LittleBoard™800
Single Board Computer
Reference Manual

P/N 5001816B Revision A

Notice Page

NOTICE

DISCLAIMER

TRADEMARKS

REVISION HISTORY

Revision	Reason for Change	Date
A, A	Initial Release	Mar/07
A, B	Added 1.0 Ghz power measurements	Nov/07
B, A	Corrected pin 1 on J30 and pin 5 on J2; corrected 800 MHz power measurements in Table 2-6; updated Southbridge from ICH4-M to ICH4; added Figure 2-7; added PCI-to-ISA Bridge Mapping to Ch 4; added pinouts to Ch 3; updated audio chip to ALC203	Mar/09

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Audience

This reference manual is for the person who designs computer related equipment, including but not limited to hardware and software design and implementation of the same. ADLINK Technology, Inc. assumes you are qualified in designing and implementing your hardware designs and their related software into your prototype computer equipment.

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Chapter 1 About This Manual

Purpose of this Manual

This manual is for designers of systems based on the LittleBoard™ 800 single board computer (SBC). This manual contains information that permits designers to create an embedded system based on specific design requirements.

Information provided in this reference manual includes:

- LittleBoard 800 specifications
- Environmental requirements
- Major integrated circuits (chips) and features implemented
- Header/connector pin numbers and definitions
- BIOS Setup information

Information not provided in this reference manual includes:

- Detailed chip specifications
- Internal component operation
- Internal registers or signal operations
- Bus or signal timing for industry standard busses and signals

References

The following list of references may be helpful for you to complete your design successfully. Most of these references are also available on the Ampro By ADLINK web site in the InfoCenter. The InfoCenter was created for embedded system developers to share ADLINK's knowledge, insight, and expertise.

Specifications:

- EBX Spec Revision 2.0, March 1 2005

  For the latest version of the EBX specifications, contact the PC/104 Consortium, at:

  Web site: http://www.pc104.org
- PC/104 Spec Revision 2.5, November 2003
- PC/104-Plus Spec Revision 2, November 2003

  For latest revision of the PC/104 specifications, contact the PC/104 Consortium, at:

  Web site: http://www.pc104.org
- PCI 2.2 Compliant Specifications

  For latest revision of the PCI specifications, contact the PCI Special Interest Group Office at:

  Web site: http://www.pcisig.com

Chip specifications used on the LittleBoard 800:

- Intel Corporation and the Celeron M or Pentium M processors used for the embedded CPU.

  Web site: http://www.intel.com/design/mobile/datashts/252612.htm = Pentium M

  Web site: http://www.intel.com/design/intarch/datashts/301753.htm = Celeron M

- Intel Corporation and the 82855GME and 82801DB chips, used for the Memory Hub/Video controller and I/O Hub, respectively.

  Web site: http://www.intel.com/products/chipsets/855gme/index.htm = Memory Hub

  Web site: http://www.intel.com/design/chipsets/datashts/290744.htm = I/O Hub

- Intel Corporation and the 82551ER and 82541(GI/PI) chips, used for the Fast Ethernet and Gigabit Ethernet controllers respectively.

  Web site: http://www.intel.com/design/network/datashts/82551ER_ds.htm = Ethernet

  Web site: http://www.intel.com/design/network/datashts/82541gi_ei.htm = Gigabit Ethernet

- Standard Microsystems Corp and the LPC47B272 chip, used for both Super I/O controllers.

  Web site: http://www.smsc.com/main/catalog/lpc47b272.html

- Realtek and the ALC203-LF chip, used for the Audio CODEC.

  Web site: http://www.realtek.com.tw/products/productsView.aspx?Langid=1&PFid=29&Level=5&Conn=4&ProdID=53

- ITE Tech. Inc. and the IT8888F chip, used for the PCI-to-ISA bridge conversion.

  Web site: http://www.ite.com.tw/EN/products_more.aspx?CategoryID=3&ID=5,76

NOTE	If you are unable to locate the datasheets using the links provided, go to the manufacturer's web site where you should be able to perform a search using the chip datasheet number or name listed, including the extension, htm, pdf, etc.

Chapter 2 Product Overview

This introduction presents general information about the EBX architecture and the LittleBoard 800 single board computer (SBC). After reading this chapter you should understand:

- EBX Architecture
- LittleBoard 800 description
- LittleBoard 800 features
- Major components
- Header definitions
- Jumper Header definitions
- Specifications (physical, environmental, power, cooling)

EBX Architecture

The “Embedded Board, eXpandable” (EBX) standard is the result of a collaboration between industry leaders, Motorola and Ampro, to unify the embedded computing industry on a full featured embedded single-board computer (SBC) standard. The EBX standard principally defines physical size, mounting hole pattern, and power connector locations. It does not specify processor type or electrical characteristics. There are recommended connector placements for serial/parallel, Ethernet, graphics, and memory expansion.

Derived from the Ampro LittleBoard form-factor originated in 1984, EBX combines a standard footprint with open interfaces. The EBX form-factor is small enough for deeply embedded applications, yet large enough to contain the functions of a fully embedded SBC (single board computer) including CPU, memory, mass storage interfaces, display controller, serial/parallel ports, today’s advanced operating systems, and other system functions. This embedded SBC standard ensures that embedded system OEMs can standardize their designs and that embedded computing solutions can be designed into space constrained environments with off-the-shelf components.

The EBX standard boasts highly flexible and adaptable system expansion, allowing easy and modular addition of functions such as additional USB 2.0 ports, Firewire or wireless networking not usually contained in standard product offerings. The EBX system expansion is based on popular existing industry standards, PC/104™ and PC/104-Plus™. PC/104 places the ISA bus on compact 3.6" x 3.8" modules with self-stacking capability. PC/104-Plus adds the power of a PCI bus to PC/104 while retaining the basic form-factor. Using PC/104 expansion cards, the PC/104 standard offers access to PC cards from the mobile and handheld computing markets.

The EBX standard integrates all these off-the-shelf standards into a highly embeddable SBC form-factor. EBX supports the legacy of PC/104, hosting the wide variety of embedded system oriented expansion modules from hundreds of companies worldwide. PC/104 brings the advantages of the latest portable and mobile system expansion technologies to embedded applications. See Figure 2-1 on page 4.

The EBX standard also brings stability to the embedded board market and offers OEMs assurance that a wide range of products will be available from multiple sources – now and in the future. The EBX standard is open to continuing technology advancements since it is processor independent. It creates opportunity for economies of scale in chassis, power supply, and peripheral devices.

The EBX specification is freely available to all interested. For further technical information on the EBX standard, go to the PC/104 Consortium web site at www.pc104.org.

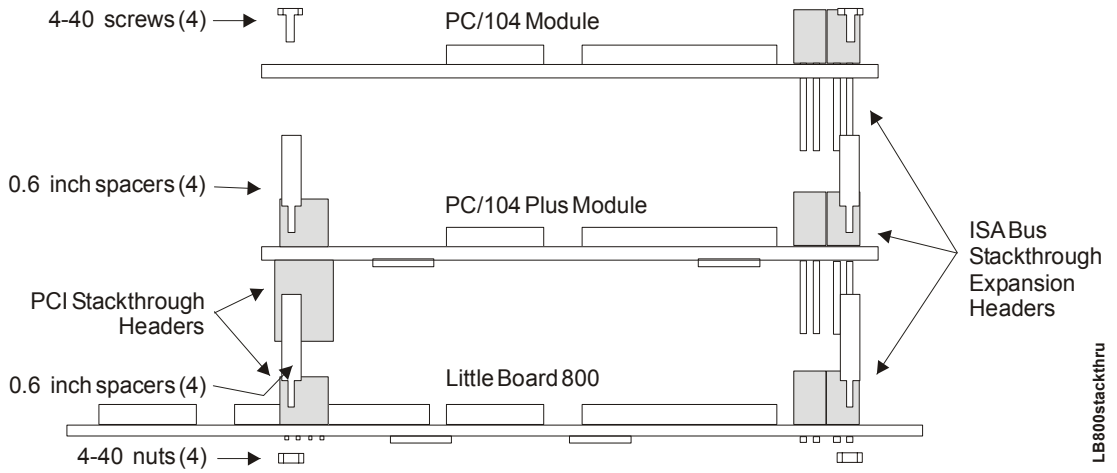

Figure 2-1. Stacking PC/104 Modules with the LittleBoard 800

Product Description

The LittleBoard 800 is an exceptionally high integration, high performance, rugged, and high quality single-board system, which contains all the component subsystems of a PC motherboard plus the equivalent of up to 3 expansion boards. Based on the Intel Pentium® M and Celeron® M ultra high performance, high-integration processor, the LittleBoard 800 gives designers a complete, high performance embedded processor based on the EBX form factor and conforms to the EBX V2.0 specifications.

Each LittleBoard 800 incorporates an Intel 855GME chipset for the Graphics and Memory Hub (Northbridge) and the I/O Hub (Southbridge) controllers. This set includes the 82855GME, Graphics and Memory Controller Hub, (also GMCH), which controls the graphics and memory interface. The other chip in this set is the 82801DB, I/O Controller Hub 4 (ICH4), which controls some of the I/O functions on the board. There are two additional chips that provide the remainder of the I/O functions: the Standard Microsystems, LPC47B272, Super I/O controllers. Together the Intel and SMSC chips provide four serial ports, an EPP/ECP parallel port, four USB 2.0 ports, PS/2 keyboard and mouse interfaces, floppy and two Ultra/DMA 33/66/100 IDE controllers supporting two IDE drives each. To provide the ISA bus on the board through the PC/104 connector, an ITE, IT8888F, PCI-to-ISA Bridge is included. The LittleBoard 800 also supports up to 1GB of DDR RAM in a single 184-pin DDR DIMM slot, and an AGP4x equivalent graphics controller, which provides CRT and LVDS flat panel video interfaces for most popular LCD panels.

The LittleBoard 800 can be expanded through the PC/104 and PC/104-Plus expansion for additional system functions, as these buses offer compact, self-stacking, modular expandability. The PC/104 and PC/104-Plus buses are the embedded system version of the signal set provided on a desktop PC's ISA and PCI buses at 8MHz and 33MHz clock speeds, respectively.

Among the many embedded-PC enhancements on the LittleBoard 800 that ensure embedded system operation and application versatility are a watchdog timer, serial console support, battery-free boot, on-board, high-density Compact Flash disk, and BIOS extensions for OEM boot customization.

The LittleBoard 800 is particularly well suited to either embedded or portable applications and meets the size, power consumption, temperature range, quality, and reliability demands of embedded system applications. It can be stacked with Ampro MiniModules™ or other PC/104-compliant expansion boards, or it can be used as a powerful computing engine.

Board Features

- CPU features
  - Intel 1.4GHz LV, Pentium® M 738, 1.0GHz ULV Celeron M 373, or 800MHz ULV Celeron M Processors
  - 2MB (Pentium) or 512KB (Celeron) L2 cache (800MHz Celeron is cacheless)

- 400MHz FSB

- Memory
  - Single standard 184-pin DDR DIMM slot
  - Supports non-ECC or unbuffered ECC memory
  - Supports +2.5V DDR RAM up to 1GB
  - Supports up to PC2700 DDR 333 (166MHz)
- PC/104-Plus Bus Interfaces
  - PCI Bus up to 33MHz
  - PCI 2.2 compliant signals
  - PC/104 (ISA) Bus up to 8MHz
- IDE Interfaces
  - Provides two enhanced IDE controllers (4 devices)
  - Supports dual bus master mode
  - Supports Ultra DMA 33/66/100 modes
  - Supports ATAPI and DVD peripherals
  - Supports IDE native and ATA compatibility modes
- Floppy Disk Interface
  - Supports one standard floppy disk drive interface
  - Supports all standard PC/AT formats: 360KB, 1.2MB, 720KB, 1.44MB, 2.88MB
- Parallel Port
  - Provides a standard printer interface
  - Supports IEEE standard 1284 protocols of EPP and ECP outputs
  - Supports Bi-directional data lines
  - Supports 16 byte FIFO for ECP mode.
- Serial Ports
  - Four buffered serial ports with full handshaking
  - Provides 16550-equivalent controllers, each with a built-in 16-byte FIFO buffer
  - Supports full modem capability on two of the four ports
  - Supports RS232, RS485, or RS422 operation on each port
  - Supports programmable word length, stop bits, and parity
  - Supports 16-bit programmable baud-rate generator and an interrupt generator
- USB Ports
  - Provides two root USB hubs
  - Provides up to four USB ports
  - Supports USB boot devices
  - Supports USB v2.0 EHCI and UHCI v1.1
  - Supports over-current detection status
- Infrared Interface
  - Supports IrDA 1.1 signals through Utility 2 connector

- Keyboard/Mouse Interface
  - Provides PS/2 keyboard interface
  - Provides PS/2 mouse interface
- Audio interface
  - Provides AC'97 CODEC on board
  - Supports AC'97 standard
- Ethernet Interface
  - Provides two fully independent Ethernet ports
  - Provides integrated LEDs on each port (Link/Activity and Speed)
  - Provides Intel 82551ER and 82541(GI/PI) controller chips
  - Provides extra header for LAN LED signals (gigabit only)
  - Supports IEEE 802.3 10/100BaseT and 10/100/1000BaseT compatible physical layers
  - Supports Auto-negotiation for speed, duplex mode, and flow control
  - Supports full duplex or half-duplex mode
    - Full-duplex mode supports transmit and receive frames simultaneously
    - Supports IEEE 802.3x Flow control in full duplex mode
    - Half-duplex mode supports enhanced proprietary collision reduction mode
- Video Interfaces (CRT/LVDS)
  - Support CRT (2048 x 1536) with up to 64MB UMA (Unified Memory Architecture)
  - AGP 4X equivalent graphics performance
  - Dual channel 9-, 12-, or 18-bit LVDS
  - LVDS outputs (1 or 2 channel, four differential signals: 3-bits + clock)
- Miscellaneous
  - Real-time clock (RTC) with replaceable battery
  - Battery-free boot (Boots even if battery is dead or missing)
  - Supports both on-board or external battery for Real Time Clock operation
  - Thermal and Voltage monitoring
  - Oops! Jumper (BIOS recovery) support
  - Serial Console
  - Watchdog timer (WDT)

Block Diagram

Figure 2-2 on page 7 shows the functional components of the board.

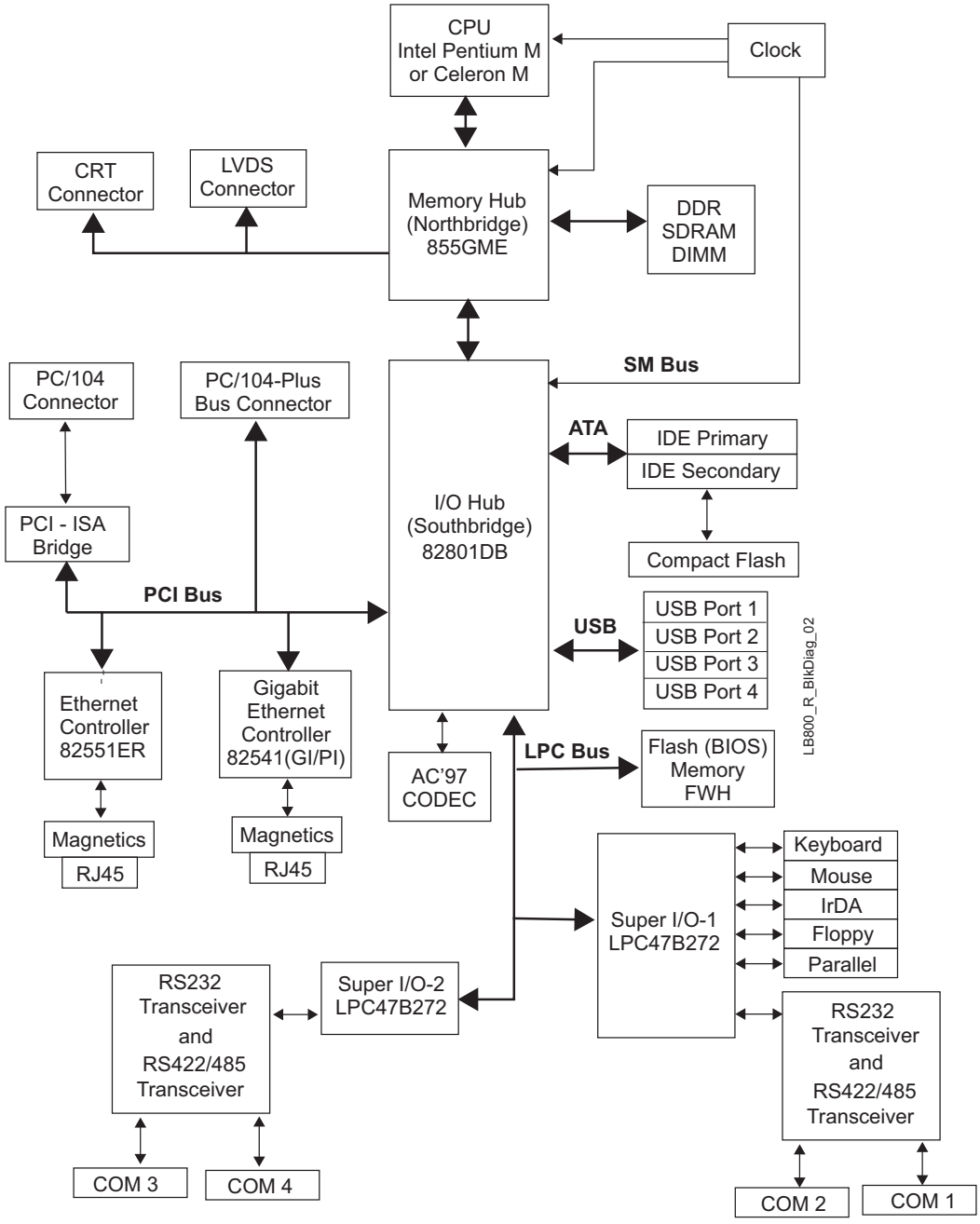

Figure 2-2. Functional Block Diagram

Major Components (ICs)

Table 2-1 on page 8 lists the major ICs, including a brief description of each, on the LittleBoard 800. Figures 2-3 and 2-4 show the locations of the chips.

Table 2-1. Major Integrated Circuit Description and Function

Chip Type	Mfg.	Model	Description	Function
CPU (U1)	Intel	Pentium M or Celeron M	CPUs offered at 1.4GHz (LV Pentium M), 1.0GHz (ULV Celeron M), or 800MHz (ULV Celeron M)	Embedded CPU
Memory Hub (U2)	Intel	82855GME	Memory functions plus Video	Memory and Video
I/O Hub (U3)	Intel	82801DB	Some of the I/O functions	I/O Functions
Super I/O 1 & 2 (U14, U16) [On back of board; see Figure 2-4]	SMC	LPC47B272	The remaining I/O controller functions	I/O Functions
Audio AC'97 CODEC (U7)	Realtek	ALC203-LF	Audio AC'97 CODEC for audio signals	Audio In/Out
Fast Ethernet Controller (U9) [On back of board; see Figure 2-4]	Intel	82551ER	10/100BaseT Ethernet controller	Ethernet functions
Gigabit Ethernet Controller (U11) [On back of board; see Figure 2-4]	Intel	82541(GI/PI)	10/100/1000BaseT Ethernet controller	Ethernet functions
Ethernet Transformer (T1)	Pulse	H5004	Gigabit Ethernet Transformer	Ethernet Magnetics
Ethernet Transformer (U31)	Pulse	H1102NLT	Fast Ethernet Transformer	Ethernet Magnetics
RS232 Transceiver (U17) [On back of board; see Figure 2-4]	Maxim	MAX213EEAI	RS232 Transceiver for COM1 and COM2	Serial Ports 1 and 2 Transceiver
RS485/422 Transceiver (U18)	Linear	LTC1334CG# PBF	RS422/485 Transceiver for COM1 and COM2	Serial Ports 1 and 2 Transceiver
RS232 Transceiver (U19)	Maxim	MAX213EEAI	RS232 Transceiver for COM3 and COM4	Serial Ports 3 and 4 Transceiver
RS485/422 Transceiver (U20)[On back of board; see Figure 2-4]	Linear	LTC1334CG# PBF	RS422/485 Transceiver for COM3 and COM4	Serial Ports 3 and 4 Transceiver
ISA Bridge (U51) [On back of board; see Figure 2-4]	ITE	IT8888F	PCI-to-ISA bridge conversion	ISA Bus

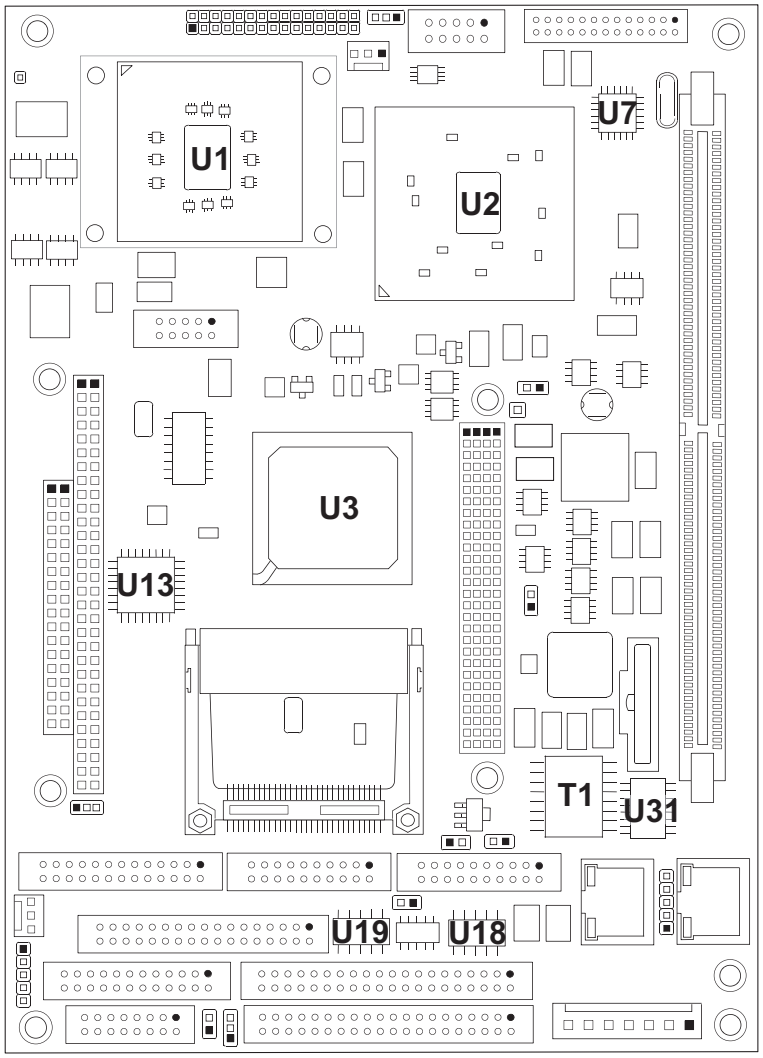

Figure 2-3. Component Locations (Front view)

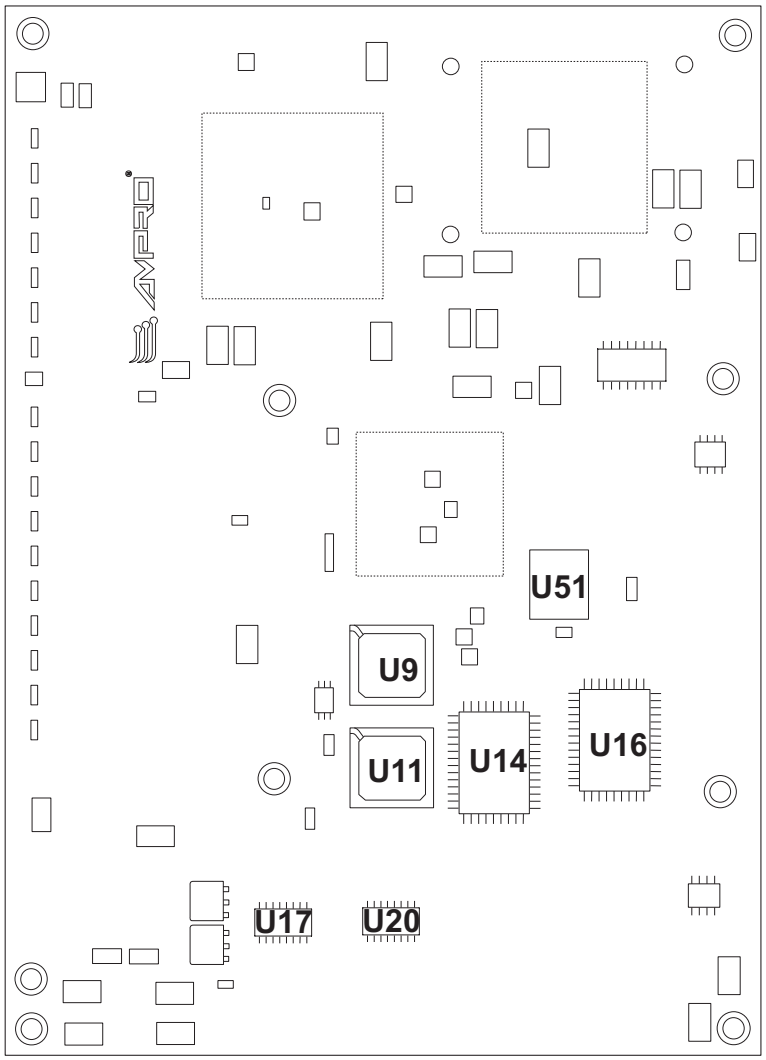

Figure 2-4. Component Locations (Back view)

Headers and Connectors

Table 2-2 describes the headers and connectors shown in Figure 2-6 on page 12. All I/O headers use 0.100" (2.54mm) pin spacing unless otherwise indicated.

Table 2-2. Header and Connector Descriptions

Jack #	Name	Description
SK1	Battery Socket	Battery socket for 3 volt Lithium battery
DIMM1	Memory	184-pin, .050" (1.27mm), slot for a single DDR RAM DIMM
J1A,B, C,D	PC/104 bus	104-pins for PC/104 connector
J2A,B, C,D	PC/104-Plus	120-pin, .079" (2mm), connector for PCI bus
J3	Video (CRT)	10-pin connector for output to a CRT type monitor

Table 2-2. Header and Connector Descriptions (Continued)

J6	Primary IDE	40-pin connector for the primary IDE interface
J7	Secondary IDE	40-pin connector for the secondary IDE interface
J8	Compact Flash	50-pin, .050" (1.27mm), socket accepts Type I or Type II Compact Flash cards
J9	Audio In/Out	26-pin, .079" (2mm), connector for all of the audio signals (input/output)
J10	Ethernet 2	8-pin RJ45 connector for 10/100/1000BaseT Ethernet port
J11	Serial A	20-pin connector for serial ports 1 and 2 (COM 1 & COM 2)
J12	Serial B	20-pin connector for serial ports 3 and 4 (COM 3 & COM 4)
J13	Utility 2	24-pin connector for mouse, IrDA, SMBus, USB 0 & 1, power button
J14	Utility 3	10-pin connector for USB2 and USB3 ports
J15	Utility 1	16-pin connector for keyboard, external battery, reset switch, speaker
J16	Parallel	26-pin connector for parallel port
J17	Floppy	34-pin connector for floppy disk drive interface
J19	Power In	7-pin, 0.156" (3.96mm), connector for input power
J21	Optional Fan	3-pin header provides +5V, tach, and ground to optional CPU fan
J23	Ethernet 1	8-pin RJ45 connector for 10/100BaseT Ethernet port
J26	Video (LVDS)	30-pin, .079" (2mm), connector for LVDS type video displays
J28	LAN LED	5-pin LAN LED connector for extra gigabit Ethernet LED
J29	Power Button	5-pin header for ATX power button cable
J30	Power-On	3-pin connector for ATX power-on functions

NOTE ADLINK uses a connector/header identification method in Chapter 3 to avoid difficult to see visible numbering next to the headers. For example, a 20-pin header with two rows of pins, using odd/even numbering, where pin-2 is directly across and adjacent to pin-1, is noted in this way; 20-pin, two rows, odd/even (1, 2). Alternately, a 20-pin header using consecutive numbering, where pin-11 is directly across and adjacent to pin-1, is noted in this way: 20-pin, two rows, consecutive (1, 11). The second number in the parenthesis is always directly across from and adjacent to pin-1, with a few exceptions (DIMM1 slot, PC/104-Plus, PC/104). See Figure 2-5.

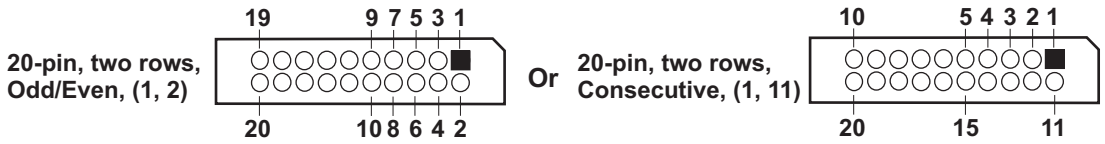

Figure 2-5. Connector Pin-Out Identification

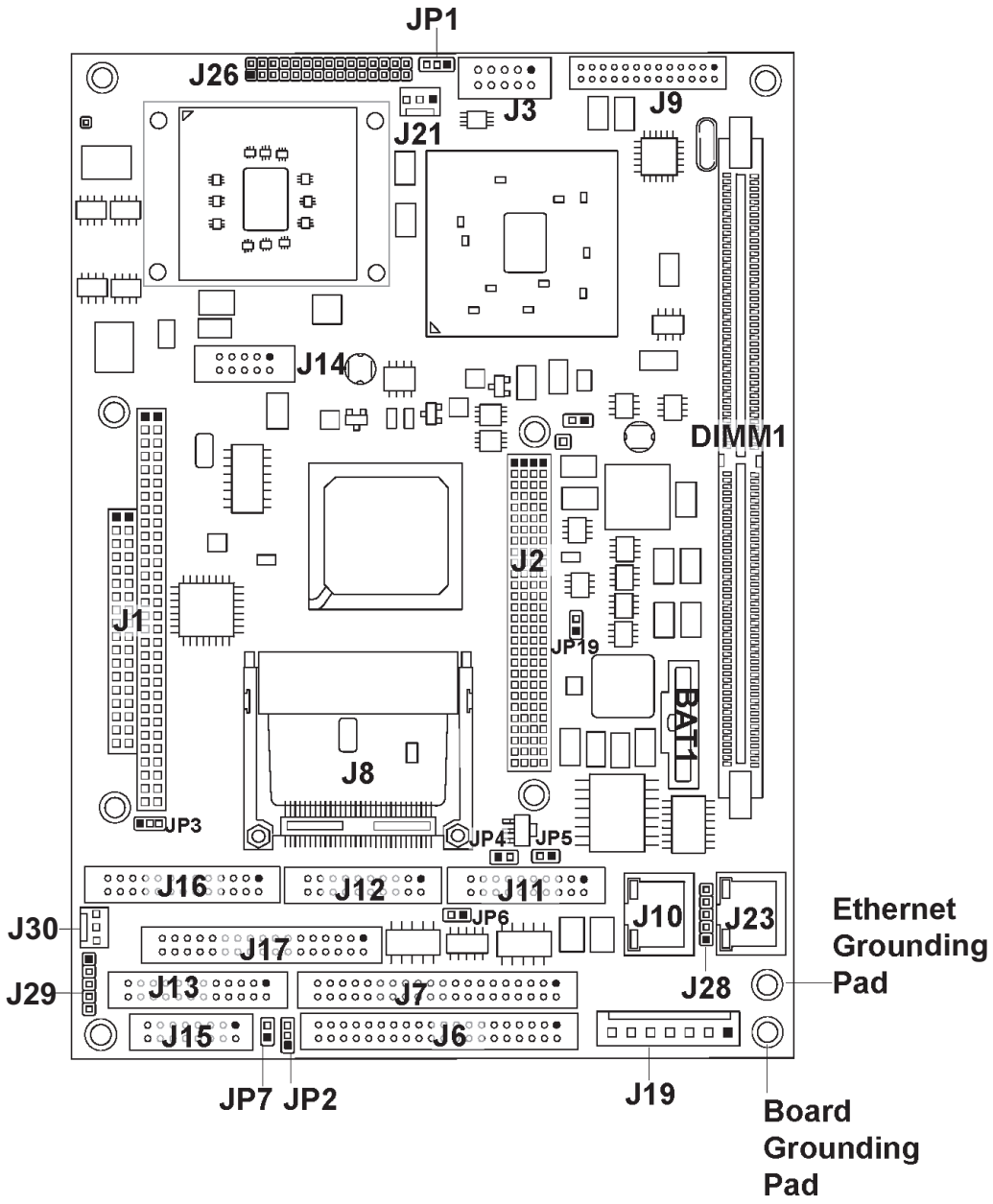

Figure 2-6. Header and Connector Locations (Front view)

CAUTION	The two Ethernet ports share a common ground (transformer center tap), that is floating until you determine how the common ground is connected. The grounding holes (8) of the LittleBoard 800 are connected to ground potential (return) of the DC power supply connected to the board through J19.

NOTE	Pin-1 is shown as a black pin (square or round) in all connectors and jumpers in all illustrations.

Jumper Headers

Table 2-3 describes the jumper headers shown in Figure 2-6 on page 12.

Table 2-3. Jumper Settings

Jumper #	Installed	Removed/Installed
JP1 – LVDS Voltage Select	Enable +3.3V (pins 1-2) **Default**	Enable +5V (pins 2-3)
JP2 – Compact Flash Master/Slave	Enable Slave (pins 1-2)	Enable Master (pins 2-3) **Default**
JP3 – Compact Flash Voltage Selection	Enable +5V (pins 1-2) **Default**	Enable +3.3V (pins 2-3)
JP4 – Serial Port 1 RS485 Termination	Enable Termination (pins 1-2)	Disable Termination (Removed) **Default**
JP5 – Serial Port 2 RS485 Termination	Enable Termination (pins 1-2)	Disable Termination (Removed) **Default**
JP6 – Serial Port 3 RS485 Termination	Enable Termination (pins 1-2)	Disable Termination (Removed) **Default**
JP7 – Serial Port 4 RS485 Termination	Enable Termination (pins 1-2)	Disable Termination (Removed) **Default**
JP19 – CMOS Normal/Clear	Clear CMOS (pins 1-2)	Normal (Removed) **Default**

Note: Only the jumper headers listed above are populated on the board. Jumpers or shunts use .079" (2mm) spacing. A jumper that is removed may be placed on one of the jumper pins for safe keeping.

Specifications

Physical Specifications

Table 2-4 gives the physical dimensions of the board.

Table 2-4. Weight and Footprint Dimensions

Item	Dimension
Weight	0.351kg. (0.775lbs.)
Height (overall)	24.94mm (0.982")
Width	146mm (5.75")
Length	203mm (8.0")
Thickness	2.36mm (0.093")

NOTE Overall height is measured from the upper board surface to the highest permanent component (battery in socket) on the upper board surface. This measurement does not include the various heatsinks or various size DIMMs inserted into the socket. The DIMMs or heatsinks could increase this dimension.

Environmental Specifications

Table 2-5 provides the most efficient operating and storage condition ranges required for this board.

Table 2-5. Environmental Requirements

	Parameter	800MHz Celeron M Conditions	1.0GHz Celeron M Conditions	1.4GHz Pentium M Conditions
Temperature	Operating	–20° to +70°C (–4° to +158°F)	–20° to +70°C (–4° to +158°F)	–20° to +70°C (–4° to +158°F)
	Extended (Optional)	–40° to +85°C (–40° to +185°F)	–40° to +85°C (–40° to +185°F)	–40° to +85°C* (–40° to +185°F)
	Storage	–55° to +85°C (–67° to +185°F)	–55° to +85°C (–67° to +185°F)	–55° to +85°C (–67° to +185°F)
Humidity	Operating	5% to 95% relative humidity, non-condensing	5% to 95% relative humidity, non-condensing	5% to 95% relative humidity, non-condensing
	Non-operating	5% to 95% relative humidity, non-condensing	5% to 95% relative humidity, non-condensing	5% to 95% relative humidity, non-condensing

Note: *The 1.4GHz Pentium M requires a fan above 70°C.

Power Specifications

Table 2-6 shows the power requirements from the baseboard and the board power output.

Table 2-6. Power Supply Requirements

Parameter	800MHz Celeron M Characteristics	1.0GHz Celeron M Characteristics	1.4GHz Pentium M Characteristics w/o fan	1.4GHz Pentium M Characteristics w/fan
Input Type	Regulated DC voltages	Regulated DC voltages	Regulated DC voltages	Regulated DC voltages
In-rush Current	14.24A (71.20W)	14.24A (71.20W)	14.44A (72.20W)	14.89A (74.45W)
Idle Power	1.94A (9.68W)	1.78A (9.90W)	1.87A (9.35W)	2.74A (13.72W)
BIT Current	2.99A (14.96W)	2.81A (14.03W)	3.57A (17.85W)	4.11A (20.56W)

Operating conditions:

- In-rush operating conditions include video, 512MB DDR RAM, and power.
- Idle operating conditions include the in-rush conditions as well as an I/O board, one IDE hard drive with Windows XP, keyboard, and mouse.
- BIT = Burn-In-Test. Operating conditions include idle conditions as well as four serial loop-backs, one parallel loop-back, one USB DVD Drive, one on-board Compact Flash drive with 256 MB Compact Flash, two Ethernet connections, two USB Compact Flash readers with 256MB Compact Flash, one USB floppy drive.

Thermal/Cooling Requirements

The CPU, Memory Hub, I/O Hub, and voltage regulators are the sources of heat on the board. The LittleBoard 800 is designed to operate at the maximum speed of the respective CPUs: 800MHz, 1.0GHz, or 1.4GHz. The Celeron M CPUs require a heatsink but no fan for -40°C to +85°C operation. The Pentium M CPU requires a heatsink but no fan for -20° to +70°C operation, but does require a fan above +70°C (+70°C to +85°C operation).

Mechanical Specifications

Figure 2-7 shows the top view of the LittleBoard 800 with the mechanical mounting dimensions.

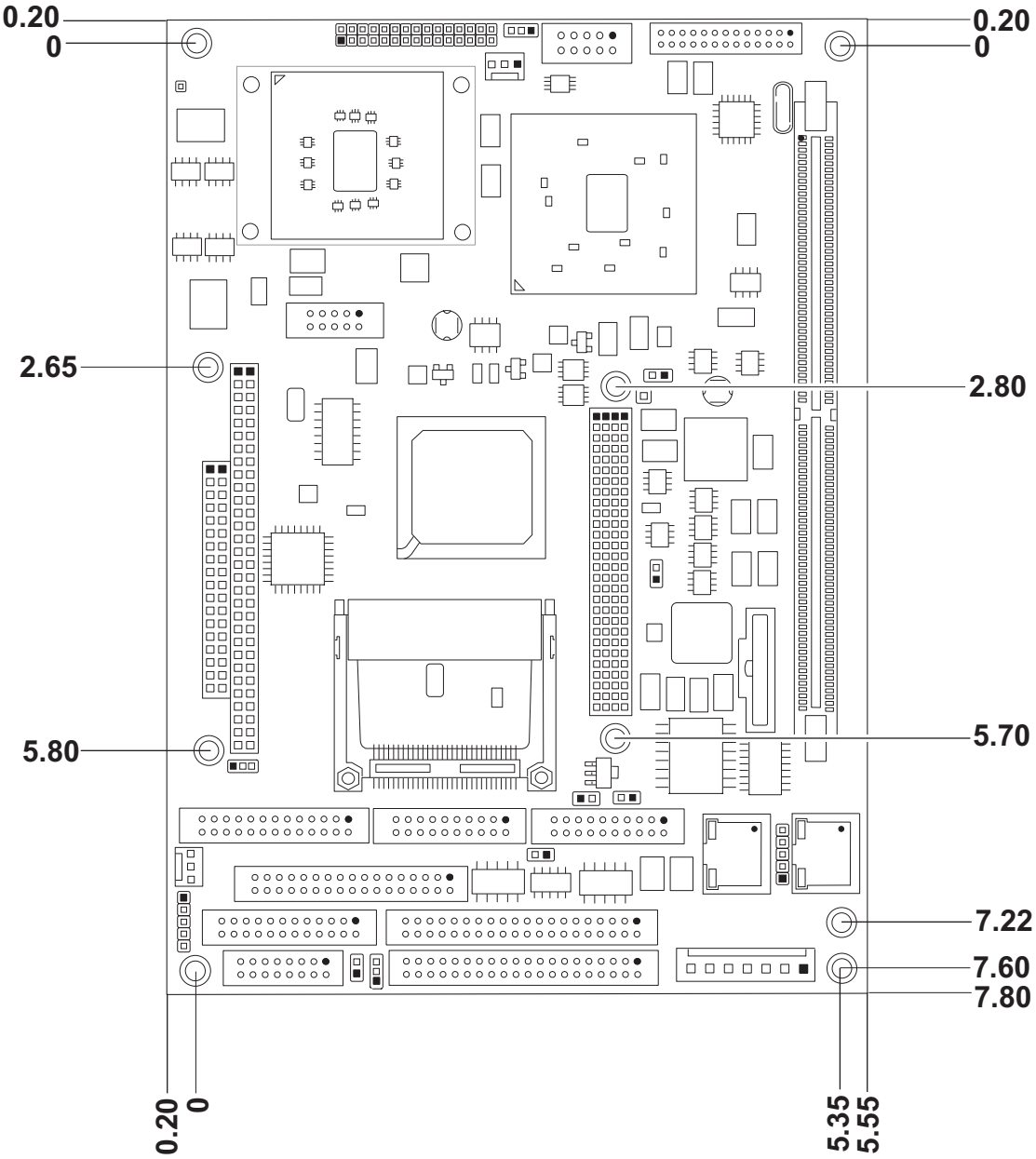

Figure 2-7. LittleBoard 800 Dimensions

NOTE	All dimensions are given in inches.

Chapter 3 Hardware

Overview

This chapter discusses the following features of the connectors:

- Interrupt Channel Assignments
- Memory Map
- I/O Address Map
- Floppy Interface
- Serial Interfaces
- Parallel Interface
- Utility Interfaces
  - Keyboard
  - Mouse
  - Battery
  - Reset Switch
  - Speaker
  - USB
  - SMBus
  - Infrared (IrDA)
- Audio Interface
- CRT/LVDS Video Interfaces
- Power Interfaces
  - Power In
  - ATX Power
- Miscellaneous
  - Time of Day/RTC
  - Temperature Monitoring
  - Oops! Jumper (BIOS recovery)
  - Serial Console
  - Watchdog timer
  - Optional CPU fan
  - LAN LED

> **NOTE** ADLINK Technology, Inc. only supports the features/options tested and listed in this manual. The main integrated circuits (chips) used in the LittleBoard 800 may provide more features or options than are listed for the LittleBoard 800, but some of these chip features/options are not supported on the board and may not function as specified in the chip documentation.
>
> This chapter does not include pinout tables for standard headers and connectors such as PC/104, Ethernet RJ45, 40-pin IDE, Floppy, and Compact Flash.

Interrupt Channel Assignments

The interrupt channel assignments are shown in Table 3-1.

Table 3-1. Interrupt Channel Assignments

Device vs IRQ No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Timer	D															
Keyboard		D														
Secondary Cascade			D													
COM1				O	D	O	O	O		O	O	O	O		O	O
COM2				D	O	O	O	O		O	O	O	O		O	O
COM3				O	O	O	O	O		O	O	D	O		O	O
COM4				O	O	O	O	O		O	D	O	O		O	O
Floppy							D									
Parallel				O	O	O	O	D		O	O	O	O		O	O
RTC									D							
IDE Primary															D	
IDE Secondary																D
Math Coprocessor														D		
PS/2 Mouse													D			
PCI INTA				O	O	D	O	O		O	O	O	O		O	O
PCI INTB				O	O	O	O	O		D	O	O	O		O	O
PCI INTC				O	O	D	O	O		O	O	O	O		O	O
PCI INTD				O	O	O	O	O		D	O	O	O		O	O
PCI INTE				O	O	D	O	O		O	O	O	O		O	O
PCI INTF				O	O	O	O	O		D	O	O	O		O	O
PCI INTH				O	O	D	O	O		O	O	O	O		O	O

Legend: D = Default, O = Optional

> **NOTE** The IRQs for the Ethernet, Video, and Internal Local Bus (ISA) are automatically assigned by the BIOS Plug and Play logic. Local IRQs assigned during initialization can not be used by external devices.

Memory Map

The following table provides the common PC/AT memory allocations. Memory below 000500h is used by the BIOS.

Table 3-2. Memory Map

Base Address			Function
00000000h	-	0009FFFFh	Conventional Memory
000A0000h	-	000AFFFFh	Graphics Memory
000B0000h	-	000B7FFFh	Mono Text Memory
000B8000h	-	000BFFFFh	Color Text Memory
000C0000h	-	000CFFFFh	Standard Video BIOS
000D0000h	-	000DFFFFh	Reserved for Extended BIOS
000E0000h	-	000EFFFFh	Extended System BIOS Area
000F0000h	-	000FFFFFh	System BIOS Area (Storage and RAM Shadowing)
00100000h	-	04000000h	Extended Memory (If on-board VGA is enabled, then the amount of memory assigned is subtracted from extended memory)
FFF80000h	-	FFFFFFFFh	System Flash

I/O Address Map

Table 3-3 shows the I/O address map.

Table 3-3. I/O Address Map

Address (hex)	Subsystem
0000-000F	Primary DMA Controller
0020-0021	Master Interrupt Controller
0040-0043	Programmable Interrupt Timer (Clock/Timer)
0060-06F	Keyboard Controller
0061	NMI, Speaker Controller
0063	NMI Controller
0064	Keyboard Controller
0065	NMI Controller
0067	NMI Controller
0070-007F	CMOS RAM, NMI Mask Reg, RT Clock
0080-09F	System reserved
0081-0083	DMA Page Registers
0084-0086	System Reserved
0087	DMA page Register
0088	System reserved
0089-008B	DMA page Registers
008C-008E	System reserved
008F	DMA page Register
0090-0091	System reserved
092	Fast A20 Gate and CPU Reset

Table 3-3. I/O Address Map (Continued)

0093-009F	System reserved
00A0-00A1	Slave Interrupt Controller
00A2-00BF	System reserved
00C0-00DF	Slave DMA Controller #2
00E0-00EF	System reserved
0F0-00FF	Math Coprocessor
0170-0177	Secondary IDE Hard Disk Controller
01F0-01F7	Primary IDE Hard Disk Controller
0278-027F	Parallel Printer
02E8-02EF	Serial Port 4 (COM4)
02F8-02FF	Serial Port 2 (COM2)
0376	Secondary IDE Disk Controller
0378-037F	Parallel Port (Standard and EPP)
03B0-03BB	Video (Monochrome)
03C0-03DF	VGA
03E8-03EF	Serial Port 3 (COM3)
03F0-03F5	Floppy Disk Controller
03F6	Primary IDE Disk Controller
03F7	Floppy Disk Controller
03F8-03FF	Serial Port 1 (COM1)
04D0-04D1	Edge/Level Trigger PIC
0778-077F	Parallel Port (ECP Extensions) (Port 378+400)
0CF8-0CFF	PCI Configuration Registers
0CF9	Reset Control Resgister

Floppy Drive Interface

The LPC47B272 chip provides the floppy controller and supports one floppy drive as configured. The floppy signals are provided through the standard 34-pin connector (J17). The floppy controller will support a 360k, 720k, 1.2M, 1.44M, or 2.88M drive.

The floppy drive header has 34 pins, 2 rows, odd/even, (1, 2) with 0.100" pitch.

Parallel Port Interface

Parallel port supports standard parallel, Bi-directional, ECP and EPP protocols. The LPC47B272 provides separate parallel port interface signals not shared with the floppy drive signals.

The parallel header uses 26 pins, 2 rows, odd/even, (1, 2), with 0.100" pitch.

Table 3-4. Parallel Interface Pin/Signal Descriptions (J16)

Pin #	Signal	In/Out	Description
1	Strobe*	Out	Strobe* – This is an output signal used to strobe data into the printer. I/O pin in ECP/EPP mode.
2	AFD*	Out	Auto Feed* – This is a request signal into the printer to automatically feed one line after each line is printed.

Table 3-4. Parallel Interface Pin/Signal Descriptions (J16) (Continued)

3	PD0	I/O	Parallel Port Data 0 – These pins (0 to 7) provide parallel port data.
4	ERR*	Out	Error* – This is a status output signal from the printer. A Low State indicates an error condition on the printer.
5	PD1	I/O	Parallel Port Data 1 – Refer to pin-3 for more information.
6	INIT*	Out	Initialize* – This signal used to Initialize printer. Output in standard Mode, I/O in ECP/EPP mode.
7	PD2	I/O	Parallel Port Data 2 – Refer to pin-3 for more information.
8	SLIN	Out	Select In – This output signal is used to select the printer. I/O pin in ECP/EPP mode.
9	PD3	I/O	Parallel Port Data 3 – Refer to pin-3 for more information.
10, 12	GND		Ground
11	PD4	I/O	Parallel Port Data 4 – Refer to pin-3 for more information.
13	PD5	I/O	Parallel Port Data 5 – Refer to pin-3 for more information.
14, 16	GND		Ground
15	PD6	I/O	Parallel Port Data 6 – Refer to pin-3 for more information.
17	PD7	I/O	Parallel Port Data 7 – Refer to pin-3 for more information.
18, 20	GND		Ground
19	ACK*	In	Acknowledge* – This printer output status indicates it has received the data and is ready to accept new data if the signal state is Low.
21	BUSY	In	Busy – This printer output status indicates the printer is not ready to accept data if the signal state is High.
22, 24	GND		Ground
23	PE	In	Paper End – The printer output status indicates the printer is out of paper if the signal state is High.
25	SLCT	In	Select – This printer output status indicates the printer is selected and powered on if the signal state is high.
26	Key/NC		Key - Not connected

Note: The shaded area denotes power or ground. The signals marked with * = Negative true logic.

Serial Interfaces

Two LPC47B272 chips provide the circuitry for the 4 serial ports. One chip provides serial ports 1 and 2 through connector J11 and the second chip provides serial ports 3 and 4 through connector J12. The four serial ports support the following features:

- Four individual 16550-compatible UARTs
- Programmable word length, stop bits and parity
- 16-bit programmable baud rate generator
- Interrupt generator
- Loop-back mode
- Four individual 16-bit FIFOs

- Serial A Interface (J11)
  - Serial Port 1 (COM1) supports RS232/RS485/RS422 and full modem support
  - Serial Port 2 (COM2) supports RS232/RS485/RS422
- Serial B Interface (J12)
  - Serial Port 3 (COM3) supports RS232/RS485/RS422 and full modem support
  - Serial Port 4 (COM4) supports RS232/RS485/RS422

> **NOTE** The RS232 and RS485/RS422 modes can be selected for any serial port in BIOS Setup under the *Advanced* menu. However, the RS232 mode is the default selection (Standard) for any serial port.

To implement the two-wire RS485 mode on any serial port, you must tie the equivalent pins together for each port.

For example, on Serial Port 1, tie pin 3 to 5 and pin 4 to 6 at the Serial A interface connector (J11) as shown in Figure 3-1. As an alternate, tie pin 2 to 3 and pin 7 to 8 at the DB9 serial connector for Serial Port 1 as shown in Figure 3-1. Refer also to the following tables for the specific pins for the other ports on each connector. The RS422 mode uses a four-wire interface and does not need any pins tied together, but you must select RS485 in BIOS Setup.

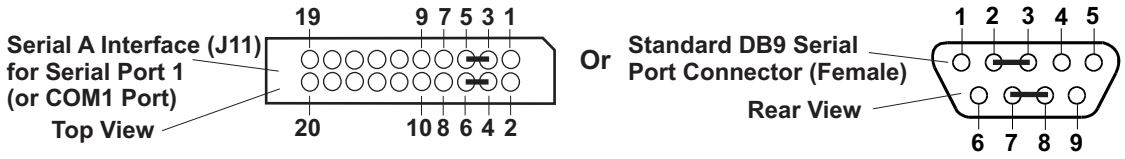

Figure 3-1. RS485 Serial Port Implementation

Table 3-5 Defines the pins and corresponding signals for the Serial A interface connector (Serial Ports 1 and 2) and Table 3-6 defines the pins and corresponding signals for the Serial B interface connector (Serial Ports 3 and 4).

Both Serial A and B headers use 20 pins, 2 rows, odd/even, (1, 2), with 0.100" pitch.

Table 3-5. Serial A Interface Pin/Signal Descriptions (J11)

Pin #	Pin # DB9	Signal	Description
1	1 (COM1)	DCD1 *	Data Carrier Detect 1 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open). In direct connect environments, this input will be driven by DTR1 as part of the DTR/DSR handshake.
2	6	DSR1*	Data Set Ready 1 – Indicates external serial communications device is powered, initialized, and ready. Used as hardware handshake with DTR1 for overall readiness to communicate.
3	2	RXD1 RX1-	Receive Data 1 – Serial port 1 receive data in. RX1- – If in RS485 or RS422 mode, this pin is Receive Data 1 -.
4	7	RTS1* TX1+	Request To Send 1 – Indicates Serial port 1 is ready to transmit data. Used as hardware handshake with CTS1 for low level flow control. TX1+ – If in RS485 or RS422 mode, this pin is Transmit Data 1 +.
5	3	TXD1 TX1-	Transmit Data 1 – Serial port 1 transmit data out. TX1- – If in RS485 or RS422 mode, this pin is Transmit Data 1 -.

Table 3-5. Serial A Interface Pin/Signal Descriptions (J11) (Continued)

6	8	CTS1* RX1+	Clear to Send 1 – Indicates external serial communications device is ready to receive data. Used as hardware handshake with RTS1 for low level flow control. RX1+ – If in RS485 or RS422 mode, this pin is Receive Data 1 -.
7	4	DTR1*	Data Terminal Ready 1 – Indicates this Serial port is powered, initialized, and ready. Used as hardware handshake with DSR1 for overall readiness to communicate.
8	9	RI1*	Ring Indicator 1 – Indicates external serial communications device is detecting a ring condition. Used by software to initiate operations to answer and open the communications channel.
9	5	GND	Ground
10	NC	KEY/ NC	Key Not connected
11	1 (COM2)	DCD2 *	Data Carrier Detect 2 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open). In direct connect environments, this input will be driven by DTR2 as part of the DTR/DSR handshake.
12	6	DSR2*	Data Set Ready 2 – Indicates external serial communications device is powered, initialized, and ready. Used as hardware handshake with DTR2 for overall readiness to communicate.
13	2	RXD2 RX2-	Receive Data 2 – Serial port 2 receive data in. RX1- – If in RS485 or RS422 mode, this pin is Receive Data 1 -.
14	7	RTS2* TX2+	Request To Send 2 – Indicates Serial port 2 is ready to transmit data. Used as hardware handshake with CTS2 for low level flow control. TX2+ – If in RS485 or RS422 mode, this pin is Transmit Data 2 +.
15	3	TXD2 TX2-	Transmit Data 2 – Serial port 2 transmit data out TX2- – If in RS485 or RS422 mode, this pin is Transmit Data 2 -.
16	8	CTS2* RX2+	Clear To Send 2 – Indicates external serial communications device is ready to receive data. Used as hardware handshake with RTS2 for low level flow control. RX2+ – If in RS485 or RS422 mode, this pin is Receive Data 2 -.
17	4	DTR2*	Data Terminal Ready 2 – Indicates Serial port 1 is powered, initialized, and ready. Used as hardware handshake with DSR2 for overall readiness to communicate.
18	9	NC	Not Connected (Ring Indicator 2)
19	5	GND	Ground
20	NC	NC	Not connected

Note: The shaded area denotes power or ground. Signals are listed in the table with RS232 first, followed by RS485/RS422.

Table 3-6. Serial B Interface Pin/Signal Descriptions (J12)

Pin #	Pin # DB9	Signal	Description
1	1 (COM3)	DCD3*	Data Carrier Detect 3 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open). In direct connect environments, this input will be driven by DTR3 as part of the DTR/DSR handshake.
2	6	DSR3*	Data Set Ready 3 – Indicates external serial communications device is powered, initialized, and ready. Used as hardware handshake with DTR3 for overall readiness to communicate.
3	2	RXD3 RX3-	Receive Data 3 – Serial port 3 receive data in RX3- – If in RS485 or RS422 mode, this pin is Receive Data 3 -.
4	7	RTS3* TX3+	Request To Send 3 – Indicates Serial port 3 is ready to transmit data. Used as hardware handshake with CTS3 for low level flow control. TX3+ – If in RS485 or RS422 mode, this pin is Transmit Data 3 +.
5	3	TXD3 TX3-	Transmit Data 3 – Serial port 3 transmit data out TX3- – If in RS485 or RS422 mode, this pin is Transmit Data 3 -.
6	8	CTS3* RX3+	Clear To Send 3 – Indicates external serial communications device is ready to receive data. Used as hardware handshake with RTS3 for low level flow control. RX3+ – If in RS485 or RS422 mode, this pin is Receive Data 3 -.
7	4	DTR3*	Data Terminal Ready 3 – Indicates this Serial port is powered, initialized, and ready. Used as hardware handshake with DSR3 for overall readiness to communicate.
8	9	RI3*	Ring Indicator 3 – Indicates external serial communications device is detecting a ring condition. Used by software to initiate operations to answer and open the communications channel.
9	5	GND	Ground
10	NC	KEY	Not Connected
11	1 (COM4)	DCD4*	Data Carrier Detect 4 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open). In direct connect environments, this input will be driven by DTR4 as part of the DTR/DSR handshake.
12	6	DSR4*	Data Set Ready 4 – Indicates external serial communications device is powered, initialized, and ready. Used as hardware handshake with DTR4 for overall readiness to communicate.
13	2	RXD4 RX4-	Receive Data 4 – Serial port 4 receive data in RX4- – If in RS485 or RS422 mode, this pin is Receive Data 4 -.
14	7	RTS4* TX4+	Request To Send 4 – Indicator to serial output port 4 is ready to transmit data. Used as hardware handshake with CTS4 for low level flow control. TX4+ – If in RS485 or RS422 mode, this pin is Transmit Data 4 +.
15	3	TXD4 TX4-	Transmit Data 4 – Serial port 4 transmit data out TX4- – If in RS485 or RS422 mode, this pin is Transmit Data 4 -.

Table 3-6. Serial B Interface Pin/Signal Descriptions (J12)

16	8	CTS4* RX4+	Clear To Send 4 – Indicator to serial port 4 that external serial communications device is ready to receive data. Used as hardware handshake with RTS4 for low level flow control. RX4+ – If in RS485 or RS422 mode, this pin is Receive Data 4 +.
17	4	DTR4*	Data Terminal Ready 4 – Indicates this Serial port is powered, initialized, and ready. Used as hardware handshake with DSR4 for overall readiness to communicate.
18	9	NC	Not connected (Ring Indicator 4)
19	5	GND	Ground
20	NC	NC	Not connected

Note: The shaded area denotes power or ground. Signals are listed in the table with RS232 first, followed by RS485/RS422.

Utility Interfaces

The Utility interfaces consist of three connectors that provide the standard interface signals for the following devices:

- Utility 1 (J15)
  - Keyboard
  - External battery connection
  - Reset Switch
  - Speaker
- Utility 2 (J13)
  - PS/2 Mouse
  - Infrared (IrDA) signals
  - SMBus signals
  - USB signals for USB ports 1 and 2
  - Power button signal
- Utility 3 (J14)
  - USB signals for USB ports 3 and 4

Utility 1 Interface

The Utility 1 (J15) interface uses a 16-pin header and provides the various interface signals to an external I/O board with external connections for the respective connectors such as, keyboard, speaker, etc. Table 3-7 provides the pin signals for the Utility 1 interface, which uses 16 pins, 2 rows, odd/even, (1, 2) with 0.100" pitch.

- Keyboard
- Battery
- Reset Switch
- Speaker
- External voltages (-5V In, -12V In, +3.3V Out to Power On LED)

Keyboard Interface

The signal lines for a PS/2 keyboard are provided through the Utility 1 interface, which is also fully PC/AT compatible.

External Battery

An external battery input connection is provided through a Utility 1 interface for the Real Time Clock's operation in the event the on-board battery is not used.

Reset Switch

The signal lines for a reset switch are provided through the Utility 1 interface.

NOTE	To perform the equivalent of a power-on reset, the reset button must be pressed and held for a minimum of three seconds.

Speaker

The signal lines for a speaker port with 0.1-watt drive are provided through a Utility 1 interface (J15).

Table 3-7. Utility 1 Interface Pin/Signal Descriptions (J15)

Pin #	Signal	I/O	Description
1	-12V	I	-12 Volts – Supplied from external power source.
2	GND	I	Ground
3	-5V	I	-5 Volts – Supplied from external power source.
4	GND	I	Ground
5	LED	O	Power On LED – This on-board +3.3 volts is provided through 330 ohm resistor to an external Power-On LED.
6	NC	-	Not connected (Power Good)
7	SPKR+	O	+ Speaker Output – This signal drives external PC "Beep" speaker.
8	GND	I	Ground
9	RSTSW*	I	Reset Switch – This signal (ground) provided from external reset switch.
10	NC	-	Not connected (Keyboard Switch)
11	KBDATA	I/O	Keyboard Data signal provided to external keyboard connector.
12	KBCLK	I/O	Keyboard Clock – Clock signal provided to external keyboard connector.
13	GND	I	Keyboard Ground
14	KBDPWR	O	Keyboard Power – This +5 volts is provided to external keyboard connector. Requires external fuse for keyboard/mouse protection.
15	BATV+	I	Backup Battery – This connection provides an additional backup battery from an external source. It can also be used in place of the on-board backup battery, B1, shipped with all LittleBoard 800s. Each RTS battery input is protected with a zener diode.
16	BATV-	I	Battery - Return (Grounded)

Note: The shaded area denotes power or ground. The signals marked with * = Negative true logic.

Utility 2 Interface

The Utility 2 (J13) interface consists of a 24-pin connector used to interface various signals to the external board with external connections, or directly to the respective connector such as, the mouse, USB, etc. Table 3-9 on page 29 lists the pin signals for the Utility 2 interface. The J13 connector uses 24 pins, 2 rows, odd/even (1, 2) with 0.100" pitch.

- PS/2 Mouse signals
- Infrared (IrDA) signals
- SMBus signals
- USB signals for USB ports 1 and 2
- Power button signal

System Management Bus (SMBus)

The I/O Hub, 82801DB, (Southbridge) contains both a host and slave SMBus port; but the host cannot access the slave internally. The slave port allows an external master access to the I/O Hub through the connector (J13). The master contained in the 82801DB is used to communicate with the SDRAM DDR DIMM, 82541(GI/PI) Gigabit Ethernet controller, and the clock generator. Table 3-8 gives the addresses for these devices with the components and corresponding binary addresses of the SMBus.

Table 3-8. SMBus Reserved Addresses

Component	Address Binary
SDRAM EPROM	$1010{,}000x_b$
Clock Generator (ICS950811)	$1101{,}001x_b$
I/O Hub (82801DB)	$0000{,}000x_b$ (default) Programmable Master

USB Signals (USB1 and USB2)

The LittleBoard 800 contains two root USB hubs with four functional USB ports. This connector (Utility 2) provides two of the four USB ports (USB0 and USB1). The hub is USB EHCI V2.0 and UHCI V1.1 compatible.

Features implemented in the USB ports include the following:

- Support for USB EHCI v2.0 and UHCI v1.1
- Integrated physical layer transceivers
- Over-current detection status (software) on all four USB ports

CAUTION	ADLINK does not recommend connecting a USB boot device to the LittleBoard 800 through an external hub. Instead, connect the USB boot device directly to the LittleBoard 800.

Mouse Interface

The signal lines for a PS/2 mouse are provided through the Utility 2 interface (J13).

Infrared Port (IrDA)

The Infrared Data Association (IrDA) port provides a two-way wireless communications port using infrared as a transmission medium at the basic level. There are two basic infrared implementations provided; the Hewlett-Packard Serial Infrared (HPSIR) and the Amplitude Shift Keyed Infrared (ASKIR) methods. HPSIR is a serial implementation of infrared developed by Hewlett-Packard. The IrDA (HPSIR and ASKIR) signals are available on the Utility 2 connector.

The HPSIR method allows serial communication at baud rates up to 115k baud. Each word is sent serially beginning with a zero value start bit. A zero is sent when a single infrared pulse is sent at the beginning of the serial bit time. A one is sent when no infrared pulse is sent during the bit time.

The Amplitude Shift Keyed infrared (ASKIR) allows serial communication at baud rates up to 19.2k baud. Each word is sent serially beginning with a zero value start bit. A zero is sent when a 500kHz waveform is sent for the duration of the serial bit time. A one is sent when no transmission is sent during the serial bit time.

Both of these methods require an understanding of the timing diagrams provided in the Super I/O-1 controller chip (LPC47B272) specifications available from the manufacture's web site and referred to earlier in this manual. For more information, refer to the SMSC LPC47B272 chip databook and the Infrared Data Association web site at http://www.irda.org.

NOTE	For faster speeds and infrared applications not covered in this brief description, refer to the LPC47B272 chip specifications by Standard Microsystems Corp.

Table 3-9. Utility 2 Interface Pin/Signal Descriptions (J13)

Pin #	Signal	I/O	Description
1	LIDSW	-	Lid Switch – This signal (Suspend Status on I/O Hub) is asserted by the I/O Hub to indicate the system will be entering a low power state soon. This signal is not shared with other devices on the LittleBoard. This signal is similar to the Lid Switch on laptop computer.
2	PWRBT*	I	Power Button – This signal from an external switch to the I/O Hub is not used with AT Power supplies.
3	BATLOW*	I	Battery Low – This signal from external battery indicates to the I/O Hub there is insufficient power to boot the system.
4	NC	O	Not connected (IR Mode select)
5	IRTX	O	IR Transmit Data – This signal goes to external IrDA Transceiver.
6	IRRX	I	IR Receive Data – This signal comes from external IrDA Transceiver.
7	GND	-	Ground
8	VCC	-	+5 Volts
9	MDATA	I/O	Mouse Data – Data signal provided to external mouse connector.
10	MCLK	I/O	Mouse Clock– Clock signal provided to external mouse connector
11	GND	-	Ground
12	VCC	-	+5 Volts
13	SMBCLK	-	SMBus Clock – Clock signal provided to external devices.
14	SMBDATA	-	SMBus Data – Data signal provided to external devices.
15	USBPWR1	-	+5V USB Port Power – Port is disabled if this input is low.
16	USBPWR2	-	+5V USB Port Power – Port is disabled if this input is low.
17	USBP1-	I/O	USB 1 Negative Data Signal
18	USBP2-	I/O	USB 2 Negative Data Signal
19	USBP1+	I/O	USB 1 Positive Data Signal
20	USBP2+	I/O	USB 2 Positive Data Signal
21	USBGND1	-	USB Port ground
22	USBGND2	-	USB Port ground
23	NC	-	Not Connected - Reserved
24	NC	-	Not Connected - Reserved

Note: The shaded area denotes power or ground. The signals marked with * = Negative true logic.

Utility 3 Interface

The Utility 3 (J14) interface is a 10-pin connector used to provide two of the four USB port signals to an external board with USB connections or directly to the respective USB connector for the USB ports. Table 3-10 gives the pin signals for the Utility 3 interface, which uses 10 pins, 2 rows, odd/even, (1, 2) with 0.100" pitch.

- USB ports 3 and 4

USB Signals (USB3 and USB4)

The LittleBoard 800 contains two root USB hubs with four functional USB ports. This header (Utility 3) provides two of the four USB ports (USB3 and USB4). The hub is USB EHCI V2.0 and UHCI V1.1 compatible.

Features implemented in the USB ports include the following:

- USB EHCI V2.0 and Universal UHCI V1.1 compatible
- Integrated physical layer transceivers
- Over-current detection status on the USB port (software)

CAUTION	ADLINK does not recommend connecting a USB boot device to the LittleBoard 800 through an external hub. Instead, connect the USB boot device directly to the LittleBoard 800.

Table 3-10. Utility 3 Interface Pin/Signal Descriptions (J14)

Pin #	Signal	I/O	Description
1	USBPWR3	-	+5V USB Port Power – Port is disabled if this input is low.
2	USBPWR4	-	+5V USB Port Power – Port is disabled if this input is low.
3	USBP3-	I/O	USB 3 Negative Data Signal
4	USBP4-	I/O	USB 4 Negative Data Signal
5	USBP3+	I/O	USB 3 Positive Data Signal
6	USBP4+	I/O	USB 4 Positive Data Signal
7	USBGND3	-	USB Port ground
8	USBGND4	-	USB Port ground
9	NC	-	Not Connected - Reserved
10	NC	-	Not Connected - Reserved

Note: The shaded area denotes power or ground.

Audio Interface

The audio solution on the LittleBoard 800 is provided by the Realtek ALC203-LF audio CODEC. The chip is defined by AC97 and is revision 2.2 compliant. The audio interface signals are supplied to the 26-pin 2mm connector (J9). Refer to the following list for the *Audio CODEC* (ALC203-LF) features.

- Analog Mixer Dynamic Range 97dB (typ)
- D/A Dynamic Range 89dB (typ) and A/D Dynamic Range 90dB (typ)
- AC'97 Rev 2.1 compliant
- High quality Sample Rate Conversion (SRC) from 4kHz to 48kHz
- 3D Sound circuitry and PC-Beep passthrough to Line Out while reset is held active low

- True Line Level Output with volume control independent of Line Out

Table 3-11 describes the pin signals of the audio interface, which uses 26 pins, 2 rows, odd/even, (1, 2) with 2mm pitch.

Table 3-11. Audio Interface Pin/Signal Descriptions (J9)

Pin #	Signal	Description
1	VIDEO_L	Video-Audio signal in left channel
2	VIDEO_GND	Video Audio ground
3	VIDEO_R	Video-Audio signal in right channel
4	CD_L	CD-ROM signal left channel
5	CD_GND	CD-ROM Audio ground
6	CD_R	CD-ROM signal right channel
7	LINE_IN_L	Line in signal left channel
8	LINE_IN_GND	Line in Audio ground
9	LINE_IN_R	Line in signal right channel
10	MIC1	Microphone in signal 1 or left channel
11	MIC_GND	Microphone Audio ground
12	MIC2	Microphone in signal 2 or right channel
13	MIC_REF	Microphone reference signal
14	NC/KEY	Not Connected - Key
15	PHONE_IN	Phone signal in
16	PHONE_GND	Phone Audio ground
17	MONO_OUT	Monaural signal out
18	MONO_GND	Monaural Audio ground
19	+AOUT_L	- Audio out signal left channel
20	-AOUT_L	+ Audio out Audio ground
21	+AOUT_R	- Audio out signal right channel
22	-AOUT_R	+ Audio out Audio ground
23	GND	Audio Ground (tied to all audio grounds)
24	HP_L	Headphone signal left channel
25	HP_R	Headphone signal right channel
26	NC	Not Connected

Note: The shaded areas denote power or ground.

Video Interfaces

The 82855GME chip provides the graphics control and video signals to the traditional glass CRT monitors and LCD flat panel displays. The chip features are listed below:

CRT features:

- Supports a max resolution of 2048 X 1536
- Supports a maximum allowable video frame buffer size of 32MB shared memory
- AGP 4X graphics performance (always enabled)

Flat Panel features:

- Supports (+3.3V or +5V, and +12V) output to LCD flat panels through an LVDS interface
- Supports panel sizes from VGA (640 x 480) up to UXGA+ (1600 x 1200).
- Supports 1-channel (18-bit) or 2-channel (36-bit) LVDS outputs

CRT Interface

Table 3-12 describes the pin signals of the CRT interface, which uses 10 pins, 2 rows, odd/even, (1, 2) with 0.100" (2.54mm) pitch.

Table 3-12. CRT Interface Pin/Signal Descriptions (J3)

Pin #	Signal	Description
1	RED	Red – This is the Red analog output signal to the CRT.
2	GND	Ground
3	GREEN	Green – This is the Green analog output signal to the CRT.
4	GND	Ground
5	BLUE	Blue – This is the Blue analog output signal to the CRT.
6	GND	Ground
7	HSYNC	Horizontal Sync – This signal is used for the digital horizontal sync output to the CRT.
8	GND	Ground
9	VSYNC	Vertical Sync – This signal is used for the digital vertical sync output to the CRT.
10	PWR	Power – Provided through fuse (F1) to +5 volts +/- 5%. F1 is next to J3 connector on board.

Note: The shaded area denotes power or ground.

LVDS Interface

Table 3-13 describes the pin signals of the LVDS interface, which uses 30 pins, 2 rows, odd/even, (1, 2) with .079" (2mm) pitch.

Table 3-13. LVDS Interface Pin/Signal Descriptions (J26)

Pin #	Signal	Description	Line	Channel
1	+12V	+12 volt input	NA	NA
2	+VCC (+3.3V/+5V)	JP1 determines voltage on pin		
3	GND	Ground		
4	GND	Ground		

Table 3-13. LVDS Interface Pin/Signal Descriptions (J26) (Continued)

5	CLK_LVDS_IYBP	Clock Positive Output	Clock	Channel 2
6	CLK_LVDS_IYBM	Clock Negative Output		
7	LVDS_IYBP3	Data Positive Output	3	
8	LVDS_IYBM3	Data Negative Output		
9	LVDS_IYBP2	Data Positive Output	2	
10	LVDS_IYBM2	Data Negative Output		
11	LVDS_IYBP1	Data Positive Output	1	
12	LVDS_IYBM1	Data Negative Output		
13	LVDS_IYBP0	Data Positive Output	0	
14	LVDS_IYBM0	Data Negative Output		
15	LVDS_PANELBKLTCTL	Control Panel Backlight	NA	NA
16	LVDS_PANELVDDEN	Enable Panel Power	NA	NA
17	CLK_LVDS_IYAP	Clock Positive Output	Clock	Channel 1
18	CLK_LVDS_IYAM	Clock Negative Output		
19	LVDS_IYAP3	Data Positive Output	3	
20	LVDS_IYAM3	Data Negative Output		
21	LVDS_IYAP2	Data Positive Output	2	
22	LVDS_IYAM2	Data Negative Output		
23	LVDS_IYAP1	Data Positive Output	1	
24	LVDS_IYAM1	Data Negative Output		
25	LVDS_IYAP0	Data Positive Output	0	
26	LVDS_IYAM0	Data Negative Output		
27	DDCPCLK	Display Data Channel Clock	NA	NA
28	DDCPDATA	Display Data Channel Data	NA	NA
29	LVDS_PANELBKLTEN	Enable Backlight Inverter	NA	NA
30	NC	Not Connected	NA	NA

Note: The shaded area denotes power or ground.

NOTE Pins 5-14 constitute 2nd channel interface of two channels. Pins 15-26 constitute 1st channel interface of two channels, or a single channel interface.

Power Interfaces

Power In

The LittleBoard 800 uses five separate voltages on the board, but only one of the voltages is provided externally (+5 volts) through the external header (J19), which uses a 7-pin vertical header with 0.156" (3.96mm) spacing. Holes for a right angle mounting header are also available at J19. All the onboard voltages are derived from the externally supplied +5 volts DC +/- 5%. The onboard voltages include the CPU core voltages as well as the other voltages used on the board.

Table 3-14 lists the pin signals for the power supply input header, which uses 7 pins, single row, with 0.156" pitch.

Table 3-14. Power Supply Input Pin/Signal Descriptions (J19)

Pin #	Signal	Description
1	+5V	+5.0 Volts – This +5.0 volts DC +/- 5% is the only voltage required for operation.
2	GND	Ground
3	GND	Ground
4	+12V	+12 Volts – This +12 volts is for the PC/104, PC/104-Plus, and LVDS power only.
5	+3.3V	+3.3 Volts – This +3.3 volts is for PC/104-Plus Bus power only (optional).
6	GND	Ground
7	+5V	+5.0 Volts – This +5.0 volts DC +/- 5% is the only voltage required for operation.

Note: The shaded area denotes power or ground. The +12V and +3.3V on the Power Supply Input connector (J19) are used for the PCI, ISA bus, and LVDS power, which are supplied externally and not generated on the LittleBoard 800. The -5V and -12V used for the PC/104 bus are supplied through the PC/104 bus or from an external power supply through the Utility 1 connector (J15).

ATX Power

Table 3-15 lists the pin signals for the J29 Power On Button and Reset Switch header, which uses 5 pins, single row with 0.100" (2.54mm) pitch.

- Power On Switch – This control signal is provided externally through a button by connecting ground to pin 1 on the J29 header.
- Reset Switch – This signal is provided externally through a switch by connecting ground to pin 3 on the J29 header.

Table 3-15. Power On Button and Reset Switch Header Pin/Signal Descriptions (J29)

Pin #	Signal	Description
1	PWRBTN	Power On input (connect between pins 1 & 2)
2	GND	Ground
3	RESET_IN	Reset Switch input or output (connect between pins 2 & 3)
4	NC	NA
5	-12V	VCC

Note: The shaded areas denote power or ground.

Table 3-16 lists the pin signals for the J30 Power On header, which uses 3 pins, single row with 0.100" (2.54mm) pitch.

Table 3-16. Power On Header Pin/Signal Descriptions (J30)

Pin #	Signal	Description
1	PS_ON*	Power Supply On – This signal is sent to the ATX power supply by the LittleBoard 800 to turn On the ATX power supply. This signal can also be used to turn Off the ATX power supply or go into a suspended or standby state.
2	GND	Ground
3	VCCSB	+5V suspend voltage (+5V, 100mA Standby) – This voltage is supplied from ATX power supply. This voltage is required for normal operation.

Note: The shaded areas denote power or ground. The signals marked with * = Negative true logic.

Miscellaneous

Real Time Clock (RTC)

The LittleBoard 800 contains a Real Time Clock (RTC). The BIOS (CMOS) RAM is backed up with a Lithium Battery. If the battery is not present, the BIOS has a battery-free boot option to complete the boot process.

Temperature Monitoring

The ADM1023 performs CPU temperature monitoring. This device has an input connection from the thermal diode in the Intel Celeron M or Pentium M CPU. The SMBus is connected to a dedicated thermal alert pin in the ADM1023 and the other devices on the SMBus.

NOTE	The LittleBoard 800 requires a heatsink for both Celeron M CPUs and a heatsink for the Pentium M CPU below 70° C.

Oops! Jumper (BIOS Recovery)

The Oops! jumper is provided in the event the BIOS settings you have selected prevent you from booting the system. By using the Oops! jumper you can prevent the current BIOS settings in the EEPROM from being loaded, forcing the use of the default settings. Connect the DTR pin to the RI pin on serial port 1 (COM 1) prior to boot up to prevent the present BIOS settings from loading. After booting with the Oops! jumper in place, remove the Oops! jumper and go into BIOS Setup. Change the desired BIOS settings, or select the default settings, and save changes before rebooting the system.

To convert the Serial A interface to an Oops! jumper, short together the DTR (7) and RI (8) pins on Serial A (J11) header for Serial Port 1. As an alternate, short the equivalent pins, 4 and 9, on the Serial Port 1 DB9 connector as shown in Figure 3-2.

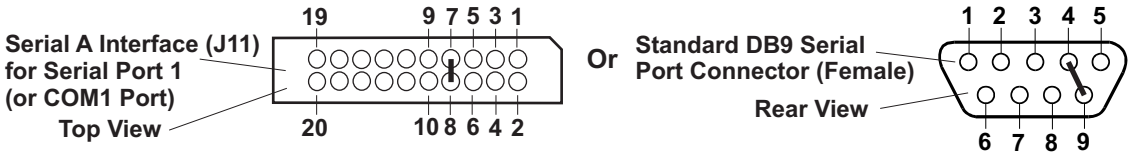

Figure 3-2. Oops! Jumper Connection

Serial Console

The LittleBoard 800 supports the serial console (or console redirection) feature. This I/O function is provided by an ANSI-compatible serial terminal, or the equivalent terminal emulation software running on another system. This can be very useful when setting up the BIOS on a production line for systems that are not connected to a keyboard and display.

Serial Console Setup

The serial console feature is implemented by connecting a standard null modem cable or modified serial cable (or "Hot Cable") between one of the serial ports, such as Serial 1 (J11A) and the serial terminal, or a PC with communications software. The BIOS Setup Utility controls the serial console settings on the LittleBoard 800. Refer to Chapter 4, BIOS Setup for the settings of the serial console option, the serial terminal, or PC with communications software and the connection procedure.

Hot (Serial) Cable

To convert a standard serial cable to a Hot Cable, specific pins must be shorted together at the Serial port connector or at the DB9 connector. For example, short the RTS (7) and RI (9) on the respective DB9 port connector as shown in Figure 3-3.

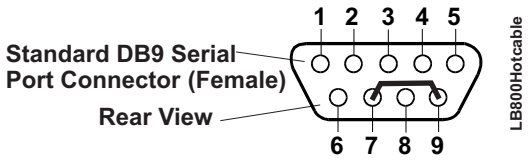

Figure 3-3. Hot Cable Jumper

Watchdog Timer

The watchdog timer (WDT) restarts the system if a mishap occurs, ensuring proper start-up after the interruption. Possible problems include failure to boot properly, the application software's loss of control, failure of an interface device, unexpected conditions on the bus, or other hardware or software malfunctions.

The WDT (watchdog timer) can be used both during the boot process and during normal system operation.

- During the Boot process – If the operating system fails to boot in the time interval set in the BIOS, the system will reset.

  Enable the WDT in Boot Settings Configuration of BIOS Setup. Set the WDT for a time-out interval in seconds, between 1 and 255, in one-second increments in the Boot Setting Configuration screen. Ensure you allow enough time for the boot process to complete and for the OS to boot. The OS or application must tickle the WDT as soon as it comes up. This can be done by accessing the hardware directly or through a BIOS call.

- During System Operation – An application can set up the WDT hardware through a BIOS call, or by accessing the hardware directly. Some ADLINK Board Support Packages provide an API interface to the WDT. The application must tickle the WDT in the time set when the WDT is initialized or the system will be reset. You can use a BIOS call to tickle the WDT or access the hardware directly.

  The BIOS implements interrupt 15 function 0C3h to manipulate the WDT.

- Watchdog Code examples – ADLINK has provided source code examples on the LittleBoard 800 Support Software DVD illustrating how to control the WDT. The code examples can be easily copied to your development environment to compile and test the examples, or make any desired changes before compiling. Refer to the WDT Readme file on the LittleBoard 800 Support Software DVD.

Optional CPU Fan

Table 3-17 lists the pin signals of the optional CPU Fan, which uses 3 pins, single row, with 0.100" pitch.

Table 3-17. Optional CPU Fan (J21)

Pin #	Signal	Description
1	Fan_Tach	Fan Tachometer – This signal indicates Fan speed
2	VCC	+5.0 volts DC +/- 5%
3	GND	Ground

Note: The shaded area denotes power or ground.

LAN LED

Table 3-18 lists the pin signals of the Ethernet external LED interface, which uses 5 pins, single row, with 0.100" pitch. This header is for an external LED, indicating Gigabit Ethernet power and activity.

Table 3-18. Ethernet External LED Pin/Signal Descriptions (J28)

Pin #	Signal	Description
1	LED YEL	Ethernet Power
2	LINK_LED_HDR#	Ethernet Connection LED
3	MAC ACTLED_RES#	Ethernet Activity
4	MAC LINK 1000# CON	Ethernet Connection
5	GND	Ground

Note: The shaded area denotes power or ground.

Chapter 4 BIOS Setup

Introduction

This section assumes the user is familiar with BIOS Setup and does not attempt to describe the inner workings of BIOS functions. Refer to the appropriate PC reference manuals for information about the on-board, ROM-BIOS software interface. If ADLINK has added to or modified the standard functions, these functions will be described.

Entering BIOS Setup (VGA Display)

To enter BIOS Setup using a VGA display for the LittleBoard 800:

1. Turn on the VGA monitor and the power supply to the LittleBoard 800.
2. Start Setup by pressing the [Del] key, when the following message appears on the boot screen.

```
Press DEL to run Setup
```

> **NOTE** If the setting for *Memory Test* is set to Fast, you may not see this prompt appear on screen if the monitor is too slow to display it on start up. If this happens, press the <Del> key early in the boot sequence to enter BIOS Setup.

3. Use the <Enter> key to select the screen menus listed in the Opening BIOS screen.
4. Follow the instructions at the bottom of each screen to navigate through the selections and modify any settings.

Entering BIOS Setup (Serial Console)

Entering the BIOS Setup, in serial console mode, is very similar to the steps you use to enter BIOS Setup with a VGA display, except the actual keys you use.

1. Set the serial terminal, or the PC with communications software to the following settings:
   - 115k baud
   - 8 bits
   - One stop bit
   - No parity
   - No hardware handshake
2. Connect the serial console, or the PC with serial terminal emulation, to Serial Port 1 or Serial Port 2 of the LittleBoard 800.
   - If the BIOS option, *Serial Console* is set to [Enable], use a standard null-modem serial cable.
   - If the BIOS option, *Serial Console* is set to [Hot Cable], use the modified serial cable described in Chapter 3, under *Hot (Serial) Cable*.
3. Turn on the serial console or the PC with serial terminal emulation and the power supply to the LittleBoard 800.
4. Start Setup by pressing the Ctl–c keys, when the following message appears on the boot screen.

```
Hit ^C if you want to run SETUP
```

5. Use the <Enter> key to select the screen menus listed in the Opening BIOS screen.

> **NOTE** The serial console port is not hardware protected, and is not listed in the COM table within BIOS Setup. Diagnostic software that probes hardware addresses may cause a loss or failure of the serial console functions.

PCI-ISA Bridge Mapping

The LittleBoard 800 supports ISA bus based modules with an on-board PCI-ISA bridge. The PCI-ISA bridge optionally maps the following resources to ISA based modules:

- IRQs
- DMA Channels

The LittleBoard 800 system BIOS, maps the above resources based on information provided in the BIOS Setup screens. By default, IRQs or DMA channels to be mapped to ISA modules must be explicitly specified by the user in the BIOS Setup screens.

The IRQs and DMA channels are mapped with the “PCIPnP/IRQx” fields in BIOS setup (where x specifies the IRQ number.) The IRQs 3, 4, 5, 7, 9, 10, 11, 14, and 15 can be mapped to ISA based modules by changing the default setting for these IRQs from “Available” to “Reserved”.

Any of the DMA channels 0, 1, 3, 5, 6, 7 can be mapped to ISA modules by changing the default setting of “Available” to “Reserved”.

Logo Screen Utility (Splash Screen)

The LittleBoard 800 BIOS supports a graphical logo utility, which can be customized by the user and displayed when enabled through the BIOS Setup Utility. The graphical image can be a company logo or any custom image the user wants to display during the boot process. The custom image can be displayed as the first image displayed on screen during the boot process and remain there, depending on the options selected in BIOS Setup, while the OS boots.

Logo Screen Image Requirements

The user’s image may be customized with any standard image editing tool.

The LittleBoard 800 logo screen utility supports the following image formats:

- Bitmap image
- Exactly 640 x 480 pixels
- Exactly 16 colors

> **NOTE** For procedures on loading custom images, see the logo screen utility document available on the Ampro By ADLINK website.

Appendix A Technical Support

ADLINK Technology, Inc. provides a number of methods for contacting Technical Support listed in the Table A-1 below. Requests for support through the Ask an Expert are given the highest priority, and usually will be addressed within one working day.

- Ampro by ADLINK Ask an Expert – This is a comprehensive support center designed to meet all your technical needs. This service is free and available 24 hours a day through the Ampro By ADLINK web site at http://ampro.custhelp.com. This includes a searchable database of Frequently Asked Questions, which will help you with the common information requested by most customers. This is a good source of information to look at first for your technical solutions. However, you must register online if you wish to use the Ask a Question feature.
- Personal Assistance – You may also request personal assistance by creating an Ask an Expert account and then going to the Ask a Question feature. Requests can be submitted 24 hours a day, 7 days a week. You will receive immediate confirmation that your request has been entered followed by an e-mail response. Once you have submitted your request, you must log in to My Stuff where you can check status, update your request, and access other features.
- InfoCenter – This service is also free and available 24 hours a day at the Ampro By ADLINK web site at http://www.ampro.com. However, you must sign up online before you can log in to access this service. The InfoCenter was created as a resource for embedded system developers to share ADLINK's knowledge, insight, and expertise. This page contains links to White Papers, Specifications, and additional technical information.

Table A-1. Technical Support Contact Information

Method	Contact Information
Ask an Expert	http://ampro.custhelp.com
Web Site	http://www.ampro.com
Standard Mail	ADLINK Technology, Incorporated 5215 Hellyer Avenue San Jose, CA 95138-1007, USA

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