RJ-11/13
APPLICATION NOTE

APPLICATION NOTE Ver 1.0

RJ-11/13

Document #: RJ11/13-A01

RJ11/13
JIG PROGRAM MANUAL

APPLICATION NOTE Ver 0.1

RJ Electronics

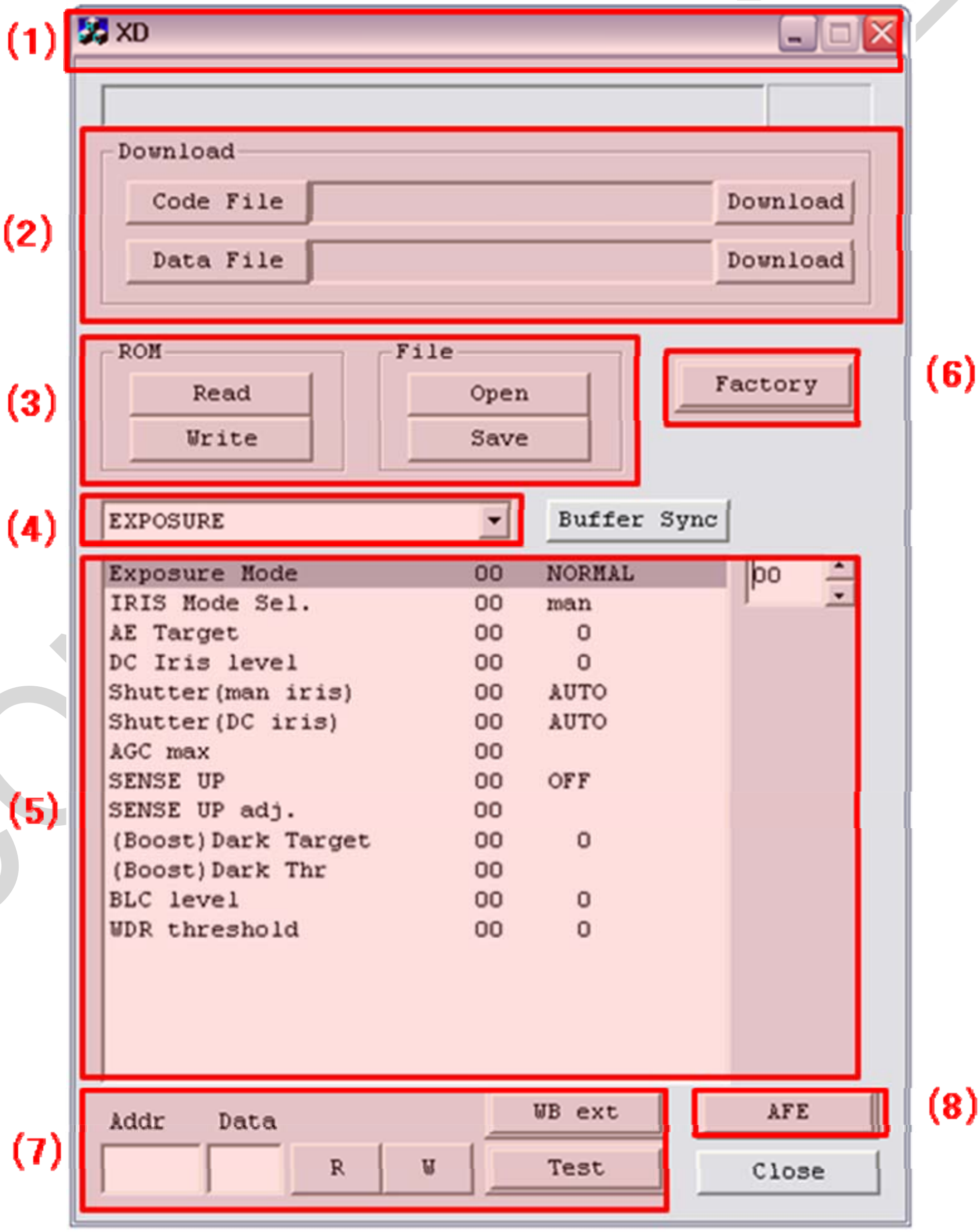
Document #: RJ11/13-A01

1. JIG Manual

1.1 Start Program

Click RJ11 icon for RJ11  RJ11_100908.exe , click RJ13 icon for RJ13  RJ13_101013.exe

1.2 Program intial Window



(1) JIG PROGRAM WINDOW : RJ11 or RJ13

(2) DOWN LOAD WINDOW

JIG PROGRAM	Format	Details	Remark
Code File	mdi(xxx).bin	OSD internal basic information	Fixed by RJ
Data File	xxx.para	TG, color for customer	User modify available

(3) ROM / FILE WINDOW

JIG PROGRAM	Remark	JIG PROGRAM	Remark
Read	Read current DSP data	Open	Open Bin & Para data
Write	Tuning data write into DSP	Save	Save Modified Para data

(4) CATEGORY WINDOW

→ Each CATEGORY shows values for End user tuning easily.

(5) CATEGORY DITAIL WINDOW

→ Each CATEGORY register values.

(6) FACTORY WINDOW

→ End user can change FACTORY values

→ After modified FACTORY values, click "ROM / Write" write on DSP or save as FILE / Save

(7) DEBUG WINDOW

→ For Engineer Testing, Engineer can READ/WRITE register values

(Should be board working promptly when debug board)

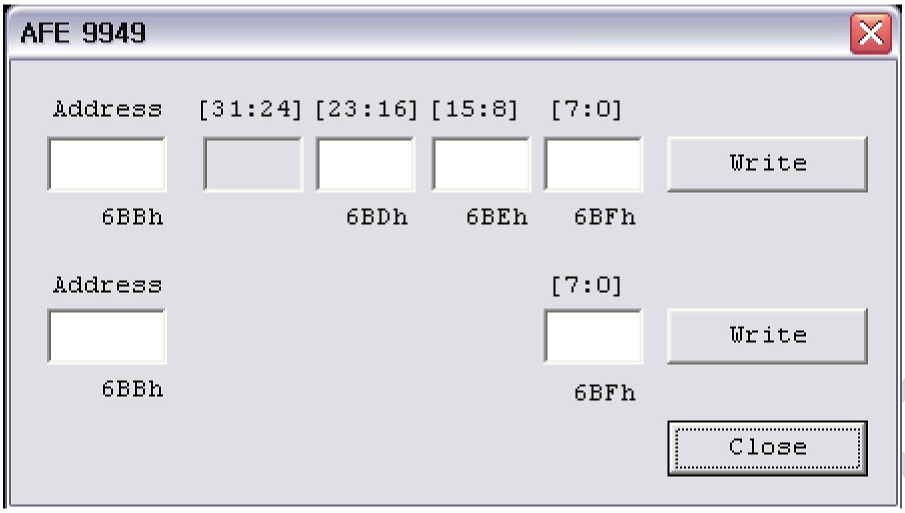
(8) RJ13 TG TEST WINDOW

→ RJ13 is using AD9949. For testing TG of AD9949 (H1, H2, RG, SHD, SHP)

→ RJ13 TG is very complicated. RJ customer should test TG by themselves first, after that The customer should be ask to RJ confirm the TG values.

→ TG Testing Method

- Click "(8)" and below AFE 9949 Window come out



- Input the Address, AD9949 TG data in AD9949 Datasheet & Test

Below is AD9949 Datasheet TG data register values for your reference

Address	Data Bit Content	Default Value	Name	Description
60	[12:0]	01001	H1CONTROL	H1 Signal Control. Polarity [0](0 = Inversion, 1 = No Inversion). H1 Positive Edge Location [6:1]. H1 Negative Edge Location [12:7].
61	[12:0]	00801	RGCONTROL	RG Signal Control. Polarity [0](0 = Inversion, 1 = No Inversion). RG Positive Edge Location [6:1]. RG Negative Edge Location [12:7].
62	[14:0]	0	DRVCONTROL	Drive Strength Control for H1 [2:0], H2 [5:3], H3 [8:6], H4 [11:9], and RG [14:12]. Drive Current Values: 0 = Off, 1 = 4.3 mA, 2 = 8.6 mA, 3 = 12.9 mA, 4 = 17.2 mA, 5 = 21.5 mA, 6 = 25.8 mA, 7 = 30.1 mA.
63	[11:0]	00024	SAMPCONTROL	SHP/SHD Sample Control. SHP Sampling Location [5:0]. SHD Sampling Location [11:6].
64	[5:0]	0	DOUTPHASE	DOUT Phase Control.

< Gragh 1. AD9949 Datasheet TG >

Above Writing Data is only for Debuging data. Once Board Power On / Off, the TG data Couldn't Save data automatically.

So once customer tune the TG values first, RJ will confirm the TG data for customer as BIN files as "mdi(xxx).bin"

1.3 Explain CATEGORY WINDOW

1. EXPOSURE

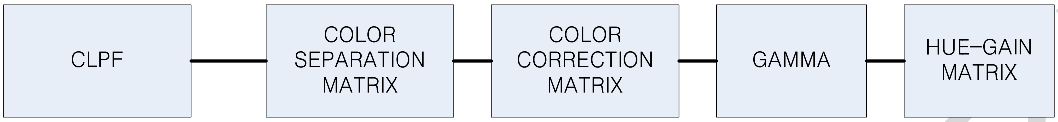
NAME		RANGE	DESCRIPTION
Exposure Mode		0 ~ 3	0 : Manual Mode 1 : BLC Mode 2 : WDR Mode 3 : HLI Mode
IRIS Mode Sel.		0 ~ 1	0 : Manual Lens 1 : DC Lens
AE Target DC Iris level		0 ~ 99	Tune current Brigtness
Shutter (man iris) Shutter (DC iris)		0 ~ 10	0 : AUTO 1 : 1/50 (1/60) 2 : 1/100 3 : 1/120 4 : 1/250 5 : 1/500 6 : 1/1000 7 : 1/2000 8 : 1/4000 9 : 1/10000 10 : 1/100000
AGC max		0 ~ 3	0 : AGC OFF 1 : Low 2 : Middle 3 : High
SENSE UP		0 ~ 8	0 : OFF 1 : X2 2 : X4 3 : X8 4 : X16 5 : X32 6 : X64 7 : X128 8 : X256
SENSE UP adj.		-	Starting point of SENSE UP (Example : 0x10 => at 10dB SENSE UP start RJ used **Ref. 18h** now)
(Boost) Dark Target		-	Dark condition AE Target. Dark condition AE Target value = AE Target value – Dark Target (Example : AE Target is 40. Dart Target is 30. Then 40 -30 = 10 Dark condition AE Target)
(Boost) Dark Thr		-	Starting AGC point (Example : 0x10 After 10dB AGC start)
BLC level		0h ~ 3h	0h : BLC OFF 1h : Weight Low 2h : Weight Middle 3h : Weight High
WDR threshold	RJ11	0h ~ 14h	WDR starting point **(Ref. Ah)**
	RJ13	0h ~ Ah	WDR Weight **(Ref. 0h)**

2. AWB

NAME	RANGE	DESCRIPTION
AWB mode	0 ~ 3	0 : ATW 1 : AWC 2 : MANUAL 3 : PUSH
Manual R/B gain	0 ~ 255	MANUAL mode R/B control
Lock Awb R/B	READ	Read current R/B values “READ Register”
G/R/B Pre Gain	0 ~ 255	PRE Gain of G/R/B
AWB R/G/B Min./Max.	0 ~ 255	

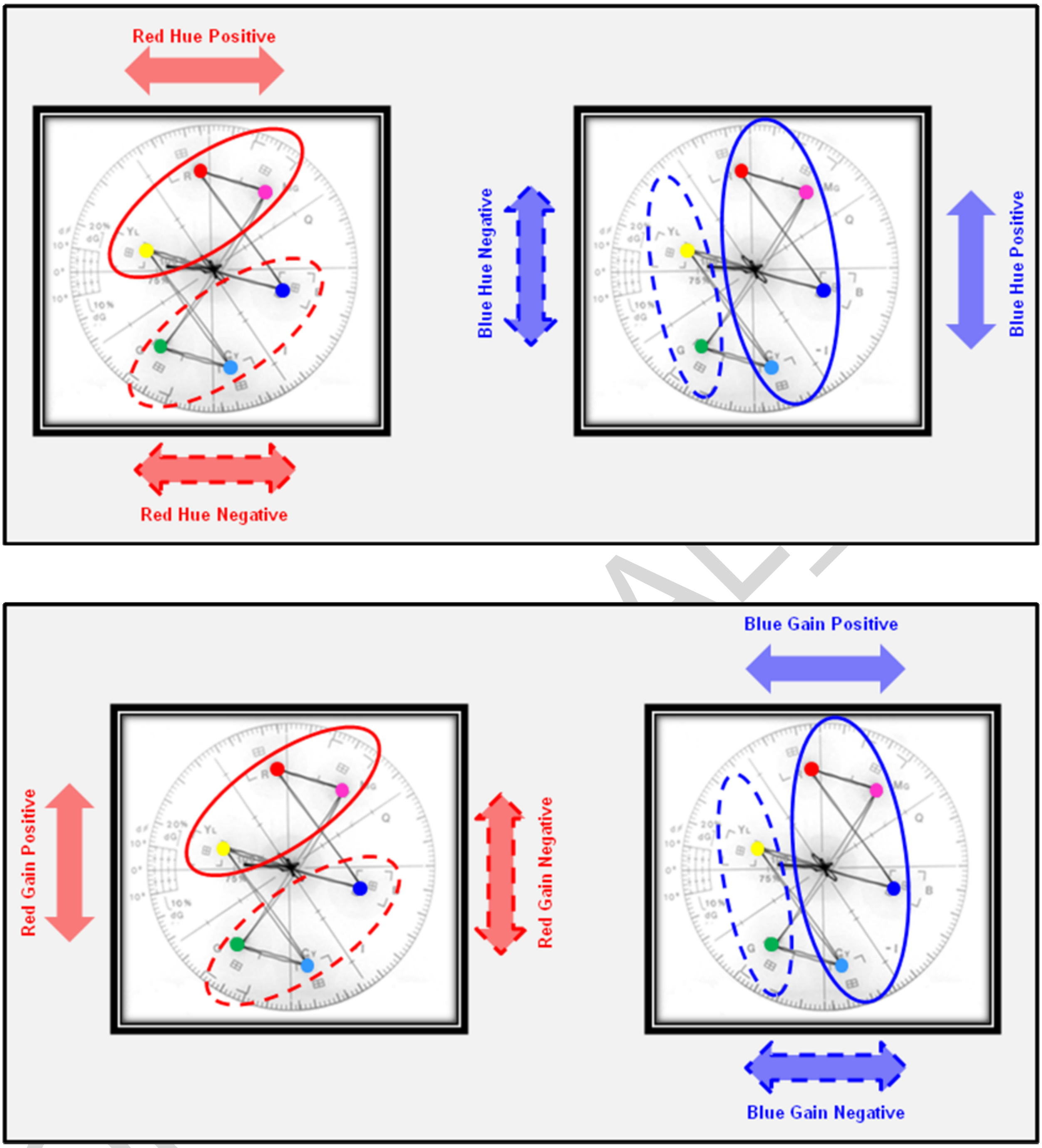
3. COLOR

C PROCESS is as the color control Block, it goes by Low pass filtering, Color Separation, Color Gain control, Color correction Matrix, RGB Gamma Correction, and Hue Gain Matrix processing. It's Block diagram as below.



< Figure 1. C Signal Processing Block Diagram>

<table>
<tr><th>NAME</th><th>RANGE</th><th>DESCRIPTION</th></tr>
<tr><td>R-Y
B-Y</td><td>0 ~ 255</td><td></td></tr>
<tr><td>RMATC
BMATC</td><td>0 ~ 255</td><td>R = CR + RMATC * G
B = CB + BMATC * G</td></tr>
<tr><td>CC R Offset
CC G Offset
CC B Offset</td><td>0 ~ 255
0 ~ 255
0 ~ 255</td><td>Color Correction Offset of R
Color Correction Offset of G
Color Correction Offset of B</td></tr>
<tr><td>B/R GAIN ±
B/R HUE ±</td><td>0 ~ 255
0 ~ 255</td><td>See <Figure 2></td></tr>
<tr><td>CC Coeff 00/01/02
CC Coeff 10/11/12
CC Coeff 20/21/22</td><td>0 ~ 255
0 ~ 255
0 ~ 255</td><td>Ref
<table><tr><td>Coeff (0,0)</td><td>203</td><td>Coeff (0,1)</td><td>E4E</td><td>Coeff (0,2)</td><td>7E</td></tr><tr><td>Coeff (1,0)</td><td>FCA</td><td>Coeff (1,1)</td><td>FE</td><td>Coeff (1,2)</td><td>7</td></tr><tr><td>Coeff (2,0)</td><td>29</td><td>Coeff (2,1)</td><td>CE1</td><td>Coeff (2,2)</td><td>3C5</td></tr></table>Fixed value. Don't modify.</td></tr>
</table>



< Figure 2. B/R Hue±, Gain±>

4. DAY&NIGHT

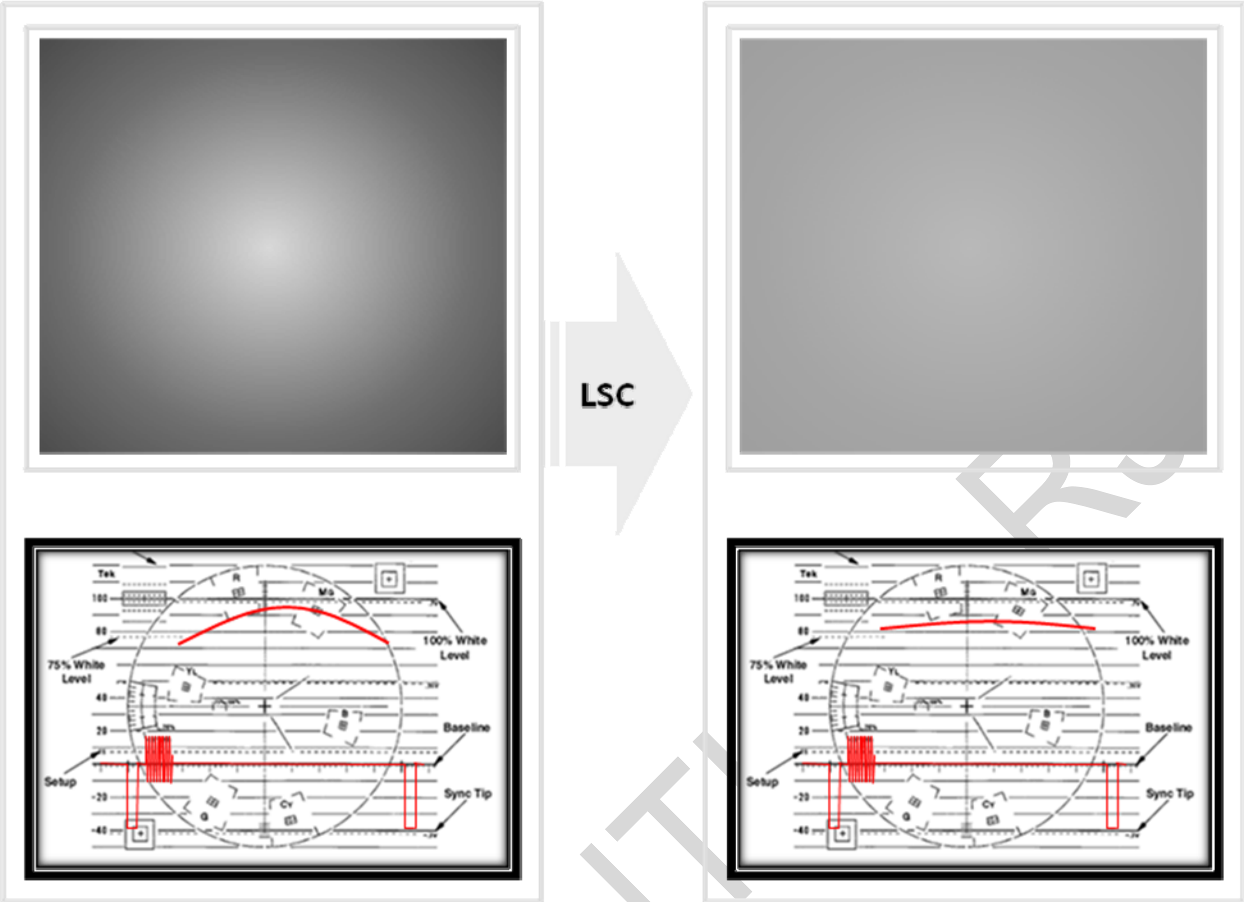
NAME	RANGE	DESCRIPTION
Day&Night mode	0	0 : AUTO 1 : DAY 2 : NIGHT 3 : CDS
Day > Night (Auto_Agc) Night > Day (Auto_Agc)	0 ~ 255	AUTO mode DAY ↔ NIGHT changing point (Day > Night values should be bigger than Night > Day values)
Use Burst at Night	0 ~ 1	0 : Burst OFF 1 : Burst ON (When it's Night mode, decide to use Burst or not.
Dwell time	0 ~ 10 sec	DAY ↔ NIGHT mode change delay time
Day > Night (Reserved) Night > Day (Reserved)	0 ~ 255	When CDS mode, DAY ↔ NIGHT changing time
Color Sup. Start [dB] Color Sup. End [dB] Color Sup. [0~100]		See < Figure 3 >
Sharpness	0 ~ 49	
Aperture Sup. Start Aperture Sup. End Aperture Sup. [0~100]		See < Figure 3 >
dNR mode	0 ~ 5	0 : 3DNR OFF 1 ~5 : 3DNR Level
Color Sup. (dNR on) Aper Sup. (dNR on)		When 3DNR, Color Sup. / Aper Sup. Values

5. MOTION DETECTION

NAME	RANGE	DESCRIPTION
Motion Detect	0 ~ 1	0 : Motion OFF 1 : Motion ON
Sensitivity	0 ~ 120	Motion Defecting sensitivity
Alarm mode	0 ~ 2	0 : OFF 1 : Message (show Icon) 2 : AREA
Output time	0 ~ 10 sec	When Motion Detection, Alarm output time
Motion Mask 1~4	1 ~ 4	Set up Motion Mask 4 area
Mask 1~4 Start X Mask 1~4 Start Y Mask 1~4 End X Mask 1~4 End Y	X : 0~16 Y : 0~14	Set up each Motion Mask Area

6. SETUP/SYSTEM

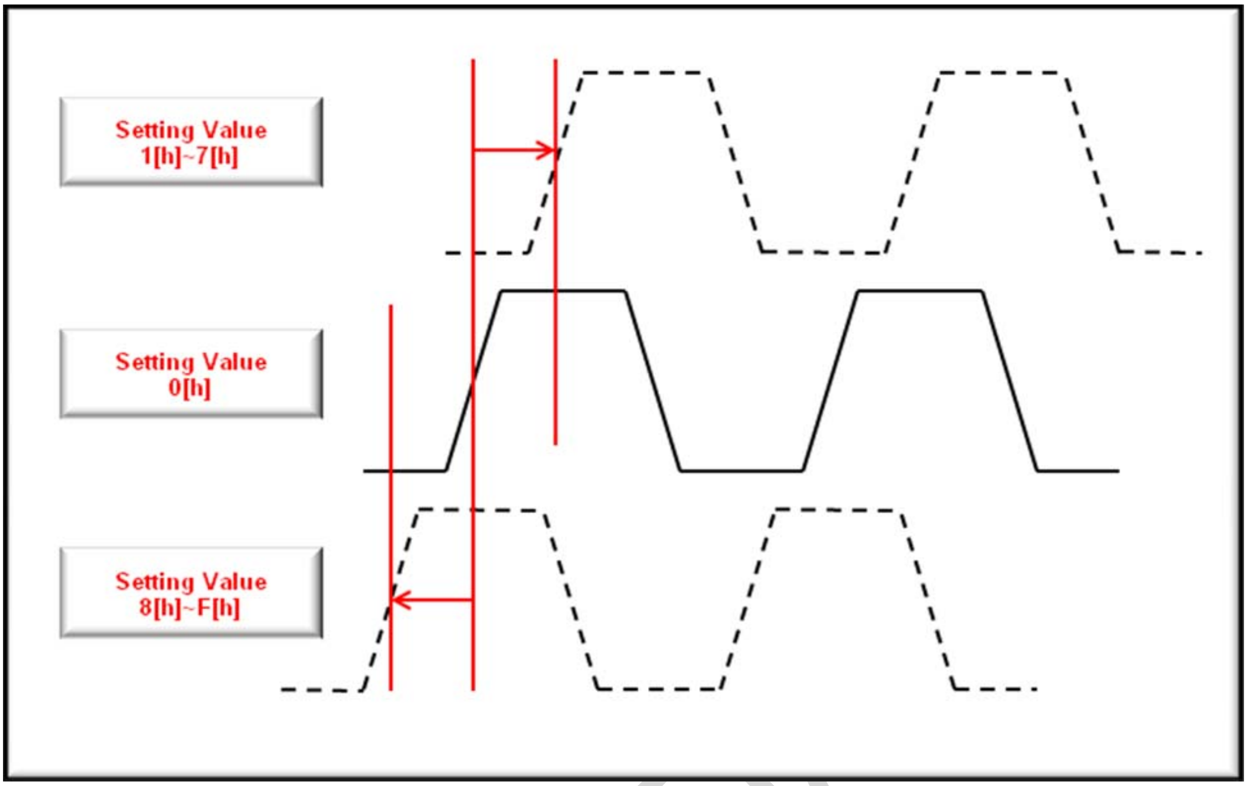
NAME	RANGE	DESCRIPTION
Ext. Sync mode	0 ~ 1	0 : Internal Mode 1 : Auto Mode (When Line Lock Mode)
Ext. Sync phase	0 ~ 255	
OSD background	0 ~ 1	0 : OSD Background OFF 1 : OSD Background ON (OSD Background setting)
Language	0 ~ 1	0 : English 1 : Chinese
NTSC mode	0 ~ 1	0 : OFF (PAL Mode) 1 : ON (NTSC Mode)
High Res mode	0 ~ 1	0 : OFF (Normal Mode) 1 : ON (High Mode)
Show TITLE	0 ~ 1	0 : OFF 1 : ON
Title Position X/Y	0 ~ 10/15	
Title 01~15		Title (16 character available)
Gamma select	0 ~ 3	0: 0.3 curve 1: 0.45 curve 2: 0.6 curve 3: 1.0 curve
ID number	0 ~ 255	
Uart Baud	0 ~ 5	0 : 2400 1 : 4800 2 : 9600 3 : 14400 4 : 19200 5 : 38400
Mirror / Flip	0 ~ 3	0 : OFF 1 : Horizontal 2 : Vertical 3 : Rotation
DPC method	0 ~ 1	0 : DPC OFF 1 : DPC AUTO
D. Zoom mode	0 ~ 1	0 : D. Zoom OFF 1 : D. Zoom ON
D. Zoom level	0 ~ 44	
D. Zoom PAN/TILT		
DIS mode	0 ~ 1	0 : DIS OFF 1 : DIS ON
Version 01~07		
LSC Gain	0 ~ 50	See < Figure 4 >
Lens Center X/Y		



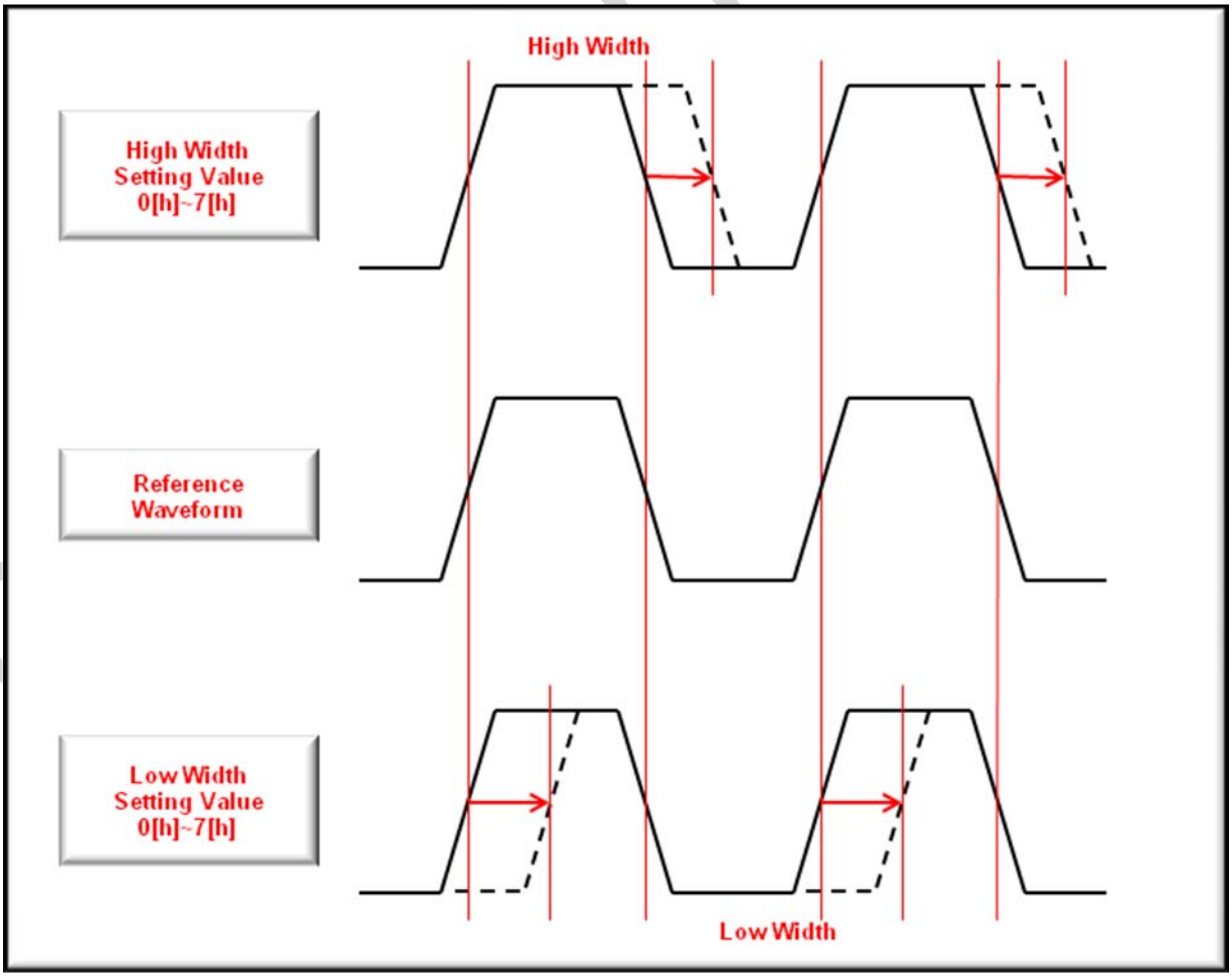
< Figure 4 . LSC function >

7. CCD TIMING

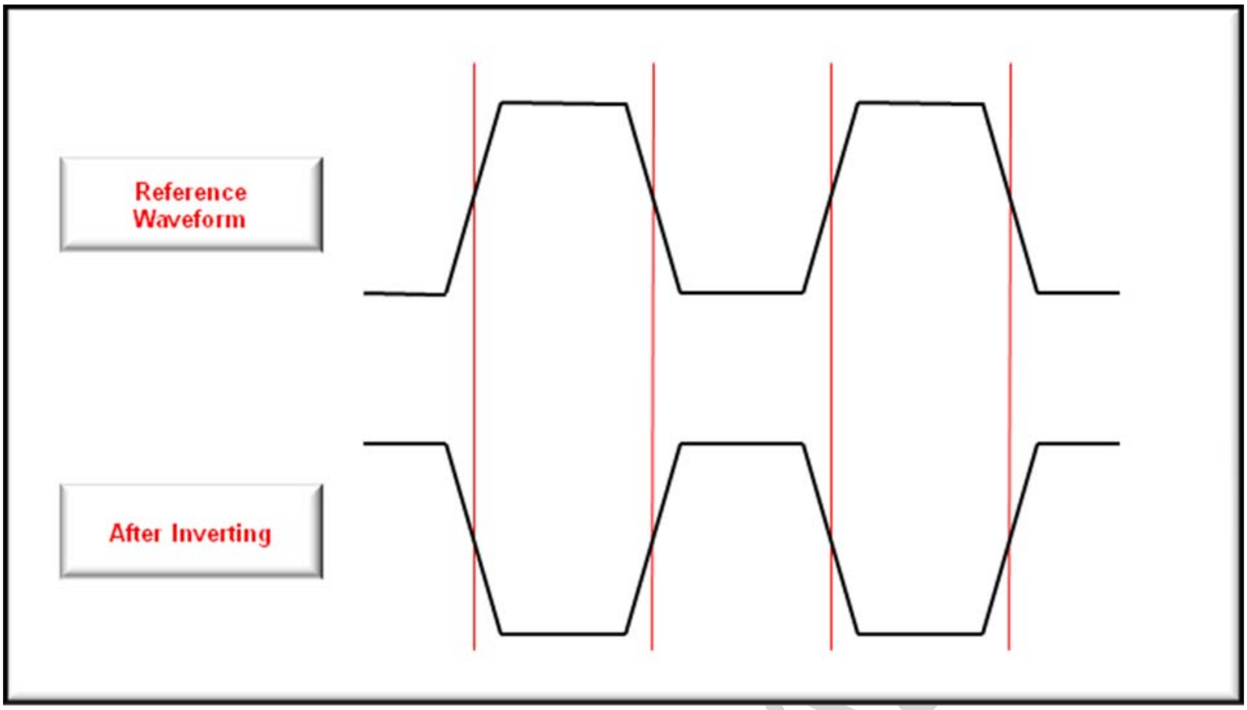
NAME		RANGE	DESCRIPTION
Delay	SHD, SHP H1, H2, RG ADCLK	0 ~ 31	See <Figure 5.>
Width	SHD, SHP H1, H2, RG ADCLK	0 ~ 15	See <Figure 6.>
Invert	SHD, SHP H1, H2, RG ADCLK	0 ~ 1	See <Figure 7.>



<Figure 5. Delay>



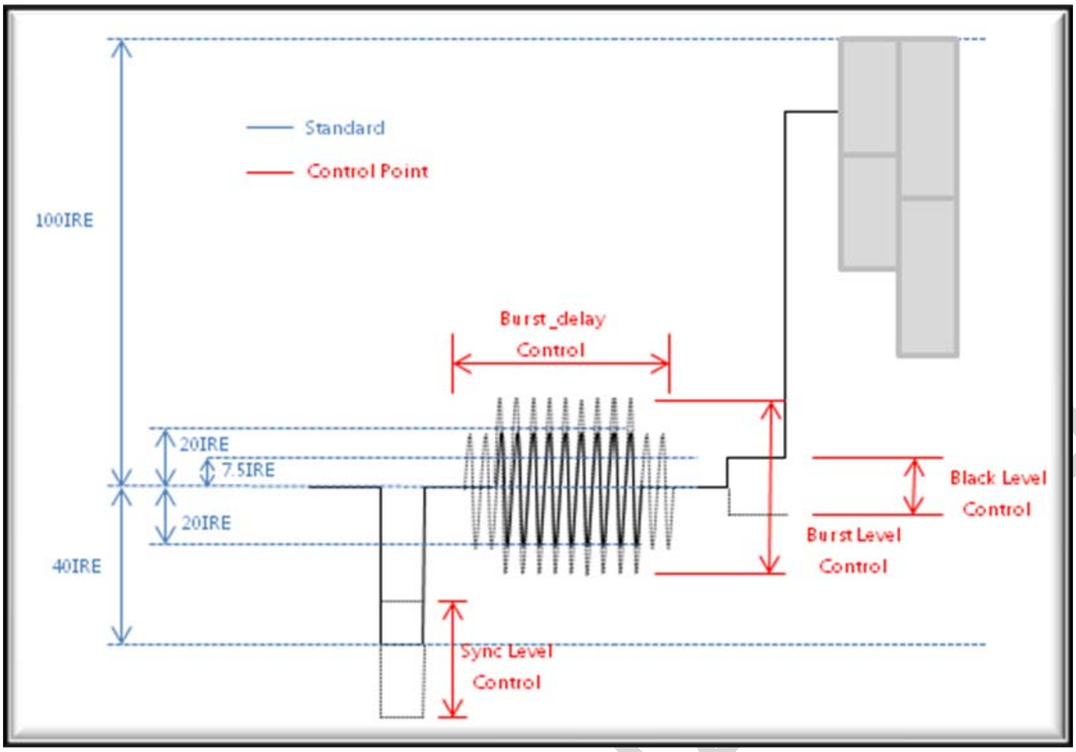
<Figure 6. Width>



<Figure 7. Invert>

8. VIDEO

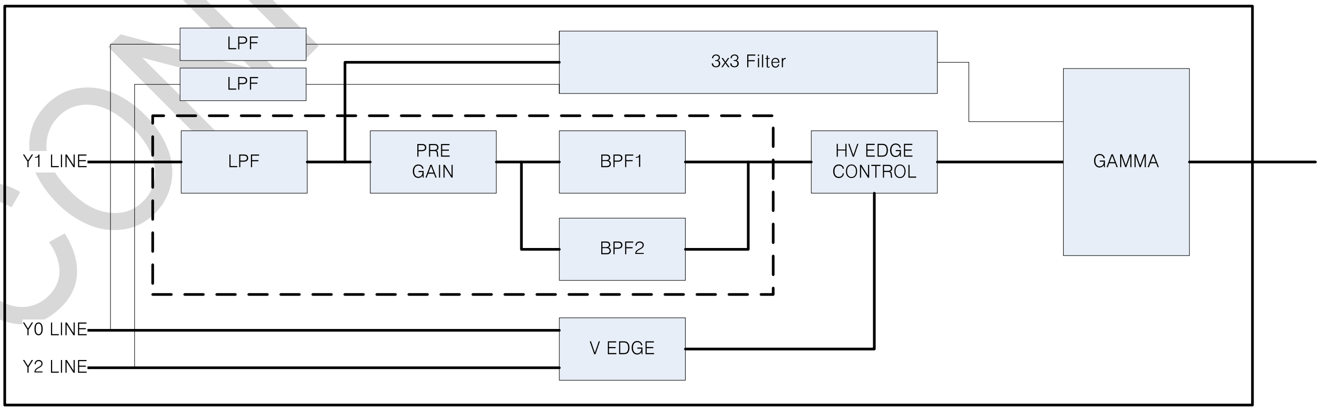
NAME	RANGE	DESCRIPTION
Burst delay		Burst phase Initial Value (Internal Setting)
Y_LPF	0 ~ 3	Select Y LPF Parameter
Y_INTP	0 ~ 3	Y Interpolation
Bypass Y	0 ~ 1	Y LPF Bypass
Setup level	0 ~ 63	See < Figure 8 >
Black level	0 ~ 255	
Sync level	0 ~ 31	
White clip	0 ~ 255	
N Burst	0 ~ 255	
C LPF	0 ~ 3	C LPF select
Bypass C	0 ~ 1	C Double Sampling Bypass
DAC1/2 mode		
Hor. Image Start [10:0] Hor. Image End [10:0]		
Expand Y	0 ~ 255	Y Expander (Y out = Y*expander_Y), Expander_Y=0~(1-1/256)
Expand C	0 ~ 255	C Expander



< Figure 8. Analog Video Output Waveform>

9. ENHANCE

Y Signal Processing is for color processing block as Edge enhancing, dark condition Edge Apperture reduction, Gamma Correction function. The Y Signal Processing Block diagram is as below.



< Figure 9. Y Signal Processing Block Diagram>

<table>
<tr><th>NAME</th><th>RANGE</th><th>DESCRIPTION</th></tr>
<tr><td>Y Clamp 1/2</td><td>0 ~ 255</td><td>Even/Odd Column Clamping</td></tr>
<tr><td>Use 3X3 Filter</td><td>0 ~ 1</td><td>0 : OFF 1 : ON
RJ11/13 Use 3X3 Filter
Ref 0x01</td></tr>
<tr><td>3X3 Filter Coeff 11~33</td><td>0 ~ 255</td><td>Ref<table>
<tr><td>Co(1,1)</td><td>ff</td><td>Co(1,2)</td><td>ff</td><td>Co(1,3)</td><td>ff</td></tr>
<tr><td>Co(2,1)</td><td>fb</td><td>Co(2,2)</td><td>10</td><td>Co(2,3)</td><td>fb</td></tr>
<tr><td>Co(3,1)</td><td>ff</td><td>Co(3,2)</td><td>ff</td><td>Co(3,3)</td><td>ff</td></tr>
</table>Fixed values. Don't change it</td></tr>
<tr><td>Y Filter Limit [19:16]
Y Fliter Limit [15:8]
Y Filter Limit [7:0]</td><td></td><td>3X3 Filtering maximum values.
Should be consider well.</td></tr>
<tr><td>Y DIV</td><td>0 ~ 15</td><td>3X3 Filter result divide as 2^y_div</td></tr>
<tr><td>Y 3X3 Coring</td><td>0 ~ 255</td><td>Coring Value</td></tr>
<tr><td>Black Defect Thr.</td><td>0 ~ 255</td><td>Black Defect Threshold</td></tr>
<tr><td>White Defect Thr.</td><td>0 ~ 255</td><td>White Defect Threshold</td></tr>
<tr><td>DPC Luminance Limit</td><td>0 ~ 255</td><td>Luminancd Value Limintation</td></tr>
<tr><td>H Edge Detect Thr [11:8]
H Edge Detect Thr [7:0]</td><td></td><td>Horizontal edge detection threshold</td></tr>
<tr><td>V Edge Detect Thr [11:8]
V Edge Detect Thr [7:0]</td><td></td><td>Vertical edge detection threshold</td></tr>
<tr><td>H Edge Detect Min [11:8]
H Edge Detect Min [7:0]</td><td></td><td>Horizontal edge detection min</td></tr>
<tr><td>V Edge Detect Max [11:8]
V Edge Detect Max [7:0]</td><td></td><td>Hotizontal edge detection max</td></tr>
<tr><td>Hor. Image Start [10:0]
Hor. Image End [10:0]</td><td></td><td></td></tr>
<tr><td>C Clamp 1/2</td><td></td><td>Even/Odd Column Clamping</td></tr>
</table>

10. PRIVACY MASK

NAME	RANGE	DESCRIPTION
PrvMask 1~8	0 ~ 1	0 : OFF 1 : ON
PrvMask 1~8 color	0 ~ 7	Select Privacy Mask Color
PrvMask 1~8 Top X PrvMask 1~8 Top Y PrvMask 1~8 Left X PrvMask 1~8 Left Y PrvMask 1~8 Right X PrvMask 1~8 Right Y PrvMask 1~8 Bottom X PrvMask 1~8 Bottom Y	0 ~ 255	Set up Privacy Mask Area

RJ-11/13_Y Signal

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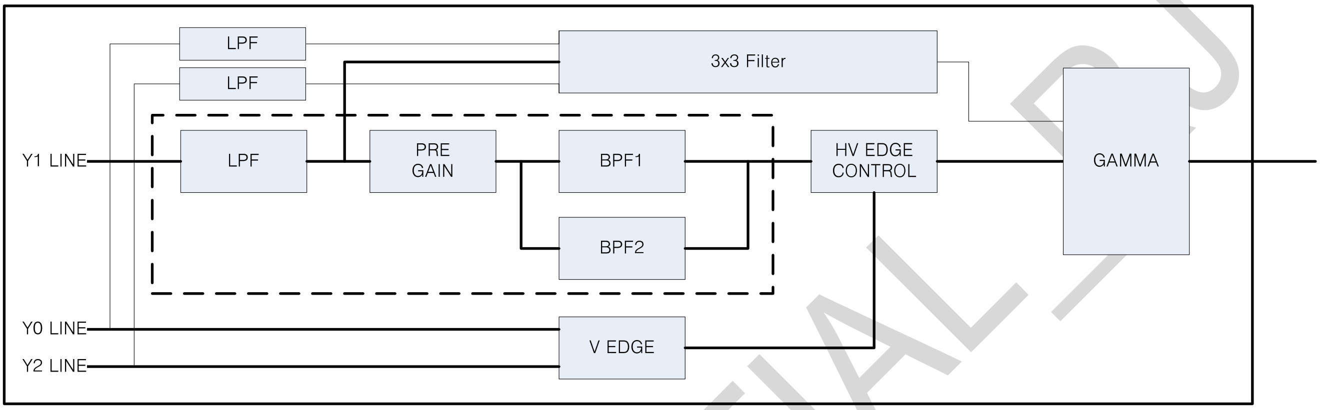
1. Y Signal Processing

1.1 Y Signal Processing Flow

Y Signal Processing is for color processing block as Edge enhancing, dark condition Edge Apperture reduction, Gamma Correction function. The Y Signal Processing Block diagram is as below.

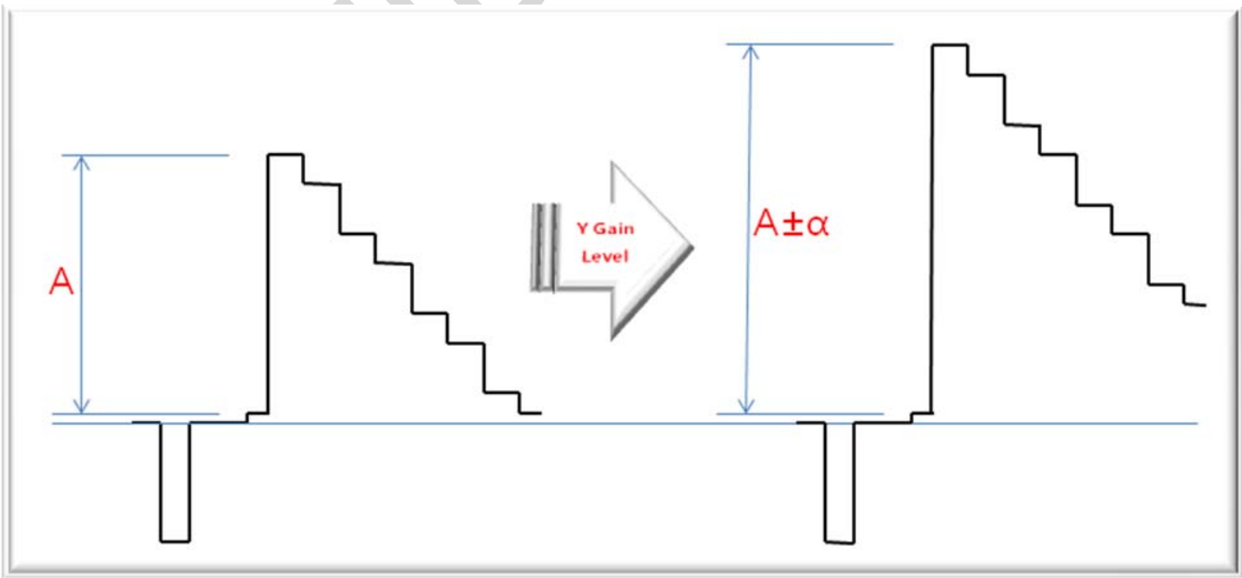


< Figure 1. Y Signal Processing Block Diagram>

1.2 Y Signal Level Control

- Y Gain (Y Expander)

Image Y Gain increase or reduce.

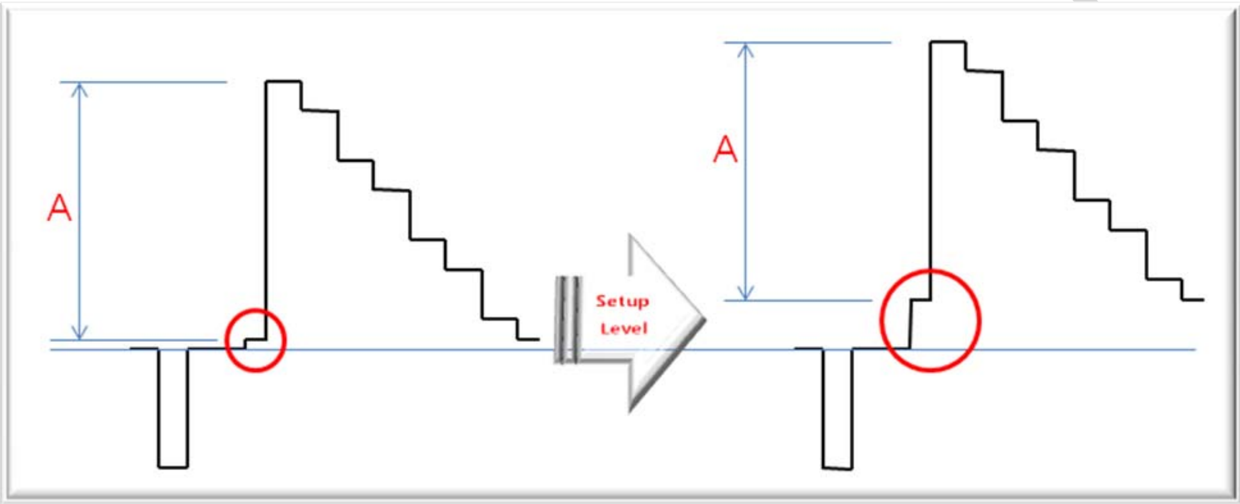


< Figure 2. Y Gain Control >

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Y Gain Control					
0x6914	7:0	Expander_y	0	RW	Y expander (yout = y * expander_y), Expander_y = 0 ~ (1-1/256)

- **Y Offset (Setup Level)**

Image setup level increase or reduce .

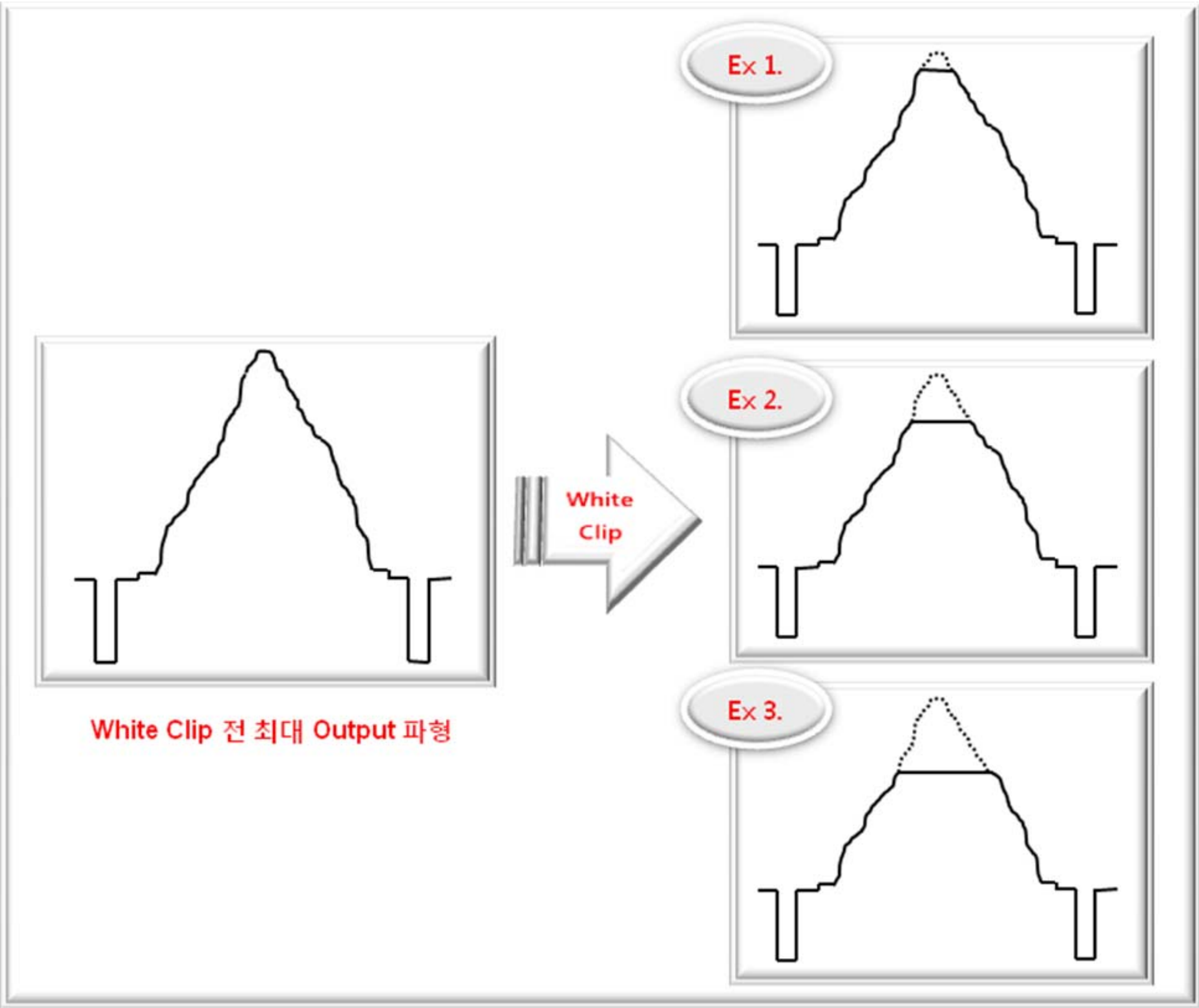


< Figure 3. Y Setup Level Control >

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Y Setup Level Control					
0x6911	5:0	Setup level	5	RW	Setup level

- **Y Clip (White Clip)**

The last signal output Y Signal maxim values tuning.



< Figure 4. Y Clip Level Control >

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
White Clip Level Control					
0x6915	7:0	White_Clip	0	RW	White Clip Level

1.3 Y Signal Main Control

● Y LPF

Y Low Pass Filter is using for reduction of Noise.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Y LPF Control					
0x6908	4:3	Y LPF	2'b11	RW	Y LPF parameter selection
	2:1	Y_INTP	2'b11	RW	Y Interpolation
	0	Bypass_y	1'b1	RW	Y LPF bypass

● Y Signal Edge Enhancing

RJ-11/13 is designed to get more clear image throught Edge Enhancing processing.

Edge Enhancing is two kind of filter. User can select each method.

Please follow below Register method for your choosing.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Using Edge Enhancing Filter					
0x4020	[0]	3X3FILTER_ENABLE	1	R/W	3x3 filter enable 1: enable (0x4002 ~ 0x4014 register useless) 0 : disable (0x4002 ~ 0x4014 register using)

- Using BPF

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Using BPF					
0x4002	[5:0]	HE_PGAIN	0x00	R/W	H_EDGE INPUT GAIN
0x4003	[3:2]	BPF1_GAIN	0x0	R/W	BPF1 OUTPUT GAIN SELECT
	[1:0]	HC_GAIN	0x0	R/W	H EDGE CORING GAIN SELECT
0x4004	[5:0]	HC_LEVEL	0x00	R/W	H EDGE CORING LEVEL
0x4005	[3:0]	VC_LEVEL	0x00	R/W	V EDGE CORING LEVEL
0x4006	[3:0]	VC_GAIN	0x00	R/W	V EDGE CORING GAIN
0x4007	[3:0]	HV_GAIN	0x00	R/W	HV EDGE TOTAL GAIN

0x4008	[3:0]	HVC_CORE	0x00	R/W	HV CORE LEVEL
0x4009	[0]	DB_SEL	0x00	R/W	HV DETAIL PART ENHANCER
0x400b	[5:0]	BPF1_CORE	0x00	R/W	BPF1 coring value
0x4010	[5:0]	BPF1_GAIN	0x20	R/W	BPF1 gain (range : 0/16 ~ 63/16) EX.) 0X20 = 32/16

- Using 3X3 Filter

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Using 3X3 Filter					
0x4021	[7:0]	3X3FILTER_COEFF_11	0xff	R/W	3x3filter coefficient (1,1) Signed , default= -1
0x4022	[7:0]	3X3FILTER_COEFF_12	0xff	R/W	3x3filter coefficient (1,2) Signed , default= -1
0x4023	[7:0]	3X3FILTER_COEFF_13	0xff	R/W	3x3filter coefficient (1,3) Signed , default= -1
0x4024	[7:0]	3X3FILTER_COEFF_21	0xfb	R/W	3x3filter coefficient (2,1) Signed , default= -5
0x4025	[7:0]	3X3FILTER_COEFF_22	0x10	R/W	3x3filter coefficient (2,2) Signed , default= +16
0x4026	[7:0]	3X3FILTER_COEFF_23	0xfb	R/W	3x3filter coefficient (2,3) Signed , default= -5
0x4027	[7:0]	3X3FILTER_COEFF_31	0xff	R/W	3x3filter coefficient (3,1) Signed , default= -1
0x4028	[7:0]	3X3FILTER_COEFF_32	0xff	R/W	3x3filter coefficient (3,2) Signed , default= -1
0x4029	[7:0]	3X3FILTER_COEFF_33	0xff	R/W	3x3filter coefficient (3,3) Signed , default= -1
0x402d	[3:0]	Y_DIV	0x2	R/W	3x3filter result divided as 2^y_div
0x402e	[7:0]	Y3X3_GAIN	0x10	R/W	Gain (x1/16) Default = 1.0
0x402f	[7:0]	Y3X3_CORING	0x0e	R/W	Coring Value

RJ-11/13_C Signal

APPLICATION NOTE Ver 1.0

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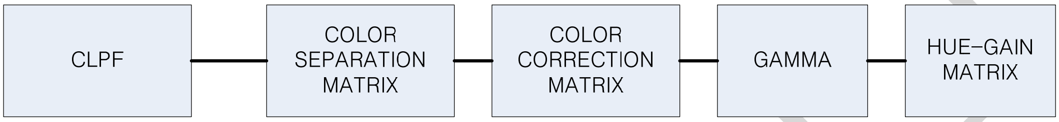


< Figure 1. C Signal Processing Block Diagram>

1.2 C Signal Main Control

● C LPF

Color Low Pass Filter is using for reduction for Noise.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
C LPF Control					
0x6920	1:0	C_LPF	1	RW	C LPF select

● Color Separation Matrix

Extracted WR, GR, WB, GB signal is changed to R, G, B signal by color Separation matrix. R and B is gained as CR+αG, CB+βG. And G is WR+GB or the other way is from WB+GR deduct CR+CB. Color Gain is simply multiple R, G, B values.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
R, B Matrix					
0x4104	[5:0]	RMATC[5:0]	0x00	R/W	R = CR + RMATC * G
0x4105	[5:0]	BMATC[5:0]	0x00	R/W	B = CB + BMATC * G
Color Gain Control					
0x4106	[7:0]	GPGAIN	0x00	R/W	PRE GAIN OF G

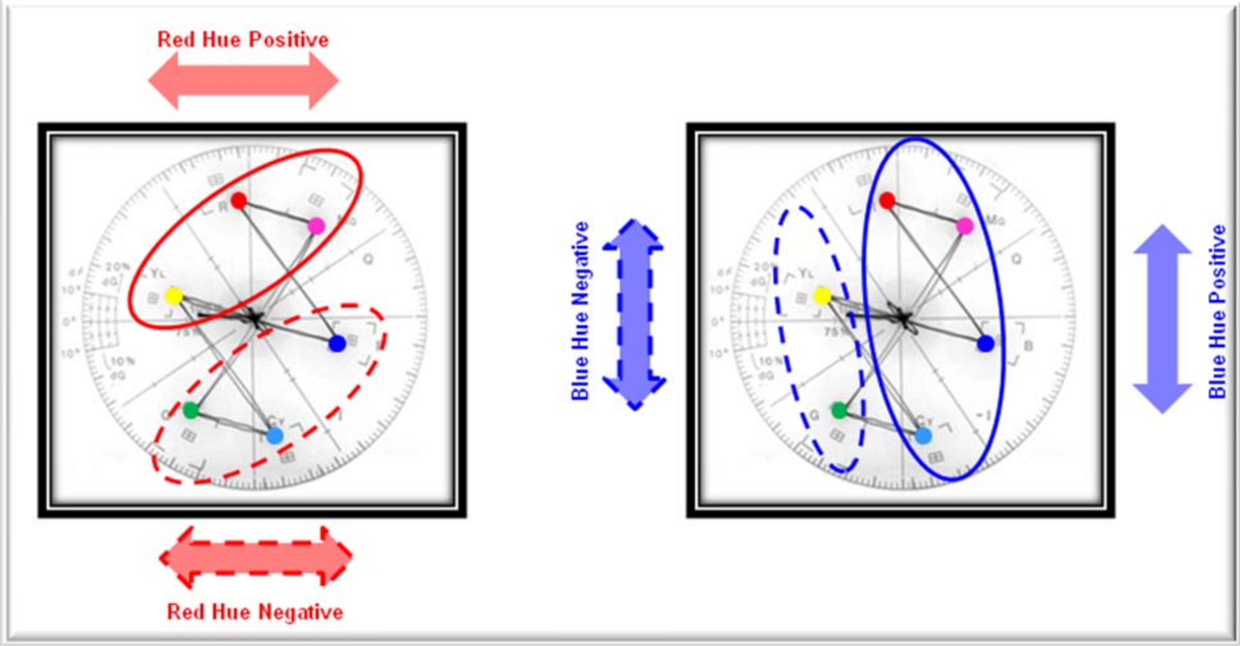
0x4107	[7:0]	RPGAIN	0x00	R/W	PRE GAIN OF R
0x4108	[7:0]	BPGAIN	0x00	R/W	PRE GAIN OF B

● Color Correction Matrix

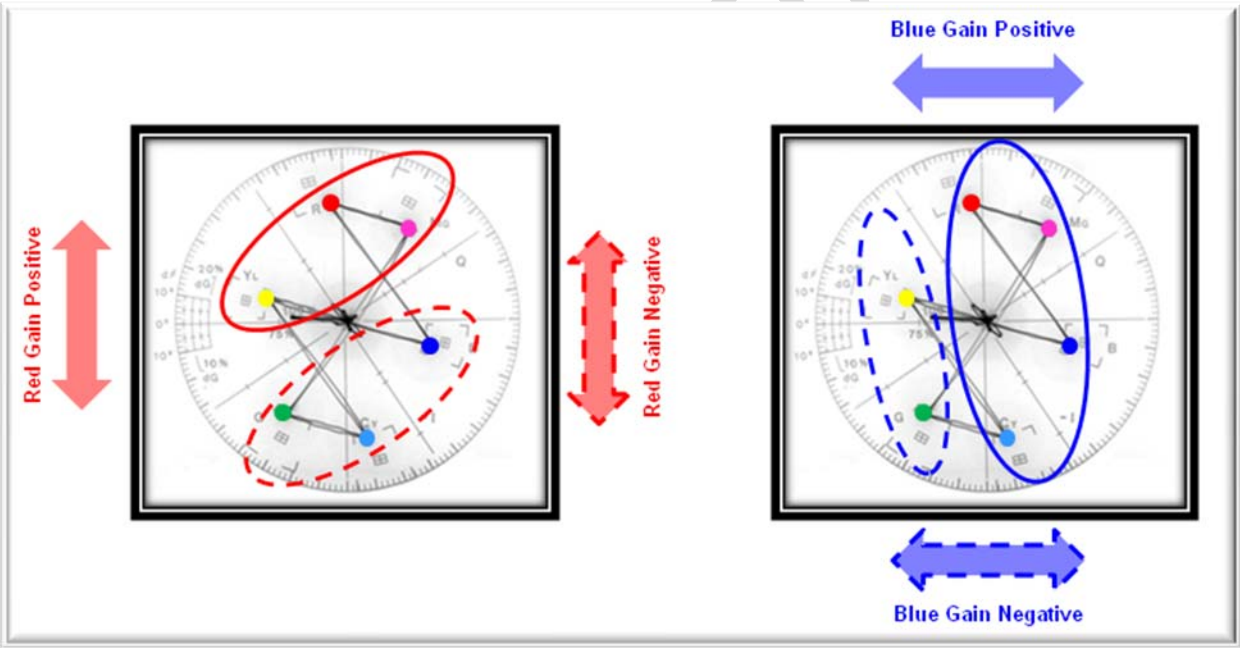
Color Correction Matrix make as 3X3 matrix. Matrix Coefficient is ±3.999 .

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Color Correction Matrix					
0x4183	[3:0]	CC_COEFF00[11:8]	0x0	R/W	Color Correction Coefficient 00 position (2 number of steps int: [11:8], fraction: 7:0) color correction coefficient is same position
0x4184	[7:0]	CC_COEFF00[7:0]	0x00		
0x4185	[3:0]	CC_COEFF01[11:8]	0x0	R/W	Color Correction Coefficient 01 position
0x4186	[7:0]	CC_COEFF01[7:0]	0x00		
0x4187	[3:0]	CC_COEFF02[11:8]	0x0	R/W	Color Correction Coefficient 02 position
0x4188	[7:0]	CC_COEFF02[7:0]	0x00		
0x4189	[3:0]	CC_COEFF10[11:8]	0x0	R/W	Color Correction Coefficient 10 position
0x418A	[7:0]	CC_COEFF10[7:0]	0x00		
0x418B	[3:0]	CC_COEFF11[11:8]	0x0	R/W	Color Correction Coefficient 11 position
0x418C	[7:0]	CC_COEFF11[7:0]	0x00		
0x418D	[3:0]	CC_COEFF12[11:8]	0x0	R/W	Color Correction Coefficient 12 position
0x418E	[7:0]	CC_COEFF12[7:0]	0x00		
0x418F	[3:0]	CC_COEFF20[11:8]	0x0	R/W	Color Correction Coefficient 20 position
0x4190	[7:0]	CC_COEFF20[7:0]	0x00		
0x4191	[3:0]	CC_COEFF21[11:8]	0x0	R/W	Color Correction Coefficient 21 position
0x4192	[7:0]	CC_COEFF21[7:0]	0x00		
0x4193	[3:0]	CC_COEFF22[11:8]	0x0	R/W	Color Correction Coefficient 22 position
0x4194	[7:0]	CC_COEFF22[7:0]	0x00		

- Color Hue adjustment



- Color Gain adjustment



ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Color Hue / Gain Control					
0x410D	[7:0]	BGAIN_P	0x00	R/W	B-G POSITIVE GAIN (2's Complement)
0x410E	[7:0]	BGAIN_N	0x00	R/W	B-G NEGATIVE GAIN (2's Complement)
0x410F	[7:0]	BHUE_P	0x00	R/W	B-G HUE (2's Complement)
0x4110	[7:0]	BHUE_N	0x00	R/W	B-G HUE (2's Complement)
0x4111	[7:0]	RGAIN_P	0x00	R/W	R-G GAIN (2's Complement)

0x4112	[7:0]	RGAIN_N	0x00	R/W	R-G GAIN (2's Complement)
0x4113	[7:0]	RHUE_P	0x00	R/W	R-G HUE Positive (2's complement)
0x4114	[7:0]	RHUE_N	0x00	R/W	R-G HUE Negative (2's complement)

RJ-11/13_TG

APPLICATION NOTE Ver 1.0

RJ-11/13

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1. Timing Generator

Timing Generator is the Block for generating CCD & AFE timing signal. User can tune the Timing Pulse (H1, H2, RG, SHP, SHD, ADCLK etc) by using JIG.

Most of signal is saved in the Hardware but every board timing should be need to fine tuning because each board's CCD Type, Chipset, design, PCB layout is different.

1.1 Delay Adjustment

Delay Adjustment can be tuned as below Register <Figure 1. Delay Adjustment Register>.
User can fine tuning as the Setting values of Delay Amount <Figure 2. Delay Amount>
<Figure 3. Delay Waveform> shows the waveform changing by Setting the timing.

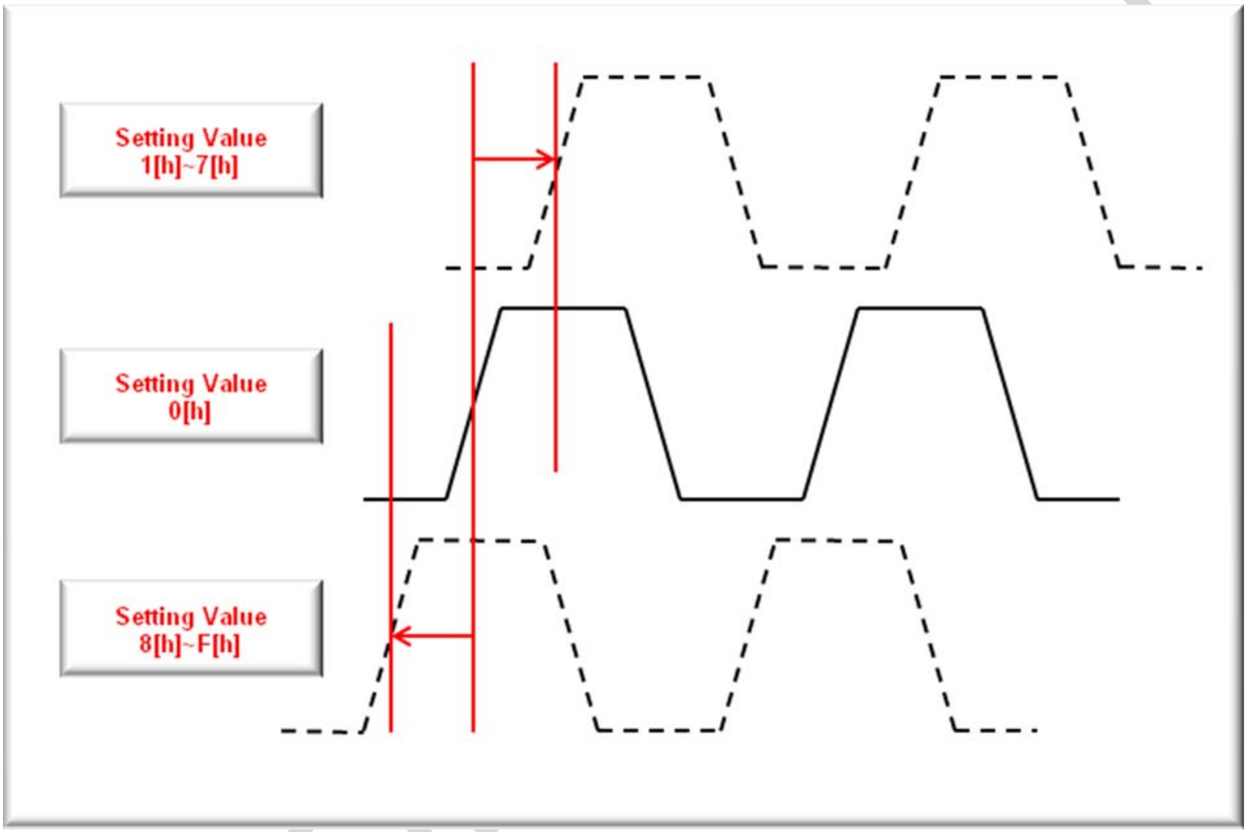
ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Delay Adjustment					
0x7100	3:0	Dly_Adj_SHP	0	RW	SHP delay adjust value
0x7101	3:0	Dly_Adj_SHD	0	RW	SHD delay adjust value
0x7102	3:0	Dly_Adj_ADCLK	0	RW	ADCLK delay adjust value
0x7103	3:0	Dly_Adj_H1	0	RW	H1 delay adjust value
0x7104	3:0	Dly_Adj_H2	0	RW	H2 delay adjust value
0x7105	3:0	Dly_Adj_RG	0	RW	RG delay adjust value

< Figure 1. Delay Adjustment Register >

Setting value	Delay Amout (ns)
0 [h]	+ 0.00
1 [h]	+ 0.51
2 [h]	+ 0.97
3 [h]	+ 1.48
4 [h]	+ 1.92
5 [h]	+ 2.42
6 [h]	+ 2.95
7 [h]	+ 3.43
8 [h]	- 4.09
9 [h]	- 3.59
A [h]	- 3.08

B [h]	- 2.57
C [h]	- 2.04
D [h]	- 1.53
E [h]	- 1.02
F [h]	- 0.53

< Figure 2. Delay Adjustment Amount >



< Figure3. Delay Waveform >

1.2 Width Adjustment

Width Adjustment can be tuned as below Register <Figure 4. Width Adjustment Register>.

User can fine tune the Width Amount as the changing of Setting value.

<Figure 5. Width Adjustment Amount>

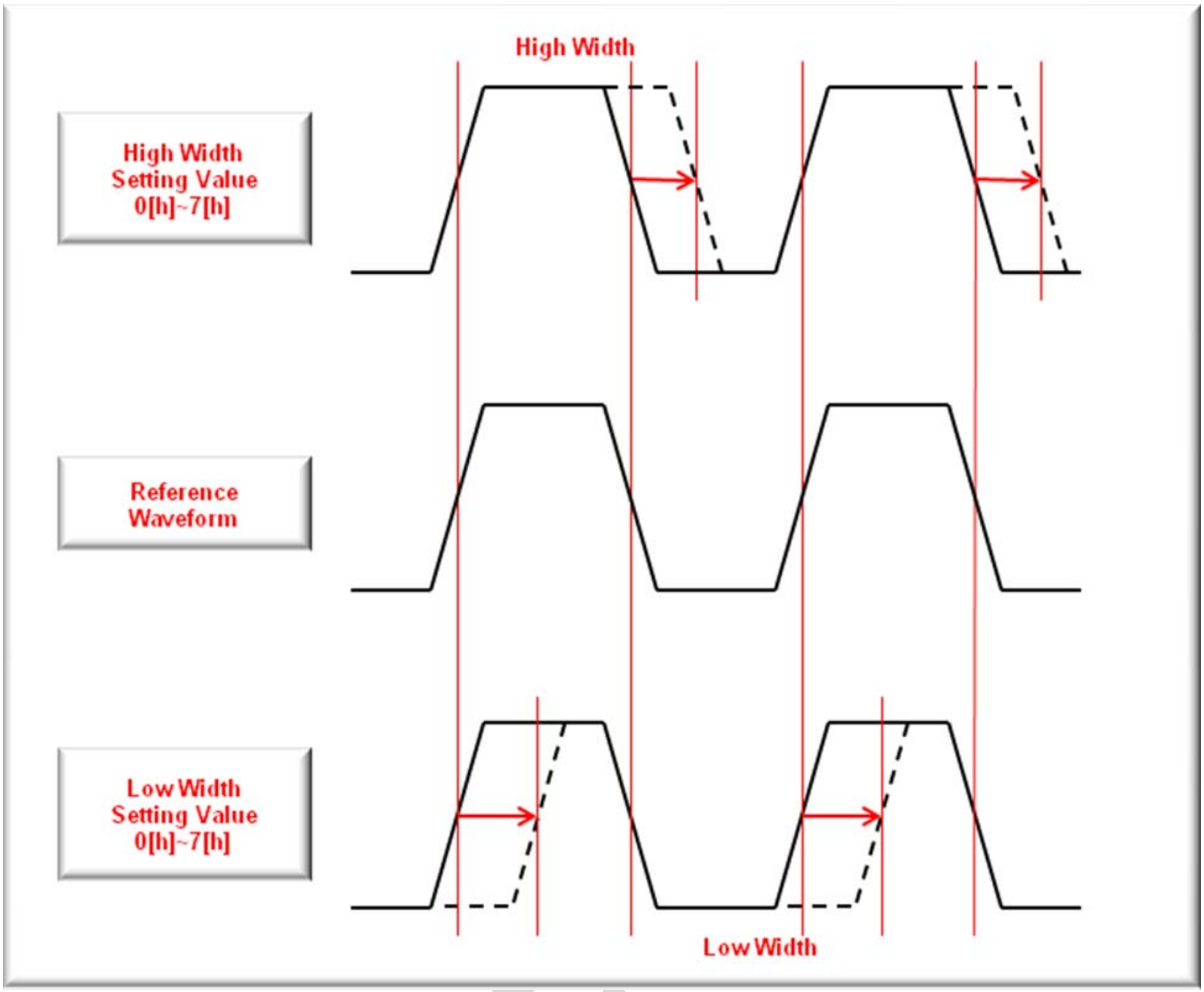
<Figure 6. Width Waveform> shows the waveform changing as Setting value changing.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Width Adjustment					
0x7100	7:4	Wid_Adj_SHP	0	RW	SHP Width adjust value
0x7101	7:4	Wid_Adj_SHD	0	RW	SHD width adjust value
0x7102	7:4	Wid_Adj_ADCLK	0	RW	ADCLK width adjust value
0x7103	7:4	Wid_Adj_H1	0	RW	H1 width adjust value
0x7104	7:4	Wid_Adj_H2	0	RW	H2 width adjust value
0x7105	7:4	Wid_Adj_RG	0	RW	RG width adjust value

< Figure 4. Width Adjustment Register >

Setting value		Delay Amout (ns)
Bit[7]	Bit[6:4]	
0 [h] High Width	0 [h]	+ 0.09
	1 [h]	+ 0.62
	2 [h]	+ 1.13
	3 [h]	+ 1.66
	4 [h]	+ 2.21
	5 [h]	+ 2.75
	6 [h]	+ 3.14
	7 [h]	+ 3.72
1 [h] Low Width	0 [h]	+ 0.23
	1 [h]	+ 0.75
	2 [h]	+ 1.24
	3 [h]	+ 1.76
	4 [h]	+ 2.28
	5 [h]	+ 2.74
	6 [h]	+ 3.26
	7 [h]	+ 3.84

< Figure 5. Width Adjustment Amount >



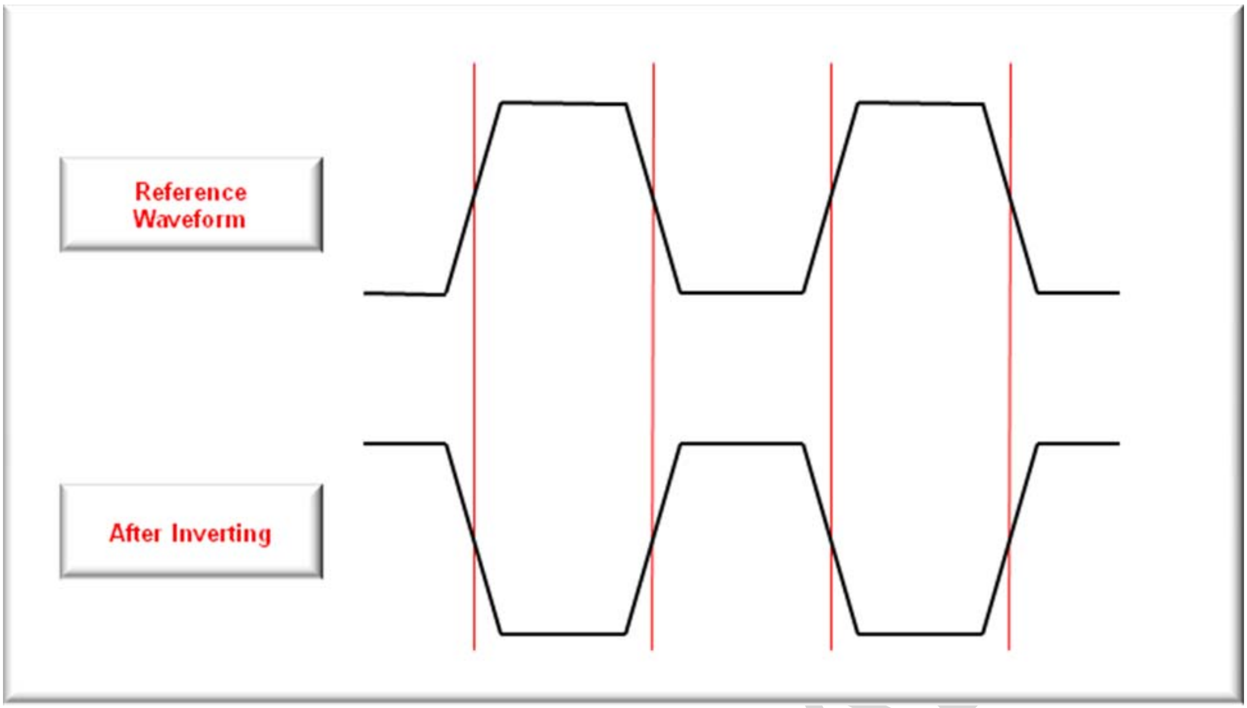
< Figure 6. Width Waveform >

1.3 Inverting Adjustment

Inverting Adjustment can be tuned as below Register <Figure 7.Inverting Adjustment Register> <Figure 8. Inverting Waveform> shows the waveform changing of Setting values.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Inverting Adjustment					
0x7002	2	H12_Inv	0	RW	To CCD H1, H2 inverting
	1	RG_Inv	0	RW	To CCD RG inverting
	0	ADCLK_Inv	0	RW	To AFE ADCLK inverting

< Figure 7. Inverting Adjustment Register >



< Figure 8. Inverting Waveform >

※ Also the other all kind of Timing values can be tuned by User's request.

RJ-11/13_Gamma

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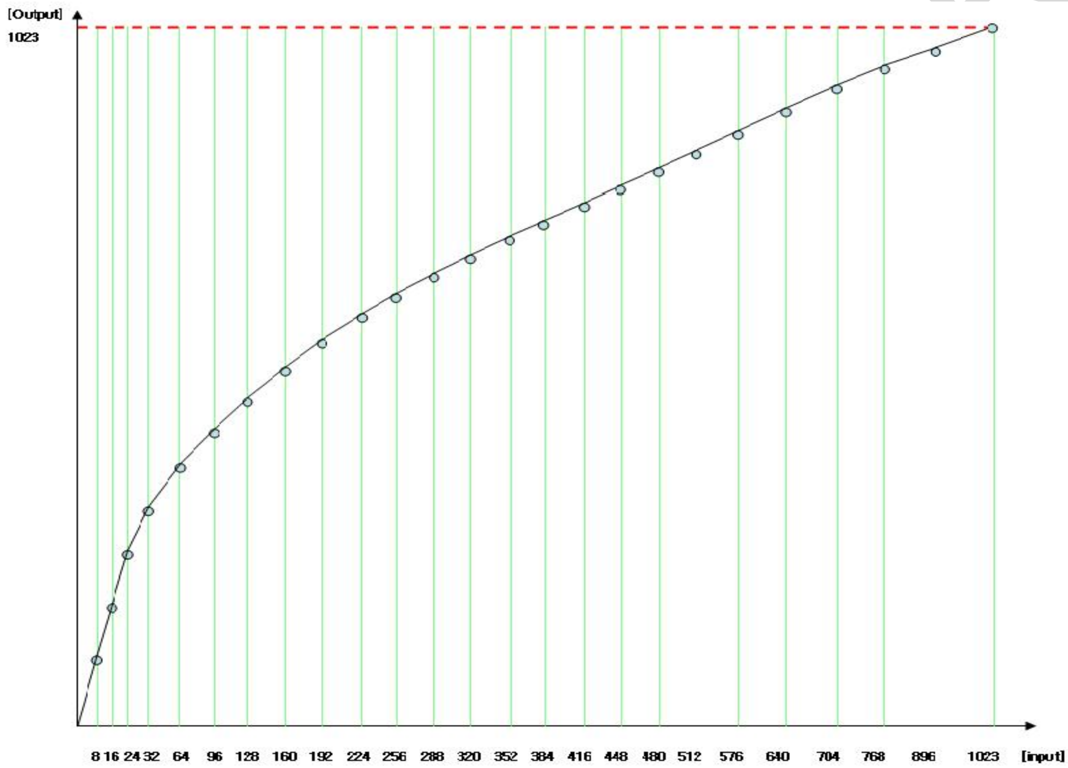
1. Gamma Processing

1.1 Y Gamma

RJ-11/13 has totally 25 number of Knee points for Y Gammar. It has narrow Knee point during low & Normal condition of contrast, because it is mostly effect for the image. And it has little bit wide Knee point in the high contrast area, because it is not effect for the image very clearly. User can be Tuning our Curve Knee point, we can get the most suitable Y Gammar.



< Figure 1. Y Gamma>

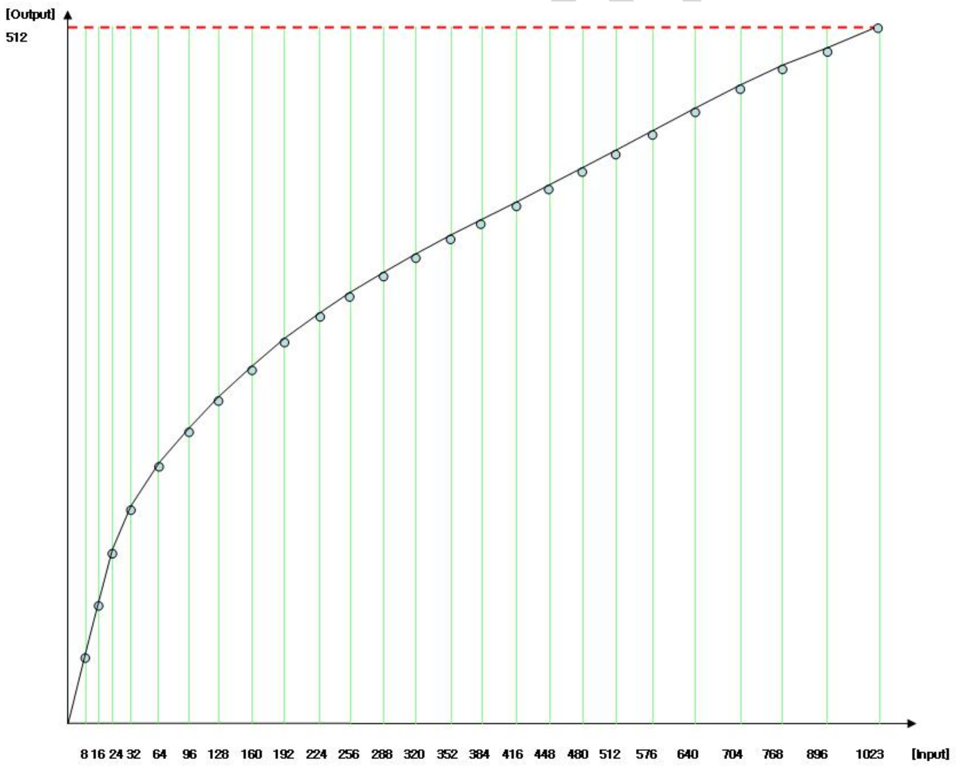
ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Y Gamma Control					
0x4060	[1:0]	YG0[9:8]	0x00	R/W	YGAMMA 0 POINT(When INPUT X = 8 OUTPUT Y VALUE)
0x4061	[7:0]	YG0[7:0]			
0x4062	[1:0]	YG1[9:8]	0x00	R/W	YGAMMA 1 POINT(When INPUT X = 16 OUTPUT Y VALUE)
0x4063	[7:0]	YG1[7:0]			
0x4064	[1:0]	YG2[9:8]	0x00	R/W	YGAMMA 2 POINT(When INPUT X = 24 OUTPUT Y VALUE)
0x4065	[7:0]	YG2[7:0]			
0x4066	[1:0]	YG3[9:8]	0x00	R/W	YGAMMA 3 POINT(When INPUT X = 32 OUTPUT Y VALUE)
0x4067	[7:0]	YG3[7:0]			

0x4068	[1:0]	YG4[9:8]	0x00	R/W	YGAMMA 4 POINT(Whn INPUT X = 64 OUTPUT Y VALUE)
0x4069	[7:0]	YG4[7:0]			
0x406A	[1:0]	YG5[9:8]	0x00	R/W	YGAMMA 5 POINT(When INPUT X = 96 OUTPUT Y VALUE)
0x406B	[7:0]	YG5[7:0]			
0x406C	[1:0]	YG6[9:8]	0x00	R/W	YGAMMA 6 POINT(When INPUT X = 128 OUTPUT Y VALUE)
0x406D	[7:0]	YG6[7:0]			
0x406E	[1:0]	YG7[9:8]	0x00	R/W	YGAMMA 7 POINT(When INPUT X = 160 OUTPUT Y VALUE)
0x406F	[7:0]	YG7[7:0]			
0x4070	[1:0]	YG8[9:8]	0x00	R/W	YGAMMA 8 POINT(When INPUT X = 192 OUTPUT Y VALUE)
0x4071	[7:0]	YG8[7:0]			
0x4072	[1:0]	YG9[9:8]	0x00	R/W	YGAMMA 9 POINT(When INPUT X = 224 OUTPUT Y VALUE)
0x4073	[7:0]	YG9[7:0]			
0x4074	[1:0]	YG10[9:8]	0x00	R/W	YGAMMA 10 POINT(When INPUT X = 256 OUTPUT Y VALUE)
0x4075	[7:0]	YG10[7:0]			
0x4076	[1:0]	YG11[9:8]	0x00	R/W	YGAMMA 11 POINT(When INPUT X = 288 OUTPUT Y VALUE)
0x4077	[7:0]	YG11[7:0]			
0x4078	[1:0]	YG12[9:8]	0x00	R/W	YGAMMA 12 POINT(When INPUT X = 320 OUTPUT Y VALUE)
0x4079	[7:0]	YG12[7:0]			
0x407A	[1:0]	YG13[9:8]	0x00	R/W	YGAMMA 13 POINT(When INPUT X = 352 OUTPUT Y VALUE)
0x407B	[7:0]	YG13[7:0]			
0x407C	[1:0]	YG14[9:8]	0x00	R/W	YGAMMA 14 POINT(When INPUT X = 384 OUTPUT Y VALUE)
0x407D	[7:0]	YG14[7:0]			
0x407E	[1:0]	YG15[9:8]	0x00	R/W	YGAMMA 15 POINT(When INPUT X = 416 OUTPUT Y VALUE)
0x407F	[7:0]	YG15[7:0]			
0x4080	[1:0]	YG16[9:8]	0x00	R/W	YGAMMA 16 POINT(When INPUT X = 448 OUTPUT Y VALUE)
0x4081	[7:0]	YG16[7:0]			
0x4082	[1:0]	YG17[9:8]	0x00	R/W	YGAMMA 17 POINT(When INPUT X = 480 OUTPUT Y VALUE)
0x4083	[7:0]	YG17[7:0]			
0x4084	[1:0]	YG18[9:8]	0x00	R/W	YGAMMA 18 POINT(When INPUT X = 512 OUTPUT Y VALUE)
0x4085	[7:0]	YG18[7:0]			
0x4086	[1:0]	YG19[9:8]	0x00	R/W	YGAMMA 19 POINT(When INPUT X = 576 OUTPUT Y VALUE)
0x4087	[7:0]	YG19[7:0]			
0x4088	[1:0]	YG20[9:8]	0x00	R/W	YGAMMA 20 POINT(When INPUT X = 640 OUTPUT Y VALUE)
0x4089	[7:0]	YG20[7:0]			
0x408A	[1:0]	YG21[9:8]	0x00	R/W	YGAMMA 21 POINT(When INPUT X = 704 OUTPUT Y VALUE)
0x408B	[7:0]	YG21[7:0]			
0x408C	[1:0]	YG22[9:8]	0x00	R/W	YGAMMA 22 POINT(When INPUT X = 768 OUTPUT Y VALUE)
0x408D	[7:0]	YG22[7:0]			

0x408E	[1:0]	YG23[9:8]	0x00	R/W	YGAMMA 23 POINT(When INPUT X = 896 OUTPUT Y VALUE)
0x408F	[7:0]	YG23[7:0]			
0x4090	[1:0]	YG24[9:8]	0x00	R/W	YGAMMA 24 POINT(When INPUT X = 1023 OUTPUT Y VALUE)
0x4091	[7:0]	YG24[7:0]			

1.2 C Gamma

C Gamma Curve is not effect the contrast of image. It only effect on Color Saturation Curve. It normaly should be set up as same as Y Gamma Factor is more easy to Tuning & let make it Color Lineaility.



< Figure 2. C Gamma>

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
G Gamma Control					
0x4120	[7:0]	G_G0[7:0]	0x00	R/W	G GAMMA 0 POINT(When INPUT X = 8 OUTPUT Y VALUE, 256 scale)

0x4121	[7:0]	G_G1[7:0]	0x00	R/W	G GAMMA 1 POINT(When INPUT X = 16 OUTPUT Y VALUE, 256 scale)
0x4122	[7:0]	G_G2[7:0]	0x00	R/W	G GAMMA 2 POINT(When INPUT X = 24 OUTPUT Y VALUE, 256 scale)
0x4123	[7:0]	G_G3[7:0]	0x00	R/W	G GAMMA 3 POINT(When INPUT X = 32 OUTPUT Y VALUE, 256 scale)
0x4124	[7:0]	G_G4[7:0]	0x00	R/W	G GAMMA 4 POINT(When INPUT X = 64 OUTPUT Y VALUE, 256 scale)
0x4125	[7:0]	G_G5[7:0]	0x00	R/W	G GAMMA 5 POINT(When INPUT X = 96 OUTPUT Y VALUE, 256 scale)
0x4126	[7:0]	G_G6[7:0]	0x00	R/W	G GAMMA 6 POINT(When INPUT X = 128 OUTPUT Y VALUE, 256 scale)
0x4127	[7:0]	G_G7[7:0]	0x00	R/W	G GAMMA 7 POINT(When INPUT X = 160 OUTPUT Y VALUE, 256 scale)
0x4128	[7:0]	G_G8[7:0]	0x00	R/W	G GAMMA 8 POINT(When INPUT X = 192 OUTPUT Y VALUE, 256 scale)
0x4129	[7:0]	G_G9[7:0]	0x00	R/W	G GAMMA 9 POINT(When INPUT X = 224 OUTPUT Y VALUE, 256 scale)
0x412A	[7:0]	G_G10[7:0]	0x00	R/W	G GAMMA 10 POINT(When INPUT X = 256 OUTPUT Y VALUE, 256 scale)
0x412B	[7:0]	G_G11[7:0]	0x00	R/W	G GAMMA 11 POINT(When INPUT X = 288 OUTPUT Y VALUE, 256 scale)
0x412C	[7:0]	G_G12[7:0]	0x00	R/W	G GAMMA 12 POINT(When INPUT X = 320 OUTPUT Y VALUE, 256 scale)
0x412D	[7:0]	G_G13[7:0]	0x00	R/W	G GAMMA 13 POINT(When INPUT X = 352 OUTPUT Y VALUE, 256 scale)
0x412E	[7:0]	G_G14[7:0]	0x00	R/W	G GAMMA 14 POINT(When INPUT X = 384 OUTPUT Y VALUE, 256 scale)
0x412F	[7:0]	G_G15[7:0]	0x00	R/W	G GAMMA 15 POINT(When INPUT X = 416 OUTPUT Y VALUE, 256 scale)
0x4130	[7:0]	G_G16[7:0]	0x00	R/W	G GAMMA 16 POINT(When INPUT X = 448 OUTPUT Y VALUE, 256 scale)
0x4131	[7:0]	G_G17[7:0]	0x00	R/W	G GAMMA 17 POINT(When INPUT X = 480 OUTPUT Y VALUE, 256 scale)
0x4132	[7:0]	G_G18[7:0]	0x00	R/W	G GAMMA 18 POINT(When INPUT X = 512 OUTPUT Y VALUE, 256 scale)
0x4133	[7:0]	G_G19[7:0]	0x00	R/W	G GAMMA 19 POINT(When INPUT X = 576 OUTPUT Y VALUE, 256 scale)

0x4134	[7:0]	G_G20[7:0]	0x00	R/W	G GAMMA 20 POINT(When INPUT X = 640 OUTPUT Y VALUE, 256 scale)
0x4135	[7:0]	G_G21[7:0]	0x00	R/W	G GAMMA 21 POINT(When INPUT X = 704 OUTPUT Y VALUE, 256 scale)
0x4136	[7:0]	G_G22[7:0]	0x00	R/W	G GAMMA 22 POINT(When INPUT X = 768 OUTPUT Y VALUE, 256 scale)
0x4137	[7:0]	G_G23[7:0]	0x00	R/W	G GAMMA 23 POINT(When INPUT X = 896 OUTPUT Y VALUE, 256 scale)
0x4138	[7:0]	G_G24[7:0]	0x00	R/W	G GAMMA 24 POINT(When INPUT X = 1023 OUTPUT Y VALUE, 256 scale)
R Gamma Control					
0x4140	[7:0]	R_G0[7:0]	0x00	R/W	R GAMMA 0 POINT(When INPUT X = 8 OUTPUT Y VALUE, 256 scale)
0x4141	[7:0]	R_G1[7:0]	0x00	R/W	R GAMMA 1 POINT(When INPUT X = 16 OUTPUT Y VALUE, 256 scale)
0x4142	[7:0]	R_G2[7:0]	0x00	R/W	R GAMMA 2 POINT(When INPUT X = 24 OUTPUT Y VALUE, 256 scale)
0x4143	[7:0]	R_G3[7:0]	0x00	R/W	R GAMMA 3 POINT(When INPUT X = 32 OUTPUT Y VALUE, 256 scale)
0x4144	[7:0]	R_G4[7:0]	0x00	R/W	R GAMMA 4 POINT(When INPUT X = 64 OUTPUT Y VALUE, 256 scale)
0x4145	[7:0]	R_G5[7:0]	0x00	R/W	R GAMMA 5 POINT(When INPUT X = 96 OUTPUT Y VALUE, 256 scale)
0x4146	[7:0]	R_G6[7:0]	0x00	R/W	R GAMMA 6 POINT(When INPUT X = 128 OUTPUT Y VALUE, 256 scale)
0x4147	[7:0]	R_G7[7:0]	0x00	R/W	R GAMMA 7 POINT(When INPUT X = 160 OUTPUT Y VALUE, 256 scale)
0x4148	[7:0]	R_G8[7:0]	0x00	R/W	R GAMMA 8 POINT(When INPUT X = 192 OUTPUT Y VALUE, 256 scale)
0x4149	[7:0]	R_G9[7:0]	0x00	R/W	R GAMMA 9 POINT(When INPUT X = 224 OUTPUT Y VALUE, 256 scale)
0x414A	[7:0]	R_G10[7:0]	0x00	R/W	R GAMMA 10 POINT(When INPUT X = 256 OUTPUT Y VALUE, 256 scale)
0x414B	[7:0]	R_G11[7:0]	0x00	R/W	R GAMMA 11 POINT(When INPUT X = 288 OUTPUT Y VALUE, 256 scale)
0x414C	[7:0]	R_G12[7:0]	0x00	R/W	R GAMMA 12 POINT(When INPUT X = 320 OUTPUT Y VALUE, 256 scale)
0x414D	[7:0]	R_G13[7:0]	0x00	R/W	R GAMMA 13 POINT(When INPUT X = 352 OUTPUT Y VALUE, 256 scale)

0x414E	[7:0]	R_G14[7:0]	0x00	R/W	R GAMMA 14 POINT(When INPUT X = 384 OUTPUT Y VALUE, 256 scale)
0x414F	[7:0]	R_G15[7:0]	0x00	R/W	R GAMMA 15 POINT(When INPUT X = 416 OUTPUT Y VALUE, 256 scale)
0x4150	[7:0]	R_G16[7:0]	0x00	R/W	R GAMMA 16 POINT(When INPUT X = 448 OUTPUT Y VALUE, 256 scale)
0x4151	[7:0]	R_G17[7:0]	0x00	R/W	R GAMMA 17 POINT(When INPUT X = 480 OUTPUT Y VALUE, 256 scale)
0x4152	[7:0]	R_G18[7:0]	0x00	R/W	R GAMMA 18 POINT(When INPUT X = 512 OUTPUT Y VALUE, 256 scale)
0x4153	[7:0]	R_G19[7:0]	0x00	R/W	R GAMMA 19 POINT(When INPUT X = 576 OUTPUT Y VALUE, 256 scale)
0x4154	[7:0]	R_G20[7:0]	0x00	R/W	R GAMMA 20 POINT(When INPUT X = 640 OUTPUT Y VALUE, 256 scale)
0x4155	[7:0]	R_G21[7:0]	0x00	R/W	R GAMMA 21 POINT(When INPUT X = 704 OUTPUT Y VALUE, 256 scale)
0x4156	[7:0]	R_G22[7:0]	0x00	R/W	R GAMMA 22 POINT(When INPUT X = 768 OUTPUT Y VALUE, 256 scale)
0x4157	[7:0]	R_G23[7:0]	0x00	R/W	R GAMMA 23 POINT(When INPUT X = 896 OUTPUT Y VALUE, 256 scale)
0x4158	[7:0]	R_G24[7:0]	0x00	R/W	R GAMMA 24 POINT(When INPUT X = 1023 OUTPUT Y VALUE, 256 scale)
B Gamma Control					
0x4160	[7:0]	B_G0[7:0]	0x00	R/W	B GAMMA 0 POINT(When INPUT X = 8 OUTPUT Y VALUE, 256 scale)
0x4161	[7:0]	B_G1[7:0]	0x00	R/W	B GAMMA 1 POINT(When INPUT X = 16 OUTPUT Y VALUE, 256 scale)
0x4162	[7:0]	B_G2[7:0]	0x00	R/W	B GAMMA 2 POINT(When INPUT X = 24 OUTPUT Y VALUE, 256 scale)
0x4163	[7:0]	B_G3[7:0]	0x00	R/W	B GAMMA 3 POINT(When INPUT X = 32 OUTPUT Y VALUE, 256 scale)
0x4164	[7:0]	B_G4[7:0]	0x00	R/W	B GAMMA 4 POINT(When INPUT X = 64 OUTPUT Y VALUE, 256 scale)
0x4165	[7:0]	B_G5[7:0]	0x00	R/W	B GAMMA 5 POINT(When INPUT X = 96 OUTPUT Y VALUE, 256 scale)
0x4166	[7:0]	B_G6[7:0]	0x00	R/W	B GAMMA 6 POINT(When INPUT X = 128 OUTPUT Y VALUE, 256 scale)
0x4167	[7:0]	B_G7[7:0]	0x00	R/W	B GAMMA 7 POINT(When INPUT X = 160 OUTPUT Y VALUE, 256 scale)

0x4168	[7:0]	B_G8[7:0]	0x00	R/W	B GAMMA 8 POINT(When INPUT X = 192 OUTPUT Y VALUE, 256 scale)
0x4169	[7:0]	B_G9[7:0]	0x00	R/W	B GAMMA 9 POINT(When INPUT X = 224 OUTPUT Y VALUE, 256 scale)
0x416A	[7:0]	B_G10[7:0]	0x00	R/W	B GAMMA 10 POINT(When INPUT X = 256 OUTPUT Y VALUE, 256 scale)
0x416B	[7:0]	B_G11[7:0]	0x00	R/W	B GAMMA 11 POINT(When INPUT X = 288 OUTPUT Y VALUE, 256 scale)
0x416C	[7:0]	B_G12[7:0]	0x00	R/W	B GAMMA 12 POINT(When INPUT X = 320 OUTPUT Y VALUE, 256 scale)
0x416D	[7:0]	B_G13[7:0]	0x00	R/W	B GAMMA 13 POINT(When INPUT X = 352 OUTPUT Y VALUE, 256 scale)
0x416E	[7:0]	B_G14[7:0]	0x00	R/W	B GAMMA 14 POINT(When INPUT X = 384 OUTPUT Y VALUE, 256 scale)
0x416F	[7:0]	B_G15[7:0]	0x00	R/W	B GAMMA 15 POINT(When INPUT X = 416 OUTPUT Y VALUE, 256 scale)
0x4170	[7:0]	B_G16[7:0]	0x00	R/W	B GAMMA 16 POINT(When INPUT X = 448 OUTPUT Y VALUE, 256 scale)
0x4171	[7:0]	B_G17[7:0]	0x00	R/W	B GAMMA 17 POINT(When INPUT X = 480 OUTPUT Y VALUE, 256 scale)
0x4172	[7:0]	B_G18[7:0]	0x00	R/W	B GAMMA 18 POINT(When INPUT X = 512 OUTPUT Y VALUE, 256 scale)
0x4173	[7:0]	B_G19[7:0]	0x00	R/W	B GAMMA 19 POINT(When INPUT X = 576 OUTPUT Y VALUE, 256 scale)
0x4174	[7:0]	B_G20[7:0]	0x00	R/W	B GAMMA 20 POINT(When INPUT X = 640 OUTPUT Y VALUE, 256 scale)
0x4175	[7:0]	B_G21[7:0]	0x00	R/W	B GAMMA 21 POINT(When INPUT X = 704 OUTPUT Y VALUE, 256 scale)
0x4176	[7:0]	B_G22[7:0]	0x00	R/W	B GAMMA 22 POINT(When INPUT X = 768 OUTPUT Y VALUE, 256 scale)
0x4177	[7:0]	B_G23[7:0]	0x00	R/W	B GAMMA 23 POINT(When INPUT X = 896 OUTPUT Y VALUE, 256 scale)
0x4178	[7:0]	B_G24[7:0]	0x00	R/W	B GAMMA 24 POINT(When INPUT X = 1023 OUTPUT Y VALUE, 256 scale)

RJ-11/13_Encoder

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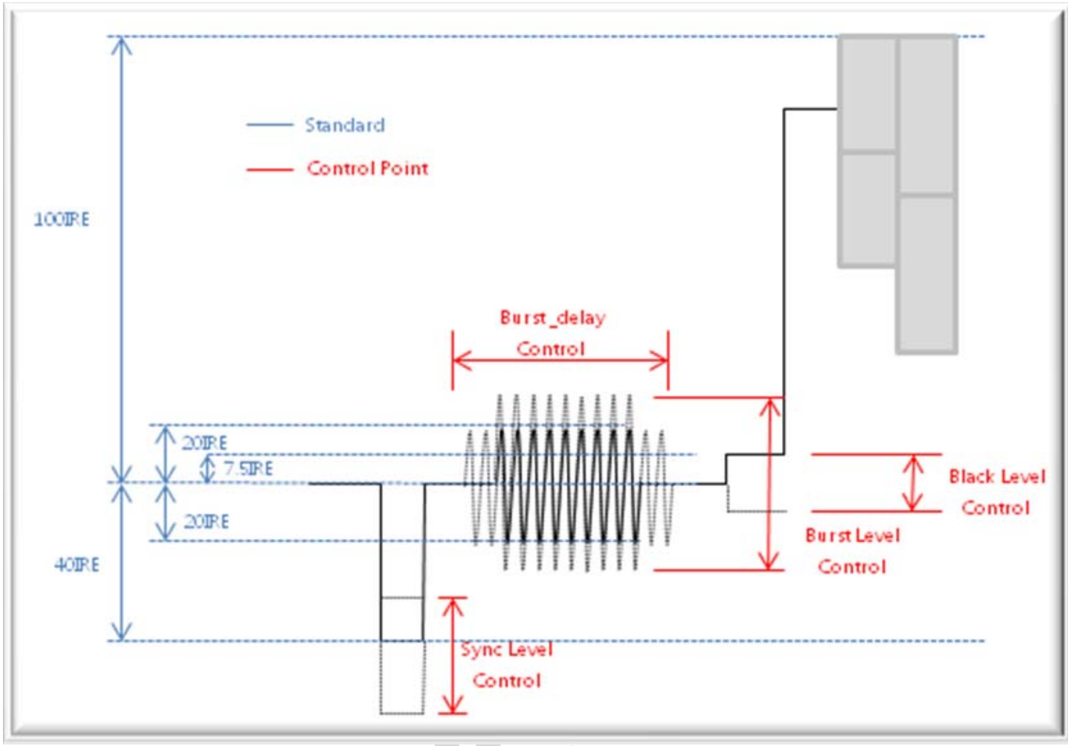
1. Encoder Control

1.1 Video Output



< Figure 1. Analog Video Output Waveform>

● **Burst Level Control**

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Burst Level Control					
0x6930	7:0	Nburst	76	RW	Burst magnitude of Sin
0x6931	7:0	Pburst	0	RW	Burst magnitude of Cos

● **Burst_delay Control**

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Burst_delay Control					
0x682c	1:0	Burst_delay[7:0]	0	RW	Burst phase/ Initial Value.

- **Sync Level Control**

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Sync Level Control					
0x6913	4:0	Sync level	16	RW	Sync level

- **Black Level Control**

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Black Level Control					
0x6912	7:0	Black level	60	RW	Black level

RJ-11/13_AE

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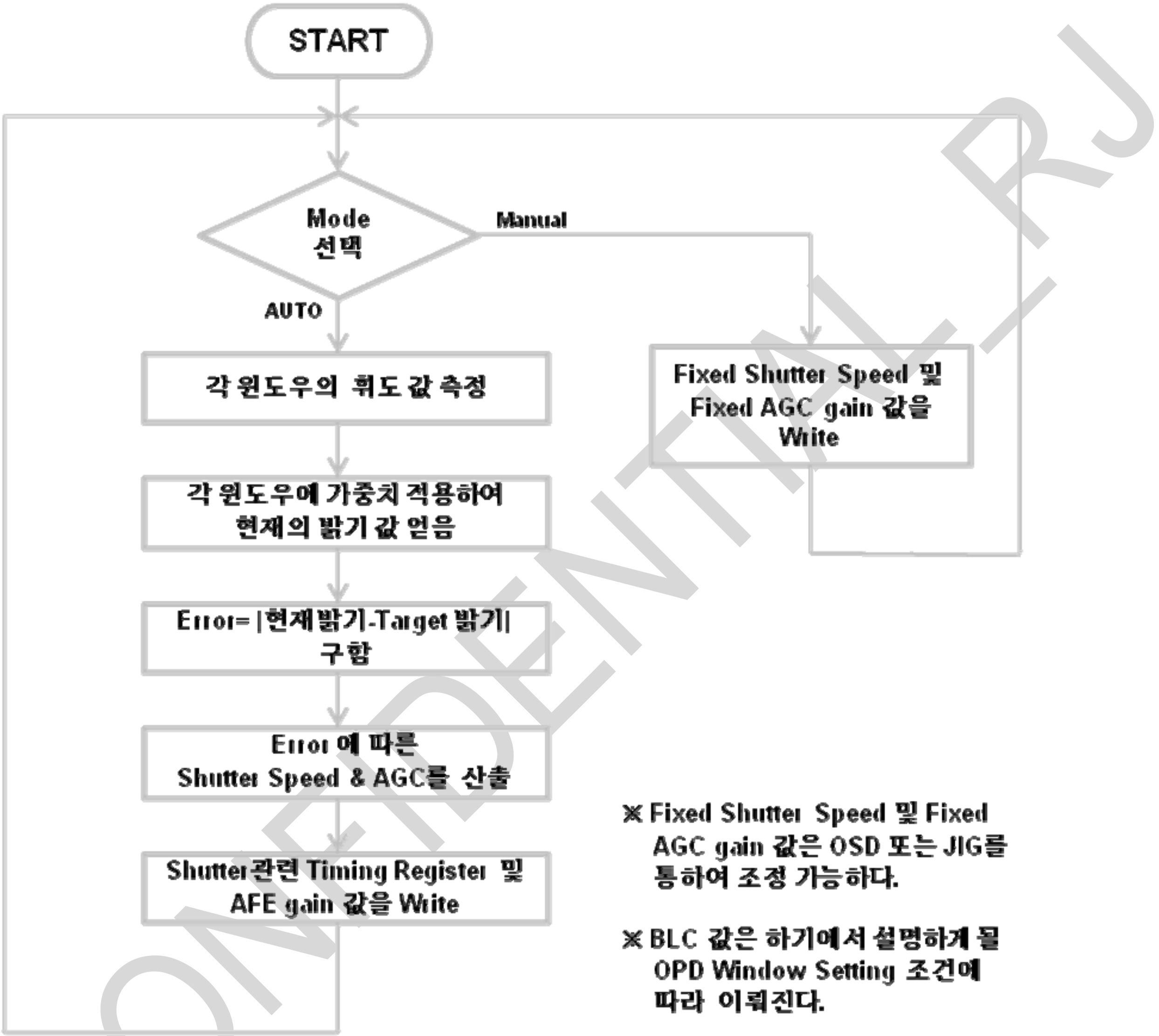
1. AE Operation

1.1 AE Operation Processing Flow

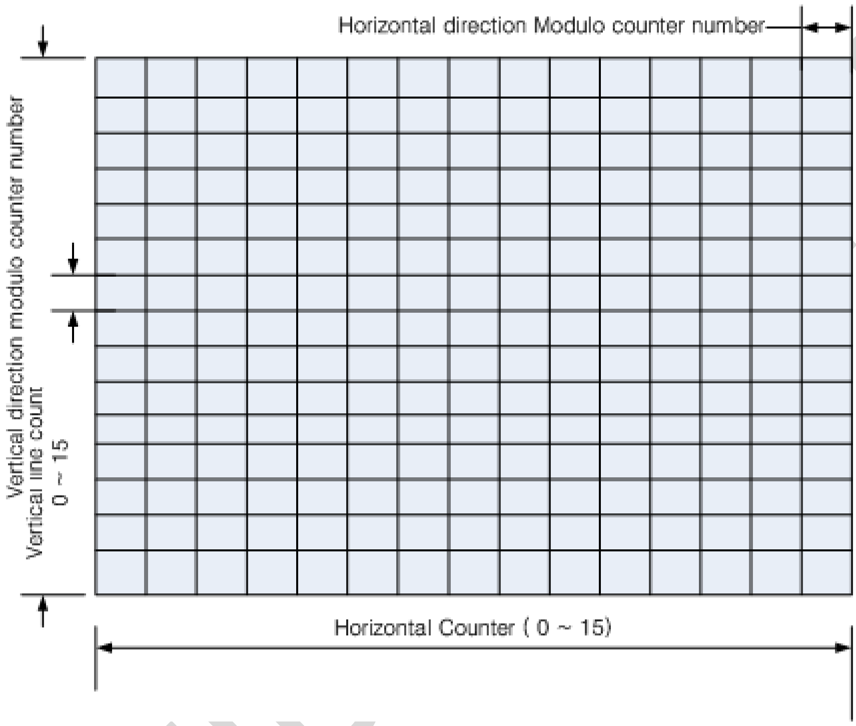


< Figure 1. AE Operation Processing Flow>

1.2 AE Operation Processing Control

● Window

For suitable AE Operation Processing, User should know the light source quantity of image. RJ-11/13 the User can tune the light source quantity for better image effect. User can set the 5 Area for tuning. (AWB case is 4 Area.) The Window is 16 x 16 's modulo counter. Each area is changed from 0 to 15, as The Horizontal pixel X & vertical pixel Y as base counter unit. User can set up Horizontal pixel x & vertical pixel y values, and start modulo count values, end modulo count values.



< Figure 2. AE, AWB Window>

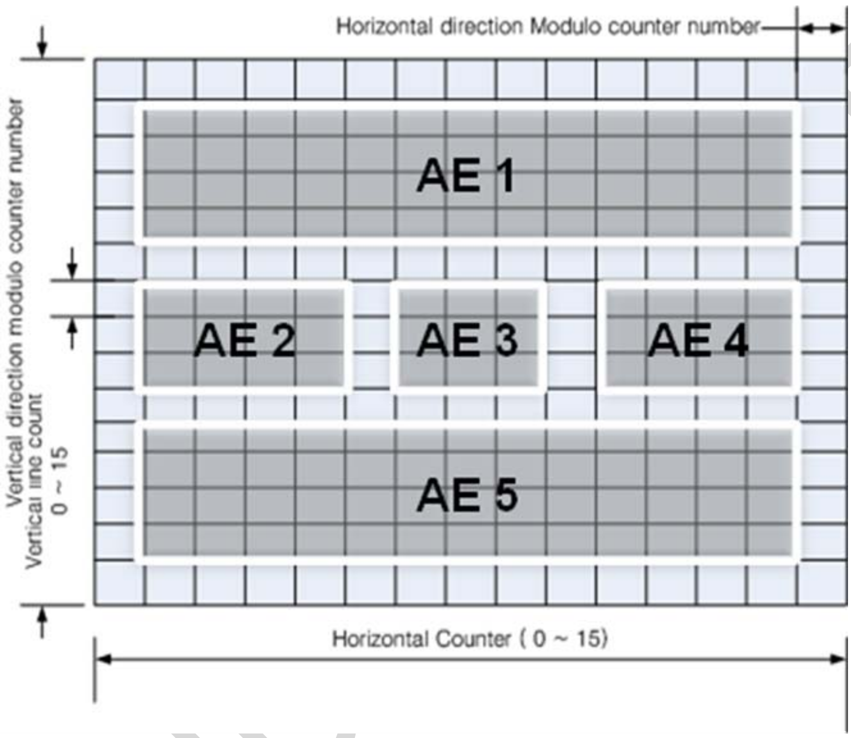
The window setting register is as below register map.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Window Setting					
0x5000	[7:0]	HMOD_Y	0x2D	R/W	When AE, AF each area H pixel number
0x5001	[7:0]	VMOD_Y	0x0F	R/W	When AE, AF each area V line number
0x5004	[1:0]	HWOFFSET[9:8]	0x38	R/W	WINDOWS H OFFSET (same as AWB Window)
0x5005	[7:0]	HWOFFSET[7:0]			
0x5006	[1:0]	VWOFFSET[9:8]	0x08	R/W	WINDOWS V OFFSET (same as AWB Window)
0x5007	[7:0]	VWOFFSET[7:0]			
0x5008	[1:0]	HWWIDTH[9:8]	0x2D0	R/W	WINDOWS HORIZONTAL SIZE (same as AWB Window)
0x5009	[7:0]	HWWIDTH[7:0]			
0x500A	[1:0]	VWWIDTH[9:8]	0x0F0	R/W	WINDOWS VERTICAL SIZE

0x500B	[7:0]	VWWIDTH[7:0]			(same as AWB Window)

● AE Area Register Setting

- 1. Regarding AE1~5 Area, User should be setting AE H-DIRECTION AREA value & AE V-DIRECTION AREA values.



< Figure 3. example of AE Window & setting Area 1~5 >

The Register is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
AE Area Register Setting					
0x5012	[7:0]	AE1_LR[7:0]	0x00	R/W	AE1 H-DIRECTION AREA H- Start area position : AE1_LR[7:4] H- End area position : AE1_LR[3:0]
0x5013	[7:0]	AE1_UD[7:0]	0x00	R/W	AE1 V-DIRECTION AREA V- Start area position : AE1_UD[7:4] V- Start area position : AE1_UD[3:0]
0x5014	[7:0]	AE2_LR[7:0]	0x00	R/W	AE2 H-DIRECTION AREA
0x5015	[7:0]	AE2_UD[7:0]	0x00	R/W	AE2 V-DIRECTION AREA
0x5016	[7:0]	AE3_LR[7:0]	0x00	R/W	AE3 H-DIRECTION AREA

0x5017	[7:0]	AE3_UD[7:0]	0x00	R/W	AE3 V-DIRECTION AREA
0x5018	[7:0]	AE4_LR[7:0]	0x00	R/W	AE4 H-DIRECTION AREA
0x5019	[7:0]	AE4_UD[7:0]	0x00	R/W	AE4 V-DIRECTION AREA
0x501A	[7:0]	AE5_LR[7:0]	0x00	R/W	AE5 H-DIRECTION AREA
0x501B	[7:0]	AE5_UD[7:0]	0x00	R/W	AE5 V-DIRECTION AREA

- 2. Regarding AE Operation, User can check the Y Summation values in each area.
  AE Data's Output Parameter values as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
AE Y Summation Value					
0x5500	[7:0]	AE1_SUM[31:24]	-	R	AE1_SUM
0x5501	[7:0]	AE1_SUM[23:16]			
0x5502	[7:0]	AE1_SUM[15:8]			
0x5503	[7:0]	AE1_SUM[7:0]			
0x5504	[7:0]	AE2_SUM[31:24]	-	R	AE2_SUM
0x5505	[7:0]	AE2_SUM[23:16]			
0x5506	[7:0]	AE2_SUM[15:8]			
0x5507	[7:0]	AE2_SUM[7:0]			
0x5508	[7:0]	AE3_SUM[31:24]	-	R	AE3_SUM
0x5509	[7:0]	AE3_SUM[23:16]			
0x550A	[7:0]	AE3_SUM[15:8]			
0x550B	[7:0]	AE3_SUM[7:0]			
0x550C	[7:0]	AE4_SUM[31:24]	-	R	AE4_SUM
0x550D	[7:0]	AE4_SUM[23:16]			
0x550E	[7:0]	AE4_SUM[15:8]			
0x550F	[7:0]	AE4_SUM[7:0]			
0x5510	[7:0]	AE5_SUM[31:24]	-	R	AE5_SUM
0x5511	[7:0]	AE5_SUM[23:16]			
0x5512	[7:0]	AE5_SUM[15:8]			
0x5513	[7:0]	AE5_SUM[7:0]			

- 3. Regarding AE Operation, the each Area Histogram values as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Histogram Setting					
0x5010	[3:0]	HIST_AREA	0x00	R/W	WINDOWS SELECT (AE1~AE5 select one)
0x5011	[1:0]	HIST_MODE	0x00	R/W	HISTOGRAM value setting
AE Y Histogram Value					

0x5514	[7:0]	HIST_SUM1[23:16]	-	R	HISTOGRAM STEP 1 SUM OUT
0x5515	[7:0]	HIST_SUM1[15:8]			
0x5516	[7:0]	HIST_SUM1[7:0]			
0x5517	[7:0]	HIST_SUM2[23:16]	-	R	HISTOGRAM STEP 2 SUM OUT
0x5518	[7:0]	HIST_SUM2[15:8]			
0x5519	[7:0]	HIST_SUM2[7:0]			
0x551A	[7:0]	HIST_SUM3[23:16]	-	R	HISTOGRAM STEP 3 SUM OUT
0x551B	[7:0]	HIST_SUM3[15:8]			
0x551C	[7:0]	HIST_SUM3[7:0]			
0x551D	[7:0]	HIST_SUM4[23:16]	-	R	HISTOGRAM STEP 4 SUM OUT
0x551E	[7:0]	HIST_SUM4[15:8]			
0x551F	[7:0]	HIST_SUM4[7:0]			
0x5520	[7:0]	HIST_SUM5[23:16]	-	R	HISTOGRAM STEP 5 SUM OUT
0x5521	[7:0]	HIST_SUM5[15:8]			
0x5522	[7:0]	HIST_SUM5[7:0]			
0x5523	[7:0]	HIST_SUM6[23:16]	-	R	HISTOGRAM STEP 6 SUM OUT
0x5524	[7:0]	HIST_SUM6[15:8]			
0x5525	[7:0]	HIST_SUM6[7:0]			
0x5526	[7:0]	HIST_SUM7[23:16]	-	R	HISTOGRAM STEP 7 SUM OUT
0x5527	[7:0]	HIST_SUM7[15:8]			
0x5528	[7:0]	HIST_SUM7[7:0]			
0x5529	[7:0]	HIST_SUM8[23:16]	-	R	HISTOGRAM STEP 8 SUM OUT
0x552A	[7:0]	HIST_SUM8[15:8]			
0x552B	[7:0]	HIST_SUM8[7:0]			
0x552C	[7:0]	HIST_SUM9[23:16]	-	R	HISTOGRAM STEP 9 SUM OUT
0x552D	[7:0]	HIST_SUM9[15:8]			
0x552E	[7:0]	HIST_SUM9[7:0]			
0x552F	[7:0]	HIST_SUM10[23:16]	-	R	HISTOGRAM STEP 10 SUM OUT
0x5530	[7:0]	HIST_SUM10[15:8]			
0x5531	[7:0]	HIST_SUM10[7:0]			
0x5532	[7:0]	HIST_SUM11[23:16]	-	R	HISTOGRAM STEP 11 SUM OUT
0x5533	[7:0]	HIST_SUM11[15:8]			
0x5534	[7:0]	HIST_SUM11[7:0]			
0x5535	[7:0]	HIST_SUM12[23:16]	-	R	HISTOGRAM STEP 12 SUM OUT
0x5536	[7:0]	HIST_SUM12[15:8]			
0x5537	[7:0]	HIST_SUM12[7:0]			
0x5538	[7:0]	HIST_SUM13[23:16]	-	R	HISTOGRAM STEP 13 SUM OUT
0x5539	[7:0]	HIST_SUM13[15:8]			

0x553A	[7:0]	HIST_SUM13[7:0]			
0x553B	[7:0]	HIST_SUM14[23:16]	-	R	HISTOGRAM STEP 14 SUM OUT
0x553C	[7:0]	HIST_SUM14[15:8]			
0x553D	[7:0]	HIST_SUM14[7:0]			
0x553E	[7:0]	HIST_SUM15[23:16]	-	R	HISTOGRAM STEP 15 SUM OUT
0x553F	[7:0]	HIST_SUM15[15:8]			
0x5540	[7:0]	HIST_SUM15[7:0]			
0x5541	[7:0]	HIST_SUM16[23:16]	-	R	HISTOGRAM STEP 16 SUM OUT
0x5542	[7:0]	HIST_SUM16[15:8]			
0x5543	[7:0]	HIST_SUM16[7:0]			
0x5544	[7:0]	HIST_SUM17[23:16]	-	R	HISTOGRAM STEP 17 SUM OUT
0x5545	[7:0]	HIST_SUM17[15:8]			
0x5546	[7:0]	HIST_SUM17[7:0]			
0x5547	[7:0]	HIST_SUM18[23:16]	-	R	HISTOGRAM STEP 18 SUM OUT
0x5548	[7:0]	HIST_SUM18[15:8]			
0x5549	[7:0]	HIST_SUM18[7:0]			
0x554A	[7:0]	HIST_SUM19[23:16]	-	R	HISTOGRAM STEP 19 SUM OUT
0x554B	[7:0]	HIST_SUM19[15:8]			
0x554C	[7:0]	HIST_SUM19[7:0]			
0x554D	[7:0]	HIST_SUM20[23:16]	-	R	HISTOGRAM STEP 20 SUM OUT
0x554E	[7:0]	HIST_SUM20[15:8]			
0x554F	[7:0]	HIST_SUM20[7:0]			
0x5550	[7:0]	HIST_SUM21[23:16]	-	R	HISTOGRAM STEP 21 SUM OUT
0x5551	[7:0]	HIST_SUM21[15:8]			
0x5552	[7:0]	HIST_SUM21[7:0]			
0x5553	[7:0]	HIST_SUM22[23:16]	-	R	HISTOGRAM STEP 22 SUM OUT
0x5554	[7:0]	HIST_SUM22[15:8]			
0x5555	[7:0]	HIST_SUM22[7:0]			
0x5556	[7:0]	HIST_SUM23[23:16]	-	R	HISTOGRAM STEP 23 SUM OUT
0x5557	[7:0]	HIST_SUM23[15:8]			
0x5558	[7:0]	HIST_SUM23[7:0]			
0x5559	[7:0]	HIST_SUM24[23:16]	-	R	HISTOGRAM STEP 24 SUM OUT
0x555A	[7:0]	HIST_SUM24[15:8]			
0x555B	[7:0]	HIST_SUM24[7:0]			
0x555C	[7:0]	HIST_SUM25[23:16]	-	R	HISTOGRAM STEP 25 SUM OUT
0x555D	[7:0]	HIST_SUM25[15:8]			
0x555E	[7:0]	HIST_SUM25[7:0]			
0x555F	[7:0]	HIST_SUM26[23:16]	-	R	HISTOGRAM STEP 26 SUM OUT

0x5560	[7:0]	HIST_SUM26[15:8]			
0x5561	[7:0]	HIST_SUM26[7:0]			
0x5562	[7:0]	HIST_SUM27[23:16]			
0x5563	[7:0]	HIST_SUM27[15:8]	-	R	HISTOGRAM STEP 27 SUM OUT
0x5564	[7:0]	HIST_SUM27[7:0]			
0x5565	[7:0]	HIST_SUM28[23:16]			
0x5566	[7:0]	HIST_SUM28[15:8]	-	R	HISTOGRAM STEP 28 SUM OUT
0x5567	[7:0]	HIST_SUM28[7:0]			
0x5568	[7:0]	HIST_SUM29[23:16]			
0x5569	[7:0]	HIST_SUM29[15:8]	-	R	HISTOGRAM STEP 29 SUM OUT
0x556A	[7:0]	HIST_SUM29[7:0]			
0x556B	[7:0]	HIST_SUM30[23:16]			
0x556C	[7:0]	HIST_SUM30[15:8]	-	R	HISTOGRAM STEP 30 SUM OUT
0x556D	[7:0]	HIST_SUM30[7:0]			
0x556E	[7:0]	HIST_SUM31[23:16]			
0x556F	[7:0]	HIST_SUM31[15:8]	-	R	HISTOGRAM STEP 31 SUM OUT
0x5570	[7:0]	HIST_SUM31[7:0]			
0x5571	[7:0]	HIST_SUM32[23:16]			
0x5572	[7:0]	HIST_SUM32[15:8]	-	R	HISTOGRAM STEP 32 SUM OUT
0x5573	[7:0]	HIST_SUM32[7:0]			

HISTOGRAM STEP	HIST_MODE = 2'B00	HIST_MODE = 2'B01,ODD	HIST_MODE = 2'B01,EVEN	HIST_MODE = 2'B10	HIST_MODE = 2'B11
1	0 – 31	16 – 31	0 – 15	0 – 15	512 – 527
2	32 – 63	48 – 63	32 – 47	16 – 31	528 – 543
3	64 – 96	80 – 97	64 – 79	32 – 49	544 – 559
4	96 – 127	112 – 127	96 – 111	48 – 63	560 – 575
5	128 – 159	114 – 159	128 – 143	64 – 79	576 – 591
6	160 – 191	176 – 191	160 – 175	80 – 95	592 – 607
7	192 – 223	208 – 223	192 – 207	96 – 111	608 – 623
8	224 – 255	240 – 255	224 – 239	112 – 127	624 – 639
9	256 – 287	272 – 287	256 – 271	128 – 143	640 – 655
10	288 – 319	304 – 319	288 – 303	144 – 159	656 – 671
11	320 – 351	336 – 351	320 – 335	160 – 175	672 – 687
12	352 – 383	368 – 383	352 – 367	176 – 191	688 – 703
13	384 – 415	400 – 415	384 – 399	192 – 207	704 – 719
14	416 – 447	432 – 447	416 – 431	208 – 223	720 – 735

15	448 – 479	464 – 479	448 – 463	224 – 239	736 – 751
16	480 – 511	496 – 511	480 – 495	240 – 255	752 – 767
17	512 – 543	528 – 543	512 – 527	256 – 271	768 – 783
18	544 – 575	560 – 575	544 – 559	272 – 287	784 – 799
19	576 – 607	692 – 607	576 – 591	288 – 303	800 – 815
20	608 – 639	624 – 639	608 – 623	304 – 319	816 – 831
21	640 – 671	656 – 671	640 – 655	320 – 335	832 – 847
22	672 – 703	688 – 703	672 – 687	336 – 351	848 – 863
23	704 – 735	720 – 735	704 – 719	352 – 367	864 – 879
24	736 – 767	752 – 767	736 – 751	368 – 383	880 – 895
25	768 – 799	784 – 799	768 – 783	384 – 399	896 – 911
26	800 – 831	816 – 831	800 – 815	400 – 415	912 – 927
27	832 – 863	848 – 863	832 – 847	416 – 431	928 – 943
28	864 – 895	880 – 895	864 – 879	432 – 447	944 – 959
29	896 – 927	912 – 927	896 – 911	448 – 463	960 – 975
30	928 – 959	944 – 959	928 – 943	464 – 479	976 – 991
31	960 – 991	976 – 991	960 – 975	480 – 495	992 – 1007
32	992 – 1023	1008 – 1023	992 - 1007	496 – 511	1008 – 1023

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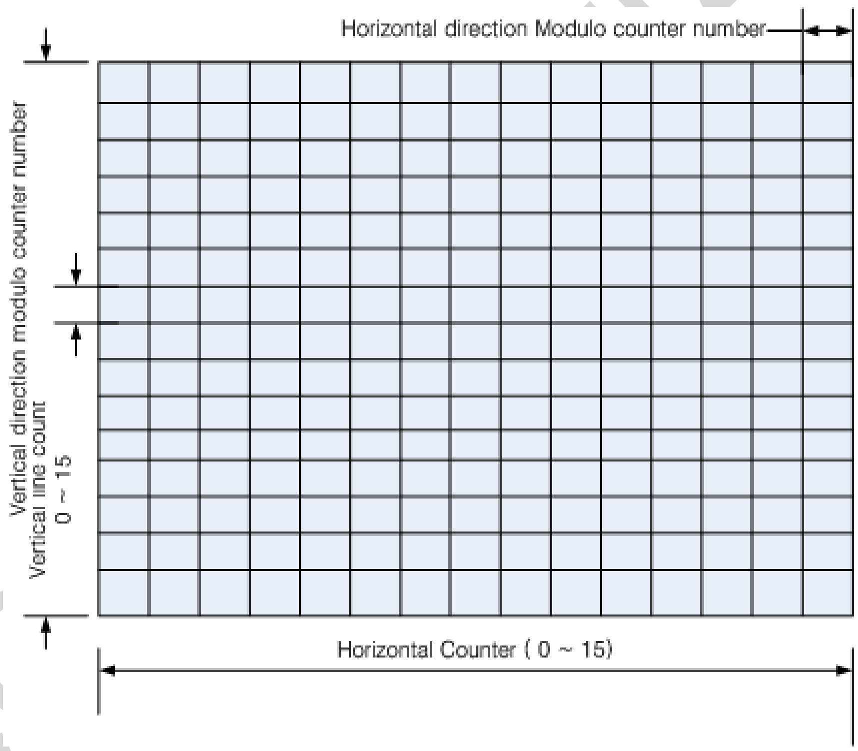
1. AWB Operation

1.1 AWB Window

● Window Setting

User should have a idea of the quatity of R, G, B values of the image for AWB Operation Processing. RJ-11/13 can set up the area by user to get the imformation of R, G, B. User can set 4 Area. (AE case is 5 Area, WPD case is 1 Area). The Window is 16 x 16 's modulo counter.
Each area is changed from 0 to 15, as The Horizontal pixel X & vertical pixel Y as base counter unit.
User can set up Horizontal pixel x & vertical pixel y values, and start modulo count values, end modulo count values.



< Figure 1. WGA, WPD, AE Window>

The window setting register is as below register map.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
AWB Window Setting					
0x5002	[7:0]	HMOD_WB	0x2D	R/W	AWB each area H pixel number
0x5003	[7:0]	VMOD_WB	0x0F	R/W	AWB each area V Line number

0x5004	[1:0]	HWOFFSET[9:8]	0x38	R/W	WINDOWS H OFFSET
0x5005	[7:0]	HWOFFSET[7:0]			(same as AE Window)
0x5006	[1:0]	VWOFFSET[9:8]	0x08	R/W	WINDOWS V OFFSET
0x5007	[7:0]	VWOFFSET[7:0]			(same as AE Window)
0x5008	[1:0]	HWWIDTH[9:8]	0x2D0	R/W	WINDOWS HORIZONTAL SIZE
0x5009	[7:0]	HWWIDTH[7:0]			(same as AE Window)
0x500A	[1:0]	VWWIDTH[9:8]	0x0F0	R/W	WINDOWS VERTICAL SIZE
0x500B	[7:0]	VWWIDTH[7:0]			(same as AE Window)

● Y Signal Selection

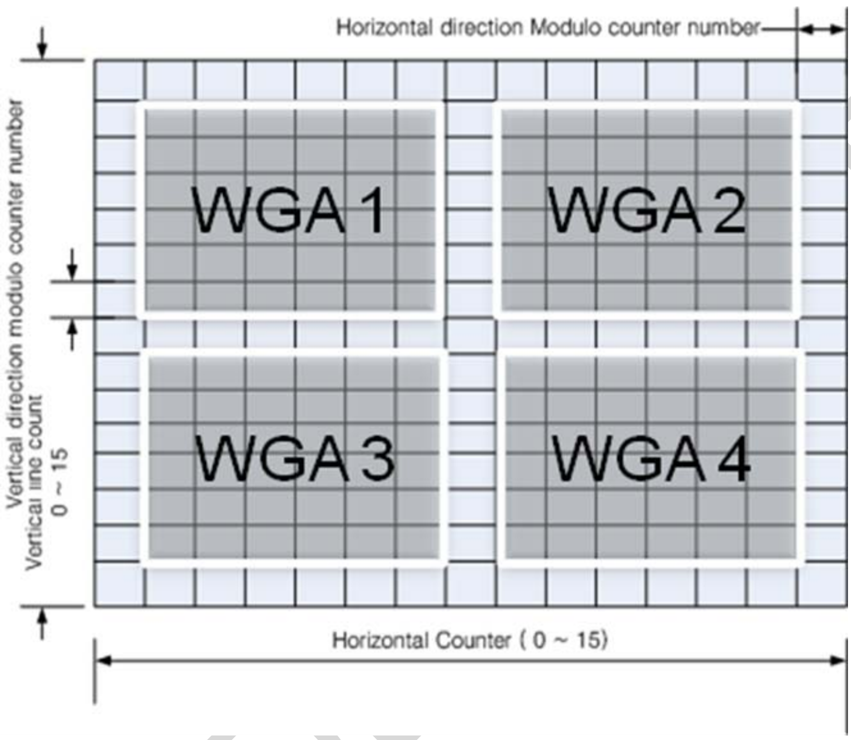
-User should select which kind of Algorithm Y for the AWB Operation Processing.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Luminance Select					
0x5060	[2:1]	LUM_SELECT	0x00	R/W	Select Y Definition. 2’b00, Y = 0.3R + 0.6G + 0.1B 2’b01, Y = (R + 2*G + B) /4 2’b10, Y = G 2’b11, Y = (R + G + B) / 3

1.2 WGA (World Grey Assumption) Operation Processing

● WGA Area Register Setting

- 1. Regarding WGA 1~4 Area, setting method WGA Left/Right boundary & WGA Upper/Down Boundary. Below is example of setting method. User can set the Area by himself.



< Figure 2. WGA Window & setting Area 1~4>

WGA Area Setting Register is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
WGA Area Register Setting					
0x5054	[7:4]	WGA1_LR[7:4]	0x00	R/W	WGA1_LR AREA
	[3:0]	WGA1_LR[3:0]			
0x5055	[7:4]	WGA1_UD[7:4]	0x00	R/W	WGA1_UD AREA
	[3:0]	WGA1_UD[3:0]			
0x5056	[7:4]	WGA2_LR[7:4]	0x00	R/W	WGA2_LR AREA
	[3:0]	WGA2_LR[3:0]			
0x5057	[7:4]	WGA2_UD[7:4]	0x00	R/W	WGA2_UD AREA
	[3:0]	WGA2_UD[3:0]			
0x5058	[7:4]	WGA3_LR[7:4]	0x00	R/W	WGA3_LR AREA
	[3:0]	WGA3_LR[3:0]			

0x5059	[7:4]	WGA3_UD[7:4]	0x00	R/W	WGA3_UD AREA
	[3:0]	WGA3_UD[3:0]			
0x505A	[7:4]	WGA4_LR[7:4]	0x00	R/W	WGA4_LR AREA
	[3:0]	WGA4_LR[3:0]			
0x505B	[7:4]	WGA4_UD[7:4]	0x00	R/W	WGA4_UD AREA
	[3:0]	WGA4_UD[3:0]			

- 2. Regarding WGA Operation, we can get the values of each Area R,G,B Summation.

WGA Data Output Parameter values is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
WGA R,G,B Summation Value					
0x55BC	[7:0]	RSUM1[31:24]	-	R	WGA1 AREA R SUM
0x55BD	[7:0]	RSUM1[23:16]			
0x55BE	[7:0]	RSUM1[15:8]			
0x55BF	[7:0]	RSUM1[7:0]			
0x55C0	[7:0]	GSUM1[31:24]	-	R	WGA1 AREA G SUM
0x55C1	[7:0]	GSUM1[23:16]			
0x55C2	[7:0]	GSUM1[15:8]			
0x55C3	[7:0]	GSUM1[7:0]			
0x55C4	[7:0]	BSUM1[31:24]	-	R	WGA1 AREA B SUM
0x55C5	[7:0]	BSUM1[23:16]			
0x55C6	[7:0]	BSUM1[15:8]			
0x55C7	[7:0]	BSUM1[7:0]			
0x55C8	[7:0]	RSUM2[31:24]	-	R	WGA2 AREA R SUM
0x55C9	[7:0]	RSUM2[23:16]			
0x55CA	[7:0]	RSUM2[15:8]			
0x55CB	[7:0]	RSUM2[7:0]			
0x55CC	[7:0]	GSUM2[31:24]	-	R	WGA2 AREA G SUM
0x55CD	[7:0]	GSUM2[23:16]			
0x55CE	[7:0]	GSUM2[15:8]			
0x55CF	[7:0]	GSUM2[7:0]			
0x55D0	[7:0]	BSUM2[31:24]	-	R	WGA2 AREA B SUM
0x55D1	[7:0]	BSUM2[23:16]			
0x55D2	[7:0]	BSUM2[15:8]			
0x55D3	[7:0]	BSUM2[7:0]			
0x55D4	[7:0]	RSUM3[31:24]	-	R	WGA3 AREA R SUM
0x55D5	[7:0]	RSUM3[23:16]			
0x55D6	[7:0]	RSUM3[15:8]			

0x55D7	[7:0]	RSUM3[7:0]			
0x55D8	[7:0]	GSUM3[31:24]	-	R	WGA3 AREA G SUM
0x55D9	[7:0]	GSUM3[23:16]			
0x55DA	[7:0]	GSUM3[15:8]			
0x55DB	[7:0]	GSUM3[7:0]			
0x55DC	[7:0]	BSUM3[31:24]	-	R	WGA3 AREA B SUM
0x55DD	[7:0]	BSUM3[23:16]			
0x55DE	[7:0]	BSUM3[15:8]			
0x55DF	[7:0]	BSUM3[7:0]			
0x55E0	[7:0]	RSUM4[31:24]	-	R	WGA4 AREA R SUM
0x55E1	[7:0]	RSUM4[23:16]			
0x55E2	[7:0]	RSUM4[15:8]			
0x55E3	[7:0]	RSUM4[7:0]			
0x55E4	[7:0]	GSUM4[31:24]	-	R	WGA4 AREA G SUM
0x55E5	[7:0]	GSUM4[23:16]			
0x55E6	[7:0]	GSUM4[15:8]			
0x55E7	[7:0]	GSUM4[7:0]			
0x55E8	[7:0]	BSUM4[31:24]	-	R	WGA4 AREA B SUM
0x55E9	[7:0]	BSUM4[23:16]			
0x55EA	[7:0]	BSUM4[15:8]			
0x55EB	[7:0]	BSUM4[7:0]			

- 3. Regarding WGA Operation, each Area's Reference White Pixel values as below.
  WGA Data Output Parameter values is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
WGA Reference White Pixels Numbers					
0x55EC	[7:0]	WGA1C[23:16]	-	R	WGA1 AREA COUNT
0x55ED	[7:0]	WGA1C[15:8]			
0x55EE	[7:0]	WGA1C[7:0]			
0x55EF	[7:0]	WGA2C[23:16]	-	R	WGA2 AREA COUNT
0x55F0	[7:0]	WGA2C[15:8]			
0x55F1	[7:0]	WGA2C[7:0]			
0x55F2	[7:0]	WGA3C[23:16]	-	R	WGA3 AREA COUNT
0x55F3	[7:0]	WGA3C[15:8]			
0x55F4	[7:0]	WGA3C[7:0]			
0x55F5	[7:0]	WGA4C[23:16]	-	R	WGA4 AREA COUNT

0x55F6	[7:0]	WGA4C[15:8]			
0x55F7	[7:0]	WGA4C[7:0]			

1.3 WPD (White Point Discrimination) Operation Processing

● WPD Area Register Setting

- WPD set up only one WPD Left/Right boundary & WGA Upper/Down boundary.
(As we mentioned, the AE, WGA, WPD has a same Window.)

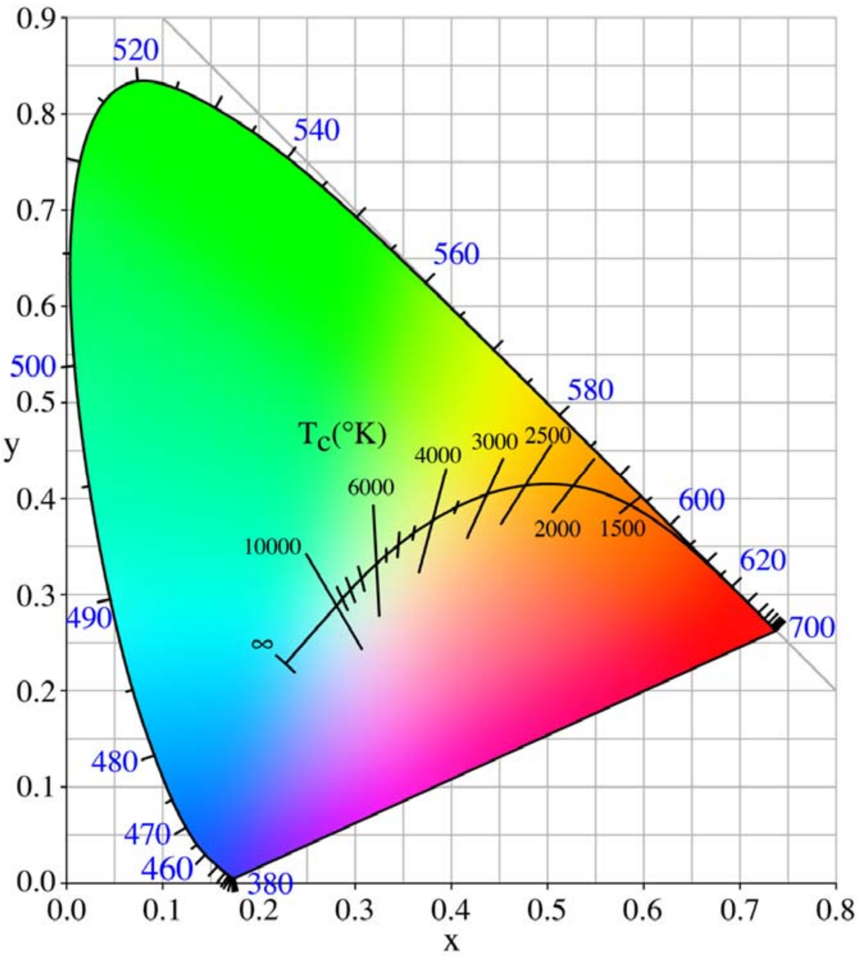
ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
AWB Window Setting					
0x5002	[7:0]	HMOD_WB	0x2D	R/W	AWB each area H pixel number
0x5003	[7:0]	VMOD_WB	0x0F	R/W	AWB each area V Line number
0x5060	[0]	WPD _DISP	0x0	R/W	WHITE PIXEL DISPLAY ON/OFF
0x5061	[7:0]	WPD_LR	0x00	R/W	WPD H-DIRECTION AREA H- Start area position : WPD_LR[7:4] H- End area position : WPD_LR[3:0]
0x5062	[7:0]	WPD_UD	0x00	R/W	WPD V-DIRECTION AREA V- Start area position : WPD_UD[7:4] V- End area position : WPD_UD[3:0]

- Regarding WPD Operation, we can check the each Area R,G,B ,Y Summation & White Pixel number. The WPD Data Output Parameter values is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
WPD R,G,B Summation Value					
0x55F8	[7:0]	WPD_R[31:24]	-	R	WHITE PIXEL R SUM
0x55F9	[7:0]	WPD_R[23:16]			
0x55FA	[7:0]	WPD_R[15:8]			
0x55FB	[7:0]	WPD_R[7:0]			
0x55FC	[7:0]	WPD_G[31:24]	-	R	WHITE PIXEL G SUM
0x55FD	[7:0]	WPD_G[23:16]			
0x55FE	[7:0]	WPD_G[15:8]			
0x55FF	[7:0]	WPD_G[7:0]			
0x5600	[7:0]	WPD_B[31:24]	-	R	WHITE PIXEL B SUM
0x5601	[7:0]	WPD_B[23:16]			
0x5602	[7:0]	WPD_B[15:8]			
0x5603	[7:0]	WPD_B[7:0]			
0x5604	[7:0]	WPD_Y[31:24]	-	R	WHITE PIXEL Y SUM
0x5605	[7:0]	WPD_Y[23:16]			

0x5606	[7:0]	WPD_Y[15:8]			
0x5607	[7:0]	WPD_Y[7:0]			
0x5608	[7:0]	WPD_C[23:16]	-	R	WHITE PIXEL Y SUM
0x5609	[7:0]	WPD_C[15:8]			
0x560A	[7:0]	WPD_C[7:0]			

- Reference White testing result is the pixel number of black body's curve area.



< Figure 3. When CIE 1931 black body curve >

1.4 Color Gain Control

After AWB Setting, User can change the Gain values of color to get their request.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Color Gain Control After AWB Setting					
0x4109	[7:0]	G_AWBG	0x00	R/W	AWB GAIN OF G
0x410A	[7:0]	R_AWBG	0x00	R/W	AWB GAIN OF R
0x410B	[7:0]	B_AWBG	0x00	R/W	AWB GAIN OF B

RJ-11/13
HighLight Inversion

APPLICATION NOTE Ver 1.0

RJ-11/13

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1. Highlight Inversion

1.1 Highlight Inversion

High Luminance image will be effective AE function as making Shutter quickly or reducing the Gain. If one frame has a very high Luminance values area, AE will make a dark background image for the very high Luminance area. So that's why too high Luminiance values make a bad image. We should make a too high Luminance values reduce to get better image.

1.2 Highlight Inversion Register

RJ-11/13 Highlight Inversion Registeris as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Highlight Inversion					
0x4015	1	HILIGHT_CHROMA_OFF	0	R/W	Gray mode
0x4015	0	HILIGHT_INV_MODE	0	R/W	Highlight inversion mode 1: enable 0: disable
0x4016	[7:0]	HILIGHT_HISTO_HI_LEVEL[9:2]	0xe0	R/W	Bigger than Highlight_histo_hi_level Luminance values make highlightsaturation values. [1:0] = 2'b11
0x4017	[7:0]	HILIGHT_SATURATION [9:2]	0x08	R/W	Cut off the High Luminance values is changing to Highlight_histo_hi_level [1:0] = 2'b00

In-door condition, HLI function testing values is as below.

- HILIGHT_HISTO_HI_LEVEL = 0xC0
- HILIGHT_SATURATION = 0x28

(※ Above values is only for Recommend.)

RJ-11/13_LSC

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1. LSC

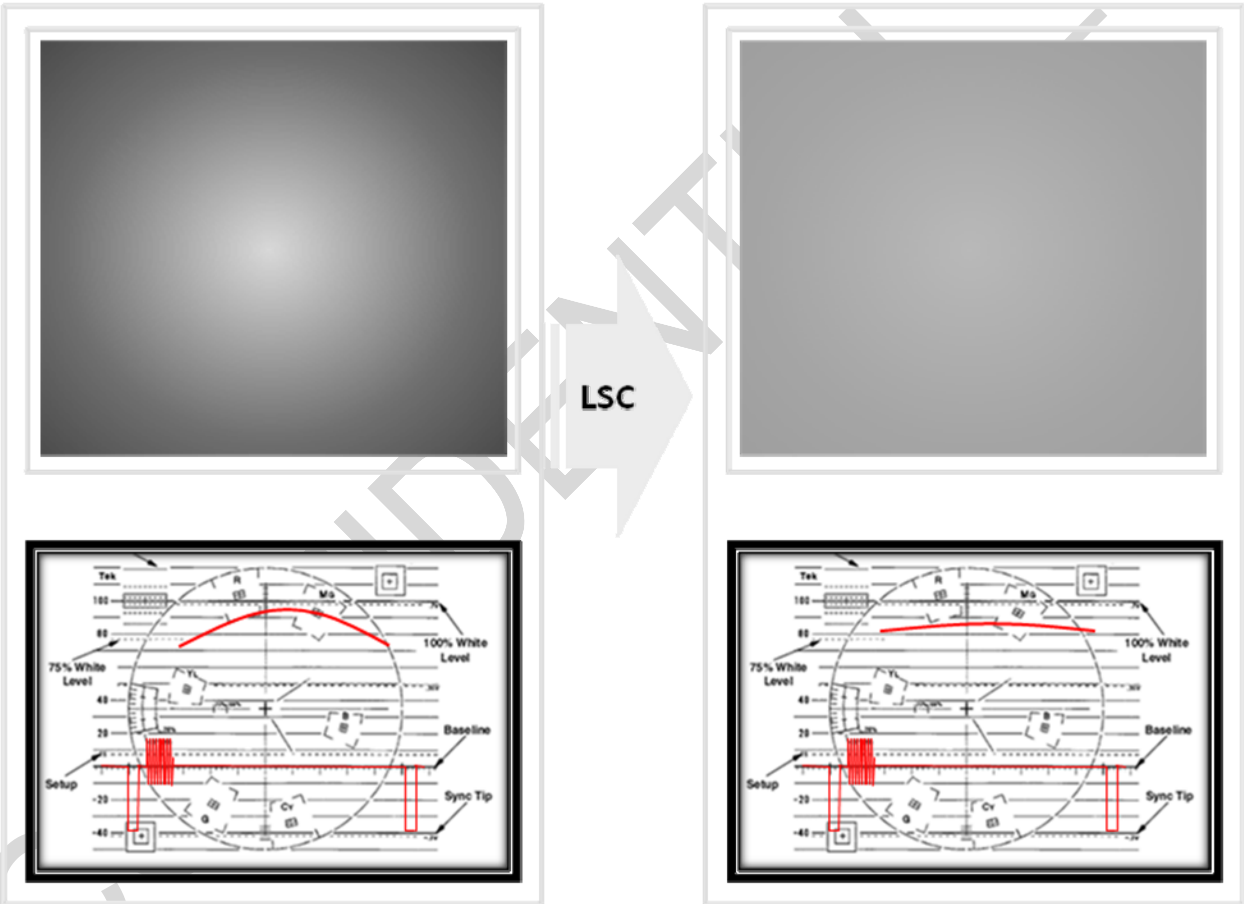
1.1 LSC

LSC is the initial of Lens Shading Correction.

Image on the screen, the center area is brighter than corner because of different distance of camera lens and CCD sensor. LSC is the function to compensation of this weak point.

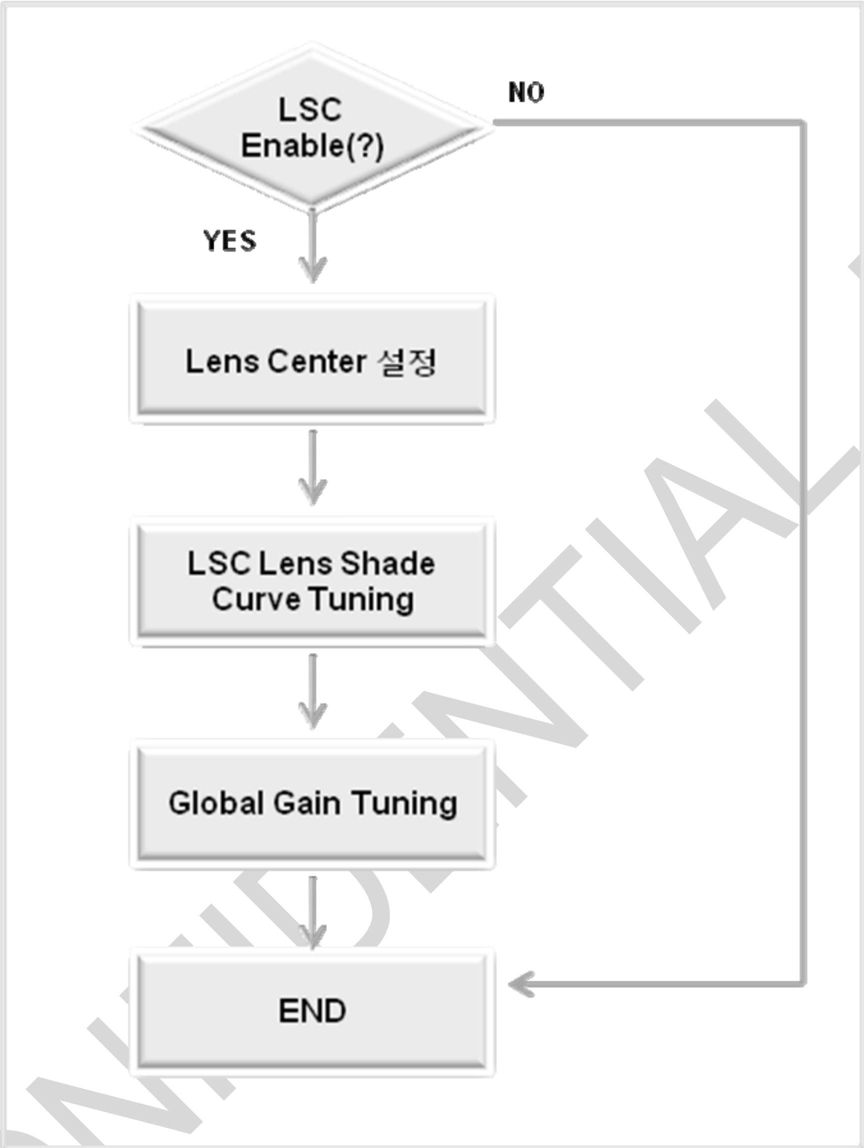
RJ-11/13 support as 4 kind of LSC of A, B, C, D as Color Filter Array Shading Correction Curve.

Each Curve devide as 32 Point, each point can control the Gain values. Point Gain is controlled by Bi-cubic Interpolation as working as Linear curve. Each Curve can set up the Center & Global Gain.



< Figure 1. LSC Function >

1.2 LSC Flow



● LSC Enable/Disable setting

- LSC function On/Off setting

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
LSC _enable					
0x4400	0	LSC_enable	0	RW	LSC enable

● Lens Center setting

- Each customer have a different lens, it should be set up Lens Center first before using LSC mode. .

Lens Center setting method is as below.

1. Set up the lens on the board and cover the lens with White Paper.
2. Avalable setting 32 point Curve arrange it from center to corner.

   The Register values as below. (0x4501~0x4580)

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Lens Center Setting					
0x4500	0	Sample_enable	0	RW	1 : Sampling mode enable 0 : disable
0x4501	3:0	LOCATE_00_X_T	0	RW	Location X[11:8](horizontal)
0x4502	7:0	LOCATE_00_X_B	0	RW	Location X[7:0] (horizontal)
…	…	…	…	…	…
0x457f	3:0	LOCATE_31_Y_T	0	RW	Location Y[11:8](vertical)
0x4580	7:0	LOCATE_31_Y_B	0	RW	Location Y[7:0] (vertical)

3. User can read the setting Point values through as below Register. (CAPTURE_DATA)

   Among them, the biggest value is Lens Center.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
CAPTURE_DATA					
0x4581	1:0	CAPTURE_DATA_00_T	0	R	Captured data[9:8] for Locate_00
0x4582	7:0	CAPTURE_DATA_00_B	0	R	Captured data[7:0] for Locate_00
…	…	…	…	…	…
0x45bf	1:0	CAPTURE_DATA_31_T	0	R	Captured data[9:8] for Locate_31
0x45c0	7:0	CAPTURE_DATA_31_B	0	R	Captured data[7:0] for Locate_31

4. Put the biggest CAPTURE_DATA's X,Y values into below Register.

   (LSC_CENTER_H_F1, LSC_CENTER_V_F1 is for F/W Register, normally

   Put it LSC_CENTER_H_F0, LSC_CENTER_V_F0 same value.)

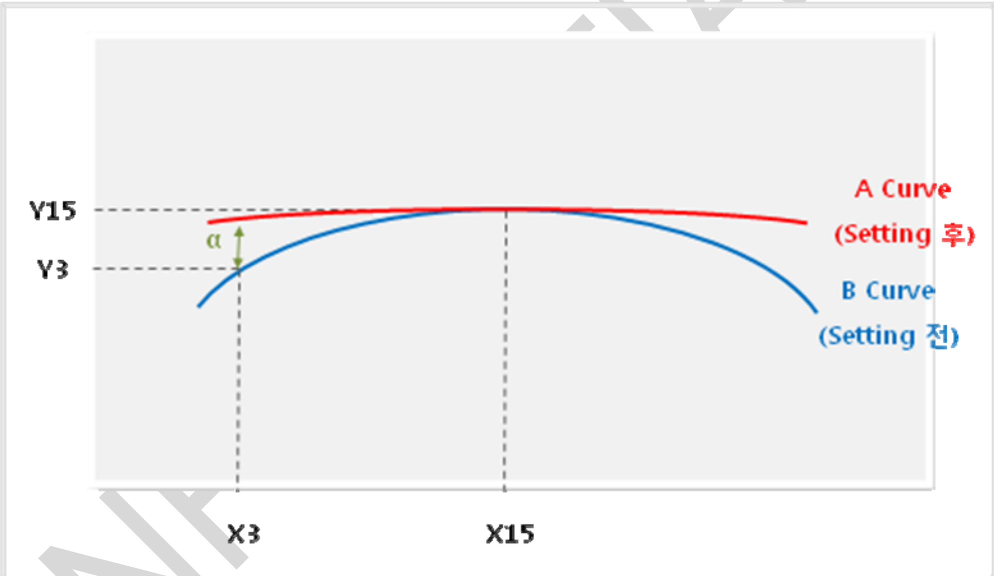
ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
LSC Center					
0x4401	3:0	LSC_A_CENTER_H_F0_T	0x1	RW	center_h_f0[11:8]
0x4402	7:0	LSC_A_CENTER_H_F0_B	0x90	RW	center_h_f0[7:0]
0x4403	3:0	LSC_A_CENTER_V_F0_T	0x0	RW	center_v_f0[11:8]
0x4404	7:0	LSC_A_CENTER_V_F0_B	0x82	RW	center_v_f0[7:0]
0x4405	3:0	LSC_A_CENTER_H_F1_T	0x1	RW	center_h_f1[11:8]

0x4406	7:0	LSC_A_CENTER_H_F1_B	0x90	RW	center_h_f1[7:0]
0x4407	3:0	LSC_A_CENTER_V_F1_T	0x0	RW	center_v_f1[11:8]
0x4408	7:0	LSC_A_CENTER_V_F1_B	0x82	RW	center_v_f1[7:0]

* The other LSC B,C,D also setting as using same method.
(Normaly, User use same A Setting same values for B,C,D Register.)

● LSC Shade Curve Setting

- After Lens Center setting, user change the Gain values to get good image.
  1. Avalable setting 32 point Curve arrange it from center to corner (0x4501~0x4580)
  2. Setting Point values can get through (CAPTURE_DATA 0x4581~0x45c0).



3. To get the good curve, we should add suitable Gain for the values.
   For example, User want to get A Curve, user should know the B curve X,Y values first, and then add Gain α to get the similar curve as A curve.
4. Each Curve's 32 Point Gain value put it into below Register.
   (Normaly A setting values is same as B,C,D Register.)

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
LSC Gain Setting					
0x440b	7:0	LSC_A_GAIN_00	0	RW	gain_00
0x440c	7:0	LSC_A_GAIN_01	0	RW	gain_01
…	…	…	…	…	…

0x4429	7:0	LSC_A_GAIN_30	174	RW	gain_30
0x442a	7:0	LSC_A_GAIN_31	174	RW	gain_31

● Global Gain Setting

- Above method is each 32 Point's Gain value tuning. Global Gain Setting is total Curve's Gain value.
  (Normaly put it A Setting values for B,C,D Register.)

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
LSC Global Gain Setting					
0x44a9	7:0	LSC_A_GAIN	5	RW	LSC_GAIN * LSC_Result resolution = 1/16 ex. 5 => gain = 5/16
0x44aa	7:0	LSC_B_GAIN	5	RW	LSC_GAIN * LSC_Result resolution = 1/16 ex. 5 => gain = 5/16
0x44ab	7:0	LSC_C_GAIN	5	RW	LSC_GAIN * LSC_Result resolution = 1/16 ex. 5 => gain = 5/16
0x44ac	7:0	LSC_D_GAIN	5	RW	LSC_GAIN * LSC_Result resolution = 1/16 ex. 5 => gain = 5/16

RJ-11/13

Defect Pixel Cancelling

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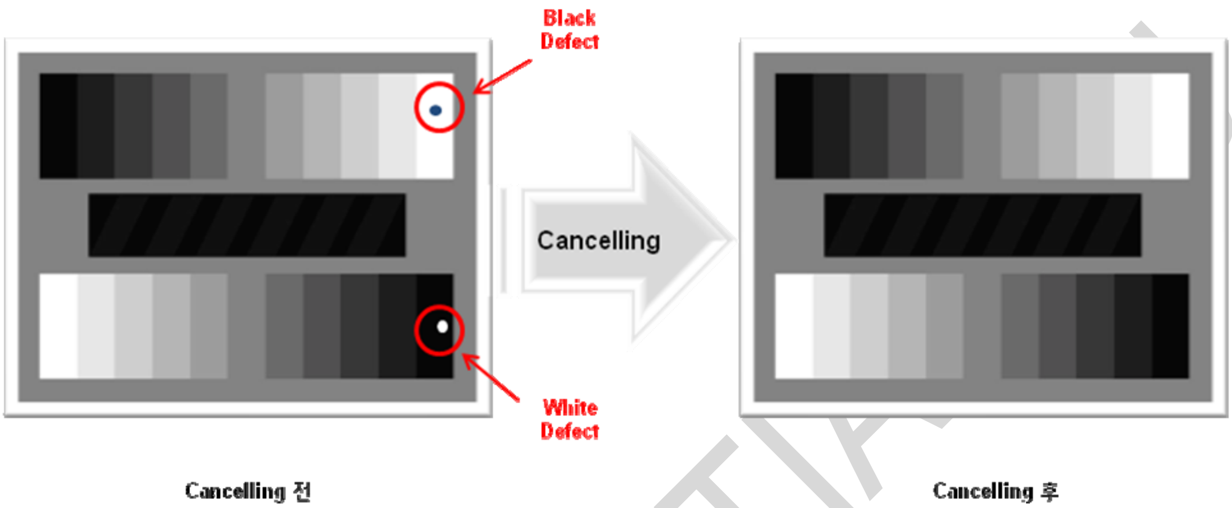
1. Defect Pixel Cancelling

1.1 Defect Pixel Cancelling

RJ-11/13 can compensate White Defect, Black Defect for CCD sensor.



1.2 Register

RJ-11/13 Defect Pixel Cancelling Register is as below.

ADDR	BITS	NAME	RESET	MODE	DESCRIPTION
Defect Pixel Cancelling					
0X4030	[0]	DPC_enable	0x0		Defect Pixel Cancelling Enable signal (0=normal, 1=defect cancel)
0x4031	[3:0]	D_black_thred[11:8]	0x00	R/W	Black defect threshold
0x4032	[7:0]	D_black_thred[7:0]			
0x4033	[3:0]	D_white_thred[11:8]	0x00	R/W	Wight defect threshold
0x4034	[7:0]	D_white_thred[7:0]			
0x4035	[1:0]	D_luminance[9:8]	0x00	R/W	Luminance value limitation
0x4036	[7:0]	D_luminance[7:0]	0x00	R/W	Luminance value limitation