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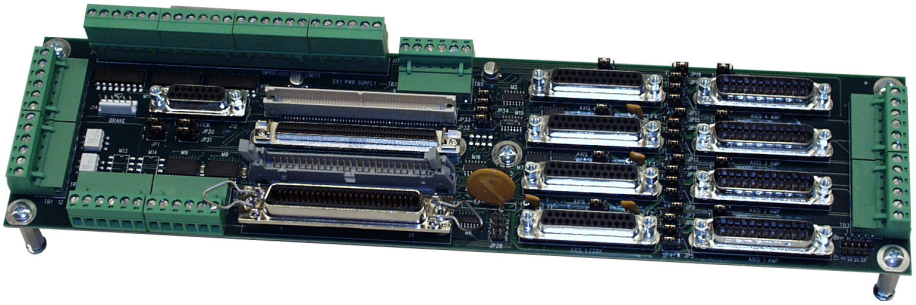
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BB501 INTERFACE BOARD

OPTION MANUAL

P/N: EDO107 (V1.6)



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The BB501, UNIDEX 500, UNIDEX 600 PC-based motion controllers are products of Aerotech, Inc.

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CHAPTER 1: INTRODUCTION AND CONFIGURATION

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- Mechanical Installation 1-4
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1.1. Introduction

The BB501 Interface Board (see Figure 1-1) provides the ability to interface an Aerotech U500 or U600 control board to Aerotech's BA Series drives. This board provides four axes of amplifier and feedback connectors, a joystick port, several I/O and miscellaneous signal ports, a power connector, and three U500/U600 connectors. Also contained on this board are several jumpers that permit the BB501 to be configured for different options and hardware.

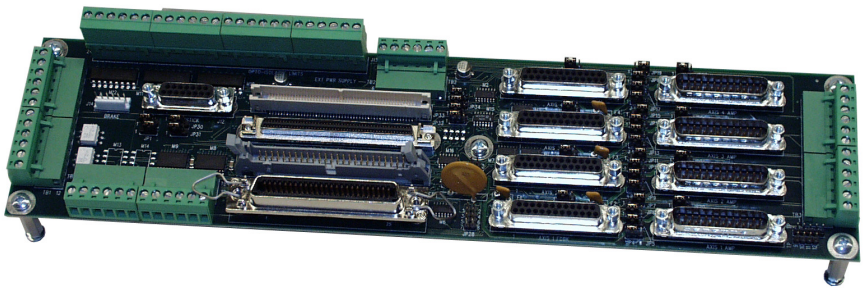
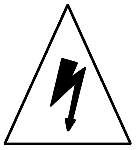


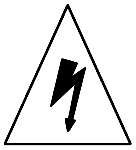
Figure 1-1. BB501 Interface Board

1.2. Safety Procedures and Warnings

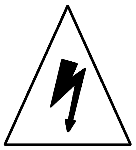
The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and/or damage to the equipment.



To minimize the risk of electrical shock and bodily injury, make certain that all of the electrical power switches are in the off position prior to making any electrical connections.



To minimize the risk of electrical shock and bodily injury when any electrical circuit is in use, ensure that no person comes into contact with the circuitry.



When this controller is installed within a system, mechanical motion will occur. Care must be exercised that all personnel remain clear of any moving parts.



To minimize the possibility of bodily injury, make certain that all electrical power switches are in the off position prior to making any mechanical adjustments.

1.3. Unpacking the BB501 Board

Before unpacking any components, visually inspect the container of the BB501 board for any evidence of shipping damage. If any such damage exists, notify the shipping carrier immediately.

All electronic equipment is wrapped in antistatic material and packaged with desiccant (a drying agent used to reduce moisture). Make certain that the antistatic material is not damaged during unpacking.

1.4. Mechanical Installation

The BB501 interface board must be mounted in an area free of electrical noise. The board is mounted using five .187" diameter mounting holes, refer to Figure 1-2 and Figure 1-3.

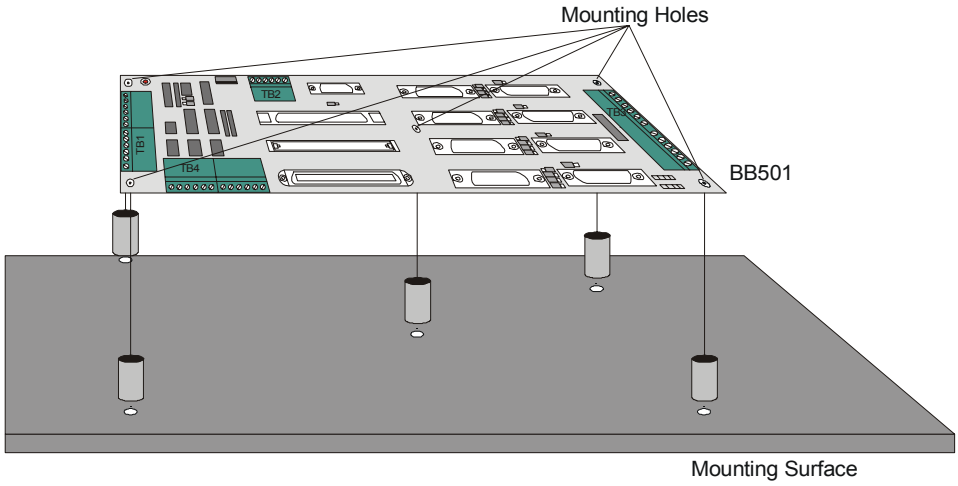


Figure 1-2. Mounting the BB501 Interface Board

Using a metal enclosure will help minimize any electrical noise pickup.

The BB501 can be mounted horizontally or vertically on a panel or wall.

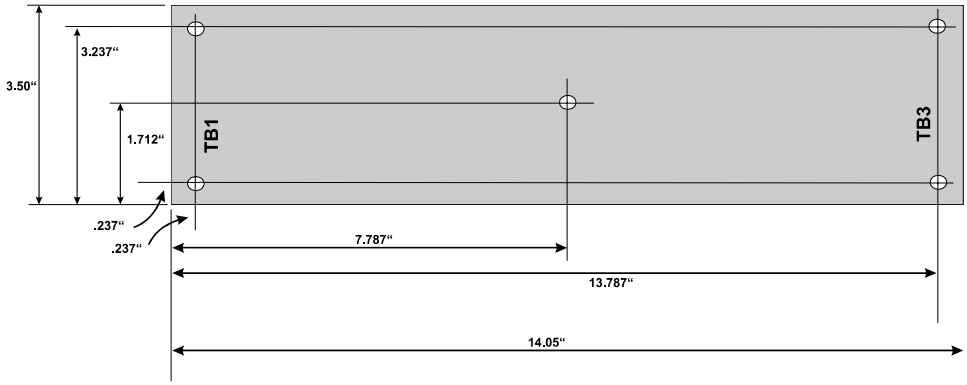
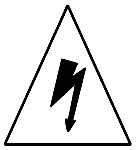


Figure 1-3. BB501 Interface Board Dimensions

1.5. Electrical Installation

The electrical installation is dependent on the user's system and options. Each Axis requires an amplifier connection (J6-J9) and a feedback connection (J2-J5). Refer to Figure 1-4. Additional connections are required to utilize other available options such as brake, joystick, miscellaneous I/O, or external power supply. Additional installation information can be found in the hardware section of this manual and in other Aerotech product manuals.

To minimize the risk of electrical shock and bodily injury, make certain that all of the electrical power switches are in the off position prior to making any electrical connections.



1.6. Hardware Configurations

This section describes the configuration, power, and system interconnects requirements for the BB501 interface board. This section contains a description of the jumper configurations and connector pinouts for system interfacing.

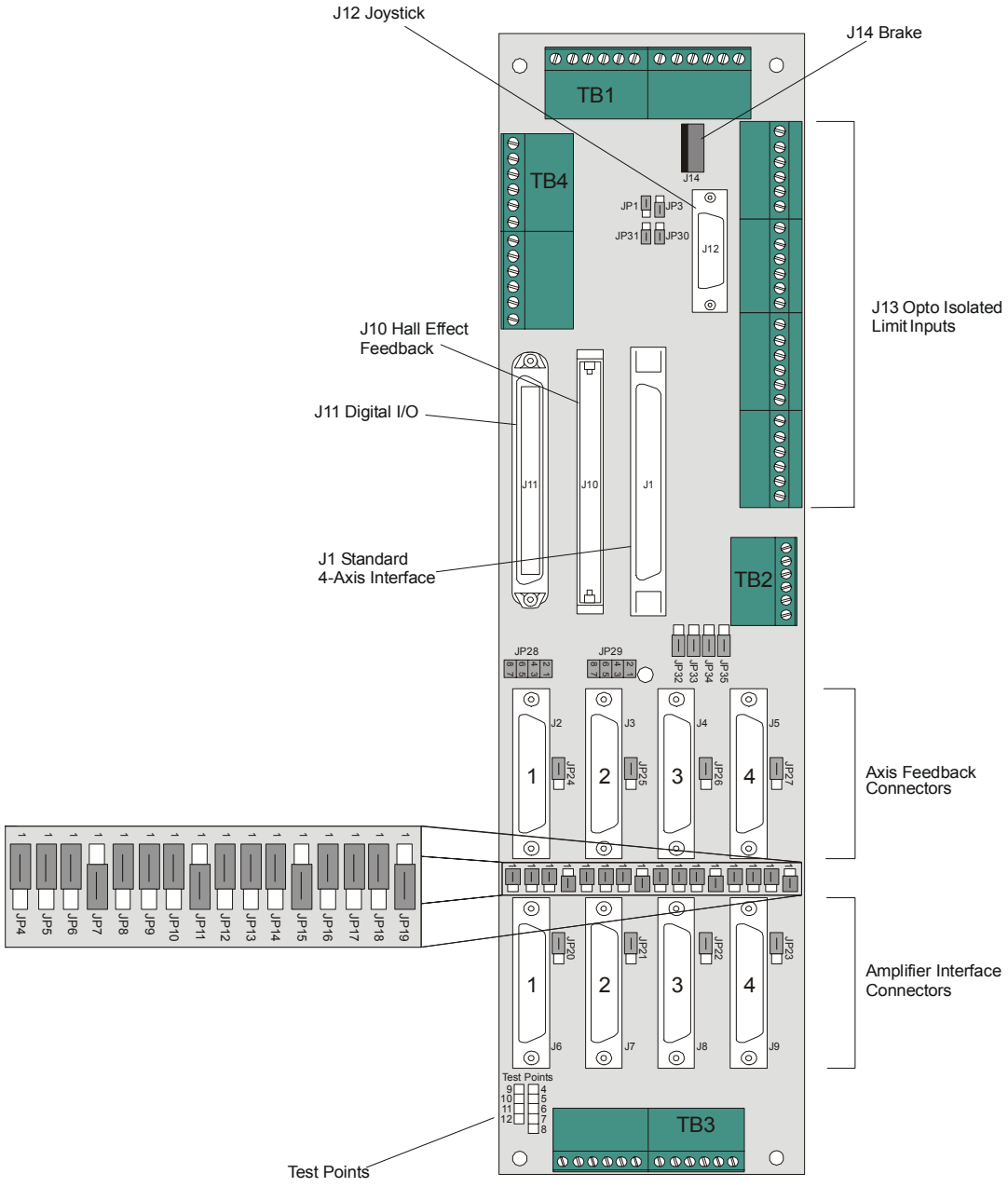


Figure 1-4. BB501 Interface Board (Connector and Jumper Locations)

1.6.1. BB501 Interface Board Jumper Configurations

The BB501 contains configuration jumpers used to configure the axis and certain options. Table 1-1 is a list of the jumpers on the BB501 interface board. Refer to Figure 1-4 for jumper locations.

Table 1-1. BB501 Jumper Descriptions

Jumper	Setting	Description
JP1	1-2	External global enable required
	2-3 (default)	External global enable defeated
JP3	1-2 (default)	Brake Control from Brake (J1-96)
	2-3	Brake Control from Out 0 (J1-63)
JP4	1-2 (default)	Axis #1 External fault input defeated (J2-2 is Gnd)
	2-3	Axis #1 External fault input enabled
JP5	1-2 (default)	Axis #1 Encoder +5V (J2-3) from J6- 2, 20 (amp)
	2-3	Axis #1 Encoder +5V (J2-3) from TB2-2
JP6	1-2 (default)	Axis #1 Limit +5V (J2-16) from J6- 2, 20 (amp)
	2-3	Axis #1 Limit +5V (J2-16) from TB2-4
JP7	1-2	Axis #1 ICMD1B to Amplifier –Input1 (J6-21)
	2-3 (default)	Axis #1 ICMD1B to Amplifier +Input1 (J6-8)
		Note: Setting JP7 to 1-2 requires JP24 to be set to 2-3.
JP8	1-2 (default)	Axis #2 External fault input defeated (J3-2 is Gnd)
	2-3	Axis #2 External fault input enabled
JP9	1-2 (default)	Axis #2 Encoder +5V (J3-3) from J7- 2, 20 (amp)
	2-3	Axis #2 Encoder +5V (J3-3) from TB2-2
JP10	1-2 (default)	Axis #2 Limit +5V (J3-16) from J7- 2, 20 (amp)
	2-3	Axis #2 Limit +5V (J3-16) from TB2-4
JP11	1-2	Axis #2 ICMD2B to Amplifier -Input2 (J7-21)
	2-3 (default)	Axis #2 ICMD2B to Amplifier +Input2 (J7-8)
		Note: Setting JP11 to 1-2 requires JP25 to be set to 2-3.
JP12	1-2 (default)	Axis #3 External fault input defeated (J4-2 is Gnd)
	2-3	Axis #3 External fault input enabled
JP13	1-2 (default)	Axis #3 Encoder +5V (J4-3) from J8- 2, 20 (amp)
	2-3	Axis #3 Encoder +5V (J4-3) from TB2-2
JP14	1-2 (default)	Axis #3 Limit +5V (J4-16) from J8- 2, 20 (amp)
	2-3	Axis #3 Limit +5V (J4-16) from TB2-4

Table 1-1. BB501 Jumper Descriptions (Continued)

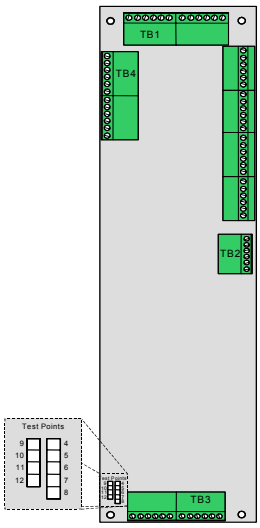
Jumper	Setting	Description
JP15	1-2 2-3 (default)	Axis #3 ICMD3B to Amplifier –Input3 (J8-21) Axis #3 ICMD3B to Amplifier +Input3 (J8-8)
		Note: Setting JP15 to 1-2 requires JP26 to be set to 2-3.
JP16	1-2 (default) 2-3	Axis #4 External fault input defeated (J5-2 is Gnd) Axis #4 External fault input enabled
JP17	1-2 (default) 2-3	Axis #4 Encoder +5V (J5-3) from J9- 2, 20 (amp) Axis #4 Encoder +5V (J5-3) from TB2-2
JP18	1-2 (default) 2-3	Axis #4 Limit +5V (J5-16) from J9- 2, 20 (amp) Axis #4 Limit +5V (J5-16) from TB2-4
JP19	1-2 2-3 (default)	Axis #4 ICMD4B to Amplifier -Input4 (J9-21) Axis #4 ICMD4B to Amplifier +Input4 (J9-8)
		Note: Setting JP19 to 1-2 requires JP27 to be set to 2-3.
JP20	1-2 (default) 2-3	Axis #1 Amp Fault (J6-23) enabled Axis #1 Amp Fault(J6-23) defeated
JP21	1-2 (default) 2-3	Axis #2 Amp Fault (J7-23) enabled Axis #2 Amp Fault (J7-23) defeated
JP22	1-2 (default) 2-3	Axis #3 Amp Fault (J8-23) enabled Axis #3 Amp Fault (J8-23) defeated
JP23	1-2 (default) 2-3	Axis #4 Amp Fault (J9-23) enabled Axis #4 Amp Fault (J9-23) defeated
JP24	1-2 (default) 2-3	Axis #1 - Input1 (J6-21) connected to common Axis #1 - Input1 (J6-21) not connected to common
		Note: Setting JP24 to 1-2 requires JP7 to be set to 2-3.
JP25	1-2 (default) 2-3	Axis #2 - Input2 (J7-21) connected to common Axis #2 - Input2 (J7-21) not connected to common
		Note: Setting JP25 to 1-2 requires JP11 to be set to 2-3.
JP26	1-2 (default) 2-3	Axis #3 - Input3 (J8-21) connected to common Axis #3 - Input3 (J8-21) not connected to common
		Note: Setting JP26 to 1-2 requires JP15 to be set to 2-3.
JP27	1-2 (default) 2-3	Axis #4 - Input3 (J9-21) connected to common Axis #4 - Input3 (J9-21) not connected to common
		Note: Setting JP27 to 1-2 requires JP19 to be set to 2-3.
JP28 and JP29 pin #'s are incorrectly labeled on some Rev. D boards. See Figure 1-4 for correct identification.	JP28	1-2 3-4 5-6 7-8	IN, to connect Brake + power to Axis 1 (J2-25) IN, to connect Brake + power to Axis 2 (J3-25) IN, to connect Brake + power to Axis 3 (J4-25) IN, to connect Brake + power to Axis 4 (J5-25)
			Note: JP28 and JP29 are normally set the same.
	JP29	1-2 3-4 5-6 7-8	IN, to connect Brake - power to Axis 1 (J2-13) IN, to connect Brake - power to Axis 2 (J3-13) IN, to connect Brake - power to Axis 3 (J4-13) IN, to connect Brake - power to Axis 4 (J5-13)
			Note: JP28 and JP29 are normally set the same.

Table 1-1. BB501 Jumper Descriptions (Continued)

Jumper	Setting	Description
JP30 (*see note*)	1-2 (default)	U600/U500 ISA
	2-3	U500 PCI Ext. DAC common (TB3-10)
JP31 (*see note*)	1-2 (default)	U600/U500 ISA
	2-3	U500 PCI Ext. DAC common (TB3-10)
JP32	1-2	Axis 4 Ext. Disable input Active Low
	2-3	Axis 4 Ext. Disable input Active High
JP33	1-2	Axis 1 Ext. Disable input Active Low
	2-3	Axis 1 Ext. Disable input Active High
JP34	1-2	Axis 2 Ext. Disable input Active Low
	2-3	Axis 2 Ext. Disable input Active High
JP35	1-2	Axis 3 Ext. Disable input Active Low
	2-3	Axis 3 Ext. Disable input Active High

JP30, JP31 are set 2-3 only for U500 PCI, and if you are using an external power supply for the DAC outputs. See the U500 manual for the required jumper settings on the U500 PCI as well.

JP28 and JP29 Pin Numbers are incorrectly labeled on some Rev. D boards. See Figure 1-4 for correct identification.



1.6.2. BB501 Interface Board Test Points

Test points are located on the top side of the BB501 board near terminal block TB3 (Figure 1-4). These test points provide easy access to critical signals on the BB501 board. Table 1-2 lists the test points and their description.

Table 1-2. BB501 Test Points

Test Points	Description
TP4	Ground
TP5	Axis #1 Amplifier ICMD1 (J6-25)
TP6	Axis #1 Amplifier IFDBK1 (J6-12)
TP7	Axis #2 Amplifier ICMD2 (J7-25)
TP8	Axis #2 Amplifier IFDBK2 (J7-12)
TP9	Axis #3 Amplifier ICMD3 (J8-25)
TP10	Axis #3 Amplifier IFDBK3 (J8-12)
TP11	Axis #4 Amplifier ICMD4 (J9-25)
TP12	Axis #4 Amplifier IFDBK4 (J9-12)

1.7. BB501 Interface Board Connectors

The BB501 board contains seventeen connectors consisting of two U500/U600 interface connectors, four amp connectors, four encoder connectors, three I/O connectors, one D/A connector, one joystick connector, one brake connector, and an external power supply connector. The following sections describe the pinouts for each of these connectors.

1.7.1. U500/U600 Interface Connector (J1)

The U500/U600 Interface connector is a 100-pin "AMPLIMITE" connector that provides the majority of the signals to and from the U500 or U600 control board. Refer to Table 1-3 for a description of the pinouts for connector J1.

Table 1-3. BB501 U500/U600 ISA Interface Connector (J1) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Interlock Send	ILOCKS(Gnd)	2	(Reserved) / Common	*Reserved / Common*
3	+5 Volts	+5	4	+5 Volts	+5
5	Encoder Ground / Hall 1 B	GND	6	Encoder Ground / Hall 1 A	GND
7	Encoder SIN +, Axis 1	SIN1+	8	Encoder SIN -, Axis 1	SIN1-
9	Encoder COS +, Axis 1	COS1+	10	Encoder COS -, Axis 1	COS1-
11	Marker +, Axis 1	MRK1+	12	Marker -, Axis 1	MRK1-
13	Encoder Ground / Hall 2 B	GND	14	Encoder Ground / Hall 2A	GND
15	Encoder SIN +, Axis 2	SIN2+	16	Encoder SIN -, Axis 2	SIN2-
17	Encoder COS +, Axis 2	COS2+	18	Encoder COS -, Axis 2	COS2-
19	Marker +, Axis 2	MRK2+	20	Marker -, Axis 2	MRK2-
21	Encoder Ground / Hall 2 C	GND	22	Encoder Ground / Hall 3 B	GND
23	Encoder SIN +, Axis 3	SIN3+	24	Encoder SIN -, Axis 3	SIN3-
25	Encoder COS +, Axis 3	COS3+	26	Encoder COS -, Axis 3	COS3-
27	Marker +, Axis 3	MRK3+	28	Marker -, Axis 3	MRK3-
29	Encoder Ground / Hall 3 A	GND	30	Encoder Ground / Hall 3 C	GND
31	Encoder SIN +, Axis 4	SIN4+	32	Encoder SIN -, Axis 4	SIN4-
33	Encoder COS +, Axis 4	COS4+	34	Encoder COS -, Axis 4	COS4-
35	Marker +, Axis 4	MRK4+	36	Marker -, Axis 4	MRK4-
37	Ground / Hall 4 B	GND	38	Ground / Hall 4 A	GND
39	CW Limit, Axis 1	CW1	40	CCW Limit, Axis 1	CCW1
41	CW Limit, Axis 2	CW2	42	CCW Limit, Axis 2	CCW2
43	CW Limit, Axis 3	CW3	44	CCW Limit, Axis 3	CCW3
45	CW Limit, Axis 4	CW4	46	CCW Limit, Axis 4	CCW4
47	Home Limit, Axis 1	HOME1	48	Home Limit, Axis 2	HOME2
49	Home Limit, Axis 3	HOME3	50	Home Limit, Axis 4	HOME4
51	Synchronization	*Reserved*	52	Ground / Hall 1 C	GND
53	DAC +12V In / PC +12V Out	+12V	54	DAC Gnd. / PC +12V	+12V
55	DAC -12V In / PC -12V Out	-12V	56	DAC Gnd. / PC -12V	-12V
57	Recirc. Axis 1(Reserved)	*Reserved*	58	Recirc. Axis 2 (Reserved)	*Reserved*
59	Input 0	IN0	60	Input 1	IN1
61	Input 2	IN2	62	Input 3	IN3
63	Output 0	OUT0	64	Output 1	OUT1
65	Output 2	OUT2	66	Output 3	OUT3
67	Recirc. Axis 3(Reserved)	*Reserved*	68	Recirc. Axis 4 (Reserved)	*Reserved*
69	Amplifier Enable 1	AEN1	70	Amplifier Enable 2	AEN2
71	Amplifier Enable 3	AEN3	72	Amplifier Enable 4	AEN4
73	Amplifier Fault 1	AFLT1	74	Amplifier Fault 2	AFLT2
75	Amplifier Fault 3	AFLT3	76	Amplifier Fault 4	AFLT4
77	Ground	GND	78	Ground	GND
79	Axis 1 Primary Current Cmd	ICMD1B	80	Axis 1 Secondary Current Cmd	ICMD1A
81	Axis 2 Primary Current Cmd	ICMD2B	82	Axis 2 Secondary Current Cmd	ICMD2A
83	Axis 3 Primary Current Cmd	ICMD3B	84	Axis 3 Secondary Current Cmd	ICMD3A
85	Axis 4 Primary Current Cmd	ICMD4B	86	Axis 4 Secondary Current Cmd	ICMD4A
87	Ground	GND	88	Ground / Hall 4 C	GND
89	Joystick Potentiometer 1 / AIN 1	JSW1 / AIN 1	90	Joystick Potentiometer 2 / AIN 2	JSW2 / AIN 2
91	Joystick Button A	JSA	92	Joystick Button B	JSB
93	Joystick Button C	JSC (JS I Lock)	94	Brake Output	BRAKE
95	Analog Input 0 / 3	AIN0	96	Analog Input 1 / 4	AIN1
97	Emergency Stop	ESTOP	98	User Interrupt	UINT
99	Opto Anode for 97 & 98	OPTOA	100	Interlock Receive	ILOCKR

1.7.2. Axis Feedback Connectors (J2-J5)

The BB501 interface board contains four encoder feedback connectors (J2-J5, one for each axis). These connectors are 25-pin "D" type connectors and have the same pinouts for each. The pinouts for the axis feedback connectors are listed in Table 1-4.

Table 1-4. BB501 Encoder Feedback Connectors (J2-J5) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Shield	SHIELD	14	COS +	COS+
2	External Fault / Input	EXTFLT	15	COS -	COS-
3	Encoder +5 Volts	5V	16	Limit +5 Volts	5V
4	Reserved	*Reserved*	17	SIN +	SIN+
5	Hall Effect B	HB	18	SIN -	SIN-
6	Marker -	MRK-	19	Tach +	TACH+
7	Marker +	MRK+	20	Ground	GND
8	Ground	GND	21	Ground	GND
9	Reserved	*Reserved*	22	Home Limit	HMLMT
10	Hall Effect A	HA	23	External Disable Input	EXTDIS
11	Hall Effect C	HC	24	Counter Clockwise Limit	CCW
12	Clockwise Limit	CW	25	Brake Output	BRK +
13	Brake Output	BRK-			

1.7.3. Axis Amp Connectors (J6-J9)

The BB501 interface board contains four amplifier connectors (J6-J9, one for each axis). These connectors are 25-pin "D" type connectors and have the same pinouts for each. The pinouts for the axis amplifier connectors are listed in Table 1-5.

Table 1-5. BB501 Axis Amp Connectors (J6 - J9) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Shield	SHIELD	14	Ground	GND
2	Amp +5V out	5V	15	Ground	GND
3	Tach +	Tach +	16	Hall Effect B	HB
4	Hall Effect A	HA	17	Hall Effect C	HC
5	COS +	COS+	18	SIN +	SIN+
6	COS -	COS -	19	SIN -	SIN -
7	Ground	GND	20	Amp +5V out	5V
8	+ Input	+INPUT	21	- Input	-INPUT
9	Current Cmd A	ICMDA	22	Current Cmd B	ICMDB
10	Axis Enable	ENABLE	23	Axis Fault	FAULT
11	Reserved	*Reserved*	24	Reserved	*Reserved*
12	Current Feedback	IFDBK	25	ICMD from Amp.	ICMD
13	PWM Osc.	PWM			

1.7.4. U500 I/O Hall Effect Connector (J10)

The U500 I/O Hall effect connector is a 50-pin ribbon type and is used for Hall effect and additional I/O signals. This connector may not be required in all applications. Table 1-6 lists the pinouts and descriptions for J10.

The mate to this connector is a 3M (P/N 3425-6050) or Aerotech (P/N ECK332).

Table 1-6. U500 I/O Hall Effect Connector (J10) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Input 15 / Hall-4C	I15/HC4	2	Ground	GND
3	Input 14 / Hall-4A	I14/HA4	4	Ground	GND
5	Input 13 / Hall-4B	I13/HB4	6	Ground	GND
7	Input 12 / Hall-3C	I12/HC3	8	Ground	GND
9	Input 11 / Hall-3A	I11/HA3	10	Ground	GND
11	Input 10 / Hall-3B	I10/HB3	12	Ground	GND
13	Input 9 / Hall-2C	I9/HC2	14	Ground	GND
15	Input 8 / Hall-2A	I8/HA2	16	Ground	GND
17	Input 7 / Hall-2B	I7/HB2	18	Ground	GND
19	Input 6 / Hall-1C	I6/HC1	20	Ground	GND
21	Input 5 / Hall-1A	I5/HA1	22	Ground	GND
23	Input 4 / Hall-1B	I4/HB1	24	Ground	GND
25	Input 3	IN3	26	Ground	GND
27	Input 2	IN2	28	Ground	GND
29	Input 1	IN1	30	Ground	GND
31	Input 0	IN0	32	Ground	GND
33	Output 7	OUT7	34	Ground	GND
35	Output 6	OUT6	36	Ground	GND
37	Output 5	OUT5	38	Ground	GND
39	Output 4	OUT4	40	Ground	GND
41	Output 3	OUT3	42	Ground	GND
43	Output 2	OUT2	44	Ground	GND
45	Output 1	OUT1	46	Ground	GND
47	Output 0	OUT0	48	Ground	GND
49	+5 Volts	+5	50	Ground	GND

1.7.5. U600 ISA I/O Hall Effect Connector (J10)

The U600 ISA I/O Hall effect connector is a 50-pin ribbon type and is used for Hall effect and additional I/O signals. This connector may not be required in all applications. Table 1-7 lists the pinouts and descriptions for J10.

The mate to this connector is a 3M (P/N 3425-6050) or Aerotech (P/N ECK332).

Table 1-7. U600 I/O Hall Effect Connector (J10) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Hall-4C	HC4	2	Ground	GND
3	Hall-4A	HA4	4	Ground	GND
5	Hall-4B	HB4	6	Ground	GND
7	Hall-3C	HC3	8	Ground	GND
9	Hall-3A	HA3	10	Ground	GND
11	Hall-3B	HB3	12	Ground	GND
13	Hall-2C	HC2	14	Ground	GND
15	Hall-2A	HA2	16	Ground	GND
17	Hall-2B	HB2	18	Ground	GND
19	Hall-1C	HC1	20	Ground	GND
21	Hall-1A	HA1	22	Ground	GND
23	Hall-1B	HB1	24	Ground	GND
25	User Reset Input	RSTIN	26	Ground	GND
27	Position Latch Input	PLATCH	28	Ground	GND
29	Reserved Output 1	ROUT1	30	Ground	GND
31	Reserved Output 2	ROUT2	32	Ground	GND
33	Output 15	OUT15	34	Ground	GND
35	Output 14	OUT14	36	Ground	GND
37	Output 13	OUT13	38	Ground	GND
39	Output 12	OUT12	40	Ground	GND
41	Output 3	OUT3	42	Ground	GND
43	Output 2	OUT2	44	Ground	GND
45	Output 1	OUT1	46	Ground	GND
47	Output 0	OUT0	48	Ground	GND
49	+5 Volts	+5	50	Ground	GND

1.7.6. Digital I/O Connector (J11)

The Digital I/O connector (J11) is a 50-pin "Champ" connector and is the digital input/output port. Table 1-8 lists the pinouts for the digital I/O connector J11 when interfacing with the U500. Table 1-9 lists the pinouts when interfacing with the U600.

The mate to this connector is a 3M (P/N 3564-1001) or Aerotech (P/N ECK353).

Table 1-8. BB501 Digital I/O Connector (J11) Pinouts with U500

Pin	Function	Description	Pin	Function	Description
1	Hall Effect C4 / Input 15	HC4/I15	26	Ground	GND
2	Hall Effect A4 / Input 14	HA4/I14	27	Ground	GND
3	Hall Effect B4 / Input 13	HB4/I13	28	Ground	GND
4	Hall Effect C3 / Input 12	HC3/I12	29	Ground	GND
5	Hall Effect A3 / Input 11	HA3/I11	30	Ground	GND
6	Hall Effect B3 / Input 10	HB3/I10	31	Ground	GND
7	Hall Effect C2 / Input 9	HC2/I9	32	Ground	GND
8	Hall Effect A2 / Input 8	HA2/I8	33	Ground	GND
9	Hall Effect B2 / Input 7	HB2/I7	34	Ground	GND
10	Hall Effect C1 / Input 6	HC1/I6	35	Ground	GND
11	Hall Effect A1 / Input 5	HA1/I5	36	Ground	GND
12	Hall Effect B1 / Input 4	HB1/I4	37	Ground	GND
13	Input 3	IN3	38	Ground	GND
14	Input 2	IN2	39	Ground	GND
15	Input 1	IN1	40	Ground	GND
16	Input 0	IN0	41	Ground	GND
17	Output 7	OUT7	42	Ground	GND
18	Output 6	OUT6	43	Ground	GND
19	Output 5	OUT5	44	Ground	GND
20	Output 4	OUT4	45	Ground	GND
21	Output 3	OUT3	46	Ground	GND
22	Output 2	OUT2	47	Ground	GND
23	Output 1	OUT1	48	Ground	GND
24	Output 0	OUT0	49	Ground	GND
25	+5 Volts	+5V	50	Ground	GND

Table 1-9. BB501 Digital I/O Connector (J11) Pinouts with U600

Pin	Function	Description	Pin	Function	Description
1	Hall Effect C4	HC4	26	Ground	GND
2	Hall Effect A4	HA4	27	Ground	GND
3	Hall Effect B4	HB4	28	Ground	GND
4	Hall Effect C3	HC3	29	Ground	GND
5	Hall Effect A3	HA3	30	Ground	GND
6	Hall Effect B3	HB3	31	Ground	GND
7	Hall Effect C2	HC2	32	Ground	GND
8	Hall Effect A2	HA2	33	Ground	GND
9	Hall Effect B2	HB2	34	Ground	GND
10	Hall Effect C1	HC1	35	Ground	GND
11	Hall Effect A1	HA1	36	Ground	GND
12	Hall Effect B1	HB1	37	Ground	GND
13	Input 3	IN3	38	Ground	GND
14	Input 2	IN2	39	Ground	GND
15	Input 1	IN1	40	Ground	GND
16	Input 0	IN0	41	Ground	GND
17	Output 15	OUT15	42	Ground	GND
18	Output 14	OUT14	43	Ground	GND
19	Output 13	OUT13	44	Ground	GND
20	Output 12	OUT12	45	Ground	GND
21	Output 3	OUT3	46	Ground	GND
22	Output 2	OUT2	47	Ground	GND
23	Output 1	OUT1	48	Ground	GND
24	Output 0	OUT0	49	Ground	GND
25	+5 Volts	+5V	50	Ground	GND

1.7.7. Joystick Connector (J12)

The joystick connector (J12) is a 5-pin "D" type connector. This connector contains the joystick wiper and button signals. The pinouts for the joystick connector are listed in Table 1-10.

Table 1-10. BB501 Joystick Connector (J12) Pinouts

Pin	Function	Description	Pin	Function	Description
1	+5 Volts	+5V	9	Reserved	*Reserved*
2	Joystick Button A	JSA	10	Reserved	*Reserved*
3	Joystick Wiper 1	JSW1	11	Reserved	*Reserved*
4	Ground	GND	12	Reserved	*Reserved*
5	Reserved	*Reserved*	13	Joystick Interlock	JSI
6	Joystick Wiper 2	JSW2	14	Reserved	*Reserved*
7	Joystick Button B	JSB	15	Reserved	*Reserved*
8	Reserved	*Reserved*			

1.7.8. Brake Connector (J14)

The brake connector (J14) is a 6-pin "IDC" locking connector and provides a brake control signal. The pinouts for the brake connector are listed in Table 1-11.

The mate to this connector in an Amp (P/N 640440-6 and 640550-6) or an Aerotech (P/N EIK297 and EIK298).

Table 1-11. BB501 Brake Connector (J14) Pinouts

Pin	Function	Description
1	+5 Volts	+5V
2	Ground	GND
3	Brake (control signal)	BRAKE
4	Ground	GND
5	Reserved	*Reserved*
6	Ground	GND

1.7.9. Miscellaneous I/O Connector (TB1)

The Miscellaneous I/O connector (TB1) is a 12-pin terminal board connector. This connector provides various system control and input signals. The pinouts for the Miscellaneous I/O connector are listed in Table 1-12.

Table 1-12. BB501 Miscellaneous I/O Connector (TB1) Pinouts

Pin	Function	Description
1	Shield	SHIELD
2	Ground	GND
3	1st Analog Input	U600 Analog Input 0 / U500 $AD1 command
4	2nd Analog Input	U600 Analog Input 1 / U500 $AD0 command
5	Brake (control signal)	BRAKE
6	Emergency Stop	ESTOP
7	User Interrupt	UINT
8	Opto Anode	OPTOA
9	Enable Common	ENBCOM
10	External Enable	EXTENB
11	Fault Common	FLTCOM
12	Fault Out	FLTOUT

1.7.9.1. Opto-Isolated Limit Inputs (J13)

The Opto-Isolated Limit Inputs connector (J13) is a 24 Pin terminal board connector. This connector provides opto-isolated inputs for Axis 1-4, CW limits, CCW limits, and Home limits. These inputs are used when isolation is required for the limit inputs. Connectors J2, J3, J4, and J5 provide un-isolated connections for the limit inputs. These limit connections must not be used when the Opto-Isolated Limit Inputs are used.

These opto-isolated inputs are configured for 12 – 24V logic level inputs. They have 3,900 Ohm series resistors limiting the current through the opto to 5mA. An external series resistor should be used if a voltage greater than 24V is to be applied. Figure 1-5 shows the opto-isolator inputs for J13. The pinouts for the Opto-Isolated Limit Inputs (J13) are listed in Table 1-13.

Table 1-13. BB501 Opto-Isolated Connector Inputs (J13) Pinouts

Pin	Description	Pin	Description
1	Axis 1 CW LMT +	13	Axis 3 CW LMT +
2	Axis 1 CW LMT -	14	Axis 3 CW LMT -
3	Axis 1 CCW LMT +	15	Axis 3 CCW LMT +
4	Axis 1 CCW LMT -	16	Axis 3 CCW LMT -
5	Axis 1 Home LMT +	17	Axis 3 Home LMT +
6	Axis 1 Home LMT -	18	Axis 3 Home LMT -
7	Axis 2 CW LMT +	19	Axis 4 CW LMT +
8	Axis 2 CW LMT -	20	Axis 4 CW LMT -
9	Axis 2 CCW LMT +	21	Axis 4 CCW LMT +
10	Axis 2 CCW LMT -	22	Axis 4 CCW LMT -
11	Axis 2 Home LMT +	23	Axis 4 Home LMT +
12	Axis 2 Home LMT -	24	Axis 4 Home LMT -

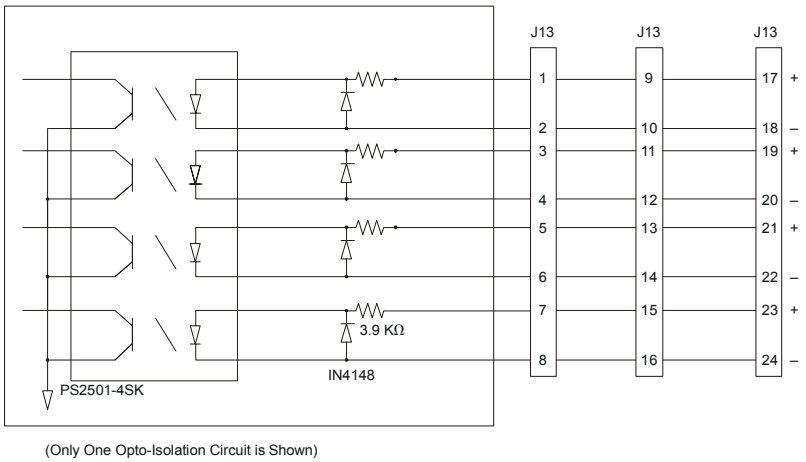


Figure 1-5. Opto-Isolated Inputs

1.7.9.2. Opto-Isolated Enable Input (TB1, 9-10)

The enable input (TB1, 9-10) can be used as a global amplifier shutdown. It can be connected to emergency stop circuit or safety interlock. Jumper JP1 must be set to 1-2 to enable this function. A forward voltage must be applied to TB1, 9-10 in order to enable the amplifiers. If the voltage is removed, all amplifiers connected to the BB501 will be disabled. Refer to Figure 1-6 for an example.

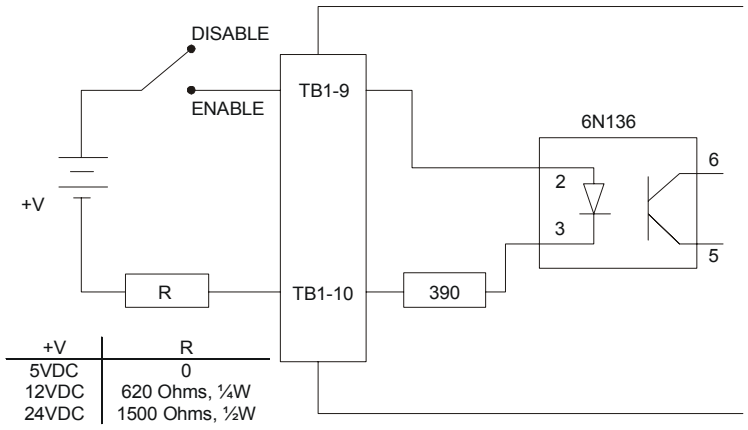


Figure 1-6. Opto-Isolated Enable Input Interface

1.7.9.3. Opto-Isolated Fault Output (TB1, 11-12)

The fault output (TB1, 11-12) is an optically isolated output that indicates a fault condition. Figure 1-7 provides an example interface for this output. A fault on any axis will cause the fault out signal (TB1-12) to go low.

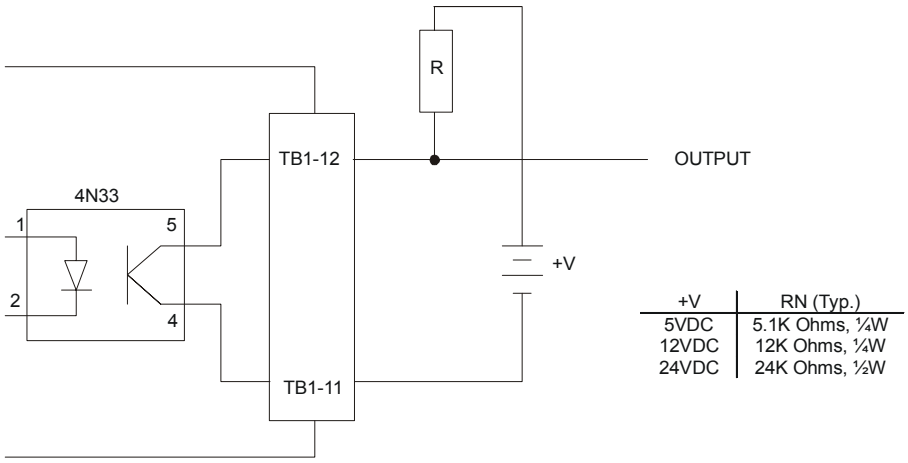


Figure 1-7. Opto-Isolated Fault Output

1.7.10. External Power Supply Connector (TB2)

The external power supply connector (TB2) is a 6-pin terminal board connector. This connector provides connections for an external power supply to power the encoder and limit circuits (possibly at a voltage other than 5 volts). The pinouts for the external power supply connector are listed in Table 1-14.

Table 1-14. BB501 External Power Supply Connector (TB2) Pinouts

Pin	Function	Description
1	Shield	SHIELD
2	Optional Encoder (power)	ENCDR (power)
3	Ground	GND
4	Optional Limit (power)	LIMIT (power)
5	Ground	GND
6	Reserved	*Reserved*

1.7.11. D/A Output Connector (TB3)

The D/A output connector (TB3) is a 12-pin terminal board connector. This connector provides eight current command or D/A outputs (available as D/A output when not used as current command on U500). The pinouts for the D/A Output connector are listed in Table 1-15.

Table 1-15. BB501 D/A Output Connector (TB3) Pinouts

Pin	Function	Description
1	Ground	GND
2	Axis 1 Current Cmd. A	ICMD1A
3	Axis 1 Current Cmd. B	ICMD1B
4	Axis 2 Current Cmd. A	ICMD2A
5	Axis 2 Current Cmd. B	ICMD2B
6	Axis 3 Current Cmd. A	ICMD3A
7	Axis 3 Current Cmd. B	ICMD3B
8	Axis 4 Current Cmd. A	ICMD4A
9	Axis 4 Current Cmd. B	ICMD4B
10	Ground (Ext. DAC com.)	GND
11	U500 PCI Ext. DAC +12V	*See Note*
12	U500 PCI Ext. DAC -12V	*See Note*

These are for use with the U500 PCI only. You must set jumpers JP30, JP31, and the jumpers on the U500 PCI card appropriately. See the schematic (Figure 1-31).

1.7.12. U600 Miscellaneous Connector (TB4)

The U600 Miscellaneous connector (TB4) is a 12-pin terminal board connector. This connector is used with the U600 and contains additional I/O signals. The pinouts for the U600 Misc. connector are listed in Table 1-16.

Table 1-16. BB501 U600 Miscellaneous Connector (TB4) Pinouts

Pin	Function	Description	Pin	Function	Description
1	Shield	SHIELD	7	Reserved Output 1 (Emitter)	Out1-E
2	Ground	GND	8	Reserved Output 2 (Collector)	Out2-C
3	E-stop Opto Anode	OPTOA	9	Reserved Output 1 (Emitter)	Out2-E
4	User Reset Input	Reset	10	Reserved	*Reserved*
5	High Speed Position Latch	Pos Latch	11	+ Brake Supply	BRK +
6	Reserved Output 1 (Collector)	Out1-C	12	- Brake Supply	BRK-

1.8. Power Requirements

The BB501 Interface board requires +5V at less than .5 amp that it obtains through the main signal connector (P1). An additional 5-volt supply will be required to power the encoder and limit circuitry if the opto-isolated inputs are used. If an external power supply is required, it should meet the following minimum requirements.

The following current capacity requirement is for a typical system (some systems may require higher amperage supplies):

+5 Volt Power Supply requirements:

Nominal Voltage (Min. - Max.)	- 4.9 Volts to 5.25 Volts
Ripple (P-P Volts)	- less than 100mv P-P
Current Capacity	- 1.0 Amps / Axis minimum. (typical).
	- 4 Amps for 4 Axis (typical)

1.9. System Interconnections

The BB501 provides system interfacing between the U600 or the U500 Control boards and Aerotech's BA Series amplifiers. Figure 1-8 shows the system interconnect using the BB501 and the BA Series amplifiers.

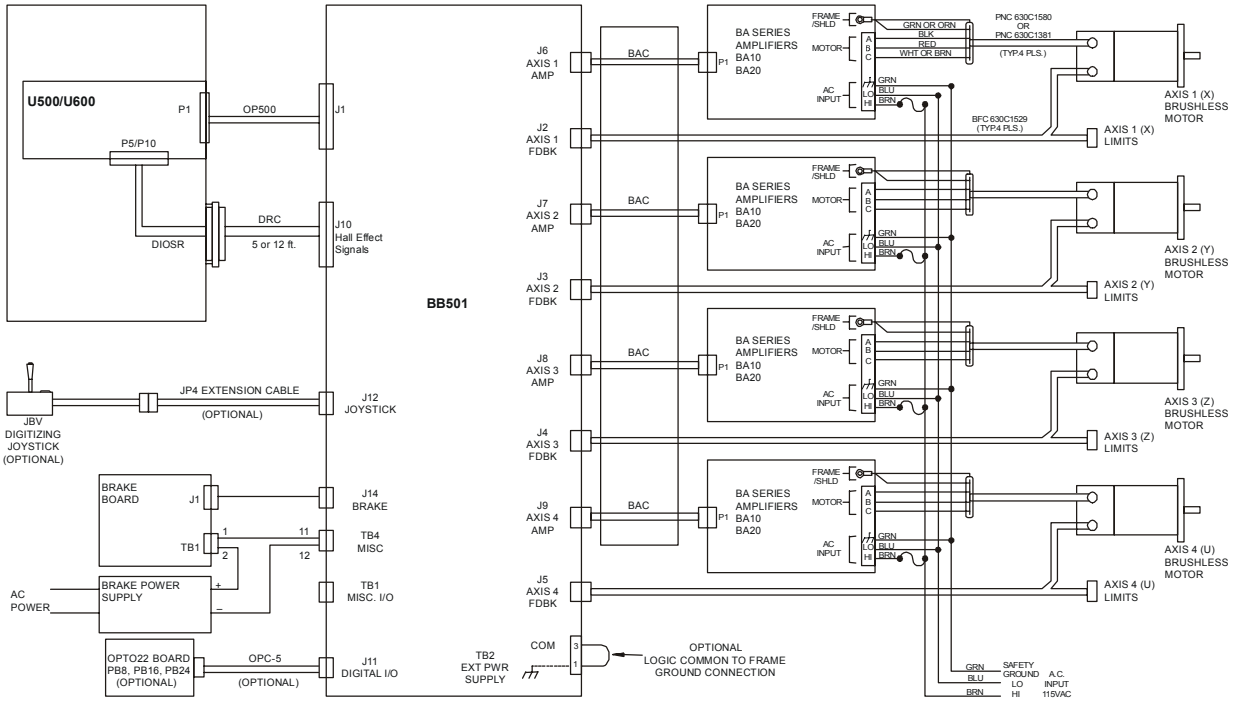


Figure 1-8. System Interconnect with BB501 Breakout Board

The following figures are interconnect drawings between the BB501 and the U500, U600, and BA Series Amplifiers.

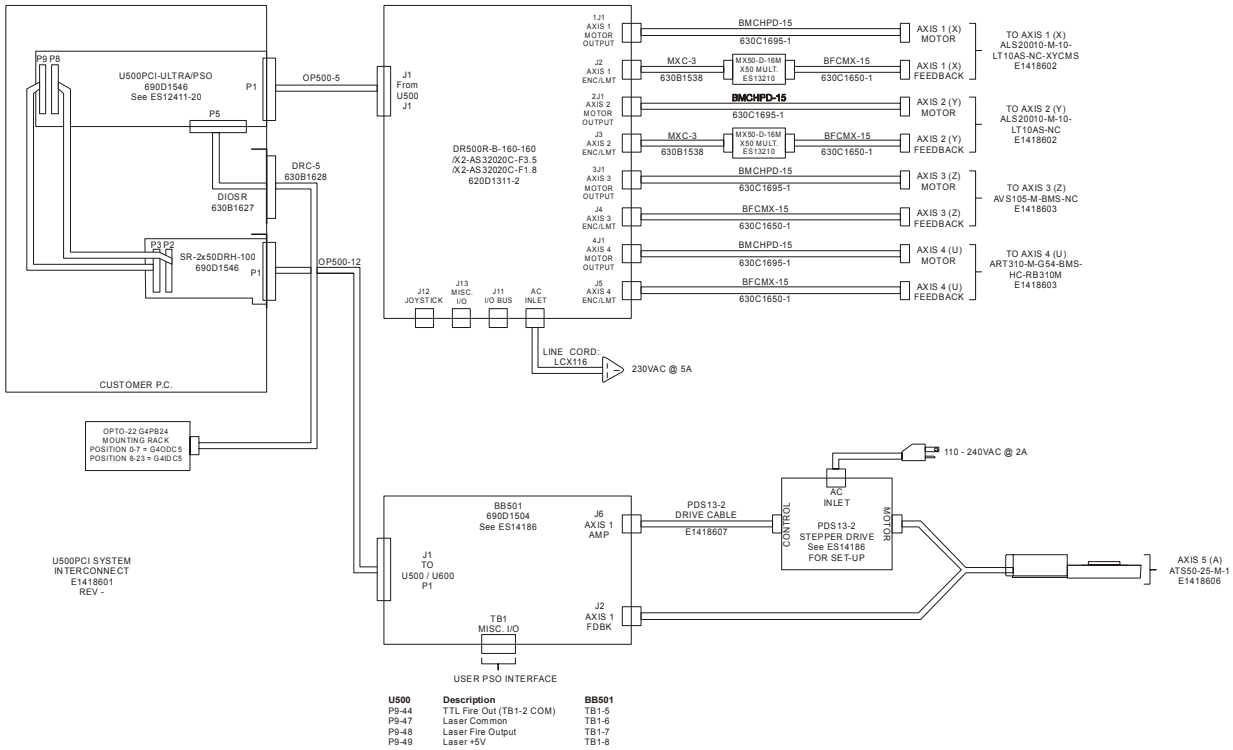


Figure 1-9. U500PCI System Interconnect w/ Steppers

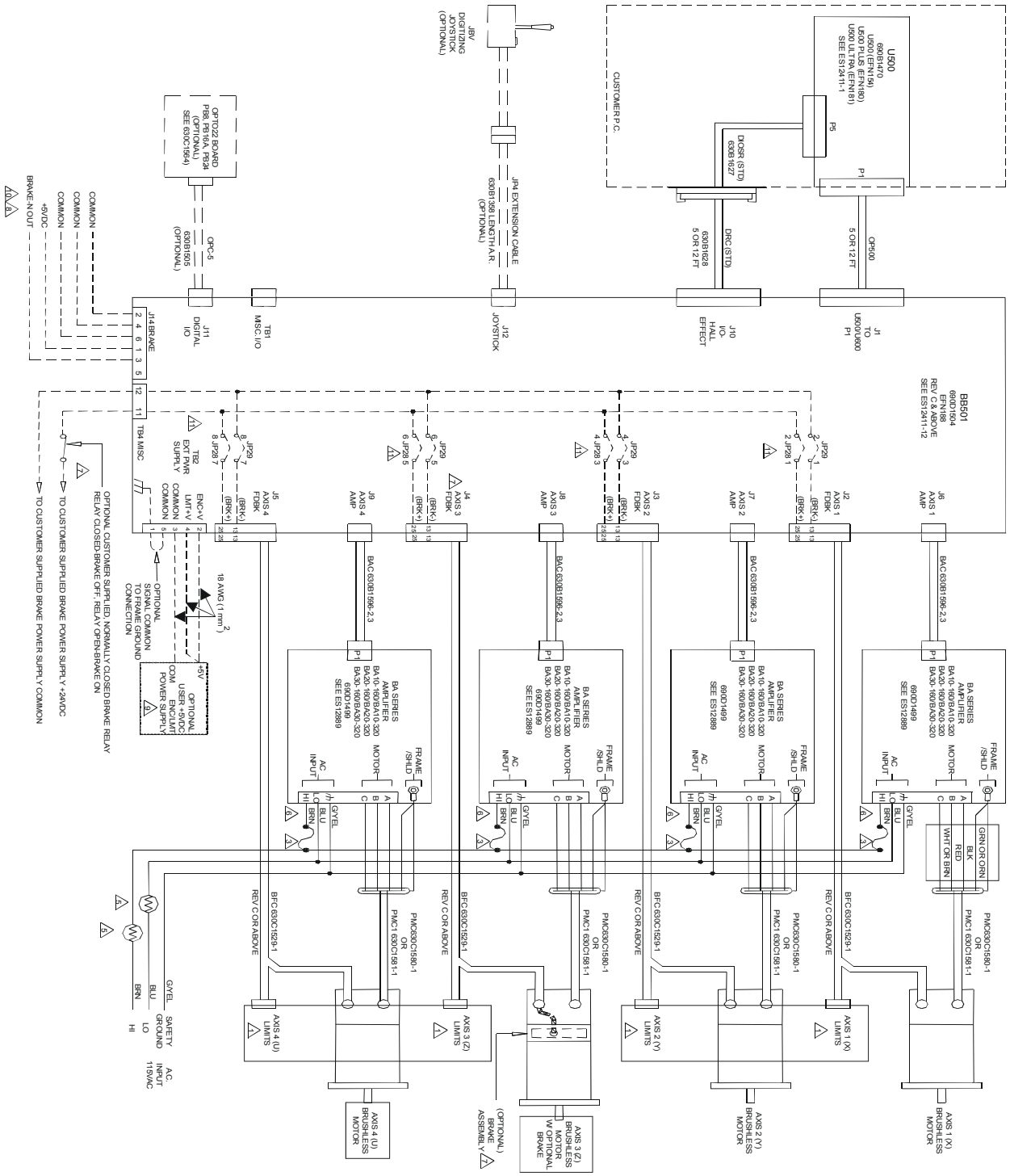
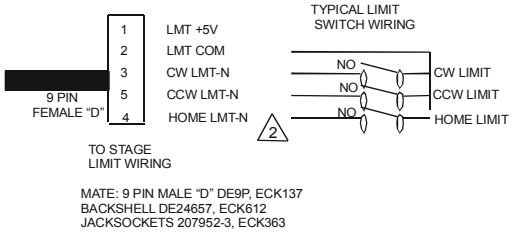


Figure 1-10. U500/BA Series Amps System Interconnect (115 VAC Off-line Operation) Rev B 620D1273-1 (Sheet 1)

1 LIMITS
CW LMT-N SIGNAL INDICATES OVERTRAVEL IN THE CLOCKWISE DIRECTION.
CCW LMT-SIGNAL INDICATES OVERTRAVEL IN THE COUNTER CLOCKWISE DIRECTION.



MATE: 9 PIN MALE "D" DE9P, ECK137
BACKSHELL DE24657, ECK612
JACKSOCKETS 207952-3, ECK363

2 HOME LIMIT (OPTIONAL)

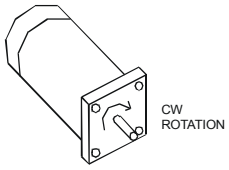
AS A STANDARD, THE CCW OR CW LIMIT SWITCH IS USED AS THE HOME LIMIT SWITCH. THIS SELECTION IS MADE BY SOFTWARE PARAMETER #x74 BEING SET TO "NO". IF AN INDEPENDENT SWITCH IS REQUIRED FOR THE HOME LIMIT , THIS PARAMETER SHOULD BE SET TO "YES" AND A SEPARATE SWITCH WIRED INTO THE SYSTEM AS SHOWN IN NOTE 1.

3 STANDARD A.C. FUSING

BA10 =10A
BA20 = 20A
BA30 = 20A

4 MOTOR ROTATION

CW ROTATION IS VIEWED FROM THE MOTOR MOUNTING FLANGE.



5 INRUSH LIMITING (METHOD 1)

DUE TO CAPACITIVE NATURE OF AMPLIFIER INPUT CIRCUIT, CURRENT INRUSH LIMITING IS RECOMMENDED. NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS ARE USED FOR THIS PURPOSE. THERMISTORS ARE TO BE PLACED IN AC HI AND AC LO LINES. RECOMMENDED MODELS ARE:

RODAN SURGE GIARD SG100 (20A RMS)
KEYSTONE CL 10 (12A RMS)

6 INRUSH LIMITING (METHOD 2)

ALTERNATELY, ONE THERMISTOR MAY BE PLACED IN AC HI LINE ALONE, IF LIMITING IS PERFORMED SEPARATELY ON EACH AMPLIFIER.

7 BRAKE INFORMATION (OPTIONAL)

A) EACH BRAKE ASSEMBLY LOAD IS 24VDC AT 250-35- Ma. (97.3 – 88 OHMS)
B) BRAKE IS FAILSAFE, OFF WHEN ENERGIZED
C) BRK - & BRAKE + ARE AVAILABLE ON ALL AXIS FEEDBACK CONNECTORS (BB501 J2, J3, J4, J5) . BRK– IS ON PIN13, BRK+ IS ON PIN 25

8 U500 BRAKE CONTROL OUTPUT:

THE U500 CONTROL BOARD SENDS OUT A LOGIC SIGNAL THAT CAN BE USED TO CONTROL AN EXTERNAL BRAKE CIRCUIT. THIS LINE IS AN OPEN COLLECTOR OUTPUT FROM A 7406 BUFFER THAT IS CURRENT SINKING (LOGIC 0) WHEN THE ASSOCIATED BRAKE IS OFF (RELEASED) AND IS HIGH IMPEDANCE WHEN THE BRAKE IS ON. THIS LINE IS ENABLED BY SETTING PARAMETER #x61, ENABLE BRAKE MASK, FOR A PARTICULAR AXIS. THIS 7406 DRIVER HAS A 30mA SINK CAPABILITY WITH A MAX 30VDC COLLECTOR VOLTAGE.

9 +5VDC IS REQUIRED FOR ENCODER AND LIMIT OPERATION. THIS 5V IS TYPICALLY SUPPLIED BY THE BA SERIES AMPLIFIER AND IS ROUTED BY JUMPERS THROUGH THE BB501. REFERENCE ES12411-12 OR THE BB501 OPERATOR'S MANUAL (P/N EDO00107) FOR JUMPER DEFINITIONS. THE 5VDC MAY BE SUPPLIED BY A SEPARATE POWER SUPPLY. THE ABOVE-MENTIONED JUMPERS MUST THEN BE RECONFIGURED.

10 BRAKE501 OPTION: SEE 630C1662-2

11 JP28 AND JP29 PIN NUMBERS ARE INCORRECTLY LABELED ON SOME REV D BOARDS. SEE FIGURE 1-4 FOR CORRECT IDENTIFICATION.

Figure 1-11. U500/BA Series Amps System Interconnect (115 VAC Off-line Operation) Rev B 620D1273-1 (Sheet 2)

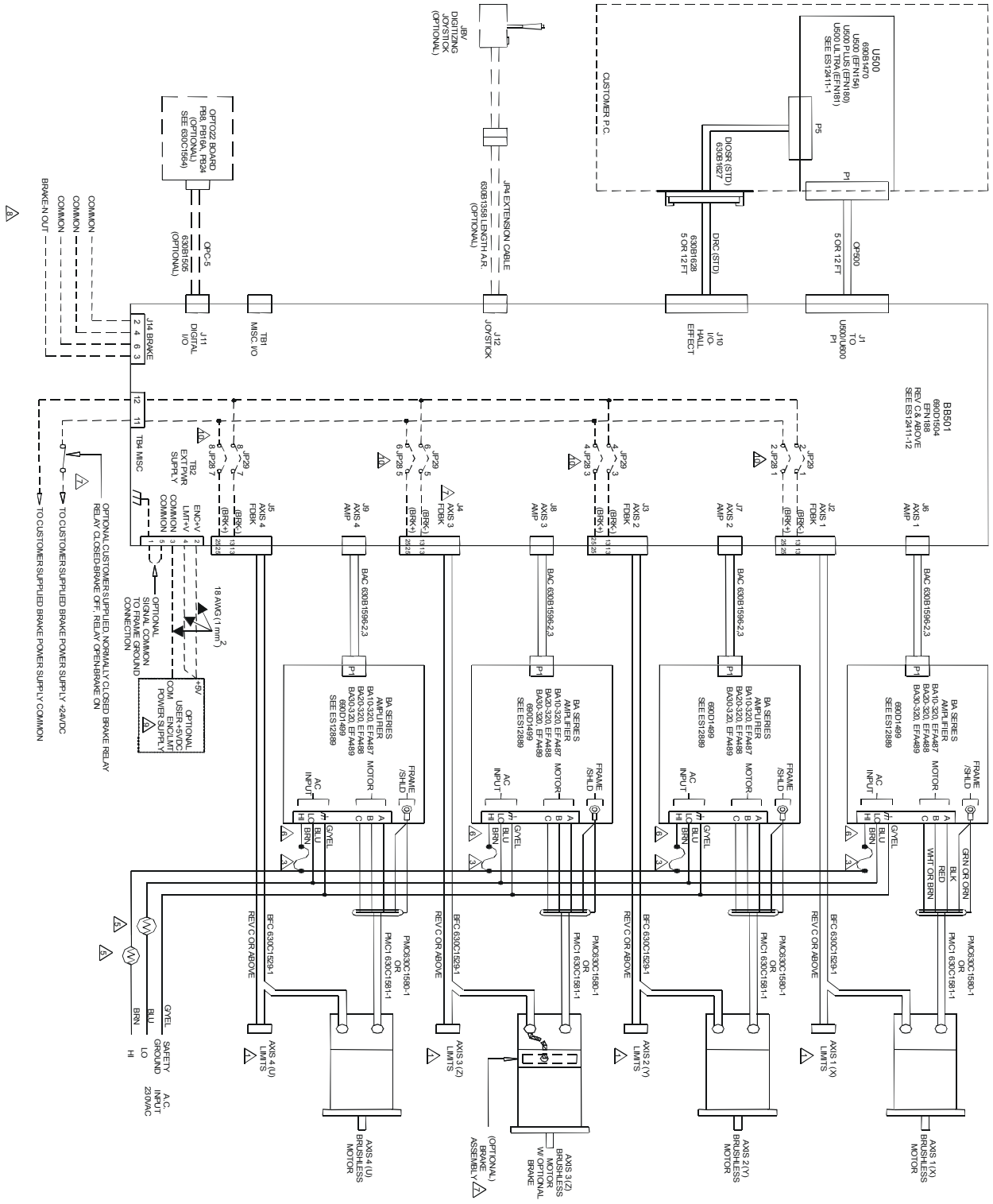


Figure 1-12. U500/BA Series Amps System Interconnect (230 VAC Off-line Operation) Rev B 620D1273-2 (Sheet 1)

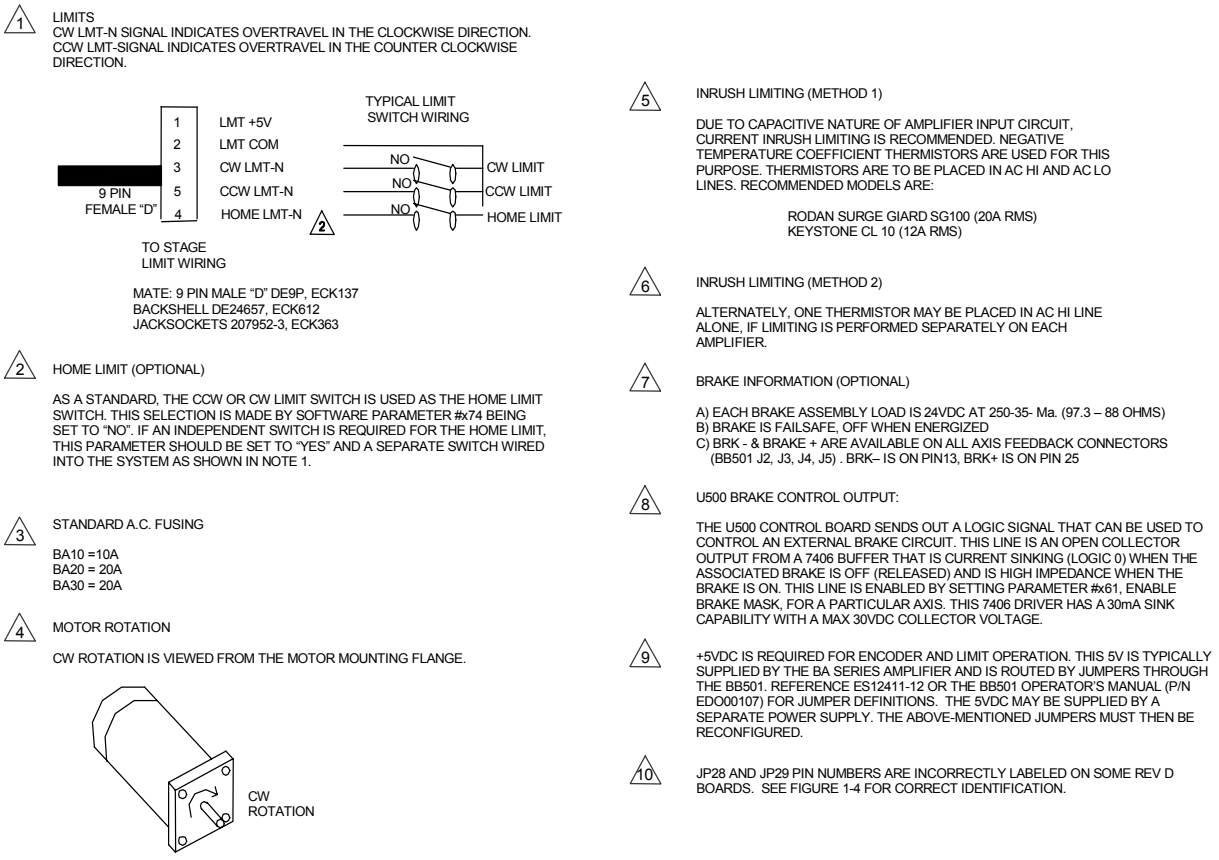


Figure 1-13. U500/BA Series Amps System Interconnect (230 VAC Off-line Operation) Rev B 620D1273-2 (Sheet 2)

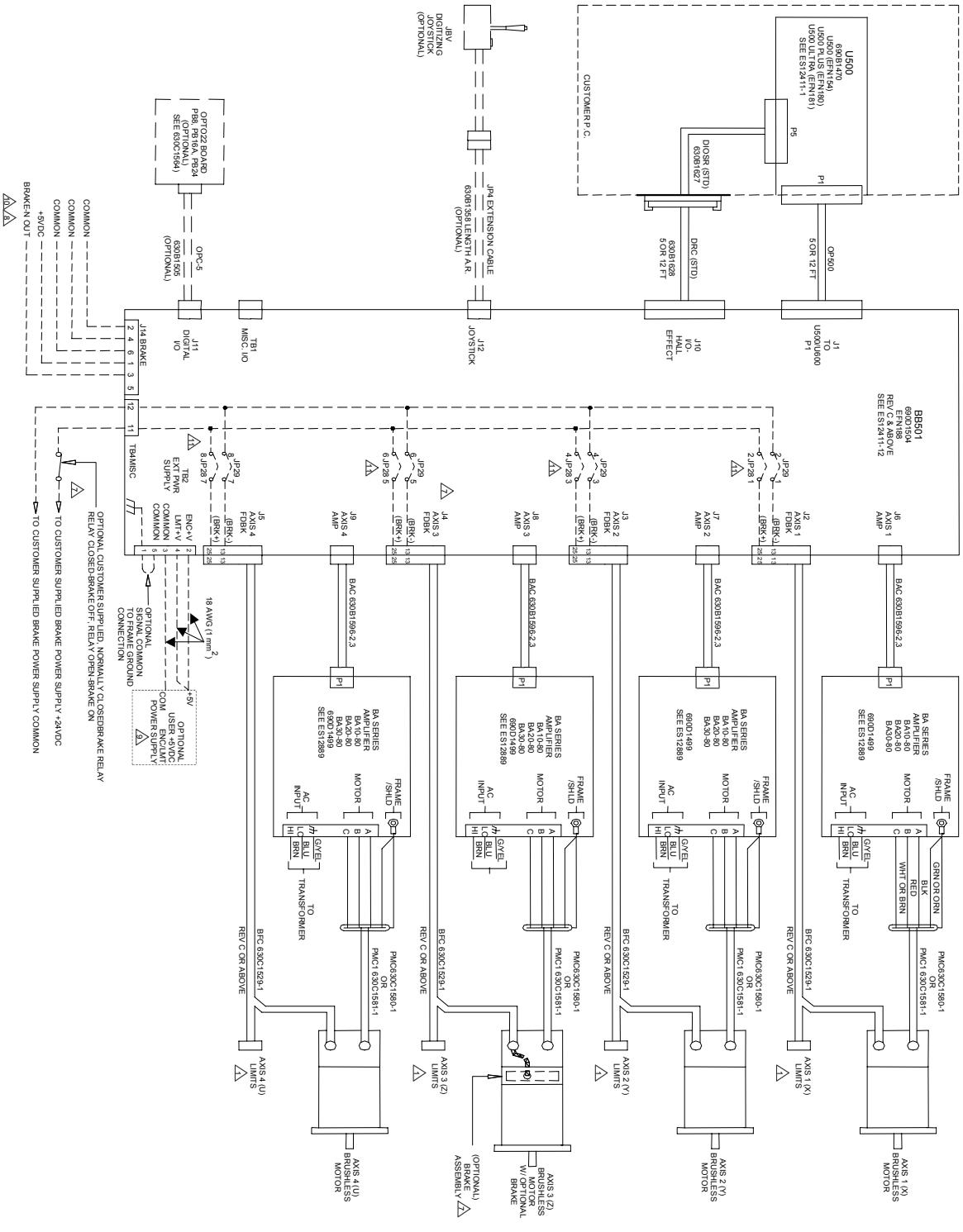


Figure 1-14. U500/BA Series Amps System Interconnect (with Transformer) Rev B 620D1273-3 (Sheet 1)

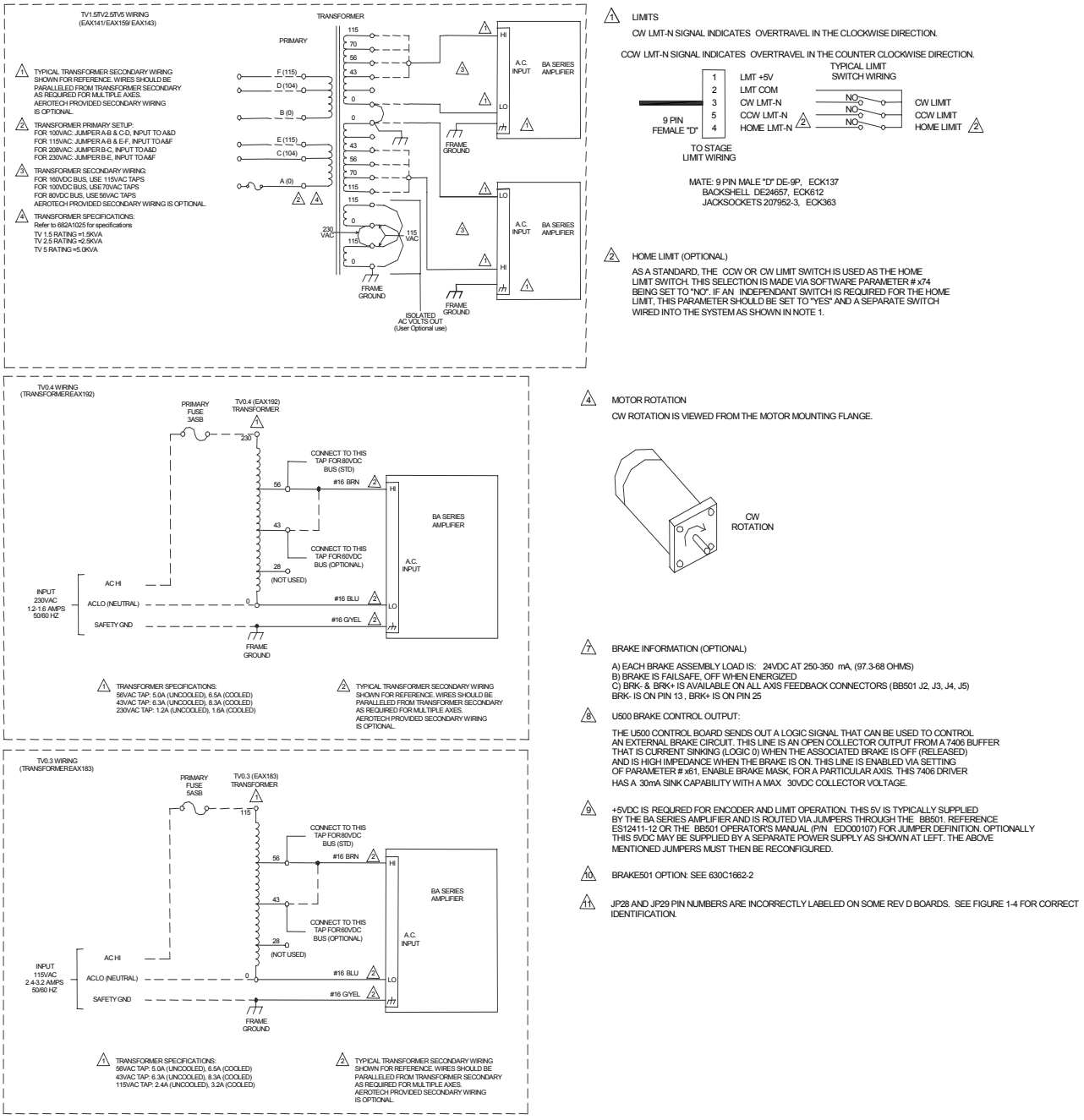


Figure 1-15. U500/BA Series Amps System Interconnect (with Transformer) Rev B 620D1273-3 (Sheet 2)

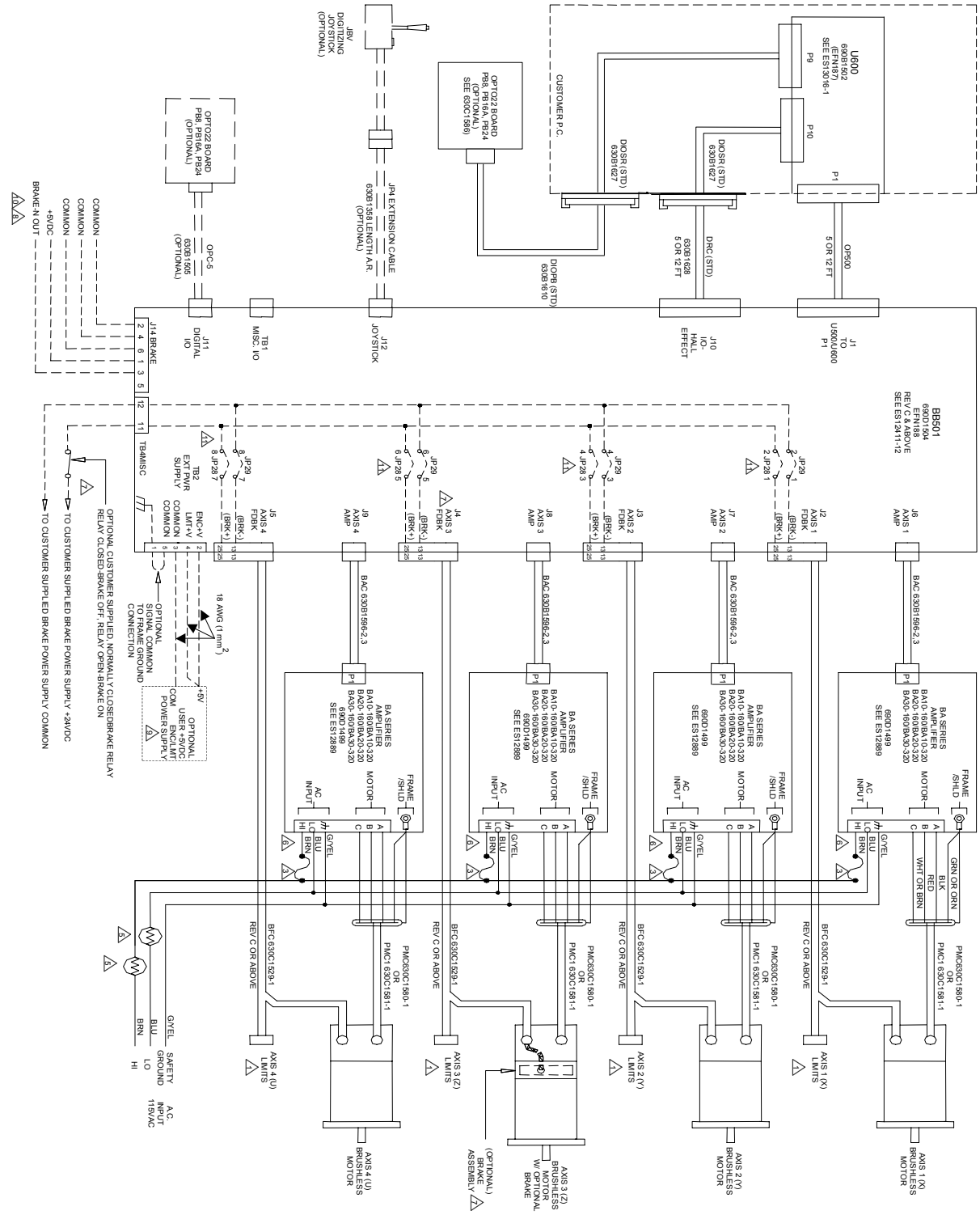
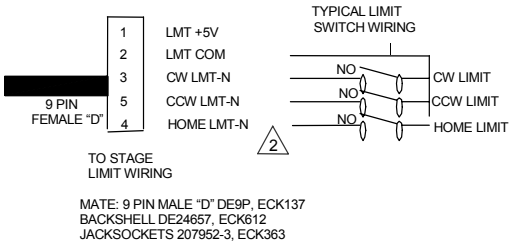


Figure 1-16. U600/BA Series Amps System Interconnect (115 VAC Off-line Operation) Rev B 620D1276-1 (Sheet 1)

△1 LIMITS
CW LMT-N SIGNAL INDICATES OVERTRAVEL IN THE CLOCKWISE DIRECTION. CCW LMT-SIGNAL INDICATES OVERTRAVEL IN THE COUNTER CLOCKWISE DIRECTION.



MATE: 9 PIN MALE "D" DE9P, ECK137
BACKSHELL DE24657, ECK612
JACKSOCKETS 207952-3, ECK363

△2 HOME LIMIT (OPTIONAL)

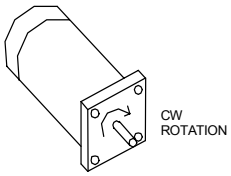
AS A STANDARD, THE CCW OR CW LIMIT SWITCH IS USED AS THE HOME LIMIT SWITCH. THIS SELECTION IS MADE BY SOFTWARE PARAMETER #x74 BEING SET TO "NO". IF AN INDEPENDENT SWITCH IS REQUIRED FOR THE HOME LIMIT, THIS PARAMETER SHOULD BE SET TO "YES" AND A SEPARATE SWITCH WIRED INTO THE SYSTEM AS SHOWN IN NOTE 1.

△3 STANDARD A.C. FUSING

BA10 =10A
BA20 = 20A
BA30 = 20A

△4 MOTOR ROTATION

CW ROTATION IS VIEWED FROM THE MOTOR MOUNTING FLANGE.



△5 INRUSH LIMITING (METHOD 1)

DUE TO CAPACITIVE NATURE OF AMPLIFIER INPUT CIRCUIT, CURRENT INRUSH LIMITING IS RECOMMENDED. NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS ARE USED FOR THIS PURPOSE. THERMISTORS ARE TO BE PLACED IN AC HI AND AC LO LINES. RECOMMENDED MODELS ARE:

RODAN SURGE GIARD SG100 (20A RMS)
KEYSTONE CL 10 (12A RMS)

△6 INRUSH LIMITING (METHOD 2)

ALTERNATELY, ONE THERMISTOR MAY BE PLACED IN AC HI LINE ALONE, IF LIMITING IS PERFORMED SEPARATELY ON EACH AMPLIFIER.

△7 BRAKE INFORMATION (OPTIONAL)

A) EACH BRAKE ASSEMBLY LOAD IS 24VDC AT 250-35- Ma. (97.3 – 88 OHMS)
B) BRAKE IS FAILSAFE, OFF WHEN ENERGIZED
C) BRK - & BRAKE + ARE AVAILABLE ON ALL AXIS FEEDBACK CONNECTORS (BB501 J2, J3, J4, J5) . BRK– IS ON PIN13, BRK+ IS ON PIN 25

△8 U600 BRAKE CONTROL OUTPUT:

THE U500 CONTROL BOARD SENDS OUT A LOGIC SIGNAL THAT CAN BE USED TO CONTROL AN EXTERNAL BRAKE CIRCUIT. THIS LINE IS AN OPEN COLLECTOR OUTPUT FROM A 7407 BUFFER THAT IS CURRENT SINKING (LOGIC 0) WHEN THE ASSOCIATED BRAKE IS OFF (RELEASED) AND IS HIGH IMPEDANCE WHEN THE BRAKE IS ON. THIS LINE IS ENABLED BY SETTING OF THE BRAKE MASK IN THE IN THE AXIS PARAMETERS. THIS 7407 DRIVER HAS A 30mA SINK CAPABILITY WITH A MAX 30VDC COLLECTOR VOLTAGE.

△9 +5VDC IS REQUIRED FOR ENCODER AND LIMIT OPERATION. THIS 5V IS TYPICALLY SUPPLIED BY THE BA SERIES AMPLIFIER AND IS ROUTED BY JUMPERS THROUGH THE BB501. REFERENCE ES12411-12 OR THE BB501 OPERATOR'S MANUAL (P/N EDO00107) FOR JUMPER DEFINITIONS. THE 5VDC MAY BE SUPPLIED BY A SEPARATE POWER SUPPLY. THE ABOVE-MENTIONED JUMPERS MUST THEN BE RECONFIGURED.

△10 BRAKE501 OPTION: SEE 630C1662-2

△11 JP28 AND JP29 PIN NUMBERS ARE INCORRECTLY LABELED ON SOME REV D BOARDS. SEE FIGURE 1-4 FOR CORRECT IDENTIFICATION.

Figure 1-17. U600/BA Series Amps System Interconnect (115 VAC Off-line Operation) Rev B 620D1276-1 (Sheet 2)

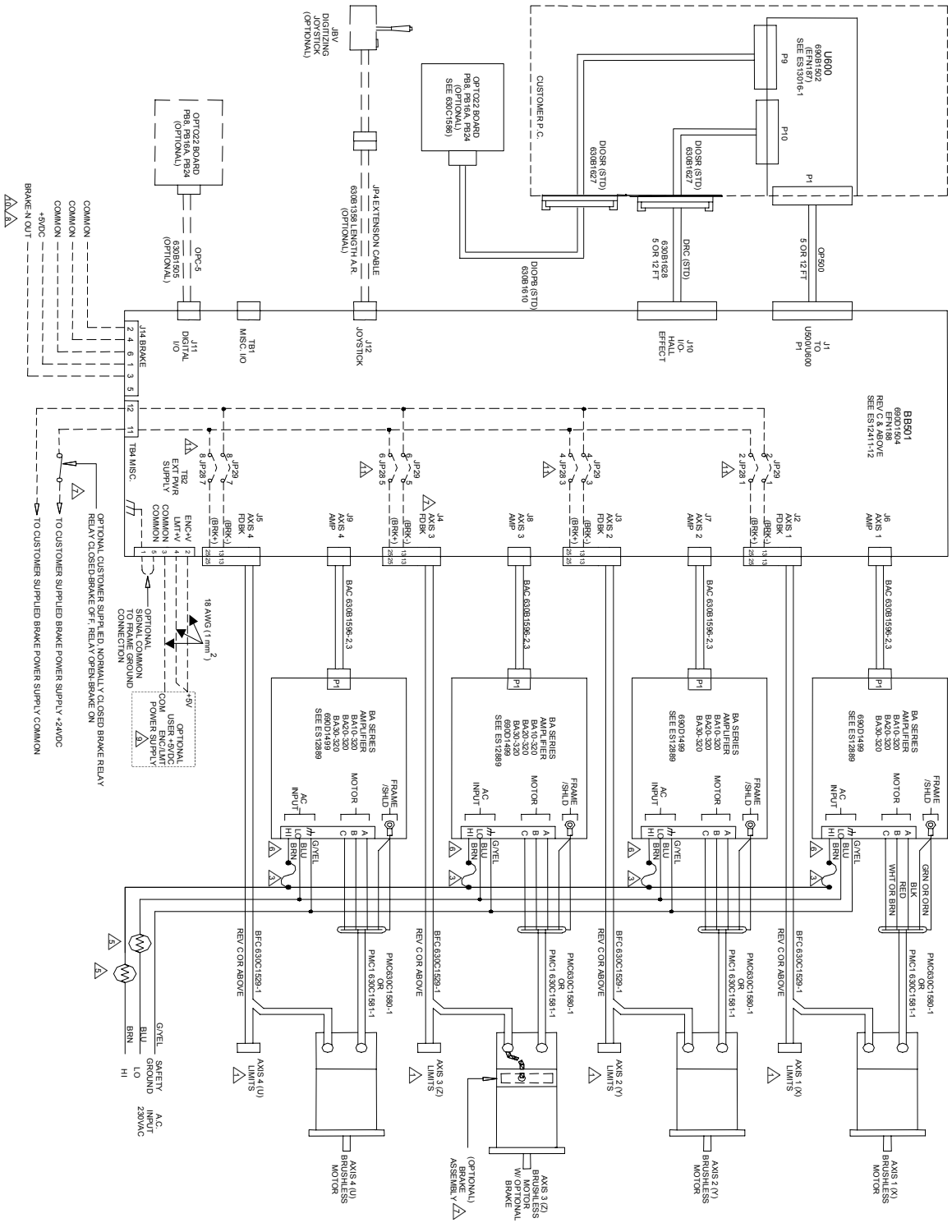


Figure 1-18. U600/BA Series Amps System Interconnect (230 VAC Off-line Operation) Rev B 620D1276-2 (Sheet 1)

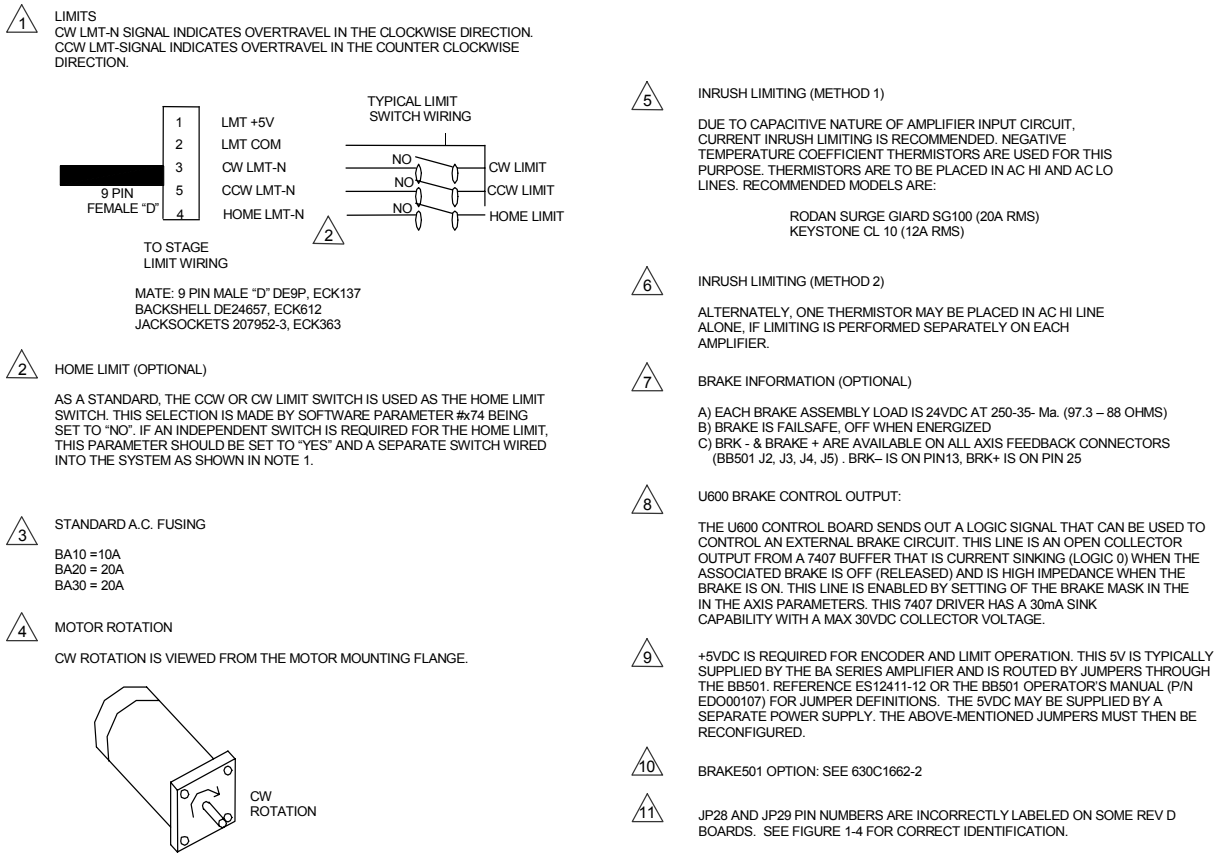


Figure 1-19. U600/BA Series Amps System Interconnect (230 VAC Off-line Operation) Rev B 620D1276-2 (Sheet 2)

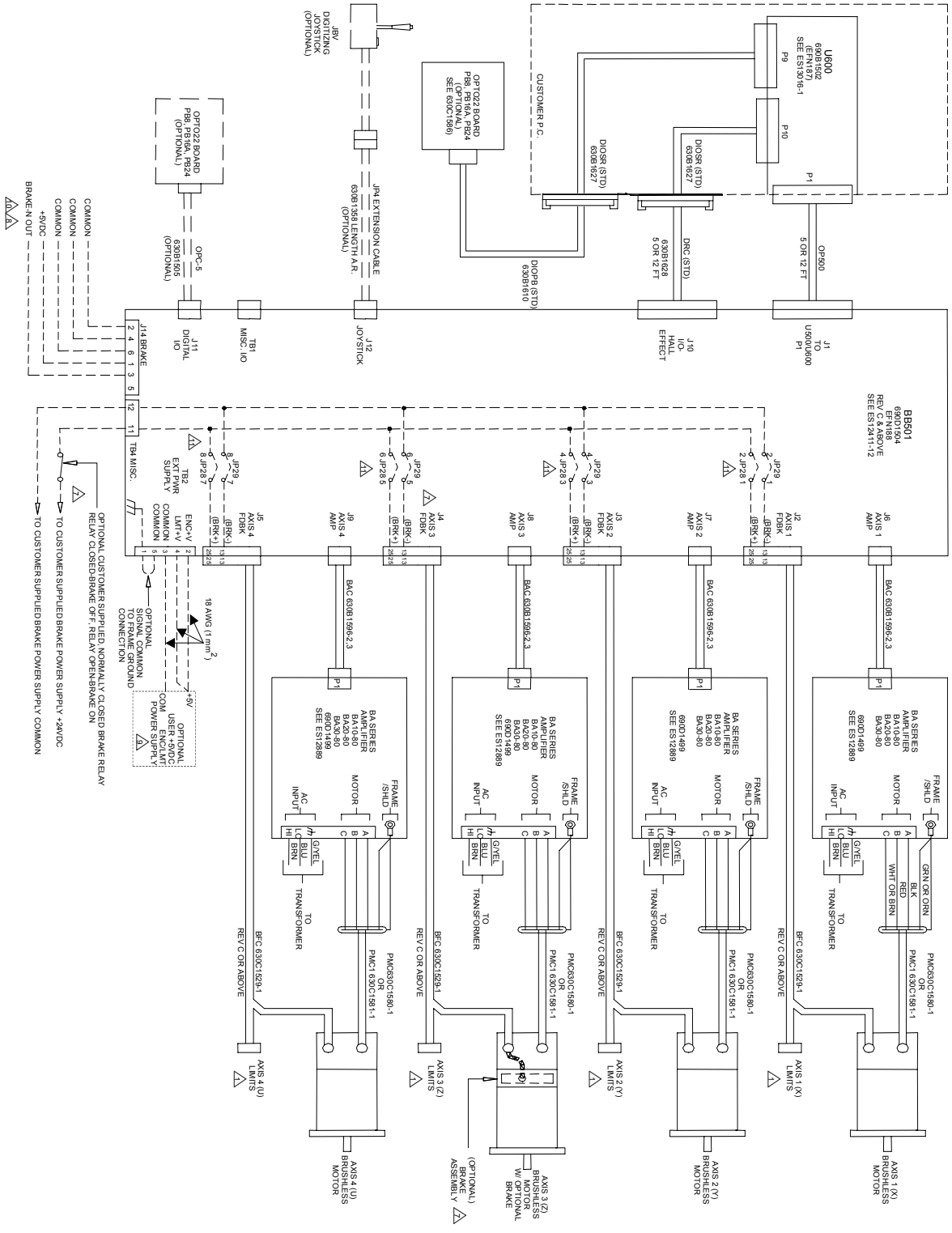


Figure 1-20. U600/BA Series Amps System Interconnect (with TV.03/TV.04 Transformer) Rev B 620D1276-3 (Sheet 1)

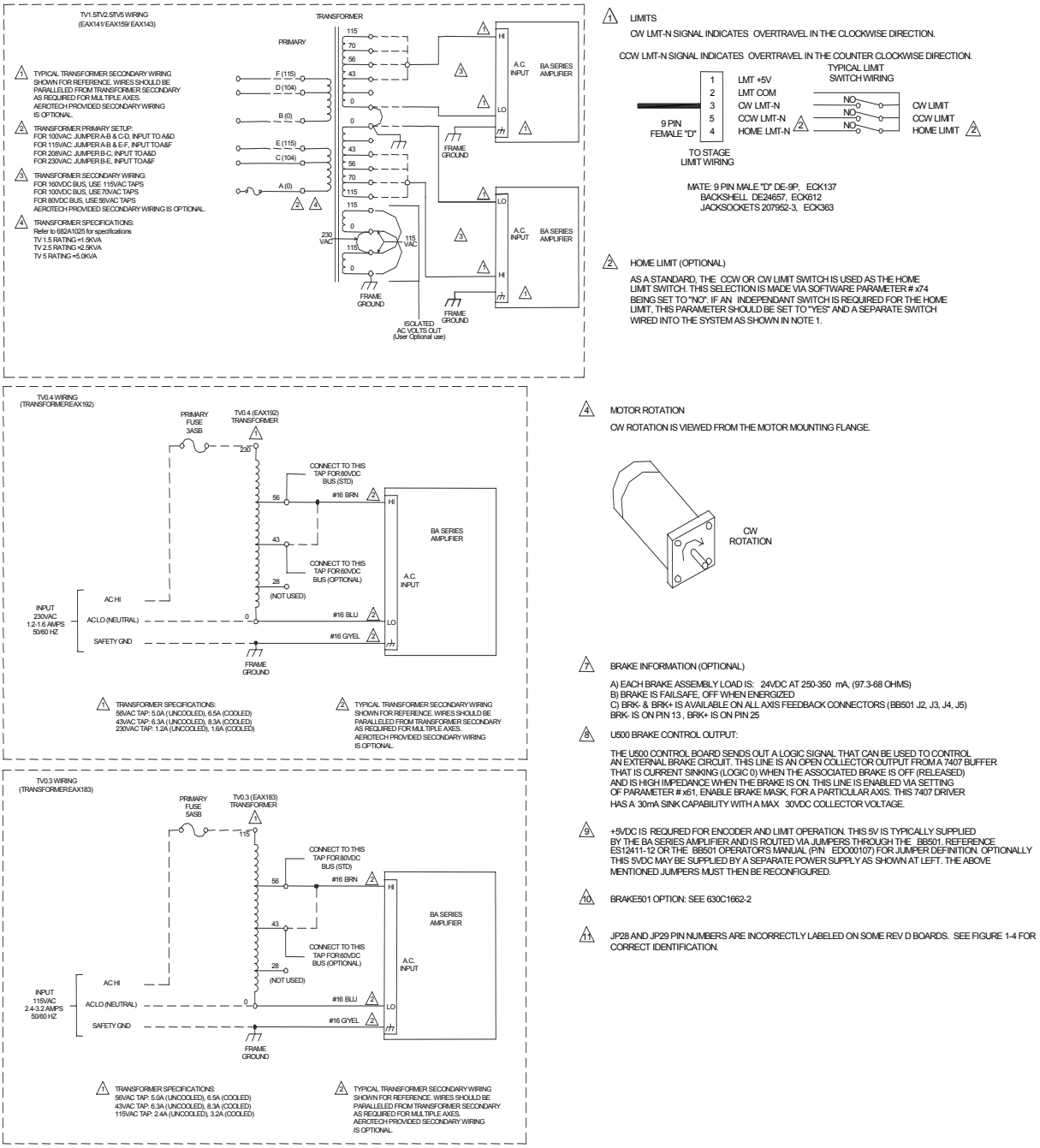


Figure 1-21. U600/BA Series Amps System Interconnect (with TV.03/TV.04 Transformer) Rev B 620D1276-3 (Sheet 2)

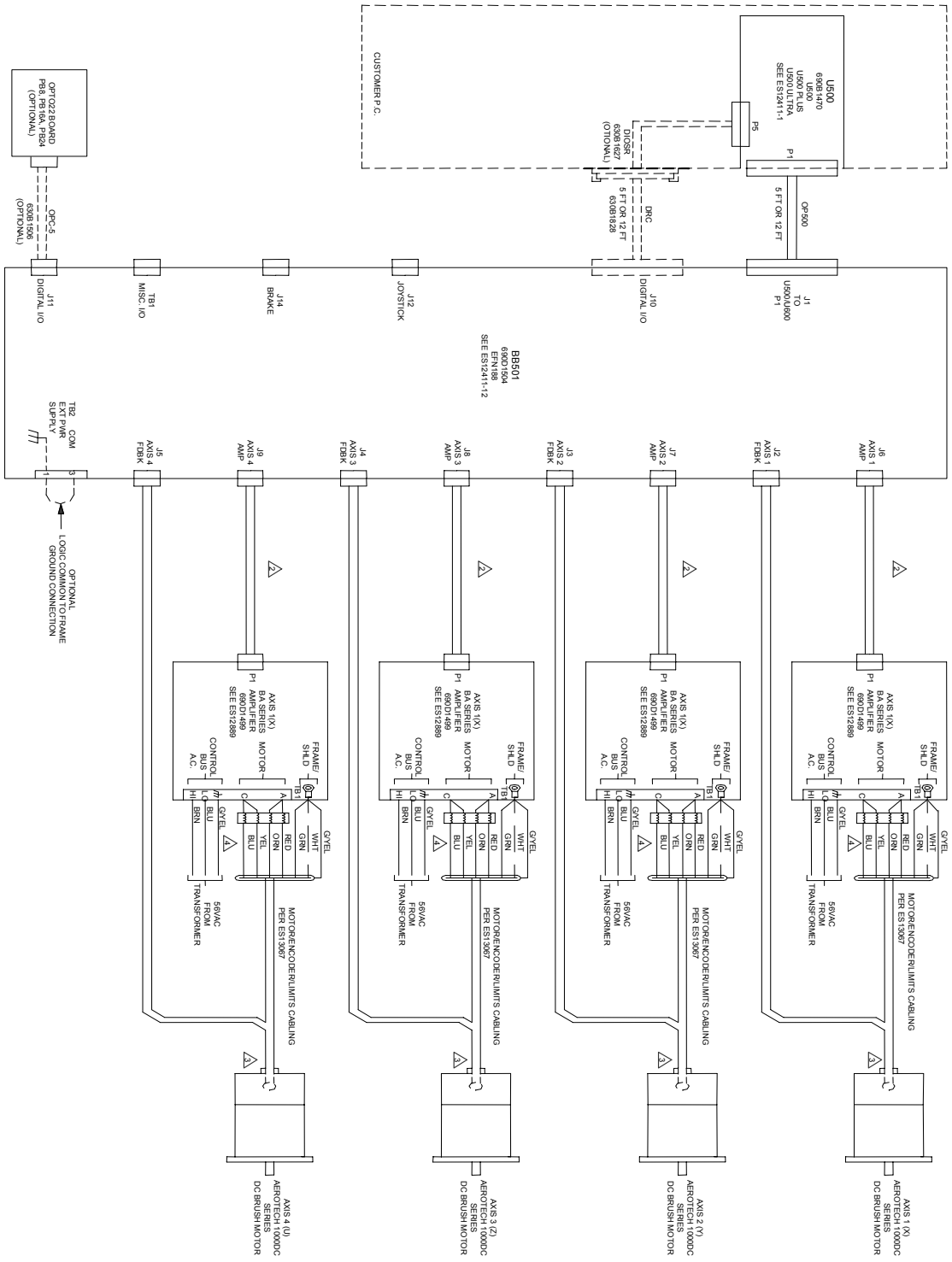
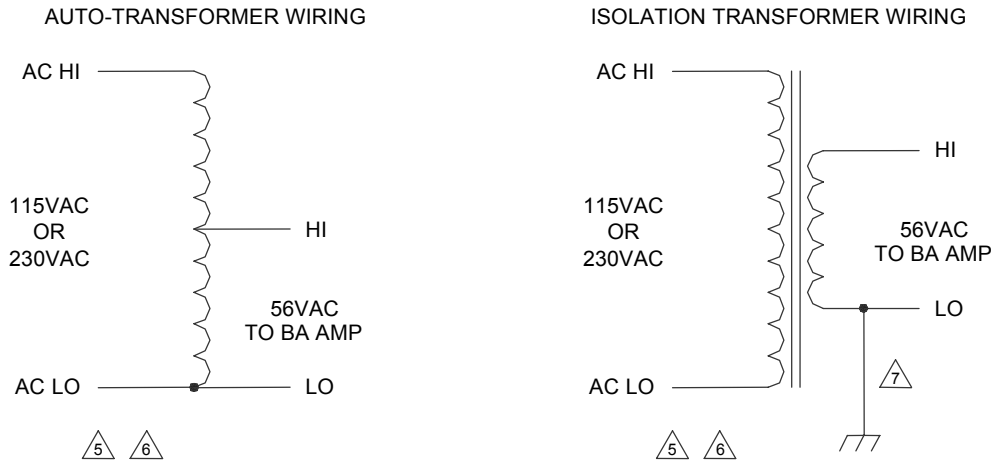
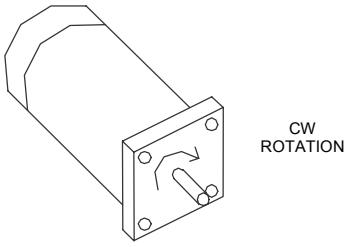


Figure 1-22. U500/BB501/BA Amps System with DC Brush Motors, Rev A 620D1285-1 (Sheet 1)



△1 MOTOR ROTATION

CW ROTATION IS VIEWED FROM THE MOTOR MOUNTING FLANGE.



△2 FOR CURRENT COMMAND OPERATION (NO TACHOMETER)
BAC4 CABLE (630B1596-4) MUST BE USED
FOR VELOCITY COMMAND OPERATION (WITH TACHOMETER)
BAC5 CABLE (630B1596-5) MUST BE USED

△3 MOTOR/ENCODER/LIMITS CABLE CAN BE INTEGRAL
TO MOTOR OR A DISCRETE CABLE

△4 12 TURNS OF EACH MOTOR WIRE THROUGH TOROID
FERROXCUBE 500T600-3C81 (ECZ280)

△5 APPROPRIATE TRANSFORMER MUST BE SELECTED FOR USE
WITH 115VAC OR230VAC LINE

△6 TRANSFORMER MUST BE CAPABLE OF CONTINUOUS OUTPUT
CURRENT OF MOTOR PER AXIS BEING SUPPLIED

△7 WHEN USING AN ISOLATION TRANSFORMER, EARTH GROUNDING
"LO" OUTPUT TAP (INPUT OF BA AMP) REDUCES ELECTRICAL
AND AUDIBLE NOISE EMISSIONS AND PROVIDES INCREASED
SERVO PERFORMANCE

Figure 1-23. U500/BB501/BA Amps System with DC Brush Motors, Rev A 620D1285-1 (Sheet 2)

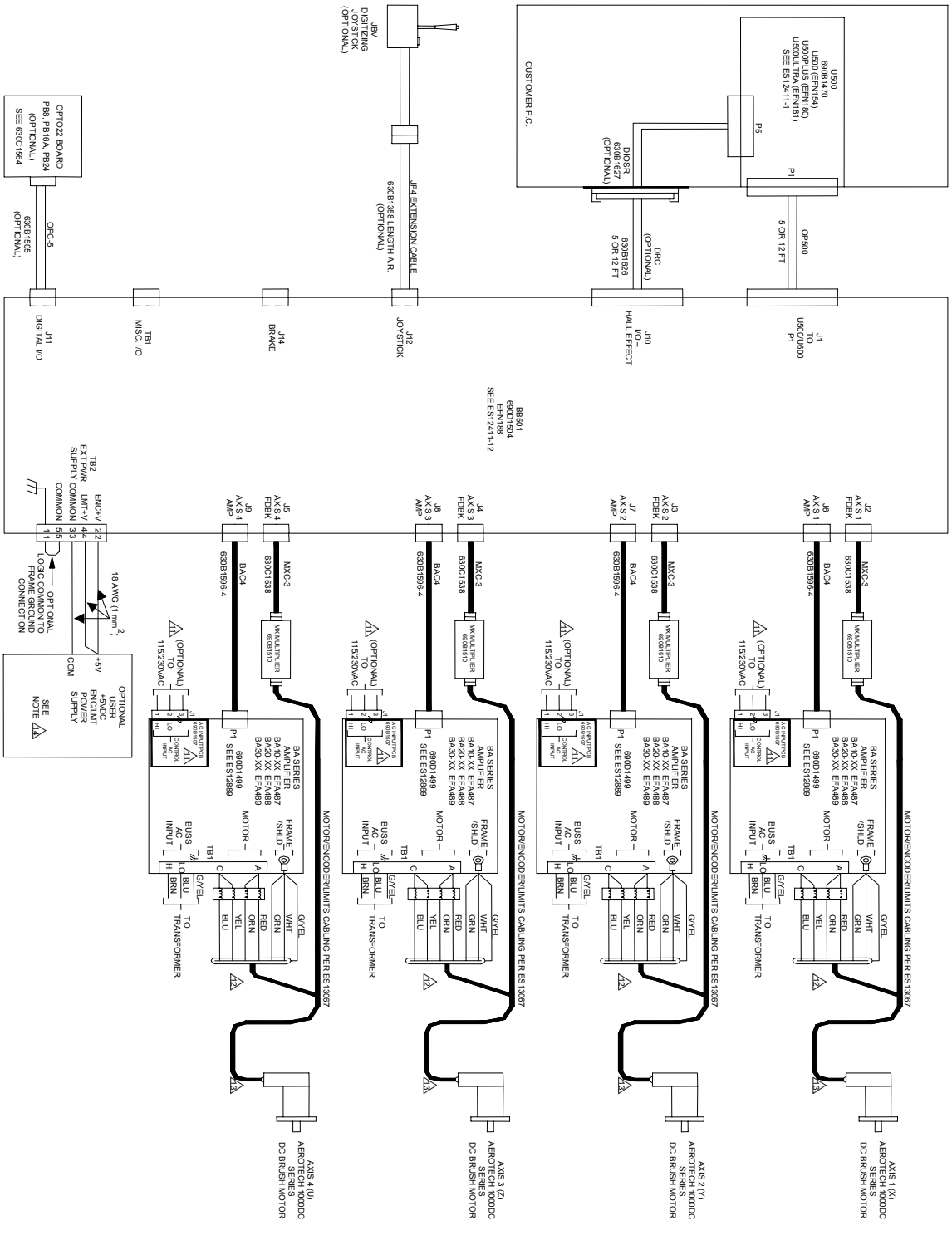
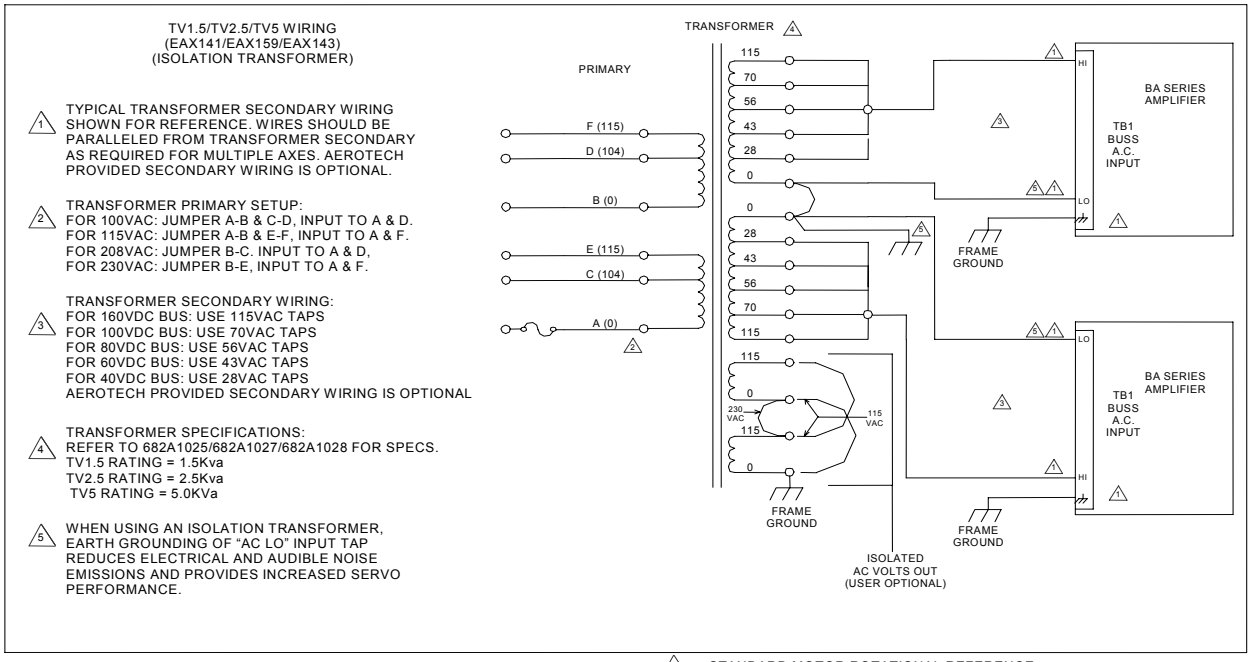
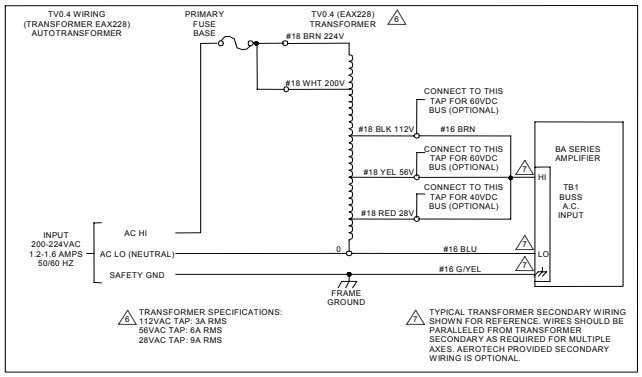
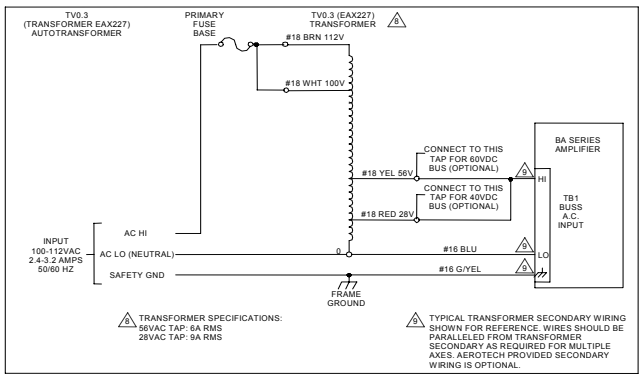


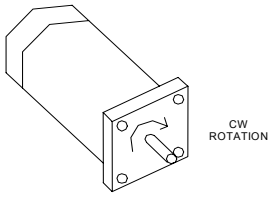
Figure 1-24. U500/BA Series Amps Brush System Interconnect, Rev A 620D1285-2 (Sheet 1)







10 STANDARD MOTOR ROTATIONAL REFERENCE CW ROTATION IS VIEWED FROM THE MOTOR MOUNTING FLANGE.



11 OPTIONAL BA SERIES CONTROL AC INPUT PCB. FOR USE WHEN BUSS VOLTAGE IS BELOW 80VDC. REFER TO ES13063, SHEETS 1 TO 3. AC INPUT TO BOARD IS 115VAC OR 230VAC.

12 12 TURNS OF EACH MOTOR WIRE THROUGH TOROID FERROXCUBE 500T600-3C81 (ECZ00280)

13 MOTOR/ENCODER/LIMITS CABLE CAN BE INTEGRAL TO MOTOR OR A DISCRETE CABLE.

14 +5VDC IS REQUIRED FOR ENCODER AND LIMIT OPERATION. THIS 5V TYPICALLY COMES FROM THE BA SERIES POWER AMPLIFIER AND IS ROUTED VIA JUMPERS THROUGH BB501 BREAKOUT BOARD (REFERENCE ES12411-12 OR THE BB501 OPERATOR'S MANUAL, EDO107, FOR JUMPER DEFINITION). OPTIONALLY, THIS 5VDC MAY COME FROM A SEPARATE POWER SUPPLY (USER PROVIDED). TO UTILIZE THIS SEPARATE SUPPLY, JUMPERS JP5, 6, 9, 10, 13, 14, 17, AND 18 MUST BE RECONFIGURED ON THE BB501 BOARD.

Figure 1-25. U500/BA Series Amps Brush System Interconnect, Rev A 620D1285-2 (Sheet 2)

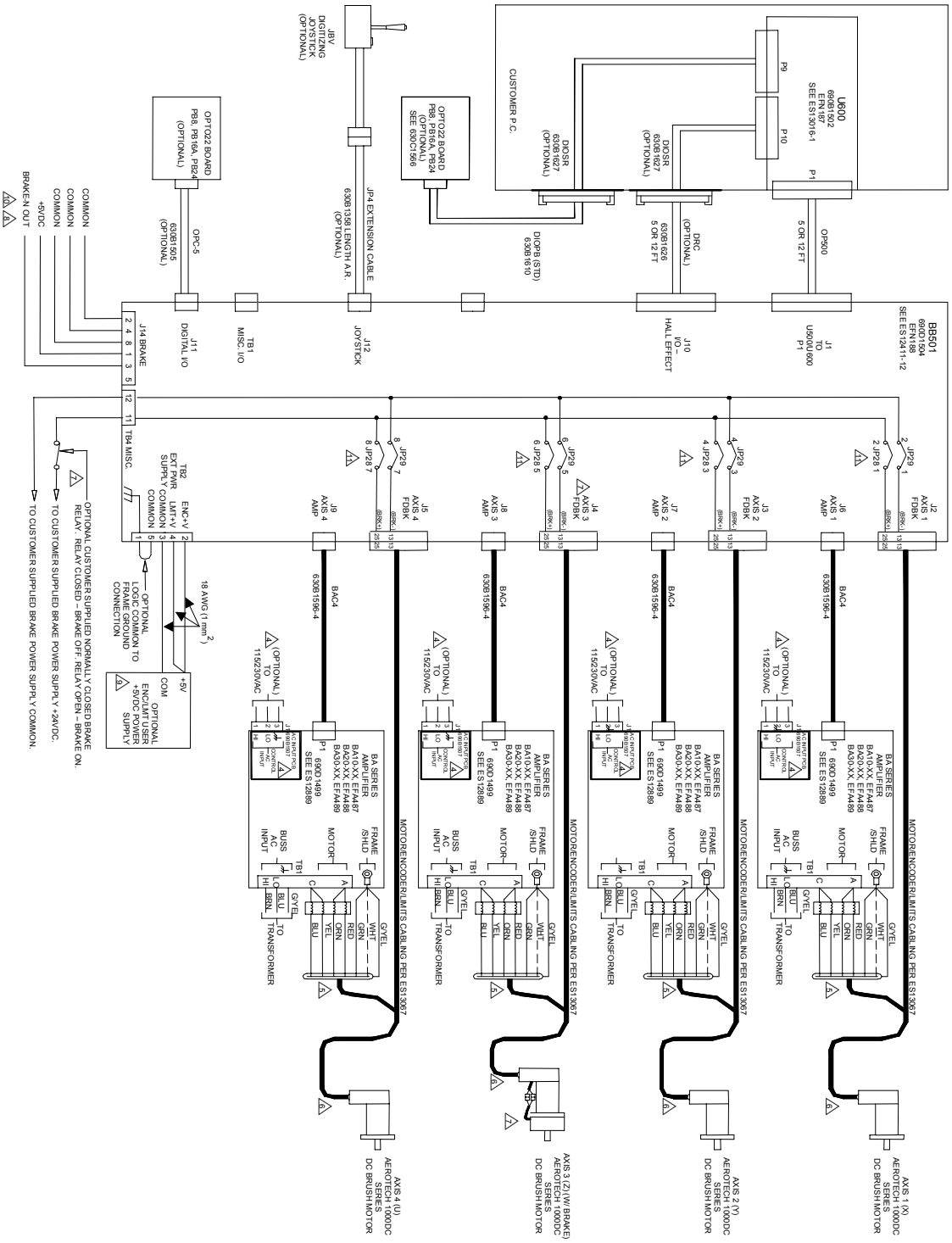
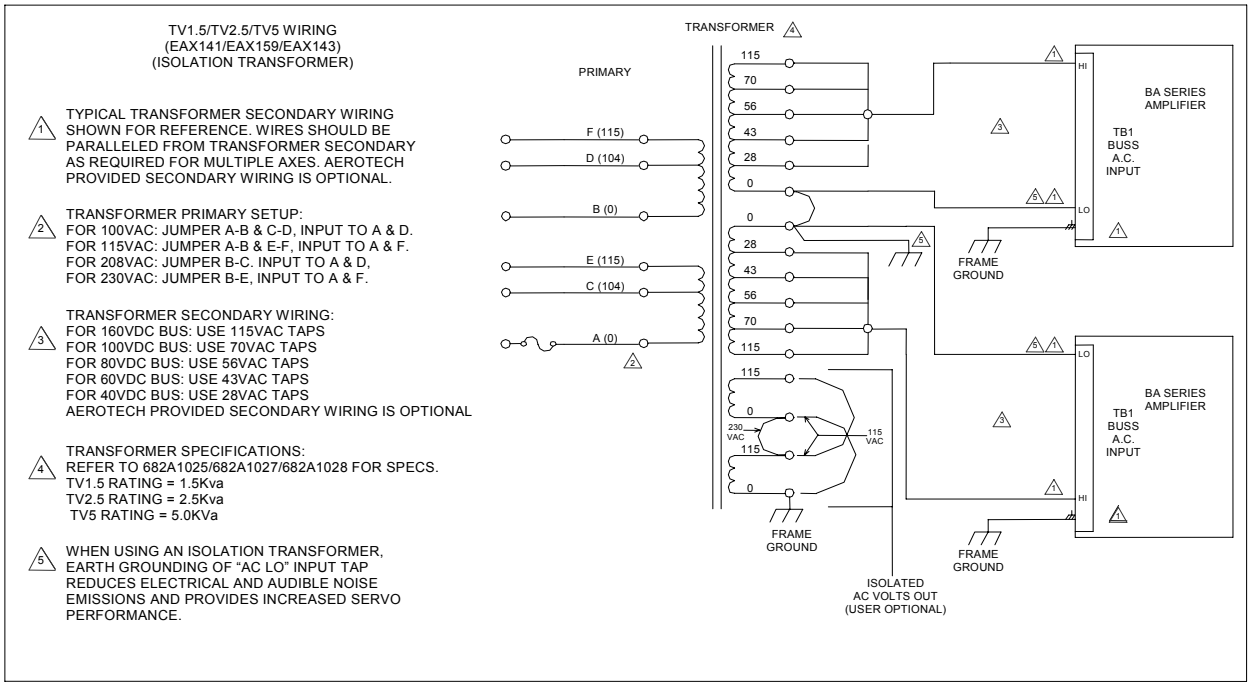


Figure 1-26. U600/BA Series Amps Brush System Interconnect (with Transformer) Rev O 620D1301-1 (Sheet 1)



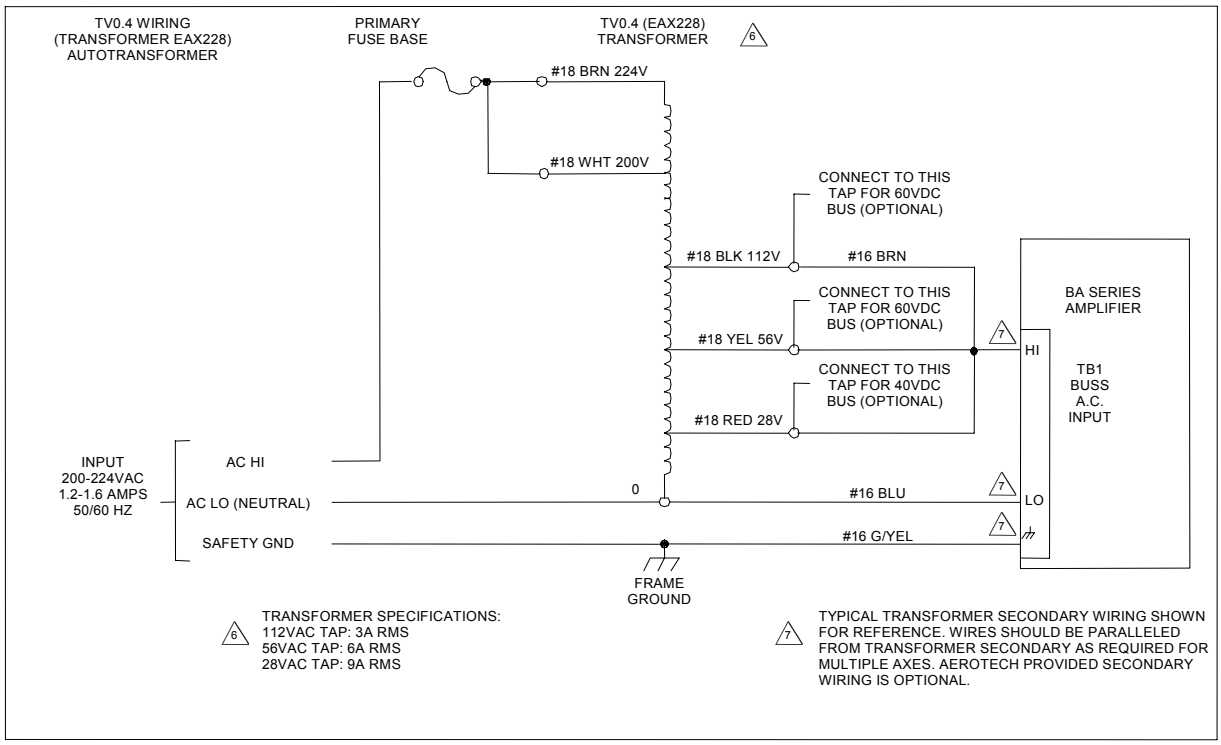
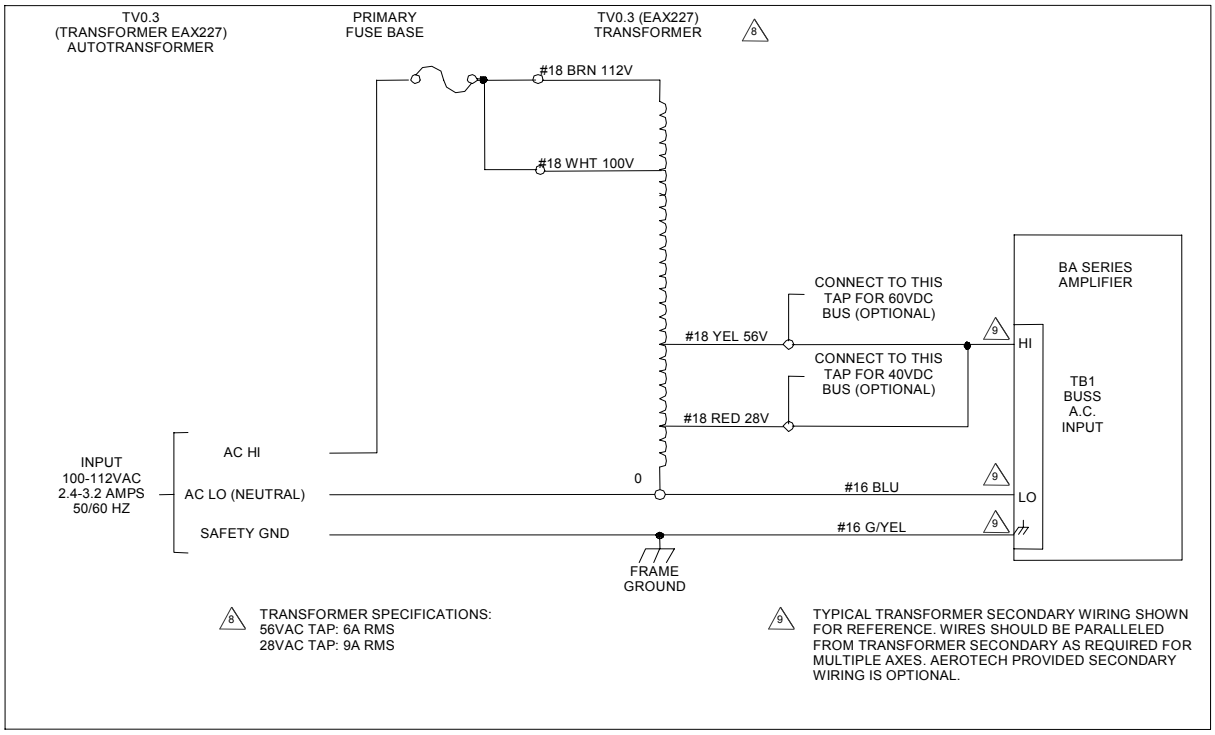
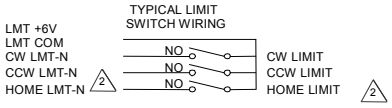


Figure 1-27. U600/BA Series Amps Brush System Interconnect (with Transformer) Rev O 620D1301-1 (Sheet 2)

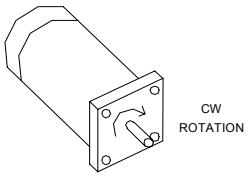


1 LIMITS
CW LMT-N SIGNAL INDICATES OVERTRAVEL IN THE CLOCKWISE DIRECTION.
CCW LMT-N SIGNAL INDICATES OVERTRAVEL IN THE COUNTER CLOCKWISE DIRECTION.



2 HOME LIMITS (OPTIONAL)
ALL AEROTECH CONTROLS ARE CONFIGURED TO ACCEPT HOME LIMIT INPUTS. THIS MAY COME FROM AN INDEPENDENT SWITCH (CAM OPTION ON ROTARY STAGES) OR BE PARALLELED FROM THE CCW (STANDARD) OR CW (OPTIONAL) LIMIT SWITCHES (ON LINEAR STAGES.

3 STANDARD MOTOR ROTATIONAL REFERENCE
CW ROTATION IS VIEWED FROM THE MOTOR MOUNTING FLANGE.



4 OPTIONAL BA SERIES CONTROL AC INPUT PCB.
FOR USE WHEN BUSS VOLTAGE IS BELOW 80VDC.
REFER TO ES13063, SHEETS 1 TO 3
AC INPUT TO BOARD IS 115VAC OR 230VAC.

5 12 TURNS OF EACH MOTOR WIRE THROUGH TOROID FERROXCUBE 500T600-3C81 (ECZ00280)

6 MOTOR/ENCODER/LIMITS CABLE CAN BE INTEGRAL TO MOTOR OR A DISCRETE CABLE

7 BRAKE INFORMATION (OPTIONAL)
A). EACH BRAKE ASSEMBLY LOAD IS: 24VDC AT 250 – 350 mA, (97.3 – 68 OHMS)
B). BRAKE IS FAILSAFE, OFF WHEN ENERGIZED.
C). BRK - & BRK + IS AVAILABLE ON ALL AXIS FEEDBACK CONNECTORS (BB501 J2, J3, J4, J6). BRK- IS ON PIN 13, BRK + IS ON PIN 25.

8 U600 BRAKE CONTROL OUTPUT
THE U600 CONTROL BOARD SENDS OUT A LOGIC SIGNAL THAT CAN BE USED TO CONTROL AN EXTERNAL BRAKE CIRCUIT. THIS LINE IS AN OPEN COLLECTOR OUTPUT FROM A 7407 BUFFER THAT IS CURRENT SINKING (LOGIC 0) WHEN THE ASSOCIATED BRAKE IS OFF (RELEASED) AND IS HIGH IMPEDANCE WHEN THE BRAKE IS ON. THIS LINE IS ENABLED BY SETTING THE BRAKE MASK IN THE AXIS PARAMETERS. THIS 7407 DRIVER HAS A 30mA SINK CAPABILITY WITH A MAX 30VDC COLLECTOR VOLTAGE.

9 +5VDC IS REQUIRED FOR ENCODER AND LIMIT OPERATION. THIS 5V IS TYPICALLY SUPPLIED BY THE BA SERIES AMPLIFIER AND IS ROUTED BY JUMPERS THROUGH THE BB501. REFERENCE ES12411-12 OR THE BB501 OPERATOR'S MANUAL (P/N EDO00107) FOR JUMPER DEFINITIONS. THIS 5VDC MAY BE SUPPLIED BY A SEPARATE POWER SUPPLY AS SHOWN AT LEFT. THE ABOVE-MENTIONED JUMPERS MUST THEN BE RECONFIGURED.

10 BRAKE500 OPTION: SEE 630C1662-2

11 JP28 AND JP29 PIN NUMBERS ARE INCORRECTLY LABELED ON SOME REV D BOARDS. SEE FIGURE 1-4 FOR CORRECT IDENTIFICATION.

Figure 1-28. U600/BA Series Amps Brush System Interconnect (with Transformer) Rev O 620D1301-1 (Sheet 3)

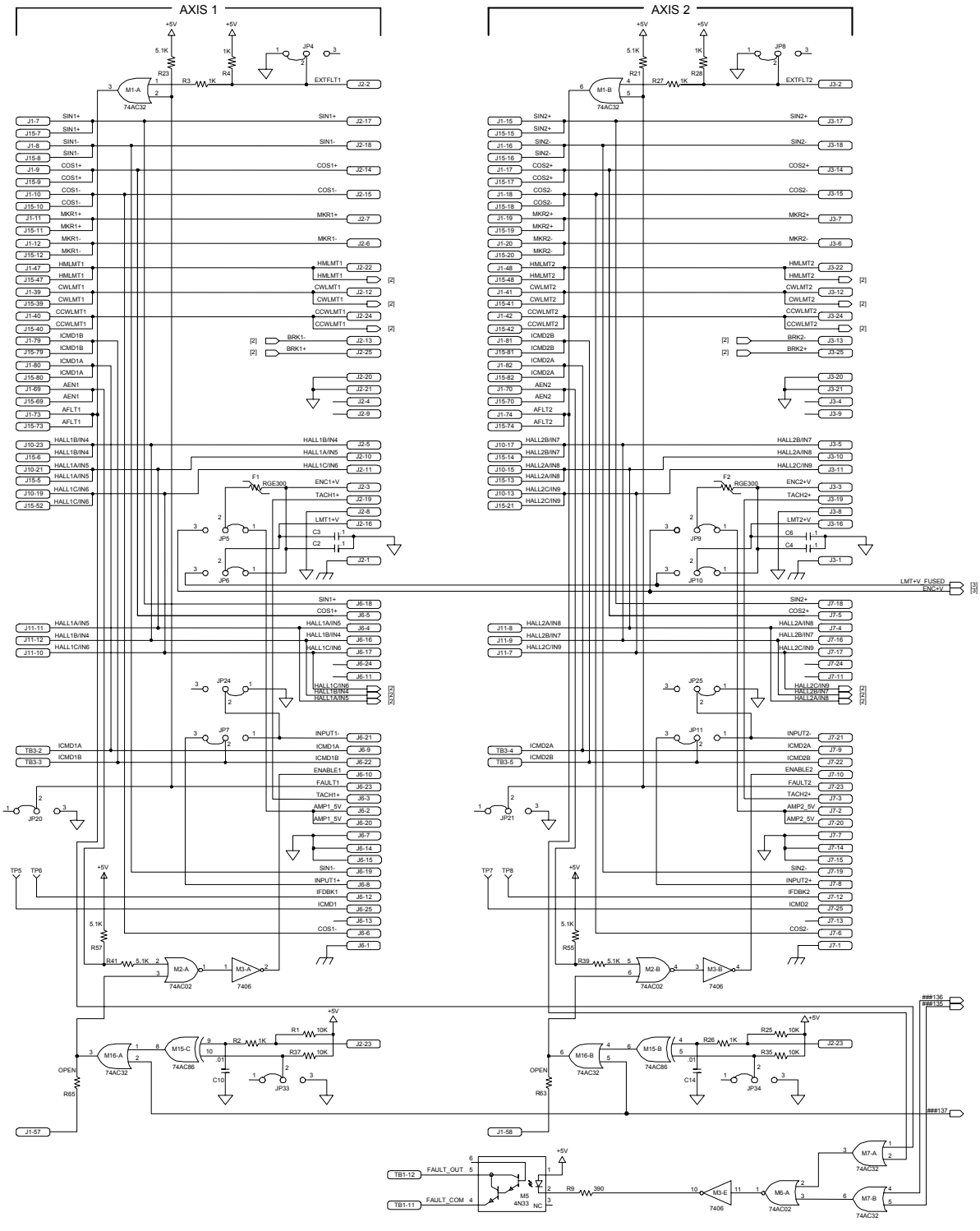


Figure 1-29. BB501 Interface Board Schematic Rev D 690D1504 (Sheet 1)

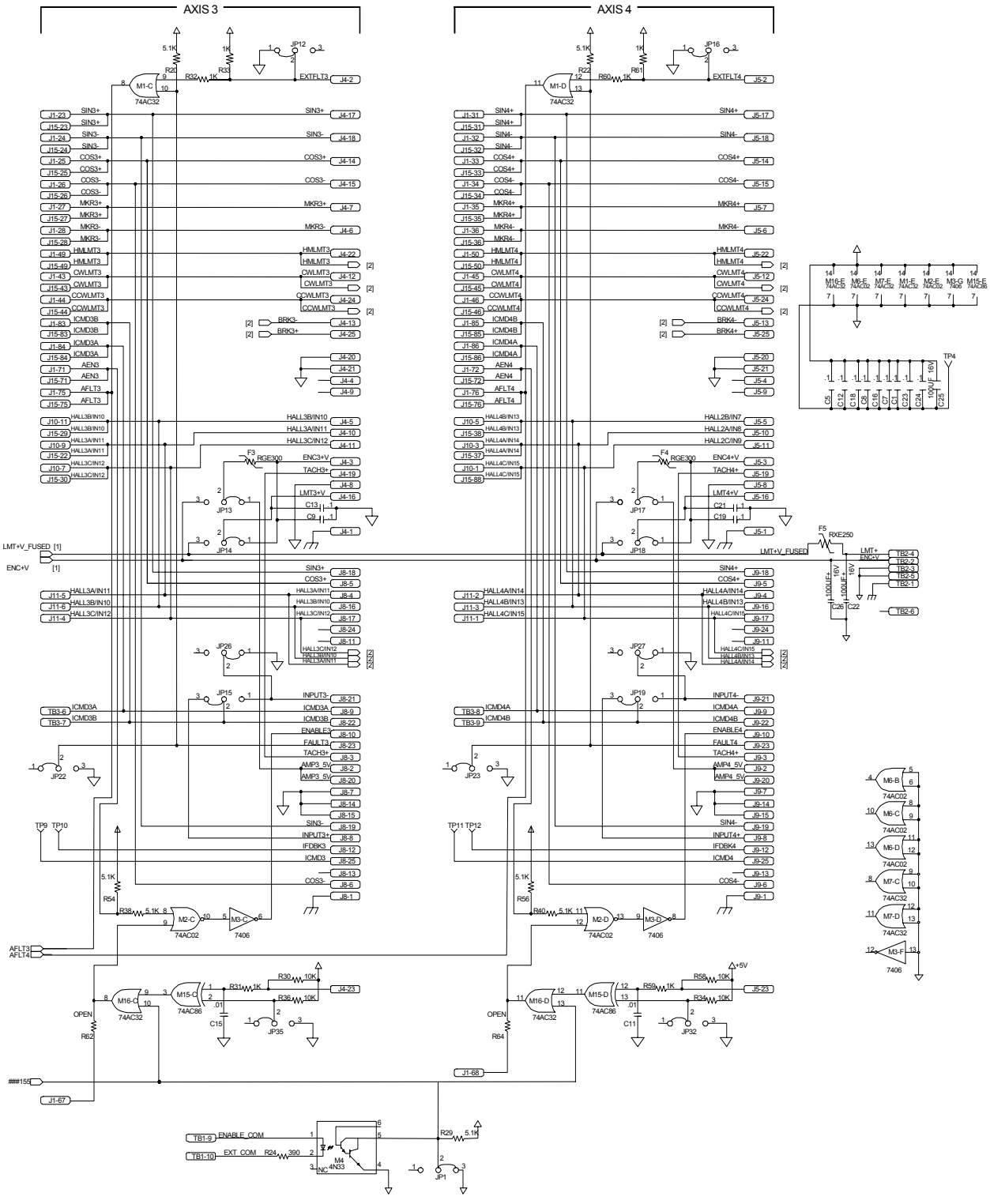


Figure 1-30. BB501 Interface Board Schematic Rev D 690D1504 (Sheet 2)

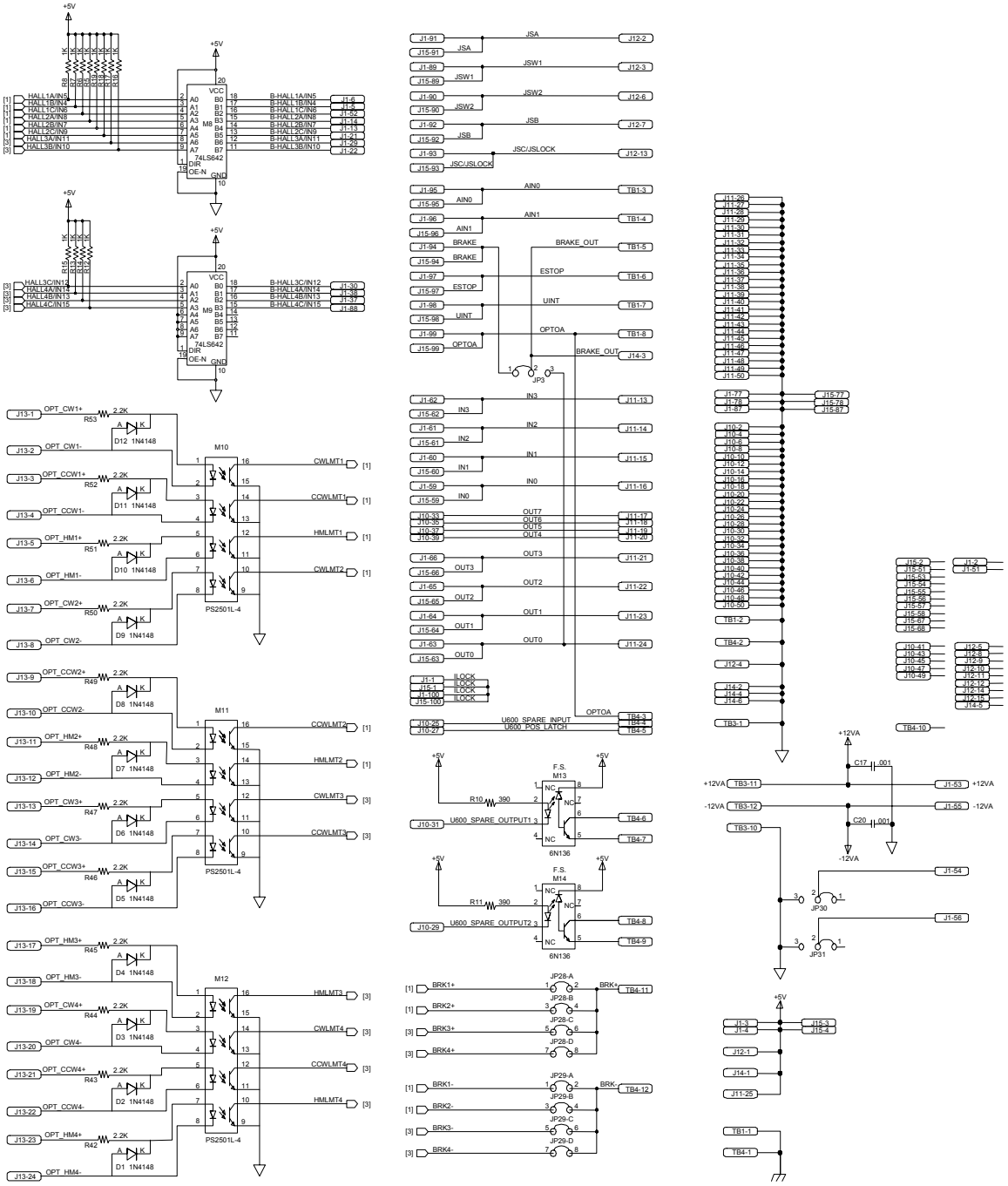


Figure 1-31. BB501 Interface Board Schematic Rev D 690D1504 (Sheet 3)

1.10. Troubleshooting and Technical Support

1.10.1. Common Problems and Causes

Table 1-17 lists some common problems and possible causes.

Table 1-17. Problems and Causes

Problem	Possible Cause/Solution
Axis Fault	Axis 1: JP4, JP20, AMP Fault (J6-23) Axis 2: JP8, JP21, AMP Fault (J7-23) Axis 3: JP12, JP22, AMP Fault (J8-23) Axis 4: JP16, JP23, AMP Fault (J9-23)
Encoder not working	Check encoder +5 volt supply and encoder supply jumpers (JP5, JP9, JP13, and JP17).
Limits not working	Check limit +5 volt supply and limit supply jumpers (JP6, JP10, JP14, and JP18).
Motor will not run or fault error occurs	Check encoder feedback, Hall feedback, and fault input. Also, check ICMD and input jumpers (JP7, JP11, JP15, JP19, JP24, JP25, JP26, and JP27).
External enable not working	Check wiring of external enable. See external enable opto circuit example (Figure 1-5). JP1 should be in position 1-2 for external operation. Opto input is enabled when current flows through opto diode.
Fault out does not work	Check wiring of fault out circuit. See the example of fault out, Figure 1-6.
Brake does not work	Check brake control selector jumper (JP3). Check external brake wiring. Verify brake voltage present at TB4-11 and TB4-12. Examine settings of the brake axis jumpers (JP28 and JP29). Check axis brake outputs on pins 13 and 25 of J2, J3, J4, and J5 - if selected.

1.10.2. +5 Volt Supply

The BB501 board requires and distributes +5 volts for system operation. If the +5 volt source is not capable of providing the required current, axis motion will be unreliable. Using a multimeter, place the common lead on TP4 and check the +5 volt supply at pin 2 of jumpers JP5, JP6, JP9, JP10, JP13, JP14, JP17, and JP18. The +5 volt supply should be between 4.9 and 5.25 volts.

> Do not remove jumper, make check from bottom side of board.

The on board logic receives power from the U500/U600 control board through J1, pins 3 and 4. Check the +5 volt signal at J14, pin 1 (brake connector). If the +5 volt signal is not there, check for blown fuse on the U500/U600 control board.

Check jumpers JP1, JP4, JP8, JP12, and JP16. Set default positions to troubleshoot.

1.10.3. Connectors

Verify that connectors are fully inserted and plugged into the correct sockets. Ensure that connector hold-in screws are tightened to prevent connectors from pulling out of sockets.

1.10.4. Technical Support

If you have technical support questions, please have the following information available before calling:

1. The current version of the Aerotech controller operating software.
2. Your customer order number. If you have purchased a product from Aerotech this number will be in the upper left hand corner on a system serial tag.
3. We may also need to know the type of PC you are using (brand name, CPU, available memory), the current version of the operating system, and the contents of your AUTOEXEC.BAT and CONFIG.SYS files.
4. If you are developing your own application, we will need to know what compiler and version number you are using (e.g., Borland C v3.1, Microsoft Visual C, etc.).
5. If at all possible, try to be in front of the system where the problems are occurring.

> Above information may be needed if software related problems are suspected.

∇ ∇ ∇

APPENDIX A: GLOSSARY OF TERMS

In This Section:

- Glossary A-1

Abbe Error — The positioning error resulting from angular motion and an offset between the measuring device and the point of interest.

Abbe Offset — The value of the offset between the measuring device and the point of interest.

Absolute Move — A move referenced to a known point or datum.

Absolute Programming — A positioning coordinate reference where all positions are specified relative to a reference or "home" position.

AC Brushless Servo — A servomotor with stationary windings in the stator assembly and permanent magnet rotor. AC brushless generally refers to a sinusoidally wound motor (such as BM series) to be commutated via sinusoidal current waveform (see DC Brushless Servo).

Acceleration — The change in velocity as a function of time.

Accuracy — An absolute measurement defining the difference between actual and commanded position.

Accuracy Grade — In reference to an encoder grating, accuracy grade is the tolerance of the placement of the graduations on the encoder scale.

ASCII — American Standard Code for Information Interchange. This code assigns a number to each numeral and letter of the alphabet. Information can then be transmitted between machines as a series of binary numbers.

Axial Runout — Positioning error of the rotary stage in the vertical direction when the tabletop is oriented in the horizontal plane. Axial runout is defined as the total indicator reading on a spherical ball positioned 50 mm above the tabletop and centered on the axis of rotation.

Axis of Rotation — A center line about which rotation occurs.

Back emf, Kemf — The voltage generated when a permanent magnet motor is rotated. This voltage is proportional to motor speed and is present whether or not the motor windings are energized.

Backlash — A component of bidirectional repeatability, it is the non-responsiveness of the system load to reversal of input command.

Ball Screw	A precision device for translating rotary motion into linear motion. A lead screw is a low-cost lower performance device performing the same function. Unit consists of an externally threaded screw and an internally threaded ball nut.
Ball Screw Lead	The linear distance a carriage will travel for one revolution of the ball screw (lead screw).
Bandwidth	A measurement, expressed in frequency (hertz), of the range which an amplifier or motor can respond to an input command from DC to -3dB on a frequency sweep.
Baud Rate	The number of bits transmitted per second on a serial communication channel such as RS-232 or modem.
BCD	Binary Coded Decimal - A number system using four bits to represent 0-F (15).
Bearing	A support mechanism allowing relative motion between two surfaces loaded against each other. This can be a rotary ball bearing, linear slide bearing, or air bearing (zero friction).
Bidirectional Repeatability	See Repeatability.
CAM Profile	A technique used to perform nonlinear motion that is electronically similar to the motion achieved with mechanical cams.
Cantilevered Load	A load not symmetrically mounted on a stage.
Closed Loop	A broad term relating to any system where the output is measured and compared to the input. Output is adjusted to reach the desired condition.
CNC	Computer Numerical Control. A computer-based motion control device programmable in numerical word address format.
Coefficient of Friction	Defined as the ratio of the force required to move a given load to the magnitude of that load.
Cogging	Nonuniform angular/linear velocity. Cogging appears as a jerkiness, especially at low speeds, and is due to magnetic poles attracting to steel laminations.
Commutation	The action of steering currents to the proper motor phases to produce optimum motor torque/force. In brush-type motors, commutation is done electromechanically via the brushes and commutator. A brushless motor is electronically commutated using a position feedback device such as an encoder or Hall effect devices. Stepping motors are electronically commutated without feedback in an open-loop fashion.

Commutation, 6-Step	Also referred to as trapezoidal commutation. The process of switching motor phase current based on three Hall effect signals spaced 120 electrical degrees beginning 30 degrees into the electrical cycle. This method is the easiest for commutation of brushless motors.
Commutation, Modified 6-Step	Also referred to as modified sine commutation. The process of switching motor phase current based on three Hall effect signals spaced 120 electrical degrees beginning at 0 electrical degrees. This method is slightly more difficult to implement than standard 6-step, but more closely approximates the motor's back emf. The result is smoother control and less ripple. Aerotech's BA series self-commutate using this method.
Commutation, Sinusoidal	The process of switching motor phase current based on motor position information, usually from an encoder. In this method, the three phase currents are switched in very small increments that closely resemble the motor's back emf. Sinusoidal commutation requires digital signal processing to convert position information into three-phase current values and, consequently, is most expensive to implement. The result, however, is the best possible control. All Aerotech controllers, as well as the BAS series amplifiers, commutate using this method.
Coordinated Motion	Multi-axis motion where the position of each axis is dependent on the other axis, such that the path and velocity of a move can be accurately controlled. Drawing a circle requires coordinated motion.
Critical Speed	A term used in the specification of a lead screw or ball screw indicating the maximum rotation speed before resonance occurs. This speed limit is a function of the screw diameter, distance between support bearings, and bearing rigidity.
Current Command	Motor driver or amplifier configuration where the input signal is commanding motor current directly, which translates to motor torque/force at the motor output. Brushless motors can be commutated directly from a controller that can output current phase A and B commands.
Current, Peak	An allowable current to run a motor above its rated load, usually during starting conditions. Peak current listed on a data sheet is usually the highest current safely allowed to the motor.
Current, rms	Root Mean Square. Average of effective currents over an amount of time. This current is calculated based on the load and duty cycle of the application.

Cycle	When motion is repeated (move and dwell) such as repetitive back-and-forth motion.
DC Brushless Servo	A servomotor with stationary windings in the stator assembly and permanent magnet rotor. (See AC Brushless Servo)
Deceleration	The change in velocity as a function of time.
Duty Cycle	For a repetitive cycle, the ratio of "on" time to total cycle time used to determine a motor's rms current and torque/force.
Dwell Time	Time in a cycle at which no motion occurs. Used in the calculation of rms power.
Efficiency	Ratio of input power vs. output power.
Electronic Gearing	Technique used to electrically simulate mechanical gearing. Causes one closed loop axis to be slaved to another open or closed loop axis with a variable ratio.
Encoder Marker	Once-per-revolution signal provided by some incremental encoders to accurately specify a reference point within that revolution. Also known as Zero Reference Signal or Index Pulse.
Encoder Resolution	Measure of the smallest positional change, which can be detected by the encoder. A 1000-line encoder with a quadrature output will produce 4000 counts per revolution.
Encoder, Incremental	Position encoding device in which the output is a series of pulses relative to the amount of movement.
Feedback	Signal that provides process or loop information such as speed, torque, and position back to the controller to produce a "closed loop" system.
Flatness (of travel)	Measure of the vertical deviation of a stage as it travels in a horizontal plane.
Force, Continuous	The value of force that a particular motor can produce in a continuous stall or running (as calculated by the rms values) condition.
Force, Peak	The maximum value of force that a particular motor can produce. When sizing for a specific application, the peak force is usually that required during acceleration and deceleration of the move profile. The peak force is used in conjunction with the continuous force and duty cycle to calculate the rms force required by the application.
Friction	The resistance to motion between two surfaces in contact with each other.

G.P.I.B.	A standard protocol, analogous to RS-232, for transmitting digital information. The G.P.I.B. interface (IEEE-488) transmits data in parallel instead of serial format. (See IEEE-488)
Gain	Comparison or ratio of the output signal and the input signal. In general, the higher the system gain, the higher the response.
Grating Period	Actual distance between graduations on an encoder.
Hall Effect Sensors	Feedback device (HED) used in a brushless servo system to provide information for the amplifier to electronically commutate the motor.
HED	Hall Effect Device. (See Hall Effect Sensors)
HMI	Human Machine Interface. Used as a means of getting operator data into the system. (See MMI)
Home	Reference position for all absolute positioning movements. Usually defined by a home limit switch and/or encoder marker.
Home Switch	A sensor used to determine an accurate starting position for the home cycle.
Hysteresis	A component of bidirectional repeatability. Hysteresis is the deviation between actual and commanded position and is created by the elastic forces in the drive systems.
I/O	Input / Output. The reception and transmission of information between control devices using discrete connection points.
IEEE-488	A set of codes and formats to be used by devices connected via a parallel bus system. This standard also defines communication protocols that are necessary for message exchanges, and further defines common commands and characteristics. (See G.P.I.B.)
Incremental Move	A move referenced from its starting point (relative move).
Inertia	The physical property of an object to resist changes in velocity when acted upon by an outside force. Inertia is dependent upon the mass and shape of an object.
Lead Error	The deviation of a lead screw or ball screw from its nominal pitch.
Lead Screw	A device for translating rotary motion into linear motion. Unit consists of an externally threaded screw and an internally threaded carriage (nut). (See Ball Screw)

Life	The minimum rated lifetime of a stage at maximum payload while maintaining positioning specifications.
Limit Switch	A sensor used to determine the end of travel on a linear motion assembly.
Limits	Sensors called limits that alert the control electronics that the physical end of travel is being approached and motion should stop.
Linear Motor	A motor consisting of 2 parts, typically a moving coil and stationary magnet track. When driven with a standard servo amplifier, it creates a thrust force along the longitudinal axis of the magnet track.
Load Carrying Capability	The maximum recommended payload that does not degrade the listed specifications for a mechanical stage.
Master-Slave	Type of coordinated motion control where the master axis position is used to generate one or more slave axis position commands.
MMI	Man Machine Interface used as a means of getting operator data into the system. (See HMI)
Motion Profile	A method of describing a process in terms of velocity, time, and position.
Motor Brush	The conductive element in a DC brush-type motor used to transfer current to the internal windings.
Motor, Brushless	Type of direct current motor that utilizes electronic commutation rather than brushes to transfer current.
Motor, Stepping	Specialized motor that allows discrete positioning without feedback. Used for non-critical, low power applications, since positional information is easily lost if acceleration or velocity limits are exceeded.
NC	Numerical Control. Automated equipment or process used for contouring or positioning. (See CNC)
NEMA	National Electrical Manufacturer's Association. Sets standards for motors and other industrial electrical equipment.
Non-Volatile Memory	Memory in a system that maintains information when power is removed.
Open Collector	A signal output that is performed with a transistor. Open collector output acts like a switch closure with one end of the switch at circuit common potential and the other end of the switch accessible.
Open Loop	Control circuit that has an input signal only, and cannot make any corrections based on external influences.

Operator Interface	Device that allows the operator to communicate with a machine. A keyboard or thumbwheel is used to enter instructions into a machine. (See HMI or MMI)
Optical Encoder	A linear or angular position feedback device using light fringes to develop position information.
Opto-isolated	System or circuit that transmits signal with no direct electrical connections, using photoelectric coupling between elements.
Orthogonality	The condition of a surface or axis which is perpendicular (offset 90 degrees) to a second surface or axis. Orthogonality specification refers to the error from 90 degrees from which two surfaces of axes are aligned.
Overshoot	In a servo system, referred to the amount of velocity and/or position overrun from the input command. Overshoot is a result of many factors including mechanical structure, tuning gains, servo controller capability, and inertial mismatch.
PID	A group of gain terms in classical control theory (Proportional Integral Derivative) used in compensation of a closed-loop system. The terms are optimally adjusted to have the output response equal the input command. Aerotech controllers utilize the more sophisticated PID FVFA loop which incorporates additional terms for greater system performance.
Pitch (of travel)	Angular motion of a carriage around an axis perpendicular to the motion direction and perpendicular to the yaw axis.
Pitch Error	Positioning error resulting from a pitching motion.
PLC	Programmable Logic Controller. A programmable device that utilizes "ladder logic" to control a number of input and output discrete devices.
PWM	Pulse Width Modulation. Switch-mode technique used in amplifiers and drivers to control motor current. The output voltage is constant and switched at the bus value (160 VDC with a 115 VAC input line).
Quadrature	Refers to the property of position transducers that allows them to detect direction of motion using the phase relationship of two signal channels. A 1000-line encoder will yield 4000 counts via quadrature.
Radial Runout	Positioning error of the rotary stage in the horizontal direction when the tabletop is oriented in the horizontal plane. Radial run out is defined as the total indicator reading on a spherical ball positioned 50 mm above the tabletop and centered on the axis of rotation.
Ramp Time	Time it takes to accelerate from one velocity to another.

Range	The maximum allowable travel of a positioning stage.
RDC	Resolver to Digital Converter. Electronic component that converts the analog signals from a resolver (transmitter type) into a digital word representing angular position.
Repeatability	The maximum deviation from the mean (each side) when repeatedly approaching a position. Unidirectional repeatability refers to the value established by moving toward a position in the same direction. Bidirectional repeatability refers to the value established by moving toward a position in the same or opposite direction.
Resolution	The smallest change in distance that a device can measure.
Retroreflector	An optical element with the property that an input light beam is reflected and returns along the same angle as the input beam. Used with laser interferometers.
Roll (of travel)	Angular motion of a carriage around an axis parallel to the motion direction and perpendicular to the yaw axis.
Roll Error	Positioning error resulting from a roll motion.
Rotor	The rotating part of a magnetic structure. In a motor, the rotor is connected to the motor shaft.
RS-232C	Industry standard for sending signals utilizing a single-ended driver/receiver circuit. As such, the maximum distance is limited based on the baud rate setting but is typically 50-100 feet. This standard defines pin assignments, handshaking, and signal levels for receiving and sending devices.
RS-274	Industry standard programming language. Also referred to as G-code machine programming. A command set specific for the machine tool industry that defines geometric moves.
RS-422	Industry communication standard for sending signals over distances up to 4000 feet. Standard line driver encoder interfaces utilize RS-422 because of the noise immunity.
Runout	The deviation from the desired form of a surface during full rotation (360 degrees) about an axis. Run out is measured as total indicated reading (TIR). For a rotary stage, axis run out refers to the deviation of the axis of rotation from the theoretical axis of rotation.
Servo System	Refers to a closed loop control system where a command is issued for a change in position and the change is then verified via a feedback system.

Settling Time	Time required for a motion system to cease motion once the command for motion has ended.
Shaft Radial Load	Maximum radial load that can be applied to the end of the motor shaft at maximum motor speed.
Shaft Runout	Deviation from straight-line travel.
Slotless	Describes the type of laminations used in a motor that eliminates cogging torque due to magnetic attraction of the rotor to the stator slots.
Stator	Non-rotating part of a magnetic structure. In a motor, the stator usually contains the mounting surface, bearings, and non-rotating windings.
Stiction	Friction encountered when accelerating an object from a stationary position. Static friction is always greater than moving friction, and limits the smallest possible increment of movement.
Straightness of Travel	Measure of the side-to-side deviation of a stage as it travels in a horizontal plane.
Torque	Rotary equivalent to force. Equal to the product of the force perpendicular to the radius of motion and distance from the center of rotation to the point where the force is applied.
Torque, Continuous	Torque needed to drive a load over a continuous time.
Torque, Peak	Maximum amount of torque a motor can deliver when the highest allowable peak currents are applied.
Torque, rms	Root Mean Square is a mathematical method to determine a steadfast or average torque for a motor.
Torque, Stall	The maximum torque without burning out the motor.
Total Indicated Reading (TIR)	The full indicator reading observed when a dial indicator is in contact with the part surface during one full revolution of the part about its axis of rotation.
Tuning	In a servo system, the process of optimizing loop gains (usually PID terms) to achieve the desired response from a stage or mechanism from an input command.
Unidirectional Repeatability	See Repeatability
Velocity Command	Motor driver or amplifier configuration where the input signal is commanding motor velocity. Motors with analog tachometers are normally driven by this driver configuration.

Wobble	An irregular, non-repeatable rocking or staggering motion of the table top of a rotary stage. Wobble is defined as an angular error between the actual axis of rotation and the theoretical axis of rotation.
Yaw (of travel)	Rotation about the vertical axis, perpendicular to the axis of travel. Angular movement (error) that affects straightness and positioning accuracy.
Yaw Error	Positioning error resulting from a yaw motion.

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APPENDIX B: WARRANTY AND FIELD SERVICE

In This Section:

- Laser Product Warranty
- Return Products Procedure
- Returned Product Warranty Determination
- Returned Product Non-warranty Determination
- Rush Service
- On-site Warranty Repair
- On-site Non-warranty Repair

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products which are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Company Address

Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238-2897
USA

Phone: (412) 963-7470
Fax: (412) 963-7459
TWX: (710) 795-3125

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APPENDIX C: TECHNICAL CHANGES

In This Section:

- Current Changes C-1
- Archive of Changes C-2

C.1. Current Changes (Manual V1.6)

Change	Reason	Sections Updated/Affected
JP28 and JP29 Pin Numbers	Pin Numbers incorrectly listed on Rev. D board	Figure 1-4 Table 1-1 Figure 1-10 through Figure 1-21 Figure 1-26 and Figure 1-28

C.2. Archive of Changes

Nothing to Archive.

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READER'S COMMENTS

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P/N EDO 107, July 2004

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