DS160 SERIES SERVO AND DSR/DSRF RACK

USER'S MANUAL

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If you should have any questions about the DS160 Series Servo Amplifier, the DSR/DSRF racks, or comments regarding the documentation, please refer to Aerotech online at:
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TABLE OF CONTENTS

∇ ∇ ∇

LIST OF FIGURES

LIST OF TABLES

∇ ∇ ∇

CHAPTER 1: DESCRIPTION

In This Section:

1.1. Introduction

The Aerotech DS16020 and DS16030 Servo Amplifiers (hereafter denoted as DS160 Servo Amplifiers) mark an advance in brush DC motor power control technology. High output power, small size, and standardized mounting (standard 160 mm, 3U Euro-card) make these Servo Amplifiers two of the most versatile on the market today.

The DS160 Series Amplifier uses a patented PWM drive scheme allowing them to produce high output power at very high efficiency. The DS16020 has a nominal rating of 160 VDC at 20 amps peak (2 seconds), 10 amps continuous (with fan cooling) at up to 50 °C ambient. The DS16030 has a nominal rating of 160 VDC at 30 amps peak (2 seconds), 15 amp continuous (with fan cooling) at up to 50 °C ambient. The patented drive scheme allows operation between 0 and 160 VDC bus levels without component adjustments. A motor output load fuse is provided.

Figure 1-1. The DS160 Series Servo Amplifiers

The PWM output switching frequency is 20 KHz, well above the audible frequency range. The PWM output stage utilizes hermetically sealed power MOSFET switching devices, providing very high reliability and long life.

Five potentiometers are provided at the front of the DS160 Servo Amplifier for easy access when adjusting the input and tach feedback gain, balance, and current limit. A

parameter adjustment module, known as the "personality module" or RCN (Resistor-Capacitor Network), provides a means of modifying all gain and current limit adjustment parameters usually adjusted with the potentiometers. The user may set predetermined gains and current limits, and match specific DC motors to the DS160 Series Amplifier without adjusting the potentiometers themselves.

The DS160 Series Amplifiers are self-contained, except for the user supplied AC voltage source needed to generate the internal DC bus voltage of 0 to 160 VDC, and ±12 VDC control voltages. Motor load short circuit protection is provided internally. A typical interconnection diagram for wiring two or more DS160 Series Amplifiers into a system is shown in Figure 2-9.

Aerotech provides two types of integrated power supply mounting racks for the DS160 Series Amplifier: the DSR and the DSRF.

The three-axis mounting rack (DSR) is shown in Figure 3-1. The six-axis mounting rack is shown in Figure 3-2. Both mounting racks have a totally integrated DC bus and control power supplies. Shunt regulators for controlling DC bus motor regeneration are standard. Isolation transformers to supply power to the DC bus may be supplied as an option for both mounting racks.

Both mounting racks provide easy termination of control and power connections to the motion controller and DC motors. These mounting racks are designed for panel mounting, reversing the mounting flanges on the six-axis DSRF rack, will permit 19" rack mounting.

The major difference between the DSR rack and the DSRF rack is the inherent mounting hardware. The six-axis DSRF rack is, in actuality, two three-axis racks joined together. The six-axis DSRF rack contains two separate three-axis power supplies, each identical to the power supply on the three-axis DSR mounting rack.

All mounting rack specifications listed in Chapter 3, except those specifying dimensional data, are in reference to the three-axis DSR mounting rack.

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CHAPTER 2: DS160 SERVO AMPLIFIER MODULE

In This Section:

2.1. Introduction

The DS160 Series Servo Amplifiers are shown in Figure 2-1 and Figure 2-2. Also shown in these figures are the various locations for potentiometer adjustments, the personality module (labeled RCN4), the motor load fuse, and the pin-out specification for the main control and power connector J1 (located at the rear of the unit). Details of the various items are included in this chapter.

2.2. Mounting Specifications

The DS160 Series is designed to "slide" into any standard 3U or partitioned 6U user supplied card rack. Integrated power supply 3U card racks for the DS160 Series can be supplied by Aerotech (see Chapter 3 for details).

A sampling of 3U/6U card rack manufacturers are listed below in Table 2-1.

Table 2-1. 3U/6U Card Rack Manufacturers

Manufacturer	Address
BICC-VERO	40 Lindeman Drive Trumbull, CT 06611 (USA)
SCHROFF	179 Commerce Drive Warwilk, RI 02886 (USA)
KNURRAG	(USA Representative) Panel Components Corp. 335 Tesconi Circle Santa Rosa, CA 95406

2.3. Power and Control Connections

A "quick-connect" mating connector is supplied with the DS160 Series Servo Amplifier when the amplifier is supplied less the DSR mounting rack. An outline of this connector is shown in Figure 2-3. This connector will mount in any 3U card rack section of DIN mounting specification 41612.

Figure 2-1. DS160 Series Servo Amplifier Module

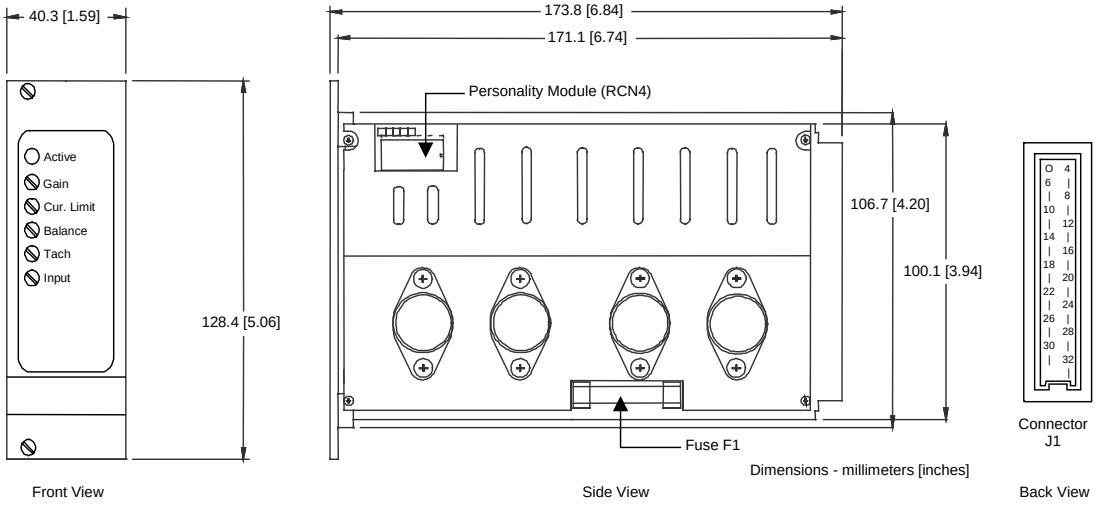


Figure 2-2. Mechanical Diagram of DS160 Series Servo Module (some detail omitted for clarity)

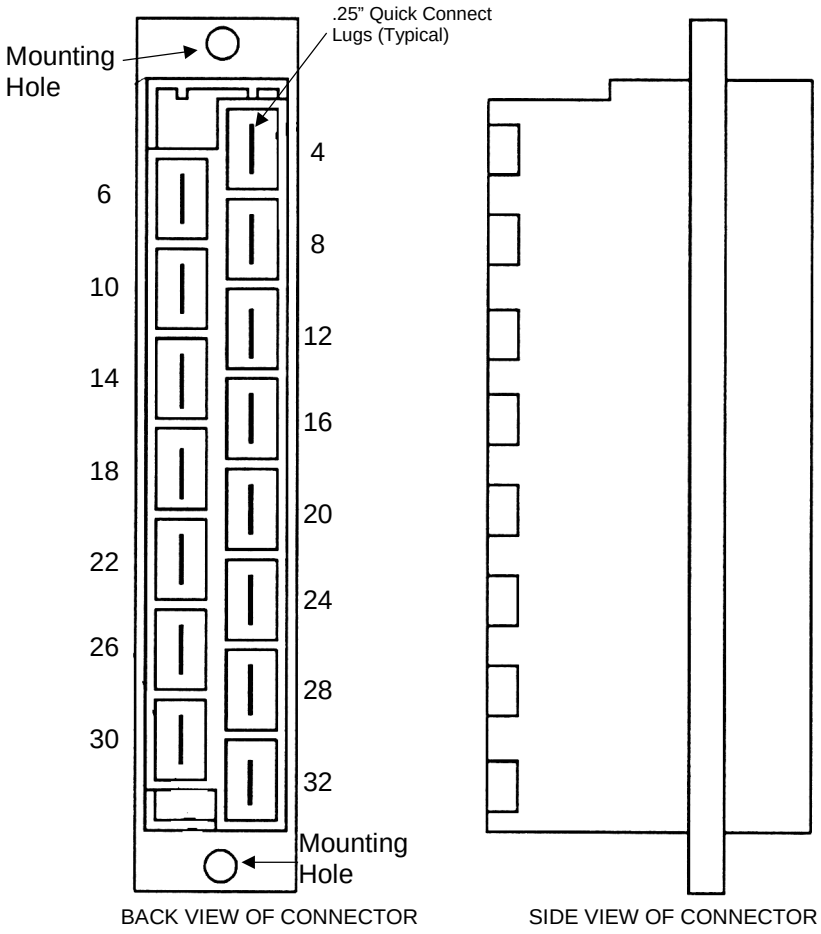


Figure 2-3. Outline of "Quick Connect" Mating Connector for Connector J1 of DS160 Series

If the user wants the DS160 Servo to be integrated into a user designed PC motherboard (DIN mounting specification 41617), a different connector designed for PC board mounting must be used. Aerotech will supply this connector as an option (P/N ECK352), or the user may purchase this connector independently. One supplier of this mating connector is Schroff (see Table 2-1).

2.4. Electrical Specifications

Electrical specifications are listed in Table 2-2.

Table 2-2. 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)	

A block diagram of the DS160 Series Servo Amplifier Module is shown in Figure 2-4. All input and output power and control connections are passed through connector J1 (see Figure 2-3, also).

Two control sections (pre-amplifier and post-amplifier, in dotted lines) are shown in Figure 2-4. These control sections are detailed in Figure 2-5 and Figure 2-8.

2.5. Fault Output

The DS160 Series Servo Amplifier Module, when equipped with the DS Series motherboard, is configured with a Fault Output of active low. If the DS160 Series Servo Amplifier is not equipped with the DS Series motherboard and the motherboard is to be user supplied, 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 2-4) from JP1-1 to 2 and connecting the jumper to JP1-2 to 3 (both are P.C.B. trace jumpers).

The active high Fault Output must not be used in conjunction with the DS Series motherboard.

2.6. Personality Module

The Personality Module pre-amplifier circuit, RCN4, (shown in Figure 2-5) is used to interface input and tach feedback signals (if any exist). Figure 2-2 shows the location of this module.

The user may reconfigure this module. An outline of the module is shown in Figure 2-7.

2.7. Control Modes

The input speed command, Vcom, (see Figure 2-5) is usually connected to the output command signal of the Motion Controller through J1, pin 16. The motor tachometer feedback connection Vfb is then connected to J1, pin 18. The component values of RCN4 are set to those values depicted in Figure 2-5.

As previously stated, there are five potentiometers that are used to tune the amplifier to a particular motor and load. See Table 2-3 for descriptions.

Table 2-3. Potentiometer Descriptions

Potentiometer	Description
Input	Provides the means of adjusting the DC gain of the input command present at J1-Pin16. Turning this pot CW increases gain.
Tach	Provides the means of adjusting the DC gain of the tach feedback signal present at J1-Pin18. 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.

For the physical position of these pots see Figure 2-2. For the circuit position and effect, see Figure 2-5 and Figure 2-6.

Modern motion controllers often provide tach feedback internally to the control. The result is that the output control signal from the motion controller is usually a current command signal rather than the traditional speed command signal described above.

For this control mode, the tach connection (pin 18 of J1) remains open. The current command signal is brought into pin 16 of J1. In this case, personality module RCN4 is usually reconfigured for unity gain by replacing RCN4 12 to 5 and RCN4 7 to 10 with 4.7Kπ resistors. The input, tach, and gain potentiometer positions are set full CCW.

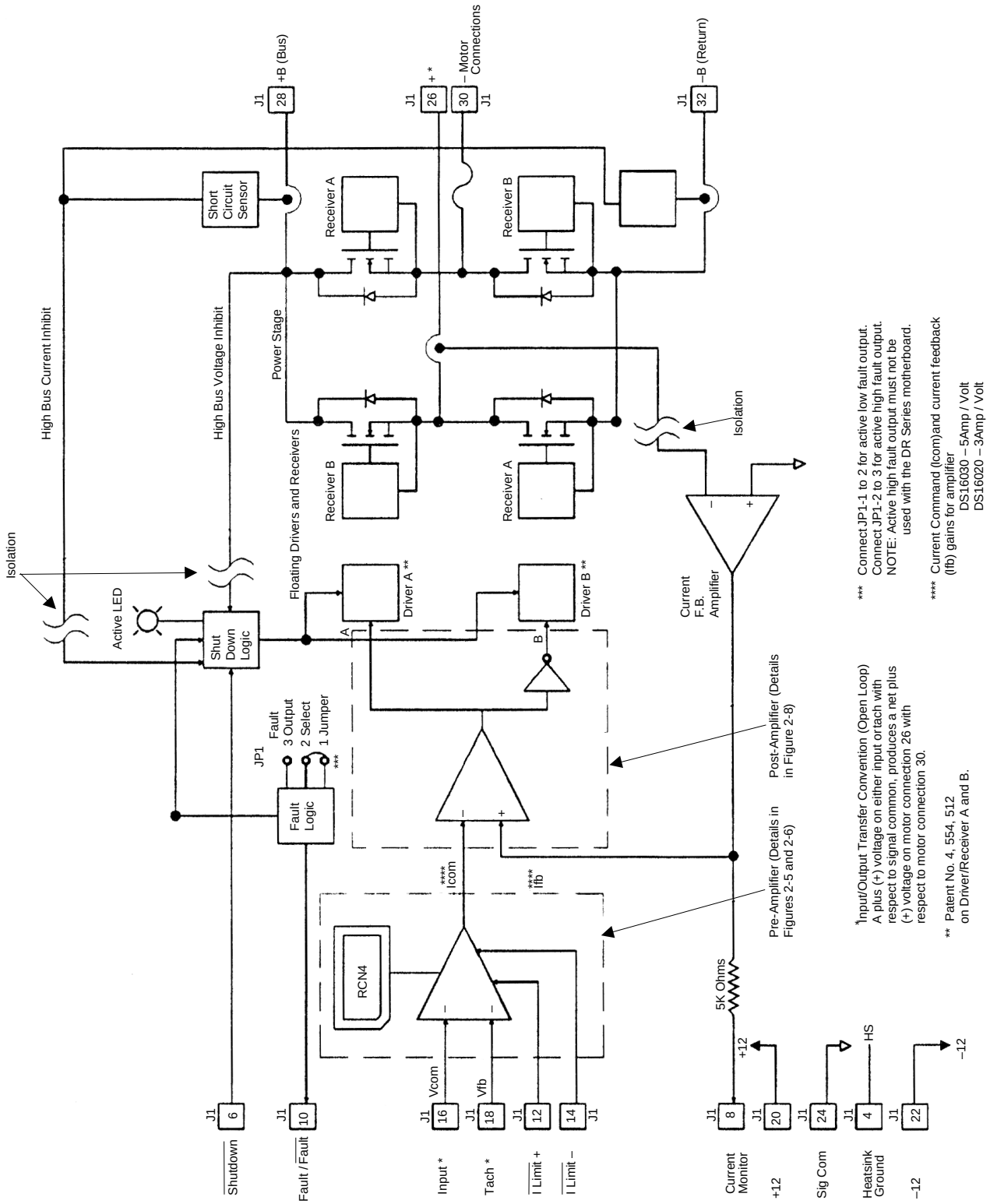


Figure 2-4. Simplified Block Diagram of the DS160 Series Servo Amplifier Module

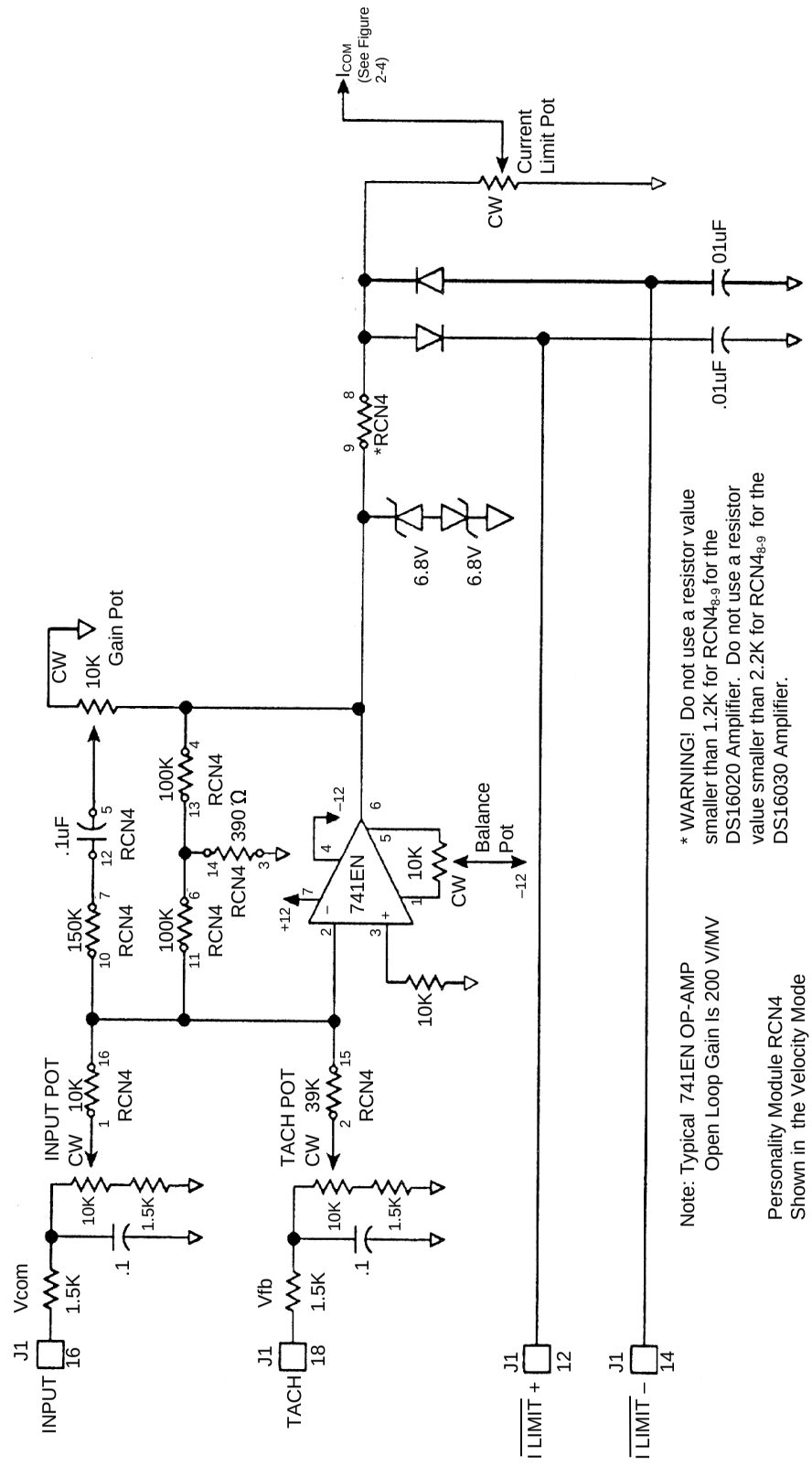


Figure 2-5. Detailed Electrical Diagram of the DS160 Series Pre-Amplifier Circuit (actual circuit)

2.8. 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).

2.9. 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 2-6. The gain curves shown in Figure 2-6 are in relation to the values of RCN4 shown in Figure 2-5.

2.10. The Post-Amplifier

A detailed circuit description of the post-amplifier (shown by dotted lines in Figure 2-4) is outlined in Figure 2-8. The circuitry shown in Figure 2-8 is for reference only and is not intended to be altered by the user.

Figure 2-8 shows the control relationships of the internal current command, Icom, with the internal current feedback signal, Ifb, (see also Figure 2-4 and Figure 2-5. A brief outline of the PWM circuit, used to control the MOFSET switches of the output power stage, is also shown in this figure.

2.11. Wiring DS160 into A System

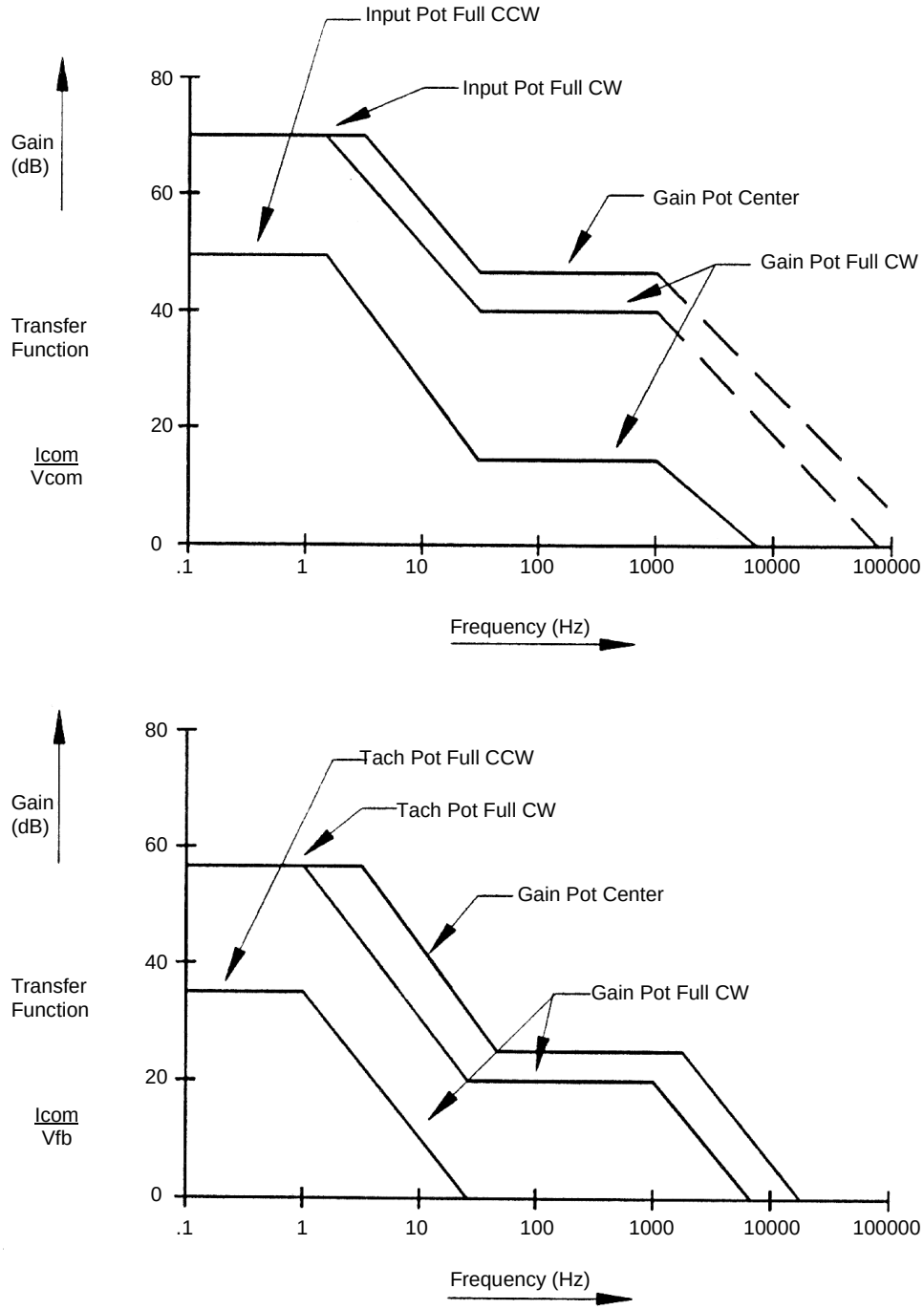
A typical user interconnect wiring diagram for two DS160 Servo's operating from a common DC bus and ± 12 VDC control supply is shown in Figure 2-9.

Exercise caution when wiring the DS160 Servo Amplifiers to the DC bus and control power supplies.

Most important of the wiring considerations is the length of the interconnect wiring between the DC bus power supply and connector J1, pins 28 and 32 of the DS160 Servo Amplifier. This interconnect wiring must never exceed 18 inches between (0.45 meter) between these two points (see Figure 2-9). Also, the interconnect wiring between the DC bus and pins 28 and 32 must be twisted tightly together and be of no less htan #14 AWG gauge ($21x10^{-3}$ CM^2).

WARNING

Failure to observe the considerations listed above may result in permanent damage to the power stage of the Servo Amplifier.



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

Figure 2-6. Transfer Function of Pre-Amplifier Circuit

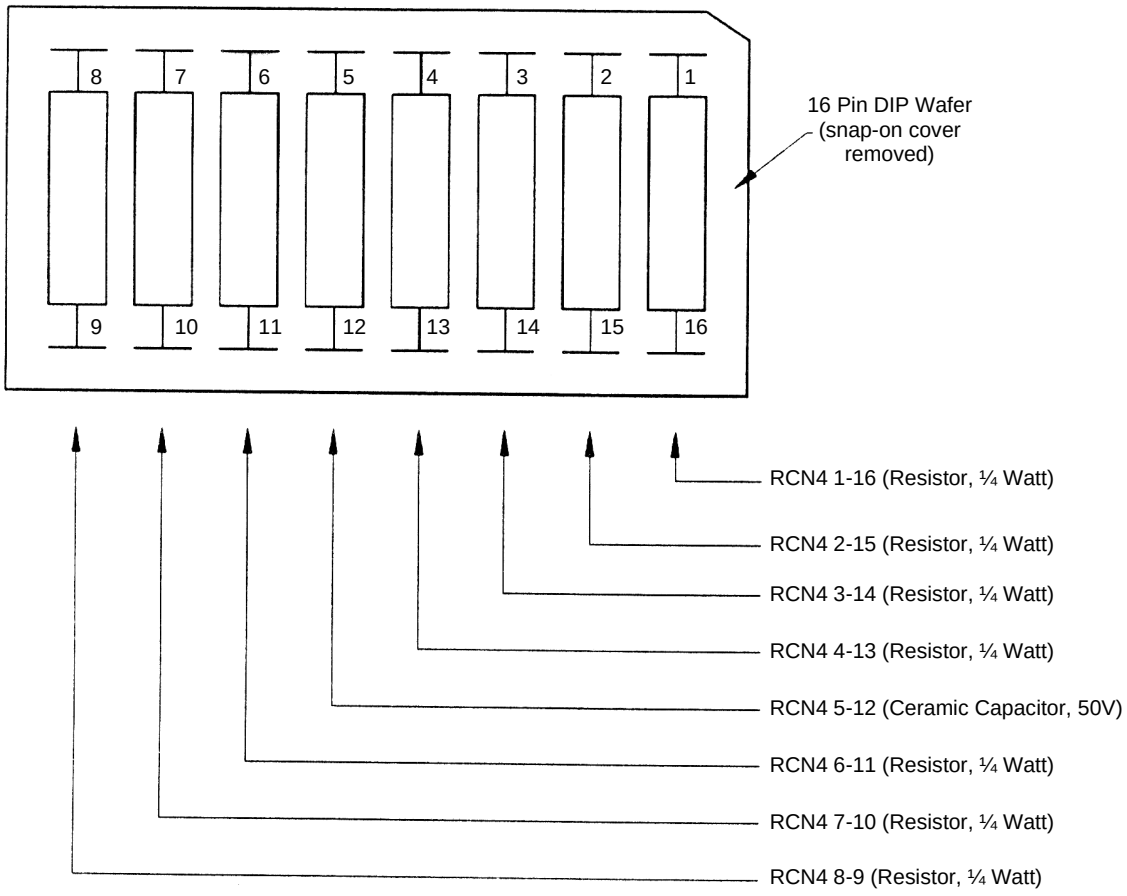


Figure 2-7. Outline of Personality Module RCN4

Table 2-4. 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.

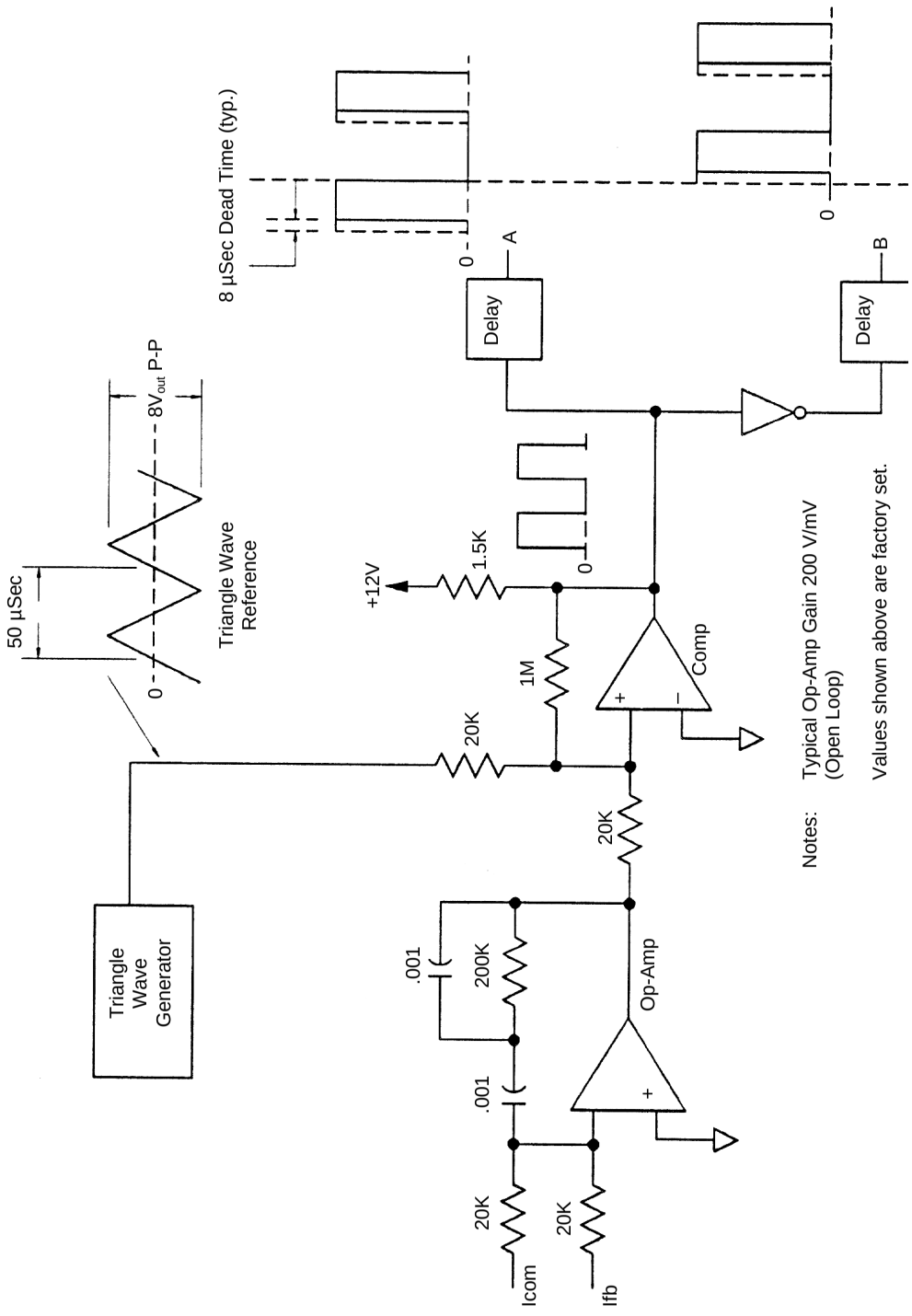


Figure 2-8. Detailed Electrical Diagram of DS160 Post-Amplifier Circuit

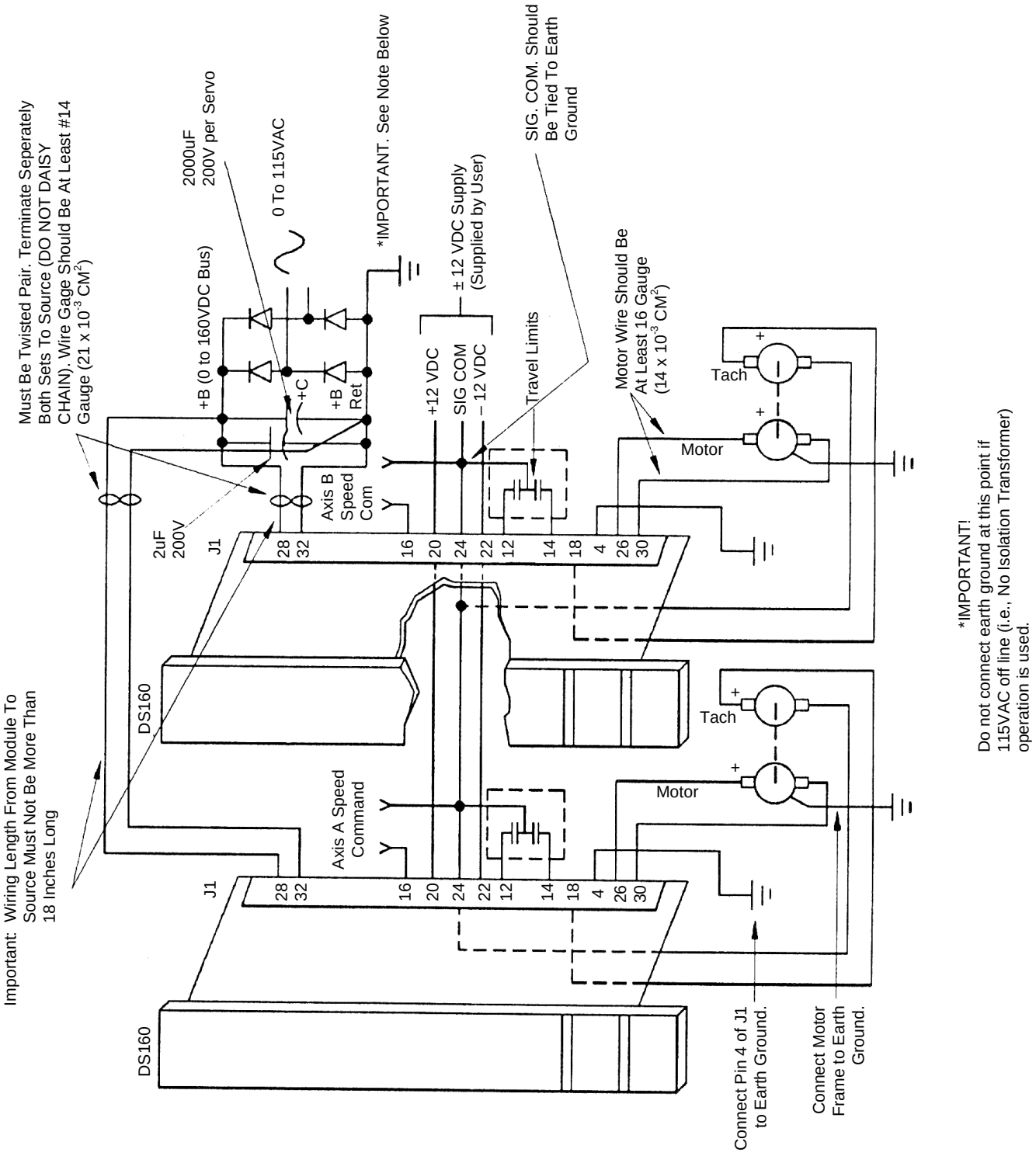


Figure 2-9. Wiring Diagram for One or More DS160 Servo Modules when not used with the Optional DSR Mounting Rack.

2.12. Troubleshooting the DS160 Series

A troubleshooting guide for the DS160 Series Servo Amplifier module is provided in Table 2-9. A list of recommended spare parts for the DS160 Series Servo Amplifier Module is shown in Table 2-10.

Table 2-5. 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 2-6. 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	Volts, DC (min)	205	J1-28, 32	Requires power-down reset.
Typical switching efficiency	% (min)	93	--	Efficiency based on switching and resistance losses.

Table 2-7. Control Interface Specifications

	Unit	Value	Pin	Comment
Input command connection	Volts (max) Kohms (impedance)	±20 6	J1-16	This connection is for the speed (current command) input control to the servo module.
Tach feedback connection	Volts (max) Kohms (impedance)	±40 6	J1-18	This connection is for velocity feedback to the servo module.
Shutdown connection	Volts (max) Kohms (impedance)	-5 to +20 10	J1-6	Provides shutdown to the power stage of the servo module. Pulling this input to signal common inhibits switching at the power stage.
I Limit + connection	VDC Kohms (impedance)	0 10	J1-12	Provides directional current limit to the servo module (via limit switch). When pin J1-12 is connected through a dry contact to signal common, current flow from J1-30 to J1-26 is limited to <1amp.
I limit – connection	VDC Kohms (impedance)	0 10	J1-14	Provides directional current limit to the servo module (via limit switch). When pin J1-14 is connected through a dry contact to signal common, current flow from J1-26 to J1-30 is limited to <1amp.
Current monitor connection	Kohms (impedance)	5	J1-8	This connection provides a point at which the output current level flowing from pin 26 to 30 of J1 signal may be monitored. Scaling is 5amp/volt for DS16030 and 3 amp/volt for DS16020.
Fault output connection (open collector)	mA (max) VDC (max)	-50 +30	J1-10	This output is used for external fault indication. This connection is field programmable to drive low (to signal common) or open, if a short circuit condition (motor load), high DC bus voltage, or low +12VDC input condition exists. Jumper points 1 to 2 at JP1 for active low. Jumper points 2 to 3 at JP1 for active high.
+12VDC source connection	VDC (min) VDC (max) mA (max loading)	+11 +13 50	J1-20	Voltage below +11VDC will inhibit output switching.
–12VDC source connection	VDC (min) VDC (max) mA (max loading) Signal Common	-11 -13 50	J1-22 J1-24	

Table 2-8. Power Connection Specifications

	Unit	Value	Pin	Comment
+B, +B return connection	VDC (max)	165	J1-28 (+B)	The DC bus voltage for the power stage of DS160 Servo is applied here. **Warning -** Interconnect wiring between these points must never be more than 18 inches in length. Both wires must be twisted together. (See Figure 2-9 for more information)
	VDC (max)	7	J1-32 (+B return)	
+, - Motor connections	Volts (max)	±165	J1-26 (+) J1-30 (-)	Provide "PWM" voltage, which controls current flow to the DC motor. The output switching frequency is 20kHz. Internal short circuit protection is provided if these outputs are shorted together or to earth ground.
	Volts (min)	0	--	
Heatsink ground	--	--	J1-4	Earth grounding point for heatsink.

Table 2-9. 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 2-4 (see also Table 2-7).
	High DC bus voltage (pins 28, 32 or J1).	See Figure 2-4, Figure 2-9.
	+12VDC input (pin 20, J1) is below +11VDC.	See Figure 2-4, Figure 2-9 (see also Table 2-7).
	Short circuit exists at motor connections (pin 26, 30 or J1)	See Figure 2-4, Figure 2-9.
Active LED is energized, but no torque is present at motor shaft	Motor load fuse F1 is open	See Figure 2-2, Figure 2-4
	I limit + (pin 12, J1) and/or I limit – (pin 14, J1) contact closed to signal common.	See Figure 2-4, Figure 2-9 (see also Table 2-7).
	No DC bus voltage on +B, +B return (pins 28, 32 of J1)	See Figure 2-4, Figure 2-9.
	Current limit pot turned full CW.	See Figure 2-2, Figure 2-4, Figure 2-5.
Motor accelerated to full speed when ±12VDC power and DC bus power was applied.	Tach feedback wires reversed (pin 18, 24 of J1)	See Figure 2-4, Figure 2-9 (see also Table 2-7).
	Personality module removed	See Figure 2-2, Figure 2-5.
Motor has high pitch (oscillation) sound when ±12VDC and DC bus power is applied	Tach and or Gain pot turned too high.	See Figure 2-2, Figure 2-5.
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 2-5.
	Ripple current (peak to peak) in excess of 20% of continuous return of motor, due to too low motor inductance.	See Figure 2-5.

Table 2-10. 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 250Volt rating). Fuse size: 3 AG
Personality Module	EIK135 and EIK162	Used for pre-selection of gain parameters for other motor combinations.
Quick-connect mating connector for connector J1	ECK381	Mating connector for discrete back plane termination.
Solder-type mating connector for connector J1	ECK352	Mating connector for printed circuit motherboard termination.

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CHAPTER 3: DSR AND DSRF MOUNTING RACKS

In This Section:

3.1. Introduction

Two types of mounting racks for the DS160 Series Servo Amplifier module may be supplied as an option (see Figure 3-1 and Figure 3-2).

3.2. Three-Axis Mounting Rack (DSR)

The three-axis mounting rack (DSR), shown in Figure 3-1, contains all necessary functions for interfacing up to three DS160 Series Servo Modules with three DC motors. If isolation from the AC line is required, the only additional item necessary is a transformer for generating power for the internal DC bus power supply.

A 2.5 KVA transformer is usually all that is necessary for driving up to three DS160 Series amplifier in a typical servo application.

The control voltages (± 12 VDC supply) are derived internally from an external 115/230 VAC, 50 to 400Hz power source.

3.3. Shunt Regulator

A DC bus shunt regulator circuit (integral to the mounting rack) is supplied to clamp an elevated DC bus voltage caused by excess motor power regeneration during deceleration. The shunt adjust pot (P1, see Figure 3-8) is factor set for 190 VDC. If a lower clamping level is required, this pot may be turned CCW appropriately.

3.4. Control & Power Connections to Mounting Racks

Control and power connections to the mounting rack are accessed via an extension board at the rear of the mounting rack. The mounting rack base height is 3U, in accordance with international DIN standards. The control and power extension board is less than 1U in additional height.

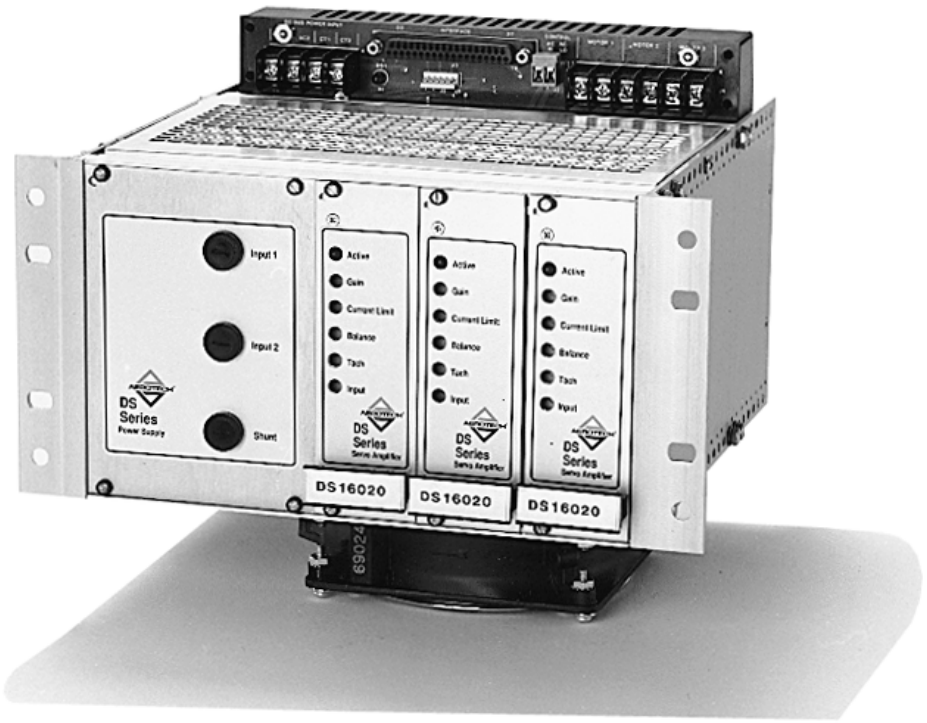


Figure 3-1. Three-Axis Mounting Rack (DSR)

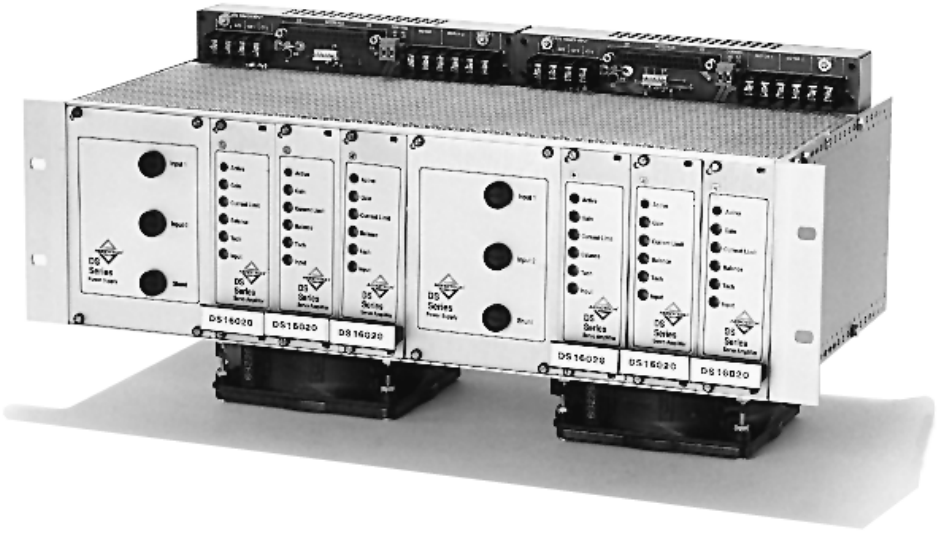


Figure 3-2. Six-Axis Mounting Rack (DSRF)

3.5. Six-Axis Mounting Rack (DSRF)

The six-axis mounting rack (DSRF) is shown in Figure 3-2. This rack consists of two three-axis racks joined together.

To simplify, this chapter provides only those specifications that are pertinent to the three-axis rack. Specifications for the six-axis rack are provided only for those specific items that differ from the three-axis version.

3.6. Mounting Specifications

Mounting specifications for the DSR and DSRF mounting racks are shown in Figure 3-4 and Figure 3-5.

Adequate ventilation space must be provided above and below the mounting rack for adequate convection cooling of the DS160 series amplifiers (see Figure 3-4 for minimum airflow space).

WARNING

A side view of the DSR/DSRF mounting racks is shown in Figure 3-3. The sides of both mounting racks can be reversed in the field by removing the six screws (from both sides) as shown. This feature allows for field selectable panel mounting or rack mounting. The DSRF (six-axis) mounting rack is the standard 19" width, allowing it to be panel or rack mounted.

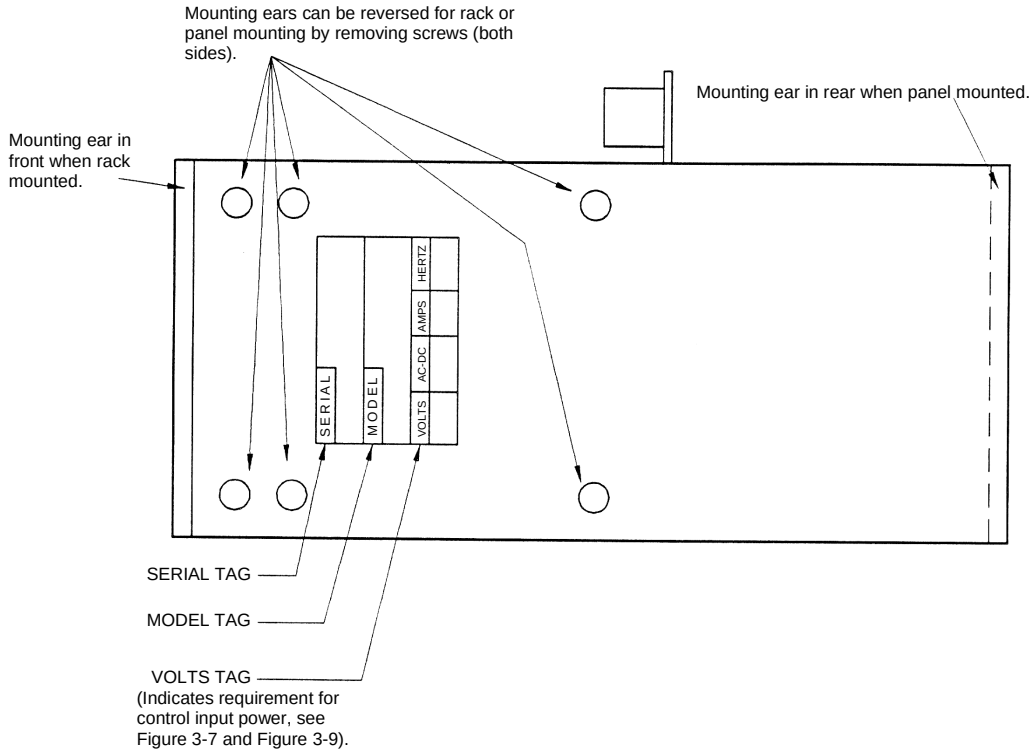


Figure 3-3. Side View of DSR/DSRF Mounting Rack

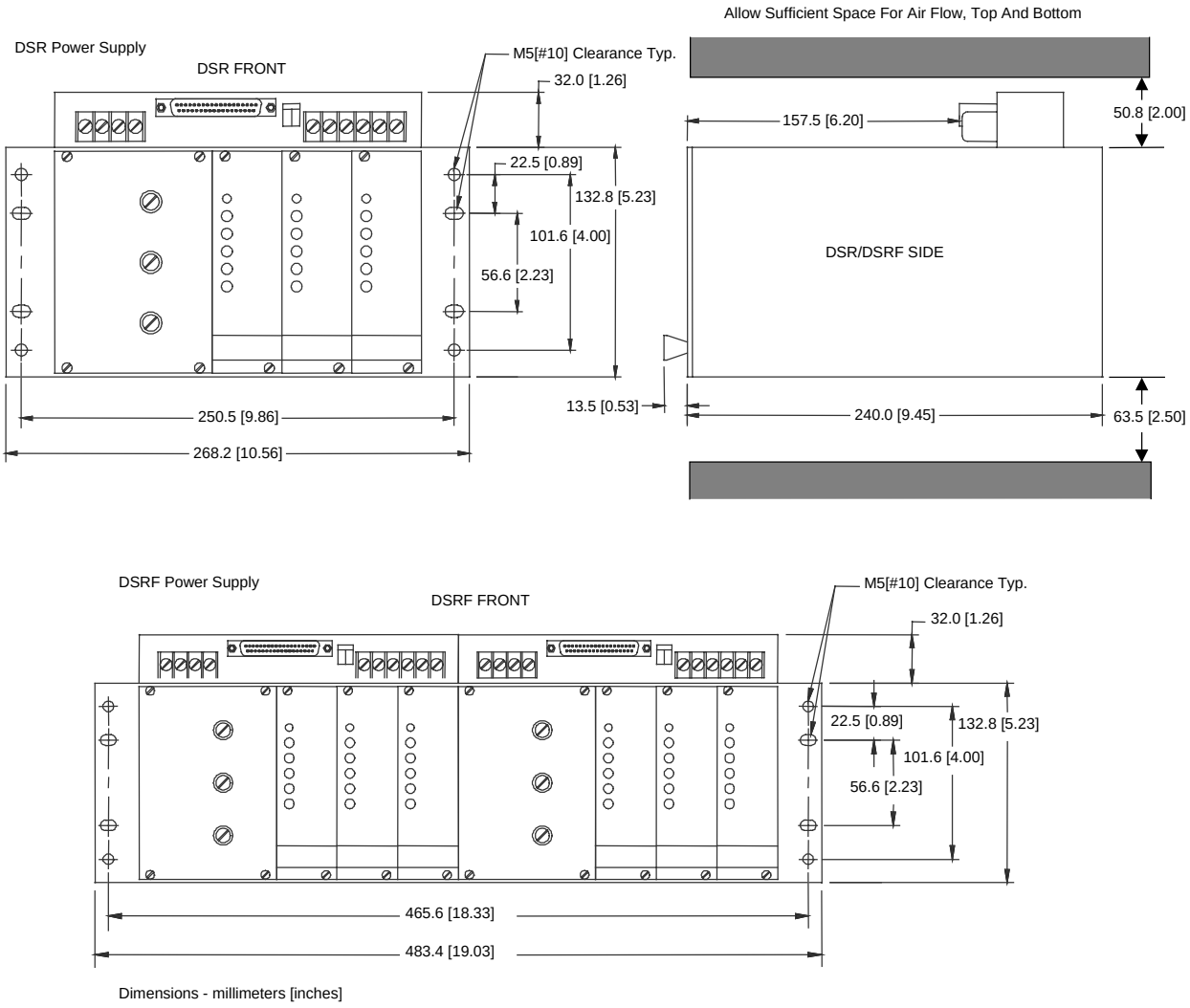


Figure 3-4. DSR/DSRF Mounting Dimensions

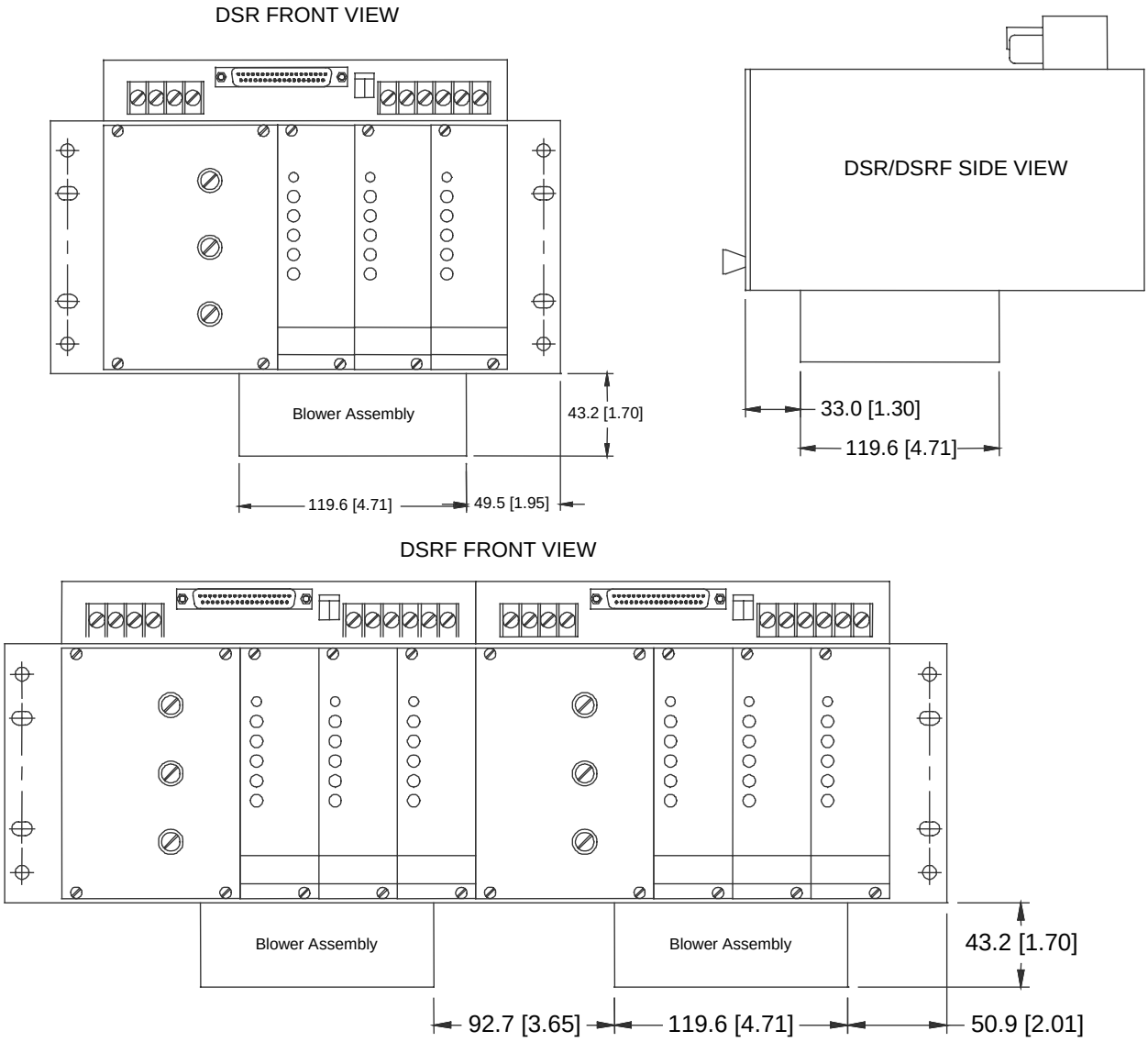


Figure 3-5. DSR/DSRF Fan Dimensions

3.7. Electrical Specifications

Electrical specifications for the DSR and DSRF mounting racks are listed in the tables below. Each specification contains reference information regarding input/output connector pin numbers. Comments are also included for each specification.

An outline of the DSR (three-axis) mounting rack is shown in Figure 3-6. This outline provides reference information for user terminated input and output control and power wiring.

A rear view of the DSRF rack is shown in Figure 3-10. This outline shows the location of jumpers A-B or B-C, which vary, depending on the type of DC bus input power (see Figure 3-9).

Table 3-1. Input/Output For DS160 Series DC Bus Power Specifications

	Units	Value	Pin	Comment
Peak DC Bus Output Current	Amps, DC (max)	60	P1, P2, P3-28, 32	Assume equal distribution of total current over all 3 sets of connections.
Continuous DC Bus Output Current	Amps, DC (max)	30	P1, P2, P3-28, 32	Max current per connection is 15 amps
DC Bus Input Supply AC Voltage	VAC (max)	115	J1-1, 2, 3, 4	Max is nominal line value. Max allowable "high line" is 10% (i.e., 127 VAC).
	VAC (min)	5		
DC Bus Shunt Regeneration Set Point	VDC (max)	190	--	--

Table 3-2. Control Input Power Specifications

		Units	Value	Pin	Comment
Voltage	115VAC	VAC (max)	130	J2-1, 2	240VAC and 220VAC (European Service) are considered nominal values for 230VAC configuration.
		VAC (min)	95		
	230VAC	VAC (max)	260		
		VAC (min)	190		
Frequency		Hz (min)	50	J2-1, 2	60Hz is typically the standard input frequency for North American Service.
		Hz (max)	400		
Current	115VAC	mA (max)	70	J2-1, 2	Power draw is typically less than 5 Watts.
	230VAC	mA (max)	35		

Table 3-3. Motor Output Power Specifications

	Units	Value	Pin	Comment
Motor Connection Output	--	--	J4-1, 2, 3, 4, 5, 6	See Table 2-2 through Table 2-8 for DS160 Series Servo Module specifications

Table 3-4. Control Interface Specifications

	Units	Value	Pin	Comment
Auxiliary ±12VDC Output Connections	mA(max)	±50	J3-11 (+12) J3-5 (-12)	This is maximum draw for external use.
Motor Shutdown Connection	Volts (max)	-5 to +20	J3-4, 10, 16	Connection is separate for each motor axis. Pulling this input to signal common inhibits switching of respective Servo Amp. This input is pulled up internally to +12.
	Kohms (impedance)	10		
System Fault Output Connection	mA(max)	-50	J3-20, 7	Open Collector output driver. Drives low if any DS160 module is current tripped, or if DC bus is too high (loss of shunt regulator), or if +12VDC supply is low.
	VDC (max)	+30		

For electrical specifications on all other connections to internal connector J3, see Table 2-6 (Control Interface Specifications).

3.8. Functional Diagram

A functional diagram of the DSR mounting rack is shown in Figure 3-7. Locations of input and output connectors J1 through J4 are shown in Figure 3-6.

Pertinent information concerning the location of key items shown in the function diagram (Figure 3-7) is shown in Figure 3-8.

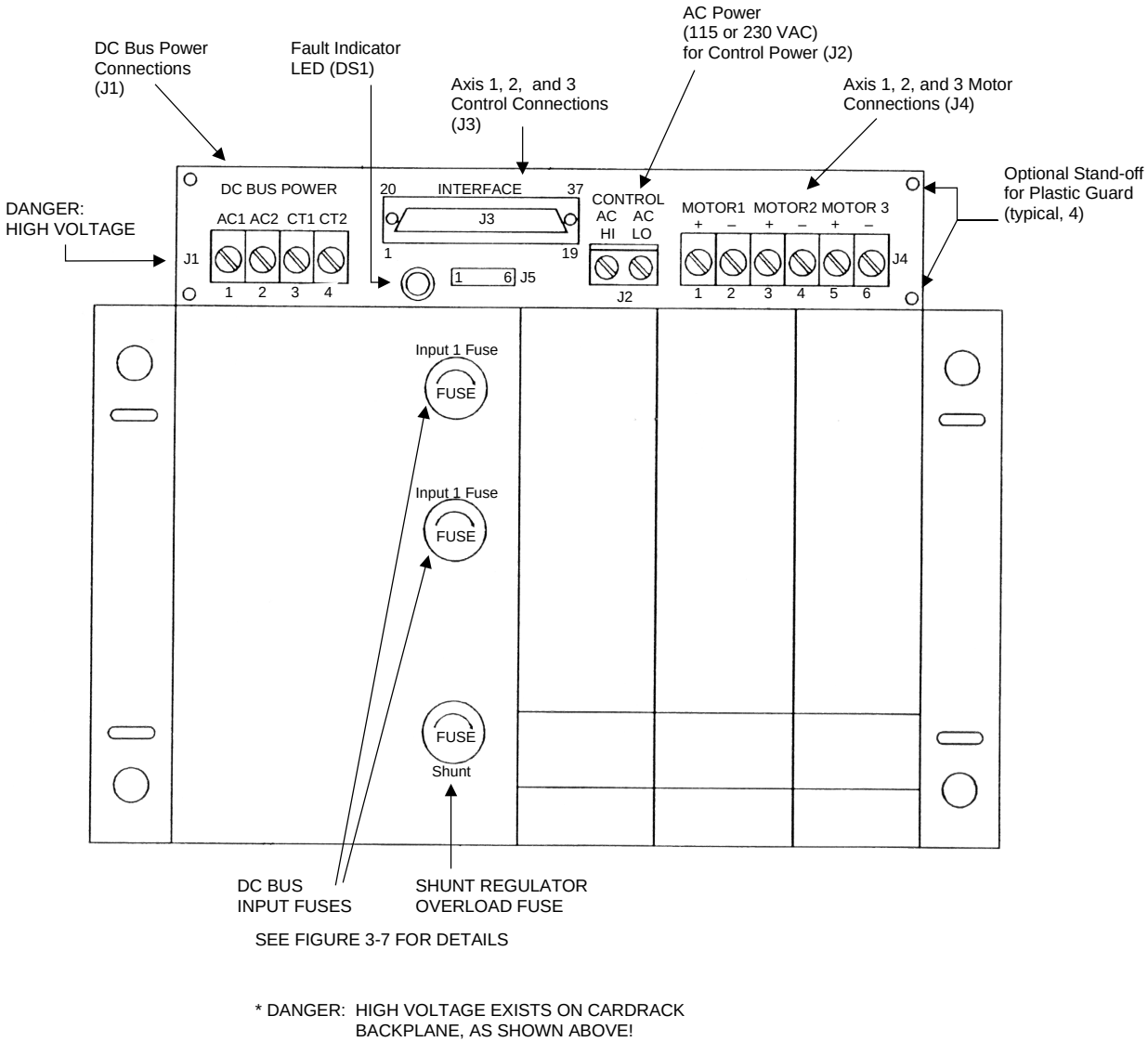


Figure 3-6. Front View of DSR (1/2 DSRF) – Showing Locations of Input/Output Control and Power Connections.

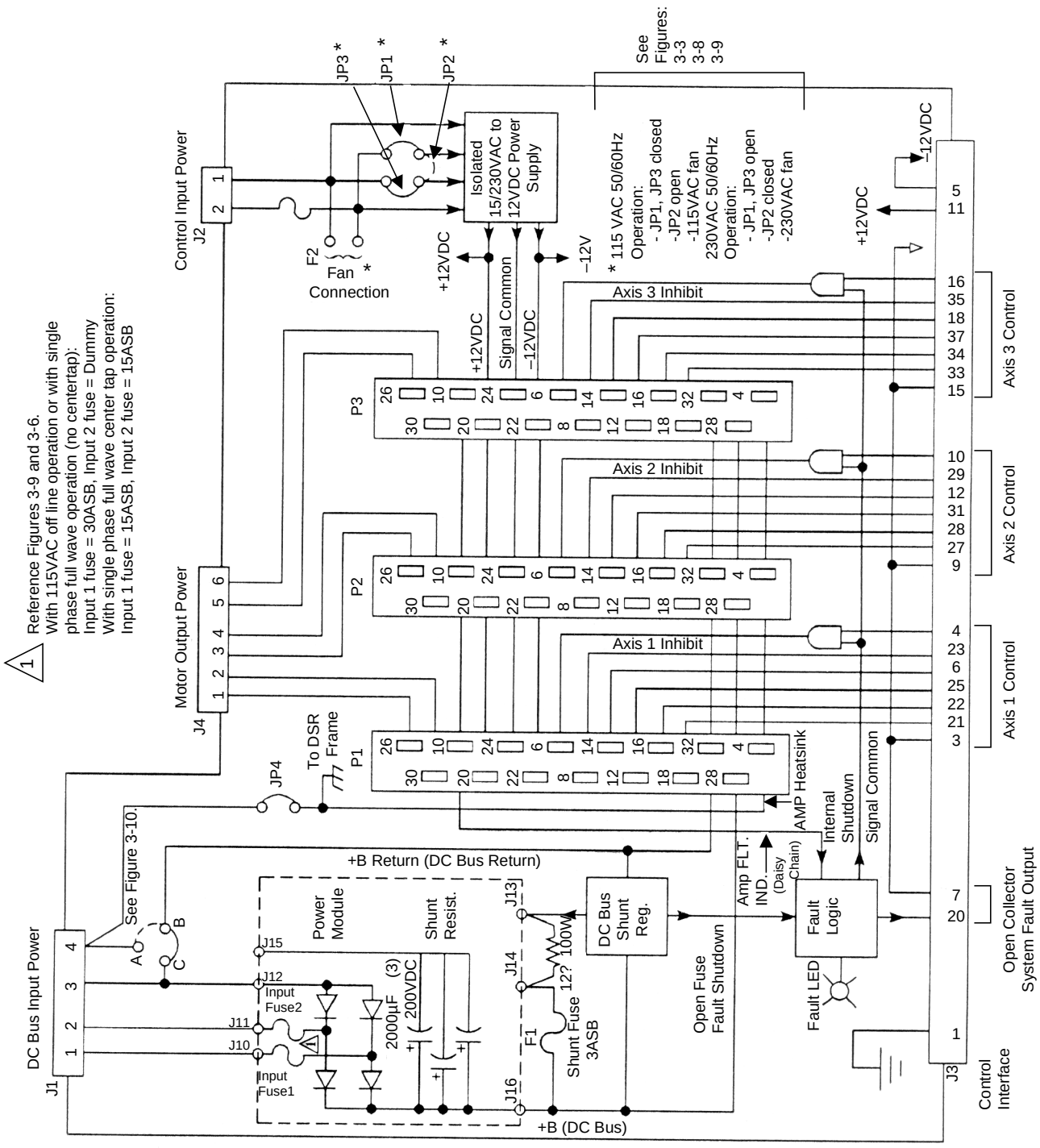


Figure 3-7. Electrical Block Diagram of DSR (1/2 DSRF) Mounting Rack

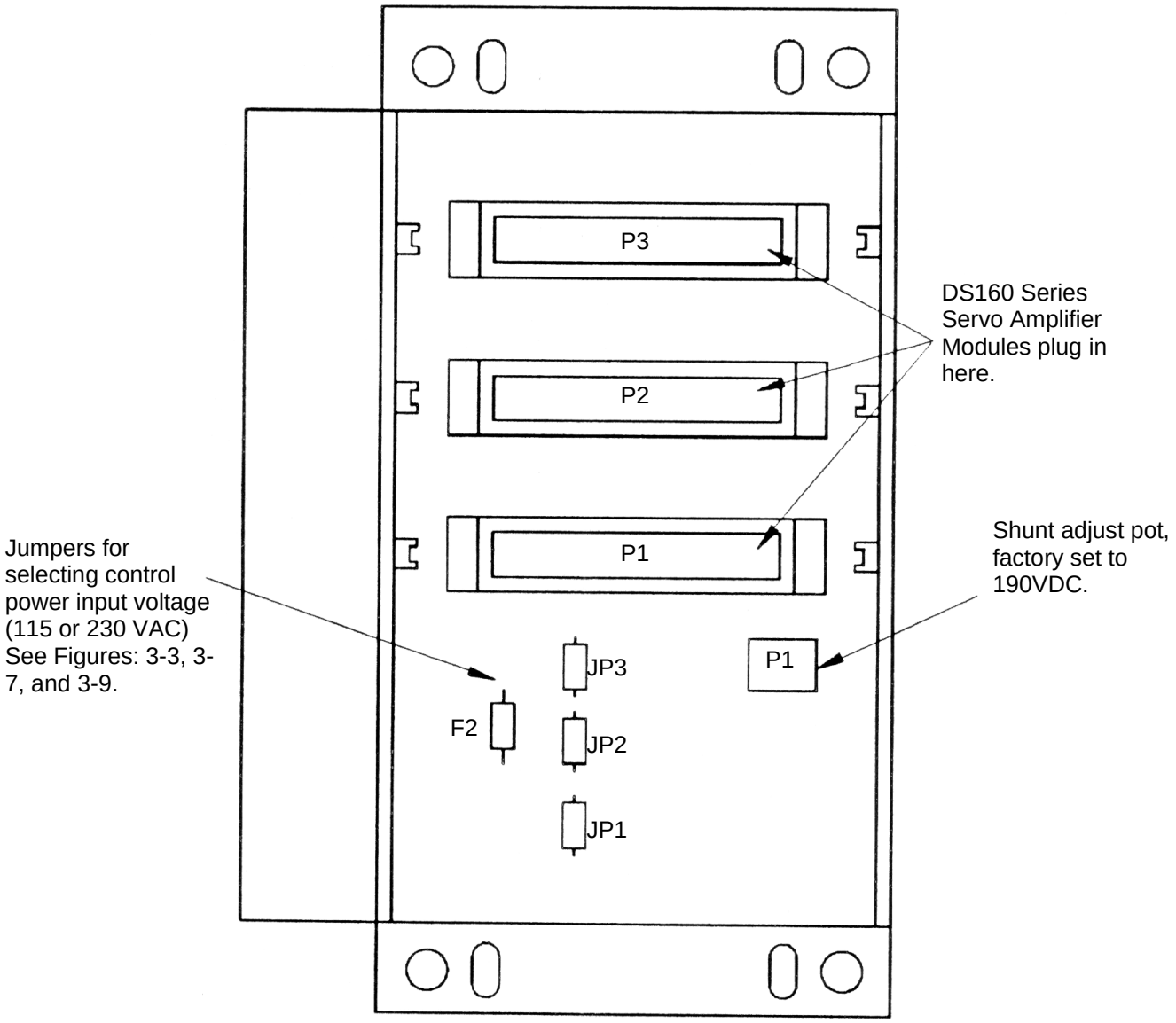


Figure 3-8. Inside View of DSR Mounting Rack (DS160 Amplifiers and Power Supply Module Removed)

3.9. Wiring DSR/DSRF into System

An interconnect diagram for input power and output motor wiring is shown in Figure 3-9. The input DC bus power wiring (J1) allows for three configurations, single-phase full wave, single-phase center tap or 115VAC off line. The internally generated DC bus voltage relationship to input AC voltage can be derived with the following equation (this equation applies to both center tap and non-center tap configurations):

DC BUS (VDC) = INPUT VAC RMS x 1.414

Connections J1 pin 4 and J3 pin 7 must both be connected to earth ground (see Figure 3-9).

An outline and pin-out specification for the control interface connector (J3) is shown in Figure 3-11. Connector J3 accommodates a standard 37-pin "D" type male mate.

3.10. The TV 2.5 DC Bus Power Transformer

An outline of the optional TV2.5 DC bus power supply transformer (P/N EAX159) is shown in Figure 3-12. This transformer is supplied as an option to the DSR and DSRF mounting racks. The transformer allows the generation of a 40 VDC bus (28 VAC taps), 60 VDC bus (43 VAC taps), 80 VDC (56 VAC taps), 100 VDC (70 VAC taps), and 160 VDC (115 VAC taps)*****.

Figure 3-13 shows the typical DC bus "droop" characteristics of the TV2.5 transformer, connected to the DC bus input power connection (J1) of the DSR rack (see Figure 3-9). DC bus voltage level V_0 of Figure 3-13 is in respect to the filter capacitors (2000µfx3) with given value of output current I_0 distributed to the three DS160 Series Amplifier modules.

*****115 VAC operation can be derived directly from the line, eliminating the need for the TV2.5 transformer.

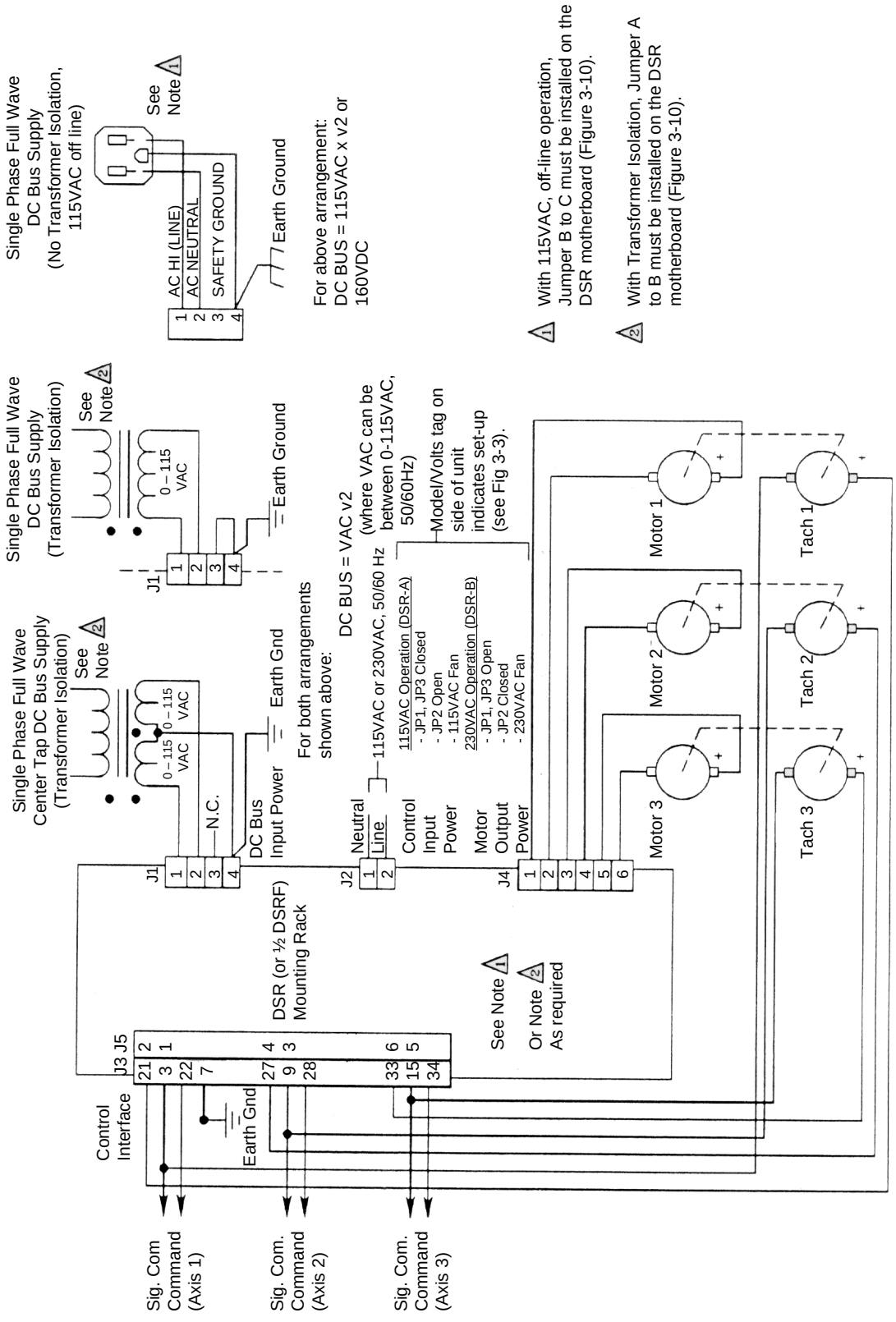


Figure 3-9. Interconnection for DSR (1/2 DSRF) Mounting Rack

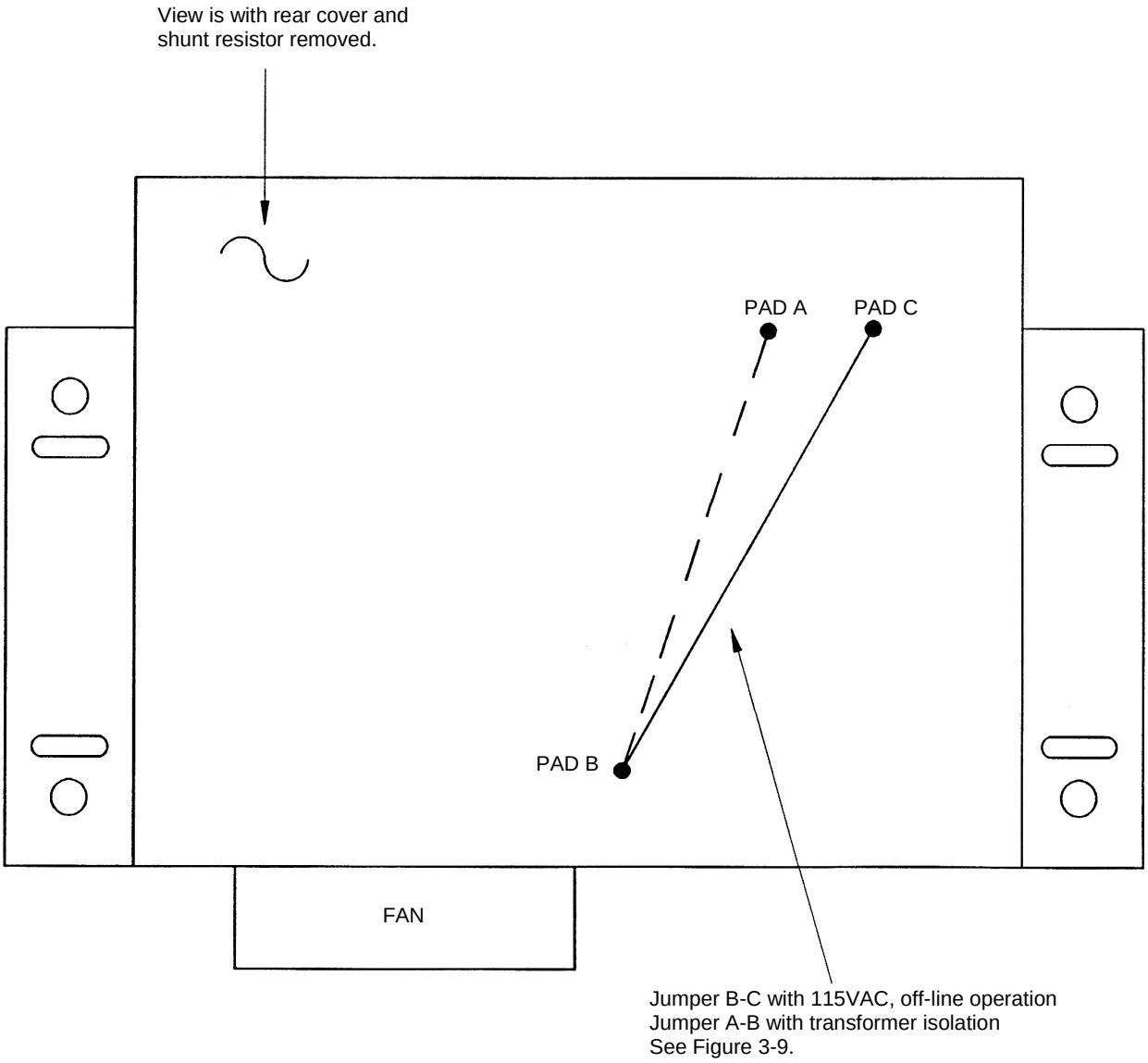
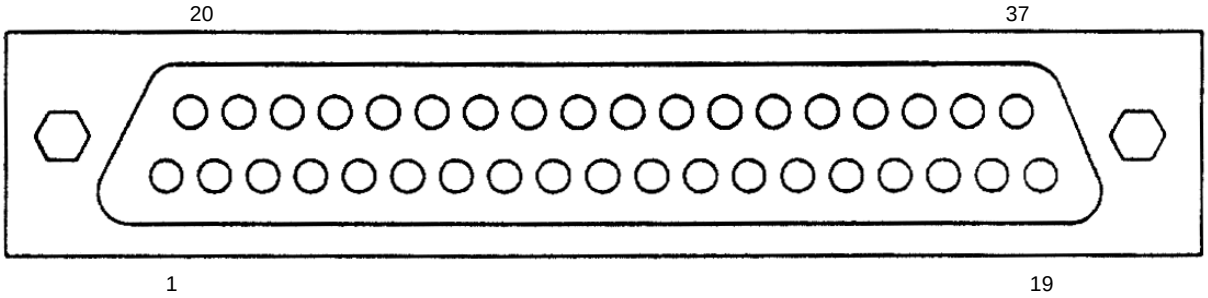


Figure 3-10. Rear View of DSR (1/2 DSRF) Mounting Rack

Outline of Connector J3

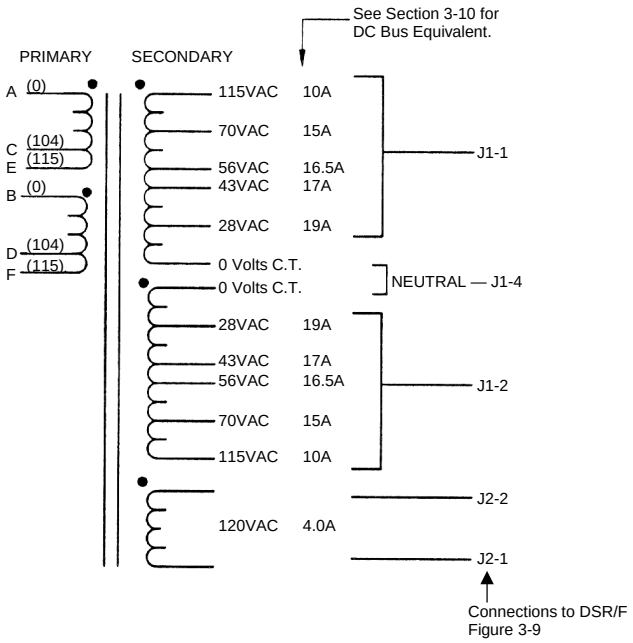


1	Shield	20	System Fault
2	(N.C.)	21	Motor 1 Tach Feedback (V_{FB})
3	Signal Common	22	Motor 1 Input Command (Vcom)
4	Motor 1 $\overline{\text{Shutdown}}$	23	Motor 1 Current Monitor (I_{FB})
5	–12VDC (for external use)	24	(N.C.)
6	Motor 1 $\overline{\text{I Limit -}}$	25	Motor 1 $\overline{\text{I Limit +}}$
7	Signal Common	26	(N.C.)
8	(N.C.)	27	Motor 2 Tach Feedback (V_{FB})
9	Signal Common	28	Motor 2 Input Command (Vcom)
10	Motor 2 $\overline{\text{Shutdown}}$	29	Motor 2 Current Monitor (I_{FB})
11	+ 12VDC (for external use)	30	(N.C.)
12	Motor 2 $\overline{\text{I Limit -}}$	31	Motor 2 $\overline{\text{I Limit +}}$
13	(N.C.)	32	(N.C.)
14	(N.C.)	33	Motor 3 Tach Feedback (V_{FB})
15	Signal Common	34	Motor 3 Input Command (Vcom)
16	Motor 3 $\overline{\text{Shutdown}}$	35	Motor 3 Current Monitor (I_{FB})
17	(N.C.)	36	(N.C.)
18	Motor 3 $\overline{\text{I Limit -}}$	37	Motor 3 $\overline{\text{I Limit +}}$
19	(N.C.)		

Alternate Tachometer connections can be made at J5. See Figure 3-6 and Figure 3-9.

Figure 3-11. Pinout Definitions for Control Connector J13

Input Voltage	Primary Jumper	Input Connection
104	A-B C-D	A&D
115	A-B E-F	A&F
208	C-B	A&D
230	B-E	A&F



MECHANICAL SPECIFICATIONS

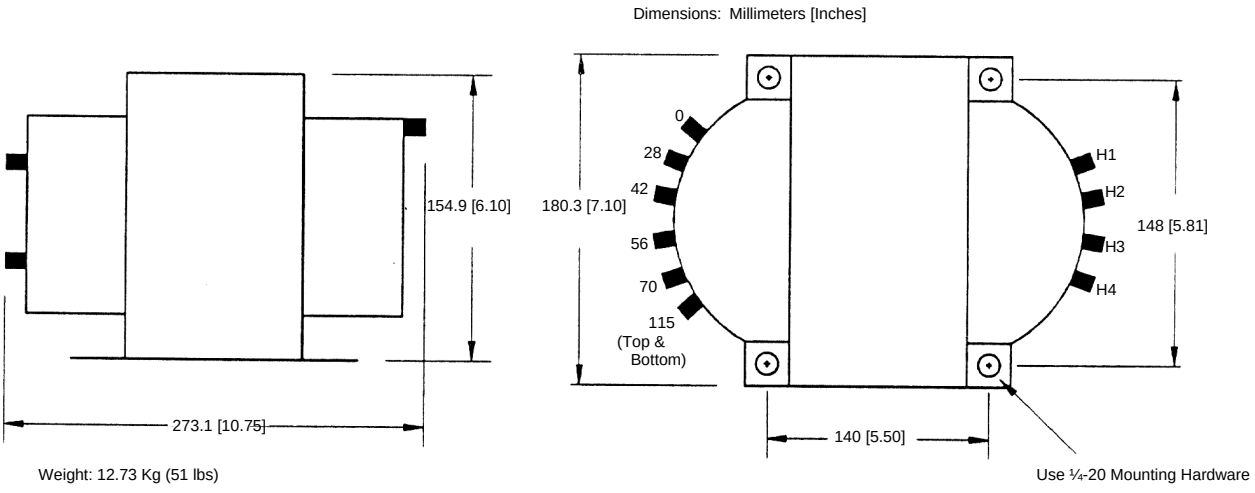
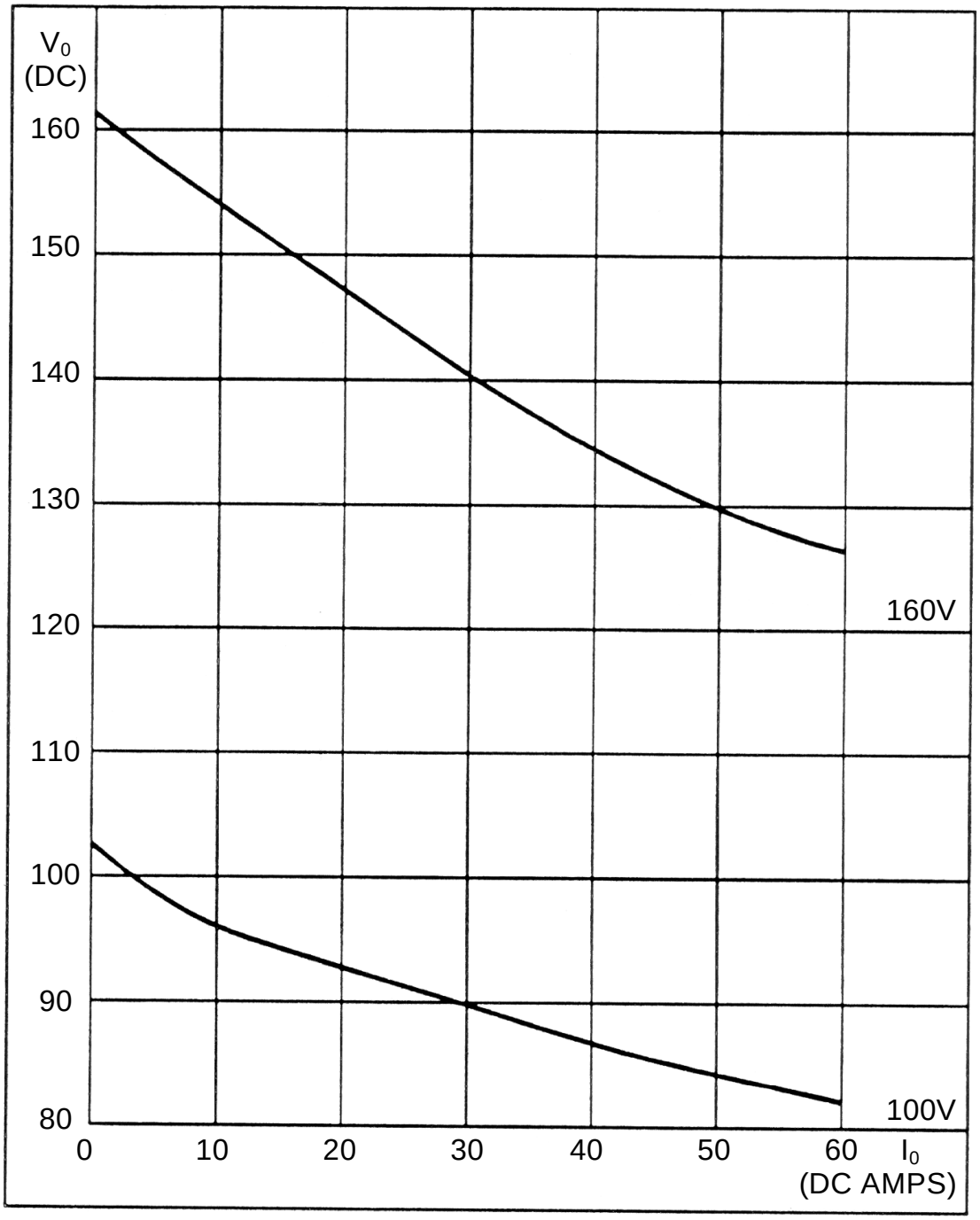


Figure 3-12. TV2.5 Transformer Specifications



Curves shown are for center-tap and full wave configurations (see Figure 3-9).

Figure 3-13. Typical DC Bus Voltage Characteristics of TV2.5 & DSR/F Mounting Rack

3.11. Troubleshooting

A troubleshooting guide for the DSR/F mounting racks appears below, in Table 3-5.

Table 3-5. Troubleshooting

Condition	Possible Cause	Reference
Active LED(s) on DS160 Series servo are de-energized with 115 (230) VAC applied at connector J2.	- Shutdown inputs (pins 4, 10, 16 of J3) are pulled to signal common.	Figure 3-7, Figure 3-11, Table 3-4.
	- 115 (230) VAC control input power below minimum level.	Figure 3-7, Figure 3-9
	- Motor short circuit condition at motor output power connections (pin 1 through 6 on J4).	Figure 3-7, Figure 3-9
	- ±12VDC power supply fuse F2 open	Figure 3-7, Figure 3-8 **If fuse is open, do not attempt repair!**
Active LED(s) on DS160 Series servo module(s) are energized, but no torque is present on motor shaft.	- Directional current limit contacts (limit + and I limit – , pins 6, 12, 18, 25, 31, and 37 of J3) are pulled to signal common.	Figure 3-7, Figure 3-11, Table 2-6
	- Current limit pots on DS160 Series servo module are full CW.	Figure 2-2, Figure 2-3, Figure 2-4, Figure 2-5
	- No DC bus input voltage (J1) or input DC bus fuse open.	Figure 3-6, Figure 3-7, Figure 3-9
Motor(s) accelerate to full speed when ±12VDC power (J2), DC bus power (J1), is applied.	Tach feedback connected (pin 21, 27, and 33 of J3) are required with respect to signal common.	Figure 3-7, Figure 3-9, Figure 3-11, Table 2-6
DC bus shunt regulator fuse opens periodically.	- Excessive motor regeneration (due to deceleration of high inertia load).	Figure 3-7, Table 3-1
	- DC input power > 115VAC	Figure 3-7, Figure 3-9, Table 3-1, Table 3-2, Table 3-3, Table 3-4
Fault LED is energized.	- Shunt regulator fuse is open (shunt option).	Figure 3-6, Figure 3-7
	- 1 or more DS160 Series servo(s) have a short circuit cruuent trip condition at motor output connections (J4).	Figure 3-7, Figure 3-9
	- DC bus voltage in excess of 195VDC.	---

3.12. DSR & DSRF Spare Parts

Table 3-6. Replacement Parts for the DSR and DSRF

Item	Aerotech Part #	Comment
DSR 3-axis mounting rack	EFA471	---
DC bus input-1 fuse, DS16020 or DS16030	---	Use 15A slow-blow, 3AG, 125V fuse with center-tap transformer
		Use a 30A slow-blow, 3AG, 125V fuse with non center-tap transformer or off line. See Figure 3-7 and Figure 3-9.
DC bus input-2 fuse, DS16020 or DS16030	---	Use 15A slow-blow, 3AG, 125V fuse with center-tap transformer
		Use dummy fuse (bus bar) with non center-tap transformer or off line. See Figure 3-7 and Figure 3-9.
Shunt regulator overload fuse (F1)	---	Use 3 amp slow-blow, 3AG, 125V fuse. **Do Not Exceed 3 Amp!**

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APPENDIX A: WARRANTY AND FIELD SERVICE

Appendix A

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 which are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Products

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

Return Procedure

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

Returned Product Warranty Determination

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

Returned Product Non-warranty Determination

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

Rush Service

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

On-site Warranty Repair

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

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

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

On-site Non-warranty Repair

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

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

Company Address

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

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

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P/N EDA119, September, 2000

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