

Manual for CamEd – High level editor for BitFlow Camera Configuration Files.

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Introduction

CamEd is BitFlow's high level GUI based application for configuring camera files. The values entered in CamEd are interpreted and the appropriate registers are set on the board. In some cases the board stores values differently than they are entered in CamEd. For example, values in the range .001 – 64 may be entered in the field under the Triggering tab. However, the frame grabber stores two integers, ENC_DIV_M and ENC_DIV_N, that are used to calculate the value for the Encoder Multiplier.

This document refers to CamEd included with SDK 5.60. Slight differences may be seen with previous versions.

Camera File Name Conventions

Every effort is made to follow a consistent naming pattern for camera files. The fields in the name are separated by single dashes and take on the following order.

Make – Model – Resolution – BitDepth Taps – Mode – Special – ext

Make: Camera manufacturer. Eg. Basler, Dalsa, Imperx, PhotonFocus.

Model: Camera model name. Eg. Ace-acA2040-180km, B0620x, Flare-2M360.

Resolution: WidthxHeight. Optional. Indicates the captured resolution. May also include 2x, which indicates the file is for high speed 80 bit capturing.

BitDepth: Captured bit depth. E = 8, T = 10, W = 12, F = 14, S = 16.

Taps: Number of camera taps. Can be, depending on frame grabber, 1,2,3,4,5,6,8, 10.

Mode: Triggering mode. Common modes are FreeRun, TTLTrigger, SWTrigger

Special: Other information. Eg. HWBayer, PulseWidthExposure.

Ext: Extension indicating frame grabber. .anlg (Alta), .cam (Roadrunner), .kcxp (Karbon CXP), .r64 (Karbon, Neon, R64), .rcl (R3).

General/Buttons

The buttons at the bottom of the window to control reset/application of configuration.

Reset: Set value of selected field to value in the file saved on disk.

Reset All: Reset all fields to value in the file saved on disk.

Apply: Send configuration to frame grabber. Does not save the configuration to the file on disk.

Line

Active pixels per line: The width of the horizontal acquisition window (HAW). Must be less than sensor width minus LEN to first active pixel. Must be a multiple of 8.

LEN to first active pixel: Number of pixels from LEN asserting to the beginning of the horizontal acquisition window.

Last active pixel to reset: The number of pixel clocks to wait after the end of the HAW to reset. This is a legacy setting and should be 0 except for rare configurations.

Frame

Active lines per frame: The height of the vertical acquisition window (VAW). Must be less than the sensor height minus FEN to first active pixel. Must be a multiple of 8.

FEN to first active pixel: Number of lines to wait after FEN asserting to begin acquiring. The vertical offset to the VAW.

Last active line to reset: The number of line clocks to wait after the end of the VAW to reset. This is a legacy setting and should be 0 except for rare configurations.

Active frames per DMA frame: Can be used to group frames together when acquiring small frame size at high frame rate. The DMA frames will have the HAW width and a height of this value times frame height, which should be entered in Active lines per frame. For example, for 8x8 frame size and 16 active frames per DMA frame, a value of 128 should be entered in Active lines per frame.

Sensor

Sensor type: Select Area scan or Line scan depending on your camera.

Sensor architecture: The readout format of the camera. Many cameras support multiple readout formats. Therefore, this setting should match the format the camera is set to. The available formats vary depending on the frame grabber model and are automatically enumerated by CamEd.

Total bits per pixel: Bit depth. Must match camera setting.

Packed: The three color channels DMA'd as a single channel. For example, the data from an 8-bit image with three color channels, each pixel is DMA'd as 24 bits. The order of the color channels is selected in the next field.

Sensor: Select grey or the order of color channels.

Color pixel read-out method: Parallel – The color channel at each pixel is read out at the same time. R,G,B is read for the first pixel before any data for the second pixel. Serial - The entire frame of each color channel is read independently. The entire frame of Red is acquired, then the entire frame of Green, then the entire frame of Blue.

Triggering

Horizontal encoder: Indicates use of a horizontal encoder and whether it controls the Control Table, NTG, or both. The horizontal encoder is useful for triggering each line individually.

Encoder polarity: Indicates whether the encoder asserts on the rising edge or falling edge.

Encoder input: Selects the type of encoder input signal. The Differential, TTL, and Opto-coupled must be physically connected to the board. Refer to your hardware manual for which pins correspond to the encoder type.

External encoder: Indicates whether an external encoder input is used.

Vertical trigger: Selects whether the vertical trigger initializes the Control Table NTG, or both. For CTAB selected, the user must select edge or level mode. In edge mode, the camera exposures are controlled by the edge (rising or falling). In level mode, the camera exposure is controlled by the time that the trigger pulse is asserted.

Trigger polarity: Indicates whether the vertical trigger asserts on the rising edge or falling edge.

Trigger input: Selects the type of input signal for the vertical trigger. The Differential, TTL, and Opto-coupled must be physically connected to the board. Refer to your hardware manual for which pins correspond to the trigger type.

External trigger: Indicates use of an external trigger.

Vertical reset: Allows acquisition of a variable size frame based on the assertion of the vertical trigger. Select End of frame (fixed size) to acquire frames the size set by the Line and Frame tabs. Select Trigger de-assert (variable size) to acquire frame heights controlled by the trigger.

Encoder multiplier: Allows for an increase or decrease in the frequency of the encoder. Valid range is 0.001 to 64. The

scaling factors are not evenly distributed. See the hardware manual for a description of how they are calculated.

Vertical trigger delay (lines): Number of LEN cycles after trigger asserts to take action.

Time out (milliseconds): Time, in milliseconds, that the frame grabber will wait for a trigger.

Identification

Manufacturer: Name of camera manufacturer.

Model: Camera model name.

Mode: Information on configuration. Typically formatted as (bit depth), (read out mode), (frame size), (trigger mode).

Comments

Additional comments on configuration. This can be left blank.

Bayer

Information for Bayer cameras

Camera bit depth: Select 8,10, or 12 bits per pixel.

Decoder phase: Configuration of Bayer pattern. Match to camera manufacturer's specification.

Red gain: An integer in the range 0-255. The value is divided by 64. This means that entering 64 will result in unity gain. Values outside the range will be clipped.

Green gain:

Blue gain:

Misc.

Power over Camera Link: Controls whether power is supplied through the CL cable. Must be selected for PoCL cameras and deselected for non-PoCL cameras.

Use CTABs for HAW: Selects CTABs as control for horizontal active window (HAW). The start of the HAW is controlled by HSTART signal from the HCTAB.

Use CTABs for VAW: Selects CTABs as control for vertical active (VAW) window. The start of the VAW is controlled by the VSTART signal in the VCTAB.

Exposure Control

Exposure time coarse: Slider for large changes in exposure time.

Exposure time fine: Slider for small changes in exposure time.

Exposure time period: Field for entering exposure time directly.

Line/Frame rate coarse: Slider for large changes in frame period.

Line/Frame rate fine: Slider for small changes in frame period.

Line/Frame rate period: Field for entering frame period directly in milliseconds.

Time base: Allows for switching between high speed control and long exposure. See New Timing Generator section of manual for more detail (Section 3.2 for Karbon).

Trigger mode: Selects operation mode of the NTG. Free run, triggered, and trigger source.

Signal: Polarity of of NTG signal.

Output signal: Selects where to output signal. Multiple outputs can be selected but it is best to only select the lines in use.

CTABs

It is recommended that the white paper “Understanding CTABs” is read before modifying this section.

This interface allows the user to configure the CTABs by specifying the start and length of 4 segments for each CTAB signal. The values are displayed as hexadecimal numbers

I/O

Allows the user to select the signal to direct to the available CCx and GPOUTx output lines.

CTx from CTAB – Comes from GPHx AND GPVx in the CTABs.

NTG – Uses the New Timing Generator.

Trigger input – Uses the signal selected un Triggering > Trigger input.

GPINx – Use the general purpose input.

Internal clock – NTG.

Encoder input – Encoder signal selected under Triggering > Encoder input.

GPOUTx bit – Use value written to CON4 by host.

0 – Set output to static low.

1 – Set output to static high.

Reserved – Value is reserved for future use.

Quad. Encoder

In general, the Quadrature Encoder is a complex configuration, it is suggested that the user also refer to the section addressing it in the hardware manual. For the Karbon and Neon, this is Chapter 4.

Decode mode: Rising edge of A and B – The encoder counter is increased on the rising edge of both A and B. Rising and falling edge – The encoder counter increases on the falling edge of both A and B, which provides a 4x increase in resolution over a single phase encoder.

Acquisition direction: Controls whether the board acquires when the counter is inceasing, decreasing, or both. This is a useful setting for when the encoder is connected to stage that is moving back and forth.

Interval mode: Set to “On” if you wish to only a subsection of counter values. The range to acquire is set by the fields “Interval upper limit” and “Interval lower limit” fields.

No reacquisition mode: Set to “On” to prevent lines from being acquired more than once. This is useful when mechanical vibration in the system may cause the repeats in encoder states. The circuit is reset by writing a 1 with software to QENC_RESET_REAQ on CON16.

Reacquisition reset mode: Controls the method by which the quadrature encoder circuit is reset. Manual – To reset QENC_RESET_REAQ ,poke to 1. Automatic, outside LL-UL – The encoder is reset automatically when the counter is outside the values of the lower limit and upper limit.

Interval upper limit: The upper limit of the counter for acquisition when the system is in interval mode.

Interval lower limit: The lower limit of the counter for acquisition when the system is in interval mode.

Encoder type: Used to indicate the type of encoder connected, single phase or quadrature.

Scan step: Turns the scan step mode on or off. This mode is used to trigger an acquisition every x counts, where x is the value set by Scan step amount.

Scan step amount: The number of counts between triggers.

Hardware Bayer Demosaick

A few frame grabber models can perform on board demosaicking of images from cameras with a Bayer color filter array. This will effectively triple the rate at which data needs to be DMA'd. Therefore, this feature is only available in 1, 2, or 4-tap configurations. Demosaicking is performed at 8 bits per pixel. 10 or 12 bit Bayer data can be accepted, but will be downshifted to 8 bits. Some of the settings for hardware demosaicking are not obvious, which are described here:

- 1) "Sensor > Total bits per pixel" will be 24 packed. 10 or 12 bit input is shifted down to 8 then each color channel calculated.
- 2) Sensor: Color (RGB) – The color format is what gets DMA'd to memory, not what is input to the frame grabber.
- 3) Decoder phase: Match this to the specification for the camera sensor. If the colors in the image are not correct there may be edge conditions that cause a shift in the decoder phase or the color gain settings need adjustment.
- 4) Red/Green/Blue gain: On the board, this value is divided by 64. So entering 64 in CamEd will result in unity gain.

Questions on specific applications

The following are general questions that have been asked about the settings in CamEd.

Q: One example: which register value(s) correspond to the field "Encoder Multiplier" in the Cam-File? Is it M or is it N2/M (manual 5.2.1) or something else?

A: The value in the field "Encoder Multiplier" is calculated from the register values ENC_DIV_N and ENC_DIV_M using the formula listed in section 5.2.1 of the Neon/Karbon manuals. Although this formula does not allow for an evenly distributed set of scaling factors, a suitable value can be found for most applications.

That is: $F_{out} = F_{in} * (2^N) / M$.

1) How do I set a horizontal ROI in the tab "Line"?

Yes. "LEN to first active pixel" is the offset to the ROI and "Active pixels per line" is the length of the ROI.

a. Q: What is "last active pixel to reset"?

A: "last pixel active to reset" is left over from the use of Control Tables. This should be set to 0 unless using CTables in a very specific and uncommon way. If that is needed then we can help set that up.

b. Q: If two of the three values are set is then third value given implicit?

A: No, but there are limits that depend on the other values.

c. Q: Applicable to both Line-scan and area-scan?

A: Yes.

2) The CamFile tab "Frame": I try to use these to set a certain ROI (vertically), is that possible?

Yes. "FEN to first active line" is the offset to the ROI and "Active lines per frame" is the height of the ROI.

a. Q: What is "last active line to reset"?

A: "last line active" is left over from the use of Control Tables. This should be set to 0 unless using CTables in a very specific and uncommon way. If that is needed then we can help set that up.

b. Q: If two of the three values are set is then third value given implicit?

A: No, but there are limits that depend on the other values.

- c. Q: What is the meaning of “Active frames per DMA-frame”?
A: This is used when the frame size is very small and the frame rate very high.
- d. Q: applicable to both Line-scan and area-scan?
A: Yes.
- 3) The CamFile tab “Triggering”: how are these different fields related?
- a. Q: If “External encoder” is on “Enable” does this have any effect if “Vertical trigger” is on “Not used”, e.g. could one still read (and count) encoder pulses in this case?
A: Encoder mode and Trigger mode are completely independent. The configuration you described is perfectly acceptable.
- b. Q: Which is the “normal” Vertical trigger setting; “Trigger Vertical CTABS (edge mode)” ?
A: There isn't necessarily a "normal" setting. It all depends on the application. “Trigger Vertical CTABS (edge mode)” is the most common.
- c. Q: If the camera is set to wait for encoder triggering, must the same setting in the Cam-file also be enabled in order to make the triggering work?
A: Yes.
- d. Q: Is the value “External trigger” always related to starting the frame?
A: Yes. How it relates to starting the frame is slightly different in each of the modes One-shot, Start-Stop, and Trigger Delay.
- e. Q: If one want to use a SW trigger for the frame of a line scan camera as the camera itself is in “free running mode”; which trigger settings to choose? The idea is to get exactly one frame visible in e.g. CiView.
A: Use Trigger Vertical CTABS (edge mode).
- f. Q: If one want to use a SW trigger for the frame of a line scan camera as the camera itself is in “encoder triggered mode”; which trigger settings to choose? The idea is to get exactly one frame visible in e.g. CiView.
A: Use Trigger Vertical CTABS (edge mode) and set Horizontal Encoder to "Trigger Horizontal CTABS" and enable external encoder.
- 4) The CamFile tab “Quad. Encoder”: how to set these values (in this tab) in order to enable 3) f. accepting only pulse from motion in one direction and not recounting pulses at positions already visited?
- Decode mode: Rising Edge of A and B
 - Set Acquisition direction to "Positive Only"
 - Interval mode: on
 - No reacquisition mode: on
 - Reacquisition reset mode: Automatic
 - Upper/Lower limit: according to application
 - Encoder type: quadrature
 - Scan step: off
 - Scan step amount: 0

Understanding CTABS

page 11: Under **Using the CTABS to Control the location of the First Active Pixel**

“Set Bit HAW_START = 0”

“Set Bit VAW_START = 0”

These should say to set the bit to 1 for the CTABS to control the acquisition window.