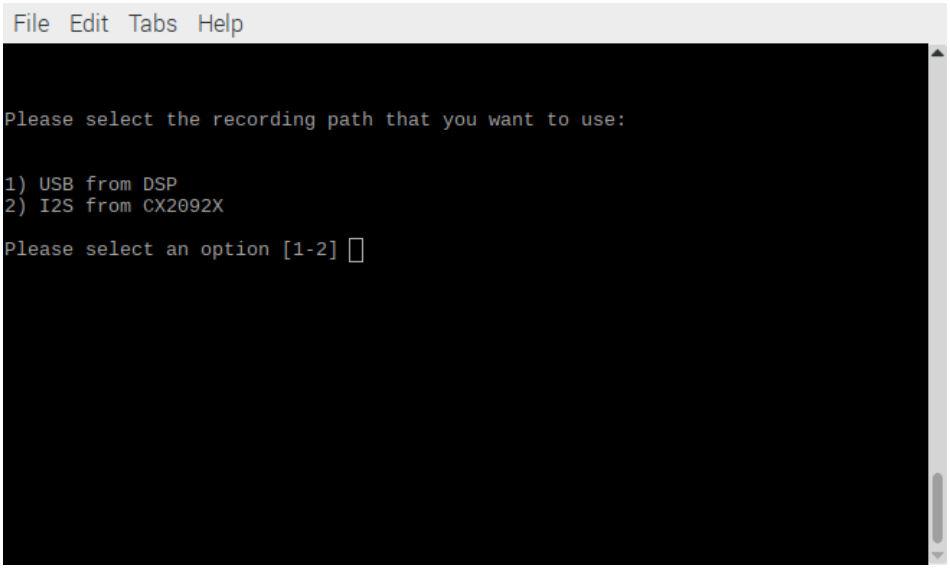
7. After the ClientId and ProductId are entered, you will be asked if your kit has LEDs. Select **3** for 32 LED ring.



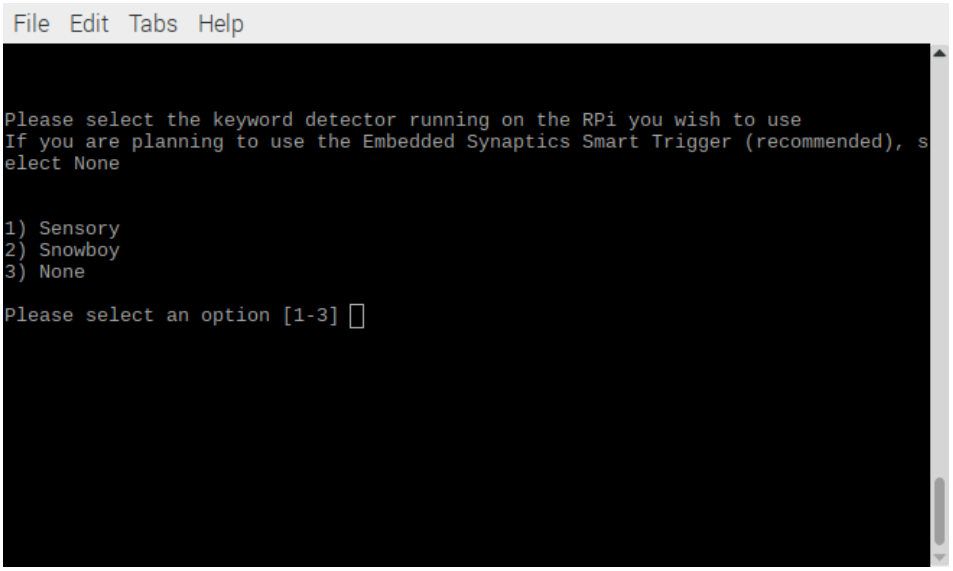
8. Next you will be asked to select which playback path to use. Select **2** for CX2X72X.



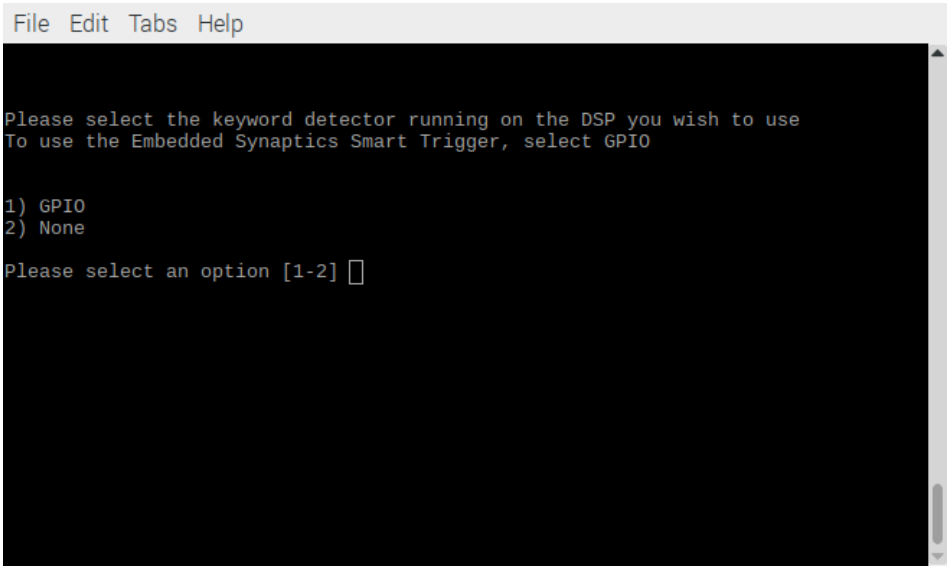
9. Next you will be asked to select which recording path to use. Select **1** for USB from DSP.



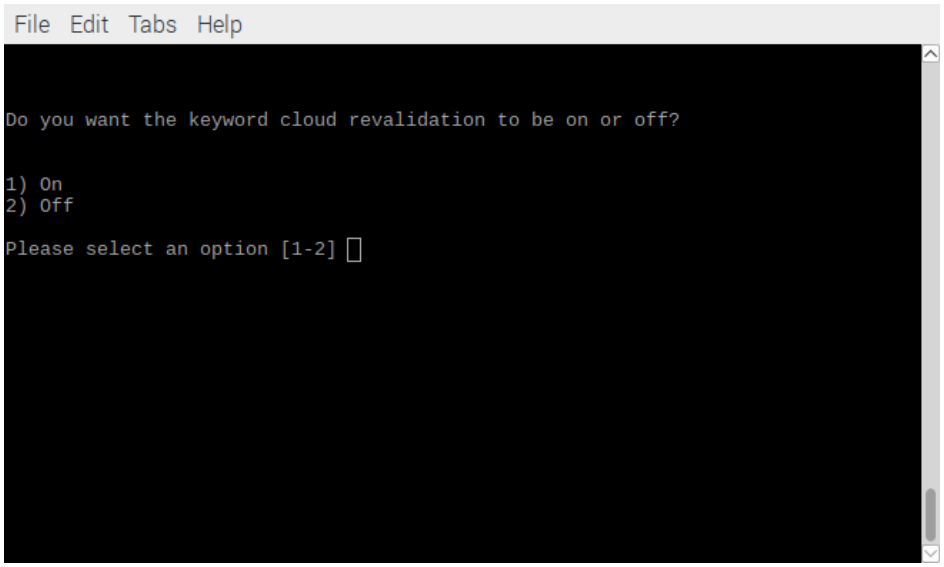
10. Next you will be asked to select the keyword detector to run on the RPi. Select **1** for Sensory.



11. Next you will be asked to select the keyword detector to run on the DSP. Select **2** for None.



12. Next you will be asked if you want keyword cloud revalidation on or off. Select **1** for On.



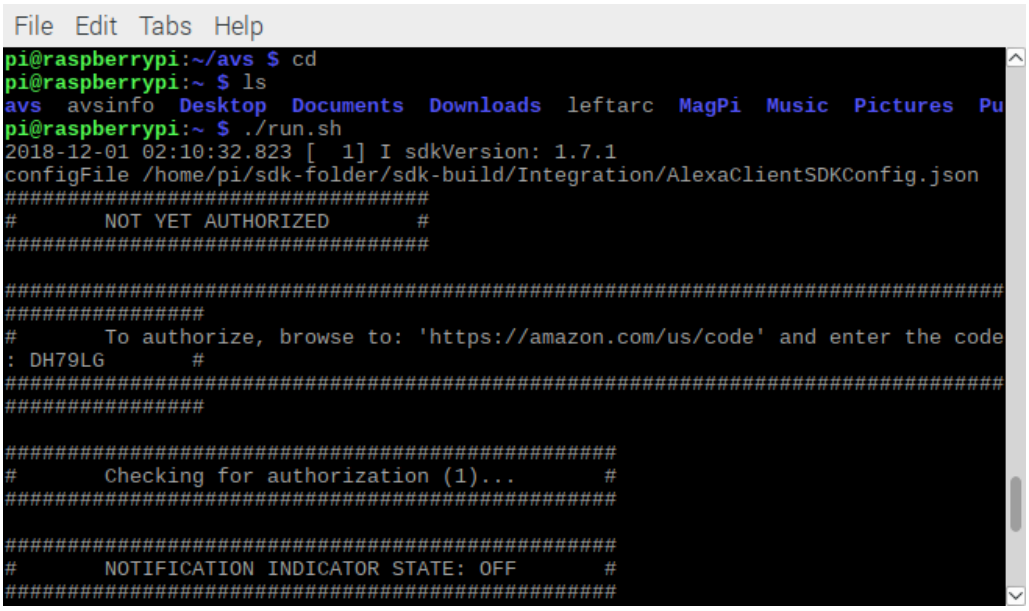
This starts the installation. Make sure to acknowledge the Sensory license agreement. After the acknowledgement, the installation will start and take several hours to complete.

3.4. Running the Setup

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

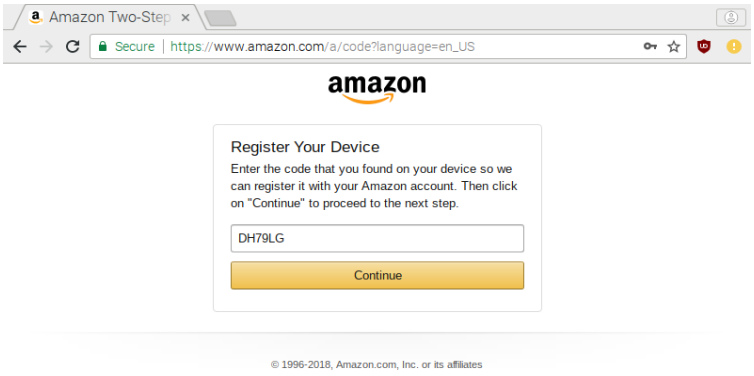
   ```
   $ bash run.sh
   ```

2. When the sample app is run for the first time, you will be asked to authorize. Find the following message (you may have to scroll up a bit):

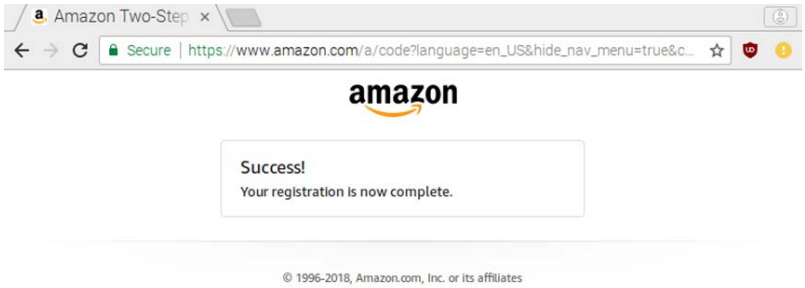


3. Open a browser and go to https://amazon.com/us/code (this can be done on your RPi3 or PC) and log into the Amazon account you wish to use.

4. Enter the code found in the AVS app (shown in previous picture) and hit continue.



Once you see the message ‘Success! Your registration is now complete’. You should also see “Authorized!” in the terminal message.



The sample app is now ready to be used, try asking Alexa a question!

3.5. 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.

4. Installing the Cypress Siena USB-to-I²C Device Driver

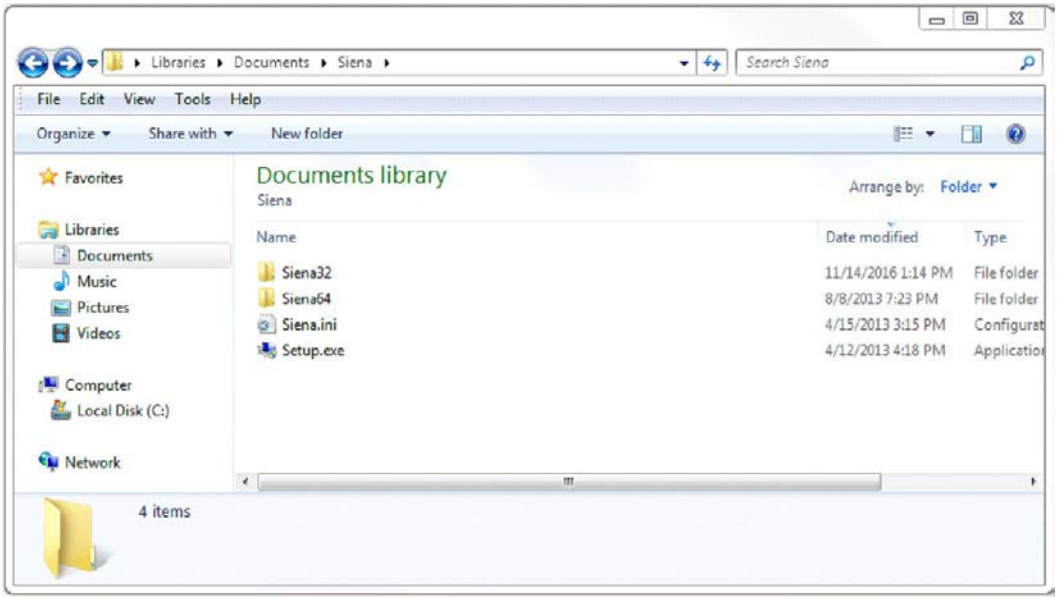
A driver must be installed to enable the onboard Cypress® Siena USB-to-I²C device. Once enabled, this device allows you to communicate with the CX20924 evaluation board over I²C. This is necessary to flash firmware.

1. Connect the Type A to Type B USB cable between your laptop and the CX20924 evaluation board to connector J2.
    a. This cable interfaces 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).
2. The Cypress Siena driver that enables USB-I²C communication between your laptop and the CX20924 evaluation board can be downloaded from:

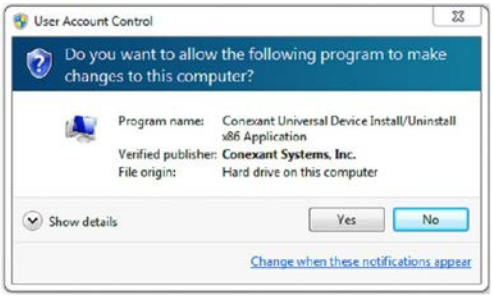
    https://raw.githubusercontent.com/wiki/conexant/avs-device-sdk/assets/Conexant_Siena_Driver.rar

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

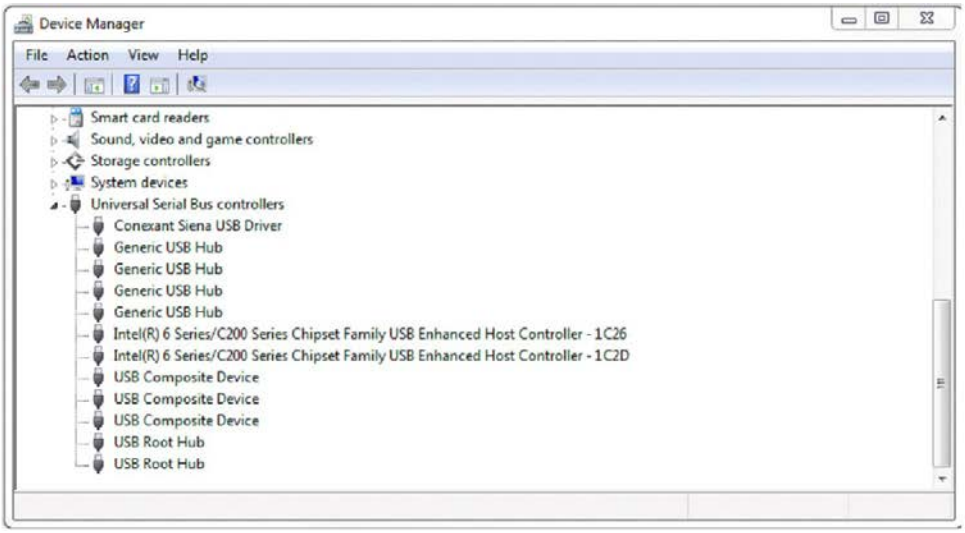
3. Run the **Setup.exe** file included in the **Conexant_Siena_Driver** folder as shown below:



4. When the following message appears. Click **Yes**.



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



The Cypress Siena device is now ready to use.

4.1. Flashing New Firmware

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

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

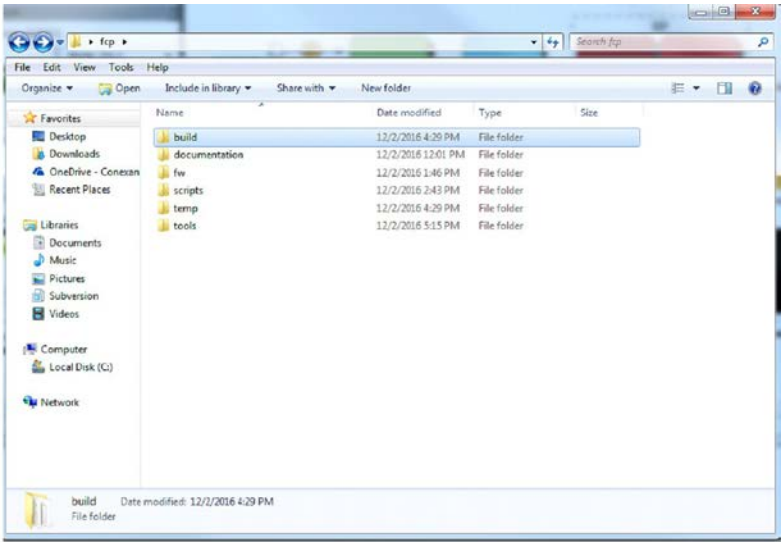


Figure 9. Example fcp folder

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

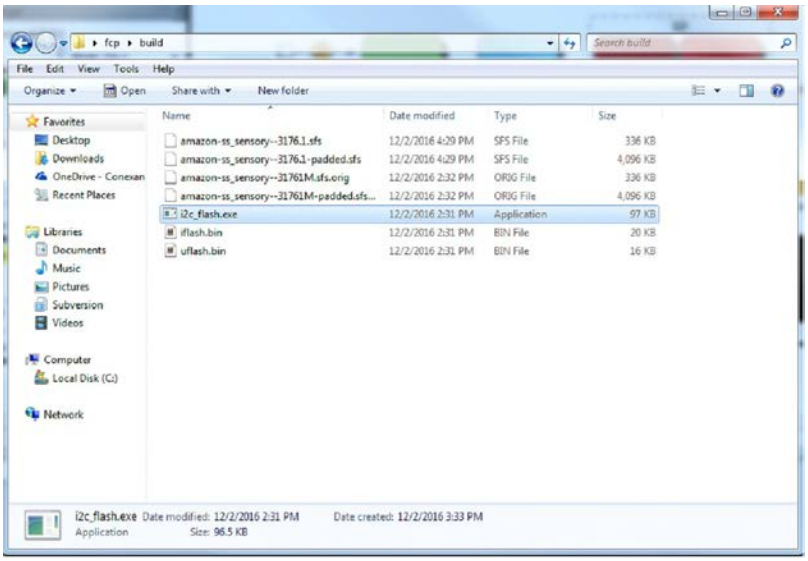
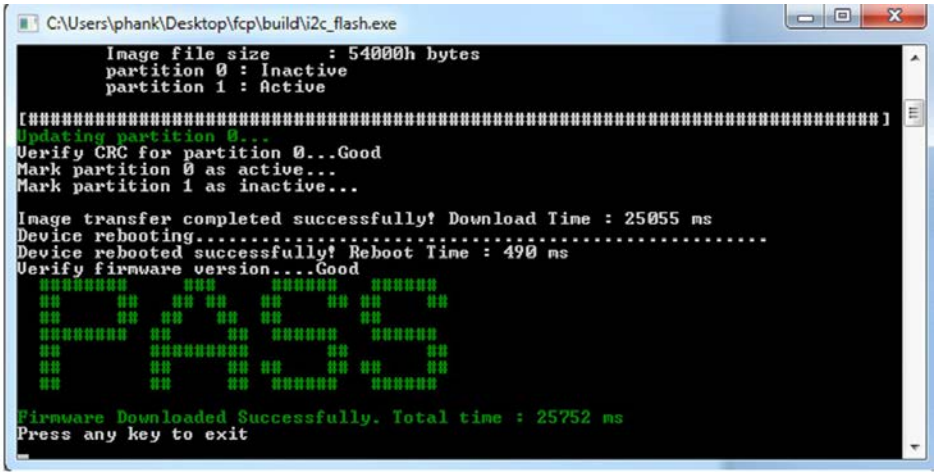


Figure 10. Build folder contents

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



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.

5. Troubleshooting

If you encounter any issues with the AVS Sample App, see the following link to the list of solutions to some common problems reported by AVS developers.

https://github.com/conexant/avs-device-sdk/wiki/Troubleshooting

6. Revision History

Revision	Description
C	Updated: Software Setup
B	Updated: Changed recommended Raspian OS on p. 12. Changed Cypress Siena driver link on p. 16.
A	Initial release

Copyright

Trademarks

Synaptics, AudioSmart, and the Synaptics logo are trademarks or registered trademarks of Synaptics Incorporated in the United States and/or other countries.

All other trademarks are the properties of their respective owners.

Notice

This document contains information that is proprietary to Synaptics Incorporated ("Synaptics"). The holder of this document shall treat all information contained herein as confidential, shall use the information only for its intended purpose, and shall not duplicate, disclose, or disseminate any of this information in any manner unless Synaptics has otherwise provided express, written permission.

Use of the materials may require a license of intellectual property from a third party or from Synaptics. This document conveys no express or implied licenses to any intellectual property rights belonging to Synaptics or any other party. Synaptics may, from time to time and at its sole option, update the information contained in this document without notice.

INFORMATION CONTAINED IN THIS DOCUMENT IS PROVIDED "AS-IS," AND SYNAPTICS HEREBY DISCLAIMS ALL EXPRESS OR IMPLIED WARRANTIES, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ANY WARRANTIES OF NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHTS. IN NO EVENT SHALL SYNAPTICS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, PUNITIVE, OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH THE USE OF THE INFORMATION CONTAINED IN THIS DOCUMENT, HOWEVER CAUSED AND BASED ON ANY THEORY OF LIABILITY, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, AND EVEN IF SYNAPTICS WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGE. IF A TRIBUNAL OF COMPETENT JURISDICTION DOES NOT PERMIT THE DISCLAIMER OF DIRECT DAMAGES OR ANY OTHER DAMAGES, SYNAPTICS' TOTAL CUMULATIVE LIABILITY TO ANY PARTY SHALL NOT EXCEED ONE HUNDRED U.S. DOLLARS.

Contact Us

Visit our website at www.synaptics.com to locate the Synaptics office nearest you.