DSA™
Digital Servo Drives

Installation Manual

Version 2.1

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Should information not covered in this document be required, contact the Customer Service Department, Giddings & Lewis, 660 South Military Road, P. O. Box 1658, Fond du Lac, WI 54936-1658. Giddings & Lewis can be reached by telephone at 920 921 7100.

Preface

Introduction 1
Who Should Use this Manual 1
Purpose of this Manual 1
Contents of this Manual 1
Conventions Used in this Manual 2
Product Receiving and Storage Responsibility 2
Giddings & Lewis Support 3
Local Product Support 3
Technical Product Assistance 3

Installing Your DSA Drive

Chapter Objectives 1
Complying with European Union Directives 1
EMC Directive 1
Low Voltage Directive 2
Before Mounting Your System 2
Storing Your DSA Drive Before Installation 3
Unpacking Modules 3
System Mounting Requirements 3
Ventilation Requirements 4
Sizing an Enclosure 5
Transformer Sizing 5
Fuse Sizing 7
Bonding Your System 7
Bonding Modules 7
Bonding Multiple Subpanels 9
Mounting Your DSA Drive 10

DSA Drive Connector Data

Chapter Objectives 1
Understanding DSA Drive Connectors 1
DSA Drive Front Panel Connections 2
DSA Drive (with SERCOS) Front Panel Connections 10
Understanding DSA Drive
I/O Specifications 18
Digital I/O Power Supply 18
Digital Inputs 18
Digital Outputs 19
Analog COMMAND Input 21
Analog ILIMIT Input 22
Analog Output 23
Auxiliary +5V Logic Supply 24
Understanding Motor Encoder Feedback Specifications 25
AM, BM, and IM Inputs 25
Hall Inputs 27
Thermostat Input 27
+ Limit and - Limit Inputs 28
Encoder Phasing 29

Motor Encoder Connection Diagram 30
Unbuffered Motor Encoder Outputs 31
Buffered Motor Encoder Outputs 31
Understanding Auxiliary Encoder Feedback Specifications 32
Understanding the Serial Interface 33
Default Serial Interface Settings 34
Restoring Drive Communications 34

Connecting Your DSA Drive

Chapter Objectives 1
Understanding Basic Wiring Requirements 1
Building Your Own Cables 2
Routing High and Low Voltage Cables 3
Grounding Your DSA Drive 4
Grounding Your System to the Subpanel 4
Grounding Multiple Subpanels 5
Motor Power Cable Shield Termination 5
Wiring Your DSA Drive 7
Connecting Interface Cables 7
Connecting Your SERCOS Fiber Optic Cables 8

Specifications and Dimensions

Chapter Objectives 1
DSA Drive Specifications 1
General Power Specifications 1
Physical and Environmental 4
Power Dissipation 5
Control 5
Inputs and Outputs 6
Serial Communication 6
Motor Feedback 6
Auxiliary Feedback 7
Connectors 7
SERCOS Communication 7
Dimensions 8

Interconnect Diagrams

Chapter Objectives 1
DSA Drive to Cable and Interconnect Diagrams 1
DSA Drive and Motor Cable Diagrams 2
DSA Drive and Motor Cable Combinations 2
DSA Drive to Motor Interconnect Diagrams 4
DSA Drive Power Wiring Diagrams 13
Start/Stop String Configuration Diagram Examples 18
24V DC Start/Stop String Examples 18
120V AC Start/Stop String Examples 23
Controlling a Brake 27
Grounding for DSA Drive CE Requirements 30
DSA Drive to Shunt Module Interconnect Diagrams 32
DSA Drive to 300W Active Shunt Module 32

DSA Drive to 200W Passive Shunt Module. 33
DSA Drive to 900W Passive Shunt Module. 34
DSA Drive to Two 900W Passive Shunt Module 36

Material Numbers and Accessories

Chapter Objectives. 1
DSA Drives. 2
DSAPro Software. 3
AC Line Filters 3
External Shunt Kits 4
Cables 5
Motor Power Cables 5
SERCOS Interface Fiber Optic Cables. 5
Motor Feedback Cables 6
DSA Drive Interface Cables 6
Break Out Boards, Cables, and Kits 7

Trooubleshooting Your DSA Drive

Chapter Objectives. 1
Maintaining the Drive 1
Periodic Maintenance. 1
General Troubleshooting. 2
Error Codes 2
Troubleshooting for SERCOS Drives 7
SERCOS Module Status LED. 7
SERCOS Network Status LED. 7

Preface

Introduction

Read this preface to familiarize yourself with the rest of the manual. This preface contains the following topics:

- Who should use this manual
- Purpose of this manual
- Contents of this manual
- Related documentation
- Conventions used in this manual
- Product receiving and storage responsibility
- Giddings & Lewis support

Who Should Use this Manual

Use this manual for designing, installing, and wiring your DSA Digital Servo Drive (DSD). The manual is intended for engineers or technicians directly involved in the installation and wiring of the DSA Drive.

If you do not have a basic understanding of the DSA Drive, contact your local Giddings & Lewis representative for information on available training courses before using this product.

Purpose of this Manual

This manual provides the mounting, wiring, and connecting procedures for the DSA Drive and standard Giddings & Lewis motors recommended for use with the DSA Drive.

Contents of this Manual

Refer to the following listing for the descriptive contents of this installation manual.

Chapter	Title	Contents
	Preface	Describes the purpose, background, and scope of this manual. Also specifies the audience for whom this manual is intended.
1	Installing Your DSA Drive	Provides mounting information for the DSA Drive.
2	DSA Drive Connector Data	Provides I/O, encoder, and serial interface connector locations and signal descriptions.

Chapter	Title	Contents
3	Connecting Your DSA Drive	Provides connection and wiring information for the DSA Drive.
Appendix A	Specifications and Dimensions	Provides physical, electrical, environmental, and functional specifications for the DSA Drive.
Appendix B	Interconnect Diagrams	Provides interconnect diagrams for the DSA Drive.
Appendix C	Material Numbers and Accessories	Provides Material Numbers and descriptions of the DSA Drive and related products.

Conventions Used in this Manual

The following conventions are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps
- Numbered lists provide sequential steps or hierarchical information
- Words that you type or select appear in bold
- When we refer you to another location, the section or chapter name appears in italics

Product Receiving and Storage Responsibility

You, the customer, are responsible for thoroughly inspecting the equipment before accepting the shipment from the freight company. Check the item(s) you receive against your purchase order. If any items are obviously damaged, it is your responsibility to refuse delivery until the freight agent has noted the damage on the freight bill. Should you discover any concealed damage during unpacking, you are responsible for notifying the freight agent. Leave the shipping container intact and request that the freight agent make a visual inspection of the equipment.

Store the product in its shipping container prior to installation. If you are not going to use the equipment for a period of time, store using the following guidelines.

- Use a clean, dry location
- Maintain an ambient temperature range of -40 to 70° C (-40 to 158° F)
- Maintain a relative humidity range of 5% to 95%, non-condensing
- Store it where it cannot be exposed to a corrosive atmosphere
- Store it in a non-construction area

Giddings & Lewis Support

Giddings & Lewis offers support services worldwide.

Local Product Support

Contact your local Giddings & Lewis representative for:

- Sales and order support
- Product technical training
- Warranty support
- Support service agreements

Technical Product Assistance

If you need technical assistance, call your local Giddings & Lewis representative or Giddings & Lewis Technical Support at (800) 558-4808 in the United States or (920) 921-7100 outside the US. For technical support via e-mail, use tech.support@giddings.com

In Europe, product assistance can be obtained between 8:30 and 17:30 local time, Monday through Friday at (+44)151-546-2010 or via fax at (+44)151-547-2801.

Installing Your DSA Drive

Chapter Objectives

This chapter provides system installation guidelines and procedures for mounting your DSA drive. This chapter covers the following topics:

- Complying with European Union directives
- Before mounting your system
- Bonding your system
- Mounting your DSA drive

ATTEN-

The following information is a guideline for proper installation. The National Electrical Code and any other governing regional or local codes overrule this information. Giddings & Lewis cannot assume responsibility for the compliance or the noncompliance with any code, national, local or otherwise, for the proper installation of this system or associated equipment. If you ignore codes during installation, hazard of personal injury and/or equipment damage exists.

Complying with European Union Directives

If this product is installed within the European Union or EEC regions and has the CE mark, the following regulations apply.

EMC Directive

This unit is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) using a technical construction file and the following standards, in whole or in part:

- EN 50081-2 EMC - Emission Standard, Part 2 - Industrial Environment
- EN 50082-2 EMC - Immunity Standard, Part 2 - Industrial Environment
- EN 61800-3 - Adjustable Speed Electrical Power Drive Systems, Part 3 - EMC Product Standard including specific test methods

The product described in this manual is intended for use in an industrial environment.

To meet CE requirements, the following additions are required:

- Install a power line filter between the AC power source and the drive input, as close to the drive as possible (refer to *Appendix C* for available AC line filters).
- Terminate the motor power cable shield to the chassis clamp provided.
- To meet CE requirements, the following additions may also be required:
- Run single-phase input wiring in a conduit that is grounded to the enclosure.
- Terminate the shields of the motor power cables and the motor feedback cables to the enclosure at the point of entry.

Low Voltage Directive

These units are tested to meet Council Directive 73/23/EEC Low Voltage Directive. The EN 60204-1 Safety of Machinery-Electrical Equipment of Machines, *Part 1-Specification for General Requirements* standard applies in whole or in part. Additionally, the standard EN 50178 *Electronic Equipment for use in Power Installations* applies in whole or in part.

Refer to *Appendix B* for interconnect information.

Before Mounting Your System

Before you mount your DSA Drive system make sure you understand the following:

- how to store your DSA Drive before installation
- how to unpack the system
- the minimum mounting requirements

Storing Your DSA Drive Before Installation

The DSA Drive should remain in the shipping container prior to installation. If the equipment is not to be used for a period of time, store it as follows:

- Use a clean, dry location
- Maintain an ambient temperature range of -40 to 70° C (-40 to 158° F)
- Maintain a relative humidity range of 5% to 95%, non-condensing
- Store it where it cannot be exposed to a corrosive atmosphere
- Store it in a non-construction area

Unpacking Modules

Each DSA Drive ships with the following:

- One DSA Drive

Remove all packing material, wedges, and braces from within and around the components. After unpacking, check the item(s) name plate Material Number against the purchase order.

System Mounting Requirements

There are several things that you need to take into account when preparing to mount the DSA Drive:

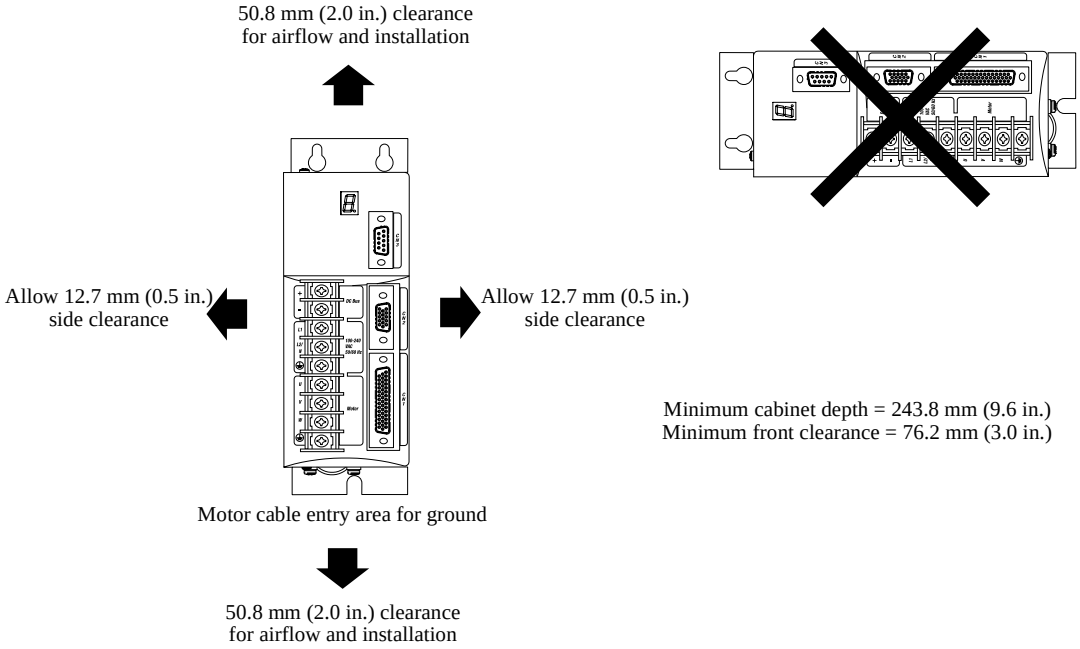
- The DSA Drive must be enclosed in a grounded conductive enclosure offering protection as defined in standard EN 60529 (IEC 529) to IP55 such that they are not accessible to an operator or unskilled person, in order to comply with UL® and CE requirements. A NEMA 4X enclosure exceeds these requirements providing protection to IP66.
- The ambient temperature of the location in which you will install the DSA Drive must not exceed 55° C (131° F).
- You must install the panel on a flat, rigid, vertical surface that won't be subjected to shock, vibration, moisture, oil mist, dust, or corrosive vapors.
- You need to maintain minimum clearances (refer to Figure 1.1) for proper airflow, easy module access, and proper cable bend radius.

Refer to *Appendix A* for mounting dimensions, power dissipation, and environmental specifications for the DSA Drive.

Ventilation Requirements

This section provides information to assist you in sizing your cabinet and locating your DSA Drive(s) inside the cabinet.

Figure 1.1
Minimum Clearance Requirements



IMPOR- If the cabinet is ventilated, use filtered or conditioned air to prevent the accumulation of dust and dirt on electronic components. The air should be free of oil, corrosives, or electrically conductive contaminants.

Refer to *Appendix A* for DSA Drive power dissipation specifications.

Sizing an Enclosure

As an additional aid in sizing an enclosure with no active method of heat dissipation, either of the following approximate equations can be used:

Metric	**Standard English**
$A = \frac{0.38Q}{1.8T - 1.1}$	$A = \frac{4.08Q}{T - 1.1}$
Where T is temperature difference between inside air and outside ambient (°C), Q is heat generated in enclosure (Watts), and A is enclosure surface area (m^2). The exterior surface of all six sides of an enclosure is calculated as	Where T is temperature difference between inside air and outside ambient (°F), Q is heat generated in enclosure (Watts), and A is enclosure surface area (ft^2). The exterior surface of all six sides of an enclosure is calculated as
A = 2dw + 2dh + 2wh	A = (2dw + 2dh + 2wh) / 144
Where d (depth), w (width), and h (height) are in meters.	Where d (depth), w (width), and h (height) are in inches.

Transformer Sizing

The DSA Drive does not require isolation transformers. However, a transformer may be required to match the voltage requirements of the controller to the available service. To size a transformer for the main AC power inputs, the power output (KVA) of each axis must be known. This can be derived by calculating the horsepower for each axis and converting that horsepower into units of watts. If you are supplying power to more than one motor and a DSA Drive, simply add the kW ratings together from each calculation to get a system kW total.

IMPOR- If using an autotransformer, ensure that the phase to neutral/ground voltages do not exceed the input voltage ratings of the drive.

Definitions:

kW = power or real power
KVA = apparent power

Transformer KVA rating = (Sum of average output power of each axis) x 2.0.

IMPOR-

If you are using the Giddings & Lewis system sizing program, the average speed and average torque data has already been calculated and can be used in the above equation. If you are not sure of the exact speed and torque in your application, another approach is to look at the speed/torque curve for your DSA Drive/motor combination and use the values for the worst case continuous speed and torque.

IMPOR-

Calculations are multiplied by a factor to compensate for the power and loss elements within a power system. A factor of 2.0 is used with a single phase system and a factor of 1.5 is used with a three phase system. This factor should minimize the effects of the secondary line voltage sagging in the transformer during peak current periods.

Example:

$$KVA = \frac{Speed(RPM) x Torque(lb-in)}{63,025} x \frac{746 Watts}{HP} x \frac{KVA}{1000 Watts} x 2.0$$

$$KVA = \frac{(5,000(RPM)) X 17.7(lb-in)}{42,250}$$

$$Transformer\ Size = 2.1\ KVA$$

The speed/torque curve information for 230V motors is based upon a DSA Drive input voltage of 230V AC. For a 115V AC input voltage, the maximum speed can be reduced up to one half.

Fuse Sizing

The DSA Drive is listed by Underwriters Laboratories, Inc. with fuses sized as four times the continuous output current of the drives (FLA), according to UL 508C.

In most cases, fuses selected to match the drive input current rating will meet the NEC requirements and provide the full drive capabilities. Dual element, time delay (slow acting) fuses should be used to avoid nuisance trips during the inrush current of power initialization. Refer to the section *General Power Specifications* in *Appendix A* for input current and inrush current specifications.

The DSA Drive utilizes solid state motor short circuit protection rated as shown in the table below.

Bonding Your System

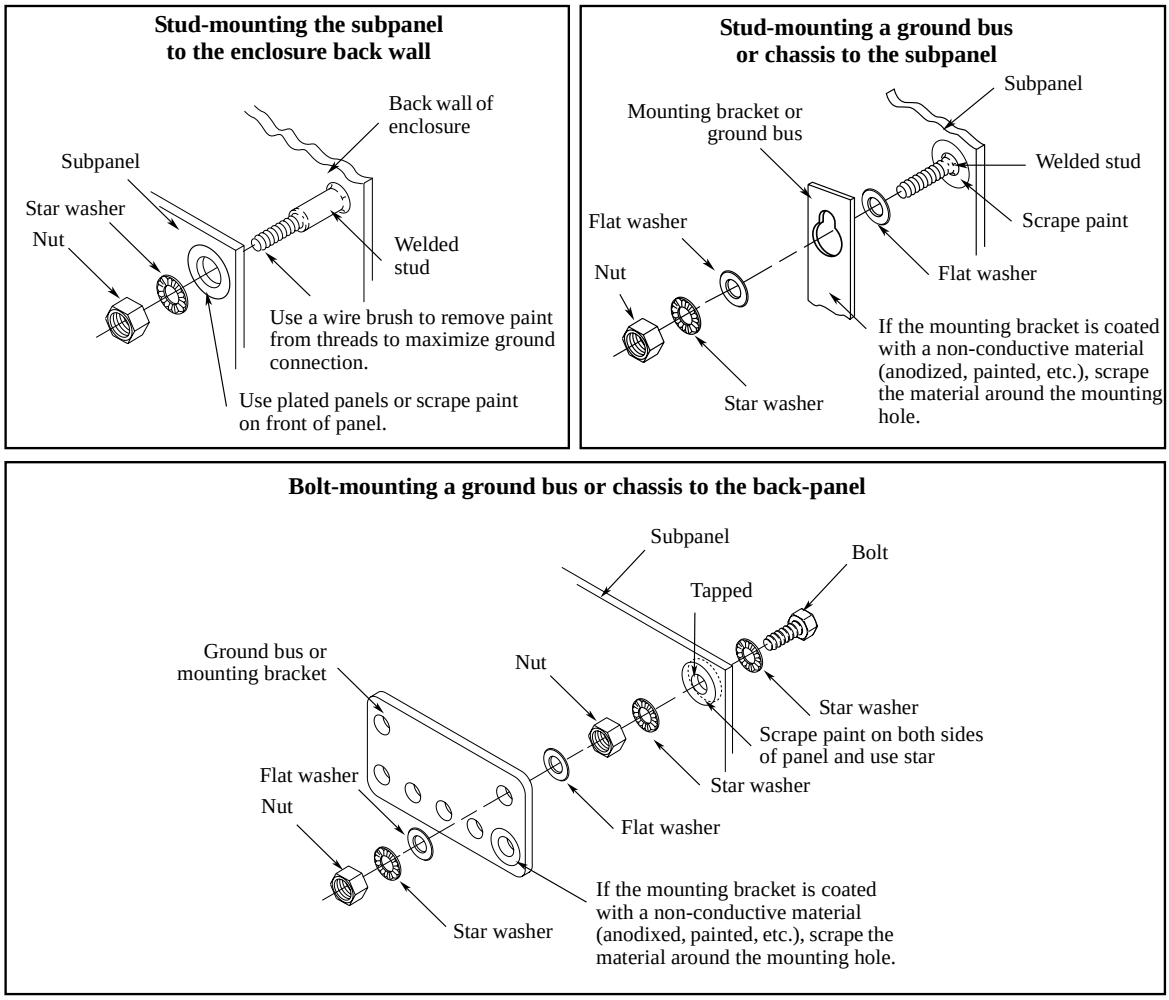
Bonding is the practice of connecting metal chassis, assemblies, frames, shields and enclosures to reduce the effects of electromagnetic interference (EMI).

Bonding Modules

Unless specified, most paints are not conductive and they act as insulators. To achieve a good bond between modules and the subpanel, surfaces need to be paint-free or plated. Bonding metal surfaces creates a low-impedance exit path for high-frequency energy.

Improper bonding blocks that direct exit path and allows high-frequency energy to travel elsewhere in the cabinet. Excessive high-frequency energy can affect the operation of other microprocessor-controlled equipment. The illustrations that follow (refer to Figure 1.2) show details of recommended bonding practices for painted panels, enclosures, and mounting brackets.

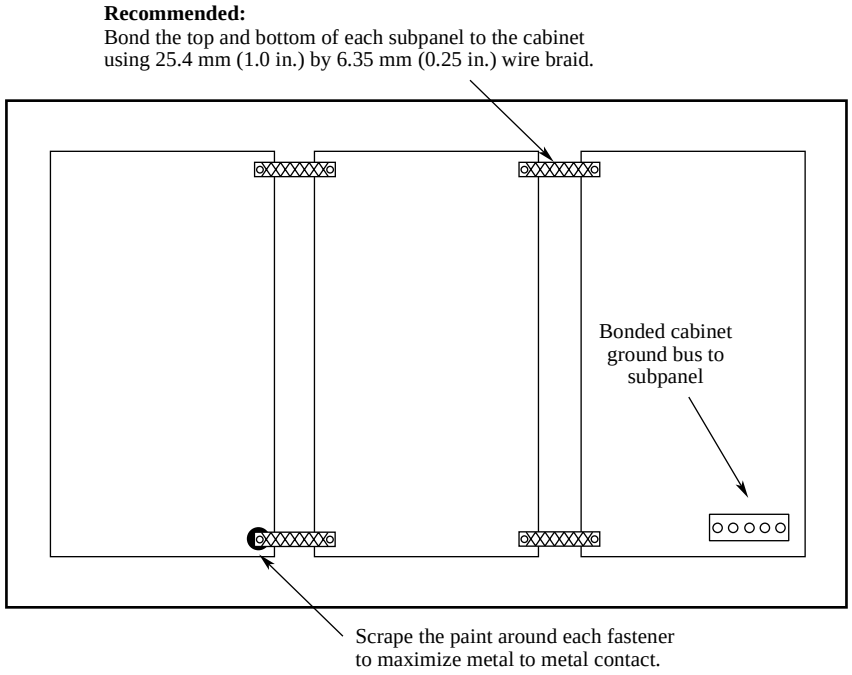
Figure 1.2
Recommended Bonding Practices



Bonding Multiple Subpanels

Bonding multiple subpanels creates a common low impedance exit path for the high frequency energy inside the cabinet. Subpanels that are not bonded together may not share a common low impedance path. This difference in impedance may affect networks and other devices that span multiple panels. Refer to the figure below for recommended bonding practices.

Figure 1.3
Multiple Subpanels and Cabinet



Mounting Your DSA Drive

The procedures in this section assume you have prepared your panel and understand how to bond your system. For installation instructions regarding other equipment and accessories, refer to the instructions that came with each of the accessories for their specific requirements.

ATTEN-

This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. You are required to follow static control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged.

To mount your DSA Drive:

1. Lay out the positions for the DSA Drive and accessories in the enclosure. Mounting hole dimensions for the DSA Drive are shown in *Appendix A*.

2. Attach the DSA Drive to the cabinet, first using the upper mounting slots of the drive and then the lower. The recommended mounting hardware is M5 metric (1/4-20) or #10 MS bolts. Observe bonding techniques as described in *Bonding Your System*.

3. Tighten all mounting fasteners.

DSA Drive Connector Data

Chapter Objectives

This chapter provides I/O, encoder, and serial interface connector locations and signal descriptions for your DSA Drive. This chapter includes:

- Understanding DSA Drive connectors
- Understanding DSA Drive I/O specifications
- Understanding motor encoder feedback specifications
- Understanding auxiliary encoder feedback specifications
- Understanding the serial interface

Understanding DSA Drive Connectors

The following table provides a brief description of the DSA Drive front panel connectors and describes the connector type.

Designator	Description	Connector
J1	User Input/Output	44-pin high-density D-shell
J2	Motor Feedback	15-pin high-density D-shell
J3	Serial Port	9-pin standard D-shell
TB	DC bus, Motor and AC power	9-position screw style barrier terminal strip
TB1	DC bus, Motor, AC power, and auxiliary AC power	11- or 12-position screw style barrier terminal strip
TB2	Shunt	3-position screw style barrier terminal strip

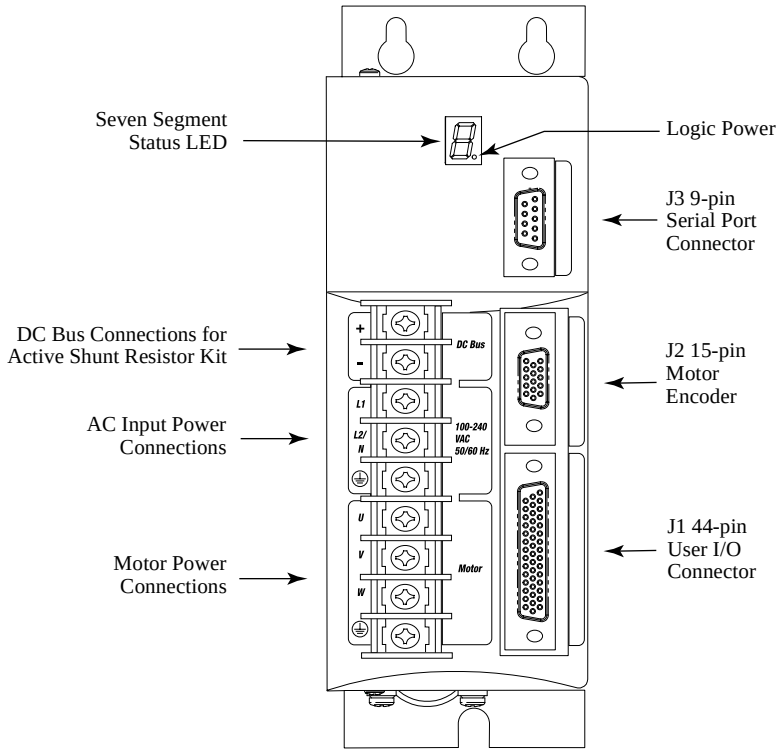
All signal connections on the DSA Drive use commonly available D-shell type connectors.

For connector pin-outs and the location of connectors, switches, and status LEDs on:	Refer to:
DSA Drive (without SERCOS Interface)	Figures 2.1- and the tables that follow on pages 2-2 through 2-9.
DSA Drive (with SERCOS Interface)	Figures 2.5-2.8 and the tables that follow on pages 2-10 through 2-17.

DSA Drive Front Panel Connections

Use the figure below to locate the front panel connections on the DSA 230V drives (500W, 1 kW, and 2 kW).

Figure 2.1
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In (+5V)	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector

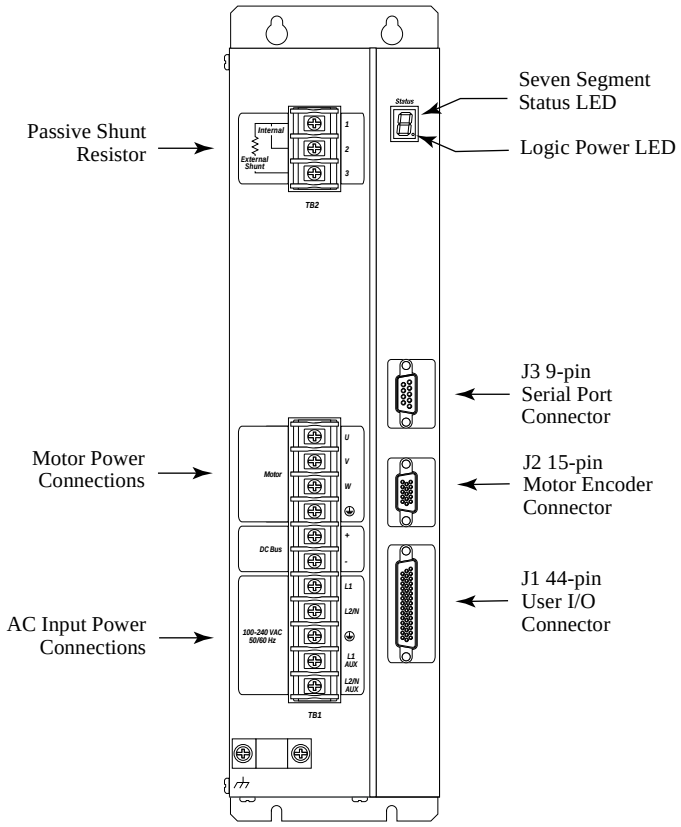
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Reserved	–
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA 230V drives (3 kW).

Figure 2.2
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector

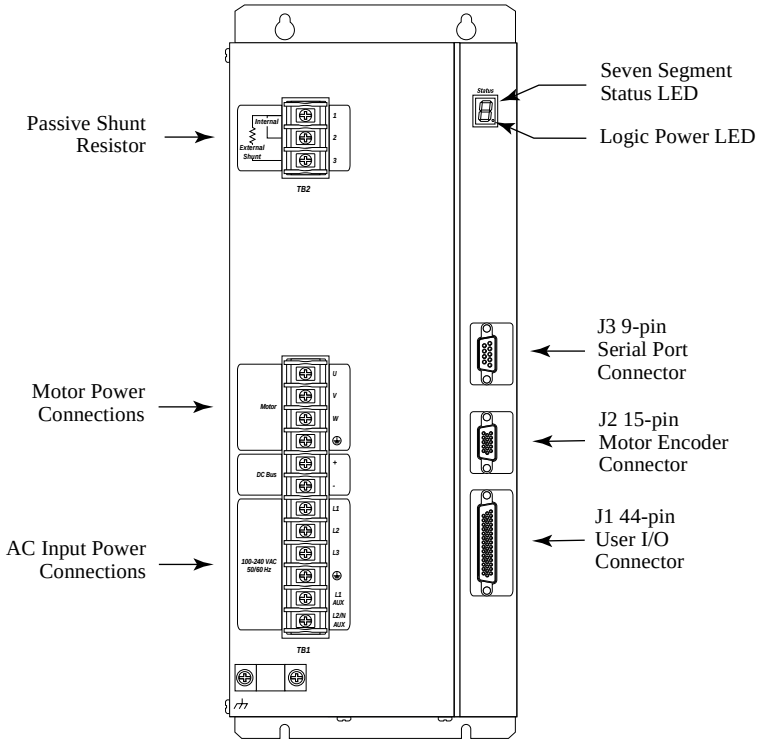
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA Drive 230V (7.5 and 15 kW).

Figure 2.3
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector

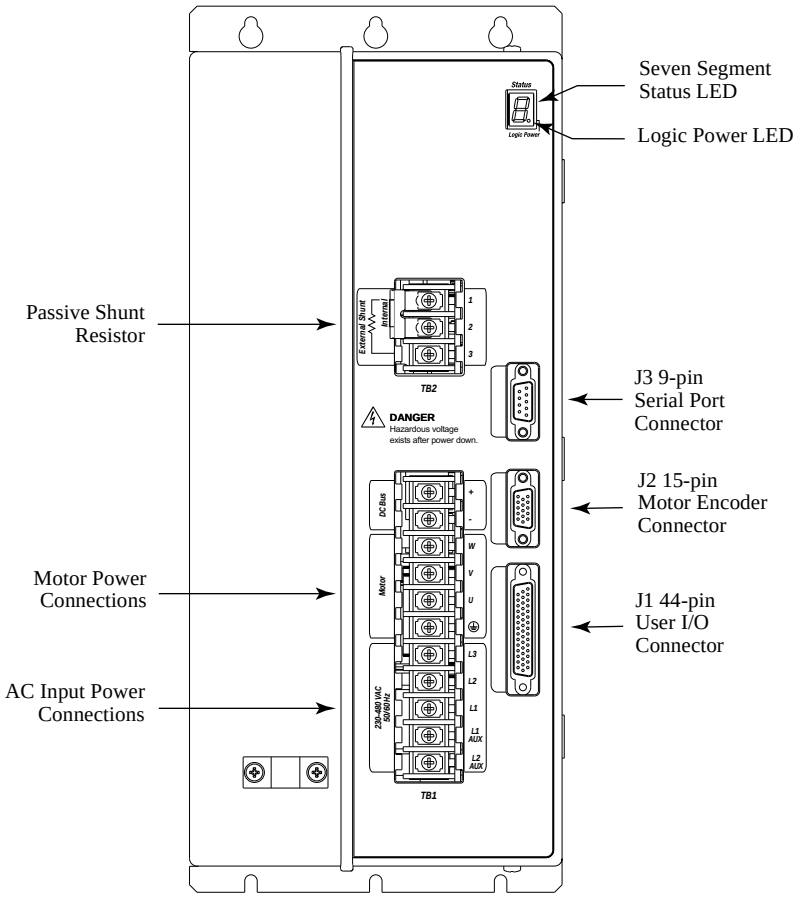
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA 460V drives (3W, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 2.4
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Digital Input 1	INPUT1
32	Digital Input 2	INPUT2
33	Digital Input 3	INPUT3
34	Digital Input 4	INPUT4
35	Digital Input 5	INPUT5
36	Digital Input 6	INPUT6
37	Digital Input 7	INPUT7
38	Digital Input 8	INPUT8
39	Digital Output 1	OUTPUT1
40	Digital Output 2	OUTPUT2
41	Digital Output 3	OUTPUT3
42	Digital Output 4	OUTPUT4
43	Normally Open Relay Output+	RELAY+
44	Normally Open Relay Output-	RELAY-

Motor Encoder Connector

The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

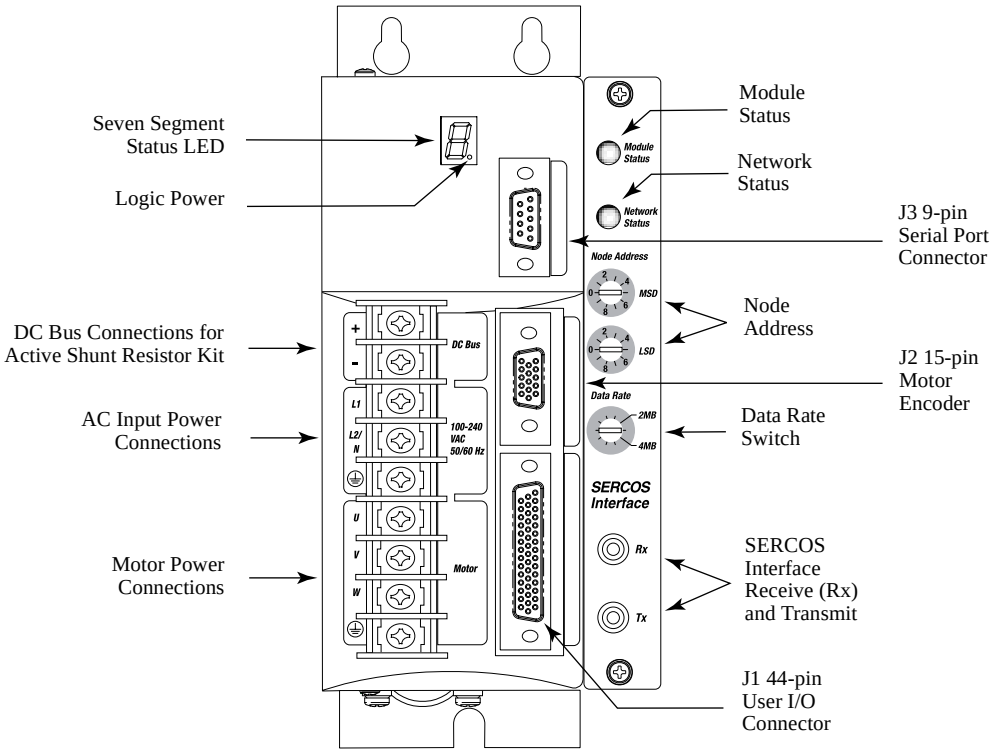
J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

DSA Drive (with SERCOS) Front Panel Connections

Use the figure below to locate the front panel connections on the DSA with SERCOS interface 230V drives (500W, 1 kW, and 2 kW).

Figure 2.5
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Auxiliary Logic Power In (+5V)	AUXPWR
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2
35	Reserved	–
36	Reserved	–
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Reserved	–
40	Reserved	–
41	Reserved	–
42	Reserved	–
43	Brake Relay Output+	BRAKE+
44	Brake Relay Output-	BRAKE-

Motor Encoder Connector

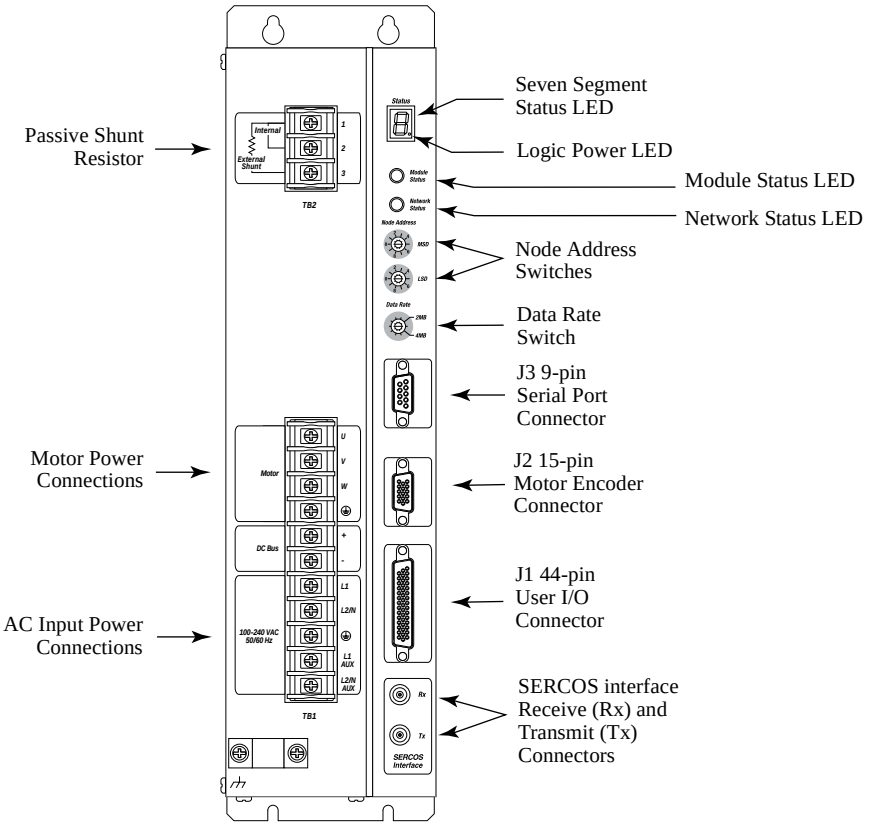
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Reserved	–
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA with SERCOS interface 230V drive (3 kW).

Figure 2.6
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2
35	Reserved	–
36	Reserved	–
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Reserved	–
40	Reserved	–
41	Reserved	–
42	Reserved	–
43	Brake Relay Output+	BRAKE+
44	Brake Relay Output-	BRAKE-

Motor Encoder Connector

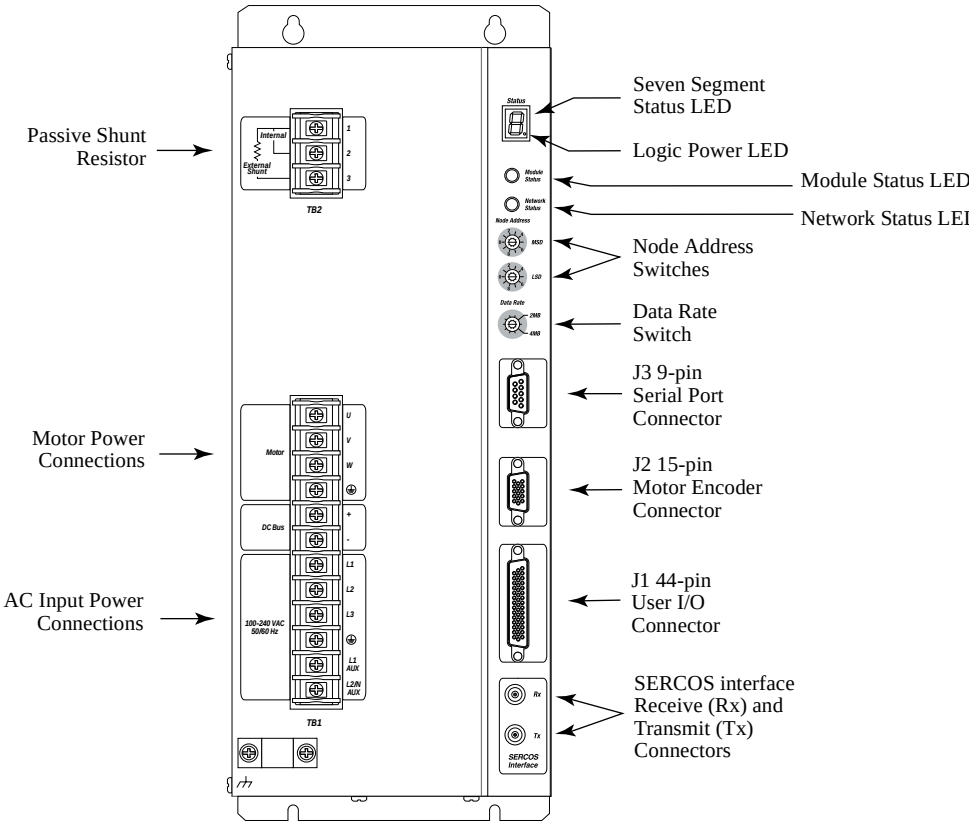
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA with SERCOS interface 230V drives (7.5 and 15 kW).

Figure 2.7
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2
35	Reserved	–
36	Reserved	–
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Reserved	–
40	Reserved	–
41	Reserved	–
42	Reserved	–
43	Brake Relay Output+	BRAKE+
44	Brake Relay Output-	BRAKE-

Motor Encoder Connector

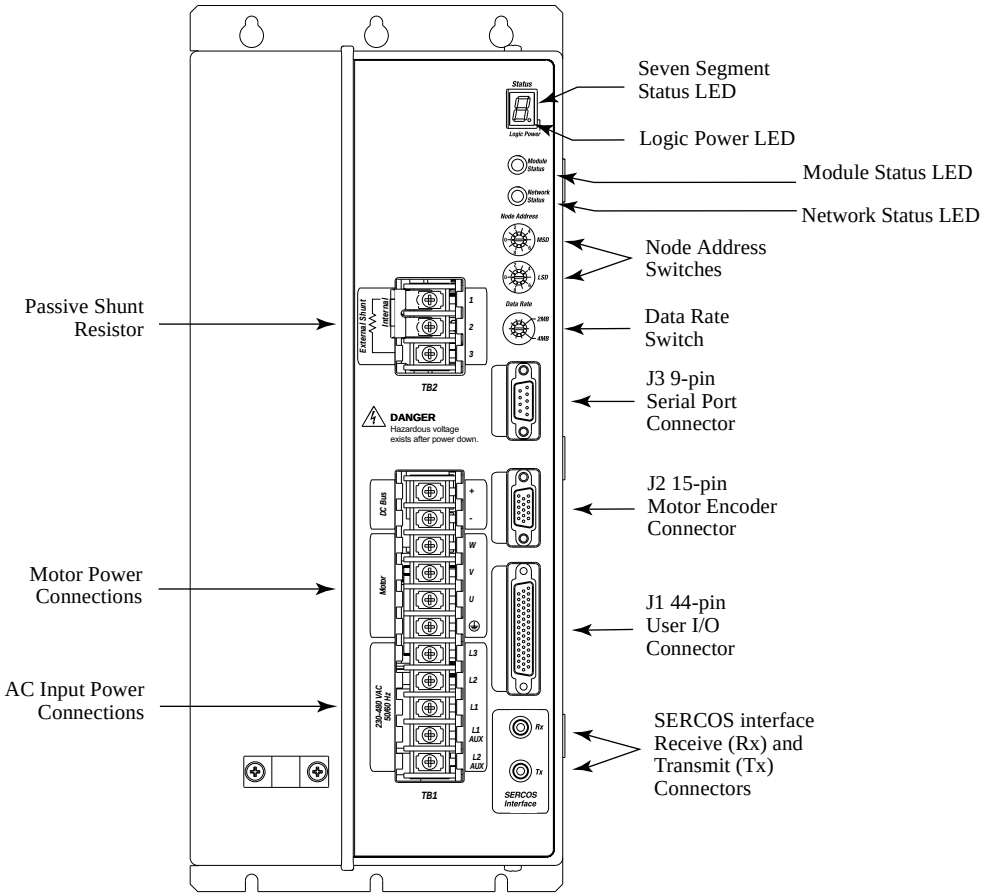
The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Use the figure below to locate the front panel connections on the DSA with SERCOS interface 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 2.8
DSA Drive Front Panel Connections



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the J3 serial port (9-pin) connector.

J3 Pin	Description	Signal
1	RS-422/RS-485 Input+	RCV+
2	RS-232 Input	RCV
3	RS-232 Output	XMT
4	RS-422/RS-485 Output+	XMT+
5	Common	COM
6	Reserved	–
7	RS-422/RS-485 Input-	RCV-
8	RS-422/RS-485 Output-	XMT-
9	Reserved	–

I/O Connector

The following table provides the signal descriptions and pin-outs for the J1 I/O (44-pin) connector.

J1 Pin	Description	Signal
1	Auxiliary Encoder Power Out (+5V)	EPWR
2	Common	ECOM
3	Reserved	–
4	Auxiliary Encoder Ch A+	AX+
5	Auxiliary Encoder Ch A+	AX-
6	Auxiliary Encoder Ch B+	BX+
7	Auxiliary Encoder CH B-	BX-
8	Auxiliary Encoder Ch I+	IX+
9	Auxiliary Encoder Ch I-	IX-
10	Unbuffered Motor Encoder Ch A+	AM+
11	Unbuffered Motor Encoder Ch A-	AM-
12	Unbuffered Motor Encoder Ch B+	BM+
13	Unbuffered Motor Encoder Ch B-	BM-
14	Unbuffered Motor Encoder Ch I+	IM+
15	Unbuffered Motor Encoder Ch I-	IM-
16	Buffered Motor Encoder Ch A+	AMOUT+
17	Buffered Motor Encoder Ch A-	AMOUT-
18	Buffered Motor Encoder Ch B+	BMOUT+
19	Buffered Motor Encoder Ch B-	BMOUT-
20	Buffered Motor Encoder Ch I+	IMOUT+
21	Buffered Motor Encoder Ch I-	IMOUT-
22	Common	ACOM

J1 Pin	Description	Signal
23	Programmable Analog Output	AOUT
24	Analog Current Limit Input	ILIMIT
25	Command +	COMMAND+
26	Command -	COMMAND-
27	I/O Common	IOCOM
28	I/O Common	IOCOM
29	I/O Power	IOPWR
30	I/O Power	IOPWR
31	Drive Enable Input	ENABLE
32	Home Sensor Input	HOME
33	Registration Sensor 1 Input	REG1
34	Registration Sensor 2 Input	REG2
35	Reserved	–
36	Reserved	–
37	Positive Overtravel Input	OT_POS
38	Negative Overtravel Input	OT_NEG
39	Reserved	–
40	Reserved	–
41	Reserved	–
42	Reserved	–
43	Brake Relay Output+	BRAKE+
44	Brake Relay Output-	BRAKE-

Motor Encoder Connector

The following table provides the signal descriptions and pin-outs for the J2 motor encoder (15-pin) connector.

J2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

J2 Pin	Description	Signal
9	Positive Overtravel Limit	+LIMIT
10	Channel I-	IM-
11	Thermostat	TS
12	Commutation Channel S1	S1
13	Commutation Channel S2	S2
14	Encoder Power (+5V)	EPWR_5V
15	Negative Overtravel Limit	-LIMIT

Understanding DSA Drive I/O Specifications

A description of the DSA Drive input/output is provided on the following pages.

Digital I/O Power Supply

All DSA Drives require an external 12-24V power supply for proper operation of the digital I/O. The following table provides a description of the digital I/O power supply.

Parameter	Description	Minimum	Maximum
I/O Power Supply voltage	Voltage range of the external power supply for proper operation of the digital I/O	10.8V	26.4V
I/O Power Supply Current	Current draw from the external power supply for the digital I/O, not including the relay output usage.	—	300 mA

Digital Inputs

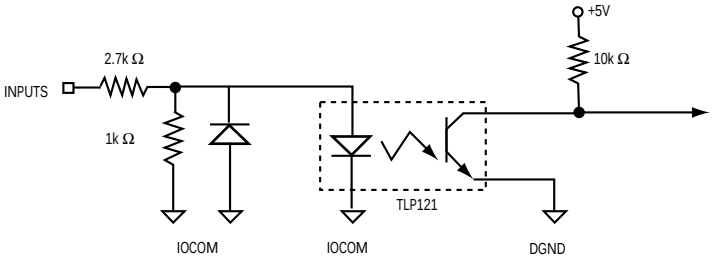
There are eight opto-isolated digital inputs. On non-SERCOS drives, any input can be configured for a variety of functions using DSA Drive. On SERCOS drives, the following inputs have dedicated functionality.

IMPOR- Overtravel limit input devices must be normally closed.

Pin	Signal	Description
J1-31	ENABLE	Drive Enable Input, an active state enables the power electronics to control the motor.
J1-32	HOME	Home Sensor, an active state indicates to a homing sequence that the sensor has been seen.
J1-33 J1-34	REG1 REG2	Registration Sensor, a transition is used to record position values.
J1-37 J1-38	OT_POS OT_NEG	Overtravel Input, an inactive state indicates that a position limit has been exceeded.

All digital inputs have the same configuration, as shown in Figure 2.9.

Figure 2.9
Digital Input Circuit



The following table provides a description of the digital input specifications.

Parameter	Description	Minimum	Maximum
ON State Voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an ON state.	10.8.V	26.4V
ON State Current	Current flow to guarantee an ON State	3.0 mA	12.0 mA
OFF State Voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an OFF state.	-1.0V	3.0V
Propagation Delay	Signal propagation delay from the digital input to the firmware-accessible registers.	—	100 µS

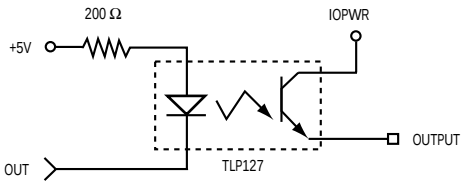
Digital Outputs

There are four opto-isolated transistor outputs that can be configured for a variety of functions through software. Additionally, the drive has a relay output with normally open contacts. On SERCOS drives, the relay output is dedicated as a Brake output, where closed contacts release a motor brake.

The configuration of the transistor outputs is shown in Figure 2.10, and the configuration of the relay output is shown in Figure 2.11.

IMPOR- There is no overload protection on the transistor outputs.

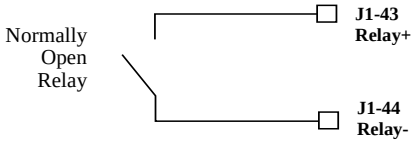
Figure 2.10
Transistor Output Hardware Configuration



The following table provides a description of the digital output specifications.

Parameter	Description	Minimum	Maximum
ON State Current	Current flow when the output transistor is ON	—	50 mA
OFF State Current	Current flow when the output transistor is OFF	—	0.1 mA
ON State Voltage	Voltage across the output transistor when ON	—	1.5V
OFF State Voltage	Voltage across the output transistor when OFF	—	50V

Figure 2.11
Relay Output Hardware Configuration



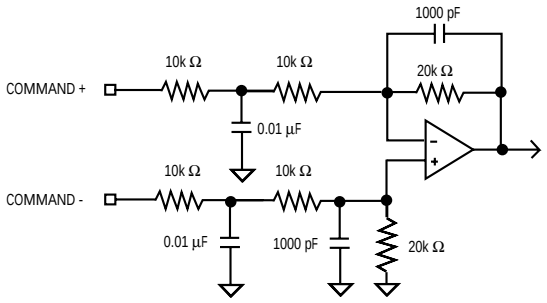
The following table provides a description of the relay output specifications.

Parameter	Description	Minimum	Maximum
ON State Current	Current flow when the relay is closed	—	1A
ON State Resistance	Contact resistance when the relay is closed	—	1Ω
OFF State Voltage	Voltage across the contacts when the relay is open	—	30V

Analog COMMAND Input

The COMMAND input to the drive can provide a position, velocity, or current command signal. A 14 bit A/D converter digitizes the signal. The configuration of the input is shown in Figure 2.12.

Figure 2.12
Analog COMMAND Input Configuration



The following table provides a description of the analog COMMAND input specifications.

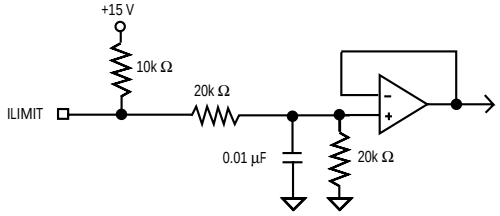
Parameter	Description	Minimum	Maximum
Resolution	Number of states that the input signal is divided into which is $2^{(\text{to the number of bits})}$.	14 bits	—
Input Impedance	Open circuit impedance measured between the + and - inputs.	20 kΩ	—
Input Signal Range	Voltage applied to the input	-10V	+10V
Offset Error	Deviation from the correct value expected from analog-to-digital conversion when 0V is applied to the input.	—	50 mV
Gain Error	Deviation of the transfer function from unity gain, expressed in a percent of full scale.	—	1%
Propagation Delay	Delay from the input to the firmware-accessible registers.	—	100 µS

Analog ILIMIT Input

The ILIMIT input specifies to the drive if the drive output current should be limited. If the ILIMIT input is not connected, current is not limited. A 10 bit A/D converter digitizes the signal. The configuration of the ILIMIT input is shown in Figure 2.13.

The input range is 0 to 10V, and the drive current is limited inversely proportional to the input voltage. A +10V input corresponds to no current limiting, and a 0V input prevents any drive current.

Figure 2.13
Analog ILIMIT Input Configuration



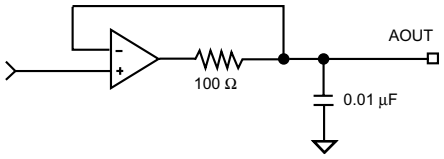
The following table provides a description of the analog ILIMIT input specifications.

Parameter	Description	Minimum	Maximum
Resolution	Number of states that the input signal is divided into which is $2^{(\text{to the number of bits})}$.	10 bits	—
Input Impedance	Open circuit impedance measured between the input and analog common.	10 kΩ	—
Input Signal Range	Voltage applied to the input	0V	+10V
Offset Error	Deviation from the correct value expected from analog-to-digital conversion when 0V is applied to the input.	—	50 mV
Gain Error	Deviation of the transfer function from unity gain, expressed in a percent of full scale.	—	1%
Propagation Delay	Delay from the input to the firmware-accessible registers.	—	100 µS

Analog Output

The DSA Drive includes a single analog output that can be configured through software to represent drive variables. Figure 2.14 shows the configuration of the analog output. The following table provides a description of the analog output.

Figure 2.14
Analog Output Configuration



IMPOR- Output values can vary during power-up until the specified power supply voltage is reached.

The following table provides a description of the analog output specifications.

Parameter	Description	Minimum	Maximum
Resolution	Number of states that the output signal is divided into, which is $2^{(\text{to the number of bits})}$.	8 Bits	—
Output Current	Current capability of the output.	-2 mA	+2 mA
Output Signal Range	Range of the output voltage.	-10V	+10V
Offset Error	Deviation when the output should be at 0V.	—	100 mV
Gain Error	Deviation of the transfer function from unity gain, expressed in a percent of full scale.	—	5%
Bandwidth	Frequency response of the analog output	50 Hz	—

Auxiliary +5V Logic Supply

The DSA Drive control board and motor encoder can be powered separately from the AC input if necessary, using an external +5V DC power supply. If an auxiliary +5V DC logic supply is used, the AC input power can be removed and the motor position can still be monitored by the drive. Since the drive is able to monitor the motor position, additional homing sequences can be avoided when the AC input power is reapplied.

IMPOR- Only the DSA007-230, DSA015-230, DSA030-230 models support an auxiliary +5V logic supply since an auxiliary AC input is not available. Refer to the chapter *Connecting Your DSA Drive* for more information on the auxiliary AC input.

The external +5V DC power supply must not be grounded inside the supply, since it will be referenced to the drive common. External +5V DC power supply connections should be made to J1-2 and J1-3.

The following table provides a description of the requirements for an external +5V DC power supply used to power the logic.

Parameter	Description	Minimum	Maximum
Voltage	Voltage tolerance of the external logic supply.	5.1V	5.25V
Current	Current output capability of the external +5V DC power supply.	2.5A	—

IMPOR- Whenever the auxiliary +5V DC logic supply is used and the AC input supply is disconnected, the drive must be disabled. When the AC input supply is reconnected, the drive should not be re-enabled for at least 100 ms to allow the power stage circuitry to fully charge.

IMPOR- Once the AC input supply is applied, the auxiliary +5V DC logic supply must not be interrupted. Removing the +5V DC logic supply with the AC input voltage applied will cause the drive to reboot and loss of control will occur.

Understanding Motor Encoder Feedback Specifications

The DSA Drive can accept motor encoder signals from the following types of encoders:

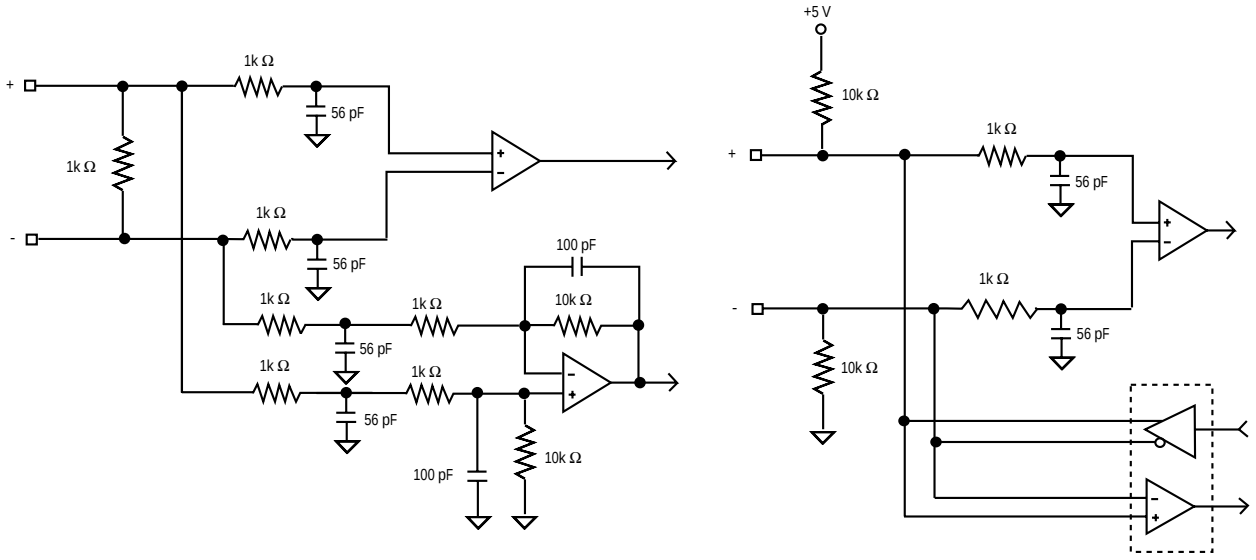
- Incremental encoders with TTL outputs, with or without Hall signals
- Sine/Cosine encoders, with or without Hall signals
- Intelligent absolute encoders
- Intelligent high-resolution encoders
- Intelligent incremental encoders

Note: The intelligent absolute, high-resolution, and incremental encoders are available only in Giddings & Lewis motors.

AM, BM, and IM Inputs

AM, BM, and IM Input encoder signals are filtered using analog and digital filtering. The inputs also include illegal state change detection. Refer to Figure 2.15 for a schematic of the AM, BM, and IM inputs.

Figure 2.15
Schematic of the Motor Encoder Inputs



AM and BM Channel Inputs

IM Channel Input

The DSA Drive supports both TTL and Sine/Cosine encoders. The following table provides a description of the AM, BM, and IM inputs for TTL encoders.

Parameter	Description	Minimum	Maximum
AM, BM, and IM ON State Input Voltage	Input voltage difference between the + input and the - input that is detected as an ON state.	+1.0V	+7.0V
AM, BM, and IM OFF State Input Voltage	Input voltage difference between the + input and the - input that is detected as an OFF state.	-1.0V	-7.0V
Common Mode Input Voltage	Potential difference between any encoder signal and logic ground.	-7.0V	+12.0V
DC Current Draw	Current draw into the + or - input.	-30 mA	30 mA
AM, BM Input Signal Frequency	Frequency of the AM or BM signal inputs. The count frequency is 4 times this frequency, since the circuitry counts all four transitions.	—	2.5 MHz
IM Pulse Width	Pulse width of the index input signal. Since the index is active for a percentage of a revolution, the speed will determine the pulse width.	125 nS	—
AM / BM Phase Error, 2.5 MHz Line Frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-22.5°	+22.5°
AM / BM Phase Error, 1 MHz Line Frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-45°	+45°

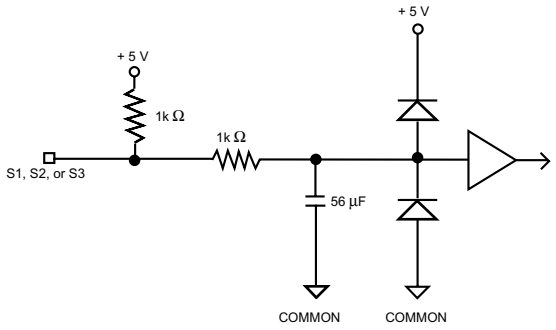
The following table provides a description of the AM and BM inputs for Sine/Cosine encoders.

Parameter	Description	Minimum	Maximum
AM and BM Input Signal Frequency	Frequency of the AM or BM signal inputs.	—	100 kHz
AM and BM Input Voltage	Peak-to-peak input voltages of the AM and BM inputs	0.5V (p-p)	2.0V (p-p)

Hall Inputs

The DSA Drive can use Hall Signals to initialize the commutation angle for sinusoidal commutation. Hall Signals must be single-ended and can be either open collector type or TTL type. Figure 2.16 shows the configuration of the Hall inputs. If the motor does not have Hall signals, the drive can be configured through software to ignore the signals.

Figure 2.16
Hall Input Configuration



Thermostat Input

The DSA Drive can monitor a thermostat signal from a motor and will generate a fault if the motor overheats. Figure 2.17 shows the configuration of the thermostat input. Figure 2.18 on page 2-28 shows a typical connection to a motor with a normally closed thermostat. The logic is designed so that an open condition will generate a fault. If the motor does not have a thermostat signal, the drive can be configured through software to ignore the signal.

Figure 2.17
Thermostat Input Configuration

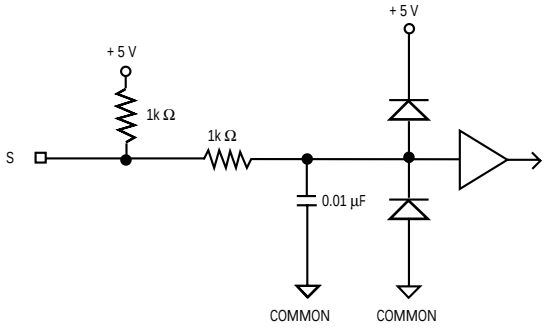
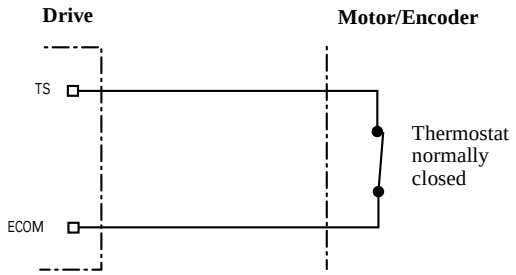


Figure 2.18
Typical Thermostat Connection



+ Limit and - Limit Inputs

The DSA Drive includes overtravel limit inputs on the motor encoder connector that can be programmed to halt motion. The logic is designed so that an open condition will halt motion in the corresponding direction. If these signals are not used, the drive can be configured through software to ignore the inputs. Figure 2.19 shows the configuration of the +Limit and -Limit inputs. Figure 2.20 shows a typical connection to a motor with integral limit switches.

Figure 2.19
+ Limit and - Limit Input Configuration

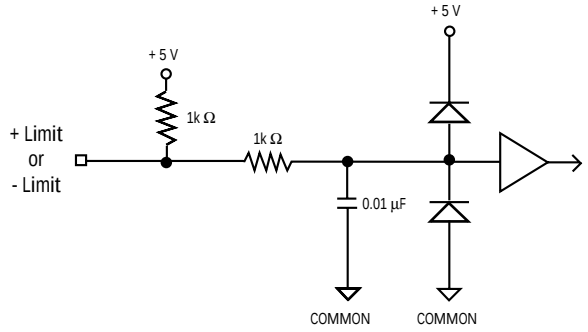
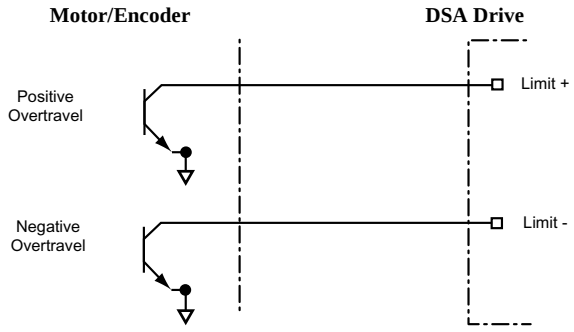


Figure 2.20
Typical + Limit and - Limit Connection



Encoder Phasing

For proper motor commutation and control, it is important that the motor feedback signals are phased properly. The drive has been designed so that a positive current applied to a motor will produce a positive velocity and increasing position readings, as interpreted by the drive. Additionally, if Hall signals are used to initialize the commutation angle, the Hall signals must sequence properly and the phase relationship to the motor back-EMF signals must be understood. Figure 2.21 shows the proper sequencing of the Hall signals when positive current is applied to the motor. If the Hall signals are out of phase with the back-EMF signals, the drive can be configured through software to compensate for the phase offset, as long as the sequencing of the Hall signals is correct. Figure 2.22 shows an example where the Hall signals have an offset of 60 degrees.

Figure 2.21
Sequencing and Phasing of the Hall Signals

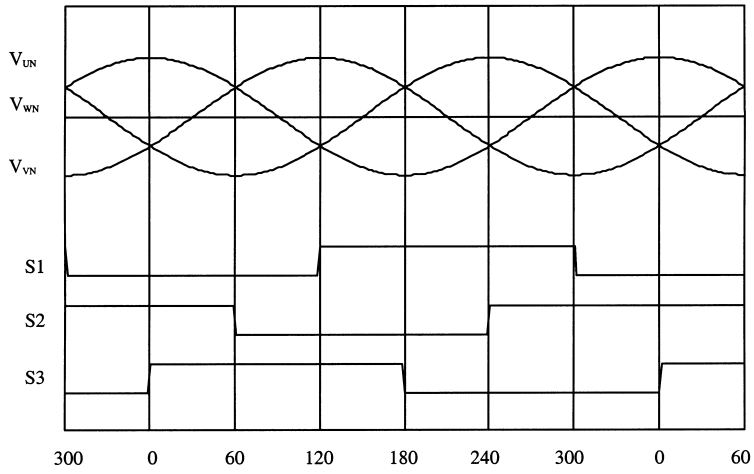


Figure 2.22
Sequencing and Phasing of the Hall Signals (60° Hall Offset Example)

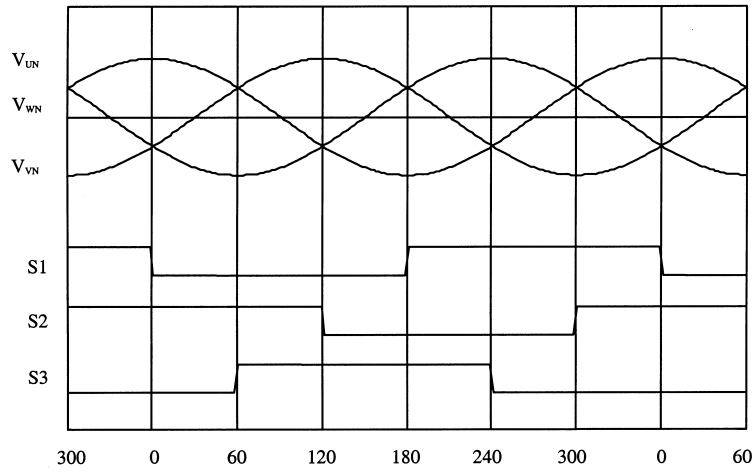


Figure 2.23 shows the proper phasing of TTL A/B encoder signals when positive current is applied.

Figure 2.23
Phasing of TTL A/B Encoder Signals

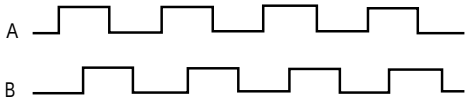
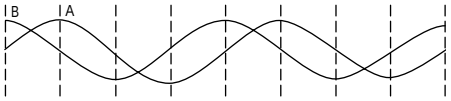


Figure 2.24 shows the proper phasing of Sine/Cosine encoder signals when positive current is applied.

IMPOR- Notice that the Sine/Cosine encoder signals phasing is different than the phasing of the TTL encoders.

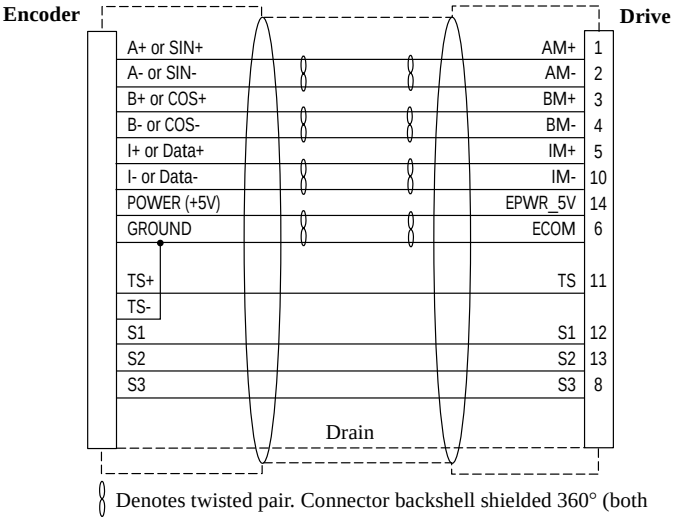
Figure 2.24
Phasing of Sine/Cosine Encoder Signals



Motor Encoder Connection Diagram

Figure 2.25 shows a typical wiring diagram of a motor feedback cable. If the thermostat, limit, or Hall signals are not available, no connections are required, but the drive must be configured through software to ignore these signals. Refer to *Appendix B* for specific DSA Drive/motor interconnect diagrams.

Figure 2.25
Drive/Motor Wiring Diagram



IMPOR- Total resistance of the wiring for encoder power and ground connections between the drive and motor must be less than 1.4 ohms.

Unbuffered Motor Encoder Outputs

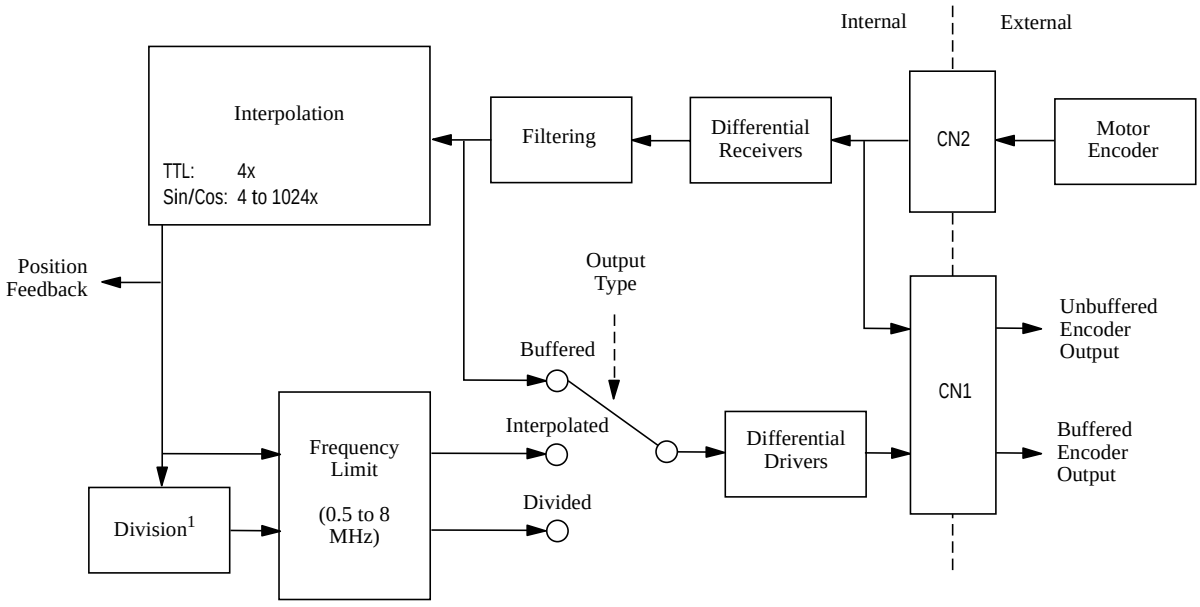
The DSA Drive passes the motor encoder signals directly to the controller connector without any conditioning. This allows the controller to access these signals directly. Figure 2.26 shows the configuration of the DSA Drive encoder outputs.

Buffered Motor Encoder Outputs

The DSA Drive includes buffered motor encoder outputs. These signals are generated by the drive after filtering and processing the actual feedback from the motor. Programmable multiplication or division may also occur.

The buffered motor encoder outputs use RS-485 differential drivers and have a maximum signal frequency of 2.5 MHz. The drivers can drive a 2V differential voltage into a 100 ohm load. Figure 2.26 shows the configuration of the DSA Drive encoder outputs.

Figure 2.26
Motor Encoder Outputs



[1] Interpolation and division operations are performed in firmware and the resulting output frequency is updated at 250 µs intervals.

Understanding Auxiliary Encoder Feedback Specifications

The DSA Drive can accept an auxiliary encoder signal of the following types.

Figure 2.27
Auxiliary Encoder Input Signal Types

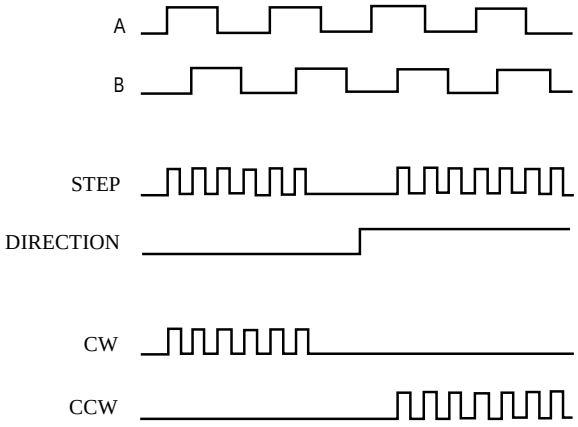
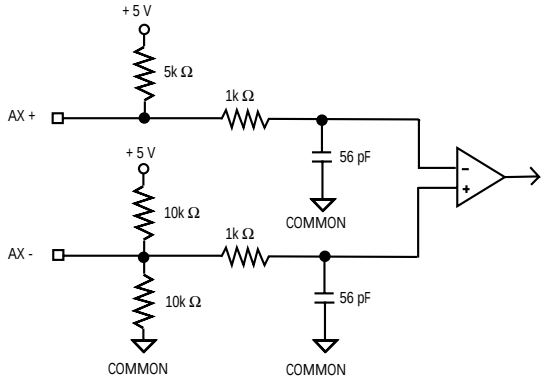


Figure 2.28 shows the configuration of the AX Auxiliary Encoder Input channel. The BX and IX channels have the same configuration.

Figure 2.28
Auxiliary Encoder Input Configuration



The following table provides a description of the auxiliary encoder interface.

Parameter	Description	Minimum	Maximum
ON State Input Voltage	Input voltage difference between the + input and the - input that is detected as an ON state.	+1.0V	+7.0V
OFF State Input Voltage	Input voltage difference between the + input and the - input that is detected as an OFF state.	-1.0V	-7.0V
Common Mode Input Voltage	Voltage between an input and logic ground.	-7.0V	+12.0V
Signal Frequency	Frequency of the AX or BX signal inputs. Count frequency is 4 times this frequency for A/B type inputs, and equal to this frequency for Step/Dir and CW/CCW type inputs.	—	2.5 MHz
Pulse Width	Time interval that a Step/Dir type input or CW/CCW type input must remain in a single state for detection.	200 nS	—
Setup Time	Time interval that the Direction, CW, or CCW must be stable before the corresponding Step, CCW, or CW signal changes state.	200 nS	—

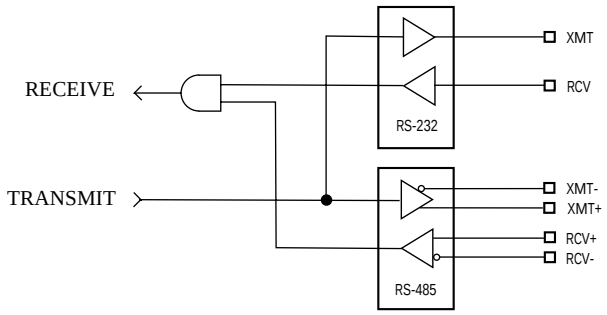
Understanding the Serial Interface

The DSA Drive includes one serial port that implements the standard NRZ asynchronous serial format, and supports RS-232, RS-422, and RS-485 communication standards.

Standard baud rates include 1200, 2400, 4800, 9600, 19200, and 38400 baud. Data lengths of 7 and 8 bits are supported. Parity settings include odd, even, and none.

The connector pinout dedicates separate pins for the RS-232 and RS-422/RS-485 signals, so that the communication standard can be changed by just using a different cable. Refer to Figure 2.29 for the serial interface configuration.

Figure 2.29
Serial Interface Configuration



Default Serial Interface Settings

The default setting of the DSA Drive serial interface is as follows.

Parameter	Default Setting
Baud Rate	38,400
Frame Format	8 Data, No Parity, One Stop
Drive Address	0

Restoring Drive Communications

The DSA Drive includes a mechanism for restoring serial communications, in case the drive has unknown serial interface settings or communications cannot be established.

For the first 3 seconds after reset or power-up, the drive listens for messages with the following serial interface settings.

Parameter	Default Setting
Baud Rate	9,600
Frame Format	8 Data, No Parity, One Stop
Drive Address	254

If a message is received during this time, the drive will respond and these settings will be retained until the next reset or power-down, allowing the normal serial interface settings to be determined. If no messages are received during this time, the normal serial interface settings are used.

IMPOR- Only one drive should be connected if this mechanism is used, since multiple drives would all respond and the response would be garbled.

Connecting Your DSA Drive

Chapter Objectives

This chapter provides procedures for wiring your DSA Drive and making cable connections. This chapter includes:

- Understanding basic wiring requirements
- Grounding your DSA Drive
- Wiring your DSA Drive

Understanding Basic Wiring Requirements

This section contains basic wiring information for the DSA Drive.

ATTEN-

Plan the installation of your system so that you can perform all cutting, drilling, tapping, and welding with the system removed from the enclosure. Because the system is of the open type construction, be careful to keep any metal debris from falling into it. Metal debris or other foreign matter can become lodged in the circuitry, which can result in damage to components.

IMPOR-

This section contains common PWM servo system wiring configurations, size, and practices that can be used in a majority of applications. National Electrical Code, local electrical codes, special operating temperatures, duty cycles, or system configurations take precedence over the values and methods provided.

Building Your Own Cables

When building your own cables, follow the guidelines listed below.

- Connect the cable shield to the connector shells on both ends of the cable for a complete 360° connection.
- Use a twisted pair cable whenever possible, twisting differential signals with each other, and single-ended signals with the appropriate ground return.

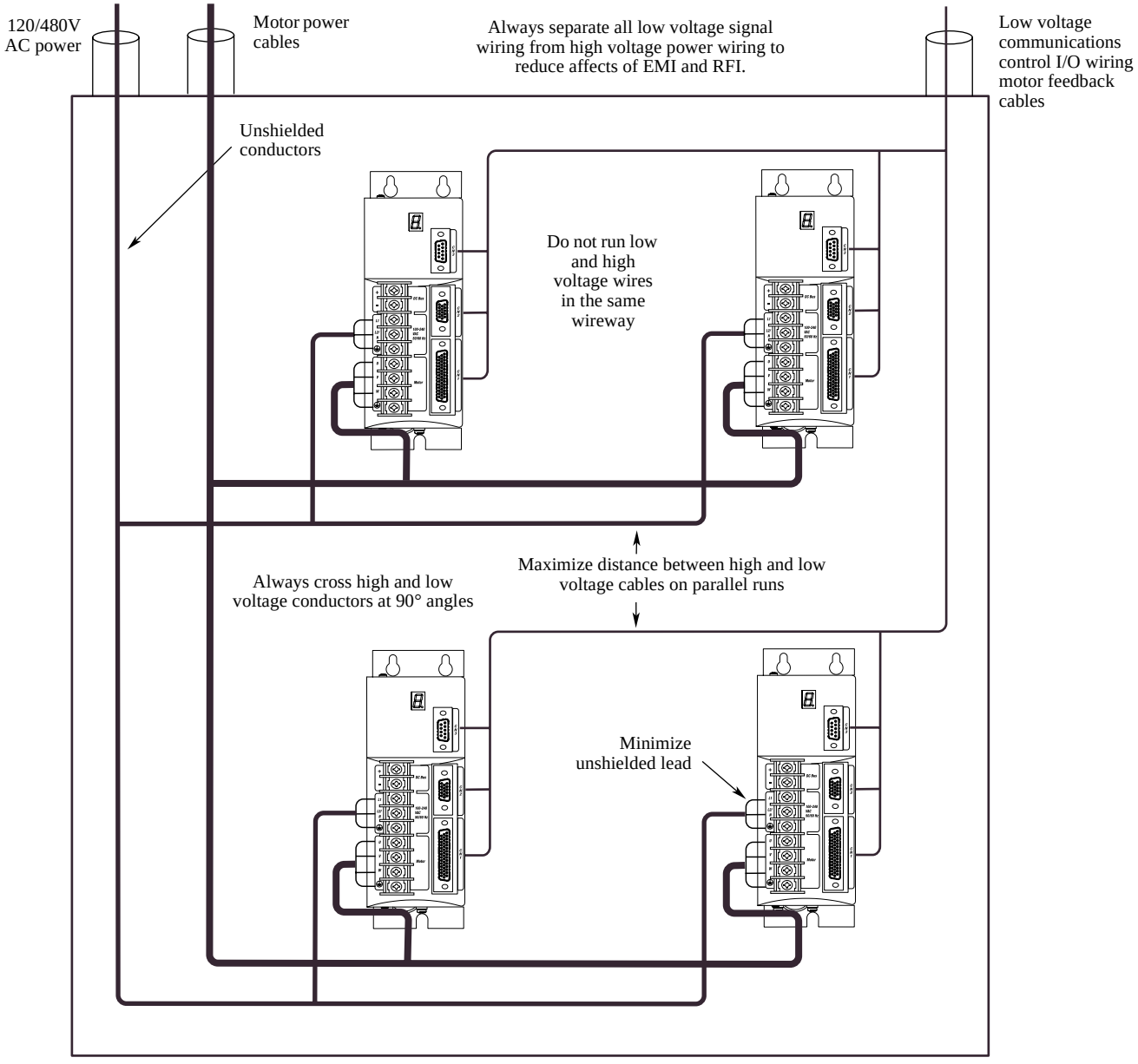
Refer to *Appendix C* for mating connector kit Material Numbers.

IMPOR- Factory-made cables are recommended over hand-built cables and are designed to minimize EMI.

Routing High and Low Voltage Cables

Be aware that when you connect and route power and signal wiring on a machine or system, radiated noise from nearby relays (relay coils should have surge suppressors), transformers, and other electronic drives, can be induced into motor or encoder feedback, communications, or other sensitive low voltage signals. This can cause system faults and communication problems. To minimize the levels of radiated noise, route machine power and signal lines separately.

Figure 3.1
Routing Power and Signal Cables Inside Your Cabinet



Grounding Your DSA Drive

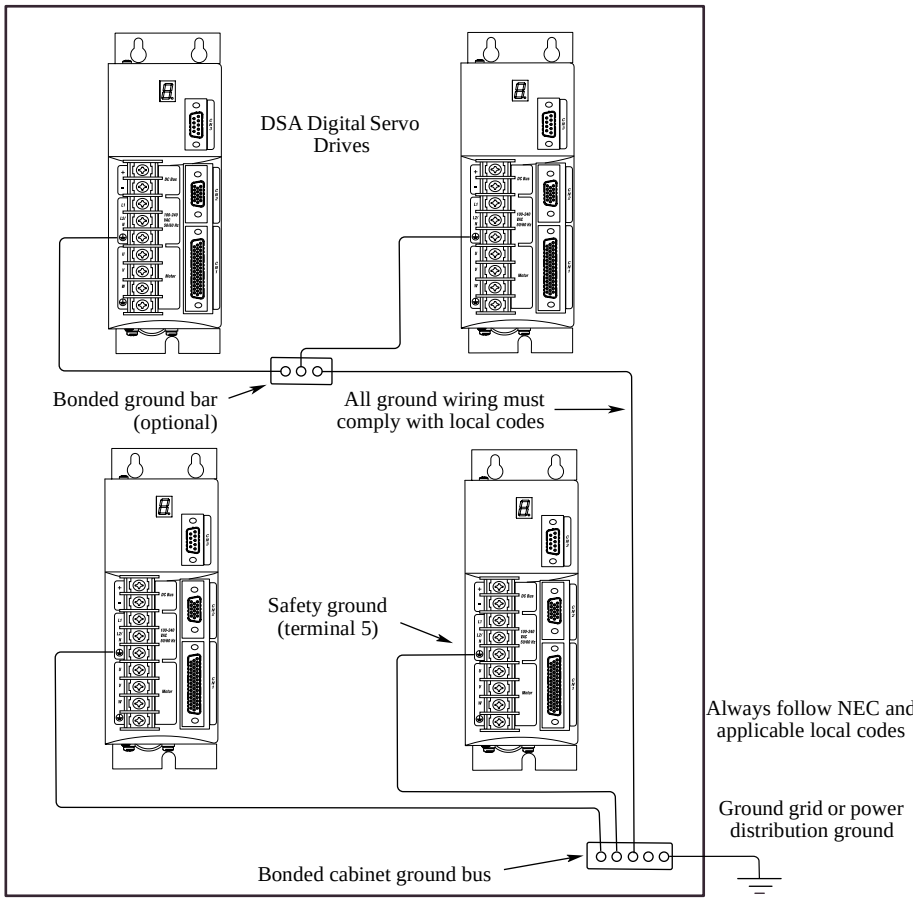
We recommend that all equipment and components of a machine or process system have a common earth ground point connected to their chassis. A grounded system provides a safety ground path for short circuit protection. Grounding your modules and panels minimizes shock hazard to personnel and damage to equipment caused by short circuits, transient overvoltages, and accidental connection of energized conductors to the equipment chassis. For CE grounding requirements, refer to *Appendix B.*

Grounding Your System to the Subpanel

ATTEN-

The National Electrical Code contains grounding requirements, conventions, and definitions. Follow all applicable local codes and regulations to safely ground your system. Refer to the illustration below for details on grounding your DSA Drive. Refer to *Appendix B* for the power wiring diagram for your DSA Drive.

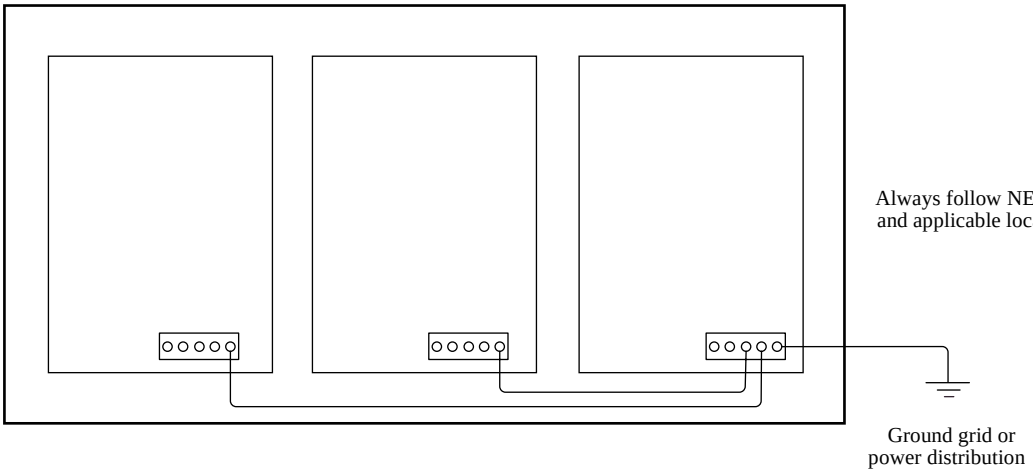
Figure 3.2
Safety Ground Configuration with Multiple DSA Drive Systems on One Panel



Grounding Multiple Subpanels

To ground multiple subpanels, refer to the figure below.

Figure 3.3
Subpanels Connected to a Single Ground Point



Motor Power Cable Shield Termination

Factory supplied motor power cables for FSM Series, HSM Series, XSM Series, YSm Series and NSM Series motors are shielded, and the power cable is designed to be terminated at the drive during installation. A small portion of the cable jacket is removed which exposes the shield braid. The exposed area must be clamped to the bottom of the drive chassis (refer to Figure 3.4) or the front of the drive chassis (refer to Figure 3.5) using the clamp provided.

ATTEN-

To avoid hazard of electrical shock, ensure shielded power cables are grounded at a minimum of one point for safety.

Figure 3.4
Motor Power Cable Shield Connection (bottom of drive)

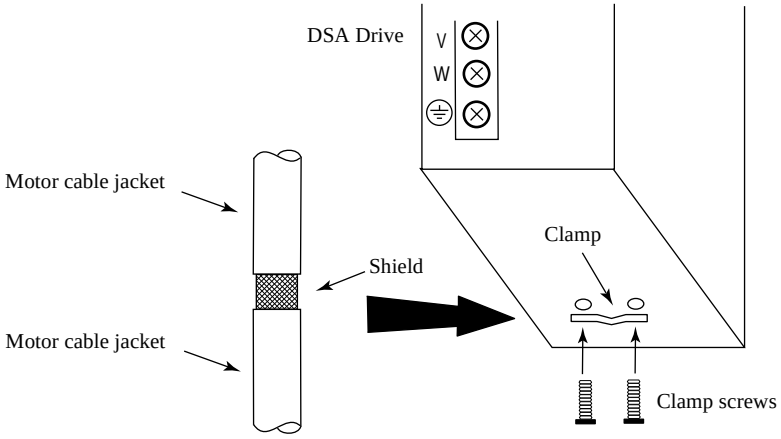
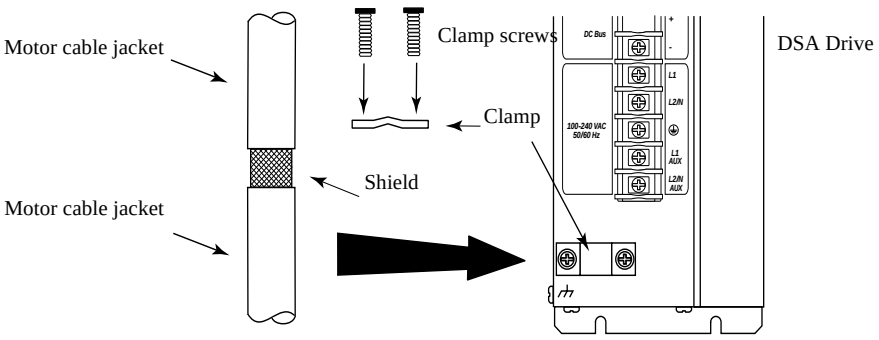
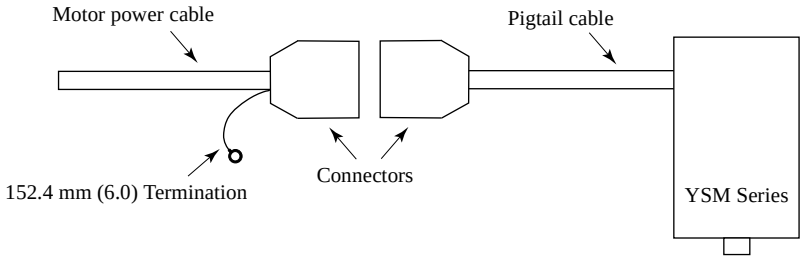


Figure 3.5
Motor Power Cable Shield Connection (front of drive)



YSM Series motors have a short pigtail cable which connects to the motor, but is not shielded. These motor power cables have a 152.4 mm (6.0 in.) shield termination wire with a ring lug that connects to the closest earth ground. The termination wire may be extended to the full length of the motor pigtail if necessary, but it is best to connect the supplied wire directly to ground without lengthening. Refer to Figure 3.6 for an illustration.

Figure 3.6
YSM Series Motor Power Cable Connection



Wiring Your DSA Drive

These procedures assume you have bonded and mounted your DSA Drive to the subpanel and that there is no power applied to the system.

ATTEN-

This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. You are required to follow static control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged.

The following sections provide information and procedures on how to wire your DSA Drive.

Connecting Interface Cables

Connect all interface cables as shown in the table below.

This cable:	Plugs into this connector:
44-pin, D-shell, Controller Interface cable	J1
15-pin, D-shell, Motor Encoder Feedback cable	J2
9-pin, D-shell, Serial Port cable	J3

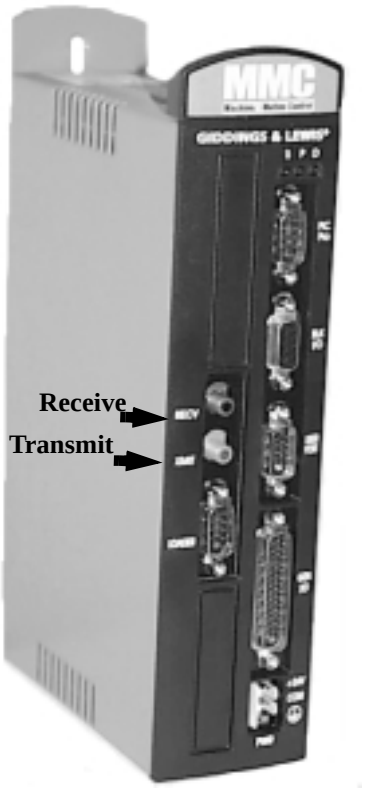
Connecting Your SERCOS Fiber Optic Cables

This procedure assumes you have your MMC S8 or MMC for PC interface and DSA Drive SERCOS interface system(s) mounted and are ready to connect the fiber optic cables.

The SERCOS fiber optic ring is connected using the SERCOS Receive and Transmit connectors. Refer to the chapter *DSA Drive Connector Data* to locate the connectors on your DSA Drive and Figure 3.7 to locate the connectors on your MMC interface module.

Refer to Figure 3.8 for an example of fiber optic ring connections between the DSA Drive and the MMC interface module.

Figure 3.7
SERCOS Fiber Optic Connections



To connect the SERCOS fiber optic cables:

1. Insert one end of a fiber optic cable into the Receive SERCOS connector on the DSA Drive.

2. Thread the connector on finger tight.

3. Insert the other end of the cable (from step 1) into the Transmit SERCOS connector on the MMC interface module.

4. Thread the connector on finger tight.

5. Insert one end of another fiber optic cable into the Transmit SERCOS connector on the DSA Drive.

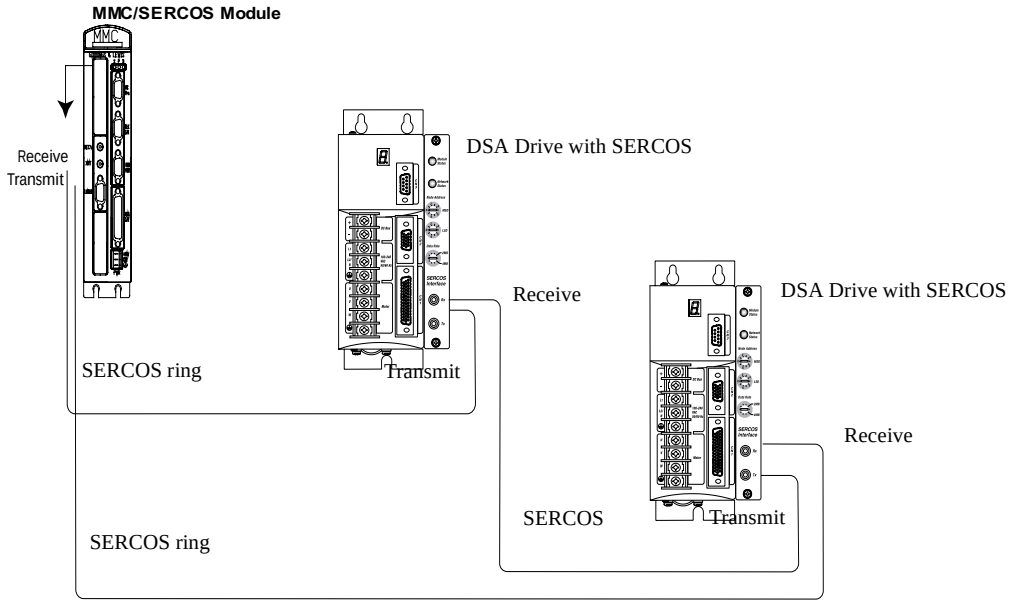
6. Thread the connector on finger tight.

7. Insert the other end of the cable (from step 5) into the Receive SERCOS connector on the MMC interface module.

8. Thread the connector on finger tight.

Note: Fiber optic cable lengths of 1, 2, 5, 10, 15, and 25 feet are available in plastic or glass. Heavy duty fiber optic cable is available in lengths of .5, 1, 2, 3, 5, and 10 meters.

Figure 3.8
Fiber Optic Ring Connection Example



The internal 5V DC power supply has a resettable fuse that opens at 3 amps and automatically resets itself when the current falls below 3 amps. There are no internal fuses requiring replacement.

The DSA Drive utilizes solid state motor overload protection which operates in accordance with UL 508C.

Motor overload protection trips:	At:
Eventually	100% overload.
Within 8 minutes	200% overload.
Within 20 seconds	600% overload.

ATTEN-

To avoid personal injury and/or equipment damage, ensure installation complies with specifications regarding wire types, conductor sizes, branch circuit protection, and disconnect devices. The National Electrical Code (NEC) and local codes outline provisions for safely installing electrical equipment.

To avoid personal injury and/or equipment damage, ensure motor power connectors are used for connection purposes only. Do not use them to turn the unit on and off.

To avoid personal injury and/or equipment damage, ensure shielded power cables are grounded to prevent potentially high voltages on the shield.

To wire your input power and motor connections:

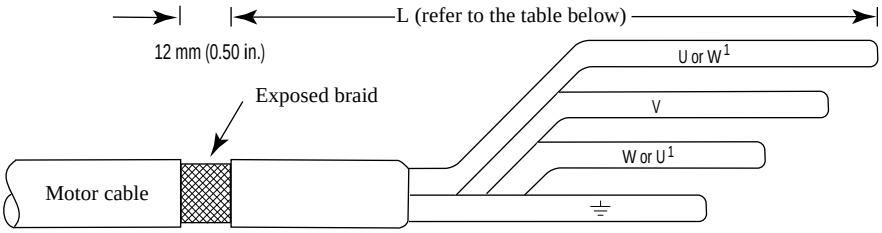
1. Prepare your wires by stripping approximately 12 mm (0.50 in.) of insulation from the end.

IMPOR-

Use caution not to nick, cut, or otherwise damage strands as you remove the insulation.

2. Prepare your motor cable for the CE clamp on the DSA Drive by exposing 12 mm (0.50 in.) of cable shield braid, as shown in Figure 3.9.

Figure 3.9
CE Clamp Cable Preparation



[1] Motor cable leads (shortest to longest) are labeled differently, depending on the drive input voltage (230V/460V). Refer to the table below in step 3 for terminal block wiring locations.

For these DSA Drives:	The dimension L is:
DSA007-230 DSA015-230 DSA030-230 DSA130-230-x DSA175-230-x	185 mm (7.25 in.)
DSAxxx-460-x	
DSA1150-230-x	241 mm (9.50 in.)

3. Using a screwdriver, loosen the screw for each of the terminal locations and attach wires as shown in the table below. Refer to *Appendix B* for the power wiring diagram for your DSA Drive.

Terminal Block Locations (DSA007-230-x, DSA015-230-x, DSA030-230-x)	Terminal Block Locations (DSA130-230-x)	Terminal Block Locations (DSA175-230-x and DSA1150·230-x)	Terminal Block Locations (DSAxxx-460-x)
DC Bus+[1]	U[2] (Motor)	U[2] (Motor)	DC Bus+[1]
DC Bus-[1]	V[2] (Motor)	V[2] (Motor)	DC Bus-[1]
L1 (Main AC)	W[2] (Motor)	W[2] (Motor)	W[2] (Motor)
L2/N (Main AC)	Motor Case Ground	Motor Case Ground	V[2] (Motor)
Safety (Earth) Ground	DC Bus+[1]	DC Bus+[1]	U[2] (Motor)
U[2] (Motor)	DC Bus-[1]	DC Bus-[1]	Ground
V[2] (Motor)	L1 (Main AC)	L1 (Main AC)	L3 (Main AC)
W[2] (Motor)	L2/N (Main AC)	L2 (Main AC)	L2 (Main AC)
Motor Case Ground	Safety (Earth) Ground	L3 (Main AC)	L1 (Main AC)
	L1 (Aux AC)[3]	Safety (Earth) Ground	L1 (Aux AC)[3]
	L2/N (Aux AC)[3]	L1 (Aux AC)[3]	L2/N (Aux AC)[3]
		L2/N (Aux AC)[3]	

[1] Do not connect an external I/O power supply to the DC bus. The DC+ and DC- terminals connect directly to the power bus of the drive.

[2] Ensure motor power is wired with proper phasing relative to the motor terminals. On some motors, the motor leads may be labeled R, S, and T which correspond to U, V, and W.

3 The auxiliary AC power inputs require dual element time delay (slow acting) fuses to accommodate inrush current. Refer to the section *General Power Specifications* in *Appendix A* for the inrush current on the auxiliary AC power input.

4. Tighten each terminal screw.

5. Gently pull on each wire to make sure it does not come out of its terminal. Reinsert and tighten any loose wires.

6. Attach the plastic cover to terminal block.

IMPOR- The DC bus connections should not be used for connecting multiple drives together. Contact your Giddings & Lewis representative for further assistance if the application may require DC power connections.

7.

If your motor is:	Then:
FSM Series, HSM Series, XSM Series, or NSM Series	1. Remove the two screws securing the cable clamp on the DSA Drive (refer to figures 3.4 or 3.5 for the cable clamp location on your DSA Drive). 2. Place the cable within the clamp and replace the screws (do not tighten). 3. Position the exposed portion of the cable braid directly in line with the clamp. 4. Tighten the screws with a torque of 0.9-1.1 Nm (8.0-10.0 lb-in.). 5. Go to main step 8.
YSM Series	1. Connect the 152.4 mm (6.0 in.) termination wire to the closest earth ground (refer to Figure 3.6 for pigtail location). 2. Go to main step 8.

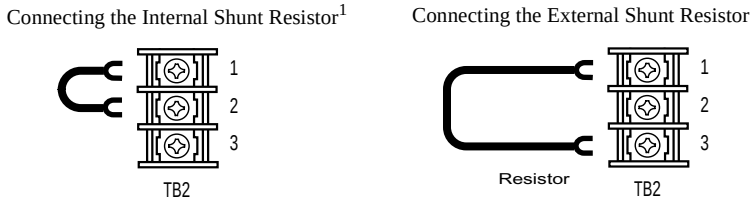
8.

If your DSA Drive Material Number begins with:	Then:
DSA007-230-x DSA015-230-x DSA030-230-x	You are finished wiring your DSA Drive power connections.
DSA130-230-x DSA175-230-x DSA1150-230-x DSAxxx-460-x	Go to main step 9.

9.

If your application requires:	**Then:**
The internal shunt resistor	Connect a jumper to TB2 between terminal 1 and 2 as shown in the figure below (for the location of TB2, refer to the chapter *DSA Drive Connector Data*).
An external shunt resistor	Connect your external shunt resistor to TB2 between terminals 1 and 3 as shown in the figure below (for the location of TB2, refer to the chapter *DSA Drive Connector Data*).

Figure 3.10
Connecting Your Shunt Resistor



[1] This is the factory default jumper setting for TB2.

Specifications and Dimensions

Chapter Objectives

This appendix covers the following topics:

- DSA Drive specifications
- Dimensions

DSA Drive Specifications

The following sections provide specifications for the DSA Drive.

General Power Specifications

The table below lists general power specifications and requirements for the DSA 230V drives..

Specification	Description		
	DSA007-230	**DSA015-230**	**DSA030-230**
AC Input Voltage[1]	100-240V_{rms} Single Phase		
AC Input Frequency	47 - 63 Hz		
AC Input Current Nominal Maximum inrush (230V AC input)	 5A_{rms} 100A (0-peak)	 9A_{rms} 100A (0-peak)	 18A_{rms} 100A (0-peak)
Output Peak Current	7.5A (0-peak)	15A (0-peak)	30A (0-peak)
Continuous Output Current	2.5A (0-peak)	5A (0-peak)	10A (0-peak)
Energy Absorption Capability 115V AC input 230V AC input	 125 Joules 51 Joules		
Continuous Power Output 115V AC input 230V AC input	 0.25 kW 0.5 kW	 0.5 kW 1.0 kW	 1.0 kW 2.0 kW

[1] Specification is for nominal voltage. The absolute limits are ±10%, or 88-265V_{rms}.

The table below lists general power specifications and requirements for the DSA 230V drives.

Specification	**Description**		
	DSA130-230-x	**DSA175-230-x**	**DSA1150-230-x**
AC Input Voltage[1]	100-240V_{rms} Single Phase	100-240V_{rms} Three Phase	
AC Input Frequency	47 - 63 Hz		
Main AC Input Current Nominal, Maximum inrush, 230V AC input	 28A_{rms} 50A_{rms}	 30A_{rms} 50A_{rms}	 46A_{rms} 68A_{rms}
Auxiliary AC Input Current Nominal, 115V AC input Nominal, 230V AC input Maximum inrush, 115V AC input Maximum inrush, 230V AC input	 1.0A_{rms} 0.5A_{rms} 47A (0-peak) 95A (0-peak)	 1.0A_{rms} 0.5A_{rms} 47A (0-peak) 95A (0-peak)	 1.0A_{rms} 0.5A_{rms} 47A (0-peak) 95A (0-peak)
Continuous Output Current	15A (0-peak)	35A (0-peak)	65A (0-peak)
Intermittent Output Current	30A (0-peak)	75A (0-peak)	150A (0-peak)
Internal Shunt Continuous power Peak power	 50W 4.5 kW	 50W 10 kW	 180W 18 kW
External Shunt Minimum resistance Continuous power Peak power	 30 Ohms 2.4 kW 6 kW	 16.5 Ohms 4 kW 10 kW	 9 Ohms 8 kW 19 kW
Energy Absorption Capability 115V AC input 230V AC input	 203 Joules 96 Joules	 321 Joules 151 Joules	 563 Joules 265 Joules
Continuous Power Output 115V AC input 230V AC input	 1.5 kW 3 kW	 3.75 kW 7.5 kW	 7.5 kW 15 kW

[1] Specification is for nominal voltage. The absolute limits are ±10%, or 88-265V_{rms}.

The table below lists general power specifications and requirements for the DSA 460V drives .

Specification	Description				
	DSA014-460-x	DSA022-460-x	DSA046-460-x	DSA068-460-x	DSA094-460-x
AC Input Voltage[1]	$230\text{-}480V_{rms}$ Three Phase				
AC Input Frequency	47 - 63 Hz				
Main AC Input Current[2] Nominal, 460V AC input Maximum inrush, 460V AC input	$4A_{rms}$ $6A_{rms}$	$7A_{rms}$ $6A_{rms}$	$14A_{rms}$ $6A_{rms}$	$20A_{rms}$ $6A_{rms}$	$28A_{rms}$ $6A_{rms}$
Auxiliary AC Input Current Nominal, 230V AC input Nominal, 360V AC input Nominal, 480V AC input Maximum inrush, 230V AC input Maximum inrush, 480V AC input	$0.55A_{rms}$ $0.35A_{rms}$ $0.25A_{rms}$ 47A (0-peak)[3] 68A (0-peak)[3]	$0.55A_{rms}$ $0.35A_{rms}$ $0.25A_{rms}$ 47A (0-peak)[3] 68A (0-peak)[3]	$0.55A_{rms}$ $0.35A_{rms}$ $0.25A_{rms}$ 47A (0-peak)[3] 68A (0-peak)[3]	$0.55A_{rms}$ $0.35A_{rms}$ $0.25A_{rms}$ 47A (0-peak)[3] 68A (0-peak)[3]	$0.55A_{rms}$ $0.35A_{rms}$ $0.25A_{rms}$ 47A (0-peak)[3] 68A (0-peak)[3]
Continuous Output Current	7A (0-peak)	11A (0-peak)	23A (0-peak)	34A (0-peak)	47A (0-peak)
Intermittent Output Current	14A (0-peak)	22A (0-peak)	46A (0-peak)	68A (0-peak)	94A (0-peak)
Internal Shunt Continuous power Peak power	100W 5.3 kW	100W 5.3 kW	200W 16 kW	200W 25.6 kW	400W 32 kW
External Shunt Minimum resistance Continuous power Peak power	120 Ohms 3 kW 5.3 kW	120 Ohms 5 kW 5.3 kW	40 Ohms 10 kW 16 kW	25 Ohms 15 kW 25.6 kW	20 Ohms 22 kW 32 kW
Energy Absorption Capability 230V AC input with 230V motor 230V AC input with 460V motor 460V AC input	58 Joules 517 Joules 219 Joules	58 Joules 517 Joules 219 Joules	88Joules 776Joules 329 Joules	117 Joules 1034 Joules 439 Joules	234 Joules 2069 Joules 878Joules
Continuous Power Output 230V AC input 460V AC input	1.5 kW 3.0 kW	2.5 kW 5.0 kW	5.0 kW 10 kW	7.5 kW 15 kW	11 kW 22 kW

[1] Specification is for nominal voltage. The absolute limits are ±10%, or $207\text{-}528V_{rms}$.

[2] The DSAxxx-460-x drives are limited to three contactor cycles per minute.

[3] 400 µs half wave sine

Physical and Environmental

The table below lists physical and environmental specifications and requirements.

Specification	Description
Weight DSA007-230-x DSA015-230-x DSA030-230-x DSA130-230-x DSA175-230-x DSA1150-230-x DSA014-460-x DSA022-460-x DSA046-460-x DSA068-460-x DSA094-460-x	 1.8 kg (4.1 lbs) 2.1 kg (4.6 lbs) 2.1 kg (4.6 lbs) 6.2 kg (13.6 lbs) 9.3 kg (20.6 lbs) 14.1 kg (31.0 lbs) 8.55 kg (18.8 lbs) 8.55 kg (18.8 lbs) 10.44 kg (22.96 lbs) 10.44 kg (22.96 lbs) 14.1 kg (31 lbs)
Operating Temperature	0^{o} C to 55^{o} C (32^{o} F to 131^{o} F)
Storage Temperature	-40^{o} C to 70^{o} C (-40^{o} F to 158^{o} F)
Humidity	5% to 95% non-condensing
Altitude	1500 m (5000 ft) Derate 3% for each 300 m above 1500m
Vibration Operating/Non-operating	5 to 2000 Hz, 2.5 g peak, 0.015 in. maximum displacement
Shock Non-operating	15 g 11 ms half sine
UL Listed to U.S. and Canadian safety standards	UL 508 C File E145959

Power Dissipation

Use the following table to size an enclosure and calculate required ventilation for the DSA Drive. Typical heat losses run approximately one-half maximum power losses. The maximum power losses are shown below.

Material Number	Maximum Loss (Watts)
DSA007-230, -S, -P	48 + dissipative shunt
DSA015-230, -S, -P	48 + dissipative shunt
DSA030-230, -S, -P	50 + dissipative shunt
DSA130-230, -S, -P	150 + dissipative shunt
DSA175-230, -S, -P	300 + dissipative shunt
DSA1150-230, -S, -P	500 + dissipative shunt
DSA014-460, -S, -P	175 + dissipative shunt
DSA022-460, -S, -P	175 + dissipative shunt
DSA046-460, -S, -P	350 + dissipative shunt
DSA068-460, -S, -P	350 + dissipative shunt
DSA094-460, -S, -P	600 + dissipative shunt

Control

The table below lists control specifications.

Specification	Description
Commutation	3 Phase Sinusoidal, Space Vector Modulated (SVM)
Current Regulator	Digital PI 125 µsec update rate
Velocity Regulator	Digital PID - 250 µsec update rate
Position Regulator	Digital PID with feed-forward - 1 mS update rate

Inputs and Outputs

The table below lists I/O specifications.

Specification	Description
Digital Inputs	8 Optically Isolated 12-24V Inputs, Active High, Current Sinking
Digital Outputs	4 Optically Isolated 12-24V Outputs, Active High, Current Sourcing
Relay Output	1 Normally Open Relay - 30V DC Maximum Voltage, 1A Maximum Current
I/O Response	100 µsec
Digital I/O Firmware Scan Period	1 mS
Analog Inputs COMMAND ILIMIT	 14 bit A/D, ±10V 10 bit A/D, 0 to 10V
Analog Output	+10V, 8 bits, 2 mA maximum

Serial Communication

The table below lists the serial communication specifications.

Specification	Description
Serial	1 RS-232/RS-422/RS-485 Port
Baud Rates	1200, 2400, 4800, 9600, 19200, and 38400 baud
Frame Format	7 Data, Even Parity, One Stop
	7 Data, Odd Parity, One Stop
	8 Data, No Parity, One Stop
	8 Data, Even Parity, One Stop
	8 Data, Odd Parity, One Stop

Motor Feedback

The table below lists motor feedback specifications.

Specification	Description
Encoder Types	Incremental, Sine/Cosine, Intelligent, and Absolute
Maximum Input Frequency	100 kHz (Sine/Cosine Input)
	2.5 MHz (TTL Input) per channel
Commutation Startup	Hall Sensor or None

Auxiliary Feedback

The table below lists auxiliary feedback specifications.

Specification	Description
Input Modes	A quad B, Step/Direction, CW/CCW
Input Types	Differential, single-ended, open collector[1]
Maximum Signal Frequency	2.5 MHz

[1] Differential input types are recommended.

Connectors

The table below lists connector specifications. Refer to *Appendix C* for a list of mating connectors available from other suppliers.

Connector	Specification	Description
J1	User Input/Output	44-pin high-density D-shell
J2	Motor Feedback Connector	15-pin high-density D-shell
J3	Serial Port Connector	9-pin standard D-shell

SERCOS Communication

The table below lists SERCOS communication specifications.

Specification	Description
Data Rates	2M baud and 4M baud
Node Addresses	01-99

Dimensions

The following diagrams show the dimensions and mounting hole locations for the DSA Drives.

Figure A.1
Dimensions and Mounting Diagram DSA007,-P

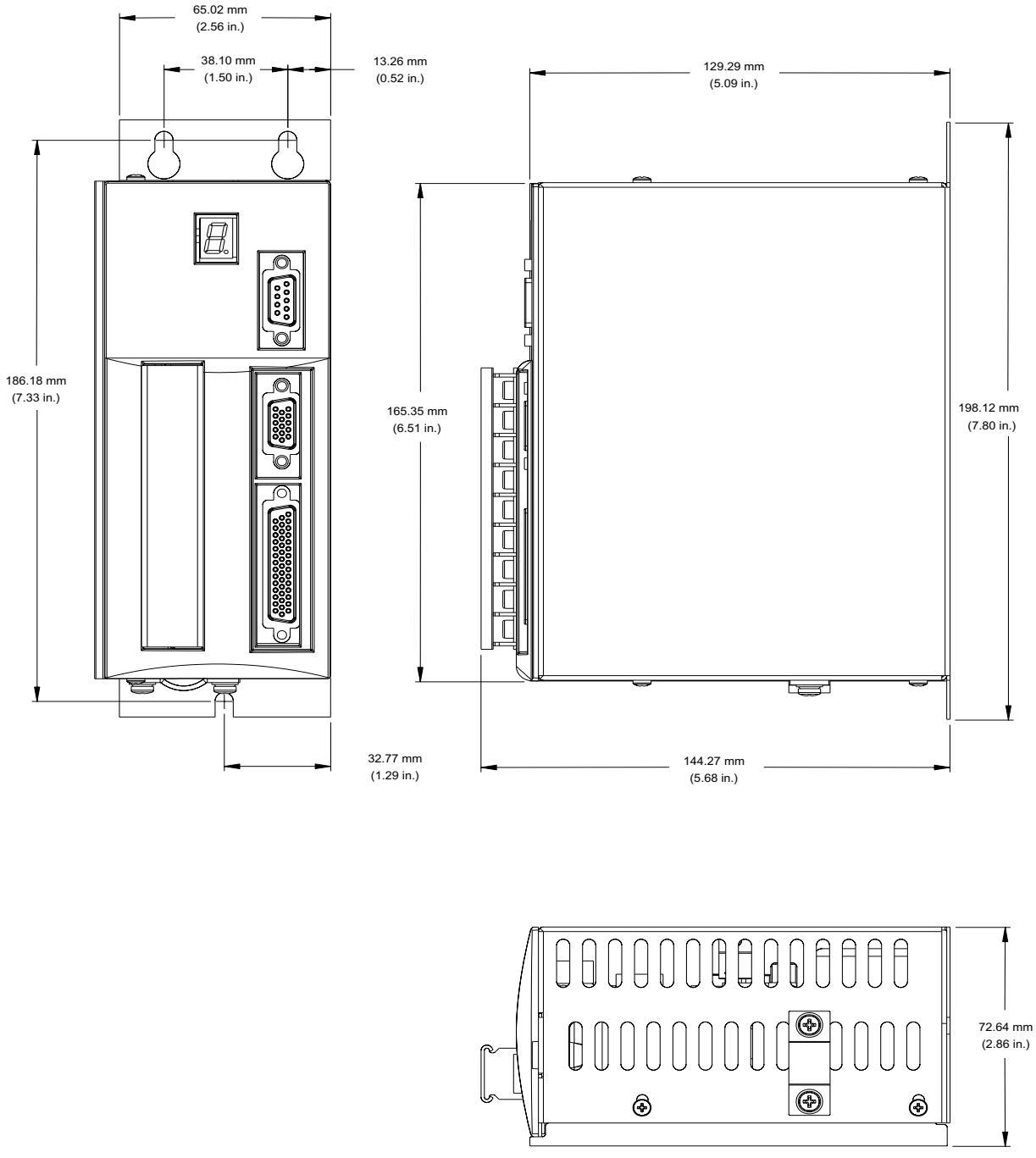
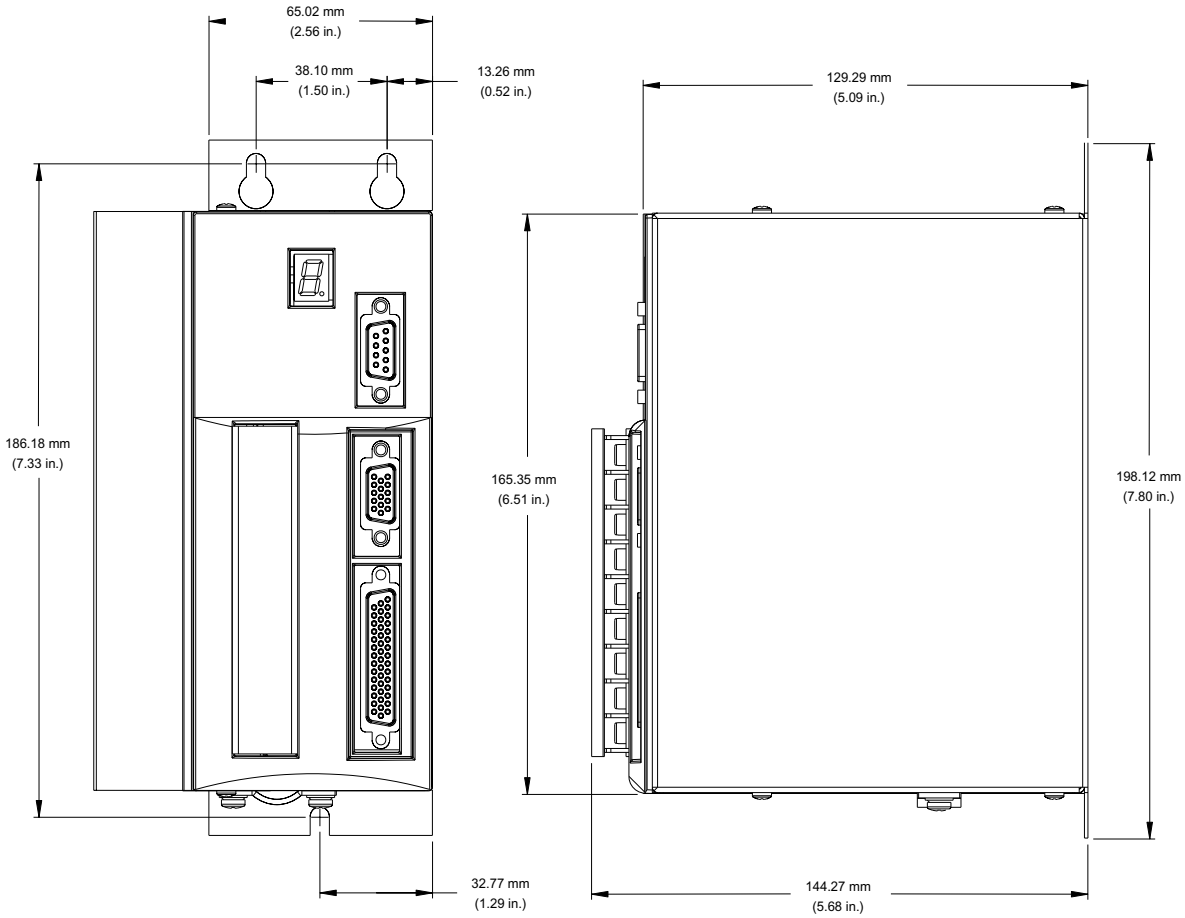
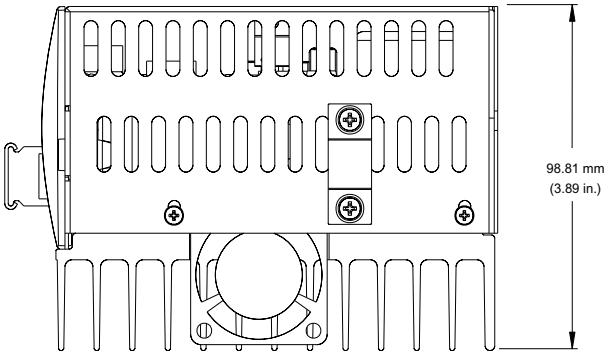


Figure A.2
Dimensions and Mounting Diagram DSA015, DSA030, -P





Fan only on 2 kW units

Figure A.3
Dimensions and Mounting Diagram DSA007S

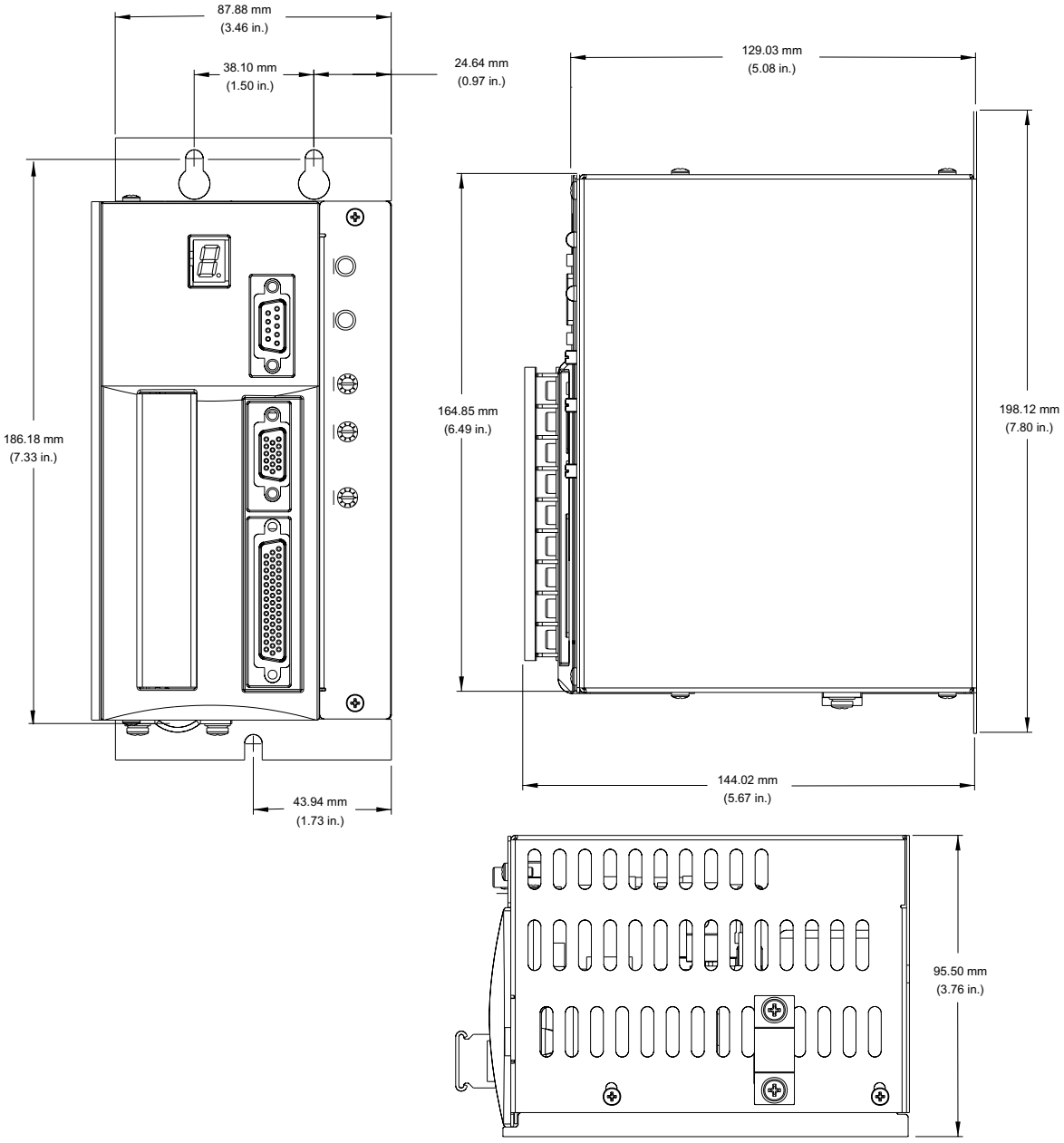
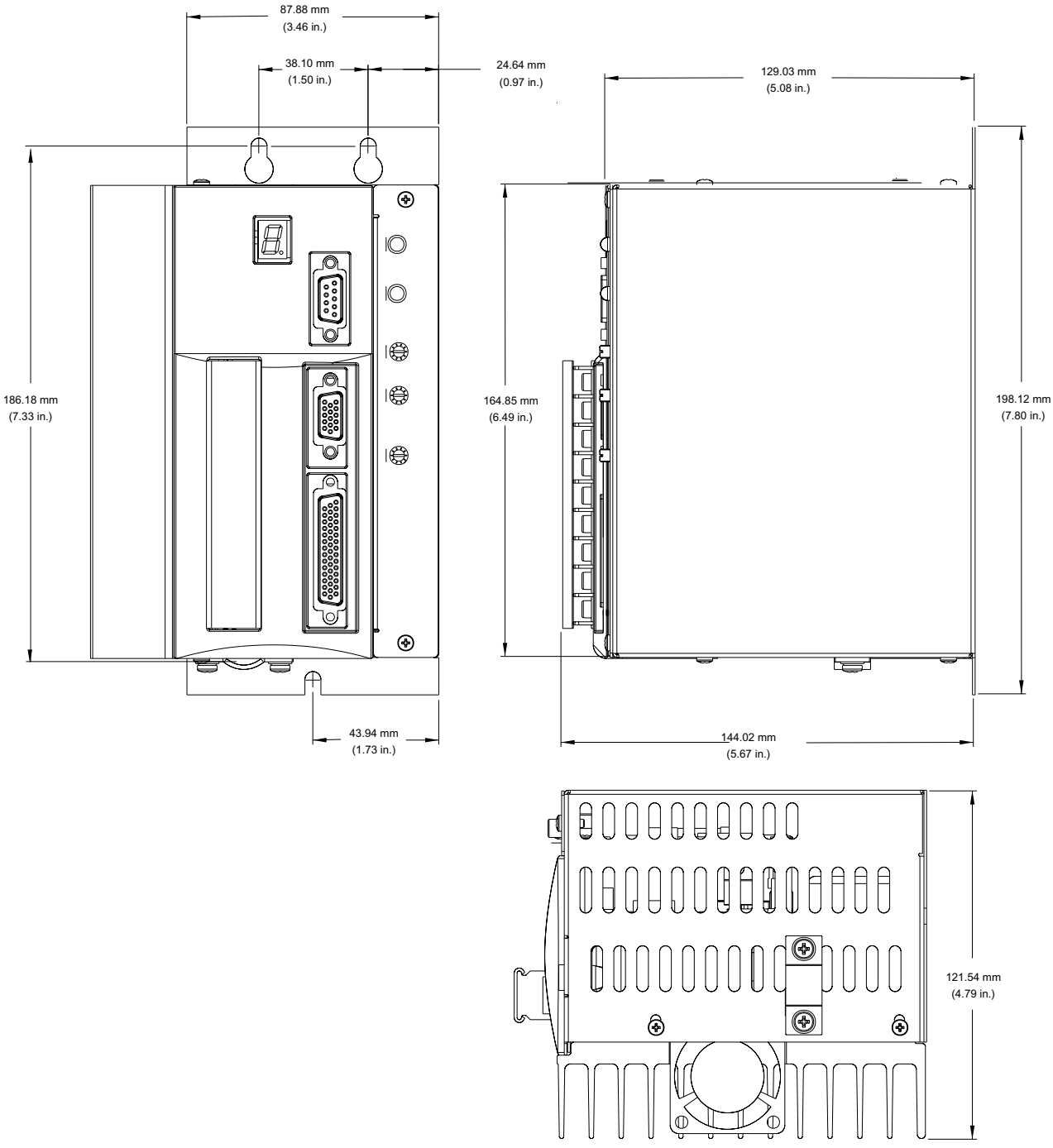


Figure A.4
Dimensions and Mounting Diagram DSA015S, DSA030S



Fan only on 2 kW units

Figure A.5
Dimensions and Mounting Diagram DSA130-230, -P

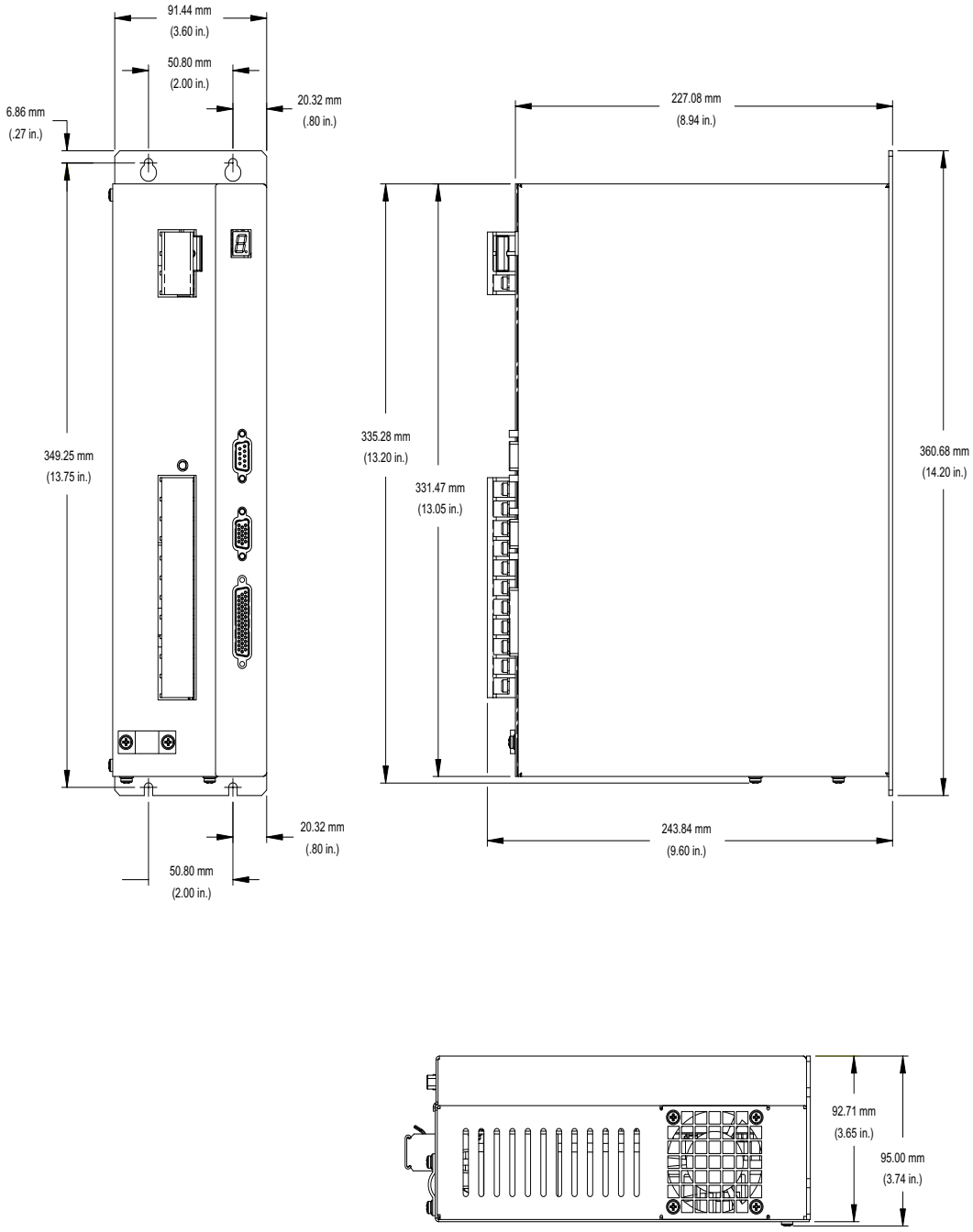


Figure A.6
Dimensions and Mounting Diagram DSA175-230, -P

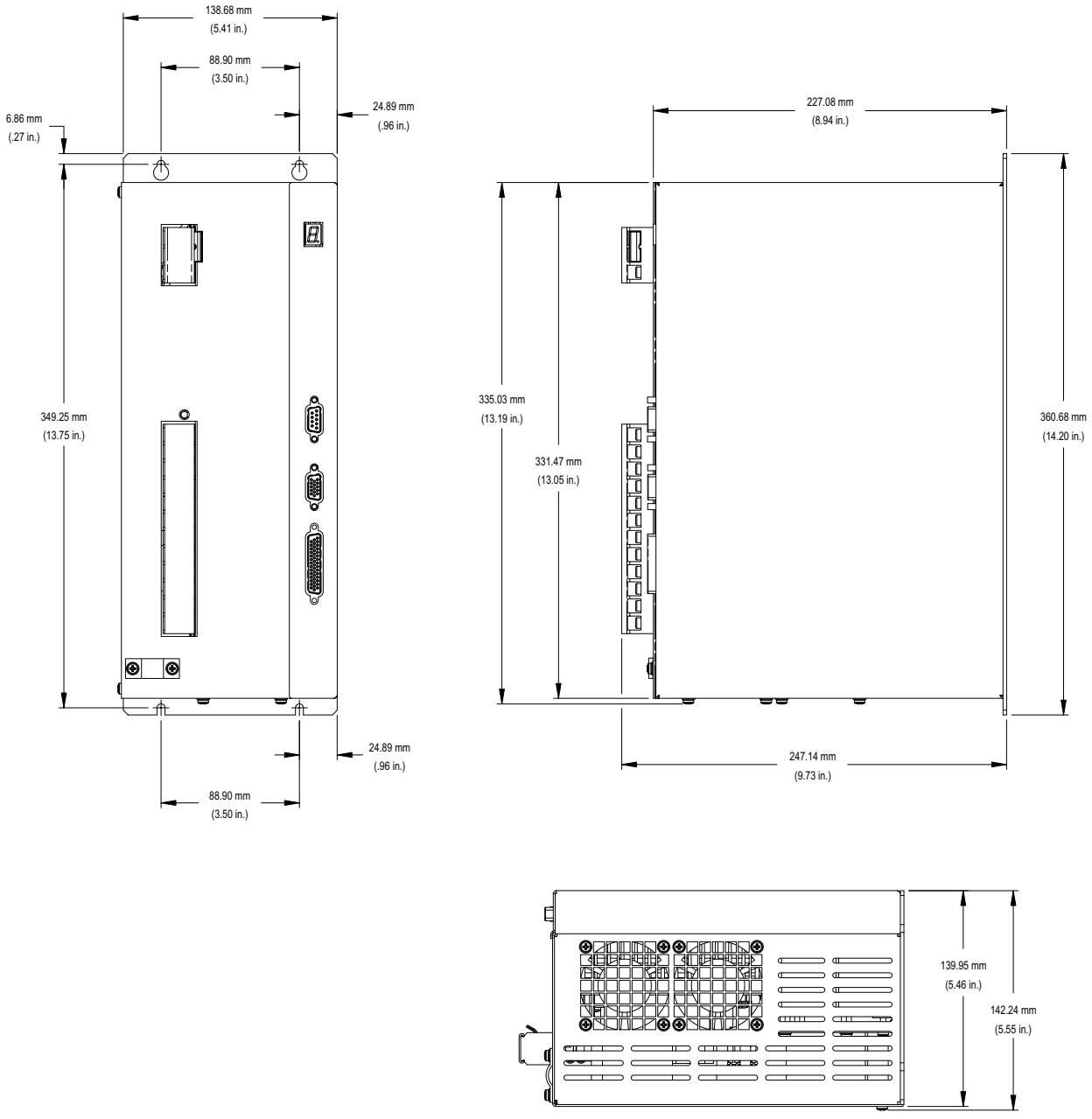


Figure A.7
Dimensions and Mounting Diagram DSA1150-230, -P

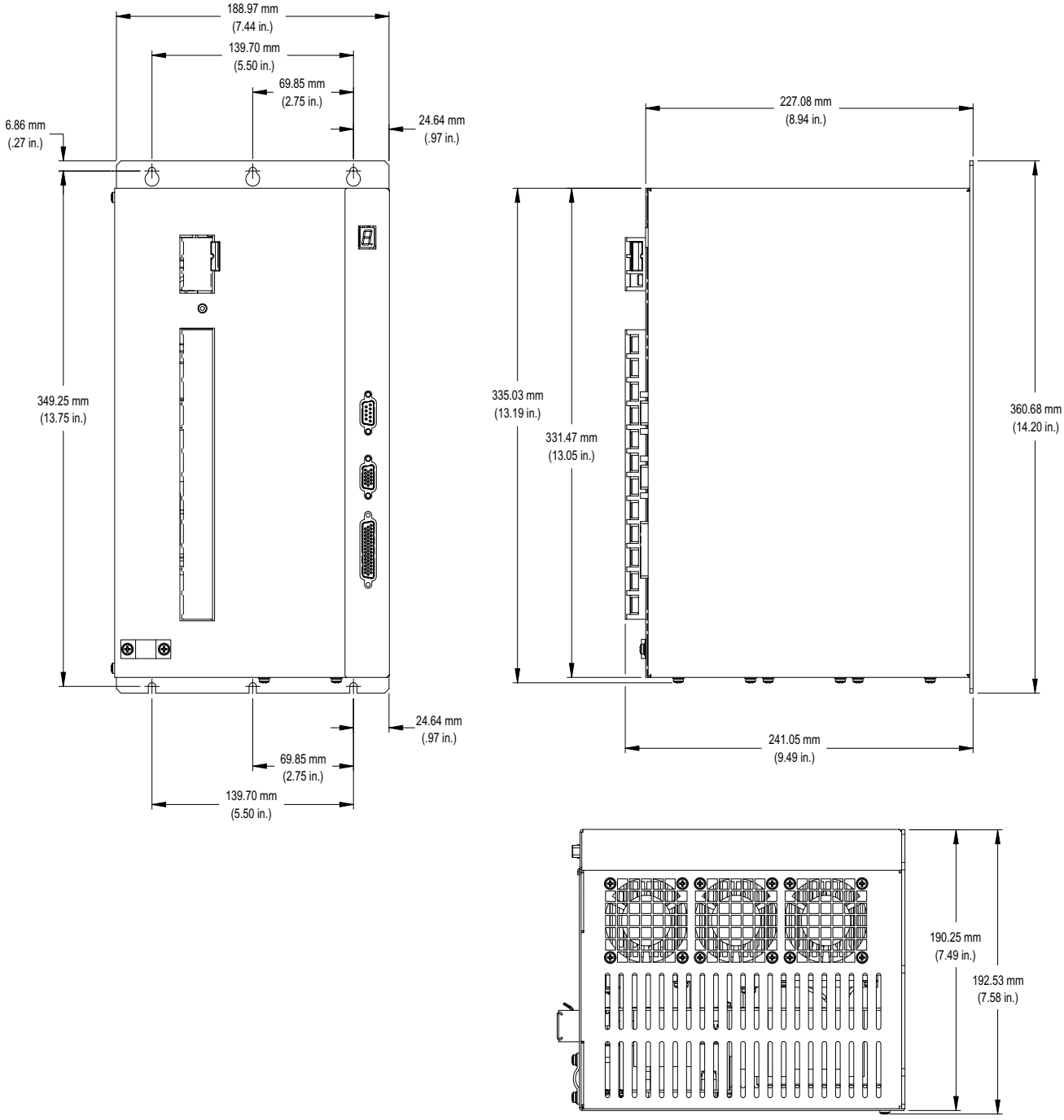


Figure A.8
Dimensions and Mounting Diagram DSA014-460, DSA022-460, -P

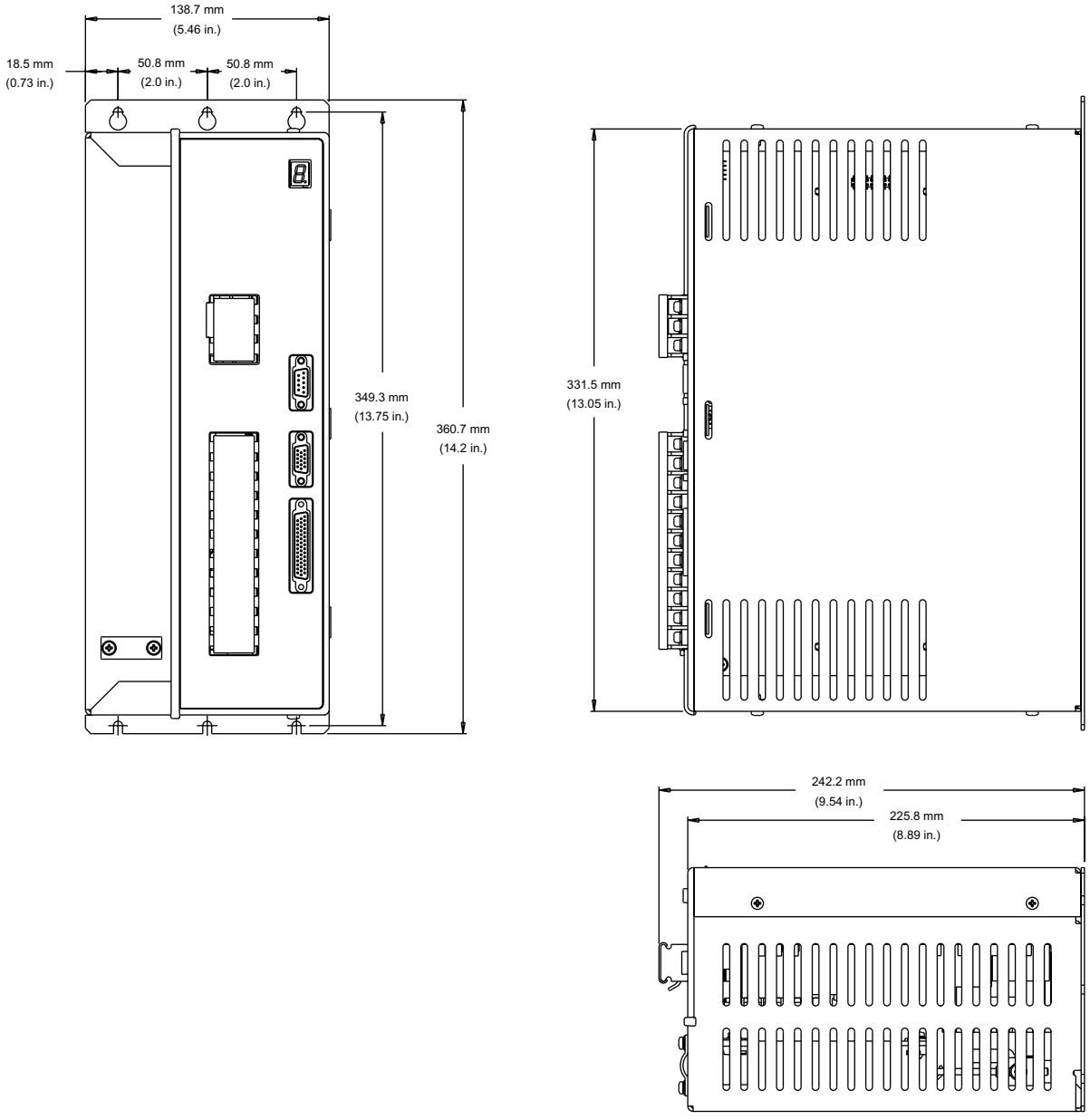


Figure A.9
Dimensions and Mounting Diagram DSA046-460, DSA-68-460, -P

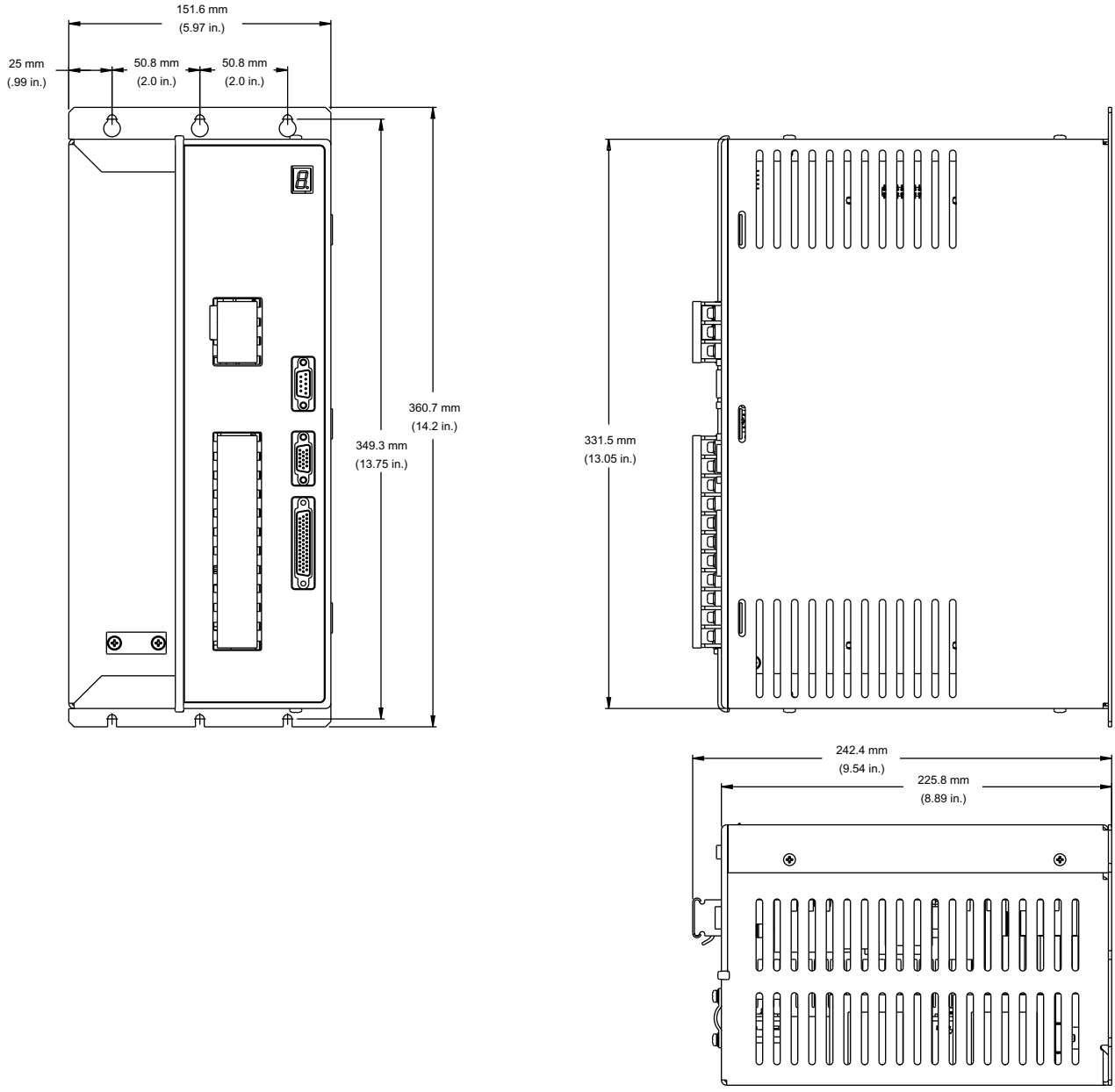
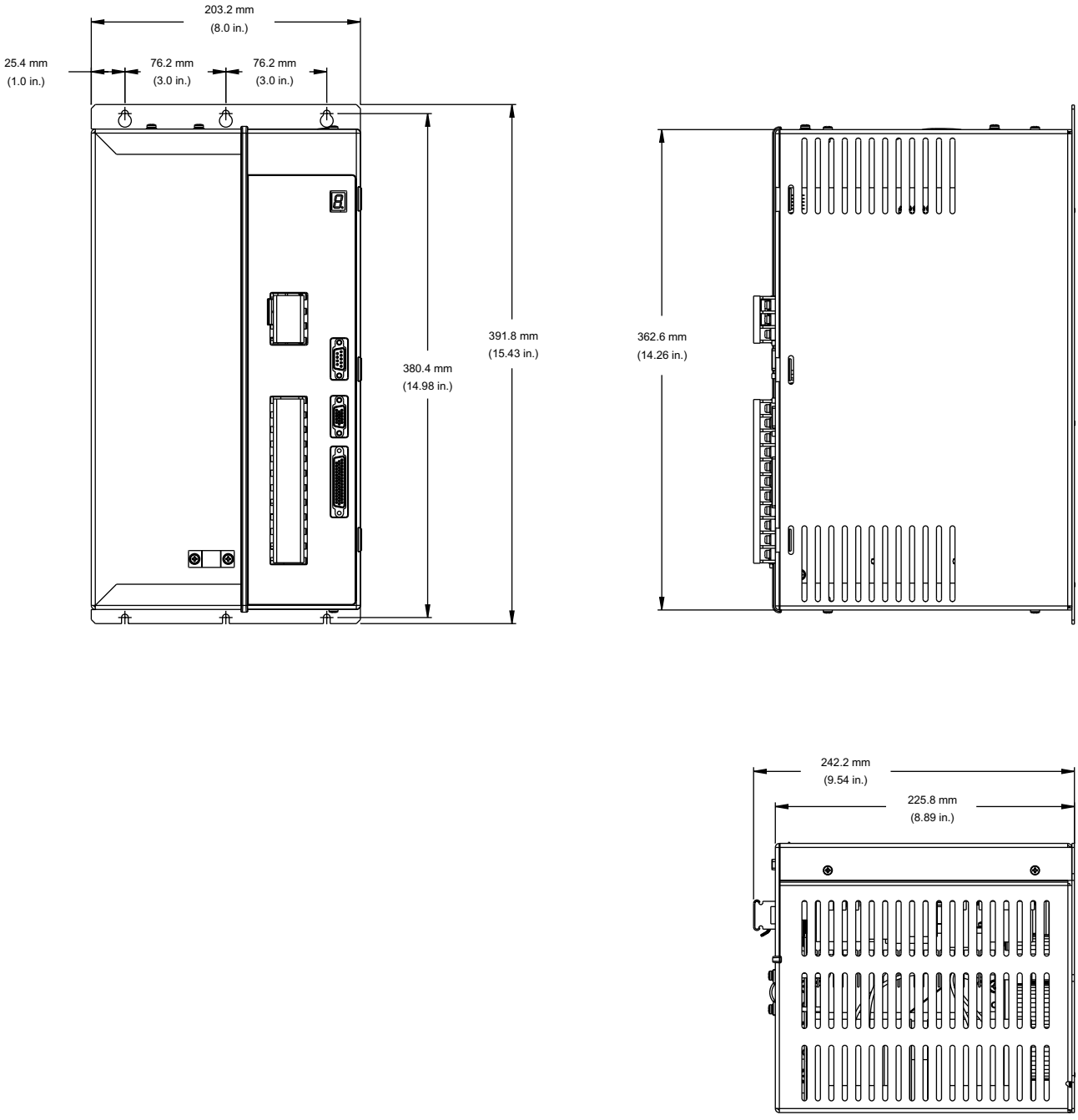


Figure A.10
Dimensions and Mounting Diagram DSA094-460, -P



Interconnect Diagrams

Chapter Objectives

DSA Drive to Cable and Interconnect Diagrams

This section provides information to assist you in wiring the servo module when connecting the control interface cable to your DSA Drive.

This appendix contains the following interconnect diagrams:

- DSA Drive and motor cable diagrams
- DSA Drive power wiring diagrams
- Start/stop string configuration diagram examples
- Controlling a brake
- Grounding for DSA Drive CE requirements
- DSA Drive to shunt module interconnect diagrams

DSA Drive and Motor Cable Diagrams

This section provides information to assist you in wiring your XSM, NSM, HSM, FSM, and YSM Series motors when connecting to your DSA Drive.

DSA Drive and Motor Cable Combinations

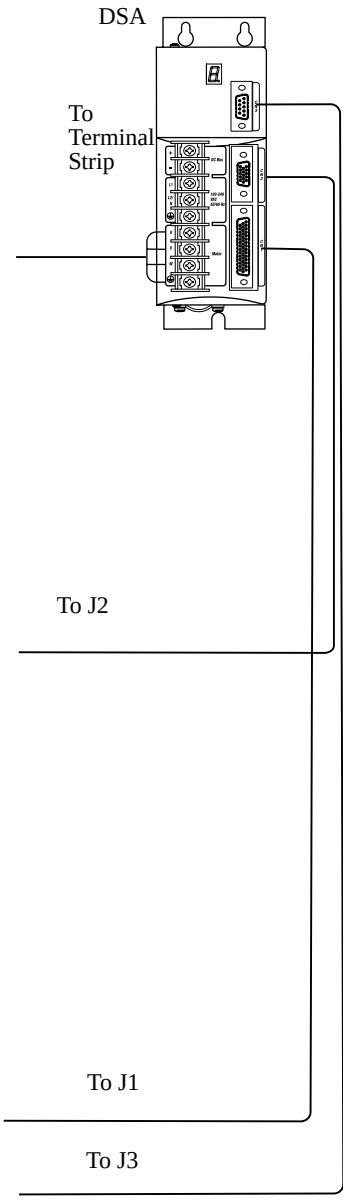
The following tables describe the motor power, feedback, and interface cables you will need for DSA Drive and motor combination. Note: Material numbers shown are for 1-meter lengths. Contact your local Giddings & Lewis representative for other lengths.

Figure B.1
DSA Drive Motor/Drive Cable Connections

Motor Power Cables	Material Number
500W, 1 kW, 2 kW DSA Drive to HSM Series Motors	M.1301.3968
7.5 kW DSA Drive to HSM and FSM Series Motors	M.1301.3978
500W, 1 kW, 2 kW DSA Drive to XSM Series Motors	M.1301.3938
2 or 3 kW DSA Drive to XSM Series Motors	M.1301.3956
7.5 kW DSA Drive to XSM Series Motors	M.1301.3962
500W, 1 kW, 2 kW DSA Drive to NSM Series Motors	M.1301.3930
500W, 1 kW, 2 kW DSA Drive to YSM Series Motors	M.1301.3889

Feedback Cables	Material Number
DSA Drive J2 port to HSM and FSM Series Motors	M.1301.3927
Flying leads on drive-end to HSM and FSM Series Motors	M.1301.4015
DSA Drive J2 port on NSM Series Motors	M.1301.3993
Flying leads on drive-end to NSM Series Motor	M.1301.3998
DSA Drive J2 port to YSM Series Motors	M.1301.3983
Flying leads on drive-end to YSM Series Motor	M.1301.3988
J2 break out board kit	M.1301.4052
J2 drive-mounted break out board	M.1301.4039

Interface cables	Material Number
DSA Drive J1 break out board kit	M.1301.4061
DSA Drive J1 port to no connector	M.1301.4047
DA Drive J1 drive-mounted break out board	M.1301.4038
DSA drive J3 serial port to personal computer	Not Required
DSA Drive J3 drive-mounted break out board	M.1301.4040



DSA Drive to Motor Interconnect Diagrams

Figure B.2
DSA Drive to XSM Series Motor Configuration (mating connector)

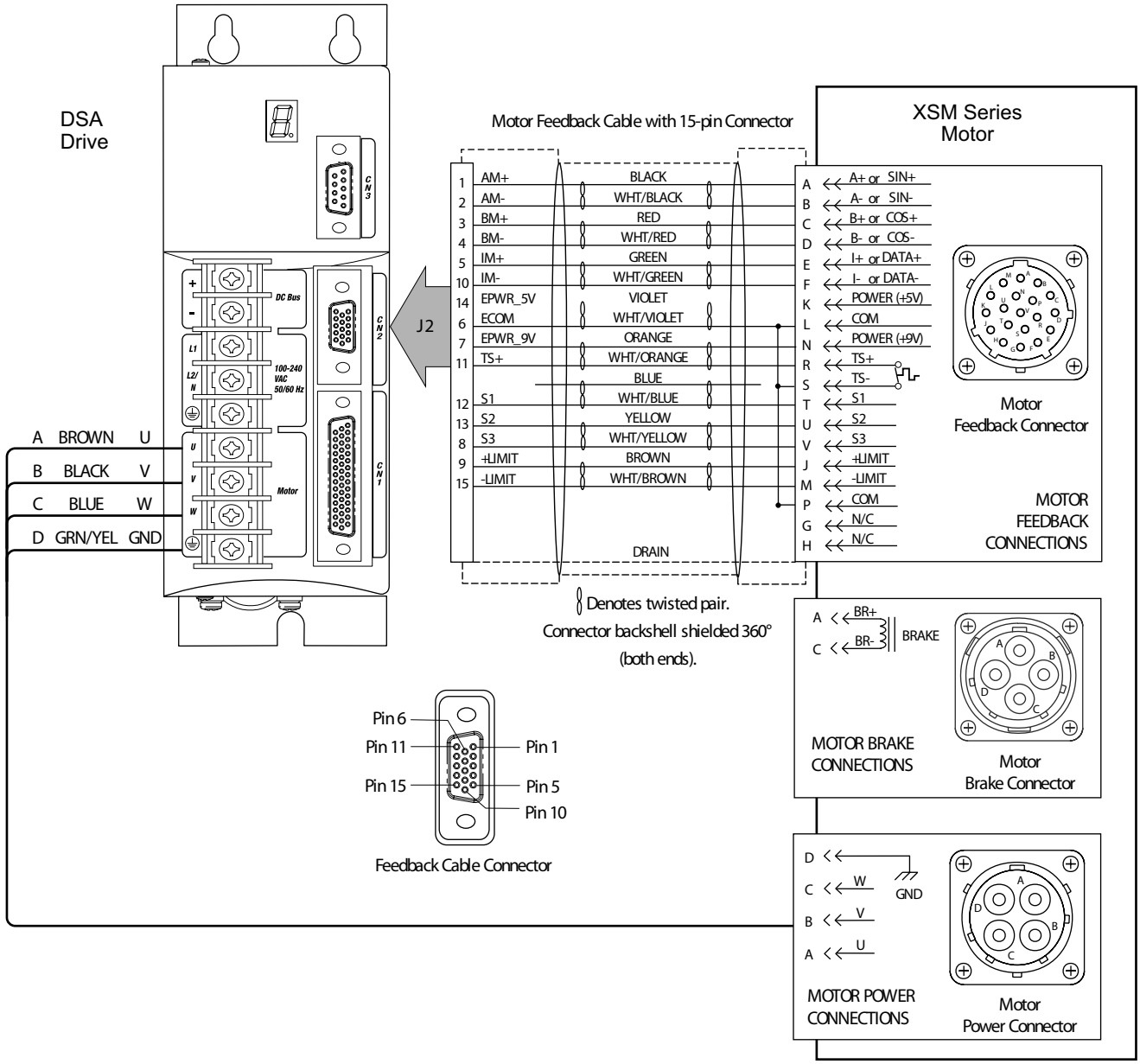


Figure B.3
DSA Drive to XSM Series Motor Configuration (flying leads)

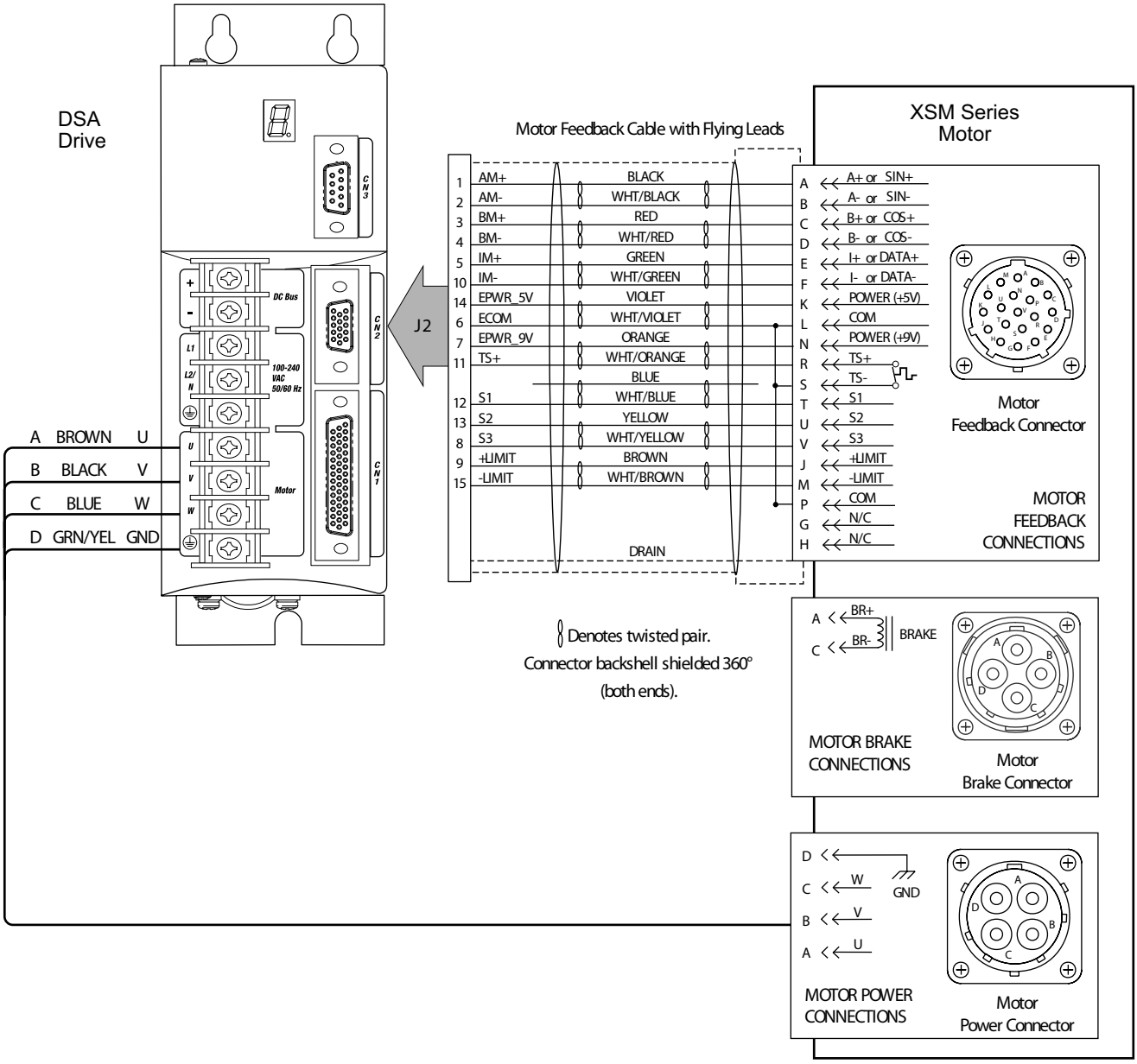


Figure B.4
DSA Drive to NSM Series Motor Configuration (mating connector)

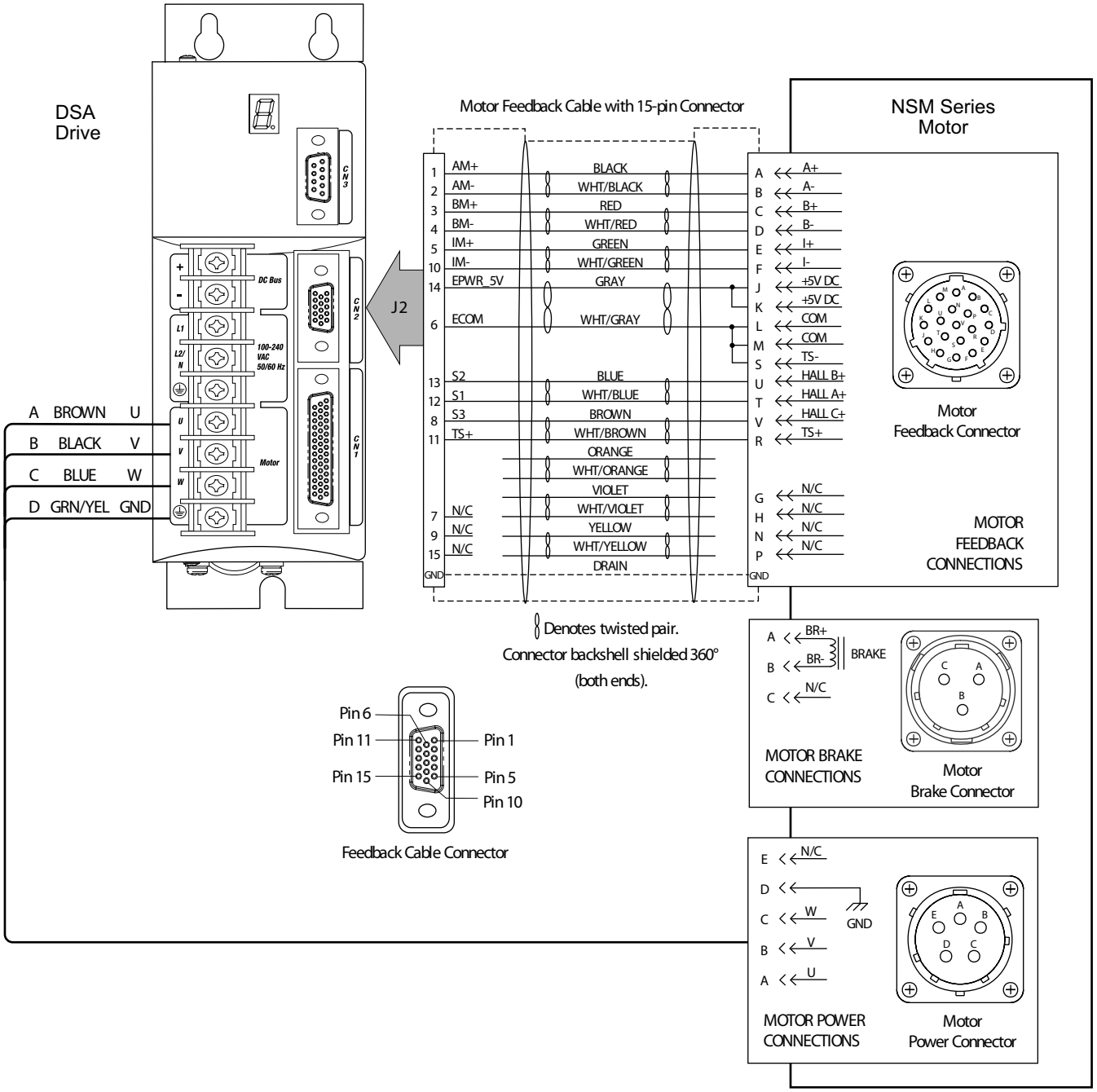


Figure B.5
DSA Drive to NSM Series Motor Configuration (flying leads)

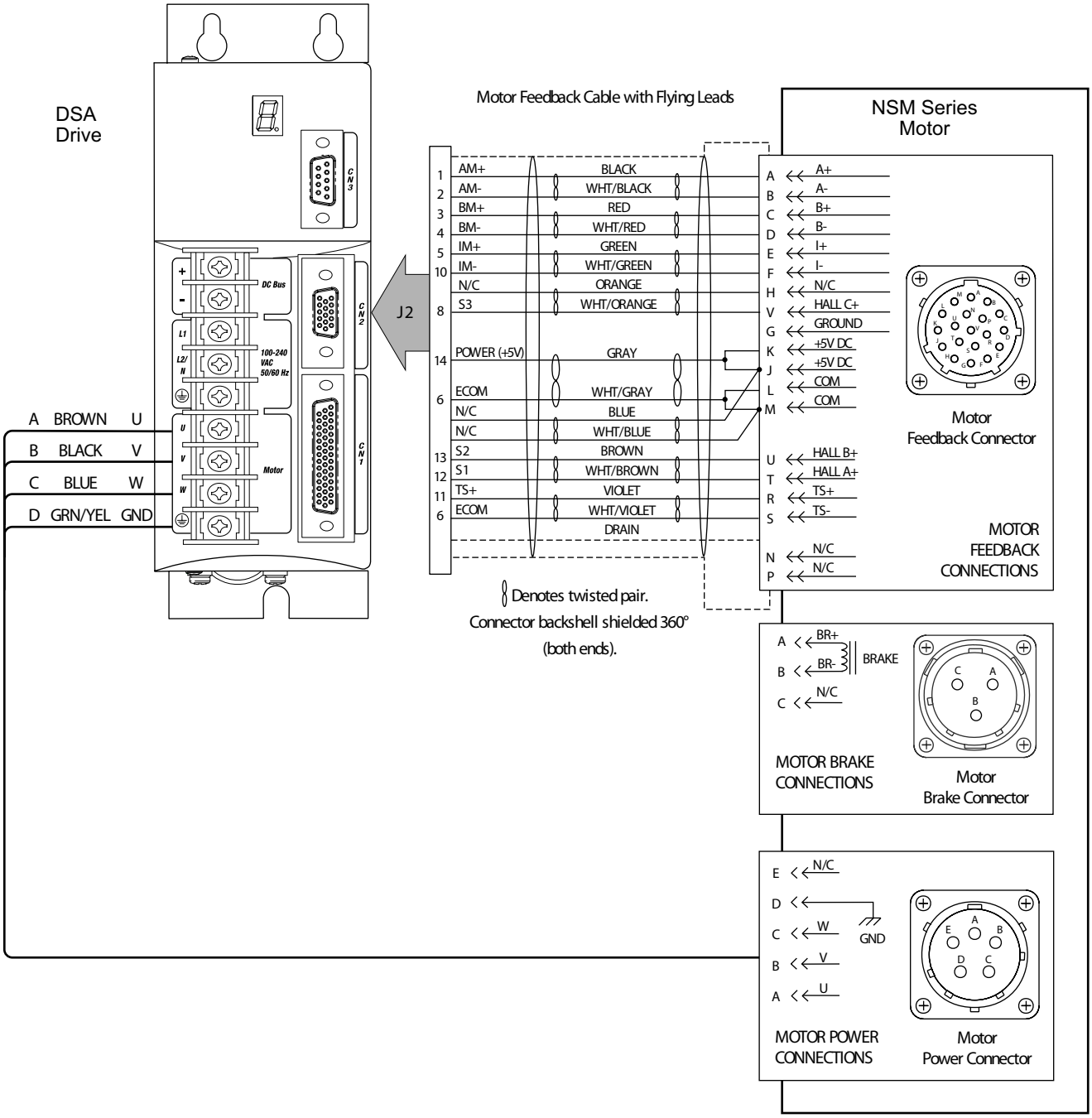


Figure B.6
DSA Drive to HSM and FSM Series Motor Configuration (mating connector)

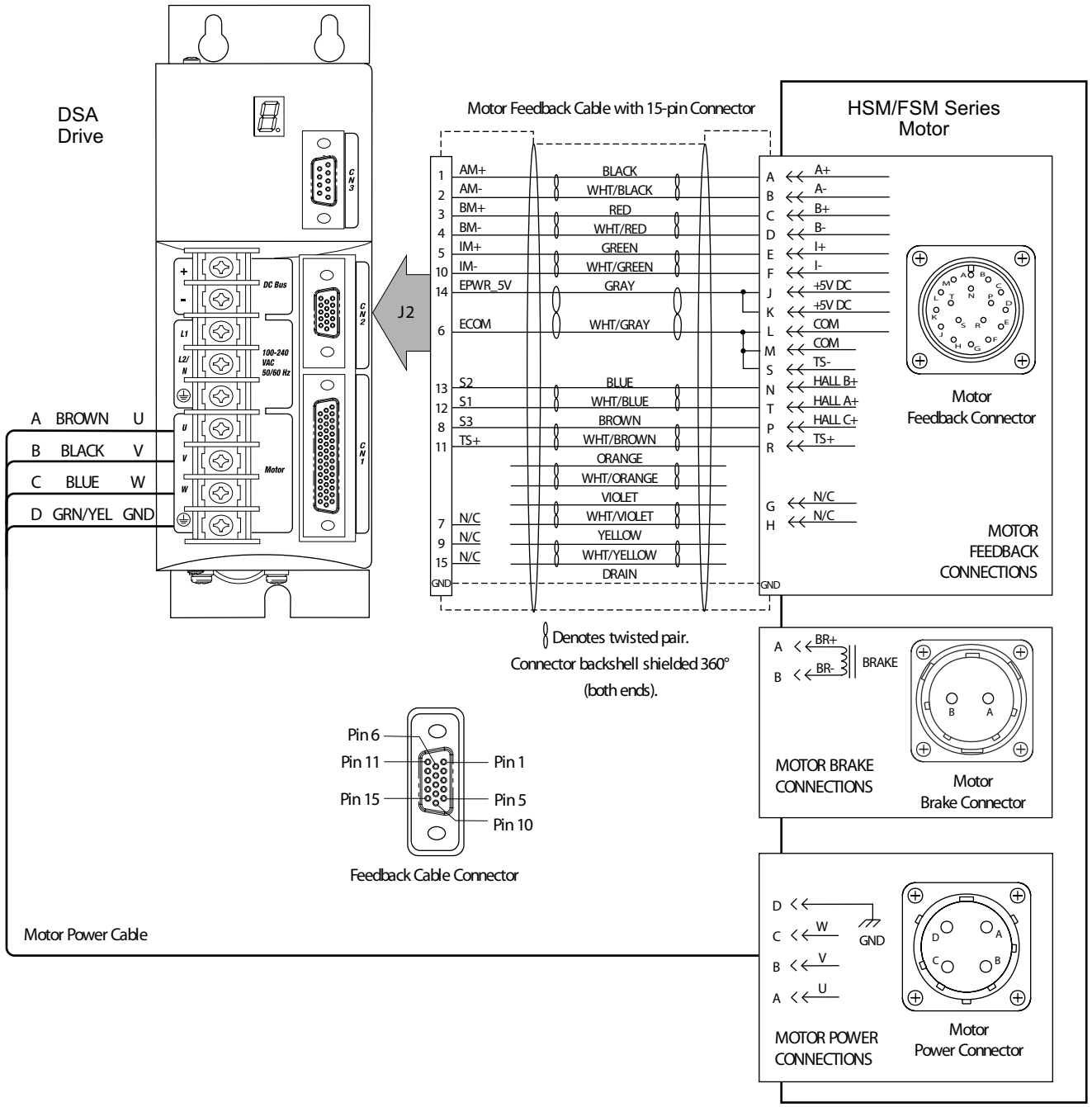


Figure B.7
DSA Drive to HSM and FSM Series Motor Configuration (flying leads)

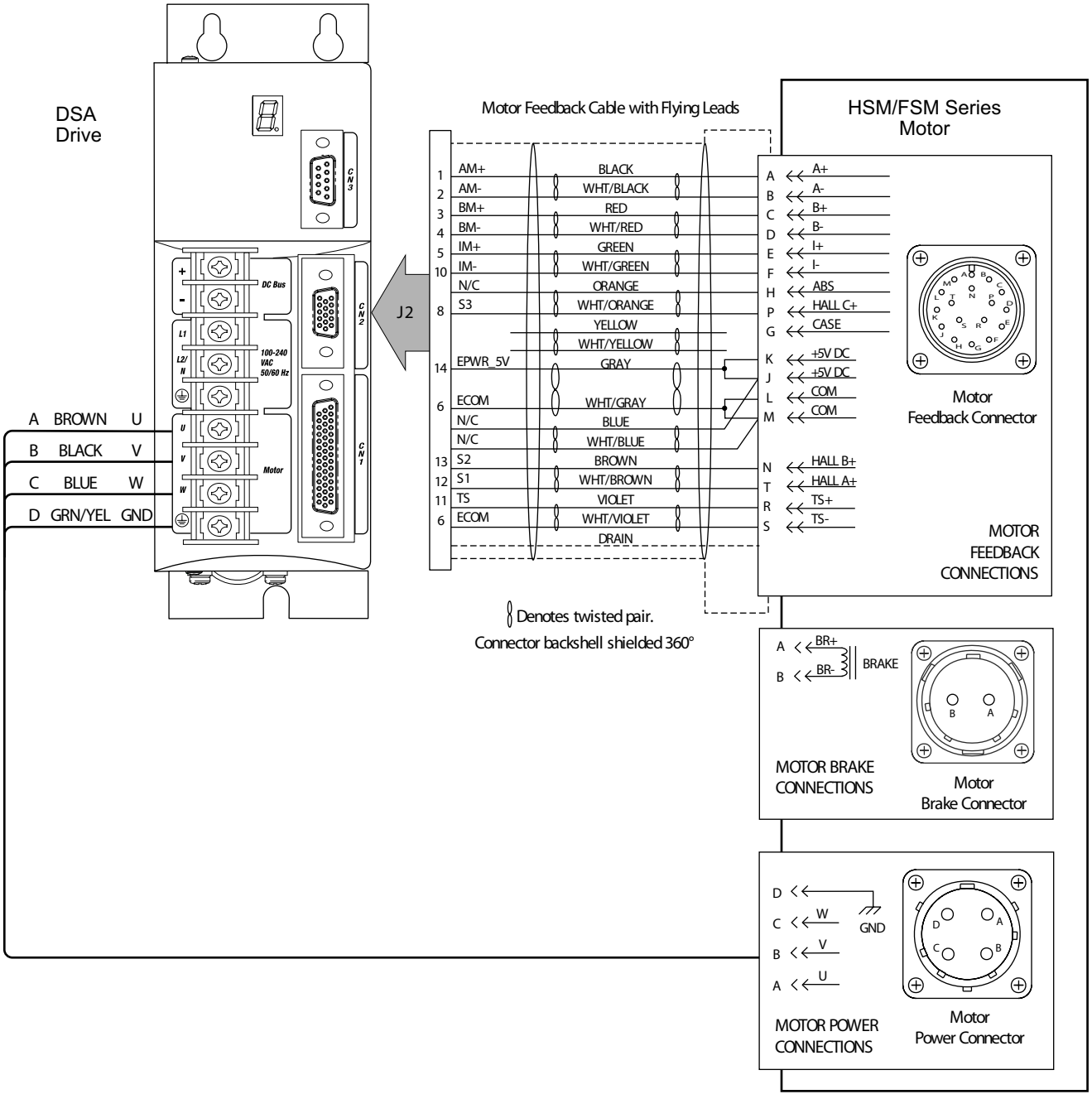


Figure B.8
DSA Drive to YSM Series Motor Configuration (mating connector)

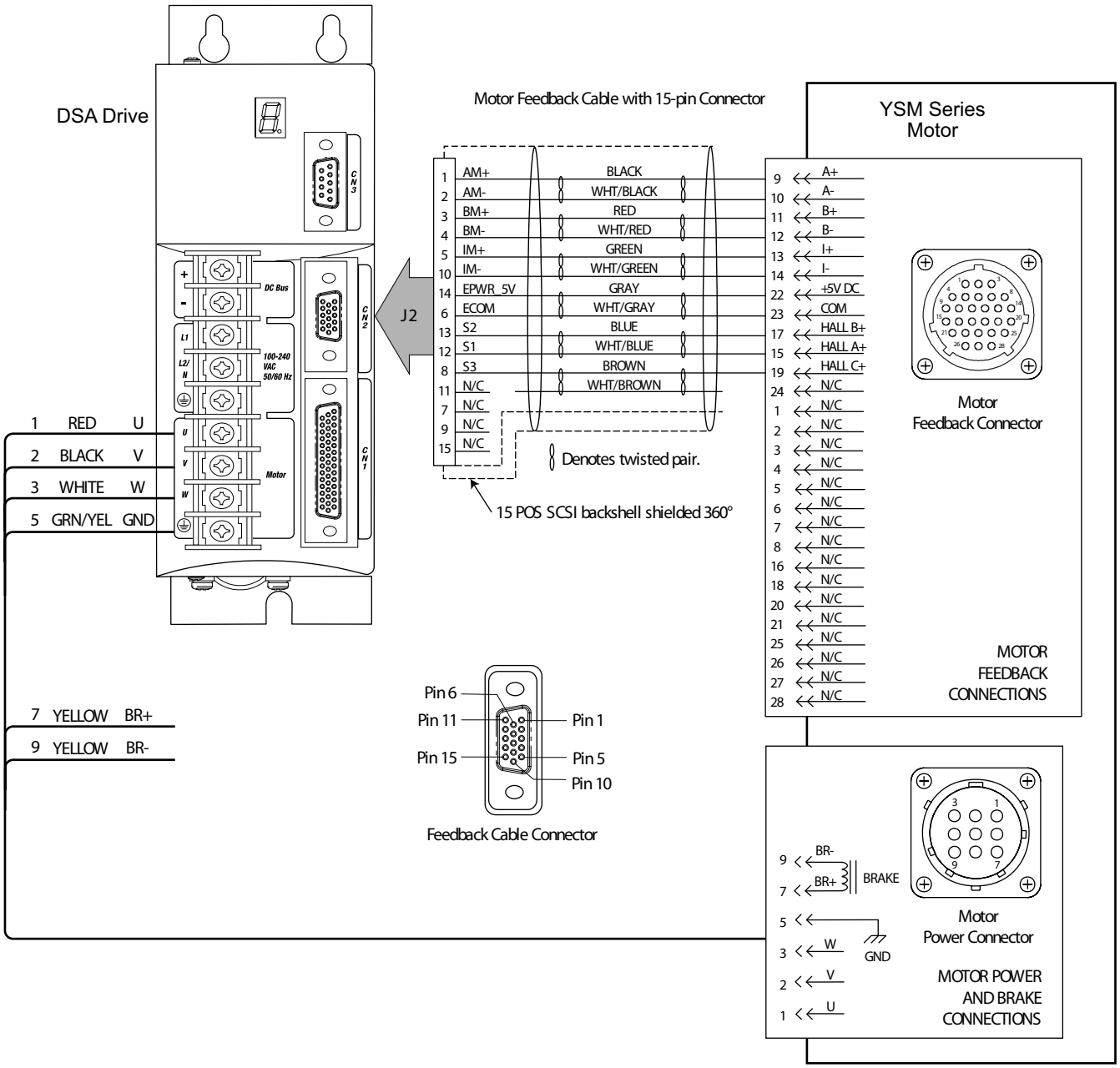
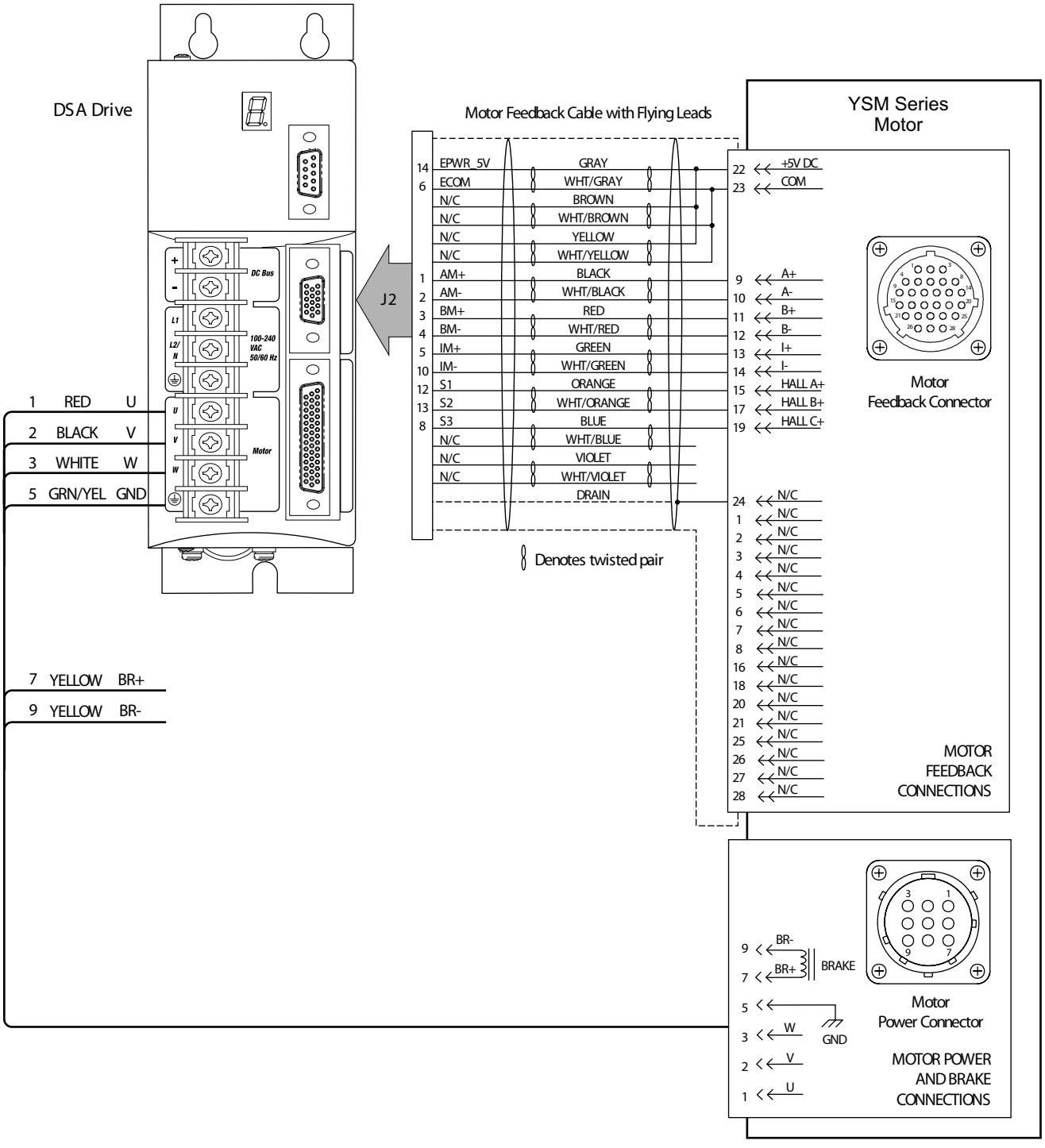


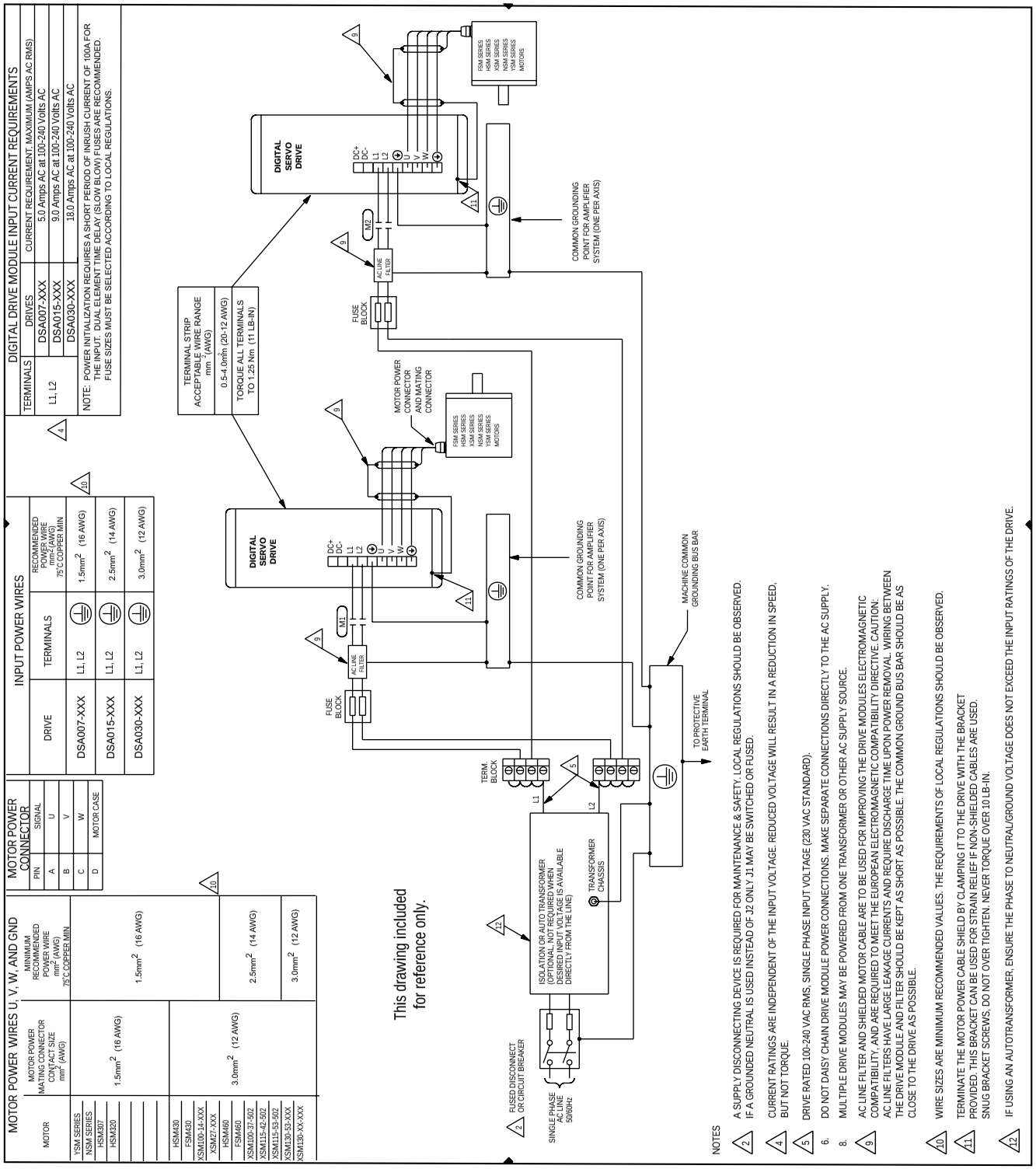
Figure B.9
DSA Drive to YSM Series Motor Configuration (flying leads)



DSA Drive Power Wiring Diagrams

This section provides information to assist you with AC input and motor power wiring to your DSA Drive.

Figure B.10
Typical Power Wiring of DSA Drive System



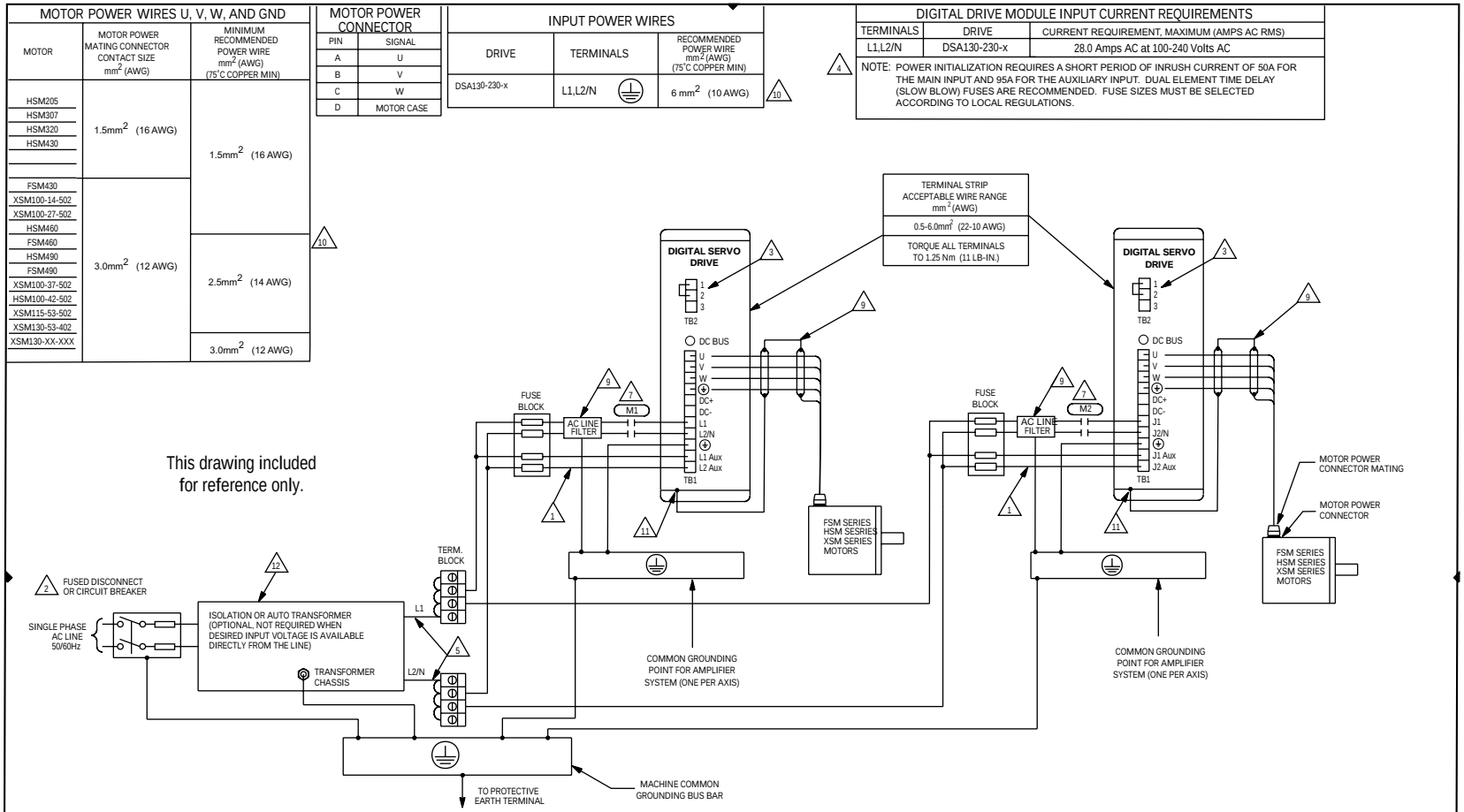
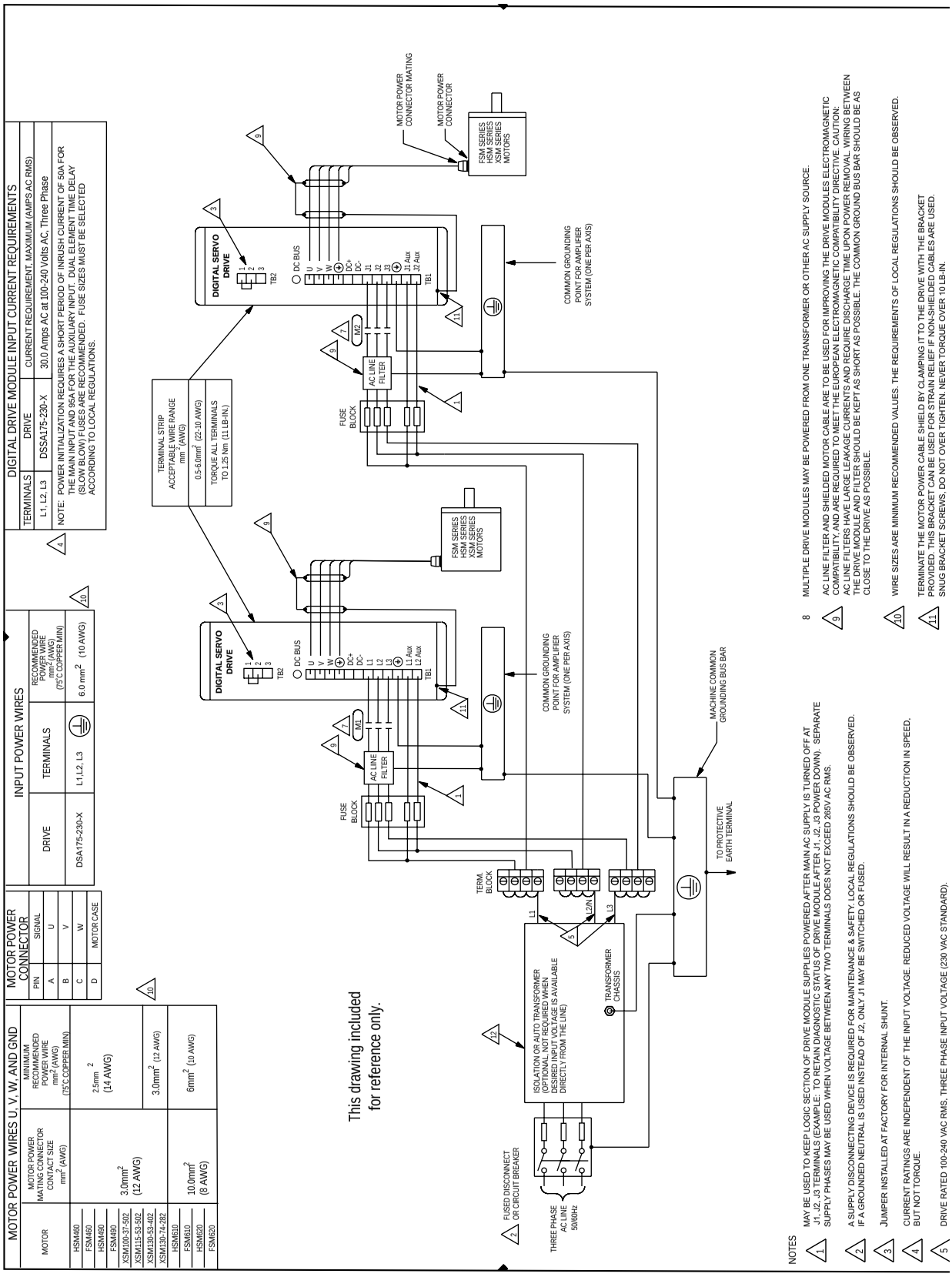


Figure B.11
Typical Power Wiring of DSA Drive System
(DSA130-230-x)

NOTES

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN AC SUPPLY IS TURNED OFF AT J1, J2\N TERMINALS (EXAMPLE: TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER J1, J2\N POWER DOWN). SEPARATE SUPPLY PHASES MAY BE USED WHEN VOLTAGE BETWEEN ANY TWO TERMINALS DOES NOT EXCEED 265V AC RMS.
2. A SUPPLY DISCONNECTING DEVICE IS REQUIRED FOR MAINTENANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A GROUNDED NEUTRAL IS USED INSTEAD OF J2, ONLY J1 MAY BE SWITCHED OR FUSED.
3. JUMPER INSTALLED AT FACTORY FOR INTERNAL SHUNT.
4. CURRENT RATINGS ARE INDEPENDENT OF THE INPUT VOLTAGE. REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED, BUT NOT TORQUE.
5. DRIVE RATED 100-240 VAC RMS, SINGLE PHASE INPUT VOLTAGE (230 VAC STANDARD).
6. DO NOT DAISY CHAIN DRIVE MODULE POWER CONNECTIONS. MAKE SEPARATE CONNECTIONS DIRECTLY TO THE AC SUPPLY.
7. DRIVE ENABLE INPUT MUST BE OPENED WHEN MAIN POWER IS REMOVED AND AUXILIARY POWER IS PRESENT, OR A DRIVE FAULT WILL OCCUR.
8. MULTIPLE DRIVE MODULES MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.
9. AC LINE FILTER AND SHIELDED MOTOR CABLE ARE TO BE USED FOR IMPROVING THE DRIVE MODULES ELECTROMAGNETIC COMPATIBILITY, AND ARE REQUIRED TO MEET THE EUROPEAN ELECTROMAGNETIC COMPATIBILITY DIRECTIVE. CAUTION: AC LINE FILTERS HAVE LARGE LEAKAGE CURRENTS AND REQUIRE DISCHARGE TIME UPON POWER REMOVAL. WIRING BETWEEN THE DRIVE MODULE AND FILTER SHOULD BE KEPT AS SHORT AS POSSIBLE. THE COMMON GROUND BUS BAR SHOULD BE AS CLOSE TO THE DRIVE AS POSSIBLE.
10. WIRE SIZES ARE MINIMUM RECOMMENDED VALUES. THE REQUIREMENTS OF LOCAL REGULATIONS SHOULD BE OBSERVED.
11. TERMINATE THE MOTOR POWER CABLE SHIELD BY CLAMPING IT TO THE DRIVE WITH THE BRACKET PROVIDED. THIS BRACKET CAN BE USED FOR STRAIN RELIEF IF NON-SHIELDED CABLES ARE USED. SNUG BRACKET SCREWS, DO NOT OVER TIGHTEN. NEVER TORQUE OVER 10 LB-IN.
12. IF USING AN AUTOTRANSFORMER, ENSURE THE PHASE TO NEUTRAL/GROUND VOLTAGE DOES NOT EXCEED THE INPUT RATINGS OF THE DRIVE.

Figure B.12
Typical Power Wiring of DSA Drive System
(DSA175-230-x)



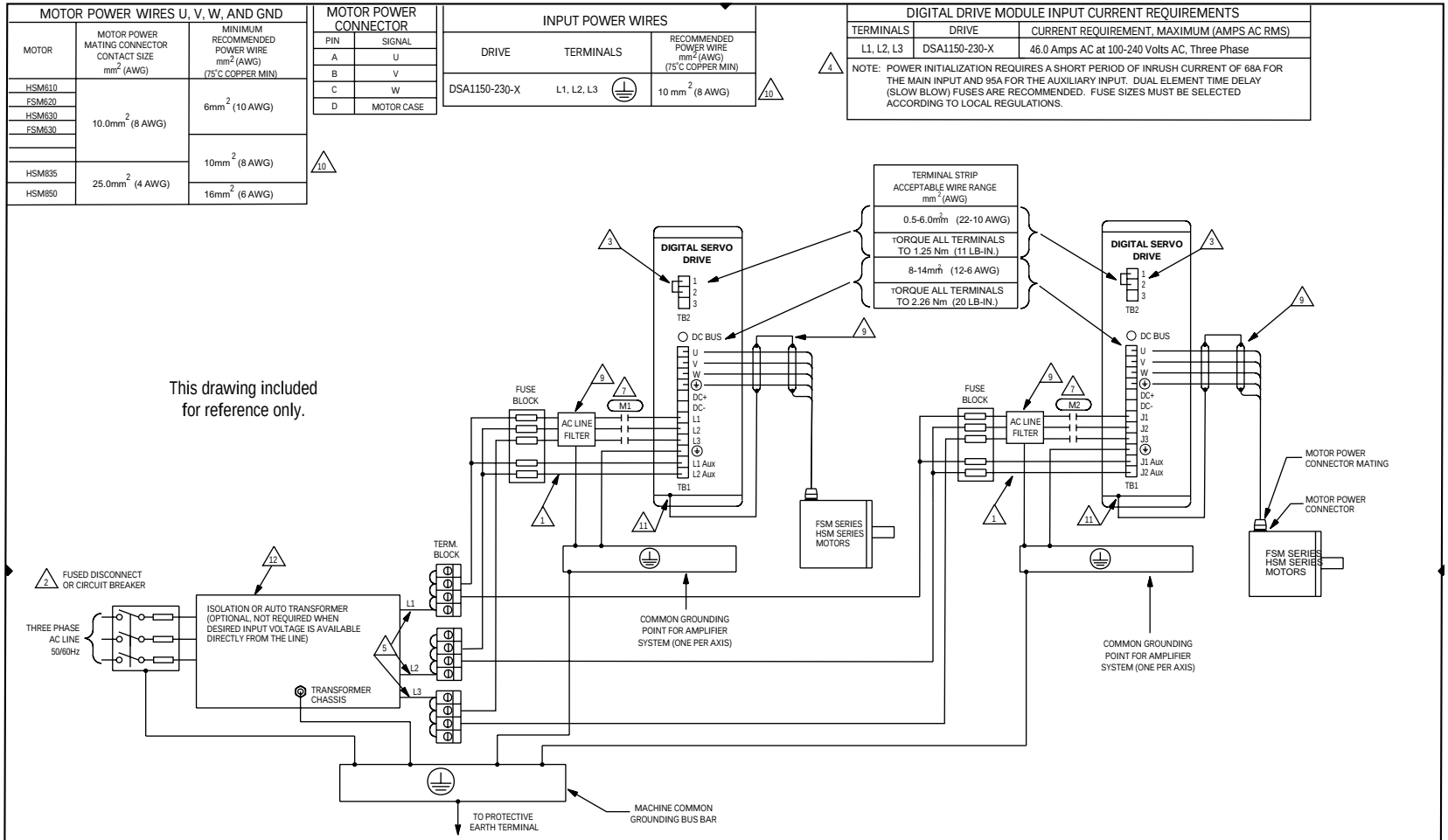


Figure B.13
Typical Power Wiring of DSA Drive System
(DSA1150-230-x)

NOTES

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN AC SUPPLY IS TURNED OFF AT L1, L2, L3 TERMINALS (EXAMPLE: TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER L1, L2, L3 POWER DOWN). SEPARATE SUPPLY PHASES MAY BE USED WHEN VOLTAGE BETWEEN ANY TWO TERMINALS DOES NOT EXCEED 265V AC RMS.
2. A SUPPLY DISCONNECTING DEVICE IS REQUIRED FOR MAINTENANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A GROUNDED NEUTRAL IS USED INSTEAD OF J2, ONLY J1 MAY BE SWITCHED OR FUSED.
3. JUMPER INSTALLED AT FACTORY FOR INTERNAL SHUNT.
4. CURRENT RATINGS ARE INDEPENDENT OF THE INPUT VOLTAGE. REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED, BUT NOT TORQUE.
5. DRIVE RATED 100-240 VAC RMS, THREE PHASE INPUT VOLTAGE (230 VAC STANDARD).
6. DO NOT DAISY CHAIN DRIVE MODULE POWER CONNECTIONS. MAKE SEPARATE CONNECTIONS DIRECTLY TO THE AC SUPPLY.
7. DRIVE ENABLE INPUT MUST BE OPENED WHEN MAIN POWER IS REMOVED AND AUXILIARY POWER IS PRESENT, OR A DRIVE FAULT WILL OCCUR.
8. MULTIPLE DRIVE MODULES MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.
9. AC LINE FILTER AND SHIELDED MOTOR CABLE ARE TO BE USED FOR IMPROVING THE DRIVE MODULES ELECTRO-MAGNETIC COMPATIBILITY, AND ARE REQUIRED TO MEET THE EUROPEAN ELECTROMAGNETIC COMPATIBILITY DIRECTIVE. CAUTION: AC LINE FILTERS HAVE LARGE LEAKAGE CURRENTS AND REQUIRE DISCHARGE TIME UPON POWER REMOVAL. WIRING BETWEEN THE DRIVE MODULE AND FILTER SHOULD BE KEPT AS SHORT AS POSSIBLE. THE COMMON GROUND BUS BAR SHOULD BE AS CLOSE TO THE DRIVE AS POSSIBLE.
10. WIRE SIZES ARE MINIMUM RECOMMENDED VALUES. THE REQUIREMENTS OF LOCAL REGULATIONS SHOULD BE OBSERVED.
11. TERMINATE THE MOTOR POWER CABLE SHIELD BY CLAMPING IT TO THE DRIVE WITH THE BRACKET PROVIDED. THIS BRACKET CAN BE USED FOR STRAIN RELIEF IF NON-SHIELDED CABLES ARE USED. SNUG BRACKET SCREWS, DO NOT OVER TIGHTEN. NEVER TORQUE OVER 10 LB-IN.
12. IF USING AN AUTOTRANSFORMER, ENSURE THE PHASE TO NEUTRAL/GROUND VOLTAGE DOES NOT EXCEED THE INPUT RATINGS OF THE DRIVE.

Start/Stop String Configuration Diagram Examples

This section provides information to assist you in using the configurable Drive Ready output in a start/stop string. The figures illustrate examples of how the start/stop string can be implemented. Refer to Figure 2.11 in the chapter *DSA Drive Connector Data* for more information on the digital relay output.

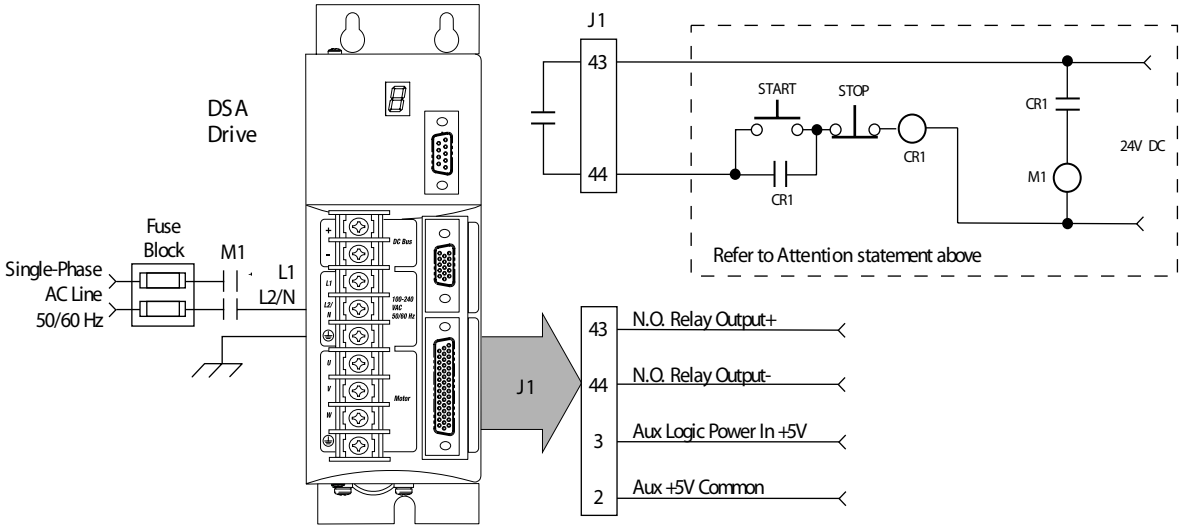
24V DC Start/Stop String Examples

The 24V DC start/stop string wired to the DSA Drives is shown in the figure below.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.14
24V DC Single-Phase Start/Stop String Example



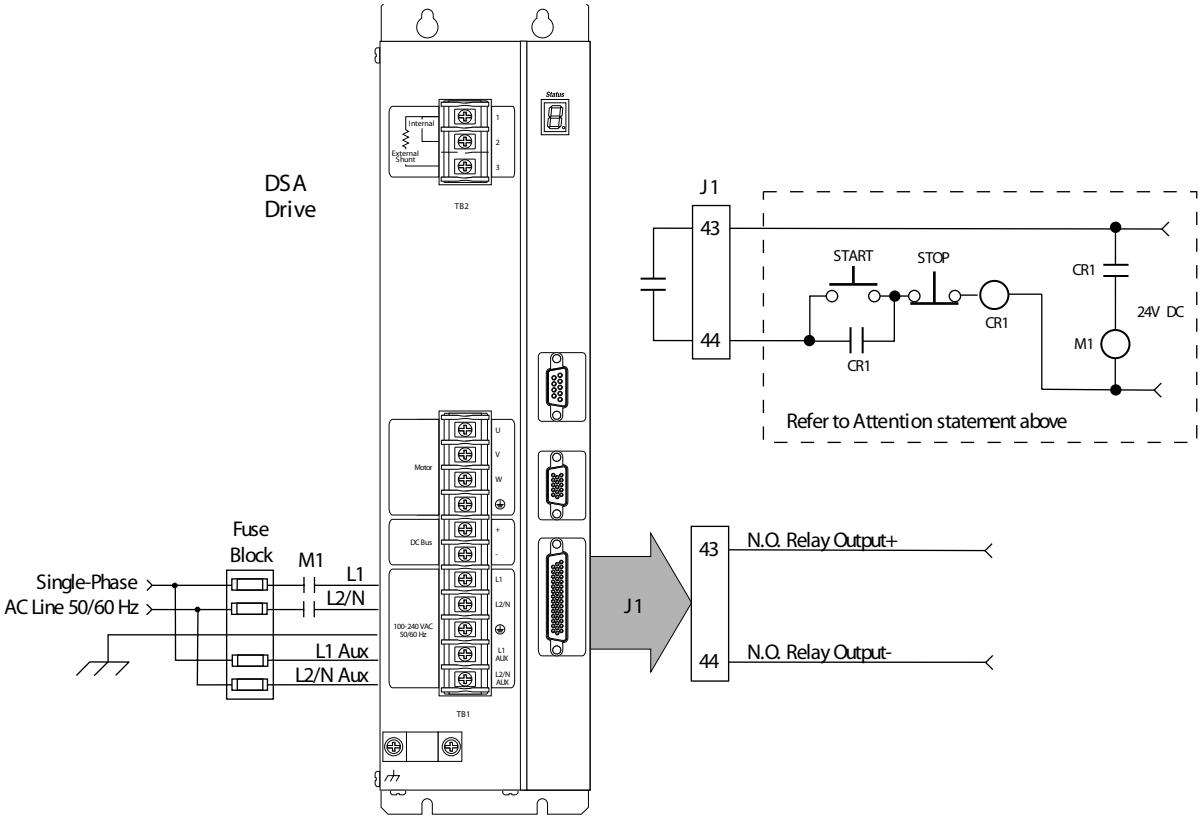
Note: Relay Output (J1, pins 43 and 44) must be configured as Ready in DSA Drive software and auxiliary +5V power is required.

The 24V DC start/stop string wired to the DSA Drives is shown in the figure below.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.15
24V DC Single-Phase Start/Stop String Example



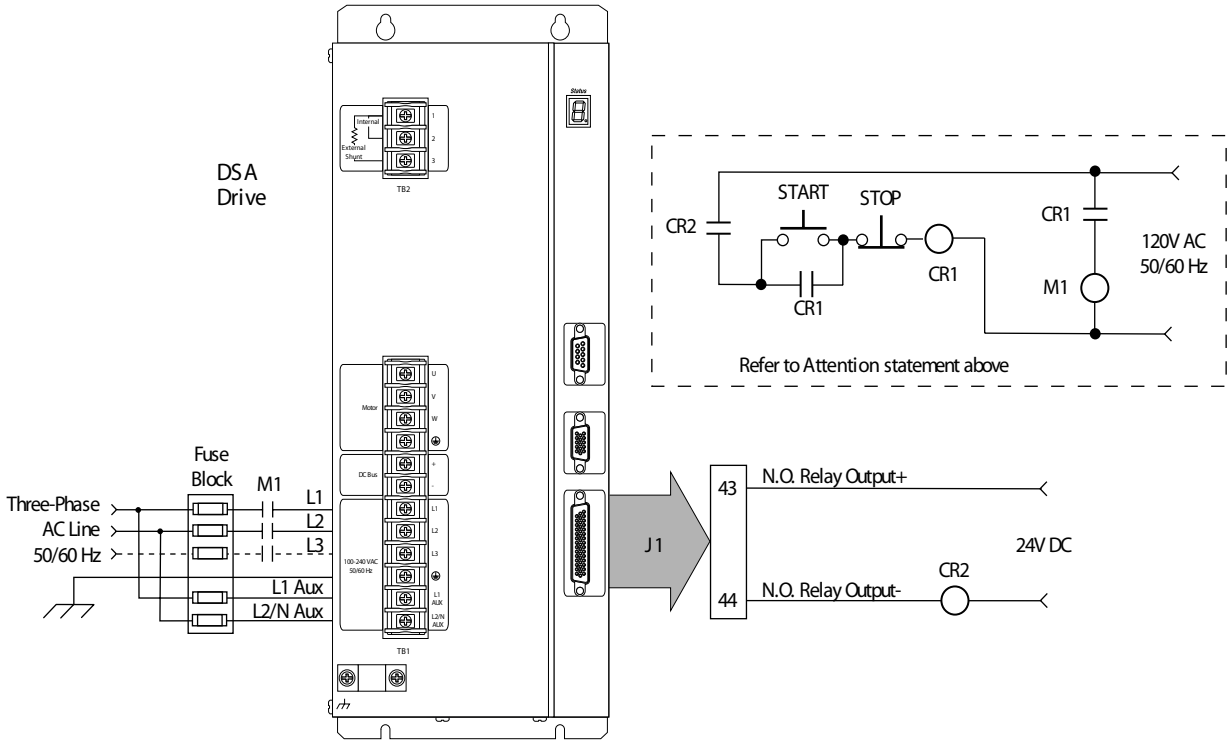
Note: Relay Output (pins 43 and 44) must be configured as Ready in DSA Drive software.

The 24V DC start/stop string wired to the DSA Drives is shown in the figure below.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.16
24V DC Three-Phase Start/Stop String Example



Note: Relay Output (pins 43 and 44) must be configured as Ready in DSA Drive software.

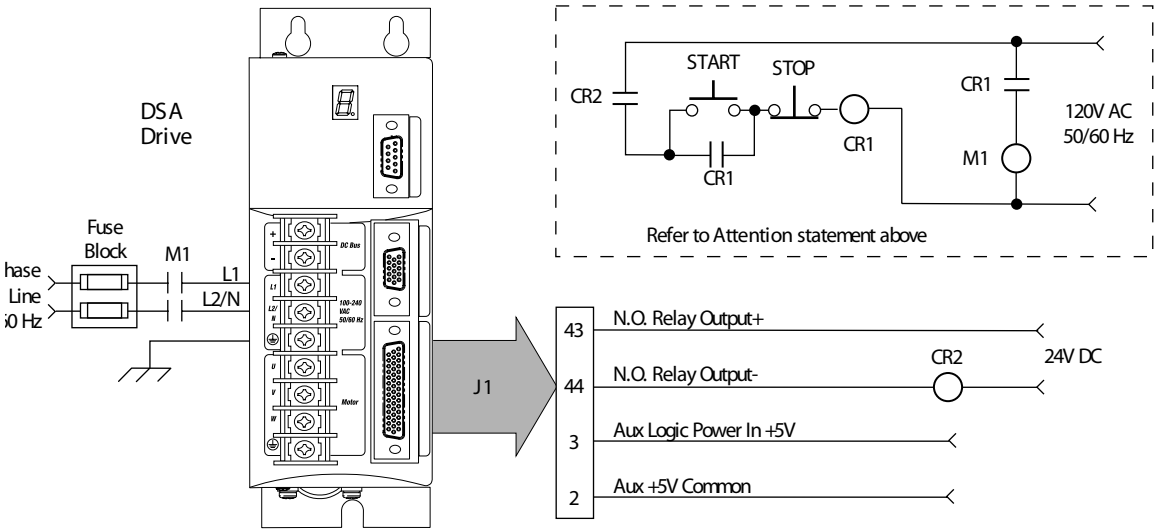
120V AC Start/Stop String Examples

The 120V AC start/stop string wired to the DSA Drives is shown in the figure below. Refer to Figure 2.11 in the chapter *DSA Drive Connector Data* for more information on the digital relay output.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.17
120V AC Single-Phase Start/Stop String Example



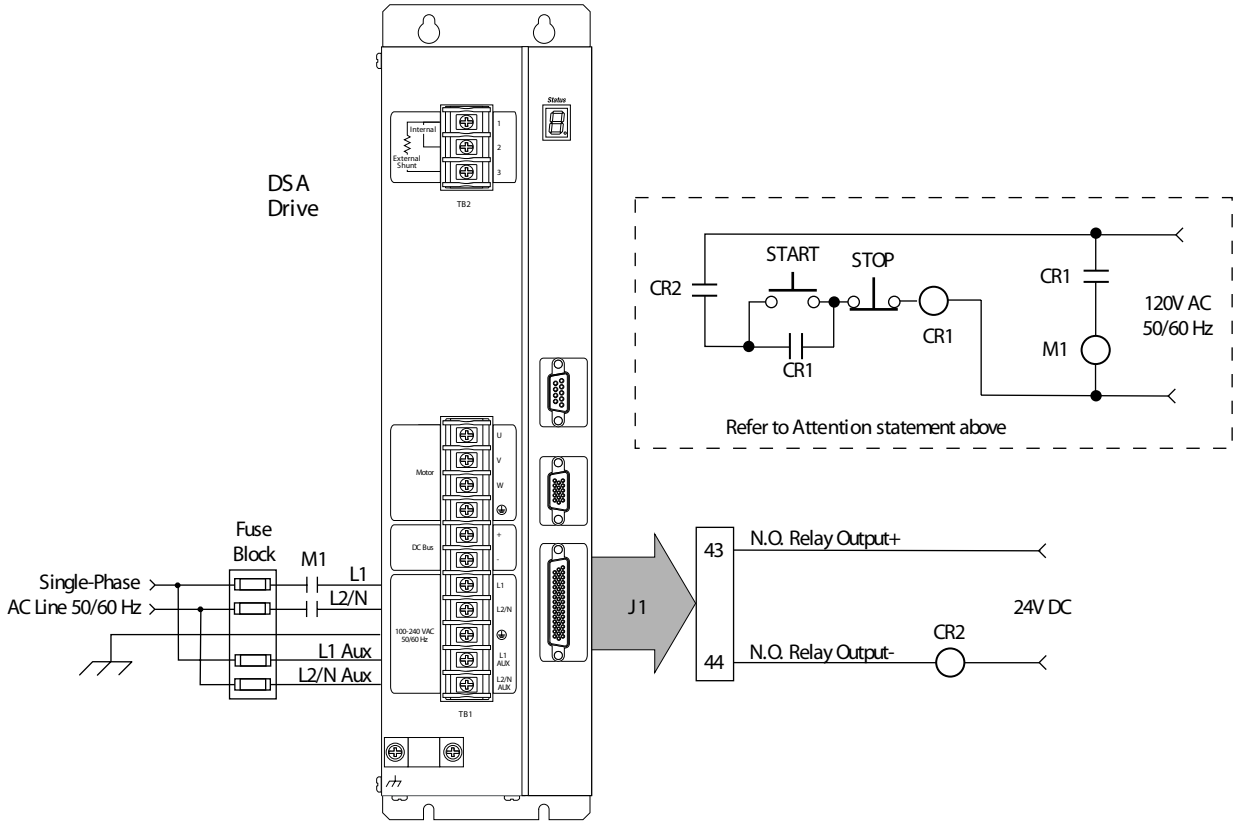
Note: Relay Output (J1, pins 43 and 44) must be configured as Ready in DSA Drive software and auxiliary +5V power is required.

The 120V AC start/stop string wired to the DSA Drives is shown in the figure below.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.18
120V AC Single-Phase Start/Stop String Example



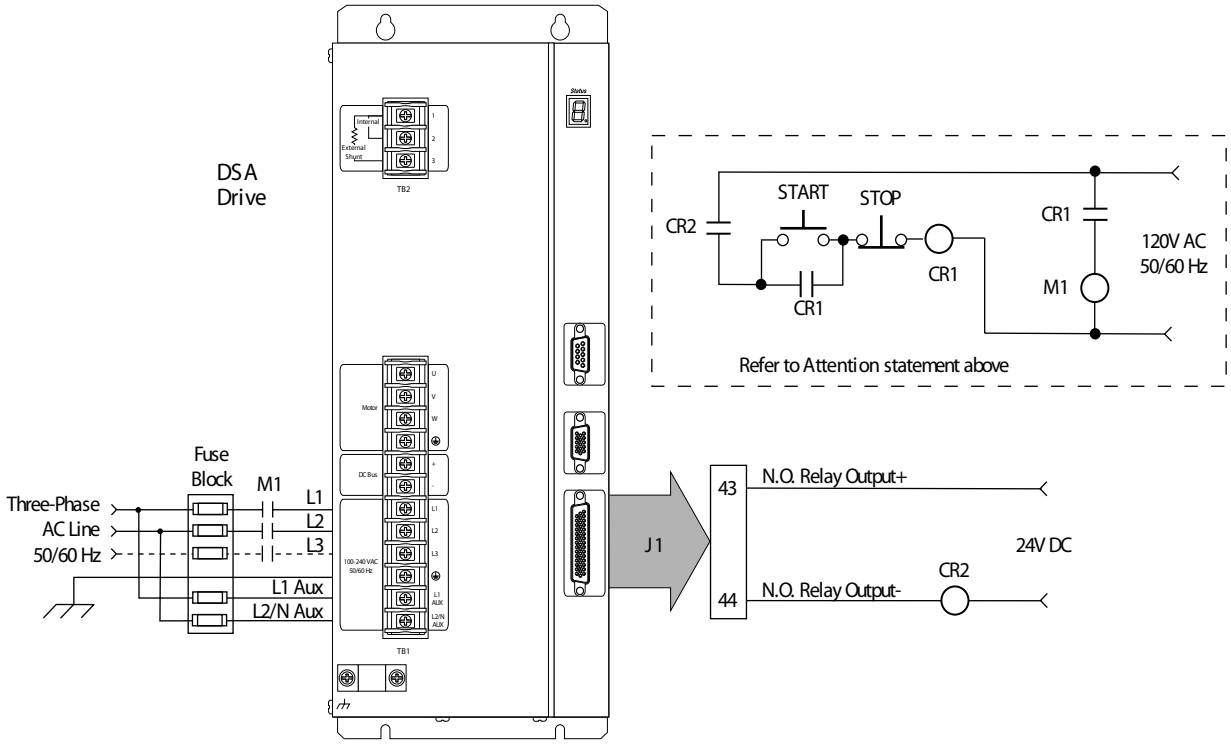
Note: Relay Output (pins 43 and 44) must be configured as Ready in DSA Drive software.

The 120V AC start/stop string wired to the DSA Drives is shown in the figure below.

ATTEN-

Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN1050 and EN954 estimation and safety performance categories.

Figure B.19
120V AC Three-Phase Start/Stop String Example



Note: Relay Output (pins 43 and 44) must be configured as Ready in DSA Drive software.

Controlling a Brake

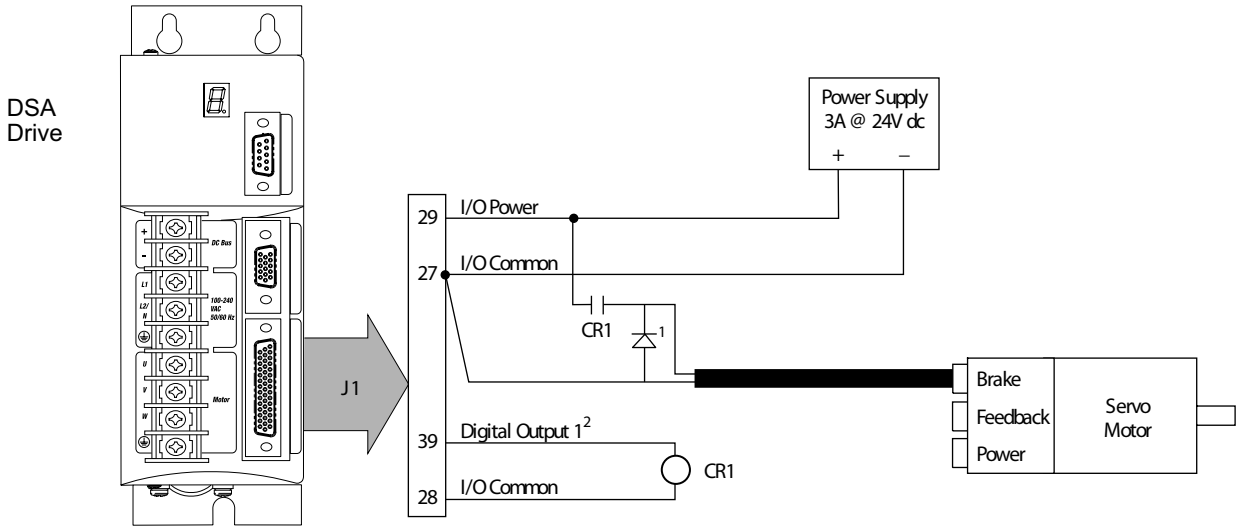
The relay output of the DSA Drive is suitable for directly controlling a motor brake, subject to the relay voltage limit of 30V dc, and the relay current limit of 1A dc. For brake requirements outside of these limits, an external relay must be used. If a transistor output is used, a control relay is also required.

The following table lists Giddings & Lewis motors that are compatible with the internal relay output (J1, pins 43 and 44), when used for controlling a brake.

Compatible Brake Motors	Brake Current
FSM430, FSM460, and FSM490	0.88A
HSM307and HSM320	0.60A
HSM430, HSM450, and HSM490	0.69A
YSM102 and YSM103	0.26A
YSM206 and YSM212	0.31A
YSM323	0.37A
XSM100-xx-xxx	0.50A
XSM 115-xx-xxx and XSM 130-xx-xxx	0.64A

Figure S.1 shows an example configuration using Digital Output 1 and control relay to control a motor brake with a transistor output.

Figure S.1
Example Configuration Controlling a Motor Brake



[1] Flyback diode (1N4004 rated 1.0A @ 400V dc) suppresses collapsing field of brake coil.
[2] Digital Output 1 (pin 39) configured as Brake in DSA Drive.

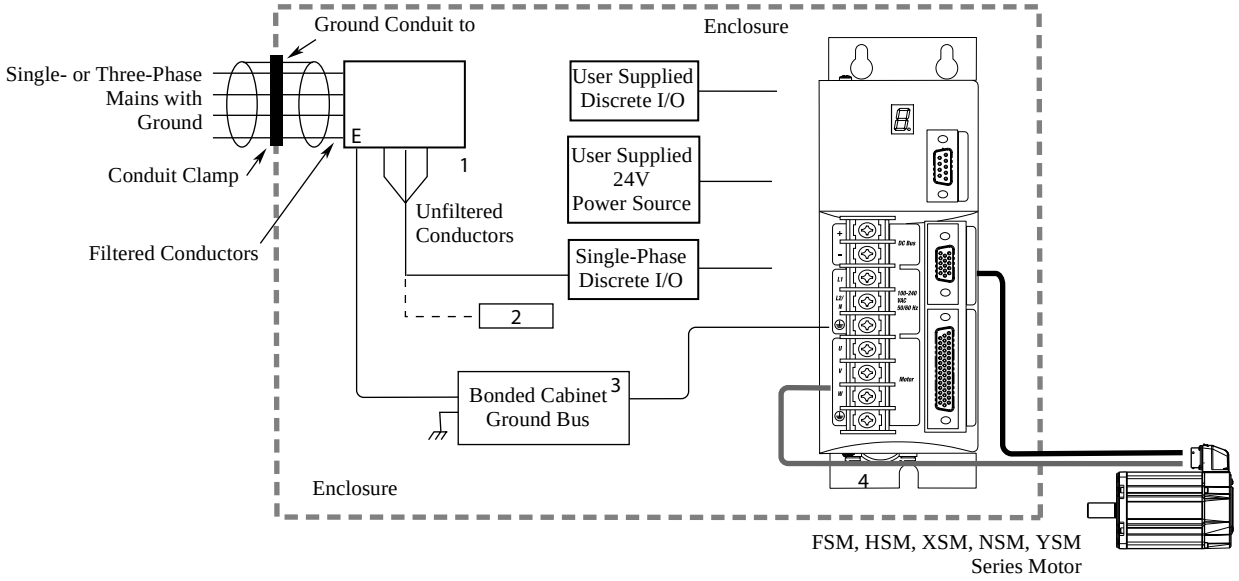
For Digital Output 1 specifications, refer to Figure 2.10 in the chapter *DSA Drive Connector Data*.

IMPOR- Flyback diodes must be used when controlling a brake coil with the relay or digital output.

Grounding for DSA Drive CE Requirements

This section provides information to assist you in complying with CE requirements. Refer to the figure below for DSA Drive CE requirements.

Figure S.2
DSA Drive CE Requirements



[1] Mount the filter as close to the DSA Drive as possible. If the distance exceeds 600 mm (2.0 ft), use a strap (greater in width than length) rather than a wire, to connect the ground between the DSA Drive and the filter. This is particularly important for attenuation of higher frequency emissions (5-30 MHz).

Shield or separate the wires connecting the AC power to the filter from other power cables (e.g., connections between the DSA Drive and the filter, motor power cable, etc.). The best method of achieving this is to mount the filter near where the AC power enters the enclosure. If the connections are not separated from each other, the EMI on the DSA Drive side of the filter can couple over to the source side of the filter, thereby reducing or eliminating the filter's effectiveness. The coupling mechanism can radiate or allow stray capacitance between the wires.

Filters need to be on all lines for filtering to be effective. When multiple power cables enter an enclosure, an unfiltered line can contaminate a filtered line.

Bond the filter and the DSA Drive to a grounded conductive surface (the enclosure) to establish a high frequency (HF) connection. To achieve the HF ground, the contact surface interface between the filter, DSA Drive, and the enclosure should be free from paint or any other type of insulator.

[2] The filter shown is sized for one DSA Drive. Equivalent filters may be used for multiple units. Size the filter following the manufacturers recommendations.

[3] Ground bar is customer-supplied item.

[4] Clamp motor power cable shield for EMC termination.

IMPOR- All AC power in the cabinet must be filtered to reduce EMI.

ATTEN-

High voltage exists in AC line filters. The filter must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels. Failure to observe this precaution could result in personal injury.

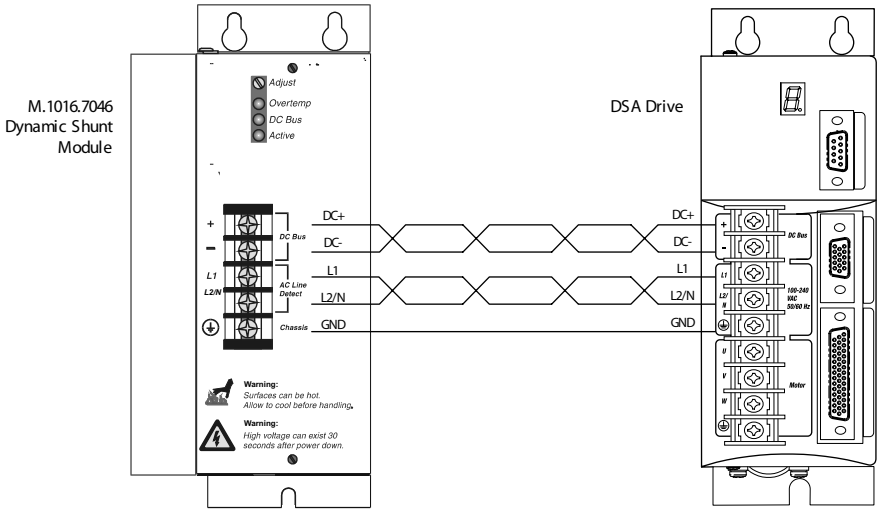
DSA Drive to Shunt Module Interconnect Diagrams

This section provides information to assist you in wiring the active or passive shunt module when connecting to your DSA Drive 230V drive.

DSA Drive to 300W Active Shunt Module

Use material number M.1016.7046 (legacy number 401-30286-00) dynamic shunt module with the DSA Drives.

Figure B.20
Wiring the 300W Active Shunt Module



Use shielded, high temperature 75° C (167° F), 600V, 2.5-4.0 mm^2 (12-14 AWG), 3.05 m (10 ft) maximum, copper wire. Follow one of the methods given below to reduce the effects of EMI noise:

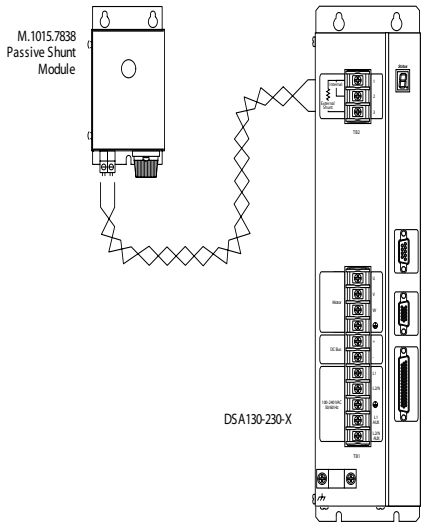
- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).

DSA Drive to 200W Passive Shunt Module

Use material number M.1015.7838 (legacy number 401-34308-00) passive shunt module with the DSA Drives

.

Figure B.21
Wiring the 200W Passive Shunt Module



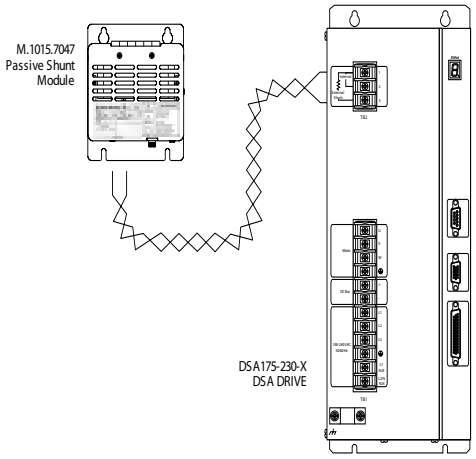
Use shielded, high temperature 75° C (167° F), 600V, 2.5 mm^2 (14 AWG), 3.05 m (10 ft) maximum, copper wire. Follow one of the methods given below to reduce the effects of EMI noise:

- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).

DSA Drive to 900W Passive Shunt Module

Use Material Number M.1015.7047 (legacy number 401-30287-00) passive shunt module with the DSA Drives.

Figure B.22
Wiring the 900W Passive Shunt Module



Use shielded, high temperature 75° C (167° F), 600V, 10 mm^2 (8 AWG), 3.05 m (10 ft) maximum, copper wire. Follow one of the methods given below to reduce the effects of EMI noise:

- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).

DSA Drive to Two 900W Passive Shunt Module

Use one or two passive shunt modules, material number M.1015.7047 (legacy number 401-30287-00) with the DSA Drives. When two 900W shunt modules are connected in parallel, the shunt capacity is doubled for a total of 1800W of continuous power dissipation on the DC bus.

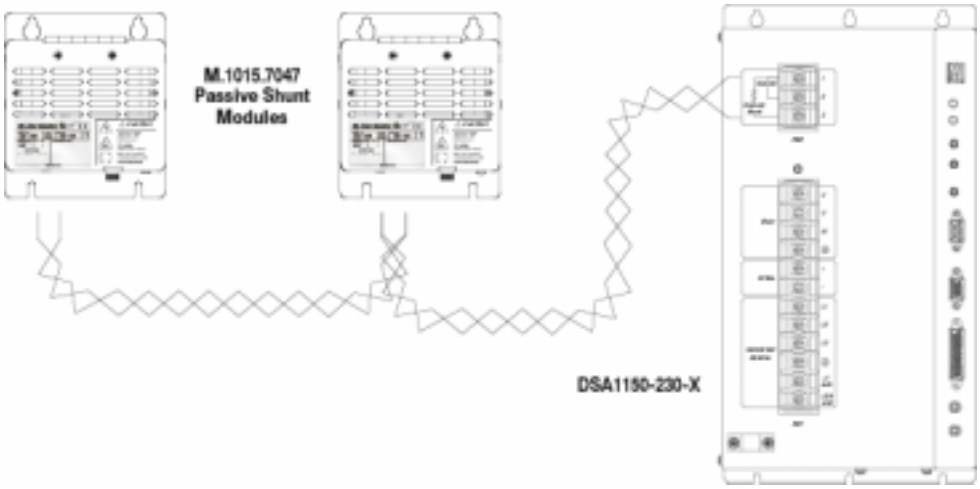
ATTEN-

Do not connect more than two 900W shunts with your drive or damage to the drive will result.

Figure B.23
Wiring Two 900W Passive Shunt Modules

Use shielded, high temperature 75° C (167° F), 600V, 10 mm^2 (8 AWG), 3.05 m (10 ft) maximum, copper wire. Follow one of the methods given below to reduce the effects of EMI noise:

- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).



Material Numbers and Accessories

Chapter Objectives

This appendix lists the DSA Drives and accessory items in tables by Material Number providing detailed descriptions of each component. This appendix describes Material Numbers for:

- DSA Drives
- DSA Drive software
- AC line filters
- External shunt kits
- Motor power cables
- SERCOS Interface fiber optic cables
- Motor feedback cables
- DSA Drive interface cables
- Mating connector kits
- Breakout boards, cables, and kits

Contact your local Giddings & Lewis sales office for additional information.

DSA Drives

DSA Series Servo Drive Modules

Description	Model Number	Material Number
2.5 Amp Cont./7.5 Amp Peak Micro DSA	DSA-007-230	M.1300.5787
5 Amp Cont./15 Amp Peak Micro DSA	DSA-015-230	M.1300.5788
10 Amp Cont./30 Amp Peak Micro DSA	DSA-030-230	M.1300.5789
15 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-130-230	M.1300.9613
35 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-175-230	M.1300.9615
65 Amp Cont./150 Amp Peak, 100 - 240 VAC	DSA-150-230	M.1300.9617
Digital Amplifier, Rated 7 Amps Continuous, and 14 Amps Peak, 207-528 VAC	DSA-014-460	M.1301.5653
Digital Amplifier, Rated 11 Amps Continuous, and 22 Amps Peak, 207-528 VAC	DSA-022-460	M.1301.5654
Digital Amplifier, Rated 23 Amps Continuous, and 46 Amps Peak, 207-528 VAC	DSA-046-460	M.1301.5657
Digital Amplifier, Rated 34 Amps Continuous, and 68 Amps Peak, 207-528 VAC	DSA-068-460	M.1301.5658
Digital Amplifier, Rated 47 Amps Continuous, and 94 Amps Peak, 207-528 VAC	DSA-094-460	M.1301.5659

DSA Series Positioning Servo Drive Modules.

Description	Model Number	Material Number
2.5 Amp Cont./7.5 Amp Peak Micro DSA	DSA-007-230	M.1300.5810
5 Amp Cont./15 Amp Peak Micro DSA	DSA-015-230	M.1300.5811
10 Amp Cont./30 Amp Peak Micro DSA	DSA-030-230	M.1300.5812
15 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-130-230	M.1300.9618
35 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-175-230	M.1300.9621
65 Amp Cont./150 Amp Peak, 100 - 240 VAC	DSA-150-230	M.1300.9623
Digital Amplifier, Rated 7 Amps Continuous, and 14 Amps Peak, 207-528 VAC	DSA-014-460	M.1301.5670
Digital Amplifier, Rated 11 Amps Continuous, and 22 Amps Peak, 207-528 VAC	DSA-022-460	M.1301.5671
Digital Amplifier, Rated 23 Amps Continuous, and 46 Amps Peak, 207-528 VAC	DSA-046-460	M.1301.5672
Digital Amplifier, Rated 34 Amps Continuous, and 68 Amps Peak, 207-528 VAC	DSA-068-460	M.1301.5673
Digital Amplifier, Rated 47 Amps Continuous, and 94 Amps Peak, 207-528 VAC	DSA-094-460	M.1301.5675

DSA Series SERCOS Servo Drive Modules

Description	Model Number	Material Number
2.5 Amp Cont./7.5 Amp Peak Micro DSA	DSA-007-230	M.1300.5140
5 Amp Cont./15 Amp Peak Micro DSA	DSA-015-230	M.1300.5141
10 Amp Cont./30 Amp Peak Micro DSA	DSA-030-230	M.1300.5142
15 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-130-230	M.1300.9601

Description	Model Number	Material Number
35 Amp Cont./30 Amp Peak, 100 - 240 VAC	DSA-175-230	M.1300.9602
65 Amp Cont./150 Amp Peak, 100 - 240 VAC	DSA-150-230	M.1300.9603
Digital Amplifier, Rated 7 Amps Continuous, and 14 Amps Peak, 207-528 VAC	DSA-014-460	M.1301.5644
Digital Amplifier, Rated 11 Amps Continuous, and 22 Amps Peak, 207-528 VAC	DSA-022-460	M.1301.8656
Digital Amplifier, Rated 23 Amps Continuous, and 46 Amps Peak, 207-528 VAC	DSA-046-460	M.1301.5647
Digital Amplifier, Rated 34 Amps Continuous, and 68 Amps Peak, 207-528 VAC	DSA-068-460	M.1301.5649
Digital Amplifier, Rated 47 Amps Continuous, and 94 Amps Peak, 207-528 VAC	DSA-094-460	M.1301.5650

Drives are not shipped with manuals. Manuals will be included at no charge if requested at time of order.

DSAPro Software

The DSA Drives are configured using DSAPro software. DSAPro is a Windows® based application that allows drive configuration to be done off-line and saved to disk.

Description	Material Number
DSAPro Software	M.1300.9083

AC Line Filters

Use the following table to identify the AC Line Filter for your application.

AC Line Filter Description	AC Line Filter Fuse Block	Material Number	Legacy Number
6 Amp, Single phase, 240V	6 Amp	M.1015.6922	401-30222-00
10 Amp, Single phase, 240V	10 Amp	M.1015.6917	401-30216-00
23 Amp, Single phase, 240V	23 Amp	M.1015.6918	401-30217-00
36 Amp, Single phase, 240V	36 Amp	M.1015.7969	401-34418-00
36 Amp, Three phase, 240V	36 Amp	M.1015.7970	401-34419-00
50 Amp, Single phase, 240V	50 Amp	M.1015.7971	401-34420-00
80 Amp, Three phase, 240V	80 Amp	M.1015.7972	401-34421-00

External Shunt Kits

Use the following table to identify the external shunt kit for your application.

This Shunt Module:	Is used on these DSA Drives:	Material Number:
DSA Dynamic Shunt)	All DSA007-230, DSA015-230, DSA 030-230	M.1016.7046 (legacy number 401-30286-00)
200W External Shunt	All DSA130-230, DSA175-230, DSA1150-230	M.1015.7838 (legacy number 401-34308-00)
900W External Shunt	All DSA175-230, DSA1150-230	M.1015.7047 (legacy number 401-30287-00)

Cables

Use the following tables to identify motor power, feedback, interface, and brake cables for your DSA Drive with 115/230V motors. Material numbers are for 1-foot lengths. Call your Giddings & Lewis representative for other lengths.

Motor Power Cables

Description	Material Number
HSM Series Motor Power Cable, non flex, 16 AWG, straight	M.1301.3968
HSM and FSM Series Motor Power Cable, non flex, 14 AWG, straight	M.1301.3973
HSM and FSM Series Motor Power Cable, non flex, 10 AWG, straight	M.1301.3478
HSM and FSM Series Motor Power Cable, non-flex, 8 AWG, straight	M.1015.7965
XSM Series Motor Power Cable, .5 - 2kW, 16 Gauge	M.1301.3938
XSM Series Motor Power Cable, 3kW, 14 Gauge	M.1301.3956
XSM Series Motor Power Cable,7.5 kW, 10 Guage	M.1301.3962
NSM Series Motor Power Cable	M.1301.3930
NSM 34XX, NSM 42XX, NSM 56XX Motor Power Cable, right angle	M.1015.7051
YSM Series Motor Power Cable	M.1301.3889

SERCOS Interface Fiber Optic Cables

Use the following table to identify the SERCOS interface fiber optic plastic cables for your DSA Drive..

Description	Material Number	Legacy Number
SERCOS Fiber Optic Cable (Material number is for 1-foot length. Call your Giddings & Lewis representative for other lengths.)	M.1016.9743	501-04170-01
SERCOS Heavy-duty Fiber Optic Cable (Material number is for 1.5-foot length. Call your Giddings & Lewis representative for other lengths.)	M.1016.9758	502-04171-01

Motor Feedback Cables

Description	Material Number
HSM and FSM Series Motor Feedback Cable, non-flex, connector at both ends, straight	M.1301.3927
HSM and FSM Series Motor Feedback Cable, non-flex, motor connector to flying leads, straight	M.1301.4015
XSM Series Motor Feedback Cable, non-flex, connector at both ends, straight	M.1301.4021
XSM Series Motor Feedback Cable, non-flex, motor connector to flying leads, straight	M.1301.4026
NSM Series Motor Feedback Cable, non-flex, connector at both ends, straight	M.1301.3993
NSM Series Motor Feedback Cable, non-flex, motor feedback connector to flying leads, straight	M.1301.3998
YSM Series Motor Feedback Cable, non-flex, connector at both ends, straight	M.1301.3983
YSM Series Motor Feedback Cable, non-flex, motor feedback connector to flying leads, straight	M.1301.3988

DSA Drive Interface Cables

Description	Material Number	Legacy Number
Serial Interface Cable, 9-pin D-shell, J3 to personal computer.	M.1016.9514 M.1016.9515 M.1016.9516	502-04020-10 502-04020-25 502-04020-50
Controller Interface Cable, 44-pin D-shell, J1 to no connector.	M.1015.7973 M.1300.3515 M.1300.3516	401-34423-10 401-34423-25 401-34423-50
J5 to J4 (RS-485) for Multi-Drop Communications	M.1016.9517	502-04021-01

Break Out Boards, Cables, and Kits

Use the following table to identify your break out board components.

Description	Masterial Number
Break Out Board, 15-pin, high density D-shell, J2.	M.1301.4060
Break Out Board Cable, 15-pin, high density D-shell, J2. Length of cable *xx* is in meters (01, 03, 09, and 15).	M.1301.4056
Break Out Board Kit. Contains J2 break out board and cable.	M.1301.4052
Drive mounted Break Out Board for 15-pin J2 connector.	M.1301.4039
Break Out Board, 44-pin, high density D-shell, J1.	M.1301.4067
Break Out Board Cable, 44-pin, high density D-shell, J1. Length of cable *xx* is in meters (01, 03, and 09)	M.1301.4064
Break Out Board Kit, Control, J1, DSA	M.1301.4061
Drive mounted Break Out Board, J1	M.1301.4038
Drive mounted Break Out Board, J2	M.1301.4039
Drive mounted Break Out Board, J3.	M.1301.4040

Trooubleshooting Your DSA Drive

Chapter Objectives

This chapter provides a description of maintenance and troubleshooting activities for the DSA Drive. This chapter includes these sections:

- Maintaining the drive
- General troubleshooting
- Troubleshooting for SERCOS drives
- Troubleshooting for DeviceNet drives

Maintaining the Drive

The DSA Drive is designed to function with a minimum of maintenance.

ATTEN-

DC bus capacitors may retain hazardous voltages after input power has been removed, but will normally discharge in several seconds.

Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the warning on the front of the drive.

Failure to observe this precaution could result in severe bodily injury or loss of life.

Periodic Maintenance

Normally the only maintenance required is removal of superficial dust and dirt from the drive and a quick check of cable insulation and connections.

Cleaning the Drive

To clean the drive, use an OSHA approved nozzle that provides compressed air under low pressure, less than 20 kPa (30 psi), to blow the exterior surface and the vents clean.

Inspecting the Cables

Ensure input power is disconnected before touching cables or connections and perform the following:

- Visually inspect all cables for abrasion.
- D-shell connectors should be inspected for proper seating and signal continuity end-to-end.

General Troubleshooting

Refer to the *Error Codes* section below to identify problems, potential causes, and appropriate actions to resolve the problems. If problems persist after attempting to troubleshoot the system, please contact your Giddings & Lewis representative for further assistance. To determine if your DSA Drive has an error, refer to the table below.

If the Logic Power LED is ON and the Status LED display on your:	**Is:**	**Then:**
DSA xxx-xxx-P	Actively cycling segments in a full circle	Your DSA Drive is ready.
DSA xxx-xxx-S	Displaying a fixed 0, 1, 2, 3, or 4	Your DSA Drive is ready.
All drives	Flashing “E” followed by two numbers	Your DSA Drive has an error. Proceed to the section *Error Codes* below.

Error Codes

The following list of problematic symptoms (no error code shown) and problems with assigned error codes is designed to help you resolve problems.

When a fault is detected, the 7-segment LED will display an E followed by the flashing of the two-digit error code, one digit at a time. This is repeated until the problem is cleared.

Error Code	**Problem or Symptom**	**Possible Cause(s)**	**Action/Solution**
	Power (PWR) indicator not ON	No AC power or auxiliary logic power.	Verify power AC power or auxiliary +5V logic power is applied to the DSA Drive.
		Internal power supply malfunction.	Call your Giddings & Lewis representative.
	Motor jumps when first enabled	Motor wiring error.	Check motor wiring.
		Incorrect motor chosen.	Verify the proper motor is selected.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
	Digital I/O not working correctly	I/O power supply disconnected.	Verify connections and I/O power source.
01	Non-Volatile Memory Endurance Exceeded	Range of motion and number of home position definitions during the product life exceeds the maximum allowed (applies only to systems with absolute feedback).	This is an unrecoverable fault, the drive must be sent back to the factory.
02	Velocity Exceeds Position Rollover /2	The velocity command or feedback exceeds half the machine cycle length per millisecond (applies only when the machine cycle position rollover is enabled).	Increase machine cycle size or reduce velocity profile. This error only applies to firmware versions prior to 1.10.
03	Absolute Feedback Range Exceeded	The motor position exceeds +/- 2047 revolutions from the home position (applies only to systems with absolute feedback).	• Decrease application range of motion. • Upgrade firmware.
04	Motor Overtemperature	Motor thermostat trips due to: • High motor ambient temperature and/or • Excessive current	• Operate within (not above) the continuous torque rating for the ambient temperature (40°C maximum). • Lower ambient temperature, increase motor cooling.
		Motor wiring error.	Check motor wiring.
		Incorrect motor selection.	Verify the proper motor has been selected.
05	IPM Fault	Motor cables shorted.	Verify continuity of motor power cable and connector.
		Motor winding shorted internally.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
		DSA Drive temperature too high.	• Check for clogged vents or defective fan. • Ensure cooling is not restricted by insufficient space around the unit.
		Operation above continuous power rating.	• Verify ambient temperature is not too high. • Operate within the continuous power rating. • Reduce acceleration rates.
		DSA Drive has a bad IPM output, short circuit, or overcurrent.	Remove all power and motor connections, and preform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
06	Hardware Overtravel (SERCOS only)	Dedicated overtravel input is inactive.	• Check wiring. • Verify motion profile.
07	Channel BM Line Loss	Motor wiring error.	Check motor encoder wiring.
08	Channel AM Line Loss		
09	Bus Undervoltage	Low AC line/AC power input.	• Verify voltage level of the incoming AC power. • Check AC power source for glitches or line drop. • Install an uninterruptible power supply (UPS) on your AC input.
10	Bus Overvoltage	Excessive regeneration of power. When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the DSA Drive's power supply. The system faults to save itself from an overload.	• Change the deceleration or motion profile. • Use a larger system (motor and DSA Drive). • Use a resistive shunt.
		Excessive AC input voltage.	Verify input is below within specifications.
		Output short circuit.	Remove all power and motor connections, and preform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
		Motor cabling wires shorted together.	Disconnect motor power cables from the drive. If faults stop, replace cable.
		Internal motor winding short circuit.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
11	Illegal Hall State	Incorrect phasing.	Check the Hall phasing.
		Bad connections.	• Verify the Hall wiring. • Verify 5V power supply to the encoder.
12	Home Search Failed	Home sensor and/or marker is outside the over travel limits.	• Check wiring. • Reposition the overtravel limits or sensor.
13	Home Position In Limit	Home sensor, marker, or final home position exceeds a hardware overtravel limit	• Reposition the overtravel limits or home sensor. • Adjust the final home position.
16	Software Overtravel (SERCOS only)	Programmed overtravel limit has been exceeded.	• Verify motion profile. • Verify overtravel settings are appropriate.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
17	User-Specified Current Fault	User-Specified average current level has been exceeded.	Increase to a less restrictive setting.
18	Overspeed Fault	Motor speed has exceeded 125% of maximum rated speed.	• Check cables for noise. • Check tuning.
19	Excess Position Error	Position error limit was exceeded.	• Increase the feed forward gain. • Increase following error limit or time. • Check position loop tuning.
20	Motor Encoder State Error	The motor encoder encountered an illegal transition.	• Replace the motor/encoder. • Use shielded cables with twisted pair wires. • Route the feedback away from potential noise sources. • Check the system grounds.
		Bad encoder.	Replace motor/encoder.
21	Auxiliary Encoder state error	The auxiliary encoder encountered an illegal transition.	• Use shielded cables with twisted pair wires. • Route the encoder cable away from potential noise sources. • Bad encoder - replace encoder. • Check the ground connections.
		Setup time violation for Step/ Direction or CW/CCW input.	Check timing of Step/Direction or CW/CCW inputs to determine if setup time requirements are being met.
22	Motor Thermal Protection Fault	The internal filter protecting the motor from overheating has tripped.	• Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger DSA Drive and motor. • Check tuning.
23	IPM Thermal Protection Fault	The internal filter protecting the drive from over heating has tripped.	• Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger DSA Drive and motor. • Check tuning.
24	Excess Velocity Error	Velocity error limit was exceeded.	• Increase time or size of allowable error. • Reduce acceleration. • Check tuning.

Error Code	Problem or Symptom	Possible Cause(s)	Action/Solution
25	Sensor Not Assigned	Homing or registration motion was attempted without a sensor assigned.	Assign a sensor to a digital input.
26	User-Specified Velocity Fault	User specified velocity level was exceeded.	Increase to a less restrictive setting.
27	Axis Not Homed	Absolute positioning was attempted without homing.	Verify homing sequence.
28	Motor Parameter Error	Parameter loaded from smart encoder or received from SERCOS controller is incompatible with the drive.	• Select a different motor through the SERCOS controller. • Select a different motor.
29	Encoder Output Frequency Exceeded	Encoder output frequency exceeds the maximum user specified value. This only applies when the encoder output is synthesized by the drive.	• Increase the encoder output maximum frequency parameter. • Decrease the encoder interpolation parameter. • Increase the encoder output divider parameter.
30	Encoder Communication Fault	Communication was not established with an intelligent encoder.	• Verify motor selection. • Verify the motor supports automatic identification. • Verify motor encoder wiring.
31	Encoder Communication	ON indicates communication was not established with an intelligent encoder.	• Verify motor selection. • Verify motor encoder wiring.
32	Encoder Data	Encoder data is corrupted.	Replace the motor/encoder.
33	Absolute Position Exceeds Position Rollover	Motion is commanded to a position outside the position rollover range. • An absolute index is initiated that specifies a position outside the position rollover range. • A homing cycle is initiated with the home position outside the position rollover range. • A define home is initiated with the home position outside the position rollover range. • A preset position is initiated that specifies a position outside the position rollover range.	Set motion command to a position within the position rollover range.
All others	RESERVED		Call your local Giddings & Lewis representative.

Troubleshooting for SERCOS Drives

SERCOS Module Status LED

Use the table below for troubleshooting the SERCOS Module Status LED.

If the SERCOS Module Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Normal	Drive is enabled.	Normal operation when drive is enabled.
Flashing Green	Standby	Drive is not enabled.	Normal operation when drive is disabled.
Flashing Red-Green	DC Bus Undervoltage	The DC bus voltage is low.	• Normal operation when using auxiliary power (main AC power is not applied). • When using main AC power, refer to the section *Error Codes* to continue troubleshooting.
Flashing Red	Minor fault	Drive is faulted, but the fault can be cleared.	Refer to the section *Error Codes* to continue troubleshooting.
Steady Red	Unrecoverable fault	Drive is faulted, and the fault cannot be cleared.	Contact your local Giddings & Lewis representative.

SERCOS Network Status LED

Use the table below for troubleshooting the SERCOS Network Status LED.

If the SERCOS Network Status LED is:	Status is:	Potential Cause is:	Possible Resolution is:
Steady Green	Communication ready	No faults or failures.	N/A
Flashing Green	Establishing communication	System is still in the process of establishing SERCOS communication.	Wait for steady green LED status.
		Node address setting on the drive module does not match SERCOS controller configuration.	Verify proper node switch setting.
Flashing Red	No communication	Loose fiber optic connection.	Verify proper fiber optic cable connections.
		Broken fiber optic cable.	Replace fiber optic cable.
		Receive fiber optic cable connected to SERCOS transmit connector and vice versa.	Check proper SERCOS fiber optic cable connections.