

OCAM²
Synchro



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OCAM2 Synchro

USER MANUAL

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1 Introduction

1.1 OBJECT OF THIS DOCUMENT

This document is the user manual of the OCAM2 camera Synchro option

1.2 REFERENCE DOCUMENTS

Cameralink 1.1 standard definition

2 Synchro operation

2.1 SYNCHRO CONNECTION

OCAM² with Synchro Mode offers the possibility to drive the frame readout with an external trigger and can provide timing information through a 4-pin Lemo connector (Mating LEMO male connector reference is FGG.00.304. series connectors).

Both input and outputs are LVDS and require two wires, ground reference is the connector body.

Here is the Sync connector layout of the rear panel (from up to down):

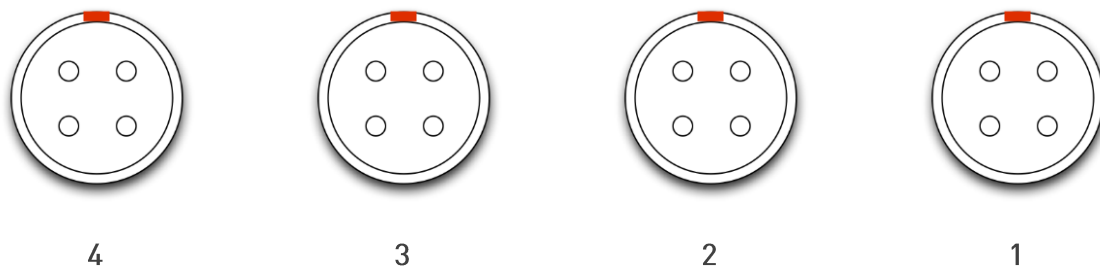


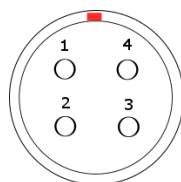
Fig 1. Sync connectors on the rear panel.

2.1.1 Input: Synchro-in

The frame rate of Ocam2 can be driven by an external source plugged on connector 1. Ocam2 allows values included between 0 and 1503 fps. The camera stays in integration mode while the synchro-in signal is high. When this signal goes low, it triggers the readout. Valid data is present on the cameralink bus 60 μ s after this trigger (which corresponds to the camera latency). While the camera readout is initiated, the status of synchro-in is ignored, the next exposure starts in parallel. Once the sensor has been read-out, the camera stays in integration if the synchro-in signal toggled to high in the meantime. If the synchro-in is still low, then another sensor readout is issued immediately, and another image is sent on the cameralink bus.

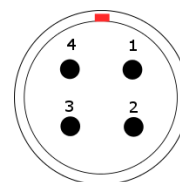
Cabling is shown in Fig 2.

OCAM2 Synchro Female Connector #1



Pin 1 : LVDS P
Pin 2 : LVDS N
Pins 3 & 4 : NC

OCAM2 Synchro mating Male Connector



Pin 1 : LVDS P
Pin 2 : LVDS N
Pins 3 & 4 : NC

Fig 2. Cabling.

➔ Free Run vs Synchro operation.

By default, OCAM² runs at full speed with no synchronization. Integration time length is constraint by the readout, readout of frame N and integration of frame N+1 are done in parallel. That's why integration and readout times are globally the same.

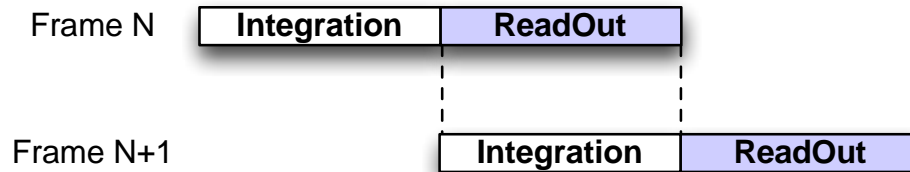


Fig 3. Free run operation.

The Synchro-In option allows to choose the exact time when Readout is done. Finally, slower the frame rate is, longer is the integration time.

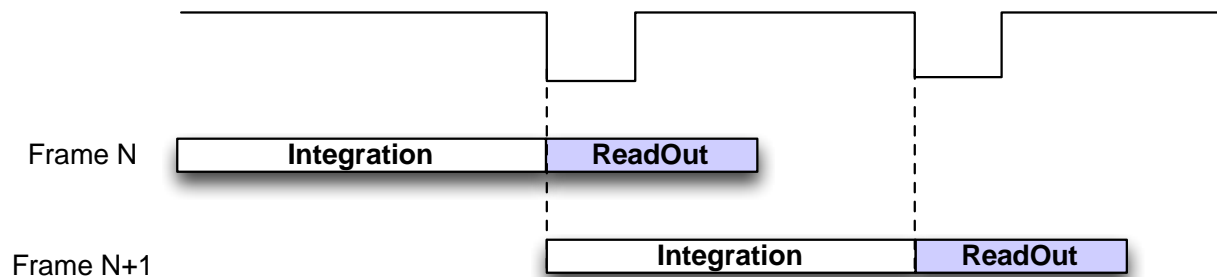


Fig 4. Synchro operation.

2.1.2 Synchro-out

This output delivers a signal synchronized with each new image delivered by Ocam. It is duplicate of the FVAL signal on the cameralink bus (frame valid). The signal is active low.

It should have the same frequency as the input FPS sync when “Synchro Mode” is on.



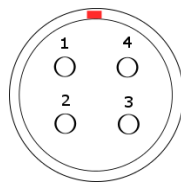
Fig 5. Input and Output signal display. Input is blue, output is yellow



Fig 6. Delay between synchro-in input (blue) and synchro-out output (yellow) is the total camera latency (60 μ s)

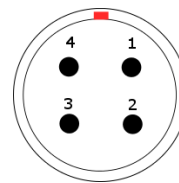
Cabling is shown in Fig 7.

OCAM2 Synchro Female Connector #4



Pin 4: LVDS P
Pin 3: LVDS N

OCAM2 synchro mating Male Connector



Pin 4 LVDS P
Pin 3: LVDS N

Fig 7. Cabling of the Synchro-out connector

2.1.3 LVAL output

This output signal appears like bursts of 121 squares synchronised with every line of each images. It is a duplicate of the cameralink LVAL signal.



Fig 8. Display of output LVAL

The duty cycle of the input frequency command should be carefully chosen to ensure that the image generation works properly. Indeed, if the lines cycle ends when the input Synchro-in signal is still at low level, a second image is generated and readout immediately. (See Fig 9)

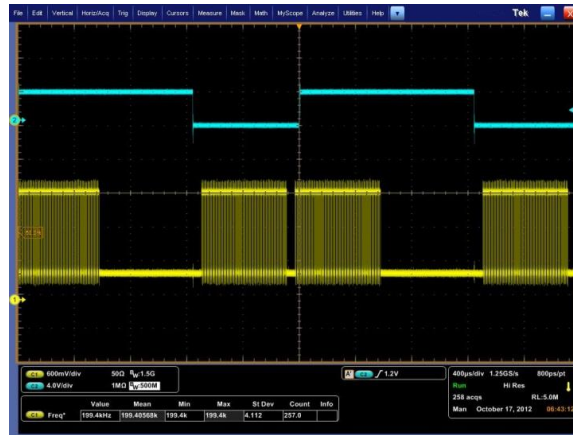


Fig 9. Double frame triggered with long synchro in signal

Here is a summary of the duty cycle that should be chosen with the frequency:

$$\text{DutyCycle}(\%) \geq 100 * (1 - f_{\text{sync}_{in}} * t_{\text{readout}})$$

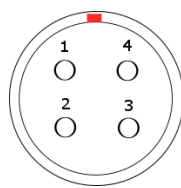
$$\text{With } t_{\text{readout}} \approx \frac{1}{2 * f_{\text{max}}}$$

Fig 10. Duty cycle with the frequency.

Finally, the duty cycle should never be below 50%.

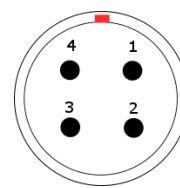
Cabling of this port is shown in Fig 11.

OCAM2 Synchro Female Connector #4



Pin 1 : LVDS P
Pin 2 : LVDS N

OCAM2 Synchro mating Male Connector



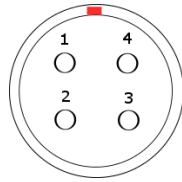
Pin 1 : LVDS P
Pin 2 : LVDS N

Fig 11. Cabling of the Output LVAL

2.1.4 Output: Pixel Clock

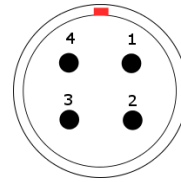
This output delivers a signal at 13.56 MHz synchronized with the pixel readout of Ocam2.

OCAM2 synchro Female Connector #3



Pin 4: LVDS P
Pin 3 : LVDS N

OCAM2 Synchro mating Male Connector



Pin 4 LVDS P
Pin 3: LVDS N

Fig 12. Cabling of the Output « Pixel Clock »



Fig 13. Pixel clock signal at 13.56 MHz

3 OCAM² firmware commands, rev. 0.9c

OCAM² Commands and results are passed through the Serial line embedded in the CameraLink connection. Serial settings are 115200 Bauds, 8-bit data, 1 bit stop, No parity. Commands are evaluated after reception of the CR/LF character pair (Carriage Return, Line Feed).

The Tab character (value 9) can be sent to recall last command.

3.1 EXTERNAL SYNCHRONIZATION

The external synchronization can be started up by entering the command “synchro on”.

3.2 ADJUSTING BASIC IMAGE PARAMETERS

This section covers adjusting fundamental image parameters such as gain and frame rate.

3.3 ADJUSTING FRAME RATE / EXPOSURE

To change the rate at which OCAM² acquires images the camera must be issued an ‘fps’ command.

Syntax is ‘fps nnn’ where nnn is the requested speed in frames per second. Accepted range is 25..1503 Hz.

The special value 0 (as in ‘fps 0 ’) instructs the camera to operate at full speed (1503.25Hz). See section 4 for a detailed explanation on how to issue commands to the camera

4 Troubleshooting

4.1 IMAGE ISSUES

➔ **Camera does not make images.**

When OCAM² appears to not produce images check these points in order:

- *Camera is properly plugged and power is on.*
- *CameraLink cables are connected in good order.*
- *Acquisition software is running. Check for zombie processes that may hold on to the drivers.*
- *Camera responds to software commands (ie. Thermal readings, monitoring functions).*
- *Synchro signal is valid. Type in the command line “synchro off” to switch back to free run mode and check that you have images. If when typing “synchro on” the frame rate drops to zero then the synchro signal is not valid.*