Power PMAC EtherLite ARM

Power PMAC MACRO/EtherCAT
PEL3-□□0-4□□-□□00□□□
September 20, 2021
Document # MN-000275

CE   c(UL)us

COPYRIGHT INFORMATION

To report errors or inconsistencies, email: odt-support@omron.com.

For inquiries about the product, contact your local OMRON representative.

Trademarks

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OPERATING CONDITIONS

All Delta Tau Data Systems, Inc. motion controller, accessory, and amplifier products 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 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.

A Warning suggests: if not handled properly, this hazard may cause a minor/moderate injury or, in the worst case, lead to a serious injury or death. It precedes the discussion of interest.

A Caution suggests: If not handled properly, this hazard may occasionally cause a minor/moderate injury or physical damage. It precedes the discussion of interest.

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**
A	Manual creation for Power EtherLite ARM	09/15/21	SM	RN

Table of Contents

INTRODUCTION

The Power PMAC CPU is the most powerful and most flexible controller that Delta Tau presently offers, now integrated into this compact, panel mount format. The Power PMAC CPU can control up to 256 axes, whether through direct local control, or distributed control over a MACRO fiber optic ring, or over an EtherCAT network. Delta Tau offers enough peripherals over MACRO such that the user can customize his or her system to his liking while maintaining modularity and flexibility. If desired, the user can also expand his system and add functionality as needed by means of 3rd party EtherCAT devices to which Power PMAC can communicate via its EtherCAT module.

In a Dual/Quad Core CPU, all of the interrupt-based tasks execute in one core, while all of the background tasks execute in the other core. This division of tasks, because of its simplicity, provides the highest *potential* efficiency of usage of the processor resources.

For the core executing background tasks, as soon as one cycle of the background tasks has completed, the next cycle begins. But for the core executing the interrupt tasks, when those tasks are finished, the core idles until the next interrupt is received.

In the single-core CPU, the interrupt-based tasks use about two-thirds of the processor time, with background tasks using the remaining one-third. In the dual/quad-core CPU, background tasks have full time use of one of the cores, so have three times as much processing time available, permitting them to run almost three times faster. The core executing interrupt-based tasks will be active two-thirds of the time, and idle the remaining one third.

With other things remaining equal, then, the dual/quad-core CPU offers more than 67% improvement over a single-core CPU of the same frequency in this example. However, several changes can be made to improve this further, closer to the theoretical limit of 100% improvement.

Some users will elect to increase their servo and phase update frequencies to improve performance. This can now be done without reducing the time available for background tasks. Similarly, other users may increase their programmed move block rate and the "segmentation" frequency.

Other users may elect to move some background tasks into foreground, interrupt-based tasks. Moving one or two background PLC programs into the real-time interrupt, even if the increased execution rate is not necessary, can yield greater overall processor utilization.

SPECIFICATIONS

Part Number

Below is a diagram for generating the Power EtherLite ARM's part number:

Power PMAC EtherLite ARM CPU* (A)(B)   (E)(F)   (G)(H)   (K)(L)(M)

| P | E | L | 3 | - | | | 0 | - | 4 | | | - | | | 0 | 0 | | | |
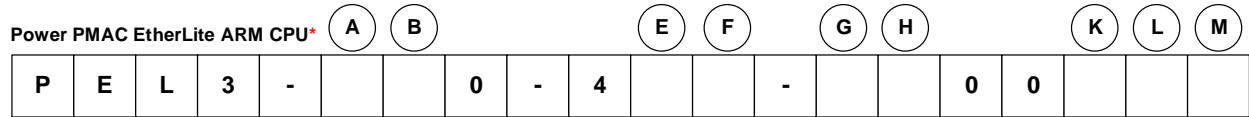
CPU, Memory, Flash Options (A)(B)

AA - Dual-Core 1GHz ARM CPU W/ 1 GB RAM & 1 GB Flash
AE - Dual-Core 1GHz ARM CPU W/ 2 GB RAM & 4 GB Flash
BE - Quad Core 1GHz ARM CPU W/ 2 GB RAM & 4 GB Flash**

* CE and UL only. This product is designed for US and Europe Only
** These Options are available with Quad Core Only

EtherCAT Options (E)

0 - No EtherCAT
1 - EtherCAT I/O Only
2 - EtherCAT 4 Servo Axes and I/O
3 - EtherCAT 8 Servo Axes and I/O
5 - EtherCAT 16 Servo Axes and I/O
9 - EtherCAT 32 Servo Axes and I/O
J - EtherCAT 64 Servo Axes and I/O**

For additional Servo Axes control contact factory

(F)

0 – No Slave Ports
1 – RJ45 EtherCAT Slave Ports, IN/OUT**

MACRO Options (604035) (G)(H)

00 - No MACRO Option**
1A - Fiber Optic MACRO / 16 Servo + 12 IO Nodes
2A - Fiber Optic MACRO / 32 Servo + 24 IO Nodes

Mounting Options (K)

0: Back panel mounting (12" depth panel)
1: Right Side Mount (4" depth panel)

Factory Assigned Options (L)(M)

00: No **Additional*** Options
XX: Factory assigned digits for **Additional*** Options

> **Note**
> The EtherCAT license is programmed in hardware on the MACRO/EtherCAT card inside the EtherLite at the factory and cannot be upgraded in the field.

Environmental Specifications

Description	Specification
Ambient Operating Temperature	0°C to 55°C
Ambient Storage Temperature	-25°C to 70°C (with no icing or condensation)
Ambient Operating Humidity	10% to 95 % (with no icing or condensation)
Atmosphere	Must be free from corrosive gases.

Electrical Specifications

Power Supply Requirements

Model	Rated Current @ +24VDC ± 5%
PEL3-A□0-4□0-□□00□□□	0.75 A
PEL3-BE0-4□0-□□00□□□	0.80 A
PEL3-BE0-4□1-□□00□□□	1.00 A

> ⚠ *Note* External 24VDC power supply must be a Class 2 rating.

Physical Specifications

Description	Specification
Height	7.02"
Width	3.90"
Depth	7.44"
Weight (No Packaging)	2.75 lbs. max.

Agency Approval and Safety

Item	Description
CE Mark	EN61326-1
EMC	EN55011 Class A Group 1 EN61000-4-2 EN61000-4-3 EN61000-4-4 EN61000-4-5 EN61000-4-6 EN61000-4-8 EN61000-4-11
UL	UL 61010-1 File E314517
cUL	CAN/CSA C22.2 No. 1010.1-92 File E314517
Flammability Class	UL 94V-0

RECEIVING AND UNPACKING

Unpacking Guidelines

Delta Tau products are thoroughly tested at the factory and carefully packaged for shipment. When the Power EtherLite ARM is received, do the following immediately:

1. Inspect the condition of the shipping container and report any damage immediately to the commercial carrier that delivered the drive.

2. Remove the device from the shipping container and remove all packing materials. Check all shipping material for connector kits, documentation, or other small pieces of equipment. Be aware that some connector kits and other equipment pieces may be quite small and can be discarded accidentally if care is not used when unpacking the equipment. The container and packing materials can be retained for future shipment.

3. Electronic components in this device are design-hardened to reduce static sensitivity. However, use proper procedures when handling the equipment.

4. If the Power EtherLite ARM is to be stored for several weeks before use, be sure that it is stored in a location that conforms to published storage humidity and temperature specifications stated in this manual.

Use of Equipment

The following guidelines describe the restrictions for proper use of Power EtherLite ARM:

- The components built into electrical equipment or machines can be used only as integral components of such equipment.

- Power EtherLite ARM must not be operated on power supply networks without a ground or with an asymmetrical ground.

- Power EtherLite ARM may be operated only in a closed switchgear cabinet, taking into account the ambient conditions defined in the environmental specifications.

Delta Tau guarantees the conformance of Power EtherLite ARM with the standards for industrial areas stated in this manual only if Delta Tau components (cables, controllers, etc.) are used.

MOUNTING

Installation Guidelines

This product should be installed in an area that is protected from direct sunlight, corrosives, harmful gases or liquids, dust, metallic particles, and other contaminants. Exposure to these can reduce the operating life and degrade the performance.

A couple other factors to evaluate carefully when selecting a location for installation:
- Allow for at least 1 inch (2.54mm) top and bottom clearance to permit airflow. At least 0.4 inches (10mm) clearance is required between each side.
- Temperature, humidity and vibration specifications should also be considered.

Power EtherLite ARM can be mounted with a 4-hole panel mount, two U-shape notches on the bottom and two pear-shaped holes on top. Mounting is also identical to this on all peripheral devices.

If multiple MACRO devices are used, they can be mounted side-by-side, leaving at least a 0.4 inch clearance between them. It is important that the airflow is not obstructed by the placement of conduit tracks or other devices in the enclosure.

Power EtherLite ARM should be mounted on an unpainted, electrically-conductive panel in order to allow for reduced electrical noise interference. The back panel should be machined to accept the mounting bolt pattern of the accessory. Make sure that all metal chips are cleaned up before the device is mounted so that there is no risk of getting metal chips inside the device.

Power EtherLite ARM is mounted to the back panel with four M4 screws and internal-tooth lock washers. The teeth of the washers must break through the device's anodizing in order to provide an electrically-conductive path in as many places as possible.

Caution

Units must be installed in an enclosure that meets the environmental IP rating of the end product (ventilation or cooling may be necessary to prevent enclosure ambient from exceeding 55° C [131° F]).

WARNING

Installation of electrical control equipment is subject to many regulations including national, state, local, and industry guidelines and rules. General recommendations can be stated but it is important that the installation be carried out in accordance with all regulations pertaining to the installation.

MACRO SETUP

The procedure used for setting up the EtherLite for controlling MACRO Stations is identical to the procedure used for all MACRO Ring Controllers using Gate3 hardware. Therefore, please refer to the Power PMAC User Manual or additional application notes for setup instructions from our file depot page http://forums.deltatau.com/filedepot/ or contact ODT support for assistance.
Phone: (800) 556-6766

Email: odt-support@omron.com

Website: https://automation.omron.com/en/us/omron-delta-tau

ETHERCAT SETUP

The procedure for setting up a Power EtherLite ARM to use an EtherCAT ring is identical for all Power PMACs. Therefore, please refer to the Power PMAC IDE Manual or contact OMRON support for assistance.
Phone: (800) 556-6766
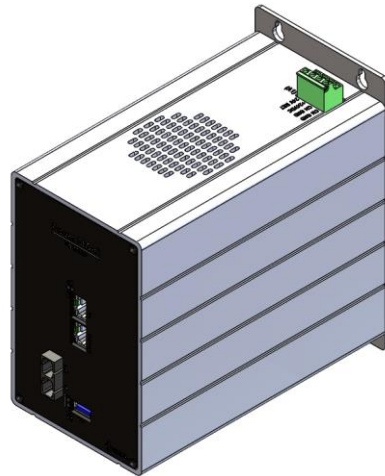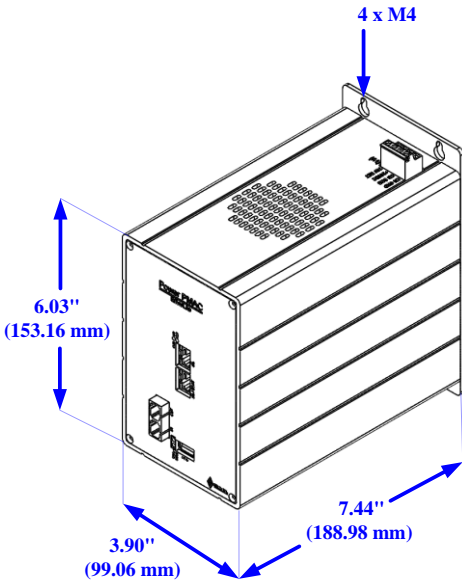Email: odt-support@omron.com
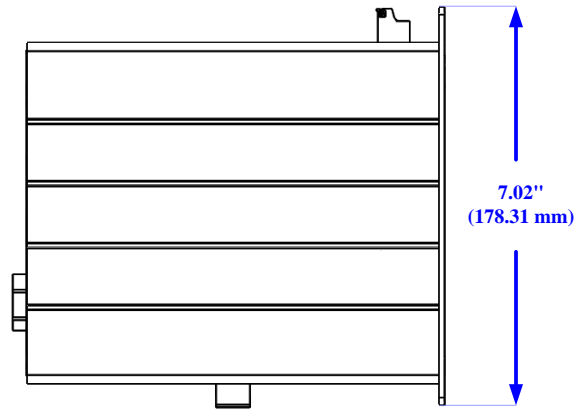Website: https://automation.omron.com/en/us/omron-delta-tau
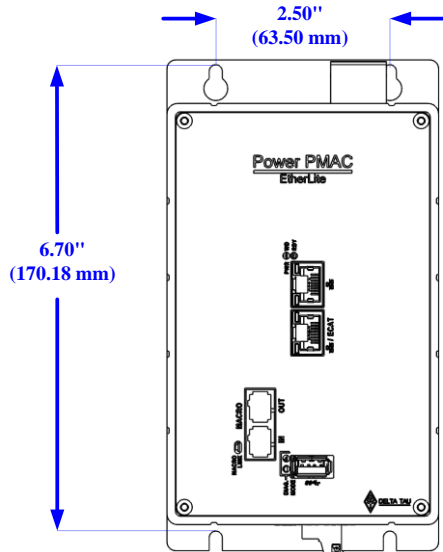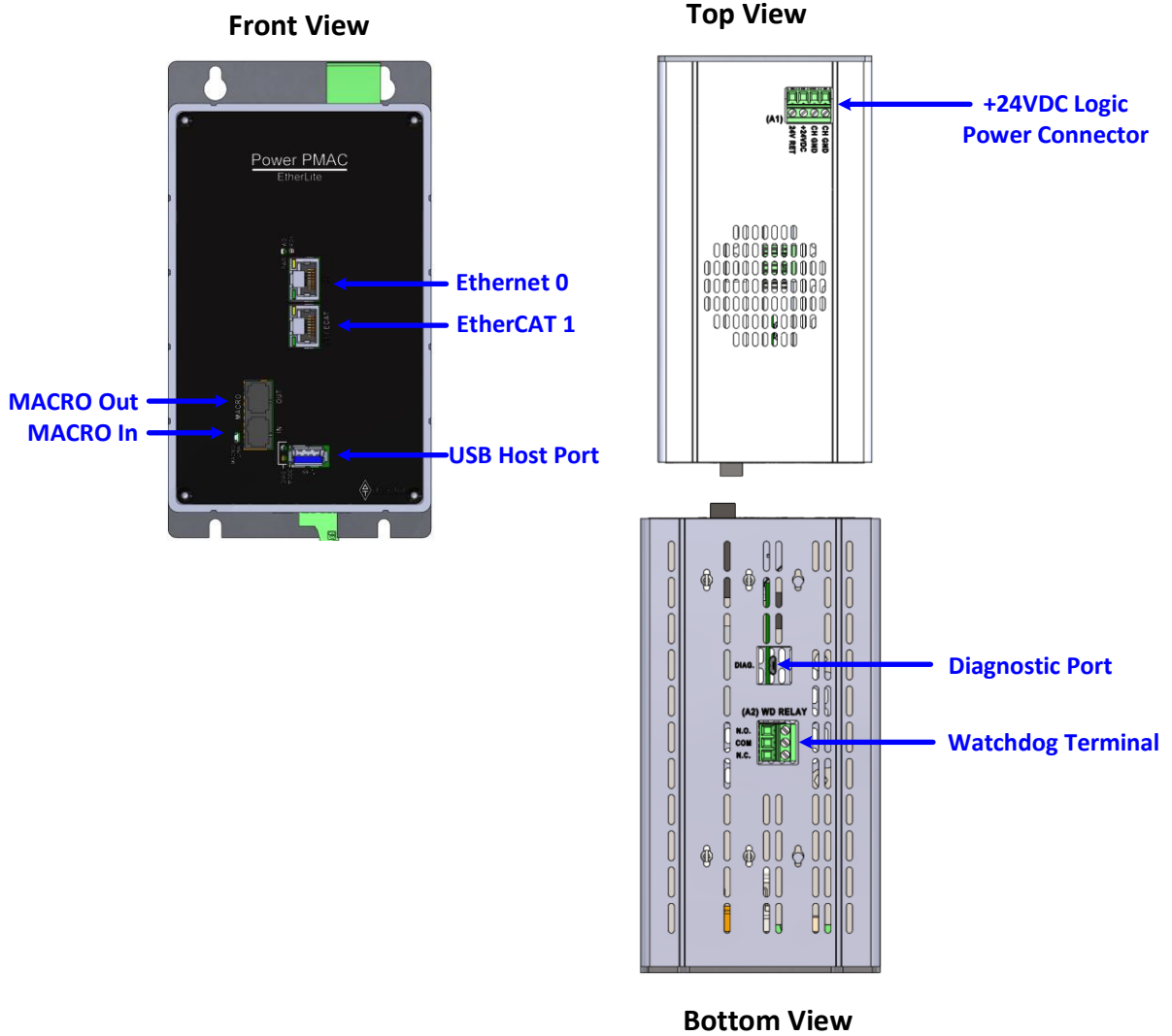
LAYOUT & PINOUTS

Layout

The external dimensions of the EtherLite do not change, regardless of the options chosen.

Connectors

Connector Layout
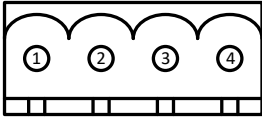
The connectors are labeled below:

Front View

Top View

Ethernet 0

EtherCAT 1

MACRO Out

MACRO In

USB Host Port

+24VDC Logic
Power Connector

Diagnostic Port

Watchdog Terminal

Bottom View

24 VDC Logic Power Input

Mating Connector **Delta Tau Part Number: 016-P00104-08P** **Phoenix Contact Part Number: 1777303** **(Front MSTB 2.5-5.08)**		**Top View**	
Pin #	**Symbol**	**Function**	**Description**
1	24VDC RET	Return for 24VDC Logic Power	
2	24VDC	+24VDC Logic Power	
3	CHGND	Chassis Ground	Internally connected to chassis ground
4	CHGND	Chassis Ground	Internally connected to chassis ground

Note   Please refer to the Power Supply Requirements section of this manual

Ethernet Connections

The Power EtherLite ARM provides two Ethernet ports on the front panel: ETH 0 and ETH 1. 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

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[TM] PC for developing your application.

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

Its pinout can be seen below:

ETH0: 8-Pin RJ45 Receptacle	**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.	

This connector is used for Ethernet communications from the UMAC to a PC. The appropriate Category 5 100/1000-Base T network cable that mates to this connector can be purchased from any local computer store. The type of network cable to purchase depends on the configuration to the host PC.

EtherCAT Connections

The user can order EtherCAT Master Out port and Slave Out & In port with the Power EtherLite ARM. Both ports can accept standard CAT-5 Ethernet cables with RJ-45 connectors. Both EtherCAT ports provide transformer isolation to prevent ground-loop problems. Each port can control its own EtherCAT ring, allowing Power PMAC to be the master to two separate rings simultaneously.
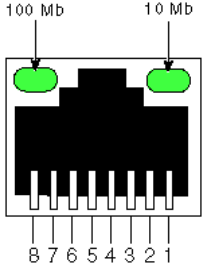
EtherCAT Port

EtherCAT Master Out port is the second RJ45 connector on the front panel which is connected to EtherCAT slave device such as OMRON 1S drive or NX-IO.

EtherCAT Slave Out port is the third RJ45 connector on the front panel which is connected to EtherCAT slave device.

EtherCAT Slave In port is the forth RJ45 connector on the front panel which is connected from EtherCAT master/slave device.

Its pinout can be seen below:

E0: 8-Pin RJ45 Receptacle			Front View	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	E0MDI0+	BIDIR	Line 0 Pos.	
2	E0MDI0-	BIDIR	Line 0 Neg.	
3	E0MDI1+	BIDIR	Line 1 Pos.	
4	E0MDI1-	BIDIR	Line 1 Neg.	
5	E0MDI2+	BIDIR	Line 2 Pos.	
6	E0MDI2-	BIDIR	Line 2 Neg.	
7	E0MDI3+	BIDIR	Line 3 Pos.	
8	E0MDI3-	BIDIR	Line 3 Neg.	

USB Connections

The Power EtherLite ARM board provides two USB ports on the front panel, one host port and one device port. Both provide USB 2.0 protocol communications.
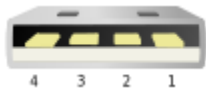
> ⚠️
> *Caution*
>
> USB ports are not electrically isolated, so care must be taken in the grounding scheme when any separately powered device is connected to one of these ports. Poor-quality communications and even permanent component damage is possible when ground loop issues or significant differences in ground potential exist.

USB Host Port

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.
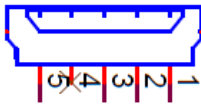
Its pinout is below:

USB 1: 4-Pin Receptacle			**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	

This connector provides a USB "host" interface on a Standard A connector. It is suitable for standard USB connectors to external devices

USB Flash Memory and USB serial Port

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 1: 4-Pin Receptacle			Front View	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	VCC	Output	Supply Voltage	
2	D-	Bidirect.	Data Neg.	
3	D+	Bidirect.	Data Pos.	
4	-	-	-	-
5	GND	Common	Ref. Voltage	

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.

```
COM45 - PuTTY                                                              [-][□][✕]
U-Boot 2015.01+SDKv1.9+geb3d4fc (Sep 29 2017 - 09:02:30)

CPU:    Freescale LayerScape LS1021, Version: 2.0, (0x87001120)
Clock Configuration:
        CPU0(ARMV7):1000 MHz,
        Bus:300  MHz, DDR:800  MHz (1600 MT/s data rate),
Reset Configuration Word (RCW):
        00000000: 0608000a 00000000 00000000 00000000
        00000010: 20000000 00403900 e0025a00 21046000
        00000020: 00000000 00000000 00000000 18000000
        00000030: 00000000 481b7340 00000000 00000000
Board: LS1021UMAC
CPLD:  V1.0
PCBA:  V2
CPLD8: RC68 WC63
I2C:   ready
DRAM:  Initializing DDR....using SPD
Detected UDIMM i-DIMM
FSLDDR: wrlvl_cntl = 0x8675f606
FSLDDR: wrlvl_cntl_2 = 0x06070700
1 GiB (DDR3, 32-bit, CL=11, ECC off)
Using SERDES1 Protocol: 32 (0x20)
Firmware 'Microcode version 0.0.1 for LS1021a r1.0' for 1021 V1.0
QE: uploading microcode 'Microcode for LS1021a r1.0' version 0.0.1
The regulator (MC34VR500) does not exist. The device does not support deep sleep
.
Flash: 64 MiB
MMC:   FSL_SDHC: 0
EEPROM: Read failed.
PCIe1: Root Complex x1 gen1, regs @ 0x3400000
     01:00.0    - 10ec:8168 - Network controller
PCIe1: Bus 00 - 01
PCIe2: Root Complex no link, regs @ 0x3500000
In:    serial
Out:   serial
Err:   serial
```

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 4 CORE CPU Board and plug a **micro** USB cable from the PC to the side of the UMAC ARM 4 CORE CPU. There will be a green LED indicating the UMAC ARM 4 CORE 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 4 CORE 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 4 CORE 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.

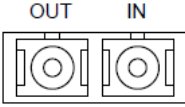Figure 1. USB Connector is for serial port diagnostics.

Figure 2. USB Connector is for a mass storage device

MACRO Port

Option A provides the following connector for MACRO communications:

MACRO SC-Style Fiber Connector	
	OUT IN **Front View**

Pin #	Symbol	Function	Description	Notes
1	MACRO IN	Input	MACRO Ring Receiver	
2	MACRO OUT	Output	MACRO Ring Transmitter	

The input connector must be inserted into the MACRO output connector of the previous device on the MACRO ring. The output connector must be inserted into the input MACRO connector of the next device on the MACRO ring.
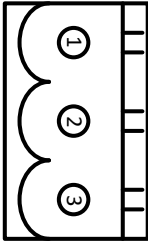
 Note The fiber optic version of MACRO uses 62.5/125 multi-mode glass fiber optic cable terminated in an SC-style connector. The optical wavelength is 1,300 nm

Watchdog Timer Connection (TB1)

The Power PMAC 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.

TB1: Watchdog Out, **3-Pin Receptacle** **Delta Tau Part #: 016-P00103-08P** **Phoenix Contact Part #: 1777293** **(Front MSTB 2.5/3-ST-5.08)**	
	 Bottom 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

Caution

Maximum current at N.O. / N.C. is 50mA@24V.

The circuit may damage if exceeded current is applied.

The TB1 connector provides the output signals for the watchdog timer circuit. It is recommended that this output be used as part of the safety circuitry for the system, so if the Power PMAC CPU loses power or trips its watchdog timer, the system will go into a safe shutdown mode without the assistance of any software on the Power PMAC CPU.

<div style="border:1px solid black; padding:10px;">

Terms and Conditions Agreement

Warranties.
(a) Exclusive Warranty. Delta Tau's exclusive warranty is that the Products will be free from defects in materials and workmanship for a period of twelve months from the date of sale by Delta Tau (or such other period expressed in writing by Delta Tau). Delta Tau disclaims all other warranties, express or implied.
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Suitability of Use.
Delta Tau shall not be responsible for conformity with any standards, codes or regulations which apply to the combination of the Product in the Buyer's application or use of the Product. At Buyer's request, Delta Tau will provide applicable third party certification documents identifying ratings and limitations of use which apply to the Product. This information by itself is not sufficient for a complete determination of the suitability of the Product in combination with the end product, machine, system, or other application or use. Buyer shall be solely responsible for determining appropriateness of the particular Product with respect to Buyer's application, product or system. Buyer shall take application responsibility in all cases.
NEVER USE THE PRODUCT FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY OR IN LARGE QUANTITIES WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE DELTA TAU PRODUCT(S) IS PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

Programmable Products.
Delta Tau shall not be responsible for the user's programming of a programmable Product, or any consequence thereof.

Performance Data.
Data presented in Delta Tau websites, catalogs and other materials is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of Delta Tau's test conditions, and the user must correlate it to actual application requirements. Actual performance is subject to the Delta Tau's Warranty and Limitations of Liability.

Change in Specifications.
Product specifications and accessories may be changed at any time based on improvements and other reasons. It is our practice to change part numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the Product may be changed without any notice. When in doubt, special part numbers may be assigned to fix or establish key specifications for your application. Please consult with your Omron's representative at any time to confirm actual specifications of purchased Product.

Errors and Omissions.

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Information presented by Delta Tau has been checked and is believed to be accurate; however, no responsibility is assumed for clerical, typographical or proofreading errors or