ArduCAM USB Camera Shield

Application Note for MT9V034

Rev 1.0, June 2017

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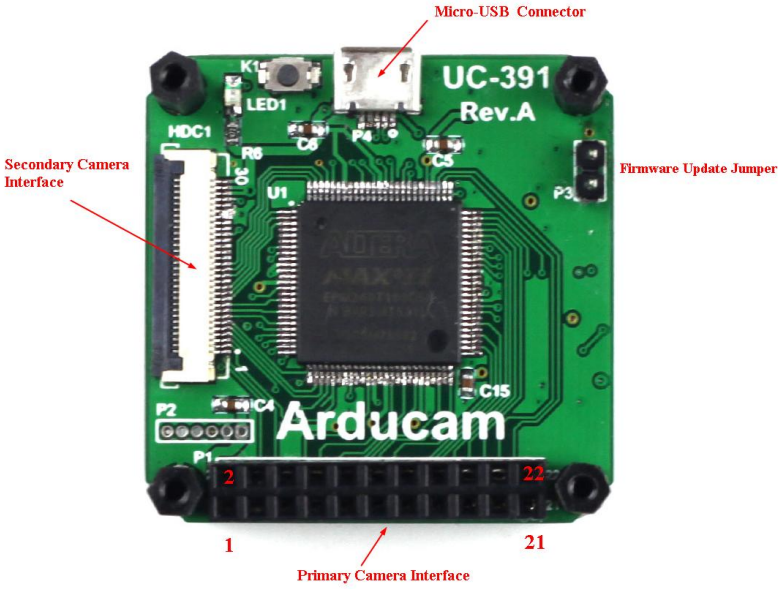
1 Introduction

This user guide describes the detail operation of ArduCAM USB camera for MT9V034. The latest deivce driver, SDK library and examples can be downloaded from the https://github.com/ArduCAM/ArduCAM_USB_Camera_Shield.

2 Hardware Installation



There are two different camera interface provided on the USB camera shield, but only one camera interface can be used at a time. The MT9V034 camera header board should be connected to the primary camera interface and should align the pin 1 of the camera breakout board to the USB camera shield camera connector pin 1.

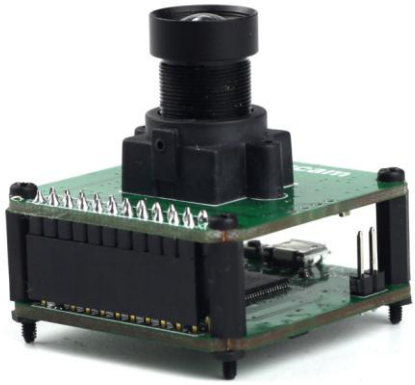


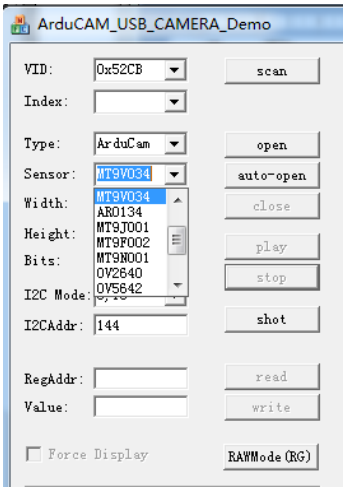
Table 1 P1 Connector Pin Definition

Pin No.	PIN NAME	TYPE	DESCRIPTION
1	VCC	POWER	3.3v Power supply
2	GND	Ground	Power ground
3	SCL	Input	Two-Wire Serial Interface Clock
4	SDA(SDATA)	Bi-directional	Two-Wire Serial Interface Data I/O
5	VS(VSYNC)	Input	Active High: Frame Valid; indicates active frame
6	HS(HREF)	Input	Active High: Line/Data Valid; indicates active pixels
7	PCLK	Input	Pixel Clock output from sensor
8	XCLK	Output	Master Clock into Sensor
9	D7	Input	Pixel Data Output 7 (MSB)
10	D6	Input	Pixel Data Output 6
11	D5	Input	Pixel Data Output 5
12	D4	Input	Pixel Data Output 4
13	D3	Input	Pixel Data Output 3
14	D2	Input	Pixel Data Output 2
15	D1	Input	Pixel Data Output 1
16	D0	Input	Pixel Data Output 0(LSB)
17		NC	
18		NC	
19		NC	
20		NC	
21		NC	
22	Trigger(EXP)	Output	External trigger output

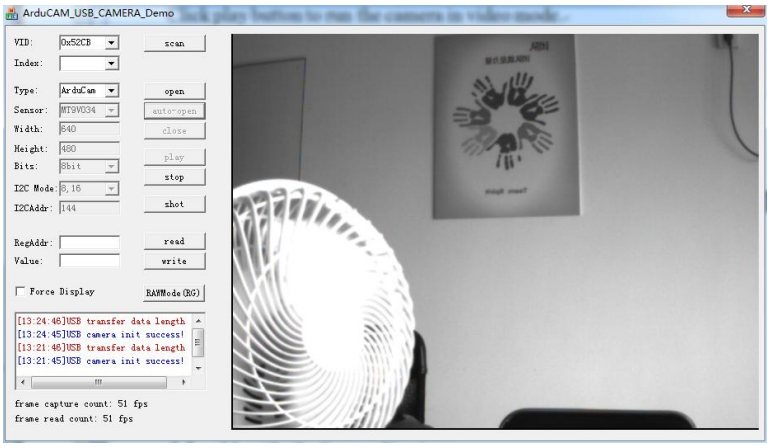
The firmware update jumper should be left open when normal operation.

3 Run the Demo

Plug in the USB cable to the camera and the host PC USB port, and open the Windows demo software. Select the MT9V034 from the Sensor drop down list then click auto-open button.



Click play button to run the camera in video mode.



4 Tune the Sensor Registers

4.1 Identify the Sensor Version

Sensor register address 0x00 is read only, and always return the chip vision 0x1324(4900) when read it.

Register Number (Hex)	Description	Data Format (Binary)	Default Value (Hex)
0x00	Chip Version	0001 0011 0010 0100 (LSB)	Iter. 1: 0x1324

Input the register address 0 in decimal to the RegAddr dialog box and click read button, the Value dialog box will show 4900 in decimal which is identical to 0x1324 in hex.

4.2 Adjust the Sensor Exposure

The exposure is also called Pixel Integration Control. The MT9V034 is global shutter so all the pixels are exposed at the same time. In manual exposure mode, the total exposure time is determined by the coarse shutter and fine shutter width registers. The actual total integration time, tINT is defined as:

$$tINT = tINTCoarse + tINTFint$$

$$= (\text{number of rows of integration} \times \text{row time}) + (\text{number of pixels of integration} \times \text{pixel time})$$

There are two sets of context that hold the coarse and fine shutter width.

Context	Coarse Shutter Width	Fine Shutter Width
Context A	0x0B	0xD5
Context B	0xD2	0x D8

The Coarse Shutter Width equals to number of rows times row time where the row time is defined by Windows Width + Horizontal Blanking registers times master clock.

Context	Windows Width	Horizontal Blanking
Context A	0x04	0x05
Context B	0xCC	0x CD

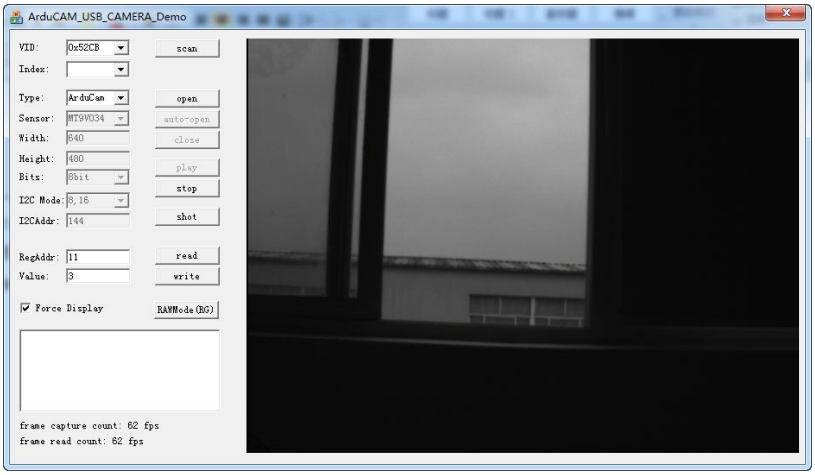
0x04 (4) Window Width Context A						
9:0	Window Width	Number of columns in image to be read out (not counting any dark columns or border columns that may be read).	2F0 (752)	N	1–752	W
0x05 (5) Horizontal Blanking Context A						
9:0	Horizontal Blanking	Number of blank columns in a row. Minimum horizontal blanking is 61 for normal mode, 71 for column bin 2 mode, and 91 for column bin 4 mode	05E (94)	Y	61–1023	W

In this case, the minimum exposure time is 260 *master clock Time*(*see datasheet 0xD5 (213) Fine Shutter Width Total Context A*), and the maximum exposure time is one *Frame* time. Basically it equals to total vertical resolution times 1 *Row Time*, but sometimes the vertical blanking rows should be added to extend the exposure time if needed.

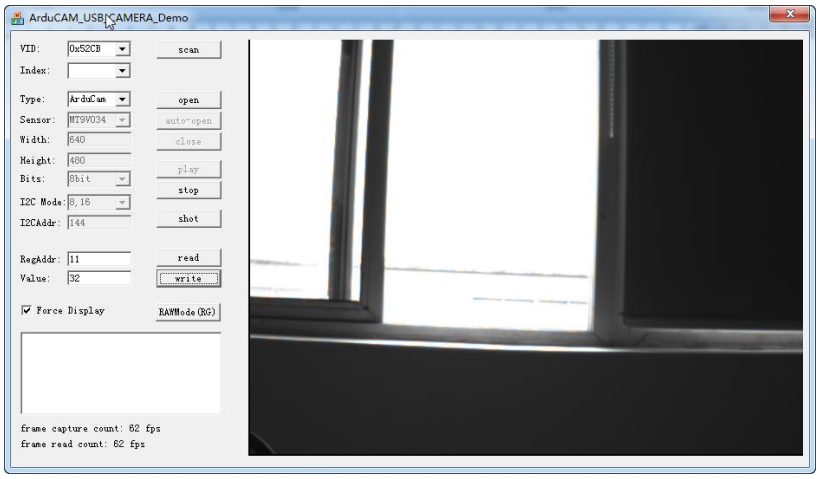
0x0B (11) Coarse Shutter Width Total Context A						
14:0	Coarse Shutter Width Total	Total integration time in number of rows. This value is used only when AEC is disabled only (bit 0 of R0xAF). This register is not shadowed, but any change made does not take effect until the following new frame.	1E0 (480)	N	0–32765	W

0xD5 (213) Fine Shutter Width Total Context A						
10:0	Fine Shutter Width Total	This register, combined with Coarse Shutter Width Total, defines the total integration time. This register is not shadowed, but any change made does not take effect until the following new frame. Register units are master clock cycles. Maximum is HBLANK (R0x05) + 751 = 1023 + 751 = 1774 Note: When Coarse Shutter Width Total is zero, Minimum Fine Shutter Width = 260	0 (0)	N	0–1774	W

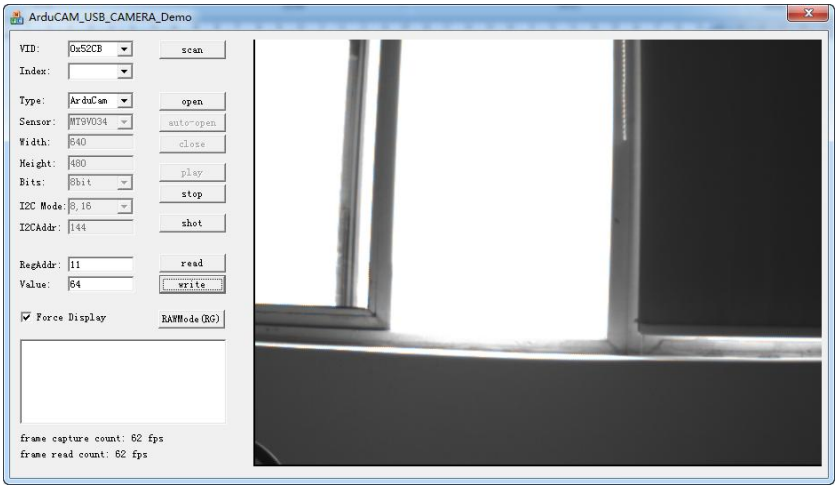
Given the master clock is 24MHz, the minimum exposure time is around 10.8us. And if Windows Width register equals to 640, Horizontal Blanking register equals to 94, the row time equals to 30.6us. If we want to set the exposure to 1ms, we can set the Coarse Shutter Width to 32.



Exposure = 0.1ms, RegAddr = 11, Value = 3



Exposure = 1ms, RegAddr = 11, Value = 32



Exposure = 2ms, RegAddr = 11, Value = 64