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**HARSH ENVIRONMENT  
PC, DVI, VIDEO, HD-Component INTERFACE CONTROLLER  
FOR TFT PANEL**

**Model: HE-1920**

Part number : 41696014X-3 or up

[Firmware version : V0.36.00]

**INSTRUCTIONS**

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**It is essential that these instructions are read and understood before connecting or powering up this controller.**

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## Introduction

Harsh Environment version of the SVH-1920. Provides full SVH-1920 feature set, plus wide range operating temperature and voltage range; shock and vibration tolerance and conformal coating for extreme environment applications.

- TFT (active matrix) LCD panels of 1920x1200, 1920x1080, 1600x1200, 1680x1050, 1440x900, 1366x768, 1280x1024, 1280x800, 1280x768 1024x768, 800x600, 800x480 and 640x480 resolutions.
- Computer video signals of VGA, SVGA, XGA, SXGA, WXGA, UXGA, WUXGA standard.
- Video signals of NTSC, PAL and SECAM standard.
- DVI input support up to 1920x1200 60Hz input signals
- Support HD component input (480p, 720p, 1035i, 1080i, 1080p)
- HD-SDI input support by using optional HD-SDI adaptor board (Kit P/N 546013410-3 / P/N 546013310-3 )
- Low mass tantalum capacitors for maximum vibration and shock tolerance, conformal coating, laboratory certified operating temperature range from -40°C to +80°C plus calculated MTBF in excess of 100K hours.

### HOW TO PROCEED

- Ensure you have all parts & that they are correct, refer to:
  - Connection diagram (separate document for each panel)
  - Connector reference (in following section)
  - 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 user of this product to:

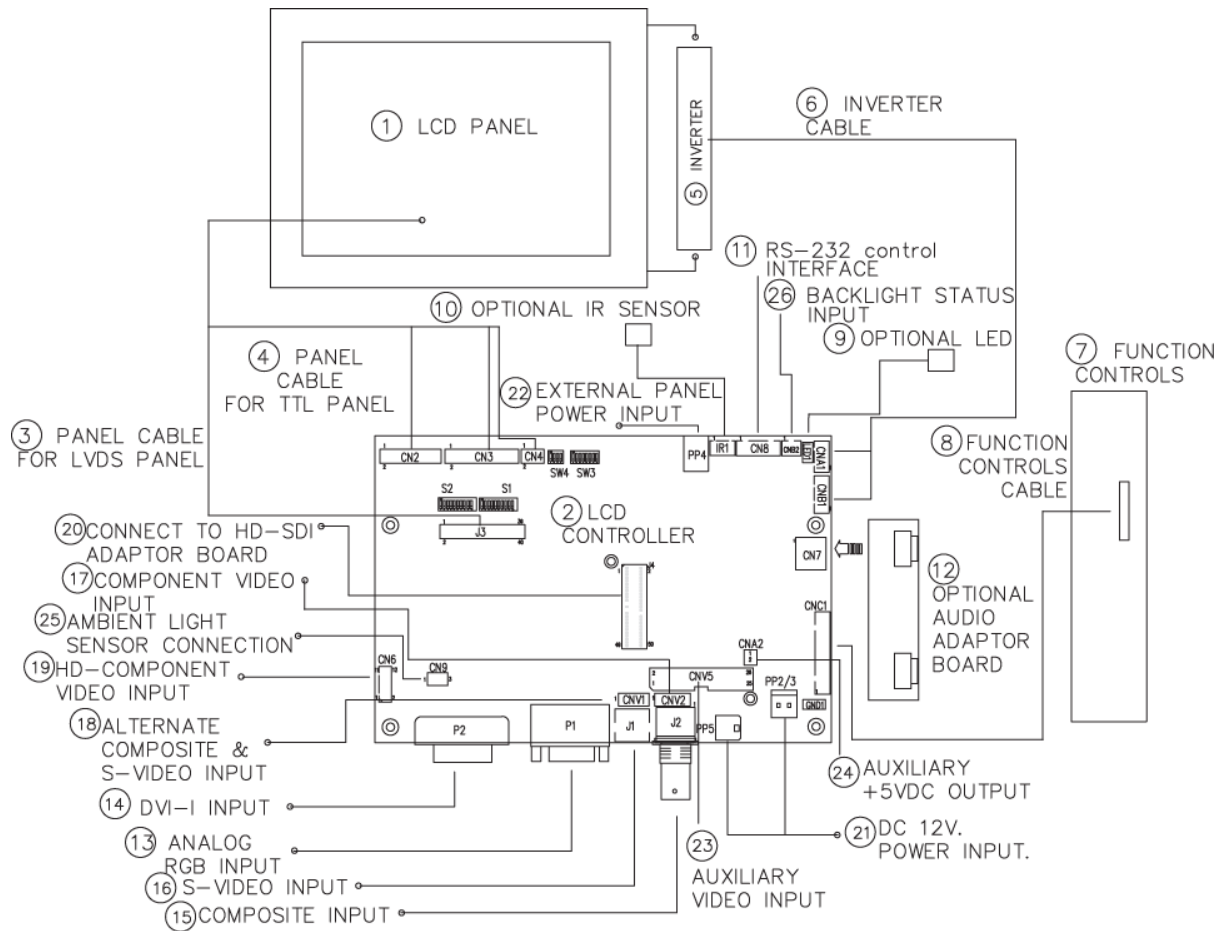
- Ensure that all necessary and appropriate safety measures are taken.
- Obtain suitable regulatory approvals as may be required.
- **Check power settings to all component parts before connection.**

### DISCLAIMER

There is no implied or expressed warranty regarding this material.

## SYSTEM DESIGN

A typical LCD based display system utilising this controller is likely to comprise the following:



### Summary:

1. LCD panel
2. LCD controller card, HE-1920
3. LCD signal cable (use for LVDS panel)
4. LCD signal cable (use for TTL panel)
5. Inverter for backlight (if not built into LCD)
6. Inverter cable
7. Function controls
8. Function controls cable
9. Status LED (optional)
10. IR sensor (optional)
11. RS-232 control interface
12. Audio add-on board (optional)
13. Analog RGB input
14. DVI-I input
15. Composite video input
16. S-Video input
17. Component video input
18. Alternate composite and S-Video input
19. HD-Component video input
20. Interface for connection with to HD-SDI adaptor board
21. +12V DC power input
22. External panel power input
23. Auxiliary video input
24. Auxiliary +5VDC, max 500mA output
25. Ambient light sensor connection
26. Backlight status input

Digital View provides a range of parts, such as listed above, to make up complete display solutions.

## ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using 1920x1200 or 1920x1080 or 1600x1200 or 1680x1050 or 1440x900 or 1366x768 or 1280x1024 or 1024x768 or 800x600 or 640x480 resolution TFT panels with a VGA, SVGA, WXGA, XGA, SXGA, UXGA or WUXGA 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 labelled. Guides to connectors and mounting holes are shown in the following relevant sections.

- 1. LCD Panel:** This controller is designed for typical LVDS or TTL interface panels with panel voltage 3.3V, 5V or 12V, External for 3.3V, 5V, 12V, 18V interface. Due to the variation between manufacturers of panels signal timing and other panel characteristics, factory setup and confirmation should be obtained before connecting to a panel. **(NOTE: Check panel power jumper settings before connection)**
- 2. Controller:** Handle the controller with care as static charge may damage electronic components. Make sure correct jumper and dip switches settings to match the target LCD panel.
- 3. LCD signal cable (LVDS panel):** In order to provide a clean signal it is recommended that LVDS signal cables are no longer than 46cm (18 inches). If those wire cabling is utilized these can be made into a harness with cable ties. Care should be taken when placing the cables to avoid signal interference. Additionally it may be necessary in some systems to add ferrite cores to the cable to minimise signal noise.
- 4. LCD signal cable (TTL panel):** In order to provide a clean signal it is recommended that LCD signal cables should not longer than 33cm (13 inches). If loose wire cabling is utilized these can be made into a harness with cable ties. Care should be taken when placing the cables to avoid signal interference. Additionally it may be necessary in some systems to add ferrite cores to the cables to minimise signal noise.
- 5. Inverter:** This will be required for the backlight of an LCD, some LCD panels 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 page 24 for more information on connection.
- 6. Inverter Cables:** Different inverter models require different cables and different pin assignment. Make sure correct cable pin out to match inverter. Using wrong cable pin out may damage the inverter.
- 7. Function Controls:** The following section discusses the controls required and the section on connectors provides the detail. The controls are minimal: On/Off, Backlight Brightness (depends on inverter), OSD (5 momentary buttons) analog VR type or (8 momentary buttons) digital type.  
The 8 momentary buttons OSD switch mount P/N 416100520-3 or OSD membrane interface P/N 416100120-3 can be used.
- 8. Function controls cable:** The cables to the function switches should be of suitable quality and length so that impedance does not affect performance. Generally lengths up to 1 meter (3 feet) should be acceptable.
- 9. Status LED:** The pin direction of the LED should be corrected for right colour indication. Red colour stands for standby. Green colours stands for signal on. The status LED is an optional part only, can be unconnected.
- 10. IR sensor:** It is an optional part only, can be unconnected if not using IR remote control.
- 11. RS-232 control interface.**
- 12. Audio add-on board P/N 416040020-3:** Provide the interface for the audio add-on board to be connected. The audio add-on board gives the audio input and output signal connection. But the volume cannot be controlled by the OSD menu on the controller. It is an optional part only, can be unconnected if not using audio.
- 13. VGA Input Cable:** As this may affect regulatory emission test results and the quality of the signal to the controller a suitably shielded cable should be utilized.
- 14. DVI-D input cable :** Plug the DVI cable to the connector P2 on the controller board.
- 15. Composite video input :** Standard Composite cables can be used. Reasonable quality cable should be used to avoid image quality degradation.
- 16. S-Video input :** Standard Composite or S-video cables can be used. Reasonable quality cable should be used to avoid image quality degradation.
- 17. Component video input :** Plug the component video input cable P/N 426000600-3 on CNV2 connector
- 18. Alternate composite and S-video input :** Plug the video input cable P/N 426000500-3 on CNV1 connector
- 19. HD component video input :** Plug the YPbPr signal input on CN6 connector. You can consider to use HD component video cable P/N 42603300-3 (YPbPr to DB15 connector) / P/N 426004100-3 (YPbPr to RCA jacks).

## 20. Interface for connecting to HD-SDI adaptor board

HD-SDI (1-in-1-out) adaptor board, Kit number P/N 546013410-3 includes :	
HD-1000 adaptor (1-in-1-out)	P/N 416013410-3
Ribbon cable	P/N 426171120-3, 180mm

HD-SDI (2-in-2-out) adaptor board, Kit number P/N 546013310-3 includes :	
HD-2000 adaptor (2-in-2-out)	P/N 416013310-3
Ribbon cable	P/N 426171120-3, 180mm

**21. Power Input:** 12V is required, this should be a regulated supply. The power rating is depending on the panel and inverter used. Normally, power supply with 3.5Amp current output should be enough for most of 4x CCFT panels. Although the controller provides power regulation for the LCD power this does not relate to the power supplied to the backlight inverter. If an unregulated power supply is provided to an inverter any fluctuations in power may affect operation, performance and lifetime of the inverter and or backlight tubes.

**22. External panel power input :** Allow to supply external power to the panel separately for max 3.3V (7A) or 5V (7A) or 12V (5A) or 18V (3.5A) via PP4 power input connector.

**23. Auxiliary video input :** This port provides Composite video 1 & 2, S-video 1 & 2, SD component 1 & 2. The video input selection can be switched via RS-232 command (0x98).

**24. Auxiliary +5VDC output :** 2 ways connector provides +5VDC output.

**25. Ambient light sensor connection :** 3 ways connector provides interface for ambient light sensor connection.

**26. Backlight status input :** 2 ways connector provides interface for connection with panel which support the panel with backlight status monitoring function.

- **Power output:** Note the controller has an overall 3Amp current limit and the current available from the auxiliary power output will be dependent on the power input and other system requirements.
- **Power Safety:** Note that although only 12VDC is required as 'power-in' a backlight inverter for panel backlighting produces significantly higher voltages (the inverter does not connect to the ground plane). We strongly advise appropriate insulation for all circuitry.
- **EMI:** Shielding will be required for passing certain regulatory emissions tests. Also the choice of external Controller to PC signal cable can affect the result.
- **Ground:** The various PCB mounting holes are connected to the ground plane.
- **Servicing:** The board is not user serviceable or repairable. Warranty does not cover user error in connecting up to the controller and is invalidated by unauthorized modification or repairs.
- **Controller Mounting:** It is recommended that a clearance of at least 10mm is provided above and 5mm below the controller when mounted. Additionally consideration should be given to:
  - Electrical insulation.
  - Grounding.
  - EMI shielding.
  - Cable management. Note: It is important to keep panel signal cables apart from the inverter & backlight cables to prevent signal interference.
  - Heat & Ventilation: Heat generated from other sources, for example the backlight of a very high brightness panel may generate significant heat which could adversely affect the controller.
  - Other issues that may affect safety or performance.
- **PC Graphics Output:** A few guidelines:
  - 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 graphics modes table in specifications section for supported modes.
  - Non-interlaced & interlaced video input is acceptable.

**IMPORTANT: Please read the Application Notes section for more information.**

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## CONNECTION & OPERATION

**CAUTION:** Never connect or disconnect parts of the display system when the system is powered up as this may cause serious damage.

### CONNECTION

Connection and usage is quite straight forward (it is useful to have the relevant connection diagram available at this time):

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. **TTL type panels:** Plug the signal cables direct to CN2, CN3 and CN4 (CN4 will not be used for 3x6-bit panel) on the controller board. Plug the other end of cables to the LCD connector board (if connector board is required, otherwise the signal can be direct plug to the LCD panel connector). Then plug the board connector to the LCD panel connector.  
**LVDS type panels:** The controller board has the built-in LVDS transmitter driver. Plug the LVDS cable to J3. Insert the panel end of the cable the LCD panel connector.
3. **Inverter & Controller:** Plug the inverter cable to CNB1 and CNA1 (if necessary). Plug another end to the connector on the inverter.
4. **Function switch & Controller:** Plug the OSD switch mount cable to CNC1 on the controller board and another to the OSD switch mount.
5. **LED & Controller:** Plug in a 3-way with dual colour LED to connector LED1 on the controller board.
6. **IR & Controller:** Plug in a 3-way with IR sensor to connector IR1 on the controller board.
7. **Jumpers & Switches:** Check all jumpers and switches (S1, S1, SW3, SW4) are set correctly. Details referring the connection diagram (a separate document) or the jumpers and switches setting table (in the following section).
8. **Jumpers & Inverter & Panel voltage:** Particularly pay attention to the settings of JA3, JA5, JA6, JB2 and JB3. JB2 & JB3 are used for inverter control (read inverter specification and information on the jumper table to define the correct settings). JA3 & JA5 & JA6 are used for panel voltage input (read panel specification and information on the jumper table to define the correct settings).
9. **VGA cable & Controller:** Plug the VGA cable to the connector P1 on the controller board.
10. **Power supply & Controller:** Plug the DC 12V power in to the connector PP5 or PP2/3. You can consider to use DigitalView mating power cable P/N 426013800-3, 160mm for PP5 connection.
11. **External panel power input :** Plug power cable : P/N 426013700-3 for external panel power input (3.3 (max 7A) / 5V (max 7A) / 12V (max 5A) / 18V (max3.5))
12. **Power on:** Switch on the controller board and panel by using the OSD switch mount.
13. **Audio Board :** The Audio Add-on Board P/N 416940020-3 can be used.

The red LED will light up when power on. The LED will change to green when VGA signal on.

General:

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

### PC SETTINGS

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

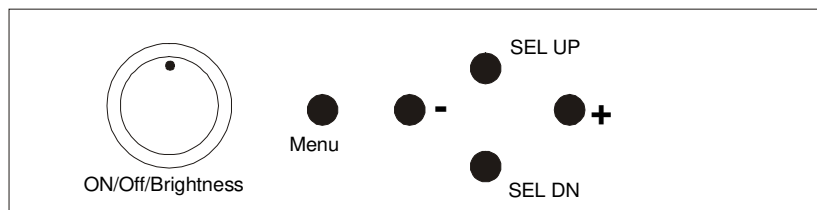
### OPERATION

Once the system has been connected and switched on there are a number of functions available to adjust the display image as summarized in the following sections. The settings chosen will be saved for each mode independently.

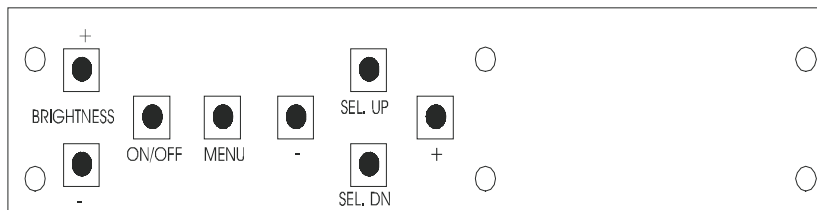
### LCD DISPLAY SYSTEM SETTINGS

NOTE: By way of explanation the following refers to a set of sample buttons that may be obtained as an option. In addition to power on/off and connection for backlight brightness the controller provides an On Screen Display of certain functions which are controlled by 5 momentary type buttons (analog VR type) or 8 momentary type buttons (digital type):

Controls	Analog VR type	Digital type
On/Off – turns controller board power on	VR toggle switch	On/Off button
Brightness – controls backlight brightness	Rotary VR	Brightness +/- buttons
Menu – Turns OSD menu On or Off (it will auto time off) – Back to previous OSD menu page	Menu button	Menu button
Select down – Moves the selector to the next function (down)	SEL DN	SEL DN
Select up – Moves the selector to the previous function (up)	SEL UP	SEL UP
+ – Increase the OSD parameter values – Go into the sub-menu page from the top – Confirm to select the OSD function	+	+
- – Decrease the OSD parameter values – Go into the sub-menu page from the bottom	-	-
Reset to Factory Defaults	Press and hold SEL DN button, then power on the controller	Press and hold SEL DN button, then power on the controller



Analog VR type



Digital type



**OSD functions**



**Picture :**

- Volume<sup>###</sup> Increase/decrease volume level, total: 100 steps
- Brightness Increase/decrease panel brightness level, total: 100 steps
- Contrast Increase/decrease panel contrast level, total: 100 steps
- Saturation Increase/decrease saturation, total: 100 steps
- Hue <sup>\*\*</sup> Increase/decrease Hue level, total: 100 steps
- Sharpness<sup>\*</sup> Increase/decrease sharpness, total: 30 steps

**Position<sup>##</sup>**



Move the image position upward



Move the image position downward



Move the image position to the left



Move the image position to the right

**Backlight ▶**

- Backlight : Backlight brightness adjustment (Function when light detector sets OFF)
- Setup ▶
  - Backlight invert : : Invert for the backlight brightness
  - Backlight Frequency : D/A 600Hz / PWM 160Hz  
 D/A 600Hz : Voltage level dimming control  
 PWM 160Hz : PWM dimming control

**Aspect / Size ▶**

- Fill Screen : Enable full screen expansion for lower resolution Image
- Fill to Aspect Ratio: Enable fill screen expansion for lower resolution image according to aspect ratio
- 4 : 3 : scaling format in 4:3
- 16 : 9 : scaling format in 16:9
- 16 : 10 : scaling format in 16:10
- 2.35 : 1 : scaling format in 2.35:1
- 2 : 1 : scaling format in 2:1
- 1 : 1 : Display the exact image resolution on the screen without image expansion.
- Custom Sizing<sup>####</sup> :
  - Overscan
  - Normal
  - Custom ▶

- H Size
- V Size
- H Pan
- V Pan

Blue Only ON / OFF : Turn off the "Red" & "Green" channel (i.e output all zero to Red & Green channel)  
 [This function will display on OSD menu when JP4 – 5-6 closed]

\* : DISPLAY IN VIDEO MODE ONLY  
 \*\* : FUNCTION IN ARGB/ DVI / VIDEO NTSC / HD COMPONENT MODE ONLY  
 # : DISPLAY IN ARGB / DVI MODE ONLY  
 ## : FUNCTION IN ARGB MODE ONLY  
 ### : DISPLAY WHEN VIDEO ADD-ON BOARD CONNECTED  
 #### : DISPLAY IN VIDEO / HD/SD SDI 1 / HD/SD SDI 2 MODE ONLY



**Input** : Select the input video signal

- HD/SD SDI 1
- HD/SD SDI 2\*\*\*
- VGA\*
- DVI
- HD Component
- Composite 1
- Composite 2\*\*\*
- S-Video
- SD Component

# : Press “-“ key to activate the “Auto Picture Setup” function.

**PIP Setup** ▶

PIP Source ▶

HD/SD SDI 1 / HD/SD SDI 2 / VGA / DVI / HD Component / Composite 1 / Composite 2 / S-Video / SD Component / Off

PIP Size : OFF / Small / Medium / Large / PBP

4 possible input groups that can be mixed for PIP :

- a) VGA/HD-component
- b) DVI
- c) HD-SDI
- d) Composite/S-Video/SD-component

It can not allow to select signal source from the same group for PIP.

PIP Position :



Move the PIP position upward



Move the PIP position downward



Move the PIP position to the left



Move the PIP position to the right

PIP Swap : Swap between the main window and PIP window

PIP Auto off :  : OFF / ON

ON : When PIP is no signal input after 30 seconds, the PIP window will turn off automatically.

OFF : PIP window keeps on

\*\*\* DISPLAY WHEN SETTING ON UNDER SETUP → AUTO SOURCE SEEK



**Utilities** :


**Setup** ▶


Auto Picture Setup# : Auto adjust the image position, phase and size

Auto Color Gain## : Auto Color Calibration (See appendix IV)

Wide Screen Mode detection# ▶ : Recognize the wide screen mode coming from ARGB port

- Off
- 1280x768
- 1366x768

Manual Clock## :  Adjust the image horizontal size

Manual Phase# :  Fine tune the data sampling position (adjust image quality)

Auto Source Seek :

- Auto :  : OFF / ON

ON – Auto source select always enable

OFF – Disable auto source select function

- Setup ▶ Selection for the corresponding input sources detection

HD/SD SDI 1 

HD/SD SDI 2 

VGA 

DVI 

HD Component 

Composite 1 

Composite 2 


S-Video 

SD Component 


The corresponding input port name display on OSD menu will disappear once setting "OFF".

**De-interlacing Mode\* ▶**

AFM  : Auto Film Mode

TNR  : Temporal Noise Reduction

MADI  : Motion Adaptive De-interlacing

LADI  : Low Angled De-interlacing

Auto Power :  OFF / ON

ON – Enable soft power off function if absence of input signals

OFF – Disable soft power function

Video Standard (SD)\* : Auto / NTSC / NTSC 4.43 / PAL / PAL M / SECAM


Image Orientation : Normal / Horizontal flip / Vertical flip / Rotate

Gamma : 1.0 / 1.6 / 2.2

**OSD ▶**

OSD position :

H POS  : Move the OSD menu image horizontally

V POS  : Move the OSD menu image vertically

OSD Timeout (sec) : ON – 60 : Adjust the OSD menu timeout period in a step of 5 seconds (max 60 seconds)

ON = Continuous to display OSD menu.


60 = 60 seconds later will turn off the OSD menu.

Language : English / Chinese : Select OSD menu language display

Transparency :  ON / OFF : Set OSD transparency

**Freeze** : Freeze the image (use "+" button)

**Zoom ▶**

Zoom level :  : Enable the zoom in function on the image displayed.  
Use "+" button to zoom in the image  
Use "-" button to decrease the zoomed image

Horizontal pan :  : Pan the image horizontally

Vertical pan :  : Pan the image vertically

Default : Restore to default values

Note : Freeze state will be cleared when you using zoom function.

**Color Temperature ▶**

5000K

6500K

8000K

9300K

User setting :

USER Red : 

USER Green : 

USER Blue : 

Default : Resume to the default values

**Hot Key ▶**

Hot key 1 : Volume / Brightness / Contrast / Input / Zoom / Freeze / Aspect / PIP Size / PIP Swap / Image Orientation

Hot key 2 : Volume / Brightness / Contrast / Input / Zoom / Freeze / Aspect / PIP Size / PIP Swap / Image Orientation

**Monochrome Mode ▶**

- Color
- Red Monochrome
- Green Monochrome
- Blue Monochrome

**Reset to Factory Defaults**

\* : DISPLAY IN VIDEO MODE ONLY

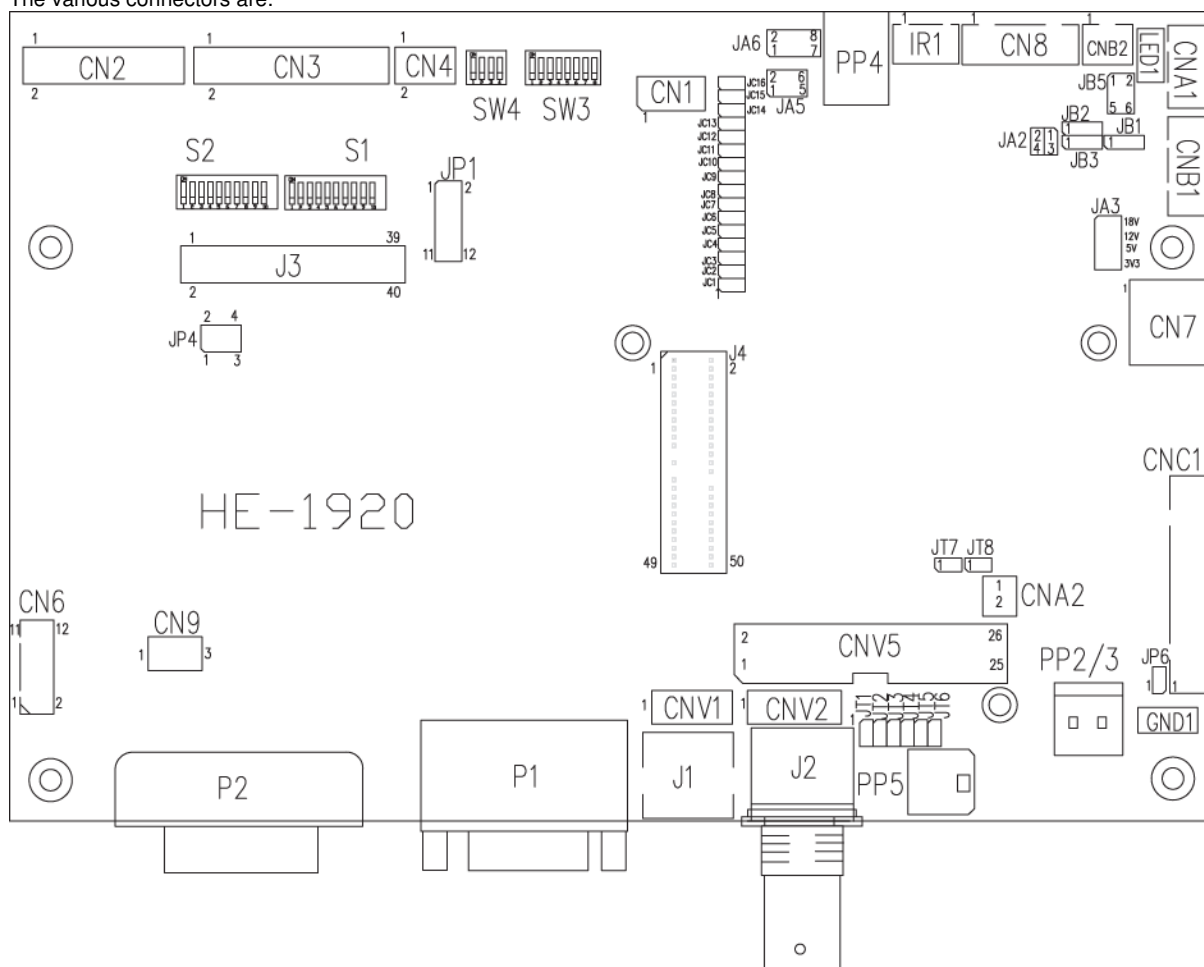
# : DISPLAY IN ARGB MODE ONLY

## : DISPLAY IN ARGB / HD COMPONENT MODE ONLY

Firmware V0.36.00

## CONNECTORS, PINOUTS & JUMPERS

The various connectors are:



### Summary: Connectors

Ref	Purpose	Description
CN1	Reserved	Reserved
CN2	Panel signal for TTL panel	Hirose 40-pin, DF20G-40DP-1V (Matching type : DF20A-40DS-1C)
CN3	Panel signal for TTL panel	Hirose 50-pin, DF20G-50DP-1V (Matching type : DF20A-50DS-1C)
CN4	Panel signal for TTL panel	Hirose 10-pin, DF20G-10DP-1V (Matching type : DF20A-10DS-1C)
CN6	HD-Component input connector	Hirose 12-pin, DF11-12DP-2DSA (Matching type : DF11-12DS-2C) (Matching signal in cable 426004100-3)
CN7	Audio board connector	DIL socket header 5x2 right angle (Matching audio Add-on Board P/N 416940020-3)
CN8	RS-232 serial control	JST 6-way, B6B-XH-A (Matching type : XHP-6)
CN9	Ambient light sensor connector	JST 3-way, B3B-PH-K (Matching type : XHP-3)
CNA1	Auxiliary power output	JST 4-way, B4B-XH-A (Matching type : XHP-4)
CNA2	Auxiliary +5VDC output	JST 2 way, B2B-PH-K (Matching type : XHP-2)
CNB1	Backlight inverter	JST 5-way, B5B-XH-A (Matching type : XHP-5)
CNB2	Backlight status input connector	JST 2 way, B2B-XH-A (Matching type : XHP-2)
CNC1	OSD controls	JST 12-way, B12B-XH-A (Mating type : XHP-12)
CNV1	Alternate video in	JST 5-way, B5B-PH-K (Matching type : PHR-5) (Matching video cable P/N 426000500-3)
CNV2	Component video in	JST 6-way, B6B-PH-K (Matching type : PHR-6) (Matching video cable P/N 426000600-3)
CNV5	Auxiliary video input	Header pin 13x2 (Matching video cable P/N 426000800-3)
J1	S-video in	Mini din 4-way
J2	Composite video in	BNC connector
J3	Panel signal for LVDS panel	Hirose 40 pin, DF13-40DP-1.25DSA (Matching type : DF13-40DS-1.25C)
J4	HD-SDI adaptor board interface connector	2 x 25 ways, 2.54x1.27 header (Matching connector type : DF13-40DS-1.25C) (Matching ribbon cable : P/N 426171100-3)
IR1	Infra-Red sensor connector	JST 3-way, B3B-XH-A (Matching type : XHP-3)
LED1	Dual color LED connector	Header pin 3x1
P1	VGA analog input	DB-15 way high density 3 row
P2	DVI-D or HD-component input	DVI-I connector

PP2/PP3	Power input (alternative)	DC power Molex 2 pin 0.156" pitch
PP4	External panel power input	Molex 43045-0400 compatible (Matching connector type : Molex 43025-0400 compatible) (Matching power cable : P/N 426013700-3)
PP5	Power input	Molex 43650-0200 compatible (Matching connector type : Molex 43645-0200 compatible) (Matching power cable : P/N 426013800-3)
S1	LVDS / TTL panel selection	10 way DIP Switch
S2	LVDS / TTL panel selection	10 way DIP Switch
SW3	Panel selection	8-way DIP Switch
SW4	Function selection	6-way DIP Switch

**Summary: Jumpers setting**

Ref	Purpose	Note
JA1	On board +5V logic power enable	1-2 & 3-4 closed, factory set, do not remove
JA2	On board +3.3V logic power enable	1-2 & 3-4 closed, factory set, do not remove
JA3	Panel power voltage select <b>CAUTION:</b> Incorrect setting can damage panel	See panel voltage setting table 1
JA5	Panel power voltage select <b>CAUTION:</b> Incorrect setting will cause panel damage	See panel voltage setting table 1
JA6	Panel power voltage select <b>CAUTION:</b> Incorrect setting will cause panel damage	See panel voltage setting table 1
JB1	Backlight brightness voltage range	1-2 closed = 3.3V max 2-3 closed = 5V max
JB2	Backlight inverter on/off control – signal level	2-3 = On/Off control signal 'High' = +5V 1-2 = On/Off control signal 'High' = +3.3V Open = On/Off control signal 'High' = Open collector <b>CAUTION:</b> Incorrect setting can damage inverter.
JB3	Backlight inverter on/off control – polarity	1-2 = control signal 'high' = CCFT ON 2-3 = control signal 'low' = CCFT ON
JB5	Backlight control type selection	1-2 = VR/Digital switch mount control 3-4 = Analog backlight brightness - voltage range 0~5V 5-6 = PWM (Pulse Width Modulation) brightness
JC1– JC16	Reserved for custom configuration	Reserved
JP2	Reserved	Reserved
JP4	Custom configuration	1-2 = Reserved 3-4 = On-board programming 5-6 = Display "Blue only" function on OSD menu
JP6	Input power control	Short = External switch control Open = Switch mount control
JT1	Composite video-in terminator enable	Open = composite video input is not terminated Close = composite video input is terminated with 75Ω
JT2	S-Video luma-in terminator enable	Open = S-video luma input is not terminated Close = S-video luma input is terminated with 75Ω
JT3	S-Video chroma-in terminator enable	Open = S-video chroma input is not terminated Close = S-video chroma input is terminated with 75Ω
JT4	Component luma-in terminator enable	Open = component luma input is not terminated Close = component luma input is terminated with 75Ω
JT5	Component Cr-in terminator enable	Open = component Cr input is not terminated Close = component Cr input is terminated with 75Ω
JT6	Component Cb-in terminator enable	Open = component Cb input is not terminated Close = component Cb input is terminated with 75Ω
JT7	Composite video 2-in terminator enable	Open = composite video input is not terminated Close = composite video input is terminated with 75Ω
JT8	Reserved	Reserved
S1 & S2	LVDS or TTL panel selection	LVDS panel : All OFF TTL panel : All ON
SW3	Panel & function selection	See table 2
SW4	Panel & function selection	See table 3

**Table 1 : Panel voltage setting table :**

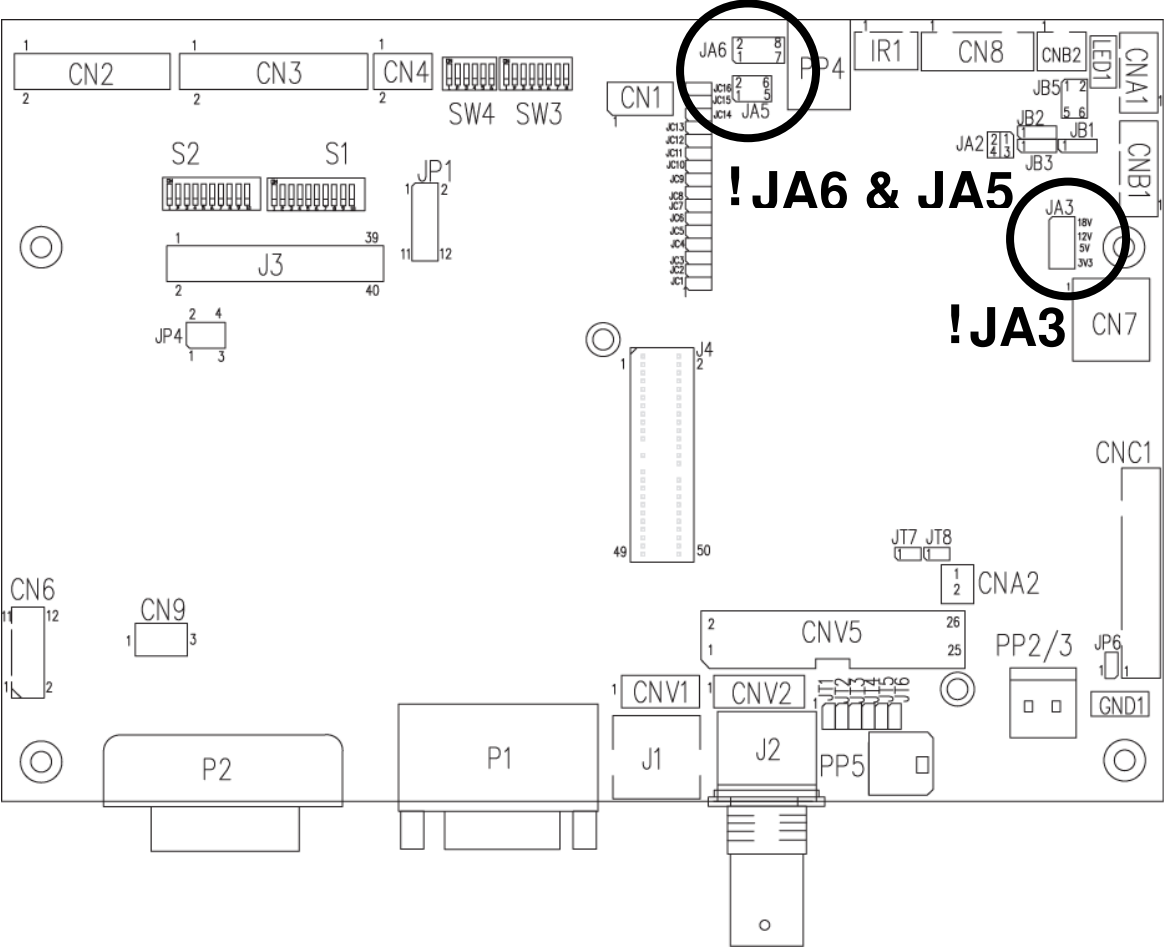
Input voltage via PP2/PP3, PP5	Panel Voltage	JA3	JA5	JA6	Jumper on board
12VDC	3.3V	3V3 closed	1-3 & 2-4	1-3 & 2-4	
	5V	5V closed	1-3 & 2-4	1-3 & 2-4	
	12V	OPEN	1-3 & 2-4	5-7 & 6-8	

**CAUTION: Incorrect setting can damage panel & controller**

Input voltage via PP4	Panel Voltage	JA3	JA5	JA6	Jumper on board
3.3 / 5 / 12 / 18VDC*	3.3V	OPEN	3-5 & 4-6	1-3 & 2-4	
	5V	OPEN	3-5 & 4-6	1-3 & 2-4	
	12V	OPEN	3-5 & 4-6	3-5 & 4-6	
	18V	OPEN	3-5 & 4-6	3-5 & 4-6	

\* Maximum current for 3.3V, 5V = 7A, Maximum current for 12V = 5A, Maximum current for 18V = 3.5A

JA3, JA5 & JA6 location on board : (Please pay attention to the jumper settings on JA3, JA5 & JA6 which are red in color)





**Table 2 : DIP Switch selection – SW3**

Pos #1	Pos #2	Pos #3	Pos.#4	Description	Panel resolution
<b>For WUXGA panels</b>					
OFF	ON	ON	OFF	LG LM260WU1-SLB1*	1920x1200
ON	ON	ON	OFF	LG LM240WU2-SLA1*	1920x1200
OFF	OFF	OFF	OFF	Sharp LQ445D3LZ19	1920x1080
ON	OFF	OFF	OFF	Samsung LTA460H2-L02	1920x1080
OFF	ON	OFF	OFF	Sharp LQ170M1LZ04	1920x1200
ON	ON	OFF	OFF	Samsung LTA700HH-LH1 (1 <sup>st</sup> trial testing)	1920x1080
OFF	OFF	ON	OFF	Samsung LTA700HH-LH1 (2 <sup>nd</sup> trial testing)	1920x1080
<b>For UXGA panels</b>					
OFF	OFF	OFF	OFF	Fujitsu FLC59UXC8V-02A	1600x1200
<b>For WXGA panels</b>					
OFF	OFF	OFF	OFF	LG LC420W02-A4	1366x768
ON	OFF	OFF	OFF	Sharp LQ315T3LZ24	1366x768
ON	ON	OFF	OFF	Samsung LTA320W2-L01 / LTA230W1-L02	1366x768
ON	ON	ON	ON	NEC NL12876BC26-21 / Samsung LTM170W1-L01	1280x768
OFF	ON	ON	ON	CHI MEI N15414-L01	1280x800
OFF	OFF	ON	OFF	AU Optronics M190PW01*	1440x900
<b>For SXGA panel</b>					
OFF	OFF	OFF	OFF	Sharp LQ181E1LW31	1280x1024
ON	OFF	OFF	OFF	AU Optronics M170EN05	1280x1024
<b>For XGA panel</b>					
OFF	OFF	OFF	OFF	Sharp LQ150X1LGN2A	1024x768
				Sharp LQ150X1LGB1	1024x768
<b>For SVGA panel</b>					
OFF	OFF	OFF	OFF	Sharp LQ121S1DG11/41	800x600
				Toshiba LTM08C351	800x600
<b>For WVGA panel</b>					
OFF	OFF	OFF	OFF	NEC NL8048BC24-01	800x480
ON	OFF	OFF	OFF	Kyocera TCG085WV1AB-G00*	800x480
<b>For VGA panel</b>					
OFF	OFF	OFF	OFF	Sharp LQ104V1DG51	640x480
ON	OFF	OFF	OFF	Sharp LQ104V1DG21	640x480
				Kyocera TCG075VG2AC-G00	640x480
<b>Others</b>					
OFF	ON	OFF	OFF	AU Optronics M201EW02 V8*	1680x1050

For additional and recent added panels, see HE-1920 / SVH-1920 panel support table at

<http://www.digitalview.com/controllers/csg.php>

\* Support in V0.36.00 firmware version or up only.

Pos #5	Pos #6	Pos #7	Description
OFF	OFF	OFF	WUXGA
ON	OFF	OFF	UXGA
OFF	ON	OFF	SXGA
ON	ON	OFF	WXGA
OFF	OFF	ON	XGA
ON	OFF	ON	SVGA
OFF	ON	ON	VGA
ON	ON	ON	WVGA / Others

Pos. #8	Video lock	ON – Disable OFF – Enable
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**Table 3 : DIP switch selection – SW4**

Pos. #	Function	Description
1	Clock phase	OFF : Normal ON : Invert
2	Panel pixel format	OFF : Double Pixel ON : Single Pixel
3	Selection of TTL / LVDS panel connection	ON : LVDS OFF : TTL
4	LVDS data mapping select (Refer to Table 2)	ON : Mapping A (LVDS panel) OFF : Mapping B (LVDS panel) Please adjust to get the correct picture. See as Appendix III for details of mapping A and B. No function for TTL panels.

**CN2 – Panel connector: HIROSE DG20G-40DP-1V (Matching type : DF20A-40DS-1C)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	GND	Ground
3	NC	No connection
4	NC	No connection
5	ER0	Even data bit R0
6	ER1	Even data bit R1
7	ER2	Even data bit R2
8	ER3	Even data bit R3
9	ER4	Even data bit R4
10	ER5	Even data bit R5
11	ER6	Even data bit R6
12	ER7	Even data bit R7
13	GND	Ground
14	GND	Ground
15	NC	No connection
16	NC	No connection
17	EG0	Even data bit G0
18	EG1	Even data bit G1
19	EG2	Even data bit G2
20	EG3	Even data bit G3
21	EG4	Even data bit G4
22	EG5	Even data bit G5
23	EG6	Even data bit G6
24	EG7	Even data bit G7
25	GND	Ground
26	GND	Ground
27	NC	No connection
28	NC	No connection
29	EB0	Even data bit B0
30	EB1	Even data bit B1
31	EB2	Even data bit B2
32	EB3	Even data bit B3
33	EB4	Even data bit B4
34	EB5	Even data bit B5
35	EB6	Even data bit B6
36	EB7	Even data bit B7
37	GND	Ground
38	GND	Ground
39	CLK	Dot clock
40	NC	No connection

**CN3 – Panel connector: HIROSE DF20G-50DP-1V (Matching type : DF20A-50DS-1C)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	GND	Ground
3	NC	No connection
4	NC	No connection
5	OR0	Odd data bit R0
6	OR1	Odd data bit R1
7	OR2	Odd data bit R2
8	OR3	Odd data bit R3
9	OR4	Odd data bit R4
10	OR5	Odd data bit R5
11	OR6	Odd data bit R6
12	OR7	Odd data bit R7
13	GND	Ground
14	GND	Ground
15	NC	No connection
16	NC	No connection
17	OG0	Odd data bit G0
18	OG1	Odd data bit G1
19	OG2	Odd data bit G2
20	OG3	Odd data bit G3
21	OG4	Odd data bit G4
22	OG5	Odd data bit G5
23	OG6	Odd data bit G6
24	OG7	Odd data bit G7
25	GND	Ground
26	GND	Ground
27	NC	No connection

28	NC	No connection
29	OB0	Odd data bit B0
30	OB1	Odd data bit B1
31	OB2	Odd data bit B2
32	OB3	Odd data bit B3
33	OB4	Odd data bit B4
34	OB5	Odd data bit B5
35	OB6	Odd data bit B6
36	OB7	Odd data bit B7
37	GND	Ground
38	GND	Ground
39	VS	Vertical sync
40	CLK	Dot clock
41	HS	Horizontal sync
42	DE	Display enable
43	PWR	Power down control signal (5v TTL)
44	VLCD	Panel power supply (3.3v/5v configurable)
45	VLCD	Panel power supply (3.3V/5v configurable)
46	VLCD	Panel power supply (3.3V/5v configurable)
47	NC	No connection
48	VLCD12	+12V panel supply (selected by JA3, JA5 & JA6)
49	VLCD12	+12V panel supply (selected by JA3, JA5 & JA6)
50	VLCD12	+12V panel supply (selected by JA3, JA5 & JA6)

**CN4 – Panel connector: HIROSE DF20G-10DP-1V (Matching type : DF20A-10DS-1C)**

PIN	SYMBOL	DESCRIPTION
1	OP1	Reserved
2	OP2	Reserved
3	OP3	Reserved
4	OP4	Reserved
5	OP5	Reserved
6	OP6	Reserved
7	OP7	Reserved
8	OP8	Reserved
9	NC	No connection
10	NC	No connection

**CN6 - HD-Component input : HIROSE DF11-12DP-2DSA**

PIN	SYMBOL	DESCRIPTION
1	R	Red, analog
2	DDC_5V	+5V power supply for DDC (optional)
3	G	Green, analog
4	GND	Ground
5	B	Blue, analog
6	GND	Ground
7	HS	Horizontal sync or composite sync, input
8	GND	Ground
9	VS	Vertical sync, input
10	DDC_SCL	DDC serial clock
11	NC	No connection
12	DDC_SDA	DDC serial data

**CN7 - Audio connector: DIL socket header 5x2 right angle**

PIN	SYMBOL	DESCRIPTION
1	VCC	Audio board logic power supply, +5V
2	VOLSEL0	Reserved
3	VOLSEL1	Reversed
4	TUNAUDSEL	Reserved
5	CLK/CNT	Reserved
6	GND	Ground
7	+12V	Audio board power supply, +12V
8	NC	No connection
9	NC	No connection
10	GND	Ground

**CN8 – RS-232 serial control: JST B6B-XH-A (Matching type : XHP-6)**

PIN	SYMBOL	DESCRIPTION
1	SDATA	Reserved
2	SCLK	Reserved
3	VCC	+5V
4	TXD	RS-232 Tx data
5	GND	Ground
6	RXD	RS-232 Rx data

**CN9 – Ambient light sensor connector : JST B3B-PH-K (Matching type : XHP-3)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	VCC_5V	VCC 5V
3	ALSF	Ambient light sensing feedback

**CNA1 - Auxiliary power output: JST B4B-XH-A (Matching type : XHP-4)**

PIN	SYMBOL	DESCRIPTION
1	AUX 12V	+12V DC, 500mA max
2	GND	Ground
3	GND	Ground
4	AUX 5V	+5V DC, 500mA max

**CNA2 - Auxiliary power output: JST B2B-PH-K (Matching type : XHP-2)**

PIN	SYMBOL	DESCRIPTION
1	Vcc_5V	+5V DC, 500mA max with fuse
2	GND	Ground

**CNB1 – Backlight inverter connector: JST B5B-XH-A (Matching type : XHP-5)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	VBKL	+12V DC, backlight power supply
3	BLCTRL	On/Off control (enable) – see JB2 & JB3
4	BVR_WIP	Brightness VR – WIP
5	BVR_A	Brightness VR A

**CNB2 – Backlight status input inverter connector: JST B2B-XH-A (Matching type : XHP-2)**

PIN	SYMBOL	DESCRIPTION
1	BL_STATUS	Backlight status (Normal = High)
2	GND	Ground

**CNC1 – Function controls connector: JST B12B-XH-A (Matching type : XHP-12)**

PIN	SYMBOL	DESCRIPTION
1	PSWIN	Power switch A
2	SW_ON	Power switch B
3	BVR_A	Backlight brightness VR pin A
4	BVR_WIP	Backlight brightness VR pin WIP
5	BVR_B	Backlight brightness VR pin B (470Ω resistor to +5V Vcc)
6	GND	Ground
7	MENU	OSD menu button
8	-/LEFT	OSD -/Left button
9	+ /RIGHT	OSD +/Right button
10	SEL_DN	OSD Select down button
11	SEL_UP	OSD Select up button
12	NC	No connection

The VR for brightness depends on the inverter. The main power load for On/Off is handled by a relay on the controller.

**CNV1 – Alternate Video in input, JST B5B-PH-K (Matching type : PHR-5)**

PIN	DESCRIPTION
1	S-Video : Chroma in
2	S-Video : Luma in
3	Ground
4	Ground
5	Composite video in

**CNV2 – Component Video in input, JST B6B-PH-K (Matching type : PHR-6)**

PIN	DESCRIPTION
1	Luma in /Green in
2	Ground
3	Cb in / Blue in
4	Ground
5	Cr in / Red in
6	Ground

**CNV5 – Auxiliary Video input connector, DIL socket header 13x2**

PIN	DESCRIPTION
1	S-Video : Chroma in
2	Ground
3	S-Video : Luma in
4	Ground
5	Composite video in
6	Ground
7	Luma in
8	Ground
9	Cb in
10	Ground
11	Cr in
12	Ground
13	S-Video_2 : Chroma in
14	Ground
15	S-Video_2 : Luma in
16	Ground
17	Composite video in_2
18	Ground
19	Cr in_2
20	Ground
21	Y in_2
22	Ground
23	Cb in_2
24	Ground
25	Short to CNV5 pin 21
26	Ground

**IR1 – Infra-Red sensor connector: JST B3B-XH-A (Matching type : XHP-3)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	STDBY_Vcc	Stand by voltage
3	IR Data	IR data

**J3 – LVDS Panel connector: Hirose, DF13A-40DP-1.25DSA (Matching type : DF13-40DS-1.25C)**

PIN	SYMBOL	DESCRIPTION
1	TXA0+	Positive differential LVDS data bit A0
2	TXA0-	Negative differential LVDS data bit A0
3	TXA1+	Positive differential LVDS data bit A1
4	TXA1-	Negative differential LVDS data bit A1
5	Reserved	-
6	Reserved	-
7	TXA2+	Positive differential LVDS data bit A2
8	TXA2-	Negative differential LVDS data bit A2
9	TXA3+	Positive differential LVDS data bit A3
10	TXA3-	Negative differential LVDS data bit A3
11	GND	Ground
12	GND	Ground
13	TXAC+	Positive LVDS clock for A channel
14	TXAC-	Negative LVDS clock for A channel
15	GND	Ground
16	GND	Ground
17	TXB0+	Positive differential LVDS data bit B0
18	TXB0-	Negative differential LVDS data bit B0
19	TXB1+	Positive differential LVDS data bit B1
20	TXB1-	Negative differential LVDS data bit B1
21	Reserved	-
22	Reserved	-
23	TXB2+	Positive differential LVDS data bit B2
24	TXB2-	Negative differential LVDS data bit B2
25	TXB3+	Positive differential LVDS data bit B3
26	TXB3-	Negative differential LVDS data bit B3
27	GND	Ground
28	GND	Ground
29	TXBC+	Positive LVDS clock for B channel
30	TXBC-	Negative LVDS clock for B channel
31	GND	Ground
32	GND	Ground
33	VDD (3,3V/5V)	Panel power supply (3,3V/5V)
34	VDD (3,3V/5V)	Panel power supply (3,3V/5V)

35	VDD (3,3V/5V)	Panel power supply (3,3V/5V)
36	VDD (3,3V/5V)	Panel power supply (3,3V/5V)
37	NC	No connection
38	VDD +12V	Panel power supply (+12V) (selected by JA3, JA5 & JA6)
39	VDD +12V	Panel power supply (+12V) (selected by JA3, JA5 & JA6)
40	VDD +12V	Panel power supply (+12V) (selected by JA3, JA5 & JA6)

**LED1 – Status LED connector: 3-pin header**

PIN	DESCRIPTION
1	Green LED pin (anode)
2	LED pin common (cathode)
3	Red LED pin (anode)

**P1 - Analog VGA in - 15 way connector**

PIN	SYMBOL	DESCRIPTION
1	PCR	Red, analog
2	PCG	Green, analog
3	PCB	Blue analog
4	ID2	Reserved for monitor ID bit 2 (grounded)
5	DGND	Digital ground
6	AGND	Analog ground red
7	AGND	Analog ground green
8	AGND	Analog ground blue
9	DDC_5V	+5V power supply for DDC (optional)
10	DGND	Digital ground
11	ID0	Reserved for monitor ID bit 0 (grounded)
12	DDC_SDA	DDC serial data
13	HS_IN	Horizontal sync or composite sync, input
14	VS_IN	Vertical sync, input
15	DDC_SCL	DDC serial clock

**P2 – DVI-I in**

PIN	SYMBOL	DESCRIPTION
1	/RX2	TMDS Data 2-
2	RX2	TMDS Data 2+
3	GND	Digital Ground
4	NC	No connection
5	NC	No connection
6	DDC_CLK	DDC Clock
7	DDC_DAT	DDC Data
8	VS_IN	Analog vertical Sync
9	/RX1	TMDS Data 1-
10	RX1	TMDS Data 1+
11	GND	Digital Ground
12	NC	No connection
13	NC	No connection
14	DDC_5V	+5V power supply for DDC (optional)
15	GND	Ground (+5, Analog H/V Sync)
16	NC	No connection
17	/RX0	TMDS Data 0-
18	RX0	TMDS Data 0+
19	GND	Digital Ground
20	NC	No connection
21	NC	No connection
22	GND	Digital Ground
23	RXC	TMDS Clock+
24	/RXC	TMDS Clock-
C1	R	Red or Pr
C2	G	Green or Y
C3	B	Blue or Pb
C4	HS_IN	Analog horizontal sync
C5	GND	Ground
C6	NC	No connection

**PP2/PP3 – Alternate 12VDC power supply**

PIN	DESCRIPTION
1	+12VDC in
2	Ground

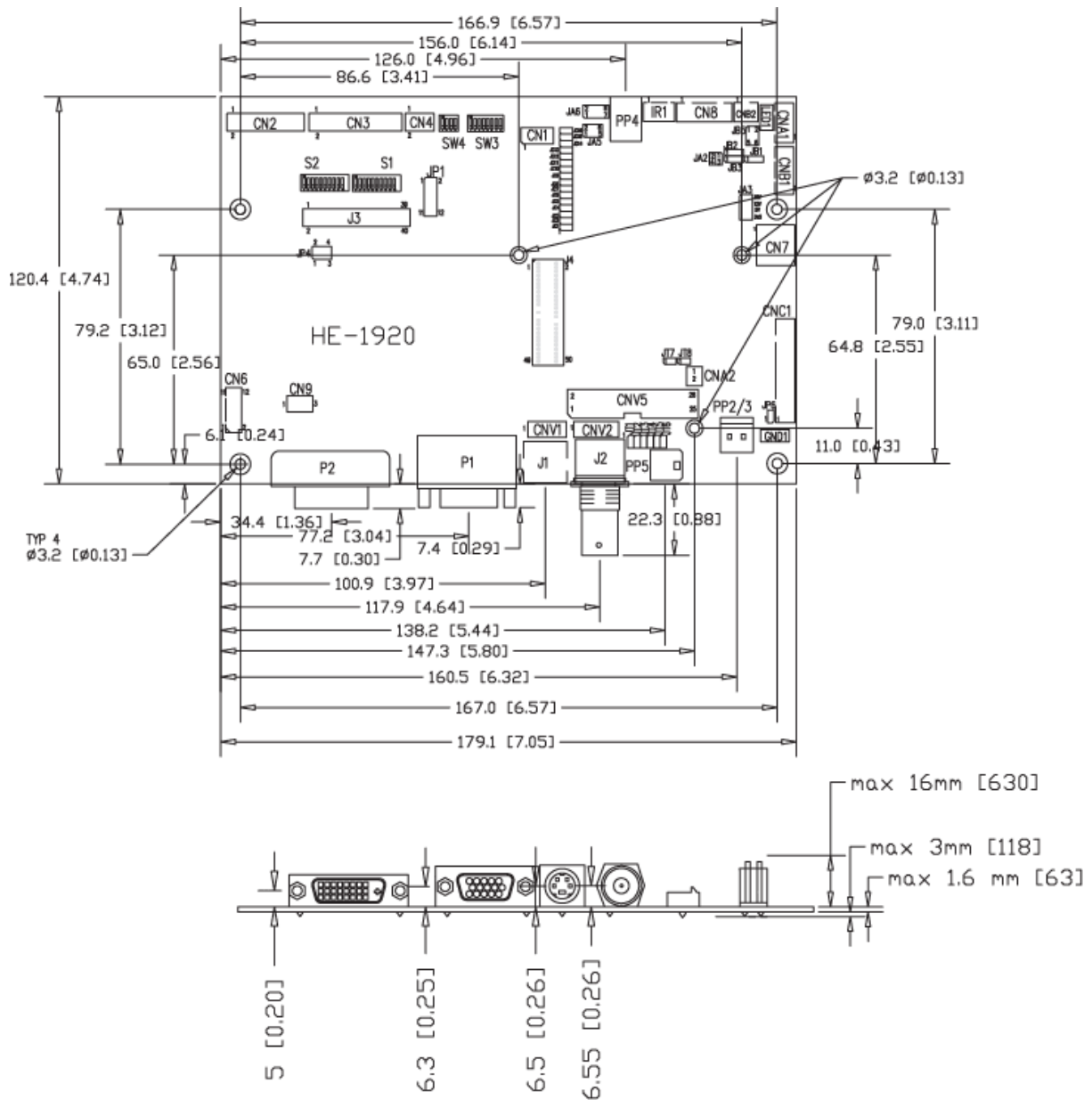
**PP4 – External panel power input**

<b>PIN</b>	<b>DESCRIPTION</b>
1	External panel power
2	Ground
3	External panel power
4	Ground

**PP5 - 12VDC power supply**

<b>PIN</b>	<b>DESCRIPTION</b>
1	+12VDC in
2	Ground

## CONTROLLER DIMENSIONS



The maximum thickness of the controller is 20.6mm with or without video add-on board (measured from bottom of PCB to top of components, including any underside components & leads). We recommend clearances of:

- 5mm from bottom of PCB - if mounting on a metal plate we also recommend a layer of suitable insulation material is added to the mounting plate surface.
- 10mm above the components
- 3~5mm around the edges

Any of the holes shown above can be used for mounting the PCB, they are 3.2mm in diameter.

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



## APPLICATION NOTES

### USING THE CONTROLLER WITHOUT BUTTONS ATTACHED

This is very straightforward:

- Firstly setup the controller/display system with the buttons. With controls attached and display system active make any settings for colour, tint and image position as required then switch everything off.
- Remove the control switches, the 12-way (CNC1) cable.
- Use a jumper or similar to connect pins 1 & 2 on CNC1, this will fix the board On.
- 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.

**Summary:** On CNC1 the only pins that are used are for On/Off and Brightness (if controller mounted inverter is used). On CNC1 the pins are for momentary type buttons so it doesn't matter that no buttons are attached.

### INVERTER CONNECTION

There are potentially 3 issues to consider with inverter connection:

- Power
- Enable
- Brightness

Please read the following sections for a guide to these issues.

**Inverter Power:** As per the table for CNB1 pin 1 is ground and pin 2 provides 12V DC. This should be matched with the inverter specification: see table.

#### CNB1

PIN	DESCRIPTION
1	Ground
2	+12VDC

Remark: For higher power inverter, more current (for 12V) can be taken from CNA1 pin 1.

**Enable:** This is a pin provided on some inverters for On/Off function and is used by this panel controller for VESA DPMS compliance. If the inverter does not have an enable pin or the enable pin is not used then DPMS will not be operational. Pin 3 should be matched to the inverters specification for the 'enable' or 'disable' pin.

#### CNB1

PIN	DESCRIPTION
3	Enable

Further, jumpers JB2 & JB3 should be set to match the inverters specification for the enable pin power and High or Low setting: see table.

Ref	Purpose	Note
JB2	Inverter enable voltage	1-2 H = 12V, 2-3 H = 5V (Vcc), OPEN H = open collector
JB3	Inverter control	1-2 H = On, 2-3 L = On

**Brightness:** There are various methods for brightness control and it is important to consider the specifications for the inverter to be used. Generally the situation is:

- Brightness can be controlled by using a resistor or VR (Variable Resistor).
- Brightness controlled by adding a circuit such as PWM (Pulse Width Modulation).
- No adjustment of brightness is possible.

CNB1 pins 4 & 5 are available for connecting to an inverter or circuit where VR control is supported.

#### CNB1

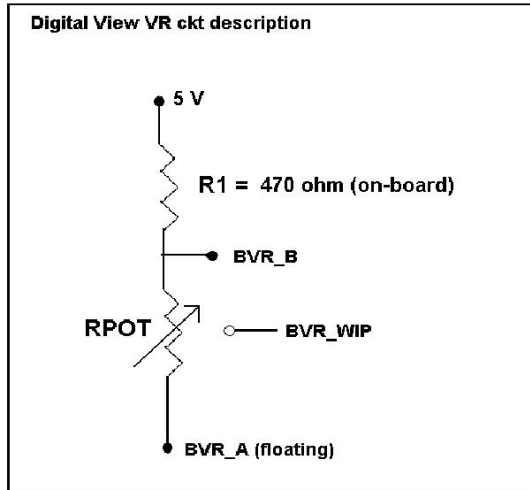
PIN	DESCRIPTION
4	VR WIP
5	VR A

This can then be matched with function controls connected to CNC1 pins 4 & 3 or 5: see table.

#### CNC1

PIN	DESCRIPTION
3	VR A
4	VR WIP
5	VR B

**Design Guideline for making VR circuitry :**



**Signal description / Notes :**

- 1) R1 : 470ohm on board
- 2) RPOT is an external potentiometer (in-line dip style) that can be plugged directly into CNC1 pins 3,4,5. RPOT must be supplied / installed by user.
- 3) BVR\_B : Voltage tapped from “top” of potentiometer, the node of R1 and RPOT.
- 4) BVR\_WIP : Voltage tapped from wiper arm of RPOT.
- 5) BVR\_A : Voltage tapped from “bottom” of RPOT.

**Note : BVR\_A voltage is left floating on the controller board. To use this circuit, you need to tie this point to a potential (usually GND, available at CNC1 pin 6).**

**CNB1 – Backlight inverter connector: JST B5B-XH-A (Matching type : XHP-5)**

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	VBKL	+12VDC, backlight power supply
3	BLCTRL	On/Off control (enable) – see JB2 & JB3
4	BVR_WIP	Brightness VR - WIP
5	BVR_A	Brightness VR A

**CNC1 – Control switch, JST B12B-XH-A (Matching type : XHP-12)**

PIN	SYMBOL	DESCRIPTION
1	PSWIN	Power button A
2	SW_ON	Power button B
3	BVR_A	Backlight Brightness VR pin A
4	BVR_WIP	Backlight Brightness R pin WIP
5	BVR_B	Backlight Brightness VR pin B (470 ohm resistor to +5V Vcc)
6	GND	Ground
7	MENU	OSD menu
8	-/LEFT	OSD -/Left
9	+ /RIGHT	OSD +/Right
10	SEL_DN	OSD Select down
11	SEL_UP	OSD Select up
12	NC	No connection

The VR for brightness depends on the inverter. The main power load for On/Off is handled by a relay on the controller.

**Example for circuit design :**

- 1.) Choose RPOT = 10K
- 2.) Tie BVR\_A to GND
- 3.) Circuit analysis gives BVR\_WIP as the following (see Figure 1)

$$BVR\_WIP = 5 \times (Rbc/10.47)$$

where BVR\_WIP is in Volts.  
And Rbc is the resistance from the wiper arm to bottom of pot in Kohms.

To evaluate, plug in different values of Rbc :

Rbc	BVR_WIP
0	0 V
2.5 K	1.2 V
5 K	2.4 V
7.5 K	3.6 V
10 K	4.8 V

So this circuit could provide Brightness adjust voltage ranging from 0V to 5V.

