



ELDIM
ELECTRONICS FOR DISPLAYS AND IMAGING DEVICES

Application Note: Capture Sequence

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Revision history

Version	Date	Content
0.1	2020/07/22	Initial version
0.2	2020/07/23	Add chapter about X, Y, Z images

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1 Introduction

Capture sequence captures necessary images to generate X, Y, Z images.

5 capture are used:

- filter X
- filter Xz
- filter Ya
- filter Yb
- filter Z

2 Exposure time configuration


Capture Sequence exposure time has 3 configurations:

- AutoExposure
- All the capture have the same exposure time
- Exposure time are defined in a json file

2.1 Auto Exposure

Check “**autoExpo**” so the exposure is calculated during the capture processing

CaptureSequence	sensorTemperature	25.00
	waitForTemp	<input type="checkbox"/>
	nd	0
	irisIndex	2
	autoExpo	<input checked="" type="checkbox"/>
	nbAcquisition	1




2.2 Manual Exposure

Uncheck “autoExpo” and uncheck “useExpoFile”

Set exposure time in “exposureTimeUs” control.

All the captures are done with this exposure time

CaptureSequence	sensorTemperature	25.00
	waitForTemp	<input type="checkbox"/>
	nd	0
	irisIndex	2
	autoExpo	<input type="checkbox"/>
	useExpoFile	<input type="checkbox"/>
	exposureTimeUs	10000
	nbAcquisition	1




2.3 Exposure File

Uncheck “autoExpo” and check “useExpoFile”

File “CaptureSequenceExposureTime.json” is used to retrieve the exposure time

CaptureSequence	sensorTemperature	25.00
	waitForTemp	<input type="checkbox"/>
	nd	0
	irisIndex	2
	autoExpo	<input type="checkbox"/>
	useExpoFile	<input checked="" type="checkbox"/>
	exposureTimeUs	10000
	nbAcquisition	1



If “CaptureSequenceExposureTime.json” does not exist, it is created with default values.

CaptureSequenceExposureTime.json example:

```
{
  "ExposureTimeUs": {
    "Filter_X": 10001,
    "Filter_Xz": 10002,
    "Filter_Ya": 10003,
    "Filter_Yb": 10004,
    "Filter_Z": 10005
  }
}
```

3 Timing measurement

3.1 Capture Sequence

Following table lists the steps required in the capture sequence:

	step	Step detail	
1	Capture image X	Setup	Moves the filters
		Measure	use AE or not, saved capture or not
		Process	
2	Capture image Xz	Setup	Moves the filters
		Measure	use AE or not, saved capture or not
		Process	
3	Capture image Ya	Setup	Moves the filters
		Measure	use AE or not, saved capture or not
		Process	
4	Capture image Yb	Setup	Moves the filters
		Measure	use AE or not, saved capture or not
		Process	
5	Capture image Z	Setup	Moves the filters
		Measure	use AE or not, saved capture or not
		Process	
6	Generate X, Y, Z		

3.2 Measurement

Measurement depends on the PC performance for **Process** steps.

Setup duration is fixed and constrained by HW

Following figures are done for an exposure time of 1000us. (**Measure** duration will increase with exposure time)

	step	Step detail	No AE	AE meas area: 300x200	AE meas area: full sensor
				Measure is done in several steps of the AE algo	
1	image X	Setup	2.5	2.5	2.5
		Measure	0.5	0.5	1.2
				0.5	1.2
				0.5	1.2
		Process	1.8	2.2	1.8
2	image Xz	Setup	2.5	2.5	2.5
		Measure	0.5	0.5	1.2
				0.5	1.2
				0.5	1.2
		Process	1.8	2.2	1.9
3	image Ya	Setup	2.5	2.5	2.5
		Measure	0.5	0.5	1.2
				0.5	1.2
				0.5	1.2
		Process	1.8	2.1	1.8
4	image Yb	Setup	2.5	2.5	2.5
		Measure	0.5	0.5	1.2
				0.5	1.2
				0.5	1.2
		Process	1.8	2.5	1.9
5	image Z	Setup	2.5	2.5	2.5
		Measure	0.5	0.5	1.2
				0.5	1.2
				0.5	1.2
		Process	1.8	2.2	1.9
6	Generate X, Y, Z				
	Total		24	33	40

All sequences have been done in the same conditions.

AE exposure has been configured to be locked within 2 captures.

4 X, Y, Z images génération

From the 5 pictures captures during the sequence, X, Y, Z are calculated by applying the calibration factor that have been calculated during the calibration.

4.1 Calibration data

From file **OpticalColumn.xml**, ColorCoefComp and ColorCoefCorr are used

Note ColorCoefComp may be replaced by ColorCoef for older version (Unit1)

Calibration data are stored in an array

colorCoefComp[irisIndex][composantType][filterIndex]

where irisIndex is the index of the iris mounted on the taprisiot [2, 3, 4, 5]

composantType is the type of the image [X, Y, Z]

filterIndex is the filter setup [X, Xz, Ya, Yb, Z]

colorCoefCorr[filterIndex][ndIndex]

where filterIndex is the filter setup [X, Xz, Ya, Yb, Z]

NdIndex is the nd setup [0, 1, 2, 3, 4]

4.2 Processing

irisIndex and NdIndex are the configuration of the Taprisiot

```
comp_X = img_X * cX +  
         img_Xz * cXz +  
         img_Ya * cYa +  
         img_Yb * cYb +  
         img_Z * cZ
```

```
Where cX = CoefComp[irisIndex][X][filter_X] * CoefCorr[filter_X][NdIndex] / exp(img_X)  
cXz = CoefComp[irisIndex][X][filter_Xz] * CoefCorr[filter_Xz][NdIndex] / exp(img_Xz)  
cYa = CoefComp[irisIndex][X][filter_Ya] * CoefCorr[filter_Ya][NdIndex] / exp(img_Ya)  
cYb = CoefComp[irisIndex][X][filter_Yb] * CoefCorr[filter_Yb][NdIndex] / exp(img_Yb)  
cZ = CoefComp[irisIndex][X][filter_Z] * CoefCorr[filter_Z][NdIndex] / exp(img_Z)
```

```
comp_Y = img_X * cX +  
         img_Xz * cXz +  
         img_Ya * cYa +  
         img_Yb * cYb +  
         img_Z * cZ
```

```
Where cX = CoefComp[irisIndex][Y][filter_X] * CoefCorr[filter_X][NdIndex] / exp(img_X)  
cXz = CoefComp[irisIndex][Y][filter_Xz] * CoefCorr[filter_Xz][NdIndex] / exp(img_Xz)  
cYa = CoefComp[irisIndex][Y][filter_Ya] * CoefCorr[filter_Ya][NdIndex] / exp(img_Ya)  
cYb = CoefComp[irisIndex][Y][filter_Yb] * CoefCorr[filter_Yb][NdIndex] / exp(img_Yb)  
cZ = CoefComp[irisIndex][Y][filter_Z] * CoefCorr[filter_Z][NdIndex] / exp(img_Z)
```

```
comp_Z = img_X * cX +  
         img_Xz * cXz +  
         img_Ya * cYa +  
         img_Yb * cYb +  
         img_Z * cZ
```

```
Where cX = CoefComp[irisIndex][Z][filter_X] * CoefCorr[filter_X][NdIndex] / exp(img_X)  
cXz = CoefComp[irisIndex][Z][filter_Xz] * CoefCorr[filter_Xz][NdIndex] / exp(img_Xz)  
cYa = CoefComp[irisIndex][Z][filter_Ya] * CoefCorr[filter_Ya][NdIndex] / exp(img_Ya)  
cYb = CoefComp[irisIndex][Z][filter_Yb] * CoefCorr[filter_Yb][NdIndex] / exp(img_Yb)  
cZ = CoefComp[irisIndex][Z][filter_Z] * CoefCorr[filter_Z][NdIndex] / exp(img_Z)
```