HARDWARE AND INSTALLATION MANUAL

CENTURION™ DSM100

SERVO AMPLIFIERS

GIDDINGS & LEWIS, INC.

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Table of Contents

CHAPTER 8 **Application and Configuration Examples**

List of Figures

List of Tables

Preface

This manual provides a step-by-step approach to building a servo system using a Centurion DSM100 Drive . The manual is divided into chapters that cover specific phases of the system design process; from ordering components that will complement the performance of the Centurion DSM100 Drive , to receiving, installing and verifying the drive's functionality.

Chapters and appendices in the manual include:

- *Safety*
- *Selecting Other System Components*
- *DSMPro Installation*
- *Unpacking,Inspecting and Storing*
- *Installation*
- *Interfaces*
- *Power Connections*
- *Application and Configuration Examples*
- *Tuning*
- *Status Display*
- *Maintenance and Troubleshooting*
-
- *Cable Diagrams, Schematics and Examples*
- *TouchPad Instructions*
- *Electromagnetic Compatibility Guidelines for Machine Design*
- *Dynamic Braking Resistor Selection*
- *Specifications*
- *Product Support*

The intent of the manual is to assemble a high-performance servo system in a methodical manner. By making correct decisions and taking appropriate actions a servo system that performs "as designed" can be assured.

About This Manual

This manual provides instructions on how to setup and connect the Centurion DSM100 Drive to a controlling device and a motor. A Centurion DSM100 Drive may operate in one of several different functional modes. The hardware connections necessary to run the drive are explained and basic software instructions are provided for common set up procedures. For detailed explanation of software instructions, refer to the comprehensive on-line instructions available in the DSMPro software.

This manual explains how to install your Centurion DSM100 Drive using DSMPro software with a personal computer. If you are using a TouchPad device, abbreviated command titles are displayed but the setup steps remain the same. If you are using the serial Host Command Language to control the drive, comprehensive instructions are accessible through the Host Mode icon displayed in the DSMPro window.

This manual is organized into chapters and appendixes. The topics covered in each chapter and section are briefly described. Typographical conventions, warning and cautions specific to the drive, and complementary manuals are also described.

Title	Description
Safety	Lists general safety requirements that must be followed when installing or servicing the drive.
Selecting Other System Components	Reviews the major features of the Centurion DSM100 Drives and identifies motors and signal types that are compatible.
DSMPro Installation	Explains how to install, access and exit DSMPro.
Unpacking,Inspecting and Storing	Lists what should be included with your Centurion DSM100 Drive and instructs you on how to perform a basic functional test before installing or storing the drive.
Installation	Instructs you on how to physically install your Centurion DSM100 Drive.
Interfaces	Provides comprehensive information about the signals available on each connector. Each signal or set of signals is identified by: • Power requirements for driving the signal. • Functions performed by the signal. • Specifications, including ON and OFF states. • Schematic depictions of the circuit design for each signal type. The signals are grouped under the following connectors. • J1 – Controller Diagrams show cable connections needed for common interfaces. • J2 – Encoder Details information about the encoder signals, Hall Effect switches and thermostat connections available through this connector. • J3 – Auxiliary Port Provides a second controller connection that duplicates the first 26 pins on J1, the Controller connector • J4 and J5 – Serial Port Diagrams and instructions detail how to connect one or more drives using RS-232 communications in a single or daisy-chain connection, or to connect several drives using Multi-Drop RS-485. • A1, A2 and COM – Analog Outputs Describes the connections that allow monitoring of the analog command signals with external equipment.
Power Connections	Provides information on making motor power, DC bus and AC Power connections.
Application and Configuration Examples	Describes the hardware and software set up necessary to install the drive as one of the following types: • Analog Control in velocity or torque mode • Preset Controller in velocity or torque mode • Position Follower (Master Encoder) in velocity mode • Position Follower (Step/Direction) in velocity mode • Position Follower (Step Up/Step Down) in velocity mode • Incremental Indexing • Registration Indexing • Absolute Indexing • Modifying User Units
Tuning	Provides instructions on how to tune a drive and motor combination using the autotuning or manual tuning features in DSMPro.
Status Display	Discusses the operator indicators available on the front panel. Operating or Error Messages are explained.
Maintenance and Troubleshooting	Describes the minimal maintenance necessary with the Centurion DSM100 Drives and provides a comprehensive troubleshooting chart of potential problems and their solutions.

Title	Description
	Lists the optional equipment available for the Centurion DSM100 Drives.
Cable Diagrams, Schematics and Examples	Provides schematics and cabling examples.
TouchPad Instructions	Describes how to program a Centurion DSM100 Drive using the optional TouchPad device. Tables reference the various motor types that are programmed to work with the Centurion DSM100 Drive. A copy of the *TouchPad Command Tree Card* for the current firmware version is bound into the manual.
Electromagnetic Compatibility Guidelines for Machine Design	Describes common electrical noise problems and suggests methods to ensure ElectroMagnetic Compatibility.
Dynamic Braking Resistor Selection	Provides equations to assist in sizing resistors for dynamic braking.
Specifications	Details the design and operational specifications for the Centurion DSM100 Drives in a tabular format.
Product Support	Describes the product assistance available from Giddings & Lewis. Telephone numbers for product assistance and on-line information are listed.

Additional Instructions and Manuals

Host Commands and DSMPro

All Centurion DSM100 Drives are setup through serial Host Commands. The drives may be configured directly through the Host Command language or indirectly through the DSMPro software. DSMPro is a graphical user interface that provides a visual method of accessing the Host Command language through the Microsoft Windows Operating System.

All documentation for both the Host Commands and DSMPro is on-line. Host Command information is available through a comprehensive on-line reference manual. DSMPro information is available through Help menus. The on-line documents provide in-depth explanations of the Host Command language as well as the menus, windows and dialog boxes that make DSMPro a convenient method for programming Centurion DSM100 Drives.

- To access the Host Command Reference
  Click on the Host Command Reference icon in the DSMPro program group.
- To access DSMPro Help
  Open DSMPro by clicking on the DSMPro icon in the DSMPro group, and
  Press the F1 key.

Touch Pad

The optional TouchPad may be used to monitor and configure the Centurion DSM100 Drive. The TouchPad command structure is similar to the structure of DSMPro, but operates through an abbreviated keypad interface. The card *TouchPad Instructions* is provided with the TouchPad. It describes the installation and operational instructions in a pocket-sized directory. The *TouchPad Command Tree Card* and additional instructions for the TouchPad are included in the section titled, “TouchPad Instructions” which begins on page C-205. The *TouchPad Command Tree Card* is a graphical presentation of both the operational instructions and the command structure for the Centurion DSM100 Drives. You may find it convenient to refer to the card when using the TouchPad with a drive.

Symbols and Conventions

Typographical and Wording Conventions

This manual uses the following typographical and wording conventions:

Example	Description
»	Text preceded by right guillemet explains how to access the particular function in the preceding paragraph. For example, To Start DSMPro in Windows » Choose the icon DSMPro.
Drive Set Up	Text shown in this font and underlined indicates a Hot Key (keystroke combination) to quickly access a command. For example, Choose **Drive Set Up**. indicates typing ALT+D followed by ENTER accesses this command.
DSMPro	Text shown in this font is information to enter in a window or dialog box. For example, Choose the icon DSMPro**.**
win	Text in lower case bold is information to enter at a keyboard. For example, To start Windows from the DOS prompt, type **win** and then press ENTER.
ALT+F4[a]	Keys that should be pressed simultaneously are shown with a plus sign (+) between the key names. This example closes the active window.
ALT, F, N	Keys that should be pressed in sequence are shown with a comma (,) between the key names. This example opens the File menu and then opens a new file.
Choose	The wording indicates that an icon or a command is to be selected from a window or a command box. For example, the instruction for accessing the command icon Drive Set Up states: Choose **Drive Set Up**.
Select	The wording indicates that options are to be defined or selected from a list. For example, the instruction for accessing or entering information states: Select Drive Type and Motor Model from the respective list box.
Type	The wording indicates that commands are to be entered into a command box. For example, the instruction for loading DSMPro states: Type **a:setup** and then press **ENTER**.
TIP	Tips provide hints or shortcuts that are useful to know. For example, DSMPro always displays the Help menu - Quick Start - when it is first accessed. To disable this automatic display, choose the menu item **Show Quick Start** from the Help menu.

a. Microsoft® Windows™ reserves certain multiple keystroke combinations to activate Windows commands.

Graphical Symbols and Warning Classifications

This manual uses the following graphical symbols and warning classifications. The use of a symbol and signal word is based on an estimation of the likelihood of exposure to the hazardous situation and what could happen as a result of exposure to the hazard.

Example	Description
	Protective conductor terminal (Earth ground)
	Chassis terminal (not a protective ground)
	Risk of electrical shock.
	Symbol plus DANGER, WARNING or CAUTION: These notices provide information intended to prevent potential personal injury and equipment damage.

Safety 1

Installing and Using the Centurion DSM100 Drive

Read the complete manual before attempting to install or operate the Centurion DSM100 Drive. By reading the manual you will become familiar with practices and procedures that allow you to operate the Centurion DSM100 Drive safely and effectively.

Safety Classifications

Safety notices describe the likelihood of exposure to hazardous situations and what could happen as a result of exposure to the hazard. Following are symbols and words used to introduce the information that is intended to prevent potential personal injury and equipment damage.

Symbols	Words
 or 	**DANGER**: Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations. **WARNING**: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury. **CAUTION**: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may be used for situations that cause property damage only. It may also be used to alert against unsafe practices.

Potential Hazards

The equipment described in this manual is intended for use in industrial drive systems. This equipment can endanger life through rotating machinery and high voltages, therefore it is essential that guards for both electrical and mechanical parts are *not* removed. The main hazards which can be encountered in the use of this equipment are:

- Electric shock hazards
- Electric fire hazards
- Mechanical hazards
- Stored energy hazards

These hazards must be controlled by suitable machine design, using the safety guidelines which follow. There are no chemical or ionizing radiation hazards.

Voltage Potentials

DANGER

DC bus capacitors may retain hazardous voltages for several minutes after input power has been removed, but will normally discharge in several seconds. Measure the DC bus voltage to verify it has reached a safe level each time power is removed before working on the drive; or wait for the time indicated in the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

Voltage potentials for the internal drive circuitry vary from 325 Volts above to 325 Volts below earth ground for a 240 Volt input. Voltages can exceed 450 VDC or 240 VAC within the Centurion DSM100 Drive. All circuits, including the connections on the front panel, should be considered “hot” when main or auxiliary power is connected and for the time specified in the warning on the front of the drive after power is removed.

Your Responsibilities

As the user or person installing this drive, you are responsible for determining the suitability of the product for the intended application. Giddings & Lewis is neither responsible nor liable for indirect or consequential damage resulting from the inappropriate use of this product.

A qualified person is someone who is familiar with all safety notes and established safety practices, with the installation, operation and maintenance of this equipment and the hazards involved. For more detailed definitions, refer to IEC 364.

It is recommended that anyone who operates or maintains electrical or mechanical equipment should have a basic knowledge of First Aid. As a minimum, they should know where the First Aid equipment is kept and the identity of the official First Aiders.

Safety Guidelines

Electrical shock and fire hazards are avoided by using normal installation procedures for electrical power equipment in an industrial environment. Installation must be undertaken by suitably qualified personnel. Note that this amplifier must be installed in an industrial cabinet such that access is restricted to suitable qualified personnel.

Mechanical hazards are associated with potentially uncontrolled movement of the motor shaft. If this imposes a risk in the machine, then appropriate precautions must be made to electrically disconnect the motor from the drive when personnel have access to moving parts of the machine. Note also that the motor must be securely mounted at all times.

Stored energy hazards are both electrical and mechanical.

- Electrical hazards can be avoided by disconnecting the drive from its power source and measuring the DC bus voltage to verify it has reached a safe level or by waiting for the time indicated in the warning on the front of the drive prior to removing the protective covers or touching any connections.
- Mechanical hazards require a risk analysis on the effects of stored mechanical energy when the machine is running at speed, as well as the potential for the conversion of electrical energy stored in the drive being converted to mechanical energy. Electrical energy may be stored in drive for the time indicated in the warning on the front of the drive.

The following points should be observed for the safety of personnel. These safety notes do not represent a complete list of the steps necessary to ensure safe operation of the equipment. Contact your nearest Giddings & Lewis representative for additional information.

- Only qualified personnel familiar with the equipment are permitted to install, operate and maintain the device.
- System documentation must be available and observed at all times.
- All non-qualified personnel are kept at a safe distance from the equipment.
- The system must be installed in accordance with local regulations.
- The equipment is intended for permanent connection to a main power input. It is *not* intended for use with a portable power input.
- Do *not* power up the unit without the covers in place and the protective conductor connected.
- Do *not* operate the unit without connecting the motor conductor to the appropriate terminal on the drive.
- Always remove power before making or removing *any* connection on the unit.
- Before removing the cover of the unit, shut off the main and auxiliary power and measure the DC bus voltage to verify it has reached a safe level or wait for the time indicated in the warning on the front of the drive.
- Do *not* make any connections to the internal circuitry. Connections on the front panel are the only points where users should make connections.
- Be careful of the DC bus and shunt terminals. High voltage is present when power is applied to the Centurion DSM100 Drive.
- Never connect the DC- terminal to earth ground, the drive requires a floating DC bus.
- Do *not* use the ENABLE input as a safety shutdown. Always remove power to the Centurion DSM100 Drive before maintaining or repairing the unit.
- When operating a DSM-175 or DSM-175P with a single phase power input, the current limits must be set correctly.
- Motors without thermal protection devices require a valid thermal time constant. Otherwise the motor overload protection will not function properly.

NOTES

Selecting Other System Components 2

The Giddings & Lewis Centurion DSM100 Drives are part of a family of digital drives that use microcontrollers to manage the current, velocity, and position. All system and application parameters are set in software, which ensures repeatability of all functions and prevents element drift.

This chapter reviews the Centurion DSM100 Drive and associated motors, command sources and interfaces. Selection of complementary servo components allows you to efficiently connect other devices to your Centurion DSM100 Drive. Pertinent information about each is provided to assist you in planning your servo system.

Centurion DSM100 Drive Overview

Drive Power Ratings

Several power levels of Centurion DSM100 Drives are available. All models have integral power supplies and shunt regulators and are functionally equivalent. They differ only in output power and physical size:

- DSM110 and DSM110P with continuous output power of 1000 Watts using a single phase power source
- DSM120 and DSM120P with continuous output power of 2000 Watts using a single phase power source
- DSM130 and DSM130P with continuous output power of 3000 Watts using a single phase power source
- DSM175 and DSM175P with continuous output power of 3000 Watts using a single phase power source
- DSM175 and DSM175P with continuous output power of 7500 Watts using a three phase power source
- DSM 1150 and DSM 1150P with continuous output power of 15000 watts using a three phase power source.

The Centurion DSM100 Drives, when combined with Giddings & Lewis brushless servomotors, provide continuous torque ranging from 0.34 Nm to 50.8 Nm (3 to 450 lb-in) and peak torque ranging from 1.02 Nm to 125 Nm (9 lb-in to 1100 lb-in).

Interface Cables

Standard Giddings & Lewis motor power and encoder feedback cables, as well as communications cables, are available to complete your motion control system and provide reliable, trouble free start-up. Refer to “” on page -173 for optional equipment. Use of these cables is required for compliance to the European Electromagnetic Compatibility (EMC) Directive and to protect your warranty rights.

Centurion DSM100 Drive Features

Stand-alone Design

A single unit fully encloses all electronics, including both the power supply and a built-in shunt regulator. An external transformer is *not* required on the main power line. All connectors and indicators are accessible and clearly marked on the front panel.

High Performance Microcontroller Technology

Dual microcontrollers perform all digital current, velocity and position loop calculations as well as the motor commutation calculation.

IPM Technology

IPM (Intelligent Power Module) technology in the output stage provides a high frequency, digital PWM (Pulse Width Modulation) sine wave that controls the current loop, including overcurrent, short circuit and overtemperature protection.

Analog and Digital Interfaces

All Centurion DSM100 Drives allow the user to select one of the following analog or digital command interfaces:

- ±10 Volt analog interface – position, velocity or torque control
- Presets (from one to eight binary inputs) – torque or velocity control
- Quadrature encoder digital interface – electronic gearing position follower
- Step/Direction digital interface – position control
- CW/CCW (step up/step down) interface – position control
- Indexing (available only on DSM110P, DSM120P, DSM130P, DSM175P and DSM 1150P.

Encoder Control

A single, motor mounted encoder provides complete commutation information and velocity feedback.

Encoder Output

A selectable output allows the encoder resolution to be specified for maximum performance without adding circuitry. Outputs are differential line drivers capable of dividing the motor encoder signal, PPR (pulses per revolution), by a factor of 1, 2, 4 or 8.

Digital I/O

Digital I/O channels allow the user to program the drive to fit the specific application. Selections include:

- Five selectable, 24 Volt, current sinking, optically isolated, active high inputs.
- One dedicated, control (ENABLE), current sinking, optically isolated, active high input.
- Four selectable, 24 Volt, current sourcing, optically isolated, active high outputs.
- Two dedicated (BRAKE and DRIVE READY), normally open relay outputs.

Analog I/O

Two analog inputs are dedicated to current limits and two analog outputs can be customized to fit the application:

- Two dedicated 10 bit, 0 – 10 Volt, analog inputs (+I LIMIT and -I LIMIT)
- Two selectable, ±10 Volt analog outputs, one 12-bit and one 8-bit (ANALOG1 and ANALOG2).

AC Input Power

Centurion DSM100 Drives are powered directly from a main 100-240 VAC line:

- DSM110, DSM110P, DSM120, DSM120P, DSM130 and DSM130P require single-phase main power
- DSM175 and DSM175P require either single phase or three-phase main power.
- DSM 1150 and DSM 1150P require three-phase main power.

Personality Module

EEPROM (electrically erasable programmable read-only memory) stores both motor and application specific settings and parameters for the drive in a removable personality module. This module simplifies installation, set up, maintenance and reduces spares requirements.

Multiple Protection Circuits

Device and circuit protection, and diagnostic information is provided by:

- Seven segment drive status display
- Overtemperature, short circuit and overcurrent protection for the power output
- I^2T (power-time) protection
- Bus Overvoltage
- Bus Undervoltage
- Overspeed
- Fault diagnostics
- Fused power supply outputs
- Three watchdog timers provide fail-safe operation

DSMPro Software

A Windows based software interface provides start-up selections. Tasks are organized for efficient set up, control and maintenance. Context sensitive, on-line help provides immediate assistance.

- Set up is simplified by a series of logically arranged set up screens.
- Files can be stored and printed for on-line or off-line modification, and on-site or off-site back-up.
- Diagnostic and set up tools make system integration easy.
- Critical information is available with complete on-line help.
- User defined velocity, acceleration, position and torque parameters.
- Tuning and diagnosis is aided with an on-screen dual channel digital oscilloscope.
- On-screen meters and software tools provide rapid debugging and measurement.

Communications

One serial port, with two connectors, allows from 1 to 32 drives to be connected in parallel using either RS-232 or four-wire RS-485 communications. The serial interface allows the user to program a drive using any PC or host computer that permits RS-232 or four-wire RS-485 communications.

Autotuning

Digital auto tuning allows easy setup. All adjustments are made in software, which immediately sets the servo system compensation parameters. This eliminates the time-consuming adjustments required by potentiometers.

Agency Approvals

- UL listed
- cUL listed
- CE marked.

Options

- Power and feedback cables are potted and molded with 360 degree shielding.
- AC line filters.
- Breakout boards for I/O control and encoder interface.
- TouchPad – a compact and highly portable input and display device.

Motors

The Centurion DSM100 Drive is compatible with many motors, both Giddings & Lewis motors and motors from other manufacturers. Drive and motor parameters for all compatible Giddings & Lewis motors are programmed into each Centurion DSM100 Drive at the factory. Giddings & Lewis motors that are compatible with the Centurion DSM100 Drives include all:

- FSM Series
- HSM Series
- NSM Series
- SSM Series
- YSM Series.

DSMPro software speeds drive and motor set up by predefined parameters for each drive and motor combination.

Refer to the Torque/Speed curves in the Giddings & Lewis standard product catalog and handbook or contact your local Giddings & Lewis distributor for motor sizing and compatibility assistance.

European Union Requirements

Centurion DSM100 Drives conform to the following European Union Directives:

- Machinery Directive (89/392/EEC, Article 4.2 and Annex II, sub B)
- Low Voltage Directive (72/23/EEC, 93/68/EEC)
- Electromagnetic Compatibility Directive (89/336/EEC, 92/31/EEC, 93/68/EEC). Compliance with the EEC Directives is contingent on:
  – Installation of AC line filters between the power source and the drive, and
  – Use of Giddings & Lewis cables to connect motors. See “European Union EMC Directives” on page 5-45; Appendix , “” lists the mentioned equipment and Giddings & Lewis part number.

Giddings & Lewis motors available for use with Centurion DSM100 Drives include all:

- FSM Series motors
- HSM Series motors
- SSM Series motors
- YSM Series motors
- NSM Series motors

DSMPro Installation 3

Installation of DSMPro on a PC is covered in this chapter, which:

- Lists the minimum PC hardware and software necessary to run DSMPro.
- Provides step-by-step instructions on how to load DSMPro.
- Shows you how to start and quit DSMPro and introduces the Drive Window, the main command window for DSMPro.
- Instructs you on how to access on-line help.

Instructions for using the features available in DSMPro are detailed in on-line help. To access the Help menu, depress the **F1** key.

Hardware and Software Requirements

The minimum personal computer (PC) requirements to run the software are:

- A DOS computer with a 286 microprocessor
- A hard disk, with 2.0 MB of free disk space
- 3½ inch, 1.44MB floppy disk drive
- 2 MB of RAM
- A Video Graphics Array (VGA) monitor
- Microsoft Windows version 3.1
- A mouse is recommended.

Windows must be installed on your PC. If Windows is *not* already installed, refer to the appropriate Microsoft manual to install Windows on your computer.

Installing DSMPro

To install DSMPro software on a hard drive:

1. Make a backup copy of the DSMPro disk in one of the following ways:
   - Copy the DSMPro disk using the disk menu in the Windows File Manager.
   - If your computer has only one floppy disk drive, type from the DOS command line prompt **diskcopy a: b:** and then press **ENTER**. The software will prompt you when to insert the SOURCE (DSMPro) disk and when to insert the TARGET (blank) disk.
2. If Windows is *not* running, type **win** at the DOS prompt (**C:>**).
   If Windows is already running, close any open applications.
3. Insert the DSMPro disk into a 1.44MB floppy disk drive, typically drive A:, and close the drive door.
4. Choose **Run**, from the File menu in Windows Program Manager.
5. Type **a:setup** and then press **ENTER**. A message box will appear saying that the setup is initializing. The message box may be present for up to 40 seconds, depending on the speed of the PC.
6. A dialog box requires you to confirm whether or not DSMPro should be installed on the hard drive (C: drive) of the PC.
   - To install DSMPro, choose **Continue**, or press **ENTER**, and continue with the next step.
   - To stop the installation, choose **Exit**. You are returned to Windows.
7. Setup then asks where you would like to install DSMPro.
   - To accept the path that Setup proposes in the **Path:** box (c:\dsmpro\...), choose **Continue,**
   - To choose another directory, type a new path in the **Path:** box, and then choose **Continue**. You will *not* have the opportunity to confirm your entry so type carefully.
   - To return to the initial Setup window, choose **Back**.
   - To stop the installation, choose **Exit**. You will return to Windows.
   - To obtain on-line help with the installation, Choose **Help**.
8. A status bar will keep you informed of the installation progress. When Setup is complete, choose **OK** or press **ENTER** to return to Windows.

Starting and Quitting DSMPro

Version Level

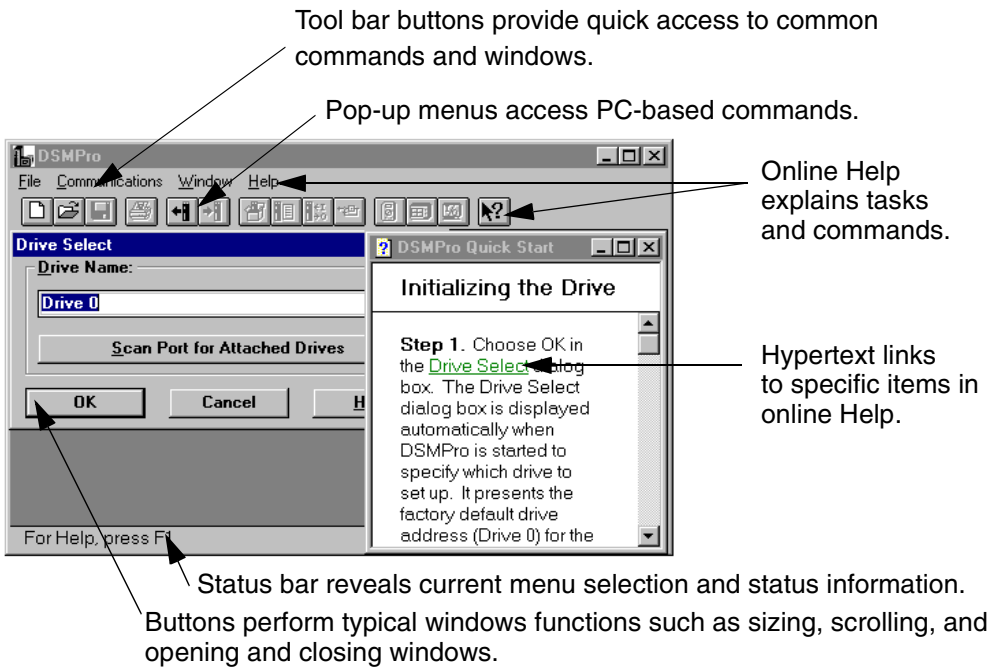
The release level and date for DSMPro may be displayed by selecting **About** DSMPro from the Help menu. This information also appears in the initial DSMPro screen. The About DSMPro window includes additional data about system resources typically displayed in Windows Help.

The DSMPro Start-Up Screen

When DSMPro starts for the first time, its default instructions are:

- Display the Help menu - Quick Start.
- Present the Drive Select window. The Drive Select window offers Drive 0, which is the default drive address assigned at the factory.

The default DSMPro Start-up screen is shown below. The comments point out many of the Windows controls that are available in DSMPro.



TIP

DSMPro displays the Help menu – **Quick Start** – when it is first accessed. To disable this automatic display, deselect the menu item **Show Quick Start** from the Help menu.

Setup automatically creates the DSMPro program group and then returns you to Windows. The DSMPro program group provides access to the DSMPro application icon,

From the C:> Prompt

1. Type **win c:\dsmpro\dsmpro.exe**.

This step assumes DSMPro was loaded into the *c:***dsmpro** directory during setup.

The DSMPro start-up screen will open.

From Windows

1. Choose the DSMPro program group from the Program Manager in Windows.

If the DSMPro window is *not* active, hold down ALT and press TAB (ALT+TAB) until the DSMPro title bar and icon are highlighted, or select DSMPro from the list in the Window menu.

2. Choose the DSMPro icon from the DSMPro program group.

The DSMPro start-up screen will open.

The Readme File

A file, titled README, may be included in the DSMPro directory. This file contains installation instructions, change notes from previous revisions, and information that became available after this manual was printed. After you install DSMPro you can access this file by choosing the Read Me icon in the DSMPro window or by using Microsoft Write or an equivalent application program to view the file **readme.wri** in the directory path where DSMPro is installed.

Firmware Files

Firmware files are supplied in the Miscellaneous directory on the DSMPro diskette.

The current revision level of drive firmware, excluding the TouchPad firmware, is displayed in the Drive Information window of DSMPro. The current revision level of TouchPad firmware is displayed as part of the TouchPad initialization when a TouchPad is connected to the drive.

The types of files and their functions are:

- Firmware – Main Operating firmware for the drive
- Boot Block – Drive Initialization firmware for the drive

Unpacking,Inspecting and Storing 4

This chapter describes four steps which should ensure that the drive functions correctly. The steps include:

- Unpacking the Centurion DSM100 Drive
- Inspecting the drive for shipping damage
- Testing the basic functionality of the drive
- Guidelines for storing the drive.

Unpacking the Drive

1. Remove the Centurion DSM100 Drive from the shipping carton and remove all packing materials from the unit. The materials and carton may be retained for storage or shipment of the drive.
2. Check all items against the packing list. A label located on the side of the unit identifies:
   - Model number
   - Serial number
   - Manufacturing date code.

Inspection Procedure

To protect your investment and ensure your rights under warranty, we recommend the following steps be performed upon receipt of the unit:

- Inspect the unit for any physical damage that may have been sustained during shipment.
- Perform the drive checkout test to verify the functionality of the unit.

If you find damage, either concealed or obvious, contact your buyer to make a claim with the shipper. If degraded performance is detected when testing the unit, contact your distributor or Giddings & Lewis to obtain a Return Material Authorization (RMA). Do this as soon as possible after receipt of the unit.

Testing the Unit

Drives are burned-in and individually tested before they leave the factory. However, damage may occur during shipping. Perform the procedures below to ensure the Centurion DSM100 Drive is operational and undamaged.

Abbreviated directions for connecting the drive to a motor and a PC are provided.

The test requires:

- Approximately 20 minutes to complete
- A motor with appropriate power and encoder cables
- A PC with the DSMPro software package installed
- An RS-232 communications cable
- A single phase or three phase 100-240 VAC, 50/60 Hz power source. Standard wall outlet power is suitable for verification testing of Centurion DSM100 Drives, except the DSM1150 or DSM1150P, which require three phase power.
- A test cable constructed from two normally open switches, several pieces of 1.5 mm^2 (16 AWG) wire and a mating connector. Connectors are listed in “Mating Connectors” on page A-179. Appendix , “” lists the cables.

During the test, power is removed several times. Measure the DC bus voltage at TB1 to verify the bus capacitors are fully discharged, or wait for the time indicated in the warning on the front of the drive. The bus capacitors must be fully discharged for the subsequent steps to be valid.

If problems are encountered during this procedure, refer to “Fuse and Jumper Locations” on page 11-159, review other appropriate sections in this manual, or call your local Giddings & Lewis distributor.

WARNING

Perform the initial power-up with the motor shaft disconnected from a load and the shaft key removed. Improper wiring or undiscovered shipping damage could result in undesired motor motion. Be prepared to remove power if excessive motion occurs.

Hardware Set Up

Make the connections described below and shown in Figure 4.1.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive.
   - An Giddings & Lewis cable connects the 9-pin serial port of the Centurion DSM100 Drive to a 9-pin D-shell connector on a serial port of the PC. Giddings & Lewis cables are available in various lengths for connecting between J4 or J5 and a computer. The Appendix “” on page -173 lists the cables.
   - A three wire cable is shown in the figure below, solely for illustrative purposes.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
3. Connect a jumper wire with a toggle switch between J1-20 (ENABLE) and J1-26 (+24VDC). This provides manual control for enabling or disabling the drive. Figure 4.1 shows the jumper, including its normally open toggle switch.
4. Connect a power cable between the external 100/240 VAC, 50/60 Hz power source:

CAUTION

When operating the DSM175 or DSM175P with single-phase power the current limits must be set correctly.

- A DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P connects to the L1, L2/N and ⏚ (Gnd) connections on TB-1 when using a single phase power source.
- A DSM175, DSM175P, DSM 1150 or DSM 1150P connects to the L1, L2, L3 and ⏚ (Gnd) connections on TB-1 when using a three phase power source.

Drive Checkout Test

This test sequentially verifies that:

- Drive power wiring is correct and start-up logic is functioning
- The drive and motor are correctly wired
- Drive serial communications are operational

WARNING

Be prepared to disable the drive or remove input power if excessive motor motion occurs while performing the following steps.

Before beginning “Initial Power-up”, please check the following:

- All wiring and mounting to verify correct installation
- Input voltages to ensure they do not exceed specifications for the drive or motor.

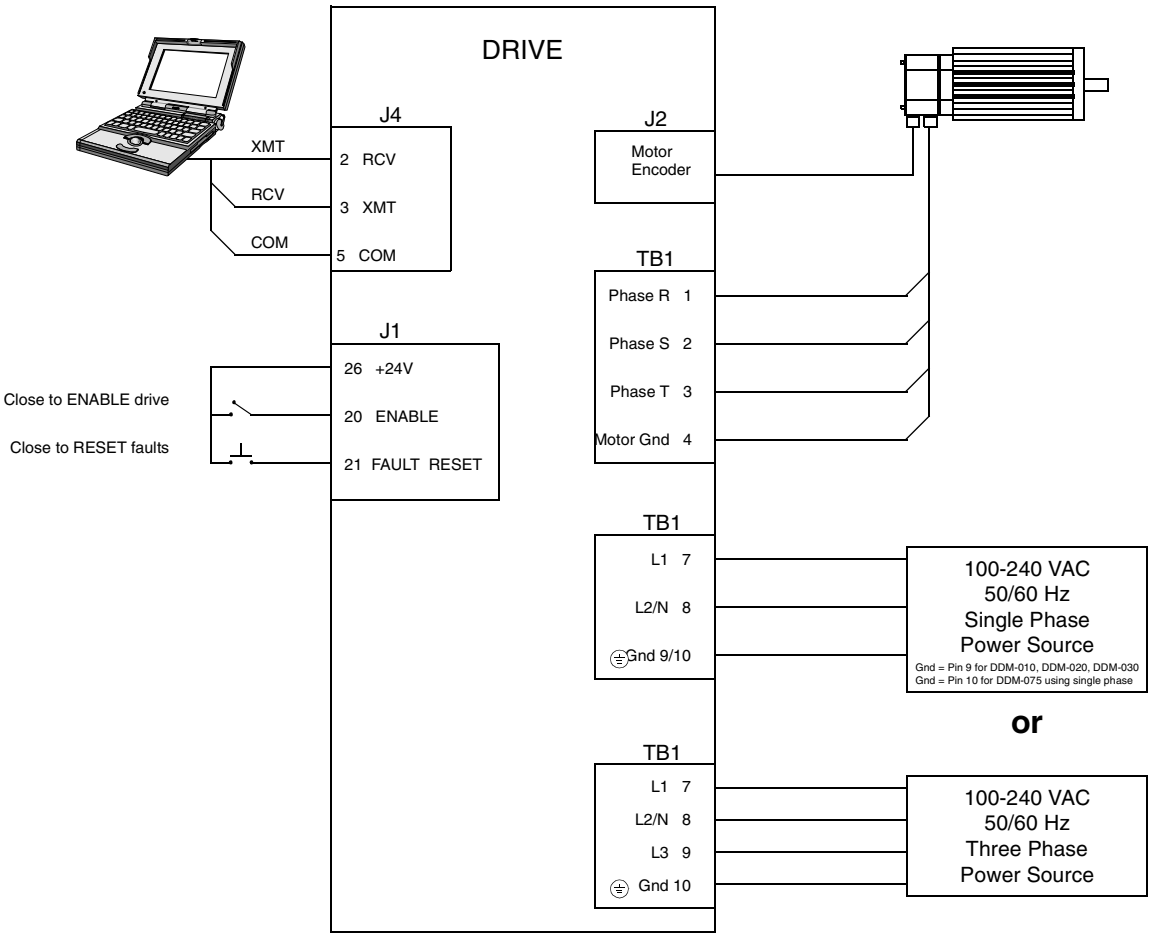


FIGURE 4.1 **Connection Diagram**

Initial Power-up

1. Verify the AC power is within specifications.
2. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display is *not* flashing.
3. Switch the power OFF and wait until the DC Bus Voltage is below 30 Volts, to prevent electrical shock.
4. Connect the motor windings to:
   - R (TB1-1)for the Phase R winding
   - S (TB1-2) for the Phase S winding
   - T (TB1-3) for the Phase T winding
   - ⏚ (TB1-4) for the Ground connection.
5. Switch AC Power ON again and verify:
   - Green DC BUS LED is ON
   - Display is *not* flashing.
6. Switch the power OFF and wait until the DC Bus Voltage is below 30 Volts, to prevent electrical shock.

Communications Verification

7. Start DSMPro on the PC.
8. Close any windows that are open in DSMPro.
9. Select **PC Set Up** from the Communications menu in DSMPro.
10. Verify the communication port settings match those of the drive, then select **OK**. Factory default drive settings are:
    - Baud Rate: **9600**
    - Data Bits: **8**
    - Parity: **None**
    - Stop Bits: **1**
    - Serial Port: **COM1**

    Assignment of communications ports on PCs varies between manufacturers. The COM port setting for the drive and PC must match. Refer to "Troubleshooting" on page 11-161 if communication problems are encountered.
11. Switch AC power ON.
12. Select **Read Drive Parameters** from the Communications menu in DSMPro.
13. Select **OK** in the Drive Select dialog box. A dialog box indicating that the PC is reading drive parameters should appear.

    If this dialog box does *not* appear, a message appears that advises you to check the COM settings and the communication cable. If necessary, refer to "Troubleshooting" on page 11-161 for instructions on how to perform these checks.

Initial Drive Operation

14. When the message appears that a motor must be selected, choose **OK**. The Drive Select dialog box is selected with Motor Selection active.
15. Select the appropriate motor from the drop-down Motor Selection box.
16. Choose **OK** when the message appears advising that the drive must reset. A change in motor parameters requires a software reset.
17. Choose **Close** from the Drive Setup window.
18. Select the **Control Panel** icon from the Drive Window. The drive displays "H" (Control Panel mode). Refer to "Operating Messages" on page 10-153 for an explanation of drive displays.
19. Close the connection between J1-26 and J1-20 to enable the drive.
20. Holding torque should be sufficient so that the shaft is either immovable or very resistant to rotation.
21. Move the Slide Bar in the Control Panel window to the right and then to the left. Verify that the motor rotates:
    - CW as the Slide Bar is moved right of center, and
    - CCW as the Slide Bar is moved left of center.

    If the motor rotates in the wrong direction (CCW when the slide bar is set to the right of center) or jumps and locks-up, motor phasing and encoder feedback phasing may be incorrect. If necessary, refer to Chapter 11, "Maintenance and Troubleshooting" for instructions on how to correct the motor power connections at TB1-1, -2, -3 and -4 or the encoder feedback connections at J2.

22. Choose **Set to Zero**. The motor will stop rotating.
23. Choose **Drive Disable** and verify the motor shaft can be rotated by hand.
24. Choose **Drive Enable** and verify the motor shaft has holding torque. (i.e., The shaft cannot be moved or moves with resistance.)
25. Open the connection between J1-26 and J1-20 to disable the drive.
26. Choose **Close** from the Control Panel window.

A drive completing these steps is functional. If the Centurion DSM100 Drive did *not* pass the steps above, refer to "Troubleshooting" on page 11-161.

For information on testing digital and analog signals, refer to "Testing Digital Outputs" on page 11-167, "Testing Digital Inputs" on page 11-168, "Testing Analog Outputs" on page 11-169 and "Testing Positive and Negative Current Limits" on page 11-169

Storing the Unit

Return the Centurion DSM100 Drive to its shipping carton using the original packing materials to enclose the unit.

Store the drive in a clean, dry place that will *not* exceed the following ranges:

- Humidity: 5% to 95%, non-condensing
- Storage temperature: -40° to 70° Celsius (-40° to 158° Fahrenheit).

Installation 5

Mechanical Installation Requirements

1. Mount the unit in an enclosure providing protection to IP54 (protected against dust and splashing water), or IP65 (dust free and protected against water jets) if the work environment is poor. Many NEMA (National Electrical Manufacturers Association) Type 4 cabinets provide this level of protection. Minimum cabinet requirements are:

   - Depth: 30.5 cm (12 inches).
   - Adequate sizing and/or ventilation to dissipate the heat generated by the Centurion DSM100 Drives. Refer to "Power Dissipation" on page F-235 for the amount of heat generated by a Centurion DSM100 Drive and enclosure sizing equations.

2. Minimum unobstructed surrounding space for cooling air intake and fan exhaust:

   - Above: 5 cm (2 inches)
   - Below: 5 cm (2 inches)
   - Sides: 1.25 cm (0.5 inches)
   - Front: 7.5 cm (3.0 inches) for cable clearance.

CAUTION

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.

3. Position the drive in a vertical position on a flat, solid surface that meets the mounting hardware should meet the following weight, vibration and shock, altitude and humidity, airflow clearance, and temperature requirements. Unit weights are:

   - DSM110 and DSM110P: 5.80 Kg (13.78 lbs)
   - DSM120 and DSM120P: 6.36 Kg (14.02 lbs)
   - DSM130 and DSM130P: 6.48 Kg (14.28 lbs)
   - DSM175 and DSM175P: 9.67 Kg (21.32 lbs)
   - DSM 1150 and DSM 1150P: 14.06 Kg (31.00 lbs)

   Vibration and shock, altitude and humidity limits are:

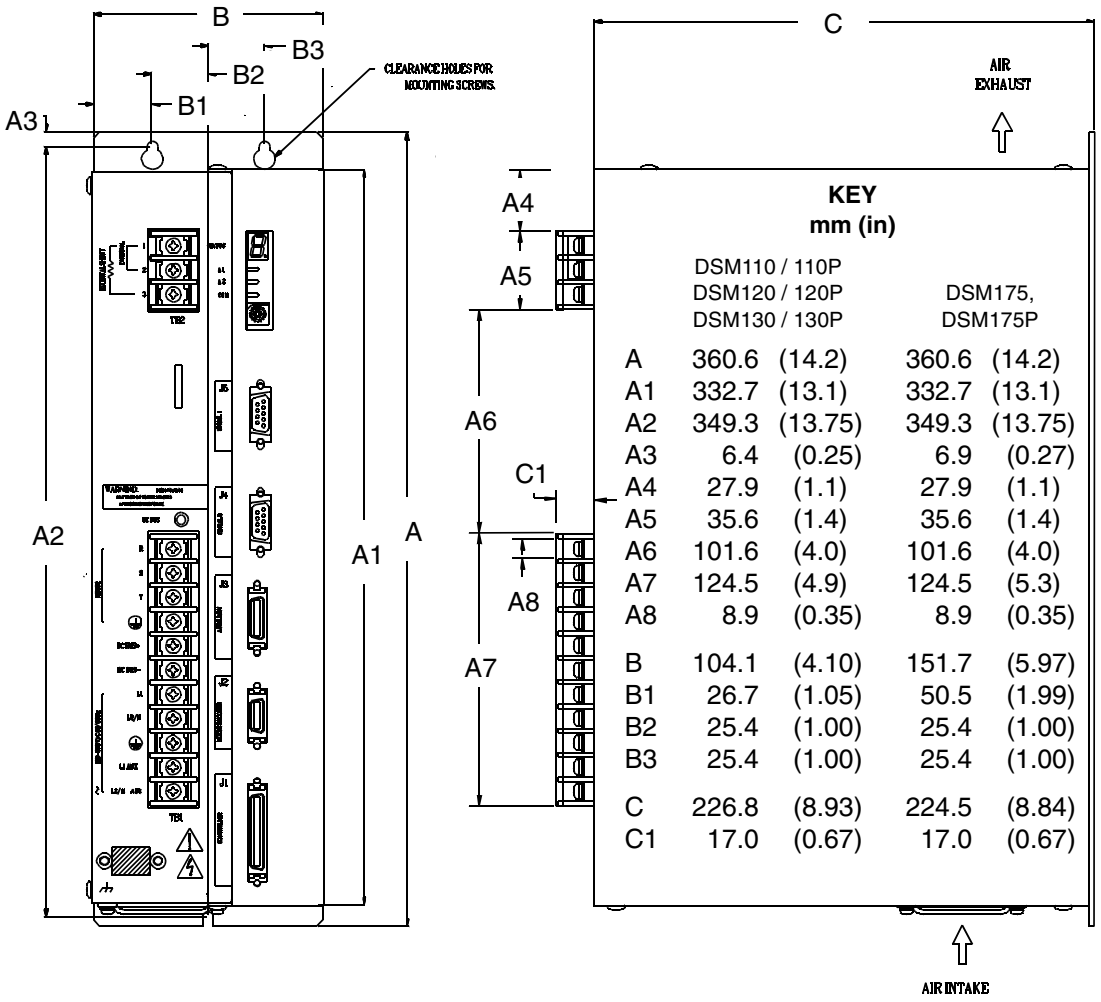
   - Vibration: 2g at 10 to 2000 Hz
   - Shock: 15g 11 msec half sine
   - Altitude: 1500 meters (5000 feet),
     Derate power performance 3% for each 300 m above 1500 m (1000 ft above 5000 ft).
   - Humidity: 5% to 95% non-condensing

   Ambient operating temperature range and airflow clearances are:

   - 0 ° to 55° Celsius (32° to 131° Fahrenheit).
   - 50.8 mm (2 inches) above and below unit for airflow.

4. Bolt the unit to the cabinet using the mounting slots in the drive. Mounting dimensions are shown in Figure 5.1. The recommended size of mounting hardware is:

   - M5 Metric (1/4-20 equivalent), or
   - #10 MS bolts.



KEY
mm (in)

	DSM110 / 110P DSM120 / 120P DSM130 / 130P		DSM175, DSM175P	
A	360.6	(14.2)	360.6	(14.2)
A1	332.7	(13.1)	332.7	(13.1)
A2	349.3	(13.75)	349.3	(13.75)
A3	6.4	(0.25)	6.9	(0.27)
A4	27.9	(1.1)	27.9	(1.1)
A5	35.6	(1.4)	35.6	(1.4)
A6	101.6	(4.0)	101.6	(4.0)
A7	124.5	(4.9)	124.5	(5.3)
A8	8.9	(0.35)	8.9	(0.35)
B	104.1	(4.10)	151.7	(5.97)
B1	26.7	(1.05)	50.5	(1.99)
B2	25.4	(1.00)	25.4	(1.00)
B3	25.4	(1.00)	25.4	(1.00)
C	226.8	(8.93)	224.5	(8.84)
C1	17.0	(0.67)	17.0	(0.67)

FIGURE 5.1 **DSM Mounting Dimensions** (sheet 1 of 2)

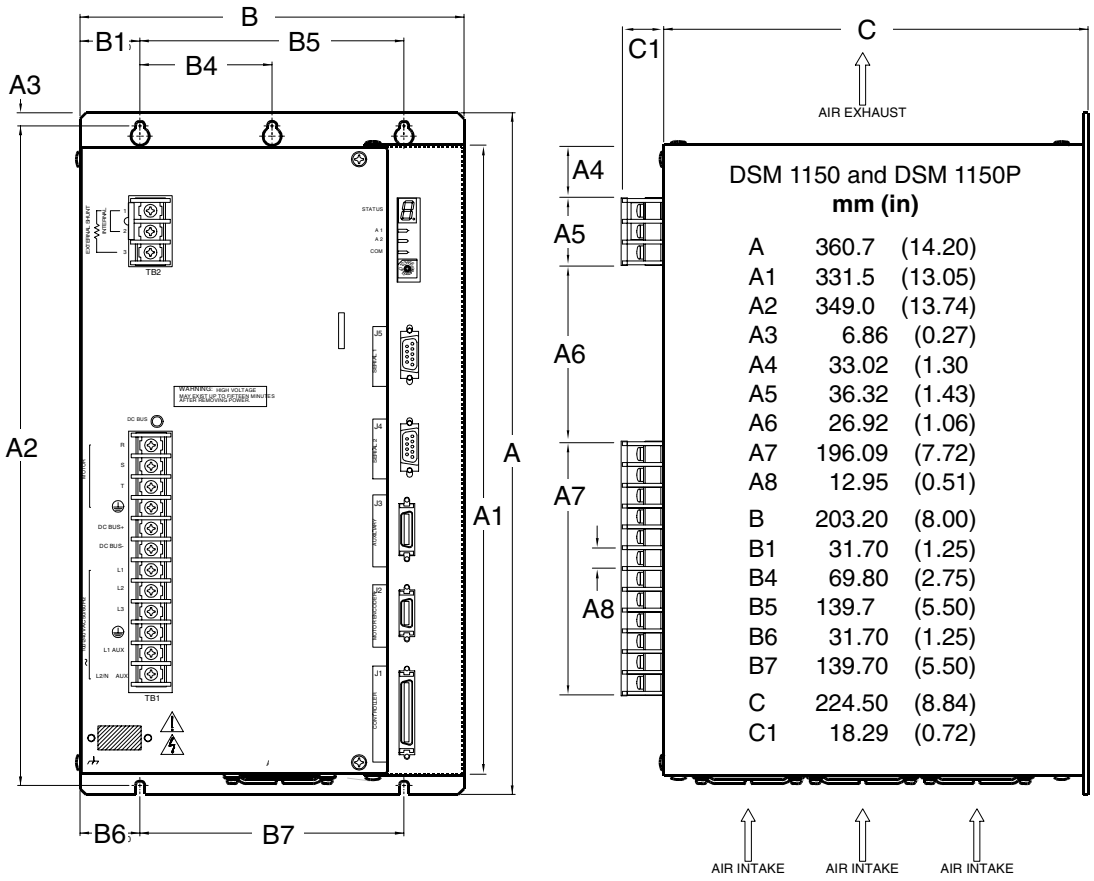


FIGURE 5.1 **DSM Mounting Dimensions** (sheet 2 of 2)

Interface Connections

Input/output and power cables connect to the front panel of a Centurion DSM100 Drive, no internal connections are necessary.

DANGER

The user is responsible for conforming with all applicable local, national and international codes. Wiring practices, grounding, disconnects and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

I/O Connections are fully described in the following sections:

- "J1 – Controller" on page 6-53 defines the controller connections
- "J2 – Encoder" on page 6-77 defines the motor encoder connections
- "J3 – Auxiliary Port" on page 6-81 defines the auxiliary controller connections
- "J4 and J5 – Serial Port" on page 6-85 defines the RS-232/RS-485 serial port connections

Power Connections are fully described in the following sections:

- "TB1 – DC Bus and AC Power" on page 7-93 defines the power connections.
- "TB2 – Shunt Regulator" on page 7-101 defines the internal and external shunt connections.

"DSM Interface Connection Diagram" on page -246 shows these inputs and outputs on a general level. Specific operational set ups are depicted in Figure 8.1 through Figure 8.12 (pages 8-106 through 8-141, respectively). These figures cover position, velocity and torque mode controls for:

- Analog Controllers,
- Preset Controllers,
- Position Followers, or
- Indexing controllers (available only on DSM110P, DSM120P, DSM130P, DSM175P and DSM 1150P).

Wiring

Wiring sizes and practices, as well as grounding and shielding techniques are described in the sections listed below. Refer to the "Power Wiring Diagrams" for graphic depictions and recommended wire gaging.

The descriptions represent common wiring practices and should prove satisfactory in the majority of applications.

Cables, listed in Appendix , "", are *not* rated for continuous flexing.

Minimum wire gages for power cables are listed in:

- "Motor Power Contact and Wire Sizing Recommendations" on page 7-96,
- "AC Input Power Sizing Requirements" on page 7-98, and
- "Auxiliary Power Sizing Requirements" on page 7-100.

Electromagnetic Compatibility

General Guidelines

Appendix D, "Electromagnetic Compatibility Guidelines for Machine Design" contains guidelines for reducing electrical noise and increasing electromagnetic compatibility (EMC) plus a discussion of electromagnetic interference (EMI).

European Union EMC Directives

The Centurion DSM100 Drives are designed and tested to meet the European EMC Directive. A Declaration of conformity, which enumerates the standards used, is located at the end of Appendix D. Two installation requirements are necessary to meet the directives:

1. Use of an external AC line filter on the main AC input, and
2. Use of Giddings & Lewis cables.

Qualified AC Line Filters

Listed below are AC line filters that have been qualified for use with Centurion DSM100 Drives. Filters equivalent to those listed are widely available, and Giddings & Lewis does not recommend one manufacturer over another. The machine builder is responsible for the suitability of the filter selection when using different filters. These filters can be used for distributing power to multiple drives, rather than using an individual filter for each drive. Further information is available from the manufacturer.

TABLE 5.1 **Qualified AC Line Filters**

Drive	Manufacturer and Part Number	
	Schaffner (1-800-367-5566)	**Roxburgh** (01724-281770) (011 44 1724 281770 from the USA)
DSM110 and DSM110P	FN 350-12	MIF 10 or MDF 16
DSM120 and DSM120P	FN 350-20	MIF 23 or MDF 18
DSM130 and DSM130P	FN 350-30	MIF 32 or MDF 36
DSM175 and DSM175P	FN 351-36	MIF 330 or MDF 336
DSM 1150 and DSM 1150P		MDF 350

Giddings & Lewis AC Line Filters

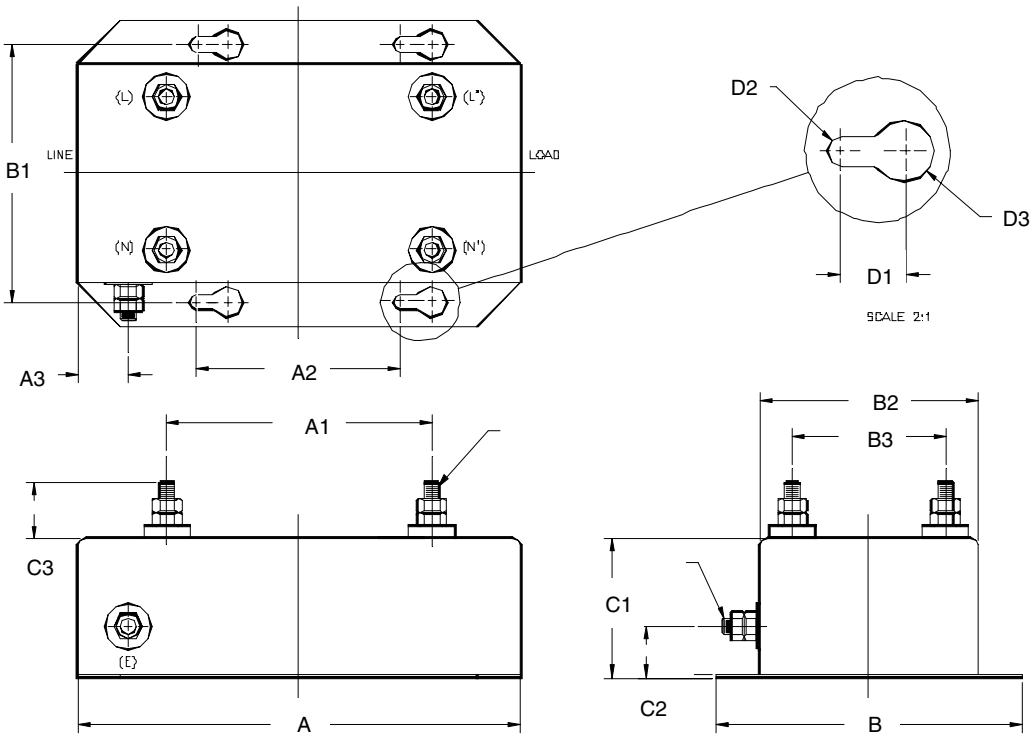
An AC line filter is *not* required on the auxiliary line input, when it is used. Refer to Appendix , "" for part numbers.

WARNING

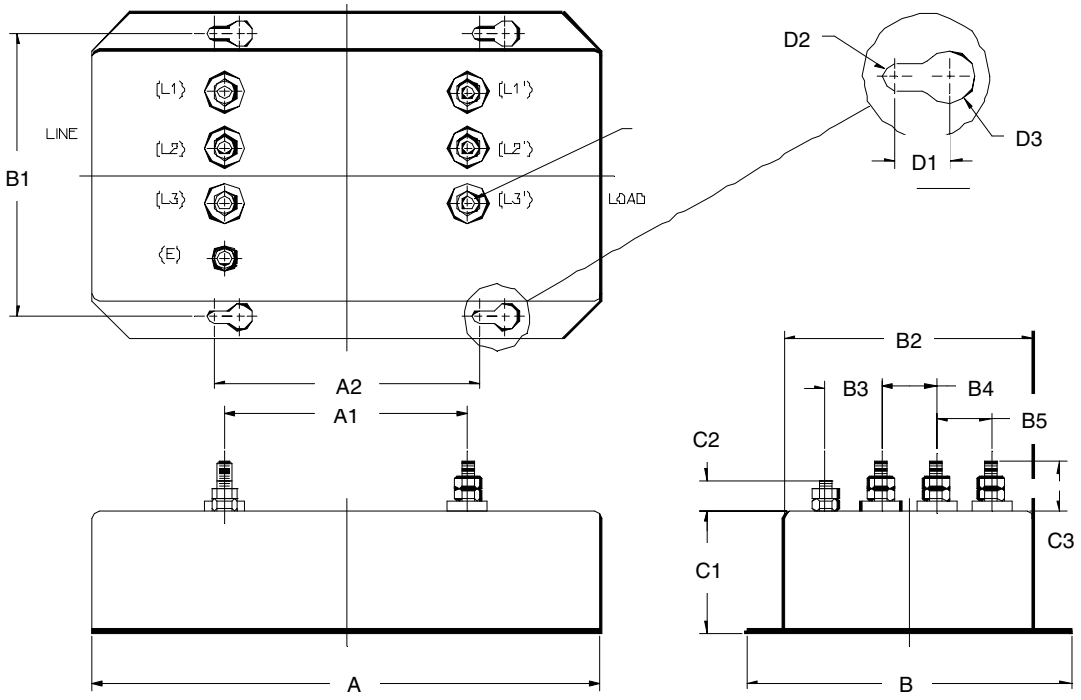
Large leakage currents exist in AC line filters. They must be grounded properly before applying power. Filter capacitors retain high voltages after power removal. Before handling the equipment, voltages should be measured to determine safe levels prior to handling the equipment.
Failure to observe this precaution could result in severe bodily injury.

Mounting dimensions for single and three phase AC line filters available from Giddings & Lewis are illustrated in Figure 5.2 and Figure 5.3, with corresponding numbers in Table 5.2 and Table 5.3.

Wiring diagrams for Giddings & Lewis AC line filters follow in Figure 5-4.



MDF Single-phase



MDF Three-phase

FIGURE 5.2 MDF AC Line Filter Mounting Diagrams

TABLE 5.2 **MDF AC Line Filter Dimensions**

DIMENSION	SINGLE PHASE 36 A and 50 A		THREE PHASE 36 A		THREE PHASE 50 A		THREE PHASE 70 A	
	mm	in	mm	in	mm	in	mm	in
A	174	6.85	230	9.06	230	9.06	238	9.37
A1	104 (2)	4.09 (2)	110 (3)	4.33 (3)	110 (3)	4.33 (3)	150 (3)	5.91 (3)
A2	80 (2)	3.15 (2)	120 (3)	4.72 (3)	120 (3)	4.72 (3)	120 (2)	4.72 (2)
A3	20	0.79	–	–	–	–	–	–
B	120	4.74	147	5.79	147	5.79	186	7.32
B1	101 (2)	3.98 (2)	128 (2)	5.04 (2)	128 (2)	5.04 (2)	167 (2)	6.57 (2)
B2	86	3.39	113	4.45	113	4.45	152	5.98
B3	60 (2)	2.36 (2)	25	0.98	25	0.98	40	1.57
B4	–	–	25 (2)	0.98 (2)	25 (2)	0.98 (2)	40 (2)	1.57 (2)
B5	–	–	25 (2)	0.98 (2)	25 (2)	0.98 (2)	40 (2)	1.57 (2)
C	77	3.03	77	3.03	77	3.03	114	4.49
C1	55	2.17	55	2.17	55	2.17	85	3.35
C2	20	0.79	14	0.55	14	0.55	14	0.55
C3	22 (4)	0.87 (4)	22 (6)	0.87 (6)	22 (6)	0.87 (6)	29 (6)	1.14 (6)
D1	12	0.47	12	0.47	12	0.47	12	0.47
D2	6	0.24	6	0.24	6	0.24	6	0.24
D3	12	0.47	12	0.47	12	0.47	12	0.47
Connectors	M6 (5)		M6 (7)		M6 (7)		M8 (6) and M6 (earth)	

NOTE: Line filters are manufactured to millimeter dimensions (inches are approximate conversions).

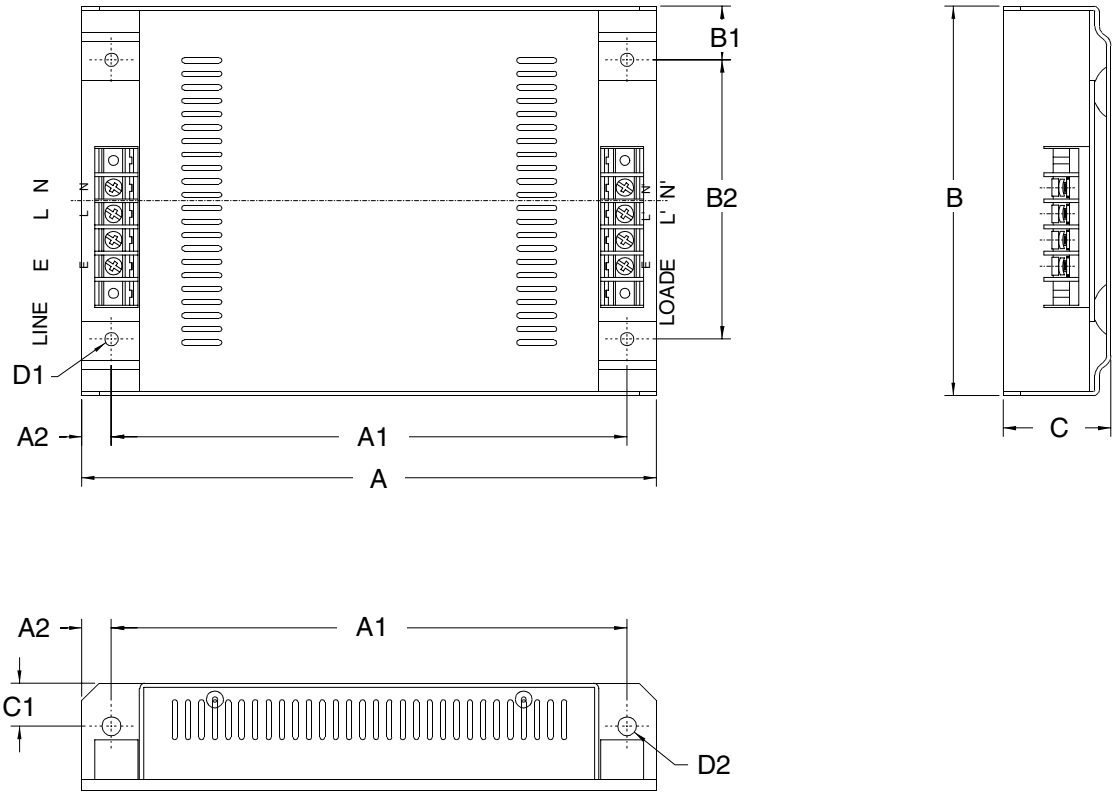
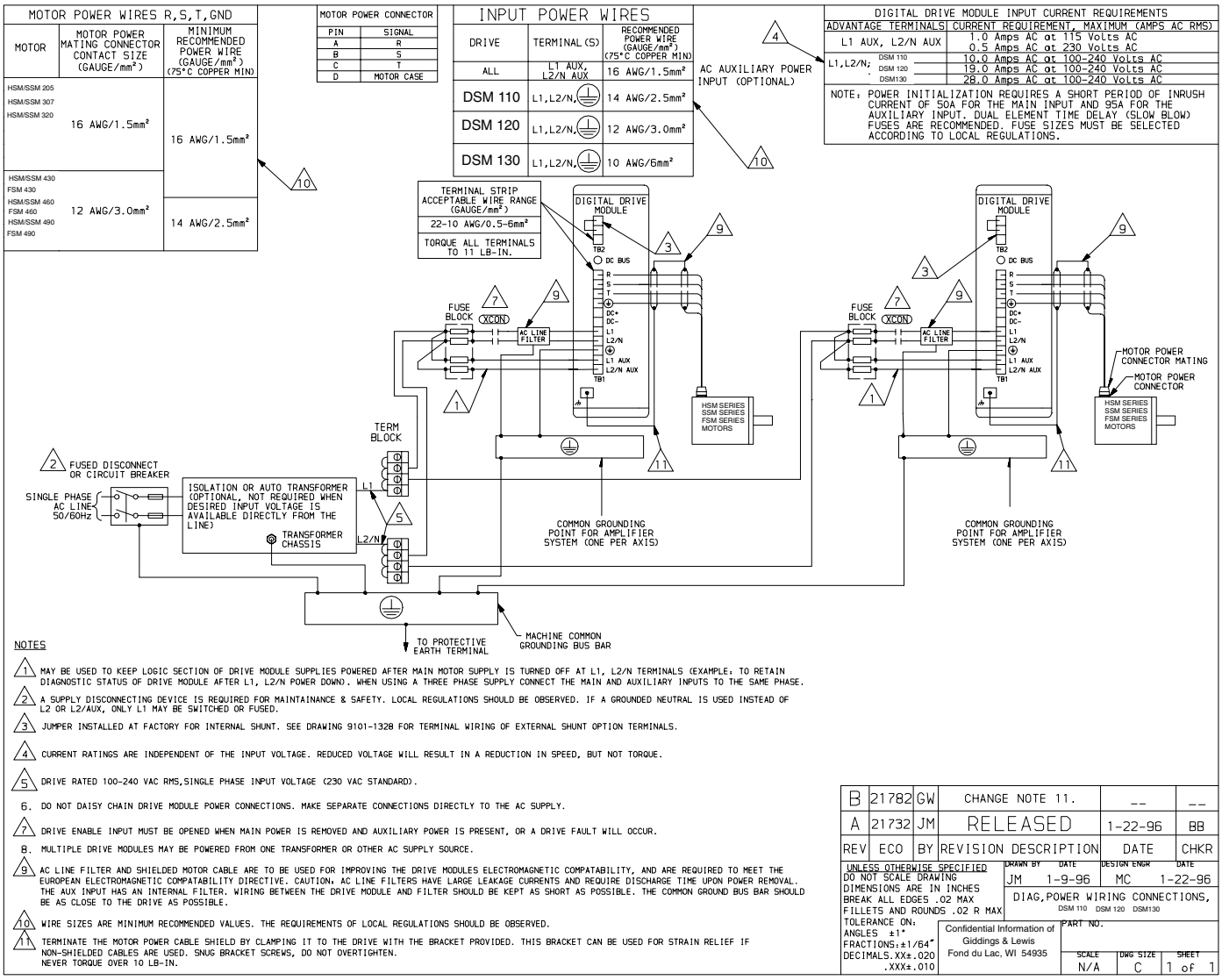


FIGURE 5.3 **MIF Single Phase AC Line Filter Mounting Diagram**

TABLE 5.3 **MIF AC Line Filter Dimensions**

DIMENSION	SINGLE PHASE 10 A		SINGLE PHASE 23 A	
	mm	in	mm	in
A	214	8.43	214	8.43
A1	192 (2)	7.56 (2)	192 (2)	7.56 (2)
A2	11 (2)	0.43 (2)	11 (2)	0.43 (2)
B	145	5.71	204	8.03
B1	20 (2)	0.79 (2)	20 (2)	0.79 (2)
B2	104 (2)	4.09 (2)	164 (2)	6.46 (2)
C	40	1.57	47	1.85
C1	16 (2)	0.63 (2)	19 (4)	0.75 (4)
D1	5 (4)	0.20 (4)	5 (4)	0.20 (4)
D2	7 (4)	0.28 (4)	7 (4)	0.28 (4)
Connectors	M4		M4	
NOTE: Line filters are manufactured to millimeter dimensions (inches are approximate conversions).				



NOTES

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN MOTOR SUPPLY IS TURNED OFF AT L1, L2/N TERMINALS (EXAMPLE, TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER L1, L2/N POWER DOWN). WHEN USING A THREE PHASE SUPPLY CONNECT THE MAIN AND AUXILIARY INPUTS TO THE SAME PHASE.
2. A SUPPLY DISCONNECTING DEVICE IS REQUIRED FOR MAINTAINANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A GROUNDED NEUTRAL IS USED INSTEAD OF L2 OR L2/AUX, ONLY L1 MAY BE SWITCHED OR FUSED.
3. JUMPER INSTALLED AT FACTORY FOR INTERNAL SHUNT. SEE DRAWING 9101-1328 FOR TERMINAL WIRING OF EXTERNAL SHUNT OPTION TERMINALS.
4. CURRENT RATINGS ARE INDEPENDENT OF THE INPUT VOLTAGE. REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED, BUT NOT TORQUE.
5. DRIVE RATED 100-240 VAC RMS,SINGLE PHASE INPUT VOLTAGE (230 VAC STANDARD).
6. DO NOT DAISY CHAIN DRIVE MODULE POWER CONNECTIONS. MAKE SEPARATE CONNECTIONS DIRECTLY TO THE AC SUPPLY.
7. DRIVE ENABLE INPUT MUST BE OPENED WHEN MAIN POWER IS REMOVED AND AUXILIARY POWER IS PRESENT, OR A DRIVE FAULT WILL OCCUR.
8. MULTIPLE DRIVE MODULES MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.
9. AC LINE FILTER AND SHIELDED MOTOR CABLE ARE TO BE USED FOR IMPROVING THE DRIVE MODULES ELECTROMAGNETIC COMPATABILITY, AND ARE REQUIRED TO MEET THE EUROPEAN ELECTROMAGNETIC COMPATABILITY DIRECTIVE. CAUTION, AC LINE FILTERS HAVE LARGE LEAKAGE CURRENTS AND REQUIRE DISCHARGE TIME UPON POWER REMOVAL. THE AUX INPUT HAS AN INTERNAL FILTER. 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 OVERTIGHTEN. NEVER TORQUE OVER 10 LB-IN.

REV	ECO	BY	REVISION DESCRIPTION	DATE	CHKR
B	21782	GW	CHANGE NOTE 11.	--	--
A	21732	JM	RELEASED	1-22-96	BB

UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING
DIMENSIONS ARE IN INCHES
BREAK ALL EDGES .02 MAX
FILLETS AND ROUNDS .02 R MAX
TOLERANCE ON:
ANGLES ±1°
FRACTIONS: ±1/64"
DECIMALS. XX±.020
.XXX±.010

Confidential Information of Giddings & Lewis Fond du Lac, WI 54935

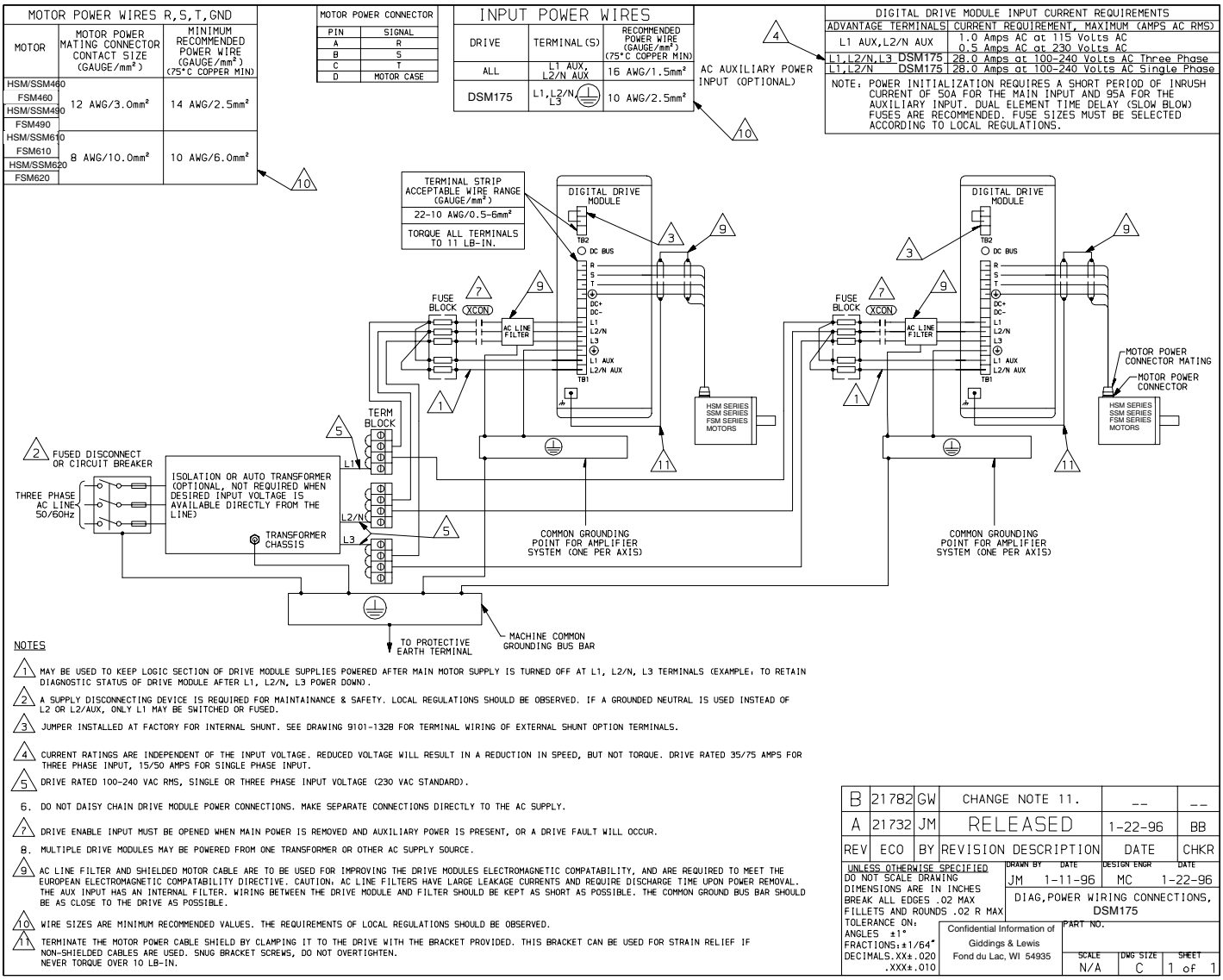
DRAWN BY JM 1-9-96
DESIGN ENGR MC 1-22-96

DIAG, POWER WIRING CONNECTIONS, DSM 110 DSM 120 DSM130

PART NO.

SCALE N/A | DWG SIZE C | SHEET 1 of 1

FIGURE 5.4 Power Wiring Diagram for DSM110,110P, 120, 120P, 130 and 130P



NOTES

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN MOTOR SUPPLY IS TURNED OFF AT L1, L2/N, L3 TERMINALS (EXAMPLE, TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER L1, L2/N, L3 POWER DOWN).
2. A SUPPLY DISCONNECTING DEVICE IS REQUIRED FOR MAINTAINANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A GROUNDED NEUTRAL IS USED INSTEAD OF L2 OR L2/AUX, ONLY L1 MAY BE SWITCHED OR FUSED.
3. JUMPER INSTALLED AT FACTORY FOR INTERNAL SHUNT. SEE DRAWING 9101-1328 FOR TERMINAL WIRING OF EXTERNAL SHUNT OPTION TERMINALS.
4. CURRENT RATINGS ARE INDEPENDENT OF THE INPUT VOLTAGE. REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED, BUT NOT TORQUE. DRIVE RATED 35/75 AMPS FOR THREE PHASE INPUT, 15/50 AMPS FOR SINGLE PHASE INPUT.
5. DRIVE RATED 100-240 VAC RMS, SINGLE OR THREE PHASE INPUT VOLTAGE (230 VAC STANDARD).
6. DO NOT DAISY CHAIN DRIVE MODULE POWER CONNECTIONS. MAKE SEPARATE CONNECTIONS DIRECTLY TO THE AC SUPPLY.
7. DRIVE ENABLE INPUT MUST BE OPENED WHEN MAIN POWER IS REMOVED AND AUXILIARY POWER IS PRESENT, OR A DRIVE FAULT WILL OCCUR.
8. MULTIPLE DRIVE MODULES MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.
9. AC LINE FILTER AND SHIELDED MOTOR CABLE ARE TO BE USED FOR IMPROVING THE DRIVE MODULES ELECTROMAGNETIC COMPATABILITY, AND ARE REQUIRED TO MEET THE EUROPEAN ELECTROMAGNETIC COMPATABILITY DIRECTIVE. CAUTION: AC LINE FILTERS HAVE LARGE LEAKAGE CURRENTS AND REQUIRE DISCHARGE TIME UPON POWER REMOVAL. THE AUX INPUT HAS AN INTERNAL FILTER. 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 OVERTIGHTEN. NEVER TORQUE OVER 10 LB-IN.

REV	ECO	BY	REVISION DESCRIPTION	DATE	CHKR
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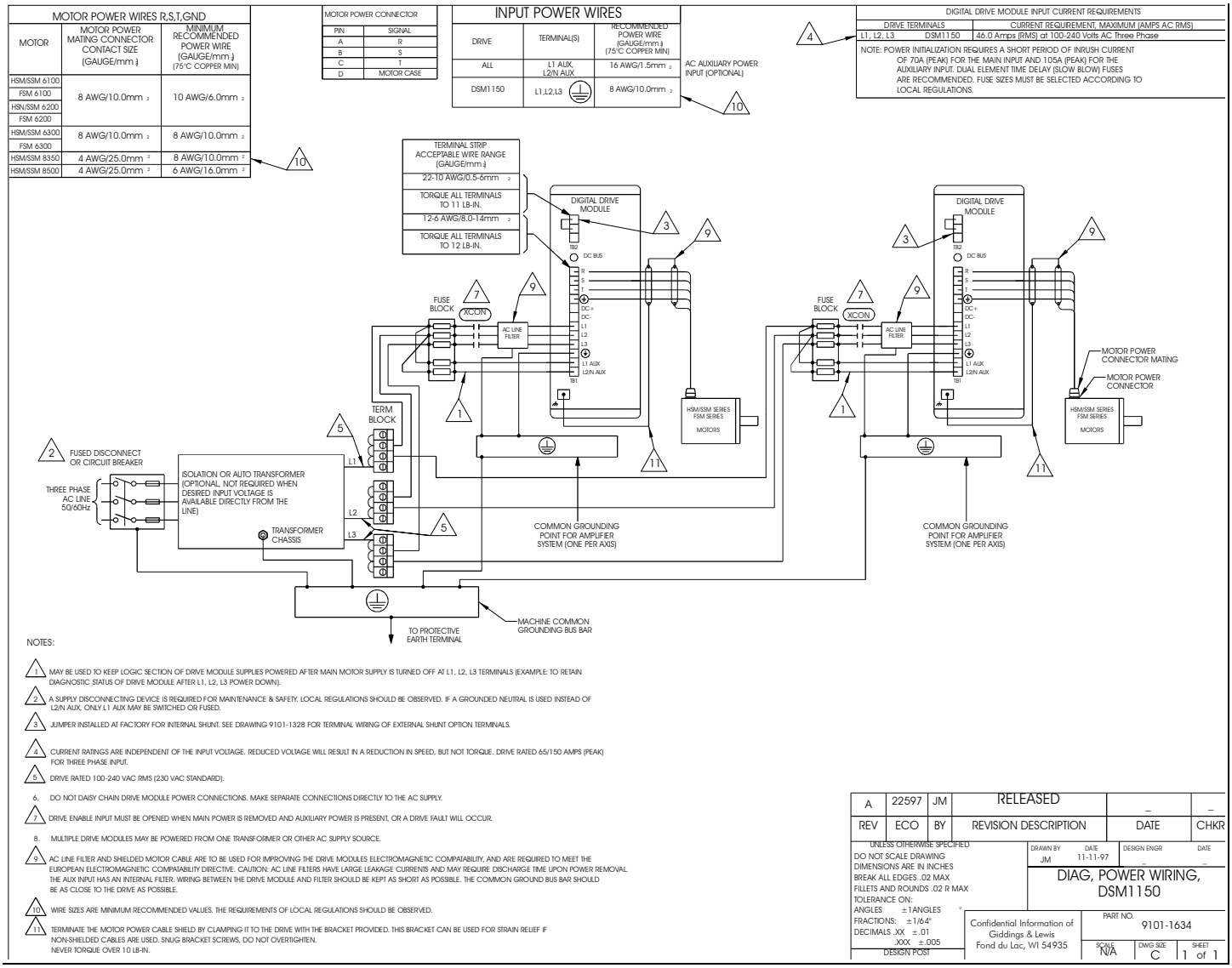
UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING
DIMENSIONS ARE IN INCHES
BREAK ALL EDGES .02 MAX
FILLETS AND ROUNDS .02 R MAX
TOLERANCE ON:
ANGLES ±1°
FRACTIONS: ±1/64"
DECIMALS.XX±.020
.XXX±.010

DRAWN BY JM DATE 1-11-96
DESIGN ENGR MC DATE 1-22-96
DIAG,POWER WIRING CONNECTIONS, DSM175
PART NO.
Confidential Information of Giddings & Lewis Fond du Lac, WI 54935
SCALE N/A DWG SIZE C SHEET 1 of 1

FIGURE 5.5 Power Wiring Diagram for DSM175 and DSM175P



NOTES:

1. MAY BE USED TO KEEP LOGIC SECTION OF DRIVE MODULE SUPPLIES POWERED AFTER MAIN MOTOR SUPPLY IS TURNED OFF AT L1, L2, L3 TERMINALS (EXAMPLE: TO RETAIN DIAGNOSTIC STATUS OF DRIVE MODULE AFTER L1, L2, L3 POWER DOWN).
2. A SUPPLY DISCONNECTING DEVICE IS REQUIRED FOR MAINTENANCE & SAFETY. LOCAL REGULATIONS SHOULD BE OBSERVED. IF A GROUNDED NEUTRAL IS USED INSTEAD OF L2/N AUX, ONLY L1 AUX MAY BE SWITCHED OR FUSED.
3. JUMPER INSTALLED AT FACTORY FOR INTERNAL SHUNT. SEE DRAWING 9101-1328 FOR TERMINAL WIRING OF EXTERNAL SHUNT OPTION TERMINALS.
4. CURRENT RATINGS ARE INDEPENDENT OF THE INPUT VOLTAGE. REDUCED VOLTAGE WILL RESULT IN A REDUCTION IN SPEED, BUT NOT TORQUE. DRIVE RATED 65/150 AMPS (PEAK) FOR THREE PHASE INPUT.
5. DRIVE RATED 100-240 VAC RMS (230 VAC STANDARD).
6. DO NOT DAISY CHAIN DRIVE MODULE POWER CONNECTIONS. MAKE SEPARATE CONNECTIONS DIRECTLY TO THE AC SUPPLY.
7. DRIVE ENABLE INPUT MUST BE OPENED WHEN MAIN POWER IS REMOVED AND AUXILIARY POWER IS PRESENT, OR A DRIVE FAULT WILL OCCUR.
8. MULTIPLE DRIVE MODULES MAY BE POWERED FROM ONE TRANSFORMER OR OTHER AC SUPPLY SOURCE.
9. AC LINE FILTER AND SHIELDED MOTOR CABLE ARE TO BE USED FOR IMPROVING THE DRIVE MODULES ELECTROMAGNETIC COMPATABILITY, AND ARE REQUIRED TO MEET THE EUROPEAN ELECTROMAGNETIC COMPATABILITY DIRECTIVE. CAUTION: AC LINE FILTERS HAVE LARGE LEAKAGE CURRENTS AND MAY REQUIRE DISCHARGE TIME UPON POWER REMOVAL. THE AUX INPUT HAS AN INTERNAL FILTER. 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 OVERTIGHTEN. NEVER TORQUE OVER 10 LB-IN.

REV	ECO	BY	REVISION DESCRIPTION	DATE	CHKR
A	22597	JM	RELEASED	–	–

UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING
DIMENSIONS ARE IN INCHES
BREAK ALL EDGES .02 MAX
FILLETS AND ROUNDS .02 R MAX
TOLERANCE ON:
ANGLES ±1 ANGLES °
FRACTIONS: ±1/64"
DECIMALS .XX ±.01
.XXX ±.005
DESIGN POST

DRAWN BY JM DATE 11-11-97
DESIGN ENGR DATE

DIAG, POWER WIRING, DSM1150

Confidential Information of Giddings & Lewis Fond du Lac, WI 54935

PART NO. 9101-1634
SCALE N/A DWG SIZE C SHEET 1 of 1

FIGURE 5.6 Power Wiring Diagram for DSM1150 and DSM1150

Interfaces 6

This chapter provides information about:

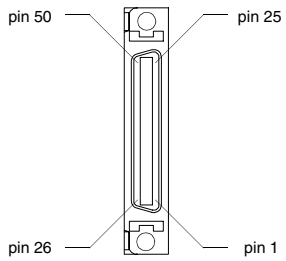
- Interface signals available on the Centurion DSM100 Drive
- Commonly encountered interface cabling methods
- Optional signal extension kits and standard Giddings & Lewis cables.

J1 – Controller

J1 is a 50 pin female mini-D connector (AMP 2-178238-7) for connecting a host computer or controller to the Centurion DSM100 Drive. Contact between the connector's shell and the grounded chassis provides shield termination. This section list the connector pin-outs and provides signal specifications.

Giddings & Lewis cables are available in various lengths for connecting between J1 and a suitable controller. Appendix , "" lists the cables. "J1 Terminal Strip/Breakout Board" on page 6-75 details the optional signal extension kit that is available.

Pin	Signal	Description	Pin	Signal	Description	Pin	Signal	Description
1	+5VDC	Encoder +5V DC	21	RESET	Fault Reset	41		Reserved
2	ECOM	Encoder Common	22	COMMAND+	Analog Command+	42	OUTPUT1	Selectable Output 1
3	+5VDC	Encoder +5V DC	23	COMMAND-	Analog Command-	43	OUTPUT2	Selectable Output 2
4	ECOM	Encoder Common	24	READY+	Drive Ready+	44	OUTPUT3	Selectable Output 3
5	+24VDC	Isolated +24 VDC	25	READY-	Drive Ready-	45	OUTPUT4	Selectable Output 4
6	24VCOM	Isolated 24V Common	26	+24VDC	Isolated +24 VDC	46		Reserved
7	AOUT+	Motor Encoder Output Channel A+	27	+I LIMIT	Positive Current Limit	47		Reserved
8	AOUT-	Motor Encoder Output Channel A-	28	ACOM	Analog Common	48		Reserved
9	BOUT+	Motor Encoder Output Channel B+	29	-I LIMIT	Negative Current Limit	49	BRAKE+	Brake Enable+
10	BOUT-	Motor Encoder Output Channel B-	30	ANALOG1	Analog Output 1	50	BRAKE-	Brake Enable-
11	IOUT+	Motor Encoder Output Channel I+	31	ANALOG2	Analog Output 2			
12	IOUT-	Motor Encoder Output Channel I-	32	INPUT1	Selectable Input 1			
13	24VCOM	Isolated 24V Common	33	INPUT2	Selectable Input 2			
14	AX+	Auxiliary Encoder Channel A+	34	INPUT3	Selectable Input 3			
15	AX-	Auxiliary Encoder Channel A-	35	INPUT4	Selectable Input 4			
16	BX+	Auxiliary Encoder Channel B+	36		Reserved			
17	BX-	Auxiliary Encoder Channel B-	37		Reserved			
18	IX+	Auxiliary Encoder Channel I+	38		Reserved			
19	IX-	Auxiliary Encoder Channel I-	39		Reserved			
20	ENABLE	Drive Enable	40		Reserved			



Digital I/O Power

Centurion DSM100 Drives provide +24VDC and +5VDC to power external devices within the following specifications.

24 Volt I/O Power

One isolated 24 Volt power supply is accessible from the connector:

- The allowable load is ≤500 mA.
- The pin-outs are:

+24VDC	J1-5	J1-26	J3-5	J3-26
24VCOM	J1-6	J1-13	J3-6	J3-13

This supply is intended for powering the digital I/O circuitry.

The 24 VCOM is a floating ground. It must be grounded during installation to meet the European Low Voltage Directive (LVD).

The +24 Volt power supply is internally fused by F1, a 1 Amp, fast acting fuse. Refer to "Fuse and Jumper Locations" on page 11-159, for the location of F1.

TIP

If an external +24VDC power source will power the I/O, remove jumpers P5 and P6. Refer to "Fuse and Jumper Locations" on page 11-159, for the location of the jumpers.

TABLE 6.1 **24 Volt Power Supply Specifications**

Parameter	Description	Minimum	Maximum
Output Voltage (VDC)	Voltage difference between +24VDC and 24VCOM	21.6	26.4
Output Current (mA)	Current flow	0	500

5 Volt I/O Power

One +5 Volt power supply is accessible from the connector:

- The allowable load is ≤250 mA.
- The pin-outs are:

+5 VDC	J1-1	J1-3	J3-1	J3-3
ECOM	J1-2	J1-4	J3-2	J3-4

This supply is intended for powering an auxiliary encoder.

The +5 Volt power supply is internally fused by F2, a 1 Amp, fast acting fuse. Refer to "Fuse and Jumper Locations" on page 11-159, for the location of F2.

TABLE 6.2 **5 Volt Power Supply Specifications**

Parameter	Description	Minimum	Maximum
Output Voltage (VDC)	Voltage between +5VDC and +5VCOM	4.75	5.25
Output Current (mA)	Current flow	0	250

Digital Inputs

Centurion DSM100 Drives have active high, current sinking inputs, which prevent disconnects and ground faults from activating a drive.

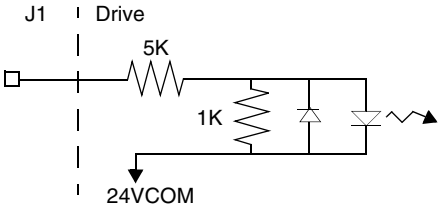


FIGURE 6.1 **Digital Input Circuit**

Two discrete input circuits types are available on the J1 connector. Both circuits support logic type interfaces with 24 Volt, optically isolated, single ended and active high, current sinking characteristics.

Dedicated Control Circuits

The ENABLE input interfaces with switch closures or sourcing type outputs. The input channel sinks 4.5 mA nominal.

Selectable Circuits

INPUT 1, INPUT 2, INPUT 3, INPUT 4 and FAULT RESET operate with switch closures or sourcing type circuitry. Each input channel sinks 4.5 mA nominal. Selectable inputs are:

- Drive Mode Select
- Integrator Inhibit
- Follower Enable
- Forward Enable
- Reverse Enable
- Preset Select A
- Preset Select B
- Preset Select C
- Operation Mode Override
- Start Index
- Define Home
- Start Homing
- Remove COMMAND Offset

Refer to the I/O Configuration section of the DSMPro manual for information on choosing the input type for each channel.

TABLE 6.3 General and Dedicated Inputs

Digital Input	Pin Number	Function/Description	Internal Connections
ENABLE	J1-20	Enables and disables the drive. Motor torque cannot be applied unless the ENABLE input is active.	J3-20
FAULT RESET	J1-21	General purpose input selectable to one of several drive functions. Refer to Table 6.4 for I/O configuration.	J3-21
INPUT 1	J1-32		
INPUT 2	J1-33		
INPUT 3	J1-34		
INPUT 4	J1-35		

TABLE 6.4 INPUT1, INPUT2, INPUT3, INPUT4 and FAULT RESET Functions

Function	Description
Drive Mode Select	Active[1] state configures the drive for Torque Mode. Inactive[2] state selects the personality EEPROM setting as the command source.
Integrator Inhibit	Active[1] state zeros the Velocity Loop Error Integrator.
Follower Enable	Active[1] state allows the position loop to track the AUXILIARY POSITION LOOP signal when in the Follower mode.
Forward Enable	Active[1] state allows forward commands in velocity mode only. If this input is inactive or not connected, no velocity command will be allowed in the forward direction. If motion is in progress when the input is pulled low or disconnected, the drive halts immediately without deceleration control. The COMMAND signal is clamped internally to 0 Volts.
Reverse Enable	Active[1] state allows reverse commands in velocity mode only. If this input is inactive or not connected, no velocity command will be allowed in the reverse direction. If motion is in progress when the input is pulled low or disconnected, the drive halts immediately without deceleration control. The COMMAND signal is clamped internally to 0 Volts.

TABLE 6.4 **INPUT1, INPUT2, INPUT3, INPUT4 and FAULT RESET Functions** (continued)

Function	Description				
Operation Mode Override	Active[1] state selects the Operation Mode Override setting as the command source. Inactive[2] state selects the Operation Mode setting as the command source. Table 6.4 on page 6-56 lists the valid Operation Mode and Operation Mode Override combinations.				
Preset Select A Preset Select B Preset Select C	Active[a] or Inactive[b] states select one of the eight presets shown in the following binary table:				
		BINARY CODE			
		C	**B**	**A**	**Description**
	Preset 0	0	0	0	Preset 0 or Index 0 is selected.
	Preset 1	0	0	1	Preset 1 or Index 1 is selected.
	Preset 2	0	1	0	Preset 2 or Index 2 is selected.
	Preset 3	0	1	1	Preset 3 or Index 3 is selected.
	Preset 4	1	0	0	Preset 4 or Index 4 is selected.
	Preset 5	1	0	1	Preset 5 or Index 5 is selected.
	Preset 6	1	1	0	Preset 6 or Index 6 is selected.
	Preset 7	1	1	1	Preset 7 or Index 7 is selected.
Start Index	A change from inactive to active starts an indexing move.				
Define Home	A change from inactive to active defines the home position for absolute indexing.				
Sensor	A change from inactive to active is sensed as a registration or home sensor. NOTE: This selection is available only on INPUT 2.				
Remove COMMAND Offset	A change from inactive to active sets the offset of the analog COMMAND input to achieve a zero command.				
Fault Reset	A change from inactive to active will clear any faults and re-enable the drive, if any faults were pending.				
Start Homing	A change from inactive to active will start the homing procedure.				

a. Active state indicates current flow through the input optocoupler.

b. Inactive state indicates no current flow.

The specifications for these inputs are as follows:

TABLE 6.5 **Digital Input Specifications**

Parameter	Description	Minimum	Maximum
ON state Voltage	Voltage applied to the input to guarantee an ON state	20 VDC	28 VDC
ON state Current	Current flow into the input to guarantee an ON state.	3.5 mA	5.5 mA
OFF state Voltage	Voltage applied to the input to guarantee an OFF state.	-1 VDC	3 VDC
OFF state Current	External leakage current into the input to guarantee an OFF state.	-0.5 mA	0.5 mA

Input Interface Circuit Examples

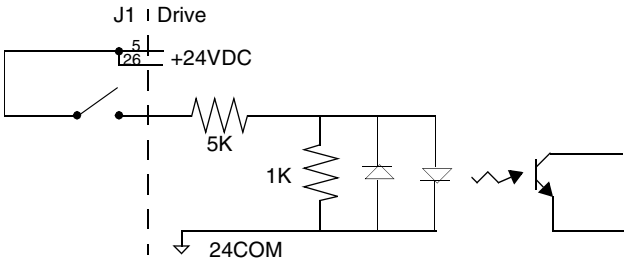


FIGURE 6.2 **Drive Input Connected to a Switch/Relay Contact**

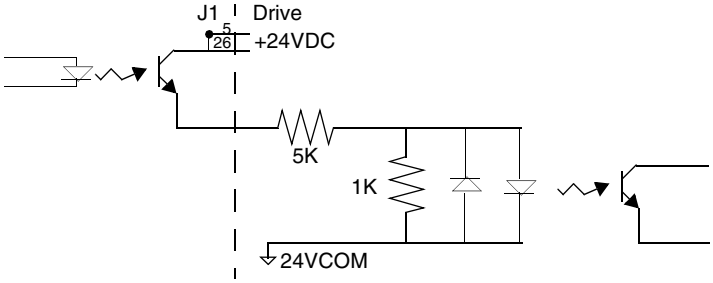


FIGURE 6.3 **Drive Input Connected to an Opto-Isolator**

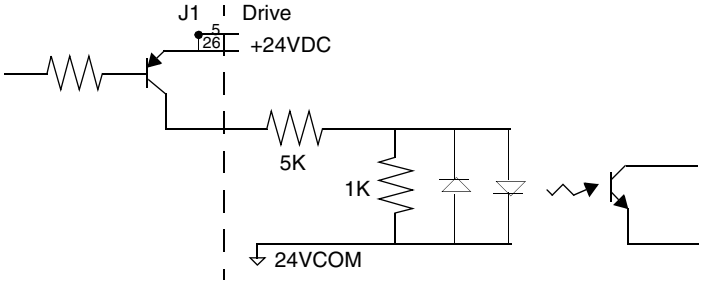


FIGURE 6.4 **Drive Input Connected to an Active High Sourcing Transistor**

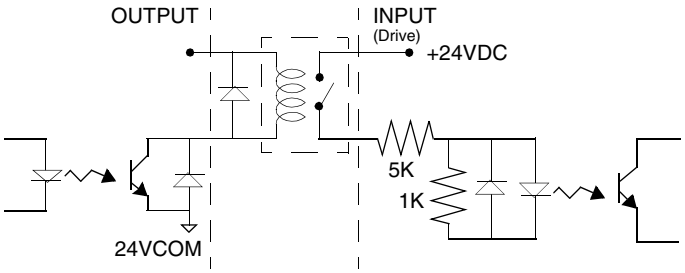


FIGURE 6.5 **Drive Input Connected to Active Low Output using a Switch/Relay**

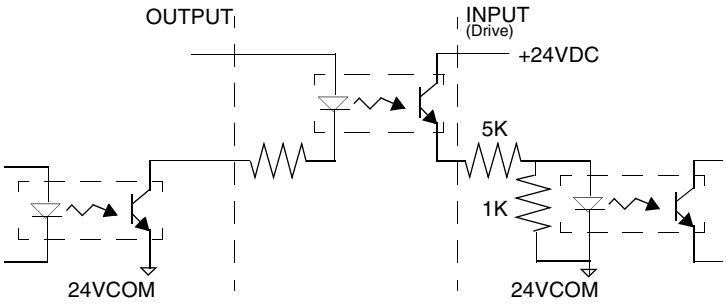


FIGURE 6.6 **Drive Input Connected to Active Low Output using an Opto-Isolator**

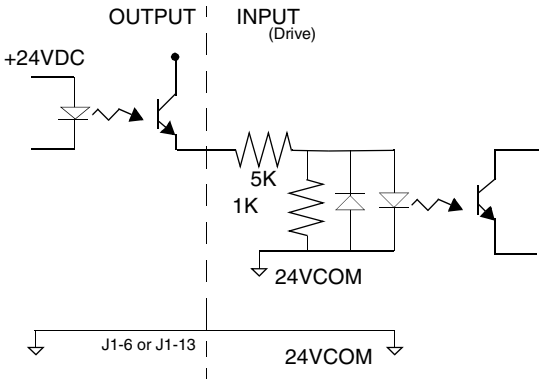


FIGURE 6.7 **Drive Input Connected to Sourcing Output**

Digital Outputs

Two types of discrete output circuits are available on the J1 connector:

- Dedicated relay outputs
- Selectable transistor based outputs

Both types support 24 VDC logic interfaces:

Dedicated Relay Outputs

BRAKE and DRIVE READY. Each output is a normally open relay. The brake contacts are rated for 1 Amp at 50 Volts. The Drive Ready contacts are rated for 100 mA at 50 Volts.

If an option, such as 90V brake, requires more power, a user provided relay may be driven by these outputs up to the specified levels.

Selectable Transistor Outputs

OUTPUT 1, OUTPUT 2, OUTPUT 3, and OUTPUT 4 are 24 VDC, optically isolated, active high, current sourcing, single ended transistor output channels. Each channel sources a maximum of 50 mA.

Ready and Brake Circuits

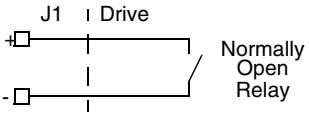


FIGURE 6.8 **READY and BRAKE Circuits**

The specifications for these outputs are as follows:

TABLE 6.6 **READY Output Specifications**

Parameter	Description	Maximum
ON state resistance	Internal resistance between J1-24 (+) and J1-25 (-) when the contacts are closed.	1 Ohm
ON state current	Current flow through the relay when contacts are closed.	100 mA
OFF state current	Leakage current from either output when the relay contacts are open.	0.01 mA
OFF state Voltage	Voltage difference between the outputs with open relay contacts.	50 Volts

TABLE 6.7 **BRAKE Output Specifications**

Parameter	Description	Maximum
ON state resistance	Internal resistance between J1-49 (+) and J1-50 (-) when the contacts are closed.	1 Ohm
ON state current	Current flow through the relay when contacts are closed.	1 A
OFF state current	Leakage current from either output when the relay contacts are open.	0.01 mA
OFF state Voltage	Voltage difference between the outputs with open relay contacts.	50 Volts

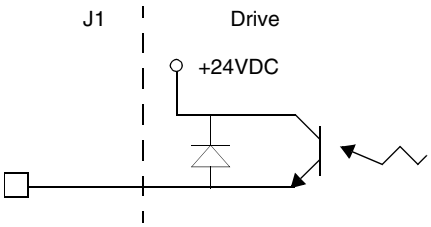


FIGURE 6.9 **Digital Output Circuit**

Selectable Output Circuits

TABLE 6.8 **General and Dedicated Outputs**

Digital Output	Pin Number	Function/Description	Internal Connections
READY	J1-24 (+) J1-25 (-)	Relay closure indicates the drive does *not* have a fault. (Refer to "READY Output Specifications" on page 6-60)	J3-24 (+) J3-25 (-)
BRAKE	J1-49 (+) J1-50 (-)	Relay closure releases the brake. Delay time is selectable. (Refer to "BRAKE Output Specifications" on page 6-60)	
OUTPUT 1	J1-42	General purpose output. Selectable from one of several drive functions. (Refer to Table 6.9)	
OUTPUT 2	J1-43		
OUTPUT 3	J1-44		
OUTPUT 4	J1-45		

TABLE 6.9 **OUTPUT1, OUTPUT2, OUTPUT3 and OUTPUT4 Functions**

Function	Description
In Position	An active state indicates the position window condition is satisfied, and the zero speed condition is satisfied. The position window and zero speed range are selectable settings.
Within Window	An active state indicates the position window condition is satisfied. The position window range is a selectable setting.
Zero Speed	An active state indicates the velocity loop zero speed signal is active. The zero speed limit is a selectable setting.
Speed Window	An active state indicates the velocity loop speed window is active. The speed window range is a selectable setting.
Current Limit	An active state indicates the torque current is limited.
Up To Speed	An active state indicates the velocity loop AT SPEED signal is active. The at speed level is a selectable setting.
Drive Enabled	An active state indicates the ENABLE signal is active and no fault is detected.
Bus Charged	An active state indicates the DC bus is energized.
Disabling Fault	An active state indicates a fault disabled the drive.
In Motion	An active state indicates the indexing sequence is in the motion portion.
In Dwell	An active state indicates the indexing sequence is in the dwell portion.
Sequence Complete	An active state indicates all batches of the indexing sequence are finished.
Registered	An active state indicates the indexing move has been adjusted after sensing the registration sensor.
At Home	An active state indicates the drive is at the home position.
Axis Homed	An active state indicates the drive has been homed.

TABLE 6.10 **Transistor Output Specifications**

Parameter	Description	Minimum	Maximum
ON state Voltage	Voltage difference between the +24 VDC supply and the output when the transistor is ON.	0 VDC	1.5 VDC
ON state current	Current flow when the transistor is ON.	0 mA	50 mA
OFF state Voltage	Voltage difference between the +24 VDC supply and the output when the transistor is OFF.	0 Volts	50 Volts
OFF state current	Leakage current from the output when the transistor is OFF.	-0.1 mA	0.1 mA

Output Interface Circuit Examples

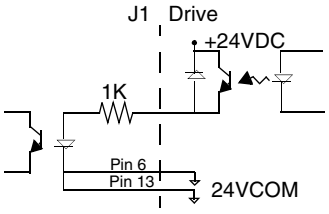


FIGURE 6.10 **Drive Output Connected to an Opto-Isolator**

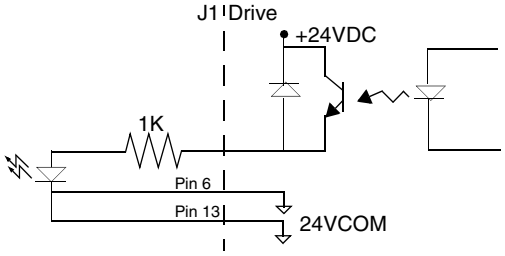


FIGURE 6.11 **Drive Output Connected to an LED Indicator**

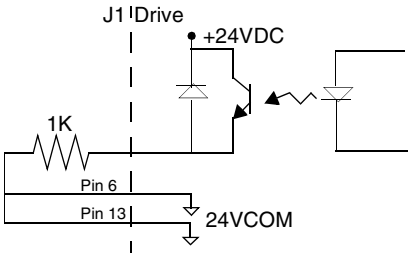


FIGURE 6.12 **Drive Output Connected to a Resistive Load**

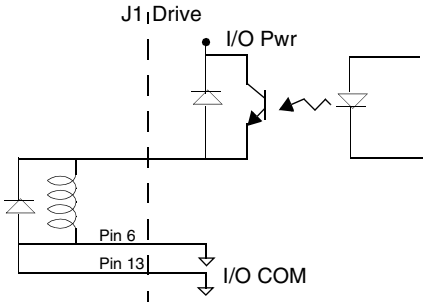


FIGURE 6.13 **Drive Output Connected to a Switch/Relay**

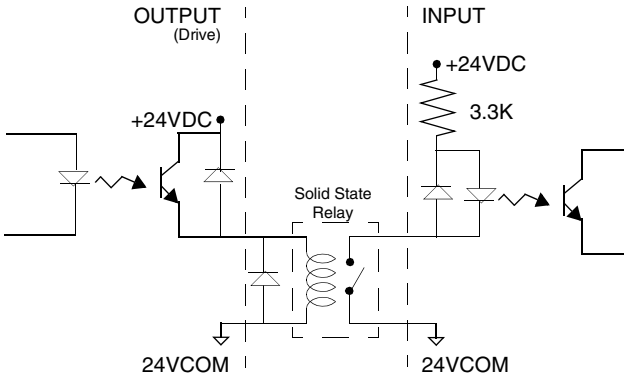


FIGURE 6.14 **Drive Output Connected to Active Low Input using a Switch/Relay**

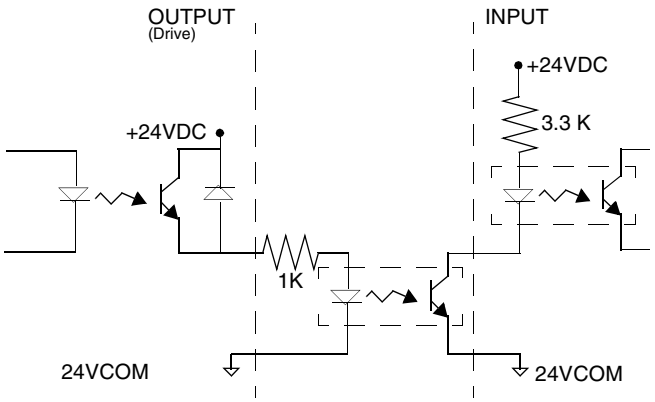


FIGURE 6.15 **Drive Output Connected to Active Low Input using an Opto-Isolator**

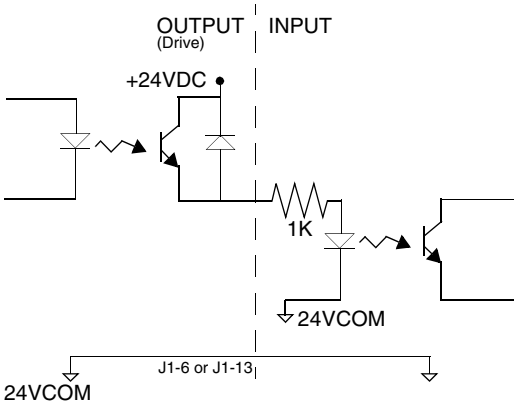


FIGURE 6.16 **Drive Output Connected to Active High (Sinking) Input**

Analog Inputs

Two types of analog input circuits are available on the J1 connector:

- The current limiting inputs support 0 to +10 Volt signals
- The command input supports 0 to ±10 Volt signals.

Positive Current Limit (+I LIMIT) and Negative Current Limit (-I LIMIT)

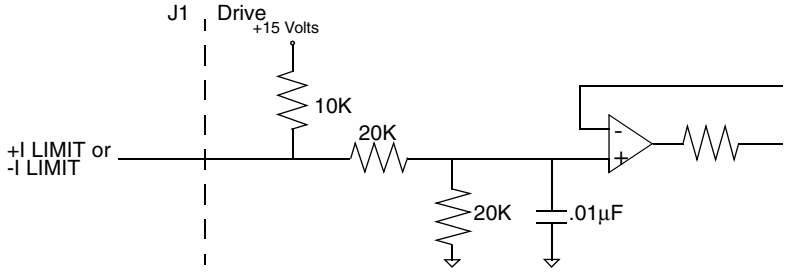


FIGURE 6.17 **Positive and Negative Current Limit Circuits**

The +I LIMIT and -I LIMIT are current limit inputs to the drive. They have a range of 0 to +10 Volts (where 10 Volts corresponds to maximum drive current). +I LIMIT limits current for producing positive torque, and -I LIMIT limits current for producing negative torque. The +I LIMIT and -I LIMIT are tied together for balanced current limiting. The analog +I LIMIT or -I LIMIT signals are converted into a digital word by a 10-bit ADC (analog to digital converter). If the +I LIMIT and -I LIMIT inputs are not connected, current is not limited.

TABLE 6.11 **Analog Inputs +I LIMIT and -I LIMIT**

Analog Input	Pin Number	Description
Positive Current Limit (+I LIMIT)	J1-27	Limits the peak positive current command, which produces positive torque.
Negative Current Limit (-I LIMIT)	J1-29	Limits the peak negative current command, which produces negative torque.

TABLE 6.12 **Positive and Negative Current Limit Input Specification**

Specification	Description	Minimum	Maximum
Resolution	Number of units that the input voltage is converted to.	10 Bits	
Maximum Current	Short circuit between the input and ground.		-1.5 mA
Input Signal Range	Allowable voltage applied to the input.	0 Volts	+10 Volts

Command Input

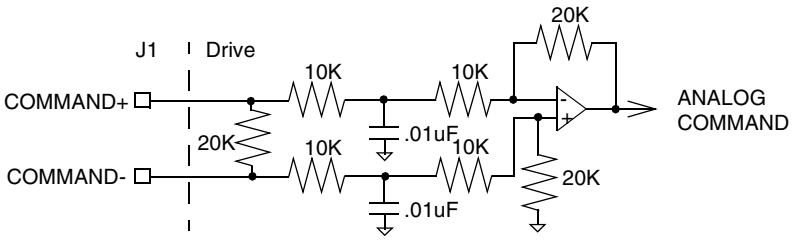


FIGURE 6.18 **Analog COMMAND Input Circuit**

The analog command signal to the drive has a range of ±10 Volts. The signal is either a torque, velocity or position command, depending on the software configuration of the drive. The differential input is processed by a 16 bit analog to digital converter (ADC) to produce a digital value.

TABLE 6.13 **Analog Command Input**

Analog Input	Pin Number	Description	Internal Connections
COMMAND	J1-22 (+) J1-23 (+)	Analog command signal is a differential type signal to drive the servo controller. Separate scale and offset parameters are used for the input, depending on whether the signal is a position, velocity or torque command.	J3-22 (+) J3-23 (-)

TABLE 6.14 **Analog Command Input Specifications**

Specification	Description	Minimum	Maximum
Resolution (Bits)	Number of units that the input voltage is converted to.	16	
Input Impedance (kOhms)	Open circuit impedance measured between (+) and (-).	13.3	
Input Signal Range (Volts)	Allowable voltage applied between (+) and (-) inputs.	0	±10

Analog Outputs

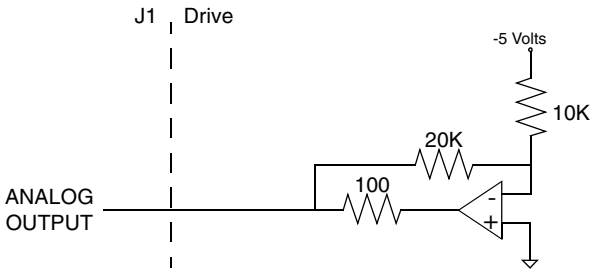


FIGURE 6.19 **ANALOG 1 and ANALOG 2 Output Circuits**

Two selectable outputs are available for monitoring by the user: ANALOG 1 (J1-30) and ANALOG 2 (J1-31). A 12 bit digital to analog converter (DAC) generates ANALOG 1. ANALOG 2 is a filtered PWM signal with 8 bit resolution and a carrier frequency of 32.8 kHz. Both outputs are scaled to a range of -10 to +10 Volts.

WARNING

The user may need to provide an external circuit to delay output of the analog signal when the signal is used to perform an operation. After reset both analog outputs may be in an indeterminate state for a short period before they stabilize at the setting stored in memory. Failure to observe this precaution could result in severe bodily injury.

TABLE 6.15 **Analog Outputs: ANALOG 1 and ANALOG 2**

Analog Output	Pin Number	Description	Internal Connections
ANALOG 1	J1-30	Selectable analog output with 12 bit resolution. Displays the selected firmware variable along with selectable scale and offset (refer to the DSMPro – I/O Configuration section).	A1
ANALOG 2	J1-31	Selectable analog output with 8 bit resolution. Displays the selected firmware variable along with selectable scale and offset (refer to the DSMPro – I/O Configuration section).	A2
ACOM	J1-28	Analog Common (return).	COM

TABLE 6.16 **Analog Output Specifications**

Specification	Description	Minimum	Maximum
ANALOG 1 Output Resolution (Bits)	Number of units that the ANALOG1 output voltage is converted into.	12	
ANALOG 2 Output Resolution (Bits)	Number of units that the ANALOG2 output voltage is converted into.	8	
Output Current (mA)	Allowable current draw of the load	-2	+2
Output Signal Range (Volts)	Voltage range of the signal	-10	+10

Motor Encoder Output Signals

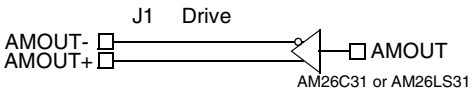


FIGURE 6.20 **Output Encoder Interface Circuit**

The motor quadrature encoder signals are supplied to an external position controller. The signals are differential, quadrature, and TTL level. The output resolution is selectable and can be divided by 1, 2, 4 or 8.

The signal frequency (*fout*) of the motor encoder output in Hertz (Hz) can be calculated with the equation:

$$f_{out} = \frac{Vm \cdot linecount}{60 \cdot N}$$

where:

Vm is the motor encoder velocity in rpm
linecount is the number of encoder lines/revolution of the motor mounted encoder, and
N is the output divider from the software selected parameter (1, 2, 4 or 8).

If the device connected to the motor encoder output counts all edges, the count frequency is four times f_{out}.

For example, a motor with a 2000 line encoder is rotating at 3000 rpm, and the Motor Encoder Output signal is set to **Divide by 1**, the encoder signal frequency is:

$$f_{out} = \frac{3000 \cdot 2000}{60 \cdot 1} = 100kHz$$

A counter counting all edges registers 400 kHz for this example.

TABLE 6.17 **Motor Encoder Output Signal**

Encoder Output	Pin Number	Description	Internal Connections
AOUT (+) AOUT (-)	J1-7 (+) J1-8 (-)	Motor Output Channels A(+) and A(-). Differential TTL levels from line driver. Signal resolution is selectable.	J3-7 (+) J3-8 (-)
BOUT (+) BOUT (-)	J1-9 (+) J1-10 (-)	Motor Output Channels B(+) and B(-). Differential TTL levels from line driver. Signal resolution is selectable.	J3-9 (+) J3-10 (-)
IOUT (+) IOUT (-)	J1-11 (+) J1-12 (-)	Motor Output Channels I(+) and I(-). Differential TTL levels from line driver. Output pulse occurs once per motor shaft revolution.	J3-11 (+) J3-12 (-)

TABLE 6.18 **Motor Encoder Output Specifications**

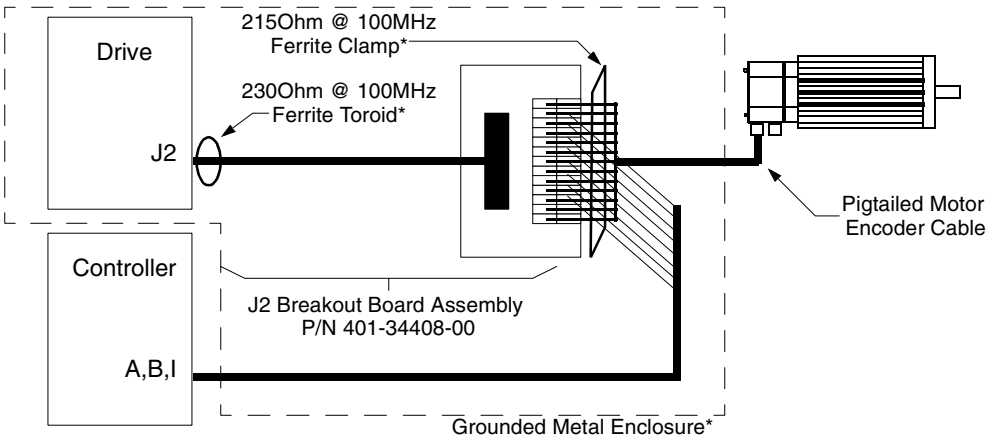
Specification	Description	Minimum	Maximum
Differential Output (Volts)	Voltage measured between the (+) and (-) pins with R_L = 100 Ohm.	2.0	
Output Current (mA)	Current flowing out of the (+) or (-) pin.	-20	+20

IOUT Signal Generation

The Index output signal (IOUT) is *not synchronized* to a particular state of the A and B output signals (AOUT and BOUT). Some controllers, such as those used in the CNC industry, use the condition I=1, A=1, B=1 to indicate a home position. In such applications the encoder outputs from the drive *cannot* be used, since an active IOUT signal (IOUT=1) cannot be guaranteed during the state AOUT=1, BOUT=1. Instead, the unbuffered motor encoder signals can be used as shown below. The J2 Breakout Board assembly connects the motor encoder signals directly to the position feedback of the controller.

TIP

If a controller connected to the drive requires the Index Output (IOUT) signal to be synchronized to a particular state of the A and B Outputs (AOUT and BOUT) the unbuffered encoder outputs from the motor must be used.



NOTE: An asterisk (*) indicates an installation option to comply with EU EMC Directives. Either a grounded metal enclosure or ferrite cores provide the requisite EMC protection.

FIGURE 6.21 **Unbuffered Encoder Signal Wiring**

Two options are available to achieve European Union EMC compliance when a Centurion DSM100 Drive uses the J2 Breakout Board Assembly to transfer an unbuffered encoder signal to a control device. Either method of installation reduces the radiated emissions to an acceptable level. Be aware that either installation option is in addition to the EMC requirements specified elsewhere in this manual.

TIP

Drives are tested using specific installation methods, and the information above is based on successful tests. If the drives are installed in this manner, then compliance with European EMC requirements may be expected, although it is impossible to guarantee that a specific installation will meet EMC requirements without testing it.

- Install the drive and J2 breakout board assembly (terminal block and cables) inside a grounded metal enclosure.

- or -

- Install ferrites of an appropriate rating at the specific locations:

  1. J2 Cable – 230 Ohm @ 100 MHz toroid (FerriShield P/N SS28B2032) immediately adjacent to the J2 connector on the drive.

  2. Pigtailed Motor Encoder Cable – 215 Ohm @ 100 MHz ribbon cable clamp (Fair-Rite P/N 2643164051 and clips Fair-Rite P/N 0199001401) over the unshielded conductors.

Auxiliary Encoder Inputs

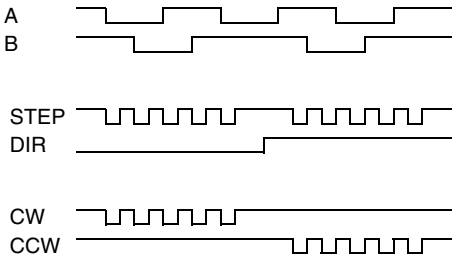


FIGURE 6.22 **Auxiliary Encoder Input Types**

The Centurion DSM100 Drive may be electronically geared by a remote signal. Electronic gearing may be driven by any of the following three signals:

- A master incremental encoder that generates quadrature encoder signals
- Step and direction signals, such as those created by indexers for step motors
- CW (Step Up)/CCW (Step Down) signals, typically used with stepper indexers.

TIP

The use of differential signals is strongly recommended. Single-ended signals are susceptible to noise, which may cause intermittent or continuous errors.

To improve noise immunity, terminate cable shields at both ends of the cable. Connect shields to the backshell of the connector with a complete circumferential (360°) termination. The cable connector should then connect to chassis ground (not signal ground.)

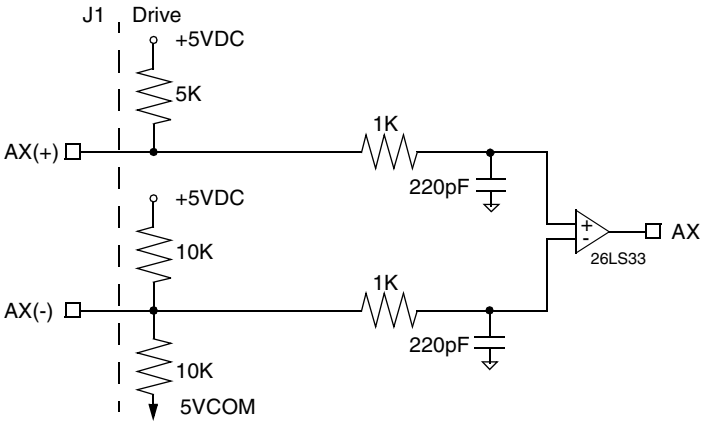


FIGURE 6.23 **Auxiliary Encoder Input Circuit**

The input circuits shown in the following diagrams support connections to differential TTL line drivers, single-ended TTL line drivers and open collector devices. These inputs are selectable under software control.

TABLE 6.19 Auxiliary Encoder/Step and Diection/CW & CCW (Step Up & Down) Signals

Auxiliary Encoder Input	Pin Number	Description	Internal Connections
AX + and AX-, or Step + and Step-, or CW+ (Step Up+) and CW- (Step Up-)	J1-14 (+) J1-15 (-)	Auxiliary Channels A(+) and A(-). Differential, quadrature, or TTL level encoder input. The signal input and resolution are selectable. (Refer to DSMPro – Drive Setup.)	J3-14 (+) J3-15 (-)
BX (+) and BX(-), or DIR (+) and DIR(-), or CCW+ (Step Down+) and CCW- (Step Down-)	J1-16 (+) J1-17 (-)	Auxiliary Channels B(+) and B(-). Differential, quadrature, or TTL level encoder inputs. The signal input and resolution are selectable. (Refer to DSMPro – Drive Setup.)	J3-16 (+) J3-17 (-)
IX (+) and IX (-)	J1-18 (+) J1-19 (-)	Auxiliary Input Channels I(+) and I(-). Differential, quadrature, or TTL level encoder inputs.	J3-18 (+) J3-19 (-)

TABLE 6.20 Quadrature Interface Specifications

Specification	Description	Minimum	Maximum
ON State Voltage (Volts)	Voltage difference between the + and – inputs that indicate an ON state.	1.0	+15
OFF State Voltage (Volts)	Voltage difference between the + and – inputs that indicates an OFF state.	-1.0	-15
Common Mode Voltage (Volts)	Voltage difference between an encoder signal input and the reference ground of the drive.	-15	+15
Current Draw (mA)	Current draw into the + input or – input	-5	+5
A or B Signal Frequency (MHz)	Frequency of the A or B line inputs. Count frequency is 4 times this frequency, since the circuitry counts each of the four transitions in a single line.		1
Index Pulse Width (nsec)	Pulse width of the index signal. The index signal is active for a percentage of the revolution, therefore the speed of the encoder dictates the pulse width.	500	

Interface Cable Examples

The use of differential signals is highly recommended. This is due to the immunity of differential signals to common mode interference. Single-ended encoder interface circuits are not recommended, and may result in system malfunction.

To improve noise immunity, a cable shield should terminate at both ends of the cable. Shields should connect to the backshell of the connectors with termination around the full circumference (360°). The connectors should attach to chassis ground (not signal common).

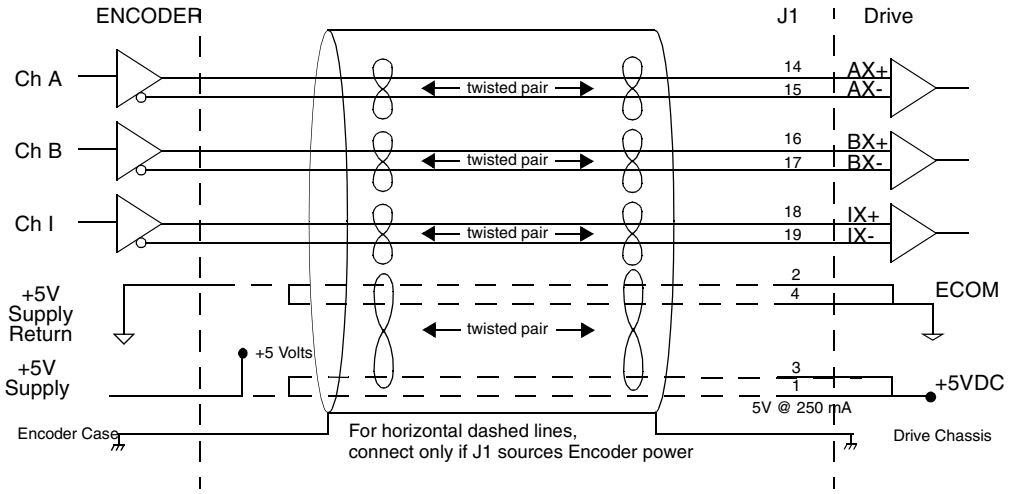


FIGURE 6.24 **External Encoder Interface via TTL Differential Line Drivers**

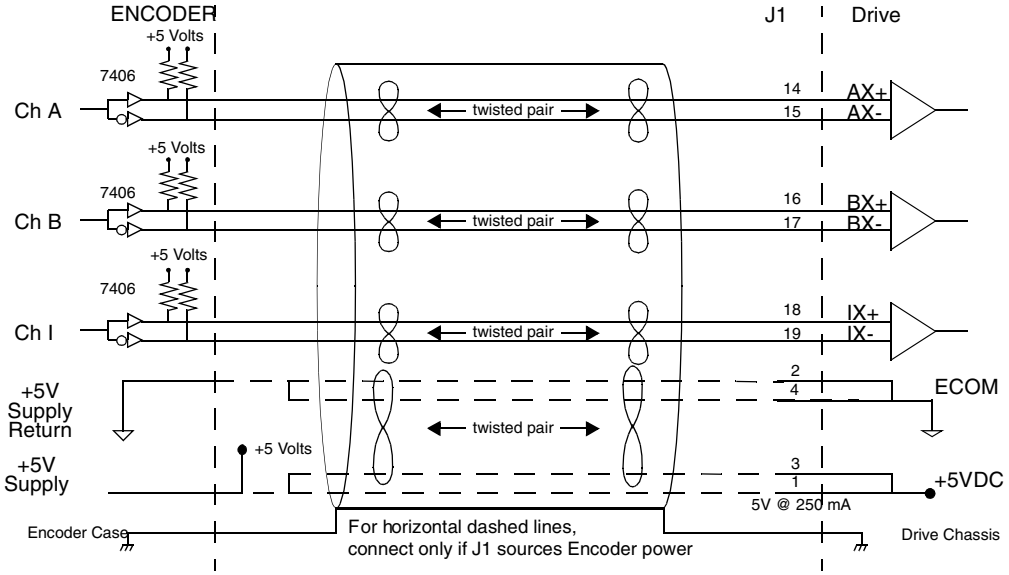


FIGURE 6.25 **Complementary Encoder Interface via 7406 Line Drivers with Pull-up Resistors**

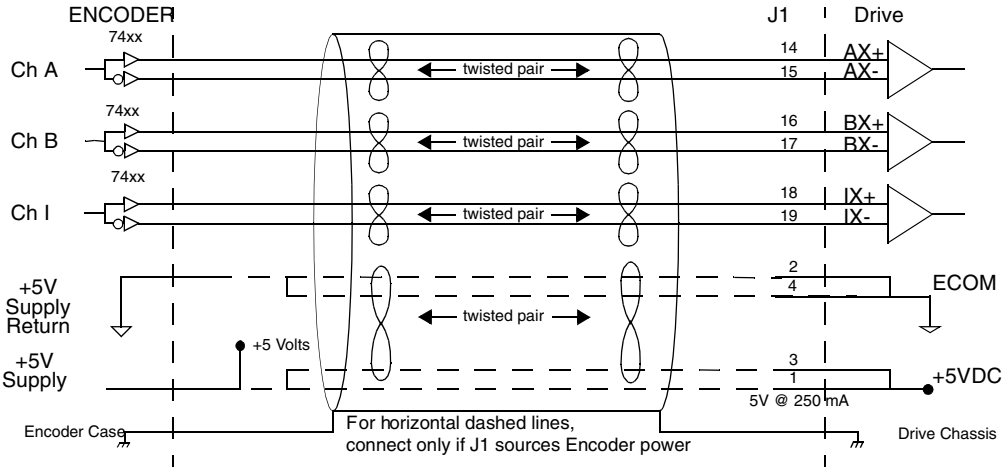


FIGURE 6.26 **Complementary Encoder Interface via Standard TTL Logic**

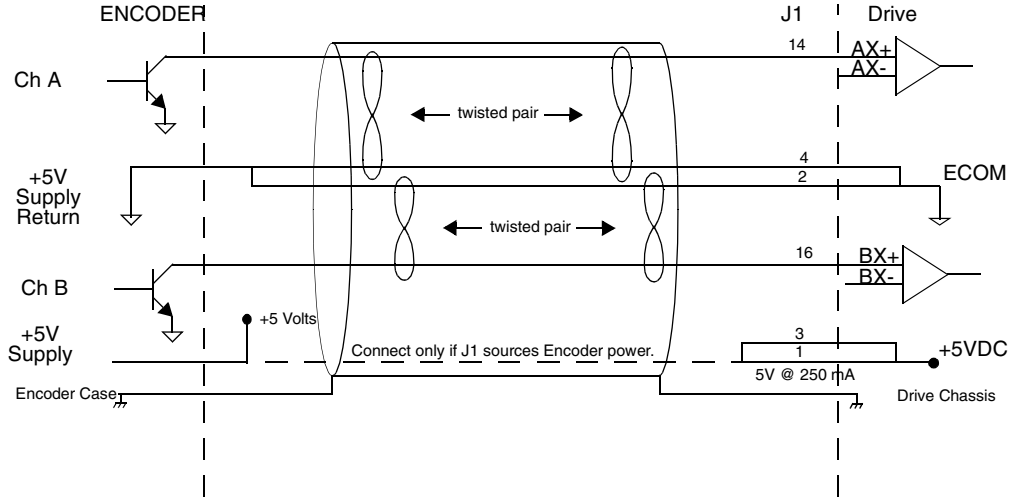


FIGURE 6.27 **Single-Ended Encoder Interface via Open Collector Transistor without Pull-up (not recommended)**

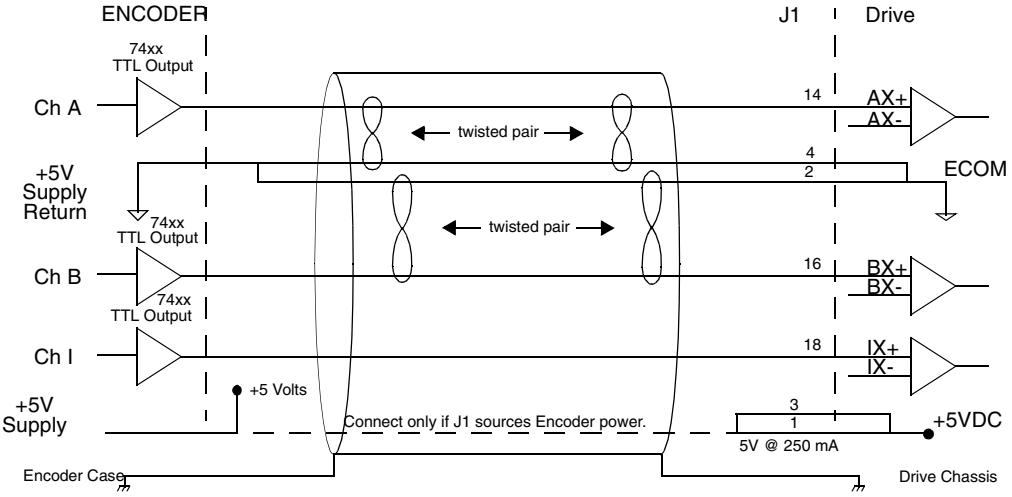


FIGURE 6.28 **Single-Ended Encoder Interface via Standard TTL Signals (not recommended)**

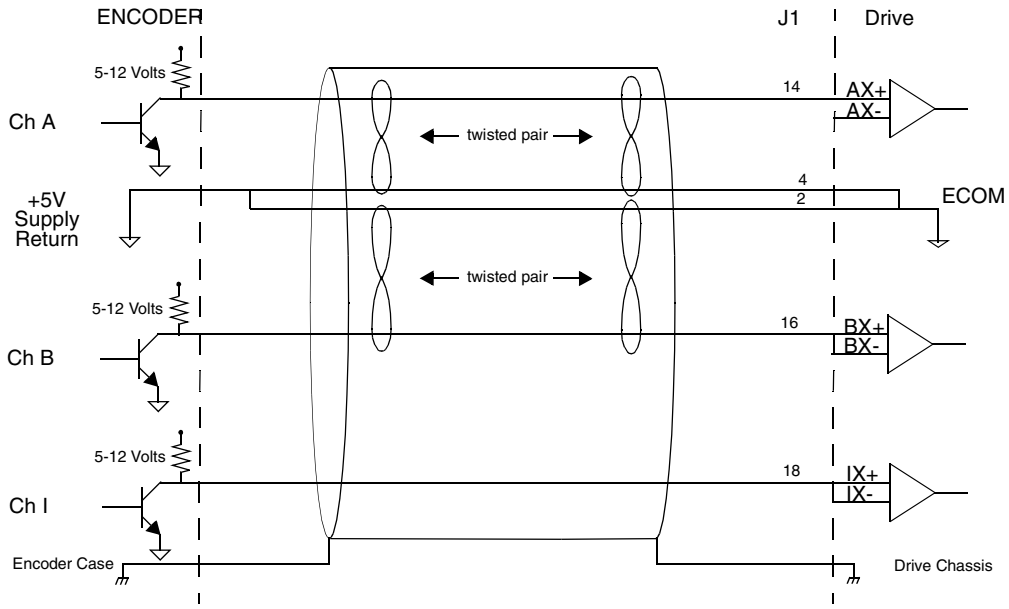


FIGURE 6.29 **Single-Ended Encoder Interface via Open Collector Transistor with 5 VDC to 12 VDC Pull-up (not recommended)**

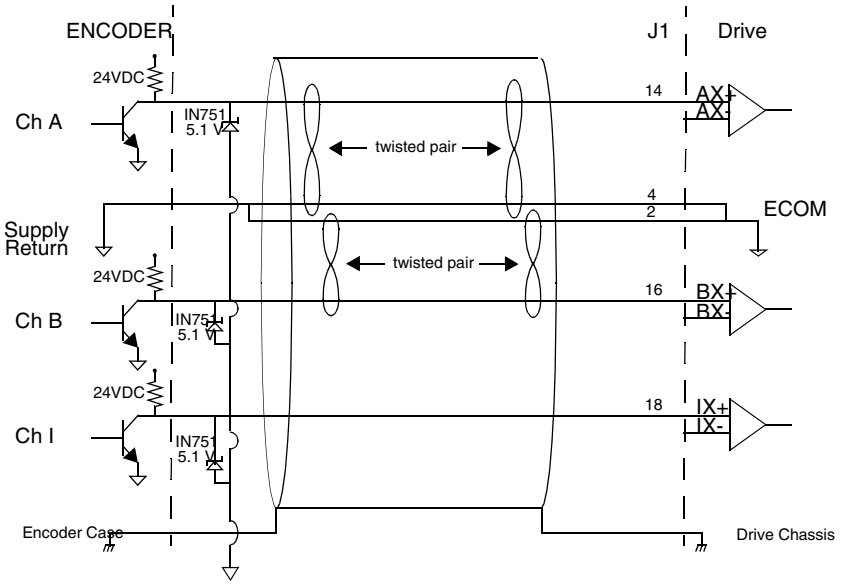
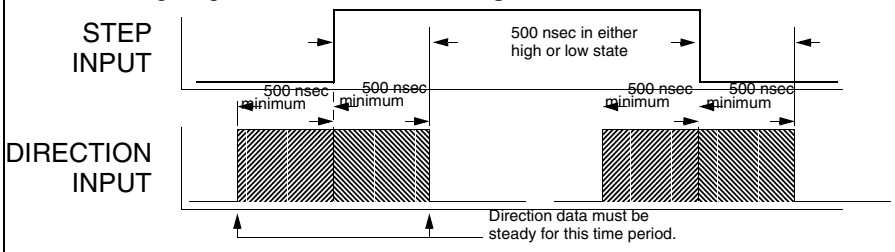


FIGURE 6.30 **Single-Ended Encoder Interface via Open Collector Transistor with 24 VDC Pull-up (not recommended)**

TABLE 6.21 **Step/Direction and CW/CCW (Step Up/Step Down) Interface Specifications**

Specification	Description	Minimum	Maximum
Signal frequency (MHz)	Frequency of the input signal.		1
Pulse Width (nsec)	Time interval the step (CW/CCW) signal must remain in a single state for detection.	500	
Setup Time (nsec)	Time interval the direction (CW/CCW) signal must be stable before the corresponding step (CCW/CW) signal changes state.	500	

The following diagram shows the relationship between STEP and DIRECTION inputs.



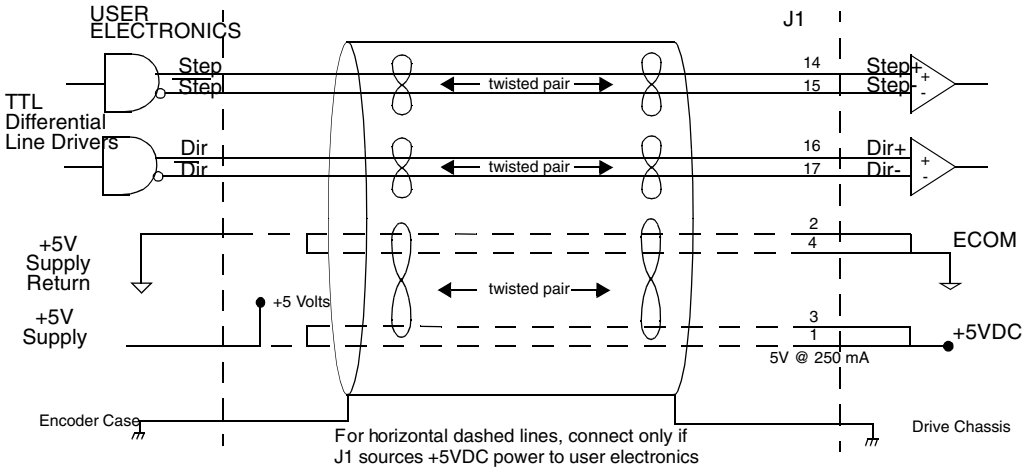


FIGURE 6.31 **External Step/Direction Interface via TTL Differential Line Drivers**

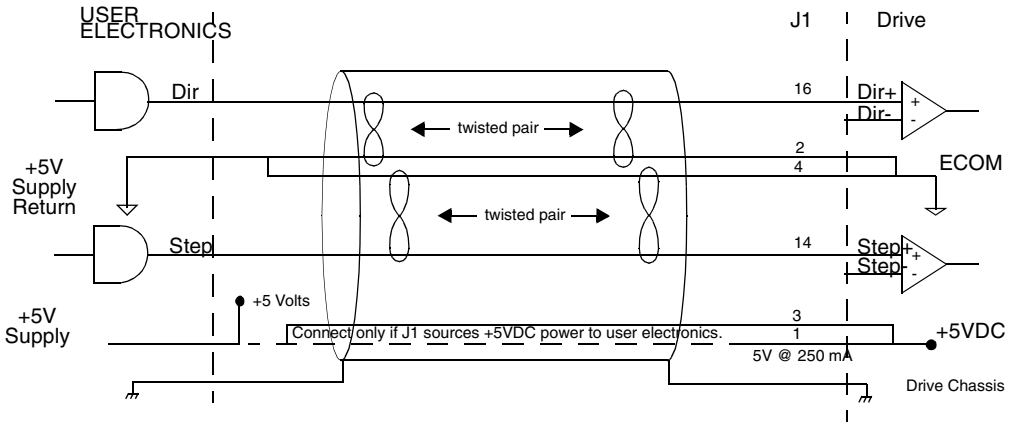


FIGURE 6.32 **External Step/Direction Interface via Single-Ended TTL Line Drivers (not recommended)**

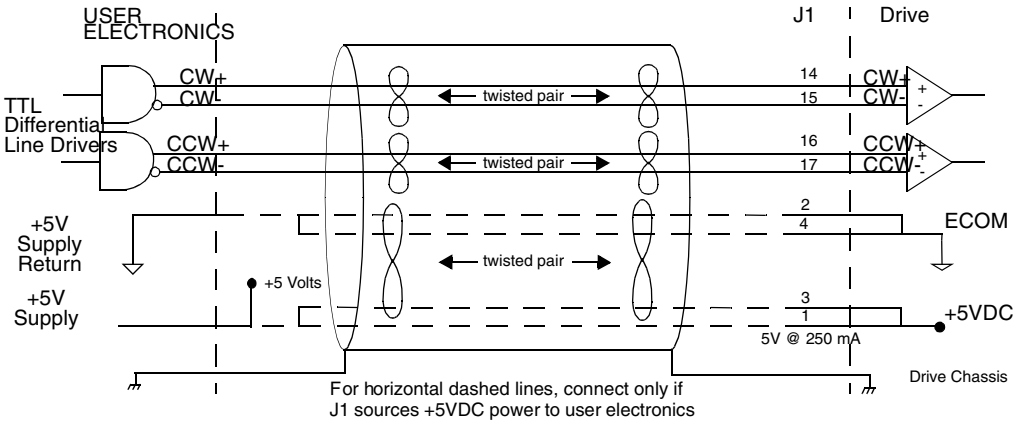


FIGURE 6.33 **External CW/CCW (Step Up/Step Down) Interface via TTL Differential Line Drivers**

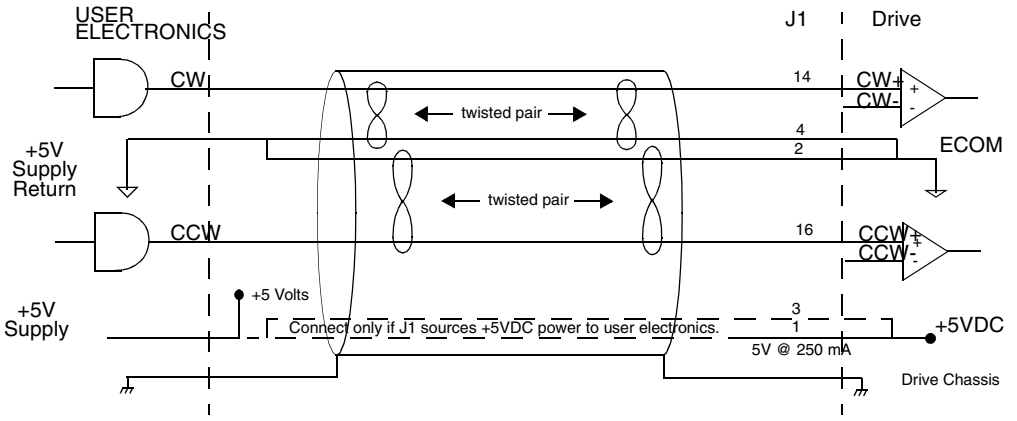


FIGURE 6.34 **External CW/CCW (Step Up/Step Down) Interface via Single-Ended Line Drivers (not recommended)**

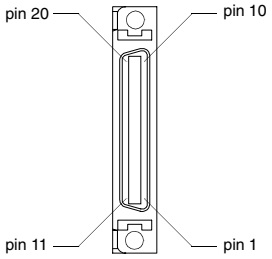
J1 Terminal Strip/Breakout Board

A 50-pin terminal strip kit is available for extending the signals from the J1 connector. The kit includes a 1 meter (3-foot) interface cable, a 50-pin terminal strip and mounting hardware. Refer to “” on page -173.

“Cabling Examples” on page B-201 depicts the use of this kit to pass a cable through a bulkhead.

J2 – Encoder

Pin	Signal	Description	Pin	Signal	Description
1	EPWR	Encoder Power	11	I (+)	Motor Encoder Input Channel I(+)
2	ECOM	Encoder Common	12	I (-)	Motor Encoder Input Channel I(-)
3	EPWR	Encoder Power	13	HALL A	Hall Effect A
4	ECOM	Encoder Common	14	HALL B	Hall Effect B
5	SENSE (+)	Encoder Power Sense (+)	15	HALL C	Hall Effect C
6	SENSE (-)	Encoder Power Sense (-)	16	ABS	Absolute Position
7	A (+)	Motor Encoder Input Channel A(+)	17		Reserved
8	A (-)	Motor Encoder Input Channel A(-)	18		Reserved
9	B (+)	Motor Encoder Input Channel B(+)	19	TS(+)	Thermal Switch (+)
10	B (-)	Motor Encoder Input Channel B(-)	20	TS(-)	Thermal Switch (-)



J2 is a 20 pin female mini-D ribbon connector (AMP 2-178238-2). It connects the motor encoder, hall effect switches, and the thermostat to the Centurion DSM100 Drive. Contact between the connector shell and a grounded chassis provides shield termination.

CAUTION: Ensure that the encoder signals are connected as shown in Figure 6.36. Incorrect connection of the encoder signals will result in improper rotor position, incorrect commutation and/or a runaway motor condition.

Giddings & Lewis cables are available in various lengths for connecting between J2 and an encoder. “” on page -173 lists the cables that are available. J2 Terminal Strip/Breakout Board” details the optional signal extension kit.

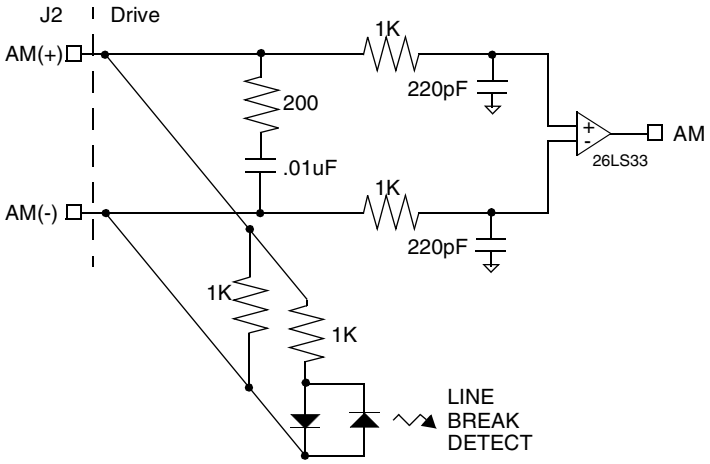


FIGURE 6.35 **Motor Encoder Interface Circuit**

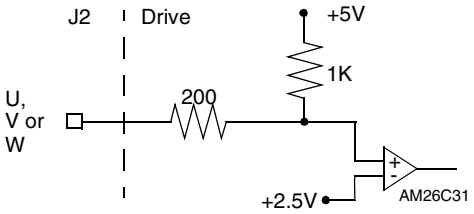


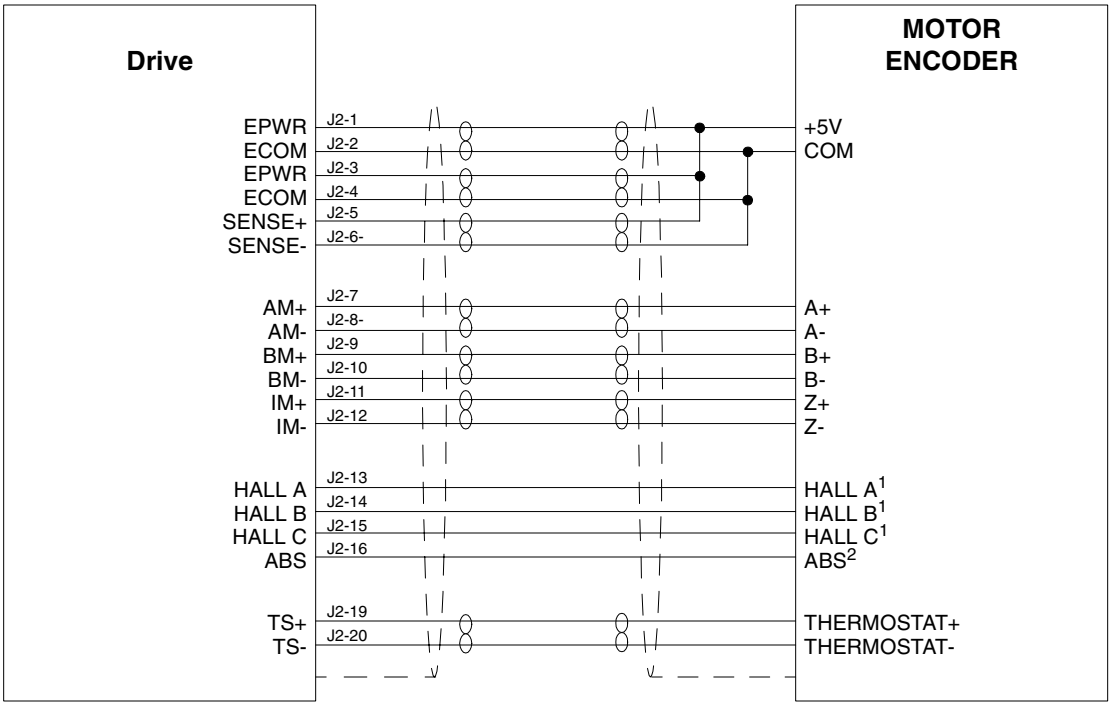
FIGURE 6.36 **Hall Effect Sensor Circuit**

TABLE 6.22 **J2- Motor Encoder Connector Pin-Outs**

Motor Encoder	Pin Number	Description
EPWR	J2-1 J2-3	Encoder power Internally fused (F3) is 1A, fast acting.
ECOM	J2-2 J2-4	Encoder common
SENSE (+) SENSE (-)	J2-5 (+) J2-6 (-)	Encoder power sense NOTE: The SENSE+ signal must be connected to the EPWR signal, and the SENSE- signal must be connected to the ECOM signal at the encoder for the motor encoder signals to be received properly by the drive.
A(+) A (-)	J2-7 (+) J2-8 (-)	Motor Encoder Input Channel A(+) and Channel A(-). Accepts TTL level signals from a line driver.
B(+) B (-)	J2-9 (+) J2-10 (-)	Motor Encoder Input Channel B(+) and Channel B(-). Accepts TTL level signals from a line driver.
I (+) I (-)	J2-11 (+) J2-12 (-)	Motor Encoder Input Channel I(+) and Channel I(-). Accepts TTL level signals from a line driver. Output pulse occurs once per motor shaft revolution.
HALL A	J2-13	Hall Effect A sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor. The input signal interfaces to both a differential and single-ended Hall effect sensor, using either a TTL level signal or open collector signal. A differential output connects only the (+) output to the drive. Software determines when the hall effect sensors are in an illegal state.

TABLE 6.22 **J2- Motor Encoder Connector Pin-Outs** (continued)

Motor Encoder	Pin Number	Description
HALL B	J2-14	Hall Effect B sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor. The input signal interfaces to both a differential and single-ended Hall effect sensor, using either a TTL level signal or open collector signal. A differential output connects only the (+) output to the drive. Software determines when the hall effect sensors are in an illegal state.
HALL C	J2-15	Hall Effect C sensor logic level input. Internally pulled up to +5VDC through a 1 kOhm resistor. The input signal interfaces to both a differential and single-ended Hall effect sensor, using either a TTL level signal or open collector signal. A differential output connects only the (+) output to the drive. Software determines when the hall effect sensors are in an illegal state.
ABS	J2-16	Absolute Position used on Giddings & Lewis motors for commutation.
	J2-17 J2-18	Reserved.
TS (+) TS(-)	J2-19 J2-20	Thermal Switch (+) and Thermal Switch (-) are thermostat inputs, with an open condition indicating a motor overtemperature fault.



NOTES:
1. For encoders with differential Hall outputs (A+, A-, B+, B-, C+ and C-) connect only the + outputs to the drive.
2. The ABS signal is only available on selected encoders.

FIGURE 6.37 **Centurion DSM Motor Encoder Connections**

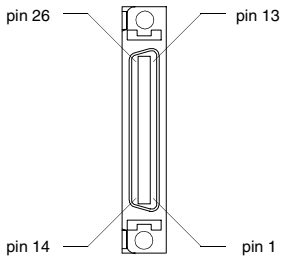
J2 Terminal Strip/Breakout Board

A 25-pin terminal strip kit is available for extending the encoder signals from the J2 connector. the kit includes a 3-foot (1 meter) interface cable, a 25-pin terminal strip. and mounting hardware. Refer to “Options and Accessories”.

“Cabling Examples” on page B-24 depicts the use of this kit to pass a cable through a bulkhead.

J3 – Auxiliary Port

Pin	Signal	Description	Pin	Signal	Description
1	+5VDC	Encoder +5V DC	14	AX+	Auxiliary Channel A+
2	ECOM	Encoder Common	15	AX-	Auxiliary Channel A-
3	+5VDC	Encoder +5V DC	16	BX+	Auxiliary Channel B+
4	ECOM	Encoder Common	17	BX-	Auxiliary Channel B-
5	+24VDC	Isolated +24 VDC	18	IX+	Auxiliary Channel I+
6	24VCOM	Isolated 24V Common	19	IX-	Auxiliary Channel I-
7	AOUT+	Motor Output Channel A+	20	ENABLE	ENABLE
8	AOUT-	Motor Output Channel A-	21	RESET	FAULT RESET
9	BOUT+	Motor Output Channel B+	22	COMMAND+	Analog Command+
10	BOUT-	Motor Output Channel B-	23	COMMAND-	Analog Command-
11	IOUT+	Motor Output Channel I+	24	READY+	READY+
12	IOUT-	Motor Output Channel I-	25	READY-	READY-
13	24VCOM	Isolated 24V Common	26	+24VDC	+Isolated +24 VDC



J3 is a 26 pin female mini-D ribbon connector (AMP 2-178238-4). It duplicates the first 26 pins of J1, the Controller connector, which are discussed in detail beginning on page 6-53. Contact between the connector shell and the grounded chassis provides shield termination.

Giddings & Lewis cables are available in various lengths for connecting between J3 and an auxiliary unit. “” on page -173 lists the cables that are available.

TABLE 6.23 **J3 – Auxiliary Connector Pin-Outs**

Motor Encoder	Pin Number	Description	Internal Connections
+ 5V	J3-1 J3-3	Encoder +5 VDC @ 250 mA power source for auxiliary encoder electronics. The output is fused internally by a 1 Amp fast acting fuse (F2). Refer to “5 Volt Power Supply Specifications” on page 6-55.	J1-1, J1-3 J3-1, J3-3
ECOM	J3-2 J3-4	Encoder common. Signal reference for the auxiliary encoder. Refer to “5 Volt Power Supply Specifications” on page 6-55.	J1-2, J1-4 J3-2, J3-4
+ 24V	J3-5 J3-26	Isolated + 24 VDC @ 500 mA power source for external I/O connection. This output is fused internally by a 1 Amp fast acting fuse (F1). Refer to “24 Volt Power Supply Specifications” on page 6-55.	J1-5 J1-26
24VCOM	J3-6 J3-13	Isolated 24 Volt common. Refer to “24 Volt Power Supply Specifications” on page 6-55.	J1-6 J1-13

TABLE 6.23 **J3 – Auxiliary Connector Pin-Outs** (continued)

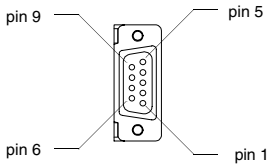
Motor Encoder	Pin Number	Description	Internal Connections
AOUT (+) AOUT (-)	J3-7 (+) J3-8 (-)	Motor Output Channels A(+) and A(-). Differential TTL levels from line driver. Refer to "Motor Encoder Output Signal" on page 6-67 and Figure 6.20.	J1-7 (+) J1-8 (-)
BOUT (+) BOUT (-)	J3-9 (+) J3-10 (-)	Motor Output Channels B(+) and B(-). Differential TTL levels from line driver. Refer to "Motor Encoder Output Signal" on page 6-67 and Figure 6.20.	J1-9 (+) J1-10 (-)
IOUT (+) IOUT (-)	J3-11 (+) J3-12 (-)	Motor Output Channels I(+) and I(-). Differential TTL levels from line driver.) Refer to "Motor Encoder Output Signal" on page 6-67 and Figure 6.20.	J1-11 (+) J1-12 (-)
AX+ and AX-, or Step+ and Step-, or CW (Step Up+) and CW (Step Up-)	J3-14 (+) J3-15 (-)	Auxiliary Channel A(+) and A(-). Differential, quadrature, or TTL level encoder input. The signals are selectable as AX+ and AX-, or Step+ and Step-, or CW (Step Up+) and CW (Step Up-). For encoder information refer to "Quadrature Interface Specifications" on page 6-70 and Figure 6.24, 6.25, 6.26, 6.27, 6.28, 6.29 and 6.30. For stepper information refer to"Step/Direction and CW/CCW (Step Up/Step Down) Interface Specifications" on page 6-74 and Figure 6.31, 6.32, 6.33 and 6.34.	J1-14 (+) J1-15 (-)
BX+ and BX-, or DIR+ and DIR-, or CCW (Step Down+) and CCW (Step Down-)	J3-16 (+) J3-17 (-)	Auxiliary Channel B(+) and B(-). Differential, quadrature, or TTL level encoder input. The signals are selectable as BX+ and BX-, or DIR+ and DIR-, or CCW (Step Down+). and CCW (Step Down-). For encoder information refer to "Quadrature Interface Specifications" on page 6-70 and Figure 6.24, 6.25, 6.26, 6.27, 6.28, 6.29 and 6.30. For stepper information refer to"Step/Direction and CW/CCW (Step Up/Step Down) Interface Specifications" on page 6-74 and Figure 6.31, 6.32, 6.33 and 6.34.	J1-16 (+) J1-17 (-)
IX (+) IX (-)	J3-18 (+) J3-19 (-)	Differential, quadrature, or TTL level encoder input. The signals are selectable. For encoder information refer to "Quadrature Interface Specifications" on page 6-70 and Figure 6.24, 6.25, 6.26, 6.27, 6.28, 6.29 and 6.30.	J1-18 (+) J1-19 (-)
ENABLE	J3-20	Enables and disables the drive. Refer to "Digital Input Specifications" on page 6-57 and Figure 6.1.	J1-20

TABLE 6.23 **J3 – Auxiliary Connector Pin-Outs** (continued)

Motor Encoder	Pin Number	Description	Internal Connections
FAULT RESET	J3-21	General purpose input, selectable to one of several drive functions. Refer to “Digital Input Specifications” on page 6-57 and Figure 6.1.	J1-21
COMMAND (+) COMMAND (-)	J3-22 (+) J3-23 (-)	Analog command signal is a differential type signal that drives the servo controller. Separate scale and offset parameters are used for the input, depending on whether the signal is a position, velocity or torque command. Refer to “Analog Command Input” on page 6-65 and Figure 6.18.	J1-22 (+) J1-23 (-)
READY (+) READY (-)	J3-24 (+) J3-25 (-)	Contact closure indicates the drive is ready to follow commands. Refer to “READY Output Specifications” on page 6-60 and Figure 6.8.	J1-24 (+) J1-25 (-)

J4 and J5 – Serial Port

Pin	Signal	Description	Use
1	RCV(+)	Receive (+)	RS-485 (four wire)
2	RCV	Receive	RS-232
3	XMT	Transmit	RS-232
4	XMT(+)	Transmit (+)	RS-485 (four wire)
5	COM	+5 VDC Common	
6		Reserved[a]	
7	RCV(-)	Receive (-)	RS-485 (four wire)
8	XMT(-)	Transmit (-)	RS-485 (four wire)
9		Reserved[1]	



a. Do *not* connect any device to J4-6, J5-6, J4-9 or J5-9 except an Giddings & Lewis TouchPad.

J4 and J5 are 9 pin female D-shell (AMP 205204-4, pins AMP 66506-3) connectors. Each connector is a serial interface that allows communication with another Centurion DSM100 Drive, a PC, a terminal, a host computer, a controller or an optional TouchPad. The signals on J4 and J5 are internally connected, which allows daisy-chain connection of several drives. The shell of the connector is grounded to the chassis for shield termination.

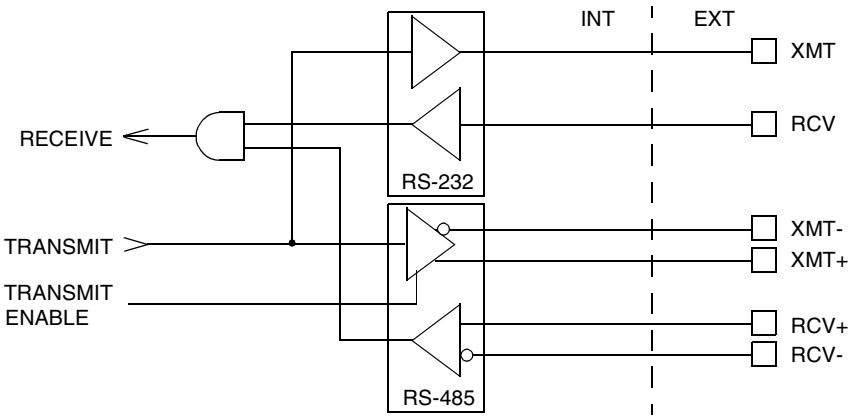


FIGURE 6.38 **RS-232/485 Interface Circuit**

The serial interface of the Centurion DSM100 Drive uses the standard NRZ asynchronous serial format, and supports both the RS-232 and the four wire RS-485 communications standards.

- Standard baud rates include 1200, 2400, 4800, 9600 and 19200 baud. 9600 is the factory default setting.
- Even, odd, and no parity generation/checking are supported. No parity is the factory default setting.
- The maximum number of Centurion DSM100 Drives allowable on an RS-485 bus is 32.
- The maximum length of an RS-232 cable is 15 meters (50 feet).
- The maximum length of an RS-485 cable is 1220 meters (4000 feet) with 0.20 mm^2 (24 AWG) wire.

Giddings & Lewis cables are available in various lengths for connecting to the serial port of an Centurion DSM100 Drive and a control unit, such as a PC. “” on page -173 lists the cables, and the male and female connectors for the cables.

TIP

The shell of the connector is grounded to the chassis for shield termination.

The following table lists the pin-outs for J4 and J5.

TABLE 6.24 **J4 and J5 – Serial Port Connector Pin-Outs**

Signal	Pin Number	Description	Internal Connections
RCV (+) RCV (-)	J4 - 1 (+) J4 - 7 (-)	RS-485 differential receiver input (to drive)	J5 - 1 (+) J5 - 7 (-)
XMT (+) XMT (-)	J4 - 4 (+) J4 - 8 (-)	RS-485 differential transmitter output (from drive)	J5 - 4 (+) J5 - 8 (-)
COM	J4 - 5	Common serial port interface	J5 - 5
	J4 - 6	Reserved[a]	J5 - 6
RCV	J4 - 2	RS-232 receiver input (to drive)	J5 - 2
XMT	J4 - 3	RS-232 transmitter output (from drive)	J5 - 3
	J4 - 9	Reserved[1]	J5 - 9

a. Do *not* connect any device to J4-6, J5-6, J4-9 or J5-9, except an Giddings & Lewis TouchPad.

Serial Communications Overview

Centurion DSM100 Drives communicate via a standard NRZ (non-return to zero) asynchronous serial format, which supports either RS-232 or four wire RS-485. The pin-out arrangement on the drive serial ports provides self-sensing of the communication standard. To change from RS-232 to four wire RS-485 requires a simple change of the cable.

In multiple drive installations, a unique address must be assigned to each drive, either through hardware (a physical address) or software. All physical addresses are set using the 16 position rotary switch on the front panel of the drive. Software based addresses are selected by setting the rotary switch to position F, as shown, which forces the drive to used the address stored in the personality module EEPROM of the drive.

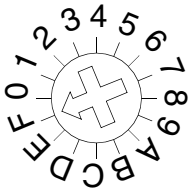


FIGURE 6.39 **Sixteen Position Rotary Addressing Switch**

The following table shows the relationship between drive addresses, whether set by hardware or software. It also lists the communications settings, whether mandatory (default) settings or software selectable.

Addressing Examples:

- Setting the rotary switch to position 0 forces the drive to communicate using the factory default settings (refer to Table 6.25). The drive ignores any software address assigned to it. However, the drive

TABLE 6.25 **Drive Addressing**

Address Range		Communications
Hardware[1]	**Software[1]**	
0	N/A	Factory Default • 9600 baud rate • 8 Data • 1 Stop Bit • No Parity
1–A	N/A	Software Selected Settings include: • 1200, 2400, 4800, 9600 and 19200 baud rates • 8 Data Bits • 1 Stop Bit • Even, Odd or No Parity
B–E	N/A	Reserved
F	1–32	Software Selected
1. Hardware (rotary address switch) and software (address and communications settings) changes are not immediate; they are logged but do not become active until *after* the drive is RESET.		

may be assigned a unique name.

This setting ensures that communications with the drive can be established at any time.

- Setting the rotary switch to position 1 assigns the drive to physical address 1. The communications parameters may be modified, but software addressing is not enabled.
- Setting the rotary switch to position F, as shown in Figure 6.39, forces the drive to read its address from EEPROM. DSMPro software supports the addressing range, 1 to 32, which is stored in EEPROM.

Each drive may be assigned a unique name of up to 32 characters in length; a name is often easier to remember than the address of a drive. DSMPro software automatically associates a drive name with the correct drive address.

RS-232 Connections

The physical address is set using the 16 position rotary switch on the front panel.

Do *not* connect any device to J4-6, J5-6, J4-9 or J5-9 except an Giddings & Lewis TouchPad.

Single Axis RS-232 Set Up

A single Centurion DSM100 Drive may be selected using RS-232 communications. After cabling is attached to the unit and the drive address is assigned, configuration of (i.e., communications with) the unit may proceed.

The following steps outline how to select the communications options:

1. Set the rotary switch to zero (0), which forces default communications with the drive.
2. Connect an RS-232 cable between the computer and a serial connector on the drive (J4 or J5).

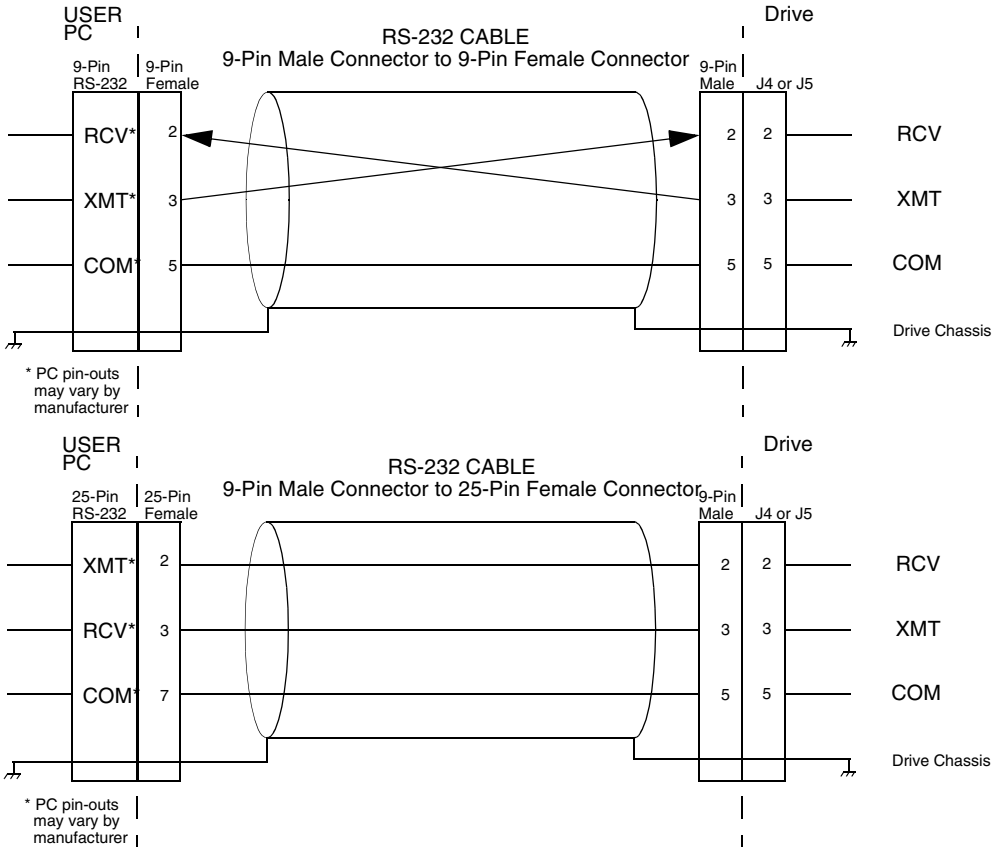


FIGURE 6.40 **RS-232 Connection Diagrams**

3. Verify the computer can communicate with the drive by performing the following:
   - Switch drive power to ON
   - Start DSMPro on the attached PC
   - Choose **CANCEL** from the Drive Select window
   - Select **Communications** from the menu
   - Select **PC Set Up** from the pull down menu
   - Verify the port settings, and if necessary, change them, then choose **OK**.
   - Select **Communications** from the menu
   - Select **Read Drive Parameters** from the pull down menu
   - Choose **OK** in the Drive Select window.
4. Verify that DSMPro reads the drive parameters. If not, refer to “Troubleshooting” on page 11-161.

The cable diagrams provide wiring examples for both 9 pin and 25 pin serial ports from an IBM compatible personal computer to the drive. RS-232 pin-outs vary between computer manufacturers. Check the hardware reference manual of your machine to ensure correct signal connections between the computer and the drive.

Four Wire RS-485 Connections

The Centurion DSM100 Drives use a variation of the RS-485 standard, known as four wire RS-485. Four wire RS-485 uses one differential signal for host to drive transmissions, and another differential signal for drive to host transmissions. (The RS-485 standard specifies a single differential signal for transmissions in both directions.)

The four wire RS-485 configuration also allows the host to use a RS-422 type interface. Because the host is driving multiple receivers and receiving from multiple transmitters, RS-422 is limited to multiple axes connections with 10 or less drives. The figure below summarizes the four wire RS-485, RS-422, and RS-485 standards.

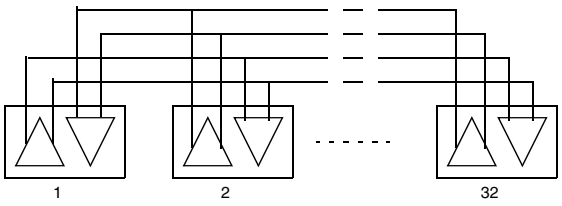
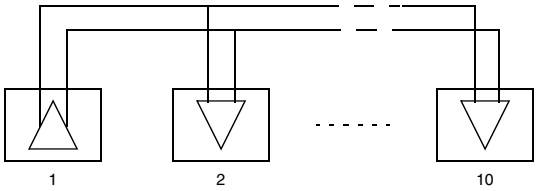
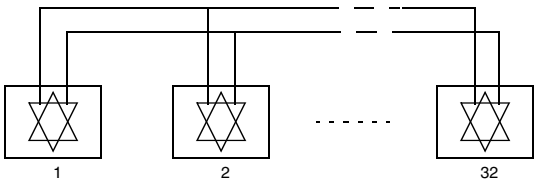
Four Wire RS-485 Differential 4 Wires 2 Signal Pairs 1 to 32 Transmitters 1 to 32 Receivers	
RS-422 Differential 4 Wires 2 Signal Pairs 1 Transmitter 1 to 10 Receivers	
RS-485 Standard Differential 2 Wires 1 Signal Pair 1 to 32 Transmitters 1 to 32 Receivers **NOTE:** Not applicable to Centurion DSM100 Drives	

FIGURE 6.41 **RS-485/RS-422 Communication Comparison**

Multiple Axes Four-Wire RS-485 Communications

TIP Do *not* connect any device to J4-6, J4-9, J5-6 or J5-9 except an Giddings & Lewis TouchPad.

1. Set the rotary address switch on each drive to an unassigned address:
   - If physical addressing is used, set the rotary switch to a previously unused address (1-A).
   - If software addressing is used, set the rotary switch to address F and then select a previously unused address (1 - 32) in DSMPro.
2. Connect cables between:
   - The host computer and the serial port on the initial drive (J4) in the multiple drive configuration.
   - The other serial port on the initial drive (J5) and the serial port on the next drive (J4) in the multiple drive configuration
3. Verify the communication settings on the computer are correct:
   - Start DSMPro on the attached PC
   - Choose CANCEL from the Drive Select window
   - Select Communications from the menu
   - Select PC Set Up from the pull down menu.
   - Verify the port settings, and if necessary, change them, then choose OK.

TIP Address 0 is the preferred address for the initial configuration of a drive. It forces the drive to the default communications parameters.

4. Verify the ability to communicate between the computer and the connected drives by:
   - Switch drive power to ON
   - Select Communications from the menu
   - Select Read Drive Parameters from the pull down menu
   - Select the drive to communicate with from Drive Select window (the drive must have an address that matches one of the drive addresses in the chain)
   - Choose OK in the Drive Select window.
5. Verify that DSMPro loads the drive parameters. If not, refer to the troubleshooting section.
6. Repeat the preceding two steps for each additional drive.

Four wire RS-485 connections are shown below. The cable diagram provides a wiring example of a daisy chain connection in a typical installation A multi-drop cable (Figure 6.43) may also be used.

TIP RS-485 pin-outs vary between manufacturers. Check the hardware reference manual to ensure correct signal connections between the host computer and the drive.

Multiple axes systems may be controlled by a computer with an RS-232 serial port. An RS-232 serial communication port may be converted to four wire RS-485 communication by attaching an RS-232 to four wire RS-485 converter. The figure below depicts the use of such a device. A daisy chain wiring configuration may also be used as shown in Figure 6.42. Interfaces

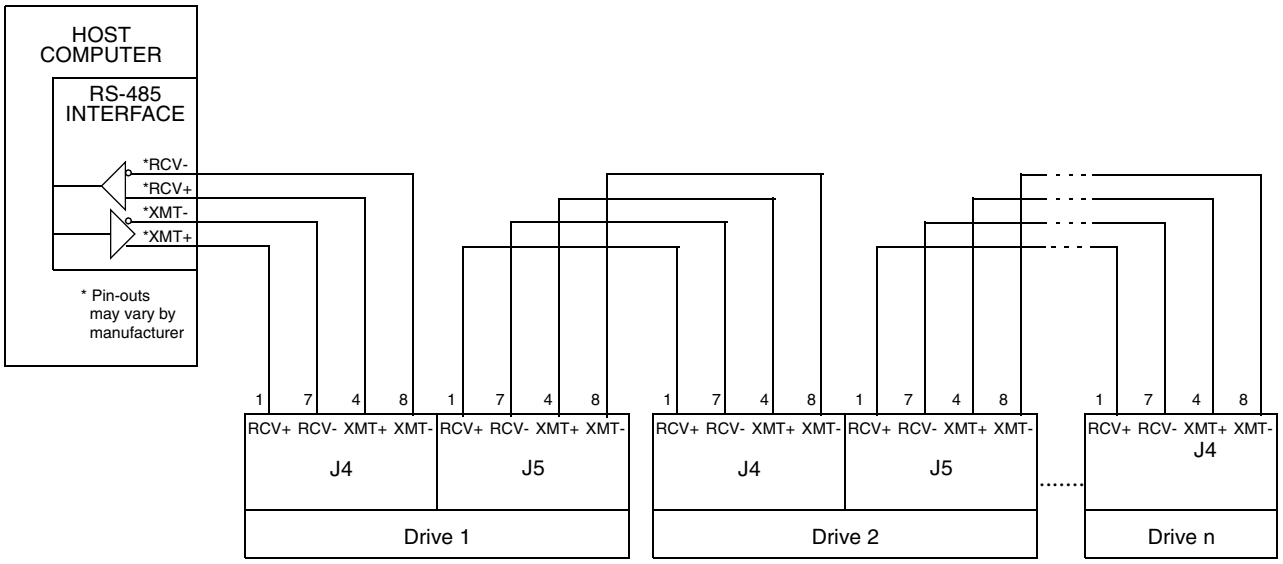


FIGURE 6.42 **Four Wire RS-485 Daisy Chain Connection Diagram**

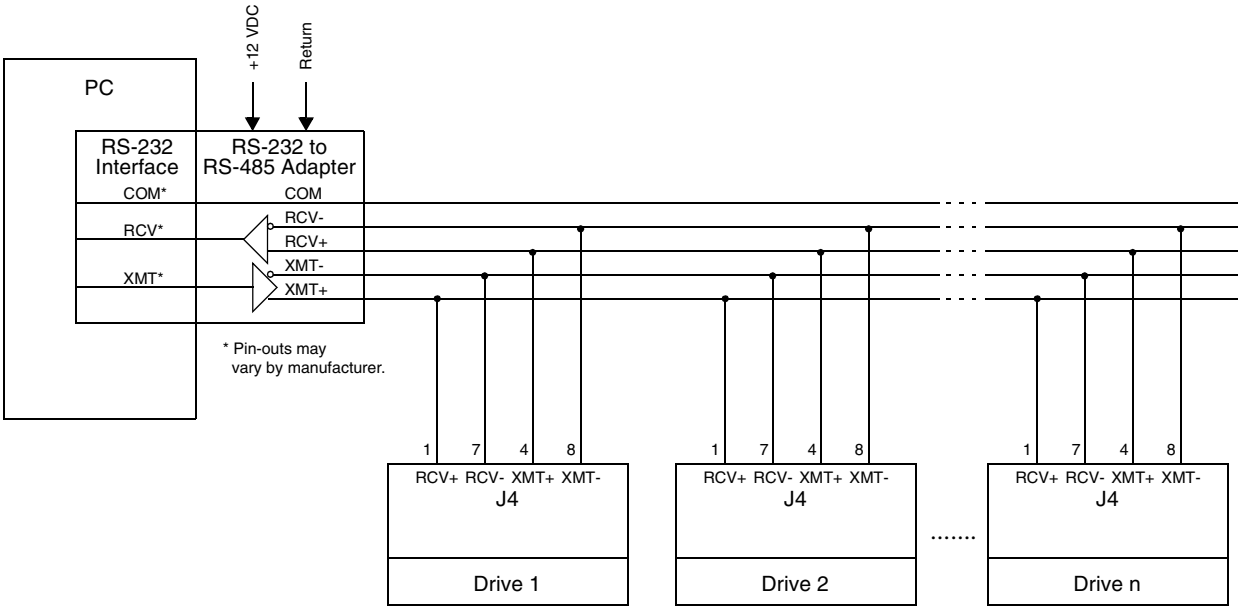


FIGURE 6.43 **RS-232 to RS-485 Multi-Drop Connection Diagram**

A1, A2 and COM – Analog Outputs

Analog outputs may be monitored with external equipment, such as an oscilloscope, on the external output pins A1 (ANALOG 1), A2 (ANALOG 2) and COM (COMMON). These output signals are parallel connections to the analog command signals available on connector J1. Refer to “Analog Outputs” on page 6-66.

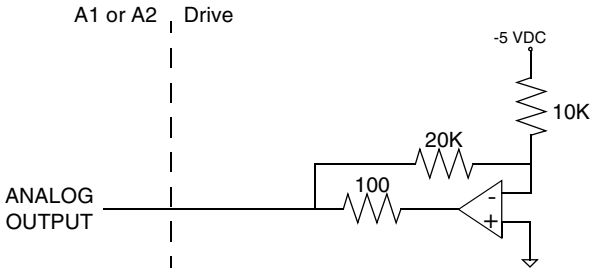


FIGURE 6.44 **ANALOG 1 and ANALOG 2 Output Circuits**

A 12-bit digital-to-analog converter (DAC) generates ANALOG 1. ANALOG 2 is a filtered PWM signal with 8 bit resolution and a carrier frequency of 32.8 kHz. Both outputs are scaled to a range of -10 to +10 Volts.

TABLE 6.26 **Analog outputs ANALOG 1 and ANALOG 2**

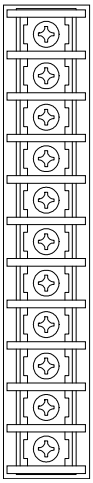
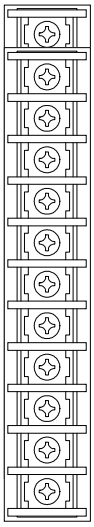
Analog Output	Pin Number	Description	Pin Number
ANALOG 1	A1	Selectable analog output with 12 bit resolution. Displays any firmware variable with selectable scale and offset.	J1-30
ANALOG 2	A2	Selectable analog output with 8 bit resolution. Displays any firmware variable with selectable scale and offset.	J1-31
COMMON	COM	Analog Common return.	J1-28

Table 6.16 on page 6-66 lists the output specifications for the signals.

Power Connections 7

TB1 – DC Bus and AC Power

Refer to Figure 5.4 for power wiring connection diagrams for the drives.

Description	Identifier	DSM110 and DSM110P DSM120 and DSM120P DSM130 and DSM130P	Terminal	DSM175 and DSM175P DSM 1150 and DSM 1150P	Identifier	Description
R phase power to motor	R		1		R	R phase power to motor
S phase power to motor	S		2		S	S phase power to motor
T phase power to motor	T		3		T	T phase power to motor
Motor case ground	⏚		4		⏚	Motor case ground
DC Bus + voltage	DC BUS +		5		DC BUS +	DC Bus + voltage
DC Bus - voltage	DC BUS -		6		DC BUS -	DC Bus - voltage
100/240 VAC input power	L1 (Line 1)		7		L1 (Line 1)	100/240 VAC input power
100/240 VAC input power	L2 (Line 2)/ N (Neutral)		8		L2 (Line 2)/ N (Neutral)	100/240 VAC neutral
Safety (earth) ground	⏚		9		L3 (Line 3)	100/240 VAC input power for three phase[1]
Auxiliary 100/240 VAC input power	L1 AUX		10		⏚	Safety (earth) ground
Auxiliary 100/240 VAC input power	L2/N AUX		11		L1 AUX	Auxiliary 100/240 VAC input power
1 CAUTION: When operating DSM-075 with a single phase power input the current limits must be set correctly.			12		L2 AUX	Auxiliary 100/240 VAC neutral for three phase.

The DSM175 and DSM175P are rated for either single phase or three phase power inputs. When connected to a single phase input, the user must change the current limits of the drive. The following drive parameters must be set:

- Positive Current Limit: 50 A peak
- Negative Current Limit: 50 A peak
- Average Current: 15 A continuous

An explanation of how to set these values is contained in DSMPro on-line help.

DANGER

DC bus capacitors may retain hazardous voltages for several minutes after input power has been removed, but will normally discharge in several seconds. Measure the DC bus voltage to verify it has reached a safe level each time power is removed before working on the drive; or wait for the time indicated in the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING

Motor power connectors are for assembly purposes only. They should not be connected or disconnected while the drive is powered.

CAUTION

Failure to set the current limits for single phase operation of the DSM175 or DSM175P can result in drive malfunction and potential damage.

Motor Power Cabling

Terminals 1 through 4 connect the drive to the windings of the motor.

Proper phasing of these outputs relative to the motor terminals is critical. Double check the connections after wiring the motor.

Table 7.1 lists the drive terminals and typical motor connections. Table 7.2 on page 7-96 lists the minimum wire size for making power wiring connections.

TABLE 7.1 **TB1 – Motor Power Terminals**

Motor Phase Signal	Description	Terminal
R[1]	R phase from drive	TB1-1
S[1]	S phase from drive	TB1-2
T[1]	T phase from drive	TB1-3
⏚ [1]	Ground for the motor case	TB1-4
NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).		
1.The I-Series and V-Series motors require swapping of the R and S motor power leads when connecting to the drive.		

Refer to “” on page -173 for a list of available Giddings & Lewis cables.

Shield Termination of Power Cables

DANGER

Shielded power cables must be grounded at a minimum of one point for safety. Failure to ground a shielded power cable will result in potentially lethal voltages on the shield and anything connected to it.

Giddings & Lewis motor power cables are shielded. The power cable is designed to be terminated at the drive during installation. A small portion of the cable jacket is stripped, which exposes the shield wires. The exposed area must be clamped at the left front of the drive chassis using the clamp provided near the bottom. It is critical for EMC performance that the shield wires be clamped against the area of the chassis which is not painted. This section of the chassis is labeled with the chassis ground symbol.

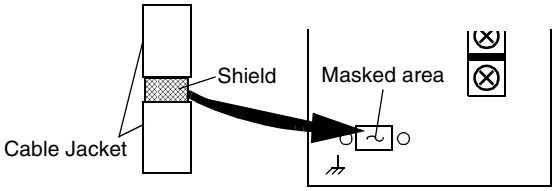


FIGURE 7.1 **Motor Power EMC Shield Connection**

YSM Series Power Cables

YSM Series motors have a short “pigtail” cable which connects to the motor but is not shielded. The motor power cables have a 6 inch shield termination wire with a ring lug which should be connected to the closest earth ground. This shield termination 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.

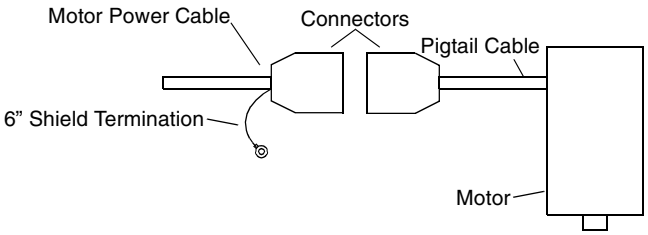


FIGURE 7.2 YSM Series Pigtail Ground

WARNING

High voltage may be present on the terminals of the Centurion DSM100 Drive. Remove power and disconnect the power cable before making or removing any connection.

CAUTION

Do *not* tin (solder) the exposed leads on cables. Solder contracts over time and may loosen the connection.

TABLE 7.2 Motor Power Contact and Wire Sizing Recommendations

Motor	Motor Power Mating Maximum Contact Size		Minimum Recommended 90°C Power Wire[a]	
	mm^2	AWG	mm^2	AWG
HSM/SSM205	1.5	16	1.5	16
HSM/SSM307	1.5	16	1.5	16
HSM/SSM320	1.5	16	1.5	16
HSM/SSM/FSM430	4.0	12	1.5	16
HSM/SSM/FSM460	4.0	12	2.5	14
HSM/SSM/FSM490	4.0	12	2.5	14
HSM/SSM/FSM610	10.0	8	4.0	12
HSM/SSM/FSM620	10.0	8	10.0	8
HSM/SSM/FSM630	10.0	8	10.0	8
HSM/SSM/FSM835	25.0	4	16.0	6
HSM/SSM845	25.0	4	16.0	6
NSM Series	1.5	16	1.5	16
YSM Series	1.5	16	1.5	16

a. Recommendations are based on motor ratings only. If the drive in the system cannot deliver rated power to the motor, then smaller wire sizes may be required for connection to the drive.

Motor Overload Protection

The drive utilizes solid state motor overload protection which operates:

- Within 8 minutes at 200% overload
- Within 20 seconds at 600% overload.

Emergency Stop Wiring

An overlapping contactor may be inserted between the motor and the drive for emergency stop purposes. The contactor must not simply break the motor current, it also must switch a three phase resistive load in parallel with the motor windings.

The three resistors provide dynamic braking. In addition, they prevent continuous arcing at the main contacts when breaking DC currents, such as when the motor stalls. Simply breaking the motor current can result in high voltages due to motor inductance, which will cause prolonged arcing in the contactor. In extreme cases, the prolonged arcing could result in the contactor catching fire. An overlapping contactor provides the required timing by engaging the braking contactors before the drive contactors disengage.

Figure 7.3 depicts a contactor installation with resistive loads. Follow these guidelines:

- The resistor values should be one to four times the winding resistance for good braking performance. Refer to Appendix E, “Dynamic Braking Resistor Selection” for resistor sizing equations.
- Screen and ground cables should be connected as shown.

- Shields should be unbraided (not a drain wire soldered to the shield).
- Connection lengths should be minimized.
- Safety ground (GND) and shield connections are permanently connected. This is essential for electrical safety.
- EMC guidelines require connection of the shield at the point where the contactor is inserted.

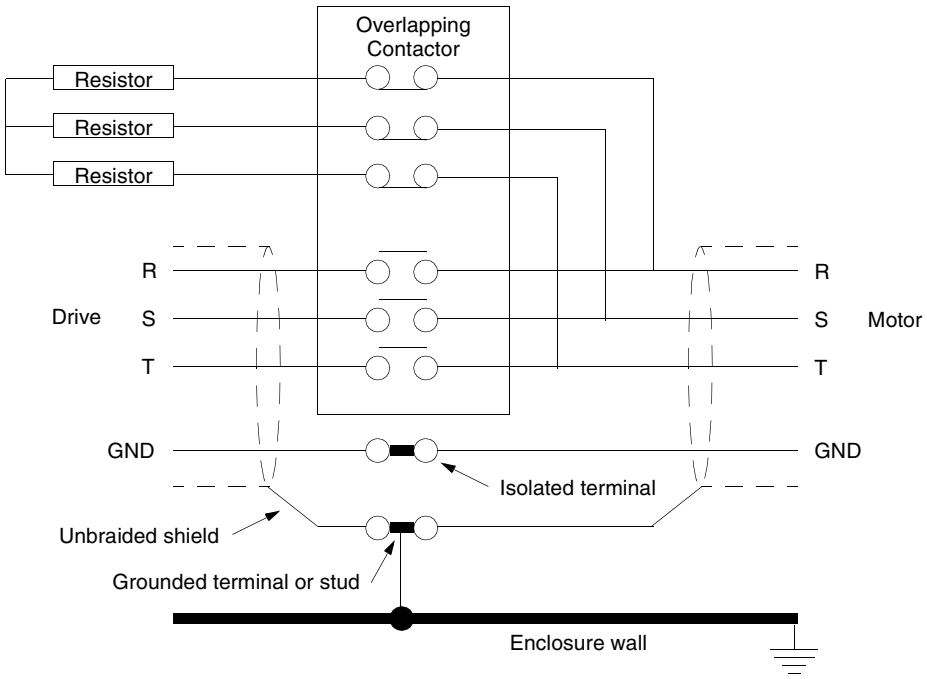


FIGURE 7.3 **Emergency Stop Contactor Wiring**

DC Bus

Terminals 5 and 6 have voltage present when AC power is applied to the drive. The DC Bus LED also illuminates when voltage is present on the terminals.

TABLE 7.3 **TB1 – DC Bus Terminals**

Signal	Description	Terminal
DC Bus +	Positive DC Bus voltage signal	TB1-5
DC Bus -	Negative DC Bus voltage signal	TB1-6
NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).		

AC Power Cabling

The Centurion DSM100 Drives require 100 to 240 VAC rms power with an input frequency of 47 - 63 Hz. The DSM110, DSM110P, DSM120, DSM120P, DSM130 and DSM130P require single phase input power. The DSM175 and DSM175P may use either single or three-phase input power, but the DSM 1150 and DSM 1150P require three-phase input power. “Centurion DSM100 Drive Power Ratings” on page F-233 lists the output power characteristics of the Centurion DSM100 Drives. The AC input supplies power to the motor and the drive logic as the default factory setting. An auxiliary power source may provide input power to the drive I/O independent of the motor power. Alternatively, the drive may be powered by an external DC power source.

Terminals 7, 8 and 9 are the single phase AC input power connections for the DSM110, DSM110P, DSM120, DSM120P, DSM130 and DSM130P. Terminals 7, 8, 9 and 10 are the three phase AC input power connections for the three-phase DSM175, DSM175P, DSM 1150 and DSM 1150P. Terminals 7, 8 and 10 are the AC input power connections when the DSM175 and DSM175P are powered from a single-phase input. .

DANGER

The user is responsible for conforming with all applicable local, national and international codes. Wiring practices, grounding, disconnects and overcurrent protection are of particular importance. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING

High voltage may be present on the terminals of the Centurion DSM100 Drive. Ensure that the drive is connected to a safety (earth) ground.

CAUTION

Do *not* tin (solder) the exposed leads on cables. Solder contracts over time and may loosen the connection.

TABLE 7.4 **TB1 – AC Power Terminals**

Signal	Description	Terminal	
		DSM110 and DSM110P, DSM120 and DSM120P, DSM130 and DSM130P	**DSM175 and DSM175P, DSM 1150 and DSM 1150P**
L1	100/240 Volts AC Line 1 input power.	TB1-7	TB1-7
L2/N	100/240 Volts AC Line 2 input power. (Neutral on single-phase drive: DSM110, 120, 130, 175 and DSM 1150)	TB1-8	TB1-8
L3	240 Volts AC Line 3 input power. Available only on three-phase drives: DSM175 and DSM 1150.	not used	TB1-9
⏚	Safety (earth) ground	TB1-9	TB1-10
NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).			

The inputs to the main (logic and motor supply) and the auxiliary (logic supply only) power sources are separated. This permits independent powering of the control power and the motor power. This dual power sourcing is useful for troubleshooting and diagnostics.

TABLE 7.5 **AC Input Power Sizing Requirements**

Model	Current		Requirements		
	Input[1] (rms Amps)	**Inrush** (peak Amps)	**Fuse** (Amps)	**Wire** (AWG)	**Transformer** [2] (kVA)
DSM110, DSM110P	10	50	10	14	2
DSM120, DSM120P	19	50	20	12	4
DSM130, DSM130P	28	50	30	10	6

TABLE 7.5 **AC Input Power Sizing Requirements** (continued)

Model	Current		Requirements		
	Input[1] (rms Amps)	**Inrush** (peak Amps)	**Fuse** (Amps)	**Wire** (AWG)	**Transformer** [2] (kVA)
DSM175, DSM175P single phase	28	50	30	10	6
DSM175[3], DSM175P three phase	28	50	30	10	12
DSM 1150, DSM 1150P	46	68	60	6	20

1. In the United States, the National Electrical Code (NEC), specifies that fuses must be selected based on the motor full load amperage (FLA), which is not to be confused with the drive input current. The largest fuse allowed under any circumstances is four times the motor FLA. Therefore the largest fuse permissible for use with the Centurion DSM100 Drive is four times the motor rated continuous current (converted to an RMS value). The Centurion DSM100 Drive has been evaluated and listed by Underwriters Laboratories Inc. with fuses sized as four times the continuous output current of the drives (FLA), according to UL 508C.

In almost all 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. The fuse sizes listed are recommended values, but local regulations must be determined and adhered to.

The Centurion DSM100 Drive utilizes solid state motor short circuit protection rated as follows:

Short Circuit Current Rating with No Fuse Restrictions:

Suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical Amperes, 240 Volts maximum.

Short Circuit Current Rating with Fuse Restrictions:

Suitable for use on a circuit capable of delivering not more than 200,000 RMS symmetrical Amperes, 240 Volts maximum, when protected by high interrupting capacity, current limiting fuses (Class CC, G, J, L, R, T).

2. The Centurion DSM100 Drives do *not* require an isolation transformer. The recommended transformer sizes are the minimum that is adequate for most servo applications. Larger transformers provide an additional safety factor. The additional safety factor may occur in applications that require minimum bus voltage sag when the motor must accelerate to high speed in minimum time or in applications with high continuous power requirements.

3. The Centurion DSM100 Drive three phase products require 240 VAC line to line power. This is not available in Europe, where the three phase power distribution is 400 VAC line to line, 240 VAC line to neutral. In Europe a transformer is required to supply the correct three phase voltage. In Europe the Centurion DSM100 Drive single phase units may run directly off the line to neutral voltage.

The inputs to the main (logic and motor supply) and the auxiliary (logic supply only) power sources are separated. This permits the logic power to operate independently of the motor. This dual power sourcing is useful for troubleshooting and diagnostics.

Auxiliary Power

Auxiliary AC (Terminals 10 and 11) supplies power to the logic/control circuits and fault logic. The main and auxiliary power must be connected in phase.

AUX power is supplied to a switching power supply. This input accepts Voltages from 100 to 240 VAC rms single phase with an input frequency 47-63 Hz.

TABLE 7.6 **Auxiliary Power Terminals**

Signal	Description	Terminal	
		DSM110, DSM110P DSM120, DSM120P DSM130, DSM130P	DSM175, DSM175P DSM 1150, DSM 1150P
L1 AUX	Auxiliary 100/240 Volts AC Line 1 input	TB1-10	TB1-11
L2 AUX IN	Auxiliary 100/240 Volts AC Line 2 input (or neutral)	TB1-11	TB1-12
NOTE: Torque all terminal connections to 1.25 Nm (11.0 lb-in).			

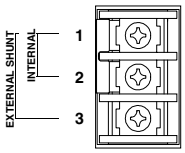
The auxiliary (logic supply only) and the main (logic and motor supply) power sources are separated. This permits the logic power to operate independently of the motor. This dual power sourcing is useful for troubleshooting and diagnostics.

TABLE 7.7 **Auxiliary Power Sizing Requirements**

Voltage Input (Volts AC)	Current		Requirements	
	Input[1] (Amps AC)	Inrush (Amps peak)	Wire mm^2 (AWG)	Transformer[2] (VA)
100	1.0	47	1.5 (16)	250
240	0.5	95	1.5 (16)	250
1. Dual element, time delay (slow acting) fuses are required to accommodate inrush current at the auxiliary terminals during power-up. Local regulations must be observed when selecting fuses.				
2. The Centurion DSM100 Drives do *not* require an isolation transformer. The recommended transformer sizes are the minimum that is adequate for most servo applications. Larger transformers provide an additional safety factor. The additional safety factor may occur in applications that require minimum bus voltage sag when the motor must accelerate to high speed in minimum time or in applications with high continuous power requirements.				

TB2 – Shunt Regulator

The Centurion DSM100 Drive has a built-in shunt regulator. The figure depicts the internal shunt selection with a factory installed jumper between terminals TB-1 and TB-2. Removal of the internal shunt jumper and installation of an external shunt between terminals TB-1 and TB-3 allows voltage to be dissipated at a faster rate than possible with the internal shunt.

Terminal	Identifier	Description	
TB2-1	1 (Internal or External)	Positive DC bus	
TB2-2	2 (Internal)	Internal shunt regulator resistor	
TB2-3	3 (External)	Shunt regulator transistor collector	

The shunt regulator is enabled when the DC bus increases to a specific value (420 VDC). An increase in DC bus voltage always occurs when the drive decelerates the motor and its load. This is due to the current flow from the motor to the DC bus. When the energy transferred from the rotating inertia causes the DC bus voltage to exceed 420 VDC the shunt is enabled and the excess energy (>420 VDC) is dissipated as heat.

WARNING

High voltage is present on the terminals of the Centurion DSM100 Drive. Remove power and disconnect the power cable before making or removing any connection. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING

DC bus capacitors may retain hazardous voltages for several minutes after input power has been removed, but will normally discharge in several seconds. Measure the DC bus voltage to verify it has reached a safe level each time power is removed before working on the drive; or wait for the time indicated in the warning on the front of the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

WARNING

External shunt resistors connect directly to the power bus. For safety reasons, an external shunt resistor must be enclosed.

CAUTION

Do *not* tin (solder) the exposed leads on cables. Solder contracts over time and may loosen the connection.

TABLE 7.8 TB2 – Shunt Regulator Terminals

Terminal	Description
TB2-1	Positive DC bus
TB2-2	Internal shunt regulator resistor
TB2-3	Shunt regulator transistor collector
NOTE: Torque all terminal connections to 11.0 lb-in.	

TABLE 7.9 **Internal Shunt Power Ratings for Drive Models**

Drive Model	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM 1150, DSM 1150P
Continuous Shunt Power (Watts)	50	50	50	50	180
Peak Shunt Power (kWatts)	4.5	4.5	4.5	10.0	19.0

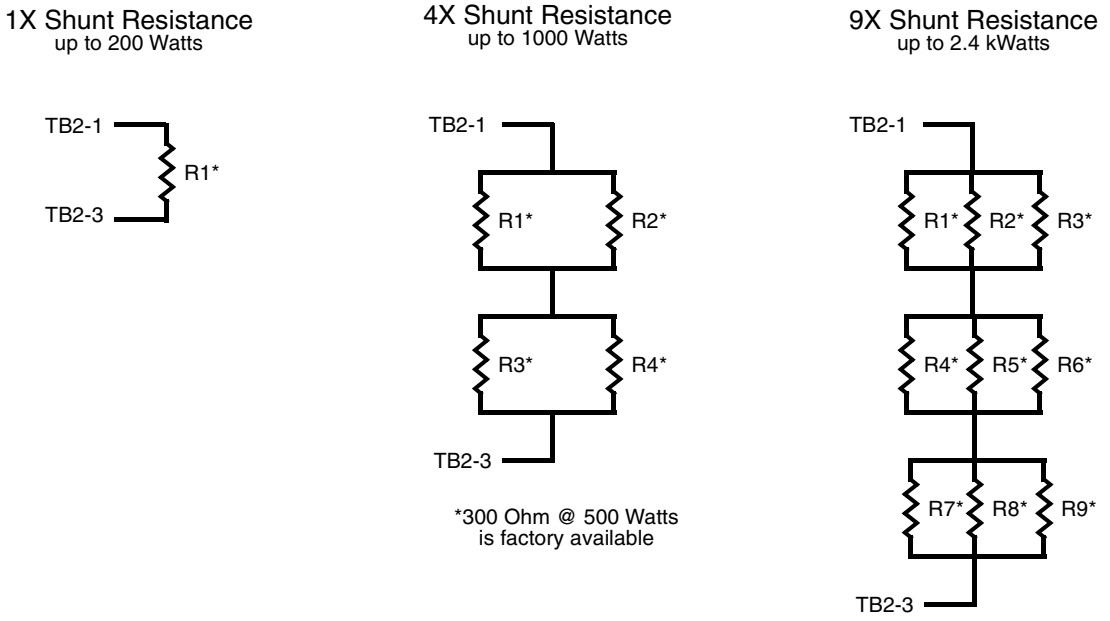
If the application requires a higher continuous power dissipation, the Centurion DSM100 Drive provides easy access to an external shunt connection. Connecting an external resistor requires disabling of the internal shunt resistor. Figure 7.4 depicts the use of one or more shunt resistors to provide 1X, 4X or 9X resistance (200 Watts to 2.4 kWatts).

TABLE 7.10 **Maximum External Shunt Power Ratings for Drive Models**

Drive Model	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM 1150, DSM 1150P
Continuous Shunt Power (kWatts)	2.4	2.4	2.4	4.0	8.0
Peak Shunt Power (kWatts)	6.0	6.0	6.0	10.0	19.0

TABLE 7.11 **Minimum Ratings for Customer Supplied External Shunt Resistor**

Drive Model	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM 1150, DSM 1150P
Minimum Resistance ± 10% (Ohms)	30	30	30	16.5	9
Wire size mm^2 (AWG)	2.5 (14)	2.5 (14)	2.5 (14)	2.5 (14)	6.0 (10)



NOTES: A single resistor of equivalent total resistance may replace multiple resistors.

Dissipation uses approximately 50% of total resistance value.

FIGURE 7.4 **External Shunt Wiring Examples**

External Shunt Connection

The following procedure outlines the installation of an external shunt resistor.

1. Remove jumper between TB1-1 and TB1-2, the internal shunt connection. The jumper is supplied with the drive.
2. Wire an external shunt resistor between TB1-1 and TB1-3, the external shunt connections. Use wire of the size recommended in “Minimum Ratings for Customer Supplied External Shunt Resistor” on page 7-102.
3. Torque all terminals to 11.0 lb-in.

TIP A fan may increase the dissipation capability of the shunt resistor.

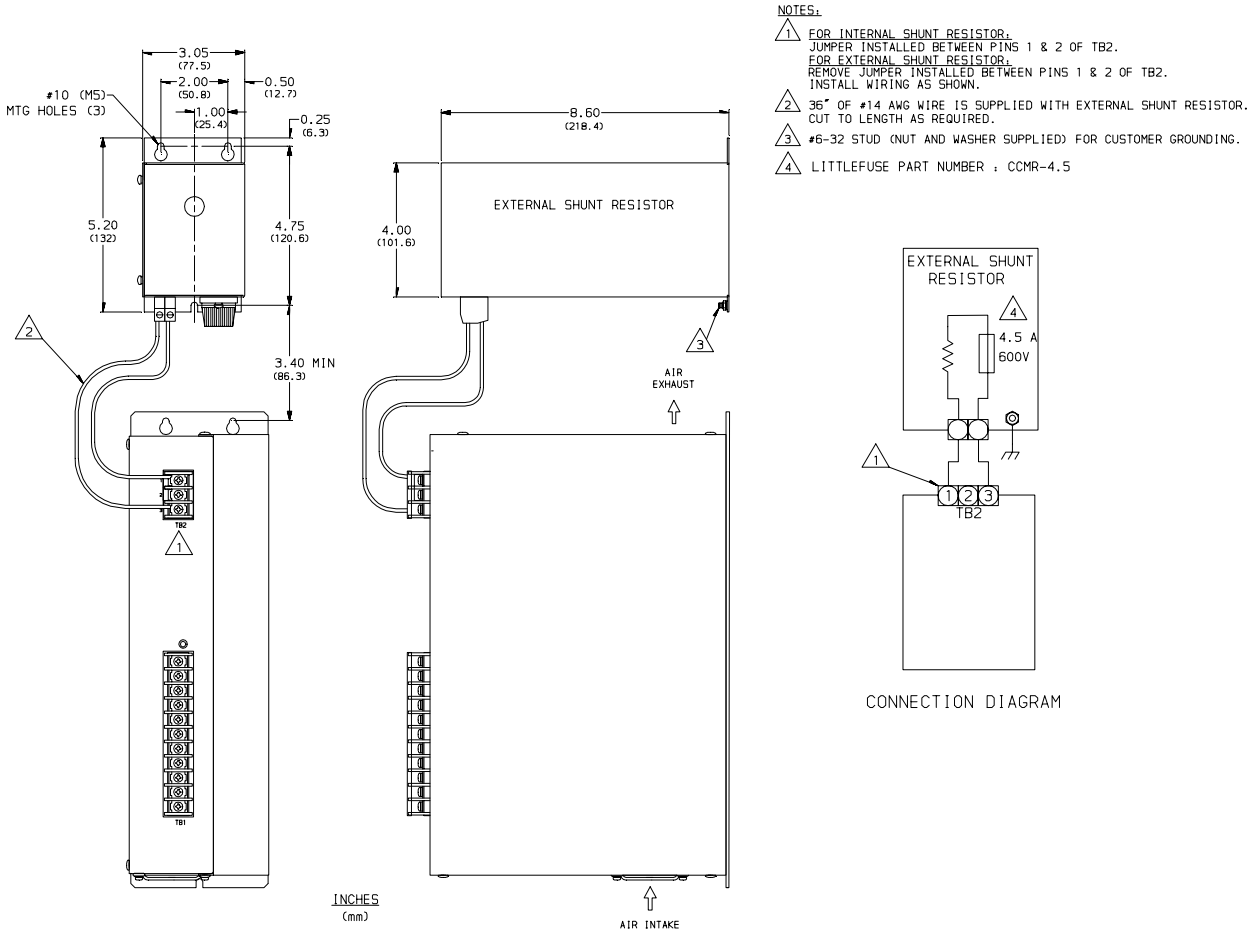


FIGURE 7.5 **External Shunt Mounting Diagram**

Application and Configuration Examples 8

This section explains how to install and verify the Centurion DSM100 Drive for various modes of operation. The procedures verify the installation by:

- Showing how the power and logic wiring is connected.
- Selecting the Operation Mode setup for the drive.
- Tuning the drive for a particular motor type and size.
- Verifying the basic functionality of the drive and motor combination.

How to modify the units of measurement for DSMPro displays is explained on page 8-141.

Analog Control

The Centurion DSM100 Drive can be set up as an analog drive in either the Velocity or Torque mode by making the hardware connections and performing the software setup and tuning described below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

Hardware Set Up

Make the connections described below and shown in the figure.

1. Connect a ±10VDC power source between J1-22 and J1-23 (ANALOG CMND +/-) to provide the analog speed or torque command.
2. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.
3. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
4. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect the drive to a 100/240 VAC, 50/60 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram

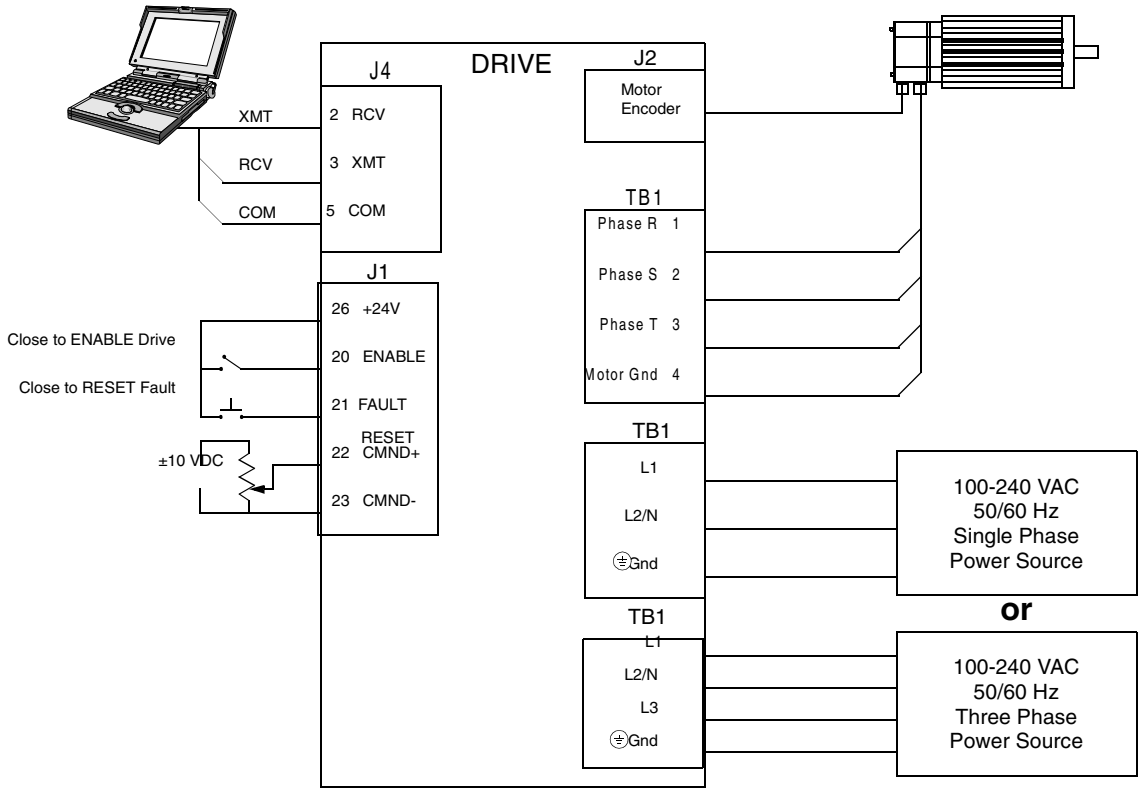


FIGURE 8.1 **Analog Controller Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

     – Stop Bits: **1**

– Serial Port: **COM1**

Refer to the section "RS-232 Communication Test" on page 11-166 for troubleshooting instructions.

6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

TIP A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Set Up window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**.
12. Select the Operation Mode parameters for the drive:

Velocity Mode Settings	Torque Mode Settings
Analog Velocity Input as the Operation Mode	**Analog Torque Input** as the Operation Mode

13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** icon from the Drive window and then select the **Analog** tab.
15. Enter appropriate **Scale** and **Offset** values for the input.

Tuning

TIP Do *not* attempt to Tune a drive with the Command mode set for Analog Torque Input. If the drive is set to Torque mode, continue with the Operation section below.

TIP Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window. The drive must be configured in Velocity mode for tuning to be effective.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current.**
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.

5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Open the switch between J1-26 and J1-20 to disable the drive.
8. Choose **Normal Drive Operation** from the Tuning window.
9. Choose **Close** to exit the Tuning windows.
10. Close any open windows or dialogs.

Operation

The drive is now configured as an Analog Controller in either the velocity or torque mode.

- The current loop is compensated properly for the selected motor.
- The servo parameters have been setup with an unloaded motor.
- The motor speed or current is commanded through the analog input.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.

Preset Controller

The Centurion DSM100 Drive can be set up as a preset controller in the Velocity or Torque mode by making the connections described below. Three discrete digital inputs provide the programmable speed or torque control. Up to eight different preset speed or torque settings can be selected by using the three digital inputs in various binary combinations, as shown in the table below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

TABLE 8.1 **Preset Binary Inputs**

	Inputs			
	C	B	A	Description
Preset 0	0	0	0	Preset 0 is a preprogrammed speed or current. All inputs are OFF[1].
Preset 1	0	0	1	Preset 1 is a preprogrammed speed or current. Only Preset Select A input is ON[2].
Preset 2	0	1	0	Preset 2 is a preprogrammed speed or current. Only Preset Select B input is ON[2].
Preset 3	0	1	1	Preset 3 is a preprogrammed speed or current. Preset Select A and Preset Select B are ON[2].
Preset 4	1	0	0	Preset 4 is a preprogrammed speed or current. Only Preset Select C input is ON[2].
Preset 5	1	0	1	Preset 5 is a preprogrammed speed or current. Preset Select A and Preset Select C are ON[2].
Preset 6	1	1	0	Preset 6 is a preprogrammed speed or current. Preset Select B and Preset Select C are ON[2].
Preset 7	1	1	1	Preset 7 is a preprogrammed speed or current. All Preset Select inputs are ON[2].
1. A preset input signal that is OFF is inactive, which means no current flows through the optocoupler.				
2. A preset input signal that is ON is active, which means current flows through the optocoupler.				

Hardware Set Up

Make the connections described below and shown in Figure 8.2. The appendix “” on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)

- J1-34 (INPUT3) and J1-26 (I/O PWR)
- Connect a switch between J1-21 (FAULT RESET) and J1-26 (I/O PWR).

These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

5. Connect the drive to a 100/240 VAC, 50/60 Hz power source appropriate to the drive:

   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram

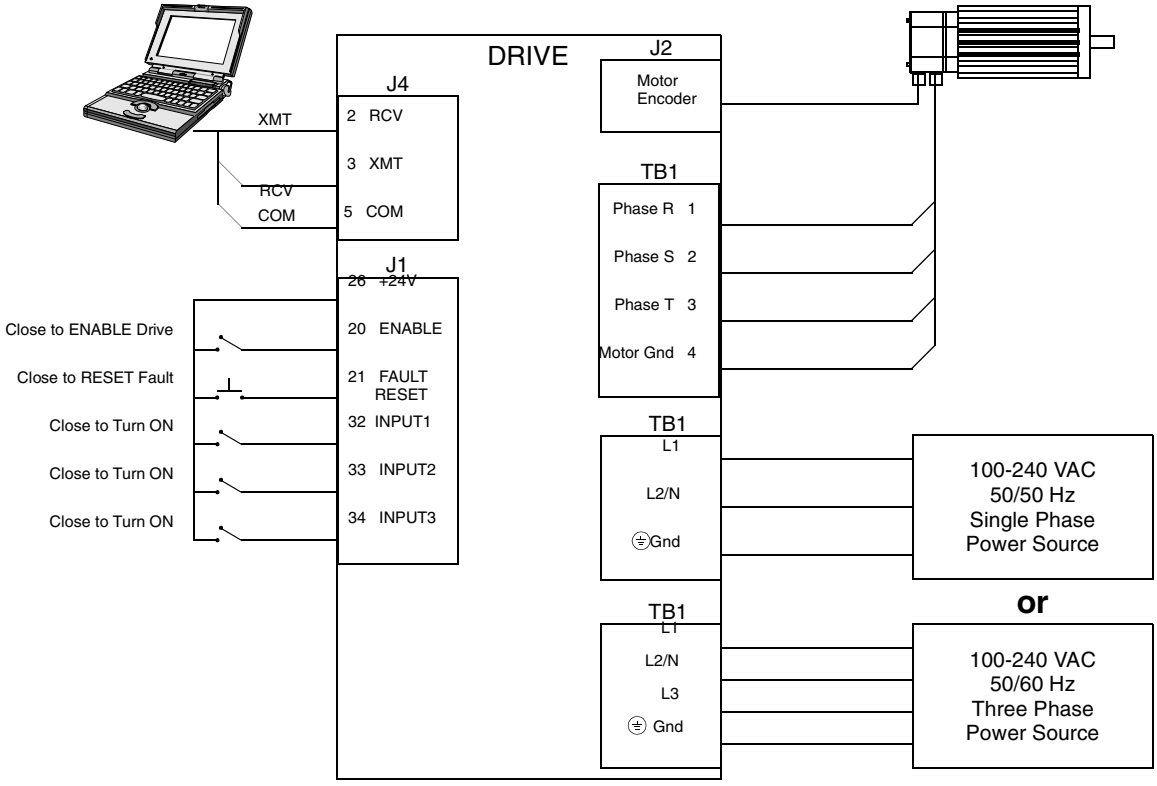


FIGURE 8.2 **Preset Controller Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

     – Stop Bits: **1**

     – Serial Port: **COM1**

   Refer to the section "RS-232 Communication Test" on page 11-166 for troubleshooting instructions.
6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

TIP A motor must be selected for the parameters to load.

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9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**,
12. Select the Operation Mode parameter for the drive:

Velocity Mode Settings	Torque Mode Settings
Preset Velocities as the Operation Mode	**Preset Torques** as the Operation Mode

13. Choose **Close** from the Drive Setup window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Preset** tab.

15. Enter the appropriate parameters for the Command mode in which the drive will operate:

Velocity Mode Settings	Torque Mode Settings
Enter the appropriate velocity value for each speed required	Enter the appropriate current value for each torque required

Up to eight presets (0-7) may be programmed.

16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive window.
18. Assign one of the three Preset Selects (A, B and C) to each of the Digital Input Assignments. For example, the following selects three presets:
    - **Input 1** to **Preset Select A**
    - **Input 2** to **Preset Select B**
    - **Input 3** to **Preset Select C**
    - **Input 4** to **Not Assigned**

The presets provide up to eight binary combinations of speed or current. Unassigned preset inputs should be set to **Not Assigned**, which forces an OFF state.

19. Verify all Digital Output Assignments are **Not Assigned**.
20. Choose **Close** to exit the I/O Configuration window.

Tuning

TIP Do *not* attempt to Tune a drive with the Command mode set for Preset Torques. If the drive is set to Torque mode, continue with the Operation section below.

TIP Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window. The drive must be configured in Velocity mode for tuning to be effective.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
    - **Distance** and
    - **Step Current.**
4. Select the appropriate entry for the Motor Direction:
    - **BiDirectional**,
    - **Forward Only** or
    - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as a Preset Controller in Velocity or Torque mode.

- The servo parameters have been setup with the unloaded motor.
- The motor speed or current is controlled through the digital inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.

Close any of the switches for INPUT1, INPUT2 or INPUT3 to run the drive at the programmed preset speed or torque. Application and Configuration Examples

Position Follower (Master Encoder)

The Centurion DSM100 Drive can be electronically geared to a master incremental encoder generating quadrature encoder signals by making the hardware connections and performing the software setup and tuning described below. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

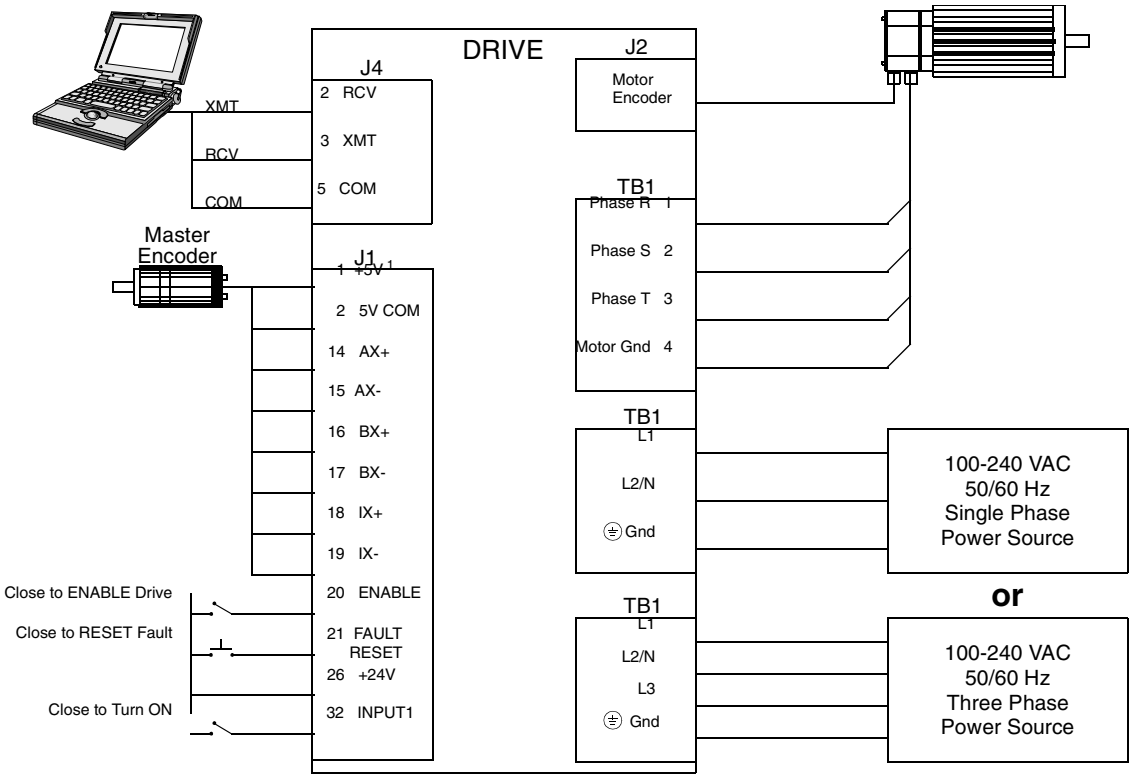
Hardware Set Up

Make the connections described below and shown in Figure 8.3. The appendix "" on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect the Master Encoder to the drive as shown in the diagram.
5. Connect a jumper wire with a switches between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect the drive to a 100/240 VAC, 50/60 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram



Note 1. Refer to Figure 6.24, 6.25, 6.26, 6.27, 6.28, 6.29 and 6.30 for additional details on the Control Interface Cable.

FIGURE 8.3 **Master Encoder Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

– Stop Bits: **1**

– Serial Port: **COM1**

Refer to the section “RS-232 Communication Test” on page 11-166 for troubleshooting instructions.

6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

TIP

A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**,
12. Select **Follower: Master Encoder** as the Operation Mode for the drive.
13. Choose **Close** from the Drive Setup window.
14. Choose the **Drive Parameter** command icon from the Drive window, then select the **Follower** tab.
15. Enter an appropriate **Gear Ratio** as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses:master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming master pulse.
16. Choose **Close** to exit the Drive Parameters window.
17. Verify the Status indicator is green.
18. Select the **I/O Configuration** command icon from the Drive Window.
19. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Follower Enable** as Input 1
    - **Not Assigned** as Inputs 2 through 4.
    - **Not Assigned** as Outputs 1 through 4.
20. Choose **Close** to exit the I/O Configuration window.

Tuning

TIP

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current.**
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only.**
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as a Position Follower (Master Encoder).

- The current loop is compensated properly for the selected motor.
- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the master encoder input.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the switch between J1-26 and J1-32 to enable following.

Position Follower (Step/Direction)

The Centurion DSM100 Drive can be set up as a Position Follower using Step/Direction commands by making the hardware connections and performing the software setup and tuning described below. This configuration allows the Centurion DSM100 Drive to electronically gear or drive a servo motor using step and direction signals that typically control a stepper drive. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a stepper indexer requires similar circuitry from the stepper indexer to J1. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad may also may be used.

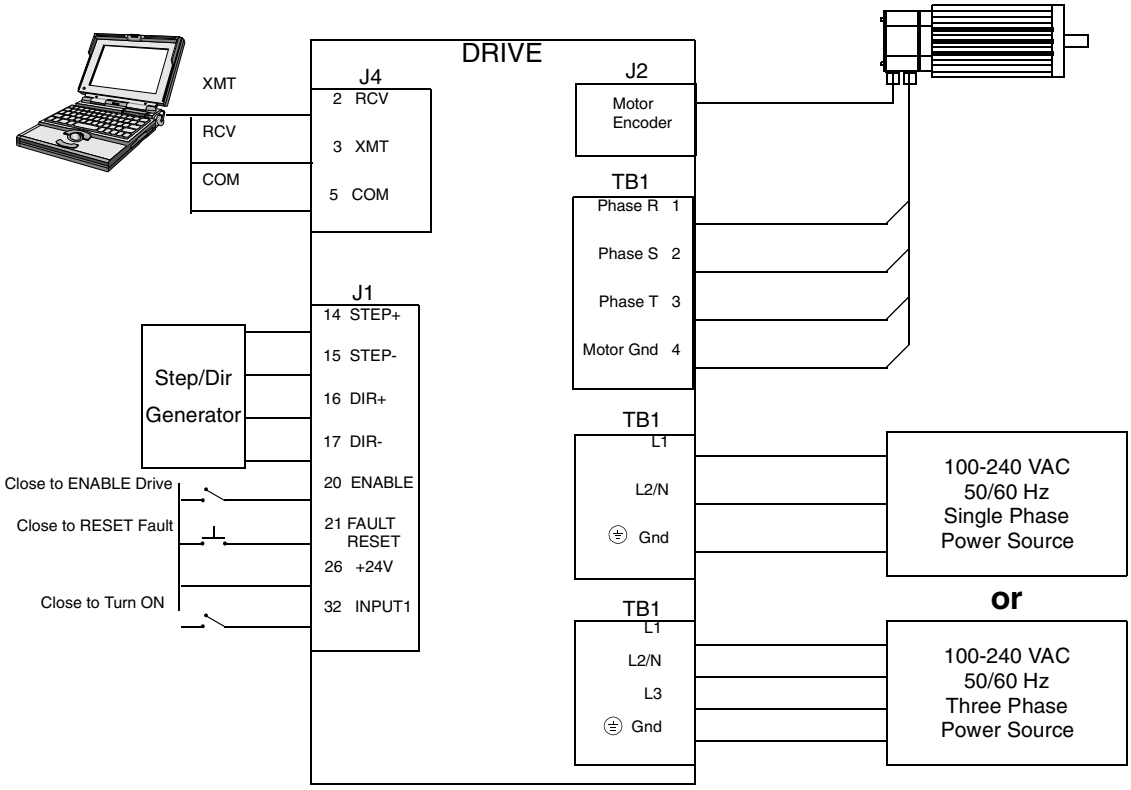
Hardware Set Up

Make the connections described below and shown in Figure 8.4. The appendix “” on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect the Step/Direction signals to the drive as shown in the diagram.
5. Connect a jumper wire with a switches between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect the drive to a 100/240 VDC, 50/60 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram



Note 1. Refer to Figure 6.31 and 6.32 for additional details on the Control Interface Cable.

FIGURE 8.4 **Step/Direction Controller Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Seven segment display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

– Stop Bits: **1**

– Serial Port: **COM1**

Refer to the section “RS-232 Communication Test” on page 11-166 for troubleshooting instructions.

6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**,
12. Select **Follower: Step/Direction** as the Operation Mode for the drive.
13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Follower** tab.
15. Enter an appropriate **Gear Ratio** as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses:master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming step pulse.
16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive Window.
18. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Follower Enable** as Input 1
    - **Not Assigned** as Inputs 2 through 4.
    - **Not Assigned** as Outputs 1 through 4.
19. Choose **Close** to exit the I/O Configuration window.

Tuning

TIP

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current**.
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as a Position Follower (Step/Direction).

- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the step/direction inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to enable following.

Position Follower (Step Up/Step Down)

The Centurion DSM100 Drive can be set up as a Position Following using Step Up and Step Down signals typically used to control stepper drives. The connection diagram depicts the minimum hardware necessary. Interfacing the drive to a controller requires similar circuitry from the indexer to J1. Instructions are provided to configure the drive with DSMPro software.

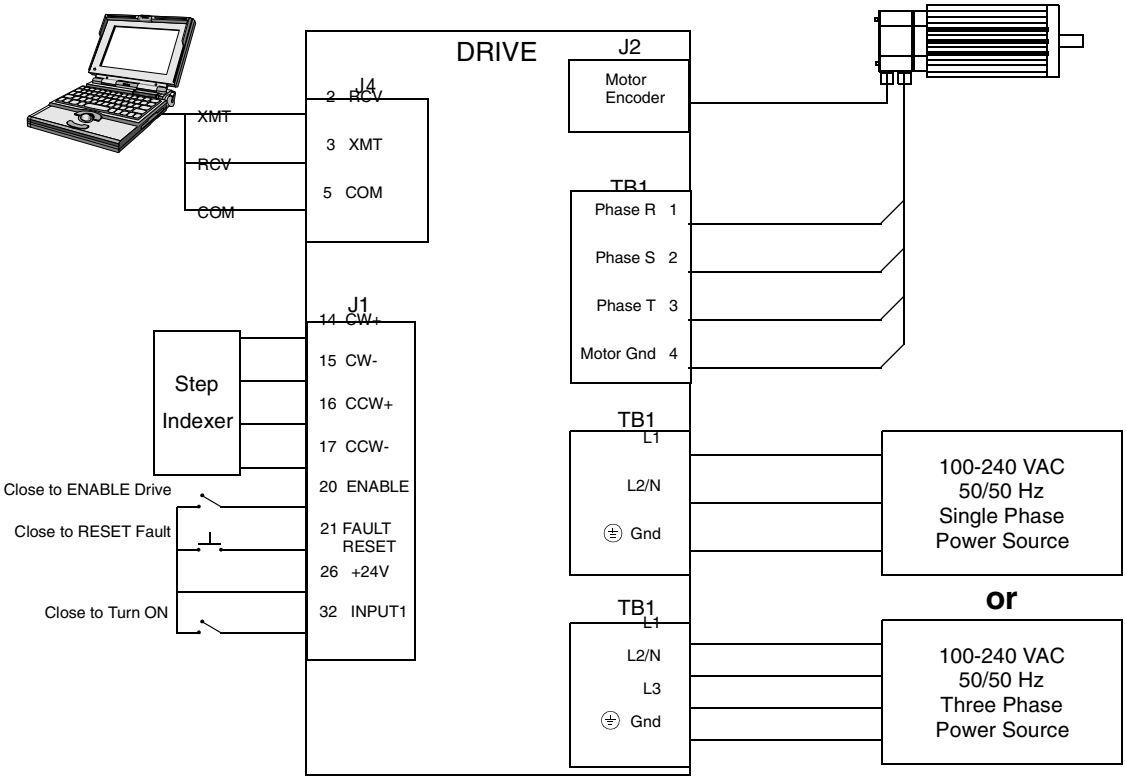
Hardware Set Up

Make the connections described below and shown in Figure 8.5. The appendix "" on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM100 Drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect the Stepper Indexer to the drive as shown in the diagram.
5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
6. Connect the drive to a 100/240 VAC, 50/50 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram



Note 1. Refer to Figure 6.33 and 6.34 for additional details on the Control Interface Cable.

FIGURE 8.5 **Step Up/Step Down Controller Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

– Parity: **None**

– Stop Bits: **1**

– Serial Port: **COM1**

Refer to the section “RS-232 Communication Test” on page 11-166 for troubleshooting instructions.

6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**,
12. Select **Follower: Step Up/Step Down** as the Operation Mode for the drive.
13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Follower** tab.
15. Enter an appropriate **Gear Ratio** as the Follower Input. The default Gear Ratio is 1:1 (motor encoder pulses:master pulses). If a Gear Ratio of 3:1 is entered, the motor is moved 3 encoder pulses for every incoming step pulse.
16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive Window.
18. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Follower Enable** as Input 1
    - **Not Assigned** as Inputs 2 through 4.
    - **Not Assigned** as Outputs 1 through 4.
19. Choose **Close** to exit the I/O Configuration window.

Tuning

TIP

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current**.
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as either a Position Follower (Step Up/Step Down).

- The servo parameters have been setup with the unloaded motor.
- The motor position is controlled by the step indexer.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to enable following.

Incremental Indexing

TIP

This feature is available only on drives capable of indexing:
DSM110P, DSM120P, DSM130P, DSM175P and DSM 1150P.

The Centurion DSM100 Drive can be set up as a incremental indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to "J1 – Controller" on page 6-53. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

The following examples depict a simple incremental index move and a batched (multiple) move using incremental indexing.

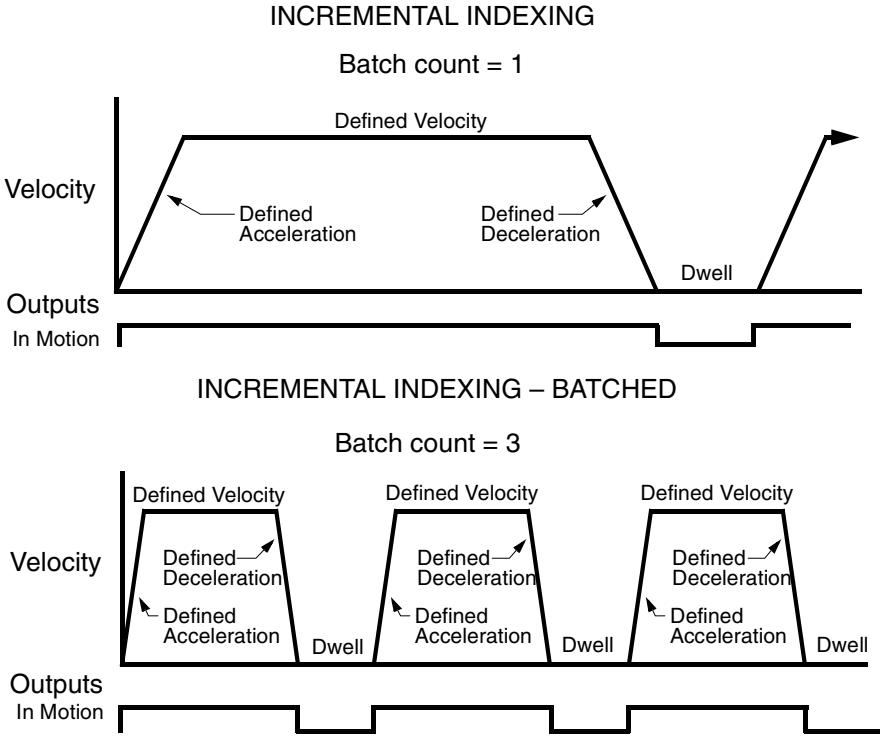


FIGURE 8.6 **Incremental Indexing Examples**

Hardware Set Up

Make the connections described below and shown in the Figure 8.7. The appendix “” on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM100 Drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

5. Connect the drive to a 100/240 VAC, 50/50 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram

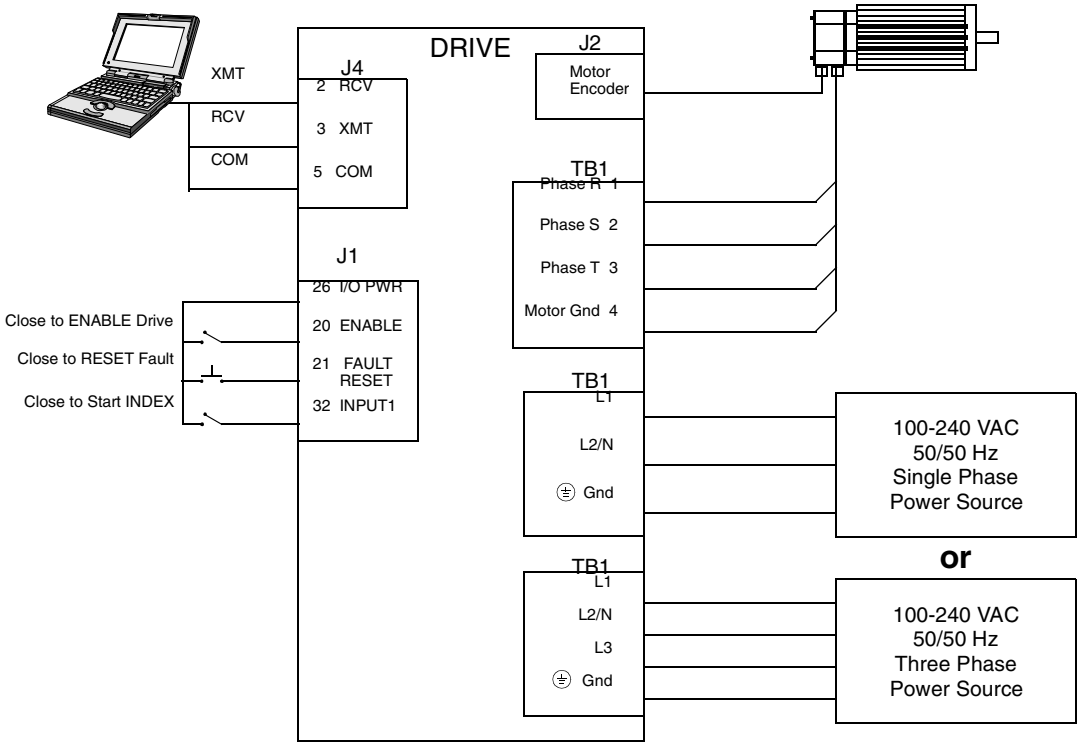


FIGURE 8.7 **Incremental Indexing Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

     – Stop Bits: **1**

     – Serial Port: **COM1**

   Refer to the section "RS-232 Communication Test" on page 11-166 for troubleshooting instructions.
6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**.
12. Select **Indexing** as the Operation Mode for the drive.
13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Indexing tab**.
15. Enter the following values for Index **0**. Refer to "Incremental Indexing Examples" on page 8-127 for examples of Single and Batched Incremental Indexing profiles.

Single Move Settings	Batched Move Settings
Incremental as Mode	Incremental as Mode
8000 as Distance	8000 as Distance
1 as the Batch Count	**3** as the Batch Count
0 as Dwell	**1000** as Dwell
Appropriate values for Acceleration and Deceleration	Appropriate values for Acceleration and Deceleration

16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive Window.
18. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Start Index** as Input 1
    - **Not Assigned** as Inputs 2 through 4.
    - **Not Assigned** as Outputs 1 through 4.
19. Choose **Close** to exit the I/O Configuration window.

Tuning

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current.**
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.

10. Close any open windows or dialog boxes.

Operation

The drive is now configured as an Incremental Indexing controller.

- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to start Index 0. Application and Configuration Examples

Registration Indexing

TIP

This feature is available only on drives capable of indexing: DSM110P, DSM120P, DSM130P, DSM175P and DSM 1150P.

The Centurion DSM100 Drive can be set up as a registration indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to “J1 – Controller” on page 6-53. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

The following example depicts a batched (multiple) move using registration indexing.

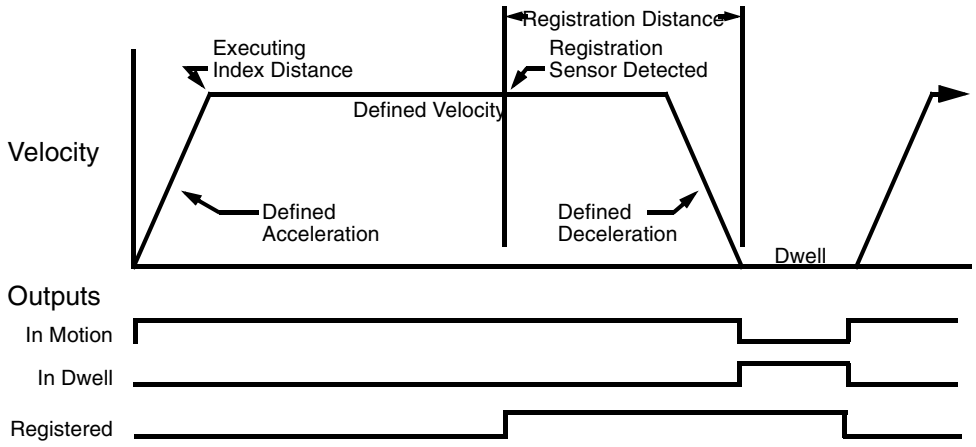


FIGURE 8.8 **Registration Indexing Examples**

Hardware Set Up

Make the connections described below and shown in the Figure 8.7. The appendix “” on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM100 Drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect the Index Sensor to the drive as shown in the diagram.
5. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.

6. Connect the drive to a 100/240 VAC, 50/50 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram

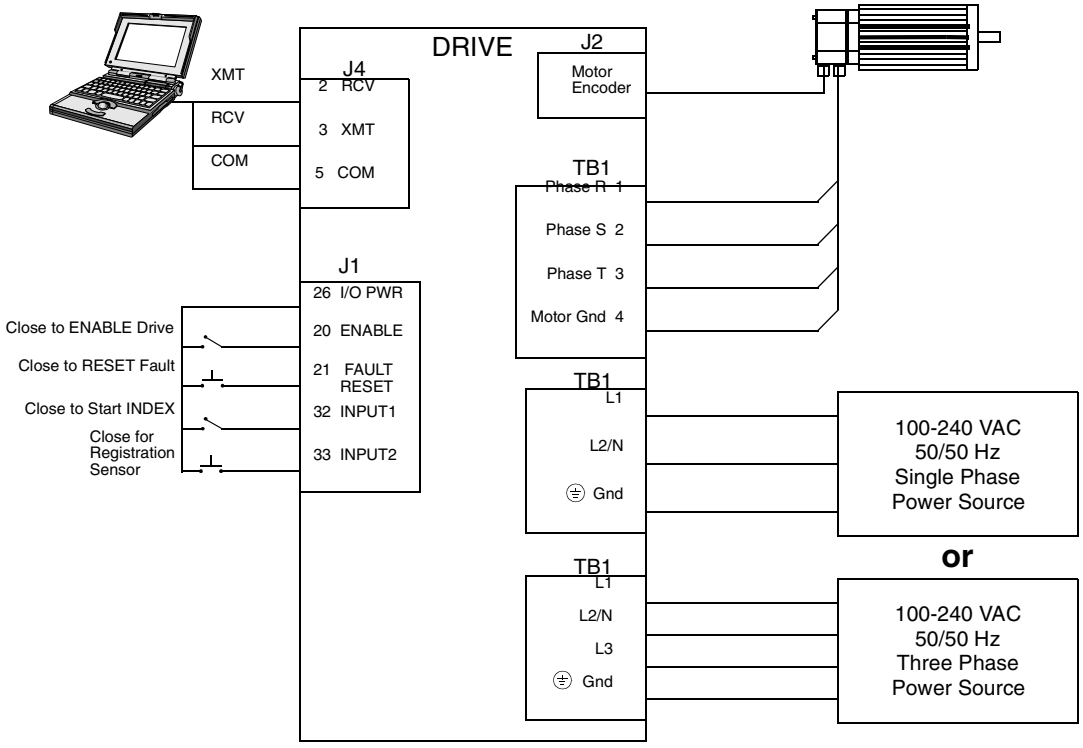


FIGURE 8.9 **Registration Indexing Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.

5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

     – Stop Bits: **1**

     – Serial Port: **COM1**

   Refer to the section "RS-232 Communication Test" on page 11-166 for troubleshooting instructions.
6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

A motor must be selected for the parameters to load.

9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**.
12. Select **Indexing** as the Operation Mode for the drive.
13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Indexing** tab.
15. Enter the following values for Index **0**.

Single Move Settings	Batched Move Settings
Registration as Mode	**Registration** as Mode
8000 as Distance	**8000** as Distance
1 as the Batch Count	**8000** as Registration Distance
0 as Dwell	**3** as the Batch Count
Appropriate values for Acceleration and Deceleration	**1000** as Dwell
	Appropriate values for Acceleration and Deceleration

The Registration Distance must be longer than the Deceleration Distance or the move will not be registered.

16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive Window.
18. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Start Index** as Input 1
    - **Registration Sensor** as Input 2.
    - **Not Assigned** as Inputs 3 and 4.
    - **Not Assigned** as Outputs 1 through 4.
19. Choose **Close** to exit the I/O Configuration window.

Tuning

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current**.
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as a Registration Indexing controller.

- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-26 and J1-20 to enable the drive.
2. Close the toggle switch between J1-26 and J1-32 to start Index 0.
3. Close the toggle switch between J1-26 and J1-33 to simulate registration.

Absolute Indexing

The Centurion DSM100 Drive can be set up as a absolute indexer by making the hardware connections and performing the software setup and tuning described below. A connection diagram depicts the minimum hardware necessary. Interfacing the drive to an external controller requires similar circuitry from the controller to J1, refer to “J1 – Controller” on page 6-53. Instructions are provided to configure the drive using a PC with DSMPro software, but the optional TouchPad also may be used.

TIP This feature is available only on drives capable of indexing: DSM110P, DSM120P, DSM130P, DSM175P and DSM 1150P.

The following example depicts a simple move from a home position.

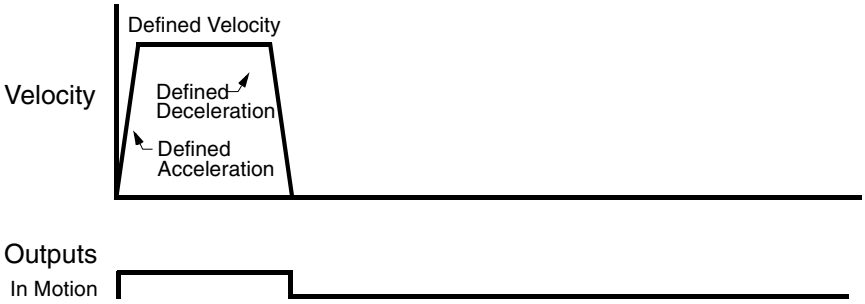


FIGURE 8.10 **Absolute Indexing Examples**

Hardware Set Up

Make the connections described below and shown in the Figure 8.11. The appendix “” on page -173 lists the interconnect cables available from the factory.

1. Connect an RS-232 cable between the serial port on the PC and the J4 connector on the Centurion DSM100 Drive. A simple 3 wire cable is depicted in the figure below.
2. Connect a Motor/Feedback cable from the motor to the J2 connector on the Centurion DSM100 Drive.
3. Connect a Power cable from the motor to TB1 (terminals R, S, T and ⏚) on the drive.
4. Connect a jumper wire with a toggle switch between the following pins:
   - J1-20 (ENABLE) and J1-26 (I/O PWR)
   - J1-32 (INPUT1) and J1-26 (I/O PWR)
   - J1-33 (INPUT2) and J1-26 (I/O PWR)
   - J1-21 (FAULT RESET) and J1-26 (I/O PWR).

   These connections provide manual control for enabling or disabling the drive and resetting faults. The figure below shows the jumper, including normally open toggle switches.
5. Connect the drive to a 100/240 VAC, 50/50 Hz power source appropriate to the drive:
   - Single Phase: DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175 or DSM175P
   - Three Phase: DSM175, DSM175P, DSM 1150 or DSM 1150P

Connection Diagram

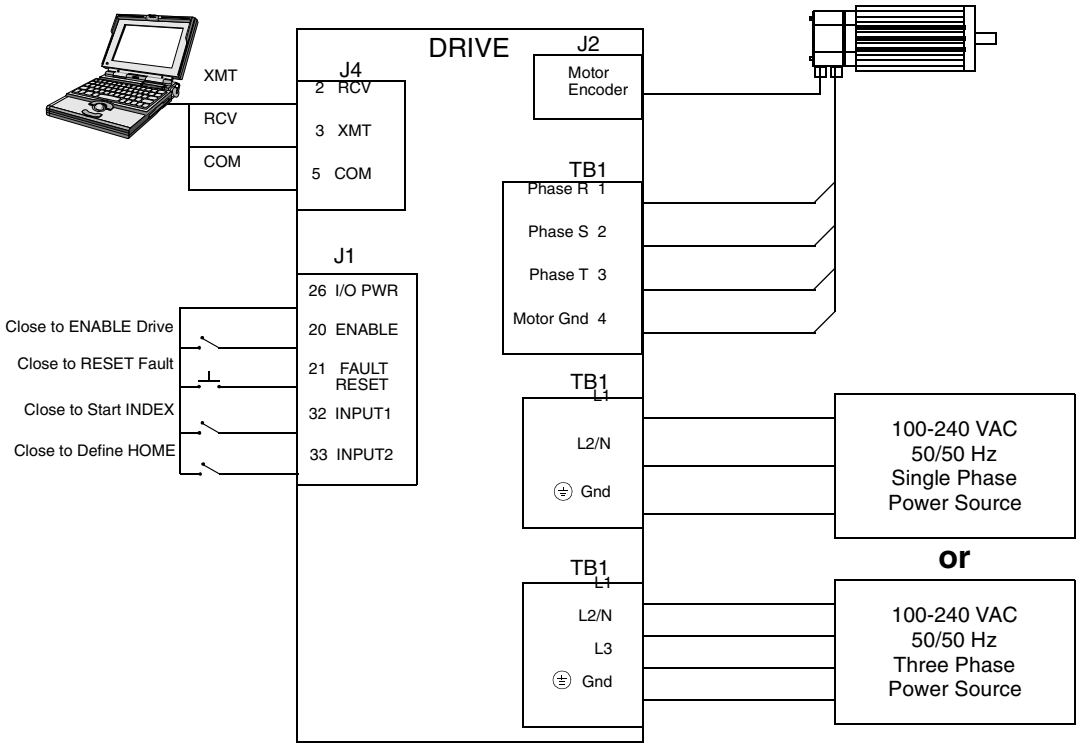


FIGURE 8.11 **Absolute Indexing Connection Diagram**

Configuration

Carefully check all connections before entering these parameters.

1. Switch the AC Power to ON and verify:
   - Green DC BUS LED is ON
   - Display shows an operational status: A, F or P (Analog, Follower or Preset mode of operation). Refer to "Operating Messages" on page 10-153 for an explanation of the display codes.
2. Start DSMPro on the PC.
3. Choose **Cancel** from the Drive Select dialog box.
4. Select **PC Set Up** from the Communications menu in DSMPro to display the personal computer's communication settings.
5. Verify the communications port settings of the PC match those of the drive.
   - If the settings are correct, select **OK** in the Port – Settings dialog box.
   - If the settings are different, correct the Port – Settings to allow communications with the drive.

     Factory default communications Port – Settings for the drive are:

     – Baud Rate: **9600**

     – Data Bits: **8**

     – Parity: **None**

     – Stop Bits: **1**

     – Serial Port: **COM1**

Refer to the section “RS-232 Communication Test” on page 11-166 for troubleshooting instructions.

6. Select **Read Drive Parameters** from the Communications menu.
7. Verify the Drive Name and Address are correct for the drive that is being addressed.
8. Choose **OK** to load the drive parameters.

TIP A motor must be selected for the parameters to load.

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9. If the message box appears that a motor must be selected, select **OK**. The Drive Setup window is displayed with Motor Model selection parameter active. The motor may be selected from the drop down box. If this message box does not appear, the motor displayed in the Motor Model box was previously selected.
10. Select or verify the correct motor model number from the drop down Motor Model list.
11. If a message advises that the drive must be reset, choose **Yes**.
12. Select **Indexing** as the Operation Mode for the drive.
13. Choose **Close** to exit the Drive Set Up window.
14. Choose the **Drive Parameters** command icon from the Drive window and then select the **Indexing** tab.
15. Select the following values for Index 0:

    Absolute as Mode
    8000 as Position
    1 as Batch Count
    0 as Dwell
    Appropriate values for Velocity, Acceleration and Deceleration

16. Choose **Close** to exit the Drive Parameters window.
17. Select the **I/O Configuration** command icon from the Drive Window.
18. Select an appropriate digital input from the pull-down lists available as Digital Input Assignments in the I/O Configuration window.
    For example:
    - **Start Index** as Input 1.
    - **Define Home** as Input 2.
    - **Not Assigned** as Inputs 3 and 4.
    - **Not Assigned** as Outputs 1 through 4.
19. Choose **Close** to exit the I/O Configuration window.

Tuning

Do *not* attempt to Auto Tune systems that have gravitational effects. The Centurion DSM100 Drive will *not* hold initial position.

1. Choose the **Tuning** command icon from the Drive window.
2. Select **AutoTune** from the Tuning mode group.
3. Select the appropriate values for the following Auto Tune commands:
   - **Distance** and
   - **Step Current**.
4. Select the appropriate entry for the Motor Direction:
   - **BiDirectional**,
   - **Forward Only** or
   - **Reverse Only**.
5. Close the toggle switch between J1-26 and J1-20 to enable the drive.

WARNING

Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and installation.

6. Choose **Start** from the Tuning window. The drive powers the motor shaft for a short period and then motion will cease. Then DSMPro displays the calculated gains and disables the drive.
7. Choose **Normal Drive Operation** from the Tuning window.
8. Open the switch between J1-26 and J1-20 to disable the drive.
9. Choose **Close** to exit the Tuning window.
10. Close any open windows or dialog boxes.

Operation

The drive is now configured as a Absolute Indexing controller.

- The servo parameters have been setup with the unloaded motor.
- Motion is commanded through the inputs.

The firmware saves the parameters in EEPROM memory. Thus the drive can be power cycled and, after power-up, will use the parameters selected in the steps above.

When motion is required:

1. Close the switch between J1-20 and J1-26 to enable the drive.
2. Close the toggle switch between J1-32 and J1-26 to start Index 0.
3. Close the switch between J1-33 and J1-26 to define the Home position.

Modifying User Units

The units displayed for any Centurion DSM100 Drive may be modified using a PC with DSMPro software. The PC Display Units help menu defines the various parameters displayed by DSMPro. Default settings for Units are shown in Figure 8.12.

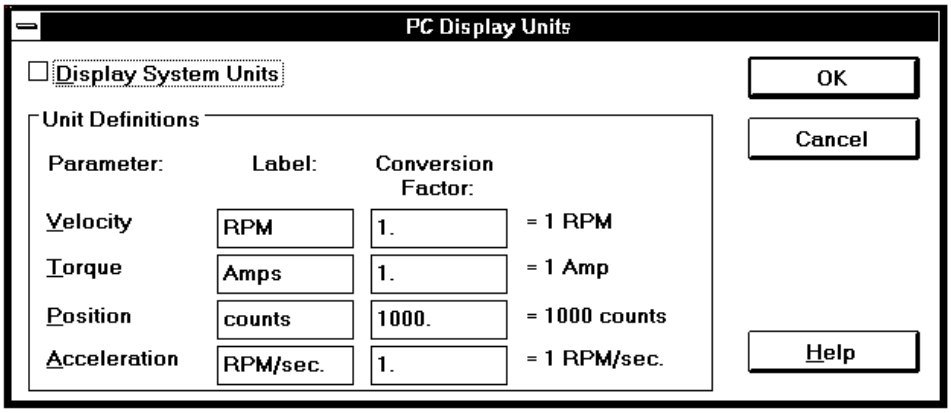


FIGURE 8.12 **PC Display Units – Default Dialog**

Changing the Display Units Settings

The following example changes the Label and Conversion Factor for the Position and Acceleration parameters. This example assumes a 2000 line encoder (8000 pulses/revolution).

- Position – from Counts to Motor Revolutions
- Acceleration – from RPM/sec^2 to Revs/sec^2

1. Choose the **Drive Parameters** command icon from the Drive window and then select the **Units** button. The PC Display Units dialog appears with default settings as shown.
2. Select the Position Label cell, and change **counts** to **Mtr Revs**.

TIP Labels are limited to 8 characters.

3. Select the Position Conversion Factor cell, and change **1000** to **0.125**. Mathematically 1/8 (0.125) of a motor revolution is 1000 counts, given that the motor has a 2000 line (8000 count) encoder.
4. Select the Acceleration Label cell, and change **RPM/sec** to **Revs/sec**.
5. Select the Acceleration Conversion Factor cell, and change **1.** to **.016**. Mathematically 1.6 x 10^{-2} revs/sec^2 is 1 RPM/sec, given the motor has a 2000 line (8000 count) encoder.
6. Choose **OK** to exit the PC Display Units dialog.

The modified units will be displayed where appropriate within the DSMPro windows. For example, these changes cause the Indexing tab in the Drive Parameters window to display:

- Distance in Mtr Revs
- Acceleration in Revs/sec^2
- Deceleration in Revs/sec^2

The following units were not effected by the changes:

- Dwell in msec
- Velocity in RPM

Tuning 9

Centurion DSM100 Drives are tuned quickly and easily for a wide variety of applications. Two tuning modes are available through the software:

- Auto Tune
- Manual Tune

Tuning Guidelines

The following tuning guidelines briefly describe the tuning adjustments. These guidelines provide you with a basic reference point should the application require additional adjustments.

General Tuning Rules

1. Tune the velocity loop first and then, if the drive uses following or step/direction commands, tune the position loop.
2. To widen the velocity loop bandwidth, increase the P-gain setting, decrease the I-gain setting or increase the low-pass filter bandwidth. This provides a faster rise time and increases drive response.
3. To increase stiffness, increase the I-gain setting. It rejects load disturbance and compensates for system friction.
4. To reduce velocity loop overshoot, increase P-gain or D-gain, or decrease I-gain.
5. To reduce mechanical resonance, use a stiffer mechanical coupling or select a nega-tive (-) D-gain value. Alternatively, decrease the low-pass filter value and the velocity loop update rate.
6. If the motor oscillates, decrease either individually or together the:
    - P-gain
    - I-gain
    - low-pass filter bandwidth.

High Inertia Loads

Proper compensation of load inertia may not be simply a matter of increasing the P-gain and I-gain settings. Problems are often encountered when tuning systems with a high load to motor inertia ratio.

Mechanical Resonance

Mechanical resonance between the motor and the load occurs when the motor and load are oscillating with the same frequency but opposite phase: when the motor is moving clockwise the load is moving counter clockwise. The amplitude of the motor and load oscillations is such that the total momentum of the oscillating system is zero. In the case of a high load to motor inertia ratio this means that the motor may be moving quite a lot while the load is not moving nearly as much. Mechanical resonance occurs as a result of compliance (springiness) between the motor inertia and load inertia. It may result from belts, flexible couplings or the finite torsional stiffness of shafts. In general, the stiffer the couplings, the higher the resonant frequency and lower the amplitude. If the motor shaft is directly coupled to the load, a mechanically resonating system usually emits a buzz or squeal at the motor.

There are several ways of dealing with this problem but they fall into two groups: change the mechanical system or change the servo-motor response. Changing the mechanical system might involve reducing the inertia ratio via gearboxes or pulleys, or by increasing the stiffness of the couplings. For very high performance systems and systems with low resonance frequencies the mechanics may require changing to effectively deal with the resonance.

The second way of dealing with mechanical resonance is by changing the servo-motor response. This may be done by using a negative D-gain value and by reducing the P-gain, I-gain, velocity loop update rate or low-pass filter value. The D-term of the PID velocity regulator (see the velocity and torque current conditioning structure) subtracts (or adds) a proportion of the motor acceleration from the velocity error. The D-gain has the effect of increasing the acceleration current if the motor is accelerating in the wrong direction, but reducing the acceleration current if the motor is already accelerating in the right direction. When used in this way the D-gain dampens an oscillating or ringing system. In the case of motor-load mechanical resonance, a positive D-gain actually worsens the situation. When a negative D-gain value is used in a mechanically resonating system it may be thought of as subtracting the *load* acceleration (the opposite sign of the motor acceleration since the system is resonating). This tends to bring the motor and load back into phase with each other and therefore reduces or eliminates mechanical resonance.

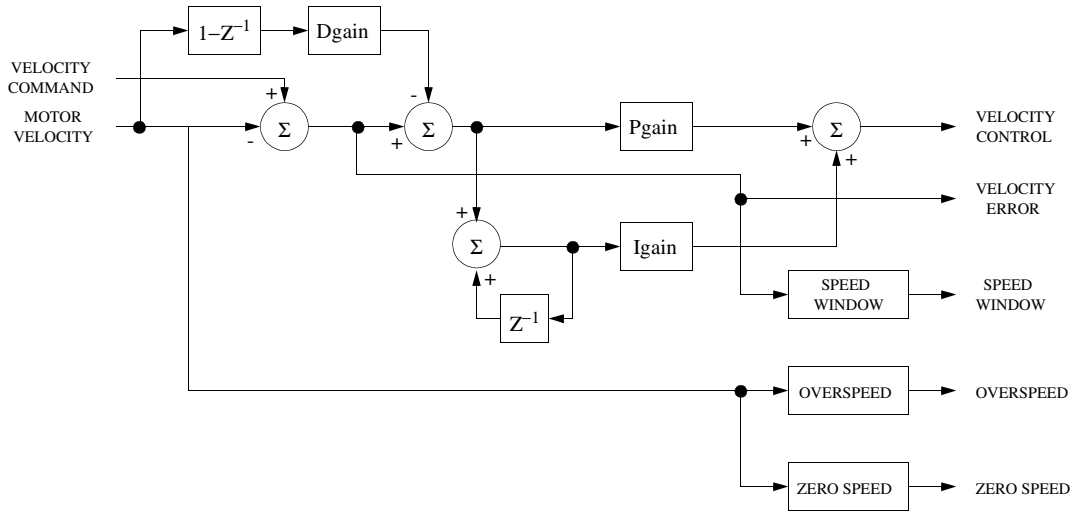


FIGURE 9.1 **Velocity Loop Structure**

Reducing the value of the P-gain, low-pass filter frequency and the update frequency all have the effect of reducing the servo-motor bandwidth. As long as the resonating frequency is fairly high this will likely be acceptable, but if the resonating frequency is low it may be necessary to modify the mechanics of the system.

Backlash

Backlash between the motor and load effectively unloads the motor over a small angle. Within this small angle, the increased bandwidth can result in oscillations. Some backlash may be unavoidable, especially with gear reduction. If backlash is present, the inertia match between the load and motor must be properly sized for good servo performance (load inertia should roughly equal motor inertia). Gearing reduces the inertia reflected to the motor by the square of the gear reduction from motor to load. Therefore, the gear ratio must provide the required match.

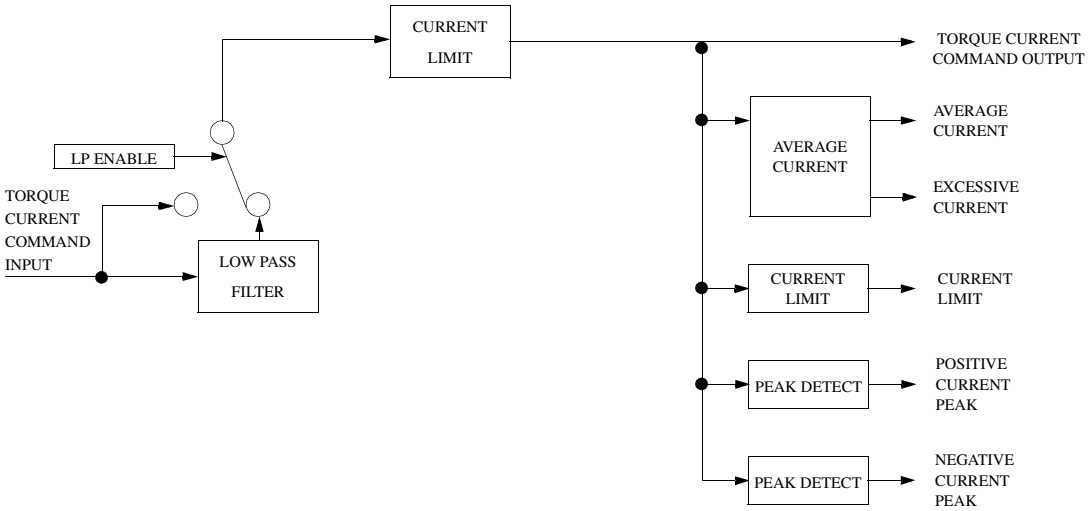


FIGURE 9.2 **Torque Current Conditioning Structure**

Auto Tune Mode

The Auto Tune mode uses a "self-tuning" algorithm that automatically adjusts the drive's velocity loop gain parameters. Adjustments do not require special equipment. This mode will tune a drive for constant velocity loop response across different applications. The results will often provide acceptable response but in general should be considered a starting point.

Tuning parameters adjustments are set to achieve a reasonable bandwidth and servo response based on the system inertia and friction. Auto tune may be used when a significant amount of compliance or backlash exists (for example, belt systems) in the mechanical load, but precise tuning requires the load be fully coupled to the motor. Instability problems occur when the load is not fully coupled to the motor.

TIP

The autotune algorithm will not provide satisfactory results in systems with significant gravitational effects.

Auto Tuning

A PC running DSMPro is required to perform tuning on a Centurion DSM100 Drive. The optional TouchPad does not support tuning.

Before auto tuning is invoked, three autotuning parameters must be set:

- Distance sets the rotation limit of the motor. This is the maximum distance the motor is allowed to move during any one test. (Note: a test in the bi-directional mode includes two different tests.)
- Step Current sets the amount of current given to the motor during the test. If this is set too low, a system may not move enough to gather sufficient data, if it is set too high the test will be too short and very jerky.
- Motor Direction (Forward Only/Reverse Only/Bi-directional) sets the rotational direction for the test. The bi-directional test does the same test in both directions, with the forward rotation first.

Auto tune procedures are explained for each drive configuration in "Application and Configuration Examples" starting on page 8-105. The following steps generalize these procedures.

When autotuning is selected, the drive rotates the motor shaft for a short time interval, typically a few seconds. Motor movement should *not* exceed 30 seconds.

WARNING Rotating motor shafts can cause extensive damage and injury. Motors must be properly guarded during testing and final installation.

1. Choose the **Tuning** command icon from the Drive window.
2. Choose **Auto Tune** from the Tuning window. This activates the Auto Tune Command and Motor Direction boxes within the Tuning window. Then enter or select:
   - appropriate values for **Distance** in the Auto Tune Command box,
   - appropriate values for **Step Current** in the Auto Tune Command box, and
   - an appropriate motor rotation in the Motor Direction box, either:
     - **BiDirectional**, if the motor will be powered in both the forward and reverse directions.
     - **Forward Only**, if the machinery is designed to operate only in the forward direction.
     - **Reverse Only**, if the motor will be powered only in the reverse direction.

Use the default settings if you are uncertain about what values to enter. The default settings are set to values appropriate to the drive and motor combination selected during drive initialization.

3. Enable the drive.
4. Choose **Start** from the Tuning window. The drive rotates the motor shaft and then motion will cease. The calculated gains are displayed and the drive is disabled.
5. Disable the drive manually.
6. Choose **Normal Drive Operation** from the Tuning window.
7. Enable the drive.
8. Choose **Close** to exit the Tuning window.

TIP Auto tuning does not have a velocity limit, but it does adhere to the motor Overspeed setting in the Drive Parameters window.

Manual Tune Mode

Manual tuning may be used to adjust the gain settings and filter frequency of the velocity regulator. The following sections briefly explain these settings. An understanding of the function for each type of gain and filtering will allow you to effectively tune the system.

Two types of manual tuning are available:

- Velocity tuning
- Position tuning.

Before manual tuning is invoked, the Velocity, Distance and Motor Direction parameters must be set. Refer to "Auto Tune Mode" on page 9-145 for information on setting these parameters.

The velocity loop should always be tuned before the position loop, as velocity loop tuning affects the position loop response.

Gain settings and signal filtering are the primary methods to electrically tune a system. A understanding of the types of gain and their purposes, as well as a general understanding of filtering, are essential background knowledge to properly tune a servo system.

Gains

TABLE 9.1 **Velocity Loop Gains**

Parameter	Description
P-gain	Proportional gain of the velocity regulator. P-gain controls the bandwidth of the velocity regulator by adjusting the control response proportional to the error. The P term of the velocity regulator commands an acceleration current that is proportional to the velocity error.
I-gain	Integral gain of the velocity regulator. Integration in the velocity regulator forces the motor velocity to precisely follow the commanded velocity. This assumes operation under steady state conditions (velocity command or load does *not* change). I-gain controls: The stiffness or the ability to reject load torque disturbance. The amount of velocity overshoot, which may cause the system to become unstable or oscillate. The I term of the velocity regulator commands an acceleration current proportional to the integral of the velocity error.
D-gain	Differential gain of the velocity regulator. Positive D-gain decreases the amount of overshoot caused by the I-gain. Negative D-gain decreases the torsional resonance between the motor and the load.

TABLE 9.2 **Position Loop Gains**

Parameter	Description
Kp-gain	Proportional gain of the position loop. Kp-gain changes: • The position loop bandwidth. • The settling time of the position loop. In general, the higher the value of Kp-gain the faster the settling time. However, a high value of Kp-gain with inadequate velocity loop bandwidth results in overshoot and ringing. Note: Kp-gain is only for use with the position following mode.
Kd-gain	Differential gain of the position loop. Provides position loop damping and reduces overshoot caused by Kp or Ki gain.
Kff-gain	Feedforward gain of the position loop. Kff-gain reduces following error. However, a high value of Kff-gain can result in position overshoot. A reduction in following error allows the system to more closely approximate gear driven systems.
Ki-gain	Integral gain of the position loop. Ki-gain decreases the time period for the error to decay. A non-zero value of Ki allows integration in the position loop which eliminates the steady state following error. However, a non-zero value for Ki may introduce overshoot and ringing, which cause system instability (oscillation). Note: Ki-gain is used in conjunction with the Ki Zone-value. Ki Zone - is the area around the commanded position where Ki - gain is active.

Filters

The velocity regulator has one low pass filter. The filter bandwidth range is from 1 Hz to 992 Hz.

The filter serves two purposes:

- Adjust the frequency range to remove (filter) the noise produced by encoder resolution.
- Reduce the amount of the mechanical resonance in the mechanical system (e.g., belt systems).

Similar results may often be achieved by reducing the update rate of the velocity loop.

Manual Tuning

Manual tuning may be used to adjust the gain control parameters P, I, D and the filters. A square wave is generated by the drive to assist in the adjustment. Manual velocity tuning requires the following:

- Step Period value to be specified
- Step Velocity value to be specified.

Always tune the velocity loop before the position loop, as Velocity loop tuning affects the position loop response.

Tuning the Velocity Loop

The Auto Tune procedure provides a starting point for velocity loop tuning. Manual tuning is desirable when very precise adjustments are required.

The following steps describe how to manually tune the velocity loop. These steps precede the manual position loop tuning procedure, which should follow velocity loop tuning.

1. Disable the drive.
2. Choose **Manual Tune (Velocity Step)** from the Tuning window.
3. Enter the desired step **Velocity (rpm)** of the internal square wave generator.
4. Enter the desired **Time** to complete one cycle of the square wave of the internal step velocity.
5. Select the desired Motor Direction (**Forward Only**, **Reverse Only**, or **Bi-Directional**).
6. Select the **Oscilloscope**.
7. Enable the drive.
8. Choose **Start**. The motor should start moving and the oscilloscope will display the commanded velocity and the motor velocity.
9. While monitoring the motor velocity waveform, increase P-gain until the desired rise time is achieved.
10. While monitoring the motor velocity waveform, increase I-gain until an acceptable amount of overshoot is reached.
11. Apply filtering by selecting **Filters**, and then select **Filter Enable**.
12. While monitoring the motor velocity waveform, decrease the filter **Bandwidth** until the overshoot begins to increase (in many applications the filter is not necessary).
13. Choose **Stop**.
14. Disable the drive.
15. Choose **Normal Drive Operation**.
16. Choose **Close**.
17. Enable the drive.

The drive's velocity loop is tuned.

Tuning the Position Loop

Specify the step period and step position values, and then input a square wave to the position loop. Adjust the gain controls parameters Kp, Kd, Kff, Ki, and Ki Zone Filters to tune the system.

Tune the velocity loop before attempting to tune the position loop. The bandwidth of the velocity loop must be set before position loop tuning is attempted.

1. Disable the drive.
2. Choose **Manual Tune (Position Step)** from the tuning window.
3. Enter an appropriate **Distance count** (step position) for the internal square wave.
4. Enter an appropriate time to complete one cycle of the square wave for the internal step position.
5. Select the desired Motor Direction (**BiDirectional**, **Forward Only** or **Reverse Only**).
6. Select the **Oscilloscope**.
7. Enable the drive.
8. Choose **Start**. The motor will move and the oscilloscope will display the Position Motor Feedback signal.
9. Increase the **Kp** gain while monitoring the signal on the scope. The Kp gain should be adjusted until the desired rise time is achieved, with no overshoot. Refer to Figure 9.3.
10. Increase **Ki** very slowly until the signal begins to overshoot.
11. Increase **Kd** very slowly to remove the overshoot caused by KI.
12. In general you may leave the **Kff** gain set to 100.
13. Choose **Stop**.
14. Disable the drive.
15. Choose **Normal Drive Operation**.
16. Choose **Close**.
17. Enable the drive.

The position loop has been tuned. The drive may be operated as a master encoder, step/direction or step up/down configuration.

Velocity Loop Tuning Examples

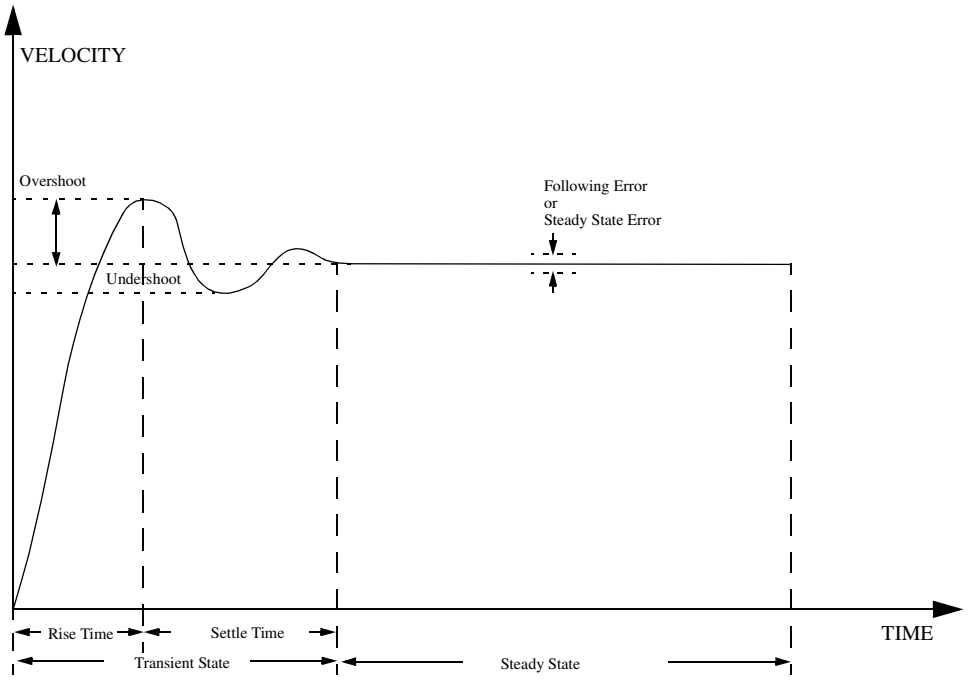
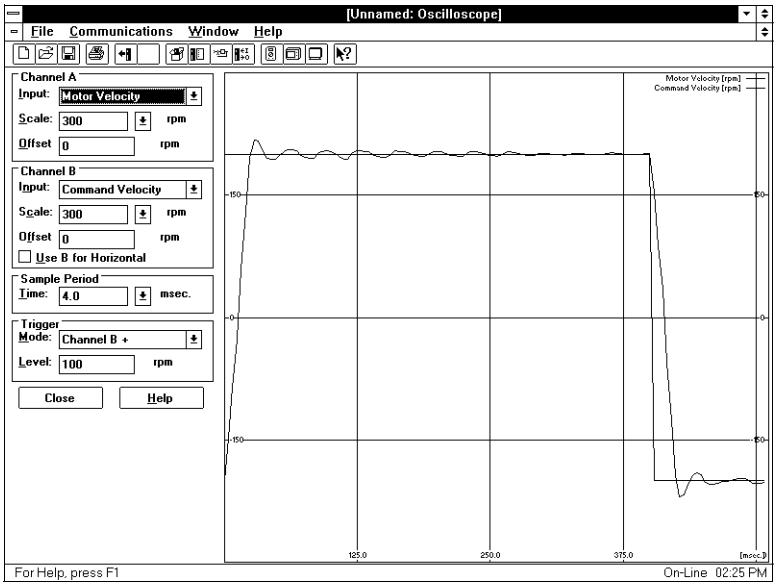
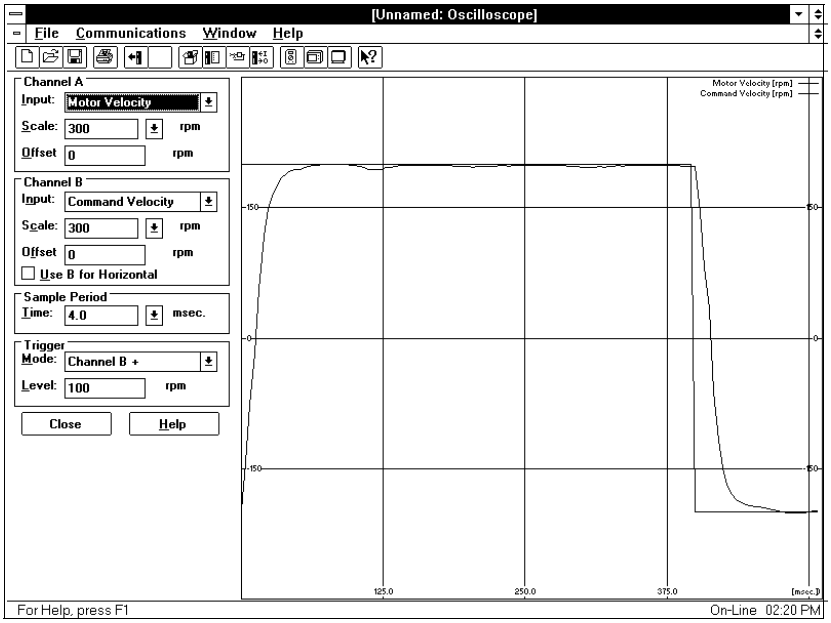


FIGURE 9.3 **Signal Nomenclature**



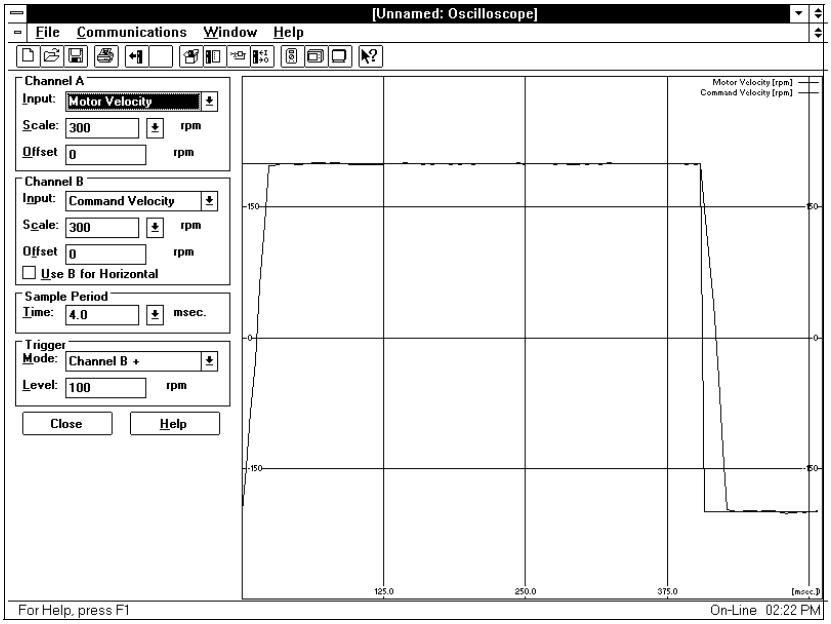
UNDERDAMPED
Motor Velocity consistently overshoots the Velocity Command. To correct:
Decrease P-gain
Decrease I-gain

FIGURE 9.4 **Underdamped Signal**



OVERDAMPED
Motor Velocity consistently undershoots the Velocity Command. To correct:
Increase I-gain
Increase P-gain

FIGURE 9.5 **Overdamped Signal**



CRITICALLY DAMPED
Motor Velocity quickly settles to the Velocity Command.

FIGURE 9.6 **Critically Damped Signal (Ideal Tuning)**

Status Display 10

Two front panel indicators display the status of the drive on a continuous basis:

- The Status display shows the operating mode of the drive.
- The DC Bus LED lights whenever the bus is energized.

The 7-segment Status display indicates the drive status and operating mode. After power-up or reset the operating mode is indicated by a single letter message. In the event of a fault, a flashing code is displayed.

Operating Messages

The drive operates in one of five command modes. The mode of operation is displayed by the 7-segment display whenever the drive is powered-up and operational. The Analog mode of operation, “A”, is the default mode of operation. A sixth mode, “L”, indicates a firmware modification routine is in progress.

The displays and their meaning are:

A = Analog

F = Follower, Master Encoder, Step/Direction, or Step Up/Down

H = Control Panel mode (controlled through the serial port.)

L = Load Firmware (the in-process state, “L” [loading] is indicated by a flashing period.)

P = Preset or Indexing

– = Tuning mode (the Tuning mode in DSMPro is active.)

Refer to“Application and Configuration Examples” beginning on page 8-105 for information on configuring the Centurion DSM100 Drives in any of these command modes.

Error Messages

If there is a fault, the drive provides specific error messages. Faults are detected by the drive in two ways: power-up hardware and run-time faults. A power-up fault usually requires servicing of the hardware, while a run-time fault can be cleared by resetting the drive.

The Status display indicates faults by flashing the letter “E”, followed by additional digits to indicate the error. The error display repeats until the drive is reset or powered down. For example, “E....0....9.....E....0....9.....E....0....9...” indicates an Bus Undervoltage fault. When an error occurs, the error code and the service time of the error is logged into a Fault History record stored in EEPROM.

Run Time fault handling executes every 1 millisecond (1 kHz rate). Thus the maximum time interval between an error occurring and the fault action is 1 millisecond.

The following errors are only available when the drive is in a specific configuration:

- Auxiliary Encoder State and Excessive Following errors require the drive to be in the position follower mode.
- Illegal Hall State error requires the motor to be configured as having a hall switch input signal.

Run-Time Error Codes

“Maintaining and Troubleshooting the Centurion DSM100 Drive” lists the error codes and possible actions or solutions to take when resolving the error condition.

TABLE 10.1 Run-Time Error Codes

Status Display	Error Code	Fault Description
E....0....1	01	+24 VDC Fuse blown
E....0....2	02	+5 VDC Fuse blown
E....0....3	03	Encoder Power Fuse blown
E....0....4	04	Motor Overtemperature, Thermostat
E....0....5	05	IPM Fault (Overtemperature / Overcurrent / Short Circuit)
E....0....6	06	Channel IM Line Break
E....0....7	07	Channel BM Line Break
E....0....8	08	Channel AM Line Break
E....0....9	09	Bus Undervoltage
E....1....0	10	Bus Overvoltage
E....1....1	11	Illegal Hall State
E....1....2	12	Unused interrupt - sub processor
E....1....3	13	Unused interrupt - main processor
E....1....4	14	Reserved
E....1....5	15	Reserved
E....1....6	16	Reserved
E....1....7	17	Excessive Average Current
E....1....8	18	Motor Overspeed
E....1....9	19	Excessive Following Error
E....2....0	20	Motor Encoder State Error
E....2....1	21	Auxiliary Encoder State Error
E....2....2	22	Motor Thermal Protection
E....2....3	23	IPM Thermal Protection
E....2....4	24	Velocity Error
E....2....5	25	Commutation Angle Error
E....2....6	26	Reserved
E....2....7	27	Axis not Homed
E....2....8	28	No Motor Selected

TABLE 10.1 **Run-Time Error Codes** (continued)

Status Display	Error Code	Fault Description
E....2....9	29	Motor Selection not in Table
E....3....0	30	Personality Write Error
E....3....1	31	Service Write Error
E....3....2	32	CPU Communications Error

Power-Up Error Codes

A power-up error indicates in almost all cases that the drive should be returned to the factory for service. In general, any occurrence of a Power-up error should be treated with extreme caution. It may indicate the hardware is marginal.

Situations that may cause drive hardware errors, and which can be remedied outside the factory include:

The drive is powered-down while a firmware upgrade is loading into flash memory. A program memory error occurs when power is reapplied. To remedy the problem, reload the firmware using DSMPro.

A watchdog time-out error may result from electrical “noise” (electromagnetic interference - EMI), a firmware error, or a hardware malfunction. The context of the watchdog error needs to be investigated to determine the source of the problem.

A personality EEPROM error results when a personality module is *not* installed or is improperly installed in the drive. Installation of the personality EEPROM will fix this error.

The following table lists the Power-Up Error Codes.

TABLE 10.2 **Power-Up Error Codes**

Status Display	Error Code	Fault Description
E....5....1	51	Program Memory Boot Block Error
E....5....2	52	Program Memory Main Block Error
E....5....3	53	Uninitialized Personality EEPROM Error
E....5....4	54	Personality EEPROM Read Error
E....5....5	55	Personality EEPROM Data Corruption
E....5....6	56	Main Processor Watchdog Error
E....5....7	57	Sub Processor Watchdog Error
E....5....8	58	Main Processor RAM Error
E....5....9	59	Sub Processor RAM Error
E....6....0	60	Uninitialized Service EEPROM Error
E....6....1	61	Service EEPROM Read Error
E....6....2	62	Service EEPROM Data Corruption Error
E....6....3	63	Main Processor A/D Converter Error
E....6....4	64	Sub Processor A/D Converter Error
E....6....5	65	ANALOG1 Output Error
E....6....6	66	Gate Array Error
E....6....7	67	ANALOG2 Output Error
E....6....8	68	Inter-Processor Communication Error
E....6....9	69	Sub Processor Initialization Error
E....7....0	70	Sub Processor SRAM Error
E....7....1	71	Sub Processor Code Loading Error
E....7....2	72	Sub Processor Start-up Error
E....7....3	73	Sub Processor Checksum Error
E....7....4	74	Personality EEPROM Write Error
E....7....5	75	Service EEPROM Write Error

TABLE 10.2 **Power-Up Error Codes** (continued)

Status Display	Error Code	Fault Description
E....7....6	76	Software Clock Error
E....7....7	77	Sub Processor Communication Checksum Error
E....7....8	78	Sine Table Generation Error
E....7....9....n	79-n	Personality Data Out of Range where n = suberror parameter 1 - Serial baud rate selection 2 - Serial stop bits/parity selection 3 - Position Loop Kp 4 - Position Loop Ki 5- Position Loop Kff 6 - Position Loop Kd 7 - Gear ratio 8 - Encoder Output Divider 9 - Velocity Loop Update Period 10 - Velocity Loop P Gain 11 - Velocity Loop I Gain 12 - Velocity Loop D Gain 13 - Reserved 14 - Analog Command Velocity Offset 15 - Analog Command Torque Offset 16 - User D/A Variable Selection 17 - Command Source 18 - Drive Mode (Torque/Velocity) 19 - Tuning Direction 20 - Motor/Encoder User Alignment Offset 21 - Encoder Size 22 - Motor Torque Constant 23 - Motor Inertia 24 - Motor Back EMF 25 - Motor Resistance per Phase 26 - Motor Inductance per Phase 27 - Motor Commutation Type 28 - Motor Encoder Hall Offset 29 - Motor Encoder Index Offset 30 - Motor Pole Count
E....8....0....1	80-1	Service Data Out of Range (Drive Type)
E....8....1	81	Motor Block Checksum Error
E....8....2	82	Mask ROM Checksum Error
E....8....3	83	Personality EEPROM Incompatibility
E....8....4	84	Service EEPROM Incompatibility

Maintenance and Troubleshooting 11

Maintenance

The Centurion DSM100 Drive is designed to function with minimum maintenance.

Periodic Maintenance

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

Cleaning

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

Cable Inspection

Inspect the connections, particularly the power connections, to ensure their tightness.

- All power connections should be torqued to 1.4 Nm (12 lb-in).
- D-shell signal connectors can be inspected for proper seating.
- Visually inspect all cables for abrasion.

CAUTION

DC bus capacitors may retain hazardous voltages for several minutes after input power has been removed, but will normally discharge in several seconds. Measure the DC bus voltage to verify it has reached a safe level each time power is removed before working on the drive; or wait for the time indicated in the warning on the front of the drive.
Failure to observe this precaution could result in severe bodily injury or loss of life.

Fuse Replacement

The +24VDC, +5VDC and Motor Encoder power lines are fused for protection. All fuses are 1A fast acting fuses, Refer to "" on page -173 for the part number and Figure 11.1 for fuse locations. A spare fuse, F4, is included on the circuit board for convenience.

EEPROM Personality Module

The serial EEPROM, or personality module, stores all the drive setup parameters. The setup parameters configure the drive to match a particular motor and operate in a particular mode of operation.

The personality module may be removed from a Centurion DSM100 Drive and installed in another drive. By transferring the personality module from a drive to another drive, the drive's "personality" is moved to the new drive. Alternatively, the data stored in the EEPROM may be transferred using DSMPro software to a peripheral device, such as diskette or tape.

The only time you may need to remove the personality module is if you do *not* have a PC available and your drive is down.

EEPROM Removal/Replacement

To remove the EEPROM from a drive:

1. Remove all power from the drive.
2. Disconnect all connections to the front of the drive.
3. Remove the protective cover by removing the screws attaching the right-side cover to the chassis.

WARNING

The circuits in the drive are potential sources of severe electrical shock. Follow the safety guidelines to avoid shock.

4. Refer to Figure 11.1 for the location of the personality module.
5. Grasp the EEPROM with an IC chip puller to remove the personality module.

To install the EEPROM on a drive:

1. Remove all power from the drive.
2. Remove all connections to the front of the drive.
3. Remove the protective cover by removing the screws attaching the right-side cover to the chassis.

CAUTION

Electronic components are subject to damage by static electricity. Follow Electrostatic Discharge (ESD) practices while handling components.

4. Refer to Figure 11.1 for the location of the personality module.
5. Align the notch on the front of the personality module and the matching notch on the socket.
6. Place the properly orientated personality module in the IC chip insertion tool. Ensure the chip and socket notches are aligned.
7. Push the personality module firmly into the socket.
8. Install the protective cover and tighten the screws.
9. Reconnect the cables to the front of the drive.
10. Reapply power to the drive.

Some combinations of firmware and personality modules are incompatible; they will generate an error message after replacement. Consult “Error Codes” on page 11-161 for the recommended action/solution.

Data Transfer

After you have configured the drive and tuned the drive, the data stored in the EEPROM personality module should be saved off-line. Saving the parameters off line will allow you to clone several machines with the same mechanics and provides an emergency backup of the drive data.

To transfer the data from the drive to a PC:

1. While on-line with a drive, click on **File** in the toolbar menu.
2. Select **Save As..**., the Save As window will appear.
3. Enter the file name and press ENTER or choose OK to save.

To transfer the data from a PC to a drive:

1. Close all windows in DSMPro.
2. Choose **File** in the toolbar menu.
3. Choose **Open**.
4. Select the desired file name or enter the file name to be loaded and press ENTER or choose OK. If you do not know the name of the file to be loaded, select the correct directory from the **Directories** box and select the file name from the displayed list of file names.
   The DSMPro Off-Line Drive window appears, along with the selected file name.
5. Select **Communications** from the toolbar menu.
6. Select **Overwrite Drive Parameters**.
   The Drive Select window will appear.
7. Select the drive to be configured, and then press **ENTER** or choose **OK** to load the parameters into the personality module.

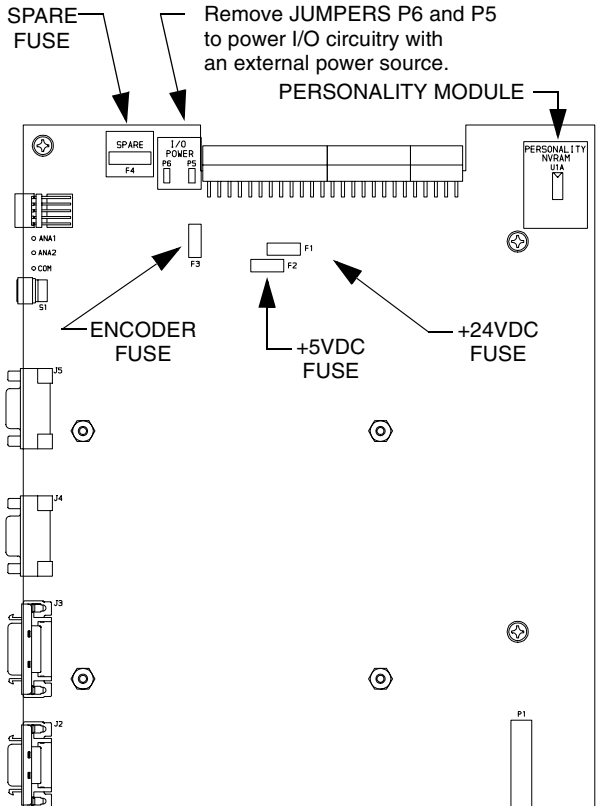


FIGURE 11.1 **Fuse and Jumper Locations**

Firmware Upgrading

Centurion DSM100 Drives may be upgraded in the field to the latest version of firmware. Firmware versions are available from the Giddings & Lewis Product Support group. The procedure describes how to reload the firmware installed in your drive using the Upgrade Firmware command available in DSMPro software.

DSMPro provides extensive checks and controls through message boxes which ensure that the loading of firmware is performed properly. Messages ensure that:

- The drive is off-line
- The correct firmware file is used.

Firmware Upgrade Procedure using DSMPro

1. Copy the new firmware into the Firmware subdirectory of the DSMPro application directory.
2. Start DSMPro.
3. When the Drive Select window appears, select **Cancel**. The Drive Select window closes without connecting to the drive.
4. Choose **Upgrade Firmware** from the File menu. The Drive Select window will appear.
5. Select the drive to upgrade, and then select **OK**. The Select Firmware File window will appear.
6. The Select Firmware File window contains a list of firmware files identified by version information. Only the files that can be applied to the connected drive are displayed, which minimizes the danger of transferring an incorrect file. To select the firmware files:
   - Select the appropriate file to upgrade the drive firmware.
   - Select **OK** when the file is highlighted.

   A visual indicator traces the progress of the firmware upgrade.

Do *not* remove power or reset either the drive or the PC during the upgrade. Any interruption of the firmware upgrade could cause the drive to become *inoperable*.

7. When the upgrade is complete a dialog box confirms completion of the upgrade and reminds you that the drive must be reset at this time.
   - Select **Yes** if you want to perform a software reset of the drive.
   - Select **No** if you wish to reset the drive by removing power.

Troubleshooting

Two front panel indicators display the status of the drive on a continuous basis:

- The Status display indicates the operating mode of the drive (A, F, P, etc.).
- The DC Bus LED lights whenever the main AC input is connected to line voltage.

A table of problems, potential causes, and appropriate actions to take to resolve the problem is included below.

Error Codes

If problems persist after attempting to carefully troubleshoot the system, please contact your local distributor for further assistance.

TABLE 11.1 **Troubleshooting Guide**

Problem or Symptom	Error Code	Possible Cause(s)	Action/Solution
Status display not lit.		No AC power	Verify power (115/230VAC single phase or 230 VAC three phase) is applied to the drive.
		Blown power fuse(s)	Check for open circuits in the AC line fuses.
DC BUS LED not lit.		No Bus power	Verify AC power is applied to the drive Check for open circuit breakers in AC line.
		Blown power fuse(s)	Check fuses.
Motor jumps when first enabled		Motor encoder wiring error	Check motor encoder wiring. See Figure 6.37 to verify connection of encoder power sense signals.
		Incorrect motor chosen in personality module	Select the proper motor in DSMPro.
Digital I/O not working correctly		24V power supply disconnected	Verify P5/P6 jumper settings are correct.
+24V Fuse Blown	01	F1 Blown	The fuse on the I/O isolated +24 VDC power supply has tripped. Check/replace fuse F1 if necessary. Check for shorts on I/O or +24VDC output
+5V Fuse Blown	02	F2 Blown	The fuse on the encoder power output for the +5 VDC power supply has tripped. Check/replace fuse F2 if necessary. Check for shorts on Encoder output signals or +5V output. Check that J4 pin 9 or J5 pin 9 is not connected to an external circuit.

TABLE 11.1 **Troubleshooting Guide** (continued)

Problem or Symptom	Error Code	Possible Cause(s)	Action/Solution
Encoder Fuse Blown	03	F3 blown	Check for shorts on motor Encoder signals and cable wiring. Check/replace fuse F3 if necessary.
		Bad encoder	Replace encoder and or motor.
Motor Overtemperature	04	Motor TS+ (J2-19) and TS- (J2-20) pins open	Verify TS+ (J2-19) and TS- (J2-20) connections for continuity.
		Motor thermostat trips due to: High motor ambient temperature, and/or Excessive RMS torque	Lower ambient temperature. Operate within (not above) the continuous torque rating for the ambient temperature (40°C maximum).
IPM Fault	05	Motor cables shorted	Verify continuity of motor power cable and connector.
		Motor winding shorted internally	Check for short on motor's R,S,T and Gnd windings.
		Drive temperature too high	Check for clogged or defective fan. Ensure cooling is not restricted by insufficient space around the unit.
		Operation above continuous power rating	Verify ambient temperature is not too high (above 60° C). Operate within the continuous power rating.
		Output short circuit or overcurrent	Drive has a bad IPM, replace drive.
Channel IM line	06	Bad connections	Verify continuity of the encoder cable. Verify continuity of the IM+ and IM- wiring signals.
		Bad Encoder	Replace the motor or the encoder.
Channel BM line	07	Bad connections	Verify continuity of the encoder cable and connectors. Verify continuity of the BM+ and BM- wiring signals.
		Bad Encoder	Replace the motor or the encoder.

TABLE 11.1 **Troubleshooting Guide** (continued)

Problem or Symptom	Error Code	Possible Cause(s)	Action/Solution
Channel AM line	08	Bad connections	Verify continuity of the encoder cable. Verify continuity of the AM+ and AM- wiring signals.
		Bad Encoder	Replace the motor or the encoder.
Bus Undervoltage	09	Low AC line/AC power input (100 V AC minimum for safe drive operation)	Verify voltage level of the incoming VAC power. Check main VAC power source for glitches or line drop (below 90 VAC). Install an uninterruptible power supply (UPS) on your VAC input.
Bus Overvoltage	10	Excessive regeneration of power When the drive is driven by an external mechanical power source, it may regenerate too much peak energy through the drive's power supply. The system faults to save itself from an overload.	Change the deceleration or motion profile and/or reduce the reflected inertia of your mechanical system. Use a larger system (motor and drive).
		Excessive AC input voltage	Verify input is below 264 VAC.
		Output short circuit	Check for shorts.
		Motor cabling wires shorted together	Check for shorts.
		Internal motor winding short circuit	Check for shorts.
Illegal Hall State	11	Incorrect phasing Bad connections	Check the Hall phasing. Verify the Hall wiring.
RESERVED	12		
RESERVED	13		
RESERVED	14		
RESERVED	15		
RESERVED	16		

TABLE 11.1 **Troubleshooting Guide** (continued)

Problem or Symptom	Error Code	Possible Cause(s)	Action/Solution
Excessive Average Current	17	Excessive time at peak current	Reduce acceleration rates Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. User larger drive and motor.
		Software parameter set too low	Increase Average Current parameter to a less restrictive setting.
		Insufficient bus voltage	Correct the under voltage condition or intermittent AC power or install a larger size transformer.
Motor Overspeed	18	OVERSPEED parameter in the drive set to low for the application	Using DSMPro (refer to Drive Parameters section) set Overspeed parameter to an acceptable range for the application.
		Motor commanded to run above Overspeed setting	Reduce command from position controller or change velocity parameter in the position controller.
		Motor Phasing is incorrect	Check motor phasing.
		Motor encoder phasing is incorrect	Check encoder phasing.
Excess Following Error	19	Software position error limit was exceeded	Increase the feed forward gain to 100%. Increase the following error window (refer to DSMPro Drive Parameters section). Retune the drive to reduce the following error. Increase the slew limit window (refer to DSMPro Drive Parameters).
Motor Encoder State Error	20	Motor encoder encountered an illegal transition	Replace the motor/encoder Use shielded cables with twisted pair wires. Route the feedback away from potential noise sources. Check the system grounds.
		Bad encoder	Replace motor/encoder.

TABLE 11.1 **Troubleshooting Guide** (continued)

Problem or Symptom	Error Code	Possible Cause(s)	Action/Solution
Auxiliary Encoder state error	21	Auxiliary encoder encountered an illegal transition	Use shielded cables with twisted pair wires. Route the encoder cable away from potential noise sources. Bad encoder - replace encoder Check the ground connections
Motor Thermal Protection Fault	22	Internal filter protecting the motor from overheating has tripped.	Reduce acceleration rates Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. User larger drive and motor.
IPM Thermal Protection Fault	23	Internal filter protecting the IPM at slow speed has tripped.	Reduce acceleration rates Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion. User larger drive and motor.
Velocity Error	24	Velocity error exceeded the specified limit and time parameters.	Increase time or size of allowable error.
Commutation Angle Error	25	Encoder index location is inconsistent.	Replace encoder. Check encoder and motor power wiring.
RESERVED	26		
Axis not Homed	27	An absolute indexing move was attempted without first homing the axis.	Home the drive before attempting an absolute indexing profile.
No Motor Selected	28	No motor was selected when the drive was enabled.	Select a motor before enabling the drive.
Motor Information Missing	29	Motor number is referencing a motor that is not currently in the drive.	Select a motor that is in the drive. Update the motor tables in the drive (contact the factory).
RESERVED	30-53		Call the factory.
Personality EEPROM Read Error	54	Personality EEPROM is incompatible with the drive firmware	Upgrade firmware.
		Hardware is malfunctioning.	Call the factory.
RESERVED	55-82		Call the factory.
Personality EEPROM Incompatibility	83	Personality EEPROM cannot be used with an indexing drive.	Use a non-indexing drive.

RS-232 Communication Test

This test verifies the functionality of the communications port on an MS-DOS® based personal computer.

The test uses the Terminal mode available in Microsoft® Windows™.

1. Close all DSMPro windows.
2. Select **Communication** from DSMPro and verify your communication settings.
3. Verify the communication cable pin out and check cable continuity. Refer to "RS-232 Connection Diagrams" on page 6-88.
4. If the communication cable is OK, do the following:
   a. Disconnect the communication cable from the drive.
      (1) Jumper pin 2 and 3 on the D connector of the communication cable.
      (2) Close and exit from DSMPro
   b. Select the **Terminal** from the Program Manager (Terminal is usually is in the Accessories group)
   c. Select **Settings** from the Main menu
      (1) Select **Terminal Emulation** from the drop down menu
      (2) Choose **DEC VT-100**
      (3) Choose **OK** to close the dialog box
   d. Select **Settings** from the Main menu
      (1) Select **Communications** from the drop down menu
      (2) Choose **COM1** (or the number of the communication port the drive is connected to) from the Connections sliding list.
      (3) Set Baud Rate to **9600**
      (4) Set Data Bits to **8**
      (5) Set Stop Bits to **1**
      (6) Set Parity to **NONE**
      (7) Set Flow Control to **XON/XOFF**
      (8) Choose **OK** to close the dialog box.
5. Type any character on the keyboard. The character should echo back on the screen.
   a. If you see the character on the screen swap pins 2 and 3, close the Windows Terminal and restart DSMPro.
   b. If the character does *not* echo back on the screen, do the following:
      (1) Disconnect the cable from your PC.
      (2) Jumper Pins 2 and 3 on the communication port of the PC.
      (3) Type any character on the keyboard.
         (a) If the character echoes back, the communication port is OK and the cable or the connectors are defective. Replace the communication cable assembly.
         (b) If the character did *not* echo back, the communication port is defective. Replace the communication port.

Testing Digital Outputs

This test verifies the functionality of the selectable outputs.

Test equipment requirements are:

- A PC running DSMPro
- A multimeter.

It assumes there are no error codes displayed, and the 24V power supply is connected correctly.

Disconnect the outputs from any external hardware while performing this test.

1. Disable the drive by opening the switch connecting J1-26 and J1-20.
2. From the Drive Window select the **Output Diagnostics** command icon.
3. Verify each of the digital Outputs in the Output Diagnostics window registers the following values when it is selected or deselected:
   a. Drive Ready box, then measure the resistance between J1-24 and J1-25.
      (1) If the box is checked, the resistance should read approximately 1 Ohm.
      (2) If the box is not checked, the resistance should read very high (> 1 MOhm).
   b. Brake Enable box, then measure the resistance between J1-49 and J1-50.
      (1) If the box is checked, the resistance should read approximately 1Ohm.
      (2) If the box is not checked, the resistance should be very high (> 1 MOhm).

      A load is necessary to test the transistor outputs listed below. A 1 kOhm resistor may be connected from the transistor output (J1-42, J1-43, J1-44 or J1-45) to the 24 VCOM (J1-6).
   c. Digital Output 1, then measure the voltage between J1-42 and J1-13.
      (1) If the box is checked, the voltmeter should read approximately +24 VDC.
      (2) If the box is not checked, the voltmeter should read approximately 0 VDC.
   d. Digital Output 2, then measure the voltage between J1-43 and J1-13.
      (1) If the box is checked, the voltmeter should read approximately +24 VDC.
      (2) If the box is not checked, the voltmeter should read approximately 0 VDC.
   e. Digital Output 3, then measure the voltage between J1-44 and J1-13.
      (1) If the box is checked, the voltmeter should read approximately +24 VDC.
      (2) If the box is not checked, the voltmeter should read approximately 0 VDC.
   f. Digital Output 4, then measure the voltage between J1-45 and J1-13.
      (1) If the box is checked, the voltmeter should read approximately +24 VDC.
      (2) If the box is not checked, the voltmeter should read approximately 0 VDC.
4. After the test has been completed you may select Close to exit Output Diagnostics window.

Testing Digital Inputs

This test verifies the functionality of the selectable inputs.

Test equipment requirements are:

- A PC running DSMPro
- A jumper wire.

It assumes there are no error codes displayed, and the 24V power supply is connected correctly.

1. Enable the drive by closing the switch connecting J1-26 and J1-20.
2. Choose the I/O Display command icon from the Drive Window.
    a. Connect J1-20 to J1-26. The Enable indicator activates.
    b. Connect J1-21 to J1- 26. The Reset Faults indicator activates.
    c. Connect J1-31 to J1-26. The Input 1 indicator activates.
    d. Connect J1-32 to J1-26. The Input 2 indicator activates.
    e. Connect J1-33 to J1-26. The Input 3 indicator activates.
    f. Connect J1-33 to J1-26. The Input 4 indicator activates.
3. Choose **Close** to exit the I/O Display window.

Testing Analog Outputs

The following tests verify the functionality of the analog outputs.

Test equipment requirements are:

- A PC running DSMPro
- A voltmeter.

Testing Analog Output 1

1. Disable the drive, by opening the connections between the ENABLE input and the + 24 VDC.
2. Disconnect the connections to J1-30.
3. From the Output Diagnostics window select **Analog Output 1**.
4. Enter 1000 in the D/A level box.
5. Connect a DC voltmeter across analog test points A1 and COM. The meter should read approximately 1 Vdc.
6. Repeat step 11.1 using different positive or negative values for the D/A Level. Verify the meter reads the values you enter.

Testing Analog Output 2

1. Disable the drive, by opening the connections between the ENABLE input and the + 24 VDC.
2. Disconnect the connections to J1-31.
3. Select **Output Diagnostics** icon from the Drive Window.
4. From the Output Diagnostics window select **Analog Output 2**.
5. Enter 1000 in the D/A level box.
6. Connect a DC voltmeter across analog test points A2 and COM. The meter should read approximately 1 VDC.
7. Repeat step 11.1 using different positive or negative values for the D/A Level. Verify the meter reads the values you enter.

Testing Positive and Negative Current Limits

The following tests verify the functionality of the analog +I LIMIT and -I LIMIT inputs.

The tests require:

- A PC running DSMPro, and
- A 10 kOhm potentiometer.

Testing Positive Current Limit

1. Verify the accuracy of the potentiometer with an ohmmeter before installing.
2. Disable the drive by opening the connections between the ENABLE input and +24VDC.
3. Disconnect the connections to J1-27 and J1-28.
4. Connect the 10K potentiometer between J1-27 and J1-28.
   Refer to "J1 – Controller" on page 6-53 for a diagram showing the location of the pins and "Interface Connections" for an interconnect diagram.
5. Choose the **Drive Signals** command icon from DSMPro.
6. Choose **Set Up**, if the Drive Signals Set Up window is not already active.
7. Choose **Current - Input Limit +** as the analog signal.
8. Choose **OK** to close the Set Up window and activate the Drive Signals window.
9. Slowly adjust the potentiometer while viewing the Drive Signals window. The Current - Input Limit + value should update as the potentiometer is adjusted.

Testing Negative Current Limit

1. Verify the accuracy of the potentiometer with an ohmmeter before installing.
2. Disable the drive by opening the connections between the ENABLE input and +24VDC.
3. Disconnect the connections to J1-29 and J1-28.
4. Connect the 10K potentiometer between J1-29 and J1-28.
   Refer to "J1 – Controller" on page 6-53 for a diagram showing the location of the pins and "Interface Connections" for an interconnect diagram.
5. Choose the **Drive Signals** command icon from DSMPro.
6. Choose **Set Up**, if the Drive Signals Set Up window is not already active.
7. Choose **Current - Input Limit –** as the analog signal.
8. Choose **OK** to close the Set Up window and activate the Drive Signals window.
9. Slowly adjust the potentiometer while viewing the Drive Signals window. The Current - Input Limit - value should update as the potentiometer is adjusted.

Testing Encoder Inputs

The following test verifies both reception and transmission of the line count from an encoder by the drive.

The tests require:

- A PC running DSMPro, and
- A motor encoder.

To test encoder inputs:

1. Disable the drive by opening the connections between the ENABLE input and +24VDC.
2. Choose the **Drive Parameters** command icon from DSMPro.
3. Choose **Master Encoder** as the Command Source.
4. Choose the **Drive Set Up** command icon from DSMPro.
5. Choose **Divide by 1** as the Master Encoder Command Input.
6. Make the following hardware connections:
   - Disconnect all connections to J3.
   - Connect the motor encoder to J2.
   - Jumper the Encoder Inputs to the Encoder Outputs by connecting the following pins:

     J1-7 to J1-14
     J1-8 to J1-15
     J1-9 to J1-16
     J1-10 to J1-17
     J1-11 to J1-18
     J1-12 to J1-19
7. Choose the **Encoder Diagnostics** command icon from DSMPro.
8. Choose **Zero Count** for both the Motor Encoder and Master Position Input.
9. Slowly rotate the encoder shaft by hand while observing the counts for both the Motor Encoder and Master Position Input. The Motor Encoder and Master Position Input line counts should be equal.

Options and Accessories A

Centurion DSM100 Drives conformance to the European Union Directives is contingent on:

- Installation of AC line filters between the power source and the drive, and
- Use of Giddings & Lewis cables to connect FSM, HSM, NSM, SSM, or YSM Series motors to a DSM110, DSM110P, DSM120, DSM120P, DSM130, DSM130P, DSM175, DSM175P, DSM1150 or DSM1150P drive. Diagrams and schematics for all Giddings & Lewis cables are shown in Appendix B, “Cable Diagrams, Schematics and Examples”.

Centurion DSM100 Drives

Model	Description
DSM007	500 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM007P	500 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM015	1000 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM015P	1000 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM110	1000 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM110P	1000 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM030	2000 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM030P	2000 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM120	2000 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM120P	2000 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM130	3000 Watt Universal Drive, single phase 100-240 VAC @ 50/60 Hz
DSM130P	3000 Watt Universal Indexing Drive, single phase 100-240 VAC @ 50/60 Hz
DSM175	7500 Watt Universal Drive, single or three phase 100-240 VAC @ 50/60 Hz
DSM175P	7500 Watt Universal Indexing Drive, single or three phase 100-240 VAC @ 50/60 Hz
DSM1150	15000 Watt Universal Drive, three phase 100-240 VAC @ 50/60 Hz
DSM1150P	15000 Watt Universal Indexing Drive, three phase 100-240 VAC @ 50/60 Hz

Fuses

Description	Part Number
1 Ampere, fast acting, inline (Littlefuse R451001, or equivalent) for DSM110 or DSM110P, DSM120 or DSM120P, DSM130 or DSMDSM130P, DSM175 or DSM175P, DSM1150 or DSM1150P	To be determined. Contact factory.

Options and Accessories

Description	Part Number
TouchPad	401-34405-00
AC Line Filter (6 A_{rms} Continuous, Single Phase) for DSM007 or DSM007P	401-30222-00
AC Line Filter (10 A_{rms} Continuous, Single Phase) for DSM015 or DSM0159P, DSM110X or DSM110P	401-30216-00
AC Line Filter (23 A_{rms} Continuous, Single Phase) for DSM030 or DSM030P, DSM120 or DSM120P	401-30217-00
AC Line Filter (30 A_{rms} Continuous, Single Phase) for DSM130 or DSM130P	401-34418-00
AC Line Filter (55 A_{rms} Continuous, Single Phase) for DSM175 or DSM175P	401-34420-00
AC Line Filter (36 A_{rms} Continuous, Three Phase) for DSM175 or DSM175P	401-34419-00
J1 to 50-pin Terminal Strip (Breakout Board), includes 1m (3ft) cable and mounting hardware	401-34409-00
J2 to 25-pin Terminal Strip (Breakout Board), includes 1m (3ft) cable and mounting hardware	401-34408-00
External Shunt Resistor for DSM110 or DSM110P, DSM120 or DSM120P, DSM130 or DSM130P	401-34308-00
Manuals	
• TouchPad Instructions	108-31019-00
• Installation Manual DSM110 or DSM110P, DSM120 or DSM120P, DSM130 or DSM130P, DSM175 or DSM175P, DSM1150 or DSM1150P	108-30083-00
• Installation Manual DSM-007 or DSM007P, DSM015 or DSM015P, DSM030 or DSM030P	108-31019-00

Interface Cables

Diagrams and schematics for cables listed below are shown in Appendix B, “Interface Cables”, beginning on page B-182.

Description	m (ft)	Part Number
J1 to customer supplied connector (no connector)	3 (10)	401-34411-10
	7.6 (25)	401-34411-25
	15 (50)	401-34411-50
	23 (75)	401-34411-75
J3 to customer supplied connector (no connector) (Standard sized drives only)	3 (10)	401-34410-10
	7.6 (25)	401-34410-25
	15 (50)	401-34410-50
	23 (75)	401-34410-75

Serial Interface Cables

Diagrams and schematics for cables listed below are shown in Appendix B “Interface Cables.”.

Description	m (ft)	Part Number
J4/J5 to PC [RS-232] (9 pin D-shell connector)	3 (10)	502-04020-10
	7.6 (25)	502-04020-25
	15 (50)	502-04020-50
J4/J5 to customer supplied connector (no connector)	3 (10)	401-34423-10
	7.6 (25)	401-34423-25
	15 (50)	401-34423-50
J4/J5 to J4/J5 four wire RS-485 communications	1 (3)	502-04021-01

Encoder Feedback Cables

Diagrams and schematics for cables listed below are shown in Appendix B, “Interface Cables”, beginning on page B-192.

Description	m (ft)	Part Number
FSM, HSM or SSM Series Motor to customer supplied connector (i.e., no connector)	3 (10)	401-34425-10
	7.6 (25)	401-34425-25
	15 (50)	401-34425-50
(Standard sized drives only)	23 (75)	401-34425-75
(Standard sized drives only)	30 (100)	401-34425-00
J2 to FSM, HSM or SSM Series Motor	3 (10)	401-34407-10
	7.6 (25)	401-34407-25
	15 (50)	401-34407-50
(Standard sized drives only)	23 (75)	401-34407-75
(Standard sized drives only)	30 (100)	401-34407-00
NSM Series Motor to customer supplied connector (i.e., no connector)	3 (10)	401-30252-10
	7.6 (25)	401-30252-25
	15 (50)	401-30252-50
(Standard sized drives only)	23 (75)	401-30252-75
(Standard sized drives only)	30 (100)	401-30252-00
J2 to NSM Series Motor	3 (10)	401-30231-10
	7.6 (25)	401-30231-25
	15 (50)	401-30231-50
(Standard sized drives only)	23 (75)	401-30231-75
(Standard sized drives only)	30 (100)	401-30231-00
YSM Series Motor to customer supplied connector (i.e., no connector)	3 (10)	401-30253-10
	7.6 (25)	401-30253-25
	15 (50)	401-30231-50
(Standard sized drives only)	23 (75)	401-30231-75
(Standard sized drives only)	30 (100)	401-30231-00
J2 to YSM Series Motor	3 (10)	401-30233-10
	7.6 (25)	401-30233-25
	15 (50)	401-30233-50
(Standard sized drives only)	23 (75)	401-30233-75
J2 to customer supplied connector (i.e., no connector)	3 (10)	401-34424-10
	7.6 (25)	401-34424-25
	15 (50)	401-34424-50
(Standard sized drives only)	23 (75)	401-34424-75
(Standard sized drives only)	30 (100)	401-34424-00

Motor Power Cables

Diagrams and schematics for cables listed below are shown in Appendix B, “Interface Cables”, beginning on page B-197.

Description	m (ft)	Part Number
Drive to 200 or 300 Motors (FSM, HSM or SSM Series)	3 (10)	401-34413-10
	7.6 (25)	401-34413-25
	15 (50)	401-34413-50
(Standard sized drives only)	23 (75)	401-34413-75
(Standard sized drives only)	30 (100)	401-34413-00
Drive to 400 Motors (FSM, HSM or SSM Series)	3 (10)	401-34414-10
	7.6 (25)	401-34414-25
	15 (50)	401-34414-50
(Standard sized drives only)	23 (75)	401-34414-75
(Standard sized drives only)	30 (100)	401-34414-00
Drive to 610 or 620 Motors (FSM, HSM or SSM Series) for DSM130 or DSM130P, DSM175 or DSM175P	3 (10)	401-34415-10
	7.6 (25)	401-34415-25
	15 (50)	401-34415-50
(Standard sized drives only)	23 (75)	401-34415-75
(Standard sized drives only)	30 (100)	401-34415-00
Drive to 610 or 620 Motors (FSM, HSM or SSM Series) for DSM175 or DSM175P NOTE: This cable is *not* CE marked.	3 (10)	Part number to be determined. Contact factory.
	7.6 (25)	
	15 (50)	
	23 (75)	
Drive to 800 Motors (FSM, HSM or SSM Series) for DSM1150 or DSM1150P	3 (10)	401-34417-10
	7.6 (25)	401-34417-25
	15 (50)	401-34417-50
(Standard sized drives only)	23 (75)	401-34417-75
(Standard sized drives only)	30 (100)	401-34417-00
Drive to 630 Motors (FSM, HSM or SSM Series) for DSM1150 or DSM1150P	3 (10)	401-34416-10
	7.6 (25)	401-34416-25
	15 (50)	401-34416-50
(Standard sized drives only)	23 (75)	401-34416-75
(Standard sized drives only)	30 (100)	401-34416-00
Drive to NSN Series Motors	3 (10)	401-30230-10
	7.6 (25)	401-30230-25
	15 (50)	401-30230-50
(Standard sized drives only)	23 (75)	401-30230-75
(Standard sized drives only)	30 (100)	401-30230-00
Drive to YSN Series Motors	3 (10)	401-30232-10
	7.6 (25)	401-30232-25
	15 (50)	401-30232-50
(Standard sized drives only)	23 (75)	401-30232-75
(Standard sized drives only)	30 (100)	401-30232-00

Connector Kits

Connector kits provide the ability to construct custom length cables. Kits are available for all Centurion DSM100 Drive connectors. Each kits consists of the appropriate 3M connector with the corresponding plastic backshell, and instructions.

Connector	Type	Part Number
J1	50 pin mini D-shell, 24-30 AWG ribbon cable solder cup, squeeze latch	401-56489-00
J2	20 pin mini D-shell, 24-30 AWG ribbon cable solder cup, squeeze latch	401-56490-00
J3	26 pin mini D-shell, 24-30 AWG ribbon cable solder cup, squeeze latch	401-56491-00
J4 or J5	50 pin D-shell solder cup for RS-232 or RS-485	401-56492-00

Mating Connectors

The following connectors are listed solely to provide a cross-reference of mating connectors for the J1, J2 or J3 connectors on the Centurion DSM100 Drives. The connectors are *not* available from Giddings & Lewis. Please contact the manufacturer or a distributor for additional information. Manufacturer phone numbers are:

3M: 1-800-225-5373,
AMP: 1-800-522-6752

Centurion DSM100 Drive conformance to the European EMC Directive is contingent on the use of Giddings & Lewis cables.

DDM	Mating Connector	Mating Backshell	Description
J1	AMP 2-175677-7	AMP 176793-7	50-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch
	3M 10150-6000EC[1]	3M 10350-A200-00	50-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch
	3M 10150-3000VE	3M 10350-52F0-008	50-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch
J2	AMP 2-175677-2	AMP 176793-2	20-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch
	3M 10120-6000EC[1]	3M 10320-A200-00	20-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch
	3M 10120-3000VE	3M 10320-52F0-008	20-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch
J3	AMP 2-175677-4	AMP 176793-4	26-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Plastic Backshell, Squeeze Latch
	3M 10126-6000EC[1]	3M 10326-A200-00	26-pin Mini D Ribbon, 28-30 AWG, Insulation Displacement, Metal Backshell, Squeeze Latch
	3M 10126-3000VE	3M 10326-52F0-008	26-pin Mini D Ribbon, 24-30 AWG, Solder Cup, Plastic Backshell, Squeeze Latch
1. For use with MDR Hand Press Tool Kit, 3M part number 3829			

Cable Diagrams, Schematics and Examples

B

Factory supplied cables allow Centurion DSM100 Drives to conform to the European Union Directives when connecting the drive to motors, controllers or computers. The following diagrams provide information on the cables available from the factory.

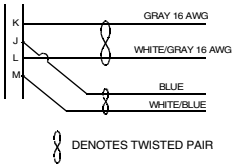
Refer to Appendix , “” for ordering information.

The information below applies to all factory supplied cables.

- Wire Insulation Type: Polyvinyl Chloride
- Conductor size: 0.08 mm^2 (28 AWG) tinned copper, except as noted below.
  [0.25 mm^2 (24 AWG) on 502-04020, 502-04021 and 401-34423]
  [1.5 mm^2 (16 AWG) on 401-34413 and 401-30232]
  [2.5 mm^2 (14 AWG) on 401-34414]
  [6 mm^2 (10 AWG) on 401-34415
- Braid Shield Coverage: 85% minimum
- Jacket Material: Thermoplastic elastomer
- Moldings: 105°C (221°F) Black PVC
- Minimum Bend Radius

Control Cables		Motor Power Cables	
Connector	**mm (in.)**	**Cable**	**mm (in.)**
Controller (J1)	171.45 (6.75)	401-34413	50.80 (2.0)
Encoder (J2)	129.54 (5.10)	401-34414	57.15 (2.25)
		401-34415	76.20 (3.0)
		401-30232	63.50 (2.50)

- Cables are manufactured to inch dimensions. Millimeter dimensions are approximate conversions from inches.
- Alternate field wiring diagram for FSM, HSM, or NSM Series encoder cables is shown below:



Interface Cables

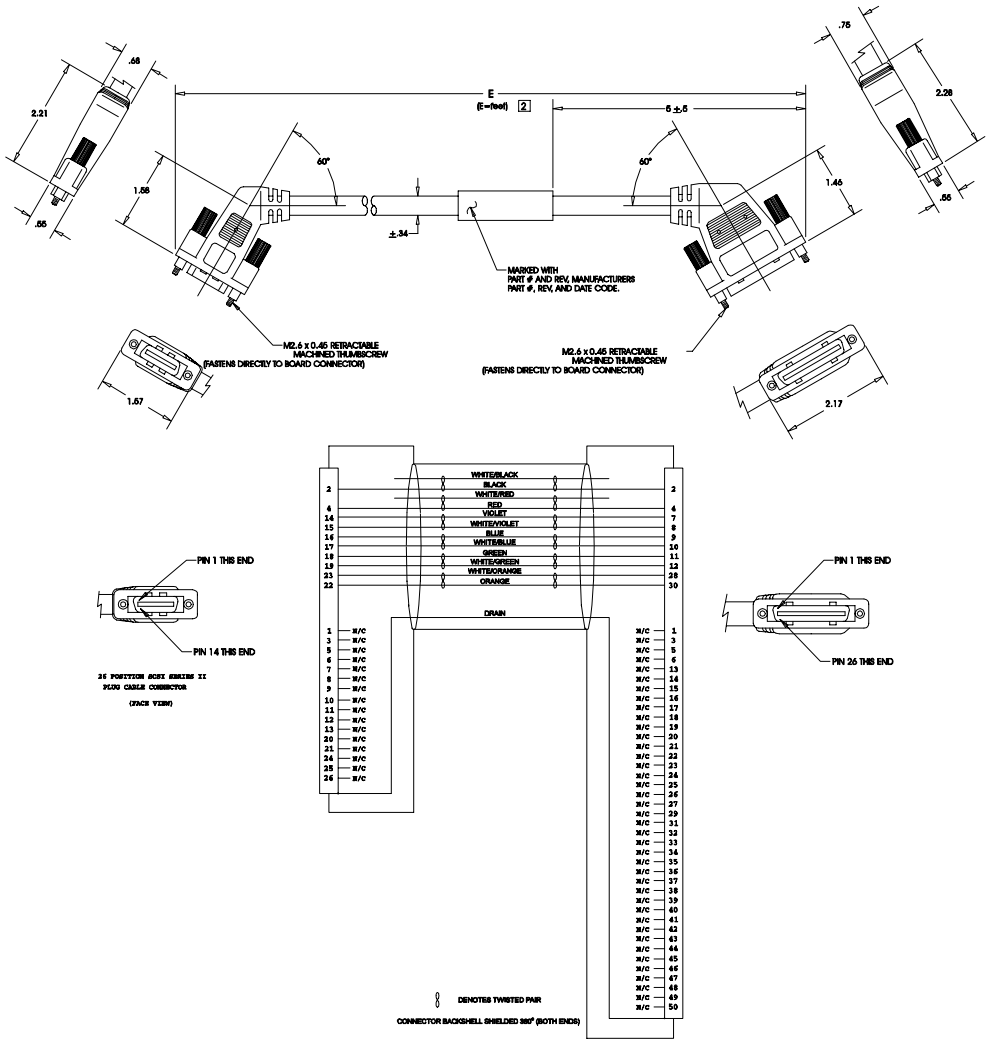


FIGURE B.1 J1 to J3 Interface Cable (P/N 401-34422)

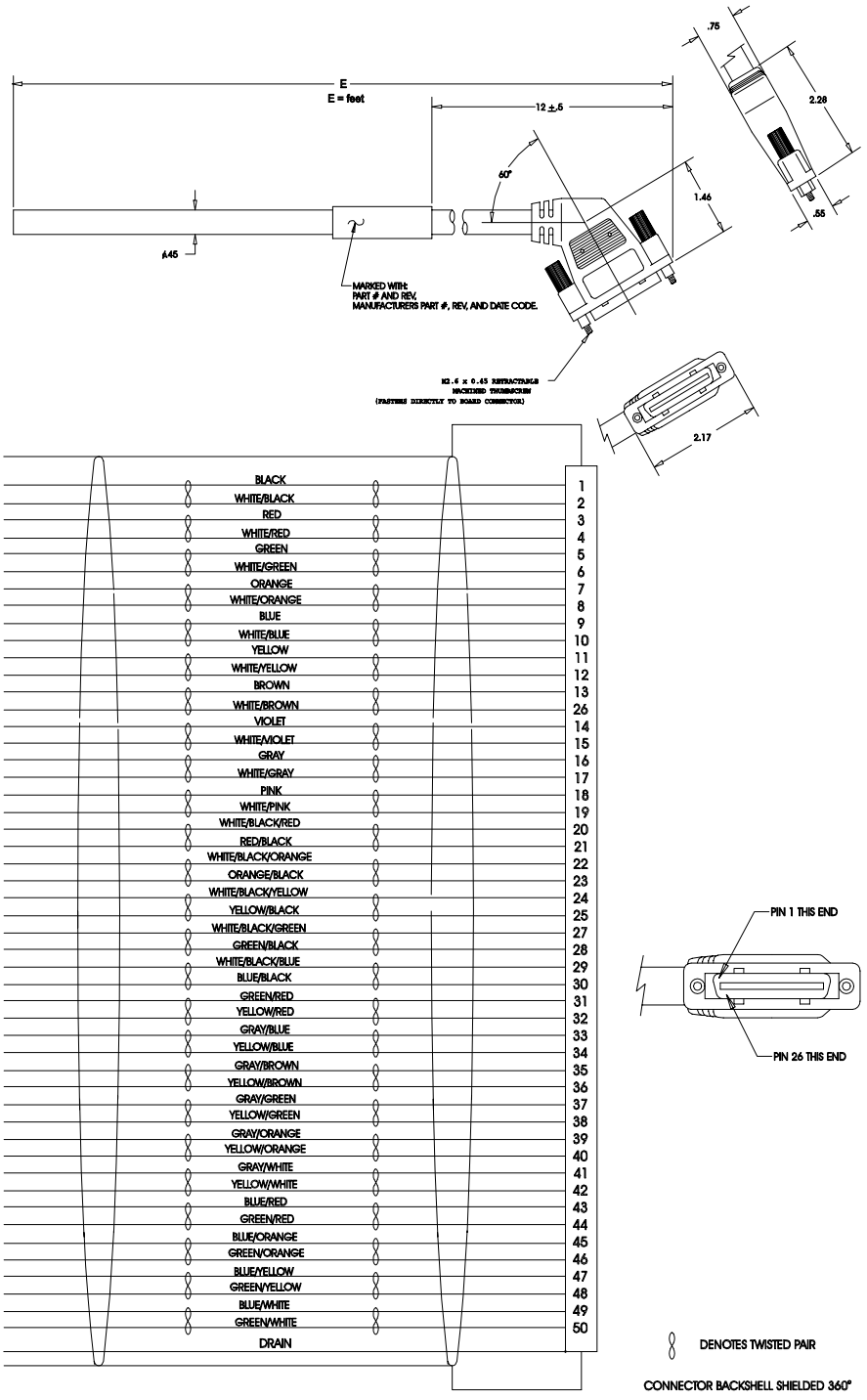


FIGURE B.2 J1 to No Connector Interface Cable (P/N 401-34411)

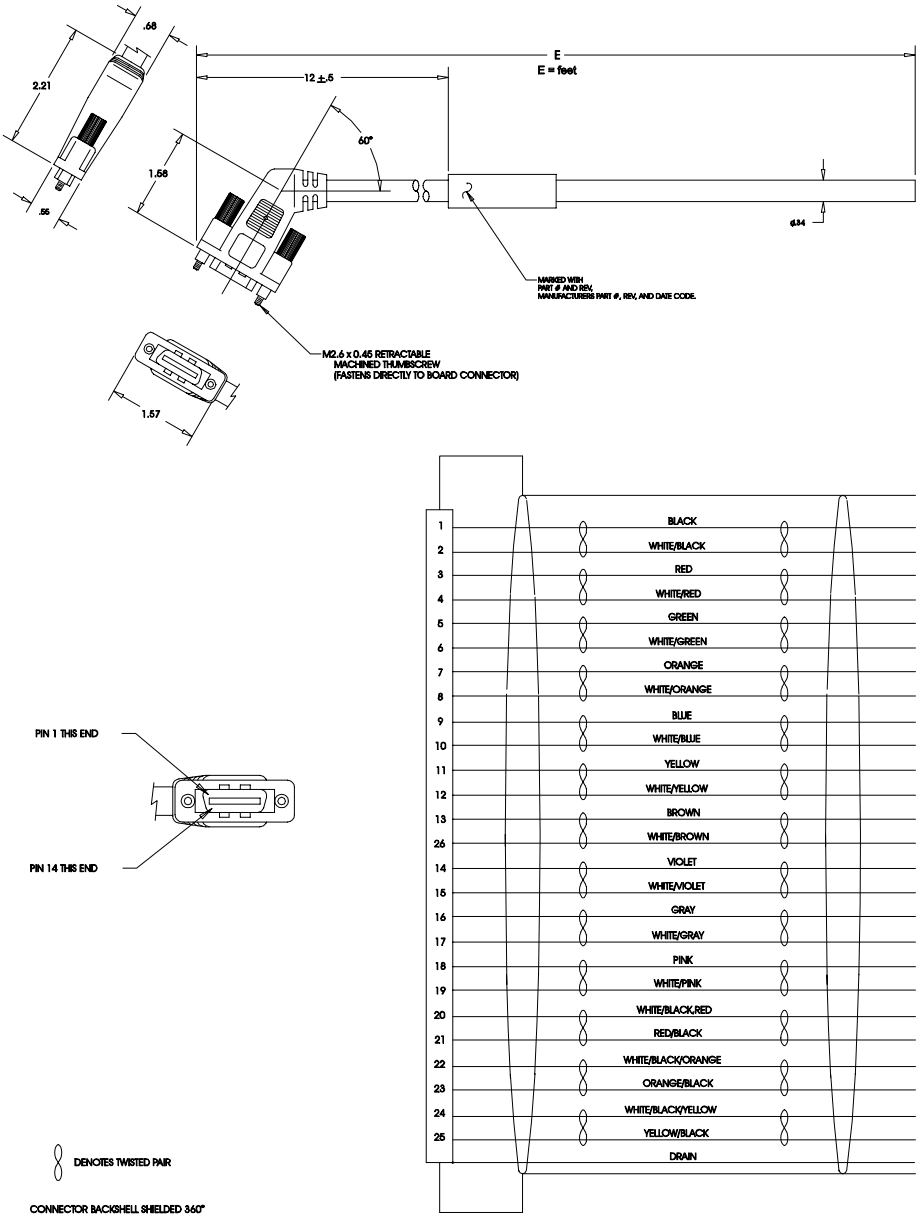
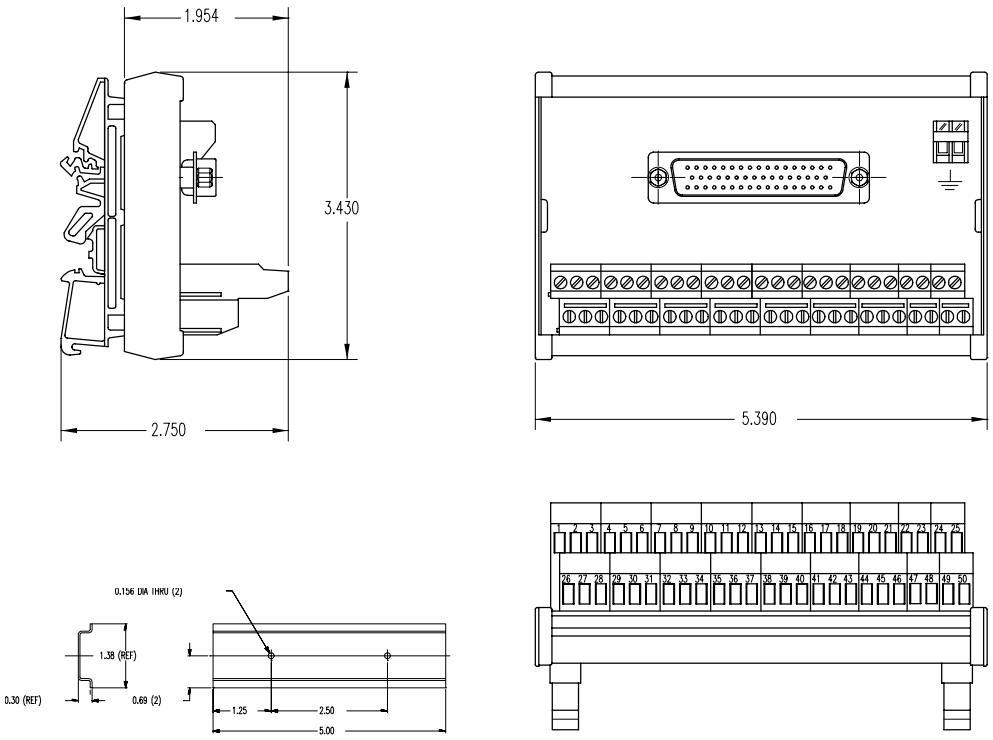


FIGURE B.3 J3 to No Connector Interface Cable (P/N 401-34410)



Mounting bracket (shown) and cable supplied with 401-34409-00 kit.

NOTES:

The terminal block and cable provide a one-to-one transfer of the signals from the connector to the respective pin(s) on the terminal block.

The cabling examples beginning on page B-201 depict the use of this kit to pass a cable through a restricted bulkhead.

FIGURE B.4 **J1 to 50-pin Terminal Block Kit Diagram (P/N 401-34409-00)**

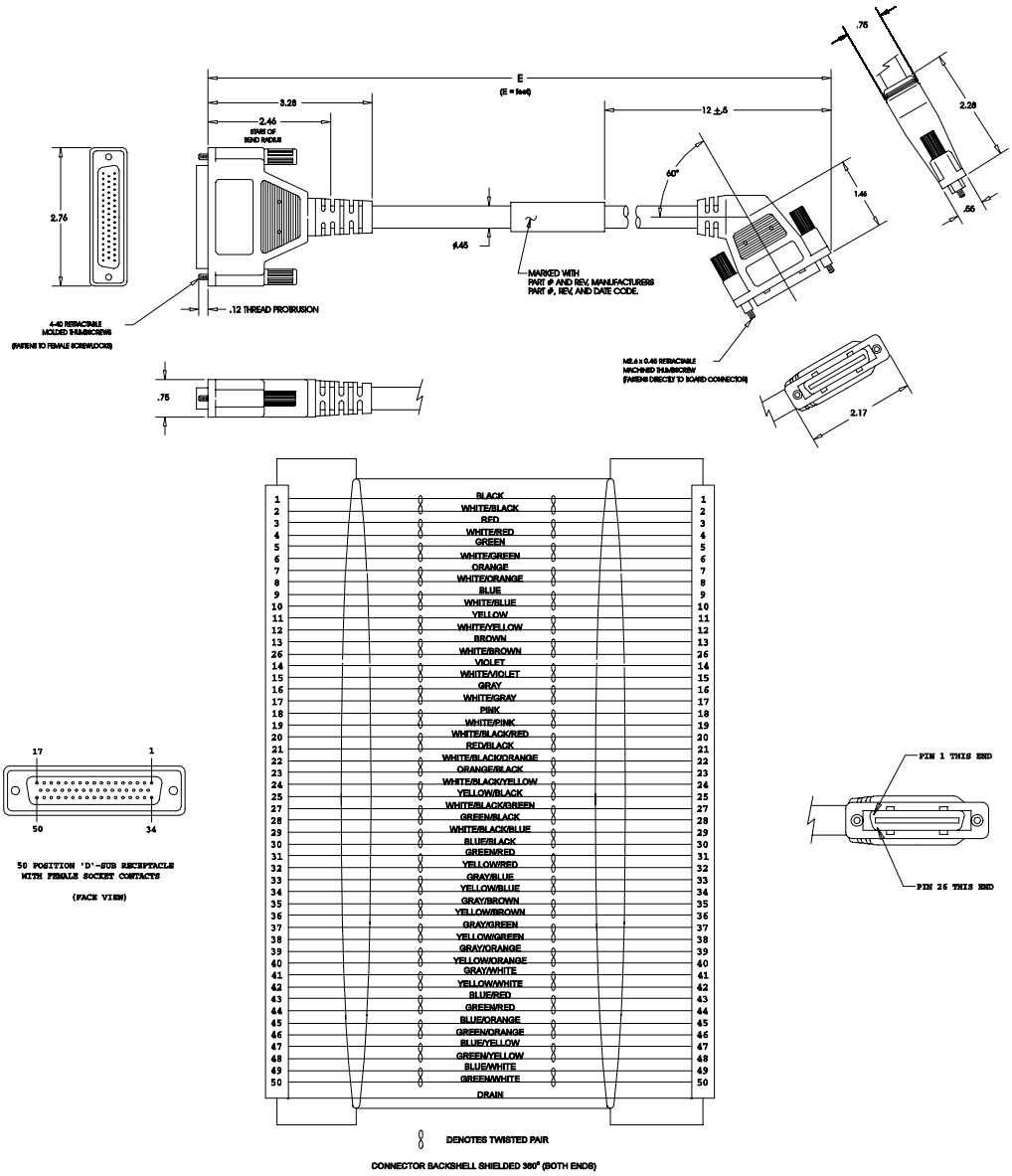
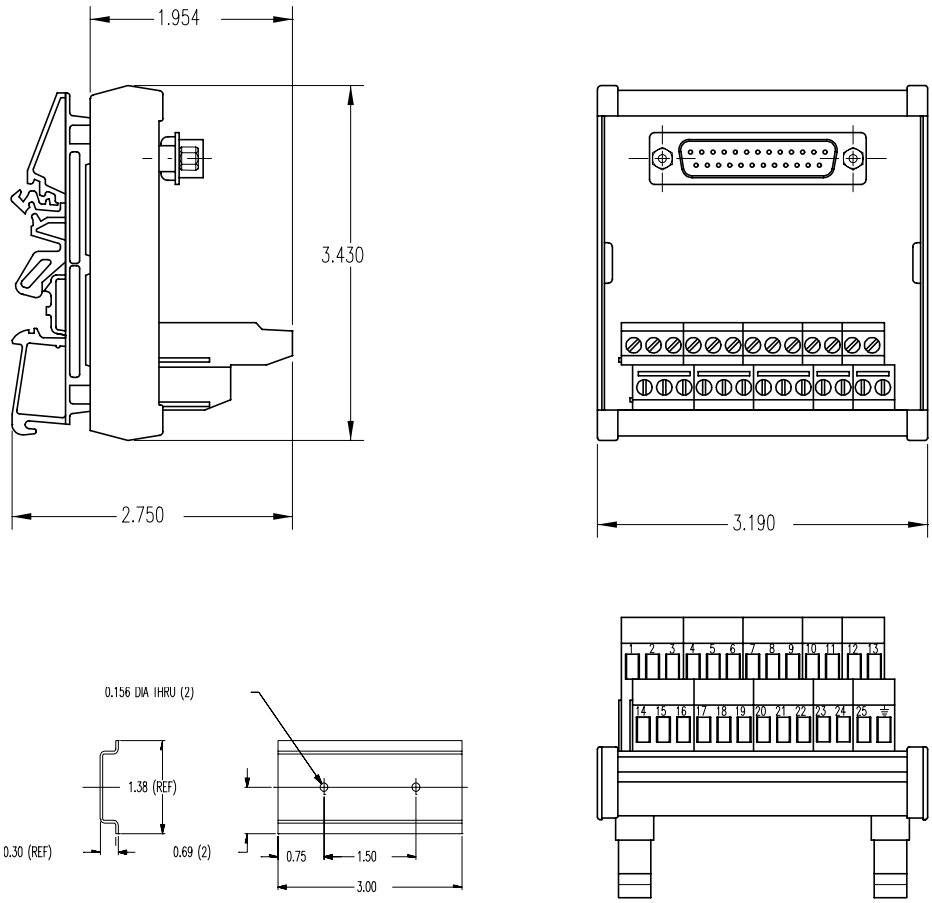


FIGURE B.5 J1 to 50-pin D-Connector Cable (supplied with 401-34409 kit)



Mounting bracket (shown) and cable (next page) supplied with kit 401-34408.

NOTES:

The terminal block and cable provide a one-to-one transfer of the signals from the connector to the respective pin(s) on the terminal block.

The cabling examples beginning on page B-201 depict the use of this kit to pass a cable through a restricted bulkhead.

FIGURE B.6 J2 to 25-pin Terminal Block Kit Diagram (P/N 401-34408-00)

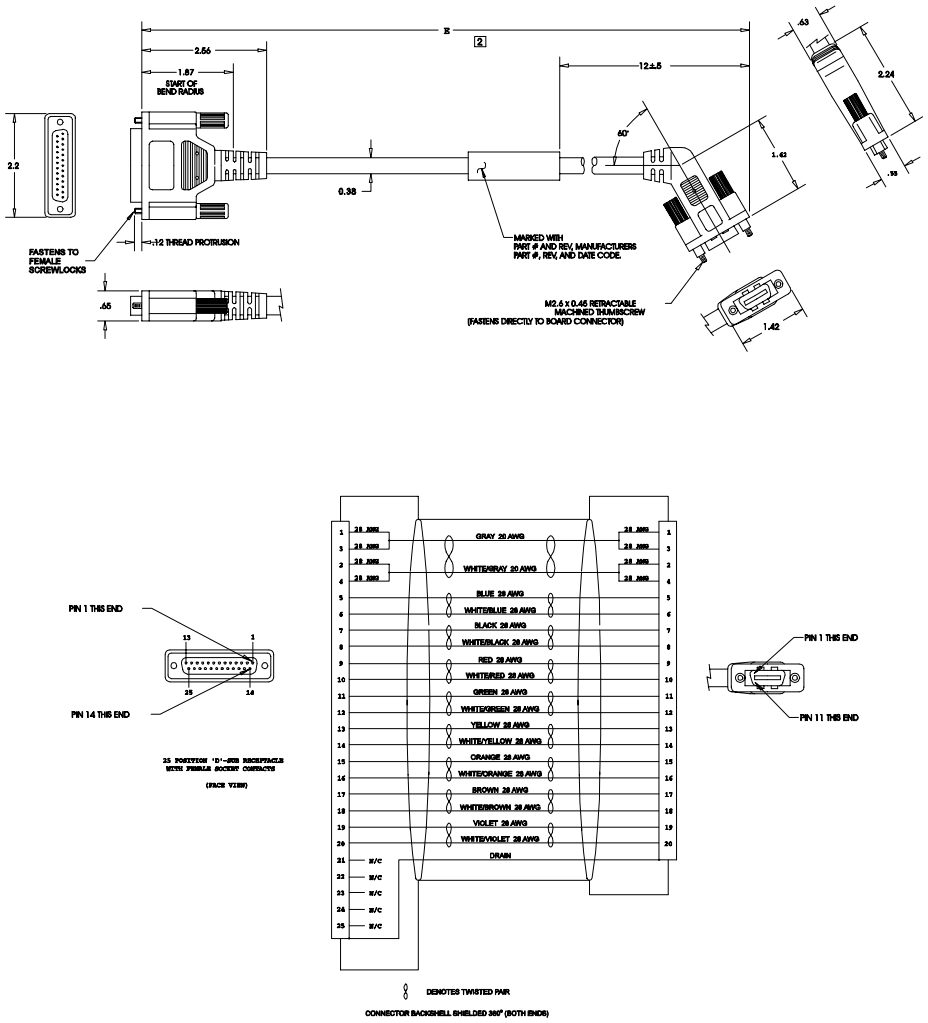


FIGURE B.7 J2 to 25-pin D-Connector Cable (supplied with kit 401-34408)

Serial Interface Cables

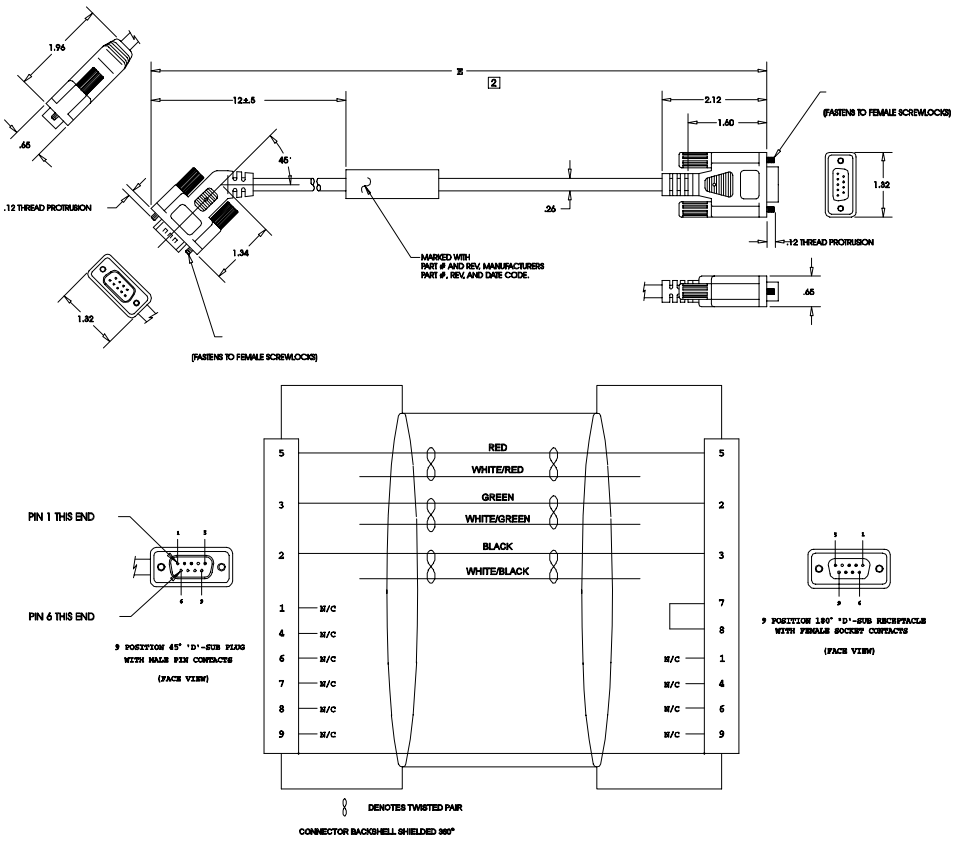


FIGURE B.8 J5 to 9-pin D-Shell Interface Diagram (P/N 502-04020-XX)

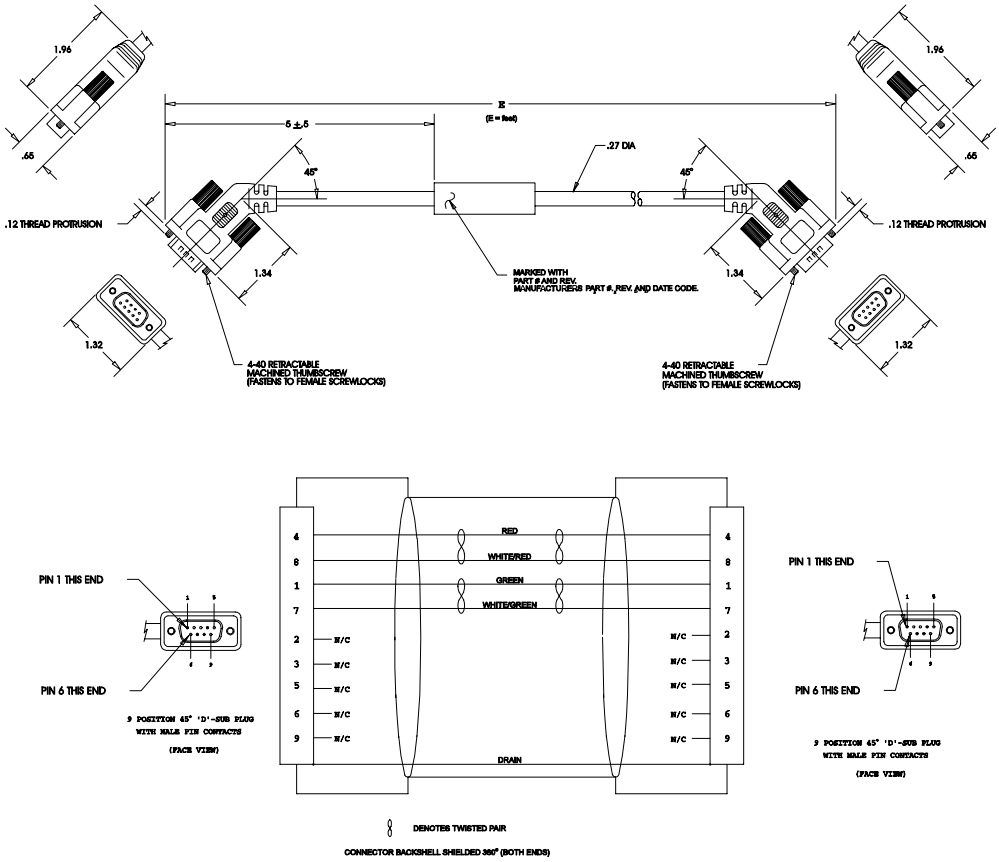


FIGURE B.9 J5 to J5 Serial Interface Cable (P/N 502-04021-XX)

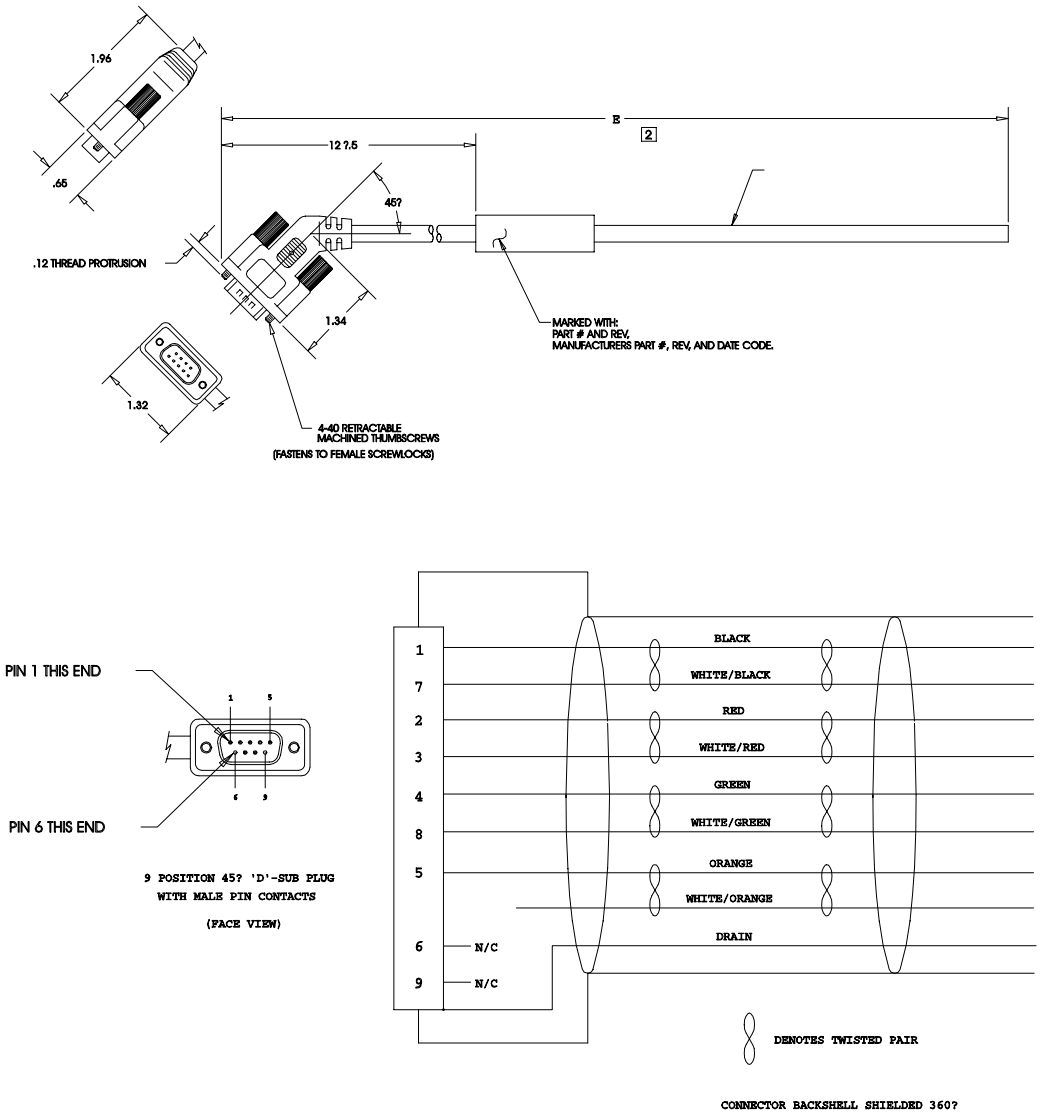


FIGURE B.10 J5 to No Connector Serial Interface Cable (P/N 401-34423-XX)

Encoder Feedback Cables

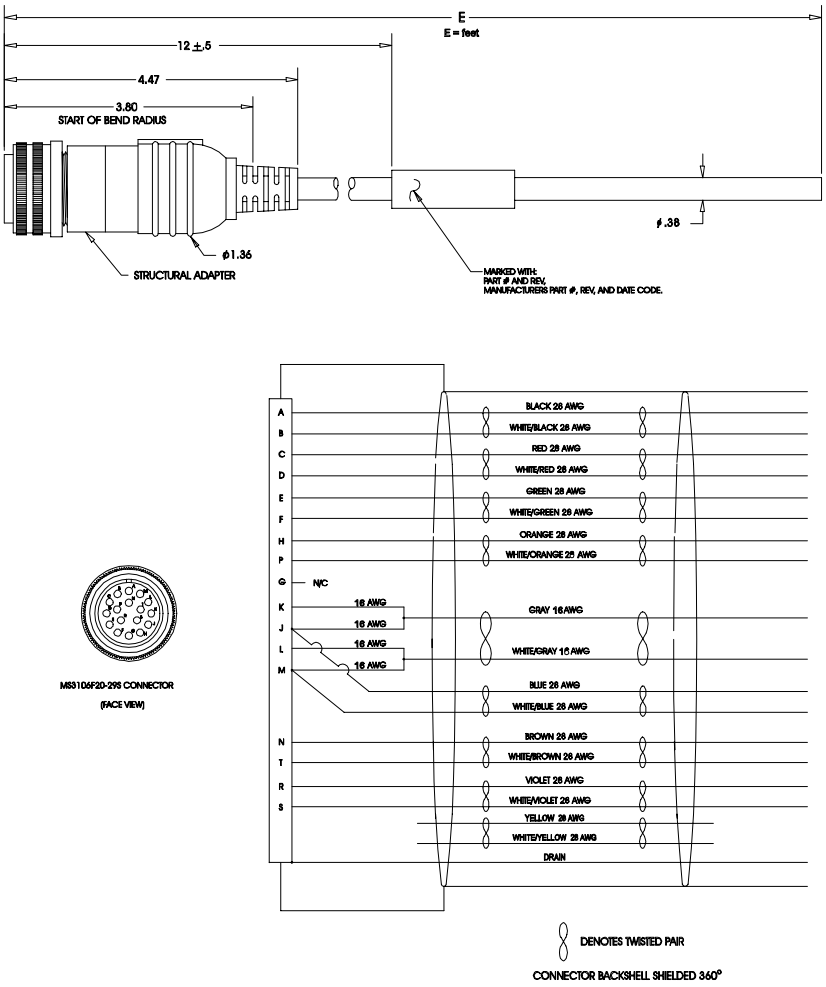


FIGURE B.11 FSM, HSM or SSM Series Motors to No Connector Encoder Cable (P/N 401-34425-XX)

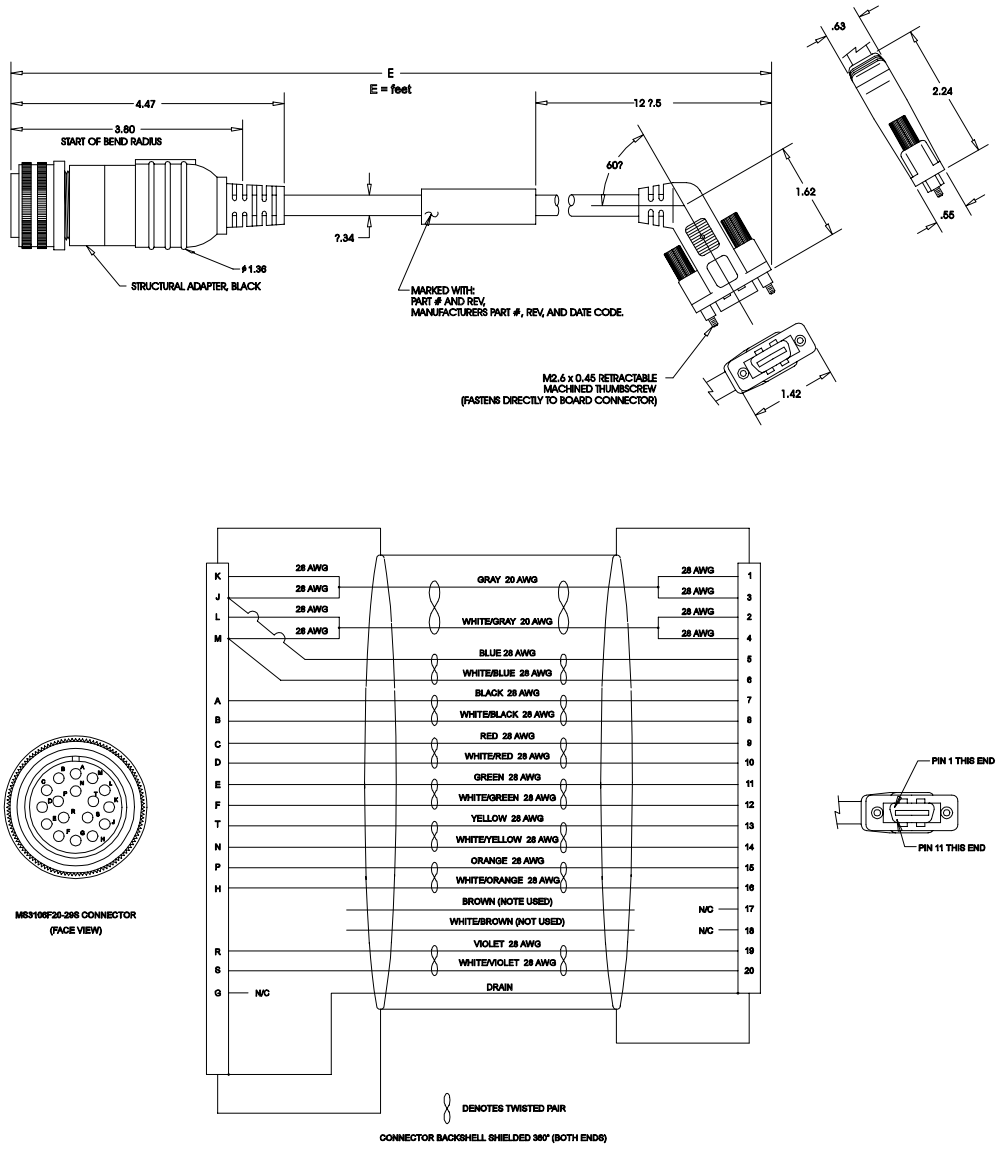


FIGURE B.12 J2 to FSM, HSM or SSM Series Encoder Cable (P/N 401-34407-XX)

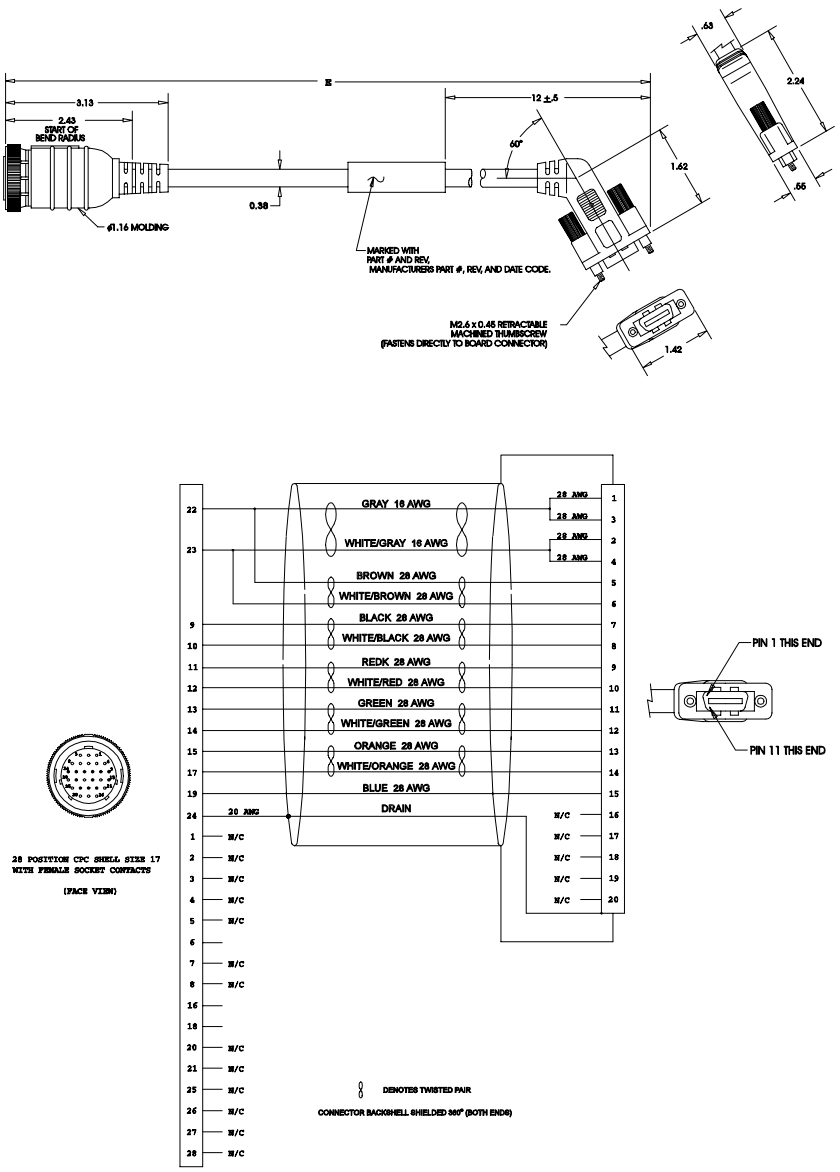


FIGURE B.13 J2 to YSM Series Encoder Cable (P/N 401-30233-XX)

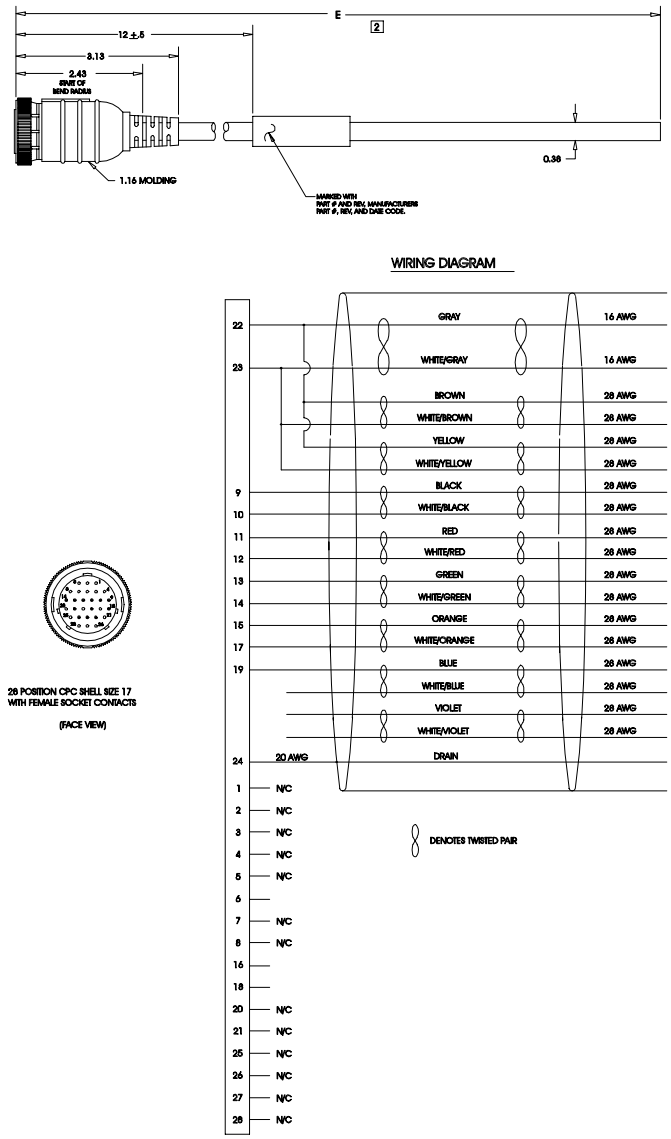
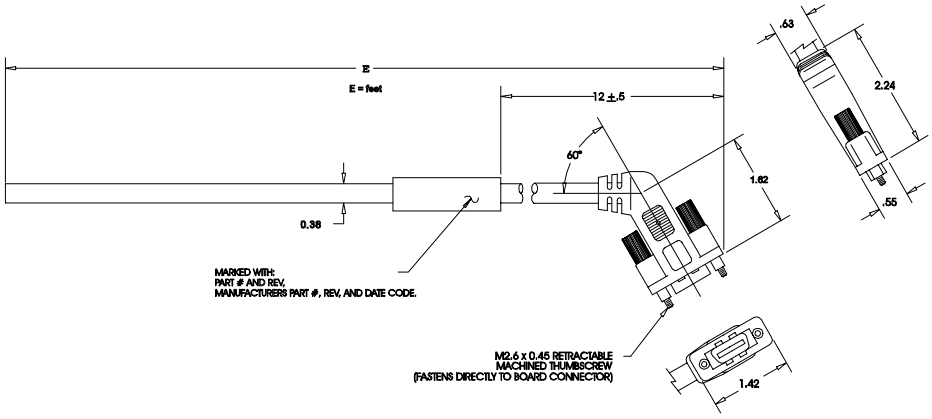


FIGURE B.14 No Connector to YSM Series Encoder Cable (P/N 401-30253-XX)



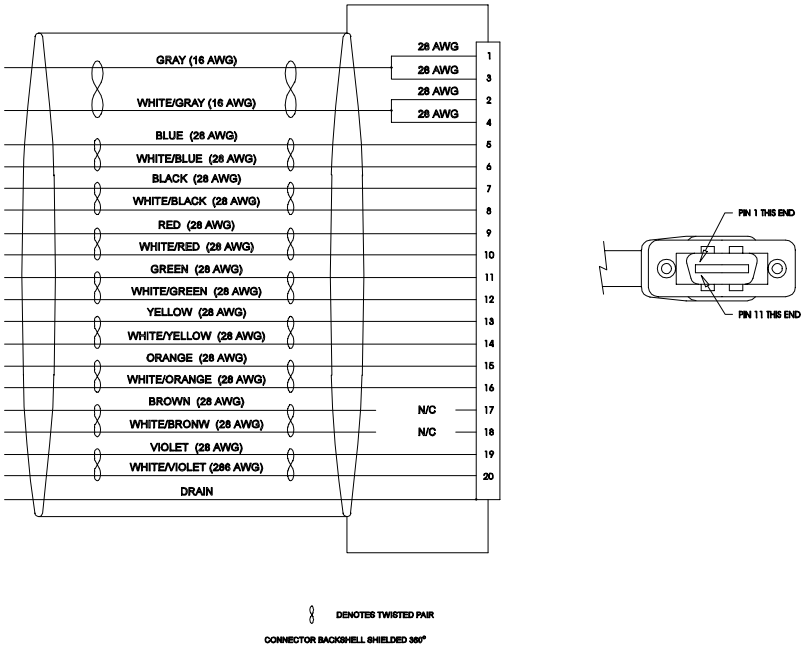


FIGURE B.15 **J2 to No Connector Encoder Cable (P/N 401-34424-XX)**

Motor Power Cables

CAUTION

Shielded power cables must be grounded at a minimum of one point for safety. Failure to ground a shielded power cable will result in potentially lethal voltages on the shield and anything connected to it.

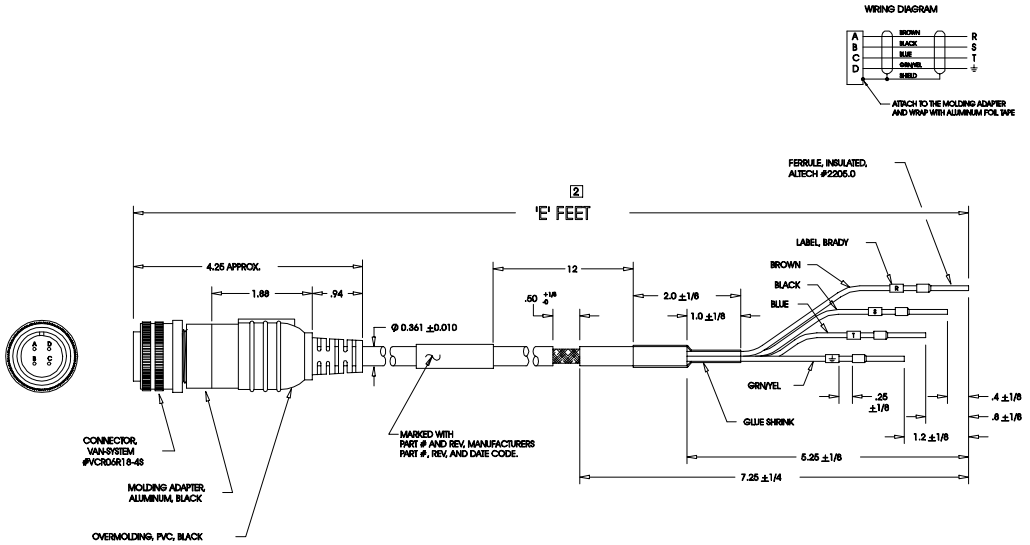


FIGURE B.16 **200 or 300 FSM, HSM or SSM Series Power Cable (P/N401-34413-XX)**

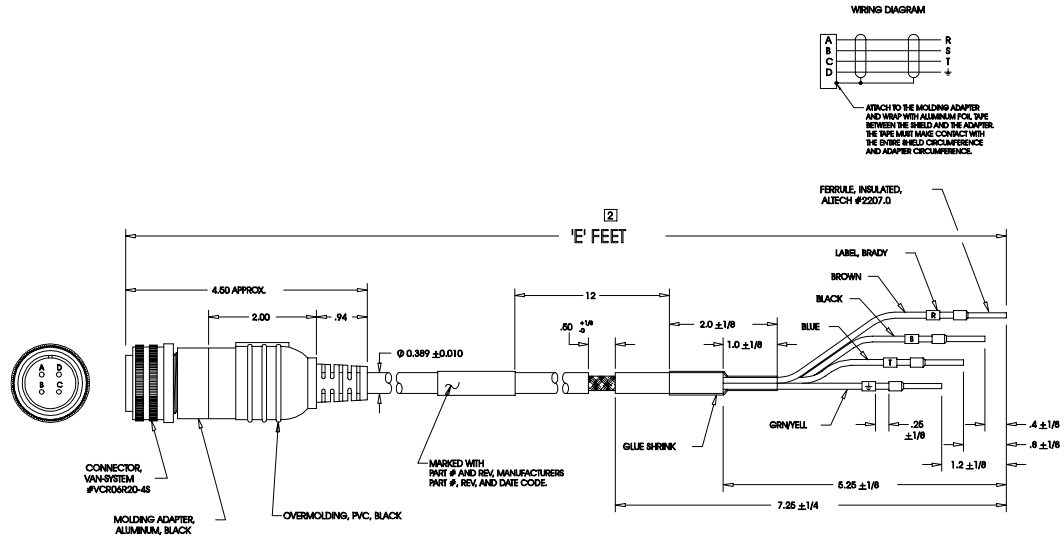


FIGURE B.17 **400 FSM, HSM or SSM -Series Power Cable (P/N 401-34414-XX)**

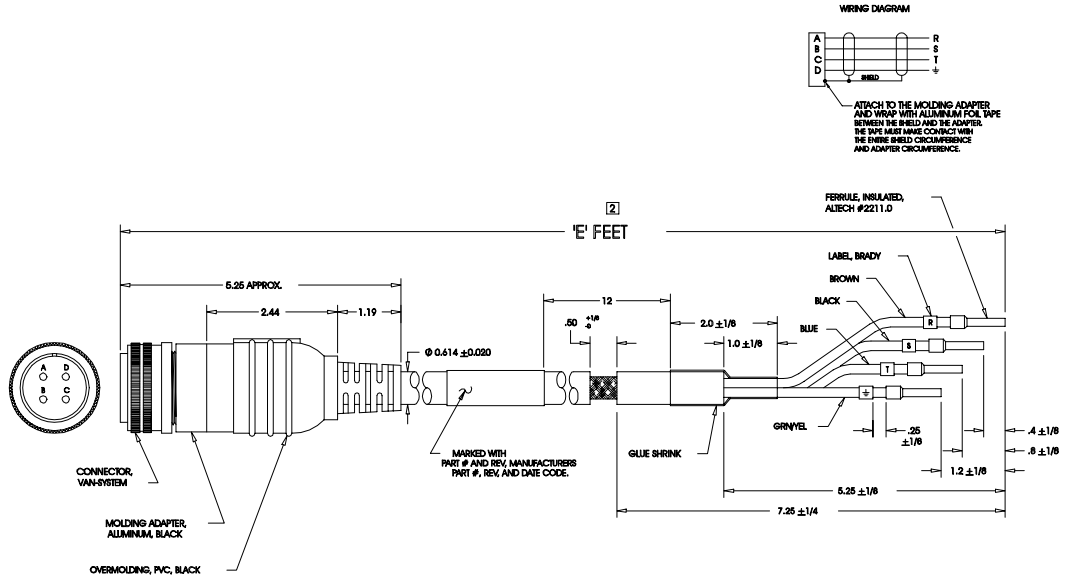


FIGURE B.18 **610 or 620 FSM, HSM or SSM Series Power Cable (P/N 401-34415-XX)**

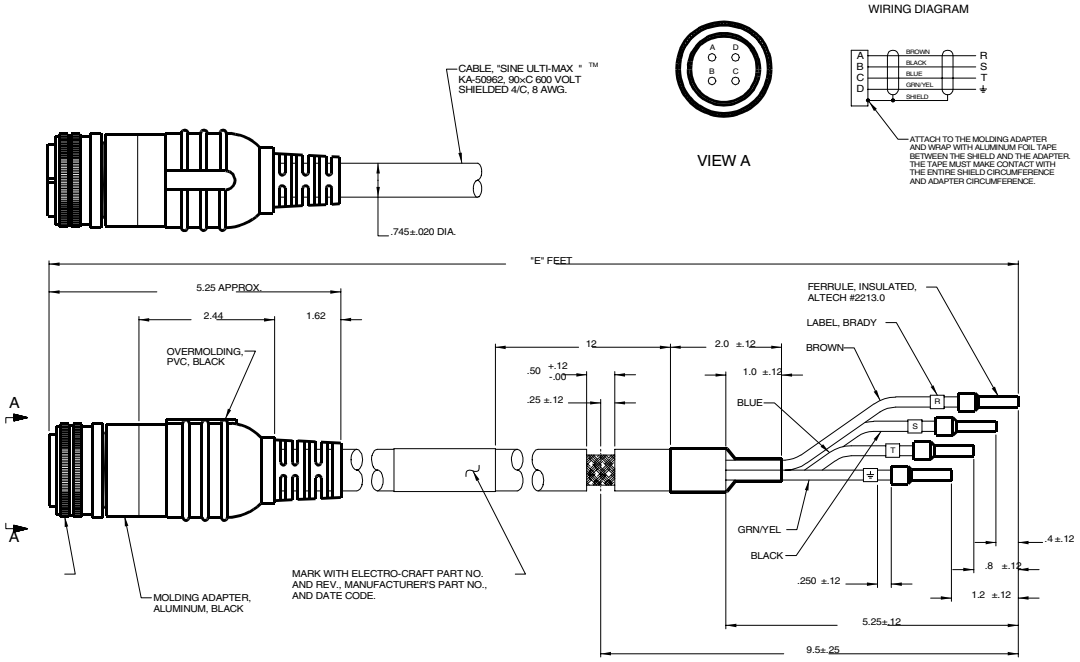


FIGURE B.19 **630 SSM or HSM Series Power Cable (P/N 401-34416-XX)**

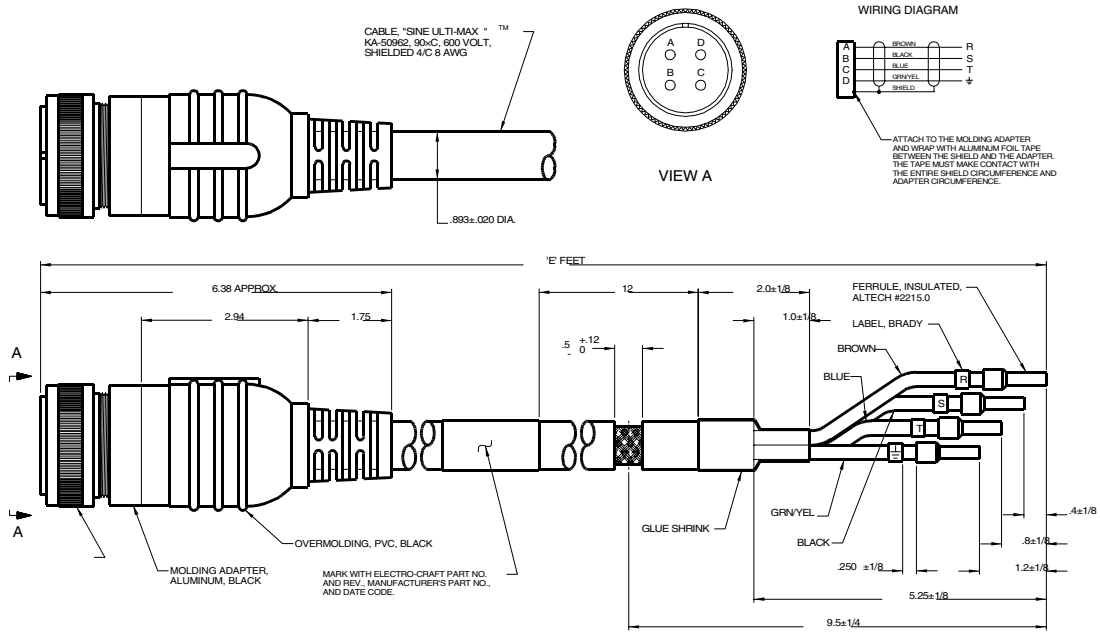


FIGURE B.20 **800 SSM or HSM Series Power Cable (P/N 401-34417-XX)**

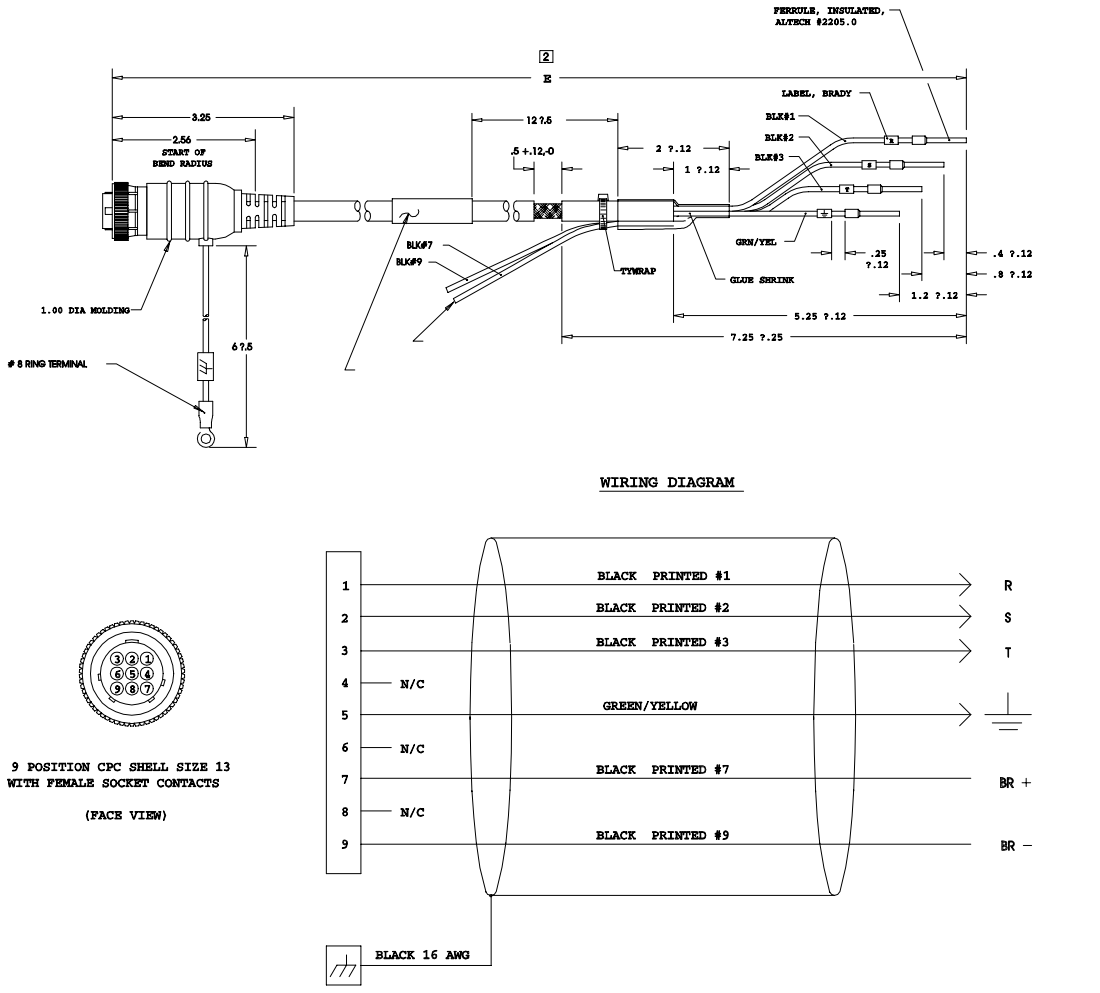
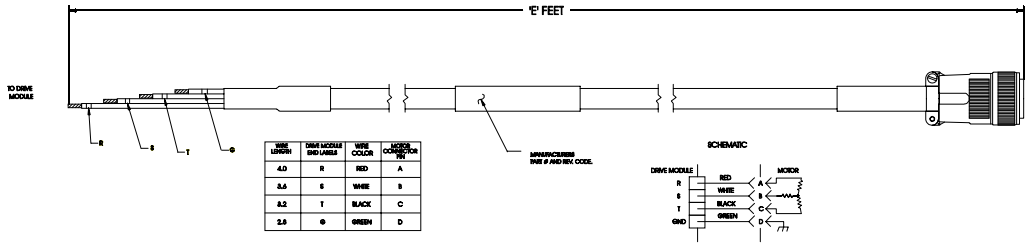


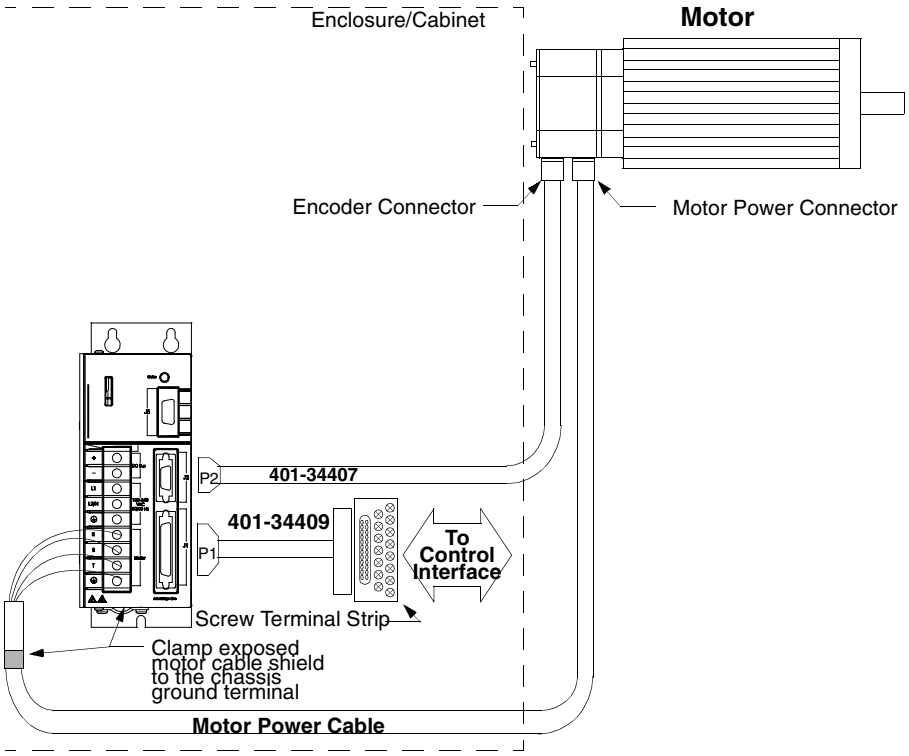
FIGURE B.21 **YSM Series Power Cable (P/N 401-30232-XX)**



NOTE: This cable is not CE marked.

FIGURE B.22 DSM175 to 600 Motors (FSM, HSM or SSM Series)(Part number to be determined, contact factory)

Cabling Examples



NOTES:

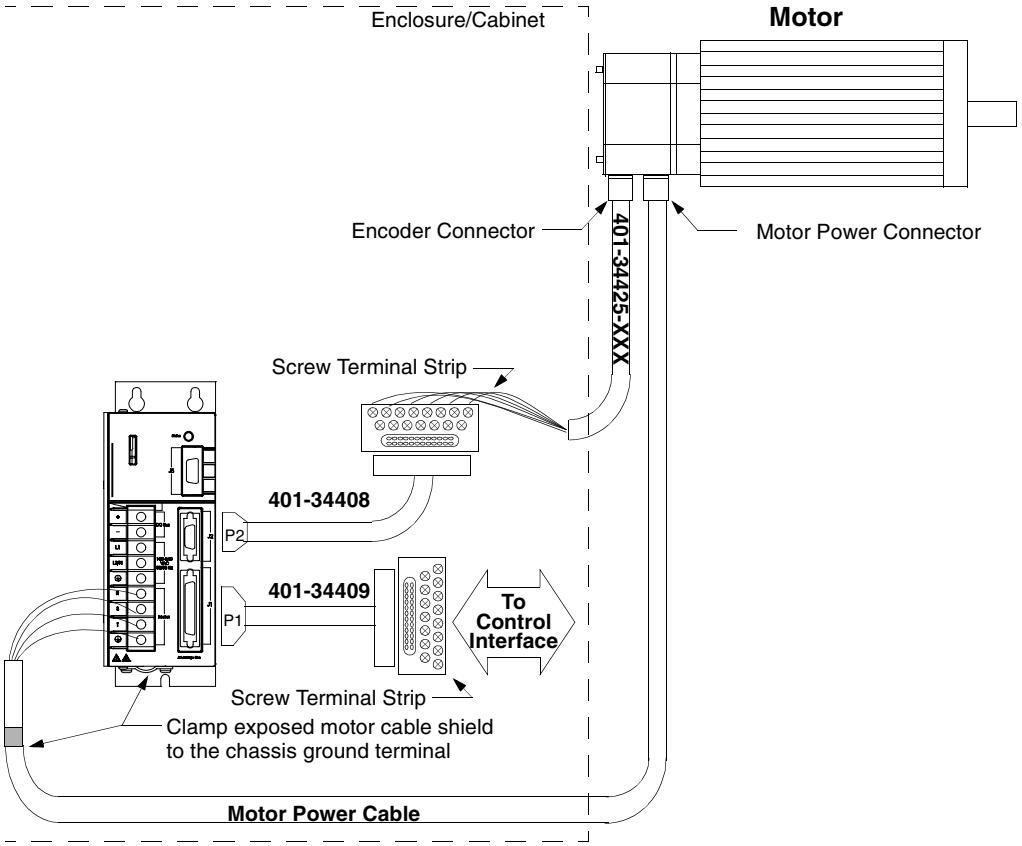
This wiring method should be used to run cables through a bulkhead or enclosure without removing the connectors.

Cable 401-34407-XXX has connectors on both ends. The connectors are molded and potted to the cable and may not be disassembled.

Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

Motor Power Cables - Use Centurion DSM100 Drive cables if the CE Mark is required. Other cables may be used if the CE Mark is not an issue. In either case, the shield on the motor power cable must be properly grounded at both ends; the shield is grounded at the motor end when the MS connector is mated.

FIGURE B.23 FSM, HSM or SSM Series Motors to Centurion DSM100 Drive



NOTES:

This wiring method provides the option to run cables through a restrictive bulkhead or enclosure.

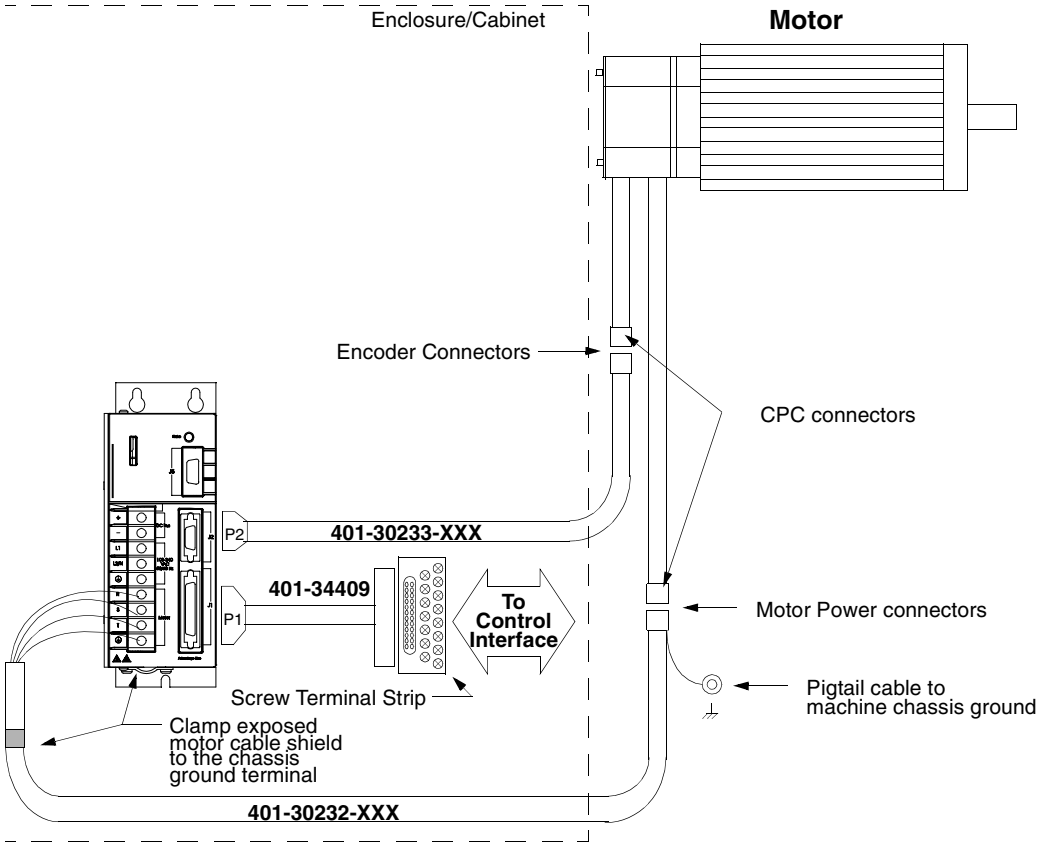
Cable 401-34425-XXX has a connectors on the motor end only. The cable connector is molded and potted to the cable and may not be disassembled. Refer to the schematic for cable 401-34407-XXX for information on wiring this cable to the J2 Terminal Strip.

Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

Adaptor Kit 401-34408 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 20-pin Mini D Ribbon connector at the drive end and a 20-pin D connector at the terminal strip end.

Motor Power Cables - Use Centurion DSM100 Drive cables if the CE Mark is required. Other cables may be used if the CE Mark is not an issue. In either case, the shield on the motor power cable must be properly grounded at both ends; the shield is grounded at the motor end when the MS connector is mated.

FIGURE B.24 FSM, HSM or SSM Series Motors to Centurion DSM100 Drive using P2 Terminal Strip



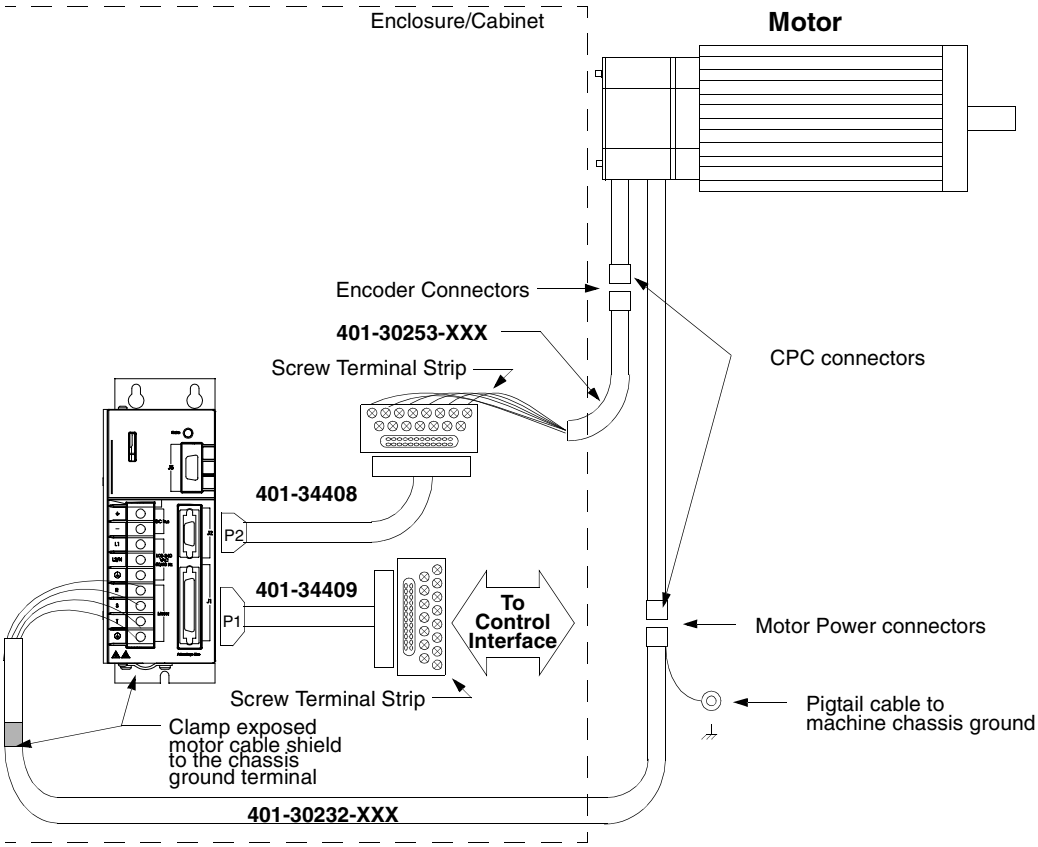
NOTES:

This wiring method should be used to run cables through a bulkhead or enclosure without removing the connectors.

Cable 401-30233-XXX has connectors on both ends. The connectors are molded and potted to the cable and may not be disassembled.

Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

FIGURE B.25 YSM Series Motors to Centurion DSM100 Drive



NOTES:

This wiring method provides the option to run cables through a restrictive bulkhead or enclosure.

Cable 401-30253-XXX has a connector on the motor end only. The cable connector is molded and potted to the cable and may not be disassembled. Refer to the schematic for cable 401-30233-XXX for information on wiring this cable to the J2 Terminal Strip.

Adaptor Kit 401-34409 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 50-pin Mini D ribbon connector at the drive end and a 50-pin D connector at the terminal strip end.

Adaptor Kit 401-34408 includes the 3 foot cable, screw terminal strip and mounting bracket. The cable has a 20-pin Mini D Ribbon connector at the drive end and a 20-pin D connector at the terminal strip end.

FIGURE B.26 YSM Series Motors to Centurion DSM100 Drive using P2 Terminal Strip

TouchPad Instructions

C

The optional TouchPad is a compact and rugged device for interfacing with Centurion DSM100 Drives. It provides the operator with a convenient device for accessing status information, program variables, and control functions, plus message display capabilities on any Centurion DSM100 Drive.

An 8-character dot matrix display and a sealed-membrane type keyboard are housed in a compact case. A locking tab and a single 9-pin D shell serial connector on the backpanel connects the TouchPad to any Centurion DSM100 Drive via four-wire RS-485 communications.

Four cursor keys and a Mode/Enter key provide access to the TouchPad menus and enable the user to select and change parameters, activate commands, and monitor drive variables. The TouchPad also allows the user to display drive status and diagnostic information, and to control functions, such as distances, speeds, and other alphanumeric data.

Installation and Operation

1. Power down the drive.
2. Plug the TouchPad into the serial port on the Centurion DSM100 Drive by latching the tab into the drive and then mating the connector as shown.

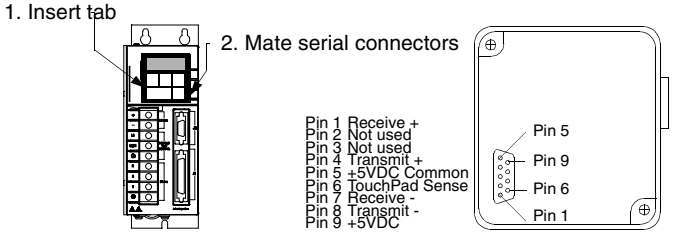


FIGURE C.1 **TouchPad Connection and Pinouts**

3. Power-up the drive. Installing the TouchPad defaults the drive to the following settings:

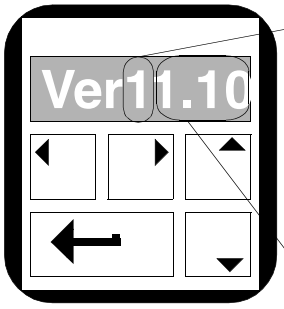
   - Address 0
   - 8 Data bits
   - No Parity bit
   - 19200 Baud
   - 1 Stop bit

   The personality module settings stored in the drive are not affected by the installation or removal of the TouchPad.

4. Verify the **Ver##.##** displayed is correct at power-up. The version number designates the type of drive and its firmware level. Figure C.2 explains this display.

   If you are referring to the TouchPad Command Tree card, verify the version number display and the Drive Type and Firmware Version of the card are the same.

5. After self-test is completed, the TouchPad display defaults to the branch title **DRVSETUP**.



Drive Type:

1 = DSM110 or DSM110P,
DSM120 or DSM120P,
DSM130 or DSM130P,
DSM175 or DSM175P,
DSM 1150 or DSM 1150P

2 = DSM 007 or DSM 007P,
DSM 015 or DSM 015P,
DSM 030 or DSM 030P

Firmware Level:

1.00 = Version 1.00
1.10 = Version 1.10
2.00 = Version 2.00 (Indexing capable)

FIGURE C.2 TouchPad Version Number Display

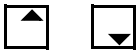
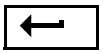
6. Horizontal and vertical movement through the TouchPad Command Tree and parameter modification is explained below. The “TouchPad Command Tree” on page C-208 illustrates the structure.

TouchPad Commands

Commands are entered by pressing a single key or combination of keys. Two modes of operation are available. Parameter mode allows you to move through the TouchPad Command Tree to each parameter. Modify mode allows you to monitor and change each parameter, often while the drive is operational.

Key	Function
 **Mode/Enter**	Toggles the parameter display between the two operating modes. **Parameter** mode shows the abbreviated command name of the selected parameter. Refer to the TouchPad Command Tree Chart for a full text definition. **Modify** mode shows the setting, often a number, for the selected parameter. Key functions in each mode are explained below.

The Parameter mode displays for the TouchPad Command Tree are explained in the "Supplemental Instructions" on page C-210.

	Mode of Operation	
Key	**Parameter**	**Modify**
 **Left Arrow**	**Previous Branch/Decrement #** Selects the previous branch in the command tree, or Decreases the Preset number when in Preset Drive Parameter mode.	**Move Left** Moves the flashing character selection to the left, advancing the level of the cursor setting. For example: **00052**00 ◻ **0005**200
 **Right Arrow**	**Next Branch/Increment #** Selects the next branch in the command tree, or Increases the Preset number when in Preset Drive Parameter mode.	**Move Right** Moves the flashing character selection to the right, lowering the level of the cursor setting. For example: **0005**200 ◻ **00052**00
 **Down Arrow**	**Next Parameter** Selects the next parameter down the branch of the command tree.	**Decrement Character** Decreases the selected character(s). For example: 2 ◻ 1, or B ◻ A
 **Up Arrow**	**Previous Parameter** Selects the next parameter up the branch of the command tree.	**Increment Character** Increases the selected character(s). For example: 1 ◻ 2, or A ◻ B
 **Up & Down Arrows** *Press both keys at the same time*	Not functional in this mode.	**Undo Change/Escape** Restores a changed parameter to its original setting. NOTE: This command must be performed before moving to another parameter or branch.
 **Mode/Enter**	**Next Mode/Last Parameter** When displaying a parameter, enters the **Modify** mode of operation. When displaying a branch title, selects the last parameter modified in branch.	**Next Mode** Returns the display to the **Parameter** mode of operation.

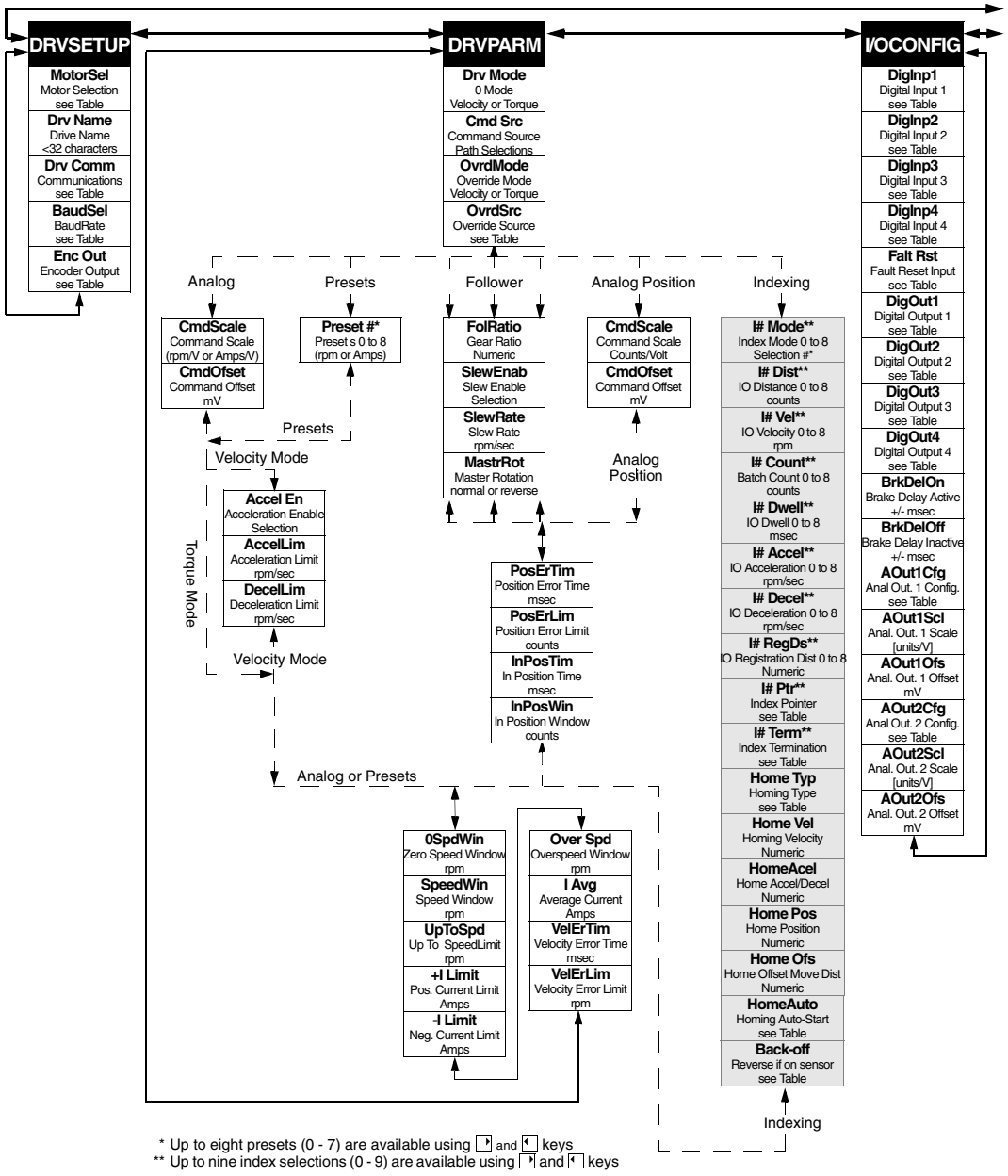


FIGURE C.3 **TouchPad Command Tree** (sheet 1 of 2)

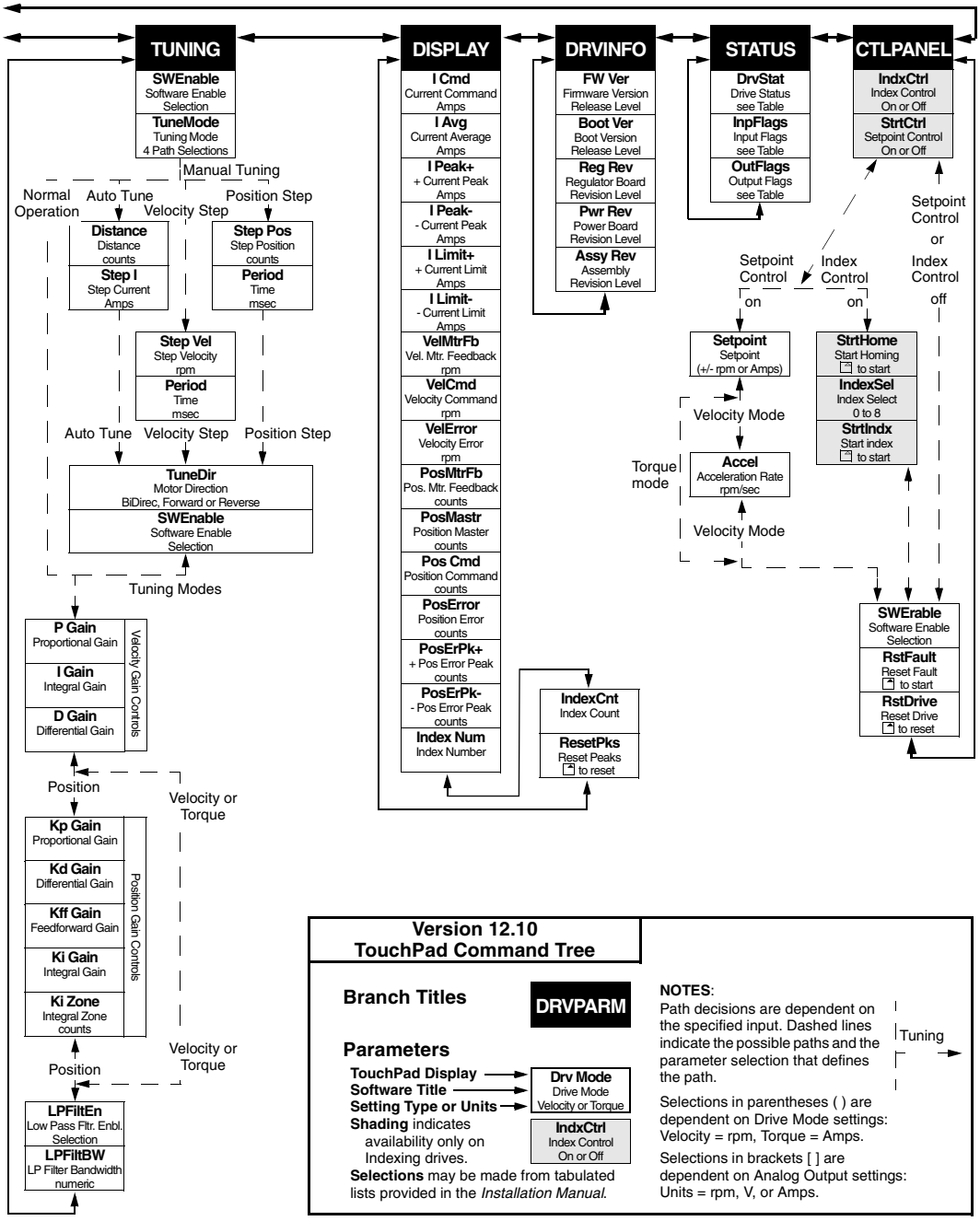


FIGURE C.3 **TouchPad Command Tree** (sheet 2 of 2)

Supplemental Instructions

Motor Selection

Enter a Motor Identification number to load the correct motor parameters into the drive. Table C.2 and Table C.3 list the motors available in the motor table directory.

Displays

Selection of a motor defines default operating parameters for the drive and motor combination.

Text

A drive name longer than eight characters may require scrolling with the Left, ◄, and Right, ►, arrow keys. Drive names may be up to 32 characters in length.

Flashing characters in the Modify mode display are the characters that are active.

- Change the cursor position and resolution using the ► and ◄ keys. For example: If the Drv Name in the Modify mode displays **InFeed** with the F flashing, pressing the ► key causes the first **e** to flash.
- Press the ▲ or ▼ keys to increment or decrement a character by scrolling through the list of valid ASCII characters. For example, If the Drv Name in the Modify mode displays **InFfed** with the lowercase **f** is flashing, pressing the ▼ key causes the flashing character to decrement to **e**.

Numeric

Flashing characters in the Modify mode display are the numbers that are active.

- Change the cursor position and resolution using the ► or ◄ key. For example: If the Over Spd in the Modify mode displays **5200** and **52** is flashing, pressing the ► key causes **520** to flash.
- Press the ▲ or ▼ key to increment or decrement these numbers.
  For example: If the Over Spd value is **5200** and **52** is flashing, pressing the ▲ key causes the setting to increment by 100 rpm each time the key is pressed.
- Parameter values may not exceed the maximum or minimum limits, regardless of the cursor position. For example: If the SpeedWin setting is **5000** rpm and the Maximum Speed in the motor table is **5200**, pressing the ▲ key increases the parameter to **5200** (the upper limit), but pressing the ▼ key decrements the parameter to **4000**.

The most significant digit is reserved when a parameter allows a negative (-) setting or the parameter provides a list of possible selections. The ▲ or ▼ key toggles the minus sign.

List

The most significant digit is reserved for an active/inactive selection marker when a parameter provides a list of possible selections.

- A filled arrow, ➧, in the most significant digit indicates the active setting from a list of possible settings. Inactive settings are indicated by a unfilled arrow, ⇨.
  For example: If the drive is functioning as Preset Controller in the Velocity mode, pressing the ⌄ key from DRVPARAM scrolls through the **CmdSrc** list which includes ➧**Presets**, ⇨**AuxEnc**, ⇨**StepDir**, ⇨**StepU/D**, and ⇨**Analog**.
- The Mode/Enter, ↵, key selects a parameter from the list.
- List selections that are undefined are indicated by ➧ **Unknown**. This display indicates the TouchPad data table is incompatible with the drive.

Lists are associated with all parameters, except **DISPLAY** and **DRVINFO**. Refer to page C-214 for items in each list. Table C.17, "Drive Status List for TouchPad" on page C-216 is read-only; all other lists contain possible parameter selections. After an option is selected, the display reverts to the parameter from which the option was selected. For example: Selection of the EncAlign parameter under STATUS provides the options ➧ Normal and ⇨ Align. Selection of either option returns you to the EncAlign display.

Ratio

A **FolRatio** (gear ratio) longer than eight characters may require scrolling with the › and ‹ keys. The ratios are numeric values that increment or decrement by 1 each time the ⌃, or ⌄, key is pressed.

The method of display is dependent on the length of the ratios:

- If the ratio is eight characters or less, it is displayed in full.
  For example, a Master to Follower ratio of one-thousand to nine-hundred is displayed as **1000:900**.
- If the ratio requires more than eight characters the ratio is displayed in two parts: a Master Ratio and a Follower Ratio. The position of the colon (:) after or before each numeric value indicates Master or Follower for these larger ratios.
  The › and ‹ keys toggle between the Master Ratio and the Follower Ratio.
  For example: A Master to Follower ratio on 1001:1000 is displayed in two separate displays. The Master Ratio is displayed as **1001:** and pressing › displays the Follower Ratio **:1000**.

Fault/Error/Warning

Table C.1lists the possible fault, error and warning messages that may appear on the TouchPad. The items below describe the different types of messages.

- The TouchPad displays **Fault** and a description. A Fault message requires additional troubleshooting of the drive.
  Clear the fault display by depressing the ⌃ and ⌄ keys simultaneously.
  Fault codes are stored in the TouchPad parameter **DrvStat** and are explained with troubleshooting guidelines in Table 11.1 on page 11-161.
- The TouchPad alternately displays **Error** and the error name. Clear an error by pressing the ↵ key.
- The TouchPad momentarily displays and then clears a warning when an invalid entry is made.

TABLE C.1 **TouchPad Fault/Error/Warning Displays**

Display	Level	Description
BufOvFlo	Error	Communications buffer overflowed.
Can'tDo	Error	An invalid function type encountered in the TouchPad data table. The TouchPad data table is incorrect for the drive.
Checksum	Error	The checksum of the command is in error. Information is corrupted.
CmdNoEnb	Error	The command is not enabled.

TABLE C.1 **TouchPad Fault/Error/Warning Displays** (continued)

Display	Level	Description
DataDisp	Warning	The parameter is a live data display and cannot be modified.
DrvEnabl	Warning	The parameter cannot be changed while the drive is enabled.
Fault	Fault	Drive fault detected.
InvlData	Warning	Invalid data was entered for the parameter.
InvldFn	Error	Illegal function code received by drive. The TouchPad data table is incorrect for the drive.
InvldRsp	Error	Invalid Response received from drive. Received code did not match transmitted code.
Lower Lim	Warning	The lower limit of the parameter has been reached.
NoMemory	Error	TouchPad memory has been exhausted.
NoRetSel	Warning	Mode/Enter key incorrectly pressed.
OverRng	Error	Value from drive is too large to display.
RAMWrite	Error	An error was detected while writing the drive's parameter memory.
ReadOnly	Warning	The parameter is Read Only and cannot be modified.
Timeout	Error	The communications port timed out.
UnxpChar	Error	The communications port received an unexpected character.
UpperLim	Warning	The upper limit of the parameter has been reached.

Motor Table

TABLE C.2 **TouchPad Motor Table Identification by Motor Series**

Motor	ID	Motor	ID	Motor	ID	Motor	ID
FSM430 B24	15	HSM610	27	NSM4220 E5000	852	SSM620	12
FSM460 B24	3	HSM620	28	NSM5630	85	SSM630	6
FSM490 B24	16	HSM630	29	NSM5630 E5000	853	SSM835	13
FSM610 B24	17	HSM835	30	NSM5637	86	SSM845	14
FSM620 B24	18	HSM845	31	NSM5637 E5000	854	YSM102 115V	69
FSM620 E5000	786	NSM2302	335	NSM5647	87	YSM102 230V	68
FSM630	19	NSM2304	336	NSM5647 E5000	855	YSM103 115V	71
HSM205	20	NSM3406	81	SSM205	8	YSM103 230V	70
HSM307	21	NSM3406 E5000	849	SSM307	4	YSM206 115V	73
HSM320	22	NSM3412	82	SSM320	5	YSM206 230V	72
HSM430	23	NSM3412 E5000	850	SSM430	9	YSM212 B24 115V	75
HSM460	25	NSM4214	83	SSM460	1	YSM212B24 230V	74
HSM490	26	NSM4214 E5000	851	SSM490	2	YSM323 230V	77
HSM490 E5000	794	NSM4220	84	SSM610	11		

TABLE C.3 **TouchPad Motor Table Identification by Motor ID**

ID	Motor	ID	Motor	ID	Motor	ID	Motor
1	SSM460	17	FSM610 B24	68	YSM102 230V	86	NSM5637
2	SSM490	18	FSM620 B24	69	YSM102 115V	87	NSM5647
3	FSM460 B24	19	FSM630	70	YSM103 230V	335	NSM2302
4	SSM307	20	HSM205	71	YSM103 115V	336	NSM2304
5	SSM320	21	HSM307	72	YSM206 230V	786	FSM620 E5000
6	SSM630	22	HSM320	73	YSM206 115V	794	HSM490 E5000
8	SSM205	23	HSM430	74	YSM212B24 230V	849	NSM3406 E5000
9	SSM430	25	HSM460	75	YSM212 B24 115V	850	NSM3412 E5000
11	SSM610	26	HSM490	77	YSM323 230V	851	NSM4214 E5000
12	SSM620	27	HSM610	81	NSM3406	852	NSM4220 E5000
13	SSM835	28	HSM620	82	NSM3412	853	NSM5630 E5000
14	SSM845	29	HSM630	83	NSM4214	854	NSM5637 E5000
15	FSM430 B24	30	HSM835	84	NSM4220	855	NSM5647 E5000
16	FSM490 B24	31	HSM845	85	NSM5630		

TouchPad Options

TABLE C.4 **Option Selections for the TouchPad**

DRVPARM		TUNING	
Parameter	**Options**	**Parameter**	**Options**
AccelEn	Enable/Disable	SWEnable	Enable/Disable
SlewEnab	Enable/Disable		
I OverRd	Enable/Disable		
STATUS		**CTLPANEL**	
Parameter	**Options**	**Parameter**	**Options**
SWEnable	Enable/Disable	SWEnable	Enable/Disable
EncAlign	Normal/Align	Start	Normal/CtlPanel
RmvOfst	↑ to Rmv		

TouchPad Lists

TABLE C.5 Drive Communications Parameter List for the TouchPad

Display	Parameter
00	7 Data Bits, 1 Stop Bit, Even Parity
01	7 Data Bits, 1 Stop Bit, Odd Parity
02	8 Data Bits, 1 Stop Bit, No Parity
03	8 Data Bits, 1 Stop Bit, Even Parity
04	8 Data Bits, 1 Stop Bit, Odd Parity

TABLE C.6 Baud Rate Parameter List for TouchPad

Display	Parameter
00	1200 Baud
01	2400 Baud
02	4800 Baud
03	9600 Baud
04	19200 Baud

TABLE C.7 Encoder Output Parameter List for TouchPad

Display	Parameter
÷ by 1	Divide Encoder counts by 1
÷ by 2	Divide Encoder counts by 2
÷ by 4	Divide Encoder counts by 4
÷ by 8	Divide Encoder counts by 8

TABLE C.8 IO Mode Parameter List for TouchPad

Display	Parameter[a]
Inc	Incremental Indexing
Abs	Absolute Indexing
Reg	Registration Indexing

a. Parameters available only if the drive supports Indexing.

TABLE C.9 Index Pointer Parameter List for TouchPad

Display	Parameter[a]
00	Index 0
01	Index 1
02	Index 2
03	Index 3
04	Index 4
05	Index 5
06	Index 6
07	Index 7
08	RAM Index

a. Parameters available only if the drive supports Indexing.

TABLE C.10 Index Termination Parameter List for TouchPad

Display	Parameter[a]
Stop	Stop
NxtINow	Start another Index immmediately
NxtIWt	Start another Index at next Start Index transition

a. Parameters available only if the drive supports Indexing.

TABLE C.11 Home Type Parameter List for TouchPad

Display	Parameter[a]
Sns/Mrk	Home to Sensor, then to Marker
Marker	Home to Marker
Sensor	Home to Sensor

a. Parameters available only if the drive supports Indexing.

TABLE C.12 Homing Auto-Start Parameter List for TouchPad

Display	Parameter[a]
Disable	Auto-Start Homing inactive
Enb/Rst	Auto-Start Homing if not already Homed
Enable	Auto-Start on every Enable

a. Parameters available only if the drive supports Indexing.

TABLE C.13 Reverse Enable for Homing

Display	Parameter[a]
Inactive	No reversing if started on Sensor
Active	Reverse if started on Sensor

a. Parameters available only if the drive supports Indexing.

TABLE C.14 Digital Input Parameter List for TouchPad

Display	Parameter
Not Asgn	Not Assigned (not used)
DrvMode	Drive Mode
IntInh	Integrator Inhibit
FolEnab	Follower Enable
FwdEnab	Forward Enable
RevEnab	Reverse Enable
CMD Ovrd	Analog COMMAND Input Override
PreSelA	Preset Select Line A
PreSelB	Preset Select Line B
PreSelC	Preset Select Line C
StrtInd	Start Index
DefHome	Define Home
Registr	Registration/Sensor
-CmdOfs	Remove Command Offset
Home	Start Homing
FaltRst	Fault Reset

TABLE C.15 Digital Output Parameter List for TouchPad

Display	Parameter
Not Asgn	Not Assigned (not used)
InPos	In Position
PosWin	Within Position
0 Speed	Zero Speed
SpdWin	Speed Window
+ILimit	Positive Current Limit
-ILimit	Negative Current Limit
UpToSpd	Up to Speed
DrvEnab	Drive Enable
BusChg	Bus Charged
Fault	Disabling Fault
AtHome	At Home
SeqEnd	Sequence Complete
Moving	In Motion
InDwell	In Dwell
Homed	Axis Homed

TABLE C.16 Analog Output Parameter List for TouchPad

Display	Parameter
I Cmd	Current Command
I Avg	Average Current Command
IPeak+	Positive Current Peak
IPeak-	Negative Current Peak
ILimit+	Positive Current Limit
ILimit-	Negative Current Limit
VelMtr	Motor Velocity
VelCmd	Velocity Command
VelErr	Velocity Error
PosMtr	Motor Position
PosCmd	Position Command Slewed
PosErr	Position Error
PosEPk+	Positive Position Peak Error
PosEPk-	Negative Position Peak Error
PosMstr	Master Position

TABLE C.17 Drive Status List for TouchPad

Display	Parameter
DrvEnab	Drive Enabled
DrvRdy	Drive Ready
+24 Fuse	+24 VDC Fuse blown
5v Fuse	+5 VDC Fuse blown
EncFuse	Encoder Power Fuse blown
MtrOvT	Motor Thermostat Overtemperature
IPMFalt	IPM Fault (Overtemperature/Overcurrent/Short Circuit)
IMLinBk	Channel IM Line Break
BMLinBk	Channel BM Line Break
AMLinBk	Channel AM Line Break

TABLE C.17 **Drive Status List for TouchPad** (continued)

Display	Parameter
BusOvV	Bus Undervoltage
BusUndV	Bus Overvoltage
IlglHal	Illegal Hall State
SubIntr	Unused Interrupt - sub processor
MainInt	Unused Interrupt - main processor
ExsAvgI	Excessive Average Current
OvSpeed	Motor Overspeed
ExsFErr	Excessive Following Error
MtrEnc	Motor Encoder State Error
MstrEnc	Auxiliary Encoder State Error
MtrThrm	Motor Thermal Protection
IPMThrm	IPM Thermal Protection
EnNoMtr	No Motor Selected while enabling drive
MtrType	Motor Selection not in Table
PersWrt	Personality Write Error
ServWrt	Service Write Error
CPUComm	CPU Communications Error
MtrOvt	Motor Overtemperature
IPMFalt	IPM Fault
ExsVErr	Excess Velocity Error
Comutat	Commutation Angle Error
Not Homd	Axis Not Homed
NOTE: The Drive Status display is read-only. DrvEnab and DrvRdy indicate the drive is functional. The other displays indicate an error condition.	

TABLE C.18 **Input Flags Parameter List for TouchPad**

Display	Parameter
FltRst	Fault Reset Input Flag
ENABLE	Drive Enable Input Flag
Input1	Input 1 Input Flag
Input2	Input 2 Input Flag
Input3	Input 3 Input Flag
Input4	Input 4 Input Flag

TABLE C.19 **Output Flags Parameter List for TouchPad**

Display	Parameter
READY	Ready Output Flag
BRAKE	Brake Output Flag
Outpt1	Output 1 Flag
Outpt2	Output 2 Flag
Outpt3	Output 3 Flag
Outpt4	Output 4 Flag

Electromagnetic Compatibility Guidelines for Machine Design

D

This appendix provides background information about Electromagnetic Interference (EMI) and machine design guidelines for Electromagnetic Compatibility (EMC). The Centurion DSM100 Drive installation requirements for compliance to the European Electromagnetic Compatibility Directive are specified in “European Union Requirements” on page 2-30. AC Line Filters necessary for European EMC compliance are listed in Chapter 5, “Installation”.

Perhaps no other subject related to the installation of industrial electronic equipment is so misunderstood as electrical noise. The subject is complex and the theory easily fills a book. This section provides guidelines that can minimize noise problems.

The majority of installations do not exhibit noise problems. However, the filtering and shielding guidelines are provided as counter measures. The grounding guidelines provided below are simply good grounding practices. They should be followed in all installations.

Electrical noise has two characteristics: the generation or emission of electromagnetic interference (EMI), and response or immunity to EMI. The degree to which a device does not emit EMI, and is immune to EMI is called the device’s Electromagnetic Compatibility (EMC).

“EMI Source-Victim Model” shows the commonly used EMI model. The model consists of an EMI source, a coupling mechanism and an EMI victim. Devices such as servo drives and computers, which contain switching power supplies and microprocessors, are EMI sources. The mechanisms for the coupling of energy between the source and victim are conduction and radiation. Victim equipment can be any electromagnetic device that is adversely affected by the EMI coupled to it.

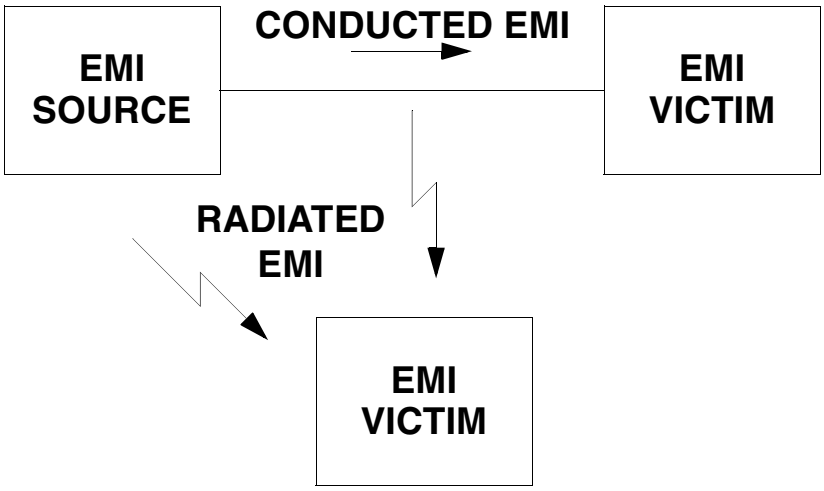


FIGURE D.1 **EMI Source-Victim Model**

Immunity to EMI is primarily determined by equipment design, but how you wire and ground the device is also critical to achieving EMI immunity. Therefore, it is important to select equipment that has been designed and tested for industrial environments. The EMI standards for industrial equipment include the EN61000-4 series (IEC 1000-4 and IEC801), EN55011 (LISDR11), ANSI C62 and C63 and MIL-STD-461. Also, in industrial environments, you should use encoders with differential driver outputs rather than single ended outputs, and digital inputs/outputs with electrical isolation, such as those provided with optocouplers.

The EMI model provides only three options for eliminating the EMC problem:

- Reduce the EMI at the source,
- Increase the victim's immunity to EMI (harden the victim), or
- Reduce or eliminate the coupling mechanism.

In the case of servo drives, reducing the EMI source requires slowing power semiconductor switching speeds. However, this adversely affects drive performance with respect to heat dissipation and speed/torque regulation. Hardening the victim equipment may not be possible, or practical. The final, and often the most realistic solution is to reduce the coupling mechanism between the source and victim. This can be achieved by filtering, shielding and grounding.

Filtering

As mentioned above, high frequency energy can be coupled between circuits via radiation or conduction. The AC power wiring is one of the most important paths for both types of coupling mechanisms. The AC line can conduct noise into the drive from other devices, or it can conduct noise directly from the drive into other devices. It can also act as an antenna and transmit or receive radiated noise between the drive and other devices.

One method to improve the EMC characteristics of a drive is to use an isolation AC power transformer to feed the amplifier its input power. This minimizes inrush currents on power-up and provides electrical isolation. In addition, it provides common mode filtering, although the effect is limited in frequency by the interwinding capacitance. Use of a Faraday shield between the windings can increase the common mode rejection bandwidth, (shield terminated to ground) or provide differential mode shielding (shield terminated to the winding).

"Common mode" noise is present on all conductors referenced to ground. "Differential mode" noise is present on one conductor referenced to another conductor.

One alternative to AC line filters to reduce the conducted EMI emitting from the drive. This allows nearby equipment to operate undisturbed. In most cases an AC line filter will not be required unless other sensitive circuits are powered off the same AC branch circuit. The basic operating principle is to minimize the high frequency power transfer through the filter. An effective filter achieves this by using capacitors and inductors to mismatch the source impedance (AC line) and the load impedance (drive) at high frequencies.

AC Line Filter Selection

Selection of the proper filter is only the first step in reducing conducted emissions. Correct filter installation is crucial to achieving both EMI attenuation and to ensure safety. All of the following guidelines should be met for effective filter use.

1. The filter should be mounted to a grounded conductive surface.
2. The filter must be mounted close to the drive input terminals. If the distance exceeds 1 foot, then a strap should be used to connect the drive and filter, rather than a wire.
3. The wires connecting the AC source to the filter should be shielded from, or at least separated from the wires (or strap) connecting the drive to the filter. If the connections are not segregated from each other, then the EMI on the drive side of the filter can couple over to the source side of the filter, thereby reducing, or eliminating the filter effectiveness. The coupling mechanism can

be radiation, or stray capacitance between the wires. The best method of achieving this is to mount the filter where the AC power enters the enclosure. “AC Line Filter Installation” shows a good installation and a poor installation.

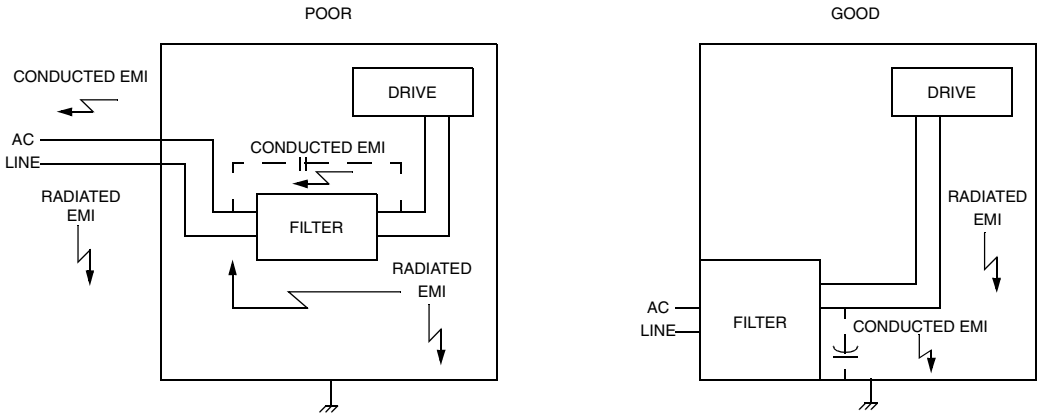


FIGURE 11.2 **AC Line Filter Installation**

When multiple power cables enter an enclosure, an unfiltered line can contaminate a filtered line external to the enclosure. Therefore, all lines must be filtered to be effective. The situation is similar to a leaky boat. All the holes must be plugged to prevent sinking.

WARNING

Before applying power, the filter must be safety grounded. Without a proper ground, current leakage could build to a hazardous level.

The only reasonable filtering at the drive output terminals is the use of inductance. Capacitors would slow the output switching and deteriorate the drive performance. A common mode choke, as is used in the Centurion DSM100 Drive, can be used to reduce the HF voltage at the drive output. This will reduce emission coupling through the drive back to the AC line. However, the motor cable still carries a large HF voltage and current. Therefore, it is very important to segregate the motor cable from the AC power cable. More information on cable shielding and segregation is contained in the section on shielding.

Grounding

High frequency (HF) grounding is different from safety grounding. A long wire is sufficient for a safety ground, but is completely ineffective as an HF ground due to the wire inductance. As a rule of thumb, a wire has an inductance of 20 nH/in regardless of diameter. At low frequencies it acts as a constant impedance, at intermediate frequencies as an inductor, and at high frequencies as an antenna. The use of ground straps is a better alternative to wires. However the length to width ratio must be 5:1, or better yet 3:1, to remain a good high frequency connection.

The ground system's primary purpose is to function as a return current path. It is commonly thought of as an equipotential circuit reference point, but different locations in a ground system may be at different potentials. This is due to the return current flowing through the ground systems finite impedance. In a sense, ground systems are the sewer systems of electronics and as such are sometimes neglected.

The primary objective of a high frequency ground system is to provide a well defined path for HF currents and to minimize the loop area of the HF current paths. It is also important to separate HF grounds from sensitive circuit grounds. "Single Point Ground Types" shows single point grounds for both series (daisy chain) and parallel (separate) connections. A single point, parallel connected ground system is recommended.

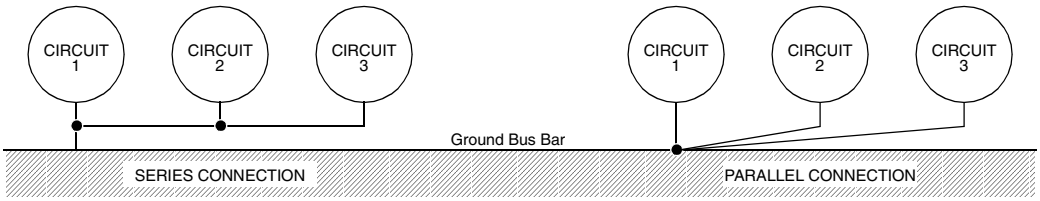


FIGURE 11.3 **Single Point Ground Types**

A ground bus bar or plane should be used as the "single point" where circuits are grounded. This will minimize common (ground) impedance noise coupling. The ground bus bar (GBB) should be connected to the AC ground, and if necessary, to the enclosure. All circuits or subsystems should be connected to the GBB by separate connections. These connections should be as short as possible, and straps should be used when possible. The motor ground conductor must return to the ground terminal on the drive, not the GBB.

Shielding and Segregation

The EMI radiating from the drive enclosure drops off very quickly over distance. Mounting the drive in an enclosure, such as an industrial cabinet, further reduces the radiated emissions.

The primary propagation route for EMI emissions from a drive is through cabling. The cables conduct the EMI to other devices, and can also radiate the EMI. For this reason, cable segregation and shielding are important factors in reducing emissions. Cable shielding can also increase the level of immunity for a drive.

The following suggestions are recommended for all installations, especially since they are inexpensive.

1. Signal cables (encoder, serial, analog) should be routed away from the motor cable and power wiring. Separate steel conduit can be used to provide shielding between the signal and power wiring. Do not route signal and power wiring through common junctions or raceways.
2. Signal cables from other circuits should not pass within 1 foot of the drive.
3. The length or parallel runs between other circuit cables and the motor or power cable should be minimized. A rule of thumb is 1 foot of separation for each 30 feet of parallel run. The 1 foot separation can be reduced if the parallel run is less than 3 feet.
4. Cable intersections should always occur at right angles to minimize magnetic coupling.
5. Do not route any cables connected to the drive directly over the drive vent openings. Otherwise the cables will pick up the emissions leaked through the vent slots.
6. The encoder mounted on the brushless servo motor should be connected to the amplifier with a cable using multiple twisted wire pairs and an overall cable shield. Giddings & Lewis offers encoder cables in various lengths that have special terminations.

Following these guidelines can minimize noise problems. However, equipment EMC performance must meet regulatory requirements in various parts of the world, specifically the European Union. Ultimately, it is the responsibility of the machine builder to ensure that the machine meets the appropriate requirements as installed.

Dynamic Braking Resistor Selection

E

This appendix provides equations to assist in sizing resistors for dynamic braking.

A properly sized resistive load may be required to dynamically brake the system by dissipating the energy stored in a motor. The section "Emergency Stop Wiring" on page 7-96 depicts the necessary circuitry.

Winding inductance is ignored in this analysis, which allows the load on the motor winding to be considered as purely resistive when dynamic braking occurs. This simplifies the evaluation to a scalar analysis, instead of a vector analysis. For simplicity, friction, damping and load torque also are ignored in the equations.

Dynamic Braking Equations

Equations for the magnitutde of instanteous velocity, and per phase current, energy and power are derived by solving the differential equation governing the motor velocity. The equations are shown below.

TABLE E.1 Dynamic Braking Resistor Parameters

Parameter	Description	Parameter	Description
i(t)	Phase Current	R_L	Line-Neutral Dynamic Braking Resistance
E(t)	Per Phase Energy	K_E	Peak Line-to-Line Back EMF
J_m	Motor Inertia	K_T	Peak Line-to-Line Torque Constant
J_L	Load Inertia	ω_o	Initial Angular Velocity
P(t)	Per Phase Power	w	Angular Velocity
R	Motor Line-to-Line Resistance	t	Time

$$\omega(t) = \omega_o e^{-t/\tau}$$

where

$$\tau = 0.866\left[\frac{(R+2R_L)(J_M+J_L)}{K_E K_T}\right] \quad (1)$$

$$i(t) = \frac{K_E \omega_o e^{-t/\tau}}{0.866(R+2R_L)}$$

$$E(t) = \frac{1}{2}(J_L+J_M)\omega_o^2 e^{-2t/\tau}$$

$$P(t) = \left[\frac{(J_L+J_M)\omega_o^2}{2\tau}\right]e^{-2t/\tau} = 1.154\left[\frac{K_E K_T \omega_o^2}{(R+2R_L)}\right]e^{-2t/\tau} \quad (2)$$

For this type of response, 98% of the energy will be dissipated in 4 time constants. Therefore the average power for each dynamic braking event can be calculated as:

$$P_{AVE} = \frac{1}{2}(J_M + J_L)\omega_o^2\left(\frac{1}{4\tau}\right) = 0.144\frac{K_E K_T \omega_o^2}{(R + 2R_L)} \quad (3)$$

Equation 1 is used in equation 2 and 3 to put the power in terms of the motor parameters and the dynamic braking resistance (i.e., independent of the load inertia).

Sample Calculations

The following example uses an HSM475 motor with a 10 times inertia mismatch and dynamic braking resistors sized at four times the motor winding resistance. The average power of the motor is 1116 Watts for the selected paramters, but it is unlikely that a resistor with this Wattage is required. Pulse type currents, such as this example, require sufficient thermal mass to absorb the energy and to dissipate or accomodate the peak Voltage. Adequate information for intermittent duty cycle and surge current applications is seldom provided by resistor manufacturers. However, often they will assist in resistor selection when supplied with the current profile.

Note: The equations using the symbol ":=" are "assigned" in Mathcad®.

H4075 Motor Parameters in MKS Units:

$K_T := 0.74 \qquad R := 0.9 \qquad J_m := 0.00068$

$K_E := 90 \qquad K_E := \frac{K_E \cdot 60}{2 \cdot \pi \cdot 1000} \qquad K_E = 0.859$

Load Inertia, Dynamic Braking Resistance and Velocity in MKS Units:

$R_L := 4 \cdot R \qquad J_L := 10 \cdot J_m \qquad \omega_o := \frac{3000 \cdot 2 \cdot \pi}{60} \qquad \omega_o = 314.159$

Time vector:

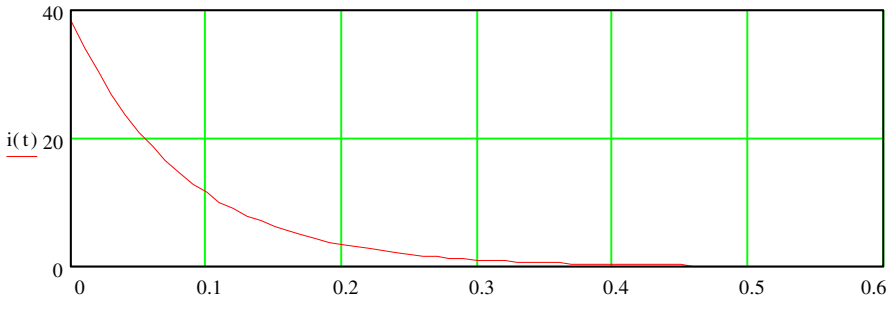
$t := 0, 0.01, \ldots 0.5$

Time Constant (seconds):

$$\tau = \frac{0.866(R + 2 \cdot R_L) \cdot (J_m + J_L)}{K_E \cdot K_T} \qquad \tau = 0.083$$

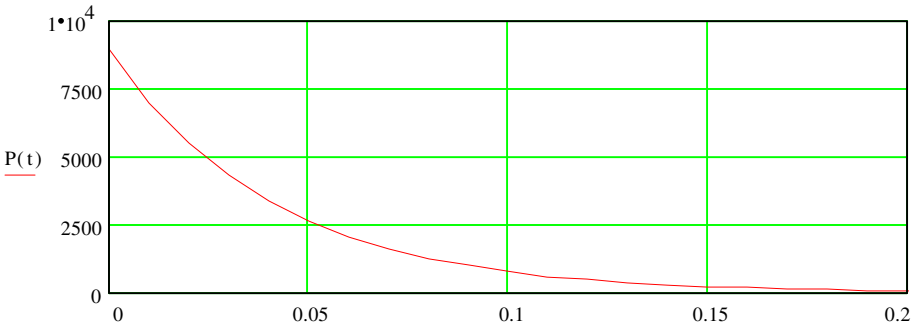
Current Calculation (Amps):

$$i(t) := \frac{K_E \cdot \omega_o \cdot e^{\frac{-t}{\tau}}}{0.866(R + 2 \cdot R_L)}$$



Instantaneous Power Calculation (Watts):

$$P(t) := \left[\frac{1.154 \cdot K_E \cdot K_T \cdot \omega_o^2}{(R + 2 \cdot R_L)}\right] \cdot e^{\frac{-2 \cdot t}{\tau}}$$



Average Power (Watts):

$$P_{ave} := \dot{0}.144\left[\frac{K_E \cdot K_T \cdot \omega_o^2}{R + 2 \cdot R_L}\right]$$

$$P_{ave} = 1116$$

Specifications F

Item	Specification
Agency Approvals	
UL and cUL	UL508C File E145959
CE mark	Low Voltage Directive and Electromagnetic Compatibility Directive Certificate of Conformity from TUV Product Service
Environmental	
Operating Temperature	
DSM110 or DSM110P,	0°C to 55°C (32°F to 131°F)
DSM120 or DSM120P	0°C to 55°C (32°F to 131°F))
DSM130 or DSM130P	0°C to 55°C (32°F to 131°F))
DSM175 or DSM175P,	0°C to 55°C (32°F to 131°F)
DSM 1150 or DSM 1150P	0°C to 50°C (32°F to 122°F)
Storage Temperature	-40°C to 70°C (-40°F to 158°F)
Humidity	5% to 95% non-condensing
Altitude	1500 meters (5000 feet) Derate 3% for each 300 m above 1500 m (1000 ft. above 5000 ft.)
Vibration	10 to 2000 Hz @ 2g
Shock	15g 11 millisecond half sine
Weight	
DSM110 or DSM110P,	5.80 Kg (13.78 lbs)
DSM120 or DSM120P,	6.36 Kg (14.02 lbs)
DSM130 or DSM130P,	6.48 Kg (14.28 lbs)
DSM175 or DSM175P,	9.67 Kg (21.32 lbs)
DSM 1150 or DSM 1150P	14.06 Kg (31.00 lbs)
Dielectric Withstanding Voltage (HI-Pot)	
Main AC	1000 VAC for 1 minute, <5.0mA leakage current
Auxiliary AC	1414 (1500) VDC for 1 minute, <5.0mA leakage current **NOTE**: EMI filter capacitors on Aux AC require VDC tests.
Motor Encoder Interface	
Power Output	5 to 7 Volts DC, Adjustable, Automatic Sensing, Fused
Encoder Inputs	A/B, Differential, 26LS33 input, 1 MHz (4 MHz Quadrature) Maximum Signal Frequency, Line Break Detection, 1/T Low Speed Measurement
Thermostat Inputs	Normally closed
Hall Inputs	Single-ended, 5 Volt Logic
ABS Input	0 to 5 Volt, 10-bit
User Interface	
Serial Port	RS-232 or four wire RS-485, 1200 to 19200 baud Daisy-chain connections accommodated by two connectors
Status Display	7 segment LED
Address Switch	16-position Rotary DIP

Item	Specification
Digital Inputs	
Selectable (5)	24 Volt, Optically Isolated, Single ended, Active High, Current Sinking, 4.5 mA nominal
ENABLE	24 Volt, Optically Isolated, Single ended, Active High, Current Sinking, 4.5 mA nominal
Digital Outputs	
Selectable (4)	24 Volt, Optically Isolated, Single-ended, Active High, Current Sourcing, 50 mA maximum
BRAKE	24 Volt, Normally Open Relay, 1 A
READY	24 Volt, Normally Open Relay, 100 mA
Digital I/O Power Supply	Isolated 24V @ 250 mA, fused
Analog Inputs	
Positive Current Limit (+I LIMIT)	0 to 10 Volt, 10-bit, single-ended, 5 kOhm input Impedance
Negative Current Limit (-I LIMIT)	0 to 10 Volt, 10-bit, single-ended, 5 kOhm input Impedance
COMMAND	±10 Volt, Differential, 16-bit, 13 kOhm input Impedance, offset software adjustable
Analog Outputs	
ANALOG1	0 to 10 Volt, 12-bit, 2 mA maximum
ANALOG2	0 to 10 Volt, 8-bit, 2 mA maximum
Auxiliary Encoder Signal Input	26LS33 Input, 4 MHz Count Frequency Differential/Single-ended A/B Step/Direction CW/CCW
5 Volt Power Supply	5V @ 250 mA, fused
Motor Encoder Output	AM26C31 or AM26LS31 Differential Driver; Divide by 1, 2, 4, or 8 Differential output is 2.0 Vdc across a 100 Ohm load
CPU/Memory	
Parameter Data Retention	20 years
Microcontrollers (2)	Motorola 68HC16
EPROM	128 kB Flash Memory
RAM	34 kB
User Parameter Memory (2)	512 kB Serial EEPROM
Motor Overload Protection	Motor overload protection operates within 8 minutes at 200% overload, and within 20 seconds at 600% overload.
PWM Carrier Frequency	
DSM110 or DSM110P,	10 kHz/5 kHz
DSM120 or DSM120P,	10 kHz/5 kHz
DSM130 or DSM130P,	10 kHz/5 kHz
DSM175 or DSM175P,	10 kHz/5 kHz
DSM 1150 or DSM 1150P	5 kHz
Current Regulation	
Type	Digital, PI with Back-EMF compensation, Synchronous
-3dB Bandwidth	1.2 kHz
-45° Bandwidth	600 Hz

Item	Specification
Resolution	10-bit
Speed Regulation	
Type	Digital, PID
Update Rate	5 kHz
-3dB Bandwidth	150 Hz
-45° Bandwidth	50 Hz
Ripple	±2 RPM @ 1000 RPM
Resolution	16-bit
Position Regulation	
Type	Digital, PID with Feedforward
Filters	
Low Pass	Digital, 0 - 1000 Hz, -3 dB Bandwidth, Selectable
Software Controls	
Data Collection (2)	128 samples @ 5 kHz Sample Rate
Firmware	Field Upgradeable via Flash Memory
Operating Modes	Torque or Velocity
Command Sources	Analog Auxiliary Encoder Presets Step/Direction CW/CCW Indexing
Autotuning	Position and Velocity Loop
Manual Tuning	Position or Velocity Loop
User Set-up	DSMPro or TouchPad
Diagnostics	Motor or Auxiliary Encoder Checks Digital Output Override Analog Output Override
Serial Protocol	7-bit ASCII, Checksum, Active Response
Power-Up Faults	EPROM Checksum EEPROM Checksum SRAM Write/Read Watchdog Reset A/D Conversion D/A Conversion Interprocessor Communication

Item	Specification
Run-Time Faults	Motor Overtemperature Bus Overvoltage IPM Fault Overspeed Excess Error Encoder State Change Encoder Line Break Fuse Illegal Hall State
Selectable Digital Inputs	Drive Mode Select Integrator Inhibit Follower Enable Forward Enable Reverse Enable Operation Mode Override Preset Selects Start Index Define Home Remove Command Offset Start Homing Sensor
Selectable Digital Outputs	In-Position Within Window Zero Speed Speed Window ± Current Limit Up To Speed Drive Enabled Bus Charged Disabling Motion In Motion In Dwell Sequence Complete Registered At Home Axis Homed
Speed Control Command	
Range	0 to ±32,767 RPM (actual maximum speed depends on the motor/drive combination)

Power

TABLE F.1 **Centurion DSM100 Drive Power Ratings**

	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM1150, DSM 1150P
Auxiliary AC Input Voltage (rms Volts nominal)	100 to 240	100 to 240	100 to 240	100 to 240	100 to 240
Frequency (Hz)	47 - 63	47 - 63	47 - 63	47 - 63	47 - 63
Current (A_{rms} @ 100 V_{rms})	1.0	1.0	1.0	1.0	1.0
(A_{rms} @ 240 V_{rms})	0.5	0.5	0.5	0.5	0.5
Main AC Input Voltage (rms Volts nominal)	100 to 240, 1∅	100 to 240, 1∅	100 to 240, 1∅	100 to 240, 1∅ or 3∅	100 to 240, 3∅
Frequency (Hz)	47 - 63	47 - 63	47 - 63	47 - 63	47 - 63
Current (rms Amps)	10	19	28	30	46
Bus Voltage (Volts DC)	141-339	141-339	141-339	141-339	141-339
Peak Output Current (Amps)	10	20	30	50, 1∅ 75, 3∅	150
Continuous Output Current (Amps)	5	10	15	15, 1∅ 35, 3∅	65
Peak Shunt Power (built in resistor) (kWatts)	4.5	4.5	4.5	10.0	18.0
Continuous Shunt Power (built in resistor) (Watts)	50	50	50	50	180
Peak Shunt Power (external resistor) (kWatts)	6.0	6.0	6.0	10.0	19.0
Continuous Shunt Power (external resistor) (kWatts)	2.4	2.4	2.4	4.0	8.0
Bus Capacitance Energy Absorption (from 325-420 Vdc Bus)[a] (Joules)	41	69	97	152	266

TABLE F.1 **Centurion DSM100 Drive Power Ratings** (continued)

	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM1150, DSM 1150P
Bus Capacitance (µF)	1170	1950	2730	4290	7520
Peak Power Output[b] (kWatts @ 120 V_{rms})	1.25	2.5	3.75		
(kWatts @ 240 V_{rms})	2.5	5	7.5	14, 1∅ 20, 3∅	36
Continuous Power Output[2] (kWatts @ 120 V_{rms})	0.6	1.2	1.8	3.5	
(kWatts @ 240 V_{rms})	1.0	2.0	3	7.5, 3∅	15, 3∅

a. Bus capacitance energy absorption is based on the following equations:

$$\varepsilon = \frac{1}{2}C(V^2_f) - \frac{1}{2}C(V^2_i)$$

$$\varepsilon = \frac{1}{2}C(420)^2 - \frac{1}{2}C(325)^2$$

$$\frac{1}{2}C \cdot (420^2 - 325^2) = C(35387)$$

$$if\ C = 7520\mu F,\ \varepsilon = 266$$

b. Power outputs are based on the following equation:

$$\text{Output Power (in Watts)} = \left(\sqrt{\frac{3}{2}}\right)(0.85)(\text{input rms Volts})(\text{output Amps})$$

Power Dissipation

The Centurion DSM100 Drive controller dissipates power that results in cabinet heating. The following table lists power dissipation values for the Centurion DSM100 Drives. Calculate the cabinet cooling requirements using the power dissipation information and formulas below.

Current as % of Rated Continuous Current	DSM110, DSM110P	DSM120, DSM120P	DSM130, DSM130P	DSM175, DSM175P	DSM 1150, DSM 1150P
100	75 W	100 W	150W	300 W	500 W
NOTE: These values do not include internal or external shunt regulator power (regenerated power). to "TB2 – Shunt Regulator" on page 7-101 for shunt regulator dissipation values.					

Maximum power losses are shown to help size a NEMA 12 or equivalent enclosure and to ensure the required ventilation. Typical power losses are about one-half maximum power losses.

When sizing an enclosure with no active method of heat dissipation, the following equation approximates the size of enclosure necessary:

$T_F = 4.08 * (Q/A) + 1.1$

or

$T_C = 2.27 * (Q/A) + 0.61$

where:

T_F = Temperature difference between inside air and outside ambient (°F)

T_C = Temperature difference between inside air and outside ambient (°C)

Q = Heat generated in enclosure (watts)

A = Enclosure surface area in ft^2 = (2dw + 2dh + 2wh) / 144

d = Depth in inches
h = Height in inches
w = Width in inches

Index

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

R

S

T

U

V

W

Pictorial Index

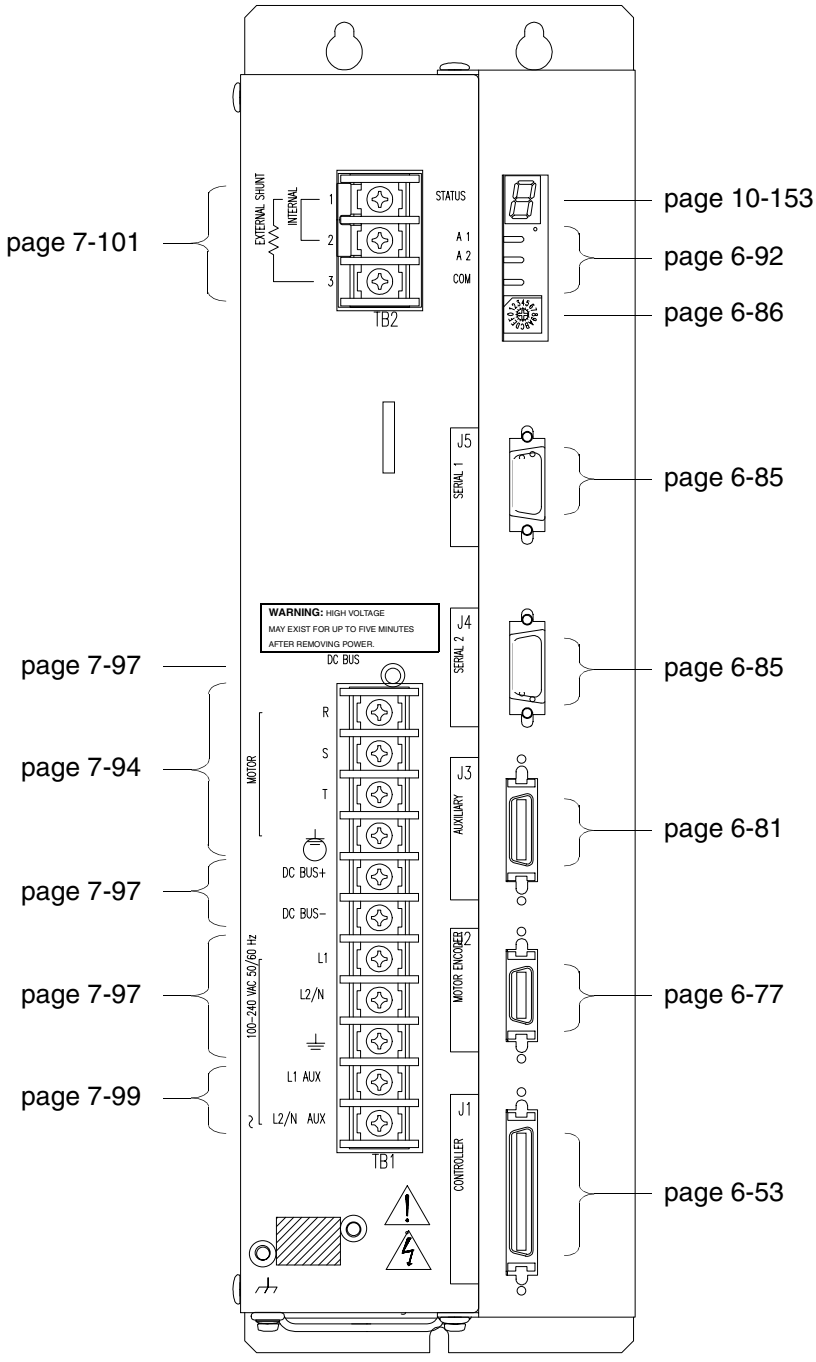
DSM 007 and DSM 007P, DSM120 and DSM120P, DSM130 and DSM130P

J4 and J5 – Serial Port		
1	RCV +	RS-485
2	RCV	RS-232
3	XMT	RS-232
4	XMT +	RS-485
5	COM	
6	RSVD	
7	RCV -	RS-485
8	XMT -	RS-485
9	RSVD	

J3 – Auxiliary Port
Duplicates J1 pins 1 – 26

J2 – Encoder	
1	Encoder Pwr
2	Encoder Com
3	Encoder Pwr
4	Encoder Com
5	Encoder Pwr Sense +
6	Encoder Pwr Sense -
7	Mtr Encdr Input Chnl A+
8	Mtr Encdr Input Chnl A-
9	Mtr Encdr Input Chnl B+
10	Mtr Encdr Input Chnl B-
11	Mtr Encdr Input Chnl I+
12	Mtr Encdr Input Chnl I-
13	Hall Effect A
14	Hall Effect B
15	Hall Effect C
16	Absolute Position
17	RSVD
18	RSVD
19	Thermal Switch +
20	Thermal Switch -

J1 – Controller	
1	Encoder +5V DC
2	Encoder Com
3	Encoder +5V DC
4	Encoder Com
5	Isolated +24 VDC
6	Isolated 24V Com
7	Mtr Output Chnl A+
8	Mtr Output Chnl A-
9	Mtr Output Chnl B+
10	Mtr Output Chnl B-
11	Mtr Output Chnl I+
12	Mtr Output Chnl I-
13	Isolated 24V Com
14	Auxiliary Chnl A+
15	Auxiliary Chnl A-
16	Auxiliary Chnl B+
17	Auxiliary Chnl B-
18	Auxiliary Chnl I+
19	Auxiliary Chnl I-
20	Drive Enable
21	Fault Reset
22	Analog Cmnd +
23	Analog Cmnd -
24	Drive Ready +
25	Drive Ready -



26	Isolated +24 VDC	31	Analog Output 2	36	RSVD	41	RSVD	46	RSVD
27	+I Limit	32	Selectable Input 1	37	RSVD	42	Selectable Output 1	47	RSVD
28	Analog Com	33	Selectable Input 2	38	RSVD	43	Selectable Output 2	48	RSVD
29	-I Limit	34	Selectable Input 3	39	RSVD	44	Selectable Output 3	49	Brake Enable +
30	Analog Output 1	35	Selectable Input 4	40	RSVD	45	Selectable Output 4	50	Brake Enable -

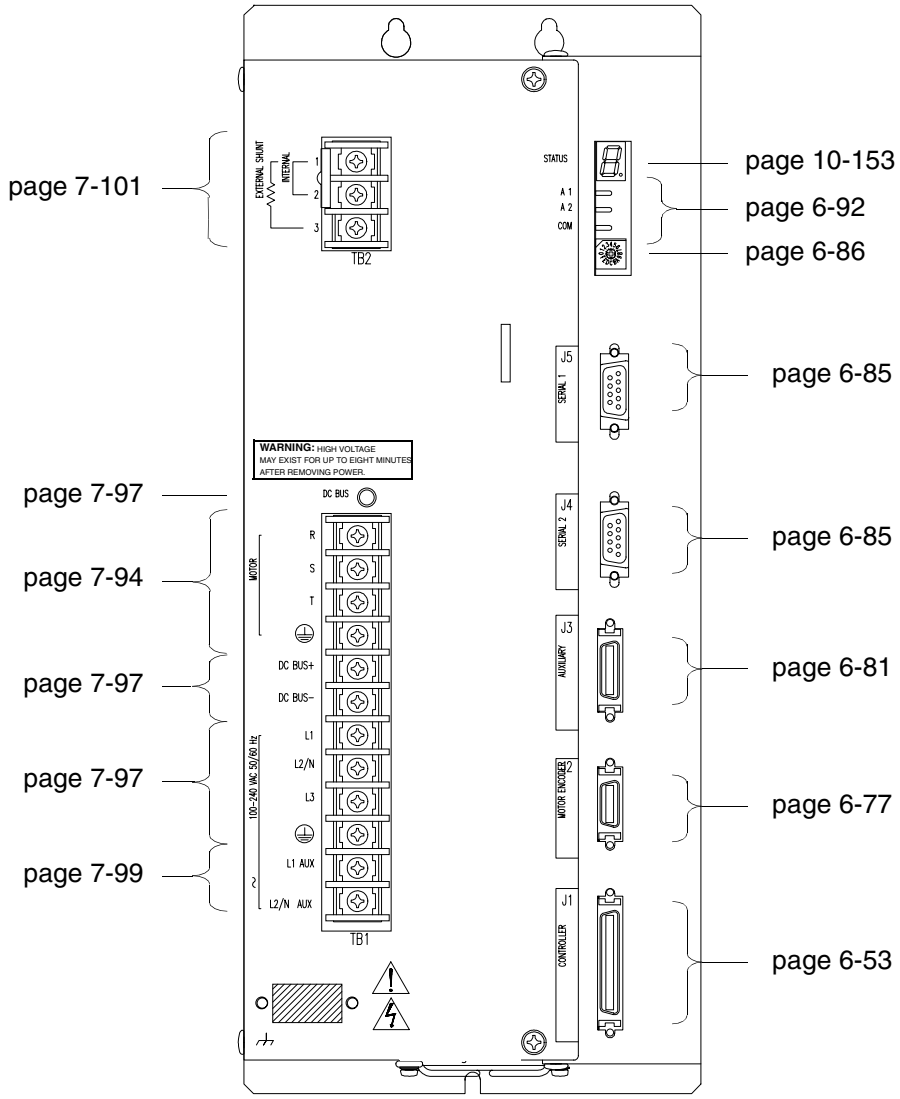
DSM175 and DSM175P

J4 and J5 – Serial Port		
1	RCV +	RS-485
2	RCV	RS-232
3	XMT	RS-232
4	XMT +	RS-485
5	COM	
6	RSVD	
7	RCV -	RS-485
8	XMT -	RS-485
9	RSVD	

J3 – Auxiliary Port
Duplicates J1 pins 1 – 26

J2 – Encoder	
1	Encoder Pwr
2	Encoder Com
3	Encoder Pwr
4	Encoder Com
5	Encoder Pwr Sense +
6	Encoder Pwr Sense -
7	Mtr Encdr Input Chnl A+
8	Mtr Encdr Input Chnl A-
9	Mtr Encdr Input Chnl B+
10	Mtr Encdr Input Chnl B-
11	Mtr Encdr Input Chnl I+
12	Mtr Encdr Input Chnl I-
13	Hall Effect A
14	Hall Effect B
15	Hall Effect C
16	Absolute Position
17	RSVD
18	RSVD
19	Thermal Switch +
20	Thermal Switch -

J1-Controller	
1	Encoder +5V DC
2	Encoder Com
3	Encoder +5V DC
4	Encoder Com
5	Isolated +24 VDC
6	Isolated 24V Com
7	Mtr Output Chnl A+
8	Mtr Output Chnl A-
9	Mtr Output Chnl B+
10	Mtr Output Chnl B-
11	Mtr Output Chnl I+
12	Mtr Output Chnl I-
13	Isolated 24V Com
14	Auxiliary Chnl A+
15	Auxiliary Chnl A-
16	Auxiliary Chnl B+
17	Auxiliary Chnl B-
18	Auxiliary Chnl I+
19	Auxiliary Chnl I-
20	Drive Enable
21	Fault Reset
22	Analog Cmnd+
23	Analog Cmnd-
24	Drive Ready+
25	Drive Ready-



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27	+I Limit	32	Selectable Input 1	37	RSVD	42	Selectable Output 1	47	RSVD
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29	-I Limit	34	Selectable Input 3	39	RSVD	44	Selectable Output 3	49	Brake Enable +
30	Analog Output 1	35	Selectable Input 4	40	RSVD	45	Selectable Output 4	50	Brake Enable -

DSM1150 and DSM1150P

J4 and J5 – Serial Port		
1	RCV +	RS-485
2	RCV	RS-232
3	XMT	RS-232
4	XMT +	RS-485
5	COM	
6	RSVD	
7	RCV -	RS-485
8	XMT -	RS-485
9	RSVD	
J3 – Auxiliary Port		
Duplicates J1 pins 1 – 26		
J2 – Encoder		
1	Encoder Pwr	
2	Encoder Com	
3	Encoder Pwr	
4	Encoder Com	
5	Encoder Pwr Sense +	
6	Encoder Pwr Sense -	
7	Mtr Encdr Input Chnl A+	
8	Mtr Encdr Input Chnl A-	
9	Mtr Encdr Input Chnl B+	
10	Mtr Encdr Input Chnl B-	
11	Mtr Encdr Input Chnl I+	
12	Mtr Encdr Input Chnl I-	
13	Hall Effect A	
14	Hall Effect B	
15	Hall Effect C	
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17	RSVD	
18	RSVD	
19	Thermal Switch +	
20	Thermal Switch -	
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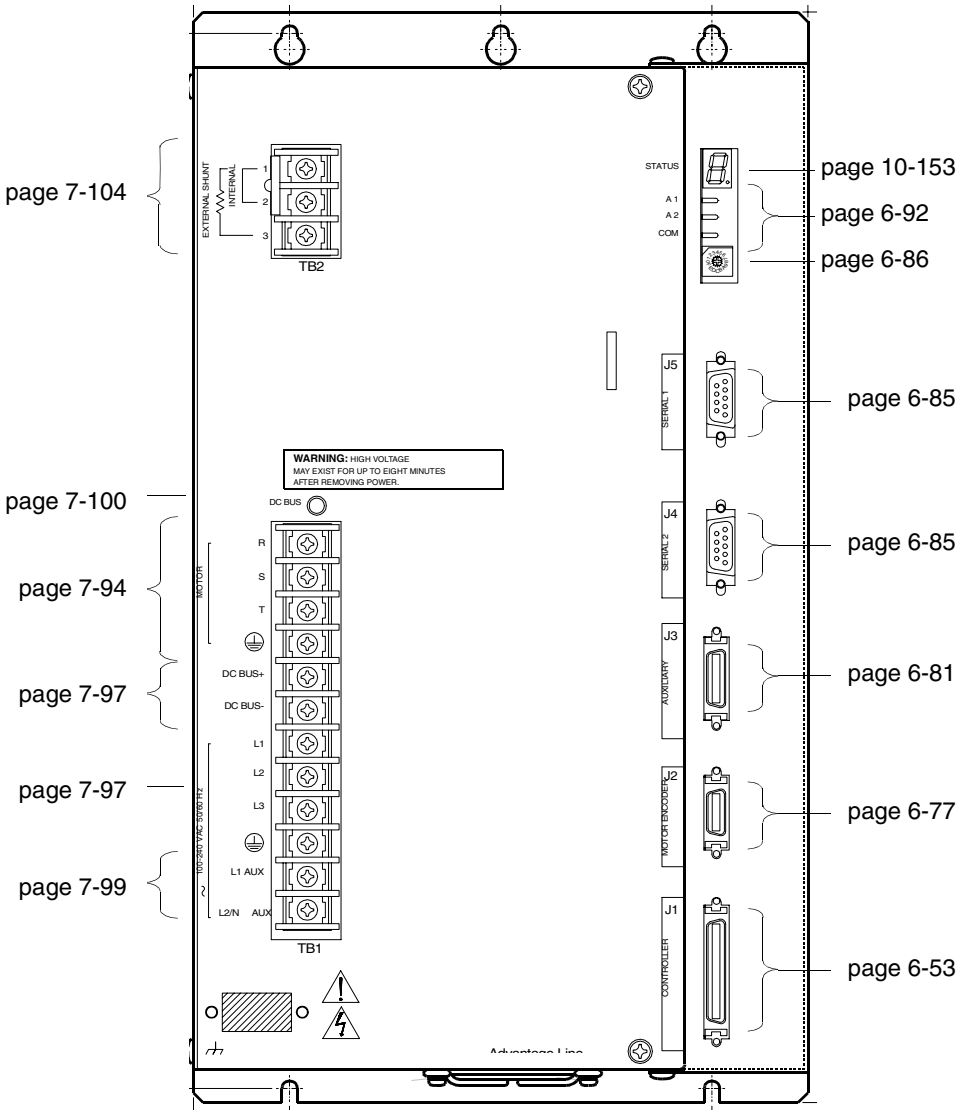
5	Isolated +24 VDC	
6	Isolated 24V Com	
7	Mtr Output Chnl A+	
8	Mtr Output Chnl A-	
9	Mtr Output Chnl B+	
10	Mtr Output Chnl B-	
11	Mtr Output Chnl I+	
12	Mtr Output Chnl I-	
13	Isolated 24V Com	
14	Auxiliary Chnl A+	
15	Auxiliary Chnl A-	
16	Auxiliary Chnl B+	
17	Auxiliary Chnl B-	
18	Auxiliary Chnl I+	
19	Auxiliary Chnl I-	
20	Drive Enable	
21	Fault Reset	
22	Analog Cmnd+	
23	Analog Cmnd-	
24	Drive Ready+	
25	Drive Ready-	



26	Isolated +24 VDC	31	Analog Output 2	36	RSVD	41	RSVD	46	RSVD
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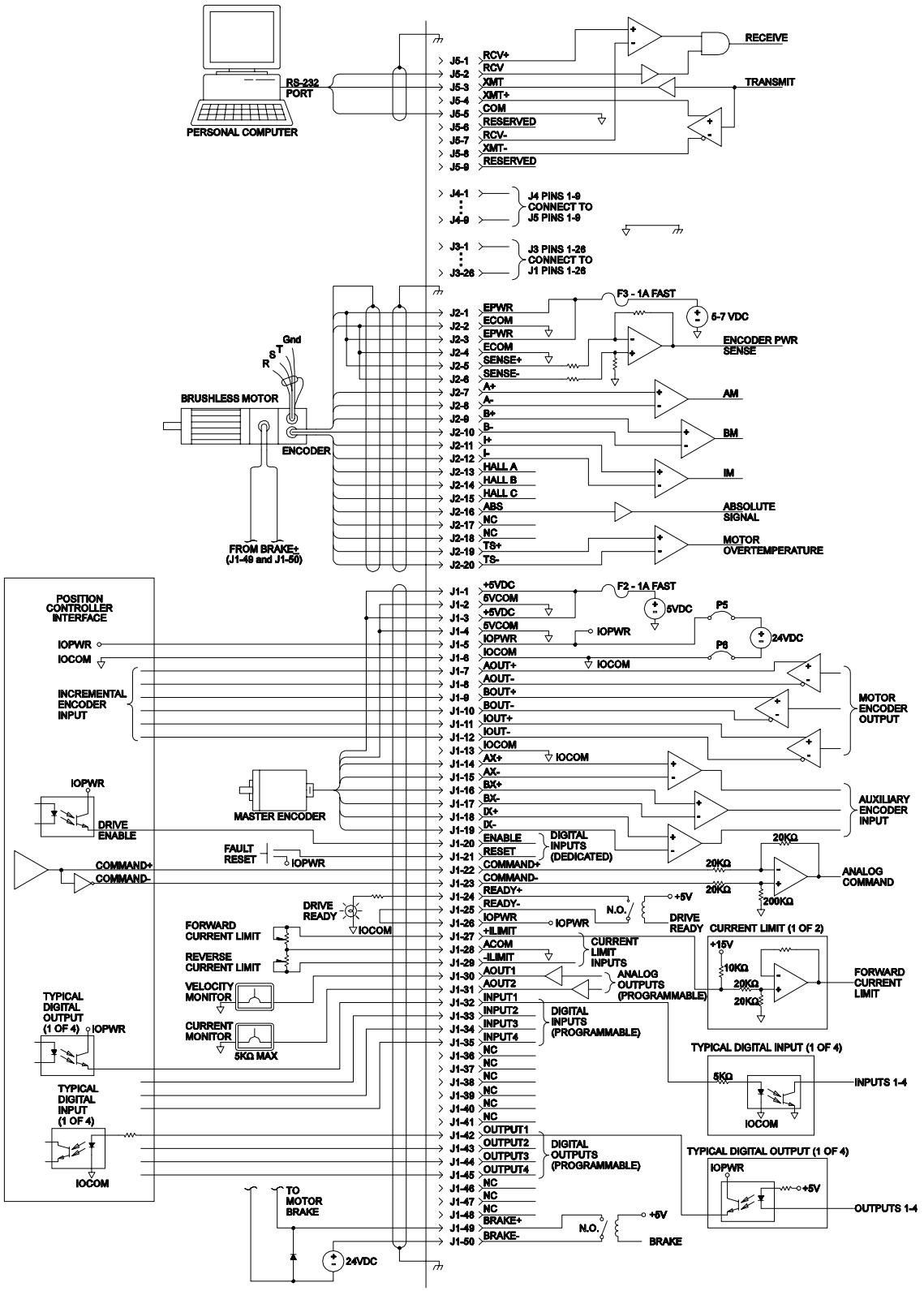
Interface Connections

Shown here are typical components and connections for a Centurion DSM100 Drive.



DSM Interface Connection Diagram

Declaration of Conformity

EMC
DECLARATION OF CONFORMITY

Application of Council Directive(s) 89/336/EEC, 92/31/EEC, 93/68/EEC

Manufacturer's Name: Giddings & Lewis
Manufacturer's Address: 666 South Military Road
Fond du Lac, Wisconsin 54936-1658

European Representative Name: Giddings & Lewis
European Representative Address: Randles Road, Knowsley Industrial Park
Prescot, Merseyside L34 9EZ England

Herewith declares that all servo drives listed below,

Model Name	Part Number	Model Name	Part Number
DSM110	401-34400-00	DSM130	401-34402-00
DSM120	401-34401-00	DSM175	401-34403-00

when operating any of the following motor families,

SSM, HSM, and FSM

when operating with or without the optional Touch Pad,

P/N 401-34405-00

and when installed in accordance with the installation instructions contained in the "Centurion DSM100 Drive Hardware and Installation Manual,"

P/N 108-30083-00

conform to the following generic and basic standards.

EN 55011:1993	(CISPR 1) Group 1 class A
EN 50082-2:1995	EN 61000-4-2, ENV 50140, ENV 50204, EN 61000-4-4, ENV 50141, EN 61000-4-8

We, the undersigned, hereby declare that the equipment specified above conforms to the above directive(s).

Manufacturer	**Legal Representative in Europe**
Signature Douglas B. Vonderhaar	Signature
Full Name Douglas B. Vonderhaar	Full Name ROGER MICHAEL COLLINS
Position Vice President and General Manager	Position FINANCE DIRECTOR
Place Giddings & Lewis Automation Control	Place Giddings & Lewis Knowsley
Date 29 MAR 96	Date APRIL 4.96.

NOTES

Product Support

Giddings & Lewis Automation Control product support is available over the phone. When you call, you should be at your computer and have the hardware and software manuals at hand. Be prepared to give the following information:

- The version numbers of the Giddings & Lewis Automation Control hardware and software products.
- The type of hardware that you are using.
- The fault indicators and the exact wording of any messages that appears on your screen.
- How you have tried to solve the problem.

Distributor & Representative Network

Giddings & Lewis Automation Control has a wide network of distributors that are trained to support our products. If you encounter problems, call the distributor or representative where you purchased the product before contacting the factory.

Applications Engineers and Field Service

In the United States you can reach the Giddings & Lewis Automation Control factory based support staff by phone 24 hours a day, 365 days a year at 1-800-558-4808. The applications engineers can assist you with programming difficulties as well as ideas for how to approach your automation task. Should your problem require on-site assistance, field service is available.

The applications engineers can also be reached via fax at 1-920-929-4669. The fax machine is open 24 hours 7 days a week. Faxes will be answered during regular business hours only.

In Europe, support can be obtained through Giddings & Lewis. The support staff may be reached by telephone between 8:30 and 17:30 local time, Monday through Friday at [44] 151-546-2010, or via fax at 011 [44] 151-547-2801.

Bulletin Board Service (BBS)

If you have a modem, you can reach the Giddings & Lewis Automation Control BBS 24 hours a day, 7 days a week at 1-920-929-4682. The following services are available through the BBS:

- Example application programs.
- Leave messages and files for the application engineers.
- Help with your application.

NOTES

Centurion DSM100 Drive
Hardware and Installation Manual

Giddings & Lewis Automation Control