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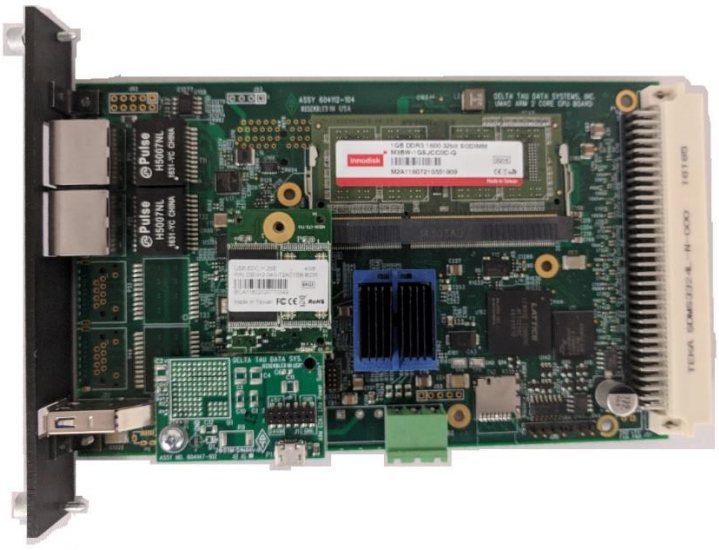
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HARDWARE REFERENCE MANUAL

POWER PMAC UMAC ARM CPU



Power PMAC UMAC ARM CPU

3-4112-xxx-xxx-xx-0xx

June 22. 2018

DELTA TAU

Data Systems, Inc.

Single Source Machine Control ..... Power // Flexibility // Ease of Use

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

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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**	**11/16/16**	**Sgm**	**Sgm**
1	**Revision**	**6/22/18**	**HB**	**Sgm**

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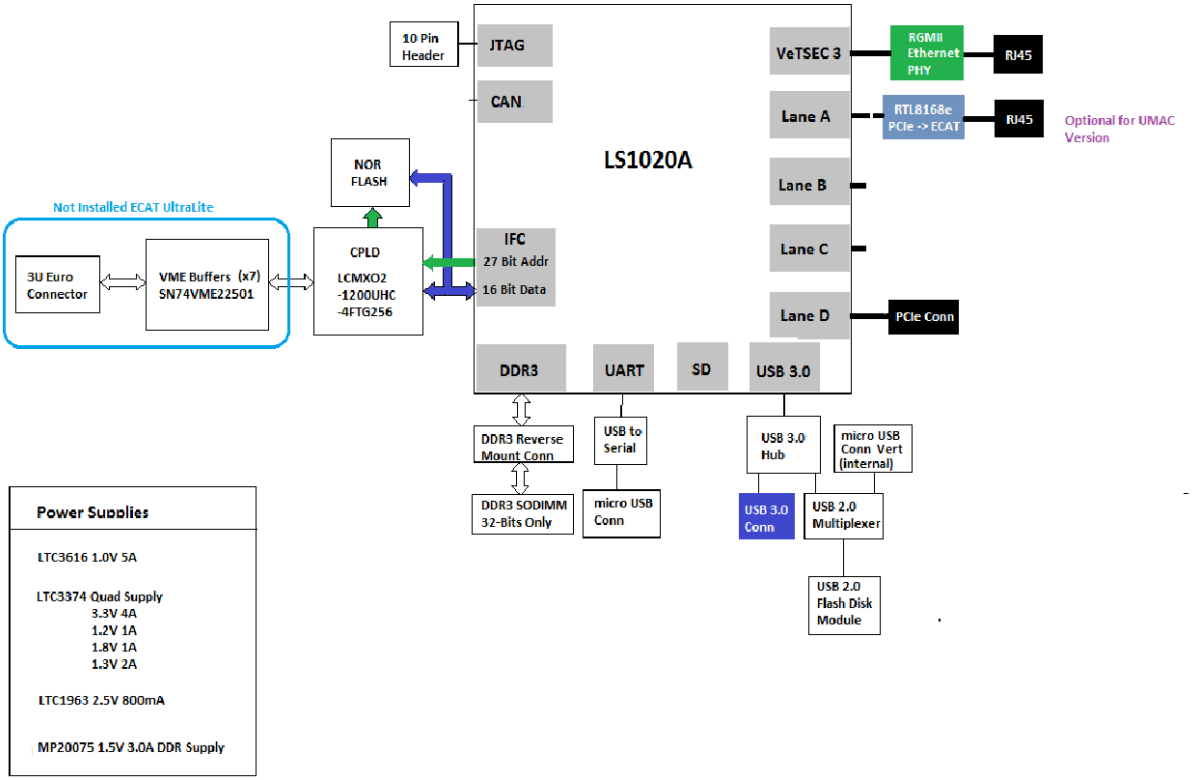
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Introduction

The Power PMAC UMAC ARM CPU board (part number 604112-10x) 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 ARM 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 ARM 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 ARM CPU board provides a 1-slot 3U-format (100mm x 160mm) Eurocard board with the following features:

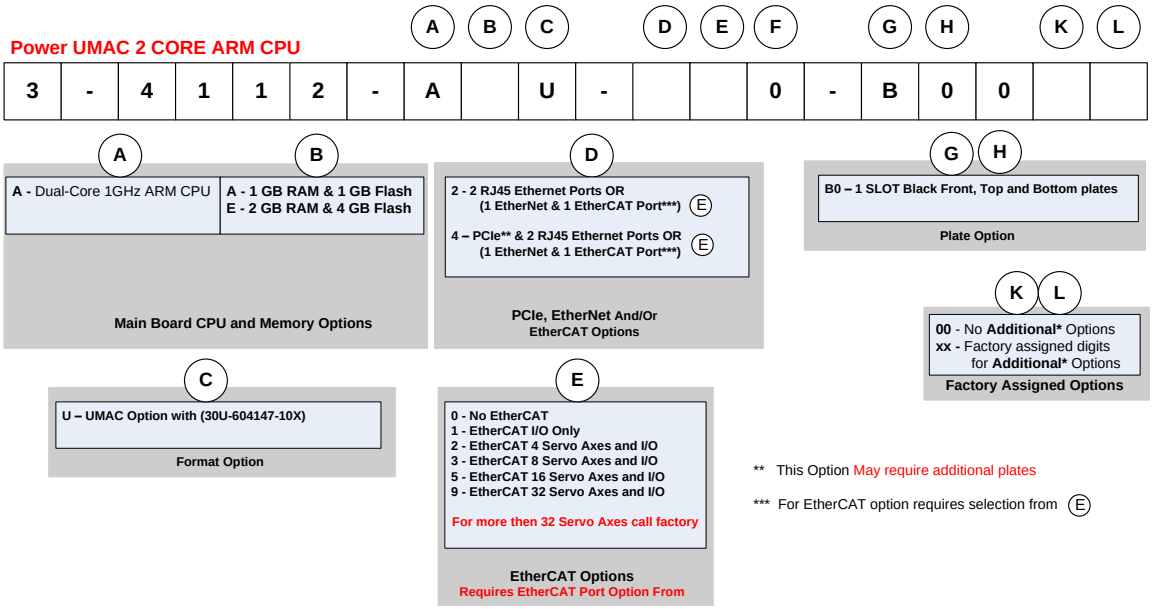
- 1.0 GHz 32-bit Dual Core ARM CPU with built-in hardware floating-point math capabilities
- 1 GByte DDR3L active memory with error correction
- 1 GByte built-in NAND flash memory for user application storage
- 1000-Base-T (1 Gbit/sec) Ethernet communications port
- USB 3.0 Host port
- RS-232 communications port
- 32-bit UBUS backplane port to UMAC accessory boards

Optional Features

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

- 2 GByte DDR3L active memory
- 4G Byte built-in NAND flash memory for user application storage
- PCI Express expansion port
- Optional EtherCAT capability

PART NUMBER ORDERING INFORMATION



Hardware Setup

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

E-Point Jumpers (Switch)

The E-point jumpers on the board have been replaced with a 4 pole switch. This is intended for factory use only. Their functionality is listed here primarily for reference.

S1-1: For factory use only. Must remain off **(open)**

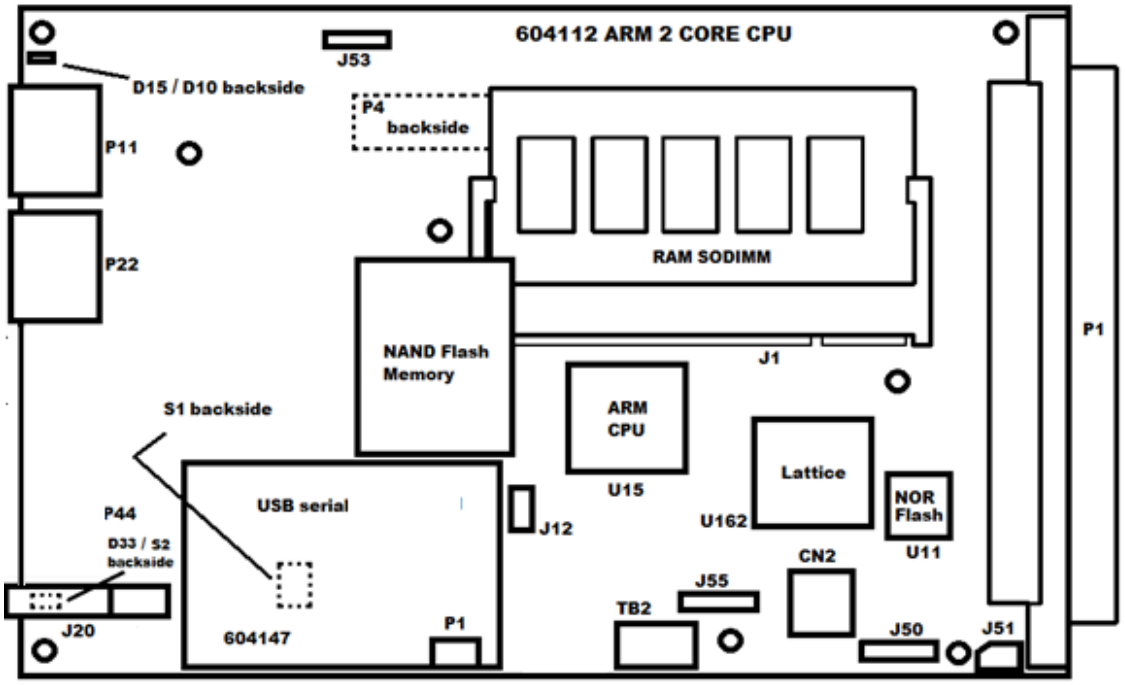
S1-2: Should remain off (**open**) for normal operation. On (**closed**) disables the watchdog timer circuit.

S1-3: Enables PCIe connector when on (**closed**). To disable PCIe connector leave off (**open**)

S1-4: For factory use only. Must remain off **(open)**

Connectors and Switches and Indicators

Board Front/Back Side



Backplane (UBUS) Connection

To connect the Power PMAC UMAC ARM 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 ARM 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 ARM CPU board is provided with two Ethernet TCP/IP communication ports on the front panel: ETH 0 and ETH 1. ETH 1 may be used for the field bus option EtherCAT provided the option has been purchased. All ports can accept standard CAT-5

Ethernet cables with RJ-45 connectors. All ports provide transformer isolation to prevent ground-loop problems.

ETH 0 Ethernet Port (P11)

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.

ETH 2 Ethernet Port (P22)

The "ETH 2" port is immediately under the top Ethernet connector on the front panel. It is the auxiliary Ethernet port and may be used as the EtherCAT port.

USB Connections

The Power PMAC UMAC ARM CPU board provides two USB ports one on the front panel as the host port and one device port internal on the PCB.



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 (J20)

The USB "host" port is labeled "USB 1" on the front panel. It is a "Standard-A" USB 3.0 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.

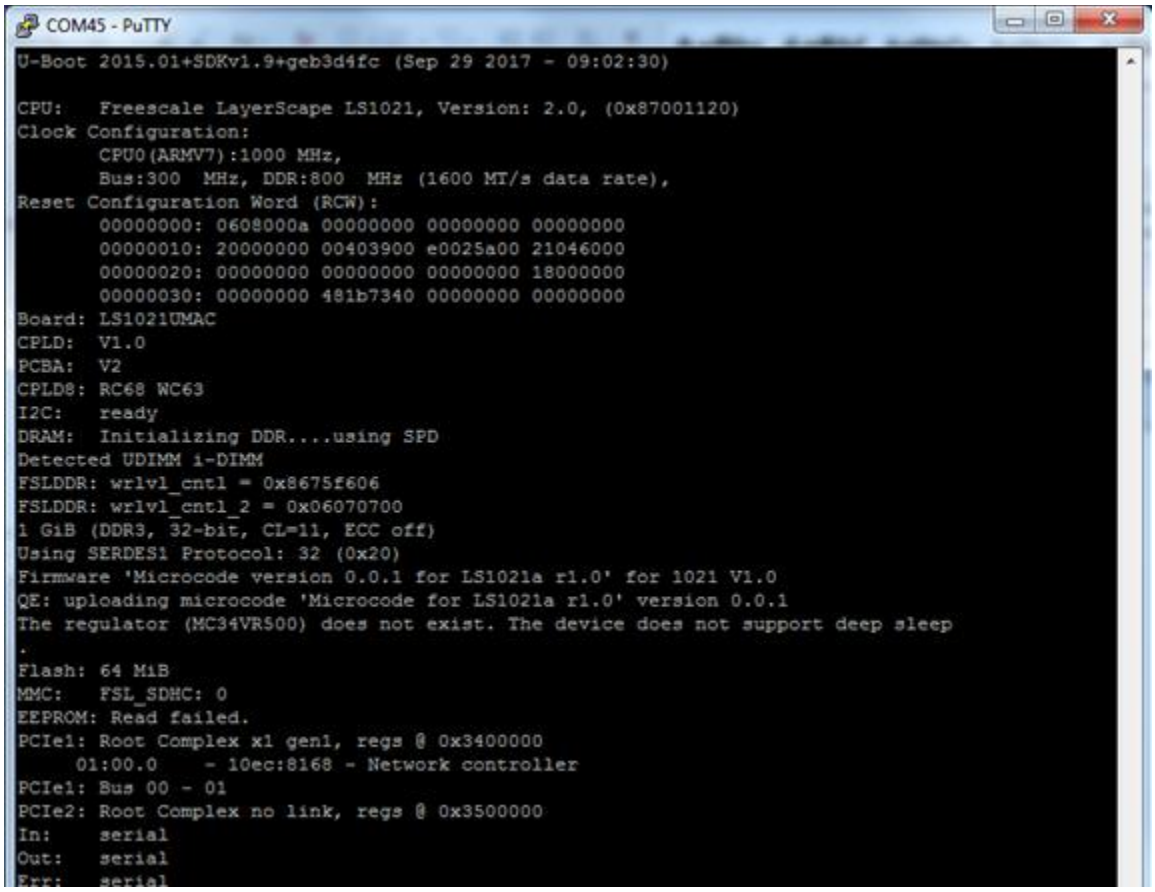
USB Flash Memory and USB serial Port (P1 on 604147 daughter card)

The USB Flash Memory/Serial Port is labeled "P1" on the 604147 daughter card. It is a "Micro-B" format connector. This port has dual functionality.

USB serial Port Functionality

When the initially plugged in the DIAG MODE LED is illuminated green,. This indicates that the USB connection is serial. The baud rate for the connection is 115200, 8 data bits, no parity and 1 stop bit. The COM port that is used by the PC is solely determined by Windows. Please

examine the Windows device manager to know what COM port Windows has chosen. The serial mode is useful for diagnostics for use with a Windows serial console program such as putty.exe. The PowerPMAC must be externally powered for data to be present from this port. Below is an example of the startup diagnostic data that the CPU prints over the serial port on startup.



USB Flash Memory Functionality

To place Processor in USB Flash memory mode do the following

1.) Make sure power is **NOT** applied to the UMAC ARM CPU Board and plug a **micro** USB cable from the PC to the side of the UMAC ARM CPU. There will be a green LED indicating the UMAC ARM CPU is receiving power from the PC USB connector to power its built in USB Serial port.

2.) Using a small screw driver click the switch S2 (see figure 2) internal to the UMAC ARM CPU Board to change the USB Diag mode connection from USB Serial to USB mass storage. The LED will switch from GREEN to ORANGE once you have successfully switched the UMAC ARM CPU Board USB diagnostic mode to mass storage. In addition simultaneously Windows will automatically open an explorer session for the Power PMAC CPU mass storage disk.

The Power PMAC CPU's USB port now acts as a flash memory stick providing internal directory structure and file access from a Windows PC while the board is unpowered.

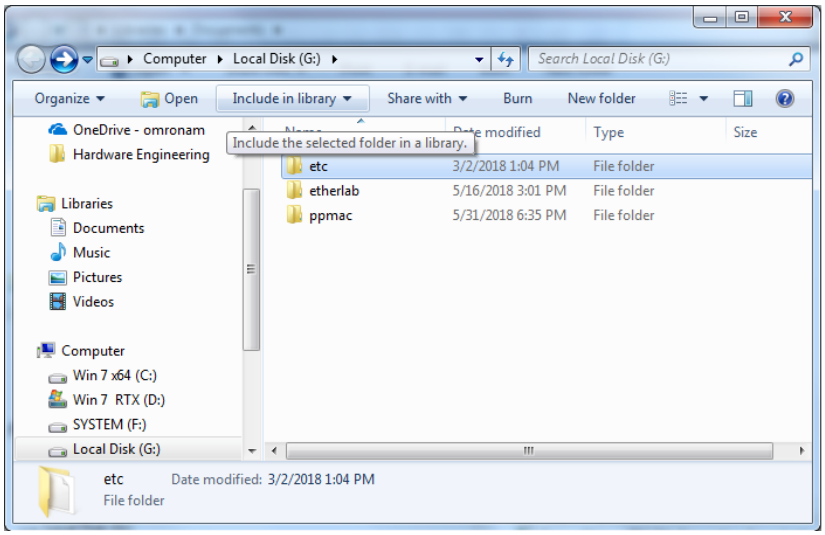
Figure 1. USB Connector is for serial port diagnostics.

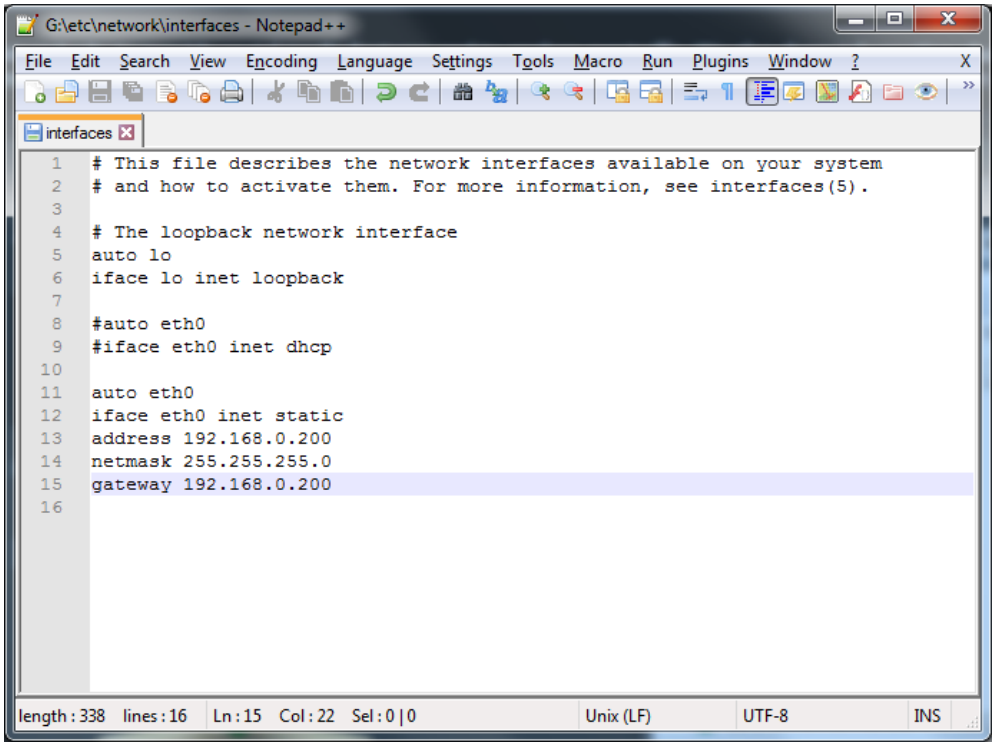


Figure 2. USB Connector is for a mass storage device



When configuring the USB connection for mass storage three folders will be present, "etc", "ppmac" and "etherlab". The "ppmac" folder represents the Power UMAC Firmware binary applications and should not be modified. The "etherlab" folder contains the EtherCAT configuration and should not be modified. The "etc" folder contains the network settings. The file interfaces maybe inspected to determine the current configured network setting of the Power PMAC. WARNING editing the interfaces file with notepad will prevent the network setting from working.

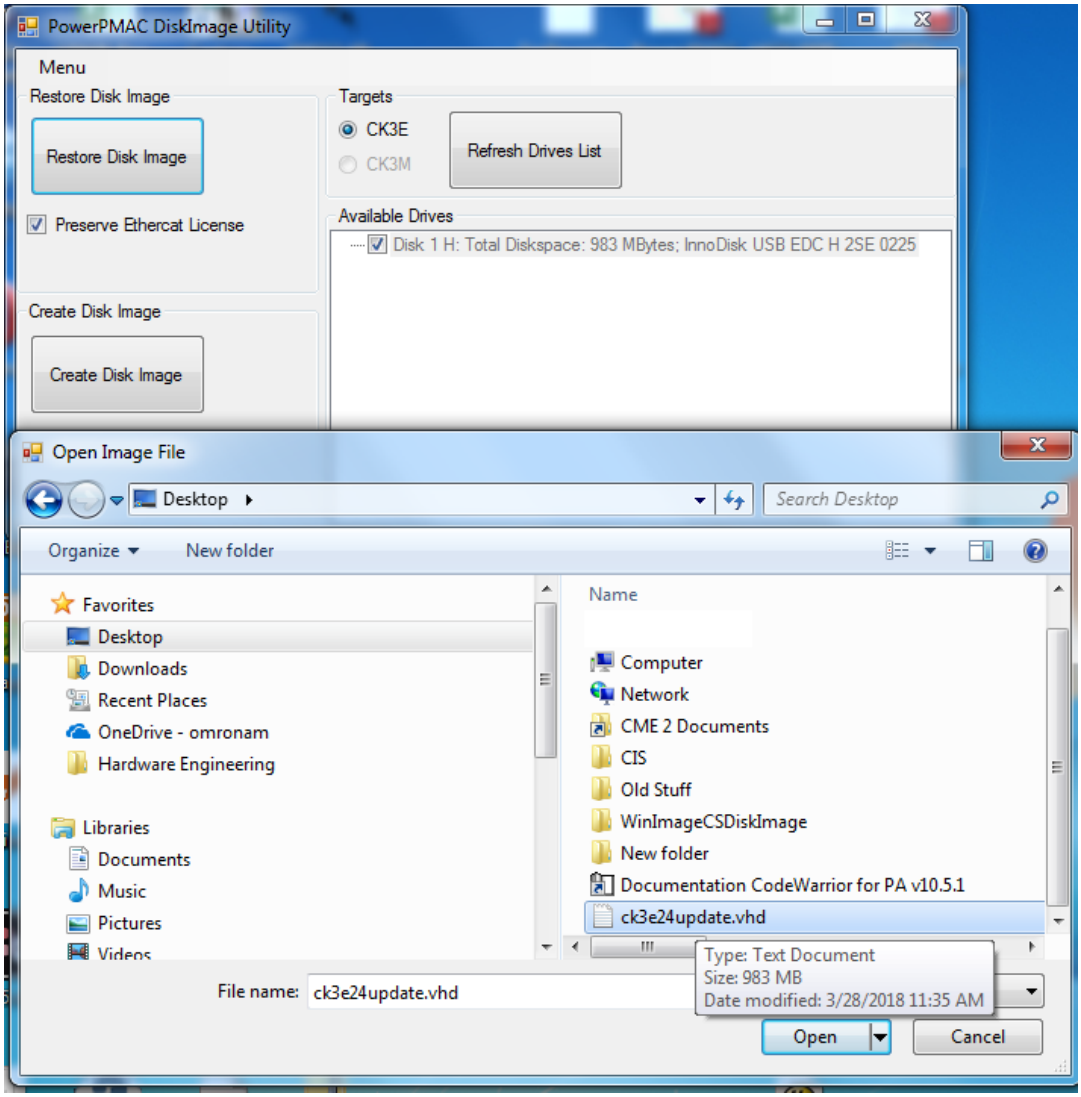




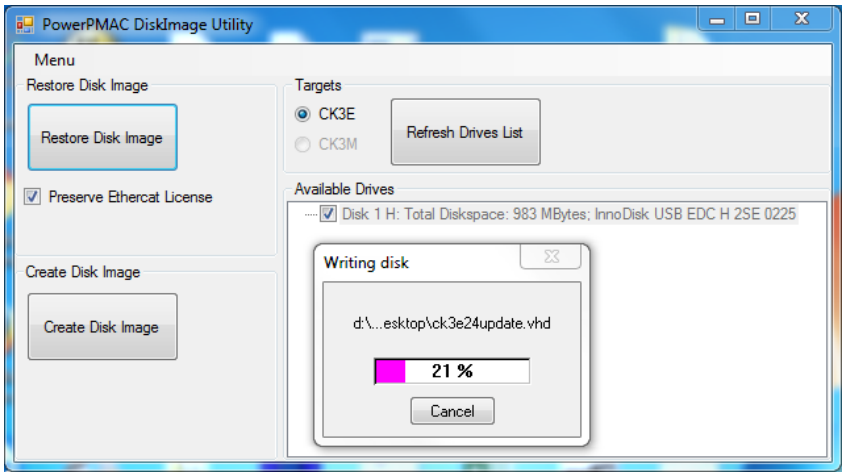
Restore Original Factory Image using CK3e2_4_1_2Update.zip

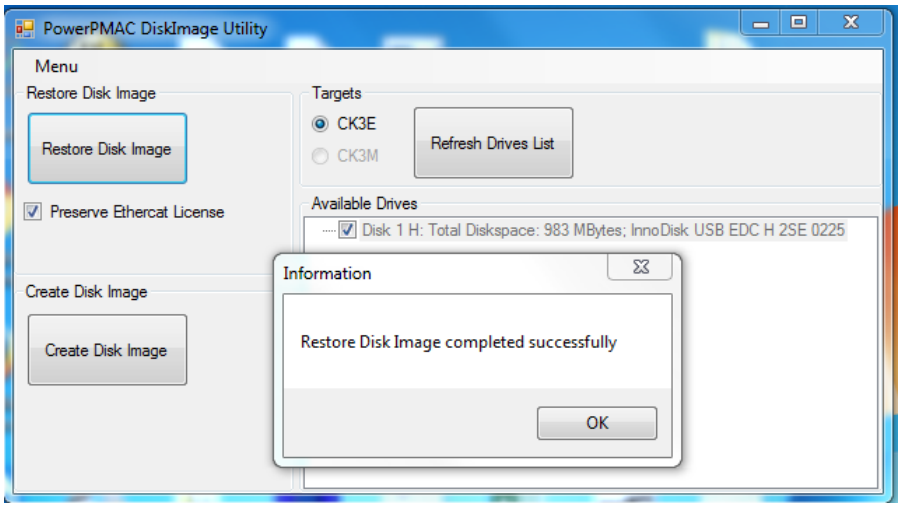
The Power PMAC CPU maybe restored to its factory image state using the CK3e2_4_1_2Update.zip package available through forums.deltatau.com in the File Depot section under Power PMAC – Firmware –Release – 2.4.1.2 when in USB Flash Memory mode

Launch the program PPMACDiskImage.exe extracted from Ck3e2_4_1_2Update.zip from a Windows PC and select CK3E for the Target Type. Click Restore Disk Image button and use the Open Image File Dialog and browse for the ck3e2_4_1_2update.vhd image file. Then select Restore Disk Image



There will be a progress bar indicating completion of the imaging process followed by a complete message.





As new images updates are made available this same method may be used to upgrade firmware. In addition, using the create disk image button a user may take a complete backup of the CPU state for restoration.

Watchdog Timer Connection (TB2)

The Power PMAC UMAC ARM 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, midway. 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 ARM 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 (P4)

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.

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.

D33: This is a dual colored LED. When this LED is green, it indicates that the "P1" port on the 604147 daughter card is in RS-232 mode. When this LED is yellow it indicates that the "P1" port on the 604147 daughter card is in USB-Flash mode. This is toggled by the micro push button switch "S2".

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”

P11- P44 ETH 0 - 3 (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	

J20 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	

P1 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	

[1 2 3]
Front View

TB2 WATCHDOG OUT (3-PIN CONNECTOR)

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

J53 PCIe POWER (4-PIN CONNECTOR)

[4 3 2 1]
Front View

PIN #	SYMBOL	FUNCTION	DESCRIPTION	NOTES
1	GND	OUTPUT	REF. VOLTAGE	
2	N.C.	BIDIRECT.		
3	+12V OUT	BIDIRECT.	OUTPUT FROM INTERNAL 12V POWER SUPPLY	JUMPER FROM 3-4 TO SUPPLY 12V FROM BUILT IN REGULATOR TO PCIE CONNECTOR
4	+V12 PCIe	COMMON	CONNECTION TO PCIe 12V	

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