일반

[4EC EVT1.1] AF guide ver 4.1

2011.03.14

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SAMSUNG ELECTRONICS

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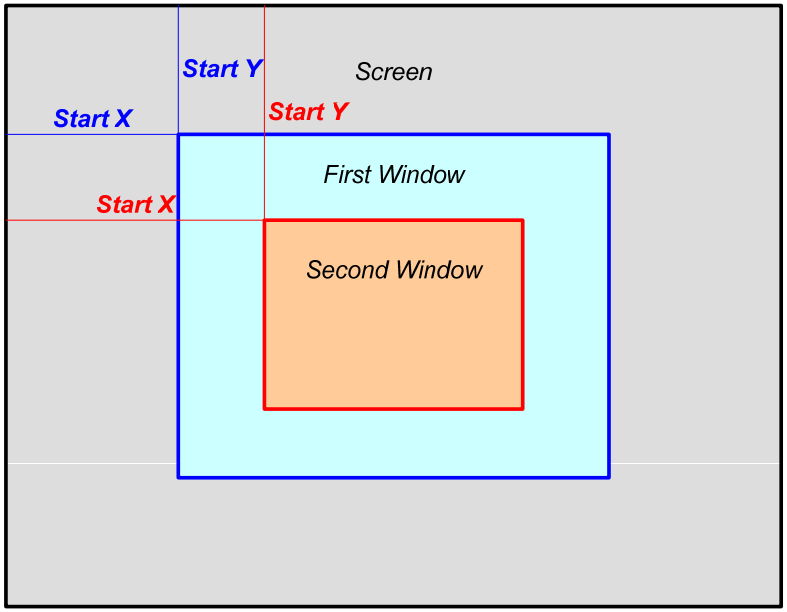
(1-1) Set AF window for Touch AF



4EC 는 2개의 AF window 로 구성됨

주의

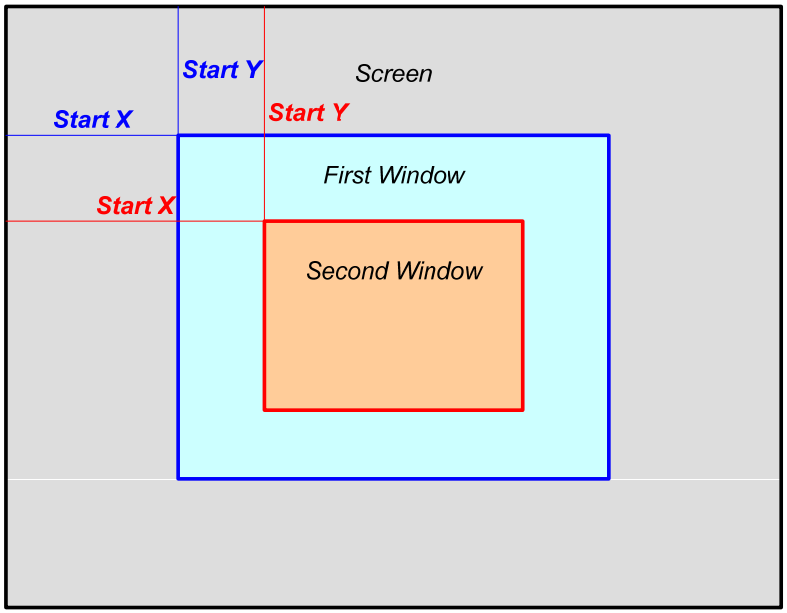
inner window, outer window위치가 바뀌지 않도록 설정함.

Second window : inner window

First window : outer window 로 반드시 설정 바람.

Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

(1-2) Set AF window for Touch AF



1. LSI 센서는 raw image size 가 변경되면 비율에 따라 자동적으로 AF window size 가 변경됨.

(예)

(1) 1280x960 size

Inner window : 100x100

Outer window : 400x400

(2) 2560x1920 size

Inner window : 200x200

Outer window : 800x800

위 예처럼, **image size 가 1280x960 => 2560x1920** 으로 변경시, 별도의 설정없이 **AF window size 가 자동으로 2배로 바뀜.**

2. AF window 관련 register 는 ,

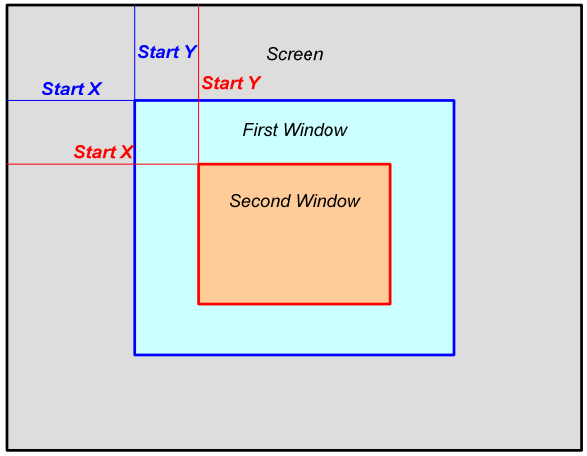
(Start X, Start Y) , width x height 로 이루어져 있음.

따라서,

Inner window, outer window 의 (Start X, Start Y) 좌표만을 변경하는 방식 으로 **AF window 의 Position** 을 움직이게 한다.

(Inner window, outer window 의 Height , Width 는 그대로 유지)

(1-3) Set AF window for Touch AF



AF window 설정법

상대비율에 따라 AF window 크기와 위치가 변경되도록 Display image size 의 (start X, start Y) ,

(Size X x Size Y) 를 설정하는 계산수식은 아래와 같음

Inner window

ScndWinStartX(Start X Position) = (Phone Display AF **start X** <<10) / Phone Display H size

ScndWinStartY(Start Y Position) = (Phone Display AF **start Y** <<10) / Phone Display V size

ScndWinSizeX (Window Width) = (Phone Display AF **size X** <<10) / Phone Display H size

ScndWinSizeY (Window Height) = (Phone Display AF **size Y** <<10) / Phone Display V size

Outter window

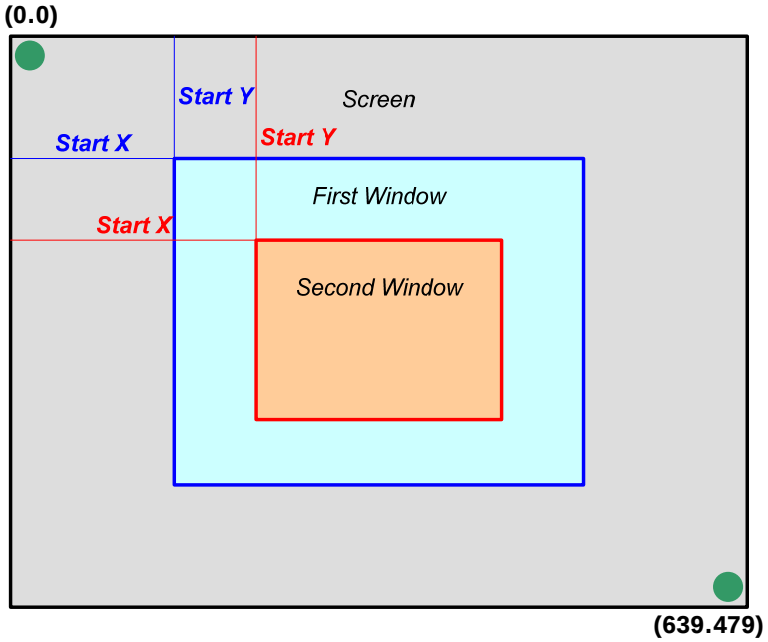
FstWinStartX(Start X Position) = (Phone Display AF **start X** <<10) / Phone Display H size

FstWinStartY(Start Y Position) = (Phone Display AF **start Y** <<10) / Phone Display V size

FstWinSizeX (Window Width) = (Phone Display AF **size X** <<10) / Phone Display H size

FstWinSizeY (Window Height) = (Phone Display AF **size Y** <<10) / Phone Display V size

(1-4) Set AF window for Touch AF



AF window setting (ex : 640x480 display, set AF window in center)

-Inner window 시작위치 (247,167), (640x480 display)

-Inner window width x height 143x143, (640x480 display)

ScndWinStartX(Start X Position) **[0x7000 029C]** = 247 x 1024(2^10) / 640 = 395(18B h)

ScndWinStartY(Start Y Position) **[0x7000 029E]** = 167 x 1024(2^10) / 480 = 356(164 h)

ScndWinSizeX (Window Width) **[0x7000 02A0]** = 143 x 1024(2^10) / 640 = 228(0E4 h)

ScndWinSizeY (Window Height) **[0x7000 02A2]** = 143 x 1024(2^10) / 480 = 305(131 h)

-Outer window 시작위치 (160,106), (640x480 display)

-Outer window width x height 320x266, (640x480 display)

FstWinStartX(Start X Position) **[0x7000 0294]** = 160 x 1024(2^10) / 640 = 256(100 h)

FstWinStartY(Start Y Position) **[0x7000 0296]** = 106 x 1024(2^10) / 480 = 226(0E2 h)

FstWinSizeX (Window Width) **[0x7000 0298]** = 320 x 1024(2^10) / 640 = 512(200 h)

FstWinSizeY (Window Height) **[0x7000 029A]** = 266 x 1024(2^10) / 480 = 567(237 h)

위 설정을 마친뒤,

WinSizesUpdated [0x7000 02A4] = 0001 을 실행하면, AF window updated 됨.

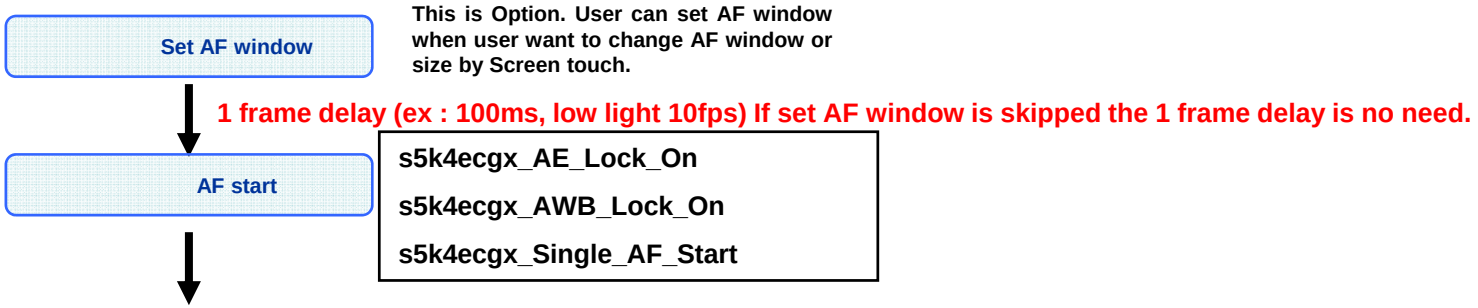
Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

(1-5) Set AF window for Touch AF

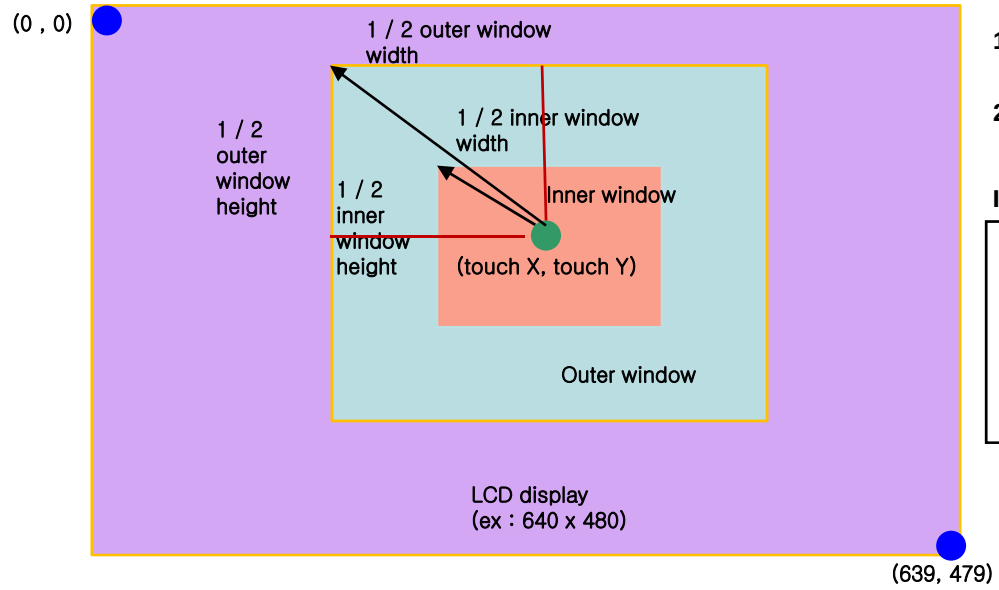
AF window 변경시 update 를 위해 0 ~ 1 frame 의 시간이 필요하므로 AF start 명령전, 반드시 1frame 의
Delay time 을 가진뒤, AF start 명령을 내릴것. 1frame delay 없이 AF start 명령을 내리게 되면,
변경된 AF window 가 lens 이동도중에 반영되므로 AF 동작에 문제 있을 수 있음.

To update changed AF window (WinSizesUpdated = 0001), sensor consumes 0~1 frame. So, BE chip should command "single AF" after 1frame delay.

If BE chip neglects 1frame delay, sensor can update AF window during AF convergence.



(1-6) Set AF window for Touch AF

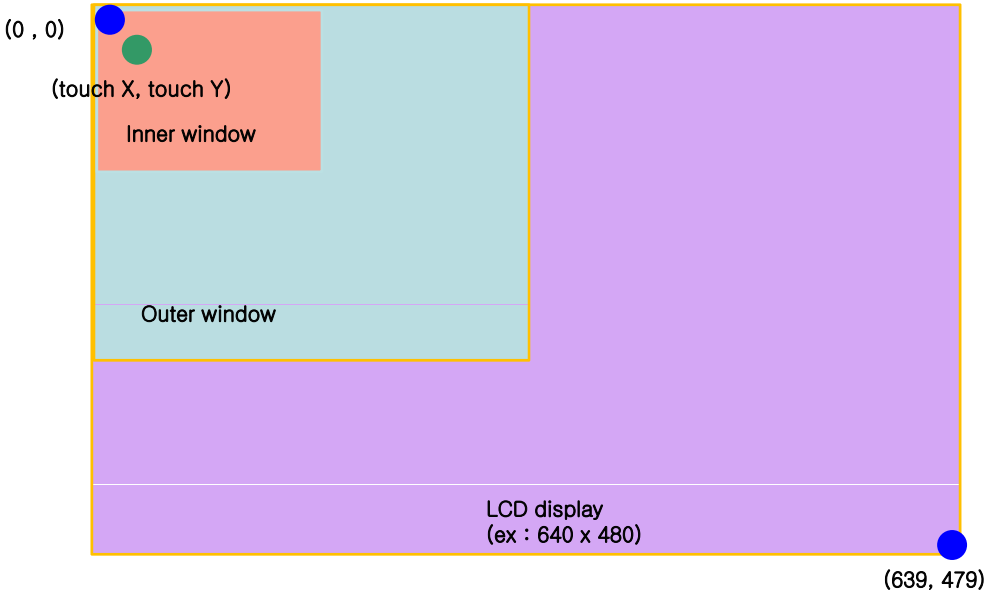


1. BE chip receives touched position user(touch X, touch Y) by cellular phone user.
2. Then, BE chip can detect AF window (Start X, Start Y) position.

If user touch center position in LCD display, formula is below.

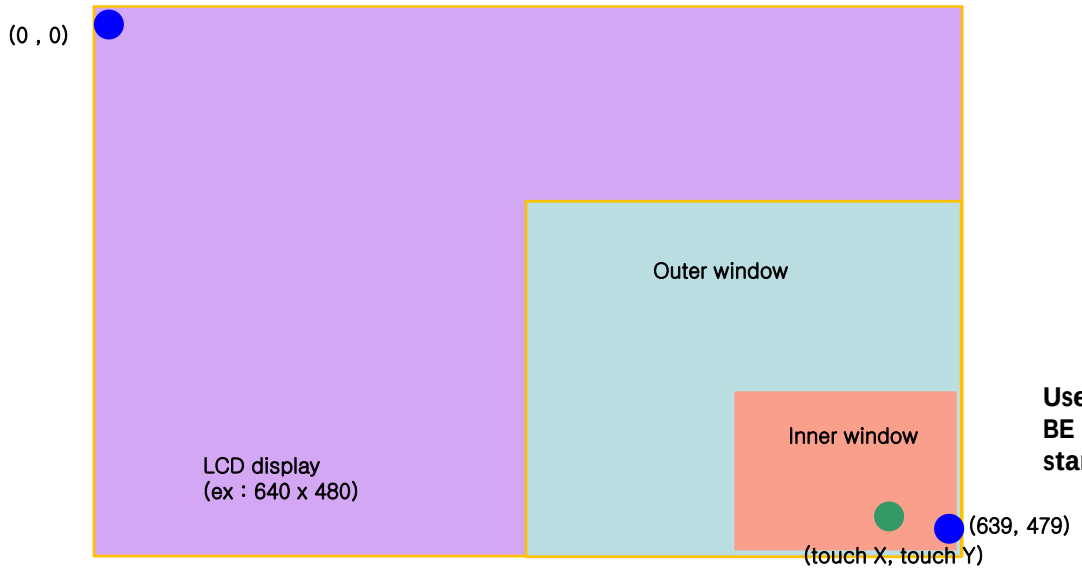
```
inner_window_start_X = touch_X – inner_window_width/2;
inner_window_start_Y = touch_Y – inner_window_height/2;

outer_window_start_X = touch X – outer_window_width/2;
outer_window_start_Y = touch Y – outer_window_height/2;
```

User touches center position in LCD display.
Inner window is placed in center of outer window.



User touches corner position in LCD display.
BE chip should not input negative value to AF start X, start Y.

(1-7) Set AF window for Touch AF



User touches corner position in LCD display.
BE chip should not input over size value to AF start X, start Y.

(1-8) Set AF window for Touch AF (set X axis)

**전제조건

- mirror/ flip 을 사용하지 않았다.(mirror/ flip 사용시 좌표 바꿔줘야 함. 뒷 page 참고)

- phone 사용자가 LCD의 center 영역을 touch 했을때, touch 지점은 inner window 와 outer window 의 center 에 있다. (inner window 가 outer window 의 center 에 있다.)

-phone 사용자가 LCD의 corner 를 touch 했을때, inner window 는 touch 지점에 최대한 가까이 가되, start X, start Y 좌표가 음수가 되지 않도록 한다. 또한, width, 와 height 은 LCD 의 크기를 벗어나지 않도록 한다.

- Phone 사용자의 touch 지점에 따라 start X, start Y 를 변경하고, width, height 는 변경하지 않는다.

-640x480 LCD display 로 가정한다

- AF window size 는 아래 size 를 사용한다고 가정한다. (아래 AF window size 는 LSI recommend 값이며 모듈업체에 따라 달라질 수 있음)

-Inner window : 143x143 size (640x480 display 기준)

-Outer window : 320x266 size (640x480 display 기준)

```
int  touch_X   // phone 사용자가 touch 한 지점 X 좌표
int  touch_Y   // phone 사용자가 touch 한 지점 Y 좌표

int  inner_window_start_X
int  inner_window_start_Y
int  inner_window_width = ( (Read (ScndWinSizeX [0x7000 02A0]) x 640 ) /1024 )
int  inner_window_height = ( (Read (ScndWinSizeY [0x7000 02A2]) x 480 ) /1024 )

int  outer_window_start_X
int  outer_window_start_Y
int  outer  window  width = ( (Read (FstWinSizeX [0x7000 0298]) x 640 ) /1024 )
int  outer_window_height = ( (Read (FstWinSizeY [0x7000 029A]) x 480 ) /1024 )
```

```
If (touch_X =< inner_window_width/2)
{ //inner  window, outer window 가 음수가 되는 것을 방어
   inner_window_start_X = 0;
   outer_window_start_X = 0;
}
else if (touch_X =< outer_window_width/2)
{  //outer window  only 가 음수가 되는 것을 방어
  inner_window_start_X = touch_X – inner_window_width/2
  outer_window_start_X = 0;
}
 else if (touch_X  >= (639 – inner_window_width/2)  //639 : H size
{ // inner window, outer window 가 LCD display size 넘는 것을 방어
  inner_window_start_X = 639 – inner_window_width ;
  outer_window_start_X = 639 – outer_window_width;
}
 else if (touch_X  >= (639 – outer_window_width/2)  //639 : H size
{ //outer window  only 가 LCD diaply size 넘는 것을 방어
  inner_window_start_X = touch_X – inner_window_width/2;
  outer_window_start_X = 639 – outer_window_width;
}
 else
{ // corner 가 아니므로 그대로 inner window, outer window 설정
  inner_window_start_X = touch_X – inner_window_width/2;
  outer_window_start_X = touch X – outer_window_width/2;
}
```

(1-9) Set AF window for Touch AF (set Y axis)

**전제조건

- mirror/ flip 을 사용하지 않았다.(mirror/ flip 사용시 좌표 바꿔줘야 함. 뒷 page 참고)

- phone 사용자가 LCD의 center 영역을 touch 했을때, touch 지점은 inner window 와 outer window 의 center 에 있다. (inner window 가 outer window 의 center 에 있다.)

-phone 사용자가 LCD의 corner 를 touch 했을때, inner window 는 touch 지점에 최대한 가까이 가되, start X, start Y 좌표가 음수가 되지 않도록 한다. 또한, width, 와 height 은 LCD 의 크기를 벗어나지 않도록 한다.

- Phone 사용자의 touch 지점에 따라 start X, start Y 를 변경하고, width, height 는 변경하지 않는다.

-640x480 LCD display 로 가정한다

- AF window size 는 아래 size 를 사용한다고 가정한다. (아래 AF window size 는 LSI recommend 값이며 모듈업체에 따라 달라질 수 있음)

-Inner window : 143x143 size (640x480 display 기준)

-Outer window : 320x266 size (640x480 display 기준)

```
int  touch_X   // phone 사용자가 touch 한 지점 X 좌표
int  touch_Y   // phone 사용자가 touch 한 지점 Y 좌표

int  inner_window_start_X
int  inner_window_start_Y
int  inner_window_width = ( (Read (ScndWinSizeX [0x7000 02A0]) x 640 ) /1024 )
int  inner_window_height = ( (Read (ScndWinSizeY [0x7000 02A2]) x 480 ) /1024 )

int  outer_window_start_X
int  outer_window_start_Y
int  outer  window  width = ( (Read (FstWinSizeX [0x7000 0298]) x 640 ) /1024 )
int  outer_window_height = ( (Read (FstWinSizeY [0x7000 029A]) x 480 ) /1024 )
```

```
If (touch_Y =< inner_window_height/2)
{ //inner  window, outer window 가 음수가 되는 것을 방어
   inner_window_start_Y = 0;
   outer_window_start_Y = 0;
}
else if (touch_Y =< outer_window_height/2)
{  //outer window  only 가 음수가 되는 것을 방어
  inner_window_start_Y = touch_Y – inner_window_height/2
  outer_window_start_Y = 0;
}
 else if (touch_Y  >= (479 – inner_window_height/2) //479 : V size
{ // inner window, outer window 가 LCD display size 넘는 것을 방어
  inner_window_start_Y = 479 – inner_window_height ;
  outer_window_start_Y = 479 – outer_window_height;
}
 else if (touch_Y  >= (479 – outer_window_width/2) //479 : V size
{ //outer window  only 가 LCD diaply size 넘는 것을 방어
  inner_window_start_Y = touch_Y – inner_window_height/2;
  outer_window_start_Y = 479 – outer_window_height;
}
 else
{ // corner 가 아니므로 그대로 inner window, outer window 설정
  inner_window_start_Y = touch_Y – inner_window_height/2;
  outer_window_start_Y = touch Y – outer_window_height/2;
}
```

(1-10) Set AF window for Touch AF

//앞 page 에서 계속

//Write value to sensor register

//write inner window start X, outer window start X

ScndWinStartX [0x7000 029C] = inner_window_start_X x 1024(2^10) / 640

FstWinStartX [0x7000 0294] = outer_window_start_X x 1024(2^10) / 640

//write inner window start Y, outer window start Y

ScndWinStartY [0x7000 029E] = inner_window_start_Y x 1024(2^10) / 480

FstWinStartY [0x7000 0296] = outer_window_start_Y x 1024(2^10) / 480

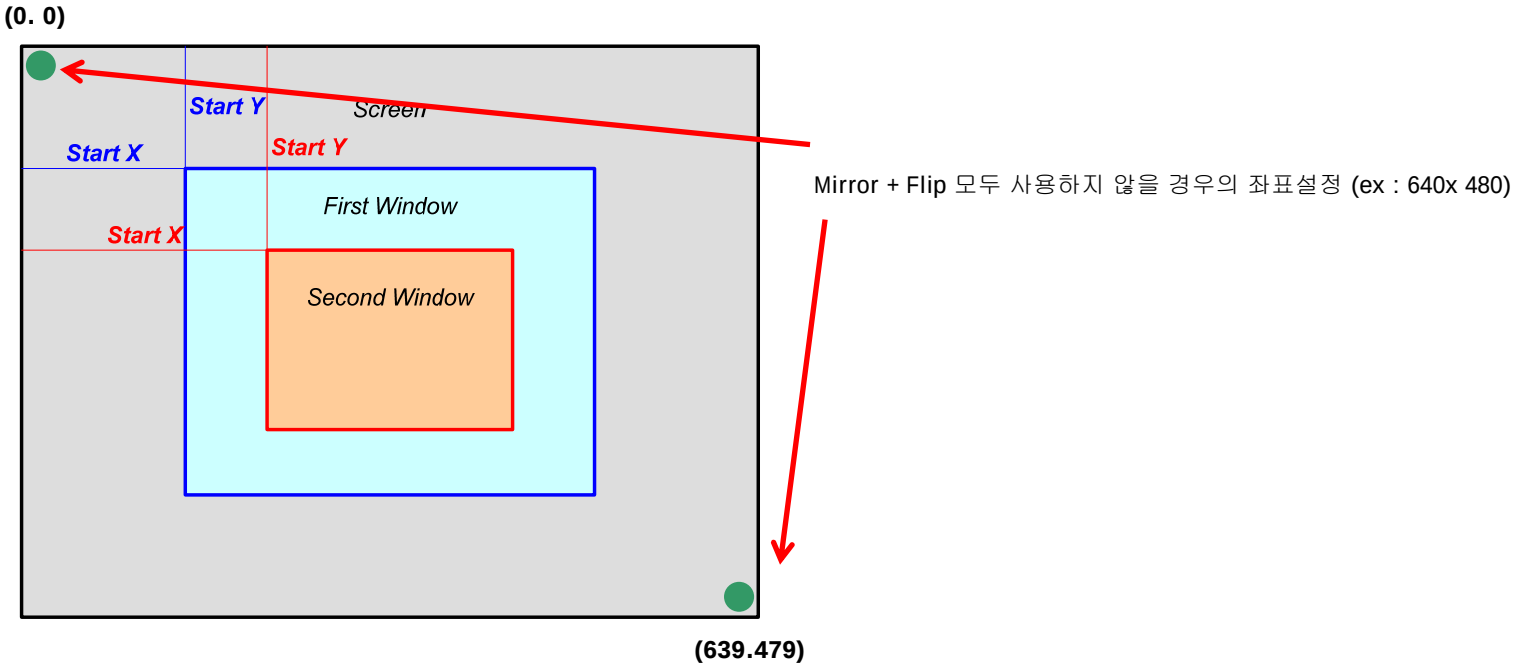
WinSizesUpdated [0x7000 02A4] = 0001 //update AF window

Delay (100ms) // 1frame delay

AF start [0x7000 028C] = 0005 //single AF

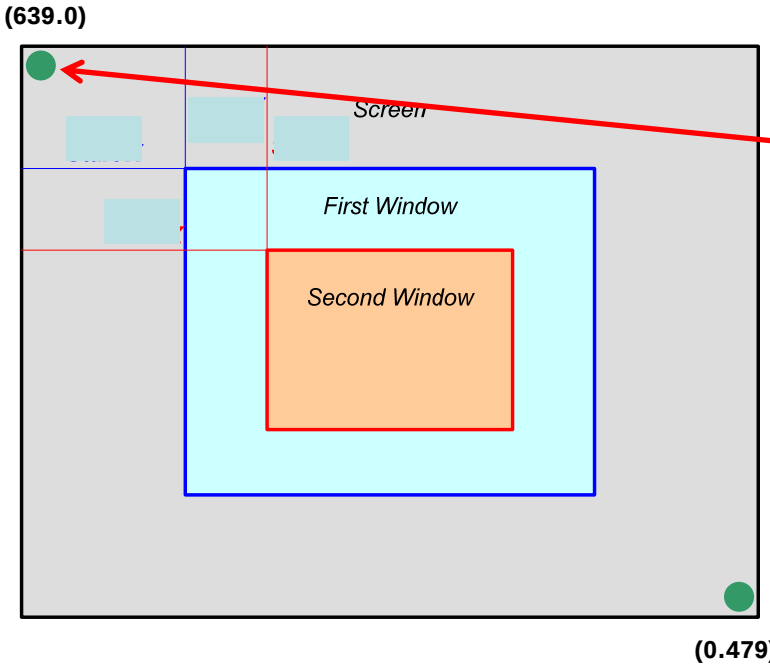
Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

(1-11) Set AF window for Touch AF



Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

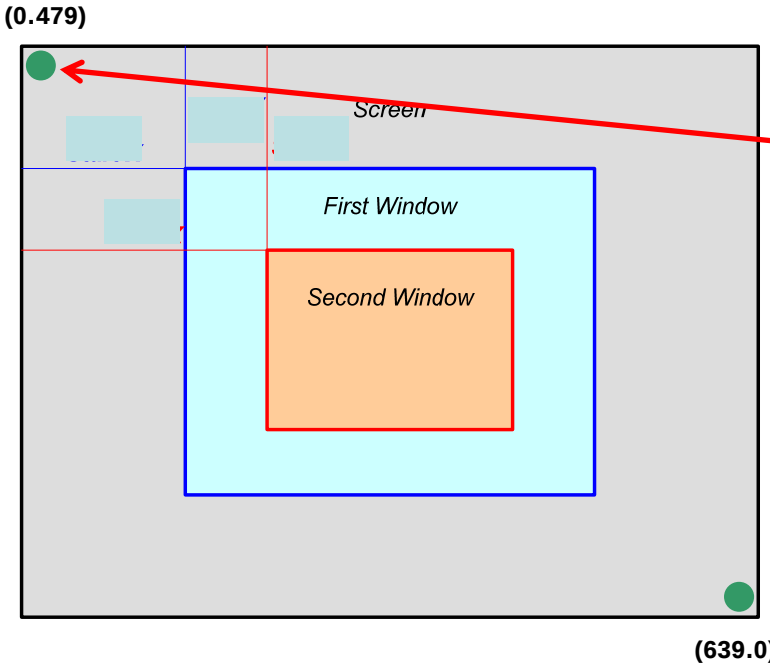
(1-12) Set AF window for Touch AF



Mirror 사용 경우, X좌표 위치를 바꾼다. (ex : 640x 480)

Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

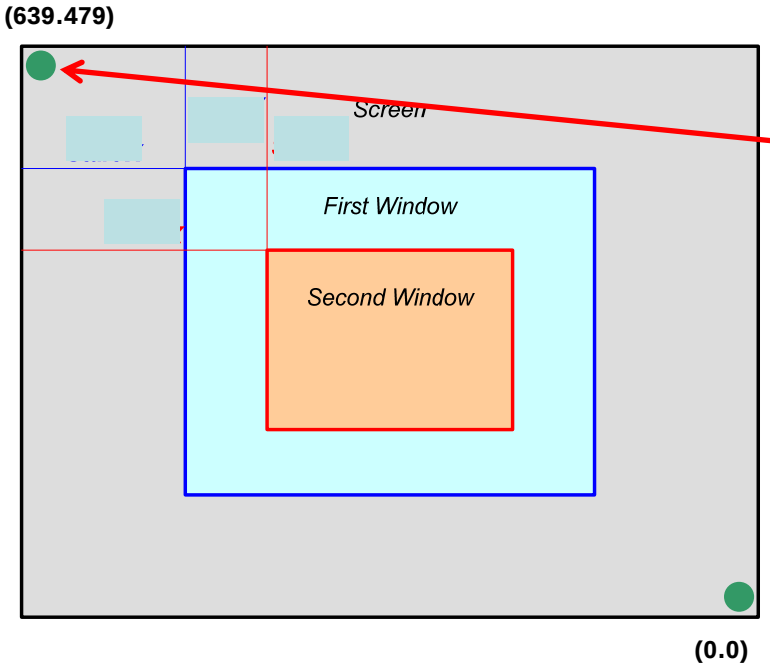
(1-13) Set AF window for Touch AF



Flip 사용 경우, Y좌표 위치를 바꾼다. (ex : 640x 480)

Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

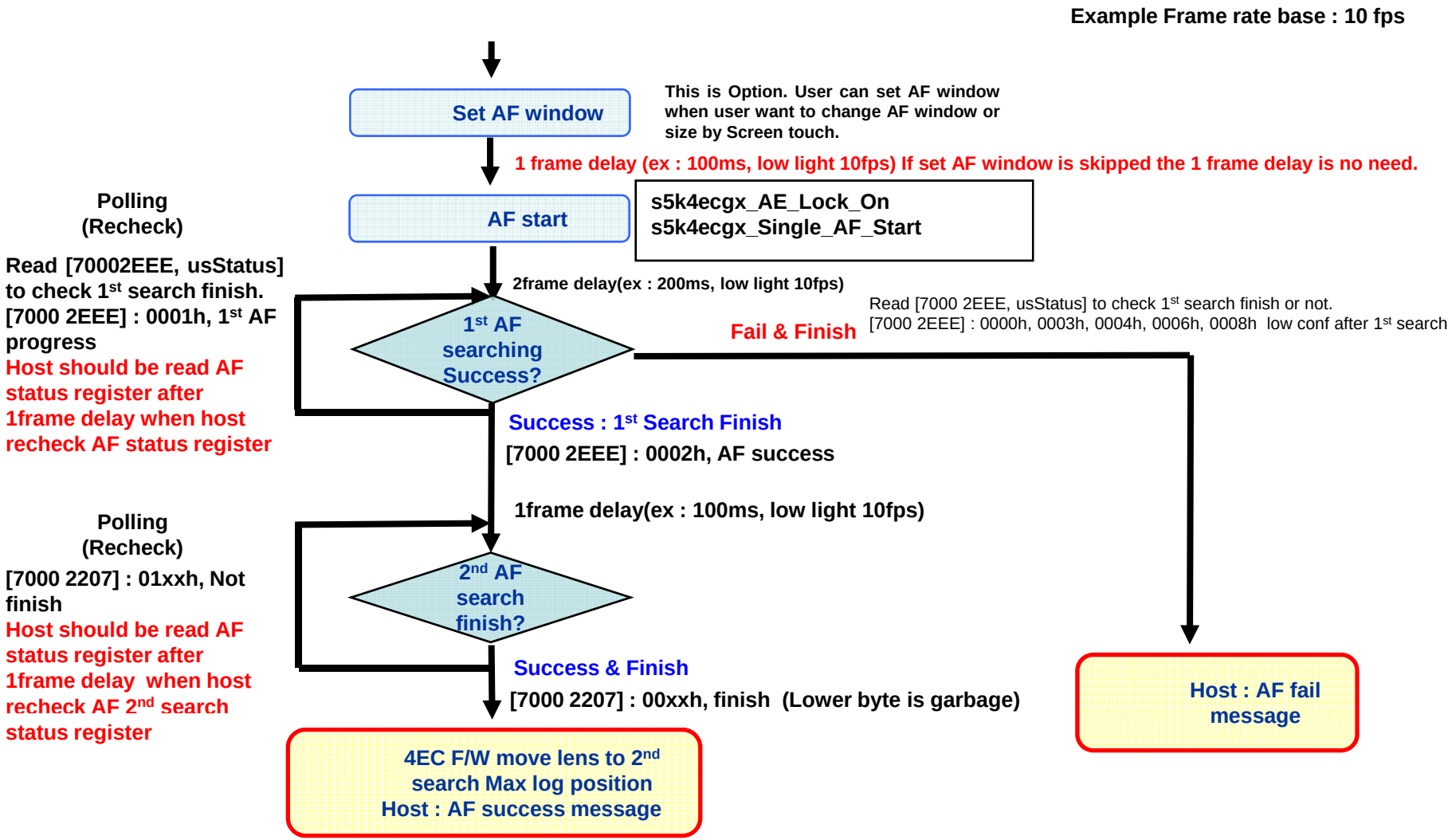
(1-14) Set AF window for Touch AF



Mirror + Flip 사용 경우, X,Y 좌표 위치를 바꾼다. (ex : 640x 480)

Parameter Name (4EC EVT1.1)	Description
FstWinStartX [0x7000 0294]	First window's start X position
FstWinStartY [0x7000 0296]	First window's start Y position
FstWinSizeX [0x7000 0298]	First window's width
FstWinSizeY [0x7000 029A]	First window's height
ScndWinStartX [0x7000 029C]	Second window's start X position
ScndWinStartY [0x7000 029E]	Second window's start Y position
ScndWinSizeX [0x7000 02A0]	Second window's width
ScndWinSizeY [0x7000 02A2]	Second window's height
WinSizesUpdated [0x7000 02A4]	If this parameter is set to 1, AF window size is updated.

(2) AF status sequence (1st + 2nd searching)



(3) AF Functions

```
s5k4ecgx_Single_AF_Start
* Start AF searching (Command for lens moving)
{
s00287000
s002A028C
s0F120005   //REG_TC_AF_AfCmd = 5, single AF
}
```

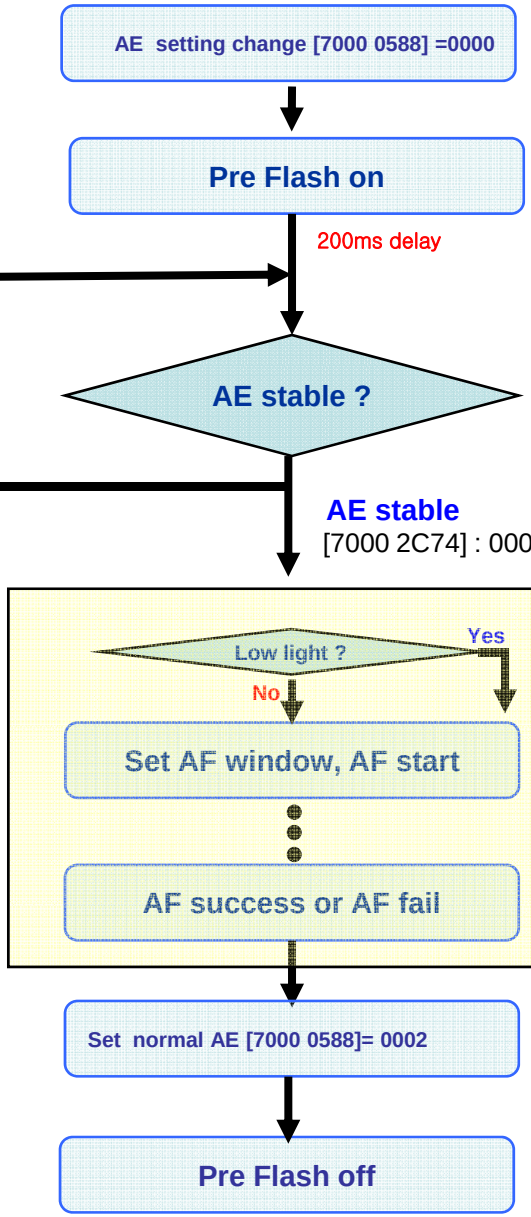
AE lock on

```
s5k4ecgx_AE_Lock_On
•AE lock on should be done before AF commands
• Remove AWB lock on/off
{
s00287000
s002A2C5E //  /* AE Lock On */
s0F120000
}
```

AE lock off

```
s5k4ecgx_AE_Lock_Off
{
s00287000
s002A2C5E //  /* AE Lock Off */
s0F120001
}
```

(4) AF sequence under flash on case



Set AE Speed up

Polling (Recheck)

AE unstable

[7000 2C74] : 0000, AE unstable
polling every 1frame
(ex : 100ms, low light 10fps)

Max unstable status: 200msec

Start AE stable check after Pre Flash On and 200ms delay

AE stable
[7000 2C74] : 0001, AE stable

Set AE lock on before AF convergence

AF sequence

AE lock off

Set normal AE speed