LCD Video Controller

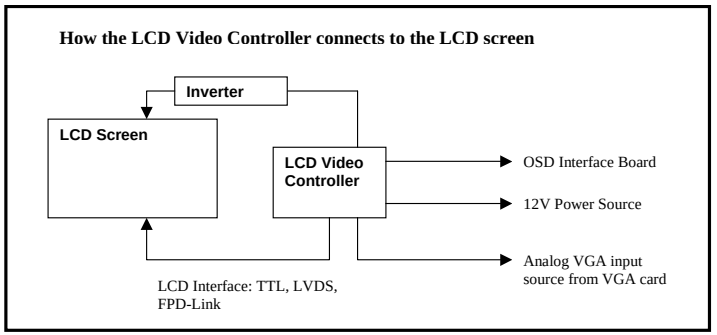
Introduction

The LCD video controller subassembly is an “in-monitor” design built around a high performance ASIC technology that enables the display of analog VGA signals on a flat panel LCD display. The LCD video board provides all the electronics necessary to drive a TFT flat panel display from VGA (640x480) up to SXGA (1280x1024) sources.

It features a multi-interface LCD video controller board that supports TTL, LVDS and TMDS protocol-based flat panel displays. The controller includes auto resolution adjustment and versatile On-Screen-Display controller adjustment.

There are three basic functional items within the LCD video controller:

- the video receiver circuit,
- the LCD driver circuit, and
- the inverter.



A computer’s video interface produces an analog video signal. Since LCD monitors require a digital signal, a video receiver circuit is required to convert the analog video signal into a digital video format that is accepted by the LCD monitor’s driver circuit.

Once the analog signal has been converted to a digital format, the digital signal is passed to the LCD driver circuit. This converts the digital video signal into the raw row and column information that actually turns pixels on and off on the display.

The light source for most flat panel displays is a cold cathode fluorescent backlight. These backlights run on high AC voltage provided by an inverter that converts the supplied DC power to AC and steps its voltage up for start-up. Once the backlight is started, the inverter drops the voltage down to its operating level.

Safety Precautions

Before you configure and assemble the controller board for your flat panel display, it is important to become familiar with the board layout and also follow certain basic safety precautions.

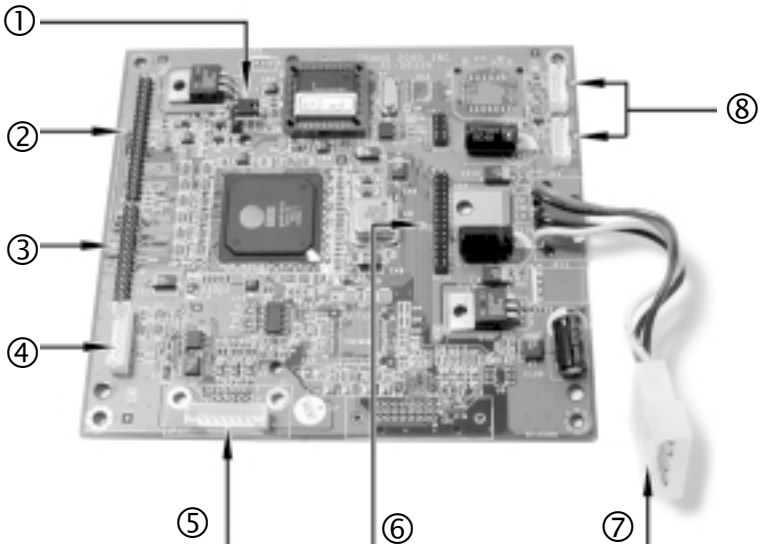
Make sure that at no time you are working on any electrical or electronic components while any part of the system is energized. Always disconnect the power! Use caution to protect the delicate electronic components. Ground your self during the installation of the motherboard and other components.

Identifying the Components

Take a moment to familiarize yourself with the board layout , mounting point locations, jumpers and connectors.

Main Board

The main board consists of the ASIC chip, firmware IC, support electronics and interface connectors.



1. Jumper for 3.3V or 5V TFT panel .
2. TTL interface 40-pin header connector.
3. TTL interface 30-pin header connector.
4. OSD push-button board connector.
5. Analog video input connector.
6. Reserved.
7. DC power input.
8. Inverter connectors.

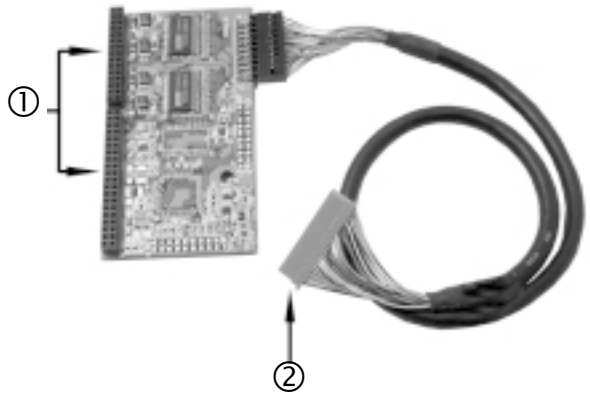
Main Board ASIC Features

The LCD video controller consists of a revolutionary scaling engine, capable of expanding any source resolution to a highly uniform and sharp image, and critically proven integrated 8 bit triple-ADC and patented Rapid-Lock digital clock recovery system. This rich feature set yields an extremely suitable match between the controller and high end XGA and SXGA applications.

- Integrated 135 MHz Triple ADC.
- Flexible resolution support without frame buffer, from low resolution VGA and NEC98 modes up to 1280 x 1024 at 75 Hz. All color depths up to 24 bits per pixel are supported.
- Best of Class Scaling Engine
  - The scaling engine algorithm is optimized to match TFT LCDs optical display response to provide uniform intensity across the entire image.
- Text font clarity and sharpness is enhanced by re-scaling convolver.
- Multiple Video Format Input Support.
- Serial Digital Receivers
  - Serial digital receivers such as TMDS, LVDS or GVIF configured in either 1 pixel per clock or 2 pixels per clock connect directly to the controller chip to create a DFP, Plug and Display or DISM compatible monitor.
- Two Analog Connector Inputs - Two separate sets of analog RGB inputs are internally multiplexed. This allows the monitor to select RGB analog signals from two PCs.
- Digital TV
  - CCIR601 input from a digital TV decoder. Using the internal YUV-to-RGB conversion circuit and expansion circuit, the de-interlaced image is displayed on a progressive-scan TFT LCD.
- Integrated High Speed Digital Clock Recovery
  - Solid and completely stable locking to the source pixel clock is achieved in worst case test patterns.
  - All clocks required are generated from a single 50 MHz reference oscillator.
- Integrated RAM based OSD Controller
  - Customer defined fonts as well as standard fonts are supported in a fully featured integrated OSD controller. Complete “look and feel” and a familiar user interface can be maintained.
- Automatic ADC Sampling Phase Optimization
  - Performs measurements so that firmware can automatically optimize the ADC sampling phase.
- Optimized Panel Clock
  - Panel clock frequency is optimized to support each mode at the lowest possible frequency. 1280 x 1024 x 75Hz is supported without driving the panel clock at 135 Mhz.
  - Panel clock pad drive strength and clock to data skew are programmable to reduce EMI in the panel interface cable.
- TFT LCD Panel Support
  - All panel resolutions and sizes are supported up to SXGA - Panel interface supports one or two pixel per clock, Sync only, DE only and Sync/DE composite. Four Wire Interface to Microcontroller Simple 4 wire serial interface connects directly to monitor microcontroller. Can be expanded to 7 wires by increasing data width from 1 to 4.

LVDS Transmitter

The subassembly comes with a LVDS (Low Voltage Differential Signaling) transmitter subsystem in the form of a pluggable daughter board. It consists of LVDS transmitter ICs that convert CMOS/TTL data into LVDS data stream.



1. TTL interface connectors (connects to main board connectors 2 and 3).
2. To Flat panel LVDS receiver.

Backlight Inverter

The subassembly comes with an inverter subsystem that converts the supplied DC power to high AC voltage for the LCD backlight.

1. DC input.
2. AC output to cold cathode fluorescent backlight.

OSD Push Button Board

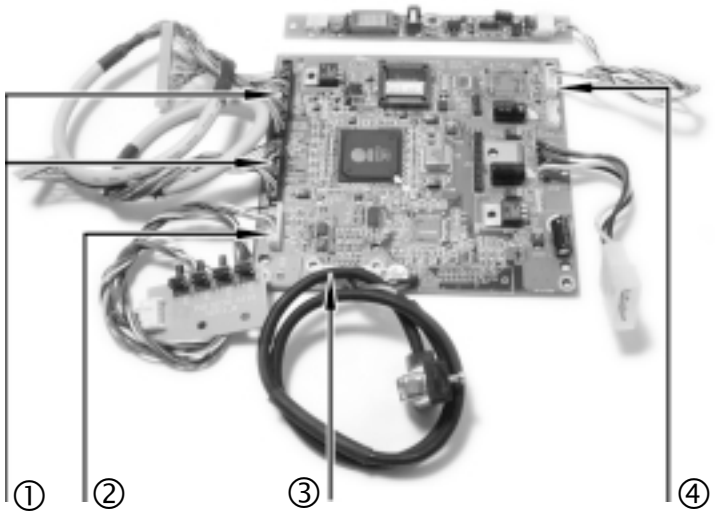
The OSD menus and parameters are accessed by 4 push buttons soldered on a separate PCB. You plug the PCB cable connector to socket 4 on the main board.

Configuring Your Controller

While your LCD controller is designed to drive a wide range of TFT LCD panels, many aspects of the ASIC chip's panel interface are programmable through a microcontroller with built-in EEPROM. Check with the supplier of your controller to find a recommended LCD panel.

LCD with TTL Interface

Refer to the illustration below to configure your controller board for a LCD that accepts TTL data source.



1. Plug in supplied cables to the TTL output connectors.
2. Plug in the OSD board.
3. Plug in the analog video cable.
4. Plug in the inverter subsystem.

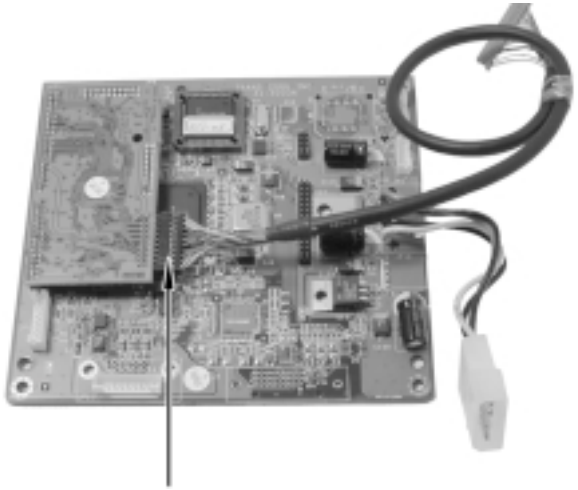
LCD with LVDS Receiver Interface

When you use the controller subassembly with a LVDS protocol-based LCD, you must first install the daughter board. It consists of LVDS transmitter ICs that convert CMOS/ TTL data into LVDS data stream.

Installing the LVDS Daughter Board

Step 1. Align the daughter board connectors to the main board header connector pins and firmly push them together.

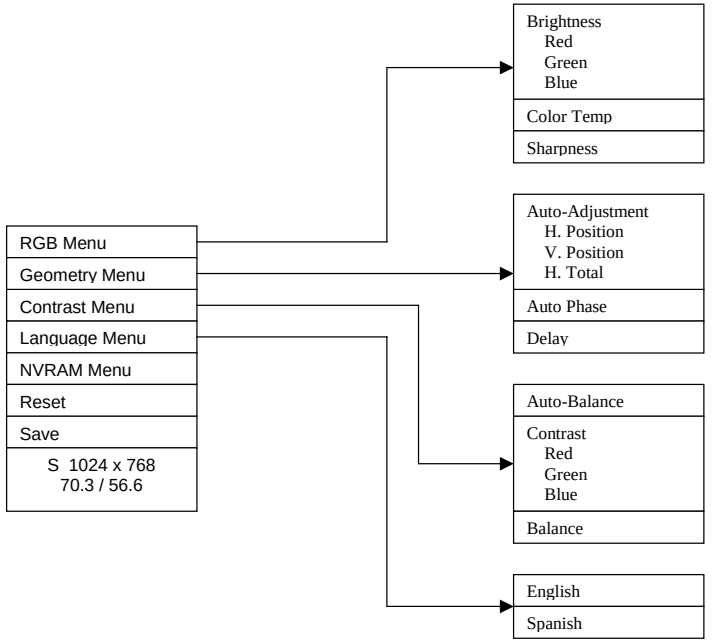
Step 2. Connect the flat panel LVDS cable to the 20-pin header connector (pin 2 is plugged preventing incorrect orientation).



Connect LVDS cable to the LVDS transmitter board.

OSD Controls

The LCD controller includes an integrated RAM-based OSD controller. Through four front panel controls you can view adjustable features of the LCD through the On-Screen Display.



OSD menu system

Follow these steps to activate the on-screen display and make any adjustments to suit your preference:

Step 1. Power up the system.
Step 2. Press MENU ▲ to invoke the on-screen menu.
Step 3. Press SEL ▼ to step through the main options.
Step 4. Press either + or - button to bring up sub-menus of the highlighted option.
Step 5. Press SEL ▼ to step through the sub-menu options.
Step 6. Press either + or - to modify the selected parameter value. Pressing a button once increases or decreases the numerical value by a single digit. Holding down a button increases the rate of change. Press MENU ▲ to return to the previous screen.
Step 7. After you've made your adjustments press MENU ▲ repeatedly until the OSD is turned off.

Adjusting the OSD Parameters

The OSD consists of a main menu and sub-menus with the following selections:

1. RGB MENU
   BRIGHTNESS: Adjusts the black level of the Red, Green and Blue channels.
   COLOR TEMP: The settings are available to set white point reference.
   SHARPNESS: Adjusts image sharpness.
2. GEOMETRY MENU
   AUTO-ADJUSTMENT: Performs automatic adjustment of the vertical and horizontal image positions within the display area of the LCD.
   H.POSITION: Adjusts the horizontal image position within the display area of the LCD.

   V.POSITION: Adjusts the vertical image position within the display area of the LCD.
   AUTO PHASE: Performs automatic adjustment of the ADC sample pixel clock.
   DELAY: Manual adjustment of the sample pixel clock phase.
3. CONTRAST MENU
   AUTO-BALANCE: Performs automatic adjustment of color brightness in relation to the background.
   CONTRAST: Manual adjustment of individual RGB channel contrast.
4. LANGUAGE MENU
   Selects English or Spanish language OSD.
5. RESET
   Reloads all parameters to factory settings.
6. SAVE
   Saves current parameters.