Specification of Control Board

(HDMI, DP, VGA, DVI & Audio supportable for 4k - 2k LCD Module)

Model Name : Saturn

Part No. : STN - xxxx....xxxx

(xxx...xxxx : target LCD part No)

April 2015

Revision History

Rev. No.	Rev. date	Revision Details
A1	Oct 2014	Initial Version issued
A2	Nov 2014	Send version PCB
AB	Feb 2015	OSD Key pad change
A3	Mar 2015	**Mass Production version (3rd ver PCB)** **H/W** HDMI Input Wafer Add RS232 Port Add Panel Power Port Add **S/W** PIP(4P)/PBP Function e-DP output Remote Function RS232 Function

1. General Description

- **UHD(3840x2160, 4096x2160) resolution display format.**
- Up scaling can do VGA, SVGA, XGA, SXGA,SXGA, UXGA to UHD VESA Standard Mode.
- Provides up to 30-bit color and 8Ch LVDS, V-by-1 interface, e-DP 1.1(2Ch)/e-DP 1.2(1Ch) Interface
- HDMI connector/**HDMI 2.0** /**4K2K@60Hz 1Port** 4K2K@30Hz 3Port, MHL
- DP connector **4K2K@60Hz, Daisy chain**
- **PIP/ PBP(L/R, Top/Bottom)/4P(4Windows) Function**
- OSD/Display Rotation Function
- Over driver / Over scan Function
- 6Color control
- PCM(Precise color management)
- Sharpness/Hue/Color Support
- Gamma Control
- Color Effect Function
- Response time Control
- Remote Control
- UART for RS232 Control
- DP MST(Multi Stream, up to FHD 4 EA) or Daisy chain Output.
- Speaker 20Wx 2ch
- PIP Sound Choice

In case of Vx1 16 lanes type TFT-LCD module, this driving board can be integrated with an FRC board separately which is shown on the separated spec file.

2. Spec Tables

2.1 General Spec

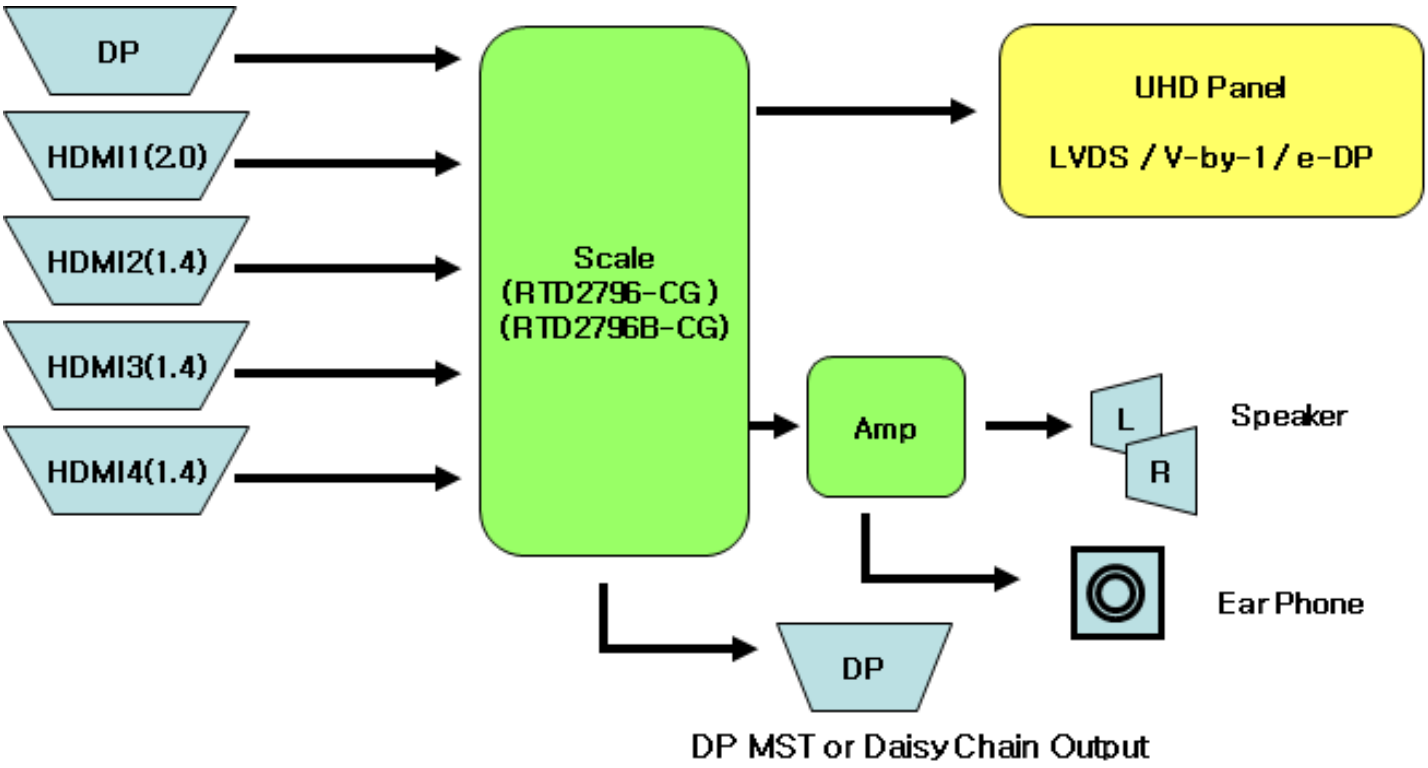
No.	Item		Description	Remarks
3	Target LCD Modules	Maker	Samsung, LG, Sharp, AUO, Innolux, etc	
		Type	23.8”/27”/28”/31”/31.5”/32”/34”/40”/42”/55’/65”/84”/98”,etc (UHD) Panel, 4k2k@120Hz Panel with FRC Board (VSB4KFRC)	with FRC Board for 120Hz 4k2k panels
4	Input Frequency		H : 31 ~ 130KHz	
			V : 56 ~ 75Hz	
5	Control	OSD	**-PIP MODEL** : Power, Menu/Enter, Source/Exit, Up/MEMC, Down/Mute, Left/volume-, Right/Volume+, IR 2Color_LED **-NON PIP MODEL** : Power, Menu/Enter, -, +/Source Exit/Mute, Volume+, Volume-, 2Color_LED	7 keys, 2 LEDs
		P&P	DDC2B	
		Remote Controller	Infrared-Rays NEC Format.	
		RS232	PC Application	
6	Sync Type			

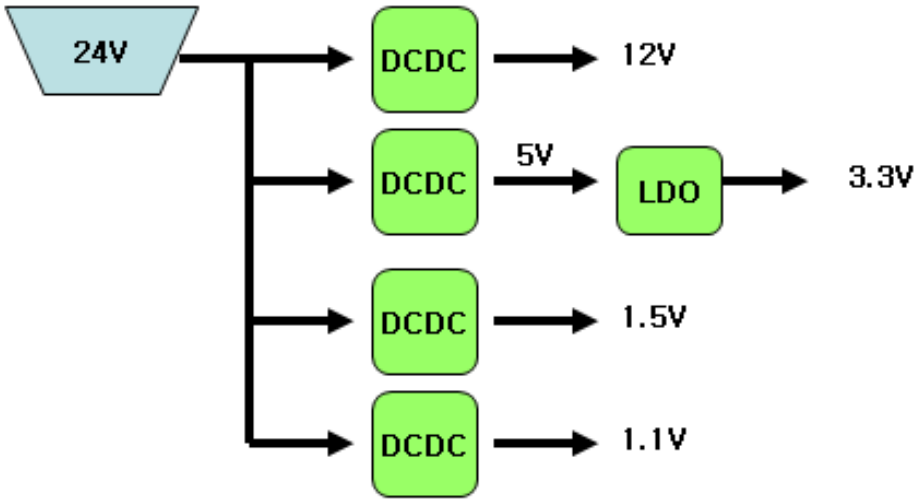
7	DC Jack	Type:	24V-DC, SMPS (or LIPS) , 12V-DC JACK(Option)		
8	Signal Input	Digital	19Pin HDMI Connector	4K2K@60 1ea, 4K2K@30Hz 3ea	
			20Pin Display Port Connector	4K2K@60Hz 1 ea	
9	Audio	Input	HDMI, DP	HDMI Jack, Display Port Jack	
		Output	Head Phone	3.5ø Stereo Jack	
			Speaker	4Pin Wafer	

2.1 Engineering Spec

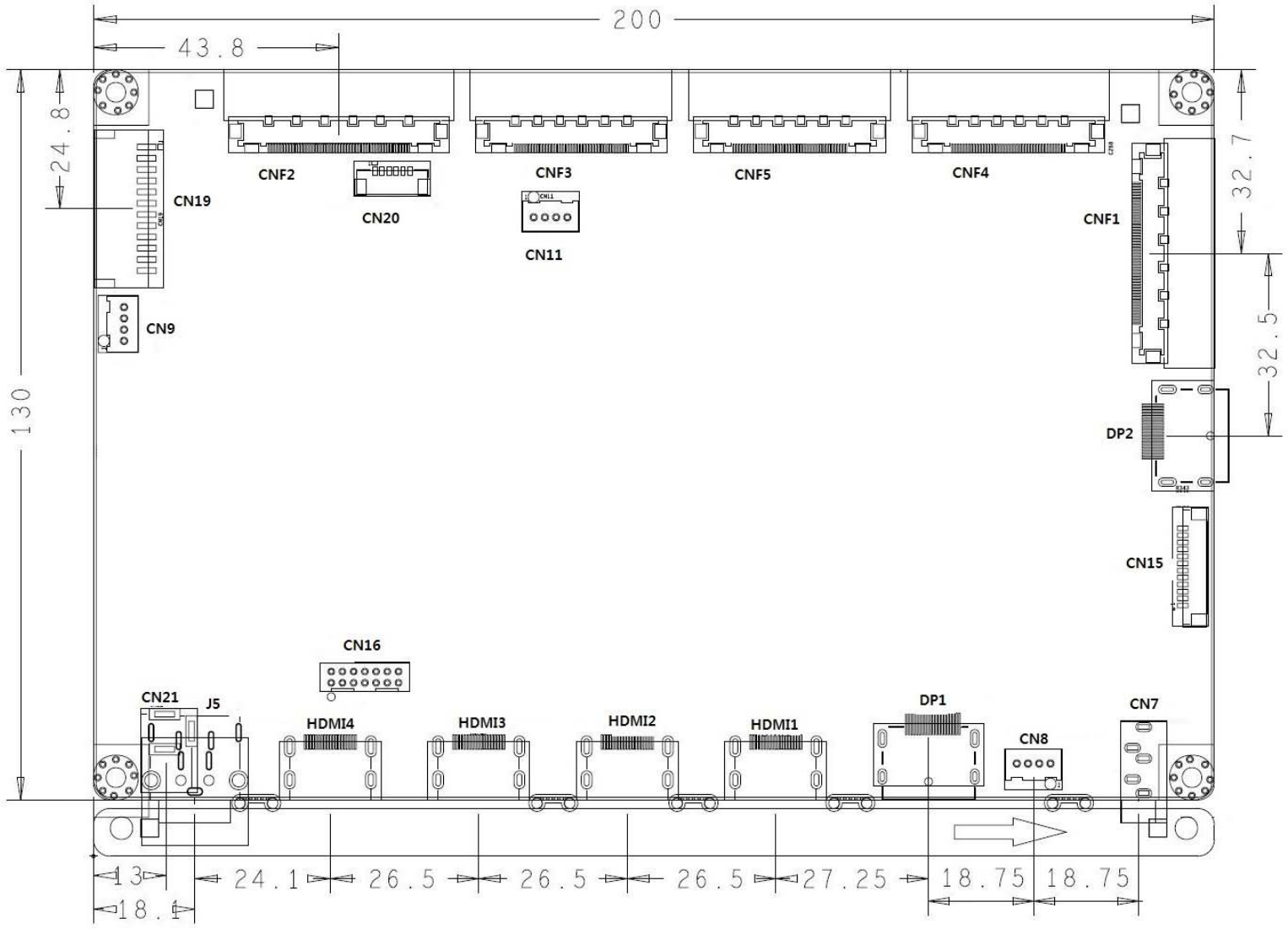
No.	Item			Description			Remarks
1	Power Supply	Stand-By +5VS		Min	Typical	Max	Option(Adaptor, SMPS)
				4.8	5.0	5.2	
		5V		5.3	5.5	5.7	
		12V		11.4	12.0	12.6	
		24V		22.8	24.0	25.2	
2	Power	Power Off	+5VS	-		≤ 1W	LED : off
		Stand By, Sleep & Suspend Mode	+5VS	-	TBD	≤ 1W	LED : red Blinking
		Normal	+5VS	-	TBD	-	LED : green without Panel Interface
			1.2V	-	0.44	0.49	
			3.3V	-	0.48	0.59	
3	Audio AMP	Power	Typical	-12V : 8Wrms+8Wrms (± 10%), 8Ω -24V : 20Wrms+20Wrms (± 10%), 8Ω			Volume :Adjust
		Response Frequency		100Hz ~ 20KHz			
		T.H.D		10% Under			
		Input		0.400Vrms			
		S/N		TBD			
4	Speaker	Type		External			
		Impedance		8Ω			20W x 2CH

3. Block Diagram

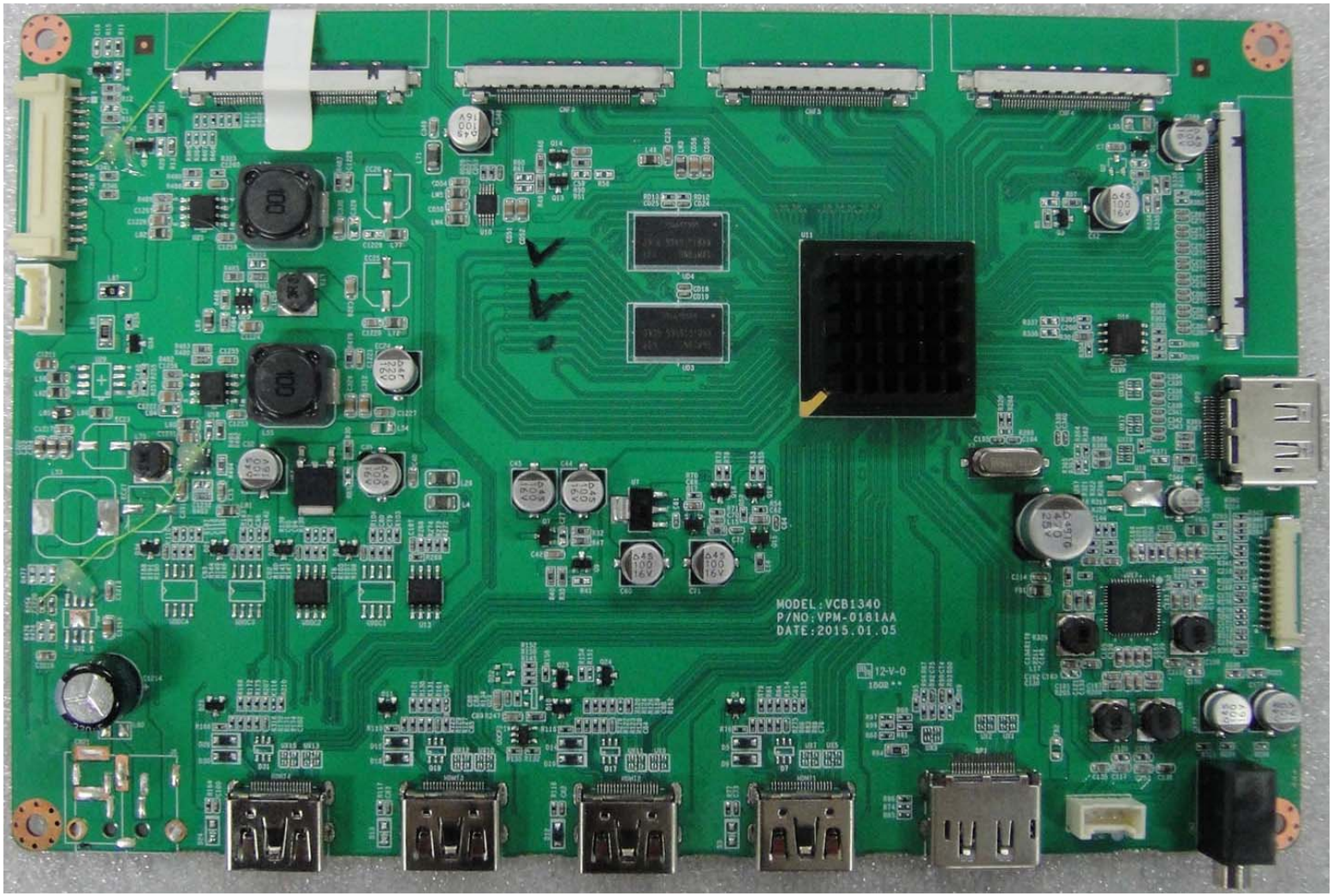




4-1. Dimensional Drawing (unit : mm, 200 x 130 x 16)



4-2. Picture



5. Connectors and Pin Information

5.1 Connector Summary

Reference	Item	Description	Type	Manufacture
CNF1	V-by-1 Wafer	For V-by-1 or e-DP(1.1) Output	FI-RE51S-HF	JAE or equivalent
CNF2	LVDS-1 Wafer	For LVDS AB Output	FI-RE51S-HF	JAE or equivalent
CNF3 CNF4 CNF5	LVDS-2/3/4 Wafer	For LVDS CD/EF/GH Output	FI-RE41S-HF	JAE or equivalent
CN7	Phone Jack	For Headphone Output	SJ3501-5 H7	Chang-Chun or equivalent
CN8	Wafer	For Speaker	SMW200-04	Yeon-Ho or equivalent
CN9	Wafer	For 120HZ FRC POWER	SMW200-04	Yeon-Ho or equivalent
CN11	Wafer	For RS232 Control	20010WS-04	Yeon-Ho or equivalent
CN15	Wafer	For OSD Control key	12505WR-12	Yeon-Ho or equivalent
CN16	Wafer	For HDMI Wafer Input(Option)	YDW200-14	Yeon-Ho or equivalent
CN19	Wafer	For Inverter or SMPS	20037WR-12	Yeon-Ho or equivalent
CN20	Wafer	For PANEL POWER	12505WS-6P	Yeon-Ho or equivalent
CN21	DC Power Jack	For 12V DC Power	DJ05H-250	Chang-Chun or equivalent
J5	DC Power Jack	For 24V DC Power	KPJ-4S-S_4P	Chang-Chun or equivalent
DP1	DP Jack	For DP Input	DPCON_SINK	Molex or equivalent
DP2	DP Jack	For DP Output, Daisy Chain	DPCON_SINK	Molex or equivalent
HDMI1	HDMI Jack	**For HDMI(2.0)** Input	51L019S-36DN-A	Freeport or equivalent
HDMI2 HDMI3 HDMI4	HDMI Jack	**For HDMI(1.4)** Input	51L019S-36DN-A	Freeport or equivalent

5.2 Pin Map Details (pin assignment)

CNF1 : For V-by-1 Output, Wafer

Pin No.	Symbol	Description
1	GND	Ground
2	VB1_TX7P	V by One Positive data input Lane 7
3	VB1_TX7N	V by One Negative data input Lane 7
4	GND	Ground
5	VB1_TX6P	V by One Positive data input Lane 6
6	VB1_TX6N	V by One Negative data input Lane 6
7	GND	Ground
8	VB1_TX5P	V by One Positive data input Lane 5
9	VB1_TX5N	V by One Negative data input Lane 5
10	GND	Ground
11	VB1_TX4P	V by One Positive data input Lane 4
12	VB1_TX4N	V by One Negative data input Lane 4
13	GND	Ground
14	VB1_TX3P	V by One Positive data input Lane 3
15	VB1_TX3N	V by One Negative data input Lane 3
16	GND	Ground
17	VB1_TX2P	V by One Positive data input Lane 2
18	VB1_TX2N	V by One Negative data input Lane 2
19	GND	Ground
20	VB1_TX1P	V by One Positive data input Lane 1
21	VB1_TX1N	V by One Negative data input Lane 1
22	GND	Ground
23	VB1_TX0P	V by One Positive data input Lane 0
24	VB1_TX0N	V by One Negative data input Lane 0
25	GND	Ground
26	VB1_PLL_LOCK	Lock Detection
27	VB1_HPD	Hot Plug Detection
28~31	N.C	No Connection
32	VB1_SDA	I2C Data Line
33	VB1_SCL	I2C Clock Line
34~40	N.C	No Connection

41~42	GND	Ground
43	N.C	No Connection
44~51	LCD_VDD	12V, VDD For LCD Module

CNF1 : For e-DP(1.1) Output, Wafer

Pin No.	Symbol	Description
1	GND	Ground
2	1st LANE3P	eDP 1st Positive data input Lane 3
3	1st LANE3N	eDP 1st Negative data input Lane 3
4	GND	Ground
5	1st LANE2P	eDP 1st Positive data input Lane 2
6	1st LANE2N	eDP 1st Negative data input Lane 2
7	GND	Ground
8	1st LANE1P	eDP 1st Positive data input Lane 1
9	1st LANE1N	eDP 1st Negative data input Lane 1
10	GND	Ground
11	1st LANE0P	eDP 1st Positive data input Lane 0
12	1st LANE0N	eDP 1st Negative data input Lane 0
13	GND	Ground
14	2nd LANE3P	eDP 2nd Positive data input Lane 3
15	2nd LANE3N	eDP 2nd Negative data input Lane 3
16	GND	Ground
17	2nd LANE2P	eDP 2nd Positive data input Lane 2
18	2nd LANE2N	eDP 2nd Negative data input Lane 2
19	GND	Ground
20	2nd LANE1P	eDP 2nd Positive data input Lane 1
21	2nd LANE1N	eDP 2nd Negative data input Lane 1
22	GND	Ground
23	2nd LANE0P	eDP 2nd Positive data input Lane 0
24	2nd LANE0N	eDP 2nd Negative data input Lane 0
25	GND	Ground
26	VB1_PLL_LOCK	Lock Detection
27	HPD	Hot Plug Detection
28	NC	No Connection
29	1st AUX_P	eDP 1st Positive AUX Channel

30	1st AUX_N	eDP 1st Negative AUX Channel
31,32	NC	No Connection
33	VB1_SCL	I2C Clock Line
34	VB1_SDA	I2C Data Line
35	NC	No Connection
36	2nd AUX_P	eDP 2nd Positive AUX Channel
37	2nd AUX_N	eDP 2nd Negative AUX Channel
38~40	N.C	No Connection
41,42	GND	Ground
43	N.C	No Connection
44~51	LCD_VDD	12V, VDD For LCD Module

2) CNF2 : For LVDS Master Output, Wafer

Pin No.	Symbol	Description	Pin No.	Symbol	Description
51	NC	No Connection			
50	NC	No Connection	25	NC	No Connection
49	NC	No Connection	24	TXB 0-	2nd Channel 0-
48	OPT1	Reserved 1	23	TXB 0+	2nd Channel 0+
47	OPT2	Reserved 2	22	TXB 1-	2nd Channel 1-
46	NC	No Connection	21	TXB 1+	2nd Channel 1+
45	OPT3	Reserved 3	20	TXB 2-	2nd Channel 2-
44	NC	No Connection	19	TXB 2+	2nd Channel 2+
43	NC	No Connection	18	GND	Ground
42	NC	No Connection	17	TXB C-	2nd Channel C-
41	GND	Ground	16	TXB C+	2nd Channel C+
40	TXA 0-	1st Channel 0-	15	GND	Ground
39	TXA 0+	1st Channel 0+	14	TXB 3-	2nd Channel 3-
38	TXA 1-	1st Channel 1-	13	TXB 3+	2nd Channel 3+
37	TXA 1+	1st Channel 1+	12	TXB 4-	2nd Channel 4-
36	TXA 2-	1st Channel 2-	11	TXB 4+	2nd Channel 4+
35	TXA 2+	1st Channel 2+	10	NC	No Connection
34	GND	Ground	9	NC	No Connection
33	TXA C-	1st Channel C-	8	GND	Ground
32	TXA C+	1st Channel C+	7	GND	Ground
31	GND	Ground	6	GND	Ground
30	TXA 3-	1st Channel 3-	5	NC	No Connection
29	TXA 3+	1st Channel 3+	4	LCD_VDD	VDD For LCD

28	TXA 4-	1st Channel 4-	3	LCD_VDD	VDD For LCD
27	TXA 4+	1st Channel 4+	2	LCD_VDD	VDD For LCD
26	NC	No Connection	1	LCD_VDD	VDD For LCD

CNF 3/4/5 : For LVDS Slave Output, Wafer

Pin No.	Symbol	Description	Pin No.	Symbol	Description
41	NC	No Connection			
40	NC	No Connection	20	TX C/E/G 4-	3rd/5th/7th Channel 4-
39	NC	No Connection	19	TX C/E/G 4+	3rd/5th/7th Channel 4+
38	NC	No Connection	18	GND	Ground
37	NC	No Connection	17	GND	Ground
36	NC	No Connection	16	TX D/F/H 0-	4rd/6th/8th Channel 0-
35	NC	No Connection	15	TX D/F/H 0+	4rd/6th/8th Channel 0+
34	NC	No Connection	14	TX D/F/H 1-	4rd/6th/8th Channel 1-
33	GND	Ground	13	TX D/F/H 1+	4rd/6th/8th Channel 1+
32	TX C/E/G 0-	3rd/5th/7th Channel 0-	12	TX D/F/H 2-	4rd/6th/8th Channel 2-
31	TX C/E/G 0+	3rd/5th/7th Channel 0+	11	TX D/F/H 2+	4rd/6th/8th Channel 2+
30	TX C/E/G 1-	3rd/5th/7th Channel 1-	10	GND	Ground
29	TX C/E/G 1+	3rd/5th/7th Channel 1+	9	TX D/F/H C-	4rd/6th/8th Channel C-
28	TX C/E/G 2-	3rd/5th/7th Channel 2-	8	TX D/F/H C+	4rd/6th/8th Channel C+
27	TX C/E/G 2+	3rd/5th/7th Channel 2+	7	GND	Ground
26	GND	Ground	6	TX D/F/H 3-	4rd/6th/8th Channel 3-
25	TX C/E/G C-	3rd/5th/7th Channel C-	5	TX D/F/H 3+	4rd/6th/8th Channel 3+
24	TX C/E/G C+	3rd/5th/7th Channel C+	4	TX D/F/H 4-	4rd/6th/8th Channel 4-
23	GND	Ground	3	TX D/F/H 4+	4rd/6th/8th Channel 4+
22	TX C/E/G 3-	3rd/5th/7th Channel 3-	2	GND	Ground
21	TX C/E/G 3+	3rd/5th/7th Channel 3+	1	GND	Ground

CN7 : For Audio Output, Head Phone Jack

Pin No.	Symbol	Description	Pin No.	Symbol	Description
1	GND	Ground	3	R	Audio Right Input Signal
2,4	DET	Detection	5	L	Audio Left Input Signal

CN8 : For Speaker, wafer

Pin	Symbol	Description	Pin	Symbol	Description
1	SP_L+	Audio Left Speaker Output Positive	3	SP_R+	Audio Right Speaker Output Positive
2	SP_L-	Audio Left Speaker Output Negative	5	SP_R-	Audio Right Speaker Output Negative

CN9 : For 120Hz FRC(VSB4KFRC) Power, wafer

Pin No.	Symbol	Description	Remarks
1,2	FRC Power	12V or 24V For FRC Power	
3,4	GND	Ground	

CN11 : For RS232 Control, wafer

Pin No.	Symbol	Description	Remarks
1	GND	Ground	
2	TXD	Signal for TX	
3	RXD	Signal For RX	
4	5V	5V Power	

CN15 : For OSD Control Key, Wafer

Pin No.	Symbol	Description	Remarks
1	LED Green Key	LED drive for Green Color	
2	LED Red_Key	LED drive for RED Color	
3	IR_Key	IR Receiver	
4	GND	Ground	
5	3.3V_Key	3.3V	
6	PWR_Key	POWER key	
7	Exit_Key	Exit key	
8	UP_Key	UP key	
9	Down_Key	Down key	
10	Right_Key	**Right / Source** key	
11	Left_Key	Left key	
12	Menu_Key	Menu / Enter key	

CN16 : For HDMI Input(HDMI4_1.4), wafer

Pin No.	Symbol	Description	Remarks
1	HDMI_DDC5V	5V Power Supply	
2	HDMI_HOT_PLUG	HDMI Hot Plug	
3	HDMI_SCL	HDMI Clock Line	

4	HDMI_SDA	HDMI Data Line	
5	GND	Ground	
6	GND	Ground	
7	RX0+	HDMI Data0 Differential Positive Signal	
8	RX0-	HDMI Data0 Differential Negative Signal	
9	RX1+	HDMI Data1 Differential Positive Signal	
10	RX1-	HDMI Data1 Differential Negative Signal	
11	RX2+	HDMI Data2 Differential Positive Signal	
12	RX2-	HDMI Data2 Differential Negative Signal	
13	RXC+	HDMI Clock Differential Positive Signal	
14	RXC-	HDMI Clock Differential Negative Signal	

CN19 : For Inverter or SMPS, wafer

Pin No.	Symbol	Description	Remarks
1	DIM-ADJ	Dimming Adjustment	
2	INVON	Inverter Power On, Off	0V (Off), 3.3V(On)
3	PWM	PWM Dimming Control	
4,5	GND	Ground	
6	PWR_CTRL	Power Control Out (SMPS), NC(Inverter)	0V (Off), 3.3V(On)
7	5VS	5VS In (SMPS), NC(Inverter)	5V ± 1%
8	5V	5V In (SMPS), NC(Inverter)	5V ± 1%
9,10,11,12	24V	24V In or 12V In(SMPS), 24V Out(Inverter)	24V ± 5% 12V ± 3%

CN20 : For Panel Power

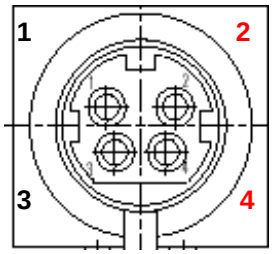
Pin No.	Symbol	Description	Remarks
1,2,3	GND	Ground	
4,5,6	Panel Power	Power of Panel	

CN21 : For 12V DC Power, Jack

Pin No.	Symbol	Description	Remarks
1	12V	12V Power Input	12V ± 5%
2,3	GND	Ground	

J5 : For 24V DC Power, Jack

Pin No.	Symbol	Description	Remarks
1,3	GND	Ground	
2,4	24V	24V Power Input	24V ± 5%



DP1 : For DP Input, DP Jack

Pin No.	Symbol	Description	Remarks
1	LANE3-	Negative Signal for Main Link 3	
3	LANE3+	Positive Signal for Main Link 3	
4	LANE2-	Negative Signal for Main Link 2	
6	LANE2+	Positive Signal for Main Link 2	
7	LANE1-	Negative Signal for Main Link 1	
9	LANE1+	Positive Signal for Main Link 1	
10	LANE0-	Negative Signal for Main Link 0	
12	LANE0+	Positive Signal for Main Link 0	
13	CA DET		
14	DP DET		
15	AUX CH+	Positive Signal for Auxiliary Channel	
17	AUX CH-	Negative Signal for Auxiliary Channel	
18	HPD	Identify the presence of a monitor	
19	RETURN	NO Connection	
20	PWR OUT	3.3V	
2, 5, 8, 11, 16	GND	Ground	

DP2 : For DP Output, DP Jack(Daisy chain)

Pin No.	Symbol	Description	Remarks
1	LANE0+	Positive Signal for Main Link 0	
3	LANE0-	Negative Signal for Main Link 0	
4	LANE1+	Positive Signal for Main Link 1	
6	LANE1-	Negative Signal for Main Link 1	
7	LANE2+	Positive Signal for Main Link 2	

9	LANE2-	Negative Signal for Main Link 2	
10	LANE3+	Positive Signal for Main Link 3	
12	LANE3-	Negative Signal for Main Link 3	
13	CONFIG1	Pull down resister 100KR	
14	CONFIG2	Pull down resister 100KR	
15	AUX CH+	Positive Signal for Auxiliary Channel	
17	AUX CH-	Negative Signal for Auxiliary Channel	
18	HPD	Hot Plug Detection	
19	RETURN	No Connection	
20	PWR OUT	3.3V	
2, 5, 8, 11, 16	GND	Ground	

HDMI 1/2/3/4 : For HDMI Input, HDMI Jack

Pin No.	Symbol	Description	Remarks
1	RX2+	HDMI DATA2 Differential Positive Signal	
2	GND	Ground	
3	RX2-	HDMI DATA2 Differential Negative Signal	
4	RX1+	HDMI DATA1 Differential Positive Signal	
5	GND	Ground	
6	RX1-	HDMI DATA1 Differential Negative Signal	
7	RX0+	HDMI DATA0 Differential Positive Signal	
8	GND	Ground	
9	RX0-	HDMI DATA0 Differential Negative Signal	
10	RXC+	HDMI CLOCK Differential Positive Signal	
11	GND	Ground	
12	RXC-	HDMI CLOCK Differential Negative Signal	
13,14	NC	NO CONNECTION	
15	HDMI_SCL	HDMI Clock Line	
16	HDMI_SDA	HDMI Data Line	
17	HDMI_CHK	HDMI Check	
18	HDMI_DDC5V	5V Power Supply	
19	HDMI_HOT_PLUG	HDMI Hot Plug	
20,21	GND	Ground	

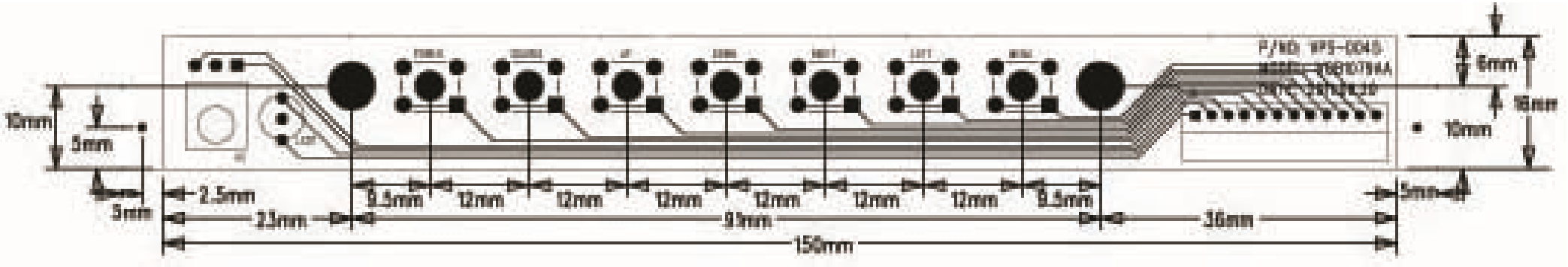
6. Applicable Graphic Mode

The microprocessor measures the H-sync, V-sync and V-sync/H-sync polarity for RGB inputs, and uses this timing information to control all of the display operation to get the proper image on a screen. This board can detect all VESA standard and MAC Graphic modes shown on the table below and provide more clear and stable image on a screen.
RGB & DIVI Input format

Resolution	Pixel Freq.	Horizontal Timing				Vertical Timing			
		Sync Polar	Freq.	Total	Active	Sync Polar	Freq.	Total	Active
	MHz		KHz	Pixel	Pixel		Hz	Line	Line
640x350 @70Hz	25.144 VESA	P	31.430	800	640	N	70.000	449	350
720x400 @70Hz	28.287 VESA	N	31.430	900	720	P	70.000	449	400
640x480 @60Hz	25.175 MAC	N	31.469	800	640	N	59.940	525	480
640x480 @60Hz	25.175 VESA	N	31.469	800	640	N	59.940	525	480
640x480 @67Hz	30.240 MAC	N	35.000	864	640	N	66.667	525	480
640x480 @72Hz	31.500 VESA	N	37.861	832	640	N	72.809	520	480
640x480 @75Hz	31.500 VESA	N	37.500	840	640	N	75.000	500	480
832x624 @75Hz	57.284 MAC	N	49.726	1152	832	N	74.551	667	624
800x600 @56Hz	36.000 VESA	P	35.156	1024	800	P	56.250	625	600
800x600 @60Hz	40.000 VESA	P	37.879	1056	800	P	60.317	628	600
800x600 @72Hz	50.000 VESA	P	48.077	1040	800	P	72.188	666	600
800x600 @75Hz	49.500 VESA	P	46.875	1056	800	P	75.000	625	600
1024x768 @60Hz	65.000 VESA	N	48.363	1344	1024	N	60.005	806	768
1024x768 @60Hz	64.000 MAC	N	48.780	1312	1024	N	60.001	813	768
1024x768 @70Hz	75.000 VESA	N	56.476	1328	1024	N	70.070	806	768
1024x768 @75Hz	80.000 MAC	N	60.241	1328	1024	N	74.927	804	768
1024x768 @75Hz	78.750 VESA	P	60.023	1312	1024	P	75.030	800	768
1280x768 @60Hz	79,500 VESA	P	47,780	1664	1280	P	59,870	798	768
1280x1024 @60Hz	108.000 VESA	P	63.981	1688	1280	P	60.020	1066	1024
1280x1024 @75Hz	135.000 VESA	P	79.976	1688	1280	P	75.025	1066	1024
1360X768 @60Hz	85.00 VESA	P	47.712	1792	1360	P	60.015	795	768
1600x1200 @60Hz	160.875 VESA	N	74.479	2160	1600	P	59.967	1242	1200
1680x1050 @60Hz	147.000 VESA	N	65.160	2256	1680	P	59.944	1087	1050
1920x1080 @60Hz	172.750 VESA	N	67.061	2576	1920	P	59.983	1118	1080
1920X1200@60Hz	193.125 VESA	N	74.508	1292	1920	P	59,990	1242	1200
2560X1440@60Hz		N	88.7		2560				1440
2560X1600@60Hz		N	98.7		2560				1600
3840X2160@60Hz		N	135		3840				2160
4096X2160@60Hz		N	135		4096				2160

7. OSD Board


Source
Menu
Left
Right
Up
Down
Power


10mm
5mm
5mm
2.5mm
23mm
9.5mm
12mm
12mm
12mm
12mm
12mm
12mm
9.5mm
95mm
36mm
150mm
6mm
16mm
10mm
5mm

8. OSD Board Menu Tree

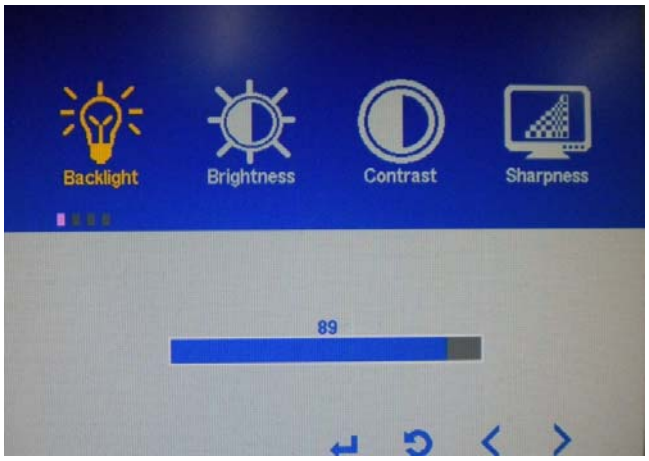
The On Screen Display consists of following menu.
These can be activated by Remote Controller or OSD Key pad manually.

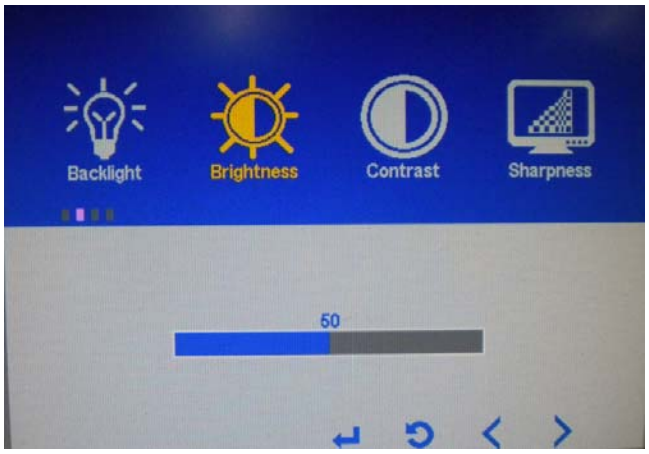
8.1 Summarized Table

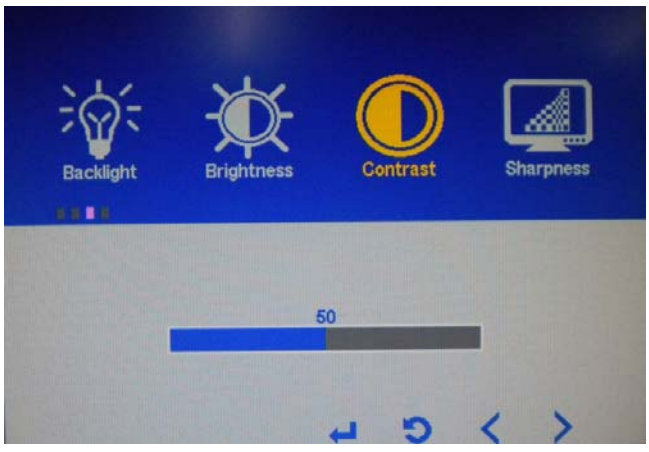
Main Menu	Sub Menu	Control	Remark
Picture	Backlight	0 ~ 100	
	Brightness	0 ~ 100	
	Contrast	0 ~ 100	
	Sharpness	0 ~ 4	
Color	Gamma	Off, 1.8, 2.0, 2.2, 2.4	
	Temperature	9300, 7500, 6500, 5800, sRGB, User	
	Color Effect	Standard, Game, Movie, Photo, Vivid, User	
	Hue	0 ~ 100	
	SAT	0 ~ 100	
Advance	Aspect Ratio	full, 16:9, 4:3, 5:4, 1:1	
	over scan	on, off	
	over drive	on off, OD Gain	
	DP Option	1.1, 1.2,	
	DP EDID	1080p, 2560X1440, 4K2K 30Hz, 4K2K 60Hz	
Input	Auto Select, D0:DP, D1:HDMI, D2:MHL, D3:HDMI, D4:HDMI		
Other	Reset		
	Menu Time	10 ~ 60	
	OSD H Position	0 ~ 100	
	OSD V Position	0 ~ 100	
	Language	English, Korean	
	Transparency	0 ~ 100	
	Rotate	0, 90, 270	OSD Menu
Information		Display Information	

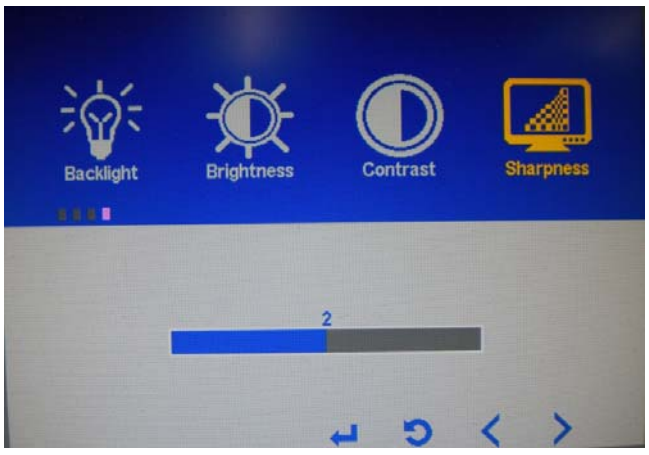
8.2 UI Design shape by the orders of Menu Tree

main menu - 1 : Picture

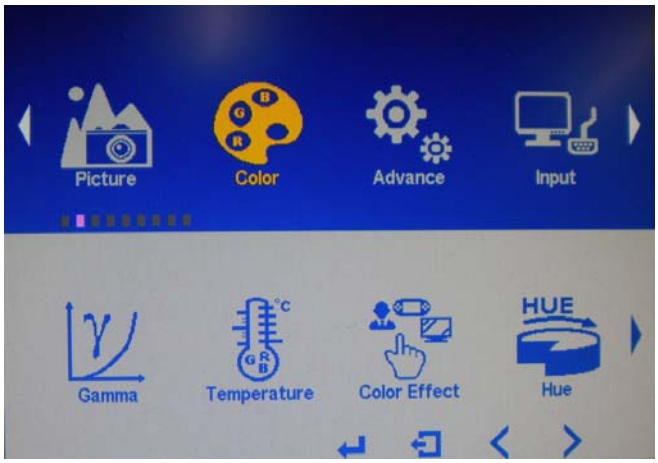


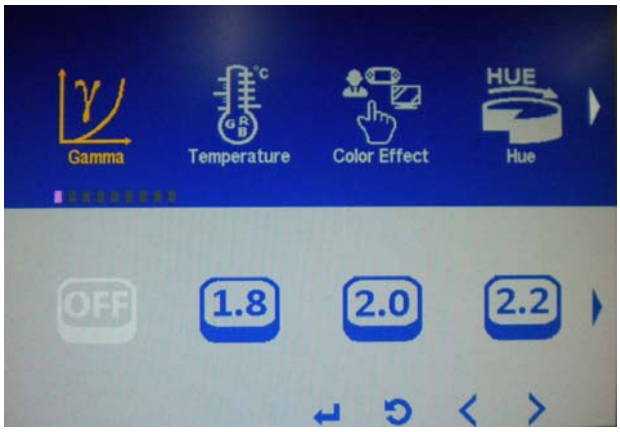


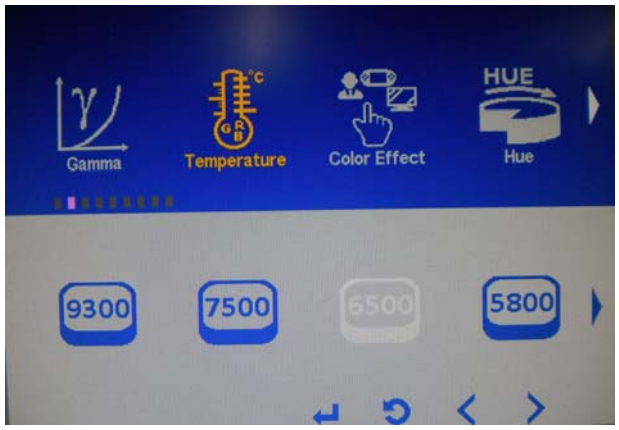


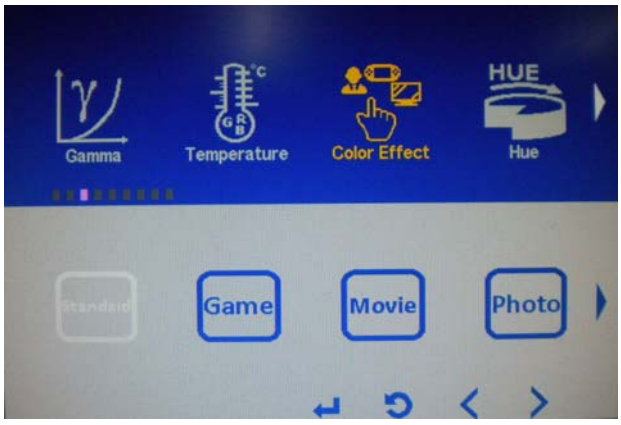


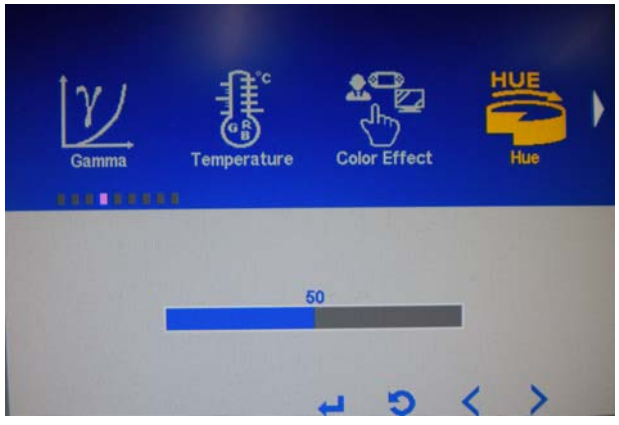
main menu - 2 : Color

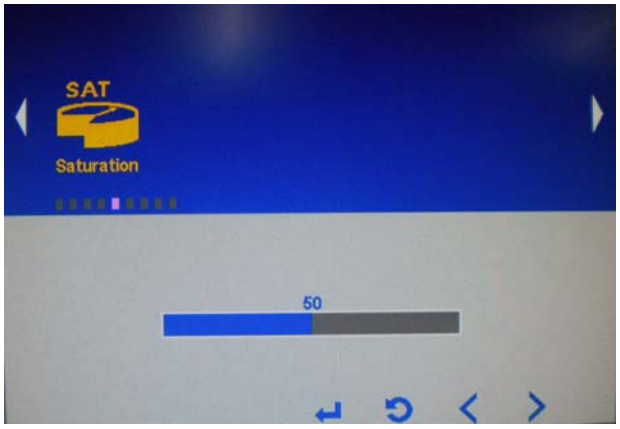




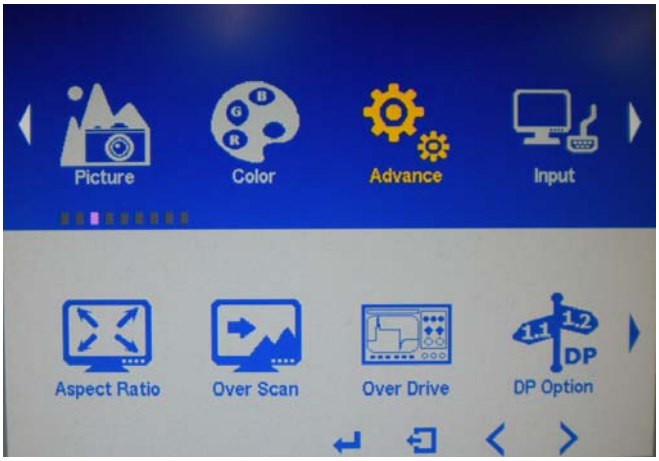


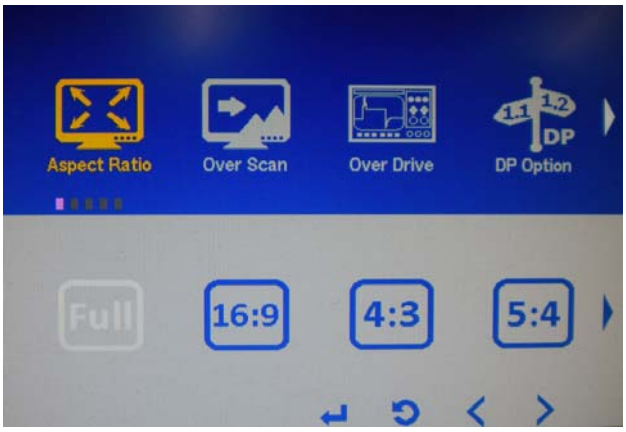


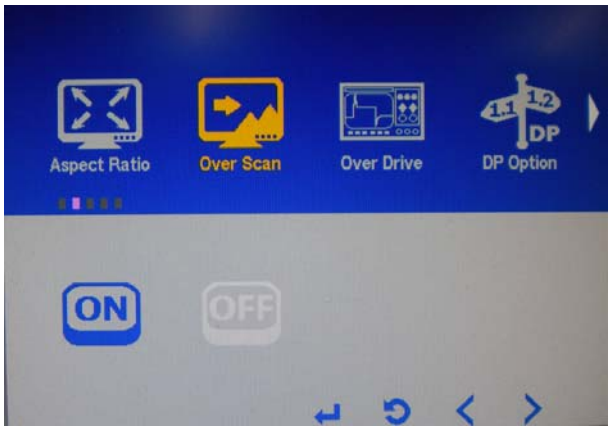


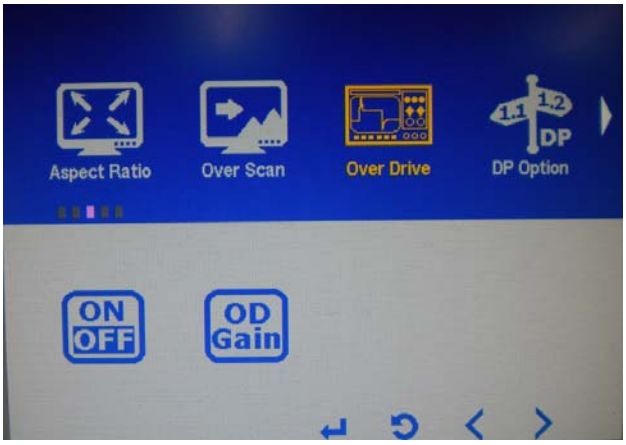


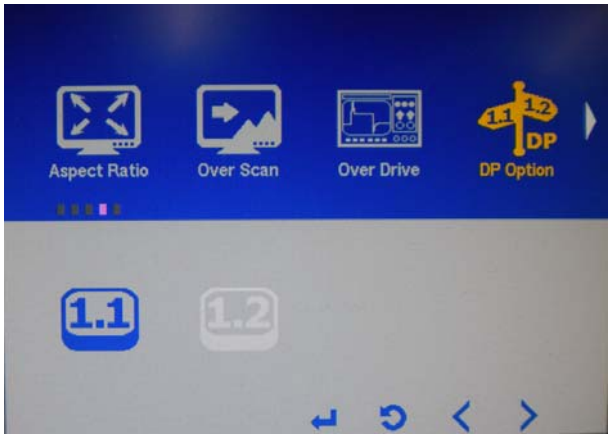
main menu - 3 : Advance





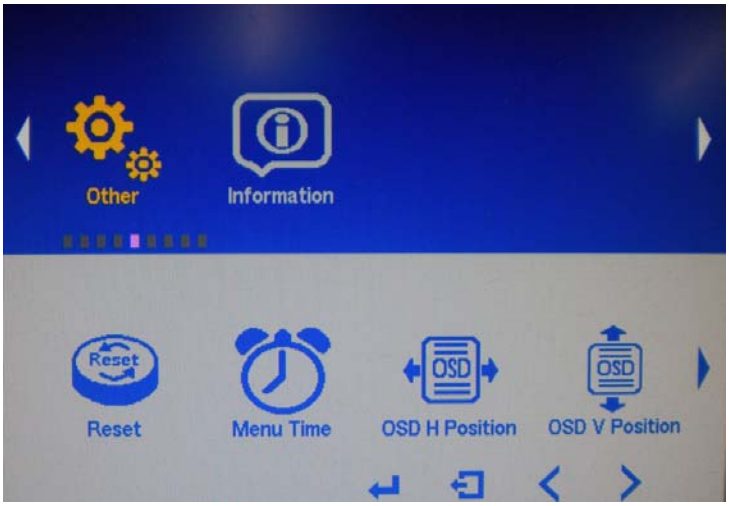


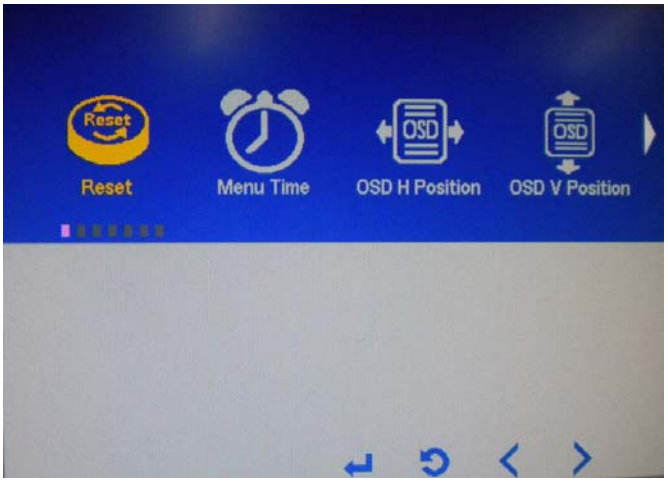


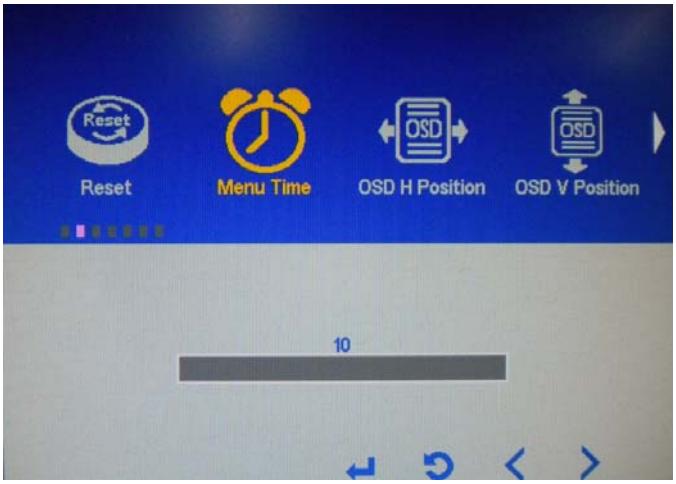


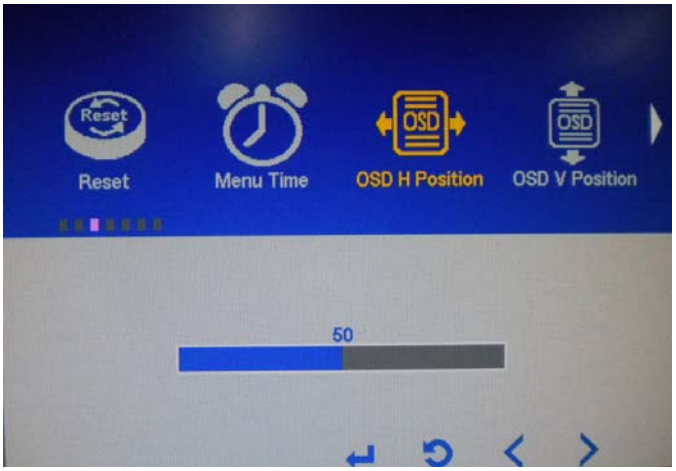
main menu - 4 : Input

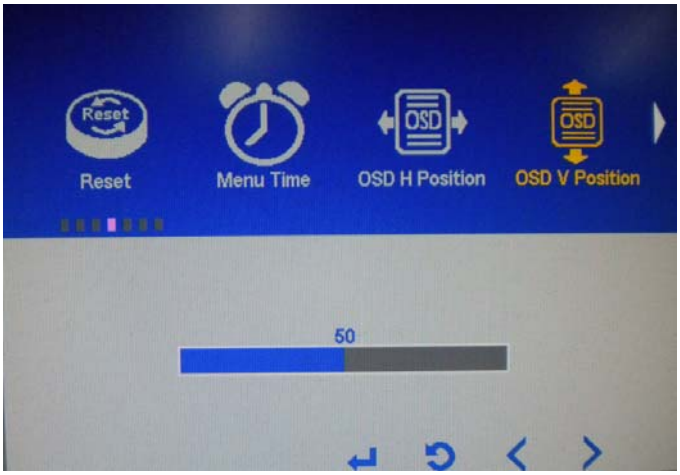
main menu - 5 : Others

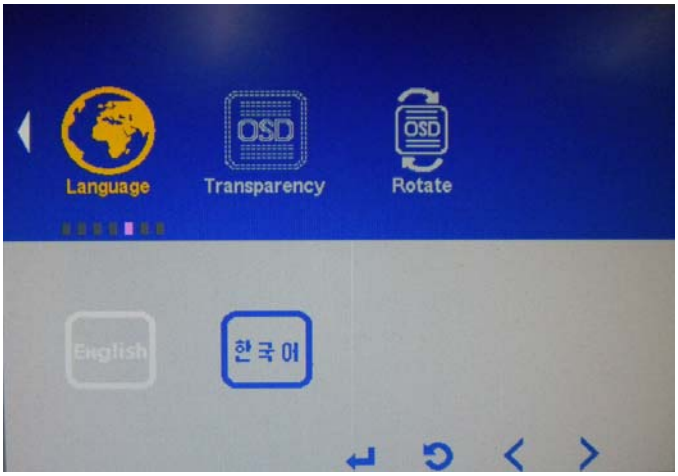


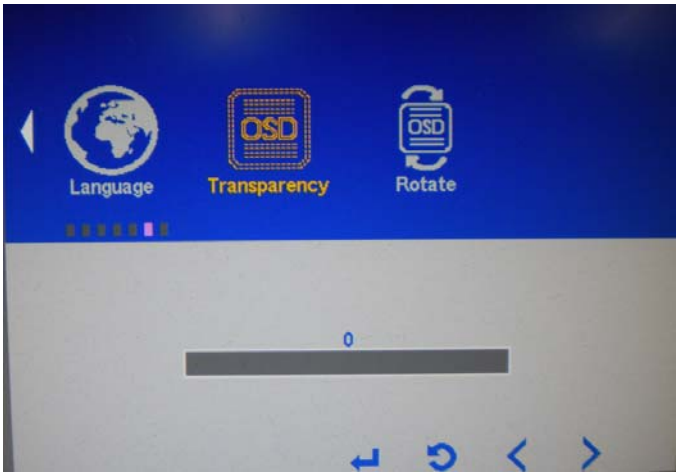


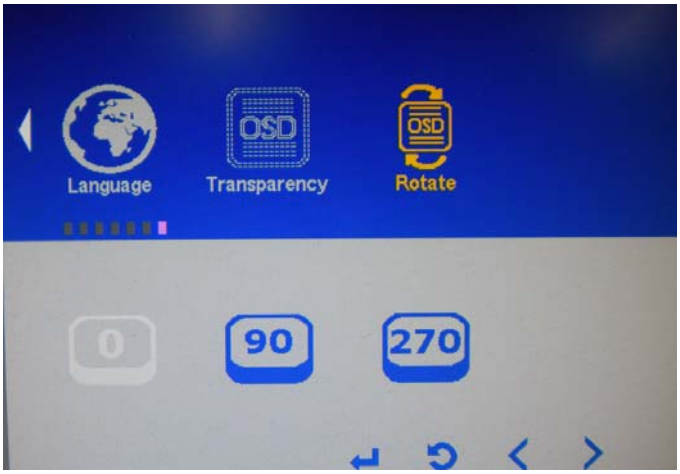



Reset
Menu Time
OSD H Position
OSD V Position
50


Reset
Menu Time
OSD H Position
OSD V Position
50


Language
Transparency
Rotate
English
한국어


Language
Transparency
Rotate
0


Language
Transparency
Rotate
0
90
270

main menu - 6 : Information

9. Remote Controller

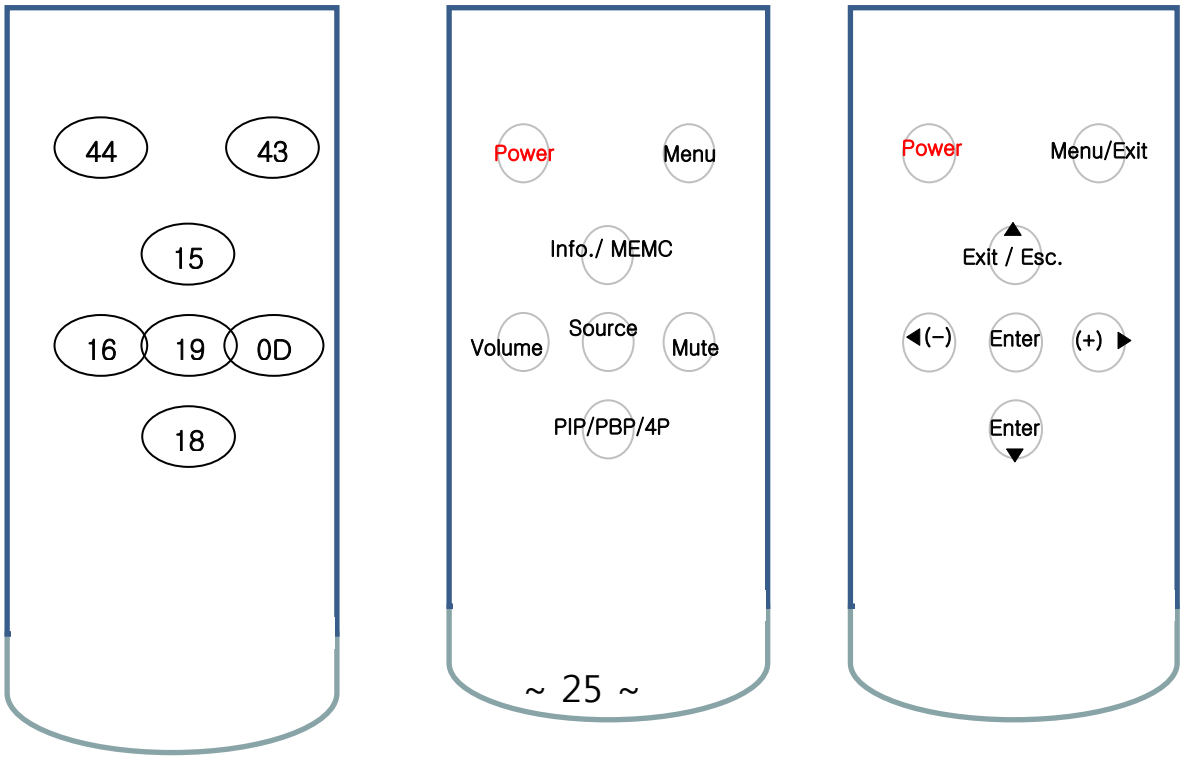
This I/R controller can be used up to 7 meters distance and 30 degree (left/right) within the receiving unit scope.

Part No : VRC-420

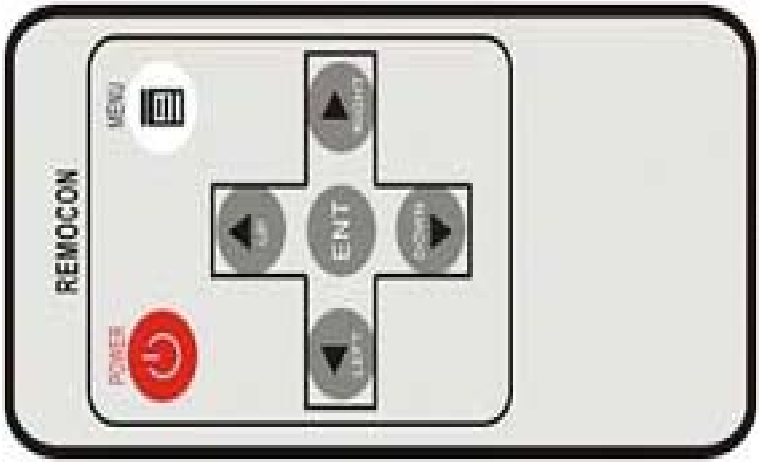
-Format : NEC

-Custom code : 00FF(Hex)

Data Code (Hex) **Hot key Function** **Menu Function**



Real Shape



10. RS232 Communication

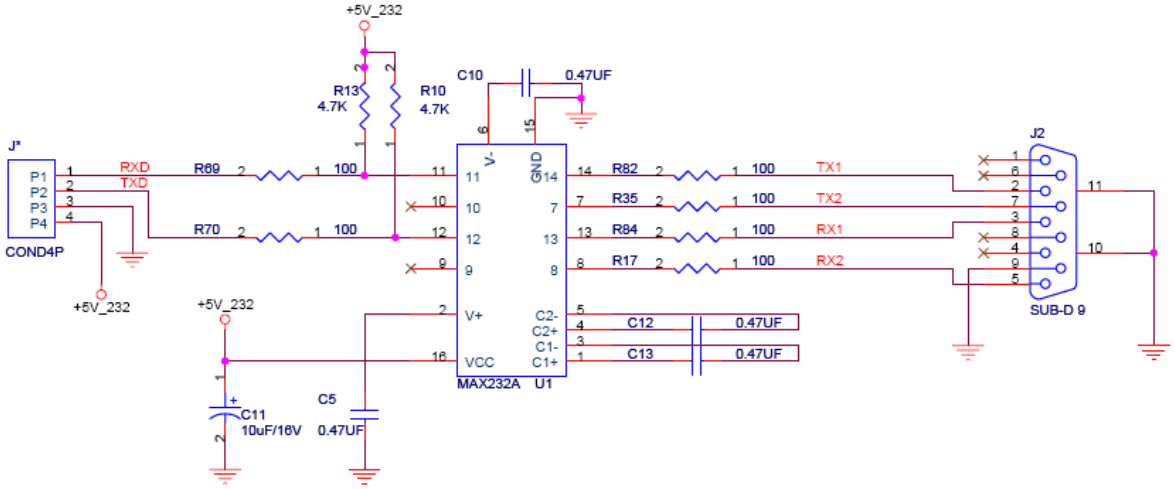
10.1 Communication Parameters

- Baud rate **:**9600 bps
- Data length : 8 bits
- Parity : None
- Stop bit : 1 bit
- Communication : ASCII CODE

10.2 Communication Spec (Optional Service)

refer to the separated addendum (Serial Command and Protocol)

10.3 Circuit Diagram of RS232C Control



Addendum - I : Serial Command and Protocol

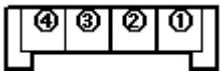
1. RS-232 Serial control

- Baud rate : 9600
- Data bit : 8 bits
- Stop bit : 1
- Parity bit : No

2. Physical connection :

Controller side:
Connector interface: CN11
Mating connector: DB9 Female or
20010HS-04, Yeon-Ho

PIN#	Description
1	Ground
2	RS-232 Tx Data
3	RS-232 Rx Data
4	Power 5V

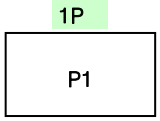
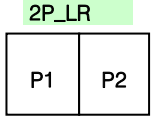


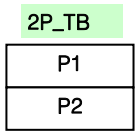
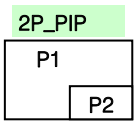
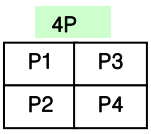
Computer side:
Connector interface: Serial port
Mating connector: DB9 Male

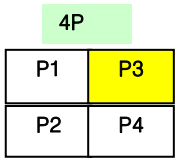
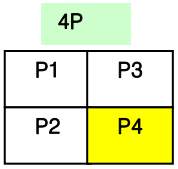
PIN#	Description
2	RS-232 Rx Data
3	RS-232 Tx Data
5	Ground

3. RS-232 Serial Protocols

Tx Format : [Command1] [Command2] [Space] [0] [0] [Space] [DataH] [DataL] [CR]
; ASCII : [Space] = 0x20 , [CR] = 0x0D, [0] = 0x30, [a] = 0x61, [A] = 0x41
Rx OK Format : [Command2] [Space] [0] [0] [Space] [O] [K] [DataH] [DataL] [x] [CR]
; OK
Rx NG1 Format : [Command2] [Space] [0] [0] [Space] [N] [G] [0] [1] [x] [CR]
; NG01 : illegal command
Rx NG2 Format : [Command2] [Space] [0] [0] [Space] [N] [G] [0] [2] [x] [CR]
; NG02 : unknown command /data

Command Set	Command	Acknowledgement	Comments
Power (ka)			
Power On	ka 00 01(CR)	a 00 OK01x	01
Power Off	ka 00 00(CR)	a 00 OK00x	00
Power Status	ka 00 ff(CR)	a 00 OK01x (On) a 00 OK00x (Off)	read
Display Mode (kb)			
1P	kb 00 00(CR)	b 00 OK00x	
2P_LR (Left, Right)	kb 00 01(CR)	b 00 OK01x	

2P_TB (Top, Bottom)	kb 00 02(CR)	b 00 OK02x	
2P_PIP	kb 00 03(CR)	b 00 OK03x	
4P	kb 00 04(CR)	b 00 OK04x	
Status	kb 00 ff(CR)	b 00 OK00x (1P) b 00 OK01x (2P_LR) b 00 OK02x (2P_TB) b 00 OK03x (2P_PIP) b 00 OK04x (4P)	read
P1 Input selection (k1)			
P1 (1P, 2P_LR_Left, 2P_TB_Top, 2P_PIP_Main, 4P_Left_Top)	k1 00 01(CR) k1 00 02(CR) k1 00 03(CR) k1 00 04(CR) k1 00 05(CR)	1 00 OK01x (DP) 1 00 OK02x (HDMI1) 1 00 OK03x (HDMI2) 1 00 OK04x (HDMI3) 1 00 OK05x (HDMI4)	01 : DP (D0 : DP) 02 : HDMI1 (D1 :HDMI) 03 : HDMI2 (D2 :MHL) 04 : HDMI3 (D3 :HDMI) 05 : HDMI4 (D4 :HDMI)
Status	k1 00 ff(CR)	1 00 OK01x (DP) 1 00 OK02x (HDMI1) 1 00 OK03x (HDM2) 1 00 OK04x (HDMI3) 1 00 OK05x (HDMI4)	read
P2 Input selection (k2)			
P2 (2P_LR_Right, 2P_TB_Bottom, 2P_PIP_Sub, 4P_Left_Bottom)	k2 00 01(CR) k2 00 02(CR) k2 00 03(CR) k2 00 04(CR) k2 00 05(CR)	2 00 OK01x (DP) 2 00 OK02x (HDMI1) 2 00 OK03x (HDM2) 2 00 OK04x (HDMI3) 2 00 OK05x (HDMI4)	01 : DP (D0 : DP) 02 : HDMI1 (D1 :HDMI) 03 : HDMI2 (D2 :MHL) 04 : HDMI3 (D3 :HDMI) 05 : HDMI4 (D4 :HDMI)
Status	k2 00 ff(CR)	2 00 OK01x (DP) 2 00 OK02x (HDMI1) 2 00 OK03x (HDM2) 2 00 OK04x (HDMI3) 2 00 OK05x (HDMI4)	read

P3 Input selection (k3)			
P3 (4P_Right_Top)  	k3 00 01(CR) k3 00 02(CR) k3 00 03(CR) k3 00 04(CR) k3 00 05(CR)	3 00 OK01x (DP) 3 00 OK02x (HDMI1) 3 00 OK03x (HDM2) 3 00 OK04x (HDMI3) 3 00 OK05x (HDMI4)	01 : DP (D0 : DP) 02 : HDMI1 (D1 :HDMI) 03 : HDMI2 (D2 :MHL) 04 : HDMI3 (D3 :HDMI) 05 : HDMI4 (D4 :HDMI)
Status	k3 00 ff(CR)	3 00 OK01x (DP) 3 00 OK02x (HDMI1) 3 00 OK03x (HDM2) 3 00 OK04x (HDMI3) 3 00 OK05x (HDMI4)	read
P4 Input selection (k4)			
P4 (4P_Right_Bottom)  	k4 00 01(CR) k4 00 02(CR) k4 00 03(CR) k4 00 04(CR) k4 00 05(CR)	4 00 OK01x (DP) 4 00 OK02x (HDMI1) 4 00 OK03x (HDM2) 4 00 OK04x (HDMI3) 4 00 OK05x (HDMI4)	01 : DP (D0 : DP) 02 : HDMI1 (D1 :HDMI) 03 : HDMI2 (D2 :MHL) 04 : HDMI3 (D3 :HDMI) 05 : HDMI4 (D4 :HDMI)
Status	k4 00 ff(CR)	4 00 OK01x (DP)4 00 OK02x (HDMI1)4 00 OK03x (HDM2)4 00 OK04x (HDMI3)4 00 OK05x (HDMI4)	read
Audio selection (kc)			
Display Mode == 1P	kc 00 01(CR)	c 00 OK01x (P1)	01 : P1
Display Mode == (2P_LR, 2P_TB, 2P_PIP)	kc 00 01(CR) kc 00 02(CR)	c 00 OK01x (P1) c 00 OK02x (P2)	01 : P1 02 : P2
Display Mode == 4P	kc 00 01(CR) kc 00 02(CR) kc 00 03(CR) kc 00 04(CR)	c 00 OK01x (P1) c 00 OK02x (P2) c 00 OK03x (P3) c 00 OK04x (P4)	01 : P1 02 : P2 03 : P3 04 : P4
Status	kc 00 ff(CR)	c 00 OK01x (P1) c 00 OK02x (P2) c 00 OK03x (P3) c 00 OK04x (P4)	read
Screen Mute (kd)			
Screen Mute ON (Picture off)	kd 00 01(CR)	d 00 OK01x (Mute ON)	01
Screen Mute OFF	kd 00 00(CR)	d 00 OK00x (Mute	00

(Picture on)		OFF)	
Status	kd 00 ff(CR)	d 00 OK01x (Mute ON) d 00 OK00x (Mute OFF)	read
Audio Mute (ke)			
Audio Mute	ke 00 01(CR) ke 00 00(CR)	e 00 OK01x (Mute ON) e 00 OK00x (Mute OFF)	01 : Mute ON 00 : Mute OFF
Status	ke 00 ff(CR)	e 00 OK01x (Mute ON) e 00 OK00x (Mute OFF)	read
Audio Volume (kf)			
Volume control	kf 00 00(CR)	f 00 OK00x (Volume = 0, Min.)	00 (Hex , Decimal)
(0~100%) (Default = 20%)	kf 00 1A(CR)	f 00 OK1Ax (Volume = 26)	1A (1Ah = 26)
00h ~ 64h (Default = 32h)	kf 00 32(CR)	f 00 OK32x (Volume = 50)	32 (32h = 50)
	kf 00 64(CR)	f 00 OK64x (Volume = 100, Max.)	64 (64h = 100)
Status	kf 00 ff(CR)	f 00 OK2Fx (Volume = 47)	read
Aspect Ratio (kg)			
Aspect Ratio	kg 00 00(CR) kg 00 01(CR) kg 00 02(CR) kg 00 03(CR) kg 00 04(CR)	g 00 OK00x (Full) g 00 OK01x (16:9) g 00 OK02x (4:3) g 00 OK03x (5:4) g 00 OK04x (1:1)	00 : Full 01 : 16:9 02 : 4:3 03 : 5:4 04 : 1:1
Status	kg 00 ff(CR)	g 00 OK00x (Full) g 00 OK01x (16:9) g 00 OK02x (4:3) g 00 OK03x (5:4) g 00 OK04x (1:1)	read
Picture			
BackLight (kh)			
0 ~ 100% (Default = 90%)	kh 00 5A(CR)	h 00 OK5Ax (BackLight = 90)	00h ~ 64h (Default = 5Ah)
Status	kh 00 ff(CR)	h 00 OK5Ax (BackLight = 90)	read
Contrast (ki)			
0 ~ 100% (Default = 50%)	ki 00 32(CR)	i 00 OK32x (Contrast = 50)	00h ~ 64h (Default = 32h)
Status	ki 00 ff(CR)	i 00 OK32x (Contrast = 50)	read
Brightness (kj)			
0 ~ 100% (Default = 50%)	kj 00 32(CR)	j 00 OK32x (Brightness = 50)	00h ~ 64h (Default = 32h)
Status	kj 00 ff(CR)	j 00 OK32x (Brightness = 50)	read

Sharpness (kk)			
0 ~ 4 (Default = 2)	kk 00 02(CR)	k 00 OK02x (Sharpness = 2)	00h ~ 04h (Default = 02h)
Status	kk 00 ff(CR)	k 00 OK02x (Sharpness = 2)	read
Color			
Gamma (kl)			
0 ~ 4 (Default = 0 : OFF)	kl 00 00(CR) kl 00 01(CR) kl 00 02(CR) kl 00 03(CR) kl 00 04(CR)	l 00 OK00x(Gamma=Off) l 00 OK01x(Gamma=1.8) l 00 OK02x(Gamma=2.0) l 00 OK03x(Gamma=2.1) l 00 OK04x(Gamma=2.2)	00 : Gamma OFF 01 : Gamma 1.8 02 : Gamma 2.0 03 : Gamma 2.2 04 : Gamma 2.4
Status	kl 00 ff(CR)	l 00 OK00x(Gamma=Off)	read
Temperature (km)			
0 ~ 4 (Default = 2 : 6500)	km 00 00(CR) km 00 01(CR) km 00 02(CR) km 00 03(CR) km 00 04(CR)	m 00 OK00x (Temperature = 9300) m 00 OK01x (Temperature = 7500) m 00 OK02x (Temperature = 6500) m 00 OK03x (Temperature = 5800) m 00 OK04x (Temperature = sRGB)	00 : 9300 01 : 7500 02 : 6500 03 : 5800 04 : sRGB
Status	km 00 ff(CR)	m 00 OK02x (Temperature = 6500)	read
Color Effect (kn)			
0 ~ 4 (Default = 0 : Standard)	kn 00 00(CR) kn 00 01(CR) kn 00 02(CR) kn 00 03(CR) kn 00 04(CR)	n 00 OK00x (Effect = Standard) n 00 OK01x (Effect = Game) n 00 OK02x (Effect = Movie) n 00 OK03x (Effect = Photo) n 00 OK04x (Effect = Vivid)	00 : Standard 01 : Game 02 : Movie 03 : Photo 04 : Vivid
Status	kn 00 ff(CR)	n 00 OK00x (Effect = Standard)	read
Local Key (mk)			
POWER KEY	mk 00 00(CR)	k 00 OK00x	00h
MENU KEY	mk 00 01(CR)	k 00 OK01x	01h
LEFT KEY	mk 00 02(CR)	k 00 OK02x	02h
RIGHT KEY	mk 00 03(CR)	k 00 OK03x	03h
DOWN KEY (/ ENTER KEY) (/ PIP)	mk 00 04(CR)	k 00 OK04x	04h
UP KEY (/ EXIT KEY) (/ INFO.)	mk 00 05(CR)	k 00 OK05x	05h
SOURCE KEY	mk 00 06(CR)	k 00 OK06x	06h