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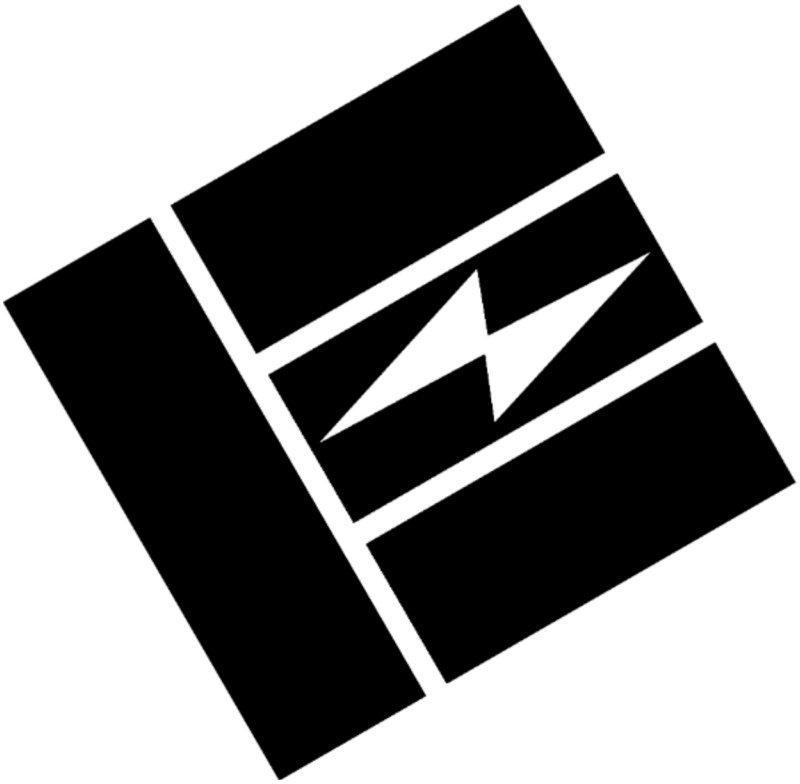
AXIMA 2000/4000
Installation Manual



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Rev.: A2
Date: October 31, 1997

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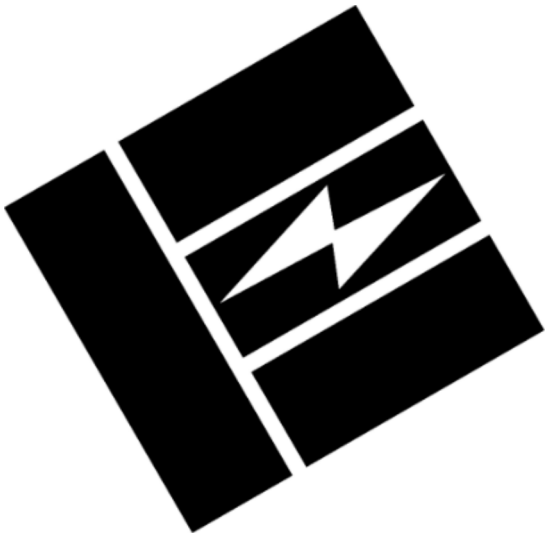

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This document has been prepared to conform to the current released version of hardware and software system. Because of our extensive development efforts and our desire to further improve and enhance the product, inconsistencies may exist between the product and documentation in some instances. Call your customer support representative if you encounter an inconsistency.

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Introduction

Overview

The *AXIMA 2000* or *AXIMA 4000* multi-axis controller from EMERSON Motion Control (referred to as *AXIMA 2000⁄4000* throughtout this manual) provides a fully integrated solution for servo control motors. It also provides a simple operator interface, machine I/O and host communications in one unit. Housed in an industrial hardened chassis, *AXIMA 2000⁄4000* combines digital servo control and 28 optically isolated I/O lines to create a powerful tool for solving motion control applications that require coordinated control of up to four axes.

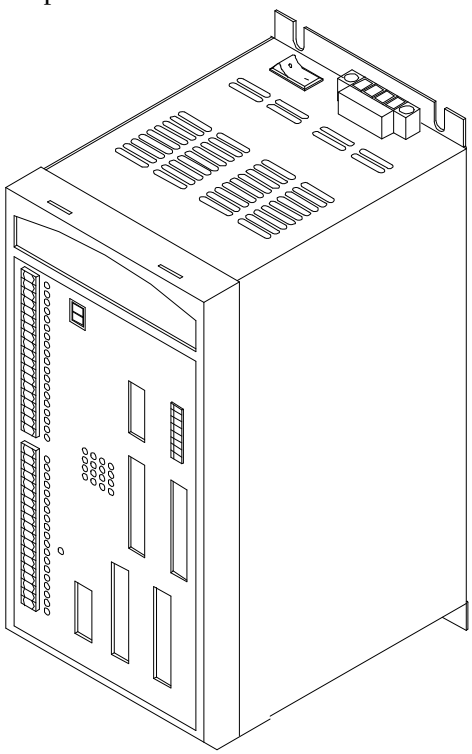

Figure 1 AXIMA 2000⁄4000

P/N 400290-00

The *AXIMA 2000⁄4000* controller uses a 32-bit floating point Digital Signal Processor (DSP). The DSP gives the *AXIMA 2000⁄4000* the processing power, flexibility and functionality to handle the wide range of multi-axis applications found in plant automation and industrial machinery.

With *AXIMA 2000⁄4000*, as many as four Motion, eight PLC and eleven Auxiliary Programs can be operating simultaneously and control up to four separate coordinate systems, one coordinate system with four axes of motion, or any combination with four coordinate systems and four axes of motion.

The onboard executive program allows axis assignments to be made to create one or multiple coordinate systems. Each coordinate system operates from an independent program. This allows the programmer to concentrate on one coordinate system at time.

Features

The *AXIMA 2000⁄4000* controller is designed for the industrial environment and easily back mounts into most NEMA type enclosures. The following are additional features of the *AXIMA 2000⁄4000* controller.

- Easy to mount configuration.
- Two and four axes controller options.
- 28 optically isolated I/O lines (16 input and 12 output).
- Two optically isolated serial ports providing communications up to 38.4 Kbaud.
- User programmable 14 segment status display.
- Analog Input (factory) option allows the *AXIMA 2000⁄4000* to accept eight single-ended or four differential inputs.
- Expanded I/O option which adds 32 optically isolated inputs and 32 optically isolated outputs.
- Connectivity option (Com 3 and Com 4) for Modbus® or Data Highway Plus®.

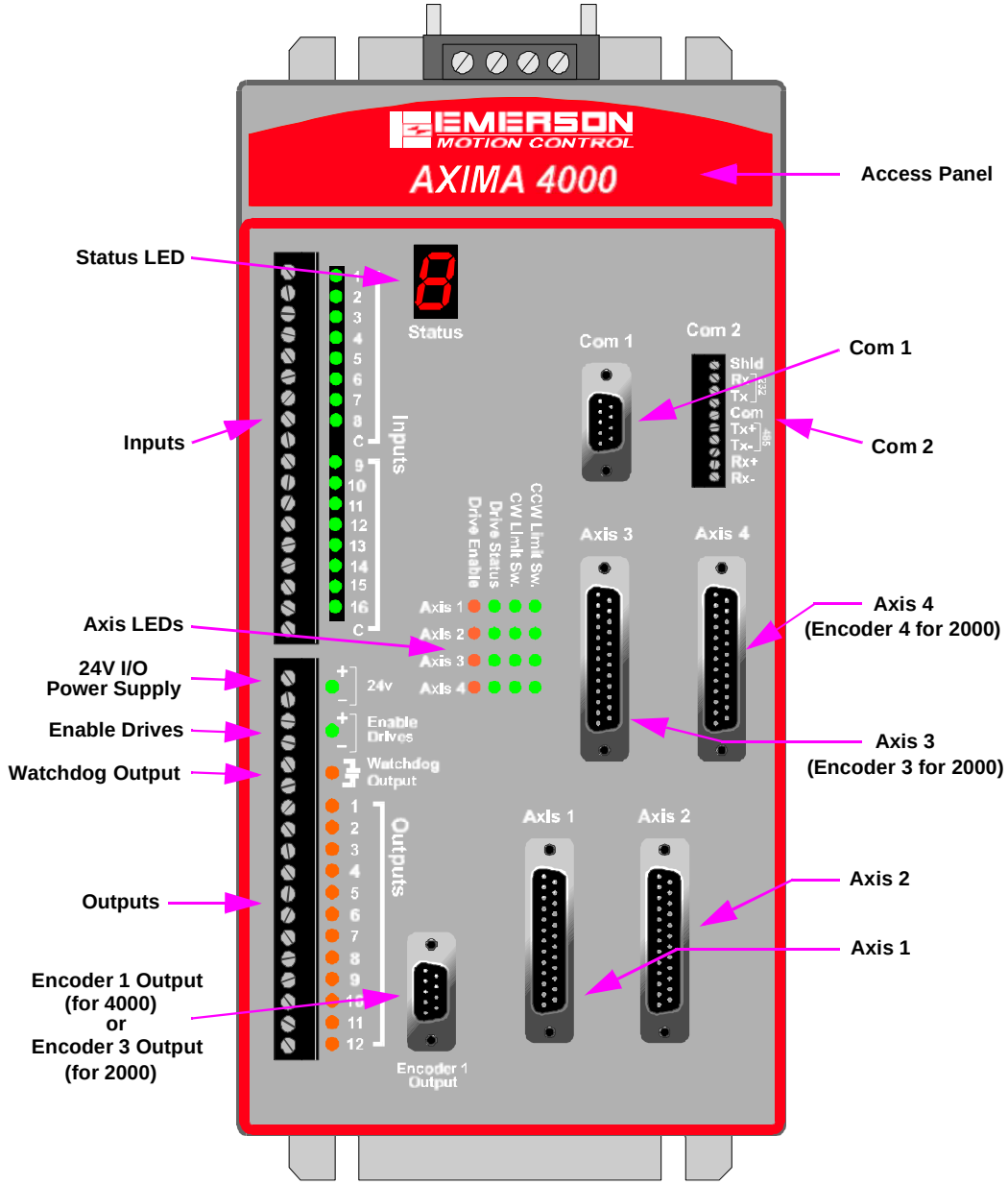

Figure 2 AXIMA 2000⁄4000 Front Panel Connections

Hardware Installation

The following installation requirements, methods and procedures are provided to assure reliable, trouble free installation and operation of your *AXIMA 2000/4000* controller. The methods and procedures outlined on the following pages include safety considerations, mounting, grounding, and power requirements.

Safety Considerations

This multi-axis controller product is intended for professional incorporation into a complete system. If installed incorrectly it may present a safety hazard. The product uses high voltages and is used to control mechanical equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning and maintenance must be carried out by personnel who have the necessary training and experience. They must read this safety information and the instruction manual carefully.

It is your responsibility to comply with the safety requirements of your system. This includes installing the system with an appropriate master interlock switch for emergency shutdown that will remove AC power from the system any time the equipment is not running or the emergency stop is activated. This reduces the possibility of electrocution or unwanted motion.

Enclosure

The controller is intended to be mounted in an enclosure which prevents access except by trained and authorized personnel, and which prevents the ingress of contamination.

P/N 400290-00

⚠ WARNING

General warning

Failure to follow safe installation guidelines can cause death or serious injury. The voltages used in the unit can cause severe electric shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to it. The installation must comply with all relevant safety legislation in the country of use.

AC supply Isolation device

The AC supply must be removed from the controller using an approved isolation device or disconnect before any servicing work is performed, other than adjustments to the settings or parameters specified in the manual.

Grounding (Earthing, equipotential bonding)

The controller must be grounded by a conductor sufficient to carry the prospective fault current in the event of a fault. The ground connections shown in the manual must be adhered to.

Fuses

Fuses or over-current protection must be provided at the input in accordance with the instructions in the manual. Failure to observe the instructions closely may cause a fire hazard.

Isolation of control circuits

The control circuits are isolated from the power circuits in the controller by basic insulation only. The installer must ensure that the external control circuits are isolated from human contact by at least one layer of insulation rated for use at the applied AC supply voltage.

Setting up, commissioning and maintenance

It is essential that changes to the controller settings are given careful consideration. Depending on the application, a change could have an impact on safety. Appropriate precautions must be taken against inadvertent changes or tampering.

Restoring default parameters set in certain applications may cause unpredictable or hazardous operation.

Mounting Requirements

The *AXIMA 2000/4000* should be back mounted vertically in a metal NEMA enclosure. A minimum spacing of four inches must be maintained above and below the controller for ventilation. The following diagram shows the dimensions of the *AXIMA 2000/4000* controller.

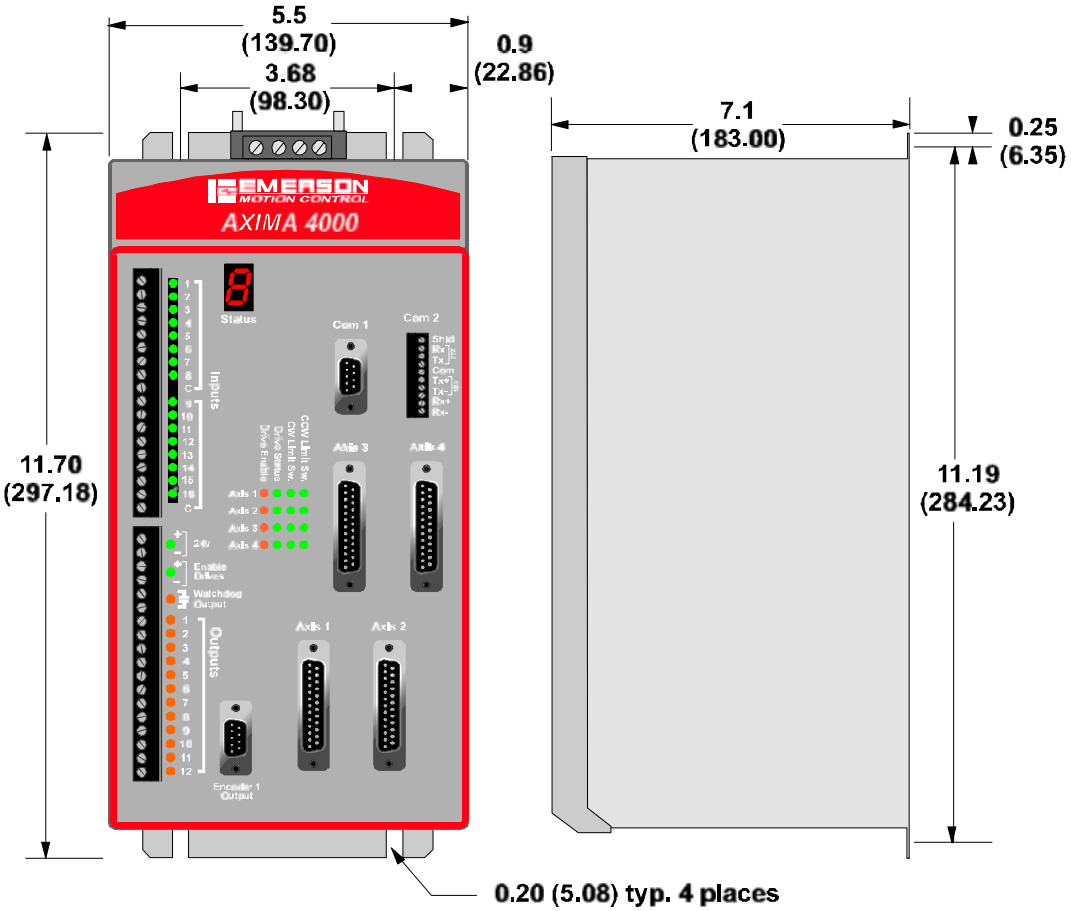

Figure 3 Mounting Dimensions

Selecting an Enclosure

The *AXIMA 2000/4000* multi-axis controller is designed for most industrial environments. However, no sophisticated electronic system can tolerate atmospheric contaminants such as moisture, oils, conductive dust, chemical contaminants and metallic particles. If the *AXIMA 2000/4000* is going to be subject to this type of environment, it must be mounted in a metal enclosure with a minimum rating of NEMA 12.

⚠ WARNING

The temperature inside the enclosure should not exceed 45° C (113° F).

System Grounding Requirements

AXIMA 2000/4000 Grounding

The GND terminal of the *AXIMA 2000/4000* is internally bonded to the chassis. The enclosure GND and the *AXIMA 2000/4000* GND should be a common signal point that ultimately is a continuous path to earth ground. These ground wires of the *AXIMA 2000/4000* should not be shared with other equipment in the enclosure.

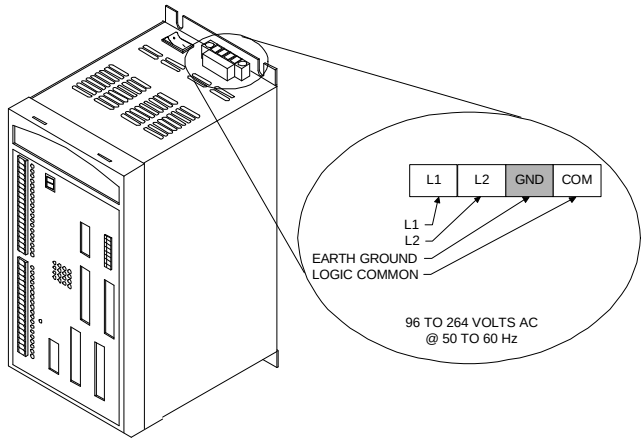

Figure 4 AXIMA 2000/4000 Grounding Point

AXIMA/E Series Drives Grounding Example

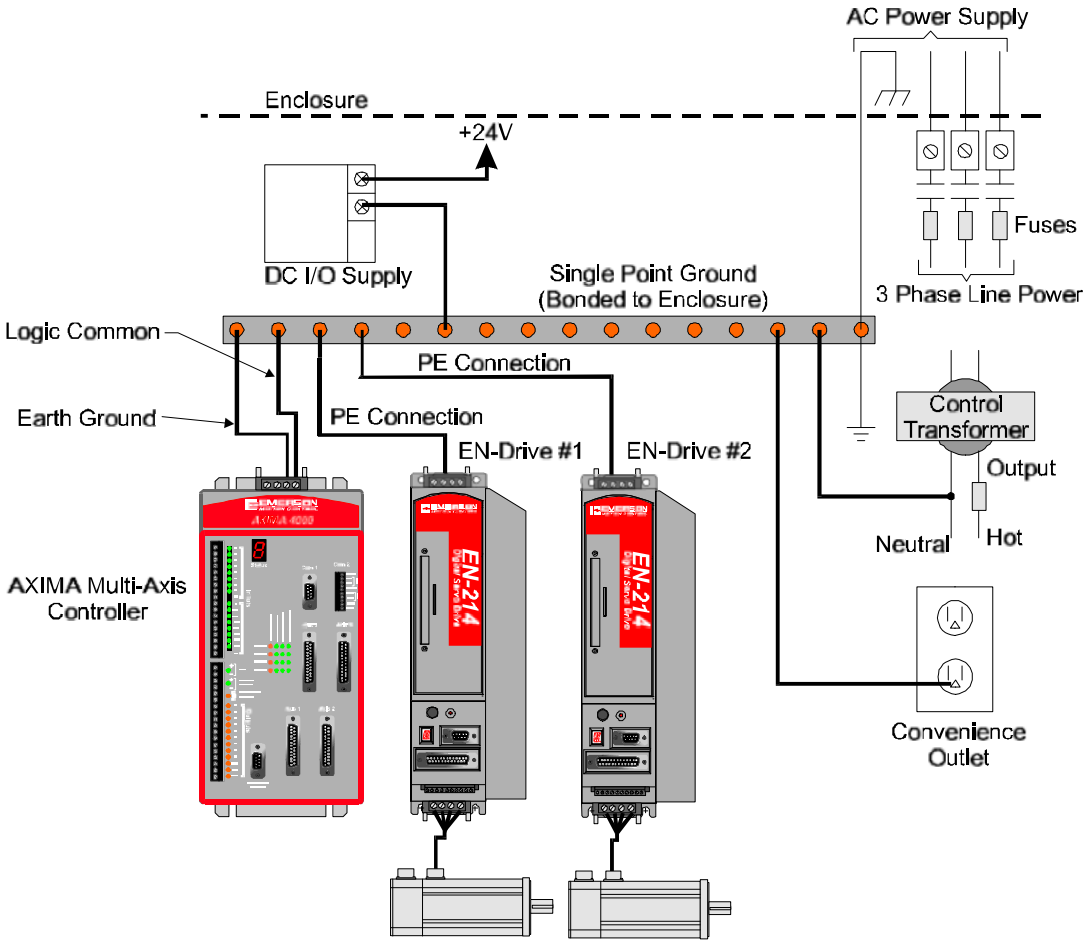

Figure 5 E Series Drive and AXIMA System Grounding Diagram

AXIMA/MX Drives Grounding Example

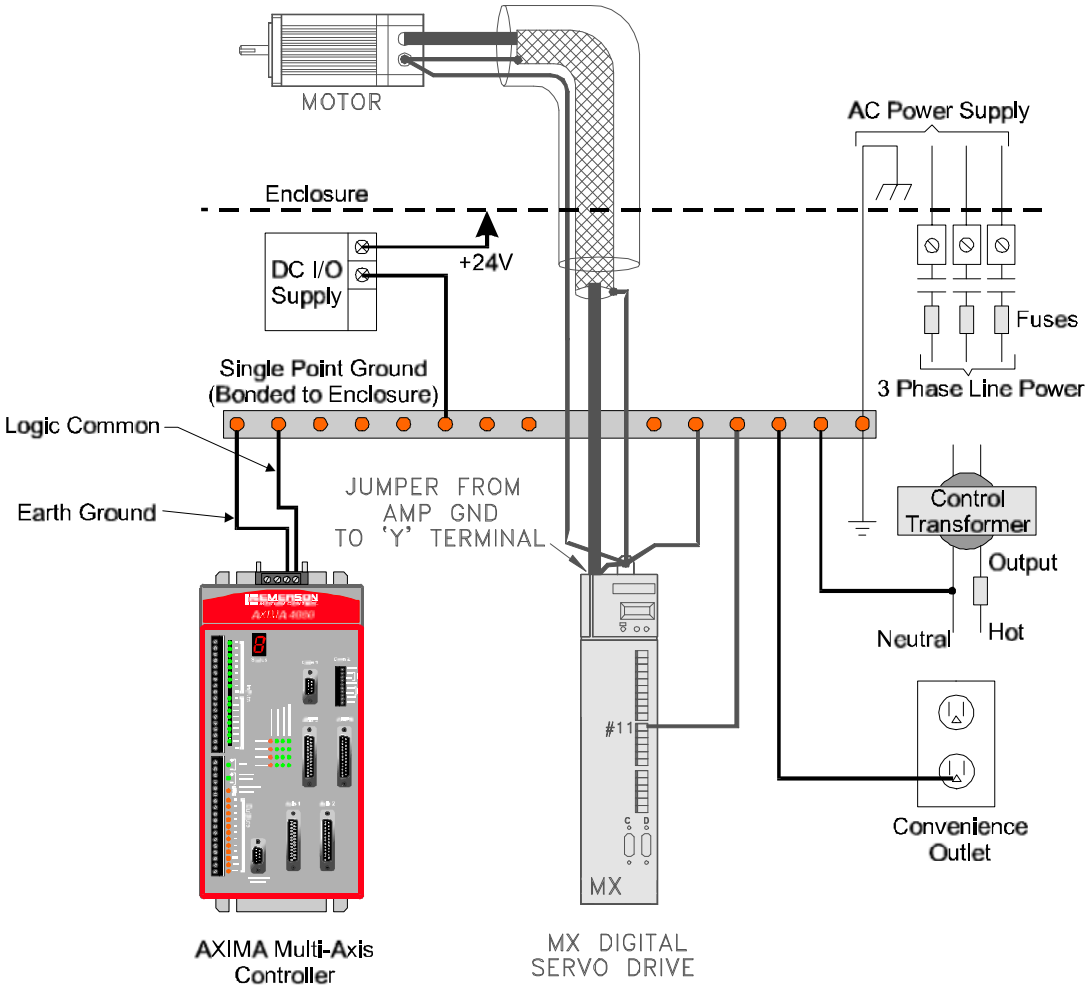

Figure 6 MX Drive and AXIMA System Grounding Diagram

AXIMA/LX Drives Grounding Example

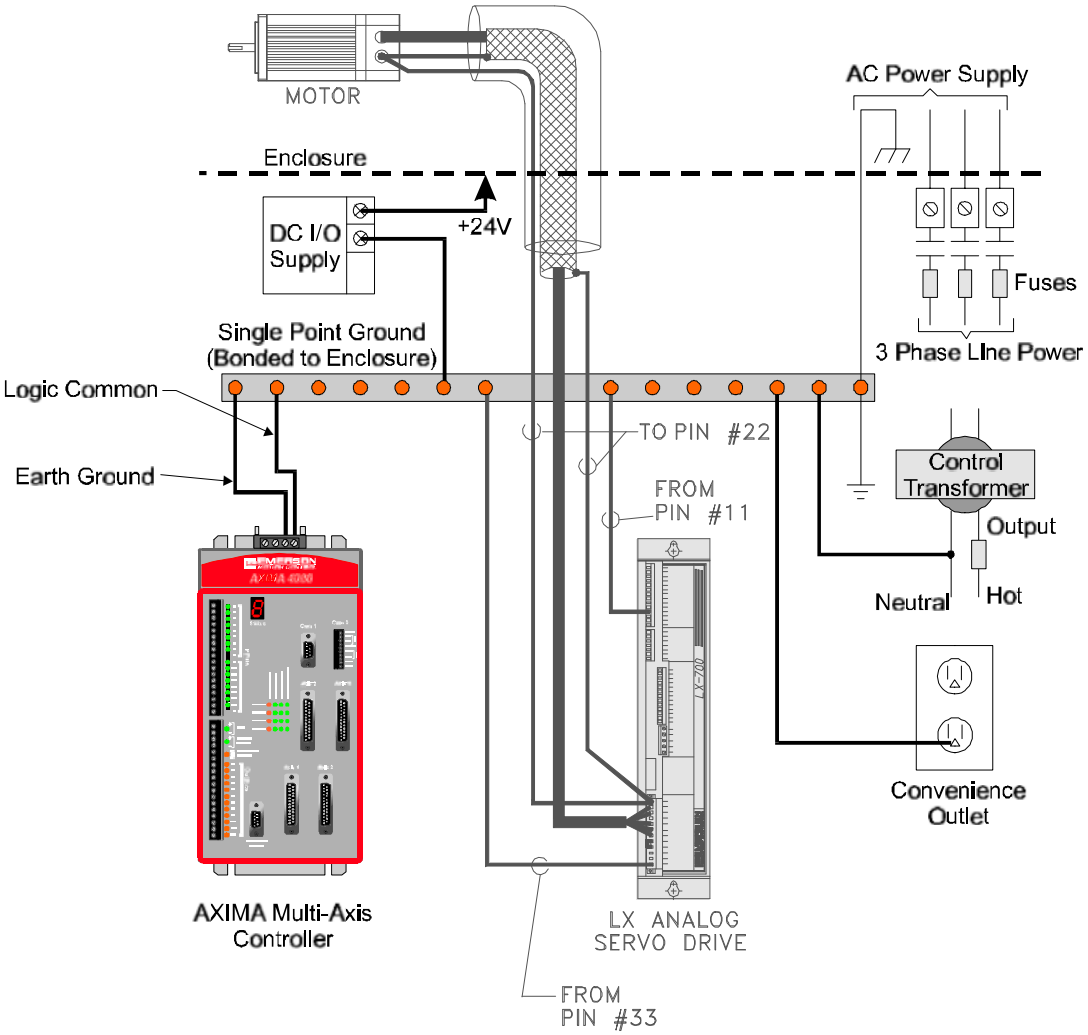

Figure 7 LX Drive and AXIMA System Grounding Diagram

Power Requirements

The AC power connects to a removable connector on the top of the *AXIMA 2000/4000* chassis. The AC power input must be between 96 and 264 VAC, single phase, and 50 to 60 Hertz. At 115 VAC, 1.0 amps RMS is required, or at 230 VAC, 0.5 amps RMS is required. However, at power-up the logic supply has an inrush current that is typically 20 amps at 115 VAC and 40 amps at 230 VAC for 2 milliseconds. This inrush current must be considered when choosing AC power fusing.

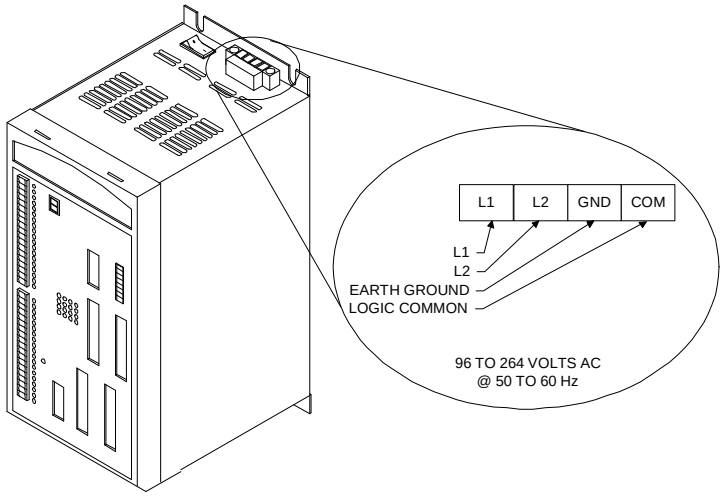

Figure 8 AC Power Connector

AC Supply Range	AC Supply Voltage	Current	Inrush Current (2 ms)	Fusing
96 to 264 VAC	115 VAC	1 Amp	20 Amps	FLM-2 or equivalent
	23 VAC	0.5 Amp	40 Amps	2 Amp Slo-Blo

External Fusing Requirement

The AC power supply must be fused with a 2 amp fuse. Littlefuse's FLM-2 SLO-BLO® type fuse or an equivalent can be used.

A significant AC power problem occurs when the secondary of the AC distribution transformer is not electrically referenced to earth ground (i.e., left floating). In this case, the voltages that develop between the AC power lines and earth ground can continuously exceed the rated voltage of 264 VAC. When this happens the protection circuit in the *AXIMA 2000/4000* will try to suppress this excess voltage. If the condition is prolonged, the *AXIMA 2000/4000* protection circuits will fail.

Connections and Cabling

Serial Communications

The *AXIMA 2000/4000* has two optically isolated serial ports (COM 1 and COM 2). COM 1 is an RS232C port. COM 2 can be configured for RS232C, RS422 or RS485 using DIP switches located behind the removable access panel on the top front of the *AXIMA 2000/4000* controller.

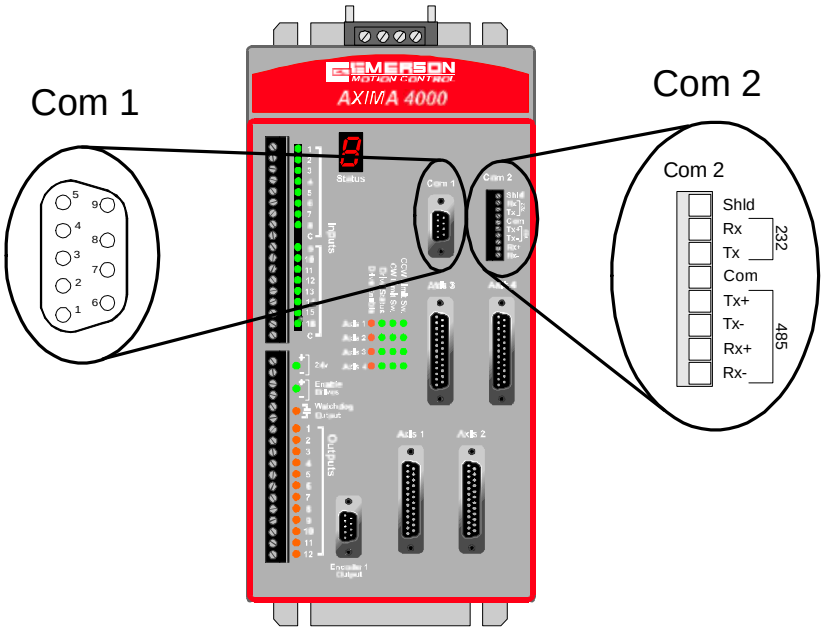

Figure 9 AXIMA 2000/4000 Communication Ports, Com 1 and Com 2

COM 1

The *AXIMA 2000/4000* COM 1 connection is a RS232C serial communication port. The COM 1 port is activated and will automatically detect the baud rate by receiving one carriage return after power up. Both serial ports, COM 1 and COM 2, can be open simultaneously and attached to different programs. For example, one port could be used as a programming and diagnostics port while the second port is communicating with an operator interface panel such as the EMERSON Motion Control T-60 panel.

Serial Port and Cable Specifications

It is recommended that all communication lines be twisted pair shielded cable. Cables should be routed away from motor power and other high voltage or noisy wiring.

Table 1 Serial Communications Port Setup

Serial Communication Setup	
Max baud rate	38.4 K
Stop bit	1
Data bits	8
Parity	none

The RS232C serial communication cables should be no longer than 50 feet to comply with RS232C specifications. However, longer cables may be used at slower baud rates (less than 9600). The wiring diagrams on the next page show the TIX and TIA serial cables which are available from EMERSON Motion Control in 10, 25 and 50 foot lengths. Non-standard lengths can be special ordered.

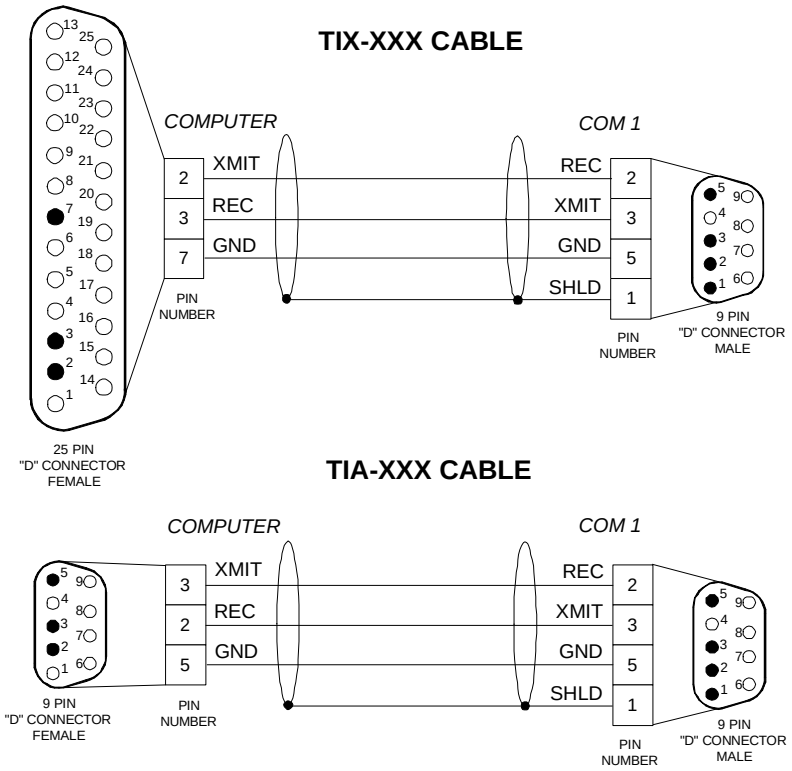

Figure 10 RS232C Serial Communication Cables Wiring Diagram

COM 2

To communicate with more than one *AXIMA 2000/4000* controller, and using the *AXIMA* Software or other host controller, you must use COM 2 configured as an RS485. The COM 2 serial communication port is shipped as a RS232C as default.

DIP Switch Settings

COM 2 can be configured for RS232C, RS422 or RS485 using switches located behind the removable access panel on the top front of the *AXIMA 2000/4000* controller.

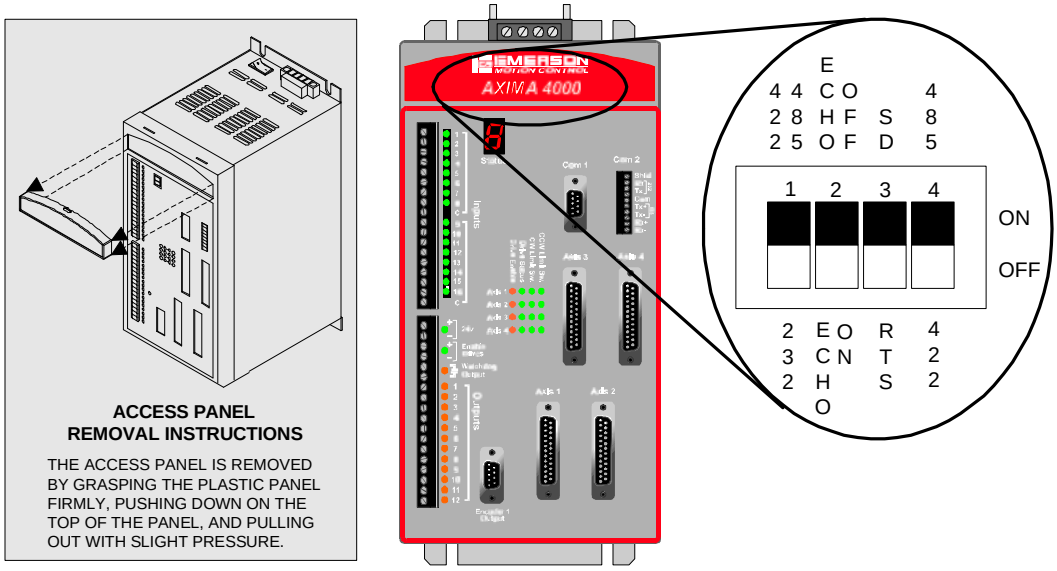

Figure 11 AXIMA 2000/4000 DIP Switches Location

Table 2 COM2 DIP Switch Settings

DIP Switch Settings				
	1	**2**	**3**	**4**
RS232C	DOWN			
RS422	UP	DOWN	DOWN	DOWN
RS485 (2 wire/SD)	UP	UP	UP	UP
RS485 (4 wire/SD)	UP	DOWN	UP	UP
RS485 (4 wire/RTS)	UP	DOWN	DOWN	UP

Mode Selection

RS232C Mode (Default Mode)

The *AXIMA 2000/4000* is shipped with COM 2 in RS232C mode.

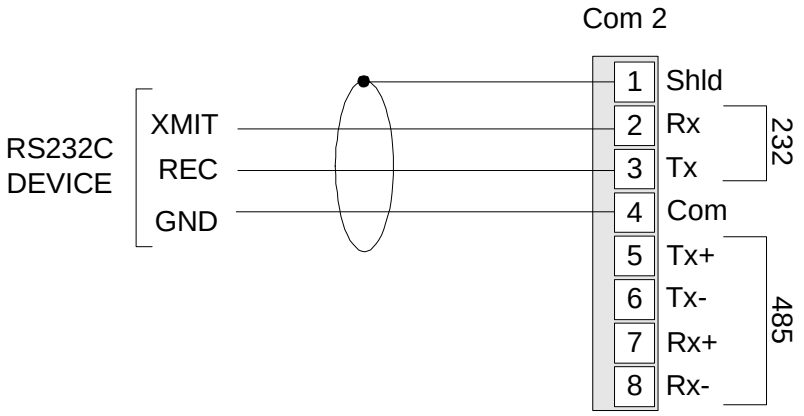

Figure 12 COM 2, RS232C Configuration

RS422 Mode

With COM 2 in RS422 mode, the transmitter is not put into a tri-state mode. The Tx (Transmit) lines of multiple *AXIMA 2000/4000*'s **CAN NOT** be wired together. The receive line of the last AXIMA should be terminated with a 120 ℅ ½ watt resister. See Figure 12, COM 2, RS232C Configuration, on page 19.

RS485 Mode

RS422 and RS485 modes are similar because they both use differential drivers and receivers. RS485 mode adds the ability to enable and disable the receivers and transmitters as required for multidrop installations. See Figure 13, RS422 Wiring Diagram, on page 21.

The enable and disable operations of the *AXIMA 2000/4000* controller serial port can be selected to operate in two different transmission methods. These methods are selectable with a DIP switch behind the access panel on the top front of the controller. It is labeled, SD (Send Data) or RTS (Ready to Send). See Figure 16, COM 2, RS485 Configuration, on page 24.

SD (Send Data) Method: This is the simplest mode. Whenever the *AXIMA 2000/4000* controller serial port senses that data is present the transmitter is enabled. The transmitter stays enabled long enough to assure the last bit has been sent then is disables or tri-states the transmission. It does this for baud rates down to 9600 baud. The transmitter is in tri-state mode or disabled when data is not being sent so it can receive data.

RTS (Ready to Send) Method: This method enables the transmitter under two conditions.

1. When a particular *AXIMA 2000/4000* controller has been chosen by the host to be online, the command, CTRL A - "Axis ID #" - Enter, is issued. The transmitter stays enabled until a "CTRL B" command is received.

2. When the *AXIMA* Software Application executes an Open Com Instruction, the transmitter is enabled. The transmitter goes back to tri-state mode when a Close Com Instruction is issued. See the *AXIMA Software User's Guide* (P/N 400263-00) for more information.

The Echo On/Off DIP switch controls the enable/disable function of the *AXIMA* receiver. With the switch "On", the receiver is always enabled. This switch should be "On" for RS422 and RS485 four wire operation. With the switch "Off", the receiver is disabled whenever the transmitter is enabled. This is needed for two wire mode. This is to prevent the *AXIMA 2000/4000* from receiving the same characters it just transmitted.

The figure below shows a wiring diagram for serial communications of a RS422 configuration.

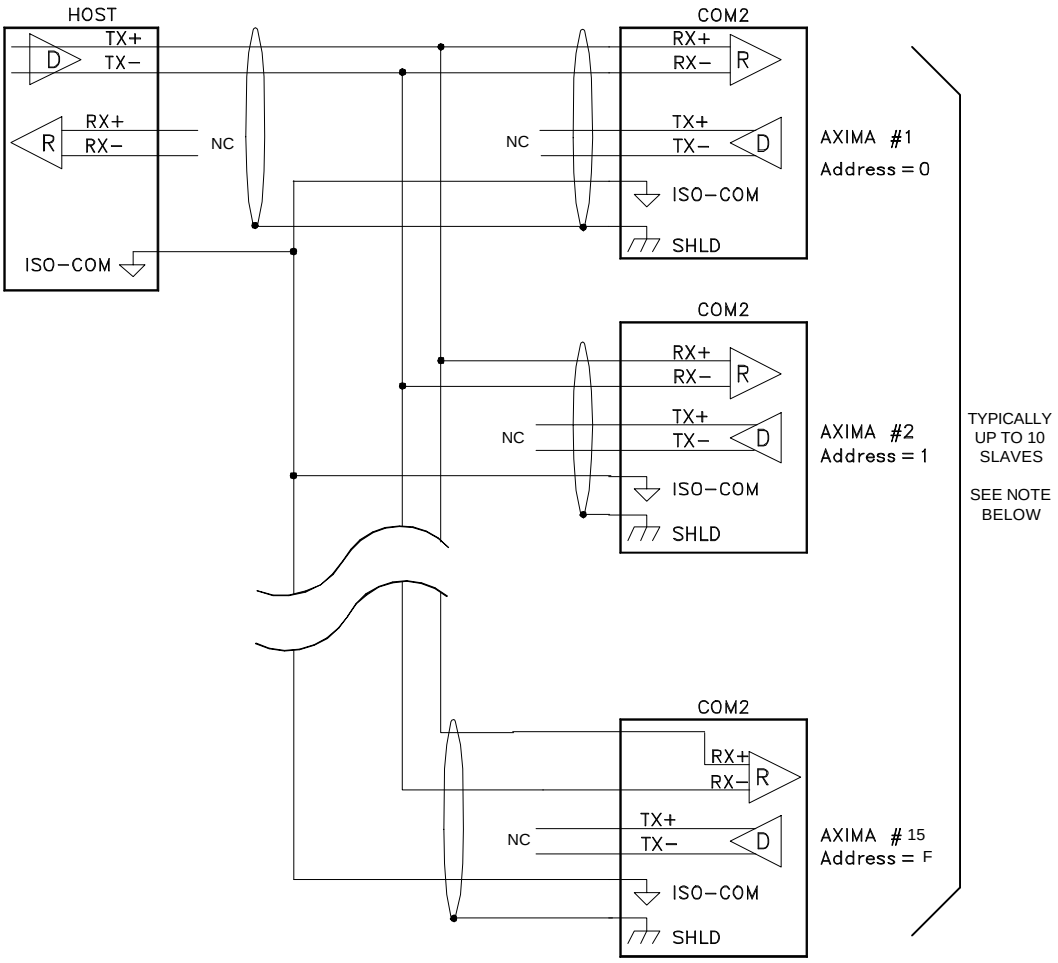

Figure 13 RS422 Wiring Diagram

NOTE: A standard RS-422 host transmitter can drive up to 10 slaves. However, the *AXIMA* transmitter can drive up to 32 slaves in RS-422 mode.

The figure below shows a wiring diagram for serial communications in an RS485 four wire multi-drop configuration.

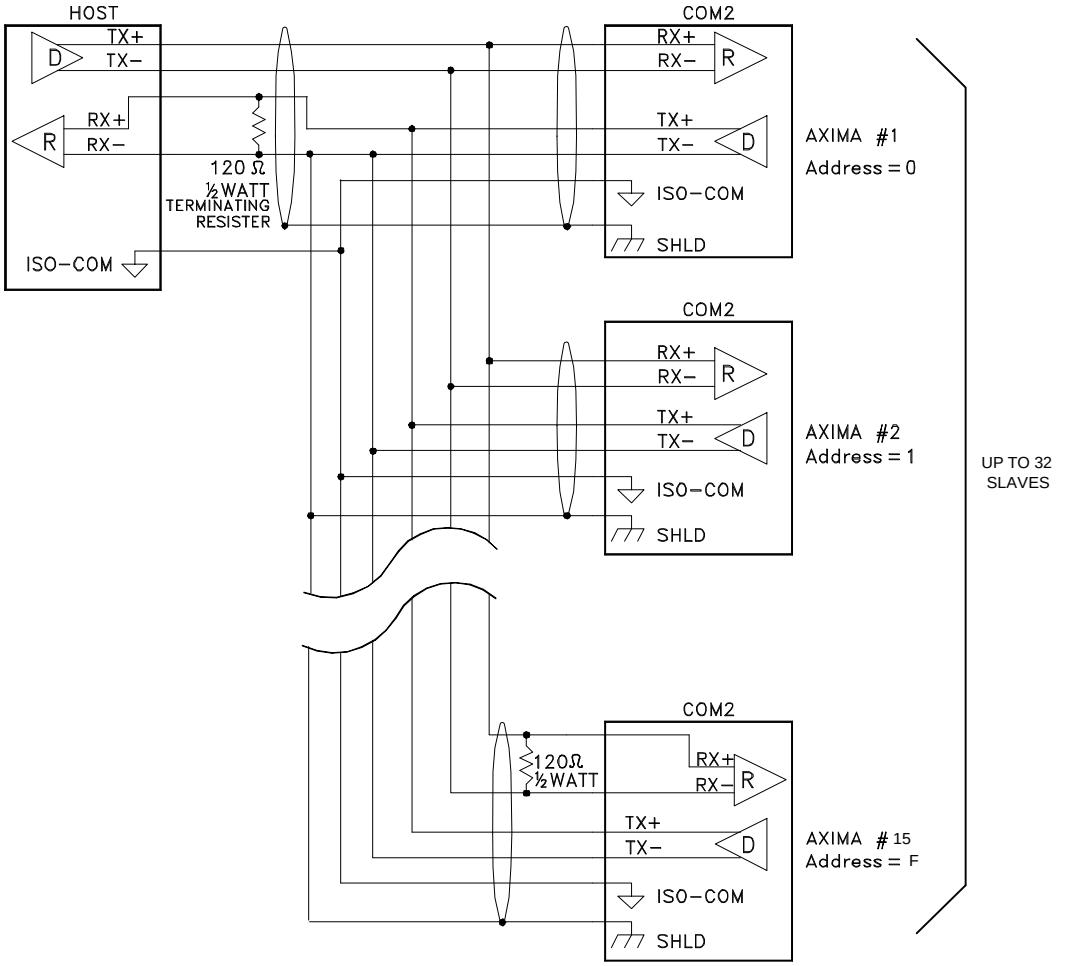

Figure 14 RS485 Four Wire Multi-Drop Wiring Diagram

The figure below shows a wiring diagram for serial communications of a RS485 two wire termination connection.

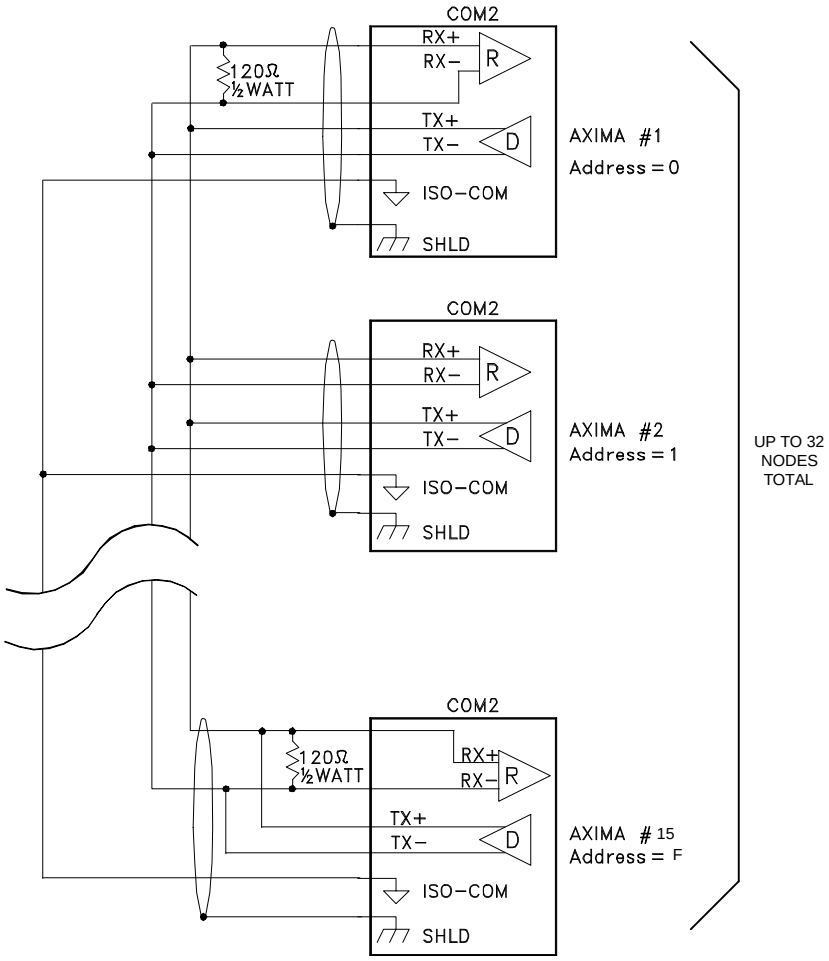

Figure 15 RS485 Two Wire Termination Connection Wiring Diagram

RS485 termination

Two 120 ℧, ½ watt resisters must be installed on an RS-485 network, one at the node (RS-485 port) physically at the beginning of the cable and one on the node at the end.

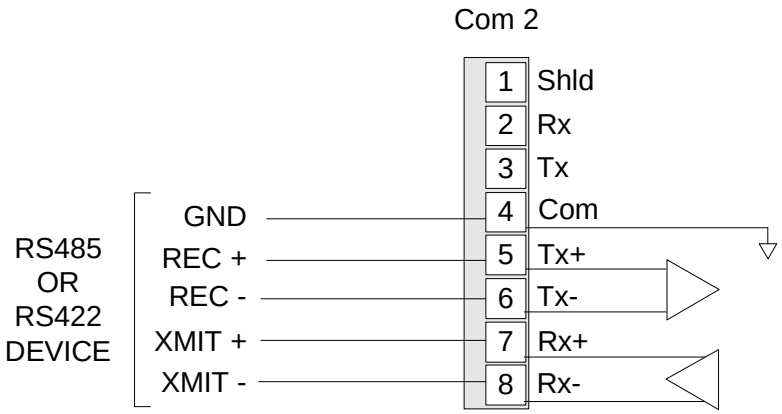

Figure 16 COM 2, RS485 Configuration

Serial Port Grounding

The *AXIMA 2000/4000* provides an isolated logic supply for its communication circuitry. ISO-COM is the circuit common for both COM port circuits. COM 1 and COM 2 devices, such as PC serial ports, typically have signal ground connected to earth ground internally in the PC.

If your COM devices do not have signal grounds that are common with respect to each other (such as both connected to earth ground) then you must connect them together. Failure to connect device grounds together could cause damage to the device or the *AXIMA 2000/4000* controller.

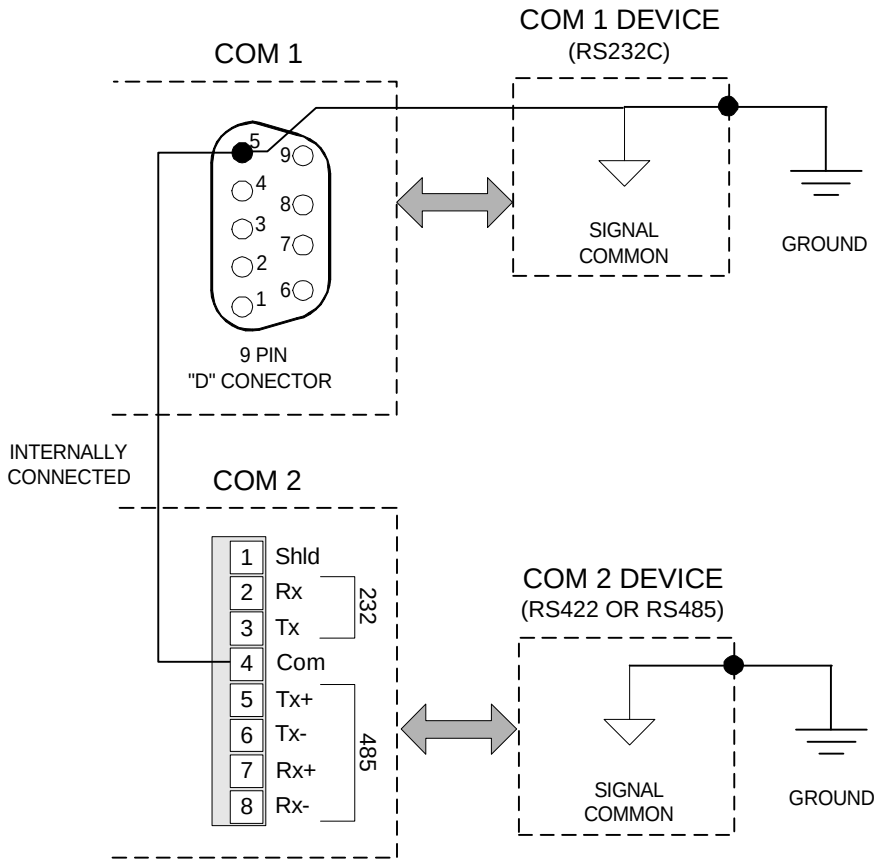

Figure 17 Serial Communications Grounding Diagram

Serial Port and Cable Specifications

It is recommended that all communication lines be twisted pair shielded cable. Low capacitance shielded twisted pair cable, such as EMERSON Motion Control CCR4 or CCR6, will deliver optimum performance especially with long cable lengths and high baud rates. Cables should be routed away from motor power and other high voltage or noisy wiring.

Table 3 Serial Communications Setup

Serial Communication Setup	
Max baud rate	38.4 K
Stop bit	1
Data bits	8
Parity	none

NOTE: As baud rates increase or cable lengths get longer your susceptibility to noise increases. Therefore, if you are experiencing communication problems, it is recommended that you install a ½ watt terminating resister, 100 ℣ for RS422 and 120 ℣ for RS485.

Controller ID Number/Address

The following table shows how the Address DIP switch positions relate to the *AXIMA 2000/4000* controller axis ID number. The DIP switches are located behind the top front access panel of the *AXIMA 2000/4000*.

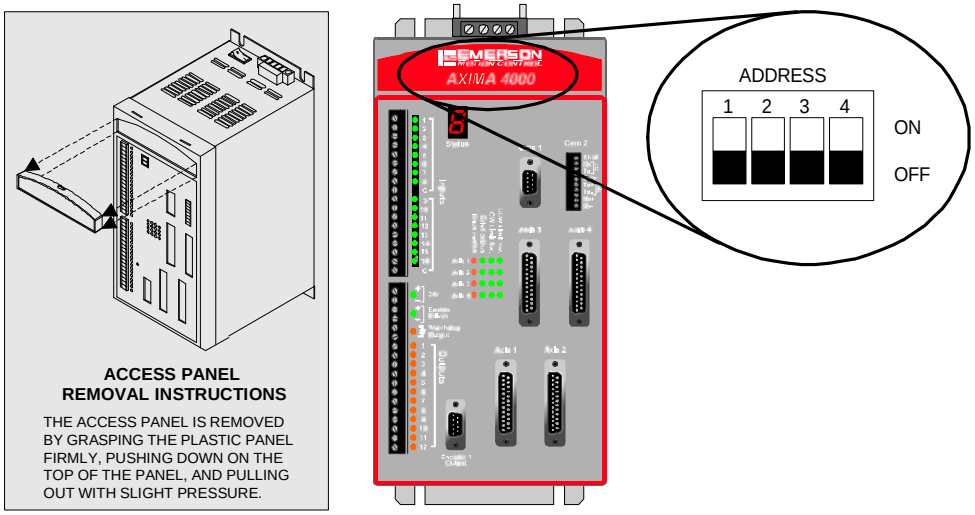

Figure 18 AXIMA 2000/4000 Address DIP Switch Location

Table 4 Controller ID Numbers (Address DIP Switch Settings)

AXIMA ID	Address DIP Switch Settings			
	1	2	3	4
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
2	OFF	OFF	ON	OFF
3	OFF	OFF	ON	ON
4	OFF	ON	OFF	OFF
5	OFF	ON	OFF	ON
6	OFF	ON	ON	OFF
7	OFF	ON	ON	ON
8	ON	OFF	OFF	OFF
9	ON	OFF	OFF	ON
A	ON	OFF	ON	OFF
B	ON	OFF	ON	ON
C	ON	ON	OFF	OFF
D	ON	ON	OFF	ON
E	ON	ON	ON	OFF
F	ON	ON	ON	ON

Multi-Drop Installations

If your application uses more than one *AXIMA 2000/4000* controller (up to 16 can be linked serially), each must have a different ID number. This allows each *AXIMA 2000/4000* to be addressed individually over the same multi-drop serial cable in the RS422 and RS485 modes.

Axis Connections

The *AXIMA 2000* has two axes and two auxiliary encoder connections, while the *AXIMA 4000* has four axes connections. On the front panel of the *AXIMA 2000⁄4000* there are four, 25 pin female "D-sub" connectors.

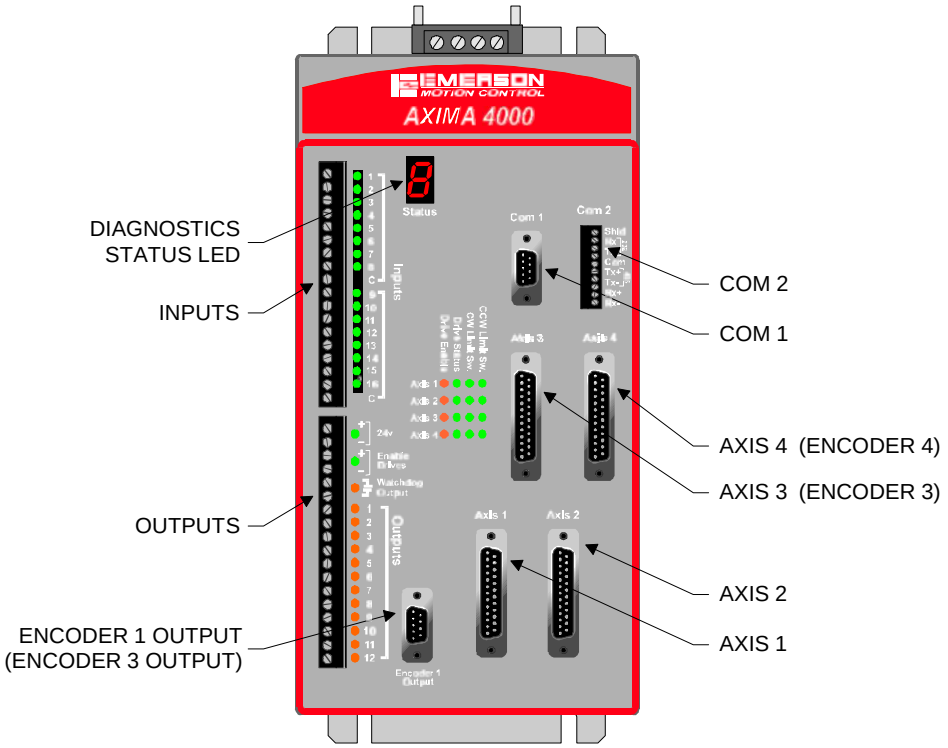

Figure 19 AXIMA 2000⁄4000 Connectors (4 Axes)

These axis connectors are used to connect the AXIMA 2000/4000 controller to the individual amplifiers (E Series, MX, LX, etc.). The following table shows the pinout of the 25 pin female "D-sub" connectors.

Table 5 Axis and Auxiliary Encoder Connector Pinouts

Pin Number	Signal Name	Pair Number
13	A Encoder Input Signal	1
25	A/ Encoder Input Signal	
12	B Encoder Input Signal	2
24	B/ Encoder Input Signal	
11	Z Encoder Input Signal	3
23	Z/ Encoder Input Signal	
10	+5 VDC for Encoder Feedback	4
22	+5 VDC Common	
-	Pulse	5
5	Pulse/	
17	Direction	6
-	Direction/	
8	Analog Command Output -	7
20	Analog Command Output +	
9	Enable Contact	8
21	Enable Contact	
14	Ø V I/O Supply Common	9
2	+24 V I/O Supply	
3	Discrete Input (CCW Travel Limit)	10
16	Discrete Input (CW Travel Limit)	
15	Discrete Input (Drive Status)	11
18	Low Current Mode	
7	Analog Input 1	12
6	Analog Input 2	
19	Analog Common	13
18	N/C	
4	Overall Shield	

* Grayed-out Pin Numbers are not available in the *AXIMA 2000*'s Encoder Connection 3 and 4.

Encoder Inputs

Encoder signals are low voltage, high frequency signals susceptible to noise if not properly shielded. For reliable operation it is important that encoder cables be shielded and routed away from motor power or other high voltage signals. Shields should be connected at the controller end.

Table 6 Encoder Signals

Specifications	
Input Signal	Quadrature square wave
Maximum Rate	8 MHz
Type	Differential Receiver, DS26LS32
Voltage	5 VDC maximum, 2 VDC minimum
Supply	5 VDC, 250 mA maximum per axis

The encoder signals may come from an encoder or from the encoder simulation output of a brushless servo drive (see wiring diagrams below).

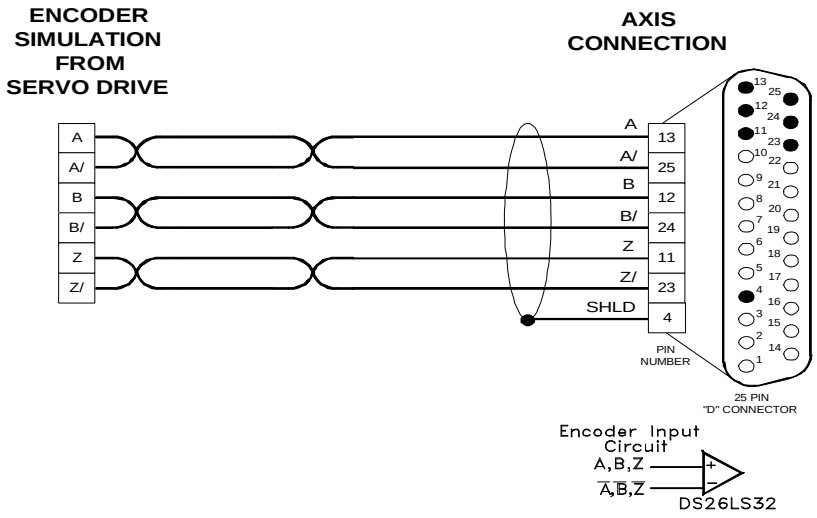

Figure 20 Encoder Simulation Wiring Diagram

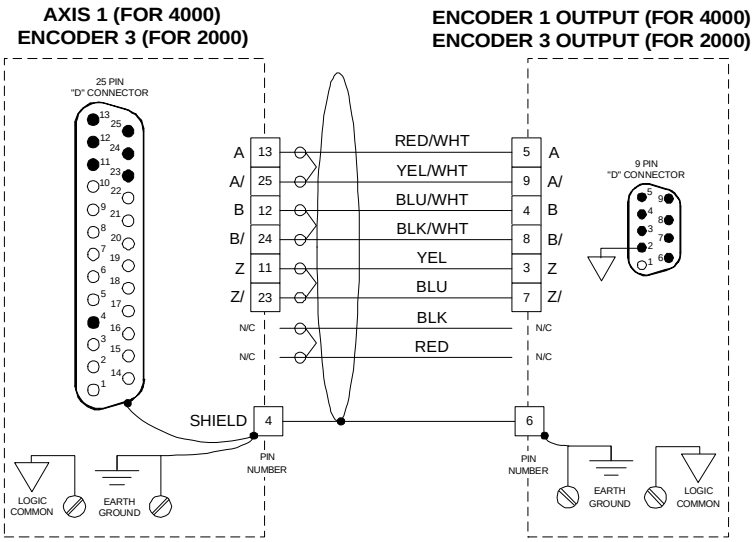

Figure 21 Encoder 1 Signal to another AXIMA Wiring Diagram

Shown below is the wiring diagram for the AX4-ENC-XXX cable which is available fom EMERSON Motion Control in 15, 25 and 50 foot lengths for connection to EMERSON Motion Control's SCS LD encoders.

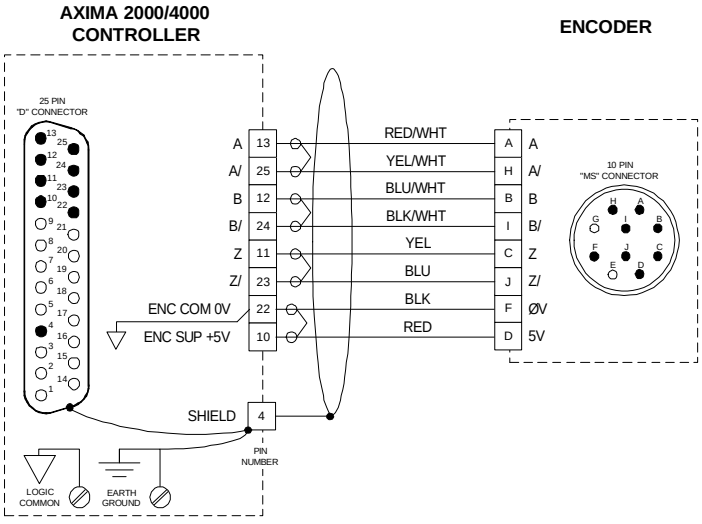

Figure 22 AX4-ENC Encoder Cable Wiring Diagram

Encoder Power Supply

The *AXIMA 2000/4000* can be used to provide the 5 volt power source for external encoders. Connections are provided on each axis I/O connector. The current on the 5 volts must be limited to 250 milliamps per axis and the maximum current for 4 encoders must be limited to 1 amp. Each 5 volt Encoder Supply has a 0.5 amp fuse in series with the internal 5 volt logic supply, thus excessive currents will blow the fuse.

Analog Outputs

AXIMA 2000/4000's analog command output to the servo amplifier is a precision 16 bit output. These signals are susceptible to noise if not properly shielded. For reliable operation it is important that command cables be shielded and routed away from motor power or other high voltage signals. Shields should be connected at the *AXIMA 2000/4000* end. The input stage of the amplifier should be a differential circuit. The output voltage is ±10 VDC, output current is 5 milliamps maximum.

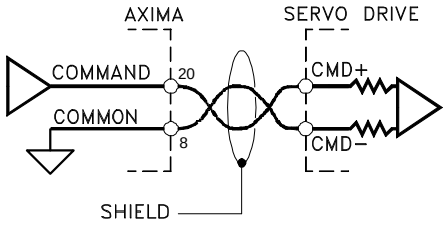

Figure 23 Command Output

Drive Enable (Enable Contact)

Each axis has an Enable Relay Contact . The contact has a rating of 30 VDC and is capable of switching 0.5 amps for a resistive load. All Enable relays are interlocked with the Watchdog relay as well as the Enable Drives input. Each relay is also individually controlled by the pre-defined Drive Enable output. See Figure 33, Watchdog, Drive Enable Circuit, on page 41.

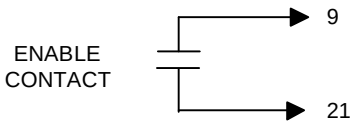

Figure 24 Drive Enable (Enable Contact) Circuit

⚠ CAUTION

It is recommended that the Enable Contact be used. If these contacts are not used, physically connecting a drive (E Series, MX, LX or other) to the controller while that drive is enabled may cause unwanted motion.

In the event the Enable Contact is not used, the following power sequence must be followed:

1. Apply power to the *AXIMA 2000/4000* controller
2. Apply power to the drives
3. Enable the drives
4. Normal machine operation
5. Disable or power down the drives
6. Power down the *AXIMA 2000/4000* controller

Drive Status and Overtravel

Drive Status or Overtravel inputs do not perform any pre-defined action in the controller. They are available as pre-defined bits and may be used in the *AXIMA* Software's PLC, Motion or Auxiliary Programs to perform desired logic.

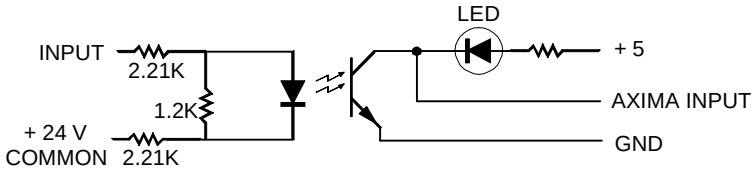

Figure 25 Drive Status and Overtravel Input Circuit

Example Axis Connections

If desired, the *AXIMA 2000/4000* can be used to generate a torque or current command instead of a speed command. When the drives are used in torque mode, the drive velocity loop gain adjustments no longer need to be considered. This can simplify the tuning procedure for some applications.

E Series Drives

All command and I/O signals are accessed using the 44 pin command connector located on the front of the E Series drive.

The wiring diagram below shows the typical command connections between the *AXIMA 2000/4000* controller and an E Series drive using the AX-CEN-XXX cable.

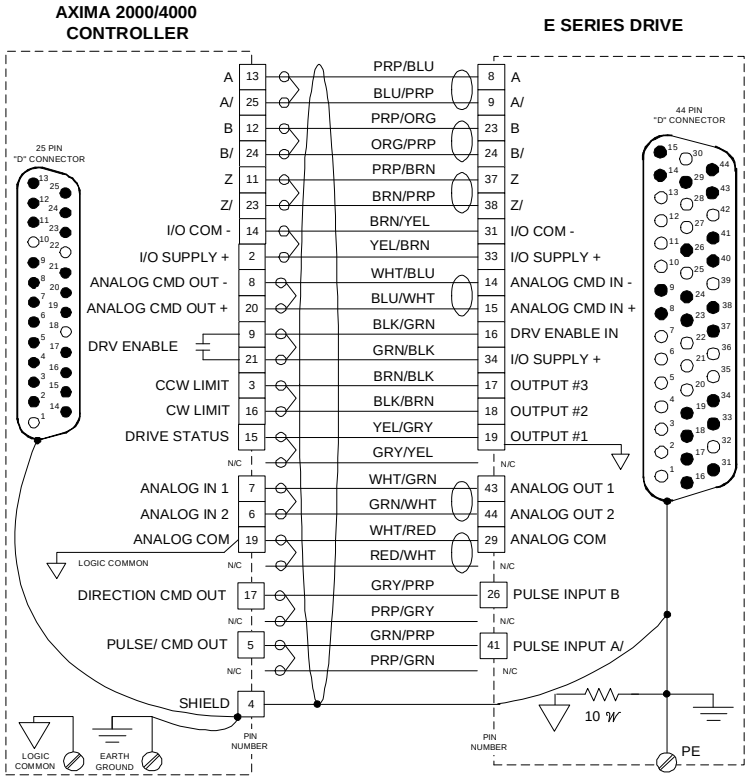

Figure 26 AXIMA 2000/4000 to E Series Drive Connections

NOTE: See Figure 5, E Series Drive and *AXIMA* System Grounding Diagram.

MX Drives

To operate an MX drive in torque mode, set the command selector bit bØ6 in the MX drive, to 1. Refer to the *MX Drives Setup and Programming Operator's Manual* (P/N 400268-00) for detailed information on setting and saving this bit status.

AXIMA 2000/4000 to MX Drive Connections (Torque Mode)

The wiring diagram below shows the typical command connections between the *AXIMA 2000/4000* controller and an MX amplifier.

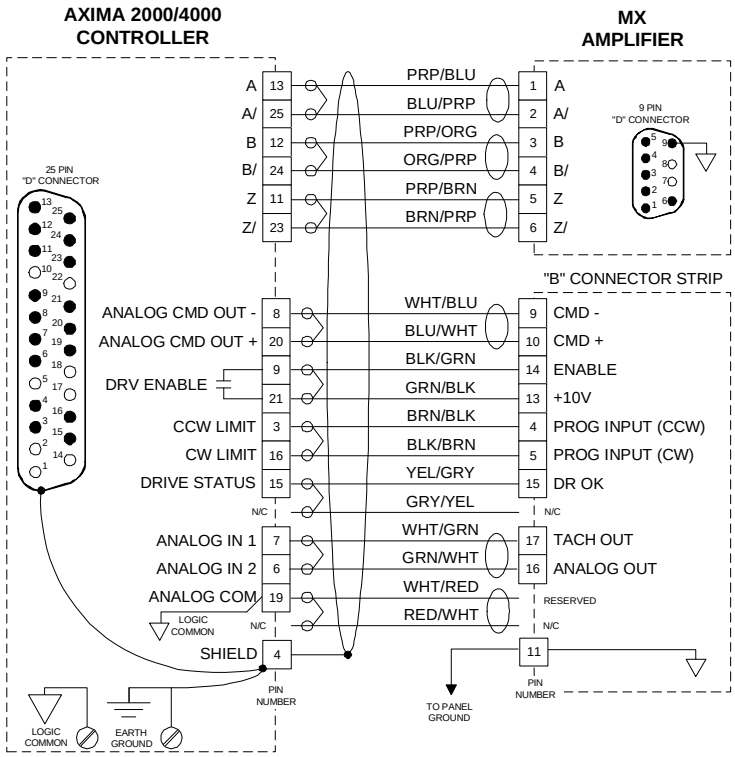

Figure 27 AXIMA 2000/4000 to MX Amplifier Connections Using The AX4-MX cable (Torque Mode)

NOTE: Make sure *AXIMA* Logic Common is connected to the same point in the cabinet as the MX Logic Common. See Figure 6, MX Drive and *AXIMA* System Grounding Diagram.

LX Drives

AXIMA 2000/4000 to LX Drive Connections (Torque Mode)

To operate an LX drive in torque mode, connect the *AXIMA 2000/4000* command wires to the **Current CMD** and **Common** inputs on the LX drive (terminal pins 2 and 3) as shown in the wiring diagram below.

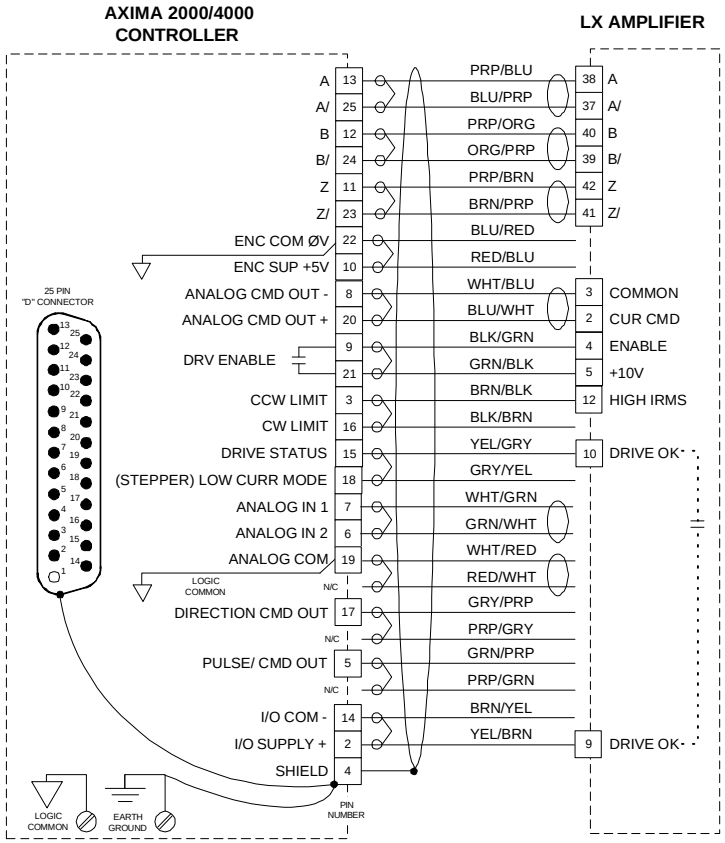

Figure 28 AXIMA 2000/4000 to LX Amplifier Connections Using The AX4-GP Cable (Torque Mode)

NOTE: Make sure AXIMA Logic Common is connected to the same point in the cabinet as the LX Logic Common. See Figure 7, LX Drive and *AXIMA* System Grounding Diagram.

The current command input of the LX amplifier is a **single ended** input not a **differential** input. Refer to the *LX Drives Setup and Programming Operator's Manual* (P/N 400272-00) for more detailed information.

⚠ WARNING

If the CMD output of the *AXIMA 2000/4000* is mistakenly connected to the common input of the LX drive, this could damage the *AXIMA 2000/4000* analog output signal.

Since the input is single ended, it will be more susceptible to noise. Be sure the LX common pin number 11 is connected to a single point ground as shown in the system grounding illustration.

When the LX amplifier is used in current mode, the LX I^2t (high RMS) circuitry is by-passed and does not fold back the current to the motor.

To prevent damage to the amplifier or motor, the high RMS output of the LX must be connected to an *AXIMA 2000/4000* input. This input would then be programmed to limit the *AXIMA 2000/4000* command voltage using the command limit instruction to decrease or shut off the analog command. This input could also be used to turn off the drive enable output.

When using the LX drive in current mode the LX limit switch inputs are inactive.

AXIMA 2000/4000 to LX Drive Connections (Velocity Mode)

The wiring diagram below shows the typical command connections between the *AXIMA 2000/4000* controller and an LX amplifier operating in velocity mode.

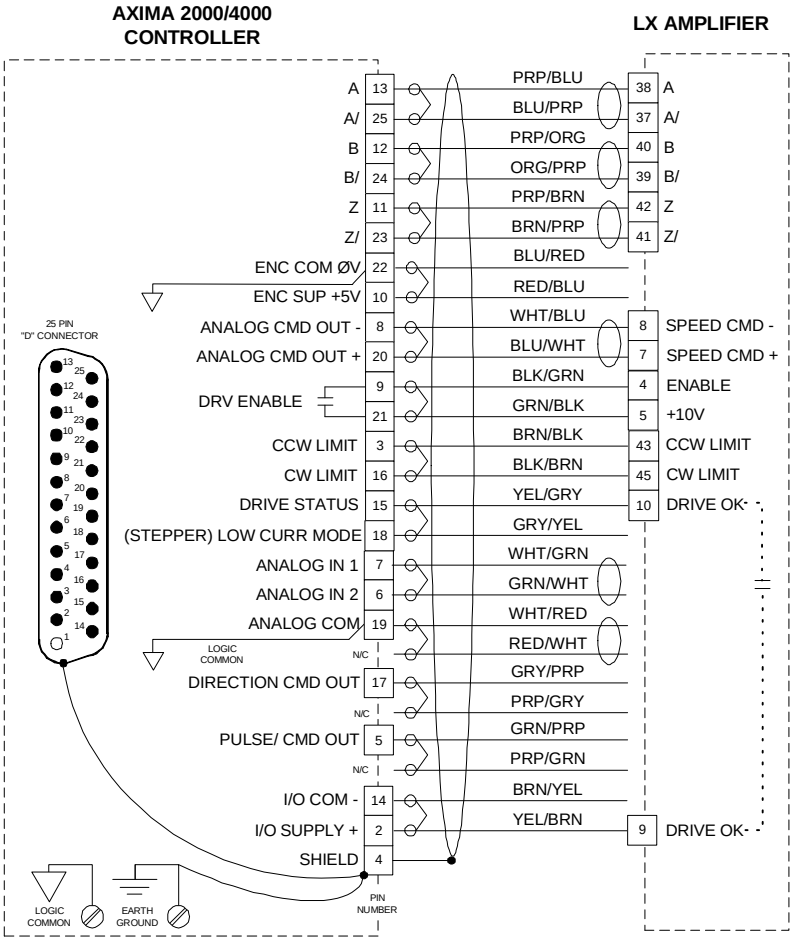

Figure 29 AXIMA 2000/4000 to LX Amplifier Connections Using The AX4-GP Cable (Velocity Mode)

NOTE: Make sure AXIMA Logic Common is connected to the same point in the cabinet as the LX Logic Common. See Figure 7, LX Drive and *AXIMA* System Grounding Diagram.

Encoder 1 or 3 Output Connection

An encoder output port is provided to allow easy cable connections between multiple *AXIMA 2000/4000*'s for line shafting type applications using the AX4-ED-XXX cable.

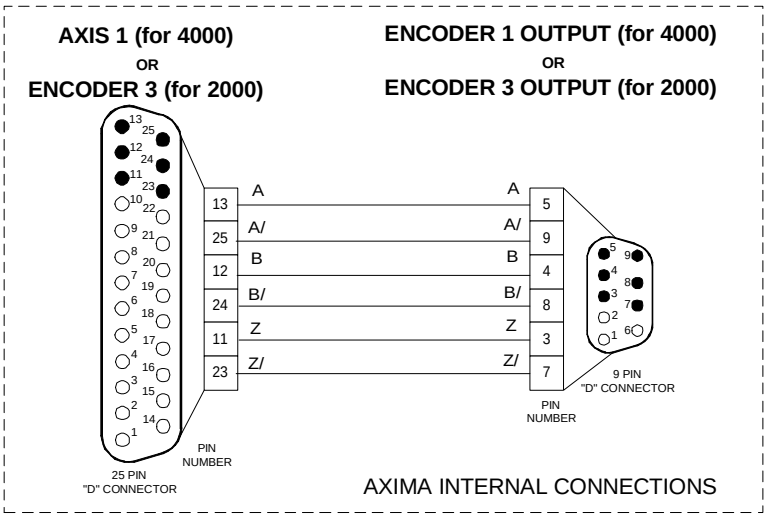

Figure 30 Internal Encoder Connections for AXIMA 2000/4000

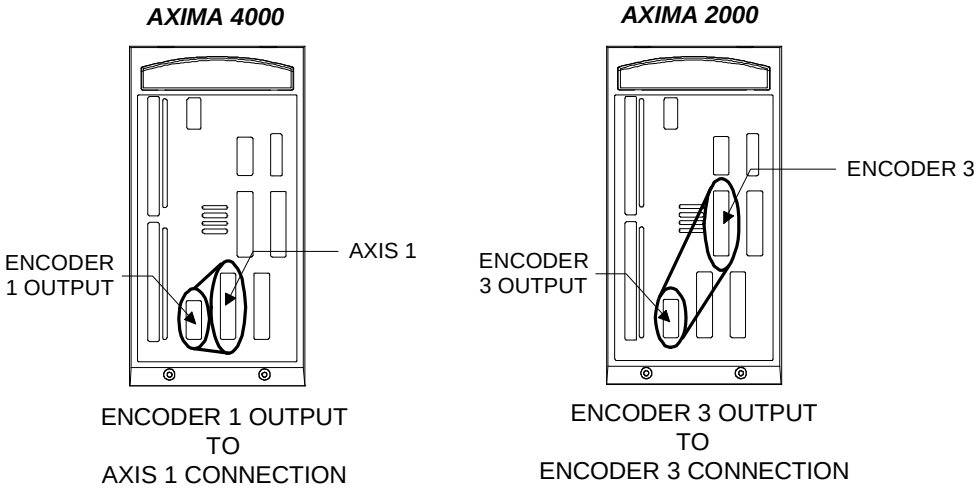

Figure 31 Front Panels of AXIMA 2000/4000 Controllers

Input/Output Connections

Dedicated I/O

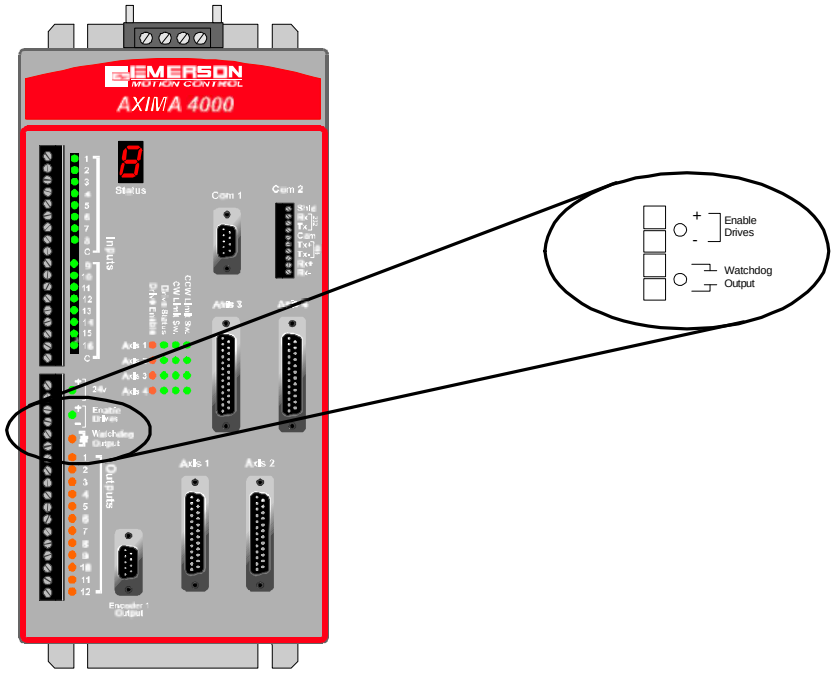

Figure 32 Enable Drives and Watchdog Output Locations on the Front Panel of the AXIMA 2000/4000

Enable Drives Input

The Enable Drives input provides the +24 volts supply to one side of all the drive enable relays. The + Enable Drives input is connected to the +24 volts terminal.

Watchdog Output

This relay contact is closed and the LED is **ON** under normal conditions. The contact is rated for 30 VDC and .5 amps maximum.

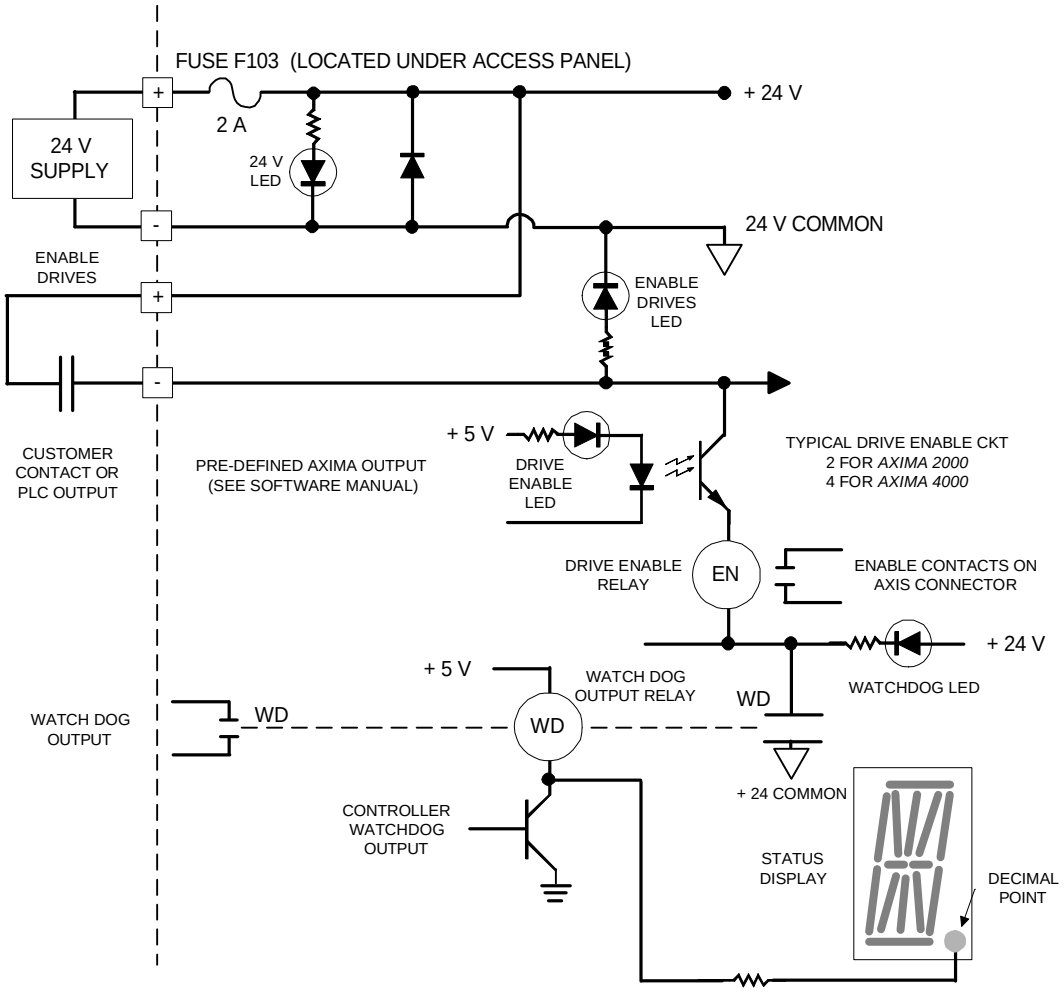

Figure 33 Watchdog, Drive Enable Circuit

User Defined I/O

Inputs

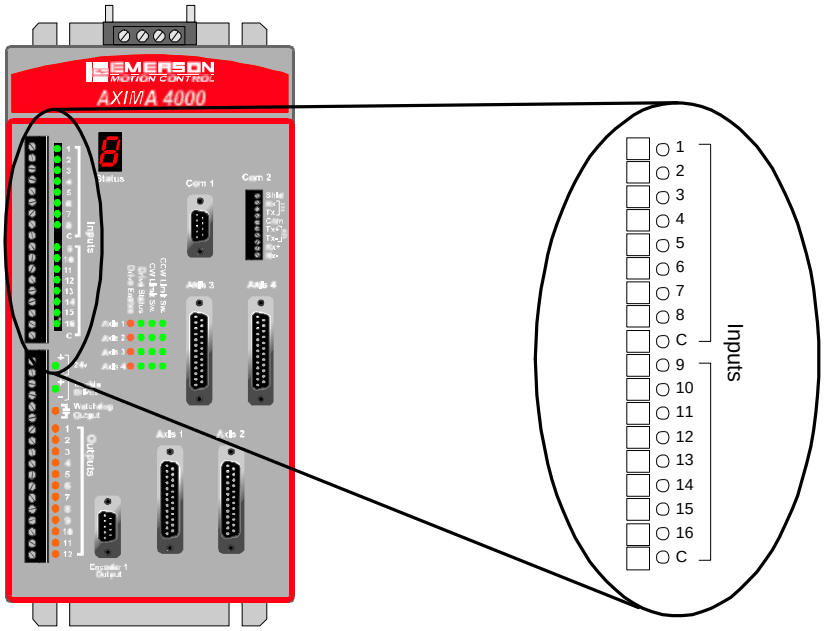

Figure 34 Inputs Location on the Front Panel of the AXIMA 2000/4000

The inputs can be wired for either sink or source mode in groups of eight. The input voltage range is 10 to 30 VDC. Each input line requires a minimum of 5 milliamps at 10 VDC to be recognized as a valid input.

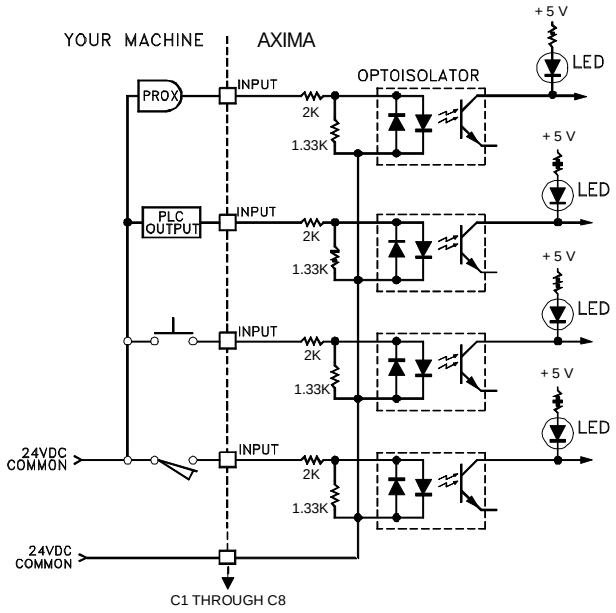

Figure 35 Sinking Mode Input Diagram

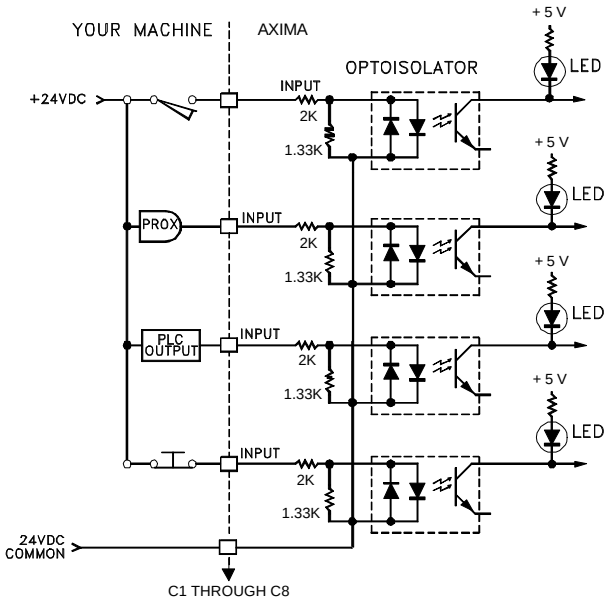

Figure 36 Sourcing Mode Input Diagram

Special Purpose Inputs

Inputs 13 through 16 can be assigned to trigger the high speed hardware encoder position capture function. These inputs and the Z encoder channels have direct connection to the encoder DSP gate arrays. If your application requires accurate positioning or measurements based on inputs from sensors or switches, inputs 13 through 16 should be used. See position capture input table below. See the Encoder Capture Instruction in the *AXIMA Software Reference Manual* (P/N 400262-00) for more information.

Table 7 Special Purpose Inputs

Encoder Input Number	Position Capture Input #
1	13 or 14
2	13 or 14
3	15 or 16
4	15 or 16

Since these inputs go through filtering and optoisolation, there is a 10 microsecond delay from the time the input is turned on until the position is captured. The capture can be programmed to trigger on rising or falling edge of the input. Due to the switching characteristics of the optoisolaters, faster triggering speeds can be obtained by using the rising edge rather than the falling edge. The encoder Z channel time delay is significantly less at .1 microsecond.

Outputs

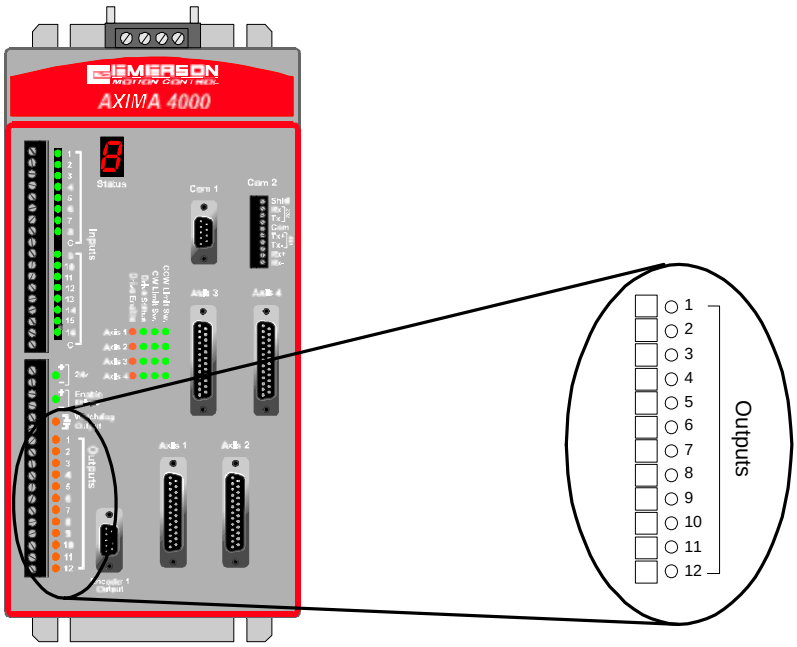

Figure 37 Outputs Location on the Front Panel of the AXIMA 2000/4000

Outputs can be operated in source mode only. Maximum allowable output voltage is 18 to 30 VDC, maximum current is 150 milliamps per output continuously.

NOTE: It is your responsibility to limit the current to 150 milliamps or less.

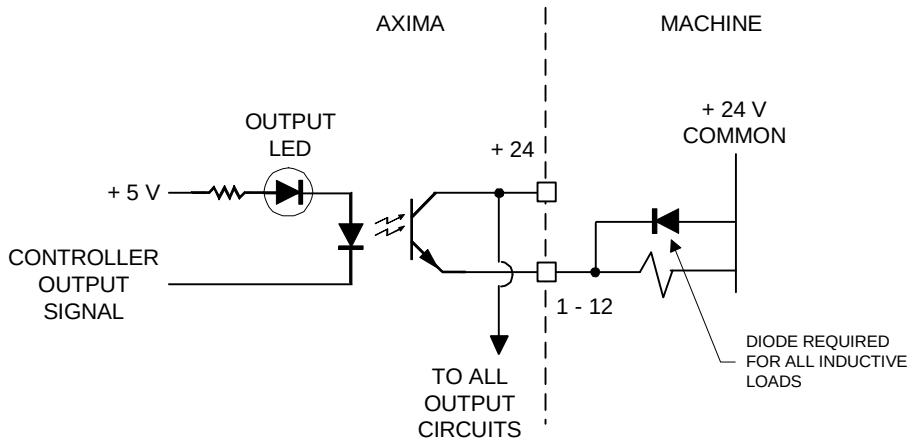

Figure 38 Output Circuit Diagram

I/O Power Supply

The AXIMA requires a customer supplied I/O power supply, usually 24 volts. This power supply must be connected to the 24V ± terminals. The 24 volts are protected against reverse polarity if the polarity is reversed the 24 volts fuse blows. The fuse is located under the front access panel. This supply is the "machine side" of the inputs and outputs and also provides power for the Enable Drive relay coils. The system is designed to operate from a 24 VDC power supply but will function with between 18 and 30 VDC.

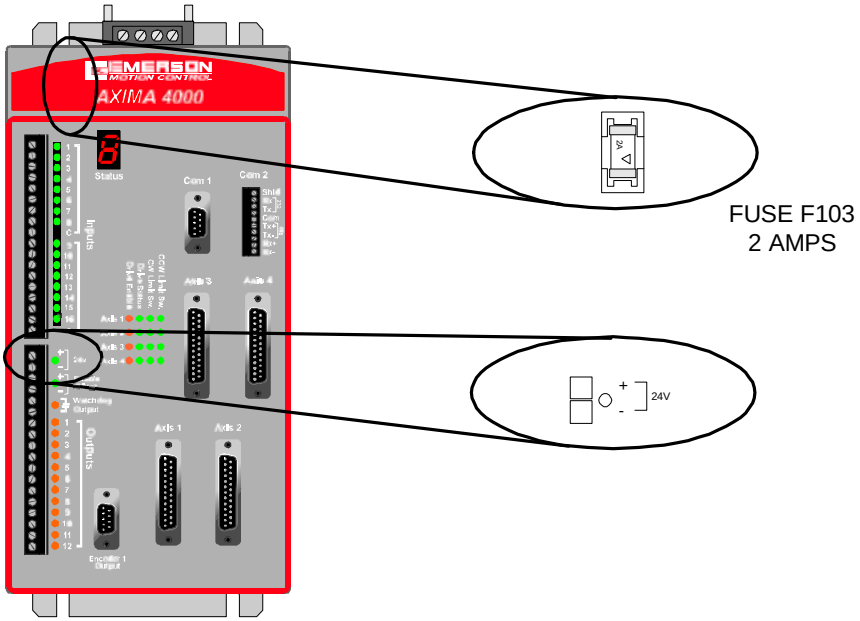

Figure 39 I/O Power Supply Location on the Front Panel of the AXIMA 2000/4000

NOTE: For situations where all 16 inputs, 12 outputs at full load and 4 relays are being used simultaneously, your power supply must supply at least 2.5 amps @ 24 volts.

Each input requires 12 mA @ 24 VDC (5 mA @ 10 VDC).

Each output can source up to 150 mA to drive a load.

Your power supply must be capable of supplying enough current for the dedicated load requirements. (Enable Drive, Drive Status, Overtravel L.S.) as well as the input and output load requirements.

Each Input:	(# of inputs) * (12 mA)
Each Output:	(# of outputs) * (Load Current)

Dedicated Circuits:

Inputs:

CW Limits SW	5 mA
CCW Limit SW	5 mA
Status	5 mA

Output:

Enable Drives	8 mA

For example

Suppose you had four axes of dedicated I/O, four inputs (# 1 through 4), and four outputs (# 1 through 4) with a 150 mA load, and your power supply was 24 VDC, in the worst case scenario (all inputs and outputs are being used simultaneously) the current load on the power supply would be 0.74 amps. This value was found using the following formula:

(12 mA * 4 IN) + (150 mA * 4 OT) + (8 mA * 4 R) + 4 axis (5 mA * 3 D)

= 0.74 Amps

Where

IN = inputs
OT = outputs
R = relays for Enable Drives
D = dedicated inputs

Diagnostics Status Display

The Diagnostic Status display on the top front of the *AXIMA 2000/4000* is controlled by the programmer and can be used to display machine status or fault codes. During the download of an *AXIMA* Software Application an asterisk (*) is displayed.

The decimal point is lit when the controller Watchdog is “On”.

NOTE: The very first time power is applied to the AXIMA controller the diagnostic status will display a random character.

Analog Input Option

Overview

An Analog Input feature is available as a factory option only. It allows the *AXIMA 2000/4000* to accept single-ended and differential inputs. You can configure these inputs with up to eight single-ended inputs, four differential inputs or combinations of single and differential inputs.

NOTE: If you wish to add the Analog Input option to an existing *AXIMA 2000/4000* controller, it must be returned to the factory.

The source of each analog input can be selected to be either from the analog input connector on the left side of the unit or the axis connector on the front of the unit. This is done by setting a DIP switch located behind the left side panel, of the *AXIMA 2000/4000* controller. This selection is provided to allow easy interface to the analog signal from an E Series drive.

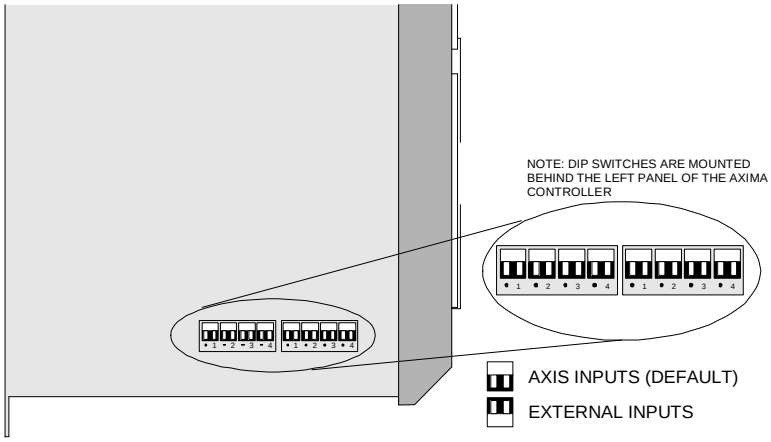

Figure 40 Analog DIP Switch Location Behind the Left-Side Panel of the AXIMA 2000/4000

The *AXIMA 2000/4000* takes raw voltage (±10 volts) from the analog input terminal and, with the *AXIMA* Software, converts it to user units. Each analog input channel can be assigned to a Pre-defined Variable, within the *AXIMA* Software, which can be used in a Motion or an Auxiliary Program.

Axis Inputs Connector Wiring

Using the *AXIMA* Software, any software channel can be attached to any hardware channel or pair of hardware channels. This gives you the flexibility to determine how the channel attachments are configured.

Analog Inputs Connector Wiring

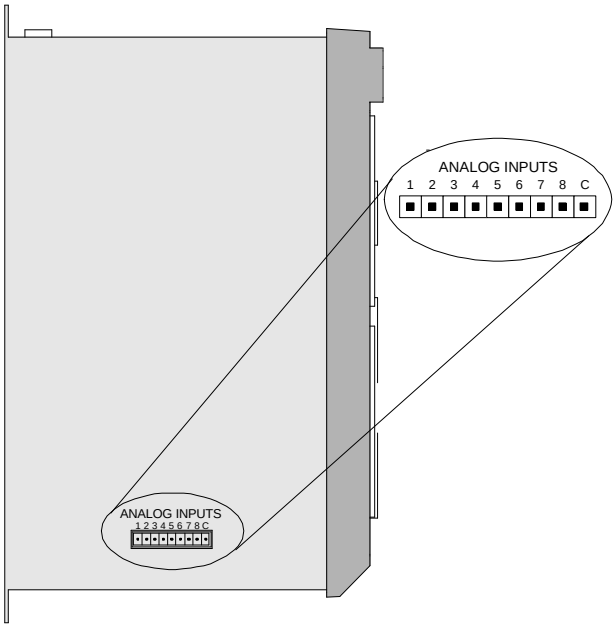

Figure 41 Location of Analog Inputs

The following diagrams show single-ended and differential configurations. Single-ended wiring configurations are with respect to the common “C” terminal. For example, voltages between input terminals 1 and C, input terminals 2 and C, etc. Differential wiring means that the resultant analog value is the difference in voltage measured between a pair of input terminals. For example, voltage between input terminals 1 and 2, 3 and 4.

NOTE: All signals, single-ended or differential, must be referenced to Pin “C”.

⚠ CAUTION

The maximum voltage between any input terminal and 'C' is ±10 VDC.

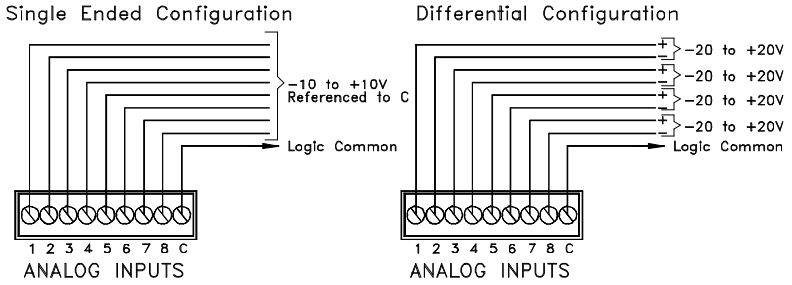

Figure 42 Single Ended Versus Differential Wiring

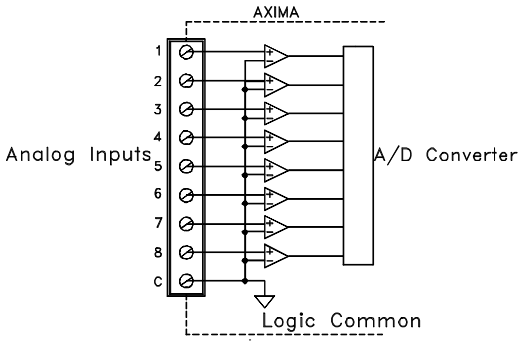

Figure 43 Analog Input Circuit Diagram

Using the *AXIMA* Software, any software channel can be attached to any hardware channel or pair of hardware channels. This gives you the flexibility to determine how the channel attachments are configured. If you choose a single-ended connection type, the negative terminal is automatically connected to terminal C. A reverse-polarity single-ended channel is not allowed.

When using a differential configuration, the *AXIMA 2000/4000* A/D converter measures the difference between two hardware channels and directs the value to a software channel. The *AXIMA 2000/4000* controller does not allow you to assign terminal number 1 as the negative input. To measure differential values between terminal 1 and another terminal, the polarity must be reversed by connecting the positive input to terminal 1, and connecting the negative input to the desired terminal.

Expanded I/O Options

Overview

There are two options for wiring the expanded I/O; by using direct wiring or external components. The direct wiring option is exactly that. All connections are directly wired from the *AXIMA 2000/4000* controller. The external components option uses the XIOR-32 mounting rack and digital input and output modules to control the I/O connections.

Sinking Versus Sourcing

In a sourcing input situation the current flows from the external source to the input terminal. The input terminal voltage is high. In a sinking situation the current flows from the input terminal to the external circuit. The input terminal voltage is low.

In a sinking output situation the current can flow from the external circuit into the output terminal. The output terminal voltage is low. In a sourcing output situation the current can flow from the terminal to the external circuit. The output terminal voltage is high.

P/N 400290-00

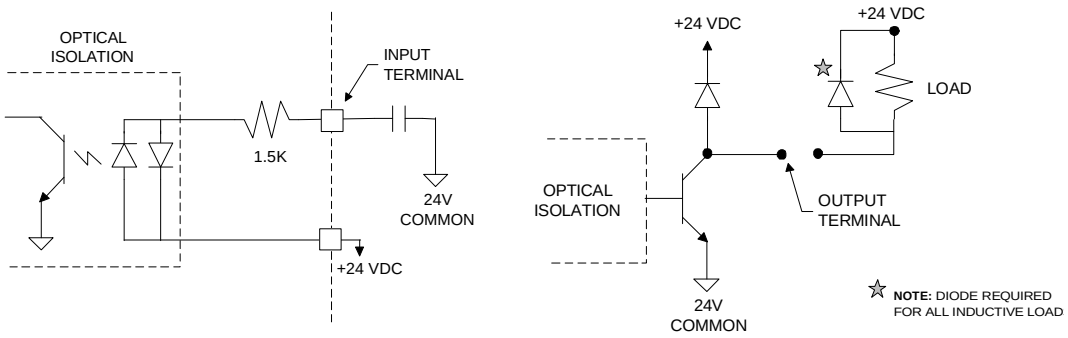

Figure 44 Sinking Inputs and Outputs

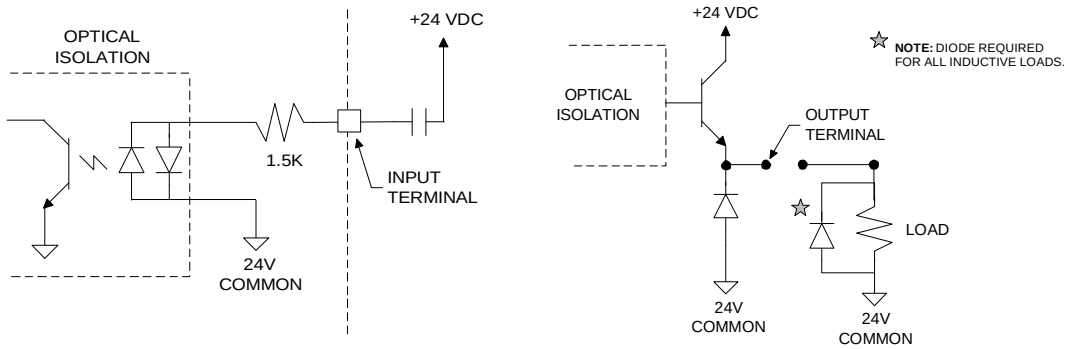

Figure 45 Sourcing Inputs and Outputs

Direct Wiring Option

If your I/O devices do not meet the criteria established for the external components option, then direct wiring may be required. These components must be assembled and wired by the user. Components include STI-32s or STI-50s and connectorized ribbon cables, all of which are available from EMERSON Motion Control.

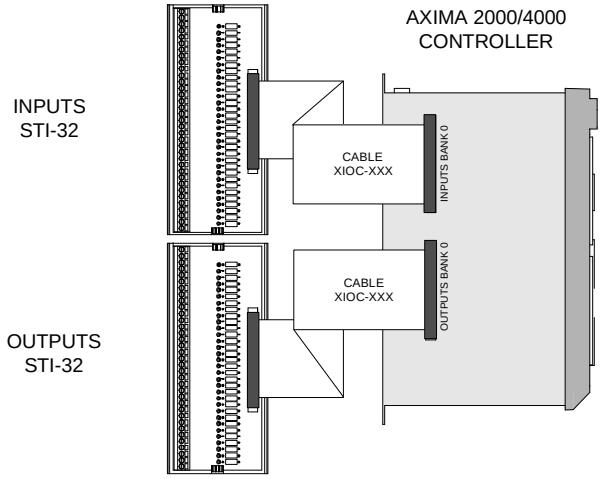

Figure 46 AXIMA 2000/4000 Direct Wiring Option Using STI-32's

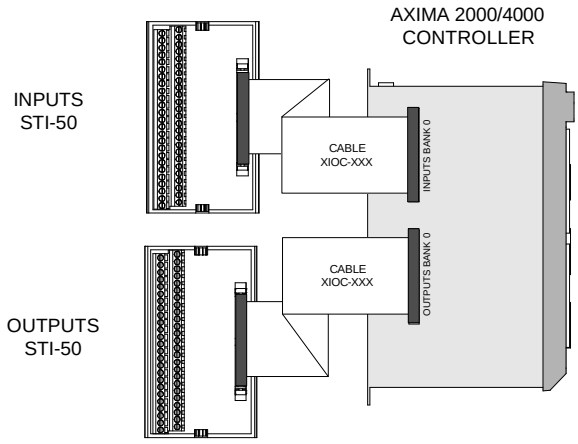

Figure 47 AXIMA 2000/4000 Direct Wiring Option Using STI-50's

Components of the Direct Wiring Option

Quantities of the components required for the direct wiring option depend on the number of I/O used.

For example:

For the full use of 32 expanded inputs and 32 expanded outputs, the required quantities are:

(1) *AXIMA 2000⁄4000* controller

(2) STI-32 or STI-50 for digital I/O

(2) Connectorized ribbon cables (50 pin) (P/N XIOC-XXX)

Dimensions of STI-50 and STI-32 Components

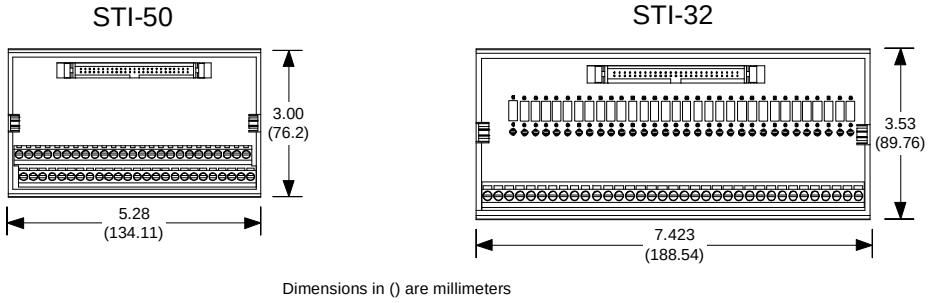

Figure 48 STI-50 and STI-32 Components

I/O Setup and Wiring

Using the direct wiring option, the inputs and outputs can be wired directly to the STI-32 (sourcing only) or STI-50 (sinking or sourcing) using ribbon cables.

To use the direct wiring option, you must meet the following criteria:

For Inputs:

Electrical specifications of 24 VDC and a minimum of 11 mA of current.

For Outputs:

Electrical specifications of 24 VDC and less than 40 mA of current.

Specifications For Direct Wiring Option

The equivalent circuits of the I/O, electrical specifications and the pin assignments are shown on next page. You are responsible for determining if your 24 VDC supply can handle the additional current load.

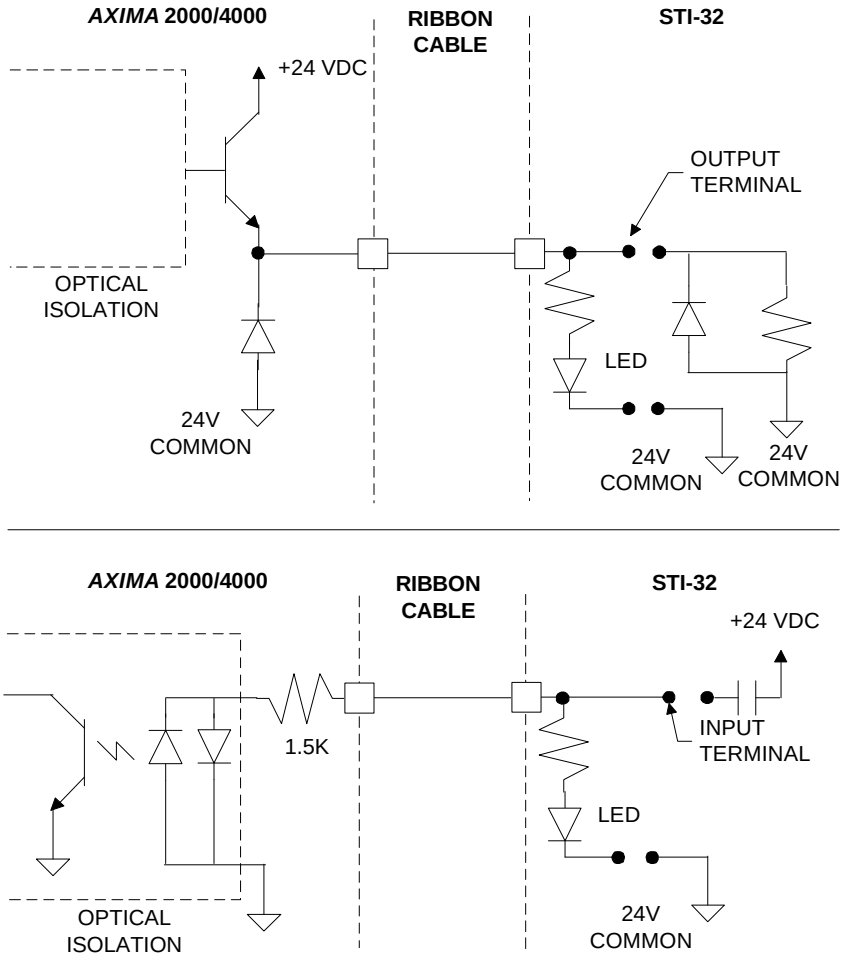

Figure 49 Outputs and Inputs Equivalent Circuit (Sourcing)

Use the table below to determine the pin assignments of the STI-50 inputs and outputs.

Inputs Pin Assignments		Outputs Pin Assignments	
Input Number	Pin Number	Input Number	Pin Number
0	37	0	37
1	39	1	39
2	38	2	38
3	40	3	40
4	35	4	35
5	42	5	42
6	36	6	36
7	41	7	41
8	47	8	47
9	50	9	50
10	44	10	44
11	48	11	48
12	49	12	49
13	43	13	43
14	46	14	46
15	45	15	45
16	14	16	14
17	12	17	12
18	13	18	13
19	11	19	11
20	16	20	16
21	9	21	9
22	15	22	15
23	10	23	10
24	4	24	4
25	1	25	1
26	7	26	7
27	3	27	3
28	2	28	2
29	8	29	8
30	5	30	5
31	6	31	6

External Components Option

If your I/O devices do not meet the criteria established for the direct wiring option, then external components are required. These components must be assembled and wired by the user. External components include; I/O mounting rack(s), digital input modules, digital output modules and connectorized ribbon cables, all of which are available from EMERSON Motion Control.

With the external components option your electrical specifications are determined by the module you select. These modules allow you to wire the I/O for sinking or sourcing. There is some time delay inherent in these devices that should be accounted for in time critical applications.

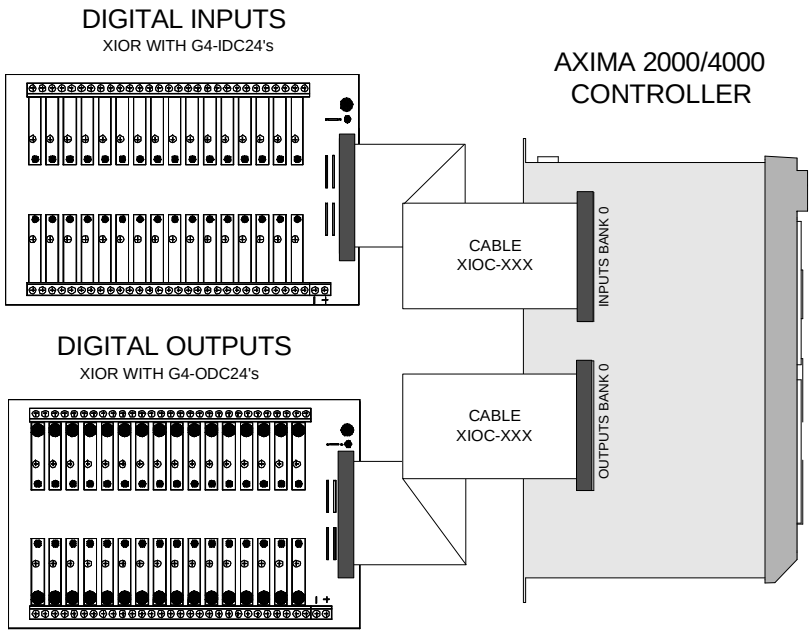

Figure 50 AXIMA 2000/4000 External Components Option

Components of the External Components Option

Quantities of the external components required depend on the number of expanded I/O used.

For example:

For the full use of 32 expanded inputs and 32 expanded outputs, the required quantities are:

(1) *AXIMA 2000/4000* controller

(2) XIOR I/O mounting racks

(32) Digital input modules (P/N IDC-24-G4 or IAC-24-G4)

(32) Digital output modules (P/N ODC-24-G4 or OAC-24-G4)

(2) Connectorized ribbon cables (50 pin) (P/N XIOC-XXX)

I/O Setup and Wiring

You need to supply 24 VDC to the XIOR-32 for the Digital I/O modules.

Specifications For Digital Modules

From these specifications you can choose the type of module needed for your particular application. Additional Digital I/O modules are also available from Opto 22® in a variety of specifications.

Digital Input And Output Module Specifications		
	G4ODC24	G4OAC24
	Digital DC output module	Digital AC output module
Input voltage range	10-32 VDC	90-140 VAC
Input voltage nominal	24 VDC	120 VAC
Input current @ nominal	16 mA	9 ma rms
Logic voltage nominal	24 VDC	24 VDC
Logic current @ 24 VDC	18 mA	18 mA
Turn on time	5 ms	20 ms
Turn off time	5 ms	20 ms
	G4ODC24	G4OAC24
	Digital DC output module	Digital AC output module
Output voltage range	5-60 VDC	12-140 VAC
Output voltage maximum	60 VDC	120 VAC
Output current @ max voltage	3 amps	3 amps rms
Off state leakage @ max voltage	1 mA	5 ma rms
Logic voltage nominal	24 VDC	24 VDC
Logic current @ 24 VDC	18 mA	18 mA
Logic pickup voltage	19.5 VDC	19.5 VDC
Logic dropout voltage	1 VDC	1 VDC
Turn on time	50 usec	8.3 msec
Turn off time	50 usec	8.3 msec

24 VDC Power Supply Loading

You are responsible for determining if your 24 VDC supply can handle the additional current load.

When using 24 VDC modules:

Inputs (on): 45 mA per input.
Outputs (on): (Load current + 21 mA) per output.*
Outputs (off): 3 mA per output.

When using 120 VAC modules:

Inputs (on): 29 mA per input.
Outputs (on): 21 mA per output.
Outputs (off): 2.4 mA per output.

* The load current for the output modules must be limited to no more than 3 amps.

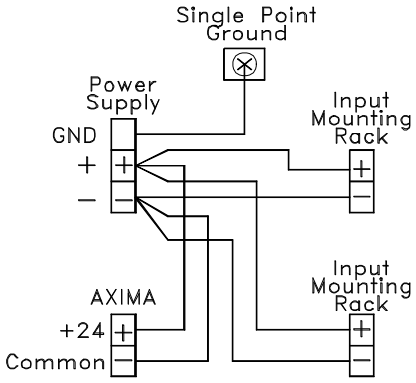

Figure 51 Power Wiring for External I/O Mounting Racks

EMERSON Motion Control recommends that you use twisted pairs for the 24 VDC power wiring.

Connection Diagrams For Mounting Rack

Input Connections

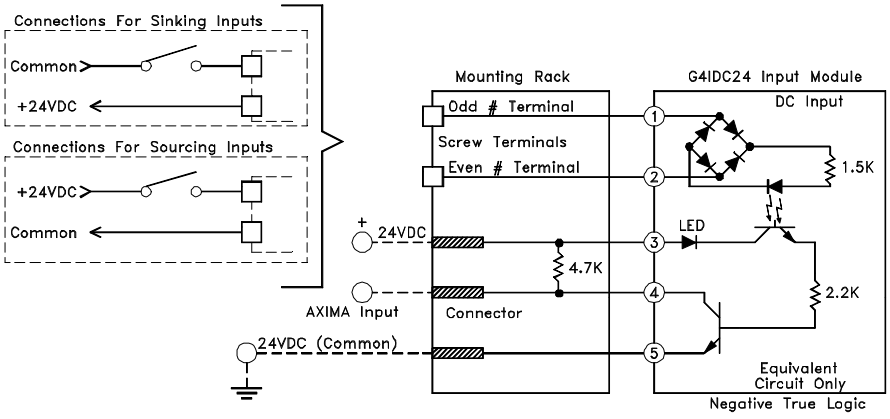

Figure 52 24 VDC Digital Input Module Connection Diagram

For sinking inputs

Switch on the 24 VDC common as shown in the diagram above and wire 24 VDC to the other terminal.

For sourcing inputs

Switch 24 VDC as shown in the diagram above, and wire 24 VDC common to the other terminal.

When wiring inputs, you can wire the switch to either the Odd or Even Terminal.

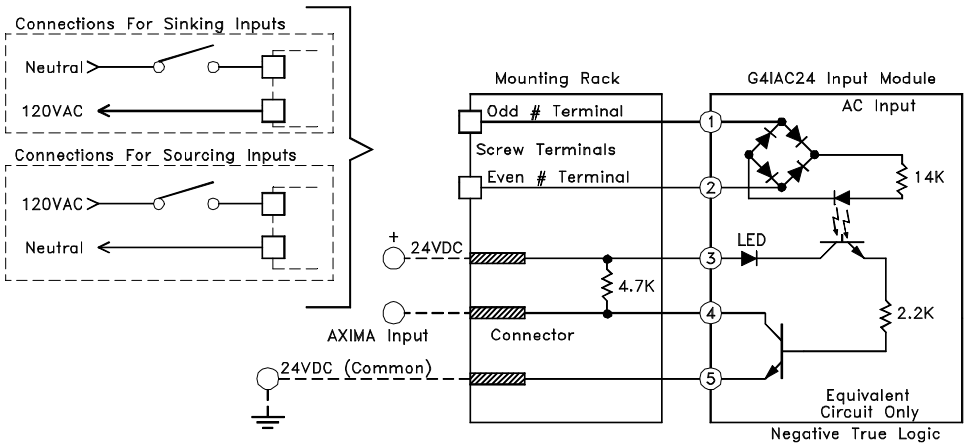

Figure 53 120 VAC Digital Input Module Connection Diagram

For sinking inputs

Switch on the neutral as shown in the diagram above and wire 120 VAC to the other terminal.

For sourcing inputs

Switch 120 VAC as shown in the diagram above, and wire neutral to the other terminal.

When wiring inputs, you can wire the switch to either the Odd or Even Terminal.

Output Connections

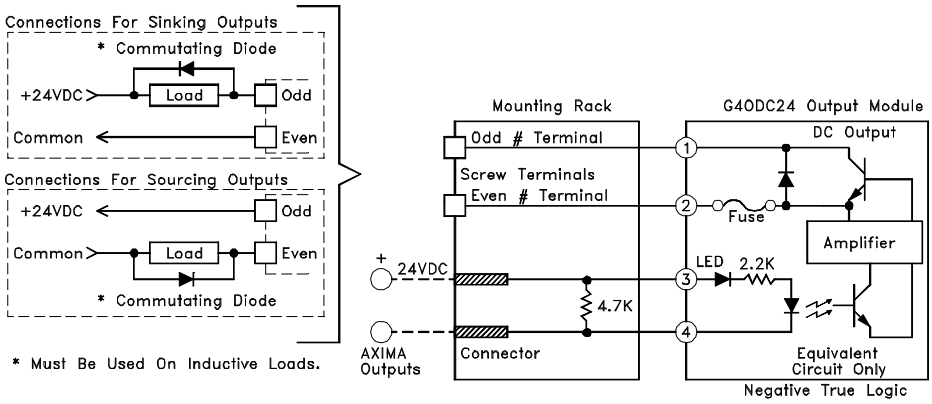

Figure 54 24 VDC Digital Output Module Connection Diagram

For sinking outputs

Wire the load to the Odd # Terminal on the mounting rack. Tie the other side of the load to 24 VDC. The 24 volt common should be wired to the Even # Terminal.

For sourcing outputs

Wire 24 VDC to the Odd # Terminal on the mounting rack. Wire the load to the Even # Terminal. Tie the other side of the load to 24 volt common.

If your load is inductive, it is recommended to use a commutating diode across the load to clamp any voltage transients during switching.

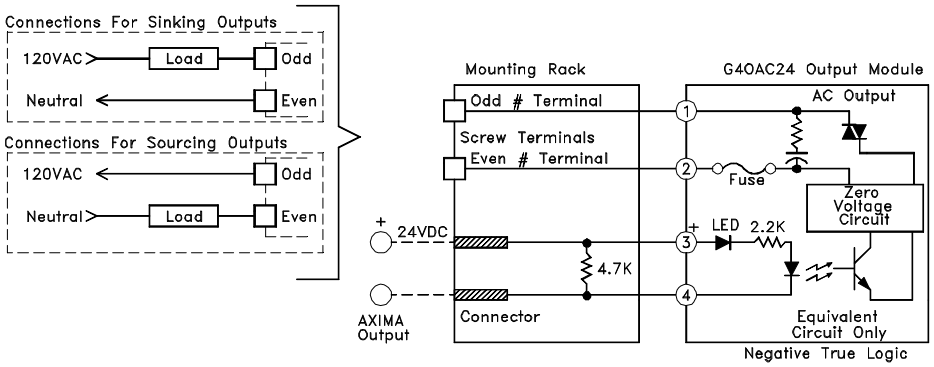

Figure 55 120 VAC Digital Output Module Connection Diagram

For sinking outputs

Wire the load to the Odd # Terminal on the mounting rack. Tie the other side of the load to 120 VAC. Neutral should be wired to the Even # Terminal.

For sourcing outputs

Wire 120 VAC to the Odd # Terminal on the mounting rack. Wire the load to the Even # Terminal. Tie the other side of the load to Neutral.

Connectivity Options

Overview

Modbus® and Data Highway Plus® (DH+) are factory options that allow the *AXIMA 2000⁄4000* controller to communicate with the Modicon Modbus serial communication protocol or Allen Bradley's Data Highway Plus.

NOTE: *AXIMA 2000/4000* controllers can be equipped with either Modbus or DH+. They cannot be used simultaneously.

AXIMA 2000⁄4000 controllers equipped with the Modbus option have two serial connectors on the left-side of the *AXIMA 2000⁄4000*, Com 3 and Com 4. Com 3 is an RS-232C nine-pin DB connector and Com 4 is an RS-485 six-pin Phoenix® connector used for multi-drop systems.

AXIMA 2000⁄4000 controllers equipped with the DH+ option are equipped with one serial connector (Com 4) on the left-side of the *AXIMA 2000⁄4000*. Com 4 is an RS-485 six-pin Phoenix connector.

P/N 400290-00

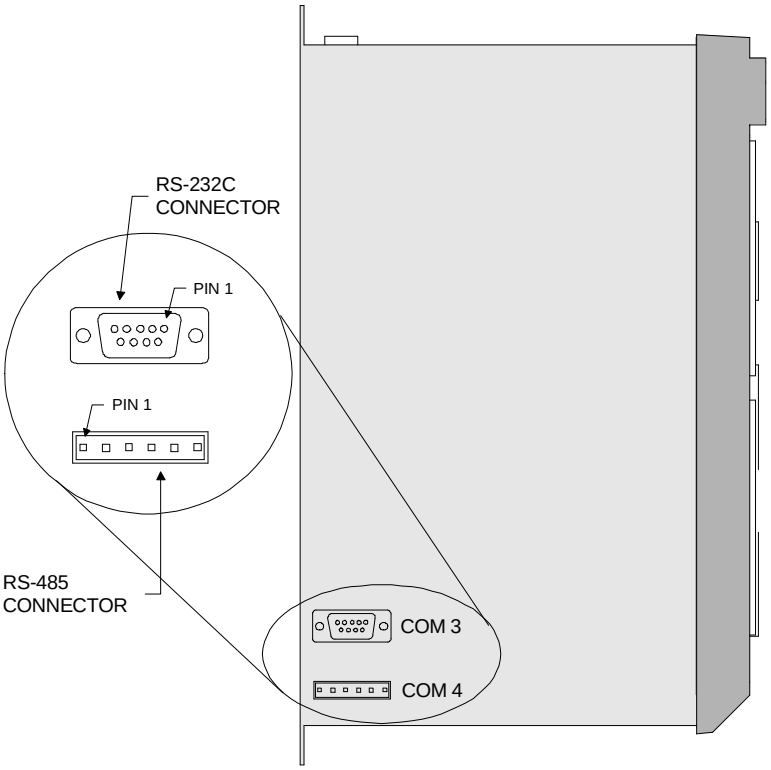

Figure 56 Left-side of AXIMA 2000/4000

The previous figure shows the Modbus configuration with the Com 3 and Com 4 connectors. When equipped with the DH+ option, only Com 4 (six-pin Phoenix connector) would be available.

Modbus Connection

The RS-232C serial port Com 3 (nine pin DB connector) pin-out is shown below.

Pin	Signal
1	Shield
2	RX (Receive)
3	TX (Transmit)
4	485 Data (+)
5	Signal Ground
6	NC (No Connect)
7	RTS (Request to Send)
8	CTS (Clear to Send)
9	485 Data (-)

The RS-485 serial port Com 4 (six-pin Phoenix connector) pin-out is shown below. Pin 1 is internally connected to 4, pin 2 is connected to pin 5, and pin 3 is connected to pin 6.

Pin	Signal
1	485 Data (+)
2	Signal Ground
3	485 Data (-)
4	485 Data (+)
5	Signal Ground
6	485 Data (-)

Data Highway Plus Connection

The DH+ network connections are available using the six-pin Phoenix connector (Com 4). The connector pin-out is shown below.

Pin	Signal	"Blue Hose" wires
1	Line 1 (485 Data +)	Clear
SH	Shield	(bare)
2	Line 2 (485 Data -)	Blue

NOTE: The nodes at the two physical ends of the network should have terminating resistors. All other nodes should not. Every network should have exactly two terminators. The *AXIMA* controller does not have an internal terminator. If you require a terminator, it consists of a resistor between the blue and clear wires. The Data Highway Plus specifications recommend a 150 ohm resistor at 57.6 and 115.2 kbaud and an 82 ohm resistor at 230.4 kbaud.

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