AN ADLINK COMPANY

ReadyBoard™ 830
Single Board Computer
Reference Manual

P/N 5001837A Revision A

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Notice Page

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REVISION HISTORY

Revision	Reason for Change	Date
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Audience

This manual provides reference only for computer design engineers, including but not limited to hardware and software designers and applications engineers. Ampro Computers, Inc. assumes you are qualified to design and implement prototype computer equipment.

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Contents

Chapter 1 About This Manual 1
Purpose of this Manual 1
References 1
Chapter 2 Product Overview 3
EPIC Architecture 3
Product Description 4
Board Features 5
Block Diagram 8
Major Integrated Circuits (ICs) 9
Header Definitions 10
Jumper Definitions 14
Specifications 14
Power Specifications 14
Environmental Specifications 15
Thermal/Cooling Requirements 15
Physical Specifications 15
Mechanical Specifications 16
Chapter 3 Hardware 17
Overview 17
Interrupt Channel Assignments 18
Memory Map 19
I/O Address Map 19
Floppy/Parallel Interface (LPT) 20
Serial Interfaces 22
USB Interfaces 25
USB 2.0 Support 25
Legacy USB Support 25
USB2 and USB3 25
USB4 and USB5 26
Audio Interface 26
Video Interfaces 27
PanelLink 28
LVDS Interface (Low Voltage Differential Signaling) 29
TV Out Header 30
Utility Interface 30
Miscellaneous 30
Real Time Clock (RTC) 30
External Battery (BT1) 31
Temperature Monitoring 31
User GPIO Signals 31
Serial Console 31
Infrared (IrDA) Port 31
System Management Bus (SMBus) 32
PCI Express (PCIe) Mini Card LED 33
Watchdog Timer 33
Power Interfaces 34
Power In Header 34

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CPU Fan 34
Power and Sleep States 34
Power On Switch 34
Sleep States (ACPI) 35
Wake Up Activities 36
Chapter 4 BIOS Setup 37
Introduction 37
Entering BIOS Setup (VGA Display) 37
Entering BIOS Setup (Remote Access) 37
OEM Logo Utility 38
Logo Image Requirements 38
Appendix A Technical Support 39

List of Figures

Figure 2-1. Typical ReadyBoard and PC/104 Module Stack 3
Figure 2-2. PC/104 Modules Stacked on a ReadyBoard 830 4
Figure 2-3. Functional Block Diagram 8
Figure 2-4. Component Locations 10
Figure 2-5. Connector and Header Locations 12
Figure 2-6. Connector Locations (bottom view) 13
Figure 2-7. I/O Panel Dimensions 16
Figure 3-1. RS485 Serial Port Implementation 22

List of Tables

Table 2-1. Major Integrated Circuit Descriptions and Functions 9
Table 2-2. Header Descriptions 10
Table 2-3. Jumper Settings 14
Table 2-4. Power Supply Requirements 14
Table 2-5. Environmental Requirements 15
Table 2-6. Weight and Footprint Dimensions 15
Table 3-1. Interrupt Channel Assignments 18
Table 3-2. Memory Map 19
Table 3-3. I/O Address Map 19
Table 3-4. Floppy/Parallel Header Pin/Signal Descriptions (J10) 20
Table 3-5. Serial A (COM1 and COM2) Interface Pin/Signal Descriptions (J6) 23
Table 3-6. Serial B (COM3 and COM4) Interface Pin/Signal Descriptions (J7) 23
Table 3-7. USB 2 & 3 Interface Pin/Signal Descriptions (J4) 25
Table 3-8. USB 4 & 5 Interface Pin/Signal Descriptions (J11) 26
Table 3-9. Audio Interface Pin/Signal Descriptions (J14) 26
Table 3-10. PanelLink Pin/Signal Descriptions (J9) 28
Table 3-11. LVDS Interface Pin/Signal Descriptions (J3) 29
Table 3-12. TV Out Pin/Signal Descriptions (J5) 30
Table 3-13. Utility Interface Pin/Signal Descriptions (J11) 30
Table 3-14. User GPIO Signals Pin/Signal Descriptions (J12) 31
Table 3-15. Infrared (IrDA) Interface Pin/Signal Descriptions (J8) 32
Table 3-16. SMBus Reserved Addresses 32
Table 3-17. SMBus Signals Pin/Signal Descriptions (J23) 33
Table 3-18. PCIe Mini Card LED Signals Pin/Signal Descriptions (CN1) 33
Table 3-19. Power In Pin/Signal Descriptions (J24) 34

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Table 3-20. CPU Fan Header Pin/Signal Descriptions (J13) 34
Table 3-21. Wake Up Activities and Conditions 36
Table A-1. Technical Support Contact Information.....39

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Chapter 1 About This Manual

Purpose of this Manual

This manual is for designers of systems based on the ReadyBoard 830™ single board computer (SBC). The information in this manual helps designers create embedded systems based on specific design requirements.

Information provided in this reference manual includes:

- ReadyBoard 830 Specifications
- Environmental requirements
- Major components (chips) and features implemented
- ReadyBoard 830 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. Some of this material is also available on the Ampro web site in the InfoCenter. The InfoCenter was created for embedded system developers to share Ampro's knowledge, insight, and expertise.

Specifications

- EPIC Specification Revision 1.0, January 2005

  Web site: http://www.ampro.com/RP/EPIC_Specification_v1.0.pdf

- Audio CODEC 1997 Standard, including all revisions

  For the latest version of the Audio (AC'97) standard developed by Intel Corporation, refer to:

  Web site: http://www.intel.com/design/chipsets/audio

- Compact Flash Specification Revision 4.0, July 2006

  For the latest revision of the compact flash specification, refer to the CompactFlash Association at:

  Web site: http://www.CompactFlash.org

Chip specifications used on the ReadyBoard 830:

- Intel Corporation and the Core Duo or the Celeron® M CPUs; the chips 945GME and 82801GBM ICH7-M, used for the Memory Hub (Northbridge/Video controller) and I/O Hub (Southbridge), respectively.

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

- Winbond Electronics, Corp. and the W83627HF chip used for the Super I/O controller

  Web site: http://www.winbond-usa.com/products/winbond_products/pdfs/PCIC/627hf.pdf

- FinTek and the F81216D chip used for the Secondary I/O (LPC UART) controller (48-pin)

  Web site: http://www.fintek.com.tw/eng/

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- Intel Corporation and the Gigabit Ethernet PCI Express 82573V, used for the Gigabit Ethernet controllers.

  Web site: http://www.intel.com/design/network/products/lan/controllers/82573.htm

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 such as htm or pdf.

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Chapter 2 Product Overview

This overview presents general information about the EPIC form factor and the ReadyBoard 830 single board computer (SBC). After reading this chapter you should understand:

- EPIC architecture
- Product Description
- ReadyBoard 830 features
- Major components
- Connectors
- Specifications

EPIC Architecture

In 2004, five companies collaborated to fill the void between the EBX size and the PC/104 size with a new industry standard form factor (115 mm x 165 mm, or 4.5" x 6.5") called “Embedded Platform for Industrial Computing™ (EPIC).” The EPIC 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 I/O, graphics, and memory expansion. This embedded SBC standard ensures that embedded system OEMs can standardize their designs and that full featured embedded computing solutions can be designed into even more space constrained environments than ever before.

The EPIC standard boasts the same highly flexible and adaptable system expansion as EBX, allowing easy and modular addition of functions such as Firewire or wireless networking not usually contained in standard product offerings. The EBX system expansion is based on popular existing industry standards, PC/104™, PC/104-Plus™, and PCI-104™. 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, but PCI-104 expansion cards only provide the PCI Bus to the PC/104 form factor. Using PC/104 expansion cards, an EPIC board can be easily adapted to meet a variety of embedded applications. See Figures 2-1 and 2-2.

The EPIC standard also brings stability to the mid-sized 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 EPIC specification is freely available to all interested companies, and may be used without licenses or royalties. For further technical information on the EPIC standard, visit the web site at: http://www.epic-sbc.org.

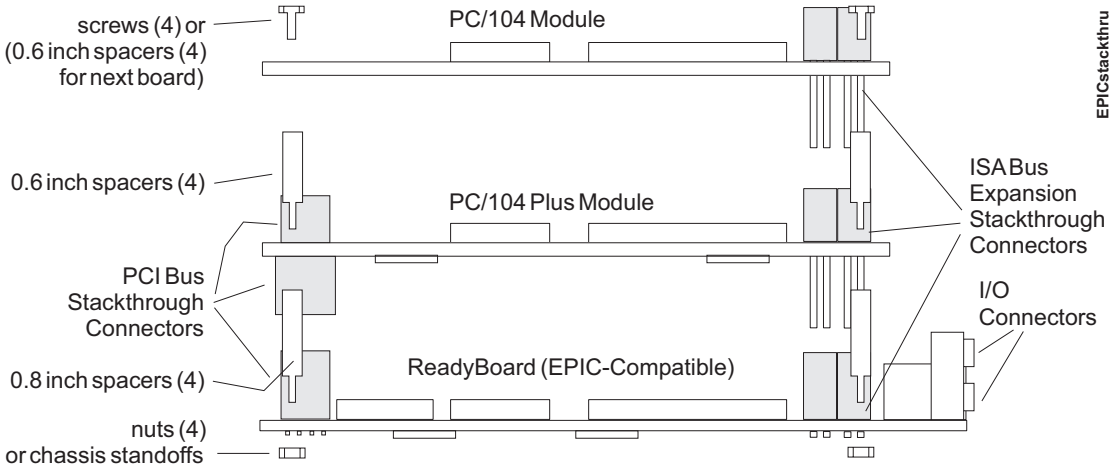


Figure 2-1. Typical ReadyBoard and PC/104 Module Stack

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Product Description

The ReadyBoard 830 is a mid-sized, EPIC-compatible, high quality single-board system, which contains all the component subsystems of a PC/AT PCI motherboard plus the equivalent of up to 4 PCI expansion boards. The ReadyBoard 830 is based on the ultra high performance, high-integration, Intel Core Duo or Celeron M processors. These processors with the matching chipset give designers a complete integration solution based on the EPIC form factor that conforms to the Revision 1.0 of the EPIC standard.

Each ReadyBoard 830 incorporates an Intel® 945GME chipset for the Memory Hub (Northbridge) and I/O Hub (Southbridge) controllers. The chipset consists of the Intel 82945GME memory hub, which controls graphics and memory interfaces and the Intel 82801GBM (ICH7-M) I/O Hub Controller which controls I/O functions. The Winbond Electronics Corp. Super I/O controller, W83627HF, and the Fintek I/O controller, F81216D, add I/O functions. Together, the Intel, Winbond, and Fintek chips provide four serial ports, a floppy or EPP/ECP parallel port, six USB 2.0 ports, PS/2 keyboard and mouse interfaces, and an Ultra/DMA 33/66/100 IDE controller supporting one CompactFlash socket. The RealTek ALC655 provides an audio AC'97 CODEC, and the Intel GMA 950 graphics controller provides CRT and LVDS flat panel video interfaces for the most popular flat panels. The ReadyBoard 830 also supports two independent Gigabit Ethernet interfaces and up to 4 GB of non-ECC DDR2 RAM in two 200-pin SODIMM sockets.

The ReadyBoard 830 can be expanded through the PCI-104 expansion bus to accept PCI-104 cards that offer compact, self-stacking, modular expandability for additional system functions. The PCI-104 bus only implements the signal set for the PCI bus and is available on the 120-pin (4 rows of 30 pins) expansion bus connector. If required for an application, the PC/104 bus—an embedded system version of the signal set provided on a desktop PC's ISA bus—is provided by the optional Ampro MiniModule ISA expansion board. The PCI bus operates at 33 MHz clock speed, and if included as an option, the ISA bus operates at 8 MHz clock speed. See Figure 2-2.

Among the many embedded enhancements on the ReadyBoard 830 that ensure embedded system operation and application versatility are a watchdog timer, serial console support, battery-free boot, customizable logo screen, on-board high-density CompactFlash socket, and ACPI support for sleep states.

The ReadyBoard 830 is particularly well suited to embedded applications by meeting the size, power consumption, temperature range, quality, and reliability demands of embedded system applications. It can be stacked with Ampro MiniModules™ or other PCI-104 compliant expansion boards, or it can be used as a powerful computing engine. The ReadyBoard 830 requires only a +12V power supply.

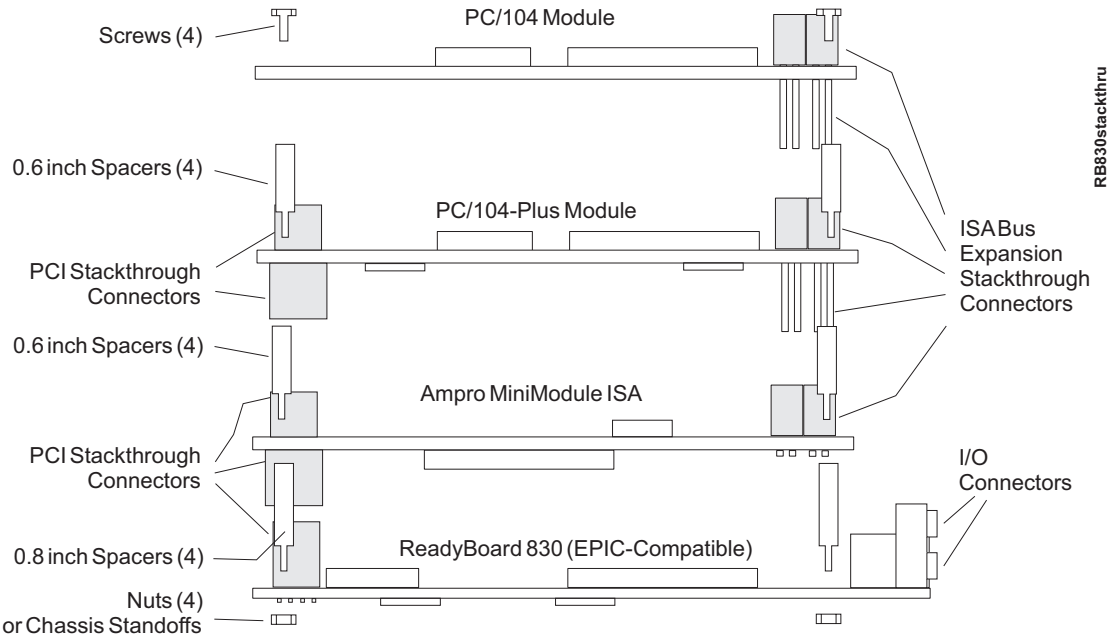


Figure 2-2. PC/104 Modules Stacked on a ReadyBoard 830

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Board Features

- CPU Features
  - 1.66GHz Core™ Duo L2400 or 1.07GHz ULV Celeron®
  - Support a Front Side Bus (FSB) of 533/667 MHz
- Memory
  - Provides two standard 200-pin DDR2 SODIMM slots
  - Supports two single DDR2 (667MHz) SODIMMs, up to 4GB total RAM
  - Supports unregistered/unbuffered non-ECC DDR2 RAM
- PCI-104 Bus Interface
  - Supports PCI 2.3 standard
  - Supports 33 MHz PCI Bus speed
  - Supports optional PC/104 standard (with add-on MiniModule ISA expansion board)
- Serial ATA Interface (SATA)
  - Supports two, 7-pin SATA ports
  - Provides 3.0 Gb/second data transfer rate
- CompactFlash Interface
  - Uses one enhanced IDE controller
  - Supports Ultra DMA 33/66/100 modes
  - Supports IDE native and ATA compatibility modes
  - Supports one CompactFlash socket
- Floppy/Parallel Interface
  - Shared floppy/parallel connector
  - Supports one floppy disk drive (1 standard 34-pin floppy drive)
  - Supports all standard PC/AT formats: 360 kB, 1.2 MB, 720 kB, 1.44 MB, 2.88 MB
  - Supports standard printer port
  - Supports IEEE standard 1284 protocols of EPP and ECP outputs
  - Bi-directional data lines
  - Supports 16 byte FIFO for ECP mode
- USB Ports
  - Provide three root USB hubs
  - Provide six USB ports
  - Provide two standard USB connectors (USB 0 and 1) and two 10-pin headers (USB 2 and 3 and USB 4 and 5)
  - Support USB bootable devices
  - Support USB 2.0 and legacy USB v1.1
  - Provide over-current fuses on board
- Serial Ports
  - Provide four buffered serial ports with full handshaking
  - Provide two 20-pin headers for four serial ports

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- Provide 16550-equivalent controllers, each with a built-in 16-byte FIFO buffer
- Support RS232 capability on all four ports
- Support full modem capability on three of the four ports
- Support RS485 or RS422 operation on two of the four ports (COM3 & COM4)
- Support programmable word length, stop bits, and parity
- Support 16-bit programmable baud-rate generator and an interrupt generator

- Infrared Interface
  - Provides a five-pin IrDA interface header
  - Supports IrDA v1.1
  - Supports HPSIR and ASKIR infrared modes
  - Supports IR mode select from the Super I/O chip
- Keyboard/Mouse Interface
  - Provides PS/2 keyboard interface (shared with mouse)
  - Provides PS/2 mouse interface (shared with keyboard)
  - Provides shared over-current fuse
- Audio Interface
  - Supports AC'97 audio standard
  - AC'97 CODEC on board
  - Provides non-amplified Stereo Line In/Out
  - Provides non-amplified MIC in (Mono)
- Ethernet Interface – Dual Gigabit
  - Includes two fully independent RJ45 Ethernet ports
  - Integrated LEDs on each port (Link/Activity and Speed)
  - Supports IEEE 802.11 10BaseT/100BaseTX/1000BaseT compatible physical layer
  - 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
  - Supports LAN Boot
- Video Interfaces (CRT/PanelLink [DVI]/LVDS/TV Out)
  - Support CRT resolution 2048x1536
  - Support Dynamic Video Memory Technology 3.0 (up to 224 MB)
  - Integrated graphics controller
  - PanelLink outputs (allow capacity to bring out TMDS signals to a DVI connector)
  - LVDS outputs (1 or 2 channel, four differential signals: 3-bits + clock)
  - Provides one TV Out interface

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- Miscellaneous
  - Provides real-time clock (RTC) with replaceable battery
  - Supports battery-free boot
  - Provides external battery connection for RTC operation
  - Provides user GPIO interface header
  - Thermal and voltage monitoring
  - Provides connector for optional CPU fan (+12 volt power supply required)
  - Supports a customizable Logo Screen
  - Supports Serial Console
  - Provides Watchdog Timer

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Block Diagram

Figure 2-3 shows the functional components of the ReadyBoard 830.

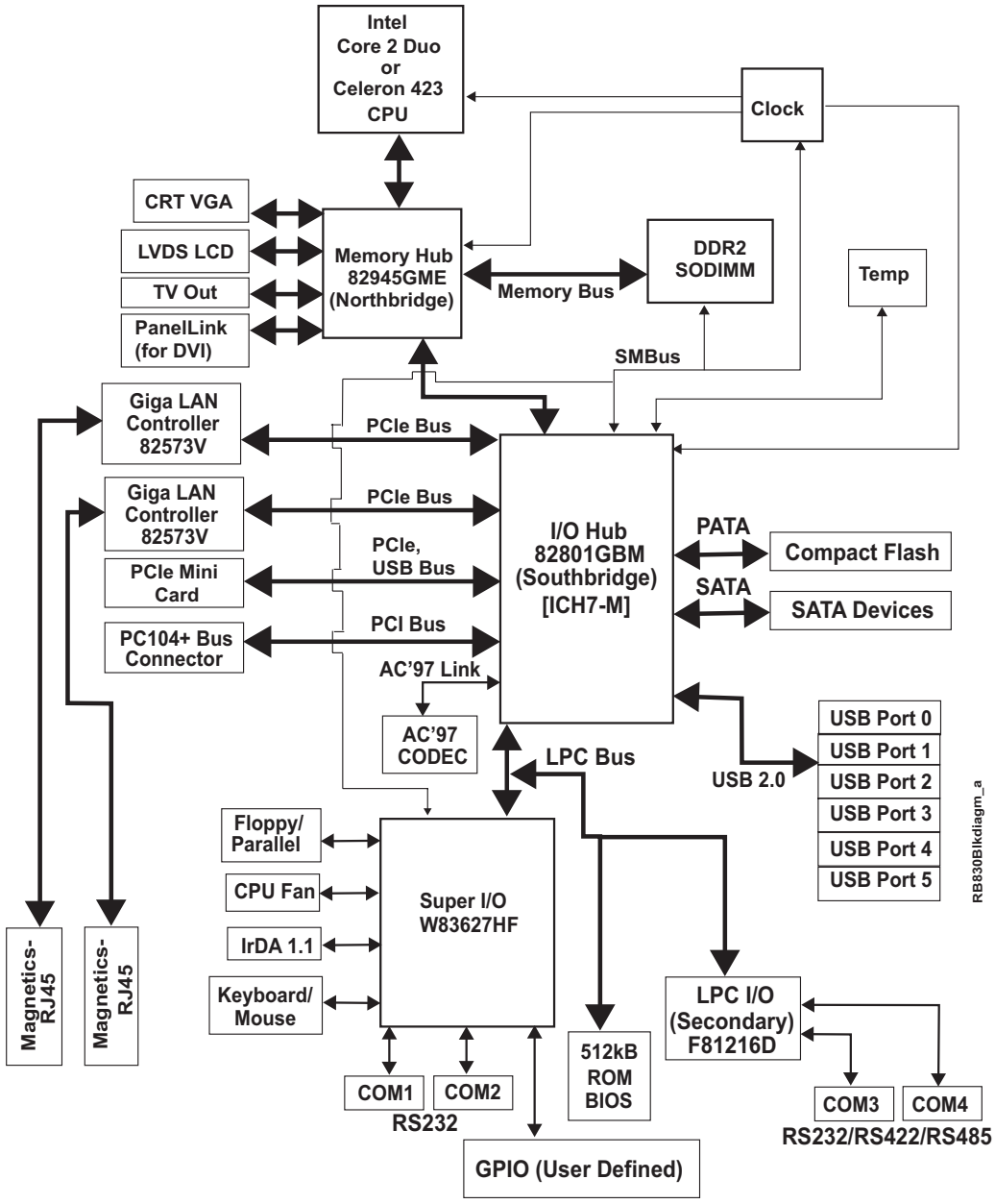


Figure 2-3. Functional Block Diagram

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Major Integrated Circuits (ICs)

Table 2-1 lists the major integrated circuits (chips) on the ReadyBoard 830, including a brief description of each, and Figure 2-4 shows the locations of the major chips.

Table 2-1. Major Integrated Circuit Descriptions and Functions

Chip Type	Mfg.	Model	Description	Function
CPU (U17)	Intel	Core Duo L2400 or Celeron M 423	1.66GHz or 1.07GHz CPUs	Embedded CPU
Memory Hub (U5)	Intel	82945GME	Northbridge Memory and Video functions	Memory and Video
I/O Hub (U8)	Intel	82801GBM (ICH7-M)	Southbridge I/O functions (HDD, Audio, USB, LAN, PCI)	I/O Functions
Super I/O (U12)	Winbond	W83627HF	Provides most of remaining I/O functions (FDD, COM 1 & 2 Serial Ports, KB, MS, LPT, Fan, IrDA)	I/O Functions
LPC (I/O) UART Controller (U9)	Fintek	F81216D	LPC controller for COM 3 & 4 Serial Ports	UART (I/O) Controller
Audio AC'97 CODEC (U16)	RealTek	ALC655	Audio '97 CODEC for audio In/Out signals	Audio In/ Out
Ethernet Controller (U14)	Intel	82573V	Gigabit Ethernet – This chip provides one independent 1000BaseT network channel	Giga LAN2 function
Ethernet Controller (U15)	Intel	82573V	Gigabit Ethernet – This chip provides one independent 1000BaseT network channel	Giga LAN1 function

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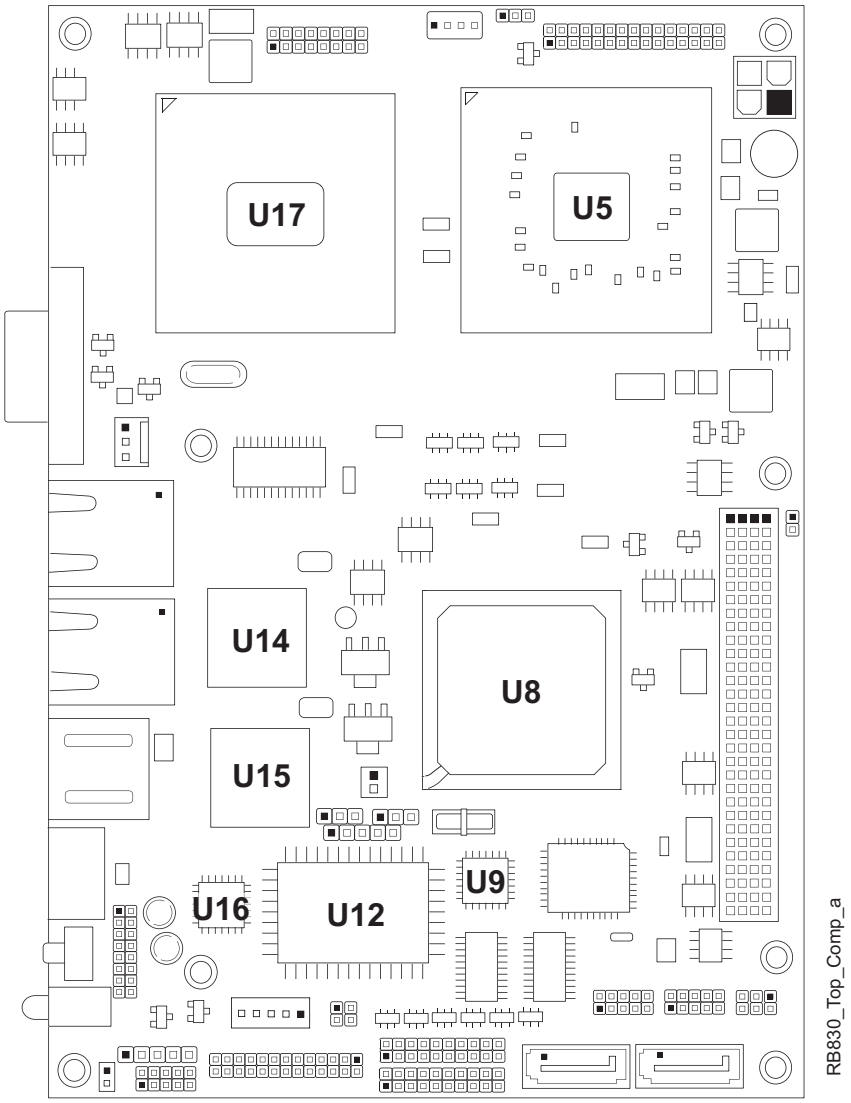


Figure 2-4. Component Locations

Header Definitions

Table 2-2 describes the headers and connectors shown in Figure 2-5.

Table 2-2. Header Descriptions

Jack #	Signal/Device	Description
BT1	RTC Battery (B1)	2-pin, 1.25 mm header for battery input
CN1	PCIe Mini Card LED	6-pin, 2 mm header for PCI Express Mini Card LED header wireless activity and connection signals
D7	Power and IDE Activity LEDs	Yellow diode indicates IDE activity, and green diode indicates power activity

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Table 2-2. Header Descriptions (Continued)

Jack #	Signal/Device	Description
DIMM1	SODIMM (on back of the board; see Figure 2-6 on page 13.)	200-pin socket for DDR2 SDRAM SODIMM
DIMM2	SODIMM (on back of the board; see Figure 2-6 on page 13.)	200-pin socket for DDR2 SDRAM SODIMM
J1	PC/104-Plus	120-pin, 2 mm standard connector for PCI bus
J2	USB 4 & 5	10-pin, 2 mm header for USB4 and USB5 ports
J3	LVDS Video	30-pin, 2 mm header for LVDS video displays
J4	USB 2 & 3	10-pin, 2 mm header for USB2 and USB3 ports
J5	TV Out	4-pin, 2 mm header for TV Out signals
J6	Serial A	20-pin, 2 mm header for serial ports 1 and 2 (COM 1 & COM 2)
J7	Serial B	20-pin, 2 mm header for serial ports 3 and 4 (COM 3 & COM 4)
J8	IrDA	5-pin, 2.54 mm header for IrDA signals
J9	PanelLink (for DVI)	16-pin, 2 mm header for PanelLink output (for DVI) from SDVO-PanelLink transmitter
J10	LPT	26-pin, 2 mm header for parallel printer or floppy disk drive
J11	Utility	5-pin, 2.54 mm header for external Power On Button, Reset, and (Beep) Speaker
J12	GPIO	10-pin, 2 mm header for Genral Purpose IO signals
J13	CPU Fan	3-pin, 2.54 mm header for CPU fan
J14	Audio Out	16-pin, 2 mm header for Audio Out signals
J15	Gigabit Ethernet	8-pin, 2.54 mm RJ45 connector with two LEDs for 10BaseT/ 100BaseTX/1000BaseT from U14 controller
J16	Gigabit Ethernet	8-pin, 2.54 mm RJ45 connector with two LEDs for 10BaseT/ 100BaseTX/1000BaseT from U15 controller
J17A/B	USB 0 & 1	8-pin, 2 mm standard connector for two 4-pin interfaces provides USB0 and USB1 output
J18	Keyboard/Mouse	6-pin, 2 mm PS/2 Keyboard/Mouse connector (dual output cable)
J19	Reset Switch	4-pin, push-button switch for hard reset
J20	Video (CRT VGA)	15-pin, 1.5 mm standard connector for output to a CRT monitor
J21	Compact Flash (on back of the board; see Figure 2-6 on page 13.)	50-pin, 1.27 mm, socket accepts Compact Flash cards (Type I or II)
J22	DNP	Do not populate
J23	SMBus	5-pin, 2 mm, SMBus header for external device connection
J24	ATX Power In	4-pin, 4.2 mm header for input power +12V, GND
Mini PCIE1	PCI Express Mini Card (on back of the board; see Figure 2-6 on page 13.)	52-pin, standard connector for PCI Express Mini Card functions
SATA1	Serial ATA	7-pin, 1.27 mm standard connector for serial ATA
SATA2	Serial ATA	7-pin, 1.27 mm standard connector for serial ATA

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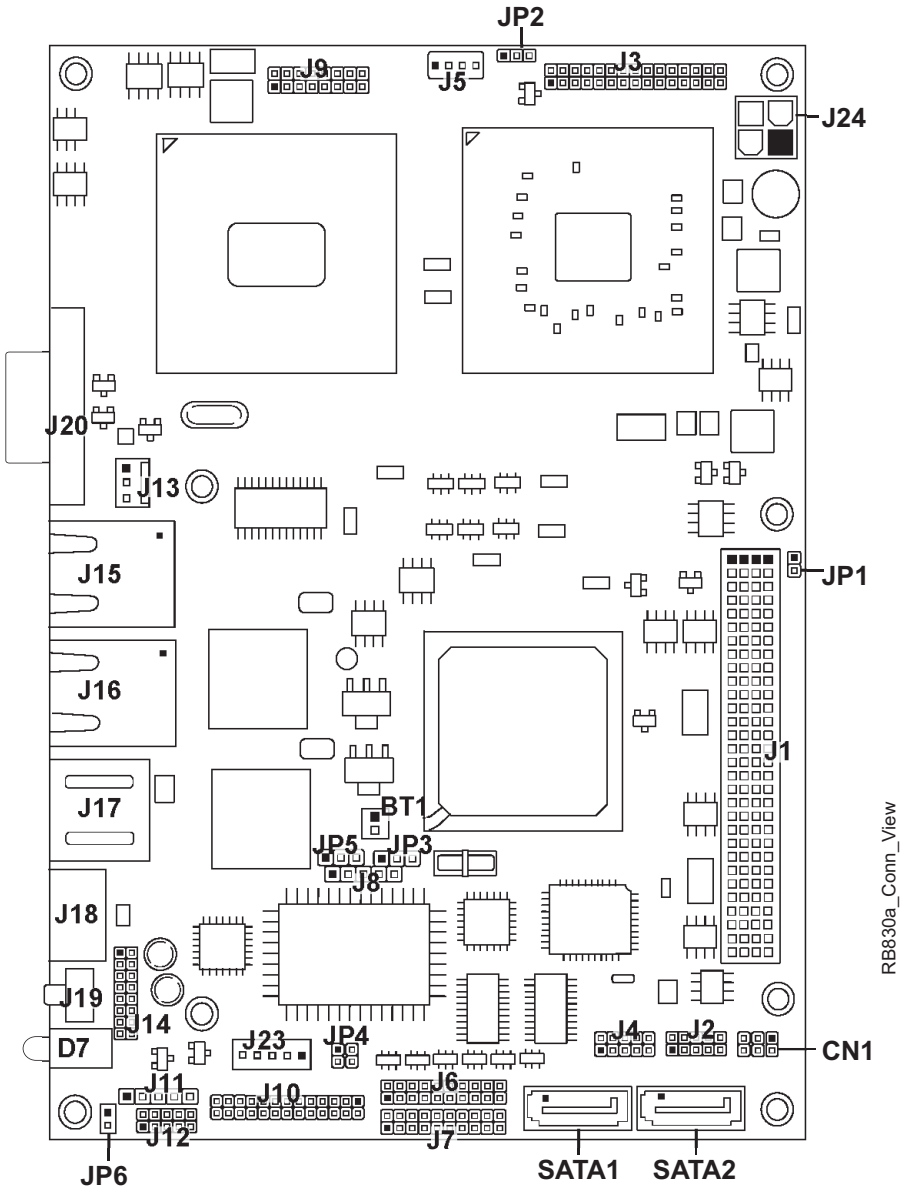


Figure 2-5. Connector and Header Locations

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

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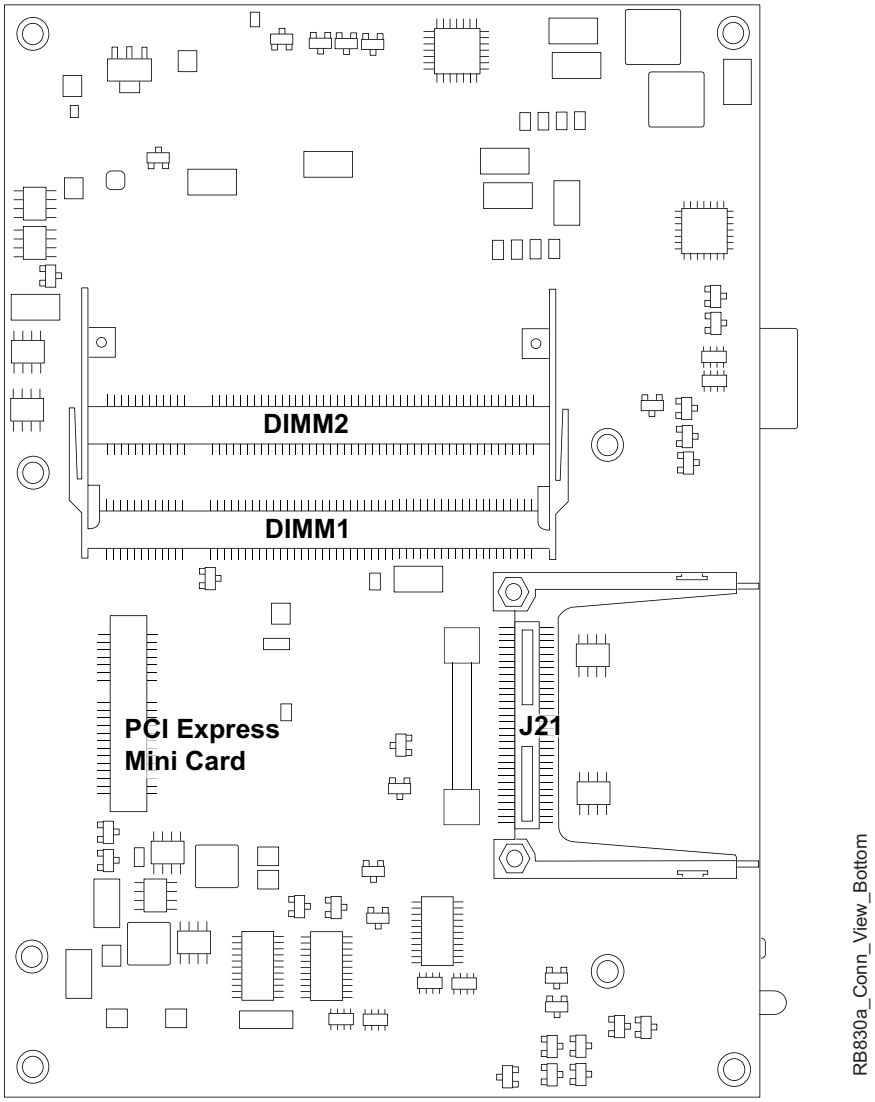


Figure 2-6. Connector Locations (bottom view)

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Jumper Definitions

Table 2-3 describes the jumpers shown in Figure 2-5 on page 12.

Table 2-3. Jumper Settings

Jumper #	Installed	Removed/Installed
JP1* – PC/104+ SERIRQ (SerialIRQ)	Enabled (pins 1-2)	Disabled (removed) **Default**
JP2 – LCD Voltage Select	Enable +3.3V (pins 1-2) **Default**	Enable +5V (pins 2-3)
JP3 – Real Time Clock (RTC)	Normal (pins 1-2) **Default**	Clear CMOS Setup (pins 2-3)
JP4 – Serial B (COM3) RS-485 Termination	Termination (pins 1-2)	No Termination (removed) **Default
JP4 – Serial B (COM4) RS-485 Termination	Termination (pins 3-4)	No Termination (removed) **Default
JP5 – Compact Flash Voltage Setup	Enable +3.3V (pins 1-2) **Default**	Enable +5V (pins 2-3)
JP6 – Power Supply Select	ATX (pins 1-2) **Default**	AT (removed)

*The ISA interrupts are required on pin 31 of the PCI-104 connector, when using the MiniModule ISA board. Use the ISA IRQ jumper (JP1) to enable ISA interrupts. For full PCI-104 compatibility, the jumper should be removed (default setting). Refer to the MiniModule ISA manual for more information.

**The jumper or shunt may be stored by connecting it to one of the pins for safe keeping.

Specifications

Power Specifications

Table 2-4 lists the power requirements for the ReadyBoard 830.

Table 2-4. Power Supply Requirements

Parameter	1.66GHz Core Duo Characteristics	1.07GHz Celeron M 423 Characteristics
Input Type	Regulated DC voltages	Regulated DC voltages
In-rush Current	5.80A (69.60W)	3.80A (45.60W)
Idle Power	1.80A (21.64W)	1.61A (19.28W)
BIT* Current	2.53A (30.37W)	2.28A (27.36W)

Operating conditions:

- In-rush operating configuration includes video, 1GB DDR RAM, and power.
- Idle operating configuration includes the in-rush configuration as well as one SATA hard drive with Windows XP, one floppy drive, one CompactFlash reader with 128MB CompactFlash card, keyboard, and mouse.
- *BIT = Burn-In-Test. Operating configuration includes idle configuration as well as four serial loop-backs, two Ethernet connections, six USB CompactFlash readers with 64MB CompactFlash, one additional SATA hard drive.

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Environmental Specifications

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

Table 2-5. Environmental Requirements

	Parameter	1.66GHz Core Duo Conditions	1.07GHz Celeron M Conditions
Temperature	Operating	0° to +60°C (+32° to +140°F)	0° to +60°C (+32° to +140°F)
	Storage	–20° to +75°C (–4° to +167°F)	–20° to +75°C (–4° to +167°F)
Humidity	Operating	5% to 90% relative humidity, non-condensing	5% to 90% relative humidity, non-condensing
	Non-operating	5% to 95% relative humidity, non-condensing	5% to 95% relative humidity, non-condensing

Thermal/Cooling Requirements

The CPU, Memory Hub (Northbridge), I/O Hub (Southbridge), and voltage regulators are the main sources of heat on the board. The ReadyBoard 830 is designed to operate at its maximum CPU speed of 1.66GHz. The I/O Hub and the Memory Hub require heatsinks, and the CPU requires a heatsink with a fan.

Physical Specifications

Table 2-6 lists the physical dimensions of the board, and Figure 2-7 on page 16 shows the dimensions of the I/O panel.

Table 2-6. Weight and Footprint Dimensions

Item	Dimension
Weight	0.20kg. (0.45lbs.)
Height (overall)	16.51mm (0.65")
Width	115mm (4.5")
Length	165mm (6.5")
Thickness	1.57mm (0.062")

NOTE Overall height is measured from the upper board surface to the highest permanent component (USB connector) on the upper board surface. This measurement does not include the heatsinks or fan available for this board.

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Mechanical Specifications

Figure 2-7 shows the I/O panel dimensions of the ReadyBoard 830.

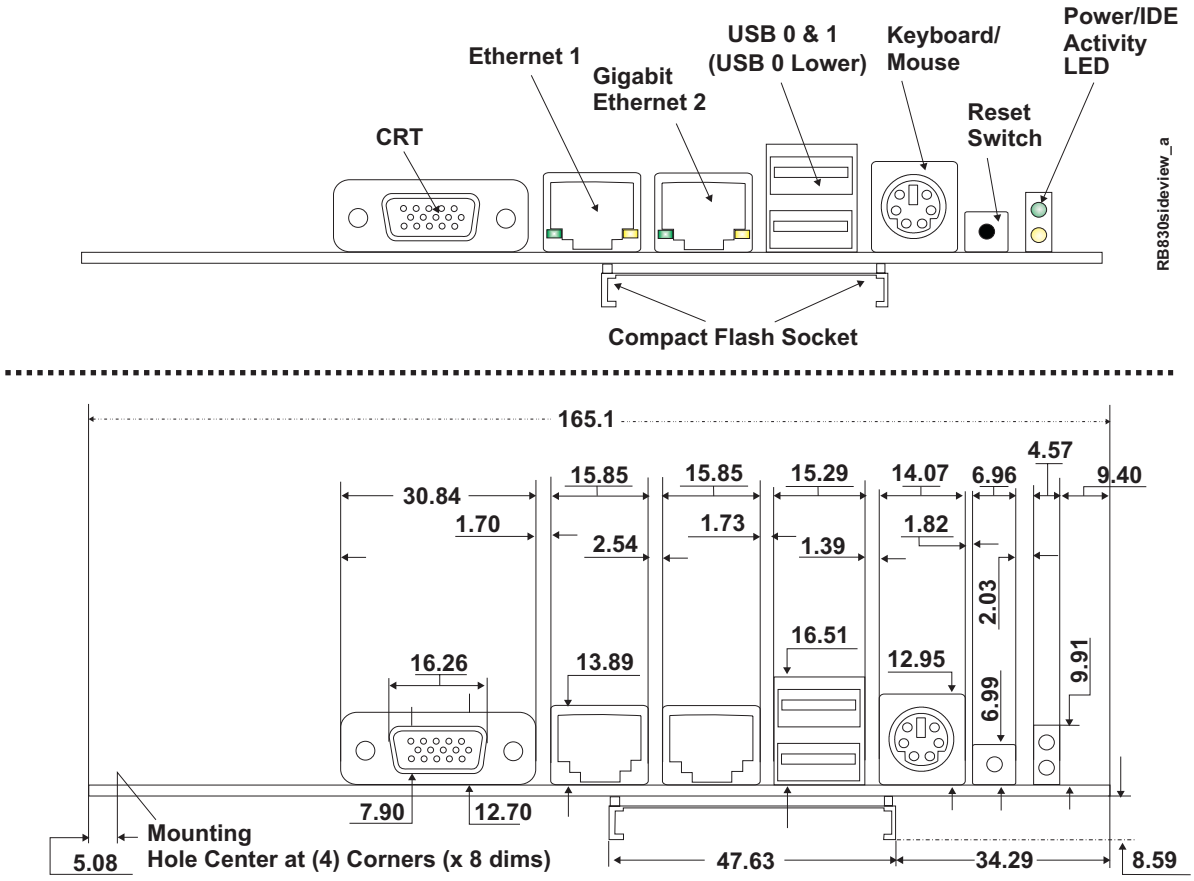


Figure 2-7. I/O Panel Dimensions

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Chapter 3 Hardware

Overview

This chapter discusses features of the ReadyBoard 830 in the following order:

- Interrupt Channel Assignments
- Memory Map
- I/O Address Map
- Floppy/Parallel Interface
- Serial Interfaces
- USB Interfaces
  - USB 2.0 Support
  - Legacy USB Support
- Audio Interface
- Video Interfaces
  - CRT
  - PanelLink
  - LVDS
  - TV Out
- Utility Interface
  - External Power-On Switch
  - External Reset Switch
  - External Speaker (Beep)
- Miscellaneous
  - Real Time Clock (RTC)
  - External Battery (BT1)
  - Temperature Monitoring
  - User GPIO Signals
  - Serial Console
  - Infrared (IrDA) Port
  - System Management Bus (SMBus)
  - Watchdog timer
- Power Interfaces
  - Power In
  - Optional CPU Fan

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- Power and Sleep States
  - Power-On Switch
  - Sleep States (ACPI)
  - Wake Up Activities

> **NOTE** Ampro Computers, Inc. supports only the features/options tested and listed in this manual. The main integrated circuits (chips) used in the ReadyBoard 830 may provide more features or options than are listed for the ReadyBoard 830, but some of these chip features/options are not supported on the board and may not function as specified in the chip documentation.

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	X															
Keyboard		X														
Secondary Cascade			X													
COM1				O	D											
COM2				D	O											
COM3						O						D				
COM4						D						O				
Floppy							X									
Parallel						O		D								
RTC									X							
IDE															D	O
Math Coprocessor														X		
PS/2 Mouse													X			
PCI INTA	Automatically Assigned															
PCI INTB	Automatically Assigned															
PCI INTC	Automatically Assigned															
PCI INTD	Automatically Assigned															
PCI INTE	Automatically Assigned															
PCI INTF	Automatically Assigned															
PCI INTH	Automatically Assigned															
USB	Automatically Assigned															
VGA	Automatically Assigned															
Ethernet	Automatically Assigned															

Legend: D = Default, O = Optional, X = Fixed

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

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Memory Map

The following table provides the common PC/AT memory allocations. These are DOS-level addresses. The OS typically hides these physical addresses by way of memory management. 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
000E0000h	-	000FFFFFh	System BIOS Area (Storage and RAM Shadowing)
00100000h	-	Top of DRAM	Extended Memory (If onboard 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. These are DOS-level addresses. The OS typically hides these physical addresses by way of memory management.

Table 3-3. I/O Address Map

Address (hex)	Subsystem
000-00F	Primary DMA Controller
020-021	Master Interrupt Controller
040-043	Programmable Interrupt Timer (Clock/Timer)
060-06F	Keyboard Controller
070-07F	CMOS RAM, NMI Mask Reg, RT Clock
080-09F	DMA Page Registers
092	Fast A20 gate and CPU reset
094	Motherboard enable
102	Video subsystem register
0A0-0BF	Slave Interrupt Controller
0C0-0DF	Slave DMA Controller #2
0F0-0FF	Math Coprocessor
1F0-1F8	IDE Hard Disk Controller
278-27F	Parallel Port
2E8-2FF	Serial Port 4 (COM4)
2F8-2FF	Serial Port 2 (COM2)
378-37F	Parallel Port (Standard and EPP)
3C0-3DF	VGA
3E8-3EF	Serial Port 3 (COM3)
3F0-3F7	Floppy Disk Controller
3F8-3FF	Serial Port 1 (COM1)

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

778-77A	Parallel Port (ECP Extensions) (Port 378+400)
CF8-CFF	PCIe bus Configuration Address and Data

Floppy/Parallel Interface (LPT)

The Super I/O controller (W83627HF) provides the floppy controller and the parallel port controller. The floppy controller and the parallel port controller share the same output connector (J10) on the board and the device selection is made in the BIOS Setup Utility.

- Floppy Port Controller supports one floppy drive in the standard formats, such as 360 kB, 720 kB, 1.2 MB, 1.44 MB, or 2.88 MB drives.
- Parallel Port controller supports standard parallel, Bi-directional, ECP and EPP protocols.

> **NOTE** Due to the multiplexed nature of the signals for the floppy and parallel ports, you can only connect one of these devices at a time. Refer to Chapter 4, BIOS Setup Utility later in this manual when selecting the floppy or parallel device in the BIOS Setup Utility. A reboot is necessary for the change of BIOS settings to take affect.

Table 3-4 describes the floppy/parallel port (J10) pin/signals with 26-pins, 2 rows, consecutive (1, 14) with 2 mm pin spacing.

Table 3-4. Floppy/Parallel Header Pin/Signal Descriptions (J10)

Pin #	Signal	Description
1	Strobe*	Parallel Strobe* – This is an output signal used to strobe data into the printer. I/O pin in ECP/EPP mode.
2	PD0	Parallel Port Data 0 – These pins (0 to 7) provide parallel port data signals.
	INDEX*	Floppy Index – Detects head positioned over the beginning of a track.
3	PD1	Parallel Port Data 1 – See pin-2 (PD0) for more information.
	TRK0*	Floppy Track 0 – Detects when head is positioned over track 0.
4	PD2	Parallel Port Data 2 – See pin-2 (PD0) for more information.
	WPRT*	Floppy Write Protect – Senses if diskette is write protected.
5	PD3	Parallel Port Data 3 – See pin-2 (PD0) for more information.
	RDATA*	Floppy Read Data – Raw serial bit stream from the drive for read operations.
6	PD4	Parallel Port Data 4 – See pin-2 (PD0) for more information.
	DSKCHG*	Floppy Disk Change – Senses when drive door is open or the diskette has been changed since the last drive selection.
7	PD5	Parallel Port Data 5 – See pin-2 (PD0) for more information.
8	PD6	Parallel Port Data 6 – See pin-2 (PD0) for more information.
9	PD7	Parallel Port Data 7 – See pin-2 (PD0) for more information.
10	ACK*	Parallel Acknowledge * – This is a status output signal from the printer. A Low State indicates it has received the data and is ready to accept new data.
	DS1*	Floppy Drive Select 1 – Select drive 1.
11	BUSY	Parallel Busy – This is a status output signal from the printer. A High State indicates the printer is not ready to accept data.
	MTR1*	Floppy Motor Control 1 – Select motor on drive 1.

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Table 3-4. Floppy/Parallel Header Pin/Signal Descriptions (J10) (Continued)

12	PE	Parallel Paper End – This is a status output signal from the printer. A High State indicates it is out of paper.
	WDATA*	Floppy Write Data – Encoded data to the drive for write operations.
13	PSLCT	Printer Select – This is a status output signal from the printer. A High State indicates it is selected and powered on.
	WGATE*	Floppy Write Enable – Drive signal to enable current flow in the write head.
14	AFD*	Parallel Auto Feed* – This is a request signal into the printer to automatically feed one line after each line is printed.
	DRVEN0*	Floppy Drive Density Select Bit 0
15	ERR*	Parallel Error – This is a error status output signal from the printer. A Low State indicates an error condition on the printer.
	HDSEL*	Floppy Head Select – Selects the side for Read/Write operations (0 = side 1, 1 = side 0)
16	PINIT*	Printer Initialize* – This signal is used to Initialize printer. Output in standard mode, I/O in ECP/EPP mode.
	DIR*	Floppy Direction – Direction of head movement (0 = inward motion, 1 = outward motion).
17	SLIN	Parallel Select In – This output signal to the printer is used to select the printer. I/O pin in ECP/EPP mode.
	STEP*	Floppy Step – Low pulse for each track-to-track movement of the head.
18	GND	Ground
19	GND	Ground
20	GND	Ground
21	GND	Ground
22	GND	Ground
23	GND	Ground
24	GND	Ground
25	GND	Ground
26	NC	Not Connected

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

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Serial Interfaces

The Super I/O (W83627HF) chip and the LPC UART controller (F81216D) provide the circuitry for the four serial ports. The Super I/O chip provides serial ports 1 and 2 through connector J6. The LPC UART controller provides serial ports 3 and 4 through connector J7. 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
  - Serial Port 1 (COM1) supports RS232 and full modem support
  - Serial Port 2 (COM2) supports RS232 and full modem support
- Serial B Interface
  - Serial Port 3 (COM3) supports RS232/RS485/RS422 and full modem support
  - Serial Port 4 (COM4) supports RS232/RS485/RS422

NOTE The RS232/RS485/RS422 modes are selected in BIOS Setup under the *Advanced/Super I/O Configuration* menu for Serial ports 3 (COM3) and 4 (COM4). However, the RS232 mode is the default (Standard) for any serial port.

RS485 mode termination is selected with jumper connector JP5, pins 1-2 (COM3), and pins 3-4 (COM4), when the RS485 mode is selected in BIOS Setup.

To implement the two-wire RS485 mode on serial ports 3 or 4, you must tie the equivalent pins together for the selected port.

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

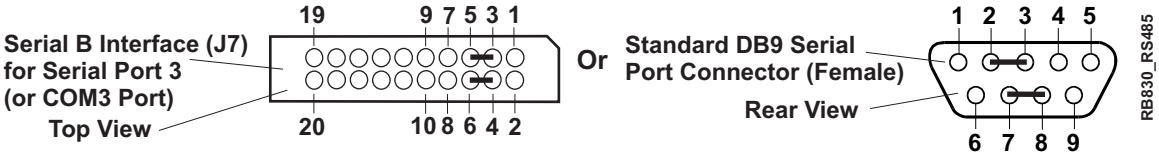


Figure 3-1. RS485 Serial Port Implementation

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Table 3-5. Serial A (COM1 and COM2) Interface Pin/Signal Descriptions (J6)

Pin #	Signal	Description
1	DCD1*	Data Carrier Detect 1 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open).
2	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	RXD1	Receive Data 1 – Serial port 1 receive data in
4	RTS1*	Request To Send 1 – Indicates Serial port 1 is ready to transmit data. Used as hardware handshake with CTS3 for low level flow control.
5	TXD1	Transmit Data 1 – Serial port 1 transmit data out
6	CTS1*	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.
7	DTR1*	Data Terminal Ready 1 – Indicates Serial port 1 is powered, initialized, and ready. Used as hardware handshake with DSR1 for overall readiness to communicate.
8	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	GND	Ground
10	NC	Not connected
11	DCD2*	Data Carrier Detect 2 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open).
12	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	RXD2	Receive Data 2 – Serial port 2 receive data in
14	RTS2*	Request To Send 2 – Indicates Serial port 2 is ready to transmit data. Used as hardware handshake with CTS2 for low level flow control.
15	TXD2	Transmit Data 2 – Serial port 2 transmit data out
16	CTS2*	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.
17	DTR2*	Data Terminal Ready 2 – Indicates Serial port 2 is powered, initialized, and ready. Used as hardware handshake with DSR2 for overall readiness to communicate.
18	RI2*	Ring Indicator 2 – Indicates external serial device is detecting a ring condition. Software initiates operation to answer and open the communications channel.
19	GND	Ground
20	NC	Not connected

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

Table 3-6. Serial B (COM3 and COM4) Interface Pin/Signal Descriptions (J7)

Pin #	Signal	Description
1	DCD3*	Data Carrier Detect 3 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open).

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Table 3-6. Serial B (COM3 and COM4) Interface Pin/Signal Descriptions (J7) (Continued)

2	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	RXD3	Receive Data 3 – Serial port 3 receive data in
	RX3-	RX3- – If in RS485 or RS422 mode, this pin is Receive Data 3 -.
4	RTS3*	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+	TX3+ – If in RS485 or RS422 mode, this pin is Transmit Data 3 +.
5	TXD3	Transmit Data 3 – Serial port 3 transmit data out
	TX3-	TX3- – If in RS485 or RS422 mode, this pin is Transmit Data 3 -.
6	CTS3*	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+	RX3+ – If in RS485 or RS422 mode, this pin is Receive Data 3 -.
7	DTR3*	Data Terminal Ready 3 – Indicates Serial port 3 is powered, initialized, and ready. Used as hardware handshake with DSR3 for overall readiness to communicate.
8	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	GND	Ground
10	NC	Not connected
11	DCD4*	Data Carrier Detect 4 – Indicates external serial communications device is detecting a carrier signal (i.e., a communication channel is currently open).
12	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	RXD4	Receive Data 4 – Serial port 4 receive data in
	RX4-	RX4- – If in RS485 or RS422 mode, this pin is Receive Data 4 -.
14	RTS4*	Request To Send 4 – Indicates Serial port 4 is ready to transmit data. Used as hardware handshake with CTS4 for low level flow control.
	TX4+	TX4+ – If in RS485 or RS422 mode, this pin is Transmit Data 4 +.
15	TXD4	Transmit Data 4 – Serial port 4 transmit data out
	TX4-	TX4- – If in RS485 or RS422 mode, this pin is Transmit Data 4 -.
16	CTS4*	Clear To Send 4 – Indicates external serial communications device is ready to receive data. Used as hardware handshake with RTS4 for low level flow control.
	RX4+	RX4+ – If in RS485 or RS422 mode, this pin is Receive Data 4 +.
17	DTR4*	Data Terminal Ready 4 – Indicates Serial port 3 is powered, initialized, and ready. Used as hardware handshake with DSR4 for overall readiness to communicate.
18	NC	Not connected
19	GND	Ground
20	NC	Not connected

Note: The shaded area denotes power or ground. Signals are listed in the following order: RS232 followed by RS485/RS422. The signals marked with * = Negative true logic.

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USB Interfaces

The I/O Hub (82801GBM) provides the USB solution for both legacy UHCI controller and EHCI controller (USB 2.0) support. The I/O Hub (Southbridge) contains port-routing logic that determines which controller (UHCI or EHCI) handles the USB data signals. The PC-style (or Standard) connector (J17) provides two of the six USB ports: USB0 and USB1. The J4 header provides USB2 and USB3, and J2 provides USB4 and USB5.

USB 2.0 Support

The I/O Hub (Southbridge) contains an Enhanced Host Controller Interface (EHCI) compliant host controller, which supports up to six high-speed USB 2.0 Specification compliant root ports. The higher speed USB 2.0 specification allows data transfers up to 480 Mbps using the same pins as the six full-speed/ low-speed USB UHCI ports. The I/O Hub (Southbridge) port-routing logic determines which of the controllers (UHCI or the EHCI) processes the USB signals.The USB 2.0 features implemented in the USB ports include the following:

- One EHCI host controller for all six USB ports
- Supports USB V2.0 Specification
- Over-current fuses, located on the board, where USB0 and USB1 share a single fuse (F1), USB2 and USB3 share a single fuse (F4), and USB4 and USB5 share a single fuse (F3).

Legacy USB Support

The I/O Hub (Southbridge) supports three USB Universal Host Controller Interfaces (UHCI) and each Host Controller includes a root hub with two separate USB ports each, for a total of six USB ports. The USB Legacy features implemented in the USB ports include the following:

- Three root hubs for six USB ports
- Support for USB v1.1 and UHCI v1.1 with integrated physical layer transceivers
- Improved arbitration latency for UHCI controllers
- UHCI controllers support Analog Front End (AFE) embedded cell instead of USB I/O buffers to allow for USB high-speed signaling rates
- Three shared over-current fuses, located on the board, are used on all six USB ports

USB2 and USB3

Table 3-7 describes USB 2 & 3, J4: 10-pins, 2 rows, odd/even (1, 2) with 2 mm pin spacing.

Table 3-7. USB 2 & 3 Interface Pin/Signal Descriptions (J4)

Pin #	Signal	Description
1, 2	VCC	USB Voltage – +5V through shared fuse (F4)
3	USBP2-	Universal Serial Bus Port 2 Data Negative
4	USBP3-	Universal Serial Bus Port 3 Data Negative
5	USBP2+	Universal Serial Bus Port 2 Data Positive
6	USBP3+	Universal Serial Bus Port 3 Data Positive
7, 8, 9, 10	GND	Ground

Note: The shaded area denotes power or ground.

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USB4 and USB5

Table 3-8 describes USB 4 & 5, J2: 10-pins, 2 rows, odd/even (1, 2) with 2 mm pin spacing.

Table 3-8. USB 4 & 5 Interface Pin/Signal Descriptions (J11)

Pin #	Signal	Description
1, 2	VCC	USB Voltage – +5V through shared fuse (F3)
3	USBP4-	Universal Serial Bus Port 2 Data Negative
4	USBP5-	Universal Serial Bus Port 3 Data Negative
5	USBP4+	Universal Serial Bus Port 2 Data Positive
6	USBP5+	Universal Serial Bus Port 3 Data Positive
7, 8, 9, 10	GND	Ground

Note: The shaded area denotes power or ground.

Audio Interface

The audio solution on the ReadyBoard 830 is provided by the I/O Hub, 82801GBM (Southbridge) and the on-board Audio CODEC (ALC655). These two chips use a digital interface to communicate between the two, which is defined by AC'97 and is revision 2.3 compliant. The input or output signals for the audio interface go through the 16-pin connector (J14), which has the respective audio connections, and are listed in Table 3-9.

Audio CODEC (ALC655) features

- AC'97 Rev 2.3 compliant
- 18-bit full duplex performance
- Variable sampling rate at 1Hz resolution
- Stereo (Left and Right) Line In
- Stereo (Left and Right) Line Out
- Microphone (mono) in
- PC Beep speaker signal also fed to CODEC for the Line Out (Left and Right) channels

Table 3-9. Audio Interface Pin/Signal Descriptions (J14)

Pin #	Signal	Description
1, 3	NC	Not Connected
2, 4, 7, 8, 11, 12, 13, 14, 16	GND_AUD	Audio ground
5	LINE_OUTL	Line Out signal left channel
6	LINE_OUTR	Line Out signal right channel
9	LINE_INL	Line in signal left channel
10	LINE_INR	Line in signal right channel
15	MICIN	Microphone signal in

Note: The shaded area denotes power or ground.

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Video Interfaces

The Memory Hub, 82945GME (Northbridge) provides the graphics control and video signals for traditional CRT monitors, PanelLink (DVI) high-resolution displays, and LVDS flat panel displays. The Memory Hub (Northbridge) features are listed below.

Support for 2D/3D graphics with extensive set of instructions including:

- 3D rendering and display
- BLT operations
- MPEG2 decode acceleration
- 3D overlay

CRT features:

- Support for an integrated 400-MHz, 24-bit RAMDAC to drive a progressive scan analog monitor and outputs to three, 8-bit DACs that provide the R, G, and B signals to the monitor
- Support for resolutions up to QXGA (2048x1536)
- Support for a maximum allowable video frame buffer size of 224MB UMA (Unified Memory Architecture)

PanelLink features:

- Lossless (digital) transmission of video signal
- Display hardware independence
- Plug and play capabilities (EDID and DDC2B)
- Digital and analog support in a single connector

LVDS Flat Panel features:

- Support for an integrated dual channel LFP Transmitter interface
- Support for LVDS LCD panel resolutions up to UXGA (1600X1200)
- Support for a maximum pixel format of 18 bpp with SSC supported frequency range from 25 MHz to 112 MHz (single channel/dual channel)

TV Out features:

- Support for three integrated 10-bit DACS
- Support for overscaling
- Provide NTSC/PAL
- Provide component, s-video, and composite output interfaces
- Support HDTV: 480p/720p/1080i/1080p

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PanelLink

This header allows the capacity to bring out the TMDS signals to a DVI (Digital Visual Interface) connector.

Table 3-10. PanelLink Pin/Signal Descriptions (J9)

Pin #	Signal	Description
1	TDC2+	TMDS Data 2+
2	VCC5	+5 Volt Power
3	TDC2-	TMDS Data 2-
4	HPDET	Hot Plug Detect
5	TDC1+	TMDS Data 1+
6	GND	Digital Ground
7	TDC1-	TMDS Data 1-
8	GND	Digital Ground
9	TDC0+	TMDS Data 0+
10	SDADDC	DDC Data
11	TDC0-	TMDS Data 0-
12	SCLDDC	DDC Clock
13	TLC+	TMDS Clock+
14	GND	Digital Ground
15	TLC-	TMDS Clock-
16	GND	Digital Ground

Note: The shaded area denotes power or ground.

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LVDS Interface (Low Voltage Differential Signaling)

Table 3-11. LVDS Interface Pin/Signal Descriptions (J3)

Pin #	Signal	Description	Line	Channel
1	VCC_INTRV	+12V source		
2	VCC_LCD	JP2 = +3.3 or +5V source		
3	GND	Ground	Gnd	
4	GND	Ground		
5	LVDSB_Clk+	Clock Positive Output	Clk	Channel 1
6	LVDSB_Clk-	Clock Negative Output		
7	LVDSB_Y3+	Not Connected	3	
8	LVDSB_Y3-	Not Connected		
9	LVDSB_Y2+	Data Positive Output	2	
10	LVDSB_Y2-	Data Negative Output		
11	LVDSB_Y1+	Data Positive Output	1	
12	LVDSB_Y1-	Data Negative Output		
13	LVDSB_Y0+	Data Positive Output	0	
14	LVDSB_Y0-	Data Negative Output		
15	LVD_BKLTCtl	Backlight Control		
16	LCD_EN	LCD Enable		
17	LVDS_Clk+	Data Positive Output	Clk	Channel 2
18	LVDS_Clk-	Data Negative Output		
19	LVDS_Y3+	Not Connected	3	
20	LVDS_Y3-	Not Connected		
21	LVDS_Y2+	Data Positive Output	2	
22	LVDS_Y2-	Data Negative Output		
23	LVDS_Y1+	Data Positive Output	1	
24	LVDS_Y1-	Data Negative Output		
25	LVDS_Y0+	Data Positive Output	0	
26	LVDS_Y0-	Data Negative Output		
27	LDDCCLK	Clock		
28	LDDCDATA	Data		
29	LBKTLEN	Backlight Enable		
30	NC	Not connected		

NOTE Pins 5-14 constitute 1st channel interface of two channels, or a single channel interface. Pins 17-26 constitute 2nd channel interface of two channels.

Note: The shaded area denotes power or ground.

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TV Out Header

Table 3-12. TV Out Pin/Signal Descriptions (J5)

Pin #	Signal	Description
4	TVDAC A	**TVDAC Channel A Output:** TVDAC_A supports the following: **Composite**: CVBS signal **Component**: Chrominance (Pb) analog signal
3	TVDAC B	**TVDAC Channel B Output:** TVDAC_B supports the following: **S-Video**: Luminance analog signal **Component**: Luminance (Y) analog signal
2	TVDAC C	**TVDAC Channel C Output:** TVDAC_C supports the following: **S-Video**: Chrominance analog signal **Component**: Chrominance (Pr) analog signal
1	GND	

Note: The shaded area denotes power or ground.

Utility Interface

- Power-On – This control signal externally is provided through a switch by connecting ground to pin 1 on the Utility header (J11).
- Reset Switch – This signal is provided externally through a switch by connecting ground to pin 3 on the Utility connector (J11). This signal line is shared with Reset Switch (J19).
- PC Beep Speaker – The output signals from the Southbridge (82801GBM) and the Super I/O (W83627HF) are fed to pin 5 of the Utility header (J11) through an OR circuit, and in conjunction with the +5V signal (pin 4), drives an external PC Beep speaker. The PC Beep speaker signal from the Southbridge is also fed to the on-board Audio CODEC to provide a PC Beep signal for the Line out connections.

Table 3-13. Utility Interface Pin/Signal Descriptions (J11)

Pin #	Signal	Description
1	PS_On	Power-On input (connect between pins 1 & 2)
2	GND	Ground
3	RST_SW	Reset Switch input or output (connect between pins 3 & 2)
4	+5V	+5 Volts
5	Speaker	PC Beep Speaker + Output (connect between pins 5 & 4)

Note: The shaded area denotes power or ground.

Miscellaneous

Real Time Clock (RTC)

The ReadyBoard 830 contains a Real Time Clock (RTC). The CMOS RAM is backed up with a Lithium Battery. If the battery is not present, a battery-free boot option in the BIOS completes the boot process and resets the clock to the default date and time.

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External Battery (BT1)

An external battery input connection is provided through the battery connector (BT1) for an external battery. The external battery is used to power the Real Time Clock. Ampro provides a small Lithium battery, affixed to the board and connected to the external battery connection (BT1). This small external Lithium battery serves as an on-board power source.

Temperature Monitoring

The Super I/O controller (W83627HF) performs the CPU temperature monitoring function.

> **NOTE** The ReadyBoard 830 requires heatsinks for the Northbridge and Southbridge and a heatsink with a fan for the CPU.

User GPIO Signals

The ReadyBoard 830 provides GPIO pins for custom use. The signals are routed to the J12 header, and the enable and initialize values are set in the BIOS. An example of how to use the GPIO pins resides in the Miscellaneous Source Code Examples on the ReadyBoard 830 Support Software DVD.

The example program can be built by using the *make.bat* file. This produces a 16-bit DOS executable application, *gpio.exe*, which can be run on the ReadyBoard 830 to demonstrate the use of GPIO pins. For more information about the GPIO pin operation, refer to the Programming Manual for the Super I/O (W83627HF) controller at:

http://www.nuvoton-usa.com/products/winbond_products/pdfs/PCIC/W83627HF_HGb.pdf

Table 3-14. User GPIO Signals Pin/Signal Descriptions (J12)

Pin #	Signal	Description
1	GND	Ground
2	VCC	+5 Volts DC +/ 5%
3	XOUT0	User defined
4	XOUT1	User defined
5	XOUT2	User defined
6	XOUT3	User defined
7	XIN0	User defined
8	XIN1	User defined
9	XIN2	User defined
10	XIN3	User defined

Note: The shaded area denotes power or ground.

Serial Console

The ReadyBoard 830 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.

Infrared (IrDA) Port

The Infrared Data Association (IrDA) signals pass through a two-way communications header for an external IrDA device using infrared as the transmission medium. 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.

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The IrDA (HPSIR and ASKIR) signals share the same header as the IrDA model select signals. These signals are operating system (OS) and/or application dependent and are based on the user's application, but can be configured and enabled in the BIOS Setup Utility.

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 controller (W83627HF) specifications available from the manufacture's web site and referred to earlier in this manual. For more information, refer to the W83627HF 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 W83627HF chip specifications by Winbond.

Table 3-15. Infrared (IrDA) Interface Pin/Signal Descriptions (J8)

Pin #	Signal	Description
1	VCC	+5 volts
2	IRTX	IR Transmit Data
3	CIRRX	IR Mode Select
4	IRRX	IR Receive Data
5	GND	Ground

Note: The shaded area denotes power or ground.

System Management Bus (SMBus)

The I/O Hub (Southbridge) chip (82801GBM) 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 header (J23). The master contained in the I/O Hub is used to communicate with the SODIMM EPROM, Super I/O, Ethernet 1 and 2, and the clock generator. Table 3-16 lists the device name and corresponding reserved binary addresses on the SMBus. Table 3-17 lists the SMBus pin/signals on 5-pins, 1 row, 2 mm pin spacing on the external SMBus header (J23).

Table 3-16. SMBus Reserved Addresses

Component	Address Binary
SODIMM EPROM	$1010{,}000x_b$
Clock Generator (ICS950201)	$1101{,}001x_b$
I/O Hub (82801DBM)	$1000{,}100x_b$
I/O Hub (82801DBM)	$0001{,}000x_b$

Note: The I/O Hub has two reserved addresses.

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Table 3-17. SMBus Signals Pin/Signal Descriptions (J23)

Pin #	Signal	Description
1	VCC5Dual	+5V standby voltage
2	SMBCLK	SMBus Clock
3	SMBDATA	SMBus Data
4	SMBALERT*	SMBus Alert
5	GND	Ground

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

PCI Express (PCIe) Mini Card LED

The I/O Hub (Southbridge) chip (82801GBM) provides PCIe Mini Card LED signals for wireless activity and connection. Table 3-18 lists the PCIe Mini Card LED pin/signals on 6 pins, 2 rows, 2 mm pin spacing on header CN1.

Table 3-18. PCIe Mini Card LED Signals Pin/Signal Descriptions (CN1)

Pin #	Signal	Description
1	LED WPAN*	Personal Area Network signal
2	VCC3	+3V voltage
3	LED WLAN*	Local Area Network signal
4	VCC3	+3V voltage
5	LED WWAN	Wide Area Network signal
6	VCC3	+3V voltage

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

Watchdog Timer

The watchdog timer (WDT) restarts the system if a mishap occurs. Possible problems include failure to boot properly, the application software's loss of control, 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 the Boot Settings of BIOS Setup. Set the WDT for a time-out interval in seconds, between 1 and 255, in one second increments. Ensure you allow enough time for the operating system (OS) to boot. The OS or application must tickle the WDT before the timer expires.

- During System Operation – An application can set up the WDT hardware through a BIOS call, or by accessing the hardware directly. Some Ampro Board Support Packages provide an API interface to the WDT. The application must tickle the WDT before the timer expires or the system will be reset. The BIOS implements interrupt 15 function 0C3h to manipulate the WDT.

- Watchdog Code examples – Ampro has provided source code examples on the ReadyBoard 830 Support Software DVD illustrating how to control the WDT. (Refer to the WDT Readme file in the *Miscellaneous Source Code Examples* on the ReadyBoard 830 Support Software DVD.)

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Power Interfaces

The ReadyBoard 830 uses various voltages onboard, but only one voltage is required externally (+12 volts) through the external connector. All onboard voltages, including the CPU core voltages, are derived from the externally supplied +12 volts DC +/- 5%.

Power In Header

Table 3-19 lists the pin signals for Power In header (J24).

Table 3-19. Power In Pin/Signal Descriptions (J24)

Pin #	Signal	Description
1	GND	Ground
2	GND	Ground
3	+12V	+12.0 volts DC +/- 5%
4	+12V	This pass through +12 voltage is primarily for PCI-104 bus power, and LCD power (may also be backlight power).

Note: The shaded area denotes power or ground. The +12V on pin 4 is used for the LVDS (LCD panel), PCI-104 Bus, and optional ISA Bus power, but may also be supplied externally.

CPU Fan

The ReadyBoard 830 provides a CPU fan header for those environmental situations that may require additional cooling.

Table 3-20. CPU Fan Header Pin/Signal Descriptions (J13)

Pin #	Signal	Description
1	DET	Fan Speed Detect – This is the fan speed tachometer signal.
2	+12	+12 volts DC +/- 5%
3	GND	Ground

Note: The shaded area denotes power or ground.

Power and Sleep States

The following information applies to the ReadyBoard 830 only if an ATX power supply is used to provide power. If a non-ATX power supply is used, the ReadyBoard 830 is controlled only by the Power On/Off switch on the power supply and the various sleep states are not available.

Power On Switch

The Power On switch turns the ReadyBoard 830 and its attached power supply to a fully On condition, if you are using an ATX power supply. Normally—if the operating system (OS) supports sleep states—the OS will turn off the ReadyBoard 830 and its power supply during the OS shut down process. If the OS supports sleep states, the Power On Switch will also transition the ReadyBoard and its power supply between a fully Powered On state, various sleep states depending on the OS control setting, and a fully Powered Off state. If the OS does not support sleep states, then the Power On Switch only turns on or off power to the ReadyBoard 830.

The sleep states are OS dependent and not available if your OS does not support power management based on the ACPI standard. An OS supporting ACPI will allow the Power On Switch to be configured through a user interface.

The Power On Switch is provided externally by connecting a momentary switch between pins 1 and 2 on the Utility connector (J11). The Power On signal occurs when ground is placed on pin 2 of J11.

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Sleep States (ACPI)

The ReadyBoard 830 supports the ACPI (Advanced Configuration and Power Interface) standard, which is a key component of certain Operating Systems' power management. The supported features (sleep states) listed here are only available when an ACPI-compliant OS is used for the ReadyBoard, such as Windows 2000/XP. The term "sleep" state refers to a reduced power consumption state, which can be re-started (awakened), restoring full operation to the ReadyBoard 830.

In these various sleep states, the ReadyBoard 830 appears to be off, indicated by such things as no display on the attached monitor and no activity for the connected CD-ROM or hard drives. However, when the ReadyBoard 830 detects certain types of activity (i.e. power button, mouse, keyboard, or LAN activity), it returns to a fully operational state. The type of activity detected is based on those supported by the ReadyBoard 830.

The ReadyBoard 830 supports at least four ACPI power states, depending on the operating system used and its ability to manage sleep states. Typically, the Power On switch is used to wake up from a sleep state, or transition from one state to another, but this is dependent on the operating system.

- 1st state is normal Power-On (S0).
  - To go to a fully powered on state, the ReadyBoard 830 must either be powered Off (S5), or in a sleep state (S1 or S4), and then the Power On/Off switch is pressed for less than 4 seconds (default).
  - The ReadyBoard 830 can transition from this state (S0) to the various states described below, depending on the power management capability of the OS and how it is programmed.
- 2nd state is a standby state (S1).

  In this state, no internal operations take place except for the internal RTC (real time clock) and the contents of RAM. This typically includes no activity for the CPU, CD-ROM, or hard disk drives. The CPU may be active, and the peripheral devices may power down if no signals occur or power to the device(s) is not provided. The ReadyBoard 830 appears to be off including the Power-On LED.
  - Normally, to enter this sleep state, the ReadyBoard 830 must be fully powered on (S0) while the OS transitions the ReadyBoard into this standby state (S1) under user control.
  - To exit this sleep state, typically the power button is used to wake up the ReadyBoard 830 to restore full operation, including the Power-On LED. Typically, pressing the power switch for less than 4 seconds (default) will restore full operation.
- 3rd state is Suspend to RAM or Standby [Windows] (S3).

  In this state, main memory (RAM) and the internal RTC (real time clock) are the only devices where power is maintained. This state (Suspend to RAM) stores the state of the operating system prior to shutdown including all open applications and open documents, etc. in main memory. This allows users to resume their work exactly where they left off just prior to entering this state (S3) when the system restores power and the contents of main memory.

  This state takes longer to restore and uses less power than S1 or S2, but if AC power is completely lost, the contents of main memory (RAM), including any changes to documents or data stored in RAM during S3, is also lost.
  - To enter the Suspend to RAM (S3) or Standby state, the computer must be fully powered on and the OS transitions the computer into this sleep state under user control.
  - To exit this sleep state, typically pressing the Power On switch for less then 4 seconds (default) will restore full operation.
- 4^{th} state is a hibernate or suspend-to-disk state (S4).

  In this state, no internal operations take place, except for the internal RTC. This includes no activity for the CPU, CD-ROM, or hard disk drives. The ReadyBoard 830 appears to be off, including the external Power-On LED if connected. Your system will take longer to wake-up in this sleep state, however, since your data is saved to the disk, it is more secure and should not be lost in the event of a power failure.
  - To enter a hibernate or suspend-to-disk state, the ReadyBoard 830 must be fully powered on while the OS transitions the ReadyBoard 830 into this sleep state (S4) under user control.

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- To exit this sleep state, typically pressing the power switch for less than 4 seconds (default) will restore full operation.

- 5th state is the normal power off or shutdown (S5).

  All activity stops, except the internal clock, if there is a backup battery installed. Removing the power cord from the power source ensures all activity is stopped, except the internal clock.

  - To go to a fully powered down state, the ReadyBoard 830 must either be powered on, or in a sleep state, and then the Power On/Off switch is pressed for more than 4 seconds.
  - To go to a fully powered up state, press the power switch for less than 4 seconds (default) and full operation is restored.

The OS may provide additional programming features to change the activation time for each state, and to shutdown or transition the ReadyBoard 830 at certain times, depending on the way the OS interface is programmed. Refer to the OS vender's documentation for power management under the ACPI standard.

NOTE Some operating systems use the keyboard, mouse, Wake-on-Ring (serial port), and Wake-on-LAN (Ethernet port) as an activity to wake up the system from a sleep state. Refer to Table 3-21 for the wake up activity conditions supported by the ReadyBoard 830.

Wake Up Activities

The wake up events listed in Table 3-21 can be used to wake up the ReadyBoard 830 from any of the supported sleep states mentioned above.

Table 3-21. Wake Up Activities and Conditions

Signal/Device	Condition
Power On Switch	If the Power-On switch is pressed for more than 4 seconds, the system will wake up from any of the sleep states.
Ethernet Ports (2) (LAN Ports)	If Wake On LAN is [Enabled], then the system will wake from one of the sleep states through direct addressing, magic packets, or link status changes.
PS/2 Keyboard & Mouse	If you use a PS/2 keyboard or mouse, any activity from the keyboard or mouse could wake the system.
USB Devices	If you use a USB keyboard or mouse instead of a PS/2 device, the USB device could wake the system.
Serial Ports (2)	If Wake On Ring is [Enabled], then Serial Ports 1 and 2 can be used to wake the system.

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Chapter 4 BIOS Setup

Introduction

This section assumes the user is familiar with general BIOS Setup. Refer to the appropriate PC reference manuals for information about the on-board ROM-BIOS software interface. If Ampro has added to or modified the standard functions, these functions will be described.

Entering BIOS Setup (VGA Display)

To access BIOS Setup using a VGA display for the ReadyBoard 830:

1. Turn on the VGA monitor and the power supply to the ReadyBoard 830.
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 *Quick Boot* is [Enabled], you may not see this prompt appear on screen. If this happens, press the <Del> key early in the boot sequence to enter BIOS Setup.

3. Follow the instructions on the right side of the screen to navigate through the selections and modify any settings.

Entering BIOS Setup (Remote Access)

This section describes how to enable the Remote Access in VGA mode and enter the BIOS setup through a serial terminal or PC.

1. Turn on the power supply to the ReadyBoard 830 and enter the BIOS Setup Utility in VGA mode.
2. Set the BIOS feature *Remote Access Configuration* to [Enable] under the **Advanced** menu.
3. Accept the default options or make your own selections for the balance of the Remote Access fields and record your settings.
4. Ensure you select the type of remote serial terminal you will be using and record your selection.
5. Select *Save Changes and Exit* and then shut down the ReadyBoard 830.
6. Connect the remote serial terminal (or the PC with communications software) to the COM port you selected and recorded earlier in the BIOS Setup Utility.
7. Turn on the remote serial terminal or PC and set it to the settings you selected in the BIOS Setup Utility.

   The default settings for the ReadyBoard 830 are:

   - COM1
   - 115200
   - 8 bits
   - 1 stop bit
   - no parity
   - no flow control
   - [Always] for *Redirection After BIOS POST*
8. Restore power to the ReadyBoard 830 and look for the screen prompt shown below.

```
Press <space bar> to update BIOS
```


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9. Press the F4 key to enter Setup (early in the boot sequence if *Quick Boot* is set to [Enabled].)

   If *Quick Boot* is set to [Enabled], you may never see the screen prompt.

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

> **NOTE** The serial console port is not hardware protected. Diagnostic software that probes hardware addresses may cause a loss or failure of the serial console functions.

OEM Logo Utility

The ReadyBoard 830 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 Image Requirements

The user's image may be customized with any image editing tool, and the system will automatically convert the image into an acceptable format to the tools (files and utilities) provided by Ampro. The ReadyBoard 830 OEM Logo utility supports the following image formats:

- Bitmap image
  - 16-Color, 640x480 pixels
  - 256-Color, 640x480 pixels
- JPG image
  - 16-Color, 640x480 pixels
  - 256-Color, 800x600 pixels
  - 256-Color, 1024x768 pixels
- PCX image
  - 256-Color, 640x480 pixels
- A file size no larger than sample image

> **NOTE** For procedures on loading custom images, see the OEM Logo Utility document available on the Ampro web site.

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Appendix A Technical Support

Ampro Computers, 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 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 web site at http://ampro.custhelp. 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. Once you have submitted your request, you must log in to go to My Stuff area 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 web site at http://www.ampro.com. However, you must sign up online before you can login to access this service.

  The InfoCenter was created as a resource for embedded system developers to share Ampro'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	Ampro Computers, Incorporated 5215 Hellyer Avenue San Jose, CA 95138-1007, USA

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