# INTRODUCTION

The Turbo PMAC2-Eth-Lite controller ("Clipper") from Delta Tau provides a very powerful, but compact and cost-effective, multi-axis controller for cost-sensitive applications. It has a full Turbo PMAC2 CPU section and provides a minimum of 4 axes of servo or stepper control with 32 general-purpose digital I/O points. It provides both Ethernet and RS-232 communications links.

The optional axis expansion board provides a set of four additional servo channels and extra I/O ports.

## Board Configuration

### Base Version

- The base version of the Clipper Controller (Turbo PMAC2-Eth-Lite) provides a 110mm x 220mm (4.25" x 8.5") board with:
- 80 MHz DSP56303 Turbo PMAC CPU
- 256k x 24 user SRAM
- 1M x 8 flash memory for user backup & firmware
- Latest released firmware version
- RS-232 serial interface
- 100 Mbps Ethernet interface
- 480 Mbit/sec USB 2.0 interface
- 4 channels axis-interface circuitry, each including:
    - 12-bit +10V analog output
    - Pulse-&-direction digital outputs
    - 3-channel differential/single-ended encoder input
    - 5 input flags, 2 output flags
    - UVW TTL-level "hall" inputs
- 50-pin IDC header for amplifier/encoder interface
- 34-pin IDC header for flag interface
- 4-pin Molex connector for power supply input (5V, +/-12V, GND)
- (+/-12V only required for analog outputs or inputs)
- PID/notch/feedforward servo algorithms
- 32 general-purpose TTL-level I/O points, direction selectable by byte:
    - 16-point multiplexer port compatible with Delta Tau I/O accessories
    - 16-point "Opto" port compatible with Opto-22-style modules
- "Handwheel" port with 2 each:
    - Quadrature encoder inputs
    - Pulse (PFM or PWM) output pairs

On-board options:

- Optional 2 channels 12-bit A/D converters, 1 12-bit D/A converter
- Optional Modbus Ethernet I/O protocol
- On-board 8K x 16 dual-ported RAM.

Stackable accessories supported:

- ACC-1P PC/104-format Channel 5-8 board
- ACC-8ES 4-channel dual 18-bit true-DAC output board
- ACC-8FS 4-channel direct-PWM output board

- ACC-8TS 4-channel ADC-interface board
- ACC-51S 2/4-channel high-resolution encoder interpolator board

# Board Options

## Option 5xx: CPU Speed Options

- OPT-5C3 80MHz DSP56303 CPU, expanded program and user data memory
- OPT-5F3 240MHz DSP56321 CPU, expanded program memory and user data memory

## Option 10: Firmware Version Specification

Normally the Turbo PMAC2-Eth-Lite Controller is provided with the newest released firmware version. A label on the memory IC shows the firmware version loaded at the factory. Option 10 provides for a user-specified firmware version.

## Option 12: Analog-to-Digital Converters

Option 12 permits the installation of two channels of on-board analog-to-digital converters with ±10V input range and 12-bits resolution. This option also provides one filtered PWM DAC output.

# Additional Accessories

## Acc-1P: Axis Expansion Piggyback Board

Acc-1P provides four additional channels axis interface circuitry for a total of eight servo channels, each including:

- 12-bit ±10V analog output
- Pulse-and-direction digital outputs
- 3-channel differential/single-ended encoder input
- Four input flags, two output flags
- Three PWM top-and-bottom pairs (unbuffered)

## Acc-1P Option 1: I/O Ports

Option 1 provides the following ports on the Acc-1P axes expansion board for digital I/O connections.

- Multiplexer Port: This connector provides eight input lines and eight output lines at TTL levels. When using the PMAC Acc-34x type boards these lines allow multiplexing large numbers of inputs and outputs on the port. Up to 32 of the multiplexed I/O boards may be daisy-chained on the port, in any combination.
- I/O Port: This port provides eight general-purpose digital inputs and eight general-purpose digital outputs at 5 to 24Vdc levels. This 34-pin connector was designed for easy interface to OPTO-22 or equivalent optically isolated I/O modules when different voltage levels or opto-isolation to the PMAC2A PC/104 is necessary.
- Handwheel port: this port provides two extra channels, each jumper selectable between encoder input or pulse output.

## Acc-1P Option 2: Analog-to-Digital Converters

Option 2 permits the installation on the Acc-1P of two channels of analog-to-digital converters with ±10V input range and 12-bits resolution.

## Acc-8TS Connections Board

Acc-8TS is a stack interface board to for the connection of either one or two Acc-28B A/D converter boards. When a digital amplifier with current feedback is used, the analog inputs provided by the Acc-28B cannot be used.

## Acc-8ES Four-Channel Dual-DAC Analog Stack Board

Acc-8ES provides four channels of 18-bit dual-DAC with four DB-9 connectors. This accessory is stacked to the Clipper Board and it is mostly used with amplifiers that require two ±10 V command signals for sinusoidal commutation.

## Acc-8FS Four-Channel Direct PWM Stack Breakout Board

Acc-8FS is a 4-channel direct PWM stack breakout board for the Clipper Board. This is used for controlling digital amplifiers that require direct PWM control signals. When a digital amplifier with current feedback is used, the analog inputs provided by the Option 12 of the Clipper Board (the Option 2 of the Acc-1P or the Acc-28B) cannot be used.

## Acc-51S Four-Channel High Resolution Interpolator Board

The Acc-51S Interpolator Accessory is a sine wave input interpolator designed to interface analog quadrature encoders to the Clipper Board. The Acc-51S stacks on top of the Clipper Board or on top of the Acc-1P 5-8 axis board. The Interpolator accepts inputs from two (optionally four) sinusoidal or quasi-sinusoidal encoders and provides encoder position data to the PMAC. This interpolator creates 4,096 steps per sine-wave cycle.