

Digital View

ANALOG INTERFACE CONTROLLER FOR 1024 x 768 RESOLUTION TFT LCD

Model: AC-9606 v.3

(Part number: 4106878xx)

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 AC-9606 v.3 controller provides an auto-input synchronisation and easy to use interface controller for:

- TFT (active matrix) LCD s of 1024 x 768 resolution;
- Computer video signals of VGA, SVGA & XGA standard.

HOW TO PROCEED

- Ensure you have all parts & that they are correct, refer to:
 - Connection diagram
 - Connector reference
 - Assembly notes
- Check controller BIOS & jumper settings (errors may damage the panel)
- Prepare the PC
- Connect the parts
- Understand the operation & functions

IMPORTANT USAGE NOTE

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

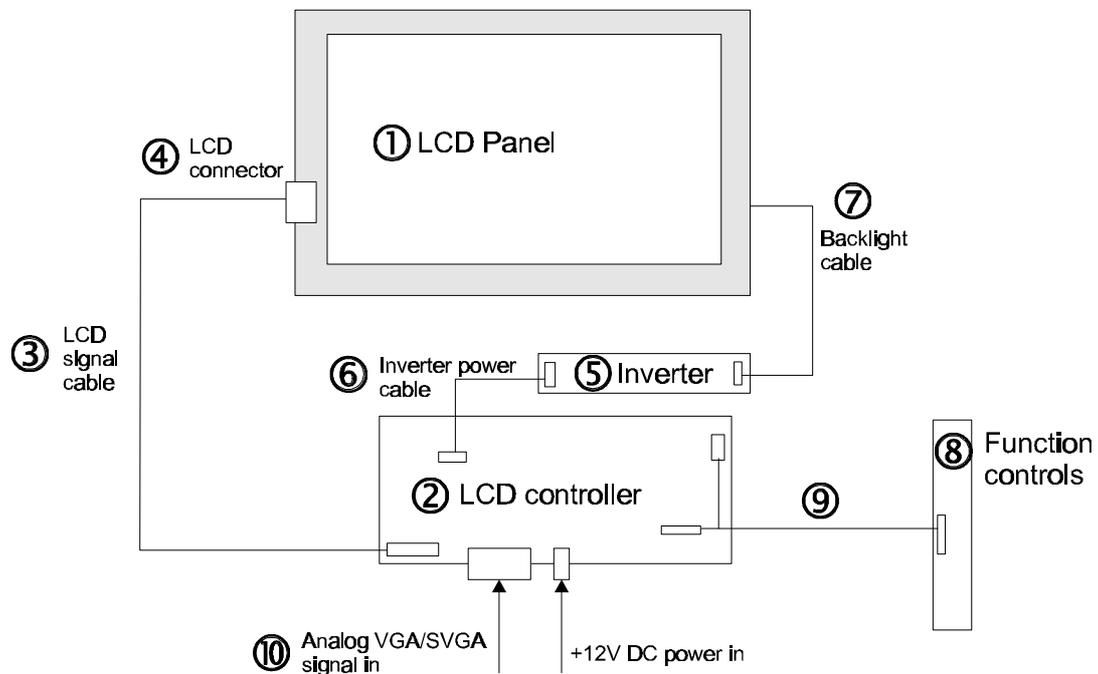
- Ensure that all necessary and appropriate safety measures are taken.
- Obtain suitable regulatory approvals as may be required.
- **Check power settings to all component parts before connection.**

DISCLAIMER

There is no implied or expressed warranty regarding this material.

SYSTEM DESIGN

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



Summary:

1. LCD panel
2. LCD controller card, AC-9606 v.3
3. LCD panel 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).

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

ASSEMBLY NOTES

This controller is designed for monitor and custom display projects using 1024 x 768 resolution TFT panels with a VGA, SVGA or XGA signal input. The following 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 the system and the various connectors, mounting holes and general layout of the controller. As much as possible connectors have been labelled. Guides to connectors and mounting holes are shown in the following relevant sections.
- **LCD Panel:** This controller is for TFT panels with 5V or 3.3V interface. Due to the variation between manufacturers 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)**
- **Controller:** Handle the controller with care as static charge may damage electronic components.
- **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. Additionally it may be necessary in some systems to add ferrite cores to the cables to minimise signal noise.
- **LCD connector:** Different makes and models of LCD panel require different panel signal connectors and different pin assignments.

WIRING NOTE: If panels of less than 3 x 8 bit are used, eg 3 x 6 bit, then connection of panel signal high value should correspond to the controllers highest bit. For example for a 6 bit panel R5 on the panel should connect to R7 on the controller, in this case R1 & R0 on the controller will not be connected.

- **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.
- **Inverter to Backlight Cables:** (Not so relevant if the inverter is built into the LCD panel module). These are high tension and thus prone to power leakage. Suitable cable should be selected of minimum length, additionally care should be taken when laying out this cable.
- **Function Controls:** The following section discusses the controls required and the section on connectors provides the detail. The controls are minimal: On/Off, Brightness (depends on inverter), OSD (4 momentary buttons).

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.

- **VGA Input Cable:** As this may affect regulatory emission test results and the quality of the signal to the controller a suitably shielded cable should be 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 output:** Note the controller has an overall 3Amp current limit and the current available from the auxiliary power output will be dependent on the power input and other system requirements.
- **Power Safety:** Note that although only 12VDC is required as 'power-in' a backlight inverter for panel backlighting produces significantly higher voltages (the inverter does not connect to the ground plane). 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:** 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.
 - Other issues that may affect safety or performance.
- **Touch Panels:** Support for touch panels or other low power consumption accessories is available by:
 - Connector CN9 provides 5V & 12V DC which can be used to power such accessories subject to a maximum loading recommended at 500mA.
- **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 video input is required.

IMPORTANT: It is recommended to 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.

CONNECTION

Connection and usage is quite straightforward however care needs to be taken with:

- Ensuring parts have been correctly connected – both power & signal considerations.
- Checking that all jumpers & switches are set correctly.
- The input signal is compatible.
- Legal & safety requirements have been met.

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.

The steps in any order are:

- Panel signal connection.
- Panel backlight connection – Inverter & backlight tubes (see Application Notes section for more information).
- Function controls connection.
- Accessory connection, ie indicator LED, touch panel.

Then in the following specific order:

- Input signal connection (ie from the computer, ensure the computer is switched Off)
- Power supply (DC 12V, ensure correct + & - orientation).
- Power on the PC (ensure the PC settings are suitable).
- Power on the display.

PC SETTINGS

The PC needs to be set to run in VGA or SVGA or XGA mode and the vertical refresh rate should be set to non-interlaced, 60Hz (this will not result in screen flicker).

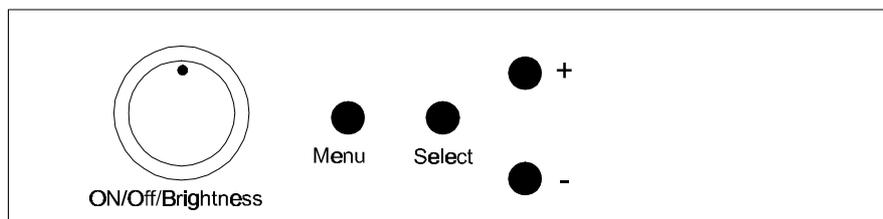
OPERATION

Once the system has been connected and switched on there are a number of functions available to adjust the display image as summarised in the following sections.

LCD DISPLAY SYSTEM SETTINGS

NOTE: By way of explanation the following refers to a set of sample buttons that may be supplied 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 4 momentary type buttons

1. **Menu** - turns the OSD menu On or Off (it will also auto time off)
2. **Select** - moves the selection indicators to the next function
3. **+** - increase the setting
4. **-** - decrease the setting



Functions: Explanation of switch functions:

1. **On/Off** - power on/off: Controller, Panel & Backlight.
2. **Brightness** - if supported by inverter and correct wiring, to control backlight brightness.

OSD functions:

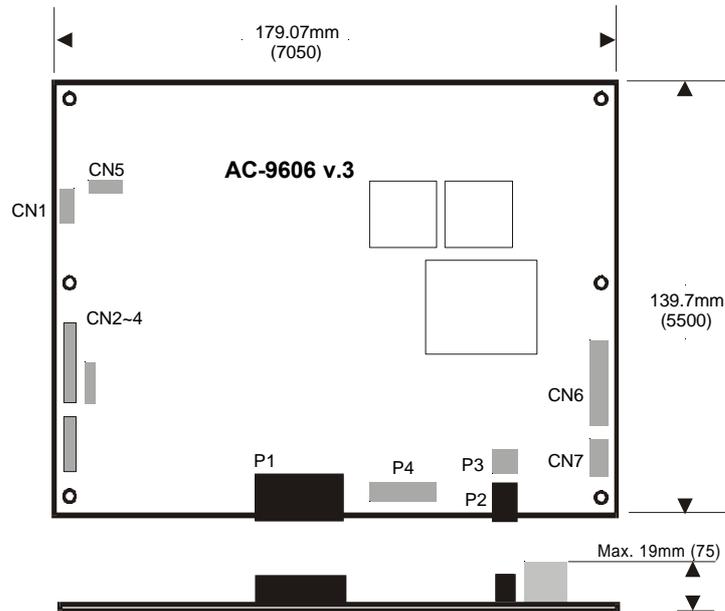
3. **Contrast** - changes colour saturation.
4. **Phase** - adjusts data sampling position (also known as Tuning).
5. **Size** - for SVGA & XGA resolutions this adjusts the image size, it may be necessary to adjust the image horizontal position occasionally while using this setting. The objective is to fill the display from edge to edge thus removing any vertical blurred columns in the image. The adjustment is not functional in VGA modes.
6. **Vert** - adjusts the vertical position.
7. **Horiz** - adjusts the horizontal position.

CONT	- ----+---- +
PHSE	- ----+---- +
SIZE	- ----+---- +
VERT	- ----+---- +
HORI	- ----+---- +

The settings chosen will be saved for each mode independently.

CONNECTORS, PINOUTS & JUMPERS

The various connectors are:



Summary: (Note 24 bit = 3 x 8 bit, 18 bit = 3 x 6 bit)

Ref	Purpose	Description	P/N (part used)
CN1	Auxiliary power	JST 4 way	B4B-XH-A
CN2	Panel signal	Hirose 28 pin	DF11-28DP-2DSA
CN3	Panel signal	Hirose 32 pin	DF11-32DP-2DSA
CN4	Panel signal – 8 bit	Hirose 20 pin	DF11-20DP-2DSA
CN5	Backlight inverter	JST 5 way	B4B-XH-A
CN6	Function controls	JST 10 way	B10B-XH-A
CN7	Reserved - contrast VR, not normally used		
P1	VGA analog input	DB-15 way high density 3 row	
P2	Main power input	DC power jack, 2.5mm contact pin diameter	
P3	Power input (alternative)	DC power Molex 2 pin 0.156" pitch	
P4	VGA input (alternative)	Pin header, 8 x 2	

Ref	Purpose	Note
JP1	Factory set	1-2, 3-4 = On board logic power supply enable
JP2	Backlight inverter on/off control	1-2=On/Off control signal 'High' = +12V 2-3=On/Off control signal 'High' = 5V Open=On/Off control signal 'High' = Open collector CAUTION: Incorrect setting can damage inverter.
JP3	Backlight inverter on/off control	1-2=control signal 'high' =CCFT On, 2-3=control signal 'low' = CCFT On
JP4	reserved	
JP5	Panel power voltage	1-2=+12V (pin removed to prevent error), 2-3=see pin JP7
JP6	Panel data signal level	1-2=+5V logic compatible, 2-3=+3.3V logic compatible
JP7	Panel power voltage	1-2=+3.3V supply, Open=+5V supply
JP8	Contrast control method	1-2=external VR, 2-3=by OSD menu
JP9	Input sync type select	1-2=separate sync, 3-4=composite sync, 5-6=sync on green
JP10	Input sync type select	1-3, 2-4 = composite sync or sync on green 3-5, 4-6 = separate sync

CN1 - Auxiliary power: 5V/12V DC power output

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

CN2 - To LCD panel

PIN	SYMBOL	DESCRIPTION
1	Gnd	Ground
2	Gnd	Ground
3	ER2	Even data bit R2
4	OR2	Odd data bit R2
5	ER3	Even data bit R3
6	OR3	Odd data bit R3
7	ER4	Even data bit R4
8	OR4	Odd data bit R4
9	ER5	Even data bit R5
10	OR5	Odd data bit R5
11	EG2	Even data bit G2
12	OG2	Odd data bit G2
13	EG3	Even data bit G3
14	OG3	Odd data bit G3
15	EG4	Even data bit G4
16	OG4	Odd data bit G4
17	EG5	Even data bit G5
18	OG5	Odd data bit G5
19	EB2	Even data bit B2
20	OB2	Odd data bit B2
21	EB3	Even data bit B3
22	OB3	Odd data bit B3
23	EB4	Even data bit B4
24	OB4	Odd data bit B4
25	EB5	Even data bit B5
26	OB5	Odd data bit B5
27	Gnd	Ground
28	Gnd	Ground

CN3 - To LCD panel

PIN	SYMBOL	DESCRIPTION
1	+12v	DC +12v, reserved & not normally used
2	+12v	DC +12v, reserved & not normally used
3	NC	no connection
4	NC	no connection
5	Gnd	Ground
6	Gnd	Ground
7	ER6	Even data bit R6
8	OR6	Odd data bit R6
9	ER7	Even data bit R7 (MSB of lower colour bit panels)
10	OR7	Odd data bit R7 (MSB of lower colour bit panels)
11	EG6	Even data bit G6
12	OG6	Odd data bit G6
13	EG7	Even data bit G7 (MSB of lower colour bit panels)
14	OG7	Odd data bit G7 (MSB of lower colour bit panels)
15	EB6	Even data bit B6
16	OB6	Odd data bit B6
17	EB7	Even data bit B7 (MSB of lower colour bit panels)
18	OB7	Odd data bit B7 (MSB of lower colour bit panels)
19	Gnd	Ground
20	Gnd	Ground
21	Vcc	DC +5v, reserved & not normally used
22	Vcc	DC +5v, reserved & not normally used
23	VS	Vertical sync
24	PwrDn	Power down control signal (5v TTL)
25	HS	Horizontal sync
26	DE	Display enable
27	VLCD	Panel supply (switched)
28	VLCD	Panel supply (switched)
29	CKE	Even dot clock (shift clock)
30	CKO	Odd dot clock (shift clock)
31	Gnd	Ground
32	Gnd	Ground

CN4 - To LCD panel - for 24 bit panels only

PIN	SYMBOL	DESCRIPTION
1	Gnd	Ground
2	Gnd	Ground
3	NC	no connection
4	NC	no connection
5	ER0	Even data bit R0
6	OR0	Odd data bit R0
7	ER1	Even data bit R1
8	OR1	Odd data bit R1
9	EG0	Even data bit G0
10	OG0	Odd data bit G0
11	EG1	Even data bit G1
12	OG1	Odd data bit G1
13	EB0	Even data bit B0
14	OB0	Odd data bit B0
15	EB1	Even data bit B1
16	OB1	Odd data bit B1
17	NC	no connection
18	NC	no connection
19	Gnd	Ground
20	Gnd	Ground

CN5 - To backlight inverter

PIN	SYMBOL	DESCRIPTION
1	gnd	ground
2	V+	+12VDC, 1A backlight power supply
3	CTRL	On/Off control (enable) – see JP1, 2 & 3
4	BRI_WIP	Brightness VR – WIP
5	BRI_A	Brightness VR A

CN6 - To control switches

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	-/LEFT	OSD -/Left button
9	+/RIGHT	OSD +/Right button
10	SEL	OSD Select down button

The VR for brightness depends on the inverter.

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

CN7 Reserved, contrast VR connector: JST 3 way, B3B-XH-A

PIN	SYMBOL	DESCRIPTION
1	CVR_WIP	External contrast VR pin WIP
2	NC	no connection
3	CVR_A or B	External contrast VR pin A or B

Set JP8 to 1-2 for external VR contrast control. Requires 10k ohm linear curve VR (OSD contrast control will be disabled).

P1 & P4 - ANALOG VGA INPUT - 15 way connector

PIN	SYMBOL	DESCRIPTION
1	AR	red, analog
2	AG	green, analog
3	AB	blue analog
4	ID2	reserved for monitor ID bit 2
5	DGND	digital ground
6	AGND	analog ground red
7	AGND	analog ground green
8	AGND	analog ground blue
9	DDC_5V	+5V power supply for DDC (optional)
10	DGND	digital ground
11	ID0	reserved for monitor ID bit 0 (grounded)
12	DDC_SDA	DDC serial data
13	HS_IN	horizontal sync or composite sync, input
14	VS_IN	vertical sync, input
15	DDC_SCL	DDC serial clock

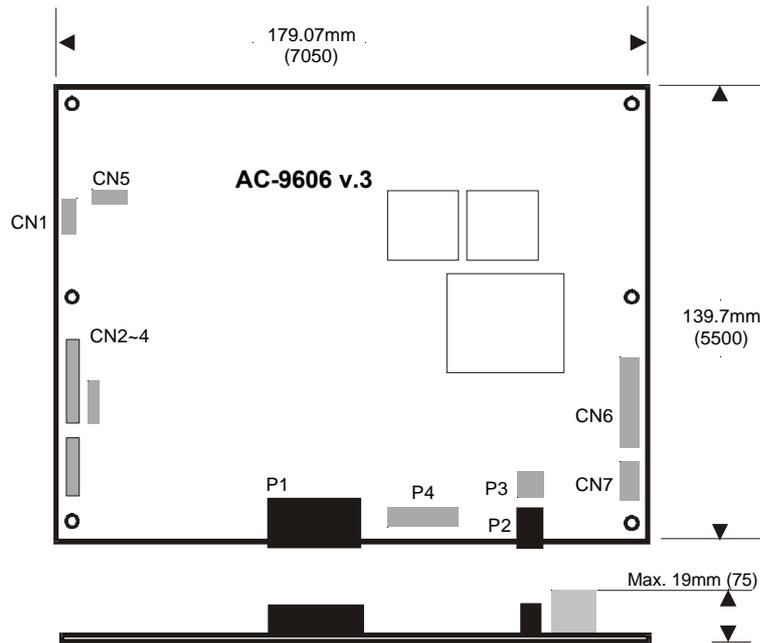
P2 - 12VDC power supply - input

PIN	DESCRIPTION
1	+12VDC in middle pin, 2A (1.85A main auto-reset fuse protected)
2	ground

P3 - 12VDC power supply - input

PIN	DESCRIPTION
1	+12VDC in middle pin, 2A (1.85A main auto-reset fuse protected)
2	ground

CONTROLLER DIMENSIONS



The maximum thickness of the controller is 19mm or 31mm with an inverter mounted on the controller (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 contrast, phase and image position as required, clear the menu from the screen then switch everything off.
- Remove the control switches, the 10 way (CN6) cable.
- 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 pins that are used are for On/Off and Brightness (if controller mounted inverter is used). Other pins on CN6 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 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 resistor or VR (Variable Resistor).
- 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 4 & 3 or 5: see table.

CN6

PIN	DESCRIPTION
3	VR A
4	VR WIP
5	VR B

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 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 adverse 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. 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 1024 x 768 resolution TFT LCD's from manufacturers such as Sharp, Toshiba, Hosiden, Hitachi though a specified BIOS and some factory adjustment may be required for individual panel timings.
No. of colours	Up to 3 x 8 bit providing 16.7 million colours.
Vertical refresh rate	VGA, SVGA (to 60Hz), XGA (to 60Hz) non-interlaced
Horizontal frequency	XGA - 65kHz \pm 10% depending on dot clock
Dot clock (pixel clock) maximum	75mHz
Graphics formats	Standard VGA, SVGA, XGA
Graphics auto mode detect	VGA, SVGA, XGA
Standard input at source	VGA analog (15 pin) standard, composite sync & sync on green.
Controls available	<ul style="list-style-type: none">• On/Off• Brightness• Contrast,• Phase• Image position (V & H).• Size (used for SVGA / XGA only)
Settings memory	Settings are stored in non volatile memory
On screen display	Functions display
PC Connectivity	VGA / SVGA / XGA analog
Controller dimensions	179mm x 140mm (7.05" x 5.5")
Power consumption	10w approx (not including panel power consumption)
Power load maximum	The controller has an overall 3Amp current limit.
Voltage output for LCD	+3.3V DC, +5V DC, +12V DC
Input voltage	12VDC
Power protection	Fuse fitted
DC Power handling	An on board relay handles the power load for On/Off and power protection to the LCD.
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.
- Layout 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 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

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-9606 v.3

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