C4742-95-12E05

(C4742-95-12ER with fast gate and multi gate option)

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HAMAMATSU PHOTONICS K.K.

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CONTENTS

1. SUMMARY OF FUNCTION

This is the specification of ultra fast shutter and repeat trigger storage function.
This function is realized to bring the electrical shutter pulse and sensor gate pulse close each other. Current fastest shutter speed is 132.1 µs with internal trigger mode, and 69.0 µs with external trigger mode. By using this new function, it is possible to set the shutter speed down to approximately 70 ns. Of course, technically it is possible to make it shorter, however CCD does not transfer the photo-charges from photo-diode to vertical CCD.
Shutter time is controlled by the serial command of "USW n" both with internal trigger mode and external trigger mode. Ultra fast shutter delay time is controlled by the serial command of "USO n" with internal trigger mode and external trigger mode. Multi gates number is controlled by the serial command of "MGS n". After specified number of trigger is input, read out of charged signal starts automatically. About detailed information, please refer to the item of "Command explanation".
When this function is used, smear image is observed. Camera is employing the progressive scan interline CCD, therefore photo-diode area (sensitive area) and vertical CCD area (shielded area by aluminum) are structured side by side each other. During the readout period of photo-charge in the vertical CCD, sensor starts to expose the photo-charge for the next frame. This means during readout period, still light is irradiated to the sensor. But the aluminum shield is not perfect and also the absorption length of near infra-red photon is long and these photons are absorbed in the deep part of silicon. At the result, some of the generated charges in the silicon reach to the vertical CCD area and it makes worse the smear characteristic. Thus, theoretically, interline CCD has a smear problem. Especially, when very short electrical shutter function is used, very strong light should be irradiated in order to get the enough contrast image. However this makes worse the situation of smear.
From these reasons, we strongly recommend to use the camera with the combination of smear subtraction or mechanical shutter to reduce the smear back-grand image.

Characteristics

Gate time			
min.	1.153 µs	max.	1.085 ms
Delay time			
min.	15.8 µs	max.	1.1 ms
Repetition			
min.	1 time	max.	100000 times
Frequency			
min.	---	max.	6.7 kHz

2. DETAILED FORMAT OF COMMAND

2-1 Mode setting command

 # Command: AMD (Acquire MoDe)

Parameter : N or E (Normal or External)
Function : This selects the timing of exposure by internally or externally.
Example : AMD N:
Camera runs by the internal clock and all function are controlled by internal micro-processor and host computer, throw RS-232C serial interface.
: AMD E:
Camera runs by the external trigger pulse. Integration period and start timing of data readout from camera are synchronized or controlled by this external pulse.

#Command: EMD (External exposure time setting MoDe)

Parameter : U (Ultra fast shutter with multi gate)
Function : This sets the exposure time setting method by external trigger pulse, when AMD E command is selected.

2-2 Parameter setting commands

#Command: SPX (Super PiXel)

Parameter : 1 or 4 or 16
(1x1 binning or 4x4 binning or 16x16 binning)
Function : This sets matrix number of binning at super pixel readout mode. When SMD S command is selected.
Example : SPX 1 : Set the 1x1 binning
SPX 4 : Set the 4x4 binning
SPX 16 : Set the 16x16 binning

#Command: USW (Ultra fast Shutter gate Width/Time)

Parameter : n n=1 to 1000 (Default n=21)
Function : This command sets the ultra fast shutter gate time, when EMD U mode is selected. Gate time is defined by the following expression.
Gate time = n x 1.085(μs) + 67.81 (ns)
Minimum gate time is 1.153 μs and maximum gate time is 1.085 ms.
Example : USW 150
Gate time is set as 162.82 μs.

#Command: USO (Ultra fast Shutter Offset/Delay time)

Parameter : m m=0 to 1000 (Default: m=0)
Function : This command sets the ultra fast shutter delay time, when EMD U mode is selected. Delay time is defined by the following expression.
T1 (Delay time) = {(m x 1.085) + 15.8} (µs)
Example : USO 1000
Delay time (T1) is set as 1.1 ms

#Command: MGS (Multi Gate Shutter number)

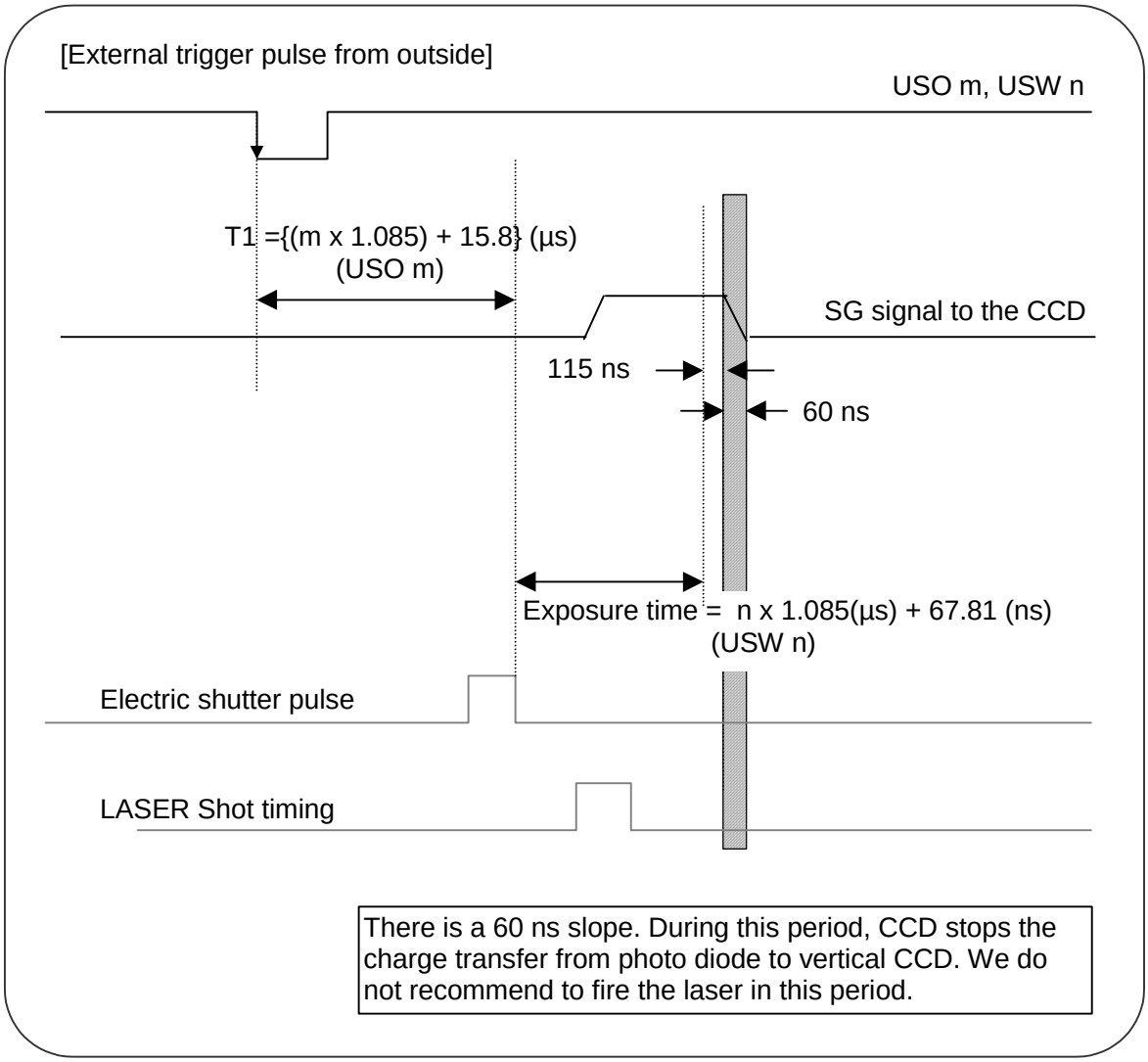
Parameter : k k=1 to 100000 (Default: k=1)
Function : This command sets the number of gate shutter in at image, when EMD U mode is selected.
Example : MGS 2000
Trigger storage number is 2000 times.

2-3 Operation Example

AMD E	Readout mode is set to the external trigger mode.
EMD U	Readout mode is set to the ultra fast shutter mode.
USW 1	Gate time is set to 1.153 µs.
USO 0	Delay time (T1) is set to 15.8 µs.
MGS 2000	Set the number of repetition to 2000 times.

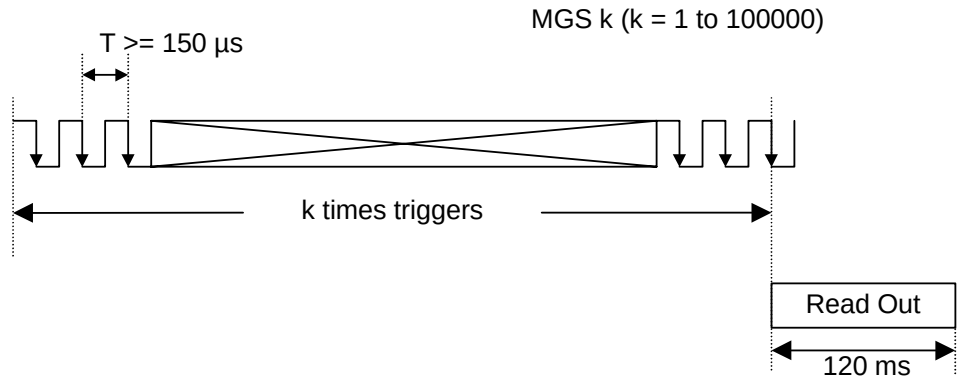
3. TIMING BETWEEN GATE TIME AND EXTERNAL TRIGGER PULSE

3-1 External trigger pulse from outside



3-2 External trigger pulse from outside (LASER Shot timing)

[External trigger pulse from outside (LASER Shot timing)]



The maximum frequency is 6.7 kHz.