ELDIM
ELECTRONICS FOR DISPLAYS AND IMAGING DEVICES

Application Note: Auto Exposure

Abstract	This documents is an application note
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Revision history

Version	Date	Content
0.1	2020/07/22	Initial version

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1 Introduction

Measurement can be performed with Auto Exposure (command **MeasureAE)**
MeasureAE command works with several iterations and will take more time than Measure command.

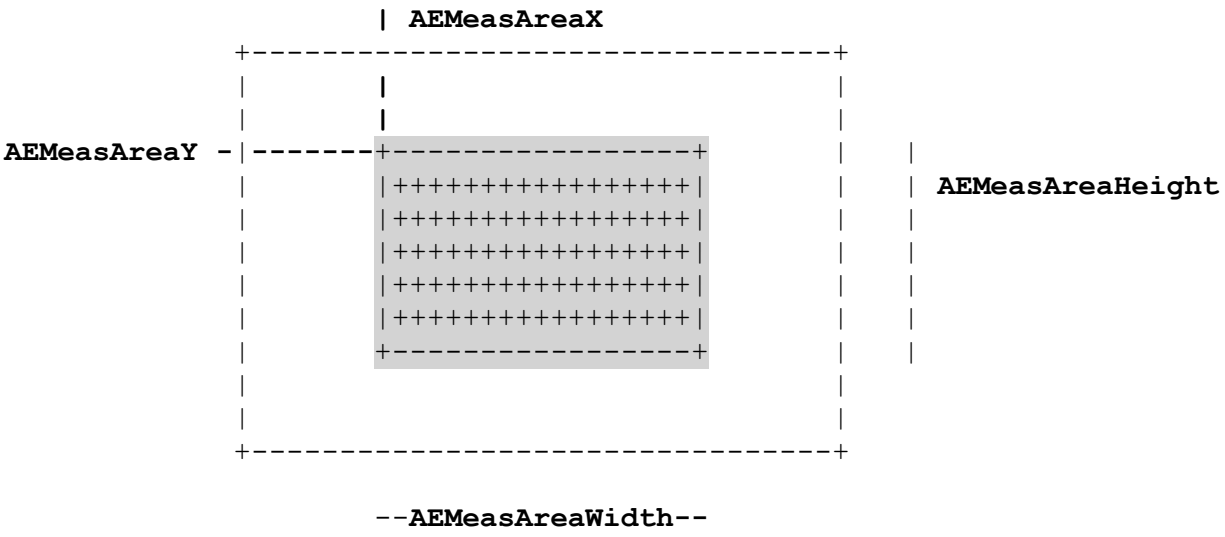
2 Mechanism

During the algorithm, an image is captured and processed (defect pixels only).
Then brightest pixel is measured and compared to a reference value.
Depending on the result of this measurement, exposure time is changed if the measurement does not fit the criteria or the capture is done.

The brightest pixel is picked inside the **measurement area**. The Smaller the area is, the faster the algorithm.

3 Measurement Area

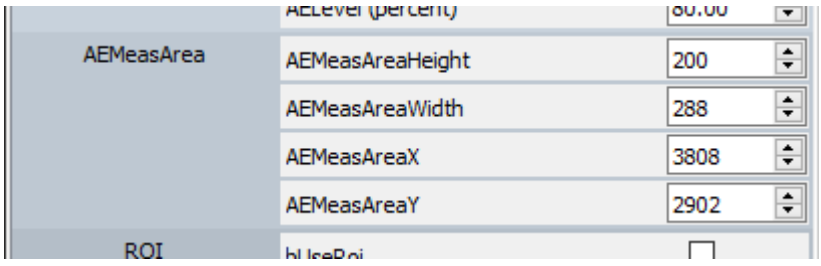
The area where the measurement is done for the auto exposure algorithm.
note: the bigger the area is, the slower the algorithm is.



3.1 Parameter range

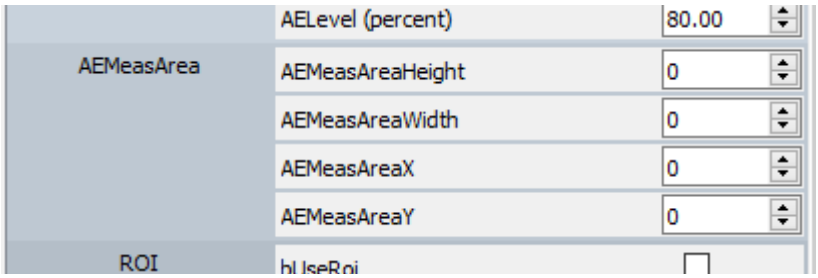
Name	Min	Max	Alignment
AEMeasAreaHeight	0	6004	4
AEMeasAreaWidth	0	7920	16
AEMeasAreaX	0	7920	16
AEMeasAreaY	0	6004	2

Following is a 300*200 area in the center of the sensor



3.2 Measurement Area Disabling

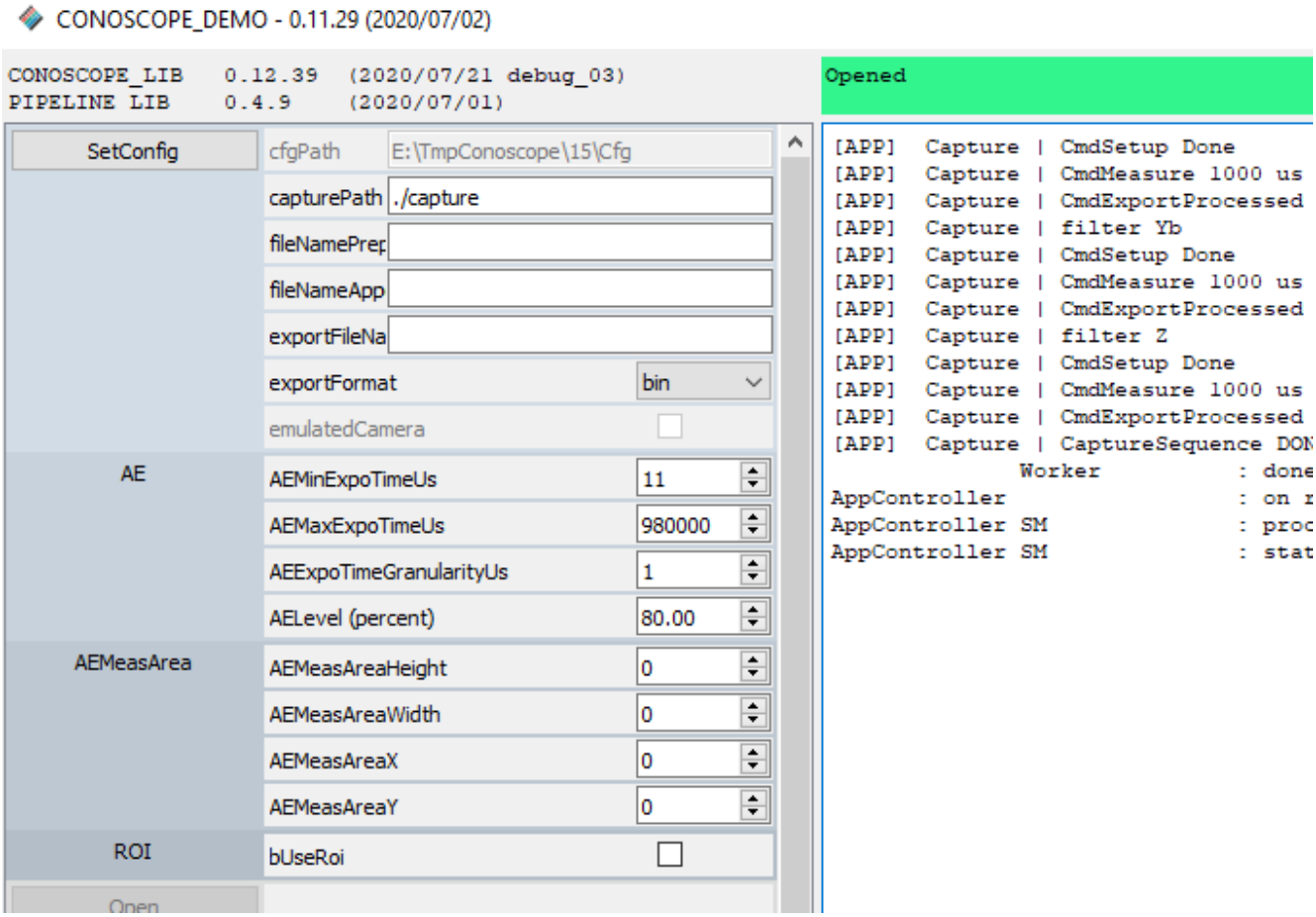
if all the parameters are set to 0, the measurement area is the full sensor



4 AutoExposure Usage

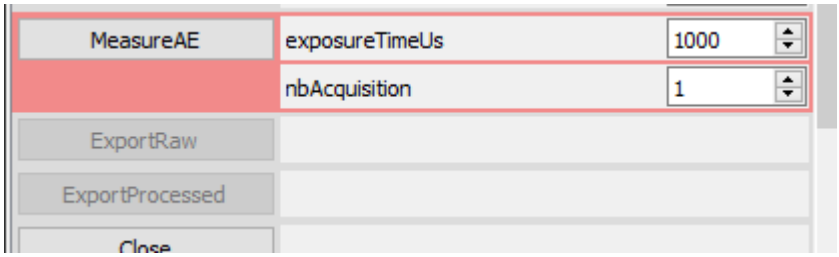
4.1 Configuration of criteria

In the algorithm, the brightest pixel is measured and compared to a reference value.
This reference value is a percentage of saturation and can be tuned with parameter **AELevel**



4.2 MeasureAE

In **MeasureAE** command, parameter **exposureTimeUs** will be the starting point of the algorithm.



The closer **exposureTimeUs** is to the target, the faster the algorithm will be.

For example:
if the target is around 1500 us.
When **exposureTimeUs** set to 1000, the algorithm will require 3 steps:

```
AppController                : MeasureAE Ok
                             : -> Ok
                             : -> TaktTimeMs               7
            Worker           : done     request [CmdMeasureAE] Ok
AppController                : on request done  [CmdMeasureAE] Ok
[APP]  Capture | [AutoExp] CmdMeasure expTime =   1000 us (1) pixelMax =  2173  Capture | UNLOCKED -> next expTime =   1543 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   1543 us (1) pixelMax =  3092  Capture | UNLOCKED -> next expTime =   1637 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   1637 us (1) pixelMax =  3258  Capture | LOCKED
            Worker           : done     request [EventMeasureAEDone] Ok
AppController                : on request done  [EventMeasureAEDone] Ok
AppController SM             : process event    [MeasureAEDone] in state [MeasuringAE]
AppController SM             : state change to  [MeasureDone]
```

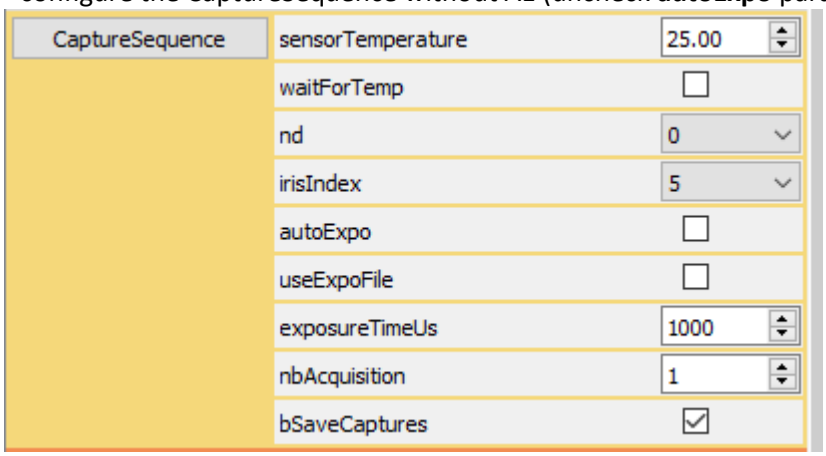
When **exposureTimeUs** set to 100000, the algorithm will require 8 steps:

```
AppController                : MeasureAE Ok
                             : -> Ok
                             : -> TaktTimeMs                4
             Worker          : done     request [CmdMeasureAE] Ok
AppController                : on request done  [CmdMeasureAE] Ok
[APP]  Capture | [AutoExp] CmdMeasure expTime = 100000 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =  50000 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =  50000 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =  25000 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =  25000 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =  12500 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =  12500 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =   6250 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   6250 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =   3125 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   3125 us (1) pixelMax =  4095  Capture | UNLOCKED -> next expTime =   1562 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   1562 us (1) pixelMax =  3118  Capture | UNLOCKED -> next expTime =   1643 us
[APP]  Capture | [AutoExp] CmdMeasure expTime =   1643 us (1) pixelMax =  3293  Capture | LOCKED
             Worker          : done     request [EventMeasureAEDone] Ok
AppController                : on request done  [EventMeasureAEDone] Ok
AppController SM             : process event    [MeasureAEDone] in state [MeasuringAE]
AppController SM             : state change to  [MeasureDone]
```

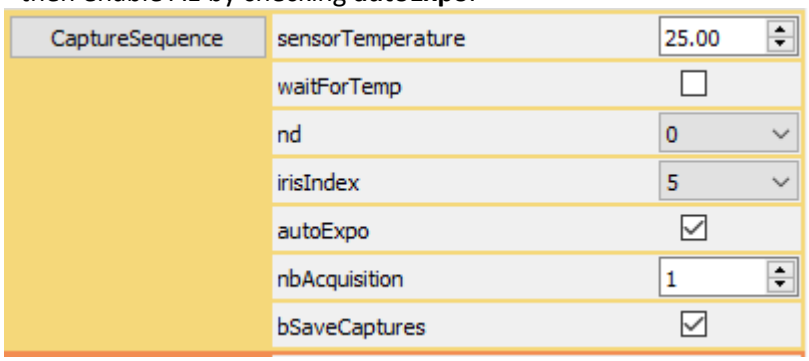
Note:
During MeasureAE processing, it is possible to know the status of the processing (**MeasureAEStatus**) and to stop the processing (**MeasureAECancel**)

4.3 CaptureSequence

Similarly to MeasureAE, it is possible to set starting point of the AE algorithm.
To set **exposureTimeUs**, follow those steps:
- configure the CaptureSequence without AE (uncheck **autoExpo** parameter)



- Set **exposureTimeUs**
- then enable AE by checking **autoExpo**.



Then launch the capture by pressing **CaptureSequence**.