



Synchronized Stereo Camera HAT for Raspberry Pi Datasheet

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1 Introduction

Now Arducam released a stereo camera HAT for Raspberry Pi which allows you to connect two 5MP OV5647 or two 8MP IMX219 pi cameras to a single standard pi board, and takes images or video at the same time, even more important they are fully synchronized. The highlight of this stereo camera HAT is that it incorporates Arducam proprietary ArduChip solution, and extends the usage of the single pi camera port, it cheats the Raspberry pi as if only one camera connected. It supports Raspistill command for preview and RaspiVID command for video capture/processing with Rpi default camera driver for its 5MP and 8MP cameras. It also supports other Arducam Raspberry Pi cameras and proprietary camera driver that works up to two 16MP. With the share oscillator and I2C broadcasting the two cameras are fully synchronized in nano-second level. With the latest new coming Pi 4 hardware, Arducam makes more camera applications possible for Raspberry Pi.

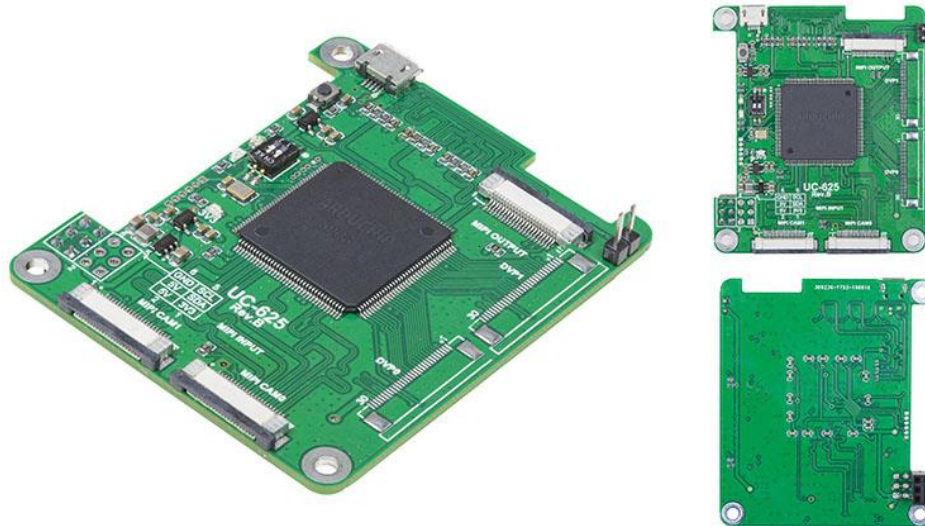


Figure 1 Synchronized Stereo Camera HAT Photos

2 Features & Key Specifications

- Support all series Raspberry Pi boards, Pi HAT board style
- Two MIPI camera inputs and one MIPI camera output
- Support 1, 2 and 4 lane MIPI cameras input up-to 800Mbps/lane
- Support 2 lane MIPI output
- Support Raspistill (preview) and Raspidvid (processing) commands for 5MP/8MP pi cameras with half resolution combine
- Support Arducam RPI cameras up to 16MP with proprietary camera driver with full resolution combine
- Support camera side-by-side combine, channel 0 and channel 1 software switching on the fly
- Support digital pan in half resolution combine, programmable pan speed control
- Board size: 65 x 56 mm
- Weight: 16 g

Note:

- Oscillator sharing requires extra cables, soldering skill needed or please use Arducam bundle kit
- Contact us for other platform support

3 Application

- Stereo Vision
- 360 Camera
- Advanced Surveillance Camera

4 Assembly Instruction

4.1 Step 1

You need to modify your current Raspberry Pi V1.3 or V2 camera board with solder iron and hot air gun. This step can be skipped if you are using Arducam 5MP or 8MP stereo camera board like the Figure2 shows.



Figure 2 Arducam Stereo Camera Board

For 8MP V2 Pi Camera

Removing the resistor and crypto IC marked in circle from one of the camera board, and using jumping wires soldered to the pads as shown in the Figure 3, twist the jumping wires will improve the signal quality.

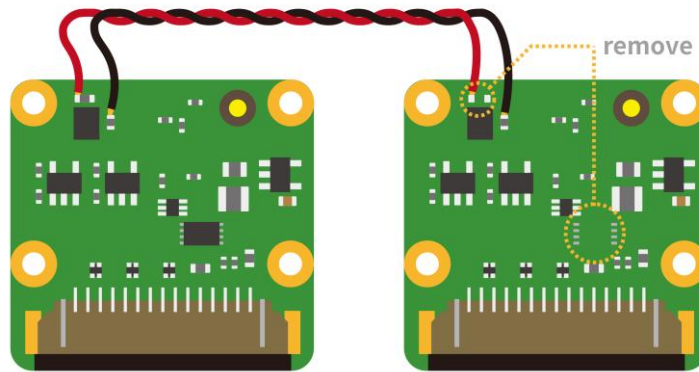


Figure 3 8MP V2 Pi Camera Rework Instruction

For 5MP V1.3 Pi Camera

Removing the oscillator IC marked in circle from one of the camera board, and using jumping wires soldered to the pads as shown in the Figure 4, twist the jumping wires will improve the signal quality.

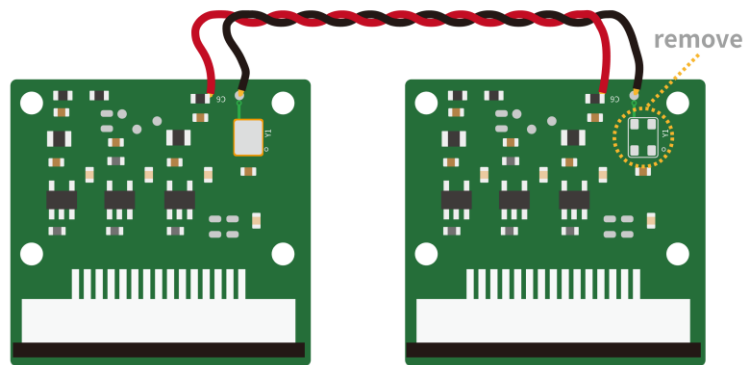


Figure 4 5MP V1.3 Pi Camera Rework Instruction

4.2 Step 2

Attach the 22pin-15pin ribbon cable to the stereo camera HAT (22pin end) and Raspberry Pi CSI port (15pin end).

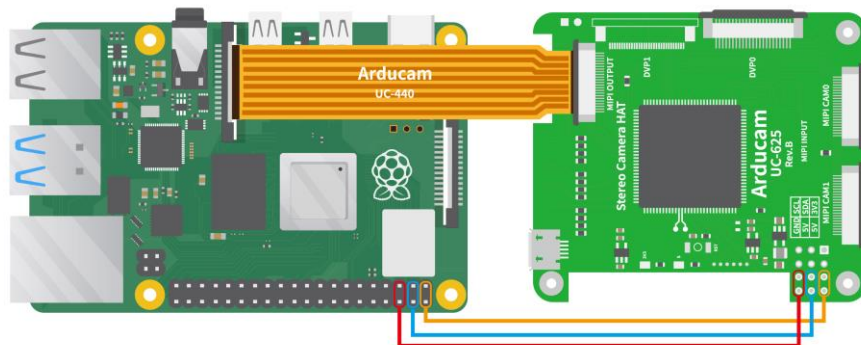


Figure 5 Connect the 15pin-22pin ribbon cable

4.3 Step 3

Plug the stereo camera HAT on top of the Raspberry Pi, align the HAT Pin1 to RPI's Pin1, then using the screws to fasten the HAT.

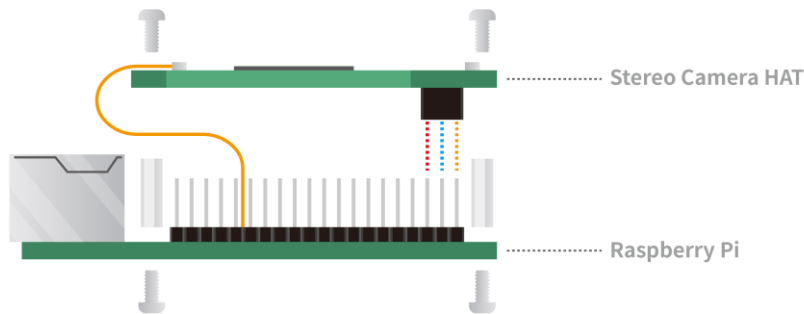


Figure 6 Connect the HAT to RPi Board

4.4 Step 4

Attach the two camera 22pin ribbon cable to the stereo camera HAT.

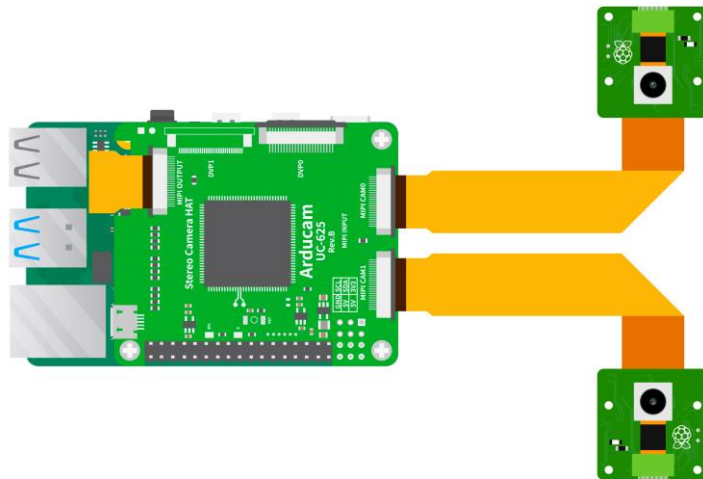


Figure 7 Connect two cameras

5 Quick Start Guide

5.1 Using Raspistill Command

Run the following command from the terminal window to preview two camera feed at the same time. Note that stereo camera HAT doesn't work with raspistill to take photos, other software requires to take photos.

```
raspistill -t 0 -p 800,100,1024,768
```

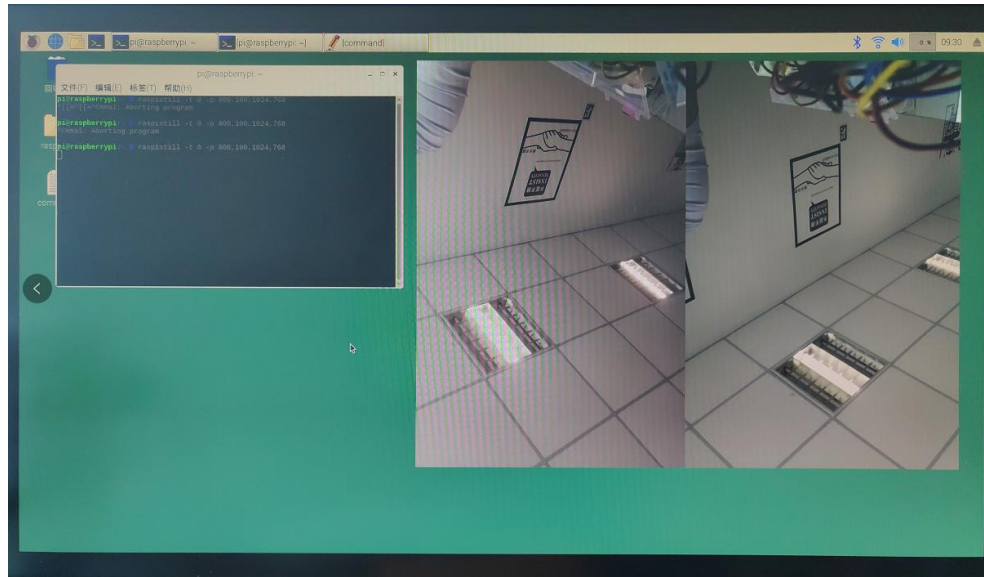


Figure 8 Preview using raspistill command

5.2 Using Raspivid Command

Run the following command from the terminal window, and playback the recorded video.h264 file from VLC player or similar.

raspivid -p 800,100,1024,768 -o video.h264 -t 20000

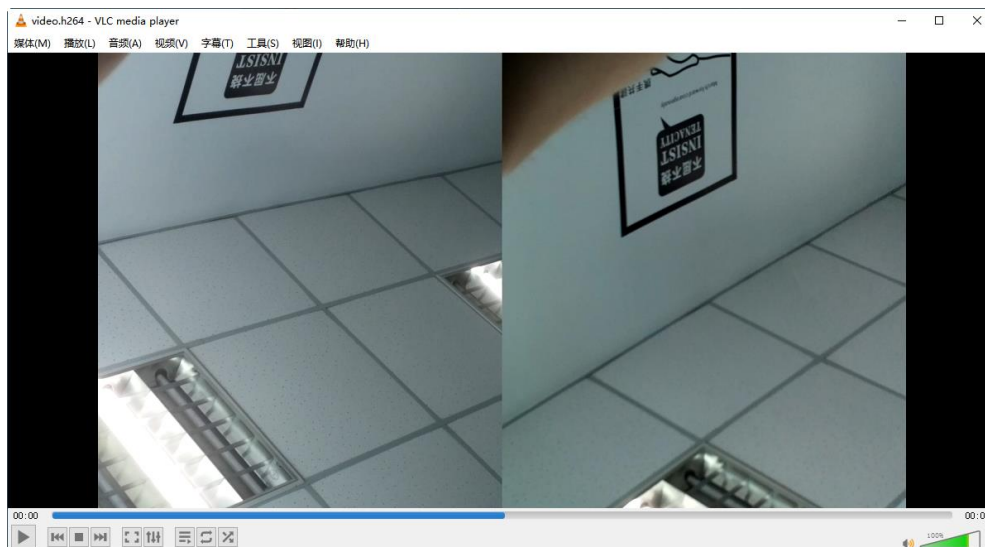


Figure 9 Record using raspivid command

5.3 Advanced Controls

The stereo camera HAT support channel selection and digital pan, it requires to write onboard ArduChip registers through I2C-0 bus on Raspberry Pi. So that user need to run the additional script to active the I2C-0 bus. More information about the ArduChip registers, please refer to the chapter 7.

Clone the github repository from https://github.com/ArduCAM/MIPI_Camera.git and run the script `./camera_i2c_vc.sh`, reboot requires.

Before issuing any control command, you have to launch preview or video using raspistill or raspivid command first, then launch another terminal window to run the following commands.

5.3.1 Switch to CAM0, Single Mode

Run command `i2cset -y 0 0x24 0x24 0x01` to switch from stereo mode to single mode CAM0 feed.

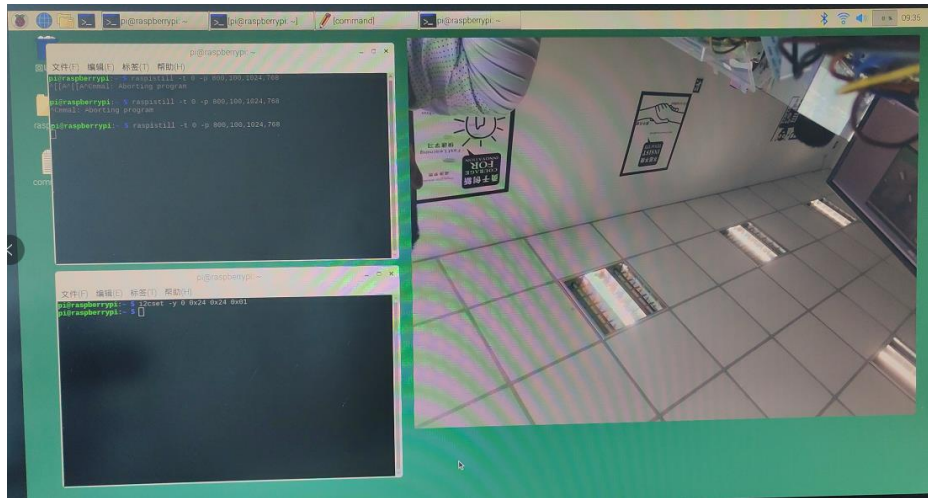


Figure 10 Single mode CAM0

5.3.2 Switch to CAM1, Single Mode

Run command `i2cset -y 0 0x24 0x24 0x02` to switch from stereo mode to single mode CAM1 feed.

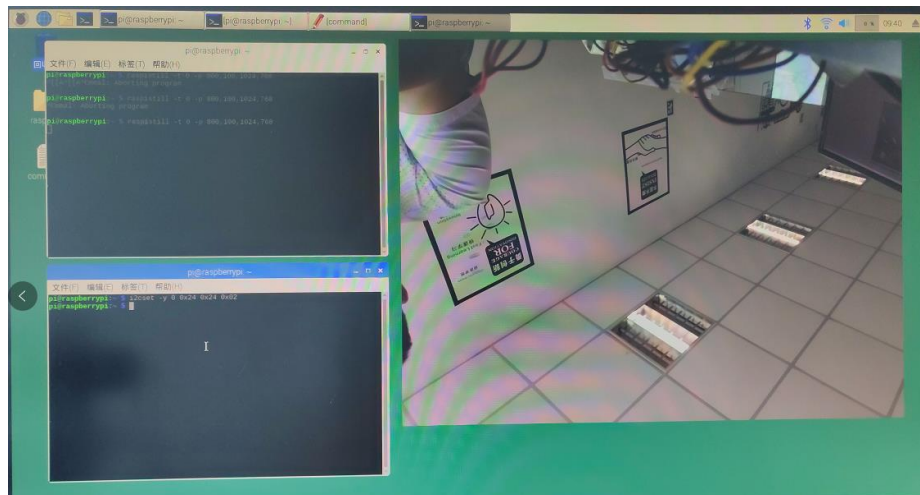


Figure 11 Single mode CAM1

5.3.3 Digital Pan Mode

Run command `i2cset -y 0 0x24 0x24 0x02` to switch to digital pan mode, each camera feed will pan back and forth to get entire field of view of the camera.

Run the command `i2cset -y 0 0x24 0x25 0x20` to change the pan speed, the speed value 0x20 can be modified from 0x01~0x60.

5.3.4 Full Combine Mode

Full resolution combine mode doesn't work with `raspistill` and `raspidvid` mode, it requires ArduCAM MIPI camera driver from github:

https://github.com/ArduCAM/MIPI_Camera/tree/master

6 Pin Definition

Table 1 MIPI CAM 0 and MIPI CAM 1 Input Ports

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	DGND	Ground	Power ground
2	CAM_D0_N	Output	MIPI data lane0 negative output
3	CAM_D0_P	Output	MIPI data lane0 positive output
4	DGND	Ground	Power ground
5	CAM_D1_N	Output	MIPI data lane1 negative output
6	CAM_D1_P	Output	MIPI data lane1 positive output
7	DGND	Ground	Power ground
8	CAM_C_N	Output	MIPI clock negative output
9	CAM_C_P	Output	MIPI clock positive output
10	DGND	Ground	Power ground
11	POWER_EN	Input	Camera module power enable active high
12	LED_EN	Input	Enable LED
13	SCL	Input	Two-Wire Serial Interface Clock
14	SDA	Bi-directional	Two-Wire Serial Interface Data I/O
15	+3.3V	POWER	3.3v Power supply

Table 2 MIPI Camera Output to Raspberry Pi CSI Port

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	DGND	Ground	Power ground
2	CAM_D0_N	Output	MIPI data lane0 negative output
3	CAM_D0_P	Output	MIPI data lane0 positive output
4	DGND	Ground	Power ground
5	CAM_D1_N	Output	MIPI data lane1 negative output
6	CAM_D1_P	Output	MIPI data lane1 positive output
7	DGND	Ground	Power ground
8	CAM_C_N	Output	MIPI clock negative output
9	CAM_C_P	Output	MIPI clock positive output
10	DGND	Ground	Power ground
11	POWER_EN	Input	Camera module power enable active high
12	LED_EN	Input	Enable LED
13	SCL	Input	Two-Wire Serial Interface Clock
14	SDA	Bi-directional	Two-Wire Serial Interface Data I/O
15	+3.3V	POWER	3.3v Power supply

Table 3 2x3 Pin Header Port to Raspberry Pi

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	3V3	Power	3.3V power from Raspberry Pi
2	5V	Power	5V power from Raspberry Pi
3	SDA	INOUT	SDA pin from Raspberry Pi
4	5V	Power	5V power from Raspberry Pi
5	SCL	INOUT	SCL pin from Raspberry Pi

6	GND	Ground	Power Ground
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7 ArduChip Registers

ArduChip is the Arducam proprietary solution to control all the hardware internal logic to do the image capture and merge timing controls. There are set of register which allow users to switch to different mode according to their application. The stereo camera HAT acts like a standard I2C slave device, its registers are accessed from the Raspberry Pi Camera CSI port with I2C-0 bus and default 7-bit I2C slave address is 0x24.

Table 4 Stereo Camera HAT Register Table

Register Address	Register Type	Description	default
0x24	read-write	bit[7:0], display mode 0x00: half resolution combine 0x01: Single channel A 0x02: Single channel B 0x03: full resolution combine 0x10: half resolution combine (Digital pan mode)	0x00
0x25	read-write	bit[7:0], Digital pan speed control in half resolution combine mode Value range: 0x01 ~ 0x60	0x10

8 Mechanical Dimension

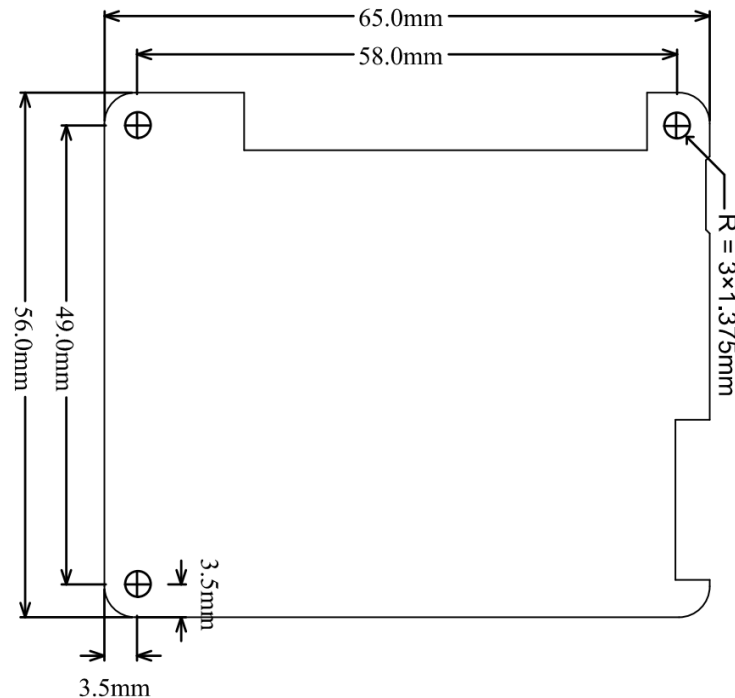


Figure 12 Mechanical Drawing