HARDWARE REFERENCE MANUAL

UMAC Turbo CPU/Communications Board

HRM for UMAC Turbo CPU/Communications Board

3xx-603766-xHxx

June 8, 2004

DELTA TAU
Data Systems, Inc.
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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.

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Table of Contents

INTRODUCTION

The UMAC (Universal Motion and Automation Controller) is a modular system built with a set of 3U-format Eurocards. The configuration of any UMAC system starts with the selection of the UMAC Turbo CPU/Communications Board and continues with the addition of the necessary axes boards, I/O boards, and any other interface boards selected from a variety of available accessories.

The UMAC Turbo CPU/Communications Board (part number 3x0-603766-10x) is a member of the Turbo PMAC2 family of boards. It is software is capable of 32 axes of control. Accessory boards installed in the UMAC Turbo system interface between the UMAC Turbo CPU/Communications Board and the machine to output amplifier command signals, to input feedback information, and to input flags information including end-of-travel limits and machine home sensors. Different kind of axes interface boards can be selected to control analog ±10V amplifiers, stepper drivers and direct digital PWM amplifiers.

Several methods of communications can be implemented between the UMAC Turbo System and the host computer. These methods include two RS-232 serial ports, USB, Ethernet and PC/104 bus communications. The UMAC Turbo CPU/Communications Board can communicate at the same time with the two RS-232 ports, USB or Ethernet ports. However, if PC/104 bus communications is used, the USB or Ethernet ports cannot be used.

Upgrade Issues

The UMAC Turbo CPU/Communications Board can be used to replace both the older UMAC CPU board (part number 3x0-603382-10x) and the Acc-54E USB/Ethernet communications board (part number 3x0-603467-10x). Combining both of these functions onto a single board saves both money and rack space. The UMAC Turbo CPU/Communications Board supports high-speed CPUs (160 MHz and 240 MHz) than the older UMAC CPU board, but it also supports the 80 MHz and 100 MHz configurations of the old board.

Usually, use of the UMAC Turbo CPU/Communications Board is compatible with older UMAC CPU board and Acc-54E communications board. However, the base address of the DPRAM IC on the CPU/Communications Board is $060000, whereas the base address of the DPRAM on the Acc-54E is higher ($06C000 by default).

Setup variable I24 should be set to $060000 (or $0) to use the automatic functions in the on-board DPRAM IC. Any M-variable used for DPRAM registers should be in the $060000 - $0603FFF address range.

The following list summarizes the differences with respect to the older version:

- Addition of on-board USB and Ethernet
- Support for 160 MHz and 240 MHz CPUs (Opt 5Ex and 5Fx)
- Main serial connector reduced to 10-pins and RS-232 only
- Elimination of upward stack connectors for axis boards
- Addition of watchdog timer relay
- Elimination of voltage interlock circuit

Board Configuration

Base Version

The base version of the UMAC Turbo CPU/Communications Board without options provides a single board 160 mm wide and 100 mm high for a 20 mm slot with:

- 80 MHz DSP56303 CPU (120 MHz PMAC equivalent) (fast internal memory for first 15 axes servo and commutation)
- 128k x 24 SRAM compiled/assembled program memory (5C0) (for firmware, compiled PLCs, user-written servo and phase)
- 128k x 24 SRAM user data memory (5C0) (for motion and uncompiled PLC programs, variables, tables, and buffers)
- 1M x 8 flash memory for user backup & firmware (5C0) version
- Latest released firmware
- 100 Mbit/sec UDP/IP, TCP/IP Ethernet Communications Interface
- 480 Mbit/sec USB 2.0 Communications Interface (USB 1.1 compatible)
- Two RS-232 serial interfaces with IDC 10-pin front connector
- PID/notch/feedforward servo algorithms
- Extended pole-placement servo algorithms
- 1-year warranty from date of shipment (External cables not included)

Option 2B: Dual-Ported RAM

Dual-ported RAM provides a high-speed communications path for bus communications with the host computer through a bank of shared memory. DPRAM is advised if more than 100 data items per second will be passed between the controller and the host computer in either direction.

- Option 2B provides the Dual-Ported RAM for PC/104, USB, or Ethernet interface

Option 5: CPU and Memory Configurations

The various versions of Option 5 provide different CPU speeds and main memory sizes. Only one Option 5xx may be selected for the board.

- Option 5C0 is the standard CPU and memory configuration. It is provided automatically if no Option 5xx is specified. It provides an 80 MHz DSP56303 CPU w/8Kx24 internal memory, 128Kx24 SRAM compiled/ assembled program memory, 128Kx24 SRAM user data memory, 1Mx8 flash memory.
- Option 5CL provides an 80 MHz DSP56303 CPU w/8Kx24 internal memory, standard external SRAM program and data memory plus added memory for PMAC Ladder algorithms and programs. Firmware support for PMAC Ladder graphical programming.
- Option 5C3 provides an 80 MHz DSP56303 CPU w/8Kx24 internal memory, expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, 4Mx8 flash memory.
- Option 5D0 provides a 100 MHz DSP56309 CPU w/34Kx24 internal memory, 128Kx24 SRAM compiled/ assembled program memory, 128Kx24 SRAM user data memory, 1Mx8 flash memory.
- Option 5DL provides an 100 MHz DSP56309 CPU w/34Kx24 internal memory, standard external SRAM program and data memory plus added memory for PMAC Ladder algorithms and programs. Firmware support for PMAC Ladder graphical programming.
- Option 5D3 provides a 100 MHz DSP56309 CPU w/34Kx24 internal memory, expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, 4Mx8 flash memory.

- Option 5E0 provides a 160 MHz DSP56311 CPU w/128Kx24 internal memory, 128Kx24 SRAM compiled/ assembled program memory, 128Kx24 SRAM user data memory, and 1Mx8 flash memory. Requires V1.939 or newer firmware.
- Option 5EL provides an 160 MHz DSP56311 CPU w/128Kx24 internal memory, standard external SRAM program and data memory plus added memory for PMAC Ladder algorithms and programs. Firmware support for PMAC Ladder graphical programming.
- Option 5E3 provides a 160 MHz DSP56311 CPU w/128Kx24 internal memory, expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, and 4Mx8 flash memory. Requires V1.939 or newer firmware.
- Option 5F0 provides a 240 MHz DSP56321 CPU w/192Kx24 internal memory, 128Kx24 SRAM compiled/ assembled program memory, 128Kx24 SRAM user data memory, and 1Mx8 flash memory. Requires V1.940 or newer firmware.
- Option 5FL provides an 240 MHz DSP56321 CPU w/192Kx24 internal memory, standard external SRAM program and data memory plus added memory for PMAC Ladder algorithms and programs. Firmware support for PMAC Ladder graphical programming.
- Option 5F3 provides a 240MHz DSP56321 CPU w/192Kx24 internal memory, expanded 512Kx24 SRAM compiled/assembled program memory, expanded 512Kx24 SRAM user data memory, and 4Mx8 flash memory. Requires V1.940 or newer firmware.

Option 8: High-Accuracy Clock Crystal

The UMAC Turbo CPU/Communications Board has a clock crystal of nominal frequency 19.6608 MHz (~20 MHz). The standard crystal's accuracy specification is ±100 ppm.

- Option 8A provides a nominal 19.6608 MHz crystal with a ±15 ppm accuracy specification.

Option 10: Firmware Version Specification

Normally, the UMAC Turbo CPU/Communications Board is provided with the newest released firmware version. A label on the flash memory IC shows the firmware version loaded at the factory.

- Option 10 provides for a user-specified firmware version.

Option 16A: Battery-Backed Parameter Memory

The contents of the standard memory are not retained through a power-down or reset unless they have been saved to flash memory first. Option 16A provides supplemental battery-backed RAM for real-time parameter storage that is ideal for holding machine state parameters in case of an unexpected power-down.

- Option 16A provides a 32k x 24 bank of battery-backed parameter RAM.

Connectors and Indicators

J7 – Main Serial Port (RS-232 Port)

J7 is the primary serial communications port. For serial communications, use a serial cable to connect the PC's COM port to the board's serial port connector. Delta Tau provides the Acc-3L cable to connect the UMAC Turbo CPU/Communications Board to a DB 9 connector.

J8 – Auxiliary Serial Port (RS-232 Port)

J8 is the auxiliary serial communications port. For serial communications, use a serial cable to connect the PC's COM port to the board's serial port connector. Delta Tau provides the Acc-3L cable to connect UMAC Turbo CPU/Communications Board to a DB 9 connector.

J9 – USB Port

This connector is used in conjunction with USB A-B cable which can be purchased from any local computer store, and is provided when Option 1A is ordered. The A connector is connected to a PC or Hub device; the B connector plugs into the J9-USB port.

J10 – Ethernet Port

This connector is used for Ethernet communications from the UMAC Turbo CPU/Communications Board to a PC.

TB1 – Power Terminal Block

This connector contains the 5V, ±15V and GND lines that power the UMAC Turbo CPU/Communications Board.

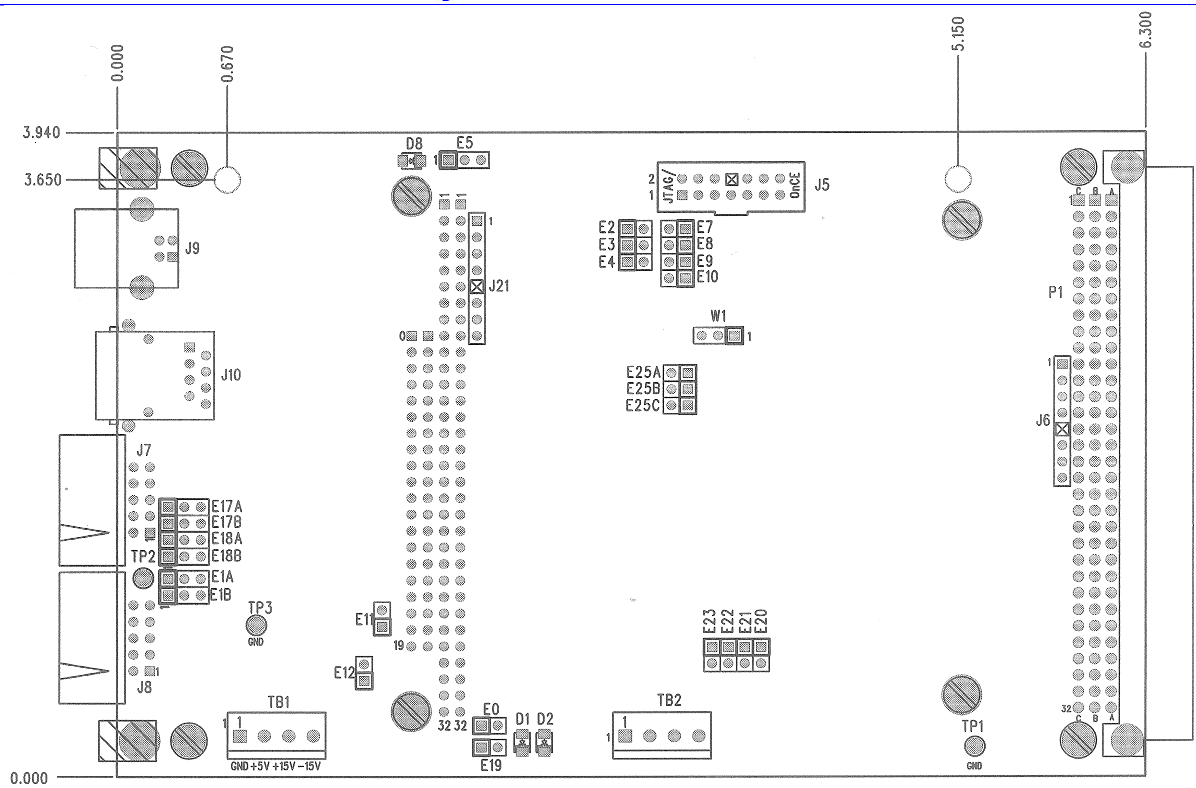
TB2 – Watchdog Relay

In case of watchdog failure, the contacts of a relay present on this connector will change state.

LED Indicators

- When lit, the D1 Red LED indicates a watchdog failure.
- When lit,
- the D2 Green LED indicates that the 5V power supply is applied to the board.
- When lit, the D8 Green LED indicates that a USB or Ethernet cable is plugged in and ready to establish communications.

Board Dimensions and Layout — Part Number 603766-100



Note:

Revision 101 of this board does not have jumper E11, but has jumper E6.

JUMPERS SETUP SUMMARY

On the UMAC Turbo CPU/Communications Board, there are many jumpers (pairs of metal prongs), called E-points. Some have been shorted together; others have been left open. These jumpers customize the hardware features of the board for a given application and must be set up appropriately. The following is an overview of the several UMAC Turbo CPU/Communications Board jumpers.

Clock Source Jumpers

In order to operate, the board must receive servo and phase clock signals from a source external to the board. These clock signals can be brought into the board from one of two possible ports: the UBUS backplane connector, or the front-side main serial-port connector. Jumpers E1A and E1B must be configured properly for the clock source used.

To receive the clock signals over the UBUS backplane, usually from an Acc-24E2x axis-interface board or an Acc-5E MACRO-interface board, E1A must connect pins 1 and 2, and E1B must connect pins 2 and 3. Use this default setup in most cases.

To receive the clock signals through the main serial port, usually from another PMAC system or a reference signal generator, E1A must connect pins 2 and 3 and E1B must connect pins 1 and 2. Though rarely used, this configuration permits complete synchronization to the system that is generating the clock signals.

To either input or output the clock signals through the J7 serial port, jumpers E17A, E17B, E18A, and E18B must be configured in positions 2-3. Otherwise, these jumpers must be set at position 1-2.

Watchdog Timer Jumper

Jumper E19 should be OFF for normal operation, leaving the watchdog timer circuit active and prepared to shut down the card in case of a severe problem. Putting jumper E19 ON disables the watchdog timer circuit. This should be used for test purposes only to try to track down the source of watchdog timer trips. Normal operation of a system with this jumper ON should never be attempted, as an important safety feature is disabled.

Operation Mode Jumpers

Jumpers E20, E21, and E22 control the operational mode of the UMAC Turbo CPU/Communications Board. For normal operation, E20 must be OFF, E21 must be ON, and E22 must be ON. Other settings of these jumpers are for factory use only.

Firmware Reload Jumper

Jumper E23 should be OFF for normal operation. To load new firmware into the flash-memory IC on the CPU, E23 should be ON when the card is powered up. This puts the card in bootstrap mode, and ready to accept a new firmware. Then try to establish communications to the card with the Executive program, the Executive program will recognize that the card is in bootstrap mode automatically, and prompt for the firmware file to download.

Re-Initialization Jumper

If jumper E3 is installed when the board is powered-up or reset, the board firmware will go through a re-initialization process, returning most I-variables to factory default values. The last saved values are not lost when this happens. It will also go through a system auto-detection process, selecting which of the Servo ICs that it finds will be the source of the servo and phase clock signals for the system. Typically, this jumper is used only when the system's setup has a problem severe enough that communications does not work – otherwise, a **$$$***** command can be used for re-initialization.

Reference Voltage Connect Jumper

Jumper E12 permits the reference voltage for the analog and digital circuits in the UMAC Turbo CPU/Communications Board to be tied together. If not isolating the analog circuits from the digital circuits, this jumper should be ON. If isolating the analog circuits from the digital circuits using separate isolated supplies for the two circuits, this jumper should be OFF.

Interrupt Select Jumpers

If the PC/104-bus interface is installed, the UMAC Turbo CPU/Communications Board can interrupt the PC/104 host computer over one of four interrupt lines as selected by jumpers E7 – E10. One of these jumpers should be ON in any configuration.

- E7 ON selects interrupt line IRQ10
- E8 ON selects interrupt line IRQ11
- E9 ON selects interrupt line IRQ12
- E10 ON selects interrupt line IRQ15

Flash Memory Bank Select Jumpers

The flash-memory IC has the capacity for eight separate banks of firmware, only one of which can be used at any given time. The eight combinations of settings for jumpers E25A, E25B, and E25C select which bank of the flash memory is used. In the factory production process, firmware is loaded only into Bank 0, which is selected by having all of these jumpers OFF.

PC/104 Bus Use Selection

If the PC/104 bus communications method is used, jumper E5 must be installed in position 1-2. If the USB or Ethernet communications ports are used, jumper E5 must be installed in position 2-3.

USB/Ethernet Firmware Reload Jumper

Jumper E6 should be ON for normal operation. To load new firmware into the USB/Ethernet micro-controller, E6 should be OFF when the card is powered. This puts the on-board USB/Ethernet micro-controller in bootstrap mode and ready to accept new firmware.

CONNECTIONS

Backplane (UMAC) Connections

To connect the UMAC Turbo CPU/Communications Board to the UBUS backplane, simply insert the P1 connector into one of the sockets on an Acc-Ux UBUS backplane board. It does not matter which socket on the UBUS backplane board is used, although customarily, the CPU board is installed in the leftmost slot. Typically, the backplane board will have been installed already in a Eurorack frame (Acc-Px or equivalent), so the CPU board is simply slid into one of the slot guides in the frame until it mates with the backplane board; then the front-plate screws are tightened for a firm connection to the rack and backplane.

If a power supply has been connected to the UBUS backplane board, this power will be supplied automatically to the Turbo CPU board. The UBUS backplane board is capable of supplying isolated analog and digital supplies, but the 3U-format power supplies (Acc-Ex) provided by Delta Tau do not keep these two supplies isolated from each other.

PC/104 Connections

If the PC/104 connector is installed, the UMAC Turbo CPU/Communications Board may be mounted on the top of a PC/104 stack. Because it does not pass the connector through, it may be mounted only on the top of such a stack. The UMAC Turbo CPU/Communications Board has four mounting holes in the standard PC/104 locations for standoff connections to the PC/104 stack. Note that the PC/104 connector used on the UMAC Turbo CPU/Communications Board provides for the Eurocard 4T standard of 20 mm (0.8”) spacing between boards, not the PC/104 standard of 15mm (0.6”), so standoff lengths must be chosen accordingly.

Serial Port Connections

The standard J7 serial-port connector on the front edge of the UMAC Turbo CPU/Communications Board is an IDC 10-pin header. The connector is designed so that a standard flat-cable connection (such as a Delta Tau Acc-3L cable) to a DB-9 connector can be used. From there, a standard DB25-to-DB9 adapter can be used if necessary. The servo and phase clock signals can be either input or output on this connector, depending on the setting of jumpers E1A, E1B, E17A, E17B, E18A and E18B.

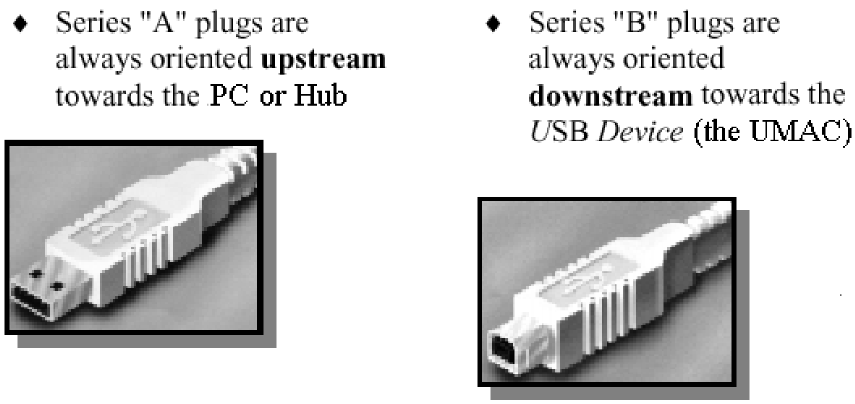
The auxiliary J8 serial-port connector is also an IDC 10-pin header. The connector is designed so that a standard flat-cable connection (such as a Delta Tau Acc-3L cable) to a DB-9 connector can be used. From there, a standard DB9-to-DB25 adapter can be used, if necessary.

Power Supply Connections

The TB1 4-point terminal block on the UMAC Turbo CPU/Communications Board can be used to bring in +5V and ±15V power to the system. In a UMAC backplane configuration, usually the power is brought in through the UBUS backplane board instead. Note that with a single reference voltage on this connector, there can be no isolation between the supplies.

USB Type B Receptacle

This connector is used in conjunction with USB A-B cable which can be purchased from any local computer store. The A connector is connected to a PC or Hub device; the B connector plugs into the UMAC Turbo CPU/Communications Board. The picture below displays what the two ends on the cable should look like.



This connector is used to communicate with the host PC through a USB connection. In addition, this connector is used to install and upgrade the micro-controller Ethernet firmware and to program the static Internet Protocol (IP) address into an EEPROM that is read on startup. Do not attach a cable to this connector when communicating to the board via Ethernet.

The maximum cable length according to the USB Specification 2.0 for a full speed cable is 5 m (~15ft). According to the USB specification, up to five USB cables can be connected together with a hub, to create a maximum length of 30 m (~98ft). In addition, to extend the length of the USB connection there are USB active extension cables available. Use a USB cable of high quality. Using higher quality USB cables, some systems have operated up to 10 m (30ft) cables without the use of an active extension cable or hub. However, violating the specification by running a cable more than 5m is not recommended or guaranteed.

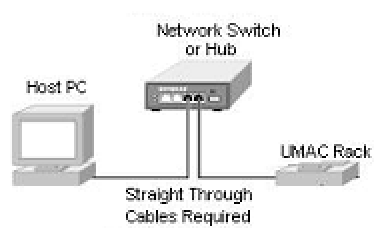
J6: Ethernet RJ45 Connector

This connector is used for Ethernet communications from the UMAC to a PC. The appropriate Category 5 10/100-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.

When making a direct connection to a Host communication Ethernet card in a PC, a Category 5 networking crossover cable must be used. A standard Category 5 straight through networking cable cannot be used in this scenario. See left section of the following diagram.

When using a connection to a network Hub or switch, the standard Category 5 straight through networking cable must be used, and not a crossover cable. See right section of the figure below.

Performance can be degraded by the use of a hub or switch. Network hubs or the more intelligent network switches have processors inside them which can add delays of at least 15 msec to the UMAC communications.



BOARD JUMPERS

E0: Factory Use Only

E1A: Servo and Phase Clock Direction Control

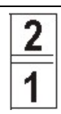
E Point and Physical Layout	Description	Default
	Jump pins 1 and 2 to use its internally generated servo and phase clock signals and to output these signals on the J7 serial port connector. E1B should connect pins 2 and 3. Jump pins 2 and 3 for the UMAC Turbo system to expect to receive its servo and phase clock signals on the J7 serial port connector. E1B should also connect pins 1 and 2. See also jumpers E17A, E17B, E18A, and E18B	Pins 1-2 jumpered

E1B: Servo/Phase Clock Source Control

E Point and Physical Layout	Description	Default
	Jump pin 1 to 2 to get phase and servo clocks from J7 serial port connector (from an external source such as another PMAC). Jump pin 2 to 3 to get phase and servo clocks from P1 backplane connector (from an Acc-24E2x, or equivalent board).	Pins 2-3 jumpered

E2: Reserved for Future Use

E3: Re-Initialization on Reset Control

E Point and Physical Layout	Description	Default
	Remove jumper for normal reset mode (default). Jump pins 1 to 2 for re-initialization on reset.	No jumper installed

E4: Reserved for Future Use

E5: Port Select

E Point and Physical Layout	Description	Default
	Jump pin 1 to 2 to use the PC/104 bus communications. Jump pin 2 to 3 to use USB or Ethernet communication ports.	Pins 2-3 jumpered

E6: USB/Ethernet Micro-Controller Firmware Reload Enable

E Point and Physical Layout	Description	Default
2 1	Remove jumper to reload firmware on power-up\reset. Install jumper for normal operations.	Pins 1-2 jumpered

E7 – E10: IRQ PC Interrupt Select

E Point and Physical Layout	Description	Default
E7: 2 1	Jump E7 pin 1 to 2 to permit UMAC to interrupt PC on PC/104 bus interrupt line IRQ10. Remove E7 jumper to inhibit interrupt capability on this line.	No jumper installed
E8: 2 1	Jump E8 pin 1 to 2 to permit UMAC to interrupt PC on PC/104 bus interrupt line IRQ11. Remove E8 jumper to inhibit interrupt capability on this line.	No jumper installed
E9: 2 1	Jump E9 pin 1 to 2 to permit UMAC to interrupt PC on PC/104 bus interrupt line IRQ12. Remove E9 jumper to inhibit interrupt capability on this line.	No jumper installed
E10: 2 1	Jump E10 pin 1 to 2 to permit UMAC to interrupt PC on PC/104 bus interrupt line IRQ15. Remove E10 jumper to inhibit interrupt capability on this line.	No jumper installed

E12: Digital/Analog Reference Connect

E Point and Physical Layout	Description	Default
2 1	Jump pin 1 to 2 to tie digital GND reference to analog AGND reference when using joint supply (e.g. from TB1 or PC/104). Remove jumper to maintain separate GND and AGND reference voltages to keep isolation when using separate supplies.	Pins 1-2 jumpered

E17 – E18: Serial Port Servo and Phase Clocks Enable

E Point and Physical Layout	Description	Default
E17A: 3 2 1	Jump E17A pin 1 to 2 to disable PHASE+ on J7 serial port. Jump E17A pin 2 to 3 to enable PHASE+ on J7 serial port.	Pins 1-2 jumpered
E17B: 3 2 1	Jump E17B pin 1 to 2 to disable PHASE- on J7 serial port. Jump E17B pin 2 to 3 to enable PHASE- on J7 serial port.	Pins 1-2 jumpered
E18A: 3 2 1	Jump E18A pin 1 to 2 to disable SERVO+ on J7 serial port. Jump E18A pin 2 to 3 to enable SERVO+ on J7 serial port.	Pins 1-2 jumpered
E18B: 3 2 1	Jump E18B pin 1 to 2 to disable SERVO- on J7 serial port. Jump E18B pin 2 to 3 to enable SERVO- on J7 serial port.	Pins 1-2 jumpered

E19: Watchdog Disable Jumper

E Point and Physical Layout	Description	Default
2 1	Jump pin 1 to 2 to disable Watchdog timer (for test purposes only). Remove jumper to enable Watchdog timer.	No jumper installed

E20 – E22: Power-Up/Reset Load Source

E Point & Physical Layout	Description	Default
E20: 2 1	To load active memory from flash IC on power-up/reset/remove jumper E20; Jump E21 pin 1 to 2 Jump E22 pin 1 to 2. Other combinations are for factory use only; the board will not operate in any other configuration.	No E20 jumper installed E21 and E22, jump pin 1 to 2.
E21: 2 1		
E22: 2 1		

E23: Firmware Reload Enable

E Point and Physical Layout	Description	Default
2 1	Install jumper to reload firmware through the communications port. Remove jumper for normal operations.	No jumper installed

E25A – E25C: Flash Memory Bank Select

E Point and Physical Layout	Description	Default
E25A: 2 1	Remove all three jumpers to select flash memory bank with factory-installed firmware. Use other configuration to select one of the seven other flash memory banks.	No jumpers installed
E25B: 2 1		
E25C: 2 1		

DIP Switch Block S1: PC Bus Base Address

S1B				S1A							
4	**3**	**2**	**1**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑	⇑
⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓	⇓
ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

The 12 DIP switches on block S1 set the base address of the UMAC Turbo CPU/Communications Board on the PC/104 bus. Together they form a binary number. Each switch, if in the ON (closed) position, sets its bit to 0; if in the OFF (open) position, sets its bit to 1. The possible base addresses are all multiples of 16, so switch 1 sets a bit value of 16, switch 2 sets a bit value of 32, and so on. According to the following table, the default settings provide a base address of 528 (210h).

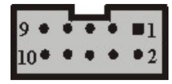
S1A Switch #	Bit Value	Default	Default Value	S1B Switch #	Default	Default Value
1	16 (10h)	OFF (x1)	16 (10h)	1	4096 (1000h)	0
2	32 (20h)	ON (x0)	0	2	8192 (2000h)	0
3	64 (40h)	ON (x0)	0	3	16384 (4000h)	0
4	128 (80h)	ON (x0)	0	4	32768 (8000h)	0
5	256 (100h)	ON (x0)	0			
6	512 (200h)	OFF (x1)	512 (200h)			
7	1024 (400h)	ON (x0)	0			
8	2048 (800h)	ON (x0)	0			

CONNECTOR SUMMARY

J1A, B:	PC/104 Main Connector, 64-pin prong connector
J2C, D:	PC/104 AT Connector, 40-pin prong connector
J5:	JTAG/OnCE (for factory use only) 10-pin IDC connector
J6:	JISP (for factory use only): 8-pin SIP connector
J7:	RS-232/RS-422 Serial Port Connector
J8:	Auxiliary RS-232 Serial Port
J9:	USB Port
J10:	Ethernet Port
J21:	JISP_B (for factory use only) (SIP 8 connector)
P1:	UBUS Expansion Port (96-pin DIN connector)
TB1:	JPWR Power Supply Connector: 4-point terminal block
TB2:	Watchdog indicator relay: 4-point terminal block

BOARD CONNECTOR PINOUTS

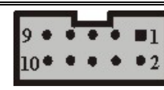
J7: Primary Serial Port Connector (RS232)



Front View

Pin #	Symbol	Function	Description	Notes
1	PHASE+	In/Out	Phasing Clock	
2	DTR \ PHASE-	Bidirect	Data Terminal Ready	
3	TXD/	Input	Receive Data	Low True
4	CTS	Input	Clear to Send	High True
5	RXD/	Output	Send Data	Low True
6	RTS	Output	Request to Send	High True
7	DSR \ SERVO-	Bidirect	Data Set Ready	
8	SERVO+	In/Out	Servo Clock	
9	GND	Common	Board Common	
10	+5V	Output	+5VDC Supply	
See jumpers E1A, E1B, E17A, E17B, E18A and E18B for details about pins 1, 2, 7 and 8				

J8: Auxiliary Serial Port Connector (RS232)



Front View

Pin #	Symbol	Function	Description	Notes
1	N.C.	In/Out	Phasing Clock	Not Connected
2	DTR	Bidirect	Data Terminal Ready	Shorted to DSR.
3	TXD/	Input	Receive Data	Low TRUE
4	CTS	Input	Clear to Send	High TRUE
5	RXD/	Output	Send Data	Low TRUE
6	RTS	Output	Request to Send	High TRUE
7	DSR	Bidirect	Data Set Ready	Shorted to DTR.
8	SERVO	In/Out	Servo Clock	Not Connected
9	GND	Common	Board Common	
10	+5V	Output	+5VDC Supply	

J9: Universal Serial Bus Port (USB)

Pin #	Function
1	N.C.
2	DATA-
3	DATA+
4	GND
5	SHIELD
6	SHIELD

This connector is used in conjunction with USB A-B cable which can be purchased from any local computer store. It is provided when Option 1A is ordered. The A connector is connected to a PC or Hub device; the B connector plugs into this port.

J10: Ethernet Port

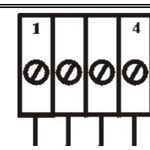
Pin #	Function
1	TXD+
2	TXD-
3	RXD+
4	No Connect
5	No Connect
6	RXD-
7	No Connect
8	No Connect
9	No Connect
10	No Connect

This connector is used for Ethernet communications from the UMAC to a PC. The appropriate Category 5 10/100-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.

When making a direct connection to a Host communication Ethernet card in a PC, a Category 5 networking crossover cable must be used. A standard Category 5 straight through networking cable cannot be used in this scenario. When using a connection to a network hub or switch, the standard Category 5 straight through networking cable must be used, and not a crossover cable.

TB1: 4-Pin Terminal Block

Power Supply Connector

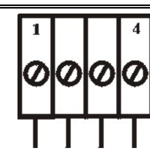


Pin #	Symbol	Function	Description
1	GND	Common	Reference Voltage
2	+5V	Input	Positive Supply Voltage
3	+12V	Input	Positive Supply Voltage
4	-12V	Input	Negative Supply Voltage

This terminal block can be used to provide the input for the power supply for the on-board circuits when it is not in a bus configuration. When the board is in a bus configuration, these supplies come through the bus connector automatically from the bus power supply; in this case, this terminal block should not be used.

TB2: 4-Pin Terminal Block

Watchdog Relay Outputs



Pin #	Symbol	Description
1	NC	Normal Close
2	COM	Common
3	NO	Normal Open
4	COM	Common

This terminal block can be used to signal an external device when the on-board watchdog safety feature has tripped.

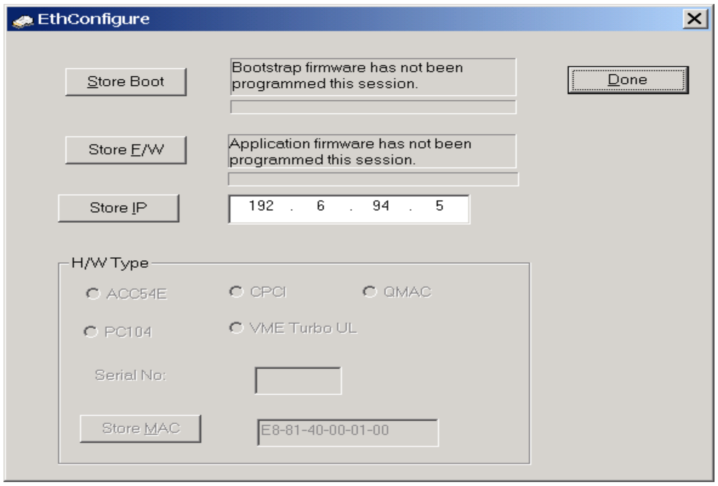
ETHERNET SOFTWARE SETUP

IP Setup

Using the Ethernet port requires Pewin Pro with at least Service Pack 2.0. Earlier revisions of software are not capable of communicating with the Ethernet port. Ethernet devices are configured by launching the `Eth2Configure.EXE` application, provided by Delta Tau as a part of the Pewin 32 Pro Suite or any other Delta Tau standard installation. Installation and configuration of Ethernet devices is independent of the operating system. Therefore, Ethernet devices are compatible with Windows NT 4.0, in addition to Windows 98/ME/2000 and Windows XP.

To configure the UMAC Turbo CPU/Communications Board side, run the application `Eth2Configure.EXE` from the Programs\Pewin32Pro\ program group. This application is provided as part of the standard installation and is placed in c:\Program files\Delta Tau\Common\ folder. The UMAC Turbo CPU/Communications Board side comes preprogrammed with a default IP (internet protocol) address of `192.6.94.5` stored in an on-board EEPROM. To change the IP address stored in the EEPROM, plug in the USB cable to reconfigure the card after powering on the UMAC.

When launching the `Eth2Configure.EXE` program with the USB cable not plugged into the Ethernet card, the following message displays. If the default IP address of the UMAC Turbo CPU/Communications Board does not need to be changed, click **OK** to the run the EthConfigure program.



By default, the address 192.6.94.5 should appear in the Store IP edit box. If it does not, enter it there. To alter the address from the default, enter a unique IP in the Store IP edit box. Click the **Store IP** button. If plugged in via USB, the address will be stored into UMAC Turbo CPU/Communications Board EEPROM; otherwise, the following message displays:

Click on **YES** to store the IP address in the registry so that software from the Pewin Pro Suite can recognize the Ethernet accessory as an available PMAC Device. Afterwards, a dialog box displays requesting a card. This number is changed from 0 to another number only when using multiple PMACs simultaneously from a single host. When doing so, the additional PMACs must be programmed with a unique IP address.

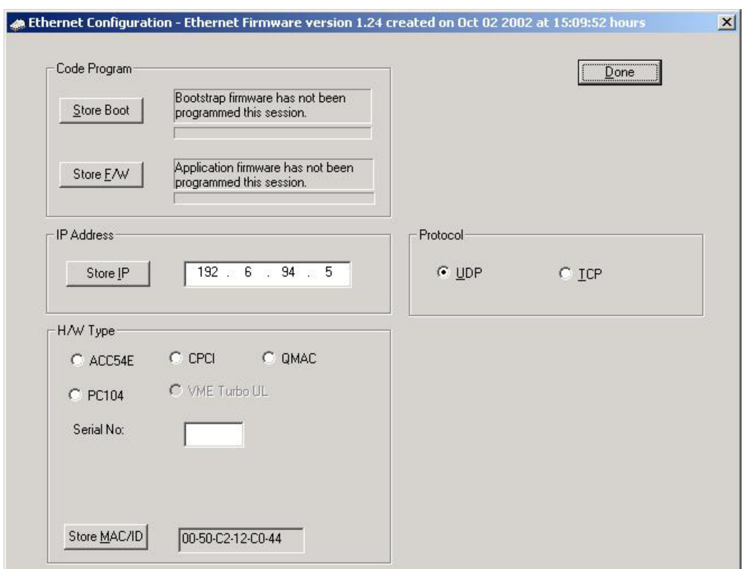
Protocol Setup

The UMAC Turbo CPU/Communications Board default protocol is TCP.

To use TCP, it is necessary that the PC Application be configured into TCP mode using the `Eth2Configure.exe` program supplied with Pewin Pro. To configure the UMAC Turbo CPU/Communications Board,

1. Plug a USB cable to the UMAC Turbo CPU/Communications Board.
2. Launch `Eth2Configure.exe`.
3. Click the **TCP** radio button in the Protocol Box (see the picture). This will set up the Windows registry of the PC so that the Pcomm32 library of Delta Tau opens a TCP connection when a program using the Library executes.

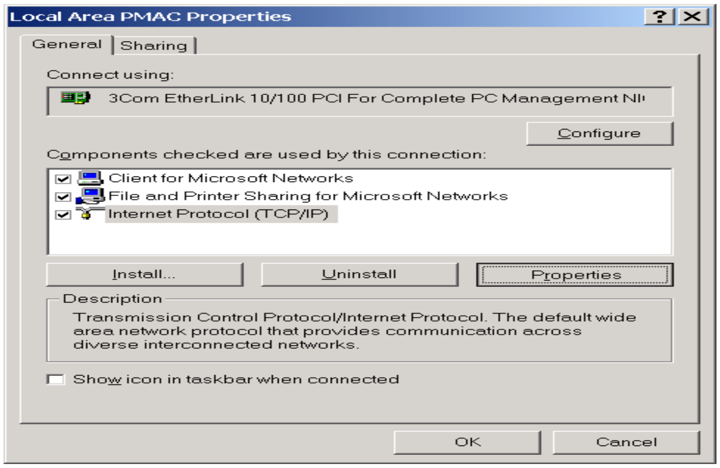
After the protocol is configured, remove the USB cable and power cycle the UMAC card.



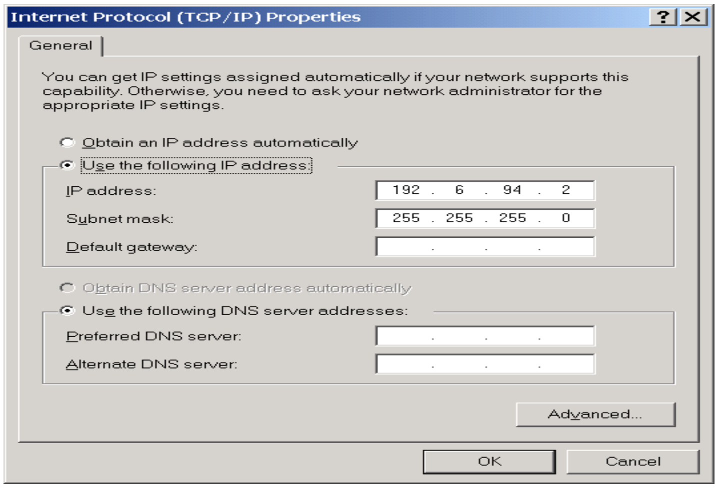
Windows OS TCP/IP Setup

Ethernet mode of communication is supported by dedicated network only. A network card must be configured on the computer to which the UMAC Turbo CPU/Communications Board connection is used before completing the following steps. Further, a crossover Ethernet cable or a private hub along with two straight cables is required for this setup. (See the RJ45 section of Hardware Setup.)

1. From the control panel, select properties of the network card that will communicate to UMAC Turbo CPU/Communications Board via Ethernet.

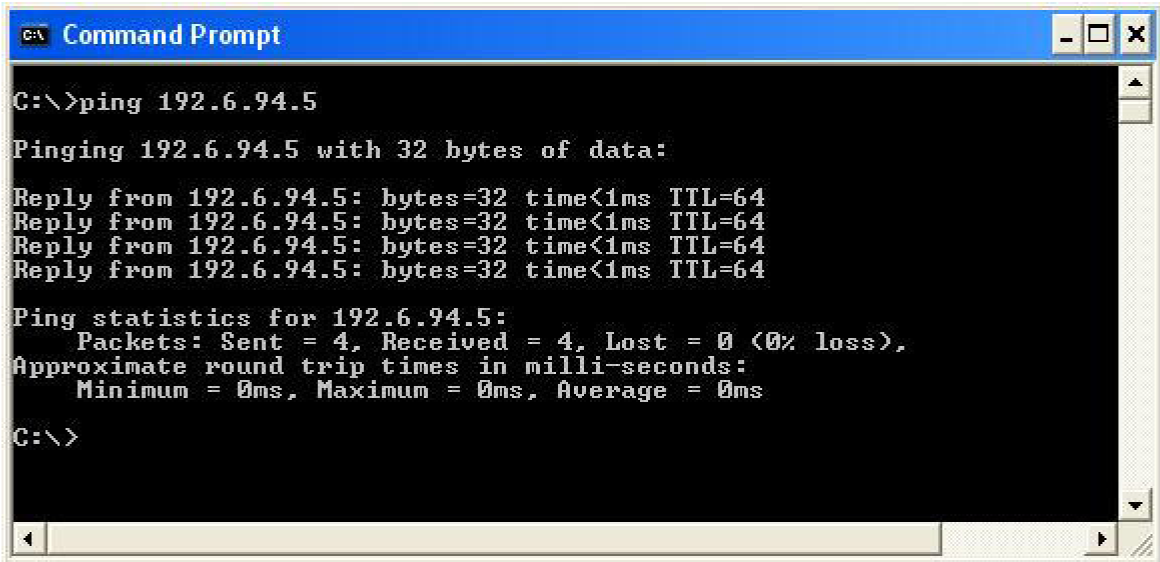


2. Highlight the Internet Protocol (TCPIP) and select properties.
3. Write the private area IP address (e.g., `192.6.94.2`) for this card and enter the subnet mask (255.255.255.0) in the provided spaces.
4. Close the Properties page and restart the computer. The Ethernet card configuration on the computer is complete. Note that the last digit in the IP address field must be a different value from any IP addresses set via the EthConfigure program.



Determining if TCP/IP is Setup Correctly

To determine if the TCP settings on the CPU board and the PC are compatible from a Windows command prompt, type Ping IP address where IP address is the IP address of the UMAC card (i.e., 192.6.94.5).



USB SOFTWARE SETUP

Device Driver Installation

Starting with Pewin Pro and Service Pack 2.0, the USB driver support for this revision of the card is bundled with the Pewin Pro installation program. The UMAC USB card will work only with Windows 98, Windows ME, Windows 2000 and Windows XP. It will not function with Windows NT 4.0; this version of Windows does not support plug and play, which is required by all USB devices.

Note:

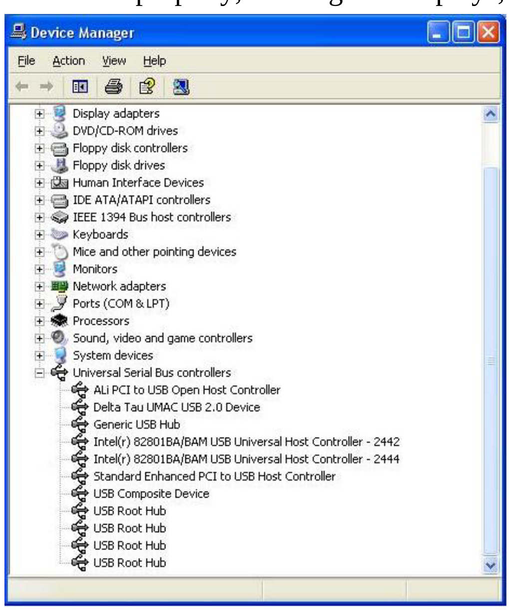
Windows XP is recommended since the UMAC has on-board USB 2.0 and only Windows XP has native USB 2.0 support.

One file is placed on the PC to achieve USB connectivity – device driver PMACUSB.SYS in the WINDOWS\SYSTEM32\DRIVERS directory and the `PMACUSB.INF` plug and play information file in the WINDOWS\INF directory. When the UMAC is plugged into the PC, a New Hardware Found Message displays. A series of dialog boxes will appear, indicating that Windows is installing the device drivers for the system.

Note:

Plug in the USB cable from the UMAC to the PC after the software Pewin Pro and its Service Pack 2.0 has been installed. If the USB cable is plugged in before the software has been installed, restart Windows.

To verify that the software device drivers have been installed properly, right click on the My Computer icon on the desktop. Select **Properties** from the drop down menu that appears. The System Properties Windows dialog box appears. Click the tab titled Device Manager. At this point, a list of device categories appears. Click the + to see a list of USB devices. Provided the device driver for the UMAC Turbo CPU/ Communications Board has been installed properly, a dialog box displays, similar to the following:



If Delta Tau UMAC USB 2.0 Device is not on the list, the device driver has not been installed. If there is a red x through that line or a yellow exclamation point through that line, then Windows had a problem installing the device.

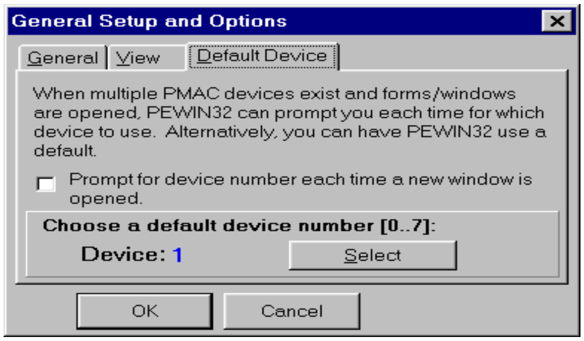
The appropriate trouble-shooting steps are:

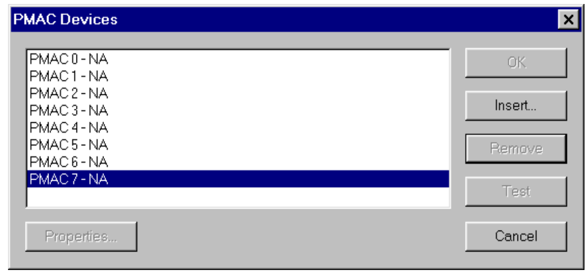
1. Reboot the computer and examine this list again.
2. If that does not work, ensure that pmacusb.sys is in the Windows\system32\Drivers directory.
3. If this is true, when using an older computer, check with the manufacturer to make sure that there is not an update to the BIOS to enable USB on the PC.
4. If the Universal Serial Bus Controllers in the device manager dialog box are not on the list, make sure that it is enabled in the BIOS of the computer.

PEWIN PRO SOFTWARE SETUP

First Time User (Register the Newly Installed Devices)

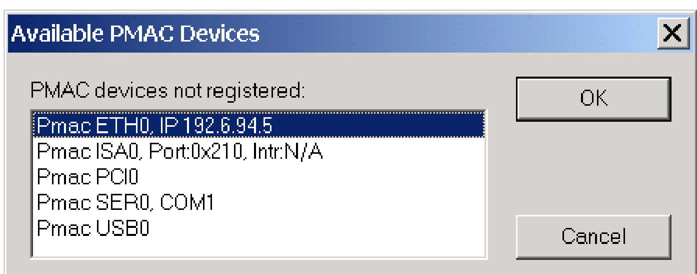
1. Once the driver is installed, it needs additional configuration by using the PmacSelect dialog. The PmacSelect dialog is accessible by all programs created with PComm 32 Pro (via the PmacSelect() function call). Launch the supplied Delta Tau application (Pewin 32 Pro, PMAC Test Pro, or any application) from the program menu and display the PmacSelect dialog.





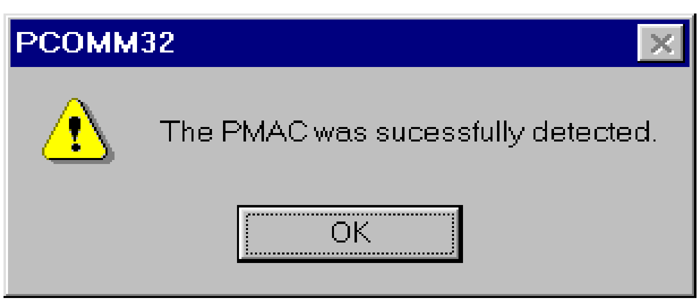
Product	Display the PmacSelect Dialog
Pewin 32 Pro	From the main menu item setup, go to Setup\General Setup and Options. Select the **Default Device** tab. Click on the **Select** button.
Pcomm 32 Pro	Run the supplied PmacTest application. From the main menu, select **Configure\Communications**. Also, the **`PmacSelect()`** function can be called from any application that has been coded.
Ptalk DT Pro	Call the **`SelectDevice()`** method of Ptalk from the supplied or self-created programs.

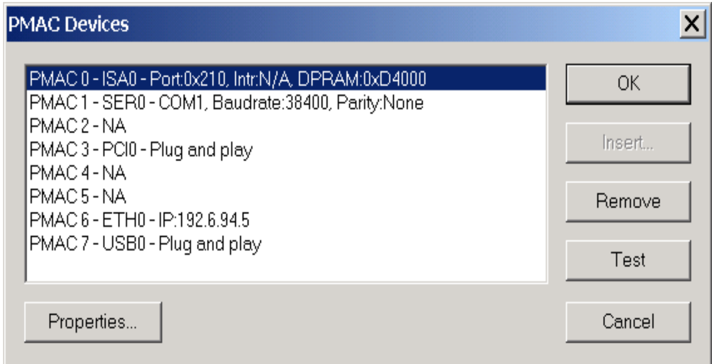
2. From the device selection screen, select the device number to insert a device and click **Insert**. Another window listing all configured devices will appear.



3. Select the device to configure and click **OK**.

4. Once a PMAC is listed in the Pmacselect window, it is registered and can accept communication. It is recommended to test a device upon registering. At this time, a screen displays and this device is ready for use in any application.




PMAC Devices
PMAC 0 - ISA0 - Port:0x210, Intr:N/A, DPRAM:0xD4000
PMAC 1 - SER0 - COM1, Baudrate:38400, Parity:None
PMAC 2 - NA
PMAC 3 - PCI0 - Plug and play
PMAC 4 - NA
PMAC 5 - NA
PMAC 6 - ETH0 - IP:192.6.94.5
PMAC 7 - USB0 - Plug and play
OK
Insert...
Remove
Test
Properties...
Cancel

USING DPRAM

If Option-2B is ordered, the UMAC Turbo CPU/Communications Board contains its own on-board DPRAM. This DPRAM can be used for automatic reporting features or as a general-purpose scratch pad area for custom data.

DPRAM for General Purpose Scratch Pad Data

The UMAC Turbo CPU/Communications Board can write to any DPRAM memory location. Use M-Variables to point to an area in the `$60000-$60FFF` address range. However, unpredictable results will occur if writing to the areas that are used for the DPRAM automatic reporting features. The automatic reporting features memory area can be determined from the Turbo Software Reference Manual by examining the address in the `$60000-$60FFF`; however, when using the UMAC Turbo CPU/Communications Board, this range is from `$60000-$60FFF`. Start the variables at the `$60D60`; this address is well outside the range of the automatic reporting features. Below is an example of pointing to a series of DPRAM locations on the USB card and the count:

```
M1000->DP:$60D60         PmacDprGetMem(0,0x3580,4,&dwData)
M1001->Y:$60D61          PmacDprGetMem(0,0x3584,2,&wData1)
M1002->X:$60D61          PmacDprGetMem(0,0x3586,2,&wData2)
M1003->F:$60D62          PmacDprGetMem(0,0x3586,4,&fData)
```

The parameters passed to the function PmacDPRGetMem are:

- The device number for the case of multiple devices
- The DPRAM offset
- The number of bytes to retrieve
- The location to place the retrieved bytes

The DPRAM offset is the number of bytes from the base DPRAM location. To compute this value, take the UMAC Turbo CPU/Communications Board DPRAM address and multiply its offset by 4. The offset is always the last three digits of the DPRAM address. For example, for the address `$60D60`, multiply $D60 by 4 to compute the offset; the offset for UMAC Turbo CPU/Communications Board address $60D60 is 0x3580. For X memory address, the same applies, except that 2 must be added to the offset calculation.

It is not wise to call PmacDprGetMem for each item of data, due to the structure of USB. The reason is that each call can take 1 msec, but so would a single call getting all the data. More efficient coding would be as follows:

```
Typedef      struct {
DWORD        dwData;
WORD         wData1;
WORD         wData2;
Float        fData;
} Data;
PmacDprGetMem(0,0x3580,12,&Data);
```

Setting DPRAM for Automatic Reporting Features

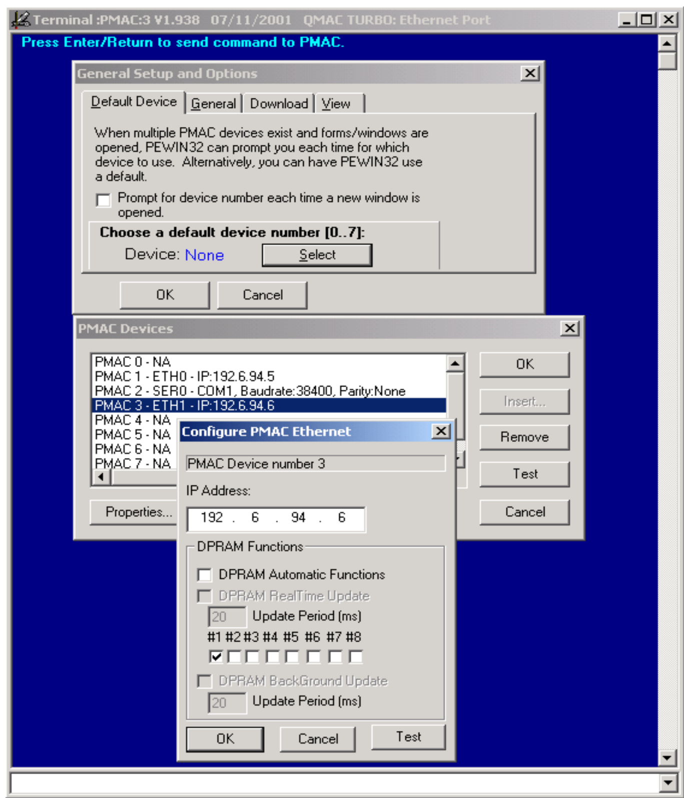
To enable the DPRAM Automatic reporting features requires that the DPRAM automatic features for the device must be activated. To do this from Pewin Pro, go to the Setup Menu Item and select the General Setup and Options Menu Item. Then click the **Select** button from the Default Device tab of the General Setup and Options dialog box.

The PMAC Devices dialog will appear from the list box. Highlight the appropriate device. Then click the **Properties** button to open a dialog box that is used to enable the DPRAM features.

Now the DPRAM automatic real-time/background function can be enabled or disabled from the SelectDevice menu. Set the update period and motor mask.

After turning on DPRAM automatic features, exit Pewin Pro and then restart it to activate the automatic features. After doing this, the speed of response when running the executive probably will slow down slightly since now the PC is reading the automatic data from DPRAM continually and placing it in PC memory.

If DPRAM Automatic features are not required, turn off this feature.



UPGRADING COMMUNICATIONS FIRMWARE

The UMAC Turbo CPU/Communications Board can have its communications firmware upgraded via its USB port. This is useful for getting the latest firmware to take advantage of bug fixes and new features.

Upgrading Ethernet or USB Firmware

Caution:

Be careful not to stop the firmware upgrade in the middle of its loading and not to load application firmware into the boot loader and not to load boot loader firmware in the application firmware. Doing so will result in having to return the card to the factory for repair.

Upgrading the application firmware can be done with the Store F/W button in the same fashion as the boot loader firmware. Probably at some time, this firmware will need an upgrade. This firmware contains all of the code that performs USB and Ethernet communications. To upgrade the firmware, click the **Store F/W** button. An Open File dialog box displays. Select the version of firmware that will be loaded into the UMAC Turbo CPU/Communications Board.

UMAC-Turbo Memory Mapping

When using the UMAC Turbo CPU/Communications Board, all of the BUS communication functions are available. In addition, there are a couple of DPRAM commands available. Using either PTALK DT or PCOMM 32, a program can be written to interface to the UMAC through the following functions:

```
PVOID CALLBACK PmacDPRGetMem(DWORD dwDevice,DWORD offset,
size_t count,PVOID val )
PVOID CALLBACK PmacDPRSetMem( DWORD dwDevice, DWORD offset, size_t count,
PVOID val )
```

Using the USB DPRAM

The UMAC Turbo CPU/Communications Board can write to any DPRAM memory location. Use M-Variables that point to an area in the `$60000 - $60FFF` address range. However, unpredictable results will occur if writing to the areas that used for the DPRAM automatic reporting features (i.e., the ASCII communications buffer ranging from $603A7-$60410). The automatic reporting features memory area can be determined from the Turbo Software Reference Manual by examining the address in the `$60000 - $60FFF`; however, when using UMAC Turbo CPU/Communications Board, this range is from `$60000 - $60FFF`. Start variables at the `$60D60`; this address is well outside the range of the automatic reporting features. Below is an example of pointing to a series of DPRAM locations on the USB card and the count:

```
M1000->DP:$60D60        PmacDprGetMem(0,0x3580,4,&dwData)
M1001->Y:$60D61         PmacDprGetMem(0,0x3584,2,&wData1)
M1002->X:$60D61         PmacDprGetMem(0,0x3586,2,&wData2)
M1003->F:$60D62         PmacDprGetMem(0,0x3586,4,&fData)
```

The parameters passed to the PmacDPRGetMem function are:

- The device number for the case of multiple devices
- The DPRAM offset
- The number of bytes to retrieve
- The location to place the retrieved bytes

The DPRAM offset is the number of bytes from the base DPRAM location. To compute this value, take the UMAC Turbo CPU/Communications Board DPRAM address and multiply its offset by 4. The offset is always the last three digits of the DPRAM address. For example, for the address `$60D60` multiply $D60 by 4 to compute the offset; the offset for UMAC Turbo CPU/Communications Board address `$60D60` is 0x3580. For X memory address, the same applies, except that 2 must be added to the offset calculation.

It is not wise to call PmacDprGetMem for each item of data, due to the structure of USB. The reason is that each call can take 1 msec, but so would a single call getting all the data. More efficient coding would be as follows:

```
typedef struct {
DWORD        dwData;
WORD         wData1;
WORD         wData2;
Float        fData;
}            Data;
PmacDprGetMem(0,0x3580,12,&Data);
```

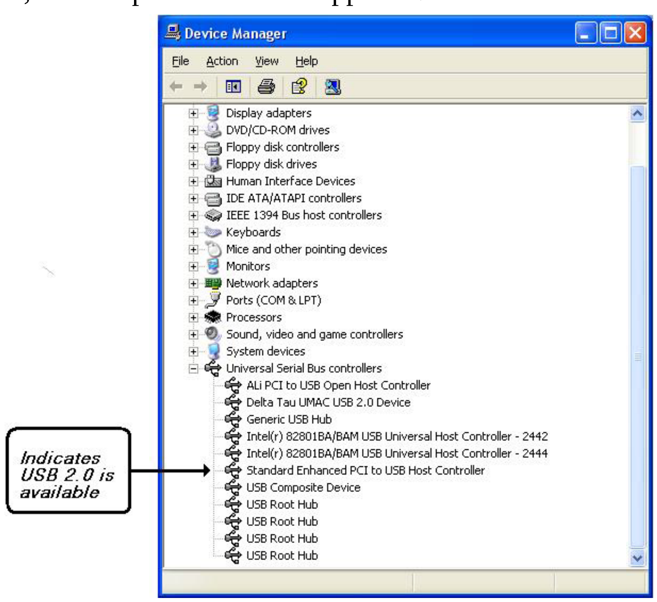
Response to a request for 1KB of data with a PmacDprGetMem call would take ~1 msec; however, if PmacDprGetMem was called for each byte, it would have taken ~1024msec.

Getting the Best Performance from USB

For the best possible performance when using USB communications, use a computer capable of USB 2.0.

To determine if the computer has USB 2.0:

1. Right click on the My Computer icon on the desktop.
2. Click on the Properties button from the drop down menu that appears.
3. Click the Hardware tab, followed by the Devine Manager button.
4. From the Device Manager dialog, select the + on Universal Serial bus Controllers. The phrase Universal Host Controller or Open Host Controller will appear. In addition, there may be a phrase Enhanced USB Host Controller. If Enhanced appears, the computer is capable of USB 2.0. If Enhanced does not appear, the computer does not support it.



If the computer does not support USB 2.0, consider either a computer upgrade if USB communication speed is important to the operation or purchase a USB 2.0 PCI expansion card available from any local computer store.

ETHERNET PROTOCOL

This section is intended for application programmers who have a fundamental understanding of Berkley sockets used in the TCP/IP protocol suite. Before any attempt to read or understand the contents of this manual, review basic sockets (recv, send and socket) and understand them before proceeding.

The examples in this manual are for demonstration purposes only and to convey the concepts of how to communicate to the Delta Tau card. Therefore, the examples do not include error checking and timeouts. Delta Tau's actual production code does, however, and application programmers are strongly encouraged to include error checking and timeouts in the code to prevent hang-ups and unresponsive behavior.

The UMAC Turbo CPU/Communications Board talks using either the UDP or the TCP protocol of the TCP/IP suite of protocols on port 1025. (See the section on protocol setup.) Therefore, the programmer should open a datagram socket on the port 1025, the PMACPORT.

```
sock = socket(PF_INET,SOCK_DGRAM,0);//    change SOCK_DGRAM to
                  SOCK_STREAM for TCP
// Embedded Ethernet's IP address
// The port that the embedded program is listening on.
sin.sin_port = htons(PMACPORT);
connect(*sock,(struct sockaddr*)&sin,sizeof(sin));
```

Ethernet Protocol Command Packet Description

Command Packets

All commands sent over the socket are in the following structure:

```
/ Ethernet command structure
typedef struct tagEthernetCmd
{
  BYTE  RequestType;
  BYTE  Request;
  WORD  wValue;
  WORD  wIndex;
  WORD  wLength;
  BYTE  bData[1492];
}  ETHERNETCMD,*PETHERNETCMD;
```

A description of the fields in the ETHERNETCMD structure follows:

RequestType is used in certain commands to indicate whether the request is an input with respect to the PC or an output command with respect to the PC.

Delta makes the following defines VR_UPLOAD = 0xC0 for a command sent to host and VR_DOWNLOAD = 0x40 for a command sent to the device.

Request indicates what type of command if requesting from the PMAC Ethernet connection. A list of defines for the currently supported command set:

```
#define VR_PMAC_SENDLINE     0xB0
#define VR_PMAC_GETLINE      0xB1
#define VR_PMAC_FLUSH        0xB3
#define VR_PMAC_GETMEM       0xB4
#define VR_PMAC_SETMEM       0xB5
#define VR_PMAC_SETBIT       0xBA
#define VR_PMAC_SETBITS      0xBB
#define VR_PMAC_PORT         0xBE
#define VR_PMAC_GETRESPONSE  0xBF
#define VR_PMAC_READREADY    0xC2
#define VR_CTRL_RESPONSE     0xC4
#define VR_PMAC_GETBUFFER    0xC5
```

```
#define VR_PMAC_WRITEBUFFER  0xC6
#define VR_PMAC_WRITEERROR   0xC7
#define VR_FWDOWNLOAD        0xCB
#define VR_IPADDRESS         0xE0
```

- **wValue** is request specific and its use is indicated under the description of each command.
- **wLength** indicates the length of the **bData** field below.
- **bData** is the meaningful data that is sent to the UMAC Turbo CPU/Communications Board.

Every command that is sent to the UMAC Turbo CPU/Communications Board uses the Ethernetcmd packet structure and is initiated with a PC send command. Every command must issue a **recv** command to either receive an acknowledgement character back via the recv command or receive meaningful data.

```
#define ETHERNETCMDSIZE 8
send(sock,(char *)&EthCmd,ETHERNETCMDSIZE,0);
recv(sock,(char *)&EthCmd,1,0);
```

Ethernet Protocol Command Set

VR_PMAC_FLUSH

This packet issues a ^X to the UMAC Turbo CPU/Communications Board and waits up to 10 msec for UMAC Turbo CPU/Communications Board to respond with a ^X. command. Set up the packet that is sent as follows. One byte is returned upon successful completion of the command.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_FLUSH;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = 0;
EthCmd.bData – not used for this command
```

Example:

```
int CALLBACK PmacSockFlush()
{
   ETHERNETCMD EthCmd;
   int         rc,iTimeout;
   EthCmd.RequestType = VR_DOWNLOAD;
   EthCmd.Request     = VR_PMAC_FLUSH;
   EthCmd.wValue      = htons(FLUSH_TIMEOUT);
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = 0;
   send(sock,
        (char *)&EthCmd,
         ETHERNETCMDSIZE ,
         0);
   recv(sock,
        (char *)&EthCmd,
        1,
        0);
}
```

The above example and all of the examples in this document do not perform error checking and timeout checking. It is the application developer’s responsibility to perform error checking and timeout checks to ensure that the application is working properly.

VR_PMAC_SENDLINE

This packet causes the string NULL terminated in EthCmd.bData to be sent to the UMAC Turbo CPU/Communications Board. The string should not be terminated with a carriage return as this is done by the firmware. One byte will be returned upon successful completion of the command.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_SENDLINE;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons( (WORD)strlen(outstr));
strncpy((char *)&EthCmd.bData[0],
         outstr
         ,(WORD)strlen(outstr));
```

Example:

```
int CALLBACK PmacSockSendLine(char *outstr)
{
   EthCmd.RequestType = VR_DOWNLOAD;
   EthCmd.Request     = VR_PMAC_SENDLINE;
   EthCmd.wValue      = 0;
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons( (WORD)strlen(outstr));
   strncpy((char *)&EthCmd.bData[0],outstr,(WORD)strlen(outstr));
   send(sock,
        (char *)&EthCmd,
        ETHERNETCMDSIZE +  strlen(outstr),
       0);
   recv(sock,(char *)&EthCmd,1 ,0);
}
```

VR_PMAC_GETLINE

This packet causes the Ethernet connection to return any available string that may be residing in the UMAC Turbo CPU/Communications Board. All characters up to a `<CR>`, `<ACK>` or `<LF>` are returned. The available string in UMAC Turbo CPU/Communications Board is returned and captured via an Ethernet recv command. Do not use this function. Use VR_PMAC_GETBUFFER instead, as this function will retrieve multiple lines and enhance performance instead of using multiple calls of VR_PMAC_GETLINE.

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_GETLINE;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     Not used
```

Example:

```
int CALLBACK PmacSockGetLine(char *instr)
{
   EthCmd.RequestType = VR_DOWNLOAD;
   EthCmd.Request     = VR_PMAC_GETLINE;
   EthCmd.wValue      = 0;
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons( (WORD)strlen(outstr));
   strncpy((char *)&EthCmd.bData[0],outstr,(WORD)strlen(outstr));
   send(sock,(char *)&EthCmd,ETHERNETCMDSIZE,0);
   recv(sock,(char *)&instr,255 ,0);
}
```

VR_PMAC_GETBUFFER

This packet causes the Ethernet connection to return any available string that may be residing in the PMAC. All characters up to an `<ACK>` or `<LF>` are returned. If a `<BEL>` or `<STX>` character is detected, only the data up to the next `<CR>` is returned. The maximum amount of data returned is 1400 Bytes. It is the caller's responsibility to determine if there is more data to follow and to call VR_PMAC_GETBUFFER again to retrieve all of the data available.

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_GETBUFFER;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons( (WORD)strlen(outstr));
EthCmd.bData       - Not Used
```

Example:

```
int CALLBACK PmacSockGetBuffer(char *instr)
{
   EthCmd.RequestType = VR_DOWNLOAD;
   EthCmd.Request     = VR_PMAC_GETBUFFER
   EthCmd.wValue      = 0;
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons( (WORD)strlen(outstr));
   send(sock,(char *)&EthCmd,ETHERNETCMDSIZE,0);
   recv(sock,(char *)&instr,1400,0);
}
```

VR_ IPADDRESS

This packet permits either setting or retrieval of the current IP address in the UMAC Turbo CPU/Communications Board. When setting the IP address to a new value, it is required that the UMAC Turbo CPU/Communications Board be powered down for the new address to take effect.

```
EthCmd.RequestType = VR_UPLOAD to retreive the IP address
```

Or

```
EthCmd.RequestType = VR_DOWNLOAD to set the IP address
EthCmd.Request  = VR_IPADDRESS;
EthCmd.wValue   = 0;
EthCmd.wIndex   = 0;
EthCmd.wLength  = htons(4);
EthCmd.bData    = contains 4 bytes of data indicating the IP
                  address set on the send command.
```

For the **`Receive`** command, four bytes of data are returned indicating the IP address.

VR_PMAC_SENDCTRLCHAR

This packet sends a single character or control character to the UMAC Turbo CPU/Communications Board. The packet below is sent. The data received is irrelevant; its purpose is to ensure that the sender's command has been received.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_SENDCTRLCHAR;
EthCmd.wValue      = htons(outch);  // the character to write
EthCmd.wIndex      = 0;
EthCmd.bData       - Not Used
```

VR_PMAC_PORT

This packet sends or receives a single byte to or from the UMAC Turbo CPU/Communications Board.

To send data to the host port, set the packet as follows. After sending the packet, the programmer must wait to receive one byte via the **Recv** function before continuing. The data received is irrelevant; its purpose is to ensure that the sender's command was received.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_PORT;
EthCmd.wValue      = htons((WORD)offset);
EthCmd.wIndex      = htons((WORD)outch);
EthCmd.wLength     = 0;
```

To receive data from the host port, set the packet as follows. After sending the packet, the programmer shall receive one byte which is the value the UMAC Turbo CPU/Communications Board read from the host port.

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_PORT;
EthCmd.wValue      = htons(offset);
EthCmd.wIndex      = 0;
EthCmd.wLength     = 0;
```

VR_PMAC_READREADY

This packet determines if there is data on the Turbo PMAC 2 CPU ready to be read.

Two bytes are returned. The first byte if non-zero indicates there is data to be read; if zero, there is no data to be read. Set up the packet as follows:

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_READREADY;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons(2);
```

Example:

```
ETHERNETCMD EthCmd;
char        data[2];
int         rc;
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_READREADY;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons(2);
rc = send(sock,((char *)&EthCmd),ETHERNETCMDSIZE,0);
rc = recv(*((SOCKET *)vh[dwDevice].hDriver),data,2,0);
return data[0];
```

VR_CTRL_REPONSE

After sending a control character, this packet obtains the response. Set up the packet as follows. The received data is the response to the sent control character. Meaningful data is returned for the following control characters `^B`, `^C`, `^F`, `^G`, `^P` and `^V`. All other data control characters do not return meaningful data.

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_CTRL_RESPONSE;
EthCmd.wValue   = htons(outchar);//outchar=ctrl char to send out
EthCmd.wIndex   = 0;
EthCmd.wLength  = htons(len);
rc = send(sock,((char *)&EthCmd),ETHERNETCMDSIZE,0);
rc = recv(sock,outstr,len,0);  // returned data appears
```

VR_PMAC_WRITEBUFFER

This packet writes multiple lines to the PMAC with just one packet. Set up the packet as follows. The received data is the response to the sent control character. Usually, it is used for downloading a file. Data should have each line separated by null byte.

For Example, OPEN PLC 1 CLEAR<00>P1=P1+1<00>CLOSE<00> where <00> indicates a null byte. The maximum data length is 1024; anything bigger must be separated into multiple calls of VR_PMAC_WRITEBUFFER. Upon receiving this packet, the PMAC sends back four bytes of data. Byte 3 indicates if there was an error downloading. If the value of this byte is 0x80, there was an error during the download. If it is 0, there was no error during download. Byte 2 indicates the PMAC Error type if there was a download error. Consult the PMAC Software Reference manual under I6. Bytes 0 and Byte 1 together form a word that indicates the line number which caused the error to occur. Byte 1 is the MSB and Byte 0 is the LSB of that word.

Example:

```
char errcode[4];
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_WRITEBUFFER;
EthCmd.wValue      = 0;
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons(len) ;
memcpy(EthCmd.bData,data, len);
send(sock,(char *)&EthCmd,ETHERNETCMDSIZE + len,0);
recv(sock,(char *)errcode,4 ,0);
```

VR_FWDOWNLOAD

This packet writes raw data to the UMAC Turbo CPU/Communications Board host port for firmware download. The firmware takes the stream of data, and then writes to the UMAC Turbo CPU/Communications Board host port at address 5, 6 and 7. The packet includes the wValue parameter that commands the start the download at host port address 5. This packet writes multiple lines to the UMAC Turbo CPU/Communications Board with just one packet. The packet is set up as follows. The received data is the response to the sent control character. Usually, it is used for downloading a file. Data should have each line separated by null byte. After sending the packet, the programmer must wait to receive one byte via the recv function before continuing. The data received is irrelevant; its purpose is to ensure that the sender’s command was received.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request= VR_FWDOWNLOAD;
EthCmd.wValue = htons((WORD)bRestart); //bRestart = 1 on start
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons((WORD)len) ;
memcpy(EthCmd.bData,data, len);
send(sock,(char *)&EthCmd,ETHERNETCMDSIZE + len,0);
recv(sock,(char *)&errcode,1 ,0);
```

VR_PMAC_GETRESPONSE

This packet causes the Ethernet connection to send a string to UMAC Turbo CPU/Communications Board, then to return any available strings that may be residing in the PMAC. All characters up to an <ACK> or <LF> are returned. If a <BEL> or <STX> character is detected, only the data up to the next <CR> is returned. The maximum amount of data that is returned is 1400 Bytes. It is the caller’s responsibility to determine if there is more data to follow and if VR_PMAC_GETBUFFER needs to be called again to retrieve all of the data available.

```
EthCmd.RequestType = VR_DOWNLOAD;
EthCmd.Request     = VR_PMAC_GETRESPONSE;
EthCmd.wValue      = 0;
```

```
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons( (WORD)strlen(outstr));
   strncpy((char *)&EthCmd.bData[0],outstr,(WORD)strlen(outstr));
   send(sock,(char*)&EthCmd,ETHERNETCMDSIZE + strlen(outstr),0);
   recv(sock, szPmacData,1400,0);
```

VR_PMAC_GETMEM

This packet causes the Ethernet connection to retrieve DPRAM data from the UMAC Turbo CPU/Communications Board. Up to 1400 bytes may be received in a single packet. The wValue field contains the byte offset to retrieve the data from, while the wLength parameter indicates how many bytes to receive.

Example:

```
   EthCmd.RequestType = VR_UPLOAD;
   EthCmd.Request     = VR_PMAC_GETMEM;
   EthCmd.wValue      = htons(offset);  //
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons(length);
  send(sock,(char *)&EthCmd,ETHERNETCMDSIZE ,0);
  recv(sock,(char *)data,1400,0);
```

VR_PMAC_SETMEM

This packet causes the Ethernet connection to write data to the DPRAM shared between the UMAC Turbo CPU/Communications Board and the host port. Up to 1400 bytes may be written in a single packet. The wValue field contains the byte offset to write the data to while the wLength parameter indicates how many bytes to write. After sending the packet, the programmer must wait to receive one byte via the **Recv** function before continuing. The data received is irrelevant; its purpose is to ensure that the sender's command was received.

Example Packet Setup:

```
   EthCmd.RequestType = VR_UPLOAD;
   EthCmd.Request     = VR_PMAC_SETMEM;
   EthCmd.wValue      = htons(offset);
   EthCmd.wIndex      = 0;
   EthCmd.wLength     = htons(length);
```

VR_PMAC_SETBIT

This packet causes the Ethernet connection to perform a write to the DPRAM shared between the PMAC and the PMAC that either sets bits in a 32-bit word or clears bits in a 32-bit word. If the wIndex parameter is supplied with a 1, a logical or is performed that sets bits. If it is 0, a logical AND is performed, which clears bits. It is the programmer's responsibility to use the appropriate mask for setting or clearing bits. The wValue field contains the byte offset to retrieve the data. After sending the packet, the programmer must wait to receive one byte via the **Recv** function before continuing. The data received is irrelevant; its purpose is to ensure that the sender's command was received.

Example:

```
DWORD       mask = 0x00000001;
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_SETBIT;
EthCmd.wValue      = htons((WORD)offset);
EthCmd.wIndex      = htons((WORD)on);
EthCmd.wLength     = htons(len);
// generate the mask
mask <<= bitno; // zero based
// If clearing a bit compliment mask to prepare the firmware for AND
if(!on)
     mask = ~mask;
```

```
memcpy(EthCmd.bData,&mask,len);
// Send command request
 send(sock,(char *)&EthCmd,ETHERNETCMDSIZE+len,0);
 recv(sock,(char *)&errcode,1,0);
```

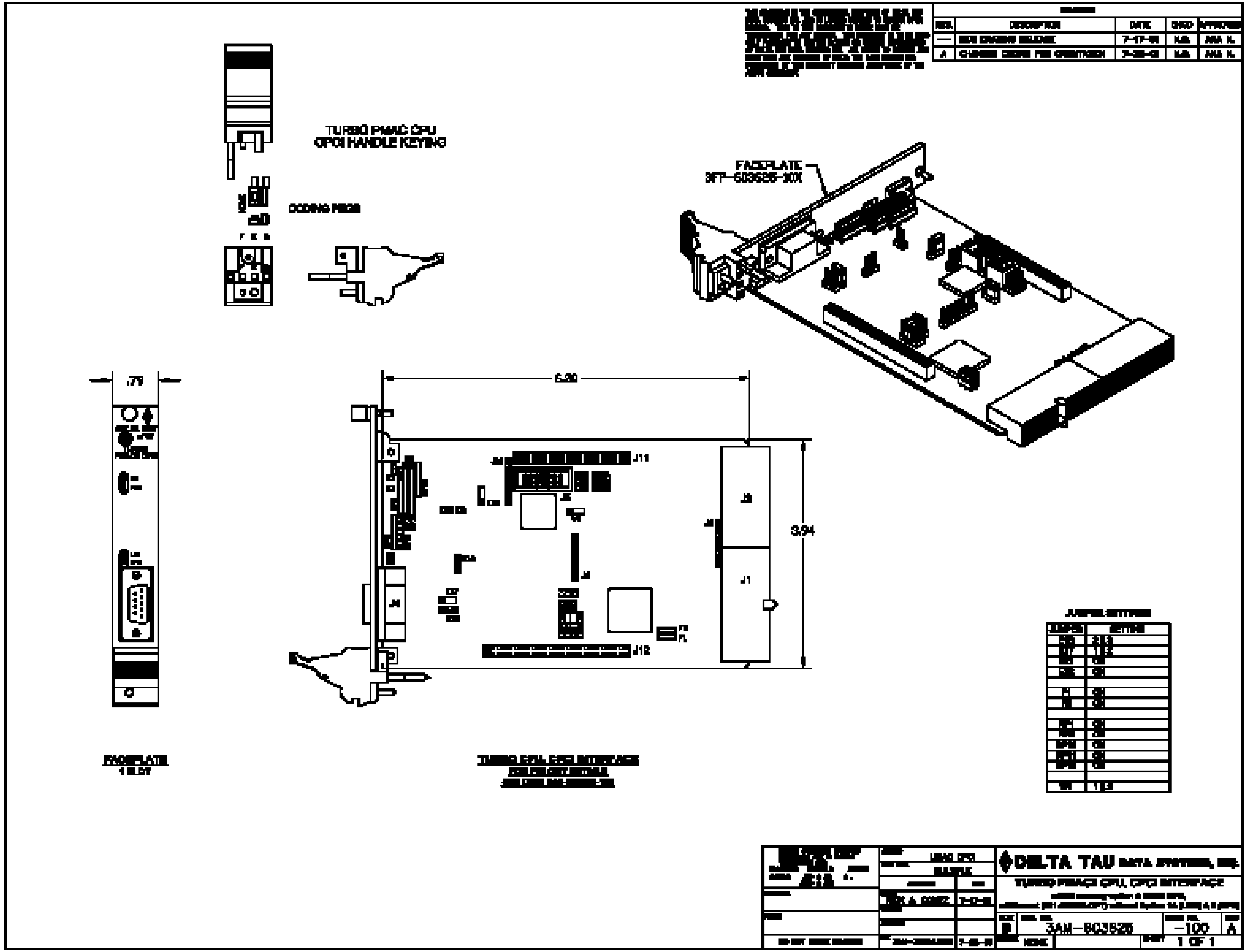
VR_PMAC_SETBITS

This packet causes the Ethernet connection to perform a write to the DPRAM shared between the PMAC and the PMAC that sets bits in a 32-bit word to a new value. The wValue field contains the byte offset to retrieve the data.. The bData field of the Ethernet command packet must be stuffed with a mask indicating which bits to set in four bytes followed by four bytes that indicate the bits to clear in a 32-bit word. After sending the packet, the programmer must wait to receive one byte via the **Recv** function before continuing. The data received is irrelevant; its purpose is to ensure that the sender's command was received.

Example:

```
EthCmd.RequestType = VR_UPLOAD;
EthCmd.Request     = VR_PMAC_SETBITS;
EthCmd.wValue      = htons((WORD)offset);
EthCmd.wIndex      = 0;
EthCmd.wLength     = htons(2*sizeof(DWORD));
temp = 0xFF03FFFF ;
memcpy(EthCmd.bData,&temp,sizeof(DWORD));
temp = 0x00030000 ;
memcpy(EthCmd.bData + 4,&temp,sizeof(DWORD));
// Send command request
send(sock,(char *)&EthCmd,ETHERNETCMDSIZE + 2*sizeof(DWORD),0);
recv(sock,(char *)&errcode,1,0);
```

SCHEMATICS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CPCI HANDLE KEYING
CODING PINS
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6.30
3.94
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J12
J4
J1
FACEPLATE
1 SLOT
DELTA TAU DATA SYSTEMS, INC.
TURBO PMAC CPU, CPCI INTERFACE
3AM-603626
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1 OF 1
UMAC CPU
SAMPLE