Delta Tau PMAC ACC-8ES

Analog Servo Interface Board

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HARDWARE REFERENCE MANUAL

Accessory 8ES

Analog Servo Interface Board for PMAC2A-PC104

3Ax-603673-1Hxx

December 15, 2009

DELTA TAU
Data Systems, Inc.
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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.

In the case of industrial applications, we expect our products to be protected from hazardous or conductive materials and/or environments that could cause harm to the controller by damaging components or causing electrical shorts. When our products are used in an industrial environment, install them into an industrial electrical cabinet 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.

REVISION HISTORY				
REV.	**DESCRIPTION**	**DATE**	**CHG**	**APPVD**
1	ADDED E1 JUMPER DESCRIPTION, P. 3	06/01/07	CP	S. MILICI
2	ADDED TURBO SETUP INFORMATION, P. 10	12/15/09	CP	S. MILICI

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INTRODUCTION

The Acc-8ES for the PMAC2A-PC/104 family of controllers provides the pinouts for four axes with analog-input amplifiers. The amplifiers can be velocity-mode, torque-mode, or sinusoidal input mode (two analog commands), or any mix of the above.

The PMAC2A-PC/104 and the Acc-1P Axis 5-8 board each have four ±10V analog outputs generated using a filtered PWM technique yielding 11- or 12-bit resolution. The Acc-8ES can be used to provide higher-resolution analog outputs, and/or two outputs per axis to support PMAC commutation with sinusoidal outputs.

The Acc-8ES board has a stack connection to the PMAC2A-PC/104 or to the Acc-1P Axis 5-8 board. Each axis has a DB-9 connector with two differential analog output pairs, plus amplifier enable and fault signals. The Acc-8ES also provides two 16-bit headers, each of which can interface via flat cable to the Acc-28B, 2- or 4-channel 16-bit A/D converter board.

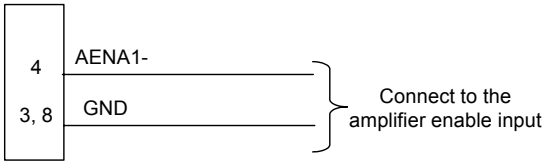
Functionality

Analog Outputs

The Acc-8ES has eight 18-bit D/A converters (DACs) to command the amplifiers with optical isolation from PMAC circuitry. The analog outputs have a range of -10V to +10V, and a maximum current output of 10mA. If one of the power supply voltages goes away, or if the PMAC's watchdog timer trips, these outputs are clamped to 0V by on-board hardware.

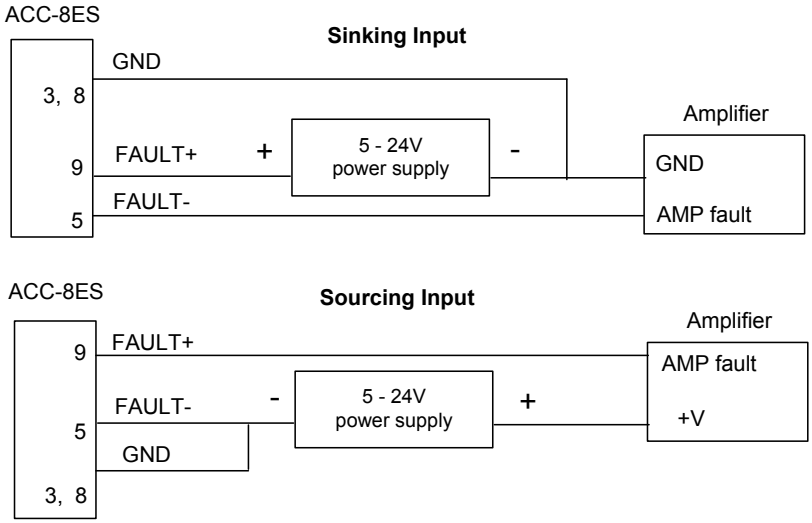
Amplifier Enable Signal (AENA-)

Most amplifiers have an enable/disable input that permits complete shutdown of the amplifier regardless of the voltage of the command signal. PMAC's AENA line is meant for this purpose. AENA1- is pin 4. This signal is an open-collector output. An external 3.3 kΩ pull-up resistor can be used if necessary.



Amplifier Fault Signal (FAULT+, FAULT-)

This input can take a signal from the amplifier so that PMAC can shut down action when the amplifier is having problems. The polarity is programmable with I-variable Ix25 (I125 for motor 1). With the default setup, this signal must be actively pulled low for a fault condition. In this setup, if nothing is wired into this input, PMAC will consider the motor not to be in a fault condition.



Encoder Inputs

Quadrature encoder inputs can be brought into PMAC2A-PC/104 or Acc-1P through 50-pin headers. They are not connected to the Acc-8ES board.

Main Input Flags

The main input flags (HOMEn, PLIMn, MLIMn, USERn) for both axes can be brought into PMAC2A-PC/104 or Acc-1P through 34-pin headers. They are not connected to the Acc-8ES board.

A/D Converter Inputs

An Acc-28B A/D converter board can be connected by flat cable to the J3 connector providing interface to channel 1 and 2 A/D registers A and B. Another Acc-28B board can be connected to the J4 connector, providing interface to channel 3 and 4 A/D registers A and B.

HARDWARE SETUP

Output Offset Pots

The following table shows the resistor pots for output voltage offset:

DAC 1A+/-	R10
DAC 2A+/-	R12
DAC 1B+/-	R14
DAC 2B+/-	R16
DAC 3A+/-	R18
DAC 4A+/-	R20
DAC 3B+/-	R22
DAC 4B+/-	R24

These pots are adjusted at the factory. They should not require further adjustment.

Jumpers

E1 (-103 boards or greater)

This jumper should be on as the factory default configuration. This will allow the use of ADC inputs through the J3 and J4 connectors with the ACC-28B. In this case, the 12bit ADC option on the PC104 CPU board or ACC-1P is not available.

If the E1 jumper is off, then the 12bit ADC option on the PC104 CPU board or ACC-1P is available.

MACHINE CONNECTIONS

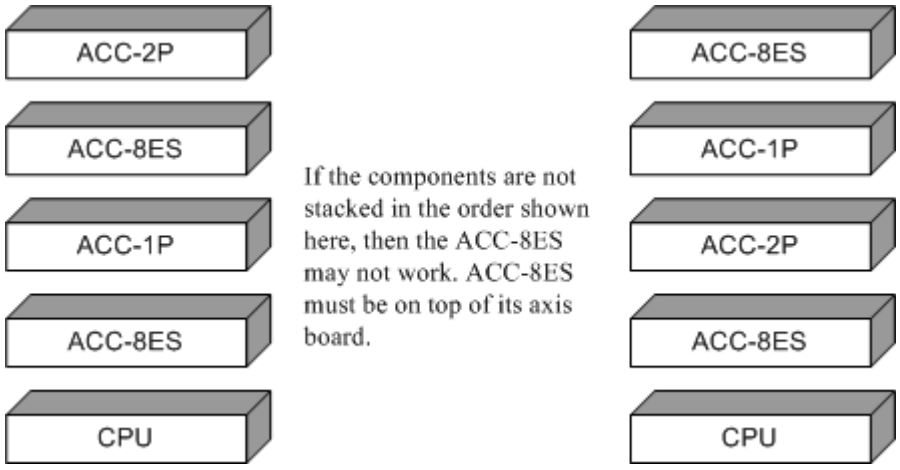
Mounting/Installation

The Acc-8ES is always stacked on top of a PMAC2A-PC/104 CPU/axis board or Acc-1P. There are mounting holes that can be used to mount the board on standoffs at each of the four corners of the PMAC2A-PC/104 board.

It is recommended that the Acc-8ES board be placed always above the board with the DSP-GATE (CPU/Axis board or Acc-1P) on the stack. Up to two Acc-8ES boards can be used in a single PMAC2A-PC/104 system (total of eight axes).

Example:

Stack the first Acc-8ES on top of the PMAC2A-PC104. Then place the Acc-1P on top of the controller. Stack the next Acc-8ES on top of the Acc-1P. Then place the Acc-2P on top of the second Acc-8ES.



Power Supply

The Acc-8ES requires 5Vdc and +/-12V to +/-15V power supply provided through PMAC2A-PC/104.

0.6AVdc
0.25@ +12 to +15V (4.5W)
0.2 @ -12 to -15V (3.8W)

(Eight-channel configuration)

PMAC2A-PC/104 SOFTWARE SETUP

PMAC I-Variables

PMAC has a large set of Initialization Parameters (I-variables) that determine the personality of the card for a specific application. Many of these are used to configure a motor properly. Once set up, these variables may be stored in non-volatile EAROM memory (using the **SAVE** command) so the card is always configured properly (PMAC loads the EAROM I-variable values into RAM on power-up.).

The programming features and configuration variables for the PMAC2A-PC/104 are fully described in the PMAC2 User and Software Reference manuals.

I9n6, Output n Mode Select

I9n6 controls what output formats are used on the command output signal lines for machine interface channel *n*. For the Acc-8ES operation, I9n6 must be set to a value of either 1 or 3 (these are not the default values):

```
I9n6 = 1 (Outputs A and B are DAC; Output C is PWM)
I9n6 = 3 (Outputs A and B are DAC; Output C is PFM)
```

Note:

An odd-numbered channel in the Acc-8ES must be set to DAC mode for the analog outputs in the next even-numbered channel to work.

I905/I909, DAC Strobe Word (DAC Resolution Configuration)

I905 controls the DAC strobe signal for machine interface channels 1 through 4. I909 controls the DAC strobe signal for machine interface channels 5 - 8. If using the 18-bits DAC circuits on the Acc-8ES board, variable I905 (channels 1 - 4) or variable I909 (channels 5 - 8) must be set to the default value of $7FFFC0.

```
I905 = $7FFFC0 (PMAC2 channels 1 - 4 are 18-bit)
I909 = $7FFFC0 (PMAC2 channels 5 - 8 are 18-bit)
```

Configuration Example and Test Procedure

Acc-8ES is connected to the PMAC2A-PC/104 using channels 1 through 4. These are the appropriate I-variables values:

```
I916=3        ; channel 1 is set for DAC outputs
I926=3        ; channel 2 is set for DAC outputs
I936=3        ; channel 3 is set for DAC outputs
I946=3        ; channel 4 is set for DAC outputs
I905=$7FFFC0  ; channels 1 - 4 are set for 18-bits DAC circuits (Acc-8ES)
```

Test this configuration using the following steps and typing the indicated commands on a terminal window communicating with PMAC2A-PC/104.

CAUTION:

Make sure the motor/amplifier is turned off during this test.

1. Make sure ±12 or ±15V is applied to the TB1 terminal block on PMAC2A-PC/104.
2. Make sure the PMAC2A-PC/104 is connected to the Acc-8ES.
3. Type these commands on the terminal window:

```
I916=3        ; channel 1 is set for DAC outputs
I905=$7FFFC0  ;channels 1-4 are set for 18-bits DAC circuits
              ;(Acc-8ES)
I100=0        ;disables motor #1. Allows direct access to the
              ;DAC register
M102->Y:$C002,8,16,S       ;OUT1A DAC command value
M102=32767    ;Measure about 10V between pins 1 and 14 of P3
```

```
M102=-32767   ;Measure about -10V between pins 1 and 14 of P3
M102=0        ;Measure about 0V between pins 1 and 14 of P3
I100=1        ;enables motor #1
SAVE          ;SAVEs this configuration in PMAC's memory
```

TURBO PMAC2A-PC/104 & CLIPPER SOFTWARE SETUP

Analog Outputs Configuration

I7mn6, Output n on Servo IC m Mode Select

I7mn6 selects the output formats to be used on the command output signal lines for machine interface channel n (1-4) on servo IC m (0-9). For the Acc-8ES operation, I7mn6 must be set to a value of either 1 or 3 (these are not the default values):

```
I7mn6 = 1   ;(Outputs A and B are DAC; Output C is PWM)
I7mn6 = 3   ;(Outputs A and B are DAC; Output C is PFM)
```

Note:

The odd-numbered channel for the Acc-8ES must be set to DAC mode for the analog outputs in either channel to work.

I7m05, DAC Strobe Word (DAC Resolution Configuration)

I7m05 controls the DAC strobe signal for machine interface channels 1-4 on servo IC m (0-9). For using the 18-bits DAC circuits on the Acc-8ES board, variable I7m05 must be set to its default value of $7FFFC0.

```
I7m05 = $7FFFC0 ;(PMAC2 channels 1-4 on Servo IC m are 18-bit)
```

WARNING:

Make sure the motor/amplifier is not powered during this test; otherwise, unexpected machine movement could occur.

Configuration Example and Test Procedure

Acc-8ES is connected to the Clipper using channels 1 through 4. These are the appropriate I-variables values:

```
I7016=3       ; channel 1 is set for DAC outputs
I7026=3       ; channel 2 is set for DAC outputs
I7036=3       ; channel 3is set for DAC outputs
I7046=3       ; channel 4is set for DAC outputs
I7005=$7FFFC0 ; channels 1 - 4 are set for 18-bits DAC circuits (Acc-8ES)
```

Test this configuration using the following steps and typing the indicated commands on a terminal window communicating with PMAC2A-PC/104.

CAUTION:

Make sure the motor/amplifier is turned off during this test.

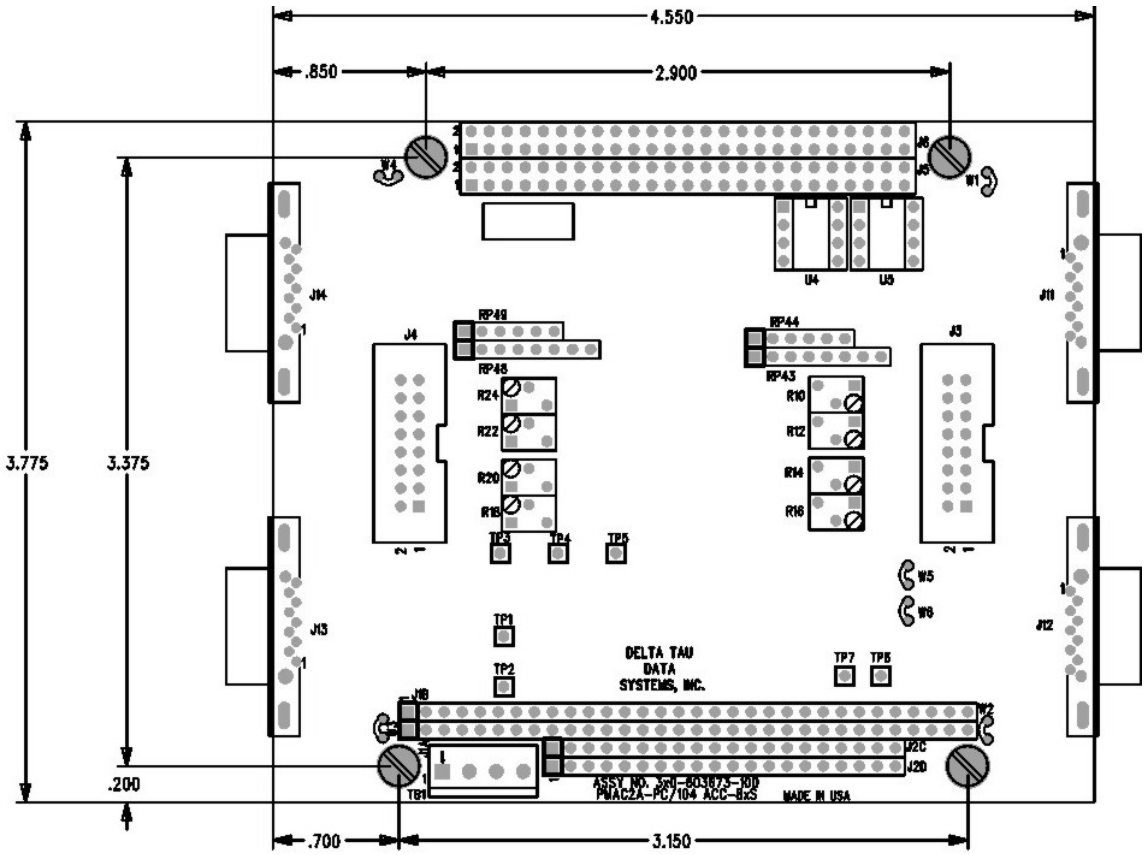
1. Make sure ±12 or ±15V are appropriately applied to the Clipper board.
2. Make sure the Clipper is connected to the Acc-8ES.
3. Type these commands on the terminal window:

```
I7016=3              ; channel 1 is set for DAC outputs
I7005=$7FFFC0        ; channels 1-4 are set for 18-bits DAC circuits (Acc-8ES)
I100=0               ; disables motor #1.
                     ;Allows direct access to the DAC register
M102->Y:$78002,8,16,S      ; OUT1A DAC command value
M102=32767           ; Measure about 10 Volts
M102=-32767          ; Measure about -10 Volts
M102=0               ; Measure about 0 Volts
I100=1               ; enables motor #1
SAVE                 ; saves this configuration in PMAC's memory
```

HARDWARE REFERENCE SUMMARY

Part Number 603673-100

Board Dimensions

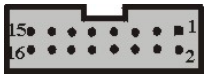


LED

D6: When this green LED is lit, it indicates that power is applied to the +5V input.

CONNECTOR PINOUTS

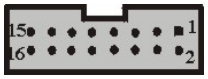
J3 A/D Converter Breakout Header (16-pin IDC Connector)



Pin #	Symbol	Function	Description	Notes
1	ADC_CLK1-	Output	A-D Clock Output	
2	ADC_CLK1+	Output	A-D Clock Output	
3	N.C.	-		
4	N.C.	-		
5	ADC_STB1+	Output	A-D Convert	Serial command word
6	ADC_STB1-	Output	A-D Convert	For future use
7	ADC_DAA1-	Input	Serial Data Input CH1/	
8	ADC_DAB1-	Input	Serial Data Input CH1/	
9	ADC_DAA2-	Input	Serial Data Input CH2/	
10	ADC_DAB2-	Input	Serial Data Input CH2/	
11	ADC_DAA1+	Input	Serial Data Input CH1	
12	ADC_DAB1+	Input	Serial Data Input CH1	
13	ADC_DAA2+	Input	Serial Data Input CH2	
14	ADC_DAB2+	Input	Serial Data Input CH2	
15	+5Vdc	Output		
16	GND	Output		

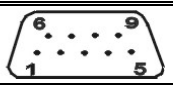
The connector is a 16-pin IDC (ribbon cable crimp-style) connector.

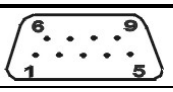
J4 A/D Converter Breakout Header (16-pin IDC Connector)

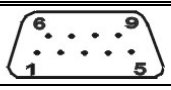


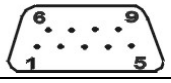
Pin #	Symbol	Function	Description	Notes
1	ADC_CLK2-	Output	A-D Clock Output	
2	ADC_CLK2+	Output	A-D Clock Output	
3	N.C.	-		
4	N.C.	-		
5	ADC_STB2+	Output	A-D Convert	Serial command word
6	ADC_STB2-	Output	A-D Convert	For future use
7	ADC_DAA3-	Input	Serial Data Input CH3/	
8	ADC_DAB3-	Input	Serial Data Input CH3/	
9	ADC_DAA4-	Input	Serial Data Input CH4/	
10	ADC_DAB4-	Input	Serial Data Input CH4/	
11	ADC_DAA3+	Input	Serial Data Input CH3	
12	ADC_DAB3+	Input	Serial Data Input CH3	
13	ADC_DAA4+	Input	Serial Data Input CH4	
14	ADC_DAB4+	Input	Serial Data Input CH4	
15	+5Vdc	Output		
16	GND	Output		

The connector is a 16-pin IDC (ribbon cable crimp-style) connector.

J15 (9-Pin DB9S Connector)			Top View 	
Term No.	**Symbol**	**Function**	**Description**	**Notes**
1	DAC1 A+	Output	Analog out positive	±10V to analog ground
2	DAC1 B+	Output	Analog out positive	±10V to analog ground
3	GND	Output	PMAC common	For amplifier logic
4	AENA 1-	Output	Amplifier-enable	Low true
5	AFAULT 1-	Input	Amplifier-fault	Failsafe
6	DAC1 A-	Output	Analog out negative	±10V to analog ground
7	DAC1 B-	Output	Analog out negative	±10V to analog ground
8	GND	Output	PMAC common	For amplifier logic
9	AFAULT 1+	Input	Amplifier fault	Failsafe

J16 (9-Pin DB9S Connector)			Top View 	
Term No.	**Symbol**	**Function**	**Description**	**Notes**
1	DAC2 A+	Output	Analog out positive	±10V to analog ground
2	DAC2 B+	Output	Analog out positive	±10V to analog ground
3	GND	Output	PMAC common	For amplifier logic
4	AENA 2-	Output	Amplifier-enable	Low true
5	AFAULT 2-	Input	Amplifier-fault	Failsafe
6	DAC2 A-	Output	Analog out negative	±10V to analog ground
7	DAC2 B-	Output	Analog out negative	±10V to analog ground
8	GND	Output	PMAC common	For amplifier logic
9	AFAULT 2+	Input	Amplifier fault	Failsafe

J17 (9-Pin DB9S Connector)			Top View 	
Term No.	**Symbol**	**Function**	**Description**	**Notes**
1	DAC3 A+	Output	Analog out positive	±10V to analog ground
2	DAC3 B+	Output	Analog out positive	±10V to analog ground
3	GND	Output	PMAC common	For amplifier logic
4	AENA 3-	Output	Amplifier-enable	Low true
5	AFAULT 3-	Input	Amplifier-fault	Failsafe
6	DAC3 A-	Output	Analog out negative	±10V to analog ground
7	DAC3 B-	Output	Analog out negative	±10V to analog ground
8	GND	Output	PMAC common	For amplifier logic
9	AFAULT 3+	Input	Amplifier fault	Failsafe

J18 (9-Pin DB9S Connector)			Top View 	
Term No.	**Symbol**	**Function**	**Description**	**Notes**
1	DAC4 A+	Output	Analog out positive	±10V to analog ground
2	DAC4 B+	Output	Analog out positive	±10V to analog ground
3	GND	Output	PMAC common	For amplifier logic
4	AENA 4-	Output	Amplifier-enable	Low true
5	AFAULT 4-	Input	Amplifier-fault	Failsafe
6	DAC4 A-	Output	Analog out negative	±10V to analog ground
7	DAC4 B-	Output	Analog out negative	±10V to analog ground
8	GND	Output	PMAC common	For amplifier logic
9	AFAULT 4+	Input	Amplifier fault	Failsafe

SCHEMATICS