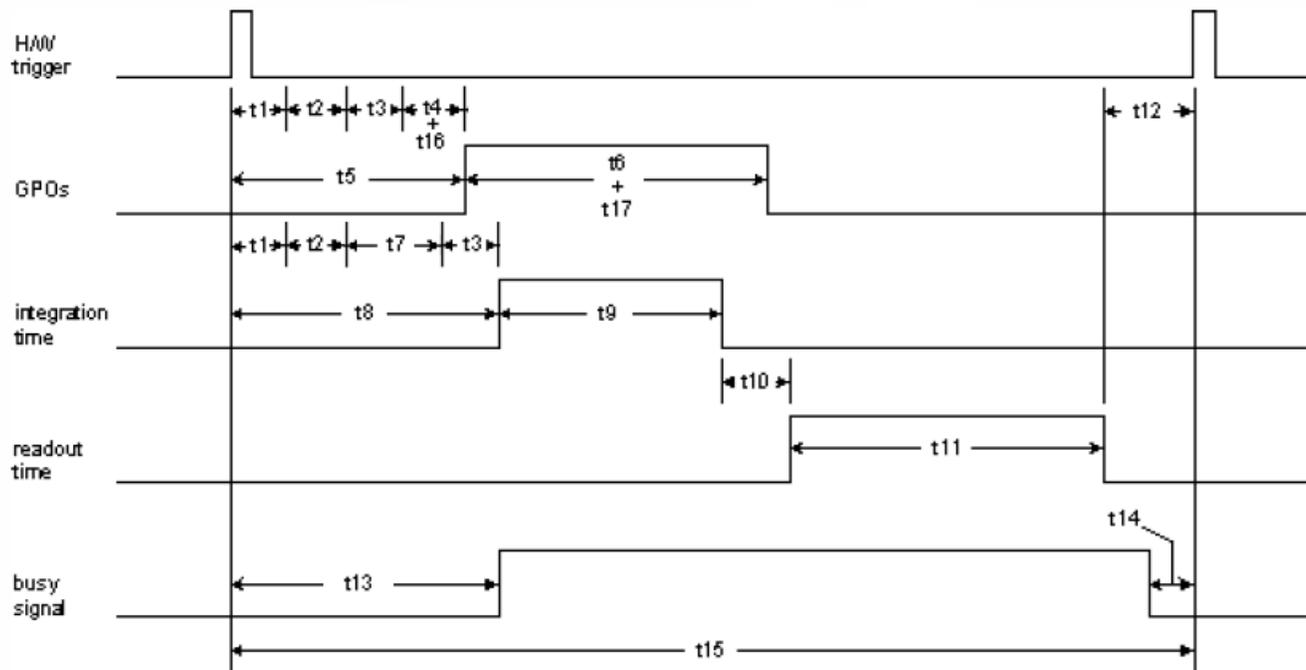


Normal Trigger Pulses



Picture 1. Timing diagram for normal trigger pulses.

Table 1.1 Signal Information

Signal	Description	Min	Typ	Max
t1	Board Level hardware propagation delay (3.3V HCMOS to trigger)		10 ns	
	Enclosed hardware propagation delay (5V to trigger optocoupler)		8 us ON 30 us OFF (Note 1)	
	Enclosed hardware propagation delay (12V to trigger optocoupler)		2.5 us ON 40 us OFF (Note 1)	
t2	Debounce time		1.0 us	
t3	1H period	0.0 us	varies between Min and Max	See Table 1.2
t4	Programmable GPO delay	0.0 us	in 10 us steps	2.5 sec
t5	Start of trigger to start of GPO (t1 + t2 + t3 + t4 + t16)			
t6	Programmable GPO time	10.0 us	in 10 us steps	2.5 sec
t7	Trigger mode 14 Programmable integration delay (Note 2)	0.0 us	in 10 us steps	2.5 sec
t8	Start of trigger to start of integration (t1 + t2 + t7 + t3)		(Note 3)	
t9	Integration time		See Integration Times	
t10	End of integration to start of read out		See Table 1.3	
t11	Readout time		See Readout Times	
t12	End of read out to start of trigger	t14 + t3 _{Max}	t15 - t8 - t9 - t10 - t11	
t13	Start of trigger to start of busy		t1 + t2 + t3	
t14	End of busy to start of trigger	30.0 ns	t15 - t8 - t9 - t10 - t11 - t3 _{Max}	
t15	Frame period		t8 + t9 + t10 + t11 + t12	
t16 & t17	Board Level hardware propagation delay (3.3V HCMOS From GPO)		20 ns	
	Enclosed hardware propagation delay (GPO optocoupler with 1K pullup to 5V)		3 us ON 70 us OFF (Note 1)	

Note:

1. "ON" refers to current flowing through the optocoupler and "OFF" refers to no current flowing through the optocoupler. Refer to [interface schematics](#).
2. For minimum hardware trigger, the programmable integration delay (t7) should be set to 0 (minimum).
3. For a software trigger, t8 is typically less than 5 ms.

Table 1.2 Maximum of 1H period for PL-X cameras with Sony sensors

PL-X camera with Sony sensor	For 8-bit output in (us)	For 12-bit output in (us)
PL-X957	2.0740	3.2323
PL-X9512	5.0505	7.0303
PL-X9520	2.6667	3.7710
PL-X9524	3.1111	4.5120

Table 1.3 End of integration to start of read out

PL-D camera with Sony sensor	For 8-bit output in (us)		For 12-bit output in (us)	
	Normal	FFR*	Normal	FFR*
PL-X957	199.10	248.88	258.58	297.37
PL-X9512	313.13	272.73	435.88	379.64
PL-X9520	352.00	437.34	467.60	558.11
PL-X9524	398.22	485.33	559.49	649.73

*where: FFR is the [Fixed Frame Rate mode](#).

Sequential Trigger Pulses (High FPS)

Sony sensors support Sequential Trigger mode or in other words they can be triggered with sequential trigger pulses. See the timing diagram below. In order to achieve the maximum frame rate for these cameras when using sequential trigger pulses, they must meet the following timing requirements

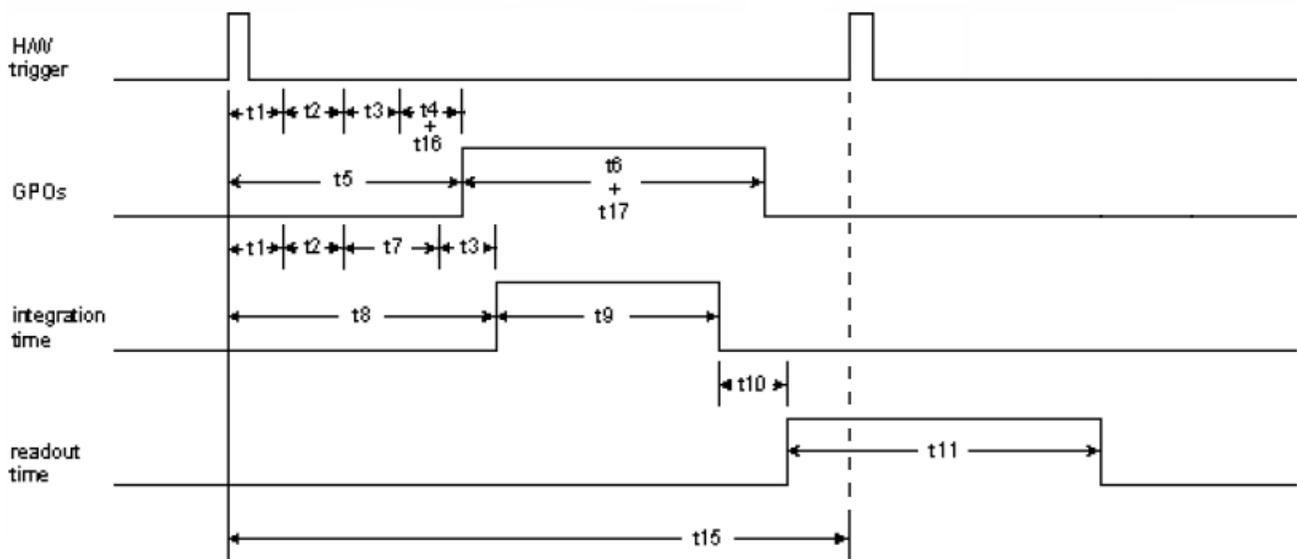
Timing requirements:

1. $t_{15} \geq t_{18}$
2. $t_{15} \geq t_{19} + t_1 + t_2 + t_{3_{Max}} + t_9$

where: t_{18} is the time of the rising edge prohibited region (Table 1.4) and t_{19} is the time of the falling edge prohibited region (Table 1.5). See Table 1.1 for t_1 , t_2 , t_3 , and t_9 .

Note: If sequential trigger pulses do not meet these requirements,

- They can lock up the camera, if Trigger mode 1 is used, or
- They will be ignored, if any other trigger mode is used, and the camera will output a lower frame rate. Usually, it is half of the targeted frame rate.



Picture 2. Timing diagram for sequential trigger pulses.

Table 1.4 Rising edge prohibited region (t18)

PL-D camera with Sony sensor	For 8-bit output in (us)		For 12-bit output in (us)	
	Normal	FFR*	Normal	FFR*
PL-X957	4761.90	$t_{11}^* + 248.88$	7369.64	$t_{11}^* + 297.37$
PL-X9512	15464.63	$t_{11}^* + 272.73$	21526.78	$t_{11}^* + 379.64$
PL-X9520	12384.15	$t_{11}^* + 437.34$	17482.36	$t_{11}^* + 558.11$
PL-X9524	14734.17	$t_{11}^* + 485.33$	21350.78	$t_{11}^* + 649.73$

*where: FFR is the [Fixed Frame Rate mode](#) and t11 is the readout time from Table 1.1.

Table 1.5 Falling edge prohibited region (t19)

PL-D camera with Sony sensor	For 8-bit output in (us)	For 12-bit output in (us)
PL-X957	103.70	109.90
PL-X9512	121.21	168.73
PL-X9520	101.33	113.13
PL-X9524	105.78	135.36