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HARDWARE REFERENCE MANUAL

Power PMAC EtherLite



Power PMAC MACRO/EtherCAT Master

PEL3-□□□-□□1-□□00□□□

August 9, 2022

Document # MN-000252

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To report errors or inconsistencies, call or email your local Omron representative

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. Before powering, please ensure there is no visible damage to the product.

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. Our products should not be placed in locations that can accrue a lot of dust, salt, or conductive iron-like powder. 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. For your own safety, please keep the product's environmental conditions within the range outlined by the Environment Specifications section that can be located from the table of contents in this manual.

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EN Dispose in accordance with applicable regulations.

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.

Security Measures

Anti-virus protection

Install the latest commercial-quality antivirus software on the computer connected to the control system and maintain to keep the software up to date.

Security measures to prevent unauthorized access

Take the following measures to prevent unauthorized access to our products.

• Install physical controls so that only authorized personnel can access control systems and equipment.

• Reduce connections to control systems and equipment via networks to prevent access from untrusted devices.

• Install firewalls to shut down unused communications ports and limit communications hosts and isolate control systems and equipment from the IT network.

• Use a virtual private network (VPN) for remote access to control systems and equipment.

• Adopt multifactor authentication to devices with remote access to control systems and equipment.

• Set strong passwords and change them frequently.

• Scan virus to ensure safety of USB drives or other external storages before connecting them to control systems and equipment.

Data input and output protection

Validate backups and ranges to cope with unintentional modification of input/output data to control systems and equipment.

• Checking the scope of data

• Checking validity of backups and preparing data for restore in case of falsification and abnormalities

• Safety design, such as emergency shutdown and fail-soft operation in case of data tampering and abnormalities

Data Recovery

Backup data and keep the data up-to-date periodically to prepare for data loss.

When using an intranet environment through a global address, connecting to an unauthorized terminal such as a SCADA, HMI or to an unauthorized server may result in network security issues such as spoofing and tampering.

You must take sufficient measures such as restricting access to the terminal, using a terminal equipped with a secure function, and locking the installation area by yourself.

When constructing an intranet, communication failure may occur due to cable disconnection or the influence of unauthorized network equipment. Take adequate measures, such as restricting physical access to network devices, by means such as locking the installation area.

When using a device equipped with the SD Memory Card function, there is a security risk that a third party may acquire, alter, or replace the files and data in the removable media by removing the removable media or unmounting the removable media. Please take sufficient measures, such as restricting physical access to the Controller or taking appropriate management measures for removable media, by means of locking the installation area, entrance management, etc., by yourself.



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**
0	Created the manual	12/21/12	DCDP	RN
1	Added the Reliability Predictions Report	2/25/13	DCDP	RN
A	Added UKCA Marking to front cover and added description in Agency of Approval section	09/01/21	AE	SM
B	Updated UKCA standard	02/02/22	AE	SF
C	Added Security Measures update	08/09/22	AE	SS

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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 UMAC 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.

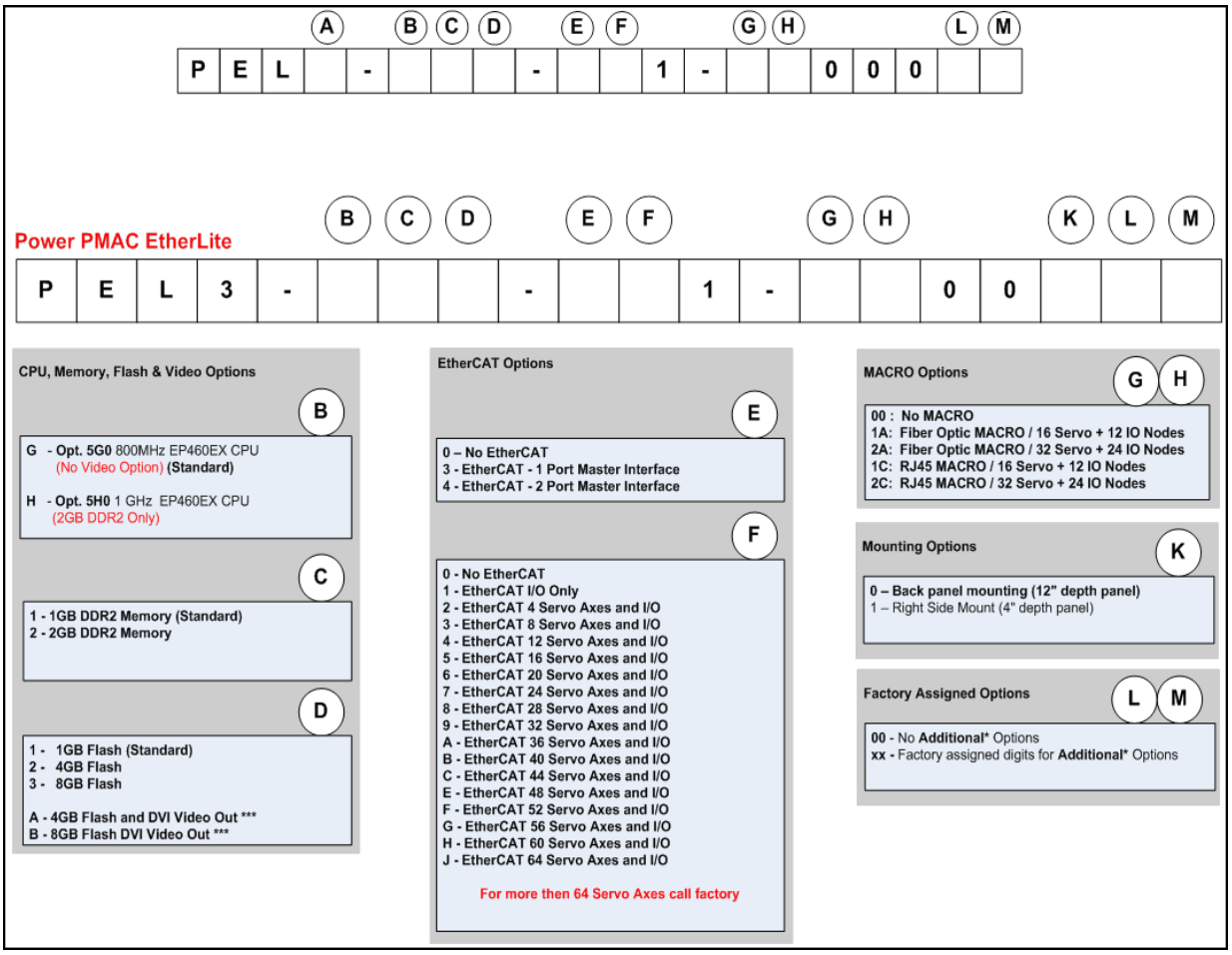
The hardware used inside EtherLite is a Power PMAC CPU and a special MACRO/EtherCAT card which is a combination Network Interface Card communicating through PCIe and the ACC-5E3 hardware without the additional I/O option that communicates through the UBUS backplane.



SPECIFICATIONS

Part Number

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





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

Safe Operating Temperature	0°C to 45°C
Safe Storage Temperature	-25°C to 70°C
Humidity	10% to 95 % non-condensing

Electrical Specifications

Current Draw at 24VDC for Logic Power	1.0 ± 0.2 Amps

Physical Specifications

Height	6.05”
Width	3.90”
Depth	7.44”
Weight (No Packaging)	No Video Option: 2.35 ± 0.05 lbs With Video Option: 2.75 ± 0.05 lbs

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
UKCA	2016 No. 1091

RECEIVING AND UNPACKING

Unpacking Guidelines

Delta Tau products are thoroughly tested at the factory and carefully packaged for shipment. When the Power PMAC EtherLite 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, diskettes, CD ROM, 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 Power PMAC EtherLite 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 PMAC EtherLite:

- The components built into electrical equipment or machines can be used only as integral components of such equipment.
- Power PMAC EtherLite must not be operated on power supply networks without a ground or with an asymmetrical ground.
- Power PMAC EtherLite 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 PMAC EtherLite 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 PMAC EtherLite 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 PMAC EtherLite 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 PMAC EtherLite 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 45° C [113° 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 MACRO User Manual for setup instructions.

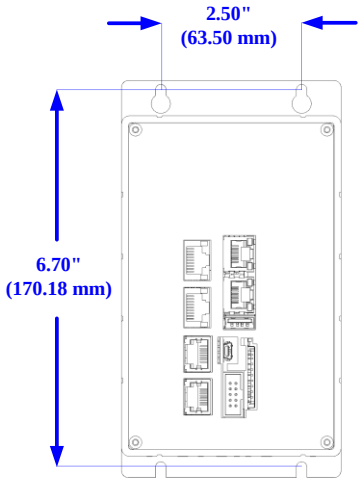
ETHERCAT SETUP

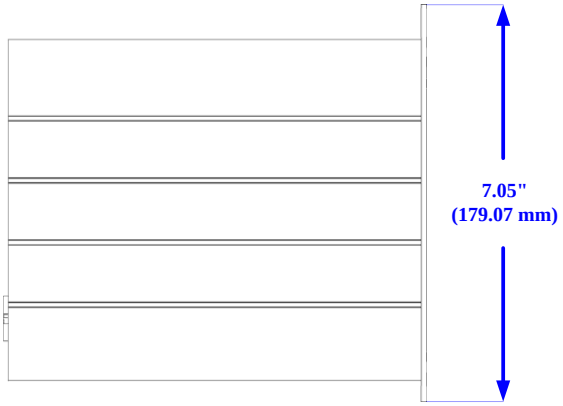
The procedure for setting up a Power PMAC EtherLite to use an EtherCAT ring is identical for all Power PMACs. Therefore, please refer to the EtherCAT Software Setup manual for details on how to set up an EtherCAT ring.

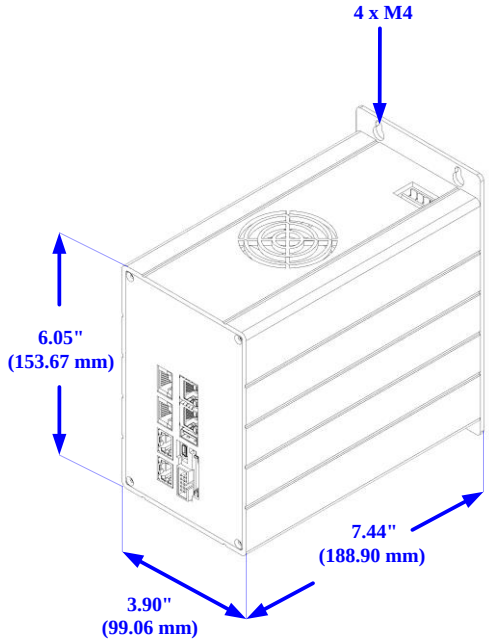
LAYOUT & PINOUTS

Layout

This layout is for a fully populated EtherLite; that is, one with two EtherCAT Master Ports and with MACRO (RJ45 connections). The external dimensions of the EtherLite do not change, regardless of the options chosen.









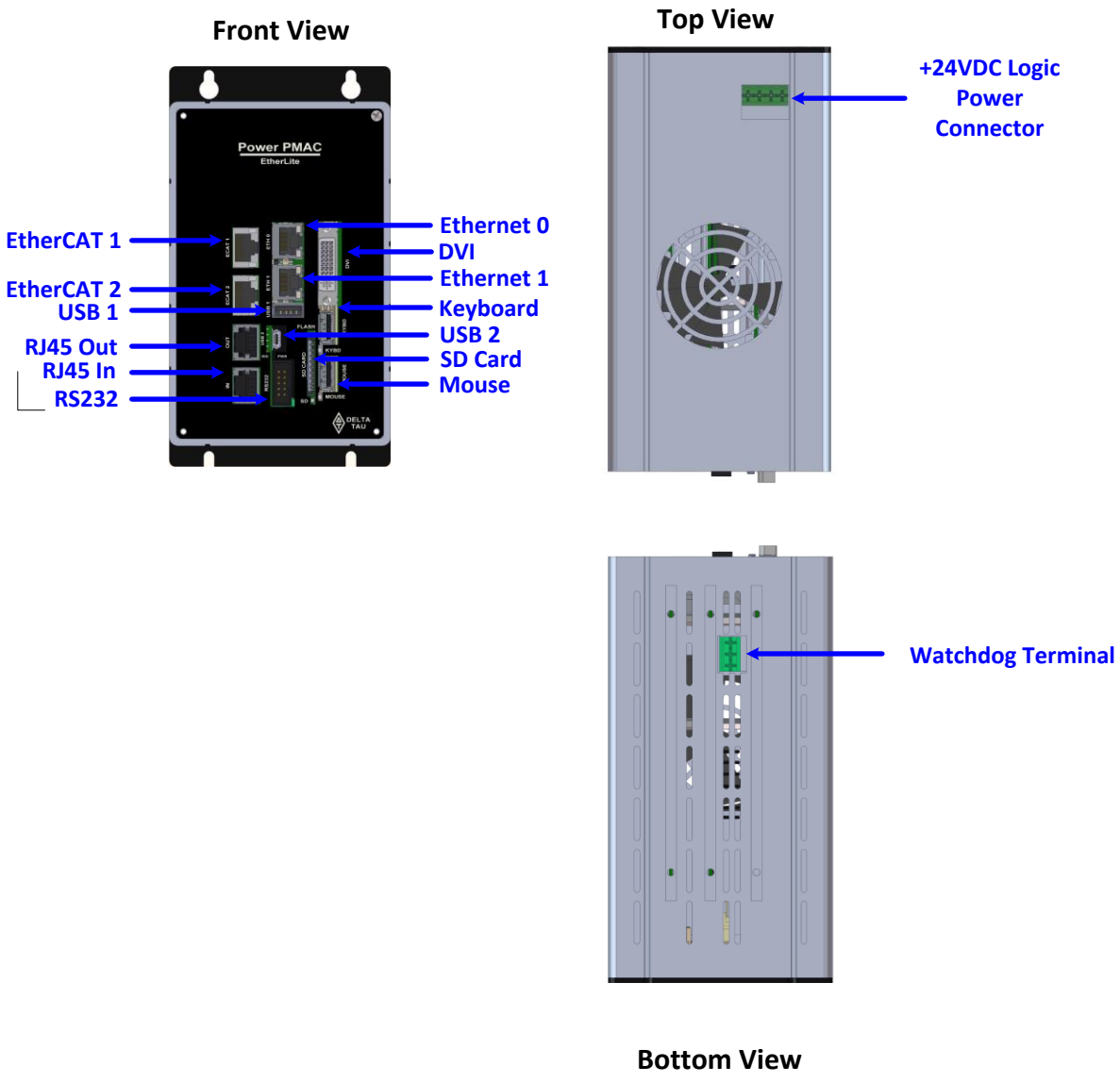
Connectors

Connector Layout

The layouts below show Power PMAC EtherLite with video options. Not all EtherLites have this option.

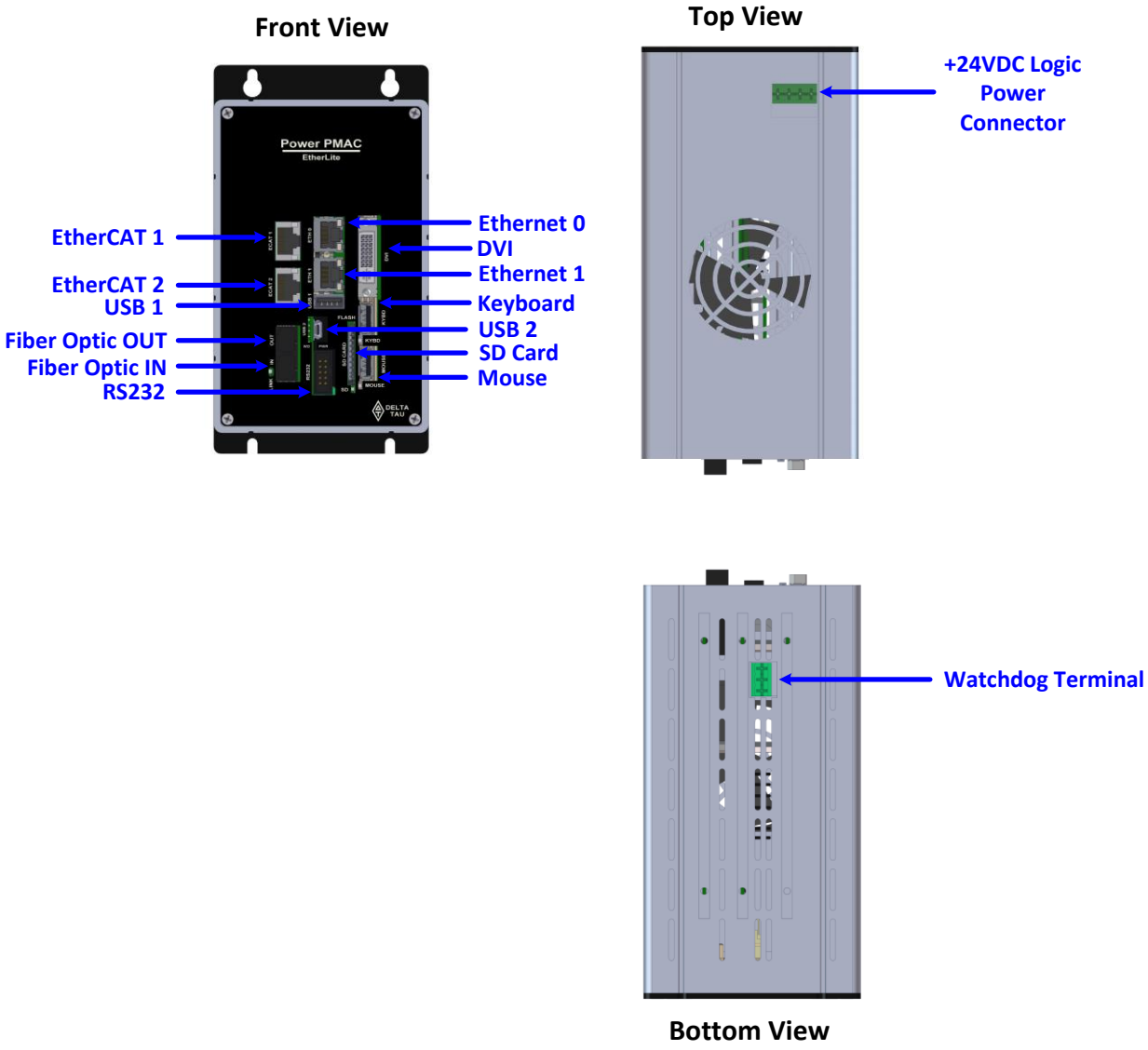
RJ45 MACRO Version

The connectors are labeled below:

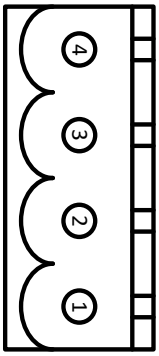


Fiber Optic MACRO Version

The connectors are labeled below:



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

The current requirement for this logic power input is 1.0 ± 0.2 Amps.

Ethernet Connections

The Power PMAC EtherLite 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.

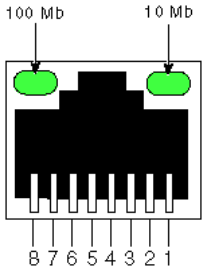
ETH 0 Ethernet Port (P13)

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

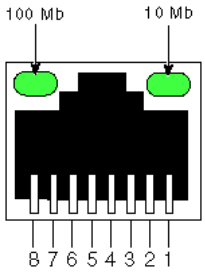
Multiple computers on a single network can independently communicate to the Power PMAC CPU board through this single hardware port.

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.

ETH 1 Ethernet Port (P16)

The "ETH 1" port is the second-to-top-connector on the front panel. It is the auxiliary Ethernet port and not intended for primary host communications. Its pinout can be seen below:

ETH1: 8-Pin RJ45 Receptacle			 **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	

This connector is used for Ethernet communications over a fieldbus network. 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 network.

EtherCAT Connections

The user can order one to two EtherCAT Master ports, E0 and E1, with the Power PMAC EtherLite. 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.

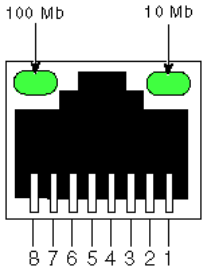
E0 EtherCAT Port (P21)

The "E0" port is the top EtherCAT connector on the front panel on the far left when looking at the front of the EtherLite. It can be used for controlling one EtherCAT ring.



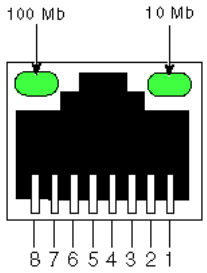
Note

Two EtherCAT rings can be controlled by one Power PMAC by utilizing both E0 and E1 EtherCAT ports.

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	

E1 EtherCAT Port (P20)

The "E1" port is the second-to-top-connector on the front panel on the far left of the front of the EtherLite. This port can be used to control an additional EtherCAT ring. Its pinout can be seen below:

E1: 8-Pin RJ45 Receptacle			 **Front View**	
Pin #	**Symbol**	**Function**	**Description**	**Notes**
1	E1MDI0+	BIDIR	LINE 0 POS	
2	E1MDI0-	BIDIR	LINE 0 NEG	
3	E1MDI1+	BIDIR	LINE 1 POS	
4	E1MDI1-	BIDIR	LINE 1 NEG	
5	E1MDI2+	BIDIR	LINE 2 POS	
6	E1MDI2-	BIDIR	LINE 2 NEG	
7	E1MDI3+	BIDIR	LINE 3 POS	
8	E1MDI3-	BIDIR	LINE 3 NEG	

USB Connections

The Power PMAC EtherLite 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 1 Host Port (P14)

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.

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 2 Device Port (P15)

The USB "device" port is labeled "USB 2" on the front panel. It is a "Micro-B" format connector located just below the USB host port. With this port, the Power PMAC CPU board acts as a peripheral device when it is powered off. That is, you can access Power PMAC's flash memory with a host computer by first powering down Power PMAC and then connecting it to the host device through this USB port. Power PMAC will then act just like a USB flash drive. This is useful for recovering Power PMAC projects which were stored in flash memory in the event that the Power PMAC is somehow damaged or stops functioning.

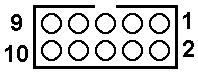
Its pinout is below:

USB 2: 5-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	ID	OUTPUT	BUS TYPE IDENT	
5	GND	COMMON	REF. VOLTAGE	

This connector provides a USB "host" interface on a "Mini-B" connector. It is suitable for standard USB connectors to external devices.

RS-232 Connection

The Power PMAC UMAC CPU board provides a RS-232 port on the front panel, at the bottom left. 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.

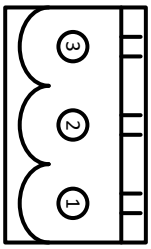
MAIN RS232: 10-Pin Receptacle			 **Front View**	
PIN #	**SYMBOL**	**FUNCTION**	**DESCRIPTION**	**NOTES**
1	N.C.	--	NO CONNECT	
2	DTR	BIDIRECT	DATA TERM RDY	TIED TO "DSR"
3	TXD/	INPUT	RECEIVE DATA	HOST TRANSMIT DATA
4	CTS	INPUT	CLEAR TO SEND	HOST READY BIT
5	RXD/	OUTPUT	SEND DATA	HOST RECIEVE DATA
6	RTS	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

SD Card Connection

The Power PMAC UMAC CPU board provides a socket for SD card insertion at the bottom right corner of the front panel. 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.

Watchdog Timer Connection (TB1)

The Power PMAC UMAC 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 Number: 016-P00103-08P Phoenix Contact Part Number: 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

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.

APPENDIX A: RELIABILITY PREDICTIONS REPORT

The following is the Reliability Predictions Report for the "most fully-loaded" version of the Power PMAC EtherLite (i.e. the part number with the most options added possible):

RELIABILITY PREDICTIONS REPORT

POWER PMAC ETHERLITE SYSTEM

1GHZ CPU, 2GB DDR2 RAM, 8GB NAND FLASH WITH VIDEO OPTION, 2 PORT ETHERCAT WITH 64 SERVO AXES & I/O, FIBER MACRO WITH 32 SERVO & 24 I/O NODES

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Delta Tau P/N: PEL3-H2B-4J1-2A0-0000

Date: 11-18-12
Revision 1.0

Document Part Number
200-PEL3H2B4J12A0-MTBF

Mean Time Between Failures (MTBF) Calculations Projected Plan

1.0 Introduction

1.0 Purpose

The reliability report predictions will be prepared for the Delta Tau products and their associated options. The report will be prepared in accordance with MIL-HDBK-217F Notice 2 with higher than actual stress ratio parameters.

1.1 Reliability Requirements

The reliability predictions for the report will utilize a series math model with operating temperatures of 30 degrees centigrade. The reliability model is defined such that failures of components in the system will have an adverse effect on the total system performance requirements. The environmental operation conditions will be Ground Fixed.

1.2 Basic Reliability Predictions

The product-line consists of separate major board assemblies with related option subdivisions. The failure predictions will be calculated using a computerized MIL-HDBK-217F based program for ground fixed (GF) environments. This environment closely represents the industrial conditions in which the system will operate.

2.0 Reliability Model and Calculations

1.3 Reliability Model

Figure 1 shows the reliability block diagram and math model to be used to compute the MTBF of any desired configuration of the system. The math model used for the prediction is a series reliability model. The failure rate calculations are the sum of the individual component failure rates that add up to a total failure rate of the subsystems that comprise a given configuration.

1.4 Failure Rate Calculations

Failure rates appearing in the predictions will be derived by using the appropriate equations and factors provided by MIL-HDBK-17F.

There are some categories of components for which no equations are provided in MIL-HDBK-217F. In these instances, failure rates will be estimated using field experience and best engineering practices selected form appropriate sources.

FIGURE 1. RELIABILITY BLOCK DIAGRAM

FAILURE RATE OF SUB SYS "A" + FAILURE RATE OF SUB SYS "B" + FAILURE RATE OF SUB SYS "C" = TOTAL FAILURE RATE

$$MTBF = \frac{1 \times 10^{6}}{\text{TOTAL FAILURE RATE}}$$

List of Products & Options for which a MTBF number is to be calculated:

Item	Name	Part Number	Failure Rate	Comments
1.				
2.				
3.				
4.				
5.				
6.				
		Total Failure Rate		Sum of all failures
		MTBF		1 million ÷ total failures

Calculation Instructions:

1. List all the products and options.
2. Enter the failure rates for each line item.
3. Add all the failure rates.
4. Divide into 1 million.
5. The quotient is the MTBF, which means "Mean Time Between Failures".

Table 1 — POWER PMAC ETHERLITE SYSTEM MTBF and Failure Rate Data.

Delta Tau P/N: PEL3-H2B-4J1-2A0-0000

Assembly Name	Part Number	Failure Rate	MTBF (Hrs)	Comments
POWER PMAC ETHERLITE SYSTEM	PEL3-H2B-4J1-2A0-0000	10.496695	95,268	
POWERPMAC POWER PC EP460EX CPU BOARD	300-604020-10X	5.256412	190,244	
OPT-5H0, 1 GHz POWERUMAC 460EX PROCESSOR	5H0-604020-OPT	0.336170	2,974,682	
OPT-P1,PCI EXPRESS SLOT 1 (X4) RT ANGLE	3P1-604020-OPT	0.324157	3,084,927	
OPT-2, 2GB DDR2 MEMORY MODULE	302-604020-OPT	0.522814	1,912,727	
POWER PMAC FLASH DVI-I – VIDEO ADAPTER	300-604033-10X	2.121456	471,374	
OPT-V,VIDEO DISPLAY OPTION	30V-604033-OPT	0.861803	1,160,358	
OPT-3, 8GB (64Gbit) FLASH	303-604033-OPT	0.676192	1,478,870	
POWER ECAT MACRO LITE INTERFACE BOARD	300-604035-10X	2.102745	475,569	
OPT-E2 DUAL ECAT OPTION	3E2-604035-OPT	0.973518	1,027,202	
OPT-M2F MACRO INTERFACE 32 AXIS FIBER	3M2-F04035-OPT	1.047626	954,539	
POWER PMAC ETHERLITE BACKPLANE	300-604036-10X	1.016081	984,173	
OPT-1 POWER PMAC ETHERLITE BACKPLANE	301-604036-OPT	0.171565	5,828,709	

To calculate the MTBF number: **Not applicable for this product (see Power PMAC EtherLite System in the table above).**

1. Enter the first line item from Table 1 on the work sheet provided on page 3.
2. Select all the options on the assembly that the calculation is being done and follow the calculation instructions.

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