



HDMI, DISPORT PORT INTERFACE CONTROLLER FOR TFT PANEL

Model: DT-4096

Part number : 41782002X-3 or up

INSTRUCTIONS

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

Introduction

Designed for LCD monitor and other flat panel display applications, the DT-4096 is a feature rich interface controller for :

- TFT (active matrix) LCD panels of 4096x2160 resolutions in 60Hz with V-by-One or eDP interface.
- Support true 10 bits panel
- Support HDMI, Display Port input.

Ordering information :

| Controller | Part number | Ordering part number |
|------------|-----------------|----------------------|
| DT-4096 | P/N 41782002X-3 | P/N 4178200XX-3 |

HOW TO PROCEED

- Ensure you have all parts & that they are correct, refer to:
 - Connection diagram

Controller Solution Generator

Full web resource matching controllers & panels with **connection diagrams** for download.
See at : <http://www.digitalview.com/csg>

- 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:

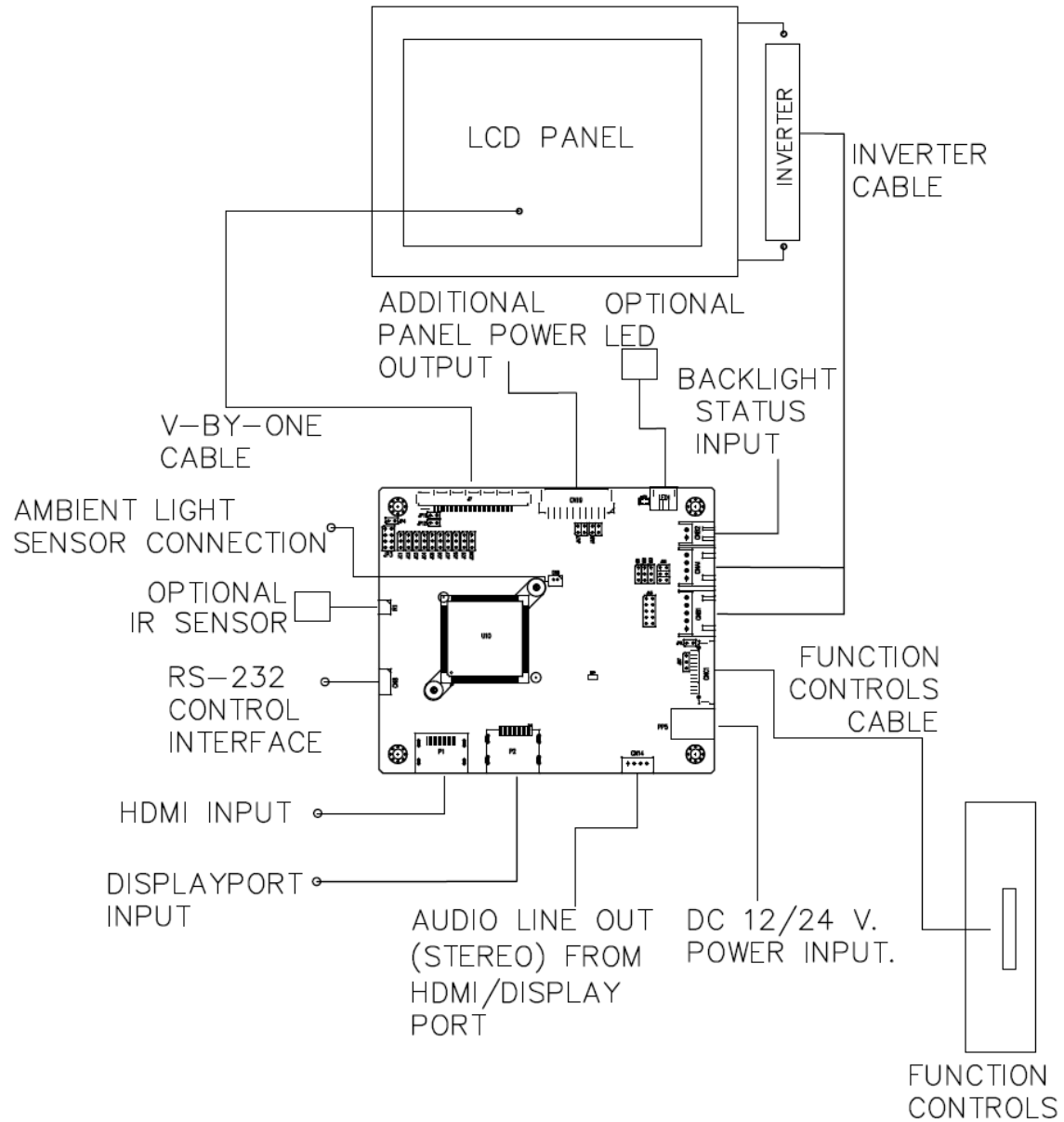
- Ensure that all necessary and appropriate safety measures are taken.
- Obtain suitable regulatory approvals as may be required.
- **Check power settings to all component parts before connection.**

DISCLAIMER

There is no implied or expressed warranty regarding this material.

SYSTEM DESIGN

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



ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using 4096x2160 resolution with V-by-One or eDP interface TFT panels. 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 is designed for typical V-by-One (8 lanes) or eDP interfaced panels with panel voltage 3.3V(4A), 5V(4A), 10V(4A), 12V(4A) or 18V(3A). 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. **LCD Controller:** Handle the controller with care as static charge may damage electronic components. Make sure correct jumper to match the target LCD panel.
3. **Panel cable:** In order to provide a clean signal it is recommended that all panel cables (V-by-One or eDP signal) supplied by Digital View. Care should be taken when placing the cables to avoid signal interference.
4. **Backlight driver:** This will be required for the backlight of an LCD, some LCD panels have a backlight driver 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 backlight driver in order to obtain optimum performance. See Application notes page 23 for more information on connection.
5. **Backlight cables:** Different backlight models require different cables and different pin assignment. Make sure correct cable pin out to match the backlight. Using wrong cable pin out may damage the backlight.
6. **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 backlight), OSD (5 momentary buttons) analog VR type or (8 momentary buttons) digital type.
7. **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.
8. **Optional LED:** The pin direction of the LED should be corrected for right color indication. Red color stands for standby. Green colors stands for signal on. The status LED is an optional part only, can be unconnected.
9. **Optional IR sensor:** It is an optional part only, can be unconnected if not using IR remote control.
10. **RS-232 control interface :** Serial control via CN8 interface port.
11. **Ambient light sensor connection :** 2 ways connector provides interface for connection using light sensor cable (with sensor) P/N 426321940-3 (1000mm) or Light sensor board P/N 416021310-3/416021330-3 with light sensor cable P/N 426305900-3 (1250mm) via CN6 connector.
12. **Backlight status input :** 2 ways connector provides interface for connection with the specific panel type which support the panel with backlight status monitoring function.
13. **HDMI input :** Plug the HDMI cable to the connector P1(HDMI 2.0) on the controller board.
14. **Display Port input :** Support single-link Display port 1.2. Plug the Display Port cable to the connector P2 on the controller board.
15. **Reserved for Audio adaptor board P/N 416940020-3:** The audio add-on board gives the audio input and output signal connection. It is an optional and reserved part only, can be unconnected if not using audio. It requires an audio cable P/N 426451800-3 to connect SP-4096 (CN14) to the Audio Add-on Board (CN2).
CAUTION : The Audio Add-on Board P/N 416940020-3 can only operate with 12VDC power input environment.
16. **Additional panel power input :** Provide additional (+10V/+12V/+18V) panel power input for driving high power consumption panels.
17. **Power Input:** 12V/24VDC is required, this should be a regulated supply. The power rating is depending on the panel and inverter used. Normally, power supply with 3.5A current output should enough for most of 4xCCFT panels. Although the controller provides power regulation for the LCD power this does not relate to the power supplied to the backlight driver. 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.
- **Power output:** Note the controller has an overall 3A 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 12V / 24VDC is required as 'power-in' a backlight driver 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.

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 & backlight:** Connect the inverter/Backlight driver (if it is not built-in the panel) to the inverter/backlight connector of the LCD panel.
2. **V-by-One interface/eDP panels:** The controller board supports V-by-One / eDP interface 4K panel. Plug the cable to J7 for driving 4K 60Hz panel. And make sure the matching panel timings and correct jumper settings (JC1-JC10) by referring to the panel support table and jumper settings table in page 12-16.
3. **Backlight driver:** Plug the backlight cable to CNB1 and CNA1 (if necessary). Plug another end to the connector on the backlight of panel side.
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 color 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 & backlight & Panel voltage:** Particularly pay attention to the settings of JA3, JA7, JA8, JB2 and JB3. JB2 & JB3 are used for backlight control (read backlight specification and information on the jumper table to define the correct settings). JA3, JA7 and JA8 are used for panel voltage input (read panel specification and information on the jumper table to define the correct settings).
8. **Input signal cable & Controller:** Plug the corresponding signal input to the connector on the controller board.
9. **Power supply & Controller:** Plug the DC 12V/24V power in to the connector PP5. You can consider to use DigitalView mating power cable P/N 426013710-3, 1000mm for PP5 connection.
10. **Power on:** Switch on the controller board and panel by using the OSD switch mount.

Controller LED status (LED1/LED1A) :

| State | LED color |
|--|-------------|
| Valid video signal received on the selected input port. | Green |
| (1) No video signal received on the selected input port. (2) Soft power off. | Red |
| The board is fail to boot up. Suggest to send it back to factory for check. | Green + Red |
| The board is not powered on. | Off |

Controller LED status (LED5) :

| Panel power output status | LED color |
|-----------------------------------|-----------|
| Panel power is supplied to panel. | Red |
| No power is supplied to panel. | Off |

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.

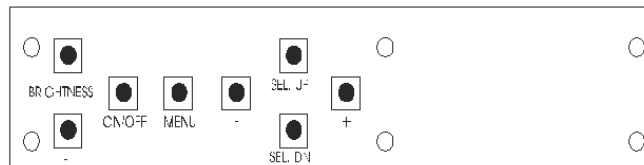
OPERATION

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):

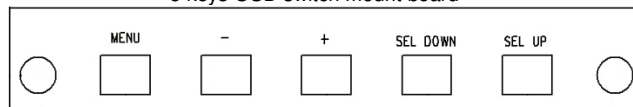
| Controls | Digital type | 5 button OSD switch mount board |
|--|---|---|
| On/Off – turns controller board power on | On/Off button | - |
| Brightness – controls backlight brightness | Brightness +/- buttons | - |
| Menu • Turns OSD menu On or Off (it will auto time off) | Menu button | Menu button |
| Select up • Moves the selector to the previous level function (up) | SEL UP | SEL UP |
| Select down • Moves the selector to the next level function (down) • Confirm the OSD selection | SEL DN | SEL DN |
| + • Increase the OSD parameter values • Moves the selector to next function (forward) | + | + |
| - • Decrease the OSD parameter values • Moves the selector to previous function (backward) | - | - |
| 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 |
| Soft power off and on | Hold Menu button for 3-4 seconds. Press Menu button to turn back on. | Hold Menu button for 3-4 seconds. Press Menu button to turn back on. |



Digital type





Digital 10K Type OSD switch mount
P/N 416100520-3 or up,
matching cable
P/N 426122200-3.






5 keys OSD switch mount board



5 buttons OSD switch mount board P/N 4161003700-3,
matching cable
P/N 426123010-3.

OSD functions

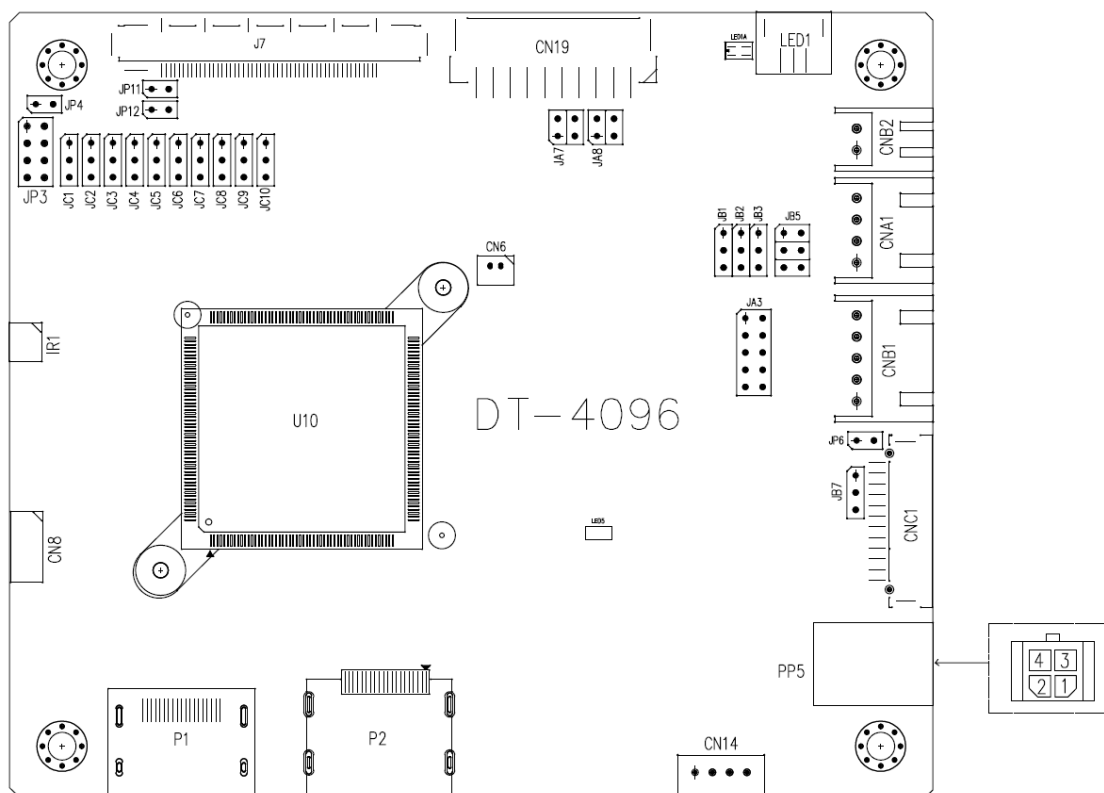
| | |
|---|---|
|  | <p>Picture:</p> <p>Brightness [0-100] [Default 100] Black level [0-100] [Default 50] Contrast [0-100] [Default 50] Sharpness [0-4] [Default 2]</p> |
|  | <p>Display:</p> <p>Disp Rotate : 0 / 180 (Rotate the image only, OSD menu not rotated)</p> |
|  | <p>Color:</p> <p>Gamma : 1.8 2.0 2.2 [Default] 2.4 2.6</p> <p>Temperature: 9300 7500 6500 [Default] 5800 3200 sRGB User : R [0-255] G [0-255] B [0-255]</p> <p>Hue: [0-100] [Default 50] Saturation [0-100] [Default 50]</p> |
|  | <p>Advanced:</p> <p>Aspect Ratio: Full [Default] 16:9 4:3 5:4 1:1</p> <p>Auto Source Seek: OFF ON [Default]</p> <p>Hot Key: Hot Key 1 (+ -) : Input Brightness Black level Contrast Sharpness Hue Saturation Aspect Ratio Display Mode Input Swap PIP Size Auto Adjust Volume No Function [Default]</p> <p>Hot Key: Hot Key 2 (Up Dn) : Input Backlight Brightness Contrast Sharpness Hue Saturation Aspect Ratio Display Mode</p> |

| | |
|--|---|
| | <p>Input Swap PIP Size Auto Adjust Volume No Function [Default]</p> <p>Power Save: OFF ON [Default]</p> <p>Default Power: OFF ON [Default]</p> |
|  <p>Input</p> | <p>Input:</p> <p>D0 : DP D1 : HDMI</p> |
|  <p>Audio</p> | <p>Audio:</p> <p>Volume [0-100] [Default 50]</p> <p>Mute: ON OFF [Default]</p> |
|  <p>Other</p> | <p>Other:</p> <p>Reset</p> <p>Menu Time [On, 11-60] [Default 11]</p> <p>OSD H Position [0-100] [Default 50]</p> <p>OSD V Position [0-100] [Default 50]</p> <p>Transparency [0-255] [Default 0]</p> <p>Rotate: 0 [Default 0] Rotate the OSD menu 90 270 180</p> |
|  <p>Information</p> | <p>Information:</p> <div data-bbox="662 1281 915 1390"> <p>D1: HDMI 3840x2160@60.1Hz H:135.1KHz PCLK: 594.4MHz HDCP Disabled</p> </div> |
|  <p>Factory</p> | <p>Factory:</p> <p>Backlight Setup: Invert : OFF [Default] ON</p> <p>D/A / PWM : PWM [Default] D/A</p> <p>Frequency : [100Hz - 440Hz] [Default 160Hz]</p> <p>Min. Level : [0% - 50%] [Default 5%]</p> <p>Light sensor OFF/ ON [Default OFF]</p> <p>EDID Setup : Reset</p> |

Firmware V1.00.00.02 or up

CONNECTORS, PINOUTS & JUMPERS

The various connectors are:



Summary: Connectors

| Ref | Purpose | Description |
|------|----------------------------------|---|
| CN6 | Ambient light sensor connector | Hirose DF13-2P-1.25DSA (Mating type : DF13-2S-1.25C) |
| CN8 | Serial control | Molex 53261-0671 compatible, 6 ways 1.25mm pitch (Mating type : Molex 51021-0600) (Matching connection cable P/N 426171800-3) |
| CN14 | Analog (Stereo) audio out | JST B4B-PH-K compatible (Matching type : PHR-4) (Matching connection cable P/N 426002500-3 (RCA plug, 610mm) or P/N 426002600-3 (RCA jack, 150mm)) |
| CN19 | Additional panel power output | JST S10B-PH-SM4-TB or compatible (Matching type : PHR-10) |
| CNA1 | Auxiliary power output | JST 4-way, S4B-XH-A or compatible (Matching type : XHP-4) (Matching cable P/N 426040200-3) |
| CNB1 | Backlight inverter | JST 5-way, S5B-XH-A or compatible (Matching type : XHP-5) (Matching cable P/N 426058300-3) |
| CNB2 | Backlight status input connector | JST 2 way, S2B-XH-A or compatible (Matching type : XHP-2) (Matching cable P/N 426020800-3) |
| CNC1 | OSD control | Hirose DF13A-12P-1.25H (Mating type : DF13-12S-1.25C) (For 8 buttons OSD switch mount (P/N 416100520-3): Matching OSD switch mount cable P/N 426122200-3 (150mm) or 426122210-3 (250mm) For 5 buttons OSD switch mount (P/N 416103700-3) : Matching OSD switch mount cable P/N 426123010-3) |
| IR1 | Infra-red sensor connector | Molex 53261-0371 or compatible (Mating type : 51021-0300) (Matching connection cable P/N 426031500-3) |
| J7 | V-by-One/eDP panel signal output | JA E FI-RE51S-HF (Matching type : FI-RE51HL) |
| LED1 | Dual color LED connector | JST S3B-ZR-SM4A or compatible (Mating type : ZHR-3) (Matching connection cable P/N 426031400-3) |
| P1 | HDMI (2.0) -- HDMI input | HDMI connector (Type A) |
| P2 | Displayport input | Display port connector |
| PP5 | 12V/24VDC input power | Molex 43045-0400 compatible (Matching connector type : Molex 43025-0400 compatible) (Matching power cable : P/N 426013710-3) |

All connectors used may use the compatible type.

Specifications subject to change without notice

Summary: Jumpers setting

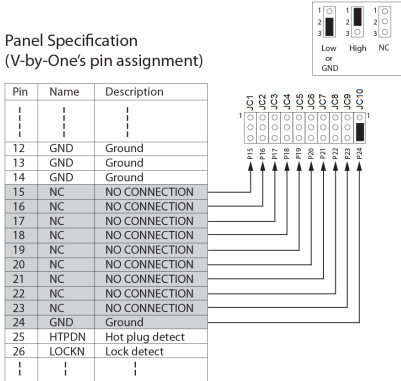
| Ref | Purpose | Note | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|----------|---|--|------|-------------|----|-----|--------|----|-----|--------|----|-----|--------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|----|---------------|----|-----|--------|----|-------|-----------------|----|-------|-------------|--|
| JA3 | Panel power voltage select CAUTION: Incorrect setting can damage panel | See panel voltage setting table 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JA7 | Panel power voltage select CAUTION: Incorrect setting will cause panel damage | See panel voltage setting table 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JA8 | Panel power voltage select CAUTION: Incorrect setting will cause panel damage | See panel voltage setting table 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JB1 | Backlight brightness voltage range | 1-2 closed = 5V max 2-3 closed = 3.3V 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 CAUTION: 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 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JB7 | Backlight control voltage on CNB1 pin 4 (Function when JB5 sets 1-2 closed) | Open = For OSD switch mount control (Default) 1-2 = 0V 2-3 = 3.3V / 5V controlled by JB1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JC1-JC10 | <p>Panel Specification (V-by-One's pin assignment)</p>  <table border="1"> <thead> <tr> <th>Pin</th><th>Name</th><th>Description</th></tr> </thead> <tbody> <tr><td>12</td><td>GND</td><td>Ground</td></tr> <tr><td>13</td><td>GND</td><td>Ground</td></tr> <tr><td>14</td><td>GND</td><td>Ground</td></tr> <tr><td>15</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>16</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>17</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>18</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>19</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>20</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>21</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>22</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>23</td><td>NC</td><td>NO CONNECTION</td></tr> <tr><td>24</td><td>GND</td><td>Ground</td></tr> <tr><td>25</td><td>HTPDN</td><td>Hot plug detect</td></tr> <tr><td>26</td><td>LOCKN</td><td>Lock detect</td></tr> </tbody> </table> | Pin | Name | Description | 12 | GND | Ground | 13 | GND | Ground | 14 | GND | Ground | 15 | NC | NO CONNECTION | 16 | NC | NO CONNECTION | 17 | NC | NO CONNECTION | 18 | NC | NO CONNECTION | 19 | NC | NO CONNECTION | 20 | NC | NO CONNECTION | 21 | NC | NO CONNECTION | 22 | NC | NO CONNECTION | 23 | NC | NO CONNECTION | 24 | GND | Ground | 25 | HTPDN | Hot plug detect | 26 | LOCKN | Lock detect | <p>1-2 close = High 2-3 close = Low or GND Open = NC</p> <p>* The setting of NC (No connection) is subject to the NC's state defined in panel specification.</p> |
| Pin | Name | Description | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 12 | GND | Ground | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 13 | GND | Ground | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 14 | GND | Ground | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 17 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 18 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 19 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 21 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 22 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 23 | NC | NO CONNECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 24 | GND | Ground | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 25 | HTPDN | Hot plug detect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 26 | LOCKN | Lock detect | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JP3 | Panel & function selection | See table 3 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JP4 | Reserved | Default Open | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JP6 | Input power control | Short = External switch control Open = Switch mount control | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JP11 | Panel output power pin selection on J7 | See panel output power pin selection table 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| JP12 | Panel output power pin selection on J7 | See panel output power pin selection table 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Table 1 : Panel voltage setting table :

| Input voltage via 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

* Maximum current for 3.3V, 5V = 4A,

| Input voltage via PP5 | Panel Voltage | JA3 | JA5 | JA6 | Jumper on board |
|-----------------------|---------------|------------|-----------|-----------|-----------------|
| 24VDC** | 3.3V | 3V3 closed | 1-3 & 2-4 | 1-3 & 2-4 | |
| | 5V | 5V closed | 1-3 & 2-4 | 1-3 & 2-4 | |
| | 10V | 10V closed | 1-3 & 2-4 | 3-5 & 4-6 | |
| | 12V | 12V closed | 1-3 & 2-4 | 3-5 & 4-6 | |
| | | | | | |

| | | | | | |
|--|-----|------------|-----------|-----------|--|
| | 18V | 18V closed | 1-3 & 2-4 | 3-5 & 4-6 | |
|--|-----|------------|-----------|-----------|--|

CAUTION: Incorrect setting can damage panel & controller

* Maximum current for 3.3V, 5V = 4A, Maximum current for 10V,12V = 4A, Maximum current for 18V = 3A

JA3, JA7 & JA8 location on board : (Please pay attention to the jumper settings on JA3, JA7 & JA8 which are red in color)

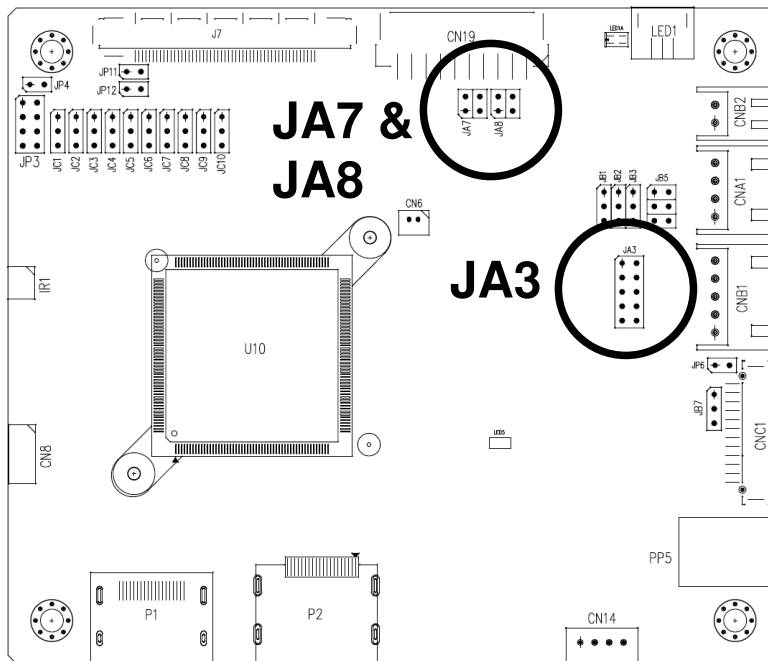
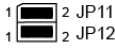
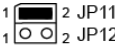
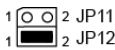
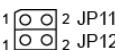


Table 2 : Panel Output power pin selection table (JP11 and JP12):

| Output power pin selection on J7 | JP11 | JP12 | Jumper on board |
|---------------------------------------|-----------|-----------|---|
| Pin-44 to Pin-51 (Pin-1 to Pin-8)* | 1-2 CLOSE | 1-2 CLOSE |  |
| Pin-48 to Pin-51 (Pin-1 to Pin-4)* | 1-2 CLOSE | 1-2 OPEN |  |
| Pin-44 to Pin-47 (Pin-5 to Pin-8)* | 1-2 OPEN | 1-2 CLOSE |  |
| No power output on pins | 1-2 OPEN | 1-2 OPEN |  |

CAUTION: Incorrect setting can damage panel & controller

*Pin # read at panel side

Table 3 : Panel timings selection – JP3

| JP3 | Description | Panel resolution | Panel resolution |
|------------|---------------------|------------------|------------------|
| OPEN | Innolux M280DGJ-L30 | 3840x2160 | V-by-1 |
| 7-8 closed | BOE MV238QVM-N20 | 3840x2160 | eDP |

Remark : The above panel timings are generated based on the panel specification. Some of the panel timings settings may not exactly to match the panel model we specified in this table.

Support "Resolution default by EDID" for different resolution panel.

The controller will set the preferred timing based off the JP3 jumper setting selection, but also be able to go higher to 4096x2160. For example, if the panel is a 3840x2160 and the JP3 jumper setting is set for 3840x2160. The preferred EDID resolution should be 3840x2160. It should also have the capability to set the max resolution to 4096x2160.

CN6 – Ambient light sensor connector : Hirose DF13-2P-1.25DSA compatible (Mating type : DF13-2S-1.25C)

| PIN | SYMBOL | DESCRIPTION |
|-----|--------|-----------------------|
| 1 | 3.3V | 3.3V |
| 2 | ALS | Ambient light sensing |

CN8 – RS-232 serial control: Molex 53261-0671 compatible (Mating type : Molex 51021-0600)

| PIN | SYMBOL | DESCRIPTION |
|-----|---------------|----------------|
| 1 | EXT_MSTR2_SCL | Reserved |
| 2 | EXT_MSTR2_SDA | Reserved |
| 3 | VCC | +5V |
| 4 | TXD | RS-232 Tx data |
| 5 | GND | Ground |
| 6 | RXD | RS-232 Rx data |

CN14 –Audio line out (Stereo) connector: JST B4B-PH-K compatible (Matching type : PHR-4)

| PIN | SYMBOL | DESCRIPTION |
|-----|------------|---------------------|
| 1 | GND | GND |
| 2 | AUDIO LOUT | AUDIO LINE OUT LEFT |
| 3 | GND | GND |
| 4 | AUDIO ROUT | AUDIO LINE OUT LEFT |

CNA1 - Auxiliary power output: JST 4-way, S4B-XH-A compatible (Mating type : XHP-4)

| PIN | SYMBOL | DESCRIPTION |
|-----|---------------|---------------------------|
| 1 | AUX 12V / 24V | +12V / +24V DC, 500mA max |
| 2 | GND | Ground |
| 3 | GND | Ground |
| 4 | AUX 5V | +5V DC, 500mA max |

CNB1 – Backlight inverter connector: JST 5-way, S5B-XH-A or compatible (Matching type : XHP-5)

| PIN | SYMBOL | DESCRIPTION |
|-----|---------|---|
| 1 | GND | Ground |
| 2 | VBKL | +12V / +24V 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 2 way, S2B-XH-A or compatible (Matching type : XHP-2)

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

CNC1 – OSD switch mount control, Hirose DF13A-12P-1.25H (Mating type : DF13-12S-1.25C)

| 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.

IR1 – Infra-Red sensor connector: Molex 53261-0371 or compatible (Mating type : 51021-0300)

| PIN | SYMBOL | DESCRIPTION |
|-----|---------|-------------|
| 1 | GND | Ground |
| 2 | VCC | +3.3V |
| 3 | IR Data | IR data |

J7 – eDP panel signal output connector: JAE FI-RE51S-HF(Matching type :JAE FI-RE51HL)

| PIN | SYMBOL | DESCRIPTION |
|-----|--------------------|--------------------------------------|
| 1 | (51) GND | Ground |
| 2 | (50) LANE7P_VB1_7N | Lane 7 (Negative) |
| 3 | (49) LANE7P_VB1_7P | Lane 7 (Positive) |
| 4 | (48) GND | Ground |
| 5 | (47) LANE6P_VB1_6N | Lane 6 (Negative) |
| 6 | (46) LANE6P_VB1_6P | Lane 6 (Positive) |
| 7 | (45) GND | Ground |
| 8 | (44) LANE5P_VB1_5N | Lane 5 (Negative) |
| 9 | (43) LANE5P_VB1_5P | Lane 5 (Positive) |
| 10 | (42) GND | Ground |
| 11 | (41) LANE4P_VB1_4N | Lane 4 (Negative) |
| 12 | (40) LANE4P_VB1_4P | Lane 4 (Positive) |
| 13 | (39) GND | Ground |
| 14 | (38) LANE3P_VB1_3N | Lane 3 (Negative) |
| 15 | (37) LANE3P_VB1_3P | Lane 3 (Positive) |
| 16 | (36) GND | Ground |
| 17 | (35) LANE2P_VB1_2N | Lane 2 (Negative) |
| 18 | (34) LANE2P_VB1_2P | Lane 2 (Positive) |
| 19 | (33) GND | Ground |
| 20 | (32) LANE1P_VB1_1N | Lane 1 (Negative) |
| 21 | (31) LANE1P_VB1_1P | Lane 1 (Positive) |
| 22 | (30) GND | Ground |
| 23 | (29) LANE0P_VB1_0N | Lane 0 (Negative) |
| 24 | (28) LANE0P_VB1_0P | Lane 0 (Positive) |
| 25 | (27) GND | Ground |
| 26 | (26) V_LOCK | No Connection (Internal Use) |
| 27 | (25) V_HPD | Hot Plug Detect |
| 28 | (24) NC | No Connection (JC10 – No connection) |
| 29 | (23) NC | No Connection (JC9 – No connection) |
| 30 | (22) AUX_CH_P_1 | Auxiliary Channel 1 (Positive) |
| 31 | (21) AUX_CH_N_1 | Auxiliary Channel 1 (Negative) |
| 32 | (20) NC | No Connection (JC6 – No connection) |
| 33 | (19) NC | No Connection (JC5 – No connection) |
| 34 | (18) NC | No Connection (JC4 – No connection) |
| 35 | (17) NC | No Connection (JC3 – No connection) |
| 36 | (16) AUX_CH_P_2 | Auxiliary Channel 2 (Positive) |
| 37 | (15) AUX_CH_N_2 | Auxiliary Channel 2 (Negative) |
| 38 | (14) GND | Ground |
| 39 | (13) GND | Ground |
| 40 | (12) GND | Ground |
| 41 | (11) GND | Ground |
| 42 | (10) GND | Ground |
| 43 | (9) NC | No Connection |
| 44 | (8) PANEL_VCC | Panel power supply(selected by JP12) |
| 45 | (7) PANEL_VCC | Panel power supply(selected by JP12) |
| 46 | (6) PANEL_VCC | Panel power supply(selected by JP12) |
| 47 | (5) PANEL_VCC | Panel power supply(selected by JP12) |
| 48 | (4) PANEL_VCC | Panel power supply(selected by JP11) |
| 49 | (3) PANEL_VCC | Panel power supply(selected by JP11) |
| 50 | (2) PANEL_VCC | Panel power supply(selected by JP11) |
| 51 | (1) PANEL_VCC | Panel power supply(selected by JP11) |

(1) - (51): Pin# read on panel side.

LED1 – Status LED connector: JST S3B-ZR-SM4A or compatible (Mating type : ZHR-3)

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

P1 – HDMI1 (HDMI 2.0) connector : HDMI connector (Type A)

| PIN | SYMBOL | DESCRIPTION |
|-----|--------|---|
| 1 | DATA2+ | TMDS Data2+ |
| 2 | DATA2S | TMDS Data2 Shield |
| 3 | DATA2- | TMDS Data2- |
| 4 | DATA1+ | TMDS Data1+ |
| 5 | DATA1S | TMDS Data1 Shield |
| 6 | DATA1- | TMDS Data1- |
| 7 | DATA0+ | TMDS Data0+ |
| 8 | DATA0S | TMDS Data0 Shield |
| 9 | DATA0- | TMDS Data0- |
| 10 | CLK+ | TMDS Clock+ |
| 11 | CLK@ | TMDS Clock Shield |
| 12 | CLK- | TMDS Clock- |
| 13 | NC | Reserved |
| 14 | NC | Reserved |
| 15 | SCL | SCL (I ² C Serial Clock for DDC) |
| 16 | SDA | SDA (I ² C Serial Data Line for DDC) |
| 17 | GND | Ground |
| 18 | +5V | HDMI +5 V power |
| 19 | HPDET | Hot Plug Detect |

P2 – Display Port input

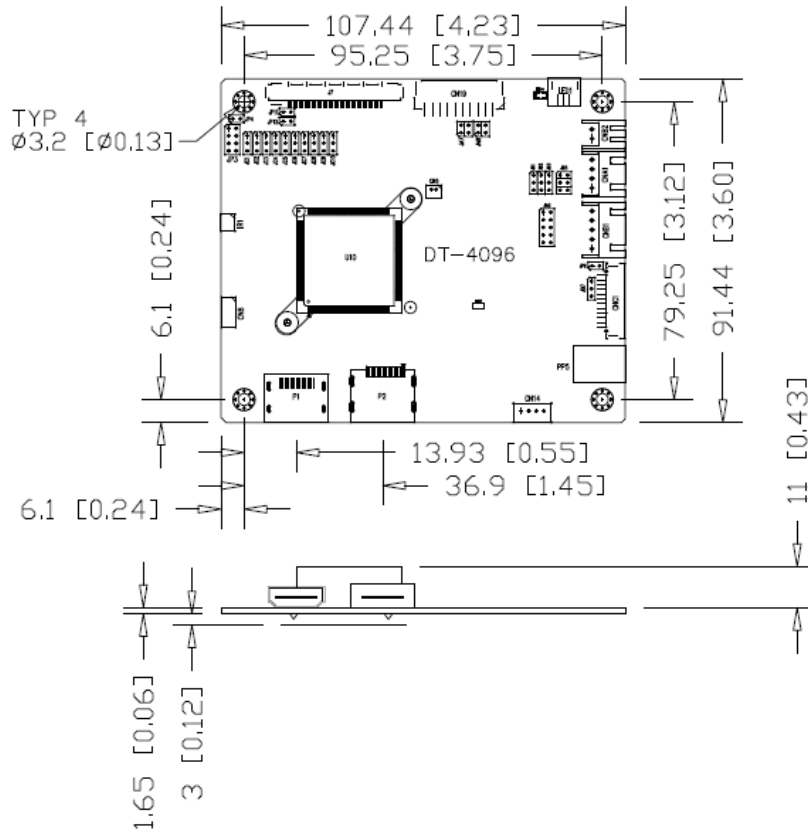
| PIN | SYMBOL | DESCRIPTION |
|-----|---------------|------------------------------------|
| 1 | ML_Lane 0 (p) | Lane 0 (positive) |
| 2 | GND | Ground |
| 3 | ML_Lane 0 (n) | Lane 0 (negative) |
| 4 | ML_Lane 1 (p) | Lane 1 (positive) |
| 5 | GND | Ground |
| 6 | ML_Lane 1 (n) | Lane 1 (negative) |
| 7 | ML_Lane 2 (p) | Lane 2 (positive) |
| 8 | GND | Ground |
| 9 | ML_Lane 2 (n) | Lane 2 (negative) |
| 10 | ML_Lane 3 (p) | Lane 3 (positive) |
| 11 | GND | Ground |
| 12 | ML_Lane 3 (n) | Lane 3 (negative) |
| 13 | CONFIG1 | connected to Ground ¹⁾ |
| 14 | CONFIG2 | connected to Ground ¹⁾ |
| 15 | AUX CH (p) | Auxiliary Channel (positive) |
| 16 | GND | Ground |
| 17 | AUX CH (n) | Auxiliary Channel (negative) |
| 18 | Hot Plug | Hot Plug Detect |
| 19 | GND | Ground |
| 20 | DP_PWR | Power for connector (3.3 V 500 mA) |

PP5 – 12V/24VDC input power: Molex 43045-0400 compatible(Matching connector type : Molex 43025-0400 compatible)

| PIN | DESCRIPTION |
|-----|-------------------|
| 1 | +12VDC / 24VDC in |
| 2 | Ground |
| 3 | +12VDC / 24VDC in |
| 4 | Ground |

* All connectors used may use the compatible type.

CONTROLLER DIMENSIONS



Ready-made 3D Pro-E (SLDPRT) drawing files - Save time and effort for your system volumetric analysis design. Includes jpg file previews. Please go to download at <https://digitalview.com/controllers/dt-4096-lcd-controller.html>

The maximum thickness of the controller is 18.9mm 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/24V DC. This should be matched with the inverter specification: see table.

CNB1

| PIN | DESCRIPTION |
|-----|-------------|
| 1 | Ground |
| 2 | +12V/+24VDC |

Remark: For higher power inverter, more current (for 12V/24V) 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 = 3.3V, 2-3 H = 5V, 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 control 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 |

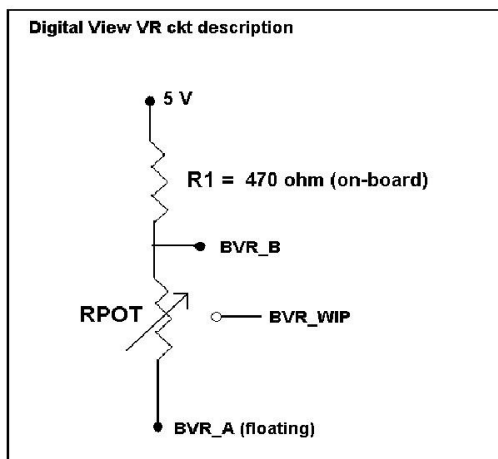
This can then be matched with function controls connected to CNC1 pins 4 & 3 or 5: see table.

CNC1

| PIN | DESCRIPTION |
|-----|-------------|
| 3 | VR A |
| 4 | VR WIP |
| 5 | VR B |

Specifications subject to change without notice

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).

CNC1 – Backlight inverter connector: JST B5B-XH-A (Matching type : XHP-5)

| PIN | SYMBOL | DESCRIPTION |
|-----|---------|---|
| 1 | GND | Ground |
| 2 | VBKL | +12V/24VDC, 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 – OSD switch mount control, Hirose DF13A-12P-1.25H (Mating type : DF13-12S-1.25C)

| 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)

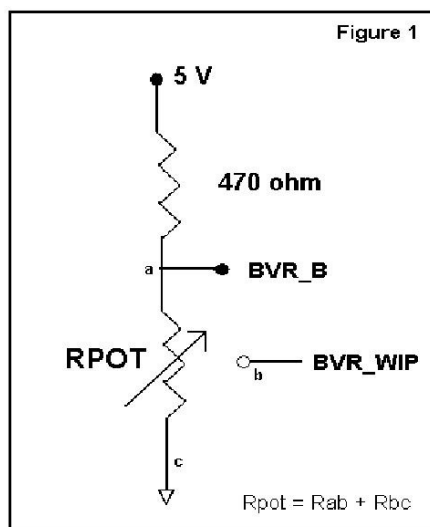
$$BVR_WIP = 5 \times (R_{bc}/10.47)$$

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.



TROUBLESHOOTING

General

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

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

Through step by step cross checking 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 just see some image on the display.
- 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 appearance:

- A faulty panel can have blank lines, failed sections, flickering or flashing display
- Incorrect graphics card refresh rate, resolution or interlaced mode will probably cause the image to be the wrong size, to scroll, flicker badly or possibly even no image.
- Incorrect jumper settings on the controller may cause everything from total failure to incorrect image. CAUTION: Do not set the panel power input incorrectly.
- Sparkling on the display: faulty panel signal cable.
- Found "Loading" message displayed on screen message at HDMI / DVI input indicates the unstable HDMI/DVI source detected (especially connected to HDMI splitter) causing flashing image.

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.
- For a specific backlight tube check the AC pins orientation (CAUTION: Never reverse any DC power pins).

Also:

- If adjusting brightness control has no effect the chances are that the VR rating or method of adjusting brightness is not compatible or correctly connected to the inverter.
- If system does not power down when there is a loss of signal

Continued failure:

If unit after unit keeps failing consider and investigate whether you are short circuiting the equipment or doing something else seriously wrong.

Generally after common sense issues have been resolved we recommend step by step substitution of known working parts to isolate the problem.

SPECIFICATIONS

| | |
|---------------------------------------|---|
| Panel compatibility | Compatible with 4096x2160 resolutions of TFT LCD panels with V-by-One /eDP panel interface. A specified BIOS and some factory adjustment is required for individual panel timings. |
| No. of colors | Up to 3 x 10 bit providing 1.06 billion colors. |
| Panel power | DC 3.3V, 5V, 10V, 12V, 18V |
| Panel signal | V-by-One (8 Lane) eDP (8 lane HBR) / (4 lane HBR2) |
| Vertical refresh rate | 60Hz at 1920x1200, 60Hz at 1920x1080, 60Hz at UXGA and up to 75Hz other lower resolution |
| Video inputs | HDMI 2.0 DisplayPort 1.2 |
| Functions display | On screen display (OSD) of functions |
| OSD menu functions | Image controls: Panel brightness/contrast, Saturation, Hue, Color temperature, Sharpness, Aspect ratio, Rotate, Gamma. |
| OSD menu controls available | Power On/Off OSD Menu OSD Select up OSD Select down Setting + Setting - |
| Control interface | Buttons, RS-232, IR Remote control, DDC/CI |
| Settings memory | Settings are stored in non volatile memory |
| PC Connectivity | VGA / SVGA / XGA / SXGA / UXGA / WUXGA digital |
| Controller dimensions | 107mm x 92mm |
| Power consumption | 4w approx. (not including panel power consumption) |
| Power load maximum | The controller has an overall 3Amp current limit. |
| Input voltage | 12V/24VDC +/- 5% |
| Power protection | Fuse fitted (Non resettable type) |
| Storage temperature limits | -40°C to +70°C |
| Operating temperature limits | 0°C to +60°C |
| Calculated Mean Time Between Failures | In excess of 100,000 hours |
| Operating frequency (Crystal) | 14.318MHz |
| Latency | 12ms [#] |
| Use of memory on board | - 1 pc SD RAM 16Mbits & 36KB which is a volatile memory for frame buffer and OSD. - 1 pc flash 16Mbits which is a non-volatile memory for system program. - 1 pc EEPROM 128KBits which is a non-volatile memory for system setting storage. - 1 pc EEPROM 2KBits which is a non-volatile memory for HDMI EDID. |

NOTES

Please note the following:

- For specific panel setup a sample of an LCD may be required (this will be returned) and a copy of the full technical specifications for the panel from the manufacturer.
- Re-layout and custom development services are available.

- Equipment used : Leo Bodnar Electronics Video Signal Input Lag Tester. Controller input port measured based on HDMI port and connect with a Innolux M280DGJ-L30 (3840x2160) panel.

APPENDIX I – SIGNAL SUPPORT MODE TABLE

HDMI input port (HDMI 2.0):

| Resolution |
|--------------------|
| 640x480 60Hz |
| 640x480 72Hz |
| 640x480 75Hz |
| 800x600 56Hz |
| 800x600 60Hz |
| 800x600 72Hz |
| 800x600 75Hz |
| 1024x768 60Hz |
| 1024x768 70Hz |
| 1024x768 75Hz |
| 1280x768 60Hz |
| 1280x768 75Hz |
| 1280x800 60Hz |
| 1280x800 75Hz |
| 1280x1024 60Hz |
| 1280x1024 75Hz |
| 1360x768 60Hz |
| 1366x768 60Hz |
| 1440x900 75Hz |
| 1600x1200 75Hz |
| 1680x1050 75Hz |
| 1920x1080 60Hz |
| 1920x1200 60Hz |
| 2560x1600 60Hz |
| 3840x2160 23.976Hz |
| 3840x2160 24Hz |
| 3840x2160 25Hz |
| 3840x2160 29.97Hz |
| 3840x2160 30Hz |
| 3840x2160 50Hz |
| 3840x2160 59Hz |
| 3840x2160 60Hz |
| 4096x2160 23.976Hz |
| 4096x2160 24Hz |
| 4096x2160 25Hz |
| 4096x2160 29.97Hz |
| 4096x2160 30Hz |
| 4096x2160 50Hz |
| 4096x2160 59Hz |
| 4096x2160 60Hz |

| Resolution |
|-------------|
| 480p59.94 |
| 576p50 |
| 720p60 |
| 720p59.94 |
| 720p50 |
| 720p30 |
| 720p29.97 |
| 720p25 |
| 720p24 |
| 720p23.976 |
| 1080p60 |
| 1080p59.94 |
| 1080p50 |
| 1080p30 |
| 1080p29.97 |
| 1080p25 |
| 1080p24 |
| 1080p23.976 |

Display port input port (DP 1.2) :

| Resolution |
|--------------------|
| 720x480 60Hz |
| 720x576 50Hz |
| 800x600 56Hz |
| 800x600 60Hz |
| 800x600 72Hz |
| 800x600 75Hz |
| 1024x768 60Hz |
| 1024x768 70Hz |
| 1024x768 75Hz |
| 1280x768 60Hz |
| 1280x800 60Hz |
| 1280x1024 60Hz |
| 1280x1024 75Hz |
| 1366x768 60Hz |
| 1400x1050 60Hz |
| 1440x900 60Hz |
| 1600x900 60Hz |
| 1600x1200 60Hz |
| 1680x1050 60Hz |
| 1920x1080 60Hz |
| 1920x1200 60Hz |
| 2560x1600 60Hz |
| 3840x2160 23.976Hz |
| 3840x2160 24Hz |
| 3840x2160 25Hz |
| 3840x2160 29.97Hz |
| 3840x2160 30Hz |
| 3840x2160 50Hz |
| 3840x2160 59Hz |
| 3840x2160 60Hz |
| 4096x2160 23.976Hz |
| 4096x2160 24Hz |
| 4096x2160 25Hz |
| 4096x2160 29.97Hz |
| 4096x2160 30Hz |
| 4096x2160 50Hz |
| 4096x2160 59Hz |
| 4096x2160 60Hz |

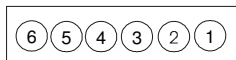
| Resolution |
|-------------|
| 480p59.94 |
| 576p50 |
| 720p60 |
| 720p59.94 |
| 720p50 |
| 720p30 |
| 720p29.97 |
| 720p25 |
| 720p24 |
| 720p23.976 |
| 1080p60 |
| 1080p59.94 |
| 1080p50 |
| 1080p30 |
| 1080p29.97 |
| 1080p25 |
| 1080p24 |
| 1080p23.976 |

Appendix II – RS-232 control protocols

RS-232 Serial control (Baud rate 9600, 8 bits, 1 stop bit and no parity)

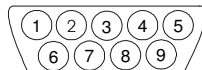
Physical connection :

Controller side
Connector interface : CN8
Mating connector : Molex 51021-0600



Mating face of CN8

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



Mating face of RS-232 DB9 Male

| PIN# | Description |
|------|----------------|
| 4 | RS-232 Tx Data |
| 5 | Ground |
| 6 | RS-232 Rx Data |

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

Remark :

(1) : RS-232 connection cable, 300mm P/N 426171800-3 can be ordered separately for connection.

Software connection :

The OSD function can be controlled through sending the RS-232 protocol.

The RS-232 program can be custom-made to fit for application or it can be used the serial control program, like Accessport, Telix or Serial Utility program developed by DigitalView. Please contact your local support for information.

1. Commands to implement switch mount control buttons

| Function | Command | Description | Remark |
|--------------------|---------|----------------------------|-------------------|
| Menu button | 0xf7 | Menu button pressed | Button equivalent |
| Select-down button | 0xfa | Select-down button pressed | Button equivalent |
| Select-up button | 0xfb | Select-up button pressed | Button equivalent |
| Right/+ button | 0xfc | Right/+ button pressed | Button equivalent |
| Left/- button | 0xfd | Left/- button pressed | Button equivalent |

2. Parameter setting - immediate, relative, reset and query

| Function | Command | Description | Acknowledge (if enabled) |
|-------------------------------------|---|---|---|
| Volume control - left+right channel | 0x80, "a" "A", nn "+" "-" "r" "R" "?" | Set audio (L+R) volume = value/increment/decrement Reset Query | nn = 0x00~ 0x64 (0~100%) Default: 0x32 (50%) |
| Volume control - on/off (mute) | 0x80, "m" "M", "0" "1" "r" "R" "?" | Disable audio output. Enable audio output. Reset Query | "0" - audio off (mute). "1" - audio on. (Default) |
| Black level control | 0x81, nn "+" "-" "r" "R" "?" "m" "n" "i", ss, nn "o", ss, | Set brightness = value/increment/decrement Reset Query Current Source Maximum query Minimum query Set, Source, value Query, Source | nn = 0x00~ 0x64 (0~100%) Default: 0x32 (50%) ss- reference by Input main select(0x98) |
| Contrast control | 0x82, "a" "A", nn "+" "-" "r" "R" "?" "m" "n" "i", ss, nn "o", ss, | Set all contrast = value/increment/decrement Reset Query Maximum query Minimum query Set, Source, value Query, Source | nn = 0x00~ 0x64 (0~100%) Default: 0x32 (50%) ss- reference by Input main select(0x98) |
| Saturation control | 0x83, nn "+" "-" "r" "R" "?" "m" "n" | Set color saturation = value/increment/decrement Reset Query Maximum query Minimum query | nn = 0x00~ 0x64 (0~100%) Default: 0x32 (50%) |
| Hue control | 0x84, nn "+" "-" "r" "R" "?" "m" "n" | Set tint = value/increment/decrement Reset Query Maximum query Minimum query | nn = 0x00~ 0x64 (0~100%) Default: 0x32 (50%) |
| Sharpness | 0x8a, n "+" "-" "m" "n" "r" "R" "?" | Set sharpness = value/increment/decrement Maximum query *1 Minimum query *1 Reset Query | nn = 0x00~ 0x34 ("0"~"4") Default: 0x32 ("2") |
| Aspect Ratio | 0x8c, "0" "1" "9" "A" "F" | Set graphic image scaling mode = Value | Image expansion on/off. "0" – 1:1. "1" – Full screen. "9" – 4:3 |

Specifications subject to change without notice

| | | | |
|---------------------------------|---|--|--|
| | "r" "R" "?" | Reset Query | "A" – 16:9 "F" – 5:4 (Default – "1") |
| Set display orientation | 0x8e, n "r" "R" "?" | Set display orientation = value Reset Query | "0" – normal (default) "5" – 180 degree (Default – "0") |
| Set OSD Menu Rotate | 0x8f, n "r" "R" "?" | Set OSD Menu orientation = value Reset Query | "0" – normal "1" – 270 degree "2" – 180 degree "3" – 90 degree (Default - "0") |
| OSD H position | 0x90, nn "+" "-" "r" "R" "?" | Set OSD horizontal position = value/increment/decrement Reset Query | nn = 0x00~ 0x64 (left ~ right) Default: 0x32 (middle) |
| OSD V position | 0x91, nn "+" "-" "r" "R" "?" | Set OSD vertical position = value/increment/decrement Reset Query | nn = 0x00~ 0x64 (top ~ bottom) Default: 0x32 (middle) |
| OSD transparency | 0x92, nn "+" "-" "r" "R" "?" | Set OSD transparency = value/increment/decrement Reset Query | nn = 0x00~ 0x64 (0~100%) Default: 0x00 (No transparency) |
| OSD menu timeout | 0x93, nn "+" "-" "r" "R" "?" | Select menu timeout = value/increment/decrement Reset Query | OSD menu timeout value. "ON" – Continuous. value – Round up to nearest available step. if value > max available step, set it to the max available step. "0x30 0x30" -- ON "0x30 0x42" – 11s " (default) up to "0x33 0x43" – 60s |
| Input main select | 0x98, nn "+" "-" "r" "R" "?" | Select input main = HDMI or Display Port available Reset Query | "0x48,0x31" HDMI "0x50,0x31" Display Port (Default – Display Port) |
| Auto source seek | 0x99, "0" "1" "r" "R" "?" | Set exclusive or priority = Off/On Reset Query | "0" – Off. "1" – On Default: "1" (On) |
| GAMMA value select | 0x9d, n "r" "R" "?" | Select GAMMA value = Value Reset Query | "n": "5" – 1.8, "7" – 2.0, "2" – 2.2, (Default) "A" – 2.4 "C" – 2.6 |
| Power Save | 0x9f, "0" "1" "r" "R" "?" | Set power save option = On/Off Reset Query | "n": "0" – Power save off "1" – Power save on (Default) |
| Hot key 1 (plus and minus keys) | 0xa0, "1", n | Set Hotkey 1= Value | "1" – Volume "2" – Backlevel (Brightness) |

| | | | |
|---|--|---|--|
| | "r" "R" "?" | Reset Query | "3" – Contrast "4" – Saturation "5" – Input source "B" – No function "E" – Aspect "G" – Hue "H" – Backlight Brightness "L" – Sharpness (Default – Volume) |
| Hot key 2 (up and down keys) | 0xa0, "2", n "r" "R" "?" | Set Hotkey 2 = value Reset Query | "1" – Volume "2" – Backlevel (Brightness) "3" – Contrast "4" – Saturation "5" – Input source "B" – No function "E" – Aspect "G" – Hue "H" – Backlight Brightness "L" – Sharpness (Default – Input) |
| Runtime counter | 0xa1, nnnnn "r" "R" "?" | Set runtime counter value = nnnnn (* 0.5 hour) Reset to zero Query | Runtime = nnnnn. Max. input = 0x1ffe (0x1ffe * 0.5 hour = 65535 hours) Runtime counter counts when backlight is on |
| Colour temperature select | 0xb3, n "r" "R" "?" "i", ss, n "o", ss, | Select colour temperature = value Reset Query Set, Source, value Query, Source | "2" – 6500K. (Default) "4" – USER. "5" – 9300K "6" – 7500K "7" – 5800K. "8" – sRGB (Default – 6500K) ss - reference by Input main select(0x98). |
| Red level of User colour temperature | 0xb4, nn "+" "-" "r" "R" "?" "m" "n" "i", ss, c, nn "o", ss, c, | Set the level of the red channel for the user colour temp. = value/increment/decrement Reset Query Maximum query Minimum query Set, Source, Temperature Group, value Query, Source | nn: 0x00~ 0xff (0~255) Default: 0x80 c – reference by Color Temperature ss - reference by Input main select(0x98). |
| Green level of User colour temperature | 0xb5, nn "+" "-" "r" "R" "?" "m" "n" | Set the level of the green channel for the user colour temp. = value/increment/decrement Reset Query Maximum query Minimum query | nn: 0x00~ 0xff (0~255) Default: 0x80 |

| | | | |
|--|---|--|---|
| | "i", ss, c, nn "o", ss, c | Set, Source, Temperature Group, value Query, Source | c – reference by Color Temperature ss - reference by Input main select(0x98). |
| Blue level of User colour temperature | 0xb6, nn "+" "-" "r" "R" "?" "m" "n" "i", ss, c, nn "o", ss, c | Set the level of the blue channel for the user colour temp. = value/increment/decrement Reset Query Maximum query Minimum query Set, Source, Temperature Group, value *1 Query, Source *1 | nn: 0x00~ 0xff (0~255) Default: 0x80 c – reference by Color Temperature ss - reference by Input main select(0x98). |
| Video horizontal resolution enquiry | 0xb7 | Horizontal resolution (in pixels) in 3 to 4 digit hex number | "nnn" = horizontal resolution |
| Video vertical resolution enquiry | 0xb8 | Vertical resolution (in lines) in 3 digit hex number | "nnn" = vertical resolution |
| Video horizontal sync frequency | 0xb9 | Horizontal sync frequency (in units of 100Hz) in 3 digit hex number | "nnn" = horizontal frequency |
| Video vertical sync frequency | 0xba | Vertical sync frequency (in units of Hz) in 3 digit hex number and 1 char | "nnnc" = vertical frequency nnn = 3 digit hex c= "i" (interlace) or "p" (progressive) |
| OSD status enquiry | 0xbb | Status of OSD | "0" – OSD turned off "1" – OSD turned on |
| OSD turn off | 0xbd | Turn off the OSD. | "0" – fail. "1" – successful. |
| Backlight control | 0xe0, nn "+" "-" "R" "r" "?" | Set Backlight level = value/increment/decrement Reset Query | nn = 0x00~ 0x64 (0~100%) Default: 0x64 (100%) |
| Backlight On/Off | 0xe1, "0" "1" "R" "r" "?" | Backlight Off / Backlight On Reset Query | "0" – Backlight Off "1" – Backlight On. (Default) "?" – Query Backlight On/Off |
| Backlight DA/PWM | 0xe5 "0" "1" "R" "r" "?" | Set backlight control method: PWM / DA Reset Query | "0" – PWM (Default) "1" – D/A |
| Backlight PWM frequency | 0xe6, nnn "+" "-" "R" "r" "?" | Set backlight PWM frequency = value/increase 20Hz/decrease 20Hz Reset Query | Value 100Hz : "0", "6", "4" 120Hz : "0", "7", "8" 140Hz : "0", "8", "C" 160Hz : "0", "A", "0" (Default) 180Hz : "0", "B", "4" 200Hz : "0", "C", "8" 220Hz : "0", "D", "C" 240Hz : "0", "F", "0" 260Hz : "1", "0", "4" 280Hz : "1", "1", "8" 300Hz : "1", "2", "C" 320Hz : "1", "4", "0" 340Hz : "1", "5", "4" 360Hz : "1", "6", "8" 380Hz : "1", "7", "C" 400Hz : "1", "9", "0" 420Hz : "1", "A", "4" 440Hz : "1", "B", "8" |
| Backlight Invert | 0xe7 | Set invert backlight level : | "0" – Off (Default) |

| | | | |
|--|--|--|--|
| | 0x4C | Read all panel timing parameter | Read all parameters from SRAM and dump each timing starting with 0xEE 0x74 0xYY nnnn to facilitate saving dump data to file for send back to DT-4096 later |
| | 0x4D, n | 0x4D Output Display Bit Mode | 1-8bit, 2-10bit |
| | 0x4E, n | 0x4E Panel Display Division | 1 - 1 division (no division) 2 - 2 division 4 - 4 division 8 - 8 division |
| | 0x57 | Write all panel timing parameters from SRAM into EEPROM | "1": Success "0": Fail |
| User EDID | "0xee", "0x76", "nn", | Command Select Port | "nn" = "0x50, 0x31": DP "0x48, 0x31": HDMI |
| EDID Block map for blocks 0 – 128 | "S" "s" "n,n+1....(256 BYTE) " | Send 128 BYTE EDID in ASCII Code Format (256BYTE) | return "1" Success return "0" Fail |
| EDID Block map for blocks 129 – 254 if more than 128 blocks used | "E" "e" "n,n+1....(256 BYTE) " | Send 128 BYTE EDID in ASCII Code Format (256BYTE) | return "1" Success return "0" Fail |
| Reset | "R" "r" | Reset to use pre-defined EDID instead of user EDID of selected port | return "1" Success return "0" Fail |
| Light Sensor Setting | 0xee, 0x78 "0x30", "n" "0x31", "nnn" "0x32", "nnn" "0x33", "nnn" "0x34", "nnn" "0x35", "nnn" "0x36", "nnn" "0x37", "nnn" "0x38", "nnn" "0x39", "nnn" "0x3A", "nnn" "0x3B", "nnn" "0x3C", "nnn" "0x3D", "nnn" "0x3E", "nnn" "0x3F", "nnn" "0x40", "nnn" "0x41", "nnn" "0x42", "nnn" "0x43", "nnn" | Light Sensor Settings 0x30 = Light Sensor Mode 0x31 = Level 1 value 0x32 = Level 2 value 0x33 = Level 3 value 0x34 = Level 4 value 0x35 = Level 5 value 0x36 = Level 6 value 0x37 = Level 7 value 0x38 = Level 8 value 0x39 = Level 9 value 0x3A = Level 10 value 0x3B = Level 11 value 0x3C = Level 12 value 0x3D = Backlight 1 value 0x3E = Backlight 2 value 0x3F = Backlight 3 value 0x40 = Backlight 4 value 0x41 = Backlight 5 value 0x42 = Backlight 6 value 0x43 = Backlight 7 value | n = "0x30": Disable, "0x31": Enable, nnn = 0 ~ 1800 : 0x30, 0x30, 0x30 ~ 0x37, 0x30, 0x38 nnn = 0 ~ 100 : 0x30, 0x30, 0x30 ~ 0x30, 0x36, 0x34 Or nnn = 0 ~ 255: 0x30, 0x30, 0x30 ~ 0x30, 0x46, 0x46 nnn = OFF: 0x45, 0x45, 0x45 |

3. Other control

| Function | Command | Description | Acknowledge (if enabled) |
|---------------------------|---|--|--|
| Select RS-232 acknowledge | 0xc1, "0" "1" | Disable/enable command acknowledge. | "0" – acknowledge disabled. "1" – acknowledge enabled. (Default) |
| Command availability | 0xc4, nn / nnnn | Check whether a command is available. | "0" – not available. "1" – available. e.g. "0x81" command send "0xc4 0x38 0x31" feedback "0xc4 0x38 0x31 0x31" |
| Power On/Off | 0xc8, "0" "1" "?" | Soft power on/off off/on query | "0" – soft power off. "1" – soft power on. |
| Query video input status | 0xc9 | Query the status of the displaying video windows source | Input status nn nn: "0", "0" : Invalid / No video source "H", "1" : HDMI "P", "1" : DP |
| Query BIOS version | 0xcb, "0" | Read BIOS version | BIOS version "VV.YY.ZZ" VV = Vx or Ex, (x is version digit) V = Release version E = Engineering Sample YY= Version Number ZZ= Customer Number |
| Query PCBA number | 0xcb, "1" | Read PCBA number | "nnnnn" = PCBA number DT-4096= "41782" |
| Query Revision Number | 0xcb, "3" | Read Revision Number | "nn" = Revision number AA in firmware version no. "VV.YY.ZZ.AA" |
| Test Pattern | 0xcd, "0" "1" "2" "3" "4" "5" "6" "7" "8" | Off Pattern: Red Green Blue White Black ColorBar SMPTEColor Bar 8 Bit GreyBar | n: action value |
| Reset parameters | 0xce | Reset all parameters to default value | "1" – successful. |
| Reset all parameters | 0xcf | Reset all parameters, including user color temperature setting, for all video modes to default value | "1" - successful. |
| CopyRight | 0xf8, "C" | Command Read CopyRight | return "DIGITALVIEW LTD." |

n = 1-byte ascii-coded hex number, e.g., parameter value of 0x1 is represented by "1" (0x31).

mn or nn = 2-byte ascii-coded hex number, e.g., parameter value of 0x1e is represented by "1", "e" | "E" (0x31, 0x6e|0x4e).

The RS-232 command strings sent in one time can support up to 380 bytes via CN8 port

The RS-232 command string sent in one time can support up to 50 bytes via J1 port.

n = 1-byte ascii-coded hex number, e.g., parameter value of 0x1 is represented by "1" (0x31).

mn or nn = 2-byte ascii-coded hex number, e.g., parameter value of 0x1e is represented by "1", "e" | "E" (0x31, 0x6e|0x4e).

Please refer to the ASCII to Hex convert table below.

Hex to ASCII conversion table

| Hex | ASCII | Hex | ASCII | Hex | ASCII | Hex | ASCII |
|------|-------|------|-------|------|-------|------|-------|
| 0x30 | 0 | 0x41 | A | 0x61 | a | 0x2B | + |
| 0x31 | 1 | 0x42 | B | 0x62 | b | 0x2D | - |
| 0x32 | 2 | 0x43 | C | 0x63 | c | 0x3F | ? |
| 0x33 | 3 | 0x44 | D | 0x64 | d | | |
| 0x34 | 4 | 0x45 | E | 0x65 | e | | |
| 0x35 | 5 | 0x46 | F | 0x66 | f | | |
| 0x36 | 6 | 0x47 | G | 0x67 | g | | |
| 0x37 | 7 | 0x48 | H | 0x68 | h | | |
| 0x38 | 8 | 0x49 | I | 0x69 | i | | |
| 0x39 | 9 | 0x4A | J | 0x6A | j | | |
| | | 0x4B | K | 0x6B | k | | |
| | | 0x4C | L | 0x6C | l | | |
| | | 0x4D | M | 0x6D | m | | |
| | | 0x4E | N | 0x6E | n | | |
| | | 0x4F | O | 0x6F | o | | |
| | | 0x50 | P | 0x70 | p | | |
| | | 0x51 | Q | 0x71 | q | | |
| | | 0x52 | R | 0x72 | r | | |
| | | 0x53 | S | 0x73 | s | | |
| | | 0x54 | T | 0x74 | t | | |
| | | 0x55 | U | 0x75 | u | | |
| | | 0x56 | V | 0x76 | v | | |
| | | 0x57 | W | 0x77 | w | | |
| | | 0x58 | X | 0x78 | x | | |
| | | 0x59 | Y | 0x79 | y | | |
| | | 0x5A | Z | 0x7A | z | | |

Appendix III – DDC/CI support at HDMI & Display port

This controller supports the following DDC/CI functions at HDMI & Display port :

- Brightness (Backlight brightness)
- Contrast
- Color Temperature (6500K/7500K/9300K/sRGB/User)
- Sharpness
- Input Source (HDMI & Displayport)
- Power mode (Power on/off)
- Restore factory defaults (exclude user color temperature, brightness)
- Volume

Appendix IV – DV remote control unit work for DT-4096

P/N 5590001xx-3 :
DigitalView remote control unit
(without DV logo silk screen
printing)

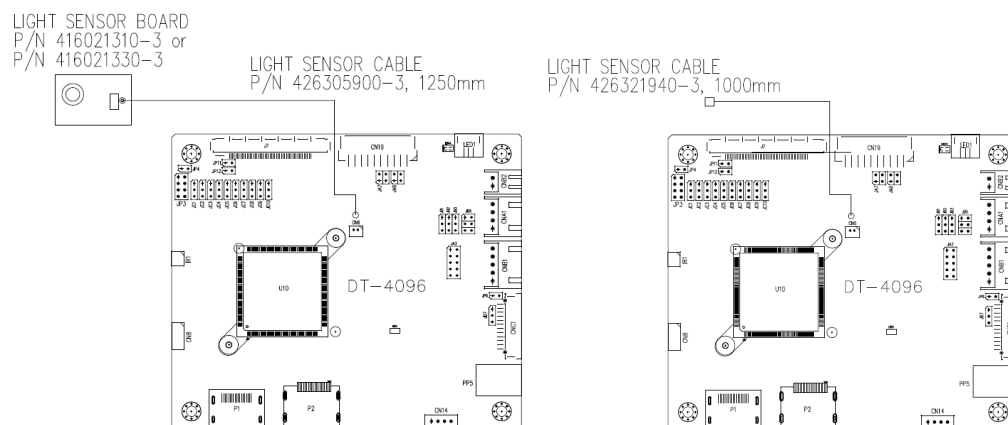


| BUTTON | FUNCTION |
|-----------------------------|--|
| POWER BUTTON | Soft power ON/OFF button. |
| SEL UP (^) / SEL DN (v) | 1. In OSD menu, pressing "SEL UP" button to move previous level of selection. 2. In OSD menu, pressing "SEL DN" button to move next level of selection or to CONFIRM the selection. |
| + BUTTON | When OSD menu displayed, press this button to select functions (forward) or increase the values. |
| - BUTTON | When OSD menu displayed, press this button to select functions (backward) or decrease the values. |
| AV/TV BUTTON | Use to select the input source. (/HDMI/Displayport) |
| OSD NEXT BUTTON | Use to turn on/off the OSD menu. |
| Mute | Mute / Un-mute audio |

Appendix V – Light Sensor Function work for DT-4096

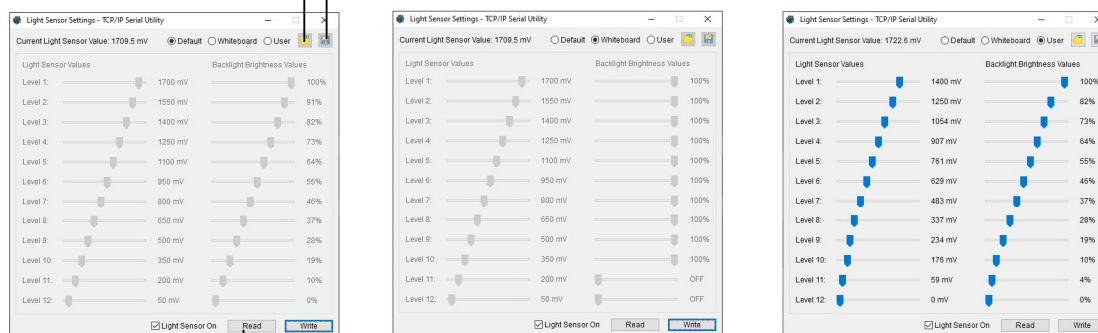
DT-4096 provides an interface to enable automatic backlight adjustment. It is possible to connect with a light sensor directly to the controller board.

Use of the light sensor board P/N 416021310/416021330-3 and light sensor cable P/N 426305900-3 connect to the DT-4096 via CN6 connector or use the light sensor cable P/N 426321940-3 as shown below :



Digital View provides a user-friendly software program (TCP/IP Serial Utility V1.14 or later revision) can set thresholds for ambient light and the LCD panel backlight adjustment.

The settings can be Open/Save as by file.



Read the current settings from controller

Confirm to write the current onto controller

Three auto dimming modes:

- Default - All the dimming level are preset as linear backlight %.
- Whiteboard - When room light 'ON', set backlight 100%, otherwise 'OFF' the backlight.
- User - Only this mode can be user configurable.

When designing a monitor a light sensor can be placed in a suitable location to detect changes in lighting and adjust the LCD panel backlight brightness appropriately.

WARRANTY

The products are warranted against defects in workmanship and material for a period of three (3) year from the date of purchase provided no modifications are made to it and it is operated under normal conditions and in compliance with the instruction manual.

The warranty does not apply to:

- Product that has been installed incorrectly, this specifically includes but is not limited to cases where electrical short circuit is caused.
- Product that has been altered or repaired except by the manufacturer (or with the manufacturer's consent).
- Product that has subjected to misuse, accidents, abuse, negligence or unusual stress whether physical or electrical.
- Ordinary wear and tear.

Except for the above express warranties, the manufacturer disclaims all warranties on products furnished hereunder, including all implied warranties of merchantability and fitness for a particular application or purpose. The stated express warranties are in lieu of all obligations or liabilities on the part of the manufacturer for damages, including but not limited to special, indirect consequential damages arising out of or in connection with the use of or performance of the products.

CAUTION

Whilst care has been taken to provide as much detail as possible for use of this product it cannot be relied upon as an exhaustive source of information. This product is for use by suitably qualified persons who understand the nature of the work they are doing and are able to take suitable precautions and design and produce a product that is safe and meets regulatory requirements.

LIMITATION OF LIABILITY

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