



SENSING CCG3 Image acquisition card Q&A

1. Product user manual

 [【CoaxCapture】 GMSL Video Capture Card_User Maunal_V1.2_EN.pdf](#)

2. Driver package download

	Content	
Supported kernel versions of the driver package	Support kernel version 5.xx.xx Kernel version 6.xx.xx is not currently supported	
Driver package download link	 pcie_v4l2_sdk_ubuntu_SHAb57105dd-20240913_def.zip	
OpenCV usage related	 SENSING CCG3 Collection Card OpenCV Application Process (Q&A)	

3. Image capture card adaptation checklist?

 [CCG3 capture card compatible camera list](#)

4. Error reported when executing step 1. How to solve it?

A: Be sure to perform the red operation below first. Make clean first, then make.

第四章 软件使用说明

1 SDK使用说明

1.1 驱动介绍

为方便客户快速高效使用采集卡，深圳森云智能科技有限公司会提供兼容ubuntu18.04、ubuntu20.04、ubuntu22.04的驱动包，具体如下

图像采集卡SDK驱动包包含以下目录和文件：










文件/目录名称	说明
bash	执行脚本
include	头文件
xdma_v4l2	图像采集卡驱动程序
tools	对串行器/解串器进行配置的应用等
Makefile(文件)	对驱动及应用程序进行Build的整体Makefile文件，也可以单独进入每一个目录进行单独编译； 注：进入下面点亮步骤前，先在该目录下执行make clean，然后再make一下。
Readme(文件)	SDK驱动包的使用说明

1.2 使用说明

Step1: 加载驱动程序，进入bash目录，执行如下脚本：（首次启动加载一次就行）

5. How to configure the parameters in the initialization script when the acquisition card is connected to different models of cameras?

A: When connecting different cameras, the corresponding configuration files are changed through the following pcie_init_cardx.sh .

pcie_v4l2_sdk_ubuntu_SHAb57105dd-20240312 > pcie_v4l2_sdk > bash		
名称	修改日期	类型
 clockdiff	2024/3/12 18:14	文件
 common_fun.sh	2024/3/12 18:14	SH 文件
 init_card.log	2024/9/13 16:27	LOG 文件
 load_modules.sh	2024/3/12 18:14	SH 文件
 pcie_init_card0.sh	2024/9/13 15:27	SH 文件
 pcie_init_card1.sh	2024/9/13 15:26	SH 文件
 pcie_init_card2.sh	2024/9/13 15:35	SH 文件
 pcie_init_card3.sh	2024/9/13 15:35	SH 文件
 timesync_pc_ptp.sh	2024/3/12 18:14	SH 文件

For example pcie_init_cardx.sh in the last part of the document,
camera_serdes_type[0]=1

value:

0: The GMSL camera value is written as "0" to indicate that it is connected to the Senyun GMSL camera

1: GMSL2 (6G) camera value Write "1" to indicate that it is connected to the camera of Senyun GMSL2

2: GMSL2F (3G) camera value Write "2" to indicate that it is connected to the camera of Senyun GMSL2F

```
1  <文件名: pcie_init_cardx.sh>
2
3  #camera 0-7 value: 0:GMSL camera 1:GMSL2(6G) camera 2:GMSL2F(3G) camera
4  camera_serdes_type[0]=1
5  camera_serdes_type[1]=1
6  camera_serdes_type[2]=1
7  camera_serdes_type[3]=1
8  camera_serdes_type[4]=1
9  camera_serdes_type[5]=1
10 camera_serdes_type[6]=1
11 camera_serdes_type[7]=1
12 camera_serdes_cfg ${camera_serdes_type[@]}
13 echo "Serdes Params Init Processed!"
```

6. How to synchronize the image capture card?

Answer:

Scheme one (the simplest scheme): [📖 Operation Instructions for Direct Connection between \[SENSING CCG3 \] and \[IPC \] - PTP Time Synchronization](#)

the PTP protocol. In this way, the time source of the entire system is unified. Then, through an external **TTL trigger** (as shown in red above), it is connected to the GPS interface of the acquisition card, which can trigger synchronous multi-channel cameras at the same time.

7. Trigger function:

7.1 TTL(PPS) trigger usage method 1:

The acquisition card [GPS] interface defines the following two interfaces (**red, green**), which are used to access an external **TTL trigger** square wave. And configure the corresponding script parameters.

5.3 GPS接口说明

挡板上的GPS是连接GPS信号的航空插座，需要和下图中线缆的航空插头端对接，注意插头的红点对应插座的红点相连。下图中线缆的另一端定义：

红色	白色	绿色	蓝色	黑色	加粗黑色
PPS信号	UART_RX	GND	无	UART_TX	外壳地

```
1  <文件名: pcie_init_cardx.sh>
2
3  # Trigger mode config {0:no trigger; 1:reserved; 2:inner trigger; 3:external
  trigger}
4  card_trigger_signal_mode          "3"
5
6  # Card external signal input fps config.
7  # Camera external output fps config.
8  # The following two configurations are valid only when
  card_trigger_signal_mode is "3".
9  card_external_signal_input_fps    "1" Hz
10 camera_external_output_fps        "20" Hz
11
12 # Camera inner output fps config
13 camera_inner_output_fps            "30" Hz
```

7.2 TTL(internal) trigger usage method 2:

If there is no external **TTL trigger** , the acquisition card can also generate a variable TTL trigger internally (only applicable to camera synchronization on a single acquisition card), which can be

flexibly set through the parameters in the script (the red settings below: indicates that the acquisition card generates a 30hz synchronous TTL signal internally).

```
1 <文件名: pcie_init_cardx.sh>
2
3 # Trigger mode config {0:no trigger; 1:reserved; 2:inner trigger; 3:external
  trigger}
4 card_trigger_signal_mode          "2"
5
6 # Card external signal input fps config.
7 # Camera external output fps config.
8 # The following two configurations are valid only when
  card_trigger_signal_mode is "3".
9 card_external_signal_input_fps    "1" Hz
10 camera_external_output_fps       "20" Hz
11
12 # Camera inner output fps config
13 camera_inner_output_fps          "30" Hz
```

Attached: Recommended Time Synchronization Box Products:



XQ-500（智驾版）多功能时间同步
盒_产品使用及应用解决方案v2.1....



47.26MB

8. Timestamp problem?

Answer: The specific explanation is as follows:


- Because the module itself has no concept of time, that is, it does not synchronize or obtain external time information, so it will not have a timestamp.
- The timestamp used by actual customers is the time on the platform (industrial computer or PTP) obtained by the acquisition card. In principle, after the acquisition card receives each frame of image data, it will put the time information obtained from the platform at this moment into the corresponding frame of image data. This time source can be the time when the external trigger signal rising edge arrives (default setting), or the time after the acquisition card receives a complete frame of image (parameter setting).
- To view this timestamp synchronously, you can refer to the V4l2 framework (as shown in the standard instructions below). Each frame of image data will have a structure array for storing time information.

If your problem is don't know how to get the timestamp.

You can reference to the v4l2-ctl tools source code is public.

Current the timestamp is Monotonic mode if you want to change it you have to modify the vi4_fops.c


```
nvidia@nvidia-desktop:~$ v4l2-ctl --stream-mmap --stream-count=3 -d /dev/video0 --verbose
VIDIOC_QUERYCAP: ok
VIDIOC_REQBUFS: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_QUERYBUF: ok
VIDIOC_QBUF: ok
VIDIOC_STREAMON: ok
      Index   : 0
      Type    : Video Capture
      Flags    : mapped
      Field    : None
      Sequence : 0
      Length   : 10450944
      Bytesused: 10450944
      Timestamp: 73428.009795s (Monotonic, End-of-Frame)
      Index   : 1
      Type    : Video Capture
      Flags    : mapped
```



9. How to set the value of delay time?

Answer: It should be less than one frame time, for example, 3ms. Now it is 600ms, which is incorrect.

```
# Camera 0-7 trigger delay config,unit "microsecond".
camera_triger_delay[0]=0
camera_triger_delay[1]=0
camera_triger_delay[2]=600000
camera_triger_delay[3]=0
camera_triger_delay[4]=0
camera_triger_delay[5]=0
camera_triger_delay[6]=0
camera_triger_delay[7]=0
trigger_delay ${camera_triger_delay[@]}
```



10. Can the CCG3-8H model's 8-channel acquisition card be connected to a PCIE x4 bus? Is the CCG3-4H model's 4-channel acquisition card an x4 or x8 bus?

产品简介

【腾云】系列二代GMSL图像采集卡（以下简称二代图像采集卡）是一款由深圳森云智能科技有限公司（简称“森云智能”）自主研发的一款基于FPGA的高速图像产品，是森云智能解决方案的一种。

二代图像采集卡相比一代卡，由于采用PCIE Gen3技术，速度和带宽都相应的有了成倍的提高。该图像采集卡能够接入GMSL摄像头，具有高帧率、高速、低延时等优点，广泛应用于无人车、自动驾驶、自主机器、数据采集等场景。

✓ CCG3-8H:

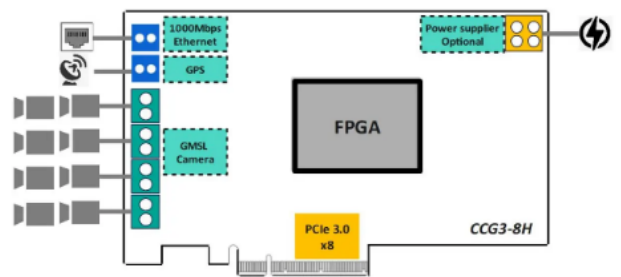
- 8个GMSL摄像头输入，最大支持800万像素30fps;
- **PCle Gen3*8lane;**
- 摄像头支持外触发同步;
- 支持GPS授时同步;
- 支持网络PTP授时同步;

✓ CCG3-4H:

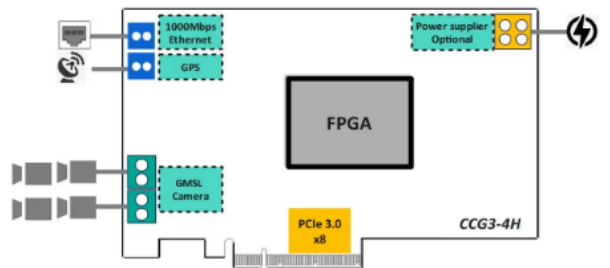
- 4个GMSL摄像头输入，最大支持800万像素30fps;
- **PCle 3.0*8lane;**
- 摄像头支持外触发同步;
- 支持GPS授时同步;
- 支持网络PTP授时同步;

2种产品形态

CCG3-8H



CCG3-4H



Answer: The acquisition cards are all PCIe Gen3.0 * 8lane electrical signals (x8 bus), which need to be inserted into a slot with a width of at least x8. The electrical signal can be * 4lane, but the bandwidth will be reduced.

11. Does the Senyun image acquisition card need an external trigger signal to support the external trigger of the camera? In other words, does the image acquisition card itself not generate an external trigger signal?

Answer: Both external and internal triggers are supported. If there is an external trigger signal, you can directly access the external signal through the following GPS port (the definition of GPS port can be found in the user manual). If there is no external signal, the acquisition card itself can also generate a trigger synchronization signal, which can be set in our driver lighting script.

采集卡接口如下：



图8：CCG3-8H采集卡接口

12. When the capture card is connected to multiple cameras, is there a requirement for resolution and frame rate, such as whether it can be mixed with arbitrary resolution?

Answer: When connecting multiple cameras, the resolution supports both the current 1-8M cameras and resolution of Senyun. The connection requirement is that each group (2 cameras) needs to use the same resolution. There are no other requirements and can be freely combined.

挡板上的A、B、C、D、E、F、G、H对应8路相机的0、1、2、3、4、5、6、7，“A”路指靠近航空插座那一路，其他路依次紧挨着。需要注意：A(0)和B(1)必须接同一种相机，C(2)和D(3)必须接同一种相机，E(4)和F(5)必须接同一种相机，G(6)和H(7)必须接同一种相机。

13. Currently, there is only one PCIE3.0 x4 reserved in the car's industrial control computer, and it is an X570 PCH channel. Whether the bandwidth is sufficient when six 2MP are connected, and whether there is a calculation formula for PCIE demand bandwidth and video stream bandwidth

--	--

	PCIe protocol
	pcie3.0
<u>x4lane</u>	Max 8M camera 30fps x 4 Max 3M camera 30fps x 8
<u>x8lane</u>	Max 8M camera 30fps x 8

- a. Recommended value, industrial computer in addition to the acquisition card, camera, and do some display, run other programs occupy bandwidth, occupy memory, bandwidth can reach 60% -70% of the following data. (The following **red** is the theoretical maximum value, **green** is the recommended maximum value)

pcie2.0

X4lane: PCIe bus bandwidth **2GB/s** * 70% = **1.4GB/s**

X8lane: PCIe bus bandwidth **4GB/s** * 70% = **2.8GB/s**

pcie3.0

X4lane: PCIe bus bandwidth **3.9GB/s** * 70% = **2.7GB/s**

X8lane: PCIe bus bandwidth **7.8GB/s** * 70% = **5.4GB/s**

b. Each camera occupies bandwidth

	Example	Lane Rate	Occupy bandwidth (30Hz)	Occupy bandwidth (20Hz)	Occupy bandwidth (10Hz)	Remarks	Calculation example
Seny un 8M camera	AR0820 full resolution	1188 Mbps/lane	594 MB	396 MB	198 MB	Lane Rate * 4/8 = Bandwidth (MB)	Bandwidth required for 8 Senyun 8M cameras at 30Hz: 594Mx8 = 4.7Gbps < 5.4Gbps (pcie3.0 * 70%)
Seny un 5M	IMX490 full	758.4 Mbps/lane	379.2 MB	252.8 MB			

came ra	resoluti on					
Seny un 3M came ra	ISX031 full resoluti on	462 Mbps/lan e	231M B	154M B		
Seny un 2M came ra	AR0233	297 Mbps/lan e	148.5 MB	99 MB		

14. The PPS + NMEA timing reserved for the acquisition card, are there any special requirements for these two signals? Currently, our car is equipped with OXTS RT3000v3. Can it be directly connected? The PPS of RT3000v3 is one thousandth of the duty cycle, and the serial port is RS232.

A: It is not recommended to use the acquisition card as the master timing .

15. Is the reserved gPTP used as the Master side or the Slave side?

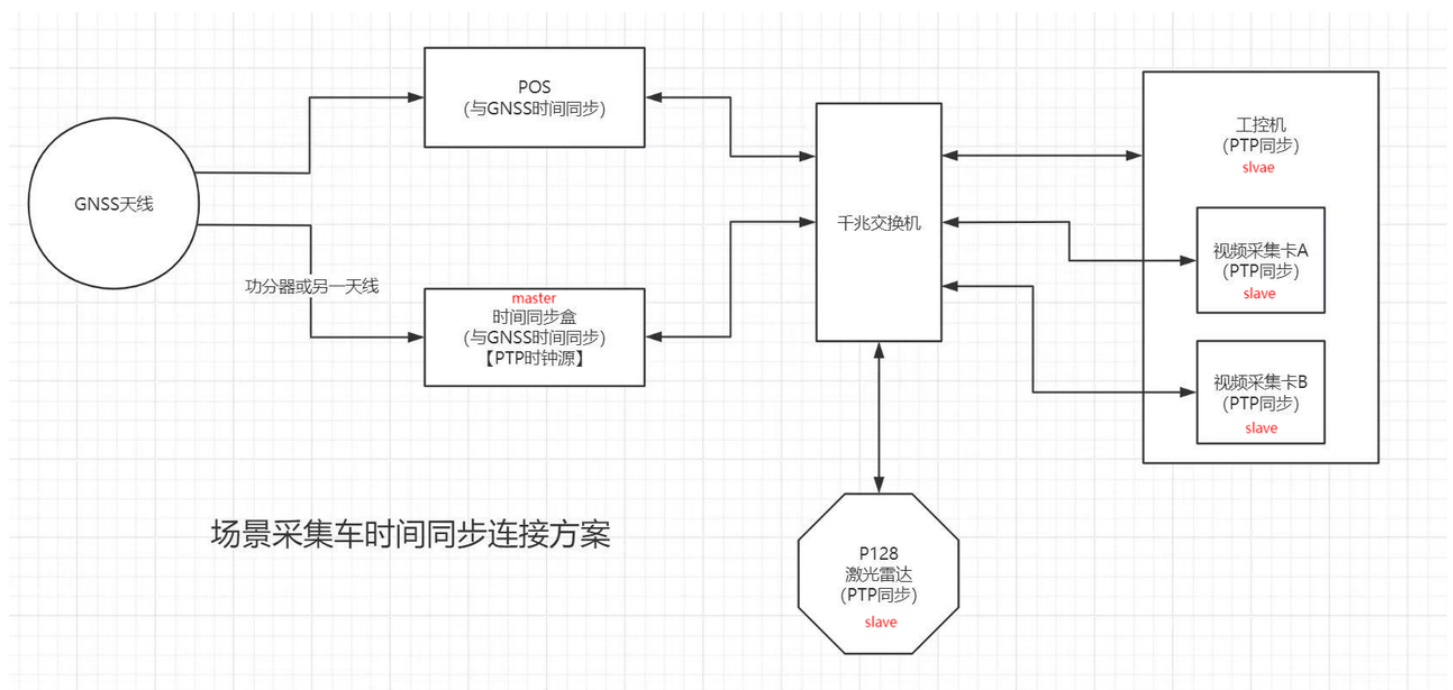
Answer: Slave side

16. Our software is currently using ROS2 Iron + Ubuntu 22.04. We may upgrade to Ubuntu 24.04 and later versions of ROS2. Can your company's driver support it?

A : Currently supports 18.04, 20.04, 22.04 (can only support the following 6.xxx (starting with 5.xxx)), temporarily does not support 24.04 .

17. PPS + NMEA Here we treat the acquisition card as a slave, and the oxts RT3000 is a GPS/INS system. Here we mainly want to inquire about the signal requirements of your company's acquisition card for GPS PPS and UART

Answer: As slaves, we only need the network. You can refer to the following usage framework. The acquisition card cannot directly handle GPS.



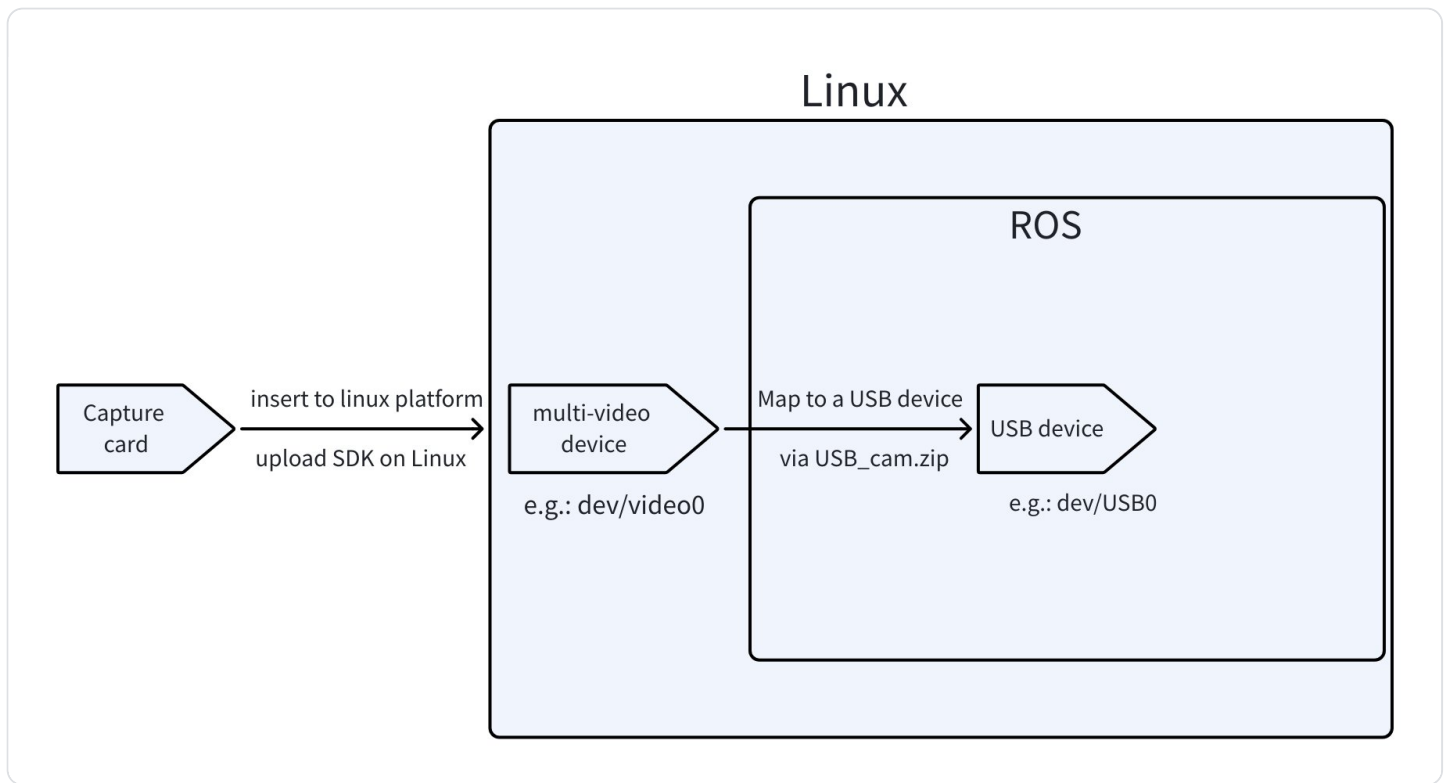
18. About Linux publish version here, may I ask if the kernel version will be affected?

A: The 18.04, 20.04, and 22.04 supported in our SDK (can only support the following 6.xxx (starting with 5.xxx)) are compatible with the kernel .

19. Is there a demo program for ROS2 ?

Currently, we are not developing the ROS application layer. You can refer to the ROS found online below for use. The theoretical usage is to install the ROS-related drivers and dependencies, use the code below, change the corresponding resolution and format in the code, and then map the video device in the capture card to a USB device that can be recognized at the ROS level for use.

[usb_cam.zip](#)



20. Are drivers currently available for Ubuntu 22 or 24? Are there any plans to support these versions in the future?

A: Currently, the driver is adapted according to the kernel version. Kernel version 5.xx.xx is supported, but **kernel version 6.xx.xx is not currently supported.**

21. Timestamp accuracy: I use PTP time synchronization and set the external trigger pulse to 1Hz. With this setting, I want the camera timestamp to be an integer, but the timestamp shows a slight offset (such as xxx.060 seconds). Can you explain this difference?

A: The **time to choose the trigger time will not appear the difference.**

22. Internal program update of acquisition card

1. Ping board 192.168.2.11 to ensure that the board and PC network is connected.
2. Copy the upgrade script `pcie_zu-update.sh` and firmware `pcie_zu_fw - 1.3.51 - 20230401.tar.gz` to your PC, then execute the following command to upgrade the firmware:

```
1 sudo ./pcie_zu-update.sh pcie_zu_fw-*.tar.gz
```



pcie_zu_fw-1.3.58-20240529-
YUV.tar.gz
33.34MB



Please refer to the following image for firmware upgrade.

```
pcie_zu_fw-1.3.58-20240529-YUV.tar.gz pcie_zu_fw-1.3.40-20221120-RC7.tar.gz pcie_zu_fw-1.3.40-20221120-RC7.tar.gz
ubuntu@ubuntu-MS-7042:~/sensing/ota/tools$ sudo ./pcie_zu-update.sh ./pcie_zu_fw-1.3.40-20221120-RC7.tar.gz
[sudo] password for ubuntu:
./pcie_zu-update.sh VER: v1.2
ota package: /home/ubuntu/sensing/ota/pcie_zu_fw-1.3.40-20221120-RC7.tar.gz

> 2, check if exist only one ota file

> 3, copy update file to /ldc partition
pcie_zu_fw-1.3.40-20221120-RC7.tar.gz

> 4, run update script in pcie_zu
-----time: 20180309_203534-----

ota-update.sh VER: v1.8

>>1, check if exist only one ota file
>>1.1, find ota file /ldc/pcie_zu_fw-1.3.40-20221120-RC7.tar.gz
BOOT.BIN
boot.scr
tar: BOOT.BIN: time stamp 2022-11-20 08:12:44 is 148304228.567866029 s in the future
image.ub
tar: boot.scr: time stamp 2022-09-30 15:19:34 is 143923438.567531409 s in the future
pcie_zu_ota.json
tar: image.ub: time stamp 2022-11-20 08:12:24 is 148304207.271726507 s in the future
tar: pcie_zu_ota.json: time stamp 2022-11-20 08:13:43 is 148304286.271440817 s in the future

>>2, check ota files md5
>>2.1, new ota version: 1.3.40-20221120-RC7

>>2.2, check md5 boot.scr
>>2.2.1, NEW_SCR_MD5: bef0ae2955eea1a7cdeb27bd98139837
>>2.2.2, BASE_SCR_MD5: bef0ae2955eea1a7cdeb27bd98139837

>>2.3, check md5 image.ub
>>2.3.1, NEW_IMG_MD5: 600ba3f86eacc2785223523356835dff
>>2.3.2, BASE_IMG_MD5: 8a8b7e98593afae4c869330e8839fa3b

>>2.4, check md5 BOOT.BIN
>>2.4.1, NEW_BOOT_MD5: d504ed3773b6598e93b45bd4c73247f8
>>2.4.2, BASE_BOOT_MD5: 96a8d290a5b54037057ae6a18b0aeaf8

>>3, check if need modify
```



Note: pcie_zu-update.sh if there is no execution permission (only rw without x), add **bash** when executing the upgrade script, that is, `sudo bash ./pcie_zu-update.sh pcie_zu_fw - *.tar.gz`.

3. After the upgrade is successful, restart the industrial computer, ensure that the board is powered off, and power on again.

23. How to change the normal green image of the acquisition card?


```
5
6 # Video output yuv format config {"YUYV" or "UYVY"}
7 video_output_yuv_format 8 "UYVY"
8 video_output_yuv_format 9 "UYVY"
9 video_output_yuv_format 10 "UYVY"
10 video_output_yuv_format 11 "UYVY"
11 video_output_yuv_format 12 "UYVY"
12 video_output_yuv_format 13 "UYVY"
13 video_output_yuv_format 14 "UYVY"
14 video_output_yuv_format 15 "UYVY"
15
```

24. Usage of i2C acquisition card:

Method 1: When accessing the ETH network port of the acquisition card, standard I2C commands can be used.

[📖 【森云CCG3图像采集卡】的I2C使用方法](#)

Method 2: When unable to access the ETH network port of the acquisition card, you can use the I2C command encapsulated on the acquisition card.

[📖 森云CCG3系列采集卡I2C读写接口使用](#)

25. Does the acquisition card driver support gstreamer?

A: Not currently supported.

26. How to modify the timestamp representative value

(1) In the script `pcie_init_card0.sh`, the configuration is as follows:

```
# Camera time stamp source {0: vsync; 1:fsync; 2:frame transfer done; }
timestamp_src 1
```

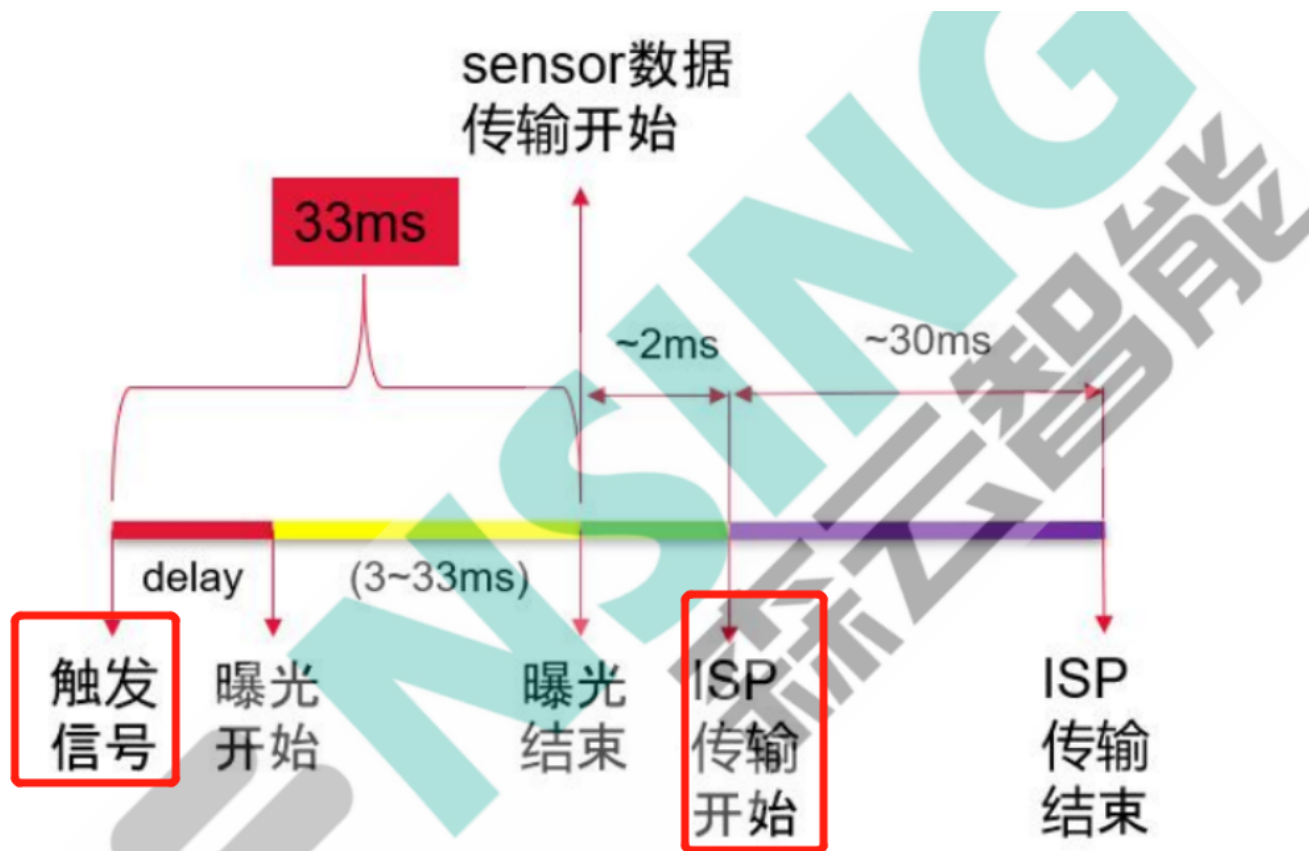
1. Trigger time;

0: The moment when the first line of ISP starts outputting;

2: ISP last line output end time.

Principle explanation: The specific parameter principle described above is shown in the following figure, which refers to the total time delay from the triggering moment of the module

to the end of the ISP output. The timing delay varies among different modules, and is for reference only. See the figure below.



After setting the function items to match the camera in this script, execute the `pcie_card *.sh` script in the bash directory to initialize all channel cameras

27. Can't open the device node in Opencv in Python?

A: With the old version of the SDK package, the detailed operation can refer to the description of this document: [SENSING CCG3 Collection Card OpenCV Application Process \(Q&A\)](#)

28. Will additional latency be introduced when the application layer reduces the frame rate through queuing/dequeuing mechanisms?

Answer: The queue mechanism will introduce a delay increment proportional to the queue depth when reducing the frame rate.

Reason:

- a. **Load impact of decoder queues: High frame rate (HFR) and high resolution (UHD) reduce inter-frame spacing and increase the arrival rate of decoder queues. If decoding speeds do not match, queue build-up results in a significant increase in tail latency.**

- b. Frame queues usually store pending frames in the order of receipt. When there are outdated frames at the front end of the queue that have not been processed for a long time, the submission of subsequent new frames will be forcibly blocked, even if these new frames have timed out.**