HARDWARE APPLETS DOCUMENTATION



MultiStream_TapSorting_1X_2YE.hap
MultiStream_TapSorting_1X_2YE_Features.hap

Impulse CX4S

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1 Introduction

This document describes the features of the hardware applets **MultiStream_TapSorting_1X_2YE.hap** and **MultiStream_TapSorting_1X_2YE_Features.hap** for the Impulse CX4S platform. The main functionality of these applets is:

- Acquisition of the 8-bit pixel streams of the two boA13440-17cmSOL camera taps.
- Merging the taps in 1X-2YE mode to frames in the correct pixel order.

The **MultiStream_TapSorting_1X_2YE_Features.hap** applet also allows you to enable shading correction and dynamic defect pixel correction.

This document describes the Requirements, the Installation steps, and offers a detailed list of the Parameters contained in the applet. Section 6 describes the procedure of how to calibrate the boA13440-17cmSOL camera and to generate the coefficients for flat field correction.

2 Functionality

2.1 MultiStream_TapSorting_1X_2YE.hap

The **MultiStream_TapSorting_1X_2YE.hap** applet provides the following functionality:

- Acquisition of 8-bit pixel streams of the two boA13440-17cmSOL camera taps and merging the taps in 1X-2YE mode to frames in the correct pixel order.
- Maximum image dimension per tap: 13392x4764 pixels
  You can set the image width per tap individually in steps of 24 pixels. You can modify the image height in steps of 1 line.
- You can choose your own simulation source as input source for acquisition and processing.

2.2 MultiStream_TapSorting_1X_2YE_Features.hap

The **MultiStream_TapSorting_1X_2YE_Features.hap** applet provides the following functionality:

- Acquisition of 8-bit pixel streams of the two boA13440-17cmSOL camera taps and merging the taps in 1X-2YE mode to frames in the correct pixel order.
- Maximum image dimension per tap: 13392x4764 pixels
  You can set the image width per tap individually in steps of 24 pixels. You can modify the image height in steps of 1 line.
- You can enable shading correction via a parameter and can set values for gain and offset corrections for each pixel in a frame.
- The output pixel values are: **(Input pixel value - offset value) * gain factor**

  (See also https://en.wikipedia.org/wiki/Flat-field_correction)
- The values are set by loading a ***.txt** file with exactly 134217728 lines. Each line contains one 24-bit value, which represents the offset and gain value for one pixel in the frame. The lower 12 bits are the gain value (4 integer bits, and 8 bits subpixel accuracy) for gain values in the range

of 0 to 16. The higher 12 bits represent the offset value (7-bit integer value, 4 subpixel bits and 1 signed bit) for offset values in the range of -128 to 127.



Calibration, i.e., the calculation of the parameters for each pixel, needs to be done individually for each camera and lens system. See section 6 for a description of how to determine the calibration parameters and to create the correction file.

You can enable the dynamic defect pixel correction by setting an enable parameter.

3 Requirements

3.1 Hardware

Impulse CX4S

3.2 Runtime

FramegrabberSDK_Setup_v5.9.52.0fd58acffec-70898_Win64_29.09.2022.exe, provided within this delivery.

3.3 Applet

MultiStream_TapSorting_1X_2YE.hap and **MultiStream_TapSorting_1X_2YE_Features.hap** for Windows 64-bit target runtime.

3.4 Documentation

This document.
The Impulse CX4S documentation is available at https://imx661--bpd.netlify.app/frame-grabbers/impulse-cx4s.html.

4 Installation

1. Install the frame grabber on a computer as described in the frame grabber documentation.
2. Connect the boA13440-17cmSOL camera to the frame grabber as described in https://imx661--bpd.netlify.app/frame-grabbers/connecting-cameras.
3. Install the Framegrabber SDK as described in the Framegrabber SDK installation guide.
4. Copy the hardware applet 64-bit version to the **%SISODIR5\Hardware Applets\IMP-CX-4S** directory. Create this folder if it doesn't exist yet.

   You can now use the applet, e.g., in microDisplay X or in the Framegrabber API.



Flashing the applet onto the frame grabber isn't necessary.

5 Parameters

The following tables list the important parameter names of the applets.

5.1 MultiStream_TapSorting_1X_2YE.hap

Parameter Name	Description	Range
Device1_Process0_Parameters_InputImageHeight	Total image height	[0,9528] lines Step size: 1 line Default: 9528 lines
Device1_Process0_Parameters_InputImageWidth	Image width	[0,13376] pixels Step size: 16 pixels Default: 13376 pixels
Device1_Process0_Parameters_SelectImageSource	Selects the image source for the acquisition	SelectCamera; SelectSimulator Default: SelectCamera
Device1_Process0_Parameters_Simulator_Framerate	Selects the frame rate for the simulator	[0.058, 312500000]

5.2 MultiStream_TapSorting_1X_2YE_Features.hap

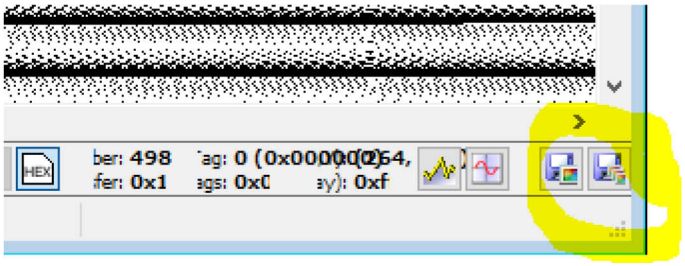
Parameter Name	Description	Range
Device1_Process0_Parameters_ InputImageHeight	Total image height	[0,9528] lines Step size: 1 line Default: 9528 lines
Device1_Process0_Parameters_ InputImageWidth	Image width	[0,13376] pixels Step size: 16 pixels Default: 13376 pixels
Device1_Process0_Parameters_ EnableDynamicDefectPixelCorrection	Enables dynamic defect pixel correction	No_DynamicDefectPixelCorrection; DynamicDefectPixelCorrection Default: No_DynamicDefectPixelCorrection;
Device1_Process0_Parameters_ EnableShadingCorrection	Enables shading correction	NoShadingCorrection; ShadingCorrection Default: NoShadingCorrection
Device1_Process0_Parameters_ LoadShadingCorrectionCoefficients	Sets the path to the *.txt file with the correction coefficients	The values of the *.txt file are 24-bit values: Lower 12 bits: Gain factor with 4 integer bits for a gain range between 0 and 16 with 8 subpixel bits Higher 12 bits: Offset value with 8 bits signed values for a range between –128 and 127 with 4 subpixel bits
Device1_Process0_Parameters_ LoadShadingCorrectionValuesFile	After setting Device1_Process0_Parameters_LoadShadingCorrectionCoefficients, set this parameter to “1”.	1
Device1_Process0_Parameters_ EnableBlackLevelCorrection	Enable this parameter when black level correction is enabled in the camera.	{0,1} Default: 0 (disabled)
Device1_Process0_Parameters_ BlackLevelCorrectionValue	Set the black level correction value analogous to the black level correction value in the camera.	[0,1024] Default: 0

6 Calibration

The **MultiStream_TapSorting_1X_2YE_Features.hap** applet enables you to perform a pixel-wise correction of the pixel values. You calculate the correction values individually for the camera and lens system. The calibration steps are described in the following:

1. Load the **MultiStream_TapSorting_1X_2YE_Features.hap** applet in microDiplay X.
2. Set the parameters as follows:
   1. To disable shading correction:
      Set the **Device1_Process0_Parameters_EnableShadingCorrection** parameter to **NoShadingCorrection**.
   2. To enable dynamic defect pixel correction:
      Set the **Device1_Process0_Parameters_EnableDynamicDefectPixelCorrection** to **DynamicDefectPixelCorrection**.
3. Acquire a dark image (see the example image **dark.tif**) and save it.

   To save an image in microDisplay X, stop the current image acquisition and click the following button in the lower right corner of the acquisition window:



4. Acquire a bright image (see example image **bright.tif**) and save it.
5. Store the images in the folder, where the application **ffx.exe** is located.
6. Run the **ffc.exe** application.
7. The application **ffc.exe** calculates the difference image between **bright.tif** and **dark.tif** and calculates the gain values and offset values. The values are written in the specific format to the **ShadingCorrectionValues.txt** file as explained in section 2.2, bullet point 5.
8. Set the value of the **Device1_Process0_Parameters_LoadShadingCorrectionCoefficients** parameter to the **ShadingCorrectionValues.txt** file's local path.
9. Set the **Device1_Process0_Parameters_ LoadShadingCorrectionValuesFile** parameter to **1**.
10. To enable shading correction:
    Set the **Device1_Process0_Parameters_EnableShadingCorrection** parameter to **ShadingCorrection**.

7 Revision History

Document Version	Date	Changes
01	9 Mar 2023	Initial version.