Digital View

ANALOG INTERFACE CONTROLLER
FOR VGA & SVGA RESOLUTION TFT LCD

Model: AC-9511 v.3

(Part number: 41068770x)

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-9511 v.3 is an interface circuit designed to allow typical colour TFT type LCD panels of 640x480 or 800x600 resolution to work with the analog signal from PC graphics cards that are normally connected to CRT type monitors.

Applications for the AC-9511 v.3 are likely to include LCD monitors and other LCD based products.

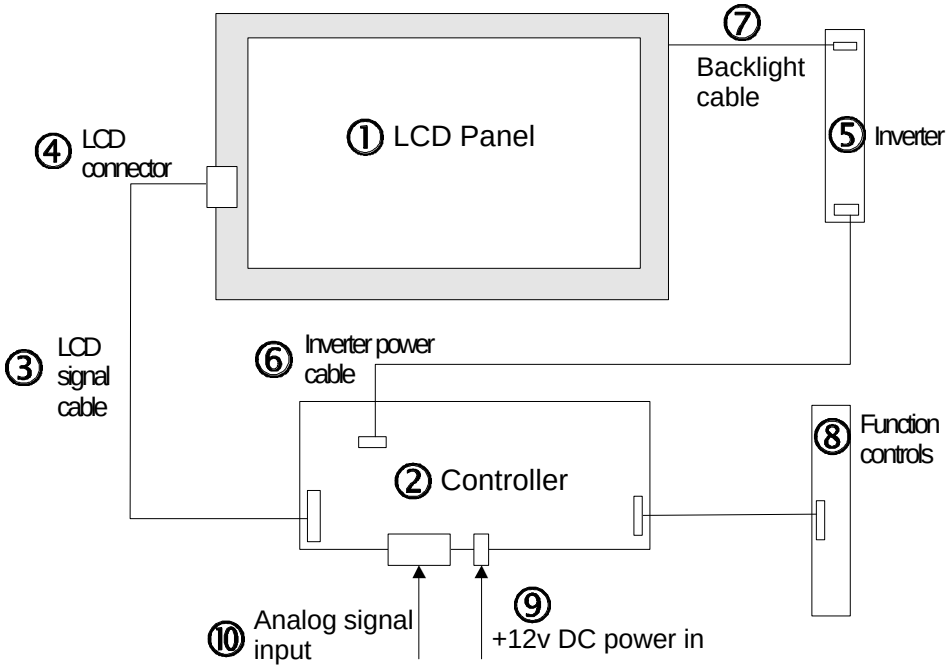
IMPORTANT USAGE NOTE
This product is for use by system developers and integrators, the manufacturer accepts no liability for damage or injury caused by the use of this product. It is the responsibility of the developer, integrators or other user of this product to:

- 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.

QUICK GUIDE

Digital View publishes a wide range of connection diagrams that clearly demonstrate the parts and connection method for various panels.

SW1 Panel BIOS Selection
The following list is provided as a general guideline. Some panels within a manufacturers range may have different timing requirements – for specific settings please refer to the Digital View connection diagram for the panel of choice.

VGA Panels: switch 4 on

Panel	1	2	3	4
Sharp	On	On	On	On
Toshiba/NEC/Hosiden	Off	On	On	On
LG	Off	Off	On	On

SVGA Panels: switch 4 off

Panel	1	2	3	4
Sharp	On	On	On	Off
Toshiba	Off	On	On	Off
IBM	On	Off	On	Off
LG LP121S1/SB	Off	Off	On	Off
Samsung	Off	On	Off	Off
LG other models	Off	Off	Off	Off

Note: These list is being added to progressively, please contact Digital View or your dealer for the latest update.

Fujitsu 21 Plasma panel: The BIOS selection is for Sharp VGA. The resistor at location R36 needs to be bypassed. For most production this will have already been done however it is noted here as a check.

ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using 640x480 or 800x600 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.

  NOTE: This controller supports up to 8 bits per colour, for panels of lower bits (eg 3 x 3 bit, 3 x 4 bit etc), connection of the panel signal high value should correspond to the controllers highest bit. For example for a 3 x 3 bit panel R2 on the panel should connect to R7 on the controller, in this case R0~4 on the controller will not be connected. For a 3 x 6 bit panel R5 on the panel should be connected to R7 on the controller. For a 3 x 8 bit panel R7 on the panel should be connected to R7 on the controller. Same for G & B.

- 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 3Amp current limit and the current available for backlighting will be dependent on the power input and other system requirements.

- ⑦ **Inverter to Backlight 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.

- 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 ‘Application notes’ section for details of operation without controls attached.

- **Function controls cable**: The cables to the function switches should be of quality and length so that impedance does not affect performance. Generally lengths up to 1 metre (3 feet) should be acceptable

- 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 **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 3Amp current limit and the current available from the auxiliary power putput 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. Consideration should be given to:
    - Electrical insulation.
    - Grounding.
    - EMI shielding.
    - Cable management.
    - Heat & ventilation.

- **Touch Panels**: Support for touch panels or other low power consumption accessories is available via connector CN1 provides 5V & 12V DC which can be used to power such accessories. See note on Power Output above.

- **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 or lower.
    - Non-interlaced is required.

OPERATIONAL FUNCTIONS

Once the circuit has been connected, operational setup needs to be considered. The following instructions are likely to form the basis of the finished product operation manual.

PC SETTINGS

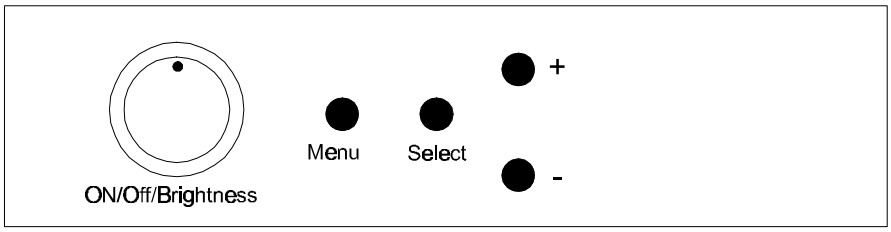
The PC needs to be set to the appropriate graphics mode for the resolution of the panel and for SVGA panels the vertical refresh rate should be set to 60Hz or less (this will not result in screen flicker), non-interlaced.

LCD DISPLAY SYSTEM SETTINGS

The OSD provides On Screen Display of certain functions which are controlled by 4 buttons. By way of explanation the following refers to a set of sample buttons that may be supplied as an option for demonstration purposes:

1. **On Off** - toggle power on/off
2. **Brightness** - a variable resistor to control backlight brightness
3. **Menu** - turns the OSD menu On or Off
4. **Select** - moves the selection indicators to the next function
5. **+** - increase the setting
6. **-** - decrease the setting

- **Default**: Pressing Select, + & - at the same time resets all items to the default.



OSD Functions: Explanation of Functions:

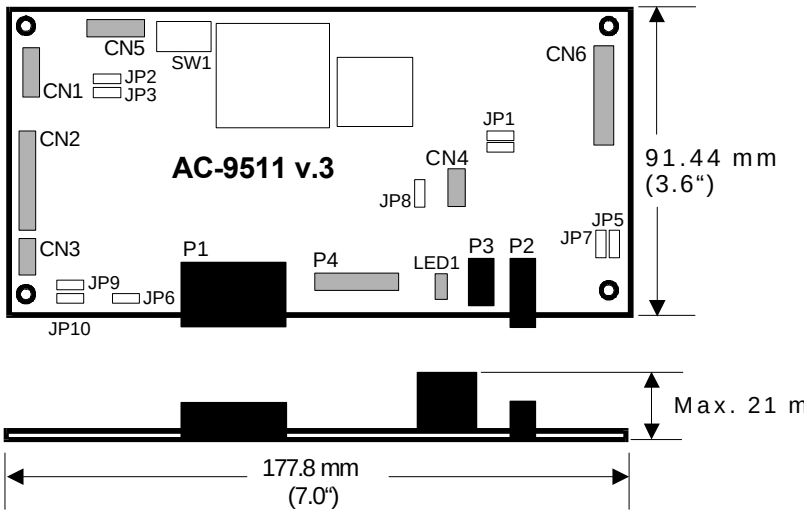
1. **On/Off** - power toggle switch
2. **Brightness** - a variable resistor to control backlight brightness
3. **Contrast** - changes colour saturation
4. **Phase** - adjusts data sampling position
5. **Size** - for SVGA resolutions this adjusts the image size, it may be necessary to adjust the image horizontal position occasionally while using this setting.
6. **Vert** - adjusts the vertical position
7. **Horiz** - adjusts the horizontal position

CONT	**- |----+---| +**
PHSE	**- |----+---| +**
SIZE	**- |----+---| +**
VERT	**- |----+---| +**
HORI	**- |----+---| +**

The settings chosen will be stored in memory.

CONNECTORS & PINOUTS

The various connectors are:



Summary

Ref	Purpose	Description	P/N (used part)
CN1	5/12V power output	JST 4 way	B 4B-XH-A
CN2	LCD signal	Hirose 32 way	DF11-32BP-2DSA
CN3	LCD signal – 8 bit	Hirose 10 way	DF11-10BP-2DSA
CN4	Reserved		
CN5	Backlight inverter	JST 5 way	B 5B-XH-A
CN6	Controls	JST 10 way	B 10B-XH-A
P1	VGA signal in	DB15 high density PCB mount, 3 row, r/angle	
P2	12V DC in	Power jack, 2.5mm internal pin	
P3	12V DC in (alt)	Molex connector, 4 pin, 0.156” pitch,	
P4	VGA signal in (alt)	8 x 2 pin header DIL, 0.1”	
LED1	Status indicator LED	3 x 1 pin header IL, 0.1”	

Ref	Purpose	Note
JP1	Factory set	Do not change (set to 1-2, 3-4)
JP2	Inverter enable voltage	1-2 H=12V, 2-3 H=5V (Vcc), OPEN H=open collector
JP3	Inverter control	1-2 H=On, 2-3 L=On
JP4	Does not exist	
JP5~7	Panel power	see table immediately below
JP8	Contrast adjust method	1-2=VR, 2-3=digital via OSD (default)
JP9	Left/Right	Changes image orientation on certain Sharp panels
JP10	Up/Down adjust	Changes image orientation on certain Sharp panels
JP11	Sync signal setting	3-5 & 4-6 = separate sync, 1-3 & 2-4 = composite or sync on green
JP12	Sync signal setting	1-2=separate sync, 3-4=composite sync, 5-6=sync on green
JP13	Panel model select	4-6=default for general panels, 1-2, 3-4, 5-6 = for LG LP121S1 & LP121SB only
JP14	Clock adjust	open=normal, 1-2=for Samsung LT121S1-153 dot clock
SW1	Panel BIOS selection	See table in Quick Guide at front of this manual

JP13 & JP14 are on boards with part number 410687706 or higher

Panel	JP5	JP6	JP7
12V DC 1A max	1-2	1-2	Na
+5V DC 1A max	2-3	1-2	Open
+3.3V DC 1A max	2-3	2-3	1-2

CN1 - 5/12V DC power output

PIN	DESCRIPTION
1	+12V DC – check current load limit (see notes)
2	Ground
3	Ground
4	+5V DC (VCC) – check current load limit (see notes)

CN2 - To LCD panel

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
29	VLCD	Panel power – 3.3V / 5.0V
30	R/L	Right / Left orientation
31	Up/Dn	Up / Down orientation
32	Reserved	

CN3 - To LCD panel, for 8 bit panel support only

PIN	SYMBOL	DESCRIPTION
1	R0	Red data
2	R1	Red data
3	G0	Green data
4	G1	Green data
5	B0	Blue data
6	B1	Blue data
7	Gnd	Ground
8	Gnd	Ground
9	Vcc 5V	
10	+12V	

CN4 Reserved

PIN	SYMBOL	DESCRIPTION
1		
2		
3		

CN5 - To backlight inverter: 5 way JST connector, 2.5mm pitch

PIN	DESCRIPTION
1	ground
2	+12VDC
3	enable
4	VR WIP
5	VR A

CN5 NOTE

- For detailed discussion of connecting different inverters see Application Notes later in this manual.

CN6 Functions

PIN	DESCRIPTION
1	+12VDC Power - in (for on/off)
2	Power - out (for on/off) - load handled on controller
3	Brightness Control VR - A pin
4	Brightness Control VR - Wip pin
5	Brightness Control VR – B pin
6	Ground
7	Menu
8	-
9	+
10	Select: down
11	Not used with 10 pin connector (Select – up)
12	Reserved

CN6 NOTE

- **On/Off**: To operate the controller without switches attached it is required that pins 1 & 2 are connected/shorted. This can be done with a jumper or equivalent method to close the circuit thus leaving the controller set to On.
- **Backlight Brightness**: Pins 3 & 4 provide a link to an inverter if the inverter is connected to CN5. In any case to operate it is required to check the specifications of the inverter being used.
- **Menu, +, -, Select**: As these controls are operated by momentary type buttons with no specified power loading they can be removed without affecting the running of the controller. Any momentary type button (ie 4 buttons required in total) can be used wired from the relevant pin (pin 1, 2, 3 or 5) to ground (pin 4) should be suitable.

P1 - ANALOG VGA INPUT - 15 way connector

PIN	DESCRIPTION	On analog VGA card connector, corresponding pin
1	red, analog	1
2	green, analog	2
3	blue analog	3
4	no connection	4
5	digital ground	5
6	analog ground (red return)	6
7	analog ground (green return)	7
8	analog ground (blue return)	8
9	no connection	9
10	digital ground	10
11	no connection	11
12	no connection	12
13	horizontal sync, input	13
14	vertical sync, input	14
15	no connection	15

P2 - To 12VDC power supply: 2 way DC power jack

PIN	DESCRIPTION
1	+12VDC in (middle pin)
2	Ground

P3 - To 12VDC power supply: 2 way DC Molex power jack

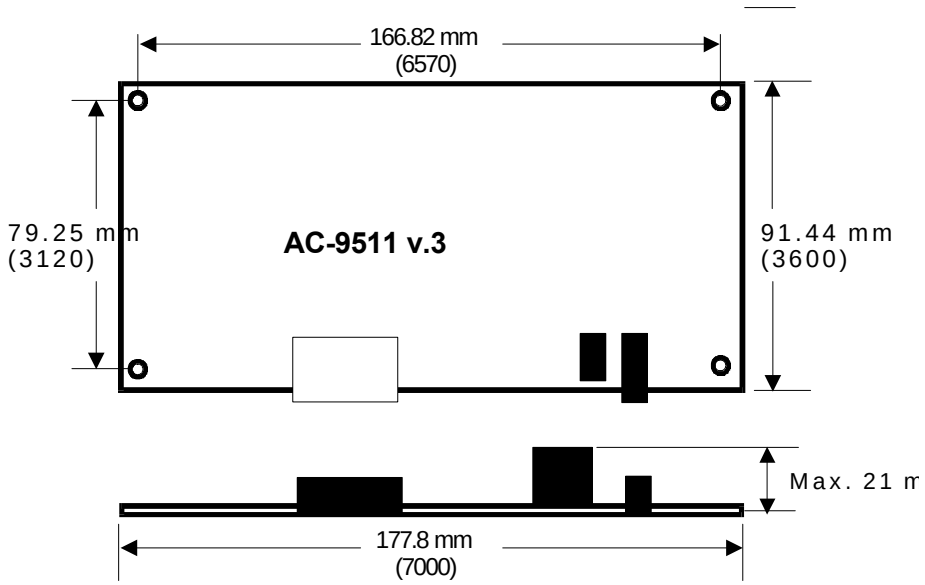
PIN	DESCRIPTION
Right	+12VDC in
Left	Ground

Note: To confirm the 12V in pin, on the underside of the board the square pad is 12V in.

P4 - ANALOG VGA INPUT: 8x2 pin header.

Pin allocation the same as for P1.

CONTROLLER DIMENSIONS



The maximum thickness of the controller is 20mm (with no piggy-back or daughterboards) or 32mm with an inverter mounted (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. Other holes are used for mounting inverters supplied as fitted options.

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 SWITCHES ATTACHED

This is very straightforward:

- 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 10 way (CN6) & 5 way (CN7) cables.
- Use a jumper or similar to connect pins 1 & 2 on CN6, 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 CN6 the only functions that are used are for On/Off and Brightness (if controller mounted inverter is used). On CN7 the pins are for momentary 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 CN5 pin 1 is ground and pin 2 provides 12V DC. This should be matched with the inverter specification: see table.

CN5

PIN	DESCRIPTION
1	ground
2	+12VDC

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.

CN5

PIN	DESCRIPTION
3	enable

Further, jumpers 2 & 3 should be set to match the inverters specification for the enable pin power and High or Low setting: see table.

Ref	Purpose	Note
JP2	inverter enable voltage	1-2 H=12V, 2-3 H=5V (Vcc), OPEN H=open collector
JP3	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 controlled by using a VR.
- Brightness controlled by adding a circuit such as PWM (Pulse Width Modulation).
- No adjustment of brightness is possible.

CN5 pins 4 & 5 are available for connecting to an inverter or circuit where VR control is supported.

CN5

PIN	DESCRIPTION
4	VR WIP
5	VR A

This can then be matched with function controls connected to CN6 pins 8 & 9: see table.

CN6

PIN	DESCRIPTION
8	VR A
9	VR WIP

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 and 800 x 600 TFT LCD's from manufacturers such as Sharp, NEC, Toshiba, IBM 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 & SVGA as per table following
Graphics mode auto detect	Yes
Standard input at source	VGA analog (15 pin)
Controls available	• On/Off • Brightness • Contrast, • Phase • Image position (V & H). • Size (for SVGA)
Settings memory	Settings are stored in non volatile memory
On screen display	For Contrast, Phase, Position & Size
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, +12V 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 3Amp current limit.
Controller power consumption	Approx 2.5W (controller logic only, no panel)
Storage temperature limits	-40^{o}C to $+70^{o}$C
Operating temperature limits	-25^{o}C to $+65^{o}$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.

Graphics modes supported:

Ref	Mode	Resolution	Colours	Hor. Freq / kHz	Vert. freq / Hz	Polarity H / V	Dot clock / MHz
0	Text	40x25 chars	B/W	31.5	70	-/+	28.35
1	Text	40x25 chars	16	31.5	70	-/+	28.35
2	Text	80x25 chars	B/W	31.5	70	-/+	28.35
3	Text	80x25 chars	16	31.5	70	-/+	28.35
4	Graphics	320 x 200	4	31.5	70	-/+	25.2
5	Graphics	320 x 200	4	31.5	70	-/+	25.2
6	Graphics	640 x 200	2	31.5	70	-/+	25.2
7	Text	80x25 chars	Mono	31.5	70	-/+	28.35
D	Graphics	320 x 200	16	31.5	70	-/+	25.2
E	Graphics	640 x 200	16	31.5	70	-/+	25.2
F	Graphics	640 x 350	Mono	31.5	70	+/-	25.2
10	Graphics	640 x 350	16	31.5	70	+/-	25.2
11	Graphics	640 x 480	2	31.5	60	-/-	25.2
12	Graphics	640 x 480	16	31.5	60	-/-	25.2
13	Graphics	320 x 200	256	31.5	70	-/-	25.2
101	Graphics	640 x 480	256	31.5	60	-/-	25.2
102	Graphics	800 x 600	16	37.8	60	Any	40
103	Graphics	800 x 600	256	37.8	60	Any	40
110	Graphics	640 x 480	32k	31.5	60	-/-	25.2
111	Graphics	640 x 480	64k	31.5	60	-/-	25.2
112	Graphics	640 x 480	16.7m	31.5	60	-/-	25.2
114	Graphics	800 x 600	64k	37.8	60	Any	40
115	Graphics	800 x 600	16.7m	38.5	60	Any	40
201	Graphics	640 x 480	256	31.5	60	-/-	25.2
202	Graphics	800 x 600	16	37.8	60	Any	40
203	Graphics	800 x 600	256	37.8	60	Any	40
212	Graphics	640 x 480	16.7m	31.5	60	-/-	25.2
	MAC 14”	640 x 480		35.000	67.00	-/-	30.240
	VESA	800 x 600		35.156	56.250	+/+	36.000

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-9511 v.3

