WM8960 Audio HAT

User Manual

OVERVIEW

This is a sound card HAT designed for Raspberry Pi, low power consumption, supports stereo encoding / decoding, features Hi-Fi playing / recording, what's more, it can directly drive speakers to play music.

FEATURES

- Raspberry Pi connectivity, compatible with Raspberry Pi Zero/Zero W/Zero WH/2B/3B/3B+
- Integrates WM8960 low power stereo CODEC, communicates via I2S interface
- Integrates dual high-quality MEMS silicon Mic, supports left & right double channels recording, nice sound quality
- Onboard standard 3.5mm earphone jack, play music via external earphone
- Onboard dual-channel speaker interface, directly drives speakers
- Supports sound effects such as stereo, 3D surrounding, etc.
- Comes with development resources and manual (python demo code for playing / recording)

SPECIFICATIONS

- CODEC: WM8960
- Power supply: 5V
- Logic voltage: 3.3V
- Control interface: I2C
- Audio interface: I2S
- DAC signal-noise ratio: 98dB
- ADC signal-noise ratio: 94dB
- Earphone driver: 40mW (16Ω@3.3V)
- Speaker driver: 1W per channel (8Ω BTL)

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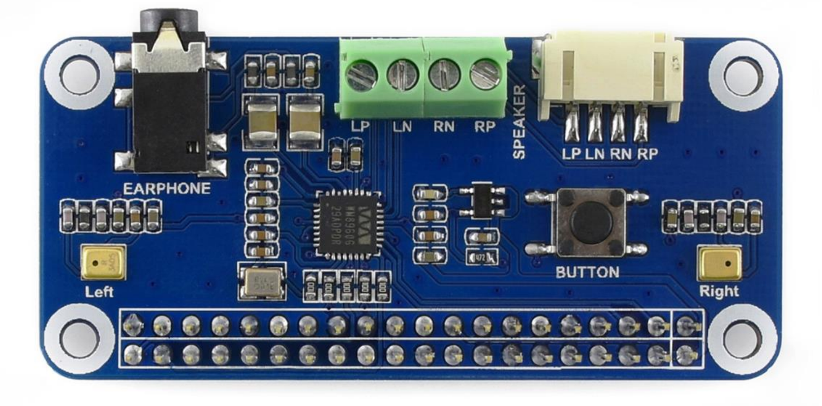
HARDWARE


EARPHONE
LP
LN
RN
RP
SPEAKER
LP LN RN RP
BUTTON
Left
Right

LP, LN are positive polar and negative polar of the left speaker separately; RP, RN are positive polar and negative polar of the right speaker.

Pinout:

PIN	RaspberryPi (BCM)	RaspberryPi (Board)	Description
5V	5V	5V	5V
GND	GND	GND	Ground
SDA	P2/SDA	3	I2C Data input
SCL	P2/SDA	5	I2C Clock input
CLK	P18	12	I2S Bit clock input
LRCLK	P19	35	I2S Frame clock input
DAC	P21	40	I2S Data output
ADC	P20	38	I2S Data input
BUTTON	P17	11	Configurable

USE GUIDES

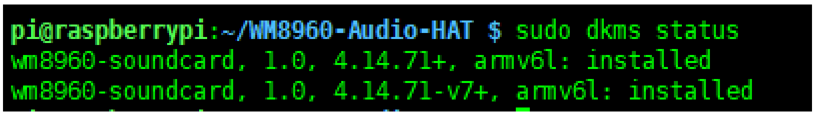
INSTALL DRIVER

Insert the WM8960 Audio HAT to Raspberry Pi. Power on Raspberry Pi and networking.

Clone the driver and install it with commands:

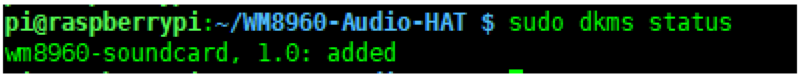
```
git clone https://github.com/waveshare/WM8960-Audio-HAT
cd WM8960-Audio-HAT
sudo ./install.sh
sudo reboot
```

Waiting for rebooting, then check the driver



```
pi@raspberrypi:~/WM8960-Audio-HAT $ sudo dkms status
wm8960-soundcard, 1.0, 4.14.71+, armv6l: installed
wm8960-soundcard, 1.0, 4.14.71-v7+, armv6l: installed
```

If the response information doesn’t include kernel version as below, you need to try to install it again.



```
pi@raspberrypi:~/WM8960-Audio-HAT $ sudo dkms status
wm8960-soundcard, 1.0: added
```

CHECK SOUND CARD

Check sound card status of Raspberry Pi with command **aplay -l** and **arecord -l**

```
pi@raspberrypi:~ $ aplay -l
**** List of PLAYBACK Hardware Devices ****
card 0: ALSA [bcm2835 ALSA], device 0: bcm2835 ALSA [bcm2835 ALSA]
  Subdevices: 7/7
  Subdevice #0: subdevice #0
  Subdevice #1: subdevice #1
  Subdevice #2: subdevice #2
  Subdevice #3: subdevice #3
  Subdevice #4: subdevice #4
  Subdevice #5: subdevice #5
  Subdevice #6: subdevice #6
card 0: ALSA [bcm2835 ALSA], device 1: bcm2835 ALSA [bcm2835 IEC958/HDMI]
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

```
card 1: wm8960soundcard [wm8960-soundcard], device 0: bcm2835-i2s-wm8960-
hifi wm8960-hifi-0 []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
pi@raspberrypi:~ $ arecord -l
**** List of CAPTURE Hardware Devices ****
card 1: wm8960soundcard [wm8960-soundcard], device 0: bcm2835-i2s-wm8960-
hifi wm8960-hifi-0 []
  Subdevices: 1/1
  Subdevice #0: subdevice #0
```

RECORD AND PLAY

Record and play Test

Use arecord to record audio and play: (earphone or speaker is required)

```
sudo arecord -f cd -Dhw:1 | aplay -Dhw:1
```

After running the command, you can hear the sound recorded by mic from earphone or speaker. Note that the speaker should away from the mic to void from noise.

Record

```
sudo arecord -D hw:1,0 -f S32_LE -r 16000 -c 2 test.wav
```

This command is used to record sounds from device 1.0, two channels, 160000Hz, 32bit, and export as test.wav

```
-D : device
-r : frequency
-c : channel
-t : type
-f : format
```

Play

```
sudo aplay -D HW:1,0 test.wav
```

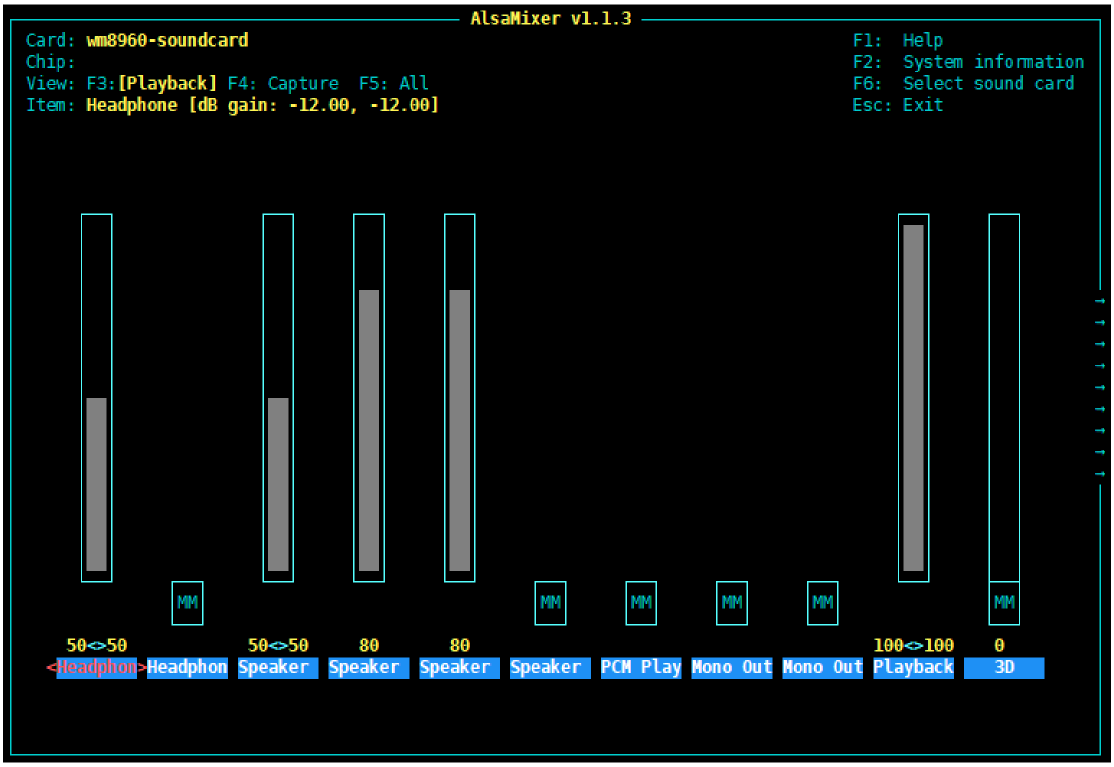
Note that aplay tool can only play *.wav audio file.

VOLUME ADJUST

To setting sound and adjust volume, you can use alsamixer tool

```
sudo alsamixer
```

If WM8960 is not the default sound card, you should press F6 to choose audio device.



```
                              AlsaMixer v1.1.3
Card: wm8960-soundcard                                    F1:  Help
Chip:                                                     F2:  System information
View: F3:[Playback] F4: Capture  F5: All                  F6:  Select sound card
Item: Headphone [dB gain: -12.00, -12.00]                 Esc: Exit
```

MM
MM
MM
MM
MM
MM
MM
50<>50
50<>50
80
80
100<>100
0
<Headphon>
Headphon
Speaker
Speaker
Speaker
Speaker
PCM Play
Mono Out
Mono Out
Playback
3D

SET DEFAULT SOUND CARD

```
sudo vi /usr/share/alsa/alsa.conf
```

Open the file and find the statement:

```
defaults.ctl.card 0
defaults.pcm.card 0
```

Modify these statements from 0 to 1. If WM8690 is device 1, you can modify the statements to the corresponding device number of WM8690.

OTHER PLAY TOOLS

aplay can only used to play .wav audio files. If you need to play other audio like MP3, you can use mpg123 software.

Install mpg123

```
sudo apt-get install mpg123
```

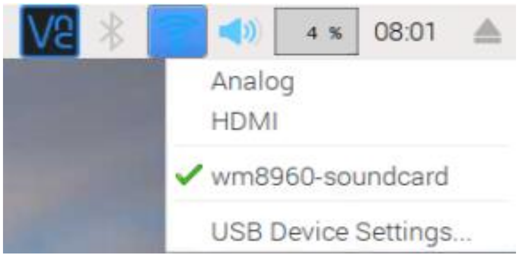
Play audio (Note: you should first set WM8960 as default sound card)

```
sudo mpg123 test.mp3
```

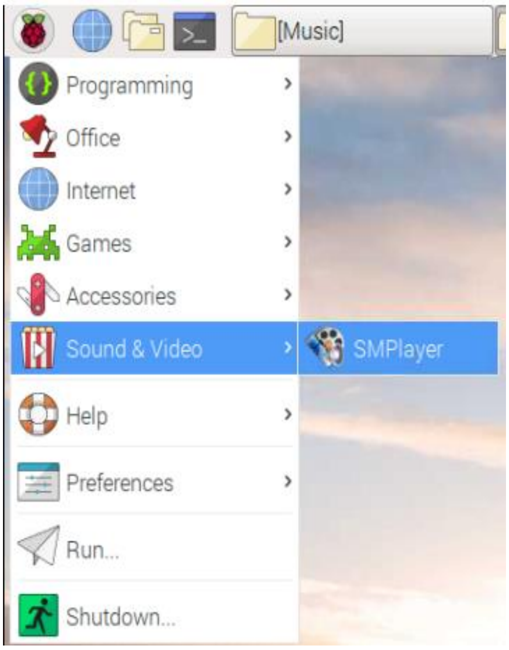
smplayer is a graphic audio playing software

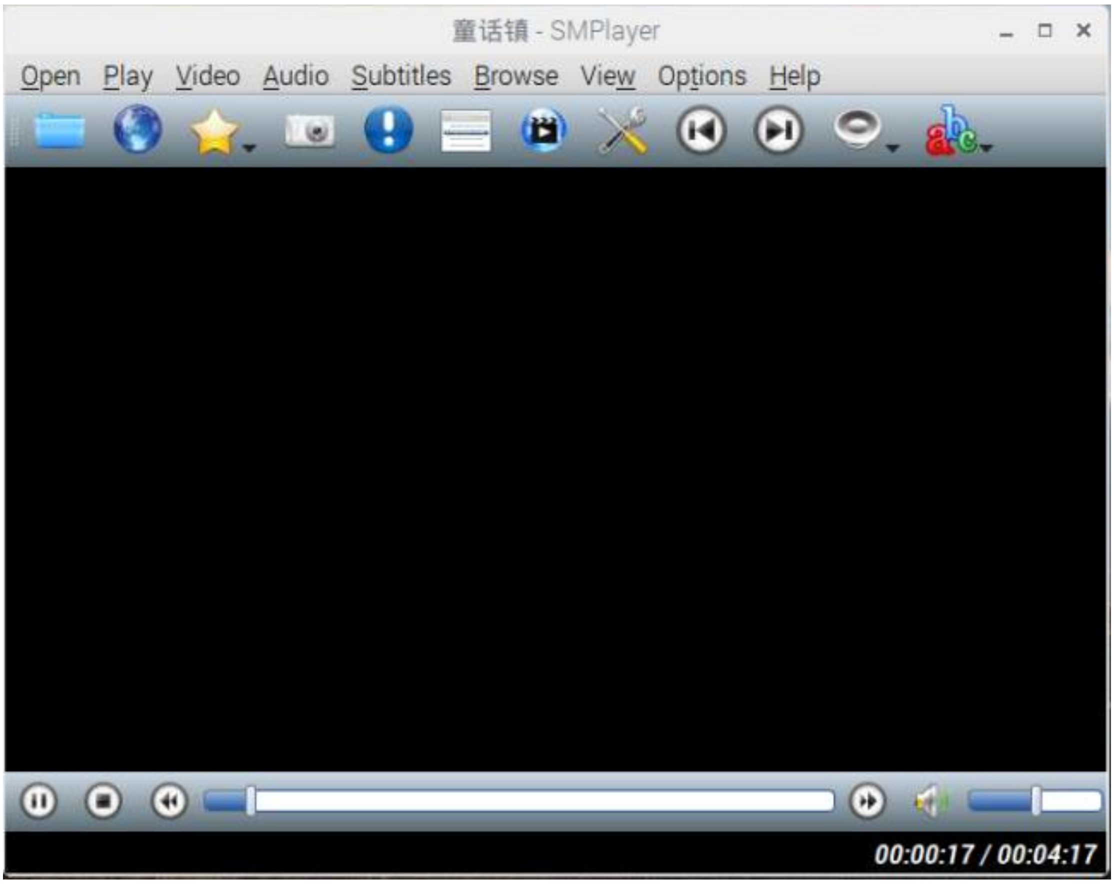
```
sudo apt-get install smplayer
```

Right click and set WM8960-soundcard as default device


4 %
08:01
Analog
HDMI
✓ wm8960-soundcard
USB Device Settings...

Open smplayer software on menu, and open audio files to play.


[Music]
Programming
Office
Internet
Games
Accessories
Sound & Video
SMPlayer
Help
Preferences
Run...
Shutdown...


童话镇 - SMPlayer
Open
Play
Video
Audio
Subtitles
Browse
View
Options
Help
00:00:17 / 00:04:17

CODSE CONTROL PLAYING

INSTALL LIBRARIES

Install libraries

```
sudo apt-get install libasound2-dev
```

Install pyalsaaudio

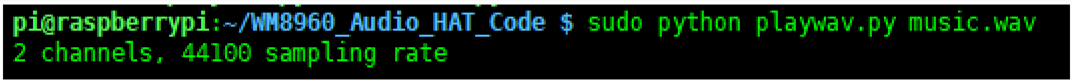
```
cd ~
git clone https://github.com/larsimmisch/pyalsaaudio
cd pyalsaaudio
sudo python setup.py build
sudo python setup.py install
```

Download demo codes from waveshare wiki and copy to raspberry pi

unzip demo codes to pi user directory.

Play:

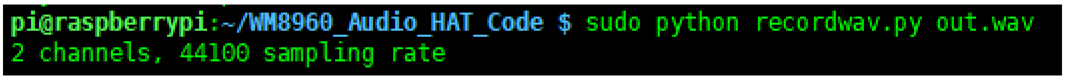
```
sudo python playwav.py music.wav
```



```
pi@raspberrypi:~/WM8960_Audio_HAT_Code $ sudo python playwav.py music.wav
2 channels, 44100 sampling rate
```

Record:

```
sudo python recordwav.py out.wav
```



```
pi@raspberrypi:~/WM8960_Audio_HAT_Code $ sudo python recordwav.py out.wav
2 channels, 44100 sampling rate
```