DIGITAL**VIEW**™

ANALOG INTERFACE CONTROLLER
FOR VGA RESOLUTION TFT LCD

Model: AC-9512 VGA
(Part number: 416900X-XX)

INSTRUCTIONS

CONTENTS

**It is essential that the sections on Assembly Notes and Connectors, Pinouts &
Jumpers is read and understood before connecting or powering up this controller.**

INTRODUCTION

The AC-9512 VGA is an interface circuit designed to allow typical colour TFT type LCD panels of 640x480 resolution to work with the analog signal from PC graphics cards.

Applications for the AC-9512 VGA are likely to include LCD monitors and other LCD based products.

IMPORTANT USAGE NOTE
This product is for use by system 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.
• Understand the operation and connectivity requirements of this controller.

DISCLAIMER
There is no implied or expressed warranty regarding this material.

SYSTEM DESIGN

A typical LCD based display system is likely to comprise the following:
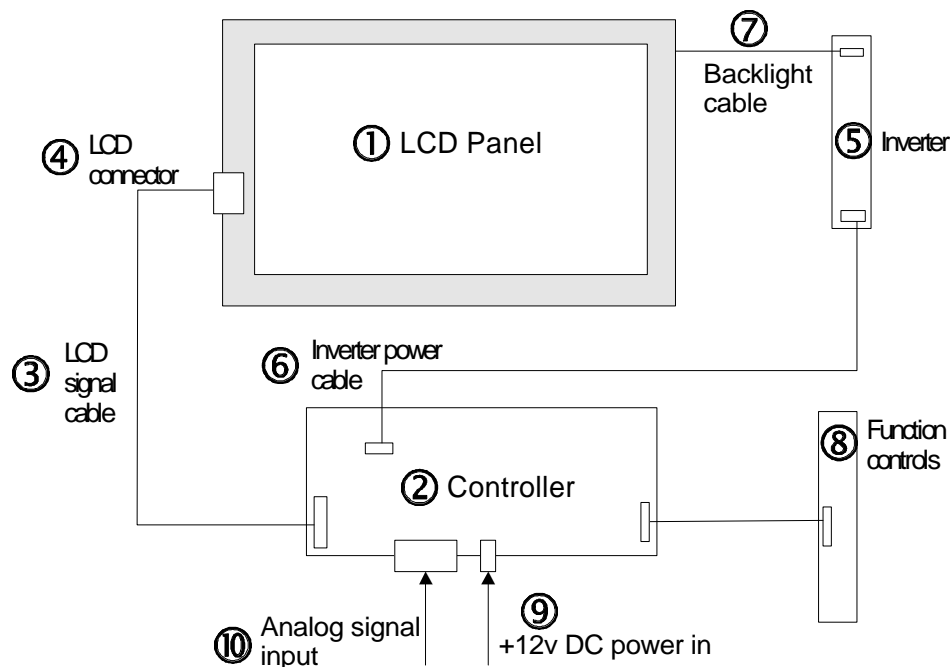
Note: Numbers cross refer to discussion in the Assembly Notes section following.

Digital View offers a range of accessories such as housings as well as items shown above.

ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using 640x480 resolution TFT panels. This section and the Application notes section provides some guidelines assembly and preparation of a finished display solution using this controller.

- **Preparation**: Before proceeding it is important to familiarise yourself with the parts making up a system and the various connectors, mounting holes and general layout of the controller. As much as possible connectors have been labelled on the controller. Connector pinouts and mechanical information is shown in the following relevant sections.

1. **LCD Panel**: This controller is designed for typical TFT panels with 5V or 3.3V TTL. Due to the variation between manufacturers of signal timing and other panel characteristics factory setup and confirmation should be obtained before connecting to a panel. **Caution**: Particular care must be taken to ensure that the panel voltage is set correctly to avoid damage.

2. **Controller :** Handle the controller card with care as static charge may damage electronic components.

3. **LCD signal cables**: In order to provide a good signal it is recommended that LCD signal cables are no longer than 30cm (12 inches). If loose wire cabling is utilised these can be made into a harness with cable ties. Care should be taken when placing the cables to avoid signal interference. Digital View offers a range of panel signal cables & connectors.

4. **LCD connector**: Different makes and models of LCD panel require different panel signal connectors and different pin assignments. Digital View offers a wide range of panel connectors.

5. **Inverter**: This will be required for the backlight of an LCD, some LCD panels have an inverter built in. As panels may have 1 or more backlight tubes and the power requirements for different panel models backlights may vary it is important to match the inverter in order to obtain optimum performance. See Application notes for more information on connection. **NOTE**: The controller has an overall 2Amp current limit and the current available for backlighting will be dependent on the power input and other system requirements.

6. **Inverter Power Cables**: (Only relevant if an inverter other than one built into the LCD panel is used). This are high tension and thus prone to power leakage. Suitable cable should be selected of minimum length and good insulation, additionally care should be taken when laying out this cable within an enclosure.

7. **Backlight Cables**: Different inverter models require different cables and different pin assignment. Make sure correct cable pin out to match the inverter. Using wrong cable pin out may damage the inverter.

8. **Function Controls**: The following section 'Operation' discusses the controls required and the section 'Connectors, jumpers & pinouts' provides the detail. The controls are minimal for ease of use: On/Off, Brightness (depends on inverter), OSD (4~5 momentary buttons). See the 'Operational Function' section for details of operation without controls attached.

9. **Power Input**: 12V DC is required, this should be a regulated supply. 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.

10. **Analog VGA Input Cable**: As this may affect regulatory emission test results a suitably shielded cable should be utilised.

- **Power Output**: An auxiliary power output is available providing 5V and 12V DC power, this can be used for accessories such as touch panels. Note the controller has an overall 2Amp 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 supplied as 'power-in' a backlight inverter for panel backlighting produces significantly higher voltages (the inverter does not connect to the ground plane). No matter whether the inverter is mounted on the controller or independently 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 and power supply can affect the result.

- **Heat:** It is likely that the main source of heat will be the backlight tubes. It is important that adequate consideration is given to ventilation and or alternative cooling.

- **Ground**: The various PCB mounting holes are connected to the ground plane, mounting holes for mounting an inverter are not connected to the ground plane.

- **Servicing**: The controller is not user serviceable or repairable. Warranty does not cover user error in connection to the controller.

- **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.
  - Vertical refresh rate should be set to 60Hz preferable.
  - Non-interlaced is required.

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 & 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 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/PanelLink type panels: A LVDS/PanelLink transmitter board is required. Plug the transmitter board to CN2, CN3. Then insert the LCD signal cable with controller end to the connector on the transmitter board. 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. **Jumpers & Switches:** Check all jumpers and switches (SW1,SW2) are set correctly. Details referring the connection diagram (a separate document) or the jumpers and switches setting table (in the following section).
7. **Jumpers & Inverter & Panel voltage:** Particularly pay attention to the settings of JA3, JB2, JB3. JB2 & JB3 are used for inverter control (read inverter specification and information on the jumper table to define the correct settings). JA3 is used for panel voltage input (read panel specification and information on the jumper table to define the correct settings).
8. **VGA cable & Controller:** Plug the VGA cable to the connector P1 on the controller board.
9. **Power supply & Controller:** Plug the DC 12V power in to the connector PP1.
10. **Power on:** Switch on the controller board and panel by using the OSD switch mount.

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

General:
➢ If you are using supplied cables & connectors, 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, "Connector, 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.

OPERATIONAL FUNCTIONS

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)	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 setting/confirm the select	+	+
- – decrease the setting	-	-
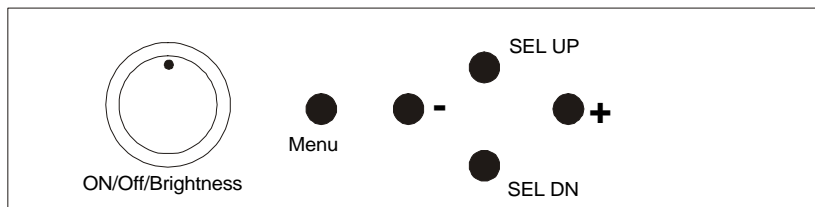
Analog VR type
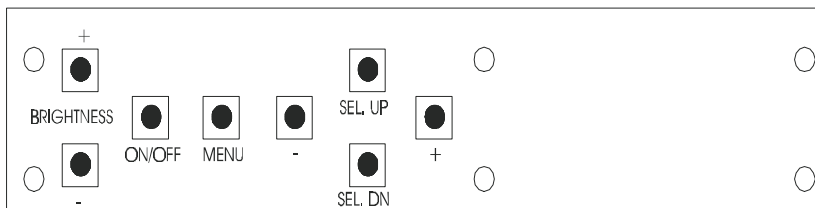
Digital type

OSD Functions

Brightness	Increase/decrease panel brightness level
	Press – or + (- ▰▰▰▱▱ +nnn), range: 0 to 236
Contrast	Increase/decrease panel contrast level.
	Press – or + (- ▰▰▰▱▱+nnn), range: 0 to 100
Tuning	Fine tune the data sampling position (adjust display quality)
	Press – or + (- ▰▰▱▱▱+nn), range: 0 to 31
Hori Position	Move the image position horizontally
	Press – or + (- ▰▰▱▱▱+ nnn),range: 0 to 255
Vert Position	Move the image position vertically
	Press – or + (- ▰▰▱▱▱+ nnn),range: 0 to 126
Image Size	Adjust the image size
	Press – or + (- ▰▰▱▱▱+ nnn),range: 768 to 888
Exit menu	Turn off the OSD menu.
	Press + turns off the OSD menu.

The settings chosen will be stored in memory.

CONNECTORS, PINOUTS & JUMPERS

The various connectors are:
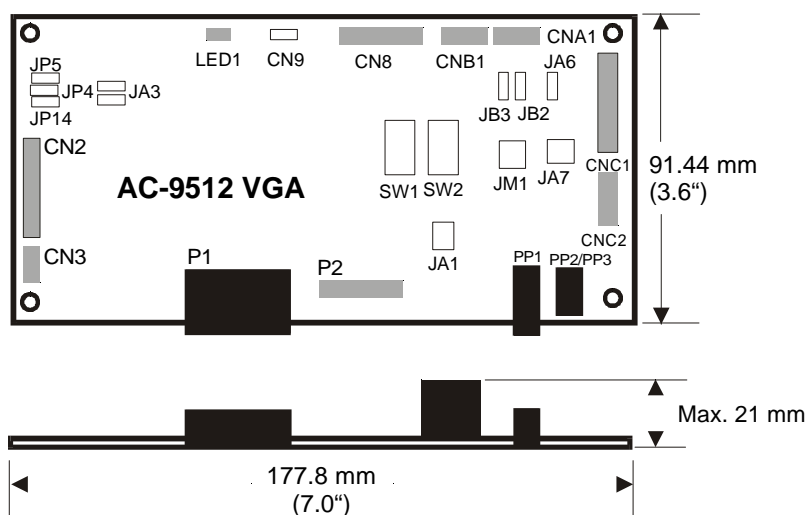
Summary

Ref	Purpose	Description
CN2	Panel connector	Hirose, DF11-32DP-2DSA
CN3	Panel connector	Hirose DF11-10DP-2DSA
CN8	Serial connector	JST B6B-XH-A
CNA1	Auxilary power connector	JST B4B-XH-A
CNB1	Backlight inverter connector	JST B5B-XH-A
CNC1	Switches and Buttons connector	JST B12B-XH-A
CNC2	Switches and buttons connector	Hirose DF13-9P-1.25DSA
P1	VGA In	DB15way DDC version
P2	Alternate VGA In	DIL Header Pin 8x2
PP1	DC Power In, DC Power Jack	DC power jack, 2.5mm contact pin diameter
PP2/3	Alternate DC Power In	DC power Molex 2 pin 0.156" pitch
LED1	Status indicator LED	Header pin 3x1

Ref	Purpose	Note
JA1	On board +5V logic power enable	1-3 & 2-4 closed, factory set, do not remove when operating
JA3	Panel power voltage select **CAUTION**: Incorrect setting can damage panel	1-3 & 2-4 = +3.3V panel voltage 3-5 & 4-6 = +5V panel voltage
JA4	RS-232 voltage level	1-3 & 2-4 = +/- 12V, 3-5 & 4-6 = +5V
JA6	Input power on/off control	1-2 = Always ON (switch mount board ON/OFF switch by-passed) Open = Controlled by switch mount board
JA7	Auxiliary power connector	1-3 & 2-4 = Aux_12V = +12V 3-5 & 4-6 = Aux_12V = B/L 12 (use this setting, together with CNA1 to drive higher power inverter)
JB2	Backlight inverter on/off control – signal level CAUTION: Incorrect setting can damage inverter	1-2=+12V 2-3=+5V Open = Open collector
JB3	Backlight inverter On/Off control-Polarity	1-2 : 'H'= Backlight ON 2-3 : 'L'= Backlight ON
JB10	Backlight inverter power control	1-2= By MCU Open = Always enable
JM1	Backlight inverter power MCU control bypass	1-2 & 3-4 = MCU Control bypassed (no MCU control) Open = Always enable
JP4	Panel Image orientation – Left/Right (for Sharp LQ10D345 only)	1-2 = Normal 2-3 = Image is turned left to right Open = For panels with no orientation control
JP5	Panel Image orientation – Up/Down (for Sharp LQ10D345 only)	1-2 = Normal 2-3 = Image is turned upside down Open = For panels with no orientation control
JP14	Panel Data clock pull low	1-2 = DCLK is pull low by 470 ohm resistor Open = DCLK is not pulled low
SW1	Panel selection	See below table 1
SW2	Other function selection	See below table 2

Table 1 : SW1 : Panel Selection

Pos. #	Function	Description	
1, 2	Panel manufacturer	ON, ON OFF, ON	Sharp, NEC, LG, Hosiden Toshiba
3	CE mode	ON OFF	Continuous CE No CE during vertical blanking
4	R, G, B data clock phase	ON OFF	Data latched at DCLK rising Data latched at DCLK falling

Table 2 : SW2 : Other function selection

Pos. #	Function	Description	
1	R, G, B calibration	ON OFF	Enable calibration mode (factory set) Disable
2, 3	Not used	OFF, OFF	
4	Soft power control	ON OFF	Disable Enable (check PWR button on switch mount board)

CN2, PANEL CONNECTOR, HIROSE, DF11-32DP-2DSA, 2mm PITCH

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	DCLK	Dot clock signal
3	H-Sync	Horizontal sync signal
4	V-Sync	Vertical sync signal
5	GND	Ground
6	R2	Red data
7	R3	Red data
8	R4	Red data
9	R5	Red data
10	R6	Red data
11	R7	Red data
12	GND	Ground
13	G2	Green data
14	G3	Green data
15	G4	Green data
16	G5	Green data
17	G6	Green data
18	G7	Green data
19	GND	Ground
20	B2	Blue data
21	B3	Blue data
22	B4	Blue data
23	B5	Blue data
24	B6	Blue data
25	B7	Blue data
26	GND	Ground
27	ENAB / DE	signal to settle the horizontal display position
28	VLCD	Panel power – 3.3V / 5.0V (Set by JA3)
29	VLCD	Panel power – 3.3V / 5.0V (Set by JA3)
30	RL	Image right/left control, set by JP4
31	UPDN	Image up/down control, set by JP5
32	/PWRDN	Power Down control signal (5V TTL level)

CN3, PANEL CONNECTOR, HIROSE, DF11-10DP-2DSA, 2mm PITCH

PIN	SYMBOL	DESCRIPTION
1	GND	Ground
2	GND	Ground
3	GND	Ground
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	Vcc	+ 5V
10	+12V	+ 12V

CN8, SERIAL CONNECTOR, 6 PIN JST B6B-XH-A (not install)

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

CNA1, AUXILARY POWER CONNECTOR, JST B4B-XH-A

PIN#	SYMBOL	DESCRIPTION
1	AUX_12V	+12V, 500mA max.
2	AUX_GND	Ground
3	AUX_GND	Ground
4	AUX_VCC	+5V, 500mA max.

CNB1, BACKLIGHT INVERTER CONNECTOR, JST B5B-XH-A

PIN #	SYMBOL	DESCRIPTION
1	GND	Ground
2	VBKL	Backlight Power supply, DC12V (Switched)
3	BLCTRL	Backlight ON/OFF control signal. (See jumper: JB2, JB3)
4	BVR_WIP	Backlight brightness VR pin WIP
5	BVR_A	Backlight brightness VR pin A

CNC1, SWITCHES AND BUTTONS CONNECTOR, JST B12B-XH-A

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 (470 ohm resistor to +5V Vcc)
6	GND	Ground
7	MENU	OSD Menu button
8	MINUS/LEFT	OSD Minus/Left button
9	PLUS/RIGHT	OSD Plus/Right button
10	SEL_DN	OSD Select down button
11	SEL_UP	OSD Select up button
12	PWR	POWER button

CNC2, SWITCHES AND BUTTONS CONNECTOR, Hirose 1.25mm 9-pin, DF13-9P-1.25DSA

PIN#	SYMBOL	DESCRIPTION
1	PWR	POWER button
2	NC	No connection
3	NC	No connection
4	MENU	OSD Menu button
5	SEL_UP	OSD Select up button
6	SEL_DN	OSD Select down button
7	PLUS/RIGHT	OSD Plus/Right button
8	MINUS/LEFT	OSD Minus/Left button
9	GND	Ground

P1, VGA IN, DB15WAY DDC VERSION (BLUE COLOR)

PIN#	SYMBOL	DESCRIPTION
1	PCR	Analog Red input
2	PCG	Analog Green input
3	PCB	Analog Blue input
4	ID2	Reserved for Monitor ID bit 2 (Grounded)
5	DGND	Ground
6	AGND	Analog Ground of Red in
7	AGND	Analog Ground of Green in
8	AGND	Analog Ground of Blue in
9	DDC_5V	+5V power supply for DDC (optional)
10	DGND	Ground
11	ID0	Reserved for Monitor ID bit 0 (Grounded)
12	DDC_SDA	DDC Serial Data
13	HS_IN	Horizontal Sync. or Composite Sync. In
14	VS_IN	Vertical Sync.
15	DDC_SCL	DDC Serial Clock

P2, ALT. VGA IN, DIL HEADER PIN 8X2

PIN ASSIGNMENT SAME AS P1, PIN 16 IS NO CONNECTION

PP1, DC POWER IN, DC POWER JACK, CENTRE PIN DIAMETER = 2.5mm

PIN#	DESCRIPTION
1	Center pin, DC12V in.
2	Ground

PP2, ALTERNATE DC POWER IN, 0.156" PITCH POWER CONNECTOR

PIN #	DESCRIPTION
1	DC12V in
2	Ground

PP3   (Not installed)
ALTERNATE DC POWER IN, 0.20" PITCH POWER CONNECTOR

PIN #	DESCRIPTION
1	DC12V in
2	Ground

CONTROLLER DIMENSIONS

AC-9512 VGA

166.82 mm (6570)

79.25 mm (3120)

91.44 mm (3600)

Max. 21 mm

177.8 mm (7000)
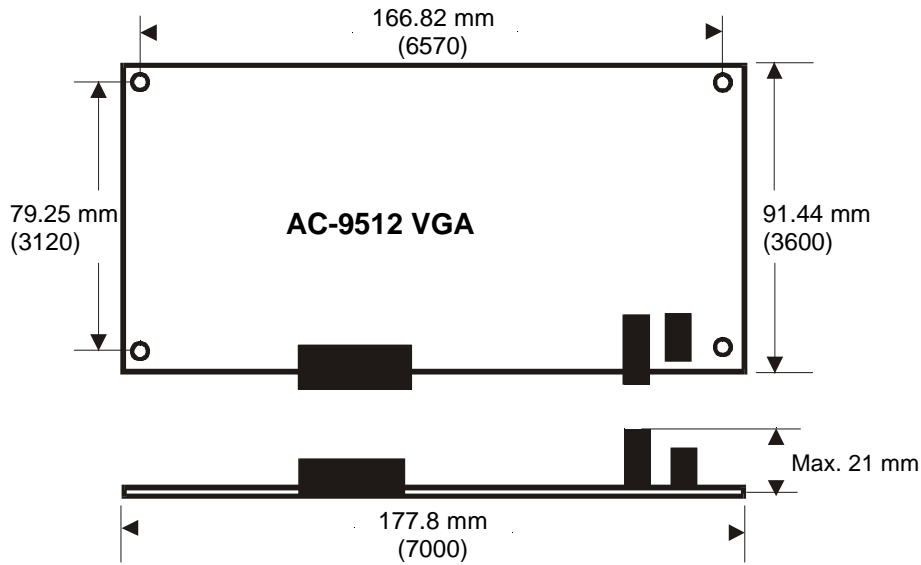
The maximum thickness of the controller is 21.0mm (measured from bottom of PCB to top of components, including any underside components & leads). We recommend clearances of:

- 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.

TROUBLESHOOTING

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 position:
- If it is impossible to position the image correctly, ie the image adjustment controls will not move the image far enough, then test using another graphics card. This situation can occur with a custom graphics card that is not close to standard timings or if something is in the graphics line that may be affecting the signal such as a signal splitter (please note that normally a signal splitter will not have any bad effect).

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.

Backlight:
Items to check include: Power input, Controls, Inverter and Tubes generally in this order.

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	640 x 480 TFT LCD's from manufacturers such as Hosiden, LG, Mitsubishi, NEC, Sharp, Toshiba though some factory adjustment may be required for individual panel timings.
No. of colours	Up to 3 x 8 bit providing 16.7 million colours.
Graphics modes	Standard VGA
Standard input at source	VGA analog (15 pin)
OSD Controls available	- Brightness - Contrast, - Tuning - Hori Position - Vert Position - Image size - Exit menu
Settings memory	Settings are stored in non volatile memory
VESA DPMS implementation	The backlight is shut off if: • Hsync signal drops below 3.5Hz. • Vsync signal drops below 3.5Hz. • Either of Vsync & Hsync signal drops below 3.5Hz. Backlight shut off is by the enable pin of the inverter. NOTE: Power On & Standby mode status is indicated by connection to a 2 colour LED.
Plug & Play	VESA DDC 2/b compatible
Voltage output for LCD	+3.3V DC, +5V DC
Input voltage	12VDC
Power protection	Fuse fitted - auto reset
DC Power handling	An on board relay handles the power load for On/Off and power protection to the LCD.
Power load maximum	The controller has an overall 2Amp current limit.
Controller power consumption	Approx 2.5W (controller logic only, no panel)
Storage temperature limits	-40°C to +70°C
Operating temperature limits	-25°C to +65°C
Controller dimensions	178mm x 91.5mm x 20mm

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.
- Relayout and custom development services are available.

WARRANTY

The products are warranted against defects in workmanship and material for a period of one (1) 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 these instructions 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

The manufacturer's liability for damages to customer or others resulting from the use of any product supplied hereunder shall in no event exceed the purchase price of said product.

TRADEMARKS

The following are trademarks of Digital View Ltd:
- Digital View
- AC-9512VGA

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