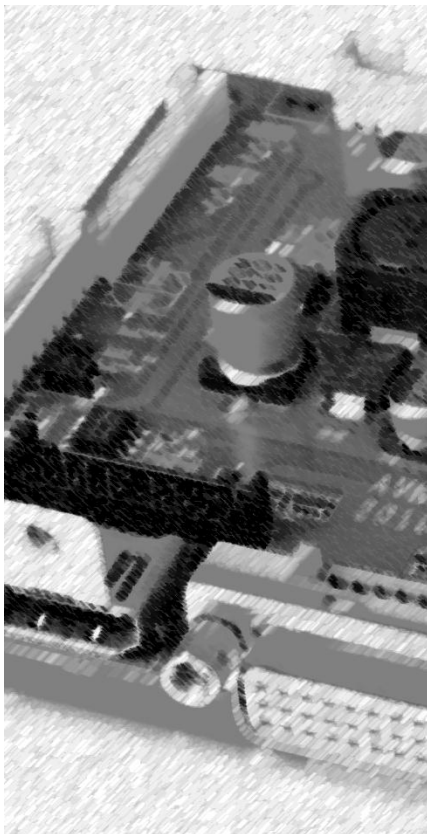


NT15H Series

Data Sheet



Preliminary Release

Final Release

NT15H
8bit, STANDARD TYPE

NT15HA
8bit, WITH AUDIO TYPE

NT15HS
10bit, STANDARD TYPE

NT15HSA
10bit, WITH AUDIO TYPE

*Nov. 2011
Rev. 0.1*

Contents

1	Introduction.....	4
2	General Specification.....	5
3	Absolute Maximum Ratings.....	5
4	Reliability-Environmental Test Condition.....	6
5	Electrical Specification.....	7
6	Block Diagram.....	8
7	Assembly Notes.....	9
8	Connection & Operation.....	11
9	OSD Control Board.....	12
10	OSD function.....	13
11	RS232C Control.....	16
12	IR Control.....	17
13	Connector, Pin Out & Jumper.....	19
14	Controller Dimensions.....	23
15	Application Notes.....	24
16	Troubleshooting.....	25
17	Applicable Graphic Mode.....	26

Revision History

No	Description	Rev.	Date
1	Preliminary Release	0.1	Nov. 2011
2			
3			
4			
5			
6			
7			

1. Introduction

Designed for LCD monitor and other flat panel display application the controller provides an auto-input synchronization and easy to use interface controller for:

- TFT (active matrix) LCD panels of 800x600, 1024x768, 1280x768, 1366x768, 1280x1024, 1440x900, 1680x1050, 1600x1200, 1920x1080 and 1920x1200 resolutions.
- Computer Analog/Digital Video signals of VGA, SVGA, XGA, WXGA, SXGA WXGA+, WSXGA+, UXGA, and WUXGA standard.
- HDMI 1 input of Digital Video Signal.
- All VESA Standard Signal Input Support.

HOW TO PROCEED

- Ensure that you have all parts & they are correct, refer to:
 - Connection diagram
 - Connector reference
 - Assembly notes
- Check controller switch & jumper settings (errors may damage the panel)
- Prepare the PC
- Connect the parts
- Understand the operation & functions

IMPORTANT USAGE NOTE

This equipment is for use by developers and integrators. The manufacturer accepts no liability for damage or injury caused by the use of this product. It is the responsibility of the developer, integrators or other users of this product to:

- Ensure that all necessary and appropriate safety measures are taken.
- Obtain suitable regulatory approvals as may be required.
- Check power settings to all component parts before connection.

DISCLAIMER

There is no implied or expressed warranty regarding this material.

2. General Specification

No	Item	Description		Remark
1	Supported Resolution	1024x768 ~ 1920x1200 resolution support		
2	LCD Module	SVGA, XGA, WXGA, SXGA, WSXGA, WSXGA+, UXGA, WUXGA		
3	Signal Input	Analog RGB, DVI(TMDS)		
4	Frequency Support	H : 31 ~ 80kHz V : 55 ~ 76Hz		
5	OSD Control	Menu, Select, Up, Down, Power		
6	Plug & Play	VESA DDC2b Ver. 1.3		
7	Power Consumption	Supply Voltage	12Vdc	
		Max Power	Max. 10W(Controller Board only)	
8	Signal Connector	Analog	D-SUB 15p	
		Digital	DVI-D, HDMI	
9	Audio	Input	Stereo Jack	
		Output	3W x 2ch	4pin Connector
10	RS232C			Option

3. Absolute Maximum Ratings

Parameter	Symbol	Values		Units	Remark
		Min	Max		
Operating Temperature	T _{OP}	0	50	°C	
Storage Temperature	T _{ST}	-20	60	°C	
Operating Ambient Humidity	H _{OP}	10	90	%RH	
Storage Humidity	H _{ST}	10	90	%RH	

- Note : No condensation of water

4. Reliability-Environmental Test Condition

Item	Condition	Method
Vibration (non-operating)	Wave form : random Vibration level : 1.0GRMS Bandwidth : 10 ~ 50Hz Duration : X, Y, Z, 10min.	One time each direction
Shock (non-operating)	Shock level : 100G Waveform : half sine wave, 2ms Direction : $\pm X$, $\pm Y$, $\pm Z$	One time each direction

- Note : Tested with Mechanical part like as metal fame or plastic housing.

5. Electrical Specification

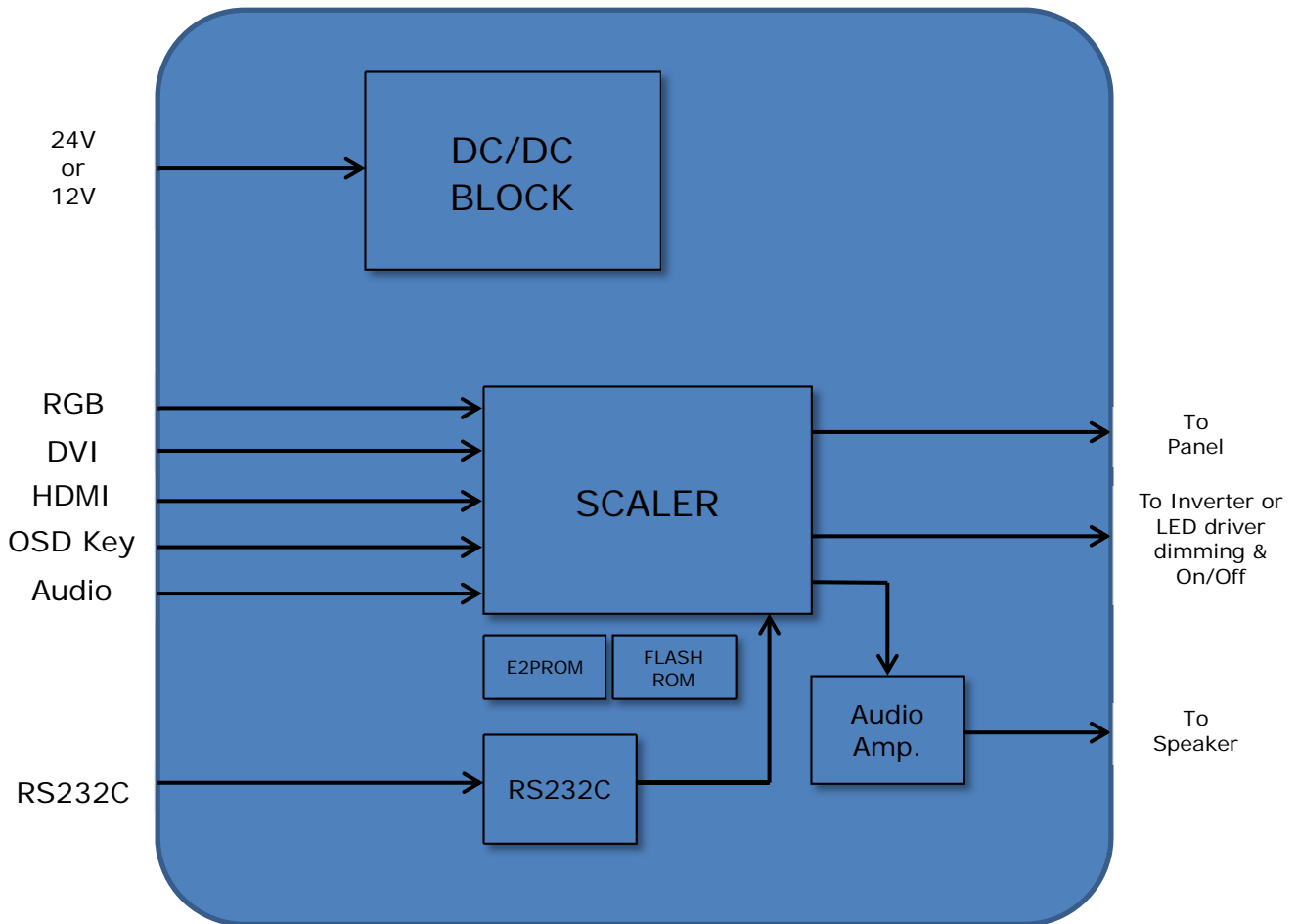
Input characteristic

Description	Signal	Unit	Min.	Type.	Max.	Remark
Power Input	12V	Vdc	11.4	12.0	12.6	
Analog RGB Input	R, G, B	Vp-p	0	0.7	-	
	Sync	Vdc	0	5.0	5.5	
	H Frequency	kHz	31	64	80	
	V Frequency	Hz	55	60	75	
DVI Input	TMDS	mVp-p	450	500	900	
HDMI Input	TMDS	mVp-p	450	500	900	

Output Characteristics

Description	Signal	Unit	Min.	Type.	Max.	Remark
Panel Power	12V	Vdc	11.4	12.0	12.6	
	5V	Vdc	4.75	5	5.25	
LVDS Interface	Differential output	mVp-p	250	350	450	
Backlight Interface	Power out	Vdc	11.4	12.0	12.6	
		Vdc	4.75	5	5.25	
	On/Off control	V	0		3.3	
	Brightness control	V	3.3		0	Panel, Inverter or LED driver option
0				3.3		

6. Block Diagram



7. Assembly Note

This controller is designed for monitors and custom display projects using TFT (active matrix) LCD panels of 1024x768, 1280x768, 1366x768, 1280x1024, 1680x1050, 1600x1200, 1920x1080 and 1920x1200 resolutions, VGA, SVGA, XGA, WXGA, SXGA, WSXGA+, UXGA, WUXGA, HD and FHD signal input. The following provides some guidelines for installation and preparation of a finished display solution.

Preparation: Before proceeding it is important to familiarize yourself with the parts making up the system and the various connectors, mounting holes and general layout of the controller. As much as possible connectors have been labeled. Guides to connectors and mounting holes are shown in the following relevant sections.

1. LCD Panel: This controller has LVDS interface logic on the Board for different kind of TFT LCD panel.
2. Controller: Handle the controller with care as static charge may damage electronic components, Make sure correct jumper and switches settings to match the target LCD and PDP panel
3. LCD connector board: Different makers and models of LCD panel require different panel signal connectors and different pin assignments.
4. LVDS signal cables: In order to provide a clean signal it is recommended that LVDS signal cables should not longer than 30cm. If loose wire cabling is utilized these can be a made into a harness with cable ties. Care should be taken when you place the cables to avoid signal interface. Additionally it may necessary in some systems to add ferrite cores to the cables to minimize signal noise.
5. Inverter: This will be required for the backlight of an LCD, some LCD panel have an inverter built in. As LCD panels may have 1 or more backlight tubes and the power requirements for different panel backlights may vary it is important to match the inverter in order to obtain optimum performance. See application notes for more information on connection.
6. Inverter cable: Different inverter models require different cables and different pin assignment. Make sure the correct cable pin out to match the inverter. Unsuitable cable pins out may damage the inverter.
7. OSD Button: See Operational Function section.
8. LED Indicator: This LED shows the state of controller.
 - Green – Normal state
 - Red – Off mode
 - Amber – DPMS mode
9. Power switch: This switch is located on OSD button board.
10. Power input: Proper power is required to supply power for the controller, the Inverter and the LCD panel
11. VGA Input Cable: As this may affect regulatory emission test result, a suitably shielded cable should be utilized.

Installation Note

EMI :

Shielding will be required for passing certain regulatory radiation tests. Also the choice of video board and power supply can affect the test result.

Consideration should be given to:

- Electrical insulation.
- Grounding.
- EMI shielding.
- Heat & ventilation

Caution:

Ensure that the adequate insulation is provided for all areas of the PCB with special attention to high voltage parts such as the inverter.

Remarks:

For a specific panel use, one panel sample and full technical specifications for the LCD panel from the manufacturer are required to test for tuning up screen image. We can provide engineering service for customer's specific controller development.

Setup Notes

Once the circuit has been connected, a setup procedure for optimal is requires a few minutes. The following instructions are likely to form the basis of the finished product operation manual.

PC Settings:

The PC needs to be set to an appropriate graphics mode that has the same resolution with the LCD panel to have clear screen image. And the vertical refresh rate should be set to one of 56~75Hz, non – interlaced signal.

Display System Settings

The OSD (On Screen Display) provides certain functions to have clear image and others. This board supports 5 buttons OSD operation as a standard. The control functions defined on OSD operation are as below.

PC Graphics Output:

Signal quality is very important, if there is noise or instability in the PC graphics output this may result in visible noise on the display
Refer to the graphic modes table in specification section for supported modes.
Non-interlaced & interlaced video input is acceptable.

Important: please read the application notes section for more information.

8.Connection & Operation

CAUTION:

Never connect or disconnect parts of the display system when the system is operating as this may cause serious damage.

CONNECTION:

1. LCD panel & Inverter: Connect the inverter (if it is not built- in the panel) to the CCFT lead connector of the LCD panel.
2. LVDS type panels: Plug the signal cables direct to J23 of the controller for 1 or 2 channel interface panel
3. Inverter & Controller: Plug the inverter cable to J912 of the controller and another end to the connector on the inverter.
4. Function switch & Controller: Plug the OSD switch mount cable to J804 of the controller and another end to the OSD board.
5. Jumpers: Check all jumpers are set correctly. Details referring the jumpers setting table (in the following section)
6. VGA cable & Controller: Plug the VGA cable to the connector J1 of the controller.
7. DIV-D Cable & Controller: Plug the DVI-D Cable to the connector J901 of the controller.
8. HDMI Cable & Controller: Plug the HDMI Cable to the connector J901 of the controller.
9. Audio Cable & Controller: Plug the Audio Cable to the connector J904 of the controller.
10. Power supply to Controller: Plug the DC 12V power in to the connector J2 of the controller.
11. SMPS & Controller : Plug the SMPS power in to the connector J914 of the controller
12. Power on: Switch on the controller and panel by using the OSD switch mount.

General:

- If you use supplied cables & accessories, ensure that they are correct for the model of the panel and the controller.
- If you make your own cables & connectors, refer carefully to both the panel & inverter specifications and the section in this manual, "Connectors, Pin outs & Jumpers" to ensure the correct pin to pin wiring.

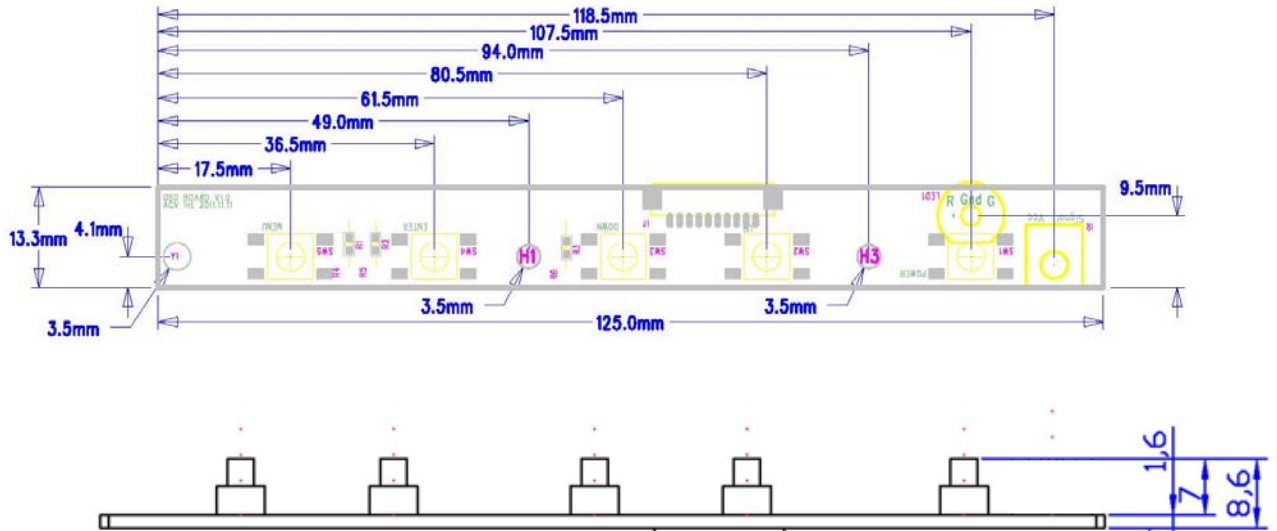
PC Setting:

The controller has been designed to take a very wide range of input signals however to optimize the PC's graphic performance we recommend choosing 60Hz vertical refresh rate – this will not cause screen flicker.

9.OSD Control Board

The OSD (On Screen Display) provides certain functions to have clear image and others. This board supports 5 buttons OSD operation as a standard. The control functions defined on OSD operation are as below. (unit: mm)

OSD Key Dimension



OSD function table

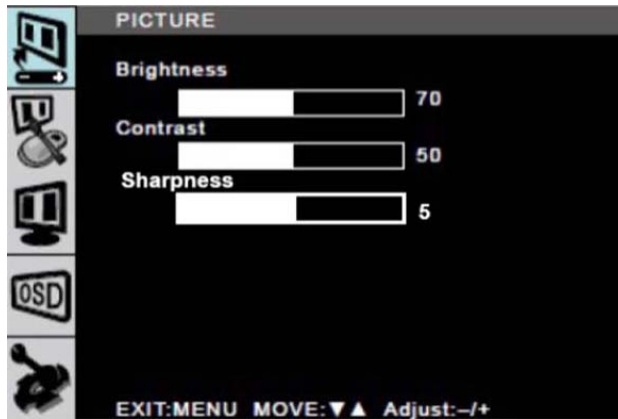
Button	Function	Status	Hot Key
LED	Indicates operation status	Green : Normal State Red : Off Mode Amber : DPMS Mode	
Power	Power On/Off		
Menu	On/Off OSD Menu Exit Sub OSD Menu		
Select	Select function HDMI, DVI, RGB Return to the previous state		Input source change (No OSD window)
Down	Move to Down or left Menu bar Access to the Volume Control Menu Directly		Volume Down (No OSD window)
Up	Move to Up or Right Menu bar Access to the Volume Control Menu Directly		Volume Up (No OSD window)

10.OSD Function

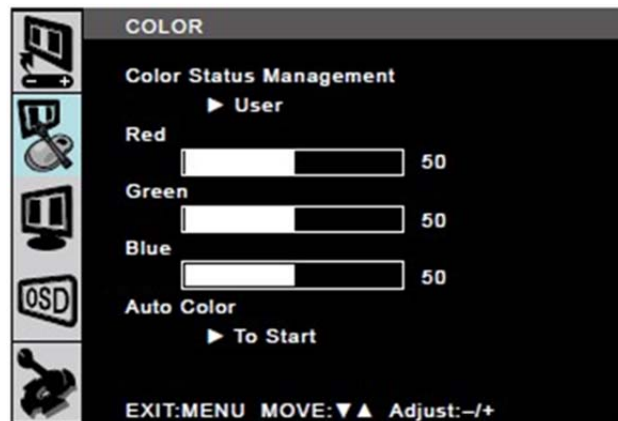
The chosen OSD settings will be stored in memory. The OSD menu can be cleared from the screen by pressing the MENU button otherwise it will be automatically cleared after a few second of non-use.

OSD Main Menu

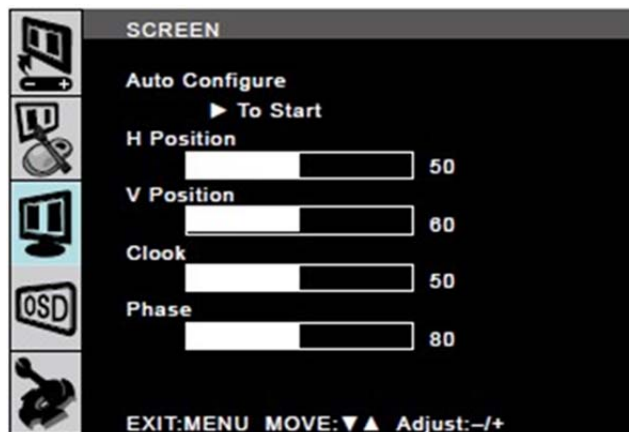
[Picture]



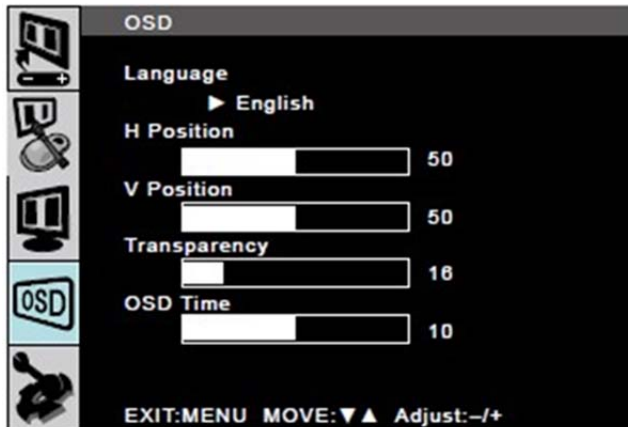
[Color]



[Screen]



[OSD]



[Setup]

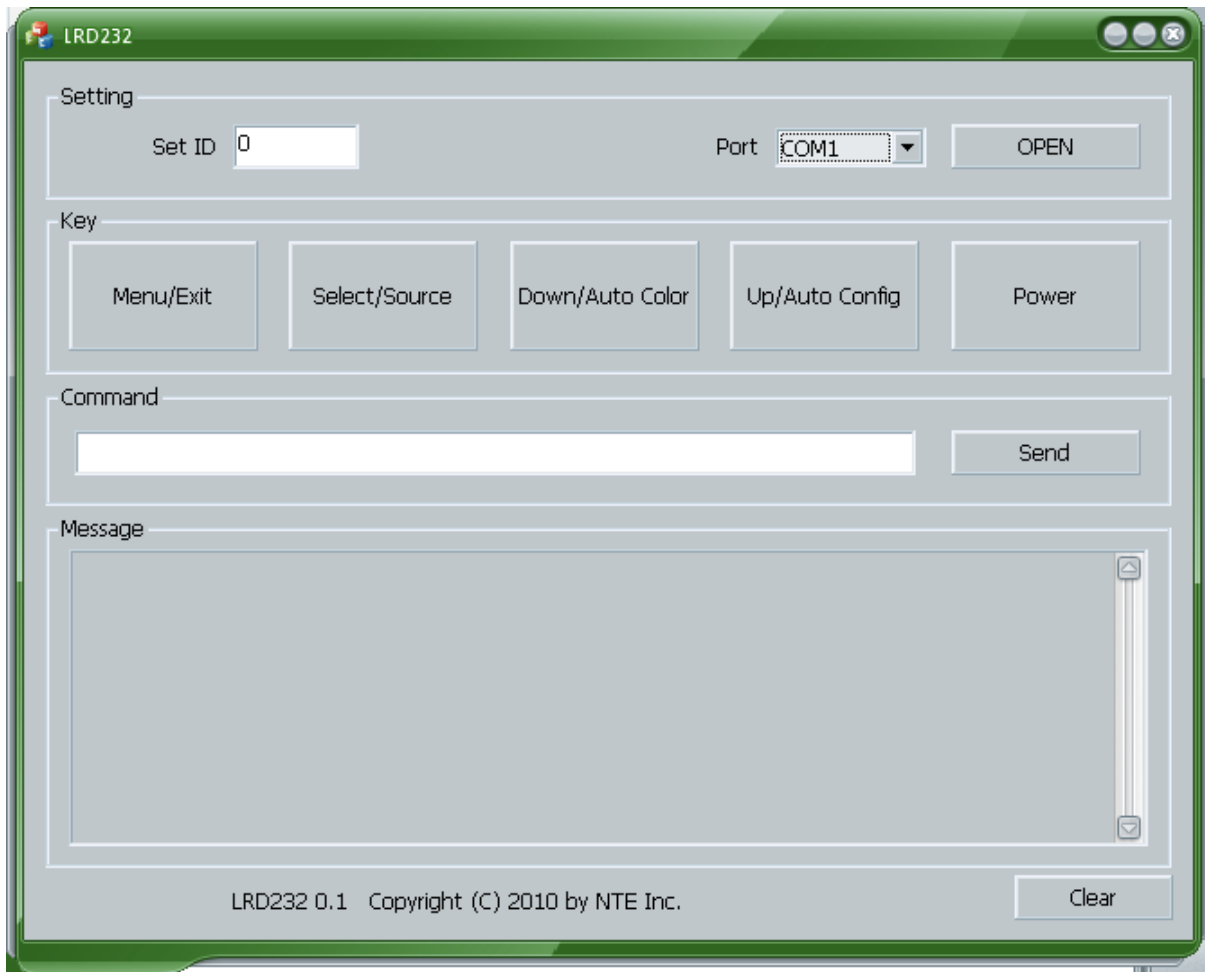


OSD GUI Control Table

Main Menu	Sub Menu	Control	
PICTURE	BRIGHTNESS	0 ~ 100	
	CONTRAST	0 ~ 100	
	SHARPNESS	0 ~ 4	
COLOR	COLOR STATUS MANAGEMENT	USER, WARM, NORMAL, COOL	
	RED	0 ~ 100	
	GREEN	0 ~ 100	
	BLUE	0 ~ 100	
	AUTO COLOR	TO START	
SCREEN	AUTO CONFIGURE		
	H.POSITION		
	V.POSITION		
	CLOCK		
	PHASE		
OSD	LANGUAGE	English(English, Deutsh, Francais, Italiano, Espanol, Korean)	
	H POSITION	0 ~ 100	
	V POSITION	0 ~ 100	
	TRANSPARENCY	0 ~ 100	
	OSD TIME	3 ~ 30	sec
SETUP	SOURCE	RGB, DVI, HDMI	
	FACTORY RESET	TO START	
	ASPECT	ON / OFF	
	SET ID	ON / OFF	option

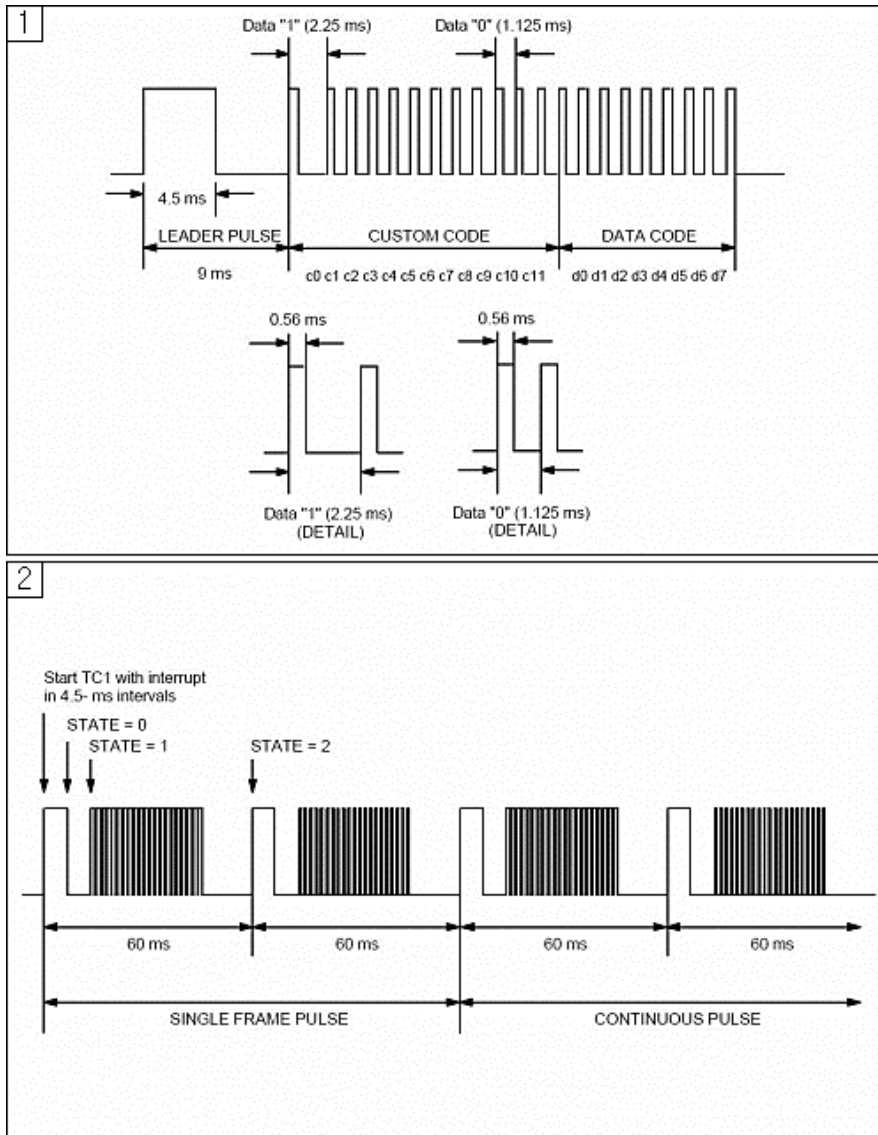
11.RS232 Control

(Option)



	Function	BYTE0	BYTE1	BYTE2	BYTE3	BYTE4	BYTE5
		Length	Set ID	CMD1	CMD2	CMD3	Checksum
POWER KEY	Power On/Off	6	0	'K' (0x4B)	'P' (0x50)	'W' (0x57)	0x08
MENU KEY	Menu/Exit	6	0	'K' (0x4B)	'M' (0x4D)	'N' (0x4E)	0x14
SELECT KEY	Source	6	0	'K' (0x4B)	'M' (0x4D)	'O' (0x4F)	0x13
UP KEY	-	6	0	'K' (0x4B)	'M' (0x4D)	'U' (0x55)	0x0D
DOWN KEY	Auto Config	6	0	'K' (0x4B)	'M' (0x4D)	'D' (0x44)	0x1E
Checksum : BYTE0 + BYTE1 + BYTE2 + BYTE3 + BYTE4 + BYTE5 = 0							

12.IR Control (Option)



Custom Code : 0x40

Data Code

Function	Date Code
POWER	0x00
MENU	0x11
SELECT	0x04
DOWN	0x06
UP	0x02
LEFT	0x03
RIGHT	0x05
VOL_DOWN	0x0B
VOL_UP	0x08
MUTE	0x0C

Remote Control
(Option)

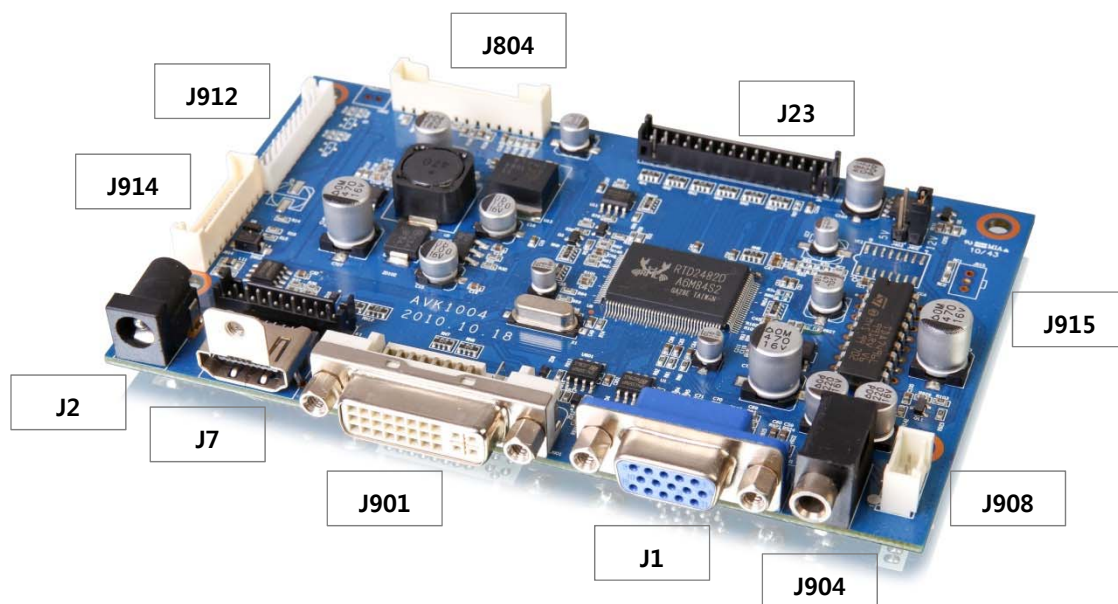


Button	Function	Remark
Power	Power on/off	
Menu	Enable MENU Window Disable MENU Window Exit from Sub function	
Select	Select function HDMI, DVI, RGB Return to the previous state	
Down	Move to Down or Left Access to the Volume Control Menu Directly	
Up	Move to Up or Right Access to the Volume Control Menu Directly	

13.Connector, Pin Out & Jumpers

Summary

L/No.	Item	Description	Type	Manufacture
J914	Wafer	For SMPS	SMW200-10P	YEONHO or Equivalent
J904	Jack	For PC Audio Input	SJ3501-5 H7	NINENEW or Equivalent
J2	Jack	DC-Jack	DJ05H-250	
J915	Wafer	For RS232C	SMW200-3P	YEONHO or Equivalent
J908	Wafer	For Speaker Output	SMW250-04P	YEONHO or Equivalent
J23	Wafer	For LVDS Interface	YDW200-30P	YEONHO or Equivalent
J804	Wafer	For OSD	SMAW200-13P	YEONHO or Equivalent
J912	Jack	For Inverter Control	20010-12P	YEONHO or Equivalent
J7	Jack	HDMI Input		
J901	Jack	DVI Input		
J1	Jack	D-SUB 15P Input		



Pin out Summary

J914 : For only SMPS

Pin No.	Symbol	Description
1, 2	12VIN	24V Logic Power Supply
3	S5V	STAND-BY 5V
4, 5	5V	5V
6	INV-ON	INVERTER-ON
7	DIM	PWM-DIMMING
8	P-ON	POWER CONTROL
9, 10	GND	GROUND

J804 : For OSD Control 5key

Pin No.	Symbol	Description
1	IR_PWR	Power for IR
2	GND	Ground
3	IR_RCVR	IR Receive Signal
4	LED_RED	LED drive for RED Color
5	LED_GREEN	LED drive for GREEN Color
6	KEY-MENU	OSD Menu
7	KEY-UP	OSD Menu Up, Channel Up
8	KEY-DOWN	OSD Menu Down, Channel Down
9	KEY-Exit	Exit
10	KEY-Auto	Auto Adjustment
11	GND	Ground
12	KEY-SEL	Source Selet
13	KEY_PWR	Power

J912 : For Inverter Control

Pin No.	Symbol	Description
1~4	12V output	24V Logic Power Supply
6~9	GND	GND
11	INV_ON/Off	INVERTER On Control Signal
12	INV_Dim	Dimimg Control

J2 : For DC Jack

Pin No.	Symbol	Description
-	GND	Ground
+	Vcc	12V

J7 : HDMI input

Digital	Video Signal	1) Signal type	TMDS data
		2) Gain level	3.3V±0.7V
3) Pixel frequency		max. 210MHz	
4) Resolution		max. 1920 X 1200 /60Hz	
Signal Connectors		HDMI, angle type, female	

J904 : For PC Audio Input

Pin No.	Symbol	Description
1	GND	Ground
1,5	RGB_AL_IN	PC Left Audio Line Input
3,4	RGB_AR_IN	PC Right Audio Line Input

J908 : For Speaker Output

Pin No.	Symbol	Description
1	GND	Ground
2	LOUT	Audio Right Speaker Output Signal
3	GND	Ground
4	ROUT	Audio Left Speaker Output Signal

J901 : DVI Input

Pin No.	Symbol	Description
1	TMDS DATA2-	TMDS DATA2 Differential Negative Signal
2	TMDS DATA2+	TMDS DATA2 Differential Positive Signal
3	TMDS DATA2/4 Shield	Shield for TMDS Channel #2/4
4	TMDS DATA4-	TMDS DATA4 Differential Negative Signal
5	TMDS DATA4+	TMDS DATA4 Differential Positive Signal
6	DDC Clock	The Data Line for the DDC Interface
7	DDC Data	The Clock Line for the DDC Interface
8	Analog Vertical Sync	No Connection
9	TMDS DATA1-	TMDS DATA1 Differential Negative Signal
10	TMDS DATA1+	TMDS DATA1 Differential Positive Signal
11	TMDS DATA1/3 Shield	Shield for TMDS Channel #1/3
12	TMDS DATA3-	TMDS DATA3 Differential Negative Signal
13	TMDS DATA3+	TMDS DATA3 Differential Positive Signal
14	+5V Power	+5 Volt signal for EDID (Un-powered Monitor)
15	GND(for +5V)	Ground for +5 Volt Power pin, Sync return
16	HPD	Identify the presence of a monitor
17	TMDS DATA0-	TMDS DATA0 Differential Negative Signal
18	TMDS DATA0+	TMDS DATA0 Differential Positive Signal
19	TMDS DATA0/5 Shield	Shield for TMDS Channel #0/5
20	TMDS DATA5-	TMDS DATA5 Differential Negative Signal
21	TMDS DATA5+	TMDS DATA5 Differential Positive Signal
22	TMDS CLOCK Shield	Shield for TMDS Clock differential Pair
23	TMDS CLOCK+	TMDS DATA0 Differential Positive Signal
24	TMDS CLOCK-	TMDS DATA0 Differential Negative Signal

J1 : D-SUB 15P Input

Pin No.	Symbol	Description
1	RED VIDEO	Red analog input
2	GREEN VIDEO	Green analog input
3	BLUE VIDEO	Blue analog input
4	N.C	Not connected
5	GROUND	Ground
6	RED GND	Ground
7	GREEN GND	Ground
8	BLUE GND	Ground
9	5V INPUT	
10	GROUND	Ground
11	N.C	Not connected
12	SDA	DDC-SDA
13	H-SYNC	Horizontal Sync
14	V-SYNC	Vertical Sync
15	SCL	Serial Clock Input

J915 : For RS-232C

Pin No.	Symbol	Description
1		
2		
3		

J23 : For LVDS Interface

Pin No.	Symbol	Description
1	MOD_PWR	Panel Power (12V or 5V)
2	MOD_PWR	Panel Power (12V or 5V)
3	MOD_PWR	Panel Power (12V or 5V)
4	Option	High/Low for LCD Option
5	GND	Ground
6	GND	Ground
7	Y4P-EVEN	Negative(+) LVDS differential first 4 data
8	Y4N- EVEN	Positive(-) LVDS differential first 4 data
9	Y3P-EVEN	Negative(+) LVDS differential first 3 data
10	Y3N- EVEN	Positive(-) LVDS differential first 3 data
11	YCP- EVEN	Negative(+) LVDS differential first Clock
12	YCN- EVEN	Positive(-) LVDS differential first Clock
13	Y2P- EVEN	Negative(+) LVDS differential first 2 data
14	Y2N- EVEN	Positive(-) LVDS differential first 2 data
15	Y1P- EVEN	Negative(+) LVDS differential first 1 data
16	Y1N- EVEN	Positive(-) LVDS differential first 1 data
17	Y0P- EVEN	Negative(+) LVDS differential first 0 data
18	Y0N- EVEN	Positive(-) LVDS differential first 0 data
19	GND	Ground
20	GND	Ground
21	Y4P-ODD	Negative(+) LVDS differential second 4 data
22	Y4N-ODD	Positive(-) LVDS differential second 4 data
23	Y3P-ODD	Negative(+) LVDS differential second 3 data
24	Y3N-ODD	Positive(-) LVDS differential second 3 data
25	YCP-ODD	Negative(+) LVDS differential second Clock
26	YCN-ODD	Positive(-) LVDS differential second Clock
27	Y2N-ODD	Positive(-) LVDS differential second 2 data
28	Y2P-ODD	Negative(+) LVDS differential second 2 data
29	Y1P-ODD	Negative(+) LVDS differential second 1 data
30	Y1N-ODD	Positive(-) LVDS differential second 1 data
31	Y0P-ODD	Negative(+) LVDS differential second 0 data
32	Y0N-ODD	Positive(-) LVDS differential second 0 data

Jumpers Summary

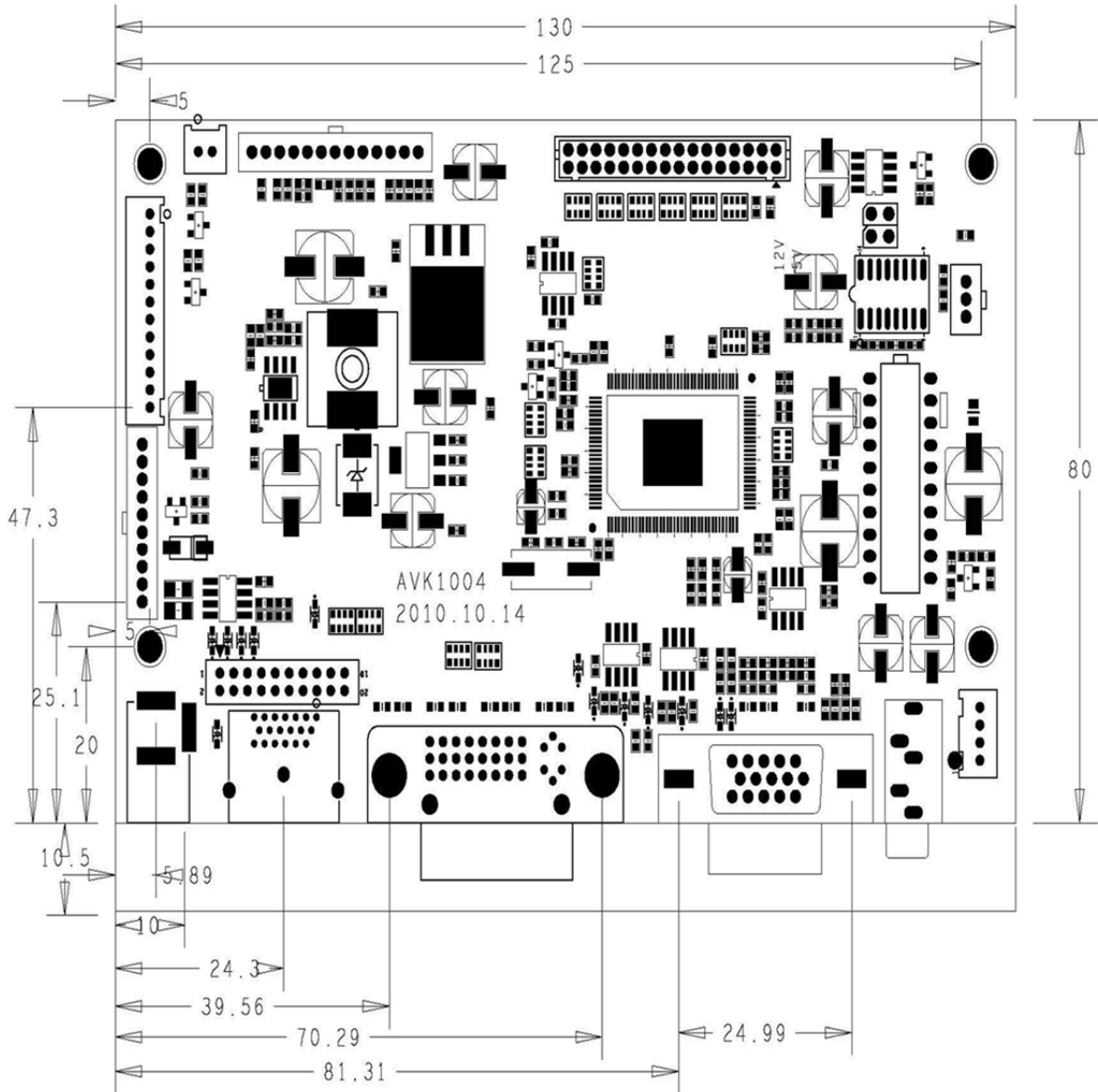
Panel Power Setting

No.		J402	J403	Remark
1	12V	Off	On	
2	5V	On	Off	

● **Caution!**

Please be careful to set Jumper for power output by checking data sheet carefully. Wrong setting may cause serious damage on the panel.
 In case of more than two wrong setting of J402, J403 as 'ON', the panel or controller board may be seriously damaged.

14. Controller Dimensions



[PCB : 1.6T]

15. Application notes

USING THE CONTROLLER WITHOUT BOTTONS ATTACHED

This is very straightforward:

- Firstly setup the controller/display system with the buttons. With the attached controllers and display system active make any settings for color, contrast and image position as required then switch everything off.
- Remove the control switches, the 7-wired cable.
- Refer to inverter specifications for details as to fixing brightness to a desired level, this may require a resistor, an open circuit or closed circuit depending on inverter

INVERTER CONNECTION

There are 3 potential issues to consider with inverter connection:

- Power
- ON/OFF
- Brightness (DIM-ADJ)

Inverter power: This should be matched with the inverter specification.

Inverter ON/OFF: This is a pin provided on some inverter for ON/OFF function and is used by this panel controller for VESA DPMS compliance. If the inverter does not have on/off pin or the on/off pin is not used DPMS will not operate. Pin 5 should be matched to the inverter specification for the ON/OFF pin.

Brightness Dimming control: The controller boards are analog dimming control method. And it is important to consider the specifications for the inverter to be used.

16. Troubleshooting

General

A general guide to troubleshooting of a flat panel display system it worth considering the system as separate elements, such as:

- Controller (jumpers, PC settings)
- Panel (controller, cabling, connection, panel, PC settings)
- Backlight (inverter, cabling, connection, panel, Pc settings)
- Cabling
- Computer system (display settings, operating system)

Through checking the system step by step cross with instruction manuals and a process of elimination to isolate the problem it is usually possible to clearly identify the problem area.

No image:

- If the panel backlight is not working it may still be possible to see just some image.
- A lack of image is most likely to be caused by incorrect connection, lack of power, failure to provide a signal or incorrect graphic card settings.

Image position:

If it is impossible to position the image correctly, the image adjustment controls will not move the image far enough, then test using another graphics card. This situation can occur when a graphic card is not close to standard timing or when something is in the graphics line that may affect the signal such as a signal splitter (please note that normally a signal splitter will not have any adverse effect).

Image appearance:

- A faulty panel can have blank lines, failed sections, flickering or flashing display.
- Incorrect graphic card refresh rate, resolution or interlaced mode will probably cause the image to be the wrong size, to scroll to, flicker badly or possibly even no image.
- Incorrect jumper settings on the controller may cause everything from incorrect image viewing to total failure.

CAUTION:

Do not set the panel power input incorrectly.

- Sparkling on the display: faulty panel signal cable.

Backlight:

Items to check include: Power input, controls, inverter and Tubes generally in this order.

If half the screen is dimmer than the other half:

- Check cabling for the inverter.

17.Applicable Graphic Mode

The microprocessor measures the, H – sync V – sync and 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 Graphic modes shown on the table below and Provide mare clear and stable image on a screen

RGB input format

Mode	Spec Pixel Freq.	Horizontal Timing				Vertical Timing			
		Sync Polar	Freq.	Total	Active	SP	Freq.	Total	Active
			KHz	Pixel	Pixel		Hz	Line	Lind
640*350@70Hz	25.144	P	31.430	800	640	N	70.000	449	350
640*400@70Hz	28.287	N	31.430	800	640	P	70.000	449	400
720*400@70Hz	28.287	N	31.430	900	720	P	70.000	449	400
640*480@70Hz	28.175	N	31.469	800	640	N	59.940	525	480
640*480@72Hz	31.500	N	37.861	832	640	N	72.809	520	480
640*480@75Hz	31.500	N	37.500	840	640	N	75.000	500	480
800*600@56Hz	36.000	P	35.156	1024	800	P	56.250	625	600
800*600@60Hz	40.000	P	37.879	1056	800	P	60.317	628	600
800*600@72Hz	50.000	P	48.077	1040	800	P	72.188	666	600
800*600@75Hz	49.500	P	46.875	1056	800	P	75.000	625	600
1024*768@60Hz	65.000	N	48.363	1344	1024	N	60.005	806	768
1024*768@70Hz	75.000	N	56.476	1328	1024	P	70.070	806	768
1024*768@75Hz	78.750	P	60.023	1312	1024	P	75.030	800	768
1280*720@60Hz	74.500	P	44.772	1664	1280	P	59.855	748	720
1280*768@60Hz	68.250	P	47.396	1440	1280	N	59.995	790	768
1360*768@60Hz	84.75	P	47.72	1776	1360	P	59.799	798	768
1280*1024@60Hz	108.000	P	63.981	1688	1280	P	60.020	1066	1024
1280*1024@75Hz	135.000	P	79.976	1688	1280	P	75.035	1066	1024
1440*1050@60Hz	101.000	P	64.744	1560	1400	N	59.948	1080	1050
1680*1050@60Hz	119.125	P	64.742	1840	1680	N	59.946	1080	1050
1600*1200@60Hz	162.000	P	75.000	2160	1600	P	60.00	1250	1200
1920*1080@60Hz	138.625	P	66.647	2080	1920	N	59.988	1111	1080
1920*1200@60Hz	154.125	P	74.099	2080	1920	N	59.999	1235	1200

ICS Components Co., Ltd.

Young-dong Techno Tower 310, 300-4 Sungsu-dong 2-ga, Sungdong-gu, Seoul, R.o.Korea
TEL +82 (0)2-701-4144~6 | FAX +82 (0)2-701-4147
www.icSCO.kr