

# **ANALOG INTERFACE CONTROLLER FOR VGA/SVGA RESOLUTION TFT LCD**

## **Model: AC-9511 VGA**

(Part number: 41068----)

### **INSTRUCTIONS**

#### **INTRODUCTION**

**Intended for LCD monitors and other LCD based products the AC-9511 V.2 controller provides an auto-input synchronisation and easy to use interface for TFT (active matrix) LCD s.**

The AC-9511 V.2 controller provides for connection of colour TFT LCD's to standard analog VGA/SVGA output from a PC. It is highly stable and versatile making it the ideal product for an LCD Monitor or display integration project.

#### **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.

#### **DISCLAIMER**

There is no implied or expressed warranty regarding this material.

#### **CONTENTS**

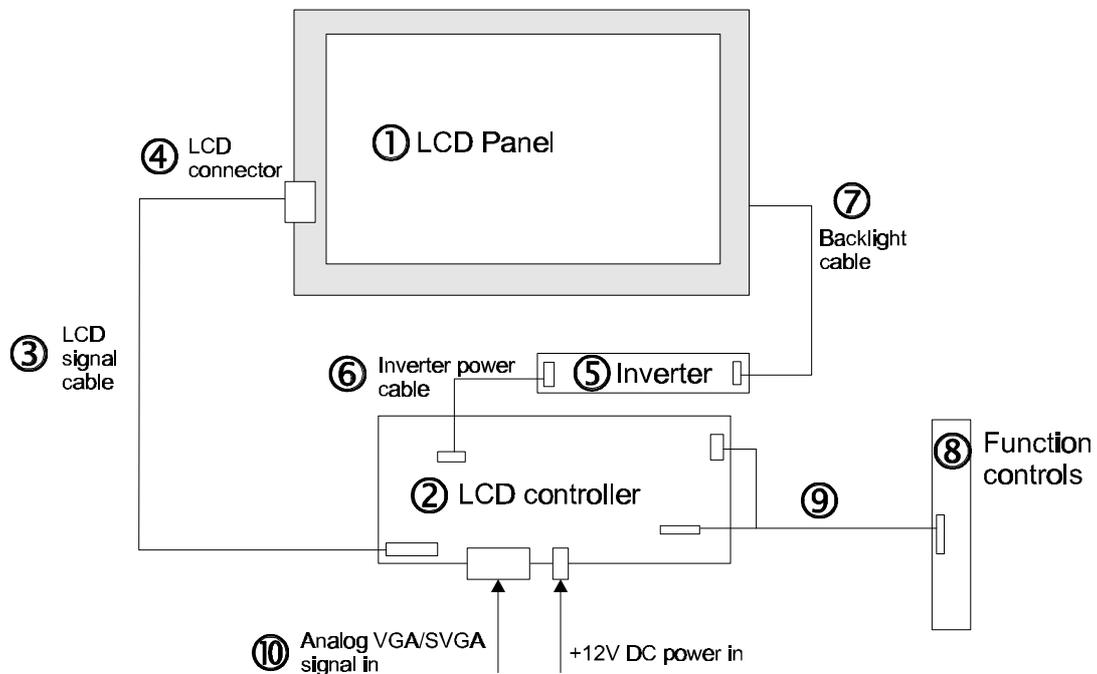
- System design - Suggested system diagram
- Assembly notes
- Operational functions
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- Controller dimensions
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Setup for:

- Sharp, Toshiba, NEC, LG, Samsung, FPD, Hosiden

## SYSTEM DESIGN

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



### Summary:

1. LCD panel
2. LCD controller card
3. LCD signal cables
4. Connector for LCD signal cables
5. Inverter for backlight (if not built into LCD)
6. Inverter power cable
7. Inverter to backlight cable (if inverter is not part of LCD or if existing panel cable is too short)
8. Function controls
9. Function controls cable
10. External type VGA cable
  - Power supply (not shown)
  - Enclosure or Mounting (not shown).

Please note that items: 2, 3, 4, 5, 6, 7, 8, 9, 10 as well as power supply and a choice of enclosures are available from Digital View as options.

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## ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using VGA or SVGA resolution TFT panels. This section and the Application notes section provides some guidelines for installation and preparation of a finished display solution.

- **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 on the controller have been labelled. Guides to connectors and mounting holes are shown in the following relevant sections.
- ① **LCD Panel:** This controller is for TFT panels with 5V or 3.3V TTL or LVDS/Panelink (see following note) interface. 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.

NOTE: For all panels including those of higher or lower bits (eg 3 x 3 bit, 3 x 8bit etc), connection of 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 R5 on the controller, in this case R2, R1, R0 on the controller will not be connected. For a 3 x 6 bit panel R5 on the panel should be connected to R5 on the controller & all pins will be used. For a 3 x 8 bit panel R7 on the panel should be connected to R5 on the controller.

- **LVDS/Panelink** : Connection to a panel with an LVDS or Panelink™ interface requires the optional LVDS/Panelink daughterboard and may require configuration.
- ③ **LCD signal cables:** In order to provide a clean 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.
- ④ **LCD connector:** Different makes and models of LCD panel require different panel signal connectors and different pin assignments.
- 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 backlights may vary it is important to match the inverter in order to obtain optimum performance. See Application notes for more information on connection.
- ⑦ **Inverter to Backlight Cables:** (Only relevant if an inverter other than one built into the LCD panel is used). These 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.
- ⑧ **Function Controls:** The following section discusses the controls required and the section on connectors provides the detail. When using the OSD BIOS version the controls are minimal: On/Off (simple low power on/off), Brightness (depends on inverter), OSD (4 momentary buttons). See connector reference and application notes for details of operation without controls attached.

- **⑨ 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
- **⑩ VGA Input Cable:** As this may affect regulatory emission test results a suitably shielded cable should be utilised.
- **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.
- **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 can affect the result.
- **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:** Aside from the replaceable fuse (on some versions this has been replaced with an auto-reset fuse) the board 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.
  - 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.
- **Touch Panels:** Support for touch panels or other low power consumption accessories is available by:
  - Connector CN1 provides 5V & 12V DC which can be used to power such accessories.
- **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.

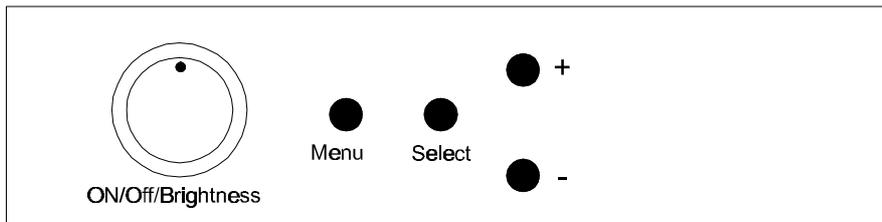
### PC SETTINGS

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:

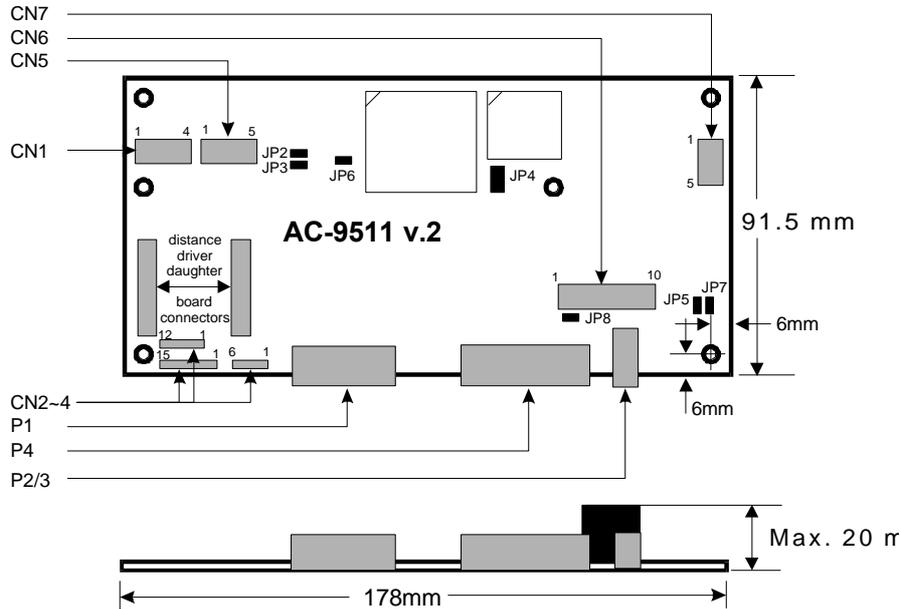
1. **On/Off** - power toggle switch
2. **Brightness** - a variable resistor to control backlight brightness
3. **Contrast** - changes colour saturation
4. **Phase** - adjusts data sampling position
5. **Size** - for SVGA resolutions this adjusts the image size, it may be necessary to adjust the image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

<b>CONT</b>	-  ----+---  +
<b>PHSE</b>	-  ----+---  +
<b>SIZE</b>	-  ----+---  +
<b>VERT</b>	-  ----+---  +
<b>HORI</b>	-  ----+---  +

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 12 way	DF13-12P-1.25DSA
CN3	LCD signal	Hirose 15 way	DF13-15P-1.25DSA
CN4	LCD signal	Hirose 6 way	DF13-6P-1.25DSA
CN5	Backlight inverter	JST 5 way	B 5B-XH-A
CN6	Controls	JST 10 way	B 10B-XH-A
CN7	OSD Controls	JST 5 way	B 5B-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)	DB26 high density PCB mount	

Ref	Purpose	Note
JP1	reserved	
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	panel select	details provided separately
JP5-7	panel power	see table immediately below
SP1	reserved, factory set	factory set - do not change

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 – xxmA guideline based on 2 tube 200cd panel & 2.5Amp psu
2	Ground
3	Ground
4	+5V DC (VCC) – 300mA max load

**CN2 - To LCD panel**

PIN	SYMBOL	DESCRIPTION
1	R0	red data - lower bit
2	R1	red data
3	R2	red data
4	gnd	ground
5	G0	green data - lower bit
6	G1	green data
7	G2	green data
8	gnd	ground
9	B0	blue data - lower bit
10	B1	blue data
11	B2	blue data
12	gnd	ground

**CN3 - To LCD panel**

PIN	SYMBOL	DESCRIPTION
1	CK	clock signal for sampling each data signal
2	gnd	ground
3	HS	horizontal synchronous signal
4	VS	vertical synchronous signal
5	R3	red data
6	R4	red data
7	R5	red data - higher bit
8	gnd	ground
9	G3	green data
10	G4	green data
11	G5	green data - higher bit
12	gnd	ground
13	B3	blue data
14	B4	blue data
15	B5	blue data - higher bit

**CN4 - To LCD panel**

PIN	SYMBOL	DESCRIPTION
1	VLCD	+3.3V / +5V power supply
2	VLCD	+3.3V / +5V power supply
3	gnd	ground
4	gnd	ground
5	enab	signal to settle the horizontal display position
6	BLON	reserved for NEC panel only

**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 - On/Off, Brightness control**

PIN	DESCRIPTION
1	+12VDC Power - in (for on/off)
2	Power - out (for on/off) - load handled on controller
3	Not used
4	Ground
5	Not used
6	Not used
7	Not used
8	Brightness Control VR - A pin
9	Brightness Control VR - Wip pin
10	Not used

**CN6 NOTE**

- **On/Off:** To operate the controller without switches attached it is required that pins 1 & 2 are connected. This can be done with a jumper or equivalent method to close the circuit thus leaving the controller set to On.
- **Backlight Brightness:** Pins 8 & 9 together with pin 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.

**CN7 - OSD controls**

PIN	DESCRIPTION
1	OSD 'Menu' - momentary
2	OSD '-' - momentary
3	OSD '+' - momentary
4	ground
5	OSD 'Select' - momentary

**CN7 NOTE**

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

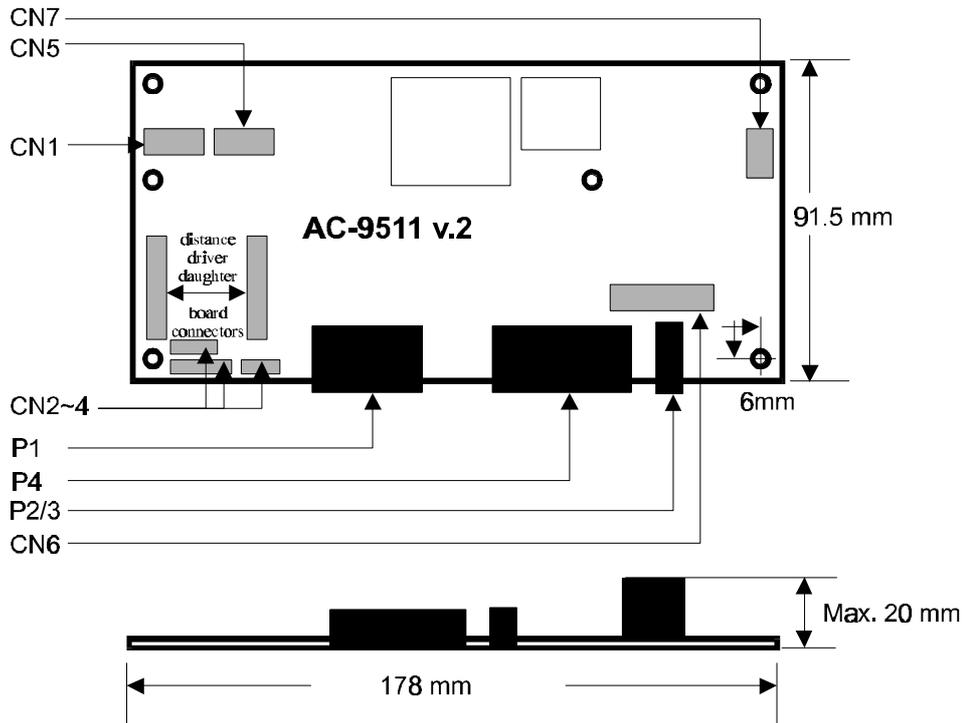
**P2 & P3 - To 12VDC power supply: 2 way DC power jack**

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

**P4 - ANALOG VGA INPUT: DB26 way connector**

PIN	DESCRIPTION	VGA card connector, corresponding pin
1	red, analog	1
2	green, analog	2
3	blue analog	3
5,6	digital ground	5, 10
10,11,12	analog ground	6, 7, 8
13	horizontal sync	13
14	vertical sync	14
4,7,8,9,15	no connection	
16, 17, 18, 19	no connection or reserved	
20, 21, 22, 23	Reserved XD1, XD2, XD3, XD4	
24,25,26	NC, Reserved XD5, XD6	

## 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 be 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**

<b>PIN</b>	<b>DESCRIPTION</b>
4	VR WIP
5	VR A

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

**CN6**

<b>PIN</b>	<b>DESCRIPTION</b>
8	VR A
9	VR WIP

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## 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	Compatible with 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 6 bit providing 262,144 colours.
Frequency auto-synchronisation range	For VGA all frequencies
Vertical refresh rate	VGA, SVGA (to 60Hz) non-interlaced
Graphics formats	Standard VGA, SVGA
Graphics auto mode detect	VGA (all modes)
Standard input at source	VGA analog (15 pin)
Controls available	<ul style="list-style-type: none"><li>• On/Off</li><li>• Brightness</li><li>• Contrast,</li><li>• Phase</li><li>• Image position (V &amp; H).</li><li>• Size (for SVGA)</li></ul>
Settings memory	Settings are stored in non volatile memory
On screen display	Functions display
Connectivity	VGA/SVGA analog
Controller dimensions	178mm x 91.5mm x 20mm
Voltage output for LCD	+3.3V DC, +5V DC, +12V DC
Input voltage	12VDC
Power protection	Fuse fitted - auto reset or glass tube type (2 Amp)
DC Power handling	An on board relay handles the power load for On/Off and power protection to the LCD.
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

## 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.
- Relay and custom development services are available.

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## **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.

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## **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.

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## **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.

Specifications subject to change without notice

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