DR500
DRIVE CHASSIS

OPERATION & TECHNICAL MANUAL

P/N: EDA120 (V1.6)

AEROTECH, Inc. • 101 Zeta Drive • Pittsburgh, PA. 15238-2897 • USA
Phone (412) 963-7470 • Fax (412) 963-7459
Product Service: (412) 967-6440; (412) 967-6870 (Fax)

www.aerotech.com

If you should have any questions about the DR500 and/or comments regarding the documentation, please refer to Aerotech online at:

http://www.aerotech.com.

For your convenience, a product registration form is available at our web site.

Our web site is continually updated with new product information, free downloadable software, and special pricing on selected products.

The DR500 Drive Chassis Operation and Technical Manual Revision History:

Rev 1.1	January 31, 1994
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Rev 1.5	December 12, 2000
Rev 1.6	May 28, 2002

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DECLARATION OF CONFORMITY

Manufacturer's Name and Address

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

Declares that the product:

Product Name: DR500

Conforms to the following product specifications:

- Electrostatic Discharge in accordance with IEC 1000-4-2 as specified by EN50082-2
- Electrical Fast Transients in accordance with IEC 1000-4-3 as specified in EN50082-2
- Immunity to radiated electromagnetic fields in accordance with IEC 1000-4-3 as specified in EN50082-2
- Immunity to conducted RF in accordance with EN 501041
- Radiated emission in accordance with EN55011; Group 1, Class A
- Conducted Emission in accordance with EN550100; Group 1, Class A
- EN61010-1:93 - safety of electrical equipment for measurement, control, and laboratory use

and complies with EMC directive 89/336/EEC and 73/23/EEC low voltage directive.

Pittsburgh, PA
March, 1998

David F. Kincel_____
Quality Assurance Manager

Alex Weibel_____
Engineer Verifying Compliance

General notes concerning the test setup.

This product was tested at Compliance Labs in Middlefield, Ohio on December 16, 1997. The report number is 1050.

The DR500 was tested with a CE-compliant, class B personal computer and it controlled four brushless AC motors. The DR500 requires a line filter (Aerotech P/N UFM) to meet conducted emission requirements. This filter may not be necessary if the DR500 is used by the OEM in a system that has a line filter.

Not all configurations of the DR500 are CE compliant. Compliant versions are indicated by the "CE" symbol on the back of the unit.

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CHAPTER 1: INTRODUCTION

In This Section:

1.1. Product Overview

Aerotech's DR500 Drive Chassis is an integral part in a UNIDEX 500 or UNIDEX 600 based control system. The DR500 is a 19" rack mount chassis with provision for holding up to four individual amplifiers (DC servo, AC brushless, or microstepping) that are inserted into the front of the DR500 panel. The DR500 also provides bus power for the amplifier modules and acts as a breakout for all control and I/O signals, as well as mating to Aerotech's standard motor and feedback cables. The DR500 is available in 19-inch rack mount and desktop packaging. The individual amplifiers (a maximum of four) are inserted into the front of the DR500 panel. The back of the DR500 has all the cable connectors as well as descriptions for each. The DR500 Drive Chassis is shown in Figure 1-1.

Figure 1-1. DR500 Drive Chassis

1.1.1. DR500 Functions

The DR500 gives the user flexibility in a motion control system, offering several different functions. These functions:

- Supply low and high level (bus) voltage to amplifiers
- Condition and set bus voltage levels
- Power incremental encoder feedback transducers
- Supply up to two high power (bus) voltages at 40, 60, 80, or 160 VDC levels
- Distribute all motion related signals to and from the U500/U600
- Distribute all motor power connections for Aerotech motor cables
- Assure a fail-safe connection to the U500/U600 controller.

1.1.2. DR500 Configurations

The DR500 is easily configured to the users needs and can be set up for a wide range of applications. It can be configured to:

- House up to 4 DC servo, AC brushless, or microstepping amplifiers
- House from 1 to 4 amplifier modules
- House up to 2 transformers
- House optional brake control logic, brake power, and passive regeneration dissipation options
- Provide all motor power connections to the amplifier modules
- Mount in a rack assembly, or on a desk top
- Power up to 4 axes of motors
- Interface with a joystick or electronic handwheel.

Figure 1-2 illustrates a typical U500/U600 System (with the DR500 and several options and accessories).

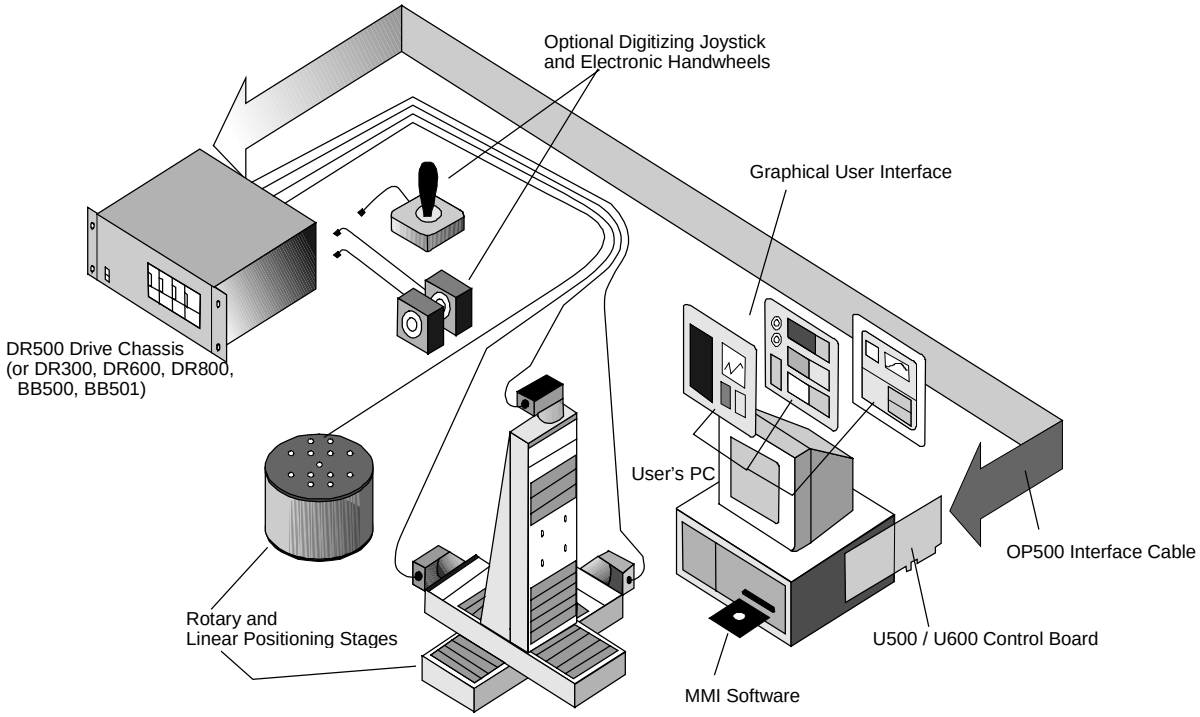


Figure 1-2. UNIDEX 500 / UNIDEX 600 System Diagram

1.2. DR500 Options

A variety of options may be purchased with the DR500 drive chassis to enhance its standard operation. The following sections discuss the available options.

1.2.1. The SHUNT500 Regulator Board

The SHUNT500 regulator board provides shunt regulated bus voltage. Figure 1-3 shows the interconnections of the SHUNT500 regulator board.

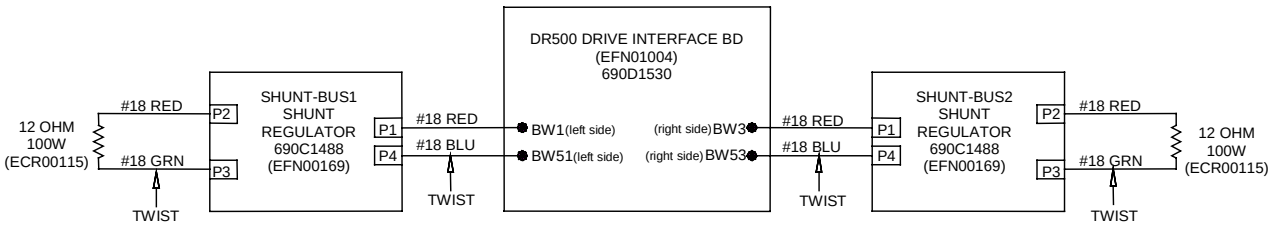
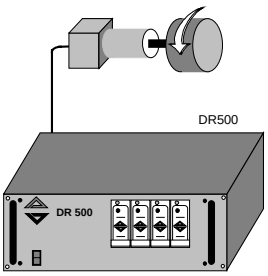


Figure 1-3. SHUNT500 Wiring



The SHUNT500 board, shown in Figure 1-5, is an integral option to the DR500 used to regulate either one or both of the bus power supplies (both, if supplies are connected together). Typically, the SHUNT500 board is required for motors operating from a 160 VDC bus with large inertial loads, which, on deceleration, return the energy back into the power supply, potentially damaging the drive module. The SHUNT500 board prevents the power from entering the power supply by dissipating the excess energy into a 95 watt resistive load.

If the board's dissipation limit is exceeded, the SHUNT500 board has an adjustable voltage set point and fusing. The set point for the regulator is factory set and should not require user adjustment. However, it may be necessary to change the fuse for the regulator circuit. This is accessible by removing the front panel to access the fuse. There are two possible mounting locations for the SHUNT500 board, refer to Figure 1-4. If the SHUNT500 board is used to regulate the bus power supply connected to axis 1, the mounting location is on the side of the divider that supports the card rails. Otherwise, the board is mounted to the right side of the chassis to regulate the bus power supply connected to axis 4.

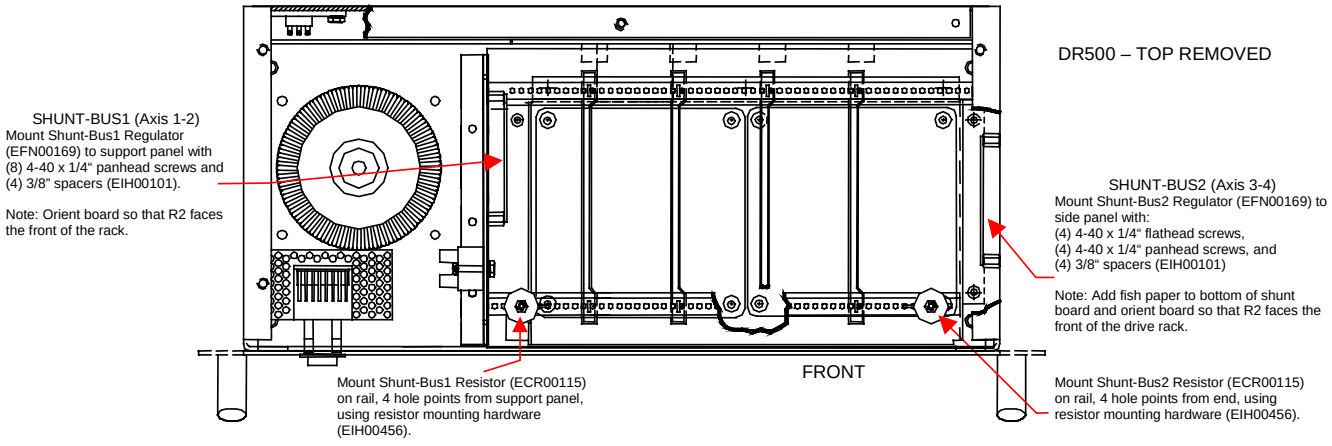


Figure 1-4. Mounting of the Shunt Board

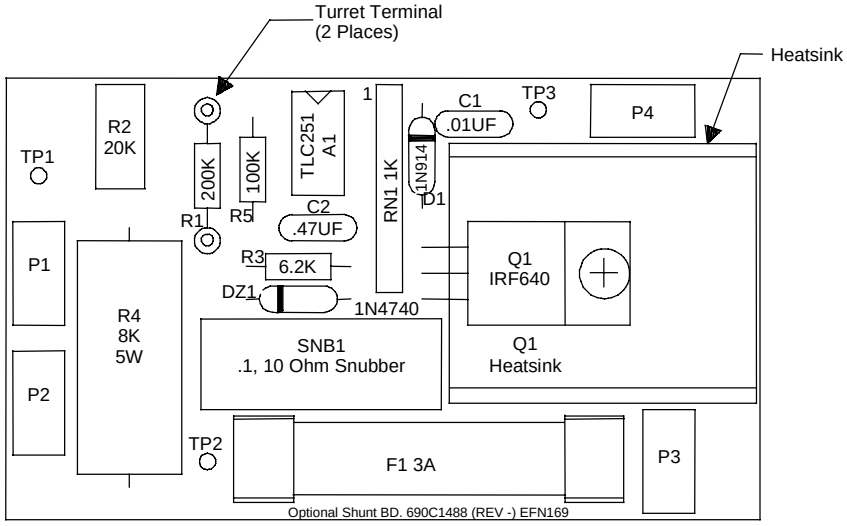
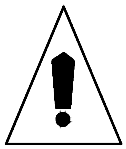


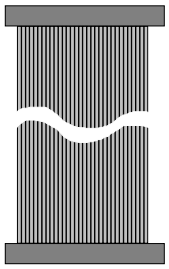
Figure 1-5. SHUNT500 Board

Shunt regulator circuit operates at a high DC bus voltage.



WARNING

1.2.2. DRC I/O Cable



The DRC I/O cable serves two purposes when used with the DR500 Drive Chassis. The primary use is for applications that use brushless motors with Hall effect sensors. In such cases, the necessary Hall effect signals are not available through the standard OP500 cable, therefore, the DRC cable is connected between the U600/U500 and the DR500. Different versions of the DRC I/O cable are available for (1) directly connecting the U600/U500 and a PB8, PB16, or PB24 interface board to allow additional inputs/outputs; or (2), connecting the U600/U500 to the DR500 (to provide Hall effect inputs and extra I/O) with an additional connection for an optional PB8, PB16, or PB24 I/O board.

The second purpose is to allow more than four user inputs or outputs (as in the case when the PB8, PB16, or PB24 I/O board is used).

Figure 1-6 is an illustration of the DRC I/O cable. Refer to Figure 1-7 for illustrations of two versions of the DRC I/O cable.

See the U600 Hardware manual, EDU154, for complete information on using the DRC cable. Figure 1-7 is for reference only.

The DRC cable is not needed to provide Hall effect signals with the U500 PCI board.

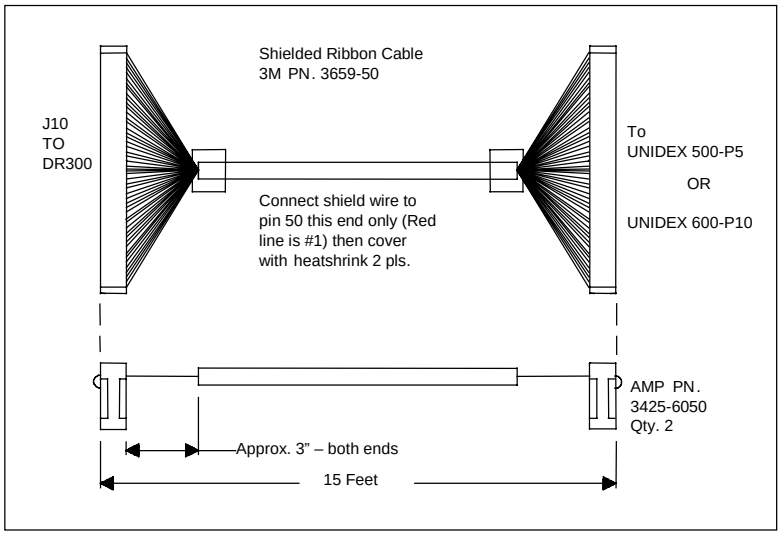


Figure 1-6. DRC I/O Cable

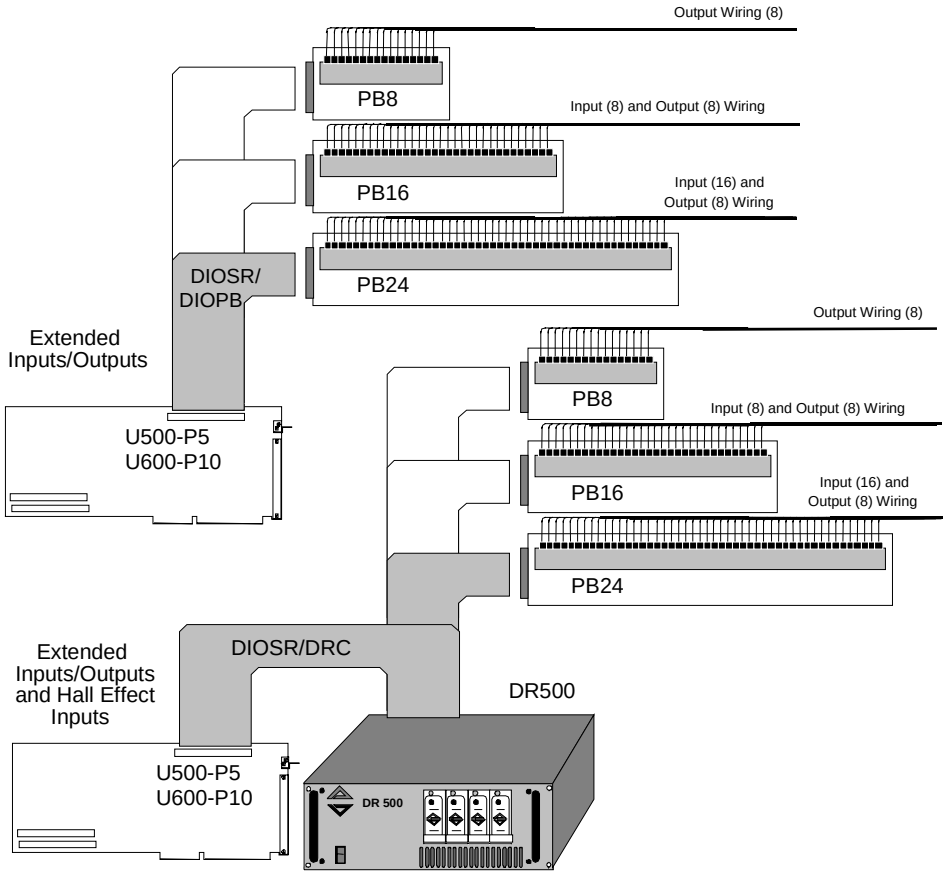
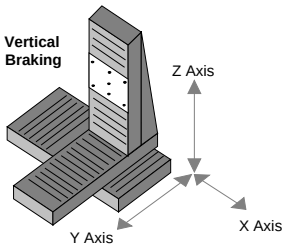


Figure 1-7. Sample Uses of the DRC Cable

1.2.3. DR500 Brake Option

The DR500 brake option, shown in Figure 1-8, is an integral option that provides a fail-safe way to maintain position on a vertical axis when power is removed from that axis. This is accomplished by means of a normally-on electromagnetic brake coupled to the load. To disable the brake, 24 VDC (typical) is applied to the brake when that axis is enabled for motion by the UNIDEX 500 or UNIDEX 600. This option requires additional wiring and the installation of several brake option components to the Drive Interface Board and the Rear Panel Interface Board that are used to sense the switching of the motor leads of PWM amplifiers. Additional modifications may also be included to meet particular brake standards.



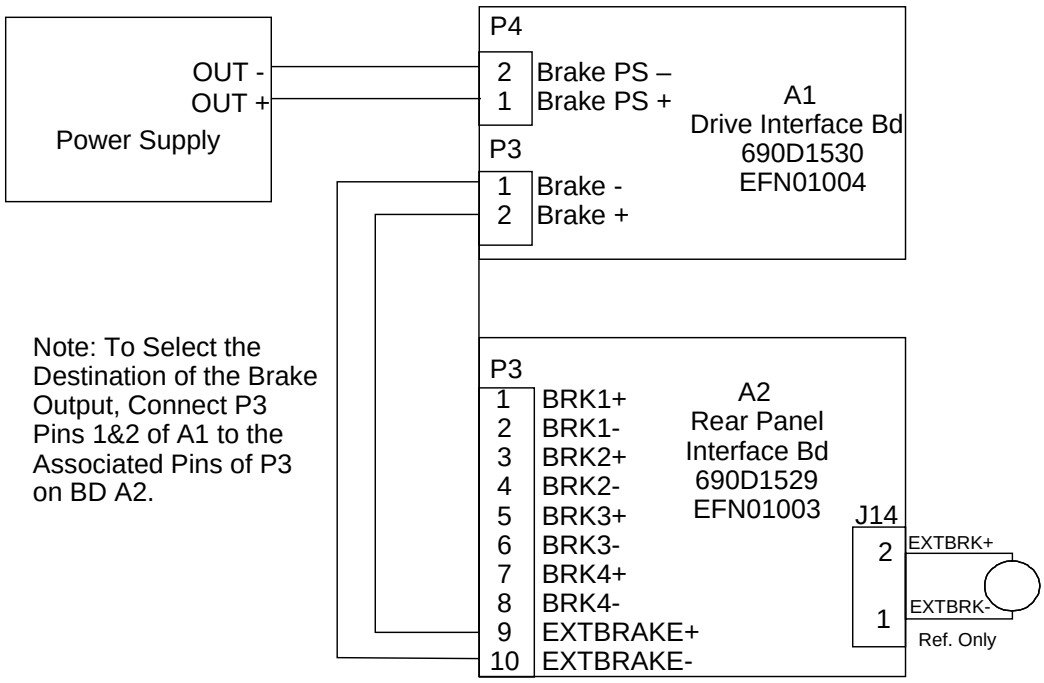


Figure 1-8. BRAKE OPTION Wiring

Brake output (J14) is typically 24 volts.

IMPORTANT

1.3. 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.

WARNING

If the equipment is used in a manner not specified by the manufacturer, the protection by the equipment may be impaired. The user should practice caution when following the given procedures. Deviation from this may result in damage to the equipment or the machinery.

WARNING

To minimize the possibility of electrical shock and bodily injury when servicing the equipment, ensure that all electrical power switches are in the off position and disconnect main power.

To minimize the possibility of electrical shock and bodily injury, extreme care must be exercised when any electrical circuits are in use, that no person be in contact with the circuitry.

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

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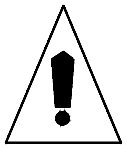
CHAPTER 2: SET UP

In This Section:

2.1. Unpacking the DR500 Drive Package

Before unpacking any components, visually inspect the container of the DR500 for any evidence of shipping damage. If any such damage exists, notify the shipping carrier immediately.

All electronic equipment and instrumentation are wrapped in antistatic material and packaged with desiccant. Ensure that the antistatic material is not damaged during unpacking.



WARNING

Remove the packing list from the DR500 container. Make sure that the items specified on the packing list are contained within the package. Certain items required for use with your DR500 are not included within the DR500 shipping container. These items may be found in the UNIDEX 500/600 shipping container.

- The DR500 Drive Chassis
  One to four axis amplifier chassis with power supply

- The OP500 Interface Cable
  12 ft, (3.6m) cable used to connect the UNIDEX 500/600 to the DR500

- AC line cord
  This cable connects the DR500 Drive Chassis to an AC outlet

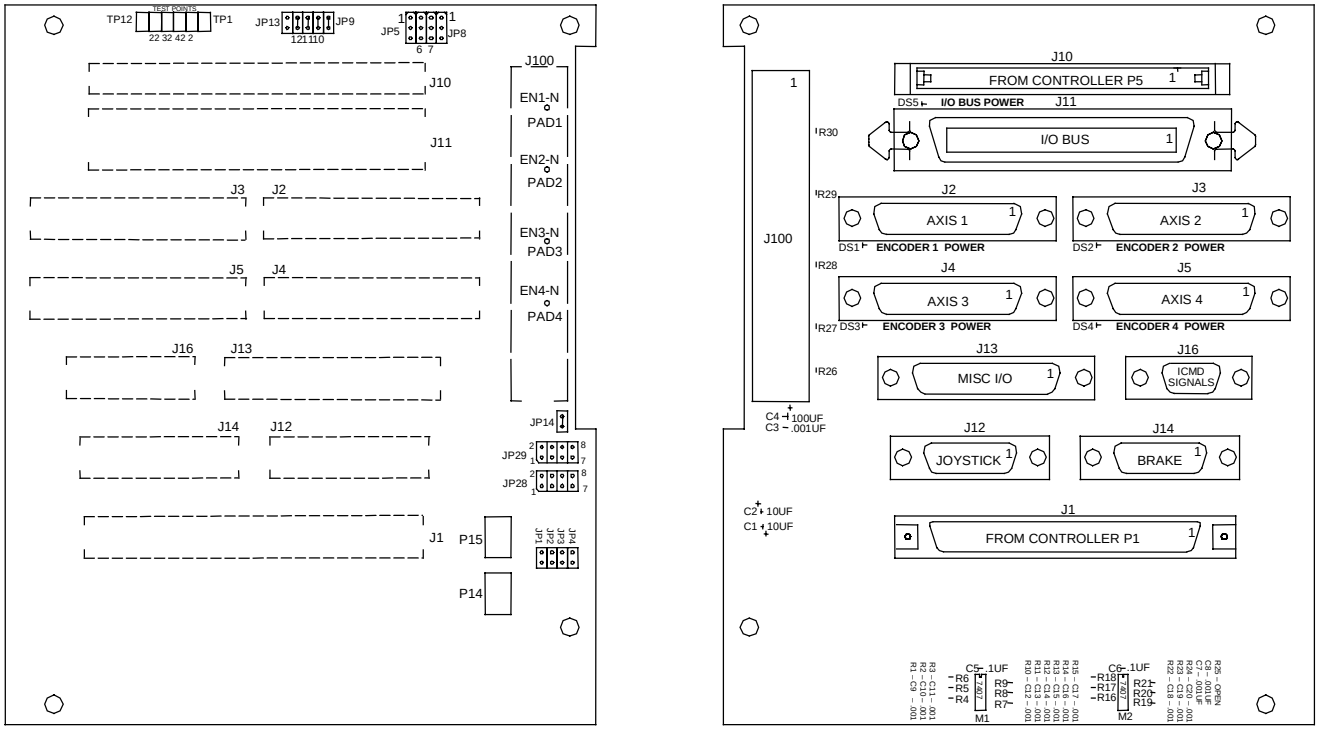
The DR500 should never have any of its cables connected or disconnected from it with power applied, nor should any drive modules be removed or inserted into it with power applied. Doing so may cause damage to the system or its components.

WARNING

2.2. DR500 Jumper Selections and Configurations

The DR500 is configured by the factory according to the specifications given by the user. The user should not need to reconfigure the DR500 chassis. However, if there is a need to add change the type of amplifier for an axis, it will be necessary to configure the slot jumpers, shown in Figure 2-1 and Figure 2-2, according to the following sections. The "BW" type slot jumpers on the Mother/Interface board are high current solid bus wire jumpers and are soldered to the board. The "JP" type jumpers are two pin headers that insert and pull out of a socket.

NOTE: There are two circuit boards within the DR500, be sure to reference the correct jumper table for setting each board's jumpers.



BOTTOM SIDE

TOP SIDE

Drawing 690D1529 Rev. D2

Figure 2-1. Rear Panel Interface Board Jumper Locations

2.2.1. Rear Panel Interface Board Internal Jumpers

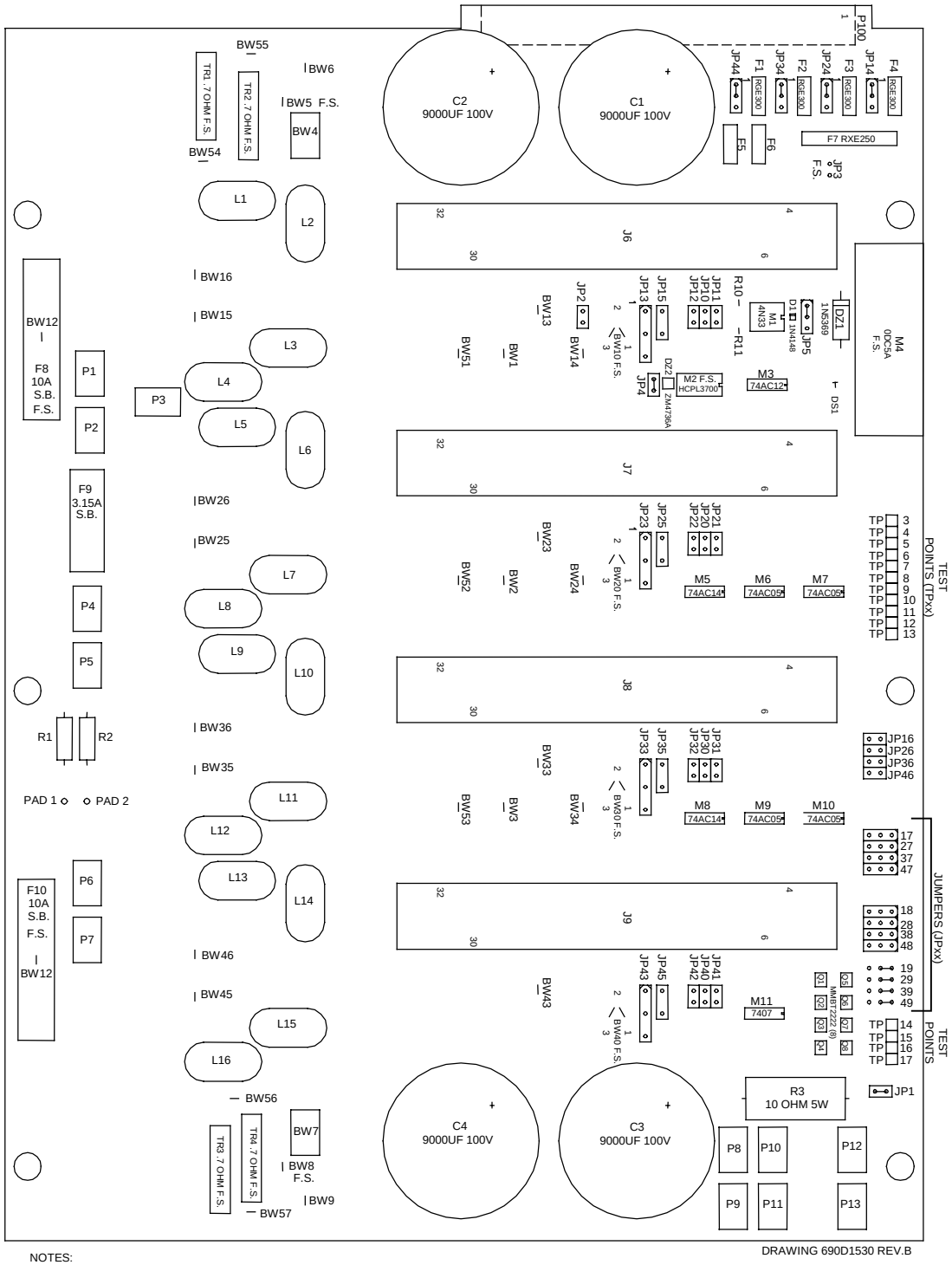
This section covers the configurations of the slot jumpers on the DR500 Rear Panel Interface board. Table 2-1 lists the configurations and jumper selections for the Rear Panel Interface board.

Table 2-1. Rear Panel Interface Board Jumper Selections

Configuration	**Jumpers**		
	Standard	**Optional**	
Power to Opto Coupled D/A's (U500PCI Only)	Remove JP1, JP2, JP3, JP4	Insert JP1, JP2, JP3, JP4 (U500 PCI Only!)	
Auxiliary Encoder Fault Input	**None**	**Disables Amp**	**Drives Mode Input**
Axis 1	Remove JP5	JP5 1-2	JP5 2-3
Axis 2	Remove JP6	JP6 1-2	JP6 2-3
Axis 3	Remove JP7	JP7 1-2	JP7 2-3
Axis 4	Remove JP8	JP8 1-2	JP8 2-3
Brake Output to Axis Connector	**No Brake**	**Brake Present**	
Axis 1 – J2	Remove JP28A, JP29A	JP28A 1-2, JP29A 1-2	
Axis 2 – J3	Remove JP28B, JP29B	JP28B 3-4, JP29B 3-4	
Axis 3 – J4	Remove JP28C, JP29C	JP28C 5-6, JP29C 5-6	
Axis 4 – J5	Remove JP28D, JP29D	JP28D 7-8, JP29D 7-8	
E-Stop Voltage Level	**5 Volt Operation** Insert JP14	**24 Volt Operation** Remove JP14	
Isolate Pins 20 to 17 of J11 I/O Bus	Insert JP9, 10, 11, 12 (U500)	Remove JP9, 10, 11, 12 (U600)	
JP13 is always out			

2.2.2. Drive Interface Board Internal Jumpers

This section covers the configurations of the slot jumpers on the DR500 Drive Interface Board. Figure 2-2 displays the Drive Interface Board internal jumper locations and Table 2-2 lists the configurations and jumper selections.



DRAWING 690D1530 REV.B

NOTES:

-F9 fuse clips (EIF00187) install before wave soldering
-M4 is F.S. install socket terminals only (EIK00117)
-M2 is F.S. install socket only (EIK00127)
-For BW jumpers, use EIK01000 (except BW4 and BW7, use EIK00226)
-For L1 through L6 assembly see 630B1684 (EFN01005)
-C1-C4 change for 160V operation

Figure 2-2. Drive Interface Board Internal Jumper Locations

Table 2-2. Drive Interface Board Jumper Selections

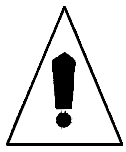
Configuration	Jumpers		
	Standard	**Optional**	
ESTOP disables drives	**No:**	**Yes:**	
Axis 1	Remove JP16	Install JP16	
Axis 2	Remove JP26	Install JP26	
Axis 3	Remove JP36	Install JP36	
Axis 4	Remove JP46	Install JP46	
Encoder Fault disables drives	**Disabled**	**Active High**	**Active Low**
Axis 1	Remove JP17	Install JP17 1-2	Install JP17 2-3
Axis 2	Remove JP27	Install JP27 1-2	Install JP27 2-3
Axis 3	Remove JP37	Install JP37 1-2	Install JP37 2-3
Axis 4	Remove JP47	Install JP47 1-2	Install JP47 2-3
Amp switching monitor for optional brake	Disabled, install JP4	Enabled, remove JP4	
Optional Brake control	Use Brake output, set JP5 1-2	Use Output 0, set JP5 2-3	
Thermistor Input	**Disabled**	**Active High**	**Active Low**
Axis 1	Remove JP18	Install JP18 1-2	Install JP18 2-3
Axis 2	Remove JP28	Install JP28 1-2	Install JP28 2-3
Axis 3	Remove JP38	Install JP38 1-2	Install JP38 2-3
Axis 4	Remove JP48	Install JP48 1-2	Install JP48 2-3
Amplifier Enable	**Active High**	**Active Low**	
Axis 1	Install JP19 1-2	Install JP19 2-3, Remove JP19 1-2	
Axis 2	Install JP29 1-2	Install JP29 2-3, Remove JP29 1-2	
Axis 3	Install JP39 1-2	Install JP39 2-3, Remove JP39 1-2	
Axis 4	Install JP49 1-2	Install JP49 2-3, Remove JP49 1-2	
Limit Power	**+5 Volts**	**From P10 (Internal)**	
Axis 1	JP14 1-2	JP14 2-3	
Axis 2	JP24 1-2	JP24 2-3	
Axis 3	JP34 1-2	JP34 2-3	
Axis 4	JP44 1-2	JP44 2-3	
1 amp load on +5V	Install JP1	Remove JP1	
Connect PC +5V to +5V	No, Remove JP3	Yes, Install JP3	
Buss Input Fuse Active	**No** (If transformer is present) Buss #1: Install BW11, Remove F8 Buss #2: Install BW12, Remove F10	**Yes** (If transformer is absent) Buss #1: Remove BW11, Install F8 Buss #2: Remove BW12, Install F10	
 **Amp GND to DAC GND**	Remove JP2	Install JP2	

Table 2-2. Drive Interface Board Jumper Selections (Continued)

Configuration	Jumpers	
	Standard	**Optional**
Bus Power Supply #1	**Unipolar** (0-X, 40-X, 80-X, 160-X) Install: BW4, BW6, BW54, BW55 Remove: BW5	**Bipolar** (30-X) Install: BW5 (EIK00226 – QUICK CONN. TAB), BW54, BW55 Remove: BW4, BW6
	Unipolar (160LT-X) Install: BW4 & BW6 Remove: BW5, BW54, BW55 Add: TR1, TR2 (CL-11, ECR130)	
Bus Power Supply #2	**Unipolar** (X-0, X-40, X-80, X-160) Install: BW7, BW9 BW56, BW57 Remove: BW8	**Bipolar** (X-30) Install: BW8 (EIK00226 – QUICK CONN. TAB), BW56, BW57 Remove: BW7, BW9
	Unipolar (X-160LT) Install: BW7, BW9 Remove: BW8, BW56, BW57 Add: TR3, TR4, (CL-11, ECR130)	
Bus Voltages Different:	30-40, 30-80, 30-160, 30-160LT, 40-30, 40-80, 40-160, 40-160LT, 80-30, 80-40, 80-160, 80-160LT, 160-30, 160-40, 160-80, 160-160LT, 160LT-30, 160LT-40, 160LT-80, 160LT-160	
	Split 2-2: IN: BW1, BW3, BW14, BW34, BW51, BW53 OUT: BW2, BW24, BW52	**Split 1-3:** IN: BW2, BW3, BW24, BW34, BW52, BW53 OUT: BW1, BW14, BW51 **Split 3-1:** IN: BW1, BW2, BW14, BW24, BW51, BW52 OUT: BW3, BW34 , BW53
Bus Separation		Bus 1 and Bus 2 the same: 40-40, 80-80, 160-160, 160LT-160LT: or Bus 1 or Bus 2 is 0V: 30-0, 40-0, 80-0, 160-0, 160LT-0, 0-30, 0-40, 0-80, 0-160, 0-160LT: IN: BW1, BW2, BW3, BW14, BW24, BW34, BW51, BW52, BW53

Table 2-3. Drive Interface Bd. Jumper Selections for AM16007 Stepper Drive

AXIS	1	2	3	4
FUNCTION	**AM16007 STEPPING DRIVE CONFIGURATION**			
MTR OUTPUT	BW15, 16 OUT	BW25, 26 OUT	BW35, 36 OUT	BW45, 46 OUT
PHASE D/B-	BW10 1-2	BW20 1-2	BW30 1-2	BW40 1-2
DRIVE +5V	JP12 IN	JP22 IN	JP32 IN	JP42 IN
MODE	JP10 IN	JP20 IN	JP30 IN	JP40 IN
ICMDA	JP11 IN	JP21 IN	JP31 IN	JP41 IN
AMP FAULT	JP13 OUT	JP23 OUT	JP33 OUT	JP43 OUT
DRIVE KEY	POS C	POS C	POS C	POS C
TACH	JP15 OUT	JP25 OUT	JP35 OUT	JP45 OUT
PHASE A	BW13 IN	BW23 IN	BW33 IN	BW43 IN

Table 2-4. Drive Interface Bd. Jumper Selections for DS16020 / DS16030 Servo Drive

AXIS	1	2	3	4
FUNCTION	**DS16020 / DS16030 BRUSH SERVO DRIVE CONFIGURATION**			
MTR OUTPUT	BW15, 16 IN	BW25, 26 IN	BW35, 36 IN	BW45, 46 IN
PHASE D/B-	BW10 OUT	BW20 OUT	BW30 OUT	BW40 OUT
DRIVE +5V	JP12 OUT	JP22 OUT	JP32 OUT	JP42 OUT
MODE	JP10 OUT	JP20 OUT	JP30 OUT	JP40 OUT
ICMDA	JP11 OUT	JP21 OUT	JP31 OUT	JP41 OUT
AMP FAULT	JP13 2-3	JP23 2-3	JP33 2-3	JP43 2-3
DRIVE KEY	POS B	POS B	POS B	POS B
TACH	JP15 IN	JP25 IN	JP35 IN	JP45 IN
PHASE A	BW13 IN	BW23 IN	BW33 IN	BW43 IN

Table 2-5. Drive Interface Bd. Jumper Selections for AS32020 / AS32030 Brushless Drive

AXIS	1	2	3	4
FUNCTION	**AS32020 / AS32030 BRUSHLESS SERVO DRIVE CONFIGURATION**			
MTR OUTPUT	BW15, 16 IN	BW25, 26 IN	BW35, 36 IN	BW45, 46 IN
PHASE D/B-	BW10 OUT	BW20 OUT	BW30 OUT	BW40 OUT
DRIVE +5V	JP12 IN	JP22 IN	JP32 IN	JP42 IN
MODE	JP10 OUT	JP20 OUT	JP30 OUT	JP40 OUT
ICMDA	JP11 IN	JP21 IN	JP31 IN	JP41 IN
AMP FAULT	JP13 1-2	JP23 1-2	JP33 1-2	JP43 1-2
DRIVE KEY	POS G	POS G	POS G	POS G
TACH	JP15 OUT	JP25 OUT	JP35 OUT	JP45 OUT
PHASE A	BW13 IN	BW23 IN	BW33 IN	BW43 IN

Table 2-6. Drive Interface Board Jumper Selections for AS3005 Brushless Drive

AXIS	1	2	3	4
FUNCTION	**AS3005 BRUSHLESS SERVO DRIVE CONFIGURATION**			
MTR OUTPUT	BW15, 16 IN	BW25, 26 IN	BW35, 36 IN	BW45, 46 IN
PHASE D/B-	BW10 2-3	BW20 2-3	BW30 2-3	BW40 2-3
DRIVE +5V	JP12 OUT	JP22 OUT	JP32 OUT	JP42 OUT
MODE	JP10 OUT	JP20 OUT	JP30 OUT	JP40 OUT
ICMDA	JP11 IN	JP21 IN	JP31 IN	JP41 IN
AMP FAULT	JP13 1-2	JP23 1-2	JP33 1-2	JP43 1-2
DRIVE KEY	POS A+E	POS A+E	POS A+E	POS A+E
TACH	JP15 OUT	JP25 OUT	JP35 OUT	JP45 OUT
PHASE A	BW13 IN	BW23 IN	BW33 IN	BW43 IN

2.2.3. Bus Configuration

The DR500 provides two different bus voltages with each capable of being set as a unipolar or bipolar power supply. Each bus power supply may be 40, 80, or 160 VDC unipolar (single supply) or as a 30 VDC bipolar supply (dual (+) and (–) supply). The 30 VDC bipolar power supply is for use with the linear three-phase AC brushless drive (AS3005). Bus power voltages are derived from isolation transformers, autotransformers, or offline, depending on the line voltage, bus voltage, and other factors. The bus supply information can be obtained from the DR500 system drawing (provided with the DR500).

2.2.3.1. Bus Type (Unipolar/Bipolar Configuration)

The DR500 Bus supplies are normally configured at that factory when the system is built. These supplies should not need to be reconfigured unless a change in bus voltage is needed and, in these cases, it is advisable to contact the factory.

2.2.3.2. Bus #1, Unipolar

When the bus #1 supply is a unipolar supply, the BW5 jumper must be removed to solder in the BW4 and BW6 jumpers.

2.2.3.3. Bus #1, Bipolar

When the bus #1 supply is a bipolar supply, jumpers BW4 and BW6 must be removed and the BW5 jumper must be soldered in.

2.2.3.4. Bus #2, Unipolar

When the bus #2 supply is a unipolar supply, the BW8 jumper must be removed to solder in the BW7 and BW9 jumpers.

2.2.3.5. Bus #2, Bipolar

When the bus #2 supply is a bipolar supply, jumpers BW7 and BW9 must be removed and the BW5 jumper must be soldered in.

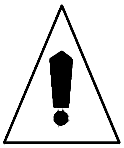
2.2.3.6. Bus Voltage Configuration

The bus voltage is dependent on the AC voltage applied to the AC input of the bus supplies (#1 bus supply AC inputs are P1 and P2, #2 bus supply AC inputs are P6 and P7). The source of AC voltage is typically from isolation transformers with output voltages of 28, 56, or 115 VAC for unipolar supplies that correspond to DC bus voltages of 40, 80 and 160 VDC. The bipolar isolation transformer AC voltage is 21 VAC (Line – CT) and this corresponds to 30 VDC. For bipolar supplies, a transformer centertap connection is also required. The Bipolar supply #1 transformer centertap connection is BW5 and the Bus supply #2 transformer centertap connection is BW8. These transformers are mounted internally on the left side of the DR500 with T1 used for bus supply #1 and T2 used for bus supply #2. When Autotransformers and offline methods are used to provide power to the bus supplies the bus supply cannot be grounded. The bus supplies are grounded by connections to BW4 (Bus supply #1) and BW7 (Bus supply #2). Bus supply #1 contains capacitors C1 and C2, and bus supply #2 contains capacitors C3 and C4. These capacitors are 100 volt capacitors for bus voltages of 80 volts or less and 200 volt capacitors for bus voltages greater than 80 volts.

If Bus supply #1 has no transformer (i.e., 160LT-x) insert F8, otherwise, insert BW11. Likewise, if Bus supply #2 (i.e., x-160LT) has no transformer, insert F10, otherwise, insert BW12.

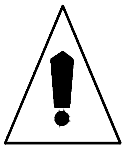
Bus supply #1 is the supply for axis #1 and any axis connected to this bus. Bus supply #2 is the supply for axis #4 and any axis connected to this bus. Axis two and three can be connected to bus supplies in several different arrangements. A restriction concerning bus separation requires that amplifiers with like voltages must be in consecutive slots. See the Bus separation selection (Table 2-2) for additional information concerning the bus separation jumpers (Bus separation jumpers: BW1, BW2, BW3, BW14, BW24, BW34, BW51, BW52 and BW53).

It may be necessary to add an optional shunt regulator to either bus to dissipate regenerative energy from the load. See Section 1.2.1.



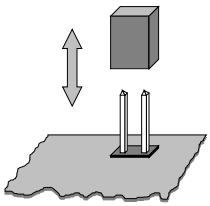
Always disconnect the main power connection before opening the DR500.

2.2.4. Installing A Drive Module in the DR500



To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power for 1 minute before inserting/removing drive modules or changing jumper configurations.

Before installing a drive module into a slot in the DR500 (refer to Figure 2-3), it is necessary to configure the jumpers on the Drive Interface board for that type of drive module. There are currently three types of modules: brush motor drive modules - the DS series, stepper motor drive modules - the AM series, and AC brushless motor drive modules - the AS series.



There are two types of jumpers discussed in the following sections: two pin headers and #16 gauge solid bus wire. The two pin header jumpers are designated as JPx#, where the "x" corresponds to a specific axis (e.g., JP23 is an axis 2 jumper, JP43 is an axis 4 jumper, JP13 is an axis 1 jumper, etc.). All the non-axis specific jumpers are outside the range of 10 through 49. The "#" designates a particular jumper having the same function for each axis. The other type of jumpers are #16 gauge solid bus wire jumpers and are designated as BWx#, where the "x" and "#" have the same meaning as previously described.

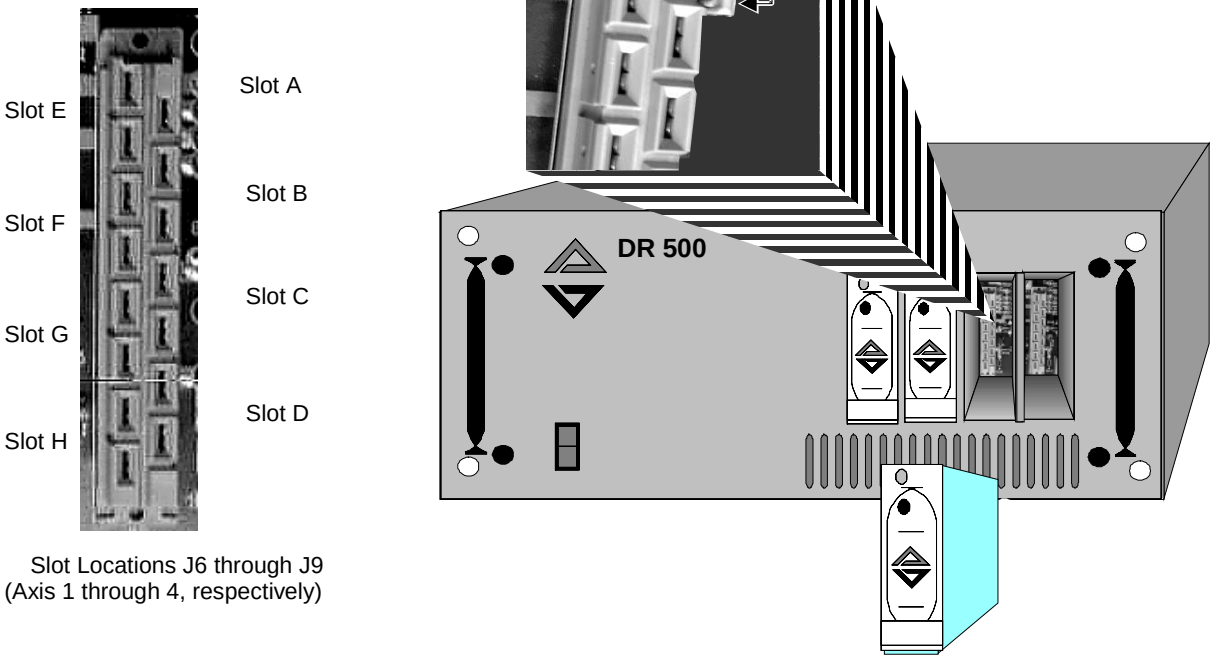


Figure 2-3. Drive Module Installation

2.2.5. Brush Drive Configuration (DS16020 or DS16030)

To configure a slot in the DR500 for a brush drive module (refer to Figure 2-4 for DS16020 and DS16030), proceed with the following steps:

- Set jumpers and drive key according to DS16020/DS16030 Brush Drive configuration (Table 2-4).

To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power for 1 minute before inserting/removing drive modules or changing jumper configurations.

To prevent another drive type from being inadvertently inserted into a slot configured for another type of drive module, the mating drive connector on the motherboard should have a key (Aerotech part number EAM857 otherwise Schroff #21101-252) inserted into slot B. Refer to Figure 2-3.

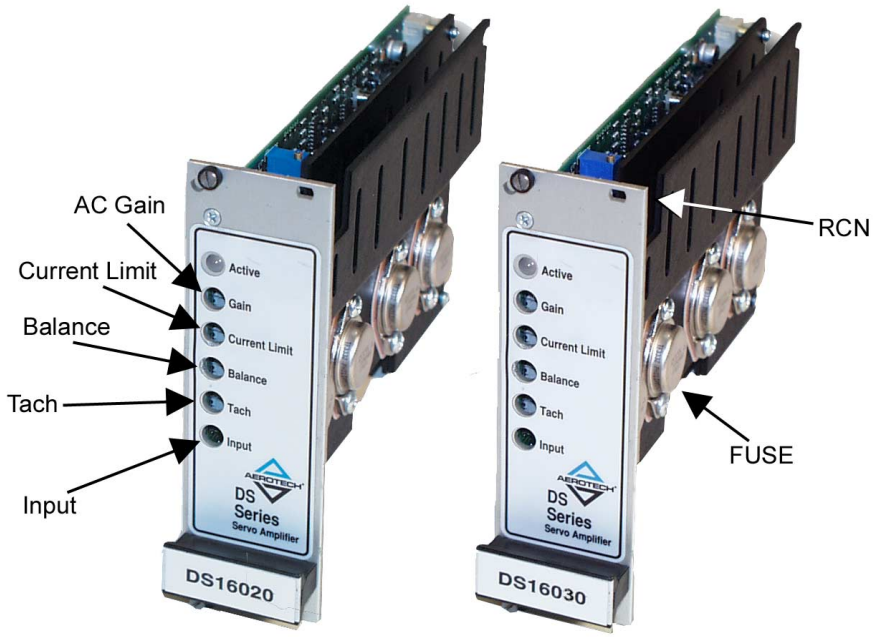


Figure 2-4. DS16020 / DS16030 Brush Drive Modules

2.2.5.1. Electrical Specifications

Electrical specifications are listed in Table 2-7.

Table 2-7. DS160 Series Electrical Specifications

	Units	DS16020	DS16030
Peak Current Output (2 sec)	Amps	±20	±30
Continuous Output Current	Amps	±10 (± 5 without fan)	±15 (± 5 without fan)
Output Fuse, F1 (3 AG, slow blow)	Amps	10 (5 w/o fan)	15 (5 w/o fan)
Peak Output Voltage	Volts	160	160
Minimum Voltage Output	Volts	10	10
Peak Power Output	Watts	2920	4200
Continuous Power Output	Watts	1530 (765 w/o fan)	2300 (765 w/o fan)
Efficiency	%	93	
Pre-Amplifier			
Voltage Gain (max open loop)	dB	100	
Drift (referred to input)	µV/°C	10	
Offset	Volts	Adjustable to Zero	
Power Amplifier			
Gain (continuous output)	Amps/Volt	1	2
Bandwidth	kHz	1	
PWM Switching Frequency	kHz	20	
Output Current Limit	Amps (max)	Adjustable: Zero to Peak	
Shutdown Input		Tristates Motor Output	
Minimum Load Inductance	mH	2	
Operating Temperature	°C	0 to 50	
Storage Temperature	°C	-30 to 85	
Weight	kg (lb)	0.5 (1)	

Two control sections (pre-amplifier and post-amplifier, in dotted lines) are shown in Figure 2-5. These control sections are detailed in Figure 2-6 and Figure 2-9.

2.2.5.2. Fault Output

The Servo Amplifier Module may be selectively configured for a Fault Output of active high. This is accomplished by removing the Fault Output Select jumper (see Figure 2-5) from JP1-1 to 2 and connecting the jumper to JP1-2 to 3 (both are P.C.B. trace jumpers).

2.2.5.3. Personality Module

The Personality Module pre-amplifier circuit, RCN4, (shown in Figure 2-6) is used to interface input and tach feedback signals (if any exist). Figure 2-3 shows the location of this module.

The user may reconfigure this module. An outline of the module is shown in Figure 2-8.

Table 2-8. DS160 Series Potentiometer Descriptions

Potentiometer	Description
Input	Provides the means of adjusting the DC gain of the input command present at J1-Pin 16. Turning this pot CW increases gain.
Tach	Provides the means of adjusting the DC gain of the tach feedback signal present at J1-Pin 18. Turning this pot CW increases gain.
Balance	Provides the means of canceling small DC offsets that may be present in the pre-amplifier circuit.
Current Limit	Provides a means of adjusting the clamp levels of the current command signal produced by the output of the pre-amplifier. Turning this pot CCW increases the clamp levels (increases the peak current).
Gain	Provides the means of adjusting the AC Gain of the pre-amplifier. Turning this pot CCW increases gain.

Pots are only used in Velocity Mode, except for current limit (typically set full CCW).

Current Limit pot may be set full CW, for zero peak current, when shipped from Aerotech.

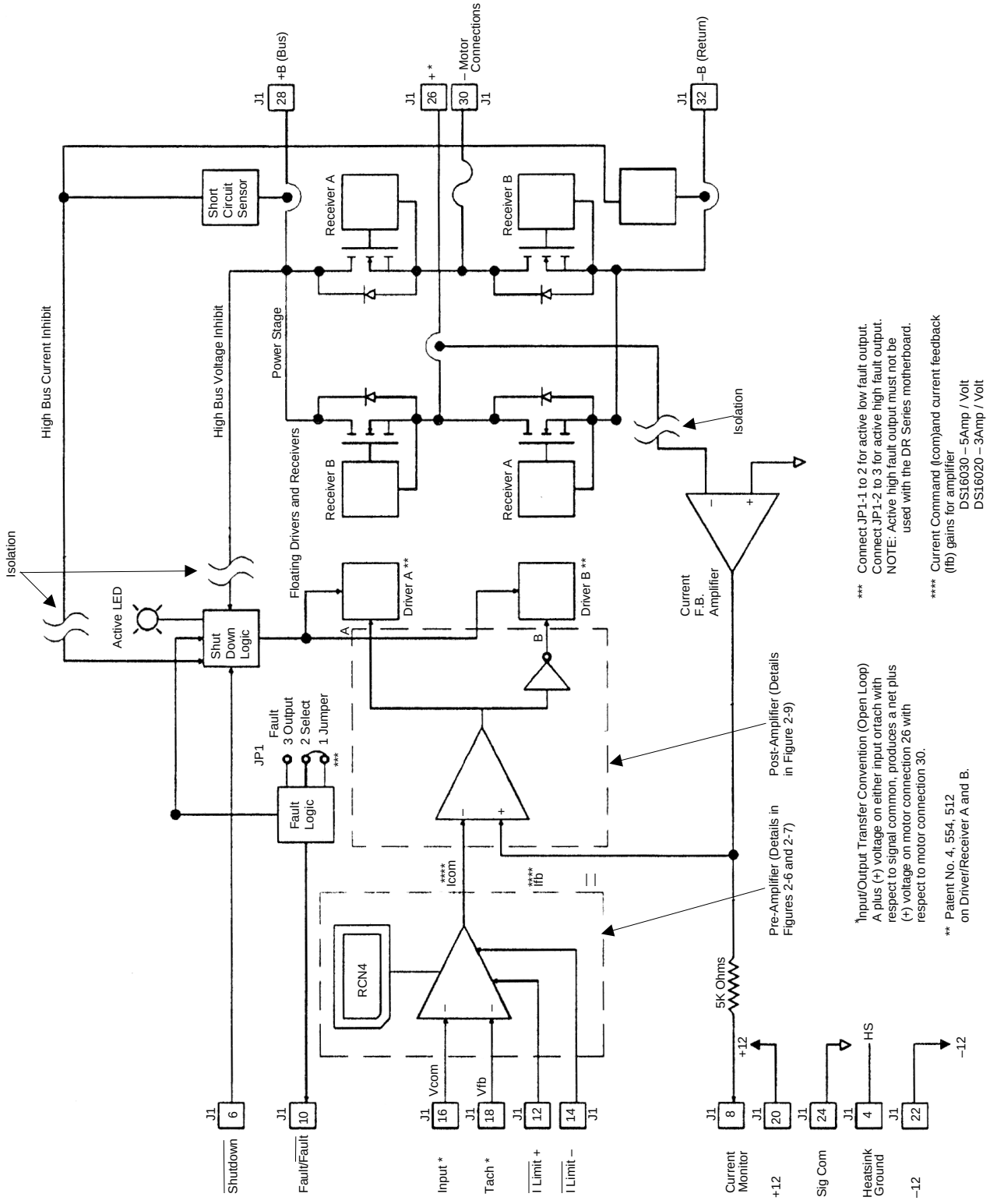


Figure 2-5. Simplified Block Diagram of the DS160 Series Servo Amplifier Module

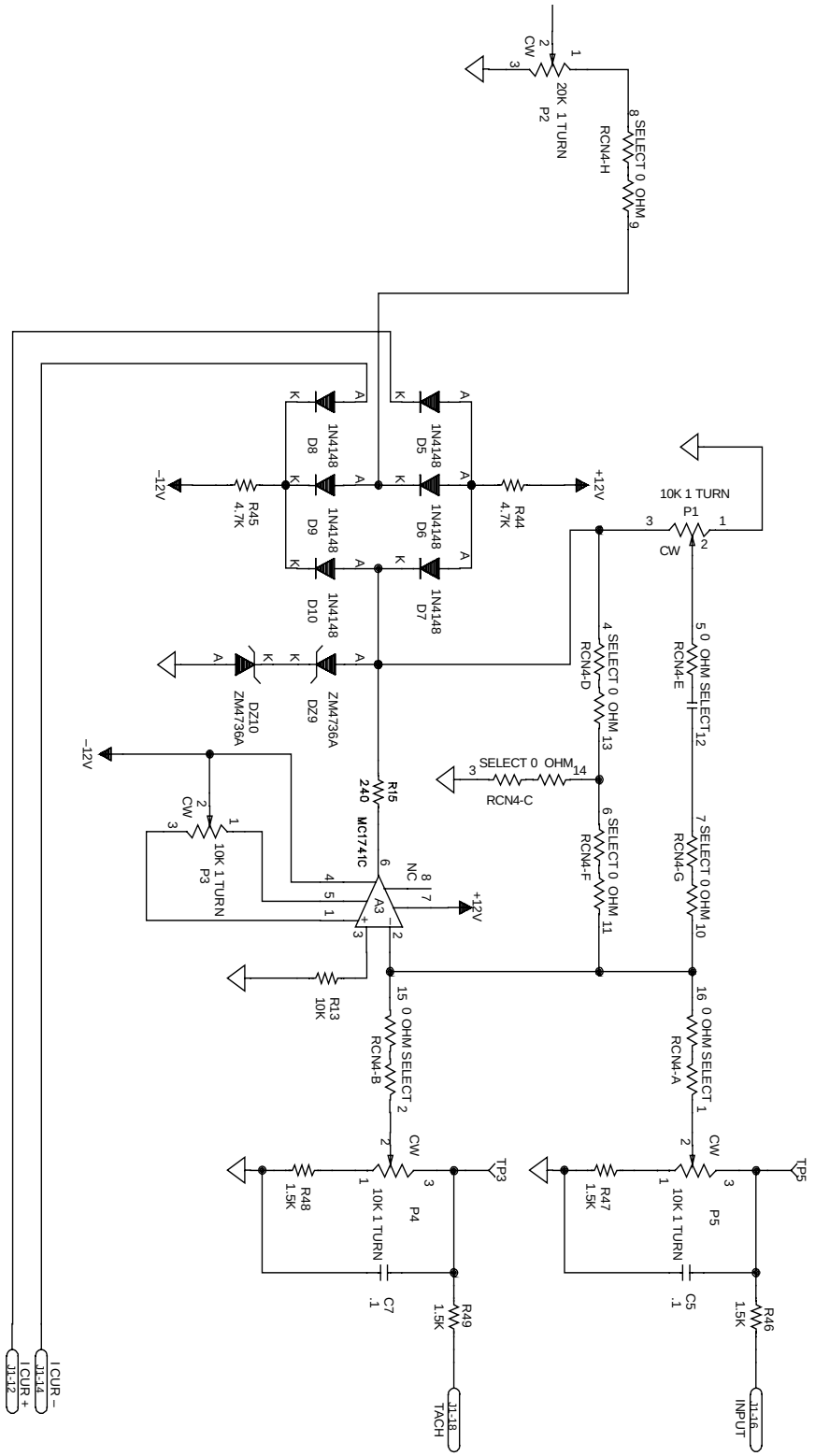


Figure 2-6. DS16020 / DS16030 Brush Drive Modules Pre-Amp Schematic

2.2.5.4. Setting the Current Limit

The RCN4 resistor component 8-9 is used to set the maximum current that can be obtained by the current limit potentiometer (full CW for zero current, full CCW for maximum current). In torque mode (default), this potentiometer should be full CCW, so the controller may limit the peak current by its parameters.

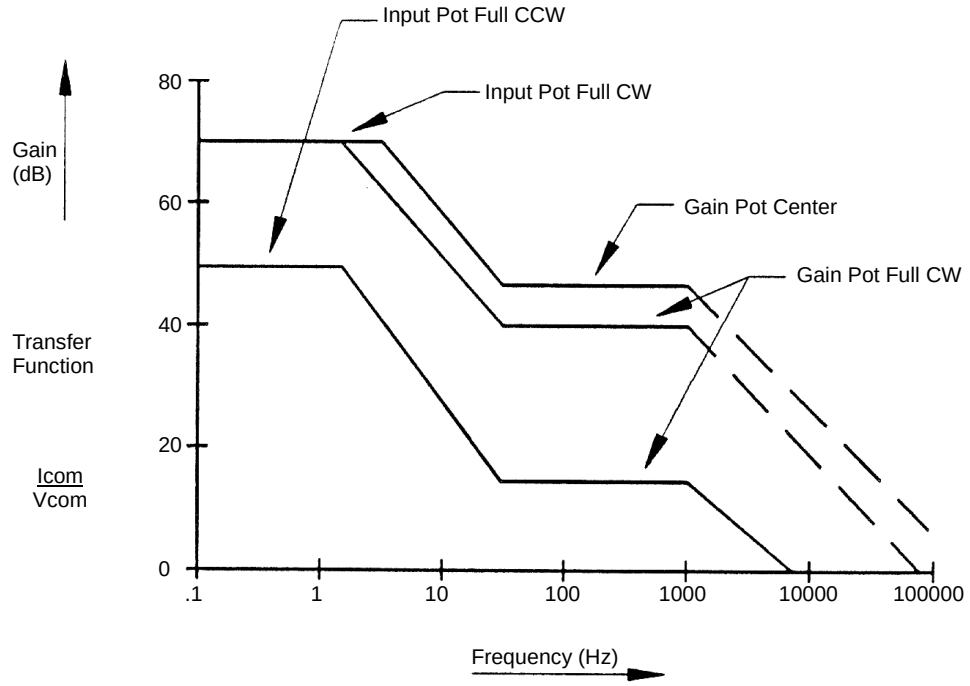
2.2.5.5. Pre-Amplifier Gain Characteristics

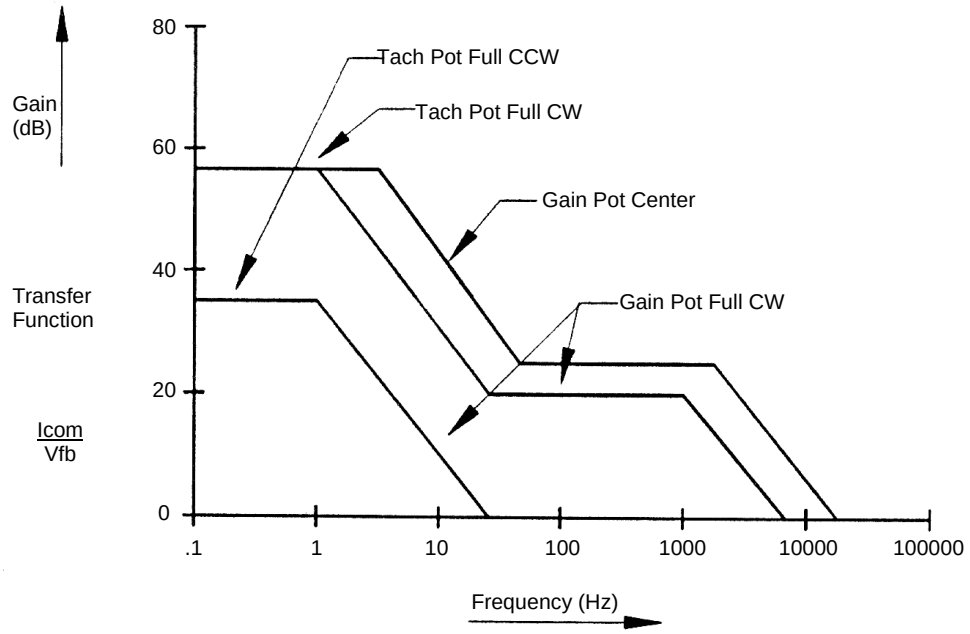
The open loop transfer function for the input connection Vcom (pin 16, J1) and tach feedback connection Vfb (pin 18, J1) to internal current command signal, Icom, is shown in Figure 2-7. The gain curves shown in Figure 2-7 are in relation to the values of RCN4 shown in Figure 2-6.

2.2.5.6. The Post-Amplifier

A detailed circuit description of the post-amplifier (shown by dotted lines in Figure 2-5) is outlined in Figure 2-9. The circuitry shown in Figure 2-9 is for reference only and is not intended to be altered by the user.

Figure 2-9 shows the control relationships of the internal current command, Icom, with the internal current feedback signal, Ifb, (see also Figure 2-5 and Figure 2-6. A brief outline of the PWM circuit, used to control the MOFSET switches of the output power stage, is also shown in this figure.





Note: Transfer functions shown above are with respect to values of RCN4 shown in Figure 2-5.

Figure 2-7. Transfer Function of Pre-Amplifier Circuit

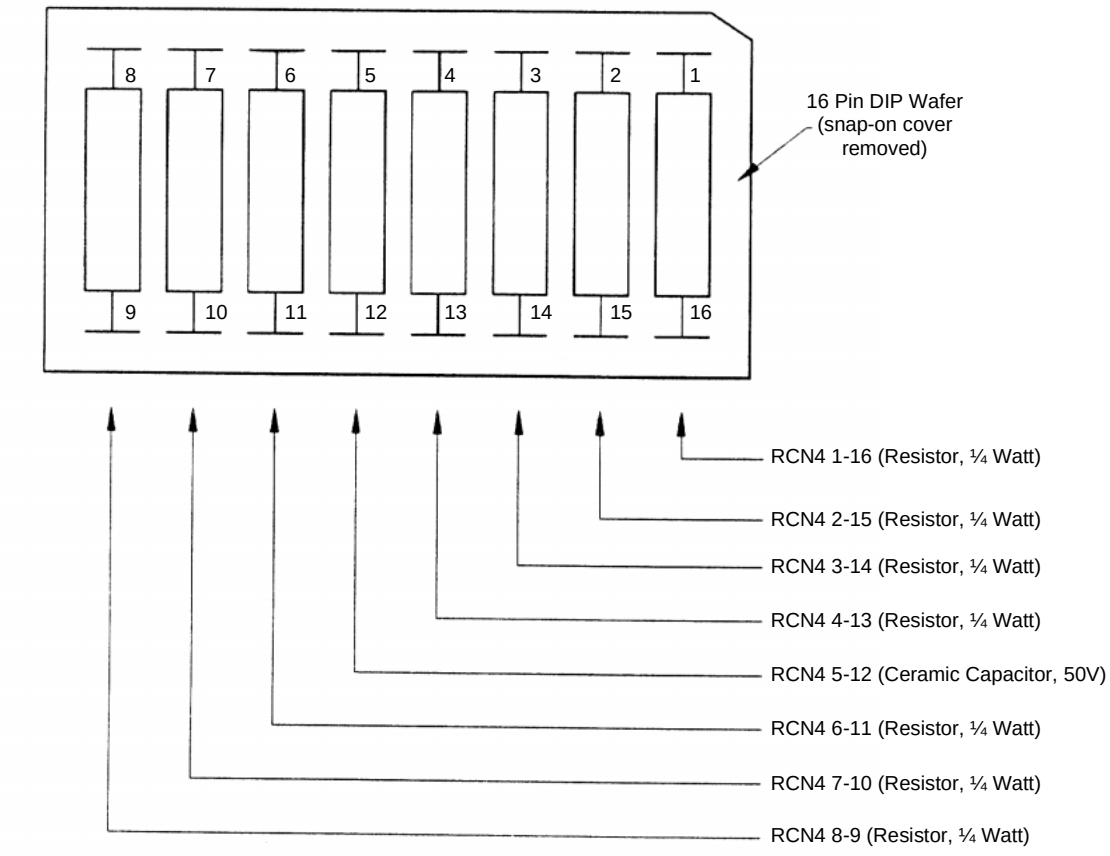


Figure 2-8. Outline of Personality Module RCN4

Table 2-9. DS160 Series Personality Module RCN4 Modes

	DS16020		DS16030	
	Torque Mode	**Velocity Mode**	**Torque Mode**	**Velocity Mode**
1-16	10KΩ	10KΩ	10KΩ	10KΩ
2-15	Open	39KΩ	Open	39KΩ
3-14	Open	390Ω	Open	390Ω
4-13	0Ω	100KΩ	0Ω	100KΩ
5-12	Open	.1uF	Open	.1uF
6-11	10KΩ	100KΩ	10KΩ	100KΩ
7-10	Open	150KΩ	Open	150KΩ
8-9	1.2KΩ	1.2KΩ	2.2KΩ	2.2KΩ

The surface mount version of this module has a 0 ohm resistor in series with each component listed.

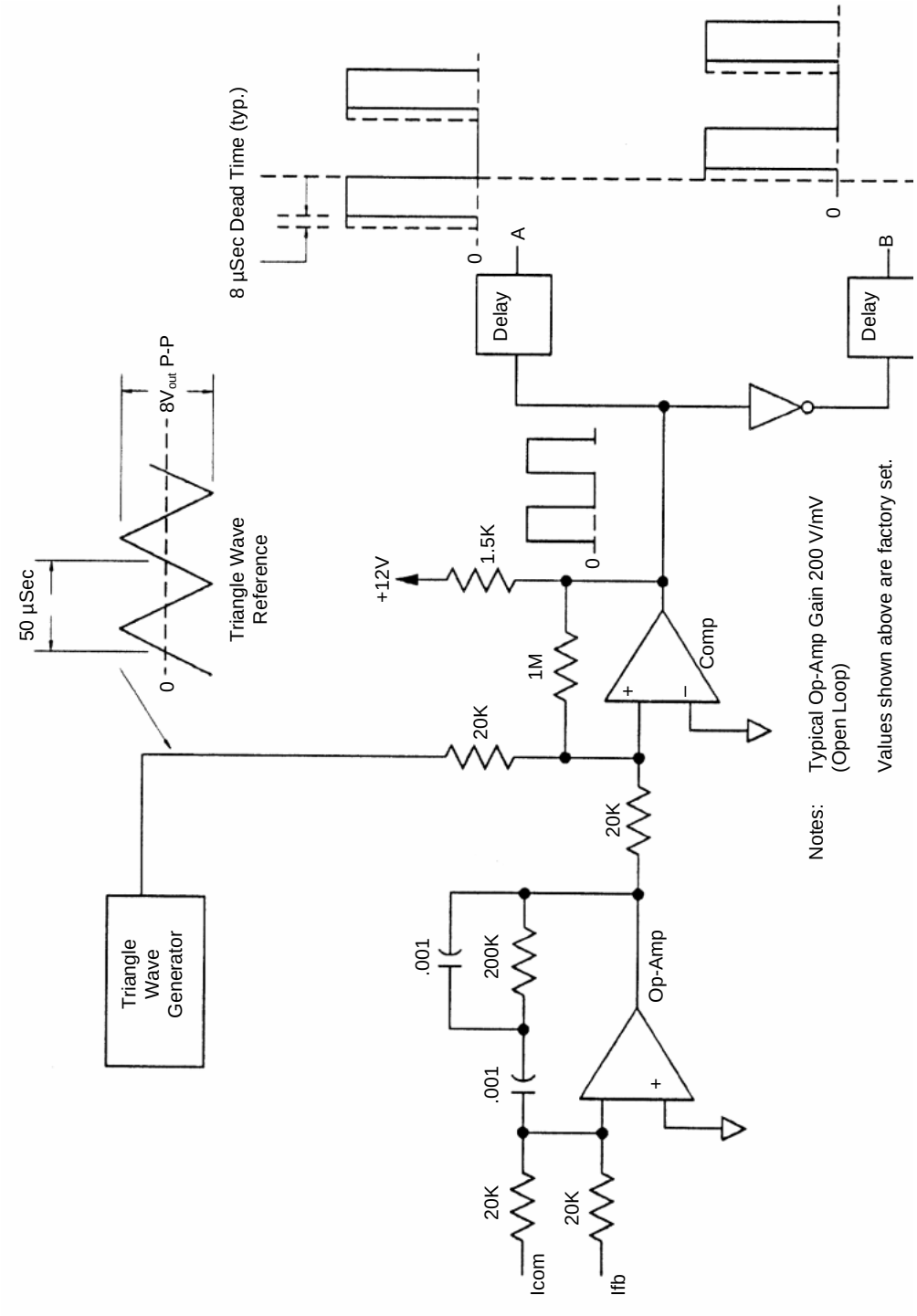


Figure 2-9. Detailed Electrical Diagram of DS160 Post-Amplifier Circuit

2.2.5.7. Troubleshooting the DS160 Series

A troubleshooting guide for the DS160 Series Servo Amplifier module is provided in Table 2-12. A list of recommended spare parts for the DS160 Series Servo Amplifier Module is shown in Table 2-13.

Table 2-10. DS160 Series Environmental Specifications

	Unit	Value	Comment
Operating Temp	°C	50 (max) – 0 (min)	Ambient temp of the servo module heatsink, not the enclosure
Storage Temp	°C	+85 (max) – -30 (min)	Shelf storage only, not stand-by use
Humidity	%	10 – 90	Non-condensing

Table 2-11. Power Stage Specifications

	Unit	Value	Pin	Comment
Short Circuit Trip	Amps (min)	40	J1-26, 30	Requires power-down reset. Max may be as high as 60 amps.
Typical input/output impedance	Ohms (max)	.3	J1-26, 28, 30, 32	From bus connection (28 or 32) to motor connection (26 or 30)
DC bus high voltage trip	VDC (min)	205	J1-28, 32	Requires power-down reset.
Typical switching efficiency	% (min)	93	--	Efficiency based on switching and resistance losses.

Table 2-12. DS160 Series Troubleshooting Guide

Condition	Possible Cause	References
Active LED is de-energized, even with ±12VDC applied to pins 20 and 22 of J1.	Shutdown input (pin 6, J1) is pulled low.	See Figure 2-5.
	High DC bus voltage (pins 28, 32 or J1).	See Figure 2-5.
	+12VDC input (pin 20, J1) is below +11VDC.	See Figure 2-5.
	Short circuit exists at motor connections (pin 26, 30 or J1)	See Figure 2-5.
Active LED is energized, but no torque is present at motor shaft.	Motor load fuse F1 is open	See Figure 2-5.
	I limit + (pin 12, J1) and/or I limit – (pin 14, J1) contact closed to signal common.	See Figure 2-5.
	No DC bus voltage on +B, +B return (pins 28, 32 of J1)	See Figure 2-5.
	Current limit pot turned full CW.	See Figure 2-5.
Motor accelerated to full speed when power was applied.	Tach feedback wires reversed (pin 18, 24 of J1)	See Figure 2-5.
	Personality module removed	See Figure 2-6.
Motor has high pitch (oscillation) sound when power is applied.	Tach and or Gain pot turned too high.	See Figure 2-6.
Motor gets excessively hot when running at minimum load condition (reference current monitor, pin 8 of J1).	Ripple current (peak to peak) in excess of 20% of continuous return of motor, due to too high pre-amplifier gains.	See Figure 2-6.
	Ripple current (peak to peak) in excess of 20% of continuous return of motor, due to too low motor inductance.	See Figure 2-6.

Table 2-13. DS160 Series Replacement Parts

Item	Aerotech Part #	Comment
DS16020 Servo Amplifier Module	EFA465	--
DS16030 Servo Amplifier	EFA469	--
Motor load fuse, F1		Use any “slow blow” fuse (no greater than 10 amp for DS16020 and 15 amp for DS16030 current with no less than 250 Volt rating). Fuse size: 3 AG
Personality Module (Blank)	EIK135 EIK162	Used for pre-selection of gain parameters for other motor combinations.

2.2.6. Stepper Drive Configuration (AM16007)

To configure a slot in the DR500 for a stepper drive module (Figure 2-10), proceed with the following steps:

- Set jumpers and drive key according to AM16007 Stepper Drive Configuration Table 2-3.

To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position for 1 minute before inserting/removing drive modules or changing jumper configurations.

To prevent another drive type from being inadvertently inserted into a slot configured for another type drive module, the mating drive connector on the motherboard should have a key (Aerotech part number EAM857 otherwise Schroff #21101-252) inserted into slot C. Refer to Figure 2-3. Electrical specifications and test points are listed in Table 2-14 and Table 2-15, respectively.

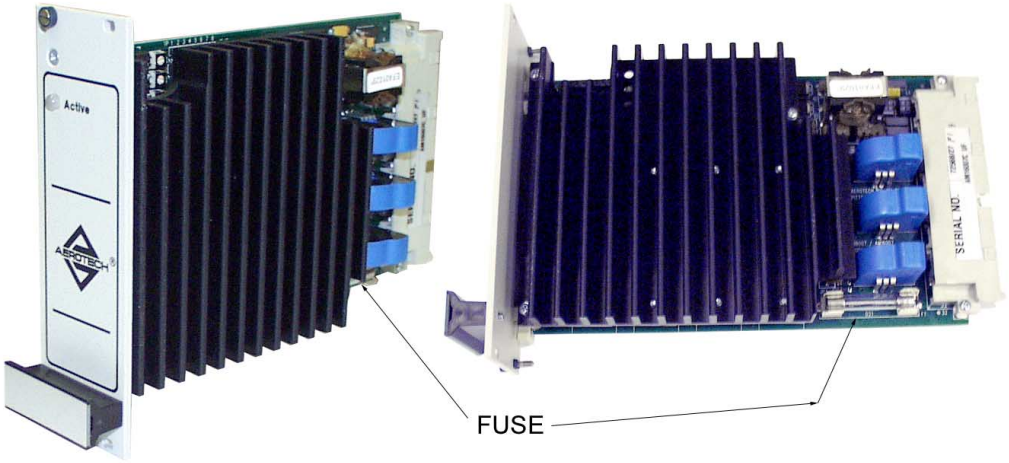


Figure 2-10. AM16007 Stepper Drive Modules

Table 2-14. AM16007 Series Electrical Specifications

	Units	AM16007
Peak Current Output (2 sec)	Amps	±7.5
Continuous Output Current	Amps	±5
Output Fuse, F1 (10 ASB)	Amps	7
Peak Output Voltage	Volts	160
Power Amplifier		
Gain (continuous output)	Amps/Volt	.75
PWM Switching Frequency	kHz	20
Shutdown Input		Tristates Motor Output
Minimum Load Inductance	mH	2
Operating Temperature	°C	0 to 50
Storage Temperature	°C	-30 to 85
Weight	kg (lb)	0.3 (.65)

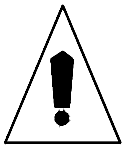
Table 2-15. AM16007 Series Test Points

Test Point	Signal
TP3	Triangle Wave (20 kHz)
TP4	Common
TP5	Sin I. Command
TP6	Sin I. Feedback
TP2	Cos I. Command
TP1	Cos I. Feedback

2.2.7. AC Brushless Drive Configuration (AS32020 or AS32030)

To configure a slot in the DR500 for an AC brushless drive module (Figure 2-11), proceed with the following steps:

- Set jumpers and drive key according to AS32020 / AS32030 Brush Drive Configuration Table 2-5.



To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power for 1 minute before inserting/removing drive modules or changing jumper configurations.

To prevent another drive type from being inadvertently inserted into a slot configured for another type drive module, the mating drive connector on the motherboard should have a key (Aerotech part number EAM857 otherwise Schroff #21101-252) inserted into slot A. Refer to Figure 2-3. Electrical specifications and test points are listed in Table 2-16 and Table 2-17, respectively.

If the drive is an AS3005 AC brushless, refer to the following section.

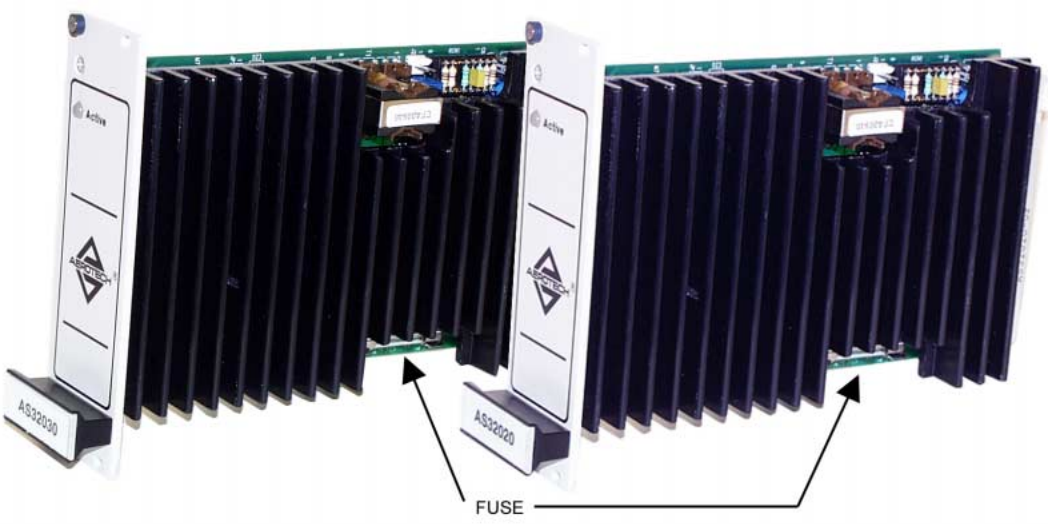


Figure 2-11. AS32020 / AS32030 AC Brushless Drive Modules

Table 2-16. AS32020 / AS32030 Series Electrical Specifications

	Units	AS32020	AS32030
Peak Current Output (2 sec)	Amps	±20	±30
Continuous Output Current	Amps	±7	±10.7
Output Fuse, F1 (3 AG, slow blow)	Amps	8	12
Peak Output Voltage	Volts	160*	160*
Efficiency	%	93	
Power Amplifier			
Gain (continuous output)	Amps/Volt	1	2
PWM Switching Frequency	kHz	20	
Output Current Limit	Amps (max)	Adjustable: Zero to Peak	
Shutdown Input		Tristates Motor Output	
Minimum Load Inductance	mH	2	
Operating Temperature	°C	0 to 50	
Storage Temperature	°C	-30 to 85	
Weight	kg (lb)	0.5 (1)	

* 320VDC, but limited by internal bus power supply to 160VDC.

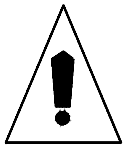
Table 2-17. AS32020/AS32030 Series Test Points

Test Point	Signal
TP4	Common
TP5	+5V
TP6	Phase A Current Command
TP7	Phase B Current Command
TP8	Phase B Feedback
TP9	Phase A Feedback
DS1	LED Drive Enable

2.2.8. AC Brushless Linear Drive Configuration (AS3005)

To configure a slot in the DR500 for an AC brushless linear drive module (Figure 2-12), proceed with the following steps:

- Set jumpers and drive key according to AS3005 Brushless Drive Configuration Table 2-6.



To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power for 1 minute before inserting/removing drive modules or changing jumper configurations.

To prevent another drive type from being inadvertently inserted into a slot configured for another type drive module, the mating drive connector on the motherboard should have a key (Aerotech part number EAM857 otherwise Schroff #21101-252) inserted into both the A and E slot. Refer to Figure 2-3. Electrical specifications and test points are listed in Table 2-18 and Table 2-19, respectively.

If the drive is not an AS3005 AC brushless drive, refer to the previous section. Configure the appropriate bus power supply for bi-polar operation following the Guidelines in Section 2.2.2., then, set BWx0 to position 1-4.

Figure 2-12. AS3005 Brushless Linear Drive Module

Table 2-18. AS3005 Series Electrical Specifications

	Units	AS3005
Peak Current Output (2 sec)	Amps	5
Continuous Output Current	Amps	*
Output Fuse, F1 (3 AG, slow blow)	Amps	*
Peak Output Voltage	Volts	30
Power Amplifier		
Gain (continuous output)	Amps/Volt	.5
Shutdown Input		Removes Input Command
Minimum Load	ohms	4
Operating Temperature	°C	0 to 50
Storage Temperature	°C	-30 to 85
Weight	kg (lb)	0.5 (1)

* Load dependent, consult factory.

Table 2-19. AS3005 Series Test Points

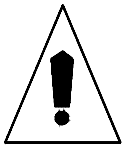
Test Point	Signal
TP5	Phase C Current Feedback
TP8	Phase B Current Feedback
TP10	Phase A Current Feedback
TP12	Torque Command (Phase A)
TP6	Phase C Current Command
TP9	Phase B Current Command
TP11	Phase A Current Command
TP7	Torque Command (Phase B)
DS1	L.E.D. Drive Enable
TP4	Common
TP3	-12V
TP2	+12V
P2	Phase B Offset Adjust
P3	Phase A Offset Adjust
P4	Phase C Offset Adjust

2.2.9. Internal System Wiring

The DR500 wiring varies depending upon the desired AC input voltage, the number of axes, and the desired DC bus voltage required for the drive modules. A system wiring drawing is provided with the documentation package for all DR500 systems.

2.3. Power Supply Fusing

The Bus Power Supply and entire DR500 chassis are fused on the AC side of the circuit by CB1, a combination power switch and circuit breaker. This will either be a 5A breaker (Aerotech P.N. EAW254, ETA P.N. 3120-F321-P7T1-R14LB4) or a 10A breaker (Aerotech P.N. EAW260, ETA P.N. 3120-F321-P7T1-W19LB4).



WARNING

To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power for 1 minute before inserting/removing drive modules or changing jumper configurations.

Aside from the two Bus power supplies, the DR500 contains a power supply that provides +5, +12, -12, and +24 VDC. This supply is located on the left side of the DR500 and is not user serviceable. Several re-settable fuses are located on the interface board for external +5V usage. These fuses do not require replacement, and are reset by turning off power for approximately 30 seconds resets this fuse (remove shorts overloads from +5V before turning power on).

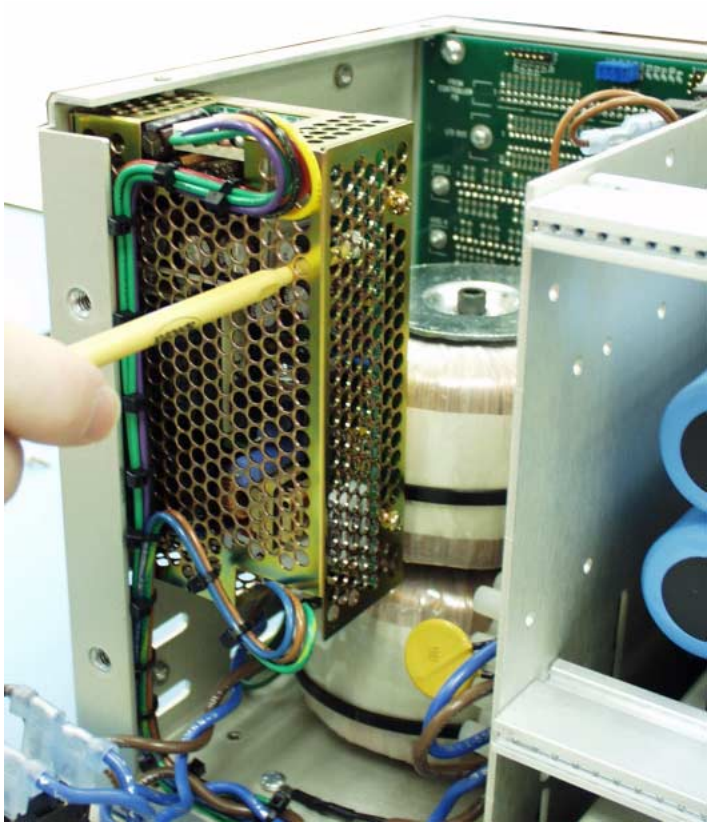


Figure 2-13. Power Supply Fusing 5V Adjust Potentiometer

2.4. Motor Fusing

Most drive modules have their own power fuse. See Sections 2.2.5. through 2.2.8. for fuse locations on the specific drive modules. To replace a drive module fuse, follow these steps.

To minimize the risk of electrical shock and bodily injury, ensure that all electrical power switches are in the off position and disconnect main power.

- Turn off the DR500 power switch
- Loosen the two screws on the cover plate of the drive module securing it to the front of the chassis, refer to Figure 2-14
- Remove the drive module from the DR500, refer to Figure 2-14
- Check for proper fuse size and type, and replace the fuse on the drive module.

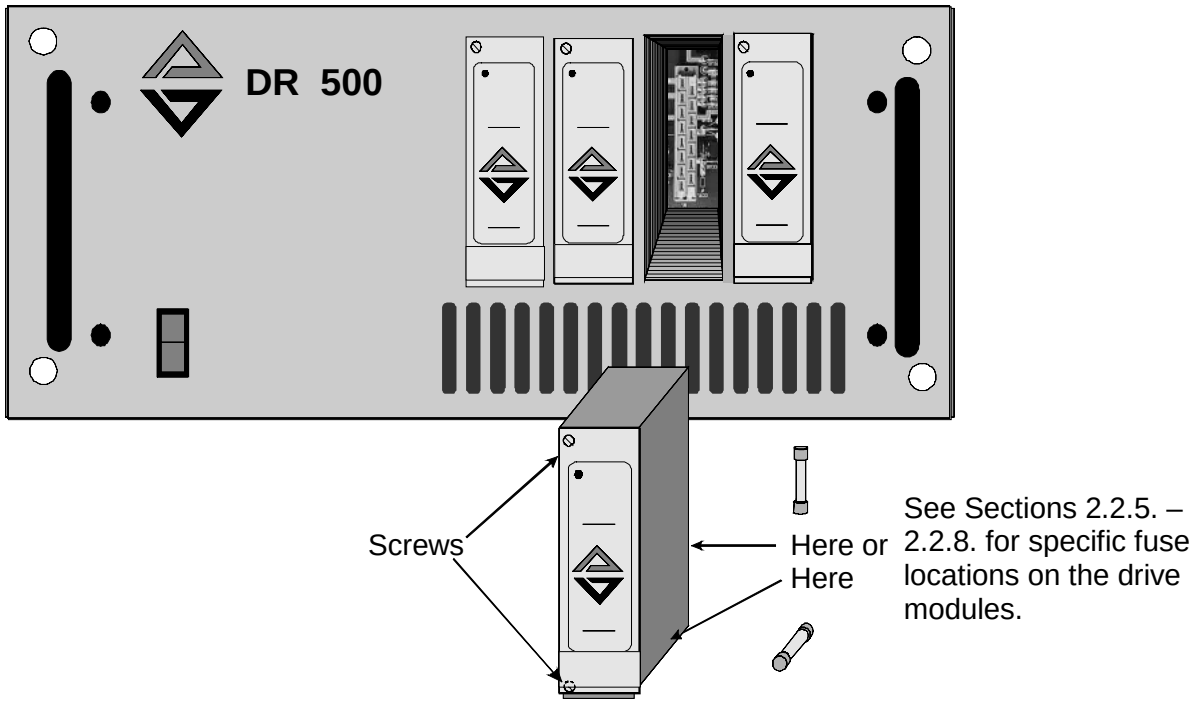


Figure 2-14. Drive Module Fuse Mounting

2.5. External Device Power

The 5 volt source for the joystick, pin 19 of the Misc. I/O connector, the encoder and limit switch power sources on the axis encoder connectors (if configured for 5 volt operation), and pin 25 of the I/O bus connector are fused by a re-settable fuse located on the interface board. Turning off power for approximately 30 seconds resets this fuse (remove shorts overloads from +5V before turning power on).

2.6. Mechanical Installation

The DR500 Rack Mount package is designed to be mounted into a standard 19" rack. The Desktop package can be placed on desk or bench top. Allowance must be made for the rear panel connections and cables.

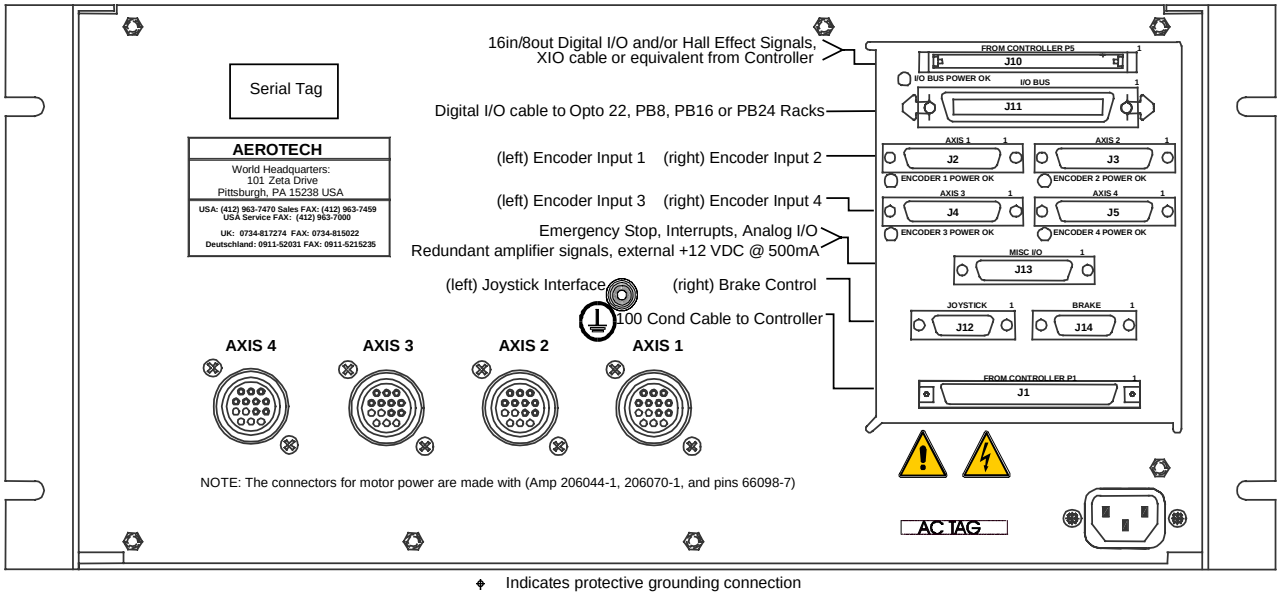


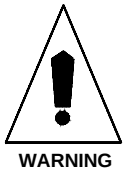
Figure 2-15. DR500 Rear Panel Connector Layout

Refer to Chapter 3 for rack mount and desktop package dimensions.

2.7. Electrical Installation

Motor, power, control, and position feedback cable connections are made to the rear of the DR500 (refer to Figure 2-15). To make the external power connection, the AC line cord (supplied with the DR500) is plugged into the lower right hand corner female plug.

Verify that the DR500 is configured for the correct AC line voltage.



The limit/encoder feedback connections connect to the appropriate axis, and the motor drive connections connect to the matching motor connector. For example, the location for the axis 1 motor connector is behind the axis 1 drive module (i.e., the axis motor connectors on the rear of the chassis are numbered 4 through 1 from left to right). Control connections are made through connector J1, labeled "From U500/U600 P1".

When using an AC brushless motor or the I/O bus, use the optional DIOSR/DRC cable that connects to P5 of the U500 or P10 of the U600 and to the rear of the DR500 to connector J10 (labeled "From UNIDEX 500-P5/U600-P10"). This cable accommodates Hall effect feedback devices. For applications that require resolver or inductosyn feedback, connect these cables directly to the resolver option board within the personal computer. When using the optional joystick or brake functions, the joystick connection is made at connector J12 (labeled "JOYSTICK") and the Brake connection is made at connector J14 (labeled "BRAKE"). Refer to Figure 2-16 for an example of the electrical connections made on the rear of the DR500.

Protective grounding (indicated by the symbol "⏚") is through the main power connection.

The supply connection is the main power cord (the main power disconnect).

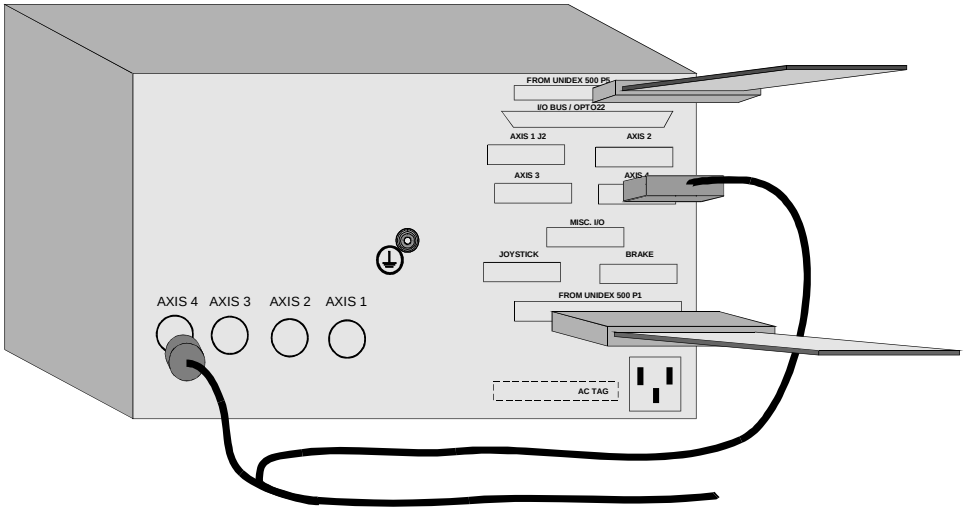


Figure 2-16. DR500 Electrical Connections

2.7.1. DR500 Power Up

To safely power up the DR500, properly connect all drive modules and cables to the DR500 before turning on the chassis. Likewise, always turn the system off before removing any cables from the DR500 chassis. Locate the system serial label in the upper left corner of the DR500 rear panel. This label contains important information such as:

- the customer order number
- the drawing number
- and the system part number.

This part number includes the required AC input voltage. The AC input voltage is determined by the following letters:

- A = 115 VAC
- B = 230 VAC
- C = 100 VAC
- D = 208 VAC.

For example, the DR500S-4-A-80/ specifies a 115 VAC input.

Before connecting the DR500 to its power source, compare the desired input power to the required input power indicated by the system part number.

A combination power switch/circuit breaker is located on the front of the DR500. This breaker is connected to the incoming AC power and provides protection for to the DR500 system in case of overloads. This breaker is selected to meet the current requirements of the DR500 system and is normally either a 5 amp or 10 amp breaker.

The external +5 volt connections are fused by re-settable fuses located on the interface board. These fuses protect the system should a fault or overload condition occur with the optical encoders, joystick, I/o bus, or Misc I/O connectors. This fuse will reset itself when the overload conditions are removed (power may also need to be turned off to reset the fuse). In addition to this fuse, each drive module has a safety fuse. To access the safety fuse, unscrew the module form the front panel.

The DR500 also provides external +12 volt supply connections for some requirements. The Misc I/O connector pin 21 (user supply) is normally connected to +12 volts. Some DR500 systems may use +12 volts for the limit switch supply (special requests / requirements). The DR500 can also provide an external +24 volt output for brake applications. The +24 volt Brake Output is only provided with the Brake Option.

2.8. DR500 Interface

The UNIDEX 500/600 is connected to the DR500 drive rack by connecting one or two optional cables between the units. The OP500 cable, a 100 conductor shielded cable, carries all control signals. This cable connects from P1 on the UNIDEX 500/600 motion processor board installed in the personal computer to the connector at the back of the DR500 Drive Chassis labeled "From UNIDEX 500/600 P1". Normally, this is the only connection required for brush and stepper motor systems.

Systems that use brushless motors require a second cable. The purpose of this cable is to connect the brushless motor Hall effect signals via the I/O bus to the U500/U600 controller board. This requires an additional 50 conductor ribbon cable (DIOSR/DRC, see Figure 2-17), connected from P5 on the UNIDEX 500 or P10 on the UNIDEX 600 to the connector on the rear of the DR500 chassis labeled "From U500-P5/U600-P10", except for the U500PCI.

A system drawing is provided in the customer documentation package for the DR500 system. This drawing will contain information concerning the AC line configuration, bus wiring, amplifier configurations, and options.

It may be necessary to add an additional slot to the user's personal computer (PC) to provide an exit for the DIOSR/DRC cable connector.

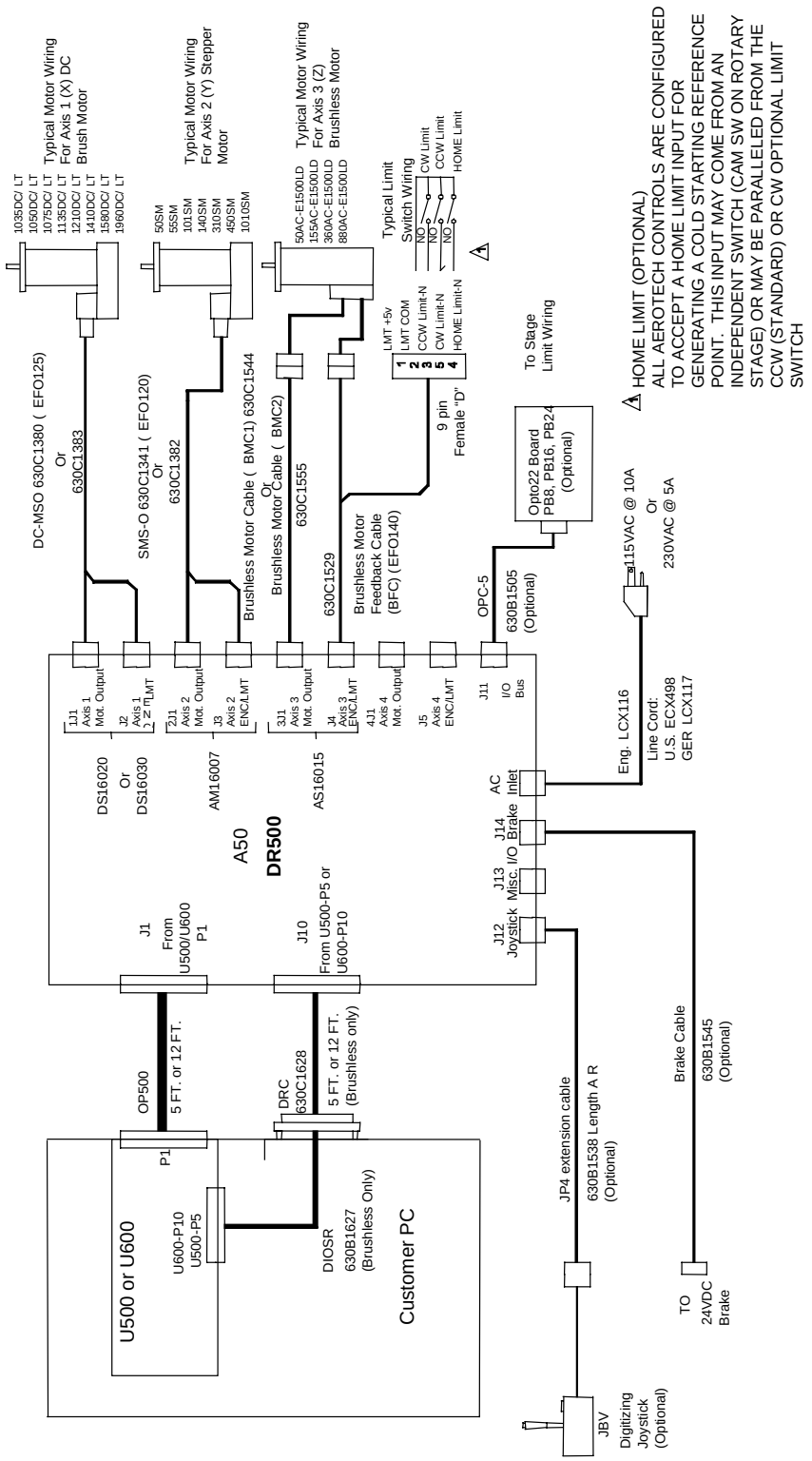


Figure 2-17. U500/U600 Generic System Interconnect

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CHAPTER 3: TECHNICAL DETAILS

In This Section:

3.1. Connector Pinouts and OP500 Interconnect Cable Specifications

Table 3-1 defines the pinouts for the 100-pin connector that mates with J1 on the rear of the DR500. This is a AMPLIMITE .050" series connector that is part of the 100 conductor shielded OP500 cable that connects the DR500 to connector P1 of the UNIDEX 500/600 CPU board. The OP500 cable carries differential encoder signals as well as analog signals which limits the maximum cable length to 15 feet.

All input and output designations are relative to the UNIDEX 500/600 CPU board, connector P1. All connectors are N.C. (no connection) where blank.

Refer to Figure 3-1 for the location of the connectors on the rear of the DR500 Chassis assembly.

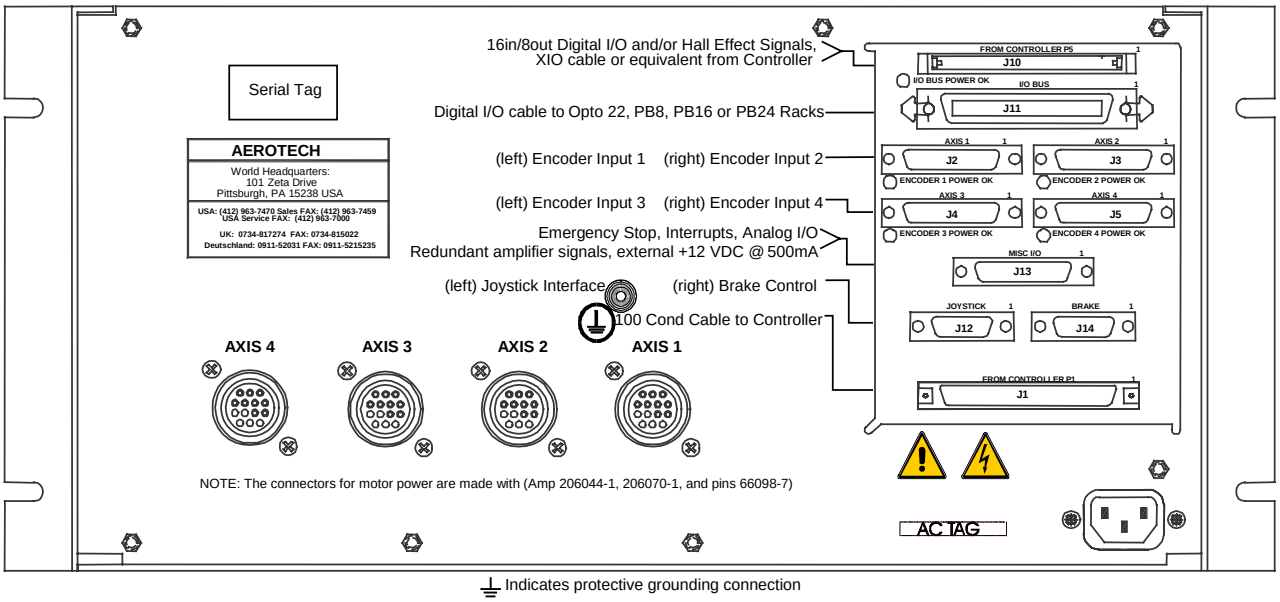


Figure 3-1. DR500 Rear Panel Connector Layout

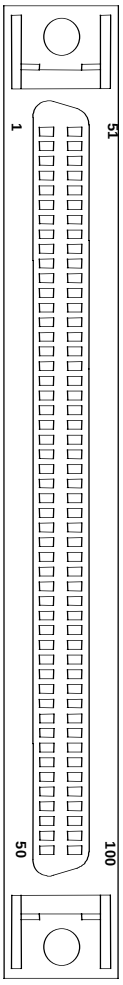


Table 3-1. Pinouts for Connector J1 (Interface to U500/U600 Connector P1)

Pin #	Description	Pin #	Description
1	Interlock Send	**51**	Common
2	Sync (unused) / Common	**52**	Hall Effect HC1
3	U500/U600 +5 Volts	**53**	+12 VDC OUT / DAC +12 VDC IN *****
4	U500/U600 +5 Volts	**54**	+12 VDC OUT / DAC Common *****
5	Hall Effect HB1	**55**	-12 VDC OUT / DAC -12 VDC IN *****
6	Hall Effect HA1	**56**	-12 VDC OUT / DAC Common *****
7	Sine Encoder + Axis 1	**57**	Mode Axis 1
8	Sine Encoder - Axis 1	**58**	Mode Axis 2
9	Cosine Encoder + Axis 1	**59**	User Input 0
10	Cosine Encoder - Axis 1	**60**	User Input 1
11	Marker Encoder + Axis 1	**61**	User Input 2
12	Marker Encoder - Axis 1	**62**	User Input 3
13	Hall Effect HB2	**63**	User Output 0
14	Hall Effect HA2	**64**	User Output 1
15	Sine Encoder + Axis 2	**65**	User Output 2
16	Sine Encoder - Axis 2	**66**	User Output 3
17	Cosine Encoder + Axis 2	**67**	Mode Axis 3
18	Cosine Encoder - Axis 2	**68**	Mode Axis 4
19	Marker Encoder + Axis 2	**69**	Axis Enable 1
20	Marker Encoder - Axis 2	**70**	Axis Enable 2
21	Hall Effect HC2	**71**	Axis Enable 3
22	Hall Effect HB3	**72**	Axis Enable 4
23	Sine Encoder + Axis 3	**73**	Axis Fault 1
24	Sine Encoder - Axis 3	**74**	Axis Fault 2
25	Cosine Encoder + Axis 3	**75**	Axis Fault 3
26	Cosine Encoder - Axis 3	**76**	Axis Fault 4
27	Marker Encoder + Axis 3	**77**	Common
28	Marker Encoder - Axis 3	**78**	Common
29	Hall Effect HA3	**79**	Current Command Axis 1
30	Hall Effect HC3	**80**	Current Command Axis 1 Phase 2
31	Sine Encoder + Axis 4	**81**	Current Command Axis 2
32	Sine Encoder - Axis 4	**82**	Current Command Axis 2 Phase 2
33	Cosine Encoder + Axis 4	**83**	Current Command Axis 3
34	Cosine Encoder - Axis 4	**84**	Current Command Axis 3 Phase 2
35	Marker Encoder + Axis 4	**85**	Current Command Axis 4
36	Marker Encoder - Axis 4	**86**	Current Command Axis 4 Phase 2
37	Hall Effect HB4	**87**	Common
38	Hall Effect HA4	**88**	Hall Effect HC4
39	Clockwise Limit Axis 1	**89**	Joystick Potentiometer 1
40	Counter Clockwise Limit Axis 1	**90**	Joystick Potentiometer 2
41	Clockwise Limit Axis 2	**91**	Joystick Button A
42	Counter Clockwise Limit Axis 2	**92**	Joystick Button B
43	Clockwise Limit Axis 3	**93**	Joystick Interlock (Button C)
44	Counter Clockwise Limit Axis 3	**94**	Brake
45	Clockwise Limit Axis 4	**95**	Analog Input 0
46	Counter Clockwise Limit Axis 4	**96**	Analog Input 1
47	Home Limit Input Axis 1	**97**	Emergency Stop Input (cathode - see pin 99)
48	Home Limit Input Axis 2	**98**	User Interrupt
49	Home Limit Input Axis 3	**99**	Opto-isolator Anodes Junction (for E-stop)
50	Home Limit Input Axis 4	**100**	Interlock Receive

*** See Individual pin descriptions**

3.1.1. Pin Descriptions

The following is a brief description for each pin of the OP500 connector that connects J1 of the DR500 to the U500/U600 CPU board.

For hardware specific information on a signal, refer to your controller's hardware manual.

Pin 1 - Interlock Send	The DR500 input is a logic signal driven by the UNIDEX 500/600 to sense the presence of the DR500 Drive Chassis. UNIDEX 500/U600 drives this line and senses the signal returned through the drive chassis (on pin 100 interlock receive) to assure the system is properly connected.
Pin 2 - Amplifier Sync / Common	The Sync. signal is a logic level square wave output at 20 kilo hertz that drives the PWM current regulators, on the drive modules, to synchronize the switching of the power output circuits. This is currently not used by any drive modules. This pin may also be configured as common.
Pins 3 & 4 - Encoder Power	These +5 volt Encoder Power inputs are not normally used by the DR500. These connections are used to provide optional +5 volt power from the U500/U600 board.
Pins 51, 77, 78, 87	These pins are common to the power supply.

The following pins repeat for all 4 axes. For each set of encoder signals refer to Figure 3-2 (Motor Phasing) and Figure 3-3 (Linear Motor (Forcer) CW Direction). On the U500/U600 board, each of the outputs are applied to a differential receiver (26LS32 typical) with a 180 ohm termination resistor across each pair of inputs. In addition, each of the sine and cosine signal pairs are also connected to an exclusive OR circuit for the purpose of detecting the loss of encoder signals (this excludes the marker signal pairs).

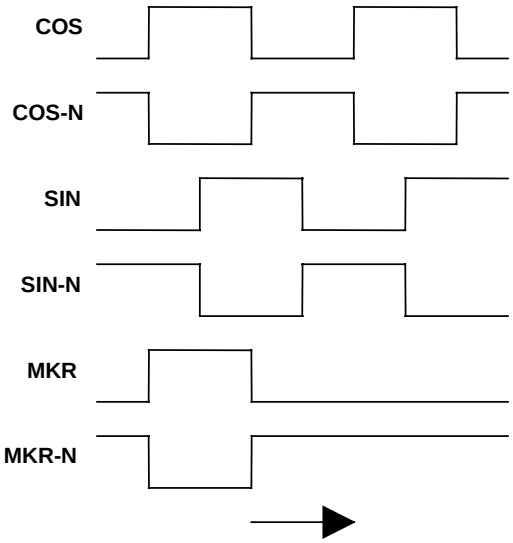


Figure 3-2. CW Motor Rotation Viewed from Mounting Flange End

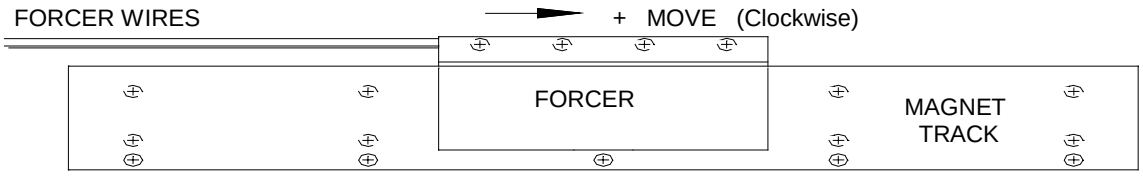


Figure 3-3. Linear Motor (Forcer) CW Direction

AXIS 1 PINOUTS INCLUDE:

Pin 5 – HB1	This is axis #1 hall Effect Sensor B output
Pin 6 – HA1	This is axis #1 Hall Effect Sensor A output
Pin 7 - Sine	This is the active high sine output from a differential quadrature type square wave encoder used for position and/or velocity feedback.
Pin 8 - Sine N	This is the active low sine output from a differential quadrature type square wave encoder used for position and/or velocity feedback.
Pin 9 - Cosine	This is the active high cosine output from a differential quadrature type square wave encoder used for position and/or velocity feedback.
Pin 10 - Cosine-N	This is the active low cosine output from a differential quadrature type square wave encoder used for position and/or velocity feedback.
Pin 11 - Marker	This is the active high marker output from a differential quadrature type square wave encoder. This produces a once per revolution indication from the motor that is used for homing the axis to an absolute reference position.
Pin 12 - Marker-N	This is the active low marker output from a differential quadrature type square wave encoder.
Pin 52 – HC1	This is axis #1 Hall Effect Sensor C output

AXIS 2 PINOUTS INCLUDE:

Pin 13 – HB2	This is axis 2 Hall Effect Sensor B output
Pin 14 – HA2	This is axis 2 Hall Effect Sensor A output
Pins 15 to 20	These follow the same sequence as those described for Axis 1 pins 7 - 12.
Pin 21 – HC2	This is axis 2 Hall Effect Sensor C output

AXIS 3 PINOUTS INCLUDE:

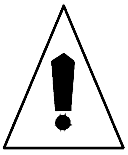
Pin 22 – HB3	This is axis 3 Hall Effect Sensor B output
Pins 23 to 28	These follow the same sequence as those described for Axis 1 pins 7 - 12.
Pin 29 – HA3	This is axis 3 Hall Effect Sensor A output
Pin 30 – HC3	This is axis 3 Hall Effect Sensor C output

AXIS 4 PINOUTS INCLUDE:

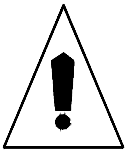
Pins 31 to 36	These follow the same sequence as those described in Axis 1 pins 7 - 12.
Pin 37 – HB4	This is axis 4 Hall Effect Sensor B output
Pin 38 – HA4	This is axis 4 Hall Effect Sensor A output
Pin 88 – HC4	This is axis 4 Hall Effect Sensor C output

Each of the following end of travel limit switch inputs (39-50) are contact closure signals. See the UNIDEX 500/U600 manuals for additional information concerning the end of travel limits.

Pin 39 - CW Limit Axis 1	When activated, this signal immediately stops all clockwise motion of the motor.
Pin 40 - CCW Limit Axis 1	When activated, this signal immediately stops all counter clockwise motion of the motor.
Pin 41 - CW Limit Axis 2	When activated, this signal immediately stops all clockwise motion of the motor.
Pin 42 - CCW Limit Axis 2	When activated, this signal immediately stops all counter clockwise motion of the motor.
Pin 43 - CW Limit Axis 3	When activated, this signal immediately stops all clockwise motion of the motor.
Pin 44 - CCW Limit Axis 3	When activated, this signal immediately stops all counter clockwise motion of the motor.
Pin 45 - CW Limit Axis 4	When activated, this signal immediately stops all clockwise motion of the motor.
Pin 46 - CCW Limit Axis 4	When activated, this signal immediately stops all counter clockwise motion of the motor.
Pin 47 - Home Limit Axis 1	This is the home limit switch output for axis 1. It is the same as the CW/CCW limit outputs except that it is used only during the home cycle to find a reference point to begin looking for the once per revolution marker pulse.
Pin 48 - Home Limit Axis 2	Refer to the description given for pin 47.
Pin 49 - Home Limit Axis 3	Refer to the description given for pin 47.
Pin 50 - Home Limit Axis 4	Refer to the description given for pin 47.

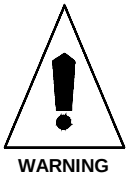


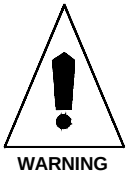
Pins 53 - +12V	This pin may be an input or output. On U500 and U600 ISA controllers, this pin is driven from the +12V from the ISA bus. On U500 PCI, this pin may be an input (+12V) to power the DAC's. See the U500 manual for more information.



Pins 54 - +12V/Common	On U500/U600 ISA controllers, this pin is driven from the +12V from the ISA bus. On the U500 PCI, this pin may be the common for the DAC's when using an isolated power supply. See the U500 manual for more information.

Pins 55 - –12V	This pin may be an input or output. On U500 and U600 ISA controllers, this pin is driven from the –12V from the ISA bus. On U500 PCI, this pin may be an input (–12V) to power the DAC's. See the U500 manual for more information.
Pins 56 - –12V/Common	On U500/U600 ISA controllers, this pin is driven from the –12V from the ISA bus. On the U500 PCI, this pin may be the common for the DAC's when using an isolated power supply. See the U500 manual for more information.





Pin 57 - Mode Control Axis 1 This input controls the AS/AM Series of stepper and brushless drive modules. See the U500 / U600 manuals for additional information concerning the Mode Control.

Pin 58 - Mode Control Axis 2 Refer to the description for pin 57.

The following four signals are the same user inputs (to the U500/U600 board) that are available on the I/O bus connector (J11) on the rear of the DR500 chassis. See the U500/600 manuals for additional information concerning the user inputs.

Pin 59 - User Input 0 This is the least significant input bit. Refer to the description given above.

Pin 60 - User Input 1 Refer to the description preceding pin 59.

Pin 61 - User Input 2 Refer to the description preceding pin 59.

Pin 62 - User Input 3 Refer to the description preceding pin 59.

The following four signals are the same user outputs that are on the I/O bus connector (J11) on the rear of the DR500 chassis. Each of these signals are logic-level open-collector outputs. All outputs go to a logic high state during reset. See the U500/U600 manuals for additional information concerning the user outputs.

Pin 63 - User Output 0 Refer to the description given above.

Pin 64 - User Output 1 Refer to the description preceding pin 63.

Pin 65 - User Output 2 Refer to the description preceding pin 63.

Pin 66 - User Output 3 Refer to the description preceding pin 63.

Pin 67 - Mode Control Axis 3 Input Refer to the description for pin 57.

Pin 68 - Mode Control Axis 4 Input Refer to the description for pin 57.

The following four input signals from the U500/U600 board are +5 volt logic level signals used to enable the drive modules. There is a pull up resistor (10K ohm typical) on each of these inputs. These inputs require the logic level to be low to engable the drive module in a standard configuration. If this input is set to a logic high (+5 volts), or is unconnected, the drive is disabled in the standard configuration. See the UNIDEX 500/U600 manuals for additional information concerning configuration of the Axis Enable signals.

Pin 69 - Axis Enable 1 Input	Refer to the description given above.
Pin 70 - Axis Enable 2 Input	Refer to the description preceding pin 69.
Pin 71 - Axis Enable 3 Input	Refer to the description preceding pin 69.
Pin 72 - Axis Enable 4 Input	Refer to the description preceding pin 69.

The following four Axis Fault signals are 5 volt logic level outputs. These outputs indicate an axis drive fault when the logic level is low. See the UNIDEX 500/U600 manuals for additional information concerning Axis Fault signals.

Pin 73 - Axis Fault 1 Output	Refer to the description given above.
Pin 74 - Axis Fault 2 Output	Refer to the description preceding pin 73.
Pin 75 - Axis Fault 3 Output	Refer to the description preceding pin 73.
Pin 76 - Axis Fault 4 Output	Refer to the description preceding pin 73.

Each of the following four pairs of inputs are the analog current command signals for the drive modules. The current commands are generated on the U500/U600 board by a serial D/A converter with 16 bit resolution scaled to a range that includes -10 to +10 volts (See the U500/U600 manuals for additional information). Each axis has two current commands associated with it. The first commands DC brush motors and the second (or phase two command output) is used in addition to the first to generate a quadrature, or a 120° offset current command, for stepping or AC brushless motors.

Pin 79 - Current Command Axis 1	Refer to the description given above.
Pin 80 - Current Command Axis 1 Phase 2	Refer to the description preceding pin 79.
Pin 81 - Current Command Axis 2	Refer to the description preceding pin 79.
Pin 82 - Current Command Axis 2 Phase 2	Refer to the description preceding pin 79.
Pin 83 - Current Command Axis 3	Refer to the description preceding pin 79.
Pin 84 - Current Command Axis 3 Phase 2	Refer to the description preceding pin 79.
Pin 85 - Current Command Axis 4	Refer to the description preceding pin 79.
Pin 86 - Current Command Axis 4 Phase 2	Refer to the description preceding pin 79.

The following two output signals are the analog outputs for the joystick interface. The joystick interface also includes three logic level outputs that are connected to the joystick buttons. The button C input is significant because it is the interlock for the joystick, indicating when it is connected to the system. The UNIDEX 500/U600 tests this input on power-up or reset so that the joystick may be calibrated for optimum performance. The controller can also sense if the joystick has become disconnected while in use, preventing a run-away condition. The U500/U600 manuals provide additional information concerning these signals.

Pin 89 - Joystick Potentiometer 1 Output	Refer to the description given above.
Pin 90 - Joystick Potentiometer 2 Output	Refer to the description preceding pin 89.

The following three logic inputs are used by the joystick interface for mode selection and detection of the joystick. The U500/U600 manuals provide additional information concerning these signals.

Pin 91 - Joystick Button A Output	Refer to the description given above.
Pin 92 - Joystick Button B Output	Refer to the description preceding pin 91.
Pin 93 - Joystick (Button C) Interlock	Refer to the description preceding pin 91.
Pin 94 - Brake Output	This input signal disengages an optional, normally on electromagnetic brake, driven by an open collector buffer. With the optional brake hardware present, there is a 10k ohm pull up resistor to the 5 volt logic supply.

The following two input signals are spare A/D signals to the U500/U600. One of these may be used as an MFO input. The U500/U600 manuals provide additional information concerning these signals.

Pin 95 - Analog A/D 0	Refer to the description given above.
Pin 96 - Analog A/D 1	Refer to the description preceding pin 95.

The following two signals vary from U500 to U600. See their respective Hardware manuals for complete information.

Pin 97 - Emergency Stop	Refer to the description given above.
Pin 98 - User Interrupt Input	Refer to the description preceding pin 97.
Pin 99 - Opto Isolator Anodes	Refer to the description preceding pin 97.
Pin 100 - Interlock Receive Output	This output is connected to pin 1 and is monitored by the U500/U600 controller to verify proper connection of the DR500. The U500/U600 manuals provide additional information concerning this signal.

3.2. DR500 Rear Panel Connectors

There are 14 connectors on the rear panel of the DR500 Chassis. The following sections show the pinouts for each connector and a description for each pin in the connector.

3.2.1. Motor Axis Connectors

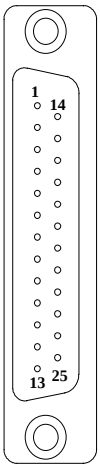


Table 3-2 shows the pinouts for Axis 1 through Axis 4. The mating connector is a Cinch #DB-25P (Aerotech # ECK101) for the Axis 1 through 4 connectors.

Table 3-2. Pinouts for Axis 1 Through Axis 4 (J2 - J5)

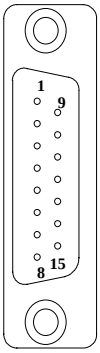
Pin #	Description	Pin #	Description
1	Shield (Chassis Frame)	**14**	Cosine Input
2	Auxiliary Shutdown Input (Remove JPx4 in DR500 to enable)	**15**	Cosine-N Input
3	+5 Volts	**16**	Limit Switch Power (+5V or +12V)
4	Common	**17**	Sine Input
5	Hall Effect Sensor B Input	**18**	Sine-N Input
6	Marker-N Input	**19**	Tachometer + Input
7	Marker Input	**20**	Common (Limit)
8	Tachometer - Input	**21**	Common (Encoder)
9	Reserved for setup (special option)	**22**	Home Limit Input
10	Hall Effect Sensor A Input	**23**	Reserved / Encoder Fault
11	Hall Effect Sensor C Input	**24**	Counter-clockwise end of travel limit input
12	Clockwise End Of Travel Limit Input	**25**	Unused / Brake + Output Option
13	Unused / Brake - Output Option		

3.2.2. Joystick Connector

Table 3-3 shows the pinouts for the Joystick connector. The mating connector is a Cinch # DA-15P (Aerotech # ECK100).

Table 3-3. Pinouts for the Joystick Interface Connector (J12)

Pin #	Description	Pin #	Description
1	+5 Volts	9	
2	Joystick Button A/C Input	10	
3	Joystick Potentiometer 1 Input	11	
4	Common	12	
5		13	Joystick Interlock (common) Input
6	Joystick Potentiometer 2 Input	14	
7	Joystick Button B/C Input	15	
8			



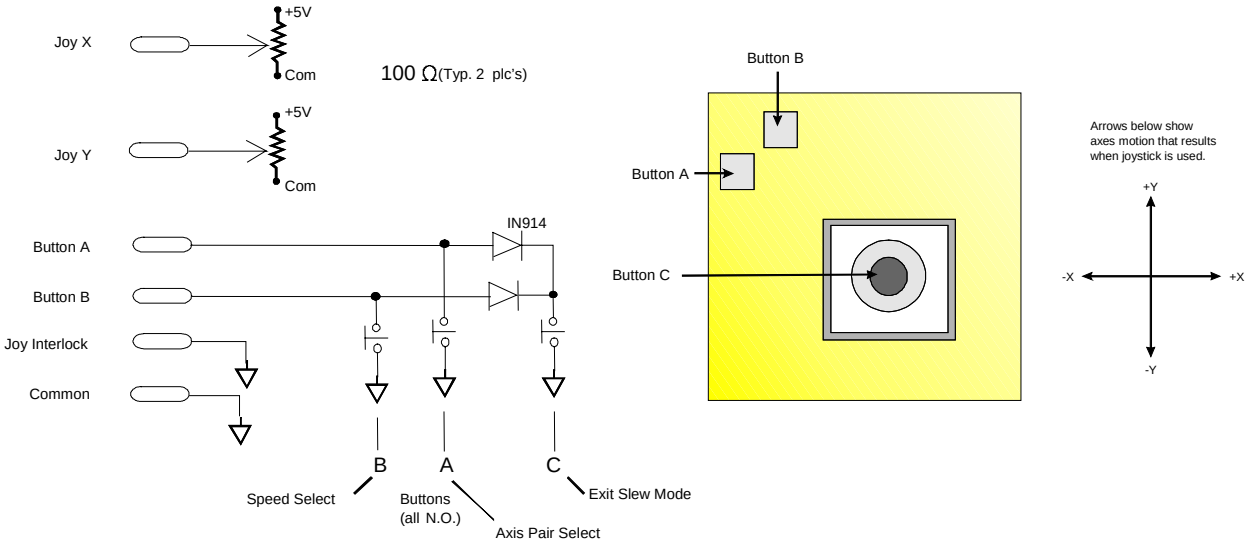


Figure 3-4. Joystick Interface

3.2.3. Miscellaneous Input/Output Connector

Table 3-4 shows the pinouts for the Miscellaneous Input/Output connector. The mate to this connector is a Cinch # DB-25P (Aerotech # ECK101).

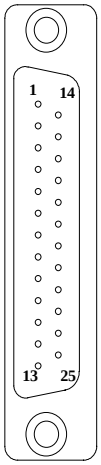


Table 3-4. Pinouts for the Miscellaneous I/O Connector (J13)

Pin #	Description	Pin #	Description
1	Shield (Chassis Frame)	**14**	Current Command Axis 1
2	User Interrupt	**15**	Current Command Axis 2
3	Emerg. Stop Opto-Isolator Input	**16**	Current Command Axis 3
4	Opto-Isolator Anode(s)	**17**	Current Command Axis 4
5	Fault Axis 1	**18**	Common
6	Fault Axis 2	**19**	+5 Volts
7	Fault Axis 3	**20**	User Common
8	Fault Axis 4	**21**	User +12 Volts (500mA max.)
9	Brake Output	**22**	Common
10	Shutdown Axis 1	**23**	Reserved
11	Shutdown Axis 2	**24**	Analog Input 0
12	Shutdown Axis 3	**25**	Analog Input 1
13	Shutdown Axis 4		

3.2.4. Brake Connector

Table 3-5 shows the pinouts for the brake connector. The mate to this connector is a Cinch # DA-15P (Aerotech # ECK100). The optional fail-safe brake may also be driven by the J2-J5 connectors (see Section 2.2.1).

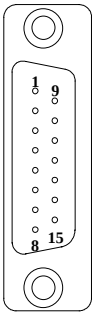


Table 3-5. Pinouts for Optional Brake Connector (J14)

Pin #	Description	Pin #	Description
1	Brake Common	**9**	
2	Brake Output	**10**	
3		**11**	
4		**12**	
5		**13**	
6	Shield (chassis frame)	**14**	
7	Brake Interlock Input	**15**	
8	Common (for interlock input)		

3.2.5. Digital I/O Connector

Table 3-6 shows the pinouts for the digital I/O or "From U500 P-5/U600 P10" connector. The mate to this connector is a 3M #3425-6050 (Aerotech # ECK332).

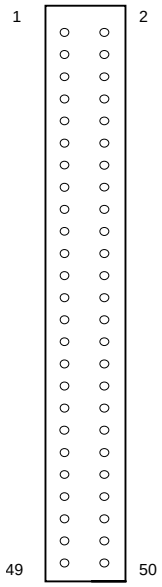
This connector is normally used to connect to U500-P5 or U600-P10. This is required if Hall effect sensors (brushless only) are used as shown in section 1.2.2. It is not required for the U500PCI.

When looking at this connector, note that all even numbered pins, 2 through 50 are common.

Table 3-6. Pinouts for the Digital I/O Connector (J10)

Pin #	Description	Pin #	Description
1	Input 15/Axis 4 Hall switch	**25**	Input 3
3	Input 14/Axis 4 Hall switch	**27**	Input 2
5	Input 13/Axis 4 Hall switch	**29**	Input 1
7	Input 12/Axis 3 Hall switch	**31**	Input 0
9	Input 11/Axis 3 Hall switch	**33**	Output 7
11	Input 10/Axis 3 Hall switch	**35**	Output 6
13	Input 9/Axis 2 Hall switch	**37**	Output 5
15	Input 8/Axis 2 Hall switch	**39**	Output 4
17	Input 7/Axis 2 Hall switch	**41**	Output 3
19	Input 6/Axis 1 Hall switch	**43**	Output 2
21	Input 5/Axis 1 Hall switch	**45**	Output 1
23	Input 4/Axis 1 Hall switch	**47**	Output 0
24		**49**	

The outputs are open collector devices and should only be exposed to +5 volt logic levels. All outputs are tri-stated (high impedance) on reset.



3.2.6. The Opto-22 Connector

Table 3-7 shows the pinouts for the Input/Output (I/O) or Opto-22 Bus connector. The mating connector is a 3M #3564-1001 (Aerotech # ECK353).

This connector is normally used to connect to U500-P5 or U600-P10 if Hall effect sensors are used. (See section 1.2.2.).

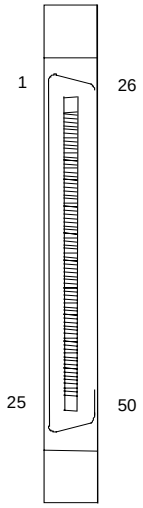


Table 3-7. Pinouts for the I/O Bus or Opto-22 Connector (J11)

Pin #	Description	Pin #	Description
1	Input 15/Axis 4 Hall switch	**14***	Input 2/High Speed Position Latch Input
2	Input 14/Axis 4 Hall switch	**15***	Input 1/Reserved Output 1
3	Input 13/Axis 4 Hall switch	**16***	Input 0/Reserved Output 2
4	Input 12/Axis 3 Hall switch	**17***	Output 7/Output 15
5	Input 11/Axis 3 Hall switch	**18***	Output 6/Output 14
6	Input 10/Axis 3 Hall switch	**19***	Output 5/Output 13
7	Input 9/Axis 2 Hall switch	**20***	Output 4/Output 12
8	Input 8/Axis 2 Hall switch	**21**	Output 3
9	Input 7/Axis 2 Hall switch	**22**	Output 2
10	Input 6/Axis 1 Hall switch	**23**	Output 1
11	Input 5/Axis 1 Hall switch	**24**	Output 0
12	Input 4/Axis 1 Hall switch	**25**	+ 5 Volts
13*	Input 3/User Reset Input	**26-50**	Common

Pins 17 through 20 are Outputs 12 through 15 when using the U600/U620 Systems. See the U600 Hardware manual for more information on pins 13 through 20.

3.2.7. DAC Outputs Connector

Table 3-8 shows the pinouts for the Input/Output (I/O) or Opto-22 Bus connector. The mating connector is a 3M #3564-1001 (Aerotech # ECK353).

Table 3-8. Pinouts for the DAC Outputs Connector (J16)

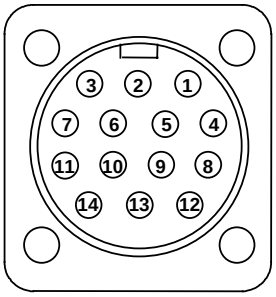
Pin #	Description	Pin #	Description
1	Common	**6**	ICMDB1
2	ICMDA1	**7**	ICMDB2
3	ICMDA2	**8**	ICMDB3
4	ICMDA3	**9**	ICMDB4
5	ICMDA4		

3.2.8. Motor Power Connector Pinouts

The motor power connector is a 14 pin AMP circular plastic motor connector. The mating connector is an AMP #206044-1 (Aerotech # ECK131). The backshell is an AMP #206070-1 (Aerotech # ECK134). The pins for the connector are AMP #66098-7 (Aerotech # EIK194).

For a Stepper motor connector, the following pins apply:

Plastic Mating Connector



Viewed From Wire Side of Connector

Table 3-9. Motor Connector (Stepper)

Pin #	Description
1	motor frame
8	motor shield
2	phase A
7	phase A/
4	phase B
3	phase B/

For a DC Brush motor connector, the following pins apply:

Table 3-10. Motor Connector (Brush)

Pin #	Description
1	motor frame
8	motor shield
5, 7	motor +
4, 6	motor -

For an AC Brushless motor connector, the following pins apply:

Table 3-11. Motor Connector (Brushless)

Pin #	Description
1	motor frame
8	motor shield
5, 7	phase C
4, 6	phase B
3, 9	phase A

3.2.9. DR500 Test Points

Table 3-12 describes the DR500 Rear Panel Interface board test points. Table 3-13 describes the DR500 Drive Interface board test points, fuses, and L.E.Ds.

Table 3-12. DR500 Rear Panel InterfaceTest Points

Signal		Axis #	Test Point or Indicator
Common			TP1
I/O Bus Power (J11)			DS5 (L.E.D.)
Amplifier Enable		1	Pad 1
		2	Pad 2
		3	Pad 3
		4	Pad 4
Encoder Power	J2	1	DS1 (L.E.D.)
	J3	2	DS2 (L.E.D.)
	J4	3	DS3 (L.E.D.)
	J5	4	DS4 (L.E.D.)
Optional Encoder Setup Sig.		1	TP12
		2	TP22
		3	TP32
		4	TP42
Internal +5V Power			TP2

Table 3-13. DR500 Drive InterfaceTest Points, Fuses, and L.E.D.s

Signal		Axis #	Test Point or Indicator
Brake Disabled			DS1 (L.E.D.)
Brake Fuse			F9
Bus 1 Fuse			F8
Bus 2 Fuse			F10
ESTOP			TP5
Drive Enable		1	TP14
		2	TP15
		3	TP16
		4	TP17
Aux. Encoder Fault	J2, Pin 23	1	TP7
	J3, Pin 23	2	TP9
	J4, Pin 23	3	TP11
	J5, Pin 23	4	TP13
Controller Enable		1	TP6
		2	TP8
		3	TP10
		4	TP12
Common			TP4
Common			TP3

3.3. DR500 Outline Drawings and Mechanical Specifications

The DR500 Desktop package includes rubber standoffs or supports. Refer to Figure 3-5 for dimensions. The rack mount package contains the same chassis as the Desktop package with a slightly wider front panel that includes handles and mounting flanges (see Figure 3-6). The package depth does not allow for the required space at the back of the chassis to allow for motor and user cable connections.

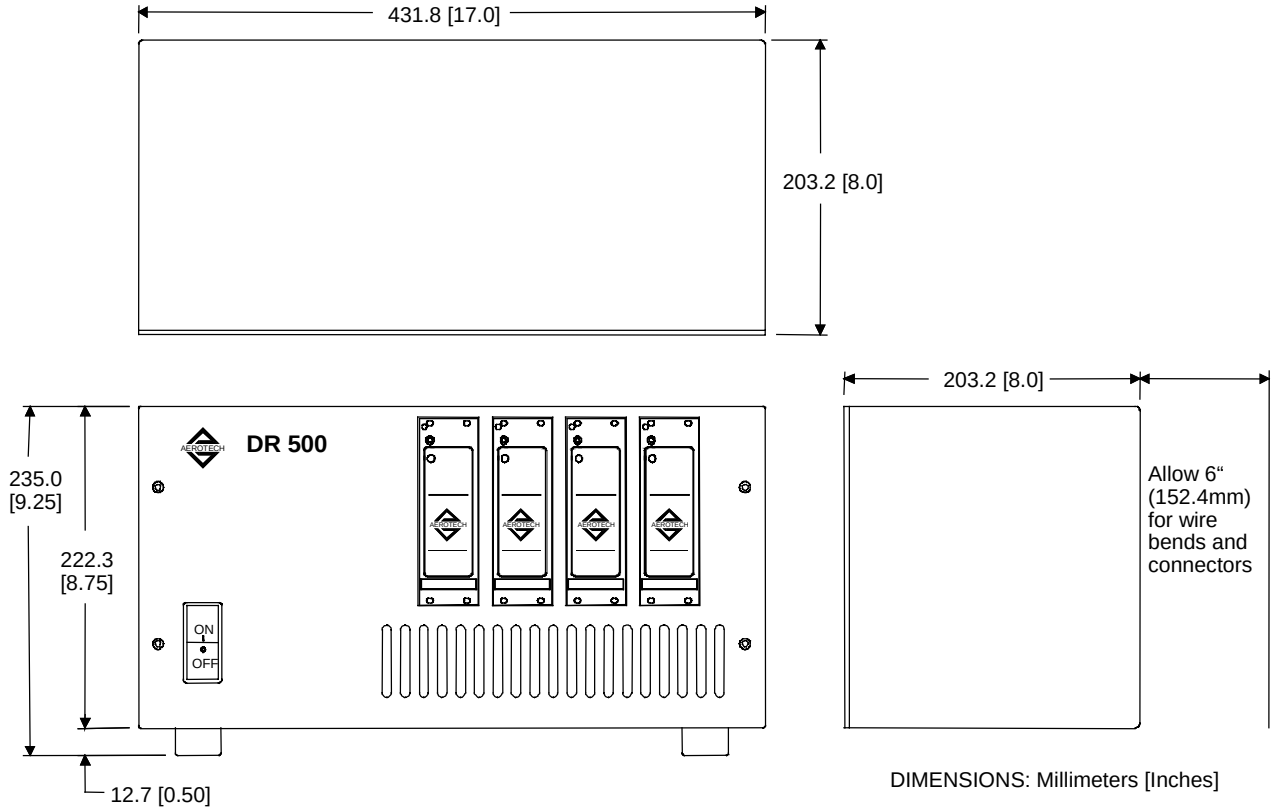


Figure 3-5. DR500 Desktop Package

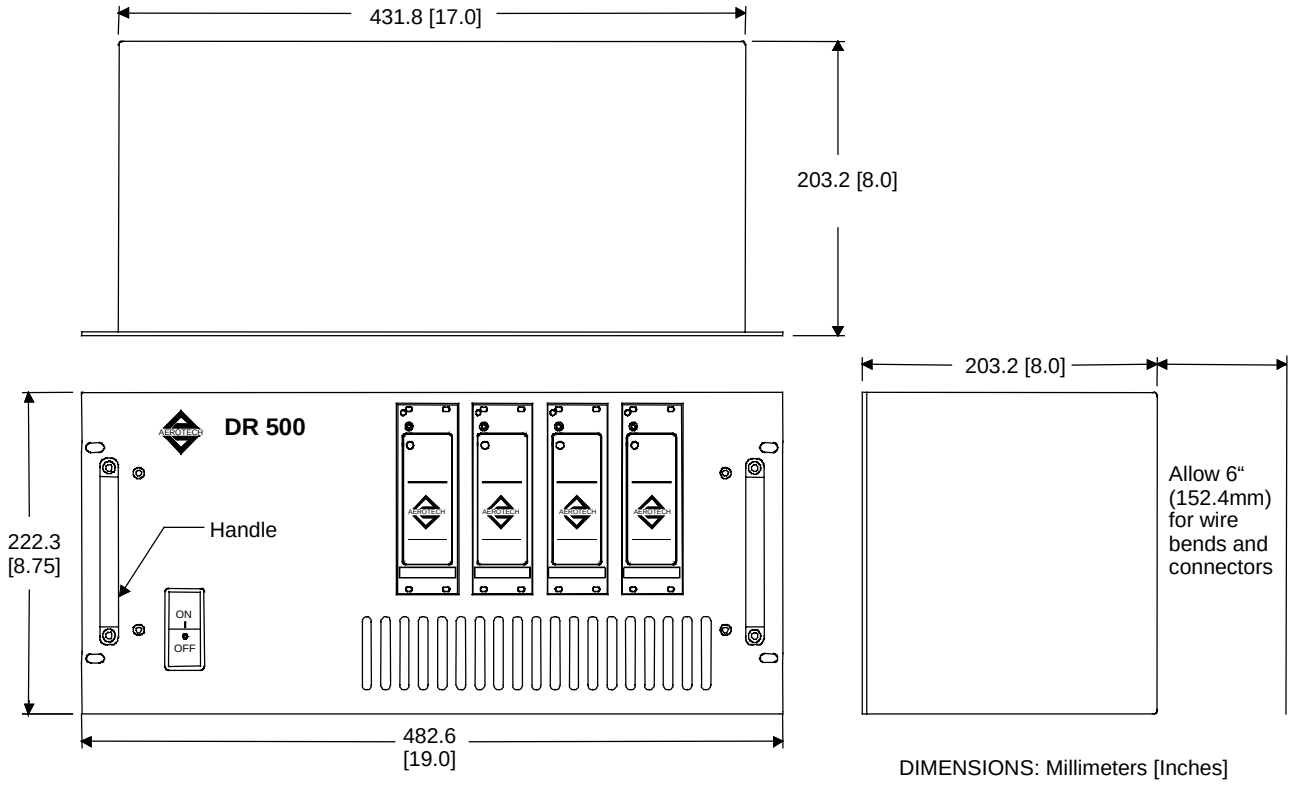


Figure 3-6. DR500 Rack Mount Package

The weights for each package are provided in Table 3-14.

Table 3-14. Weights for DR500 Packages (not including drives)

VAC IN	# of Axes	160V Bus	40, 60, or 80V Bus	40, 60, or 80, and 160V Bus
115VAC	2	17lbs (7.7kg)	25lbs (11.3kg)	25lbs (11.3kg)
	4	17lbs (7.7kg)	33lbs (14.9kg)	25lbs (11.3kg)
100,208, and 230VAC	2	25lbs (11.3kg)	25lbs (11.3kg)	25lbs (11.3kg)
	4	33lbs (14.9kg)	33lbs (14.9kg)	33lbs (14.9kg)

3.4. Electrical Specifications

Aerotech configures each DR500 to fit the user's particular power requirements. The possible input voltages are 115 VAC, 230 VAC, 100 VAC, and 208 VAC (refer to Table 3-15). Each DR500 systems power specifications can be found on the power specification tag located on the rear of the DR500 chassis (see following example).

Example:

115V~ 50/60Hz 5A

Hazardous voltage may be present.

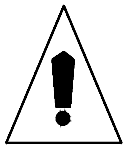


Table 3-15. Electrical Specifications

VAC IN RMS	# of Axis	Max. AC Line Input	Bus Voltage	Max. Watts Out
115VAC ±10%	2	5A	40,60,80	350
	2	10A	160	1000
	4	10A	(40,60,80,160)	2000
230VAC ±10%	2	5A	(40,60,80,160)	350
	4	5A	(40,60,80,160)	700
100VAC ±10%	2	5A	(40,60,80,160)	350
	4	10A	(40,60,80,160)	700
208VAC ±10%	2	5A	(40,60,80,160)	350
	4	5A	(40,60,80,160)	700

- Line Frequency: 50 Hz to 60 Hz
- Installation category: Overvoltage Category II
- Equipment class: Class I (equipment with basic insulation/grounded)

3.5. Environmental Specifications

- Temperature: Ambient
  - Operating: 5° - 40°C (41° - 104°F)
  - Storage: -20 - 70°C (-4 - 158°F)
- Humidity: Maximum relative humidity is 80% for temperatures up to 31°C. Decreasing linearly to 50% relative humidity at 40°C. Non-condensing.
- Altitude: Up to 2,000 m.
- Pollution: Pollution degree 2 (normally only non-conductive pollution.
- Use: Indoor use only.

3.6. Emergency Stop Sense Input

The UNIDEX 500/U600 has an optically isolated emergency stop sense input. See your controller's hardware manual for more information.

The U500 and U600 require a parameter change before it will recognize the ESTOP circuit. Refer to the UNIDEX 500 Technical and Operation Manual or the UNIDEX 600 User's Guide for more details.

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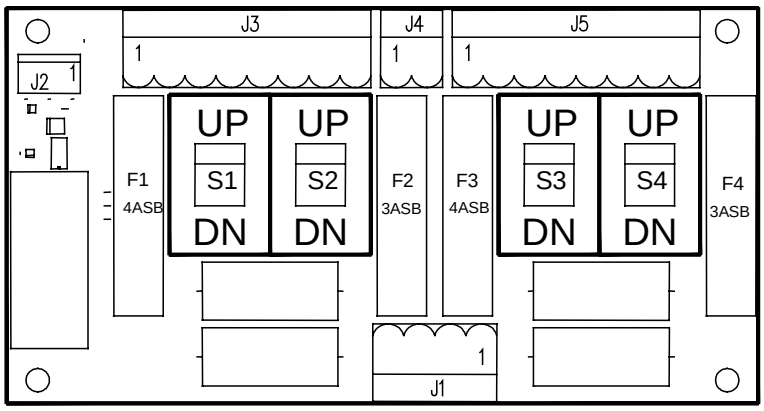
CHAPTER 4: SOFT-START / VOLTAGE SELECTOR BOARD

In This Section:

4.1. Soft-Start / Voltage Selector Overview

The Soft-Start / Voltage Selector Board is used to limit AC inrush current during turn-on and selection of the AC line voltage. The Soft-Start / Voltage Select Board is shown below.



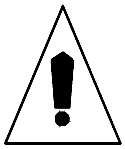
SWITCH SETTINGS				
	S1	S2	S3	S4
100VAC	UP	DN	UP	DN
115VAC	UP	UP	UP	UP
200VAC	DN	DN	DN	DN
230VAC	DN	UP	DN	UP

WARNING: S1, S2, S3 AND S4 MUST BE SET FOR THE APPLIED AC POWER INPUT VOLTAGE. SETTING S1-S4 INCORRECTLY MAY RESULT IN DAMAGE TO UNIT.

Figure 4-1. Soft-Start / Voltage Select Board

4.2. Soft-Start Operation

Soft-start operation is an automatic function that limits inrush current to approximately 10 amps for 100/115 VAC operation and 20 amps for 200/230 VAC operation. Inrush current limiting is only activated during initial power-up or when AC power interruptions last longer than .3 seconds. Short Power interruptions (less than about .3 seconds) will not initiate a soft-start activation. This prevents the possibility of soft-start induced nuisance trips during normal operation.



The Soft-Start circuit requires +24 VDC for proper operation (provided internally). Damage to the Soft-Start circuit may result if +24 VDC is not connected.

4.3. Voltage Selector Function

The Soft-Start / Voltage Select Board contains four user settable switches (S1-S4) to configure the controller for 100 VAC, 115 VAC, 200 VAC or 230 VAC input power. The voltage selector can only be used with transformers designed to interface with this board. The location of these switches is shown in Figure 4-1.

Procedure for setting AC voltage selector switches:

1. Turn-off and disconnect all power from unit.
2. Determine the AC line operating voltage that unit needs be set to (Nominal settings: 100VAC, 115VAC, 200VAC and 230 VAC).
3. Use Table 4-1 to set all four of the voltage selector switches to the position indicated for the desired operating voltage. See Figure 4-1 for additional information.

   Example: For 230VAC Operation: Set S1 to "DN" position, S2 to "UP" position, S3 to "DN" position, and S4 to "UP" position.

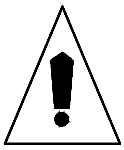
Table 4-1. Voltage Selector Switch Settings

AC Volts	S1	S2	S3	S4
100 VAC	UP	DN	UP	DN
115 VAC	UP	UP	UP	UP
200 VAC	DN	DN	DN	DN
230 VAC	DN	UP	DN	UP

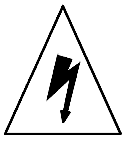
NOTE: "UP" and "DN" refer to positions of S1-S4 shown in Figure 4-1.

The Voltage Selector can only be used with transformers designed to interface with this circuit. This Voltage Selector function will not work with off-line supplies. Damage to unit may result if this function is used improperly.

The Voltage Selector must be setup to match the AC line voltage. Damage to unit may result if the Voltage Selector is set to a voltage that is different from the input AC Line voltage.



Disconnect Mains power before opening chassis. Voltage selector settings must not be changed with Mains power applied to unit.



4.4. Connector Pinouts

The Soft-Start / Voltage Selector Board contains five interface connectors, described in the following sections.

4.4.1. AC Input Power Connector (J1)

The pinouts for the AC Input Power connector are listed in Table 4-2.

Table 4-2. AC Input Power Connector (J1) Pinouts

Pin	Description	Pin	Description
1	AC LO	3	AC HI
2	AC LO	4	AC HI

4.4.2. +24 VDC Power Connector (J2)

The pinouts for the +24 VDC connector are listed in Table 4-3.

Table 4-3. +24 VDC Power Connector (J2) Pinouts

Pin	Description	Pin	Description
1	COMMON	3	+24 VDC
2	COMMON	4	+24 VDC

4.4.3. Transformer Interface Connectors (J3, J5)

The pinouts for the Transformer Interface connectors are listed in Table 4-4.

Table 4-4. Transformer Interface Connectors (J3, J5) Pinouts

Pin	Description	Pin	Description
1	Transformer Thermal Switch (WHT WIRE)	5	Transformer 100VAC Lead (GRN WIRE)
2	Transformer 0VAC Lead (BLU WIRE)	6	Transformer 115VAC Lead (BRN WIRE)
3	Transformer 0VAC Lead (GRY WIRE)	7	Transformer 100VAC Lead (ORN WIRE)
4	Transformer Thermal Switch (WHT WIRE)	8	Transformer 115VAC Lead (BLK WIRE)

NOTE: Transformer colors are referenced to custom Aerotech transformers only (P.N. EAX01010). Do not use with other transformers.

4.4.4. Fan Interface Connector (J4)

The pinouts for the Fan Interface connector are listed in Table 4-5.

Table 4-5. Fan Interface Connector (J4) Pinouts

Pin	Description
1	Fan AC HI (115VAC)
2	FAN AC LO

The Fan Interface Connector is for AC fans (115 VAC typical) only. Do Not Use With DC Fans.

4.5. Fuse Information

The Soft-Start / Voltage Select Board contains four fuses (F1-4) used in the Voltage Select circuit to protect the transformers. Fuses F1 and F3 (Typical value: 4 Amps) provide the primary protection for 100 and 115 VAC operation. Fuses F2 and F4 (Typical value: 3 Amps) provide the primary protection for 200 and 230 VAC operation. Fuses F1 and F2 are used to protect the transformer connected to J3. Fuses F3 and F4 are used to protect the transformer connected to J5. Fuses are shown in Figure 4-1. Table 4-6 lists the Part #'s for these fuses.

Table 4-6. Fuse Replacement Part Numbers

FUSE	Manufacturer P/N	Aerotech P/N
3 amp, 3AG	PN. BK/MDA-3	EIF103
4 amp, 3AG	PN. BK/MDA-4	EIF104

Disconnect Mains power before opening chassis. Fuses must not be changed with Mains power applied to unit.

Refer to Chapter 5, section 5.4., for Fuse Replacement information regarding the DR500.

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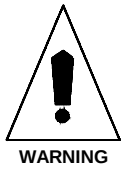
CHAPTER 5: TROUBLESHOOTING

In This Section:

5.1. Warning and Cautions

The user must be aware of the following cautions and dangers when troubleshooting the DR500.

There are no user serviceable parts.



The cord is the disconnect device when servicing.

Hazardous voltages may be present at power inlet and motor connectors.

Voltages up to 24 Volts may be present at I/O and Brake connectors.

Motors must be mechanically secured before applying power.

Motor temperatures may exceed 50°C.

Danger, risk of electric shock.

5.2. Amplifier Related Problems

Amplifier related problems are usually related to cable connections and parameter settings. Table 5-1 provides a list of some common amplifier related problems.

Table 5-1. Amplifier Problems

Symptom	Possible Causes
Axis will not Enable	Check Motor and Controller cables. Verify DR500 power is on. Verify Parameters. Check Encoder and Hall feedback. Check Amp and Bus fuses.
Motor oscillates or squeals when in position	Check tuning parameters and gains.
Motor traps out	Check parameters. Check Encoder and Hall feedback phasing. Motor load too high or mechanically locked. Programmed speed too fast.
Motor unstable	Check parameters. Check Encoder and Hall feedback.
Motor runs away	Check parameters. Check Encoder and Hall feedback phasing.

Always disconnect main power connection before opening the DR500 chassis.

5.3. Power Related Problems

The DR500 contains several power supplies that generate +5V, +12V, -12V, and the bus supplies. Table 5-2 lists some power checks that can be made.

Table 5-2. Power Checks

Symptom	Possible Causes
DR500 appears dead	Verify power switch is on. Verify DR500 has AC power (listen for internal fans).
+5 Volts low or not present	The +5V is used in several places. Drive Interface Bd. P4-4 is +5V, P4-3 is common. Rear Panel Interface Bd. P5 is +5V, P6 is common Check for +5 Volt short (disconnect all cables to DR500). Check that the L.E.D.s on the Rear Panel Interface Bd. Are ON (if an L.E.D. is OFF, this indicates that the associated connector may have a +5V short). **Note**: Latter versions use resettable fuse for 5V supply. Reset by turning off power for 30 seconds.
Axis will not enable and/or no motor torque	Check +5 Volt supply. Check Bus supply fuses (see system drawing). **Note**: Bus supply fuse failure usually indicates more serious problem (contact Aerotech).

Always disconnect main power connection before opening the DR500 chassis.

5.4. Fuse Replacement

Table 5-3 lists the manufacturer and Aerotech's part number for typical replacement fuses. Additional fuse information can be found on the system drawing supplied with the unit.

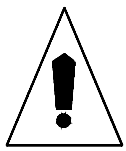
Table 5-3. Fuse Replacement Part Numbers

Fuse	Manufacturer P/N	Aerotech P/N
15 amp, 3AG, Bus	BK/MDA-15	EIF116
12 amp, 3AG, Bus	BK/MDA-12	EIF173
10 amp, 3AG, Bus	BK/MDA-10	EIF117
2 amp, 5x20mm fuse	Littlefuse 235002	EIF195
1 amp, 5x20mm fuse	Littlefuse 218001	EIF189
5 amp, CB1	ETA 3120-F321-P7T1-R14LB4	EAW254
10 amp, CB1	ETA 3120-F321-P7T1-W19LB4	EAW260

Bus fuses are usually located in the left compartment (transformer / power supply area) of the DR500.

The system drawing and amplifier documentation contains information regarding the fuses on the power amps.

10, 12, and 15 amp fuses are not user replaceable. An open fuse usually indicates that the unit should be returned for service.



Always disconnect the mains power connection before opening the DR500 chassis.

5.5. Preventative Maintenance

The DR500 and external wiring should be inspected monthly. Inspections may be required at more frequent intervals, depending on the environment and use of the system. Table 5-4 lists the recommended checks that should be made during these inspections.

Table 5-4. Preventative Maintenance

Check	Action to be Taken
Visually Check chassis for loose or damaged parts / hardware. **Note**: Internal inspection is not required.	Parts should be repaired as required. If internal damage is suspected, these parts should be checked and repairs made if necessary.
Inspect cooling vents.	Remove any accumulated material from vents.
Check for fluids or electrically conductive material exposure.	Any fluids or electrically conductive material must not be permitted to enter the DR500 and should be removed immediately. **Note**: Disconnect power to avoid shock hazard.
Visually inspect all cables and connections.	Tighten or resecure any loose connections. Replace worn or frayed cables. Replace broken connectors.

5.6. Cleaning

The DR500 should be wiped with a clean, dry (or slightly damp with water), soft cloth. Fluids and sprays are not recommended because internal contamination may result in electrical shorts and/or corrosion. The electrical power must be disconnected from the DR500 while cleaning. Do not allow cleaning substance to enter DR500 or onto any of the connectors. Cleaning labels (on the rear panel) should be avoided to prevent erasing of label information.

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APPENDIX A: WARRANTY AND FIELD SERVICE

In This Section:

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 that 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, whether 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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Symbols

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REVISION HISTORY

In This Section:

Revisions

The following section provides the user with general information regarding the latest changes to this manual. Extensive changes, if made, may not be itemized – instead, the section or chapter will be listed with "extensive changes" in the corresponding General Information cell.

Table R-1. Revisions

Revision	Section(s) Affected	General Information
1.6	2.2.2.	In Table 2-2. – part number ECR130 now refers to CL-11 (not CL-10, as previously indicated)
	2.2.6.	AM16007: Output Fuse, F1, changes from 3 ASB to 10 ASB
	Chapter 4	New Chapter 4 (Soft-Start/Voltage Selector Board)
	Chapter 5	Chapter 5 (Troubleshooting) – previously Chapter 4.

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READER'S COMMENTS

DR500 Drive Chassis
P/N EDA 120, May 2002

Please answer the questions below and add any suggestions for improving this document. Is the information:

	Yes	No
Adequate to the subject?	____	____
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How do you use this document in your job? Does it meet your needs?
What improvements, if any, would you like to see? Please be specific or cite examples.

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AEROTECH, INC.
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Pittsburgh, PA. 15238-2897 U.S.A.
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