

Times are changing

Camera timestamps are a recommended GigE Vision/GenICam/SFNC feature to add the information when an image was taken (exactly: when the exposure of the image started). Without additional synchronization it is merely a camera individual timer with a vendor specific increment and implementation dependent accuracy. Each camera starts its own timestamp beginning with zero and there are no means to adjust or synchronize them among cameras or host PCs. There is effort ongoing to widely establish the precision timestamp according to IEEE 1588 into GigE Vision cameras. This involves cameras which are able to perform the required synchronization as well as specific network hardware and driver software and procedures to do and maintain the synchronization. There are many applications which do not or cannot profit from 1588 but have certain synchronization needs. The following article describes solutions for these scenarios.

Using and resetting timestamp

First of all the standard does not provide hardware means to reset the timestamp in a camera other than plug off and on again. Therefore MATRIX VISION has created its own mechanism *mvTimestampReset* to reset the timestamp by a hardware input.

<input type="checkbox"/> Trigger Selector	mvTimestampReset
Trigger Mode	On
Trigger Source	Line4
Trigger Activation	RisingEdge
Trigger Delay	0.000

This can be elegantly used for synchronization purposes by means of wiring an input of all cameras together and reset all camera timestamps at the beginning by a defined signal edge from the process. From this reset on all cameras start at zero local time and will increment independently their timestamp so that we achieve a basic accuracy only limited by drift of the clock main frequency (e.g. a 1 MHz oscillator in the FPGA) over time. In order to compensate for this drift we can in addition reset the timestamp every second or minute or so and count the reset pulse itself by a counter in each camera.

Assuming this reset pulse is generated by the master camera itself by means of a timer and output as the hardware reset signal for all cameras, we now can count the reset pulse with all cameras and put both the count and the reset timestamp as so called chunk data in the images. We thus have achieved a synchronized timestamp with the precision of the master camera among all connected cameras.

Settings required are shown using MATRIX VISION's wxPropView tool:

[-] Counter And Timer Control	
[-] Counter Selector	Counter1
Counter Event Source	Timer1End
Counter Reset Source	AcquisitionStart
Counter Trigger Source	Off
Counter Duration	10000
Counter Value	0
Counter Value At Reset	0
int CounterReset()	
[-] Timer Selector	Timer1
Timer Trigger Source	Timer1End
Timer Duration	1000000.000
Timer Delay	3.000
Timer Value	12650.000
int TimerReset()	
[+] Analog Control	
[+] mv Logic Gate Control	
[-] Chunk Data Control	
Chunk Mode Active	<input checked="" type="checkbox"/>
[-] Chunk Selector	Image
Chunk Enable	<input checked="" type="checkbox"/>

If one wants to eliminate the (unknown) drift of the master camera's reset pulse one can use instead a precise 1PPS signal (pulse per second) which can be supplied from host PCs if they are equipped with NTP (network time protocol) software or GPS devices. Now the synchronization is very accurate, in the range of several dozen μ s due to hardware delay variations in the input line which acts as reset and the accuracy of the local quartz-based timestamp oscillator (~ 100 ppm). Now the counter inside the camera counts seconds and the timestamp adds precise micro seconds resulting in a very reliable timestamp. An example of the chunk data attached to the image can be seen below. The timestamp is in μ s and Counter1 counts the reset pulses, in this case itself generated by the camera via Timer1.

```

FrameNr: 89441
TimeStamp_us: 418765
SettingUsed: Base
Image Processing Applied: Decoupler -> Buffer
ChunkData/ChunkOffsetX: 0
ChunkData/ChunkOffsetY: 0
ChunkData/ChunkWidth: 2048
ChunkData/ChunkHeight: 1536
ChunkData/ChunkPixelFormat: RGB8Packed
ChunkData/ChunkTimestamp: 418765500
ChunkData/ChunkLineStatusAll: 0x0
ChunkData/ChunkCounterSelector/Counter1/ChunkCounterValue: 16
ChunkData/ChunkCounterSelector/Counter2/ChunkCounterValue: 0
ChunkData/ChunkCounterSelector/Counter3/ChunkCounterValue: 0
ChunkData/ChunkCounterSelector/Counter4/ChunkCounterValue: 0
ChunkData/ChunkTimerSelector/Timer1/ChunkTimerValue: 418763.000
ChunkData/ChunkTimerSelector/Timer2/ChunkTimerValue: 8800.000
ChunkData/ChunkExposureTime: 1747.500

```

The task of resetting the counter at the beginning of the acquisition can be done by setting the reset property accordingly. Of course is this all independent whether the camera is acquiring images in triggered or continuous mode.

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