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Author:	Firmin Louis

Document Revision History

Date	Rev.	Author	Description of modifications
2015-11-25	1.0	FL	First edition
2015-12-01	1.1	FL	Editorial corrections § 5.2.1.8 Change enumeration values of ExposureDelayControl parameter.
2015-12-02	1.2	FL	Editorial corrections. CAM File update.
2015-12-03	1.3	FL	Editorial corrections. CAM File update.

1 Introduction

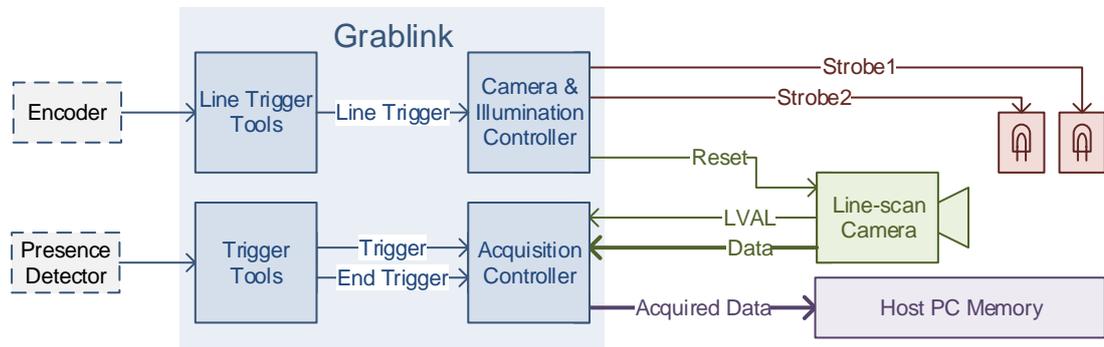
This document describes the [Interleaved Line-scan Acquisition](#) feature of Grablink boards.

Thanks to the Interleaved Line-scan Acquisition feature, a line-scan imaging system is capable of acquiring, in a single scanning operation, a composite image where the odd and even lines are captured with different exposure times, lighting sources and/or conditions.

This feature is available since MultiCam 6.9.7 on Grablink Base, Grablink DualBase, Grablink Full and Grablink Full XR.

2 Short Description

The following drawing shows the main elements of one acquisition channel configured for Interleaved Line-scan Acquisition.



To be able to use the Interleaved Line-scan Acquisition feature, a line-scan imaging system must include:

- An asynchronous reset line-scan camera with grabber-controlled exposure,
- A Grablink Base, Grablink DualBase, Grablink Full or Grablink Full XR frame grabber configured for Interleaved Line-scan acquisition,
- Two illumination devices, each being controlled by a specific strobe output of the frame grabber.

When Interleaved Line-scan Acquisition is enabled, the Camera and Illumination Controller operates in the 2-program mode.

In the 2-program mode, on the occurrence of a line trigger event, the Camera and Illumination Controller alternatively executes one of two programs. Each of these two programs defines a camera and illumination cycle including:

- One Reset pulse controlling the start and the end of exposure of the camera,
- One Strobe pulse on one or the other Strobe output.

As for any line-scan imaging systems, the generation of the Line Trigger event may be configured with various schemes including rate converter, rate divider, etc... Usually, the Line Trigger event is obtained by processing signals delivered by a motion encoder.

As for any grabber-controlled imaging systems, the Camera and Illumination Controller implements the camera trigger overrun protection mechanism.

As for any line-scan imaging systems, the generation of the Trigger and End Trigger events may be configured with various schemes. All line-scan acquisition modes (WEB, PAGE and LONGPAGE) are available.

The program sequence is initialized every start-of-scan to ensure that the first captured image line of an object is obtained with the same camera and illumination cycle program.

3 Camera and Illumination Control

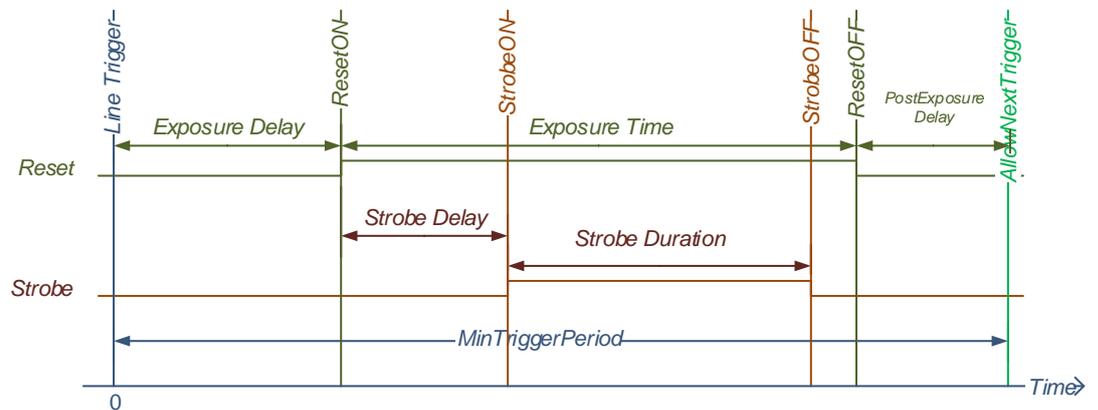
This section describes the operation of the Camera and Illumination Controller – CIC – when Interleaved Line-scan Acquisition is enabled.

3.1 Camera and Illumination Cycle Programs

When Interleaved Line-scan Acquisition is enabled, the Camera and Illumination Controller is configured with two, possibly different, camera and illumination cycle programs. These programs are named P1 and P2 respectively.

Each camera and illumination cycle program defines five events on a timeline beginning with a Line Trigger event.

- *ResetON*: turn ON time of the Reset pulse and Start of Exposure
- *ResetOFF*: turn OFF time of the Reset pulse and End of Exposure
- *StrobeON*: turn ON time of the Strobe pulse and Start Of Illumination
- *StrobeOFF*: turn OFF time of the Strobe pulse and End Of Illumination
- The *AllowNextTrigger* event: the last event of a program indicating that a new cycle may be initiated.



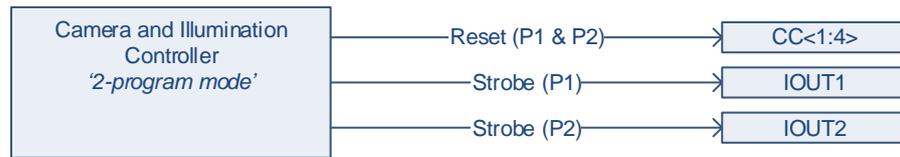
Each program defines two pulses: one Reset pulse and one Strobe pulse. Their timing is user configurable:

- **Exposure Time** is the time interval between the *ResetON* and the *ResetOFF* events.
- **Strobe Duration** is the time interval between the *StrobeON* and the *StrobeOFF* events.
- **Exposure Delay** is the time interval between the Line Trigger and *ResetON* events.
- **Strobe Delay** is the time interval between the *ResetON* and *StrobeON* events. This value can be positive, null, or negative allowing the Strobe pulse to be positioned anywhere relatively to the start of exposure.

The following restrictions apply on the position order of the events on the timeline:

- $0 \leq \text{ResetON} < \text{ResetOFF} \leq \text{AllowNextTrigger}$
- $0 \leq \text{StrobeON} < \text{StrobeOFF} \leq \text{AllowNextTrigger}$

3.2 Reset and Strobe Signals Routing



The Reset pulses of both programs are applied to the same Reset signal.

The Reset signal can be sent to any of the 4 Camera Link Control lines CC1 ... CC4.

The Strobe pulse of program P1 is sent to the IOUT1 System I/O output.

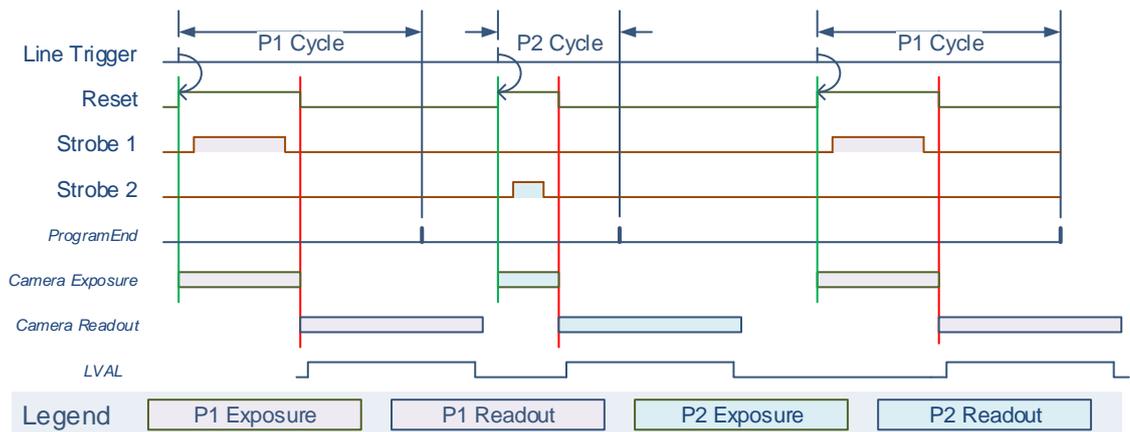
The Strobe pulse of program P2 is sent to the IOUT2 System I/O output.

3.3 Program Execution Sequence

3.3.1 Toggling Program Sequence

When Interleaved Line-scan Acquisition is enabled, the Camera and Illumination Controller executes both programs alternatively: P1 then P2 then P1 ...

The following timing diagram illustrates the program toggling:



Note: In this example, the line trigger interval is larger than the minimum allowed.

3.3.2 Program Sequence Reset

The toggling program sequence is reset at every start-of-scan. This ensures that the first captured image line of a scanned object is always built using P1. No reset occurs at the beginning of the subsequent phases of the same sequence.

In WEB acquisition mode, a reset occurs only once at the beginning of the acquisition sequence.

In PAGE acquisition mode, a reset occurs at the beginning of every acquisition phase.

In LONGPAGE acquisition mode, a reset occurs at the beginning of the first acquisition phase of every acquisition sequence. No reset occurs at the beginning of the subsequent phases of the same sequence.

3.4 Camera Trigger Overrun Protection Mechanism

This section describes the protection mechanism that protects the system against missed camera triggers.

3.4.1 Principle

At channel configuration time, MultiCam checks if the exposure time user setting can be achieved by the camera. If the user setting of the exposure time is out of bound, MultiCam corrects its value. The effective exposure time will be set to the nearest boundary.

Also at channel configuration time, MultiCam calculates the position on the timeline of the *AllowNextTrigger* event of P1 and P2 programs. This calculation takes into account:

- The camera operating limits,
- The user-defined exposure and strobe timing settings for P1 and P2 programs.

At channel run time, MultiCam reports a “line trigger violation” error if a Line Trigger event is issued before the *AllowNextTrigger* event during the execution of a program.

3.4.2 Camera Operating Limits

The following camera operating limits are considered:

- Exposure time range
- Minimum time interval between two consecutive Exposure
- Maximum line rate

In MultiCam, the following parameters describe the operating limits of the camera:

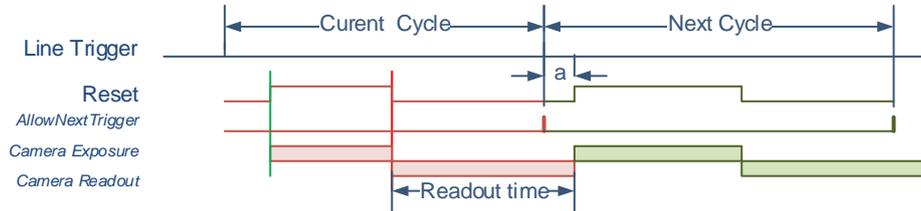
- **ExposeMin_us**: declares the minimum exposure time, expressed in microseconds (*= the minimum duration of a Reset pulse*).
- **ExposeMax_us**: declares the maximum exposure time, expressed in microseconds (*= the maximum duration of a Reset pulse*).
- **ResetDur**: when the exposure is controlled by the grabber, this parameter declares the minimum time interval between two consecutive Reset pulses.
- **LineRate_Hz**: declares the highest line rate supported by the camera (*=the reciprocal of the readout time*)
- **ExposeOverlap**: declares that the camera allows or forbid the next exposure to begin before the completion of the current readout.

3.4.3 AllowNextTrigger Rules

MultiCam applies the following rules when it calculates the position of the *AllowNextTrigger* event:

3.4.3.1 RULE 1a – Readout time limitation (Expose Overlapping forbidden)

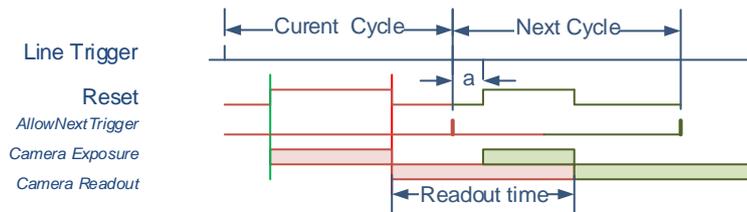
If the camera forbids exposure/readout overlapping (**ExposeOverlap = FORBID**), the start of exposure of the next cycle must not occur before the end of the camera readout.



Note: If there is any exposure delay (a) in the next cycle, the AllowNextTrigger event may be generated anticipatively

3.4.3.2 RULE 1b - Readout time limitation (Expose Overlapping allowed)

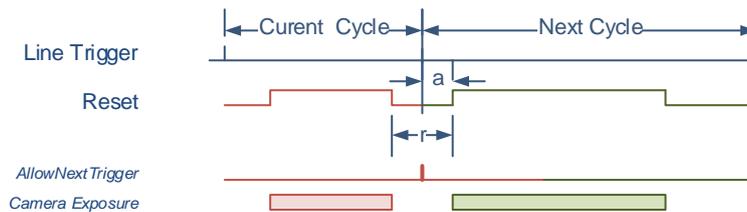
If the camera allows exposure/readout overlapping (**ExposeOverlap = ALLOW**), the end of exposure of the next cycle must not occur before the end of the camera readout.



Note: If there is any exposure delay (a) in the next cycle, the AllowNextTrigger event may be generated anticipatively

3.4.3.3 RULE 2 – Reset interval limitation

The time interval (r) between consecutive Reset pulses may not be shorter than the value specified by **ResetDur**.



Note: If there is any exposure delay (a) in the next cycle, the AllowNextTrigger event may be generated anticipatively

3.4.3.4 Next Cycle

The next cycle after P1 is undetermined, it can be either P2 or P1! The next one after P2 is always P1.

For the calculation of the position of the *AllowNextTrigger* event of P1, MultiCam evaluates both hypothesis (P1 and P2) and keeps the worst case

For the calculation of the position of the *AllowNextTrigger* event of P2, MultiCam assumes that the next cycle is P1.

3.4.4 Exposure Delay

By default, MultiCam configures P1 and P2 with the smallest possible value:

- 0 if $\text{StrobeDelay_P<1,2>_us} \geq 0$
- $(-\text{StrobeDelay_P<1,2>_us})$ if $\text{StrobeDelay_P<1,2>_us} < 0$

If required, the exposure delay can be configured using any of the following methods:

3.4.4.1 Manual method

This method is invoked when `ExposureDelayControl` is set to `MAN`. This is the default method.

With this method, the user may specify the exposure delay for P1 and P2 with:

`ExposureDelay_MAN_P1_us` and `ExposureDelay_MAN_P2_us`.

By default, these parameters are set to 0.

MultiCam calculates the smallest possible value for each program separately as follows:

- `ExposureDelay_MAN_P<1,2>_us` if $\text{StrobeDelay_P<1,2>_us} \geq (-\text{ExposureDelay_MAN_P<1,2>_us})$
- $(-\text{StrobeDelay_P<1,2>_us})$ if $\text{StrobeDelay_P<1,2>_us} < (-\text{ExposureDelay_MAN_P<1,2>_us})$

3.4.4.2 Automatic method 1 (Same Start of Exposure)

Select this method by setting `ExposureDelayControl` to `SAME_START_EXPOSURE`.

MultiCam calculates, the smallest value ensuring that the start of exposure occurs at the same position on the program timeline.

3.4.4.3 Automatic method 2 (Same End of Exposure)

Select this method by setting `ExposureDelayControl` to `SAME_END_EXPOSURE`.

MultiCam calculates the smallest values ensuring that the end of exposure occurs at the same position on the program timeline.

3.4.5 Effective Timing Parameters

3.4.5.1 Exposure Time

The effective exposure time values, calculated and/or corrected by MultiCam are reported through the following parameters:

`ExposureTime_P1_Effective_us` and `ExposureTime_P2_Effective_us`.

In general, the effective values are very close to the user settings, the slight differences can be explained by rounding issues to the nearest timer tick period.

Large differences can be observed in the case of an out-of-bound user setting.

3.4.5.2 Strobe Duration and Strobe Delay

The effective strobe duration and strobe delay values, calculated by MultiCam are reported through the following parameters:

`StrobeDuration_P1_Effective_us`, `StrobeDuration_P2_Effective_us`,

`StrobeDelay_P1_Effective_us` and `StrobeDelay_P2_Effective_us`.

The effective values are, in any case, very close to the user settings, the slight differences can be explained by rounding issues to the nearest timer tick period.

3.4.5.3 Exposure Delay

The effective exposure delay values, calculated by MultiCam are reported through the following parameters:

`ExposureDelay_P1_Effective_us` and `ExposureDelay_P2_Effective_us`.

When `ExposureDelayControl = MAN`, the effective values are very close to the user settings, the slight differences can be explained by rounding issues to the nearest timer tick period. Large differences can be observed in the case of negative strobe delay values.

3.4.5.4 Minimum Line Trigger Period

The run time of each program, calculated by MultiCam, is reported through the following parameters:

`MinTriggerPeriod_P1_us` and `MinTriggerPeriod_P2_us`.

Notice that the values can be different. Considering that programs are executed alternatively, the user should only consider the larger value as the minimum time interval between line triggers.

4 MultiCam Setup

This section describes the MultiCam setup procedure for Interleaved Line-scan Acquisition.

4.1 CAM File Template

The “MyCameraLink_LxxxxRG_IA.cam” provides a CAM File template suitable for Interleaved Line-scan Acquisition.

The User is invited to customize this CAM File according to the application needs.

4.2 Customizing the CAM File template

4.2.1 Camera Parameters

As for any line-scan camera, the following camera parameters must be set according to the selected camera model:

Spectrum TapConfiguration TapGeometry ColorMethod DvalMode ResetEdge
CC1Usage CC2Usage CC3Usage CC4Usage Hactive_Px HSyncAft_Tk

For correct operation of the camera trigger overrun protection mechanism it is essential to carefully set the following parameters:

LineRate_Hz ExposeMin_us ExposeMax_us ResetDur

4.2.2 Acquisition Control parameters

As for any line-scan application, the following acquisition control parameters must be set according to the application needs:

AcquisitionMode TrigMode NextTrigMode EndTrigMode BreakEffect SeqLength_Pg
SeqLength_Ln PageLength_Ln

4.2.3 Trigger Control parameters

As for any line-scan application, the following trigger and end trigger control parameters must be set according to the application needs:

TrigCtl TrigEdge TrigFilter TrigLine
EndTrigCtl EndTrigEdge EndTrigFilter EndTrigLine

4.2.4 Interleaved Acquisition parameters.

Enable Interleaved Line-scan Acquisition by assigning the value **ON** to **InterleavedAcquisition**.

4.2.4.1 Exposure and Strobe Timing parameters

When Interleaved Line-scan Acquisition is enabled, the following exposure and strobe parameters are irrelevant:

Expose_us **ExposeTrim** **StrobeMode** **StrobeDur** **PreStrobe_us**

Instead, the exposure and strobe timings must be defined for P1 and P2 using the following parameter set:

ExposureTime_P1_us **ExposureTime_P2_us**

StrobeDuration_P1_us **StrobeDuration_P2_us**

StrobeDelay_P1_us **StrobeDelay_P2_us**

4.2.4.2 Exposure Delay parameters

By default, MultiCam configures P1 and P2 with the smallest possible Exposure Delay value.

This setting is satisfactory for the use cases where the exposure time is shorter than the readout time.

Optionally, keeping **ExposureDelayControl** set to **MAN**, you may manually change the minimum exposure delay value of P1 and/or P2 using the **ExposureDelay_MAN_P1_us** **ExposureDelay_MAN_P2_us** parameters.

Alternatively, you may also change **ExposureDelayControl** to one of the automatic control methods: **SAME_START_EXPOSURE** or **SAME_END_EXPOSURE**.

With **SAME_START_EXPOSURE** the start of exposure is delayed by the same amount of time for both programs: both exposure delay values are equal.

With **SAME_END_EXPOSURE** the end of exposure is delayed by the same amount of time for both programs.

TIP: In case of asymmetric exposure times, when at least one exposure time is greater than the readout time, the minimal line trigger period can be achieved when:

- *Assigning the longest exposure time to P2*
- *Inserting an exposure delay prior to the lowest one*

4.2.5 Encoder Control parameters

As for any line-scan application, the following encoder control parameters must be set according to the application needs:

LineCaptureMode **LineRateMode**

Period_us **PeriodTrim**

LinePitch **EncoderPitch** **ConverterTrim** **OnMinSpeed**

LineTrigCtl **LineTrigEdge** **LineTrigFilter** **LineTrigLine**

RateDivisionFactor **ForwardDirection** **BackwardMotionCancellationMode**

4.2.6 Strobe Control parameters

The `StrobeLine_P1` and `StrobeLine_P2` parameters designate the System I/O lines used as strobe outputs for P1 and P2 respectively. The default values are `IOUT1` for P1 and `IOUT2` for P2.

Setting `StrobeLine_P2` to `NONE` disconnects the `IOUT2` output from the P2 Strobe and makes it available for another usage (Software controlled I/O).

The `StrobeOutput_P1` and `StrobeOutput_P2` parameters control the delivery of the strobe pulse for P1 and P2 respectively. The delivery is enabled by default. Assigning the `DISABLE` value, inhibits the delivery of the strobe pulse.

4.2.7 Grabber Timing parameters

As for any line-scan application, the following grabber configuration, timing and conditioning parameters must be set according to the application needs:

`GrabWindow` `WindowX_Px` `OffsetX_Px`

4.2.8 Cluster parameters

As for any line-scan application, the following cluster parameters must be set according to the application needs:

`ColorFormat` `ImageFlipX`

5 Appendix

5.1 MultiCam CAM Files Update

The following generic CAM file is dedicated to the support of Interleaved Line-scan Acquisition.

5.1.1 MyCameraLink_LxxxxRG_IA.cam generic CAM file template

```

;*****
; Camera Manufacturer: Templates
; Camera Model: MyCameraLink
; Camera Configuration: Interleaved Line-Scan Acquisition, Grabber-Controlled Rate and Exposure
; Board: Grablink
;*****
; This CAM file template is suitable for the following camera configuration:
; - Line-scan camera
; - Grabber-controlled rate
; - Pulse-Width grabber-controlled exposure
; This CAM file template is suitable for the following system configuration:
; - WEB, PAGE, or LONGPAGE Acquisition Modes
; - Take all lines
; - Interleaved Acquisition
;
; *****
; ** CAUTION: **
; ** This file is a template, it can be further customized! **
; ** The lines that can be edited are marked with an arrow followed by the most **
; ** popular alternate values for that parameter. **
; ** For a complete list of possible values; refer to MultiCam Studio and/or to **
; ** the MultiCam Reference documentation. **
; *****
;*****
; ==Begin of "Camera properties Section"==
;
; -Camera Specification category-
; Camera = MyCameraLink;
; CamConfig = LxxxxRG;
; Imaging = LINE;
; Spectrum = BW; <== BW COLOR ...
;
; -Camera Features category-
; TapConfiguration = BASE_1T8; <== BASE_1T8 BASE_1T10 BASE_1T24 ...
; TapGeometry = 1X; <== 1X 1X2 2X ...
; Expose is WIDTH;
; Readout is INTCTL;
; ColorMethod = NONE; <== NONE PRISM TRILINEAR RGB
;
; --Downstream signals--
; FvalMode = FN;
; LvalMode = LA;
; DvalMode = DN; <== DN DG
;
; --Upstream signals--
; ResetCtl = DIFF;
; ResetEdge = GOHIGH; <== GOHIGH GOLOW
; CC1Usage = RESET; <== LOW HIGH RESET SOFT
; CC2Usage = LOW; <== LOW HIGH RESET SOFT
; CC3Usage = LOW; <== LOW HIGH RESET SOFT
; CC4Usage = LOW; <== LOW HIGH RESET SOFT
;
; -Camera Timing category-
; Hactive_Px = 4096; <==
; HSyncAft_Tk = 0; <==
; LineRate_Hz = 5000; <== Max. line rate (= reciprocal of readout duration)
; ExposeMin_us = 1; <== Min. exposure time (= RESET signal pulse width)
; ExposeMax_us = 10000; <== Max. exposure time (= RESET signal pulse width)
; ResetDur = 3000; <== Min. time interval, in ns, between consecutive RESET pulses
;
; ==End of "Camera properties Section"==
;*****

```

```

; ==Begin of "System properties Section"==
;
; -Acquisition Control category-
  AcquisitionMode =  WEB;                <== WEB PAGE LONGPAGE
  TrigMode =        IMMEDIATE;          <== IMMEDIATE HARD SOFT COMBINED
  NextTrigMode =    REPEAT;             <== REPEAT (when AcquisitionMode = WEB or LONGPAGE)
;                                         <== SAME REPEAT HARD SOFT COMBINED (when AcquisitionMode = PAGE)
  EndTrigMode =     AUTO;               <== AUTO HARD (when AcquisitionMode = LONGPAGE)
;                                         <== AUTO (when AcquisitionMode = WEB or PAGE)
  BreakEffect =     FINISH;             <== FINISH ABORT
  SeqLength_Pg =    -1;                 <== -1 1 .. 65534 (when AcquisitionMode = PAGE)
  SeqLength_Ln =    -1;                 <== -1 1 .. 65534 (when AcquisitionMode = WEB or LONGPAGE)
  PageLength_Ln =   500;                <== 1 .. 65535
;
; -Trigger Control category-
;   The set of values and the default value assigned by MultiCam for the parameter TrigCtl are board specific!
;   If the default value is not adequate for your application, it is then necessary to edit the value and
;   to remove the leading semi-column of one of the following 3 lines
;   TrigCtl =        ISO;               <== Full/DualBase/Base: ISO DIFF
;   TrigCtl =        ITTL;             <== Avenue/Express: TTL ITTL I12V LVDS
;   TrigCtl =        ITTL;             <== Value/Expert 2: TTL ITTL I12V
  TrigEdge =        GOHIGH;           <== GOHIGH GOLOW
  TrigFilter =      MEDIUM;          <== OFF ON MEDIUM STRONG
  TrigLine =        NOM;              <== NOM ...
;
;   The following 4 parameters are relevant only when EndTrigMode = HARD!
;   The set of values and the default value assigned by MultiCam for the parameter EndTrigCtl are board
specific!
;   If the default value is not adequate for your application, it is then necessary to edit the value and
;   to remove the leading semi-column of one of the following 3 lines
;   EndTrigCtl =     ISO;               <== Full/DualBase/Base: ISO DIFF
;   EndTrigCtl =     ITTL;             <== Avenue/Express: TTL ITTL I12V LVDS
;   EndTrigCtl =     ITTL;             <== Value/Expert 2: TTL ITTL I12V
  EndTrigEdge =     GOLOW;            <== GOHIGH GOLOW
  EndTrigFilter =   MEDIUM;          <== OFF ON MEDIUM STRONG
  EndTrigLine =     NOM;              <== NOM ...
;
; -Interleaved Acquisition category-
  InterleavedAcquisition =  ON;        <== Enable interleaved acquisition
;   Define the exposure time for P1 and P2 (= RESET signal pulse width)
  ExposureTime_P1_us =      64.0;      <== Float (0.16 up to 5000000)
  ExposureTime_P2_us =      64.0;      <== Float (0.16 up to 5000000)
;   Define the strobe duration for P1 and P2 (= STROBE1 and STROBE2 signals pulse width)
  StrobeDuration_P1_us =    32.0;      <== Float (0.16 up to 5000000)
  StrobeDuration_P2_us =    32.0;      <== Float (0.16 up to 5000000)
;   Define the strobe delay for P1 and P2 (relative time offset from RESET going ON to STROBEx going
ON)
;   The time offset can be positive, null or negative
  StrobeDelay_P1_us =       16.0;      <== Float (-10000 up to 5000000)
  StrobeDelay_P2_us =       16.0;      <== Float (-10000 up to 5000000)
;   Select the Exposure delay control method
  ExposureDelayControl =    MANUAL;     <== MANUAL SAME_END_EXPOSURE SAME_START_EXPOSURE
;   When ExposureDelayControl is MANUAL, select the minimum delay from the trigger
;   to the start of exposure (RESET signal going on)
  ExposureDelay_MAN_P1_us =  0;         <== Float (0 up to 5000000)
  ExposureDelay_MAN_P2_us =  0;         <== Float (0 up to 5000000)
  StrobeLine_P1 =          IOUT1;       <== IOUT1
  StrobeLine_P2 =          IOUT2;       <== IOUT2 NONE
  StrobeOutput_P1 =        ENABLE;      <== ENABLE DISABLE
  StrobeOutput_P2 =        ENABLE;      <== ENABLE DISABLE
;
; -Encoder Control category-
  LineCaptureMode =  ALL;
  LineRateMode =     PERIOD;            <= PERIOD PULSE CONVERT
;   The following 2 parameters are relevant only when LineRateMode = PERIOD:
  Period_us =        1000;             <=
  PeriodTrim =       0;                <=
;   The following 5 parameters are relevant only when LineRateMode = CONVERT:
  LinePitch =        100;               <=
  EncoderPitch =     100;               <=
  ConverterTrim =    0;                 <=
  OnMinSpeed =      IDLING;            <= IDLING MUTING
;   The following 4 parameters are relevant only when LineRateMode = PULSE or CONVERT:

```

```

;      The set of values and the default value assigned by MultiCam for the parameter LineTrigCtl are board
specific!
;      If the default value is not adequate for your application, it is then necessary to edit the value and
;      to remove the leading semi-column of one of the following 3 lines
;      LineTrigCtl =      DIFF_PAired;      <== Full/DualBase/Base: ISO DIFF ISO_PAired DIFF_PAired
;      LineTrigCtl =      ITTL;            <== Avenue/Express: TTL ITTL I12V LVDS
;      LineTrigCtl =      ITTL;            <== Value/Expert 2: TTL ITTL I12V
;      The set of values and the default value assigned by MultiCam for the parameter LineTrigEdge are board
specific!
;      If the default value is not adequate for your application, it is then necessary to edit the value and
;      to remove the leading semi-column of the following line
;      LineTrigEdge =      GOHIGH;          <== GOHIGH GOLOW RISING_A FALLING_A ALL_A (when LineTrigCtl = ISO or
DIFF)
;
;      <== ALL_A_B (when LineTrigCtl = ISO_PAired or DIFF_PAired)
;      <== GOHIGH GOLOW (when LineTrigCtl = TTL ITTL I12V or LVDS)
;
LineTrigFilter =      MEDIUM;              <== OFF ON MEDIUM STRONG
LineTrigLine =      NOM;                   <== NOM ...
;      The following parameter controls the Rate divider circuit that is available
;      exclusively on Grablink Full/DualBase/Base boards when LineRateMode = PULSE.
;      Remove the leading semi-column if the function is required!
;      RateDivisionFactor = 1;              <== 1..512
;      The following 2 parameters are controlling the Backward Motion Cancellation circuit that is available
;      exclusively on Grablink Full/DualBase/Base boards when LineTrigCtl = ISO_PAired or DIFF_PAired.
;      Remove the leading semi-column on both parameters if the function is required!
;      ForwardDirection = A_LEADS_B;       <== A_LEADS_B B_LEADS_A
;      BackwardMotionCancellationMode = OFF; <== OFF FILTERED COMPENSATE
;
; ==End of "System properties Section"==
;*****
; ==Begin of "Grabber properties Section"==
;
; -Grabber Configuration, Timing & Conditioning categories-
GrabWindow =      NOBLACK;                 <== NOBLACK MAN ...
;      The following 2 parameters are relevant only when GrabWindow = MAN:
WindowX_Px =      2048;                    <==
OffsetX_Px =      0;                       <==
;
; -Look-Up Tables category-
;      The Look-Up Table operator is available exclusively on Grablink Full/DualBase/Base boards.
;      LUT configuration parameters can be inserted here if required by the application
;
; -Cluster category-
ColorFormat =      Y8;                     <== Y8 Y10 RGB24 RGB24PL ...
ImageFlipX =      OFF;                     <== OFF ON
;
; End of "Grabber properties Section"
;*****
; End of File
;=====

```

5.2 MultiCam Parameters Update

The following parameters are dedicated to the support of Interleaved Line-scan Acquisition

5.2.1 Channel Class – Interleaved Acquisition Category

5.2.1.1 InterleavedAcquisition

Type	Level	Access
Enum	Select	Set/Get

Description: Master control of the Interleaved Line-scan Acquisition.

Applies to: Grablink Base/DualBase/Full/Full XR

Possible values:

Value	Description
OFF	Interleaved Line-scan Acquisition is disabled – Default value.
ON	Interleaved Line-scan Acquisition is enabled.

The ON value is applicable only when `CamConfig=LxxxxRG`.

5.2.1.2 ExposureTime_P1_us and ExposureTime_P2_us

Type	Level	Access
Float	Adjust	Set/Get

Description: Exposure time (= Reset pulse duration) for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

The default value is the largest exposure time allowed by the camera when operating at the maximum line rate.

The user must set the exposure time according to the application needs.

Value range: 0.16 (160 nanoseconds) up to 5000000 (5 seconds).

5.2.1.3 ExposureTime_P1_Effective_us and ExposureTime_P2_Effective_us

Type	Level	Access
Float	Expert	Get only

Description: Effective exposure time for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

5.2.1.4 StrobeDuration_P1_us and StrobeDuration_P2_us

Type	Level	Access
Float	Adjust	Set/Get

Description: Strobe pulse duration for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when *InterleavedAcquisition = ON*.

The default value is 50% of the default exposure time.

The user must set the strobe duration according to the application needs.

Value range: 0.16 (160 nanoseconds) up to 5000000 (5 seconds).

Recommendation: the *StrobeOFF* event should occur before the *ResetOFF* event.

5.2.1.5 StrobeDuration_P1_Effective_us and StrobeDuration_P2_Effective_us

Type	Level	Access
Float	Expert	Get only

Description: Effective strobe pulse duration for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when *InterleavedAcquisition = ON*.

5.2.1.6 StrobeDelay_P1_us and StrobeDelay_P2_us

Type	Level	Access
Float	Adjust	Set/Get

Description: Time delay from *ResetON* event to *StrobeON* event for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when *InterleavedAcquisition = ON*.

The default value is 25% of the default exposure time.

The user must set the strobe delay according to the application needs.

Value range: -10000 (-10 milliseconds) up to 5000000 (5 seconds).

Note: Negative values allow the StrobeON event to occur before the ResetON event.

5.2.1.7 StrobeDelay_P1_Effective_us and StrobeDelay_P2_Effective_us

Type	Level	Access
Float	Expert	Get only

Description: Effective strobe delay for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when *InterleavedAcquisition = ON*.

5.2.1.8 ExposureDelayControl

Type	Level	Access
Enum	Expert	Set/Get

Description: Control method of the exposure delay.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

Possible Values:

Value	Description
MANUAL	Manual control. The user specifies the minimum delay for P1 and P2 respectively using the <code>ExposureDelay_MAN_P1_us</code> and <code>ExposureDelay_MAN_P2_us</code> parameters. Default value.
SAME_START_EXPOSURE	Automatically align the Start Of Exposure of both programs.
SAME_END_EXPOSURE	Automatically align the End Of Exposure of both programs.

5.2.1.9 ExposureDelay_MAN_P1_us and ExposureDelay_MAN_P2_us

Type	Level	Access
Float	Expert	Set/Get

Description: Minimum value of the `ResetON` event time for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON` and `ExposureDelayControl=MANUAL`.

The default value is 0.

The user may adjust the exposure delay to optimize the cycle period according to the application needs.

Value range: 0 up to 5000000 (5 seconds).

5.2.1.10 ExposureDelay_P1_Effective_us and ExposureDelay_P2_Effective_us

Type	Level	Access
Float	Expert	Get only

Description: Effective exposure delay for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

5.2.1.11 MinTriggerPeriod_P1_us and MinTriggerPeriod_P2_us

Type	Level	Access
Float	Expert	Get only

Description: Effective minimum time interval before the next trigger for P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

5.2.1.12 StrobeLine_P1

Type	Level	Access
Enum	Expert	Set/Get

Description: System I/O line assigned to Strobe output for P1.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

Possible values:

Value	Description
IOUT1	Isolated Output 1 – Default value.

5.2.1.13 StrobeLine_P2

Type	Level	Access
Enum	Expert	Set/Get

Description: System I/O line assigned to Strobe output for P2.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

Possible values:

Value	Description
NONE	No System I/O line assigned to Strobe output for P2.
IOUT2	Isolated Output 2 – Default value.

5.2.1.14 StrobeOutput_P1 and StrobeOutput_P2

Type	Level	Access
Enum	Expert	Set/Get

Description: Strobe output control of P1 and P2 respectively.

Applies to: Grablink Base/DualBase/Full/Full XR

Applies only when `InterleavedAcquisition = ON`.

Possible values:

Value	Description
ENABLE	The Strobe output is enabled. Default value when <code>InterleavedAcquisition = ON</code> .
DISABLE	The Strobe output is disabled. Default value when <code>InterleavedAcquisition = OFF</code> .