



# Interfacing LCDs to Logic's Development Kit Baseboards

## Application Note 161

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### Abstract

This application note explains how to interface LCD panels to Logic's Zoom Development Kits.

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## Revision History

REV	EDITOR	DESCRIPTION	APPROVAL	DATE
A	MAA	Initial release	HAR	12/04/03
B	JCA	Throughout: Updates to make the document applicable to both the Zoom SDK and Zoom LV Baseboards; formatting and layout changes; New images; Updated connector part number information	JCA	12/01/08

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# 1 Introduction

This application note guides users through the necessary steps to interface an LCD (Liquid Crystal Display) to Logic's Zoom Development Kit baseboards—this document pertains to both the Zoom SDK Baseboard and the Zoom LV Baseboard. Included are steps for users who have chosen Logic's displays and services, as well as steps for users who have chosen alternative display products. Since each LCD, SOM/LCD controller, and software configuration is unique, it is beyond the scope of this document to provide details for every conceivable scenario. Therefore, the intention of this document is to point users in the right direction so that they may confidently approach their particular situation.

The most frequently asked question about displays and SOMs / Development Kits is: "Will this SOM work with this display?" The answer is typically "yes"—for STN (mono and color), CSTN, TFT, ADTFT, and HRTFT displays—qualified by fact that users must verify this conclusion with the appropriate documentation: SOM specification, LCD controller specification, processor specification (in most cases), and an LCD specification. Keep in mind that most SOMs will display up to at least SVGA (800x600) resolution.

Free support is provided on the Logic Technical Discussion Group (TDG) for help with answering frequently asked questions; for direct phone/email support, please set up a contract with Logic ([www.logicpd.com/support](http://www.logicpd.com/support)). Logic urges customers who are not familiar with displays and LCD controllers to (1) use the available support channels, and (2) study available specification manuals before trying to interface an LCD to a Development Kit baseboard.

## 2 Interfacing LCDs to Development Kit Baseboards

### 2.1 Options

You have three options for interfacing a display with a Zoom baseboard.

1. Buy a Logic Display Kit (several available): [www.logicpd.com/products/displaykits](http://www.logicpd.com/products/displaykits)
  - a. What value does this provide?
    - i. Application development begins immediately.
    - ii. Schematics are provided for the interface, saving engineering time.
    - iii. No time is lost on acquiring a display, touch screen, inverter, cable, etc.
  - b. **Note:** Logic does not sell components from the kit separately.
2. Allow Logic to do all of the interfacing for you:
  - a. Set up a contract. [www.logicpd.com/products/supportpackages](http://www.logicpd.com/products/supportpackages)
  - b. Contact Logic. Logic can do as much or as little as you want, including:
    - i. Hardware integration
      1. Acquire display
      2. Acquire touch
      3. Acquire backlight inverter power supply
      4. Create a custom professional cable and custom circuit board, if necessary
    - ii. Software integration
      1. Determine the correct LCD controller registers for the display

2. Integrate the LCD settings into the software display driver
- iii. Design reviews
  1. Logic can review your schematics for your product design
- c. What value does this provide?
  - i. Logic has a great deal of experience interfacing displays, so you know you will receive a quality end product on time.
  - ii. Logic will add the display mode to the software source code, meaning you will not have to do any software work besides picking the correct mode from the registry.
  - iii. You don't spend time and money acquiring the components, designing the interface circuit, determining the correct register values in the LCD controller, and modifying the software to reflect the new display mode.
  - iv. Logic can provide indispensable feedback on your design schematics, which can eliminate costly board spins.
3. Interface the display yourself
  - a. Use this document as a reference. It provides the hardware information and the processes that you need to get a display working with your Zoom Development Kit.

## 2.2 The Zoom Baseboard and LCD Interface

### 2.2.1 The Zoom Baseboard

The Zoom baseboards have a 60-pin 0.100" header (Tyco part number 1-761606-6), located at reference designator J11, that connects all of the LCD signals directly from the SOM's LCD controller. Depending on your specific display, only a few of the LCD signals may be needed. The arrows in Figure 2.1 and Figure 2.2 show the location of this connector on the respective baseboards (the baseboard silkscreen will point out which is pin on the connector is pin 1 and which is pin 60); Figure 2.3 provides signal connection information.

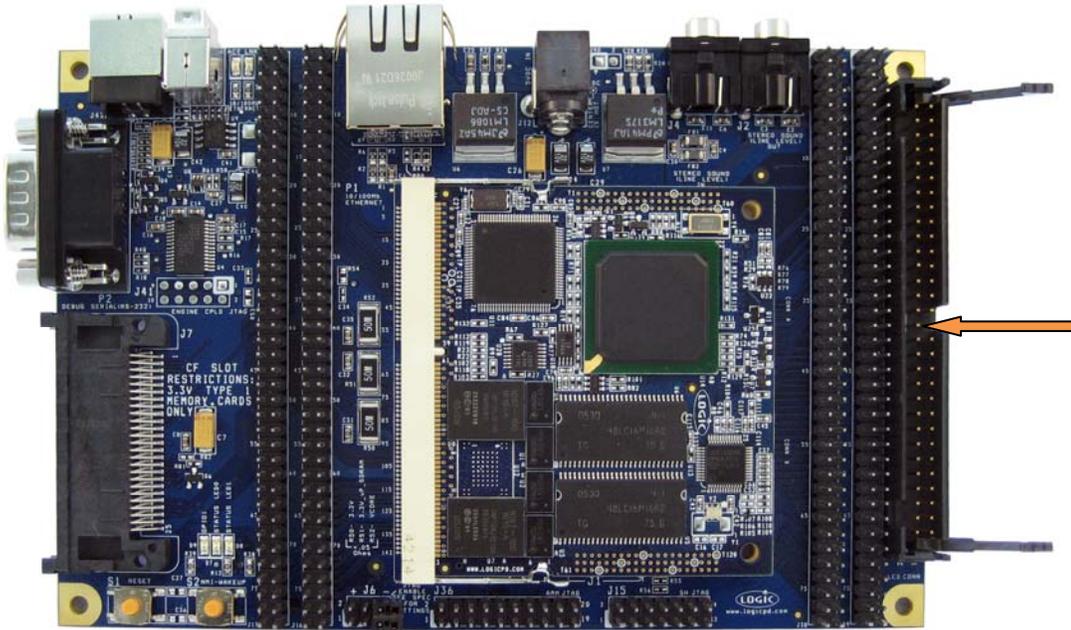


Figure 2.1: 60-pin LCD Connector on the Zoom SDK Baseboard

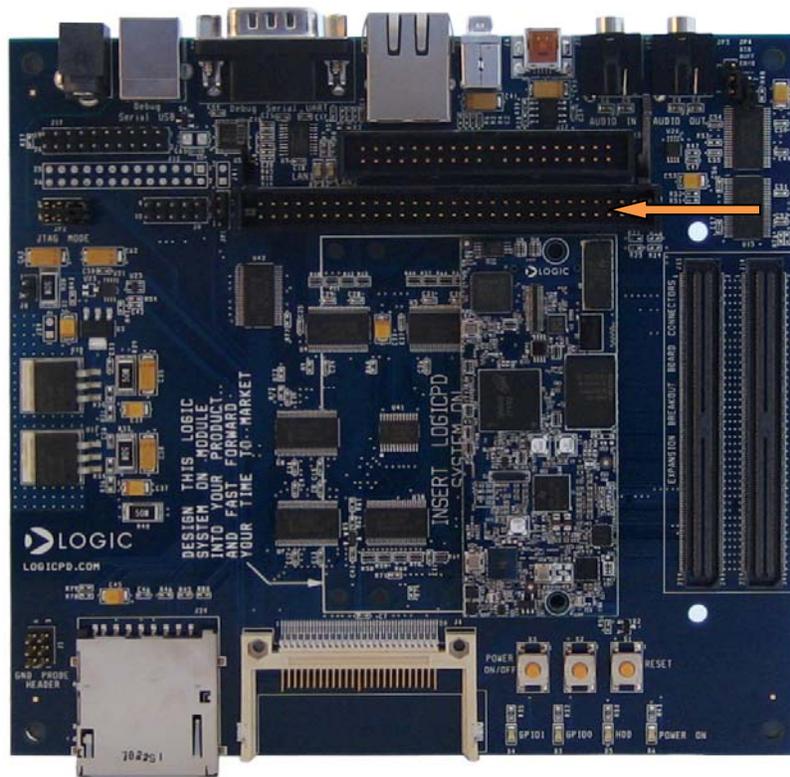
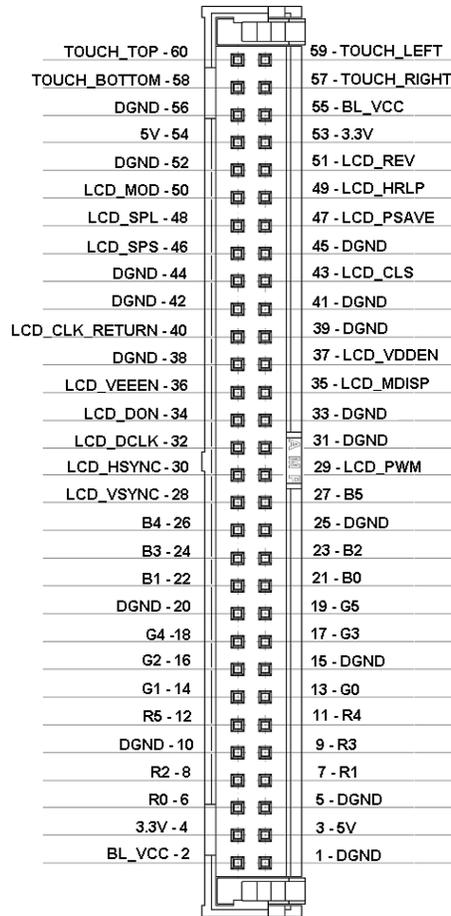


Figure 2.2: 60-pin LCD Connector on the Zoom LV Baseboard



**Figure 2.3: Signal Connection Information: Tyco PN 1-761606-6**

### 2.2.2 Display Signals

The display signals should be adequate for any ADTFT, TFT, or STN display. Table 2.1 provides examples of connections to each display type.

**Table 2.1: Connection Examples for each Display Type**

<b>Display Interfacing Table</b>	
<b>Example TFT Display</b>	
<b>Typical Signals</b>	<b>Zoom Baseboard Signals</b>
B0 - B5	B0 - B5
G0 - G5	G0 - G5
R0 - R5	R0 - R5
Hsync	LCD_HSYNC
Vsync	LCD_VSYNC
Dclk	LCD_DCLK
ENAB / DISP	LCD_MDISP
<b>Example ADTFT/HRTFT Display</b>	
<b>Typical Signals</b>	<b>Zoom Baseboard Signals</b>
B0 - B5	B0 - B5
G0 - G5	G0 - G5
R0 - R5	R0 - R5
MOD	LCD_MOD
SPL	LCD_SPL
SPS	LCD_SPS
REV	LCD_REV
HRLP	LCD_HRLP
PSAVE	LCD_PSAVE
CLS	LCD_CLS
<b>Example STN Display</b>	
<b>Typical Signals</b>	<b>Zoom Baseboard Signals</b>
D0-D15	* B0-B5, G0-G5,R0-R5
FLM (Frame)	LCD_VSYNC
CL1 (Load)	LCD_HSYNC
CL2 (CP)	LCD_DCLK
M	LCD_MDISP
<p>* Each SOM maps the D0-D15 pins differently to the Color Bits. For example, B2 might be the LCD controller's D4 pin. The table showing the mapping of Colors bits to LCD Data signals is located on the specific SOM schematics.</p> <p>* STN (mono/color) displays will typically use 4 or 8 data signals, meaning all of the data signals would not be used.</p>	

**Note:** The signals displayed above are the most common signals you will see in the industry. Also, LCD manufacturers may have chosen different names for signals displayed in this table.

### 2.2.3 Power Signals and Power Enable Signals

There are several power signals and power enable signals. Display signals have been noted in Table 2.1. Table 2.2 is a timing diagram of the power and power enable signals.

**Table 2.2: Enable Signals Timing Diagram**

<b>Zoom Baseboard Signals</b>	<b>Description</b>
5V	5V Power Supply
3.3V	3.3V Power Supply
LCD_DON	<sup>1</sup> DON signal
LCD_VDDEN	VDD enable
LCD_VEEEN	<sup>1</sup> VEE enable
DGND	Ground
LCD_PWM	<i>No circuitry on Zoom baseboard</i>
BL_VCC	<sup>2</sup> Alternative Backlight Power
<sup>1</sup> Available on some SOMs, please see SOM specification for availability of this signal.	
<sup>2</sup> If an alternative Power Supply is needed besides 3.3V or 5V, a power supply may be hooked up to baseboard power-input connector. This power supply will then be available on BL_VCC.	

## 2.3 User Display Interfacing: A Process Guide

1. Acquire components:
  - a. Display
  - b. Touch screen (if needed)
  - c. Backlight Inverter (if needed)
2. Create a custom cable and circuit board using:
  - a. LCD specification, including:
    - i. Signals needed
    - ii. Necessary power supplies
    - iii. Backlight info
    - iv. Touch info (if it is a built-in touch screen)
    - v. Notes:
      1. The LCD controller is typically built into the processor; therefore, the processor specification should be used in such a situation.
      2. This is created by the silicon manufacturer, not Logic.
  - b. This application note, including:
    - i. Pinout
    - ii. Example signal interfacing
    - iii. Short signal descriptions
  - c. LCD controller specification; highlights:
    - i. This document provides the best description of each signal.
    - ii. Notes:

1. The LCD controller is typically built into the processor; therefore, the processor specification should be used in such a situation.
      2. This is created by the silicon manufacturer, not Logic.
    - d. Zoom Baseboard Schematic, providing:
      - i. Available signals
      - ii. Pinout
    - e. SOM schematic, providing:
      - i. Available signals
      - ii. A depiction of how signals are mapped to the LCD controller
    - f. SOM specification, providing:
      - i. Available signals
      - ii. Short descriptions of functions
  3. Fabricate the circuit board and/or cable
    - a. For custom cables, Logic typically uses the company Quadrangle to create the cabling. You can find information by searching for Quadrangle Products on the web. *Please note that Logic has no affiliation with Quadrangle and only provides this useful information based on past experience; certainly there are other companies that provide similar services.*
  4. Determine LCD controller register settings using:
    - a. LCD controller specification
      - i. This is the most important in terms of figuring out the register settings for the display. This information is not provided in the SOM specification.
      - ii. Notes:
        1. The LCD controller is typically built into the processor; therefore, the processor specification should be used in such a situation.
        2. This is created by the silicon manufacturer, not Logic.
    - b. LCD specification
      - i. Typically gives timing characteristics.
    - c. Logic software user manual / documentation (specific to the SOM and software being used, e.g., LogicLoader, LoCE, Linux)
      - i. Applicable document describes the process of entering new modes into the display driver.
  5. Once the LCD controller registers have been calculated, it is time to test them out on the hardware.
    - a. Logic software user manual / documentation (specific to software being used, e.g., LogicLoader, LoCE, Linux)
      - i. Applicable document describes the process of entering new modes into the display driver.