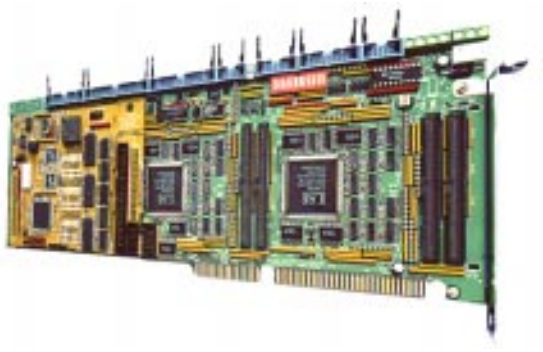
PRODUCT DATA SHEETS

The following data sheets represent the products manufactured by Delta Tau Data Systems which support MACRO fieldbus protocol.

The PMAC2 product data sheet is shown here because the PMAC2 Ultralite products have the same functionality as PMAC2 with other enhancements.



(PMAC2 - PC SHOWN)

DELTA TAU
DATA SYSTEMS, INC.

PMAC2

Delta Tau Data Systems has been the world leader in multi-axis motion control for over 20 years. Available in PC bus and VME bus versions, PMAC2 is Delta Tau Data Systems' 5th generation motion controller.

While maintaining the same programming language and using the experience developed by the successful operation of over 40,000 PMAC controllers in the field, Delta Tau Data Systems has been able to add speed enhancements and versatility to the PMAC2 product line!

Why PMAC2?

Developing a controller that performs digital PWM drive to amplifiers was a prime goal in developing the PMAC2 product. Increasing performance of the original PMAC product was the result.

Extensive testing and real world experience have demonstrated that the best response of a controller-amplifier-motor system occurs when the control loop has the smallest number of analog components in it. The closer that the controller gets to the final output stages of an amplifier in a digital format, the better the performance becomes. PMAC2 supports this strategy by providing a digital means of receiving current information from a drive and sending direct digital PWM signals to the drive power transistors. These are the basic requirements for a direct digital PWM drive system.

A short cable is used to interconnect a breakout accessory which allows PMAC2 to connect to the direct digital PWM drive. The PMAC2 board contains the core circuitry that is required for trajectory, position calculation and digital current loop control. There is no need for digital-to-analog converters on the PMAC2 baseboard.

Since the removal of the digital-to-analog converters from the PMAC2 base-board further simplifies the interfacing to different types of drive schemes, PMAC2 has capabilities to utilize low cost accessory interface cards that will allow the user to mix and match different drive schemes. Imagine a PMAC2 controller driving a digital PWM amplifier (driving a brushless D.C. motor), with a stepper motor, a linear motor, and an A.C. induction motor... *All at the same time!!!*

FEATURES:

- PC bus or VME bus versions available
- Dual feedback position and velocity loops
- Notch filter for control of resonant systems
- Feedforward terms: velocity, acceleration, and friction compensation
- Optional 35-term extended "pole-placement" servo algorithm
- Sinusoidal commutation for brushless and induction AC motors
- Leadscrew compensation tables: cross-axis and planar compensation
- Tool radius compensation
- Electronic cams with full motion flexibility (external time base)
- Electronic gearing- may be superimposed on programmed motion
- Real-time matrix transformation of axes
- Timer-based (1/T) sub-count interpolation
- Various encoder feedback formats
  - Digital quadrature encoder
  - Sinusoidal Interpolation
  - Parallel encoder, interferometer
  - Analog feedback (e.g. LVDT, RVDT)
  - Resolvers and Inductosyns™
  - MLDTs (e.g. Temposonics™)
  - Yaskawa absolute encoders
- Dual-ported RAM (on-board, optional)
- 16 D/A converter interfaces
- Digital Pulse/Direction output (stepper interface)
- Internal MLDT interface
- 16 multiplexed 12 bit A-D inputs (on-board, optional)
- 8 channels of dual serial A-D converter inputs (used for digital current loop or voltage metering)
- Support for MACRO interface
- Supplemental Flags for Hall Effect inputs
- Position capture and position compare implemented in hardware for lightning fast response
- 32 bits of machine I/O (user configurable)

Drive Types Supported:

- •Analog ±10V velocity command
- •Analog ±10V torque command
- •Sinusoidal Analog ±10V phase commands
- •Direct digital PWM output
- •Pulse and Direction outputs (for steppers, step-replacement servo drives, laser modulation)
- •Optical ring MACRO output

Stand Alone Operation

As with all PMAC products, the PMAC2 may be installed as a stand-alone device which will execute motion programs and completely control a machine's operation.

The PMAC2 requires only a +5Vdc power supply for the main board's operation. Some of the accessory cards require additional power supply inputs.

PMAC2 inside a Computer

When used inside a computer, PMAC2 is configured to appear to the computer as a small block of I/O. This I/O block is relocatable by the user and allows for easy access to command machine processes from his own target program.

Delta Tau has drivers for various languages and target software packages.

Dual port memory option allows a large number of data values to be passed to the target software process quickly and efficiently.

Providing a dual port memory window to the computer allows the system designer the fullest flexibility for developing his application.

SPECIFICATIONS:

Number of Axes	–	STD: 4 Axes OPT: 8 Axes (total)
Processor speed	–	STD: 40 MHz OPT: 60,80MHz
# of encoder inputs	–	4 axis PMAC2 - 6 channels 8 axis PMAC2 - 10 channels
Max enc input rate	–	40 MHz
Enc Input Filter	–	Best 2-of-3 on A, B, Index
Pos. Compare Update Rate	–	10 MHz (Automatic hardware update)
Flag Hardware interface	–	Sinking or Sourcing- best 2-of-3 input filter
# of DAC channels	–	STD: 8 OPT: 16 (DACS are located on an accessory card)
DAC accessory resolution	–	Up to 18 bits, selectable
# of serial A-D interfaces	–	STD: 8 OPT: 16
Serial A-D input resolution	–	Up to 18 bits, selectable

Your Local Representative Is:

INTERFACE CONNECTORS:

J1 -	JANA	Analog input port
J2 -	JTHW	Multiplexer port
J3 -	JI/O	General input/output
J4 -	JMACRO	Network interface
J5 -	JRS232	RS232 port
JRS422 -	JRS422	RS422 port (optional)
J6 -	JDISP	Display port
J7 -	JHW	Handwheel encoder
J8 -	JEQU	Position compare
J9 -	JMACH1	
J10 -	JMACH2	
J11 -	JMACH3	(8 axis option)
J12 -	JMACH4	(8 axis option)
TB1 -	POWER	
TB2 -	WDOG	
P1 -	VME	PMAC-VME only
P2 -	JMACHA	PMAC-VME only
P2A -	JMACHB	PMAC-VME 8 axis

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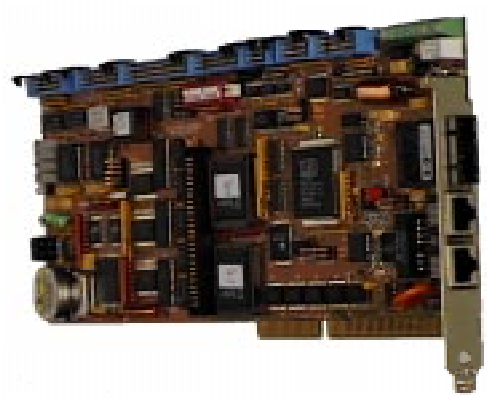

(PMAC2 - PC ULTRA-LITE SHOWN)

DELTA TAU
DATA SYSTEMS, INC.

PMAC2 Ultralite

Delta Tau Data Systems, has been the world leader in multi-axis motion control for over 20 years. PMAC2 Ultralite is Delta Tau Data Systems' 5th generation of motion controller

While maintaining the same programming language and using the experience developed by the successful operation of over 40,000 PMAC controllers in the field, Delta Tau Data Systems has been able to add MACRO fiber optic technology, speed enhancements and versatility to the PMAC2 product line!

Why PMAC2 Ultralite?

Developing a low cost controller that performs a digital fiber optic interface to amplifiers was the goal in developing the PMAC2 Ultralite product. This was accomplished by adding MACRO to the original PMAC2 product and removing the direct PWM output. The result is a low cost "MACRO only" PMAC2.

Extensive testing and real-world experience have demonstrated that the best response of a controller-amplifier-motor system occurs when the control loop has the smallest number of analog components in it. Adding MACRO high-bandwidth fiber optic technology maintains the digital connection. PMAC2 Ultralite is the ideal product for motor and I/O control in machinery because it eliminates the wire connection between the controller and the motor equipment and replaces it with fiber optics!!!

No more electrical noise to be coupled between the motor amplifier and the computer control system. The PMAC2 Ultralite board contains the CPU and core circuitry that is required for position and trajectory calculations and MACRO communication. All existing PMAC and PMAC2 user programs can be run on the PMAC2 Ultralite.

PMAC2 Ultralite simplifies the interfacing to different types of drive schemes. The terminology used by the MACRO fiber interface is identical to the terminology that has been used in the PMAC product line and the motor control industry for years!

Connect the MACRO ring (either fiber optic or RJ45 twisted wire) from the PMAC2 Ultralite to either a MACRO station or the fiber optic input of a MACRO motor drive or other MACRO compatible I/O devices!

FEATURES:

- MACRO (fiber optic) master or slave
- PC bus or VME bus models are available
- PLC Program compatibility with PMAC2 products
- Identical tuning parameters to PMAC2 products
- Identical encoder feedback formats to PMAC2 products
- Dual-ported RAM (on-board optional)
- JDISP port for remote LCD display
- JTHW port for thumbwheel accessories
- JIO port for 32 bits of user configurable machine I/O
- JHW port for 2 handwheel inputs
- JRS232 serial port or optional JRS422 serial port
- SC optical fiber interface
- RJ/45 connectors for wired MACRO interface (option)

MACRO Drive Types Supported:

- Velocity command
- Torque command
- Sinusoidal phase commutation commands
- Direct digital PWM output
- Pulse and Direction outputs (for steppers, step-replacement servo drives, laser modulation)
- I/O rack modules

Stand Alone Operation

As with all PMAC products, the PMAC2 Ultralite may be installed as a stand-alone device which will execute motion programs and completely control a machine's operation.

The PMAC2 Ultralite requires only a +5Vdc power supply for the main board's operation.

PMAC2 Ultra-lite inside a Computer

When used inside a computer the PMAC2 Ultralite is configured to appear to the computer as a small block of I/O. This I/O block is relocatable by the user and allows the user easy access to command machine processes from his own target program.

Delta Tau has drivers for various languages and target software packages.

Dual Port Memory

The dual port memory option allows a large number of data values to be passed to the target software process quickly and efficiently with simple handshaking.

Providing a dual port memory window to the computer allows the system designer the fullest flexibility for developing his application.

SPECIFICATIONS:

Number of Axes	–	8 Axes through MACRO port
Processor speed	–	STD: 40 MHz OPT: 60,80MHz
# of encoder inputs	–	8 axis PMAC2 - 10 channels (8 channels through MACRO port)
Max enc input rate	–	40 MHz
Enc Input Filter	–	Best 2-of-3 on A, B, Index
Pos. Compare Update Rate	–	10 MHz (Automatic hardware update)

Your Local Representative Is:

INTERFACE CONNECTORS:

J2 -	JTHW	Multiplexer port
J3 -	JI/O	General input/output
J5 -	JRS232	RS232 port
J5A -	JRS422	RS422 port (optional)
J6 -	JDISP	Display port
J7 -	JHW	Handwheel encoder
TB1 -	POWER	
TB2 -	WDOG	
P1 -	JVME	-VME only
P2 -	JMACHA	-VME only

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(MACRO STACK 4 AXIS SHOWN)

DELTA TAU
DATA SYSTEMS, INC.

MACRO STATION

Delta Tau Data Systems, has been the world leader in multi-axis motion control for over 20 years. The MACRO Station is Delta Tau Data Systems' solution for a high speed complete motion controller-drive-motor and I/O system that uses high bandwidth MACRO (Motion And Control Ring Optical) fiber optic technology to interconnect various system components.

A PMAC2 that is a MACRO bus master is capable of driving the MACRO Station as if it were a part of the PMAC2 itself! The use of MACRO in this implementation is identical to splitting the traditional controller into two pieces; 1) CPU section that performs motion calculations and user interface (such as PMAC2 - Ultra-lite), 2) interface section that contains encoder counters, buffer circuitry, and direct PWM or ±10Vdc outputs to drive various motor amplifiers.

The MACRO Station is the second part of the above description. Consisting of 3U size rack-mountable cards, the MACRO station is capable of being configured to drive up to 8 axes and over 1000 points of digital I/O.

The MACRO station concept was developed specifically for reducing the system cost associated with fiber optic control distribution since each station may service as many as 8 axes of motion plus I/O. The MACRO station allows the use of amplifiers, motors and I/O modules that are available from *any* source rather than devices exclusively desgined for MACRO.

While maintaining the same programming language and using the experience developed by the successful operation of over 40,000 PMAC controllers in the field, Delta Tau Data Systems has been able split the PMAC2 motion controller to add MACRO fiber optic technology and maintain complete drive compatibility!

Why use a MACRO Station?

Developing a controller that performs a digital fiber optic interface to amplifiers was the goal in developing the PMAC2 MACRO products. Adding a MACRO Station completes the drive interface picture whereby the system may contain motor drives that are not specifically MACRO interface compatible.

MACRO Station simplifies a system design by separating the controller's computer from the drive cabinet electrically. Imagine a large machine that is 100 feet in length and has multi-horsepower motors that are coordinated by the same PMAC and yet there is complete electrical noise immunity through the control cabinet and each motor drive and I/O cabinet! This is a reliable implementation!

FEATURES:

- MACRO slave
- Addressable to any of 16 masters and 14 slaves (224 addressable axes total)
- VME bus model (3U) simplifies rack mounting
- 2, 4, 6 or 8 axis board stacking configurations using 2 and 4 axis cards
- Direct PWM drive is standard output
- Optional ±10V analog output circuitry available
- Sinusoidal ±10V commutation
- Encoders: standard quadrature, Yaskawa Absolute, resolver, MLDT
- JTHW port for thumbwheel accessories
- Extended I/O: 144 points Opto 22 compatible, software configurable (option 3). *Future option*⇒ 48 points, software configurable, 24V opto-isolated.
- Analog inputs (optional 8 or 16 channel, 12 bit resolution on 2 axis card only)
- Over 1,000 I/O points supported
- RS232 serial port
- Requires +5Vdc, ±15Vdc power
- SC connectors for fiber MACRO interface (option)
- RJ/45 connectors for wired MACRO interface (option)

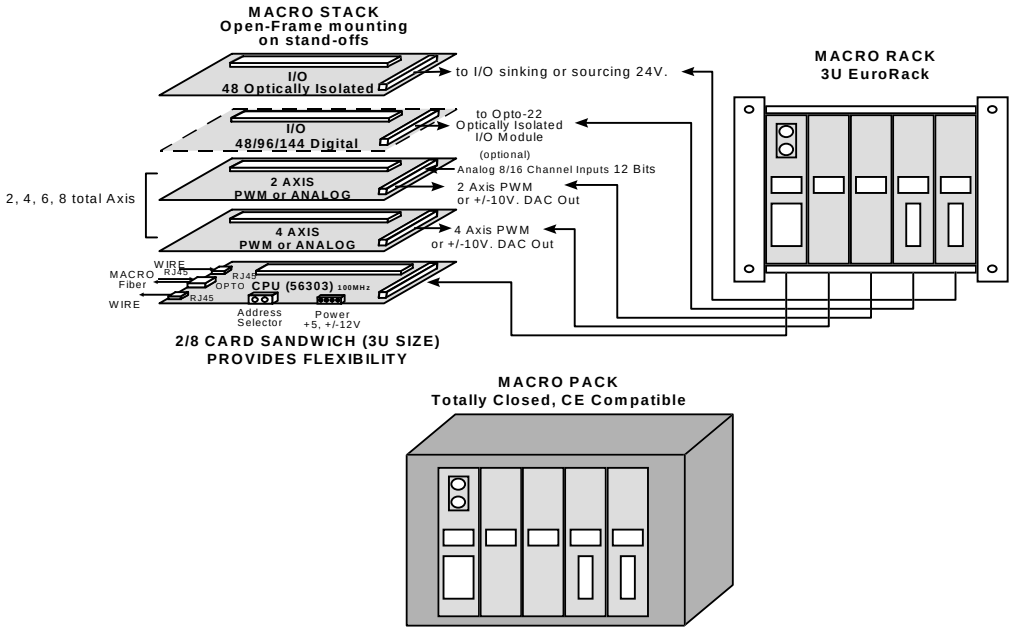
MACRO Drive Types Supported:

- ±10Vdc Velocity command
- ±10Vdc Torque command
- Sinusoidal phase commands (2 analog sinusoidal)
- Direct digital PWM output (6 outputs/channel)
- Pulse and Direction outputs (for steppers, step-replacement servo drives, laser modulation)
- I/O rack modules

MACRO STATION BOARD OPTIONS:

MACRO Interface/CPU Board (fiber optic and/or RJ45 wire ring connection)
MACRO 2 Axis Interface (optional 8 or 16 analog, 12 bit resolution inputs)
MACRO 4 Axis Interface
MACRO 144 Point I/O card (has expansion port for additional I/O cards). Available in 48 I/O increments. Directly connects to OPTO-22 I/O modules.
MACRO 48 Point I/O Card with Opto-Isolation.

MACRO Station Types



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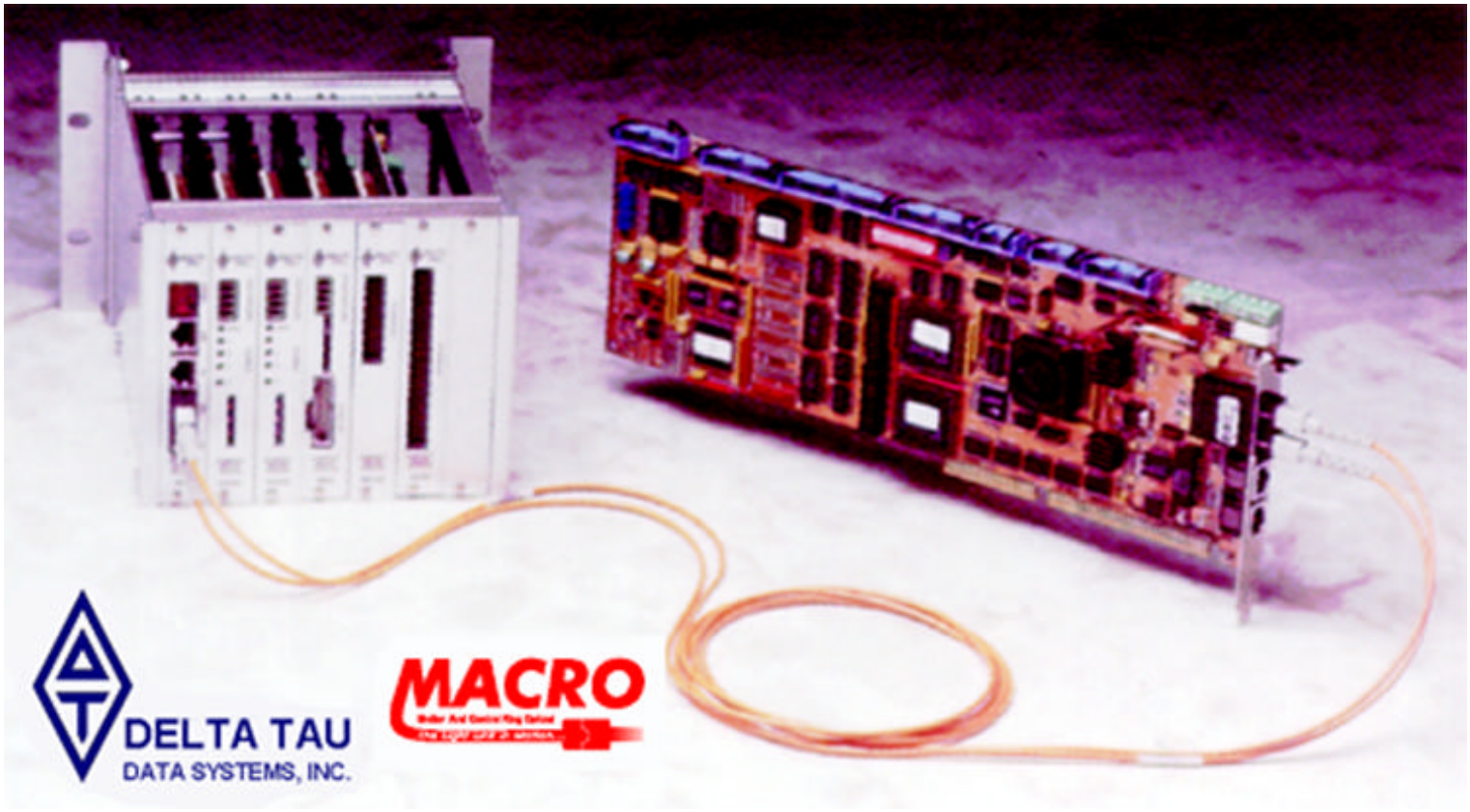
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MACRO