User Manual

Allen-Bradley

Kinetix 7000 High Power Servo Drive

Catalog Numbers 2099-BM06-S, 2099-BM07-S, 2099-BM08-S, 2099-BM09-S, 2099-BM10-S, 2099-BM11-S, 2099-BM12-S

Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

	**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
	**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.

	**SHOCK HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.
	**BURN HAZARD:** Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.
	**ARC FLASH HAZARD:** Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

This manual contains new and updated information. Changes throughout this revision are marked by change bars, as shown to the right of this paragraph.

New and Updated Information

This table contains the changes made to this revision.

Topic	Page
In Figure 1, updated the image of the LIM to reflect the current design of the LIM.	13
Revised Figure 49 to reflect current design and location of ground wires.	81
In the Feedback and I/O Cable Connections section, updated the information about the cables that can be used with HPK-Series motors.	94
In Figure 83, updated the information about the cables that can be used with Bulletin MPL and MPM motors.	176
In Figure 84, updated the information about the cables that can be used with HPK-Series motors.	177

Notes:

Chapter 4

Connect the Kinetix 7000 Drive System

Appendix B

Interconnect Diagrams

Appendix C

Upgrade Firmware

About This Publication

This manual provides detailed installation instructions for mounting, wiring, and troubleshooting your Kinetix® 7000 drive, and system integration for your drive/motor combination with a Logix controller.

Who Should Use This Manual

This manual is intended for engineers or technicians directly involved in the installation and wiring of the Kinetix 7000 drive, and programmers directly involved in the operation, field maintenance, and integration of the Kinetix 7000 drive with a SERCOS interface module.

If you do not have a basic understanding of the Kinetix 7000 drive, contact your local Rockwell Automation sales representative before using this product for the availability of training courses.

Conventions Used in This Manual

These conventions are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.

Additional Resources

The following documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Kinetix 7000 DC-DC Converter and Control Board Kits, publication 2099-IN002	Provides information on removing and replacing the DC-DC converter, DC-DC converter fuse, and the control board assembly in a Kinetix 7000 drive.
Kinetix 7000 Drive Installation Instructions, publication 2099-IN003	Provides information on installing a Kinetix 7000 drive.
Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010	Provides information on proper handling, installing, testing, and troubleshooting fiber-optic cables.
ControlLogix® SERCOS interface Module Installation Instructions, publication 1756-IN572	Provides details about installing a 3, 8, or 16-Axis ControlLogix SERCOS interface module.
Logix5000™ Controllers General Instructions Reference Manual, publication 1756-RM003	Provides programmers with details about each available instruction for a Logix5000 controller. You should be familiar with how the Logix5000 controller stores and processes data before consulting this publication.
ControlLogix System User Manual, publication 1756-UM001	Provides information about configuring and troubleshooting a ControlLogix system.
CompactLogix™ SERCOS interface Module Installation Instructions, publication 1768-IN005	Provides information on installing and troubleshooting a CompactLogix SERCOS interface motion module.
CompactLogix Controllers User Manual, publication 1768-UM001	Provides information on installing, configuring, programming, and operating a CompactLogix system.
SoftLogix™ Motion Card Setup and Configuration Manual, publication 1784-UM003	Provides information on configuring and troubleshooting a SoftLogix PCI card.
SoftLogix 5800 User Manual, publication 1789-UM002	Provides information on configuring, programming, and operating a SoftLogix system.
8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001	Provides a hardware description and start-up and programming procedures for the 8720MC-RPS Regenerative Power Supply.
System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001	Provides information, examples, and techniques designed to minimize system failures caused by electrical noise.

Resource	Description
Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002	Provides detailed installation instructions for wiring and troubleshooting a Kinetix 7000 safe-off drive.
Kinetix Motion Control Selection Guide, publication GMC-SG001	Provides descriptions and specifications for the 2099 product family including motors and accessories.
Kinetix 7000 Drive Systems Design Guide, publication GMC-RM007	The purpose of this publication is to assist you in identifying the drive system components and accessory items you'll need for your Kinetix 7000 drive/motor combination.
Kinetix Servo Drives Specifications Technical Data, publication GMC-TD003	Provides catalog numbers and product specifications, including performance, environmental, certifications, load force, and dimension drawings for Allen-Bradley® servo drives.
Kinetix Motion Accessories Specifications Technical Data, publication GMC-TD004	Provides catalog numbers, product specifications, and dimensions for Allen-Bradley servo drive accessories.
Motion Analyzer Sizing and Selection Tool, https://motionanalyzer.rockwellautomation.com	Online tool for sizing and selecting servo drive systems with the compatible motor, actuator, and accessories required for each axis.
Rockwell Automation Configuration and Selection Tools, http://www.rockwellautomation.com/global/support/configuration.page	Provides online product selection and system configuration tools, including AutoCAD (DXF) drawings.
Rockwell Automation Product Certification Website: http://www.rockwellautomation.com/products/certification/	Provides online access to declarations of conformity (DoC) currently available from Rockwell Automation.
SERCOS and Analog Motion Configuration and Startup, publication MOTION-UM001	Provides information to create a motion coordinate system with SERCOS or analog motion modules.
Motion Coordinate System User Manual, publication MOTION-UM002	Provides information on configuring and troubleshooting your ControlLogix, CompactLogix, and SoftLogix SERCOS interface modules.
Logix5000 Controllers Motion Instructions Reference Manual, publication MOTION-RM002	Provides programmers with details about the motion instructions that are available for a Logix5000 controller.
National Electrical Code, published by the National Fire Protection Association of Boston, MA	Provides access to articles on wire sizes and types for grounding electrical equipment.
Safety Products, publication S117-CA001	Provides information on principle standards and implementation of safety products and catalogs available safety products.
Safety Guidelines for the Application, Installation, and Maintenance of Solid State Controls, publication SGI-IN001	Provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solidstate components.
Understanding the Machinery Directive, publication SHB-900	Provides information on the CE marking process, with references to key European requirements and resources, and examples of safety component applications.
Allen-Bradley Industrial Automation Glossary, publication AG-7.1	A glossary of industrial automation terms and abbreviations.

You can view or download publications at http://literature.rockwellautomation.com. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

Start

Use this chapter to become familiar with the design and installation requirements for Kinetix 7000 drive systems.

About the Drive System

The Kinetix 7000 high-power servo drive is designed to provide a Kinetix Integrated Motion solution for applications with output power requirements in the range of 22...149 kW (40...248 A).

Table 1 - Kinetix 7000 Drive System Overview

Kinetix 7000 Component	Catalog Numbers	Description
Servo Drive	2099-BM*xx*-S (1)	The Kinetix 7000 servo drive with safe-off feature is available with 460V AC input power, or capable of operating with a shared DC bus.
Regenerative Power Supply	8720MC-RPS	The 8720MC-RPS is a sinusoidal PWM converter that may serve as a regenerative power supply for one or more drives.
Logix Controller Platform	1756-L60M03SE module 1756-M*xx*SE module 1768-M04SE module 1784-PM16SE PCI card	The SERCOS interface module/PCI card serves as a link between the ControlLogix/CompactLogix/SoftLogix platform and Kinetix 7000 drive system. The communication link uses the IEC 61491 SErial Real-time COmmunication System (SERCOS) protocol over a fiber-optic cable.
RSLogix™ 5000 Software	9324-RLD300ENE	RSLogix 5000 provides support for programming, commissioning, and maintaining the Logix family of controllers.
Rotary Servo Motors	MP-Series, HPK-Series, and RDD-Series	Compatible rotary servo motors include MP-Series (Bulletin MPL and MPM) 400V class motors, HPK-Series motors, and RDD-Series direct-drive motors.
Cables	Motor Power, Feedback, and Brake cables	Bulletin 2090 motor power/brake and feedback cables are available with bayonet, threaded, and SpeedTec connectors. Power/brake cables have flying leads on the drive end and straight connectors that connect to servo motors. Feedback cables have flying leads that wire to low-profile connector kits on the drive end and straight connectors on the motor end. Large power motors may require user power wiring to handle larger current requirements.
	Communication	Bulletin 2090 SERCOS fiber-optic cables are available as enclosure only, PVC, nylon, and glass with connectors at both ends.
AC Line Filters	2090-XXLF-TC*xxxx*	Bulletin 2090-XXLF-TC*xxxx* three-phase AC line filters are required to meet CE and available for use in all Kinetix 7000 drive systems.
Line Interface Module	2094-BL50/75S, or 2094-XL75S-C*x*	The line interface module (LIM) contains the circuit breakers, power supplies, and safety contactor required for Kinetix 7000 operation. Individual components can be purchased separately in place of the LIM.
External Shunt Modules	NA	See External Shunt Modules on page 158 for active shunt solutions from Rockwell Automation® Encompass Partners and intended for use with Kinetix 7000 drives.

(1) See the Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002, for more information.

Typical Drive System Diagrams

Typical Kinetix 7000 system installations include three-phase AC configurations, with and without the line interface module (LIM), and DC common bus configurations.

Figure 1 - Kinetix 7000 System Configuration with LIM and External Resistive Shunt

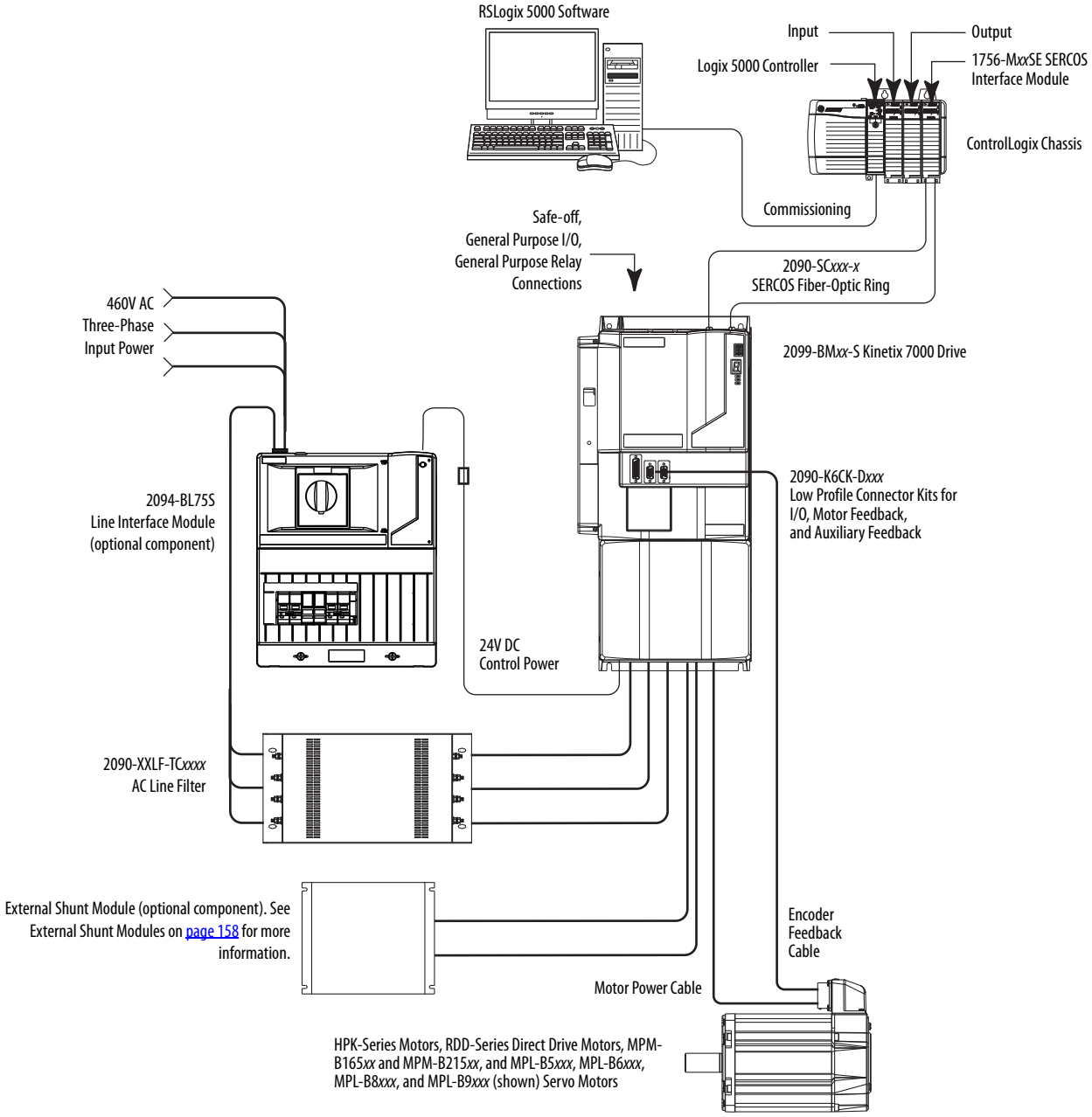
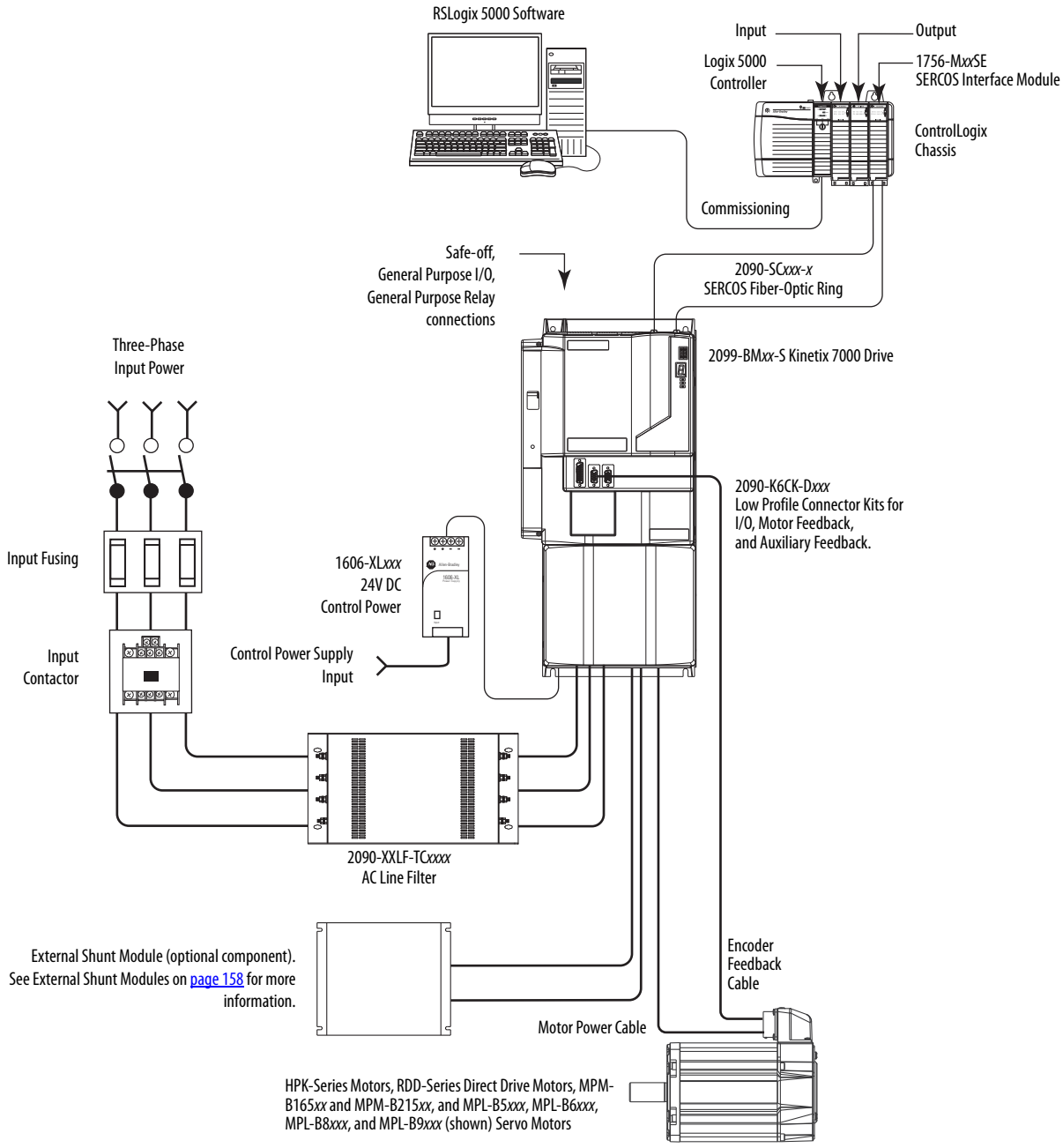
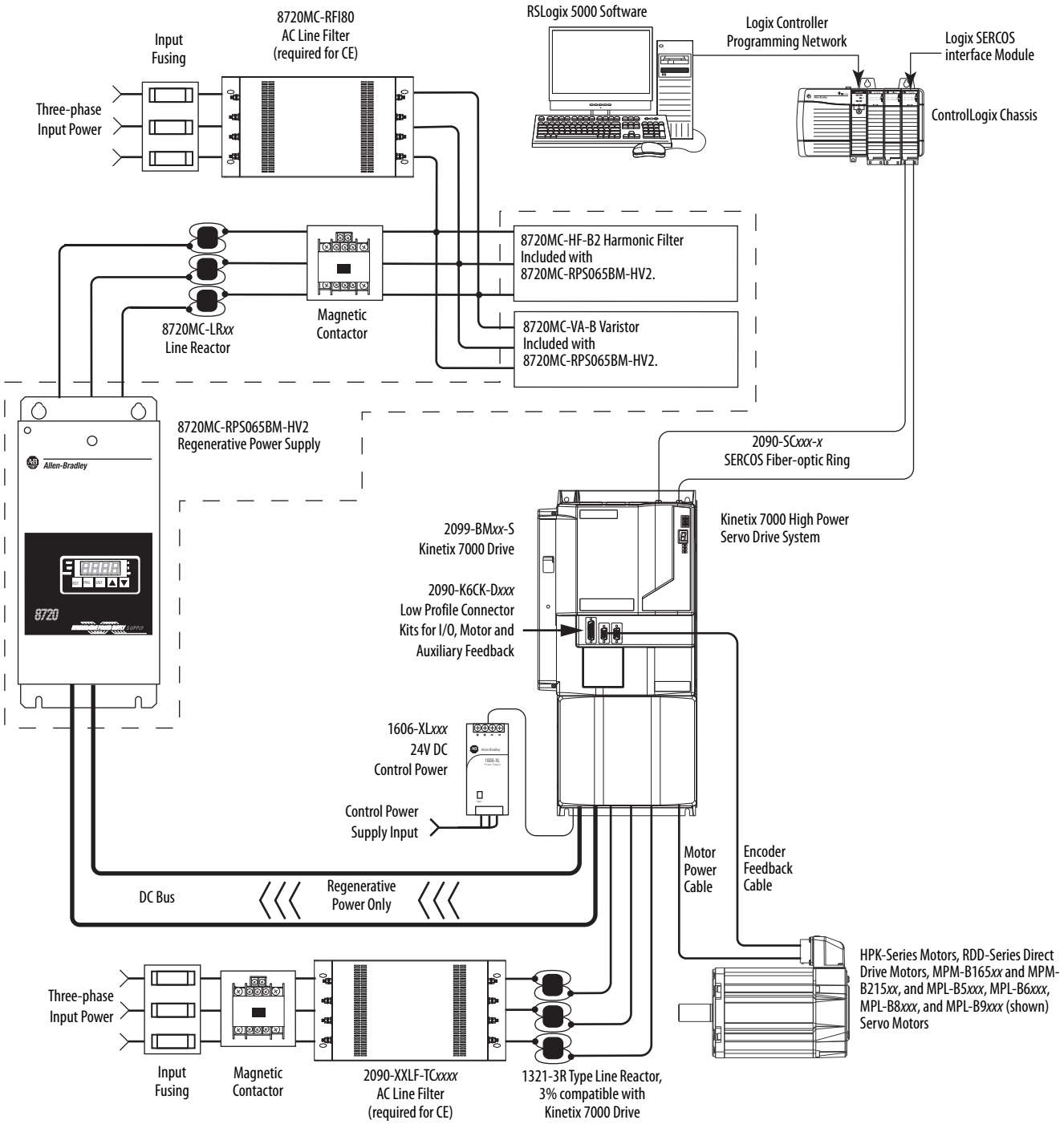


Figure 2 - Kinetix 7000 System Configuration without Line Interface Module (LIM)



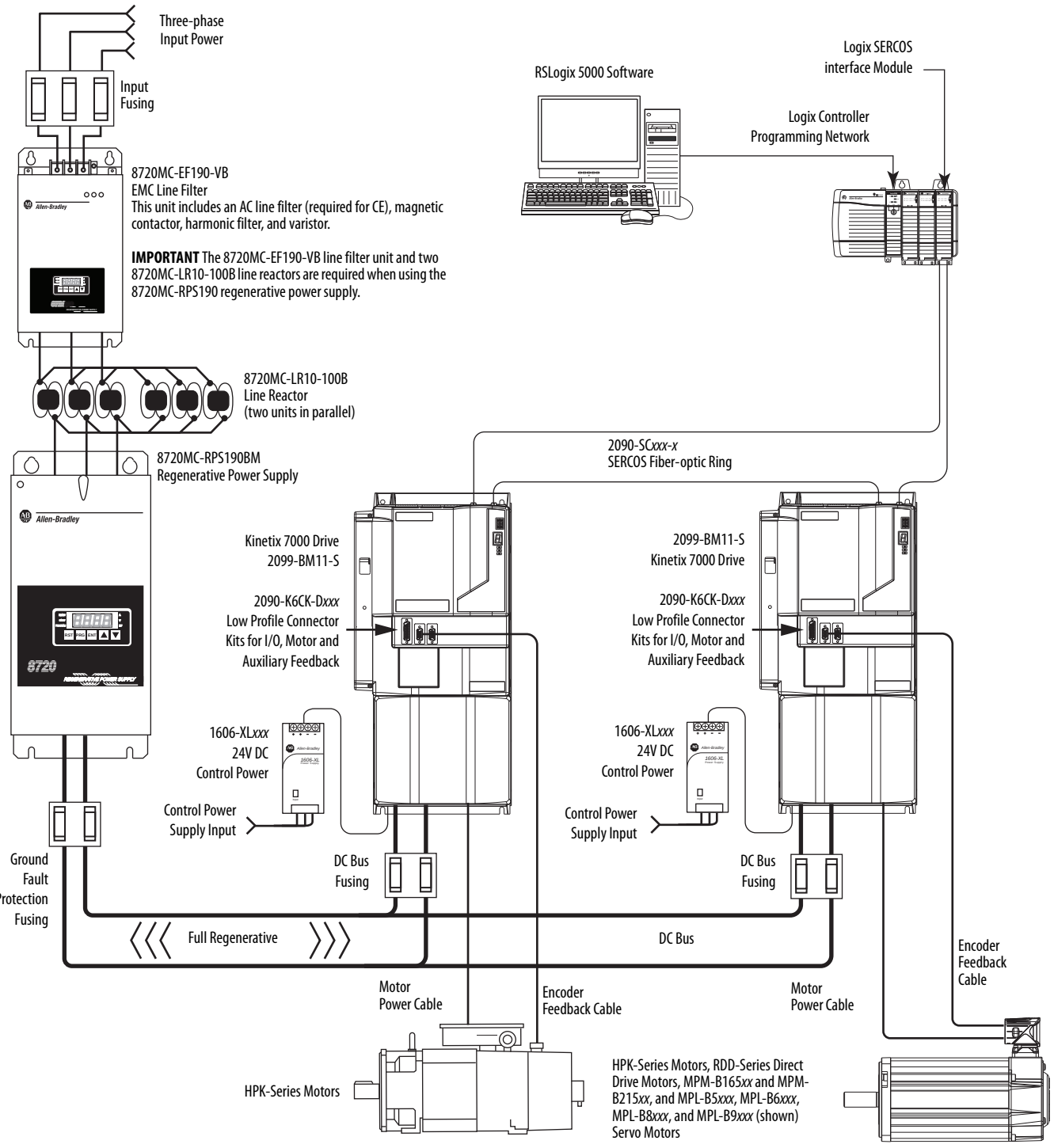
The Kinetix 7000 drive system shown in Figure 3 illustrates a regenerative power only configuration with a 8720MC regenerative power supply (RPS). The harmonic filter and varistor are available separately, but are included with the RPS unit when ordering the 8720MC-RPS065BM-HV2. In this configuration the Kinetix 7000 drive provides motoring power and the 8720MC-RPS065 provides regenerative power.

Figure 3 - Kinetix 7000 System Configuration with AC Input and Regenerative Power Supply



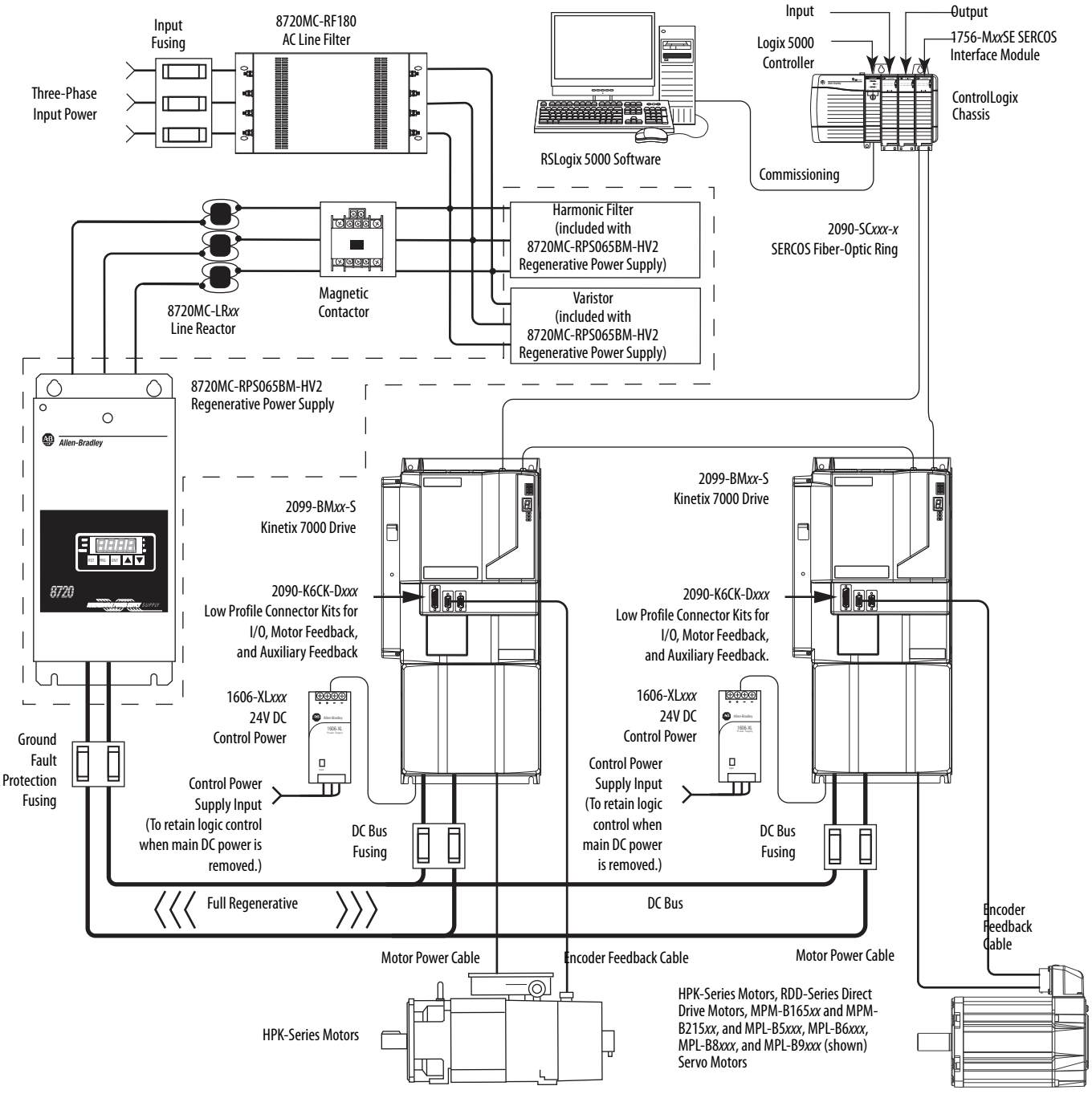
The Kinetix 7000 drive system shown in Figure 4 illustrates a DC common bus configuration with two follower Kinetix 7000 (2099-BM11-S) drives and an 8720MC regenerative power supply (RPS). In full-line regenerative mode the 8720MC-RPS190 unit provides motoring and regenerative power.

Figure 4 - Kinetix 7000 System Configuration with AC Input and 8720MC-RPS190 with Full-line Regeneration



The Kinetix 7000 drive system shown in Figure 5 illustrates a DC common bus configuration with two follower Kinetix 7000 drives and an 8720MC regenerative power supply (RPS). The harmonic filter and varistor are available separately, but are included when ordering the 8720MC-RPS065BM-HV2 RPS unit. In full-line regenerative mode the 8720MC-RPS065BM-HV2 unit provides motoring power and regenerative power. In common bus mode, you must calculate the total bus capacitance of your DC common bus system. This lets you plan your panel layout and sufficiently size the 8720MC-RPS to precharge the entire system.

Figure 5 - Kinetix 7000 System Configuration with DC Input from 8720MC-RPS065 Providing Full-line Regeneration



Catalog Number Explanation

Kinetix 7000 drive catalog numbers and descriptions are listed in the table below.

Kinetix 7000 Drive	Cat. No.
Kinetix 7000, 460V, 22 kW, 40 A continuous output	2099-BM06-S
Kinetix 7000, 460V, 30 kW, 52 A continuous output	2099-BM07-S
Kinetix 7000, 460V, 37 kW, 65 A continuous output	2099-BM08-S
Kinetix 7000, 460V, 56 kW, 96 A continuous output	2099-BM09-S
Kinetix 7000, 460V, 75 kW, 125 A continuous output	2099-BM10-S
Kinetix 7000, 460V, 112 kW, 180 A continuous output	2099-BM11-S
Kinetix 7000, 460V, 149 kW, 248 A continuous output	2099-BM12-S

Agency Compliance

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

ATTENTION: Meeting CE requires a grounded system, and the method of grounding the AC line filter and drive must match. Failure to do this renders the filter ineffective and may cause damage to the filter.

For grounding examples, see Grounded Power Configurations on page 75.

For more information on electrical noise reduction, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

CE Requirements - System without LIM

To meet CE requirements when your Kinetix 7000 system does not use a 2094 line interface module to supply AC line and DC control power, the following requirements apply:

- Install an 8720MC-RF180 line filter as close to the 8720MC-RPS unit as possible, and the AC line filter (2090-XXLF-TC*xxxx*) as close to the Kinetix 7000 drive as possible.
- For MP*x* motors, use 2090 series motor power cables or use connector kits. Terminate cable shields at the chassis and the motor terminal block with a 360° connection.
- For HPK-Series motors, use UL Approved 4 wire, 600V AC, shield, VFD cabling. Terminate cable shields at the chassis and the motor with a 360° connection.
- Combined motor power/feedback cables must not exceed 90 m (295.3 ft).
- Use 2090 series motor feedback cables or connector kits and terminate the feedback shield as shown in Chapter 4 for wiring instructions and Appendix B for motor feedback connector kit catalog numbers. Drive to motor feedback cables must not exceed 90 m (295.3 ft).
- Install the Kinetix 7000 system inside an enclosure. Run input power wiring in conduit (grounded to the enclosure) outside of the enclosure. Separate signal and power cables.
- Output power, control (I/O), and signal wiring must be braided, shielded cable with a coverage of 75% or better, metal conduit or equivalent attenuation.
- All shielded cables should terminate with a properly shielded connector.

See the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, for information on electrical noise reduction and grounding practices.

CE Requirements - System with LIM

To meet CE requirements when your Kinetix 7000 system includes the line interface module (LIM), follow all the requirements as stated in CE Requirements - System without LIM on page 19 and these additional requirements that also apply to the AC line filter:

- Install the LIM, 2094-XL75S-C*x* or 2094-BL50/75S, and line filter (2090-XXLF-TC*xxx*) as close to the Kinetix 7000 drive as possible.

IMPORTANT	The full rated current on the AC input line should not exceed that of the line interface module. Catalog numbers 2094-XL75S-C*x* or 2094-BL50S for 2099-BM06-S and 2099-BM07-S Kinetix 7000 drives, or 2094-BL75S for 2099-BM08-S Kinetix 7000 drives.

IMPORTANT	CE requires use of a grounded secondary or source with a 2099-BM*xx*-S drive. Never use a LIM in an ungrounded input, due to the potential for high line-to-neutral voltages damaging components within the line filter.

CE Requirements - System with DC Common Bus through 8720MC-RPS

To meet CE requirements when your Kinetix 7000 system includes a common DC bus with an 8720MC-RPS, follow all the requirements as stated in the CE Requirements - System without LIM on page 19, the recommended installation and wiring in the 8720MC Regenerative Power Supply Reference Manual, publication 8720MC-RM001, and these additional requirements:

- Install a three-phase line filter on the AC input power line of the RPS as indicated in Interconnect Diagrams beginning on page 163.
- Install a single-phase line filter when attaching an AC line input to the RPS MC1/2 circuit as indicated in the Interconnect Diagrams beginning on page 163.

Install the Kinetix 7000 Drive System

This chapter describes system installation guidelines in preparation for mounting your Kinetix 7000 drive components.

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

System Design Guidelines

To design your enclosure and plan where to mount the system components on the panel, use this section and the information in the Kinetix Servo Drives Specifications Technical Data, publication GMC-TD003.

For online product selection and system configuration tools, including AutoCAD (DXF) drawings of the product, go to: http://www.rockwellautomation.com/en/e-tools/.

System Mounting Requirements

Follow these system mounting requirements.

- To comply with UL and CE requirements, the Kinetix 7000 drive system must be enclosed in a grounded conductive enclosure offering protection as defined in standard EN 60529 (IEC 529) to NEMA/UL Type IP2X such that they are not accessible to an operator or unskilled person. A NEMA/UL Type 4X enclosure exceeds these requirements providing protection to IP66.
- The panel you install inside the enclosure for mounting your system components must be on a flat, rigid, vertical surface that won't be subjected to shock, vibration, moisture, oil mist, dust, or corrosive vapors (as specified in Environmental Specifications on page 156).
- Size the drive enclosure so as not to exceed the maximum ambient temperature rating. Consider heat dissipation specifications for all drive components.
- Segregate input power wiring and motor power cables from control wiring and motor feedback cables. Use shielded cable for power wiring and provide a grounded 360° clamp termination.
- Use high-frequency (HF) bonding techniques to connect the modules, enclosure, machine frame, and motor housing, and to provide a low-impedance return path for HF energy and reduce electrical noise.

See the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, to better understand the concept of electrical noise reduction.

Transformer Selection

The Kinetix 7000 drive does not require an isolation transformer for three-phase input power. However, a transformer may be required to match the voltage requirements of the controller to the available service.

To size a transformer for the AC power inputs to devices peripheral to the Kinetix 7000 drive, refer to the manufacturer continuous output power specification.

IMPORTANT	If using an autotransformer, make sure that the phase to neutral/ground voltages do not exceed the input voltage ratings of the drive.

IMPORTANT	Use a form factor of 1.5 for three-phase power (where form factor is used to compensate for transformer, drive module and motor losses, and to account for utilization in the intermittent operating area of the torque speed curve). For example: using a secondary of 480 VAC and a 2099-BM06-S with a rated power output = 22 kW continuous: 22 * 1.5 = 33 kVA transformer

Circuit Breaker/Fuse Selection

The Kinetix 7000 drive uses internal solid-state motor short-circuit protection and, when protected by suitable branch circuit protection, are rated for use on a circuit capable of delivering up to 200,000 A. Fuses or circuit breakers, with adequate withstand and interrupt ratings, as defined in NEC or applicable local codes, are permitted.

The 2094-BL50 and 2094-BL75S LIMs contain supplementary protection devices, but require a customer-supplied external line filter. See the Line Interface Module Installation Instructions, publication 2094-IN005, for power specifications and more information on using the LIM module.

The Bulletin 140M motor protection circuit breakers are another acceptable means of protection. As with fuses and circuit breakers, you must make sure that the selected components are properly coordinated and meet applicable codes including any requirements for branch circuit protection. When applying the 140M product, evaluation of the short circuit available current is critical and must be kept below the short circuit rating of the 140M product.

In most cases, fuses selected to match the drive input current rating will meet the NEC requirements and provide the full drive capabilities. Dual element, time delay (slow acting) fuses should be used to avoid nuisance trips during the inrush current of power initialization.

See Circuit Breaker/Fuse Specifications on page 153 for recommended circuit breakers and fuses.

See Power Specifications on page 152 for input current and inrush current specifications for your Kinetix 7000.

Enclosure Selection

To assist you in sizing an enclosure, the following example is provided. The example system consists of the following components.

- 2-axis Kinetix 7000 servo drive system
- ControlLogix chassis and modules

Size the Kinetix 7000 servo drive using Motion Analyzer software, version 4.2 or later, and use the results to predict the amount of heat dissipated into the enclosure. You will also need heat dissipation data from other equipment inside the enclosure (such as ControlLogix). Once the total amount of heat dissipation (in watts) is known, the minimum enclosure size can be calculated. It is recommended that you also contact the enclosure manufacturer for the best enclosure fit, including possible cooling methods to help reduce enclosure size.

Using Motion Analyzer to Determine Heat Dissipation

To obtain Motion Analyzer software, go to: http://ab.rockwellautomation.com/Motion-Control/Motion-Analyzer-Software

Complete the Motion Analyzer Axis View data to find an acceptable Kinetix 7000 drive and motor solution to meet the application needs. In the Axis View Solutions window find the Drive Capacity value. In this example, the 2099-BM11-S Drive Capacity characteristic can be used for the estimation of the Rated Power Output used for the percentage of watts dissipated.

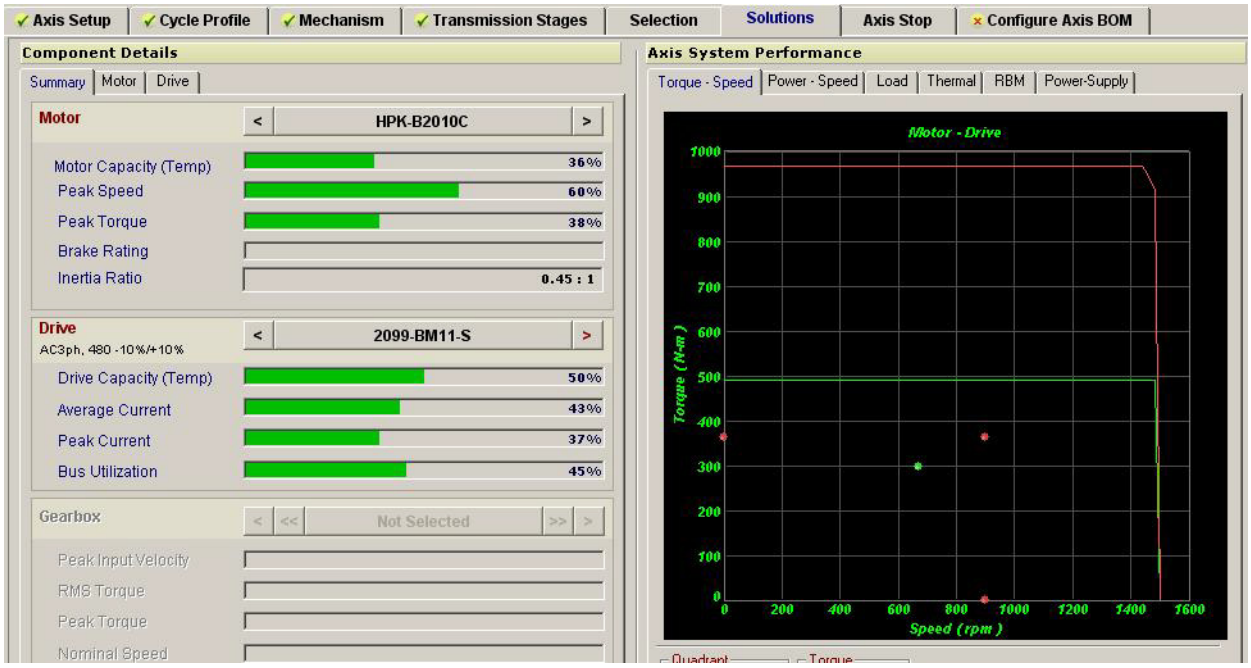


Table 2 - Kinetix 7000 System Heat Dissipation Example

Enclosure Component	Description	Loading (1) (Motion Analyzer)	Heat Dissipation (2) Watts
2099-BM08-S	Kinetix 7000 Servo Drive	50%	452
2099-BM11-S	Kinetix 7000 Servo Drive	50%	1275
Total Wattage of Kinetix 7000 system			1727

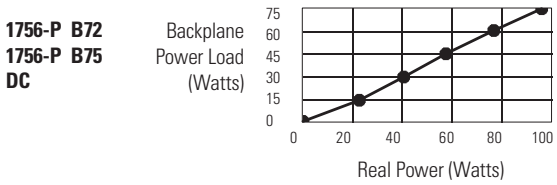
(1) Loading determined using Motion Analyzer software.
(2) To determine heat dissipation specifications for the Kinetix 7000 drive, see Power Dissipation Specifications on page 154.

Table 3 - ControlLogix Heat Dissipation Example

Enclosure Component	Description	Backplane Power Load (1) Watts	Heat Dissipation (1) Watts
1756-M08SE	8-axis SERCOS interface module	3.2	0.0
1756-L5563	L63 ControlLogix processor	4.5	0.0
1756-IB16D	16-point input module	0.84	5.8
1756-OB16D	16-point output module	4.64	3.3
1756-EN*x*T*x*	EtherNet/IP communication module	4.0	0.0
Backplane total		17.18 (2)	N/A
1756-PB72	24V DC ControlLogix power supply	N/A	25.0 (2)
1756-A7	7-slot mounting chassis	N/A	N/A
Total ControlLogix system wattage			34.1

(1) For ControlLogix module specifications, see the ControlLogix Selection Guide, publication 1756-SG001.
(2) Real power heat dissipation is determined by applying the backplane power load (17.18 W) to the graph in Figure 6.

Figure 6 - ControlLogix Real Power



For backplane power loading requirements of other ControlLogix power supplies, see the ControlLogix Selection Guide, publication 1756-SG001.

In this example, the amount of power dissipated inside the cabinet is the sum of the Kinetix 7000 drive (2099-BM08-S and 2099-BM11-S) system value (1727 W) and the ControlLogix value (34.1 W) for a total of 1761 W.

With no active method of heat dissipation (such as fans or air conditioning) either of the following approximate equations can be used.

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

The maximum ambient rating of the Kinetix 7000 drive is 50 °C (122 °F) and if the maximum environmental temperature is 30 °C (86 °F) then Q=1761 and T=20 in this equation.

$$A = \frac{0.38\ (1761)}{1.8\ (20) - 1.1}$$

$$A = 19.2\ m^2$$

In this example, the enclosure must have an exterior surface of 19.2 m^2. If any portion of the enclosure is not able to transfer heat, it should not be included in the calculation. For instance, if an externally-mounted shunt system is used with the Kinetix 7000 system, it should not be included in the equation.

The minimum enclosure size must take into account the physical size and minimum clearance requirements of the two Kinetix 7000 drives and the additional ControlLogix and other devices required to meet the application needs.

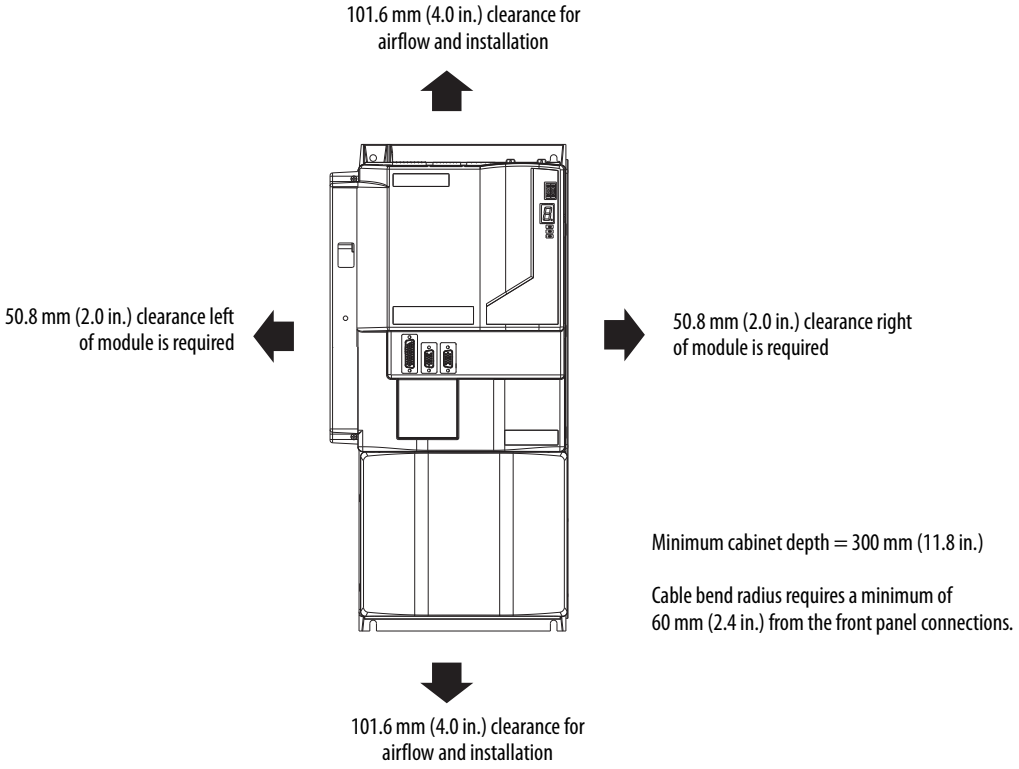
If the enclosure size is considerably larger than what is necessary to house the system components, it may be more efficient to provide a means of cooling in a smaller enclosure. Contact your enclosure manufacturer for options available to cool your enclosure.

Minimum Clearance Requirements

This section provides information to assist you in sizing your cabinet and positioning your Kinetix 7000 system components.

IMPORTANT	Mount the module in an upright position as shown. Do not mount the module on its side.

Figure 7 - Minimum Clearance Requirements



See page 154 for power dissipation specifications.

Minimizing Electrical Noise

This section outlines best practices that minimize the possibility of noise-related failures as they apply specifically to Kinetix 7000 drive installations. For more information on the concept of high-frequency (HF) bonding, the ground plane principle, and electrical noise reduction, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Bonding Modules

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

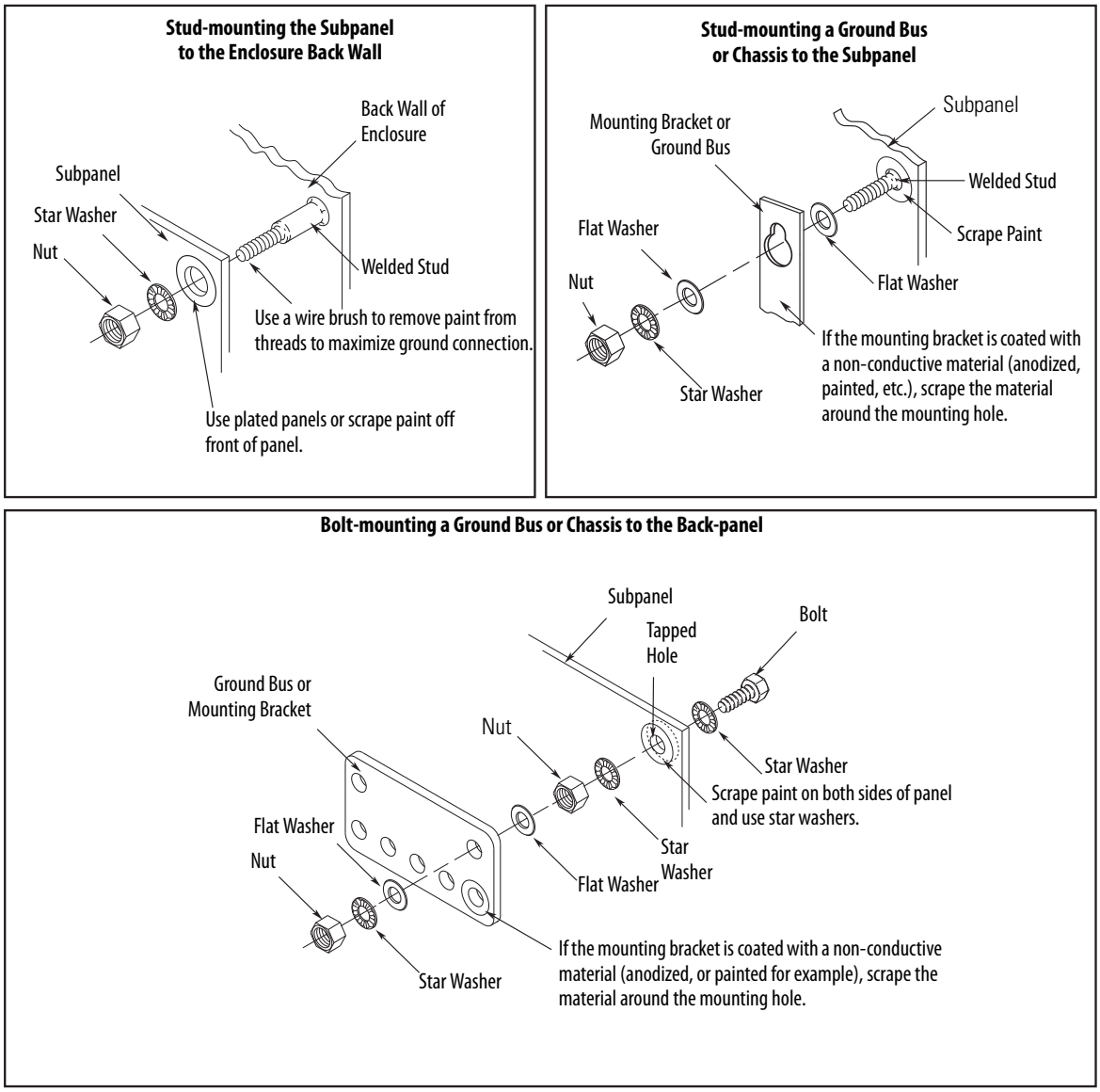
Unless specified, most paints are not conductive and act as insulators. To achieve a good bond between the drive and subpanel, surfaces need to be unpainted or plated. Bonding metal surfaces creates a low-impedance return path for high-frequency energy.

IMPORTANT	To improve the bond between the drive and subpanel, construct your subpanel out of zinc-plated (unpainted) steel.

Improper bonding blocks the direct return path and routes high-frequency energy to elsewhere in the cabinet. Excessive high-frequency energy can effect the operation of other microprocessor controlled equipment.

Figure 8 shows details of recommended bonding practices for painted panels, enclosures, and mounting brackets.

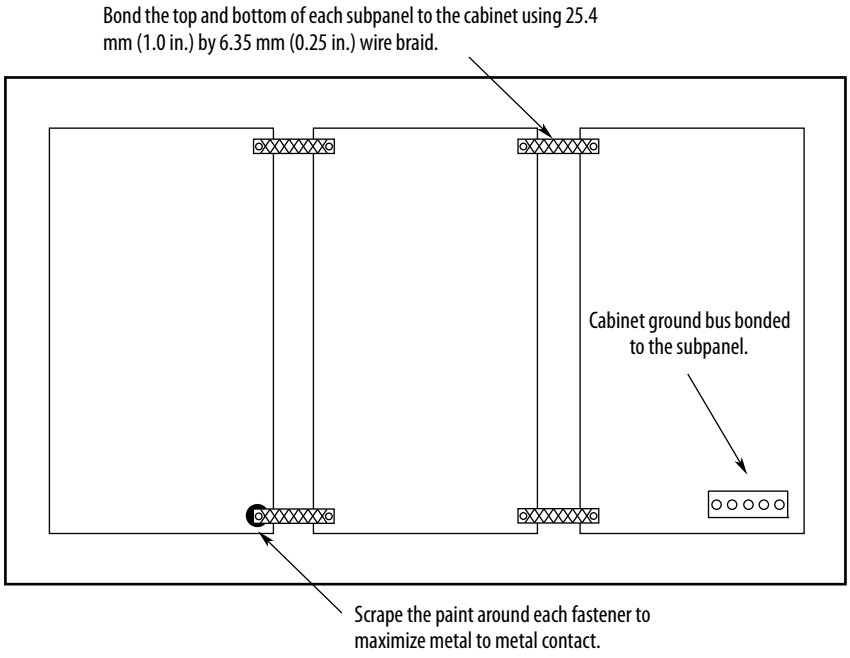
Figure 8 - Recommended Bonding Practices for Painted Panels



Bonding Multiple Subpanels

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

Figure 9 - Multiple Subpanels and Cabinet Recommendations



Establish Noise Zones

When designing a panel for a Kinetix 7000 system, observe the following guidelines with additional attention to zone locations.

Noise Zones when Using Regenerative Power Supplies (with/without a Line Filter Unit)

Observe the following guidelines when laying out a Kinetix 7000 system panel if a regenerative power supply (8720-RPS*xxxxx*) is used (see Figure 10), and if a regenerative power supply and line filter unit are used (see Figure 11 on page 32).

- Mount the regenerative power supply to the right of the drive.
- The clean zone (C) is beneath and left of the Kinetix 7000 drive. This zone includes the motor feedback, auxiliary feedback and registration signals from the IOD connector (grey wireway).
- The dirty zone (D) is to the right of the Kinetix 7000 drive. This zone includes the motor power, GPIO, GPR, SO, and IOD connections (black wireway).
- The very dirty zone (VD) includes both the 8720MC-RPS DC output to the Kinetix 7000 drive and the fuses, contactors, circuit breakers, and AC line input to the EMC line filter to the right of the 8720MC-RPS. Shielded cable is required only if the very dirty cables enter a wireway.
- The SERCOS fiber-optic cables are immune to electrical noise.

Figure 10 - Establishing Noise Zones (Regenerative Power Supply)

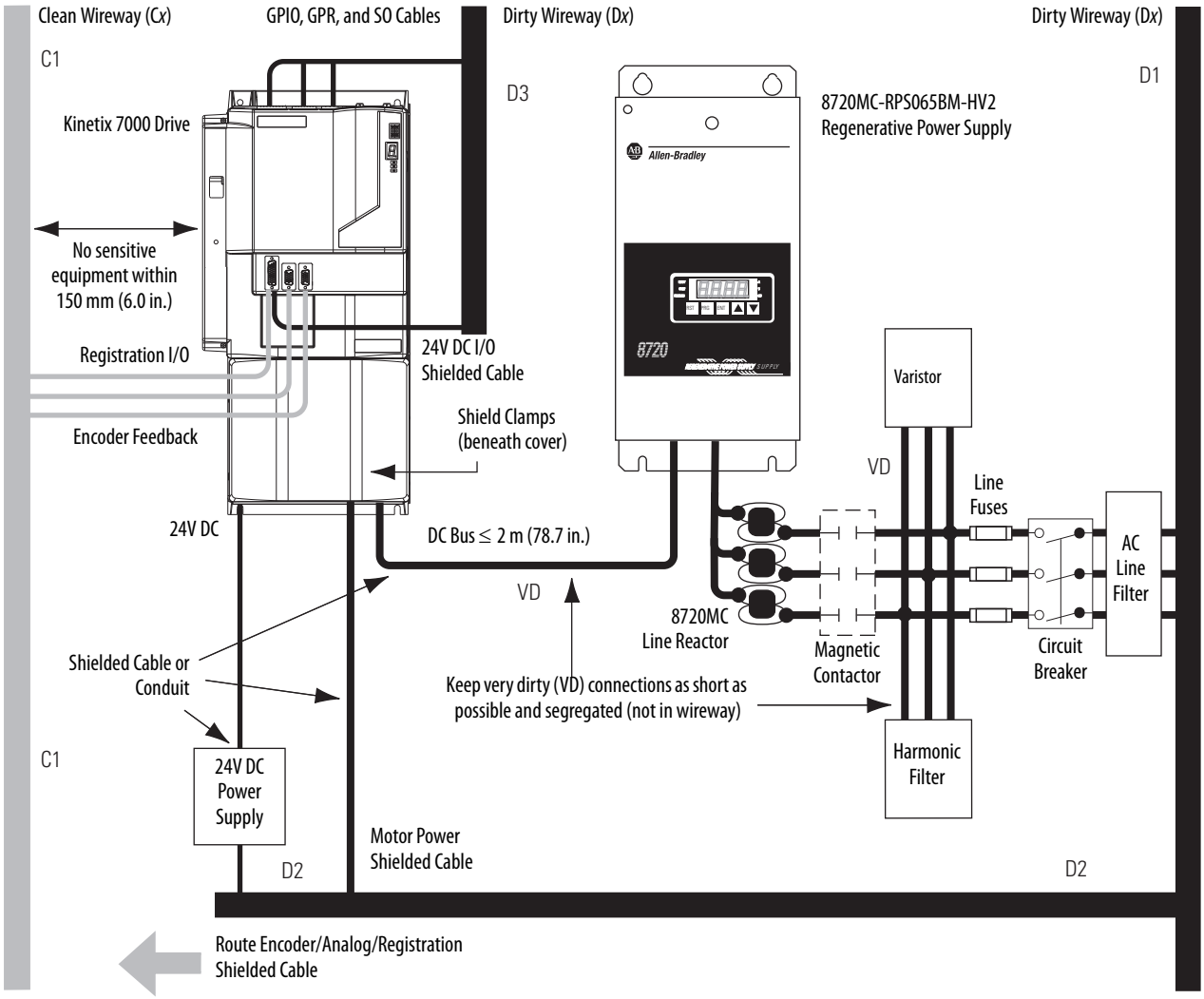
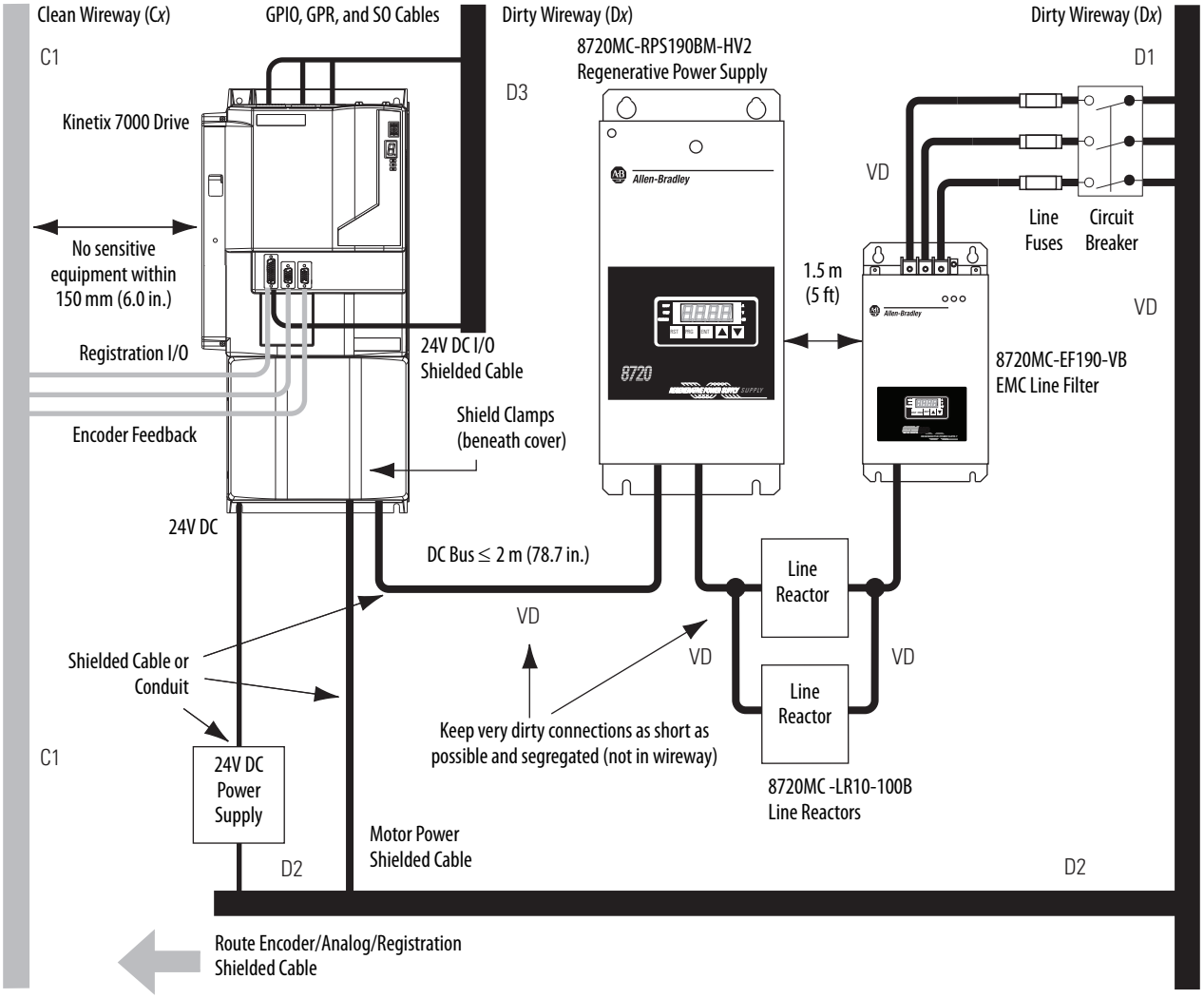


Figure 11 - Establishing Noise Zones (Regenerative Power Supply with Line Filter Unit)

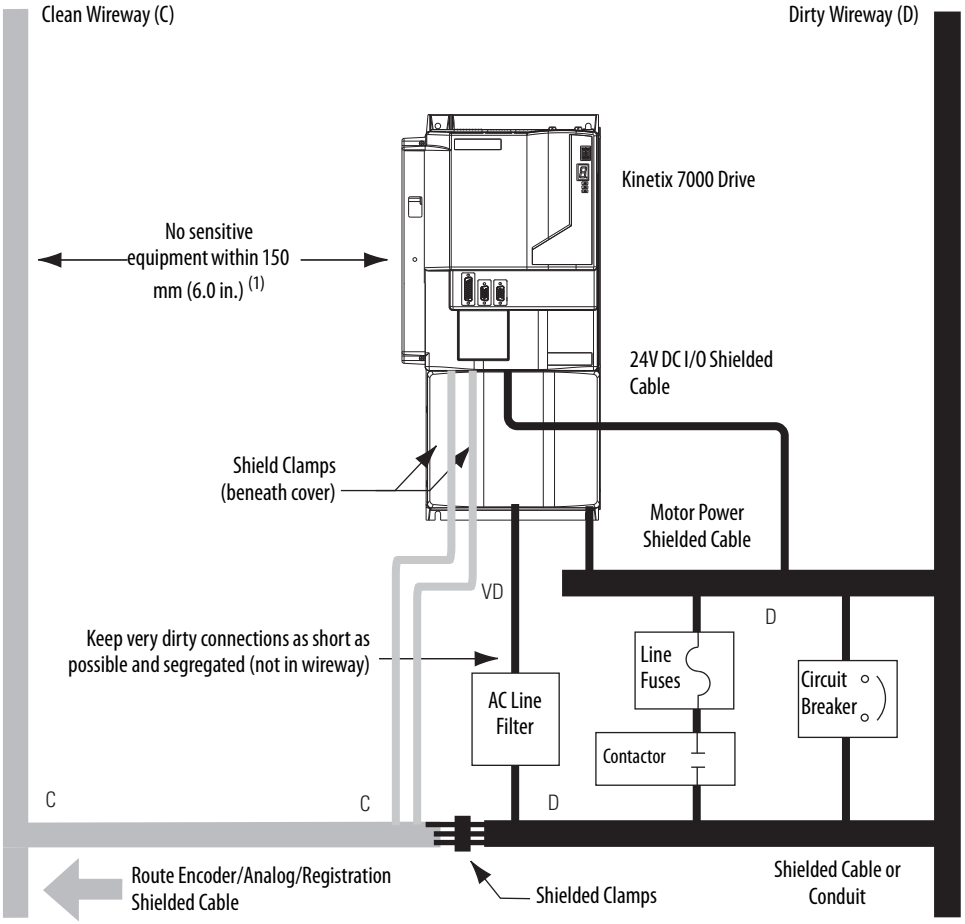


AC Power Noise Zones

Observe the following guidelines when laying out a Kinetix 7000 system panel, if an AC power supply is used (and regenerative power will not be used).

- The clean zone (C) is beneath and left of the Kinetix 7000 drive. This zone includes the motor feedback, auxiliary feedback and registration signals from the IOD connector (grey wireway).
- One dirty zone (D) is beneath and right of the Kinetix 7000 drive. This zone includes fuses, contactors, circuit breakers, AC line input to the EMC line filter (black wireway).
- The very dirty zone (VD) is limited to where the AC line output exits from the EMC line filter and connects to the Kinetix 7000 drive. Shielded cable is required only if the very dirty cables enter a wireway.
- The SERCOS fiber-optic cables are immune to electrical noise.

Figure 12 - Establishing Noise Zones (AC Power)



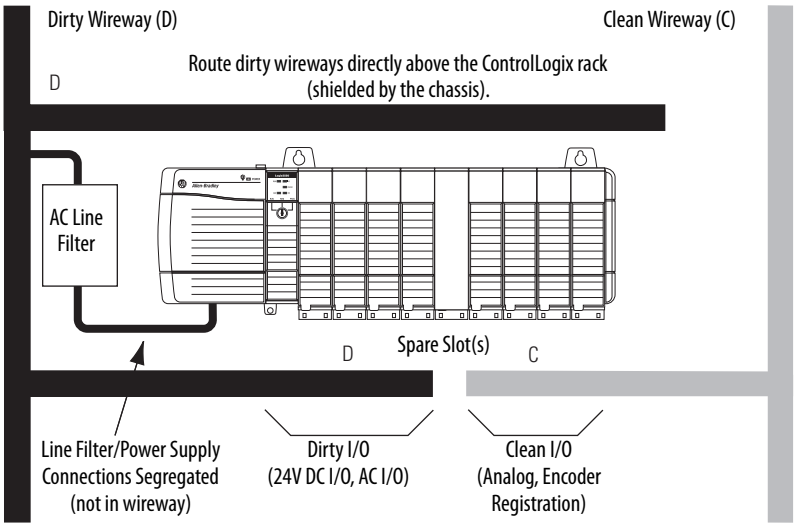
(1) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, see the System Design for Control of electrical Noise Reference Manual, publication GMC-RM001.

1756-MxxSE SERCOS Interface Module Noise Zones

Observe the following guidelines when installing your 1756-M*xx*SE SERCOS interface module.

- The clean zone (C) is beneath the less noisy I/O modules (analog, encoder, registration) - - (grey wireway).
- The dirty zone (D) is above and below the power supply and noisy modules (black wireway).
- The SERCOS fiber-optic cables are immune to electrical noise.

Figure 13 - Establishing Noise Zones (ControlLogix)



Cable Categories for Kinetix 7000 Systems

The table below indicates the zoning requirements of input power cables connecting to the Kinetix 7000 drive.

Table 4 - Kinetix 7000 Drive

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
Control Power	CP		X			
DC-/DC+	PTB	X				
L1, L2, L3 (shielded cable)			X			X
L1, L2, L3 (unshielded cable)		X				
DPI	DPI			X		X

The table below indicates the zoning requirements of power and control cables connecting to the Kinetix 7000 system.

Table 5 - Kinetix 7000 System

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
U, V, W (Motor Power)	MP		X			X
GPR+, GPR- (Motor Brake)	GPR		X			
24V DC (PWR), COM, filtered	GPIO, GPR			X		
24V DC (PWR), COM, unfiltered			X			
24V DC (PWR), COM, safety enable, and feedback signals for safe-off feature	SO		X			
Motor Feedback	MF			X		X
Auxiliary Feedback	AF			X		X
Registration and Analog Outputs	IOD			X		X
Others			X			
Fiber-optic	Rx and Tx	No Restrictions				

Table 6 - Line Interface Module

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
VAC line (main input)	IPL		X			
230V AC input	APL		X			
VAC load (shielded option)	OPL		X			X
VAC load (unshielded option)		X				
Control power output	CPL		X			
MBRK PWR, MBRK COM	P1L/PSL		X			
Status I/O	IOL		X			
Auxiliary 230V AC	P2L		X			

Table 7 - External Shunt Resistor Kit

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
COL, DC+ (shielded option)	RC		X			X
COL, DC+ (unshielded option)		X				
Thermal switch	TS		X			X
Fan (if present)	N/A		X			

Noise Reduction Guidelines for Drive Accessories

When mounting an AC (EMC) line filter or external shunt resistor refer to the sections below for guidelines designed to reduce system failures caused by excessive electrical noise.

AC Line Filters

Observe the following guidelines when mounting your AC (EMC) line filter.

See the Establishing Noise Zones (AC Power) on page 33 for an example.

- Mount the AC line filter on the same panel as the Kinetix 7000 drive and as close to the power input as possible.
- Good HF bonding to the panel is critical.

  For painted panels, refer to the examples on page 29.
- Segregate input and output wiring as far as possible.

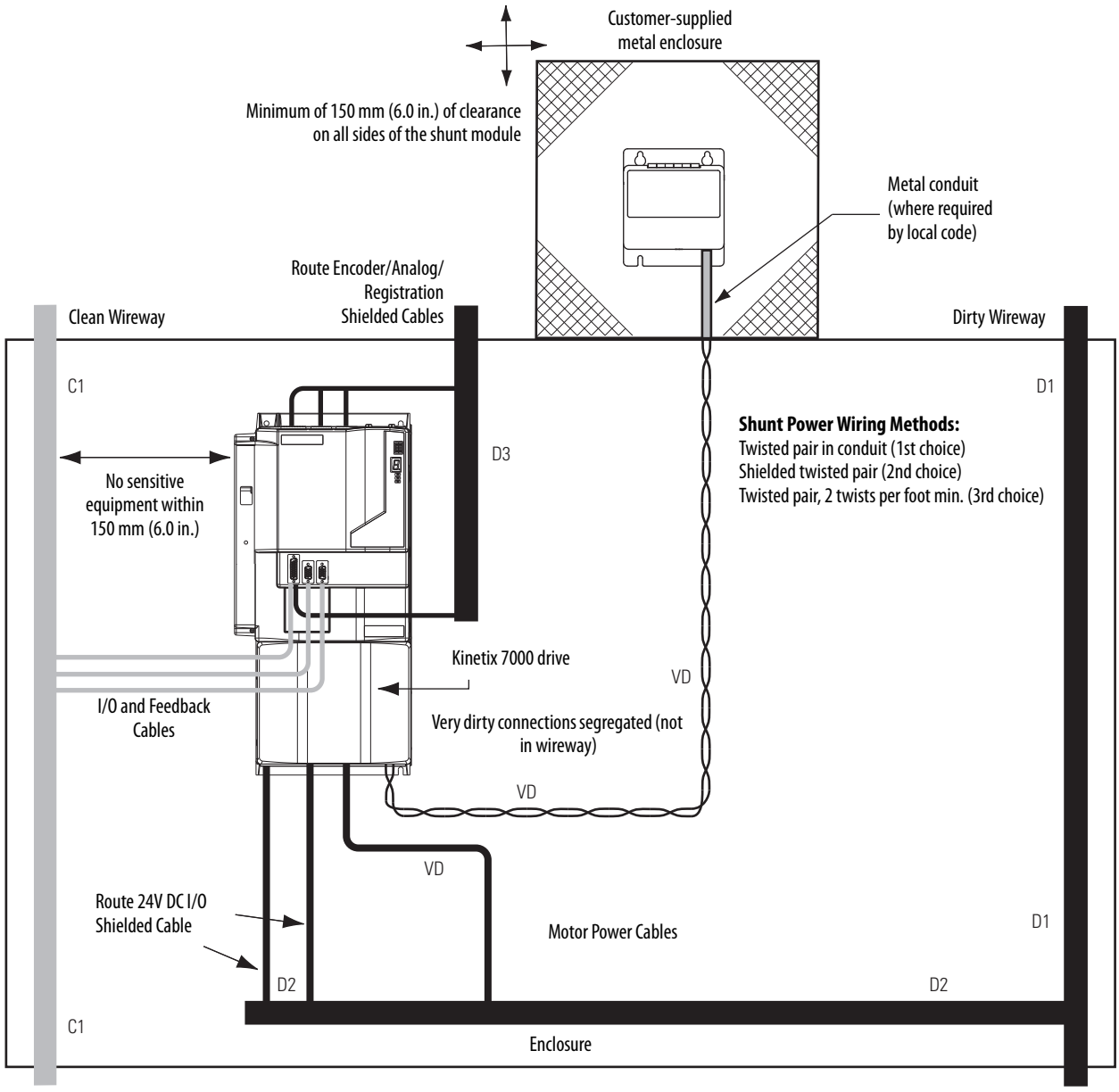
IMPORTANT CE test certification applies only to AC line filter and single drive. Sharing a line filter with multiple drives may perform satisfactorily, but the user takes legal responsibility.

Shunt Resistor

Observe the following guidelines when mounting your external shunt resistor outside the enclosure.

- Mount circuit components and wiring in the very dirty zone or in an external shielded enclosure. Run shunt power and fan wiring inside metal conduit to minimize the effects of EMI and RFI.
- Mount resistors (other than metal-clad) in a shielded and ventilated enclosure outside the cabinet
- Keep unshielded wiring as short as possible. Keep shunt wiring as flat to the cabinet as possible.
- Route thermal switch and fan wires separate from shunt power.

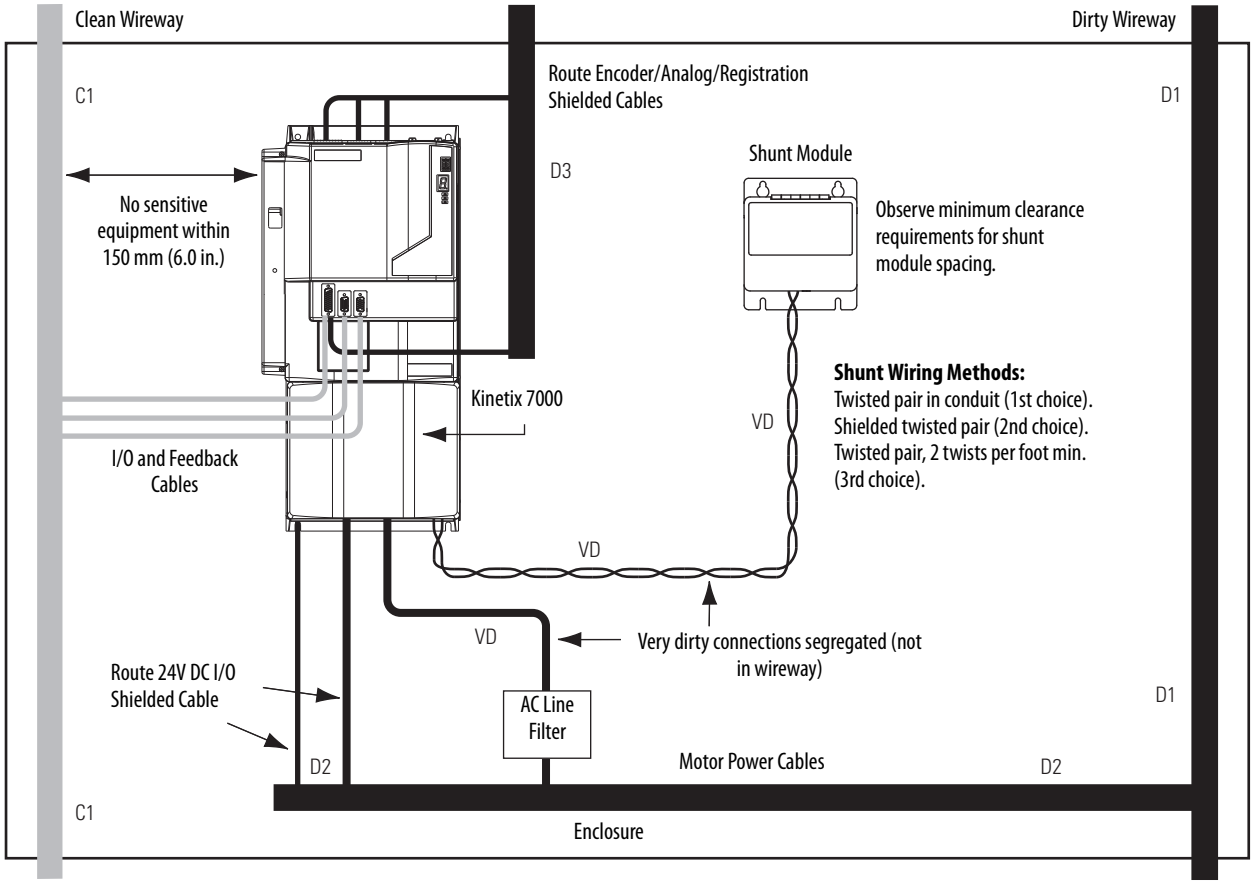
Figure 14 - External Shunt Resistor Outside the Enclosure



When mounting your shunt module inside the enclosure, follow these additional guidelines.

- Metal-clad modules can be mounted anywhere in the dirty zone, but as close to the Kinetix 7000 system as possible.
- Shunt power wires can be run with motor power cables.
- Keep unshielded wiring as short as possible. Keep shunt wiring as flat to the cabinet as possible.
- Separate shunt power cables from other sensitive, low voltage signal cables.
- The shunt module watts dissipation must be included in the Kinetix 7000 system heat dissipation calculation for selecting an enclosure.

Figure 15 - External Shunt Resistor Inside the Enclosure



Motor Brake and Thermal Switch

The thermal switch and brake are mounted inside the motor, but how you connect to the axis module depends on the motor series.

See Wire Motor Output Power on page 93 for wiring guidelines specific to your drive/motor combination, and to Interconnect Diagram Notes on page 164 for the interconnect diagram of your drive/motor combination.

Mount the Kinetix 7000 Drive

SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the drive prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.

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

Follow these steps to install your Kinetix 7000 drive.

1. Layout and mark the position for your drive in the enclosure.

   Follow the Kinetix 7000 mounting information provided in Figure 16 on page 40. Clearance requirements on page 27 must also be followed.

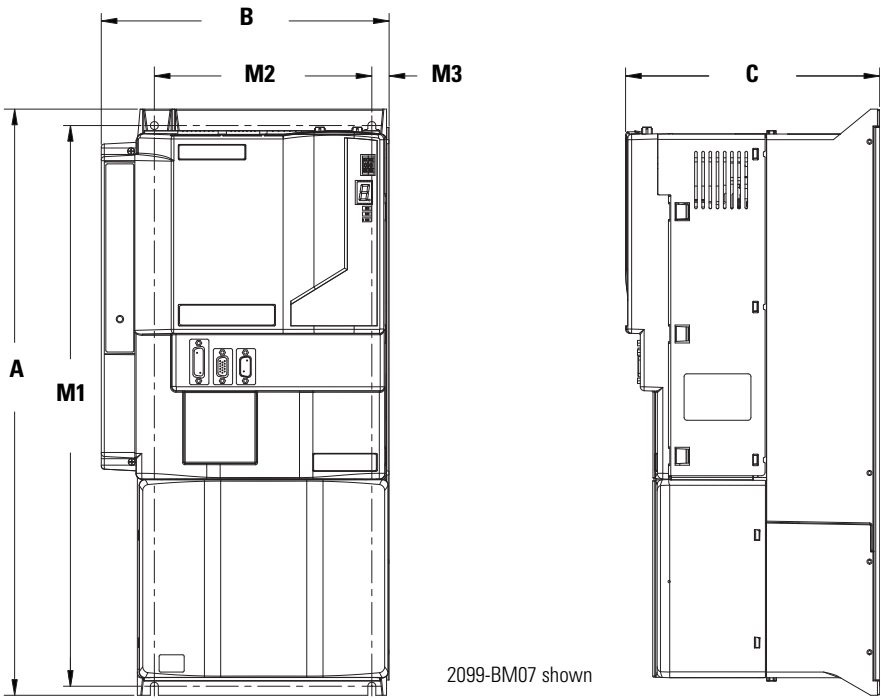
2. Attach the drive to the cabinet.

   The recommended mounting bolts are listed in the table on page 40. Follow the recommended high-frequency (HF) bonding techniques as shown in Bonding Modules beginning on page 28.

   Follow the lifting instructions found in the Kinetix 7000 High Power Servo Drive Installation Instructions, publication 2099-IN003.

3. Tighten all mounting fasteners.

Figure 16 - Kinetix 7000 Approximate Mounting Dimensions



Kinetix 7000 Drive Cat. No.	Dimensions in mm (in.)						Mounting Screw Size
	A	B	C	M1	M2	M3	
2099-BM06-S 2099-BM07-S 2099-BM08-S	517.5 (20.37)	254.12 (10.0)	224.3 (8.83)	495.0 (19.49)	192.0 (7.56)	15.3 (0.60)	M6 (0.25)
2099-BM09-S	644.5 (25.37)	331.9 (13.07)	286.7 (11.29)	625.0 (24.61)	225.0 (8.86)	37.5 (1.48)	M6 (0.25)
2099-BM10-S	690.3 (38.47)	331.9 (13.07)	286.7 (11.29)	625.0 (24.61)	225.0 (8.86)	37.5 (1.48)	M6 (0.25)
2099-BM11-S 2099-BM12-S	977.1 (38.47)	429.2 (16.90)	282.7 (11.13)	824.0 (32.44)	300.0 (11.81)	49.6 (1.95)	M8 (0.3125)

IMPORTANT Each Kinetix 7000 drive requires four mounting screws.

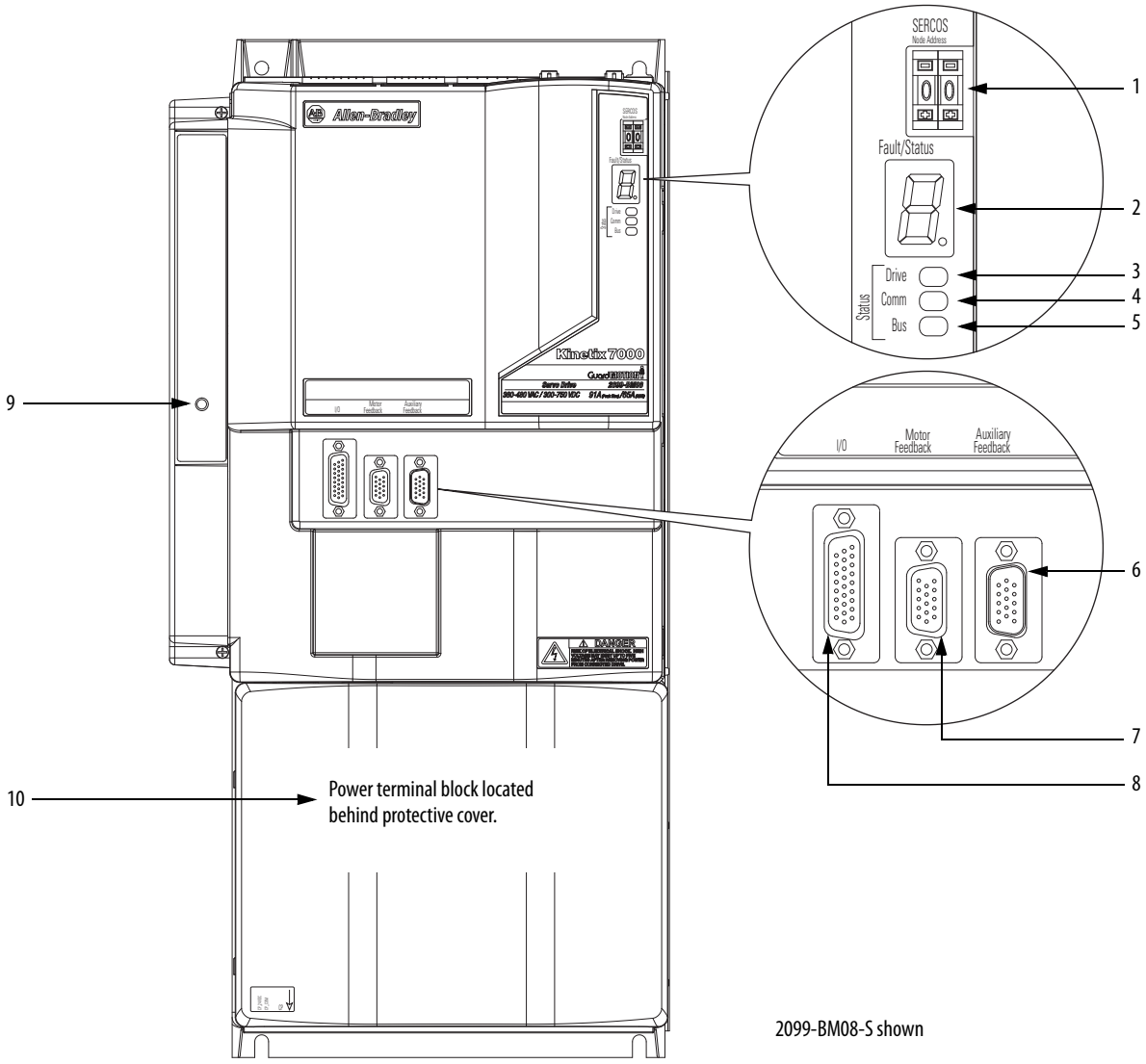
Kinetix 7000 Connector Data

This chapter provides power, feedback, and I/O connector locations and signal descriptions for a Kinetix 7000 drive.

Locate and Identify Connectors and Indicators

Although the physical size of the drives vary, the location of the connectors and indicators is identical.

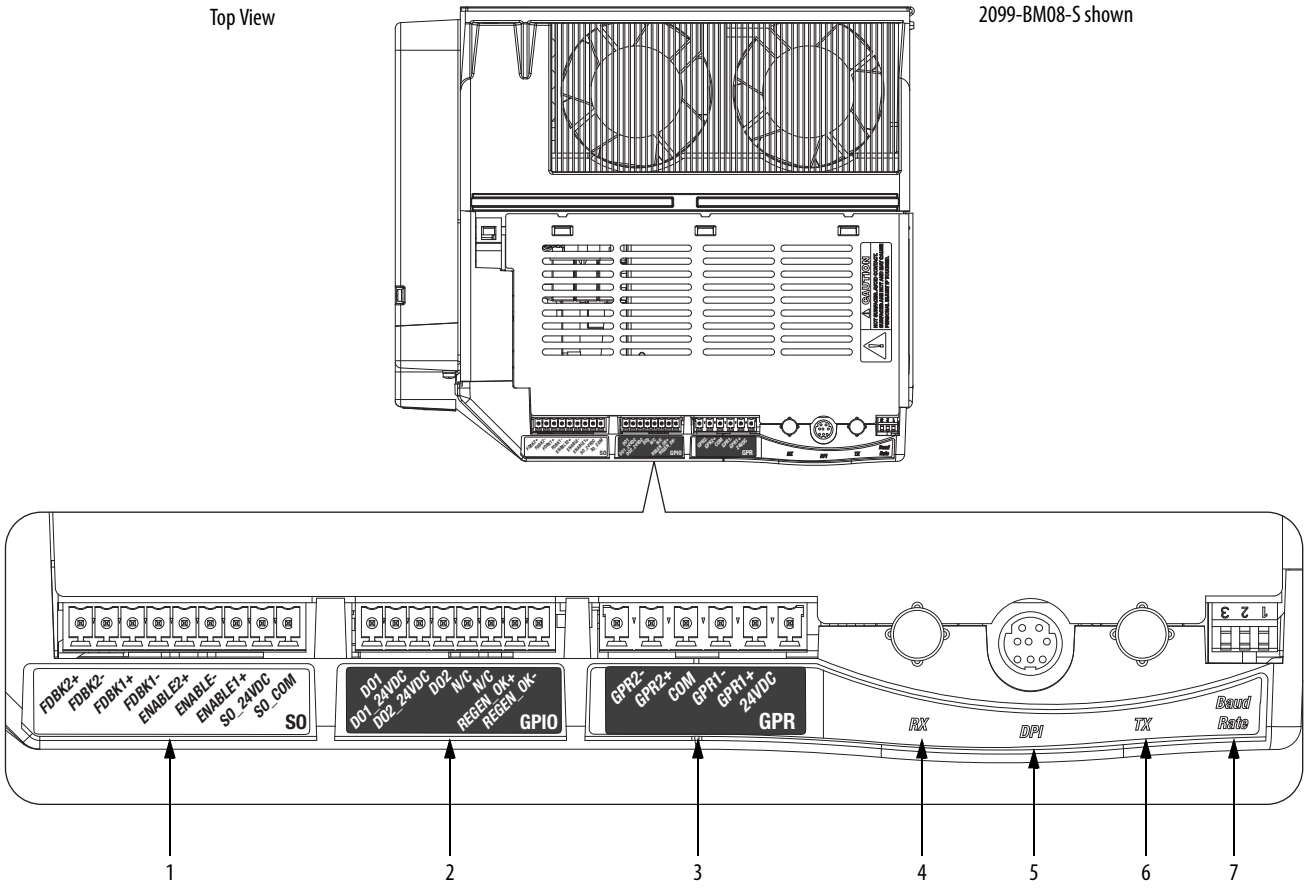
Figure 17 - Kinetix 7000 Front Panel Connectors and Displays



2099-BM08-S shown

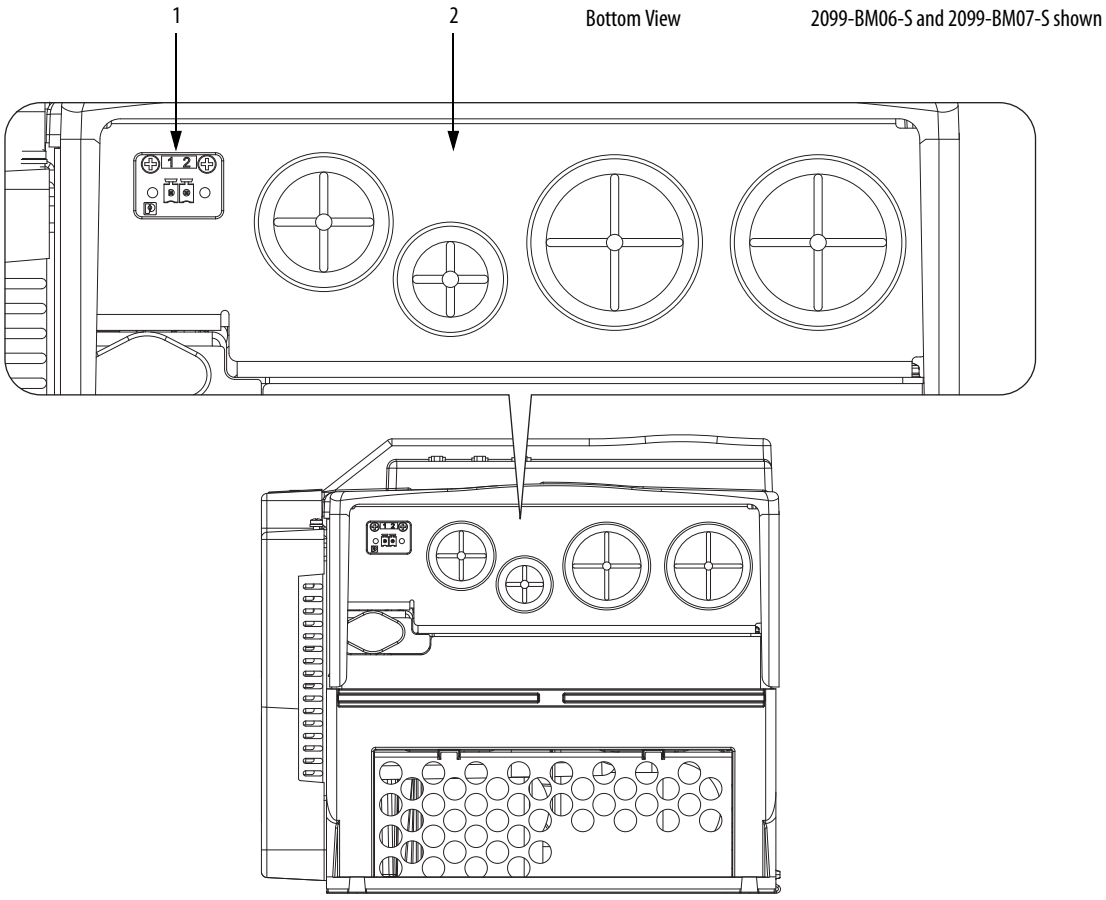
Item	Designator/Label	Description	Connector	See Page
1	Node Address	SERCOS Node Address Switches	–	Chapter 6
2	Fault/Status	Fault Status Display	–	Chapter 7
3	Drive	Drive Status Indicator	–	Chapter 7
4	Comm	Communication Status Indicator	–	Chapter 7
5	Bus	Bus Status Indicator	–	Chapter 7
6	AF	Auxiliary Feedback Connector	15-pin high-density D-shell (male)	49
7	MF	Motor Feedback Connector	15-pin high-density D-shell (female)	47
8	IOD	Digital and Analog Input/Output Connector	26-pin high-density D-shell	45
9	–	Control Power Status Indicator	–	Chapter 7
10	PTB	Power Terminal Block	Terminal block	51

Figure 18 - Kinetix 7000 Top Panel Connectors and Switches



Item	Designator/Label	Description	Connector	See Page
1	SO	Safe-off Terminal Block	9-position plug/header	50
2	GPIO	General Purpose I/O Terminal Block	8-position plug/header	63
3	GPR	General Purpose Relay Terminal Block	6-position plug/header	64
4	Rx	SERCOS Fiber-optic Receive Port	SERCOS fiber-optic	65
5	DPI	Device Peripheral Interface Connector	–	–
6	Tx	SERCOS Fiber-optic Transmit Port	SERCOS fiber-optic	65
7	Baud Rate	SERCOS Baud Rate and Optical Power Switches	–	65

Figure 19 - Kinetix 7000 Bottom Panel Connectors



Item	Designator/Label	Description	Connector	See Page
1	CP	Control Power Terminal Block	2-position terminal	51
2	PTB	Power Terminal Block Access	Terminal block	51

Digital and Analog Input/Output (IOD) Connector Pinout

The following diagram and table provide the signal description and pin-out information for the 26-pin Digital and Analog Input/Output connector.

See Kinetix 7000 Front Panel Connectors and Displays on page 42 for the location of the 26-pin connector. IOD signals are described in greater detail later in this chapter.

Figure 20 - Pin Orientation for 26-pin I/O (IOD) Connector

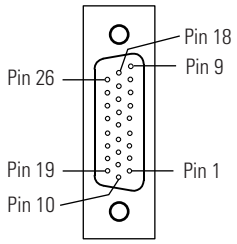


Table 8 - Digital and Analog Input/Output 26-pin (IOD) Connector

Pin	Description	Signal Name	Pin	Description	Signal Name
1	Drive supplied +24V DC	HW_Enable_Pwr	14	Registration 1 Input	Reg_1_In
2	Hardware Enable Switch Input	HW_Enable_In	15	Registration 1 Common	Reg_1_Com
3	Hardware Enable Common	HW_Enable_Com	16	Drive supplied Registration 2 Output Power	Reg_2_Pwr
4	Drive supplied +24V DC	Home_Switch_Pwr	17	Registration 2 Input	Reg_2_In
5	Home Switch Input	Home_Switch_In	18	Registration 2 Common	Reg_2_Com
6	Home Common	Home_Switch_Com	19	Differential Analog Channel 1 Input	Analog_Input_1
7	Drive supplied +24V DC	Pos_OverTravel_Pwr	20	Differential Analog Channel 1 Common	Analog_Input_1_Ret
8	Positive Overtravel Limit Switch Input	Pos_ OverTravel_In	21	Differential Analog Channel 2 Input	Analog_Input_2
9	Positive Overtravel Common	Pos_OverTravel_Com	22	Differential Analog Channel 2 Common	Analog_Input_2_Ret
10	Drive supplied +24V DC	Neg_OverTravel_Pwr	23	Programmable Analog Channel 1 Output	Analog_Out_1
11	Negative Overtravel Limit Switch Input	Neg_OverTravel_In	24	Analog Channel 1 Common	Analog_Out_1_Ret
12	Negative Overtravel Common	Neg_OverTravel_Com	25	Programmable Analog Channel 2 Output	Analog_Out_2
13	Drive supplied Registration 1 Output Power	Reg_1_Pwr	26	Analog Channel 2 Common	Analog_Out_2_Ret

IMPORTANT The Drive supplied +24V DC and Common source signals (at pins 1, 3, 4, 6, 7, 9, 10, and 12) can only be used for the inputs listed above.

General Purpose I/O (GPIO) Terminal Block Connections

The following diagram and table provide the orientation and signal description for the General Purpose Input/Output terminal block.

Figure 21 - Orientation for General Purpose I/O (GPIO) Terminal Block

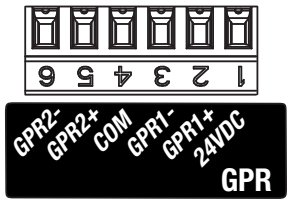
Table 9 - General Purpose I/O (GPIO) Terminal Block

Terminal	Description	Signal Name
1	Digital Output 1	Digital_Out_1
2	+24V DC for digital output 1 (customer-supplied)	DO_24VDC_1
3	+24V DC for digital output 2 (customer-supplied)	DO_24VDC_2
4	Digital Output 2	Digital_Out_2
5	Reserved	N/C
6	Reserved	N/C
7	Regenerative power supply OK (customer supplied)	Regen_OK+
8	Common for Regenerative power supply OK	Regen_OK-

General Purpose Relay (GPR) Terminal Block Connections

The following diagram and table provide the orientation and signal description for the General Purpose Relay terminal block.

Figure 22 - Orientation for General Purpose Relay (GPR) Terminal Block



Note: The GPR terminal number orientation is rotated 180 degrees relative to the other I/O connectors.

Table 10 - General Purpose Relay (GPR) Terminal Block

Terminal	Description	Signal Name
1	24V DC customer-supplied power input for Relay 1	24VDC
2	Programmable N.O. Relay 1 output	GPR1+
3	Programmable Relay 1 common	GPR1-
4	24V DC customer-supplied power supply common	COM
5	Programmable N.O. Relay 2 output	GPR2+
6	Programmable Relay 2 common	GPR2-

Motor Feedback (MF) Connector Pinouts

The following diagram and tables provide the orientation and signal description for the Motor Feedback (MF) connector for each applicable feedback device.

Figure 23 - Pin Orientation for 15-pin Motor Feedback (MF) Connector

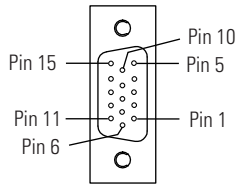


Table 11 - Motor Feedback (MF) Connections for Stegmann Hiperface (SRS/SRM)

Pin	Description	Signal
1	Sine differential input+	SIN+
2	Sine differential input-	SIN-
3	Cosine differential input+	COS+
4	Cosine differential input-	COS-
5	Hiperface data channel	DATA+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V (2)
8	Reserved	—
9	Reserved	—
10	Hiperface data channel	DATA-
11	Motor thermal switch (normally-closed) (1)	TS
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V (2)
15	Reserved	—

(1) Not applicable unless the motor has integrated thermal protection.
(2) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

Table 12 - Motor Feedback (MF) Connections for TTL or Sine/Cosine with Index Pulse and Hall Commutation

Pin	Description	Signal
1	AM+ / Sine differential input+	AM+ / SIN+
2	AM- / Sine differential input-	AM- / SIN-
3	BM+ / Cosine differential input+	BM+ / COS+
4	BM- / Cosine differential input-	BM- / COS-
5	Index pulse+	IM+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V (2)
8	Single-ended 5V hall effect commutation	S3
9	Reserved	—
10	Index pulse-	IM-
11	Motor thermal switch (normally-closed) (1)	TS
12	Single-ended 5V hall effect commutation	S1
13	Single-ended 5V hall effect commutation	S2
14	Encoder power (+5V)	EPWR_5V (2)
15	Reserved	—

(1) Not applicable unless motor has integrated thermal protection.
(2) Encoder power supply uses either 5V or 9V DC based on encoder/motor used.

Kinetix 7000 drives do not natively support Heidenhain EnDat high-resolution feedback. However, you can use the drive motor feedback connection with the 2090-K7CK-KENDAT feedback module to convert Heidenhain EnDat 2.1 high-resolution feedback from an RDD motor. Use the table below to connect the motor feedback wires to the 2090-K7CK-KENDAT feedback module.

IMPORTANT Only 2099-BM*xx*-S drives with firmware revision 1.104 or higher support the use of 2090-K7CK-KENDAT feedback modules.

Table 13 - Connections for Heidenhain EnDat

Pin	Description	Signal
1	Sine differential input+	SIN+
2	Sine differential input-	SIN-
3	Cosine differential input+	COS+
4	Cosine differential input-	COS-
5	Encoder power (+5V)	EPWR_5V
6	Common	ECOM
7	Serial data clock signal +	CLK+

Pin	Description	Signal
8	Serial data clock signal -	CLK-
9	Serial data differential signal+	DATA+
10	Serial data differential signal -	DATA-
11	Motor thermal switch+ (1)	TS+
12	Reserved	—
13	Reserved	—

(1) Not applicable unless motor has integrated thermal protection.

IMPORTANT Drive-to-motor power cables must not exceed 90 m (295.3 ft).

Auxiliary Feedback (AF) Connector Pinouts

For TTL devices, the position count will increase when A leads B. For sinusoidal devices, the position count will increase when cosine leads sine.

Figure 24 - Pin Orientation for 15-pin Auxiliary Feedback (AF) Connector

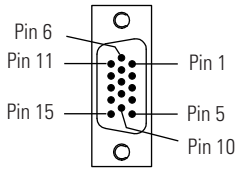


Table 14 - Stegmann Hiperface (SRS and SRM only)

Pin	Description	Signal
1	Sine differential input+	SIN+
2	Sine differential input-	SIN-
3	Cosine differential input+	COS+
4	Cosine differential input-	COS-
5	Hiperface data channel	DATA+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V (1)
8	Reserved	—
9	Reserved	—
10	Hiperface data channel	DATA-
11	Reserved	—
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V (1)
15	Reserved	—

(1) Encoder power supply uses either 5V or 9V DC based on encoder used.

Table 15 - TTL or Sine/Cosine with Index Pulse

Pin	Description	Signal
1	A+ / Sine differential input+	A+ / SIN+
2	A- / Sine differential input-	A- / SIN-
3	B+ / Cosine differential input+	B+ / COS+
4	B- / Cosine differential input-	B- / COS-
5	Index pulse+	I+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V (1)
8	Reserved	—
9	Reserved	—
10	Index pulse-	I-
11	Reserved	—
12	Reserved	—
13	Reserved	—
14	Encoder power (+5V)	EPWR_5V (1)
15	Reserved	—

(1) Encoder power supply uses either 5V or 9V DC based on encoder used.

Safe-off (SO) Terminal Block Connections

Figure 25 - Safe-off (SO) Terminal Block

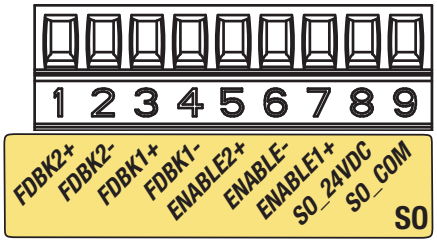


Table 16 - Safe-off (SO) Terminal Block

Terminal	Description	Signal Name
1	Normally-closed monitoring contact for safety relay 2	FDBK2+
2	Return for safety relay 2	FDBK2-
3	Normally-closed monitoring contact for safety relay 1	FDBK1+
4	Return for safety relay 1	FDBK1-
5	Coil of safety relay 2	ENABLE2+
6	Common for safety relays 1 and 2	ENABLE-
7	Coil of safety relay 1	ENABLE1+
8	24V DC, 500 mA max., power for Safe Off circuit	SO_24VDC
9	Common for 24V power Safe off circuit	SO_COM

IMPORTANT Terminals 8 and 9 (24V+ and Common) are only used by the motion-allowed jumper. When using the Safe-off feature, the 24V supply must come from an external source.

Control Power (CP) Terminal Block Connections

Kinetix 7000 drives must be wired to a 24V DC control power source through the Control Input Power (CP) connector. The Control Power input terminal is located on the bottom of the drive as illustrated in Figure 19 on page 44.

IMPORTANT	An external power supply provides the ability to retain control of the drive's logic independent of its bus power status.

Figure 26 - Control Power (CP) Terminal Block Detail

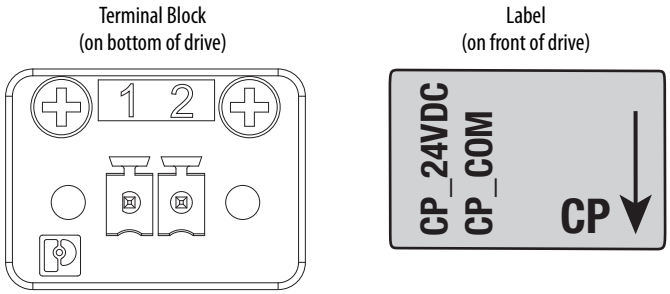


Table 17 - Control Power (CP) Terminal Block

Terminal	Description	Signal Name
1	Control Power 24V DC Input	CP_24VDC
2		CP_COM

Power Terminal Block (PTB) Connections

The power terminals are located behind the lower front panel of the drive. The figures below identify the input power, motor power, DC bus, ground, and cooling fan input terminals.

The 2099-BM09-S or 2099-BM10-S drives (frame 5), and the 2099-BM11-S or 2099-BM12-S drives (frame 6) provide connections for you to supply 120V AC or 240V AC to power an internal cooling fan. The fan VA rating is 100 VA for 2099-BM09-S and 2099-BM10-S, and 138 VA for the 2099-BM11-S and 2099-BM12-S drives.

The 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S drives (frame 3) use the internal power supply for fan power and thus no terminals are provided.

Figure 27 - 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S

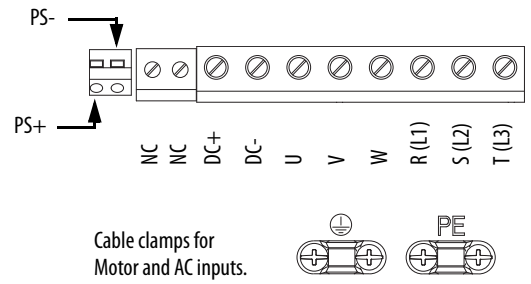


Figure 28 - 2099-BM09-S

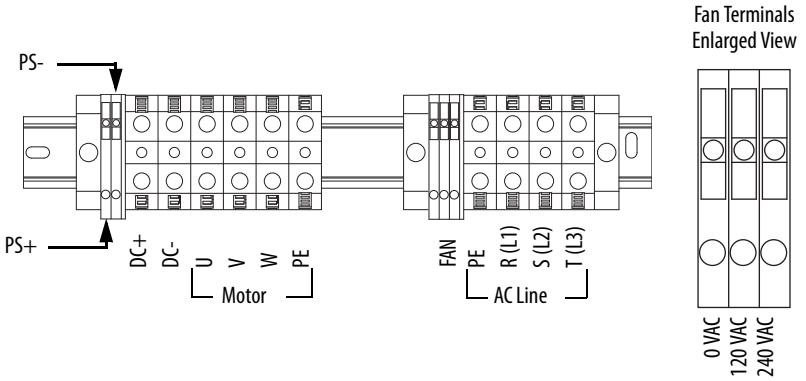


Figure 29 - 2099-BM10-S

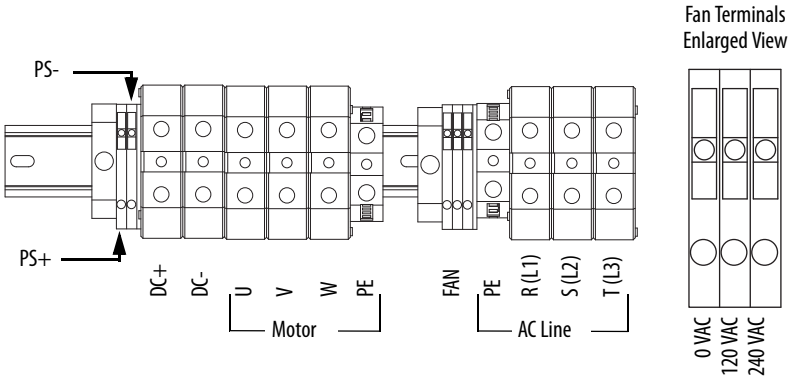


Figure 30 - 2099-BM11-S and 2099-BM12-S

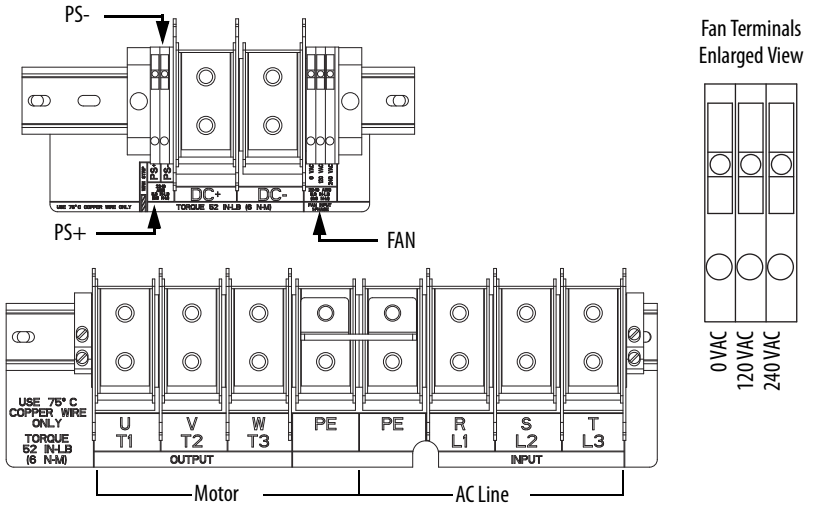


Table 18 - Power Terminal Block

Terminal	Description	Name
DC+	DC Bus Power	DC Bus (+)
DC-		DC Bus (-)
PE	Main Ground of the Drive System	PE Ground
GND	Motor Ground	Motor Ground
U-T1	Motor Phase U Output	U (T1)
V-T2	Motor Phase V Output	V (T2)
W-T3	Motor Phase W Output	W (T3)
R-L1	Main 380…480V AC +/-10% Input Power, Three-phase to R, S and T Input Terminals	R
S-L2		S
T-L3		T
120VAC	+120V AC Input for Fan Power	VAC_FAN_1
240VAC	+240V AC Input for Fan Power	VAC_FAN_2
0VAC	Fan Common	GND_FAN
PS-	For factory use only	–
PS+	For factory use only	–

Control Signal Specifications

This section provides specifications for the Kinetix 7000 drive input/output (IOD), SERCOS, motor feedback (MF), auxiliary feedback (AF) and brake (BC) connectors.

Digital Inputs (IOD Connector)

Two fast registration inputs and four other inputs are available for the machine interface on the Kinetix 7000 drive. The drive supplies 24V DC @ 300 mA for the purpose of registration, home, enable, over-travel positive, and over-travel negative inputs. These are sinking inputs that require a sourcing device. A 24V DC power and common connection is provided for each input.

IMPORTANT To improve registration input EMC performance, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Table 19 - Digital Input Descriptions

IOD Pin	Signal	Description	Capture Time	Edge/Level Sensitive
IOD-2	ENABLE	Single optically isolated, single-ended active high signal. Current loading is nominally 10 mA. A 24V DC input is applied to this terminal to enable each axis.	20 ms	Level
IOD-5	HOME	Single optically isolated, single-ended active high signal. Current loading is nominally 10 mA. Home switch (normally-open contact) inputs for each axis require 24V DC (nominal).	20 ms	Level
IOD-14 IOD-17	REG1 REG2	Fast registration inputs are required to inform the motor interface to capture the positional information with less than 3 µs uncertainty. Single optically isolated, single-ended active high signal. Current loading is nominally 10mA. A 24V DC input is applied to this terminal to enable each axis.	500 ns	Edge
IOD-8 IOD-11	OT+ OT-	Overtravel detection is available as a dual-input, optically isolated, single-ended active high signal. Current loading is nominally 10 mA per input. The pos/neg limit switch (normally-closed contact) inputs for each axis require 24V DC (nominal).	20 ms	Level

Table 20 - Digital Input Specifications

Parameter	Description	Min	Max	Leakage
ON-state voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an ON-state.	10.8V	26.4V	—
ON-state current	Current flow to guarantee an ON-state	3.0 mA	10.0 mA	—
OFF-state voltage	Voltage applied to the input, with respect to IOCOM, to guarantee an OFF-state.	-1.0V	3.0V	<1.5 mA

24V I/O Power

IMPORTANT Signals +24V_PWR and +24V_COM are a 24V DC source that can be used only for the inputs listed below.

The Kinetix 7000 drive provides 24V DC power @ 300 mA total for the HW_Enable_Pwr, Home_Switch_Pwr, Pos_OverTravel_Pwr, Neg_OverTravel_Pwr, Reg_1_Pwr, and Reg_2_Pwr inputs on the specific drive. The supply is protected with an automatically reset fuse. A temperature versus time curve automatically controls closing of the fuse.

A common mode choke filters the registration power connection. An additional common mode choke is provided for the remaining inputs.

Hardware Enable

The Hardware Enable input is an optically isolated (500V), single-ended, active high signal. A 24V DC input applied to this pin enables the drive.

The status of this digital input can be monitored in the axis servo drive tag in RSLogix.

If the Drive Hardware Enable option is selected in Logix, an MSO (Motion Servo On) instruction must be executed in RSLogix software. This causes IOD-1 to supply 24V DC to IOD-2, and completes the enable circuit for servo loop and drive power structure.

If the Drive Hardware Enable option is not selected in Logix, an MSO instruction will enable the drive without the need for a Drive Enable signal confirmation.

This input is level sensitive. See Table 19 - Digital Input Descriptions and Table 20 - Digital Input Specifications starting on page 54 for On/Off signal voltages and current levels.

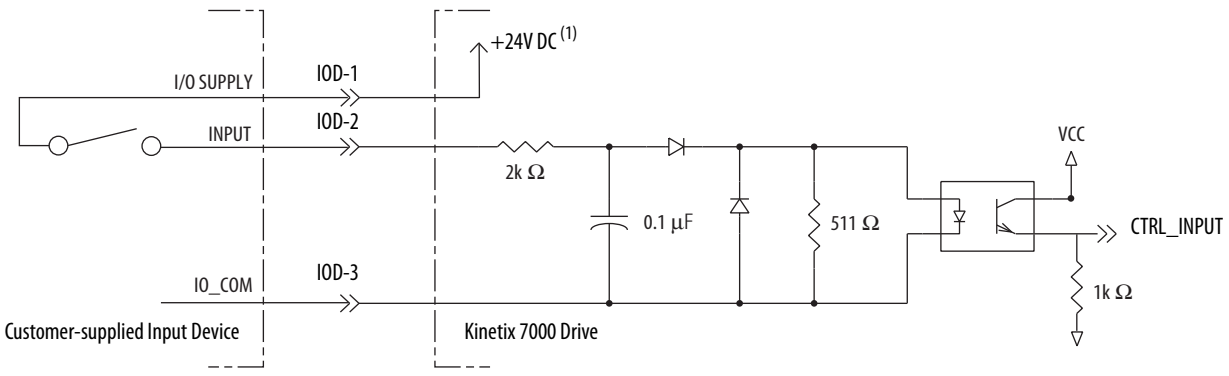
Kinetix 7000 drive Hardware Enable functions and faults actions are programmed through RSLogix software. Kinetix 7000 dive firmware provides an additional 50 ms of debounce.

ATTENTION: Overvoltage protection is not provided for the Hardware Enable input signal.

It is recommended to use the on-drive power to power the Hardware Enable signal. If an external power source is used, you must take responsibility to be sure that the voltage/current does not exceed the rating of the input.

The schematic below depicts the Hardware Enable circuit. It is provided as a reference only.

Figure 31 - Hardware Enable Digital Input Circuit Diagram



(1) +24V DC source (range) = 21.6V…26.4V (supplied by the drive, not to exceed 300 mA total). Maximum current input = 10 mA.

Home

The Home input is an optically isolated (500V), single-ended, active high signal. A 24V DC input applied to this pin by a normally-open contact indicates this axis is in the home position. Firmware provides an additional 50 ms of debounce.

You can configure the required Home type in the axis servo drive properties in RSLogix. You can monitor the Home input "on/off" status in the axis servo drive tag.

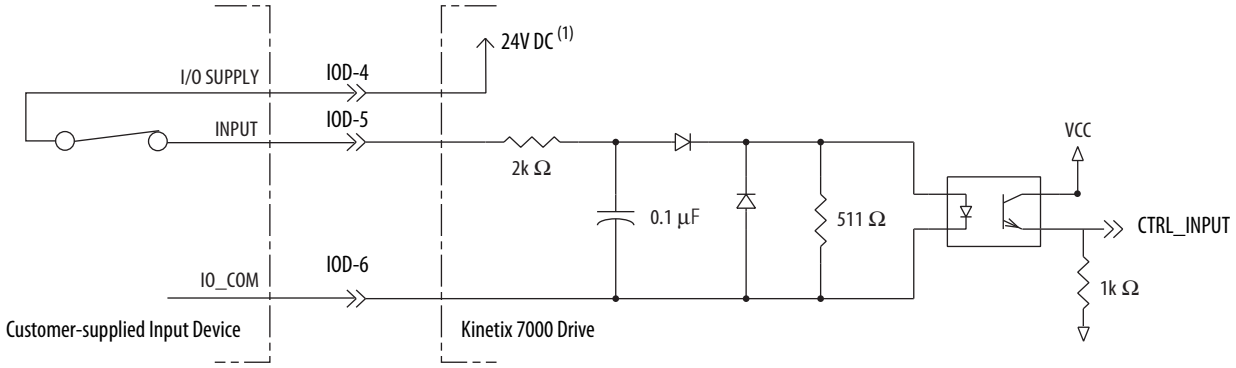
This input is level sensitive. See Table 19 - Digital Input Descriptions and Table 20 - Digital Input Specifications starting on page 54 for On/Off signal voltages and current levels.

ATTENTION: Overvoltage protection is not provided for the Home input signal.

It is recommended to use the on-drive power to power the Home signal. If an external power source is used, you must take responsibility to be sure that the voltage/current does not exceed the rating of the input.

The schematic below depicts the Home circuit. It is provided as a reference only.

Figure 32 - Home Digital Input Circuit Diagram



(1) +24V DC source (range) = 21.6…26.4V (supplied by the drive, not to exceed 300 mA total). Maximum current input = 10 mA.

Positive and Negative Overtravel

The Positive and Negative Overtravel detection is provided by two optically isolated (500V), single-ended, normally-closed, active high signals. Breaking the 24V DC input at either pin indicates an overtravel condition.

You can enable hard travel limits on the axis servo drive Limit tab in RSLogix. Hard travel limits require power to both the positive and negative overtravel inputs. You can monitor the positive and negative overtravel input status in the axis servo drive tag.

Notes:

- A status of "1" indicates a normally closed input and a drive ready for movement.
- Hard overtravel limits can only be selected in a linear conversion selection.

This input is level sensitive. See Table 19 - Digital Input Descriptions and Table 20 - Digital Input Specifications starting on page 54 for On/Off signal voltages and current levels.

IMPORTANT Overtravel limit input devices must be normally-closed.

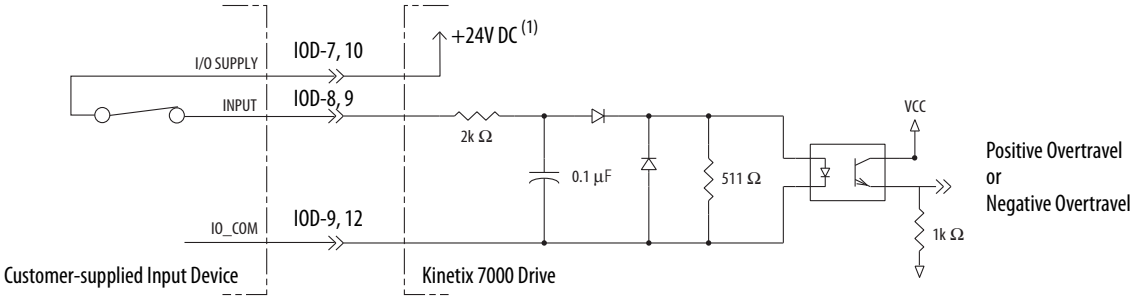
Kinetix 7000 drive Positive and Negative Overtravel functions and faults actions are programmed through RSLogix software. Kinetix 7000 drive firmware provides an additional 50ms of debounce.

ATTENTION: Overvoltage protection is not provided for the Positive and Negative Overtravel input signal.

It is recommended to use the on drive power to power the Positive and Negative Overtravel signals. If an external power source is used, you must take responsibility to be sure that the voltage/current does not exceed the rating of the input.

The schematic below depicts the Positive and Negative Overtravel circuits. It is provided as a reference only.

Figure 33 - Positive and Negative Overtravel Input Diagram

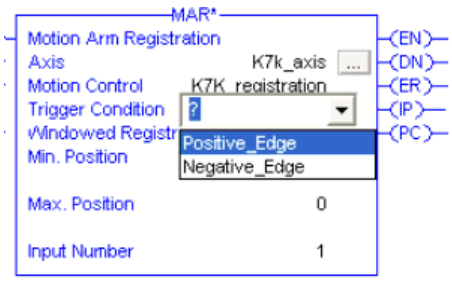


(1) +24V DC source (range) = 21.6…26.4V (supplied by the drive, not to exceed 300 mA total). Maximum current input = 10 mA.

Registration

The two fast Registration inputs are provided on the Kinetix 7000 drive, Reg 1 (IOD-14) and Reg 2 (IOD-17). Unlike the Drive Enable, Home, and Overtravel signals, these inputs are either positive-edge or negative-edge triggered. They are based on the user-defined MAR (Motion Axis Registration) configured using RSLogix software.

Figure 34 - MAR (Motion Axis Registration) Entry in RSLogix Software



The MAR instruction captures position data within a 3 µs uncertainty. The position is directly input to the axis_servo_drive.Registration_Position register in Logix software.

Figure 35 - Logix Position Register Entry

K7k_axis.Registration1Position	0.0		Float	REAL
K7k_axis.Registration2Position	0.0		Float	REAL

Power for the inputs is supplied by an internally supplied 24V DC supply.

See Table 19 - Digital Input Descriptions and Table 20 - Digital Input Specifications starting on page 54 for On/Off signal voltages and current levels.

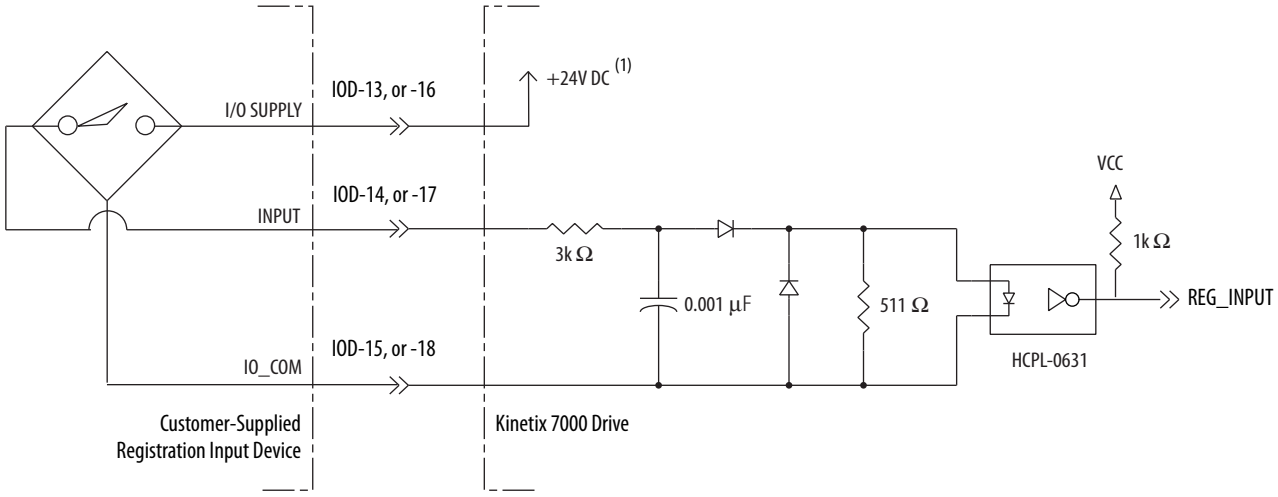
Registration functions and faults actions are programmed through RSLogix software. Kinetix 7000 firmware provides an additional 50 ms of debounce.

ATTENTION: Overvoltage protection is not provided for the Registration input signal.

It is recommended to use the on drive power to power Registration. If an external power source is used, you must take responsibility to be sure that the voltage/current does not exceed the rating of the input.

The schematic below depicts the Registration circuits. It is provided as a reference only.

Figure 36 - Registration Digital Input Circuit Diagram



(1) +24V DC source (range) = 21.6V. . . 26.4V (supplied by the drive, not to exceed 300 mA total). Maximum current input = 10 mA.

Analog Inputs (IOD Connector)

IMPORTANT RSLogix 5000 software, version 15, does not support analog input utilization.

Two analog inputs are provided, with 14-bit resolution (13 data bits, plus sign). The analog data streamed to RSLogix by these inputs is useful for managing dynamic machine operations, for example tension transducers in an outer tension control loop.

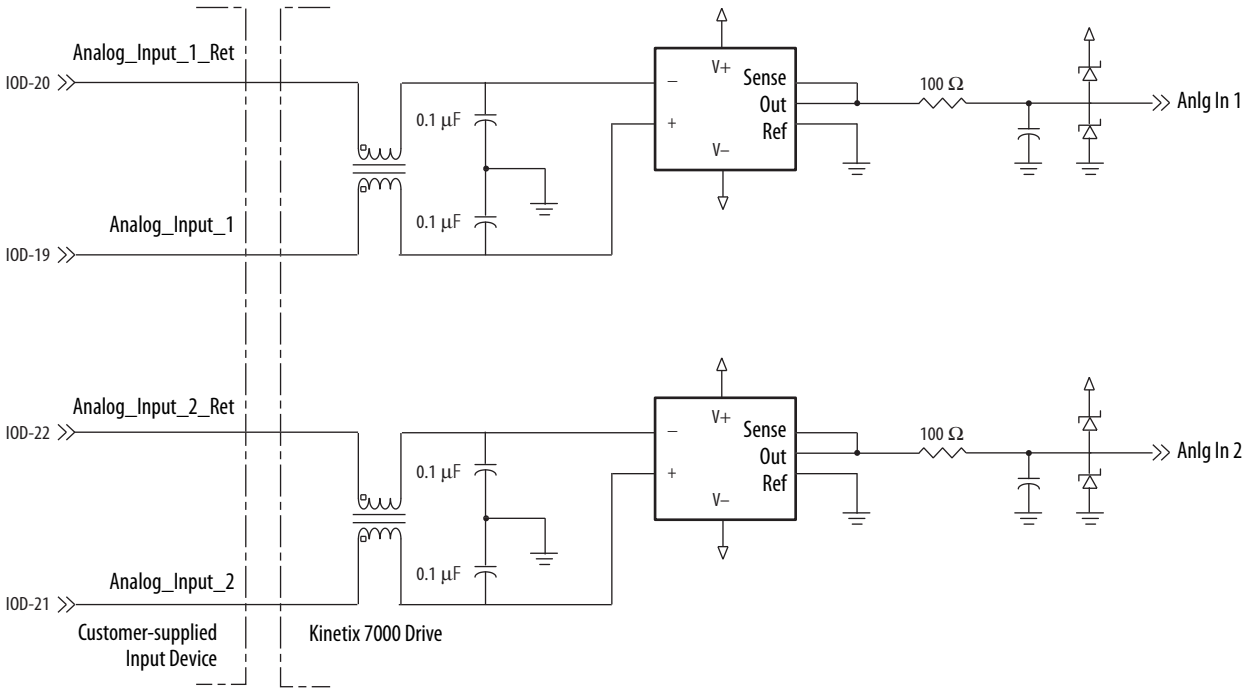
The input range of these inputs is ±10V, and overvoltage protection is ±12V. Inputs are updated at the drive every 125 µs. Frequency response of the input is up to 4 kHz, and input impedance is 12 kΩ.

Analog inputs are available as a real time attribute and Get System Value (GSV) within RSLogix software.

ATTENTION: Gain and offset attributes are not provided for the Analog Inputs input signals, and no drive faults are issued.

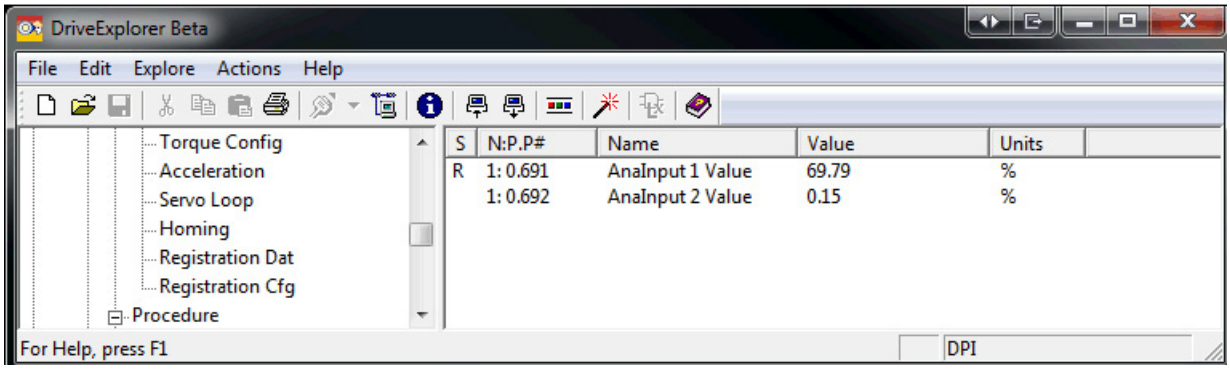
The schematic below depicts the Analog Input circuits. It is provided as a reference only.

Figure 37 - Analog Input Circuit Diagram



Reading Analog Input Voltage Values

When connecting to the Kinetix 7000 drive via DriveExecutive™ or DriveExplorer™, the input voltage is displayed as a percentage in parameters 691 [AnaInput 1 Value] and 692 [AnaInput 2 Value].



In the example above, analog input 1 displays 69.79%. This value equals 100% of ±10V DC. Therefore the actual value of analog input 1 is 6.98V DC.

When viewed in RSLogix 5000 using a real time attribute on the Drive/Motor tab on the Module Properties dialog, the corresponding bit value displays as in the example below.

TEST_AXIS.ActualPosition	0.0		Float	REAL
TEST_AXIS.ActualVelocity	0.0		Float	REAL
TEST_AXIS.AnalogInput1	6978.0		Float	REAL
TEST_AXIS.AnalogInput2	0.0		Float	REAL
TEST_AXIS.AttributeErrorCode	16#0000		Hex	INT
TEST_AXIS.AttributeErrorID	16#0000		Hex	INT

Divide the value displayed by 100 to determine the actual voltage on the input. 6978 / 100 = 69.78% or 6.98V DC.

Analog Outputs (IOD Connector)

The two analog outputs (Analog_Out_1 and Analog_Out_2) are strictly for troubleshooting and cannot be used to drive other loads.

The analog outputs provide 12-bit resolution (11 data bits, plus sign) of the gain and filtering parameters within RSLogix software. In this way a data stream can be displayed by a meter or scale as velocity, torque, or following error information.

The ±10V outputs provide positive and negative direction range, with a null setting of 0V. For example, ±10V range, with 0V = 0. The drive update rate for these outputs is 125 µs, and is current limited to 25 mA.

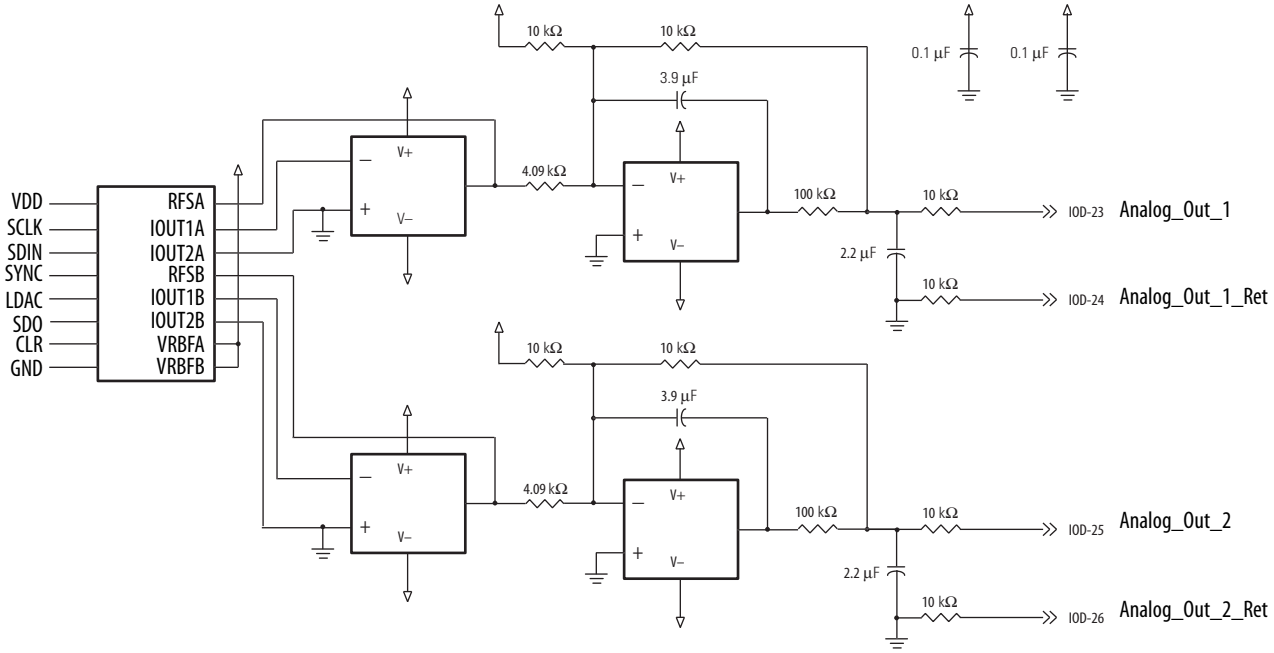
Analog output functions are programmed in RSLogix software using a message instruction. The default pin assignments and the default gain values for the velocity, torque, and following error parameters are listed below.

Signal	Default Pin	Parameter	Gain Value	Analog Output
Analog_Out_1	IOD-23	Velocity	0.0060	1V = 1000 rpm
Analog_Out_2	IOD-25	Torque	0.1	1V = 100% torque

A single pole low pass digital filter is provided for each analog output. The digital filter frequency range is 1...4 kHz.

The schematic depicts the Analog Output circuits. It is provided as a reference only.

Figure 38 - Analog Outputs Circuit Diagram



General Purpose I/O (GPIO Connector)

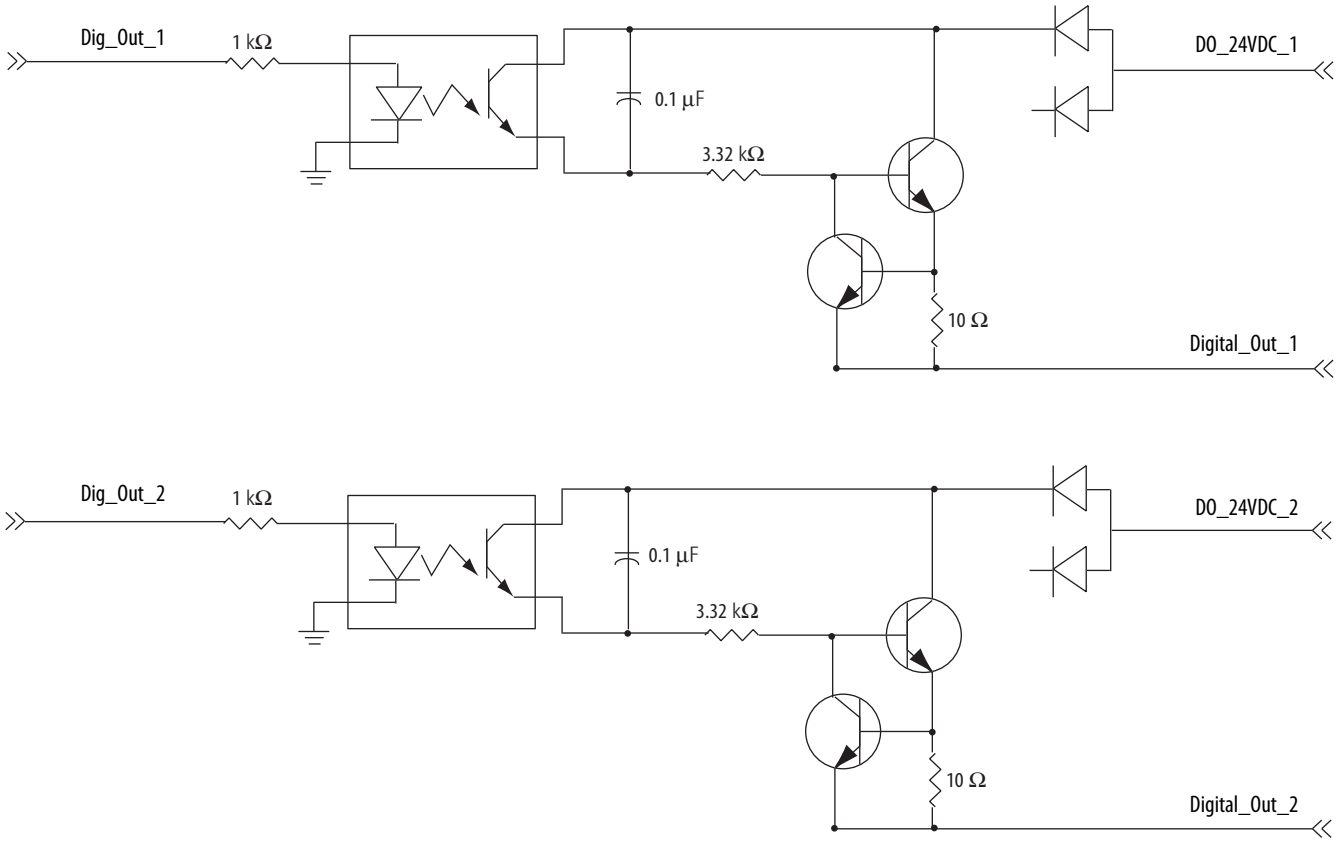
Two 24V digital outputs are user programmable. You can monitor the status the an optional regenerative power supply. An isolated, external 24V DC power source must be customer supplied to power the digital outputs.

Table 21 - General Purpose I/O Digital Output Specifications

Pin	Signal	Description	On Condition	Off Condition Leakage
1	Digital_Out_1	Optically isolated to 500V, current sourcing up to 75 mA	24…40V DC	<0.25 mA
2	DO_24VDC_1	24V DC power source to digital inputs (customer-supplied)	—	—
3	DO_24VDC_2			
4	Digital_Out_2	Optically isolated to 500V, current sourcing up to 75 mA	24…40V DC	<0.25 mA
5	Reserved			
6				

The two DC current sourcing outputs default settings are Zero_Speed (Digital_Out_1) and In_Position (Digital_Out_2). Zero_Speed is the motor at 0 rpm velocity. In_Position can be set to the commanded position by the Position Lock Tolerance (set in Axis Properties/Limits). Default parameter selections can also be set with an IDN function.

Figure 39 - General Purpose I/O Digital Output Diagram

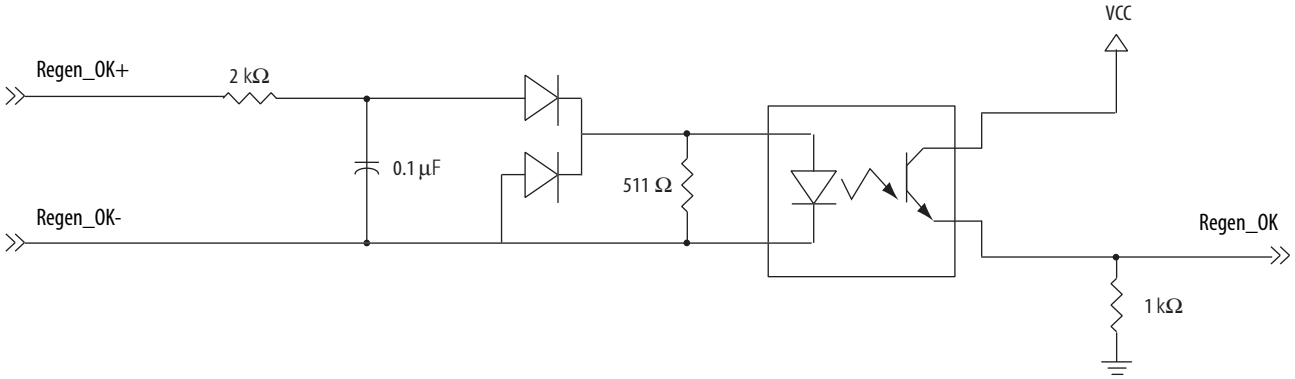


The regenerative power supply OK provides status on the regenerative converter; in doing so, provides status to the Kinetix 7000 drive that there is DC bus power. Selecting the 8720MC-RPSxxx on the Power tab in the Kinetix 7000 drive I/O configuration in RSLogix requires the customer to provide a 24V DC power source to GPIO pins 7 and 8 as shown in Table 22 and in the interconnect diagrams in Appendix B. A failure to do so will cause a Regen_PS_OK (E111) fault, which indicates that he Regen_OK signal is missing at pins 7 and 8 of the GPIO connector. Kinetix 7000 drive firmware provides an additional 50 ms debounce.

Table 22 - General Purpose I/O Regenerative Power Supply OK Specifications

Pin	Signal	Description	On Condition	Off Condition
7	Regen_OK+	Optically isolated (500V), single-ended active high signal	12…38V DC @ 3.3…12 mA	less than 6.6V DC, less than 1.5 mA
8	Regen_OK-			

Figure 40 - General Purpose I/O Regenerative Power Supply OK Diagram



General Purpose Relay (GPR Connector)

Two general purpose relay connections are accessed through the GPR connector. GPR1+ is a normally-open, dry relay contact, supporting 2 A at 30V DC ±10% with suppression. This relay defaults to Motor Brake control, and specifically provides suppression. GPR2+ is a normally-open, dry relay contact, supporting 2 A at 250V AC or 2 A at 30V DC without suppression. This relay defaults to Drive OK. An external 24V DC power source must be supplied.

The following are default values for the general purpose relays.

Table 23 - General Purpose Relay Outputs Descriptions

Output:	Default Relay Setting in RSLogix Software	Description
GPR1+	Motor Brake	Turn-on and turn-off delays are specified by the Brake Engage Delay Time and Brake Release Delay Time in RSLogix software.
GPR2+	Drive OK (DROK)	

SERCOS Connections

Two fiber-optic connectors (transmit and receive) are provided on the Kinetix 7000 drive.

Table 24 - SERCOS Communication Specifications

Specification	Description
Data Rates	4 and 8 Mbps
Node Addresses	01…99 (1)

(1) Node addresses for additional axes on the same system are assigned by sequentially incrementing each additional axis. See Node Addressing Examples on page 110 for more information.

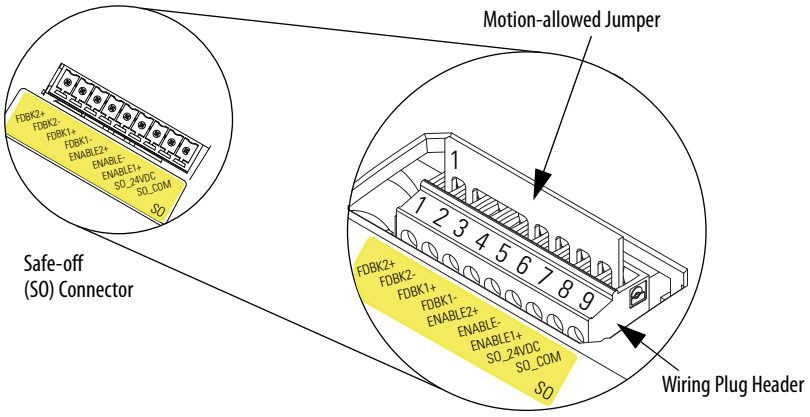
Safe-off (SO Connector)

Kinetix 7000 drives provide safety functions and system integrity.

The Kinetix 7000 drive ships with a (9-pin) wiring-plug header having a motion-allowed jumper installed in the safe-off (SO) connector. With the motion-allowed jumper installed, the safe-off feature is disabled.

For safe-off wiring information, see the Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002.

Figure 41 - Safe-Off, Motion-allowed Jumper



Control Power Specifications

The following table provides specifications for the Control Power (CP) connector.

Attribute	Value
Auxiliary DC input voltage	24V DC, 3 A max, range 18…30 V DC

Motor (MF) and Auxiliary Feedback (AF) Connections

The motor interface and auxiliary feedback interfaces are consistent across the Kinetix product line. This section provides information on motor and auxiliary feedback connections.

The Kinetix 7000 motor (MF) and auxiliary (AF) feedback ports can accept the following encoder types:

- SRM/SRS Stegmann Hiperface encoders
- 5V TTL differential line driver with index pulse and hall commutation
- Sin/Cos differential input with index pulse and hall commutation

Motor feedback requires RSLogix 5000 motion.db file to properly commutate the motor. Motors available in RSLogix software include feedback types designated as S and M in Allen-Bradley catalog numbers. Following are further definitions of these feedback types.

- S type - single-turn 1024 cycles per rotation (interpolated to over 2 million counts in the drive) For example, the MPL-B980D-SJ72AA has this feedback type.
- M type - multi-turn 1024 cycles per rotation (interpolated to over 2 million counts in the drive). For example, the MPL-980D-MJ72AA has this feedback type. The “M” type allows for 4096 cycles absolute retention when the encoder is powered down.

RDD motor feedback from Heidenhain EnDat high-resolution encoders is also accepted, but only when using drive firmware revision 1.104 or higher and the 2090-K7CK-KENDAT low-profile feedback module.

Third-party motor requests must be pre-qualified and a custom motor file developed. Contact your local distributor or Rockwell Automation Sale Representative for more information.

Kinetix 7000 drives cannot drive open loop (no feedback) or other motor types not defined in the Kinetix motor database.

Motor and Auxiliary Feedback Specifications

AM, BM, and IM input encoder signals are filtered using analog and digital filtering. The inputs also include illegal state change detection. Figure 42 is a schematic of the AM, BM, and IM inputs.

Figure 42 - AM, BM, and IM Motor Encoder Inputs

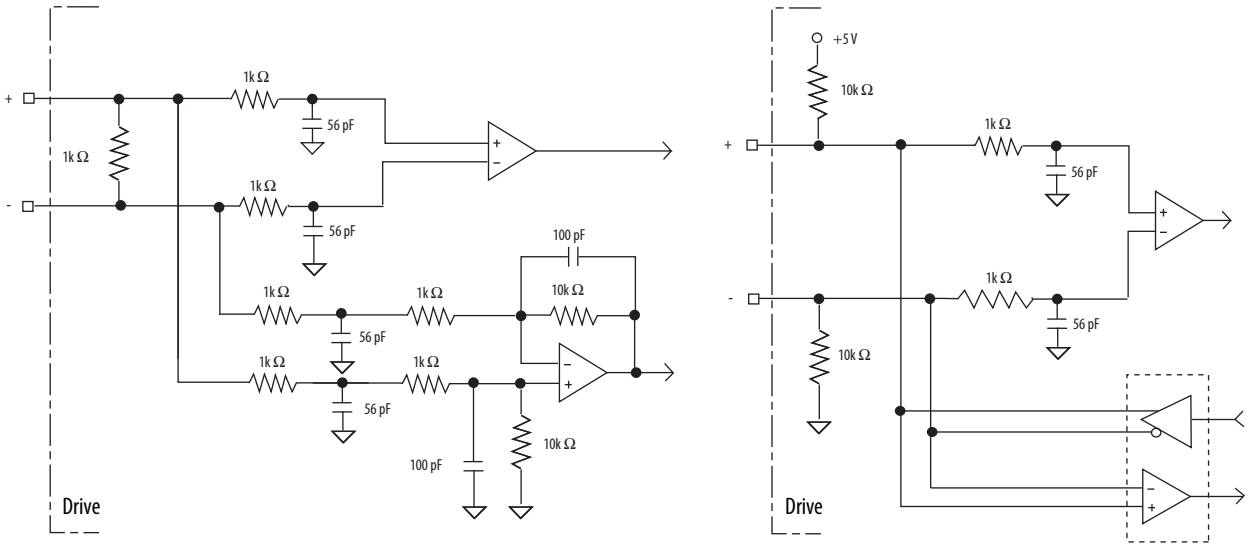


Table 25 - Motor Encoder Feedback Specifications

Attribute	Value
Encoder Types	Incremental, A quad B, Sine/Cosine, Intelligent, and Absolute
Maximum Input Frequency	5.0 MHz (TTL input) per channel
	250 kHz (Sine/Cosine input)
Commutation Feedback	Hall sensor

Table 26 provides a description of the AM, BM, and IM inputs for TTL encoders.

Table 26 - TTL Encoder Specifications

Parameter	Description	Minimum	Maximum
AM, BM, and IM ON-state Input Voltage	Input voltage difference between the + input and the - input that is detected as an ON-state.	+1.0V	+7.0V
AM, BM, and IM OFF-state Input Voltage	Input voltage difference between the + input and the - input that is detected as an OFF-state.	-1.0V	-7.0V
Common Mode Input Voltage	Potential difference between any encoder signal and logic ground.	-7.0V	+12.0V
DC Current Draw	Current draw into the + or - input.	-30 mA	30 mA
AM, BM Input Signal Frequency	Frequency of the AM or BM signal inputs. The count frequency is 4 times this frequency, since the circuitry counts all four transitions.	—	5.0 MHz

Parameter	Description	Minimum	Maximum
IM Pulse Width	Pulse width of the index input signal. Since the index is active for a percentage of a revolution, the speed will determine the pulse width.	125 nS	—
AM, BM Phase Error 2.5 MHz Line Frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-22.5°	+22.5°
AM, BM Phase Error 1 MHz Line Frequency	Amount that the phase relationship between the AM and BM inputs can deviate from the nominal 90°.	-45°	+45°

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

Table 27 - AM, BM and IM Input Specifications for Sine/Cosine Encoders

Parameter	Description	Minimum	Maximum
Sine/cosine Input Signal Frequency	Frequency of the Sine or Cosine signal inputs.	—	250 kHz
Sine/cosine Input Voltage	Peak-to-peak input voltages of the Sine or Cosine inputs.	0.5V (p-p)	2.0V (p-p)

Table 28 - Specifications for Heidenhain EnDat Encoders

Command Set	Order Designation	Description
EnDat 2.1	EnDat 01	1V (p-p) Sin/Cos, <2 MHz clock frequency

Auxiliary Feedback (AF)

These requirements apply to the Auxiliary Feedback signals.

- For TTL devices, the position count increases when A leads B.
- For sinusoidal devices, the position count increases when cosine leads sine.
- TTL devices must be 5V devices within the input voltage specification.
- Use the Low Profile Connector Kit, catalog number 2090-K6CK-D15F to access the Auxiliary Feedback signals. You must supply cabling that has shielding, and other EMI protection for motor feedback cables.

Feedback Power Supply

The power circuit board generates the +5V and +9V DC for the motor and auxiliary feedback power supplies. Short-circuit protection and separate common mode filtering for each channel is included.

- MP*x*-B, and HPK-B and -E motors all use 9V power sources from the MF connector.
- Compatible Auxiliary Feedback devices include Stegmann Hiperface, Sine/Cosine, and 5V TTL encoder types. Note: Heidenhain EnDat 2.1 encoders are only compatible when using the 2090-K7CK-KENDAT feedback module, however an interface module does not exist for the auxiliary encoder input.

- See the Kinetix Motion Control Selection Guide, publication GMC-SG001, for cables compatible with the Kinetix 7000 drive and motor.
- Low profile connector let you develop a custom cable for the Motor Feedback (MF) or Auxiliary Feedback (AF) connectors.

The following table details power supply specifications for the motor and auxiliary feedback connectors.

Table 29 - Motor and Auxiliary Feedback Power Supply Specifications

Power Supply	Signal Name	Voltage (V DC)			Current (mA)	
		Min	Nom	Max	Min	Max
+5V	EPWR_5V	5.13	5.4	5.67	10	400 (1) (3)
+9V	EPWR_9V	8.3	9.1	9.9	10	275 (2) (3)

(1) 400 mA on the 5V supply split in any manner between the channels with no load on the 5V supply.
(2) 275 mA on the 9V supply split in any manner between the channels with no load on the 9V supply.
(3) 300 mA on the 5V supply on one channel with 150 mA on the 9V supply on the second channel.

Notes:

Connect the Kinetix 7000 Drive System

This chapter provides procedures for wiring your Kinetix 7000 drive system components and making cable connections.

Basic Wiring Requirements

This section contains basic wiring information for the Kinetix 7000 drive.

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

SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.

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

Building Your Own Motor Cables

IMPORTANT	Factory-made cables are designed to minimize EMI and are recommended over hand-built cables to optimize system performance.

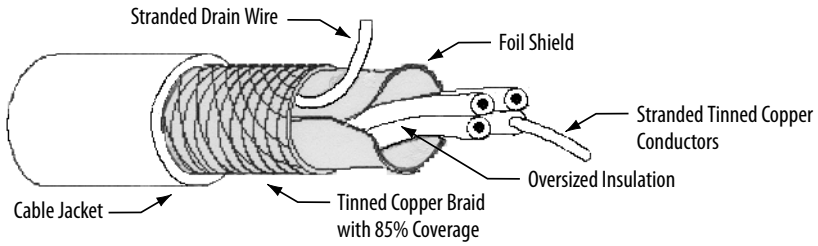
- Connect the cable shield to the connector shells on both ends of the cable with a complete 360° connection. If separate power wires are used in a customer-supplied power cable, the shield may alternatively be connected to a ground terminal.
- Use a twisted pair cable whenever possible. Twist differential signals with each other and twist single-ended signals with the appropriate ground return.
- Discrete power cables require 360° shielding. Connect the shield to a ground terminal.

See the Kinetix Motion Control Selection Guide, publication GMC-SG001, for low-profile connector kit, drive-end (mating) connector kit, and motor-end connector kit catalog numbers.

Shielded Motor Cable

The use of a four-wire type Variable Frequency Drive (VFD), 600 volt, UL listed cable is strongly recommended for all motor currents at or below 130 Amperes. The illustration below illustrates the type of cable required.

Figure 43 - Type of Cable Required for Kinetix 7000 Drive Interconnects



Required Cable Types

You should always use shielded motor cable. The shield must connect to the drive chassis (PE) connection and the motor frame. Make the connection at both ends to minimize the external magnetic field. If you use cable trays or large conduits to distribute the motor leads for multiple drives, use shielded cable to reduce noise from the motor leads.

Cable Sizes

In the table below the appropriate VFD shielded cable to use based on 150% overload capability and 25 °C (77 °F) operating temperature is shown.

For applications above 130 Amps, use thick insulation lead wire, such as RHW-2 or equal. Make sure you thread the four wires (U, V, W, and ground) through a single, grounded, metal conduit.

Table 30 - 1.5x Rated Continuous Motor Current Cable Size

Motor Current	Cable Size	
	mm^2	AWG
12 A	1.5	16
17 A	2.5	14
21 A	4	12
30 A	6	10
55 A	10	8
65 A	16	6
95 A	25	4
130 A	35	2

Conduit

For applications above 130 Amperes, metal conduit is required for cable distribution. Follow these guidelines:

- Drives are normally mounted in cabinets, and ground connections are made at a common ground point in the cabinet. If the conduit is connected to the motor junction box and the drive end is connected to the ground panel in the cabinet, you do not need any additional conduit connections.
- Route no more than three sets of motor leads and a ground wire through a single conduit. This minimizes cross talk that also reduces the effectiveness of the noise reduction methods described. If more than three drive/motor connections per conduit are required, use shielded cable. If practical, each conduit should contain only one set of motor leads.
- You should use a thick insulation lead wire, such as type RHW-2 or equal.

General Wire Guidelines

Observe all applicable safety and national and local regulations when selecting the appropriate wire size for your system. Due to the drive overload capacity of 150% of the continuous current rating, the conductors for the transformer primary and secondary must be sized (at a minimum) for 125...160% of the maximum continuous input current for the motor selected. The motor conductors must also be rated for a minimum of 125...160% of the full load motor continuous current. If less than 150% overload is required the torque limit parameters must be set in the drive accordingly. The distance between the drive and motor may affect the size of the conductors used. To protect against interference, use shielded wire in motor and control circuits. A shielded cable is required for all feedback signal wires.

ATTENTION: To avoid a possible shock hazard caused by induced voltages, ground unused wires in the conduit at both ends.

For the same reason, if a drive sharing a conduit is being serviced or installed, disable all drives using this conduit. This removes the possible shock hazard from cross-coupled drive motor leads.

Routing the Power and Signal Cables

Be aware that when you route power and signal wiring on a machine or system, radiated noise from nearby relays, transformers, and other electronic drives can be induced into motor or encoder feedback signals, input/output communication, or other sensitive low voltage signals. This can cause system faults and communication problems.

See Minimizing Electrical Noise on page 28 for examples of routing high and low voltage cables in wireways, and to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, for more information.

Determine the Input Power Configuration

Before wiring input power to your Kinetix 7000 drive system, you must determine the type of input power within your facility. The drive is designed to operate in both grounded and ungrounded environments.

ATTENTION: When you are using a LIM module with your Kinetix 7000 drive, the AC line input power must come from a grounded power configuration.

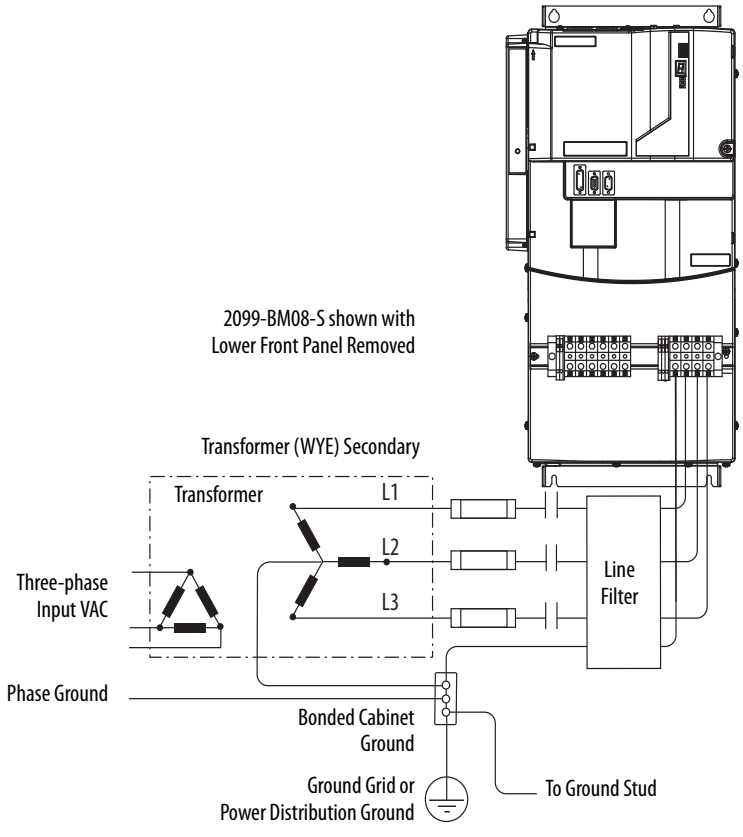
When you are not using a LIM module with your Kinetix 7000 drive, ungrounded, corner-grounded, and impedance-grounded input power configurations are permitted, but you must set the ground jumper as indicated in Table 32. In addition, set the ground jumper when an active converter supplies the DC-bus voltage.

See Set the Ground Jumper in Select Power Configurations on page 79 for additional information.

Grounded Power Configurations

The grounded (WYE) power configuration lets you ground your three-phase power at a neutral point. This type of grounded power configuration is preferred.

Figure 44 - Grounded Three-phase Power Configuration - (WYE Secondary)



IMPORTANT If you determine that you have grounded power distribution in your facility, you do not need to set the ground jumper.

Figure 45 - Corner-grounded Power Configuration

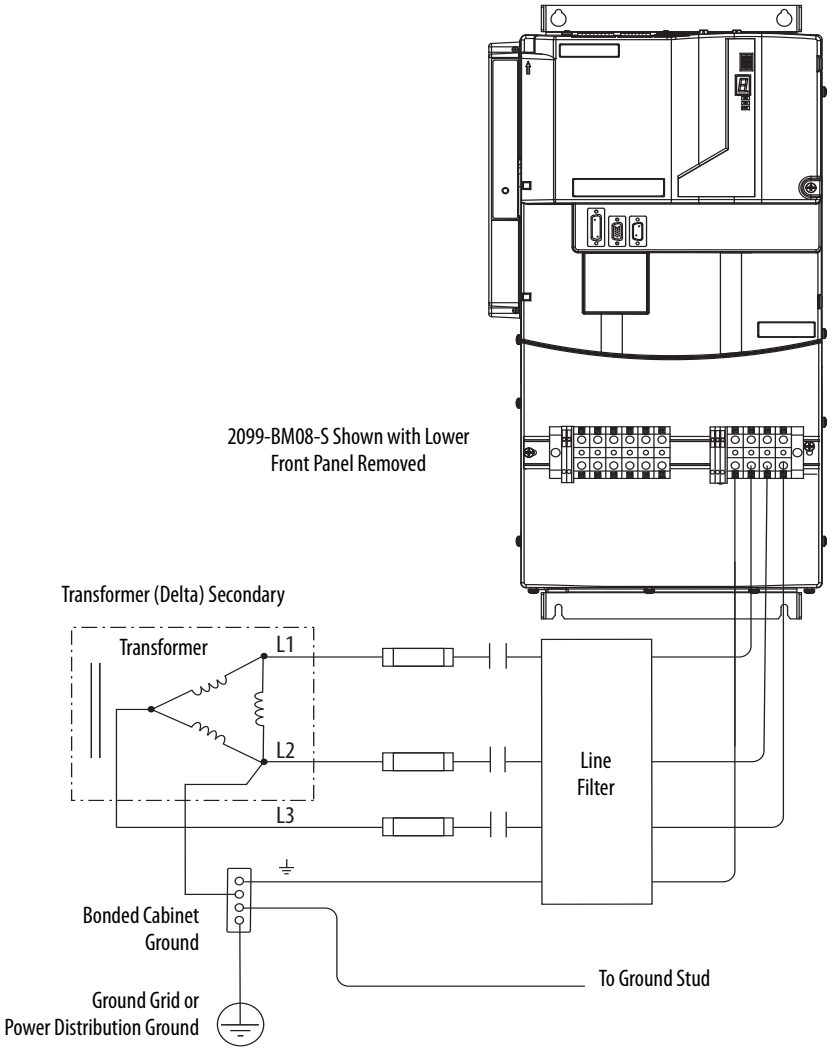
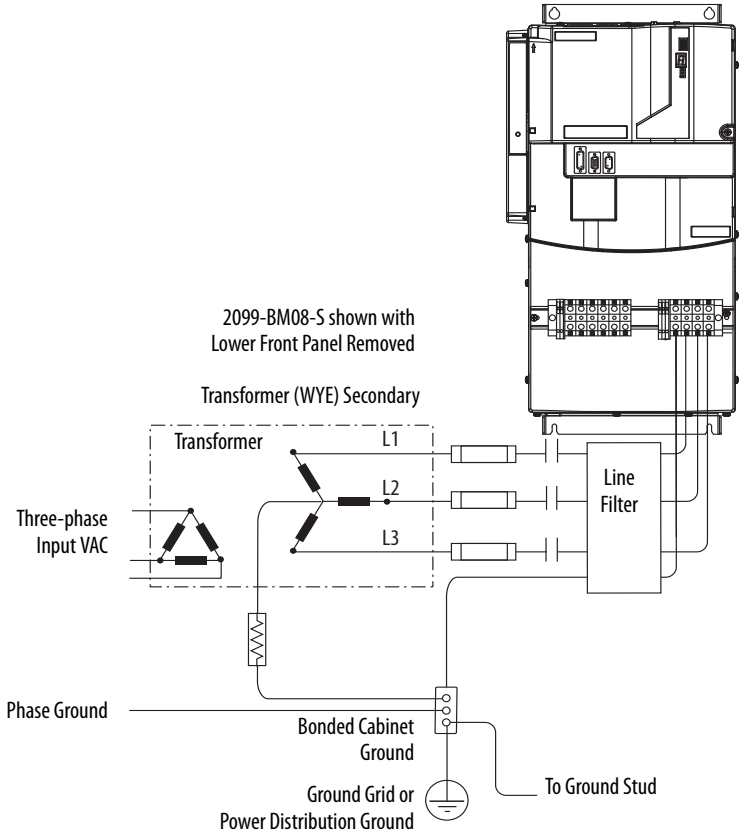


Figure 46 - Impedance-grounded Power Configuration (WYE Secondary)



IMPORTANT Even though impedance-grounded and corner-grounded power configurations have a ground connection, treat them as ungrounded when installing Kinetix 7000 drives.

See Interconnect Diagrams beginning on page 163 for input power interconnect diagrams.

Ungrounded Power Configurations

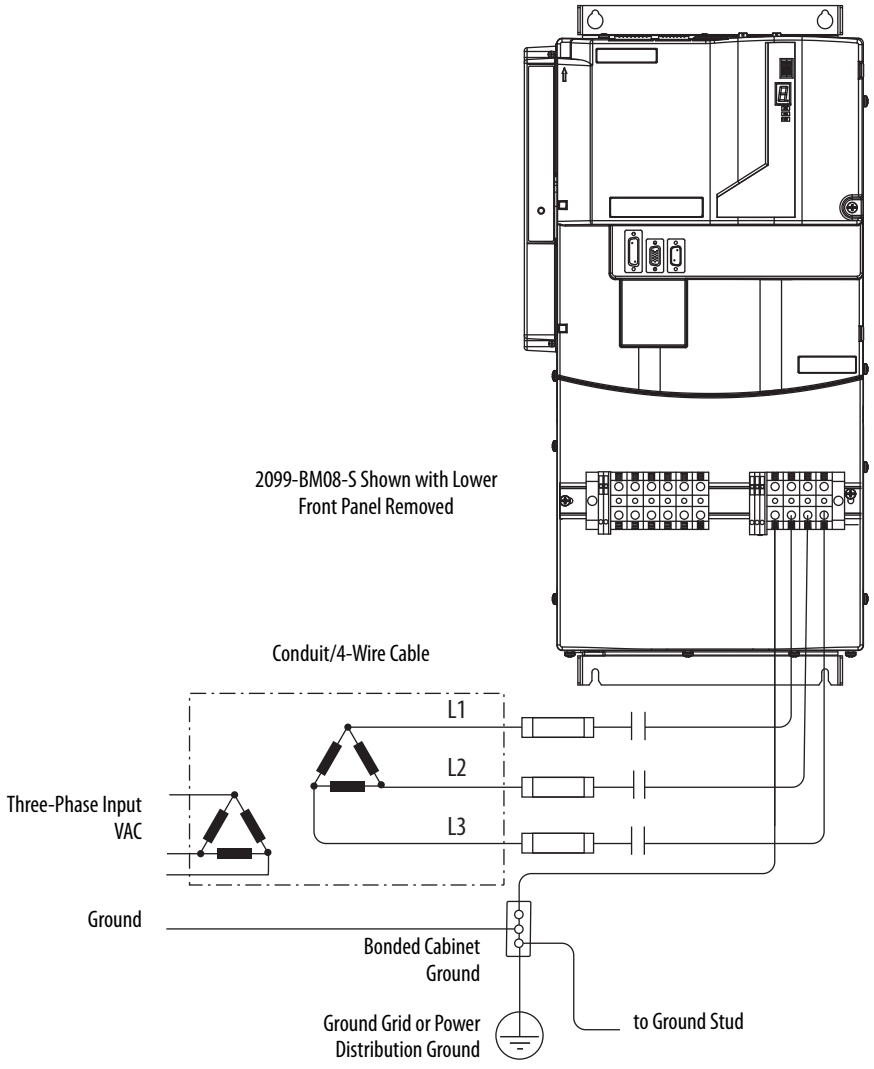
Kinetix 7000 drives contain protective MOV devices and common-mode capacitors that are referenced to ground. Disconnect the protective MOV devices and capacitors if the drive has an ungrounded, impedance-grounded, or corner-grounded power configuration where the line-to-ground voltages on any phase exceeds 125% of the nominal line-to-voltage.

ATTENTION: To avoid unstable operation and/or drive damage, these devices must be disconnected if the drive has an ungrounded, impedance-grounded, or corner-grounded power configuration.

Ungrounded systems do not reference each phase potential to a power distribution ground. This can result in an unknown potential to earth ground.

A Kinetix 7000 drive application using an active converter for DC-bus voltage is considered an ungrounded power distribution system.

Figure 47 - Ungrounded Power Wiring



Set the Ground Jumper in Select Power Configurations

Setting the ground jumper is necessary when using an ungrounded, corner-grounded, and impedance-grounded power configuration. Also, set the ground jumper when you are using the Bulletin 8720MC regenerative power supply, or any active converter, for DC-bus voltage. Setting the ground jumper involves accessing the power chassis and removing jumper plugs or disconnecting wires on the power terminals.

ATTENTION: To avoid personal injury, the ground jumper access area must be kept closed when power is applied. If power was present and then removed, wait at least 5 minutes for the DC-bus voltage to dissipate and verify that no DC-bus voltage exists before accessing the ground jumper.

Because the unit no longer maintains line-to-neutral voltage protection, risk of equipment damage exists when you remove the ground jumper.

Table 31 - Ground Jumper Configurations

Ground Configuration	Example Diagram	Ground Jumper Configuration	Benefits of Correct Configuration
Grounded (wye)	Figure 44 on page 75	Installed (default setting)	• UL and EMC compliance • Reduced electrical noise • Most stable operation • Reduced voltage stress on components and motor bearings
• Corner grounded • Impedance grounded • AC-fed ungrounded	Figure 45 on page 76 Figure 46 on page 77 Figure 47 on page 78	Removed	• Helps avoid severe equipment damage when ground faults occurs • Reduced leakage current
DC-bus from active converter	Figure 74 on page 167		

Table 32 - Jumper/Wire Location and Removal Instructions

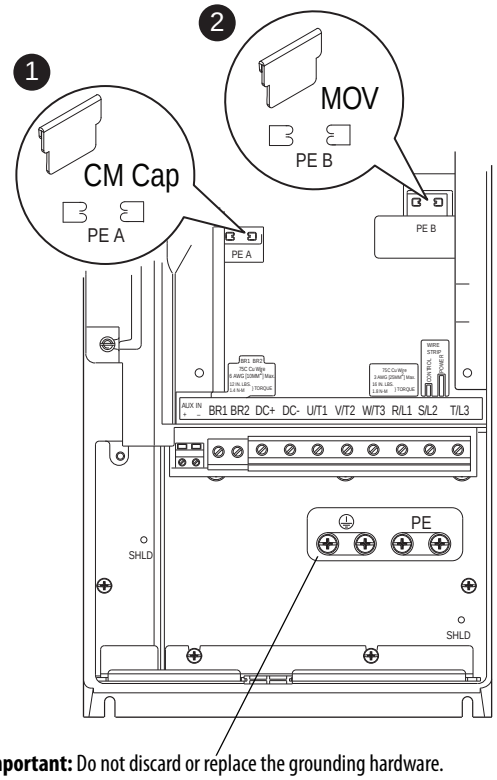
Drive	Jumper/Wire	ID No.	Component	Location
2099-BM06-S, 2099-BM07-S and 2099-BM08-S	PEA	1	Common mode capacitor	Remove the two jumpers located above the power terminal block. See Remove the Ground Jumper on 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S Drives on page 80.
	PEB	2	MOVs	
2099-BM09-S and 2099-BM10-S	Green/yellow wire	3	Common mode capacitor	Remove DC-DC converter and drive top cover, and disconnect the green/yellow wire from the drive chassis. Insulate and secure the wire to prevent unintentional contact with the chassis or components. See Remove the Ground Wires on 2099-BM09-S and 2099-BM10-S Drives on page 81.
		4	MOVs/input filter cap	Disconnect the green/yellow wire next to the power terminal block. Insulate and secure the wire to prevent unintentional contact with the chassis or components. See Remove the Ground Wires on 2099-BM09-S and 2099-BM10-S Drives on page 81.
2099-BM11-S and 2099-BM12-S	Green/yellow wire	5	Common mode capacitor	Disconnect the two green/yellow wires from the PE terminals on the power terminal block. Insulate and secure each of these wires to prevent unintentional contact with the chassis or components. See Remove the Ground Wires on 2099-BM11-S and 2099-BM12-S Drives on page 81.
		6	MOVs	

Remove the Ground Jumper on 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S Drives

Figure 48 shows the location of the jumpers in 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S drives on the power chassis. The common mode capacitor jumper is indicated by callout 1 (PEA) and the MOV jumper is indicated by callout 2 (PEB).

Remove each jumper by carefully pulling it straight out.

Figure 48 - Ground Jumper Location on 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S

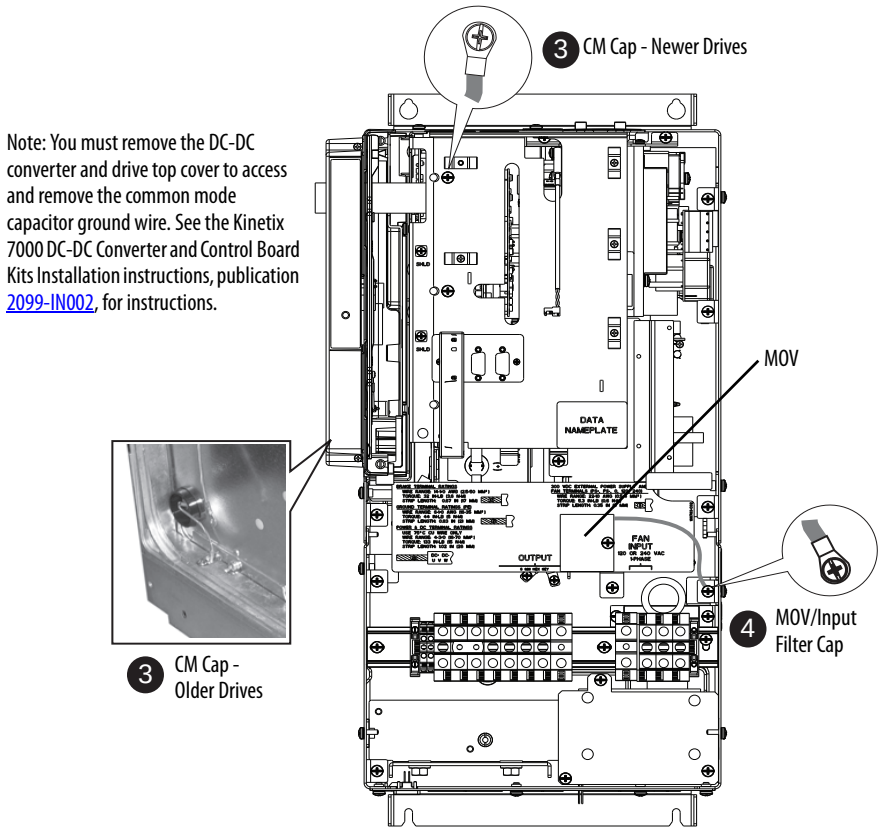


Important: Do not discard or replace the grounding hardware.

Remove the Ground Wires on 2099-BM09-S and 2099-BM10-S Drives

Figure 49 shows the locations of the common mode capacitor and MOV/input filter capacitor ground wires in 2099-BM09-S and 2099-BM10-S drives. The common mode capacitor ground wire is indicated by callout 3 and the MOV/input filter cap ground wire is indicated by callout 4.

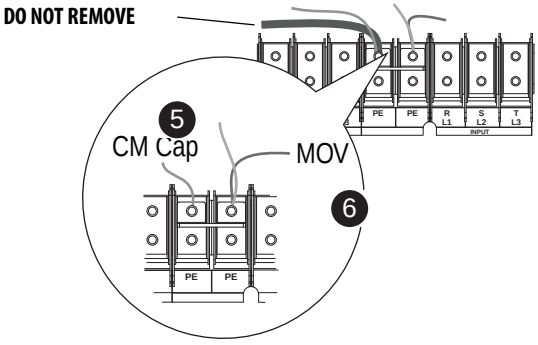
Figure 49 - Ground Wire Locations on Terminal Block of 2099-BM09-S and 2099-BM10-S



Remove the Ground Wires on 2099-BM11-S and 2099-BM12-S Drives

Figure 50 shows the locations of the common mode capacitor and MOV ground wires in 2099-BM11-S and 2099-BM12-S drives. The common mode capacitor ground wire is indicated by callout 5 and the MOV ground wire is indicated by callout 6.

Figure 50 - Ground Wire Location on Power Terminal Block of 2099-BM11-S and 2099-BM12-S



Grounding the Kinetix 7000 Drive System

All equipment and components of a machine or process system must have a common earth ground point connected to their chassis.

A grounded system provides a ground path for short-circuit protection. Grounding your modules and panels minimize shock hazard to personnel and damage to equipment caused by short-circuits, transient overvoltages, and accidental connection of energized conductors to the equipment chassis.

See Agency Compliance on page 18 for CE grounding requirements.

IMPORTANT To improve the bond between the drive and subpanel, construct your subpanel out of zinc-plated (paint-free) steel.

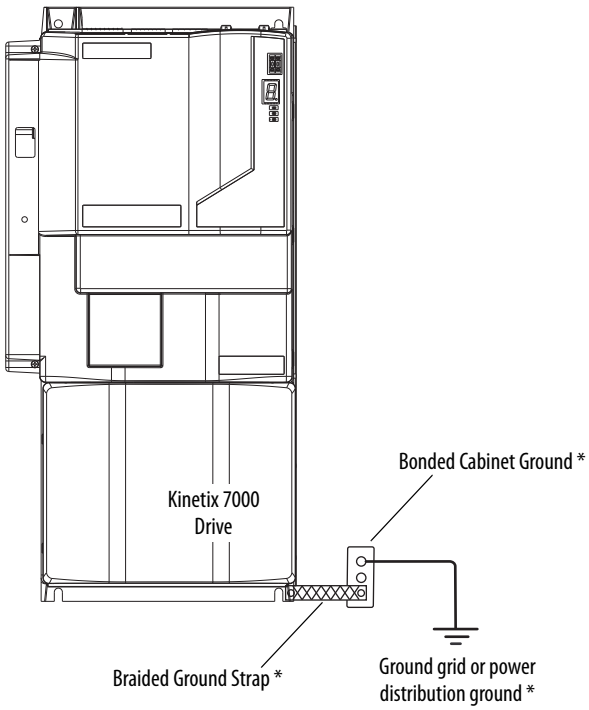
Grounding Your System to the Subpanel

In Figure 51, the drive is shown properly grounded to the bonded cabinet ground on the subpanel.

ATTENTION: The National Electrical Code contains grounding requirements, conventions, and definitions. Follow all applicable local codes and regulations to safely ground your system.

See the Interconnect Diagram Notes diagrams beginning on page 164.

Figure 51 - Drive Chassis Ground Connection



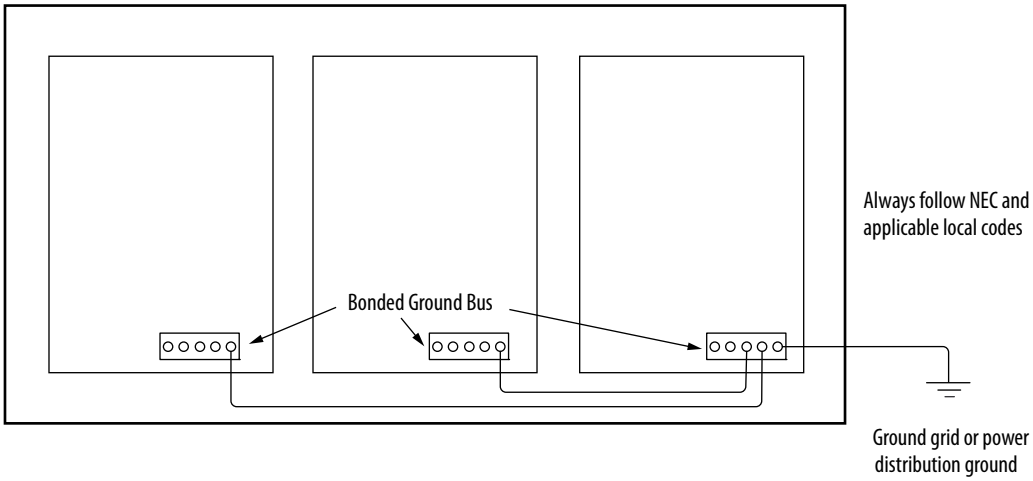
* Indicates customer-supplied item.

Grounding Multiple Subpanels

To extend the chassis ground to multiple subpanels, see Figure 52.

IMPORTANT HF bonding is not illustrated. For HF bonding information, see Bonding Multiple Subpanels on page 30.

Figure 52 - Subpanels Connected to a Single Ground Point



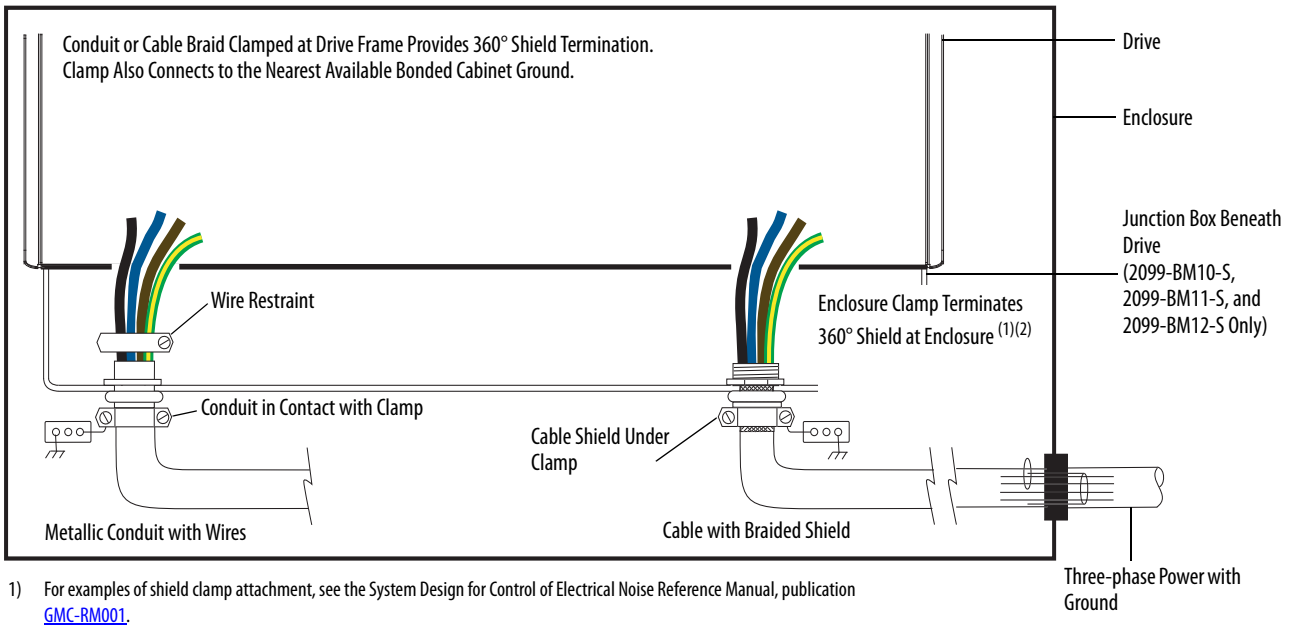
Motor Power Cable Shield Termination

Factory-supplied motor power cables for MP-series motors are shielded, and the braided cable shield must terminate at the drive when installed. A small portion of the cable jacket must be removed to expose the shield braid. The exposed area must be clamped (using the clamp provided on the 2099-BM06-S, -BM07-S and -BM08-S drives) to the drive to provide a 360° termination. Factory-supplied power cables must also be terminated in the motor power (MP) connector plug.

ATTENTION: To avoid hazard of electrical shock, be sure the shielded power cables are grounded at a minimum of one point for safety.

Customer-supplied power cables must be shielded, and the braided cable shield or conduit must terminate at the drive when installed. An area of the power cable shield must be exposed and terminated for 360° at the drive. In a similar manner, conduit enclosing discrete power cables must be terminated for 360° at the drive.

Figure 53 - Power Cable Shielding Techniques Recommended for Kinetix 7000 Drives



1) For examples of shield clamp attachment, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.
2) If enclosure is painted, remove paint to provide metal-to-metal contact.

MP-Series (Bulletin MPL) Motor Connectors

Bulletin MPL motors equipped with circular DIN connectors (specified by 7 in the catalog number) are not compatible with cables designed for motors equipped with bayonet connectors (specified by 2 in the catalog number). The motors with bayonet connectors are being discontinued.

Bayonet connectors can be mounted facing the motor shaft or end plate and provide a separate connector for power, feedback, and brake connections. Circular DIN connectors rotate up to 180° and combine power and brake wires in the same connector, eliminating the brake connector.

Figure 54 - Bayonet and Circular DIN Motor Connectors

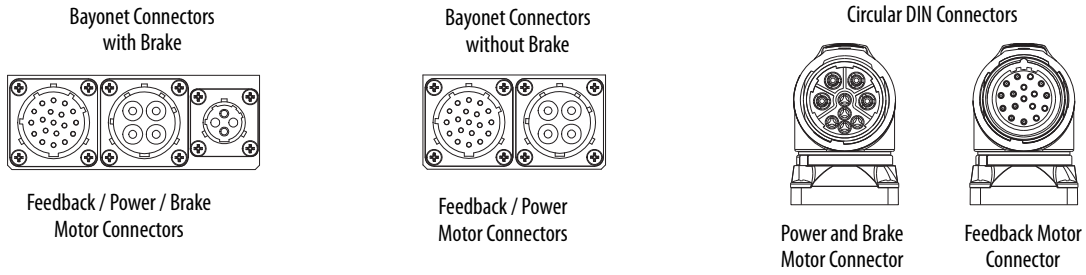


Table 33 - Motor Power Cable Compatibility

Motor/Actuator	Connector	Motor/Actuator Cat. No.	Motor Power Cables (with brake wires)	Motor Power Cables (without brake wires)
MP-Series (Bulletin MPL)	Circular DIN	MPL-B5*xxx*, MPL-B6*xxx*, MPL-B8*xxx*, and MPL-B9*xxx*	2090-CPBM7DF-*xx*AA*xx* or 2090-XXNPMF-*xx*S*xx* (standard, non-flex) 2090-CPBM7DF-*xx*AF*xx* (1) (continuous-flex)	2090-CPWM7DF-*xx*AA*xx* (standard, non-flex) 2090-CPWM7DF-*xx*AF*xx* (1) (continuous-flex)
	Bayonet	MPL-A/B5*xxx*, MPL-B6*xxx*, and MPL-B8*xxx* MPL-B960B, MPL-B960C, MPL-B980B, and MPL-B980C	N/A	2090-XX*x*PMP-*xx*S*xx* (2)
		MPL-B960D and MPL-B980D		2090-MCNPMP-6S*xx*
MP-Series (Bulletin MPM)	Circular DIN	MPM-B165 and MPM-B215	2090-CPBM7DF-*xx*AA*xx* or 2090-XXNPMF-*xx*S*xx* (standard, non-flex) 2090-CPBM7DF-*xx*AF*xx* (1) (continuous-flex)	2090-CPWM7DF-*xx*AA*xx* (standard, non-flex) 2090-CPWM7DF-*xx*AF*xx* (1) (continuous-flex)
RDD-Series	Circular DIN	RDB-B*xxxx*	N/A	2090-CPWM7DF-*xx*AA*xx* (standard, non-flex) 2090-CPWM7DF-*xx*AF*xx* (1) (continuous-flex)
HPK-Series	N/A	HPK-B*xxxxx*, HPK-E*xxxxx*	Customer-supplied	

(1) You must remove the motor-side o-ring when using 2090-CP*x*M7DF-*xx*A*xxx* cables.

(2) For Bulletin MPL motors equipped with bayonet connectors. These cables are available as standard, non-flex (catalog number 2090-XXNPMP-xxSxx) and continuous-flex (catalog number 2090-XXTPMP-xxSxx).

Motors may have a separate brake connector or need routing of thermal switch wires. These are often separately shielded and routed in an existing cable.

See Wiring Examples beginning on page 164 for interconnect diagrams, and the Power Terminal Block (PTB) Connections diagram on page 51 for the location of the U, V, W, and ground (PE) motor power terminals.

IMPORTANT Securing the cable shield in the clamp with a tie wrap is recommended to improve stress relief.

Input Power Wiring Requirements

National codes and standards (NEC, VDE, BSI etc.) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices.

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

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

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

Acceptable Cable Types

Do not use cable with an insulation thickness less than or equal to 15 mils (0.4 mm/0.015 in.). Use copper wire only. Wire gauge requirements and recommendations are based on 75 °C. Do not reduce wire gauge when using higher temperature wire.

As an approximate guide, provide spacing of 0.3 meters (1 foot) for every 10 meters (32.8 feet) of length. In all cases, long parallel runs must be avoided.

Shielded/Armored Cable

Shielded cable contains all of the general benefits of multi-conductor cable with the added benefit of a copper braided shield that can contain much of the noise generated by a typical AC drive. Strong consideration for shielded cable should be given in installations with sensitive equipment such as weigh scales, capacitive proximity switches and other devices that may be affected by electrical noise in the distribution system. Applications with large numbers of drives in a similar location, imposed EMC regulations, or a high degree of communication and networking are also good candidates for shielded cable.

Shielded cable may also help reduce shaft voltage and induced bearing currents for some applications. In addition, the increased impedance of shielded cable may help extend the distance that the motor can be located from the drive without the addition of motor protective devices such as terminator networks.

Consideration should be given to the general specifications dictated by the environment of the installation, including temperature, flexibility, moisture characteristics and chemical resistance. In addition, a braided shield should be included and be specified by the cable manufacturer as having coverage of at least 75%. An additional foil shield can greatly improve noise containment.

A good example of recommended cable is Belden/E 295*xx* (*xx* determines gauge). This cable has four XLPE insulated conductors with a 100% coverage foil and an 85% coverage copper braided shield (with drain wire) surrounded by a PVC jacket.

Other types of shielded cable are available, but the selection of these types may limit the allowable. Particularly, some of the newer cables twist four conductors of THHN wire and wrap them tightly with a foil shield. This construction increases the cable charging current required and reduces the overall drive performance. Unless specified in the individual distance tables as tested with the drive, these cables are not recommended and their performance against the lead length limits supplied is not known.

The table below describes the recommended shielded cables.

Table 34 - Shielded Cable Ratings and Types

Location	Rating/Type	Description
Standard (Option 1)	600V, 90 °C (194 °F), XHHW2/RHW-2 Anixter B209500-B209507, Belden B29501-B229507, or equivalent	• Four tinned copper conductors with XLPE insulation • Copper braid/aluminum foil combination shield and tinned copper drain wire • PVC jacket
Standard (Option 2)	600V, 90 °C (194 °F), RHH/RHW-2 Anixter OLF-7*xxxxx*, or equivalent	• Three tinned copper conductors with XLPE insulation • 5 mil single helical copper tape (25% overlap minimum) with three bare copper grounds in contact with shield • PVC jacket
Class I & II; Division 1 & II	Tray rated 600V, 90 ° C (194 ° F), XHHW2/RHW-2 Anixter 7V-7*xxxxx*-3g, or equivalent	• Three bare copper conductors with XLPE insulation and impervious corrugated continuously welded aluminum armor • Black sunlight resistant PVC jacket overall • Three copper grounds on 5 mm^2 (10 AWG) and smaller

Contactors

A contactor or other device that routinely disconnects and reapplies the AC line to the drive to start and stop the motor can cause drive hardware damage. The drive is designed to use control input signals that will start and stop the motor. If an input device is used, operation must not exceed four cycles per minute maximum, or damage will occur to the drive precharge circuit.

The start/stop/enable control circuitry for the drive includes solid state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional stop circuitry may be required to remove the AC line to the drive. An auxiliary braking method also may be required.

IMPORTANT It is recommended that the drive safe-off function be used to minimize contactor cycling.

Power Wire Specifications

Wire should be copper with 75 °C (167 °F) minimum rating. Phasing of main AC power is arbitrary and earth ground connection is required for safe and proper operation.

For additional information see Power Specifications on page 152, and Interconnect Diagram Notes on page 164 for interconnect diagrams.

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

See publication 8000-4.5.2, Guarding Against Electrostatic Damage or any other applicable ESD protection handbook.

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

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

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

Power Wiring Guidelines

Use these guidelines when wiring the power connectors on your Kinetix 7000 drive (without a LIM).

IMPORTANT	To achieve system performance, run wires and cables in the wireways as established in Chapter 1.

IMPORTANT	To limit coil switching transients generated by the LINE contactor, use of a surge suppressor is recommended. For an example, see Appendix B.

This procedure assumes you have separate power supply/line filter components mounted on your panel and are ready to wire the AC input power to the drive.

1. Prepare the wires for attachment to each connector by removing insulation equal to an acceptable strip length.

   The actual strip length will vary based on the wire gauge and terminal size of the Kinetix 7000 drive.
2. Route the wires to your Kinetix 7000 drive.
3. Insert the wires into the connector or connect the wires to the terminals.
4. Tighten the terminal screws/nuts to the recommended torque for the specific terminal.
5. Pull on each wire to make sure it does not come out of its terminal. If any wires are loose, reinsert/connect and tighten the wire to the recommended torque.

Wire the Kinetix 7000 Drive Connectors

See Appendix B for all Kinetix 7000 drive interconnect diagrams.

Wire the Control Power (CP) Connector

Wire the 24V DC control power supply to your Kinetix 7000 drive as described in Table 35. See Control Power (CP) Terminal Block Connections for more information.

Table 35 - Control Power Connections

Signal	Terminal	Recommended Wire Size mm^2 (AWG)	Strip Length mm^2 (in.)	Torque N·m (lb·in)
CP_24VDC	1	0.75 (18) (stranded wire with ferrule) 1.5 (16) (solid wire)	7.0 (0.275)	0.235 (2.0)
CP_COM	2			

Wire AC Input Power

Wire 460V AC input power to your Kinetix 7000 drive as described in Table 36. See Power Terminal Block (PTB) Connections for more information.

Table 36 - AC Input Power Connections

Kinetix 7000 Drive Cat. No.	Signal	Terminal	Recommended Wire Size mm^2 (AWG)	Torque N·m (lb·in)
2099-BM06-S 2099-BM07-S 2099-BM08-S	L1 L2 L3 Ground	R S T PE	25…2.5 (3…14)	1.8 (16)
2099-BM09-S	L1 L2 L3	R S T	50…4 (1/0…12)	3.6 (32)
	Ground	PE	50…4 (1/0…12)	5 (44)
2099-BM10-S	L1 L2 L3	R S T	70…10 (2/0…8)	15 (133)
	Ground	PE	50…4 (1/0…12)	5 (44)
2099-BM11-S 2099-BM12-S	L1 L2 L3	R S T	100…10 (4/0…8)	12 (104)
	Ground	PE	50…4 (1/0…12)	5 (44)

Wire DC Input Power (Common Bus Configurations Only)

Wire the DC input power from a leader regenerative power supply (8720MC-RPS) to a Kinetix 7000 drive as described in Table 37. See Power Terminal Block (PTB) Connections on page 51 for more information.

IMPORTANT	DC power from the regenerative power supply (8720MC-RPS) is typically routed to a power distribution box. Fusing will be placed before and after the distribution box, providing protection for both the 8720MC-RPS and Kinetix 7000 drive.

Table 37 - DC Input Power Connections

Kinetix 7000 Drive Cat. No.	Signal Description	Terminal(s)	Recommended Wire Size mm^2 (AWG)	Torque N•m (lb•in)
2099-BM06-S 2099-BM07-S 2099-BM08-S	DC+ DC-	DC+ DC-	25…2.5 (3…14)	1.8 (16)
2099-BM09-S	DC+ DC-	DC+ DC-	50…4 (1/0…12)	3.6 (32)
2099-BM10-S	DC+ DC-	DC+ DC-	70…10 (2/0…8)	15 (133)
2099-BM11-S 2099-BM12-S	DC+ DC-	DC+ DC-	100…10 (4/0…8)	12 (104)

Wire the Safe-off (SO) Connector

Wire the Safe-off connections to your Kinetix 7000 drive as described in Table 38. See Safe-off (SO) Terminal Block Connections for more information.

IMPORTANT Terminals 8 and 9 (24V+ and Common) are only used by the motion-allowed jumper. When using the Safe-off feature, the 24V supply must come from an external source.

Table 38 - Safe-off Connections

Signal	Terminal	Recommended Wire Size mm^2 (AWG)	Strip Length mm^2 (in.)	Torque N•m (lb•in)
FDBK2+	1	0.75 (18) (stranded wire with ferrule) 1.5 (16) (solid wire)	7.0 (0.275)	0.235 (2.0)
FDBK2-	2			
FDBK1+	3			
FDBK1-	4			
ENABLE2+	5			
ENABLE-	6			
ENABLE1+	7			
SO_24VDC	8			
SO_COM	9			

Wire the General Purpose Relay (GPR) and General Purpose I/O (GPIO) Connectors

Wire the control and interface signals on the General Purpose Relay (GPR) and General Purpose I/O (GPIO) connectors as described in Table 39 and Table 40. See General Purpose I/O (GPIO) Terminal Block Connections on page 46 and General Purpose Relay (GPR) Terminal Block Connections on page 46 for more information.

ATTENTION: Wiring the DRIVE OK signal on the General Purpose Relay is required. To avoid injury or damage to the drive, wire the DRIVE OK relay into your safety control string.

In common bus configurations, a REGEN connection on the General Purpose Input/Output connector is also required for the drives. This connection must be wired in series to the safety control string, and also wired from the 8720MC-RPS to the Kinetix 7000 drive to indicate bus voltage is present.

Table 39 - General Purpose Relay Connections

Signal	Terminal	Description	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
DRIVE OK+	5	Programmable N.O. Relay 2 output	0.75 (18) (stranded wire with ferrule) 1.5 (16) (solid wire)	7.0 (0.275)	0.235 (2.0)
DRIVE OK-	6	Programmable Relay 2 common			

Table 40 - General Purpose I/O Connections

Signal	Terminal	Description	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
Regen_OK+	7	Regenerative power supply status	0.75 (18) (stranded wire with ferrule) 1.5 (16) (solid wire)	7.0 (0.275)	0.235 (2.0)
Regen_OK-	8	Regenerative power supply status common			

Wire Motor Output Power

Wire motor output power as described in Table 41. See Power Terminal Block (PTB) Connections on page 51 for more information.

Table 41 - HPK-Series and MP-Series Servo Motor Power Connections

Kinetix 7000 Drive Cat. No.	Signal	Terminal	Recommended Wire Size mm² (AWG)	Torque N•m (lb•in)
2099-BM06-S 2099-BM07-S 2099-BM08-S	U / Brown V / Black w / Blue ⏚ Green/Yellow	U V W ⏚	25…2.5 (3…14)	1.8 (16)
2099-BM09-S	U / Brown V / Black w / Blue	U V W	50…4 (1/0…12)	3.6 (32)
	⏚ Green/Yellow	⏚	50…4 (1/0…12)	5 (44)
2099-BM10-S	U / Brown V / Black w / Blue	U V W	70…10 (2/0…8)	15 (133)
	⏚ Green/Yellow	⏚	50…4 (1/0…12)	5 (44)
2099-BM11-S 2099-BM12-S	U / Brown V / Black w / Blue	U V W	100…10 (4/0…8)	12 (104)
	⏚ Green/Yellow	⏚	50…4 (1/0…12)	5 (44)

Wire the Motor Brake

Wire the motor brake (if applicable) as described in Table 42. See Power Terminal Block (PTB) Connections on page 51 for more information on the motor power connections.

IMPORTANT Use surge suppression when controlling a brake coil.
See Figure 81 on page 174.

Table 42 - Motor Brake Connections

Motor Brake Terminal (Signal)		Drive Terminal (Signal)	Recommended Wire Size mm² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
Bulletin MPL w/Bayonet Connector	Bulletin MP*x* w/Circular DIN Connector				
A (BR+)	F (BR+)	2 (GPR1+)	2.5 (14)	10 (0.38)	0.5…0.6 (4.4…5.3)
C (BR-)	G (BR-)	3 (GPR1-)			

Notes: HPK-Series motor brake terminations are BR+ and BR-. RDD-Series motors do not have a motor brake.

Motor brake wiring varies slightly, depending on the motor connector type. The table below identifies the brake wire option for your servo motor and the appropriate brake cable or connector kit catalog number required.

Motor Series	Connector Type	Brake Wire Option	Cable Cat. No.
Bulletin MPL	Circular DIN	The brake terminals are in the motor power connector. Drive to motor power cables must be ordered with the brake option.	2090-CPBM7DF-*xx*AA*xx* (1) 2090-XXNPMF-*xx*S*xx* (standard, non-flex) 2090-CPBM*x*DF-*xx*AF*xx* (1) (continuous-flex)
	Bayonet	The motor has a separate brake connector and requires a brake power cable.	2090-UX*x*BMP-18S*xx* brake cable (2)
Bulletin MPM	Circular DIN	The brake terminals are in the motor power connector. Drive to motor power cables must be ordered with the brake option.	2090-CPBM7DF-*xx*AA*xx* (1) 2090-XXNPMF-*xx*S*xx* (standard, non-flex) 2090-CPBM*x*DF-*xx*AF*xx* (1) (continuous-flex)
HPK-Series	N/A	The motor has a separate brake wiring connection.	Customer-supplied

(1) You must remove the motor-side o-ring when using 2090-CP*x*M7DF-*xx*A*xxx* cables.

(2) For Bulletin MPL motors equipped with bayonet connectors. These cables are available as standard, non-flex (catalog number 2090-UXNBMP-18Sxx) and continuous-flex (catalog number 2090-UXTBMP-18Sxx).

Feedback and I/O Cable Connections

Factory-made cables with premolded connectors are designed to minimize EMI and are recommended over hand-built cables to improve system performance. However, other options are available for building your own feedback and I/O cables.

Table 43 - Motor Feedback Cable Compatibility - Bayonet Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable	
			Premolded	Flying-lead
MPL-B*xxxx*-S	Bayonet	High-resolution encoder	2090-UXNFBMP-S*xx*	2090-XX*x*FMP-S*xx* (1)

(1) For Bulletin MPL and 1326AB (M2L/S2L) motors equipped with bayonet connectors. These cables are available as standard, non-flex (catalog number 2090-XXNFMP-Sxx) and continuous-flex (catalog number 2090-XXTFMP-Sxx).

Table 44 - Motor Feedback Cable Compatibility - Circular Threaded DIN

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable	
			Premolded	Flying-lead
HPK-Series	Circular Threaded DIN	High-resolution encoder	N/A	2090-XXNFMF-S*xx* (standard, non-flex) 2090-CFBM4DF-CDAF*xx* (continuous-flex)

Table 45 - Motor Feedback Cable Compatibility - SpeedTec DIN Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable (1)	
			Premolded	Flying-lead
MPL-B5*xxx*-S/M*x*7*x*AA, MPL-B6*xxx*-S/M*x*7*x*AA, MPL-B8*xxx*-S/M*x*7*x*AA MPL-B9*xxx*-S/M*x*7*x*AA	SpeedTec DIN	High-resolution encoder	2090-CFBM7DD-CEAA*xx* (standard, non-flex) or 2090-CFBM7DD-CEAF*xx* (continuous-flex)	2090-CFBM7DF-CEAA*xx* (standard, non-flex) or 2090-CFBM7DF-CEAF*xx* (continuous-flex)
MPM-B*xxxxx*-S/M				
HPK-Series				
RDB-B*xxxx*-7/3			N/A	2090-XXNFMF-S*xx* (standard, non-flex) or 2090-CFBM7DF-CDAF*xx* (continuous-flex)

(1) You must remove the motor-side o-ring when using 2090-CFBM7*xx-xx*A*xxx* cables.

Flying-lead Feedback Cable Pinouts

Table 46 - 2090-XX*x*FMP-S*xx* Feedback Cable(1)

Motor Bayonet Connector Pin	Rotary Motors with High Resolution Feedback: MPL-B5*xxxx*-M/S*x*2*x*AA, MPL-B6*xxxx*-M/S*x*2*x*AA, MPL-B8*xxxx*-M/S*x*2*x*AA, and MPL-B9*xxxx*-M/S*x*2*x*AA	Drive MF Connector Pin
	Signal	
A	Sine+	1
B	Sine-	2
C	Cos+	3
D	Cos-	4
E	Data+	5
F	Data-	10
K	Reserved	–
L	Reserved	–
N	EPWR_9V	7
P	ECOM	6
R	TS+	11
S	TS-	–
T	Reserved	–
U	Reserved	–
V	Reserved	–

(1) The 2090-XX*x*FMP-S*xx* cables are available as standard, non-flex (catalog number 2090-XX**N**FMP-S*xx*) and continuous-flex (catalog number 2090-XX**T**FMP-S*xx*).

Table 47 - 2090-XXNFMF-S*xx* and 2090-CFBM*x*DF-CDAF*xx* Feedback Cable

Motor Circular DIN Connector Pin	Motors with High Resolution Feedback: MPL-B5*xxxx*-M/S*x*7*x*AA, MPL-B6*xxxx*-M/S*x*7*x*AA, MPL-B8*xxxx*-M/S*x*7*x*AA, MPL-B9*xxxx*-S/M-M/S*x*7*x*AA, HPK-B*xxxx*-S/M, and HPK-E*xxxx*-S/M	Drive MF Connector Pin
	Signal	
1	Sine+	1
2	Sine-	2
3	Cos+	3
4	Cos-	4
5	Data+	5
6	Data-	10
9	Reserved	–
10	Reserved	–
11	EPWR_9V	7
12	ECOM	6
13	TS+	11
14	TS-	–
15	Reserved	–
16	Reserved	–
17	Reserved	–

Table 48 - 2090-XXNFMF-S*xx* and 2090-CFBM*x*DF-CDAF*xx* Feedback Cable

Motor Circular DIN Connector Pin	RDB-B*xxxxx*-3/7 Motors	2090-K7CK-KENDAT Pin
	Signal	
1	Sine+	1
2	Sine-	2
3	Cos+	3
4	Cos-	4
5	Data+	9
6	Data-	10
7	CLK+	7
8	CLK-	8
9	EPWR_5V	5
10	ECOM	6
11	Reserved	–
12	Reserved	–
13	TS+	11
14	TS-	–
15	Reserved	–
16	Reserved	–
17	Reserved	–

Wire Feedback and I/O Connectors

Wire your feedback and I/O cables.

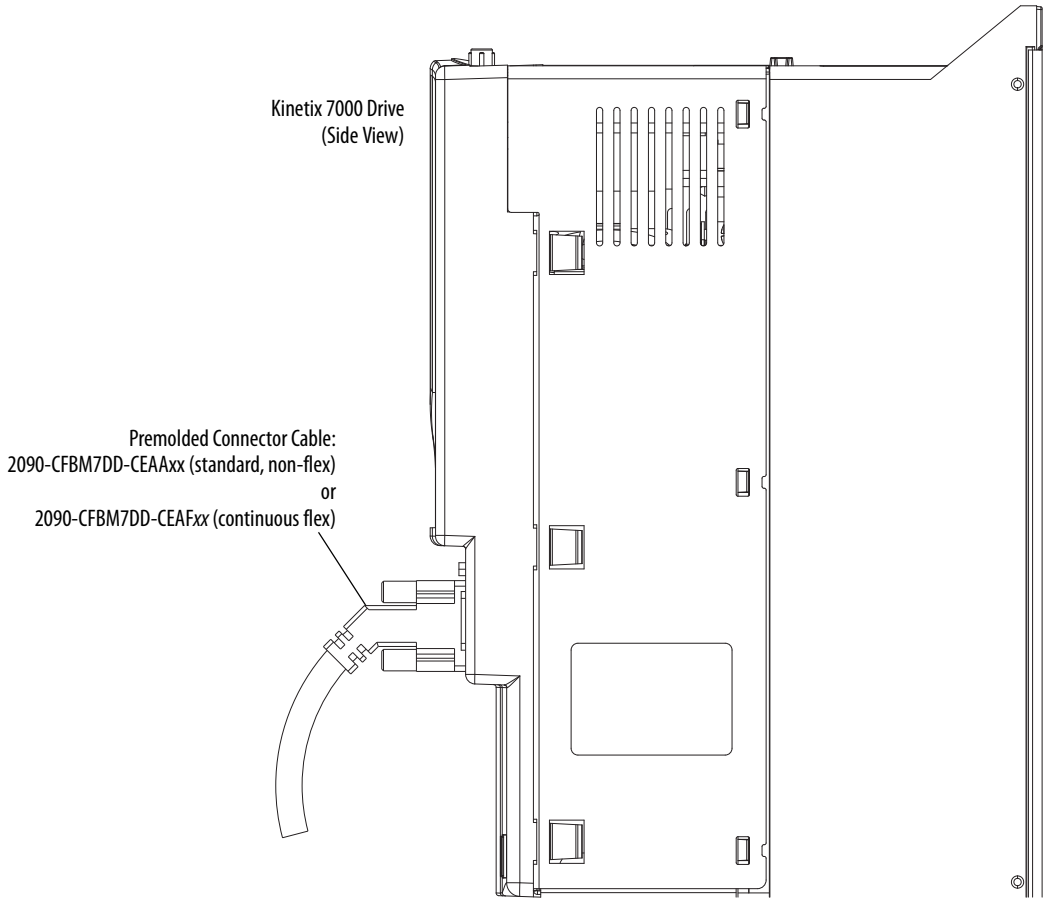
To make this type of connection	Go to
Premolded Cable	Connect Premolded Motor Feedback Cables below.
Panel-mounted Breakout Board	Wire Panel-mounted Breakout Board Kits on page 98.
Low-profile Connector	Wire Low-profile Connectors on page 100.

Connect Premolded Motor Feedback Cables

Motor feedback cables (with premolded connectors) plug directly into 15-pin motor feedback (MF) connectors on Kinetix 7000 drive (no wiring is necessary).

IMPORTANT When using Bulletin 2090 cables with premolded connectors, tighten the mounting screws (finger tight) to improve system performance.

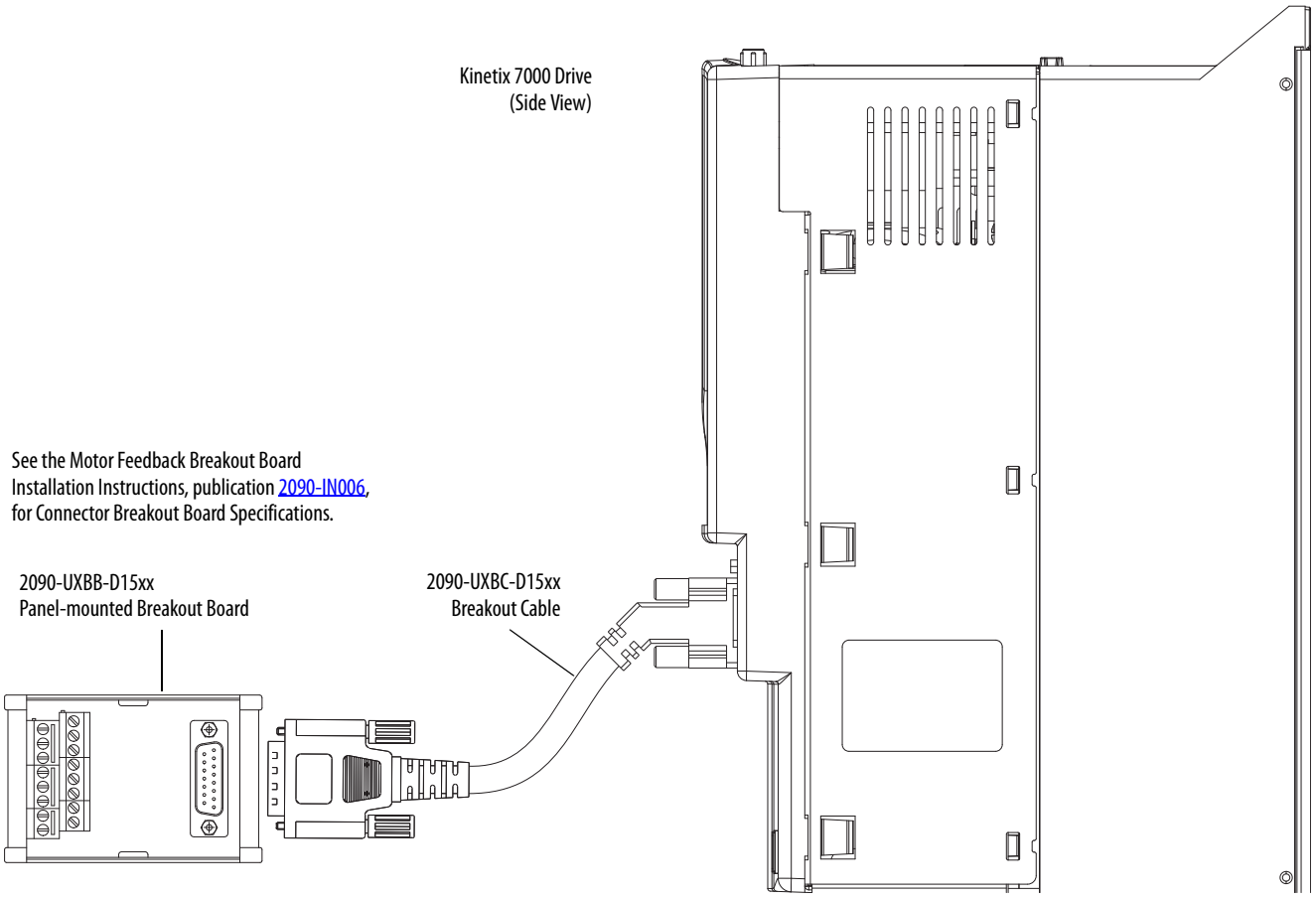
Figure 55 - Premolded Motor Feedback Cable Connection



Wire Panel-mounted Breakout Board Kits

The panel-mounted breakout board kit (catalog number 2090-UXBK-D15*xx*) includes a (DIN rail) terminal block and cable. The cable connects between the terminal block and the motor feedback (MF) connector. Wires from your flying-lead motor feedback cable connect to the terminals.

Figure 56 - Panel-mounted Breakout Board Connection Example

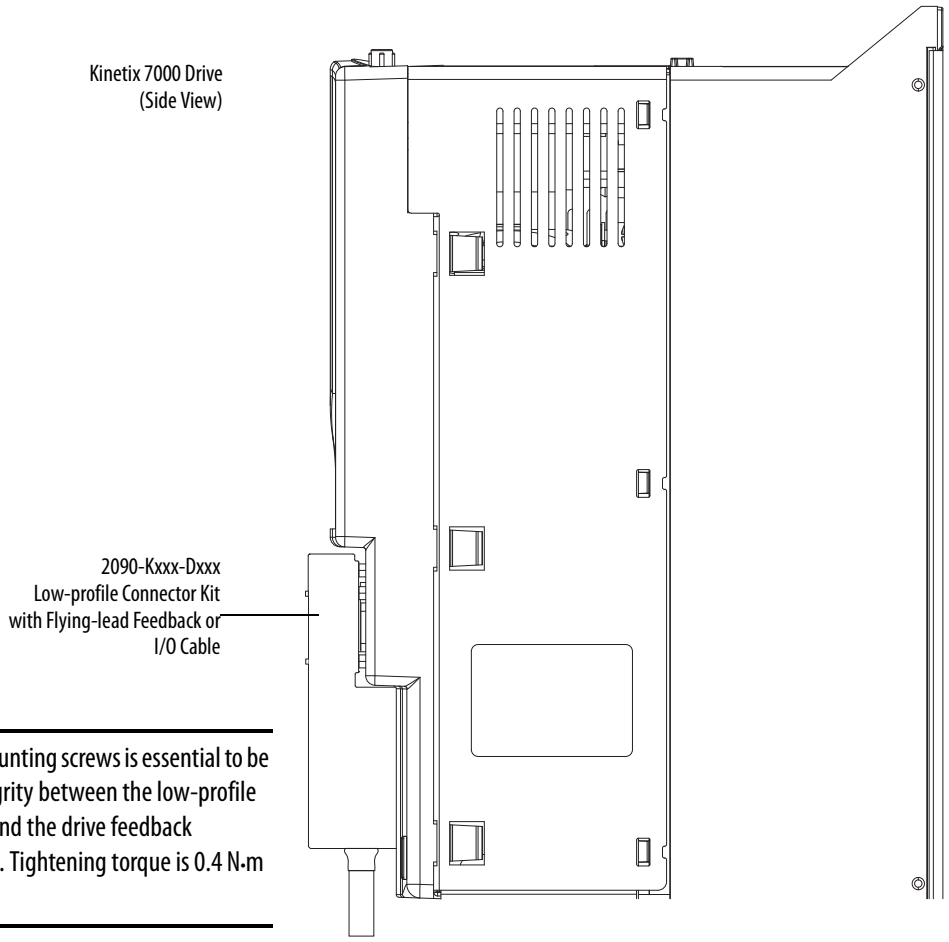


Wire Low-profile Connectors

Low-profile connectors (2090-K6CK-D*xxx*) are suitable for motor feedback (MF), auxiliary feedback (AF), and I/O connections (IOD) on Kinetix 7000 drive.

Table 49 - Low-profile Connector Kits

Connector Kit Cat. No.	Description	Cable Compatibility
2090-K7CK-KENDAT	Low-profile feedback module for connecting to Heidenhain EnDat high-resolution feedback device (15-pin, male, D-sub). Use with any Kinetix 7000 drive and Bulletin RDB direct-drive motor with EnDat high-resolution feedback. **NOTE:** Only 2099-BM*xx*-S drives with firmware revision 1.104 or higher support the use of this feedback module.	2090-XX*x*FMP-S*xx*, 2090-XXNFMF-S*xx*, 2090-CFBM*x*DF-C*x*A*xxx*
2090-K6CK-D15M	Low-profile connector kit for motor feedback (15-pin, male, D-sub). Use with any Kinetix 7000 drive and compatible motors.	
2090-K6CK-D15F	Low-profile connector kit for auxiliary feedback (15-pin, female, D-sub). Use with any Kinetix 7000 drive for auxiliary feedback applications.	Customer supplied
2090-K6CK-D26M	Low-profile connector kit for I/O (26-pin, male, D-sub). Use with any Kinetix 7000 drive or 2094-BL02 LIM module for making I/O connections.	



IMPORTANT Tightening the mounting screws is essential to be sure of shield integrity between the low-profile connector covers and the drive feedback connector D-shells. Tightening torque is 0.4 N•m (35 lb•in).

Figure 57 - Wiring (15-pin) Flying-lead Feedback Cable Connections 2090-K6CK-D15M and 2090-K6CK-D15F Connector Kits

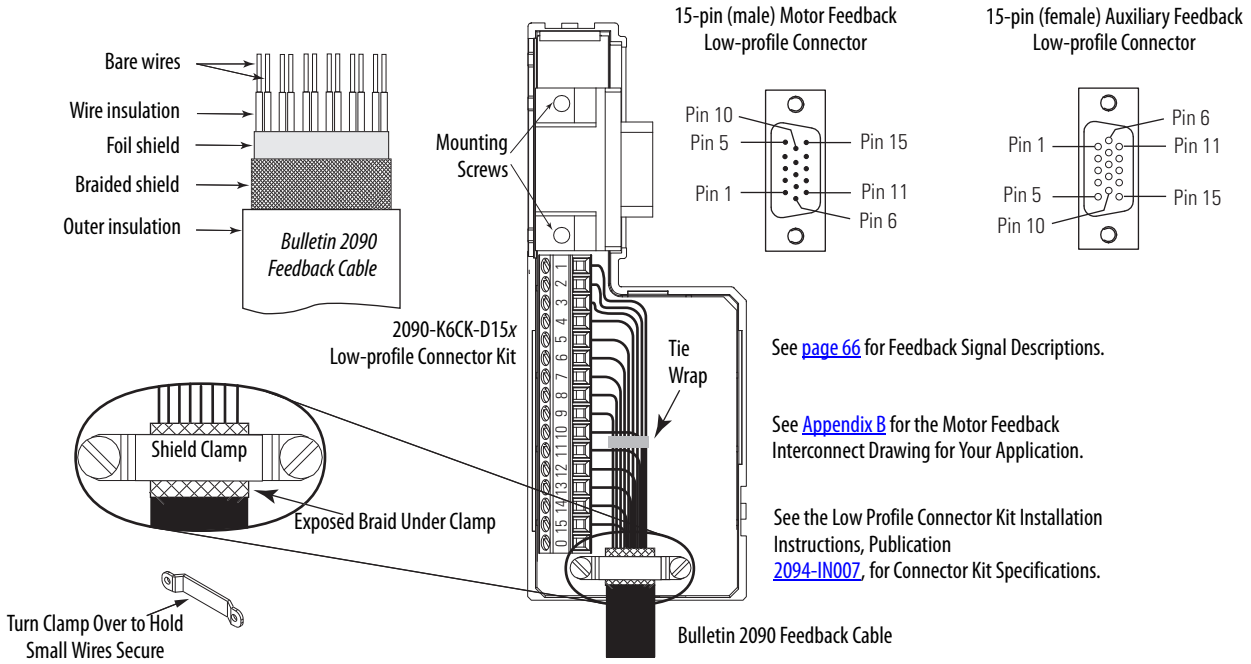
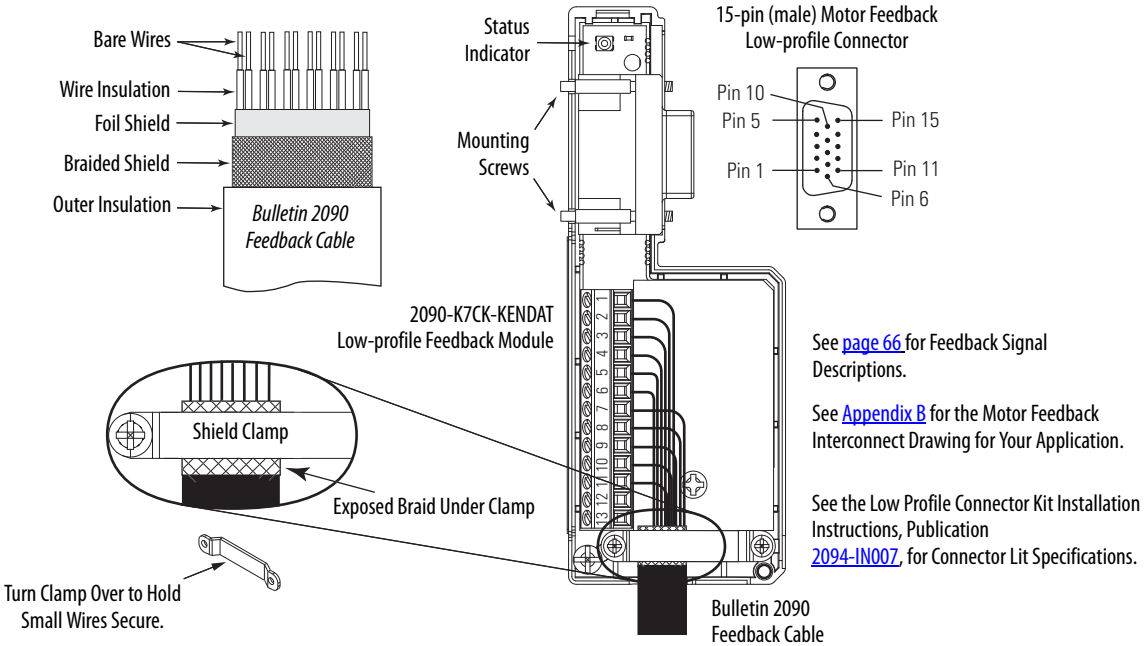


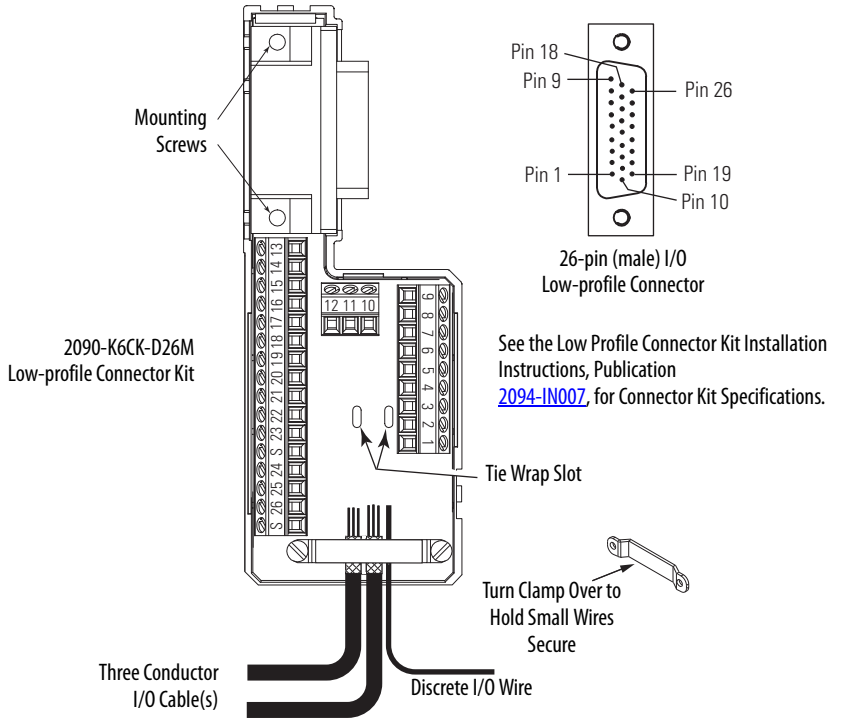
Figure 58 - Wiring (15-pin) Flying-lead Feedback Cable Connections 2090-K7CK-KENDAT Feedback Module



IMPORTANT The purpose of the cable shield clamp is to provide a proper ground and improve system performance, not stress relief.

Clamping the exposed braid under the shield clamp is critical. Turn the clamp over, if necessary, to be sure of a proper ground.

Figure 59 - Wiring (26-pin) I/O Cable Connections
2090-K6CK-D26M Connector Kit



IMPORTANT	The purpose of the cable shield clamp is to provide a proper ground and improve system performance, not stress relief. Clamping the exposed braid under the shield clamp is critical. Turn the clamp over, if necessary, to be sure of a proper ground.

External Shunt Module Connections

External active shunt modules listed in the table on page 158 are compatible with Kinetix 7000 drives. Follow these guidelines when wiring your external active shunt module kit.

- Refer to Shunt Resistor on page 37 for important wiring recommendations.
- Refer to Appendix B for the Kinetix 7000 drive interconnect diagrams.
- Refer to the installation instructions provided with your shunt module.

IMPORTANT	When tightening screws to secure the wires to the DC bus terminals, see Table 37 on page 91 for torque values.

SERCOS Fiber-optic Cable Connections

This procedure assumes you have your Logix SERCOS interface module/PCI card and Kinetix 7000 drive mounted and are ready to connect the fiber-optic cables.

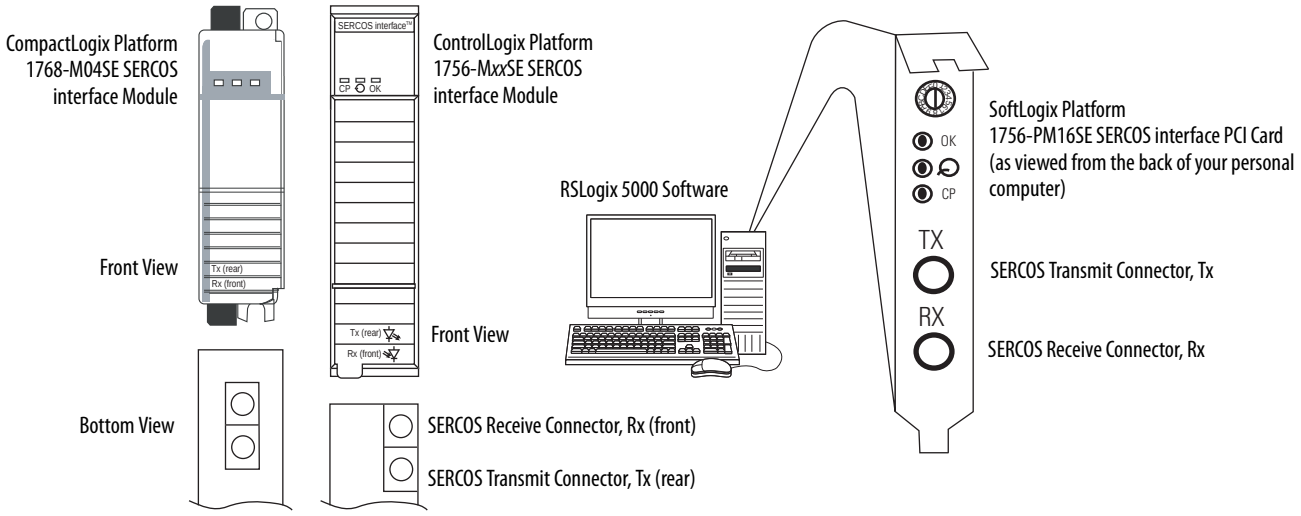
The SERCOS fiber-optic ring is connected using the SERCOS receive (Rx) and transmit (Tx) connectors.

See page 65 to locate the SERCOS connectors on your Kinetix 7000 drive. See the figure below to locate the connectors on your SERCOS interface module or PCI card.

Plastic cable is available in lengths up to 32 m (105 ft). Glass cable is available in lengths between 50 m (164 ft) and 200 m (656 ft).

IMPORTANT	When connecting Kinetix 7000 drives, use at least a 2090-SCEP1-0, 1 m (3 ft) or longer cable. Larger drives may require longer cables.

Figure 60 - CompactLogix, ControlLogix, and SoftLogix SERCOS Connector Locations

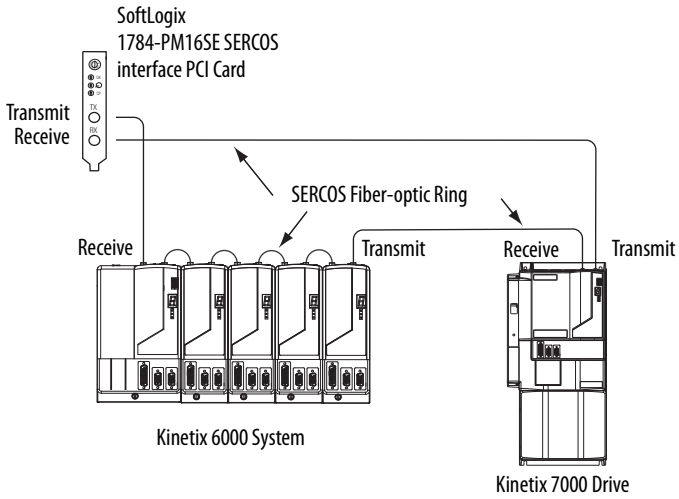


Connect the cable from transmit on the Logix module to receive on the Kinetix 7000 drive, then transmit to receive (drive to drive), and from transmit on the last drive back to receive on the Logix module.

ATTENTION: To avoid damage to the SERCOS Rx and Tx connectors use only finger-tight torque when attaching the fiber-optic cables to the Kinetix 7000 drive. Do not use a wrench or any other mechanical assistance.

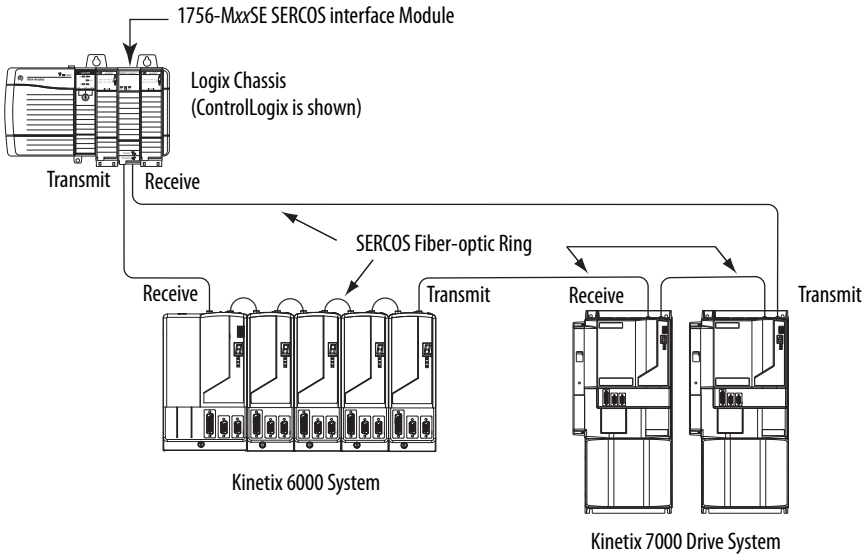
For more information, see the Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010.

Figure 61 - Fiber-optic Cable Connections to a SoftLogix Module



The following fiber-optic cable examples are shown using ControlLogix modules. CompactLogix modules connect in the same way, however the ring cannot include more than four drives.

Figure 62 - Fiber-optic Cable Connections to ControlLogix/CompactLogix Modules



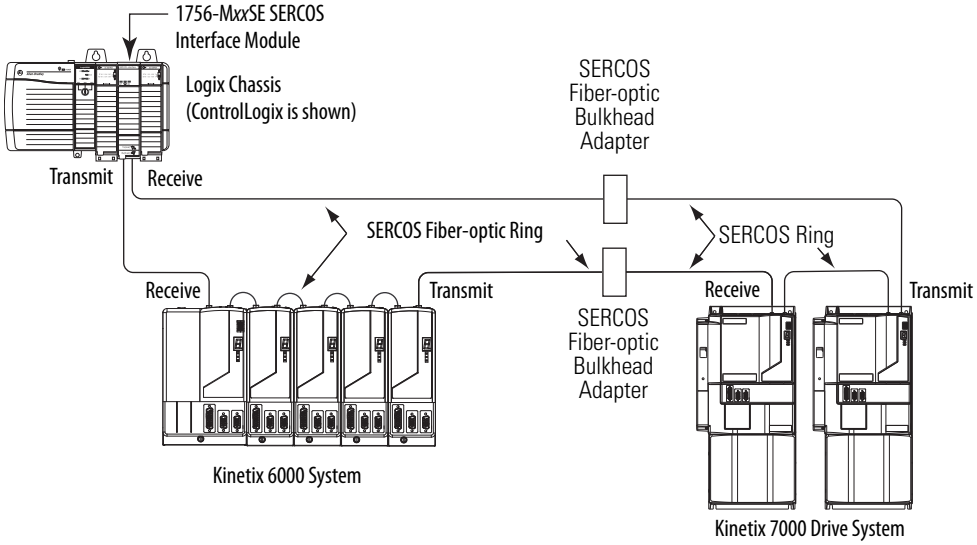
You can also mount the two Logix SERCOS modules in two separate chassis, or you can mount them in the same chassis.

IMPORTANT	Clean the fiber-optic cable connectors prior to installation. Dust in the connectors can reduce signal strength. See the Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010, for more information.

The following example depicts the second Kinetix system, consisting of Kinetix 7000 drives, located in a separate cabinet and connected with bulkhead adapters.

IMPORTANT To avoid signal loss, do not use bulkhead adapters to connect glass cables. Use bulkhead adapters for making plastic-to-plastic cable connections only.

Figure 63 - Fiber-optic Cable Connections (ControlLogix/CompactLogix)



Configure and Start the Kinetix 7000 Drive System

This chapter provides procedures for configuring your Kinetix 7000 system components with the Logix SERCOS module.

Before you begin, make sure you know the characteristics of the following system components.

- Logix processor
- Logix module(s), including the SERCOS module
- Kinetix 7000 drive(s) and accessories
- Servo motor(s)/actuator(s)
- transmission/load for the conversion constant

Configure the Drive Modules

Follow these steps to configure the Kinetix 7000 drive.

1. Verify that there is no power applied to the drive and that the SERCOS fiber-optic cables are plugged into the Tx and Rx connectors.

   To verify your fiber-optic cable connections, refer to page 103.

2. Set the base node address for the drive by setting the SERCOS Node Address switch.

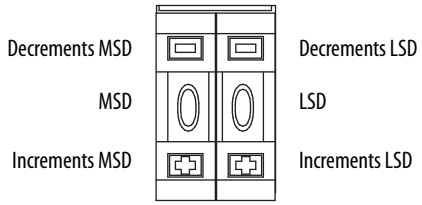
   Valid node addresses are 01...99. The left hand switch sets the most significant digit (MSD) and the right hand switch sets the least significant digit (LSD).

   Refer to the table and figure below for switch operation.

Table 49 - Node Addressing Switch Settings

To	Press
Increment the (MSD/LSD) node address	The plus (+) switch.
Decrement the (MSD/LSD) node address	The minus (-) switch.

Figure 63 - N ode Addressing Switch Settings



IMPORTANT When two or more drives are connected to the same SERCOS interface module, each node address must be unique.

Refer to the node addressing examples beginning on page 110.

3. Cycle control power to initialize the drive.

IMPORTANT The base node address setting takes effect only after the drive is initialized.

4. Set the SERCOS communication rate using DIP switches 2 and 3.

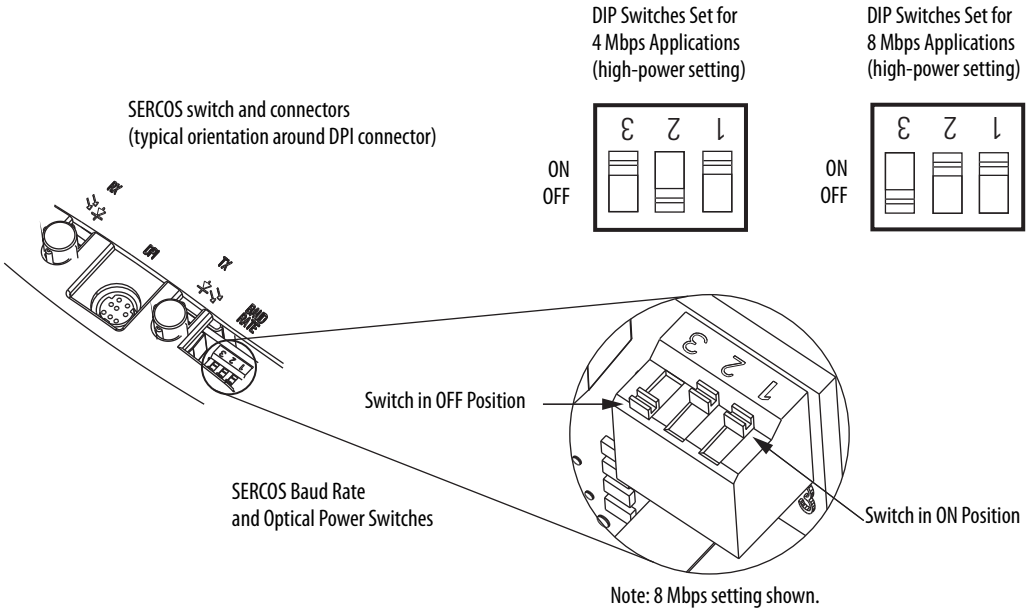
For This Communication Rate	Set Switch 2	Set Switch 3
4 Mbps	OFF	ON
8 Mbps	ON	OFF

5. Set the SERCOS optical power level to High using DIP switch 1.

For This Optical Power Level	Set Switch 1
Low	OFF
High	ON

IMPORTANT All drives on the SERCOS ring must have the same baud rate and power setting.

Figure 64 - SERCOS DIP Switch Settings and Locations

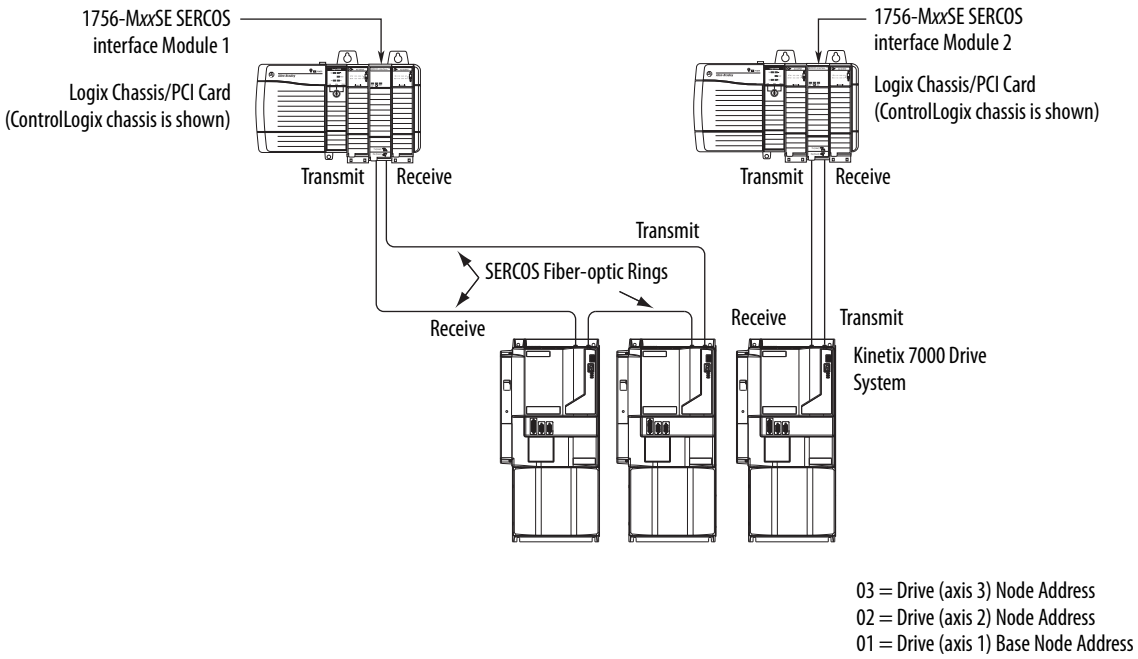


6. Repeat Steps 4 and 5 for each Kinetix 7000 drive.

Node Addressing Examples

The examples below illustrate how each axis in the fiber-optic ring is assigned a node address. The ControlLogix platform is used in the examples, but the node addressing is typical for Logix platforms.

Figure 65 - Node Addressing Example 1

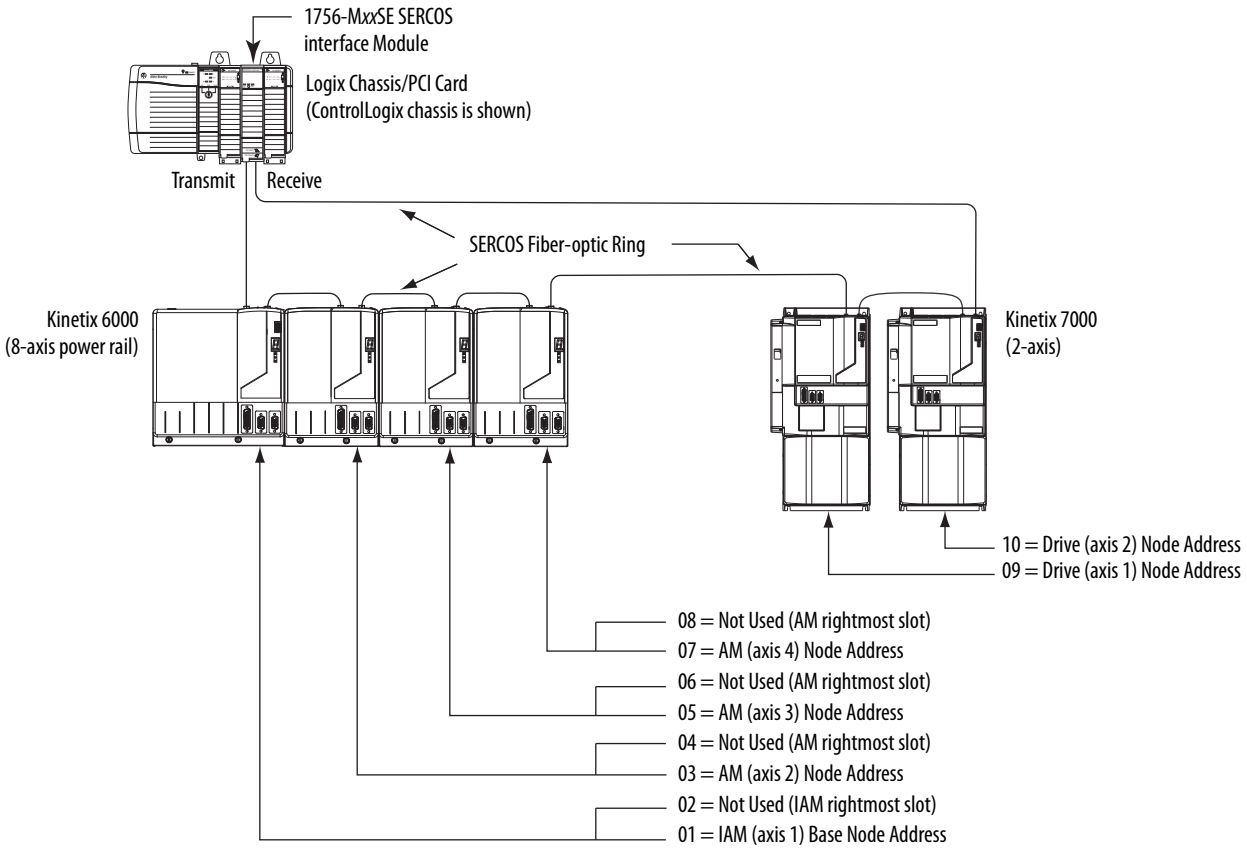


In this example, SERCOS interface module 1 controls Kinetix 7000 axes 1 and 2. SERCOS interface module 2 controls Kinetix 7000 axis 3.

TIP You can mount the two SERCOS interface modules in two separate Logix chassis (as shown above) or you can mount them in the same chassis.

Utilizing two SERCOS interface modules to control axes from a single Kinetix 7000 drive lets you reduce cycle times.

Figure 66 - Node Addressing Example 2



In this example, a Kinetix 6000 (8-axis) power rail contains a double-wide IAM, and three double-wide AMs.

The leftmost slot of a double-wide module determines the node address. So, in the example above, node addresses 02, 04, and 06 (the rightmost slots of the double-wide modules) are not used.

The Kinetix 7000 (2-axis) drive system contains two drives. The base node address of the system must be set for an address of ≥ 9.

Configure the Logix SERCOS interface Module

This procedure assumes that you have wired your Kinetix 7000 system and set the Kinetix 7000 baud rate and optical power switches.

IMPORTANT For the Kinetix 7000 drive to communicate with the SERCOS interface module (indicated by three solid-green status indicators on the SERCOS module), your RSLogix 5000 software must be revision 15.0 or later.

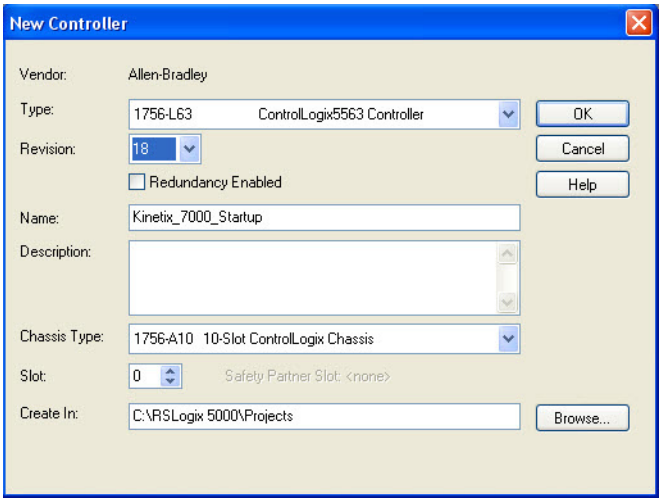
For resources on using RSLogix 5000 software as it applies to configuring the ControlLogix, CompactLogix, or SoftLogix SERCOS modules, refer to Additional Resources on page 9.

Configure the Logix Controller

Follow these steps to configure the Logix controller.

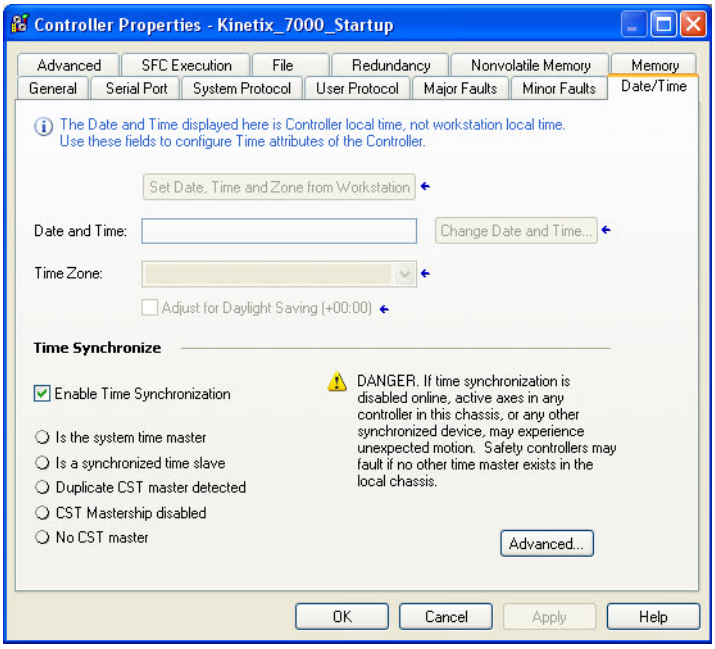
1. Apply power to your Logix chassis containing the SERCOS interface module and open your RSLogix 5000 software.
2. From the File menu, choose New.

   The New Controller dialog box opens.



3. Configure the controller.
   a. From the Type pull-down menu, choose the controller type.
   b. From the Revision pull-down menu, choose the revision.
   c. Type the file Name.
   d. From the Chassis Type pull-down menu, choose the chassis.
   e. Choose the Logix processor Slot.
4. Click OK.
5. From the Edit menu, choose Controller Properties.

The Controller Properties dialog box opens.



6. Click the Date/Time tab.
7. Check Enable Time Synchronization.

   This assigns the controller as the Grandmaster clock. The motion modules set their clocks to the module you assign as the Grandmaster.

IMPORTANT	You can assign only one module in the Logix chassis as the Grandmaster clock.

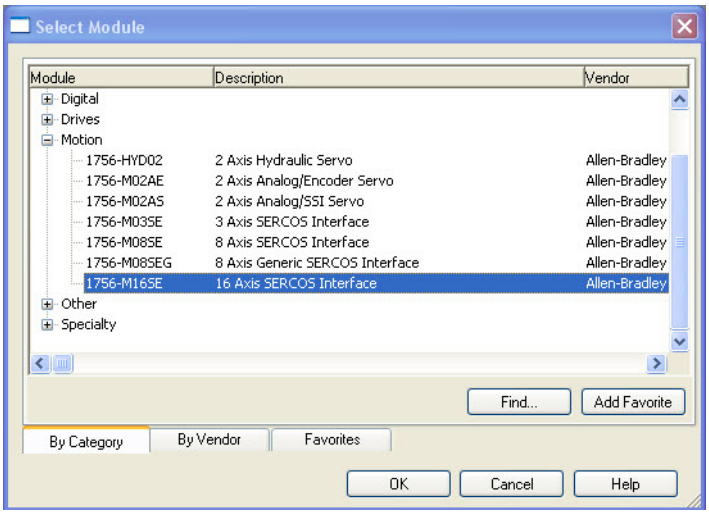
8. Click OK.

Configure the SERCOS Module

Follow these steps to configure the SERCOS module.

1. Right-click on I/O Configuration in the Controller Organizer and choose New Module.

   The Select Module dialog box opens.

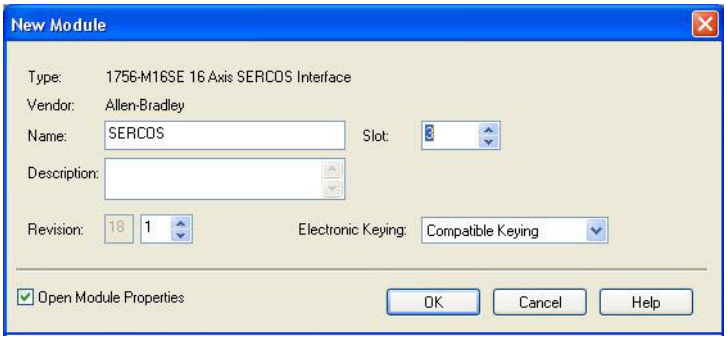


2. Expand the Motion category and select 1756-M*xx*SE, 1756-L60M03SE, 1768-M04SE, or 1784-PM16SE as appropriate for your actual hardware configuration.

   In this example, the 1756-M16SE module is selected.

3. Click OK.

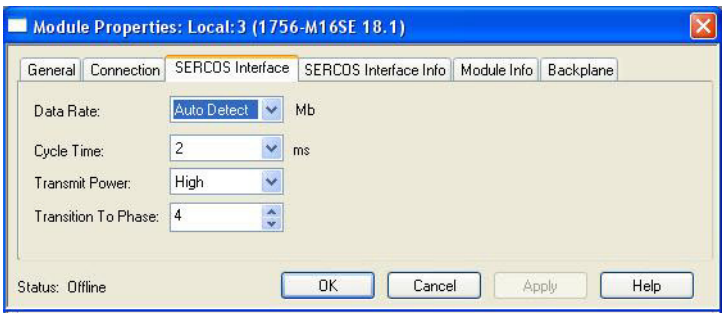
   The New Module dialog box opens.



4. Configure the module.
   a. Type the module Name.
   b. Enter the Logix SERCOS module slot (leftmost slot = 0).
   c. Check Open Module Properties.
5. Click OK.

Your new module appears under the I/O Configuration folder in the Controller Organizer and the Module Properties dialog box opens.

6. Click the SERCOS Interface tab and reference the table below.



Logix SERCOS Module	Number of Axes	Data Rate
1756-M03SE or 1756-L60M03SE	Up to 3	4 or 8 Mbps
1756-M08SE	Up to 8	
1756-M16SE or 1784-PM16SE	Up to 16	
1768-M04SE	Up to 4	

7. Verify that the Data Rate setting matches DIP switches 2 and 3 (communication rate) as set on the drive, or use the Auto Detect setting.
8. From the Cycle Time pull-down menu, choose the Cycle Time according to the following table.

Data Rate	Number of Axes	Cycle Time
4 Mbps	Up to 2	0.5 ms
	Up to 4	1 ms
	Up to 8	2 ms
	No support for axes 9...16	
8 Mbps	Up to 4	0.5 ms
	Up to 8	1 ms
	Up to 16	2 ms

TIP The number of axes/module is limited to the number of axes as shown in step 6.

9. Verify that the Transmit Power setting (high) matches the Optical Power DIP switch 1 as set on the drive.
10. Enter the Transition to Phase setting.

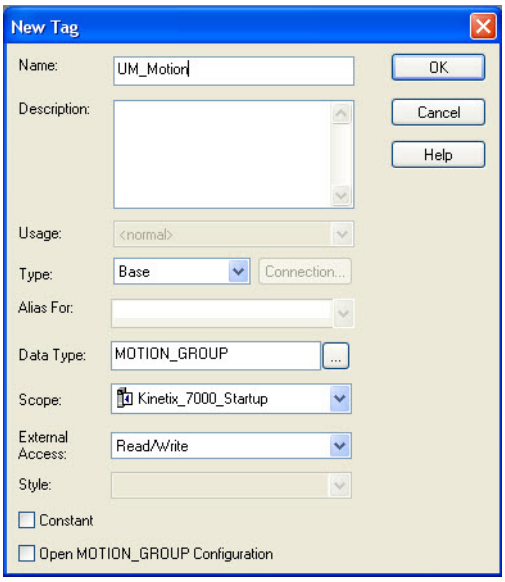
    The Transition to Phase default setting is 4 (phase 4). The Transition to Phase setting stops the ring in the phase specified.
11. Click OK.
12. Repeat steps 1...11 for each SERCOS module.

Configure the Motion Group

Follow these steps to configure the motion group.

1. Right-click Motion Groups in the Controller Organizer and choose New Motion Group.

   The New Tag dialog opens.

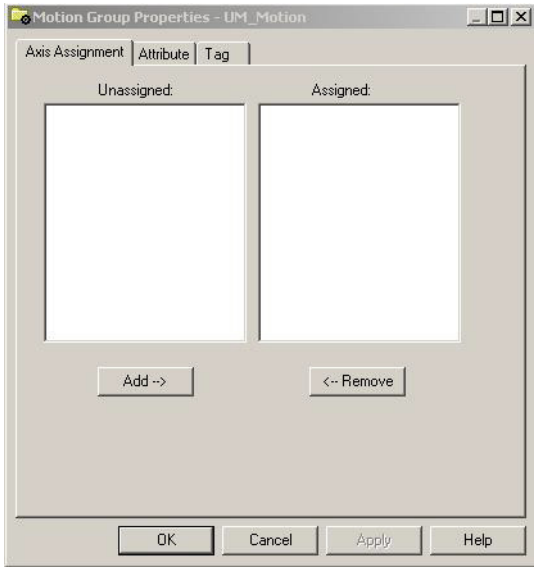


2. Type the new motion group Name.
3. Click OK.

   The new motion group appears under the Motion Groups folder.

4. Right-click the new motion group and select Properties.

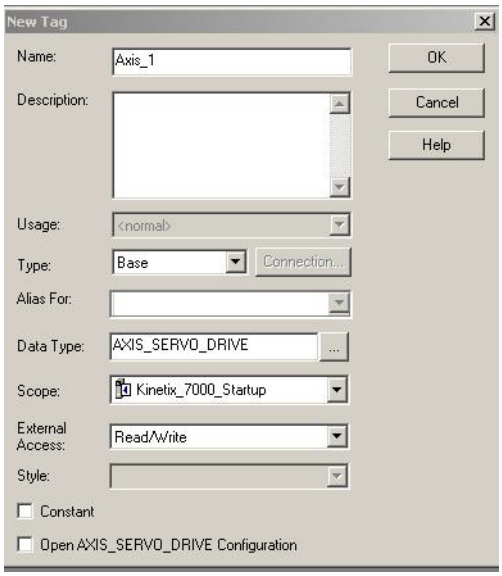
   The Motion Group Properties dialog box opens.



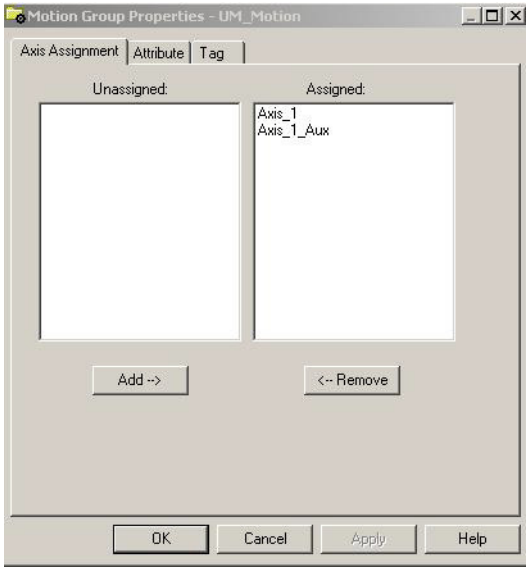
No axis have been created yet. For this setup, a servo axis named Axis_1 and a feedback only axis named Axis_1_Aux will be created. Both axes will be assigned to the Kinetix 7000 axis in the Configure the Kinetix 7000 Drive Modules section.

5. Right-click the Motion group name created and select New Axis.
6. Select an Axis_Servo_Drive (SERCOS controlled axis).

   The New Tag dialog opens.

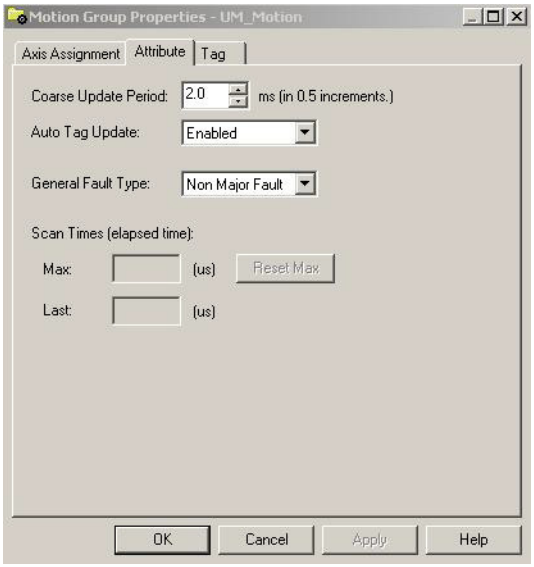


7. Type Axis_1 (or the name of your axis) in the Name field. Axis_Servo_Drive is the correct Data Type.
8. Click Ok.
9. Repeat steps 5 and 6 above for the Axis_1_Aux Feedback Only axis.
10. Right-click on the Motion Group name created and select Properties.



Both Axis_1 and Axis_1_Aux are Assigned to the Motion Group. This means both axis will be part of the SERCOS and Motion planner updates from/to the controller/SERCOS card/drive.

11. Open the Attribute folder.



The Motion Planner coarse update period must be set according to the application needs. Guidelines for the coarse update period for the processor used and the number of servo drive axes created in the motion group can be found in the following resources.

- Rockwell Automation Knowledgebase at: http://www.rockwellautomation.com/knowledgebase/
- SERCOS and Analog Motion Configuration and Startup User Manual, publication MOTION-UM001
- The various Logix controller user manuals

Only 1 Motion group per processor is allowed.

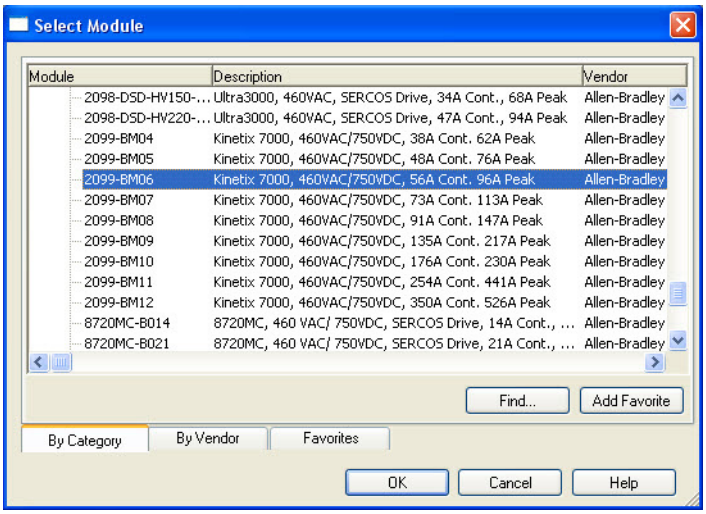
12. Click Ok.

Configure the Kinetix 7000 Drive Modules

Follow these steps to configure the Kinetix 7000 drive modules.

1. Right-click the Logix module you just created and choose New Module.

   The Select Module dialog box opens.

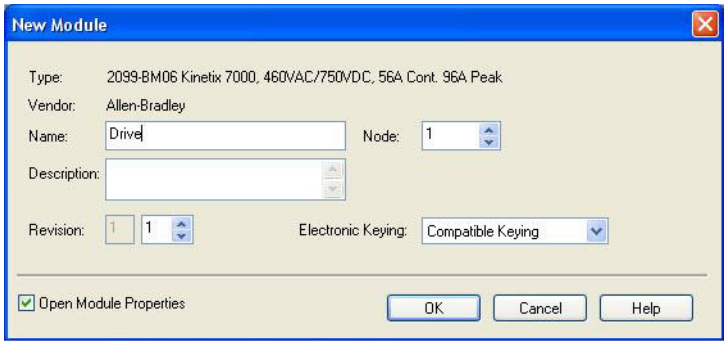


2. Expand the Drives category and select your drive as appropriate for your actual hardware configuration.

IMPORTANT In order for the Kinetix 7000 drive to communicate with the SERCOS interface module (indicated by three solid-green status indicators on the SERCOS module), your RSLogix 5000 software must be revision 15.0 or later.

3. Click OK.

   The New Module dialog box opens.

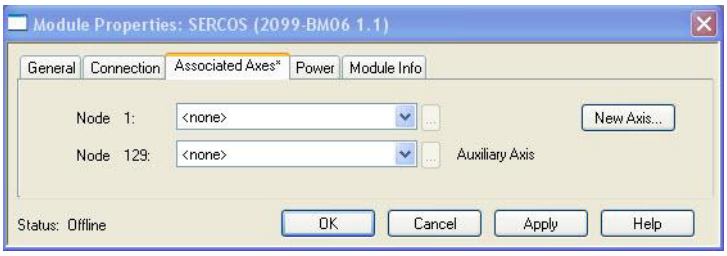


4. Configure the new drive module.
   a. Type the module Name.
   b. Enter the Node address.

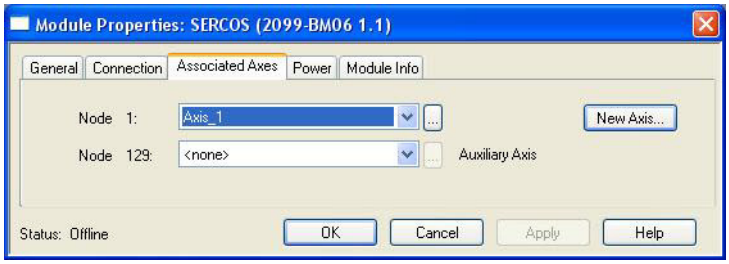
Set the node address in the software to match the node setting on the drive. Refer to Configure the Drive Modules, step 2, on page 108.

c. Check Open Module Properties.

5. Click OK.
6. Select the Associated Axes tab.



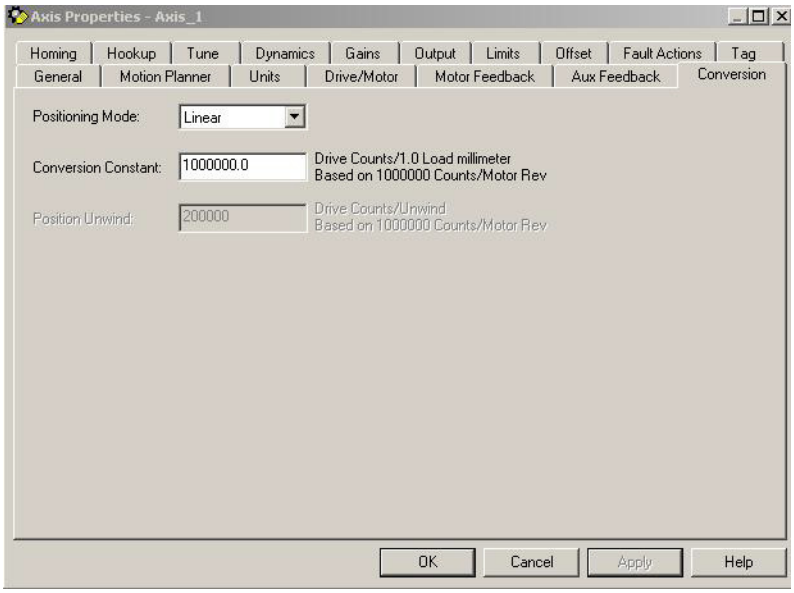
7. Assign Axis_1 to Node 1 in the Associated Axis folder. This assigns Axis 1 in the motion group to the Kinetix 7000 drive at node address 1. Select the Associated Axes tab.



8. Click Apply.
9. Click ... next to Axis_1.

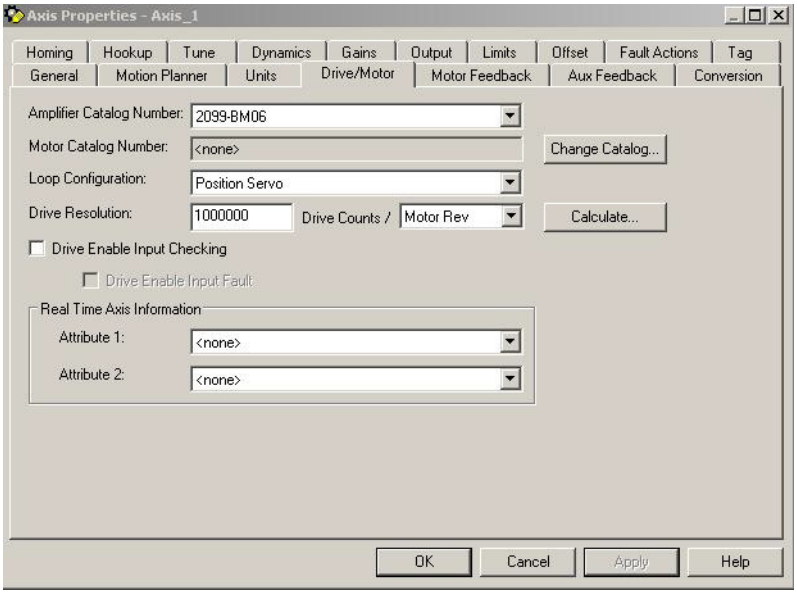
   The Axis Properties dialog box opens on the General tab.
10. Select the Units tab.
11. Select the correct position units to be used in your application. This example uses load millimeter.

12. Select the Conversion tab. Based on the type of application, the system can be configured for a linear or rotary system. To simplify the setup, a linear system is utilized. The calculate tool on the Drive/Motor tab will be used to set the drive resolution and conversion constant. If a rotary system is used, the Drive/Motor tab calculate tool will be used to set the drive resolution, conversion constant, and position unwind.



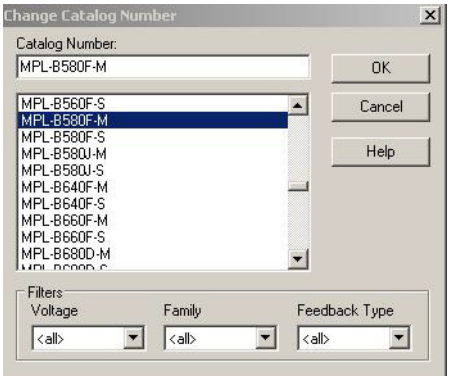
13. Click Apply.

14. Select the Drive/Motor tab.

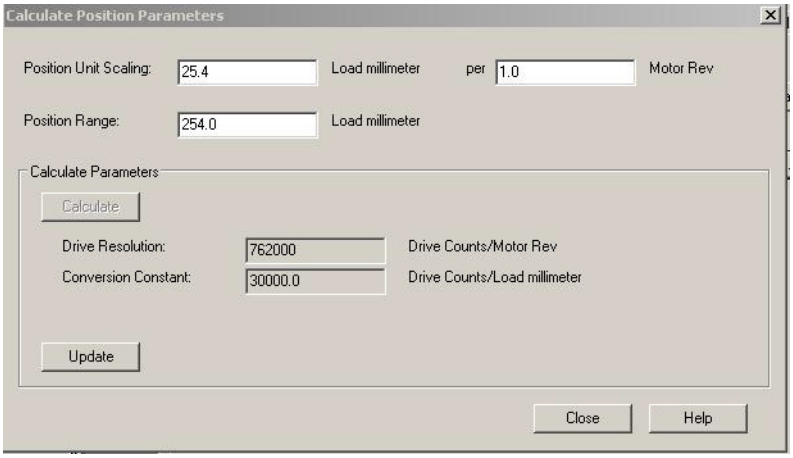


15. Click Change Catalog in order to select the appropriate motor for configuration.

16. The Change Catalog Number dialog box appears.

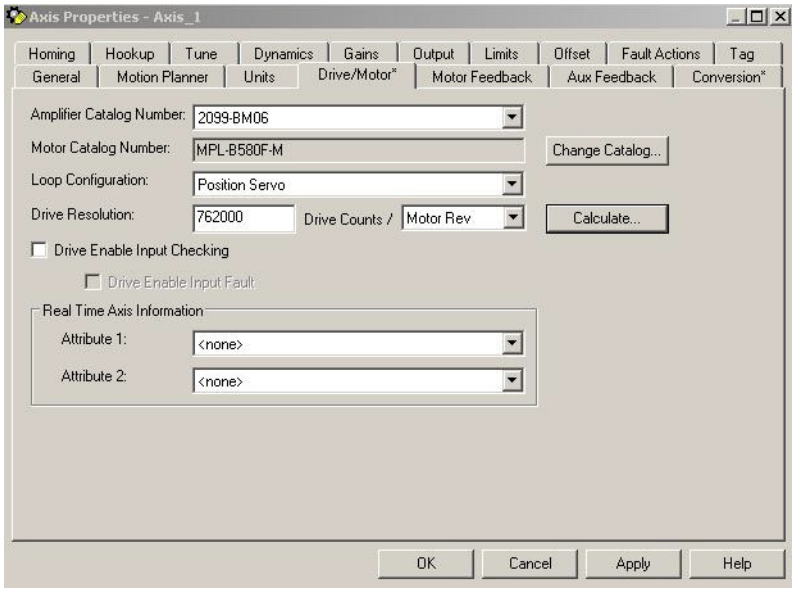


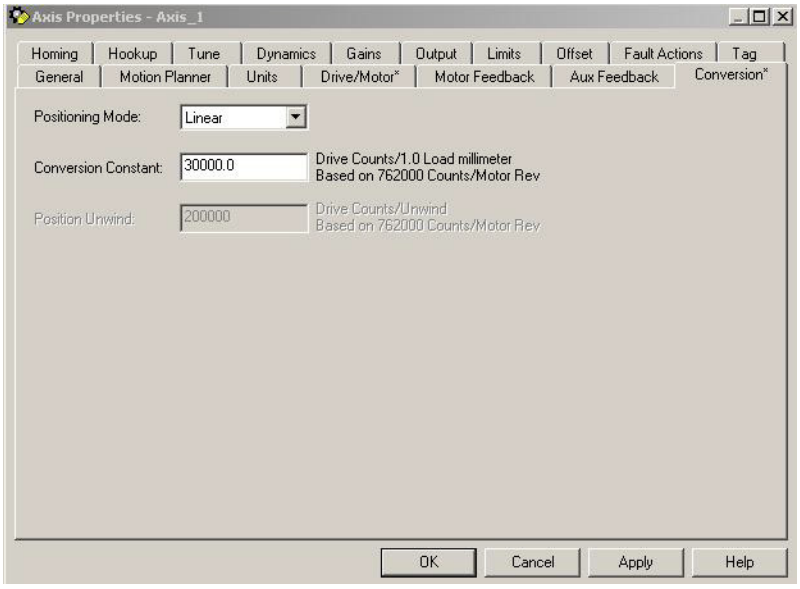
17. Select the appropriate motor catalog number for your application. It is important to verify the motor catalog number on the motor nameplate as well as in your design specification.
18. Click OK.
19. Click Calculate, to configure the drive resolution and conversion constant. The position unwind is also calculated if rotary load is used.
20. In this example, a linear load is used and a 25.4 mm (1 in.) movement on a ballscrew is made with every 1 motor revolution. The total position movement on the ballscrew is 254 mm (9.8 in.).



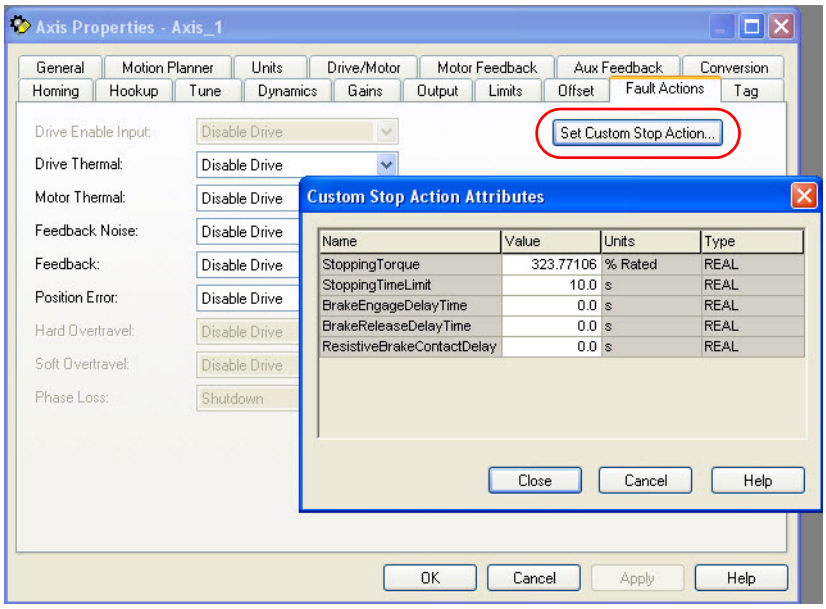
21. Click Update.
22. Click Close.
23. The Drive Enable Input Checking is selected by default. When checked (default) a hard drive enable input signal on the IOD connector (pin 2) is required. Uncheck Drive Enable Input Checking if a hard drive enable input signal is not required.

The Drive/Motor tab and Conversion tabs should look similar to these examples or reflect your application configuration.





24. Click the Fault Actions tab.



25. Click Set Custom Stop Action.

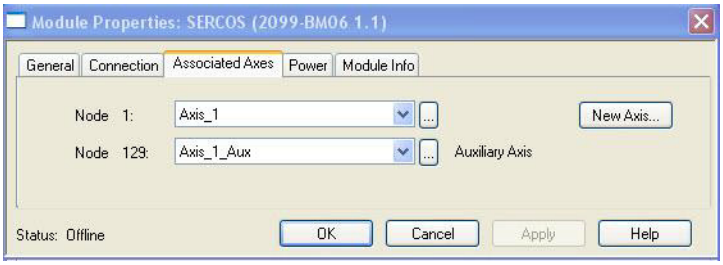
    The Custom Stop Action Attributes dialog box opens and lets you set delay times for servo motors with a brake and resistive brake modules. For recommended motor brake delay times, refer to refer to the Kinetix Motion Control Selection Guide, publication GMC-SG001.

26. Configure the delay times.
    a. Type the Brake Engage Delay Time.
    b. Type the Brake Release Delay Time.
    c. Set the Resistive Brake Contact Delay time (0...1000 ms range).
    d. Click Close.

27. Click OK.

28. In the Module Properties > Associated Axes tab, select the auxiliary axis Axis_1_Aux and click Apply.

TIP The base node is the servo axis utilizing the motor feedback, and the base node (plus 128) is a feedback-only axis utilizing the auxiliary feedback port (as shown below).

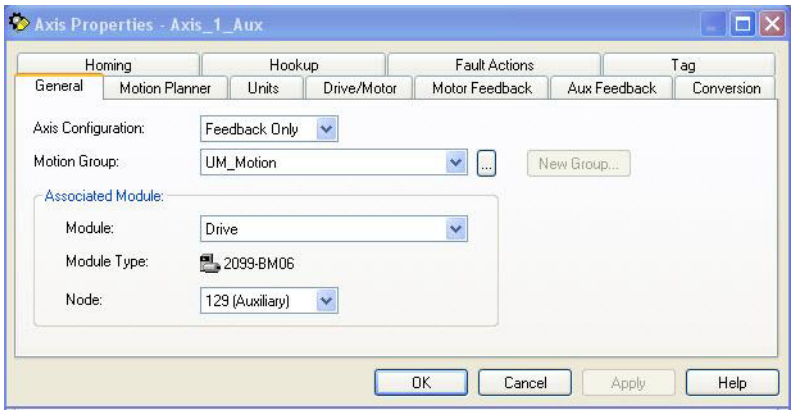


Axis_1_Aux is configured similar to Axis_1, except that only a feedback device is configured.

29. Configure the Auxiliary Axis properties. Click ... next to Axis_1_Aux.

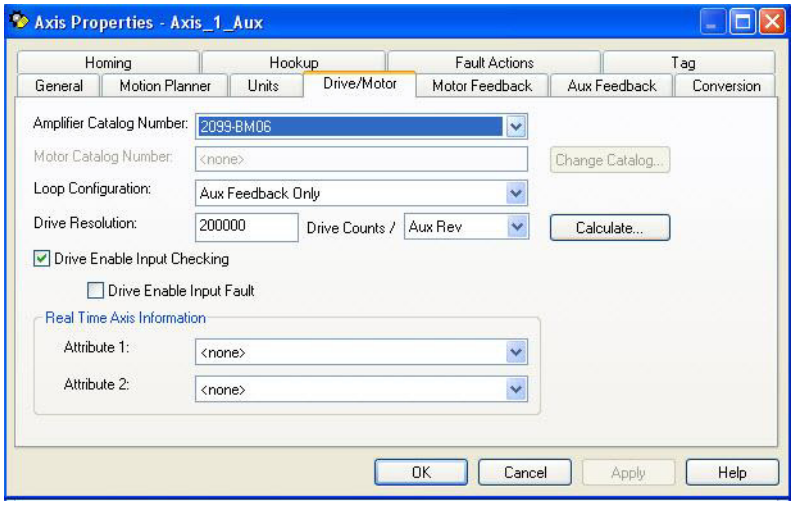
    The Axis Properties dialog box opens on the General tab.

    If an axis is associated to the auxiliary axis node, set the Axis Configuration on the General tab of the Axis Properties dialog box to Feedback Only.

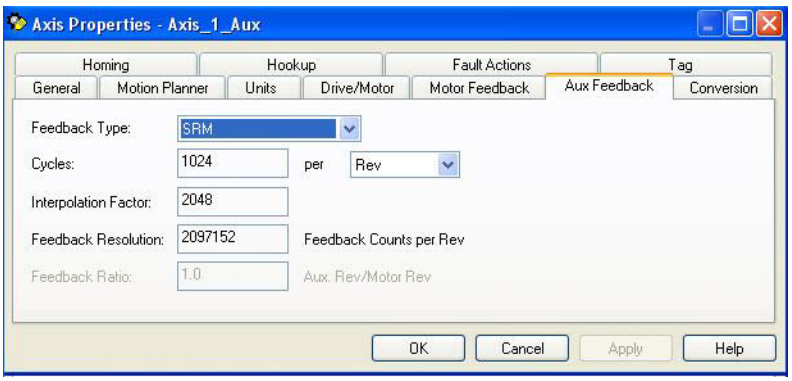


30. Select the Units tab and configure the same as in steps 10...13 of this procedure.
31. Select the Conversion tab and configure the same as in steps 10...13 of this procedure.
32. Select the Drive/Motor tab.

    The Drive/Motor tab displays the amplifier being used and the Loop Configuration is Aux Feedback Only. This is the only choice if the amplifier is using the primary node for Servo (motor) configuration.

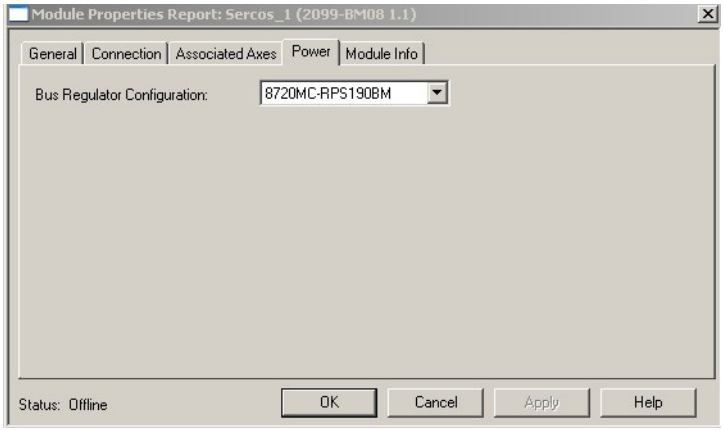


33. Configure the drive resolution / conversion constant (position unwind, if rotary) as in step 19...22 of this procedure.
34. Click the Aux Feedback tab.



IMPORTANT The Aux Feedback tab must be configured for the auxiliary feedback type being used. In this example, an SRM feedback device is being used.

35. From the Feedback Type pull-down menu, choose the feedback type appropriate for your auxiliary feedback motor.
36. Click Apply.
37. Click OK.
38. In the Module Properties, click the Power tab.



39. From the Bus Regulator Configuration pull-down menu, choose the component appropriate for your actual hardware configuration. Note: The Kinetix 7000 drive internal dynamic brake IGBT is not utilized by the drive main control for bus regulation therefore any type of regulation must come from an external source.

If your drive requires	Then choose
No bus regulator configuration	<none>
External Shunt configuration	1336-MOD-KB005, KB010 or KB050 1336-WB009, WB035 or WB110 (1)
External regeneration power supply	8720MC-RPS027, 8720MC-RPS065, or 8720MC-RPS190 (2)(3)(4)

(1) External shunt configuration 1336 MOD-KB*xxx* and 1336-WB*xxx* are no longer available for new sale but are selectable as of this manual release.
(2) 8720MC-RPS*xxx* is an external regenerative converter system used to regulate the DC bus connected to the Kinetix 7000 drive. Selecting this device will require the Kinetix 7000 drive GPIO terminal block pins 7 and 8 to be wired. See Figure 74 on page 167 for an example.
(3) 8720MC-RPS027BM-HV1 is no longer available for sale.
(4) 8720MC-RPS065BM-HV1 has been superseded by 8720MC-RPS065BM-HV2.

40. Click OK.
41. Repeat steps 1...27 for each additional axis.
42. Verify your Logix program and save the file.

Download the Program

After completing the Logix configuration you must download your program to the Logix processor.

Apply Power to the Drive

This procedure assumes that you have completed the following tasks:

- Wired your Kinetix 7000 drive.
- Connected your Logix controller, SERCOS interface module fiber-optic connections to your Kinetix 7000 drive.
- Configured and verified a RSLogix 5000 program.
- Connected the motor power and motor feedback cables to your Kinetix 7000 drive.

SHOCK HAZARD: To avoid hazard of electrical shock, complete all mounting and wiring prior to applying power. Once power is applied, connector terminals may have voltage present even when not in use.

Refer to the Line Interface Module Installation Instructions, publication 2094-IN005, when troubleshooting the LIM status indicators, and for the location of LIM circuit breakers, connectors, and status indicators.

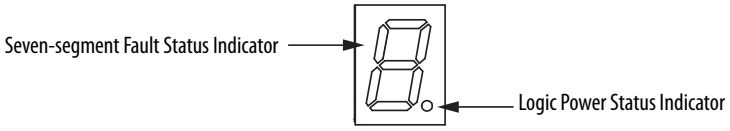
Follow these steps to apply power to the Kinetix 7000 system.

ATTENTION: To avoid personal injury or damage to equipment, disconnect the load to the motor. Make sure each motor is free of all linkages when initially applying power to the system.

1. Determine your source of control power.

If Your Control Power	Then
Is sourced from a LIM module	1. Verify that the LIM CB1, CB2, and CB3 are in the OFF position. 2. Apply three-phase input power to the LIM VAC Line connector. 3. Set CB3 to the ON position. 4. Set CB2 to the ON position. 5. Go to main step 2.
Is not sourced from a LIM module	1. Apply 24V DC control power to the drive (CP connector). 2. Go to main step 2.

2. Verify the status of the drive logic power status indicator.



If the Logic Power Status Indicator is	Then
ON	Go to step 3.
Not ON	1. Check your control power connections. 2. Go back to main step 1.

3. Define the three-phase input power as described below.

If Your Three-phase Power	Then
Is sourced from a LIM module	1. Set the LIM CB1 to the ON position. 2. Verify that the LIM, IPL, and OPL connections for phase-to-phase voltage is 324…528V AC (460V). 3. Verify that the input voltage at terminals R (L1), S (L2), and T (L3) on the Kinetix 7000 drive is 324…528V AC (460V). 4. If used, verify that the Kinetix 7000 drive Hardware Enable Input signal (IOD pin 2) for each axis is off. 5. Go to main step 4.
Is not sourced from a LIM module	1. Apply 324...528V AC (460V) input power to the Kinetix 7000 drive R (L1), S (L2), and T (L3) input terminals. 2. If used, verify that the Kinetix 7000 drive Hardware Enable Input signal (IOD pin 2) is off. 3. Go to main step 4.

4. Observe the seven-segment fault status indicator display on the drive.

   The status indicator will first flash the SERCOS node address, then cycle through phases until final configuration (phase 4) is reached.

Kinetix 7000 Drive Status Indicator	Status	Do This
Actively cycling (phase 0)	The drive is looking for a closed SERCOS ring. Wait for phase 1 or take corrective action until you reach phase 1.	Check fiber-optic connections.
Displaying a fixed 1 (phase 1	The drive is looking for active nodes. Wait for phase 2 or take corrective action until you reach phase 2.	Check node addressing.
Displaying a fixed 2 (phase 2)	The drive is configuring nodes for communication. Wait for phase 3 or take corrective action until you reach phase 3.	Check program motor and drive configuration against installed hardware.
Displaying a fixed 3 (phase 3)	The drive is configuring device specific parameters. Wait for phase 4 or take corrective action until you reach phase 4.	Check motor catalog number against selection. (1)
Displaying a fixed 4 (phase 4)	The drive is configured and active.	Go to step 5.
Flashing an E followed by two numbers	Drive is faulted.	Go to Error Codes on page 140.

(1) To get diagnostic information from the module, highlight the module name in RSLogix 5000 software. A Pseudo Key Failure often indicates that the motor selection does not match the motor installed.

5. Observe the three status indicators on the front of the drive.

Status Indicator	Condition	Status	Do This
Drive	Off	Normal condition	Observe the Comm status LED.
	Steady red	Drive is faulted	Go to Status Indicators on page 145.
Comm	Flashing green	Establishing communication with network	Wait for steady green.
	Steady green	Communication is ready	Observe the Bus status LED
	Off	No ring present	Go to Interpret Error Codes and Status Indicators on page 140.
Bus	Steady green	Axis is enabled when status should be disabled	1. Verify Hardware Enable Input (IOD-2) is open. 2. Verify MSO instruction is not commanded in RSLogix 5000 software. 3. Return to Apply Power to the Drive on page 128.
	Flashing green (1)	Bus is up, axis is disabled (normal status)	Go to step 6.
	Off	DC bus is not present	Go to Status Indicators on page 145.

(1) The follower drive has a 2.5 second delay after DC bus voltage is applied before the Bus Status LED begins flashing. This provides the common bus leader time to complete precharge.

6. Observe the three SERCOS status indicators on the SERCOS module.

SERCOS Status Indicators	Status	Do This
Flashing green and red	Establishing communication	Wait for steady green on all three LEDs.
Steady green	Communication is ready	Go to Test and Tune the Axes on page 131.
Not flashing green and red/ not steady green	SERCOS module is faulted	Go to the appropriate Logix manual for specific instructions and troubleshooting.

Test and Tune the Axes

This procedure assumes that you have configured your Kinetix 7000 drive, your SERCOS interface module, and applied power to the system.

For help using RSLogix 5000 software as it applies to testing and tuning your axes with ControlLogix, CompactLogix, or SoftLogix SERCOS modules, refer to Additional Resources on page 9.

Test the Axes

Follow these steps to test the axes.

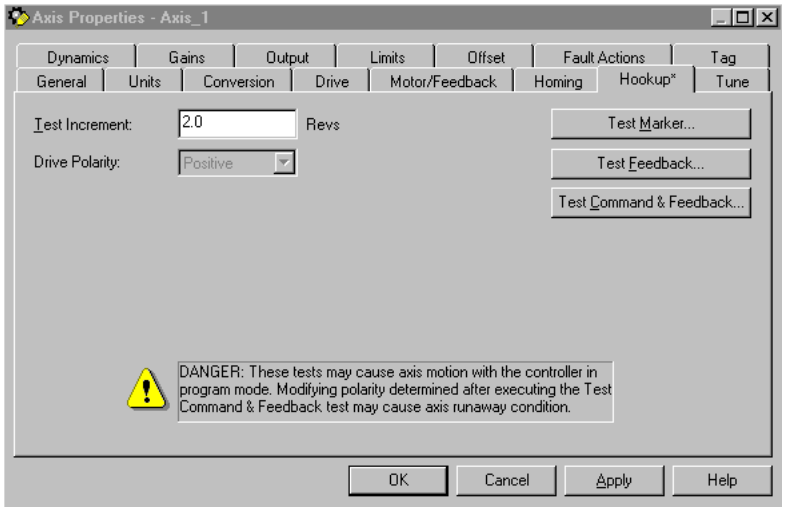
1. Verify the load was removed from each axis.

> **ATTENTION:** To reduce the possibility of unpredictable motor response, tune your motor with the load removed first, then reconnect the load and perform the tuning procedure again to provide an accurate operational response.

2. Right-click an axis in your Motion Group folder and choose Properties.

   The Axis Properties dialog box opens.

3. Click the Hookup tab.



4. Type 2.0 as the number of revolutions for the test or another number more appropriate for your application.

This Test	Performs this Test
Test Marker	Verifies marker detection capability as you rotate the motor shaft.
Test Feedback	Verifies feedback connections are wired correctly as you rotate the motor shaft.
Test Command & Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate. Also, lets you define polarity.

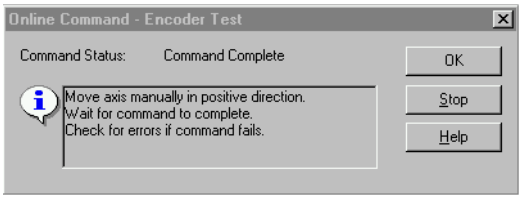
5. If Drive Enable Input Checking was selected in step 18 of the Configure the Kinetix 7000 Drive Modules section, apply Hardware Enable Input signal (IOD-2) for the axis you are testing.

ATTENTION: To avoid personal injury or damage to equipment, apply 24V ENABLE signal (IOD-2) only to the axis you are testing.

ATTENTION: The drive will enable the power module at the appropriate time during hookup and autotune.

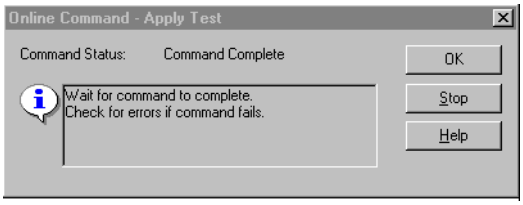
6. Select the Test (Marker/Feedback/Command & Feedback) to verify connections.

   The Online Command dialog opens. Follow the on-screen test instructions. When the test completes, the Command Status changes from Executing to Command Complete.



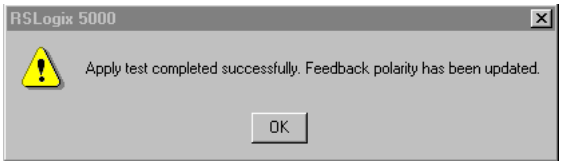
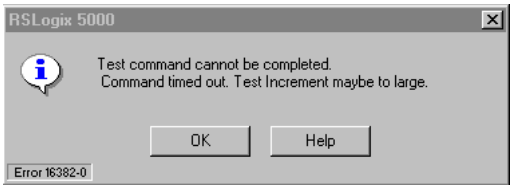
7. Click OK.

   The Online Command - Apply Test dialog opens (Feedback and Command & Feedback tests only). When the test completes, the Command Status changes from Executing to Command Complete.



8. Click OK.

9. Determine if your test completed successfully.

If	Then
Your test completes successfully, this dialog box opens. 	1. Click OK. 2. Remove Hardware Enable Input signal (IOD-2). 3. Go to Tune the Axes on page 133.
Your test failed, this dialog box opens. 	1. Click OK. 2. Verify the Bus Status LED turned solid green during the test. 3. Verify that the Hardware Enable Input signal (IOD-2) is applied to the axis you are testing. 4. Verify conversion constant entered in the Conversion tab. 5. Return to main step 6 and run the test again.

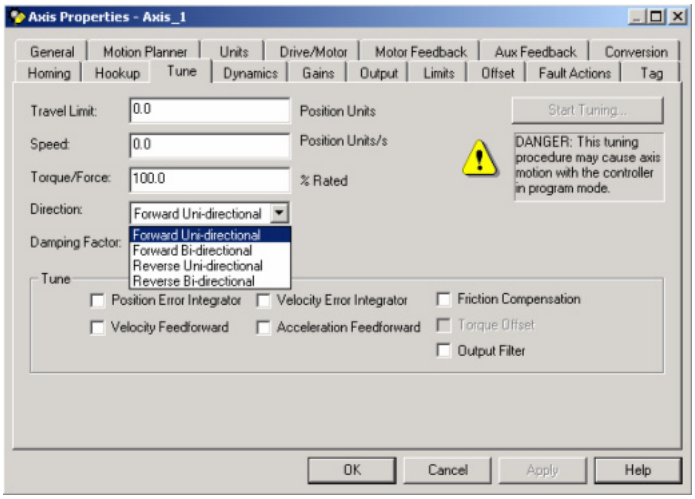
Tune the Axes

Follow these steps to tune the axes.

1. Verify the load is still removed from the axis being tuned.

ATTENTION: To reduce the possibility of unpredictable motor response, tune your motor with the load removed first, then reconnect the load and perform the tuning procedure again to provide an accurate operational response.

2. Click the Tune tab.



3. Enter values for Travel Limit and Speed.

   In this example, Travel Limit = 5 and Speed = 10. The actual value of programmed units depend on your application.

4. From the Direction pull-down menu, choose a setting (Forward Uni-directional is default).

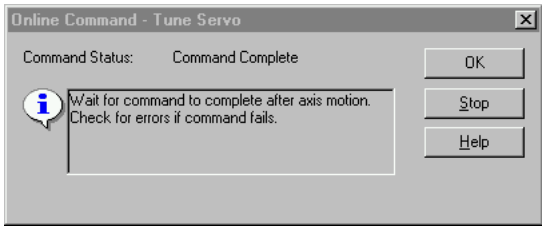
5. Check Tune boxes as appropriate for your application.

6. Apply Hardware Enable Input signal (IOD-2) for the axis you are tuning.

ATTENTION: To avoid personal injury or damage to equipment, apply 24V ENABLE signal (IOD-2) only to the axis you are tuning.

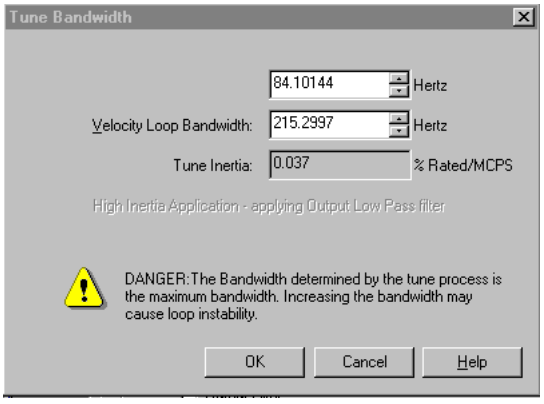
7. Click Start Tuning to auto-tune your axis.

   The Online Command - Tune Servo dialog box opens. When the test completes, the Command Status changes from Executing to Command Complete.



8. Click OK.

   The Tune Bandwidth dialog box opens.

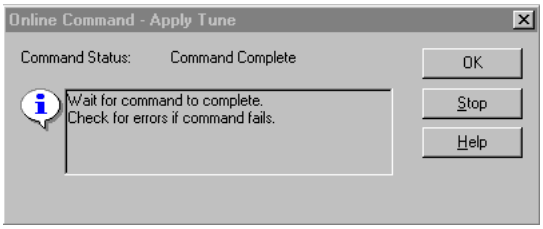


   Actual bandwidth values (Hz) depend on your application and may require adjustment once motor and load are connected.

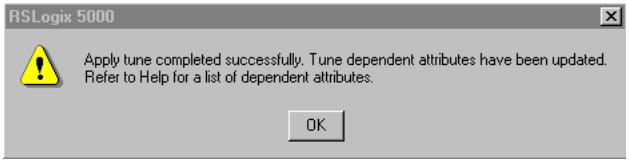
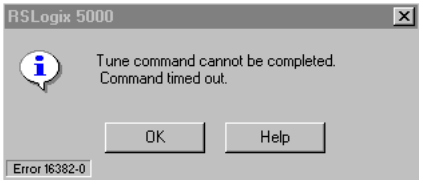
9. Record your bandwidth data for future reference.

10. Click OK.

The Online Command - Apply Tune dialog box opens. When the test completes, the Command Status changes from Executing to Command Complete.



11. Click OK.
12. Determine if your test completed successfully.

If	Then
Your test completes successfully, this dialog box opens. 	1. Click OK. 2. Remove the Hardware Enable Input signal (IOD-2) applied earlier. 3. Go to step 13.
Your test failed, this dialog box opens. 	1. Click OK. 2. Make an adjustment to motor velocity. 3. Refer to appropriate Logix motion module setup and configuration manual for more information. 4. Return to step 7 and run the test again.

13. Repeat Test and Tune the Axes for each axis.

Configure Drive Parameters and System Variables

This section provides information for accessing and changing parameters not accessible through RSLogix 5000 software.

Tools for Changing Parameters

Most parameters are accessible through RSLogix 5000 software. Alternatives include the DPI compatible Human Interface Module (HIM), and DriveExplorer and DriveExecutive software.

Table 50 - Software For Changing Parameters

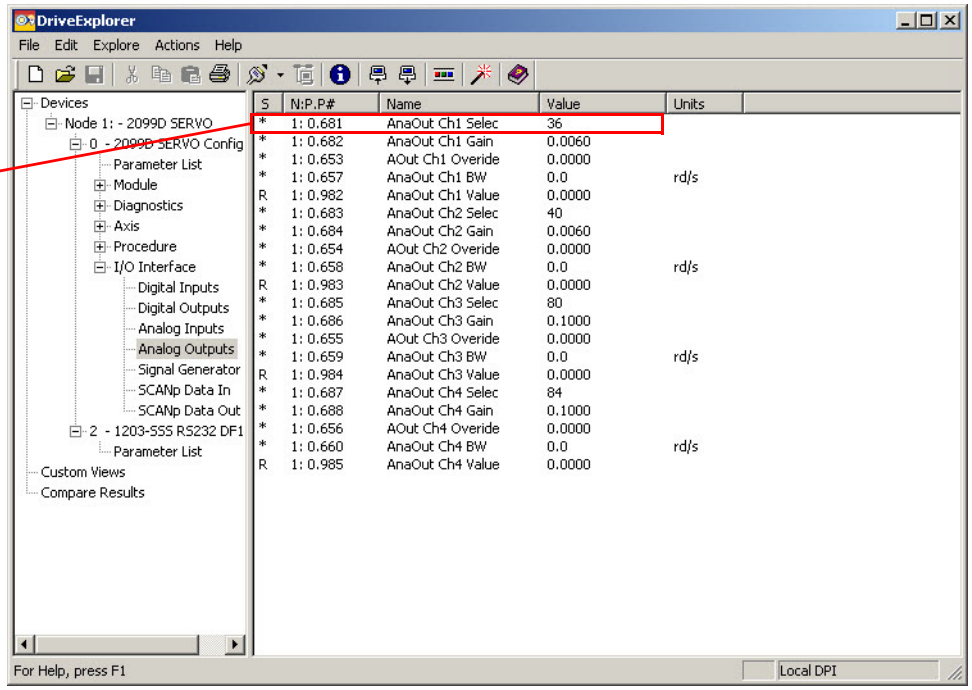
Method	Description	Cat. No.	Firmware Revision
DriveExplorer	DriveExplorer software (1)	9306-4EXP02ENE	2.01 or later
	Serial to SCANport adapter	1203-SSS (Series B), or 1203-USB	3.004 or later
Drive HIM	Full numeric LCD HIM	20-HIM-A3 (2)	N/A

(1) Refer to DriveExplorer Getting Results Manual, publication 9306-GR001, for instructions.
(2) Compatible catalog numbers include all 20-HIM-Ax.

Change Parameters with DriveExplorer Software

To edit a parameter using DriveExplorer software, refer to the example dialog box below. In this example, the I/O Interface group folder is open and the Analog Outputs file is selected in the tree view pane on the left. The parameters and corresponding elements are displayed in the pane to the right. Double-click on a parameter in the list to open the edit dialog box where you can change the value for the desired parameter.

Figure 67 - DriveExplorer Software Example



Change Parameters with the HIM Module

When using the HIM module to monitor or change parameters, use the up and down arrows (∧ and ∨) to arrive at selections. Refer to the instructions that came with your HIM module for more information.

Follow these steps to monitor or change parameters with the HIM module.

1. Select parameter, and press ↵.
2. Select I/O AM1 Group (for IAM module), and press ↵.
3. Select Analog Outputs, and press ↵.
   a. Analog Output 1 is displayed, and press ↵.
   b. For Analog Output 2 use arrows to select, and press ↵.
4. Press Sel.
5. Enter parameter number, and press ↵.

Notes:

Troubleshoot the Kinetix 7000 Drive System

This chapter provides troubleshooting tables for your Kinetix 7000 system components.

IMPORTANT Equipment connected to the Kinetix 7000 drive may store error data, and may take precedence when troubleshooting the system.

For example, the regenerative power supply (8720MC-RPS*xxxxx*) should be examined first when the DC common bus is providing system power.

Refer to the product manuals listed in the Additional Resources section on page 9 for troubleshooting information on other products.

Safety Precautions

Observe the following safety precautions when troubleshooting your Kinetix 7000 drive.

ATTENTION: Capacitors on the DC bus may retain hazardous voltages after input power has been removed. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval as 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.

ATTENTION: Do not attempt to defeat or override the drive fault circuits. You must determine the cause of a fault and correct it before you attempt to operate the system. Failure to correct the fault could result in personal injury and/or damage to equipment as a result of uncontrolled machine operation.

ATTENTION: Provide an earth ground for test equipment (oscilloscope) used in troubleshooting. Failure to ground the test equipment could result in personal injury.

Interpret Error Codes and Status Indicators

Refer to these troubleshooting tables to identify faults, potential causes, and the appropriate actions to resolve the fault. If the fault persists after attempting to troubleshoot the system, please contact your Rockwell Automation sales representative for further assistance.

Error Codes

Common hardware errors that prevent a drive from completing the power sequencing and fault assessment are listed first. Error codes that may appear on the Fault Status display immediately follow the start-up errors.

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

Table 51 - Seven-segment Status Indicator Error Codes

Error Code	Fault Message RSLogix	Anomaly or Symptom	Potential Cause	Possible Resolution
No Error Code Displayed		Power (PWR) indicator not ON	No AC power or auxiliary logic power.	Verify AC control power is applied to the Kinetix 7000 system.
			Internal power supply malfunction.	Call your Rockwell Automation sales representative to return module for repair.
		Motor jumps when first enabled	Motor wiring error.	Check motor wiring.
				Run Hookup test in RSLogix 5000 software.
			Incorrect motor chosen.	Verify the proper motor is selected.
		Digital I/O not working correctly	I/O power supply disconnected.	Verify connections and I/O power source.
E04	**MotorOvertemp Fault**	Motor thermal switch tripped	High motor ambient temperature and/or excessive current.	Operate within (not above) the continuous torque rating for the ambient temperature, 40 °C (104 °F) maximum.
				Lower ambient temperature, increase motor cooling.
			Motor wiring error.	Check motor wiring at MF connector on the drive.
			Incorrect motor selection.	Verify the proper motor has been selected.
			Mechanical failure.	Check for motor bearing failure or machine jam.

Table 51 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix	Anomaly or Symptom	Potential Cause	Possible Resolution
E05	**DriveOvercurrent Fault**	Inverter Overcurrent (IOC) indicates a major power related fault condition.	Motor cables shorted.	Verify continuity of motor power cable and connector.
			Motor winding shorted internally.	Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it may need to be replaced.
			Drive temperature too high.	Check for clogged vents or defective fan.
				Verify cooling is not restricted by insufficient space around the unit.
			Operation above continuous power rating and/or product environmental ratings.	Verify ambient temperature is not too high.
				Operate within the continuous power rating.
				Reduce acceleration rates.
			Kinetix 7000 drive has a short-circuit, overcurrent, or failed component.	Remove all power and motor connections, and preform a continuity check from the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminals, or send drive in for repair.
E06	**HardOvertravelFault**	Axis moved beyond the physical travel limits in the positive/negative direction.	Dedicated overtravel input is inactive.	Check wiring.
				Verify motion profile.
				Verify axis configuration in RSLogix 5000 software.
E07	**MotFeedbackFault**	The feedback wiring is open, shorted, or missing.		Check motor encoder and wiring.
				Run Hookup test in RSLogix 5000 software.
E09	**BusUndervoltageFault**	With three-phase power present, the DC bus voltage is below precharge limits.	Bus voltage for 460V system is below 275V DC.	Verify voltage level of the incoming AC power.
				Verify integrity and consistency of AC power source.
				Install an uninterruptible power supply (UPS) on your AC input.
		DC bus voltage fell below the undervoltage limit while an axis was enabled.	Bus voltage is at least 180V DC below the precharge level of 323 . . . 525V DC.	Verify bus supply is OK.
				Disable axis before removing input power.
			One of more phases of AC input power failed.	Check AC input power on all phases.
E10	**DriveOvervoltageFault**	The DC bus voltage is above limits.	Excessive regeneration of power.	Change the deceleration or motion profile.
			When the motor 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.	Use a larger system (motor and drive).
				Install shunt module.
				Install larger active shunt module or regenerative converter module.
			Bus voltage for 460V system is over 800V DC.	Verify line input integrity and that it is within specification.
E11	**MotFeedbackFault**	State of Hall feedback inputs is incorrect.	Improper connection.	Verify the Hall wiring at the MF connector on the drive.
				Verify 5V power supply to the encoder.
				Check feedback device.
E16	**SoftOvertravelFault**	Axis moved beyond the software axis position in either the positive or negative direction.		Verify motion profile.
				Verify overtravel settings are appropriate.

Table 51 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix	Anomaly or Symptom	Potential Cause	Possible Resolution
E18	**OverSpeedFault**	Motor speed has exceeded 150% of maximum rated speed. The 100% trip point is dictated by the lesser of the user velocity limits or the motor rated base speed.		Check cables for noise.
				Check tuning.
				Check feedback device.
				Verify velocity limit settings.
E19	**PositionErrorFault**	Position error limit exceeded.		Increase the feed forward gain.
				Increase following error limit or time.
				Check position loop tuning.
				Verify sizing of system.
				Verify mechanical integrity of system within specification limits.
E20	**MotFeedbackFault**	Motor encoder state error.	The motor encoder encountered an illegal transition.	Use shielded cables with twisted pair wires.
				Route the feedback away from potential noise sources.
				Check the system grounds.
				Replace the motor/encoder.
				Check feedback device and wiring.
E21	**AuxFeedbackFault**	Communication was not established with an intelligent encoder.		Verify auxiliary encoder wiring.
E23	**DriveOvertempFault**	IPM thermal protection fault	The internal filter protecting the drive from overheating has tripped.	Reduce acceleration rates.
				Reduce duty cycle (ON/OFF) of commanded motion.
				Increase time permitted for motion.
				Use larger Kinetix 7000 drive and motor.
				Check tuning.
E30	**MotFeedbackFault**	Communication was not established with an intelligent encoder.		Verify motor selection.
				Verify the motor supports automatic identification.
				Verify motor encoder wiring.
E34	**GroundShortFault**	Excessive ground current detected in the converter.	Wiring error.	Check motor power wiring.
				Check input power wiring.
			Motor internal ground short.	Replace motor.
			Internal malfunction.	Disconnect motor power cable from drive and enable drive with current limit set to 0. If fault clears, then a wiring error or motor internal problem exists. If fault remains, call your Rockwell Automation sales representative.
				Remove ground from control power input.
				Wire control power to use main power as shown in Appendix B.
				Add isolation transformer for control power.
E35	**DriveUndervoltageFault**	Converter precharge cycle failed.	Low AC input voltage.	Check input AC voltage on all phases.
			Internal malfunction.	Call your Rockwell Automation sales representative.
E37	**PowerPhaseLossFault**	One or more phases of the AC input power is missing.		Check input AC voltage and fusing on all phases and DC bus.
				Disable axis before removing power.

Table 51 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix	Anomaly or Symptom	Potential Cause	Possible Resolution
E38	**SERCOSFault**	The SERCOS ring is not active after being active and operational.	Cable disconnected.	Check that fiber-optic cable is present and properly connected.
E39	**DriveHardFault**	Self-sensing Commutation Startup Error.	Obstruction prevents motion required for self-sensing startup commutation.	Verify that there are no impediments to motion at startup, such as hard limits. Increase self-sensing current if high friction or load conditions exist. Check motor or encoder wiring using wiring diagnostics.
E43	**DriveEnableInputFault**	Missing Drive Enable input signal.	Attempted to enable the axis through software while the Drive Enable hardware input was inactive. The Drive Enable input transition from active to inactive occurred while the axis was enabled.	Disable the Drive Enable Input fault. Verify that Drive Enable hardware input is active whenever the drive is enabled through software. Verify wiring and shielding. If error persists, return the drive to Rockwell Automation.
E49	**DriveHardFault**	Safe-off function mismatch. Drive will not permit motion.	Loose wiring at SO connector. Cable/header not seated properly in SO connector. Safe-off circuit missing +24V DC.	Verify wire terminations, cable/header connections, and +24V DC. Reset error and run proof test. If error persists, return the drive to Rockwell Automation.
		Refer to the Kinetix Safe-off Feature Safety Reference Manual, GMC-RM002, for additional troubleshooting information and proof test procedures.		
E50	**SERCOSFault**	Duplicate node address detected on SERCOS ring.		Verify that each SERCOS drive is assigned a unique node address.
E54	**DriveHardFault**	Excessive Current Feedback Offset.	Defective current feedback sensing.	If error persists, return the drive to Rockwell Automation.
E61	**AuxFeedbackFault**	Auxiliary Encoder State Error.	The auxiliary encoder encountered an illegal transition.	Use shielded cables with twisted pair wires. Route the feedback away from potential noise sources. Check the system grounds. Replace the motor/encoder.
E62	**AuxFeedbackFault**	The feedback wiring is open, shorted, or missing.		Check the motor feedback cable connectors/wiring to the drive and motor.
E63	**AuxFeedbackNoise**	Noise on auxiliary feedback cable.	Recommended grounding, per installation instructions, has not been followed.	• Verify grounding. • Route feedback cable away from noise sources. • Refer to System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.
E64	**MotorFeedbackNoise**	Noise on motor feedback cable.		
E65	**No Fault Message** (condition indicated by on-screen message)	Hookup procedure failed.	Motor or feedback device malfunction.	Check motor power/feedback wiring. Refer to displayed message for resolution.
E66	**No Fault Message** (condition indicated by on-screen message)	Autotune procedure failed.	Motor or feedback device malfunction.	Check motor power/feedback wiring. Refer to displayed message for resolution. Perform Hookup in RSLogix 5000 software. Consult RSLogix 5000 help message.
E67	**DriveHardFault**	Operating system failed.	Software initialization fault detected due to hardware failure.	Cycle power. If fault persists, replace module.
E68	**DriveHardFault**	DPI communication failed.	The DPI device or cable is faulty.	Check DPI connections.

Table 51 - Seven-segment Status Indicator Error Codes (Continued)

Error Code	Fault Message RSLogix	Anomaly or Symptom	Potential Cause	Possible Resolution
E69	**DriveHardFault**	Nonvolatile memory is corrupt due to control board hardware failure.		Load default parameters, save to nonvolatile memory, and recycle power or reset the drive.
				If fault persists, replace module.
E70	**DriveHardFault**	Nonvolatile memory is corrupt due to control board software error.		Load default parameters, save to nonvolatile memory, and recycle power or reset the drive.
				If fault persists, replace module.
E71	**DriveHardFault**	RAM or flash memory validation failure.		Cycle power.
				If fault persists, replace module.
E72	**DriveOvertemp Fault** (Drive Overtemp)	Inverter thermal switch tripped	The drive fan failed.	Replace the failed module.
			The cabinet ambient temperature is above rating.	Check the cabinet temperature. See System Design Guidelines on page 22.
			The machine duty cycle requires an RMS current exceeding the continuous rating of the controller.	Change the command profile to reduce speed or increase time.
			The airflow access to the Kinetix 7000 drive is limited or blocked.	Check airflow and remove any fan blockage.
E76	**DriveHardFault**	DPI hardware initialization fault detected.	Control board hardware failure.	Reset System.
				If fault persists, replace system module.
E78	**DriveHardFault** (Sercos Init)	Control hardware fault detected.		Cycle power.
				If fault persists, replace module.
E80	**DriveHardFault** (CPLD Flt)	Control hardware fault detected.		A-to-D conversion state machine error.
				If fault persists, replace module.
E109	**IGBT_TempFault**	Junction temperature of Insulated Gate Bipolar Transistor exceeded.		Check for proper drive sizing.
				Install larger kW rated drive.
E110	**EEPROM_Fault**	EEPROM failed.	EEPROM data corrupted or bus not calibrated.	If fault persists, replace module.
E111	**Regen_PS_OK**	The Regen_OK signal is missing at pins 7 and 8 of the GPIO connector.		Check error displays on RPS, and troubleshoot per error message.
				Reset system.
All others RESERVED.				

Status Indicators

Table 52 - Drive Status Indicator

Drive Status LED	Status	Potential Cause	Possible Resolution
Off	Normal, no faults	N/A	N/A
Steady Red	Drive faulted	Seven-segment status indicator displays error code.	See the Error Codes on page 140 section and continue troubleshooting.

Table 53 - Comm Status Indicator

Comm Status LED	Status	Potential Cause	Possible Resolution
Off	No communication (1)	Loose fiber-optic connection.	Verify proper fiber-optic cable connection.
		Broken fiber-optic cable.	Replace fiber-optic cable.
		Receive fiber-optic cable connected to SERCOS transmit connector and vice versa.	Check proper SERCOS fiber-optic cable connections.
Flashing Green	Establishing communication	System is still in the process of establishing SERCOS communication.	Wait for steady green indicator.
		Node address setting on the drive module does not match SERCOS controller configuration.	Verify proper node switch setting.
Steady Green	Communication ready	No faults or failures.	N/A

(1) Refer to Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010, for more information.

Table 54 - Bus Status Indicator

Bus Status LED	Status	Condition
Off	Bus power not present.	• Normal when bus power is not applied. • Fault exists, see the Interpret Error Codes and Status Indicators beginning on page 140.
	Bus power is present in follower drive.	• Follower drive is not configured as Common Bus Follow in RSLogix 5000 software. • After DC bus voltage is applied, a 2.50 second delay occurs before the indicator begins flashing green. This is normal operation and provides the common bus leader time to complete precharge.
Alternating Red-Green	Bus power not present. 24V DC control power is present.	• Normal when bus power is not applied. Verify 460V AC connections. • Fault exists, see the Interpret Error Codes and Status Indicators beginning on page 140.
Flashing Green	Bus power is present, axis disabled. No faults or failures.	Normal when: • 24V is not applied to Hardware Enable Input (IOD-2). • MSO instruction is not commanded in RSLogix 5000 software.
Steady Green	Bus power is present, axis enabled. No faults or failures.	Normal when: • 24V is applied to Hardware Enable Input (IOD-2). • MSO instruction is commanded in RSLogix 5000 software.

Table 55 - SERCOS Status Indicator

SERCOS Status	Status	Condition
Actively cycling Phase 0	The drive is looking for a closed SERCOS ring. Wait for phase 1 to complete or take corrective action to reach phase 1.	Check fiber-optic connections. Serial ring must enter at the Rx connector and exit TX connector.
		Baud rate switch settings conflict. Verify drive and Logix setup parameters.
Displaying a fixed 1 Phase 1	The drive is looking for active nodes. Wait for phase 2 to complete or take corrective action to reach phase 2.	Check node addressing on drive and in ControlLogix and RSLogix 5000.
Displaying a fixed 2 Phase 2	Logix is configuring nodes for communication. Wait for phase 3 to complete or take corrective action to reach phase 3.	Check RSLogix programming to verify drive configuration against installed hardware.
		Verify the appropriate drive model is selected in RSLogix software.
Displaying a fixed 3 Phase 3	The drive is configuring device specific parameters. Wait for phase 4 to complete or take corrective action to reach phase 4.	Check RSLogix software programming to verify motor configuration against installed hardware. (1)
		Verify motor feedback cable connects to MF connector on the drive.
		If low profile connector is used, verify the connection for correct pinout, pinched insulation, and loose wires.
		Verify motor feedback cable for continuity and shorts.
		Replace the motor.
Displaying a fixed 4 Phase 4	The drive is configured and the SERCOS ring is active.	
Flashing an E followed by two numbers	Drive is faulted.	See the Error Codes section on page .140.

(1) You can access diagnostic information from the module by highlighting the module name in RSLogix 5000 software. A Pseudo Key Failure often indicates that the motor selection does not match the motor installed.

Table 56 - Control Power Status Indicator

CP Status LED	Status	Condition
Off	Control power not present.	Normal when auxiliary power is not applied to the Control Power (CP) terminal.
Steady Green	Control power applied.	Normal when auxiliary power is applied to the Control Power (CP) terminal.

General System Anomalies

These anomalies do not always result in a fault code, but may require troubleshooting to improve performance.

Condition	Potential Cause	Possible Resolution
Axis or system is unstable.	The position feedback device is incorrect or open.	Check wiring.
	Unintentionally in Torque mode.	Check to see what primary operation mode was programmed.
	Motor tuning limits are set too high.	Run Tune in RSLogix 5000 software.
	Position loop gain or position controller accel/decel rate is improperly set.	Run Tune in RSLogix 5000 software.
	Improper grounding or shielding techniques are causing noise to be transmitted into the position feedback or velocity command lines, causing erratic axis movement.	Check wiring and ground.
	Motor Select limit is incorrectly set (servo motor is not matched to axis module).	• Check setups. • Run Tune in RSLogix 5000 software.
	Mechanical resonance.	Notch filter or output filter may be required. Refer to Axis Properties dialog, Output tab in RSLogix 5000 software.

Condition	Potential Cause	Possible Resolution
You cannot obtain the motor acceleration/deceleration that you want.	Torque Limit limits are set too low.	Verify that current limits are set properly.
	Incorrect motor selected in configuration.	Select the correct motor and run Tune in RSLogix 5000 software.
	The system inertia is excessive.	• Check motor size against the application need. • Review servo system sizing.
	The system friction torque is excessive.	Check motor size against the application need.
	Available current is insufficient to supply the correct accel/decel rate.	• Check motor size against the application need. • Review servo system sizing.
	Acceleration limit is incorrect.	Verify limit settings and correct them, as necessary.
	Velocity Limit limits are incorrect.	Verify limit settings and correct them, as necessary.
Motor does not respond to a velocity command.	The axis cannot be enabled for 1.5 seconds after disabling.	Disable the axis, wait for 1.5 seconds, and enable the axis.
	Enable signal has not been applied or the enable wiring is incorrect.	• Check the controller. • Check the wiring.
	The motor wiring is open.	Check the wiring.
	The motor thermal switch has tripped.	• Check for a fault. • Check the wiring.
	The motor has malfunctioned.	Repair or replace the motor.
	The coupling between motor and machine has broken. For example, the motor moves, but the load/machine does not.	Check and correct the mechanics.
	Primary operation mode is set incorrectly.	Check and properly set the limit.
	Velocity or current limits are set incorrectly.	Check and properly set the limits.
Presence of noise on command or motor feedback signal wires.	Recommended grounding per installation instructions have not been followed.	• Verify grounding. • Route wire away from noise sources. • Refer to System Design for Control of Electrical Noise, publication GMC-RM001.
	Line frequency may be present.	• Verify grounding. • Route wire away from noise sources.
	Variable frequency may be velocity feedback ripple or a disturbance caused by gear teeth, ballscrew balls, or other mechanical wear. The frequency may be a multiple of the motor power transmission components or ballscrew speeds resulting in velocity disturbance.	• Decouple the motor for verification. • Check and improve the performance of the gearbox, ballscrew, and other mechanical items.
No rotation.	The motor connections are loose or open.	Check motor wiring and connections.
	Foreign matter is lodged in the motor.	Remove foreign matter.
	The motor load is excessive.	Verify the servo system sizing.
	The bearings are worn.	Return the motor for repair.
	The motor brake is engaged (if supplied).	• Check brake wiring and function. • Return the motor for repair.
	The motor is not connect to the load.	Check coupling.
Motor overheating.	The duty cycle is excessive.	Change the command profile to reduce accel/decel or increase time.
	The rotor is partially demagnetized, causing excessive motor current.	Return the motor for repair.

Condition	Potential Cause	Possible Resolution
Abnormal noise	Motor tuning limits are set too high.	Run Tune in RSLogix 5000 software again.
	Loose parts are present in the motor.	• Remove the loose parts. • Return motor for repair. • Replace motor.
	Through bolts or coupling is loose.	Tighten bolts.
	The bearings are worn.	Return motor for repair.
	Mechanical resonance.	Notch filter may be required (refer to Axis Properties dialog, Output tab in RSLogix 5000 software).
Erratic operation - Motor locks into position, runs without control or with reduced torque.	Motor power phases U and V, U and W, or V and W reversed.	Check and correct motor power wiring.
	Sine, Cosine or Rotor leads are reversed in the feedback cable connector.	Check and correct motor feedback wiring.
	Sine, Cosine, Rotor lead sets of resolver feedback are reversed.	Check and correct motor feedback wiring.

Logix/Drive Fault Behavior

These RSLogix 5000 fault actions are configurable from the Axis Properties dialog box, Fault Actions tab.

Table 57 - Drive Fault Action Definitions

Drive Fault Action	Definition
Shutdown	The drive is disabled and the contactor enable relay opens. An uncontrolled stop occurs, and the motor coasts to a stop.
Disable Drive	The drive is disabled. An uncontrolled stop occurs, and the motor coasts to a stop.
Stop Motion	Logix configuration for velocity loop Kp/Ki is followed. When zero speed is reached or stopping time is exceeded, the drive is disabled. Stopping time and stopping torque are configurable parameters in RSLogix 5000 software.
Status Only	Drive continues to operate. Status is provided by the seven-segment status indicator, drive status indicator, and DPI (if used).

Only selected faults are programmable. In Table 58 on page 149, the controlling attribute is given for programmable fault actions.

Figure 68 - RSLogix 5000 Axis Properties - Fault Actions Tab Example

Drive Fault Action/Attribute for Motor Overtemp fault (E04).

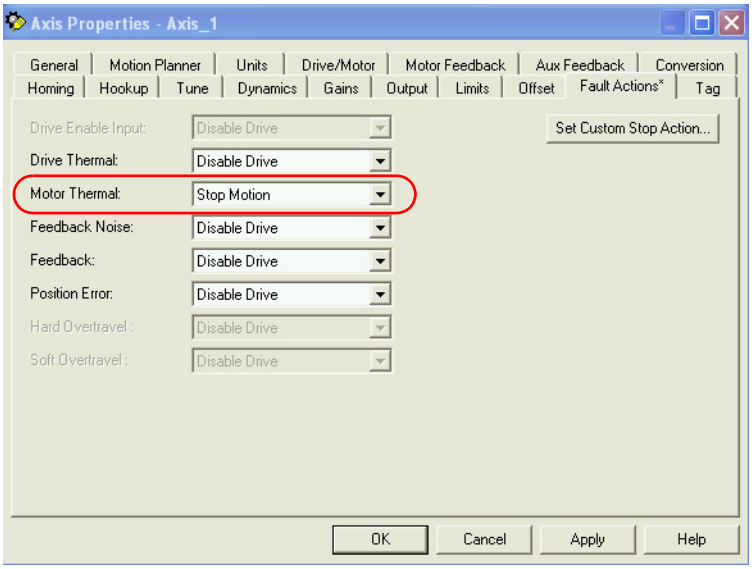


Table 58 - Logix/Drive Fault Behavior Definitions

Logix Fault Message (HIM)	Error Code	Description	Drive Fault Action/ Attribute	RSLogix Programmable Fault Action?
MotorOvertempFault (Motor Overtemp)	E04 (1)	The motor thermal switch was tripped. Firmware I^2t protection does not generate a fault, rather it dynamically folds back current when 110% of motor rating is reached. Setting the Motor Thermal fault action to Status Only will bypass this function.	STOP MOTION / Motor Thermal	Yes
DriveOvercurrentFault (Power Fault)	E05	An instantaneous overcurrent was detected in the inverter power section	SHUTDOWN	No
HardOvertravelFault (+/- Hard Overtravel)	E06	Axis moved beyond the physical travel limits in the positive/negative direction. This fault can be configured for status only.	STOP MOTION / Hard Overtravel	Yes
MotFeedbackFault (Motor Feedback Loss)	E07	The feedback wiring is open, shorted or missing.	DISABLE DRIVE	No
BusUndervoltageFault (Bus Under Voltage)	E09	With three-phase present, the DC bus voltage is below limits. The trip point is 800V DC for 460 drives.	SHUTDOWN	No
		DC bus voltage is below limits when any axis on common-bus follower was enabled.		
DriveOvervoltageFault (Bus Overvoltage)	E10	The DC bus voltage is above limits. The trip point is 800V DC for 460 drives.	SHUTDOWN	No
MotFeedbackFault (Illegal Hall State)	E11	State of Hall feedback inputs in incorrect.	DISABLE DRIVE	No
SoftOvertravelFault (+/- Software Overtravel)	E16	Axis position exceeded maximum software setting in the positive/negative direction. This fault can be configured for status only.	STOP MOTION / Soft Overtravel	Yes
OverSpeedFault (Overspeed Fault)	E18	Axis speed has reached 150% of the maximum rated setting. The 100% trip point is dictated by the lesser of the user velocity limits or the motor rated base speed.	DISABLE DRIVE	No
PositionErrorFault (Follow Error)	E19	Axis position error limit has been exceeded. This fault can be configured for status only.	STOP MOTION / Position Error	Yes
MotFeedbackFault (Mtr Fdbk AQB)	E20	Motor encoder has encountered an illegal state transition.	DISABLE DRIVE	No
AuxFeedbackFault (Aux Feedback Comm)	E21	Communication was not established with an intelligent (Stegmann) encoder on the Auxiliary feedback port.	STOP MOTION	No
DriveOvertempFault (Drive Overtemperature Fault)	E23	An IPM thermal protection fault occurred.	DISABLE Drive Thermal	Yes
MotFeedbackFault (Motor Feedback Comm)	E30	Communication was not established with an intelligent (Stegmann) encoder on the motor feedback port.	STOP MOTION	No
GroundShortFault (Ground Fault)	E34	Excessive ground current in the converter was detected.	SHUTDOWN	No
DriveUndervoltageFault (Precharge Fault)	E35	The converter precharge cycle has failed.	SHUTDOWN	No
PowerPhaseLossFault (Phase Loss Flt)	E37	• One or more phases of the input AC power is missing. • Axis was enabled when main (three-phase) power was removed. • Common bus follower axis was enabled when DC bus power was removed.	SHUTDOWN/ STOP MOTION	No
SERCOSFault (SERCOS Ring Flt)	E38	The SERCOS ring is not active after being active and operational.	STOP MOTION	No
DriveHardFault (Self Sense Flt)	E39	Self-sensing commutation fault detected	DISABLE DRIVE	No
DriveEnableInputFault (Drive Enable Flt)	E43	Generated when Enable input switches off when drive is enabled.	STOP MOTION	Yes
DriveHardFault (Safe-Off HW Flt)	E49	Safe-off function mismatch. Drive will not permit motion. Refer to the Kinetix Safe-off Feature Safety Reference Manual, publication GMC-RM002, for more information. Only applies to drives with Safe-off feature.	SHUTDOWN	No
SERCOSFault (SERCOS Same ADDR)	E50	Duplicate node address detected on SERCOS ring.	STOP MOTION	No
DriveHardFault (Ifbk HW Fault)	E54	Current feedback hardware fault detected.	SHUTDOWN	No

Logix Fault Message (HIM)	Error Code	Description	Drive Fault Action/ Attribute	RSLogix Programmable Fault Action?
AuxFeedbackFault (Aux Fdbk AQB)	E61	Auxiliary encoder has encountered an illegal state transition.	DISABLE DRIVE	No
AuxFeedbackFault (Aux Fdbk Loss)	E62	The feedback wiring is open, shorted or missing.	DISABLE DRIVE	No
AuxFeedbackNoise (Aux Fdbk Noise)	E63	Presence of noise on auxiliary feedback cable.	DISABLE DRIVE / Feedback Noise	Yes
MotorFeedbackNoise (Mtr Fdbk Noise)	E64	Presence of noise on motor feedback cable.		
No Fault Message (condition indicated by on-screen message) (Hookup Fault)	E65	Hookup procedure failed.	DISABLE DRIVE	No
No Fault Message (condition indicated by on-screen message) (Atune Flt)	E66	Autotune procedure failed.	DISABLE DRIVE	No
DriveHardFault (Task Init)	E67	Operating system failed.	SHUTDOWN	No
DriveHardFault (SCANport Comm)	E68	DPI communication failed.	STOP MOTION	No
DriveHardFault (Objects Init)	E69	Nonvolatile memory attribute out of range.	SHUTDOWN	No
DriveHardFault (NV Mem Init)	E70	Nonvolatile memory corrupted.	SHUTDOWN	No
DriveHardFault (Memory Init)	E71	RAM or flash memory validation failure.	SHUTDOWN	No
DriveOvertempFault (Drive Overtemp)	E72	Inverter temperature limit exceeded. Firmware I^2t protection does not generate a fault, rather it dynamically folds back current when 110% of drive rating is reached.	SHUTDOWN	Yes
DriveHardFault (Can Init)	E76	Either DPI or backplane CAN initialization failure.	SHUTDOWN	No
DriveHardFault SERCOS Init	E78	Control hardware fault detected.	SHUTDOWN	No
HardwareFault (CPLD FLT)	E80	Control hardware fault detected.	SHUTDOWN	No
IGBTTempFault (IGBTFLT)	E109	Junction temperature of IGBT exceeded.	SHUTDOWN	No
EEPROMFault (CPLD FLT)	E110	EEPROM failure. EEPROM data corrupt or bus not calibrated.	SHUTDOWN	No
RegenPSOK (CPLD FLT)	E111	Regenerative PS+/- missing at GPIO.	SHUTDOWN	No
All Others RESERVED				

(1) The Logix Motor Thermal Fault Action is tied to the motor thermostat fault. If this is set to Shutdown or Disable (in Logix), the drive will fold back the current when the I^2T calculation indicates that the motor temperature has exceeded 10% of its rated temperature. If it is set to Stop Motion or Status Only, the drive will not fold back the current. The I^2T calculation never generates a fault.

Specifications and Dimensions

This appendix provides product specifications and mounting dimensions for your Kinetix 7000 system components.

Power Specifications

This section contains power specifications for the Kinetix 7000 drive.

Attribute	2099-BM06-S	2099-BM07-S	2099-BM08-S	2099-BM09-S	2099-BM10-S	2099-BM11-S	2099-BM12-S
AC input voltage	342…528V AC rms three-phase (380…480V nom)						
AC input frequency	47…63 Hz						
Bandwidth [1] Velocity loop Current loop	500 Hz 1300 Hz					500 Hz 500 Hz	
PWM frequency	4 kHz					2 kHz	
Main AC input current Nom (rms) Max inrush (A peak)	36.7 A 18.0 A	47.7 A 18.0 A	59.6 A 18.0 A	90.1 A 96.0 A	117 A 118 A	169 A 141 A	233 A 141 A
DC input voltage	450…750V DC						
DC input current	42.9 A	55.7 A	69.7 A	105 A	137 A	204 A	281 A
Control power input Voltage	18…30V DC (24V DC, nom)						
Control power DC input current Nom (rms) Maximum inrush (rms)	3.3 A 6.0 A						
Continuous output current (rms)	40.0 A	52.0 A	65.0 A	96.0 A	125 A	180 A	248 A
Continuous output current (0-pk)	56.0 A	73.0 A	92.0 A	135 A	176 A	254 A	351 A
Peak output current (rms) 3 s duration 60 s duration	68.0 A 51.0 A	80.0 A 60.0 A	104 A 78.0A	154 A 115 A	163 A 138 A	312 A 234 A	372 A 273 A
Peak output current (0-pk) 3 s duration 60 s duration	96.0 A 72.0 A	113 A 84.8 A	147 A 110 A	217.7 A 162.6 A	230.5 A 195 A	441 A 331 A	526 A 386 A
Bus overvoltage	800V DC						
Bus undervoltage	275…560V DC [2]						
Continuous power output, nom	22 kW	30 kW	37 kW	56 kW	75 kW	112 kW	149 kW
Continuous power output (Hp)	30 Hp	40 Hp	50 Hp	75 Hp	100 Hp	150 Hp	200 Hp
Maximum power cycles/minute AC line DC bus	4 per minute (pre-charge provided by drive) 2 per minute (DC pre-charge provided by the regenerative power supply)						
DC bus discharge time	3 minutes after removal of main AC power						
Efficiency	97.5%						
Total capacitance [3]	1800 μF	2400 μF	3000 μF	4500 μF	6000 μF	8400 μF	8400 μF
Short circuit current rating	200,000 A (rms) symmetrical						

(1) Bandwidth values vary based on tuning parameters and mechanical components.

(2) Bus undervoltage will vary based on input line voltage.

(3) If DC input is supplied to 2099-BM09-S, 2099-BM10-S, 2099-BM11-S, or 2099-BM12-S drives, the precharge capability must be provided at the system level. Disconnect switches must not be used between the input of the drive and a common DC bus without the use of an external precharge device.

Circuit Breaker/Fuse Specifications

While circuit breakers offer some convenience, there are limitations for their use. Circuit breakers do not handle high current inrush as well as fuses.

Make sure the selected components are properly coordinated and meet acceptable codes including any requirements for branch circuit protection. Evaluation of the short-circuit available current is critical and must be kept below the short-circuit current rating of the circuit breaker.

Use class CC, T, RK1, or J fuses, with current rating as indicated in the table below. The following fuse examples and short-circuit current ratings are recommended for use with the 2099-BM*xx*-S drives when the Line Interface Module (LIM) is not used.

IMPORTANT LIM modules (catalog numbers 2094-BL*xx*S and 2094-XL75S-C*x*) provide branch circuit protection to the Kinetix 7000 drive. Follow all applicable NEC and local codes.

Table 59 - 460V AC Input Drive Fuse and Motor Circuit Protector Specifications

Drive Cat. No.	Bussmann Fuse	Dual Element Time Delay Fuse (min/max) A rms	Non-Time Delay Fuse (min/max) A rms	Motor Circuit Protector (max) A rms
2099-BM06-S	LPJ-90SP	50/90	50/150	50
2099-BM07-S	LPJ-110SP	60/110	60/200	70
2099-BM08-S	LPJ-125SP	80/125	80/250	100
2099-BM09-S	LPJ-200SP	125/200	125/300	125
2099-BM10-S	LPJ-250SP	150/250	150/500	150
2099-BM11-S	LPJ-400SP	225/400	225/600	250
2099-BM12-S	LPJ-500SP	300/550	300/700	400

Common DC Bus Fuse Specifications

Table 60 - Ferraz Shawmut Fuse Recommendations

Drive Cat. No.	Drive Current Rating (ADC)	Recommended Fuse	Fuse Current Rating	i^2t (A^2sec)		Peak Let-Through Current at 100 kA rms
				Pre-Arc	Max. Clearing @ 600V AC	
2099-BM06-S	42.9	HSJ80	80	1600	15000	7000 A
2099-BM07-S	55.7	HSJ90	90	2300	21000	7400 A
2099-BM08-S	69.7	HSJ100	100	2700	23000	7700 A
2099-BM09-S	105	HSJ175	175	8000	60000	12000 A
2099-BM10-S	137	HSJ200	200	14000	92000	13000 A
2099-BM11-S	204	HSJ400	400	63000	450000	21000 A
2099-BM12-S	281	HSJ400	400	63000	450000	21000 A

Table 61 - Bussmann Fuse Recommendations

Drive Cat. No.	Drive Current Rating (ADC)	Recommended Fuse	Fuse Current Rating	i^2t (A^2sec)		Peak Let-Through Current at 100 kA rms
				Pre-Arc	Max Clearing @ 600V AC	
2099-BM06-S	42.9	FWJ-80A	80	1550	9700	6300 A
2099-BM07-S	55.7	FWJ-100A	100	2800	17500	8000 A
2099-BM08-S	69.7	FWJ-125A	125	4800	35000	10000 A
2099-BM09-S	105	FWJ-175A	175	7500	65000	12000 A
2099-BM10-S	137	FWJ-200A	200	11700	80000	13000 A
2099-BM11-S	204	FWJ-500A	500	39500	329000	21000 A
2099-BM12-S	281	FWJ-500A	500	39500	329000	21000 A

Contactor Ratings

The table below lists the recommended contactor ratings for Kinetix 7000 drives installed without a Line Interface Module (LIM).

Drive Cat. No.	Contactor	Safety Contactor	Coil Type	Coil Voltage Requirements
2099-BM06-S	100-C43DJ01	100S-C43-DJD4C	Standard with Diode	24V DC
2099-BM07-S	100-D95EN11	100S-D95EN22C	Electronic Coil (1)	24V DC for control and 480V AC for coil power
2099-BM08-S				
2099-BM09-S				
2099-BM10-S	100-D140EN11	100S-D140EN22C		
2099-BM11-S	100-D180EN11	100S-D180EN22C		
2099-BM12-S	100-D250EN11	100S-D250EN22C		

(1) Electronic coil control power requirements = 24V DC @ 15 mA.

Power Dissipation Specifications

Use this table to size an enclosure and calculate required ventilation for your Kinetix 7000 drive system.

Drive Cat. No.	Usage as a % of Rated Power Output W	
	50%	100%
2099-BM06-S	294	465
2099-BM07-S	388	619
2099-BM08-S	452	730
2099-BM09-S	645	1072
2099-BM10-S	882	1479
2099-BM11-S	1275	2125
2099-BM12-S	1438	2437

General Specifications

Maximum Feedback Cable Lengths

Although motor power and feedback cables are available in standard lengths up to 90 m (295.3 ft), the drive/motor/feedback combination may limit the maximum feedback cable length. These tables assume the use of recommended 2090-series cables.

Table 62 - Cable Lengths for Compatible Rotary Motors

Motor Cat. No.	Absolute High-resolution (5V) Encoder m (ft)	Absolute High-resolution (9V) Encoder m (ft)
MPL-B5*xxx*… MPL-B9*xxx*-S/M		90 (295.3)
MPM-B165*xx*… MPM-B215*xx*-S/M		90 (295.3)
RDB-B215*xx*-7/3	30 (98.4)	
RDB-B290*xx*-7/3 or RDB-B410*xx*-7/3	90 (295.3)	
HPK-B*xxxxx*-S/M or HPK-E*xxxxx*-S/M		90 (295.3)

Weight Specifications

Drive Cat. No.	Weight, approx. kg (lb)
2099-BM06-S	18.55 (40.9)
2099-BM07-S	
2099-BM08-S	
2099-BM09-S	37.2 (82.0)
2099-BM10-S	
2099-BM11-S	71.4 (157.5)
2099-BM12-S	

Certifications

Agency Certification [1]	Standards
c-UL-us [2]	UL Listed to U.S. and Canadian safety standards (UL 508C File E59272).
	Solid-state motor overload protection provides dynamic fold-back of motor current when 110% of the motor rating is reached with a peak current limit based on the peak rating of the motor as investigated by UL to comply with UL 508C (UL File E59272, volume 1, section 22).
CE	European Union 2004/108/EC EMC Directive compliant with: • EN 60034-1:2004: Rotating electrical machines - Part 1: Rating and performance • EN 61800-3:2004: Adjustable speed electrical power drive systems - Part 3: EMC requirements and specific test methods
	European Union 2006/95/EC Low Voltage Directive compliant with: • EN 50178:1997 - Electronic equipment for use in power installations
Functional Safety	• EN 60204-1:2006 - Safety of Machinery - Electrical equipment of machines - Part 1: General requirements • IEC 61508 Part 1-7:2000 - Functional safety of electrical/electronic/programmable electronic safety-related systems • EN ISO 13849-1:2008 - Safety of machinery. Safety-related parts of control systems - Part 1: General principles for design
C-Tick	• Radiocommunications Act: 1992 • Radiocommunications (Electromagnetic Compatibility) Standard: 1998 • Radiocommunications (Compliance Labelling - Incidental Emissions) Notice: 1998 • AS/NZS CISPR 11: 2002 (Group 2, Class A)
KC	Korean Registration of Broadcasting and Communications Equipment, compliant with: • Article 58-2 of Radio Waves Act, Clause 3 • Registration Number: KCC-REM-RAA-2099

(1) When product is marked, refer to www.rockwellautomation.com/products/certification/for Declarations of Conformity Certificates.

(2) Underwriters Laboratories Inc. has not evaluated the safe-off, safe torque-off, or safe speed-monitoring options in these products.

Environmental Specifications

Attribute	Operational Range	Storage Range (nonoperating)
Temperature, ambient	0…50 °C (32…122 °F)	-40…70 °C (-40…158 °F)
Relative humidity	5…95% noncondensing	5…95% noncondensing
Altitude	1000 m (3281 ft) 3000 m (9843 ft) with derating	3000 m (9843 ft) during transport
Vibration	5…55 Hz @ 0.35 mm (0.014 in.) double amplitude, continuous displacement; 55…500 Hz @ 2.0 g peak constant acceleration (10 sweeps in each of 3 mutually perpendicular directions).	
Shock	15 g, 11 ms half-sine pulse (3 pulses in each direction of 3 mutually perpendicular directions)	

AC Line Filter Specifications

Line filters compatible with a Kinetix 7000 drive sourcing input power from an AC power supply are listed below.

Kinetix 7000 Drive Cat. No.	AC Line Filter Cat. No.
2099-BM06-S	2090- XXLF-TC350
2099-BM07-S	
2099-BM08-S	2090- XXLF-TC365
2099-BM09-S	2090- XXLF-TC3100
2099-BM10-S	2090- XXLF-TC3150
2099-BM11-S	2090- XXLF-TC3200
2099-BM12-S	2090- XXLF-TC3250

Line filters compatible with a Kinetix 7000 drive sourcing input power from a regenerative DC bus with a 8720MC-RPS unit are listed below.

8720MC-RPS Cat. No.	AC Line Filter Manufacturer and Cat. No.
8720MC-RPS065BM-HV2	Schaffner: FN3100-80-35 Soshin Electric: HF3080C-TOA
8720MC-RPS190BM	8720MC-EF190-VB

AC Line Reactors

380...480V, 50/60 Hz, three-phase, line reactors compatible with a Kinetix 7000 drive connected to a three-phase, AC input power source are listed below.

Table 63 - Compatible Kinetix 7000 Drives and AC Line Reactors

Kinetix 7000 Drive Cat. No.	3% Impedance Input Line Reactor (1)		5% Impedance Input Line Reactor (1)	
	IP00 (Open Style) Cat. No.	IP11 (NEMA/UL Type 1) Cat. No.	IP00 (Open Style) Cat. No.	IP11 (NEMA/UL Type 1) Cat. No.
2099-BM06-S	1321-3R45-B	1321-3RA45-B	1321-3R45-C	1321-3RA45-C
2099-BM07-S	1321-3R55-B	1321-3RA55-B	1321-3R55-C	1321-3RA55-C
2099-BM08-S	1321-3R80-B	1321-3RA80-B	1321-3R80-C	1321-3RA80-C
2099-BM09-S	1321-3R100-B	1321-3RA100-B	1321-3R100-C	1321-3RA100-C
2099-BM10-S	1321-3R130-B	1321-3RA130-B	1321-3R130-C	1321-3RA130-C
2099-BM11-S	1321-3R200-B	1321-3RA200-B	1321-3R200-C	1321-3RA200-C
2099-BM12-S	1321-3RB250-B	1321-3RAB250-B	1321-3RB250-C	1321-3RAB250-C

(1) Input line reactors were sized based on the NEC fundamental motor amps.

Line reactors compatible with a 8720MC-RPS Regenerative Power Supply sourcing input power from an AC power supply are listed below. They must be configured as shown in the Regenerative Power Supply example on page 171.

Table 64 - Compatible Kinetix 7000 Drives, 8720MC-RPS Regenerative Power Supplies and 8720MC Line Reactors

Kinetix 7000 Drive Cat. No.	8720MC-RPS Regenerative Power Supply Cat. No. (1)	8720MC Line Reactor Cat. No.
2099-BM07-S	8720MC-RPS065BM	8720MC-LR05-048B
2099-BM08-S		
2099-BM09-S		8720MC-LR10-062B
	8720MC-RPS065BM and 8720MC-RPS065BS	8720MC-LR05-048B (requires two units, one for the master RPS unit and one for the slave RPS unit.)
2099-BM11-S		8720MC-LR10-062B (requires two units, one for the master RPS unit and one for the slave RPS unit.)
	8720MC-RPS190BM	8720MC-LR10-100B (required two units)
2099-BM12-S		

(1) Regenerative Power Supply (RPS) selection is for a single motor/drive combination. When combining multiple drives on the same RPS module, the selection will change.

External Shunt Modules

Refer to this table for active shunt solutions for use with Kinetix 7000 drives from Rockwell Automation Encompass Partners.

Rockwell Automation Encompass Partner	Contact Information
Powerohm Resistors, Inc.	5713 13th Street Katy, TX 77493 Tel: (800) 838-4694 http://www.powerohm.com
Bonitron, Inc.	521 Fairground Court, Nashville, TN 37211 Tel: (615) 244-2825 http://www.bonitron.com

Precharge Capacities of the Regenerative Power Supply

Internal (built-in) and external precharge capacities of the regenerative power supply (RPS) are listed below.

Attribute	8720MC-RPS065B*x*-HV2	8720MC-RPS190B*x*
Rated Output kVa (750V DC bus) (1)	45	133
DC Amperes Continuous (1)	64	190
DC Amperes Peak (1 minute) (1)	96	285
Built-in Capacitor	1900 µF	7600 µF
Built-in Resistor (Resistance/W)	7000 µF (22 Ohms/120 W)	25000 µF (10 Ohms/400 W)
External Resistor (Min Resistance) (2) (3)	110000 µF (20 Ohms)	165000 µF (10 Ohms)
External Circuit (Min Resistance) (3)	220000 µF (4.7 Ohms)	495000 µF (1.5 Ohms)

(1) For 8720MC-RPS065-HV2 and 8720MC-RPS190, you may have up to two slave units with a master unit. Multiply these values by the number of slave units.
(2) Use this case only when the bus capacitance exceeds the internal precharge rating. You must use the specified resistor. Calculate rated wattage and surge resistivity for that resistor. See the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, for configuration details.
(3) Use this case only when the bus capacitance exceeds the external resistor rating. You must use the specified resistor. Calculate rated wattage and surge resistivity for that resistor. See the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, for configuration details.

IMPORTANT Large levels of load capacitance may require modification of the 8720 regenerative power supply internal precharge/discharge circuit.

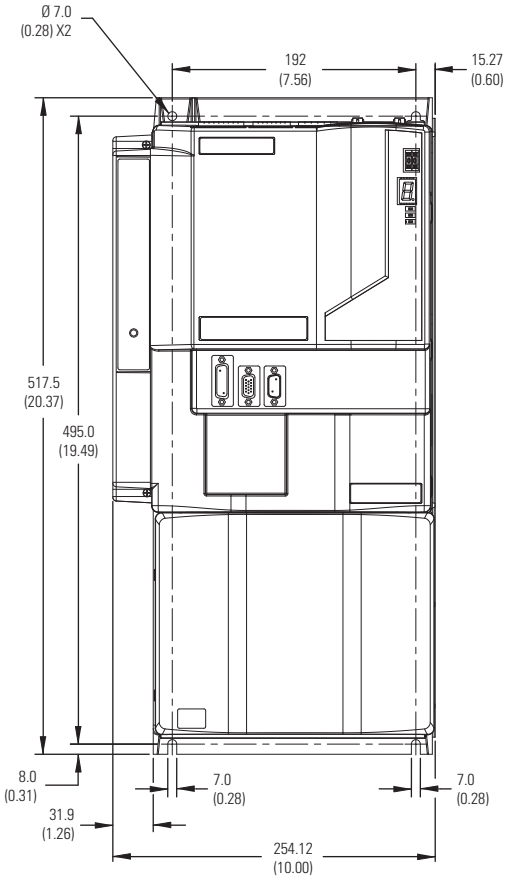
See the Wiring instructions in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, for information on how to determine the appropriate precharge/discharge resistance power value (Ohms/Watt) to accommodate the capacitance of your system.

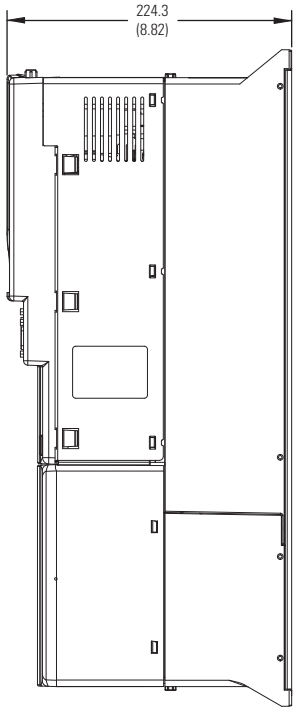
Product Dimensions

This section provides a quick reference table to common dimensions for Kinetix 7000 drives (height, width, depth, and mounting hole locations), and outline drawings with dimensions related to the specific frame sizes.

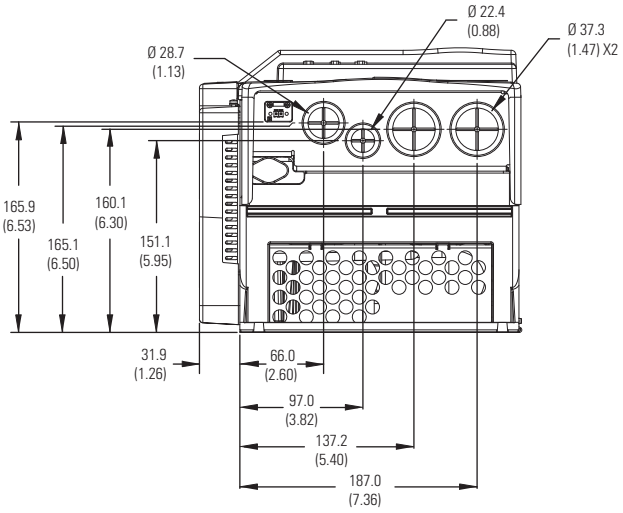
Figure 69 - 2099-BM06-S 2099-BM07-S, and 2099-BM08-S Approximate Dimensions

Dimensions are in millimeters (inches)

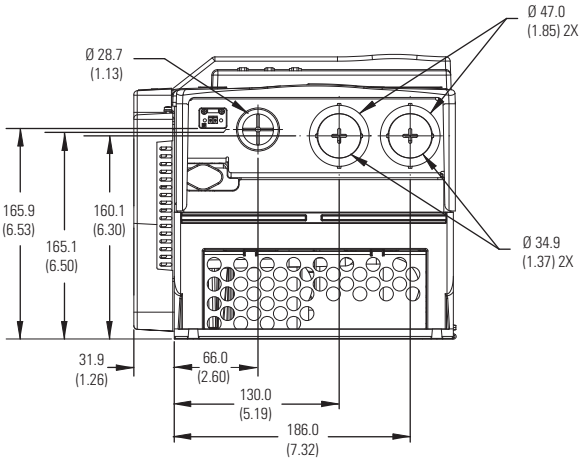




Important: Additional clearance below the connector is necessary to provide the recommended cable bend radius.



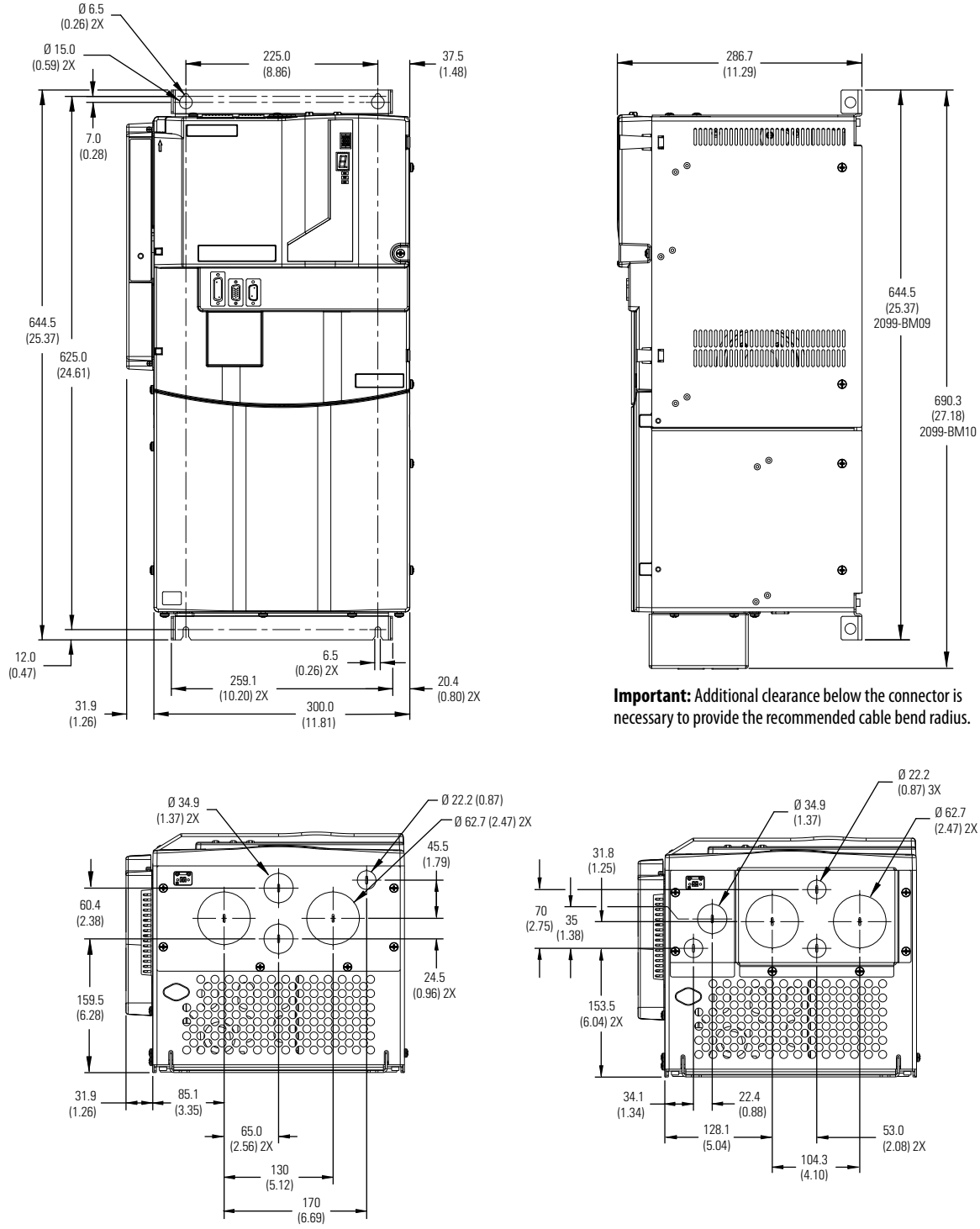
Bottom View
(2099-BM06-S and 2099-BM07-S)



Bottom View
(2099-BM08-S)

Figure 70 - 2099-BM09-S and 2099-BM10-S Approximate Dimensions

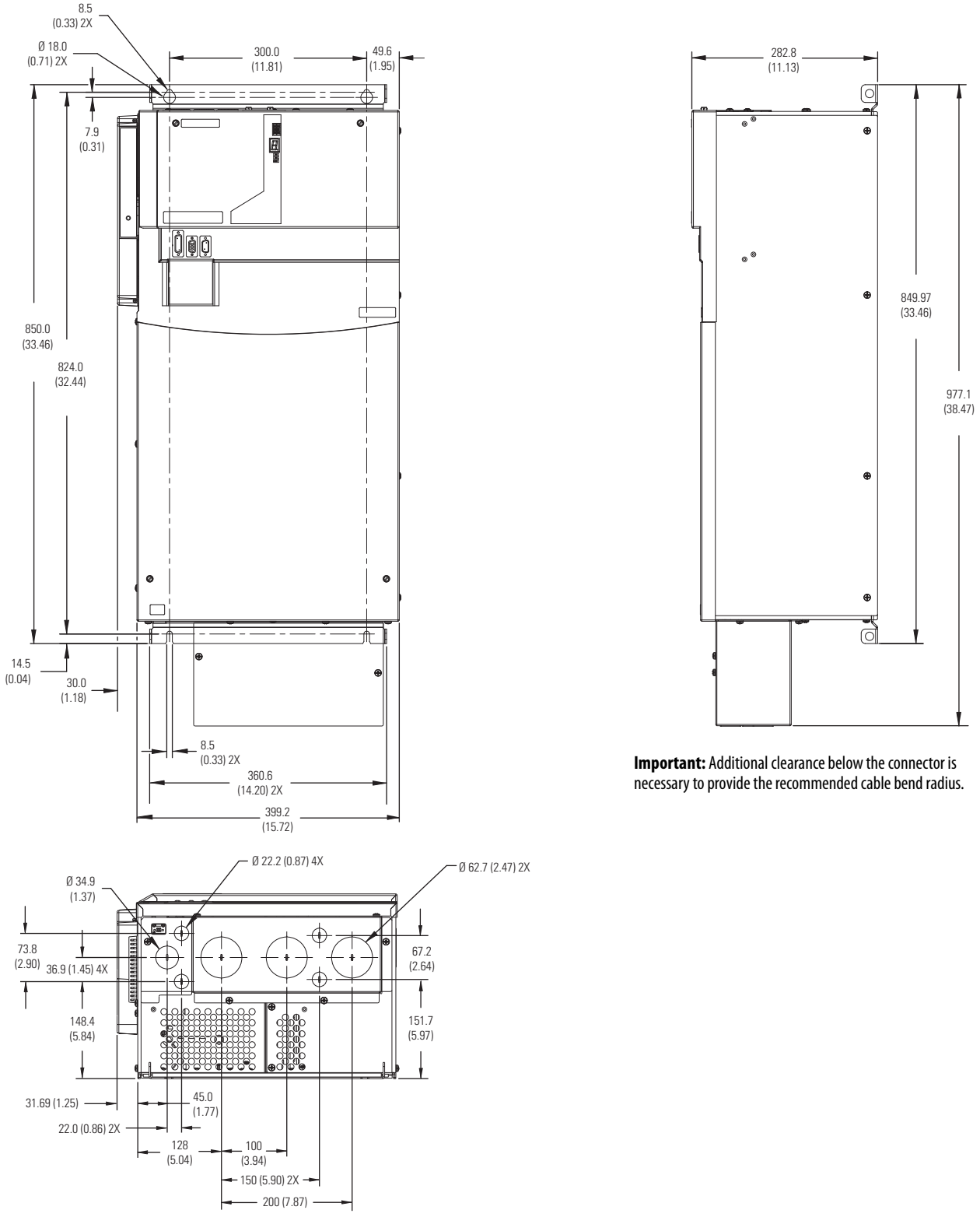
Dimensions are in millimeters (inches)



Important: Additional clearance below the connector is necessary to provide the recommended cable bend radius.

Figure 71 - 2099-BM11-S and 2099-BM12-S Approximate Dimensions

Dimensions are in millimeters (inches)



Important: Additional clearance below the connector is necessary to provide the recommended cable bend radius.

Interconnect Diagrams

This appendix provides wiring examples and system block diagrams to assist you in wiring your Kinetix 7000 system components.

Interconnect Diagram Notes

The notes below apply to the Kinetix 7000 drive wiring examples on the following pages.

Note	Information
1	For power wiring specifications, refer to Power Wiring Requirements on page 86.
2	For input fuse and circuit breaker sizes, refer to Circuit Breaker/Fuse Specifications on page 153 and 148.
3	Place AC (EMC) line filters as close to the drive as possible and do not route very dirty wires in wireway. If routing in wireway is unavoidable, use shielded cable with shields grounded to the drive chassis and filter case. For line filter specifications, refer to the AC Line Filter Specifications on page 157. See Establish Noise Zones on page 30 for wire routing guidelines.
4	Contactor coil (M1) needs integrated surge suppressors for AC coil operation. Refer to the Contactor Ratings on page 154 for more information.
5	The default configuration for the ground jumper is for grounded power at the customer site. Ungrounded, impedance grounded, high resistive grounded, B phase grounded, or common DC bus power distribution system sites must disconnect the protective MOVs and Common Mode Capacitors to guard against unstable operation and/or drive damage. Refer to Determine the Input Power Configuration on page 75 for more information.
6	 **ATTENTION:** Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN 1050 and EN 954 estimation and safety performance categories. For more information, refer to Understanding the Machinery Directive, publication SHB-900.
7	Use of an external 24V DC control power supply is recommended for energizing the main control board. This allows the SERCOS ring to remain active when main power is removed. The main control board is powered from the DC bus during drive operation and can be used in this manner, if necessary.
8	The General Purpose Relay outputs on the Kinetix 7000 drive are configured as follows: GPR1+ and GRP1- have noise suppression circuitry and should be used for the motor brake, if used. The default setting for GPR2+ and GPR2- is DROK or Drive_OK. The GPR2 contacts close when external 24V DC control power is applied to the Control Power terminals and there are no shutdown faults.
9	External AC input power for the cooling fan is required only for 2099-BM09-S, 2099-BM10-S, 2099-BM11-S, and 2099-BM12-S drives. The cooling fans on 2099-BM06-S, 2099-BM07-S, and 2099-BM08-S drives are powered internally.
10	Dual 8720MC-RPS*xxx* units use a ribbon cable to connect the master unit to the slave unit control. The ribbon cable is included with the slave unit.
11	Contact for use with a safety circuit or other system requirement.

Power Wiring Examples

Figure 72 - Kinetix 7000 Drive AC Power Wiring

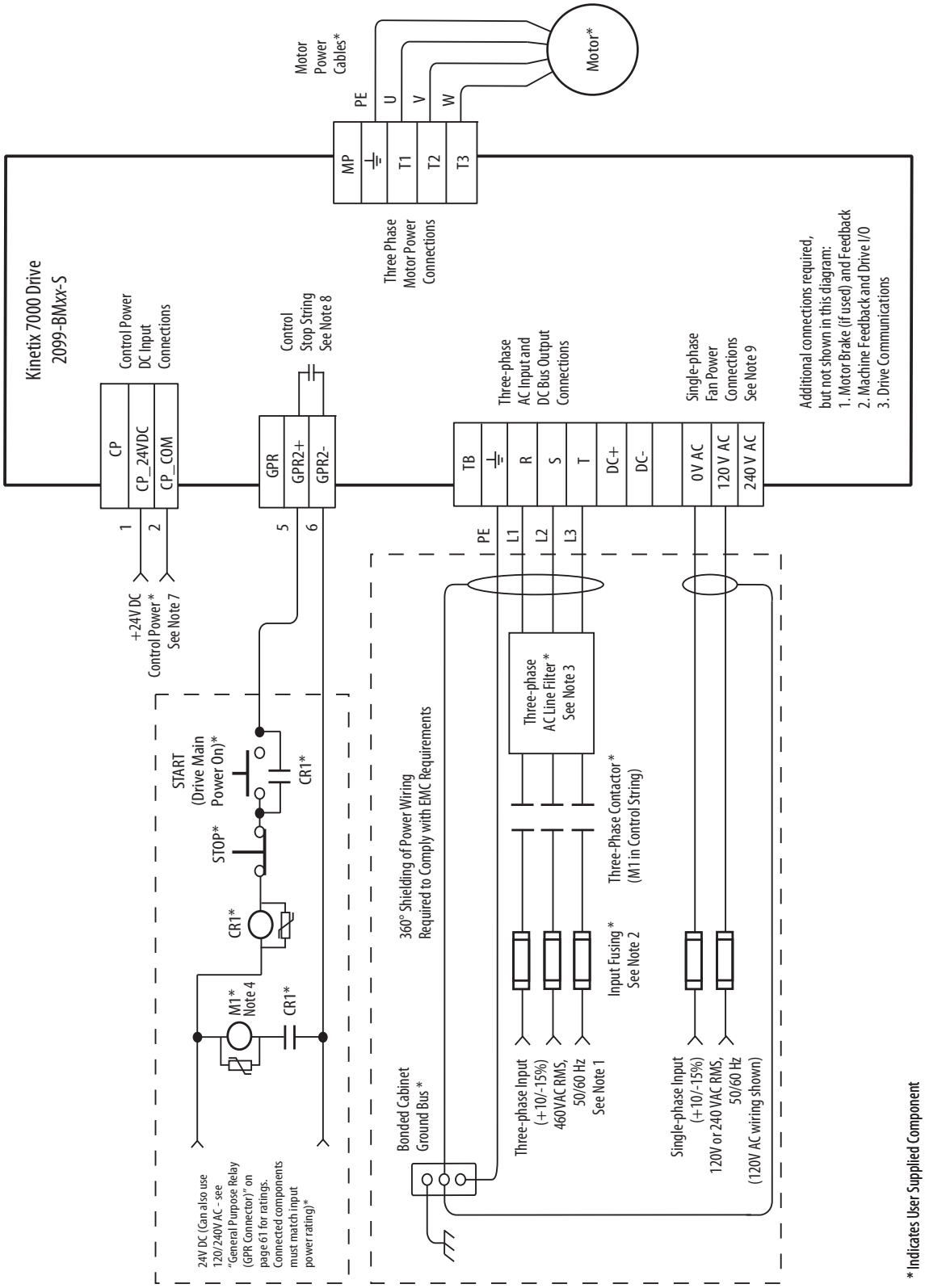
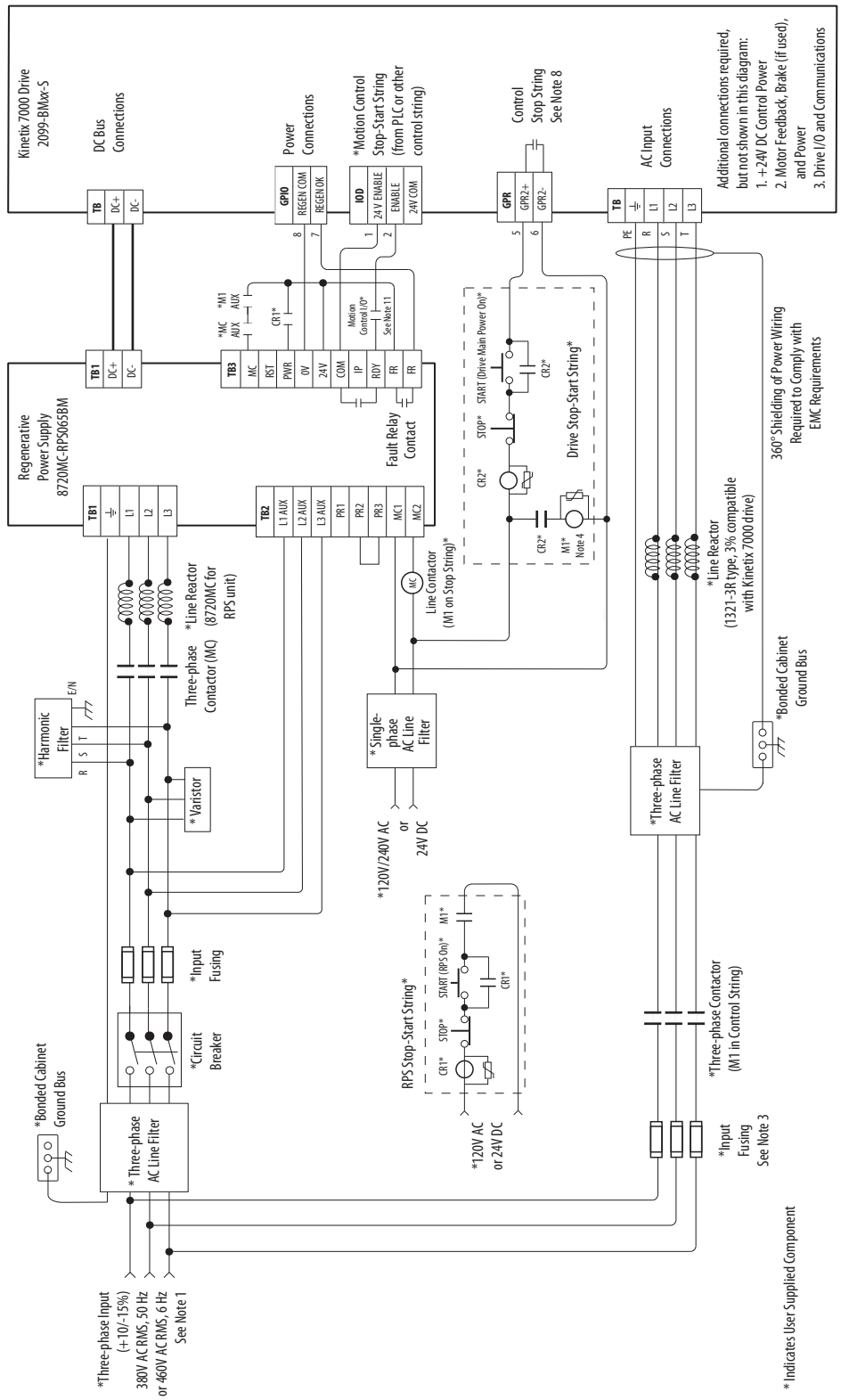
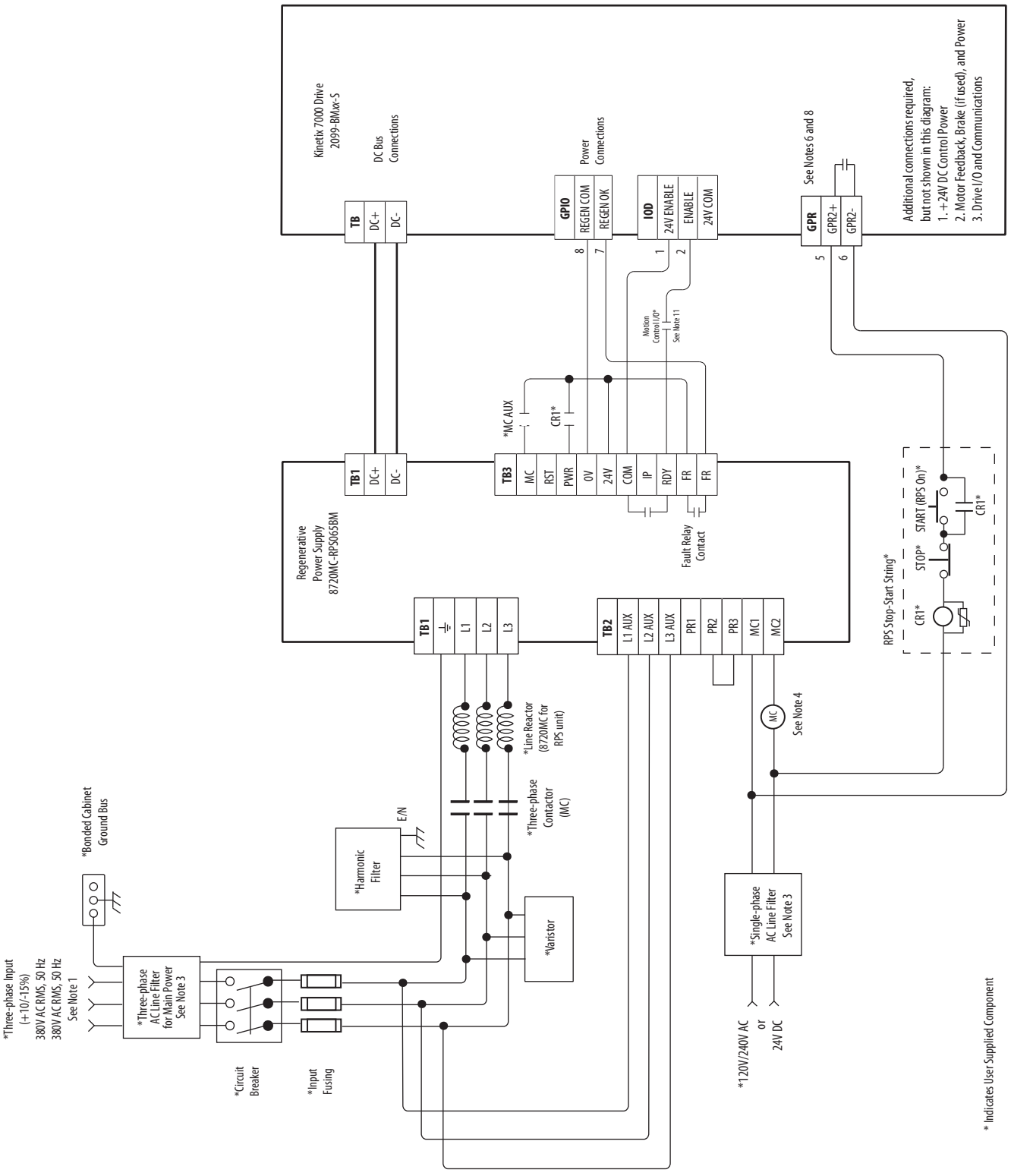


Figure 73 - Kinetix 7000 Drive AC Powered with a 8720MC-RPS065BM Regenerative Power Supply



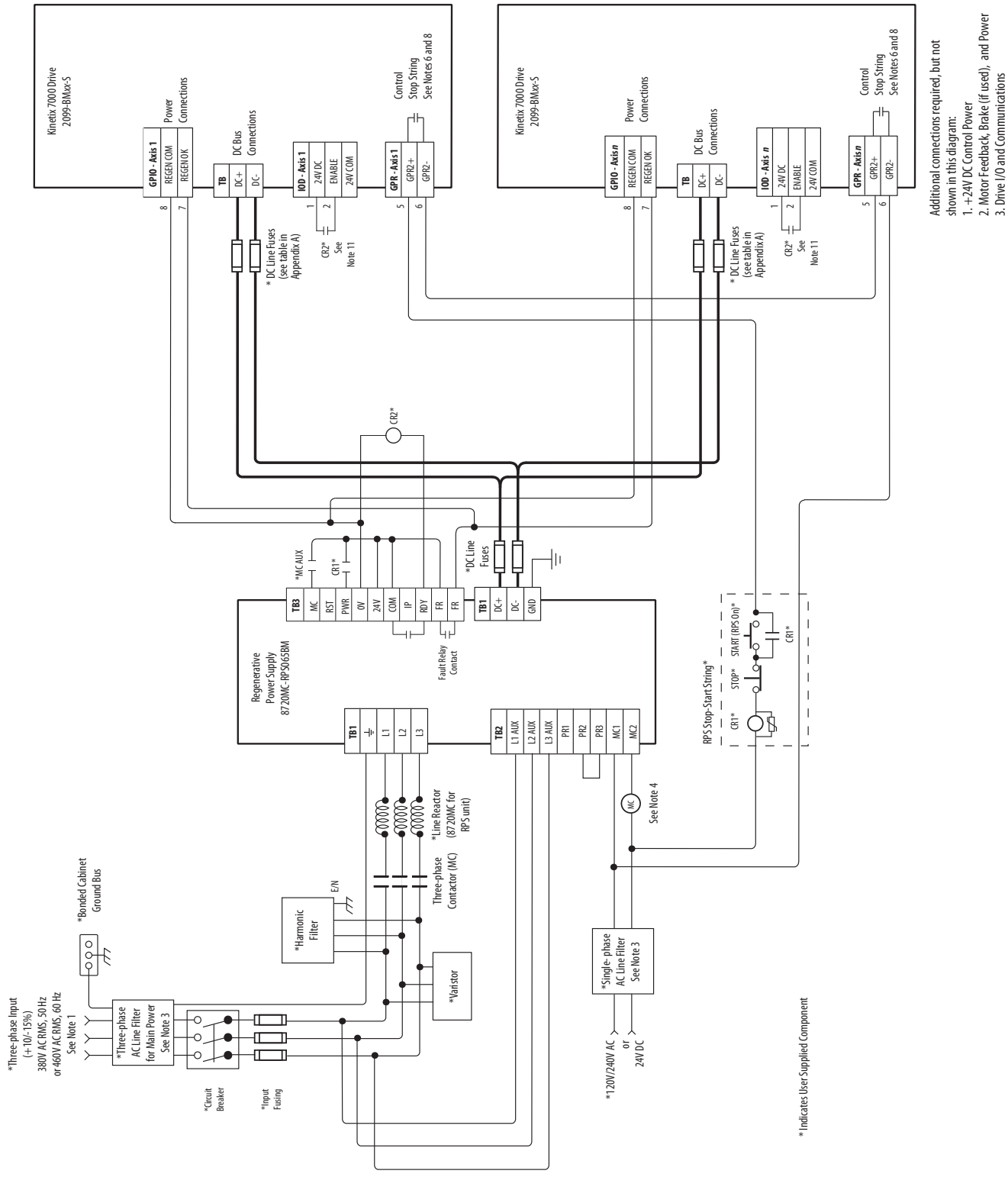
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 74 - 8720MC-RPS065BM Regenerative Power Supply to a Single Kinetix 7000 Drive



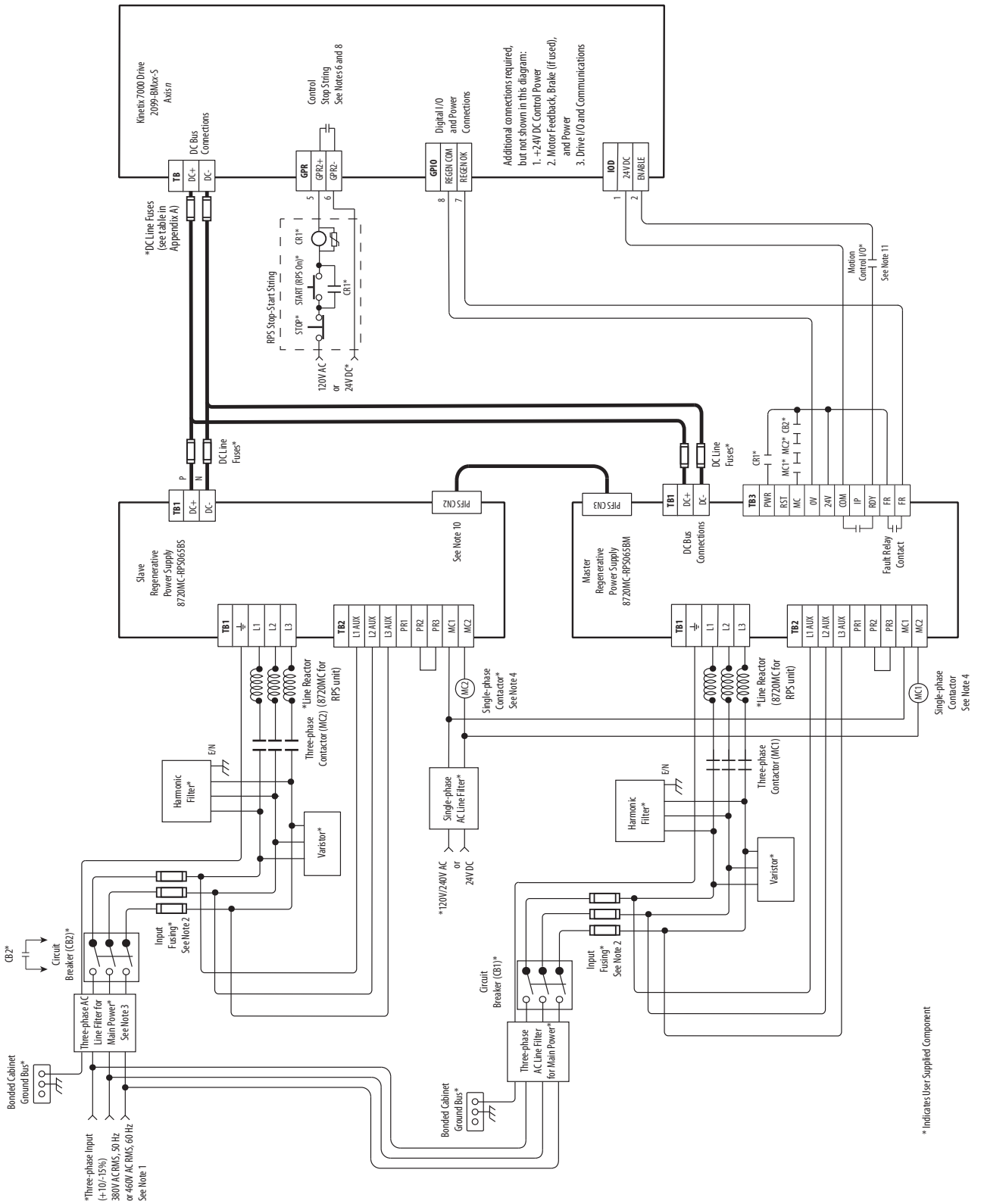
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 75 - 8720MC-RPS065BM Regenerative Power Supply to Multiple Kinetix 7000 Drives



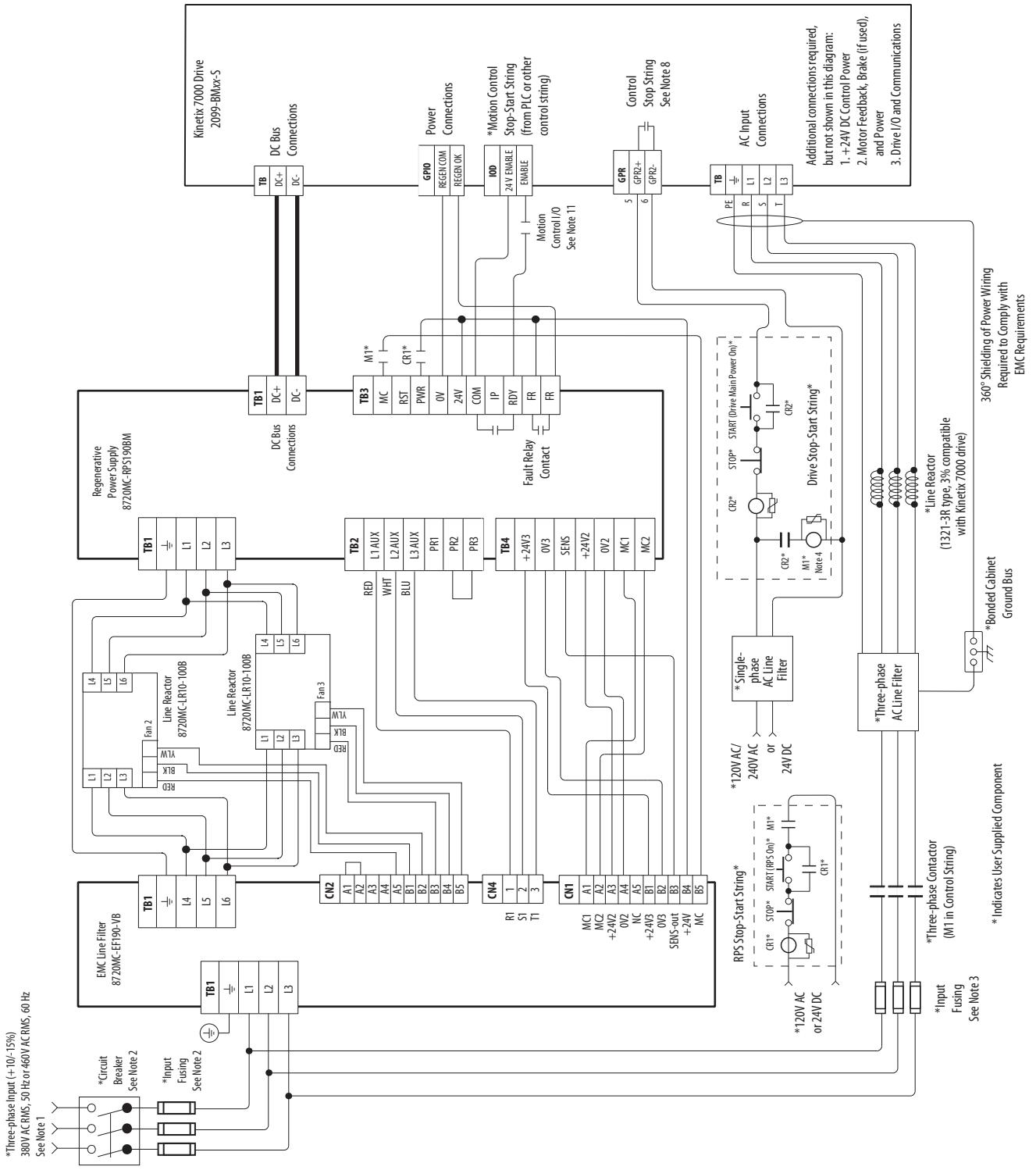
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 76 - Dual 8720MC-RPS065B*x* Regenerative Power Supplies to a Single Kinetix 7000 Drive



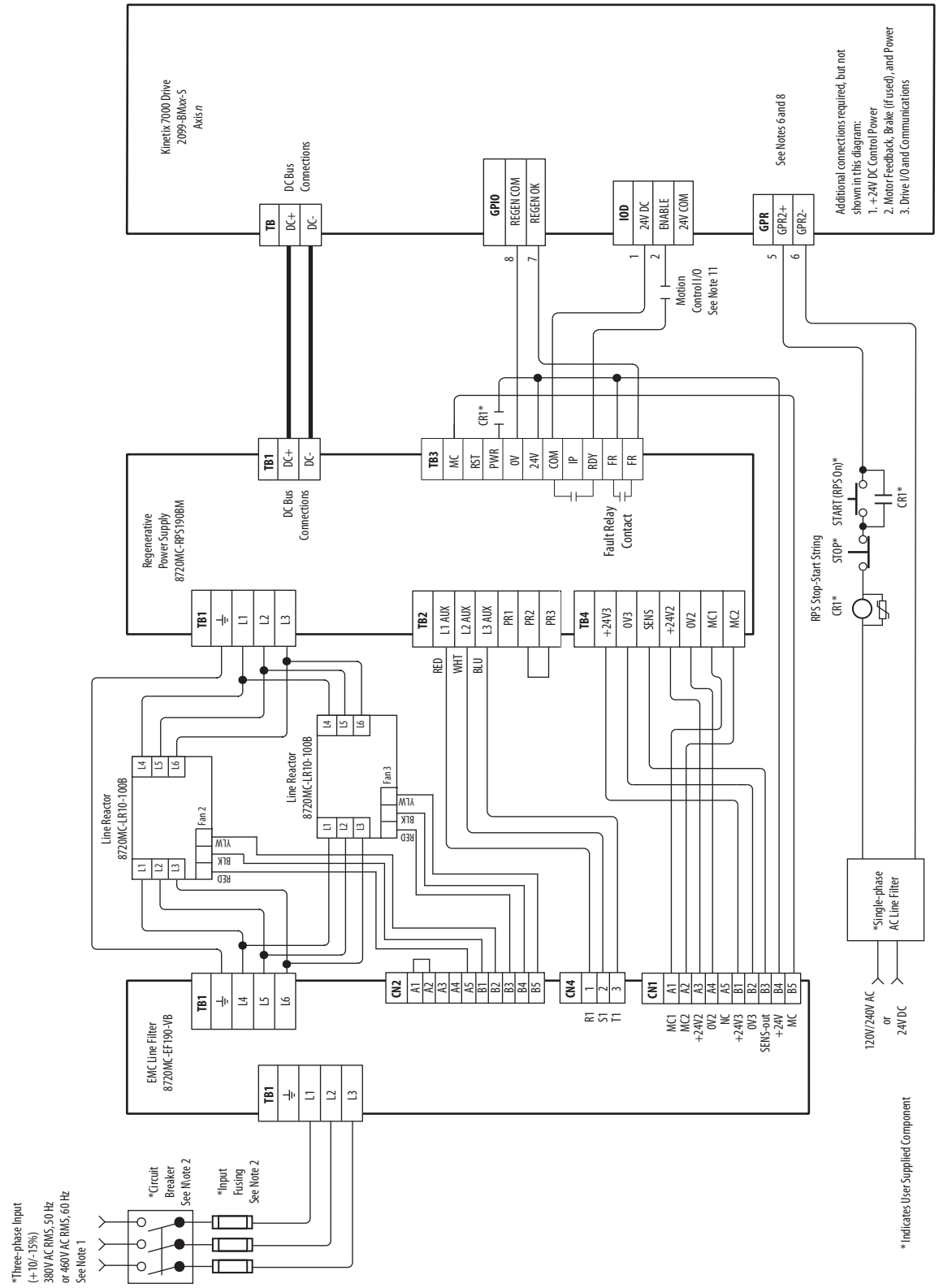
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 77 - Kinetix 7000 Drive AC Powered with a 8720MC-RPS190BM Regenerative Power Supply



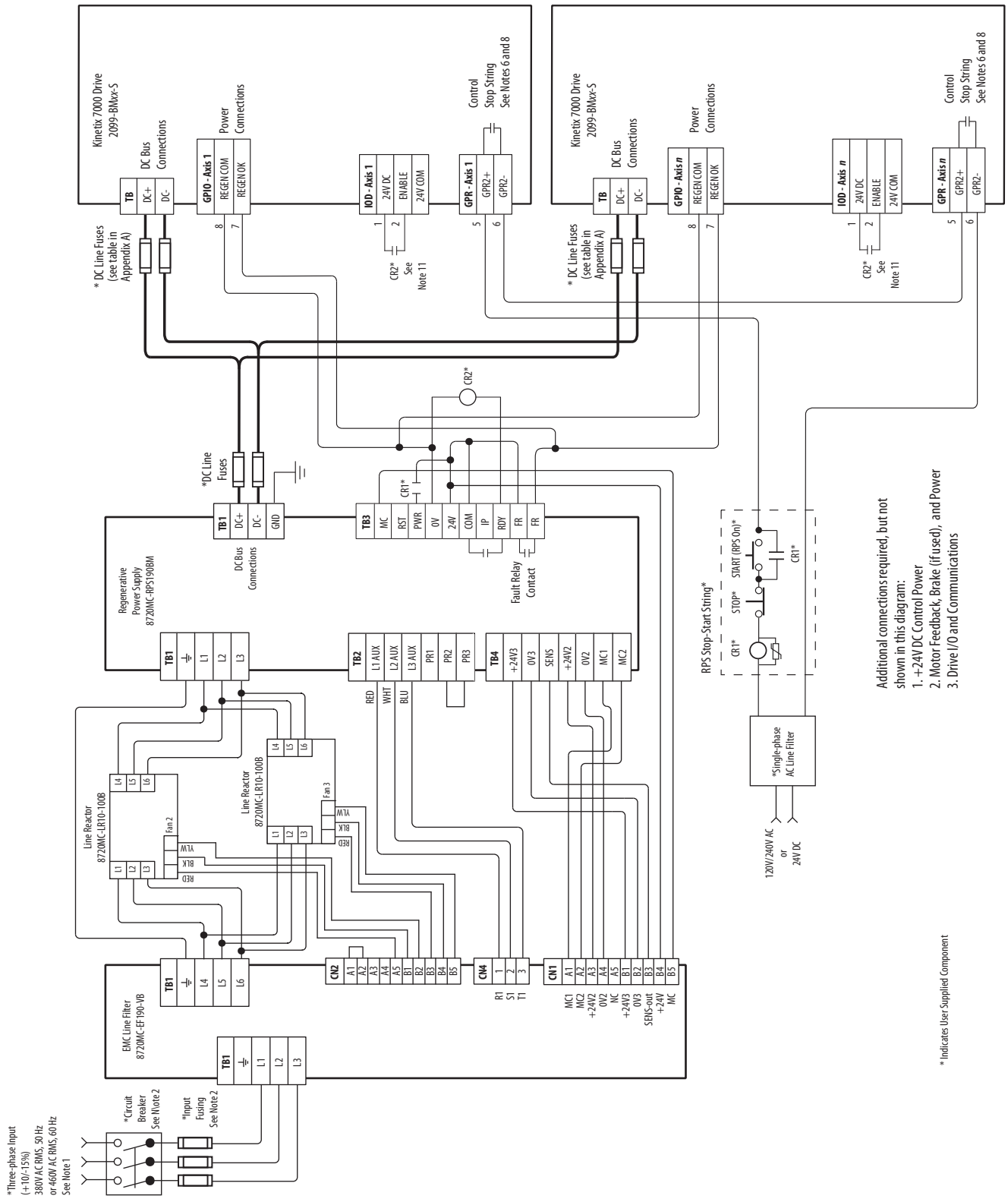
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 78 - 8720MC-RPS190BM Regenerative Power Supply to a Single Kinetix 7000 Drive



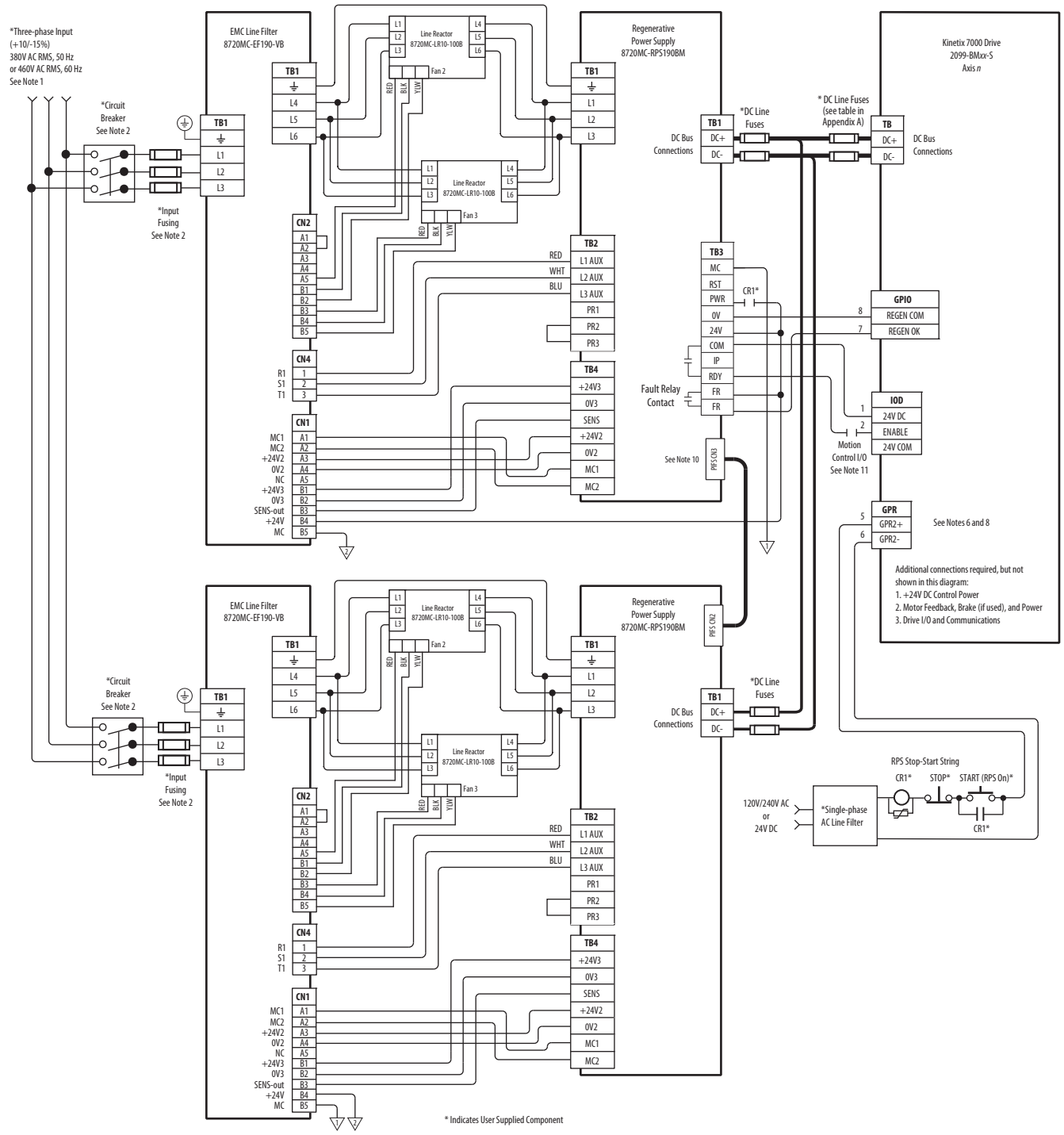
IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 79 - 8720MC-RPS190BM Regenerative Power Supply to Multiple Kinetix 7000 Drives



IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Figure 80 - Dual 8720MC-RPS190B*x* Regenerative Power Supplies to a Single Kinetix 7000 Drive

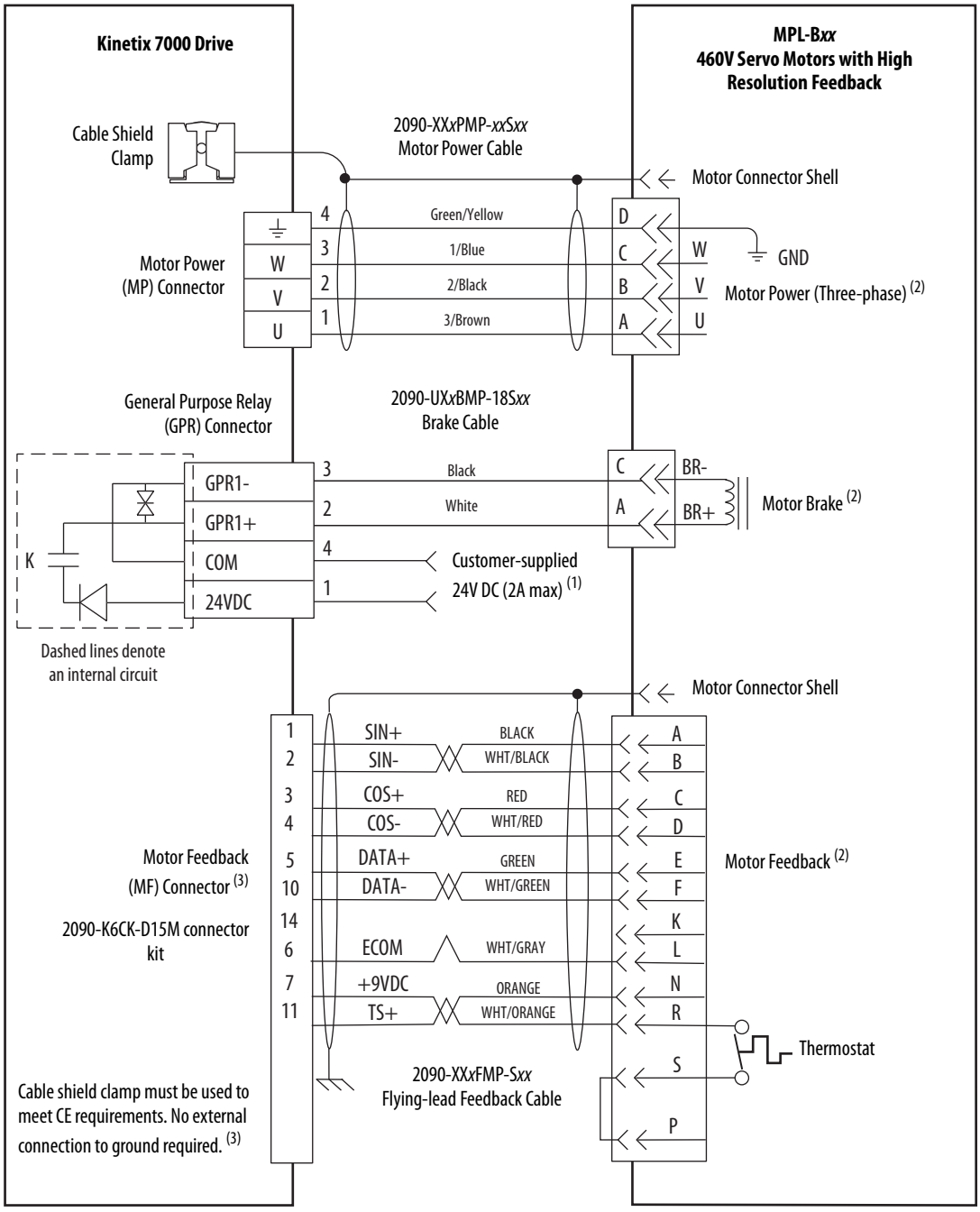


IMPORTANT This configuration requires the power regenerative mode settings as described in the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001, and setting of the power tab in RSLogix 5000 software is set to the appropriate bus regulator catalog number. Common mode capacitors should be disconnected on DC common bus drives.

Kinetix 7000 Drive/Rotary Motor Wiring Examples

IMPORTANT The Bulletin MPL motor wiring example on this page applies to motors equipped with bayonet connectors.

Figure 81 - Bulletin MPL Motors (Bayonet Style Connector)

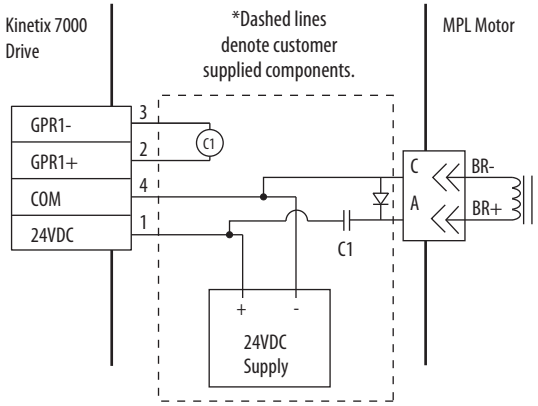


(1) See Customer-supplied 24V DC Power Supply Notes on page 175 for important wiring information.
(2) See MP-Series (Bulletin MPL) Motor Connectors on page 84 for more information on bayonet and circular DIN connectors.
(3) See Wire Low-profile Connectors on page 100 for more information on grounding feedback cables when using low-profile connectors.

Customer-supplied 24V DC Power Supply Notes

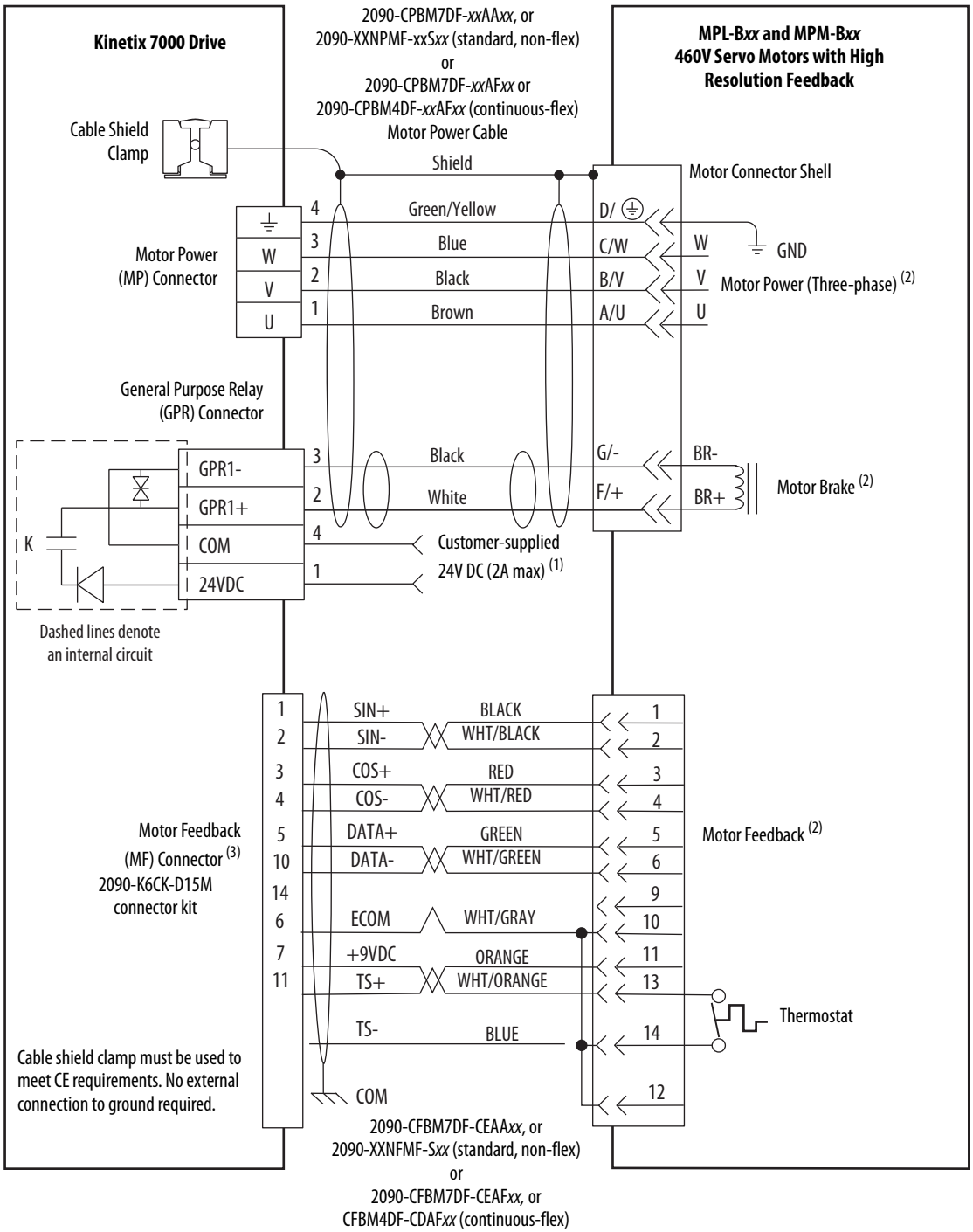
- The contact connected to GPR1+ and GPR1- is rated 2 Amps inductive @ 250V AC/30V DC maximum.
- MPx motors with a brake have various coil current requirements. Refer to the Kinetix Motion Control Selection Guide, publication GMC-SG001 for coil current requirements.
- For motors that utilize above 2 Amp coil current it is recommended that a customer-supplied external device, such as an interposing relay, be used between the drive and motor. See Figure 82 below.
- A customer-supplied diode or metal oxide varistor (MOV) is recommended for use with an interposing relay to prevent an electrical arc that may occur before the brake coil power dissipates. Use of an MOV can also reduce the amount of time required to mechanically engage the brake. See Figure 82 below.

Figure 82 - Customer-supplied 24V DC Power Supply Wiring Example



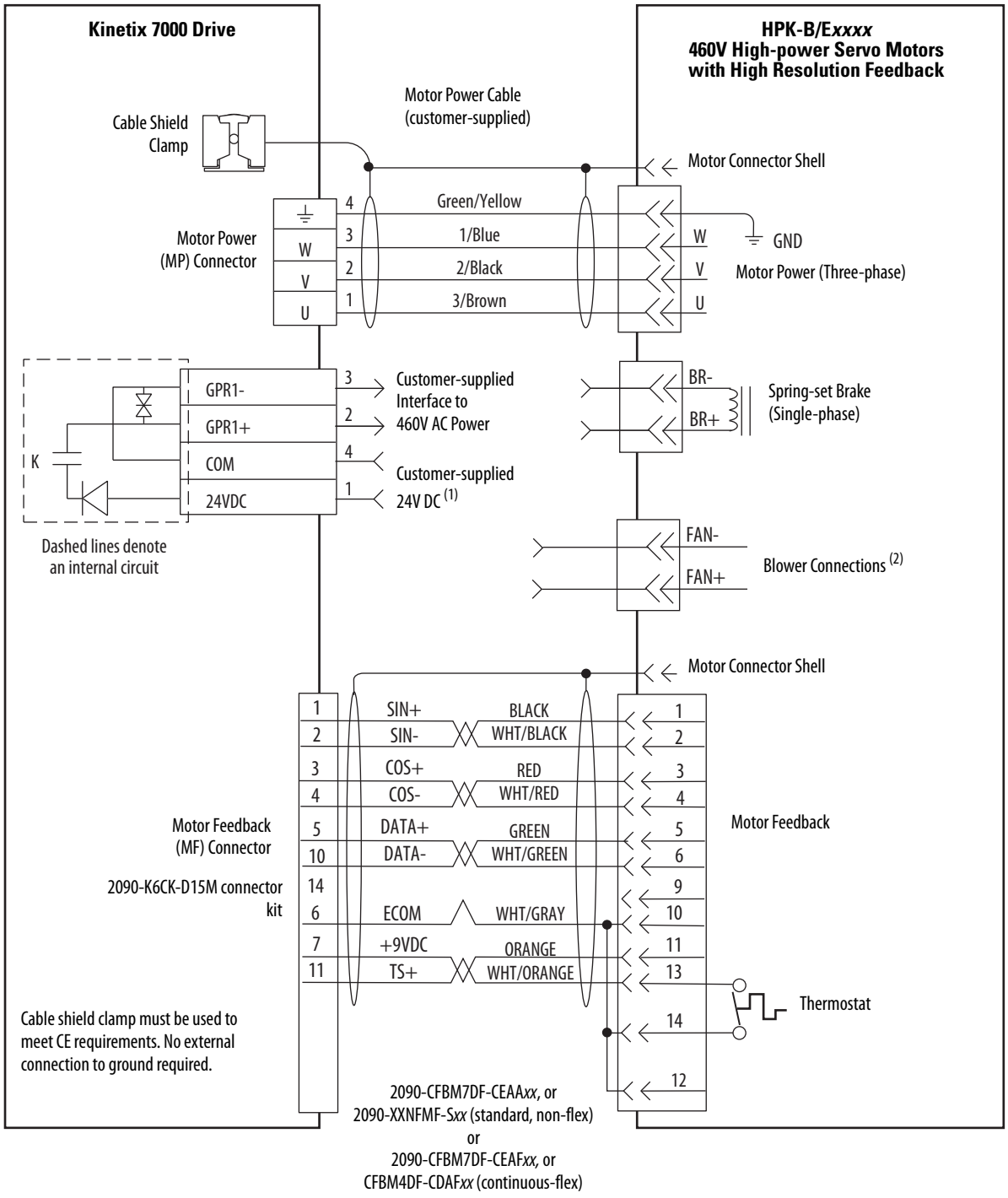
IMPORTANT The Bulletin MPL motor wiring example on this page applies to motors equipped with circular DIN connectors.

Figure 83 - Bulletin MPL and MPM Motors (Circular DIN Style Connector)



(1) See Customer-supplied 24V DC Power Supply Notes on page 175 for important wiring information.
(2) See MP-Series (Bulletin MPL) Motor Connectors on page 84 for more information on bayonet and circular DIN connectors.
(3) See Wire Low-profile Connectors on page 100 for more information on grounding feedback cables when using low-profile connectors.

Figure 84 - HPK-Series High-power Motors

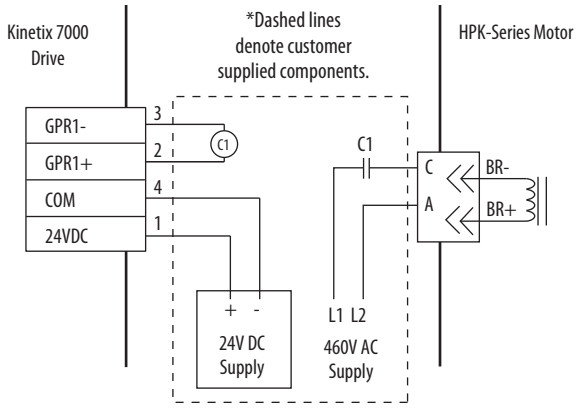


(1) See Customer-supplied 24V DC Power Supply Notes (HPK-series motors) on page 178 for important wiring information.
(2) See HPK-Series Motor Blower Connections on page 178 for more information.

Customer-supplied 24V DC Power Supply Notes (HPK-series motors)

- HPK-series motors require a customer-supplied 460V AC single-phase supply, rather than a 24V DC supply. However, the brake current ratings required by HPK-series motors are higher than the contact rating of the GPR connector. Therefore, if using an HPK-series motor with a brake, it is recommended that a customer-supplied, external interposing relay or equivalent circuit be used. See Figure 85 below.
- The contact connected to GPR1+ and GPR1- is rated 2 Amps inductive @ 250V AC/30 VDC maximum.
- See the Kinetix Motion Control Selection Guide, publication GMC-SG001 for HPK-series motor brake ratings.

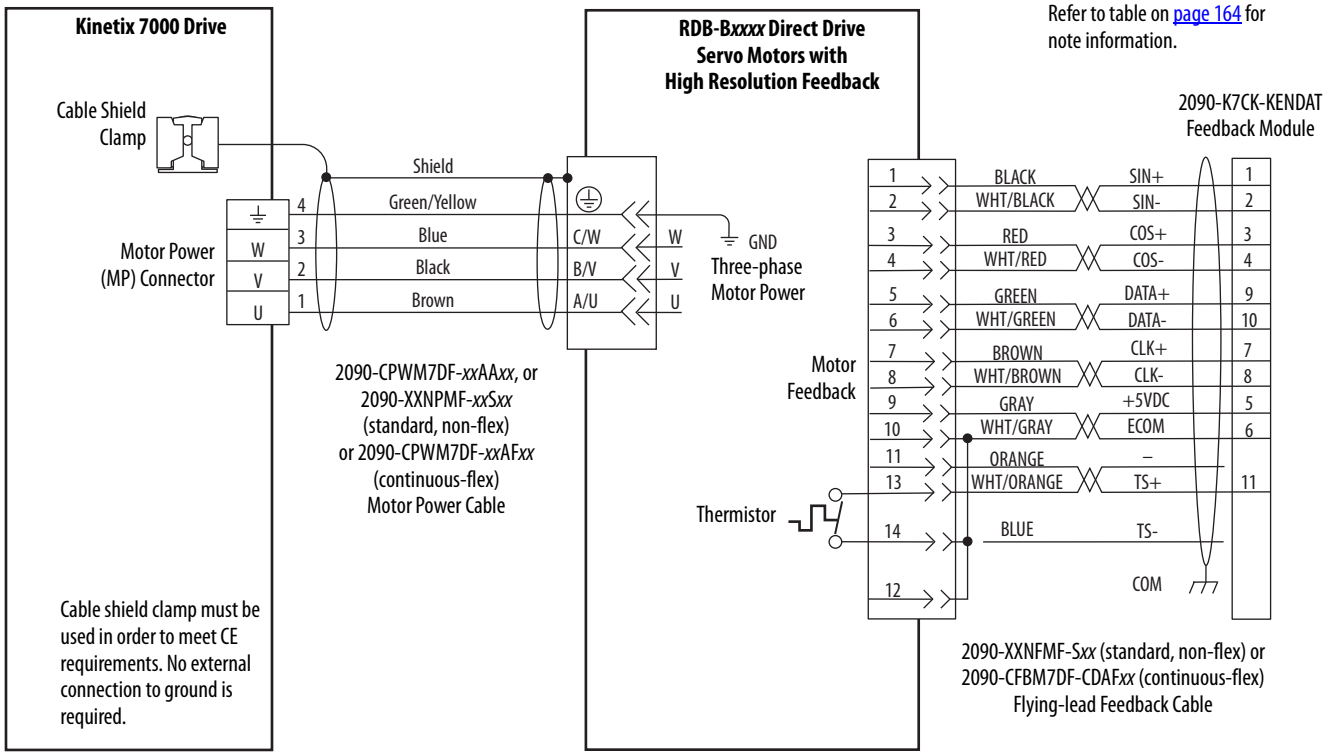
Figure 85 - Customer-supplied HPK-Series Motor Brake Wiring Example



HPK-Series Motor Blower Connections

- The HPK-series motor blower must be used to ensure proper motor performance.
- The blower connections can use either a Star (460 V AC) or Delta (230V AC) three-phase configuration. See the HPK-Series Asynchronous Servo Motor Installation Instructions, publication HPK-IN001, for connection diagrams.
- HPK-series Motors with a brake and without a brake have different blower assemblies and, therefore, have different connection and electrical characteristics.
- The HPK-series motor has a conduit box with terminals/leads for external power connections.
- See the Kinetix Motion Control Selection Guide, publication GMC-SG001 for HPK-series motors blower voltage and current specifications.

Figure 86 - Example with RDD-Series (Bulletin RDB-B) Motors

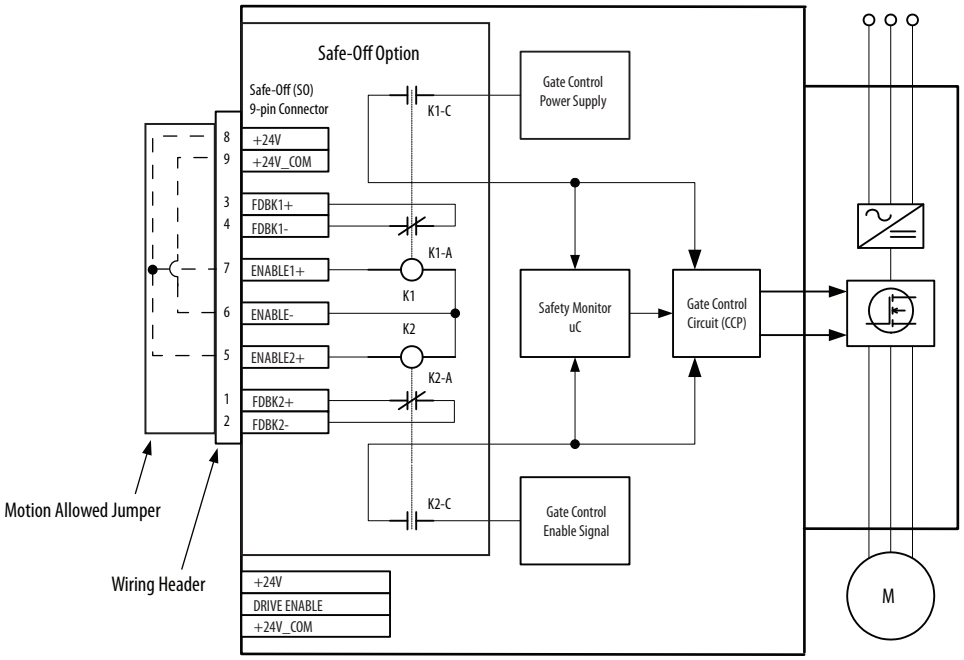


Refer to table on page 164 for note information.

Kinetix Safe-off Feature Block Diagram

Kinetix 7000 drives with the Safe-off feature installed ship with the wiring header and a motion-allowed jumper installed. In this configuration, the safe-off feature is disabled (not used).

Figure 87 - Kinetix Safe-off Feature



Upgrade Firmware

This appendix provides procedures for using ControlFLASH™ utility to upgrade the firmware in a Kinetix 7000 drive.

Before You Begin

Upgrading the firmware of a Kinetix 7000 servo drive using ControlFLASH involves entering the name of the target device, locating the SERCOS interface module and Kinetix 7000 servo drive to be flashed, finding the existing new firmware levels, and flashing the drive firmware.

Before you begin this procedure, make sure you have the following.

Description	Catalog Numbers	Version
RSLogix 5000 Software	9324-RLD300NE	15.0 or later
RSLinx Software	0355-RSLETENE	2.50.00 or later
ControlFLASH Kit (1)	N/A	4.00.09 or later
Firmware for Logix SERCOS interface module or PCI card	1756-M*xx*SE	15.32 or later
	1756-L60M03SE	15.4 or later
	1768-M04SE	15.35 or later
	1784-PM16SE	15.33 or later
Firmware upgrade file for Kinetix 7000	(2),(3)	

(1) For ControlFLASH information not specific to the Kinetix 7000 drive family, refer to the ControlFLASH Firmware Upgrade Kit Quick Start, publication1756-QS105.

(2) Contact Rockwell Automation Technical Support at (440) 646-5800 for firmware upgrade files and assistance.

(3) Go to http://support.rockwellautomation.com/firmware.asp for firmware upgrades.

Upgrade Firmware

This procedure requires you to use ControlFLASH software to upgrade the firmware in a Kinetix 7000 drive.

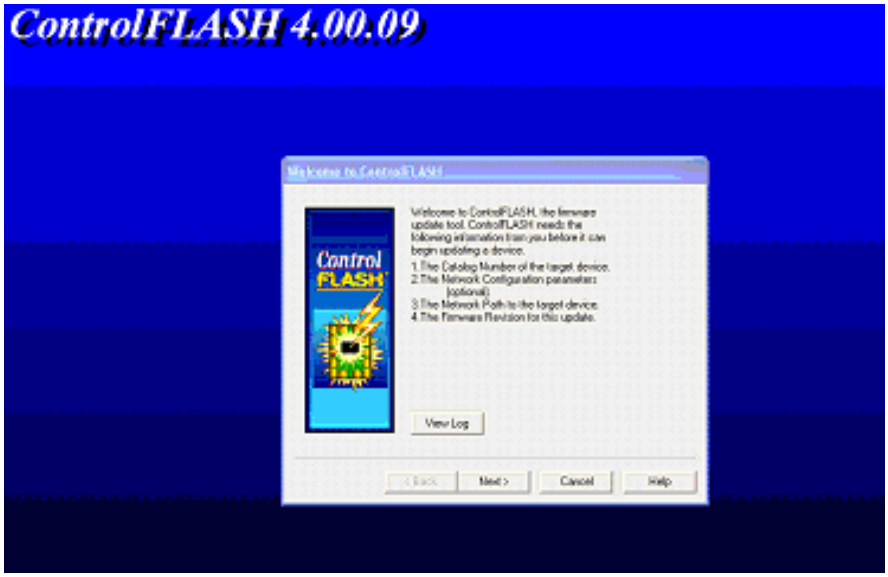
1. Verify 24V DC control power is supplied to the Kinetix 7000 drive requiring firmware upgrade.

IMPORTANT The seven segment LED on the Kinetix 7000 must display a 2, 3, or 4 before beginning this procedure. Only these displays indicates the drive has been recognized by the SERCOS interface.

ATTENTION: To avoid injury or damage to equipment due to unpredictable motor activity, do not apply main input power to the drive, or source drive power from a DC common bus.

2. Open your ControlFLASH software or select ControlFLASH from the Tools menu of RSLogix 5000 software.

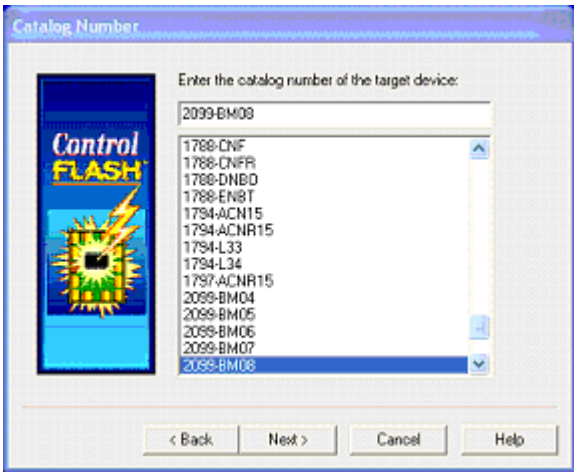
   The Welcome to ControlFLASH dialog opens.



3. Click Next.

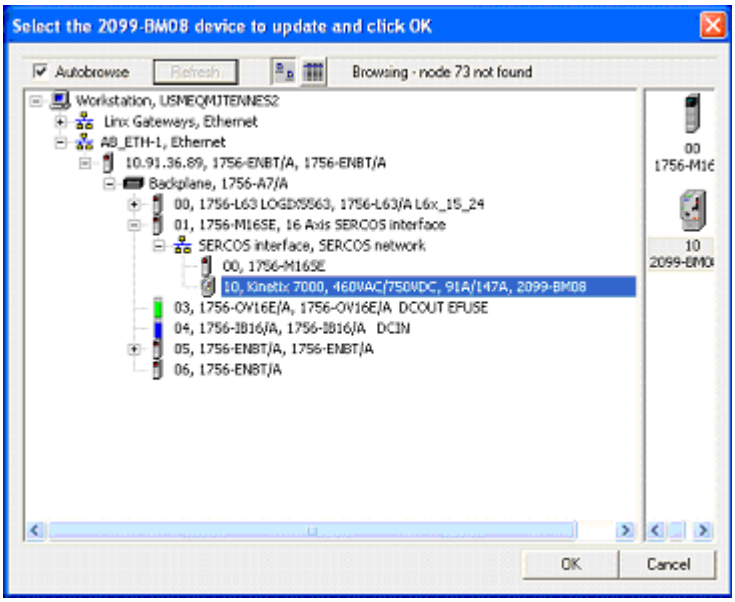
   The Catalog Number dialog opens.

4. Select the catalog number of the Kinetix 7000 (2099-BM*xx*-S) drive to upgrade.



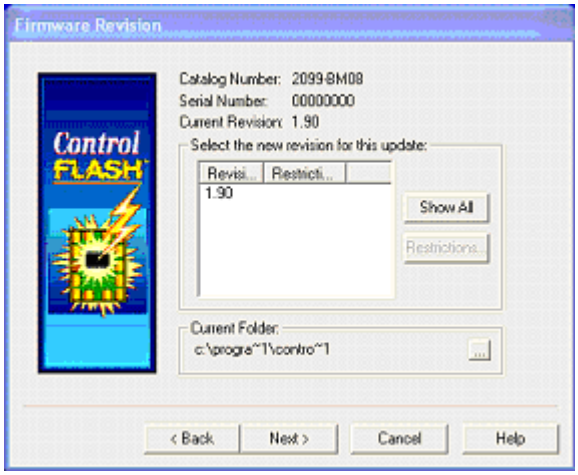
5. Click Next.

6. Select the SERCOS interface module and Kinetix 7000 drive to flash in the RSLinx Gateway dialog.



7. Click OK.

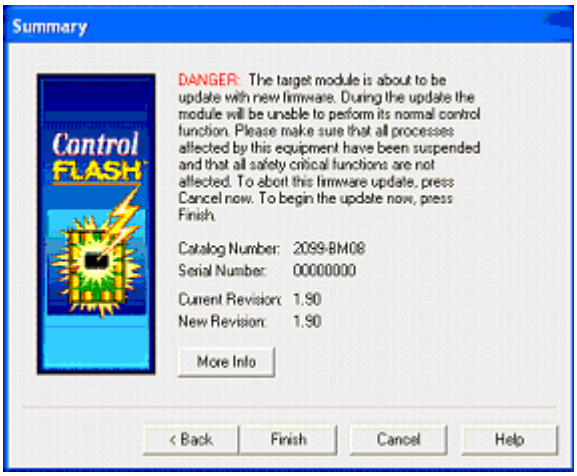
8. Select the firmware revision to use in this update.



   Select the new firmware from the list, or browse for it using the Current Folder option.

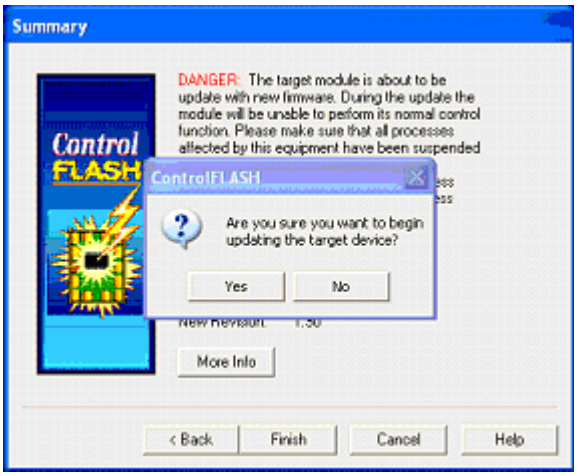
9. Click Next.

10. Confirm the catalog number and serial number of the drive, and its current revision and new revision of firmware.

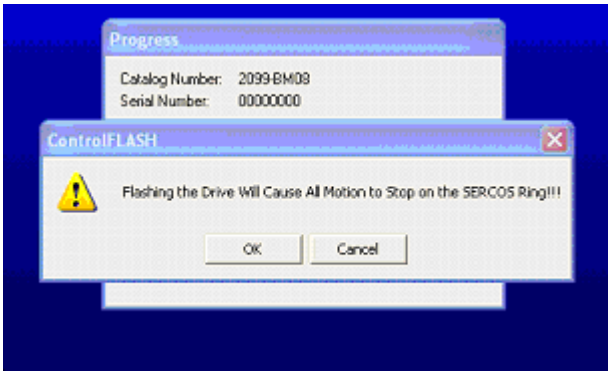


11. Click Finish.

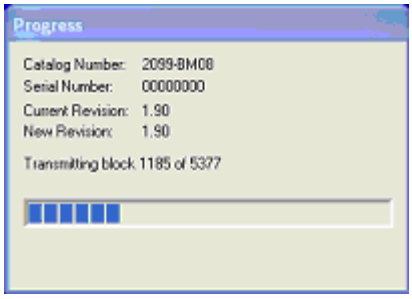
12. Click Yes to confirm updating of the target device.



13. Click OK to acknowledge the Motion Stop notice.



A dialog will display the progress of the flash update.



While this display is active, the Status display on the drive will display an F.

The Update Status dialog indicates success or failure as described below.

Flashing	If
Succeeded	5. Update complete appears in a GREEN status dialog. 6. Go to Step 2.
Failed	1. Update failure appears in a RED status dialog. 2. Contact Technical Support.

14. Click OK.

The ControlFLASH software returns to the Welcome screen where you can flash another drive or select Cancel to exit the program.

Numerics

A

B

C

D

E

R

S

T

W

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication RA-DU002, available at http://www.rockwellautomation.com/literature/.

Rockwell Automation maintains current product environmental information on its website at http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page.

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