Allen-Bradley

Ultra3000
Digital Servo Drives

(Catalog Numbers
2098-DSD-005, -010, and -020
2098-DSD-*xxx*X
2098-DSD-*xxx*-SE
2098-DSD-*xxx*-DN
2098-DSD-*xxx*X-DN

2098-DSD-030, -075, and -150
2098-DSD-*xxx*X
2098-DSD-*xxx*-SE
2098-DSD-*xxx*-DN
2098-DSD-*xxx*X-DN

2098-DSD-HV030, -HV050, -HV100, -HV150, and -HV220
2098-DSD-HV*xxx*X
2098-DSD-HV*xxx*-SE
2098-DSD-HV*xxx*-DN
2098-DSD-HV*xxx*X-DN)

Installation Manual

Rockwell Automation

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley® does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Throughout this manual we use notes to make you aware of safety considerations:

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid a hazard
- recognize the consequences

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

Appendix B

Interconnect Diagrams

Appendix C

Catalog Numbers and Accessories

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
- Allen-Bradley support

Who Should Use this Manual

Use this manual for designing, installing, and wiring your Ultra3000™ Digital Servo Drive (DSD). The manual is intended for engineers or technicians directly involved in the installation and wiring of the Ultra3000.

If you do not have a basic understanding of the Ultra3000, contact your local Allen-Bradley 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 Ultra3000 and standard Rockwell Automation/ Allen-Bradley motors recommended for use with the Ultra3000.

For troubleshooting and system integration with the ControlLogix™ SERCOS interface™ module (1756-M08SE) or motion module (1756-M02AE), refer to the *Ultra3000 Digital Servo Drives Integration Manual* (publication 2098-IN005*x*-EN-P). This manual is available at TheAutomationBookstore.com electronically (as a .pdf) or in hardcopy.

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 Ultra3000	Provides mounting information for the Ultra3000.
2	Ultra3000 Connector Data	Provides I/O, encoder, and serial interface connector locations and signal descriptions.
3	Connecting Your Ultra3000	Provides connection and wiring information for the Ultra3000.
Appendix A	Specifications and Dimensions	Provides physical, electrical, environmental, and functional specifications for the Ultra3000.
Appendix B	Interconnect Diagrams	Provides interconnect diagrams for the Ultra3000.
Appendix C	Catalog Numbers and Accessories	Provides catalog numbers and descriptions of the Ultra3000 and related products.

Related Documentation

The following documents contain additional information concerning related Allen-Bradley products. To obtain a copy, contact your local Allen-Bradley office or distributor.

For:	Read This Document:	Catalog Number:
Information on configuring and troubleshooting your Ultra3000	*Ultra3000 Digital Servo Drives Integration Manual*	2098-IN005*x*-EN-P
Ultraware™ Installation Instructions	*Ultraware CD Installation Instructions*	2098-IN002*x*-EN-P
Information on configuring your Ultra3000 using Ultraware	*Ultraware User Manual*	2098-UM001*x*-EN-P
More detailed information on the use of ControlLogix motion features and application examples	*ControlLogix Motion Module Programming Manual*	1756-RM086*x*-EN-P
ICP 8 Axis SERCOS interface module installation instructions	*ICP 8 Axis SERCOS interface Module Installation Instructions*	1756-IN572*x*-EN-P
The instructions needed to program a motion application	*Logix5000 Controller Motion Instruction Set Reference Manual*	1756-RM007*x*-EN-P
Information on configuring and troubleshooting your ControlLogix motion module	*ControlLogix Motion Module Setup and Configuration Manual*	1756-UM006*x*-EN-P
Information on communicating with the Ultra3000 using DeviceNet™	*Ultra3000 DeviceNet Reference Manual*	2098-RM001*x*-EN-P
Information on attaching Ultra3000 drives to a DeviceNet network	*DeviceNet Cable System Planning and Installation Manual*	DN-6.7.2

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

Allen-Bradley Support

Allen-Bradley offers support services worldwide, with over 75 Sales/ Support Offices, 512 authorized Distributors and 260 authorized Systems Integrators located throughout the United States alone, plus Allen-Bradley representatives in every major country in the world.

Local Product Support

Contact your local Allen-Bradley 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 Allen-Bradley representative or Rockwell Automation Technical Support at (440)-646-5800. Please have the catalog numbers of your products available when you call.

Installing Your Ultra3000

Chapter Objectives

This chapter provides system installation guidelines and procedures for mounting your Ultra3000. This chapter covers the following topics:

- Complying with European Union directives
- Before mounting your system
- Bonding your system
- Mounting your Ultra3000 drive

ATTENTION

The following information is a guideline for proper installation. The National Electrical Code and any other governing regional or local codes overrule this information. The Allen-Bradley Company 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 Ultra3000 system make sure you understand the following:

- how to store your Ultra3000 before installation
- how to unpack the system
- the minimum mounting requirements

Storing Your Ultra3000 Before Installation

The Ultra3000 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 Ultra3000 ships with the following:

- One Ultra3000 drive
- One installation manual (publication 2098-IN003*x*-EN-P)
- One reference manual (publication 2098-RM001*x*-EN-P) for Ultra3000 drives with DeviceNet

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

System Mounting Requirements

There are several things that you need to take into account when preparing to mount the Ultra3000:

- The Ultra3000 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 Ultra3000 must not exceed 55° C (131° F).

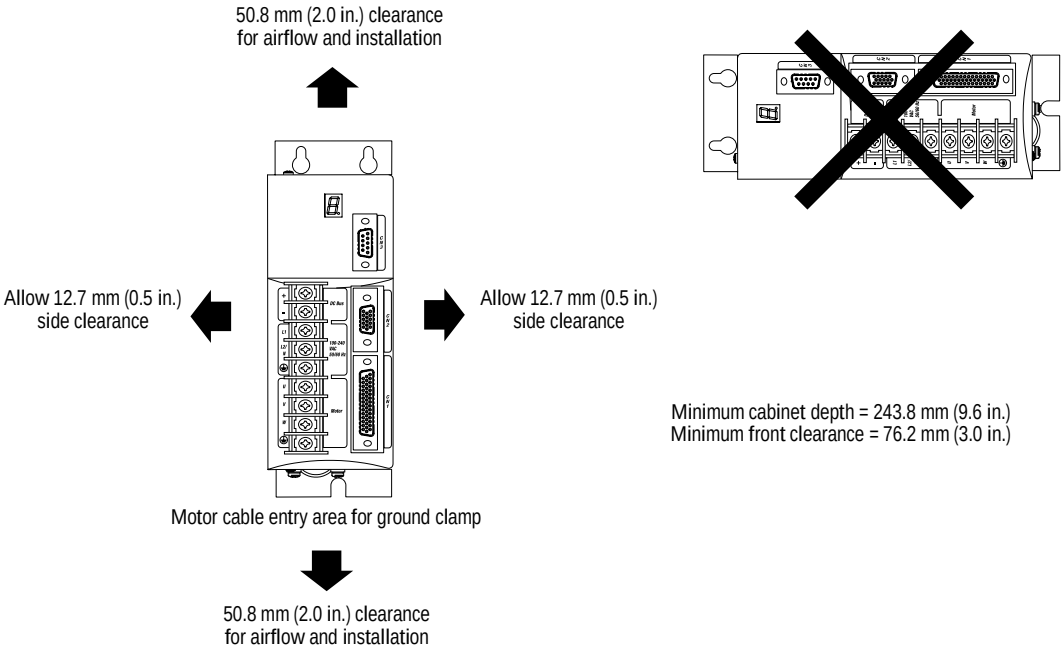
- You must install the panel on a flat, rigid, vertical surface that won't be subjected to shock, vibration, moisture, oil mist, dust, or corrosive vapors.
- You need to maintain minimum clearances (refer to Figure 1.1) for proper airflow, easy module access, and proper cable bend radius.

Refer to *Appendix A* for mounting dimensions, power dissipation, and environmental specifications for the Ultra3000.

Ventilation Requirements

This section provides information to assist you in sizing your cabinet and locating your Ultra3000 drive(s) inside the cabinet.

Figure 1.1
Minimum Clearance Requirements



IMPORTANT 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 contaminates.

Refer to *Appendix A* for Ultra3000 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 Ultra3000 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 an Ultra3000, simply add the kW ratings together from each calculation to get a system kW total.

IMPORTANT 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.

IMPORTANT If you are using the Rockwell Automation/ Allen-Bradley 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 Ultra3000/motor combination and use the values for the worst case continuous speed and torque.

IMPORTANT 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: sizing a transformer to the voltage requirements of an 2098-DSD-020 and MPL-A320P motor:

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

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

Transformer Size = 2.1 KVA

The speed/torque curve information for 230V motors is based upon an Ultra3000 input voltage of 230V ac. For a 115V ac input voltage, the maximum speed can be reduced up to one half.

Fuse Sizing

The Ultra3000 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 Ultra3000 utilizes solid state motor short circuit protection rated as shown in the table below.

Drive Models:	Short Circuit Current Rating with No Fuse Restrictions:	Short Circuit Current Rating with Fuse Restrictions:
2098-DSD-*xxx*-*xx* or *xxx*X-*xx*	Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240V maximum.	Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, 240V maximum, when protected by high interrupting capacity, current limiting fuses (Class CC, G, J, L, R, T).
2098-DSD-HV*xxx*-*xx* or HV*xxx*X-*xx*	Suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 480V maximum.	Suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, 480V maximum, when protected by high interrupting capacity, current limiting fuses (Class CC, G, J, L, R, T).

Bonding Your System

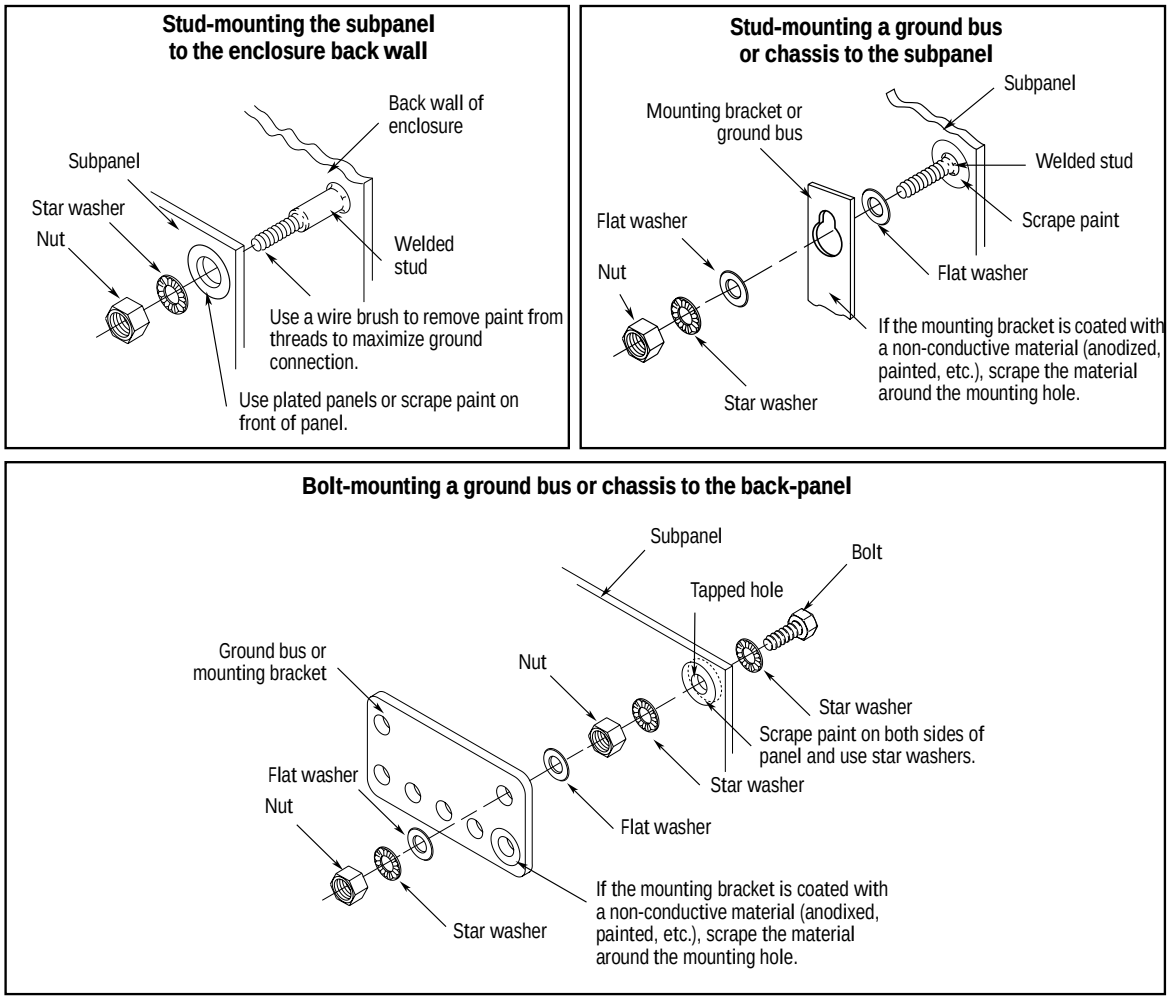
Bonding is the practice of connecting metal chassis, assemblies, frames, shields and enclosures to reduce the effects of electromagnetic interference (EMI).

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 effect 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.

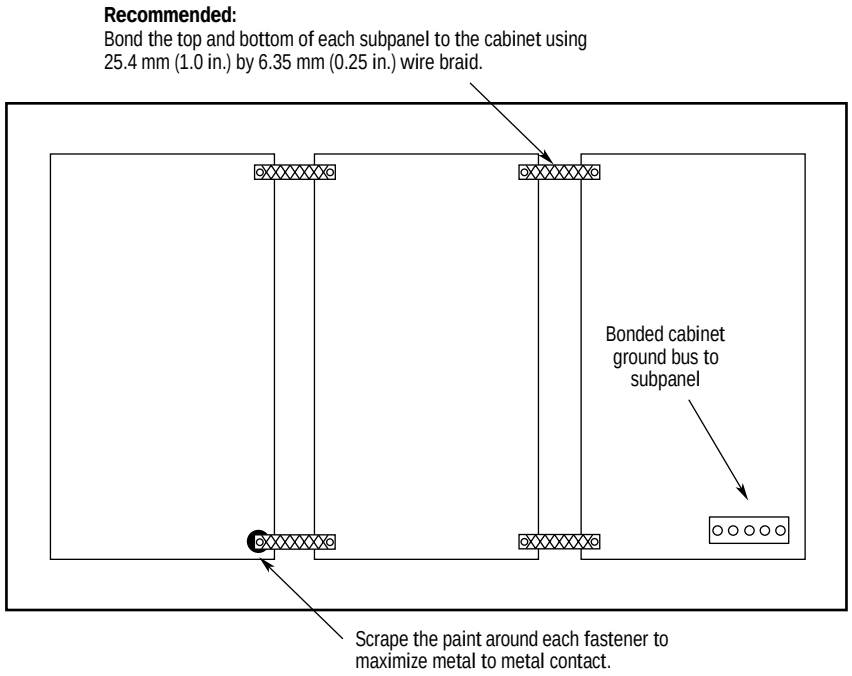
Figure 1.2
Recommended Bonding Practices



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 Ultra3000 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.

ATTENTION

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. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD Protection Handbook.

To mount your Ultra3000 drive:

1. Layout the positions for the Ultra3000 and accessories in the enclosure. Mounting hole dimensions for the Ultra3000 are shown in *Appendix A*.

2. Attach the Ultra3000 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.

Ultra3000 Connector Data

Chapter Objectives

This chapter provides I/O, encoder, and serial interface connector locations and signal descriptions for your Ultra3000. This chapter includes:

- Understanding Ultra3000 connectors
- Understanding Ultra3000 I/O specifications
- Understanding motor encoder feedback specifications
- Understanding auxiliary encoder feedback specifications
- Understanding the serial interface

Understanding Ultra3000 Connectors

The following table provides a brief description of the Ultra3000 front panel connectors and describes the connector type.

Designator	Description	Connector
CN1	User Input/Output	44-pin high-density D-shell
CN2	Motor Feedback	15-pin high-density D-shell
CN3	Serial Port	9-pin standard D-shell
TB	DC bus, Motor and AC power	9-position screw style barrier terminal strip (2098-DSD-005*x-xx*, -010*x-xx*, and -020*x-xx*)
TB1	DC bus, Motor, AC power, and auxiliary AC power	11- or 12-position screw style barrier terminal strip (2098-DSD-030*x-xx*, -075*x-xx*, -150*x-xx*, HV*xxx-xx*, and HV*xxx*X-*xx*)
TB2	Shunt	3-position screw style barrier terminal strip (2098-DSD-030*x-xx*, -075*x-xx*, -150*x-xx*, HV*xxx-xx*, and HV*xxx*X-*xx*)

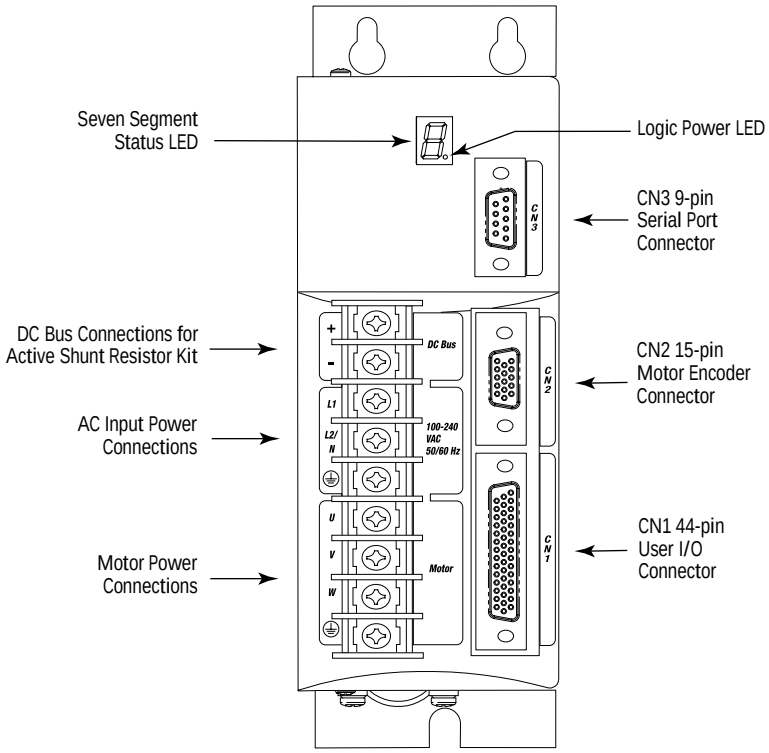
All signal connections on the Ultra3000 use commonly available D-shell type connectors.

For connector pin-outs and the location of connectors, switches, and status LEDs on:	Refer to:
2098-DSD-*xxx* and -HV*xxx* Ultra3000 drives	Figures 2.1-2.4 and the tables that follow on pages 2-2 through 2-9.
2098-DSD-*xxx* and -HV*xxx* Ultra3000 drives with SERCOS interface	Figures 2.5-2.8 and the tables that follow on pages 2-10 through 2-17.
2098-DSD-*xxx* and -HV*xxx* Ultra3000 drives with DeviceNet interface	Figures 2.9-2.12 and the tables that follow on pages 2-18 through 2-25.

Ultra3000 Front Panel Connections

Use the figure below to locate the front panel connections on the Ultra3000 230V drives (500W, 1 kW, and 2 kW).

Figure 2.1
Ultra3000 Front Panel Connections
for 2098-DSD-005, -005X, -010, -010X, -020, and -020X



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

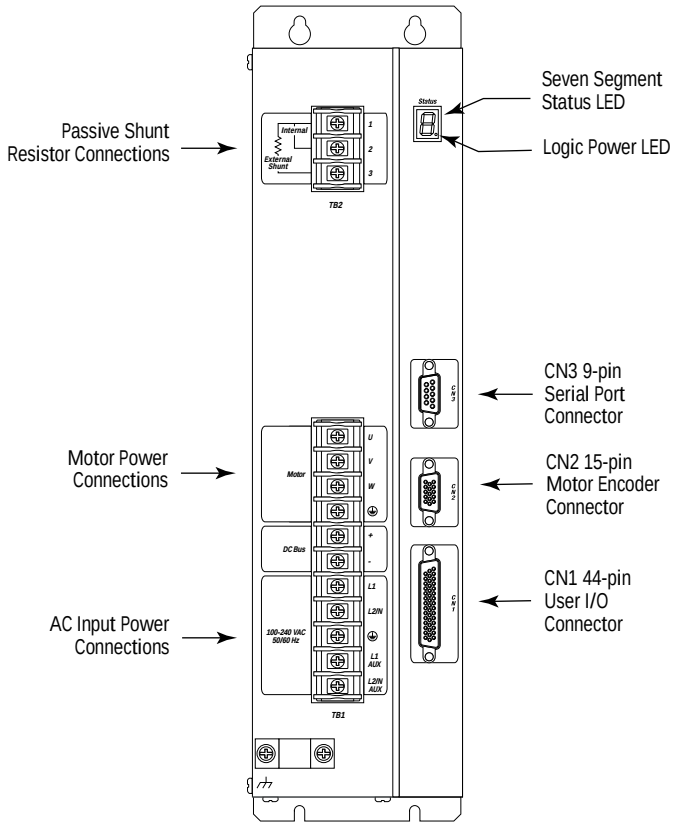
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 230V drives (3 kW).

Figure 2.2
Ultra3000 Front Panel Connections for 2098-DSD-030 and -030X



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

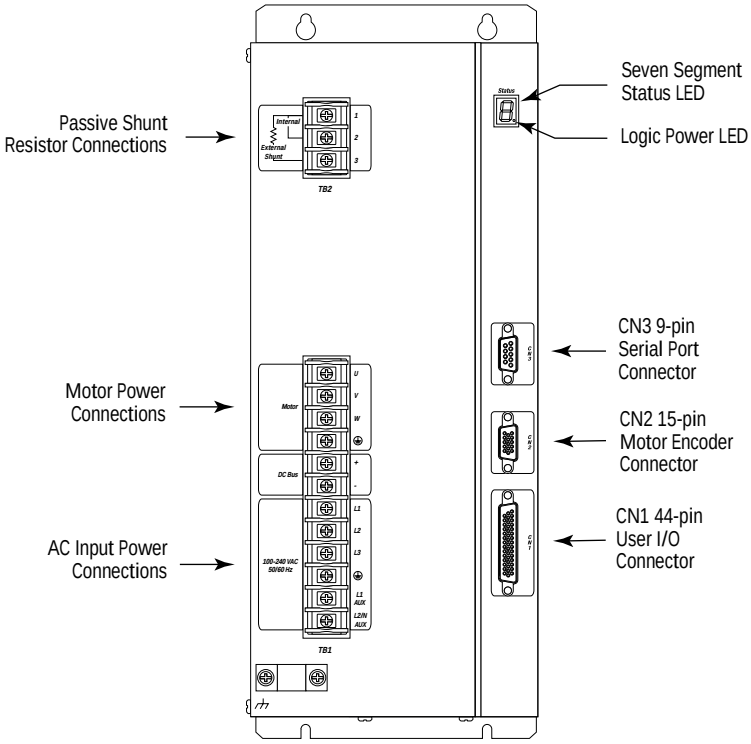
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 230V (7.5 and 15 kW).

Figure 2.3
Ultra3000 Front Panel Connections for 2098-DSD-075, -075X, -150, and -150X



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

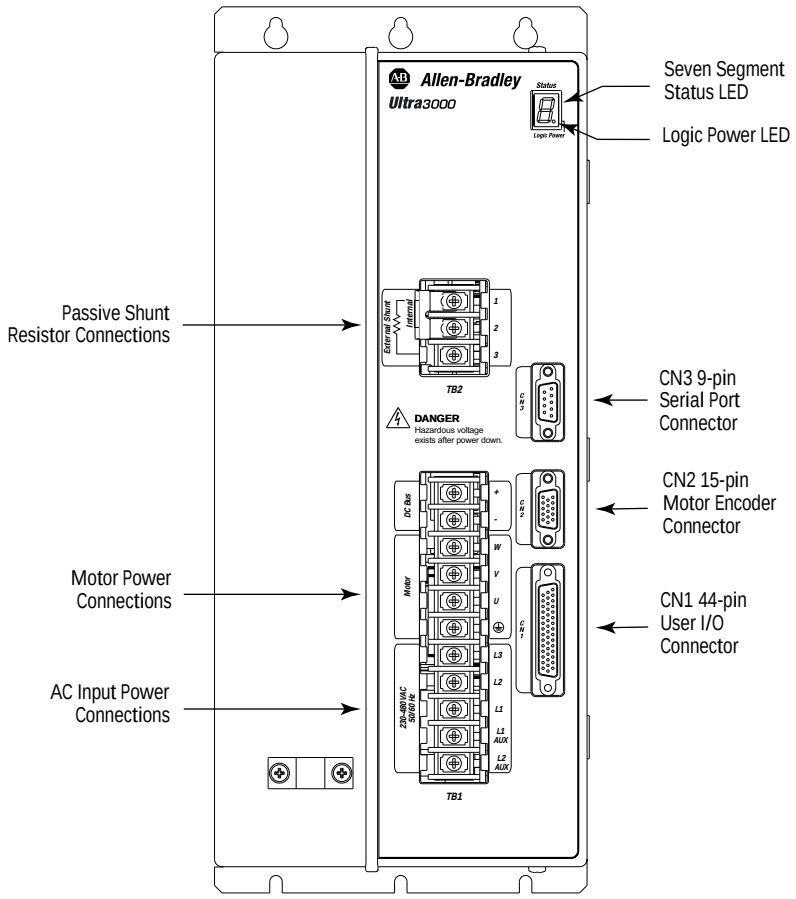
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 460V drives (3W, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 2.4
Ultra3000 Front Panel Connections for 2098-DSD-HV*xxx* and HV*xxx*X



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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 CN2 motor encoder (15-pin) connector.

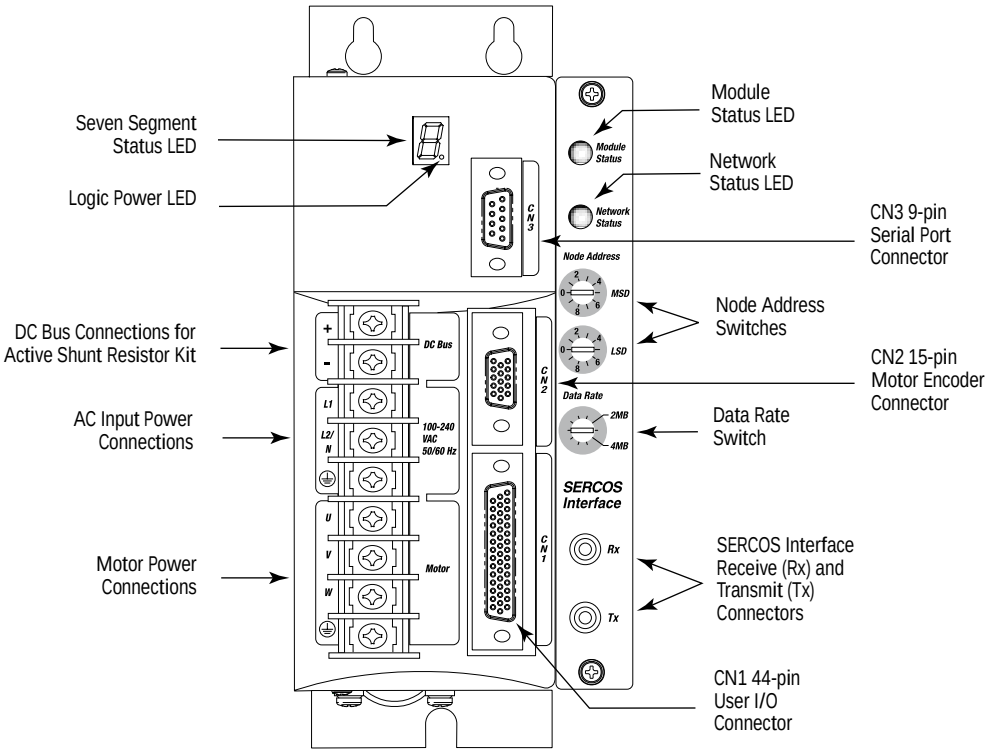
CN2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

CN2 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

Ultra3000 (with SERCOS) Front Panel Connections

Use the figure below to locate the front panel connections on the Ultra3000 with SERCOS interface 230V drives (500W, 1 kW, and 2 kW).

Figure 2.5
Ultra3000 Front Panel Connections for 2098-DSD-005-SE, -010-SE, and -020-SE



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

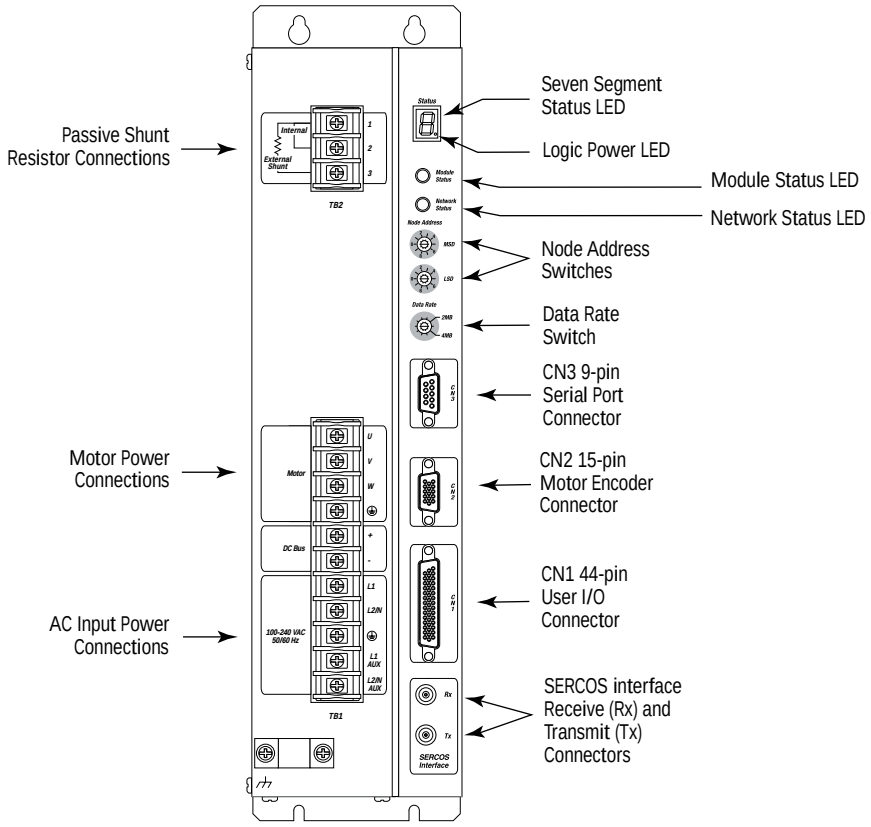
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with SERCOS interface 230V drive (3 kW).

Figure 2.6
Ultra3000 Front Panel Connections for 2098-DSD-030-SE



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

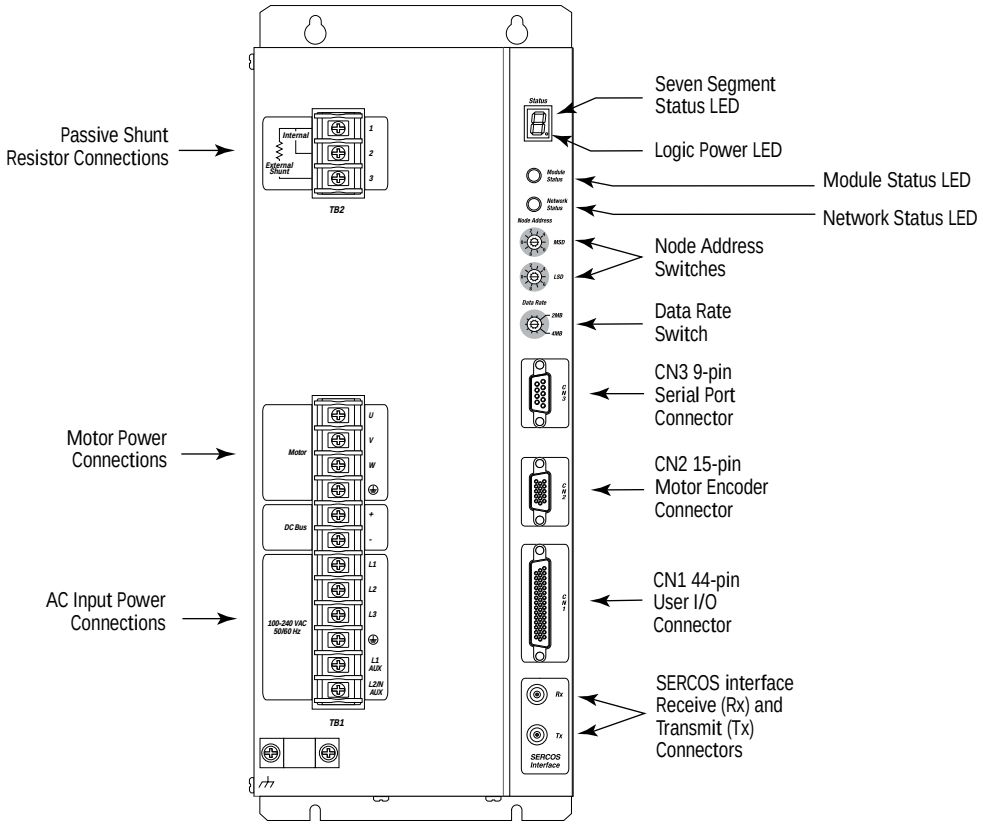
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with SERCOS interface 230V drives (7.5 and 15 kW).

Figure 2.7
Ultra3000 Front Panel Connections for 2098-DSD-075-SE and -150-SE



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

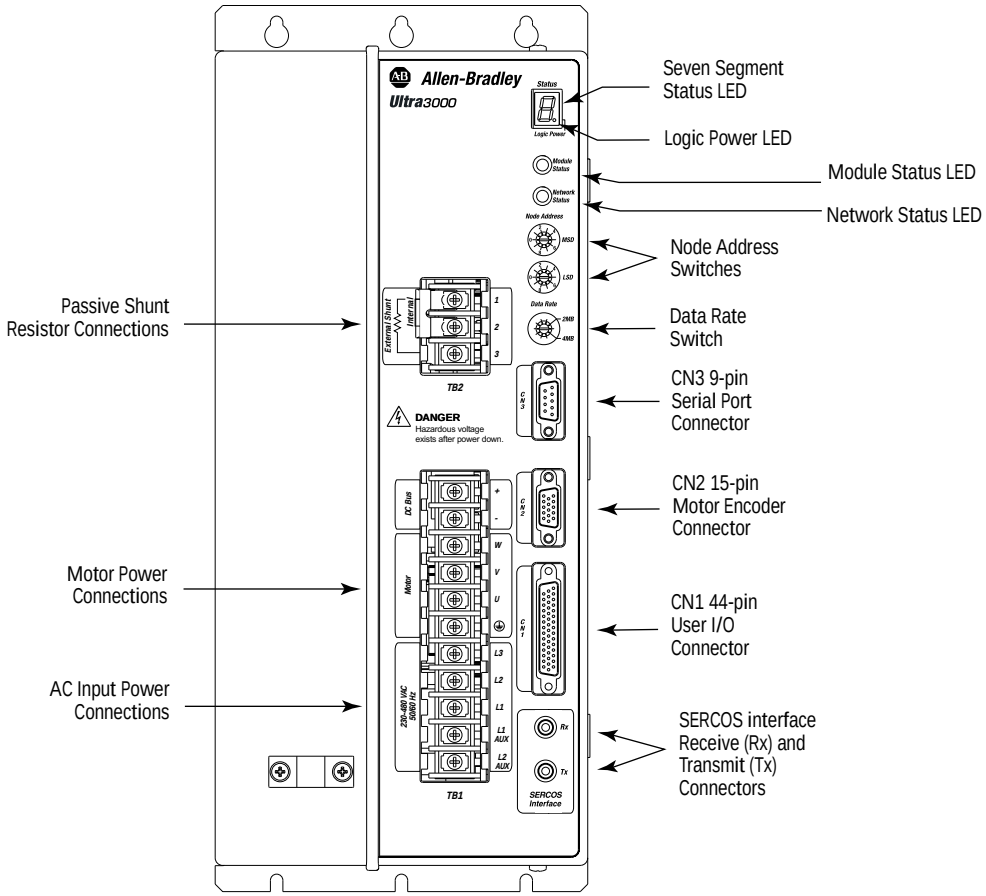
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with SERCOS interface 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 2.8
Ultra3000 Front Panel Connections for 2098-DSD-HV*xxx*-SE



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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 CN2 motor encoder (15-pin) connector.

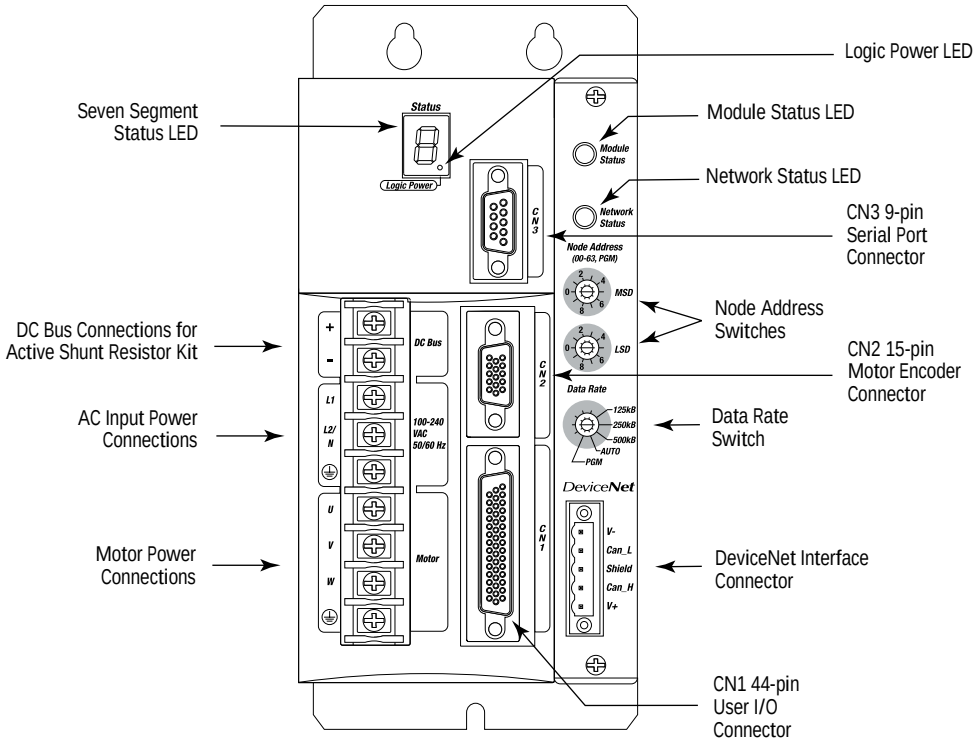
CN2 Pin	Description	Signal
1	Channel A+	AM+
2	Channel A-	AM-
3	Channel B+	BM+
4	Channel B-	BM-
5	Channel I+	IM+
6	Common	ECOM
7	Encoder Power (+9V)	EPWR_9V
8	Commutation Channel S3	S3

CN2 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

Ultra3000 (with DeviceNet) Front Panel Connections

Use the figure below to locate the front panel connections on the Ultra3000 with DeviceNet Interface 230V drives (500W, 1 kW, and 2 kW).

Figure 2.9
Ultra3000 Front Panel Connections
for 2098-DSD-005-DN, -005X-DN, -010-DN, -010X-DN, -020-DN, and -020X-DN



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

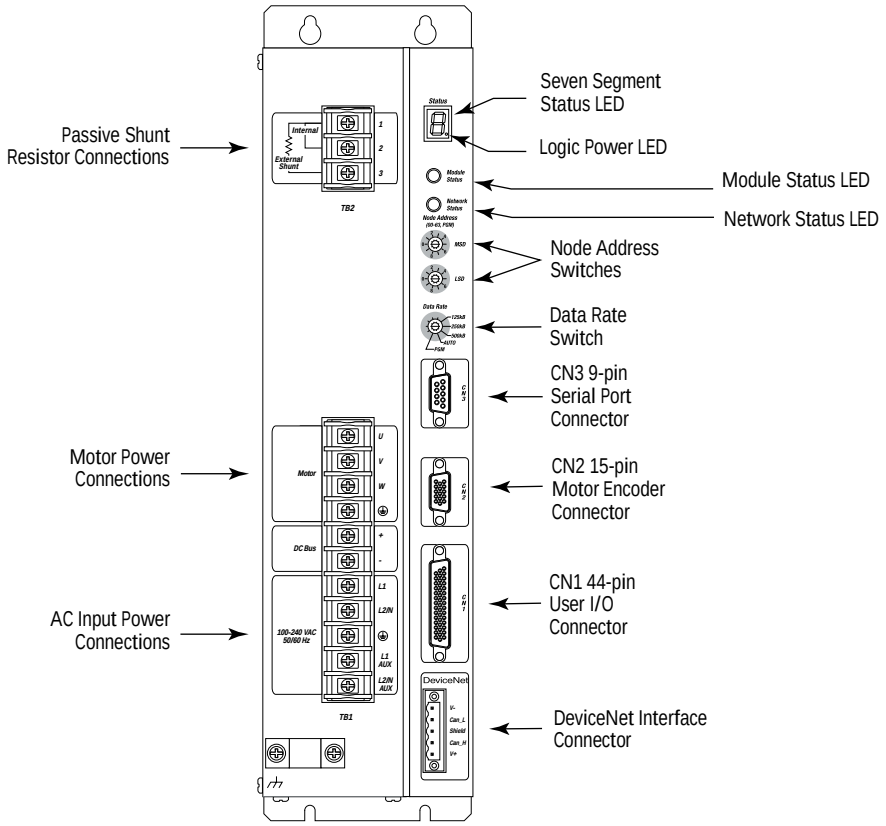
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with DeviceNet Interface 230V drives (3 kW).

Figure 2.10
Ultra3000 Front Panel Connections for 2098-DSD-030-DN and -030X-DN



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

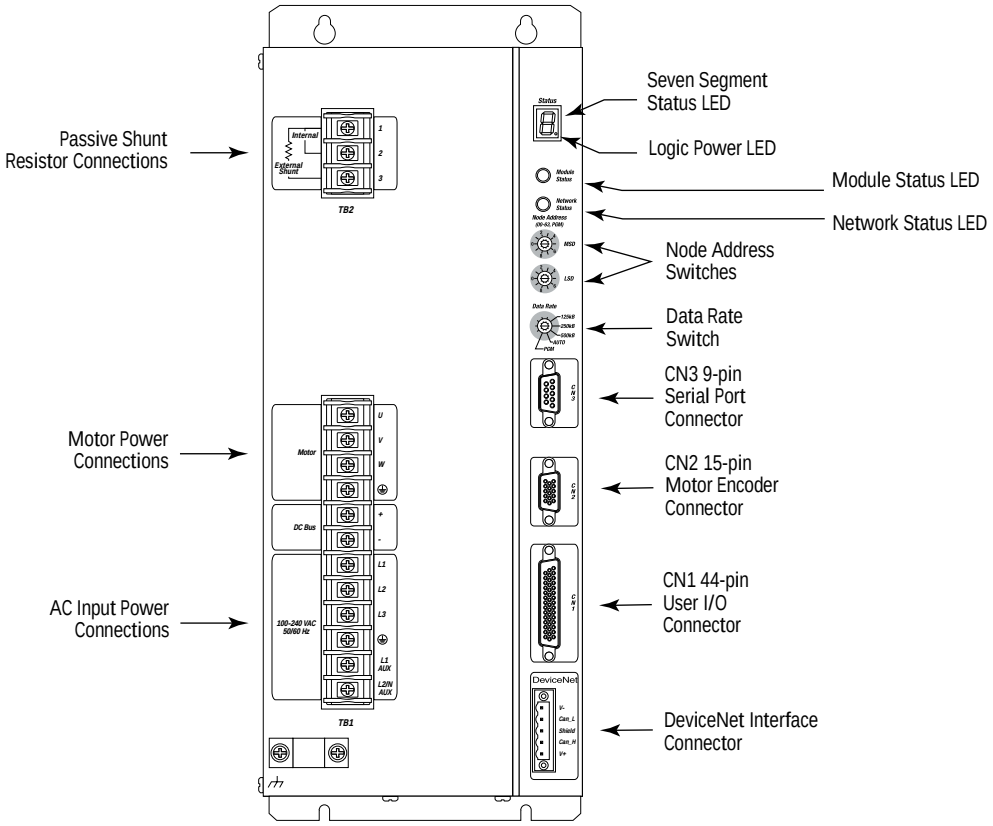
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with DeviceNet Interface 230V drives (7.5 and 15 kW).

Figure 2.11
Ultra3000 Front Panel Connections
for 2098-DSD-075-DN, -075X-DN, -150-DN, and -150X-DN



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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

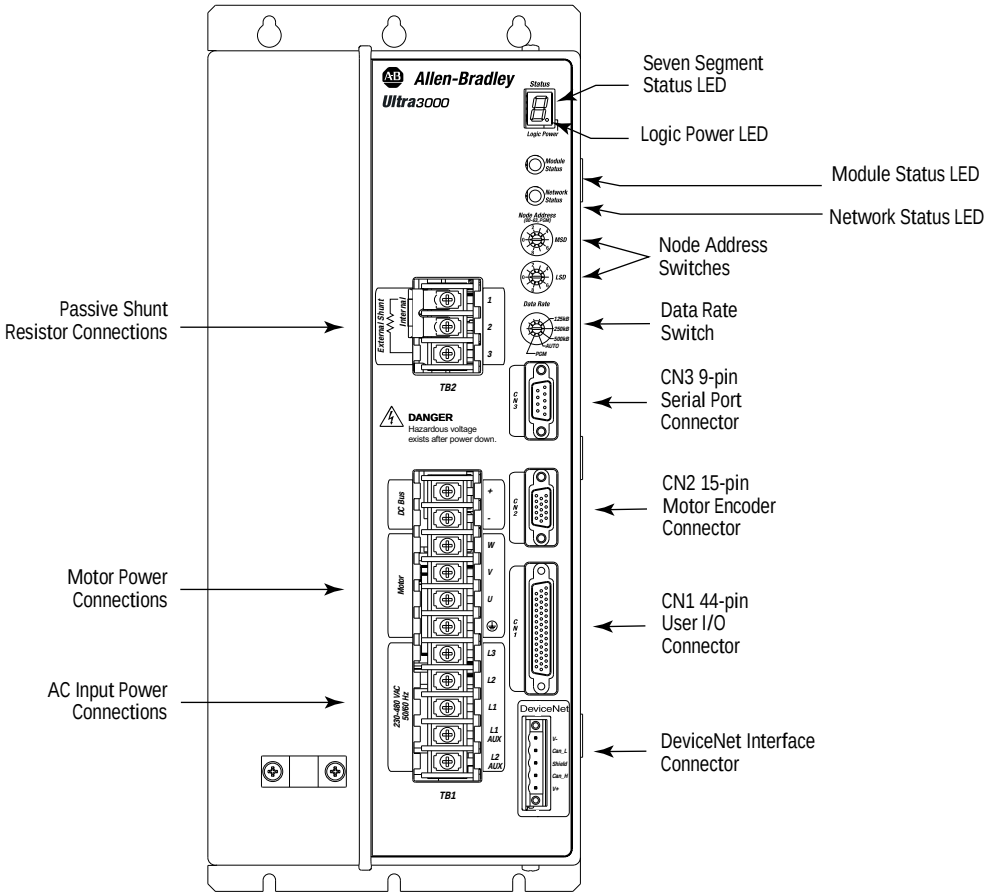
The following table provides the signal descriptions and pin-outs for the CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 with DeviceNet Interface 460V drives (3 kW, 5 kW, 10 kW, 15 kW, and 22 kW).

Figure 2.12
Ultra3000 Front Panel Connections for 2098-DSD-HV*xxx*-DN and HV*xxx*X-DN



Serial Port Connector

The following table provides the signal descriptions and pin-outs for the CN3 serial port (9-pin) connector.

CN3 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 CN1 I/O (44-pin) connector.

CN1 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

CN1 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 CN2 motor encoder (15-pin) connector.

CN2 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

CN2 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 Ultra3000 I/O Specifications

A description of the Ultra3000 input/output is provided on the following pages.

Digital I/O Power Supply

All Ultra3000 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

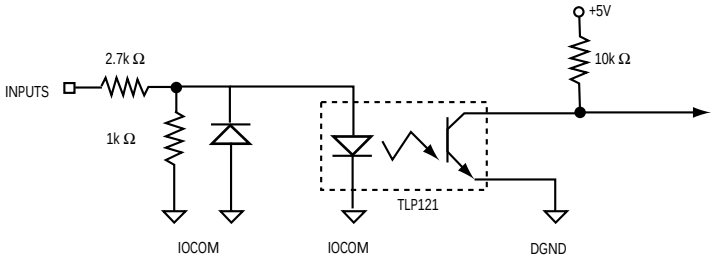
There are eight opto-isolated digital inputs. On non-SERCOS drives, any input can be configured for a variety of functions using Ultraware. On SERCOS drives, the following inputs have dedicated functionality.

IMPORTANT Overtravel limit input devices must be normally closed.

Pin	Signal	Description
CN1-31	ENABLE	Drive Enable Input, an active state enables the power electronics to control the motor.
CN1-32	HOME	Home Sensor, an active state indicates to a homing sequence that the sensor has been seen.
CN1-33 CN1-34	REG1 REG2	Registration Sensor, a transition is used to record position values.
CN1-37 CN1-38	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 2.13.

Figure 2.13
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

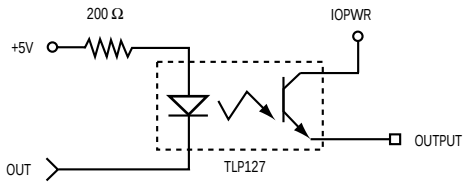
Digital Outputs

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 2.14, and the configuration of the relay output is shown in Figure 2.15.

IMPORTANT There is no overload protection on the transistor outputs.

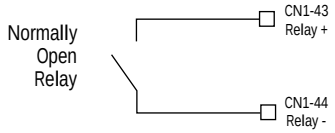
Figure 2.14
Transistor Output Hardware Configuration



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 2.15
Relay Output Hardware Configuration



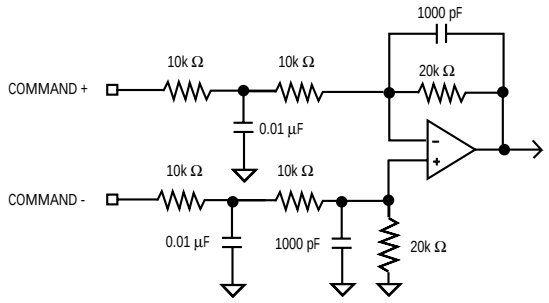
The following table provides a description of the relay output specifications.

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 2.16.

Figure 2.16
Analog COMMAND Input Configuration



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

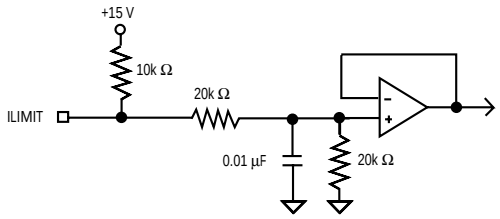
Parameter	Description	Minimum	Maximum
Resolution	Number of states that the input signal is divided into which is $2^{(\text{to the number of bits})}$.	14 bits	—
Input Impedance	Open circuit impedance measured between the + and - inputs.	20 kΩ	—
Input Signal Range	Voltage applied to the input	-10V	+10V
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 2.17.

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 2.17
Analog ILIMIT Input Configuration



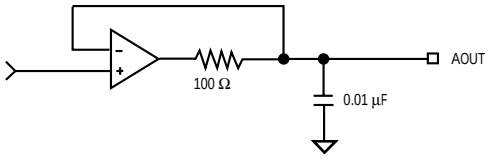
The following table provides a description of the analog ILIMIT input specifications.

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 Ultra3000 includes a single analog output that can be configured through software to represent drive variables. Figure 2.18 shows the configuration of the analog output. The following table provides a description of the analog output.

Figure 2.18
Analog Output Configuration



IMPORTANT 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 at0V.	—	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 Ultra3000 (2098-DSD-005, -010, and -020) 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 re-applied.

IMPORTANT Only the 2098-DSD-005, -010, and -020 models support an auxiliary +5V logic supply since an auxiliary AC input is not available. Refer to the chapter *Connecting Your Ultra3000* 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 CN1-2 and CN1-3.

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	—

IMPORTANT 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.

IMPORTANT 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 Ultra3000 can accept motor encoder signals from the following types of encoders:

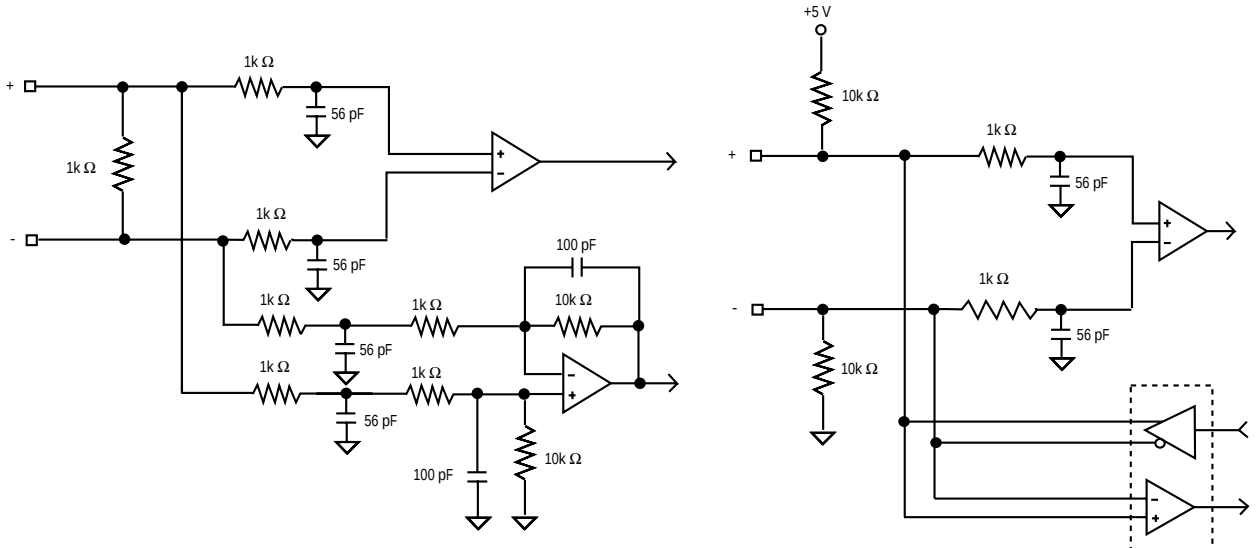
- Incremental encoders with TTL outputs, with or without Hall signals
- Sine/Cosine encoders, with or without Hall signals
- Intelligent absolute encoders
- Intelligent high-resolution encoders
- Intelligent incremental encoders

Note: The intelligent absolute, high-resolution, and incremental encoders are available only in Allen-Bradley 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 2.19 for a schematic of the AM, BM, and IM inputs.

Figure 2.19
Schematic of the Motor Encoder Inputs



The Ultra3000 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°

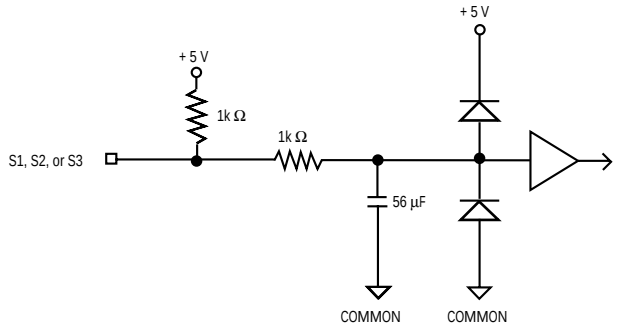
The following table provides a description of the AM and BM inputs for Sine/Cosine encoders.

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 Ultra3000 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 2.20 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 2.20
Hall Input Configuration



Thermostat Input

The Ultra3000 can monitor a thermostat signal from a motor and will generate a fault if the motor overheats. Figure 2.21 shows the configuration of the thermostat input. Figure 2.22 on page 2-36 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 2.21
Thermostat Input Configuration

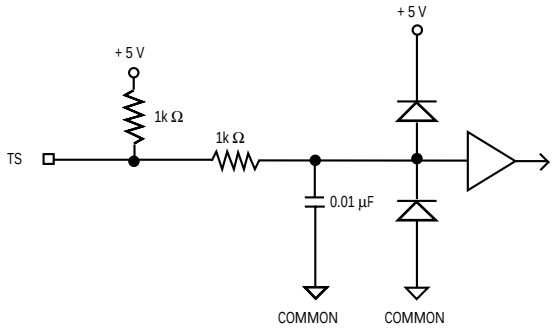
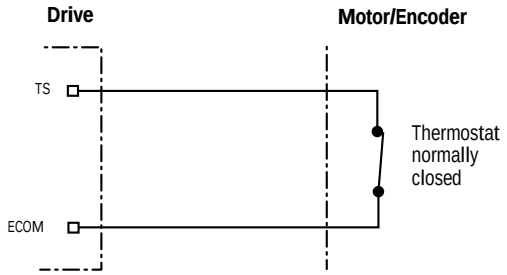


Figure 2.22
Typical Thermostat Connection



+ Limit and - Limit Inputs

The Ultra3000 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 2.23 shows the configuration of the +Limit and -Limit inputs. Figure 2.24 shows a typical connection to a motor with integral limit switches.

Figure 2.23
+ Limit and - Limit Input Configuration

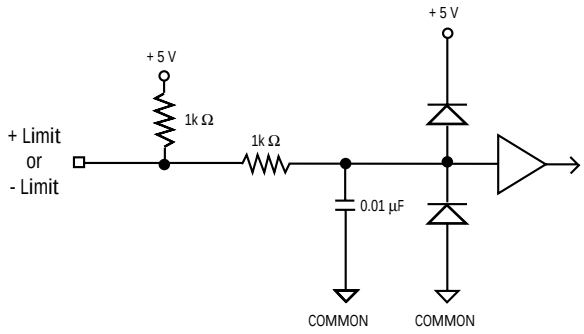
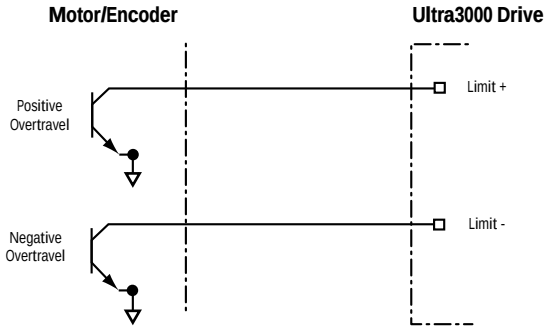


Figure 2.24
Typical + Limit and - Limit Connection



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 2.25 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 2.26 shows an example where the Hall signals have an offset of 60 degrees.

Figure 2.25
Sequencing and Phasing of the Hall Signals

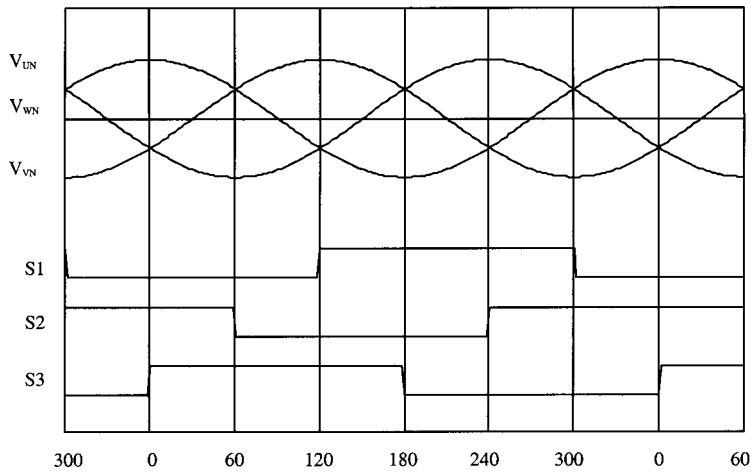


Figure 2.26
Sequencing and Phasing of the Hall Signals (60° Hall Offset Example)

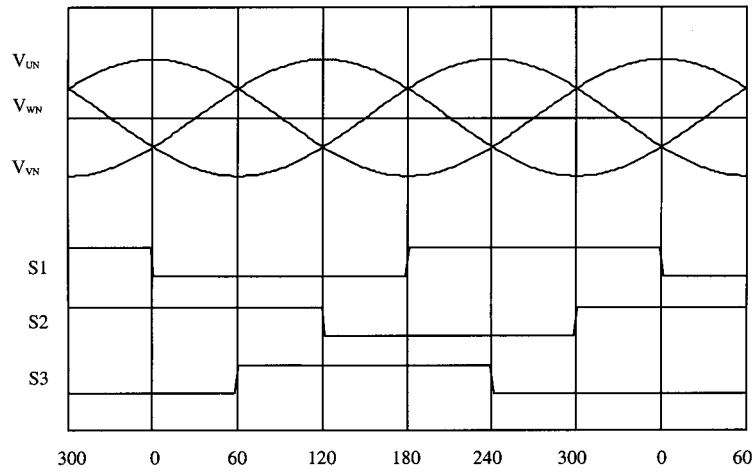


Figure 2.27 shows the proper phasing of TTL A/B encoder signals when positive current is applied.

Figure 2.27
Phasing of TTL A/B Encoder Signals

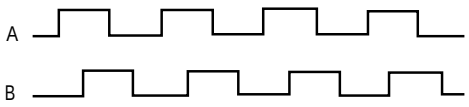
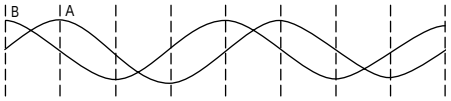


Figure 2.28 shows the proper phasing of Sine/Cosine encoder signals when positive current is applied.

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

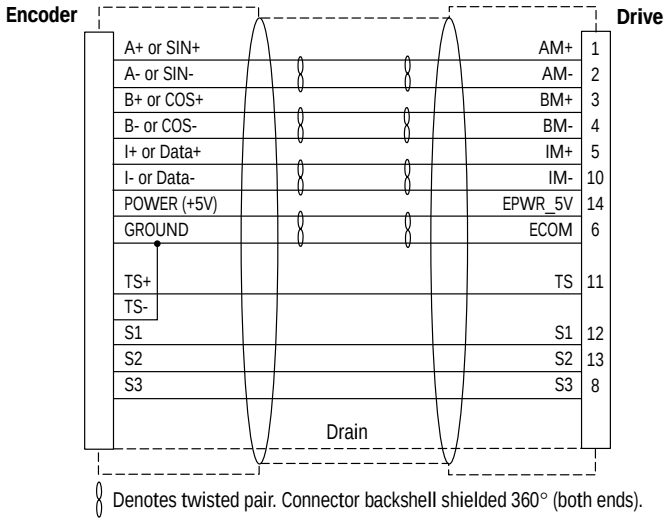
Figure 2.28
Phasing of Sine/Cosine Encoder Signals



Motor Encoder Connection Diagram

Figure 2.29 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 Ultra3000 drive/motor interconnect diagrams.

Figure 2.29
Drive/Motor Wiring Diagram



IMPORTANT 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

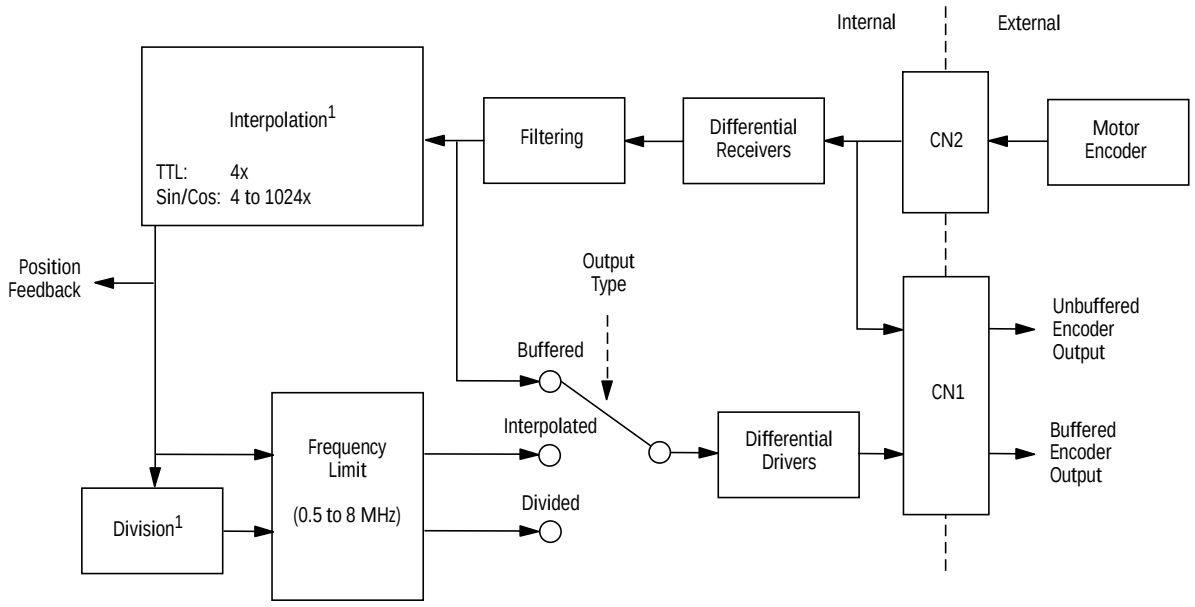
The Ultra3000 passes the motor encoder signals directly to the controller connector without any conditioning. This allows the controller to access these signals directly. Figure 2.30 shows the configuration of the Ultra3000 encoder outputs.

Buffered Motor Encoder Outputs

The Ultra3000 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 2.30 shows the configuration of the Ultra3000 encoder outputs.

Figure 2.30
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 Ultra3000 can accept an auxiliary encoder signal of the following types.

Figure 2.31
Auxiliary Encoder Input Signal Types

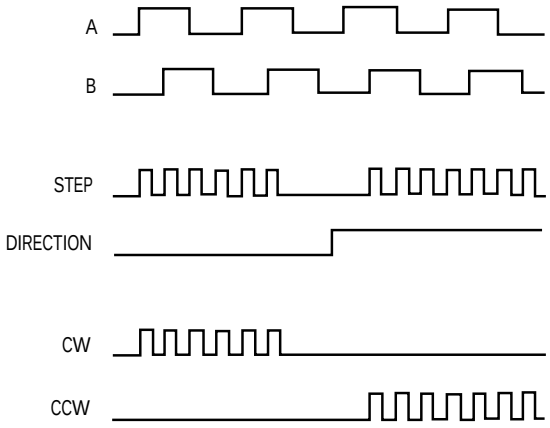
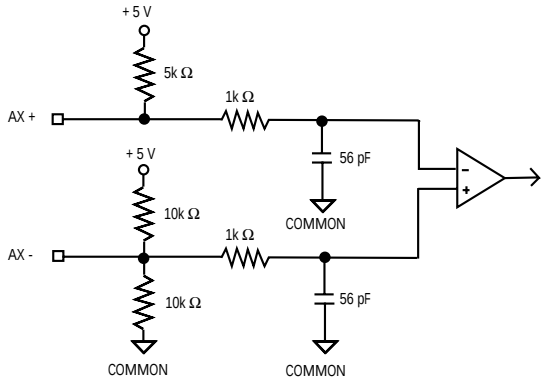


Figure 2.32 shows the configuration of the AX Auxiliary Encoder Input channel. The BX and IX channels have the same configuration.

Figure 2.32
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	—

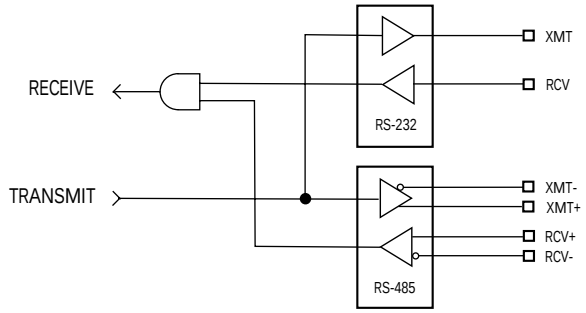
Understanding the Serial Interface

The Ultra3000 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 1,200, 2,400, 4,800, 9,600, 19,200, and 38,400 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 2.33 for the serial interface configuration.

Figure 2.33
Serial Interface Configuration



Default Serial Interface Settings

The default setting of the Ultra3000 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 Ultra3000 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.

IMPORTANT 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 Ultra3000

Chapter Objectives

This chapter provides procedures for wiring your Ultra3000 and making cable connections. This chapter includes:

- Understanding basic wiring requirements
- Grounding your Ultra3000
- Wiring your Ultra3000

Understanding Basic Wiring Requirements

This section contains basic wiring information for the Ultra3000.

ATTENTION

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.

IMPORTANT

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.

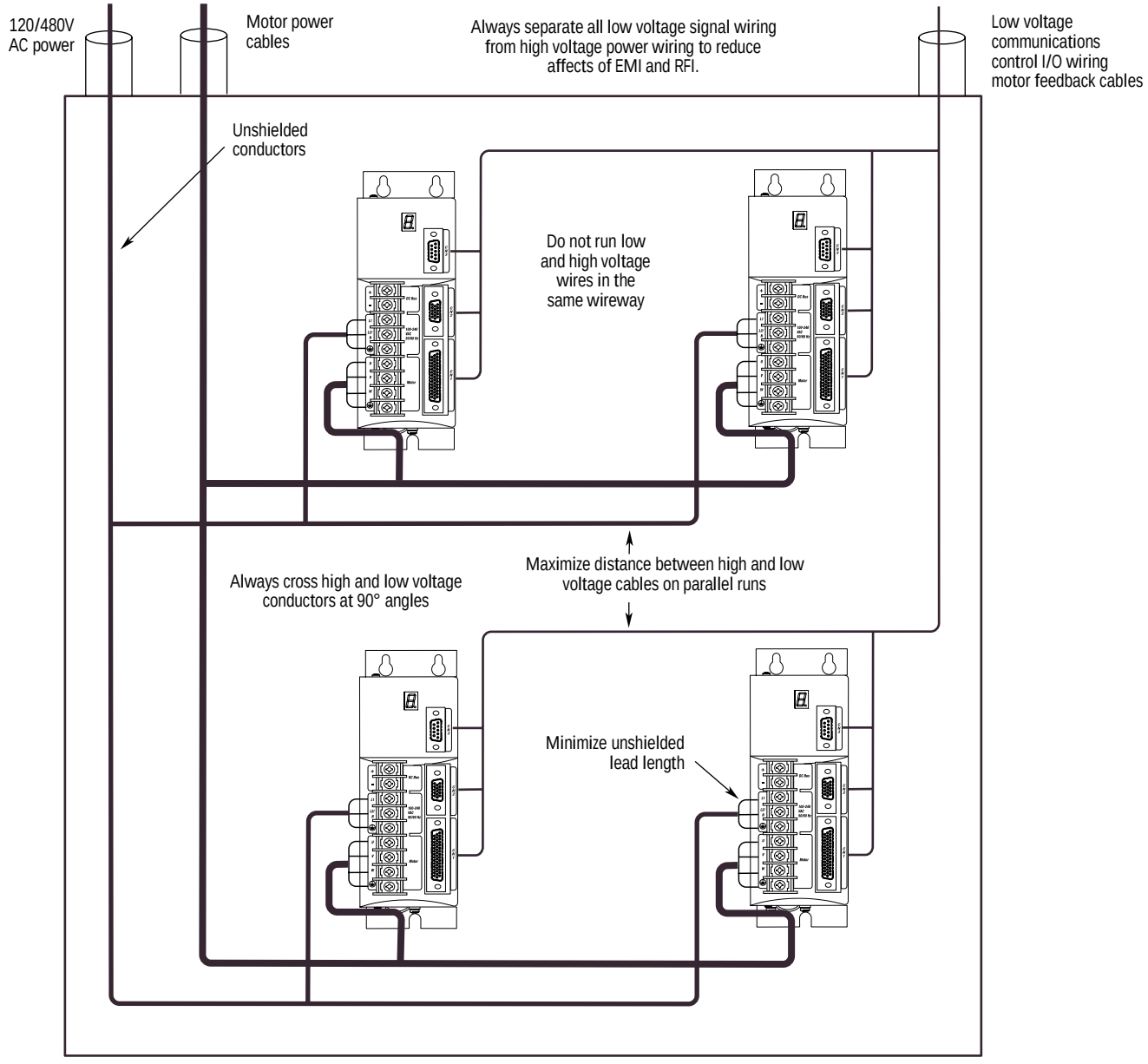
Refer to *Appendix C* for mating connector kit catalog numbers.

IMPORTANT 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 Ultra3000

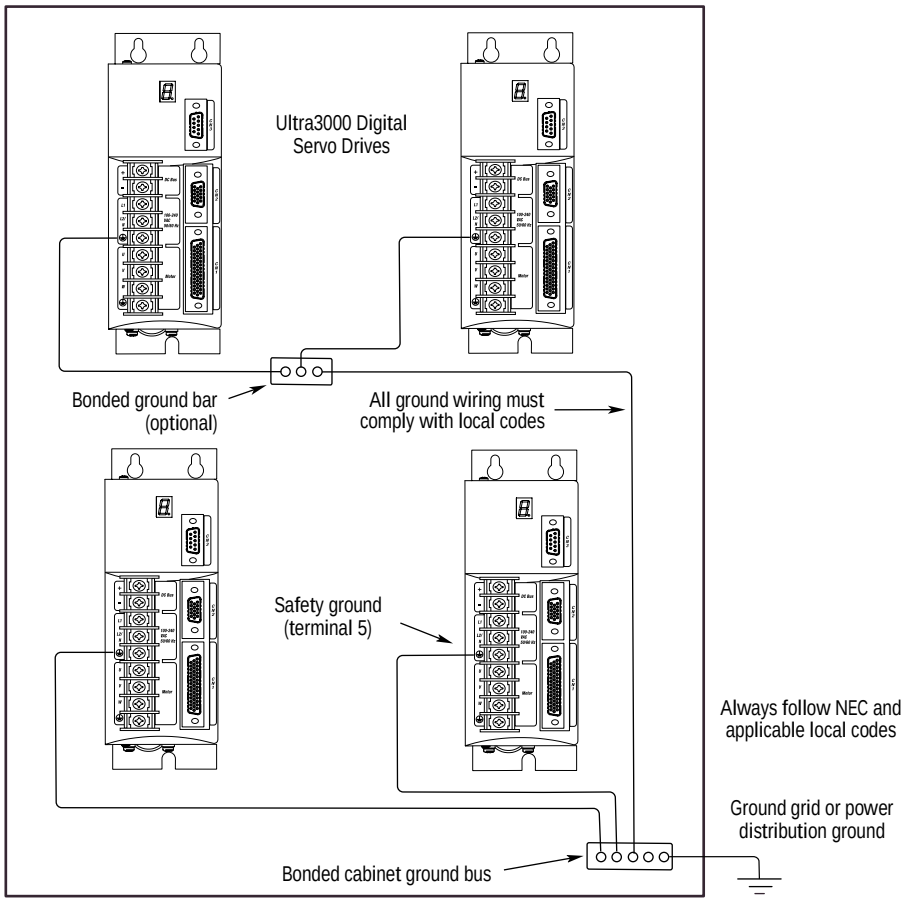
We recommend that all equipment and components of a machine or process system have a common earth ground point connected to their chassis. A grounded system provides a safety ground path for short circuit protection. Grounding your modules and panels minimize shock hazard to personnel and damage to equipment 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

ATTENTION

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 Ultra3000. Refer to *Appendix B* for the power wiring diagram for your Ultra3000 drive.

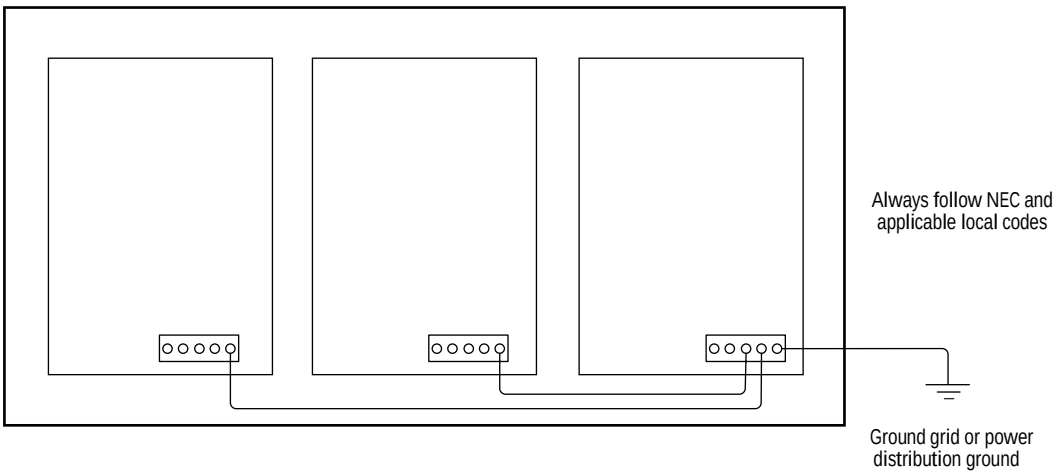
Figure 3.2
Safety Ground Configuration with Multiple Ultra3000 Systems on One Panel



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 F-Series, H-Series, MP-Series, and N-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.

ATTENTION

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)

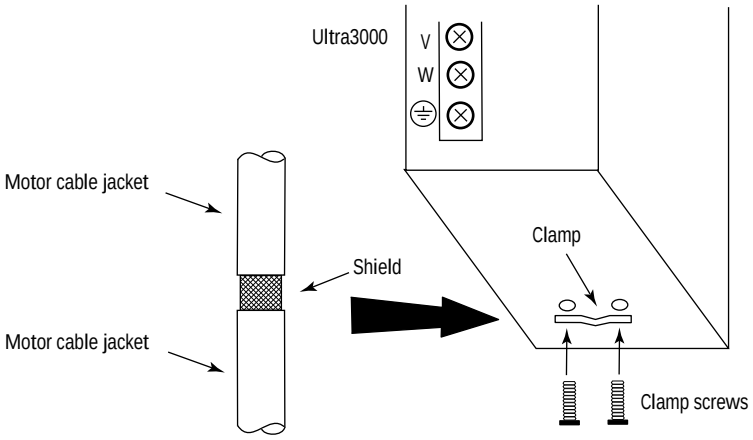
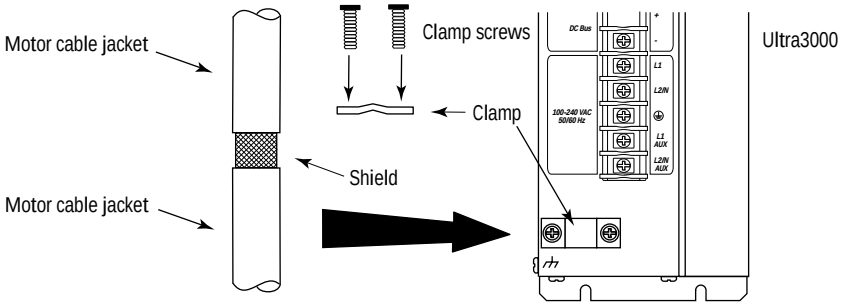
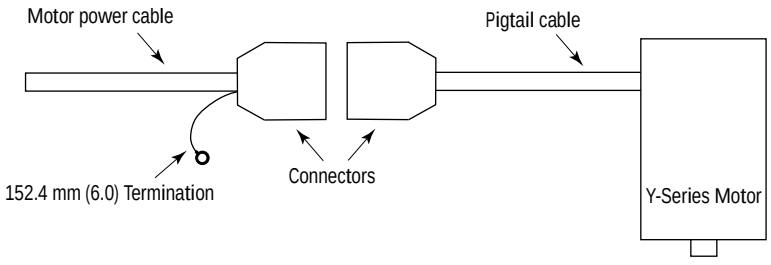


Figure 3.5
Motor Power Cable Shield Connection (front of drive)



Y-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
Y-Series Motor Power Cable Connection



Wiring Your Ultra3000

These procedures assume you have bonded and mounted your Ultra3000 to the subpanel and that there is no power applied to the system.

ATTENTION

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. If you are not familiar with static control procedures, refer to Allen-Bradley publication 8000-4.5.2, *Guarding Against Electrostatic Damage* or any other applicable ESD Protection Handbook.

The following sections provide information and procedures on how to wire your Ultra3000.

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	CN1
15-pin, D-shell, Motor Encoder Feedback cable	CN2
9-pin, D-shell, Serial Port cable	CN3

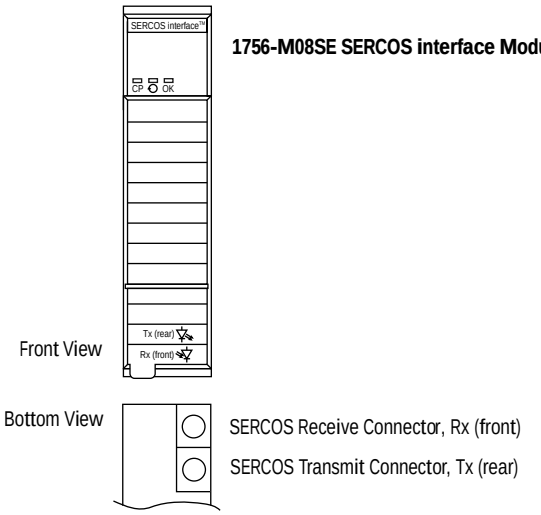
Connecting Your SERCOS Fiber Optic Cables

This procedure assumes you have your ControlLogix chassis with 1756-M08SE interface and Ultra3000 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 *Ultra3000 Connector Data* to locate the connectors on your Ultra3000 drive and Figure 3.7 to locate the connectors on your 1756-M08SE interface module.

Refer to Figure 3.8 for an example of fiber optic ring connections between the Ultra3000 drive and the 1756-M08SE interface module.

Figure 3.7
SERCOS Fiber Optic Connections



To connect the SERCOS fiber optic cables:

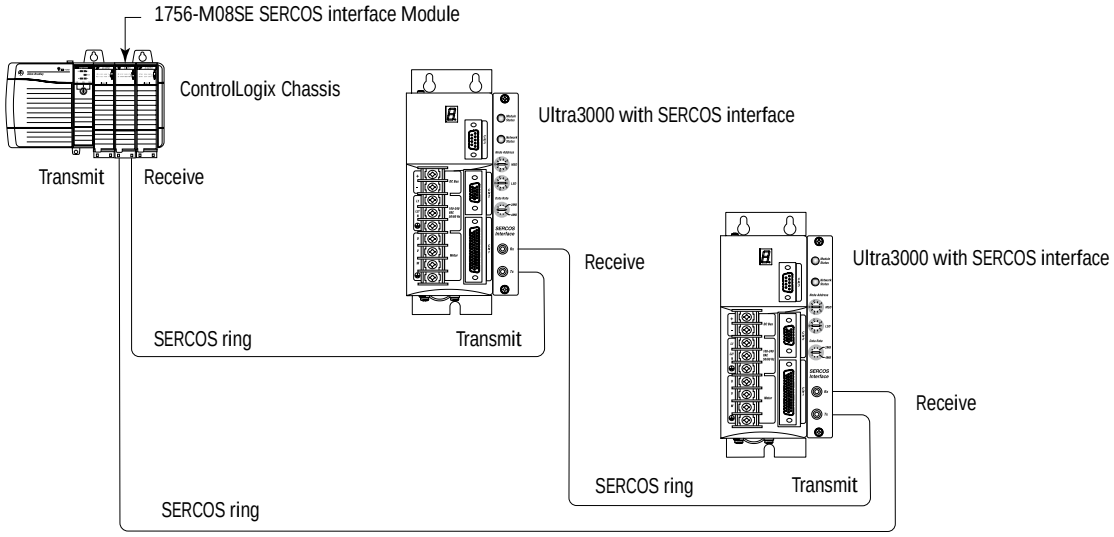
1. Insert one end of a fiber optic cable into the Receive SERCOS connector on the Ultra3000 drive.
2. Thread the connector on finger tight.
3. Insert the other end of the cable (from step 1) into the Transmit SERCOS connector on the 1756-M08SE interface module.
4. Thread the connector on finger tight.
5. Insert one end of another fiber optic cable into the Transmit SERCOS connector on the Ultra3000 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 1756-M08SE interface module.

8. Thread the connector on finger tight.

Note: Fiber optic cable lengths of 1.0 m (3.2 ft) to 32 m (105.0 ft) are available in plastic or glass. Lengths of 50 m (164.2 ft) to 200 m (656.7 ft) are available in glass only.

Figure 3.8
Fiber Optic Ring Connection Example



Connecting to a DeviceNet Network

A DeviceNet network is an arrangement of electrical power and device distribution. A DeviceNet network is planned and adjusted for optimal communications.

Before proceeding to add devices, you need to record the following:

- Network data rate
- Network cable system map (topology) to which you are connecting
- Distances between cable system components
- Device current draw and voltage drop for each device on the network
- Limitation of the trunk and drop cables

Refer to the table below for recommended trunk and drop lengths.

Data Rates	125 Kbps	250 Kbps	500 Kbps
Thick Trunk Line	500 m (1,640 ft)	250 m (820 ft)	100 m (328 ft)
Thin Trunk Lengths	100 m (328 ft)	100 m (328 ft)	100 m (328 ft)
Maximum Drop Length	6 m (20 ft)	6 m (20 ft)	6 m (20 ft)
Cumulative Drop Budget	156 m (512 ft)	78 m (256 ft)	39 m (128 ft)

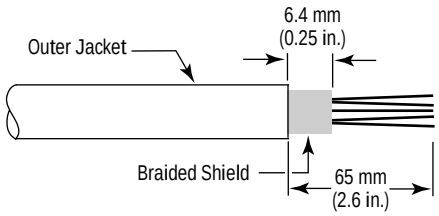
Refer to the *DeviceNet Cable System Planning and Installation Manual* (publication DN-6.7.2) for specific guidance in calculating and attaching the Ultra3000 to a network.

Connecting Your DeviceNet Cable

To attach a plugable, open style, screw-connector to the DeviceNet cable:

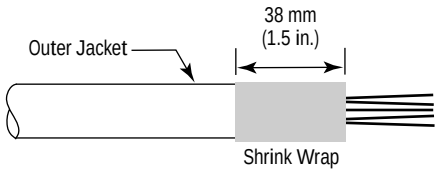
1. Strip 65 mm (2.6 in.) to 75 mm (2.96 in.) of the outer jacket from the end of the cable, leaving no more than 6.4mm (0.25 in.) of the braided shield exposed.

Figure 3.9
Exposing the braided shield



2. Wrap the end of the cable with 38 mm (1.5 in.) of shrink wrap, covering part of the exposed wires and part of the outer jacket.

Figure 3.10
Adding shrink wrap

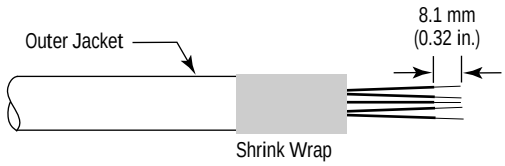


3. Strip 8.1 mm (0.32 in.) of the insulation from the end of each of the insulated wire.

   Note: Be careful not to nick, cut, or otherwise damage the individual strands of wire.

   Trim the last 6.5 mm (0.26 in.) of the bare wires so that the outside dimension does not exceed 0.17 mm (0.045 in.).

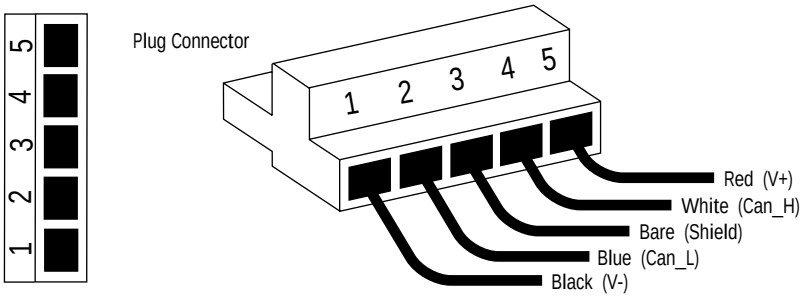
Figure 3.11
Exposing wire stands



4. Insert each wire into the appropriate clamping cavity of the plugable screw connector, according to the color of the cable insulation. Tighten the clamping screws to secure each wire.

5. Use an 1/8 inch flat blade screwdriver to firmly attach wires in the connector.

Figure 3.12
Wiring the DeviceNet Connector



Terminal	Cable Color	Designation
5	Red	V +
4	White	Can_H
3	Bare	Shield
2	Blue	Can_L
1	Black	V -

6. Attach the Ultra3000 with DeviceNet to the DeviceNet network.

Wiring Power Connections

Power wiring requirements are given in the table below.

Ultra3000 Drives:	Provide this input power:[1]	With this type of wire:	Phasing of main AC power:	Earth ground connection:	Terminal block torque values:	
					TB1	TB2
2098-DSD-005*x-xx*, -010*x-xx*, and -020*x-xx*	100-240V ac single phase	Copper with 75° C (194° F) minimum rating	Arbitrary	Required (for safe and proper system operation)	1.25 Nm (11 lb-in.)	N/A
2098-DSD-030*x-xx*						1.25 Nm (11 lb-in.)
2098-DSD-075*x-xx*	100-240V ac 3-phase					
2098-DSD-150*x-xx*					2.26 Nm (20 lb-in.)	
2098-DSD-HV*xxx-xx*, and -HV*xxx*X-*xx*	207-528V ac 3-phase				1.25 Nm (11 lb-in.)	

[1] The input power may be optionally isolated through a transformer.

For additional information refer to the *General Power Specifications* section in *Appendix A*. Refer to *Appendix B* for the power wiring diagram for your Ultra3000 drive.

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 Ultra3000 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.

ATTENTION

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.

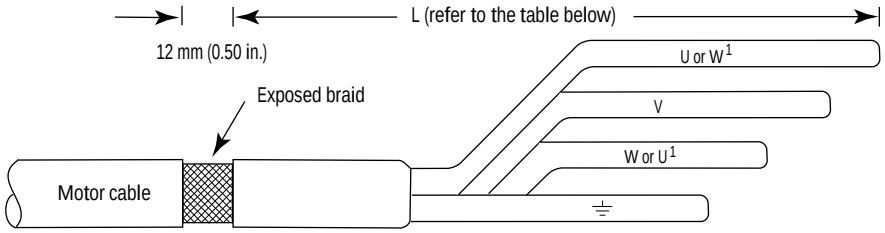
To wire your input power and motor connections:

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

IMPORTANT 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 Ultra3000 drive by exposing 12 mm (0.50 in.) of cable shield braid, as shown in Figure 3.13.

Figure 3.13
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 Ultra3000 drives:	The dimension L is:
2098-DSD-005*x*-*xx* 2098-DSD-010*x*-*xx* 2098-DSD-020*x*-*xx* 2098-DSD-030*x*-*xx* 2098-DSD-075*x*-*xx*	185 mm (7.25 in.)
2098-DSD-HV*xxx*-*xx* and -HV*xxx*X-*xx*	
2098-DSD-150*x*-*xx*	241 mm (9.50 in.)

3. Using a screw driver, 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 Ultra3000 drive.

Terminal Block Locations (2098-DSD-005*x*-*xx*, -010*x*-*xx*, -020*x*-*xx*)	Terminal Block Locations (2098-DSD-030*x*-*xx*)	Terminal Block Locations (2098-DSD-075*x*-*xx* and -150*x*-*xx*)	Terminal Block Locations (2098-DSD-HV*xxx*-*xx* and -HV*xxx*X-*xx*)
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. Refer to the table on page 3-12 for torque values.

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

6. Attach the plastic cover to terminal block.

IMPORTANT The DC bus connections should not be used for connecting multiple drives together. Contact your Allen-Bradley representative for further assistance if the application may require DC power connections.

7.

If your motor is:	Then:
F-Series, H-Series, MP-Series, or N-Series	1. Remove the two screws securing the cable clamp on the Ultra3000 drive (refer to figures 3.4 or 3.5 for the cable clamp location on your Ultra3000 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.
Y-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.

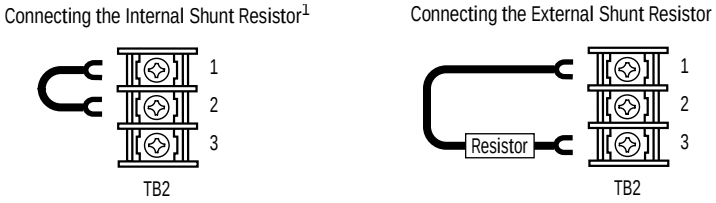
8.

If your Ultra3000 catalog number begins with:	Then:
2098-DSD-005 2098-DSD-010 2098-DSD-020	You are finished wiring your Ultra3000 power connections.
2098-DSD-030 2098-DSD-075 2098-DSD-150 2098-DSD-HV*xxx*-*xx*, and -HV*xxx*X-*xx*	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 *Ultra3000 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 *Ultra3000 Connector Data*).

Figure 3.14
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:

- Ultra3000 specifications
- Dimensions

Ultra3000 Specifications

The following sections provide specifications for the Ultra3000.

General Power Specifications

The table below lists general power specifications and requirements for the Ultra3000 230V drives (2098-DSD-005*x*-*xx*, -010*x*-*xx*, and -020*x*-*xx*).

Specification	Description		
	2098-DSD-005*x*-*xx*	**2098-DSD-010*x*-*xx***	**2098-DSD-020*x*-*xx***
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 Ultra3000 230V drives (2098-DSD-030*x*-*xx*, -075*x*-*xx*, and -150*x*-*xx*).

Specification	Description		
	2098-DSD-030*x*-*xx*	**2098-DSD-075*x*-*xx***	**2098-DSD-150*x*-*xx***
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 Ultra3000 460V drives (2098-DSD-HV030*x-xx*, -HV050*x-xx*, -HV100*x-xx*, -HV150*x-xx*, and -HV220*x-xx*).

Specification	Description				
	2098-DSD-HV030*x-xx*	**2098-DSD-HV050*x-xx***	**2098-DSD-HV100*x-xx***	**2098-DSD-HV150*x-xx***	**2098-DSD-HV220*x-xx***
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 2098-HV*xxx* -*xx* and -HV*xxx*X-*xx* (460V) 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 2098-DSD-005*x*-*xx* 2098-DSD-010*x*-*xx* 2098-DSD-020*x*-*xx* 2098-DSD-030*x*-*xx* 2098-DSD-075*x*-*xx* 2098-DSD-150*x*-*xx* 2098-DSD-HV030*x*-*xx* 2098-DSD-HV050*x*-*xx* 2098-DSD-HV100*x*-*xx* 2098-DSD-HV150*x*-*xx* 2098-DSD-HV220*x*-*xx*	 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 (31.0 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 Ultra3000. Typical heat losses run approximately one-half maximum power losses. The maximum power losses are shown below.

Catalog Number	Maximum Loss (Watts)
2098-DSD-005, -005X, -005-SE, -005-DN, -005X-DN	48 + dissipative shunt
2098-DSD-010, -010X, -010-SE, -010-DN, -010X-DN	48 + dissipative shunt
2098-DSD-020, -020X, -020-SE, -020-DN, -020X-DN	50 + dissipative shunt
2098-DSD-030, -030X, -030-SE, -030-DN, -030X-DN	150 + dissipative shunt
2098-DSD-075, -075X, -075-SE, -075-DN, -075X-DN	300 + dissipative shunt
2098-DSD-150, -150X, -150-SE, -150-DN, -150X-DN	500 + dissipative shunt
2098-DSD-HV030, -HV030X, -HV030-SE, -HV030-DN, -HV030X-DN	175 + dissipative shunt
2098-DSD-HV050, -HV050X, -HV050-SE, -HV050-DN, -HV050X-DN	175 + dissipative shunt
2098-DSD-HV100, -HV100X, -HV100-SE, -HV100-DN, -HV100X-DN	350 + dissipative shunt
2098-DSD-HV150, -HV150X, -HV150-SE, -HV150-DN, -HV150X-DN	350 + dissipative shunt
2098-DSD-HV220, -HV220X, -HV220-SE, -HV220-DN, -HV220X-DN	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
CN1	User Input/Output	44-pin high-density D-shell
CN2	Motor Feedback Connector	15-pin high-density D-shell
CN3	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

DeviceNet Communication

The table below lists DeviceNet communication specifications.

Specification	Description
Power Consumption from Network	60 mA
Data Rates	125 kps, 250 kps, and 500 kps
Node Addresses	00-63
Messaging Capabilities	Explicit, polled I/O, change of state, and cyclic messaging

Dimensions

The following diagrams show the dimensions and mounting hole locations for the Ultra3000 drives.

Figure A.1
Dimensions and Mounting Diagram
(2098-DSD-005 and -005X)

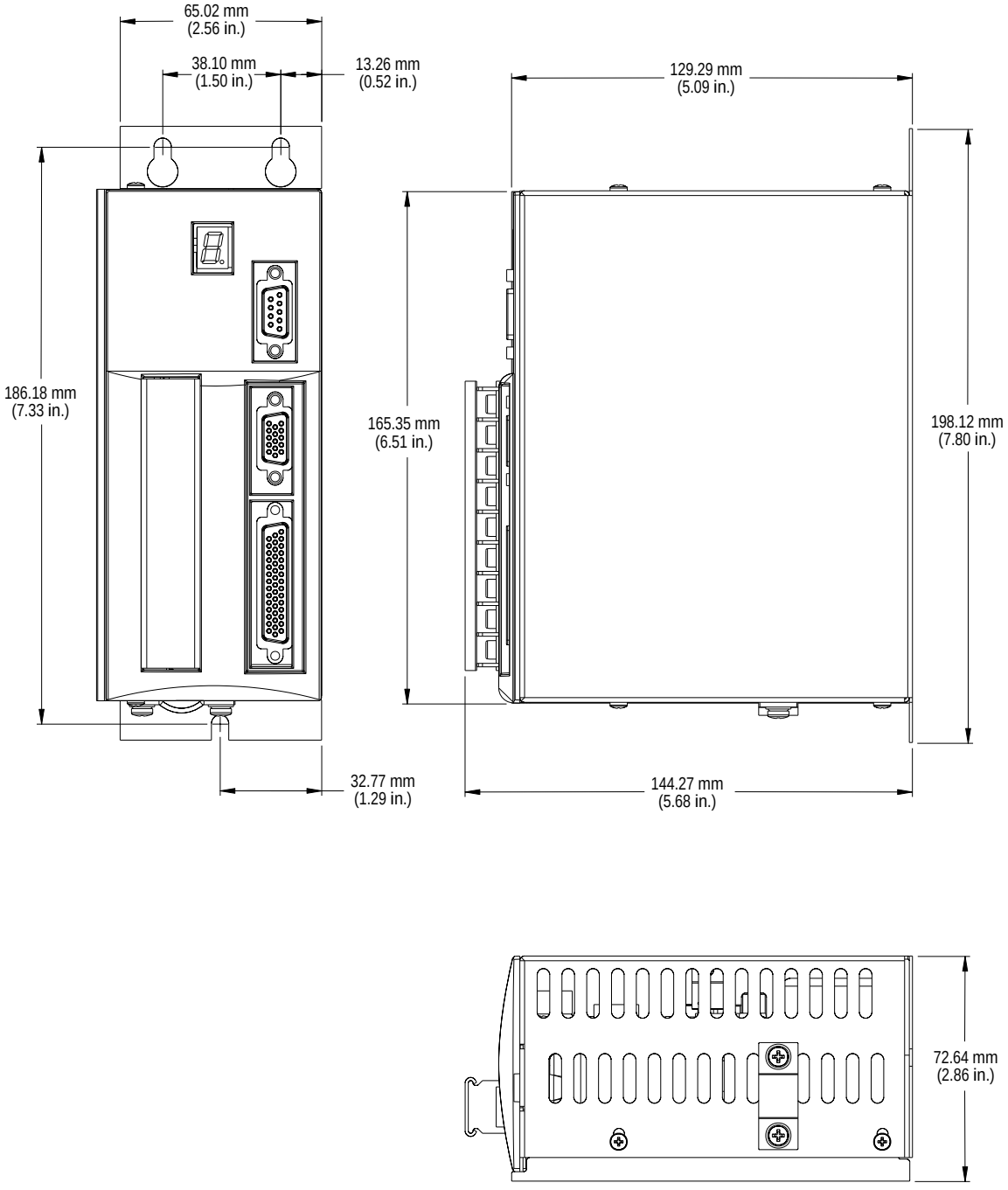
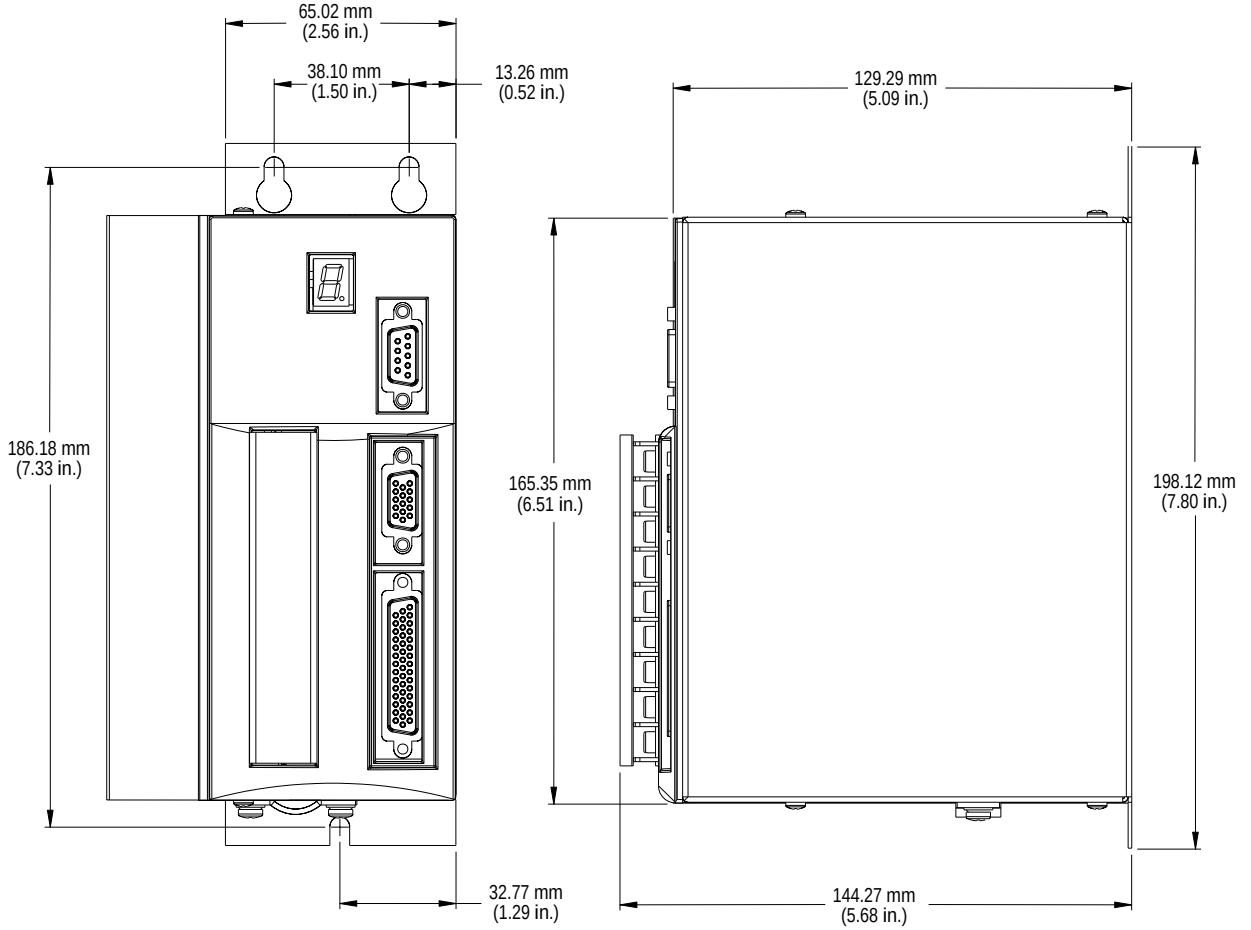
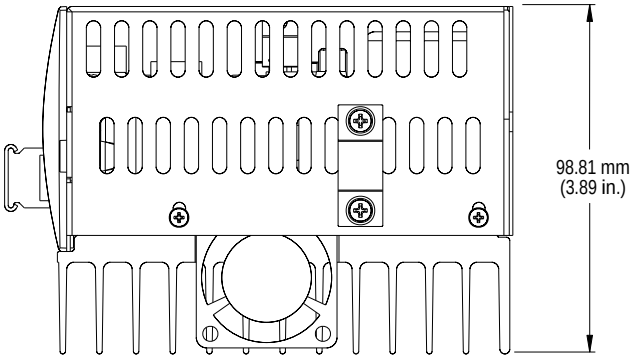


Figure A.2
Dimensions and Mounting Diagram
(2098-DSD-010, -010X, -020, and -020X)





Fan only on 2 kW units

Figure A.3
Dimensions and Mounting Diagram
(2098-DSD-005-SE, -005-DN, and -005X-DN)

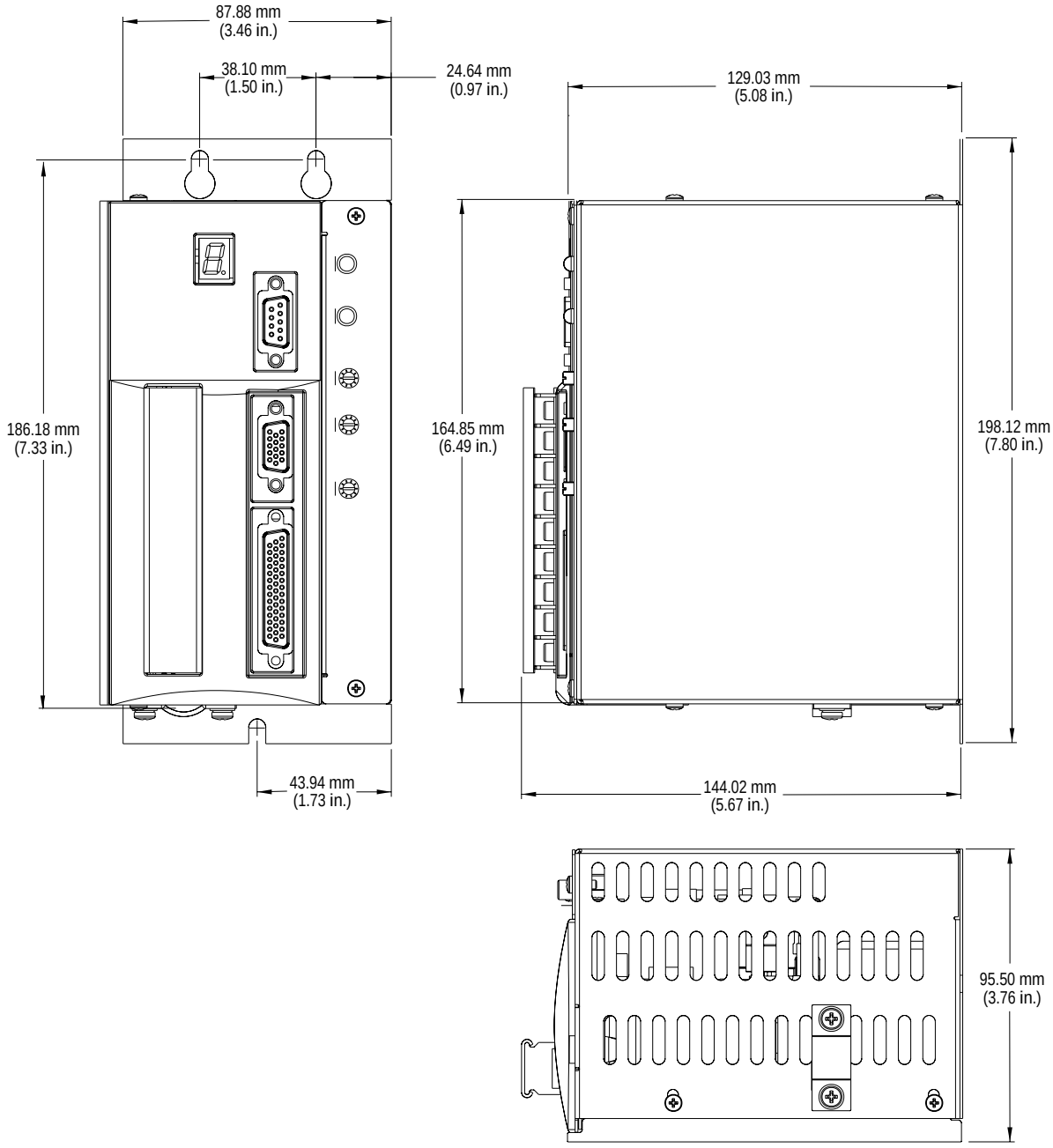
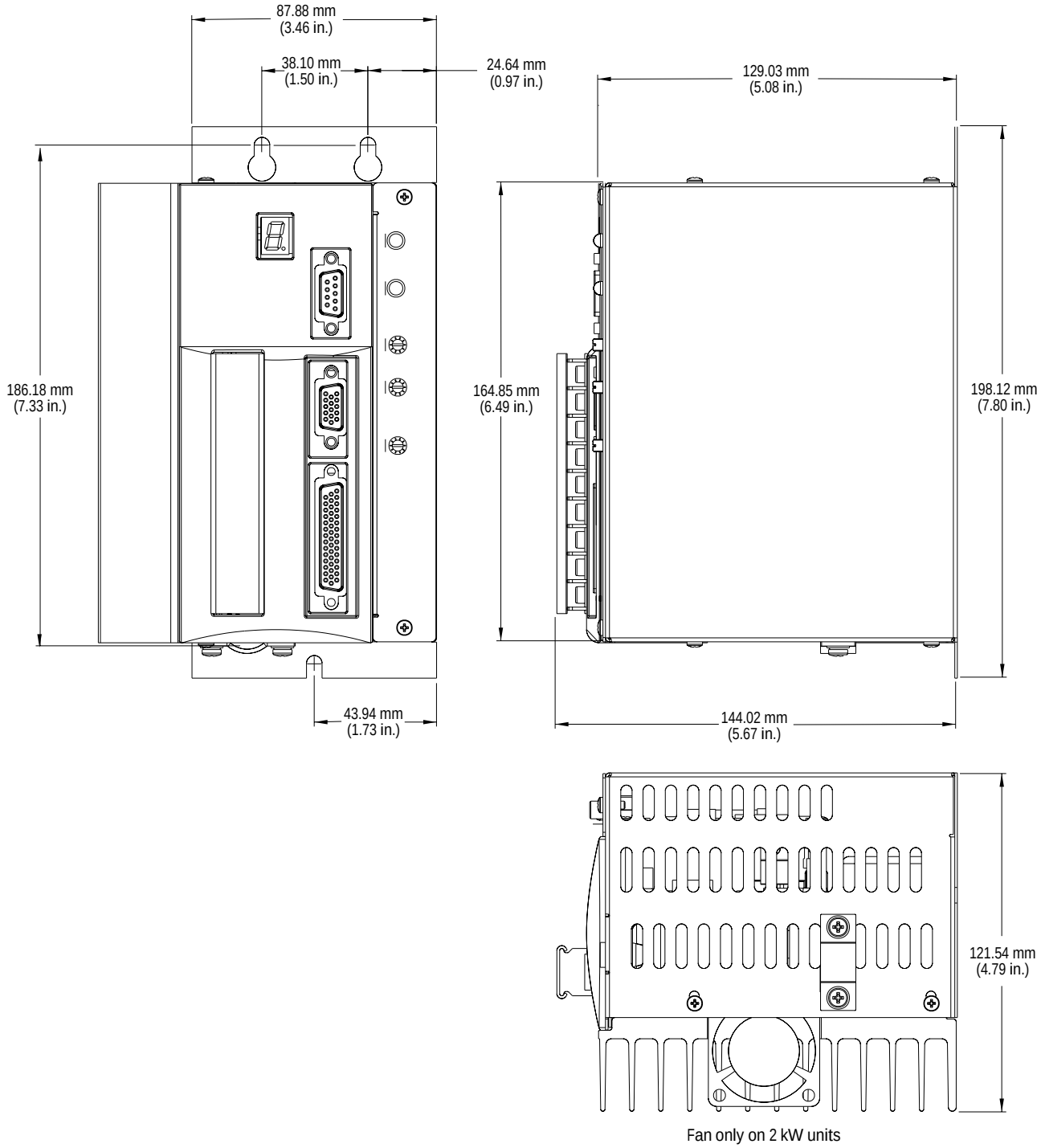


Figure A.4
Dimensions and Mounting Diagram
(2098-DSD-010-SE, -020-SE, -010-DN, -010X-DN, -20-DN, and -020X-DN)



Fan only on 2 kW units

Figure A.5
Dimensions and Mounting Diagram
(2098-DSD-030, -030X, -030-SE, -030-DN, and -030X-DN)

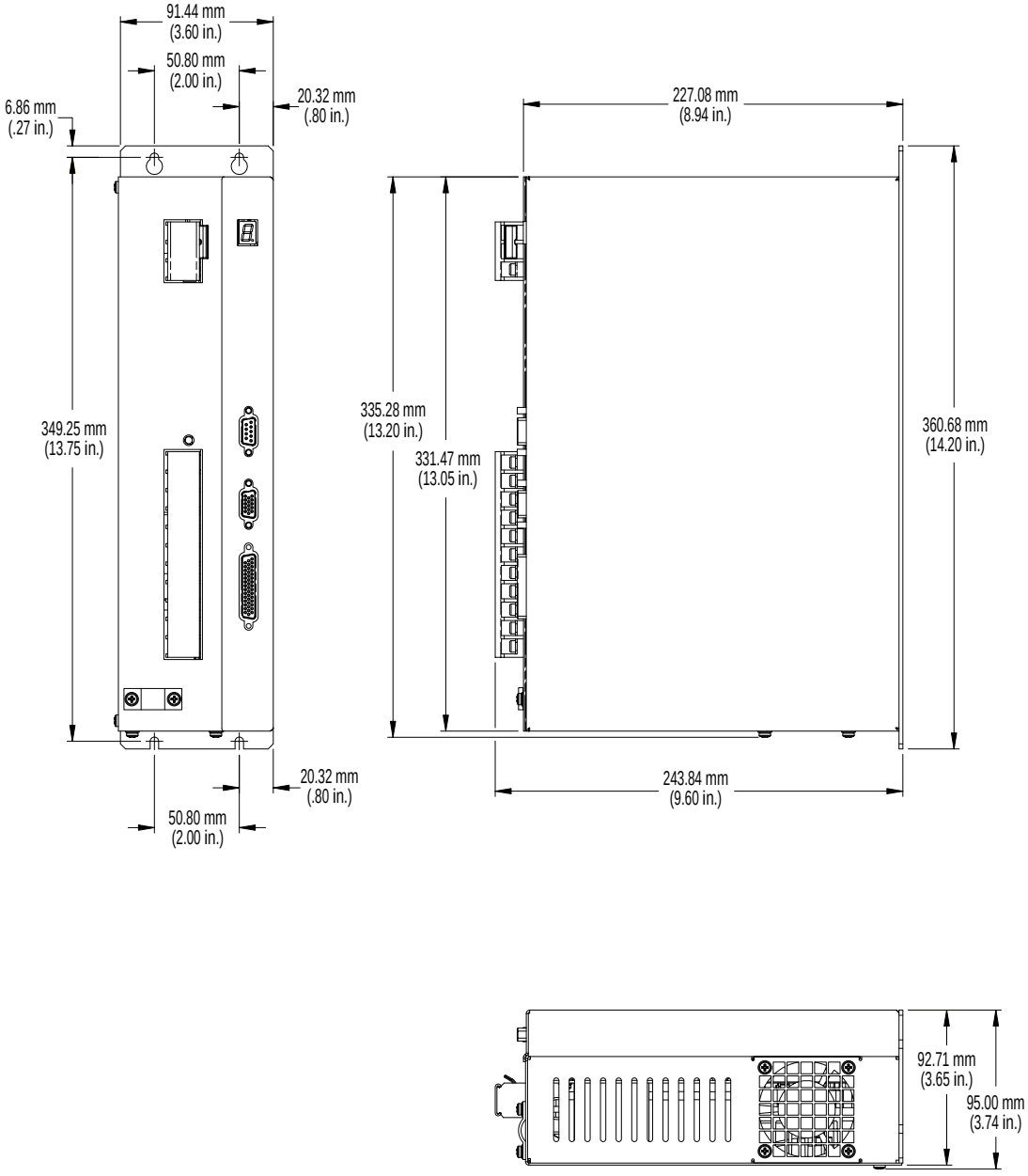


Figure A.6
Dimensions and Mounting Diagram
(2098-DSD-075, -075X, -075-SE, -075-DN, and -075X-DN)

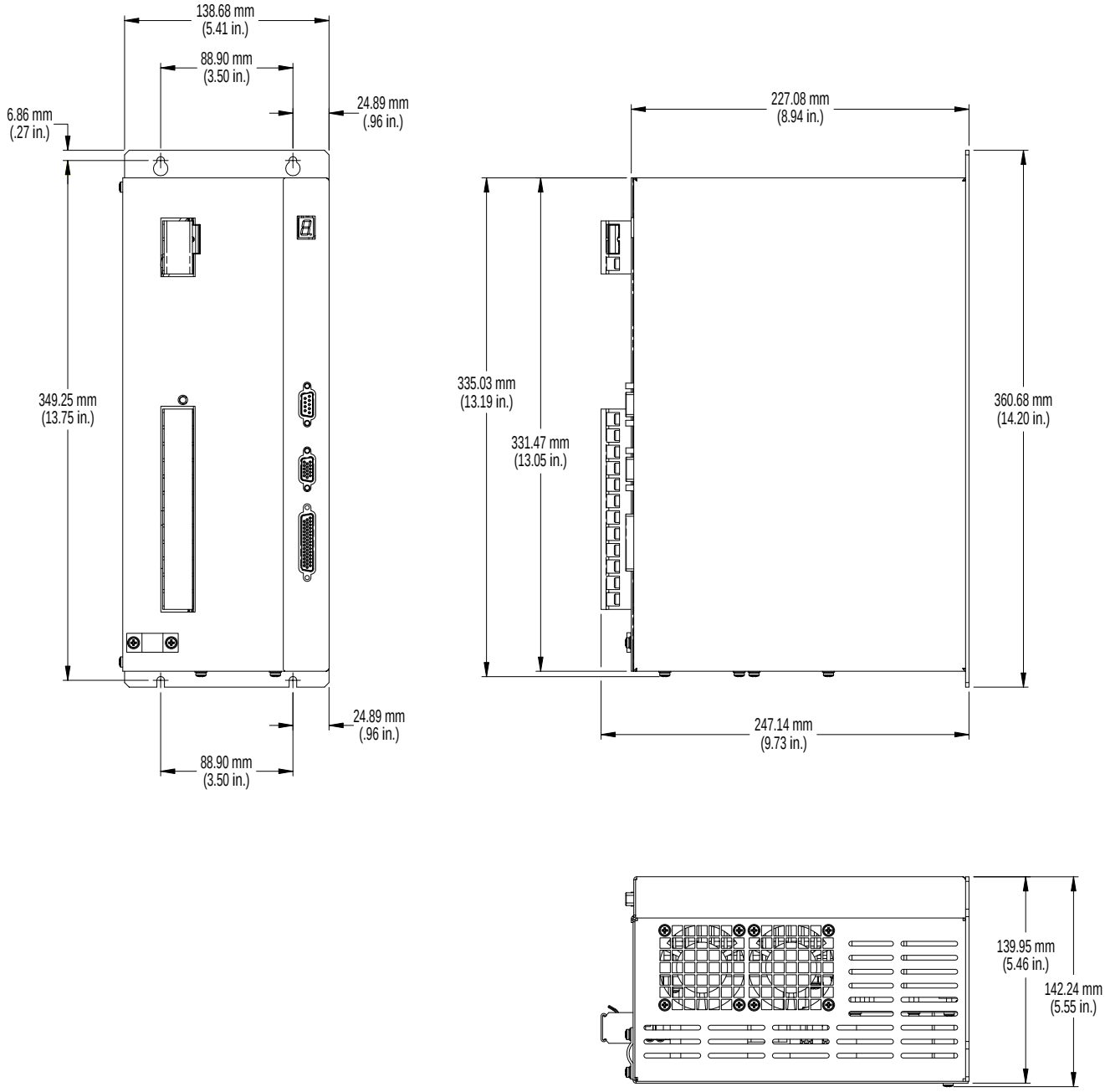


Figure A.7
Dimensions and Mounting Diagram
(2098-DSD-150, -150X, -150-SE, -150-DN, and -150X-DN)

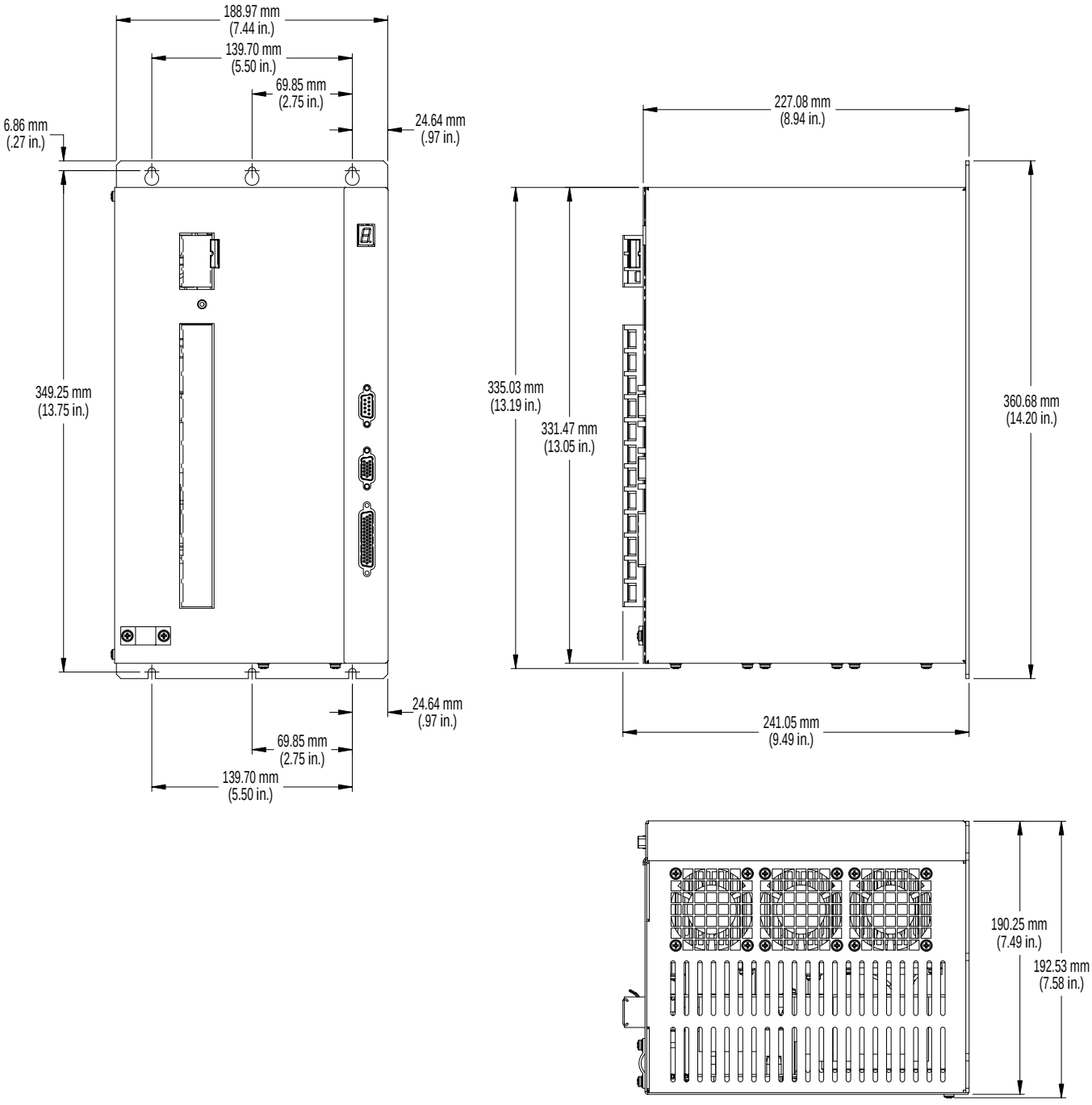


Figure A.8
Dimensions and Mounting Diagram
(2098-DSD-HV030, -HV030X, -HV030-SE, -HV030-DN, -HV030X-DN, and 2098-DSD-HV050, -HV050X, -HV050-SE, -HV050-DN, -HV050X-DN)

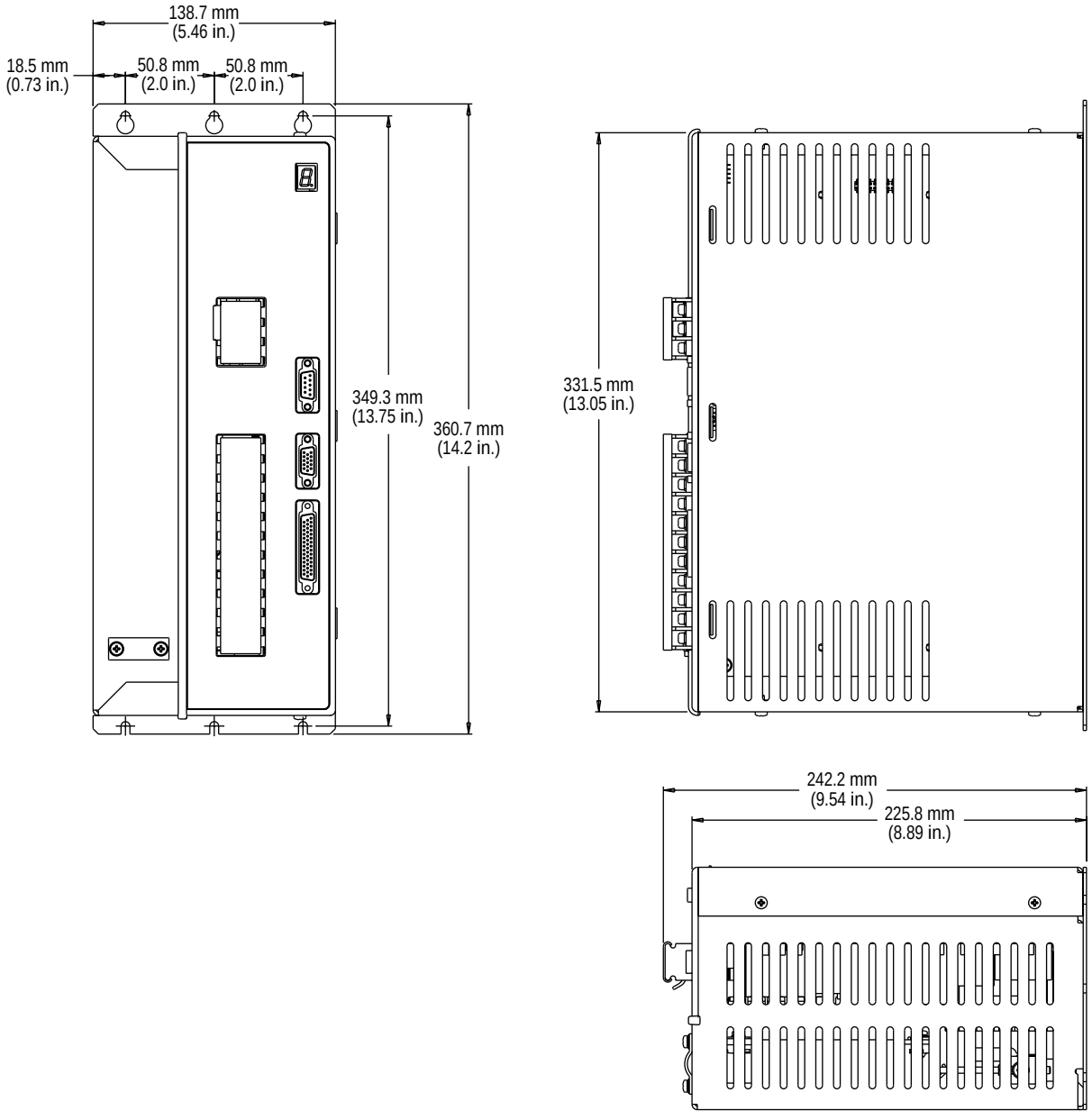


Figure A.9
Dimensions and Mounting Diagram
(2098-DSD-HV100, -HV100X, -HV100-SE, -HV100-DN, -HV100X-DN, and 2098-DSD-HV150, -HV150X, -HV150-SE, -HV150-DN, -HV150X-DN)

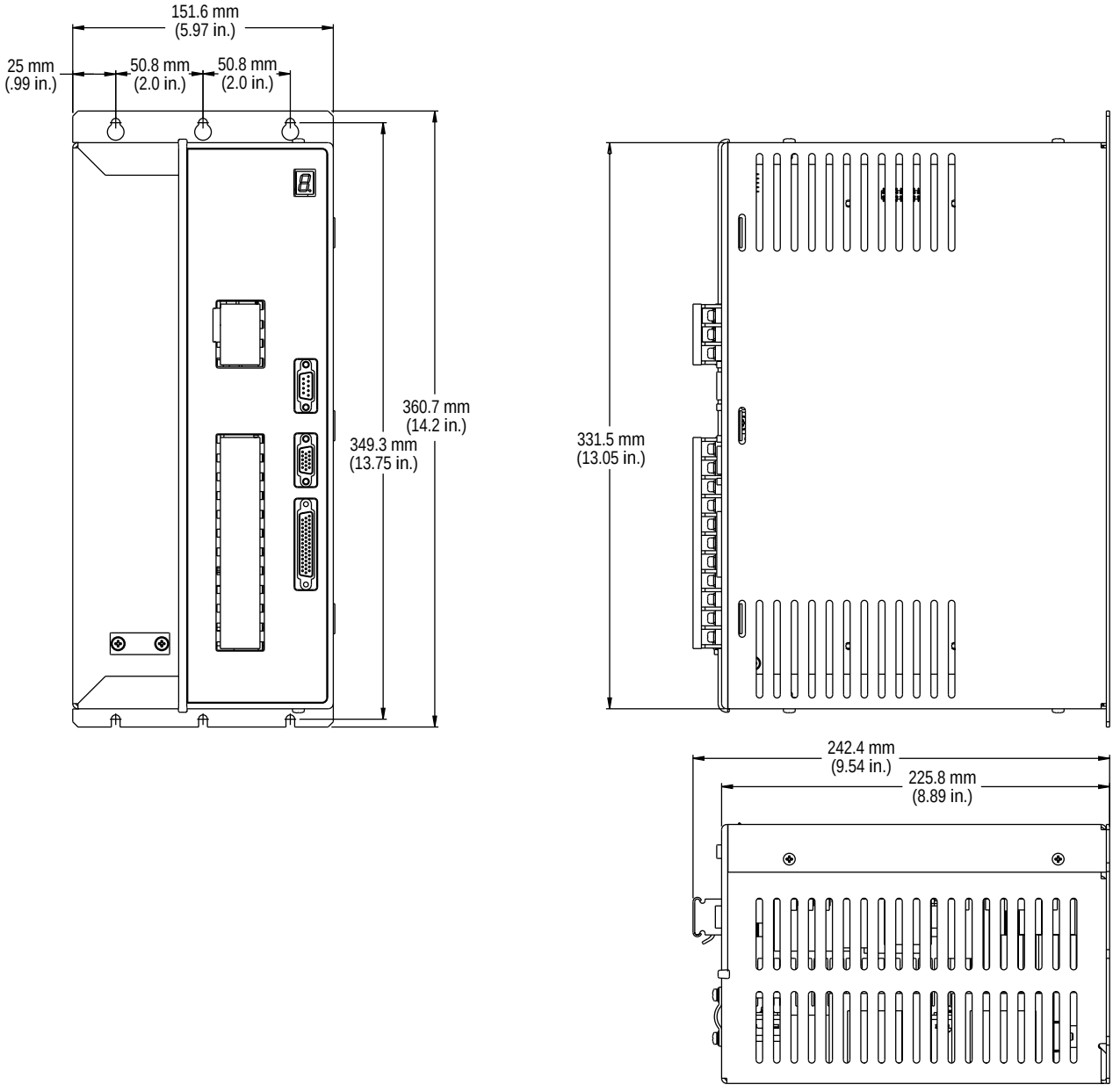
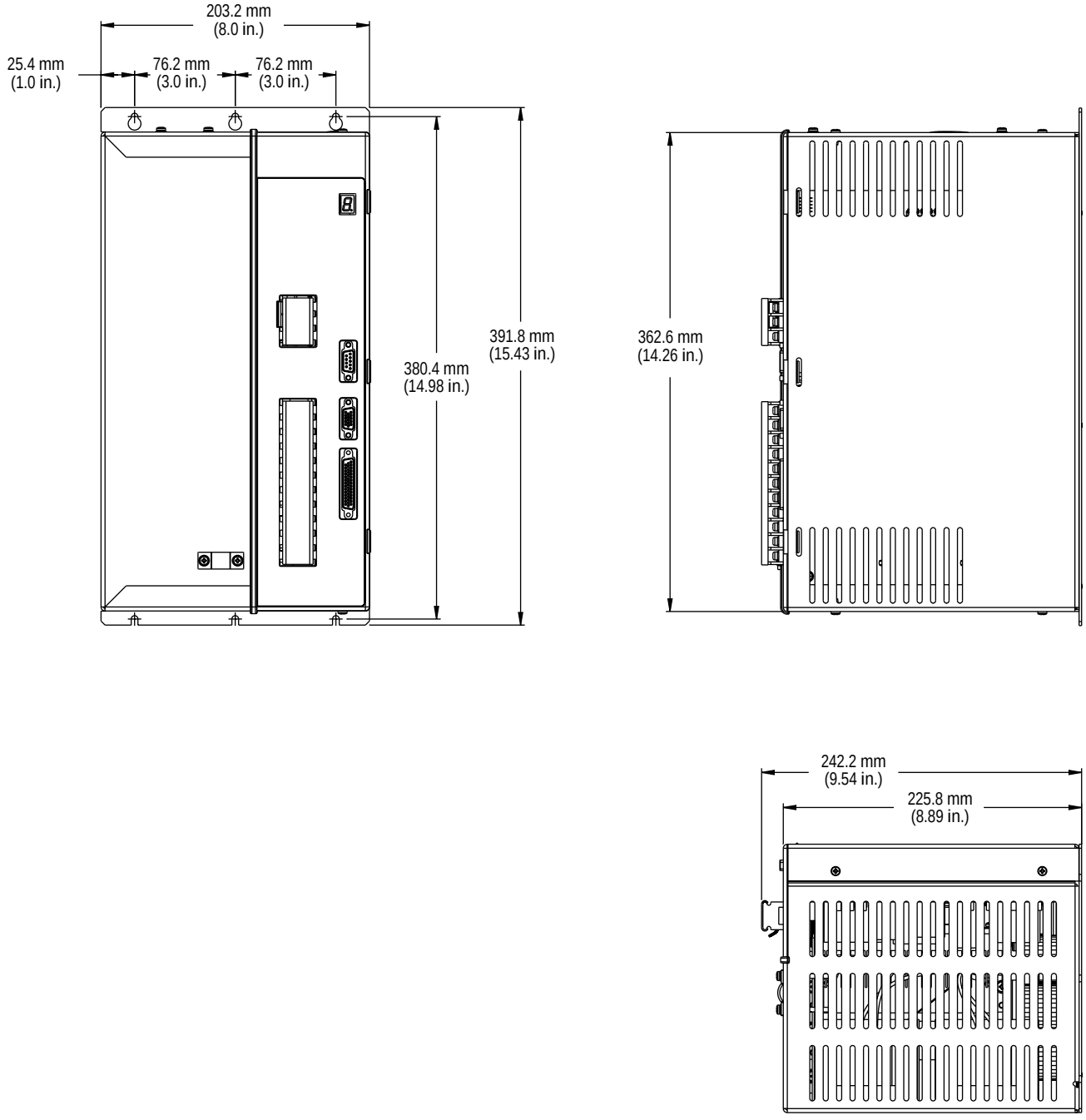


Figure A.10
Dimensions and Mounting Diagram
(2098-DSD-HV220, -HV220X, -HV220-SE, -HV220-DN, and -HV220X-DN)



Interconnect Diagrams

Chapter Objectives

This appendix contains the following interconnect diagrams:

- Ultra3000 to ControlLogix cable and interconnect diagrams
- Ultra3000 and motor cable diagrams
- Ultra3000 power wiring diagrams
- Start/stop string configuration diagram examples
- Controlling a brake
- Grounding for Ultra3000 CE requirements
- Ultra3000 to shunt module interconnect diagrams

Ultra3000 to ControlLogix Cable and Interconnect Diagrams

This section provides information to assist you in wiring the 1756-M02AE servo module when connecting the 2090-U3AE-D44*xx* control interface cable to your Ultra3000.

Figure B.1
2090-U3AE-D44*xx* Cable

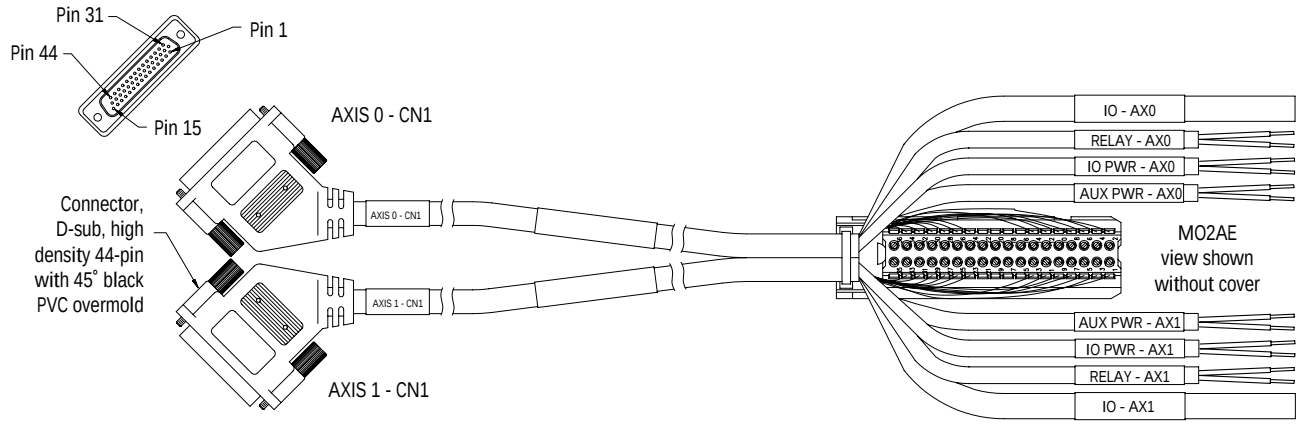
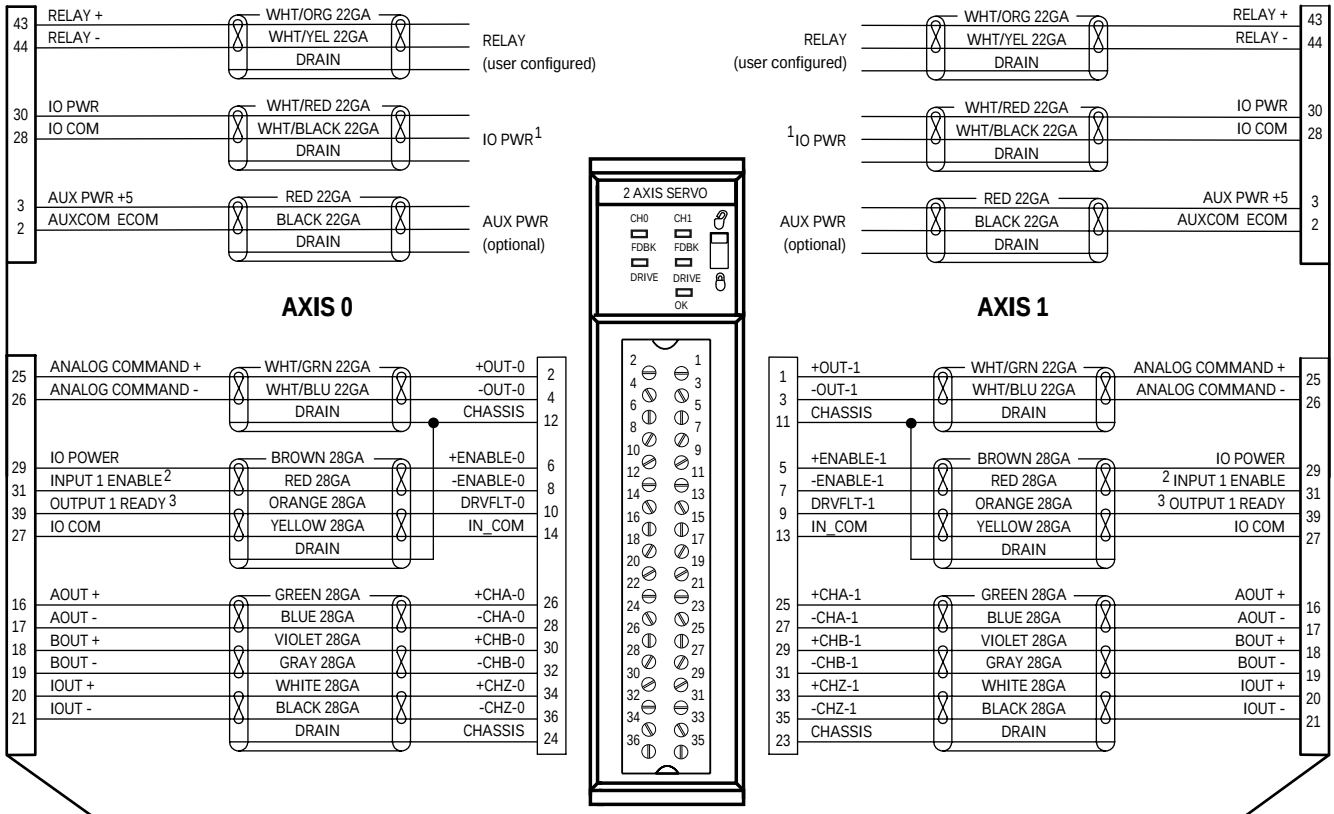


Figure B.2
Ultra3000 to ControlLogix Servo Module Interconnect Diagram



1 I/O power (pins 28 and 30) must be connected to user-supplied 12-24V dc.

2 Input 1 (pin 31) must configured as Drive Enable using Ultraware software.

3 Output 1 (pin 39) must be configured as Ready using Ultraware software.

Ultra3000 and Motor Cable Diagrams

This section provides information to assist you in wiring your MP, N, H/F, and Y-Series motors when connecting to your Ultra3000.

Ultra3000 Drive and Motor Cable Combinations

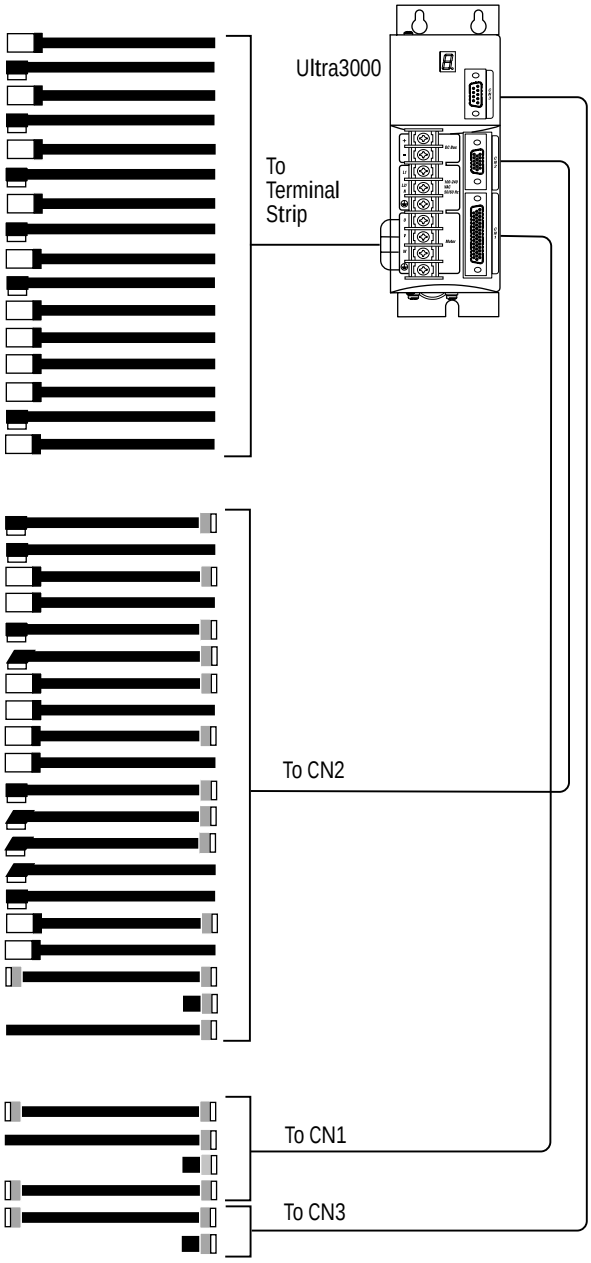
The figure below describes the motor power, feedback, and interface cables you will need for your specific Ultra3000 and motor combination.

Figure B.3
Ultra3000 Motor/Drive Cable Connections

Motor Power Cables	Catalog Number
500W, 1 kW, 2 kW Ultra3000 to H-Series Motors	2090-UXNPAH-16S*xx*
500W, 1 kW, 2 kW Ultra3000 to H-Series Motors	2090-UXNPAH-16R*xx*
15 kW Ultra3000 to H-Series Motors	2090-UXNPAH-6S*xx*
15 kW Ultra3000 to H-Series Motors	2090-UXNPAH-6R*xx*
2 or 3 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-14S*xx*
2 or 3 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-14R*xx*
7.5 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-10S*xx*
7.5 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-10R*xx*
15 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-8S*xx*
15 kW Ultra3000 to H and F-Series Motors	2090-UXNPAHF-8R*xx*
500W, 1 kW, 2 kW Ultra3000 to MP-Series Motors	2090-UXNPAMP-16S*xx*
2 or 3 kW Ultra3000 to MP-Series Motors	2090-UXNPAMP-14S*xx*
7.5 kW Ultra3000 to MP-Series Motors	2090-UXNPAMP-10S*xx*
500W, 1 kW, 2 kW Ultra3000 to N-Series Motors	2090-UXNPAN-16S*xx*
500W, 1 kW, 2 kW Ultra3000 to N-Series Motors	2090-UXNPAN-16R*xx*
500W, 1 kW, 2 kW Ultra3000 to Y-Series Motors	2090-UXNPAY-16S*xx*

Feedback Cables	Catalog Number
Ultra3000 CN2 port to H-Series Motors, RA	2090-UXNFBH-R*xx*
Flying Leads on drive-end to H-Series Motor, RA	2090-UXNFDH-R*xx*
Ultra3000 CN2 port to H and F-Series Motors	2090-UXNFBHF-S*xx*
Flying Leads on drive-end to H and F-Series Motor	2090-UXNFDHF-S*xx*
Ultra3000 CN2 port to H and F-Series Motors, RA	2090-UXNFBHF-R*xx*
Ultra3000 CN2 port to H and F-Series Motors, RA, skewed	2090-UXNFBHF-K*xx*
Ultra3000 CN2 port to MP-Series Motors	2090-UXNFBMP-S*xx*
Flying Leads on drive-end to MP-Series Motor	2090-UXNFDMP-S*xx*
Ultra3000 CN2 port to N-Series Motors	2090-UXNFBN-S*xx*
Flying leads on drive-end to N-Series Motors	2090-UXNFDN-S*xx*
Ultra3000 CN2 port to N-Series Motors, RA	2090-UXNFBN-R*xx*
Ultra3000 CN2 port to N-Series Motors, RA, skewed	2090-UXNFBN-K*xx*
Ultra3000 CN2 port to N-Series Motors, RA, skewed	2090-UXNFBN23-K*xx*
Flying leads on drive-end to N-Series Motors, RA, skewed	2090-UXNFDN23-K*xx*
Flying leads on drive-end to N-Series Motors, RA	2090-UXNFDN-R*xx*
Ultra3000 CN2 port to Y-Series Motors	2090-UXNFBY-S*xx*
Flying Leads on drive-end to Y-Series Motor	2090-UXNFDY-S*xx*
CN2 Break Out Board Kit (see description o n pageC-7)	2090-UXBK-D15*xx*
CN2 drive mounted Break Out Board	2090-UXBB-DM15
Drive Feedback Cable (CN2) to flying leads, straight	2090-UXNFM-S*xx*

Interface Cables	Catalog Number
Ultra3000 CN1 Break Out Board Kit (see p a g eC-7)	2090-U3BK-D44*xx*
Ultra3000 CN1 port to no connector	2090-U3CC-D44*xx*
Ultra3000 CN1 drive mounted Break Out Board	2090-U3BB-DM44
Ultra3000 CN1 port to ControlLogix servo module	2090-U3AE-D44*xx*
Ultra3000 CN3 serial port to personal computer	2090-UXPC-D09*xx*
Ultra3000 CN3 drive mounted Break Out Board	2090-UXBB-DM09



Length of cable *xx* is in meters; 01, 03, 09, 15, 30 (3.3, 9.8, 29.5, 49.2, 98.5 ft)

Ultra3000 to Motor Interconnect Diagrams

Figure B.4
Ultra3000 to MP-Series Motor Configuration (mating connector)

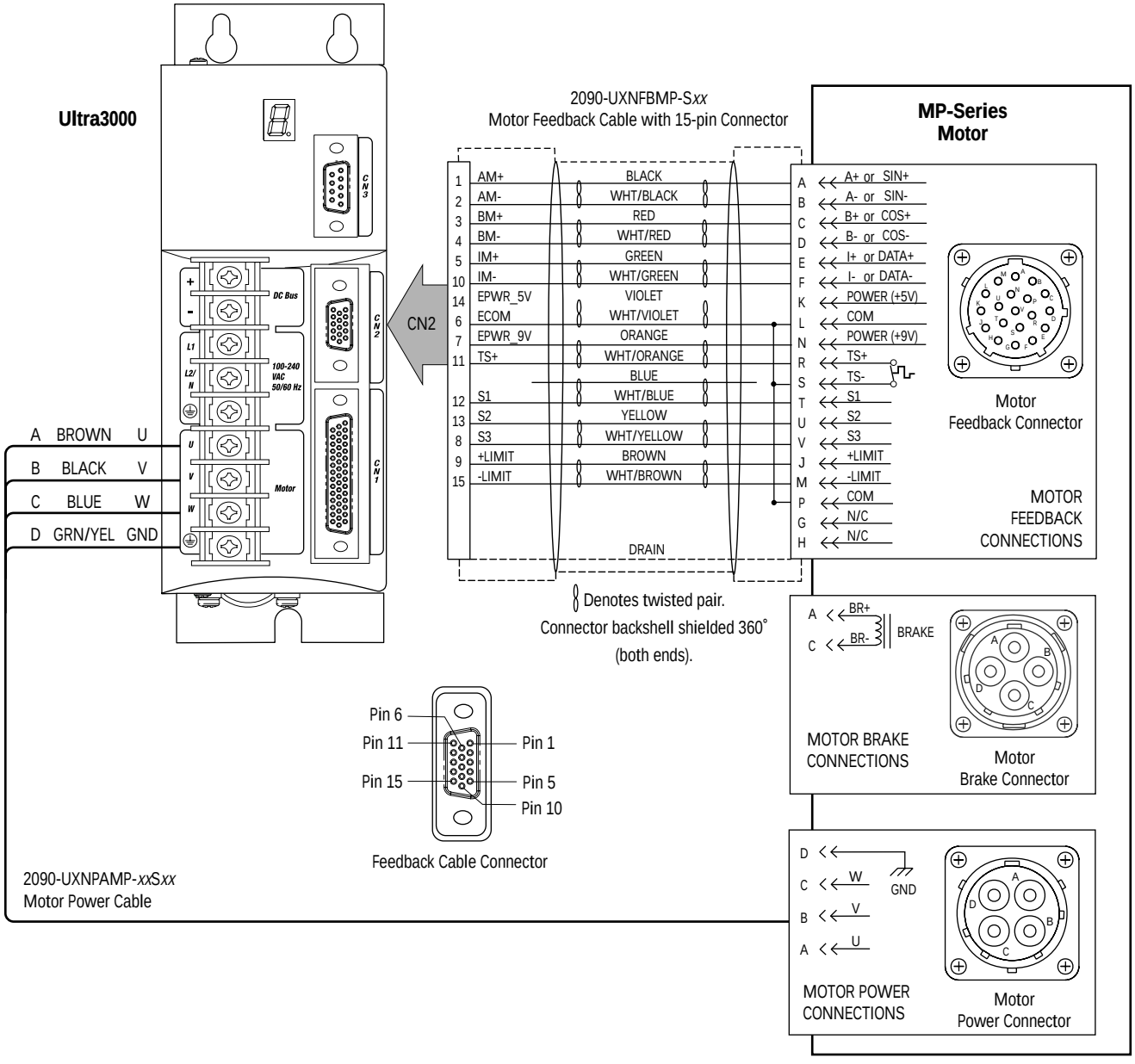


Figure B.5
Ultra3000 to MP-Series Motor Configuration (flying leads)

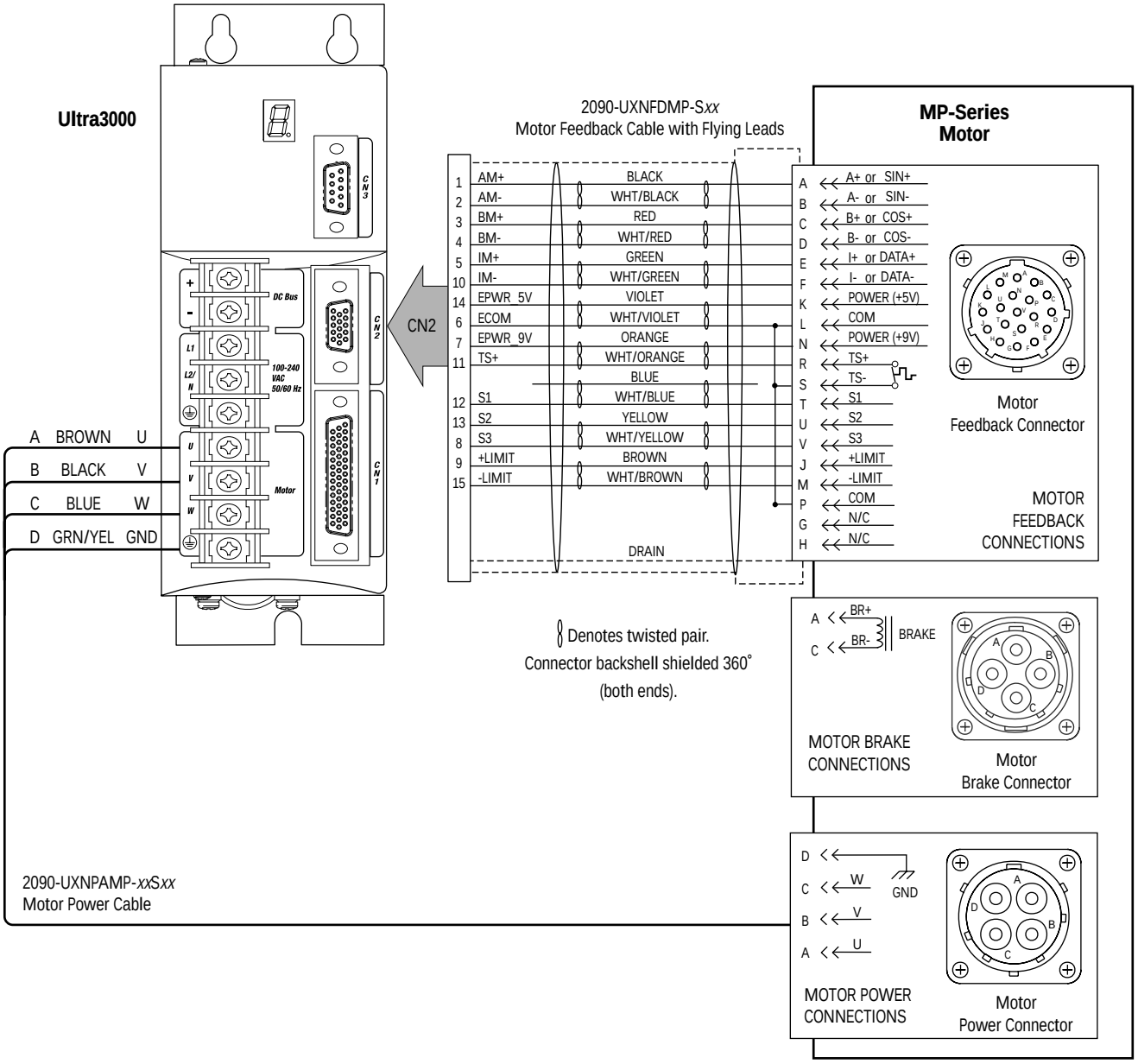


Figure B.6
Ultra3000 to N-Series Motor Configuration (mating connector)

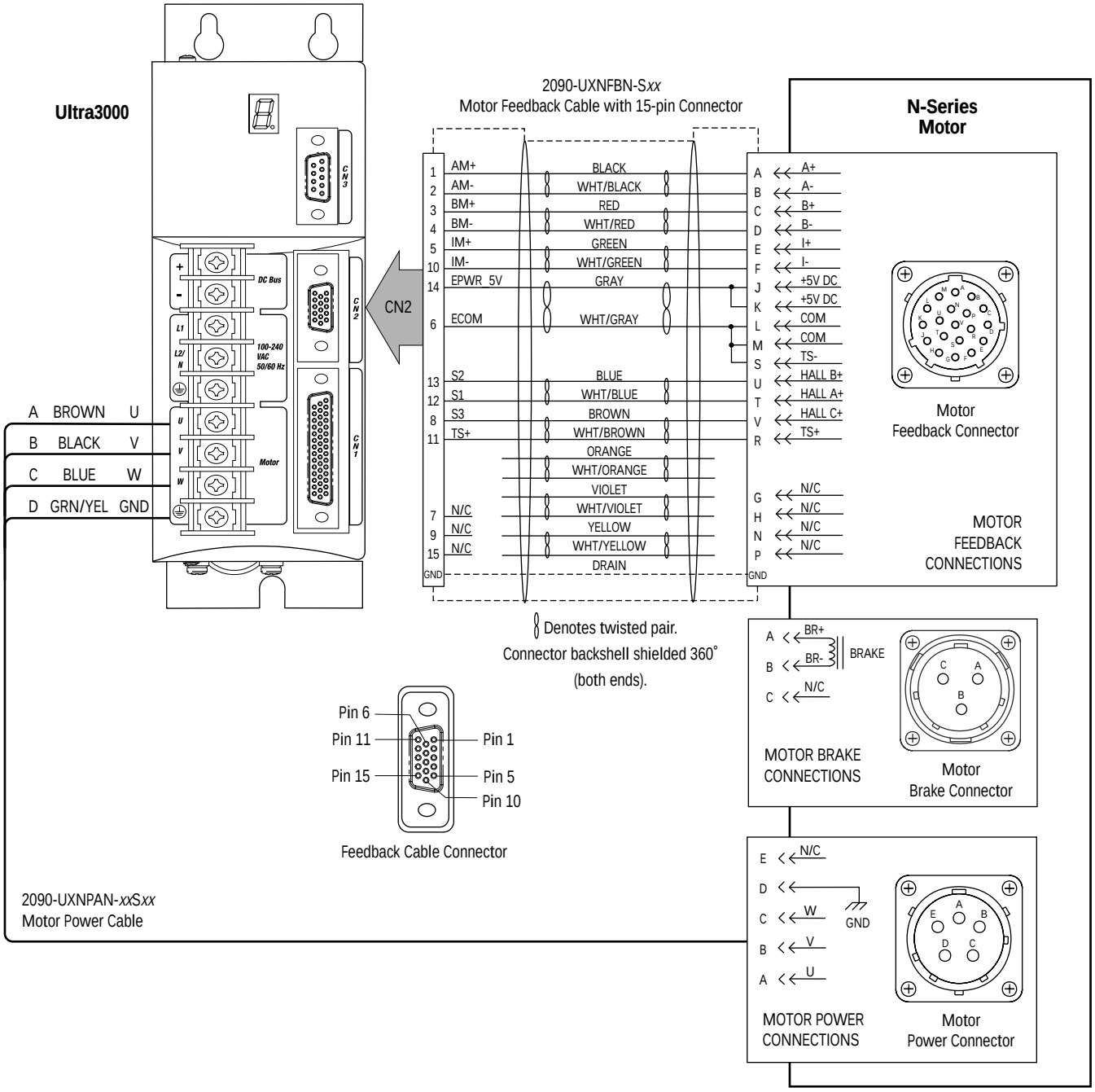


Figure B.7
Ultra3000 to N-Series Motor Configuration (flying leads)

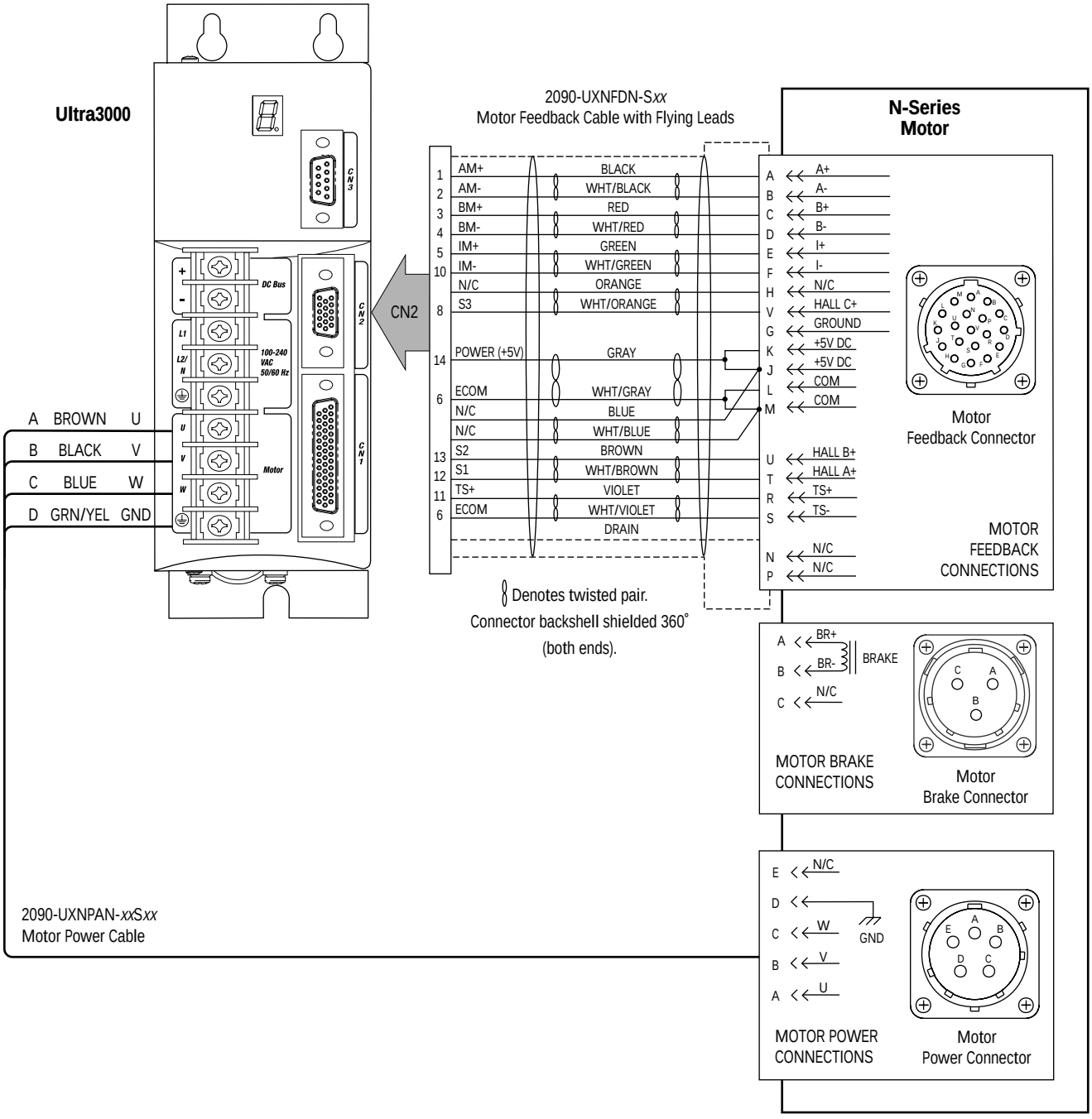


Figure B.8
Ultra3000 to H and F-Series Motor Configuration (mating connector)

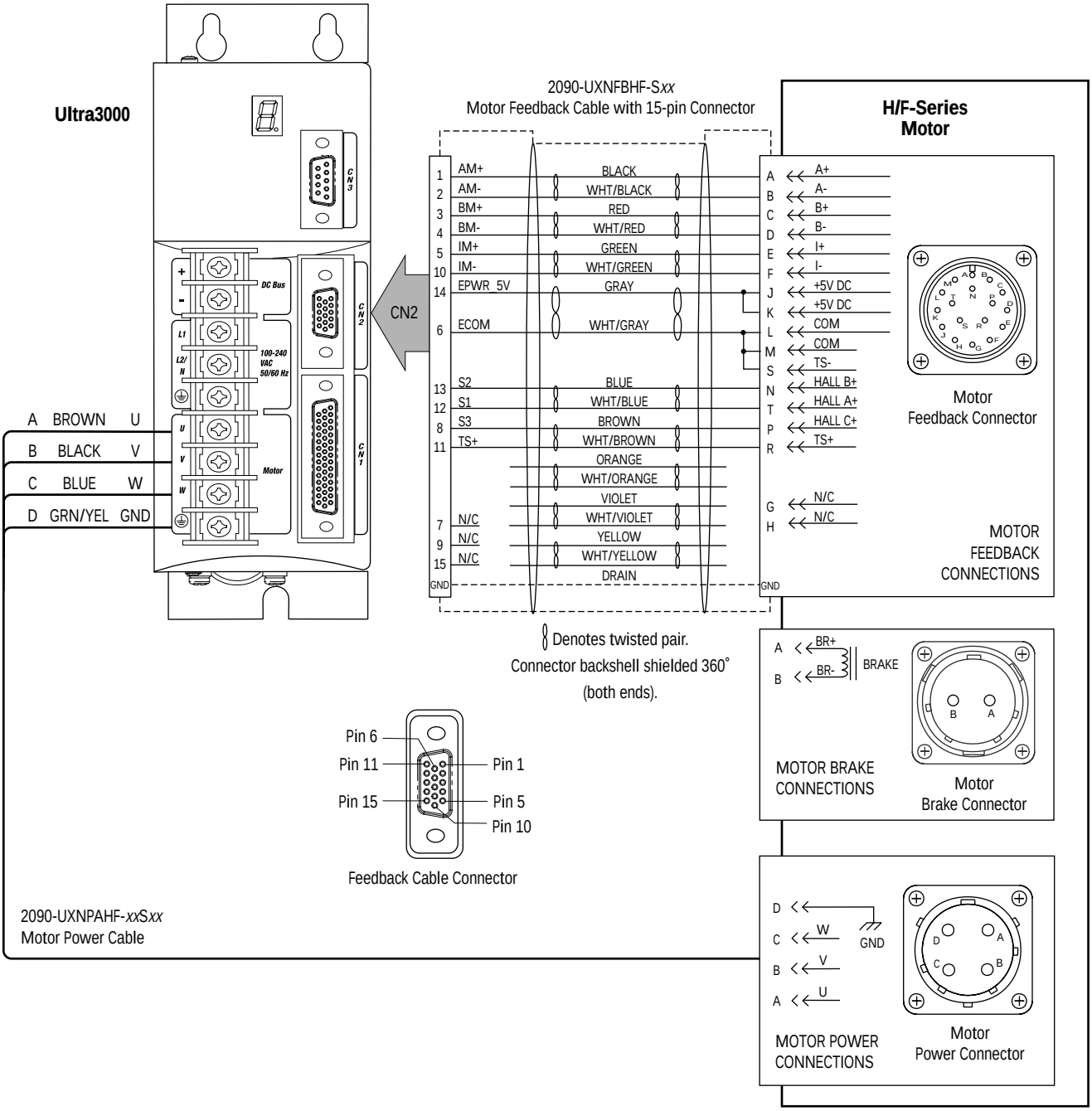


Figure B.9
Ultra3000 to H and F-Series Motor Configuration (flying leads)

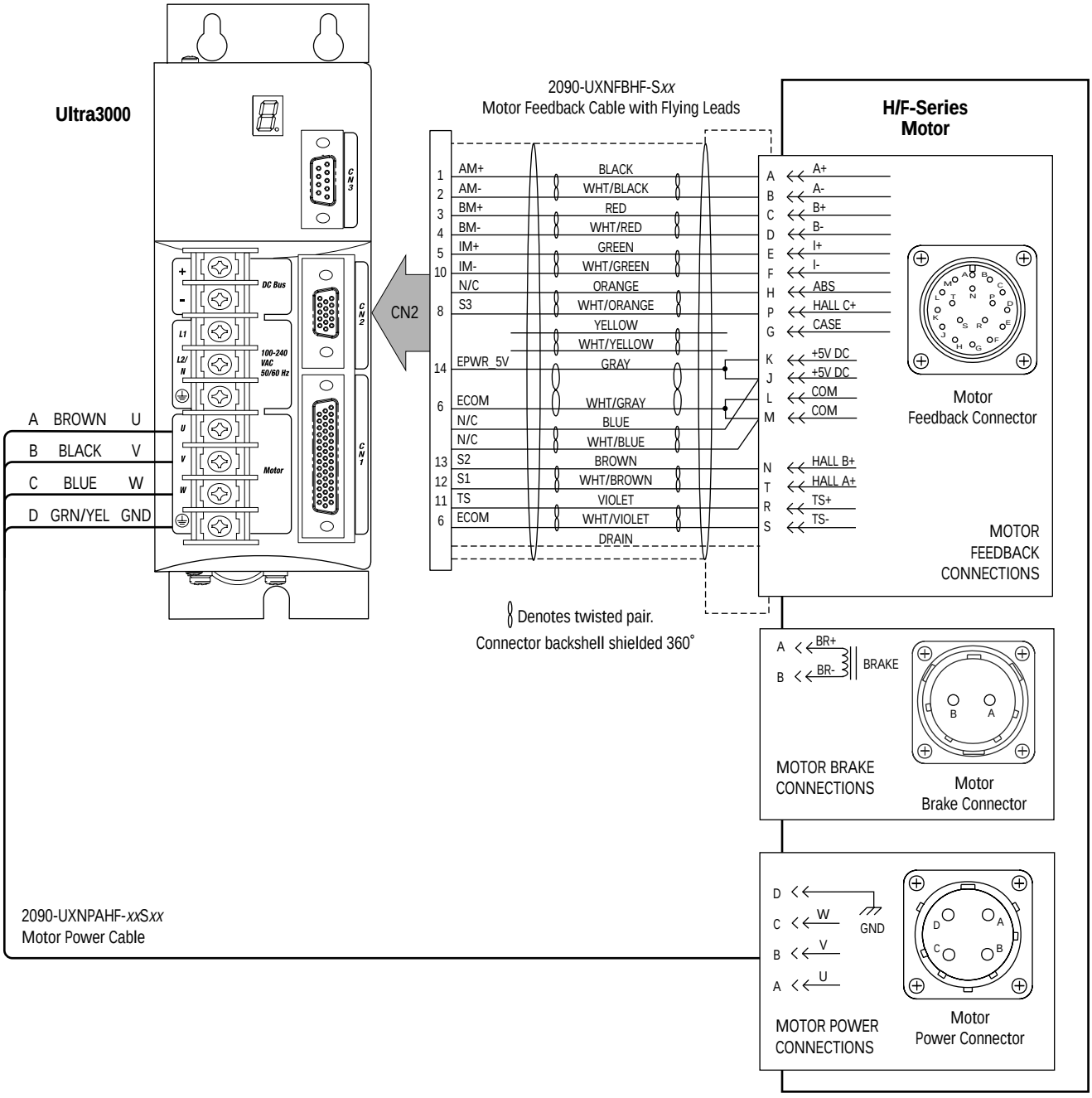


Figure B.10
Ultra3000 to Y-Series Motor Configuration (mating connector)

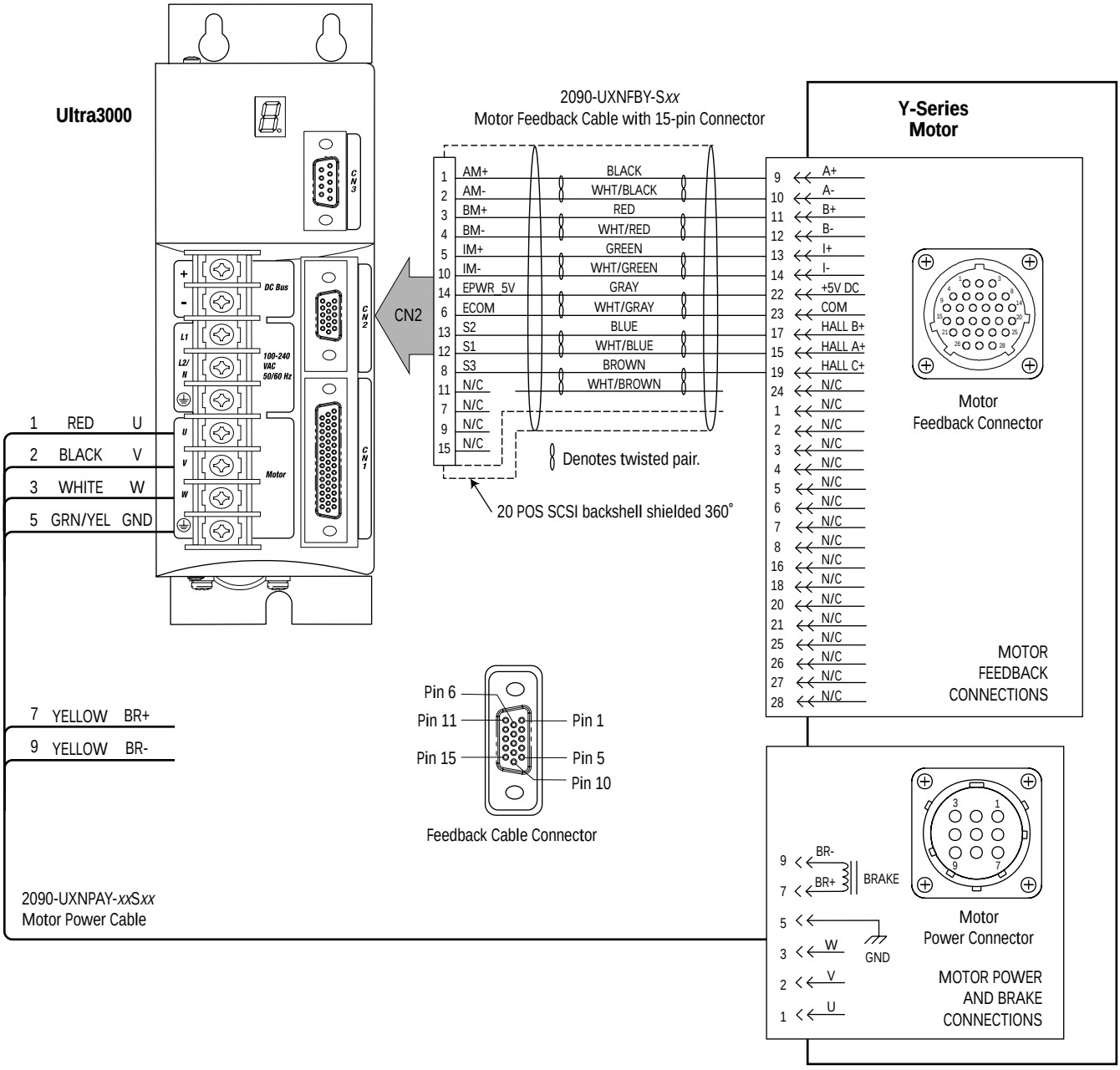
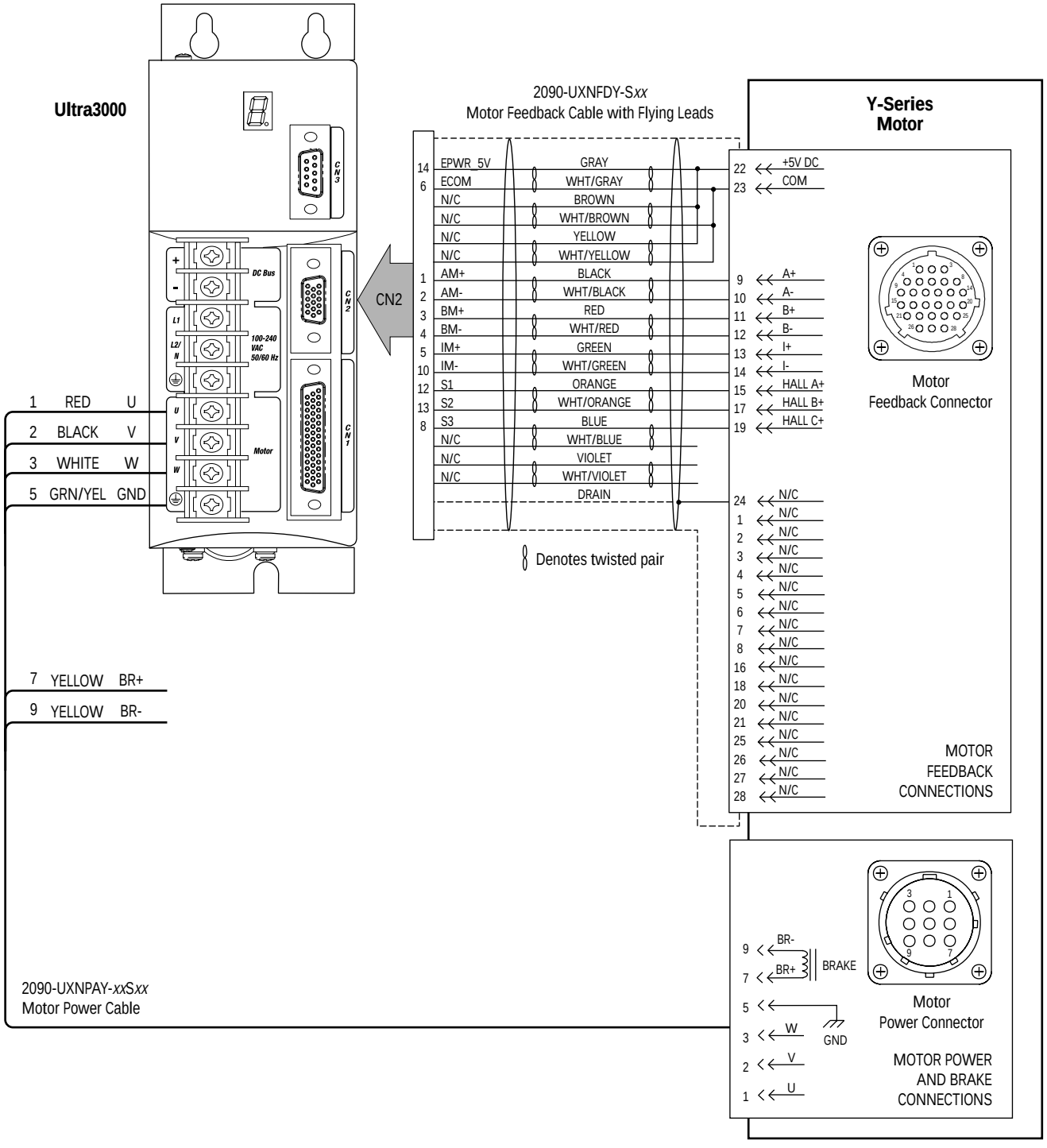


Figure B.11
Ultra3000 to Y-Series Motor Configuration (flying leads)



Ultra3000 Power Wiring Diagrams

This section provides information to assist you with AC input and motor power wiring to your Ultra3000 drive.

Figure B.12
Typical Power Wiring of Ultra3000 System
(2098-DSD-005*x*-*xx*, -010*x*-*xx*, and -020*x*-*xx*)

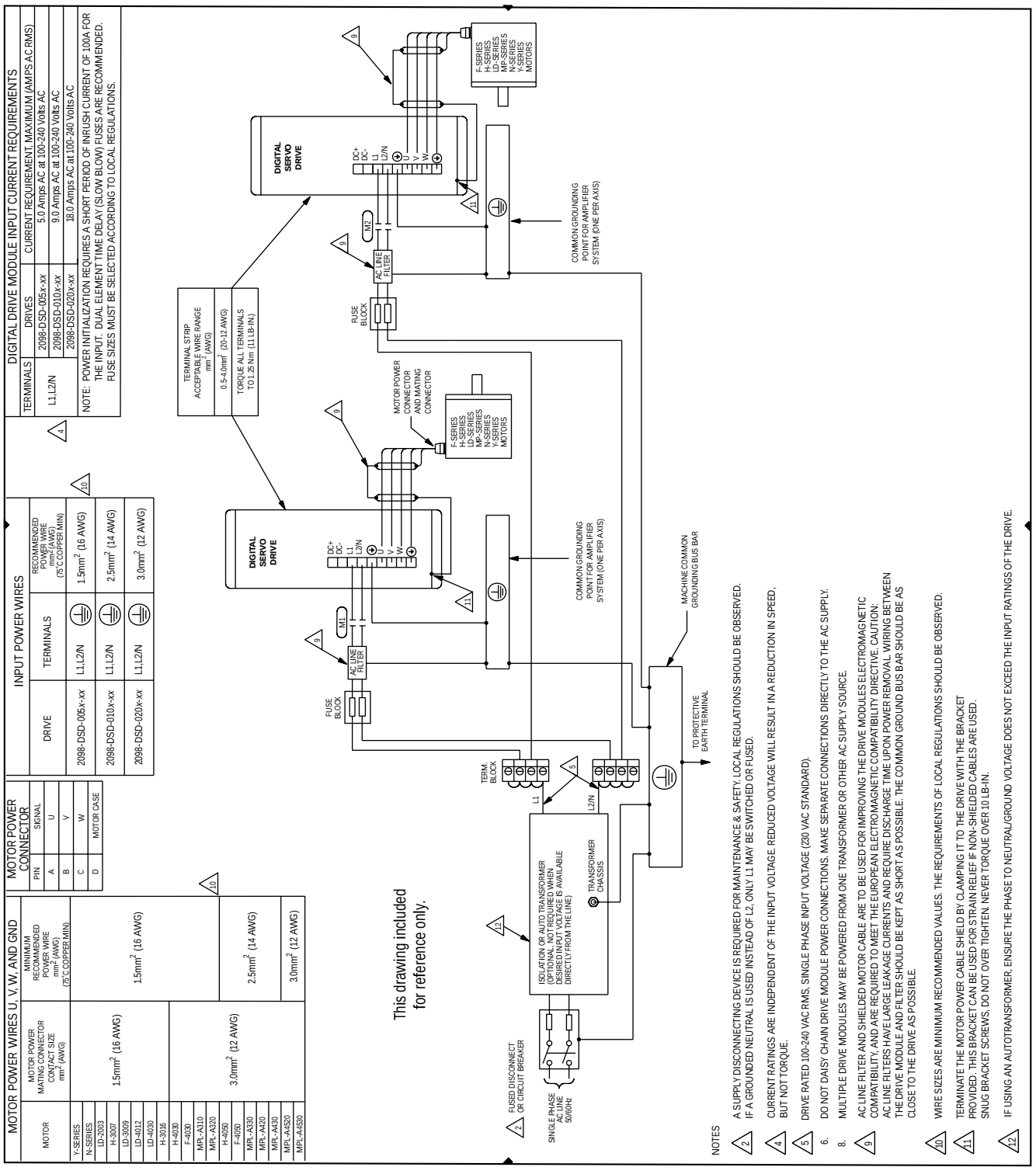
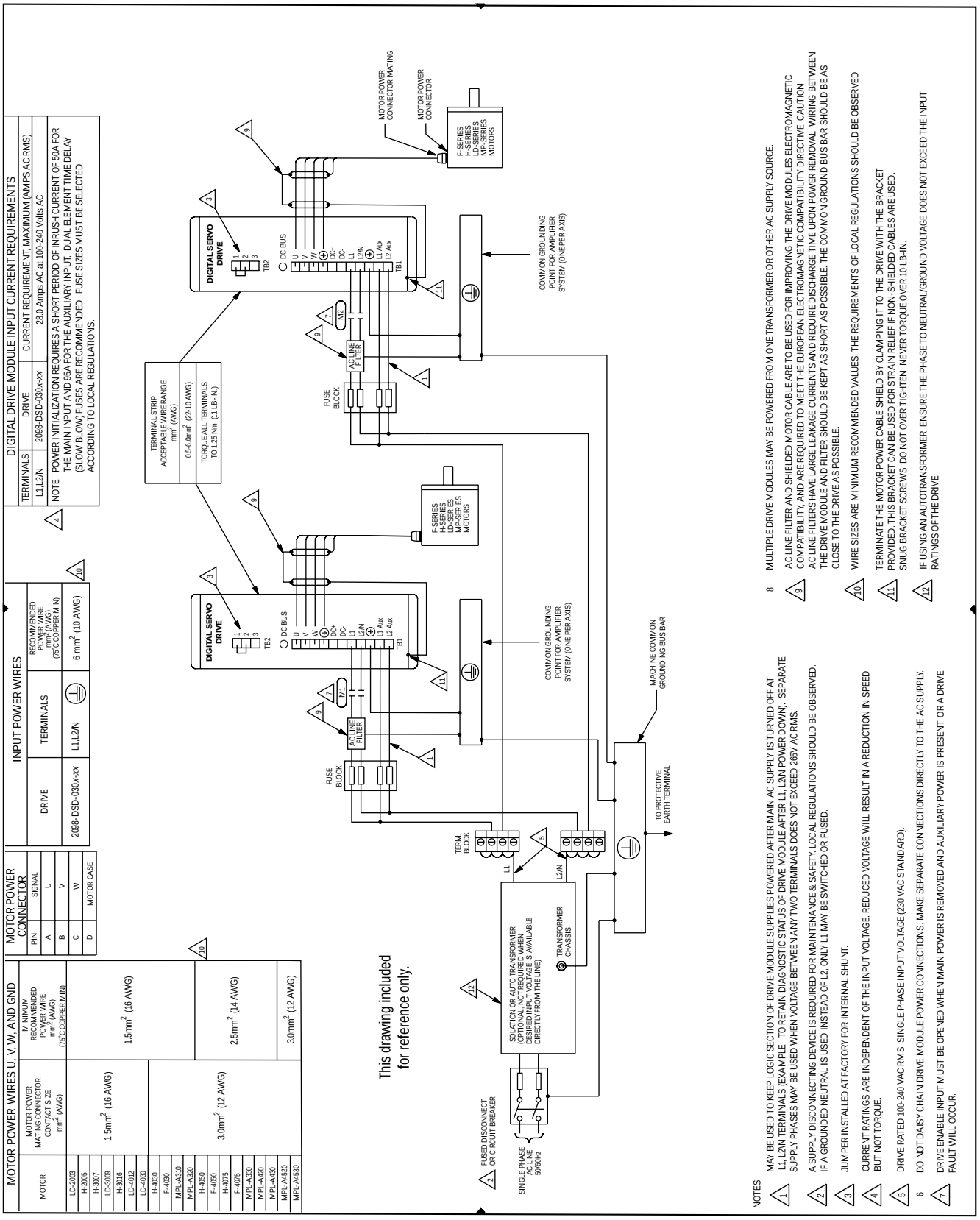


Figure B.13
Typical Power Wiring of Ultra3000 System
(2098-DSD-030*x*-*xx*)



NOTES

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN AC SUPPLY IS TURNED OFF AT L1, L2/N TERMINALS (EXAMPLE: TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER L1, L2/N POWER DOWN). SEPARATE SUPPLY PHASES MAY BE USED WHEN VOLTAGE BETWEEN ANY TWO TERMINALS DOES NOT EXCEED 266V 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 L2, ONLY L1 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. DRIVEENABLE 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.14
Typical Power Wiring of Ultra3000 System
(2098-DSD-075*x-xx*)

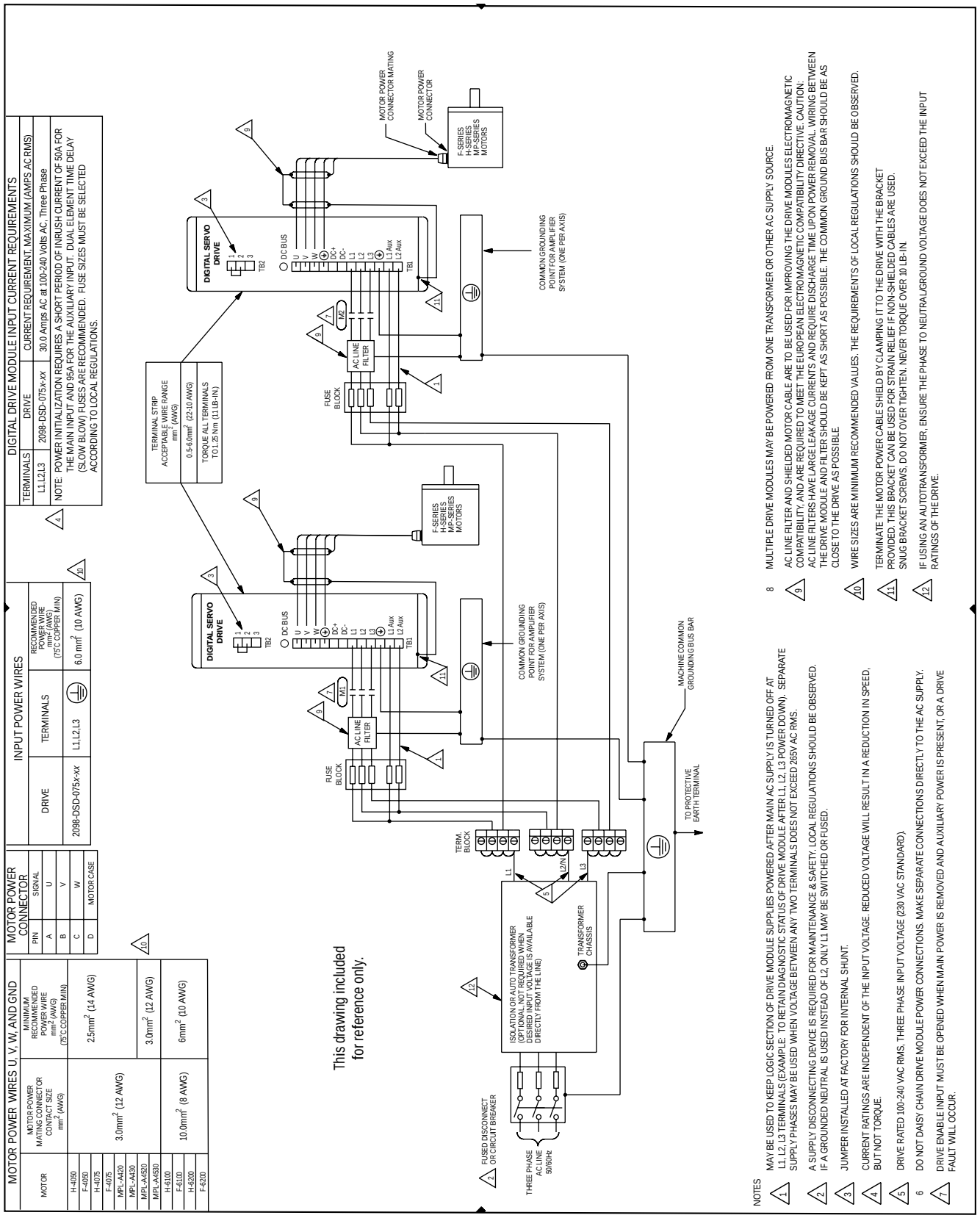


Figure B.15
Typical Power Wiring of Ultra3000 System
(2098-DSD-150*x*-*xx*)

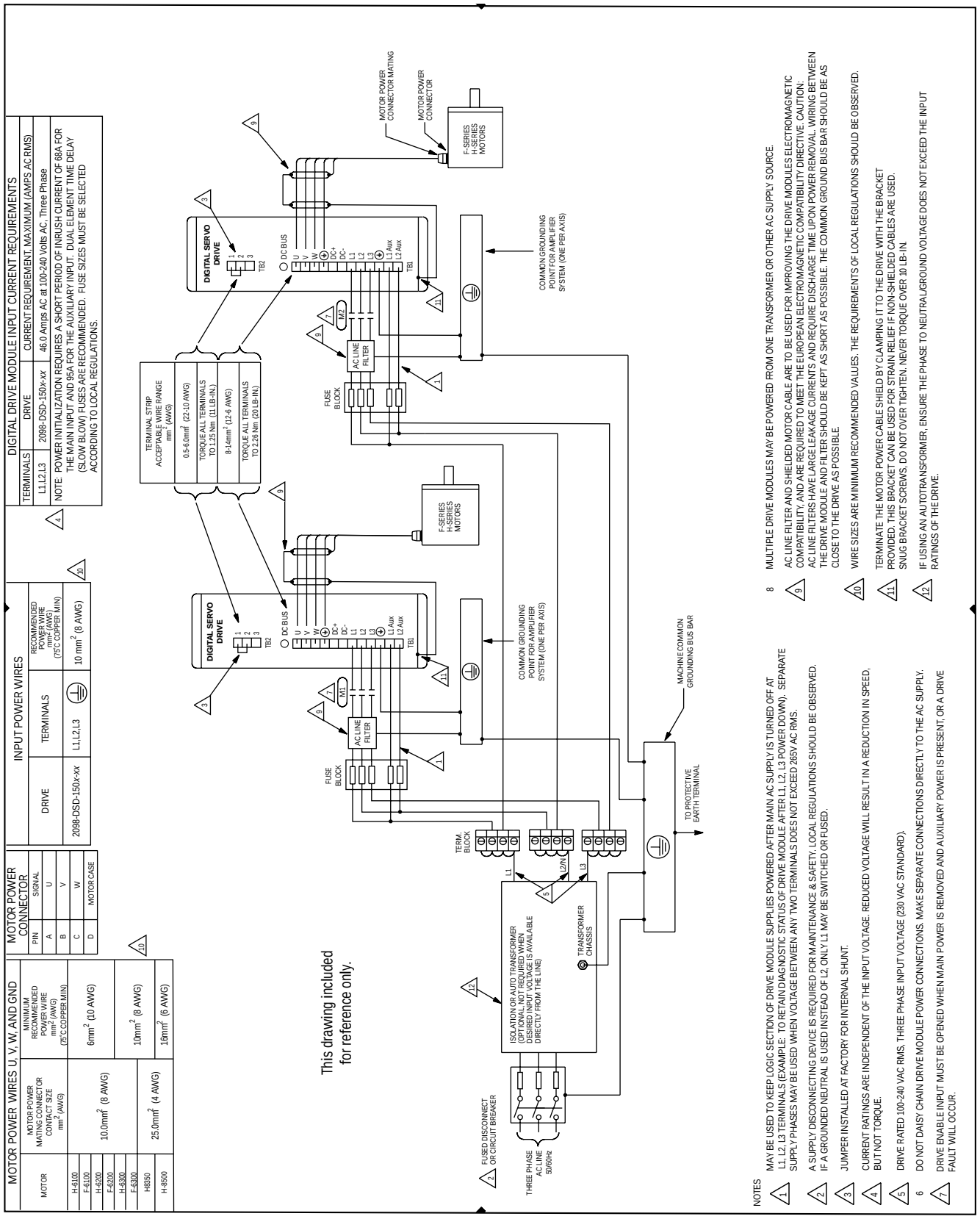
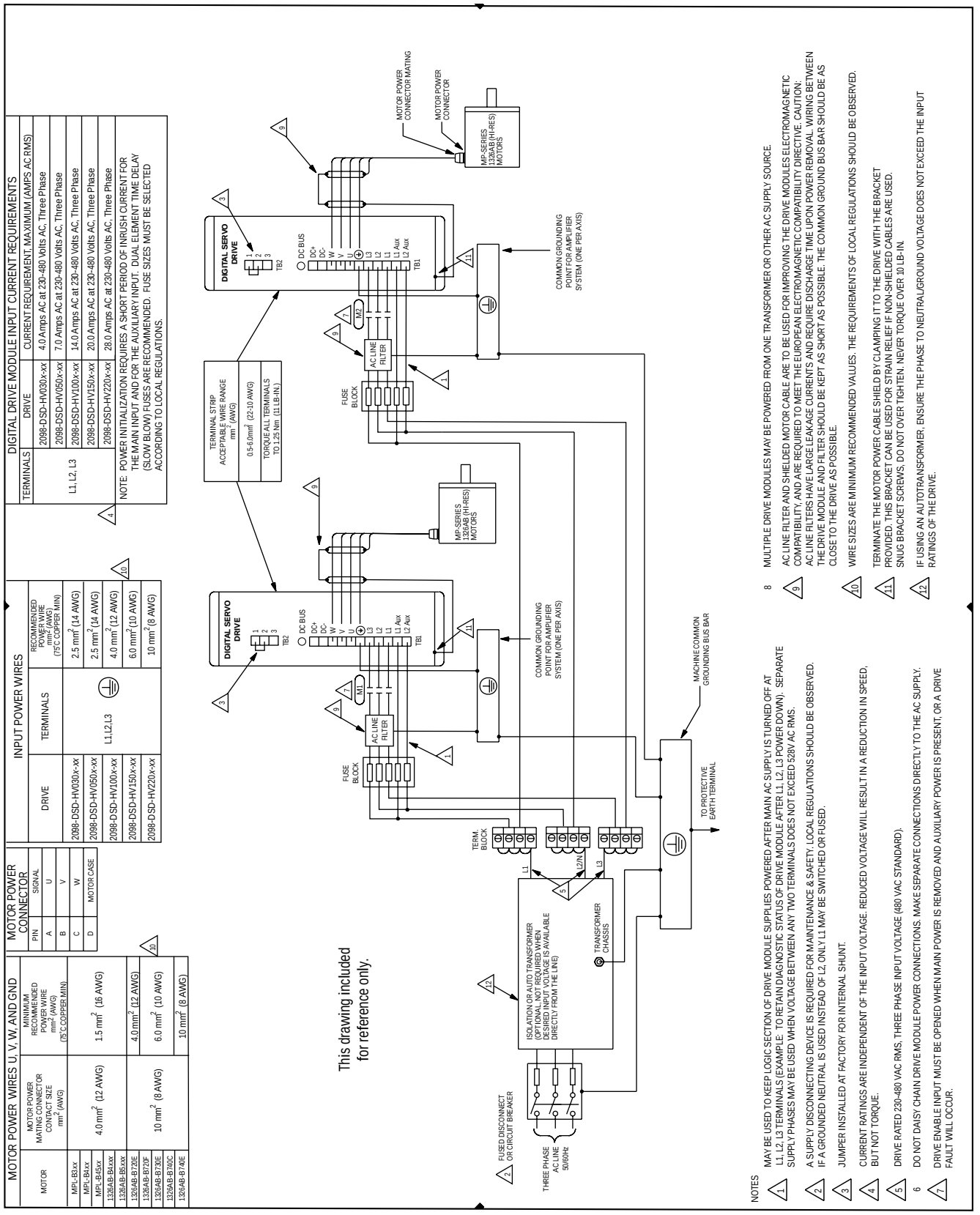


Figure B.16
Typical Power Wiring of Ultra3000 System
(2098-DSD-HV*xxx*-*xx* and -HV*xxx*X-*xx*)



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 2.15 in the chapter *Ultra3000 Connector Data* for more information on the digital relay output.

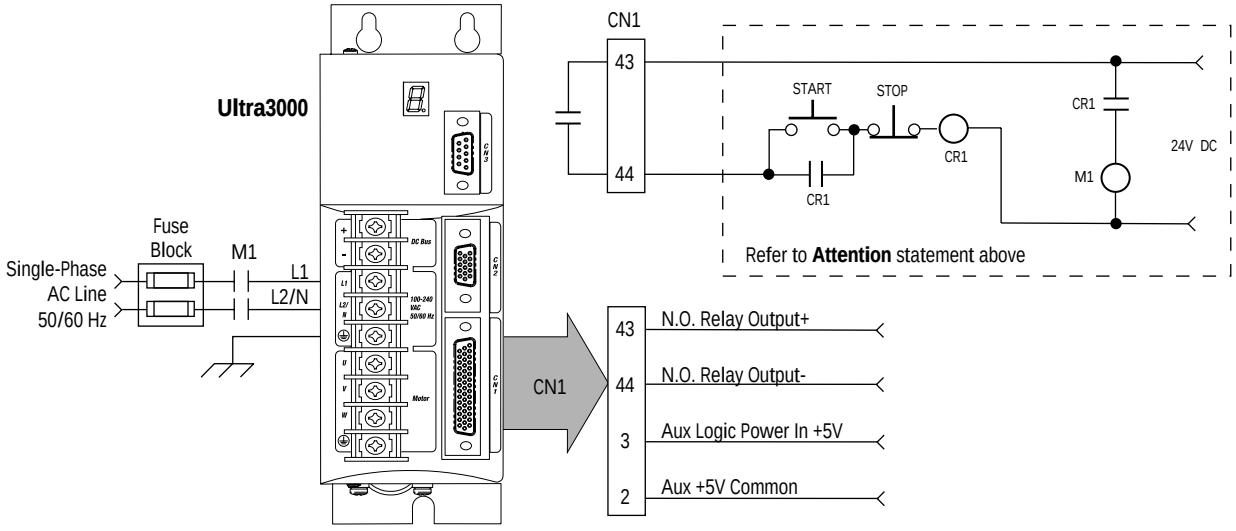
24V dc Start/Stop String Examples

The 24V dc start/stop string wired to the Ultra3000 drives (2098-DSD-005*x*-*xx*, -010*x*-*xx*, or -020*x*-*xx*) is shown in the figure below.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.17
24V dc Single-Phase Start/Stop String Example



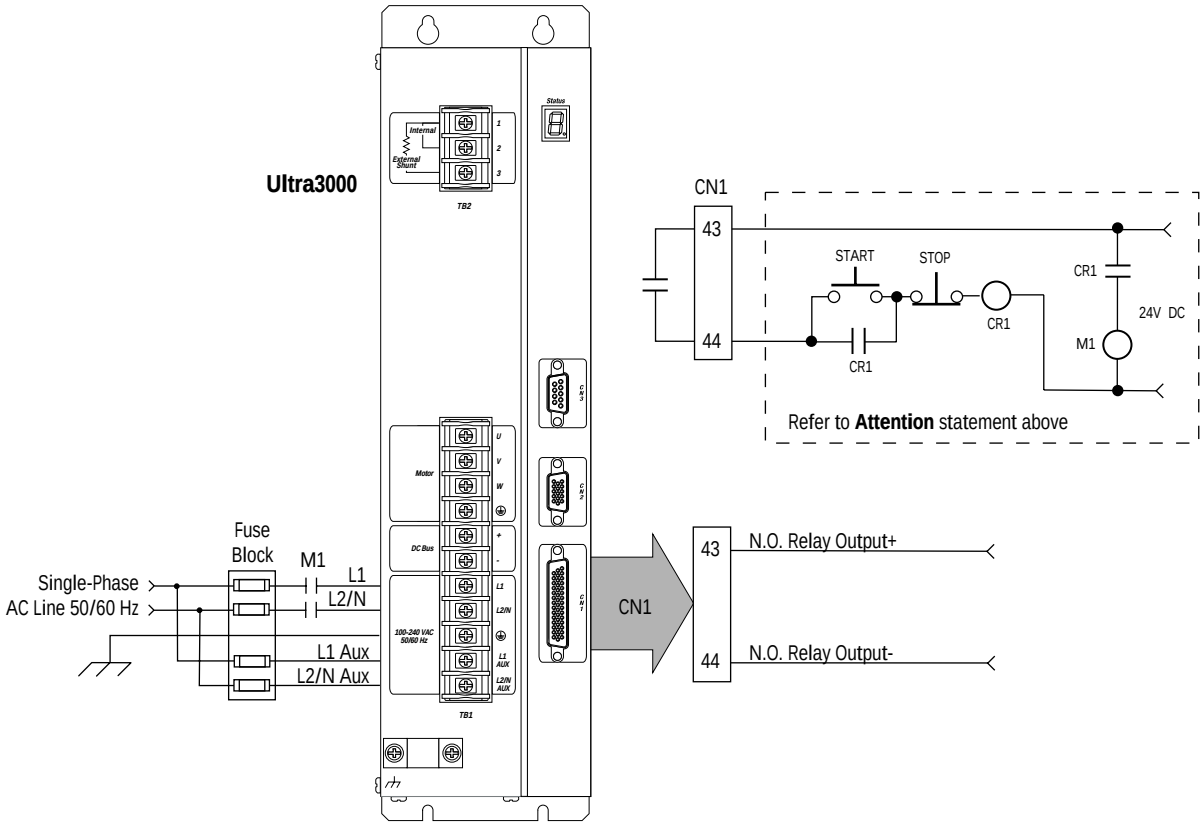
Note: Relay Output (CN1, pins 43 and 44) must be configured as Ready in Ultraware software and auxiliary +5V power is required.

The 24V dc start/stop string wired to the Ultra3000 drives (2098-DSD-030*x*-*xx*) is shown in the figure below.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.18
24V dc Single-Phase Start/Stop String Example



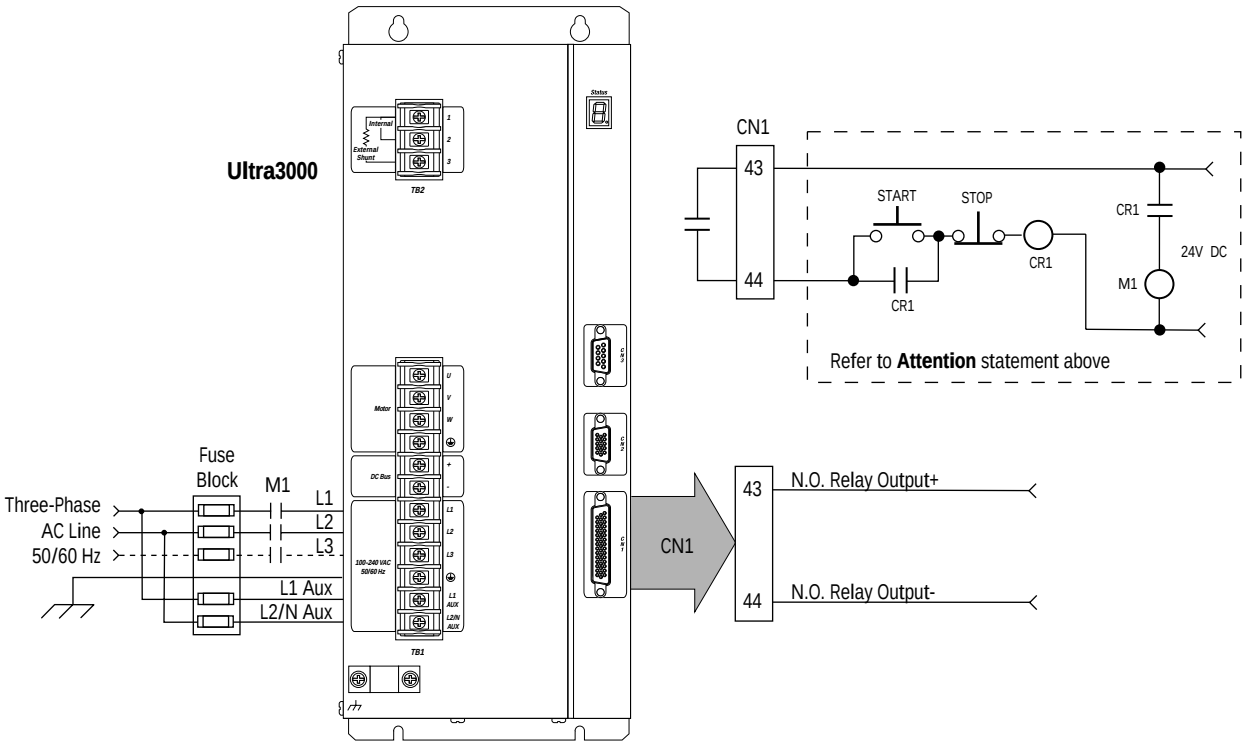
Note: Relay Output (pins 43 and 44) must be configured as Ready in Ultraware software.

The 24V dc start/stop string wired to the Ultra3000 drives (2098-DSD-075*x*-*xx*, -150*x*-*xx*, -HV*xxx*-*xx*, and -HV*xxx*X-*xx*) is shown in the figure below.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.19
24V dc Three-Phase Start/Stop String Example



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

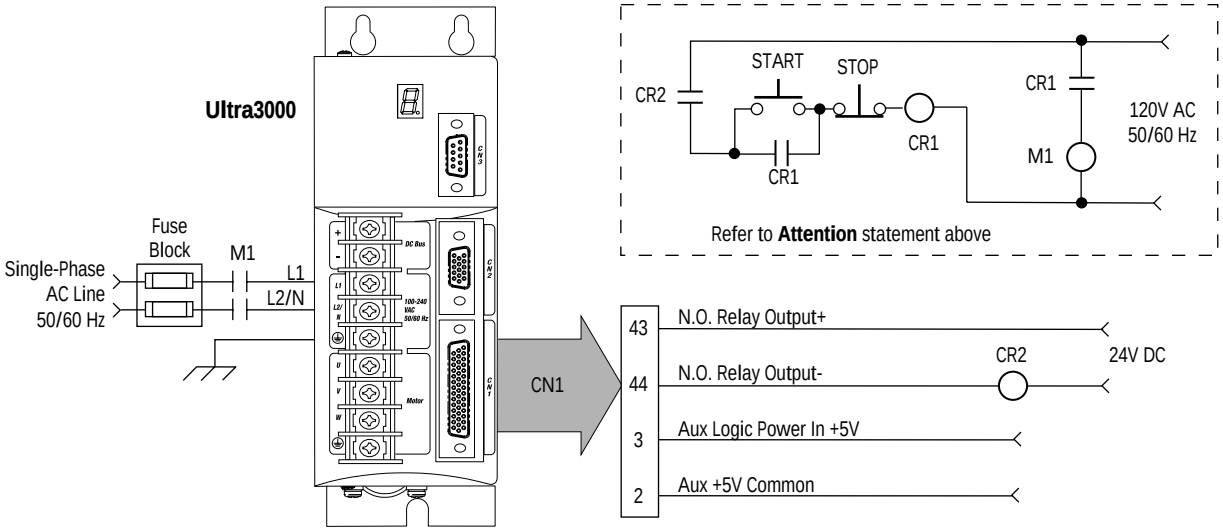
120V ac Start/Stop String Examples

The 120V ac start/stop string wired to the Ultra3000 drives (2098-DSD-005*x*-*xx*, -010*x*-*xx*, or -020*x*-*xx*) is shown in the figure below. Refer to Figure 2.15 in the chapter *Ultra3000 Connector Data* for more information on the digital relay output.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.20
120V ac Single-Phase Start/Stop String Example



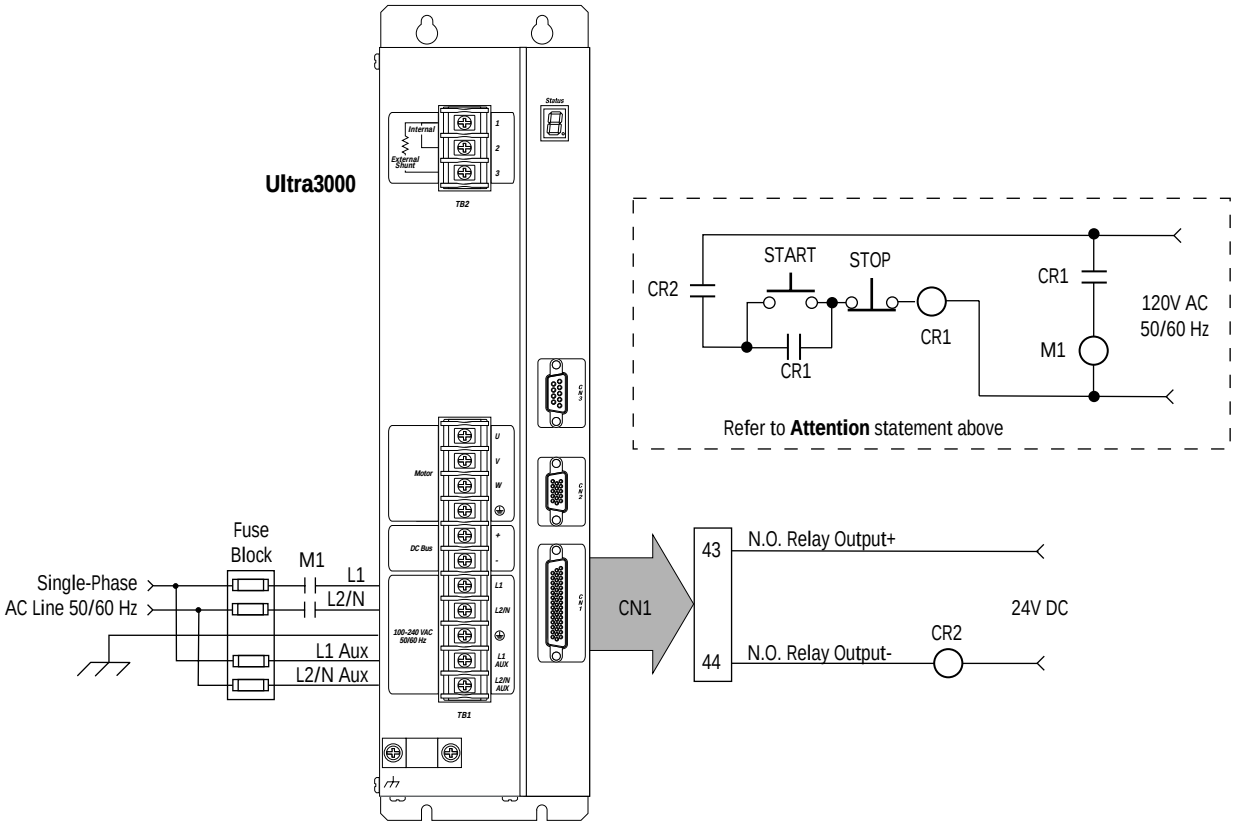
Note: Relay Output (CN1, pins 43 and 44) must be configured as Ready in Ultraware software and auxiliary +5V power is required.

The 120V ac start/stop string wired to the Ultra3000 drives (2098-DSD-030*x*-*xx*) is shown in the figure below.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.21
120V ac Single-Phase Start/Stop String Example



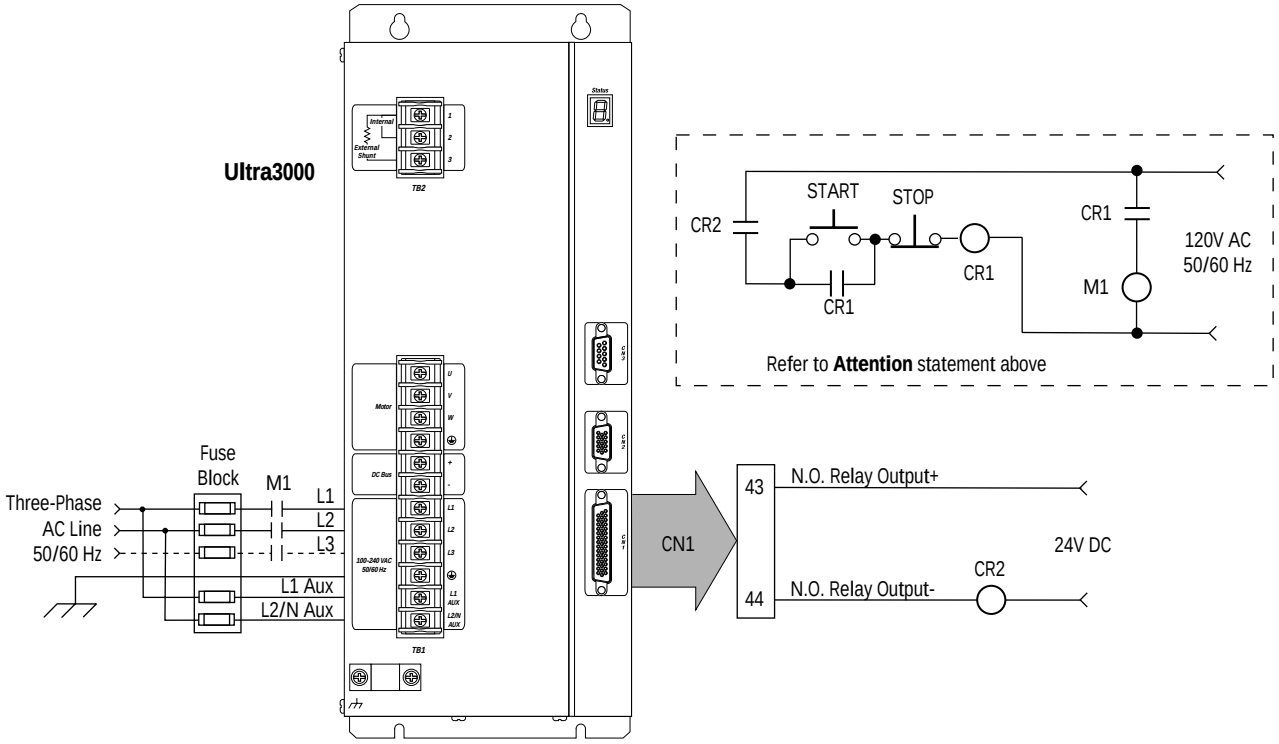
Note: Relay Output (pins 43 and 44) must be configured as Ready in Ultraware software.

The 120V ac start/stop string wired to the Ultra3000 drives (2098-DSD-075*x*-*xx*, -150*x*-*xx*, -HV*xxx*-*xx*, and -HV*xxx*X-*xx*) is shown in the figure below.

ATTENTION

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. For more information refer to *Understanding the Machinery Directive* (publication SHB-900).

Figure B.22
120V ac Three-Phase Start/Stop String Example



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

Controlling a Brake

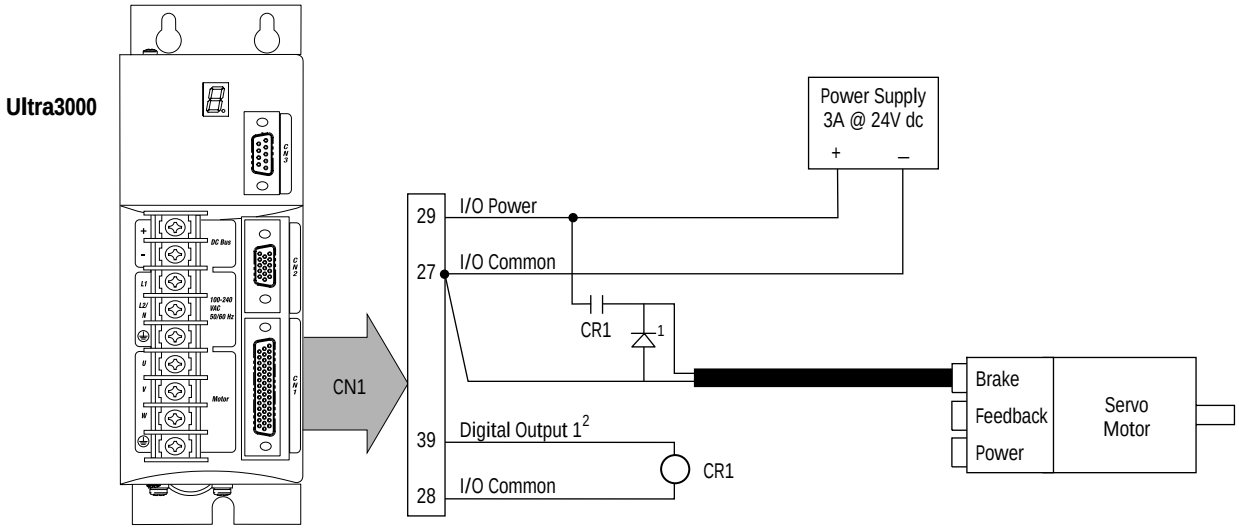
The relay output of the Ultra3000 is suitable for directly controlling a motor brake, subject to the relay voltage limit of 30V dc, and the relay current limit of 1A dc. For brake requirements outside of these limits, an external relay must be used. If a transistor output is used, a control relay is also required.

The following table lists Allen-Bradley motors that are compatible with the internal relay output (CN1, pins 43 and 44), when used for controlling a brake.

Compatible Brake Motors	Brake Current
F-4030, F-4050, and F-4075	0.88A
H-3007 and H-3016	0.60A
H-4030, H-4050, and H-4075	0.69A
Y-1002 and Y-1003	0.26A
Y-2006 and Y-2012	0.31A
Y-3023	0.37A
MPL-A310, MPL-A320, and MPL-A330	0.50A
MPL-A420, MPL-A430, MPL-A4520, MPL-A4530, and MPL-A4540	0.64A

Figure B.23 shows an example configuration using Digital Output 1 and control relay to control a motor brake with a transistor output.

Figure B.23
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 Ultraware.

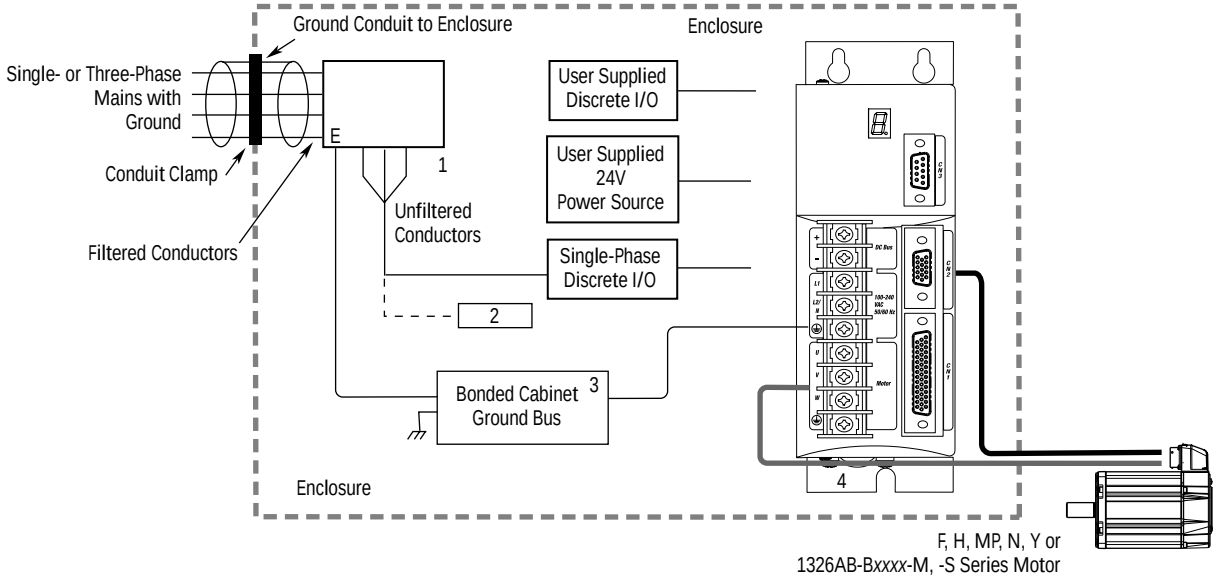
For Digital Output 1 specifications, refer to Figure 2.14 in the chapter *Ultra3000 Connector Data*.

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

Grounding for Ultra3000 CE Requirements

This section provides information to assist you in complying with CE requirements. Refer to the figure below for Ultra3000 CE requirements.

Figure B.24
Ultra3000 CE Requirements



1 Mount the filter as close to the Ultra3000 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 Ultra3000 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 Ultra3000 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 Ultra3000 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 Ultra3000 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, Ultra3000, and the enclosure should be free from paint or any other type of insulator.

2 The filter shown is sized for one Ultra3000. 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.

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

ATTENTION 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.

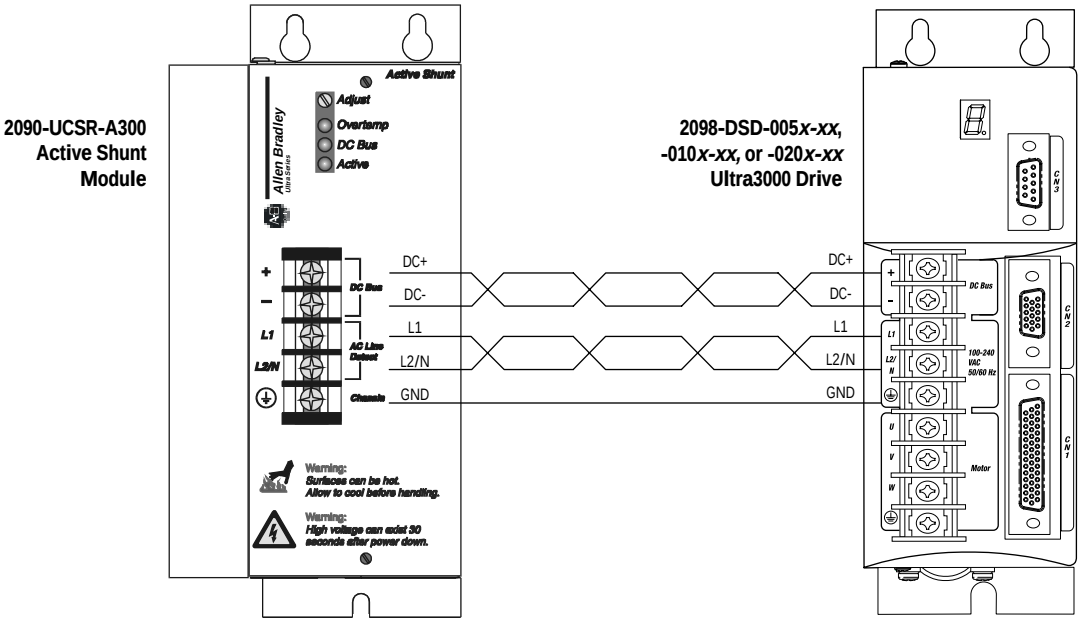
Ultra3000 to Shunt Module Interconnect Diagrams

This section provides information to assist you in wiring the active or passive shunt module when connecting to your Ultra3000 230V drive (2098-DSD-*xxx*-*xx* or -*xxx*X-*xx*).

Ultra3000 to 300W Active Shunt Module

Use the 2090-UCSR-A300 active shunt module with the Ultra3000 drives (2098-DSD-005*x*-*xx*, -010*x*-*xx*, and -020*x*-*xx*).

Figure B.25
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:

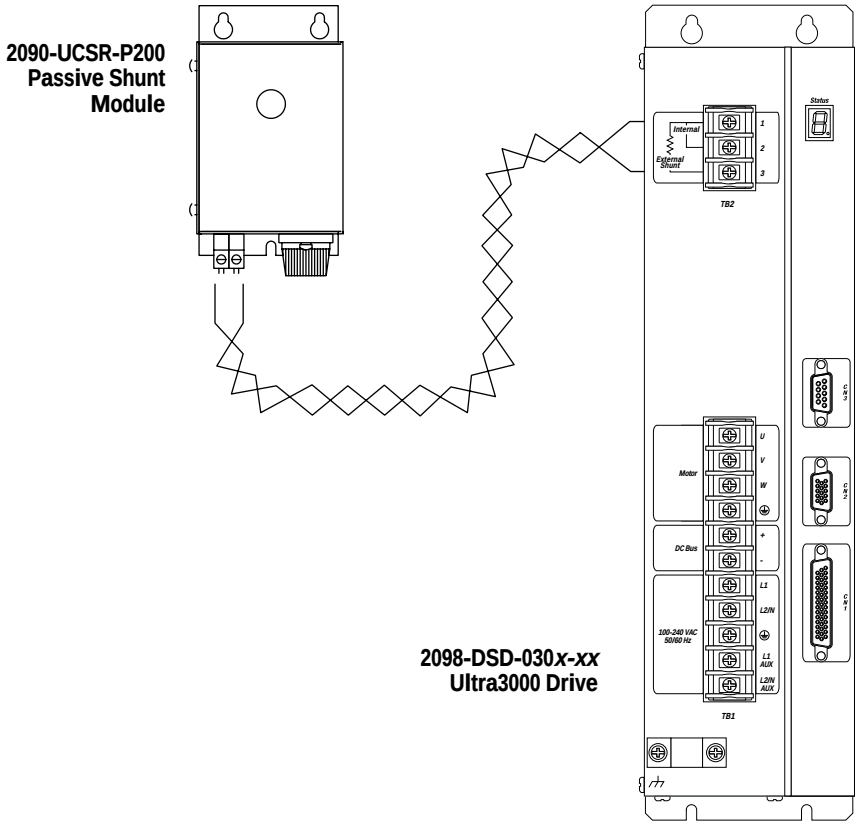
- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).

For more information, refer to the *300 Watt Active Shunt Regulator Installation Instructions* (publication 2090-IN002*x*-EN-P).

Ultra3000 to 200W Passive Shunt Module

Use the 2090-UCSR-P200 passive shunt module with the Ultra3000 drives (2098-DSD-030*x*-*xx*).

Figure B.26
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:

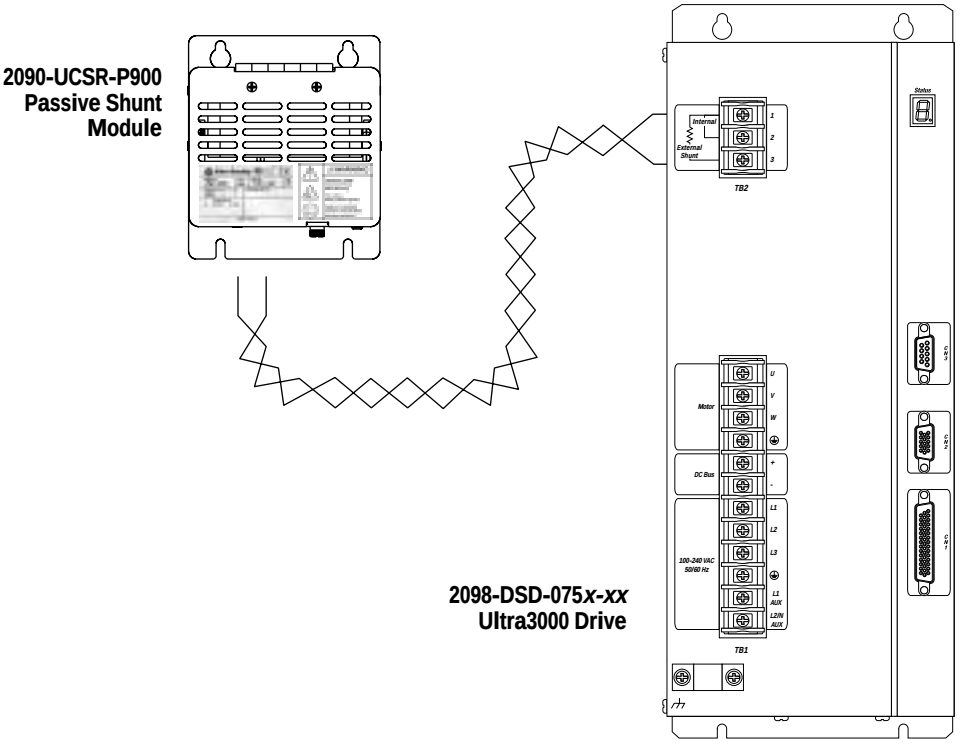
- Install wires using twisted pairs (two turns per foot minimum), as shown in the figure above. Keep unshielded wires as short as possible.
- Use shielded, twisted cable (ground shield at shunt and drive).
- Use shielded metal conduit (ground conduit at shunt and drive).

For more information, refer to the *200 Watt Passive Shunt Module Installation Instructions* (publication 2090-IN003*x*-EN-P).

Ultra3000 to 900W Passive Shunt Module

Use the 2090-UCSR-P900 passive shunt module with the Ultra3000 drives (2098-DSD-075*x*-*xx*).

Figure B.27
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).

For more information, refer to the *900 Watt Passive Shunt Module Installation Instructions* (publication 2090-IN001*x*-EN-P).

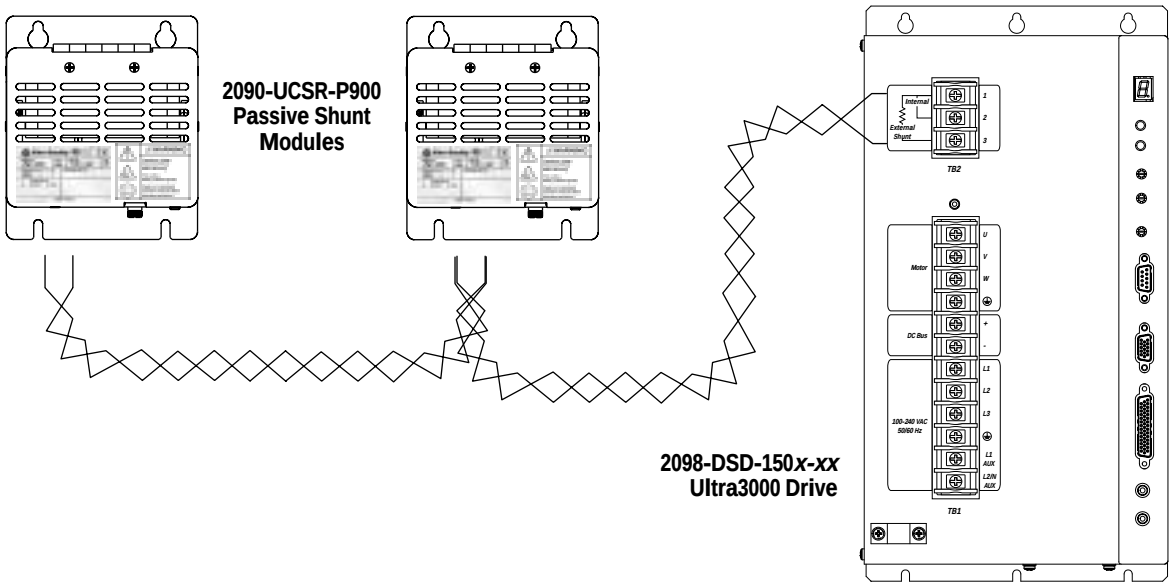
Ultra3000 to Two 900W Passive Shunt Module

Use one or two 2090-UCSR-P900 passive shunt modules with the Ultra3000 drives (2098-DSD-150*x*-*xx*). 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.

ATTENTION

Do not connect more than two 900W shunts with your 2098-DSD-150*x*-*xx* drive, or damage to the drive will result.

Figure B.28
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).

For more information, refer to the *900 Watt Passive Shunt Module Installation Instructions* (publication 2090-IN001*x*-EN-P).

Catalog Numbers and Accessories

Chapter Objectives

This appendix lists the Ultra3000 drives and accessory items in tables by catalog number providing detailed descriptions of each component. This appendix describes catalog numbers for:

- Ultra3000 drives
- Ultraware software
- AC line filters
- External shunt kits
- Motor power cables
- SERCOS Interface fiber optic cables
- Motor feedback cables
- Ultra3000 interface cables
- Mating connector kits
- Breakout boards, cables, and kits
- MP-Series motor brake cable

Contact your local Allen-Bradley sales office for additional information. Refer to the *Motion Control Selection Guide* (publication GMC-SG001*x*-EN-P) for details on products.

Ultra3000 Drives

Use the following table to identify Ultra3000 240V drives with ratings of 500W, 1 kW, and 2 kW where *-xxx* equals 005, 010, or 020.

Description	Catalog Number
Ultra3000 Digital Servo Drive	2098-DSD-*xxx*
Ultra3000i Digital Servo Drive (with Indexing)	2098-DSD-*xxx*X
Ultra3000 Digital Servo Drive (with SERCOS)	2098-DSD-*xxx*-SE
Ultra3000 Digital Servo Drive (with DeviceNet)	2098-DSD-*xxx*-DN
Ultra3000 Digital Servo Drive (with DeviceNet and Indexing)	2098-DSD-*xxx*X-DN

Use the following table to identify Ultra3000 240V drives with ratings of 3 kW, 7.5 kW, and 15 kW where *-xxx* equals 030, 075, or 150.

Description	Catalog Number
Ultra3000 Digital Servo Drive	2098-DSD-*xxx*
Ultra3000i Digital Servo Drive (with Indexing)	2098-DSD-*xxx*X
Ultra3000 Digital Servo Drive (with SERCOS)	2098-DSD-*xxx*-SE
Ultra3000 Digital Servo Drive (with DeviceNet)	2098-DSD-*xxx*-DN
Ultra3000 Digital Servo Drive (with DeviceNet and Indexing)	2098-DSD-*xxx*X-DN

Use the following table to identify Ultra3000 460V drives with ratings of 3 kW, 5 kW, 10 kW, 15 kW, and 22 kW where *-xxx* equals 030, 050, 100, 150, or 220.

Description	Catalog Number
Ultra3000 Digital Servo Drive	2098-DSD-HV*xxx*
Ultra3000i Digital Servo Drive (with Indexing)	2098-DSD-HV*xxx*X
Ultra3000 Digital Servo Drive (with SERCOS)	2098-DSD-HV*xxx*-SE
Ultra3000 Digital Servo Drive (with DeviceNet)	2098-DSD-HV*xxx*-DN
Ultra3000 Digital Servo Drive (with DeviceNet and Indexing)	2098-DSD-HV*xxx*X-DN

Ultraware Software

The Ultra3000 drives are configured using Ultraware. Ultraware is a Windows® based application that allows drive configuration to be done off-line and saved to disk.

Description	Catalog Number
Ultraware Software	2098-UWCPRG

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	Roxburgh Part Number	Catalog Number
6 Amp, Single phase, 240V	6 Amp	MIF06	2090-UXLF-106
10 Amp, Single phase, 240V	10 Amp	MIF10	2090-UXLF-110
23 Amp, Single phase, 240V	23 Amp	MIF23	2090-UXLF-123
36 Amp, Single phase, 240V	36 Amp	MDF36	2090-UXLF-136
36 Amp, Three phase, 240V	36 Amp	MDF336	2090-UXLF-336
50 Amp, Single phase, 240V	50 Amp	MDF50	2090-UXLF-150
50 Amp, Three phase, 240V	50 Amp	MDF350	2090-UXLF-350
70 Amp, Three phase, 240V	70 Amp	MDF370	2090-UXLF-370
23 Amp, Three phase, 480V	23 Amp	MIF323	2090-UXLF-HV323
30 Amp, Three phase, 480V	30 Amp	MIF330	2090-UXLF-HV330
50 Amp, Three phase, 480V	50 Amp	MIF350	2090-UXLF-HV350

External Shunt Kits

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

This Shunt Module:	Is used on these Ultra3000 drives:	Catalog Number:
Active Shunt Module (300W)	All 2098-DSD-005, -010, -020	2090-UCSR-A300
Passive Shunt Module (200W)	All 2098-DSD-030, -075, -150	2090-UCSR-P200
Passive Shunt Module (900W)	All 2098-DSD-075, -150	2090-UCSR-P900

Cables

Use the following tables to identify motor power, feedback, interface, and brake cables for your Ultra3000 with 115/230V motors. Length of cable *xx* is in meters (01, 03, 09, 15, and 30) unless otherwise noted.

Motor Power Cables

Description	Catalog Number
H-Series Motor Power Cable, non flex, 16 AWG, straight	2090-UXNPAH-16S*xx*
H-Series Motor Power Cable, non-flex, 16 AWG, right angle	2090-UXNPAH-16R*xx*
H-Series Motor Power Cable, non-flex, 6 AWG, straight	2090-UXNPAH-6S*xx*
H-Series Motor Power Cable, non-flex, 6 AWG, right angle	2090-UXNPAH-6R*xx*
H and F-Series Motor Power Cable, non flex, 14 AWG, straight	2090-UXNPAHF-14S*xx*
H and F-Series Motor Power Cable, non-flex, 14 AWG, right angle	2090-UXNPAHF-14R*xx*
H and F-Series Motor Power Cable, non flex, 10 AWG, straight	2090-UXNPAHF-10S*xx*
H and F-Series Motor Power Cable, non-flex, 10 AWG, right angle	2090-UXNPAHF-10R*xx*
H and F-Series Motor Power Cable, non-flex, 8 AWG, straight	2090-UXNPAHF-8S*xx*
H and F-Series Motor Power Cable, non-flex, 8 AWG, right angle	2090-UXNPAHF-8R*xx*
MP-Series Motor Power Cable, non flex, 16 AWG, straight	2090-UXNPAMP-16S*xx*
MP-Series Motor Power Cable, non flex, 14 AWG, straight	2090-UXNPAMP-14S*xx*
MP-Series Motor Power Cable, non flex, 10 AWG, straight	2090-UXNPAMP-10S*xx*
N-Series Motor Power Cable, non flex, 16 AWG, straight	2090-UXNPAN-16S*xx*
N-Series Motor Power Cable, non-flex, 16 AWG, right angle	2090-UXNPAN-16R*xx*
Y-Series Motor Power Cable, non flex, 16 AWG, straight	2090-UXNPAY-16S*xx*

SERCOS Interface Fiber Optic Cables

Use the following table to identify the SERCOS interface fiber optic plastic cables for your Ultra3000. Connectors are provided at both ends. Length of cable *x-x* is in meters (0-3, 1-0, 3-0, 5-0, 8-0, 10-0, 15-0, 20-0, 25-0, 32-0, 50-0, 100-0, 150-0, and 200-0).

Description	Catalog Number
SERCOS fiber optic plastic cable (for use inside enclosure only)	2090-SCEP*x-x*
SERCOS fiber optic plastic (PVC) cable (for use outside enclosure)	2090-SCVP*x-x*
SERCOS fiber optic plastic (nylon) cable (for use outside enclosure in harsh environments)	2090-SCNP*x-x*
SERCOS fiber optic glass (PVC) cable	2090-SCVG*x-x*

Note: Lengths of 0.3 m (1.0 ft) to 32 m (105.0 ft) are available in plastic or glass. Lengths of 50 m (164.2 ft) to 200 m (656.7 ft) are available in glass only.

Motor Feedback Cables

Description	Catalog Number
H-Series Motor Feedback Cable, non-flex, connector at both ends, right angle	2090-UXNFBH-R*xx*
H-Series Motor Feedback Cable, non-flex, motor connector to flying leads, right angle	2090-UXNFDH-R*xx*
H and F-Series Motor Feedback Cable, non-flex, connector at both ends, straight	2090-UXNFBHF-S*xx*
H and F-Series Motor Feedback Cable, non-flex, motor connector to flying leads, straight	2090-UXNFDHF-S*xx*
H and F-Series Motor Feedback Cable, non-flex, connector at both ends, right angle	2090-UXNFBHF-R*xx*
H and F-Series Motor Feedback Cable, non-flex, connector at both ends, right angle, skewed	2090-UXNFBHF-K*xx*
MP-Series Motor Feedback Cable, non-flex, connector at both ends, straight	2090-UXNFBMP-S*xx*
1326AB-B*xxxx*-M or -S Motor Feedback Cable, non-flex, connector at both ends, straight	
MP-Series Motor Feedback Cable, non-flex, motor connector to flying leads, straight	2090-UXNFDMP-S*xx*
1326AB-B*xxxx*-M or -S Motor Feedback Cable, non-flex, motor connector to flying leads, straight	
N-Series Motor Feedback Cable, non-flex, connector at both ends, straight	2090-UXNFBN-S*xx*
N-Series Motor Feedback Cable, non-flex, motor feedback connector to flying leads, straight	2090-UXNFDN-S*xx*
N-Series Motor Feedback Cable, non-flex, connector at both ends, right angle	2090-UXNFBN-R*xx*
N-Series Motor Feedback Cable, non-flex, connector at both ends, right angle, skewed	2090-UXNFBN-K*xx*
N-Series Motor Feedback Cable, non-flex, connector at both ends, right angle, skewed	2090-UXNFBN23-K*xx*
N-Series Motor Feedback Cable, non-flex, motor connector to flying leads, right angle, skewed	2090-UXNFDN23-K*xx*
N-Series Motor Feedback Cable, non-flex, motor connector to flying leads, right angle	2090-UXNFDN-R*xx*
Y-Series Motor Feedback Cable, non-flex, connector at both ends, straight	2090-UXNFBY-S*xx*
Y-Series Motor Feedback Cable, non-flex, motor feedback connector to flying leads, straight	2090-UXNFDY-S*xx*
Drive Feedback Cable, non-flex, CN2 connector to flying leads, straight	2090-UXNFM-S*xx*

Ultra3000 Interface Cables

Description	Catalog Number
Serial Interface Cable, 9-pin D-shell, CN3 to personal computer.	2090-UXPC-D09*xx*
Controller Interface Cable, 44-pin D-shell, CN1 to no connector.	2090-U3CC-D44*xx*

Mating Connector Kits

The Ultra3000 has one serial connector, one motor feedback connector, and one controller connector. Use the following table to identify the mating connector kits for your Ultra3000. Refer to the chapter *Ultra3000 Connector Data* for pin signal, and wiring information.

Description	Catalog Number
Mating Connector Kit (9-pin D-shell)	2090-UXCK-D09
Mating Connector Kit (15-pin high density D-shell)	2090-UXCK-D15
Mating Connector Kit (44-pin high density D-shell)	2090-U3CK-D44

The following table lists Amp mating connectors that are not available from Rockwell Automation. Please contact Amp at 1-800-522-6752 or a distributor for additional information.

Connector Components	CN1 Controller 44-Pin High-Density D-Shell	CN2 Motor Feedback 15-Pin High-Density D-Shell	CN3 Serial 9-Pin Standard-Density D-Shell
Mating Connector	748366-1	748364-1	205204-4
Crimp Pin Contacts	748333-4 [1]	748333-4 [1]	5-66506-7 [2]
Unshielded Backshell Kit	748678-3	748678-1	748678-1
Shielded Backshell Kit	745173-3	745171-5	745171-5
Ferrules [3]	745508-1	745508-6	745508-6

[1] Accepts 22-28 AWG wire.

[2] Accepts 20-24 AWG wire.

[3] Ferrules are only required for use with shielded backshell kits.

Break Out Boards, Cables, and Kits

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

Description	Catalog Number
Break Out Board, 15-pin, high density D-shell, CN2.	2090-UXBB-D15
Break Out Board Cable, 15-pin, high density D-shell, CN2. Length of cable *xx* is in meters (01, 03, 09, and 15).	2090-UXBC-D15*xx*
Break Out Board Kit. Contains CN2 break out board and cable.	2090-UXBK-D15*xx*
Drive mounted Break Out Board for 15-pin CN2 connector.	2090-UXBB-DM15
Break Out Board, 44-pin, high density D-shell, CN1.	2090-U3BB-D44
Break Out Board Cable, 44-pin, high density D-shell, CN1. Length of cable *xx* is in meters (01, 03, and 09)	2090-U3BC-D44*xx*
Break Out Board Kit. Contains CN1 break out board and cable.	2090-U3BK-D44*xx*
Drive mounted Break Out Board for 44-pin CN1 connector.	2090-U3BB-DM44
Drive mounted Break Out Board for 9-pin CN3 connector.	2090-UXBB-DM09

MP-Series Motor Brake Cable

Description	Catalog Number
MP-Series motor brake cable, 0.75 mm^2 (18 AWG)	2090-UXNBMP-18S*xx*

Numerics

A

B

C

D

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F

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