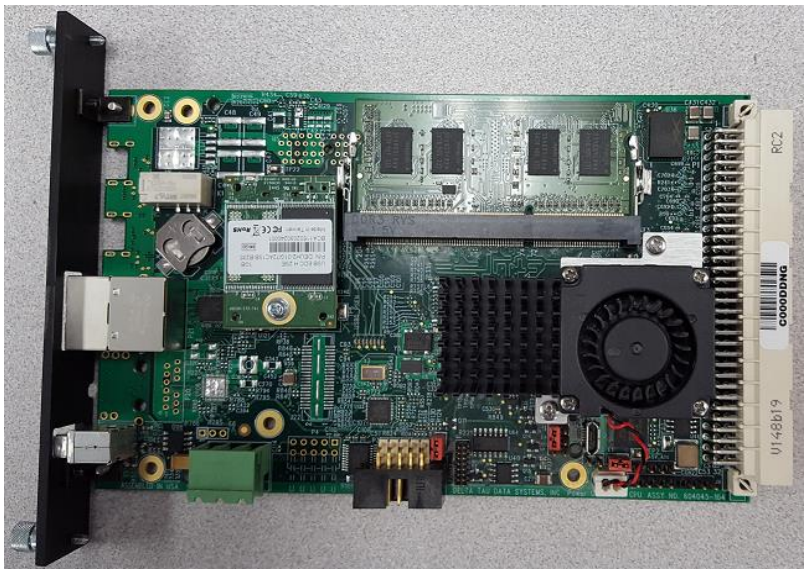
HARDWARE REFERENCE MANUAL

POWER PMAC UMAC 465 CPU



Power PMAC UMAC 465 CPU

3-4045-xxx-xxx-xx-0xx

July 27, 2015

DELTA TAU

Data Systems, Inc.

NEW IDEAS IN MOTION …

21314 Lassen St. Chatsworth, CA 91311 // Tel. (818) 998-2095 Fax. (818) 998-7807 // www.deltatau.com

Copyright Information

To report errors or inconsistencies, call or email:

Delta Tau Data Systems, Inc. Technical Support

Phone: (818) 717-5656

Fax: (818) 998-7807

Email: support@deltatau.com

Website: http://www.deltatau.com

Operating Conditions

All Delta Tau Data Systems, Inc. motion controller products, accessories, and amplifiers contain static sensitive components that can be damaged by incorrect handling. When installing or handling Delta Tau Data Systems, Inc. products, avoid contact with highly insulated materials. Only qualified personnel should be allowed to handle this equipment.

In the case of industrial applications, we expect our products to be protected from hazardous or conductive materials and/or environments that could cause harm to the controller by damaging components or causing electrical shorts. When our products are used in an industrial environment, install them into an industrial electrical cabinet or industrial PC to protect them from excessive or corrosive moisture, abnormal ambient temperatures, and conductive materials. If Delta Tau Data Systems, Inc. products are directly exposed to hazardous or conductive materials and/or environments, we cannot guarantee their operation.

Safety Instructions

Qualified personnel must transport, assemble, install, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, and operation of equipment. The qualified personnel must know and observe the following standards and regulations:

IEC364resp.CENELEC HD 384 or DIN VDE 0100
IEC report 664 or DIN VDE 0110
National regulations for safety and accident prevention or VBG 4

Incorrect handling of products can result in injury and damage to persons and machinery. Strictly adhere to the installation instructions. Electrical safety is provided through a low-resistance earth connection. It is vital to ensure that all system components are connected to earth ground.

This product contains components that are sensitive to static electricity and can be damaged by incorrect handling. Avoid contact with high insulating materials (artificial fabrics, plastic film, etc.). Place the product on a conductive surface. Discharge any possible static electricity build-up by touching an unpainted, metal, grounded surface before touching the equipment.

Keep all covers and cabinet doors shut during operation. Be aware that during operation, the product has electrically charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating. Never disconnect or connect the product while the power source is energized to avoid electric arcing.

Warning

A Warning identifies hazards that could result in personal injury or death. It precedes the discussion of interest.

Caution

A Caution identifies hazards that could result in equipment damage. It precedes the discussion of interest.

Note

A Note identifies information critical to the understanding or use of the equipment. It follows the discussion of interest.

REVISION HISTORY				
REV.	**DESCRIPTION**	**DATE**	**CHG**	**APPVD**
1	Released	07/27/15	Sgm	Sgm

(This page intentionally left blank)

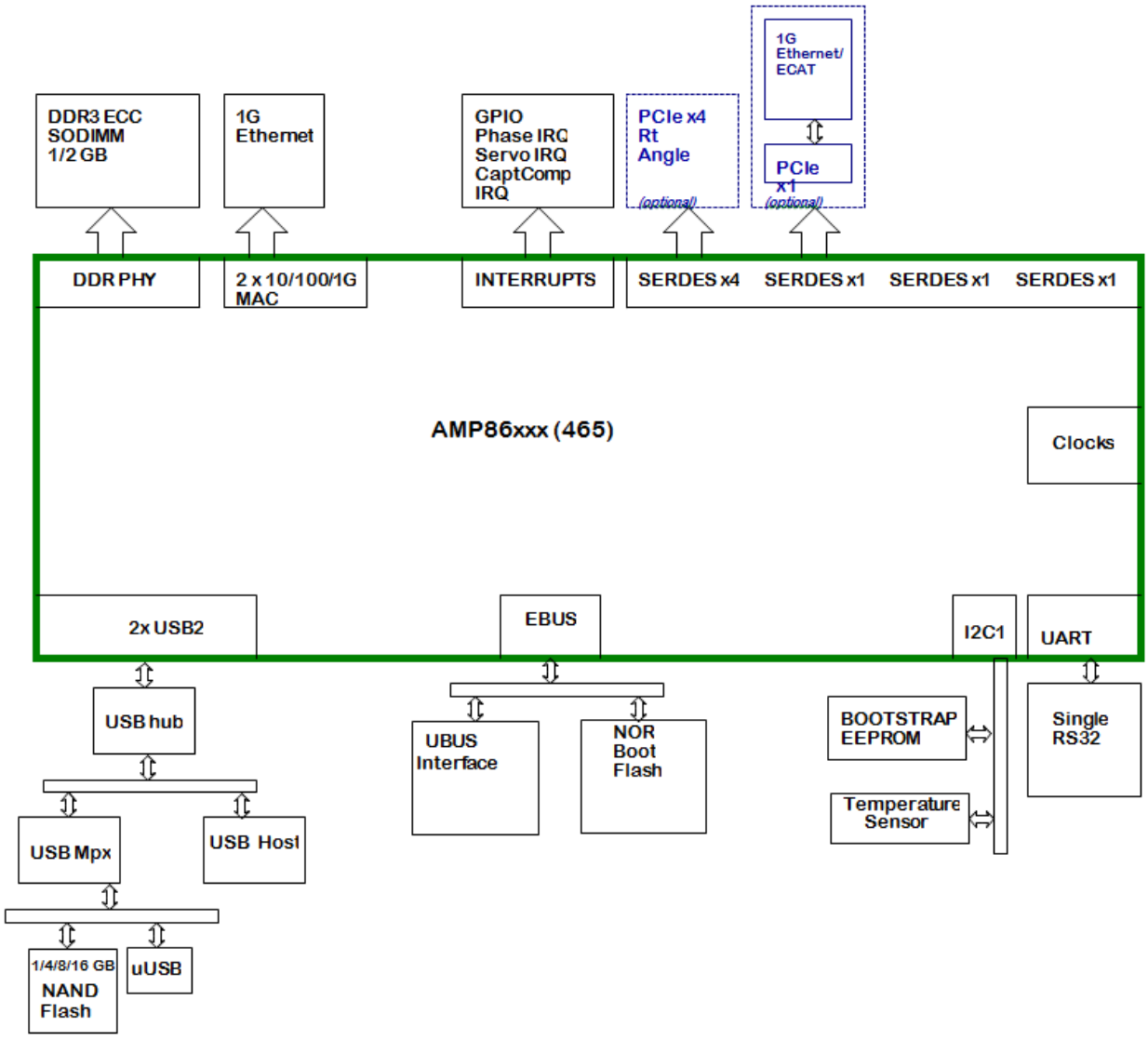
Table of Contents

Introduction

The Power PMAC UMAC 465 CPU board (part number 604045-10x) provides a powerful computing engine for UMAC (Universal Motion and Automation Controller) rack-mounted systems. This 3U-format Eurocard (100 mm x 160 mm) can communicate with multiple accessory boards over the UBUS backplane. These accessory boards provide interfaces to the various machine elements for both motion and non-motion I/O, digital and analog.

The Power PMAC UMAC 465 CPU board can communicate with all accessory boards that the older Turbo PMAC2 UMAC CPU board (603766-10x) could use. In addition, it can communicate with a new generation of "PMAC3" UMAC accessory boards for motion, MACRO ring, and I/O that employ a new generation ASIC and a 32-bit data bus on the backplane.

The Power PMAC UMAC 465 CPU board acts as both a dedicated controller and a general-purpose embedded computer. It uses the Linux operating system with a hard-real-time kernel that guarantees determinacy of tasks such as servo loop closure.



Configuration

The base version of the Power PMAC UMAC 465 CPU board provides a 1-slot 3U-format (100mm x 160mm) Eurocard board with the following features:

- 1.0 GHz 32/64-bit Dual Core Power PMAC CPU with built-in hardware floating-point math capabilities
- 1 GByte DDR2 active memory with error correction
- 64 MByte NOR boot flash memory
- 1 GByte built-in NAND flash memory for user application storage
- 1000-Base-T (1 Gbit/sec) Ethernet communications port
- USB 2.0 Host port
- RS-232 communications port
- 32-bit UBUS backplane port to UMAC accessory boards

Optional Features

The following features are optionally present on the Power PMAC UMAC 465 CPU board:

- 1.2 GHz 32/64-bit Dual Core Power PMAC CPU with built-in hardware floating-point math capabilities
- 2 GByte DDR2 active memory with error correction
- 1, 4, 8 or 16 GByte built-in NAND flash memory for user application storage
- PCI Express “x4” expansion port
- Port for SD-format flash memory cards on optional mezzanine
- Additional 1000-Base-T (1 Gbit/sec) Ethernet communications port with optional EtherCAT capability

Hardware Setup

There is virtually no hardware setup required before installation of the Power PMAC UMAC 465 CPU board in the system.

E-Point Jumpers

The E-point jumpers on the board are intended for factory use. Their functionality is listed here primarily for reference.

E0: The two pins of E0 at the bottom edge of the board must not be shorted together in normal operation. Shorting the two pins together with a shunt locks the board in a reset state.

E1: The two pins of E1 at the bottom edge of the board must not be shorted together in normal operation. Shorting the two pins together with a shunt disables the watchdog timer circuit. This is necessary to load "bootstrap" firmware at the factory.

Shorting the two pins of E1 together during an actual application disables an important safety feature and can be very dangerous!

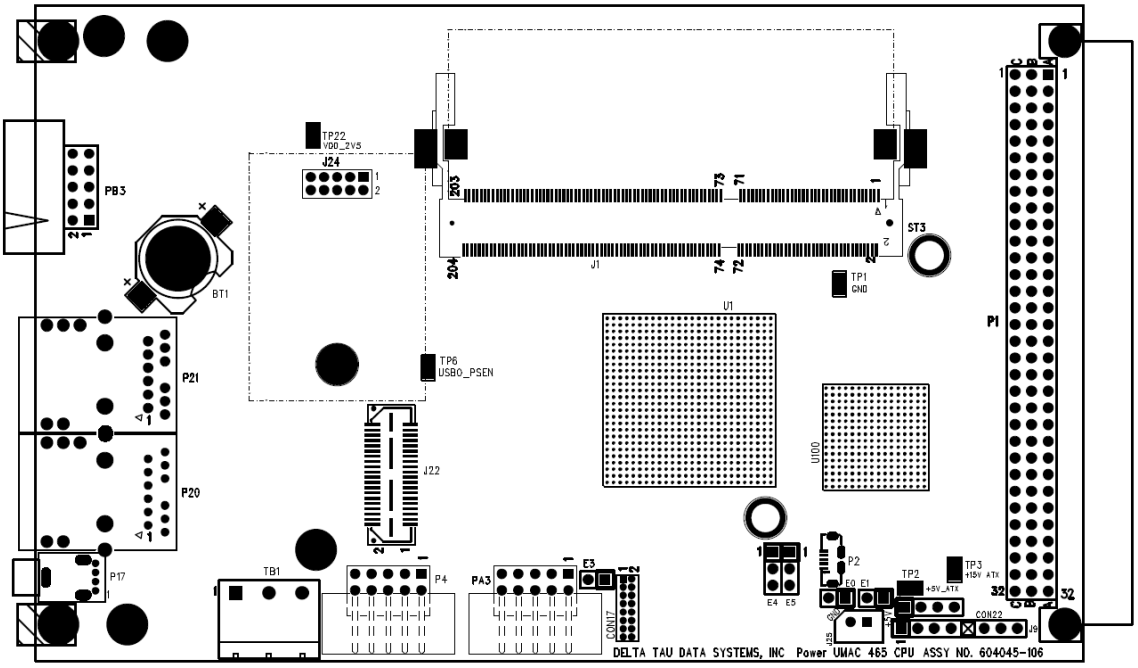
E3: Jumper installed for normal operation, this jumper is used at the factory for test purposes.

E4: Jumper installed for normal operation, this jumper is used at the factory for test purposes.

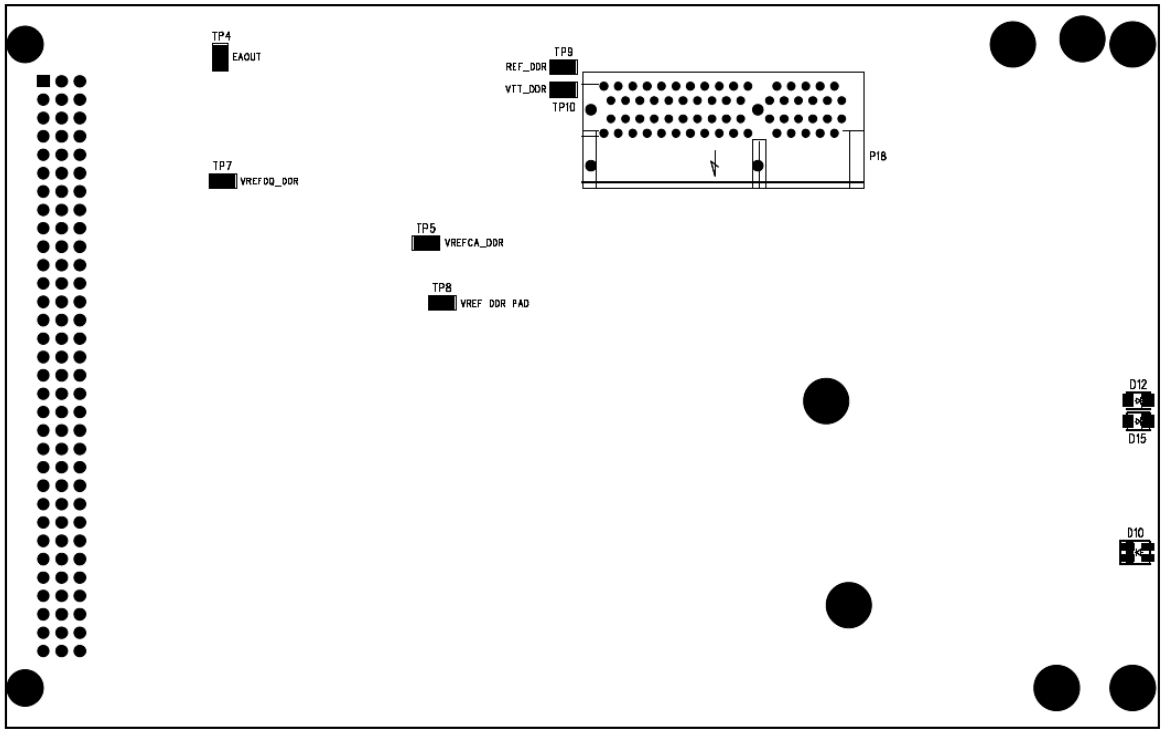
E5: No jumper installed for normal operation, this jumper is used at the factory for test purposes.

Connectors and Jumpers and Indicators

Board Front Side



Board Back Side



Backplane (UBUS) Connection

To connect the Power PMAC UMAC 465 CPU board to the UBUS backplane, simply slide the board into any slot of a UMAC that has a bus connection socket of a UBUS backplane board. It does not matter which socket on the backplane board is used, although customarily the CPU board is installed in the leftmost slot.

Getting the P1 backplane connector on the CPU board to mate firmly with the socket on the backplane requires some force, but can easily be done by hand. In a standard UMAC rack, getting the front plate flush with the front of the rack and turning the front screws firmly will ensure a good connection with the backplane.

The Power PMAC UMAC 465 CPU board gets its electrical power through the UBUS backplane board, whether the power comes from a Delta Tau power supply or an external user-provided supply.

Ethernet Connections

The Power PMAC UMAC 465 CPU board provides two Ethernet ports on the front panel: ETH 0 and ETH 1 (optional). Both ports can accept standard CAT-5 Ethernet cables with RJ-45 connectors. Both Ethernet ports provide transformer isolation to prevent ground-loop problems.

ETH 0 Ethernet Port (P21)

The "ETH 0" port is the top Ethernet connector on the front panel. It is the primary port for communicating with the CPU board from a host computer, as when using the Integrated Development Environment (IDE) program running on a Windows™ PC for developing your application.

Note that multiple computers on a single network can independently communicate to the Power PMAC CPU board through this single hardware port.

Optional ETH 1 Ethernet Port (P20)

The "ETH 1" port is the second-to-top-connector on the front panel. It is the auxiliary Ethernet port intended for EtherCAT connectivity. Although not intended for primary host communications it can be reprogrammed in the Linux system for Power PMAC communications.

USB Connections

The Power PMAC UMAC 465 CPU board provides two USB ports one on the front panel as the host port and one device port internal on the PCB. Both provide USB 2.0 protocol communications.

Caution: USB ports are not electrically isolated, so care must be taken in the grounding scheme when any separately powered device is connected to one of these ports. Poor-quality communications and even permanent component damage is possible when ground loop issues or significant differences in ground potential exist.

USB Host Port (P17)

The USB "host" port is labeled "USB 1" on the front panel. It is a "Standard-A" format connector located just below the Ethernet ports and has a horizontal orientation. With this port, the Power

PMAC CPU acts as the host computer and various peripheral devices can be connected through this port.

Probably the most common peripheral device used on this port is the "USB stick" flash drive. The Power PMAC CPU board will automatically recognize standardly formatted flash drives connected to this port. It is even possible to boot the CPU from this drive if the proper boot files are present on the drive. It is also possible to use USB peripheral devices such as true disk drives and keyboards.

USB Flash Memory Port (P2)

The USB Flash Memory Port is labeled "P2" on the PCB. It is a "Micro-B" format connector located just below the cooling fan for the CPU. With this port, the Power PMAC CPU board acts as a flash memory stick providing internal directory structure and file access from a Windows PC while the board is unpowered.

RS-232 Connection

The Power PMAC UMAC 465 CPU board provides one RS-232 port on the front panel, at the top. The connector is an IDC 10-pin connector, with the pinout arranged such that a flat cable crimped to an IDC 10-pin header at this end and a 9-pin D-sub connector at the other end will provide a standard RS-232 connection. The Delta Tau ACC-3L cable provides this connectivity.

Watchdog Timer Connection (TB1)

The Power PMAC UMAC 465 CPU board provides a dedicated connector for the output of the on-board watchdog timer. This 3-point removable terminal block is on the bottom edge of the board, near the front end. The solid-state relay output on this connector can be used for fail-safe shutdown of power circuitry in case of timer trip or loss of controller power.

Optional PCI Express Connection

The Power PMAC UMAC 465 CPU board optionally provides one PCI Express connector on the "back side" of the board (the left side when looking at the rack from the front). This permits the installation of PCI Express expansion cards inside the rack provided there is space available in the rack to the left of the CPU board, such as video cards, vision systems, and additional Ethernet ports in the Power PMAC system.

PCIe (x4) Connector (P18)

The P18 connector near the top of the back side of the CPU board provides a "times 4" (x4 – four serial channels) PCI Express connection. It is considered Port 1/Slot 1 by the CPU. PCI Express "x1" and "x4" accessories can be installed in this connector. This connector is in the right-angle configuration. The PCIe accessory board will be parallel to the CPU board, and the assembly will occupy 2 or 3 slots in the UMAC rack.

LED Indicators

D10: This is a dual colored LED. When this LED is green, it indicates that power is applied to the +5V input when this LED is red, it indicates that the watchdog timer has tripped.

D12: This is a red colored LED. When this LED is lit it indicates that the "Power Good" subsystem has failed.

D15: This is an amber colored LED. When this LED is lit it indicates that the backplane reset has completed and Power PMAC is ready for communication.

Optional Mezzanine Board

An optional mezzanine board can provide the following additional options.

Optional SD Card Connection

The Power PMAC UMAC 465 CPU board provides a socket for SD card insertion at the bottom right corner of the front panel adjacent to the Ethernet connectors. This permits the use of standard "camera card" flash memory for many uses. It is even possible to boot the CPU from an SD card if the proper boot files are present on the card.

Connector Pinouts

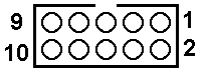
P1 UBUS32 Backplane Connector Pinout

Pin #	Row A	Row B	Row C
1	+5V	+5V	+5V
2	GND	GND	GND
3	BD09 (*BD01*)	BD00 (*rsvrd.*)	BD08 (*BD00*)
4	BD11 (*BD03*)	BD01 (*rsvrd.*)	BD10 (*BD02*)
5	BD13 (*BD05*)	BD02 (*rsvrd.*)	BD12 (*BD04*)
6	BD15 (*BD07*)	BD03 (*rsvrd.*)	BD14 (*BD06*)
7	BD17 (*BD09*)	BD04 (*rsvrd.*)	BD16 (*BD08*)
8	BD19 (*BD11*)	BD05 (*rsvrd.*)	BD18 (*BD10*)
9	BD21 (*BD13*)	BD06 (*rsvrd.*)	BD20 (*BD12*)
10	BD23 (*BD15*)	BD07 (*rsvrd.*)	BD22 (*BD14*)
11	BD25 (*BD17*)	rsrvd	BD24 (*BD16*)
12	BD27 (*BD19*)	rsrvd	BD26 (*BD18*)
13	BD29 (*BD21*)	rsrvd	BD28 (*BD20*)
14	BD31 (*BD23*)	BCSDIR(*rsvrd.*)	BD30 (*BD22*)
15	rsrvd	BCS0-(*rsvrd.*)*	rsrvd
16	BA01	BCS1-(*rsvrd.*)*	BA00
17	BA04 (*BA03*)	BCS5-(*rsvrd.*)*	BA02
18	BA03 (*BX/Y*)	BA15 (*BA14*)	BA05 (*BA04*)
19	BCS3-	BA07 (*BA06*)	BCS2-
20	BA06 (*BA05*)	BA08 (*BA07*)	BCS4-
21	BCS12-	BA09 (*BA08*)	BCS10-
22	BCS16-	BA10 (*BA09*)	BCS14-
23	BA14 (*BA13*)	BA11 (*BA10*)	BA13 (*BA12*)
24	BRD-	BA12 (*BA11*)	BWR-
25	rsrvd	DPRCS1-	rsrvd
26	WAIT-	VMECS1-	BRESET
27	PHASE+	UMAC_INT-	SERVO+
28	PHASE-	INT1- (*EQU1-*)	SERVO-
29	AGND	INT2- (*EQU2-*)	AGND
30	A-15V	PWM_ENA	A+15V
31	GND	GND	GND
32	+5V	+5V	+5V

Notes:

1. These signals are provided primarily for reference, as this is typically an "internal" connector inside the system without direct user access.
2. Names in italics refer to the naming of this pin for the older UBUS24 24-bit backplane. Accessory boards designed for the Turbo PMAC UMAC CPU use these signal designations.
3. "rsvrd" means "reserved for future use"
4. "B" as the first letter means "buffered"

RS232 (10-PIN CONNECTOR)



Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	N.C.	--	NO CONNECT	
2	DTR	BIDIRECT	DATA TERM RDY	TIED TO "DSR"
3	TXD/	INPUT	RECEIVE DATA	HOST TRANSMIT DATA
4	CTS	INPUT	CLEAR TO SEND	HOST READY BIT
5	RXD/	OUTPUT	SEND DATA	HOST RECIEVE DATA
6	RTS	OUTPUT	REQ. TO SEND	PMAC READY BIT
7	DSR	BIDIRECT	DATA SET READY	TIED TO "DTR"
8	N.C.	--	NO CONNECT	
9	GND	COMMON	PMAC COMMON	
10	RESET_SW/	INPUT	SYSTEM RESET	RESET LOW, RELEASE HI

P21 ETH 0 ETHERNET (8-PIN CONNECTOR)

Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	P0MDI0+	BIDIR	LINE 0 POS	
2	P0MDI0-	BIDIR	LINE 0 NEG	
3	P0MDI1+	BIDIR	LINE 1 POS	
4	P0MDI1-	BIDIR	LINE 1 NEG	
5	P0MDI2+	BIDIR	LINE 2 POS	
6	P0MDI2-	BIDIR	LINE 2 NEG	
7	P0MDI3+	BIDIR	LINE 3 POS	
8	P0MDI3-	BIDIR	LINE 3 NEG	

P20 ETH 1 ETHERNET (8-PIN CONNECTOR)

Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	P1MDI0+	BIDIR	LINE 0 POS	
2	P1MDI0-	BIDIR	LINE 0 NEG	
3	P1MDI1+	BIDIR	LINE 1 POS	
4	P1MDI1-	BIDIR	LINE 1 NEG	
5	P1MDI2+	BIDIR	LINE 2 POS	
6	P1MDI2-	BIDIR	LINE 2 NEG	
7	P1MDI3+	BIDIR	LINE 3 POS	
8	P1MDI3-	BIDIR	LINE 3 NEG	

P17 USB (4-PIN CONNECTOR)

[4 3 2 1]
Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	VCC	OUTPUT	SUPPLY VOLTAGE	
2	D-	BIDIRECT.	DATA NEG.	
3	D+	BIDIRECT.	DATA POS.	
4	GND	COMMON	REF. VOLTAGE	

P2 USB (4-PIN CONNECTOR)

[4 3 2 1]
Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	VCC	OUTPUT	SUPPLY VOLTAGE	
2	D-	BIDIRECT.	DATA NEG.	
3	D+	BIDIRECT.	DATA POS.	
4	GND	COMMON	REF. VOLTAGE	

TB1 WATCHDOG OUT (3-PIN CONNECTOR)

[1 2 3]
Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	N.O.	OUTPUT	NORMALLY OPEN CONTACT	CLOSED UNDER PROPER OPERATION
2	COM	RETURN	COMMON	USED WITH N.O. OR N.C.
3	N.C.	OUTPUT	NORMALLY CLOSED CONTACT	OPEN UNDER PROPER OPERATION