



COM Express™ Baseboard (EBX) Reference Manual

P/N 5001835A Revision A

Notice Page

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Ampro Computers, Incorporated
5215 Hellyer Avenue
San Jose, CA 95138-1007
Tel. 408 360-0200
Fax 408 360-0222
www.ampro.com
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Audience Assumptions

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. Ampro Computers, Inc. assumes you are qualified in designing and implementing your hardware designs and its related software into your prototype computer equipment.

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Chapter 1 About this Manual

Introduction

This manual is for designers of systems based on Ampro's COM family of embedded processors. This manual contains information regarding the use of Ampro's RoHS compliant COM Express Baseboard when used as connection platform for an Ampro Computer-on-Module (COM) product. The COM Express Baseboard is supplied by Ampro with each COM QuickStart Kit, which provides both a reference design and "gold" environment for developing COM Express Baseboards.

Purpose of this Manual

This manual provides designers of systems based on a COM Express module with reference material for using the COM Express Baseboard as a development, test, and debug platform.

Information provided in this reference manual includes:

- COM Express Baseboard hardware specifications
- Major integrated circuits
- COM Express Baseboard connector/pin numbers and definitions
- COM Express Baseboard integration details with COM Express modules and any peripheral equipment

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
- COM Express module specific information

Reference Material

The following list of reference material may be helpful for you to complete your evaluation and development successfully. Most of this reference material is also available on the support software CD-ROM or DVD provided with each QuickStart kit, or on Ampro's InfoCenter web page. The InfoCenter was created for embedded system developers to share Ampro's knowledge, insight, and expertise.

Specifications and Manuals

- EBX Specification Revision 1.1, 2005
Web site: <http://www.pc104.org>
- COM Express Design Guide
Web site: <http://www.ampro.com>
- PCI 2.2 Compliant Specifications
For copies of the PCI specifications, contact the PCI Special Interest Group Office at:
Web site: <http://www.pcisig.com>
- EBX drawings
Web site: <http://www.ampro.com>

NOTE Check the Ampro web site at www.ampro.com , for the latest version of these Ampro documents.

Major Integrated Circuit (Chip) Specifications used in the COM Express Baseboard design

- Intel Corp. and the 82572EI Gigabit Ethernet controller:
Web site: <http://www.intel.com>
- SMSC and the SCH3114I-NU LPC Super I/O controller:
Web site: <http://www.smsc.com>
- Realtek and the ALC888 Audio Codec
Web site: <http://www.realtek.com.tw>
- Agere Systems and the L-FW32207T100-DB 1394 controller
Web site: <http://www.lsi.com>
- Chrontel, Inc. and the CH7308A-TF SDVO to LVDS transmitter
Web site: <http://www.chrontel.com>
- Chrontel, Inc. and the CH7307C-DEF SDVO to PanelLink transmitter
Web site: <http://www.chrontel.com>

Chapter 2 Product Overview

This introduction presents general information about the COM Express Baseboard and the COM Express Concept. After reading this chapter you should understand more about the following items:

- COM Express Concept and Development Approach
- COM Express Baseboard Features
- COM Express Baseboard Block Diagram
- Components
- Headers and Jumpers
- Specifications (Physical, Power, Environmental, Mechanical)

COM Express Concept

Embedded system designers face increasing pressures to bring products to market quickly. Many products that once incorporated a custom CPU design can no longer afford the time to develop and debug a custom CPU let alone port operating system software to it. Furthermore, CPU subsystem design usually plays a small part in providing any uniqueness to an embedded product. The remainder of the embedded product design adds key circuits that provide a unique product and differentiate it from other products serving the same market. The challenge is to speed these designs to market by eliminating the need for a custom CPU design while providing the flexibility to include all critical elements, which make the embedded product unique.

The COM Express module provides an off-the-shelf CPU subsystem that can be included in virtually any embedded system. COM Express modules work like high-integration chips, plugging into your custom circuit board design to provide specific control for your logic application. See [Figure 2-1](#).

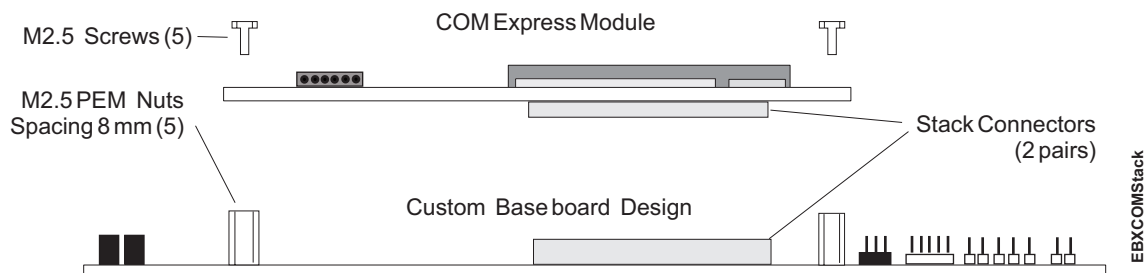


Figure 2-1. COM Express Baseboard and COM Express Board Assembly

COM Express provides a simple, standard interface, independent of the x86 processor used. The COM Express interface includes the industry-standard COM Express bus, I/O signals from the peripheral components on the COM Express module, power, and ground. Visit the Ampro web site (www.ampro.com) for the latest COM Express module processor availability and support information.

The standard COM Express interface lets you try different processors in your actual product environment with the ability to defer a processor choice until late in the project if you so choose. The interface also lets you easily offer different versions of your product with different capabilities by either selecting different COM Express modules for the same baseboard, or by designing different baseboards for the same CPU. This concept allows you to upgrade by selecting a more powerful CPU without baseboard redesign or by enhancing the baseboard without touching the CPU subsystem or the bulk of the applications software.

The COM Express flexibility enables designers to take an accelerated, low risk path by using proven COM Express module designs. Your design flow might look similar to the one shown in [Figure 2-2](#). This diagram gives a typical design flow of hardware and software functions.

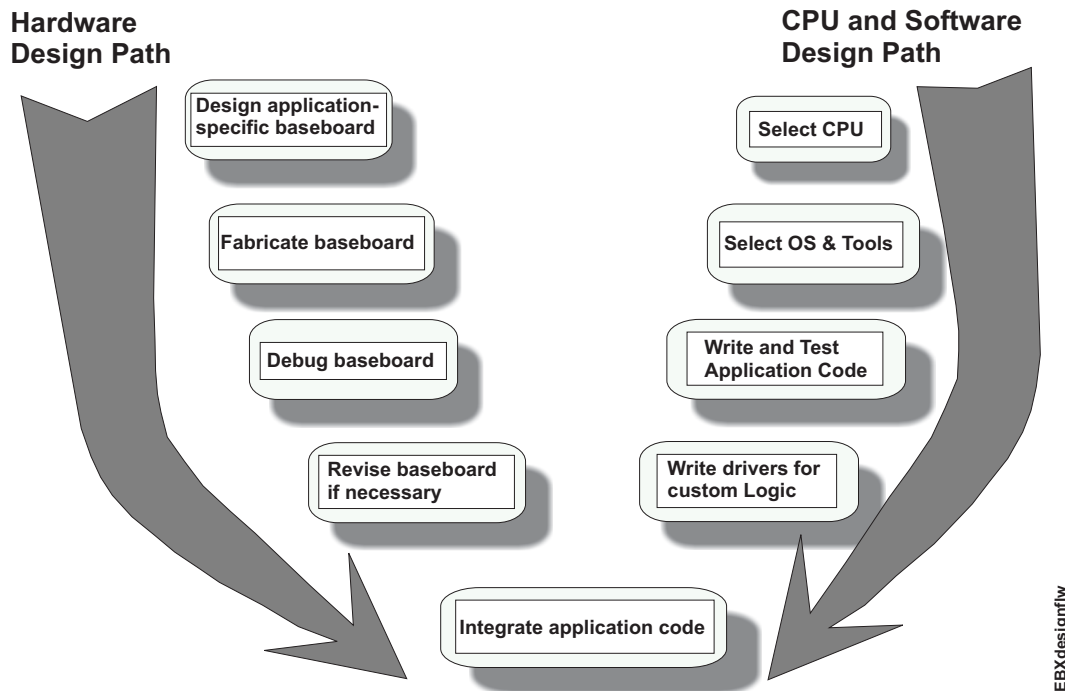


Figure 2-2. Typical Design Flow

Product Description

The Ampro COM Express Baseboard is the host baseboard for Ampro's COM Express modules and serves as reference design or "gold board" for the COM Express modules. The EBX module plugs directly into the COM Express Baseboard where the baseboard becomes a design platform for testing and developing your applications.

The Ampro COM Express Baseboard supports connections for a keyboard, mouse, LPT parallel port, eight USB ports, four serial ports, one IDE header (2.54 mm), CompactFlash socket, five video headers, and three audio headers. The COM Express Baseboard also includes connections for a 10BaseT/100BaseTX/1000BaseT Ethernet port. Refer to the following items for a more complete feature list.

Baseboard Features

The COM Express Baseboard includes the following features:

- Provides COM Express 8 mm interface height (J33A-B and J33C-D) connectors
- IDE interface channel (supporting two devices)
 - ♦ Provides 40-pin, 0.1 in connector (1) on IDE
 - ♦ Provides CompactFlash socket on primary IDE
 - ♦ Supports Type I and II CompactFlash cards
- Parallel Printer (LPT) interface
- Serial Port interfaces (4)
 - ♦ Provides Full Modem RS-232 and RS422/485 on serial ports 1 and 2
 - ♦ Provides RS-232 on serial ports 3 and 4
- PS/2 Keyboard and Mouse ports
 - ♦ Provides Keyboard and Mouse header

- USB interfaces (4 headers for 7 ports)
 - ♦ Provide one USB header for Ports 0 & 1
 - ♦ Provide one USB header for Ports 2 & 3
 - ♦ Provide one USB header for Ports 4 & 5
 - ♦ Provide one USB header for Port 6 (Port 7 is dedicated to Mini PCIe)
- Ethernet interface
 - ♦ Provides Gigabit Ethernet in standard RJ-45 connectors
 - ♦ Provides Activity/Link and Speed LED on Ethernet connectors
 - ♦ Provides Ethernet Magnetics on baseboard
- Audio interfaces and options
 - ♦ Supports HD Audio and AC'97 (Rev 2.1 standard)
 - ♦ Provides Line In (2), Line Out, and MIC In
- Video interfaces (5)
 - ♦ Provides CRT (VGA) Interface
 - ♦ Provides two LVDS Interfaces
 - ♦ Provides one TV-Out Interface
 - ♦ Provides one PanelLink (DVI) Interface
- Power interface
 - ♦ Provides ATX power supply In (all standard voltages available to baseboard headers)
 - +12 Volts needed to power COM Express module
- Fan headers
- SATA interfaces
 - ♦ Provides two SATA ports

Block Diagram

Figure 2-3 shows the functional components of the COM Express Baseboard.

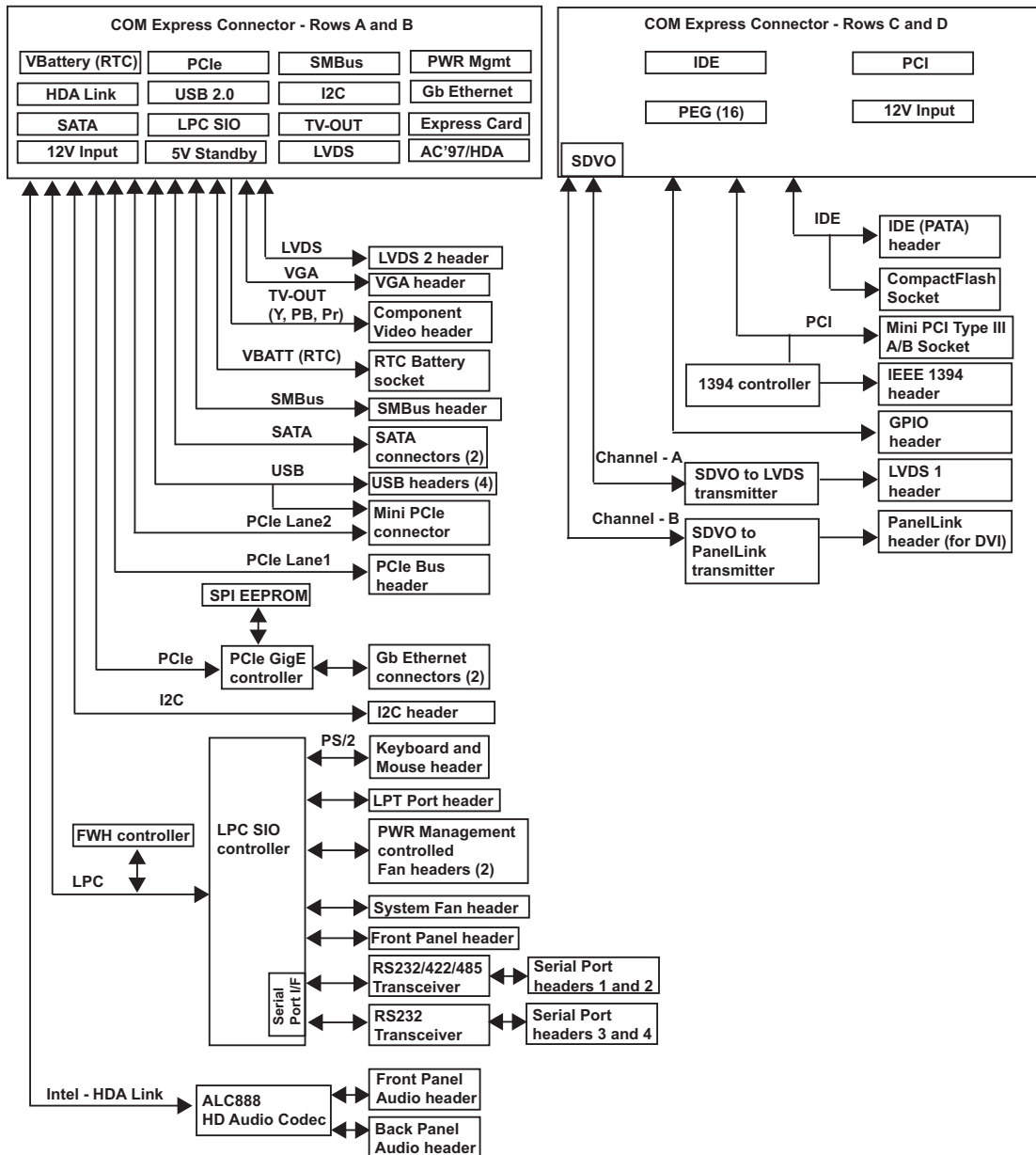


Figure 2-3. Simplified Block Diagram

Major Components (ICs)

Table 2-1. Major Components (ICs)

Chip Type	Mfg.	Model	Description
Ethernet Controller (U1)	Intel	82572EI	Provides Gigabit Ethernet with fully integrated Gigabit Ethernet Media Access Control (MAC) and Physical Layer (PHY) port.
LPC Super I/O Controller (U5 - on back of the board; see Figure 2-7 on page 12.)	SMSC	SCH3114I-NU	Provides Low Pin Count (LPC) interface with 3.3 volt operation.
Audio Codec (U10)	Realtek	ALC888	Provides ten DAC channels that simultaneously support 7.1 sound playback, plus 2 channels of independent stereo sound output (multiple streaming) through the back panel stereo outputs.
1394 Controller (U11)	Agere Systems	L-FW32207 T100-DB	Provides a high-performance, PCI-based controller for open host implementation of IEEE 1394a compliant systems or devices.
SDVO-LVDS Transmitter (U13 - on back of the board; see Figure 2-7 on page 12.)	Chrontel, Inc.	CH7308A-TF	Provides display control which accepts digital graphics input signals and upscales, encodes, and transmits data to an LCD panel.
SDVO-PanelLink Transmitter (U15 - on back of the board; see Figure 2-7 on page 12.)	Chrontel, Inc.	CH7307C-DEF	Provides display control which accepts digital graphics input signals and upscales, encodes, and transmits data to a DVI panel.

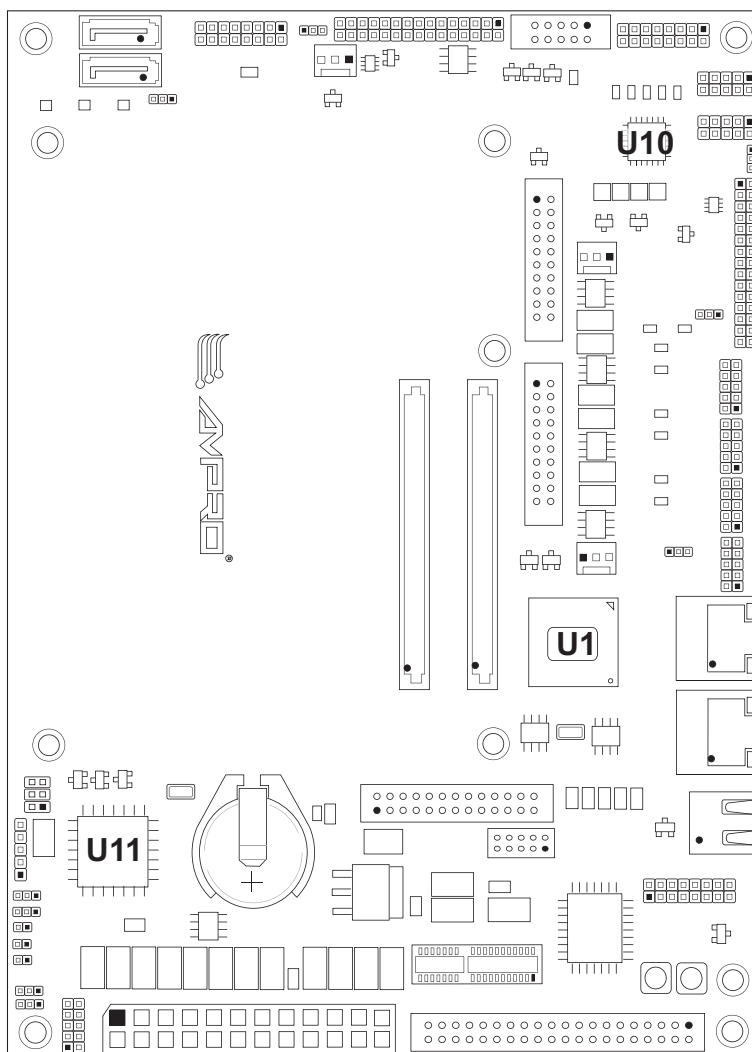


Figure 2-4. Major Component Locations (Top view)

Header Descriptions

The COM Express Baseboard headers and their respective descriptions are listed in the following table and shown in [Figures 2-5 and 2-6](#). [Table 2-2](#) provides pin spacing where applicable.

Table 2-2. Header Definitions

Jack#	Signal/Device	Description
BAT	RTC Battery (B1)	2-pin Lithium battery socket (3.0V Lithium, coin)
SW1	Switch	Reset switch, momentary
SW2	Switch	Power On switch, momentary
J1	DNP	Do not populate
J2	LPT (Parallel)	26-pin, 2 mm header for parallel printer port
J3	Serial A	20-pin, 2.54 mm header for serial ports 1 and 2 (COM1 and COM2)
J4	Audio In 2	10-pin, 2 mm header for Expanded Stereo Line In and Stereo Microphone signals

Table 2-2. Header Definitions (Continued)

J5	Audio In 1	10-pin, 2 mm header for Stereo Line In and Stereo Microphone
J6	Audio Out	16-pin, 2 mm header for Audio Out signals
J7	1394	8-pin, firewire connector for IEEE 1394 systems or devices
J8	ATX Power In	24-pin, 4.2 mm connector for ATX Power In
J9	IDE	40-pin, 2.54 mm, standard IDE connector
J10	CompactFlash (on back of the board; see Figure 2-7 on page 12)	50-pin, 1.27 mm, CF socket accepts Type I or II CF cards
J11	VGA Video	10-pin, 2.54 mm header for VGA video signals
J12	TV-Out	6-pin, 2.54 mm header for TV-Out signals
J13	Keyboard and Mouse	10-pin, 2 mm header for PS/2 keyboard and mouse signals
J14	SMBus	5-pin, 2.54 mm header for external SMBus interface
J15	I2C	3-pin, 2 mm header for I2C bus
J16	CPU Fan1	3-pin, 2.54 mm header for CPU fan1
J17	CPU Fan2	3-pin, 2.54 mm header for CPU fan2
J18	System Fan	3-pin, 2.54 mm header for system fan
J19	USB 0 and 1	10-pin, 2 mm header for USB 2.0 Ports 0 and 1
J20	USB 2 and 3	10-pin, 2 mm header for USB 2.0 Ports 2 and 3
J21	USB 4 and 5	10-pin, 2 mm header for USB 2.0 Ports 4 and 5
J22	USB 6	10-pin, 2 mm header for USB 2.0 Port 6 (Port 7 is dedicated to Mini PCIe.)
J23	Ethernet	8-pin RJ45 connector with two LEDs for 10BaseT/100BaseTX/1000BaseT from the PCI-Express bus
J24	Ethernet	8-pin RJ45 connector with two LEDs for 10BaseT/100BaseTX/1000BaseT from the COM Express module
J25	LVDS 1	30-pin, 2 mm header for LVDS signals from SDVO-LVDS transmitter
J26	PanelLink (for DVI)	16-pin, 2 mm header for PanelLink output (for DVI) from SDVO-PanelLink transmitter
J27	LVDS 2	30-pin, 2 mm header for LVDS signals from COM Express module
J28	SATA 1	7-pin connector for serial ATA signals from the COM Express interface
J29	SATA 2	7-pin connector for serial ATA signals from the COM Express interface
J30	PCIe	36-pin, standard edge connector for x1 PCI Express interface with six express lanes (one used by the Ethernet controller)
J31	N/A	Not applicable
J32	Mini PCI (on back of the board; see Figure 2-7 on page 12)	124-pin, standard Mini PCI connector
J33	COM Express A-D	440-pin, standard COM Express interface
J34	Miscellaneous	16-pin, 2 mm header for miscellaneous functions

Table 2-2. Header Definitions (Continued)

J35	N/A	Not applicable
J36	GPIO	10-pin, 2 mm header for general purpose I/O signals from COM Express interface
J37	Serial B	20-pin, 2.54 mm header for serial ports 3 and 4 (COM3 and COM4)
J38	Mini PCI Express (on back of the board; see Figure 2-7 on page 12)	52-pin, standard connector for Mini PCI Express functions

Note: Refer to connector/header pin-out identification Note on the following page.

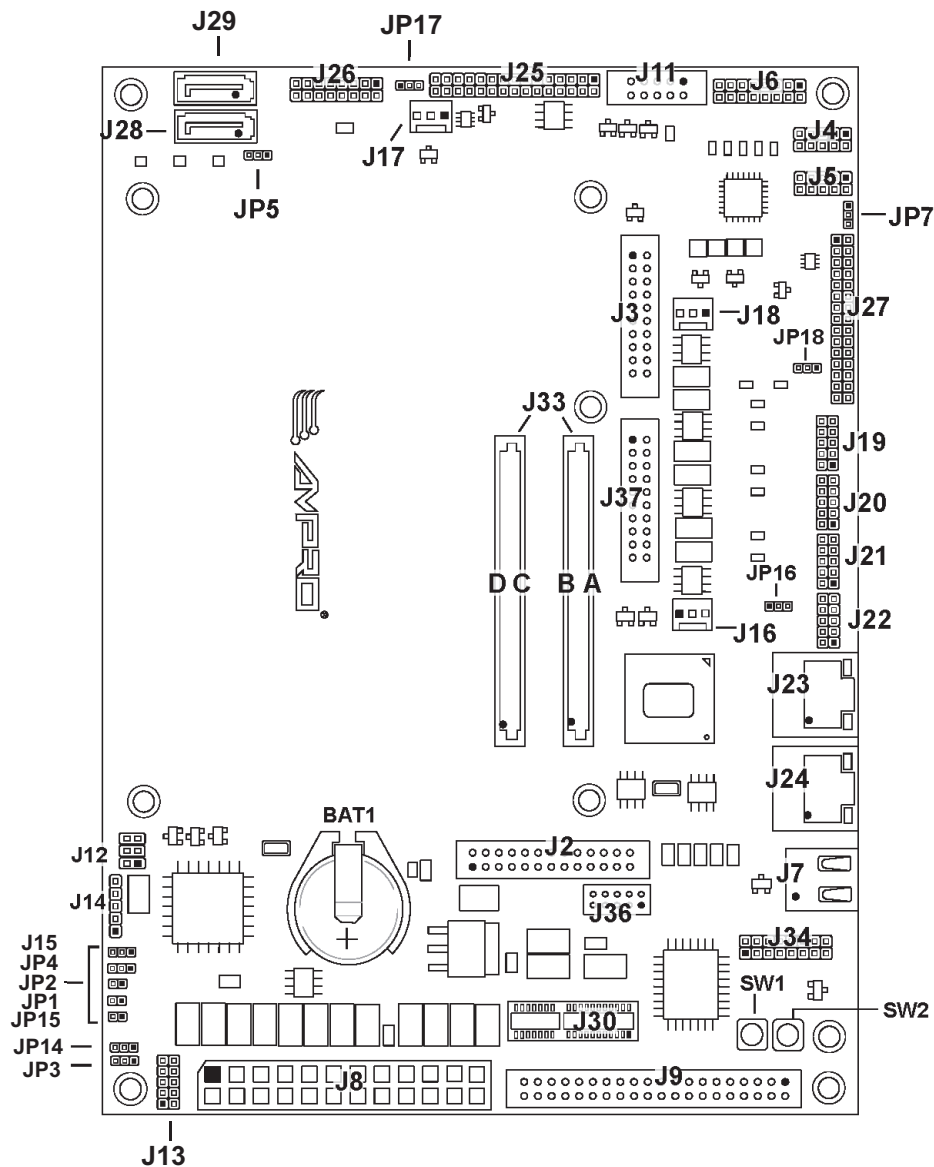


Figure 2-5. Main Header Locations (Top view)

NOTE Ampro uses an identification method in Chapters 2 & 3 to ease connector pin identification. 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 connector 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. See [Figure 2-6](#).

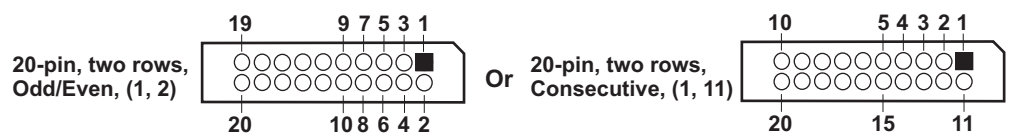


Figure 2-6. Connector/Header Pin-Out Identification

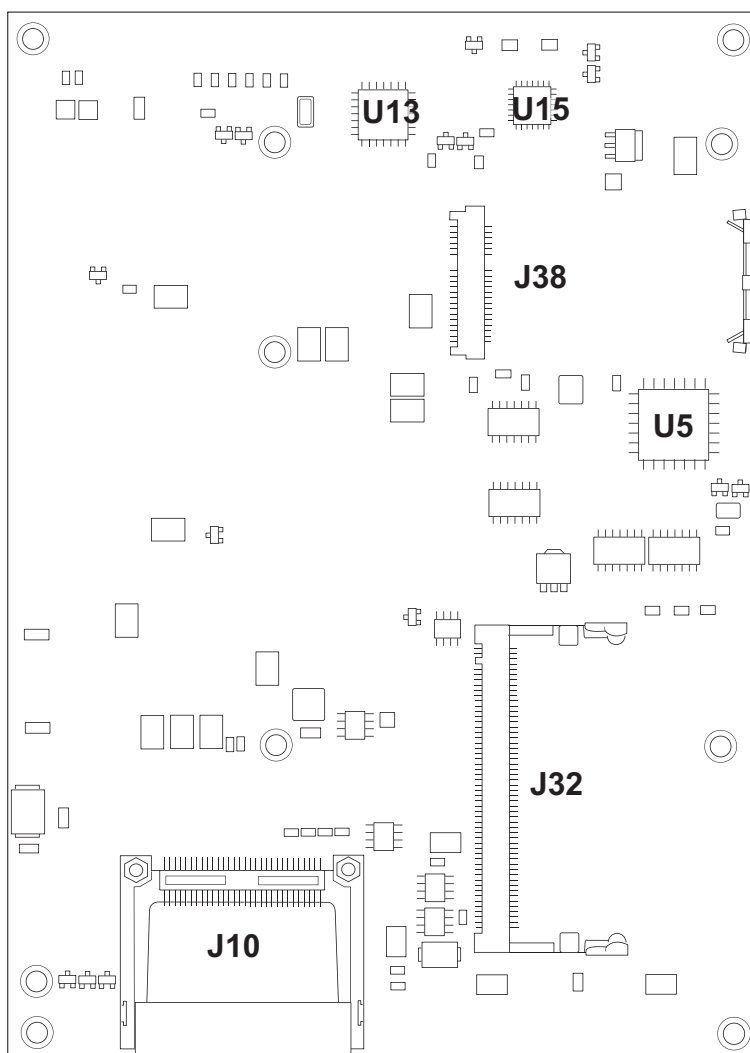


Figure 2-7. Additional Connector and Component Locations (Bottom view)

Baseboard Jumper Headers

Table 2-3 provides the COM Express Baseboard jumper headers and the respective functions.

Table 2-3. Baseboard Jumper Header Settings

Jumper Pins	Installed	Removed/Installed
JP1 – COM 2 RS485	Termination (pins 1-2)	No Termination (removed) Default
JP2 – COM 1 RS485	Termination (pins 1-2)	No Termination (removed) Default
JP3 – J_SIDE (ATA Master, CF Slave) Default	ON (pins 1-2)	OFF (pins 2-3)
JP3 – J_SIDE (CF Master, ATA Slave)	OFF (pins 1-2)	ON (pins 2-3)
JP4 – CF Voltage Select	Enable +3.3V (pins 1-2)	Enable +5V (pins 2-3) Default
JP5 – LVDS 1 Voltage Select	Enable +3.3V (pins 1-2) Default	Enable +5V (pins 2-3)
JP7 – LVDS 2 Voltage Select	Enable +3.3V (pins 1-2) Default	Enable +5V (pins 2-3)
JP14 – Power Up Select	Power Up by signal S3 (pins 1-2) Default	Power Up by signal S5 (pins 2-3)
JP15 – Disable BIOS	Termination (pins 1-2)	No termination (removed) Default
JP16 – CPU Fan1 Voltage Select	Enable +5V (pins 1-2)	Enable +12V (pins 2-3) Default
JP17 – CPU Fan2 Voltage Select	Enable +5V (pins 1-2)	Enable +12V (pins 2-3) Default
JP18 – System Fan Voltage Select	Enable +5V (pins 1-2)	Enable +12V (pins 2-3) Default

Note: When a jumper is removed, it may be placed on one of the jumper pins for safe keeping. The jumper headers use 2 mm pin spacing.

Specifications

Physical Specifications

Table 2-4 provides the EBX mounting dimensions. The COM Express Baseboard conforms to the EBX physical standards to ensure accurate design coverage for developers.

Table 2-4. Baseboard Weight and Dimensions

Weight	0.259 kg (0.57 lbs)	NOTE Overall height is measured from the upper board surface to the highest permanent component on the upper board surface. This measurement does not include the COM board or the heatsinks available for COM board.
Height (overall)	16.5 mm (0.65") (without COM board)	
Width	203 mm (7.99")	
Length	208 mm (8.2")	

Power Specifications

The COM Express Baseboard power requirements from the power supply are listed in the following table.

Table 2-5. Power Supply Requirements

Parameter	1.6GHz Characteristics
Input Type	Regulated DC voltage
In-rush Voltage & Current	6.08A (72.96W)
Typical Idle Power	1.04A (12.47W)
BIT Voltage & Current	1.85A (22.26W)

Operating conditions:

- In-rush operating conditions include CRT video, 512MB DDR RAM, COM 840 1.6 GHz board, and power.
- Idle operating conditions include the in-rush conditions as well as IDE hard drive with Windows XP, keyboard, and mouse.
- BIT = Burn-In-Test. Operating conditions include idle conditions as well as two serial COM ports with loop-backs, one Ethernet connection, one USB floppy drive, and five USB Compact Flash readers.

Environmental Specifications

Table 2-6. Environmental Requirements

Parameter	Conditions
Temperature	
Operating	-20° to +70°C (-4° to +158°F)
Extended	-40° to +85°C (-40° to +185°F)
Non-operating	-55° to +85°C (-67° to +185°F)
Humidity	
Operating	5% to 95% relative humidity, non-condensing
Non-Operating	5% to 95% relative humidity, non-condensing

Mechanical Specifications

Refer to [Figure 2-8](#) for simplified mechanical dimensions. For more detailed mechanical dimensions of the Ampro baseboard, refer to the Baseboard Design Library on the specific COM module's Support Software and Design Library DVD.

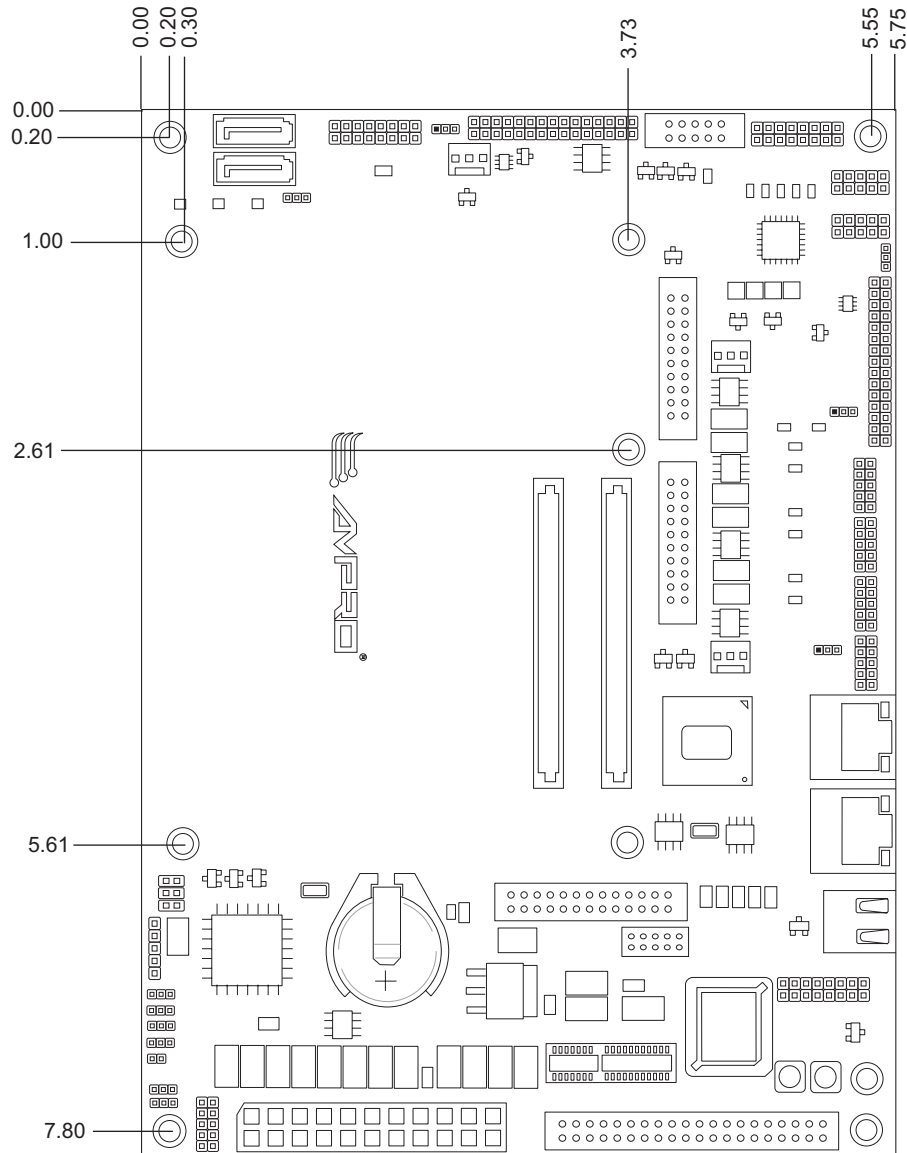


Figure 2-8. Mechanical Dimensions

Note: All Dimensions are shown in inches.

Chapter 3 Hardware

Overview

This chapter is divided into the following headings with tables and descriptions where appropriate.

- Parallel Port Interface (LPT)
- Serial Port Interface
- Audio Input/Outputs
- PS/2 Keyboard
- PS/2 Mouse
- I2C Bus
- USB
- Fans
- Video Interfaces
 - ♦ CRT
 - ♦ LVDS
 - ♦ PanelLink (for DVI)
 - ♦ TV-Out
- Miscellaneous (header for Front Panel functions)
- GPIO
- System Management Bus
- Power Interfaces
 - ♦ ATX power supply input

LPT (Parallel) Port Interface

Table 3-1 provides the pins/signals and descriptions for a standard parallel port (LPT1), 26-pin, 2 rows, consecutive (1, 14) with 2 mm pin spacing.

Table 3-1. LPT Port Interface Pin/Signal Definitions (J2)

Pin #	Signal	Descriptions
1	STROBE*	Strobe – Output used to strobe data into the printer. I/O pin in ECP/EPP mode.
2	AFD*	Auto Feed – This is Request signal to the printer to automatically feed one line after each line is printed.
3	PD0	Parallel Port Data 0 – These signals (0 to 7) provide the parallel port data.
4	ERR*	Error – This is a Status output signal from the printer. A Low State indicates an error condition on the printer.
5	PD1	Parallel Port Data 1 – These signals (0 to 7) provide the parallel port data.
6	INIT*	Initialize – This signal used to Initialize printer. Output in standard mode, I/O in ECP/EPP mode.
7	PD2	Parallel Port Data 2 – These signals (0 to 7) provide the parallel port data.
8	SLIN*	Select In – This signal Output used to select the printer. I/O pin in ECP/EPP mode.
9	PD3	Parallel Port Data 3 – These signals (0 to 7) provide the parallel port data.
11	PD4	Parallel Port Data 4 – These signals (0 to 7) provide the parallel port data.
13	PD5	Parallel Port Data 5 – These signals (0 to 7) provide the parallel port data.
15	PD6	Parallel Port Data 6 – These signals (0 to 7) provide the parallel port data.
17	PD7	Parallel Port Data 7 – These signals (0 to 7) provide the parallel port data.
19	ACK*	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.
21	BUSY	Busy – This is a Status output signal from the printer.
23	PE	Paper End – This is a Status output signal from the printer. A High State indicates it is out of paper.
25	SLCT	Select – This is a Status output signal from the printer. A High State indicates it is powered on.
26	Key	Not connected
27	PEG	Not connected
10, 12, 14, 16, 18, 20, 22, 24	GND	Ground

Note: The shaded area denotes power or ground. The signals marked with * indicate signal inversion.

Serial Ports

The Super I/O chip provides serial ports 1 - 4 through headers J3 and J37. Both headers use 20-pin, 2-row, consecutive (1, 6) pin sequences with 2.54 mm spacing. The four serial ports support the following features:

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

Table 3-2. Serial A (COM1 and COM2) Interface Pin/Signal Descriptions (J3)

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	RT2	Not connected
19	GND	Ground
20	NC	Not connected

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

Table 3-3. Serial B (COM3 and COM4) Interface Pin/Signal Descriptions (J37)

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).
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
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.
5	TXD3	Transmit Data 3 – Serial port 3 transmit data out
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.
7	DTR3*	Data Terminal Ready 3 – Indicates Serial port 1 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
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.
15	TXD4	Transmit Data 4 – Serial port 4 transmit data out
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.
17	DTR4*	Data Terminal Ready 4 – Indicates Serial port 4 is powered, initialized, and ready. Used as hardware handshake with DSR4 for overall readiness to communicate.
18	RI4*	Ring Indicator 4 – Indicates external serial communications device is detecting a ring condition. Used by software to initiate operations 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.

Audio Interfaces

The Audio interfaces use 2-row, odd/even (1, 2) headers. See [Tables 3-4 to 3-6](#) for the audio input/output signals.

Audio In 1

Table 3-4. Audio In 1 Pin/Signal Descriptions (J5)

Pin #	Signal	Description
1	LINE1 L	Line In signal left channel
2	LINE1 R	Line In signal right channel
3	LINE1 JD	Line In signal JD (Jack Detect)
4	GND_AUD	Ground
5	GND_AUD	Ground
6	GND_AUD	Ground
7	MIC1 L	Microphone signal in left
8	MIC1 R	Microphone signal in right
9	MIC1 JD	Microphone signal in JD (Jack Detect)
10	GND_AUD	Ground

Note: The shaded area denotes audio ground.

Audio In 2

Table 3-5. Audio In 2 Pin/Signal Descriptions (J4)

Pin #	Signal	Description
1	MIC2 L	Microphone signal in left
2	GND_AUD	Ground
3	MIC2 R	Microphone signal in right
4	+3V	+3 Volts power
5	LINE2 R	Line In signal left channel
6	MIC2 JD	Microphone signal JD
7	FRONT IO SENSE	Front IO Sensor (sensor for front panel jack)
8	NC	Not connected
9	LINE2 L	Line In signal left channel
10	LINE2 JD	Line In JD (Jack Detect)

Note: The shaded area denotes audio ground or power.

Audio Out

Table 3-6. Audio Out Pin/Signal Descriptions (J6)

Pin #	Signal	Description
1	FRONT L	Front audio out left channel

Table 3-6. Audio Out Pin/Signal Descriptions (J6) (Continued)

2	FRONT R	Front audio out right channel
3	FRONT JD	Front audio out (Jack Detect)
4	GND_AUD	Ground
5	LFE OUT	LFE out (Low Frequency Output)
6	CEN OUT	Center audio out
7	CEN JD	Center JD (Jack Detect) out
8	GND_AUD	Ground
9	SURR L	Surround left
10	SURR R	Surround right
11	SURR JD	Surround JD (Jack Detect)
12	GND_AUD	Ground
13	SIDESURR L	Side surround left
14	SIDESURR R	Side surround right
15	SIDESURR JD	Side surround JD (Jack Detect)
16	GND_AUD	Ground

Note: The shaded area denotes audio ground.

Keyboard/Mouse Interface

The keyboard and mouse use a 6-pin, 2-row, odd/even (1, 2) header for PS/2 signals. See [Table 3-7](#) for pin signals.

Table 3-7. Keyboard/Mouse Interface Pin/Signal Definitions (J13)

Pin #	Signal	Description
1	KEY VCC	+5 Volts
2	KEY DATA	Keyboard data
3	KEY CLK	Keyboard clock
4	KEY GND	Keyboard ground
5	KEY GND	Keyboard ground
6	KEY GND	Keyboard ground
7	KEY VCC	+5 Volts
8	CON DAT MOUSE	Mouse data
9	CON CLK MOUSE	Mouse clock
10	KEY GND	Keyboard ground

Note: The shaded area denotes power or ground.

I²C Bus

Table 3-8 lists the pin signals for the I²C bus.

Table 3-8. I²C Header Pin/Signal Definitions (J15)

Pin #	Signal	Description
1	I ² C CK	I ² C clock and 3.3 volts power
2	I ² C DAT	I ² C data and 3.3 volts power
3	GND	Ground

Note: The shaded area denotes power or ground.

CPU Fan 1

Table 3-9 lists the pin signals for the CPU Fan 1 header.

Table 3-9. CPU Fan 1 Header Pin/Signal Definitions (J16)

Pin #	Signal	Description
1	FAN_TACH1	Fan tachometer
2	VCC_FAN1	+5/12 volts power
3	GND	Ground

Note: The shaded area denotes power or ground.

CPU Fan 2

Table 3-10 lists the pin signals for the CPU Fan 2 header.

Table 3-10. CPU Fan 2 Header Pin/Signal Definitions (J17)

Pin #	Signal	Description
1	FAN_TACH2	Fan tachometer
2	VCC_FAN2	+5/12 volts power
3	GND	Ground

Note: The shaded area denotes power or ground.

System Fan

Table 3-11 lists the pin signals for the System Fan header.

Table 3-11. System Fan Header Pin/Signal Definitions (J18)

Pin #	Signal	Description
1	FAN_TACH3	Fan tachometer
2	VCC_FAN3	+5/12 volts power
3	GND	Ground

Note: The shaded area denotes power or ground.

USB Interfaces

The COM Express Baseboard has eight USB ports using 10-pin, 2-row, odd/even (1, 2) headers. See [Tables 3-12 to 3-15](#).

Table 3-12. USB 0 and 1 Interfaces Pin/Signal Definitions (J19)

Pin #	Signal	Description
1	USB POWER 0	+5 volts power
2	USB POWER 1	+5 volts power
3	CONN USB0 N	USB0 data negative
4	CONN USB1 N	USB1 data negative
5	CONN USB0 P	USB0 data positive
6	CONN USB1 P	USB1 data positive
7	USB GND0	Ground
8	USB GND2	Ground
9	USB GND1	Ground
10	USB GND2	Ground

Note: The shaded area denotes power or ground.

Table 3-13. USB 2 and 3 Interfaces Pin/Signal Definitions (J20)

Pin #	Signal	Description
1	USB POWER 2	+5 volts power
2	USB POWER 3	+5 volts power
3	CONN USB2 N	USB2 data negative
4	CONN USB3 N	USB3 data negative
5	CONN USB2 P	USB2 data positive
6	CONN USB3 P	USB3 data positive
7	USB GND2	Ground
8	USB GND3	Ground
9	USB GND2	Ground
10	USB GND3	Ground

Note: The shaded area denotes power or ground.

Table 3-14. USB 4 and 5 Interfaces Pin/Signal Definitions (J21)

Pin #	Signal	Description
1	USB POWER 4	+5 volts power
2	USB POWER 5	+5 volts power
3	CONN USB4 N	USB4 data negative
4	CONN USB5 N	USB5 data negative
5	CONN USB4 P	USB4 data positive
6	CONN USB5 P	USB5 data positive
7	USB GND4	Ground

Table 3-14. USB 4 and 5 Interfaces Pin/Signal Definitions (J21) (Continued)

8	USB GND5	Ground
9	USB GND4	Ground
10	USB GND5	Ground

Note: The shaded area denotes power or ground.

Table 3-15. USB 6 Interface Pin/Signal Definitions (J22)

Pin #	Signal	Description
1	USB POWER 6	+5 volts power
2	USB POWER 7	+5 volts power
3	CONN USB6 N	USB6 data negative
4	NC	Port 7 (dedicated to Mini PCIe)
5	CONN USB6 P	USB6 data positive
6	NC	Port 7 (dedicated to Mini PCIe)
7	USB GND6	Ground
8	USB GND7	Ground
9	USB GND6	Ground
10	USB GND7	Ground

Note: The shaded area denotes power or ground.

Video Interfaces

Five supported video connections reside on the baseboard to support the video functions provided by selected COM Express modules. The VGA (10-pin) header (J11) is used for the standard VGA (CRT) video display. The LVDS (30-pin) headers (J25 and J27) support LVDS flat panel displays. The PanelLink (16-pin) header (J26) allows for interface with DVI panels. The TV-OUT (6-pin) header (J12) provides TV output signals.

VGA Interface

Table 3-16 provides the standard VGA CRT monitor interface pin/signal descriptions on a 10-pin header using 2 rows, consecutive (1, 6) with 2.54 mm pin spacing.

Table 3-16. CRT Interface Pin/Signal Definitions (J11)

Pin #	Signal	Description
1	RED	Red – This signal is the Red analog output to the CRT.
2	GND	Ground
3	GREEN	Green – This signal is the Green analog output to the CRT.
4	GND	Ground
5	BLUE	Blue – This signal is the Blue analog output to the CRT.
6	GND	Ground
7	HSYNC	Horizontal Sync – This signal is used for the digital horizontal sync output to the CRT. Also used (with VSYNC) to pass signal power management state information to the CRT per the VESA™ DPMS™ standard.
8	GND	Ground
9	VSYNC	Vertical Sync – This signal is used for the digital vertical sync output to the CRT. Also used (with HSYNC) to pass signal power management state information to the CRT per the VESA™ DPMS™ standard.
10	PWR	Power

Note: The shaded area denotes power or ground.

LVDS Interfaces

The COM Express Baseboard provides two Low Voltage Differential Signal (LVDS) headers. The two headers, LVDS1 (J25) and LVDS2 (J27) both are 30-pin headers.

NOTE The LVDS Voltage Select jumper pins (JP5 and JP7) only control the voltage to the LVDS panel, not the panel signal level voltages, which remain at +3.3V CMOS logic levels regardless of the position of the LVDS voltage select jumper. Ensure you use a flat panel with +3.3V CMOS logic.

Table 3-17 describes LVDS 1 pin/signals on 30-pins, 2 rows, odd/even (1, 2) with 2 mm pin spacing.

Table 3-17. LVDS 1 Interface Pin/Signal Definitions (J25)

Pin #	Signal	Description	Line	Channel	
1	+12V	+12 volts for flat panel and backlight			
2	+VCC	VCC Voltage selected by LVDS Voltage Select (JP5) jumper at +3.3V or +5V.			
3	GND	Ground	Gnd	Channel 2	
4	GND	Ground			
5	CLK_LVDS1_BP	Clock Positive Output	Clk		
6	CLK_LVDS1_BN	Clock Negative Output			
7	LVDS1_B3P	Data Positive Output	3		
8	LVDSB_B3N	Data Negative Output			
9	LVDS1_B2P	Data Positive Output	2		
10	LVDS1_B2N	Data Negative Output			
11	LVDS1_B1P	Data Positive Output	1		
12	LVDS1_B1N	Data Negative Output			
13	LVDS1_B0P	Data Positive Output	0		
14	LVDS1_B0N	Data Negative Output			
15	BKL_Control	Backlight Control, if supported.			
16	VDDEN	Enable VDD			
17	CLK_LVDS1_AP	Data Positive Output	Clk	Channel 1	
18	CLK_LVDS1_AN	Data Negative Output			
19	LVDS1_A3P	Data Positive Output	3		
20	LVDS1_A3N	Data Negative Output			
21	LVDS1_A2P	Data Positive Output	2		
22	LVDS1_A2N	Data Negative Output			
23	LVDS1_A1P	Data Positive Output	1		
24	LVDS1_A1N	Data Negative Output			
25	LVDS1_A0P	Data Positive Output	0		
26	LVDS1_A0N	Data Negative Output			
27	DDC_CLK	Display Channel Clock			
28	DDC_DATA	Display Channel Data			
29	LBKLT_EN	Backlight Enable, if supported.			
30	NC	Not connected			

NOTE: Pins 17-26 constitute 1st channel interface of two channels, or a single channel interface.

Pins 5-14 constitute 2nd channel interface of two channels.

NOTE: Pins 17-26 constitute 1st channel interface of two channels, or a single channel interface.

Pins 5-14 constitute 2nd channel interface of two channels.

Note: The shaded area denotes power or ground.

Table 3-18 describes LVDS 2 pin/signals on 30-pins, 2 rows, odd/even (1, 2) with 2 mm pin spacing.

Table 3-18. LVDS 2 Interface Pin/Signal Definitions (J27)

Pin #	Signal	Description	Line	Channel	
1	+12V	+12 volts for flat panel and backlight			
2	+VCC	VCC Voltage selected by LVDS Voltage Select (JP7) jumper at +3.3V or +5V.			
3	GND	Ground	Gnd		
4	GND	Ground			
5	CLK_LVDS1_BP	Clock Positive Output	Clk	Channel 2	
6	/LVDSB_CLK	Clock Negative Output			
7	LVDSB_DATA3	Data Positive Output	3		
8	/LVDSB_DATA3	Data Negative Output			
9	LVDSB_DATA2	Data Positive Output	2		
10	/LVDSB_DATA2	Data Negative Output			
11	LVDSB_DATA1	Data Positive Output	1		
12	/LVDSB_DATA1	Data Negative Output			
13	LVDSB_DATA0	Data Positive Output	0		
14	/LVDSB_DATA0	Data Negative Output			
15	BKL_Control	Backlight Control, if supported.			
16	VDDEN	Enable VDD (DIGON)			
17	LVDSA_CLK	Data Positive Output	Clk	Channel 1	
18	/LVDSA_CLK	Data Negative Output			
19	LVDSA_DATA3	Data Positive Output	3		
20	/LVDSA_DATA3	Data Negative Output			
21	LVDSA_DATA2	Data Positive Output	2		
22	/LVDSA_DATA2	Data Negative Output			
23	LVDSA_DATA1	Data Positive Output	1		
24	/LVDSA_DATA1	Data Negative Output			
25	LVDSA_DATA0	Data Positive Output	0		
26	/LVDSA_DATA0	Data Negative Output			
27	DDC_CLK	Display Channel Clock			
28	DDC_DATA	Display Channel Data			
29	LBKLT_EN	Backlight Enable, if supported.			
30	NC	Not connected			

NOTE: Pins 17-26 constitute 1st channel interface of two channels, or a single channel interface.

Pins 5-14 constitute 2nd channel interface of two channels.

NOTE: Pins 17-26 constitute 1st channel interface of two channels, or a single channel interface.

Pins 5-14 constitute 2nd channel interface of two channels.

Note: The shaded area denotes power or ground.

PanelLink (for DVI interface)

The PanelLink header provides TMDS signals for a DVI (Digital Visual Interface) interface and uses 16-pins, 2 rows, odd/even (1, 2) with 2 mm pin spacing.

Table 3-19. PanelLink Pin/Signal Descriptions [for DVI] (J26)

Pin #	Signal	Description
1	TDC2_P	TMDS Data 2 Positive
2	VCC5	+5 Volt Power
3	TDC2_N	TMDS Data 2 Negative
4	HPDET	Hot Plug Detect
5	TDC1_P	TMDS Data 1 Positive
6	GND	Digital Ground
7	TDC1_N	TMDS Data 1 Negative
8	GND	Digital Ground
9	TDC0_P	TMDS Data 0 Positive
10	SDADDC	DDC Data
11	TDC0_N	TMDS Data 0 Negative
12	SCLDDC	DDC Clock
13	TLC_P	TMDS Clock Positive
14	GND	Digital Ground
15	TLC_N	TMDS Clock Negative
16	GND	Digital Ground

Note: The shaded area denotes power or ground.

TV-OUT

The TV-OUT interface is a 6-pin, 2.54 mm header using 2 rows, odd/even (1, 2) for TV-Out signals.

Table 3-20. TV-Out Header (J12)

Pin #	Signal	Description
1	TV_Pb	Chrominance analog signal
2	GND	Ground
3	TV_Y	Luminance analog signal
4	GND	Ground
5	TV_Pr	Chrominance analog signal
6	GND	Ground

Miscellaneous (Front Panel) Interface

The miscellaneous header is a 16-pin, 2 mm interface using 2 rows, odd/even (1, 2) for miscellaneous, Front Panel functions.

Table 3-21. Miscellaneous (Front Panel) Header (J34)

Pin #	Signal	Description
1	+5V CONN	+5 volts
2	IDE LED_R	IDE LED signals
3	+5V CONN	+5v
4	IDE LED	IDE LED signals
5	GND	Ground
6	/PWRBTN	Power Button
7	+5V CONN	+5 volts
8	GND	Ground
9	NC	Not connected
10	/SYS_RESET	System Reset
11	NC	Not Connected
12	GND	Ground
13	SPEAKER	Speaker
14, 15, 16	NC	Not Connected

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

GPIO

The COM Express Baseboard provides GPIO (General Purpose I/O) pins for custom use through the COM Express C-D connector. The GPIO header is a 10-pin, 2mm interface using a 2 row, odd/even (1, 2) pin sequence.

Table 3-22. User GPIO Signals Pin/Signal Descriptions (J36)

Pin #	Signal	Description
1	+3.3V	+3.3 Volts Power
2	GND	Ground
3	GPI0	User defined
4	GPO0	User defined
5	GPI1	User defined
6	GPO1	User defined
7	GPI2	User defined
8	GPO2	User defined
9	GPI3	User defined
10	GPO3	User defined

Note: The shaded area denotes power or ground.

ATX Power Supply Interface

The power supply interface, J8, uses a 24-pin connector for direct interface with a standard ATX power supply. The power supply interface provides +3.3V, +5V, and +12V to the baseboard. The COM Express modules require +12 volts for operation.

System Management Bus

The System Management Bus (SMBus) addresses are based on components connected to the SMBus on the Ampro COM board.

[Table 3-23](#) lists the SMBus pin/signals on 5-pins, 1 row, 2 mm pin spacing on the SMBus header (J14).

Table 3-23. SMBus Signals Pin/Signal Descriptions (J14)

Pin #	Signal	Description
1	+VSMBUS	+5V
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.

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 Amprom 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 COM Express Baseboard:

1. Turn on the monitor and the power supply to the COM Express Baseboard.
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 <i>Memory Test</i> 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 key early in the boot sequence to enter BIOS Setup.
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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 (Remote Access)

Once you set up the BIOS Utility for Remote Access (serial console or console redirection) in VGA mode, entering the BIOS in the remote access mode is very similar to the method used when entering the BIOS with a VGA display.

1. Turn on the power supply to the COM Express Baseboard and access the BIOS Setup Utility in VGA mode.
2. Set the BIOS feature *Remote Access* to [Enabled] 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 COM Express Baseboard.
6. Connect the remote serial terminal (or the PC with communications software) to the COM port you selected on the COM Express Baseboard using a Hot Cable or a standard null-modem serial cable.
7. Turn on the remote serial terminal (or the PC with communications software) and set it to the settings you selected and recorded earlier in the BIOS Setup Utility.

COM1, 115200, 8 bits, 1 stop bit, no parity, no flow control, and [Always] for *Redirection After BIOS POST* are the default settings for the COM Express Baseboard.

8. Restore power to the COM Express Baseboard and look for the screen prompt shown below.

Press ^C to run SETUP

9. Press the CTRL-C keys 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, and is not listed in the COM table within BIOS Setup Utility. Diagnostic software that probes hardware addresses may cause a loss or failure of the serial console functions.

Logo Screen Utility (Splash Screen)

The COM Express Baseboard BIOS supports a graphical logo utility, which can be customized by the user and displayed on screen 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 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 COM Express Baseboard OEM 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 web site.

- 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 of not larger than the sample image

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

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.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. 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

