

# USER MANUAL

## AMP-4

4-Channel H-Bridge 65V Amplifier Board

3Ax-603486-xUxx

June 11, 2004

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## INTRODUCTION

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The Quad H-Bridge High Power Drive is a 3U-size amplifier designed to drive DC brushed type motors. This amplifier provides four 520W continuous PWM amplifiers. The Quad H-Bridge High Power Drive may be interfaced conveniently to the PMAC controller via ACC-24E2A. The maximum bus voltage for this amplifier is 65VDC and the continuous rating for each drive is 8A.

The amplifiers on this product will output current proportional to the voltage input. The product was designed to be used with torque or current command inputs from the controller, but if the controller has microstepping capabilities, the product can be used to drive stepper motors.

### Power Supply Considerations

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The Quad H-Bridge High Power Drive requires a single power supply of +15V to +65Vmax. The current requirement can vary depending on the load, but should not exceed 32A continuous and 48A peak for a one-second period: i.e. 12A peak per channel. A slow blow 5A fuse is installed for the shunt and a fast acting 30A fuse for the main bus.

The bus power supply can be provided to the amplifier unit through Amplifier Backplane board or through the TB3 and TB4 terminal connectors located on the amplifier unit.

The amplifier receives its logic power supply ( $\pm 15V$ ) from an external power supply or the 3U power supply used for a UMAC system via the Amplifier Backplane board (part number 603490 or 603470, see last section of this manual).

If the amplifier is driven beyond its rated power, driver overheating may occur. In this event, the driver will output a fault signal on the corresponding pin of the terminal block 2, TB2, and turn on the corresponding red LED next to Terminal Block 1, TB1, shown in Diagram.

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*Note:*

The bus voltage should be completely separate from PMAC analog ground.

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### Current Mode Considerations

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The Quad H-Bridge High Power Drive is a current amplifier with a fixed current gain 1.25A/V. This means that the  $\pm 10V$  signal input from each DAC on the J1 connector corresponds to  $\pm 12A$  of current across the load, provided that the bus supply voltage is not exceeded.

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*Note:*

If the amplifier is driving a DC motor at high speeds, the current supply to the motor may be reduced if the back emf voltage of the motor is sufficiently large (refer to the motor manufacture's data sheet).

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### Amplifier-Enable/Fault Polarity Selection

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The controller (PMAC) should be configured for low-true amplifier-enable signals. A green LED next to Terminal Block 1 (TB1) for each amplifier on the Quad H-Bridge is lit when the board is receiving power and that amplifier is enabled.

Also, if the amplifier fault signal is fed back to PMAC, bit 23 (the most significant bit) of Ix25 should be set to zero for "Low True" fault input. The red LED for each channel is lit when the amplifier faults (overheats).

## Torque/Velocity Control

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For direct torque or velocity control, the following I-variables may be adjusted as part of the motor software setup (Example for PMAC1-Turbo):

- Ixx00 Set to 1 to activate motor.
- Ixx02 Motor xx Command Output Address. For example: I102=\$078003 to use DAC1 with motor 1.
- Ixx03 Motor xx Position Loop Feedback Address. For example: I103=\$3501 to use Encoder 1.
- Ixx04 Motor xx Velocity Loop Feedback Address. For example: I104=\$3501 to use Encoder 1.
- Ixx24 Set motor xx Flag Mode Control. For example: I124=\$100001 to specify high-true fault input.
- Ixx25 Set motor xx Flag Address. For example: I125=\$078000 to specify channel 1 flags.
- Ixx69 Set motor xx Output Command Limit.

Refer to the Turbo PMAC/PMAC2 Software Reference Manual for a full description of these I-variables.

## HARDWARE DESCRIPTION

There are six connectors on the Quad H-Bridge Amplifier board:

- TB1: 13-Pin PMAC Interface Terminal Block
- TB2: 8-Pin Motor Amplifier Output Terminal Block
- TB3: External Power Ground
- TB4: External Power
- TB5: Bus Power Terminal Block
- P1: 96-Pin Power Input Connector

### TB1: 8-Pin PMAC Interface Terminal Block

This terminal block provides the actual connection to the motors.

Pin	Symbol	Function	Description
1	AMPOUT1	Output	1 <sup>st</sup> motor + lead
2	AMPOUT1/	Output	1st motor - lead
3	AMPOUT2	Output	2nd motor + lead
4	AMPOUT2/	Output	2nd motor - lead
5	AMPOUT3	Output	3 <sup>rd</sup> motor + lead
6	AMPOUT3/	Output	3 <sup>rd</sup> motor - lead
7	AMPOUT4	Output	4 <sup>th</sup> motor + lead
8	AMPOUT4/	Output	4th motor - lead

### TB2: 13-Pin Motor Amplifier Output Terminal Block

This connector brings in up to four analog command signals and amplifier-enable lines. It also sends the amplifier fault signal back to the controller.

Pin	Symbol	Function	Description	Notes
1	DAC1+	Input	Command Signal 1	Ref. to AGND
2	AENA1-	Input	Amplifier Enable 1	Ref. to AGND
3	FAULT1-	Output	Amplifier Fault 1	Ref. to AGND
4	DAC2	Input	Command Signal 2	Ref. to AGND
5	AENA2-	Input	Amplifier Enable 2	Ref. to AGND
6	FAULT2-	Output	Amplifier Fault 2	Ref. to AGND
7	AGND		Analog Ground	
8	DAC3	Input	Command Signal 3	Ref. to AGND
9	AENA3-	Input	Amplifier Enable 3	Ref. to AGND
10	FAULT3-	Output	Amplifier Fault 3	Ref. to AGND
11	DAC4	Input	Command Signal 4	Ref. to AGND
12	AENA4-	Input	Amplifier Enable 4	Ref. to AGND
13	FAULT4-	Output	Amplifier Fault 4	Ref. to AGND

### TB3: External Power Ground

Pin	Symbol	Function	Description
1	PGND	Input	Bus power reference

### TB4: External Power

Pin	Symbol	Function	Description
1	A+65V	Input	Bus power supply

## TB5: Logic Power Terminal Block

Pin	Symbol	Function	Description
1	AGND	INPUT	Logic Power Reference
2	+15V -	INPUT	15V Logic Power
3	AGND	INPUT	Logic Power Reference
4	-15V	INPUT	-15V Logic Power

## P1: 96-Pin Power Input Connector

Pin	Row A	Row B	Row C
1	PGND	PGND	PGND
2	PGND	PGND	PGND
3	PGND	PGND	PGND
4	PGND	PGND	PGND
5	PGND	PGND	PGND
6	PGND	PGND	PGND
7	PGND	PGND	PGND
8	PGND	PGND	PGND
9	NC	NC	NC
10	+65V (bus)	+65V (bus)	+65V (bus)
11	+65V (bus)	+65V (bus)	+65V (bus)
12	+65V (bus)	+65V (bus)	+65V (bus)
13	+65V (bus)	+65V (bus)	+65V (bus)
14	+65V (bus)	+65V (bus)	+65V (bus)
15	+65V (bus)	+65V (bus)	+65V (bus)
16	+65V (bus)	+65V (bus)	+65V (bus)
17	+65V (bus)	+65V (bus)	+65V (bus)
18	NC	NC	NC
19	DB R+	DB R+	DB R+
20	DB R+	DB R+	DB R+
21	DB R+	DB R+	DB R+
22	DB R+	DB R+	DB R+
23	NC	NC	NC
24	DB R-	DB R-	DB R-
25	DB R-	DB R-	DB R-
26	DB R-	DB R-	DB R-
27	DB R-	DB R-	DB R-
28	NC	NC	NC
29	AGND	AGND	AGND
30	A+15V	A+15V	A+15V
31	AGND	AGND	AGND
32	A-15V	A-15V	A-15V

## AMPLIFIER SPECIFICATIONS

### Power Stage Specifications

Description	Specification
V+ Input Voltage	15V minimum 65V maximum
Logic Power	15V @ 100mA -15V @ 50mA
Transconductance Factor	0.8V/A
Max Continuous Current	32A (8A per channel)
Peak Current	48A (12A per channel)
Internal Switching Frequency	20 KHz
Reference Input Voltage	± 10V

### Mechanical Specifications

Description	Specification
Size & Dimension	See Diagram
TB1 Connector	8 pin Screw Terminal
TB2 Connector	13 pin Phoenix
P1 Connector	48 pin 3U back plane

### Environmental Specifications

Description	Specification
Operating Temperature	0°C to 55°C (32°F to 135°F)
Storage Temperature	-12°C to 82°C (10°F to 180°F)
Humidity	0% to 95%, Non-Condensing



## AMPLIFIER USER COMPONENTS DESCRIPTION

### Fuses

Label	Type	Description
F1	30A	Fast blow for BUS
F2	5A	Slow blow

### LEDs

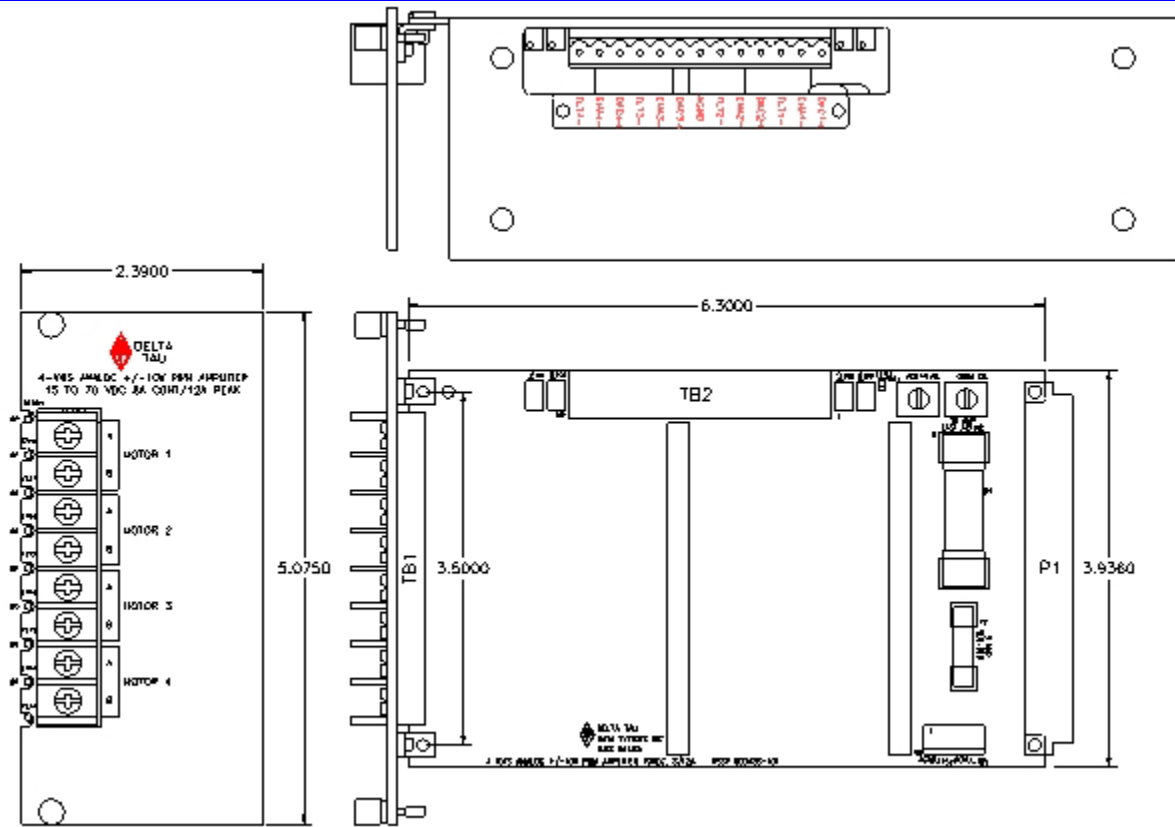
Label	Function
LD1	Channel 1 Enable
LD2	Channel 1 Fault
LD3	Channel 2 Enable
LD4	Channel 2 Fault
LD5	Channel 3 Enable
LD6	Channel 3 Fault
LD7	Channel 4 Enable
LD8	Channel 4 Fault
LD9	REGEN
LD10	Power Fault

### Offset Pots

Name	Label	Function
A	R6	Channel 1 Current Offset
B	R33	Channel 2 Current Offset
C	R60	Channel 3 Current Offset
D	R87	Channel 4 Current Offset

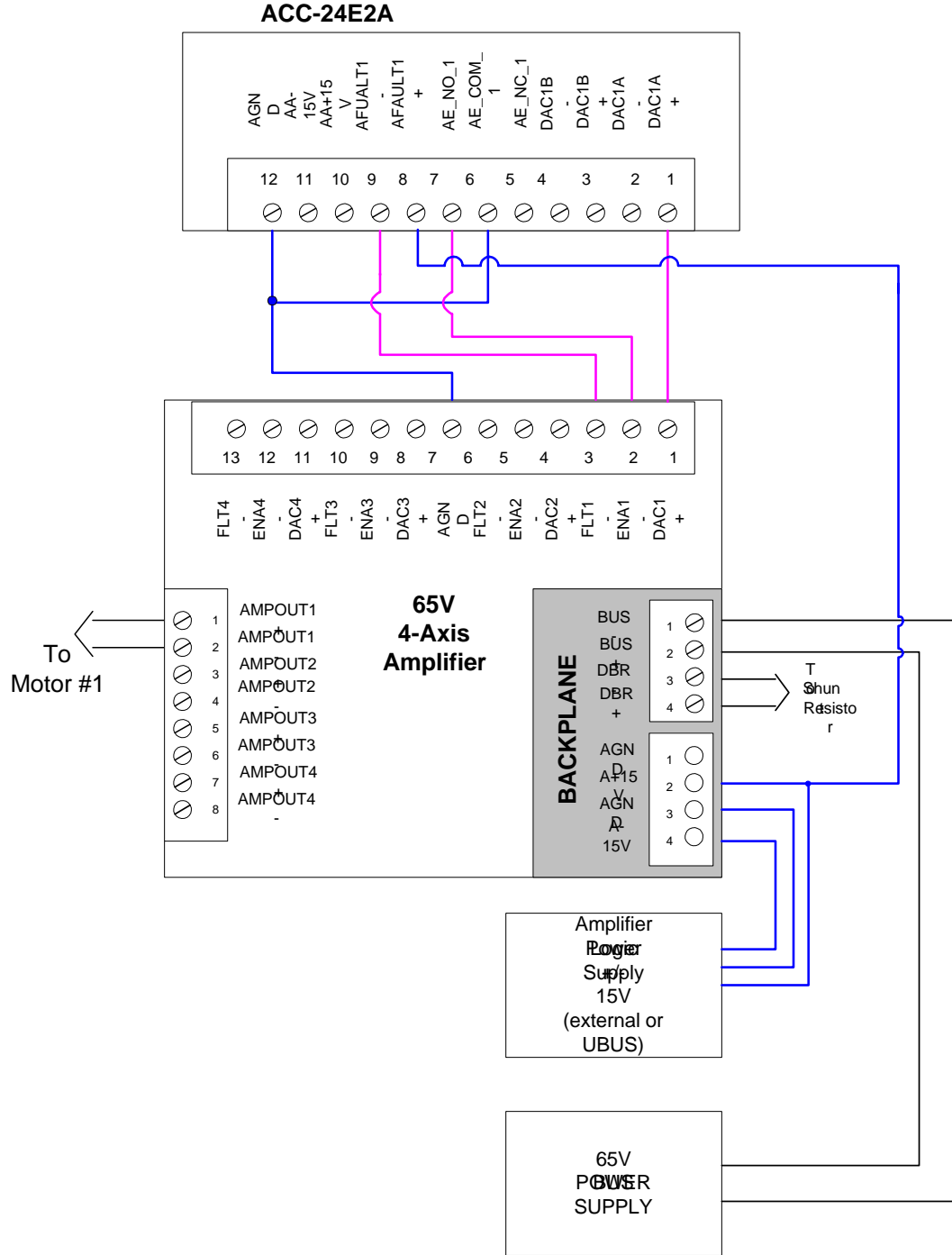


# AMPLIFIER DIAGRAM





# SAMPLE WIRING DIAGRAM



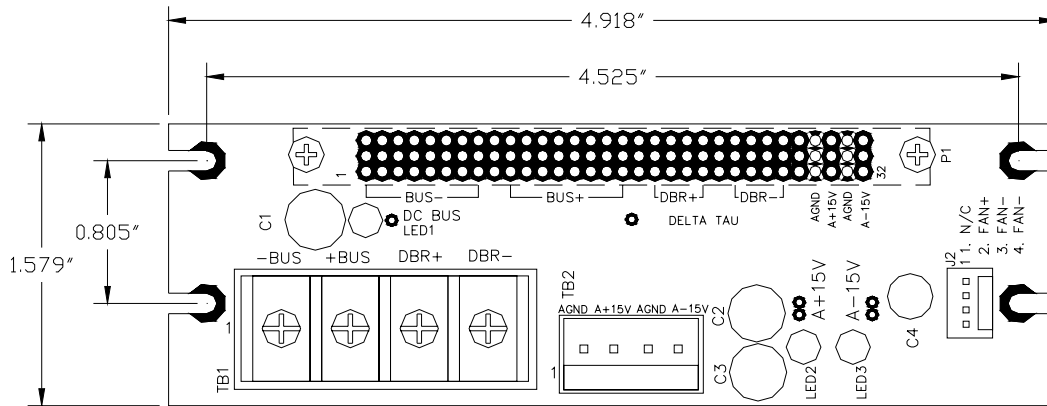


## ANALOG AMPLIFIER BACKPLANE BOARD

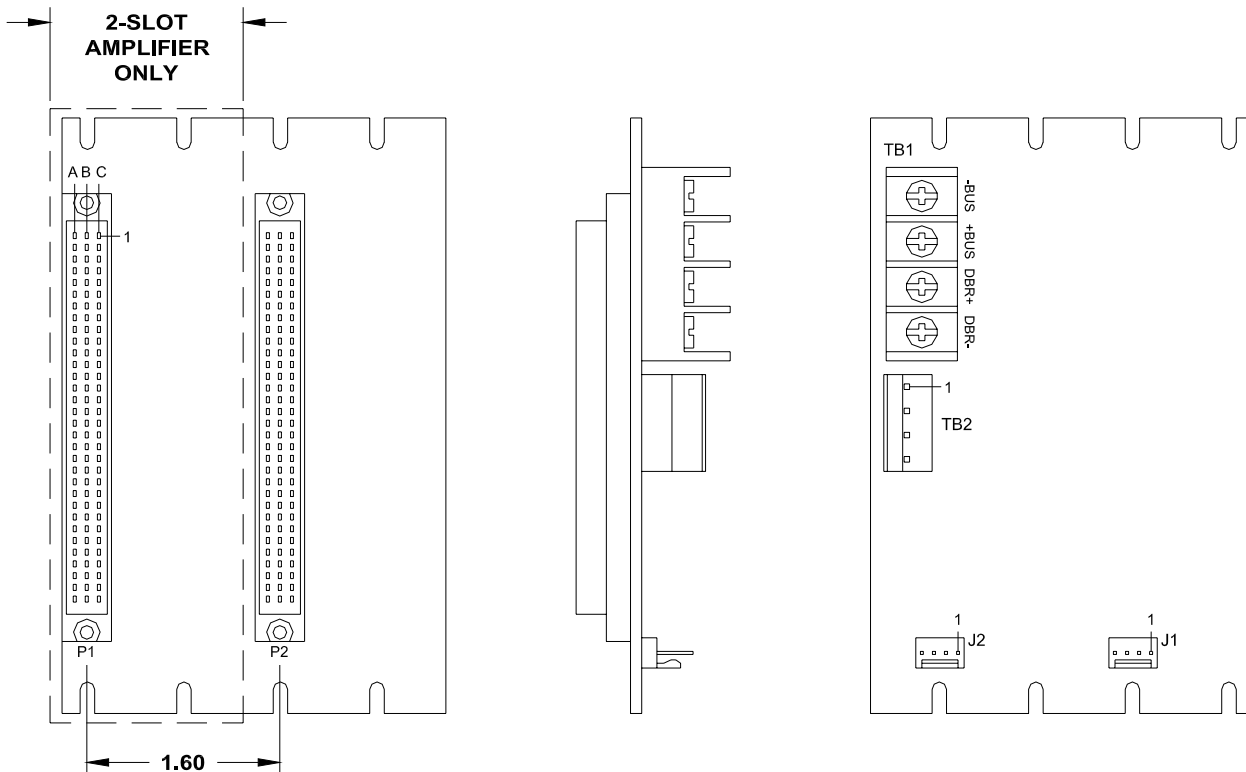
The analog amplifier backplane board allows easy access to power the Quad H-Bridge amplifier units when placed in the 3U racks. The amplifier backplane boards come in two options: Single amplifier 2-slot assemblies or a dual amplifier 4-slot assemblies. The board itself has terminal screws for the external bus, external shunt resistors, a Molex connector for the logic power, and another Molex connector for the cooling fans.

Backplane Board	Part Number	3U Slots used
Single Amplifier	603490-10x	2
Dual Amplifier	603470-10x	4

### Single Quad H-Bridge Amplifier Backplane Layout



### Dual Quad H-Bridge Amplifier Backplane Layout



## Analog Amplifier Backplane Connectors

### TB1 Bus Power and Shunt Resistor Inputs

Pin	Label	Description
1	-BUS	BUS Voltage reference
2	+BUS	BUS Voltage (15V to 65V)
3	DBR+	Shunt Resistor Input
4	DBR-	Shunt Resistor Input

### TB2 Logic Power Supply and Fan Power Supply Input

Pin	Label	Description
1	AGND	Logic and Fan Supply Reference
2	+15V	+15V input
3	AGND+	Logic and Fan Supply Reference
4	-15V	-15V input

### J1 Fan Power Supply Output

Pin	Label	Description
1	NC	No Connection
2	+FAN	+12V output
3	-FAN	AGND Reference voltage for fan
4	-FAN	-12V output

### J2 Fan Power Supply Output

(for Dual Quad Amp Backplane only 603470-10x)

Pin	Label	Description
1	NC	AGND
2	+FAN	+12V output
3	-FAN	AGND Reference voltage for fan
4	-FAN	-12V output

P1 - CONNECTOR					
PIN	DESCRIPTION	PIN	DESCRIPTION	PIN	DESCRIPTION
1A	PGND	1B	PGND	1C	PGND
2A	PGND	2B	PGND	2C	PGND
3A	PGND	3B	PGND	3C	PGND
4A	PGND	4B	PGND	4C	PGND
5A	PGND	5B	PGND	5C	PGND
6A	PGND	6B	PGND	6C	PGND
7A	PGND	7B	PGND	7C	PGND
8A	PGND	8B	PGND	8C	PGND
9A	N/C	9B	N/C	9C	N/C
10A	A+65V	10B	A+65V	10C	A+65V
11A	A+65V	11B	A+65V	11C	A+65V
12A	A+65V	12B	A+65V	12C	A+65V
13A	A+65V	13B	A+65V	13C	A+65V
14A	A+65V	14B	A+65V	14C	A+65V
15A	A+65V	15B	A+65V	15C	A+65V
16A	A+65V	16B	A+65V	16C	A+65V
17A	A+65V	17B	A+65V	17C	A+65V
18A	N/C	18B	N/C	18C	N/C
19A	DBR+	19B	DBR+	19C	DBR+
20A	DBR+	20B	DBR+	20C	DBR+
21A	DBR+	21B	DBR+	21C	DBR+
22A	DBR+	22B	DBR+	22C	DBR+
23A	N/C	23B	N/C	23C	N/C
24A	DBR-	24B	DBR-	24C	DBR-
25A	DBR-	25B	DBR-	25C	DBR-
26A	DBR-	26B	DBR-	26C	DBR-
27A	DBR-	27B	DBR-	27C	DBR-
28A	N/C	28B	N/C	28C	N/C
29A	AGND	29B	AGND	29C	AGND
30A	A+15V	30B	A+15V	30C	A+15V
31A	AGND	31B	AGND	31C	AGND
32A	A-15V	32B	A-15V	32C	A-15V

CONNECTORS	
CONNECTOR	DESCRIPTION
TB1	TERM. BLOCK 20A, 8 POS., MOTOR AMPLIFIER
TB2	TERM. BLOCK, 13 PIN, I/O INTERFACE
TB3	LUG CONNECTOR, PGND
TB4	LUG CONNECTOR, A+65V
TB5	TERM. BLOCK, 4 POS. POWER OUTPUT
P1	96 PIN DIN INPUT/OUTPUT CONNECTOR

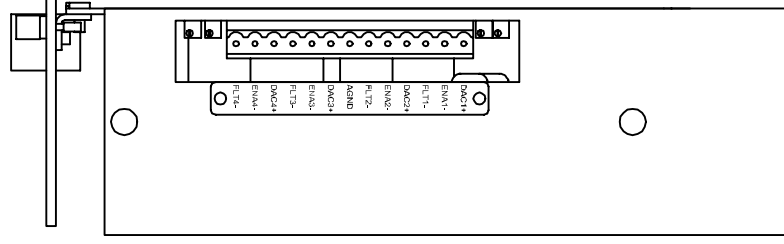
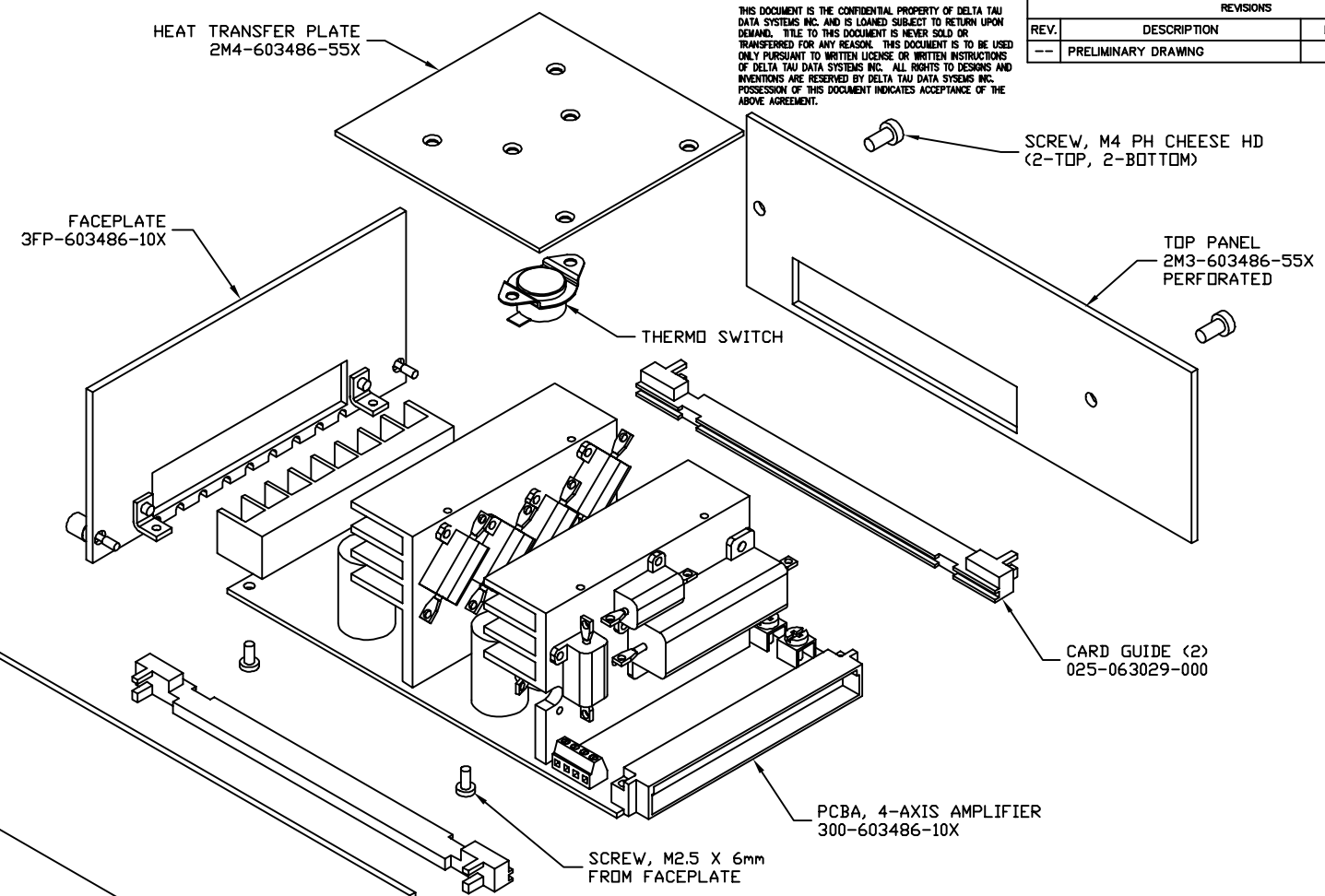
TB1 - 8 POSITION TERMINAL BLOCK	
PIN	DESCRIPTION
1	AMP OUT 1+
2	AMP OUT 1-
3	AMP OUT 2+
4	AMP OUT 2-
5	AMP OUT 3+
6	AMP OUT 3-
7	AMP OUT 4+
8	AMP OUT 4-

TB2 - 13 PIN TERMINAL BLOCK	
PIN	DESCRIPTION
1	DAC1+
2	AENA1-
3	FAULT1-
4	DAC2+
5	AENA2-
6	FAULT2-
7	AGND
8	DAC3+
9	AENA3-
10	FAULT3-
11	DAC4+
12	AENA4-
13	FAULT4-

TB5 - 6 PIN TERMINAL BLOCK	
PIN	DESCRIPTION
1	AGND
2	A+15V
3	AGND
4	A-15V

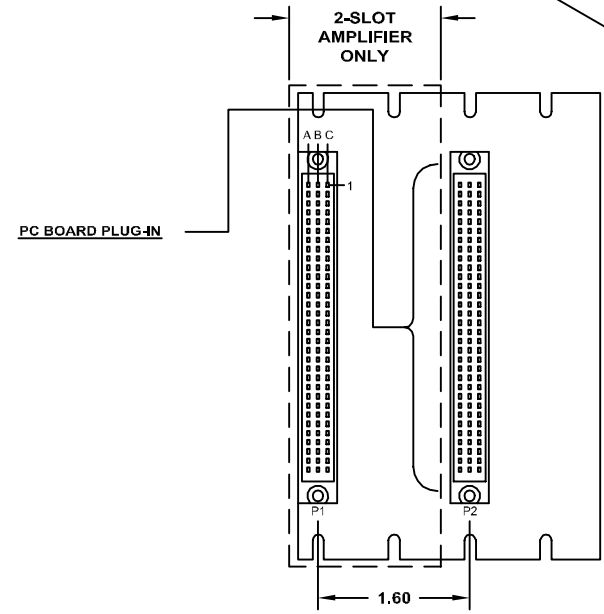
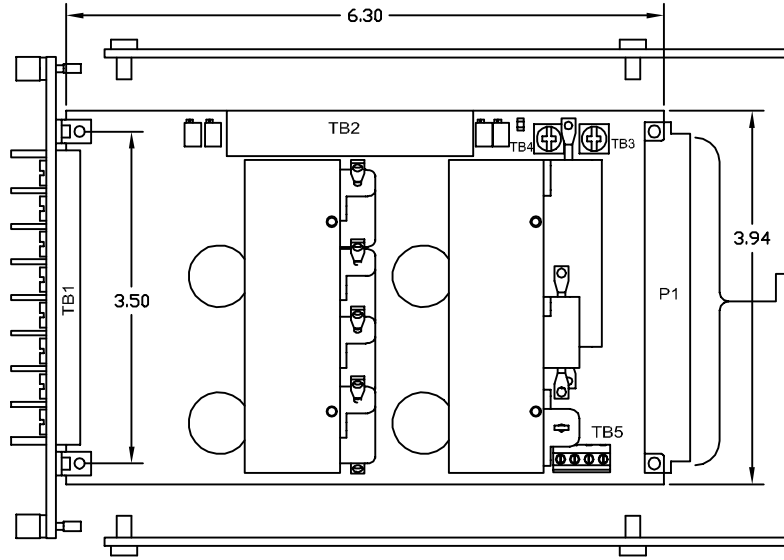
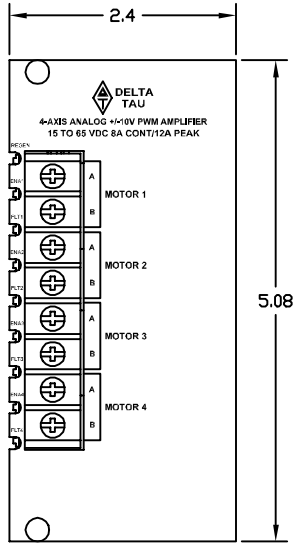
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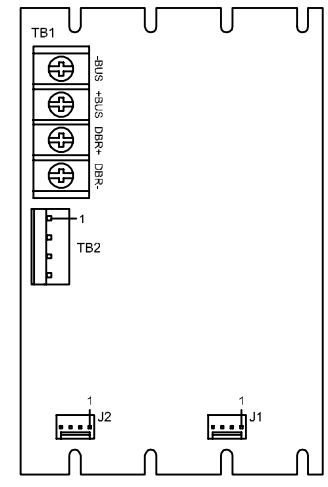
**"ANALOG AMPLIFIER" BACKPLANE**

J1, & J2 - 4 PIN MOLEX CONNECTOR		TB2 - 4 PIN MOLEX CONNECTOR	
PIN	DESCRIPTION	PIN	DESCRIPTION
1	N/C	1	AGND
2	FAN+	2	A+15V
3	FAN-	3	AGND
4	FAN-	4	A-15V



TB1 - 4 POSITION TERMINAL BLOCK

PIN	DESCRIPTION
1	-BUS
2	+BUS
3	DBR+
4	DBR-



P - 96 PIN CONNECTORS

PIN	DESCRIPTION	PIN	DESCRIPTION	PIN	DESCRIPTION
1A	-BUS	1B	-BUS	1C	-BUS
2A	-BUS	2B	-BUS	2C	-BUS
3A	-BUS	3B	-BUS	3C	-BUS
4A	-BUS	4B	-BUS	4C	-BUS
5A	-BUS	5B	-BUS	5C	-BUS
6A	-BUS	6B	-BUS	6C	-BUS
7A	-BUS	7B	-BUS	7C	-BUS
8A	-BUS	8B	-BUS	8C	-BUS
9A	N/C	9B	N/C	9C	N/C
10A	+BUS	10B	+BUS	10C	+BUS
11A	+BUS	11B	+BUS	11C	+BUS
12A	+BUS	12B	+BUS	12C	+BUS
13A	+BUS	13B	+BUS	13C	+BUS
14A	+BUS	14B	+BUS	14C	+BUS
15A	+BUS	15B	+BUS	15C	+BUS
16A	+BUS	16B	+BUS	16C	+BUS
17A	+BUS	17B	+BUS	17C	+BUS
18A	N/C	18B	N/C	18C	N/C
19A	DBR+	19B	DBR+	19C	DBR+
20A	DBR+	20B	DBR+	20C	DBR+
21A	DBR+	21B	DBR+	21C	DBR+
22A	DBR+	22B	DBR+	22C	DBR+
23A	N/C	23B	N/C	23C	N/C
24A	DBR-	24B	DBR-	24C	DBR-
25A	DBR-	25B	DBR-	25C	DBR-
26A	DBR-	26B	DBR-	26C	DBR-
27A	DBR-	27B	DBR-	27C	DBR-
28A	N/C	28B	N/C	28C	N/C
29A	AGND	29B	AGND	29C	AGND
30A	A+15V	30B	A+15V	30C	A+15V
31A	AGND	31B	AGND	31C	AGND
32A	A-15V	32B	A-15V	32C	A-15V

**4-AXIS AMPLIFIER CONNECTOR LOCATIONS AND DESIGNATIONS**  
 (Note: 65V Amplifier can be used as stand alone, with 2-slot backplane or on the right side of 4-slot backplane)

**"ANALOG AMPLIFIER" BACKPLANE FRONT VIEW**  
 AVAILABLE IN  
 2 SLOT, 603490-10X - 4 SLOT, 603470-10X  
 (4 SLOT BACKPLANE SHOWN)

**"ANALOG AMPLIFIER" BACKPLANE REAR VIEW**

FACEPLATE  
3 SLOT

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± FRACTION .00 ± .03 .00 ± .20	PROJECT	UMAC	<b>DELTA TAU DATA SYSTEMS, INC.</b> 4-AXIS ANALOG +/-10V PWM AMPLIFIER 15 TO 65VDC, 1PH, 8/12A, DETAIL LAYOUT
	NEXT LEVEL	MULTIPLE	
MATERIAL	APPROVALS	DATE	SIZE DWG. NO. DASH NO. REV D 3R0-603486 -101
FINISH	CHECKED	DATE	
DO NOT SCALE DRAWING	FILE	3R0-3486-1.DWG	SCALE NONE SHEET 1 OF 1