User Manual

Original Instructions

Allen-Bradley

Kinetix 6200 and Kinetix 6500 Modular Multi-axis Servo Drives

Catalog Numbers
2094-BC*xx*-M*xx*-M, 2094-BM*xx*-M
2094-SE02F-M00-S*x*, 2094-EN02D-M01-S*x*,
2094-BSP2, 2094-PRF, 2094-SEPM-B24-S

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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.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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).

Chapter 4

Connector Data and Feature Descriptions

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Connect the Kinetix 6200 and Kinetix 6500 Drive System

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Configure and Start the Kinetix 6500 Drive System

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Appendix A

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This manual contains new and updated information as indicated in the following table.

Topic	Page
Added publication MOTION-RM003 to Additional Resources.	12
Added line-filter part numbers for systems without LIM modules and single-phase control power.	25
Updated the internal solid-state motor short-circuit protection rating to include 200,000 A (fuses) and 65,000 A (circuit breakers).	30
Corrected errors in the Absolute Position Feature table and figure.	79
Updated all instances of EnDat 2.1 and EnDat 2.2 to read EnDat Sine/Cosine and EnDat Digital, respectively.	79 and throughout
Added a footnote regarding supported model ECI119 in Table 46.	86
Corrected pinouts in Auxiliary Feedback Signals by Device Type table (pins 6…15). Also, added footnote and ATTENTION for wiring encoder power.	87
Updated intro text in Tune the Axes with reference to Kinetix® 6200 drive firmware 1.049 and link to Appendix D,	165
Updated FLT S47 fault code Possible Resolutions and added sub-code definitions.	203
Updated Symptom and Resolution columns for INHIBIT S04 fault code.	209
Added INHIBIT M07 fault code.	209
Added Appendix D, Configure the Load Observer Feature	271
Updated the torque low-pass filter bandwidth value for Kinetix 6200 drives and removed references to Kinetix 6000 drive firmware revisions.	275
Added Appendix E, Web Server Interface	287
Added Appendix H, EC Certifications	317

Notes:

This manual provides detailed installation instructions for mounting, wiring, and troubleshooting Kinetix 6200 and Kinetix 6500 (Bulletin 2094) servo drives; and system integration for your drive and motor/actuator combination with a Logix5000™ controller.

For information on wiring, configuring, and troubleshooting the Safe Speed Monitor functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Safety Reference Manual, publication 2094-RM001.

For information on wiring, configuring, and troubleshooting the Safe Torque Off functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Torque-off Safety Reference Manual, publication 2094-RM002.

This manual is intended for engineers or technicians directly involved in the installation and wiring of the Kinetix 6200 and Kinetix 6500 drives; and programmers directly involved in the operation, field maintenance, and integration of these drives with a sercos interface or EtherNet/IP™ communication module.

If you do not have a basic understanding of the Kinetix 6200 and Kinetix 6500 drives, contact your local Rockwell Automation sales representative for information on available training courses.

Conventions Used in This Manual

The conventions starting below are used throughout this manual.

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- Acronyms for the Kinetix 6200 and Kinetix 6500 drive modules are shown in the table below and are used throughout this manual.

Acronym	Kinetix 6200 and Kinetix 6500 Drive Modules	Cat. No.
IAM	Integrated Axis Module	2094-*x*BC*xx*-M*xx*-*x*M
AM	Axis Module	2094-*x*BM*xx*-*x*M
LIM	Line Interface Module	2094-*x*BL*xx* and 2094-*x*BL*xx*S-*xx*
RBM	Resistive Brake Module	2090-XB*xx*-*xx*

Acronym	Kinetix 6000M Drive Modules	Cat. No.
IDM	Integrated Drive-Motor	MDF-SB*xxxxx*
IPIM	IDM Power Interface Module	2094-SEPM-B24-S

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
Kinetix 6000 Power Rail Installation Instructions, publication 2094-IN003	Information on the installation of your Bulletin 2094 power rail.
Kinetix 6000 Shunt Module Installation Instructions, publication 2094-IN004	Information on the installation of your Bulletin 2094 shunt module.
Slot-filler Module Installation Instructions, publication 2094-IN006	Information on the installation of Bulletin 2094 slot-filler module.
Line Interface Module Installation Instructions, publication 2094-IN005	Information on the installation and troubleshooting of Bulletin 2094 line interface modules (LIM).
2094 Mounting Bracket Installation Instructions, publication 2094-IN008	Information on the installation of Bulletin 2094 mounting brackets.
Resistive Brake Module Installation Instructions, publication 2090-IN009	Information on the installation and wiring of Bulletin 2090 Resistive Brake Modules.
Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010	Information on proper handling, installing, testing, and troubleshooting fiber-optic cables.
External Shunt Modules Installation Instructions, publication 2090-IN004	Information on mounting and wiring the Bulletin 1394 shunt modules with Bulletin 2094 servo drive systems.
System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001	Information, examples, and techniques designed to minimize system failures caused by electrical noise.
Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003	Information on installing, configuring, startup, troubleshooting, and applications for your Kinetix 6000M integrated drive-motor (IDM) system.
Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Servo Drives Safety Reference Manual, publication 2094-RM001	Information on wiring, configuring, and troubleshooting the Safe Speed Monitor features of your Kinetix 6200 and Kinetix 6500 drives.
Kinetix 6200 and Kinetix 6500 Safe Torque-off Servo Drives Safety Reference Manual, publication 2094-RM002	Information on wiring, configuring, and troubleshooting the safe torque-off features of your Kinetix 6200 and Kinetix 6500 drives.
Kinetix 6000 and Kinetix 6200/6500 Drive Systems, publication GMC-RM003	System design guide to select the required (drive specific) drive module, power accessory, connector kit, motor cable, and interface cable catalog numbers for your drive and motor/actuator motion control system.
Kinetix Motion Control Selection Guide, publication KNX-SG001	Overview of Kinetix servo drives, motors, actuators, and motion accessories designed to help make initial decisions for the motion control products best suited for your system requirements.
Kinetix Rotary Motion Specifications, publication GMC-TD001	Product specifications for MP-Series™ (Bulletin MPL, MPM, MPF, MPS), Kinetix 6000M (Bulletin MDF), TL-Series™, RDD-Series™, and HPK-Series™ rotary motors.
Kinetix Linear Motion Specifications, publication GMC-TD002	Product specifications for Bulletin MPAS and MPMA linear stages, Bulletin MPAR, MPAI, and TLAR electric cylinders, and LDC-Series™ and LDL-Series™ linear motors.
Kinetix Servo Drives Specifications, publication KNX-TD003	Product specifications for Kinetix Integrated Motion over the EtherNet/IP network, Integrated Motion over sercos interface, EtherNet/IP networking, and component servo drive families.
Kinetix Motion Accessories Specifications, publication KNX-TD004	Product specifications for Bulletin 2090 motor and interface cables, low-profile connector kits, drive power components, and other servo drive accessory items.
Rockwell Automation® Configuration and Selection Tools website http://www.rockwellautomation.com/en/e-tools	Motion Analyzer application analysis software for drive/motor sizing and online product selection and system configuration tools, including AutoCAD (DXF) files.
Rockwell Automation Product Certification, website http://www.rockwellautomation.com/products/certification	For declarations of conformity (DoC) currently available from Rockwell Automation.
Sercos and Analog Motion Configuration User Manual, publication MOTION-UM001	Information on configuring and troubleshooting your ControlLogix®, CompactLogix™, and SoftLogix™ sercos interface modules.
Motion Coordinate System User Manual, publication MOTION-UM002	Information to create a motion coordinate system with sercos or analog motion modules.
Integrated Motion on the EtherNet/IP Network Configuration and Startup User Manual, publication MOTION-UM003	Information on configuring and troubleshooting your ControlLogix and CompactLogix EtherNet/IP network modules.
Integrated Motion on the EtherNet/IP Network Reference Manual, publication MOTION-RM003	Information on descriptions of the AXIS_CIP_DRIVE attributes and the Studio 5000 Logix Designer® application Control Modes and Methods.
SoftLogix Motion Card Setup and Configuration Manual, publication 1784-UM003	Information on configuring and troubleshooting SoftLogix PCI cards.
ControlFLASH Firmware Upgrade Kit User Manual, publication 1756-QS105	For ControlFLASH™ information not specific to any drive family.
Rockwell Automation Industrial Automation Glossary, publication AG-7.1	A glossary of industrial automation terms and abbreviations.

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

Chapter 1

Start

Use this chapter to become familiar with the design and installation requirements for Kinetix 6200 and Kinetix 6500 drive systems.

About the Kinetix 6200 and Kinetix 6500 Drive Systems

The Kinetix 6200 and Kinetix 6500 modular multi-axis servo drives are designed to provide a Kinetix Integrated Motion solution for your drive/motor/actuator applications.

Table 1 - Kinetix 6200 and Kinetix 6500 Drive System Overview

System Component	Cat. No.	Description
Integrated Axis Module	2094-BC*xx*-M*xx*-M	Integrated Axis (power) Modules (IAM) with Safe Speed Monitor are available with 400V-class AC input power and contains an inverter and converter section. The IAM power module requires one control module.
Axis Module	2094-BM*xx*-M	Axis (power) Modules (AM) are a shared DC-bus inverter rated for 400V-class input power. The AM power modules each require one control module and must be used with an IAM power module.
Control Module	2094-SE02F-M00-S*x*	Interchangeable modular components for wiring I/O, safety, and feedback options using sercos interface.
	2094-EN02D-M01-S*x*	Interchangeable modular components for wiring I/O, safety, and feedback options using EtherNet/IP networking.
Shunt Module	2094-BSP2	The Bulletin 2094 shunt module mounts to the power rail and provides additional shunting in regenerative applications.
Kinetix 6000M IDM System	2094-SEPM-B24-S Bulletin MDF	The Kinetix 6000M integrated drive-motor (IDM) system consists of the IDM power interface module (IPIM) and up to 16 (Bulletin MDF) IDM units. The IPIM module mounts on the Bulletin 2094 power rail and provides power and communication to the IDM units. The IPIM module also monitors power output and provides overload protection.
Power Rail	2094-PRS*x* 2094-PR*x*	The Bulletin 2094 power rail consists of copper bus bars and a circuit board with connectors for each module. The power rail provides power and control signals from the converter section to adjacent inverters. The IAM and AM power modules, shunt module, slot-filler modules mount to the power rail.
Slot-filler Module	2094-PRF	The Bulletin 2094 slot-filler module is used when one or more slots on the power rail are empty after all the other power rail modules are installed. One slot-filler module is required for each empty slot.
Logix5000™ Controllers	1756-M*xx*SE modules 1768-M04SE module 1784-PM16SE PCI card	The sercos interface module/PCI card serves as a link between the ControlLogix®/CompactLogix™/SoftLogix™ controllers and the Kinetix 6200 drive system. The communication link uses the IEC 61491 SErial Real-time COmmunication System (sercos) protocol over a fiber-optic cable.
	1756-EN*x*T*x* modules CompactLogix 5370 controllers	The EtherNet/IP network module serves as a link between the ControlLogix platform and Kinetix 6500 drive system. Linear, device-level ring (DLR), and star topology is supported. The Kinetix 6000M IPIM module connects to the EtherNet/IP network for monitoring, diagnostics, and firmware upgrades.
Studio 5000® Environment	9324-RLD300*xx*E	The Studio 5000 Logix Designer® application provides support for programming, commissioning, and maintaining the Logix5000 family of controllers.
Rotary Servo Motors	MP-Series™, RDD-Series™ 1326AB	Compatible rotary motors include the MP-Series (Bulletin MPL, MPM, MPF, and MPS), RDD-Series (Bulletin RDB), and 1326AB (M2L/S2L) 400V-class motors.
Linear Motors	LDC-Series™	Compatible motors include LDC-Series iron core (400V-class) linear motors.
Linear Actuators	MP-Series	Compatible actuators include MP-Series (400V-class) Bulletin MPAS single-axis and Bulletin MPMA multi-axis integrated linear stages, and MP-Series (400V-class) Bulletin MPAR and MPAI electric cylinders.
	LDAT-Series	LDAT-Series integrated linear actuators are compatible with 400V-class drive systems.
Cables	2090-Series motor/ actuator cables	Bulletin 2090 motor/actuator 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.
	Kinetix 6000M integrated drive-motor cables	Bulletin 2090 integrated drive-motor (IDM) hybrid and network cables connect between the 2094 IPIM module and the Kinetix 6000M IDM units. Bulletin 889D and 879D cables connect between digital input connectors and sensors.
	Communication	Bulletin 2090 sercos fiber-optic cables are available as enclosure only, PVC, nylon, and glass with connectors at both ends.
		Ethernet cables are available in standard lengths for Kinetix 6500, Kinetix 6200, and Kinetix 6000M IPIM modules. Shielded cable is recommended.
AC Line Filters	2090-XXLF-*xxxx*	Bulletin 2090-XXLF-*xxxx* three-phase AC line filters are required to meet CE in all 400V-class drive systems.
Line Interface Modules	2094-*x*L*xx* 2094-*x*L*xx*S 2094-XL75S-C*x*	Line interface modules (LIM) include the circuit breakers, AC line filter (catalog number 2094-BL02 only), power supplies, and safety contactor required for Kinetix 6200 and Kinetix 6500 operation. The LIM module does not mount to the power rail. You can purchase individual components separately in place of the LIM module.
External Shunt Modules	1394-SR*xxxx*	You can use Bulletin 1394 external passive shunt modules when the IAM/AM power module internal shunt and power rail mounted 2094-BSP2 shunt module capability is exceeded.
Resistive Brake Module	2090-XB*xx*-*xx*	Resistive Brake Modules (RBM) include a safety contactor for use in a control circuit. Contactors and resistors reside in this module such that the motor leads can be disconnected from the drive with the permanent magnet motor brought to an immediate stop. This module does not mount to the power rail.

Typical Hardware Configurations

Typical Kinetix 6200 and Kinetix 6500 system installations include three-phase AC configurations, with and without the line interface module (LIM), and DC common-bus configurations.

SHOCK HAZARD: To avoid personal injury due to electrical shock, place a 2094-PRF slot-filler module in all empty slots on the power rail. Any power rail connector without a module installed disables the Bulletin 2094 system; however, control power is still present.

Figure 1 - Typical Kinetix 6200 or Kinetix 6500 System Installation (with LIM)

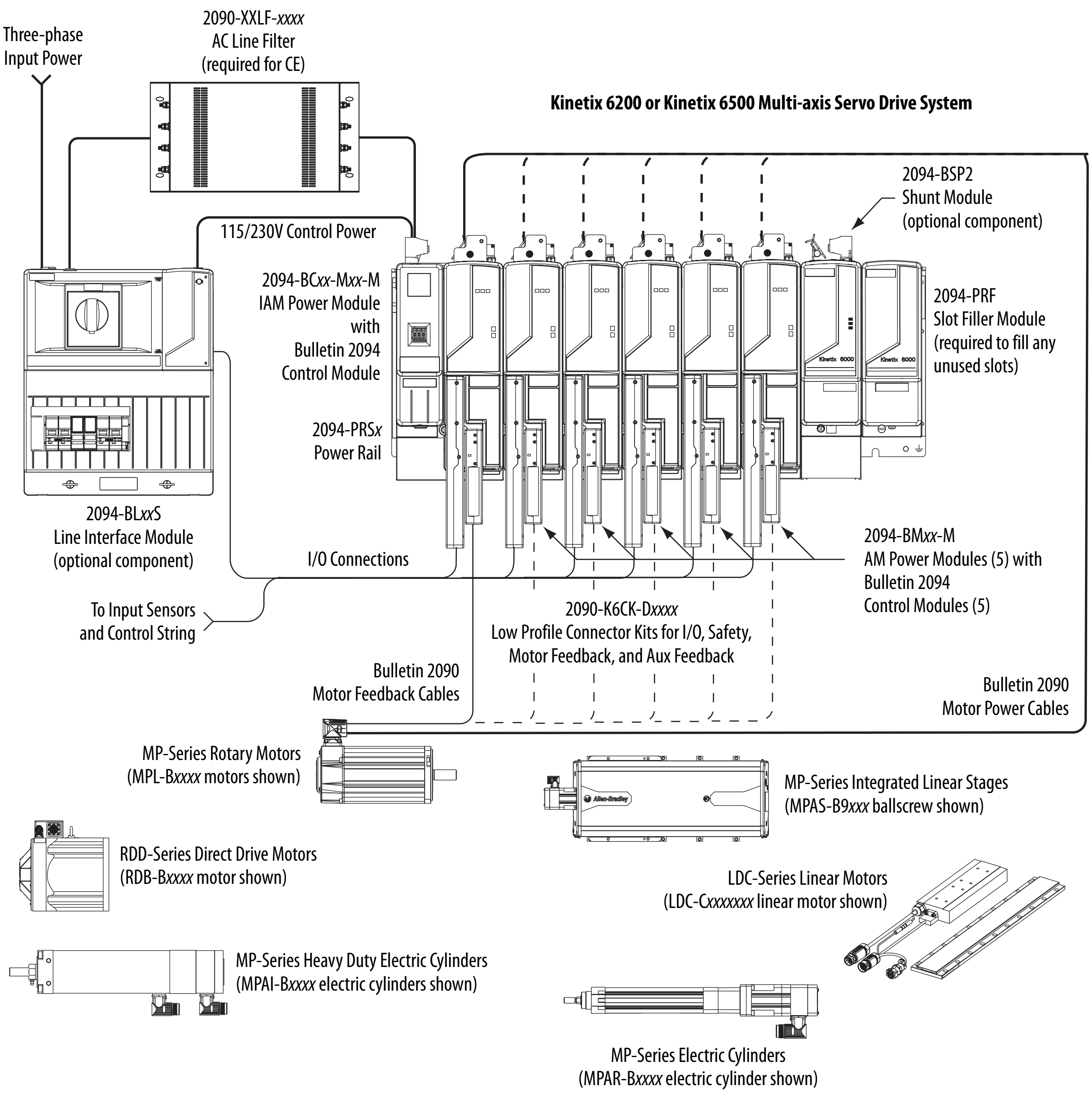
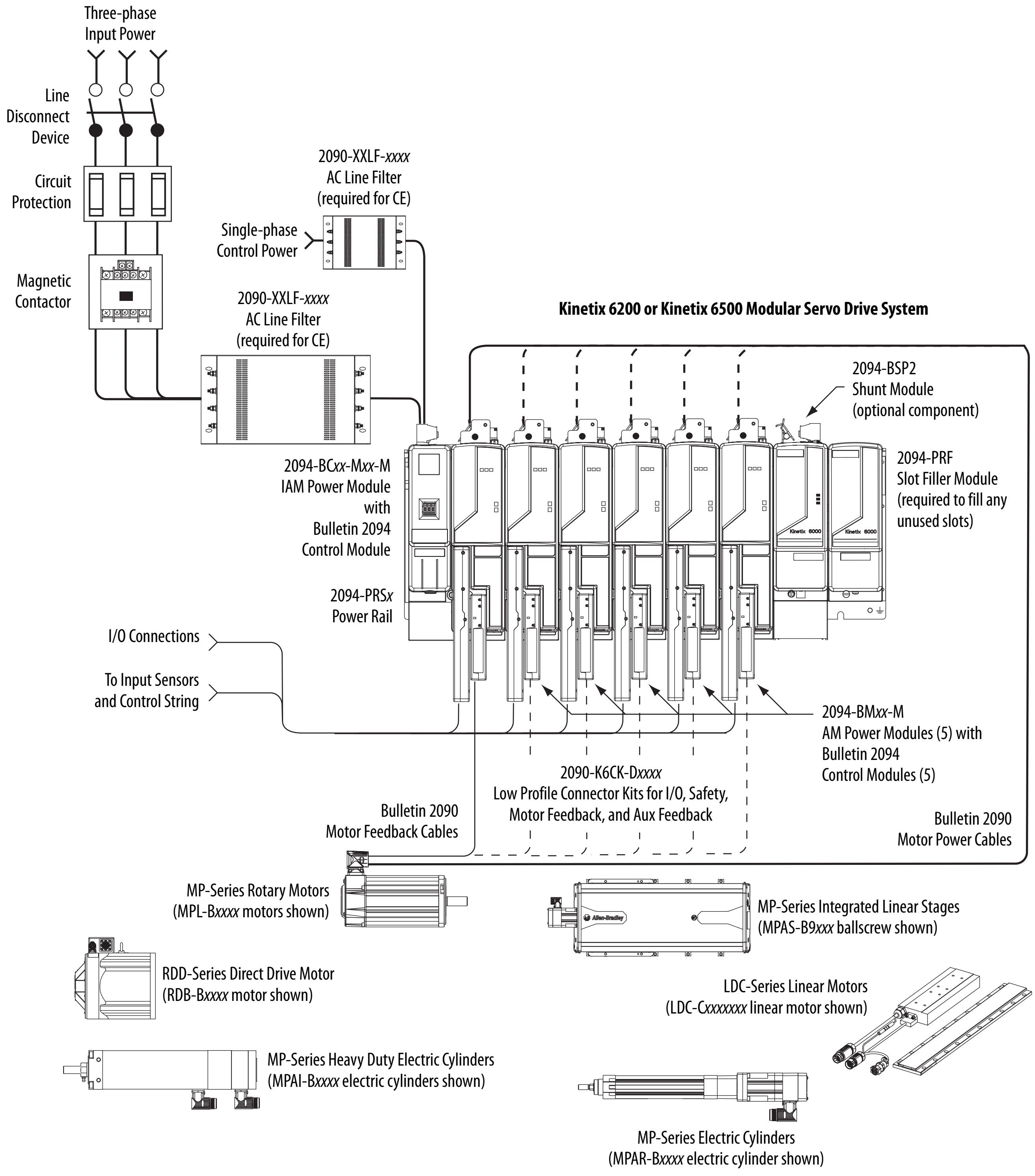
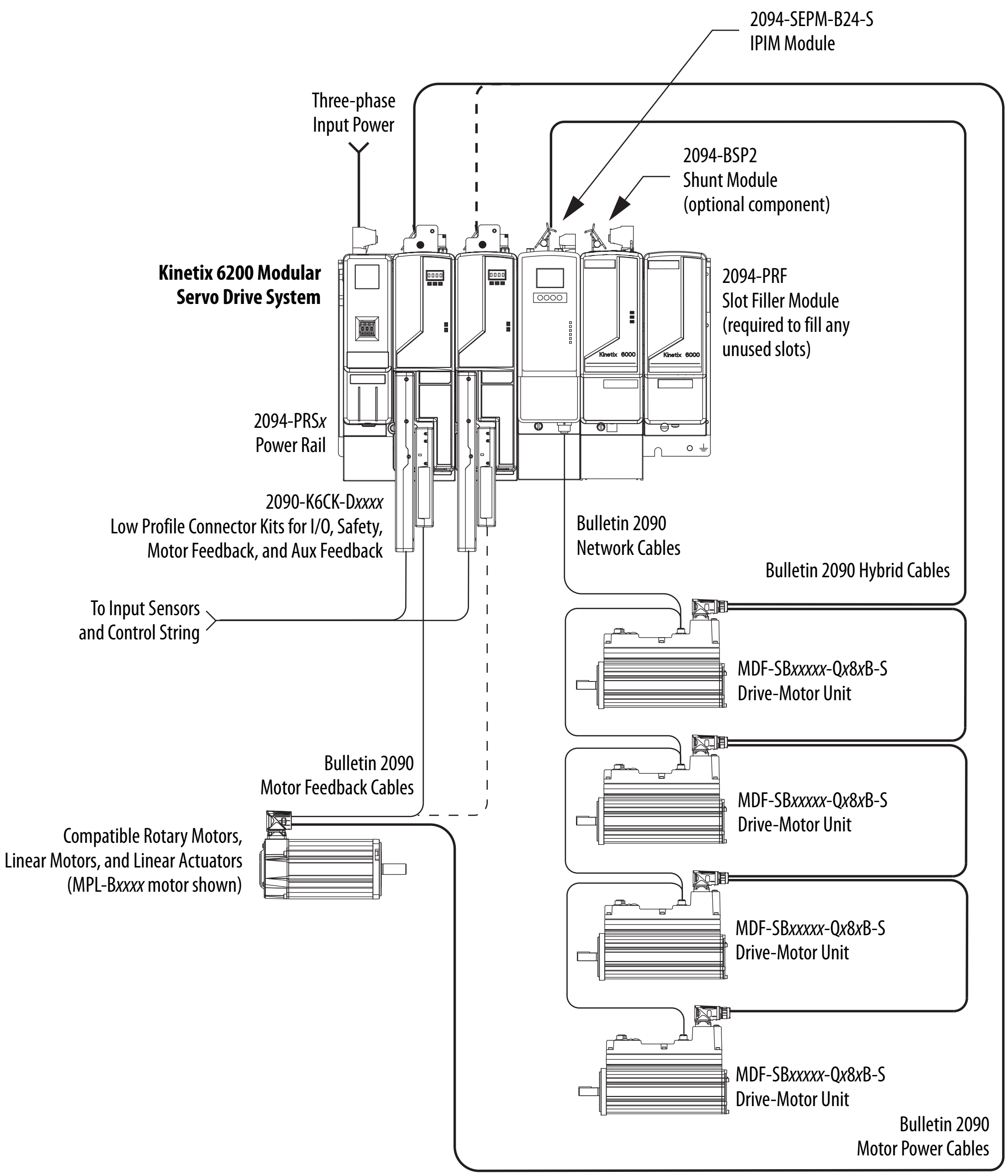


Figure 2 - Typical Kinetix 6200 or Kinetix 6500 System Installation (without LIM)



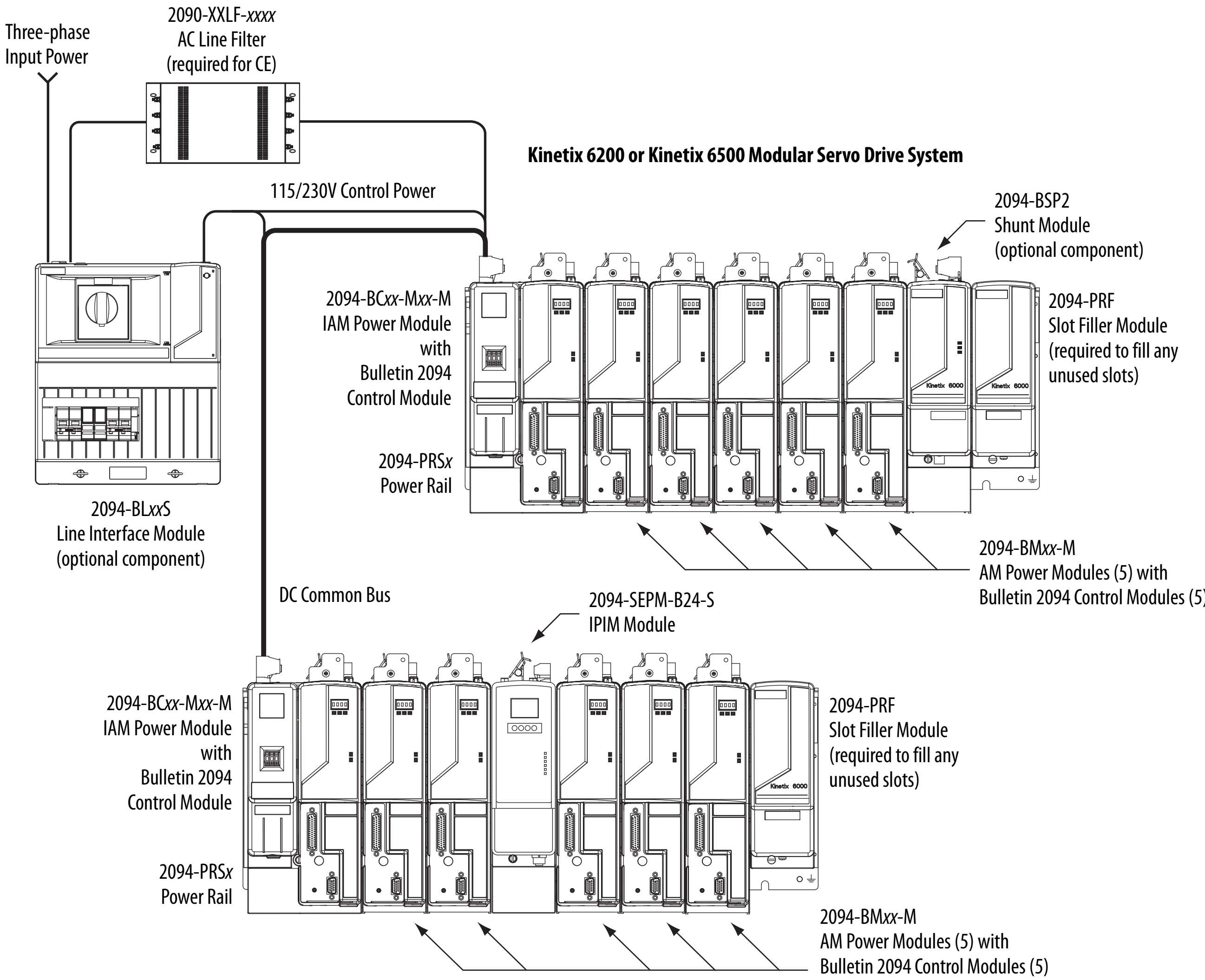
This configuration illustrates the Kinetix 6000M integrated drive-motor (IDM) system with IDM power interface module (IPIM) installed on the Bulletin 2094 power rail. The IPIM module is included in the drive-to-drive fiber-optic cable installation along with the axis modules.

Figure 3 - Typical Kinetix 6000M Integrated Drive-Motor System Installation



For more information on Kinetix 6000M integrated drive-motor system installation, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Figure 4 - Typical DC Common Bus System Installation



In the example above, the leader IAM module is connected to the follower IAM module via the DC common-bus. The follower system also includes the Kinetix 6000M integrated drive-motor (IDM) power interface module (IPIM) that supports up to 16 IDM units.

When planning your panel layout, you must calculate the total bus capacitance of your DC common-bus system to be sure that the leader IAM module is sized sufficiently to pre-charge the entire system. Refer to Appendix C, beginning on page 267, for more information.

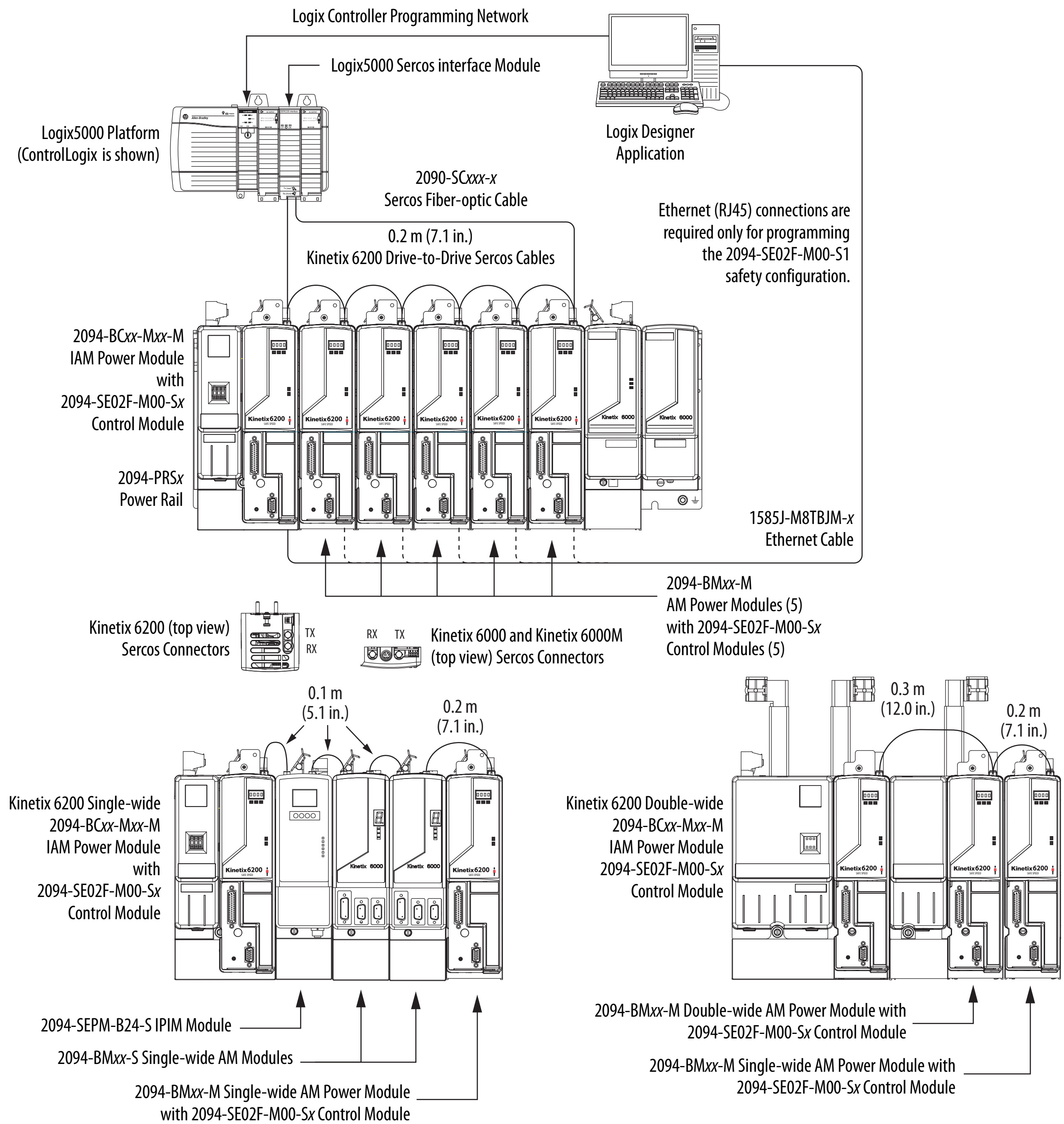
IMPORTANT	If total bus capacitance of your system exceeds the leader IAM power module pre-charge rating, the IAM module four-character display scrolls a power cycle user limit condition. If input power is applied, the display scrolls a power cycle fault limit condition. To correct this condition, you must replace the leader IAM power module with a larger module or decrease the total bus capacitance by removing the IPIM module or AM power modules.

Typical Communication Configurations

In this example, drive-to-drive sercos cables and catalog numbers are shown when Kinetix 6000, Kinetix 6000M, and Kinetix 6200 drive modules exist on the same power rail.

The Kinetix 6200 control modules use sercos interface for configuring the Logix5000 module and the EtherNet/IP network for diagnostics and configuring safety functions. An Ethernet cable is connected to each control module during safety configuration. For more information on Ethernet cables, refer to the Industrial Ethernet Media Brochure, publication 1585-BR001.

Figure 5 - Typical Kinetix 6000 and Kinetix 6200 Communication (sercos)



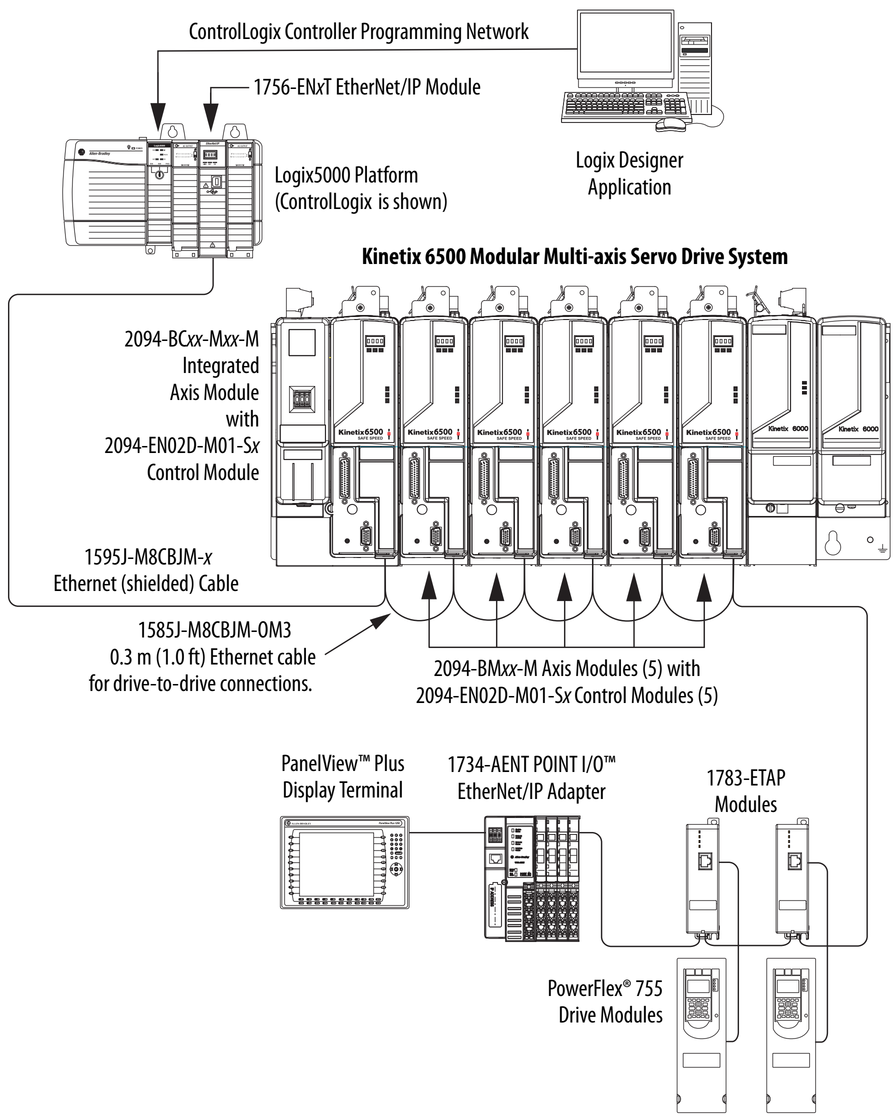
The Kinetix 6500 control modules can use any Ethernet topology including star, linear, and device-level ring (DLR). DLR is an ODVA standard and provides fault tolerant connectivity.

TIP 1756-EN2F modules are available for applications that require fiber-optic cable for noise immunity.

In this example, all devices are connected in linear topology. The Kinetix 6500 control module includes dual-port connectivity. Devices without dual ports should include the 1783-ETAP module or be connected at the end of the line.

- Up to 64 devices in linear configurations.
- No redundancy. If any device becomes disconnected, all the devices downstream loose communication.

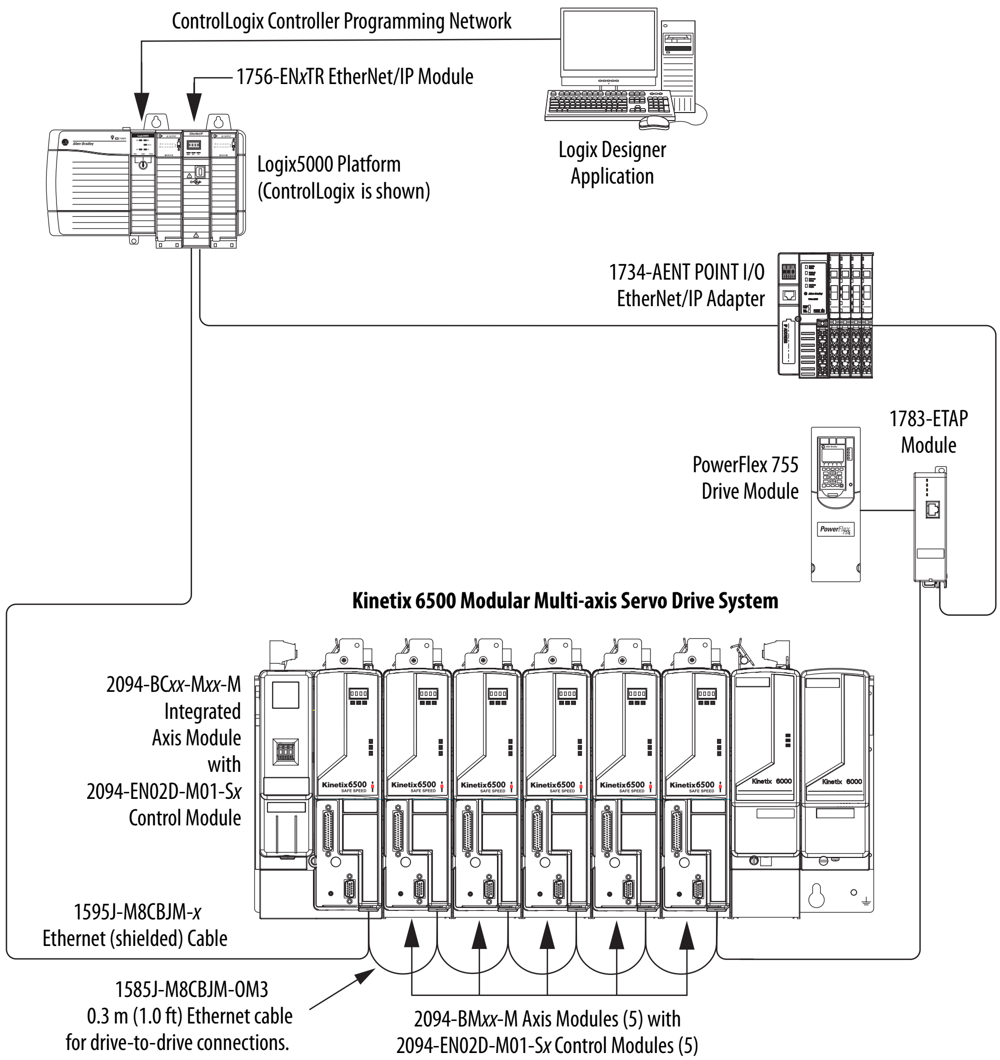
Figure 6 - Kinetix 6500 Linear Communication Installation (EtherNet/IP network)



In this example, the devices are connected by using device-level ring (DLR) topology. DLR topology is fault redundant. For example, if a device in the ring is disconnected, the rest of the devices in the ring continue to maintain communication.

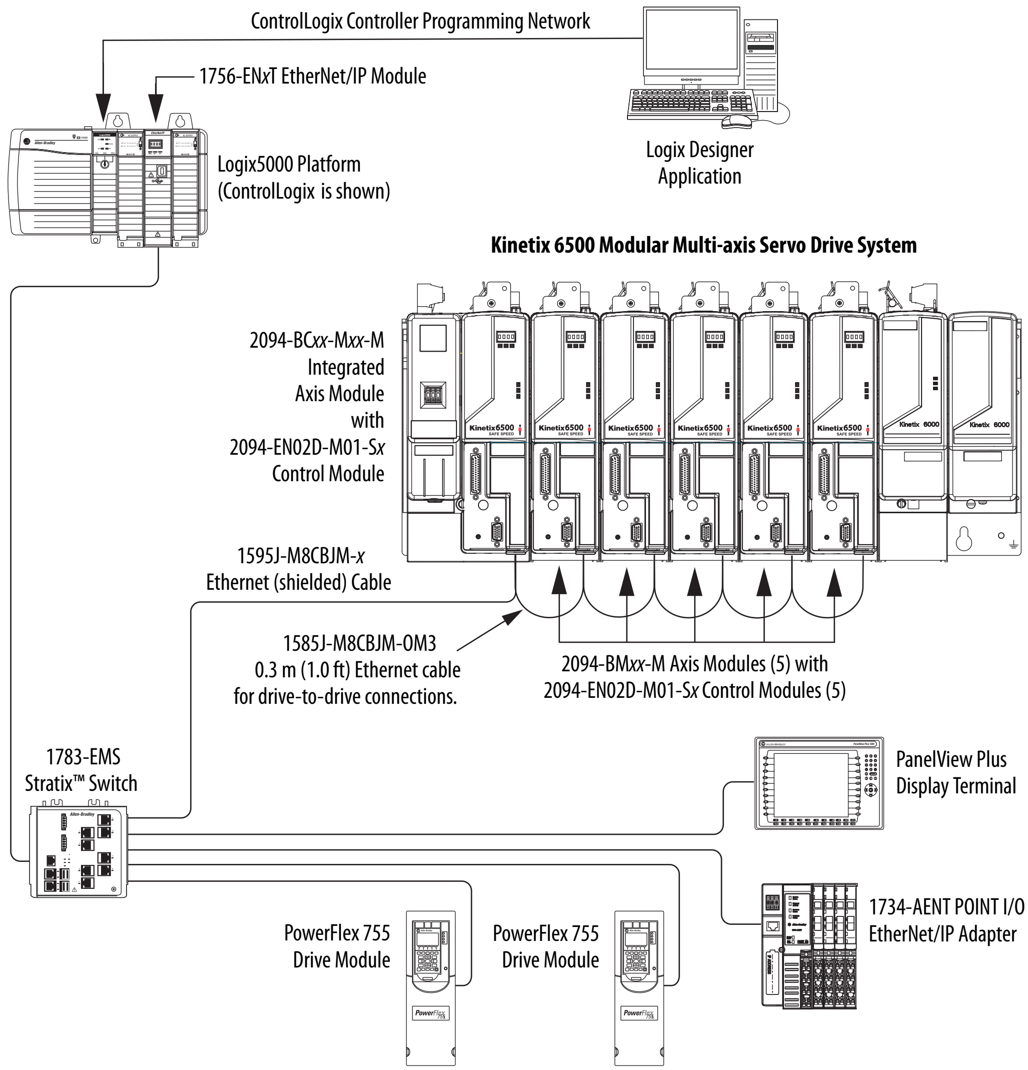
- Up to 64 devices in the DLR configurations.
- All Devices in a DLR ring should have dual-port connectivity or be connected in the ring by using a 1783-ETAP module.

Figure 7 - Kinetix 6500 Ring Communication Installation (EtherNet/IP network)



In this example, the devices are connected by using star topology. Each device is connected directly to the switch, making this topology fault tolerant. The 2094 power rail modules and other devices operate independently. The loss of one device does not impact the operation of the other devices.

Figure 8 - Kinetix 6500 Star Communication Installation (EtherNet/IP network)



Catalog Number Explanation

Kinetix 6200 and Kinetix 6500 (Bulletin 2094) modular drive catalog numbers and descriptions are listed in the tables below. All power modules are compatible with the Kinetix 6200 and Kinetix 6500 control modules.

Table 2 - Kinetix 6200 and Kinetix 6500 Drive Catalog Numbers

Integrated Axis Modules (460V)	Cat. No.
IAM power module, 400V-class, 6 kW converter, 4 A (0-pk) inverter	2094-BC01-MP5-M
IAM power module, 400V-class, 6 kW converter, 9 A (0-pk) inverter	2094-BC01-M01-M
IAM power module, 400V-class, 15 kW converter, 15 A (0-pk) inverter	2094-BC02-M02-M
IAM power module, 400V-class, 28 kW converter, 30 A (0-pk) inverter	2094-BC04-M03-M
IAM power module, 400V-class, 45 kW converter, 49 A (0-pk) inverter	2094-BC07-M05-M
Axis Modules (460V)	
AM power module, 400V-class, 4 A (0-pk)	2094-BMP5-M
AM power module, 400V-class, 9 A (0-pk)	2094-BM01-M
AM power module, 400V-class, 15 A (0-pk)	2094-BM02-M
AM power module, 400V-class, 30 A (0-pk)	2094-BM03-M
AM power module, 400V-class, 49 A (0-pk)	2094-BM05-M
Kinetix 6200 Control Modules	
Control module, sercos interface, Safe Torque Off	2094-SE02F-M00-S0
Control module, sercos interface, Safe Speed Monitor	2094-SE02F-M00-S1
Kinetix 6500 Control Modules	
Control module, EtherNet/IP network, Safe Torque Off	2094-EN02D-M01-S0
Control module, EtherNet/IP network, Safe Speed Monitor	2094-EN02D-M01-S1

Table 3 - Kinetix 6000 Drive Component Catalog Numbers

Drive Components	Cat. No.
Integrated power interface (IPIM) module, 400V-class, 15 kW, 24 A (rms)	2094-SEPM-B24-S
Kinetix 6000 shunt module, 200/400V-class, 200 W	2094-BSP2
Kinetix 6000 slot-filler module, 200/400V-class	2094-PRF

Kinetix Drive Component Compatibility

The 2094-BC*xx*-M*xx*-M and 2094-BM*xx*-M power modules contain the same power structure as the 2094-BC*xx*-M*xx*-S and 2094-BM*xx*-S drive modules. Because of this, the 2094-BSP2 shunt module, 2094-PRF slot-filler module, and 2094-PRS*x* power rails are supported by both drive families.

In addition, 2094-BM*xx*-M AM power modules with sercos interface are supported on power rails with a 2094-BC*xx*-M*xx*-S IAM drive module. Conversely, 2094-BM*xx*-S AM drive modules are supported on power rails with a 2094-BC*xx*-M*xx*-M IAM power module with sercos interface.

IMPORTANT	Kinetix 6500 EtherNet/IP control modules (catalog numbers 2094-EN02D-M01-S*x*) are not compatible with IAM/AM modules on the same Bulletin 2094 power rail with Kinetix 6000 or Kinetix 6200 sercos drives.

Table 4 - IAM and AM Module/Network Compatibility

<table>
<tr><th rowspan="2">IAM Module</th><th rowspan="2">Control Module</th><th rowspan="2">2094-BMxx-S
Kinetix 6000 AM Module</th><th colspan="2">2094-BMxx-M
AM Power Modules</th></tr>
<tr><th>2094-SE02F-M00-Sx
Kinetix 6200 Control Module</th><th>2094-EN02D-M01-Sx
Kinetix 6500 Control Module</th></tr>
<tr><td>2094-BCxx-Mxx-S
(series B and C)</td><td>N/A</td><td rowspan="2">Fully compatible</td><td rowspan="2">Fully compatible</td><td rowspan="2">Not compatible</td></tr>
<tr><td rowspan="2">2094-BCxx-Mxx-M
(IAM power module)</td><td>2094-SE02F-M00-Sx
sercos interface</td></tr>
<tr><td>2094-EN02D-M01-Sx
EtherNet/IP network</td><td>Not compatible</td><td>Not compatible</td><td>Fully compatible</td></tr>
</table>

For additional information on the 2094-BC*xx*-M*xx*-S IAM and 2094-BM*xx*-S AM modules, refer to the Kinetix 6000 Multi-axis Servo Drives User Manual, publication 2094-UM001.

Kinetix 6000M Integrated Drive-Motor System Compatibility

Bulletin 2094 power rails with Kinetix 6000 (series B and C) or Kinetix 6200 drives are compatible with Kinetix 6000M integrated drive-motor (IDM) systems. The IDM power interface module (IPIM) mounts to the power rail and connects to as many as 16 IDM units.

Table 5 - IPIM Module Compatibility

<table>
<tr><th>IAM Module</th><th>Control Module</th><th>2094-SEPM-B24-S
IDM Power Interface Module (IPIM)</th></tr>
<tr><td>2094-BCxx-Mxx-S
(series B and C)</td><td>N/A</td><td rowspan="2">Fully compatible</td></tr>
<tr><td rowspan="2">2094-BCxx-Mxx-M
(IAM power module)</td><td>2094-SE02F-M00-Sx sercos interface</td></tr>
<tr><td>2094-EN02D-M01-Sx EtherNet/IP network</td><td>Not compatible</td></tr>
</table>

For more information on Kinetix 6000M integrated drive-motor system installation, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Agency Compliance

If this product is installed within the European Union 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 can cause damage to the filter. For grounding examples, refer to Grounded Power Configurations on page 93.

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

CE Requirements (system without LIM module)

To meet CE requirements when your Kinetix 6200 and Kinetix 6500 system does not include the LIM module, these requirements apply.

- Install 2090-XXLF-*xxxx* AC line filters for three-phase input power and single-phase control power (for example, Schaffner P/N FN 355-10-05 or Roxburgh P/N RES5F08) as close to the IAM module as possible.
- Use 2090 series motor power cables or use connector kits and terminate the cable shields to the chassis clamp provided.
- Combined motor power cable lengths for all Kinetix 6200 and Kinetix 6500 axes and hybrid cable lengths for all IDM units on the same DC bus must not exceed 240 m (787 ft) with 400V-class systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).
- Use 2090 series motor feedback cables or use connector kits and properly terminate the feedback cable shield. Drive-to-motor feedback cables must not exceed 90 m (295.5 ft).
- Install the Kinetix 6200 and Kinetix 6500 system inside an enclosure. Run input power wiring in conduit (grounded to the enclosure) outside of the enclosure. Separate signal and power cables.

Refer to Appendix A on page 231 for interconnect diagrams, including input power wiring and drive/motor interconnect diagrams.

CE Requirements (system with LIM module)

To meet CE requirements when your Kinetix 6200 and Kinetix 6500 system includes the LIM module, follow all the requirements as stated in CE Requirements (system without LIM module) and these additional requirements as they apply to the AC line filter.

- Install the LIM module (catalog numbers 2094-BL02) as close to the IAM module as possible.
- Install the LIM module (catalog numbers 2094-BL*xx*S or 2094-XL75S-C*x*) with line filter (catalog number 2090-XXLF-*xxxx*) as close to the IAM module as possible.

  When the LIM module (catalog numbers 2094-BL*xx*S or 2094-XL75S-C*x*) supports two IAM modules, each IAM module requires an AC line filter installed as close to the IAM module as possible.

Chapter 2

Plan the Kinetix 6200 and Kinetix 6500 Drive System Installation

This chapter describes system installation guidelines used in preparation for mounting your Kinetix 6200 and Kinetix 6500 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

Use the information in this section when designing your enclosure and planning to mount your system components on the panel.

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

System Mounting Requirements

- To comply with UL and CE requirements, the Kinetix 6200 and Kinetix 6500 drive systems must be enclosed in a grounded conductive enclosure offering protection as defined in standard EN 60529 (IEC 529) to IP54 such that they are not accessible to an operator or unskilled person. A NEMA 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.
- Size the drive enclosure so as not to exceed the maximum ambient temperature rating. Consider heat dissipation specifications for all drive components.
- Combined motor power cable lengths for all axes and hybrid cable lengths for all IDM units on the same DC bus must not exceed 240 m (787 ft) with 400V-class systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

IMPORTANT	System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

- Combined length of Ethernet cables on Kinetix 6500 systems connecting drive-to-drive, drive-to-controller, or drive-to-switch must not exceed 100 m (328 ft).
- 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 high-frequency (HF) energy and reduce electrical noise.

Refer to 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 IAM power module does not require an isolation transformer for three-phase input power. However, a transformer can be required to match the voltage requirements of the controller to the available service.

To size a transformer for the main AC power inputs, refer to the Kinetix 6200/6500 power specifications in the Kinetix Servo Drives Technical Data, publication KNX-TD003.

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, to size a transformer to the voltage requirements of a 2094-BC01-M01-M integrated axis module:
2094-BC01-M01-M = 6 kW continuous x 1.5 = 9.0 KVA transformer

AC Line Filter Selection

These AC line filters are available for your servo drive input power.

Table 6 - Kinetix 6200/6500 (three-phase) AC Line Filter Selection

Drive Cat. No.	Voltage	Current A @ 50 °C (122 °F)	Weight, approx kg (lb)	AC Line Filter Cat. No.
2094-BC01-MP5-M	500V AC 50/60 Hz	30	2.7 (5.9)	2090-XXLF-X330B
2094-BC01-M01-M				
2094-BC02-M02-M				
2094-BC04-M03-M		75	5.2 (11.4)	2090-XXLF-375B
2094-BC07-M05-M		100	9.5 (20.9)	2090-XXLF-3100

Refer to the Kinetix Motion Accessories Specifications Technical Data, publication KNX-TD004, for additional AC line filter specifications.

Circuit Breaker/Fuse Options

The 2094-BC*xx*-M*xx*-M and 2094-BM*xx*-M drive modules, and the Kinetix 6000M integrated drive-motor system (2094-SEPM-B24-S IPIM module and MDF-SB*xxxxx* IDM units) use 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) and 65,000 A (circuit breakers).

Table 7 - Control and DC-bus Circuit Protection Specifications

IAM Module Cat. No.	Control Input Power		DC-bus Power	
	Bussmann Fuse (1)	Allen-Bradley® Circuit Breaker (2) (non-UL)	Bussmann Fuse	Mersen Fuse (3)
2094-BC01-MP5-M	FNQ-R-10 (10 A) or FNQ-R-7.5 (7.5 A)	1492-SPM2D060 or 1492-SPM1D150	FWJ-20A14F	DCT20-2
2094-BC01-M01-M				
2094-BC02-M02-M			FWJ-40A	A70QS40-4
2094-BC04-M03-M			FWJ-70A	A70QS70-4
2094-BC07-M05-M			FWJ-125A	A70QS125-4

(1) Use FNQ-R-7.5 circuit breaker for higher single -cycle inrush current capability. This is recommended when the continuous control-power current exceeds 3.0 A.

(2) Use 1492-SPM1D150 circuit breaker for higher single -cycle inrush current capability. This is recommended when the continuous control-power current exceeds 3.0 A.

(3) Mersen fuses were formerly known as Ferraz Shawmut.

Input Power Circuit Protection (LIM)

The 2094-BL02 line interface module (LIM) contains supplementary protection devices and, when protected by suitable branch circuit protection, is rated for use on a circuit capable of delivering up to 5000 A. When this module is used, protection on the line side of the LIM module is required. Fuses must be class J or CC only.

The 2094-BL*xx*S and 2094-XL75S-C*x* LIM modules contain branch circuit rated devices suitable for use on a circuit capable of delivering up to 65,000 A (400V-class).

Refer to the Line Interface Module Installation Instructions, publication 2094-IN005, for power specifications and more information on using the LIM module.

Refer to Input Power Circuit Protection (without LIM) on page 31 when your drive system does not include the LIM module.

Input Power Circuit Protection (without LIM)

The fuses and Allen-Bradley circuit breakers shown in Table 8 are recommended for use with 2094-BC*xx*-M*xx*-M IAM power modules when the line interface module (LIM) is not used.

IMPORTANT	LIM Module (catalog number 2094-BL*xx*S) provides branch circuit protection to the IAM power module. Follow all applicable NEC and local codes.

Table 8 - Input Power Circuit Protection Specifications

Kinetix 6200 and Kinetix 6500 Drives		UL Applications				IEC (non-UL) Applications			
IAM Module Cat. No.	**Drive Voltage (three-phase) nom**	**Fuses (Bussmann) Cat. No.**	**Miniature CB Cat. No.**	**Motor Protection CB, Self-protected CMC Cat. No.**	**Molded Case CB Cat. No.**	**Miniature CB Cat. No.**		**Motor Protection CB Cat. No.**	**Molded Case CB Cat. No.**
2094-BC01-MP5-M	360…480V	KTK-R-20 (20 A) Class CC	1489-M3D300	140M-F8E-C32	NA	1492-SPM3D300	1489-M3D300	140M-F8E-C32	NA
2094-BC01-M01-M	360…480V	KTK-R-20 (20 A) Class CC		140M-F8E-C32				140M-F8E-C32	
2094-BC02-M02-M	360…480V	KTK-R-30 (30 A) Class CC	1489-M3D400	140M-F8E-C45		1492-SPM3D400	1489-M3D400	140M-F8E-C45	
2094-BC04-M03-M	360…480V	LPJ-45SP (45 A) Class J	N/A	NA	140G-G6C3-C50	N/A	N/A	NA	140G-G6C3-C50
2094-BC07-M05-M	360…480V	LPJ-80SP (80 A) Class J			140G-G6C3-C90				140G-G6C3-C90

Refer to the Kinetix Servo Drives Technical Data, publication KNX-TD003, for additional power specifications for your IAM power module.

Enclosure Selection

This example is provided to assist you in sizing an enclosure for your Bulletin 2094 drive system. The example system consists of these components:

- 6-axis Bulletin 2094 servo drive system
- Line Interface Module (LIM)
- ControlLogix® chassis and modules (controller)

Size the Bulletin 2094 servo drive and LIM module and use the results to predict the amount of heat dissipated into the enclosure. You also need heat dissipation data from other equipment inside the enclosure (such as the ControlLogix controller). Once the total amount of heat dissipation (in watts) is known, you can calculate the minimum enclosure size.

Table 9 - Bulletin 2094 System Heat Dissipation Example

Enclosure Component	Description		Loading (1)	Heat Dissipation (1) watts
2094-BC02-M02-M	Integrated axis module (IAM), 400/460V	15 kW (converter section)	20%	44
		15 A (inverter section)	40%	72
2094-BM02-M	Axis module (AM), 400/460V, 15 A		60%	93
2094-BM02-M	Axis module (AM), 400/460V, 15 A		60%	93
2094-BM01-M	Axis module (AM), 400/460V, 9 A		40%	73
2094-BM01-M	Axis module (AM), 400/460V, 9 A		40%	73
2094-BM01-M	Axis module (AM), 400/460V, 9 A		20%	57
2094-BL25S	Line interface module (LIM), 400/460V, 25 A; 24V DC 20 A		100%	43
2094-PRS6	Power rail, 460V, 6 axis		N/A	0
2090-XB33-32	Resistive brake module (RBM), 33 A, 32 Ω		N/A	30
Total Kinetix 6200 and Kinetix 6500 system wattage				578

(1) To determine heat dissipation specifications for your drive system components, refer to Table 11 on page 34.

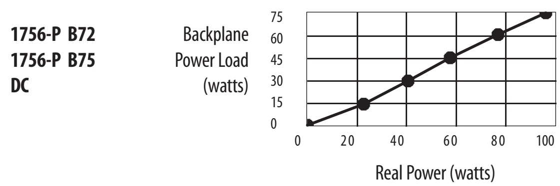
Table 10 - ControlLogix System Heat Dissipation Example

Enclosure Component	Description	Backplane Power Load (1) watts	Heat Dissipation (1) watts
1756-M08SE	8-axis sercos interface module	3.2	0
1756-L5563	L63 ControlLogix processor	4.5	0
1756-IB16D	16 -point input module	0.84	5.8
1756-OB16D	16 -point output module	4.64	3.3
1756-EN*xTx*	EtherNet/IP communication module	4.0	0
Backplane total		17.18 (2)	N/A
1756-PB72	24V DC ControlLogix power supply	N/A	25 (2)
1756-A7	7-slot mounting chassis	N/A	N/A
Total ControlLogix system wattage			34.1

(1) For ControlLogix module specifications, refer to the ControlLogix Selection Guide, publication 1756-SG001.

(2) Real power heat dissipation is determined by applying the backplane power load (17.18W) to the graph below.

Figure 9 - ControlLogix Real Power



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

In this example, the amount of power dissipated inside the cabinet is the sum of the Bulletin 2094 system value (578 W) and the ControlLogix system value (34 W) for a total of 612 W.

With no active method of heat dissipation (such as fans or air conditioning) either of these 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.

Total system watts dissipated (Q) was calculated at 612 W. The maximum ambient rating of the Bulletin 2094 system is 50 °C (122 °F) and if the maximum environmental temperature is 30 °C (86 °F), then T=20 in the equation below.

$$A = \frac{0.38\,(612)}{1.8\,(20) - 1.1} = 6.66\ m^2$$

In this example, the enclosure must have an exterior surface of 6.66 m^2. If any portion of the enclosure is not able to transfer heat, do not include that portion in the calculation.

Because the minimum cabinet depth to house the 460V drive (selected for this example) is 302 mm (11.9 in.), then the cabinet needs to be approximately 2500 mm (high) x 950 mm (wide) x 302 mm (deep).

$$2 \times (0.3 \times 0.95) + 2 \times (0.3 \times 2.5) + 2 \times (0.95 \times 2.5) = 6.82\ m^2$$

Because this cabinet size is considerably larger than what is necessary to house the system components, consider some means of cooling in a smaller cabinet to be more efficient. Contact your cabinet manufacturer for options available to cool your cabinet.

Table 11 - Power Dissipation Specifications

Bulletin 2094 Drive Modules (1)	Usage as % of Rated Power Output (watts)				
	20%	**40%**	**60%**	**80%**	**100%**
IAM (converter) power module (2)					
2094-BC01-MP5-M	18	21	25	29	34
2094-BC01-M01-M					33
2094-BC02-M02-M	36	44	54	64	75
2094-BC04-M03-M	50	67	87	110	135
2094-BC07-M05-M	71	101	137	179	226
IAM (inverter) module or AM power module (2)					
2094-BC01-MP5-S or 2094-BMP5-M	46	54	61	69	77
2094-BC01-M01-S or 2094-BM01-M	57	73	90	108	126
2094-BC02-M02-S or 2094-BM02-M	53	72	93	116	142
2094-BC04-M03-S or 2094-BM03-M	94	130	169	211	255
2094-BC07-M05-S or 2094-BM05-M	121	183	252	326	407
Shunt module - 2094-BSP2	68	121	174	227	280
IPIM module - 2094-SEPM-B24-S	To calculate power dissipation for IPIM modules on your 2094 power rail, refer to the Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003.				

(1) Power dissipation for the Bulletin 2094 control modules, catalog numbers 2094-SE02F-M00-S*x* and 2094-EN02D-M01-S*x*, is included in the IAM and AM power module specifications.
(2) Internal shunt power is not included in the calculations and must be added based on utilization.

Minimum Clearance Requirements

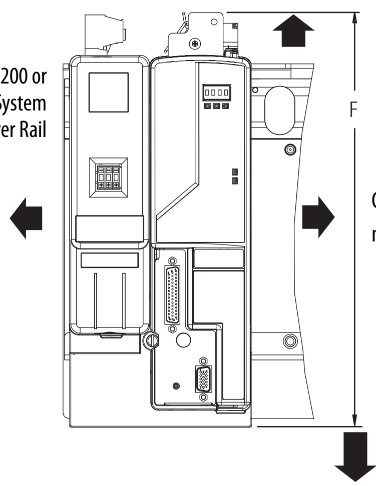
This section provides information to assist you in sizing your cabinet and positioning your Bulletin 2094 system components.

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

Figure 10 illustrates minimum clearance requirements for proper airflow and installation:

- Additional clearance is required for the cables and wires connected to the top and front of the drive.
- Additional clearance left and right of the power rail is required when the drive is mounted adjacent to noise sensitive equipment or clean wireways.

Figure 10 - Minimum Clearance Requirements



Drive Cat. No.	F
2094-BC01-M*xx*-M 2094-BC02-M02-M	285 mm (11.2) in.
2094-BMP5-M, 2094-BM01-M, 2094-BM02-M	
2094-SEPM-B24-S 2094-BSP2	287 mm (11.3) in.
2094-BC04-M03-M 2094-BM03-M	375 mm (14.7) in.
2094-BC07-M05-M 2094-BM05-M	

Refer to Power Dissipation Specifications on page 34, and Kinetix Servo Drives Technical Data, publication KNX-TD003, for Kinetix 6000 drive dimensions.

(1) The power rail (slim), catalog number 2094-PRS*x*, extends left and right of the first and last module 5.0 mm (0.20 in.). The Bulletin 2094-PR*x* power rail extends approximately 25.4 mm (1.0 in.) left of the IAM module and right of the last module mounted on the rail.

Table 12 - Minimum Cabinet Depth

Drive Cat. No.	Cabinet Depth, min (1)	Drive Cat. No.	Cabinet Depth, min (1)
2094-BC01-M*xx*-M, 2094-BC02-M02-M, 2094-BMP5-M, 2094-BM01-M, 2094-BM02-M	302 mm (11.9 in.)	2094-BC04-M03-M, 2094-BC07-M05-M, 2094-BM03-M, 2094-BM05-M	302 mm (11.9 in.)
2094-BSP2	272 mm (10.7 in.)	2094-SEPM-B24-S	263 mm (10.3 in.)

(1) Minimum cabinet depth is based on the use of 2090-K6CK-*xxxx* low-profile connector kits. Other means of making feedback connections can require additional clearance.

Electrical Noise Reduction

This section outlines best practices that minimize the possibility of noise-related failures as they apply specifically to Kinetix 6200 and Kinetix 6500 system installations. For more information on the concept of high-frequency (HF) bonding, the ground plane principle, and electrical noise reduction, refer to 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).

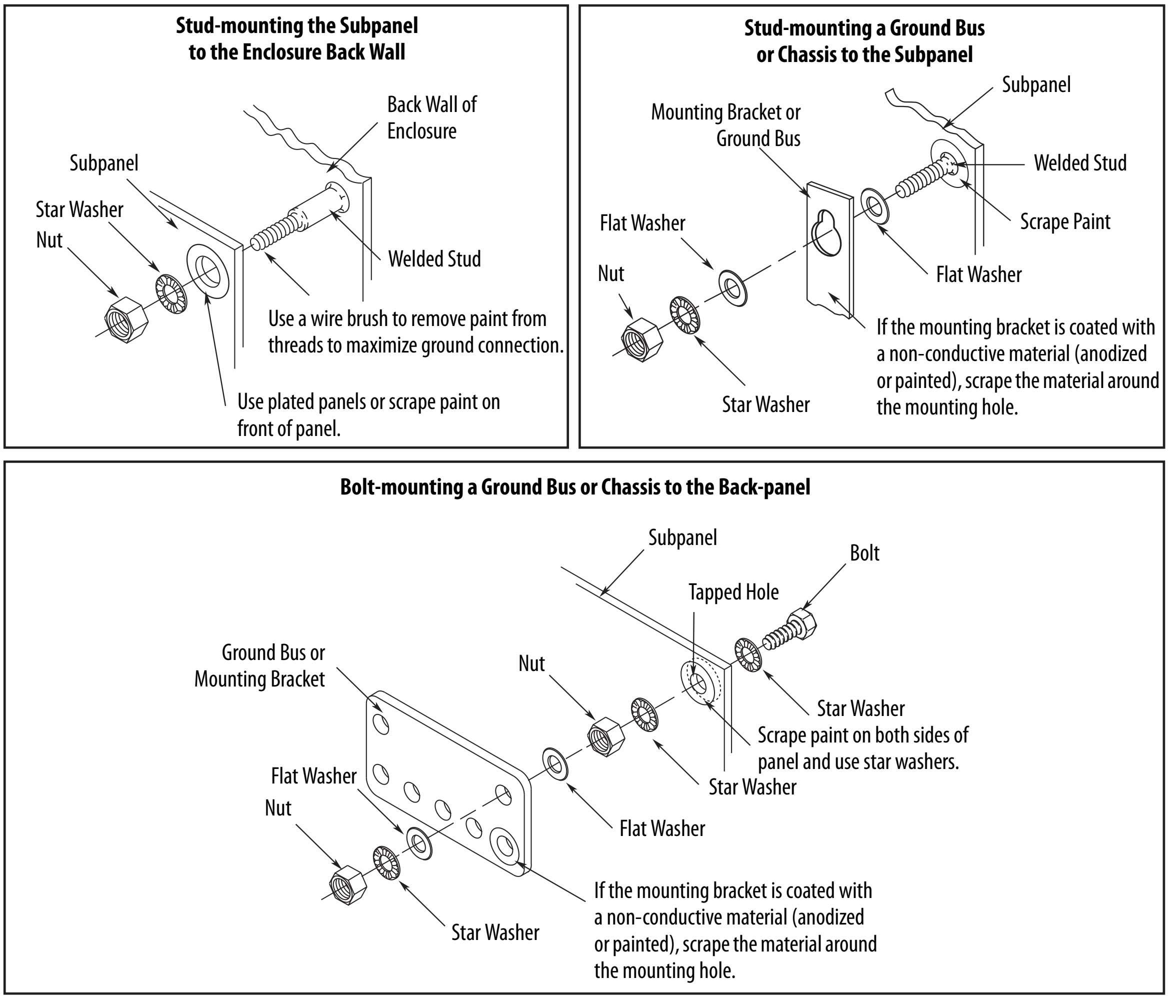
Unless specified, most paints are not conductive and act as insulators. To achieve a good bond between power rail and the subpanel, surfaces need to be paint-free or plated. Bonding metal surfaces creates a low-impedance return path for high-frequency energy.

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

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

These illustrations show details of recommended bonding practices for painted panels, enclosures, and mounting brackets.

Figure 11 - Recommended Bonding Practices for Painted Panels

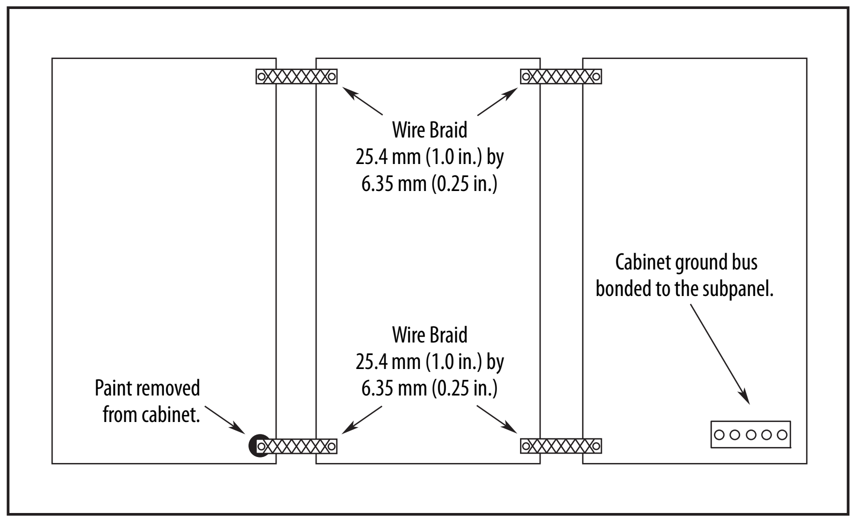


Bonding Multiple Subpanels

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

- Bond the top and bottom of each subpanel to the cabinet by using 25.4 mm (1.0 in.) by 6.35 mm (0.25 in.) wire braid. As a rule, the wider and shorter the braid is, the better the bond.
- Scrape the paint from around each fastener to maximize metal-to-metal contact.

Figure 12 - Multiple Subpanels and Cabinet Recommendations

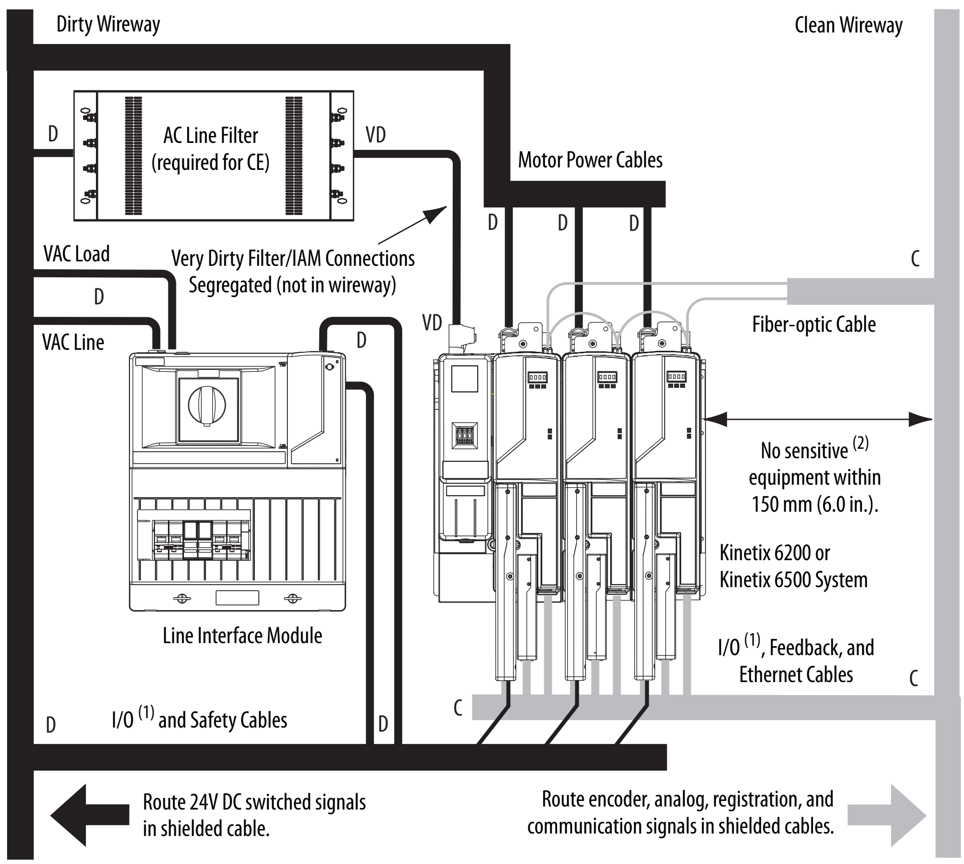


Establishing Noise Zones

Observe these guidelines when the 2094-BL*xx*S or 2094-XL75S-C*x* LIM module is used in the Bulletin 2094 system and mounted left of the IAM module with the AC (EMC) line filter mounted above the LIM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to IAM module. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp provided.
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

Figure 13 - Noise Zones (LIM mounted left of IAM module)



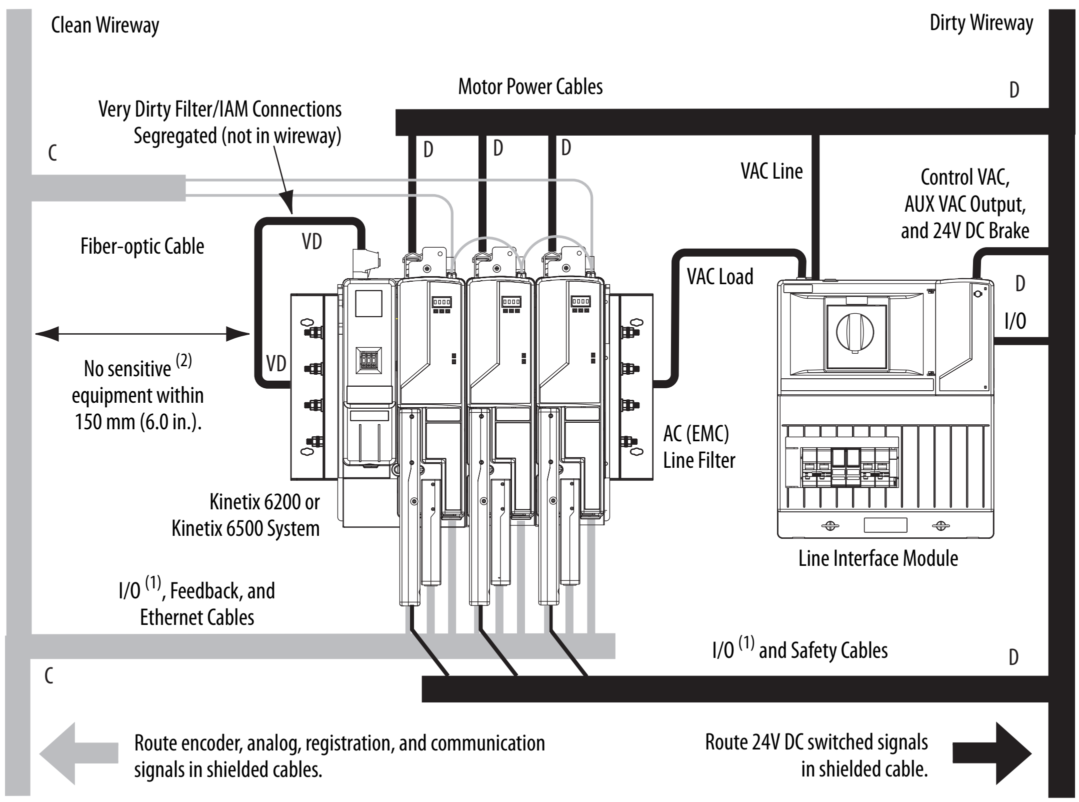
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

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

Observe these guidelines when the 2094-BL*xx*S or 2094-XL75S-C*x* LIM module is used in the Bulletin 2094 system and mounted right of the IAM module with the AC (EMC) line filter mounted behind the IAM module:

- The clean zone (C) is to the left and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the right and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to IAM module. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp provided.
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

Figure 14 - Noise Zones (LIM with EMC filter behind IAM module)



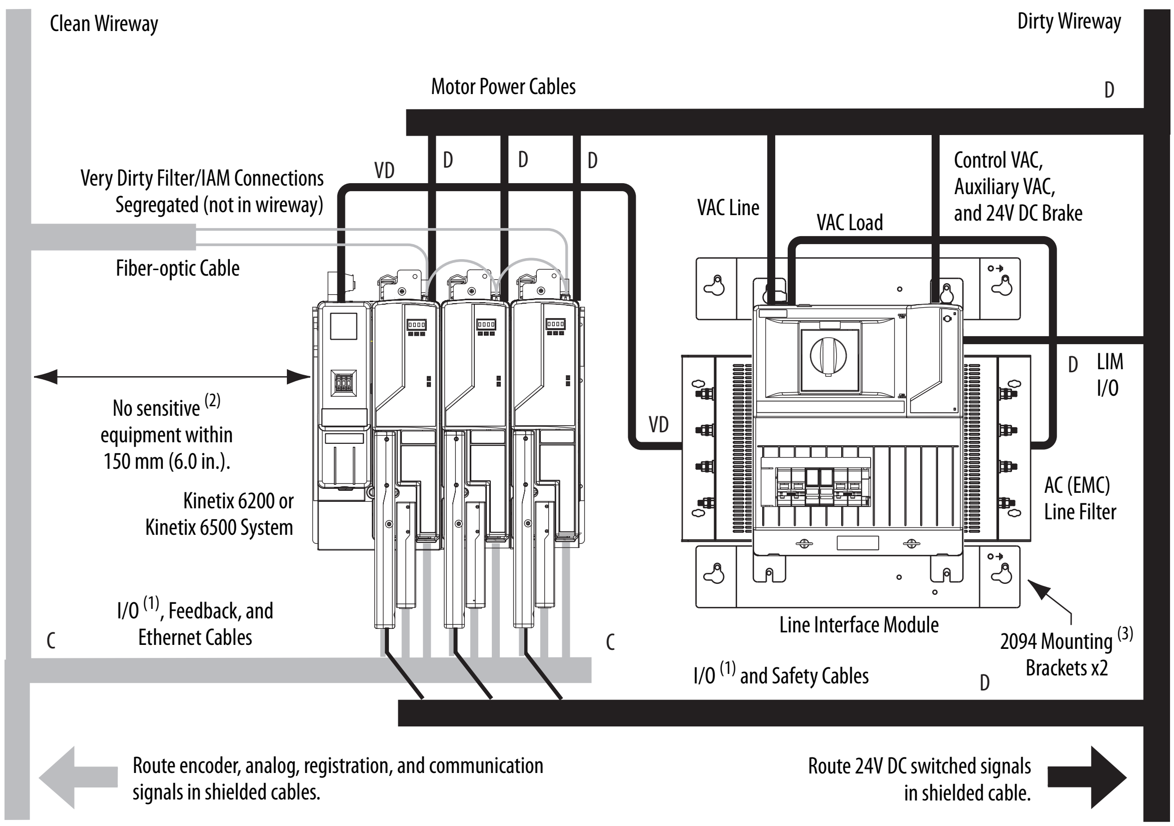
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

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

Observe these guidelines when the 2094-BL*xx*S or 2094-XL75S-C*x* LIM module is used in the Bulletin 2094 system and mounted right of the drive with the AC (EMC) line filter mounted behind the LIM module:

- The clean zone (C) is to the left and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the right and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is from the filter output to drive. Shielded cable is required on the EMC filter (load side) and the braided shield attached to the clamp (when provided).
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

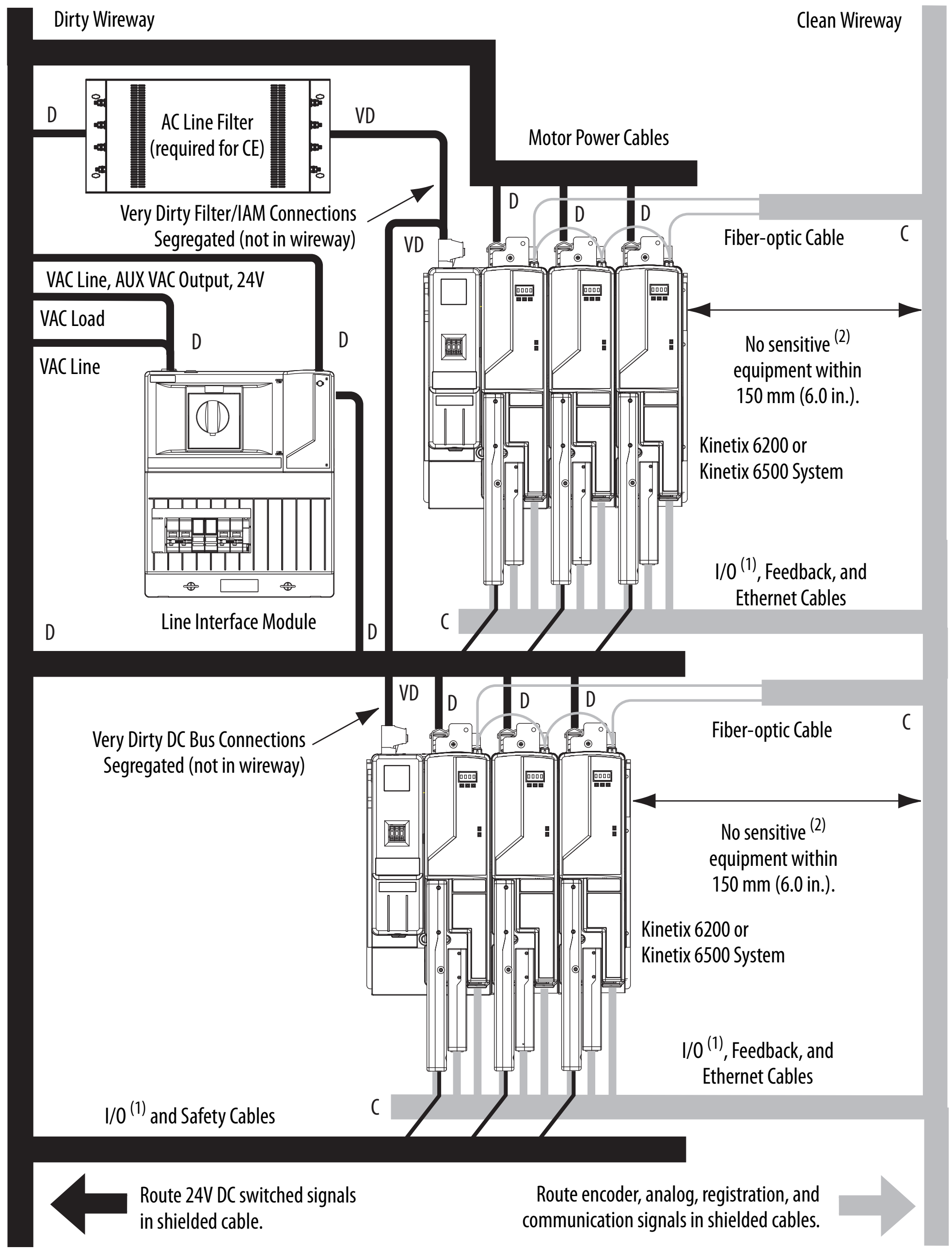
Figure 15 - Noise Zones (EMC filter behind LIM module)



(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.
(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.
(3) Only the 2094-AL*xx*S and 2094-XL75S-C*x* LIM modules are compatible with the 2094 mounting brackets. The 2094-BL*xx*S, 2094-AL09, and 2094-BL02 LIM modules are not compatible.

Keep the DC common-bus cable (very dirty) segregated from all other cables (not in a wireway) when the 2094-BL*xx*S or 2094-XL75S-C*x* LIM module is used in a DC common-bus configuration and the follower IAM module is mounted below the leader IAM module.

Figure 16 - Noise Zones (DC common bus)



(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

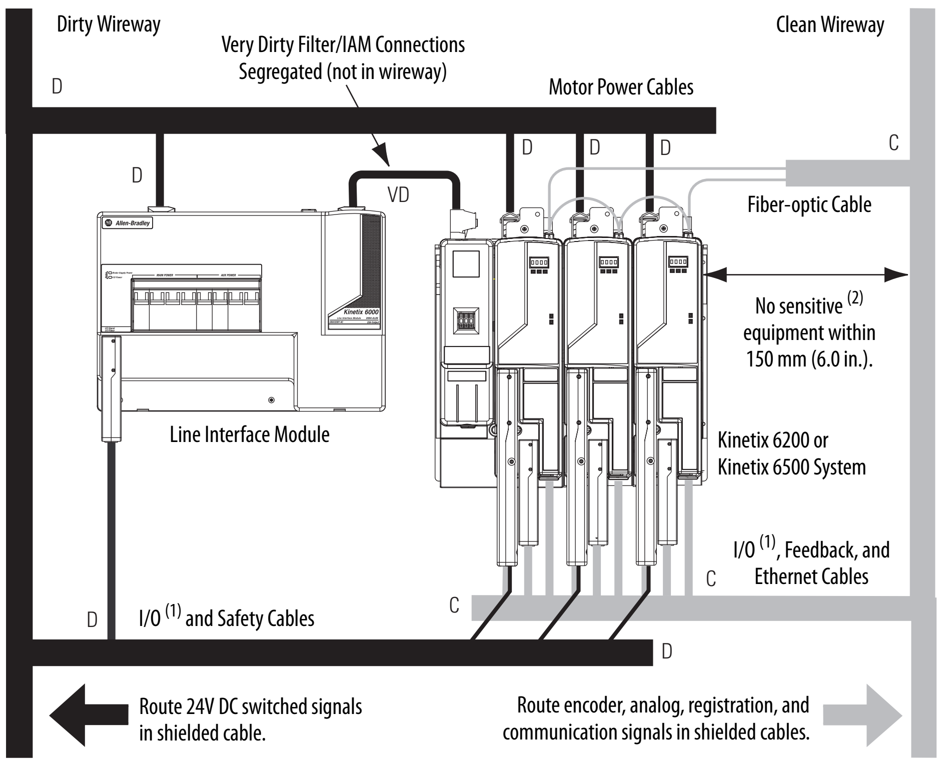
(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Observe these guidelines when the 2094-BL02 LIM module is used in the Bulletin 2094 system and mounted left of the IAM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The very dirty zone (VD) is limited to where the LIM module VAC output jumpers over to the IAM module. Shielded cable is required only if the very dirty cables enter a wireway.
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

This layout is preferred due to the reduced size of the very dirty zone.

Figure 17 - Noise Zones (LIM mounted left of IAM module)

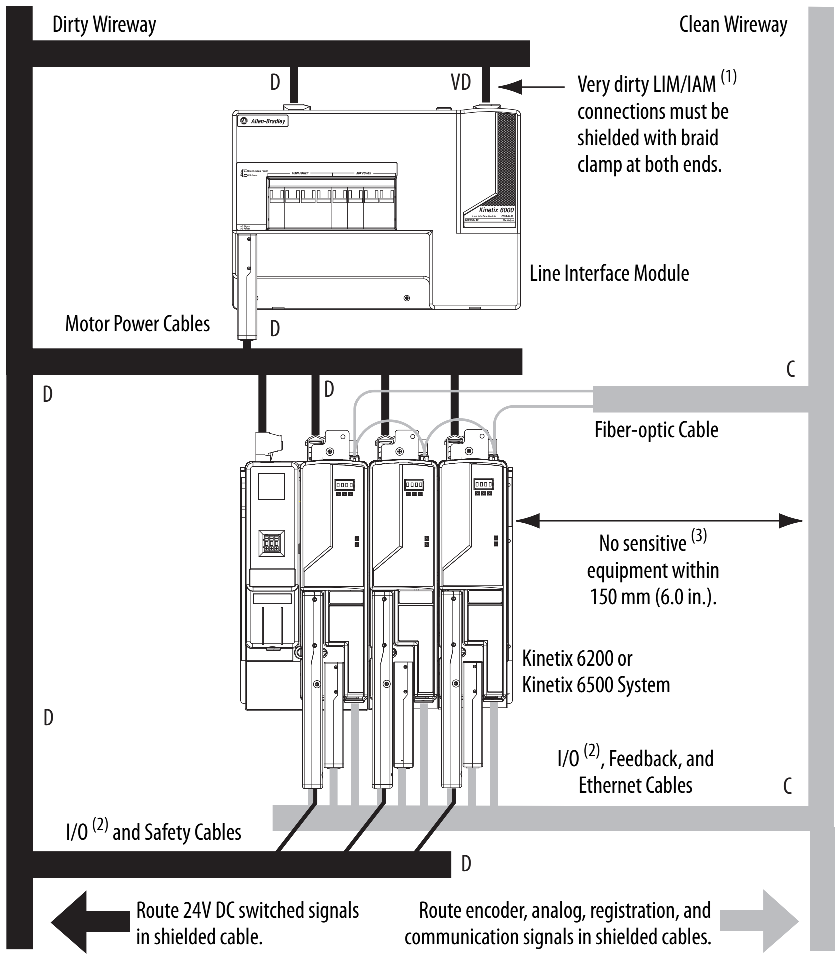


(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.
(2) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Observe these guidelines when the 2094-BL02 LIM module is used in the Bulletin 2094 system and mounted above the IAM module:

- The clean zone (C) is to the right and beneath the Bulletin 2094 system (gray wireway).
- The dirty zone (D) is to the left and above the Bulletin 2094 system, and above and below the LIM module (black wireway).
- The LIM VAC output is very dirty (VD). Use shielded cable with a braid clamp attached at both ends of the cable to reduce the rating to dirty (D).
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

Figure 18 - Noise Zones (LIM mounted above IAM module)



(1) For examples of shield clamp attachment, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

(2) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.

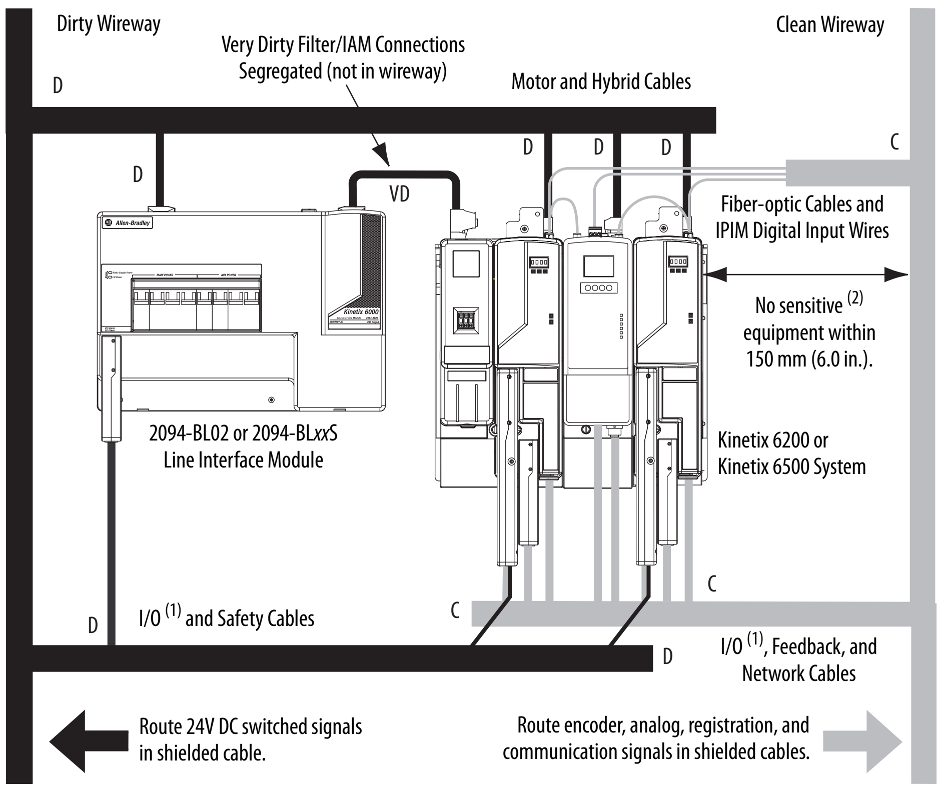
(3) When space does not permit the 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Observe these guidelines when your system includes the 2094-SEPM-B24-S IPIM module. In this example, a 2094-BL02 LIM module is used in the Bulletin 2094 system and mounted left of the IAM module:

- Establish clean (C) and dirty zones (D) similar to other Bulletin 2094 drive systems.
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone.
- IPIM digital input wires are noise sensitive and belong with the fiber-optic cables in the clean zone.
- Ethernet cables are noise sensitive and belong in the clean zone, however, they are connected only when programming the IPIM module.
- IDM network cables, although noise sensitive by nature, are shielded and can be routed with the hybrid cables outside of the enclosure.
- The Bulletin 2090 hybrid cable is dirty and belongs in the dirty zone.

This layout is preferred due to the reduced size of the very dirty zone.

Figure 19 - Noise Zones (Bulletin 2094 power rail with IPIM module)



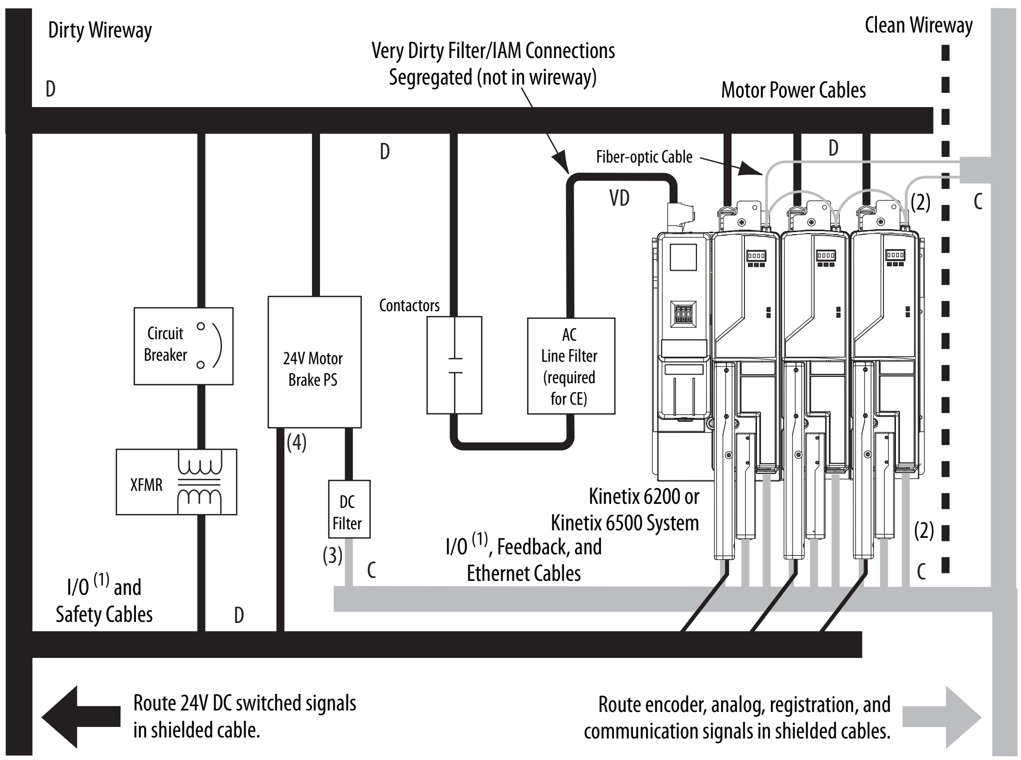
(1) If drive system I/O cable contains (dirty) relay wires, route cable with LIM module I/O cable in dirty wireway.

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

Observe these guidelines when individual input power components are used in the Bulletin 2094 system and the Bulletin 2094 LIM module is not used:

- The clean zone (C) is beneath the Bulletin 2094 system and includes the I/O wiring, feedback cable, and DC filter (gray wireway).
- The dirty zone (D) is above the Bulletin 2094 system (black wireway) and includes the circuit breakers, transformer, 24V DC power supply, contactors, AC line filter, and motor power cables.
- The very dirty zone (VD) is limited to where the AC line (EMC) filter VAC output jumpers over to the IAM module. Shielded cable is required only if the very dirty cables enter a wireway.
- The sercos fiber-optic cables are immune to electrical noise, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

Figure 20 - Noise Zones (without LIM module)

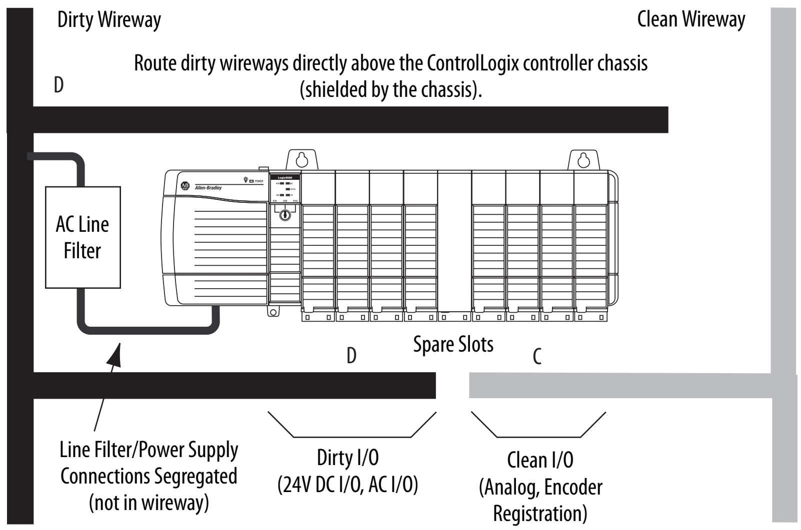


(1) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.
(2) When space to the right of the IAM does not permit 150 mm (6.0 in.) segregation, use a grounded steel shield instead. For examples, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.
(3) This is a clean 24V DC available for any device that requires it. The 24V enters the clean wireway and exits to the right.
(4) This is a dirty 24V DC available for motor brakes and contactors. The 24V enters the dirty wireway and exits to the left.

Observe these guidelines when installing your Logix5000™ sercos interface module:

- The clean zone (C) is beneath the less noisy modules (I/O, analog, encoder, registration, an so forth (gray 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, but due to their delicate nature, route them in the clean zone. Ethernet cables are noise sensitive and belong in the clean zone.

Figure 21 - Noise Zones (ControlLogix chassis)



Cable Categories for Kinetix 6200 and Kinetix 6500 Systems

These tables indicate the zoning requirements of cables connecting to the Kinetix 6200 and Kinetix 6500 drive components.

Table 13 - IAM Power Module (converter side)

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
CTRL 1 and 2	CPD		X			
DC-/DC+ (unshielded cable)	IPD	X				
L1, L2, L3 (shielded cable)			X			X
L1, L2, L3 (unshielded cable)		X				
CONT EN- and CONT EN+ (M1 contactor)	CED		X			

Table 14 - AM Power Module or Axis Module (inverter side)

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
U, V, W (motor power)	MP		X			X
COM, PWR (24V DC), filtered [1]	BC			X		
COM, PWR (24V DC), unfiltered [2]			X			
DBRK-, DBRK+ (resistive brake)			X			
MBRK-, MBRK+ (motor brake)			X			

(1) This is a clean 24V DC available for any device that requires it.
(2) This is a dirty 24V DC available for motor brakes and contactors.

Table 15 - Control Module

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
Motor feedback	MF			X		X
Auxiliary feedback	IOD			X		X
Registration and I/O				X		X
Safety			X			
Fiber-optic (sercos)	Rx and Tx	No restrictions				
Ethernet	PORT1, PORT2			X		X

Table 16 - Line Interface Module (LIM)

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
VAC line (main input)	IPL		X			
Aux power 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			
Aux power output	P2L		X			

Table 17 - Shunt Module

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			

Table 18 - IDM Power Interface Module (IPIM)

Wire/Cable	Zone			Method	
	Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
Hybrid DC bus power, control power, inter-module communication, and Safe Torque Off [1]		X			X
Enable input			X		X
Fiber-optic	No restrictions				
Ethernet network			X		X
IDM network [1]			X		X

(1) There is no option for making your own hybrid power or IDM network cables.

Table 19 - Resistive Brake Module (RBM)

Wire/Cable	Connections	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
Resistive brake module coil power	TB3-6 and TB3-7		X			
Resistive brake module I/O	TB1-1…TB1-5 and TB3-8		X			
Resistive brake module drive and motor power	TB1 and TB2		X			X
230V power	TB4		X			

Noise Reduction Guidelines for Drive Accessories

Refer to this section when mounting an AC (EMC) line filter or external shunt module for guidelines designed to reduce system failures caused by excessive electrical noise.

AC Line Filters

Observe these guidelines when mounting your AC (EMC) line filter (refer to the figure on page 46 for an example):

- Mount the AC line filter on the same panel as the Kinetix 6200 and Kinetix 6500 drive and as close to the power rail as possible.
- Good HF bonding to the panel is critical. For painted panels, refer to the examples on page 37.
- Segregate input and output wiring as far as possible.

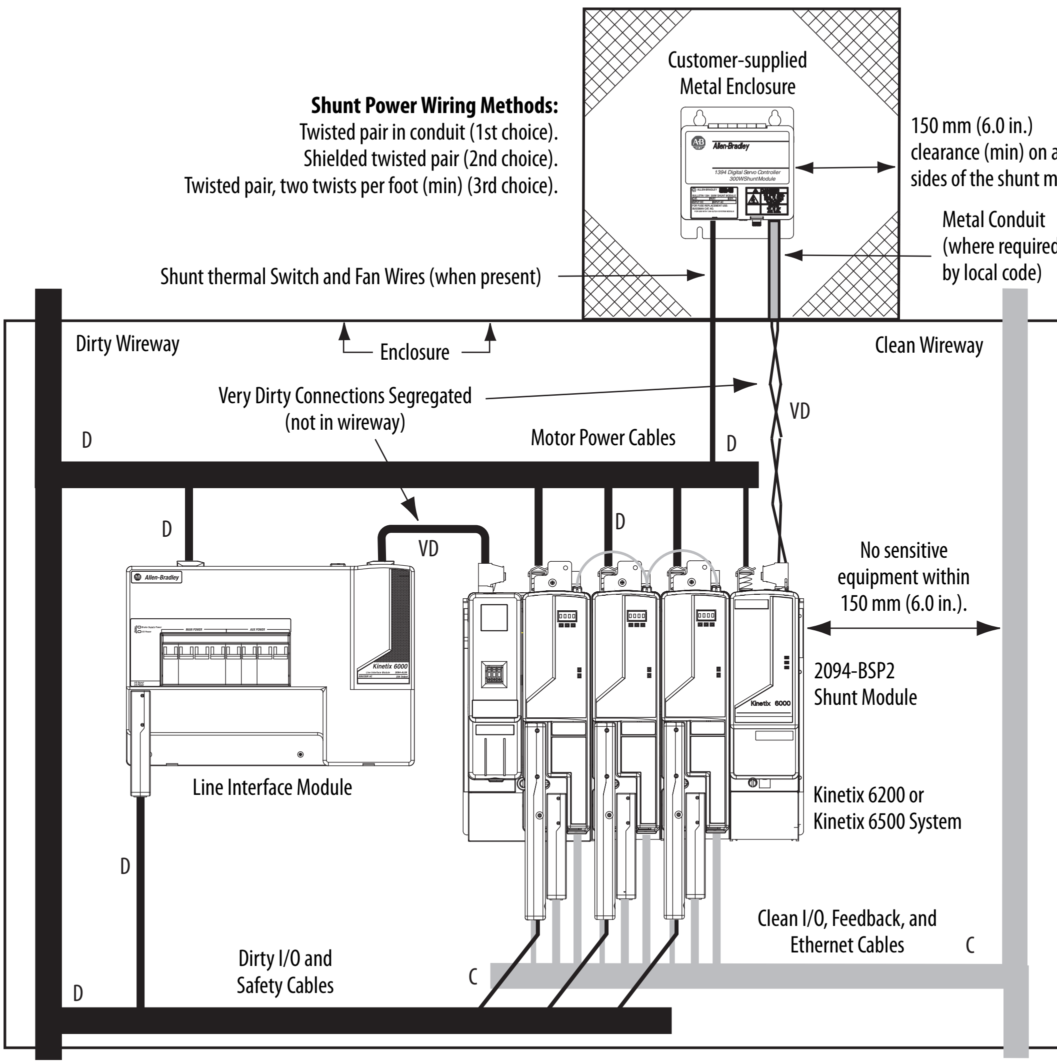
IMPORTANT	CE test certification applies only to AC line filter and single power rail. Sharing a line filter with multiple power rails can perform satisfactorily, but the user takes legal responsibility.

External Shunt Modules

Observe these guidelines when mounting your external shunt module 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.

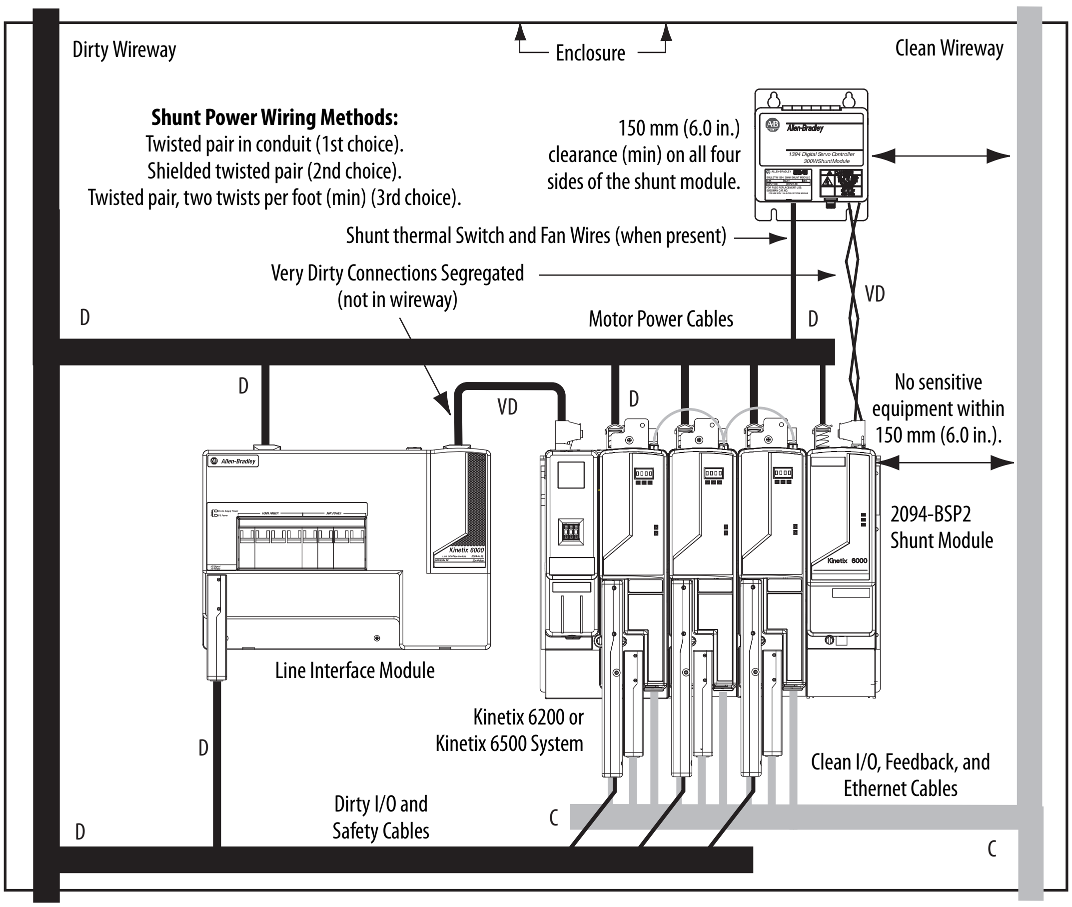
Figure 22 - External Shunt Module Outside the Enclosure



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

- Mount metal-clad modules anywhere in the dirty zone, but as close to the Bulletin 2094 drive system as possible.
- Route shunt power wires 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.

Figure 23 - External Shunt Module Inside the Enclosure

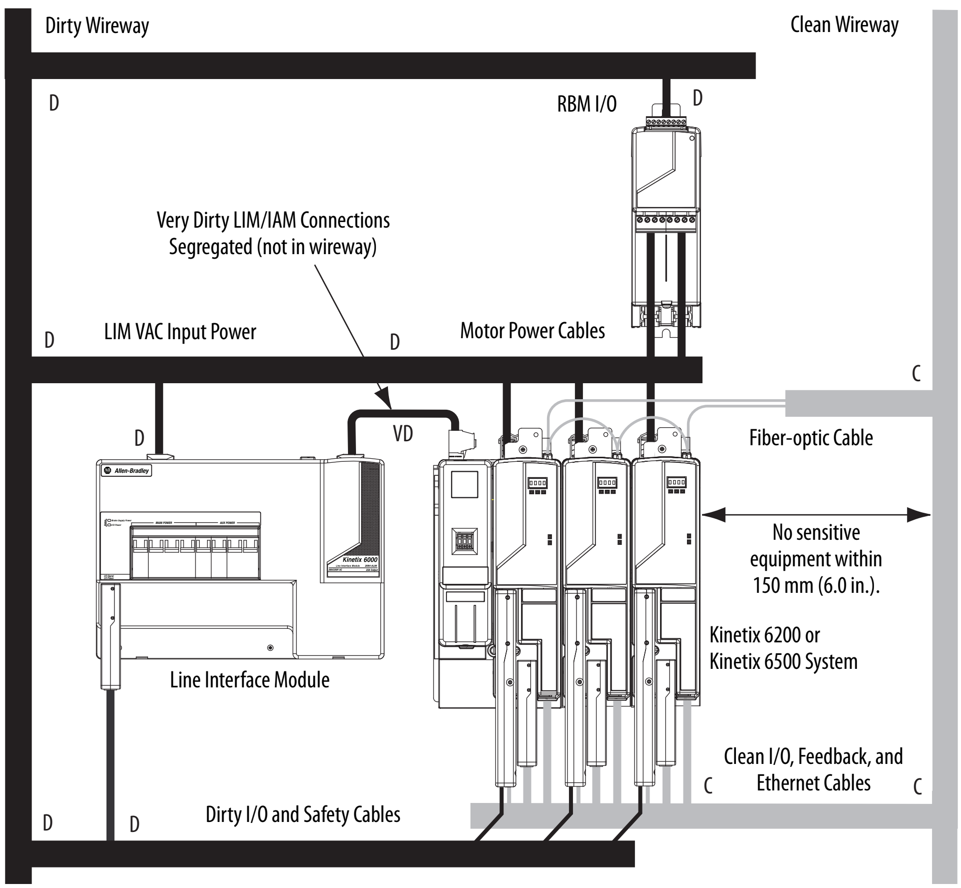


Resistive Brake Modules

Observe these guidelines when mounting your RBM module:

- Mount circuit components and wiring in the dirty zone or in an external shielded enclosure. If mounting the RBM module in a separate ventilated shielded enclosure, run wiring inside metal conduit to minimize the effects of EMI and RFI.
- Keep unshielded wiring as short as possible. Keep wiring as flat to the cabinet as possible.
- Route RBM module power and I/O cables separate from other sensitive low voltage signal cables.

Figure 24 - Noise Zones (RBM mounted above AM power module)



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.

Refer to Wire the Motor/Resistive Brake (BC) Connector on page 116 for wiring guidelines. Refer to Axis Module/Rotary Motor Wiring Examples beginning on page 242 for the interconnect diagram of your drive/motor combination.

Mount the Kinetix 6200 and Kinetix 6500 Drive System

This chapter provides the system installation procedures for mounting your Kinetix 6200 and Kinetix 6500 drive components on the Bulletin 2094 power rail.

This procedure assumes you have prepared your panel, mounted your Bulletin 2094 power rail, and understand how to bond your system. For installation instructions regarding equipment and accessories not included here, refer to the instructions that came with those products.

SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules prior to applying power. Once power is applied, connector terminals can 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.

Before You Begin

Before you begin, consider your Bulletin 2094 power rail installation and using 2094 mounting brackets.

Using the 2094 Mounting Brackets

You can use Bulletin 2094 mounting brackets to mount the power rail or LIM module over the AC line filter. Refer to the 2094 Mounting Brackets Installation Instructions, publication 2094-IN008, when using mounting brackets with your Kinetix 6200 and Kinetix 6500 drive system.

Installing the 2094 Power Rail

The Bulletin 2094 power rail comes in lengths to support one IAM module and up to seven additional AM/IPIM modules, or up to six additional AM/IPIM modules and one shunt module. The connector pins for each slot are covered by a protective cover. The cover is designed to protect the pins from damage and make sure that no foreign objects lodge between the pins during installation. Refer to the Kinetix 6000 Power Rail Installation Instructions, publication 2094-IN003, when installing your power rail.

ATTENTION: To avoid damage to the power rail during installation, do not remove the protective covers until the module for each slot is ready for mounting.

The Kinetix 6000M integrated drive-motor (IDM) system is supported by Bulletin 2094 (400V-class) power rail configurations. You can mount up to four IDM power interface (IPIM) modules on the Bulletin 2094 power rail. Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for more information.

Determine Mounting Order

Mount IAM, AM/IPIM, shunt, and slot-filler modules in the order (left to right) as shown in Figure 25. Mount axis modules and the IPIM module according to power utilization (highest to lowest) from left to right starting with the highest power utilization.

Power utilization is the average power (kW) consumed by a servo axis. If Motion Analyzer software was used to size the axis, the calculated axis power required can be used for the power utilization value. If Motion Analyzer software was not used, you can use the continuous power value (kW) for each module to determine mounting order.

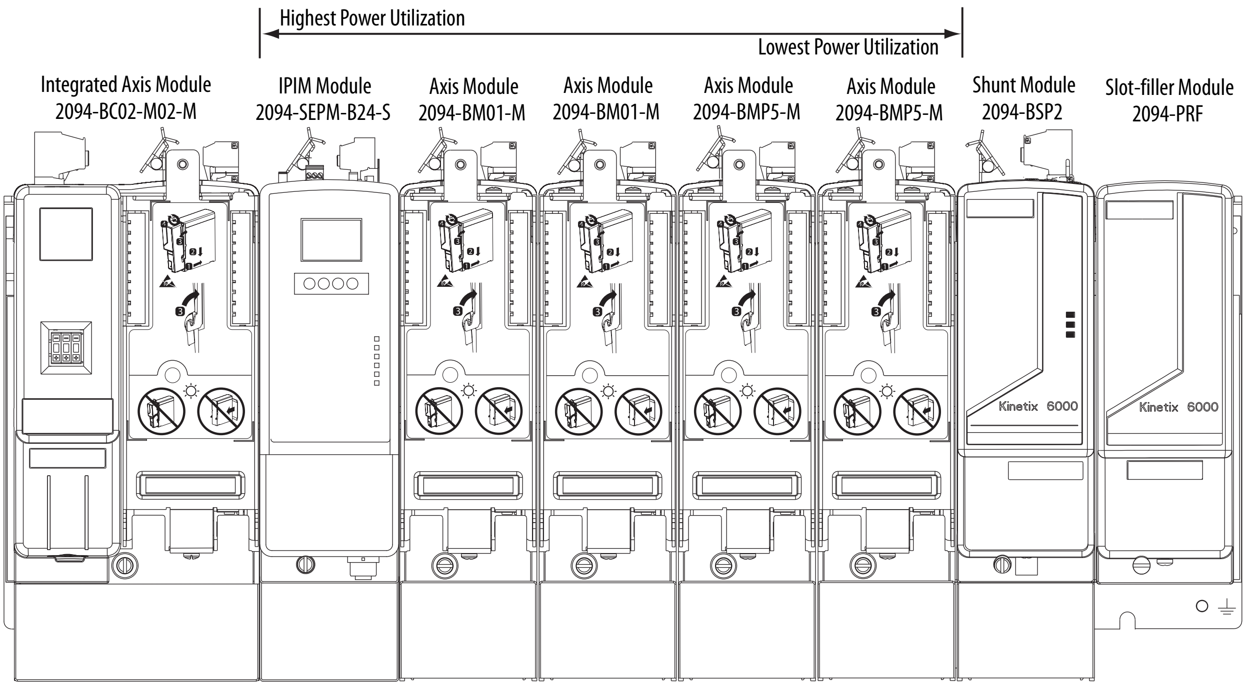
Table 20 - Kinetix 6200/6500 (400V-class) Axis Modules

Attribute	2094-BMP5-M	2094-BM01-M	2094-BM02-M	2094-BM03-M	2094-BM05-M
Continuous Power Output, nom	1.8 kW	3.9 kW	6.6 kW	13.5 kW	22.0 kW

Table 21 - Kinetix 6000M (400V-class) IPIM Module

Attribute	2094-SEPM-B24-S
Continuous Power Output, nom	15.0 kW

Figure 25 - Module Mounting Order Example



IMPORTANT The IAM module must be positioned in the leftmost slot of the power rail. Position your AM/IPIM modules, shunt module, and slot-filler modules to the right of the IAM module.

The shunt module must be installed to the right of the last AM/IPIM module. Only slot-filler modules can be installed to the right of the shunt module.

Do not mount the shunt module on power rails with a follower IAM module. Common-bus follower IAM modules disable the internal, rail mounted, and external shunt modules.

SHOCK HAZARD: To avoid personal injury due to electrical shock, place a 2094-PRF slot-filler module in all empty slots on the power rail. Any power rail connector without a module installed disables the Bulletin 2094 system; however, control power is still present.

Mount Modules on the Power Rail

Follow these steps to mount the IAM, AM, IPIM, shunt, and slot-filler modules.

TIP All modules mount to the power rail by using the same technique; however, only the IAM module is used in the examples.

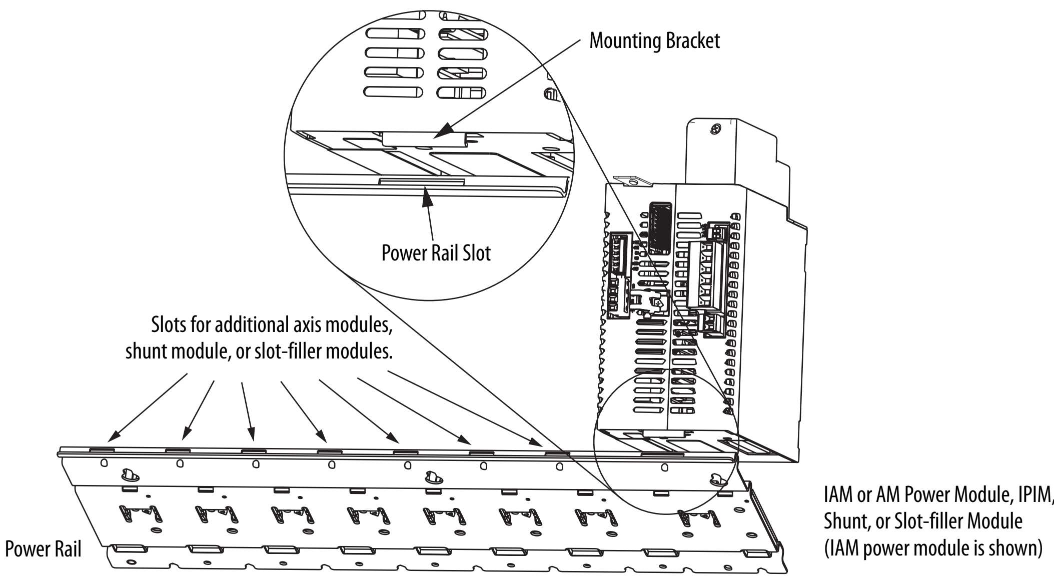
1. Remove the protective covers from the power rail connectors.

IMPORTANT The IAM module must be positioned in the leftmost slot of the power rail. Position your axis modules, shunt module, and slot-filler modules to the right of the IAM module.

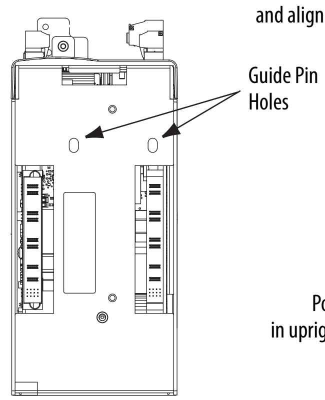
2. Determine the next available slot and module for mounting.

> **ATTENTION:** To avoid damage to the pins on the back of each IAM, AM, IPIM, shunt, and slot-filler module and to make sure that module pins mate properly with the power rail, hang modules as shown in step 3 through step 6.
>
> The power rail must be mounted vertically on the panel before hanging modules on the power rail. Do not mount modules if the power rail is horizontal.

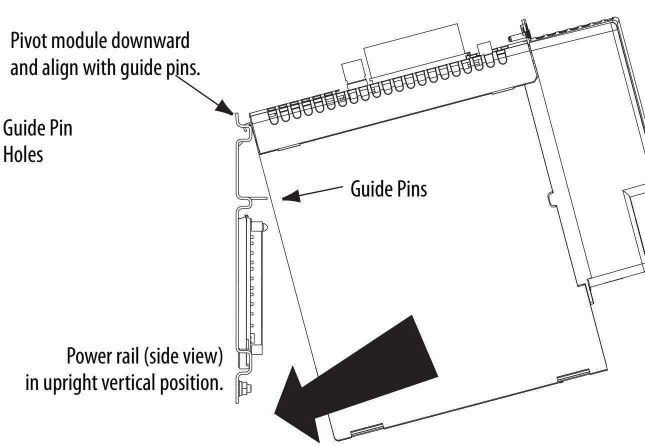
3. Hang the mounting bracket from the slot on the power rail.



4. Pivot module downward and align the guide pins on the power rail with the guide pin holes in the back of the module.



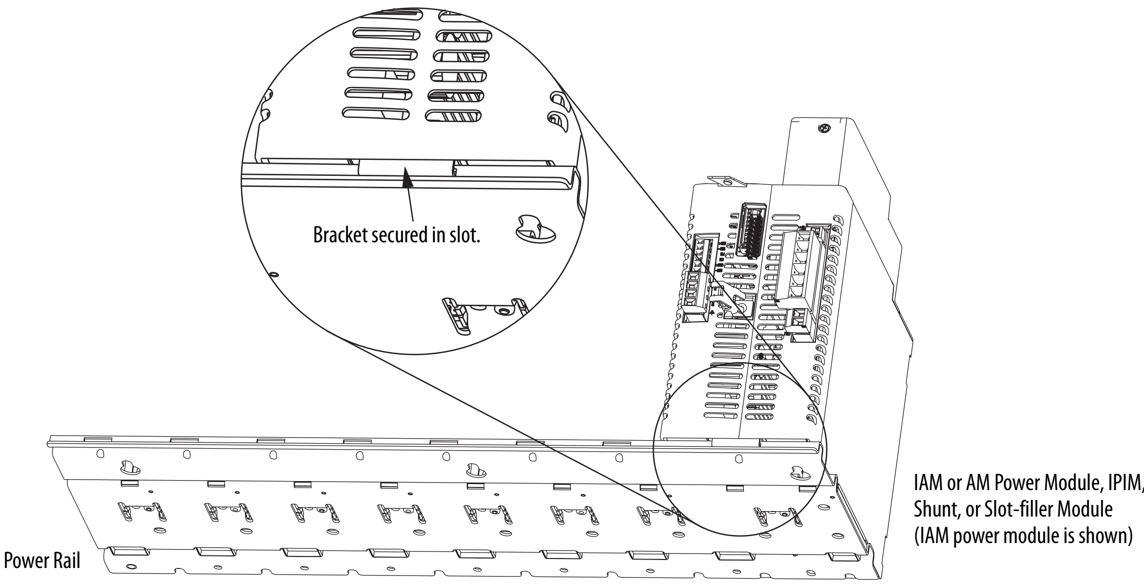
IAM or AM Power Module, IPIM, Shunt, or Slot-filler Module, Rear View (AM power module is shown)



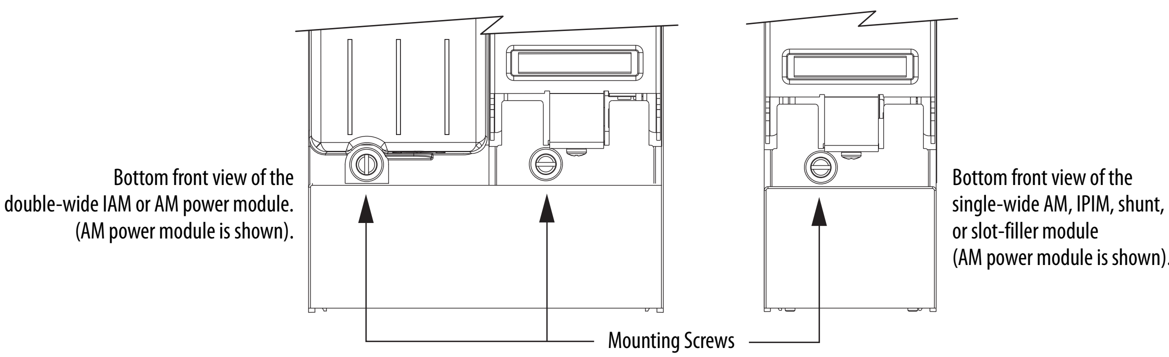
IAM or AM Power Module, IPIM, Shunt, or Slot-filler Module, Side View (IAM power module is shown)

TIP The IAM module can have two or three power rail connectors and guide pins, the AM module can have one or two, all other modules have one.

5. Gently push the module against the power rail connectors and into the final mounting position.



6. Use 2.26 N•m (20 lb•in) torque to tighten the mounting screws.



IMPORTANT There are two mounting screws when mounting 2094-BC04-M03-M, and 2094-BC07-M05-M (double-wide) IAM modules, and 2094-BM03-M and 2094-BM05-M (double-wide) AM modules.

Repeat step 1 through step 6 for each AM, IPIM, shunt, or slot-filler module in your Bulletin 2094 drive system

Mount the Control Modules

The IAM and AM power modules are equipped with two mounting hooks and a threaded hole. The control module has two mounting studs, guide pins, and a captive screw for mating the control module with a power module.

IMPORTANT	For convenience and ease of use, mount the IAM and AM power modules on the power rail before mounting the control modules. When the power modules are placed on a flat surface, with the power-rail connectors facing down, the mounting screw that extends from the front of the drive and fastens to the power rail, pushes back and interferes with the control module installation.

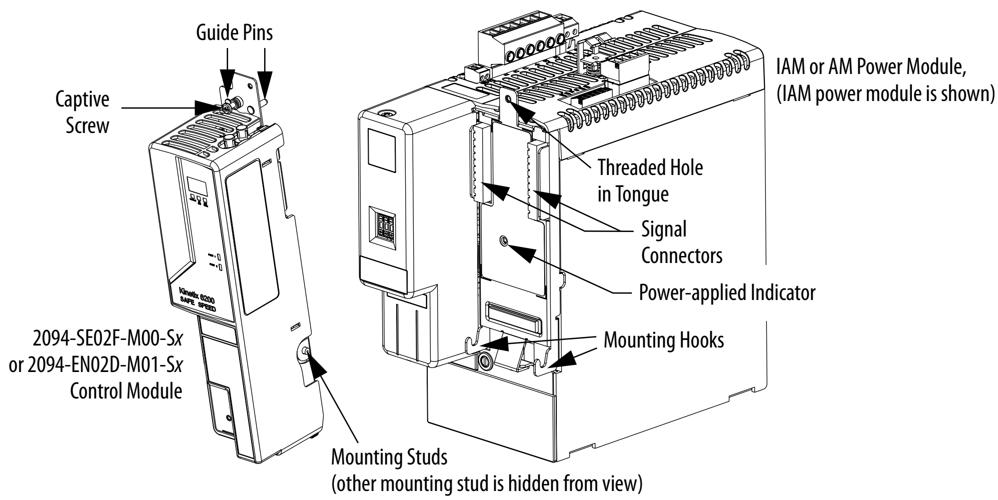
Follow these steps to mount control modules to either IAM (inverter) power modules or AM power modules. In this procedure an IAM power module is shown.

1. Remove all input power from the IAM power module.

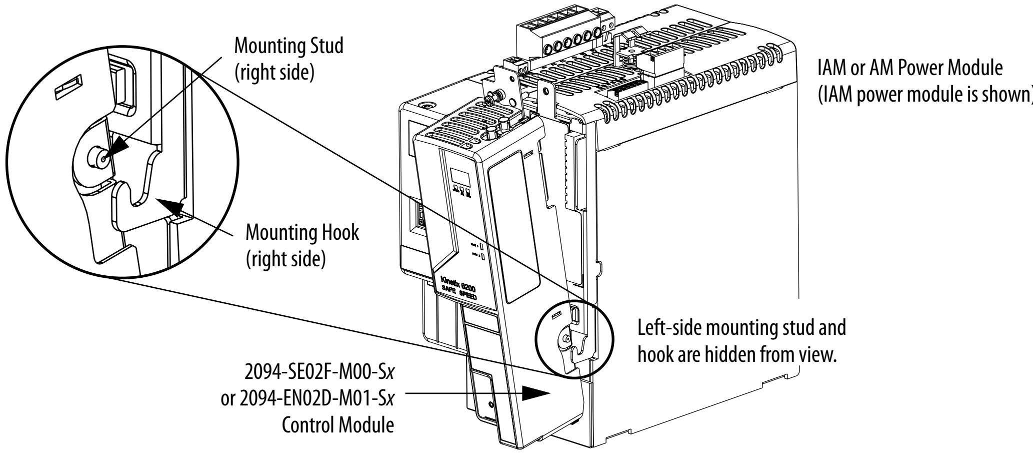
   Verify that the Power-applied indicator is off. When the indicator is on, voltage is present on the IAM and AM power module signal connectors.

   ATTENTION: To avoid damage to equipment, do not mount your Bulletin 2094 control module to the power module when the Power-applied indicator is on. Remove all input power from the IAM power module before mounting the control module.

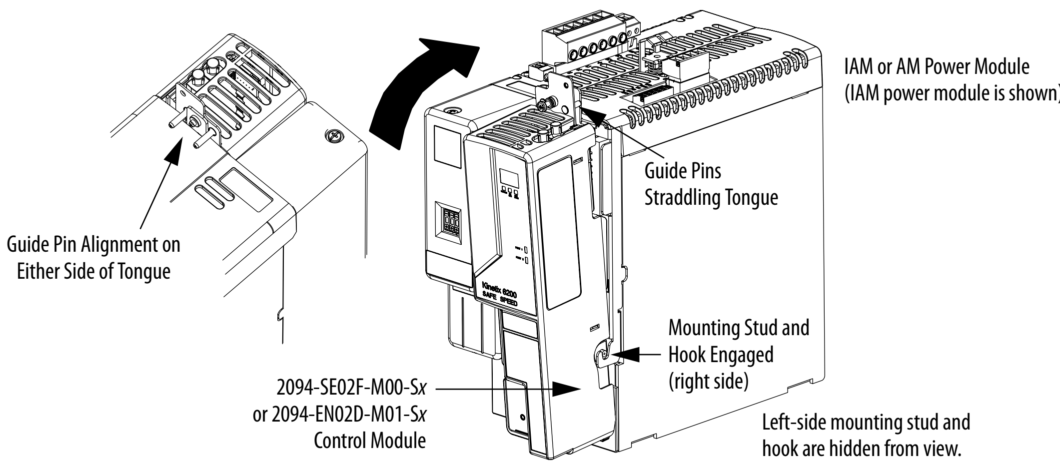
2. Position the control module in front of the power module.



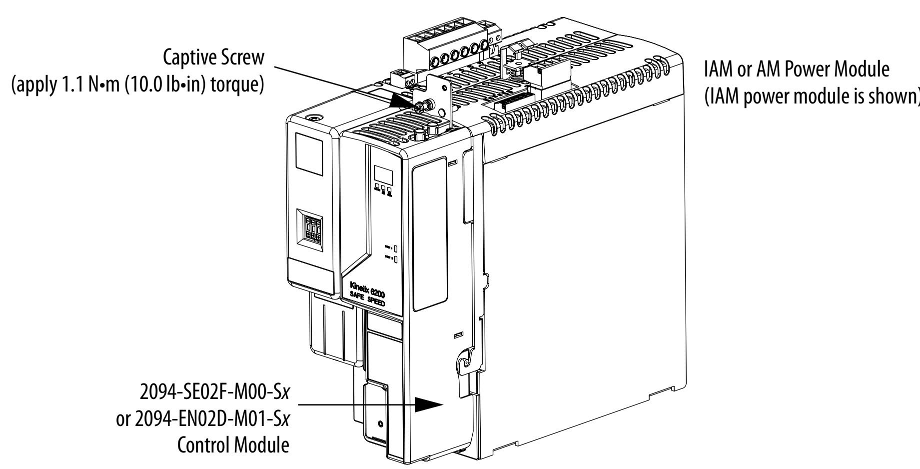
3. Guide the control module mounting studs so they engage with the power module hooks.



4. Pivot the control module toward the power module to engage the signal connectors and guide pins.



5. Tighten the captive screw.



6. Repeat step 2 through step 5 to mount a control module onto each IAM and AM power module installed on your Bulletin 2094 power rail.

Notes:

Connector Data and Feature Descriptions

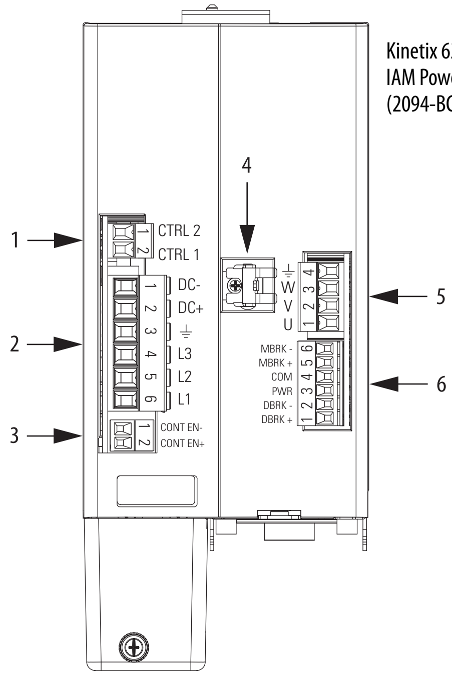
This chapter illustrates drive connectors and indicators, including connector pinouts, and provides descriptions for Kinetix 6200 and Kinetix 6500 drive features.

For the Kinetix 6000M integrated drive-motor (IDM) unit and IDM power interface module (IPIM) connector locations and signal descriptions, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

2094 Power Module and Control Module Features

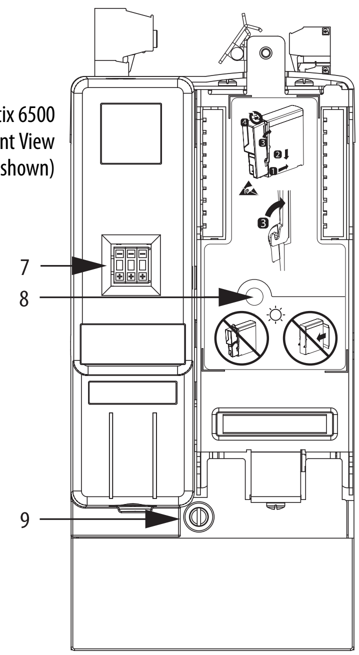
Use these illustrations to identify the connectors and indicators for the IAM/AM power modules and control modules. Sercos interface and Ethernet network connectors for the Kinetix 6000M IPIM module are also shown. For the remainder of the IPIM module features and indicators, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Figure 26 - IAM Power Module Features and Indicators



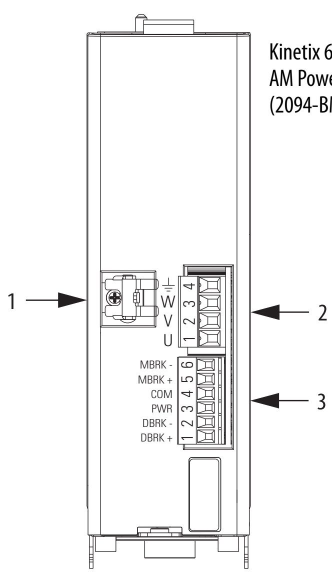
Kinetix 6200 or Kinetix 6500
IAM Power Module, Top View
(2094-BC01-MP5-M is shown)

Kinetix 6200 or Kinetix 6500
IAM Power Module, Front View
(2094-BC01-MP5-M is shown)



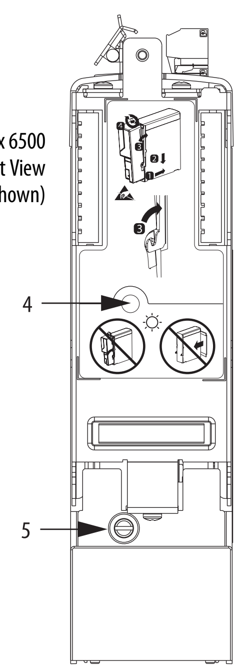
Item	Description
1	Control power (CPD) connector
2	DC bus/AC input power (IPD) connector
3	Contactor enable (CED) connector
4	Motor cable shield clamp
5	Motor power (MP) connector
6	Motor/resistive brake (BC) connector
7	Node address switch
8	Power-applied indicator
9	Mounting screw

Figure 27 - AM Power Module Features and Indicators



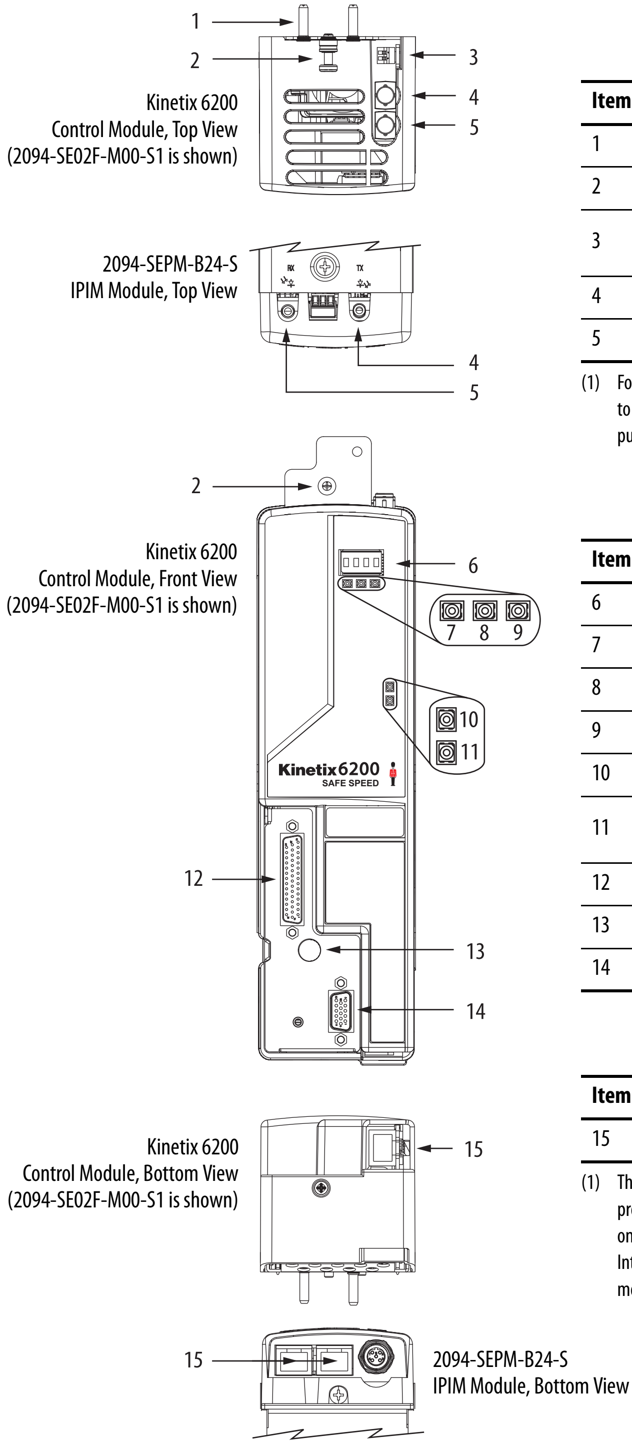
Kinetix 6200 or Kinetix 6500
AM Power Module, Top View
(2094-BMP5-M is shown)

Kinetix 6200 or Kinetix 6500
AM Power Module, Front View
(2094-BMP5-M is shown)



Item	Description
1	Motor cable shield clamp
2	Motor power (MP) connector
3	Motor/resistive brake (BC) connector
4	Power-applied indicator
5	Mounting screw

Figure 28 - Control Module Features and Indicators (sercos)



Item	Description
1	Guide pins (2x)
2	Captive screw
3	Sercos communication rate and optical power switches
4	Sercos transmit (Tx) Connector [1]
5	Sercos receive (Rx) Connector [1]

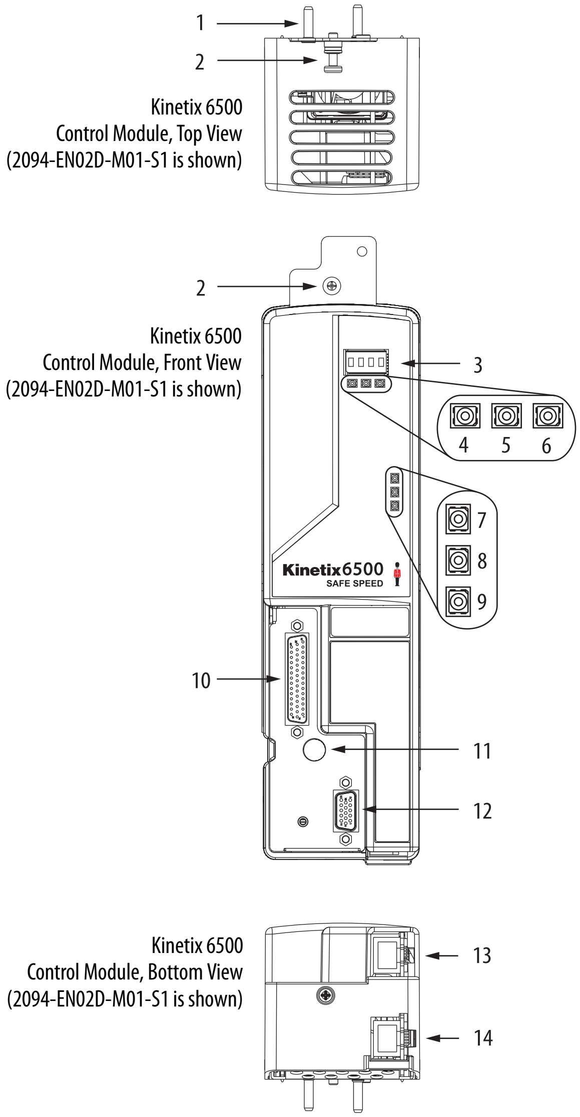
(1) For the remainder of the IPIM module features and indicators, refer to the Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003.

Item	Description
6	Four-character status display
7	PORT 1 status indicator
8	Drive status indicator
9	Comm status indicator
10	DC bus status indicator
11	Safety lock status indicator (2094-SE02F-M00-S1 modules only)
12	I/O, safety, and aux feedback (IOD) connector
13	Power module mounting screw access hole
14	Motor feedback (MF) connector

Item	Description
15	Ethernet (PORT1) connector [1]

(1) The Kinetix 6000M IPIM module has two Ethernet ports. They provide the same function on the IPIM module as the Ethernet port on the Kinetix 6200 control module. Refer to the Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003, for more information.

Figure 29 - Control Module Features and Indicators (Ethernet)



Item	Description
1	Guide pins (2x)
2	Captive screw

Item	Description
3	Four-character status display
4	PORT 1 status indicator
5	PORT 2 status indicator
6	Module status indicator
7	Network status indicator
8	DC bus status indicator
9	Safety lock status indicator (2094-EN02D-M01-S1 modules only)
10	I/O, safety, and aux feedback (IOD) connector
11	Power module mounting screw access hole
12	Motor feedback (MF) connector

Item	Description
13	Ethernet (PORT1) connector
14	Ethernet (PORT2) connector

Table 22 - Kinetix 6200 and Kinetix 6500 Power Module and Control Module Connectors

Designator	Description	Connector	Module
IOD	User I/O (drive), safety, and auxiliary feedback	44-pin high-density D-shell (female)	Control
MF	Motor feedback	15-pin high-density D-shell (female)	Control
CPD	Control input power (drive)	2-position plug/header	IAM
IPD	VAC input power (drive) and DC bus	6-position plug/header	IAM
CED	Contactor enable	2-position plug/header	IAM
MP	Motor power	4-position plug/header	IAM/AM
BC	Motor/Resistive brake	6-position plug/header	IAM/AM
Tx and Rx	Sercos transmit and receive	Sercos fiber-optic (2)	Control
PORT1 and PORT2	EtherNet/IP network	RJ-45 Ethernet (2)	Control

I/O, Safety, and Auxiliary Feedback Connector Pinout

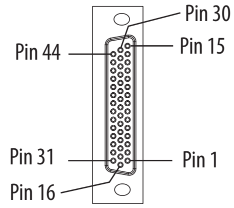
IOD Pin [1]		Description	Signal
1		Sine differential input + A differential input +	AUX_SIN+ AUX_A+
2		Sine differential input - A differential input -	AUX_SIN- AUX_A-
3		Cosine differential input + B differential input +	AUX_COS+ AUX_B+
4		Cosine differential input - B differential input -	AUX_COS- AUX_B-
5		Data differential input + Index differential input +	AUX_DATA+ AUX_I+
6		Data differential input - Index differential input -	AUX_DATA- AUX_I-
7		Clock output +	AUX_CLK+
8		Clock output -	AUX_CLK-
9		Encoder 5V power output	EPWR5V [2]
10		Encoder common	ECOM
11		Encoder 9V power output	EPWR9V [2]
12		Reserved	–
13		Reserved	–
14		24V power out	24VPWR [3]
15		24V common	24VCOM [3]
16		Reserved	–
17	(A1)	Safety 24V power input	SPWR
18	(A2)	Safety 24V common	SCOM
19	(S12)	Safe stop input 0	SS_IN_CH0
20	(S22)	Safe stop input 1	SS_IN_CH1
21	(34)	Safe stop output 0	SS_OUT_CH0
22	(44)	Safe stop output 1	SS_OUT_CH1
23	(S52)	Safe limited speed input 0	SLS_IN_CH0
		Safe stop input 2	SS_IN_CH2 [3]
24	(S62)	Safe limited speed input 1	SLS_IN_CH1
		Safe stop input 3	SS_IN_CH3 [3]
25		Reset reference	RESET_REF
26	(S34)	Reset input	RESET_IN
27	(S11)	Pulse test output 0	TEST_OUT_0
28	(S21)	Pulse test output 1	TEST_OUT_1
29	(68)	Safe limited speed output 0	SLS_OUT_CH0
30	(78)	Safe limited speed output 1	SLS_OUT_CH1
31	(S32)	Door monitor input 0	DM_IN_CH0
32	(S42)	Door monitor input 1	DM_IN_CH1
33	(X32)	Lock monitor input 0	LM_IN_CH0
34	(X42)	Lock monitor input 1	LM_IN_CH1
35	(51)	Door control channel output-	DC_OUT_CH0
36	(52)	Door control channel output+	DC_OUT_CH1
37	(S72)	Enabling switch monitor input 0	ESM_IN_CH0
38	(S82)	Enabling switch monitor input 1	ESM_IN_CH1
39		24V power out	24VPWR [4]
40		24V common	24VCOM [4]
41		Digital input 1 (drive enable)	INPUT1 [5]
42		Digital input 2 (home)	INPUT2 [5]
43		Digital input 3 (registration 1)	INPUT3 [5]
44		Digital input 4 (registration 2)	INPUT4 [5]

(1) Designators in parenthesis refer to the Guardmaster® MSR57P safety relay and PowerFlex® 750-Series safety option terminals.
(2) Determine which power supply your encoder requires and connect to only the specified supply. Do not make connections to both.
(3) This signal applies to only the 2094-SE02F-M00-S0 and 2094-EN02D-M01-S0 control modules. Use this supply to power the Safety 24V (SPWR/SCOM) input. Do not connect this 24V supply to any external safety device.
(4) Use signals 24VPWR and 24VCOM (IOD-39 and IOD-40) as a 24V DC source to operate the digital inputs (50 mA maximum per input).
(5) Default assignments are in parenthesis. Use sercos IDN Write instruction to change default assignments. Refer to Digital Inputs on page 69 for more information.

ATTENTION: To avoid damage to components, determine which power supply your encoder requires and connect to either the 5V or 9V supply, but not both.

Refer to Additional Resources on page 12 for links to Kinetix 6200 and Kinetix 6500 safety reference manuals.

Figure 30 - Pin Orientation for 44-pin I/O, Safety, and Auxiliary Feedback (IOD) Connector



Motor Feedback Connector Pinout

MF Pin	Description	Signal
1	Sine differential input + A differential input +	MTR_SIN+ MTR_AM+
2	Sine differential input - A differential input -	MTR_SIN- MTR_AM-
3	Cosine differential input + B differential input +	MTR_COS+ MTR_BM+
4	Cosine differential input - B differential input -	MTR_COS- MTR_BM-
5	Data differential input/output + Index differential input +	MTR_DATA+ MTR_IM+
6	Encoder common	MTR_ECOM
7	Encoder 9V power output	MTR_EPWR9V (1)
8	Hall commutation S3 input	MTR_S3

MF Pin	Description	Signal
9	Clock output +	MTR_CLK+
10	Data differential input/output - Index differential input -	MTR_DATA- MTR_IM-
11	Motor thermostat (normally closed) (2)	MTR_TS
12	Hall commutation S1 input	MTR_S1
13	Hall commutation S2 input	MTR_S2
14	Encoder 5V power output	MTR_EPWR5V (1)
15	Clock output -	MTR_CLK-

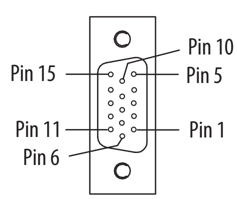
(1) Determine which power supply your encoder requires and connect to only the specified supply. Do not make connections to both.
(2) Not applicable unless motor has integrated thermal protection. Common (TS-) signal for thermal switch is tied to MF-6 (ECOM) in Bulletin 2090 cables.

ATTENTION: To avoid damage to components, determine which power supply your encoder requires and connect to either the 5V or 9V supply, but not both.

IMPORTANT Combined motor-power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

Figure 31 - Pin Orientation for 15-pin Motor Feedback (MF) Connector

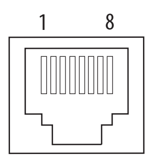


Ethernet Communication Connector Pinout

ATTENTION: To avoid damage to components, determine which power supply your encoder requires and connect to either the 5V or 9V supply, but not both.

Pin	Description	Signal
1	Transmit+	TD+
2	Transmit-	TD-
3	Receive+	RD+
4	Reserved	—
5	Reserved	—
6	Receive-	RD-
7	Reserved	—
8	Reserved	—

Figure 32 - Pin Orientation for 8-pin Ethernet PORT1 and PORT2 Connectors



IAM Input Connector Pinout

Table 23 - Control Power Connector

CPD Pin	Description	Signal
1	Control power VAC input	CTRL 2
2		CTRL 1

Table 24 - DC Bus and Input Power Connector

IPD Pin	Description	Signal
1	An integral, unregulated power supply, consisting of AC line input, three-phase bridge rectifier, and filter capacitors.	DC-
2		DC+
3	Chassis ground.	⏚
4	Three-phase input power.	L3
5		L2
6		L1

Table 25 - Contactor Enable Connector

CED Pin	Description	Signal
1	Relay-driven dry contact used in the control string for a three-phase power contactor.	CONT EN-
2		CONT EN+

IAM and AM Motor Power and Brake Connector Pinout

Table 26 - Motor Power Connector

MP Pin	Description	Signal
4	Chassis ground	⏚
3	Three-phase motor power	W
2		V
1		U

IMPORTANT Combined motor-power cable length for all axes on the same DC bus must not exceed 240 m (787 ft) with 460V systems. Drive-to-motor power cables must not exceed 90 m (295.5 ft).

System performance was tested at these cable length specifications. These limitations also apply when meeting CE requirements.

Table 27 - Motor Brake/Resistive Brake Connector

BC Pin	Description	Signal
6	Motor brake connections	MBRK-
5		MBRK+
4	Motor brake common	COM
3	+24V brake input power (from LIM module or customer supplied)	PWR
2	RBM module connections (from RBM module and safety string)	DBRK-
1		DBRK+

Control Signal Specifications

This section provides a description of the Kinetix 6200 and Kinetix 6500 drive I/O (IOD), communication, contactor enable (CED), brake (BC), and control power (CPD) connectors.

Digital Inputs

Four assignable inputs are available for the machine interface on the control module. Each IAM and AM module supplies 24V DC @ 200 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 the digital inputs.

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

IMPORTANT	Over-travel limit input devices must be normally closed.

The four digital inputs (IOD-41 through IOD-44) have default assignments, however, you can reassign them according to the needs of your specific application.

Table 28 - Digital Input Default IDN Assignments

IOD Pin	Input	IDN	Type	Default
41	1	P-0-052	INT	Enable
42	2	P-0-053		Home
43	3	P-0-054		Registration 1
44	4	P-0-055		Registration 2

You can change the digital input default settings on Kinetix 6200 control modules by using a sercos IDN Write instruction. For example, digital input 4 (IOD-44) is configured by IDN P-0-055. By default the value is 4 (Registration 2). You can use the sercos IDN Write instruction to change IDN P-0-055 value to 7, and then digital input 4 is configured as Regeneration OK. Digital input IDN values are in the table on page 70. Refer to Appendix F on page 307 for more information on changing default IDN values.

You can change the digital input default settings on Kinetix 6500 control modules by using the Logix Designer application. Refer to Configure the Drive Modules on page 169 for more information on changing default values.

Table 29 - Understanding Digital Input Functions

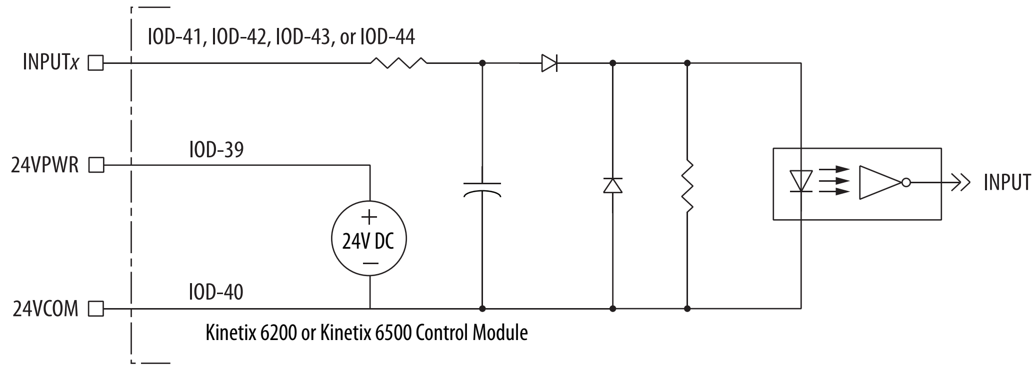
Function	Description	Default Behavior	IDN Value
Enable	If the controller configuration specifies checking of the enable input, an active state enables the power electronics to control the motor and an inactive state prevents motion. The drive generates an exception if the input is inactive when the controller commands motion and has authorized checking. The drive behavior in this situation is programmable.	The function is always inactive. If the controller instructs the drive to monitor the Enable input, the drive issues a vendor-specific initialization fault (Enable Input Assignment).	1
Home	An active state indicates to a homing sequence that the referencing sensor has been seen. Typically, a transition of this signal is used to establish a reference position for the machine axis.	The function is always inactive. If the controller instructs the drive to perform a home procedure, the drive issues a vendor-specific exception (Sensor Assignment).	2
Registration 1	An inactive-to-active transition (also known as a positive transition) or active-to-inactive transition (also known as a negative transition) is used to latch position values for use in registration moves.	The function is always inactive. If the controller instructs the drive to perform a registration procedure, the drive issues a vendor-specific exception (Sensor Assignment).	3
Registration 2			4
Positive Over-travel	If the controller configuration specifies checking of the hardware over-travel inputs, an inactive state indicates that a position limit has been exceeded in the positive direction. The drive generates an exception if the input is inactive when the controller authorizes checking. The drive behavior in this situation is programmable.	The function is always inactive. If the controller instructs the drive to monitor the hardware over-travel inputs, the drive issues a vendor-specific initialization fault (Over-travel Input Assignment).	5
Negative Over-travel	If the controller configuration specifies checking of the hardware overtravel inputs, an inactive state indicates that a position limit has been exceeded in the negative direction. The drive generates an exception if the input is inactive when the controller authorizes checking. The drive behavior in this situation is programmable.	The function is always inactive. If the controller instructs the drive to monitor the hardware over-travel inputs, the drive issues a vendor-specific initialization fault (Over-travel Input Assignment).	6
Regeneration OK	An inactive state indicates that an external regenerative power supply has a fault and a regenerative power supply exception is generated by the drive.	The function is always active. If the controller instructs the drive that a regenerative power supply with a fault output is present, the drive issues a vendor-specific initialization fault (Regeneration OK Input Assignment).	7

Table 30 - Digital Input Specifications

Attribute	Value
Type	Active high, single-ended, current sinking
Assignable functions	Enable, Home, Positive Over-travel, Negative Over-travel, Registration 1, Registration 2, and Regeneration OK
Default function assignments (sercos) (1)	Input 1 = Enable Input 2 = Home Input 3 = Registration 1 Input 4 = Registration 2
Input current (with 24V applied)	11 mA, typical
On-state input voltage	21.6…26.4V @ 200 mA total
Off-state input voltage	-1.0…3.0V
Pulse reject filtering Home Registration All other functions	 15 ms 1.0 µs, nom 1.0 ms, nom
Propagation delay (Registration functions only)	10 µs
Registration repeatability	500 ns
Windowed registration invalid-to-valid event delay	125 µs, min
Home-to-marker event delay	10 µs, min
Input reaction time (Disable)	25 ms, max
Input reaction time (Enable, Positive Over-travel, and Regeneration OK inputs)	20 ms, max

(1) The default settings are overwritten by the Logix Designer configuration settings during phase-up or through sercos IDN Write instruction. Refer to Appendix F on page 307 for information on changing default settings.

Figure 33 - Digital Input Circuitry



Ethernet Communication Specifications

The PORT1 and PORT2 (RJ-45) Ethernet connectors are provided for communication with the Logix controller (Kinetix 6500 control modules) and for programming the safety configuration (Kinetix 6200 and Kinetix 6500 control modules).

Attribute	Value
Communication	100BASE-TX, full duplex
Cyclic update period	1.0 ms, min
Embedded switch features	Three-port, cut-through, time correction on IEEE-1588 packets, limited filtering, quality of service with four priority levels
Auto MDI/MDIX crossover detection/ correction	Yes
Port-to-port time synchronization variation	100 ns, max
Cabling	CAT5e shielded, 100 m (328 ft) max

Sercos Communication Specifications

The Rx and Tx sercos connectors are provided on the Kinetix 6200 control module for communication with the Logix5000™ controller.

Attribute	Value
Data rates	4 and 8 Mbps, selectable via DIP switch (1)
Light intensity	Low power or high power, selectable via DIP switch
Cyclic update period	500 µs, min
Node addresses	001…099 (2)

(1) The Kinetix 6000M IDM system supports only 8 Mbps and is hardwired for this setting.

(2) Node address assignments begin with the IAM module. Node addresses for additional axes on the same power rail are assigned by incrementing from left to right (starting with the IAM module address).
Each IDM unit has it's own node address switches and can be set to any valid address. However, node addresses for the IAM and AM modules on the power rail and for IDM units must be unique.

Contactor Enable Relay

Contactor enable is a relay-driven contact used in the three-phase power-enable control string to protect the drive electronics during certain fault conditions. It is capable of handling 120V AC or 24V DC at 1 A or less. Contactor enable is a function of the converter and is not available in the axis modules. An active state indicates the drive is operational and does not have a fault.

ATTENTION: Wiring the contactor enable relay is required. To avoid personal injury or damage to the drive, wire the contactor enable relay into your three-phase power-enable control string so that:

- three-phase power is removed from the drive in the event of shutdown fault conditions.
- drive operation is prevented when the power rail is not fully populated.
- control power is applied to the drive prior to three-phase power.

Refer to IAM Module (without LIM module) on page 236 for a wiring example.

IMPORTANT All power rail slots must have a module installed or the contactor enable relay does not close.

Figure 34 - Contactor Enable Relay Circuit

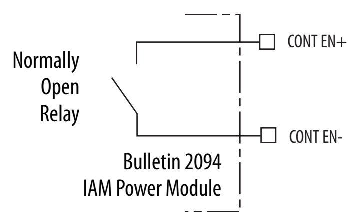


Table 31 - Contactor Enable Relay Output Specifications

Attribute	Value	Min	Max
On-state current	Current flow when the relay is closed	–	1 A
On-state resistance	Contact resistance when the relay is closed	–	1 Ω
Off-state voltage	Voltage across the contacts when the relay is open	–	120V AC or 24V DC

Power and Relay Specifications

This section provides a description of the Bulletin 2094 power module brake relay (BC), input power (IPD), motor power (MP), and control power (CPD) connectors.

Motor/Resistive Brake Relay

The brake option is a spring-set holding brake that releases when voltage is applied to the brake coil in the motor. The customer-supplied 24V power supply drives the brake output through a solid-state relay. The solid-state brake driver circuit provides the following:

- Brake current-overload protection
- Brake over-voltage protection

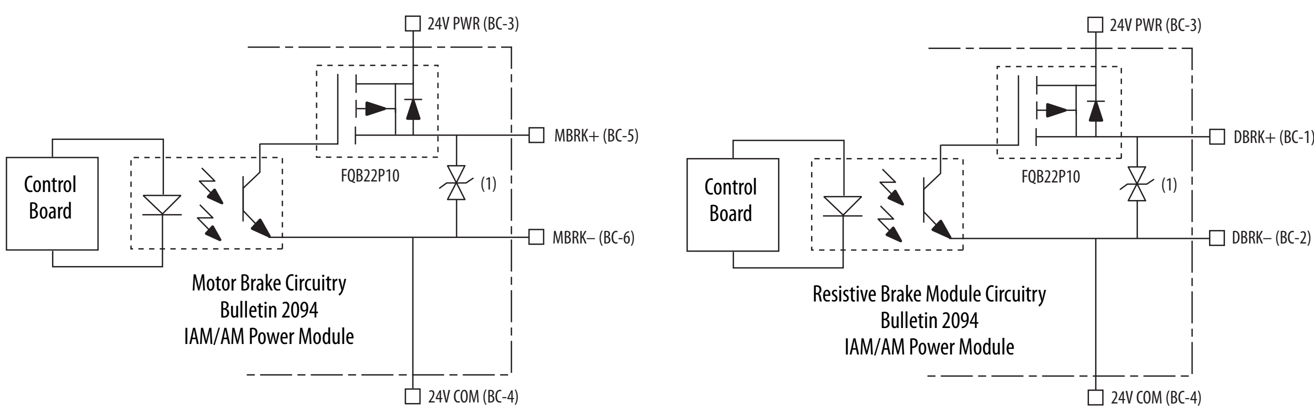
Two connections are required for the (customer-supplied) motor/resistive brake input power (BC-3 and BC-4) and two connections each for the motor and resistive brake output, as shown in Figure 35. Wiring is consistent with all series releases. Connections are rated for +24V and current as shown in Table 32.

Table 32 - Brake Relay Output Specifications

Attribute	Description	IAM/AM Power Module	Value, Max
On-state current (1)	Current flow when the relay is closed	2094-BC01-M*xx*-M, 2094-BC02-M02-M, 2094-BMP5-M, 2094-BM01-M, 2094-BM02-M	3.0 A
		2094-BC04-M03-M, 2094-BC07-M05-M, 2094-BM03-M, 2094-BM05-M	
On-state resistance	Contact resistance when the relay is closed		1 Ω
Off-state voltage	Voltage across the contacts when the relay is open		30V

(1) For motors requiring more than the maximum current specified, a relay must be added.

Figure 35 - Brake Relay Circuit



(1) Noise suppression device.

IMPORTANT	Motor parking-brake switching frequency must not exceed 10 cycles/min.

Control of the relay to release the motor brake (BC-5 and BC-6) is configurable in the Logix Designer application (refer to Configure Axis Properties on page 157). An active signal releases the motor brake. Turn-on and turn-off delays are specified by the BrakeEngageDelayTime and BrakeReleaseDelayTime settings. Refer to Controlling a Brake Example on page 253 for brake coil currents.

IMPORTANT	Holding brakes that are available on Allen-Bradley® rotary motors are designed to hold a motor shaft at 0 rpm for up to the rated brake-holding torque, not to stop the rotation of the motor shaft, or be used as a safety device. You must command the servo drive to 0 rpm and engage the brake only after verifying that the motor shaft is at 0 rpm.

The resistive brake relay (BC-1 and BC-2) controls the resistive brake module (RBM) contactor. The RBM module is wired between the drive and motor by using an internal contactor to switch the motor between the drive and a resistive load. The RBM module contact delay is the time it takes to fully close the contactor across the motor power input lines, and must be configured in the software. Refer to RBM Module Interconnect Diagrams beginning on page 313 for wiring examples.

These steps provide one method you can use to control a brake.

1. Wire the mechanical brake according to the appropriate interconnect diagram in Appendix A beginning on page 231.
2. Enter the BrakeEngageDelay and BrakeReleaseDelay times in the Logix Designer application.

   Refer to Axis Properties>Parameter List. The delay times must be from the appropriate motor family brake specifications table in the Kinetix Rotary Motion Specifications Technical Data, publication GMC-TD001.
3. Use the drive stop-action default setting (Current Decel & Disable).

   Refer to Axis Properties>Actions>Stop Action in the Logix Designer application (this step applies to only Kinetix 6500 servo drives).
4. Use the motion instruction Motion Axis Stop (MAS) to decelerate the servo motor to 0 rpm.
5. Use the motion instruction Motion Servo Off (MSF) to engage the brake and disable drive.

Input Power Cycle Capability

The power cycle capability is inversely proportional to the system capacitance (including DC bus follower), but cannot exceed 2 contactor cycles per minute with up to 4 axes or 1 contactor cycle per minute with 5…8 axes.

The cycle capability also depends on the converter power rating and the total system capacitance. Refer to Appendix C on page 267 to calculate total system capacitance.

Table 33 - Maximum Input Power Cycling Specifications (460V)

Attribute	2094-BC01-MP5-M, 2094-BC01-M01-M	2094-BC02-M02-M	2094-BC04-M03-M	2094-BC07-M05-M
Main AC input power cycling (cycles per minute for 10,000 µf)	0.12	0.52	2.15	4.30

For example, in a 4 axis system with a 2094-BC02-M02-M IAM power module and 2,000 µF total capacitance, the calculated capability is 0.52 x 10,000/2000 = 2.6 cycles per minute. However, this value is reduced to 2.0 by the 4 axes per system limitation.

Peak Current Specifications

Figure 36 - Load Duty-cycle Profile Example

$$D = \frac{T_{PK}}{T} \times 100\%$$

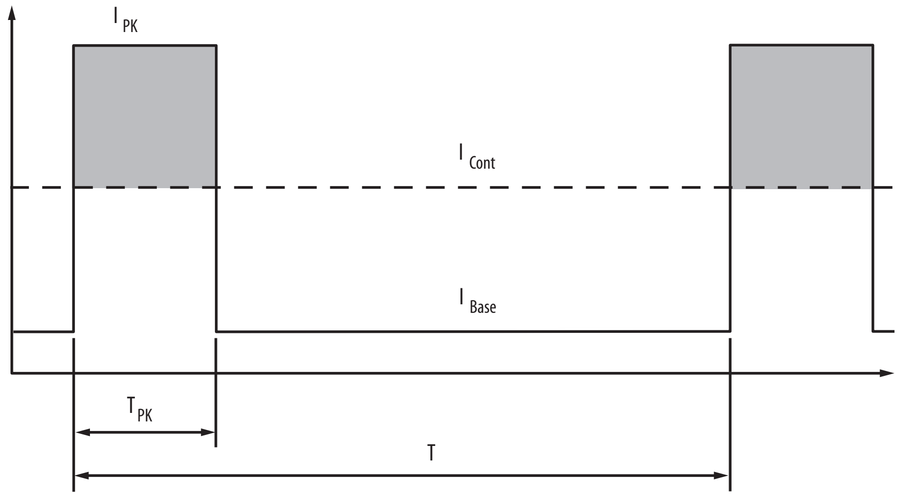
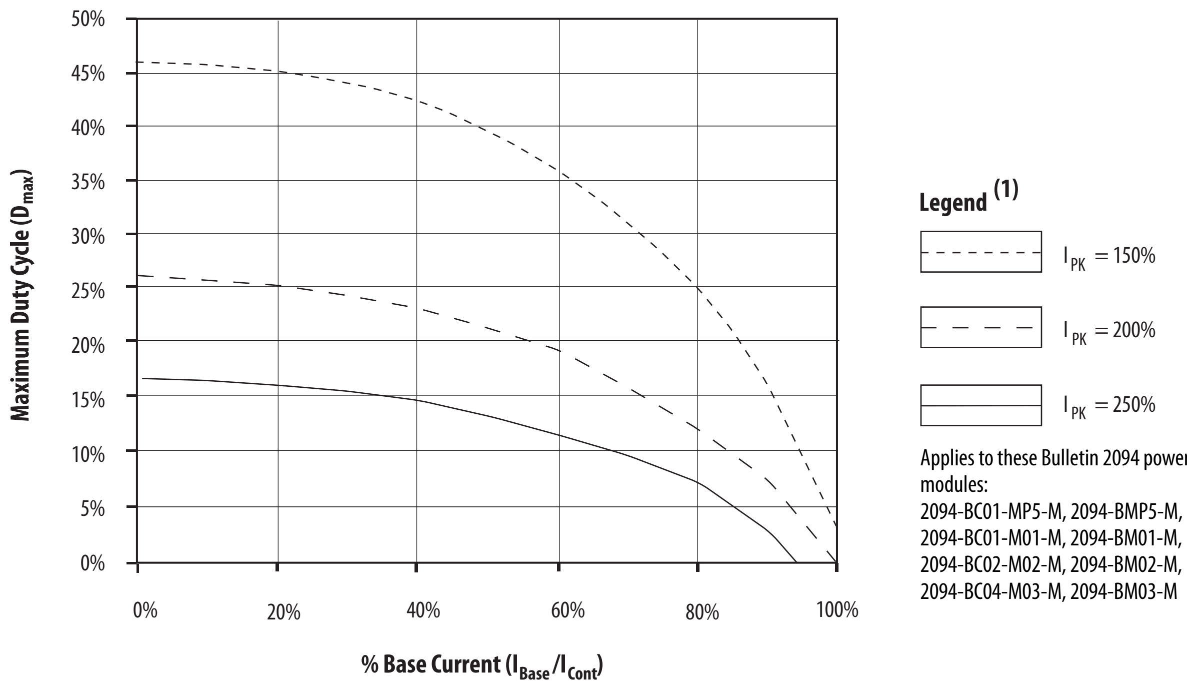


Table 34 - Peak Duty Cycle Definition of Terms

Term	Definition [1]
Continuous Current Rating (I_{Cont})	The maximum value of current that can be output continuously.
Peak Current Rating (I_{PKmax})	The maximum value of peak current that the drive can output. This rating is valid only for overload times less than T_{PKmax}.
Duty Cycle (D)	The ratio of time at peak to the Application Period and is defined as: $D = \frac{T_{PK}}{T} \times 100\%$
Time at Peak (T_{PK})	The time at peak current (I_{PK}) for a given loading profile. Must be less than or equal to T_{PKmax}.
Peak Current (I_{PK})	The level of peak current for a given loading profile. I_{PK} must be less than or equal to the Peak Current Rating (T_{PKMAX}) of the drive.
Base Current (I_{Base})	The level of current between the pulses of peak current for a given loading profile. I_{Base} must be less than or equal to the continuous current rating ($I_{Cont)}$ of the drive.
Loading Profile	The loading profile is comprised of I_{PK}, I_{Base}, T_{PK}, and D (or T) values and completely specify the operation of the drive in an overload situation. These values are collectively defined as the Loading Profile of the drive.
Application Period (T)	The sum of the times at I_{PK} (T_{PK}) and I_{Base}.

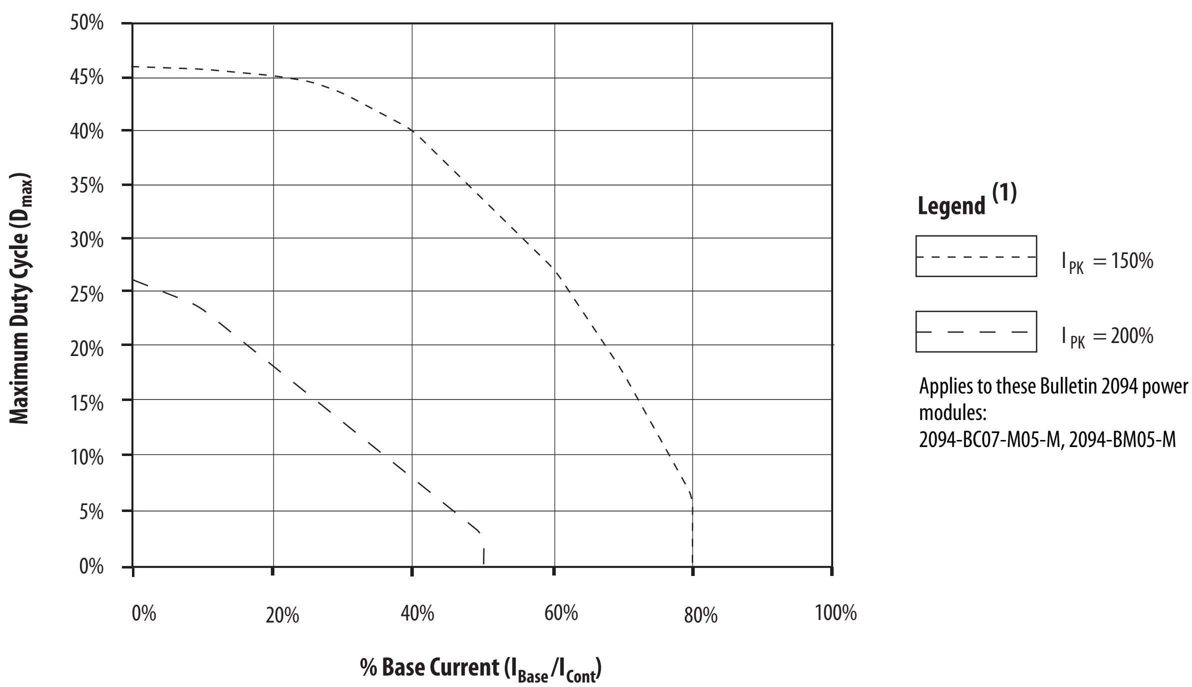
(1) All current values are specified as RMS.

Figure 37 - Peak Inverter Overload (T_{PK} < 2.0 s)



(1) Base current (I_{Base}) and peak current (I_{PK}) are a percentage of the continuous drive current rating (I_{Cont}).

Figure 38 - Peak Inverter Overload (T_{PK} < 2.0 s)



(1) Base current (I_{Base}) and peak current (I_{PK}) are a percentage of the continuous drive current rating (I_{Cont}).

Control Power

The IAM power module requires AC input power for logic circuitry.

IMPORTANT	The control power input requires an AC (EMC) line filter for CE certification. For filter examples, refer to Agency Compliance on page 25.

IMPORTANT	2094-BC*xx*-M*xx*-M (460V) IAM modules require a step down transformer for single-phase control power input. The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Table 35 - Control Power Input Power Specifications

Attribute	Value
Input voltage	95…264V AC rms, single-phase
Input power frequency	47…63 Hz
Control power AC input current Nom @ 220/230V AC rms Nom @ 110/115V AC rms Max inrush (0-pk)	 6 A 6 A 98 A (1)

(1) For eight axis systems with 230V AC control input voltage and 50 °C (122°F) ambient temperature the maximum inrush duration is less than 1/2 line cycle. Use this equation to calculate maximum inrush current for systems with different axis count and control input voltage.

$$I_{PK} = 0.043 \text{ x } (V_{IN}) + 6.72 \text{ x } (\text{\# of axes}) + 0.000333 \text{ x } (V_{IN}^2) - 0.816 \text{ x } (\text{\# of axes})^2 + 0.0358 \text{ x } (\text{\# of axes x } V_{IN})$$

Table 36 - Control Power Current Requirements

Modules on Power Rail	110/115V AC Input		220/230V AC Input	
	Input Current A	Input VA VA	Input Current A	Input VA VA
IAM module only	0.56	67	0.36	85
IAM and 1 AM module	0.99	119	0.64	153
IAM and 2 AM module	1.43	172	0.92	220
IAM and 3 AM module	1.87	224	1.20	287
IAM and 4 AM module	2.31	277	1.48	354
IAM and 5 AM module	2.74	329	1.75	421
IAM and 6 AM module	3.18	382	2.03	488
IAM and 7 AM module	3.62	434	2.31	555
IDM power interface module (IPIM)	For specifications and an example for calculating the IPIM module current requirements, refer to the Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003.			

For Kinetix 6000M systems, calculate the sum of the control power current requirements for each IPIM module on the power rail and add that value with the appropriate value from Table 36 for the number of axes on the power rail.

Feedback Specifications

The control module accepts motor and auxiliary feedback signals from the following types of encoders with these general specifications.

Table 37 - Motor and Auxiliary Feedback General Specifications

Attribute	Motor Feedback	Auxiliary Position Feedback
Feedback device support	• Stegmann Hiperface • Generic TTL Incremental • Generic Sine/Cosine Incremental • Tamagawa 17-bit Serial • Heidenhain EnDat Sin/Cos • Heidenhain EnDat Digital	• Stegmann Hiperface • Generic TTL Incremental • Generic Sine/Cosine Incremental • Heidenhain EnDat Sin/Cos • Heidenhain EnDat Digital
Power supply voltage (MTR_EPWR5V) (1)	5.1…5.4V	
Power supply current (MTR_EPWR5V) (1)	300 mA, max	
Power supply voltage (MTR_EPWR9V) (1)	8.3…9.9V	
Power supply current (MTR_EPWR9V) (1)	150 mA, max	
Thermostat	Single-ended, under 500 Ω = no fault, over 10 kΩ = fault	N/A

(1) The EPWR_5V and EPWR_9V power supplies are shared between the motor feedback interface and the auxiliary feedback interface on the I/O (IOD) connector.

TIP Auto-configuration in the Logix Designer application of intelligent absolute, high-resolution, incremental, and EnDat encoders is possible only with Allen-Bradley motors.

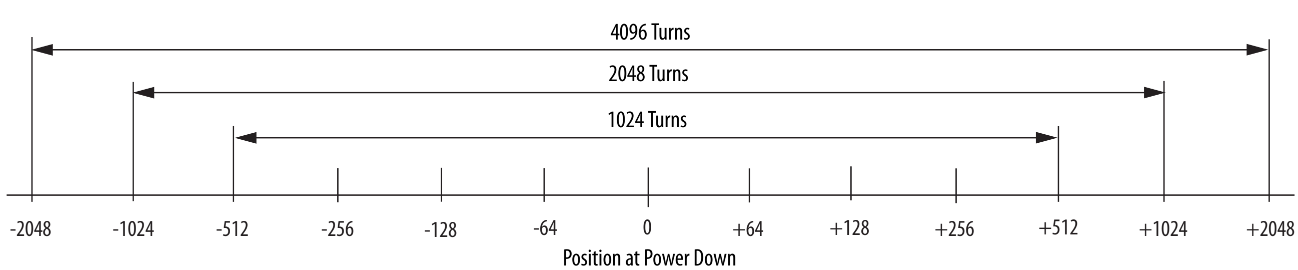
Absolute Position Feature

The drive's absolute position feature tracks the position of the motor, within the multi-turn retention limits, while the drive is powered off. The absolute position feature is available with only these multi-turn encoders.

Table 38 - Absolute Position Designator Examples

Encoder Type	Cat. No. Designator	Motor/Actuator Cat. No.	Retention Limits (turns)	
			Kinetix 6200	Kinetix 6500
Stegmann Hiperface	-M	MPL-B*xxxxx*-M, MPM-B*xxxxx*-M, MPF-B*xxxxx*-M, MPS-B*xxxxx*-M, MPAR-B3*xxxx*-M, MPAI-B*xxxxx*M	4096 (±2048)	2048 (±1024)
	-V	MPL-B*xxxxx*-V, MPAS-B*xxxx*1-V05, MPAS-B*xxxx*2-V20, MPAR-B1*xxxx*-V, MPAR-B2*xxxx*-V, MPAI-B*xxxxx*V	4096 (±2048)	4096 (±2048)
Heidenhain EnDat	-7	RDB-B*xxxxxx*-7	4096 (±2048)	1024 (±512)

Figure 39 - Absolute Position Limits (measured in turns)



Motor Feedback Specifications

The Kinetix 6200 and Kinetix 6500 control modules support multiple types of feedback devices by using the 15-pin (MF) motor feedback connector and sharing connector pins in many cases.

Table 39 - Motor Feedback Signals by Device Type

MF Pin	Stegmann Hiperface	Generic TTL Incremental	Generic Sine/Cosine Incremental	Tamagawa 17-bit Serial	Heidenhain EnDat Sine/Cosine	Heidenhain EnDat Digital
1	MTR_SIN+	MTR_AM+	MTR_AM+	–	MTR_SIN+	–
2	MTR_SIN-	MTR_AM-	MTR_AM-	–	MTR_SIN-	–
3	MTR_COS+	MTR_BM+	MTR_BM+	–	MTR_COS+	–
4	MTR_COS-	MTR_BM-	MTR_BM-	–	MTR_COS-	–
5	MTR_DATA+	MTR_IM+	MTR_IM+	MTR_DATA+	MTR_DATA+	MTR_DATA+
6	MTR_ECOM	MTR_ECOM	MTR_ECOM	MTR_ECOM	MTR_ECOM	MTR_ECOM
7	MTR_EPWR9V	–	–	–	–	–
8	–	MTR_S3	MTR_S3	–	–	–
9	–	–	–	–	MTR_CLK+	MTR_CLK+
10	MTR_DATA-	MTR_IM-	MTR_IM-	MTR_DATA-	MTR_DATA-	MTR_DATA-
11	MTR_TS	MTR_TS	MTR_TS	MTR_TS	MTR_TS	MTR_TS
12	–	MTR_S1	MTR_S1	–	–	–
13	–	MTR_S2	MTR_S2	–	–	–
14	–	MTR_EPWR5V	MTR_EPWR5V	MTR_EPWR5V	MTR_EPWR5V	MTR_EPWR5V
15	–	–	–	–	MTR_CLK-	MTR_CLK-

This is the motor thermostat interface schematic. Although the thermostat signal is shown for all feedback types, some motors may not support this feature because it is not part of the feedback device.

Figure 40 - Motor Thermostat Interface

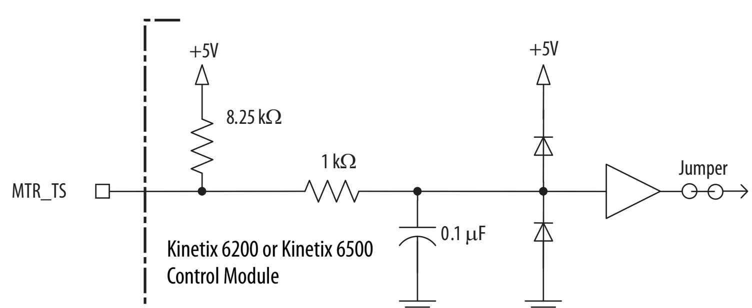


Table 40 - Stegmann Hiperface Specifications

Attribute	Value
Protocol	Hiperface
Memory support	Not programmed, or programmed with Allen-Bradley motor data
Hiperface data communication	9600 baud, 8 data bits, no parity
Sine/cosine interpolation	2048 counts/sine period
Input frequency (AM/BM)	250 kHz, max
Input voltage (AM/BM)	0.6…1.2V, p-p, measured at the drive inputs
Line loss detection (AM/BM)	Average ($\sin^2 + \cos^2$) > constant
Noise filtering (AM and BM)	Two-stage coarse count pulse reject filter with rejected pulse tally
Incremental position verification	Position compare between incremental accumulator and serial data performed every 50 ms or less

Figure 41 - Stegmann Hiperface Interface, MTR_SIN and MTR_COS Signals

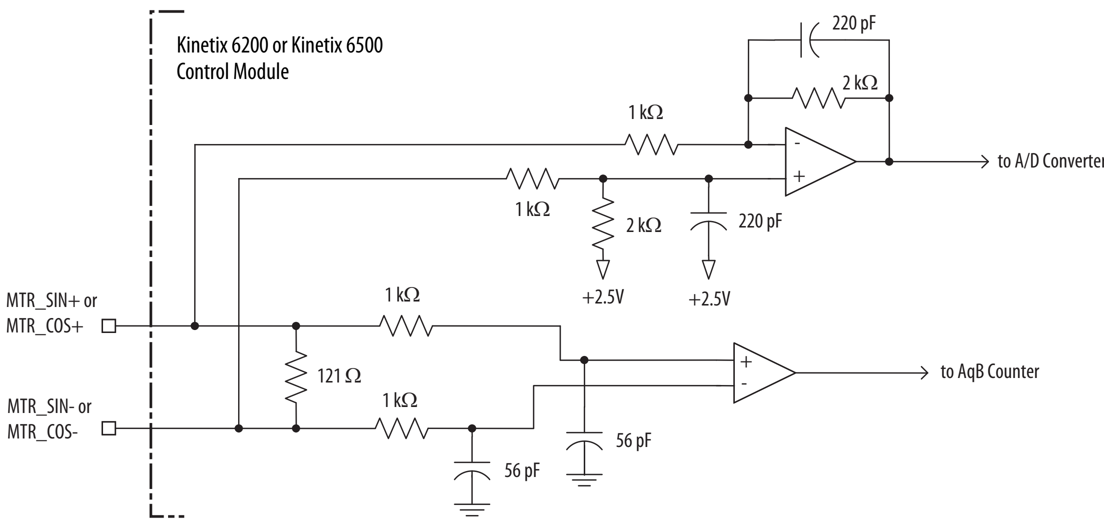


Figure 42 - Stegmann Hiperface Interface, MTR_DATA Signals

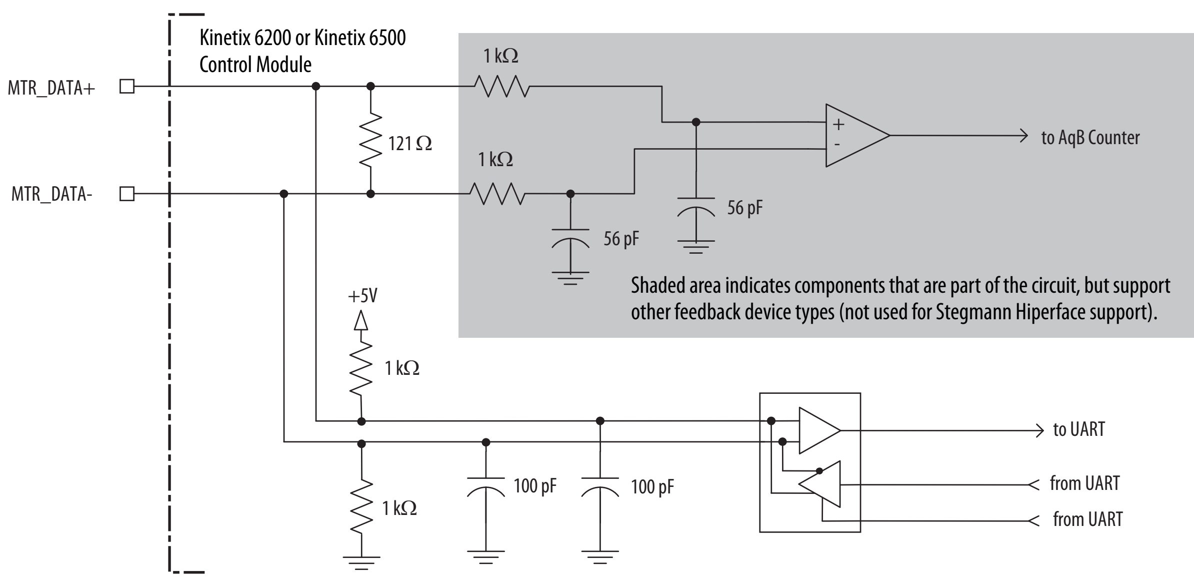


Table 41 - Generic TTL Incremental Specifications

Attribute	Value
TTL incremental encoder support	5V, differential A quad B
Quadrature interpolation	4 counts / square wave period
Differential input voltage (MTR_AM, MTR_BM, and MTR_IM)	1.0…7.0V
DC current draw (MTR_AM, MTR_BM, and MTR_IM)	30 mA, max
Input signal frequency (MTR_AM, MTR_BM, and MTR_IM)	5.0 MHz, max
Edge separation (MTR_AM and MTR_BM)	42 ns min, between any two edges
Line loss detection (MTR_AM and MTR_BM)	Average ($MTR\_AM^2 + MTR\_BM^2$) > constant
Noise filtering (MTR_AM and MTR_BM)	Two-stage coarse count pulse reject filter with rejected pulse tally
Commutation verification	Commutation angle verification performed at every Hall signal transition
Hall inputs (MTR_S1, MTR_S2, and MTR_S3)	Single-ended, TTL, open collector, or none

Figure 43 - Generic TTL Incremental, MTR_AM and MTR_BM Signals

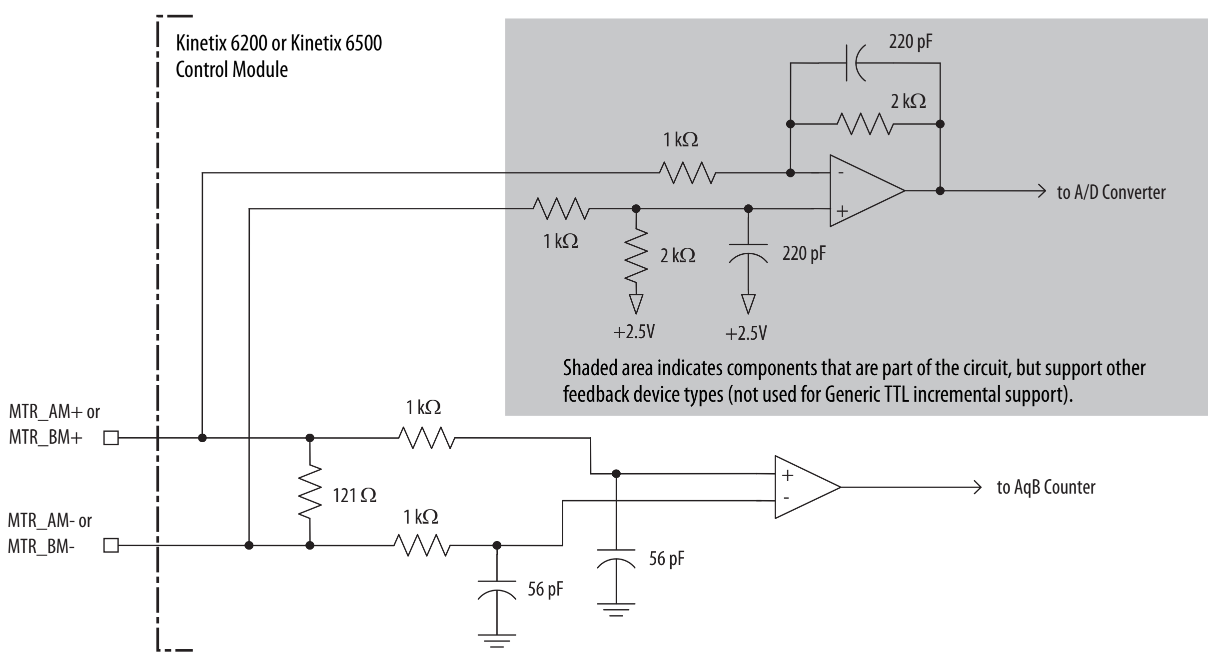


Figure 44 - Generic TTL Interface, MTR_IM Signals

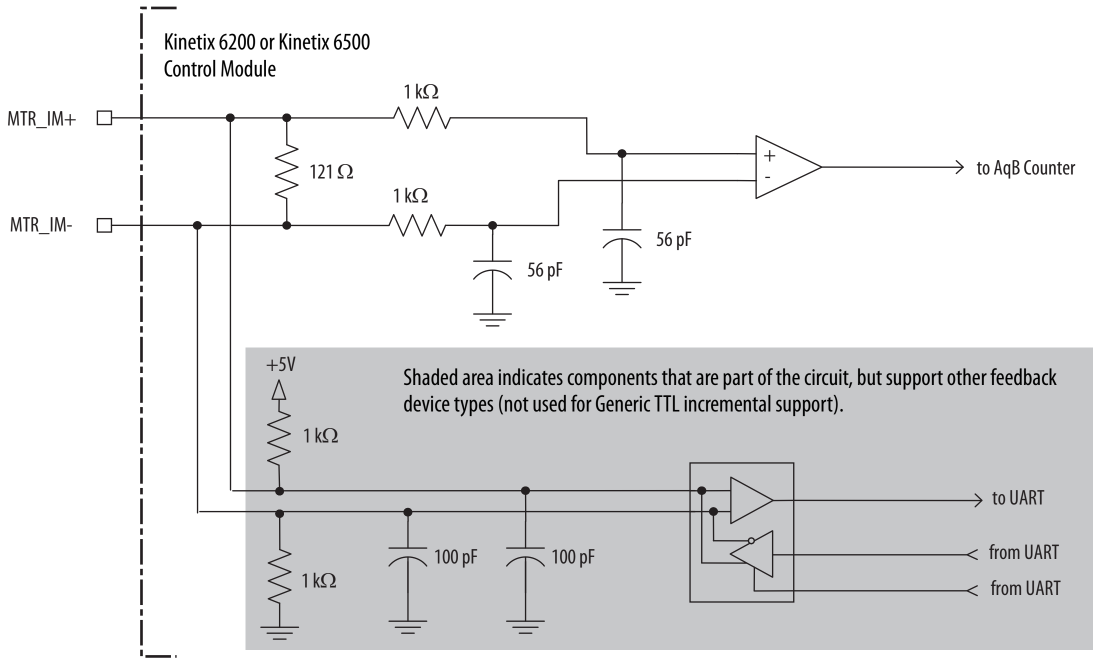


Figure 45 - Generic TTL Interface, MTR_S1, MTR_S2, or MTR_S3 Signals

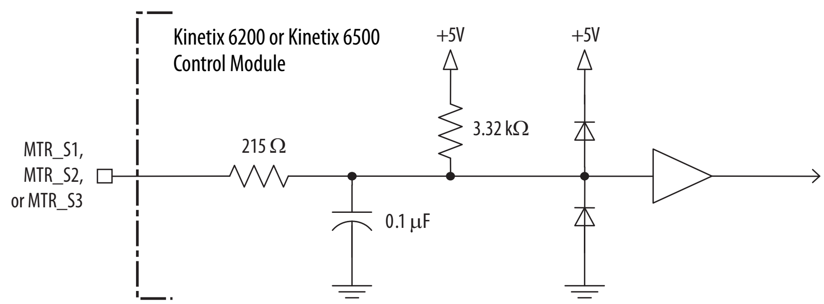


Table 42 - Generic Sine/Cosine Incremental Specifications

Attribute	Value
Sine/Cosine interpolation	2048 counts/sine wave period
Input frequency (MTR_SIN and MTR_COS)	250 kHz, max
Differential input voltage (MTR_SIN and MTR_COS)	0.6…1.2V, p-p
Line loss detection (MTR_SIN and MTR_COS)	Average ($\sin^2 + \cos^2$) > constant
Noise filtering (MTR_SIN and MTR_COS)	Two-stage coarse count pulse reject filter with rejected pulse tally
Commutation verification	Commutation angle verification performed at every Hall signal transition
Hall inputs (MTR_S1, MTR_S2, and MTR_S3)	Single-ended, TTL, open collector, or none

Refer to page 81 for the generic sine/cosine interface schematic. It is identical to the Stegmann Hiperface (MTR_AM and MTR_BM) signals schematic.

Refer to page 83 for the Hall (MTR_S1, MTR_S2, and MTR_S3) signals schematic.

Table 43 - Tamagawa 17-bit Serial Specifications

Attribute	Value
Tamagawa model support	TS5669N124
Protocol	Tamagawa proprietary
Memory support	Programmed with Allen-Bradley motor data
Differential input voltage	1.0…7.0V
Data communication	2.5 Mbps, 8 data bits, no parity
Battery	3.6V, located external to drive in low-profile connector kit

Refer to page 81 for the Tamagawa 17-bit serial interface schematic. It is identical to the Stegmann Hiperface (MTR_DATA) signals schematic.

Table 44 - EnDat Sine/Cosine Interface Specifications

Attribute	Value
Protocol	EnDat Sine/Cosine
Memory support	Unprogrammed
EnDat Sine/Cosine data communication	4 Mbps, synchronous
Sine/Cosine interpolation	2048 counts/sine wave period
Input frequency (MTR_SIN and MTR_COS)	250 kHz, max
Differential input voltage (MTR_SIN and MTR_COS)	0.6…1.2V, p-p
Line loss detection (MTR_SIN and MTR_COS)	Average ($\sin^2 + \cos^2$) > constant
Noise filtering (MTR_SIN and MTR_COS)	Two-stage coarse count pulse reject filter with rejected pulse tally
Incremental position verification	Position compare between incremental accumulator and serial data performed every 50 ms or less.

Refer to page 81 for the EnDat sine/cosine interface schematic. It is identical to the Stegmann Hiperface (MTR_SIN and MTR_COS) schematic.

Figure 46 - EnDat Sine/Cosine and EnDat Digital Interface Schematic for Serial Communication

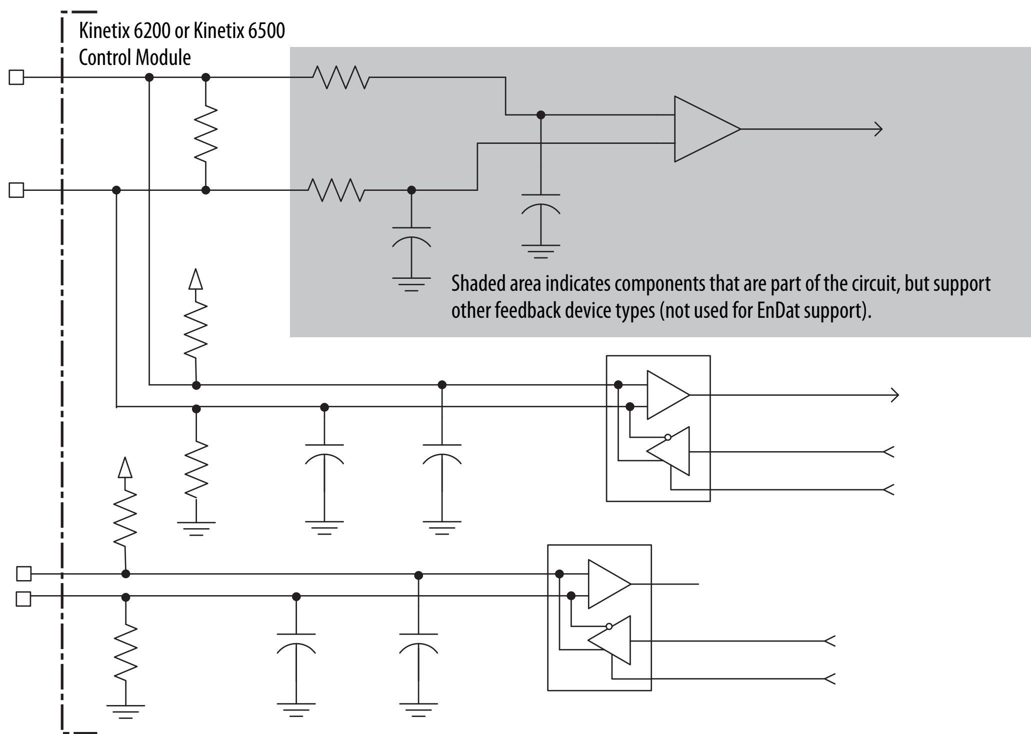


Table 45 - EnDat Digital Interface Specifications

Attribute	Value
Memory support	Unprogrammed
EnDat Digital data communication	4 Mbps, synchronous

Table 46 - Support Requirements for EnDat Encoders on Third-party Motors

Requirement	EnDat Sine/Cosine	EnDat Digital	EnDat Digital (with sine/cosine)
Supported models	ECI1319 / EQI1331 ECI1118 / EQI1130 ECI119 (1)	LC483 LIC4000 ECN125 ROQ437 ECN1123 / EQN1135 ECN1325 / EQN1337	ECN113 ECN1313 / EQN1325 ECN413 / EQN425 ROQ425
Cable length, max	50 m (164 ft)		
Position initialization	Digital		
Position tracking	Uses sine/cosine signals	Digital	Uses sine/cosine signals
Cabling	Shielded, twisted pair	Heidenhain EnDat Digital cable only	Shielded, twisted pair
Blob programming	Not required		
Commissioning/ field replacement	Kinetix 6200 or Kinetix 6500 drives: A one-time procedure must be executed via message instructions to program the blob file in the encoder (using a Kinetix 6500 drive) so that it can be operated like any other Rockwell Automation® motor. This is similar to the Stegmann encoder third-party motor requirement, except that a Kinetix 6500 drive is used instead of a Kinetix 6000 drive.		
	Kinetix 6500 drives only: The Logix Designer commutation test procedure (released with RSLogix 5000® software, version 19) must be executed to obtain the commutation offset value and store it in the controller. This procedure must be executed any time a drive is connected to a new motor.		
Data frequency	100 kHz	4.125 MHz	100 kHz
Sine/cosine frequency	0…250 kHz	–	0…250 kHz

(1) ECI119 is supported by only Kinetix 6500 drives.

IMPORTANT To properly support system EnDat feedback, the keying configuration on the drive Module Properties tab of the Logix Designer application must be selected to the correct firmware revision as follows:

- For EnDat Sine/Cosine encoders, use Kinetix 6200 drive firmware revision 1.35 or later
- For or EnDat Digital encoders, use Kinetix 6200 drive firmware revision 1.40 or later

IMPORTANT To make sure your drive and motor integration is successful, refer to commissioning notes relative to EnDat encoders on third-party motors.

Auxiliary Position Feedback Specifications

The Kinetix 6200 and Kinetix 6500 control modules support multiple types of feedback devices by using the 44-pin (IOD) connector and sharing connector pins in many cases.

Table 47 - Auxiliary Feedback Signals by Device Type

IOD Pin	Stegmann Hiperface	Generic TTL Incremental	Generic Sine/Cosine Incremental	Heidenhain EnDat Sine/Cosine	Heidenhain EnDat Digital
1	AUX_SIN+	AUX_AM+	AUX_SIN+	AUX_SIN+	–
2	AUX_SIN-	AUX_AM-	AUX_SIN-	AUX_SIN-	–
3	AUX_COS+	AUX_BM+	AUX_COS+	AUX_COS+	–
4	AUX_COS-	AUX_BM-	AUX_COS-	AUX_COS-	–
5	AUX_DATA+	AUX_IM+	AUX_IM+	AUX_DATA+	AUX_DATA+
6	AUX_DATA-	AUX_IM-	AUX_IM-	AUX_DATA-	AUX_DATA-
7	–	–	–	AUX_CLK+	AUX_CLK+
8	–	–	–	AUX_CLK-	AUX_CLK-
9	AUX_EPWR5V (1)	AUX_EPWR5V	AUX_EPWR5V	AUX_EPWR5V	AUX_EPWR5V
10	AUX_ECOM	AUX_ECOM	AUX_ECOM	AUX_ECOM	AUX_ECOM
11	AUX_EPWR9V (1)	–	–	–	–

(1) Determine which power supply your encoder requires and connect to only the specified supply. Do not make connections to both supplies.

ATTENTION: To avoid damage to components, determine which power supply your encoder requires and connect to either the 5V or 9V supply, but not both.

Specifications for the auxiliary feedback channel are identical to the motor feedback channel, except for specifications related to commutation.

The 9.0V and 5.0V power supplies for auxiliary feedback devices are shared with the motor feedback channel, and the total current capability is outlined in the table on page 79.

Allen-Bradley Bulletin 842HR, 844D, 847H, and 847T encoders are the preferred encoders for auxiliary feedback connections.

Table 48 - Allen-Bradley Auxiliary Feedback Encoders

Cat. No.	Description
842HR-MJDZ115FWYD (multi-turn) 842HR-SJDZ115FWYD (single-turn)	Size 25, sine/cosine (serial), square flange, 3/8 in. solid shaft with flat, 5…12V DC, digital RS-485 interface, M23, 17-pin connector
844D-B5CC1FW	HS35, hollow-shaft incremental encoders, rear (through-shaft), 5/8 inch, tether, 3/8 in. bolt on a 2.5…4.0 in. diameter, 10-pin connector, 5V DC in, 5V DC DLD out
844D-B5CC1CS	
844D-B5CC1DR	
847H-DN1A-RH01024	Size 25, incremental encoder, standard square flange , 3/8 inch diameter shaft with flat, 4.5…5.5V line driver, TTL (B-Leads-A, CW, Z gated with BN), MS connector, 10-pin
847H-DN1A-RH02048	
847H-DN1A-RH05000	
847T-DN1A-RH01024	Size 20, incremental encoder, standard square flange , 3/8 inch diameter shaft with flat, 4.5…5.5V line driver, TTL (B-Leads-A, CW, Z gated with BN), MS connector, 10-pin
847T-DN1A-RH02048	

Refer to the Kinetix Motion Accessories Technical Data, publication KNX-TD004, for more information on these Allen-Bradley encoders.

Safe Speed Monitor Safety Features

Kinetix 6200 and Kinetix 6500 control modules with Safe Speed Monitoring, catalog number 2094-*xx*02*x*-M*xx*-S1, incorporate Safe Torque Off functionality as well as Safe Speed Monitor and door control/monitoring. Speed monitoring allows for other stop categories such as a controlled stop and disable or even a controlled stop and hold position.

The table on page 89 summarizes the safety modes of operation supported by the Safe Speed Monitor control modules. The table also describes which I/O is active depending on the operation mode. In addition to the modes listed in the table, the Safe Speed Monitor control modules support two additional safety features.

- Safe Maximum Speed
- Safe Direction Monitoring

You can operate these features independent of the other modes, relying on the Safe Stop function.

When the Safe Maximum Speed feature is activated through a software configuration, the feedback velocity is monitored and compared against a user-programmable limit. If the measured velocity exceeds the limit, the Safe Stop function is executed.

Safe Direction Monitoring is also activated through software configuration and monitors the feedback direction and executes the Safe Stop function when motion in the illegal direction is detected.

When a new Safe Speed Monitor control module is installed, it is pre-configured in the Disabled operation mode. When installing a new module, you must first complete the basic drive configuration by using the Logix Designer application. Next, you use the safety configuration tool to configure the safety functions. As a part of the safety configuration process, you verify that the safety functions are configured, operate correctly, and you lock the safety circuitry.

Connections for safety functions are made at the IOD connector by using the 2090-K6CK-D44M low-profile connector kit. A customer-supplied 24V power supply (IOD-17 and IOD-18) is required to support the safety inputs and outputs.

Table 49 - Safety I/O Power Supply Specifications

Attribute	Value
Voltage rating	21.6…28.8V DC (24V nom) per IEC/EN 60204 and IEC/EN 61558-1
Current rating	0.105 A max

Table 50 - Safety Modes of Operation

Safety Mode	Description	SS Input	SLS Input	ESM Input	LM Input (1)	DM Input	DC Output
Disabled	In this mode, all safety functions are disabled.	–	–	–	–	–	–
Safe Stop	The drive activates the configured Stop Category upon deactivation of the Safe Stop input or the occurrence of a Stop Category Fault.	X	–	–	X	–	X
Safe Stop with Door Monitoring	In addition to monitoring for Safe Stop, the drive monitors the status of the door.	X	–	–	X	X	X
Safe Limited Speed	In addition to monitoring for Safe Stop, the drive monitors the feedback velocity and compares it to a configurable Safe Speed Limit. If the velocity exceeds the limit, the drive initiates the configured Stop Category.	X	X	–	X	–	X
Safe Limited Speed with Door Monitoring	In addition to monitoring for Safe Stop and Safe Limited Speed, the drive monitors the status of the door.	X	X	–	X	X	X
Safe Limited Speed with Enabling Switch Control	In addition to monitoring for Safe Stop and Safe Limited Speed, the drive monitors the status of the Enabling Switch input.	X	X	X	X	–	X
Safe Limited Speed with Door Monitor and Enabling Switch	In addition to monitoring for Safe Stop and Safe Limited Speed, the drive monitors the status of the door and the Enabling Switch input.	X	X	X	X	X	X
Safe Limited Speed (status only)	In addition to monitoring for Safe Stop, the drive monitors the feedback velocity and compares it to a configurable Safe Speed Limit. If the velocity exceeds the limit, the system status is made available as a safe output intended for a safety programmable logic controller. No stopping action takes place.	X	X	–	X	–	X
Slave, Safe Stop	The drive performs the same functions as Safe Stop. However, it regards the Door Monitor input as a Door Control output from an upstream axis, and performs a logical AND with its internal Door Control signal to form the cascaded Door Control output.	X	–	–	–	–	X
Slave, Safe Limited Speed	The drive performs the same functions as Safe Limited Speed mode. However, it regards the Door Monitor input as a Door Control output from an upstream axis, and performs a logical AND with its internal Door Control signal to form the cascaded Door Control output.	X	X	–	–	–	X
Slave, Safe Limited Speed (status only)	The drive performs the same functions as Safe Limited Speed Status Only mode. However, it regards the Door Monitor input as a Door Control output from an upstream axis, and performs a logical AND with its internal Door Control signal to form the cascaded Door Control output.	X	X	–	–	–	X

(1) Use of this input is optional.

Refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Safety Reference Manual, publication 2094-RM001, for more information on configuring and wiring the safety functions.

Safe Torque Off Safety Features

Kinetix 6200 and Kinetix 6500 control modules with Safe Torque Off, catalog numbers 2094-*xx*02*x*-M*xx*-S0, incorporate the capability to safely turn off the power transistors on the inverter board in response to a monitored digital input, also known as a Category 0 Stop. These drives also support dual-channel outputs that allow for cascading of the Safe Torque Off function to additional axes, and a safety circuit reset input. The 2090-K6CK-D44S0 connector kit and 2090-CS0DSDS-AA*xx* cable were designed specifically for this purpose. Refer to Figure 71 on page 128 for more information.

Refer to the Kinetix 6200 and Kinetix 6500 Safe Torque-off Safety Reference Manual, publication 2094-RM002, for more information on configuring and wiring the safety functions.

Notes:

Connect the Kinetix 6200 and Kinetix 6500 Drive System

This chapter provides procedures for wiring your Kinetix 6200 and Kinetix 6500 system components and making cable connections.

Basic Wiring Requirements

This section contains basic wiring information for the Kinetix 6200 and Kinetix 6500 drive modules.

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.

SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules prior to applying power. Once power is applied, connector terminals can 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 Cables

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

Building your own cables is not an option for the hybrid and network cables used in Kinetix 6000M integrated drive-motor systems.

Follow these guidelines when building cables for compatible motors and actuators:

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

Refer to the Kinetix Motion Accessories Technical Data, publication KNX-TD004, for low-profile connector kit, drive-end (mating) connector kit, and motor-end connector kit catalog numbers.

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 anomalies.

Refer to Electrical Noise Reduction on page 36 for examples of routing high and low voltage cables in wireways. Refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, for more information.

Determine the Input Power Configuration

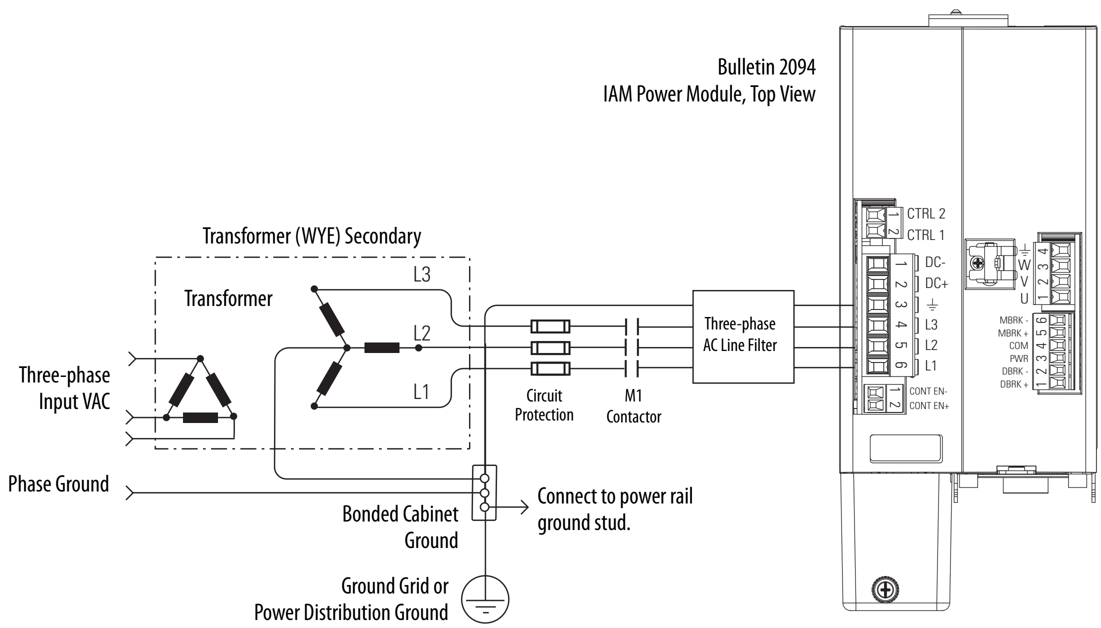
Before wiring input power to your Kinetix 6200 or Kinetix 6500 system, you must determine the type of input power you are connecting to. The IAM power module is designed to operate in both grounded and ungrounded environments.

ATTENTION: When you are using a LIM module for input power, the VAC LINE input power must come from a grounded configuration. When you are not using a LIM module for input power, ungrounded, corner-grounded, and impedance-grounded power configurations are permitted, but you must set the ground jumper to the ungrounded position for proper drive operation. In addition, set the ground jumper when an active converter supplies the DC-bus voltage. Refer to Set the Ground Jumper in Select Power Configurations on page 97 for more 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 47 - Grounded Power Configuration (WYE Secondary)



The IAM power module has a factory-installed ground jumper for grounded power distribution.

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

Refer to Power Wiring Examples beginning on page 233 for input power interconnect diagrams with and without the LIM module.

Figure 48 - Corner-grounded Power Configuration (Delta Secondary)

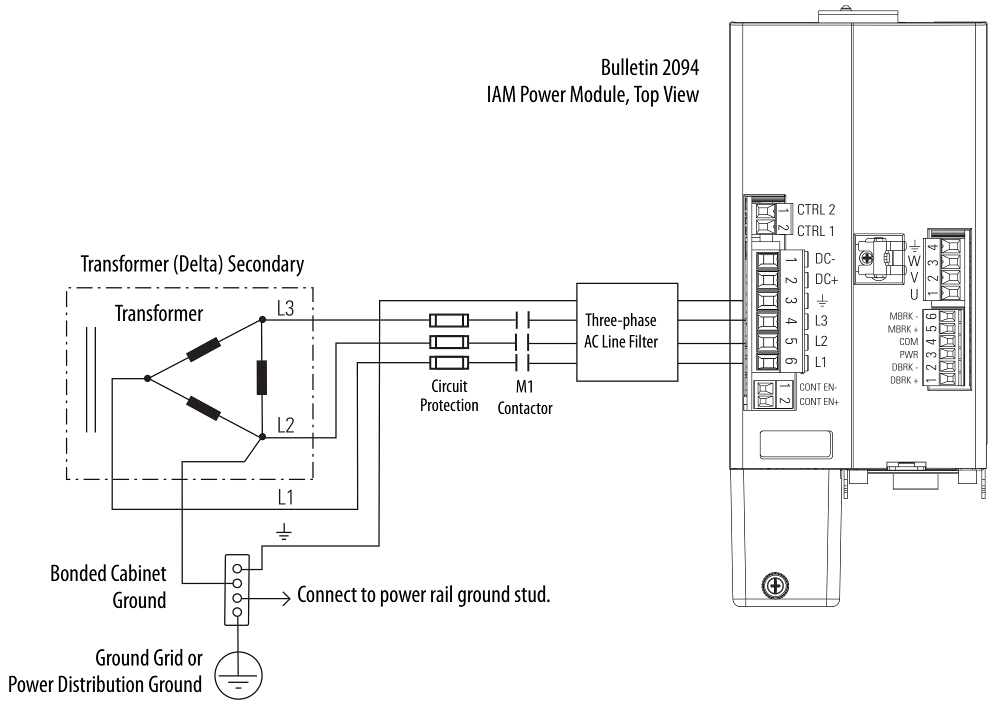
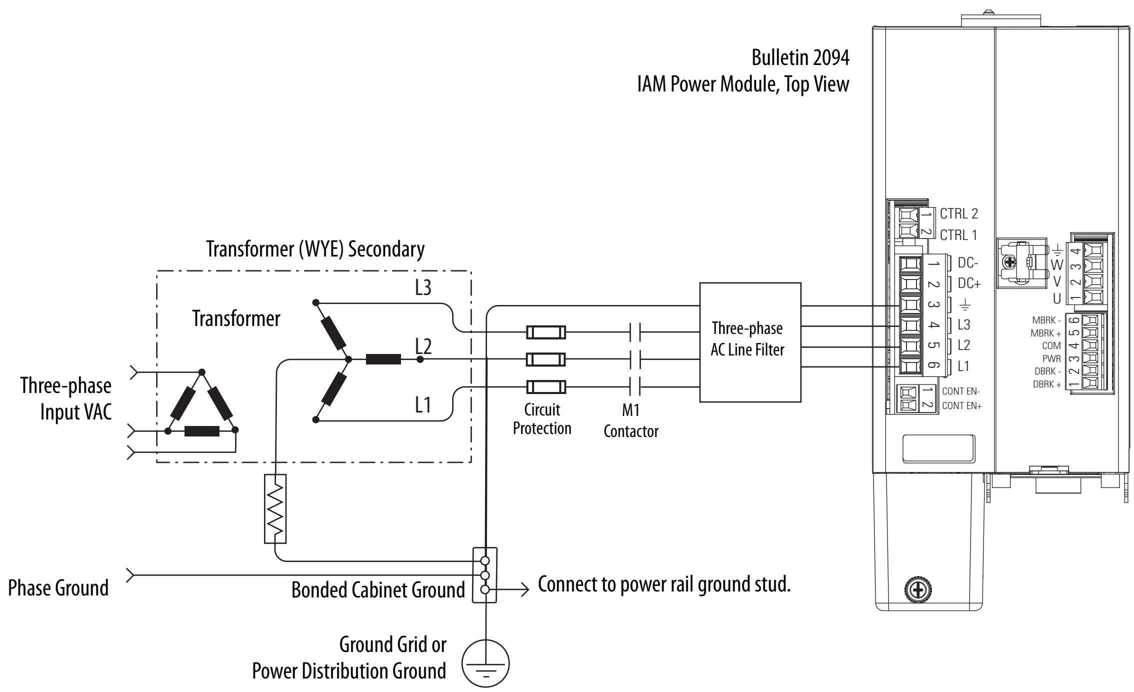


Figure 49 - Impedance-grounded Power Configuration (WYE Secondary)



IMPORTANT	Even though impedance-grounded and corner-grounded power configurations have a ground connection, treat them as ungrounded when installing Kinetix 6000 drive systems.

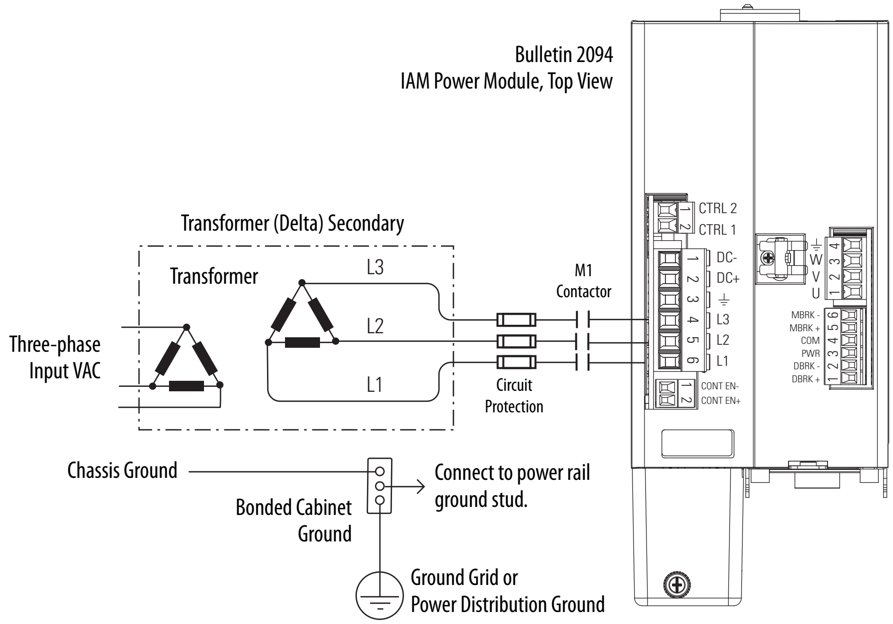
Refer to Appendix A on page 231, for input-power interconnect diagrams with and without the LIM module.

Ungrounded Power Configurations

The ungrounded power configuration (Figure 50) does not provide a neutral ground point. Ungrounded, impedance-grounded, and corner-grounded power configurations are allowed, but you must move a jumper (internal to the IAM power module) across a 120 kΩ resistor. The IAM power module ground jumper (default configuration) is set for grounded power distribution.

IMPORTANT	If you determine that you have ungrounded, impedance-grounded, or corner-grounded power distribution in your facility, you must move the ground jumper (configured for grounded power) to the ungrounded power position inside the IAM power module. Refer to Set the Ground Jumper in Select Power Configurations on page 97 for more information.

Figure 50 - Ungrounded Power Configuration



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

Refer to Appendix A on page 231, for input-power interconnect diagrams with and without the LIM module.

DC Common Bus Configurations

When the IAM power module is used in a DC common-bus configuration, the IAM module is known as a leader IAM or follower IAM module. The IAM (non-common bus) and leader IAM module have identical three-phase input power connections. The leader IAM module is responsible for discharging the DC bus, and for providing common-bus follower drives with DC bus pre-charge, bus regulation, phase-loss detection, and ground fault detection. Follower IAM modules do not have three-phase input power connections, but have DC bus connections from a leader IAM module.

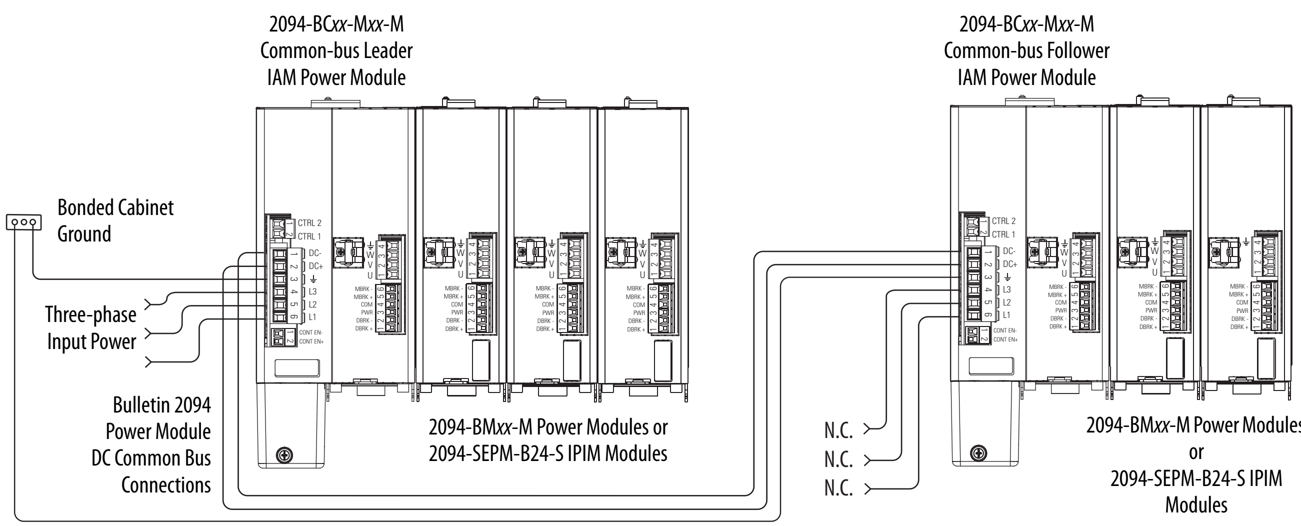
Table 51 - IAM Module Terminology and Use

This Module	Is Wired	And is
IAM	With three-phase input power.	Not wired in Common-bus mode.
Leader IAM	With three-phase input power, but has DC common-bus connections to a follower IAM module.	Wired in Common-bus mode.
Follower IAM	Without three-phase input power, but has DC common-bus connections from a leader IAM module.	Wired in Common-bus mode and configured by using the Logix Designer application.

The Bulletin 2094 leader IAM power module can operate with non-Bulletin 2094 follower drives, as can the Bulletin 2094 follower IAM module operate with non-Bulletin 2094 common-bus leader drives. However, non-Bulletin 2094 leader and follower drives must meet the same functional requirements as the Bulletin 2094 leader and follower IAM modules.

IMPORTANT Any non-Bulletin 2094 common-bus leader IAM module that does not provide pre-charge is required to add an additional external pre-charge circuit before connecting to any Bulletin 2094 common-bus follower IAM module.

Figure 51 - Typical DC Common-bus Configuration



Common Bus Fusing Requirements

When using a Bulletin 2094 leader IAM power module, DC-bus fuses are required only when wiring to more than one Bulletin 2094 follower IAM module. When wiring multiple follower IAM modules, terminal blocks are required to extend the DC common-bus power to additional drives. Install fuses in both lines of the DC bus between the DC bus terminal block and each follower IAM module. Base these fuse ratings on the DC input current of each follower IAM module.

When using a non-Bulletin 2094 common-bus leader drive, DC bus fuses are required in both lines of the DC bus, between the common-bus leader drive and follower IAM module. Base these fuse ratings on the common-bus leader drive DC output current. When using more than one follower IAM module, install fuses in both lines of the DC bus between the non-Bulletin 2094 common-bus leader and the terminal block as well as between the DC bus terminal block and each follower IAM module.

Refer to Circuit Breaker/Fuse Options on page 30, for recommended circuit breaker/fuse sizes. Refer to DC Common Bus Wiring Examples on page 237 for interconnect diagrams.

Set the Ground Jumper in Select Power Configurations

Setting the ground jumper is required when using an ungrounded, corner-grounded, and impedance-grounded power configurations. Setting the ground jumper is also required when the Bulletin 8720MC regenerative power supply or any active converter provides DC-bus power.

Setting the jumper involves removing the IAM power module from the power rail, opening the IAM module, and moving the jumper.

IMPORTANT If you have grounded power distribution, you do not need to set the ground jumper. Go to Grounding the Modular Drive System on page 101.

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

Setting the ground jumper is best done when the IAM power module is removed from the power rail and placed face-up on a solid surface equipped as a grounded static-safe workstation.

ATTENTION: This drive contains electrostatic discharge (ESD) sensitive parts and assemblies. You are required to follow static-control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, publication 8000-4.5.2, or any other applicable ESD awareness handbook.

When using ungrounded input power in common-bus configurations, use this table to determine where to set the ground jumper.

Table 52 - Ground Jumper to Set

Leader Drive	Follower Drive	Set the Jumper in This Drive
Kinetix 6200/6500 IAM power module	Kinetix 6200/6500 IAM power module	Leader drive
Kinetix 6200/6500 IAM power module	Non-Kinetix 6200/6500 drive	Leader drive
Non-Kinetix 6200/6500 drive	Kinetix 6200/6500 IAM power module	Follower drive (if no setting exists in the leader drive)

ATTENTION: Risk of equipment damage exists. The facility ground configuration must be accurately determined. Do not move the ground jumper for grounded power configurations (default). Move the ground jumper for ungrounded, corner-grounded, and impedance-grounded power, or when an active converter supplies the DC-bus voltage.

Table 53 - Ground Jumper Configurations

Ground Configuration	Example Diagram	Ground Jumper Configuration	Benefits of Correct Configuration
Grounded (wye)	Figure 47 on page 93	Grounded power (default setting)	• UL and EMC compliance • Reduced electrical noise • Most stable operation • Reduced voltage stress on components and motor bearings
• AC-fed ungrounded • Corner grounded • Impedance grounded	Figure 50 on page 95 Figure 48 on page 94 Figure 49 on page 94	Set for ungrounded power	• Helps avoid severe equipment damage when ground faults occurs • Reduced leakage current
DC-bus from active converter	Figure 99 on page 240		

Set the Ground Jumper

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.

Follow these steps to set the ground jumper for ungrounded power.

1. Remove the IAM power module from the power rail.

   For detailed instructions, refer to Remove Kinetix 6200 and Kinetix 6500 Drive Modules on page 224.

2. Remove the top and bottom front-panel screws.

   Refer to the figure on page 100 for an illustration of your actual hardware.

3. Swing the front panel open to the right, as shown, and locate the ground jumper.

   IMPORTANT Do not attempt to remove the front panel from the IAM module. The front panel status indicators and switches are also connected to the IAM module with a ribbon cable. The ribbon cable acts like a hinge and lets you swing the front panel open to access the ground jumper.

4. Move the ground jumper.

IAM Module	Configuration	
	Grounded (default)	Ungrounded
2094-BC01-MP5-M (460V)	P16 and P17	P18 and P19
2094-BC01-M01-M (460V)		
2094-BC02-M02-M (460V)		
2094-BC04-M03-M (460V)		
2094-BC07-M05-M (460V)		

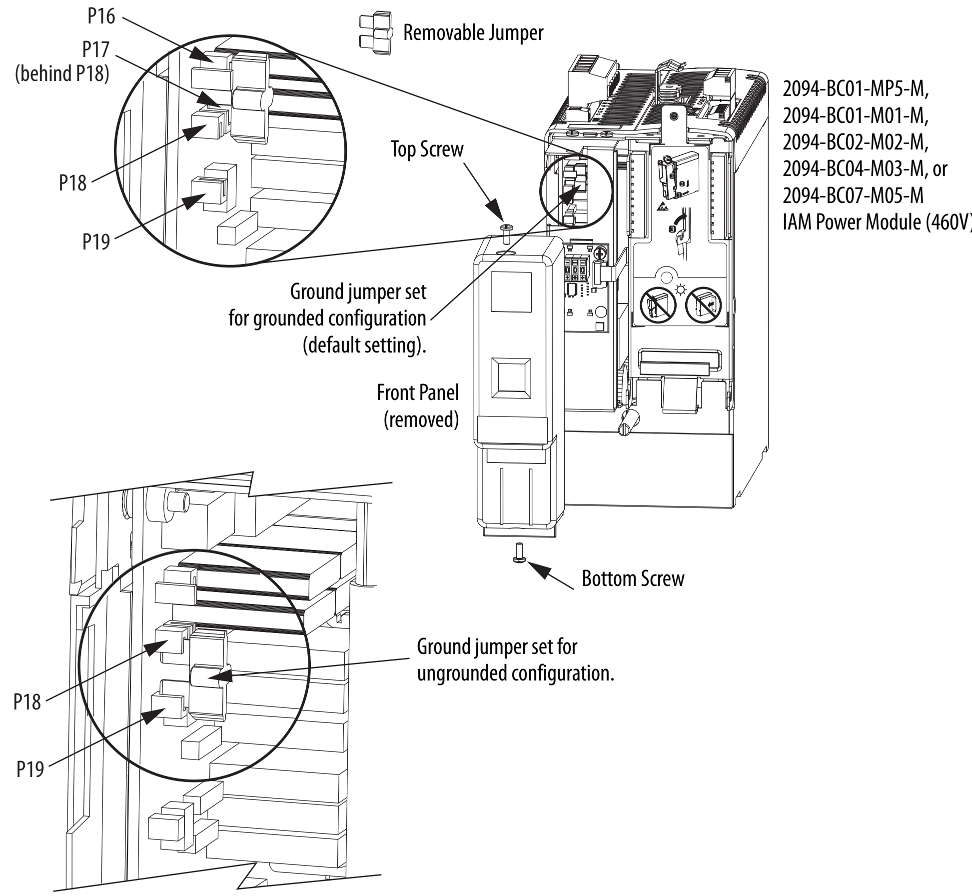
5. Replace the IAM module front panel and two screws.

   Apply 1.6 N•m (14 lb•in) torque.

6. Mount the IAM module back on the power rail.

   For detailed instructions, refer to Replace Kinetix 6200 and Kinetix 6500 Drive Modules on page 227.

Figure 52 - Setting the Ground Jumper (460V IAM power modules)



IMPORTANT	Use the default jumper setting for grounded power configurations. Move the jumper, as shown above, for ungrounded power.

Grounding the Modular Drive System

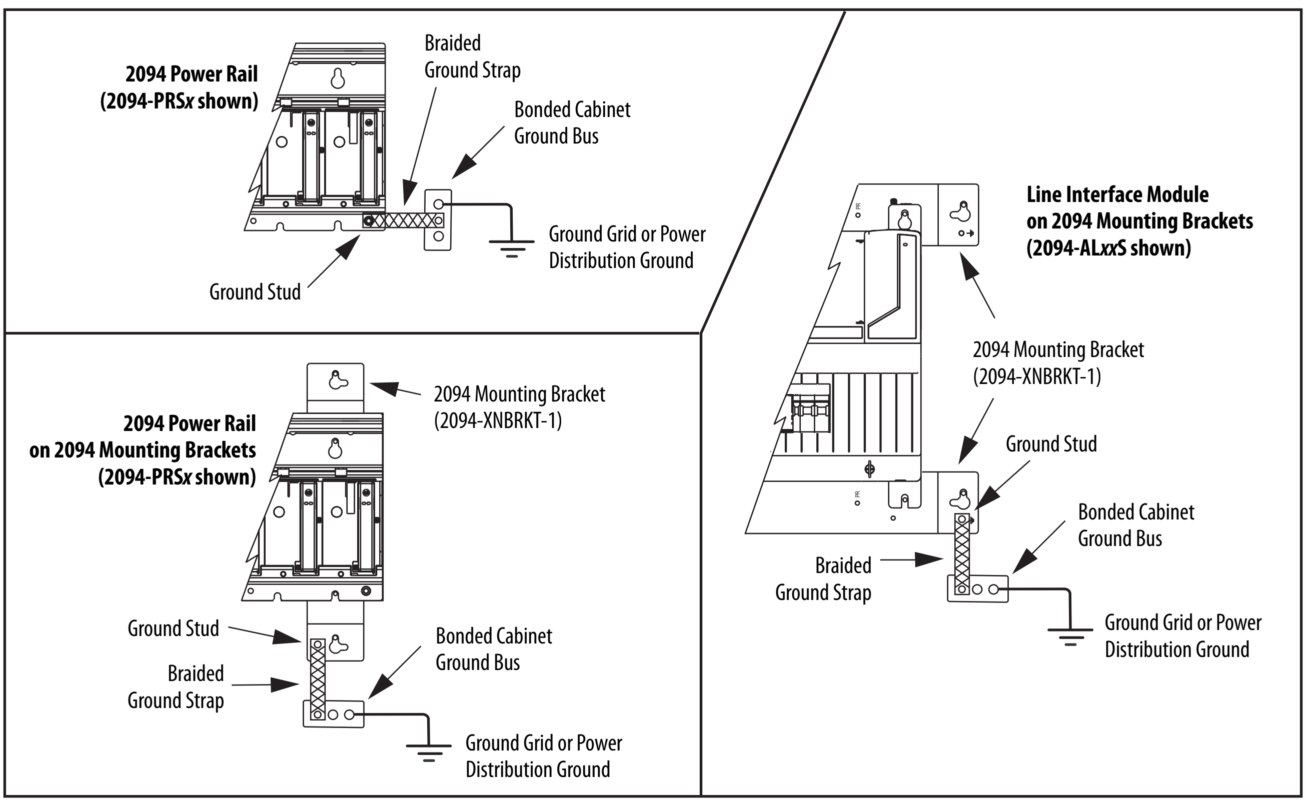
All equipment and components of a machine or process system must have a common earth ground point connected to chassis. A grounded system provides a ground path for short circuit protection. Grounding your modules and panels minimize shock hazard to personnel and damage to equipment caused by short circuits, transient overvoltages, and accidental connection of energized conductors to the equipment chassis.

ATTENTION: The National Electrical Code contains grounding requirements, conventions, and definitions. Follow all applicable local codes and regulations to safely ground your system.
For CE grounding requirements, refer to Agency Compliance on page 25.

Ground the Power Rail to the System Subpanel

The 2094-PR*x* and 2094-PRS*x* power rail ships with a braided ground strap, 100 mm (3.9 in.), that connects to the bonded cabinet ground bus. Connect the other end to either the power rail ground stud or mounting bracket ground stud, if mounting brackets are used.

Figure 53 - Connecting the Braided Ground Strap Examples



For power rail dimensions, refer to the Kinetix 6000 Power Rail Installation Instructions, publication 2094-IN003.

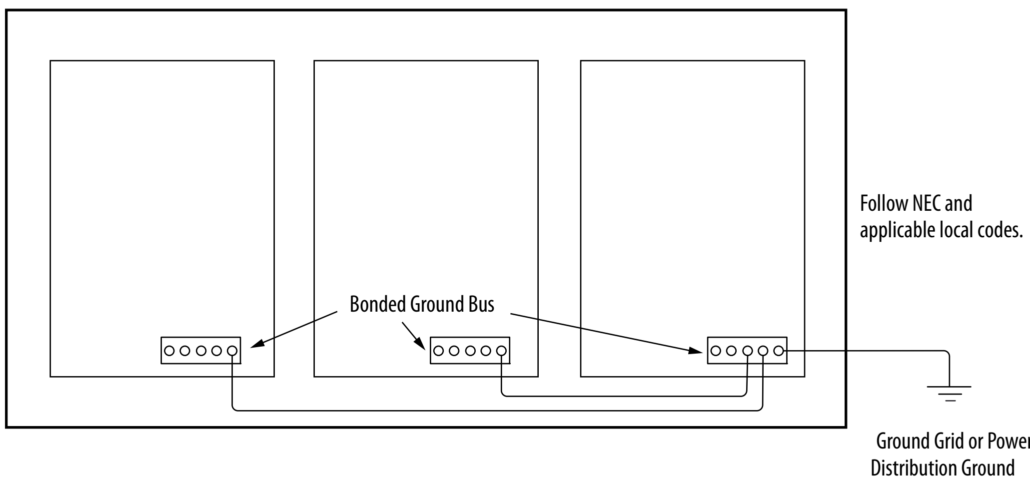
For mounting bracket dimensions, refer to the 2094 Mounting Brackets Installation Instructions, publication 2094-IN008.

IMPORTANT	When 2094 mounting brackets are used to mount the power rail or LIM module over the AC line filter, the braided ground strap must be removed from the power rail and attached to a mounting bracket ground stud.

Ground Multiple Subpanels

In this figure, the chassis ground is extended to multiple subpanels.

Figure 54 - Subpanels Connected to a Single Ground Point



High-frequency (HF) bonding is not illustrated. For HF bonding information, refer to Bonding Multiple Subpanels on page 38.

Power Wiring Requirements

Wire must 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 IPIM module power wiring requirements, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Refer to Power Wiring Examples on page 233 for interconnect diagrams.

IMPORTANT	The National Electrical Code and local electrical codes take precedence over the values and methods provided.

Table 54 - IAM Power Wiring Requirements

<table>
<tr><th rowspan="2">Bulletin 2094 Drive Cat. No.</th><th rowspan="2">Description</th><th colspan="2">Connects to Terminals</th><th rowspan="2">Recommended Wire Size
mm² (AWG)</th><th rowspan="2">Strip Length
mm (in.)</th><th rowspan="2">Torque Value
N•m (lb•in)</th></tr>
<tr><th>Pin</th><th>Signal</th></tr>
<tr><td>2094-BC01-Mxx-M
2094-BC02-M02-M</td><td rowspan="3">DC bus (1)
and
VAC input power</td><td rowspan="3">IPD-1
IPD-2
IPD-3
IPD-4
IPD-5
IPD-6</td><td rowspan="3">DC-
DC+
⏚
L3
L2
L1</td><td>10…2.5
(8…14)</td><td>10
(0.38)</td><td>1.2…1.5
(10.6…13.2)</td></tr>
<tr><td>2094-BC04-M03-M</td><td>10…6
(8…10)</td><td rowspan="2">16
(0.63)</td><td rowspan="2">2.4…3.0
(21.6…26.5)</td></tr>
<tr><td>2094-BC07-M05-M</td><td>30 (3)</td></tr>
<tr><td rowspan="4">2094-BCxx-Mxx-M</td><td rowspan="2">Control input power</td><td>CPD-1</td><td>CTRL 2</td><td rowspan="2">4…2.5
(12…14)</td><td rowspan="4">10
(0.38)</td><td rowspan="2">0.5…0.6
(4.4…5.3)</td></tr>
<tr><td>CPD-2</td><td>CTRL 1</td></tr>
<tr><td rowspan="2">Contactor Enable</td><td>CED-1</td><td>CONT EN-</td><td rowspan="2">4…2.5
(12…14) (2)</td><td rowspan="2">0.5…0.6
(4.4…5.3)</td></tr>
<tr><td>CED-2</td><td>CONT EN+</td></tr>
</table>

(1) DC common-bus connections (leader IAM to follower IAM module) should be kept as short as possible.

(2) The actual gauge of the contactor enable wiring depends on the system configuration. Consult your machine builder, the NEC, and applicable local codes.

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.

ATTENTION: 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.

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

Table 55 - IAM/AM Power Wiring Requirements

Bulletin 2094 Drive Cat. No.	Description	Connects to Terminals		Recommended Wire Size mm² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
		Pin	Signal			
2094-BC01-M*xx*-M, 2094-BC02-M02-M, 2094-BMP5-M, 2094-BM01-M, 2094-BM02-M	Motor power	MP-4 MP-3 MP-2 MP-1	⏚ W V U	Motor power cable depends on motor/drive combination. 6…1.5 (10…16)	10 (0.38)	0.5…0.6 (4.4…5.3)
2094-BC04-M03-M, 2094-BM03-M				10…1.5 (8…16)	10 (0.38)	1.2…1.5 (10.6…13.2)
2094-BC07-M05-M, 2094-BM05-M				30…2.5 (3…14)	16 (0.63)	2.4…3.0 (21.6…26.5)
IAM or AM (230 or 460V) 2094-BC*xx*-M*xx*-M and 2094-BM*xx*-M	Brake power	BC-6 BC-5 BC-4 BC-3 BC-2 BC-1	MBRK- MBRK+ COM PWR DBRK- DBRK+	0.75 (18)	10 (0.38)	0.22…0.25 (1.9…2.2)

Table 56 - Shunt Module Power Wiring Requirements

Drive Module Cat. No.	Description	Connects to Terminals		Recommended Wire Size mm² (AWG)	Torque Value N•m (lb•in)
		Pin	Signal		
2094-BSP2 Shunt module (200/400V-class)	1394-SR*xxxx* External passive shunt module	RC-1	DC+	10 (8) (1)	1.2…1.5 (10.6…13.2)
		RC-2	INT		
		RC-3	COL		
	Thermal switch	TS-1	TS1	0.75 (18)	0.22…0.25 (1.9…2.2)
		TS-2	TS2		

(1) 105 °C (221 °F), 600V.

Power Wiring Guidelines

Use these guidelines as a reference when wiring the power connectors on your IAM and AM power modules.

For IPIM module power wiring guidelines, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

IMPORTANT	For connector locations of the Kinetix 6200 and Kinetix 6500 drive modules, refer to 2094 Power Module and Control Module Features on page 62. When tightening screws to secure the wires, refer to the tables beginning on page 103 for torque values. When removing insulation from wires, refer to the tables beginning on page 103 for strip lengths.

IMPORTANT	To improve system performance, run wires and cables in the wireways as established in Establishing Noise Zones on page 39.

Follow these steps when wiring the connectors on your IAM and AM power modules.

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

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

2. Route the cable/wires to your IAM and AM power modules.
3. Insert wires into connector plugs.

   Refer to connector pinout tables in Chapter 4 or the interconnect diagrams in Appendix A.
4. Tighten the connector screws.
5. Gently pull on each wire to make sure it does not come out of its terminal; reinsert and tighten any loose wires.
6. Insert the connector plug into the module connector.

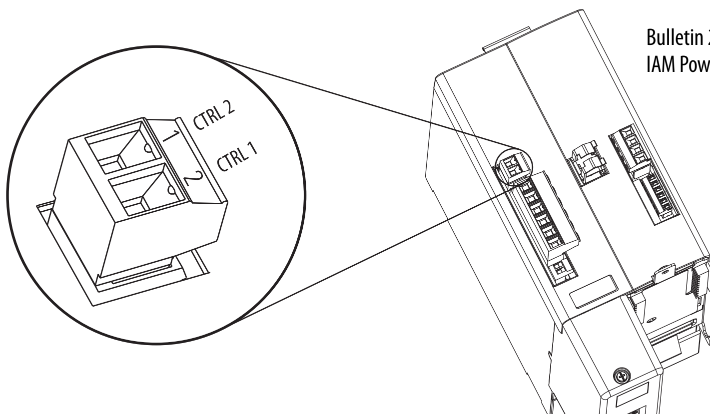
Wiring the IAM/AM Module Connectors

This section provides examples and wiring tables to assist you in making connections to the IAM and AM power modules.

Wire the Control Power (CPD) Connector

This example applies to any IAM, leader IAM, or follower IAM power module.

Figure 55 - IAM Power Module (CPD connector)



IMPORTANT The 2094-BL75S and 2094-XL75S-C2 LIM modules can supply input power for up to eight axes. The 2094-XL75S-C1 LIM module can supply up to sixteen axes.

The IPIM module control power load must be calculated for Kinetix 6000M systems and the LIM module control power input must have a sufficient current rating. If no LIM module can support the current requirement, then discrete components must be used.

The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Refer to Control Power on page 78 for more information and IAM Module (without LIM module) on page 236 for the interconnect drawing.

Table 57 - Control Power (CPD) Connector

CPL Connector (LIM module(1)) or Other Single-phase Input				CPD Connector (IAM module)		Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-AL*xx*S, 2094-BL*xx*S or 2094-XL75S-C*x* LIM Module		2094-AL09 and 2094-BL02 LIM Module						
CPL Pin	**Signal**	**CPL Pin**	**Signal**	**CPD Pin**	**Signal**			
1	CTRL 1	2	L1	1	CTRL 2	2.5 (14)	10 (0.38)	0.5…0.6 (4.4…5.3)
2	CTRL 2	1	L2/N	2	CTRL 1			

(1) The Bulletin 2094 power modules are compatible with only the 2094-BL02, 2094-BL*xx*S, and 2094-XL75-C*x* (460V) LIM modules.

Wire the Input Power (IPD) Connector

This example applies to any IAM module or common-bus leader IAM power module.

ATTENTION: Make sure the input power connections are correct when wiring the IPD connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

Figure 56 - IAM Power Module (IPD connector)

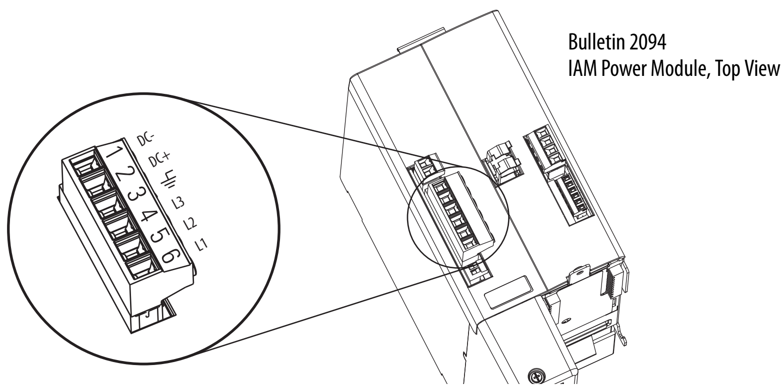


Table 58 - Input Power (IPD) Connections

OPL Connector (LIM module(1)) or Other Three-phase Input				IPD Connector (IAM or leader IAM module)	
2094-AL09 LIM Module		2094-AL*xx*S, 2094-BL*xx*S or 2094-XL75S-C*x* LIM Modules			
OPL Pin	**Signal**	**OPL Pin**	**Signal**	**IPD Pin**	**Signal**
1	L1′	4	L1′	6	L1
2	L2′	3	L2′	5	L2
3	L3′	2	L3′	4	L3
4	⏚	1	⏚	3	⏚
N/A				2	DC+
				1	DC-

(1) The Bulletin 2094 power modules are compatible with only the 2094-BL02, 2094-BL*xx*S, and 2094-XL75-C*x* (460V) LIM modules.

Table 59 - Termination Specifications

IAM Module Cat. No.	Input VAC	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-BC01-M*xx*-M 2094-BC02-M02-M	460V AC	2.5 (14)	10 (0.38)	1.2…1.5 (10.6…13.2)
2094-BC04-M03-M		6 (10)	16 (0.63)	2.4…3.0 (21.6…26.5)
2094-BC07-M05-M		30 (3)		

This example applies to a common-bus follower IAM power module.

ATTENTION: Make sure the common-bus power connections are correct when wiring the IPD connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

Figure 57 - IAM Power Module (IPD connector)

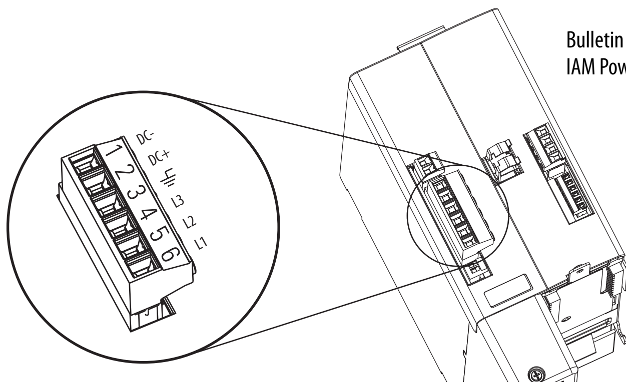


Table 60 - Input Power (IPD) Connections

IPD Connector (IAM or follower IAM module)	
IPD Pin	**Signal**
6	N.C.
5	N.C.
4	N.C.
3	⏚
2	DC+
1	DC-

IMPORTANT Do not connect three-phase input power to the common-bus follower IAM module.

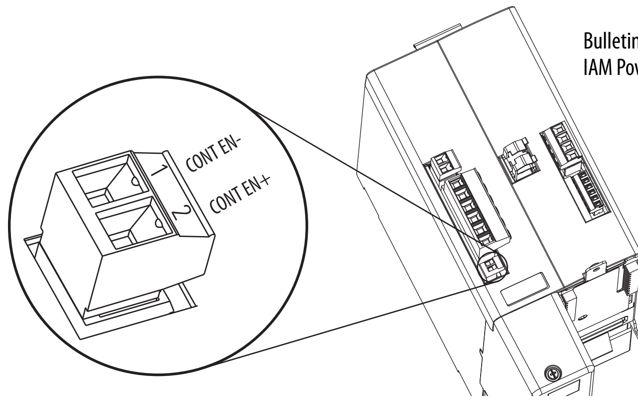
Table 61 - Termination Specifications

IAM Module Cat. No.	Input VAC	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-BC01-M*xx*-M 2094-BC02-M02-M	460V AC	2.5 (14)	10 (0.38)	1.2…1.5 (10.6…13.2)
2094-BC04-M03-M		6 (10)	16 (0.63)	2.4…3.0 (21.6…26.5)
2094-BC07-M05-M		30 (3)		

Wire the Contactor Enable (CED) Connector

This example applies to any IAM, common-bus leader IAM, or common-bus follower IAM power module.

Figure 58 - IAM Power Module (CED connector)



ATTENTION: Wiring the contactor enable relay is required. To avoid personal injury or damage to the drive, wire the contactor enable relay into your control string. Refer to Contactor Enable Relay on page 72.
In common-bus configurations, the contactor enable (CED) connections for leader and follower drives must be wired in series to the control string.
For interconnect diagrams, refer to Interconnect Diagram Notes beginning on page 232.

Table 62 - Contactor Enable (CED) Connector

LIM Module [1] I/O (IOL) Connector or Other Control String		CED Pin	Signal	Recommended Wire Size mm² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-AL*xx*S, 2094-BL*xx*S or 2094-XL75S-C*x* LIM Module	**2094-AL09 and 2094-BL02 LIM Module**					
IO_COM1	IO_COM	1	CONT EN-	2.5 (14) [2]	10 (0.38)	0.5…0.6 (4.4…5.3)
COIL_E2	COIL_A2	2	CONT EN+			

(1) The Bulletin 2094 power modules are compatible with only the 2094-BL02, 2094-BL*xx*S, and 2094-XL75-C*x* (460V) LIM modules.
(2) The actual gauge of the contactor enable wiring depends on the system configuration. Consult your machine builder, the NEC, and applicable local codes.

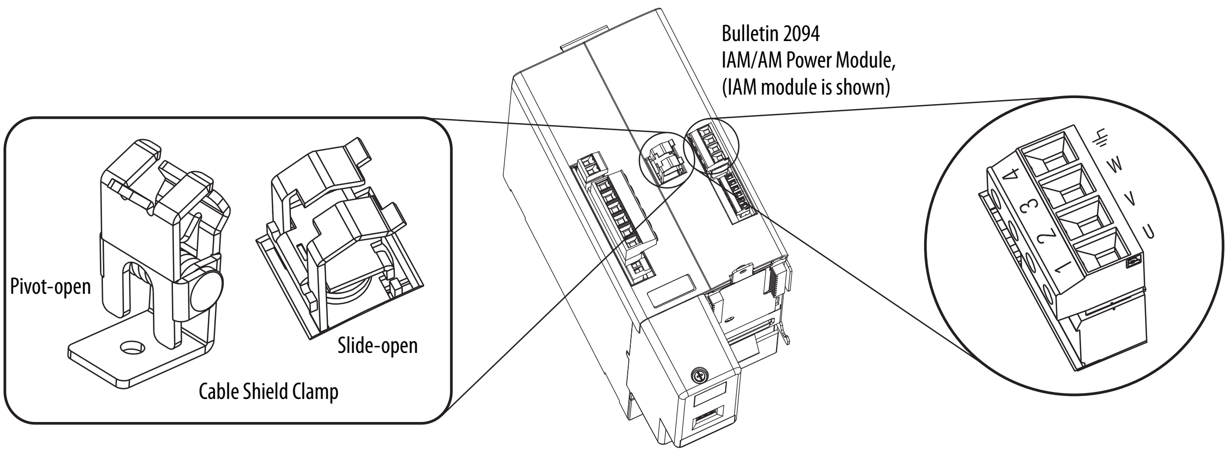
Wire the Motor Power (MP) Connector

Connections to the motor power (MP) connector include rotary motors, linear motors, and motor driven actuators.

ATTENTION: Make sure the motor power connections are correct when wiring the MP connector plug and that the plug is fully engaged in the module connector. Incorrect wiring/polarity or loose wiring can cause explosion or damage to equipment.

This example applies to AM modules and the inverter section of IAM power modules.

Figure 59 - IAM/AM Power Module (MP connector)



Cable Shield Terminations

Factory-supplied Bulletin 2090 motor power cables for motors and acutators are shielded, and the braided cable shield must terminate at the drive during installation. A small portion of the cable jacket must be removed to expose the shield braid. The exposed area must be clamped (with the clamp provided) on top of the IAM or AM modules and the power wires terminated in the motor power (MP) connector plug.

SHOCK HAZARD: To avoid hazard of electrical shock, make sure shielded power cables are grounded at a minimum of one point for safety.

MP-Series Motor and Actuator Connectors

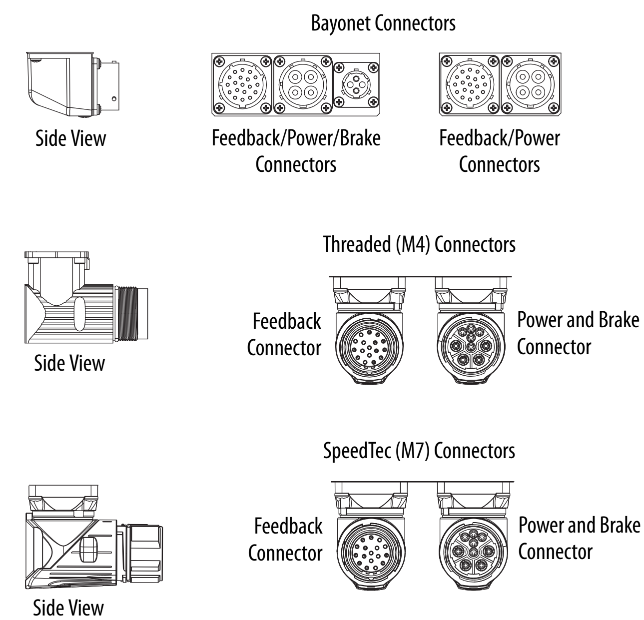
Bulletin MPL motors equipped with circular DIN connectors (specified by 4 or 7 in the catalog number) are not compatible with cables designed for motors equipped with bayonet connectors (specified by 2 in the catalog number). The motors with bayonet connectors are being discontinued.

Table 63 - MP-Series (Bulletin MPL) Motor Catalog Numbers

Motor Cat. No. /SpeedTec DIN Connectors	Motor Cat. No. /Threaded DIN Connectors	Motor Cat. No. /Bayonet Connectors
MPL-B15*xxx-xx*7*x*AA MPL-B2*xxx-xx*7*x*AA	MPL-B15*xxx-xx*4*x*AA MPL-B2*xxx-xx*4*x*AA	N/A
MPL-B3*xxx-xx*7*x*AA, MPL-B4*xxx-xx*7*x*AA, MPL-B45*xxx-xx*7*x*AA, MPL-B5*xxx-xx*7*x*AA	N/A	MPL-B3*xxx-xx*2*x*AA, MPL-B4*xxx-xx*2*x*AA, MPL-B45*xxx-xx*2*x*AA, MPL-B5*xxx-xx*2*x*AA
MPL-B6*xxx-xx*7*x*AA, MPL-B8*xxx-xx*7*x*AA, MPL-B9*xxx-xx*7*x*AA	N/A	MPL-B6*xxx-xx*2*x*AA, MPL-B8*xxx-xx*2*x*AA, MPL-B9*xxx-xx*2*x*AA

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 60 - Bayonet and Circular DIN Motor Connectors



MP-Series™ (Bulletin MPAR and MPAS) linear actuators and MP-Series (Bulletin MPS) stainless-steel motors have also transitioned from threaded (M4) to SpeedTec (M7) connectors.

Motor Power Wiring Examples

The procedure for wiring motor power varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series Motor and Actuator Connectors on page 111 for more information on circular DIN and bayonet connectors.

Table 64 - Motor Power Cable Compatibility - Bayonet Connectors

Motor/Actuator	Connector Type	Motor/Actuator Cat. No.	Motor Power Cables (with brake wires)	Motor Power Cables (without brake wires)
MP-Series (Bulletin MPL)	Bayonet	MPL-B3*xxx*-*xx*2*x*AA, MPL-B4*xxx*-*xx*2*x*AA, MPL-B45*xxx*-*xx*2*x*AA, MPL-B5*xxx*-*xx*2*x*AA, MPL-B6*xxx*-*xx*2*x*AA, MPL-B8*xxx*-*xx*2*x*AA, MPL-B960B-*xx*2*x*AA, MPL-B960C-*xx*2*x*AA, MPL-B980B-*xx*2*x*AA, and MPL-B980C-*xx*2*x*AA	N/A	2090-XX*x*PMP-*xx*S*xx* (1)
		MPL-B960D-*xx*2*x*AA, MPL-B980D-*xx*2*x*AA		2090-MCNPMP-6S*xx*
1326AB (M2L/S2L)		1326AB-B*xxxx*-M2L/S2L		2090-XX*x*PMP-*xx*S*xx* (1)

(1) For Bulletin MPL or 1326AB motors equipped with bayonet connectors. These cables are available as standard (catalog number 2090-XXNPMP-*xx*S*xx*) and continuous-flex (catalog number 2090-XXTPMP-*xx*S*xx*).

Table 65 - Motor Power Cable Compatibility - Threaded DIN Connectors

Motor/Actuator	Connector Type	Motor/Actuator Cat. No.	Motor Power Cables (with brake wires)	Motor Power Cables (without brake wires)
MP-Series (Bulletin MPL)	Circular (threaded) DIN	MPL-B15*xxx*-*xx*4*x*AA, MPL-B2*xxx*-*xx*4*x*AA	2090-XXNPMF-*xx*S*xx* (standard) or 2090-CPBM4DF-*xx*AF*xx* (continuous-flex)	2090-CPWM4DF-*xx*AF*xx* (continuous-flex)
MP-Series (Bulletin MPS)		MPS-B*xxxx*		
MP-Series (Bulletin MPAS)		MPAS-B*xxxx*		
MP-Series (Bulletin MPAR)		MPAR-B1*xxx* and MPAR-B2*xxx* (series A)		

Table 66 - Motor Power Cable Compatibility - SpeedTec DIN Connectors

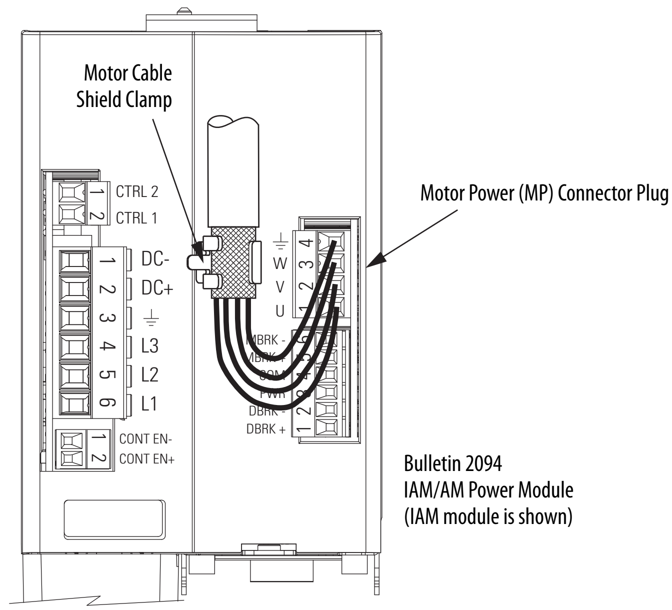
Motor/Actuator	Connector Type	Motor/Actuator Cat. No.	Motor Power Cables (1) (with brake wires)	Motor Power Cables (1) (without brake wires)
MP-Series (Bulletin MPL)	Circular (SpeedTec) DIN	MPL-B15*xxx*-*xx*7*x*AA, MPL-B2*xxx*-*xx*7*x*AA, MPL-B3*xxx*-*xx*7*x*AA, MPL-B4*xxx*-*xx*7*x*AA, MPL-B45*xxx*-*xx*7*x*AA, MPL-B5*xxx*-*xx*7*x*AA, MPL-B6*xxx*-*xx*7*x*AA, MPL-B8*xxx*-*xx*7*x*AA MPL-B9*xxx*-*xx*7*x*AA	2090-CPBM7DF-*xx*AA*xx* (standard) or 2090-CPBM7DF-*xx*AF*xx* (continuous-flex)	2090-CPWM7DF-*xx*AA*xx* (standard) or 2090-CPWM7DF-*xx*AF*xx* (continuous-flex)
MP-Series (Bulletin MPM)		MPM-B*xxxx*		
MP-Series (Bulletin MPF)		MPF-B*xxxx*		
MP-Series (Bulletin MPS)		MPS-B*xxxx*		
RDD-Series™		RDD-B*xxxx*		
LDC-Series™		LDC-C*xxxx*		
MP-Series (Bulletin MPAS)		MPAS-B*xxxx*		
MP-Series (Bulletin MPAI)		MPAI-B*xxxx*		
MP-Series (Bulletin MPAR)		MPAR-B3*xxx*, MPAR-B1*xxx* and MPAR-B2*xxx* (series B)		

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

These cables contain only the three-phase power wires. The motors/actuators either have no brake or a separate connector for brake connections. Thermal switch wires are included in the feedback cable.

Refer to Axis Module/Rotary Motor Wiring Examples beginning on page 242 for interconnect diagrams.

Figure 61 - Motor Power Terminations (cables without brake wires)

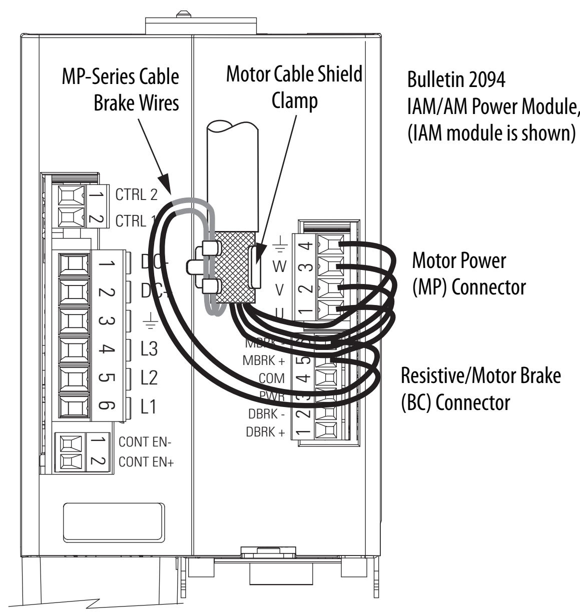


The cable shield clamp shown above is mounted to an IAM module. Cables attach to the clamp on each AM module in the same way.

These cables contain three-phase power wires and brake wires. The brake wires have a shield braid (shown below as gray) that folds back under the cable clamp before the conductors are attached to the motor brake (BC) connector. Thermal switch wires are included in the feedback cable.

Refer to Axis Module/Rotary Motor Wiring Examples beginning on page 242 for interconnect diagrams.

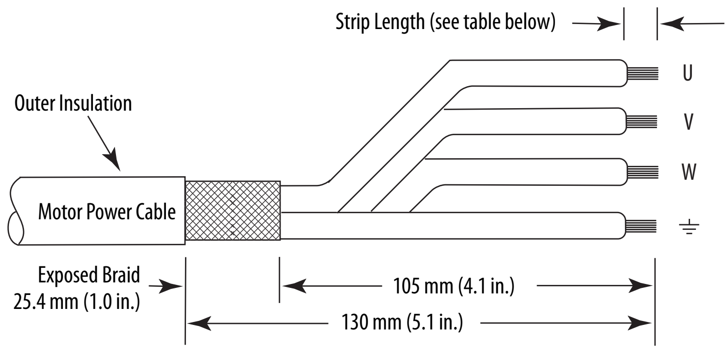
Figure 62 - Motor Power Terminations (cables with brake wires)



The cable shield clamp shown above is mounted to an IAM module. Cables attach to the clamp on each AM module in the same way.

Cable shield and lead preparation is provided with most Allen-Bradley® cable assemblies. Follow these guidelines if your motor power cable shield and wires require preparation.

Figure 63 - Cable Shield and Lead Preparation



Refer to Axis Module/Rotary Motor Wiring Examples beginning on page 242 for interconnect diagrams.

Table 67 - Motor Power (MP) Connector

Servo Motor	MP Connector (IAM/AM module)	
MP-Series, LDC-Series, and 1326AB (M2L/S2L)	**MP Pin**	**Signal**
U / Brown	1	U
V / Black	2	V
W / Blue	3	W
⏚ Green/Yellow	4	⏚

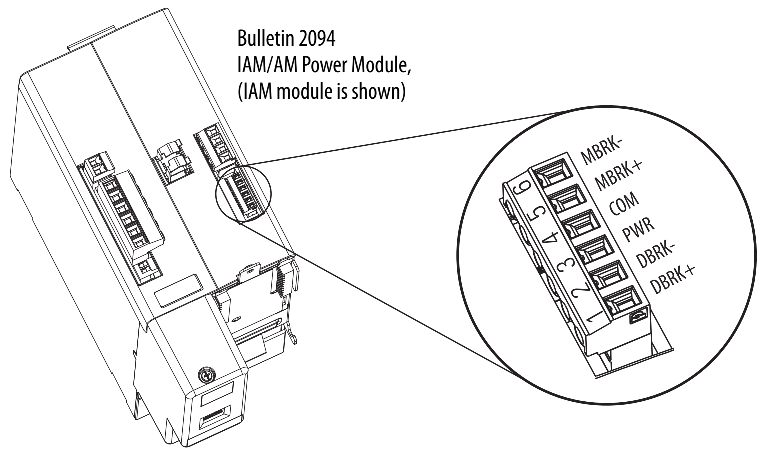
Table 68 - Termination Specifications

IAM/AM Module Cat. No.	Recommended Wire Size mm² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2094-BC01-M*xx*-M, 2094-BMP5-M, 2094-BM01-M 2094-BC02-M02-M, 2094-BM02-M	Motor power cable depends on motor/drive combination. 6 (10) max	10 (0.38)	0.5…0.6 (4.4…5.3)
2094-BC04-M03-M, 2094-BM03-M	10 (8) max	10 (0.38)	1.2…1.5 (10.6…13.2)
2094-BC07-M05-M, 2094-BM05-M	30 (3) max	16 (0.63)	2.4…3.0 (21.6…26.5)

Wire the Motor/Resistive Brake (BC) Connector

This example applies to AM modules and the inverter section of IAM power modules.

Figure 64 - IAM/AM Power Module (BC connector)



24V DC Brake Input Power Connections

IMPORTANT	If your system includes a LIM module, you can source the 24V DC from the LIM module (P1L or PSL connector).

Table 69 - Motor/Resistive Brake (BC) Connector

2094-BL*xx*S or 2094-XL75S-C*x* LIM Module		2094-BL02 LIM Module		BC Connector (IAM/AM modules)	
P1L Pin	**Signal**	**PSL Pin**	**Signal**	**BC Pin**	**Signal**
1	IO_PWR2	1	MBRK PWR	3	PWR
2	IO_COM2	2	MBRK COM	4	COM

RBM Module Connections

Table 70 - Motor/Resistive Brake (BC) Connector

RBM Module I/O Connections		BC Connector (IAM/AM power modules)	
TB3 Pin	**Signal**	**MP Pin**	**Signal (1)**
6	COIL_A1	1	DBRK+
7	COIL_A2	2	DBRK-

(1) Firmware revision 1.071 or later is required to use the DBRK outputs on the Kinetix 6200 and Kinetix 6500 IAM/AM power module.

Motor Brake Connections

The procedure for wiring your motor brake varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series Motor and Actuator Connectors on page 111 for more information on circular DIN and bayonet connectors.

Table 71 - Motor Brake Cable Compatibility - Bayonet Connectors

Motor Series	Connector Type	Brake Wires	Cable Cat. No.
MPL-B3*xxx-xx*2*x*AA, MPL-B4*xxx-xx*2*x*AA, MPL-B45*xxx-xx*2*x*AA, MPL-B5*xxx-xx*2*x*AA, MPL-B6*xxx-xx*2*x*AA, MPL-B8*xxx-xx*2*x*AA, MPL-B9*xxx-xx*2*x*AA	Bayonet	The motor has a brake connector. Brake wires are in the brake cable.	2090-UX*x*BMP-18S*xx* brake cable [1]
1326AB (M2L/S2L)			

(1) For Bulletin MPL and 1326AB motors equipped with bayonet connectors. These cables are available as standard (catalog number 2090-UXNBMP-18S*xx*) and continuous-flex (catalog number 2090-UXTBMP-18S*xx*).

Table 72 - Motor Brake Cable Compatibility - Threaded DIN and Circular Plastic Connectors

Motor Series	Connector Type	Brake Wires	Cable Cat. No.
MPL-B15*xxx-xx*4*x*AA, MPL-B2*xxx-xx*4*x*AA	Circular (threaded) DIN	The motor/actuator does not have a brake connector. Brake wires are included in the power cable.	2090-XXNPMF-*xx*S*xx* (standard) or 2090-CPBM4DF-*xx*AF*xx* (continuous-flex)
MPS-B*xxx*, MPAS-B*xxx*, MPMA-B*xxx,* MPAR-B1*xxx,* MPAR-B2*xxx* (series A)			

Table 73 - Motor Brake Cable Compatibility - SpeedTec DIN Connectors

Motor Series	Connector Type	Brake Wires	Cable Cat. No. [1]
MPL-B15*xxx-xx*7*x*AA, MPL-B2*xxx-xx*7*x*AA	Circular (SpeedTec) DIN	The motor/actuator does not have a brake connector. Brake wires are included in the power cable.	2090-CPBM7DF-*xx*AA*xx* (standard) or 2090-CPBM7DF-*xx*AF*xx* (continuous-flex)
MPL-B3*xxx-xx*7*x*AA, MPL-B4*xxx-xx*7*x*AA, MPL-B45*xxx-xx*7*x*AA, MPL-B5*xxx-xx*7*x*AA, MPL-B6*xxx-xx*7*x*AA, MPL-B8*xxx-xx*7*x*AA MPL-B9*xxx-xx*7*x*AA			
MPM-B*xxx*, MPF-B*xxx,* MPS-B*xxx*			
MPAS-B*xxx*, MPAR-B1*xxx,* MPAR-B2*xxx* (series B), MPAR-B3*xxx,* MPAI-B*xxx*			

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

IMPORTANT	Use surge suppression when controlling a brake coil. Refer to Controlling a Brake Example on page 253.

Figure 65 - Brake Cable Preparation

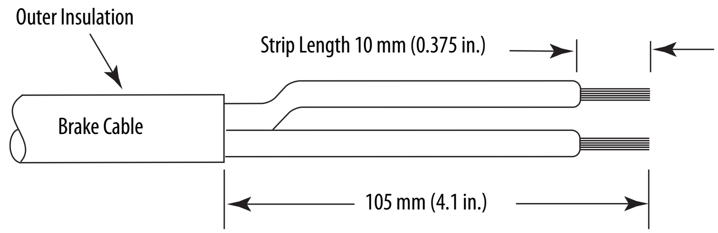


Table 74 - Motor/Resistive Brake (BC) Connector

Motor Brake Wires			BC Connector (IAM/AM module)	
2090-UX*x*BMP-18S*xx* Brake Cable	**2090-XXNPMF-*xx*S*xx* 2090-CPBM*x*DF-*xx*A*xxx* Power Cable**	**2090-CPBM6DF-16AA*xx* Power Cable**	**BC Pin**	**Signal**
BR+	BR+/MBRK+	MBRK+	5	MBRK+
BR-	BR-/MBRK-	MBRK-	6	MBRK-

Table 75 - Termination Specifications

BC Connector (IAM/AM module)		Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
BC Pin	**Signal**			
BC-6 BC-5 BC-4 BC-3 BC-2 BC-1	MBRK- MBRK+ COM PWR DBRK- DBRK+	0.75 (18)	10 (0.38)	0.22…0.25 (1.9…2.2)

Apply the Motor Cable Shield Clamp

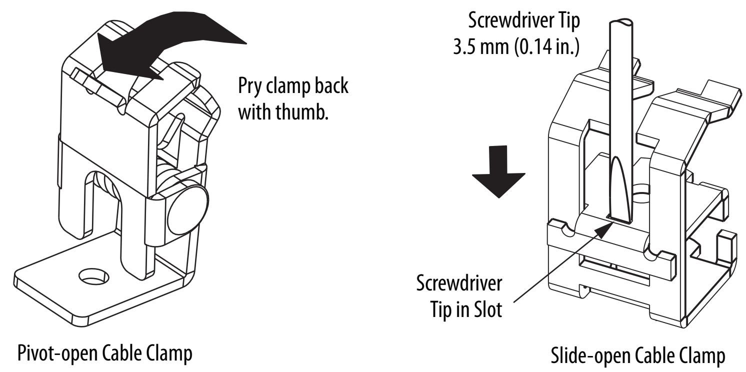
This procedure assumes you have completed wiring your motor power (MP) connector and are ready to apply the cable shield clamp.

TIP Your drive can be equipped with either the pivot-open or slide-open cable clamp.

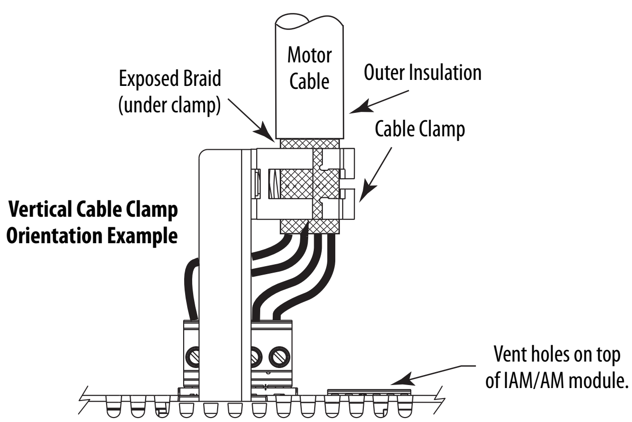
Follow these steps to apply the motor cable shield clamp.

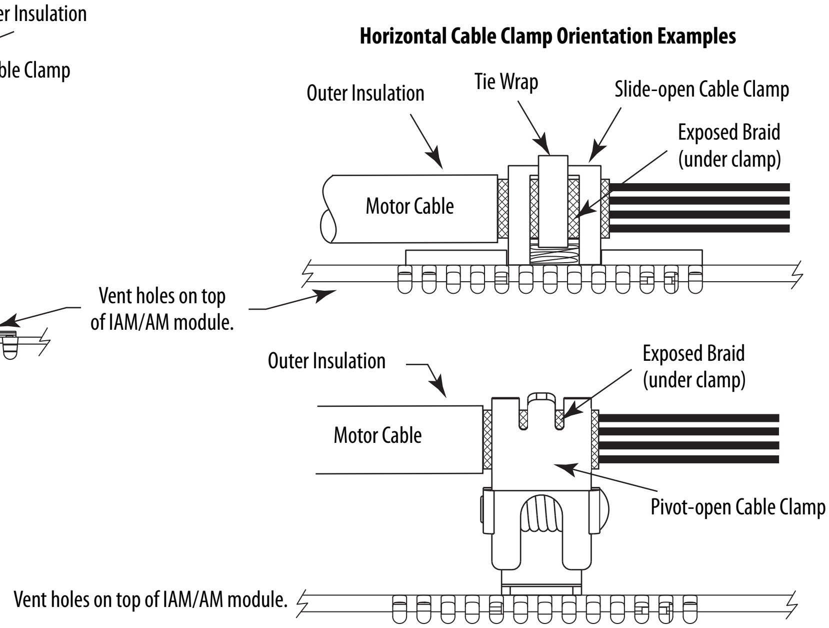
1. Depress the spring loaded clamp.

The pivot-open cable clamp was designed to replace the slide-open cable clamp.
Pivot-open clamp features include:
- Screwdriver not required for depressing the spring
- Tie wrap not required or recommended



2. Position the exposed portion of the cable braid directly in line with the clamp.
3. Release the spring, making sure the cable and cable braid are held secure by the clamp.
4. Attach tie wrap (slide-open clamp only) around cable and clamp for additional strain relief.





5. Repeat step 1 through step 4 for each IAM, AM, or IPIM module.

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 76 - Options for Connecting Motor Feedback and I/O

Connection Option	Connector Kit Cat. No.	Cable	Using this Type of Cable
Premolded connector	N/A	Motor feedback	Refer to Table 77 and Table 78 for the flying-lead cable available for your motor.
Low-profile connector kit	2090-K6CK-D15M	Motor feedback	
	2090-K6CK-D44M	I/O interface, safety, and auxiliary feedback	User-supplied flying-lead cable.
Low-profile connector kit	2090-K6CK-D44S0	I/O and cascading safe-off signals	2090-CS0DSDS-AA*xx*
Panel-mounted breakout board kit	2090-UXBK-D15*xx*	Motor feedback	Refer to Table 77…Table 79 for the flying-lead cable available for your motor.

The procedure for wiring your motor feedback varies slightly, depending on the motor family. The cables compatible with your motor or actuator depend on the connectors installed on the motor or actuator. Refer to MP-Series Motor and Actuator Connectors on page 111 for more information on circular DIN and bayonet connectors.

Table 77 - Motor Feedback Cable Compatibility - Bayonet Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable	
			Premolded	Flying-lead
MPL-B*xxxx*-S/M*x*2*x*AA	Bayonet	High-resolution encoder	2090-UXNFBMP-S*xx*	2090-XX*x*FMP-S*xx* (1)
MPL-A3*xxx*-H*x*2*x*AA MPL-A4*xxx*-H*x*2*x*AA MPL-A45*xxx*-H*x*2*x*AA		Incremental encoder		
1326AB-B*xxxx*-M2L/S2L		High-resolution encoder	2090-UXNFBMP-S*xx*	2090-XX*x*FMP-S*xx* (1)
F-Series		Incremental encoder	2090-UXNFBHF-S*xx*	2090-XXNFHF-S*xx*

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

Refer to Flying-lead Feedback Cable Pinouts beginning on page 122 for the motor-to-drive feedback cable pinout used in your application.

Refer to MP-Series Motor and Actuator Connectors on page 111 for more information on circular DIN and bayonet connectors.

Table 78 - Motor Feedback Cable Compatibility - Threaded DIN Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable (1)	
			Premolded	Flying-lead
MPL-B15*xxx*-V/E*x*4*x*AA MPL-B2*xxx*-V/E*x*4*x*AA	Circular (threaded) DIN	High-resolution encoder	N/A	2090-XXNFMF-S*xx* (standard) or 2090-CFBM4DF-CDAF*xx* (continuous-flex)
MPL-B15*xxx*-H*x*4*x*AA MPL-B2*xxx*-H*x*4*x*AA		Incremental encoder		
MPS-B*xxxx*-S/M		High-resolution encoder		
MPAS-B*xxxxx*-V/A				
MPAR-B1*xxxx*-V and MPAR-B2*xxxx*-V (series A)				

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

Table 79 - Motor Feedback Cable Compatibility - SpeedTec DIN Connectors

Motor/Actuator	Connector Type	Feedback Type	Feedback Cable (2)	
			Premolded	Flying-lead
MPL-B15*xxx*-V/E*x*7*x*AA MPL-B2*xxx*-V/E*x*7*x*AA	Circular (SpeedTec) DIN	High-resolution encoder	2090-CFBM7DD-CEAA*xx* (standard) or 2090-CFBM7DD-CEAF*xx* (continuous-flex)	2090-CFBM7DF-CEAA*xx* (standard) or 2090-CFBM7DF-CEAF*xx* (continuous-flex)
MPL-B15*xxx*-H*x*7*x*AA MPL-B2*xxx*-H*x*7*x*AA		Incremental encoder		
MPL-B3*xxx*-S/M*x*7*x*AA, MPL-B4*xxx*-S/M*x*7*x*AA, MPL-B45*xxx*-S/M*x*7*x*AA, 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		High-resolution encoder		
MPL-B3*xxx*-H*x*7*x*AA (1) MPL-B4*xxx*-H*x*7*x*AA (1) MPL-B45*xxx*-H*x*7*x*AA (1) LDAT-S*xxxxxx*-*x*B*x* (1)		Incremental encoder	N/A	2090-XXNFMF-S*xx* (standard) or 2090-CFBM7DF-CDAF*xx* (continuous-flex)
MPF-B*xxxx*-S/M	Circular (SpeedTec) DIN	High-resolution encoder	2090-CFBM7DD-CEAA*xx* (standard) or 2090-CFBM7DD-CEAF*xx* (continuous-flex)	2090-CFBM7DF-CEAA*xx* (standard) or 2090-CFBM7DF-CEAF*xx* (continuous-flex)
MPS-B*xxxx*-S/M				
MPM-B*xxxxx*-S/M				
MPAS-B*xxxxx*-V MPAR-B1*xxxx*-V and MPAR-B2*xxxx*-V (series B) MPAR-B3*xxxx*-M				
MPAI-B*xxxxx*M3				
RDB-B*xxxx*-7/3			N/A	2090-XXNFMF-S*xx* (standard) or 2090-CFBM7DF-CDAF*xx* (continuous-flex)
MPAS-B*xxxxx*-A		Incremental encoder		
LDC-C*xxxx* (1)		Sin/Cos encoder or TTL encoder		

(1) These motors/linear thrusters are equipped with SpeedTec DIN connectors, however, the feedback option requires the additional conductors supplied with the cables listed.
(2) You must remove the motor-side o-ring when using 2090-CFBM7*xx*-*xx*A*xxx* cables.

Flying-lead Feedback Cable Pinouts

Refer to the following tables for the motor-to-drive feedback cable pinout used in your application.

Table 80 - 2090-XX*x*FMP-S*xx* Feedback Cable

Bayonet Connector	High-resolution Feedback	Drive MF Connector Pin
Rotary Motor Connector Pin	**MPL-B3*xxx*…MPL-B9*xxx*-M/S*x*2*x*AA, 1326AB-B*xxx*-M2L/S2L**	
A	Sin+	1
B	Sin-	2
C	Cos+	3
D	Cos-	4
E	Data+	5
F	Data-	10
K	Reserved	14
L	Reserved	6
N	EPWR_9V	7
P	ECOM	6
R	TS+	11
S	TS-	–
T	Reserved	12
U	Reserved	13
V	Reserved	8

Table 81 - 2090-XXNFMF-S*xx* or 2090-CFBM*x*DF-*xx*A*xxx* Feedback Cables

Circular DIN Connector Pin	High-resolution Feedback		Incremental Feedback	Drive MF Connector Pin
Rotary Motors	**MPL-B15*xxx*…MPL-B2*xxx*-V/E*x*4/7*x*AA** **MPF/MPS-B*xxx*-M/S**	**RDB-B*xxxxx*-3/7**	**MPL-B15*xxx*-H*x*4/7*x*AA** **MPL-B2*xxx*-H*x*4/7*x*AA** **MPL-A3*xxx*-H*x*7*x*AA** **MPL-A4*xxx*-H*x*7*x*AA** **MPL-A45*xxx*-H*x*7*x*AA**	
	MPL-B3*xxx*…MPL-B9*xxx*-M/S*x*7*x*AA **MPM-B*xxxxx*-M/S**			
Linear Motors	**N/A**	**LDC-C*xxxx***	**LDC-C*xxxx***	
Linear Actuators	**MPAS-B*xxxxx*-V*xx*S*x*A** **MPAR-B*xxxx*, MPAI-B*xxxx***	**N/A**	**MPAS-B*xxxxx*-ALM*x*2C** **LDAT-S*xxxxxx*-*x*B*x***	
1	Sin+	Sin+	AM+	1
2	Sin-	Sin-	AM-	2
3	Cos+	Cos+	BM+	3
4	Cos-	Cos-	BM-	4
5	Data+	Data+	IM+	5
6	Data-	Data-	IM-	10
7	Reserved	CLK+ (1)	Reserved	9
8	Reserved	CLK- (1)	Reserved	15
9	Reserved	EPWR_5V	EPWR_5V	14
10	Reserved	ECOM	ECOM	6
11	EPWR_9V	Reserved	Reserved	7
12	ECOM	Reserved	Reserved	6
13	TS+	TS+	TS+	11
14	TS-	TS-	TS-	–
15	Reserved	Reserved	S1	12
16	Reserved	Reserved	S2	13
17	Reserved	Reserved	S3	8

(1) Applies to RDB-B*xxxxx*-3/7 direct-drive motors only.

Wiring the Feedback and I/O Connectors

These procedures assume you have mounted your Kinetix 6200 and Kinetix 6500 system, completed all power wiring, and are ready to connect your feedback and I/O cables.

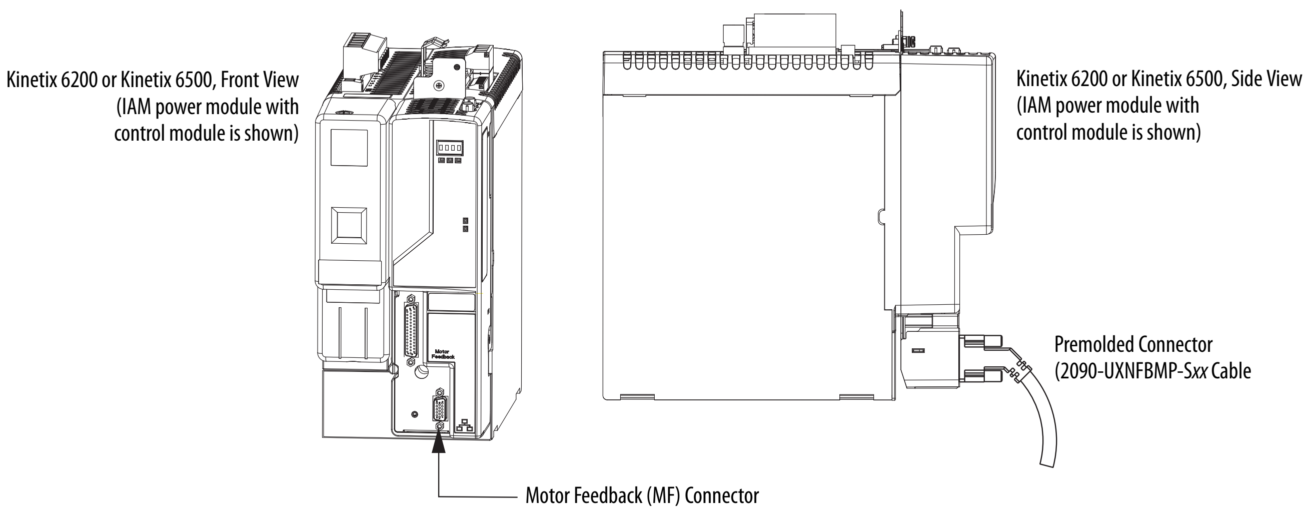
For This Connection	Go to
Premolded cable	Connect Premolded Motor Feedback Cables on page 124.
Panel-mounted breakout board	Connect Panel-mounted Breakout Board Kits on page 125.
Low-profile connector	Wire Low-profile Connector Kits on page 126.

Connect Premolded Motor Feedback Cables

Motor feedback cables with premolded connectors plug directly into 15-pin motor feedback (MF) connectors on the control modules (no wiring is necessary).

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

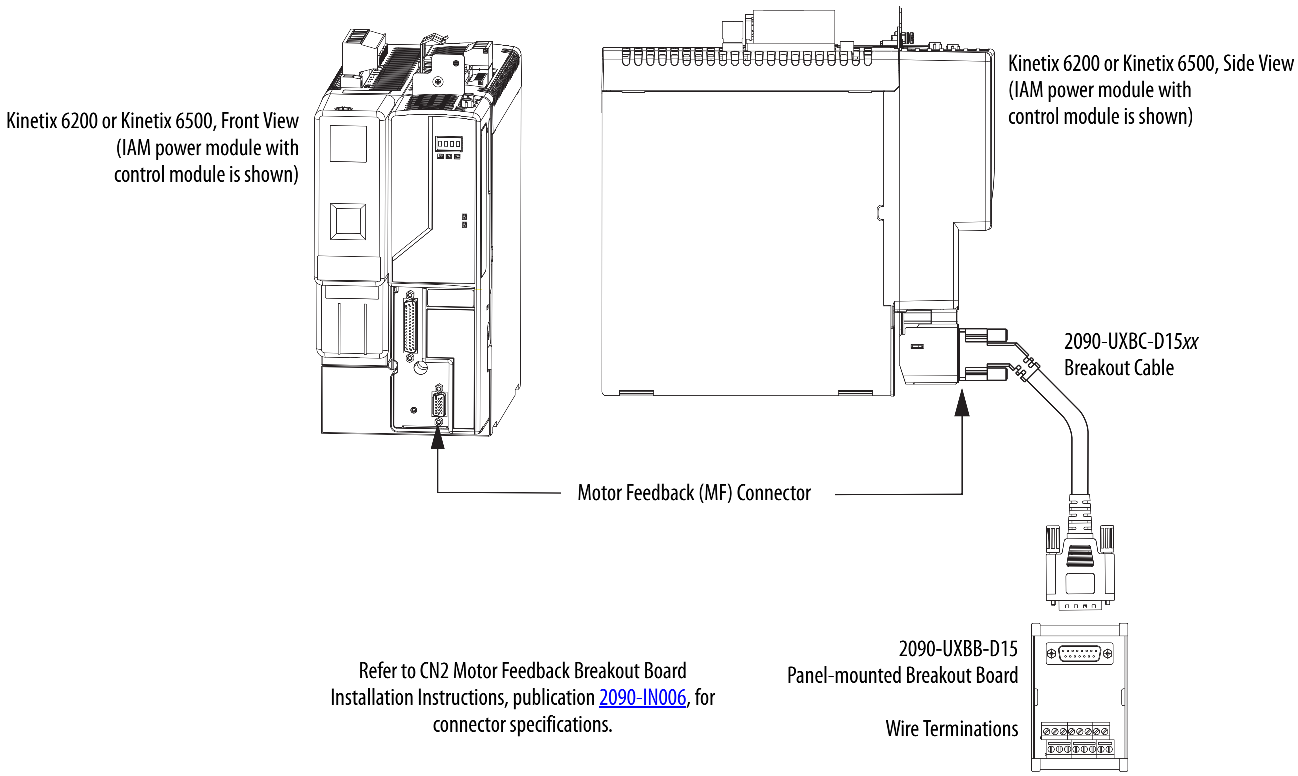
Figure 66 - IAM/AM Power Module/Control Module (MF connector)



Connect Panel-mounted Breakout Board Kits

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

Figure 67 - IAM/AM Power Module/Control Module (MF connector)



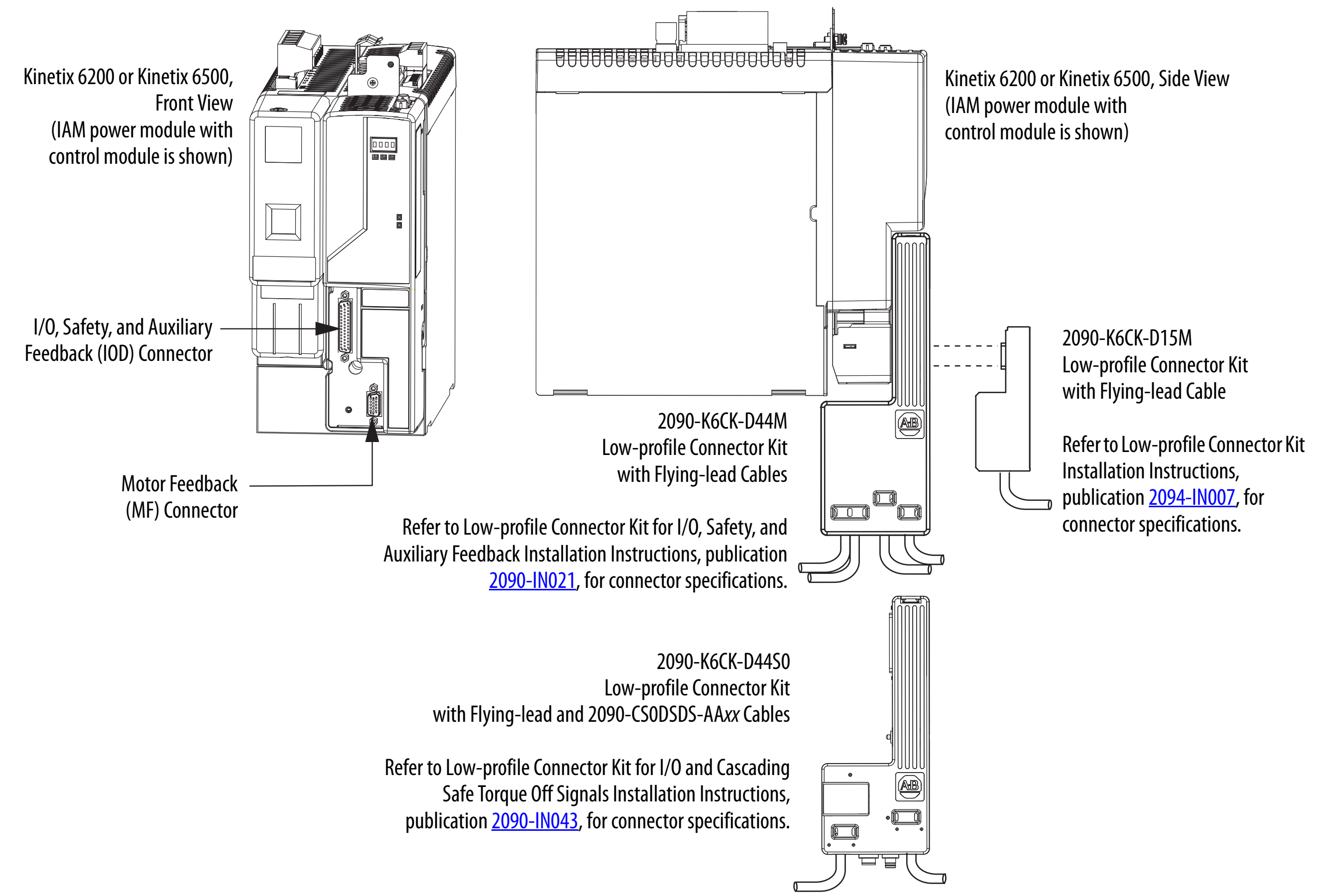
Wire Low-profile Connector Kits

The 2090-K6CK-D*xx*M low-profile connector kits are suitable for terminating flying-lead motor feedback, auxiliary feedback, and I/O connections. They also apply to I/O connections on the 2094-BL02 LIM module.

Table 82 - Low-profile Connector Kits

Connector Kit Cat. No.	Description	Cable Compatibility
2090-K6CK-D15M	Low-profile connector kit for motor feedback (15-pin, male, D-sub). Use with any Kinetix 6200 and Kinetix 6500 control module and compatible motors with incremental or high-resolution feedback.	2090-XX*x*FMP-S*xx*, 2090-XXNFMF-S*xx*, 2090-CFBM*x*DF-C*x*A*xxx*
2090-K6CK-D44M	Low-profile connector kit for I/O (44-pin, male, D-sub). Use with any Kinetix 6200 and Kinetix 6500 control module for making I/O, safety, and auxiliary feedback connections.	Customer supplied
2090-K6CK-D44S0	Low-profile connector kit for I/O and cascading Safe Torque Off signals (44-pin, male, D-sub). For use with any Kinetix 6200 or Kinetix 6500 (Safe Torque Off, -S0 control module).	2090-CS0DSDS-AA*xx*

Figure 68 - IAM/AM Power Module with Control Module (IOD/MF connectors)



IMPORTANT	Tightening the mounting screws is essential to ensure shield integrity of the low-profile connector covers with the drive feedback connector D-shells. Use 0.4 N•m (3.5 lb•in) torque.

Figure 69 - Wiring (15-pin) Flying-lead Feedback Cable Connections 2090-K6CK-D15M Connector Kit

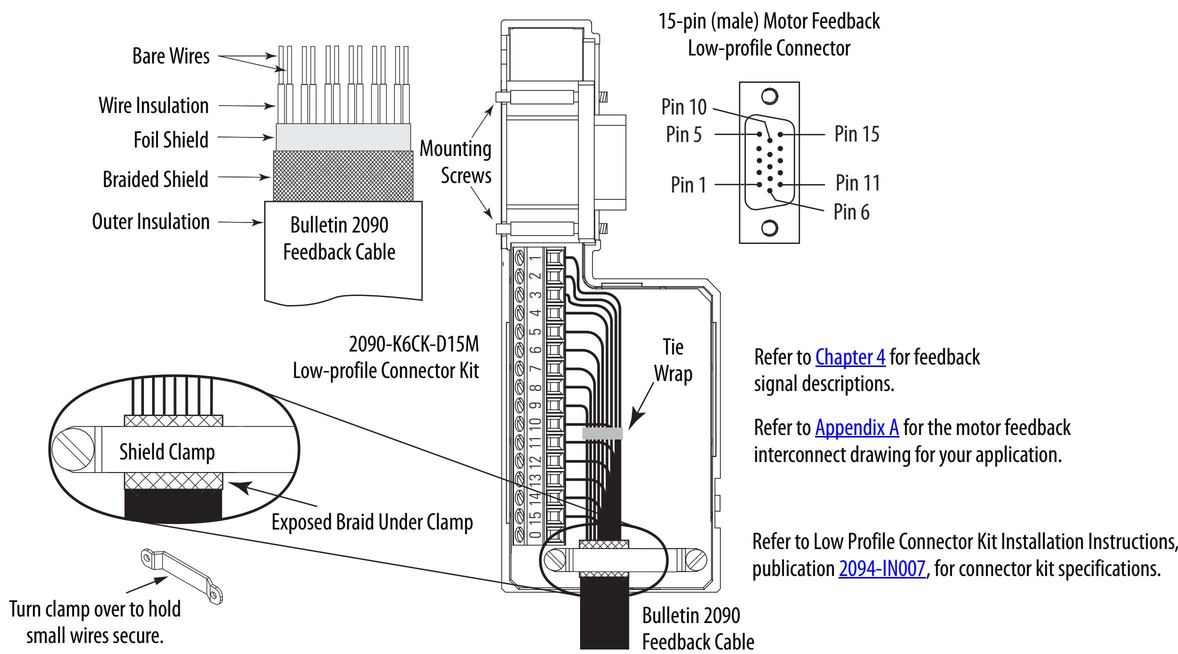


Figure 70 - Wiring (44-pin) I/O, Safety, and Auxiliary Feedback Cable Connections 2090-K6CK-D44M Connector Kit

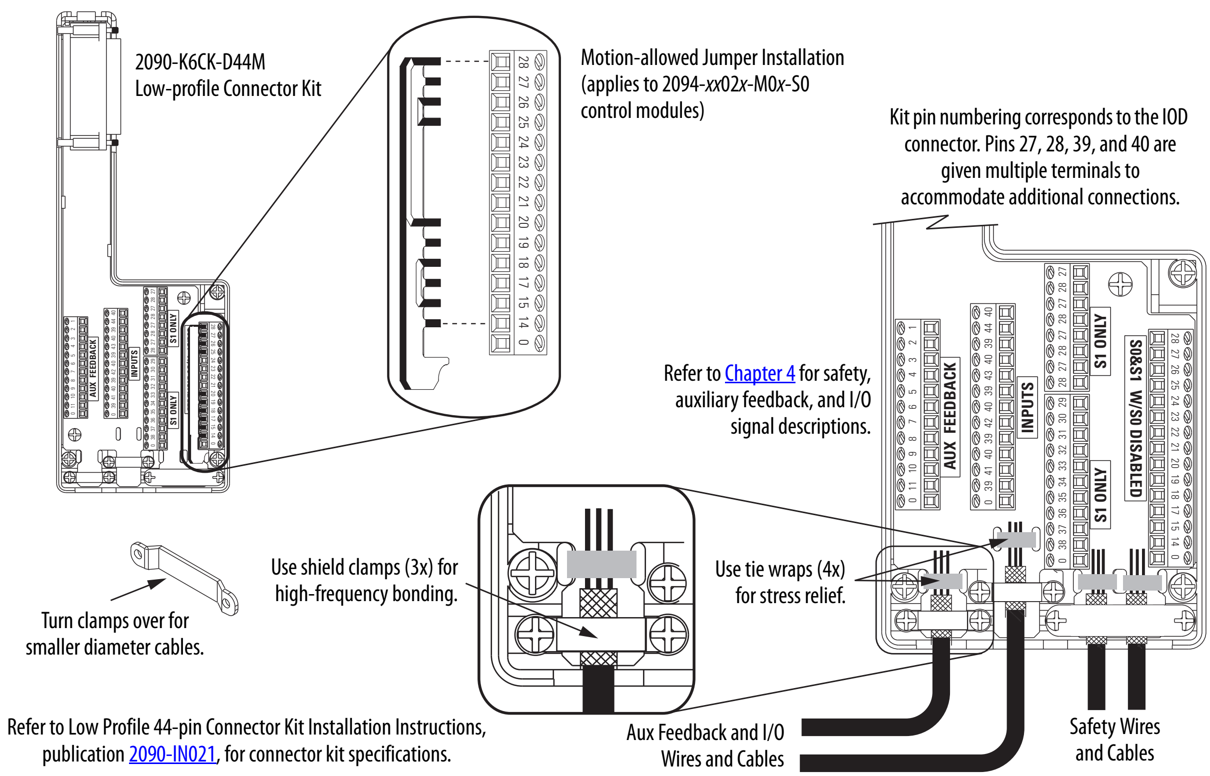
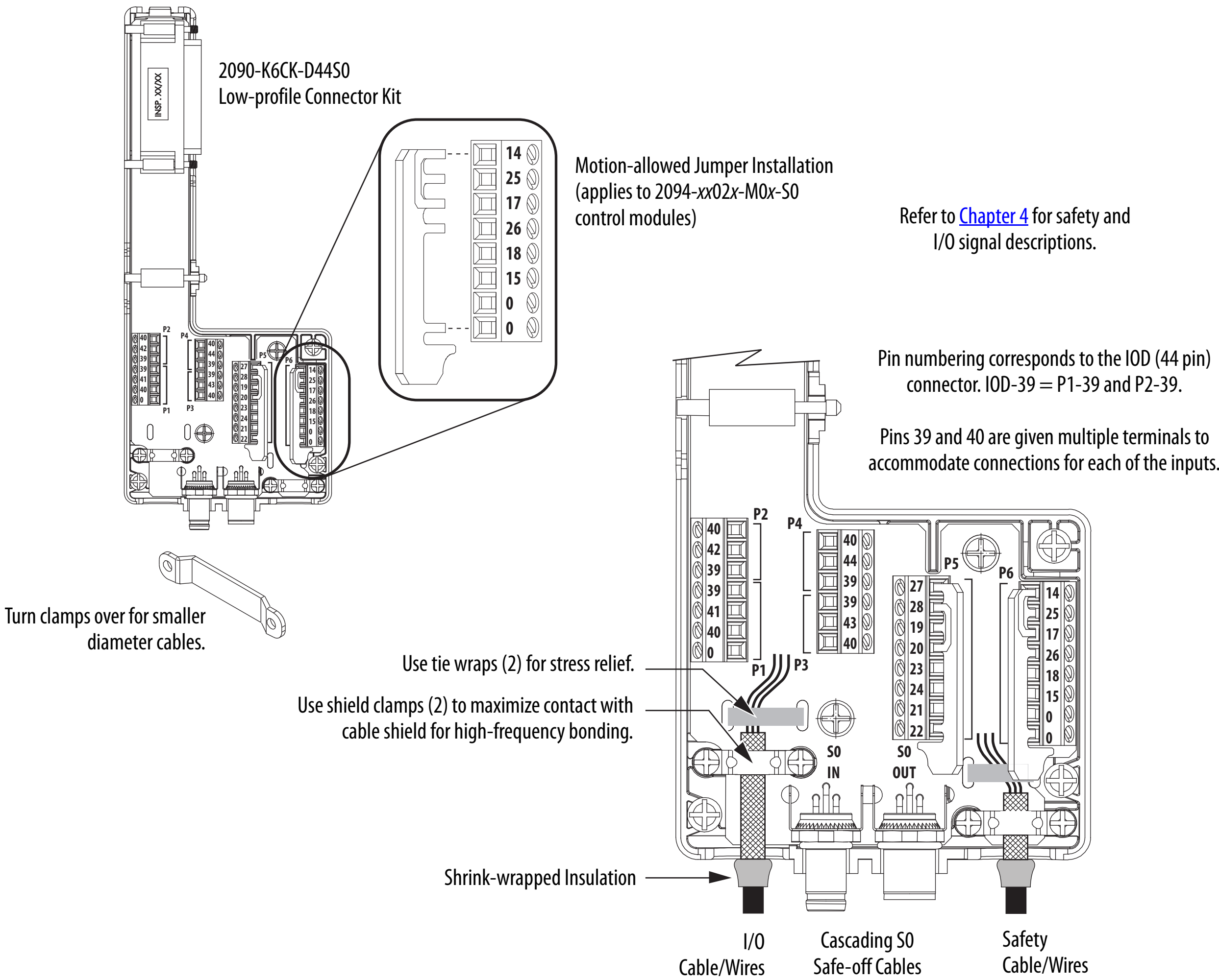
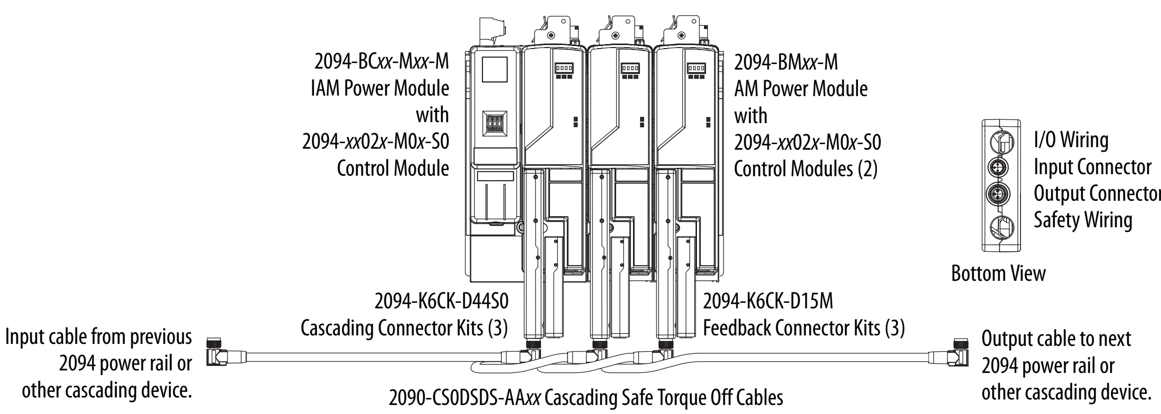


Figure 71 - Wiring (44-pin) I/O and Cascading Safe Torque Off Feedback Connections 2090-K6CK-D44S0 Connector Kit



In this example, three Safe Torque Off drives are shown using the Bulletin 2090 low-profile connector kit and cables. The right-angled cable connectors are keyed to exit left as shown. Cables loop back and cascade to the next drive or other cascading device.

Figure 72 - Cascading Safe Torque Off Cable Example



External Shunt Module Connections

Follow these guidelines when wiring your external passive shunt module.

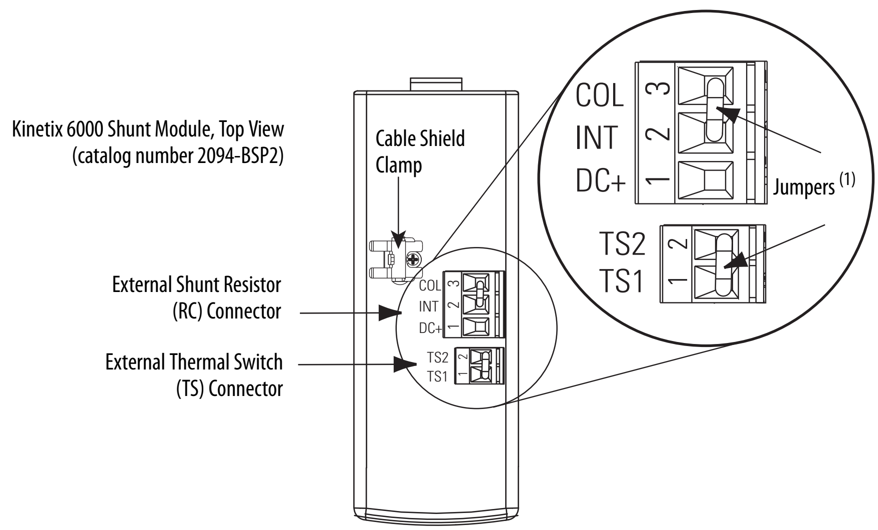
IMPORTANT	When tightening screws to secure the wires, refer to the tables beginning on page 103 for torque values.

IMPORTANT	To improve system performance, run wires and cables in the wireways as established in Chapter 2.

Table 83 - Shunt Module Wiring

Use This Shunt Module	Cat. No.	With This Drive Module	Do This
Power rail mounted shunt module.	2094-BSP2	N/A	• Verify the internal shunt jumper is in place between RC-2 and RC-3 (refer to Figure 73). • Verify the thermal switch jumper is in place between TS-1 and TS-2 (refer to Figure 73).
External passive shunt module connected to the power rail shunt module.	1394-SR*xxxx*	2094-BSP2 Shunt module	• Remove the internal shunt jumper between RC-2 and RC-3. • Remove the thermal switch jumper between TS-1 and TS-2 (if your shunt module includes a thermal switch). • Refer to External Shunt Modules on page 50 for noise zone considerations. • Refer to Shunt Module Wiring Examples on page 241. • Refer to the installation instructions provided with your Bulletin 1394 shunt module, publication 2090-IN004.

Figure 73 - Shunt Module Jumper Settings



(1) These are the default jumper settings.

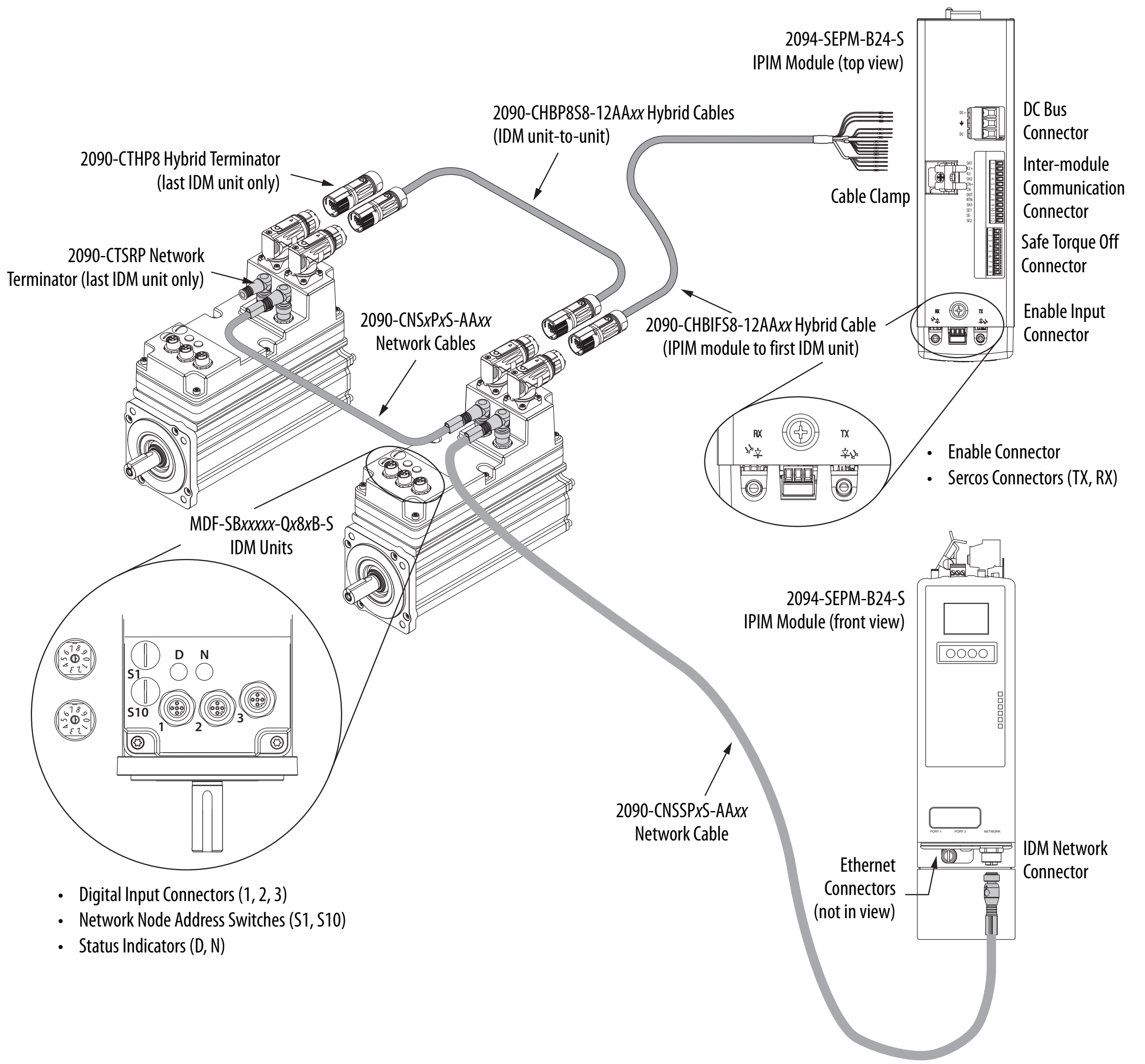
IPIM Module Connections

An overview of the Kinetix 6000M integrated drive-motor (IDM) system connections are shown here.

- Refer to Chapter 2 on page 27, for noise zone considerations.
- Refer to Appendix A, on page 252, for an interconnect diagram featuring the Kinetix 6000M integrated drive-motor (IDM) system.
- Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for more information when wiring your IPIM module.

IMPORTANT	To improve system performance, run wires and cables in the wireways as established in Chapter 2.

Figure 74 - IPIM Module Connections



RBM Module Connections

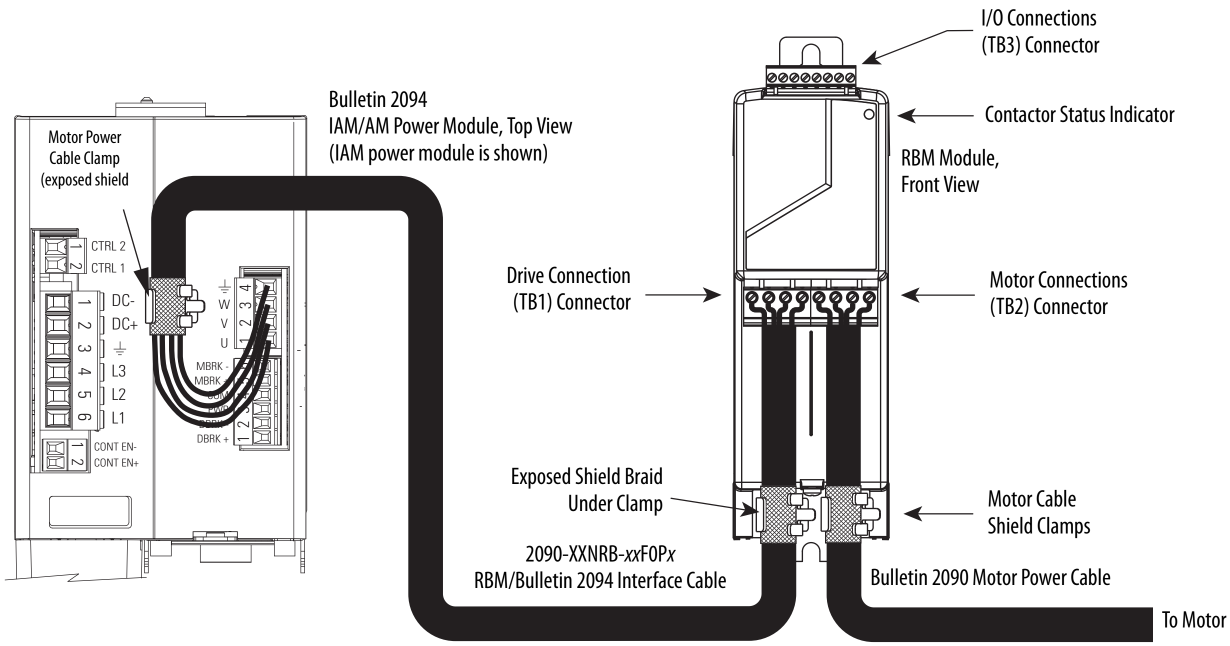
Follow these guidelines when wiring your Bulletin 2090 Resistive Brake Module (RBM).

IMPORTANT	To be sure of system performance, run wires and cables in the wireways as established in Chapter 2.

If your application requires an RBM module and you are wiring to a Bulletin 2094 IAM/AM power module, then refer to the following:

- Cable Categories for Kinetix 6200 and Kinetix 6500 Systems on page 47 to establish noise zones when mounting the RBM module on your panel.
- Resistive brake module to Bulletin 2094 drive interface cable (catalog number 2090-XXNRB-*xx*F0P*x*).
- The example diagram below and others in Appendix G, beginning on page 313.
- The installation instructions provided with your RBM module, publication 2090-IN009.

Figure 75 - RBM Module Connections



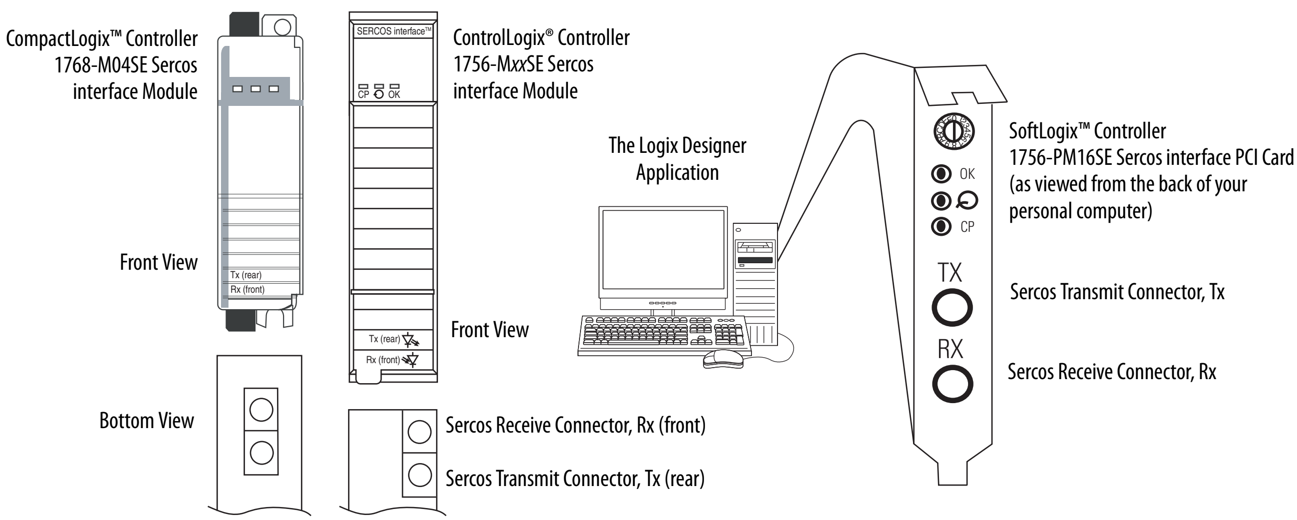
Sercos Fiber-optic Cable Connections

This procedure assumes you have your Logix5000™ sercos interface module/PCI card and Kinetix 6200 control modules mounted and are ready to connect the fiber-optic cables.

The sercos fiber-optic ring is connected by using the sercos receive (Rx) and transmit (Tx) connectors. Refer to page 62 to locate the sercos connectors on your Kinetix 6200 control module and IPIM module. Refer to the figure below to locate the connectors on your Logix5000 sercos interface module or PCI card.

Plastic cable is available in lengths up to 32 m (105.0 ft). Glass cable is available in lengths between 50 m (164.2 ft) and 200 m (656.7 ft).

Figure 76 - CompactLogix, ControlLogix, and SoftLogix Sercos Connectors



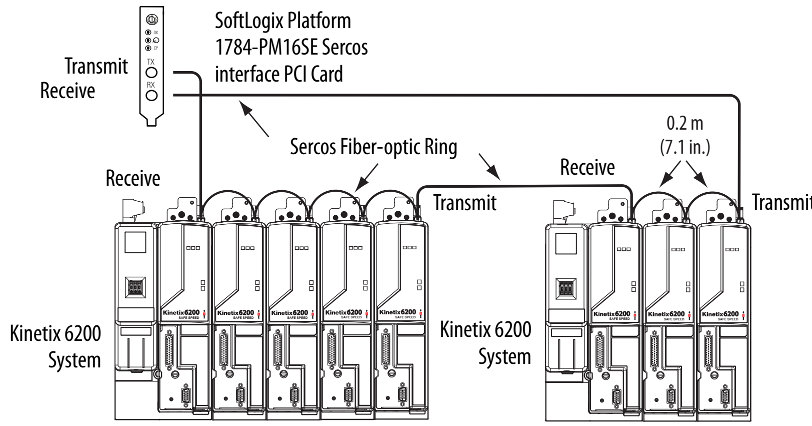
Connect the cable from transmit on the Logix5000 module to receive on the control or IPIM module, then transmit to receive (drive to drive), and from transmit on the last drive back to receive on the Logix5000 module.

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 6200 control module and IPIM module. Do not use a wrench or any other mechanical assistance.
For more information, refer to Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010.

SoftLogix and ControlLogix controllers are used in the following examples; however, CompactLogix controllers connect in the same manner.

When connecting 2094-SE02F-M00-S*x* control modules, use 2090-SCEP0-2, 0.2 m (7.1 in.) cables.

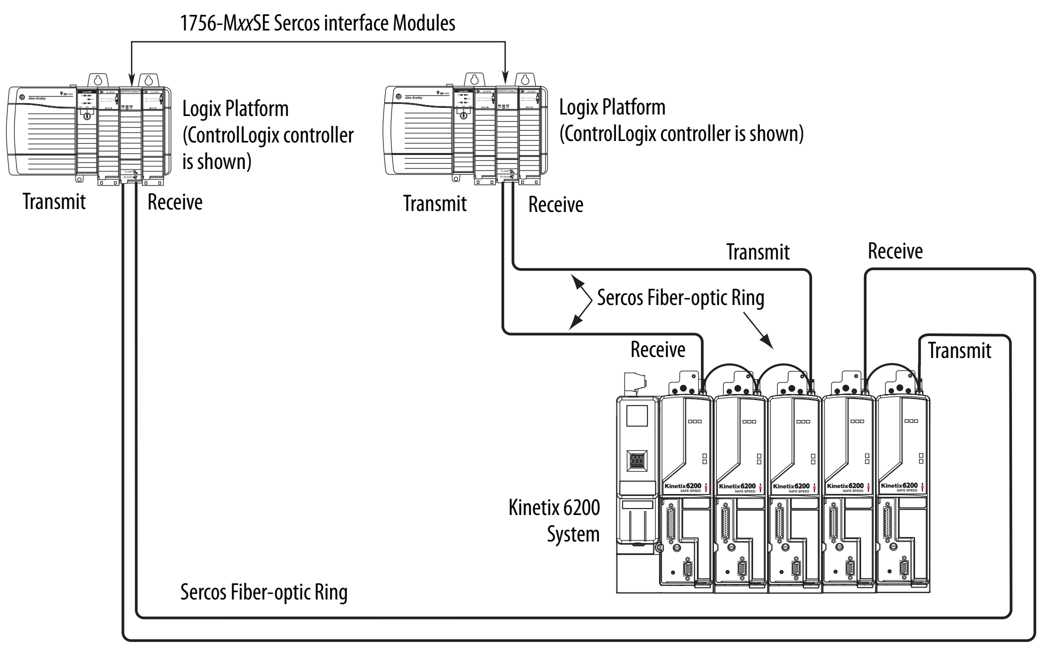
Figure 77 - Fiber-optic Cable Example - SoftLogix Platform



IMPORTANT	The CompactLogix controller (catalog number 1768-M04SE) is limited to four axes per module.

In this example, two Logix5000 modules are installed in separate chassis.

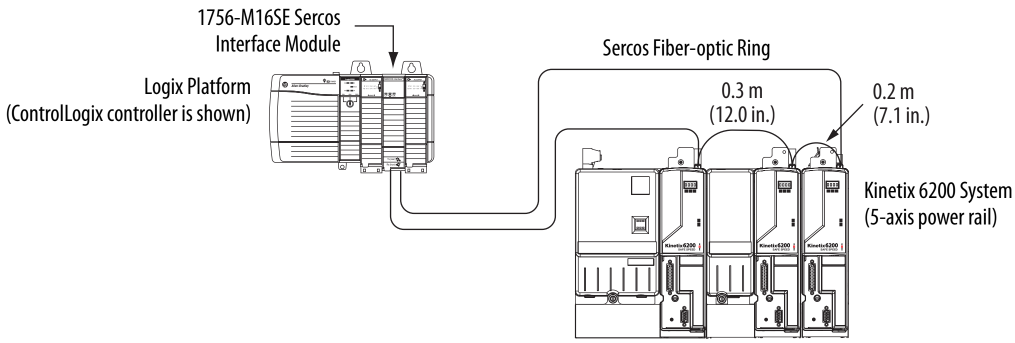
Figure 78 - Fiber-optic Cable Example - Two Logix Platforms



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

When connecting 2094-BM03-M and 2094-BM05-M (double-wide) axis modules, use 2090-SCEP0-3, 0.3 m (12.0 in.) cables. When connecting 2094-BMP5-M, 2094-BM01-M, and 2094-BM02-M (single-wide) axis modules, use 2090-SCEP0-2, 0.2 m (7.1 in.) cables.

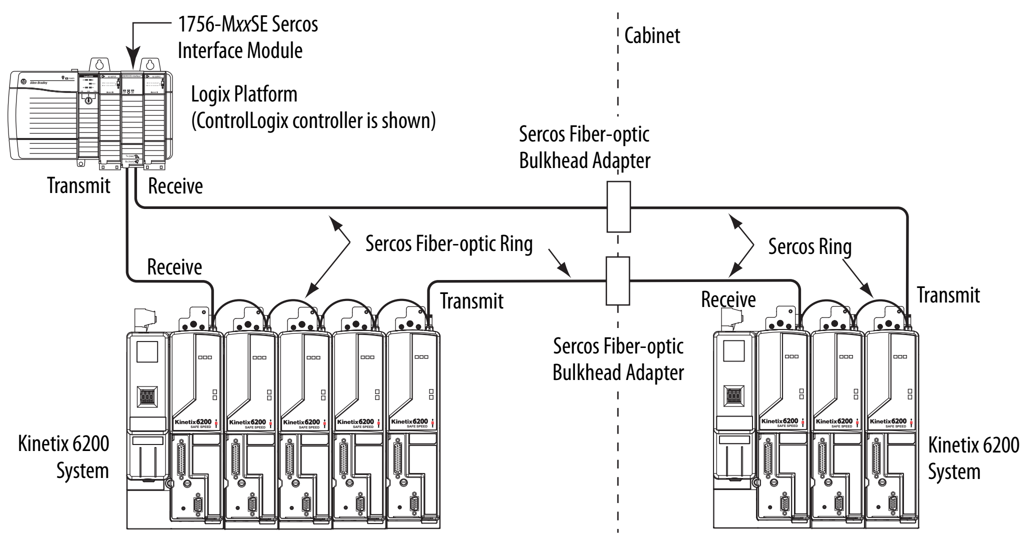
Figure 79 - Fiber-optic Cable Example - Logix Platform with Double-wide Modules



In this example, the second Kinetix 6200 system is mounted in a separate cabinet and connected with bulkhead adapters.

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

Figure 80 - Fiber-optic Cable Example - Logix Platform with Bulkhead Adapters

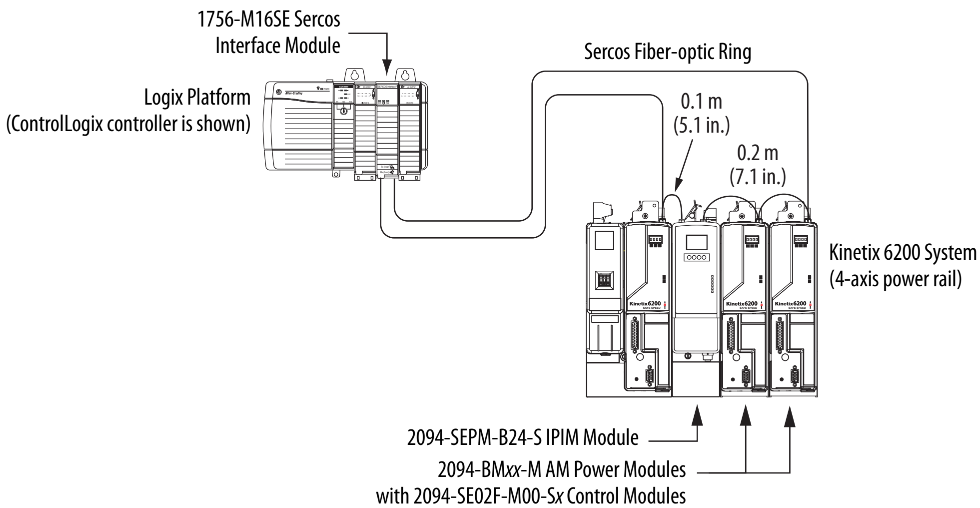


Kinetix 6000M Integrated Drive-Motor Sercos Connections

The Kinetix 6200 sercos ring includes the Kinetix 6000M integrated drive-motor (IDM) units and IDM power interface modules (IPIM). Fiber-optic connections are made from drive-to-drive and drive-to-IPIM module. IDM network connections continue from the IPIM module to the IDM units.

When connecting from the IPIM module to Kinetix 6200 (2094-BM*xx*-M) drives, you must use the 0.2 m (7.1 in.) cables.

Figure 81 - Fiber-optic Cable Example - Logix5000 Platform with Kinetix 6000M (IPIM) Modules



In this example, all the drive modules and the IPIM module are on the same sercos ring. The ring begins and ends at the 1756-M16SE sercos module. IDM units (not shown for simplicity) connected to the IPIM module, are also part of this sercos ring.

For more Kinetix 6000 IDM system examples including the IDM units, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Ethernet Cable Connections

This procedure assumes you have your ControlLogix or CompactLogix EtherNet/IP module and Bulletin 2094 control modules mounted and are ready to connect the Ethernet network cables.

The EtherNet/IP network is connected by using the PORT 1 and/or PORT 2 connectors.

Table 84 - EtherNet/IP Connector Location

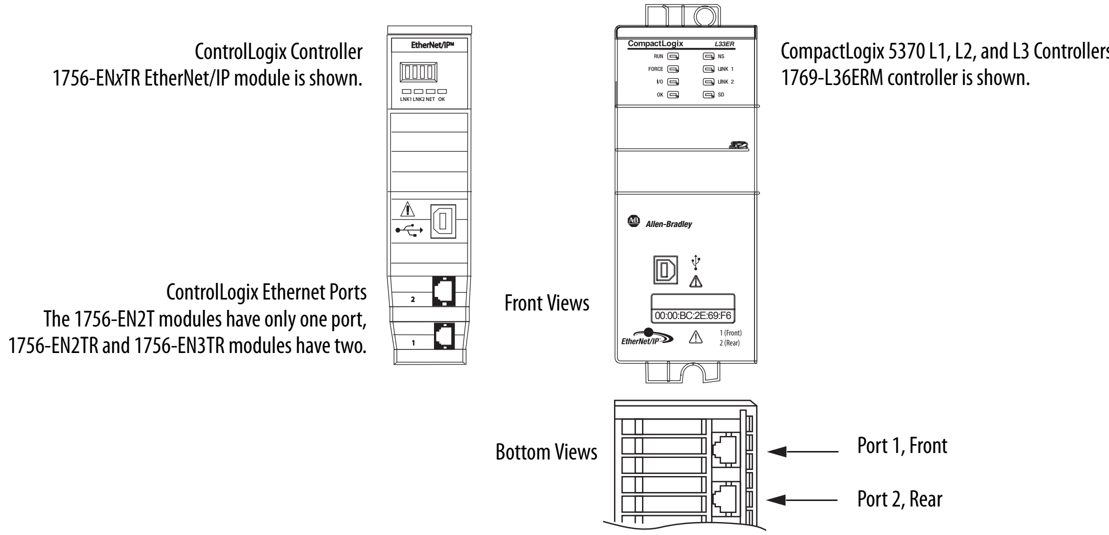
Drive Family	Cat. No.	EtherNet/IP Network	Refer to
Kinetix 6500	2094-EN02D-M01-S*x*	Programming the safety configuration and the Logix Designer application	page 64
Kinetix 6200	2094-SE02F-M00-S*x*	Programming the safety configuration	page 63
Kinetix 6000M	2094-SEPM-B24-S	Monitoring, diagnostics, and firmware upgrades	page 63

Shielded Ethernet cable is available in lengths up to 78 m (256 ft). However, the total length of Ethernet cable connecting drive-to-drive, drive-to-controller, or drive-to-switch must not exceed 100 m (328 ft).

If the entire channel is constructed of stranded cable (no fixed cable), then this is the equation for calculating maximum length:

Maximum Length = (113-2N)/y, meters
where N = the number of connections in the channel
and y = the loss factor compared to fixed cable (typically 1.2…1.5).

Figure 82 - ControlLogix and CompactLogix Ethernet Port Locations

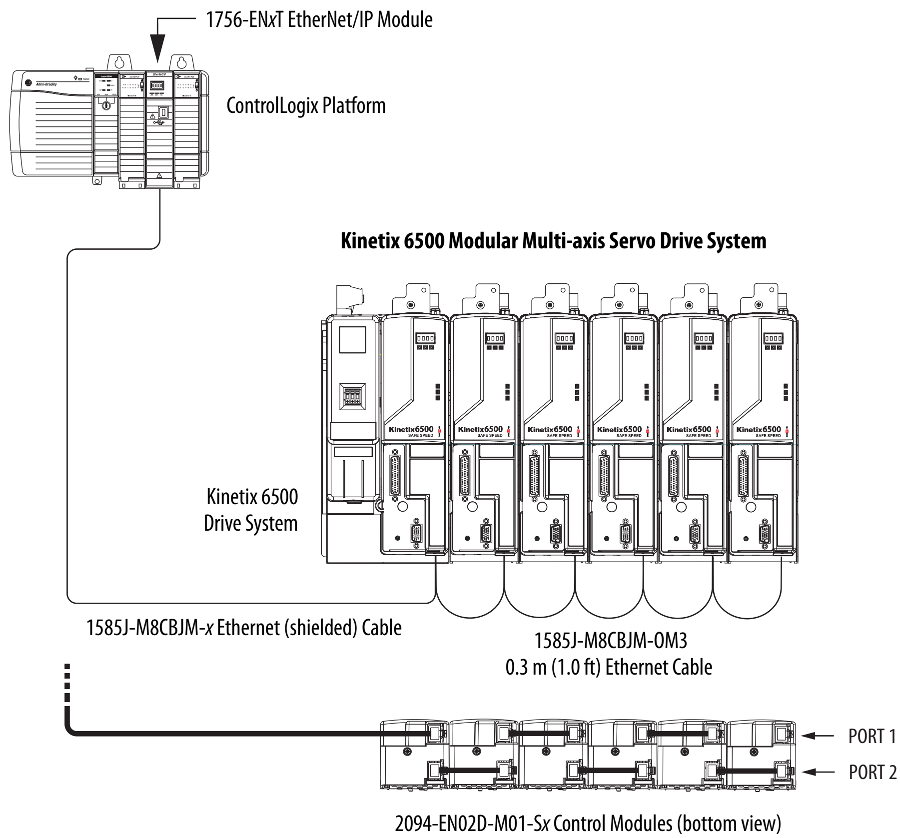


The 1756-EN*x*T EtherNet/IP modules accept linear and star network configurations. The 1756-EN*x*TR modules and CompactLogix 5370 controllers accept linear, ring (DLR), and star network configurations.

IMPORTANT	When using an external Ethernet switch for routing traffic between the controller and the drive, switches with IEEE-1588 time synchronization features must be used.

In this example, all devices are connected in linear topology. The Kinetix 6500 control module includes dual-port connectivity for drive-to-drive connections.

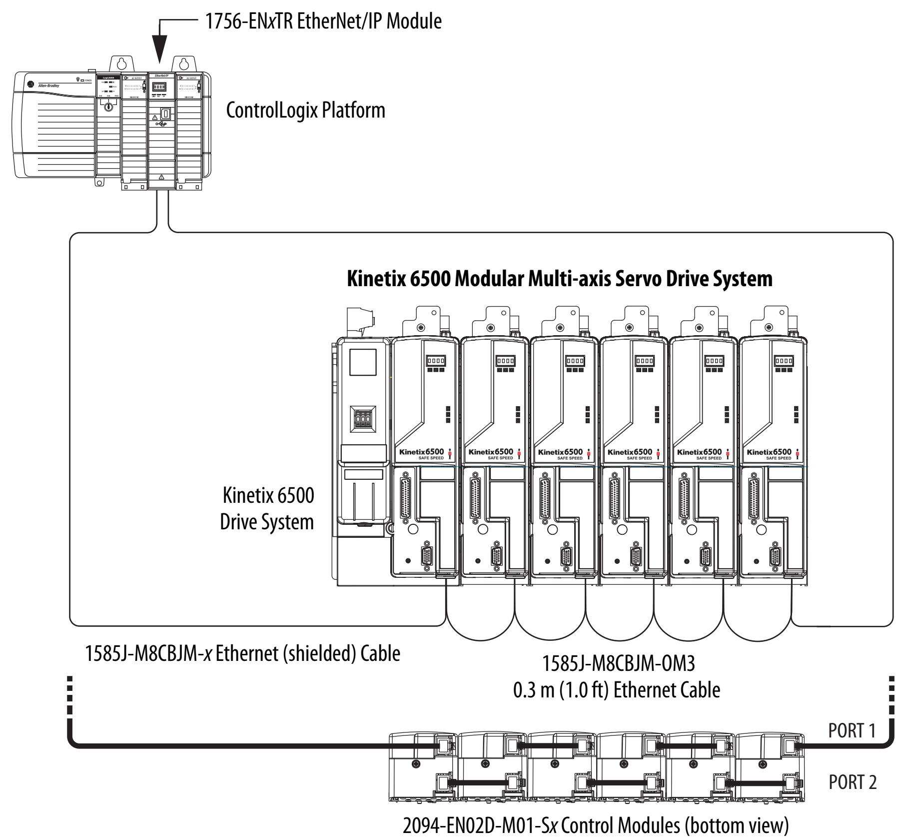
Figure 83 - Ethernet Wiring Example - Linear



In this example, the drives are connected by using device-level ring (DLR) topology. DLR topology is fault redundant. For example, if a device in the ring is disconnected, the rest of the devices in the ring continue to maintain communication.

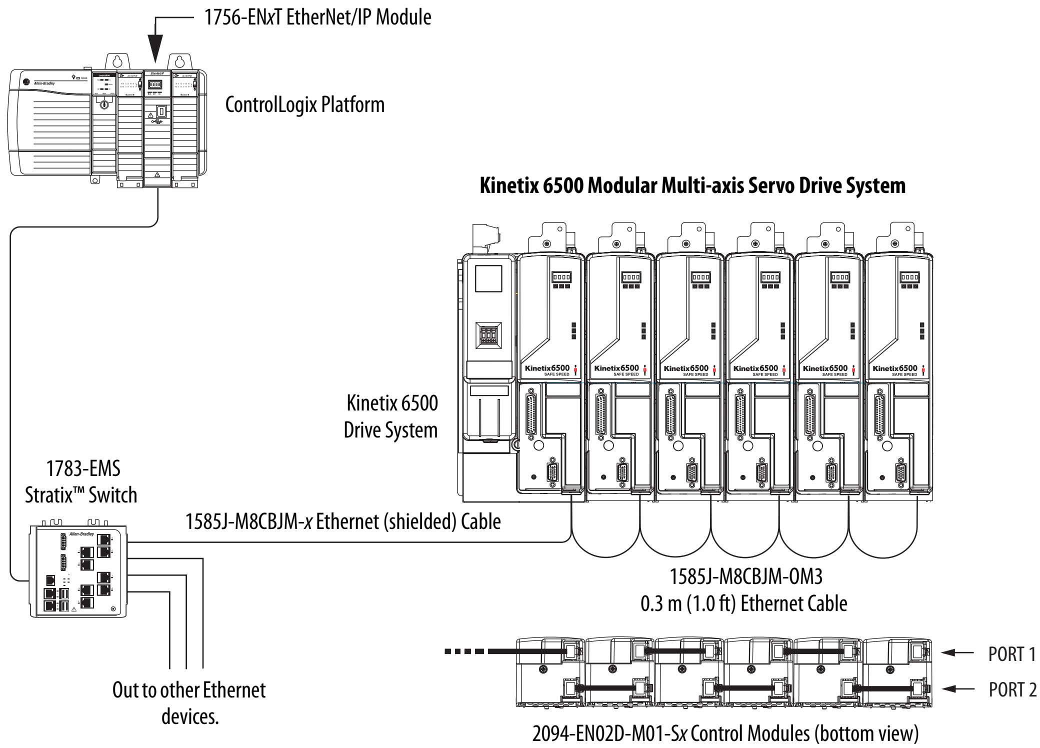
IMPORTANT	DLR topology requires the dual-port 1756-EN*x*TR module.

Figure 84 - Ethernet Wiring Example - DLR Ring



In this example, the devices are connected by using star topology. Each device is connected directly to the switch, making this topology fault tolerant. The 2094 power rail modules and other devices operate independently. The loss of one device does not impact the operation of the other devices.

Figure 85 - Ethernet Wiring Example - Star



Notes:

Configure and Start the Kinetix 6200 Drive System

This chapter provides procedures for configuring the Kinetix 6200 system components with your Logix5000™ sercos communication module.

TIP Before you begin, make sure you know the catalog number for each drive component, the Logix5000 module, and the servo motor/actuator in your motion control application.

Configure the Kinetix 6000M Integrated Drive-Motor System

Configuration for the Kinetix 6000M integrated drive-motor (IDM) system follows a procedure similar to what is described in this chapter. You'll assign each IDM unit a node address and configure the IDM system in the Logix Designer application.

The IPIM module does not require configuration for your IDM units to be configured in the sercos ring. However, you can include the IPIM module in your project by connecting it to a configured Ethernet module in the Logix5000 chassis and adding it under the Ethernet module in the I/O configuration tree. An Add-On Profile is also needed to use the IPIM module in the project, but as a result you can view IPIM module status information in the configuration software and use it in your application program. The Ethernet connection is also used to upgrade the IPIM module firmware by using ControlFLASH™ software.

For system configuration and startup procedures specific to the IDM system, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Configure the Drive Modules

Follow these steps to configure the IAM power module and the control modules attached to your IAM and AM power modules.

IMPORTANT	If you have one or more IDM power interface modules (IPIM) on your power rail, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for system configuration information specific to the Kinetix 6000M IDM system.

1. Verify that no power is applied to the IAM and AM power modules and that the communication cables are plugged into the appropriate connectors.

   To verify communication, refer to Sercos Fiber-optic Cable Connections on page 132.

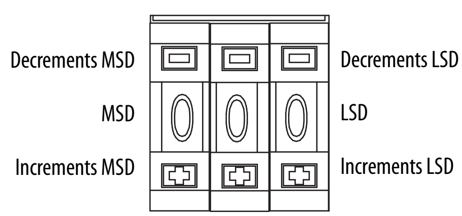
To Configure	Begin With
The IAM module	step 2
Any control module	step 4
Kinetix 6000M IDM system (1)	Kinetix 6000M Integrated Drive-Motor User Manual, publication 2094-UM003.

(1) Sercos fiber-optic cable connections for the Kinetix 6000M integrated drive-motor (IDM) system are on page 135.

2. Set the base node address for the IAM power module by setting the Node Address switches.

   Valid node addresses for sercos communication are 001…099. The left switch sets the most significant digit (MSD) and the right switch sets the least significant digit (LSD).

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



   Setting the base node address on the IAM power module determines the node address for the control module mounted on the IAM (inverter) module. Node addressing for all slot locations on the same power rail increment (from the IAM inverter) left to right.

3. Cycle control power to initialize the IAM module.

IMPORTANT	The base node address setting takes effect only after the IAM power module is initialized.

IMPORTANT	When two or more IAM power modules are connected to the same sercos interface module, each node address must be unique. Refer to the node addressing examples beginning on page 144.

4. Set the sercos communication rate by using DIP switches 1 and 2.

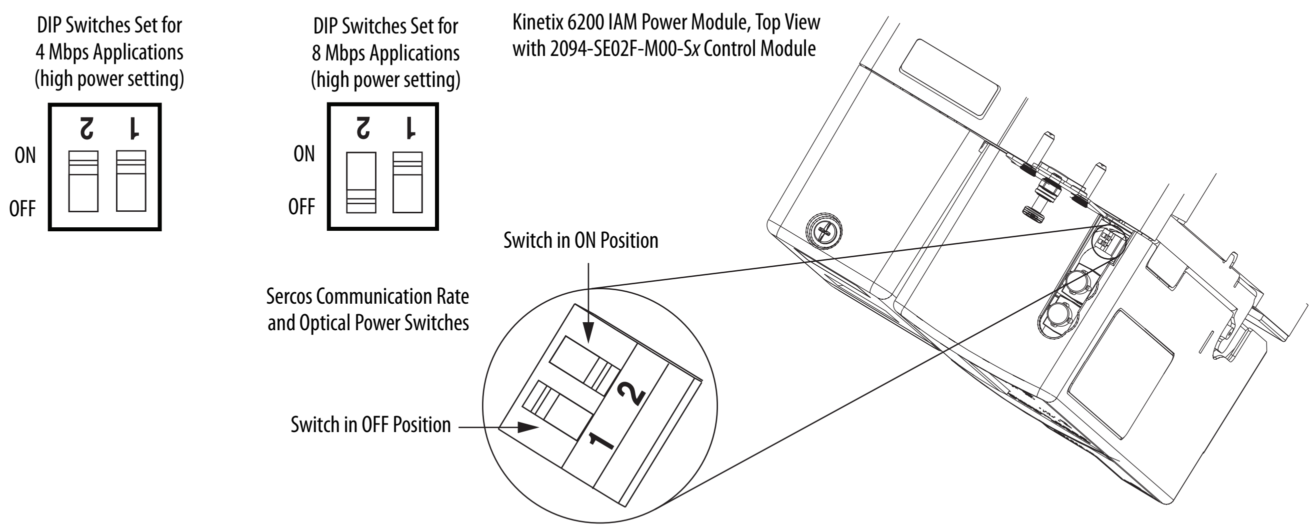
Setting	Switch	Switch Position
4 Mbps baud rate	SW2	ON
8 Mbps baud rate (1)	SW2	OFF
Low power light intensity	SW1	OFF
High power light intensity	SW1	ON

(1) The Kinetix 6000M IDM system supports only 8 Mbps and is hardwired for this setting.

The optical power setting you use depends on the type of sercos cable you're using and the length of the cable.

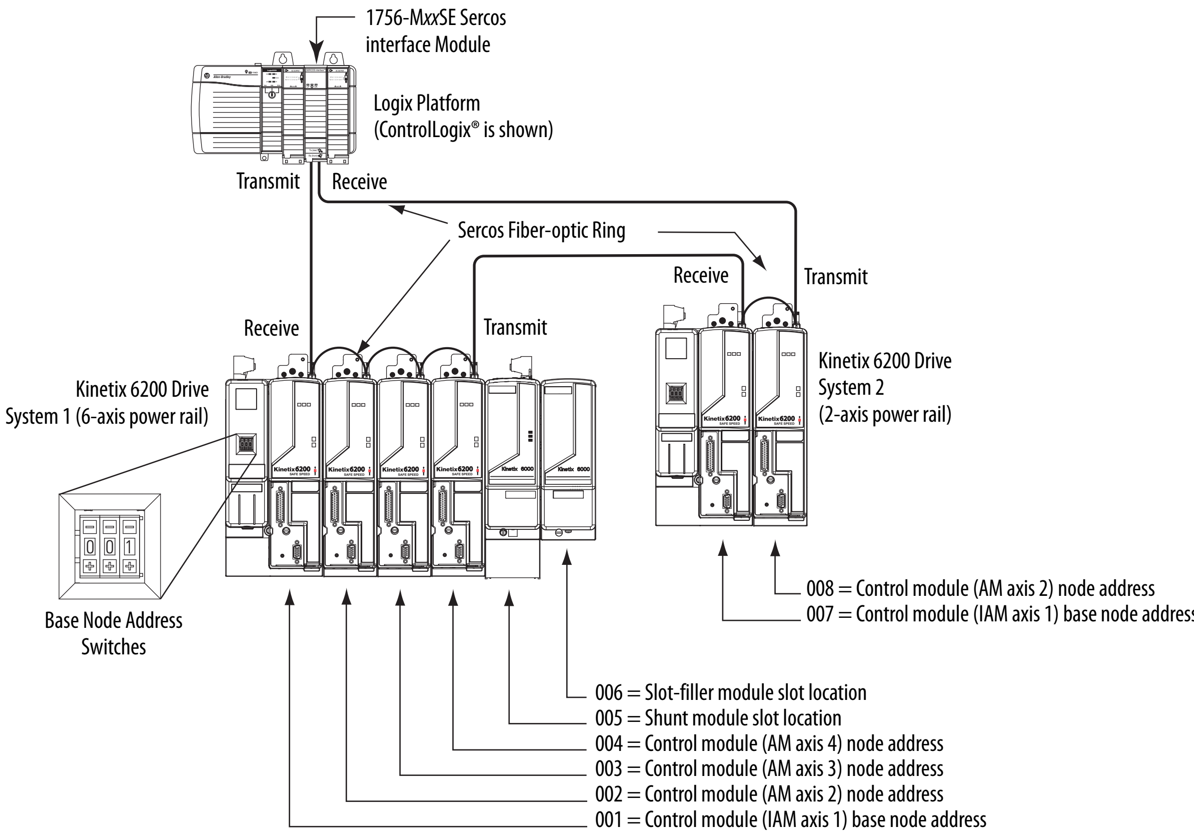
Power Setting (1)	Plastic (2)	Glass (3)
Low	≤ 15 m (49.2 ft)	≤ 100 m (382 ft)
High	> 15 m (49.2 ft)	> 100 m (382 ft)

(1) Other factors include attenuation caused by the use of bulkhead connectors and cable bending.
(2) Catalog numbers 2090-SC*x*P.
(3) Catalog numbers 2090-SCVG.



5. Repeat step 4 for each 2094-BM*xx*-M axis module with 2094-SE02F-M00-S*x* control module.

Figure 86 - Node Addressing Example 1



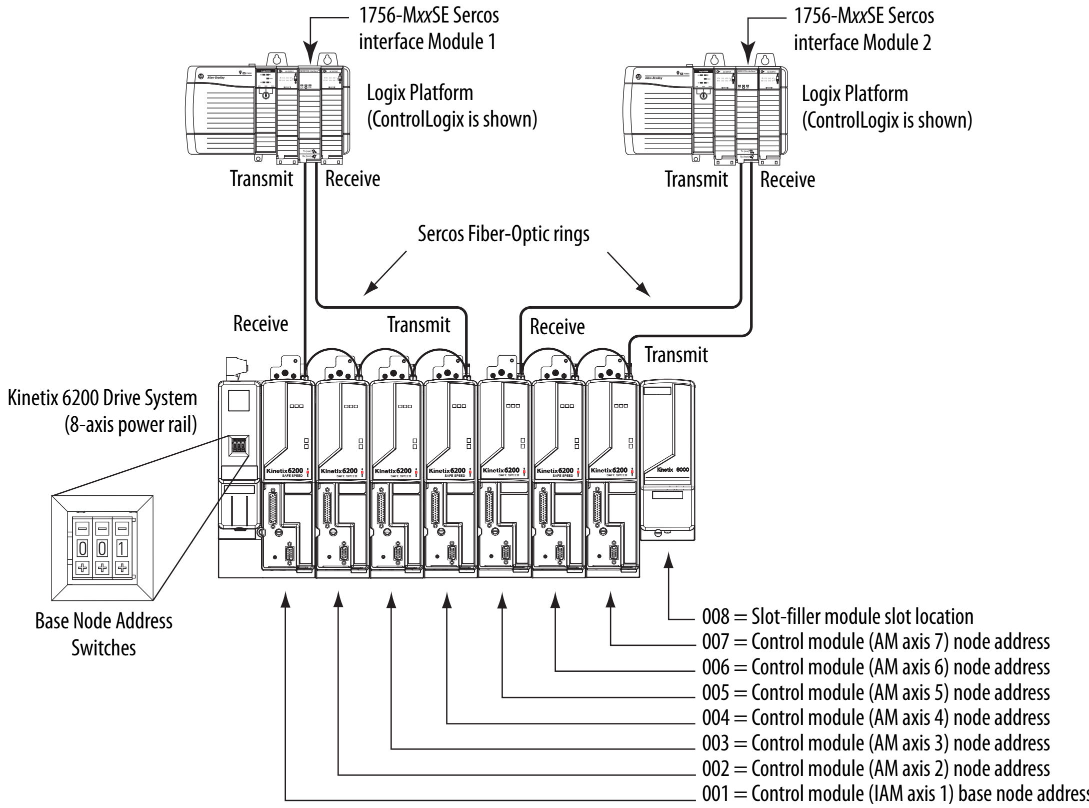
In Example 1, the Kinetix 6200 (6-axis) drive system 1 power rail contains four control modules, one shunt module, and one slot-filler module. The shunt module and slot-filler modules are not assigned a sercos node address, but the system identifies them with a slot location.

Kinetix 6200 (2-axis) drive system 2 power rail contains two control modules. The base node address of the (system 2) control module must be set for an address of ≥007.

IMPORTANT	The node address for each AM (control) module is determined by the base node-address switch setting on the IAM power module. Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Figure 87 - Node Addressing Example 2



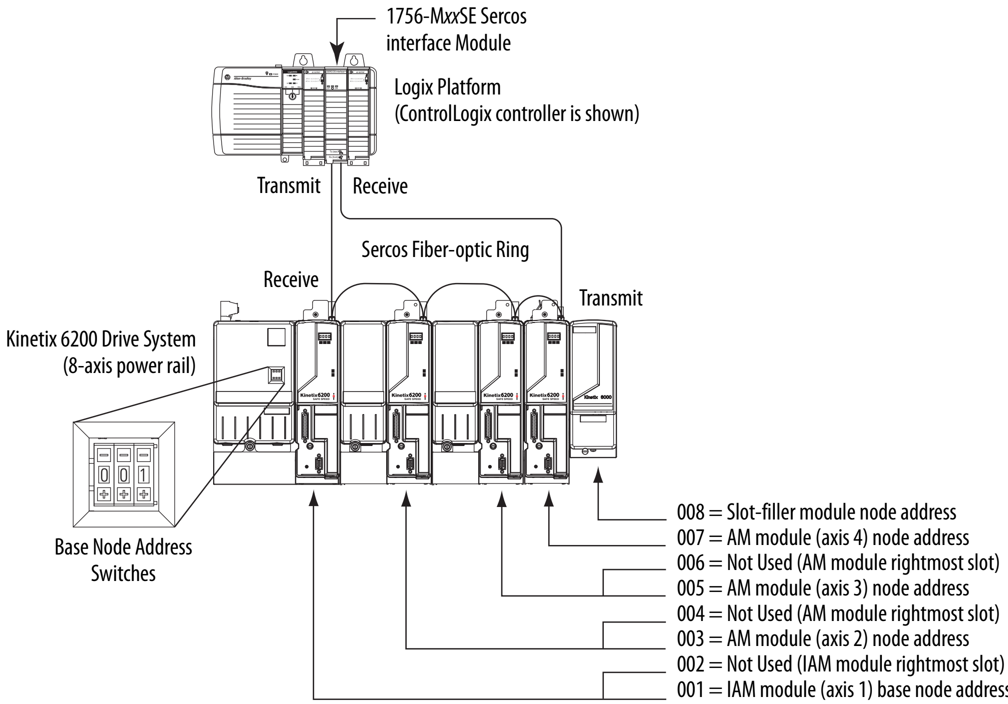
In this example, sercos interface module 1 controls axes 1…4 and module 2 controls axes 5…7. The slot-filler module is not assigned a sercos node address, but the system identifies it with a slot location.

You can mount the two sercos interface modules in two separate ControlLogix chassis (as shown) or you can mount them in the same chassis.

IMPORTANT	The node address for each AM (control) module is determined by the base node-address switch setting on the IAM power module. Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Figure 88 - Node Addressing Example 3



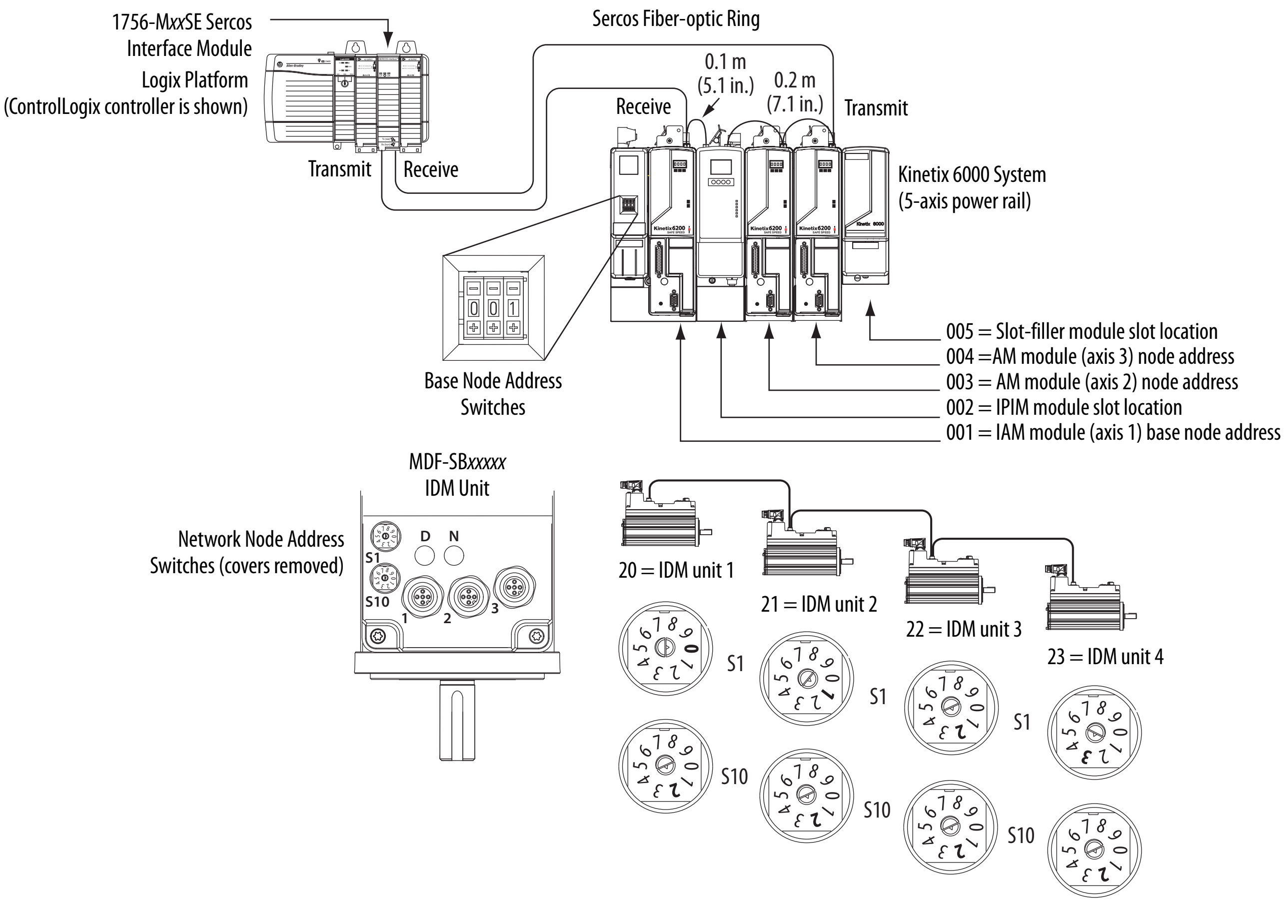
In this example, the Kinetix 6200 (8-axis) power rail contains a double-wide IAM module, two double-wide AM modules, one single-wide AM module, and one slot-filler module. The slot-filler module is not assigned a sercos node address, but the system identifies it with a slot location.

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.

IMPORTANT	The node address for each AM (control) module is determined by the base node-address switch setting on the IAM power module. Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Figure 89 - Node Address Example 4



In this example, the Kinetix 6200 (5-axis) power rail contains two single-wide axis modules and one IDM system. Neither the slot-filler or IPIM module is assigned a sercos node address, but the system identifies them with a slot location.

Node addressing on the power rail is no different than the previous examples. Node address 002 and 005 are available for any of the IDM units, but to avoid confusion, the node addressing for the IDM units was started at 20. Unlike the axis modules, each IDM unit has switches that determine its node address. In this example, the IDM unit node addressing is sequential, but it doesn't have to be.

IMPORTANT	Creating a duplicate node address between the axis modules mounted on the power rail and the IDM system (in the same sercos ring) generates error code NODE FLT 133. Each node address on the sercos ring must be unique within the range of 001…099. Axes on the same power rail as the IPIM module do not have to be in the same sercos ring as the IDM units.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail. However, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Configure the Logix5000 Sercos interface Module

This procedure assumes that you have wired your Kinetix 6200 system and have configured the communication rate and optical power switches.

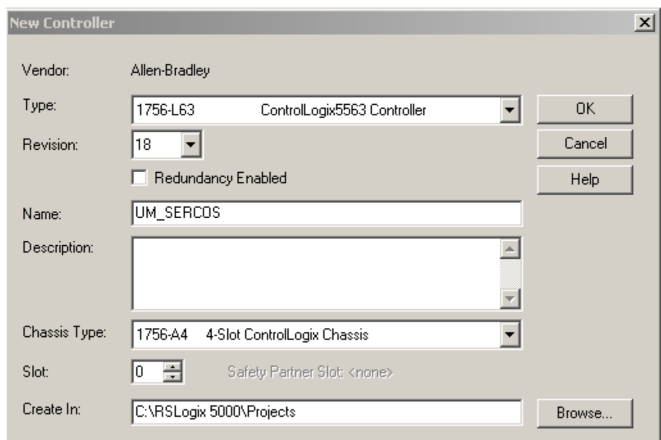
For help with using the Logix Designer application as it applies to configuring the ControlLogix, CompactLogix™, or SoftLogix™ sercos modules, refer to Additional Resources on page 12.

Configure the Logix5000 Controller

Follow these steps to configure the Logix5000 controller.

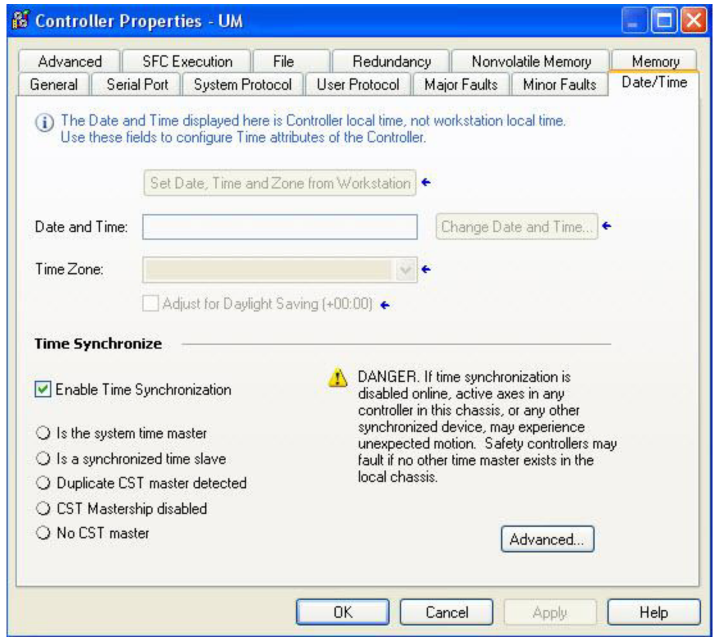
1. Apply power to your Logix5000 chassis containing the sercos interface module/PCI card and open your Logix Designer application.
2. From the File menu, choose New.

   The New Controller dialog box opens.



3. Configure the new 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. Enter the Logix5000 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 Logix5000 chassis as the Grandmaster clock.

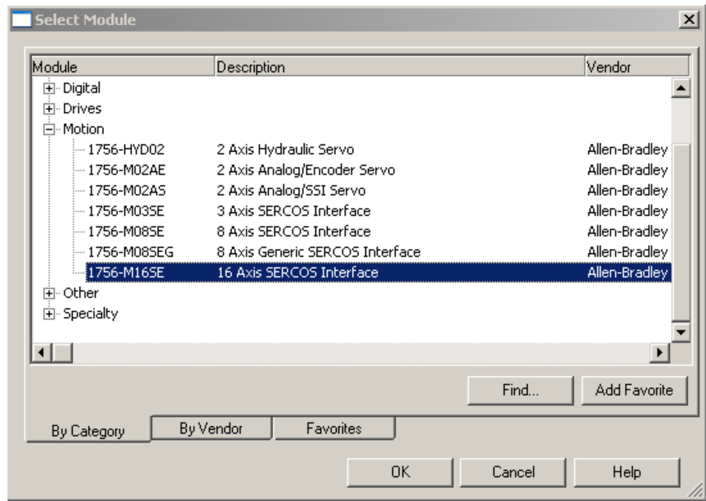
8. Click OK.

Configure the Logix5000 Module

Follow these steps to configure the Logix5000 module.

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

   The Select Module dialog box opens.

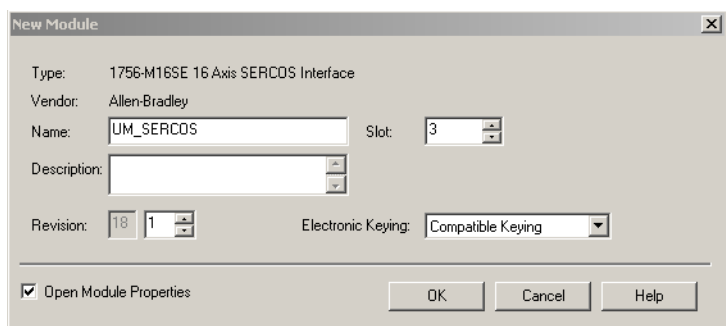


2. Expand the Motion category and select 1756-M*xx*SE, 1756-L60M03SE, 1768-M04SE, or 1784-PM16SE as appropriate for your actual hardware configuration.

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

3. Click OK.

   The New Module dialog box opens.



4. Configure the new module.

   a. Type the module Name.

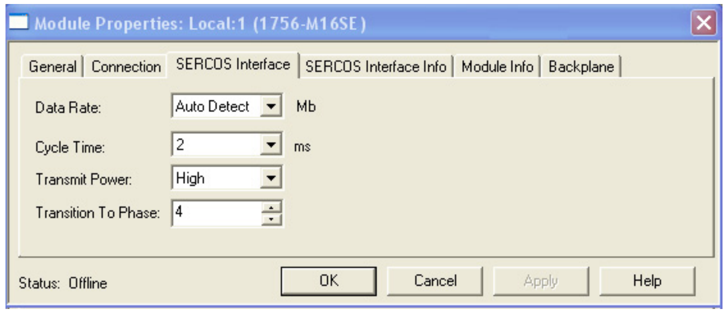
   b. Enter the Logix5000 sercos module slot (leftmost slot = 0).

   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.



Logix5000 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 switch 1 (communication rate), as set on the control module, or choose the Auto Detect setting.

8. From the Cycle Time pull-down menu, choose the Cycle Time according to the table below.

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 (1)	Up to 4	0.5 ms
	Up to 8	1 ms
	Up to 16	2 ms

(1) The Kinetix 6000M IDM system supports only 8 Mbps and is hardwired for this setting.

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

9. From the Transmit Power pull-down menu, choose High.

   The default setting is High, however this setting is dependent on the cable length (distance to next receiver) and cable type (glass or plastic).

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.

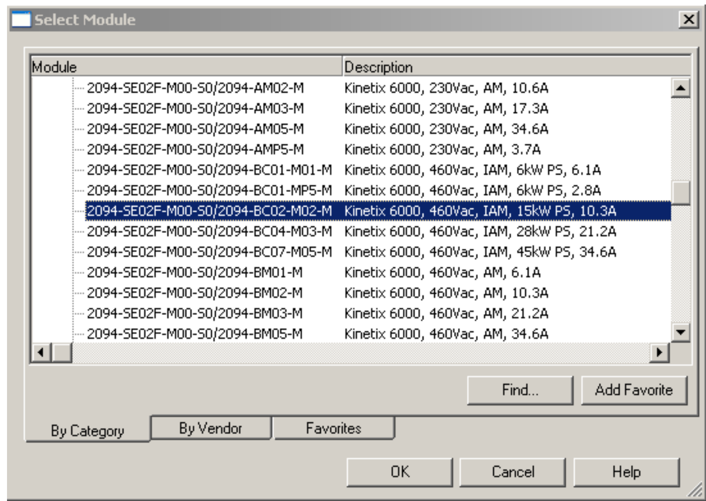
12. Repeat step 1 through step 11 for each Logix5000 module.

Configure the Kinetix 6200 Drive Modules

Follow these steps to configure the Kinetix 6200 drive modules.

1. Right-click the Logix5000 module you just created and choose New Module.

   The Select Module dialog box opens.



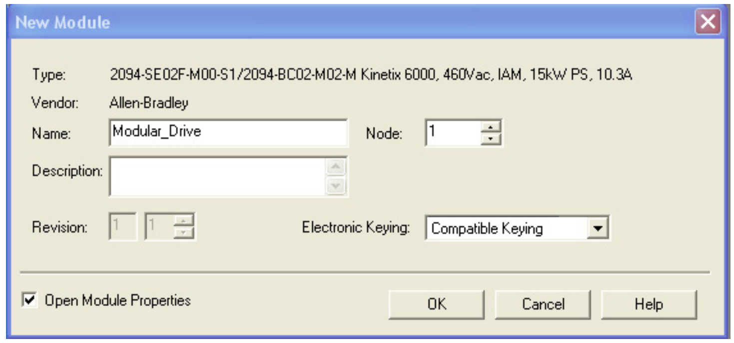
2. Expand the Drives category and select drive components appropriate for your actual hardware configuration.

IMPORTANT	To configure Kinetix 6200 drive modules (catalog numbers 2094-SE02F-M00-S*x*, 2094-BC*xx*-M*xx*-M, and 2094-BM*xx*-M) you must be using the Logix Designer application or RSLogix 5000® software, version 17.00 or later. To configure Kinetix 6000M IDM units (catalog numbers MDF-SB*xxxxx*) you must be using the Logix Designer application or RSLogix 5000 software, version 20.01 or later.

   For Kinetix 6200 drive modules, selection is based on your control module and power module combination. In this example, the 2094-SE02F-M00-S1 control module and 2094-BC02-M02-M IAM power module are selected.

3. Click OK.

The New Module dialog box opens.



4. Configure the new module.

   a. Type the module Name.

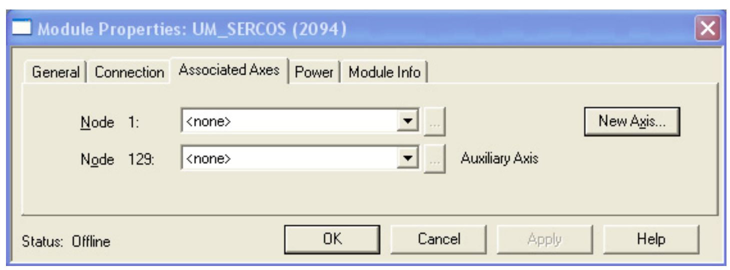
   b. Enter the Node address.

   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 142.

   c. Check Open Module Properties.

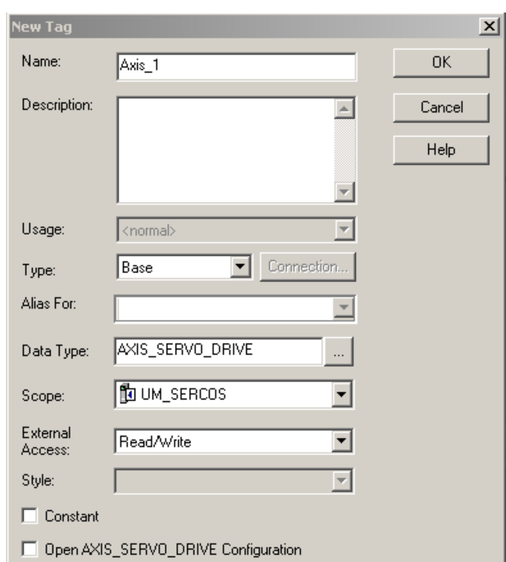
5. Click OK.

6. Click the Associated Axes tab.



7. Click New Axis.

   The New Tag dialog box opens.



8. Type the axis Name.

   AXIS_SERVO_DRIVE is the default Data Type.

9. Click OK.

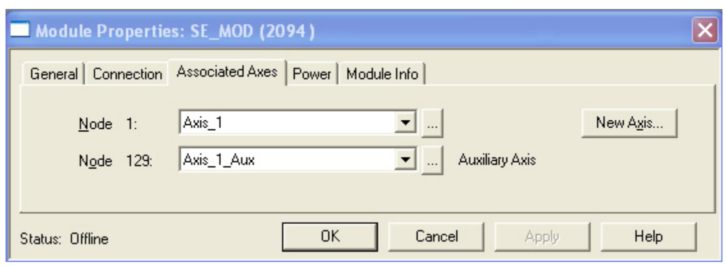
   The axis appears under the Ungrouped Axes folder in the Controller Organizer.

10. Assign your axis to Node 1.

11. Click Apply.

TIP It is possible to configure the Auxiliary Axis feedback port as a Feedback Only axis. With this feature, you can configure each drive module to appear as two axes/nodes on the sercos ring. The base node is the servo axis using the motor feedback, and the base node (plus 128) is a feedback-only axis that uses the auxiliary feedback port.

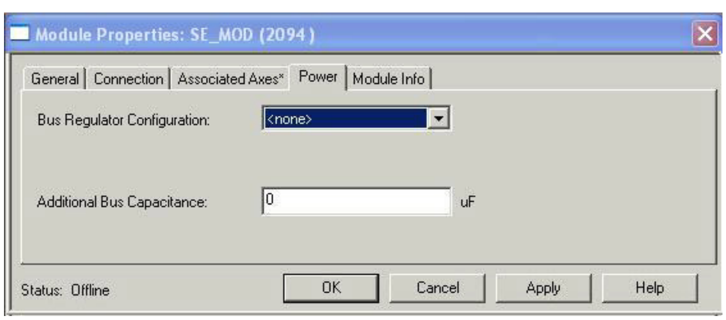
Auxiliary feedback is not supported by the Kinetix 6000M IDM units.



The Auxiliary Axis (Node 129) is configured identical to Node 1 by clicking New Axis and creating a new tag.

12. Click Apply if you made changes.

13. Click the Power tab.



14. From the Bus Regulator Catalog Number pull-down menu, choose the shunt option appropriate for your actual hardware configuration.

If your IAM power module is	And your hardware configuration includes this shunt option	Then choose
Configured as an IAM module or common-bus leader IAM module (1)	Internal shunt resistors only	Internal or <none>
	Bulletin 2094 (rail mounted) shunt module (3)	2094-BSP2
	Bulletin 1394 passive shunt module (connected to the 2094-BSP2 shunt module)	1394-SR*xxxx*
	External active shunt module	Internal or <none>
Configured as a common-bus follower IAM module (2)	N/A. Shunts are disabled on follower IAM module	CommonBus Follow

(1) Drive does not accept Internal, <none>, 2094-BSP2, or 1394-SR*xxxx* selection if DC bus voltage is present without having three-phase power applied.

(2) Drive does not accept CommonBus Follow selection if three-phase power or DC bus power is applied.

(3) To use the 2094-BSP2 shunt module with 2094-BC*xx*-M*xx*-M power modules, you must be using Motion Database 5.12.1 or later. Contact Rockwell Automation Technical Support for more information.

To avoid damage to your Bulletin 1394 external shunt module when wired to the 2094-BSP2 shunt module, verify that the proper 460V fuse is installed prior to applying power.

Refer to Kinetix Motion Accessories Specifications Technical Data, publication KNX-TD004, for more information.

IMPORTANT When configured to use the Bulletin 1394 or 2094 shunt modules, the IAM bus regulator capacity attribute displays the utilization of total shunt power available (as a percent) based on the power rail configuration.

Refer to Kinetix Motion Accessories Specifications Technical Data, publication KNX-TD004, for shunt power specification and examples.

15. Calculate additional bus capacitance, if this applies to your application, and enter the value here (version 20.00 or later), or refer to Appendix F on page 307 to set the Add Bus Cap parameter.

The Additional Bus Capacitance field applies only to the IAM power module.

IMPORTANT DC common-bus applications must calculate Total Bus Capacitance and Additional Bus Capacitance and set the Add Bus Cap parameter in the leader IAM power module. However, you can set the parameter as shown in step 15 or by using the Logix Designer application, as shown in Appendix F.

Refer to Appendix C beginning on page 267, for more information on making the calculations. Refer to Appendix F beginning on page 307, for more information on setting the Add Bus Cap parameter.

16. Click OK.

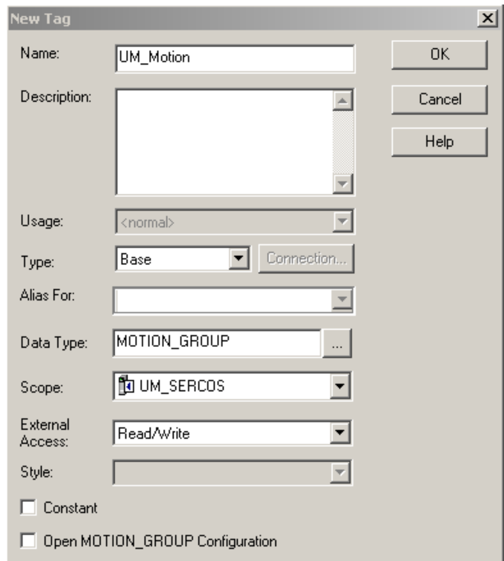
17. Repeat step 1 through step 10 for each Bulletin 2094 AM power module and control module combination, and each IDM unit.

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 box opens.

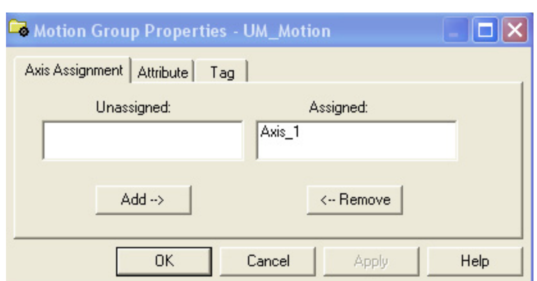


2. Type the new motion group Name.
3. Click OK.

   The new motion group appears under the Motion Groups folder.

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

   The Motion Group Properties dialog box opens.



5. Click the Axis Assignment tab and move your axes (created earlier) from Unassigned to Assigned.
6. Click the Attribute tab and edit the default values as appropriate for your application.
7. Click OK.

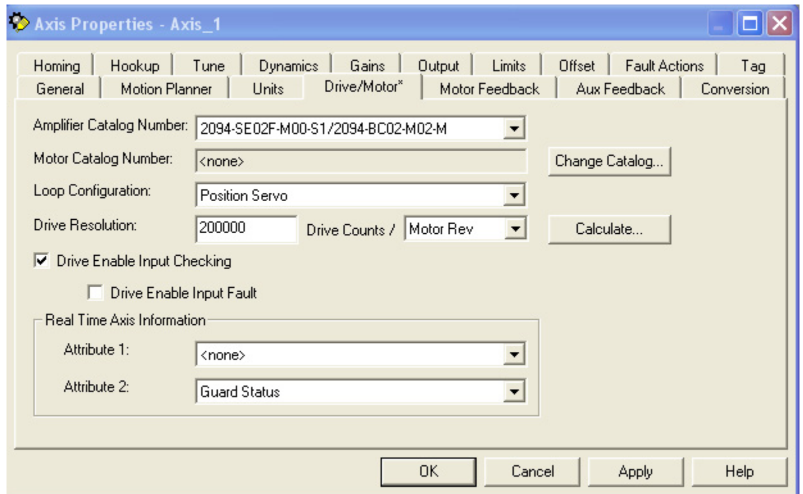
Configure Axis Properties

Follow these steps to configure Axis properties for motor feedback.

1. Right-click an axis in the Controller Organizer and choose Properties.

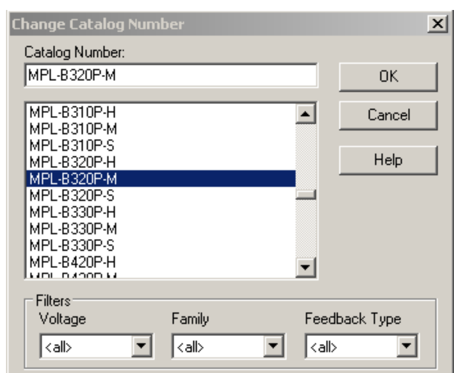
   The Axis Properties dialog box opens.

2. Click the Drive/Motor tab.



3. Click Change Catalog.

   The Change Catalog Number dialog box opens.



4. Select the motor catalog number appropriate for your application.

   To verify the motor catalog number, refer to the motor name plate.

5. Click OK.

6. On the Drive/Motor tab, check Drive Enable Input Checking.

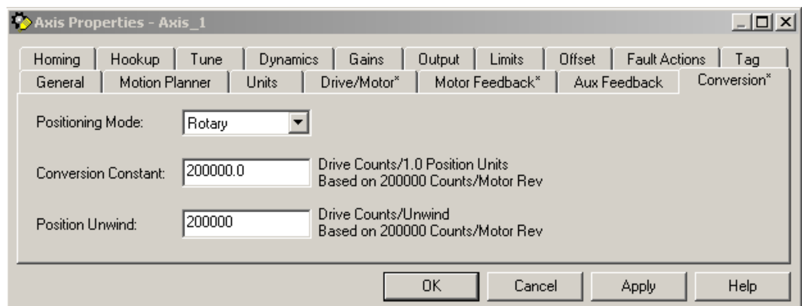
   When checked (default), means a hard drive-enable input signal is required. Uncheck to remove that requirement.

7. Click Apply.

8. Click the Motor Feedback tab and verify the Feedback Type shown is appropriate for your actual hardware configuration.

9. Click the Units tab and edit default values as appropriate for your application.

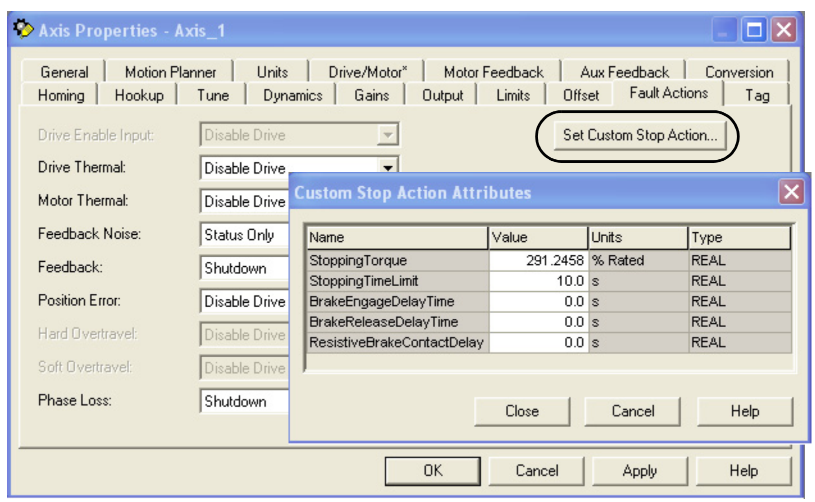
10. Click the Conversion tab and edit default values as appropriate for your application.



In this example, Rotary is chosen from the Positioning Mode pull-down menu.

11. Click Apply if you made changes.

12. Click the Fault Actions tab.



13. Click Set Custom Stop Action.

    The Custom Stop Action Attributes dialog box opens and lets you set delay times for servo motors and RBM modules.

14. 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).

    TIP For recommended motor brake response times, refer to the Kinetix Rotary Motion Specifications Technical Data, publication GMC-TD001.
    The recommended delay time for 2090-XB33-*xx* and 2090-XB120-*xx* RBM modules is 71 ms.

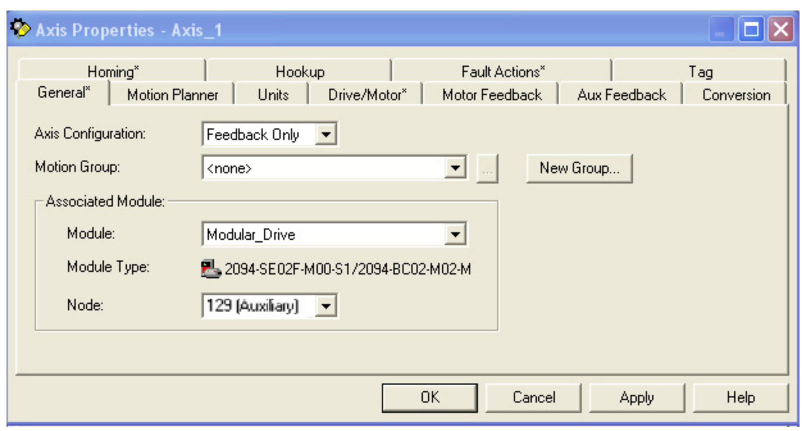
    d. Click Close to close the Custom Stop Action Attributes dialog box.
15. Click Apply.
16. Repeat step 1 through step 15 for each Bulletin 2094 AM power module and control module combination.

Follow these steps to configure Auxiliary Axis properties.

IMPORTANT	Auxiliary feedback is not supported by the Kinetix 6000M IDM units.

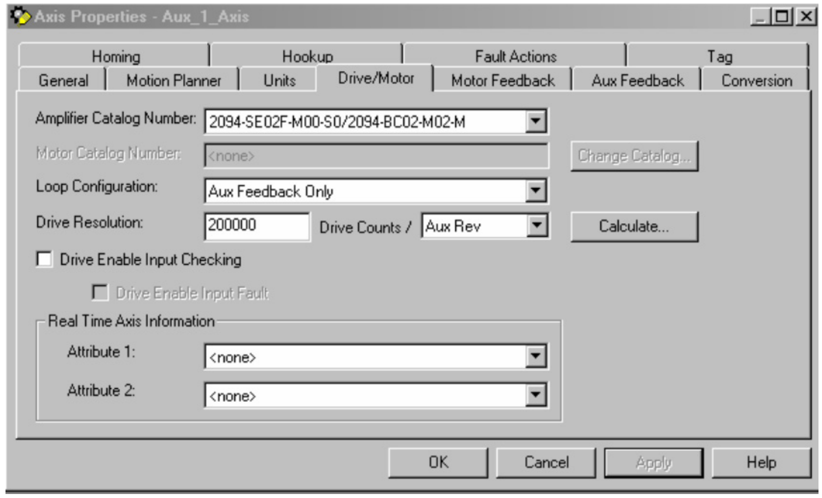
1. Right-click an auxiliary axis in the Controller Organizer and choose Properties.

   The Axis Properties dialog box opens on the General tab.
2. 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.

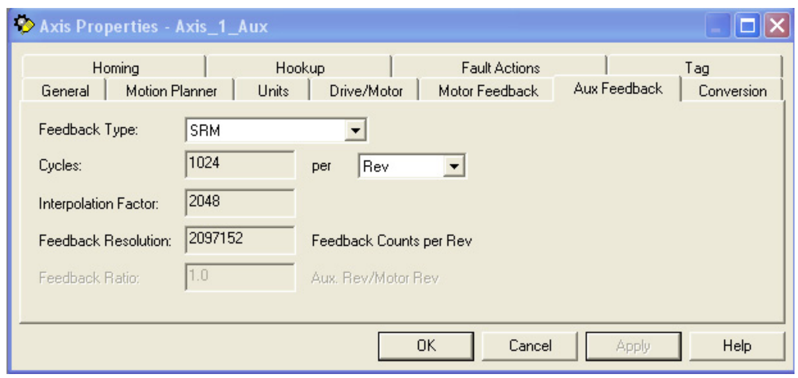


3. Click the Drive/Motor tab.

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.



4. 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.

5. From the Feedback Type pull-down menu, choose the feedback type appropriate for your auxiliary feedback motor.
6. Click OK.
7. Verify your Logix5000 program and save the file.

Download the Program

After completing the Logix5000 configuration you must download your program to the Logix5000 processor.

Apply Power to the Kinetix 6200 Drive

This procedure assumes that you have wired and configured your Kinetix 6200 system (with or without the LIM module) and your sercos interface module.

ATTENTION: Capacitors on the DC bus can 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.

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

Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for connector locations and when troubleshooting the IPIM module and IDM unit status indicators.

Follow these steps to apply power to the Kinetix 6200 drive system.

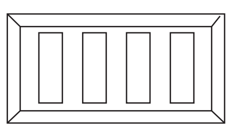
1. Disconnect the load to the motor.

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.

2. Determine your source of control power.

If Your Control Power	Then
Is sourced from a LIM module	1. Verify that CB1, CB2, and CB3 are in the OFF position. 2. Apply three-phase input power to the LIM module VAC Line connector. 3. Set CB3 to the ON position. 4. Set CB2 to the ON position. 5. Go to main step 3.
Is not sourced from a LIM module	1. Apply (95…264V AC) control power to the IAM module (CPD connector). 2. Go to main step 3.

3. Observe the control module four-character status indicator.



Four-character Status Indicator

The four-character status indicator displays several messages, for example BOOT, INIT, and LOAD, while the control module powers-up.

If the Four-character Status Display is (1)	Then
ON	Go to step 4.
Not ON	1. Check your control power connections. 2. Go back to main step 2.

(1) If your 2094 drive system includes a Kinetix 6000M IDM system, observe the drive status indicator and verify that it is on.

4. Determine your source of three-phase input power.

If Your Three-phase Power	Then
Is sourced from a LIM module	1. Set CB1 to the ON position. 2. Verify the Hardware Enable Input signal for each axis is at 0 volts. (1) 3. Go to main step 5.
Is not sourced from a LIM module	1. Apply 324…528V AC (460V) input power to the IAM module (IPD connector). 2. Verify the Hardware Enable Input signal for each axis is at 0 volts. (1) 3. Go to main step 5.

(1) The hardware enable input for IDM units is on the IPIM module.

5. Observe the control module four-character status display.

   The four-character status display scrolls the node address, then cycles through phases until final configuration is reached.

Four-character Status Indicator	Status	Do This
Scrolling CP-0	The drive is looking for a closed sercos ring (phase 0). Wait for CONFIGURING or take corrective action.	Check fiber-optic connections.
Scrolling CP-1	The drive is looking for active nodes (phase 1). Wait for CONFIGURING or take corrective action.	Check node addressing.
Scrolling CP-2	The drive is configuring nodes for communication (phase 2). Wait for CONFIGURING or take corrective action.	Check program motor and drive configuration against installed hardware.
Scrolling C O N F I G U R I N G	The drive is configuring device specific parameters (phase 3). When phase 4 is reached the drive displays the drive state.	Check motor catalog number against selection. (1)
Scrolling drive state (for example S H U T D O W N or S T O P P E D)	The drive is configured and active (phase 4).	Go to step 6.
Scrolling error code message	Drive is faulted.	Go to Fault Codes on page 200.

(1) You can get diagnostic information from the module by highlighting the module name in the Logix Designer application. A Pseudo Key Failure often indicates that the motor selection does not match the motor installed.

6. Observe the status indicators on the front of the control module.

   Refer to troubleshooting tables for the Drive, Comm, and Bus status indicators in Control Module Status Indicators on page 210. Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for IPIM module and IDM unit status indicator troubleshooting tables.

7. Observe the three sercos indicators on the Logix5000 sercos module.

Three Sercos Indicators	Status	Do This
Flashing green and red	Establishing communication	Wait for steady green on all three indicators.
Steady green	Communication ready	Go to Test and Tune the Axes on page 163.
Not flashing green and red/ not steady green	Sercos module is faulted	Go to the appropriate Logix5000 manual for specific instructions and troubleshooting.

Test and Tune the Axes

These procedures assume that you have configured your Kinetix 6200 drive, your Logix5000 sercos interface module, and applied power to the system.

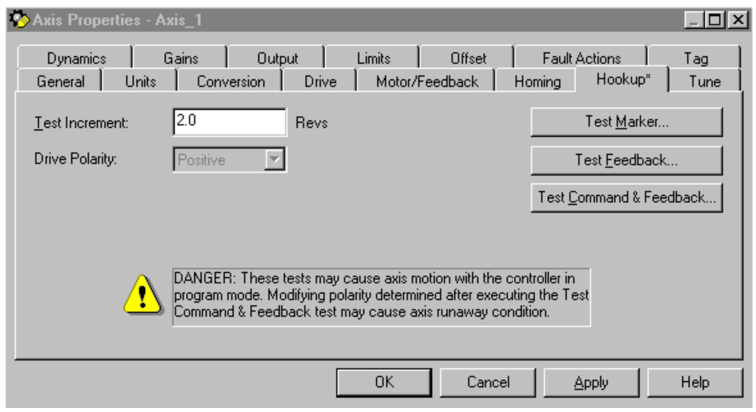
For help with using the Logix Designer application, as it applies to testing and tuning your axes with ControlLogix, CompactLogix, or SoftLogix sercos modules, refer to Additional Resources on page 12.

Test the Axes

Follow these steps to test the axes.

1. Verify the load was removed from each axis.
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 (1)	Verifies marker detection capability as you rotate the motor shaft.
Test Feedback (1)	Verifies feedback connections are wired correctly as you rotate the motor shaft. Also, lets you define polarity.
Test Command & Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate. Also, lets you define polarity.

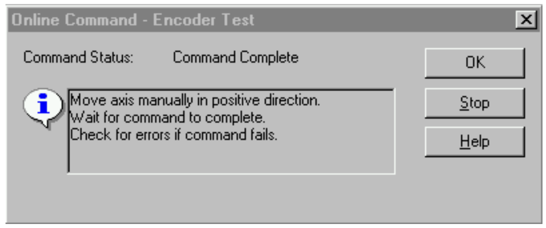
(1) If testing motor with brake, energize the brake circuit to release the brake prior to test.

5. Apply Hardware Enable Input signal for the axis you are testing.

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

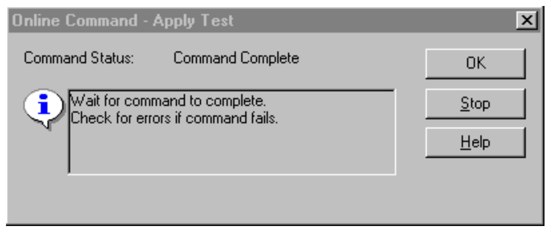
6. Click the desired test (Marker/Feedback/Command & Feedback) to verify connections.

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

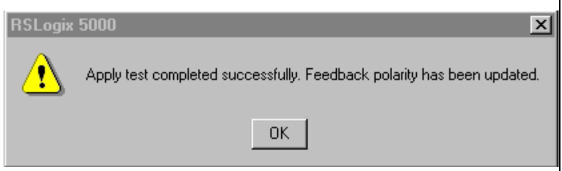
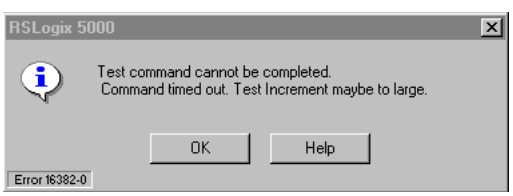


7. Click OK.

   The Online Command - Apply Test dialog box 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.

<table>
<tr><th>If</th><th>Then</th></tr>
<tr><td>Your test completes successfully, this dialog box opens.

</td><td>1. Click OK.
2. Remove Hardware Enable Input signal.
3. Go to Tune the Axes on page 165.</td></tr>
<tr><td>Your test failed, this dialog box opens.

</td><td>1. Click OK.
2. Verify the Bus status indicator turned solid green during the test.
3. Verify that the Hardware Enable Input signal 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.</td></tr>
</table>

Tune the Axes

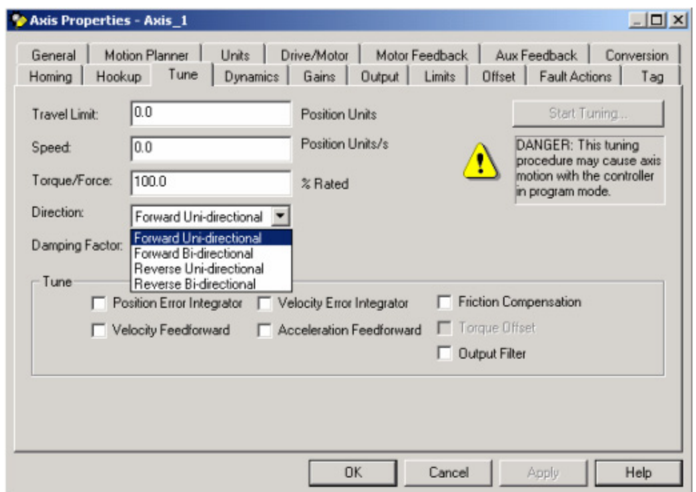
The load observer feature (available with drive firmware revision 1.049 or later) can provide good performance without having to tune your axis. Using load observer with auto-tuned gains can maximize system performance. Refer to Appendix D beginning on page 271 for more load observer information.

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 re-attach the load and perform the tuning procedure again to provide an accurate operational response.

2. Click the Tune tab.



3. Type 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.

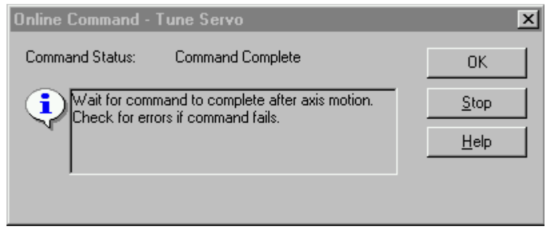
5. Check Tune boxes as appropriate for your application.

6. Apply Hardware Enable Input signal for the axis you are tuning.

> **ATTENTION:** To avoid personal injury or damage to equipment, apply 24V ENABLE signal only to the axis you are tuning.

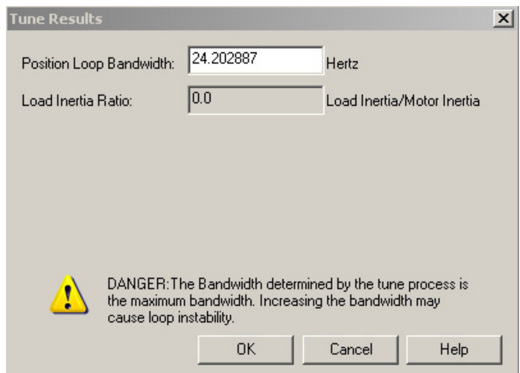
7. Click Start Tuning to auto-tune your axis.

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



8. Click OK.

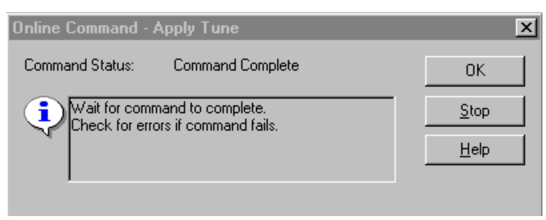
The Tune Bandwidth dialog box opens.



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

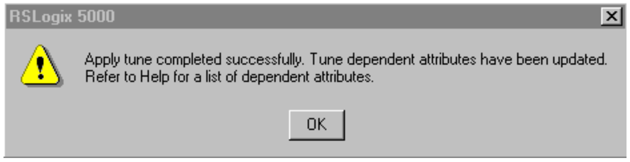
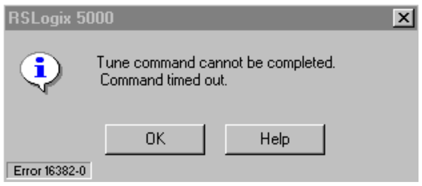
9. Record your bandwidth data for future reference.
10. Click OK.

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 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 the appropriate Logix5000 motion module user manual for more information. 4. Return to step 7 and run the test again.

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

Notes:

Configure and Start the Kinetix 6500 Drive System

This chapter provides procedures for configuring your Kinetix 6500 system components with your ControlLogix® EtherNet/IP module.

TIP Before you begin make sure you know the catalog number for each drive component, the Logix module, and the servo motor/actuator in your motion control application.

Configure the Drive Modules

Follow these steps to configure the node address of your IAM power module. This setting establishes the node address for each control module installed on the Bulletin 2094 power rail.

1. Verify that there is no power applied to the IAM and AM power modules and that the communication cables are plugged into the appropriate connectors.

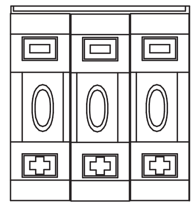
   To verify communication, refer to Ethernet Cable Connections on page 136.

To Configure	Begin With
The IAM module	step 2
Any control module	step 4

2. Set the base node address for the IAM power module by setting the Node Address switches.

   Valid node addresses for EtherNet/IP network communication are 001…254. The left switch sets the most significant digit (MSD) and the right switch sets the least significant digit (LSD).

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



   Setting the base node address on the IAM power module determines the node address for the control module mounted on the IAM (inverter) module. Node addressing for all slot locations on the same power rail increment (from the IAM inverter) left to right. The Kinetix 6500 drives have a private network address of http://192.168.1.*x*, although you do not have to use it.

   The final octet of the IP address is determined by the IAM base node address. For example, if using the private network and your node address switches are set to 001, the IP address is http://192.168.1.1. If your base node address switches are set to 002, the IP address is http://192.168.1.2, and so on.

3. Cycle control power to initialize the IAM module.

IMPORTANT The base node address setting takes effect only after the IAM power module is initialized.

IMPORTANT When two or more IAM power modules are connected to the same EtherNet/IP module, each node address must be unique.

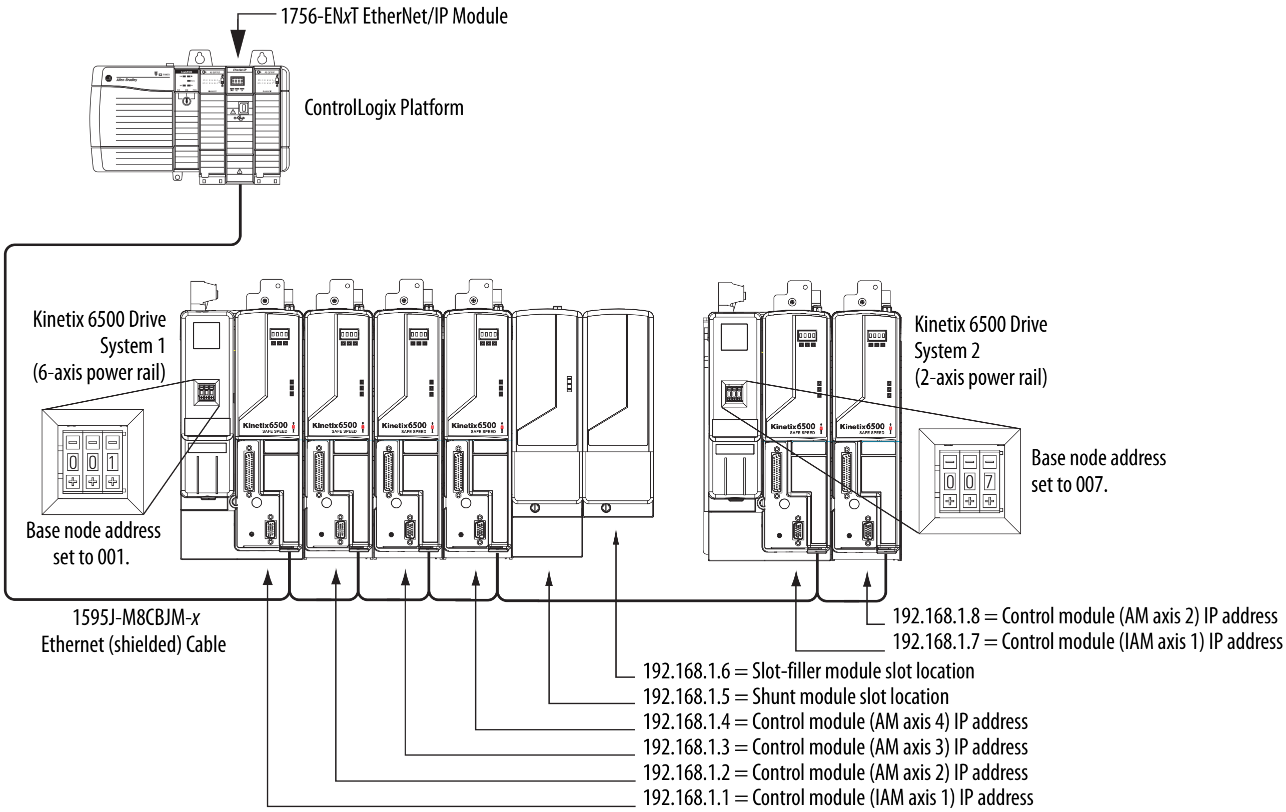
Refer to the node addressing examples beginning on page 171.

TIP To configure the IP address without using the private network, refer to the Rockwell Automation® Knowledgebase (520452).

4. Verify the node address for the IAM and each AM control module.

   The node address scrolls across the four-character display. If your IAM power module base node address is 001, then the node address for the adjacent AM control module is 192.168.1.2, and so on.

Figure 90 - Node Addressing Example 1



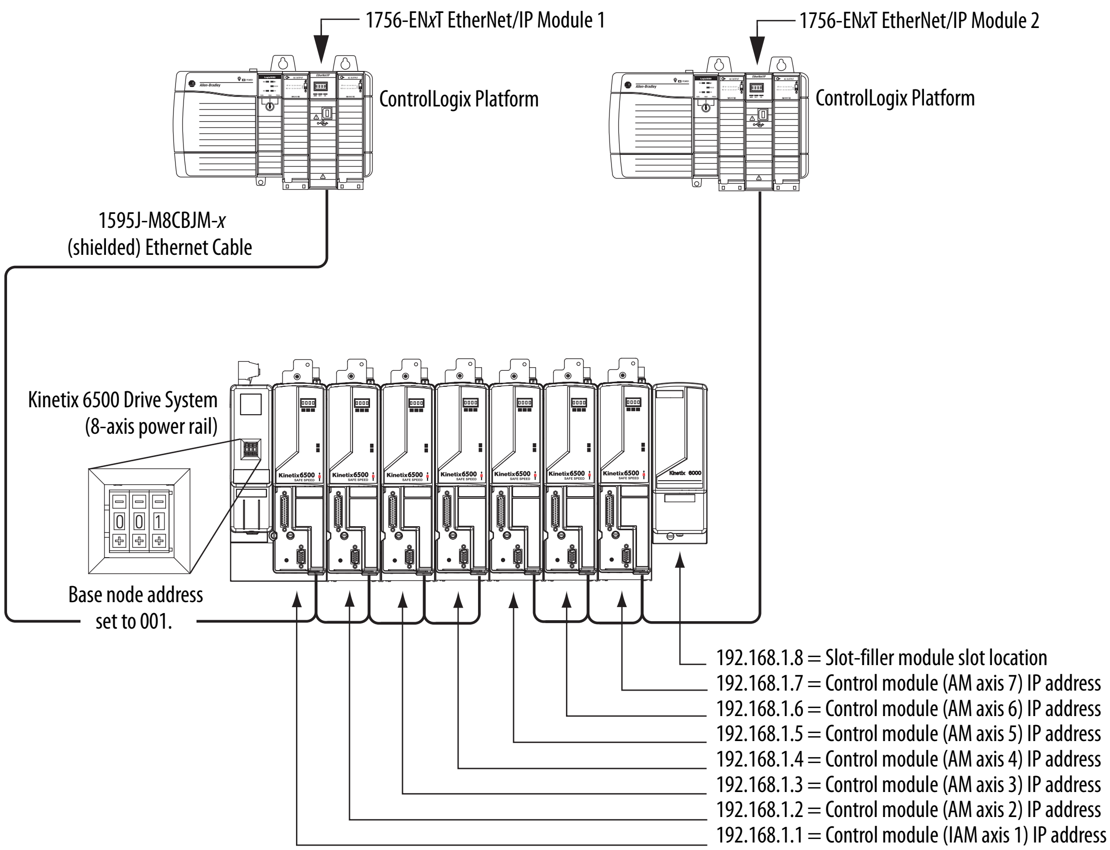
In Example 1, the Kinetix 6500 (6-axis) drive system 1 power rail contains four control modules, one shunt module, and one slot-filler module. The shunt module and slot-filler modules are not assigned a IP address, but the system identifies them with a slot location.

Kinetix 6500 (2-axis) drive system 2 power rail contains two control modules. The base node address of the (system 2) control module must be set for an address of ≥007.

IMPORTANT	The IP address for each AM (control) module is determined by the base-node address switch setting on the IAM power module. Do not position axis modules to the right of shunt or slot-filler modules. The added distance between non-adjacent axes can increase electrical noise and impedance, and requires longer fiber-optic cable lengths.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail; however, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Figure 91 - Node Addressing Example 2



In this example, EtherNet/IP module 1 controls axes 1…4 and module 2 controls axes 5…7. The slot-filler module is not assigned an IP address, but the system identifies it with a slot location.

You can mount the two EtherNet/IP modules in two separate ControlLogix chassis (as shown) or you can mount them in the same chassis.

IMPORTANT	Slot-filler modules must be used to fill any unoccupied slot on the power rail; however, you can replace slot-filler modules with AM power modules or the 2094-BSP2 shunt module (maximum one 2094-BSP2 shunt module per power rail).

Configure the Logix EtherNet/IP Module

This procedure assumes that you have wired your Kinetix 6500 drive system.

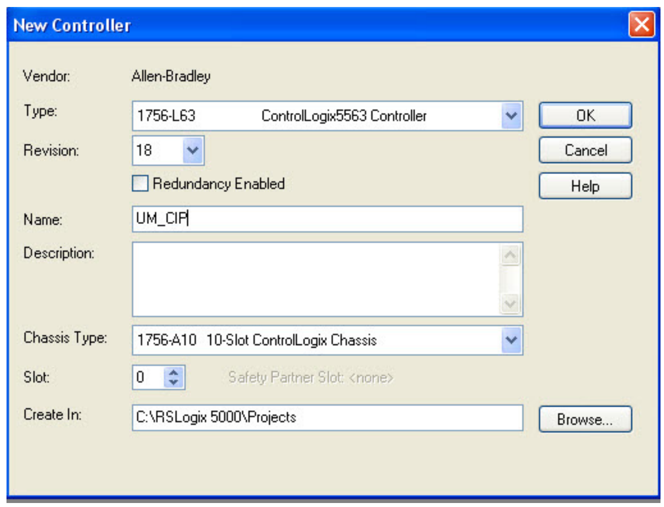
For help using the Logix Designer application as it applies to configuring the ControlLogix EtherNet/IP modules, refer to Additional Resources on page 12.

Configure the Logix Controller

Follow these steps to configure the Logix controller.

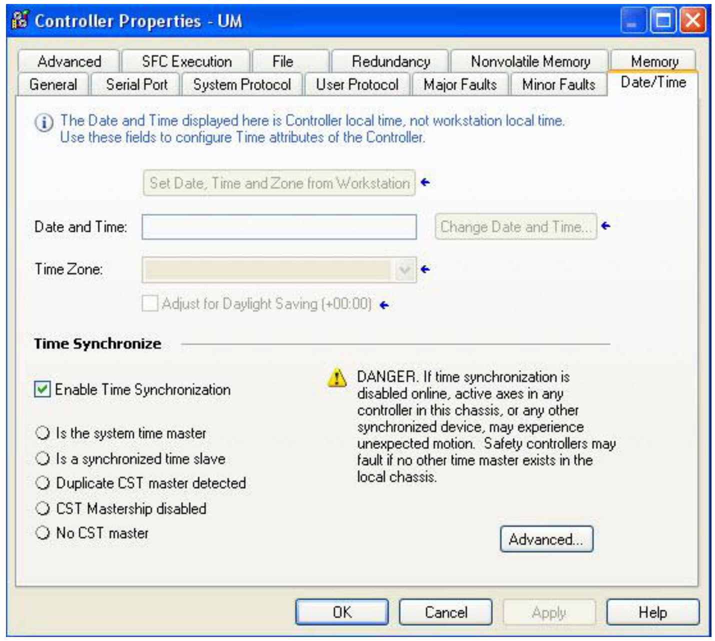
1. Apply power to your Logix chassis containing the EtherNet/IP module and open the Logix Designer application.
2. From the File menu, choose New.

   The New Controller dialog box opens.



3. Configure the new 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. Enter the Logix processor slot (leftmost slot = 0).
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.

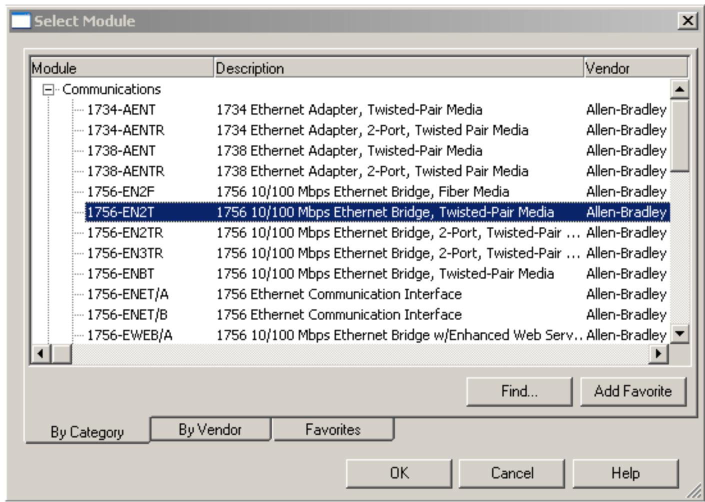
8. Click OK.

Configure the Logix Module

Follow these steps to configure the Logix module.

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

   The Select Module dialog box opens.

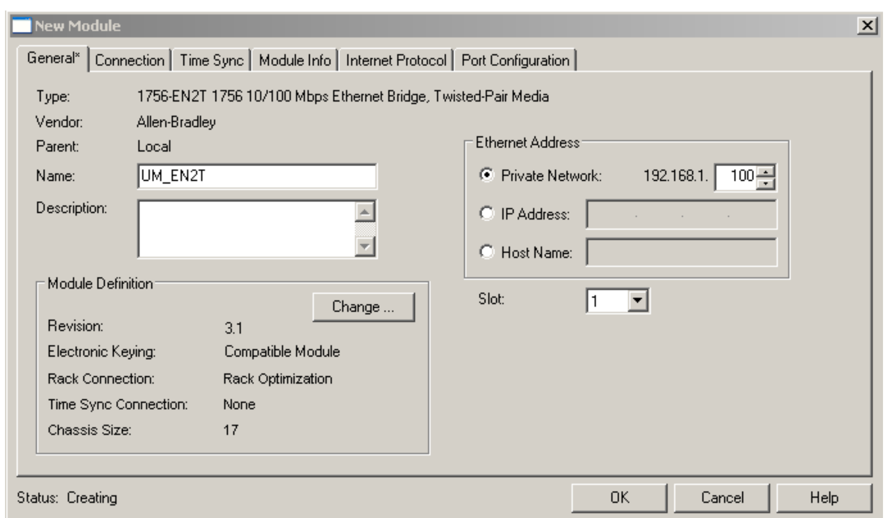


2. Expand the Communications category and select 1756-EN2F, 1756-EN2T, 1756-EN2TR, or 1756-EN3TR as appropriate for your actual hardware configuration.

   In this example, the 1756-EN2T module is selected.

3. Click OK.

   The New Module dialog box opens.



4. Configure the new module.

   a. Type the module Name.

   b. Enter the Logix EtherNet/IP module slot (leftmost slot = 0).

   c. Select an Ethernet Address option.

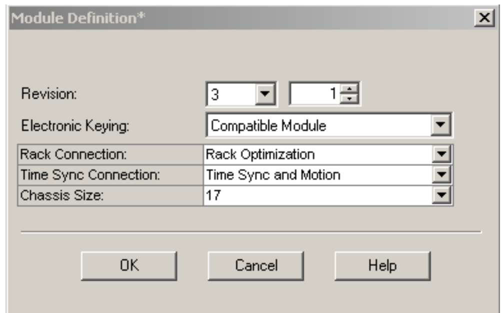
   In this example, the Private Network address is selected.

   d. Enter the address of your EtherNet/IP module.

   In this example, the last octet of the address is 100.

5. Click Change in the Module Definition area.

   The Module Definition dialog box opens.

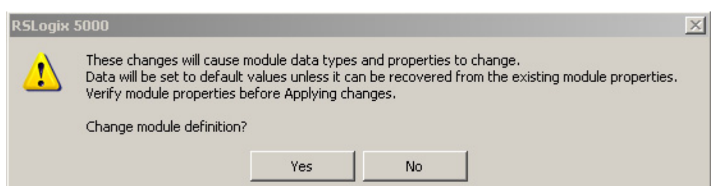


6. From the Time Sync Connection pull-down menu, choose Time Sync and Motion.

IMPORTANT	Time Sync functionality is what enables motion control on an Ethernet network. Without this setting, you won't be able to run your motion application.

7. Click OK to close the Module Definition dialog box.

8. Click Yes when prompted to confirm your module definition changes.



9. Click OK to close the New Module dialog box.

   Your new module appears under the I/O Configuration folder in the Controller Organizer.

10. Repeat step 1 through step 9 for each Logix module.

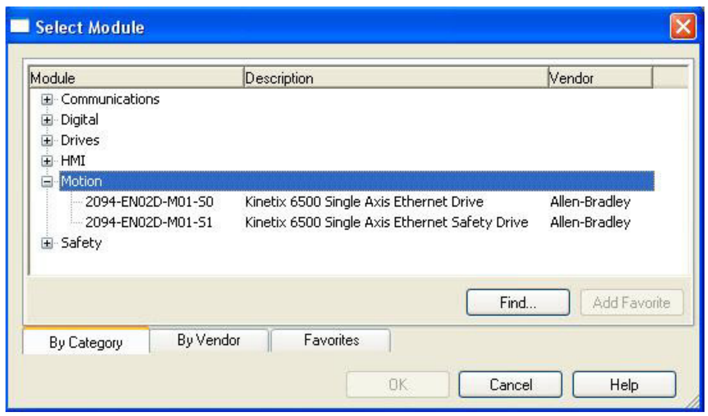
Configure the Kinetix 6500 Drive Modules

IMPORTANT	To configure Kinetix 6500 drive modules (catalog numbers 2094-EN02D-M01-S*x*, 2094-BC*xx*-M*xx*-M, and 2094-BM*xx*-M) you must be using the Logix Designer application or RSLogix 5000® software, version 18 or later.

Follow these steps to configure the Kinetix 6500 drive modules.

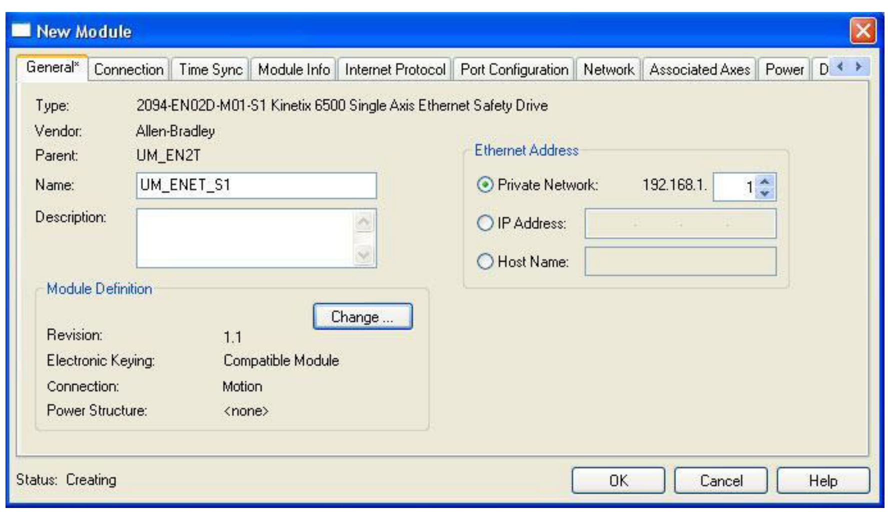
1. Right-click the Logix EtherNet/IP module you just created and choose New Module.

   The Select Module dialog box opens.



2. Expand the Motion category and select your 2094-EN02D-M01-S*x* control module as appropriate for your actual hardware configuration.
3. Click OK.

   The New Module dialog box opens.



4. Configure the new control module.
   a. Type the module Name.
   b. Select an Ethernet Address option.

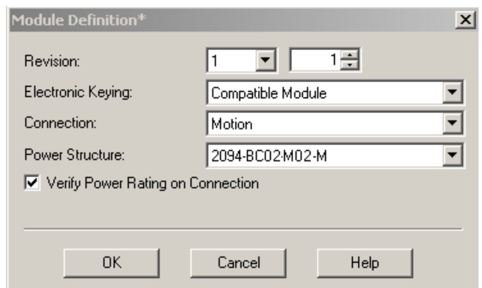
   In this example, the Private Network address is selected.

   TIP To configure the IP address without using the private network, refer to the Rockwell Automation Knowledgebase (520452).

   c. Enter the address of your EtherNet/IP module.

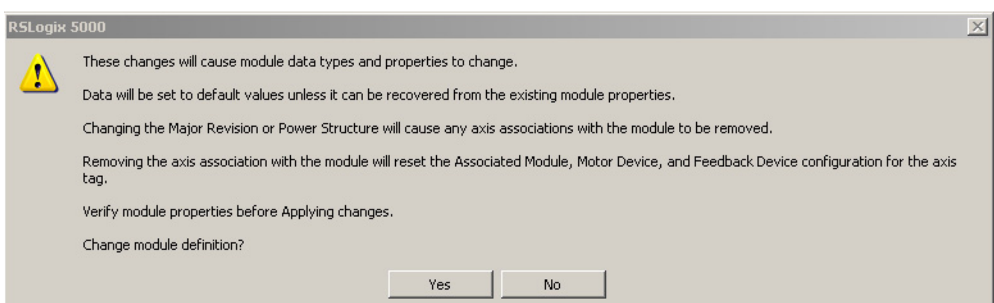
   In this example, the last octet of the address is 1. This must match the base node address of the IAM power module.
5. Click Change in the Module Definition area.

   The Module Definition dialog box opens.



6. From the Power Structure pull-down menu, choose the Bulletin 2094 power module appropriate for your application.

   In the example, the 2094-BC02-M02-M IAM module is chosen.
7. Click OK to close the Module Definition dialog box.
8. Click Yes when prompted to confirm your module definition changes.

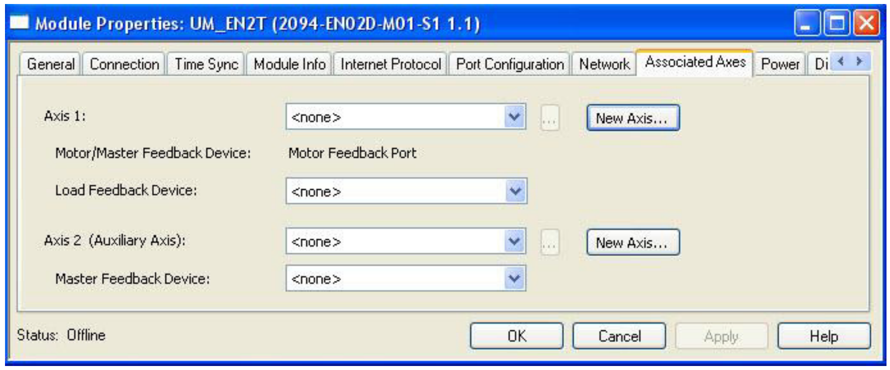


9. Click OK to close the Module Properties dialog box.

   The 2094-EN02D-M01-S1 module appears under the EtherNet/IP module in the I/O Configuration folder.
10. Right-click the 2094-EN02D-M01-S1 module you just created and choose Properties.

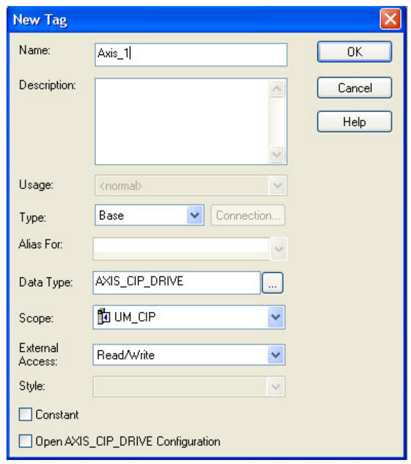
    The Module Properties dialog box opens.

11. Click the Associated Axes tab.



12. Click New Axis.

The New Tag dialog box opens.

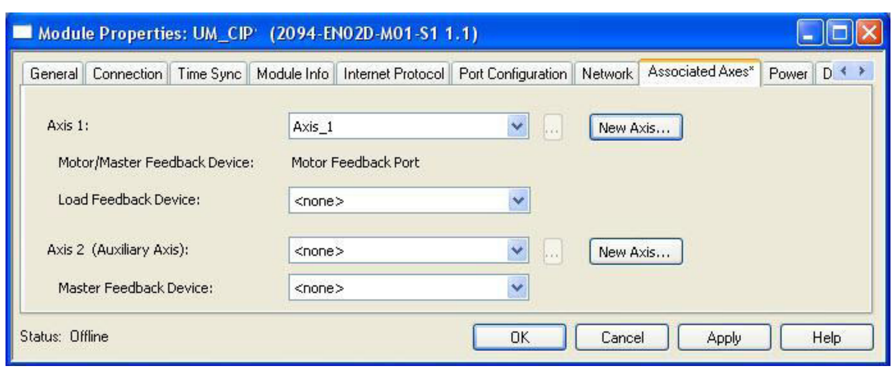


13. Type the axis Name.

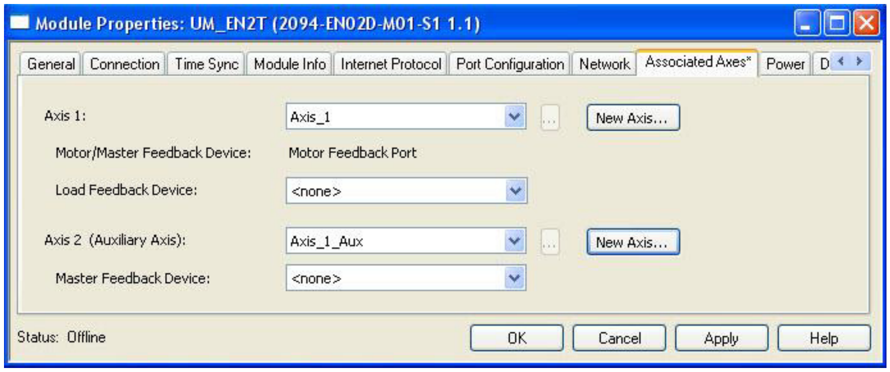
AXIS_CIP_DRIVE is the default Data Type.

14. Click OK.

The new axis (Axis_1) appears under Motion Groups>Ungrouped Axes in the Controller Organizer and is assigned as Axis 1.

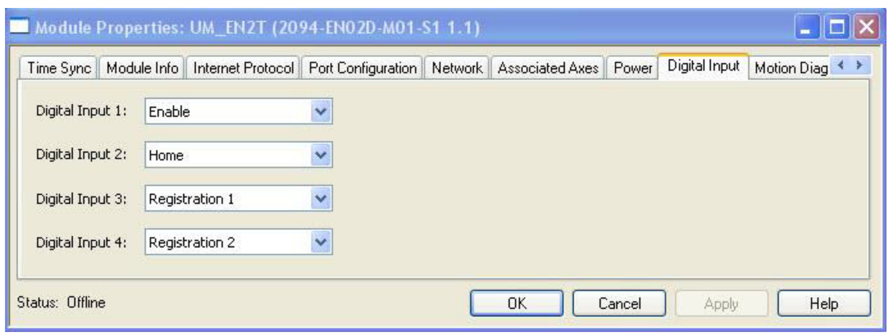


TIP It is possible to configure Axis 2 as a Feedback Only axis. With this optional feature, you can configure each control module to appear as two axes on the EtherNet/IP network. Axis 1 is the servo axis using the motor feedback port, and Axis 2 is a feedback-only axis using the auxiliary feedback port.



Axis 2 is configured identical to Axis 1 by clicking New Axis and creating a new tag.

15. Click Apply.
16. Click the Digital Input tab.

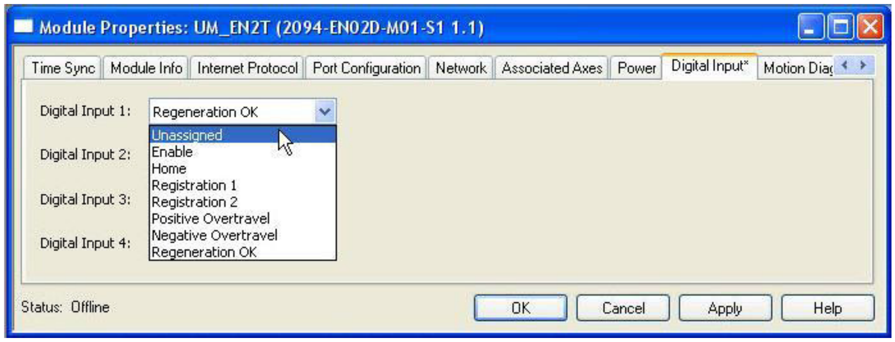


The digital inputs (1…4) are assigned default values. You can reassign them, using the pull-down menus, according to the needs of your application.

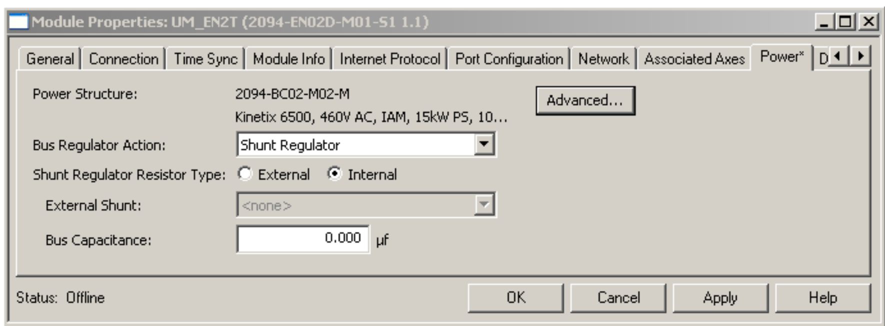
They can also be unassigned, if your application does not use them or you want to remove the default assignments.

17. From the Digital Input 1 pull-down menu, choose Unassigned.

    This removes the Enable assignment from IOD-41.



18. Click Apply.
19. Click the Power tab.



20. From the Bus Regulator Action pull-down menu, choose the shunt option appropriate for your actual hardware configuration.

Choose	To
Disable	Disable the shunt resistor internal to the IAM power module.
Shunt Regulator	Choose an internal or external shunt option.
Common Bus Follower [(1)]	To configure your IAM power module as a common-bus follower IAM module.

(1) Drive will not accept CommonBus Follower selection if three-phase power or DC bus power is applied.

If You Choose	Then
Shunt Regulator	Select Internal to use the shunt resistor internal to the IAM power module.
	Select External to use the External Shunt pull-down menu and choose between the Bulletin 1394 shunt modules and the Bulletin 2094-BSP2 shunt module. [(1)]

(1) Drive will not accept Internal, 2094-BSP2, or 1394-SR*xxxx* selection if DC bus voltage is present without having three-phase power applied.

To avoid damage to your Bulletin 1394 external shunt module when wired to the 2094-BSP2 shunt module, verify that the proper 460V fuse is installed prior to applying power.

Refer to Kinetix Motion Accessories Specifications Technical Data, publication KNX-TD004, for more information.

IMPORTANT	When configured to use the Bulletin 1394 or 2094 shunt modules, the IAM bus regulator capacity attribute displays the utilization of total shunt power available (as a percent) based on the power rail configuration. Refer to Kinetix Motion Accessories Specifications Technical Data, publication KNX-TD004, for more information.

21. Calculate additional bus capacitance, if this applies to your application, and enter the value here (version 18.00 or later), or refer to Appendix F on page 307 to set the Add Bus Cap parameter.

The Additional Bus Capacitance field only applies to the IAM power module.

IMPORTANT	DC common-bus applications must calculate Total Bus Capacitance and Additional Bus Capacitance and set the Add Bus Cap parameter in the leader IAM power module. However, you can set the parameter as shown in step 21 or by using the Logix Designer application as shown in Appendix F. Refer to Appendix C beginning on page 267, for more information on making the calculations. Refer to Appendix F beginning on page 307, for more information on setting the Add Bus Cap parameter.

22. Click OK.

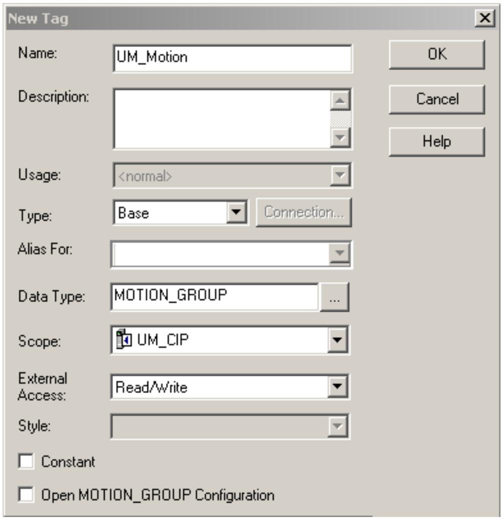
23. Repeat step 1 through step 18 for each 2094-EN02D-M01-S*x* control module.

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.

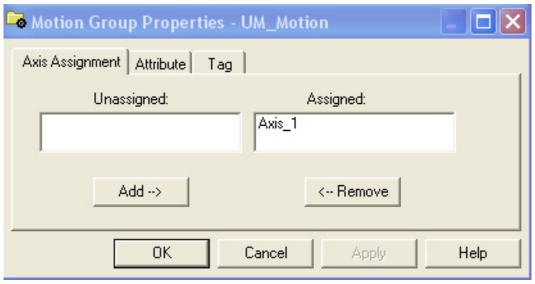
   The New Tag dialog box opens.



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 choose Properties.

   The Motion Group Properties dialog box opens.



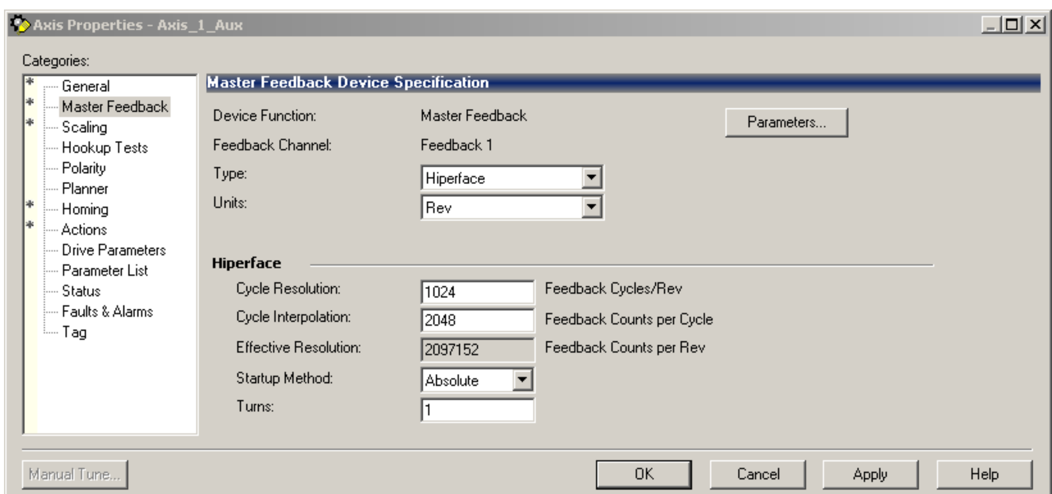
5. Click the Axis Assignment tab and move your axes (created earlier) from Unassigned to Assigned.
6. Click the Attribute tab and edit the default values as appropriate for your application.
7. Click OK.

Configure Axis Properties

Follow these steps to configure auxiliary axis properties.

1. Right-click an auxiliary axis in the Controller Organizer and choose Properties.

2. Click the Master Feedback category.



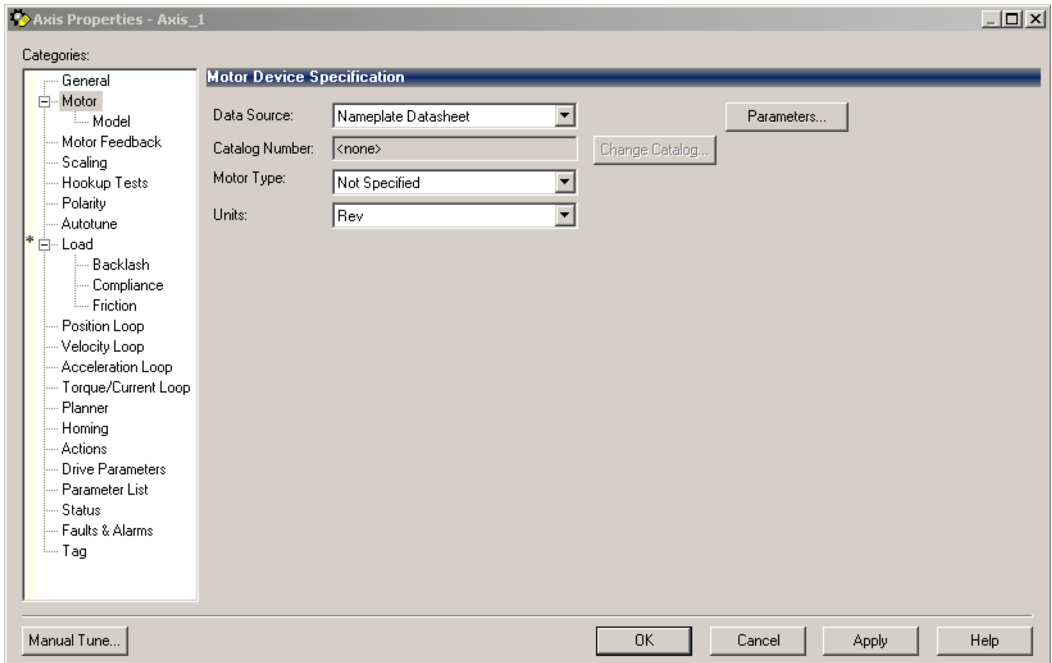
3. Configure the auxiliary axis feedback.
   a. From the Type pull-down menu, choose the auxiliary feedback type.
   b. From the Startup Method pull-down menu, choose the auxiliary feedback startup method.

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

Follow these steps to configure axis properties.

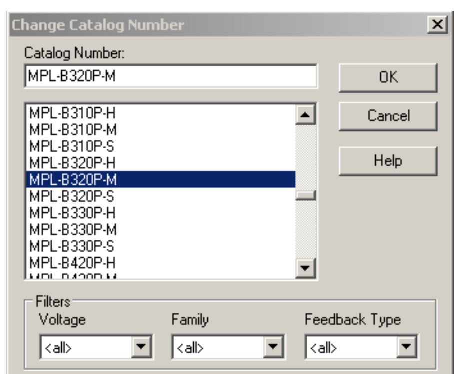
1. Right-click an axis in the Controller Organizer and choose Properties.
2. Click the Motor category.

   The Motor Device Specification dialog box opens.



3. From the Data Source pull-down menu, choose Catalog Number.
4. Click Change Catalog.

   The Change Catalog Number dialog box opens.



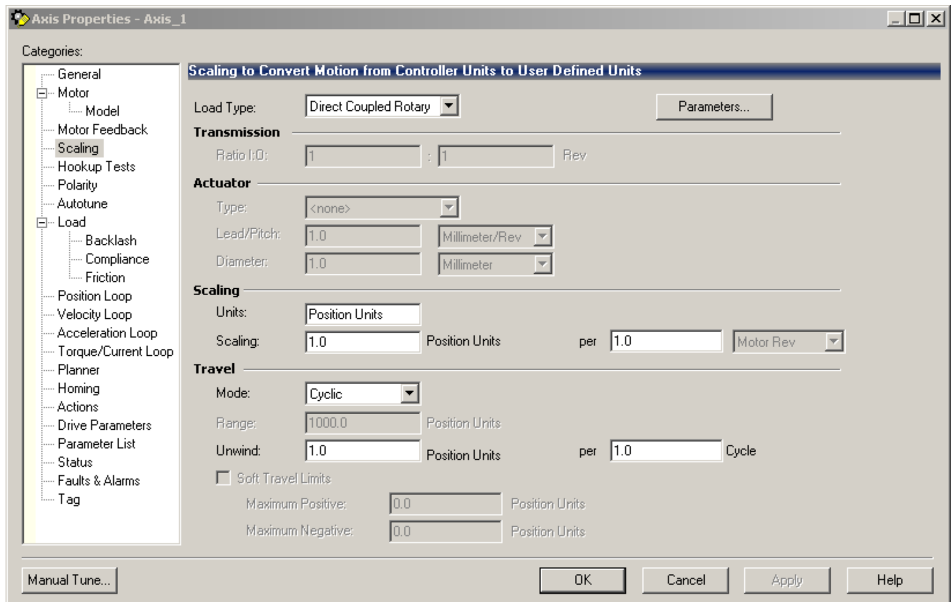
5. Select the motor catalog number appropriate for your application.

   To verify the motor catalog number, refer to the motor name plate.
6. Click OK to close the Change Catalog Number dialog box.

7. Click Apply.

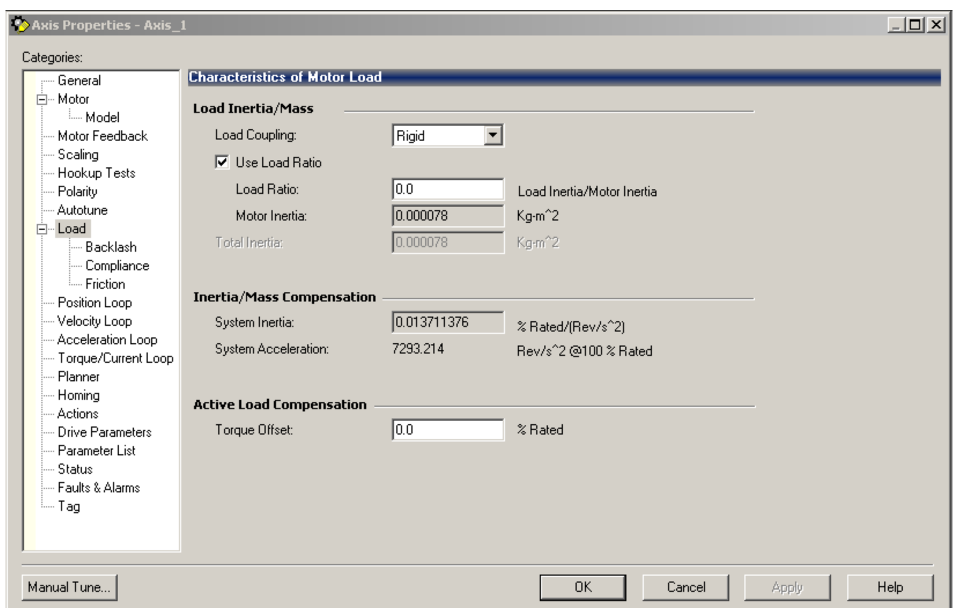
   Motor data specific to your motor appears in the Motor category.

8. Click the Scaling category and edit the default values as appropriate for your application.



9. Click Apply, if you make changes.

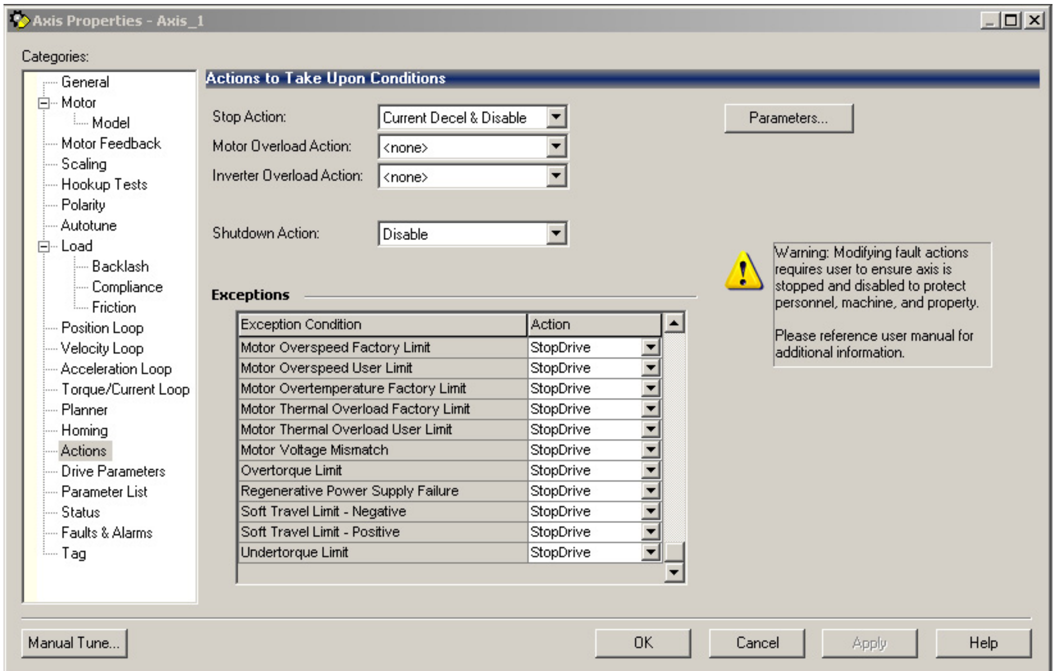
10. Click the Load category and edit the default values as appropriate for your application.



11. Click Apply, if you make changes.

12. Click the Actions category.

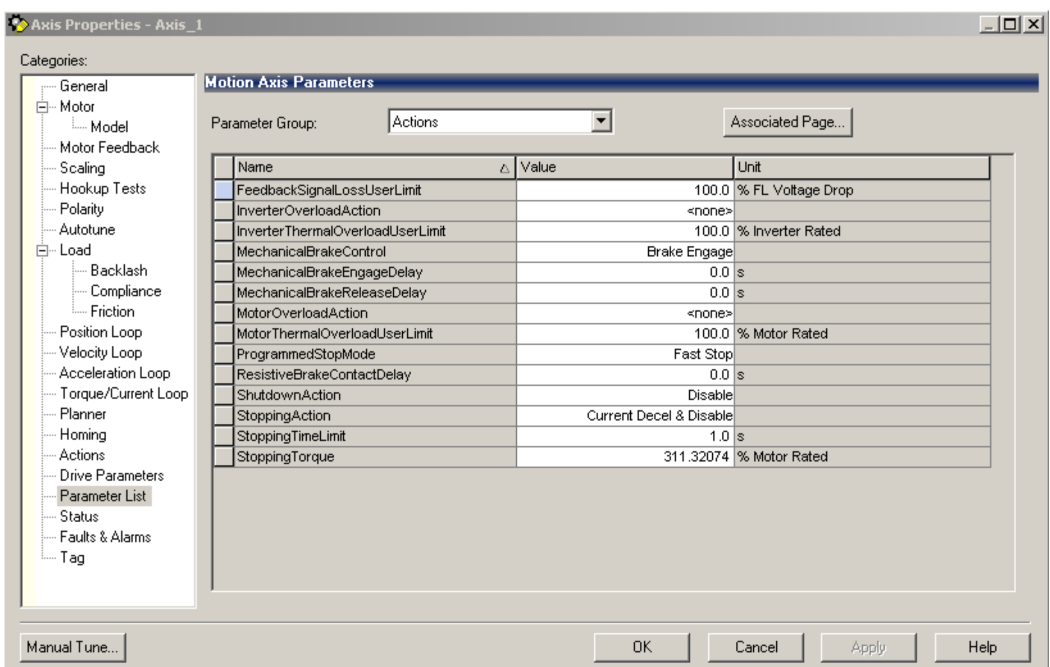
    The Actions to Take Upon Conditions dialog box opens.



From this dialog box, you can program actions and change the action for exceptions (faults). Refer to Logix5000 Controller and Drive Behavior on page 215 for more information.

13. Click Parameters.

    The Motion Axis Parameters dialog box opens.



From this dialog box you can set delay times for servo motors and RBM modules. For recommended motor brake delay times, refer to the Kinetix Rotary Motion Specifications Technical Data, publication GMC-TD001.

For example, The recommended ResistiveBrakeContactDelay time (0…1000 ms) is 71 ms.

14. Click OK.
15. Repeat step 1 through step 14 for each Bulletin 2094 AM power module and control module combination.
16. 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 Kinetix 6500 Drive

This procedure assumes that you have wired and configured your Kinetix 6500 system (with or without the LIM module) and your EtherNet/IP module.

SHOCK HAZARD: To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2094 power rail and drive modules 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 module status indicators, and for the location of LIM module circuit breakers, connectors, and status indicators.

Follow these steps to apply power to the Kinetix 6500 system.

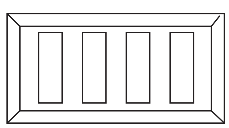
1. Disconnect the load to the motor.

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.

2. Determine your source of control power.

If Your Control Power	Then
Is sourced from a LIM module	1. Verify that CB1, CB2, and CB3 are in the OFF position. 2. Apply three-phase input power to the LIM module VAC Line connector. 3. Set CB3 to the ON position. 4. Set CB2 to the ON position. 5. Go to main step 3.
Is not sourced from a LIM module	1. Apply (95…264V AC) control power to the IAM module (CPD connector). 2. Go to main step 3.

3. Observe the control module four-character status display.



Four-character Status Display

The four-character status display provides several messages, for example BOOT, INIT, LOAD, DONE, and TEST while the control module powers-up.

If the Four-character Status Display is	Then
ON	Go to step 4.
Not ON	1. Check your control power connections. 2. Go back to main step 2.

4. Determine your source of three-phase input power.

If Your Three-phase Power	Then
Is sourced from a LIM module	1. Set CB1 to the ON position. 2. Verify the Hardware Enable Input signal for each axis is at 0 volts. 3. Go to main step 5.
Is not sourced from a LIM module	1. Apply 324…528V AC (460V) input power to the IAM power module (IPD connector). 2. Verify the Hardware Enable Input signal for each axis is at 0 volts. 3. Go to main step 5.

5. Observe the control module four-character status display.

Four-character Status Display	Drive Status
BOOT, INIT, LOAD, DONE, TEST	The drive is initializing. This sequence of four-character words continues to scroll up to three times.
Scrolling FW Version: *x.xxx*	The drive is scrolling the current drive firmware revision.
Scrolling IP = 192.168.1.1	The drive is scrolling the drive IP address.
Scrolling CONFIGURING	The drive is receiving configuration information from the controller.
Scrolling STANDBY	The drive is trying to establish communication with the Logix EtherNet/IP module.
Scrolling STOPPED	The drive is fully configured, but the control loops are not enabled.
Scrolling error code message	The drive is faulted. Refer to Interpret Status Indicators beginning on page 198.

6. Observe the status indicators on the front of the control module.

   Refer to troubleshooting tables for the PORT1, PORT2, OK, DC Bus, and Safety Lock status indicators in Control Module Status Indicators on page 210.

7. Observe the four-character display and status indicators on the Logix EtherNet/IP module.

   Refer to troubleshooting tables for the four-character display and LINK, NET, and OK EtherNet/IP module status indicators in the ControlLogix Enhanced Redundancy System User Manual, publication 1756-UM535.

Test and Tune the Axes

This procedure assumes that you have configured your Kinetix 6500 drive, your ControlLogix EtherNet/IP module, and applied power to the system.

IMPORTANT	Before proceeding with testing and tuning your axes, verify that the control module status indicators are operating as described in Control Module Status Indicators on page 210.

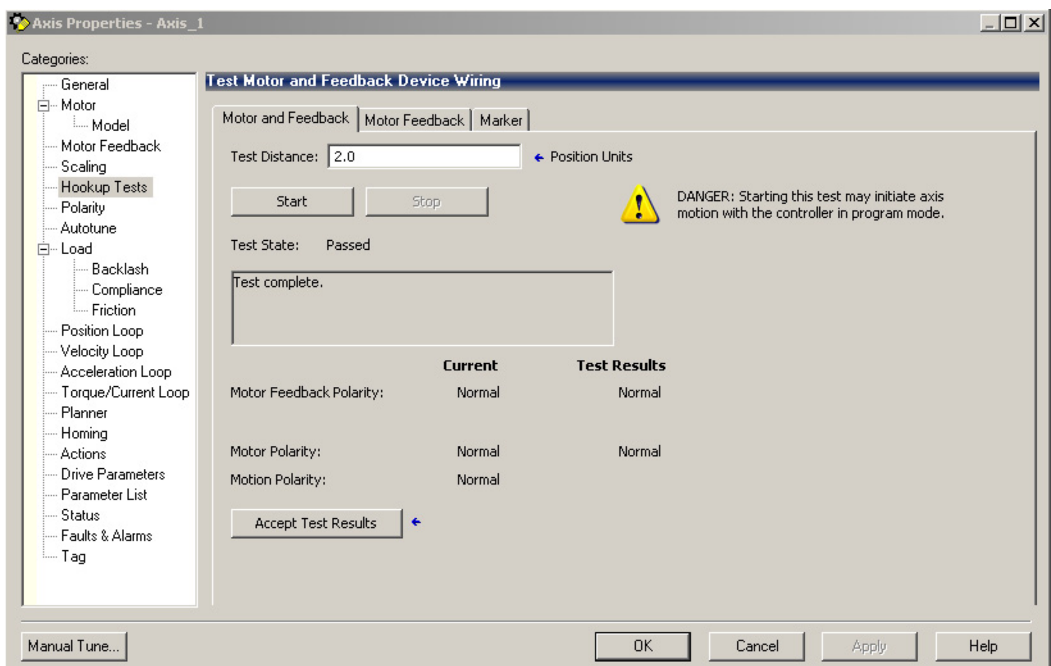
For help using the Logix Designer application as it applies to testing and tuning your axes with ControlLogix EtherNet/IP modules, refer to Additional Resources on page 12.

Test the Axes

Follow these steps to test the axes.

1. Verify the load was removed from each axis.
2. Right-click an axis in your Motion Group folder and choose Properties.

   The Axis Properties dialog box opens.
3. Click the Hookup Tests category.



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
Marker	Verifies marker detection capability as you rotate the motor shaft.
Motor Feedback	Verifies feedback connections are wired correctly as you rotate the motor shaft.
Motor and Feedback	Verifies motor power and feedback connections are wired correctly as you command the motor to rotate.

5. Determine your need for a hardware enable input at IOD-41 on the I/O connector.

   Digital input 1 (IOD-41) is configured as Enable in the Logix Designer application by default. You may have changed that on page 181.

If Digital Input 1 is configured as	Then
Enable	Go to step 6.
Unassigned	Go to step 7.

6. Apply Hardware Enable Input signal for the axis you are testing.

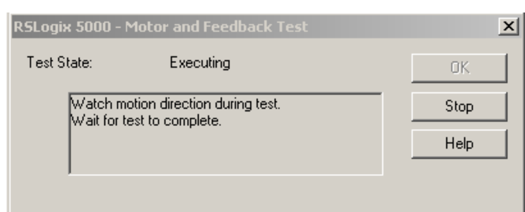
ATTENTION: To avoid personal injury or damage to equipment, apply 24V ENABLE signal only to the axis you are testing.

7. Click the desired tab (Marker/Motor Feedback/Motor and Feedback).

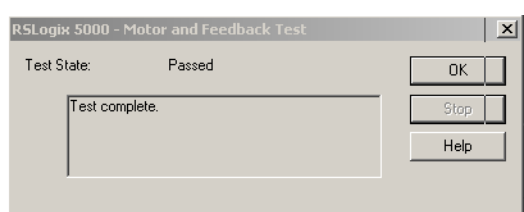
   In this example, the Motor and Feedback test is chosen.

8. Click Start.

   The RSLogix 5000 - Motor and Feedback Test dialog box opens. The Test State is Executing.

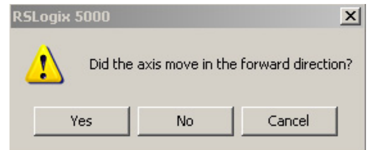


When the test completes successfully, the Test State changes from Executing to Passed.

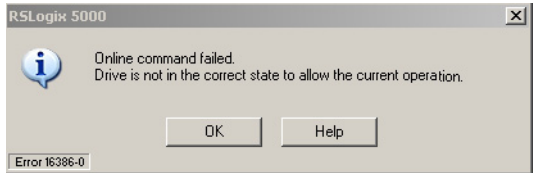


9. Click OK.

   This dialog box opens asking if the direction was correct.



10. Click Yes.
11. If the test fails, this dialog box opens.



   a. Click OK.
   b. Verify the Bus status indicator turned solid green during the test.
   c. Verify that the Hardware Enable Input signal is applied to the axis you are testing.
   d. Verify unit values entered in the Scaling category.
   e. Return to main step 7 and run the test again.

Tune the Axes

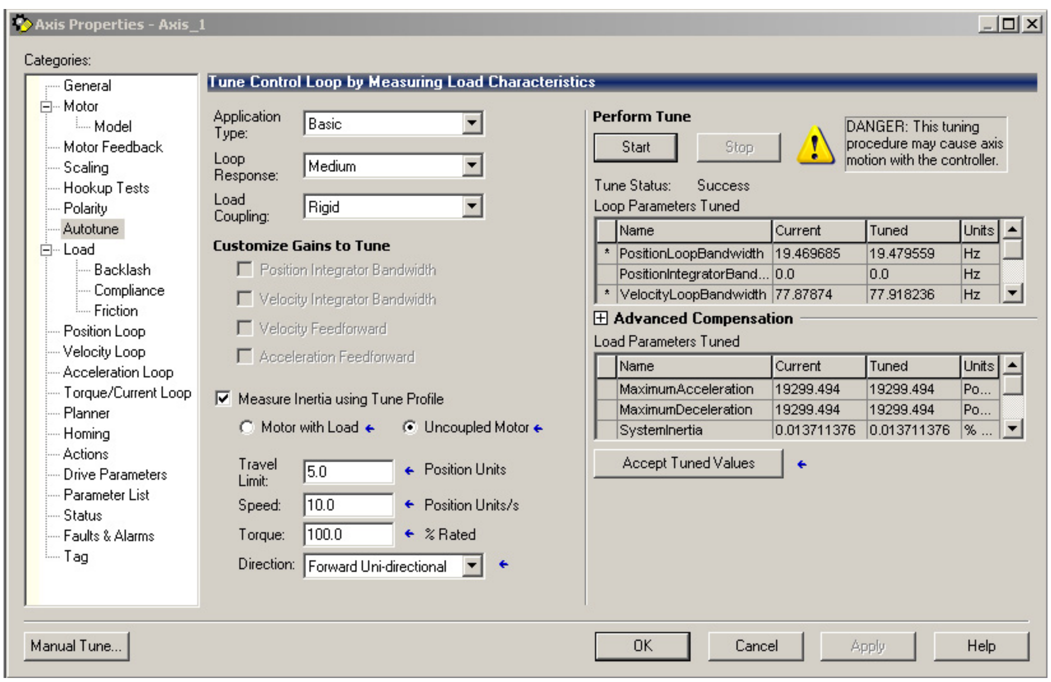
The load observer feature (available with drive firmware revision 2.001 or later) can provide good performance without having to tune your axis. Using load observer with auto-tuned gains can maximize system performance. Refer to Motion System Tuning Application Techniques, publication MOTION-AT005, for more load observer information. Refer to the Load Observer Feature section.

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 re-attach the load and perform the tuning procedure again to provide an accurate operational response.

2. Click the Autotune category.



3. Type 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 appropriate for your application.

   Forward Uni-directional is default.

5. Edit other fields as appropriate for your application.

6. Determine your need for a hardware enable input at IOD-41 on the I/O connector.

   Digital input 1 (IOD-41) is configured as Enable in the Logix Designer application by default. You may have changed that on page 181.

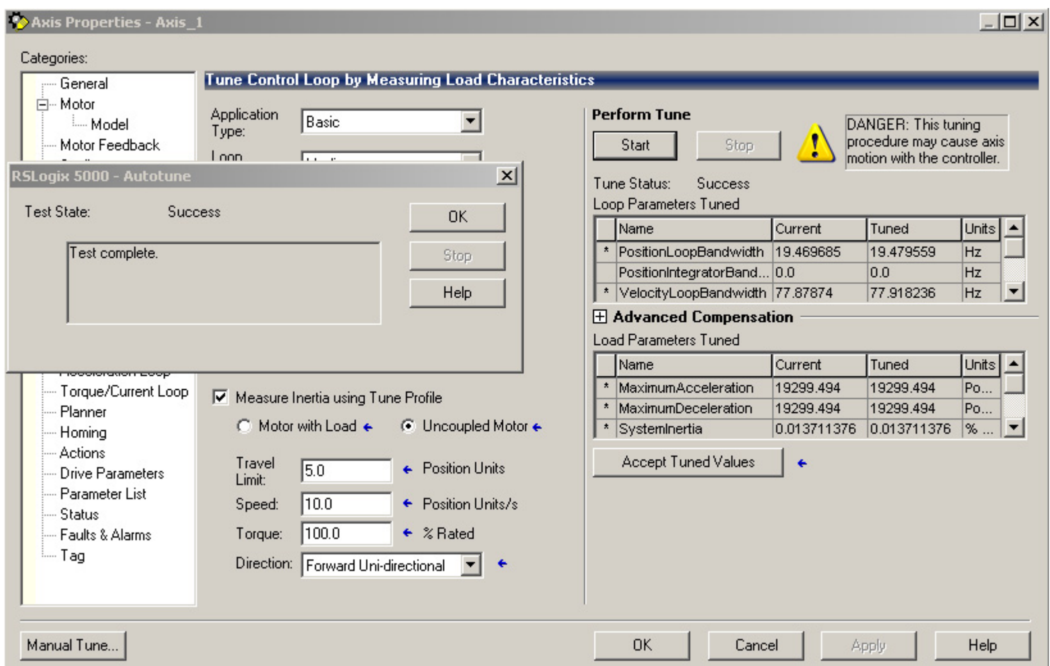
If Digital Input 1 is configured as	Then
Enable	Go to step 7.
Unassigned	Go to step 8.

7. Apply Hardware Enable Input signal for the axis you are tuning.

> **ATTENTION:** To avoid personal injury or damage to equipment, apply 24V ENABLE signal only to the axis you are tuning.

8. Click Start.

   The RSLogix - Autotune dialog box opens. When the test completes, the Test State changes from Executing to Success.

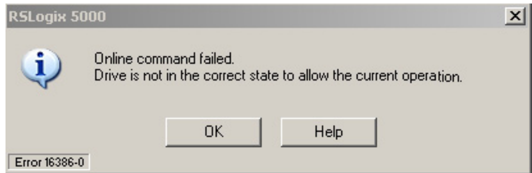


   Tuned values populate the Loop and Load parameter tables. Actual bandwidth values (Hz) depend on your application and may require adjustment once motor and load are connected.

9. Click OK to close the RSLogix 5000 - Autotune dialog box.

10. Click OK to close the Axis Properties dialog box.

11. If the test fails, this dialog box opens.



a. Click OK.

b. Make an adjustment to motor velocity.

c. Refer to the appropriate Logix motion module user manual for more information.

d. Return to step 8 and run the test again.

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

Troubleshoot the Kinetix 6200 and Kinetix 6500 Drive System

This chapter provides troubleshooting tables for your Kinetix 6200 and Kinetix 6500 system components.

Safety Precautions

Observe the following safety precautions when troubleshooting your Kinetix 6200 and Kinetix 6500 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 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.

Kinetix 6000M IDM System Error Codes

The IAM module reports a single, generic IPIM Fault whenever a fault occurs on any IPIM in the same backplane as the IAM module. All IPIM faults result in an open contactor. The Logix Axis Tag for this fault is IPIMFault.

The IPIM module is not a sercos device, so the IAM module reports any IPIM faults to the Logix motion subsystem. IPIM faults are reset by performing a fault reset on the IAM module. Issuing a fault reset command to the IAM module also generates a fault reset to all the IPIM modules in the same backplane as the IAM. Detailed information about the IPIM fault status may be obtained by messaging to the IAM module.

Connecting the IPIM module into the Logix environment as an EtherNet/IP device does not disable fault reporting through the IAM module. Only the IAM fault reporting lets the Logix motion sub-system take action based on the IPIM module fault status. IPIM faults are also reported to Logix over the Ethernet connection. However, IPIM faults must be reset by applying a fault reset instruction to the IAM module. The integration of the IPIM module into the Logix environment through the EtherNet/IP network provides additional capabilities you may choose to take advantage of in your Logix program.

Refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003, for more information on troubleshooting the IDM drive-motor system.

Four-character Display Messages

The control modules include a four-character display for status and fault messages. The display scrolls to display long text strings.

The Four-character Display Messages table lists the messages along with their priorities. When messages of different priorities need to be displayed, for example, when the drive has both a fault and an alarm, only the higher priority message is displayed. When messages of equal priority are needed, for example, when there is more than one fault, the messages are displayed in a round-robin fashion.

The IP address is displayed only once after powerup and an IP address has been acquired. The safety signature ID is displayed for 20 seconds when a new safety configuration is applied from the safety configuration tool.

Refer to the table on page 190 for a description of the messages that scroll across the display during powerup.

Table 85 - Four-character Display Messages

Drive Condition	Display String			Priority	Maximum Number of Messages Displayed
	Auxiliary Feedback Not Configured as Feedback Only	Auxiliary Feedback Configured as Feedback Only			
	Axis 1	Axis 1	Axis 2		
IP Address Display [1]	IP = *xxx.xxx.xxx.xxx*			1	2
Sercos Node Address Display [2]	Sercos NODE = *xx*			1	2
Safety Signature ID [3]	SAFETY SIGNATURE = *xxxxxxx*				
Firmware Upgrade	FIRMWARE UPDATE			2	2
Decelerating to a Stop as a Result of a Fault	ABORTING		Refer to footnote [4]		
Initialization Fault - Std. and Fault Code [5]	INIT FLT S*xx*	X1:INIT FLT S*xx*	X2:INIT FLT S*xx*	3	4 [6]
Initialization Fault - Mfg. and Fault Code [5]	INIT FLT M*xx*	X1:INIT FLT M*xx*	X2:INIT FLT M*xx*		
Safety Fault [5]	SAFE FLT *xx*		Refer to footnote [4]		
Node Fault [5]	NODE FLT *xx*		Refer to footnote [4]		
Major Fault - Std. and Fault Code [5]	FLT S*xx*	X1:FLT S*xx*	X2:FLT S*xx*		
Major Fault - Mfg. and Fault Code [5]	FLT M*xx*	X1:FLT M*xx*	X2:FLT M*xx*		
Minor Fault - Std. and Fault Code [5]	FLT S*xx*	X1:FLT S*xx*	X2:FLT S*xx*	4	3 [7]
Minor Fault - Mfg. and Fault Code [5]	FLT M*xx*	X1:FLT M*xx*	X2:FLT M*xx*		
Inhibit - Std. and Fault Code [5]	INHIBIT S*xx*		Refer to footnote [4]	5	2
Inhibit Fault - Mfg. and Fault Code [5]	INHIBIT M*xx*		Refer to footnote [4]		
Safe Limited Speed	SAFE LIMITED SPEED		Refer to footnote [4]	6	10
Power-up [8]	'BOOT'…'INIT'…'LOAD'…'DONE'…'BOOT'…'INIT'…'DONE'…'LOAD'…'TEST'…FW Version: X.XXX				
Waiting for CIP connection	STANDBY				
Connecting	CONNECTING				
Configuring Drive Attributes	CONFIGURING				
Synchronizing [1]	SYNCING				
Waiting for DC-bus Up	PRE-CHARGE				
Drive has been Shutdown	SHUTDOWN		Refer to footnote [4]		
Drive Axis has Stopped	STOPPED		Refer to footnote [9]		
Drive is Starting	STARTING		Refer to footnote [4]		
Drive is Running	RUNNING		Refer to footnote [4]		
Drive is Executing a Test Procedure	TESTING		Refer to footnote [4]		
Decelerating to a Stop as a Result of a Disable	STOPPING		Refer to footnote [4]		
Alarm Fault - Standard Fault Code [5]	ALARM S*xx*	X1:ALARM S*xx*	X2:ALARM S*xx*		
Alarm Fault - Mfg. Specific Fault Code [5]	ALARM M*xx*	X1:ALARM M*xx*	X2:ALARM M*xx*		
Node Alarm	NODE ALARM *xx*		Refer to footnote [4]		

(1) Applies to only 2094-EN02D-M01-S*x* EtherNet/IP control modules.
(2) Applies to only 2094-SE02F-M00-S*x* sercos control modules.
(3) Applies to only 2094-*xx*02*x*-M0*x*-S1 (Safe Speed Monitor) control modules.
(4) Condition not supported by auxiliary feedback-only axis.
(5) A short descriptive string follows the displayed code.
(6) One node fault, two initialization, safety, major, or minor faults for axis 1, and one initialization, major, or minor fault for axis 2.
(7) One node fault, one initialization, safety, major, or minor faults for axis 1, and one initialization, major, or minor fault for axis 2.
(8) Text in single quotation marks, 'BOOT' for example, is shown one word at a time (not scrolled).
(9) Condition not displayed.

Fault Codes

These fault code tables are designed to help you resolve anomalies. When a fault is detected, the four-character status indicator scrolls the display message. This is repeated until the fault code is cleared.

For information on troubleshooting SAFE FLT fault codes, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Safety Reference Manual, publication 2094-RM001.

Table 86 - Fault Code Summary

Fault Code Type	Description
FLT S*xx*	Standard runtime anomalies.
FLT M*xx*	
INIT FLT S*xx*	Anomalies that prevent normal operation and occur during the initialization process.
INIT FLT M*xx*	
NODE FLT*xx*	Anomalies that prevent normal operation of all drives on the power rail.
NODE ALARM *xx*	Anomalies that prevent normal operation of all drives on the power rail, but do not result in any action other than reporting the alarm to the controller.
INHIBIT S*xx*	Conditions that prevent normal operation and indicate that the drive module is prevented from being enabled.
INHIBIT M*xx*	
ALARM S*xx* ALARM M*xx*	Warnings of conditions that may affect normal operation, but do not result in any action other than reporting the alarm to the controller.

TIP Fault codes triggered by conditions that fall outside factory set limits are identified by FL at the end of the display message. For example, FLT S03…MTR OVERSPEED FL.

Fault codes triggered by conditions that fall outside user set limits are identified by UL at the end of the display message. For example, FLT S04…MTR OVERSPEED UL.

Table 87 - FLT S*xx* Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT S02…MTR COMMUTATION	Illegal Hall State	State of Hall feedback inputs is incorrect.	Improper connections.	• Check Hall wiring at motor feedback (MF) connector. • Check 5V power supply to the encoder.
FLT S03…MTR OVERSPEED FL	Motor Overspeed	Motor speed has exceeded 125% of maximum rated speed.		• Check cables for noise. • Check tuning.
FLT S04…MTR OVERSPEED UL (Kinetix 6500 drives only)	Motor Overspeed	Motor speed has exceeded user velocity limits.		
FLT S05…MTR OVERTEMP FL nn	Motor Overtemperature	The motor thermostat, motor thermistor, or encoder temperature sensor indicates that the motor factory temperature limit has been exceeded. The nn sub-code is defined as follows:	High motor ambient temperature and/or Excessive Current.	• Operate within (not above) the continuous torque rating for the ambient temperature. • Lower ambient temperature or increase motor cooling.
		01:Motor Thermostat or Thermistor.	Motor wiring error.	Check motor wiring at motor feedback (MF) connector.
		02:Encoder Temperature Sensor.	Incorrect motor selection.	Verify the proper motor has been selected.

Table 87 - FLT S*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT S06…MTR OVERTEMP UL nn (Kinetix 6500 drives only)	Motor Overtemperature	The motor thermostat, motor thermistor, or encoder temperature sensor indicates that the motor factory temperature limit has been exceeded. The nn sub-code is defined as follows:	High motor ambient temperature and/or Excessive Current.	• Operate within (not above) the continuous torque rating for the ambient temperature. • Lower ambient temperature or increase motor cooling.
		01:Motor Thermostat or Thermistor.	Motor wiring error.	Check motor wiring at motor feedback (MF) connector.
		02:Encoder Temperature Sensor.	Incorrect motor selection.	Verify the proper motor has been selected.
FLT S07…MTR OVERLOAD FL	Motor Thermal Protection	The thermal model for the motor indicates that the temperature has exceeded 110% of its rating.	The machine duty cycle requires an RMS current exceeding the continuous rating of the motor.	Change the command profile to reduce speed or increase time.
FLT S08…MTR OVERLOAD UL (Kinetix 6500 drives only)	Motor Thermal Protection	The thermal model for the motor indicates that the temperature has exceeded a user programmable limit.	The machine duty cycle requires an RMS current exceeding the continuous rating of the motor.	Change the command profile to reduce speed or increase time.
FLT S10…INV OVERCURRENT	IPM Fault	The IPM fault output indicates that the power transistors were turned off because of overcurrent, overtemperature, or power supply problems.	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.
			The drive temperature is too high.	• Check for clogged vents or defective fan. • Make sure cooling is not restricted by insufficient space around the unit. • Verify ambient temperature is not too high.
			Operation above continuous power rating and/or product environmental ratings.	• Operate within the continuous power rating. • Reduce acceleration rates. • Reduce deceleration rates.
			The 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.
FLT S11…INV OVERTEMP FL	Inverter Overtemperature	Inverter thermal switch tripped.	IAM or AM power module fan failed.	Replace the failed module.
			The cabinet ambient temperature is above rating.	Check the cabinet temperature.
			The machine duty cycle requires an RMS current exceeding the continuous rating of the inverter.	Change the command profile to reduce speed or increase time.
			The airflow access to the drive system is limited or blocked.	Check airflow and re-route cables away from the drive system.
FLT S13…INV OVERLOAD FL	Inverter Thermal Protection	The thermal model for the power transistors indicates that the temperature has exceeded 110% of its rating.	The machine duty cycle requires an RMS current exceeding the continuous rating of the inverter.	Change the command profile to reduce speed or increase time.
FLT S14…INV OVERLOAD UL (Kinetix 6500 drives only)	Inverter Thermal Protection	The thermal model for the power transistors indicates that the temperature has exceeded the user-programable limit.	The machine duty cycle requires an RMS current exceeding the continuous rating of the inverter.	Change the command profile to reduce speed or increase time.
FLT S16…GROUND CURRENT	Ground Fault	Excessive ground current was 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 anomaly exists. If fault remains, call your sales representative.

Table 87 - FLT S*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT S18…CONV OVERTEMP FL	Converter Overtemperature	Converter thermal switch tripped.	Excessive heat exists in the power circuitry.	• Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger IAM power module. • Check for clogged vents or defective fan. • Make sure cooling is not restricted by insufficient space around the unit.
FLT S20…CONV OVERLOAD FL	Converter Thermal Protection	The thermal model for the converter indicates that the temperature has exceeded its rating.	Excessive current is being drawn by the power circuitry.	• Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger IAM power module.
FLT S21…CONV OVERLOAD UL (Kinetix 6500 drives only)	Converter Thermal Protection	The thermal model for the converter indicates that the temperature has exceeded a user-programmable limit.		
FLT S22…AC POWER LOSS	AC Power Loss	All three AC input phases are detected as absent when an axis is enabled.	Axis was enabled when main (three-phase) power was removed.	Disable axis before removing power.
FLT S23…AC PHASE LOSS nn	AC Phase Loss	Some, but not all AC input phases are detected as absent. The nn sub-code is defined as follows: 01: L1 is missing. 02: L2 is missing. 03: L3 is missing.	Faulty AC line control equipment.	Check input AC voltage on all phases.
FLT S25…PRECHARGE FAILURE	Pre-charge Failure	The converter pre-charge circuit detected that the DC bus did not reach an appropriate voltage level after charging for a period of time.	Low AC input voltage.	Check input AC voltage on all phases
			Internal malfunction.	Call your sales representative.
FLT S29…SHUNT OVERLOAD FL	Shunt Thermal Protection	The thermal model for the shunt circuitry indicates that the temperature has exceeded its rating.		• Use a properly sized shunt or modify duty cycle of the application. • System uses internal shunt and requires external shunt for additional capacity.
FLT S30…SHUNT OVERLOAD UL (Kinetix 6500 drives only)	Shunt Thermal Protection	The thermal model for the shunt circuitry indicates that the temperature has exceeded a user-programmable limit.		
FLT S31…SHUNT MODULE	Shunt Module Fault	The shunt module in a multi-axis system has a fault.	Over-temperature fault indicator on Bulletin 2094 shunt module is steady red.	Refer to Temperature Fault Status Indicator on page 212.
			Shunt-fault indicator on Bulletin 2094 shunt module is steady red.	Refer to Shunt Fault Status Indicator on page 212.
			Bulletin 2094 shunt module is missing from power rail.	Install missing module on power rail.
				Fill empty slot with slot-filler module.
FLT S33…BUS UNDERVOLT FL	Bus Undervoltage	With three-phase power present, the DC bus voltage is below limits. DC bus voltage fell below the undervoltage limit while an axis on the follower power rail was enabled.	DC bus voltage for 460V system is below 275V.	• Verify voltage level of the incoming AC power. • Check AC power source for glitches or line drop. • Install an uninterruptible power supply (UPS) on your AC input. • Disable follower axis before removing power.
FLT S34…BUS UNDERVOLT UL (Kinetix 6500 drives only)	Bus Undervoltage	The DC bus voltage is measured below a user limit when the DC bus was expected to be charged.		
FLT S35…BUS OVERVOLT FL	Bus Overvoltage	The DC bus voltage is measured above a factory limit.	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 power supply. The system faults to save itself from an overload.	Use a larger system (motor and drive).
			DC bus voltage for 460V system is over 820V.	Install shunt module.
FLT S38…FUSE BLOWN	Blown Fuse (Bus Loss)	A blown fuse was detected in the power structure.	Blown fuse.	Call your Rockwell Automation sales representative to return module for repair.

Table 87 - FLT S*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT S41…MTR AQB STATE FL	Motor Feedback State Error	The number of illegal state transitions of the AQB encoder signals has exceeded a factory limit.	The motor feedback wiring is open, shorted, or missing.	• Use shielded cables with twisted pair wires. • Route the feedback away from potential noise sources. • Check the system grounds. • Replace the motor/encoder.
FLT S41…AUX AQB STATE FL	Aux Feedback State Error		The auxiliary feedback wiring is open, shorted, or missing.	
FLT S42…MTR AQB STATE UL	Motor Feedback State Error	The number of illegal state transitions of the AQB encoder signals has exceeded a user limit.	The motor feedback wiring is open, shorted, or missing.	• Use shielded cables with twisted pair wires. • Route the feedback away from potential noise sources. • Check the system grounds. • Replace the motor/encoder.
FLT S42…AUX AQB STATE UL	Aux Feedback State Error		The auxiliary feedback wiring is open, shorted, or missing.	
FLT S43…MTR FDBK LOSS FL	Feedback Loss	• On sin/cos encoders, the sum of the square of the sin/cos signals has been measured below a factory limit. • On TTL encoders, the absolute value of the differential A/B signals is below a factory limit.	The motor feedback wiring is open, shorted, or missing.	• Check motor encoder wiring. • Run Hookup test in the Logix Designer application.
FLT S43…AUX FDBK LOSS FL			The auxiliary feedback wiring is open, shorted, or missing.	
FLT S44…MTR FDBK LOSS UL (Kinetix 6500 drives only)	Motor Feedback Loss	• On sin/cos encoders, the sum of the square of the sin/cos signals has been measured below a user limit. • On TTL encoders, the absolute value of the differential A/B signals is below a user limit.	The motor feedback wiring is open, shorted, or missing.	• Check motor encoder wiring. • Run Hookup test in the Logix Designer application.
FLT S44…AUX FDBK LOSS UL (Kinetix 6500 drives only)	Aux Feedback Loss		The auxiliary feedback wiring is open, shorted, or missing.	
FLT S45…MTR FDBK COMM FL	Feedback Serial Comms	The number of consecutive missed or corrupted serial data packets from the feedback device has exceeded a factory set limit.	Communication was not established with an intelligent encoder.	• Verify motor selection. • Verify the motor supports automatic identification. • Verify motor encoder wiring. • Consult Possible Solutions for FLT S47
FLT S45…AUX FDBK COMM FL				
FLT S46…MTR FDBK COMM UL (Kinetix 6500 drives only)	Motor Fdbk Serial Comms	The number of consecutive missed or corrupted serial data packets from the feedback device has exceeded a user set limit.	Communication was not established with an intelligent encoder.	• Verify motor selection. • Verify the motor supports automatic identification. • Verify motor encoder wiring.
FLT S46…AUX FDBK COMM UL (Kinetix 6500 drives only)	Aux Feedback Serial Comms			
FLT S47…MTR ENC SELF TEST nn	Feedback Self Test	The Hiperface feedback device has detected an internal error. The nn sub-code is defined as follows: 01: INCORRECT ALIGNMENT DATA 02: INCORRECT INTERNAL ANGULAR OFFSET 03: DATA FIELD PARTITIONING TABLE DESTROYED 04: ANALOG LIMIT VALUES NOT AVAILABLE 05: INTERNAL I2C BUS INOPERATIVE 06: INTERNAL CHECKSUM ERROR 07: ENCODER RESET OCCURRED AS A RESULT OF PROGRAM MONITORING 08: COUNTER OVERFLOW 09: PARITY ERROR 10: CHECKSUM OF TRANSMITTED DATA IS INCORRECT 11: UNKNOWN COMMAND CODE 12: NUMBER OF TRANSMITTED DATA IS INCORRECT 13: TRANSMITTED COMMAND AGRUMENT IS NOT ALLOWED 14: THE SELECTED DATA FIELD MAY NOT BE WRITTEN TO 15: INCORRECT ACCESS CODE 16: SIZE OF SPECIFIED DATA FIELD CANNOT BE CHANGED 17: SPECIFIED WORD ADDRESS LIES OUTSIDE THE DATA FIELD 18: ACCESS TO NON-EXISTENT DATA FIELD 28: VALUE MONITORING OF THE ANALOG SIGNALS (process data) 29: TRANSMITTER CURRENT CRITICAL (contamination, transmitter breakage) 30: ENCODER TEMPERATURE CRITICAL 31: SPEED TOO HIGH, NO POSITION FORMATION POSSIBLE 32: SINGLETURN POSITION UNRELIABLE 33: MULTITURN POSITION ERROR 34: MULTITURN POSITION ERROR 35: MULTITURN POSITION ERROR		• Check motor feedback cable for proper connectivity and continuity • Check motor phasing (U, V, W) and Hiperface feedback 15-pin wire connections at the drive • Review Electrical Noise Reduction on page 38 – See bonding painted panels on page 39 – See wire-braid bonding on page 40 • Cycle control power • Check feedback shield connection • Reduce shock and vibration to motor • Upgrade firmware, revision 2.045 or later (Kinetix 6200 drives) • Upgrade firmware, revision 2.010 or later (Kinetix 6500 drives) • Replace motor if fault continues
FLT S47…AUX ENC SELF TEST nn				
FLT S50…POS HW OTRAVEL	Hardware Overtravel - Positive	Axis moved beyond the physical travel limits in the positive direction.	Dedicated overtravel input is inactive.	• Check wiring. • Verify motion profile. • Verify axis configuration in software.
FLT S51…NEG HW OTRAVEL	Hardware Overtravel - Negative	Axis moved beyond the physical travel limits in the negative direction.		

Table 87 - FLT S*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT S52…POS SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel - Positive	Axis position exceeded maximum software setting.		• Verify motion profile. • Verify overtravel settings are appropriate.
FLT S53…NEG SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel - Negative			
FLT S54…POSN ERROR	Excessive Position Error	Position error limit was exceeded.	Improperly sized drive or motor.	• Increase the feed forward gain. • Increase following error limit or time. • Check position loop tuning. • Verify sizing of system.
			Mechanical system out of specifications.	• Verify mechanical integrity of system within specification limits. • Check motor power wiring.
FLT S55…VEL ERROR nn	Excessive Velocity Error	The velocity error has exceeded a limit for a period of time. The nn sub-code is defined as follows: 00: Velocity error referenced to the velocity loop feedback. 01: Velocity error referenced to the nonvelocity feedback (in dual-feedback configurations).	Improperly sized drive or motor.	• Increase velocity error limit or time. • Check velocity loop tuning. • Verify sizing of system.
			Mechanical system out of specifications.	• Verify mechanical integrity of system within specification limits. • Check motor power wiring. • Reduce acceleration.
FLT S56…OVERTORQUE (Kinetix 6500 drives only)	Overtorque Limit	Motor torque has exceeded a user-programmable setting.	• Overly aggressive motion profile • Mechanical binding	• Verify motion profile. • Verify Overtorque settings are appropriate. • Verify sizing of system. • Verify torque offset
			Mechanical system out of specifications.	• Verify mechanical integrity of system within specification limits.
FLT S57…UNDERTORQUE (Kinetix 6500 drives only)	Undertorque Limit	Motor torque has fallen below a user-programmable setting.	• Improperly configured limit • Improperly configured motion • Improperly drive/motor sizing	• Verify motion profile. • Verify Overtorque settings are appropriate. • Verify sizing of system.
			Mechanical system out of specifications.	• Verify mechanical integrity of system within specification limits.
FLT S60…ILLEGAL MODE	Illegal Control mode	An illegal mode of operation was attempted.	Axis 1 was configured for dual feedback or load feedback with Axis 2 also configured for Feedback Only operation, but with different feedback attribute values.	• Use Aux Feedback for one axis only. • Verify Axis 1 and Axis 2 have identical feedback configuration for aux feedback.
FLT S61…ENABLE INPUT	Drive Enable Input	The hardware enable input was deactivated while the drive was enabled.	An attempt was made to enable the axis through software while the Drive Enable hardware input was inactive.	Disable the Drive Enable Input fault.
			The Drive Enable input transitioned from active to inactive while the axis was enabled.	Verify that Drive Enable hardware input is active whenever the drive is enabled through software.
FLT S62…CONTROLLER (Kinetix 6500 drives only)	Controller Initiated Exception	The controller has requested the drive to generate an exception.	User configured software overtravel	• Move axis out of soft overtravel range. • Clear soft overtravel fault. • Check soft overtravel configuration. • Consult controller documentation.

Table 88 - FLT M*xx* Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT M01…SELF SENSING	Self-sensing Startup Fault	The self-sensing commutation start-up algorithm failed.	Extremely light or heavy load on the motor.	Clear faults and re-try.
			Mechanical obstruction.	• Reduce friction. • Check for mechanical obstruction.
FLT M02…MOTOR VOLTAGE	Motor Voltage Mismatch	Motor voltage incompatible with drive voltage.	Check the Logix Designer configuration.	Correct the Logix Designer configuration.
			Wrong motor connected to drive.	Connect appropriate motor to drive.
FLT M04…MTR FDBK FILTER nn (Kinetix 6500 drives only)	Motor Feedback Filter	Excessive levels of noise have been detected by the digital feedback filter. The nn field is defined as follows: 01: Sine or A channel 02: Cosine or B channel	The motor feedback wiring is open, shorted, or missing.	• Use shielded cables with twisted pair wires. • Route the feedback away from potential noise sources. • Check the system grounds. • Replace the motor/encoder.
FLT M04…AUX FDBK FILTER nn (Kinetix 6500 drives only)	Aux Feedback Filter		The auxiliary feedback wiring is open, shorted, or missing.	
FLT M05…MTR FDBK BATT LOSS	Motor Encoder Battery Loss	The battery voltage on a battery-backed motor encoder is low enough such that absolute position is no longer available.	Weak battery or poor battery connection.	• Replace battery. • Check battery connection.
FLT M06…MTR FDBK BATT LOW	Motor Encoder Battery Caution	The battery voltage on a battery-backed motor encoder is below a caution level.		
FLT M07…MTR INCR LOSS	Motor Incremental Position Loss	The periodic check of the incremental encoder position against the absolute encoder position or Hall edges (when available) indicates they are out of tolerance.	The motor feedback wiring is open, shorted, or missing.	• Check motor encoder wiring. • Run Hookup test in the Logix Designer application.
FLT M07…AUX INCR LOSS	Aux Incremental Position Loss		The auxiliary feedback wiring is open, shorted, or missing.	
FLT M10…CTRL OVERTEMP FL	Control Module Overtemperature	The control module temperature has exceeded its limit.	Cabinet ambient temperature has exceeded 50 °C (122 °F).	Reduce cabinet ambient temperature.
FLT M11…CTRL OVERTEMP UL (Kinetix 6500 drives only)	Control Module Overtemperature	The control module temperature has exceeded a user limit.		
FLT M12…POWER CYCLE FL	Pre-charge Overload	The converter estimates that the pre-charge circuit has exceeded its limit due to excessive power cycling.	The DC bus power has been cycled too frequently.	Limit power cycles to two per minute maximum.
FLT M13…POWER CYCLE UL (Kinetix 6500 drives only)	Pre-charge Overload	The converter estimates that the pre-charge circuit is approaching its user-defined limit due to excessive power cycling.		
FLT M14…CURR FDBK OFFSET	Excessive Current Feedback Offset	Current feedback hardware fault detected.		Replace the power module.
FLT M15…REGEN PWR SUPPLY	Regenerative Power Supply Fault	The hardware Regeneration OK input was deactivated while the drive was enabled.	Regen unit faulted.	Reset faulted regen unit.
FLT M19…DC BUS LIMIT	DC Bus Limited Position Error	During a DC bus limit condition, the position error exceeded a user limit for a programmable period of time.	Excessive load drawn from DC bus by application.	Modify application to reduce loading on DC Bus. Increase converter size to provide additional bus capacity.
FLT M25…COMMON BUS	DC Common Bus Fault	AC Power was detected by the drive while configured for Common Bus Follower operation.	Improper configuration or connection.	Check IAM power configuration and wire accordingly.
FLT M26…RUNTIME ERROR	Runtime Drive Error	The drive firmware encountered an unrecoverable runtime error.		Cycle control power. Replace Module
FLT M27…BACKPLANE COMM	Backplane COM	Communication over the backplane detected a problem.	Electrical Noise.	Cycle control power.
			Poor module connection.	With power off, reseat power module in rail and control module in power module.
			Faulty module.	Replace module.

Table 88 - FLT M*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
FLT M28…SAFETY COMM	Internal Safety Communication	Communication with the safety hardware within the drive malfunctioned.		Cycle control power. Replace module.
FLT M64…SENSOR ASSIGNMENT	No Quick View message	• The Home, Registration1, or Registration2 digital input function has been requested but is not assigned to an input. • Multiple inputs have been assigned the same function.		Assign proper function to the four available digital inputs.
FLT M68…IPIM	IPIM Module Fault	A fault has occurred in one or more IPIM modules on the power rail.		Refer to the troubleshooting chapter in the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Table 89 - INIT FLT Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
INIT FLT S03…NVMEM CHKSUM	User Non-volatile Memory Checksum	Data in the user nonvolatile memory has a checksum error.	Non-volatile memory is corrupt due to control board software error.	• Cycle power or reset the drive. • Contact your Rockwell Automation sales representative and return module for repair.
INIT FLT M01…ENCODER DATA	Smart Encoder Data Corruption Fault	The motor data stored in a smart encoder has a checksum error.	Faulty intelligent encoder.	• Cycle power or reset the drive. • Replace motor if faulting continues.
INIT FLT M02…MTR DATA RANGE nn	Motor Data Range Error	Data within a motor data blob is out of range. The nn sub-code is defined as follows: 01: Memory map revision of the blob is not supported by the firmware. 02: Rated current is out of range. 03: Peak current is out of range. 04: Rated power is out of range. 05: Overload limit is out of range. 06: Thermal capacitance is out of range. 07: Thermal resistance is out of range. 08: Motor resistance is out of range. 09: Motor inductance is out of range. 10: Inertia is out of range. 11: Rated speed is out of range. 12: Max speed is out of range. 13: Rated torque is out of range. 14: Torque constant is out of range. 15: Back EMF is out of range. 16: Pole pitch is out of range. If there is error in the blob that comes from the controller then 50 is added to the subcode.	Faulty intelligent encoder or incorrect motor file.	• Cycle power or reset the drive. • Check validity of the motion database. • Replace motor if faulting continues.
INIT FLT M03…MTR ENC STARTUP	Motor Feedback Communication Startup	Communication with a smart encoder could not be established on the motor feedback port.	Incorrect motor selected or connected.	Check motor selection.
			Faulty wiring.	Check motor encoder wiring.
INIT FLT M03…AUX ENC STARTUP	Auxiliary Feedback Communication Startup	Communication with a smart encoder could not be established on the auxiliary feedback port.	Incorrect motor selected or connected.	Check motor selection.
			Faulty wiring.	Check motor encoder wiring.
INIT FLT M04…MTR ABS SPEED	Motor Absolute Encoder Overspeed Fault	Excessive speed was detected in the motor battery-backed encoder while power was off.	High motor speed while power was off.	Clear faults and re-home.
INIT FLT M05…MTR ABS TRAVEL	Motor Absolute Encoder Power-off Travel	The power-off travel range of the motor battery-backed encoder has been exceeded.	Large travel distance while power was off.	Clear faults and re-home.
INIT FLT M06…MTR ABS STARTUP	Motor Absolute Startup Speed	The motor absolute encoder was not able to accurately determine the position after powerup due to motor speed greater than 100 rpm.	Mechanical movement of machine causing excessive rotation of motor during powerup.	Allow machine motion to stop before powerup.
INIT FLT M07…COMMUTATION OFFSET (Kinetix 6500 drive only)	Uninitialized Commutation Offset	The commutation offset stored in a third-party motor has not been initialized.	Third party motors do not contain Rockwell Automation® motor data.	Run Commutation Test from the Logix Designer application.

Table 89 - INIT FLT Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
INIT FLT M12…INVALID KCL REV	Invalid KCL revision	The FPGA image is incompatible with hardware operation.		• Flash control module with correct firmware. • Replace module.
INIT FLT M13…INVALID BSP REV	Invalid BSP revision	The board support package is incompatible with hardware operation.		• Flash control module with correct firmware. • Replace module.
INIT FLT M14…SAFETY FIRMWARE	Invalid Safety Firmware	The loaded Safety firmware is not a valid revision for the rev of drive firmware.		Flash control module with correct revision of safety firmware.
INIT FLT M19…VOLTAGE MISMATCH	Voltage Mismatch on Power Rail	The IAM detected that both 230V and 460V modules have been installed on the same power rail.		Replace the mismatched AM module with one that matches the IAM module.
INIT FLT M20…UNKNOWN MODULE	Unknown Axis on Backplane	Unknown module is detected on the modular backplane.	Faulty Module.	• Recycle control power. • Replace module.
INIT FLT M21…FACTORY CFG	Factory Configuration	Factory Configuration Data is missing or invalid.	Defective memory in module.	Replace defective module.
INIT FLT M22…ILLEGAL ADDRESS	Illegal Node Switch Setting	AM Node Address is out of range (>254).	IAM node switch set such that an AM node address is greater than 254.	Select IAM node address that permits all AM node addresses to be less than 254.
INIT FLT M23…SERIES MISMATCH	Series Mismatch on Power Rail	Sercos and EtherNet/IP control modules exist on the same power rail.		Replace the mismatched control module.
INIT FLT M24…OPEN SLOT	Open Power Rail Slot	IAM detects an open slot on the power rail.	Missing module or bent pins on module.	• Check control pin on back of module. • Install slot filler module in open slot.
INIT FLT M32…MTR KEYING nn (Kinetix 6200 drives only)	Motor Keying Fault	The attached motor model does not match the model in the axis configuration. The nn sub-code is defined as follows: 01: Encoder communication expected but not operational. 02: Feedback type does not match. 03: Motor ID does not match. 04: Single-turn resolution does not match.	Incorrect motor selected from motor database.	Verify motor selection in Axis Properties configuration.
INIT FLT M33…ENABLE UNASSIGNED (Kinetix 6200 drives only)	Enable Input Not Assigned	The enable function has been requested for use but has not been assigned to a digital input.		Assign an available digital input as Enable.
INIT FLT M34…OTRAVEL UNASSIGNED (Kinetix 6200 drives only)	Overtravel Input Not Assigned	The positive or negative overtravel function has been requested for use but has not been assigned to a digital input.		Assign an available digital input for the desired overtravel function.
INIT FLT M35... NAND FLASH nn	Storage failure	The nn sub-code is defined as follows: 01: Main application storage failed. 02: Log file storage failed. 03: Web file storage failed.	Faulty memory component.	• Recycle control power or reset the drive. • Replace control module if problem persists.

Table 90 - NODE FLT Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
NODE FLT 01…LATE CTRL UPDATE (Kinetix 6500 drives only)	Control Update Fault	Several consecutive updates from the controller have been lost.	Excessive network traffic.	• Remove unnecessary network devices from the motion network. • Change the network topology so that fewer devices share common paths. • Use faster/higher performance network equipment.
			Noisy environment.	• Segregate signal wiring from power wiring. • Use shielded cables. • Add snubbers to power devices.
NODE FLT 02…PROC WATCHDOG	Processor Watchdog Fault	The watchdog circuit monitoring processor operation detected a problem.		• Recycle control power or reset the drive. • Replace control module if problem persists.

Table 90 - NODE FLT Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
NODE FLT 03…HARDWARE nn	Hardware Fault	The drive has an internal hardware problem. The nn sub-code is defined as follows:		• Recycle control power or reset the drive. • Replace power module or power rail if problem persists
		01: Invalid slot ID.	Faulty power rail or power module.	
		02: Cannot read slot ID.		
		03: Nonvolatile write to memory failed.	Faulty memory component.	• Recycle control power or reset the drive. • Replace control module if problem persists.
		04: Nonvolatile memory read failed.		
NODE FLT 04…DATA FORMAT ERROR (Kinetix 6200 drives only)	Data Format Error	A data format error was discovered in the controller-to-drive message.	Faulty memory component.	• Recycle control power or reset the drive. • Replace control module if problem persists.
NODE FLT 06…LOST CTRL CONN (Kinetix 6500 drives only)	Lost Controller Connection	communication with the controller have been lost	• Faulty Ethernet cable. • Ethernet cable disconnected.	Check Ethernet connection.
			Controller lost power.	Check controller operation.
NODE FLT 08…LOGIC WATCHDOG (Kinetix 6500 drives only)	Custom Logic Update Timeout	The watchdog circuit monitoring custom logic operation detected a problem.	Faulty control module.	• Recycle control power or reset the drive. • Replace control module if problem persists.
NODE FLT 09…IP ADDRESS (Kinetix 6500 drives only)	Duplicate IP Address	This drive and another EtherNet device on the same subnet have identical IP addresses.	Incorrect node switch setting.	Select a node address not already in use on the network.
NODE FLT 128…DRAM TEST	DRAM Test Fault	A power-up test of the DRAM indicated a memory problem.	Faulty memory component.	• Recycle control power or reset the drive. • Replace Control module if problem persists.
NODE FLT 129…FPGA CONFIG	FPGA Configuration Fault	The FPGA could not be configured properly.	Faulty component.	Replace module.
NODE FLT 133…SERCOS ADDRESS (Kinetix 6200 drives only)	Duplicate Sercos Node Address	This axis and one or more other axes have identical sercos addresses.		Check Node Switch configuration of all axes on the sercos ring and adjust for no overlap of addresses.
NODE FLT 139…SERCOS RING (Kinetix 6200 drives only)	Sercos Ring Fault	The sercos ring is not active after being active and operational.	Loose or damaged sercos cable.	Check that fiber-optic cable is present and connected properly.

Table 91 - NODE ALARM Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
NODE ALARM 01…CTRL UPDATE	Control Connection Update Alarm	The Control Update Alarm bit is used to indicate that updates from the controller have been late	Excessive network traffic.	• Remove unnecessary network devices from the motion network. • Change the network topology so that fewer devices share common paths. • Use faster/higher performance network equipment.
			Noisy environment.	• Segregate signal wiring from power wiring. • Use shielded cables. • Add snubbers to power devices.
NODE ALARM 05…CLOCK SYNC	Clock Jitter Alarm	Sync Variance has exceeded the Sync Threshold while the device is running in Sync mode.	• Switched to grandmaster clock of significantly different frequency. • Lost connection to grandmaster clock.	• Drive auto-corrects upon time synchronization. • Restore network connections.
NODE ALARM 128…NODE SWITCH	No Quick View message	The node address switches have been altered because they were first read after powerup.	Node Switches adjusted after powerup.	Return node switches to power-up setting.

Table 92 - INHIBIT Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
INHIBIT S01…ENABLE INPUT	Axis Enable Input Fault - Start Inhibit	When Enable Input Checking is enabled, the drive displays Axis Enable Input start inhibit when it detects the enable input is inactive and while the axis is in Starting/Running/Testing/Hold sub-state of Stopped state.		• Confirm that the digital input assigned to the Enable is active • Check module enable input wiring • Check digital input assignments
INHIBIT S02…MOTOR NOT CONFIGURED	Motor Not Configured	The motor has not been properly configured for use.		Verify motor configuration in the Logix Designer application.
INHIBIT S03…FEEDBACK NOT CONFIGURED	Feedback Not Configured	The feedback has not been properly configured for use.		Verify feedback configuration in the Logix Designer application.
INHIBIT S04…COMMUTATION NOT CONFIGURED	Commutation Not Configured - Standard Start Inhibit	• Associated permanent magnet motor commutation has not been configured for use. • After commutation test, the offset value stored on the motor encoder differs from value sent from the controller by 15° or more.		1. Verify that the proper motor feedback commutation alignment has been selected. To run the commutation test and to measure the commutation offset it should be set as Controller Offset. 2. Download project or power-cycle drive after accepting commutation test results.
INHIBIT M05…SAFE TORQUE OFF	Start Inhibit – Safe Torque Off	The safety function has disabled the power structure.		• Check safety input wiring • Check state of safety devices
INHIBIT M07…SAFETY NOT CONFIGURED	Start Inhibit – Safety Not Configured Inhibit	Drive firmware was uploaded.		Reapply safety configuration signature by using Apply File from the Safety Main web page.

Table 93 - ALARM Fault Codes

Four-character Display Message	Logix Designer Fault Message	Problem or Symptom	Potential Cause	Possible Resolution
ALARM S52…POS SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel - Positive	Axis position exceeded maximum software setting.		• Verify motion profile. • Verify overtravel settings are appropriate.
ALARM S53…NEG SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel - Negative			
ALARM M13…POWER CYCLE UL (Kinetix 6200 drives only)	N/A (1)	The converter estimates that the pre-charge circuit has exceeded its limit due to excessive power cycling.	The DC bus power has been cycled too frequently.	Limit power cycles to two per minute maximum.

(1) Use the sercos Read IDN message instruction to check the status of this fault condition.

Control Module Status Indicators

Table 94 - Drive Status Indicator (sercos control modules)

Condition	Drive Status	Possible Resolution
Off	No power	Apply power.
Alternating green/red	Self-test (power-up diagnostics)	Wait for steady green.
Flashing green (1)	Standby (device not configured)	Wait for steady green.
Steady green	Normal operation, no faults	N/A
Flashing red	Minor fault (recoverable)	Refer to four-character fault message.
Steady red	Major fault (non-recoverable)	Refer to four-character fault message.

(1) This condition is the same as sercos ring phases 0, 1, 2, and 3.

Table 95 - Comm Status Indicator (sercos control modules)

Condition	Drive Status	Potential Cause	Possible Resolution
Off	No communication (1)	Loose fiber-optic connection.	Verify proper fiber-optic cable connections.
		Broken fiber-optic cable.	Replace fiber-optic cable.
		Receive fiber-optic cable connected to sercos transmit connector and vice versa.	Check proper sercos fiber-optic cable connections.
Flashing green (2)	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
Steady red	No communication	Duplicate node address	Verify proper node addressing. Refer to Configure the Drive Modules on page 169.

(1) Refer to Fiber-optic Cable Installation and Handling Instructions, publication 2090-IN010, for more information.
(2) This condition is the same as sercos ring phases 1, 2, and 3.

Table 96 - Bus Status Indicator

Condition	Bus Status	Condition
Off	No power or DC bus is not present.	• Normal when bus power is not applied. • Fault exists, refer to Fault Codes troubleshooting on page 200.
	Bus power is present in follower IAM.	• Follower IAM power module is not configured as CommonBus Follow in Logix Designer application. • After DC bus voltage is applied, a 2.5 second delay before the indicator begins flashing green is normal operation to provide the common-bus leader module time to complete pre-charge.
Flashing green	Bus power is present, axis disabled. No major faults.	Normal when: • 24V is not applied to Hardware Enable Input. • MSO instruction is not commanded in the Logix Designer application.
Steady green	Bus power is present, axis enabled. No major faults.	Normal when: • 24V is applied to Hardware Enable Input. • MSO instruction is commanded in the Logix Designer application.

Table 97 - Safety Lock Status Indicator

Condition [1]	Status
Off	No power or safety circuitry not configured.
Flashing amber	Safety circuitry configured, but not locked.
Steady amber	Safety circuitry locked.

(1) This status indicator applies to only 2094-*xx*02*x*-M0*x*-S1 control modules.

Table 98 - Port 1 and Port 2 Ethernet Communication Status Indicators

Condition	Status
Off	No link partner present.
Flashing green	Link partner present, communication occurring.
Steady green	Link partner present, no communication occurring.

Table 99 - Module and Network Status Indicators (EtherNet/IP control modules)

Condition	Status
Off	No power or no IP address defined.
Alternating green/red	Self-test mode (powerup diagnostics).
Flashing green	Standby (device not configured, or connection not established.
Steady green	Normal operation. Device has at least one established connection.
Flashing red	Recoverable minor fault or connection timeout.
Steady red	Non-recoverable major fault or duplicate IP address.

Shunt Module Status Indicators

Each of the shunt module status indicators provide specific troubleshooting information.

Table 100 - General Shunt Module Troubleshooting

Module	Status	Under These Conditions
Shunt	Fault is latched.	Until fault condition is corrected and cleared.
	Fault is cleared.	• Using MASR, MAFR, MGSR instructions or the HIM (red stop button). • Only after the DC bus is discharged (bus status indicator is flashing). • Drive must be configured with 2094-BSP2 shunt module or Bulletin 1394 external shunt module.
IAM/AM	Disabled (for DC bus regulation).	• When the 2094-BSP2 shunt module is used on a 230V system. • When either 230V or 460V system is configured with a Bulletin 1394 external shunt module. • When configured in Common-bus Follower mode.
	Enabled to discharge the DC bus.	Drive (IAM or leader IAM module) three-phase power is removed.
	Disabled from discharging the DC bus.	When configured in Common-bus Follower mode.

IMPORTANT	Under some fault conditions, two reset commands can be required to clear drive and shunt module faults.

Table 101 - Bus Status Indicator

Bus Status Indicator	Status	Potential Cause	Possible Resolution
Flashing	Normal condition when control power is applied and bus voltage is less than 60V DC.		N/A
Steady Green	Normal condition when control power is applied and bus voltage is greater than 60V DC.		N/A
Off	Control power is not present.	Internal power supply failure.	Replace shunt module.

Table 102 - Temperature Fault Status Indicator

Over-Temp Fault Indicator	Status	Potential Cause	Possible Resolution
Off	Normal condition.		N/A
Steady Red	Shunt module internal temperature exceeds operating temperature specification.	Shunt module fan failed.	Replace shunt module.
		Shunt module temperature exceeds rating.	• Wait for shunt module to cool. • Reset faults. • Verify IAM module bus regulator configuration.
	External over temperature condition.	External temperature switch is open.	• Wait for shunt module to cool. • Reset faults. • Verify IAM module bus regulator configuration.
		TS jumper is not present.	Install jumper.

Table 103 - Shunt Fault Status Indicator

Shunt Fault Indicator	Status	Potential Cause	Possible Resolution
Off	Normal condition		N/A
Steady Red	Shorted internal or external shunt resistor.	Mis-wired shunt jumper or other short on RC connector.	• Correct mis-wire (shorted) condition. • If problem persists, replace shunt module.
		Mis-wired (shorted) external shunt wiring.	

Table 104 - All Shunt Module Status Indicators

Shunt Module Status Indicator	Status	Potential Cause	Possible Resolution
• Bus Status • Over-Temp Fault • Shunt Fault	All three status indicators flash simultaneously.	Shunt module hardware failure.	• Cycle power. • If problem persists, replace shunt module.

General System Anomalies

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

Table 105 - General System Anomalies

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 the Logix Designer application.
	Position loop gain or position controller accel/decel rate is improperly set.	Run Tune in the Logix Designer application.
	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 the Logix Designer application.
	Mechanical resonance.	Notch filter or output filter may be required (refer to Axis Properties dialog box, Output tab in the Logix Designer application).
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 the Logix Designer application again.
	The system inertia is excessive.	• Check motor size versus application need. • Review servo system sizing.
	The system friction torque is excessive.	Check motor size versus application need.
	Available current is insufficient to supply the correct accel/decel rate.	• Check motor size versus 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 or ballscrew balls, and so forth. 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 mechanical performance, for example, the gearbox or ballscrew mechanism.

Table 105 - General System Anomalies (continued)

Condition	Potential Cause	Possible Resolution
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.
Abnormal noise	Motor tuning limits are set too high.	Run Tune in the Logix Designer application.
	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 box, Output tab in Logix Designer application).
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.

Logix5000 Controller and Drive Behavior

By using the Logix Designer application, you can configure how the Bulletin 2094 control modules respond when a drive fault/exception occurs. The set of drive actions that apply depends on the whether you are using an integrated motion on EtherNet/IP (Kinetix 6500) servo drive or sercos (Kinetix 6200) servo drive.

TIP The INIT FLT *xxx* faults are always generated after powerup, but before the drive is enabled, so the stopping behavior does not apply.

ALARM *xxx* and NODE ALARM *xxx* faults do not apply because they do not trigger stopping behavior.

Kinetix 6500 Drive Exception Behavior

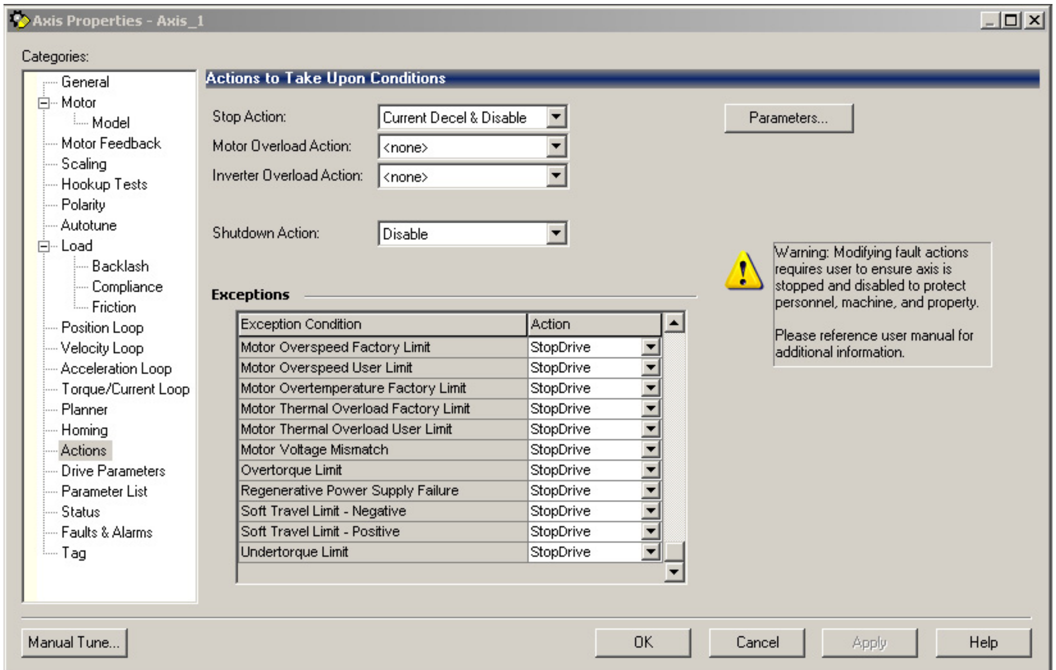
For Kinetix 6500 (integrated motion on EtherNet/IP) drives, you can configure exception behavior in the Logix Designer application from the Axis Properties dialog box, Actions category.

Table 106 - Kinetix 6500 Drive Exception Action Definitions

Exception Action	Definition
Ignore	The controller completely ignores the exception condition. For some exceptions that are fundamental to the operation of the planner, Ignore will not be an available option.
Alarm	The controller sets the associated bit in the Motion Alarm Status word but does not otherwise affect axis behavior. Like Ignore, if the exception is so fundamental to the drive, Alarm will not be an available option. When an exception action is set to Alarm, the Alarm will go away by itself when the exceptional condition has cleared.
Fault Status Only	Like Alarm, Fault Status Only instructs the controller to set the associated bit in the Motion Fault Status word, but does not otherwise affect axis behavior. However, unlike Alarm an explicit Fault Reset is required to clear the fault once the exceptional condition has cleared. Like Ignore and Alarm, if the exception is so fundamental to the drive, Fault Status Only will not be an available option.
Stop Planner	The controller sets the associated bit in the Motion Fault Status word and instructs the Motion Planner to perform a controlled stop of all planned motion at the configured maximum deceleration rate. An explicit Fault Reset is required to clear the fault once the exceptional condition has cleared. If the exception is so fundamental to the drive, Stop Planner will not be an available option.
Stop Drive	When the exception occurs, the associated bit in the Fault Status word is set and the axis will come to a stop by using the stopping action defined by the drive for the particular exception that occurred. There is no controller based configuration to specify what the stopping action is, the stopping action is device dependant.
Shutdown	When the exception occurs, the drive brings the motor to a stop by using the stopping action defined by the drive (as in Stop Drive) and the power module is disabled. Optionally, if the Shutdown Action attribute is configured for Drop DC Bus, the contactor will open. An explicit Shutdown Reset is required to restore the drive to operation.

Only selected drive exceptions are configurable. In the Drive Exception/Fault Behavior tables beginning on page 218, the controlling attribute is given for programmable fault actions.

Figure 92 - Logix Designer Axis Properties - Actions Category



This dialog box applies to Kinetix 6500 (EtherNet/IP network) servo drives.

Kinetix 6200 Drive Fault Behavior

For Kinetix 6200 (sercos) drives, you can configure fault behavior in the Logix Designer application from the Axis Properties dialog box, Fault Actions tab.

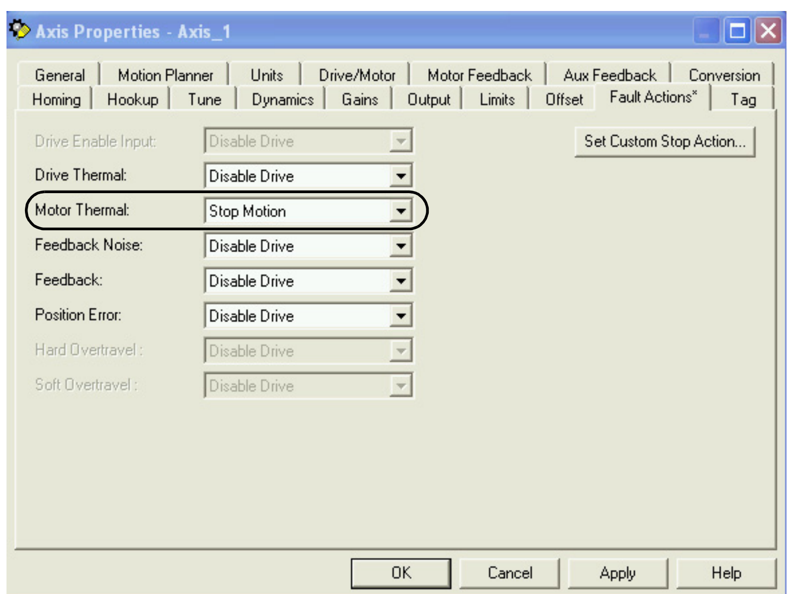
Table 107 - Kinetix 6200 Drive Fault Action Definitions

Drive Fault Action	Definition
Shutdown	The drive disables the axis as defined in the Drive Exception/Fault Behavior tables below (Table 108…Table 111). In addition, the axis in Logix Designer enters the Shutdown state, which disables any axes that are using this axis as a camming or gearing master. In addition, the AxisHomedStatus tag for the faulted axis is cleared. Shutdown is the most severe action to a fault and it is usually reserved for faults that could endanger the machine or operator if power is not removed as quickly as possible.
Disable Drive	The drive disables the axis as defined in the Drive Exception/Fault Behavior, Table 108.
Stop Motion	The axis decelerates at the maximum deceleration rate (set in the Logix Designer application>Axis Properties>Dynamics tab). Once the axis has come to a stop, the servo loops remain enabled but no further motion can be generated until the fault is reset. This is the gentlest stopping mechanism in response to a fault. It is usually used for less severe faults.
Status Only	The drive continues to operate. Status is provided by the four-character fault status indicator and drive status indicator. The application program must handle any motion faults. In general this setting should only be used in applications where the standard fault actions are not appropriate.

Only selected drive faults are configurable. In the Drive Exception/Fault Behavior tables beginning on page 218, the controlling attribute is given for programmable fault actions. All faults that are not configurable have a fault action of Shutdown.

Figure 93 - Logix Designer Axis Properties - Fault Actions Tab

Drive Fault Action/Attribute for Motor Overtemp fault (FLT S05).



This dialog box applies to Kinetix 6200 (sercos) servo drives.

Drive Exception/Fault Behavior

Table 108 - Drive Behavior, FLT S*xx* Fault Codes

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion Exception Behavior	Sercos Fault Behavior
FLT S02…MTR COMMUTATION	Illegal Hall State	The motor encoder Hall inputs are all high or all low.	Coast/Disable	Coast/Disable
FLT S03…MTR OVERSPEED FL	Motor Overspeed	The motor speed has exceeded 125% of the motor maximum speed ratings.	Coast/Disable	Coast/Disable
FLT S04…MTR OVERSPEED UL (Kinetix 6500 drives only)	Motor Overspeed	Motor speed has exceeded 125% of maximum rated speed. The 100% trip point is dictated by the lesser of the user velocity limits or the motor rated base speed.	Decel/Hold	N/A
FLT S05…MTR OVERTEMP FL nn	Motor Overtemperature	The motor thermostat, motor thermistor, or encoder temperature sensor indicates that the motor factory temperature limit has been exceeded. The nn sub-code is defined as follows: 01:Motor Thermostat or Thermistor. 02:Encoder Temperature Sensor.	Coast/Disable	Coast/Disable
FLT S06…MTR OVERTEMP UL nn (Kinetix 6500 drives only)	Motor Overtemperature		Decel/Hold	N/A
FLT S07…MTR OVERLOAD FL	Motor Thermal Protection	The thermal model for the motor indicates that the temperature has exceeded 110% of its rating.	Decel/Disable	Decel/Disable
FLT S08…MTR OVERLOAD UL (Kinetix 6500 drives only)	Motor Thermal Protection	The thermal model for the motor indicates that the temperature has exceeded a user programmable limit.	Decel/Hold	N/A
FLT S10…INV OVERCURRENT	IPM Fault	The IPM fault output indicates that the power transistors were turned off because of overcurrent, overtemperature, or power supply problems.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S11…INV OVERTEMP FL	Inverter Overtemperature	The inverter temperature has exceeded its limit.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S13…INV OVERLOAD FL	Inverter Thermal Protection	The thermal model for the power transistors indicates that the temperature has exceeded 110% of its rating.	Coast/Disable	Coast/Disable
FLT S14…INV OVERLOAD UL (Kinetix 6500 drives only)	Inverter Thermal Protection	The thermal model for the power transistors indicates that the temperature has exceeded the user-programable limit.	Decel/Hold	N/A
FLT S16…GROUND CURRENT	Ground Fault	Excessive ground current was detected in the converter.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S18…CONV OVERTEMP FL	Converter Overtemperature	The converter temperature has exceeded its limit.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S20…CONV OVERLOAD FL	Converter Thermal Protection	The thermal model for the converter indicates that the temperature has exceeded its rating.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S21…CONV OVERLOAD UL (Kinetix 6500 drives only)	Converter Thermal Protection	The thermal model for the converter indicates that the temperature has exceeded a user-programmable limit.	Decel/Hold	N/A
FLT S22…AC POWER LOSS	AC Power Loss	All three AC input phases are detected as absent when an axis is enabled.	Coast/Disable	Decel/Disable
FLT S23…AC PHASE LOSS nn	AC Phase Loss	Some, but not all AC input phases are detected as absent. The nn sub-code is defined as follows: 01: L1 is missing. 02: L2 is missing. 03: L3 is missing.	Coast/Disable (open contactor enable relay) (IAM modules) Decel/Hold (AM modules)	Coast/Disable (open contactor enable relay) (IAM modules) Decel/Hold (AM modules)
FLT S25…PRECHARGE FAILURE	Pre-charge Failure	The converter pre-charge circuit detected that the DC bus did not reach an appropriate voltage level after charging for a period of time.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S29…SHUNT OVERLOAD FL	Shunt Thermal Protection	The thermal model for the shunt circuitry indicates that the temperature has exceeded its rating.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S30…SHUNT OVERLOAD UL (Kinetix 6500 drives only)	Shunt Thermal Protection	The thermal model for the shunt circuitry indicates that the temperature has exceeded a user-programmable limit.	Decel/Hold	N/A
FLT S31…SHUNT MODULE	Shunt Module Fault	The shunt module in a multi-axis system has a fault.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S33…BUS UNDERVOLT FL	Bus Undervoltage	The DC bus voltage is measured below a factory limit when the DC bus was expected to be charged.	Decel/Disable (open contactor enable relay)	Decel/Disable (open contactor enable relay)
FLT S34…BUS UNDERVOLT UL (Kinetix 6500 drives only)	Bus Undervoltage	The DC bus voltage is measured below a user limit when the DC bus was expected to be charged.	Decel/Hold	N/A
FLT S35…BUS OVERVOLT FL	Bus Overvoltage	The DC bus voltage is measured above a factory limit.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)

Table 108 - Drive Behavior, FLT S*xx* Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion Exception Behavior	Sercos Fault Behavior
FLT S38…FUSE BLOWN	Blown Fuse (Bus Loss)	A blown fuse was detected in the power structure.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT S41…MTR AQB STATE FL	Motor Feedback State Error	The number of illegal state transitions of the AQB encoder signals has exceeded a factory limit.	Coast/Disable	Coast/Disable
FLT S41…AUX AQB STATE FL	Aux Feedback State Error		Coast/Disable	Coast/Disable
FLT S42…MTR AQB STATE UL	Motor Feedback State Error		Decel/Hold	Coast/Disable
FLT S42…AUX AQB STATE UL	Aux Feedback State Error		Decel/Hold	Coast/Disable
FLT S43…MTR FDBK LOSS FL	Feedback Loss	On sin/cos encoders, the sum of the square of the sin/cos signals has been measured below a user limit. On TTL encoders, the absolute value of the differential A/B signals is below a user limit. **IMPORTANT:** Motors with non-intelligent SIN/COS encoders or incremental encoders without Hall effect sensors do not see the feedback loss fault if the motor is running at high speed and if only one line in the feedback cable is opened.	Coast/Disable	Coast/Disable
FLT S43…AUX FDBK LOSS FL	Feedback Loss		Coast/Disable	Coast/Disable
FLT S44…MTR FDBK LOSS UL (Kinetix 6500 drives only)	Motor Feedback Loss		Decel/Hold	N/A
FLT S44…AUX FDBK LOSS UL (Kinetix 6500 drives only)	Aux Feedback Loss		Decel/Hold	N/A
FLT S45…MTR FDBK COMM FL	Feedback Serial Comms	The number of consecutive missed or corrupted serial data packets from the feedback device has exceeded a factory set limit.	Coast/Disable	Coast/Disable
FLT S45…AUX FDBK COMM FL	Feedback Serial Comms		Coast/Disable	Coast/Disable
FLT S46…MTR FDBK COMM UL (Kinetix 6500 drives only)	Motor Fdbk Serial Comms	The number of consecutive missed or corrupted serial data packets from the feedback device has exceeded a user set limit.	Decel/Hold	N/A
FLT S46…AUX FDBK COMM UL (Kinetix 6500 drives only)	Aux Feedback Serial Comms		Decel/Hold	N/A
FLT S47…MTR ENC SELF TEST nn	Feedback Self Test	The feedback device has detected an internal error. Sub code (nn) is available for factory use.	Coast/Disable	Coast/Disable
FLT S47…AUX ENC SELF TEST nn	Feedback Self Test		Coast/Disable	Coast/Disable
FLT S50…POS HW OTRAVEL	Hardware Overtravel Positive	The positive hardware overtravel input is monitored.	Decel/Disable	Coast/Disable
FLT S51…NEG HW OTRAVEL	Hardware Overtravel Negative	The negative hardware overtravel input is monitored.	Decel/Disable	Coast/Disable
FLT S52…POS SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel Positive	The feedback position is compared to the positive limit.	N/A	Coast/Disable
FLT S53…NEG SW OTRAVEL (Kinetix 6200 drives only)	Software Overtravel Negative	The feedback position is compared to the negative limit.	N/A	Coast/Disable
FLT S54…POSN ERROR	Excessive Position Error	The position error has exceeded a user limit for a programmable period of time.	Coast/Disable	Decel/Disable
FLT S55…VEL ERROR nn	Excessive Velocity Error	The velocity error has exceeded a limit for a period of time. The nn sub-code is defined as follows: 00:Velocity error referenced to the velocity loop feedback. 01:Velocity error referenced to the nonvelocity feedback (in dual-feedback configurations).	Coast/Disable	Decel/Disable
FLT S56…OVERTORQUE (Kinetix 6500 drives only)	Overtorque Limit	Motor torque has exceeded a user-programmable setting.	Decel/Hold	N/A
FLT S57…UNDERTORQUE (Kinetix 6500 drives only)	Undertorque Limit	Motor torque has fallen below a user-programmable setting.	Decel/Hold	N/A
FLT S60…ILLEGAL MODE	Illegal Control mode	An illegal mode of operation was attempted.	Decel/Hold	Decel/Hold
FLT S61…ENABLE INPUT	Drive Enable Input	The hardware enable input was deactivated while the drive was enabled.	Decel/Disable	Decel/Disable
FLT S62…CONTROLLER (Kinetix 6500 drives only)	Controller Initiated Exception	The controller has requested the drive to generate an exception.	Coast/Disable	N/A

Table 109 - Drive Behavior, FLT M*xx* Fault Codes

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion Exception Behavior	Sercos Fault Behavior
FLT M01…SELF SENSING	Self-sensing Startup Fault	The self-sensing commutation start-up algorithm failed.	Coast/Disable	Coast/Disable
FLT M02…MOTOR VOLTAGE	Motor Voltage Mismatch	Motor voltage is incompatible with drive voltage.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M04…MTR FDBK FILTER nn (Kinetix 6500 drives only)	Motor Feedback Filter	Excessive levels of noise have been detected by the digital feedback filter. The nn field is defined as follows: 01: Sine or A channel 02: Cosine or B channel	Coast/Disable	N/A
FLT M04…AUX FDBK FILTER nn (Kinetix 6500 drives only)	Aux Feedback Filter		Coast/Disable	N/A
FLT M05…MTR FDBK BATT LOSS	Motor Encoder Battery Loss	The battery voltage on a battery-backed motor encoder is low enough such that absolute position is no longer available.	Decel/Hold	Decel/Disable
FLT M06…MTR FDBK BATT LOW	Motor Encoder Battery Caution	The battery voltage on a battery-backed motor encoder is below a caution level.	Decel/Hold	Decel/Disable
FLT M07…MTR INCR LOSS	Motor Incremental Position Loss	The periodic check of the incremental encoder position against the absolute encoder position or Hall edges (when available) indicates they are out of tolerance.	Coast/Disable	Coast/Disable
FLT M07…AUX INCR LOSS	Aux Incremental Position Loss		Coast/Disable	Coast/Disable
FLT M10…CTRL OVERTEMP FL	Control Module Overtemperature	The control module temperature has exceeded its limit.	Coast/Disable	Coast/Disable
FLT M11…CTRL OVERTEMP UL (Kinetix 6500 drives only)	Control Module Overtemperature	The control module temperature has exceeded a user limit.	Decel/Hold	N/A
FLT M12…POWER CYCLE FL	Pre-charge Overload	The converter estimates that the pre-charge circuit has exceeded its limit due to excessive power cycling.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M13…POWER CYCLE UL (Kinetix 6500 drives only)	Pre-charge Overload	The converter estimates that the pre-charge circuit is approaching its user-defined limit due to excessive power cycling.	Decel/Hold	N/A
FLT M14…CURR FDBK OFFSET	Excessive Current Feedback Offset	The current feedback circuitry requires excessive offset compensation.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M15…REGEN PWR SUPPLY	Regenerative Power Supply Fault	The hardware Regeneration OK input was deactivated while the drive was enabled.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M19…DC BUS LIMIT	DC Bus Limited Position Error	During a DC bus limit condition, the position error has exceeded a user limit for a programmable period of time.	Decel/Hold	Decel/Disable
FLT M25…COMMON BUS	DC Common Bus Fault	AC Power was detected by the drive while configured for Common Bus Follower operation.	Coast/Disable (open contactor enable relay)	Coast/Disable
FLT M26…RUNTIME ERROR	Runtime Drive Error	The drive firmware encountered an unrecoverable runtime error.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M27…BACKPLANE COMM	Backplane COM	Communication over the backplane detected a problem.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M28…SAFETY COMM	Internal Safety Communication	Communication with the safety hardware within the drive malfunctioned.	Coast/Disable (open contactor enable relay)	Coast/Disable (open contactor enable relay)
FLT M64…SENSOR ASSIGNMENT	Sensor Assignment	The Home, Registration1, or Registration 2 digital input function has been requested but is not assigned to an input. Multiple inputs have been assigned the same function.	Coast/Disable	Coast/Disable
FLT M68…IPIM	IPIM Module Fault	A fault has occurred in one or more IPIM modules on the power rail.	N/A	Coast/Disable (open contactor enable relay) Applies to the IAM module.

Table 110 - Drive Behavior, NODE FLT Fault Codes

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion and Sercos Drive Behavior
NODE FLT 01…LATE CTRL UPDATE (Kinetix 6500 drives only)	Control Update Fault	Several consecutive updates from the controller have been lost.	Decel/Disable
NODE FLT 02…PROC WATCHDOG	Processor Watchdog Fault	The watchdog circuit monitoring processor operation detected a problem.	Coast/Disable
NODE FLT 03…HARDWARE nn	Hardware Fault	The drive has an internal hardware problem. The nn sub-code is defined as follows: 01: Invalid slot ID. 02: Cannot read slot ID. 03: Nonvolatile write to memory failed. 04: Nonvolatile memory read failed.	Coast/Disable (open contactor enable relay)
NODE FLT 04…DATA FORMAT ERROR (Kinetix 6200 drives only)	Data Format Error	A data format error was discovered in the controller-to-drive message.	Coast/Disable
NODE FLT 06…LOST CTRL CONN (Kinetix 6500 drives only)	Lost Controller Connection	communication with the controller have been lost	Decel/Disable
NODE FLT 08…LOGIC WATCHDOG (Kinetix 6500 drives only)	Custom Logic Update Timeout	The watchdog circuit monitoring custom logic operation detected a problem.	Coast/Disable (open contactor enable relay)
NODE FLT 09…IP ADDRESS (Kinetix 6500 drives only)	Duplicate IP Address	This drive and another EtherNet device on the same subnet have identical IP addresses.	Coast/Disable
NODE FLT 128…DRAM TEST	DRAM Test Fault	A power-up test of the DRAM indicated a memory problem.	Coast/Disable (open contactor enable relay)
NODE FLT 129…FPGA CONFIG	FPGA Configuration Fault	The FPGA could not be configured properly.	Coast/Disable (open contactor enable relay)
NODE FLT 133…SERCOS ADDRESS (Kinetix 6200 drives only)	Duplicate Sercos Node Address	This axis and one or more other axes have identical sercos addresses.	Coast/Disable
NODE FLT 139…SERCOS RING (Kinetix 6200 drives only)	Sercos Ring Fault	The sercos ring is not active after being active and operational.	Decel/Disable

Table 111 - Drive Behavior, SAFE FLT Fault Codes

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion and Sercos Drive Behavior
SAFE FLT 01…INTERNAL HDWR nn	Internal Hardware	An internal hardware fault has been detected. On Safe Torque Off (-S0) models, the nn sub-code is defined as follows: 01: Internal SPI communication fault. 02: Internal SPI write buffer overrun detected. 03: Internal SPI buffer write collision detected. 04: Internal SPI read buffer error detected. 05: Internal SPI read buffer overflow detected. 06: Internal SPI data integrity failure detected. 07: Internal watchdog time out reset occurred. 08: Internal stack overflow reset occurred. 09: Internal stack underflow detected. 10: Power supply brown out detected. 11: Over voltage monitor circuit test failure. 12: Under voltage monitor circuit test failure. 13: Error occurred during flash download. 14: Internal flash programming failure detected. 15: Safety firmware failed checksum verify. 16: Boot block is active.	Coast-Disable (open contactor enable relay)
SAFE FLT 02…INVALID CONFIG	Invalid Configuration Fault	One or more safety attributes have illegal values.	Coast-Disable
SAFE FLT 03…MP OUT nn	Motion Power Output Fault	A fault has been detected on the motion power output circuitry. On Safe Torque Off (-S0) models, the nn sub-code is defined as follows: 01: Gate power evaluation fault. 02: Gate enable evaluation fault.	Coast-Disable
SAFE FLT 04…RESET AT POWERUP	Reset at Powerup	The reset was detected as active at powerup.	Coast-Disable
SAFE FLT 05…FEEDBACK 1	Motor Feedback Fault	Feedback loss or an illegal state change has been detected on the motor AQB inputs.	Coast-Disable
SAFE FLT 06…FEEDBACK 2	Auxiliary Feedback Fault	Feedback loss or an illegal state change has been detected on the auxiliary AQB inputs.	Coast-Disable
SAFE FLT 07…DUAL FB SPEED	Feedback Speed Compare Fault	A speed miss-compare was detected between the two feedback devices.	Coast-Disable

Table 111 - Drive Behavior, SAFE FLT Fault Codes (continued)

Four-character Display Message	Logix Designer Fault Message	Description	Integrated Motion and Sercos Drive Behavior
SAFE FLT 08…DUAL FB POSITION	Feedback Position Compare Fault	A position miss-compare was detected between the two feedback devices.	Coast-Disable
SAFE FLT 09…SS IN nn	SS Input Fault	The safe stop (SS) input circuitry has detected a problem. On Safe Torque Off (-S0) models, the nn sub-code is defined as follows: 01: Input 0 failed pulse test. 02: Input 0 failed optocoupler test. 03: Input 1 failed pulse test. 04: Input 1 failed optocoupler test. 05: Input 3 failed optocoupler test. 06: Input 4 failed optocoupler test.	Coast-Disable (1)
SAFE FLT 10…SS OUT nn	SS Output Fault	The safe stop (SS) output circuitry has detected a problem. On Safe Torque Off (-S0) models, the nn sub-code is defined as follows: 01: Output 0 fault detected. 02: Output 1 fault detected.	Coast-Disable (1)
SAFE FLT 11…DECELERATION	Deceleration Fault	The motor was detected to be not decelerating fast enough.	Coast-Disable
SAFE FLT 12…STOP SPEED	Zero Speed Fault	Zero speed was not detected by the end of the stop delay.	Coast-Disable
SAFE FLT 13…MOTION AFTER STOP	Motion After Stopped Fault	Motion has been detected after the axis was already detected as stopped and the door was unlocked.	Coast-Disable
SAFE FLT 14…SLS IN	SLS Input Fault	The safe limited speed (SLS) input circuitry has detected a problem.	Coast-Disable (1)
SAFE FLT 15…SLS OUT	SLS Output Fault	The safe limited speed (SLS) output circuitry has detected a problem.	Coast-Disable (1)
SAFE FLT 16…SLS SPEED	SLS Speed Fault	The monitored speed has exceeded the safe limited speed (SLS) limit.	Coast-Disable (1)
SAFE FLT 17…SMS SPEED	SMS Speed Fault	The monitored speed has exceeded the safe maximum speed (SMS) limit.	Coast-Disable (1)
SAFE FLT 18…ACCELERATION	Acceleration Fault	The motor was detected not accelerating fast enough.	Coast-Disable (1)
SAFE FLT 19…DIRECTION	Direction Fault	The monitored direction was found to be in the restricted direction.	Coast-Disable (1)
SAFE FLT 20…DM IN	DM Input Fault	The door monitor (DM) input was detected as OFF when it should have been ON.	Coast-Disable (1)
SAFE FLT 21…DOOR MONITORING	Door Monitoring	The door monitor (DM) input was detected as being in the wrong state.	Coast-Disable (1)
SAFE FLT 22…DC OUT	DC Output Fault	The door control (DC) output circuitry has detected a problem.	Coast-Disable (1)
SAFE FLT 23…LM IN	LM Input Fault	The lock monitor (LM) input circuitry has detected a problem.	Coast-Disable (1)
SAFE FLT 24…LOCK MONITORING	LM Input State Fault	The lock monitor (LM) input was detected as OFF when the Door should have been locked or detected as ON when the door was opened.	Coast-Disable (1)
SAFE FLT 25…ESM IN	ESM Input Fault	The enabling switch monitor (ESM) input was detected as OFF when it should have been ON.	Coast-Disable (1)
SAFE FLT 26…ESM MONITORING	ESM Input State Fault	The enabling switch monitor (ESM) input was detected as being in the wrong state.	Coast-Disable (1)
SAFE FLT 27…ENCODER 1 VOLTAGE	Encoder 1 Voltage Fault	Encoder voltage is outside of the limits.	Coast-Disable
SAFE FLT 28…ENCODER 2 VOLTAGE	Encoder 2 Voltage Fault	Encoder voltage is outside of the limits.	Coast-Disable

(1) The Safe Stop fault behavior is determined by parameter settings in the safety configuration.

Remove and Replace the Kinetix 6200 and Kinetix 6500 Drive Modules

This chapter provides remove and replace procedures for your Kinetix 6200 and Kinetix 6500 system components.

ATTENTION: This drive contains electrostatic discharge (ESD) sensitive parts and assemblies. You are required to follow static-control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to Guarding Against Electrostatic Damage, publication 8000-4.5.2, or any other applicable ESD awareness handbook.

Before You Begin

These tools are required before you begin removal and replacement procedures:

- Screwdriver, 3.5 mm (0.14 in.)
- Voltmeter

Remove Kinetix 6200 and Kinetix 6500 Drive Modules

Follow these steps to remove the control modules, power modules, IPIM, shunt, and slot-filler modules from the Bulletin 2094 power rail.

1. Verify that all control and input power has been removed from the system.

> **ATTENTION:** To avoid shock hazard or personal injury, assure that all power has been removed before proceeding. This system can have multiple sources of power. More than one disconnect switch can be required to de-energize the system.

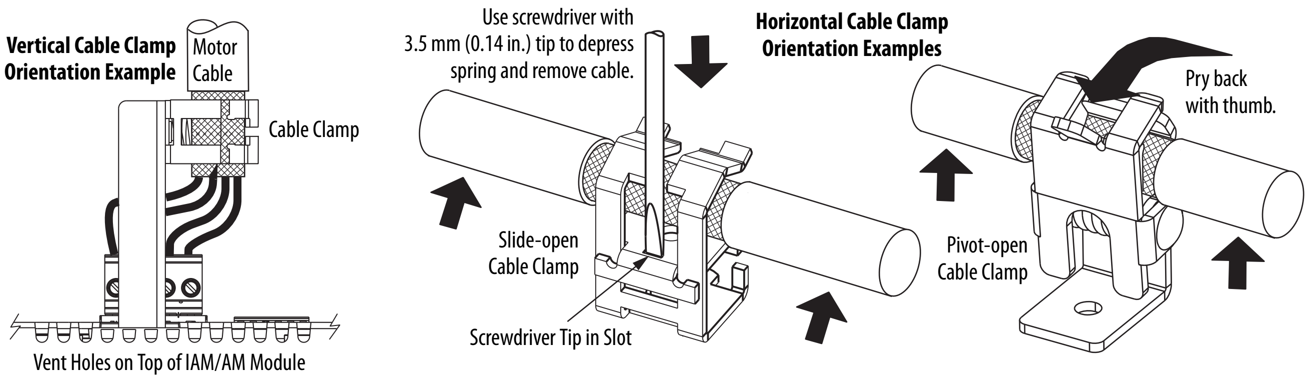
2. Wait five minutes for the DC bus to discharge completely before proceeding.

> **ATTENTION:** This product contains stored energy devices. To avoid hazard of electrical shock, verify that all voltage on capacitors has been discharged before attempting to service, repair, or remove this unit. Do not attempt the procedures in this document unless you are qualified to do so and are familiar with solid-state control equipment and the safety procedures in publication NFPA 70E.

3. Label and remove all connectors from the IAM/AM module you are removing.

   To identify each connector, refer to page 62.

4. Remove the motor cable from the cable shield clamp, as shown in these examples.



Remove the Control Module

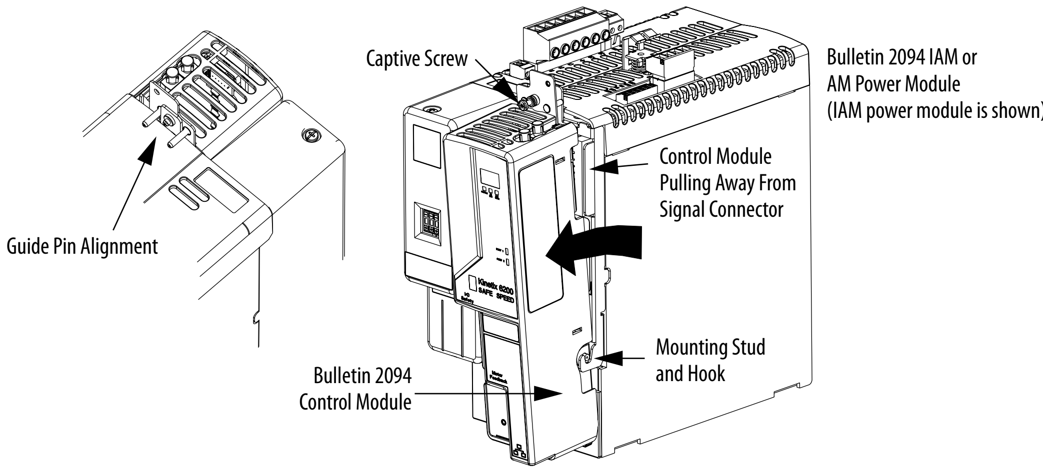
You can remove the control module from the power module (to replace the control module) or you can remove the control module and power module as a single unit, for example, to move an axis to another slot on the power rail. To remove the control module and power module as a single unit, refer to Remove the Drive Modules on page 226.

This procedure assumes that you are starting with the Kinetix 6200 or Kinetix 6500 drive system mounted on the power rail.

Follow these steps to remove the control module.

1. Loosen the captive screw on top of the control module.
2. Grasp the control module and power module, and gently pull the control module away from the connectors enough to clear the guide pins.

   The control module mounting studs pivot on the hooks.
3. Lift the control module off of the hooks and remove the control module from the power module.



Remove the Drive Modules

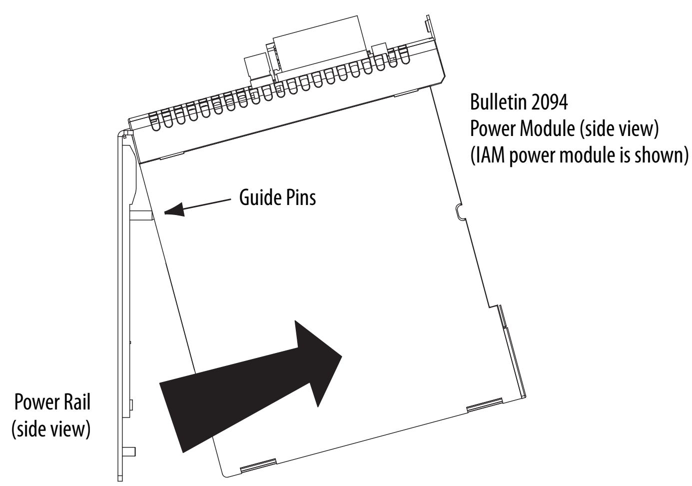
You can remove the control module from the power module (to replace the power module) or you can remove the control module and power module as a single unit.

TIP If you intend to reuse any control module and power module pair, you can remove them as a single unit, for example, to move an axis to another slot on the power rail.

IMPORTANT This procedure also applies to Bulletin 2094-BSP2 shunt module, 2094-PRF slot-filler module, and 2094-SEPM-B24-S IPIM module.

Follow these steps to remove the power modules.

1. Loosen the mounting screw (bottom center of each module).
2. Grasp the top and bottom of the module with both hands and gently pull the module away from the connectors enough to clear the guide pins (module pivots on top bracket).
3. Lift the bracket out of the power rail slot and remove the module from the power rail.



Replace Kinetix 6200 and Kinetix 6500 Drive Modules

Follow these steps to replace control modules, power modules, shunt modules, and slot-filler modules from the Bulletin 2094 power rail.

Replace the Drive Modules

Follow these steps to replace the drive modules.

1. Determine your power module, shunt module, or slot-filler module replacement.

If you are	Then
Replacing a drive module on an existing power rail	Go to step 3.
Replacing a drive module on a new power rail	Go to step 2.

2. Prepare to mount your replacement drive module by removing the protective covers from the power rail connectors.
3. Hang the mounting bracket from the slot on the power rail.

IMPORTANT	Power rails must be in vertical orientation before replacing drive modules for pins to seat properly.

4. Align the guide pins on the power rail with the guide pin holes in the back of the drive module (refer to the figure above).

TIP	The IAM power module can have two or three power rail connectors and guide pins, the AM power module can have one or two, all other modules have only one connector and one guide pin.

5. Use 2.26 N•m (20 lb•in) torque to tighten the mounting screw.

Replace the Control Modules

Refer to Mount the Control Modules on page 58 to replace your control modules.

Follow these steps when you have finished replacing your control modules.

1. Reconnect the module connectors.
2. Reapply power to the system.
3. Verify that the system is operating properly.

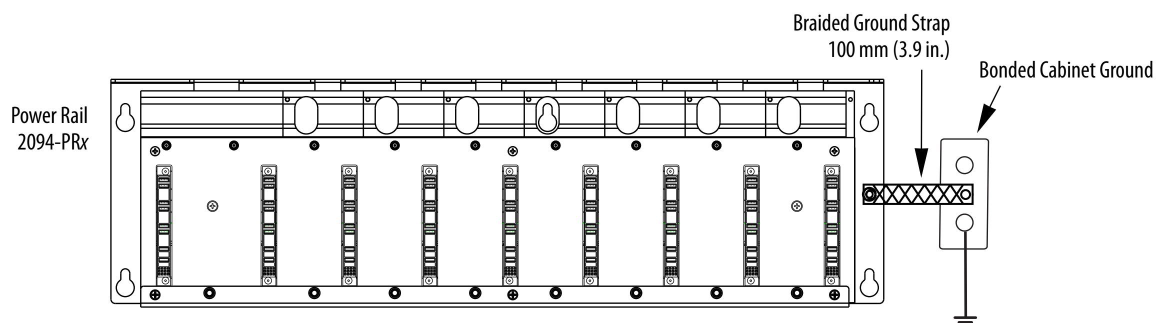
TIP However, after you replace a 2094-*xx*02*x*-M0*x*-S1 Safe Speed Monitor control module, the safety configuration (web page) can be from the previous control module of the same IP address. To correct this condition, go to Internet Explorer/Tools/Internet Options and under Browsing history, click Delete, to delete temporary files, cookies, and web form information.

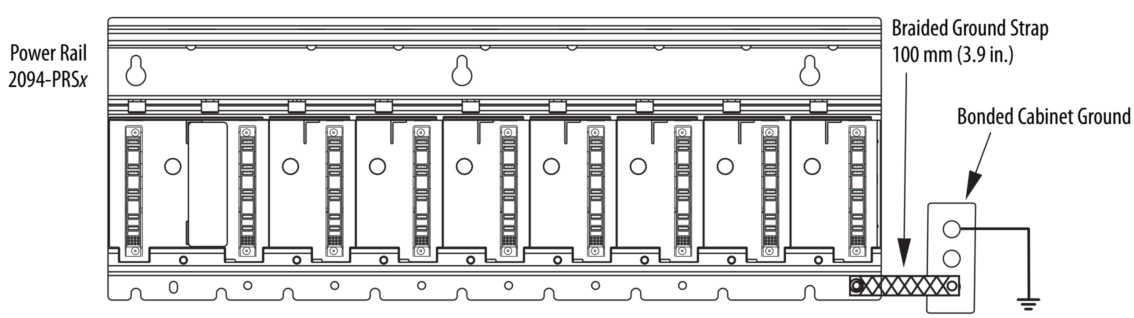
Remove the Power Rail

This procedure assumes you have removed all modules from the power rail.

Follow these steps to remove the power rail.

1. Disconnect the braided grounding strap from the grounding stud on the right side of the power rail.





2. Loosen the mounting bolts (removing the bolts is not necessary).
3. Lift the power rail up and off of the mounting bolts.

Replace the Power Rail

This procedure assumes you do not need to change the location of the power rail on the panel and you intend to reuse the mounting bolts of the power rail you just removed.

IMPORTANT	If you need to change the location of the power rail, or if you are installing a power rail designed for additional or fewer modules than you removed, refer to Kinetix 6000 Power Rail Installation Instructions, publication 2094-IN003.

ATTENTION: To avoid damage to the power rail during installation, do not remove the protective covers until the module for each slot is ready for mounting.

Follow these steps to replace the power rail.

1. Align the replacement power rail over the existing mounting bolts.

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

2. Tighten the mounting bolts.
3. Reattach the braided grounding strap to the power rail grounding stud (refer to page 228).

Notes:

Interconnect Diagrams

This appendix provides wiring examples and system block diagrams for your Kinetix 6200 and Kinetix 6500 system components.

Interconnect Diagram Notes

This appendix provides wiring examples to assist you in wiring the Kinetix 6200 and Kinetix 6500 drive systems. These notes apply to the wiring examples on the following pages.

Note	Information
1	For power wiring specifications, refer to Power Wiring Requirements on page 103.
2	For input fuse and circuit breaker sizes, refer to Circuit Breaker/Fuse Options on page 30.
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 AC line filter specifications, refer to the Kinetix Motion Accessories Technical Data, publication KNX-TD004.
4	Terminal block is required to make connections.
5	2094-BC*xx*-M*xx*-M (460V) IAM modules require a step-down transformer for single-phase control power input. The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.
6	2094-BL*xx*S and 2094-XL75S-C2 LIM modules can supply input power for up to eight axes. 2094-XL75S-C1 LIM modules can supply input power for up to sixteen axes. For common-bus systems with more than sixteen axes, multiple LIM modules (or control power transformers) are required. For Kinetix 6000M systems, the control power current needs to be calculated and the LIM module needs to be sized.
7	2094-BL*xx*S, and 2094-XL75S-C*x* LIM modules are capable of connecting to two IAM modules, providing each IAM module has its own line filter and the maximum current specification is not exceeded.
8	Contactor coil (M1) needs integrated surge suppressors for AC coil operation. Refer to the Kinetix Servo Drives Technical Data, publication KNX-TD003.
9	Drive Enable input must be opened when main power is removed, or a drive fault occurs. A delay of at least 1.0 second must be observed before attempting to enable the drive after main power is restored.
10	Cable shield clamp must be used to meet CE requirements. No external connection to ground is required.
11	Default configuration for jumper is for grounded power at user site. Ungrounded sites must jumper the bleeder resistor to prevent high electrostatic buildup. Refer to Determine the Input Power Configuration on page 93 for more information.
12	Leave jumper between PR2 and PR3 as shown to use the internal pre-charge resistor. Remove jumper when external pre-charge/circuit is required. For more information, refer to the 8720MC Regenerative Power Supply Installation Manual, publication 8720MC-RM001.
13	**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.
14	**ATTENTION:** Wiring the contactor enable relay is required. To avoid personal injury or damage to the drive, wire the contactor enable relay into your safety control string. Refer to Contactor Enable Relay on page 72, for more information. The recommended minimum wire size for wiring the three-phase power enable control circuit to the contactor enable connector is 1.5 mm^2 (16 AWG).
15	The Bulletin 2094 power module referenced is either an individual axis module (catalog number 2094-BM*xx*-M) or the same axis module that resides within an integrated axis module (catalog number 2094-BC*xx*-M*xx*-M).
16	For motor cable specifications, refer to the Kinetix Motion Accessories Technical Data, publication KNX-TD004.
17	Wire colors are for flying-lead cable and can vary from the premolded cable connectors.
18	Motor power cables (2090-XXNPMF-*xx*S*xx* and 2090-CPBM6DF-16AA*xx*) have a drain wire that must be folded back under the cable shield clamp.
19	MPL-B*xx*, MPM-B*xx*, MPF-B*xx*, MPS-B*xxx*, MPAR-B*xxx*, and MPAS-B*xxx* encoders use the +9V DC supply.
20	Brake connector pins are labeled plus (+) and minus (-) or F and G respectively. Power connector pins are labeled U, V, W, and GND or A, B, C, and D respectively.

Power Wiring Examples

These examples apply to power wiring configurations with and without the Bulletin 2094 line interface module (LIM), DC common bus wiring, and shunt module wiring.

Figure 94 - Single IAM Module with 2094-BL02 LIM Module

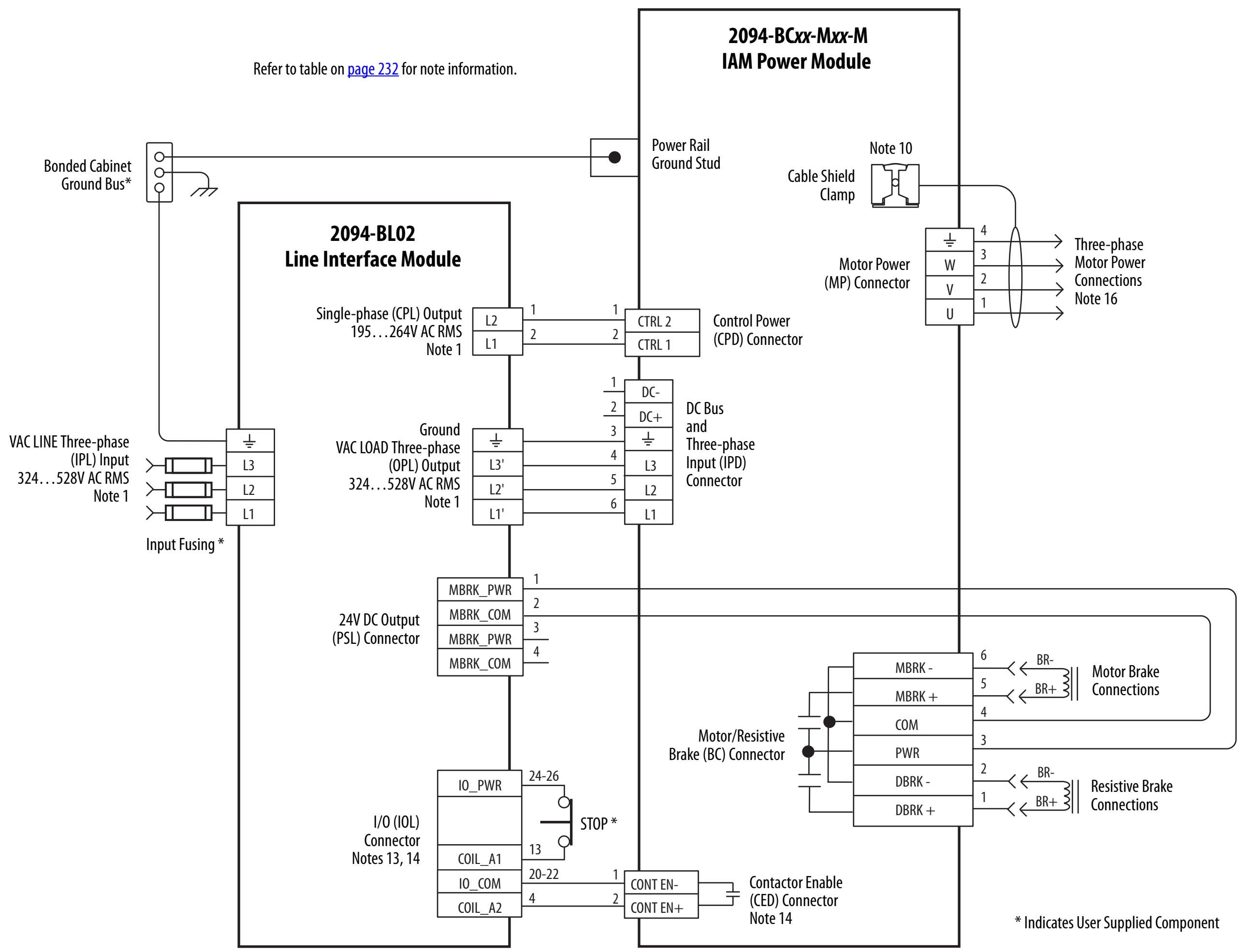
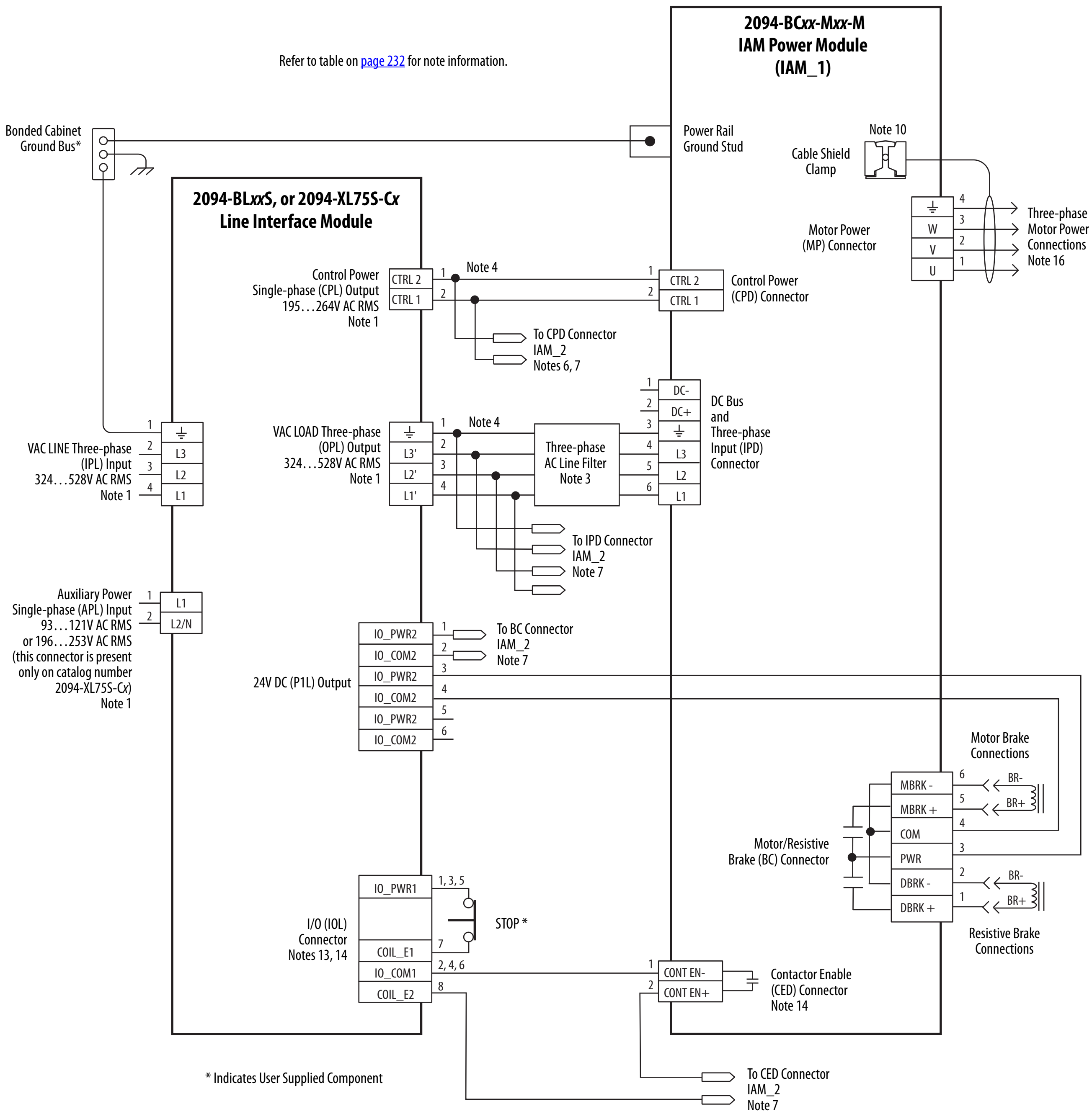
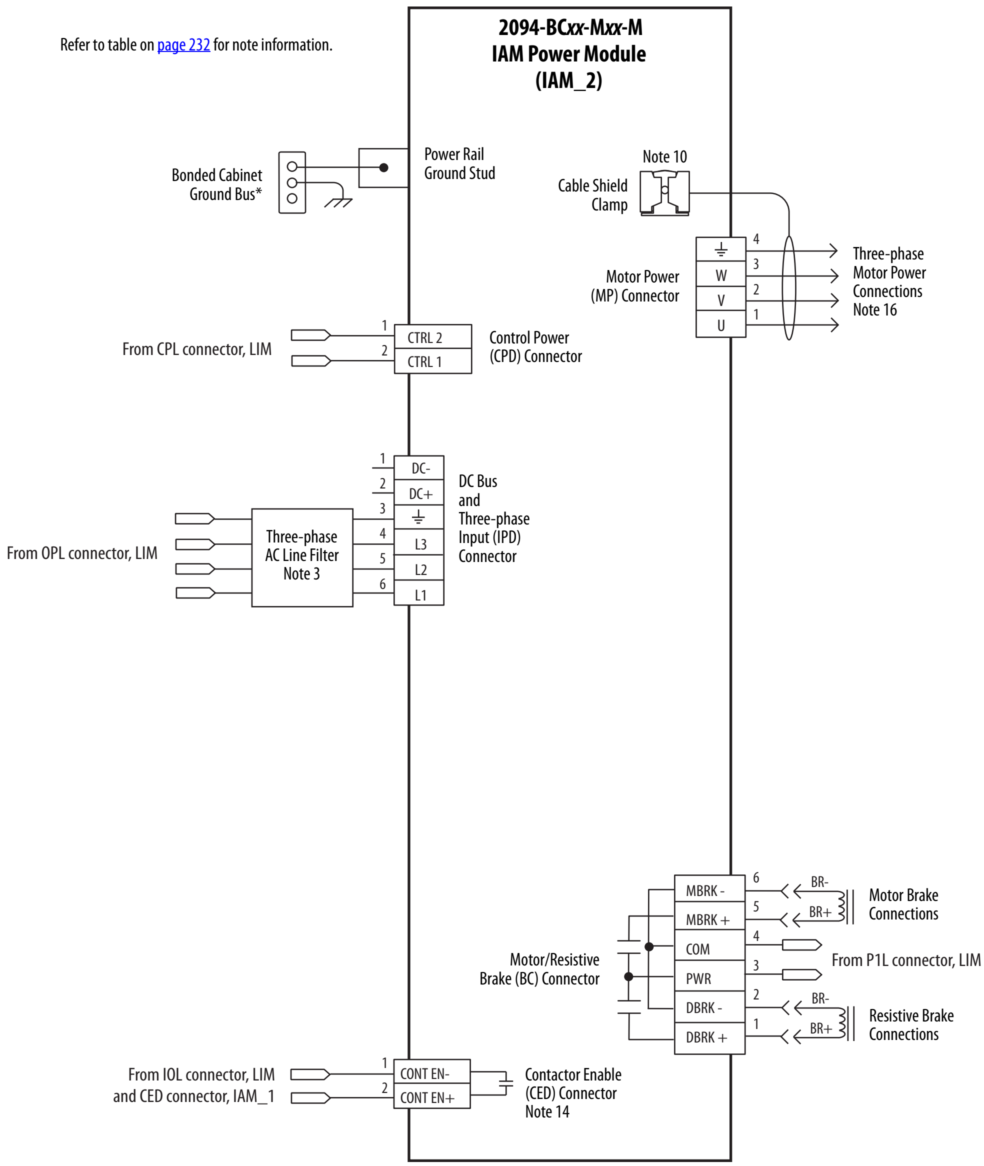


Figure 95 - Multiple IAM Module with LIM Module



* Indicates User Supplied Component

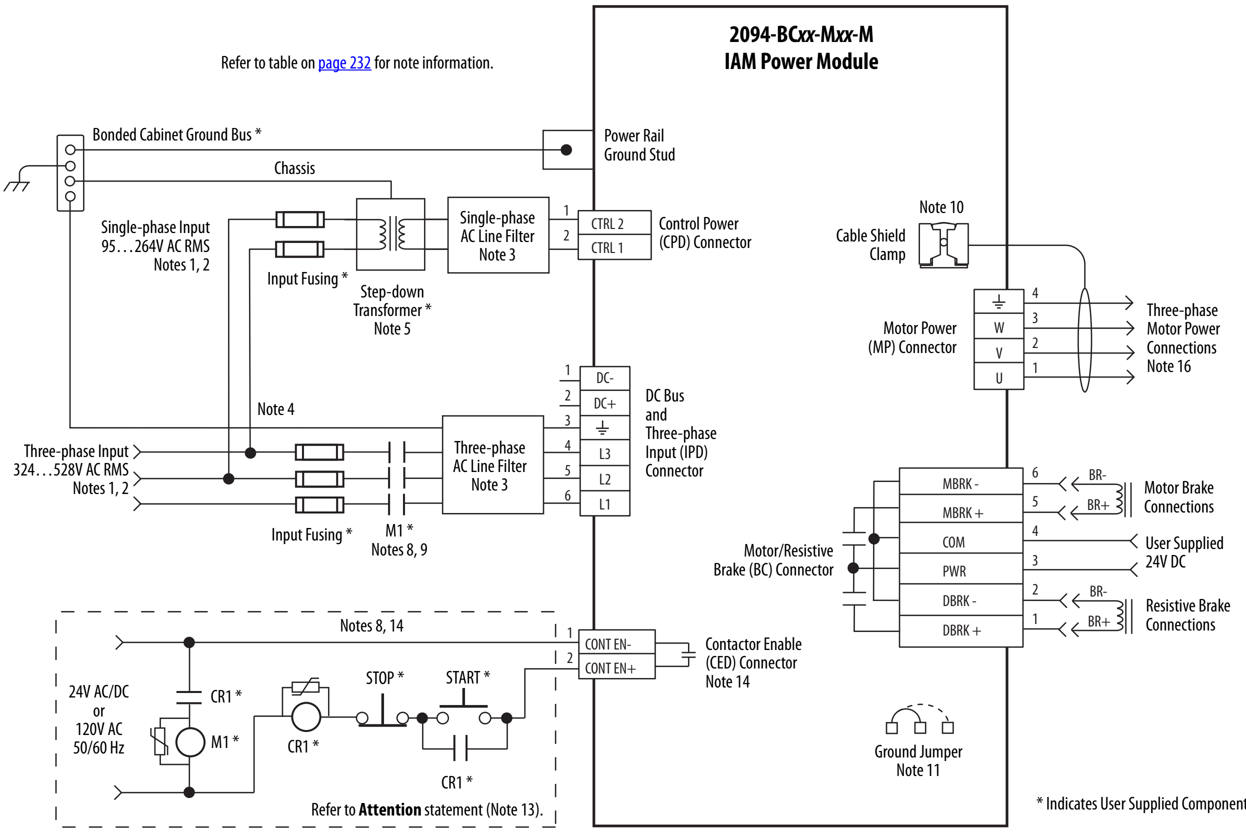
Figure 95 - Multiple IAM Module with LIM Module (continued)



This configuration does not include a LIM module. You must supply input power components. The single-phase and three-phase line filters are wired downstream of fusing and the M1 contactor.

ATTENTION: Wiring the contactor enable (CED) relay is required. To avoid injury or damage to the drive, wire the contactor enable relay into your control string.
Refer to Contactor Enable Relay on page 72 for more information.

Figure 96 - IAM Module (without LIM module)



DC Common Bus Wiring Examples

Figure 97 - Leader IAM Module with Single Follower IAM Module

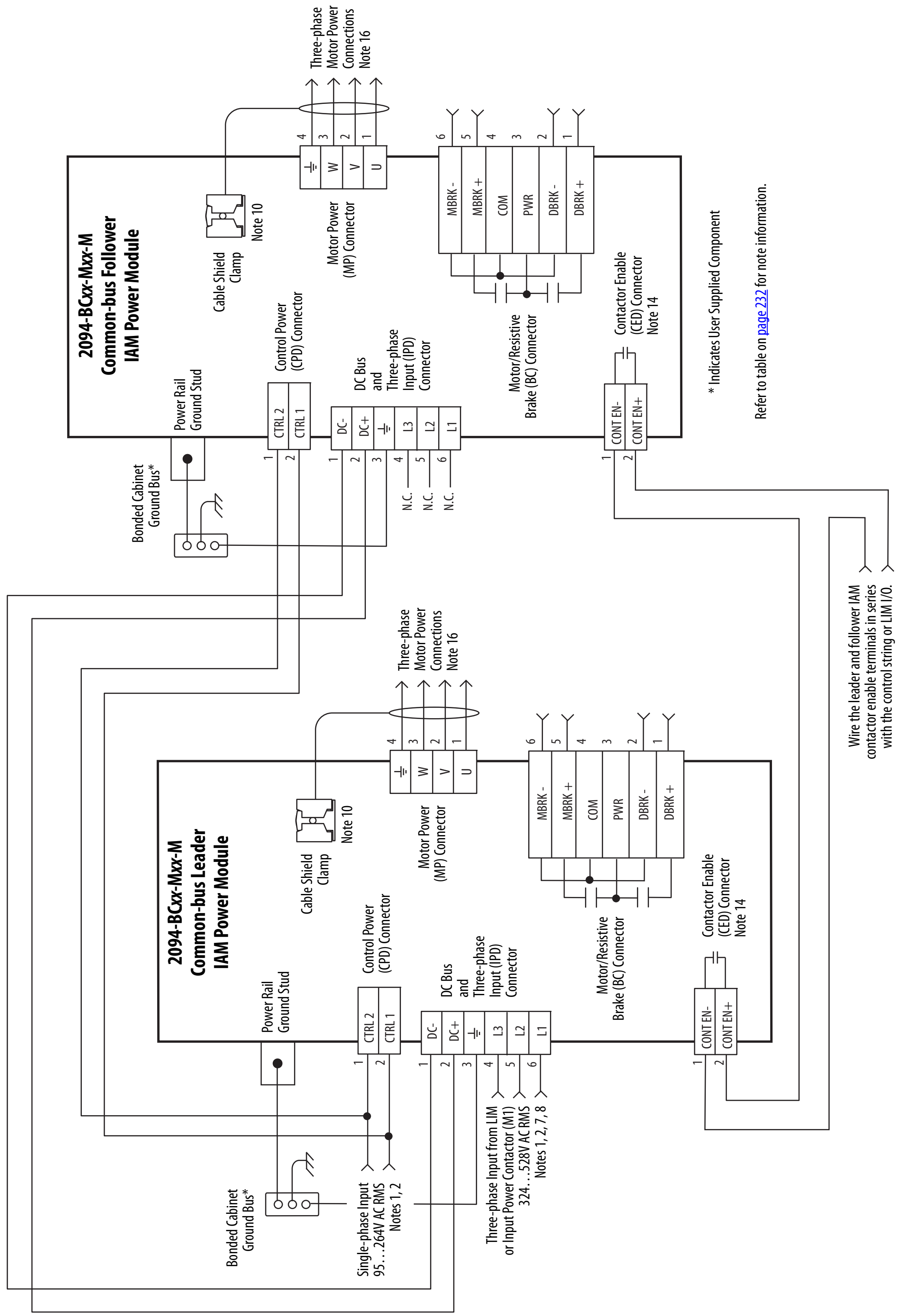


Figure 98 - Leader IAM Module with Multiple Follower IAM Modules

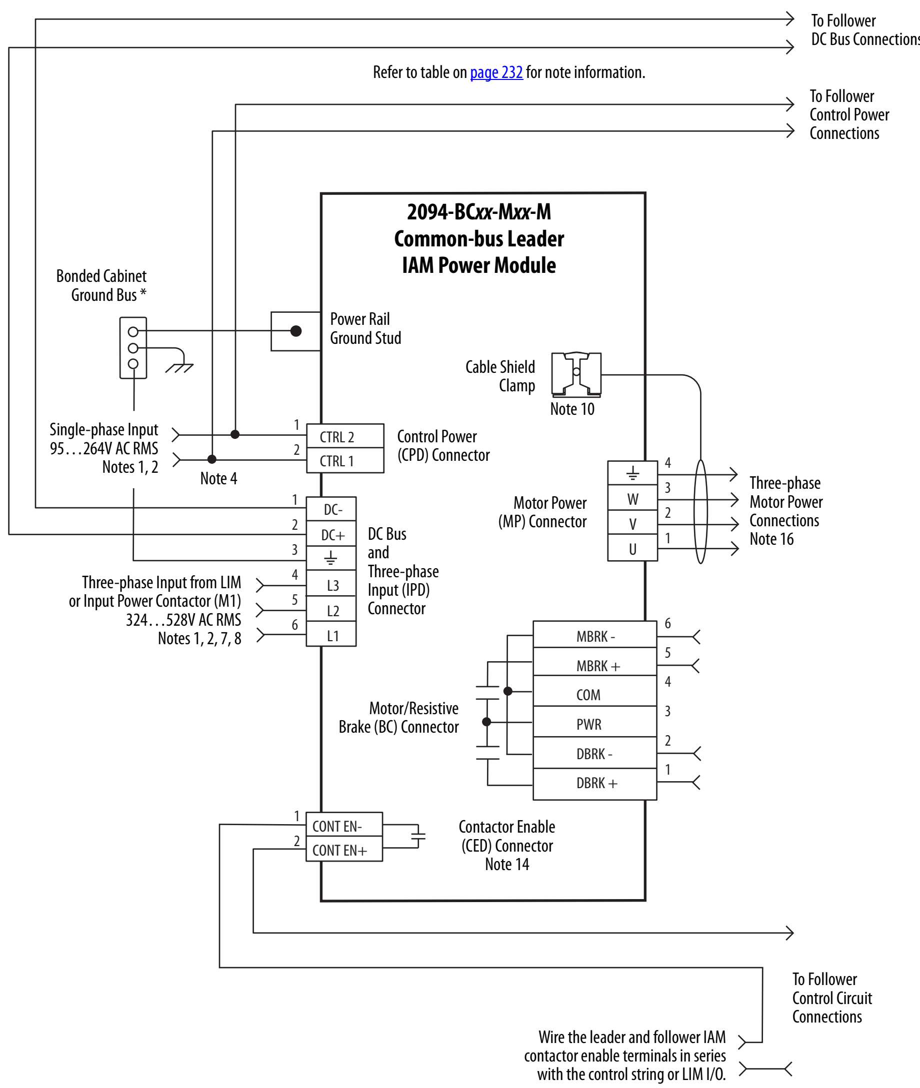
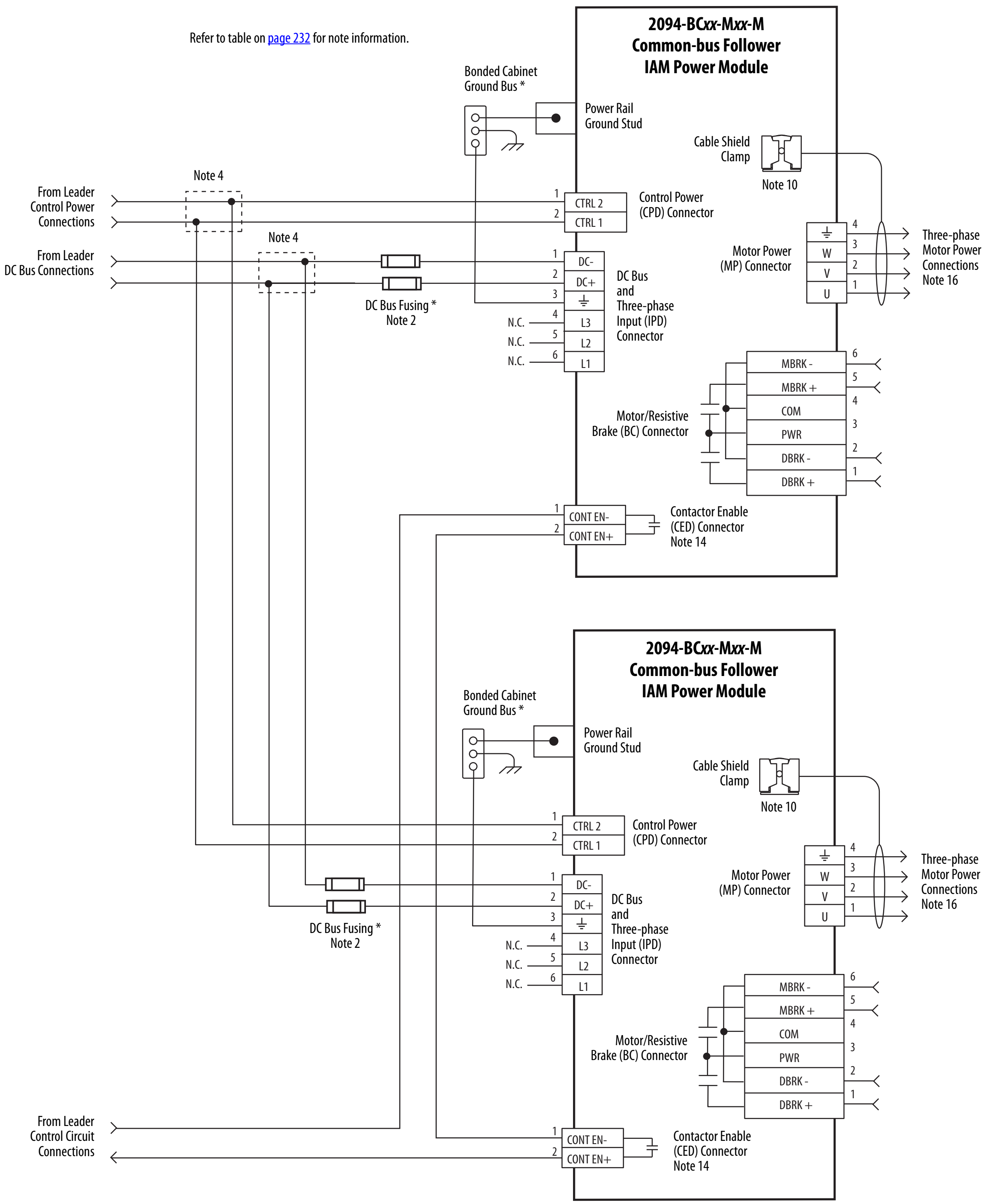


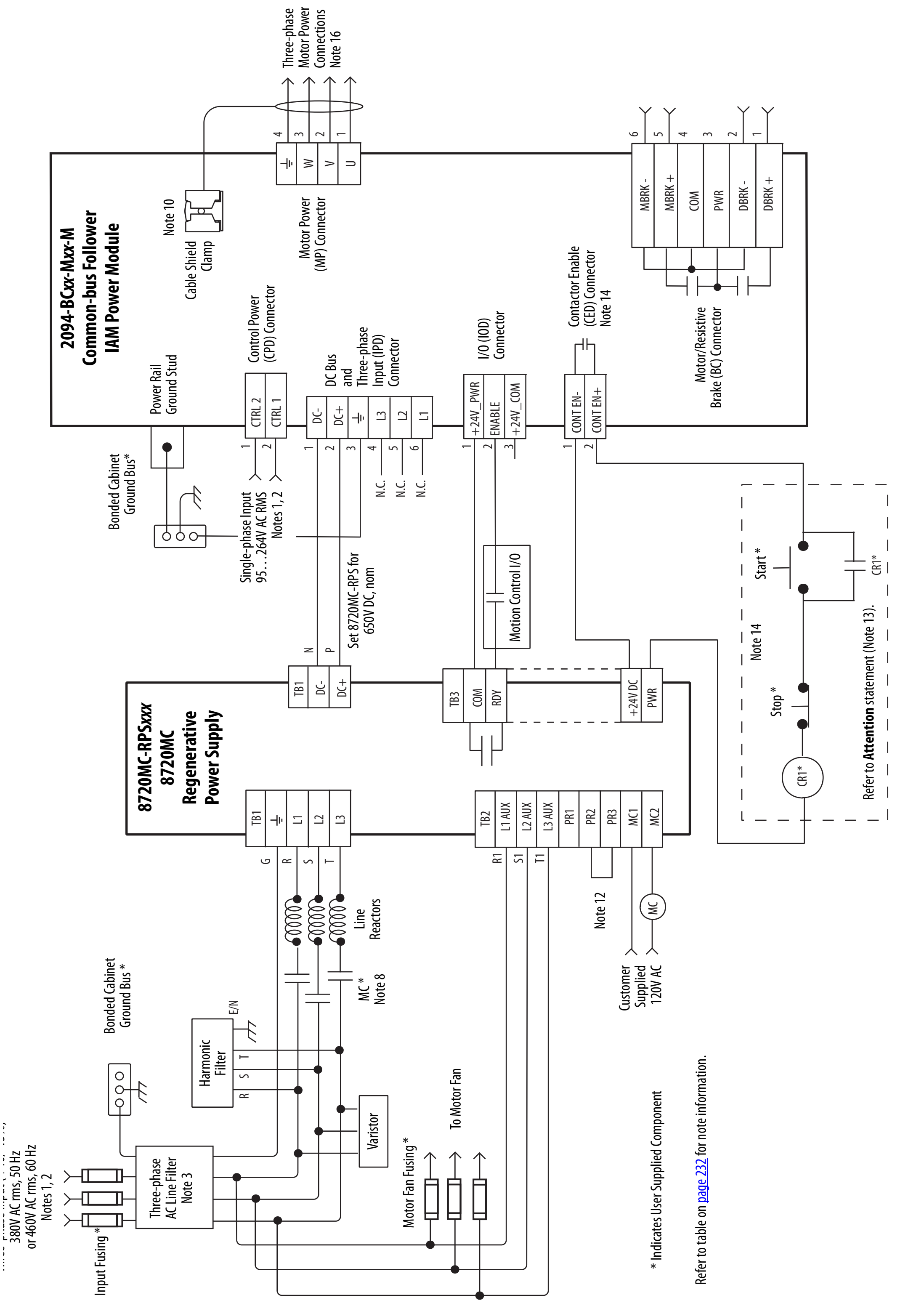
Figure 98 - Leader IAM Module with Multiple Follower IAM Modules (continued)

Refer to table on page 232 for note information.



* Indicates User Supplied Component

Figure 99 - 8720MC-RPS Leader Drive with Single Follower IAM Module

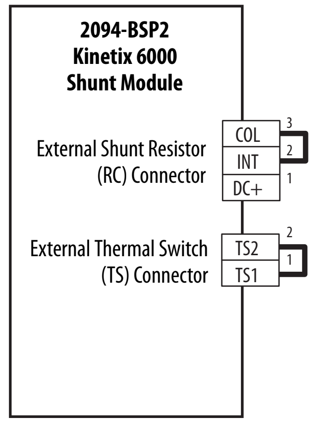


IMPORTANT Use a push button circuit (instead of an SPST toggle switch) in series with the contactor enable string (between the 8720MC-RPS and servo drive) to allow a drive fault to remove the DC bus power, and to prevent the drive from applying DC bus power without your input after clearing a drive fault.

Shunt Module Wiring Examples

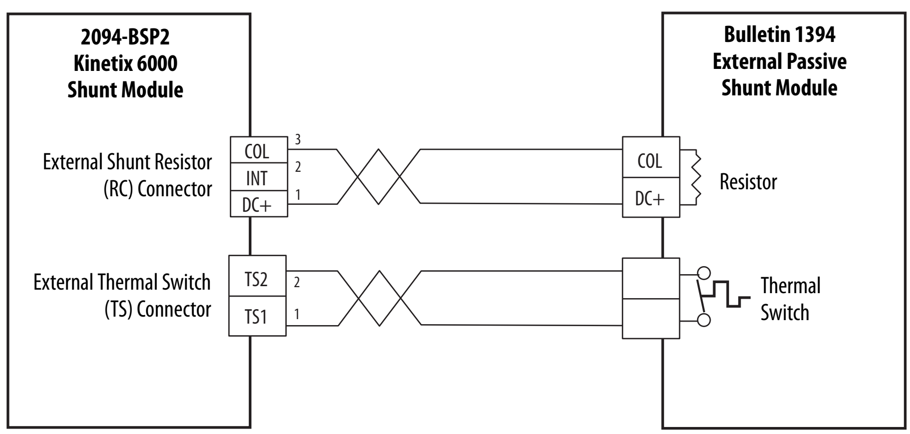
Refer to Kinetix Motion Accessories Technical Data, publication KNX-TD004 for the Bulletin 1394 external shunt module catalog numbers available for the Kinetix 6200 and Kinetix 6500 drive systems.

Figure 100 - Shunt Module Wired for Internal Operation (default configuration)



Refer to the Kinetix 6000 Shunt Module Installation Instructions, publication 2094-IN004, for additional installation information.

Figure 101 - Shunt Module with External Passive Shunt



IMPORTANT	Only passive shunts with a thermal switch are wired to the TS connector on the Kinetix 6000 shunt module. If your external passive shunt does not have a thermal switch, leave the jumper (default configuration) in place on the TS connector.

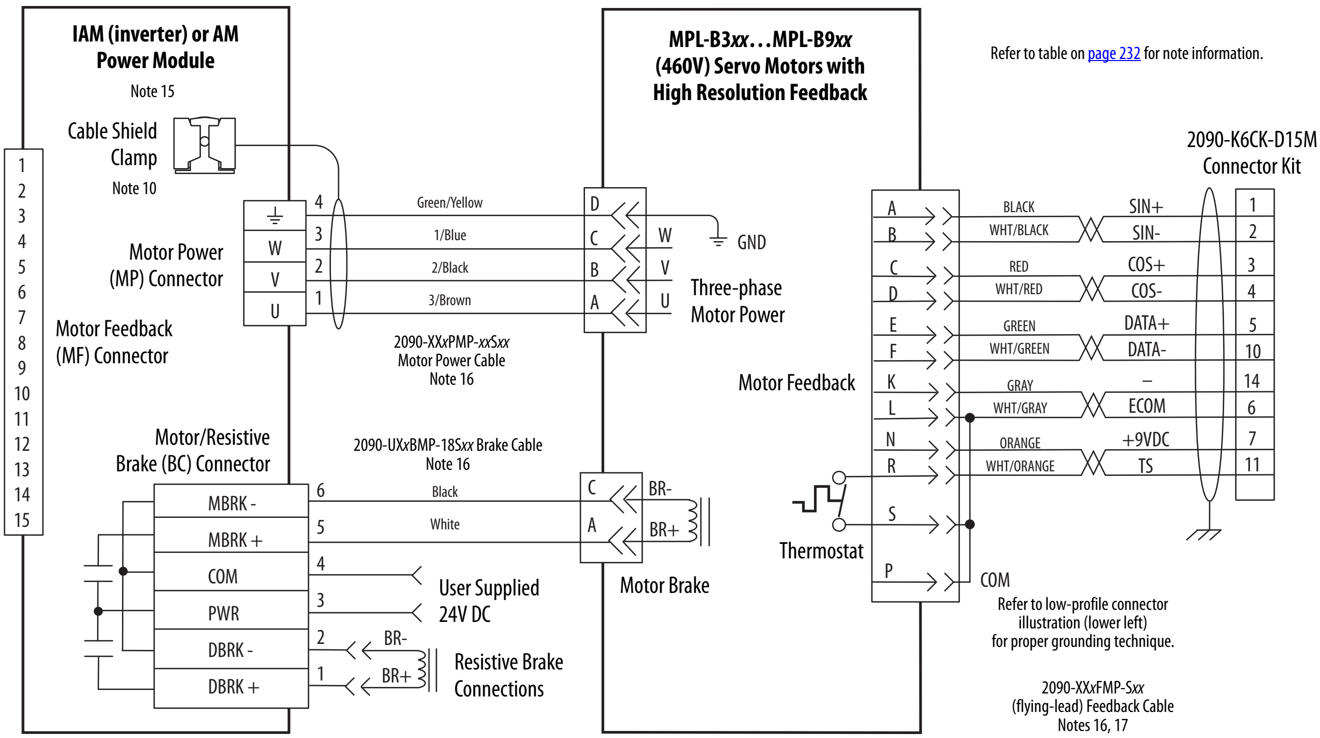
Refer to the External Shunt Module Installation Instructions, publication 2090-IN004, for additional installation information.

Axis Module/Rotary Motor Wiring Examples

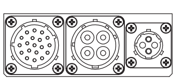
These examples apply to Kinetix 6200 and Kinetix 6500 drives with Allen-Bradley® rotary motors.

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

Figure 102 - AM Module with MP-Series™ (Bulletin MPL-B) Rotary Motors

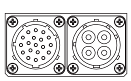


Bayonet Connectors with Brake



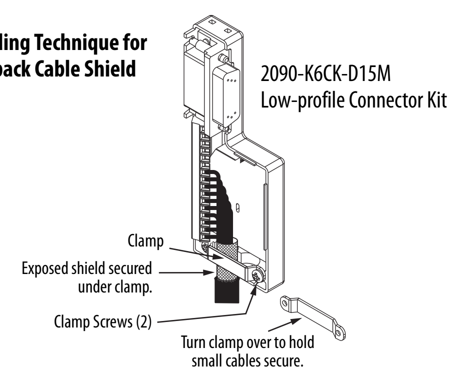
Feedback / Power / Brake Connectors

Bayonet Connectors without Brake

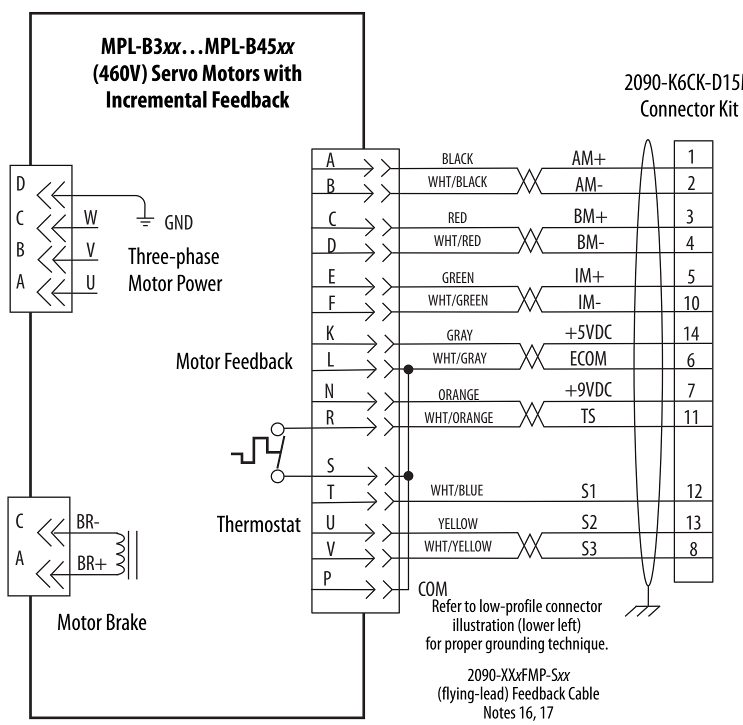


Feedback / Power Connectors

Grounding Technique for Feedback Cable Shield

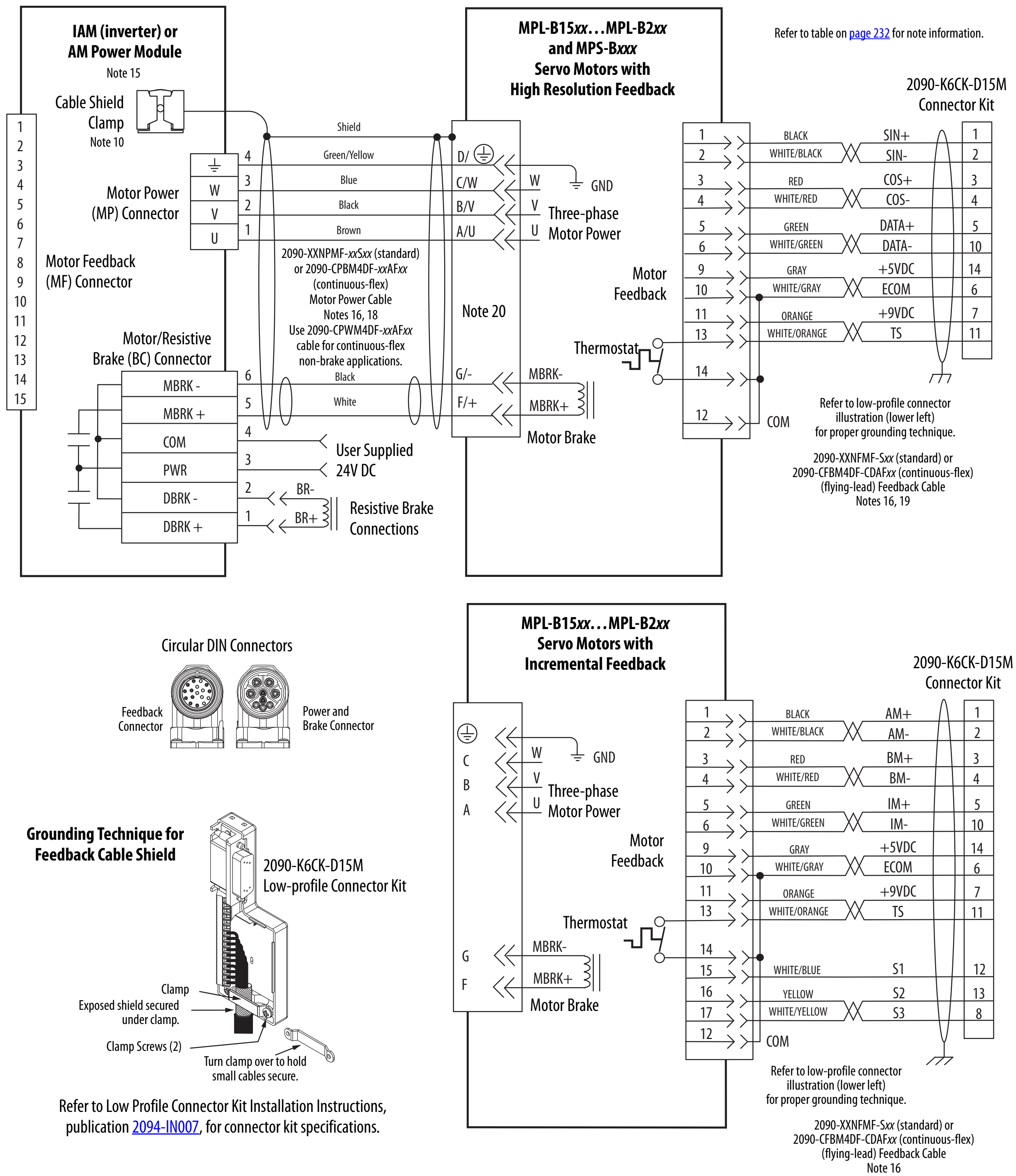


Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.



IMPORTANT	The Bulletin MPL motor wiring examples on this page apply to motors equipped with circular DIN (threaded) connectors.

Figure 103 - AM Module with MP-Series (Bulletin MPL-B and MPS-B) Motors



Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

IMPORTANT	The Bulletin MPL motor wiring examples on this page apply to motors equipped with circular DIN (SpeedTec) connectors.

Figure 104 - AM Module with MP-Series Motors (Bulletin MPL-B, MPM-B, MPF-B, and MPS-B)

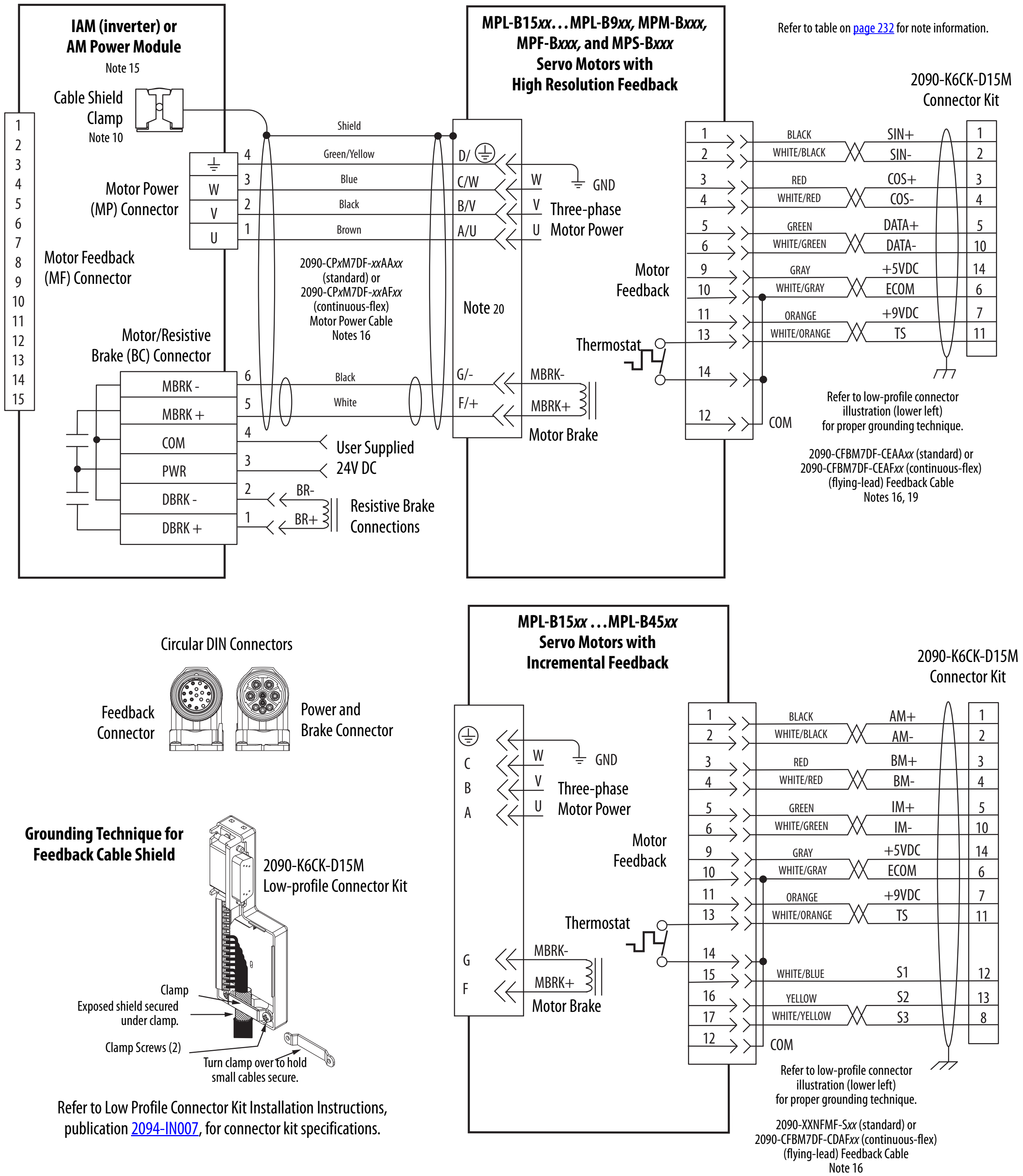
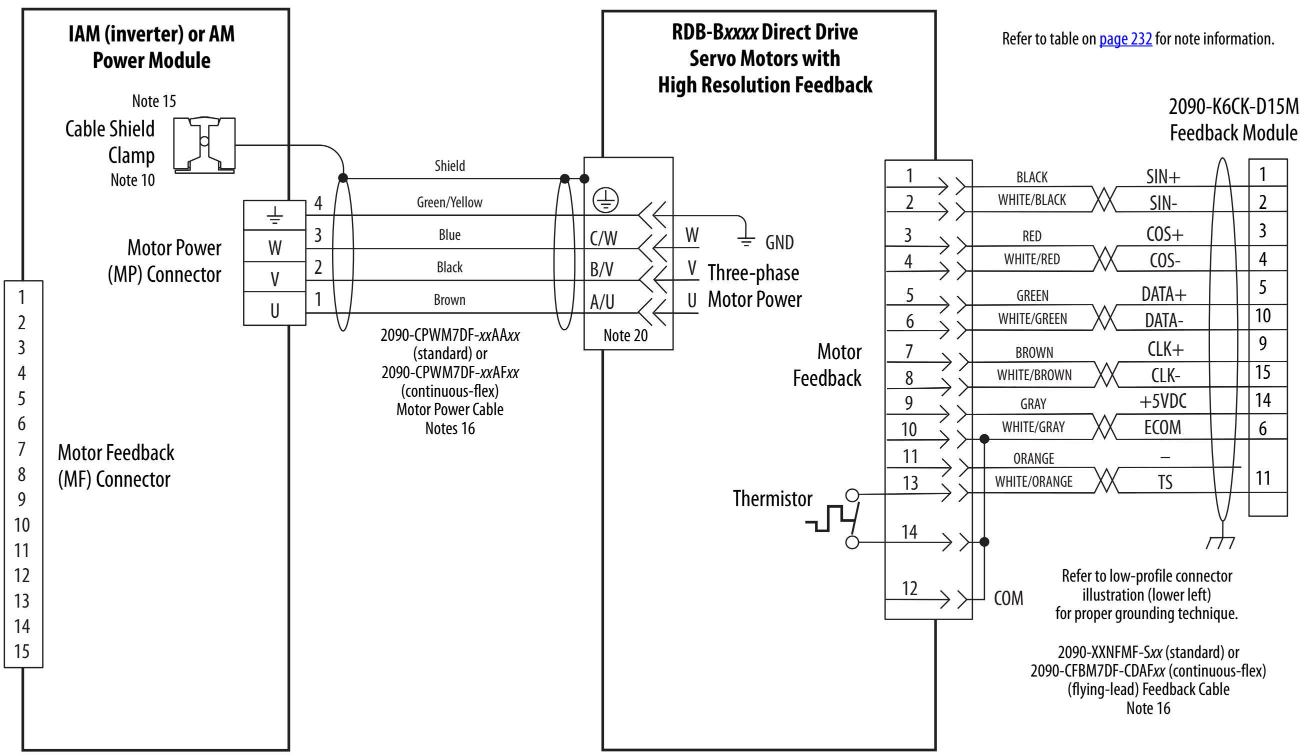
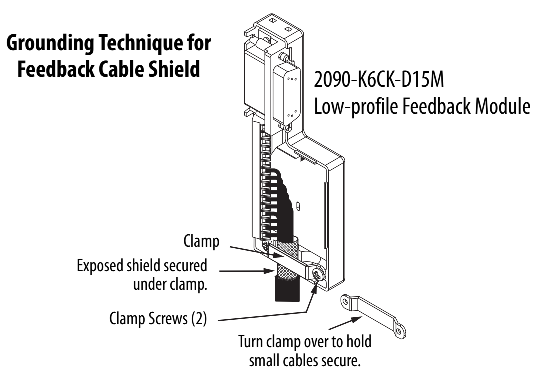


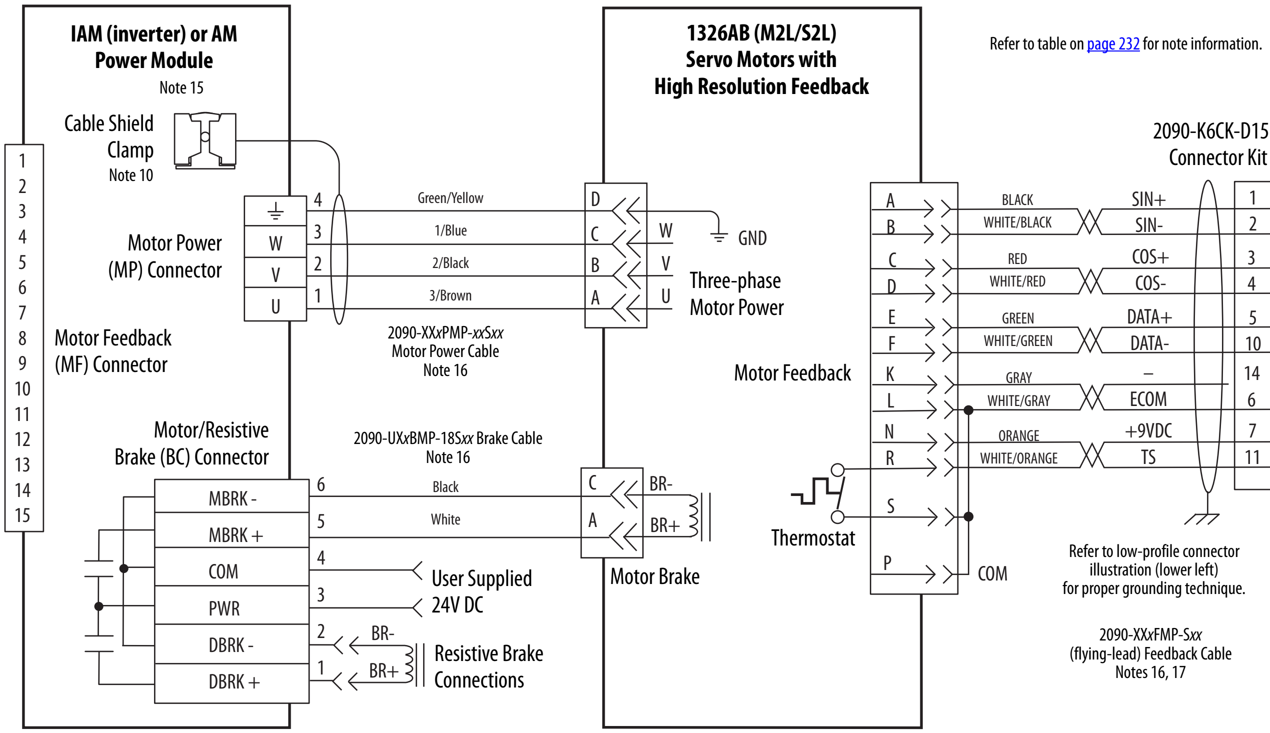
Figure 105 - AM Module with RDD-Series™ Direct Drive Motors



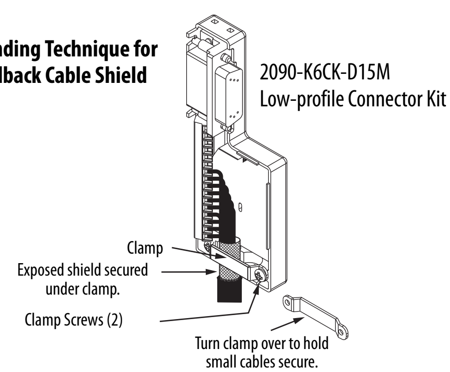


Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Figure 106 - AM Module (460V) Wiring Examples with 1326AB Motors



Grounding Technique for Feedback Cable Shield

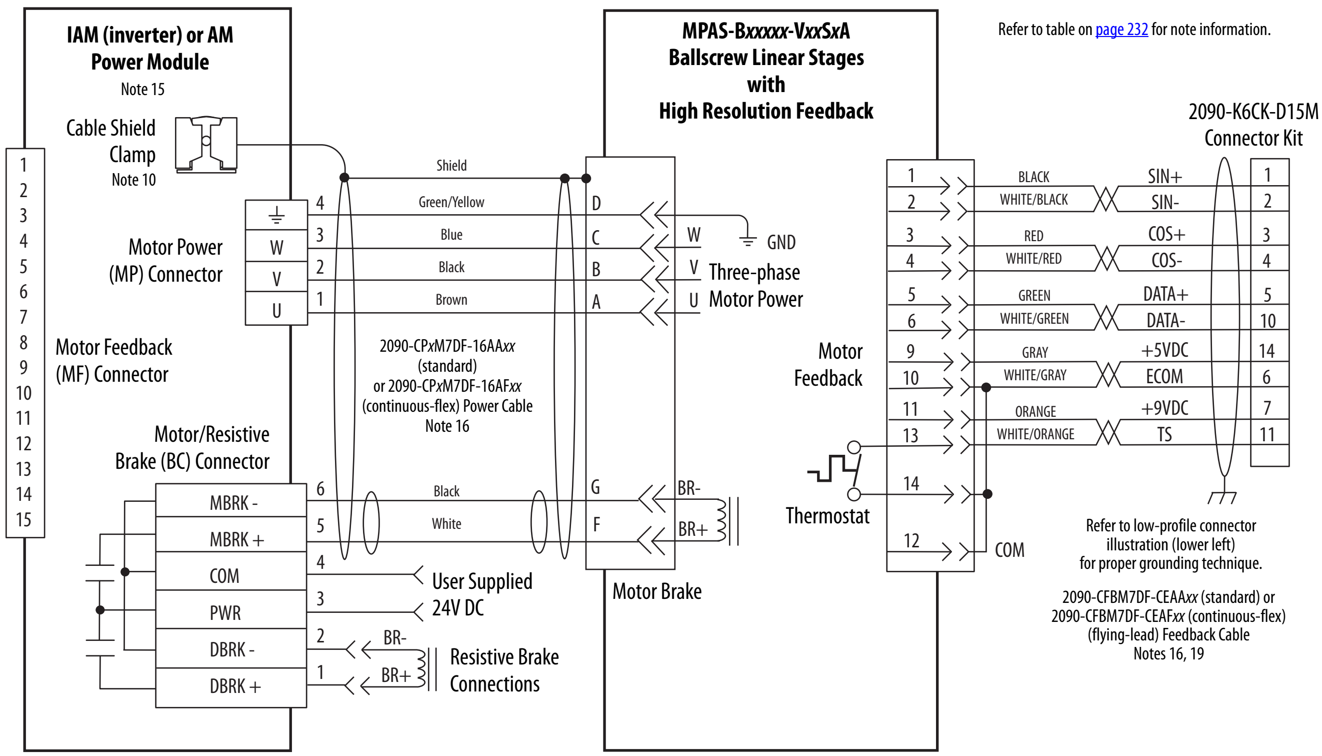


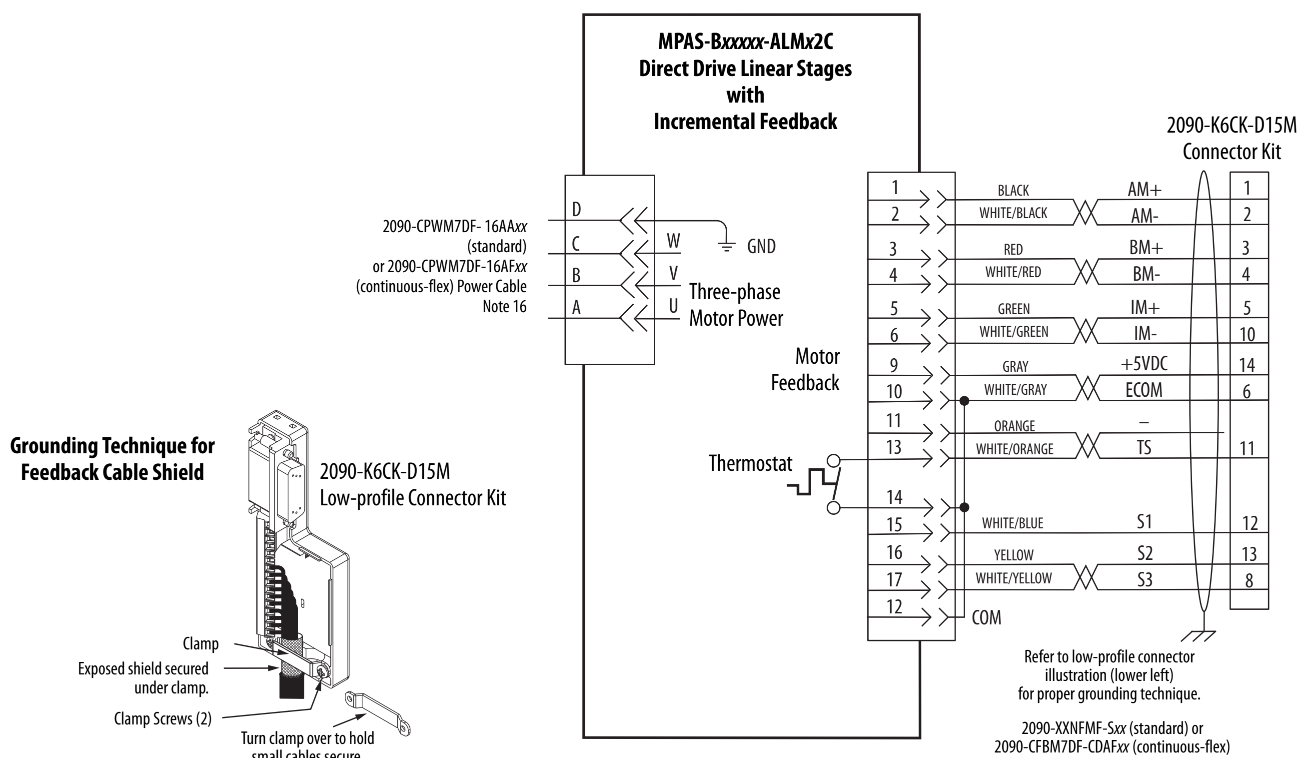
Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Axis Module/Linear Motor/ Actuator Wiring Examples

These examples apply to Kinetix 6200 and Kinetix 6500 drives with Allen-Bradley linear motors and actuators.

Figure 107 - AM Module with MP-Series Integrated Linear Stages





Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Figure 108 - AM Module with MP-Series Electric Cylinders

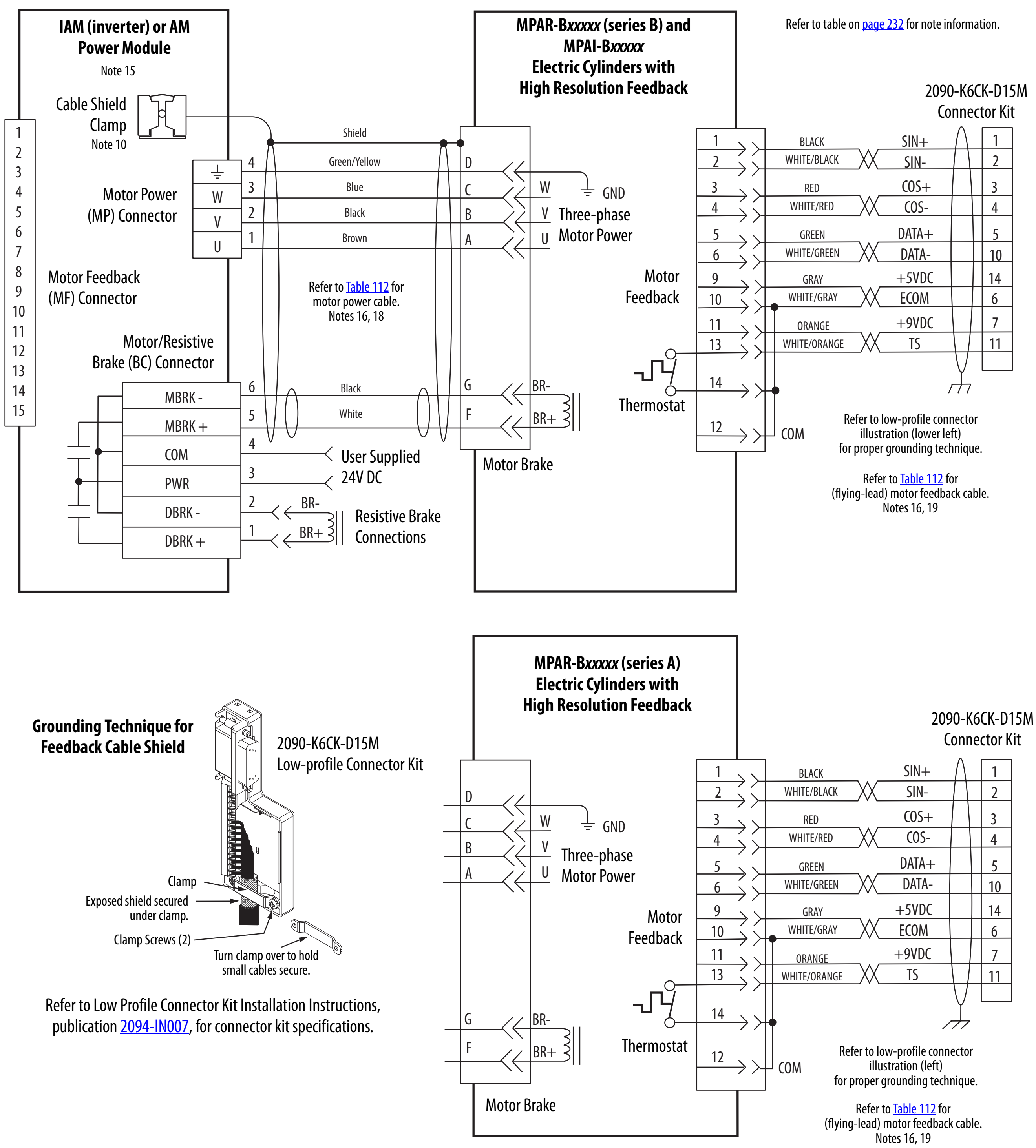
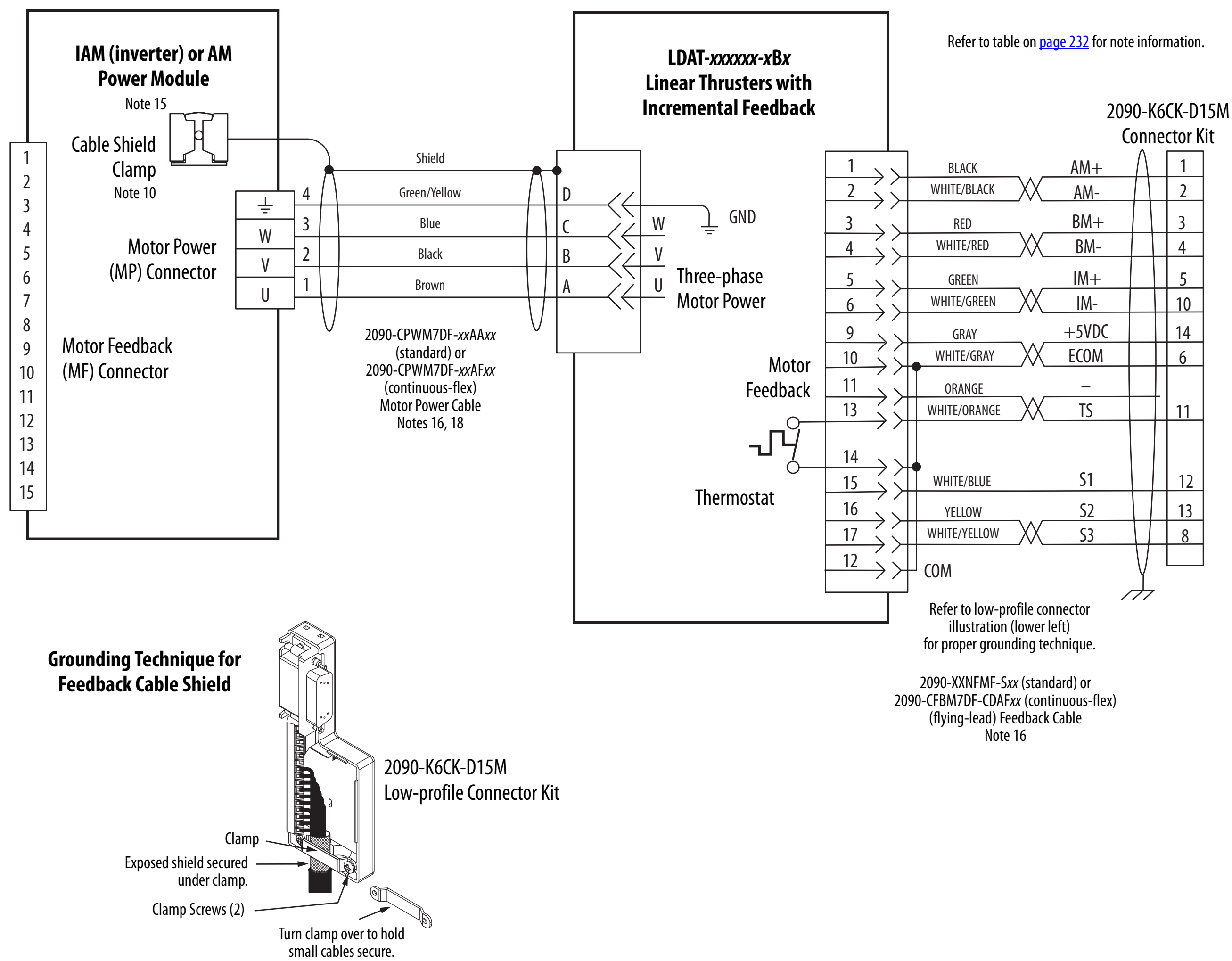


Table 112 - MP-Series Electric Cylinder Power and Feedback Cables

MP-Series Electric Cylinder Cat. No.	Frame	Power Cable Cat. No.	Feedback Cable Cat. No.
MPAR-B1*xxx* (series A) (1)	32	2090-XXNPMF-16S*xx* (standard) or 2090-CP*x*M4DF-16AF*xx* (continuous-flex)	2090-XXNFMF-S*xx* (standard) or 2090-CFBM4DF-CDAF*xx* (continuous-flex)
MPAR-B2*xxx* (series A)	40		
MPAR-B1*xxx* (series B)	32	2090-CP*x*M7DF-16AA*xx* (standard) or 2090-CP*x*M7DF-16AF*xx* (continuous-flex)	2090-CFBM7DF-CEAA*xx* (standard) or 2090-CFBM7DF-CEAF*xx* (continuous-flex)
MPAR-B2*xxx* (series B)	40		
MPAR-B3*xxx*	63		
MPAI-B2*xxxx*	64		
MPAI-B3*xxxx*	83		
MPAI-B4*xxxx*	110		
MPAI-B5*xxxx*	144		

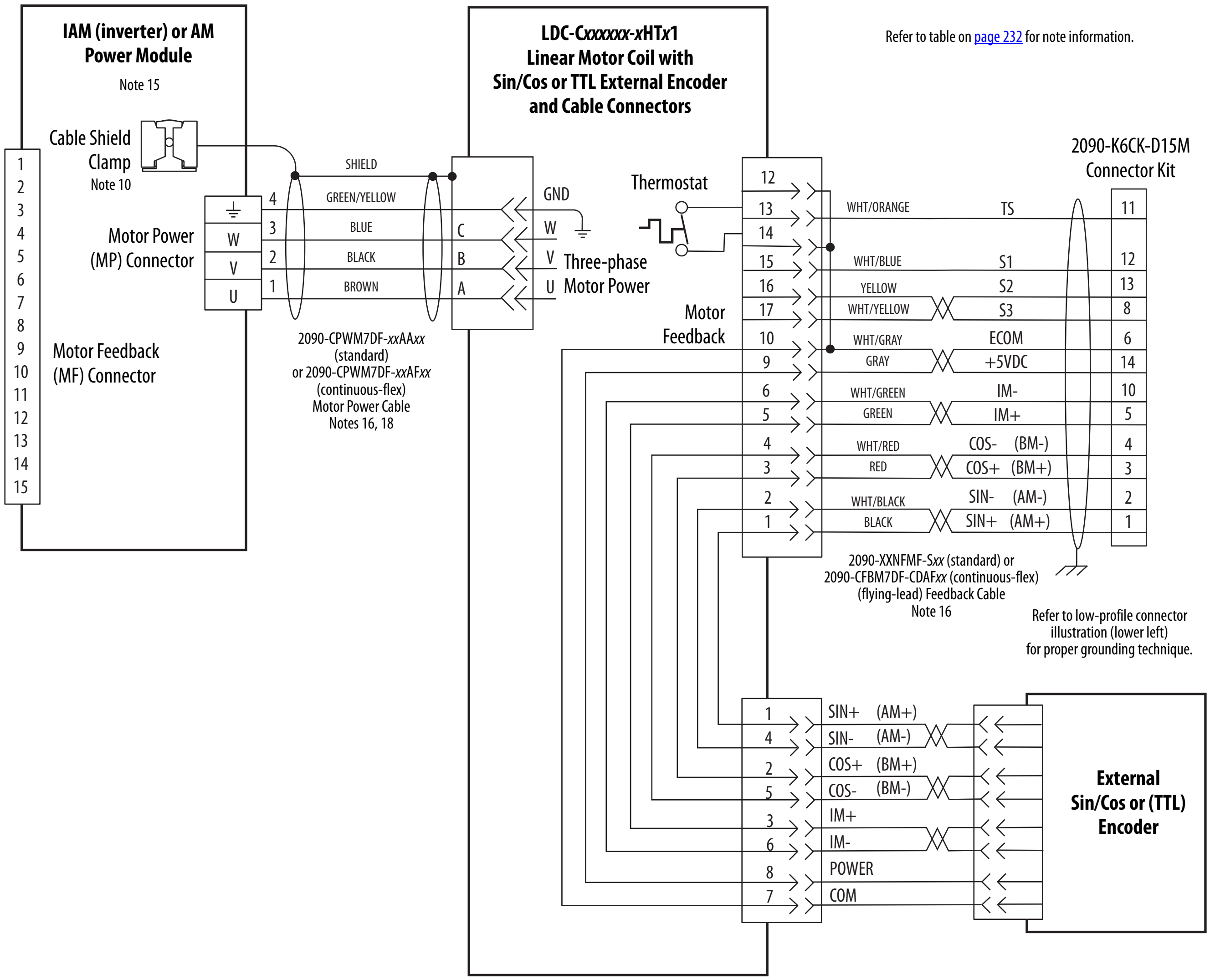
(1) Bulletin MPAR (series A) electric cylinders have threaded (M4) connectors and require threaded (M4) cable connectors.

Figure 109 - AM Module with LDAT-Series Linear Thrusters

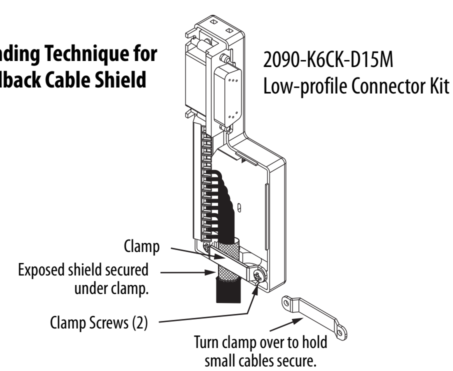


Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Figure 110 - AM Module with LDC-Series™ Linear Motors (cable connectors)



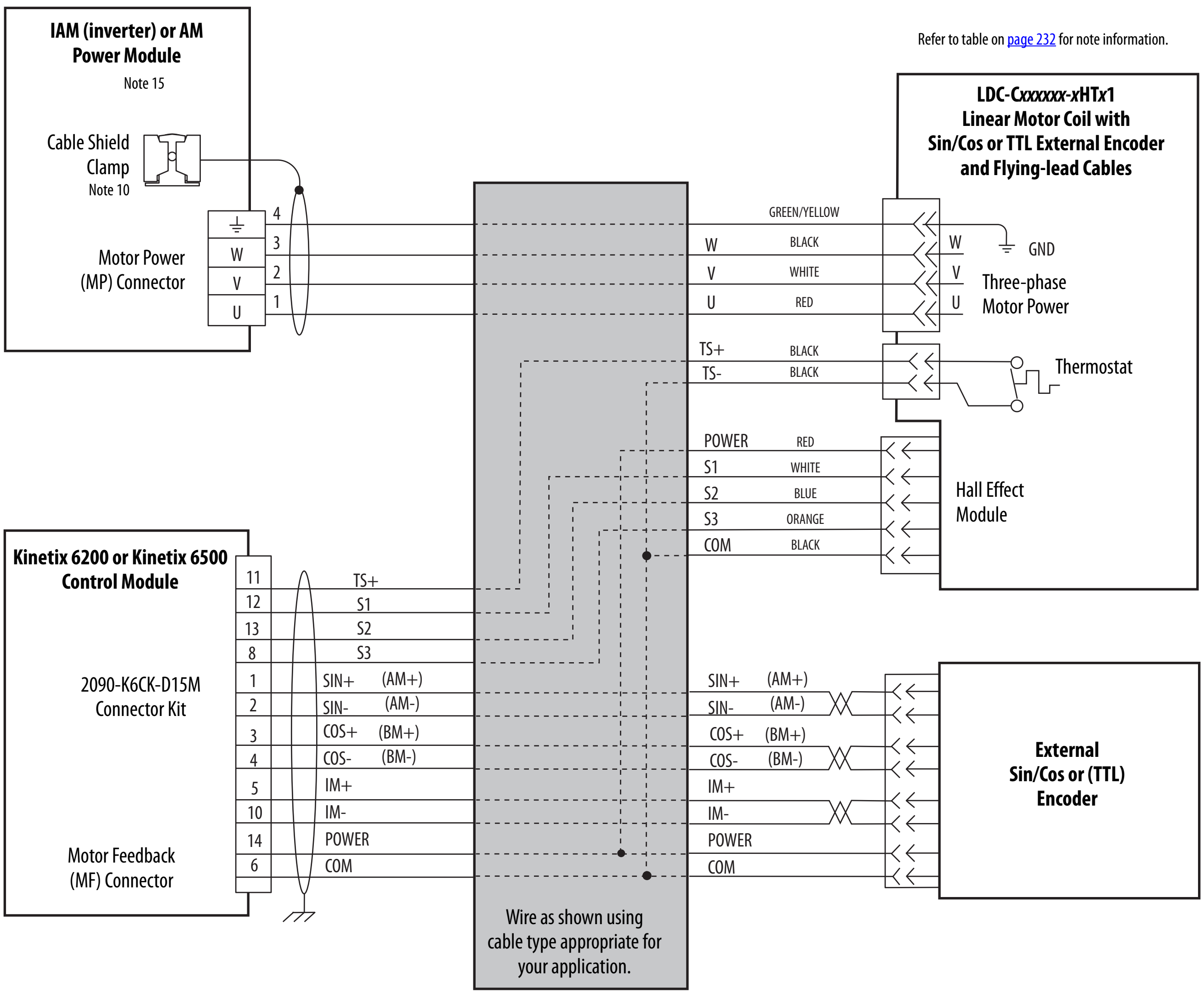
Grounding Technique for Feedback Cable Shield

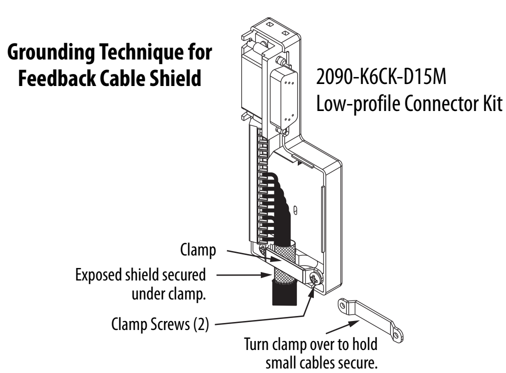


Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Figure 111 - AM Module with LDC-Series Linear Motors (flying-lead cables)

Refer to table on page 232 for note information.





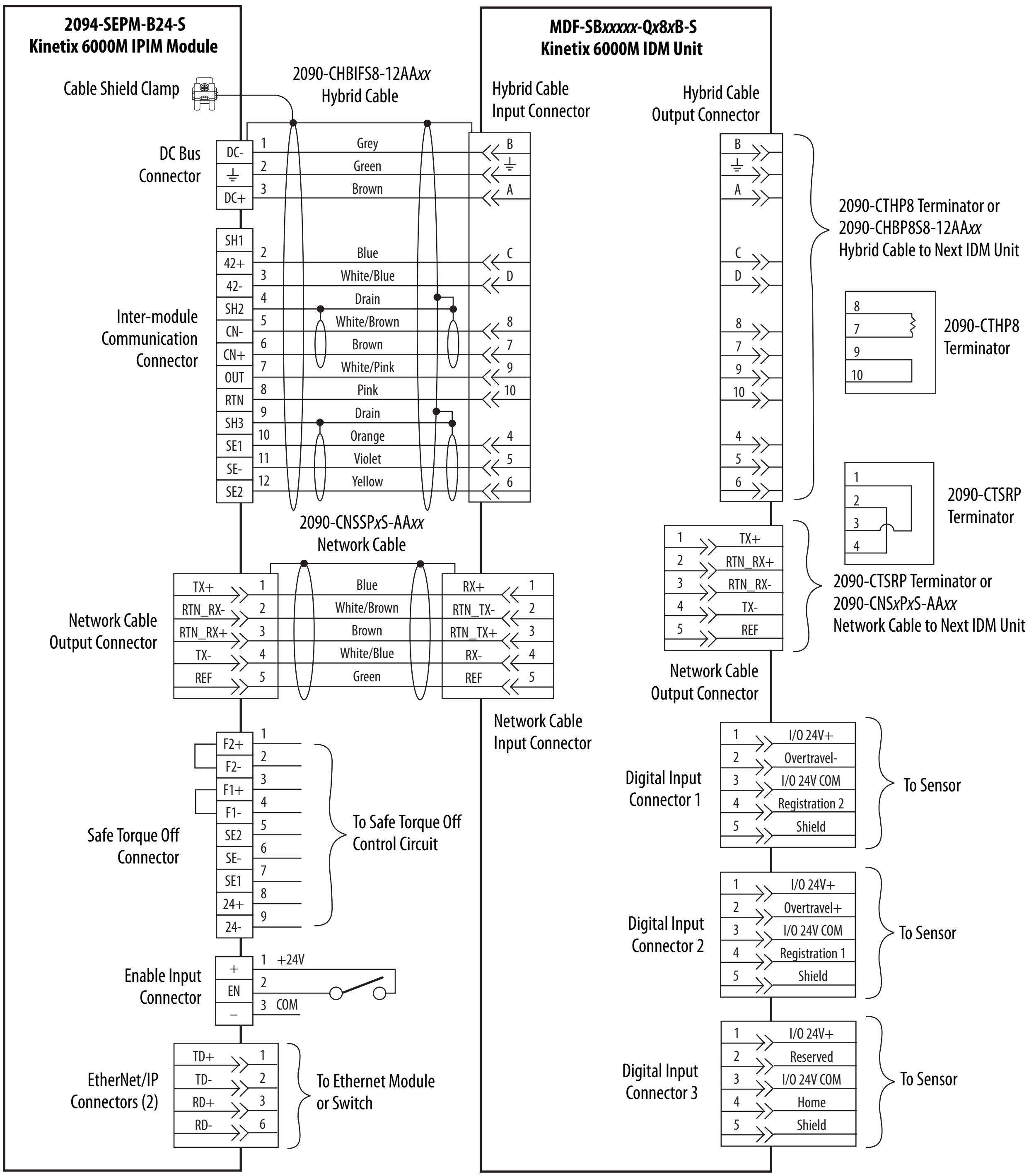
Refer to Low Profile Connector Kit Installation Instructions, publication 2094-IN007, for connector kit specifications.

Kinetix 6000M Integrated Drive-Motor Wiring Example

This example applies to Kinetix 6200 drives with Kinetix 6000M integrated drive-motor (IDM) systems.

ATTENTION: When using the Kinetix 6000M IDM system, with Kinetix 6200 drives, the IPIM module only forwards the safety-feedback monitoring signals to the adjacent (downstream) drive on the power rail. To avoid personal injury due to unexpected motion, make sure that the safety-feedback connections are fed through each drive on the power rail so that safety devices can recognize when the Kinetix 6200 drive opens the feedback contactor in the cascaded safety string.

Figure 112 - IPIM Module with IDM Unit



Controlling a Brake Example

The relay output of the Bulletin 2094 IAM/AM module (MBRK± BC-5 and BC-6) is suitable for directly controlling a motor brake, subject to the relay voltage limit of 30V DC, and the relay current limit as shown below.

Table 113 - Brake Relay Current Limit

Bulletin 2094 IAM/AM Power Module	Brake Current Rating, max
2094-BC01-M*xx*-M, 2094-BC02-M02-M, 2094-BMP5-M, 2094-BM01-M, 2094-BM02-M	3.0 A
2094-BC04-M03-M, 2094-BC07-M05-M, 2094-BM03-M, 2094-BM05-M	

Table 114 - Coil Currents Rated at <1.0 A

Compatible Brake Motors/Actuators	Coil Current
MPL-B1510, MPL-B1520, MPL-B1530	0.43…0.53 A
MPL-B210, MPL-B220, MPL-B230	0.46…0.56 A
MPL/MPF-B310, MPL/MPF-B320, MPL/MPF-B330	0.45…0.55 A
MPS-B330, MPM-B115, MDF-SB1003	
MPL-B420, MPL-B430, MPL-B4520, MPL-B4530, MPL-B4540, MPL-B4560	0.576…0.704 A
MPF-B430, MPF-B4530, MPF-B4540	
MPS-B4540, MPM-B130, MDF-SB1153, MDF-SB1304	
1326AB-B4*xxx*	0.88 A

Table 115 - Coil Currents Rated at >1.0 A and ≤ 1.3 A

Compatible Brake Motors	Coil Current
MPL-B520, MPL-B540, and MPM-B165	1.05…1.28 A
1326AB-B5*xxx*	1.20 A

System Block Diagrams

This section provides block diagrams of the Kinetix 6200 and Kinetix 6500 drive modules. For block diagrams of the LIM module, refer to Additional Resources on page 12 for the documentation available for those products.

Figure 113 - IAM/AM Power Module (inverter) Block Diagram

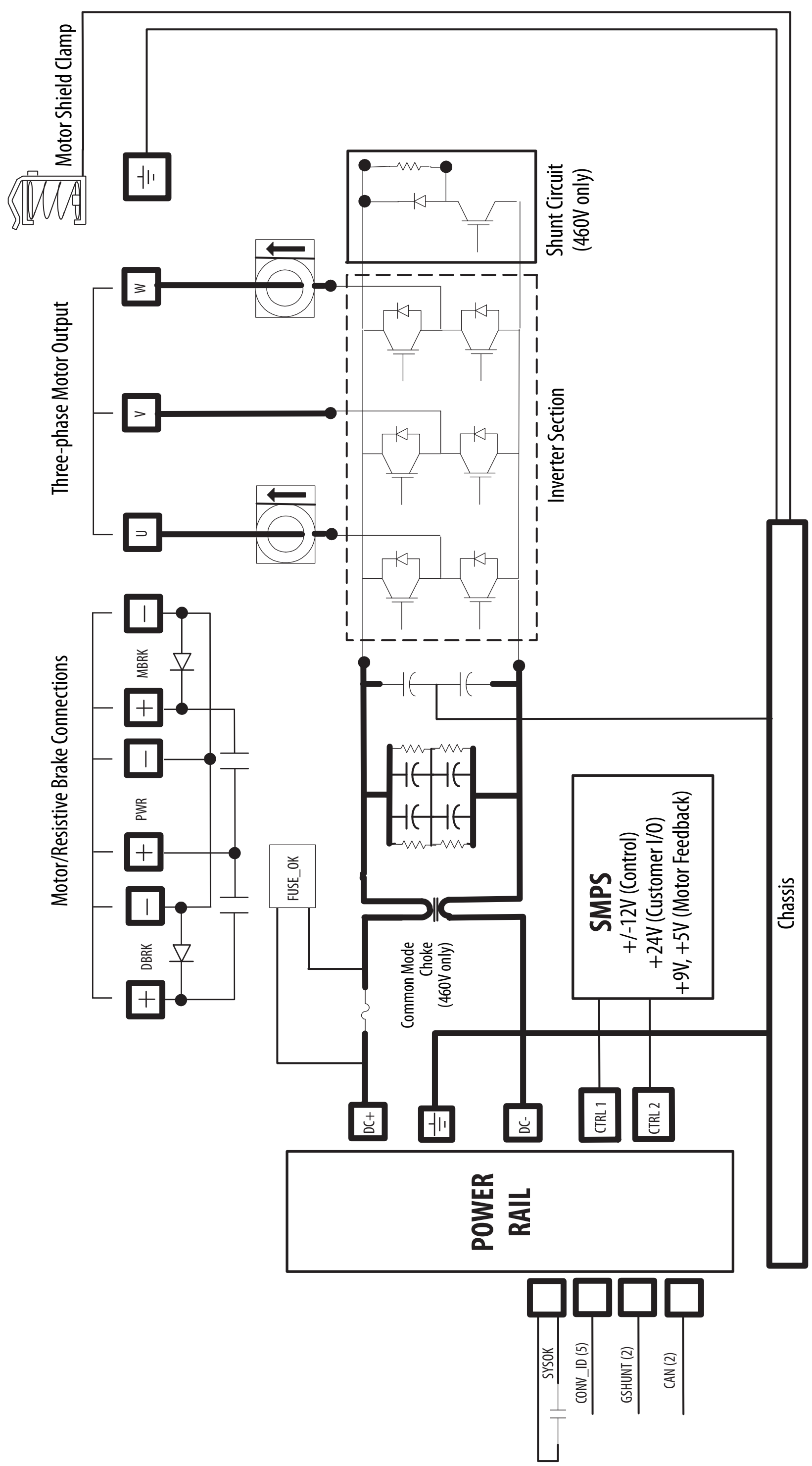
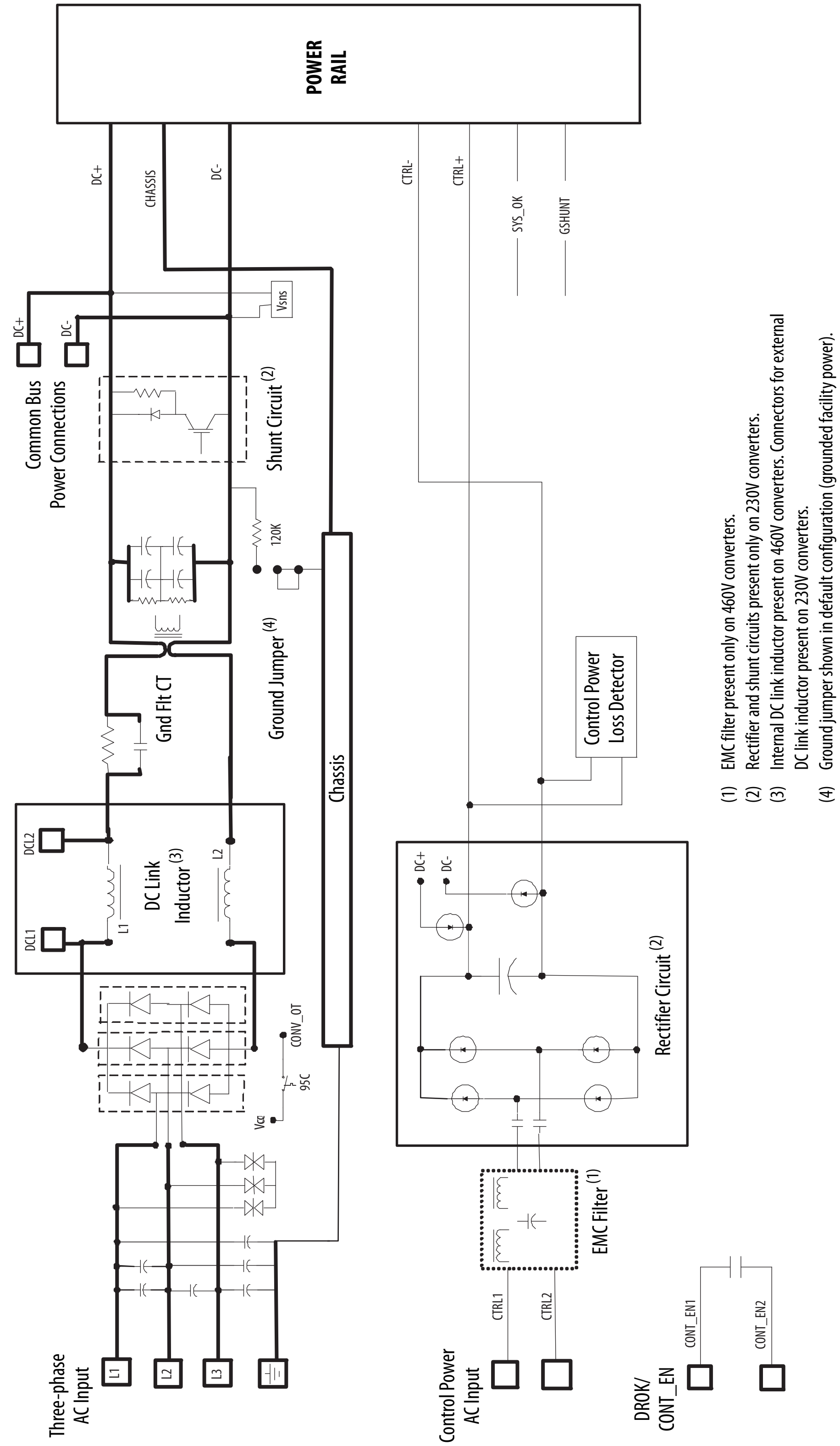
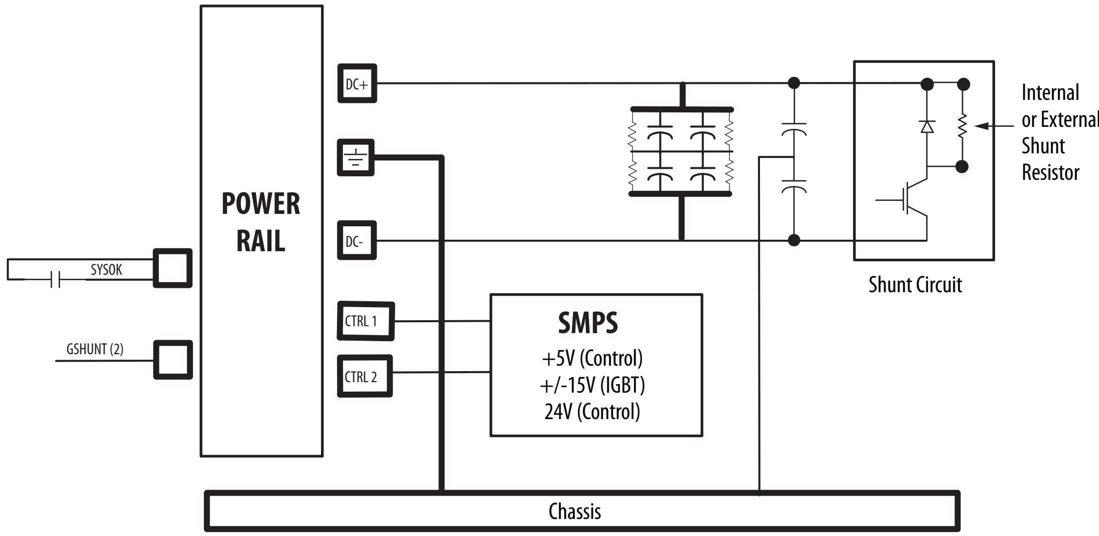


Figure 114 - IAM Power Module (converter) Block Diagram



(1) EMC filter present only on 460V converters.
(2) Rectifier and shunt circuits present only on 230V converters.
(3) Internal DC link inductor present on 460V converters. Connectors for external DC link inductor present on 230V converters.
(4) Ground jumper shown in default configuration (grounded facility power).

Figure 115 - Shunt Module Block Diagram



Upgrade the Drive Firmware

This appendix provides procedures for upgrading firmware by using ControlFLASH™ software.

Upgrade Kinetix 6000M System Firmware

Upgrading firmware for the Kinetix 6000M integrated drive-motor (IDM) system is done by using ControlFLASH software. The procedure for upgrading the IDM units uses the sercos interface, similar to the axis modules. However, upgrading firmware on the IPIM module is accomplished over the EtherNet/IP network.

For the firmware upgrade procedure specific to the IDM system, refer to the Kinetix 6000M Integrated Drive-Motor System User Manual, publication 2094-UM003.

Upgrade Drive Firmware with ControlFLASH Software

Upgrading axis module firmware by using ControlFLASH software involves configuring your controller communication, selecting the drive to upgrade, and upgrading the firmware.

IMPORTANT	If the *xx*02*x*-M*xx*-S0 (Safe Torque Off) drive firmware contains updated safety firmware, you must de-energize the safety inputs first or the upgrade will fail.

Before You Begin

The firmware revision for software and modules varies, depending on whether your drive system uses sercos or EtherNet/IP networks.

Table 116 - Kinetix 6200 (sercos interface) System Requirements

Description	Cat. No.	Firmware Revision
RSLogix 5000® software or Studio 5000 Logix Designer® application	RSLogix 5000 software	17.*x* or later
	Logix Designer application	21.*x* or later
ControlLogix® sercos module	1756-M*xx*SE	17.16 or later
	1756-L60M03SE	17.2 or later
CompactLogix™ sercos module	1768-M04SE	17.16 or later
SoftLogix™ sercos PCI card	1784-PM16SE	17.10 or later
RSLinx® software		2.54 or later
ControlFLASH software kit (1)		4.00.00 or later
Catalog numbers of the targeted Kinetix 6200 drive module you want to flash.		
Network path to the targeted Kinetix 6200 drive module you want to flash.		

Table 117 - Kinetix 6500 (EtherNet/IP network) System Requirements

Description	Cat. No.	Firmware Revision
RSLogix 5000 software or Studio 5000 Logix Designer	RSLogix 5000 software	18.*x* or later
	Logix Designer application	21.*x* or later
RSLinx software		2.54 or later
ControlFLASH software kit (1)		8.00.017 or later
Catalog numbers of the targeted Kinetix 6500 drive module you want to flash.		
Network path to the targeted Kinetix 6500 drive module you want to flash.		

(1) Download the ControlFLASH kit from http://support.rockwellautomation.com/controlflash. Contact Rockwell Automation Technical Support at (440) 646-5800 for assistance.
For more ControlFLASH information (not drive specific), refer to the ControlFLASH Firmware Upgrade Kit Quick Start, publication 1756-QS105.

IMPORTANT Control power must be present at CPD-1 and CPD-2 prior to upgrading your target drive.

For sercos drives, the four-character status indicator on the target IAM (inverter) module or AM module must be scrolling CP-2, CONFIGURING, STOPPED, RUNNING, or PRE-CHARGE before beginning this procedure.

For EtherNet/IP drives, the four-character status indicator on target the IAM (inverter) module or AM module must be scrolling STANDBY, CONFIGURING, CONNECTING, STOPPED, RUNNING, or PRE-CHARGE before beginning this procedure.

ATTENTION: To avoid personal injury or damage to equipment during the firmware upgrade due to unpredictable motor activity, do not apply three-phase AC or common-bus DC input power to the drive.

Configure Logix5000 Communication

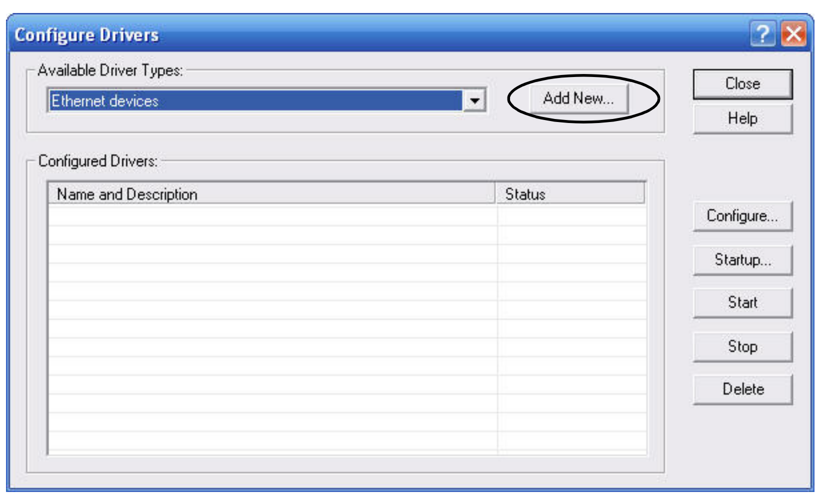
This procedure assumes that your communication method to the Logix5000™ controller is using the Ethernet protocol. It is also assumed that your Logix5000 Ethernet module has already been configured.

For more information, refer to the ControlLogix System User Manual, publication 1756-UM001.

Follow these steps to configure Logix5000 communication.

1. Open your RSLinx Classic software.
2. From the Communications pull-down menu, choose Configure Drivers.

   The Configure Drivers dialog box opens.



3. From the Available Drive Types pull-down menu, choose Ethernet devices.

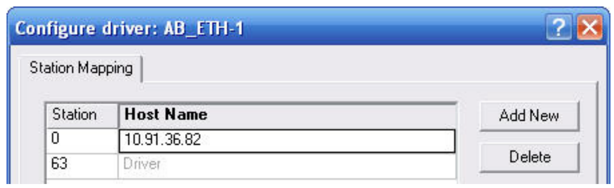
4. Click Add New.

   The Add New RSLinx Classic Driver dialog box opens.

5. Type the new driver name.

6. Click OK.

   The Configure driver dialog box opens.



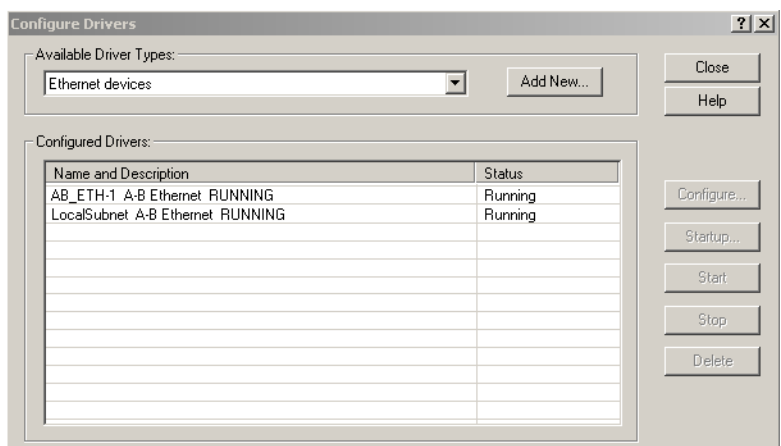
7. Type the IP address.

   For Kinetix 6200 drive systems, type the IP address of your Logix Ethernet module.

   For Kinetix 6500 drive systems, type the IP address of your IAM power module.

8. Click OK.

   The new Ethernet driver appears under Configured Drivers.



9. Click Close.

10. Minimize the RSLinx application dialog box.

Upgrade Firmware

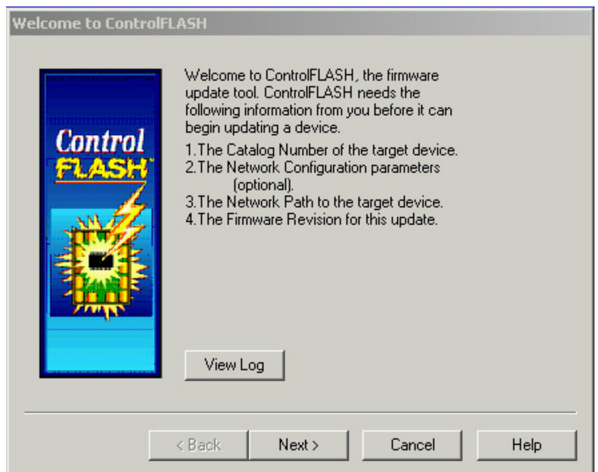
Follow these steps to select the drive module to upgrade.

1. Open your ControlFLASH software.

   You can access the ControlFLASH software by either of these methods:

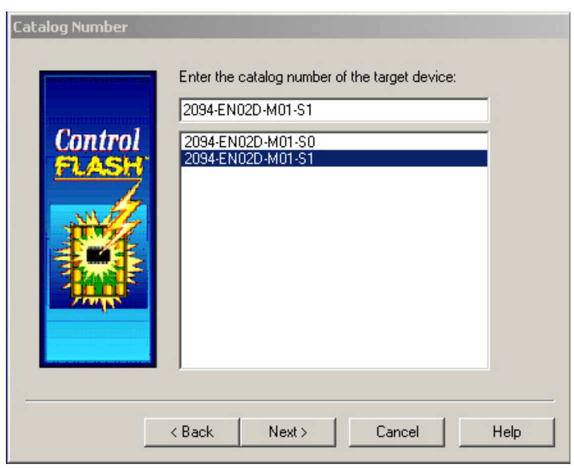
   - From the Tools menu in the Logix Designer application, choose ControlFLASH.
   - Choose Start>Programs>FLASH Programming Tools>ControlFLASH.

   The Welcome to ControlFLASH dialog box opens.



2. Click Next.

   The Catalog Number dialog box opens.

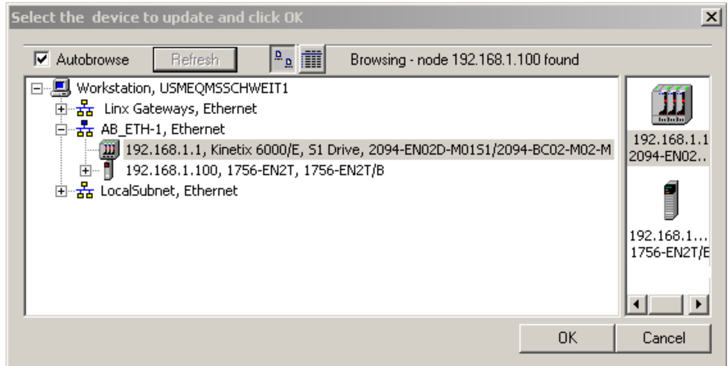


3. Select your drive module.

   In this example, the Kinetix 6500 control module is selected. If you are flashing a Kinetix 6200 control module, you'll select your Bulletin 2094 power module and control module combination.

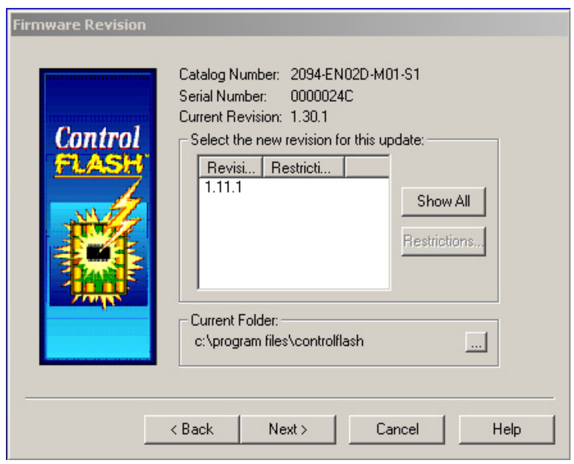
4. Click Next.

The Select Device to Update dialog box opens.



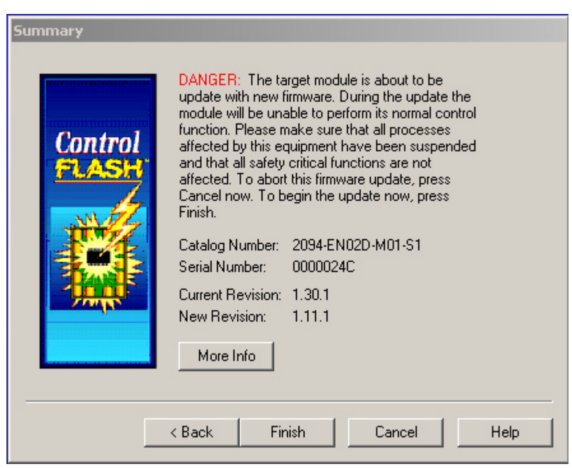
5. Expand your Ethernet node, Logix5000 backplane, and EtherNet/IP network module.
6. Select the servo drive to upgrade.
7. Click OK.

   The Firmware Revision dialog box opens.



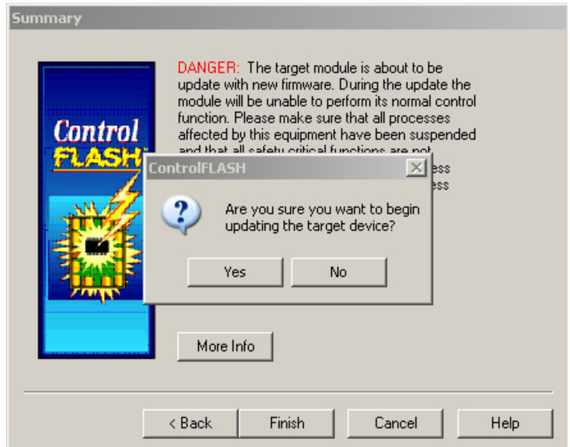
8. Select the firmware revision to upgrade.
9. Click Next.

   The Summary dialog box opens.



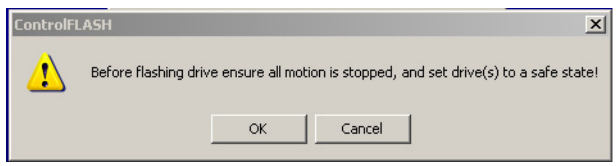
10. Confirm the drive catalog number and firmware revision.
11. Click Finish.

    This ControlFLASH warning dialog box opens.



12. Click Yes (only if you are ready).

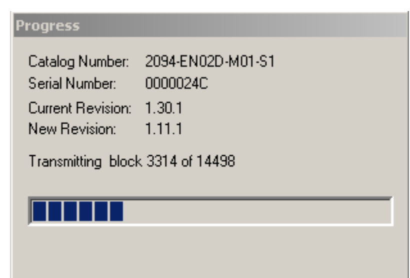
    This ControlFLASH warning dialog box opens.



    In this example, the warning applies to the Kinetix 6500 control modules. If you are flashing a Kinetix 6200 control module, the warning will be different.

13. Acknowledge the warning and click OK.

    The Progress dialog box opens and flashing begins.

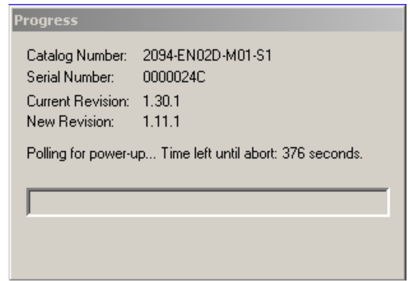


    The control module four-character status indicator changes from CP-2, CONFIGURING, STOPPED, RUNNING, or PRE-CHARGE to FIRMWARE UPDATE, which indicates that upgrading is in progress.

After the flash information is sent to the drive, the drive resets and performs diagnostic checking.

14. Wait for the Progress dialog box to time out.

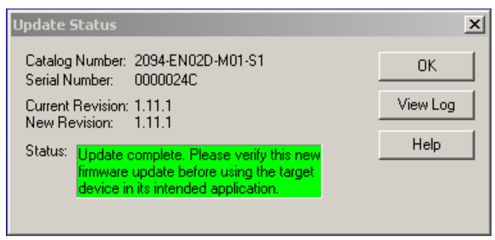
    It is normal for this process to take several minutes.



IMPORTANT	Do not cycle power to the drive during this process or the firmware upgrade will not complete successfully.

15. The Update Status dialog box opens and indicates success or failure as described below.

Upgrading Status	If
Success	1. Update complete appears in a GREEN Status dialog box. 2. Go to step 16.
Failure	1. Update failure appears in a RED Status dialog box. 2. Refer to ControlFLASH Firmware Upgrade Kit Quick Start, publication 1756-QS105, for troubleshooting information.



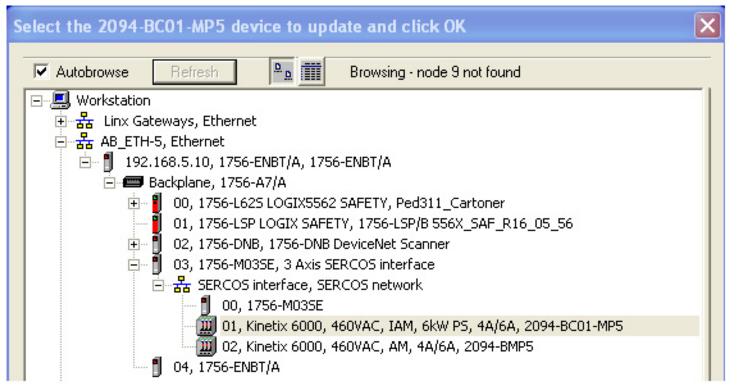
16. Click OK.

Verify the Firmware Upgrade

Follow these steps to verify your firmware upgrade was successful.

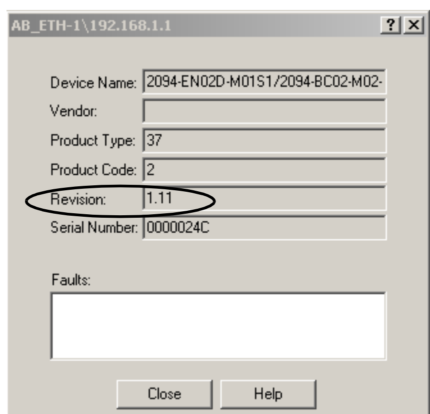
TIP Verifying the firmware upgrade is optional.

1. Open your RSLinx software.
2. From the Communications pull-down menu, choose RSWho.



3. Expand your Ethernet node, Logix5000 backplane, and EtherNet/IP network module.
4. Right-click the drive module and choose Device Properties.

   The Device Properties dialog box opens.



5. Verify the new firmware revision level.
6. Click Close.

Notes:

DC Common Bus Applications

This appendix provides information and an example for calculating additional bus capacitance specific to the Kinetix 6200 and Kinetix 6500 modular drive systems configured for DC common bus.

Calculating capacitance, as it applies to the Bulletin 2094 shunt module and Kinetix 6000M IPIM module, is also included in this appendix.

Before You Begin

These procedures assume you have mounted and wired your Kinetix 6200 or Kinetix 6500 DC common-bus system.

Before you set the Additional Bus Capacitance (Add Bus Cap) parameter in the Logix Designer application, you need to calculate these values:

- Total bus capacitance
- Additional bus capacitance

Calculate Total Bus Capacitance

Total bus capacitance is the sum of all capacitance values for your Bulletin 2094 common-bus modules. Specifically, this includes the capacitance values for each of these modules:

- Leader IAM (converter and inverter) module
- Each AM and shunt module (if present) on the leader IAM power rail
- Each IPIM module (if present) on the leader IAM power rail
- Each follower IAM (converter and inverter) module
- Each AM module on the follower IAM power rail
- Each IPIM module (if present) on the follower IAM power rail

Refer to Bulletin 2094 Drive Capacitance Values on page 269 for IAM, AM, IPIM, and shunt module capacitance values.

IMPORTANT	If total bus capacitance of your system exceeds the leader IAM power module pre-charge rating, the IAM module four-character display scrolls a power cycle user limit condition. If input power is applied, the display scrolls a power cycle fault limit condition. To correct this condition, you must replace the leader IAM power module with a larger module or decrease the total bus capacitance by removing AM power modules or IPIM modules.

Table 118 - Maximum IAM Module Bus Capacitance

Leader IAM (400V-class) Modules	Bus Capacitance, max µF
2094-BC01-MP5-M	4585
2094-BC01-M01-M	
2094-BC02-M02-M	8955
2094-BC04-M03-M	8955
2094-BC07-M05-M	17,915

IMPORTANT	If your total bus capacitance value exceeds the value in the table above, you must increase the size of the leader IAM module or decrease the total bus capacitance by removing other modules on the power rail.

Calculate Additional Bus Capacitance

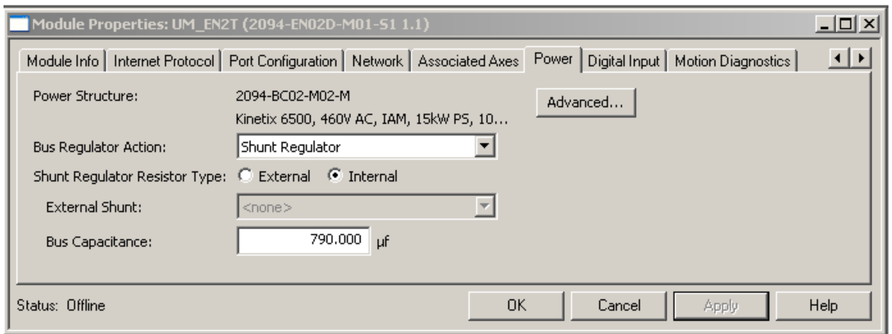
Additional bus capacitance is the sum of all follower IAM, AM, and IPIM module capacitance values for your Bulletin 2094 common-bus modules. Specifically, this includes the capacitance values for each of these modules:

- Each follower IAM (converter and inverter) module
- Each AM module on the follower IAM module power rail
- Each IPIM module on the follower IAM module power rail

If you are using Kinetix 6200 (sercos) drives or Kinetix 6500 (integrated motion on EtherNet/IP) drives, calculate additional bus capacitance in this appendix and enter the value in Module Properties>Power tab>Bus Capacitance.

In the example on page 270, the value is 790 μF.

Figure 116 - Module Properties>Power Tab



Bulletin 2094 Drive Capacitance Values

Use these tables when calculating total bus capacitance and additional bus capacitance for your Bulletin 2094 common-bus application.

Table 119 - IAM/AM (400V-class) Modules

IAM Converter (400V-class)	Capacitance μF
2094-BC01-MP5-M	110
2094-BC01-M01-M	
2094-BC02-M02-M	220
2094-BC04-M03-M	940
2094-BC07-M05-M	1410

AM Inverter (400V-class)	Capacitance μF
2094-BMP5-M	75
2094-BM01-M	150
2094-BM02-M	270
2094-BM03-M	840
2094-BM05-M	1175

Table 120 - Shunt Module (400V-class)

Shunt Module (200/400V-class)	Capacitance μF
2094-BSP2	470

Table 121 - IPIM Module (400V-class)

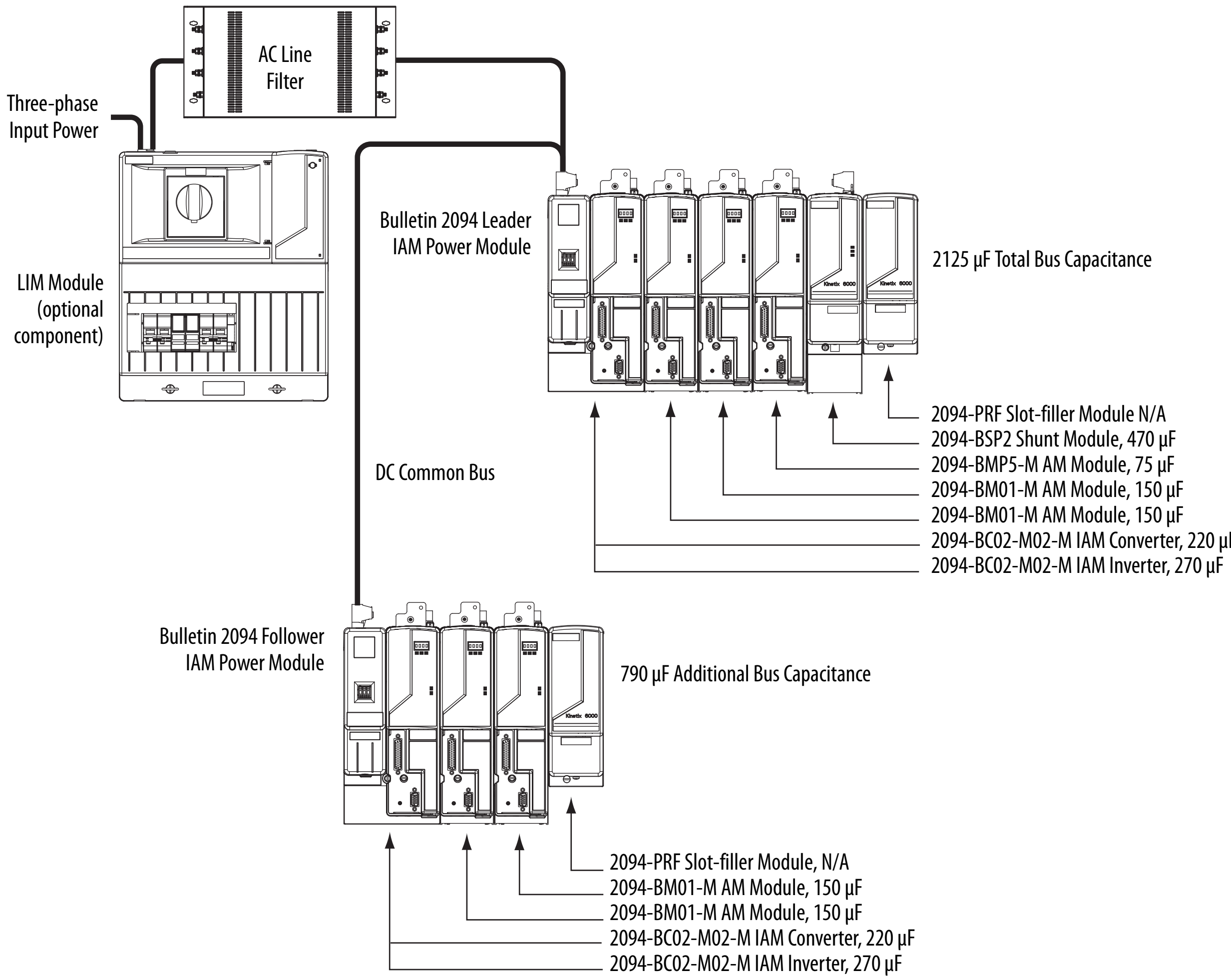
IPIM Module (400V-class)	Capacitance μF
2094-SEPM-B24-S	840

Common Bus Capacitance Example

In this example, the sum of the leader IAM power rail modules capacitance (1335 µF) and the follower IAM power rail modules capacitance (790 µF) equals 2125 µF total bus capacitance.

The sum of the follower IAM module power rail equals 790 µF additional bus capacitance.

Figure 117 - Calculating Common Bus Capacitance



Configure the Load Observer Feature

The load observer feature is a control loop inside the Kinetix 6200 drive (firmware revision 1.049 or later) that estimates the mechanical load on the motor and compensates for it, thereby forcing the motor to behave as if it is unloaded and relatively easy to control. As a result, load observer automatically compensates for disturbances and load dynamics, such as sudden inertia/torque changes, compliance, backlash, and resonances.

Benefits

You can use load observer with out-of-box controller gains, where the load is unknown and thus the Load Inertia Ratio = 0, or with auto-tuned controller gains, where the Load Inertia Ratio is known or calculated by performing an auto-tune procedure.

When used with out-of-box controller gains, load observer does the following.

- Provides relatively high-performance motion control without tuning
- Automatically compensates for load resonances and machine wear over time

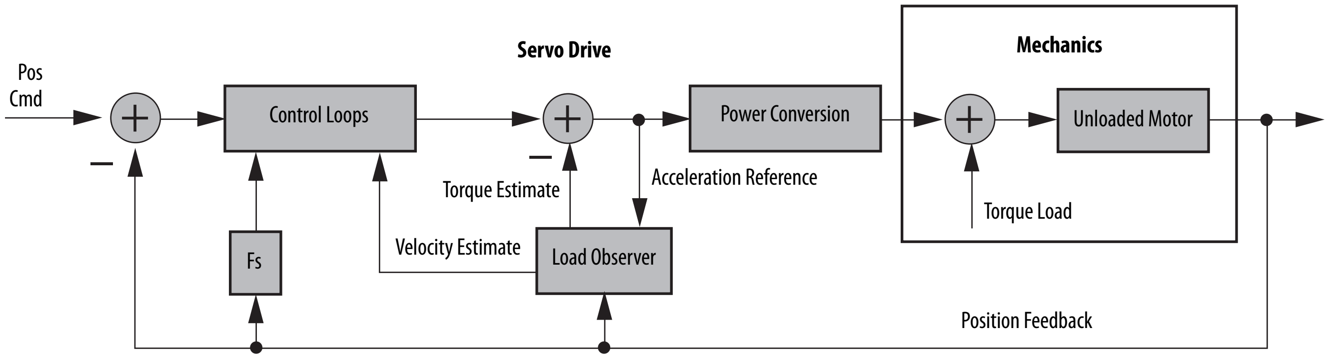
When used with auto-tuned controller gains, load observer does the following.

- Increases controller bandwidth
- Reduces tracking errors, so line speeds can be increased
- Provides tighter control of moving parts, reducing wear and saving material costs

How it Works

Load observer acts on the acceleration signal within the control loops and monitors the Acceleration Reference and the Actual Position Feedback. Load observer models an ideal unloaded motor and generates a load Torque Estimate, in torque units, that represents any deviation in response of the actual motor and mechanics from the ideal model. This deviation represents the reaction torque placed on the motor shaft by the load mechanics. It is estimated in real time and compensated by closed loop operation.

Figure 118 - Load Observer and Control Loop Signals Relationship Block Diagram



Load observer also generates a Velocity Estimate signal that you can apply to the velocity loop. The Velocity Estimate has less delay than the Velocity Feedback signal derived from the actual feedback device. It also helps to reduce high frequency output noise caused by load observer's aggressive action on the acceleration reference. Together, load observer with the Velocity Estimate setting provides the best overall performance.

Configuration

You can configure the load observer feature in a variety of ways by writing to a set of configuration IDN parameters. The overall behavior of load observer is controlled by Load Observer Configuration (IDN P-431). This parameter is used to select the load observer mode. It can be set to the following values.

Table 122 - Load Observer Modes

Mode	Value	Description	
Disabled (default)	0	Load Observer is inactive	
Load Observer Only	1	Provides a Torque Estimate only	This setting is a filtered acceleration feedback with the addition of integral action in the acceleration forward path that is active below the observer bandwidth. This greatly increases the disturbance rejection properties (stiffness) over the acceleration feedback setting. However, it is also fairly aggressive and the observer bandwidth must be decreased for stable operation.
Load Observer with Velocity Estimate	2	Standard Operation: Provides Torque and Velocity Estimates	This setting combines the best of the Load Observer Only and Velocity Estimate Only settings. Separately, load observer removes error, but increases phase lag and is fairly aggressive, whereas velocity estimate provides a smooth response and reduces phase lag, but creates error. Together, they remove error and provide a smooth response. Load observer performs well in situations that require adapting to changing inertia and velocity integrator anti-windup.
Velocity Estimate Only	3	Provides a Velocity Estimate only	This setting creates a filtered velocity feedback signal that is void of phase lag. Less phase lag (delay around the loop) allows for higher performance. However, the signal is modeled at frequencies above the observer bandwidth, producing error in velocity feedback. This generates a fictitiously lower velocity error since velocity error equals velocity command minus velocity feedback. Nevertheless, the steady state error disappears when used in position mode with either the position integrator or the observer integrator. This configuration is not desirable for Velocity mode applications.
Acceleration Feedback	4	Provides acceleration feedback by disconnecting Acceleration Reference to load observer	This setting creates a filtered acceleration feedback signal. This setting is fairly aggressive and the observer bandwidth must be decreased significantly for stable operation. The Load Observer Only setting is similar, but without the additional phase lag (delay) created by necessary filtering.

The following figures illustrate the high-level operation of each observer mode.

Figure 119 - Load Observer Disabled Configuration (Value 0)

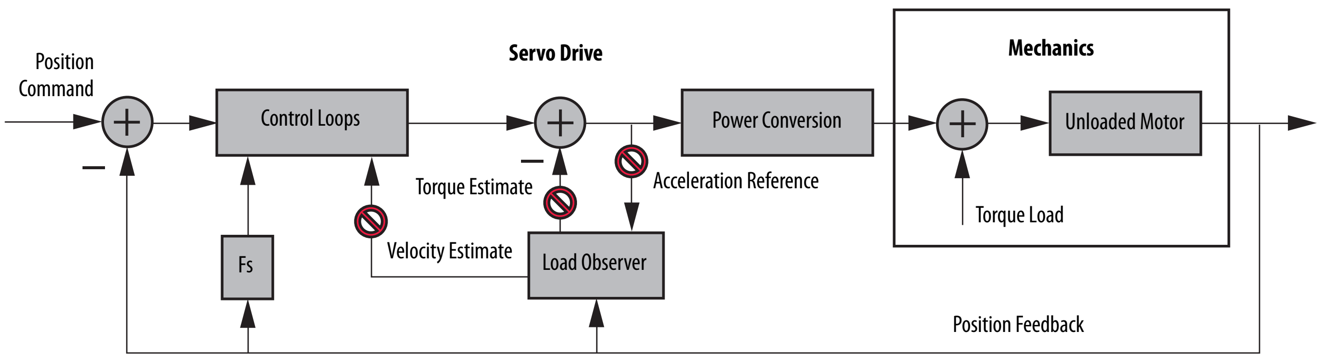


Figure 120 - Load Observer Only Configuration (Value 1)

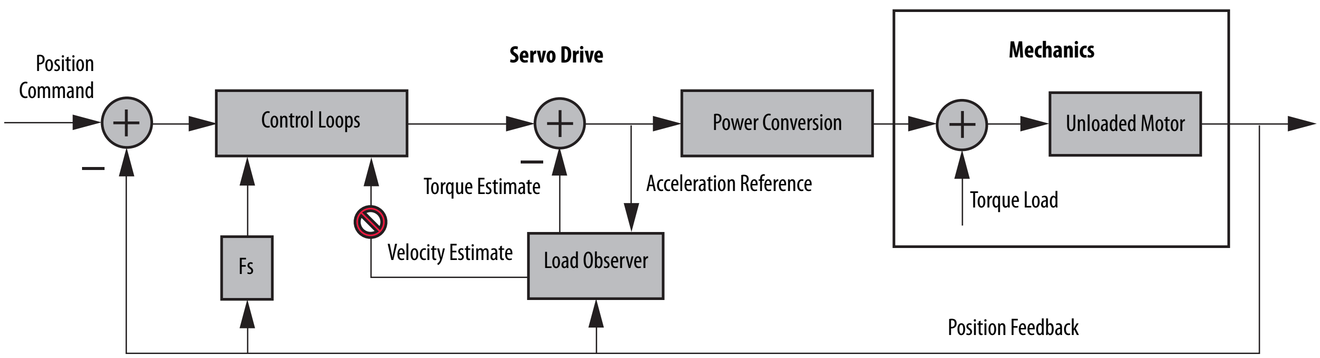


Figure 121 - Load Observer with Velocity Estimate Configuration (Value 2)

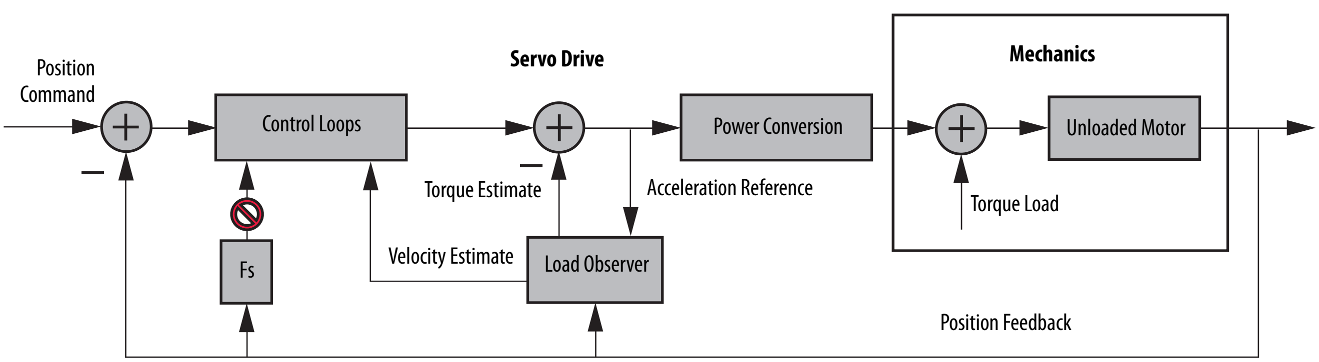


Figure 122 - Velocity Estimate Only Configuration (Value 3)

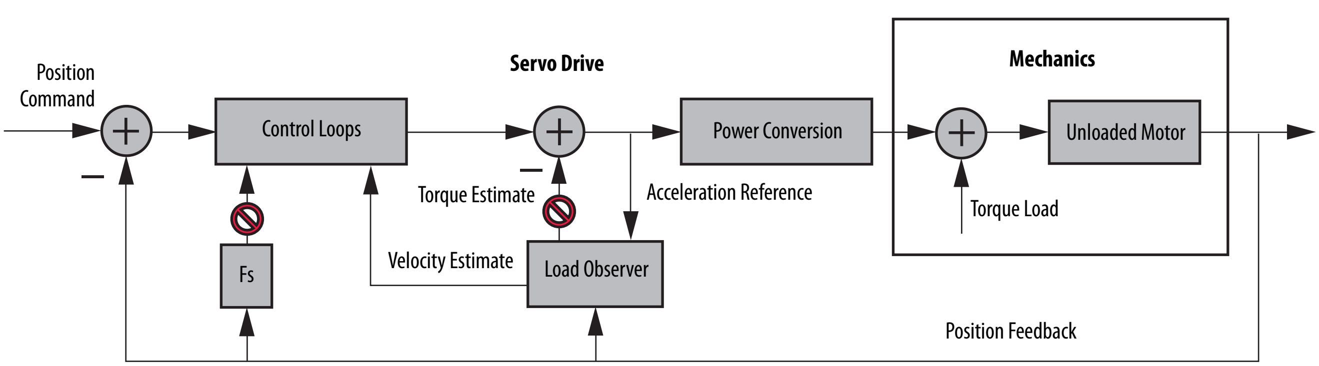
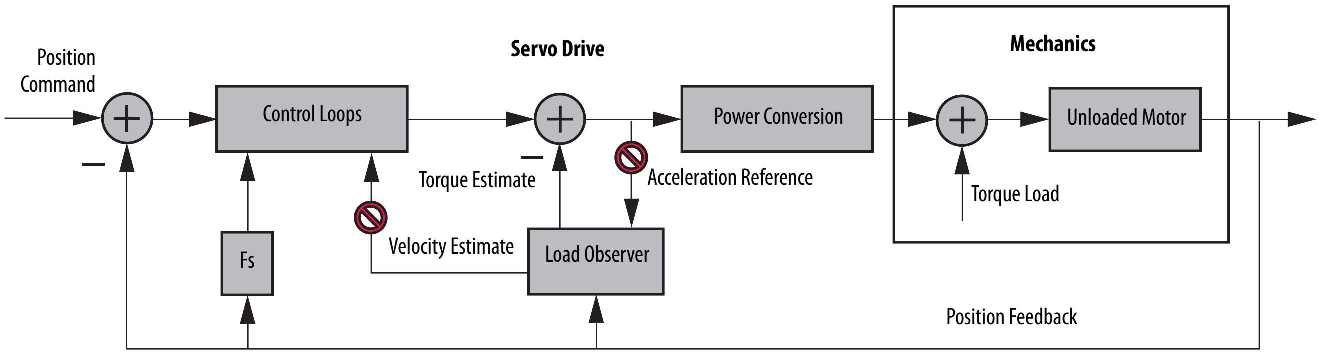


Figure 123 - Acceleration Feedback Configuration (Value 4)

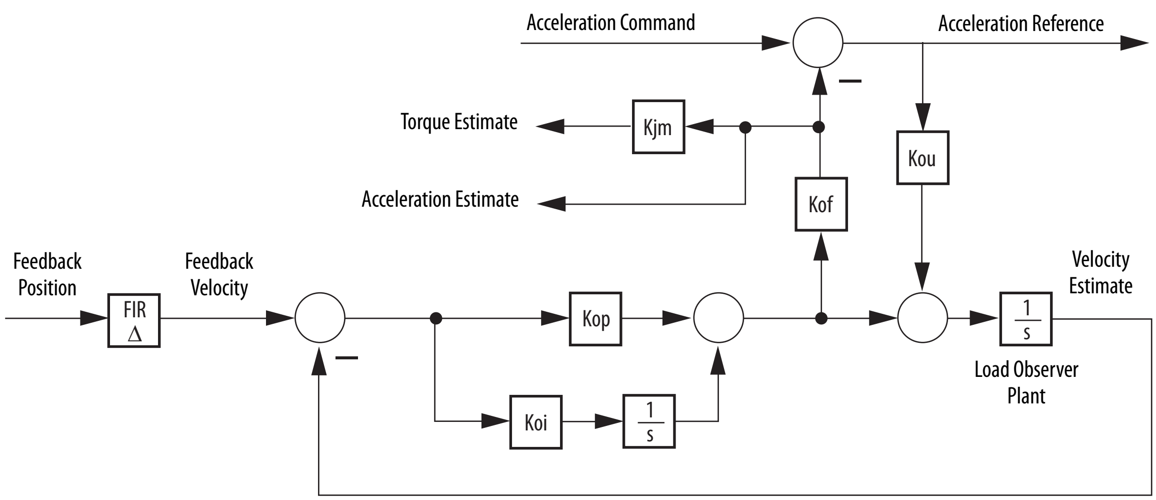


You can configure the load observer feature in a variety of ways by writing to a set of configuration IDN parameters. The overall behavior of load observer is controlled by Load Observer Configuration (IDN P-431). This parameter is used to select the Load Observer mode. Use it to set the IDN values listed in Table 122 on page 272

Remaining IDN Parameter Descriptions

Load observer gains that require user interaction are Load Observer Bandwidth (Kop) and Load Observer Integral Bandwidth (Koi). They are set by IDN P-432 and IDN P-433, respectively. Guidelines for setting these gains are provided in the following sections. In general, Kop acts like a velocity integrator without windup and Koi acts a like a position integrator without windup. Typically, Koi = 0.

Figure 124 - Load Observer Gains



Load observer gains that do not require user interaction are Load Observer Feedback Gain (Kof) and the Load Observer Input Gain (Kou). They are automatically set internally based on the Load Observer Configuration. However, when in Acceleration Feedback mode, Kof can also be set manually by IDN P-434 with typical values between zero and one.

Table 123 - Load Observer Gain Parameters

IDN	Name	Units	Format	Value, min	Value, max
P:0:432	Load Observer Bandwidth (Kop)	Rad/s			12,500
P:0:433	Load Observer Integral Bandwidth (Koi)	Rad/s	16 bit unsigned int	0	65,535
P:0:434	Load Observer Feedback Gain (Kof)	–			200

The Acceleration Estimate and Torque Estimate signals are read by using IDN-435 and P-436, respectively. Definitions for these IDN parameters are given in the following table.

Table 124 - Load Observer Output Signals

IDN	Name	Units	Format	Value, min	Value, max
P:0:435	Load Observer Acceleration Estimate	Acceleration	32bit signed int	-2^{31}	$2^{31}-1$
P:0:436	Load Observer Torque Estimate	Torque	16 bit signed int	-2^{15}	$2^{15}-1$

When load observer and the torque low-pass filter are both enabled, and the low-pass filter bandwidth is less than 5 times the load observer bandwidth, their interaction can interfere with each other, causing instability. The low-pass filter is always limited to a bandwidth under 400 Hz in drive firmware. IDN P-065 can be used to override the torque low-pass filter bandwidth limiting. The filter is also bypassed if the override IDN P-065 is set to 1 and the torque low-pass filter bandwidth is set to zero.

Table 125 - Torque Low-pass Filter Bandwidth

IDN P:0:065	Bandwidth in the Logix Designer Application	Actual Bandwidth in Drive
0	= 0	400 Hz
	> 0	Limited to ≤ 400 Hz
1	= 0	Filter bypassed
	> 0	Limited to ≤ 10,430 Hz

Refer to Appendix F on page 307 for more information on changing IDN parameter values with read/write messages in the Logix Designer application.

Out-of-Box Gain Settings

This method of setting controller gains works for unknown loads or when an auto-tune is not performed. It produces a relatively high level of performance in 90% of motion applications. Most of the time, there is no need to perform an auto-tune procedure or further optimize gain settings.

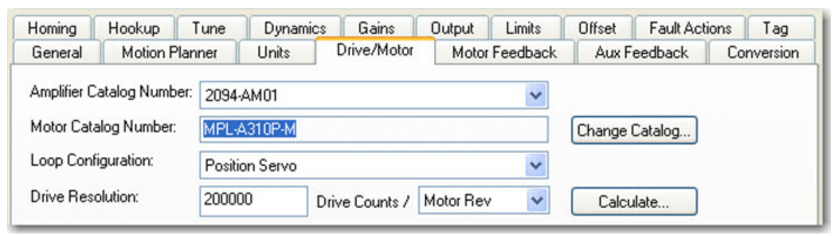
TIP Try this method before executing Auto-tune.

Follow these steps to configure the drive for high performance right out of the box. This procedure uses load observer to automatically account for the unknown load. As a result, you must be familiar with creating an axis in the Logix Designer application and accessing drive IDN parameters.

1. Create a new axis with type AXIS_SERVO_DRIVE.

   If you need more information to create a new axis, refer to Configure the Kinetix 6200 Drive Modules on page 152.

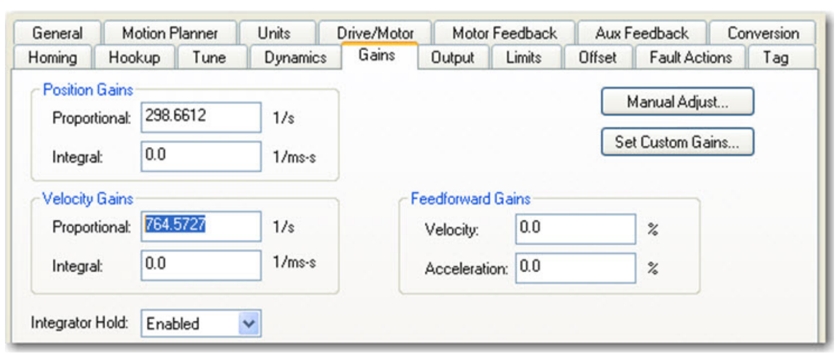
2. Click the Drive/Motor tab in the Axis Properties dialog box and add a motor.



   If you need more information to add a motor, refer to Configure Axis Properties on page 157.

3. Click the Gains tab in the Axis Properties dialog box.

   The current Velocity Proportional Gain (Initial Kvp) value is used to recalculate other gain values.

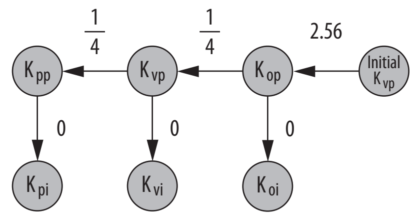


4. Make the following calculations:

   a. Load Observer Bandwidth: Kop = Velocity Proportional Gain x 2.56

   b. Velocity Loop Bandwidth: Kvp = Kop/4

c. Position Loop Bandwidth: Kpp = Kvp/4



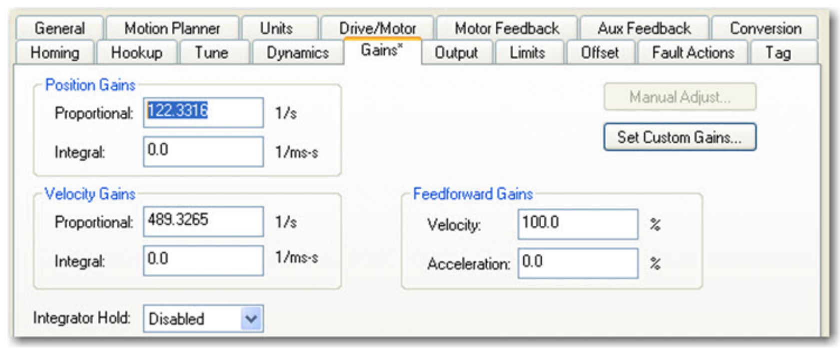
5. Configure these settings and values on the Gains tab.

   a. Position Proportional Gain = Kpp

   b. Velocity Proportional Gain = Kvp

   c. Velocity Feedforward Gain = 100%

   d. Integrator Hold = Disabled



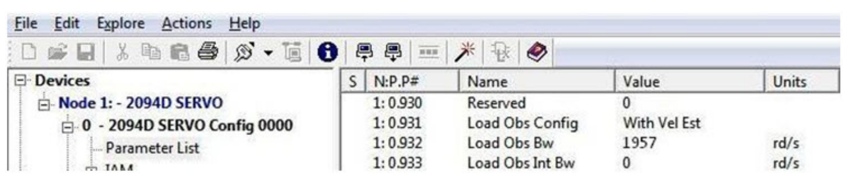
6. Configure these IDN parameter values.

   a. IDN P-431 = 2 (load observer with velocity estimate)

   b. IDN P-432 = Kop

   c. IDN P-433 = 0

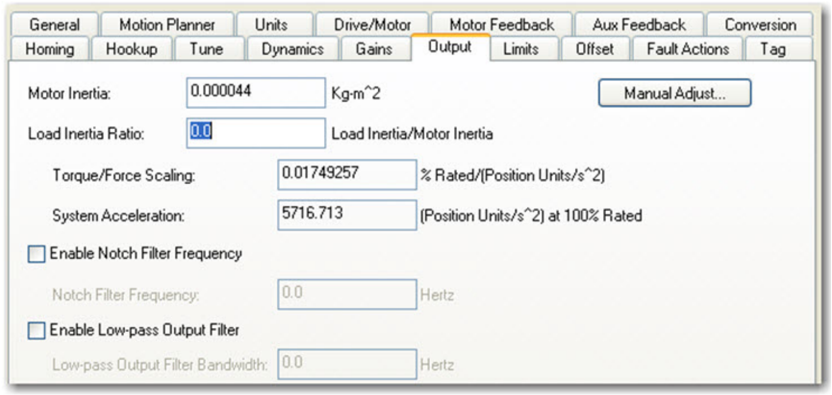
   d. IDN P-065 = 1



7. Click the Output tab in the Axis Properties dialog box and verify these settings.

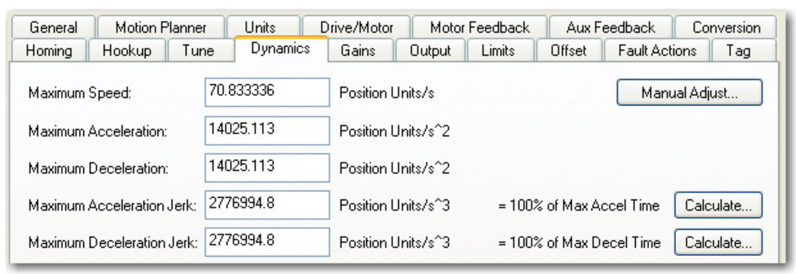
   a. Load Inertia Ratio = 0

b. Enable Low-pass Output Filter = Unchecked



8. If required, reduce the Maximum Acceleration and Maximum Deceleration values to meet application requirements and protect the drive and motor from overload.

   Acceleration limits, by default, are set to their maximum value, providing the best performance for a Load Inertia Ratio of zero. However, your application loads the motor and it will not be able to accelerate as fast.



9. Refer to Compensate for High Frequency Resonances on page 285, to tune-out resonant frequencies.

Auto-tune Gain Settings

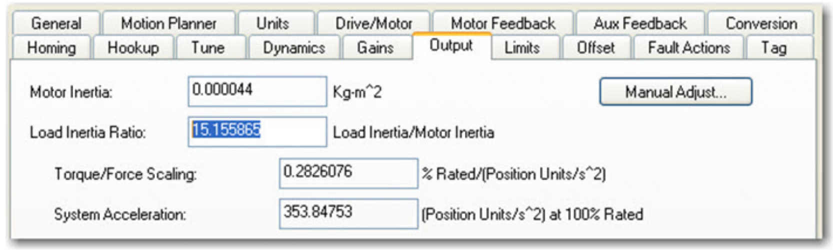
This procedure explains how to configure the load observer feature after running Auto-tune. This method also works for any existing set of gains where the Load Inertia Ratio is known or manually calculated, for example, when the Load Inertia Ratio > 0.

TIP Try the out-of-box method before executing Auto-tune. Refer to Out-of-Box Gain Settings on page 276.

1. Click the Tune tab in the Axis Properties dialog box and perform Auto-tune.

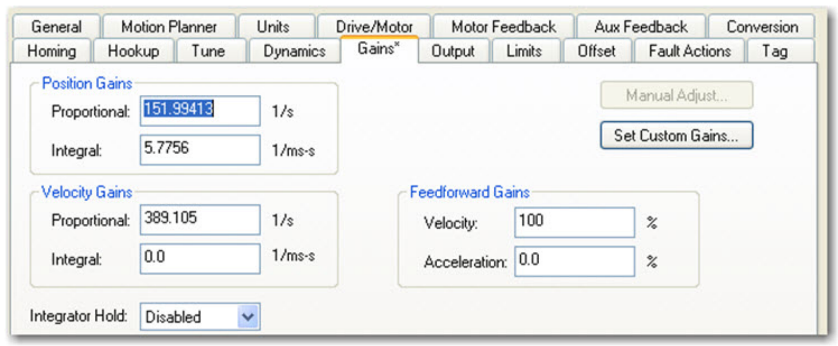
   For variable inertia loads, perform Auto-tune at the point of lowest mechanical inertia. If you manually calculate the Load Inertia Ratio, use the minimum load inertia.

2. Click the Output tab in the Axis Properties dialog box and verify that the Load Inertia Ratio > 0.



3. Click the Gains tab in the Axis Properties dialog box.

   The current Position and Velocity gain values are used to recalculate other gain values.



4. Determine if the mechanical load connected to the motor is rigid or compliant.

   - Rigid systems typically involve high-performance load mechanics that are tightly coupled directly to the motor shaft and there is no lost motion.

     Refer to Rigid Mechanical Loads on page 279, for rigid applications.

   - Everything else is compliant, including systems with belts and pulleys, long shafts, short shafts with heavy loads, and couplings and gearboxes with backlash and/or lost motion.

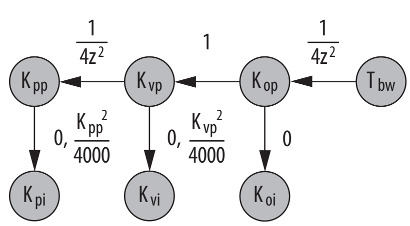
     Refer to Compliant Mechanical Loads on page 280, for compliant applications.

Rigid Mechanical Loads

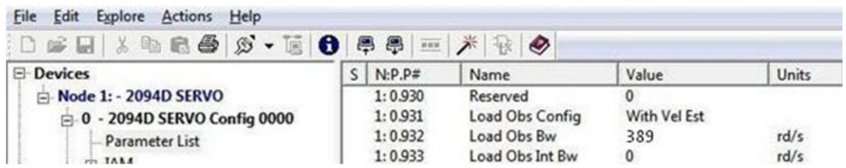
Follow these steps if the load is rigid.

1. Calculate the Load Observer Bandwidth.

   Load Observer Bandwidth: Kop = Velocity Proportional Gain



2. Configure these IDN parameter values.
   a. IDN P-431 = 2 (Load Observer with Velocity Estimate)
   b. IDN P-432 = Kop
   c. IDN P-433 = 0
   d. IDN P-065 = 1



3. If the Low-pass Output Filter is enabled, verify that the Low-pass Output Filter Bandwidth is ≥ the Velocity Proportional Gain x 2/(2pi).

   Sercos IDN P-065 has an impact on how the Low-pass Output Filter functions. Refer to Torque Low-pass Filter Bandwidth on page 275 for more information.

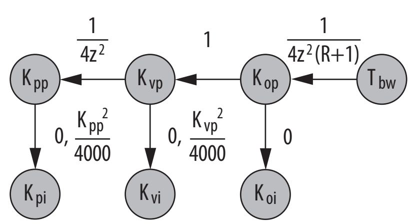
4. Refer to Compensate for High Frequency Resonances on page 285, to tune-out resonant frequencies.

Compliant Mechanical Loads

The compliant setting reduces all of the gains by a factor of (Load Inertia Ratio +1) and then calculates the Load Observer Bandwidth. Typically, this reduction is too conservative, making the loop response sluggish and the error too large. However, it does assure stability.

Follow these steps if the load is compliant.

1. Make the following calculations to de-tune all gains by a factor of the (Load Inertia Ratio + 1):
   a. Position Loop Bandwidth:
      Kpp = Position Proportional Gain/(Load Inertia Ratio + 1)
   b. Position Integral Bandwidth:
      Kpi = Position Integral Gain/(Load Inertia Ratio + 1)^2
   c. Velocity Loop Bandwidth:
      Kvp = Velocity Proportional Gain/(Load Inertia Ratio + 1)
   d. Velocity Integral Bandwidth:
      Kvi = Velocity Integral Gain/(Load Inertia Ratio + 1)^2
   e. Load Observer Bandwidth: Kop = Kvp



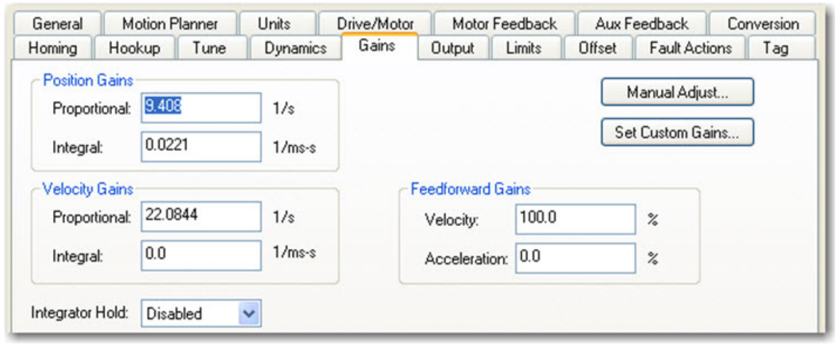
2. Configure these settings and values on the Gains tab.

a. Set the Position Proportional Gain = Kpp

b. Position Integral gain = Kpi

c. Velocity Proportional Gain = Kvp

d. Velocity Integral Gain = Kvi



To manually increase the gains by some factor to optimize the response, refer to Manual Tuning for Further Optimization on page 282.

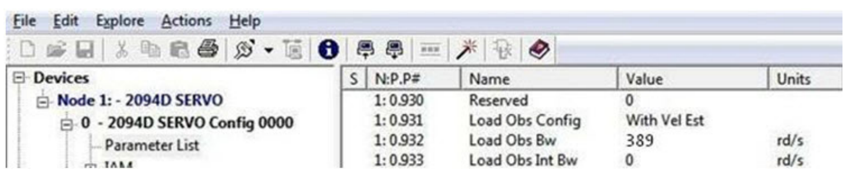
3. Configure these IDN parameter values.

a. IDN P-431 = 2 (Load Observer with Velocity Estimate)

b. IDN P-432 = Kop

c. IDN P-433 = 0

d. IDN P-065 = 1



4. If the Low-pass Output Filter is enabled, verify that the Low-pass Output Filter Bandwidth ≥ Velocity Proportional Gain x 5/(2pi).

Sercos IDN P-065 has an impact on how the Low-pass Output Filter functions. Refer to Torque Low-pass Filter Bandwidth on page 275 for more information.

5. Refer to Compensate for High Frequency Resonances on page 285, to tune-out resonant frequencies.

Tuning Mode Summary

This table summarizes the primary difference between the two tuning modes.

Table 126 - Tuning Mode Comparison

Tuning Mode	Description
Out-of-box or unknown load Load Inertia Ratio = 0	Load Observer Bandwidth Kop = 4 times the new Velocity Proportional Gain, Kvp
Auto-tuning or known load Load Inertia Ratio > 0	Load Observer Bandwidth = Velocity Proportional Gain

Manual Tuning for Further Optimization

The out-of-box and auto-tune rigid methods achieve relatively high performance. However, the manual tuning method can help to optimize performance for the auto-tune compliant method, or if every ounce of performance is required. It involves incrementally increasing controller gains to the point of marginal stability, then backing them off by a given percentage. Typical ranges for various gains are also given to provide guidelines.

Follow these steps to manually tune your drive.

1. Select a factor (N) that you can incrementally increase the gains by in an iterative process, for example, 1.5>N>2.
2. Create a trend to monitor Torque Reference.
3. Manually tune the velocity loop.
    a. Make note of the Position and Feedforward Gains.

       You must change them temporarily to isolate the velocity loop and later restore them to the original values.

    b. Isolate the velocity loop.
       - Zero out the Position Proportional Gain, Position Integral Gain, and Acceleration Feedforward Gain
       - Set the Velocity Feedforward = 100

    c. While Jogging the axis and monitoring the Torque Reference trend, incrementally increase the following gains simultaneously and stop when the Torque Reference begins to become oscillatory or unstable:
       - Low-pass Output Filter Bandwidth = Low-pass Output Filter Bandwidth x N
       - Load Observer Proportional Gain = Load Observer Proportional Gain x N
       - Load Observer Integral Gain = Load Observer Integral Gain x N
       - Velocity Proportional Gain = Velocity Proportional Gain x N
       - Velocity Integral Gain = Velocity Integral Gain x N^2

d. Decrease the gains by using the previous equations with N = 0.5.

A typical range of values for various integral gains are given:

- 0 ≤ Load Observer Integral Gain ≤ Load Observer Proportional Gain/4
- 0 ≤ Velocity Integral Gain ≤ Velocity Proportional Gain^2/4000

e. If the Low-pass Output Filter is enabled, a typical range of values for the Low-pass Output Filter Bandwidth are given:

- Rigid: Low-pass Output Filter Bandwidth ≥ Velocity Proportional Gain x 2/(2pi)
- Compliant: Low-pass Output Filter Bandwidth ≥ Velocity Proportional Gain x 5/(2pi)

4. Manually tune the position loop.

a. Restore the Position and Feedforward Gains to the original values to re-enable the position loop.

b. While Jogging the axis and monitoring the Torque Reference trend, incrementally increase the following gains simultaneously and stop when the Torque Reference begins to become oscillatory or unstable:

- Position Proportional Gain = Position Proportional Gain x N
- Position Integral Gain = Position Integral Gain x N^2

c. Decrease the gains by using the previous equations with an N = 0.5.

A typical range of values for the Position Integral Gain is given:

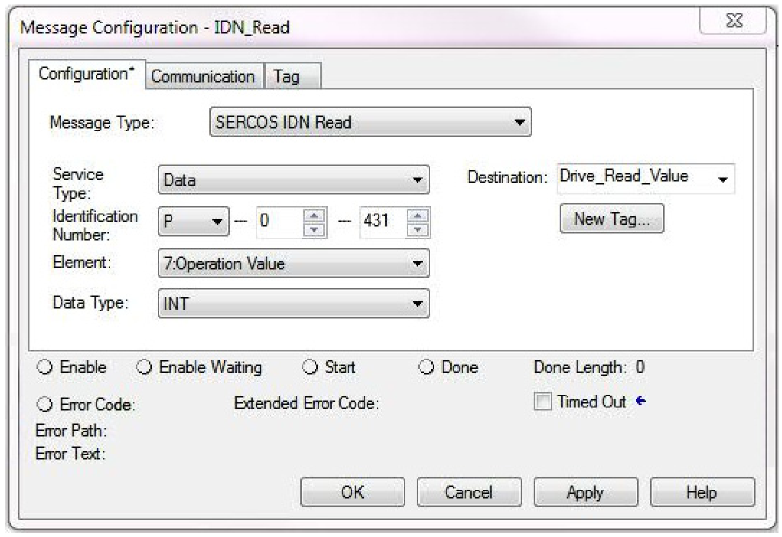
0 ≤ Position Integral Gain ≤ Position Proportional Gain^2/4000

Setting Gains with Sercos IDN Write Messages

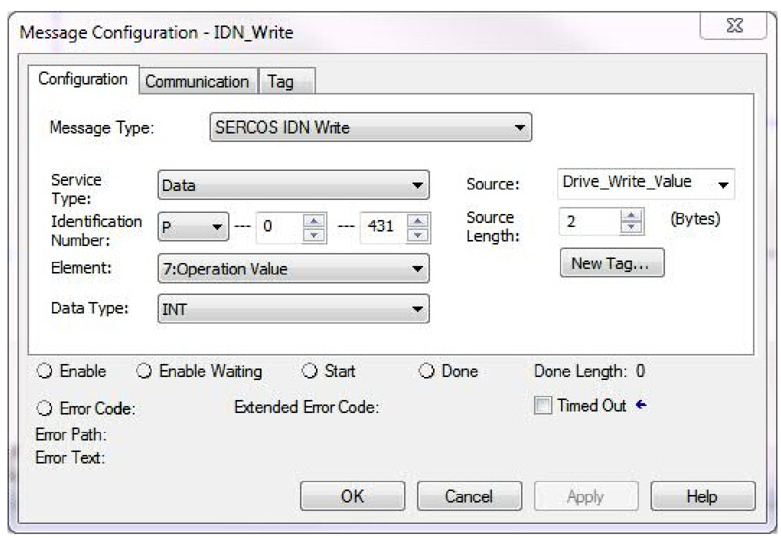
Write the Load Observer Configuration attribute and the Load Observer gains each time the drive gets initialized after applying power.

The Sercos IDN write instruction is accomplished by using RSLogix 5000® software or the Logix Designer application. Refer to Appendix F on page 307 for more information on changing IDN parameter values by using this method.

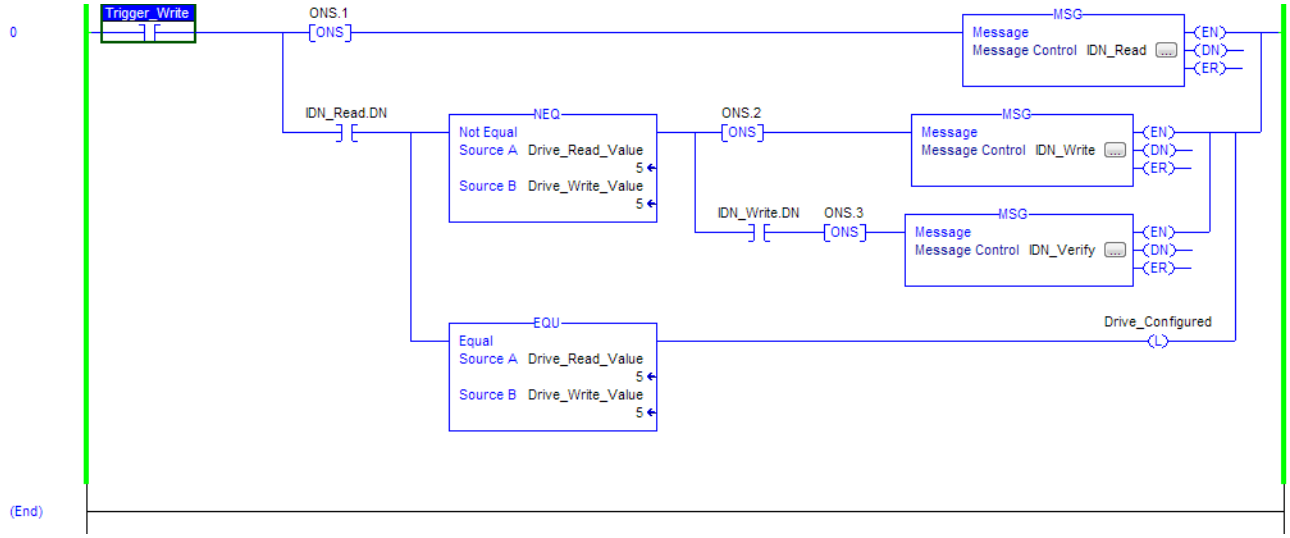
1. Upon initialization of the drive, read the INT value of the configuration of the drive at Sercos IDN P:0:431.



2. If the value is not what you want, latch it and write the new value back to the drive at the same address, again as type INT.



3. Verify the change with another sercos IDN Read Message from IDN P:0:431.



TIP The procedure for setting each of the gains is similar.

Compensate for High Frequency Resonances

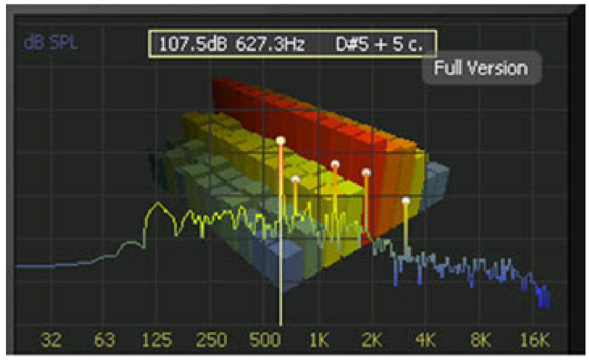
Approximately 15% of all motion applications exhibit a high-frequency resonance that is apparent by an audible high-frequency squealing of the load mechanics.

Follow these steps to identify and reduce the presence of high-frequency resonances.

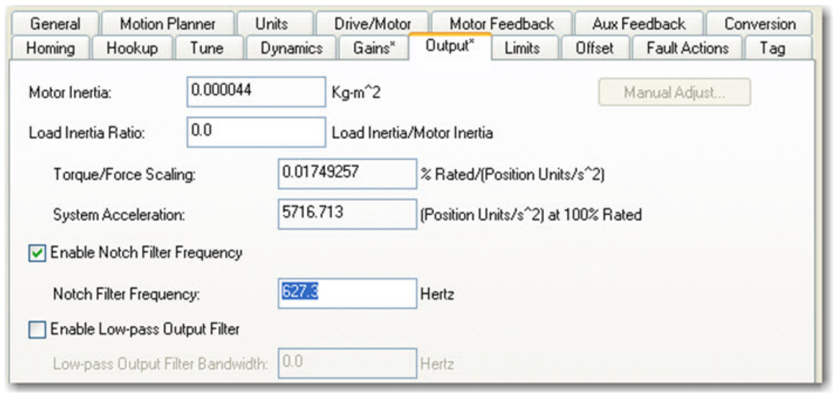
1. Perform the following move sequence by using Motion Direct Commands:
   a. Enable the axis with an MSO
   b. Slowly jog the axis with an MAJ
   c. Stop the axis with an MAS
   d. Disable the axis with a MSO

IMPORTANT	Sometimes an audible resonance is heard before the axis is jogged, making the MAJ and MAS unnecessary.

2. Determine if an audible high-frequency resonance exists in your motion application.
   - If an audible high frequency resonance is not present during the move sequence, skip the remaining steps and tuning is complete.
   - If an audible high frequency resonance is present during the move sequence, use an FFT smart phone or tablet application to identify the dominant resonant frequencies.



3. Click the Output tab in the Axis Properties dialog box.



a. Check Enable Notch Filter Frequency and set the Notch Filter Frequency to the resonant frequency with the largest amplitude.

b. If multiple resonances have nearly the same amplitude, set the Notch Filter Frequency to the lowest resonant frequency.

c. If the problem persists, also check Enable Low-pass Output Filter and set the Low-pass Output Filter Frequency to the next largest resonant frequency.

d. Click OK.

Web Server Interface

The Kinetix 6200 and Kinetix 6500 drives support a web-server interface for common status reporting and network configuration attributes. The web server also supports the safety configuration for 2094-SE02F-M00-S1 and 2094-EN02D-M01-S1 control modules.

Overview

The web-server interface is accessed through an Ethernet connection between the drive and your personal computer. The drive has a private IP address, with the final octet determined by the drive node address or Ethernet address (configured in the Logix Designer application>Axis Properties). For example, with http://192.168.1.1, the IAM power module node address is 001.

Refer to Chapter 6 (for Sercos drives) or Chapter 7 (for EtherNet/IP drives) for more information on setting the node address of your Kinetix 6200 servo drive or Ethernet address of your Kinetix 6500 servo drive.

The web-server interface provides a Home page that displays the current status of the safety configuration and buttons to lock/unlock the configuration, save the configuration to a file, apply a specific configuration, and set an optional password. Though optional, you can configure a password to help protect the system configuration from unauthorized modifications. Use the Change Safety Password page to change the password.

Web-server Interface Categories

Table 127 describes how the categories are organized on the web-server interface.

Table 127 - Web-server Interface Categories

Main Categories	Sub-categories	Page
Home		289
Diagnostics	Drive Indicators	290
	Drive Information	291
	Motor Information	292
	Network Settings	293
	Ethernet Statistics	294
	CIP Statistics	295
	Encoder Statistics	296
	Peak Detection	297
	Monitor Signals	298
	Oscilloscope	299
Fault logs	Fault Log	300
	Configure Fault Log	300
Data logs	Temperatures	301
Administrative settings	Device Identity	302
Browse power rail		302
Safety configuration (1)	Safety Main	303
	Safety Configuration	304
	Configuration Summary	305
	Change Safety Password	306

(1) The Safety Configuration section is only visible with 2094-SE02F-M00-S1 and 2094-EN02D-M01-S1 control modules.

Home Category

From the Home tab, you can monitor many of the drive characteristics.

Figure 125 - Home Tab

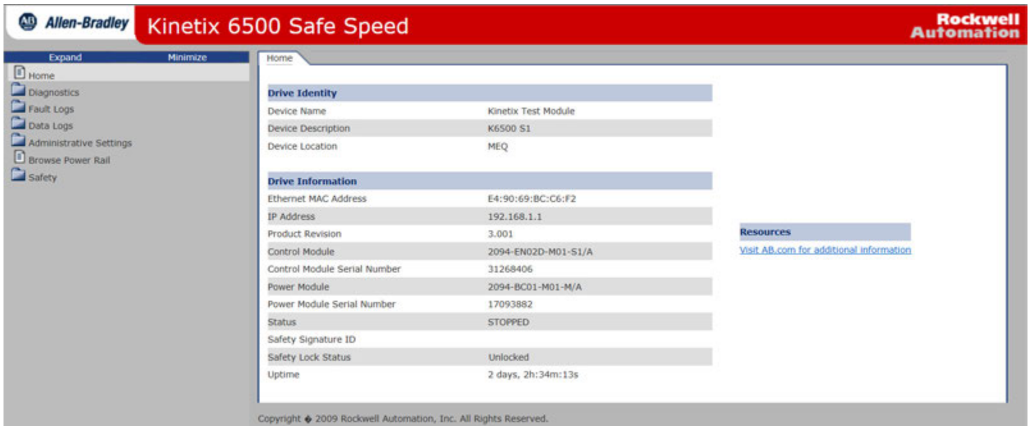


Table 128 - Home Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
Device Name	User-defined information from the device identity page.	–	–	X	X
Device Description	User-defined information from the device identity page.	–	–	X	X
Device Location	User-defined information from the device identity page.	–	–	X	X
Ethernet MAC Address	Media Access Control (MAC) hardware address	X	X	X	X
Ethernet IP Address	IP address	X	X	X	X
SERCOS Node Address	SERCOS node address	X	X	–	–
SERCOS Phase	0, 1, 2, 3, or 4	X	X	–	–
Product Revision	Complete firmware revision	X	X	X	X
Control Module	Control module catalog number and series	X	X	X	X
Control Module Serial Number	Control module serial number	X	X	X	X
Power Module	Power module catalog number and series	X	X	X	X
Power Module Serial Number	Power module serial number	X	X	X	X
Status	Aborting, firmware update, Safe Torque Off, safe limited speed, self test, connecting, configuring, syncing, pre-charge, shutdown, stopped, starting, running, testing. stopping, faulted	X	X	X	X
Safety Signature ID	Advanced safety signature identifier	–	X	–	X
Safety Lock Status	Advanced safety lock status	–	X	–	X
Uptime	Cumulative time with control power applied	X	X	X	X
Resources	Link to www.ab.com	X	X	X	X

Diagnostics Category

The Diagnostics category includes several tabs for monitoring drive, motor, network, encoder, and signal status.

Drive Indicators

From the Drv. Ind tab, you can monitor the control module status indicators.

Figure 126 - Diagnostics>Drv. Ind Tab

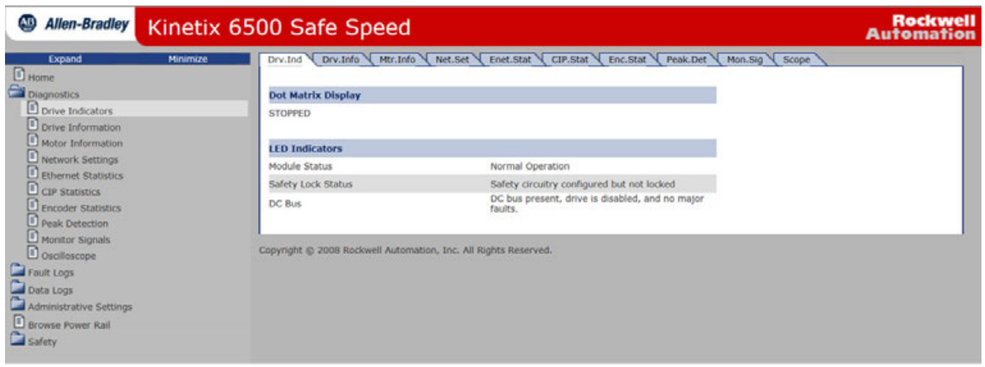


Table 129 - Drive Indicators Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
Dot Matrix Display	String that matches the dot matrix display identically.	X	X	X	X
COMM Status	State of the COMM status indicator on SERCOS models.	X	X	–	–
DRIVE Status	State of the DRIVE status indicator on SERCOS models.	X	X	–	–
Module Status	State of the MODULE status indicator on EtherNet/IP models.	–	–	X	X
Network Status	State of the NETWORK status indicator on EtherNet/IP models.	–	–	X	X
SAFETY LOCK Status	State of the SAFETY LOCK status indicator on Safe Speed Monitor (-S1) models.	–	X	–	X
DC BUS Status	State of the DC BUS status indicator.	X	X	X	X

Drive Information

From the Drv. Info tab, you can monitor data that can assist with troubleshooting drive faults.

Figure 127 - Diagnostics>Drv. Info Tab

Table 130 - Drive Information Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	**-S1**	**-S0**	**-S1**
Main Power Cycles	Cumulative number of main power cycles	X	X	X	X
Control Power Cycles	Cumulative number of control power cycles	X	X	X	X
Cumulative Time with Control Power Applied	Cumulative time with control power applied	X	X	X	X
Elapsed Time since Last Control Power Cycle	Time since control power was last applied	X	X	X	X
Cumulative Time with Main Power Applied	Cumulative time with main power applied	X	X	X	X
Elapsed Time since Last Main Power Cycle	Time since main power was last applied	X	X	X	X
Cumulative Time with Power Stage Enabled	Cumulative time with power stage enabled	X	X	X	X
Elapsed Time with Power Stage Enabled	Time since power stage was last enabled	X	X	X	X
Cumulative Energy Usage	Cumulative amount of energy consumed by the inverter	X	X	X	X
Motor Brake Relay Cycles	Cumulative number of motor brake relay cycles	X	X	X	X
Control Module Date Code	Manufacturing date code	X	X	X	X
Power Module Date Code	Manufacturing date code	X	X	X	X
Safety Firmware Version	Safety firmware revision	X	X	X	X
KCL Version	KCL build	X	X	X	X
Processor Board Hardware Version	PCBA part number and revision	X	X	X	X
I/O Board Hardware Version	PCBA part number and revision	X	X	X	X
Power Module Part Number / Revision	Final assembly part number and revision	X	X	X	X
Control Module Part Number / Revision	Final assembly part number and revision	X	X	X	X

Motor Information

From the Mot. Info tab, you can monitor data that can assist with troubleshooting drive faults.

Figure 128 - Diagnostics>Mtr. InfoTab

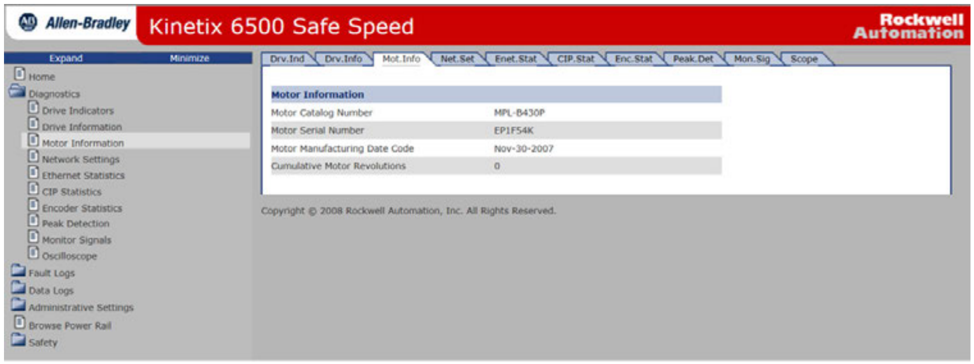


Table 131 - Motor Information Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	**-S1**	**-S0**	**-S1**
Motor Catalog Number	Motor catalog number and series from encoder-based motor BLOB.	X	X	X	X
Motor Serial Number	Motor serial number from encoder-based motor BLOB.	X	X	X	X
Motor Manufacturing Date Code	Manufacturing date code from encoder-based motor BLOB.	X	X	X	X
Cumulative Motor Revolutions	Cumulative number of motor revolutions since last motor catalog number or serial number change.	X	X	X	X

Network Settings

From the Net. Set tab, you can monitor the EtherNet/IP network settings.

Figure 129 - Diagnostics>Net. Set Tab

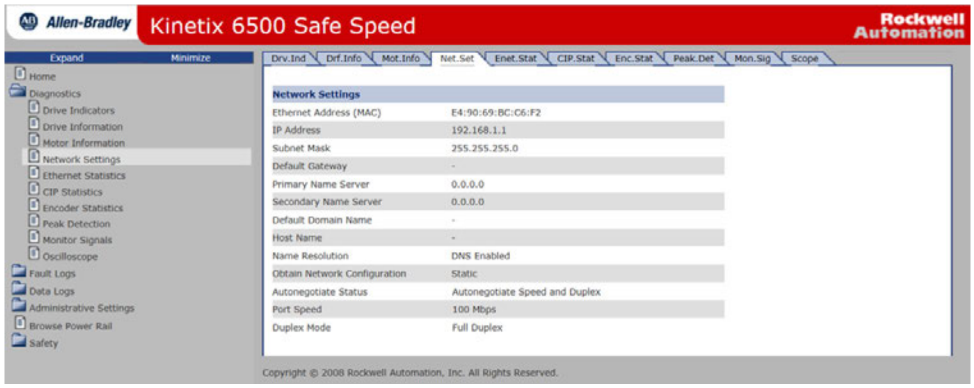


Table 132 - Network Settings Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
Ethernet Address (MAC)	Media Access Control (MAC) hardware address	X	X	X	X
IP Address	IP address of the drive	X	X	X	X
Subnet Mask	Subnet mask	X	X	X	X
Default Gateway	IP address of the default gateway	X	X	X	X
Primary Name Server	IP address of the primary name server	X	X	X	X
Secondary Name Server	IP address of the secondary name server	X	X	X	X
Default Domain Name	Name representing the IP resource.	X	X	X	X
Host Name	Name representing the host encapsulated in the domain.	X	X	X	X
Name Resolution	Mechanism used for name resolution.	X	X	X	X
SMTP Server	IP address of the SMTP server	X	X	X	X
Obtain Network Configuration	IP settings Static or Automatic.	X	X	X	X
Autonegotiate Status	Negotiation status bits of the Ethernet link object	X	X	X	X
Port Speed	10 Mbps or 100 Mbps	X	X	X	X
Duplex Mode	Full duplex or half duplex	X	X	X	X

Ethernet Statistics

The Enet. Stat tab displays counters that assist with troubleshooting EtherNet/IP network problems. The interface counters reflect the state of the packets received and transmitted to the local MAC address, but do not include packets that traverse the switch, destined for another device.

Figure 130 - Diagnostics>Enet. Stat Tab

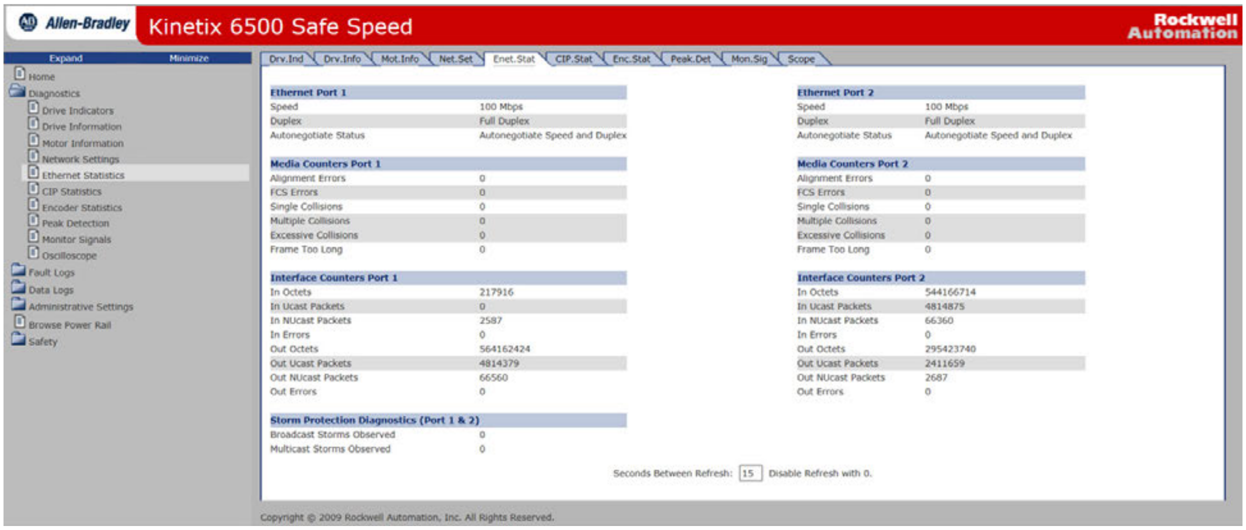


Table 133 - Ethernet Statistics Attributes

Field Name	Port 1 Attributes	Port 2 Attributes [2]
Ethernet	Speed	Speed
	Duplex	Duplex
	Autonegotiate Status	Autonegotiate Status
Media Counters	Alignment Errors	Alignment Errors
	FCS Errors	FCS Errors
	Single Collisions	Single Collisions
	Multiple Collisions	Multiple Collisions
	Excessive Collisions	Excessive Collisions
	Frame Too Long	Frame Too Long
Interface Counters	In Octets	In Octets
	In Ucast Packets	In Ucast Packets
	In NUcast Packets	In NUcast Packets
	In Errors	In Errors
	Out Octets	Out Octets
	Out Ucast Packets	Out Ucast Packets
	Out NUcast Packets	Out NUcast Packets
	Out Errors	Out Errors
Storm Protection [1] Diagnostics	Broadcast Storms Observed	
	Multicast Storms Observed	

(1) Apply to Port 1 and Port 2.
(2) Port 2 attributes do not apply to 2094-SE02F-M00-S*x* (Sercos) drives.

CIP Statistics

The CIP. Stat tab displays counters that assist with troubleshooting EtherNet/IP network problems.

Figure 131 - Diagnostics>CIP. Stat Tab

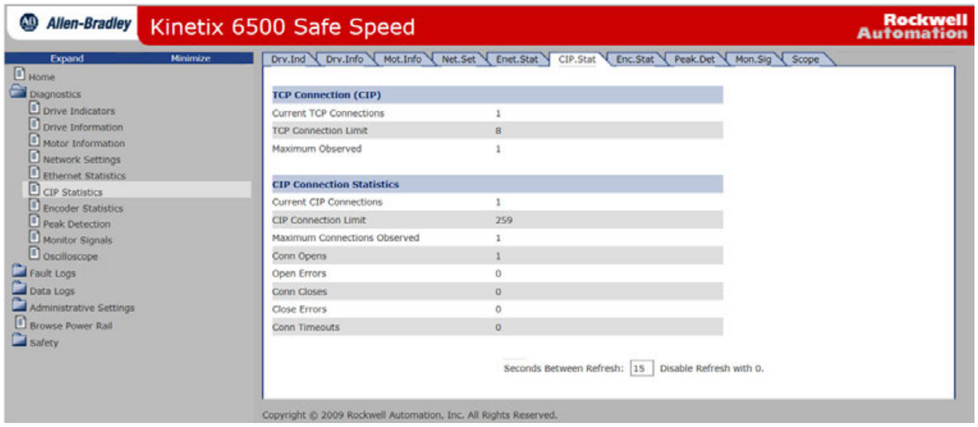


Table 134 - CIP Statistics Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	**-S1**	**-S0**	**-S1**
Current TCP Connections	Current TCP connection	–	–	X	X
TCP Connection Limit	TCP connection limit	–	–	X	X
Maximum Observed	Number of maximum observed connections	–	–	X	X
Current CIP Connections	Current CIP connections	–	–	X	X
CIP Connection Limit	CIP connection limit	–	–	X	X
Max. Connections Observed	Number of maximum observed connections	–	–	X	X
Connection Opens	Total connection opened since powerup	–	–	X	X
Open Errors	Total errors since powerup	–	–	X	X
Connection Closes	Total connection closed since powerup	–	–	X	X
Close Errors	Total connection closed since powerup	–	–	X	X
Connection Timeouts	Connection timeout since powerup	–	–	X	X

Encoder Statistics

The Enc. Stat tab displays counters that assist with troubleshooting motor encoder problems.

Figure 132 - Diagnostics>Enc. Stat Tab

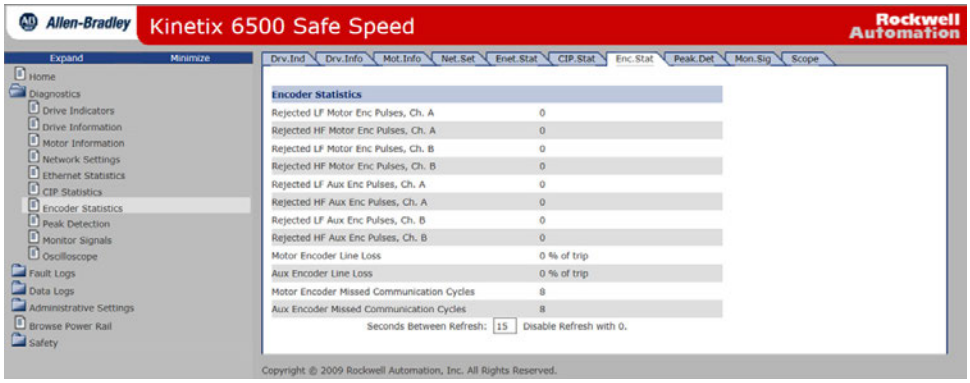


Table 135 - Encoder Statistics Features

Field Name	**Description**	**SERCOS** (2094-SE02F-M00-S*x*)		**EtherNet/IP** (2094-EN02D-M01-S*x*)	
		-S0	**-S1**	**-S0**	**-S1**
Rejected LF Motor Enc Pulses, Ch. A	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected HF Motor Enc Pulses, Ch. A	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected LF Motor Enc Pulses, Ch. B	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected HF Motor Enc Pulses, Ch. B	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected LF Aux Enc Pulses, Ch. A	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected HF Aux Enc Pulses, Ch. A	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected LF Aux Enc Pulses, Ch. B	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Rejected HF Aux Enc Pulses, Ch. B	Cumulative number of rejected encoder pulses since the last control power cycle.	X	X	X	X
Motor Encoder Line Loss	Current state of the motor encoder line-loss algorithm, in units of % of trip level.	X	X	X	X
Auxiliary Encoder Line Loss	Current state of the auxiliary encoder line-loss algorithm, in units of % of trip level.	X	X	X	X
Motor Encoder Missed Communication Cycles	Cumulative number of missed motor-encoder communication responses since the last control power cycle.	X	X	X	X
Auxiliary Encoder Missed Communication Cycles	Cumulative number of missed motor-encoder communication responses since the last control power cycle.	X	X	X	X

Peak Detection

The Peak. Det tab displays attributes that have integrated peak detection for troubleshooting. All peaks are measured with 5 ms resolution.

Figure 133 - Diagnostics>Peak. Det Tab

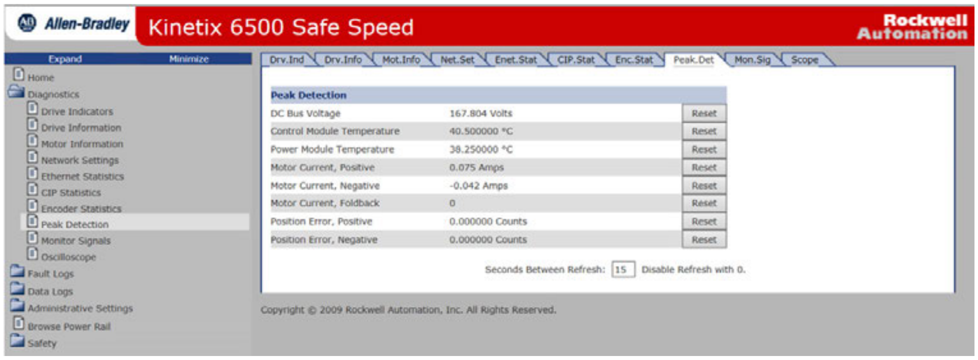


Table 136 - Peak Detection Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
DC Bus Voltage [(1)]	Maximum value of the DC-bus voltage since control power was last applied.	X	X	X	X
Control Module Temperature	Maximum value of the control module temperature.	X	X	X	X
Power Module Temperature	Maximum value of the power module temperature.	X	X	X	X
Motor Current, Positive [(1)]	Maximum positive value of the motor current since control power was last applied.	X	X	X	X
Motor Current, Negative [(1)]	Minimum negative value of the motor current since control power was last applied.	X	X	X	X
Motor Current, Foldback [(1)]	True if the motor current has experienced foldback since control power was last applied.	X	X	X	X
Position Error, Positive [(1)]	Maximum positive value of the position error since control power was last applied.	X	X	X	X
Position Error, Negative [(1)]	Minimum negative value of the position error since control power was last applied.	X	X	X	X

(1) This field also includes a button that lets you reset the peak to zero.

Monitor Signals

The Mon. Sig tab displays dynamic attributes that can assist field troubleshooting.

Figure 134 - Diagnostics>Mon. Sig Tab

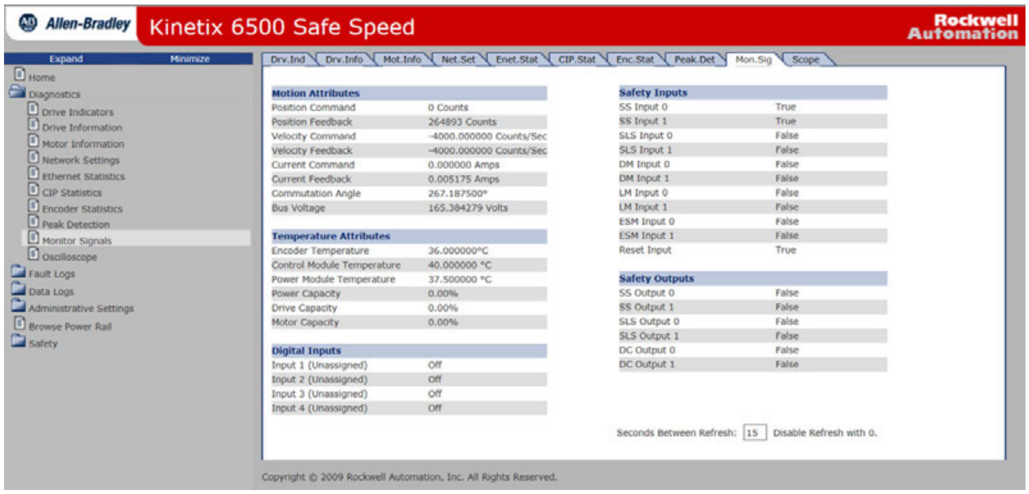


Table 137 - Dynamic Attributes

Motion Attributes	**Safety Inputs**
Position Command	SS Input 0
Position feedback	SS Input 1
Velocity Command	SS Input 2
Velocity feedback	SS Input 3
Current Command	SLS Input 0
Current feedback	SLS Input 1
Commutation angle	DM Input 0
Bus voltage	DM Input 1
Temperature Attributes	LM Input 0
Encoder temperature	LM Input 1
Control module temperature	ESM Input 0
Power module temperature	ESM Input 1
Converter duty cycle	Reset Input
Inverter duty cycle	**Safety Outputs**
Motor duty cycle	SS Output 0
Digital Inputs	SS Output 1
Input 1	SLS Output 0
Input 2	SLS Output 1
Input 3	DC Output 0
Input 4	DC Output 1

Oscilloscope

The Scope tab provides a data collection mechanism for viewing up to four channels of dynamic attribute data collected synchronously. The triggering methods are positive edge, negative edge, and immediate, with programmable trigger thresholds. The capture can be done in either single-shot or continuous mode. Click Save to export the window to a spreadsheet. The trigger and collected data attributes include the following

Figure 135 - Diagnostics>Scope Tab

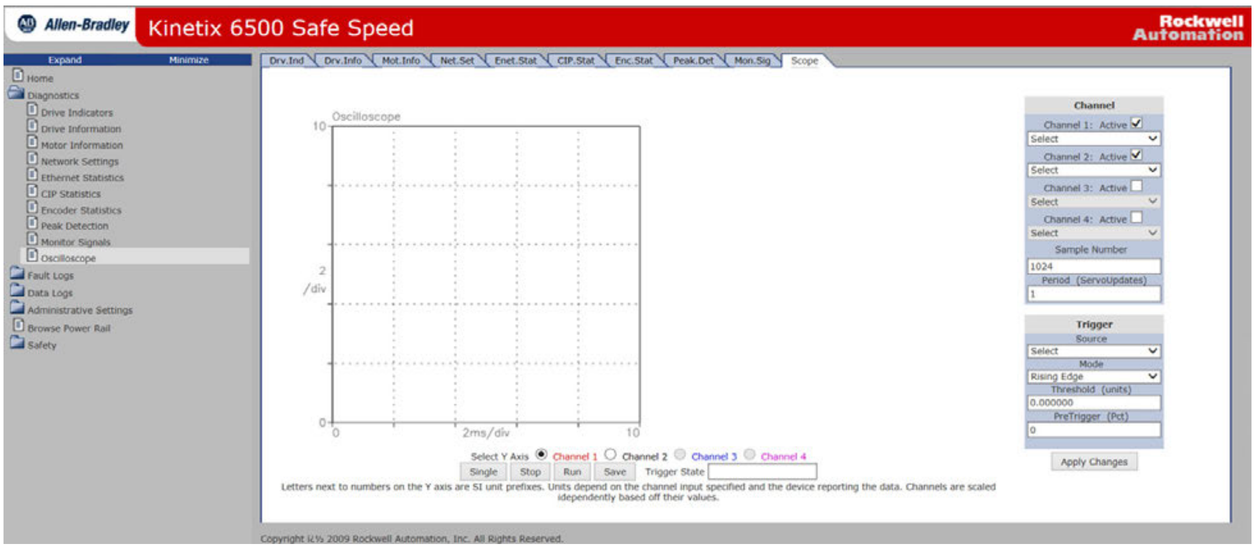


Table 138 - Trigger and Collected Data Attributes

Motion Attributes
Position Command
Position feedback
Velocity Command
Velocity feedback
Current Command
Current feedback
Commutation angle
Bus voltage

Digital Inputs
Input 1
Input 2
Input 3
Input 4

Fault Logs Category

The Fault Log tab provides access to faults logged by the drive for future retrieval. Each log in the list is a link and you can view the details. You can configure individual channels in the fault log via the Configure Fault Log page. All logs can be exported separately into spreadsheets.

Figure 136 - Fault Logs>Fault Log Tab

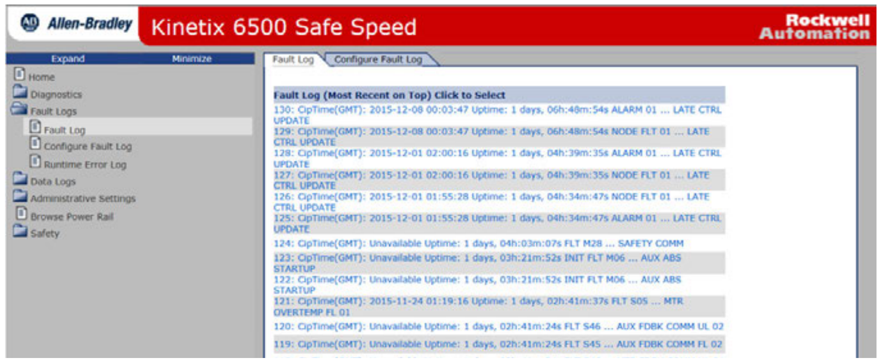


Table 139 - Fault Log Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
Fault	A 20-sample non-volatile fault log with programmable 8-channel variable tracing. Each log entry includes the following: • Fault code and sub-code • 4 channels of variables collected at the servo update rate • 4 channels collected at a programmable sample rate • CIP time stamp (1) • Local time stamp	X	X	X	X

(1) CIP time stamps are available on only 2094-EN02D-M01-S*x* (EtherNet/IP) drives.

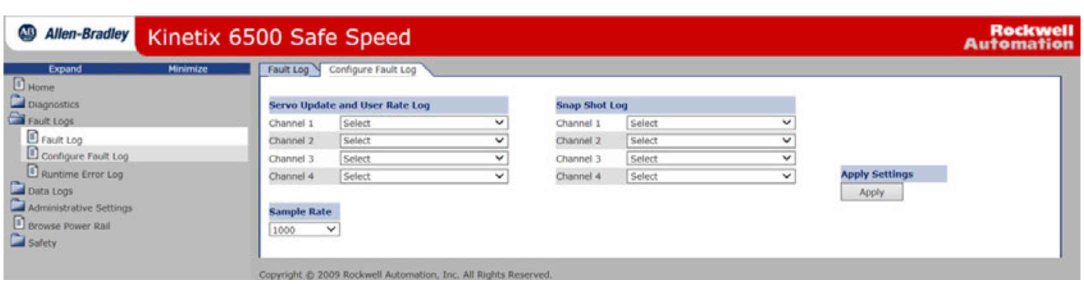
Configure Fault Log

The Configure Fault Log tab lets you select channels to capture during a fault that are listed in the fault log. You can select channels for:

- Servo Update and User Rate Log
- Snap Shot Log

A maximum of four channels can be selected for each mode. Once you have selected the channels, click Apply to save the settings to the drive. These settings are persistent over power cycles.

Figure 137 - Fault Logs>Configure Fault Log Tab



Data Logs Category

The Data Logs pages provides access to data that is logged by the drive for future retrieval.

Temperatures

The Temperatures tab reports temperatures from the control module, power module, and encoder.

Figure 138 - Data Logs>Temperatures Tab

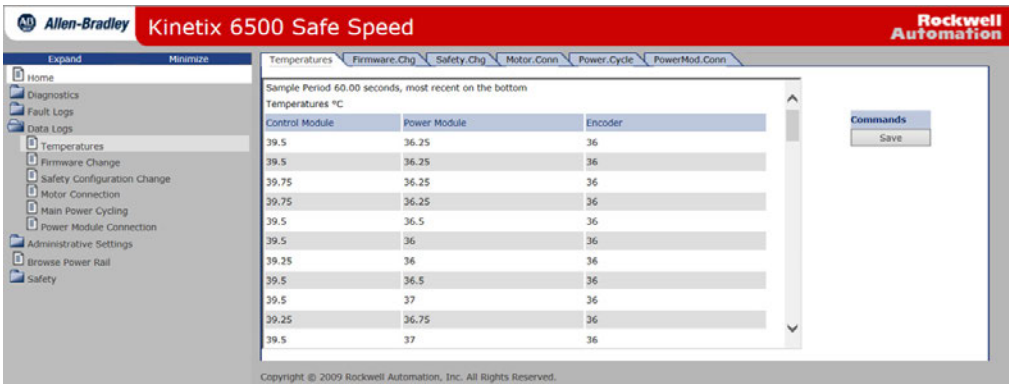


Table 140 - Temperatures Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	**-S1**	**-S0**	**-S1**
Control Module Temperature	A 2048-sample log of control module temperature sampled at 1-minute intervals.	X	X	X	X
Power Module Temperature	A 2048-sample log of power module temperature sampled at 1-minute intervals.	X	X	X	X
Encoder Temperature	A 2048-sample log of encoder temperature sampled at 1-minute intervals.	X	X	X	X
Firmware Change	A 16-sample non-volatile log of firmware updates. Each log entry stores the firmware version, CIP time stamp, and local time stamp.	X	X	X	X
Safety Configuration Change	A 16-sample non-volatile log of safety configuration changes. Each log entry stores the signature, CIP time stamp, and local time stamp.	–	X	–	X
Motor Connection	An 8-sample log of motor catalog number or serial number changes. Each log entry stores the motor catalog number, motor serial number, CIP time stamp, and local time stamp.	X	X	X	X
Main Power Cycling	A 16-sample non-volatile log of main power cycle events. Each log entry stores the type (on or off), CIP time stamp, and local time stamp.	X	X	X	X
Power Module Connection	An 8-sample non-volatile log of power module catalog number or serial number changes. Each log entry stores the power module catalog number, serial number, CIP time stamp, and local time stamp.	X	X	X	X

Administrative Settings Category

From the Administrative Settings web pages, you can update the drive identification settings.

The Device Identity tab lets you update the device description and name that appears on the Home page. By default, all the fields are blank on first power up (or if they have never been updated). Click Apply to save the values to the drive.

Figure 139 - Administrative Settings>Device Configuration>Device Identity Tab

Table 141 - Device Identity Features

Field Name	Description	SERCOS (2094-SE02F-M00-Sx)		EtherNet/IP (2094-EN02D-M01-Sx)	
		-S0	-S1	-S0	-S1
Device Identity	A non-volatile identification of the drive.	–	–	X	X

Browse Power Rail Category

When connected to an integrated axis module (IAM), you are able to browse the power rail and see the axis modules and their respective location (slot) on the power rail. Click the link and you are directed to the specific axis module web page.

IMPORTANT The axis modules must be connected to the EtherNet/IP network for the link to work.

Figure 140 - Power Rail Tab

Table 142 - Power Rail Features

Field Name	Description	SERCOS (2094-SE02F-M00-Sx)		EtherNet/IP (2094-EN02D-M01-Sx)	
		-S0	-S1	-S0	-S1
Browse Power Rail	Link to all the AM modules that are connected to the same network.	X	X	X	X

Safety Category

This appendix provides an overview of the safety configuration web pages. For information on how to configure the safety functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Multi-axis Servo Drives Safety Reference Manual, publication 2094-RM001.

Safety Main

The Safety Main tab lets you lock or unlock the safety configuration, save the configuration to a file, apply a safety configuration, and enter a password. The default [Safety Lock Status] parameter setting is Unlock.

Figure 141 - Safety Main Tab

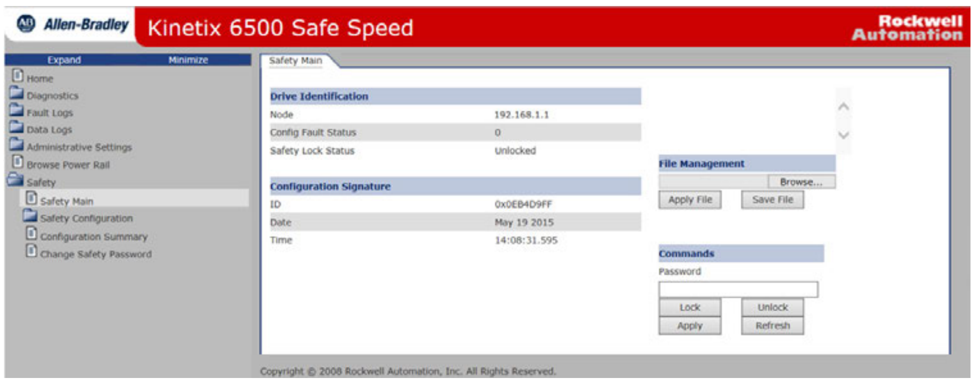


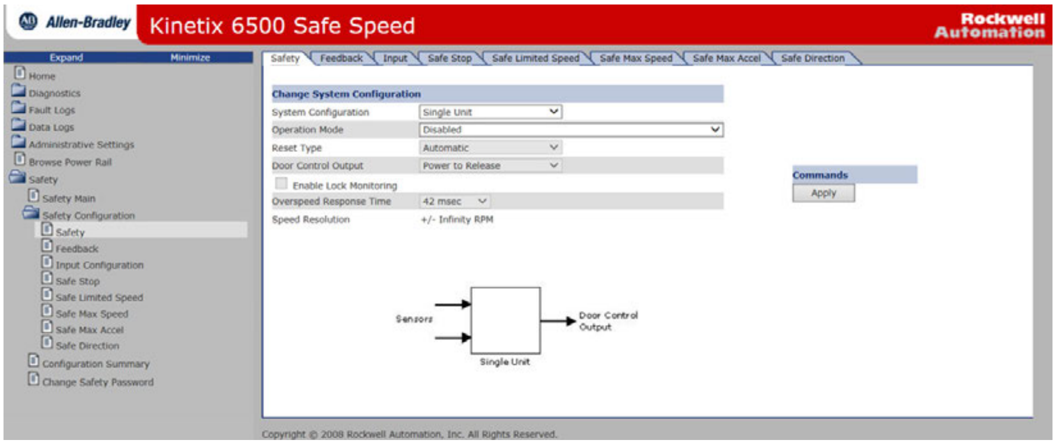
Table 143 - Safety Main Features

Field Name	Description	SERCOS (2094-SE02F-M00-S*x*)		EtherNet/IP (2094-EN02D-M01-S*x*)	
		-S0	-S1	-S0	-S1
Save File	Click Safe File to save a data file containing the safety configuration information. This file can be used to configure additional drives with the same safety configuration.	–	X	–	X
Apply File	Click Apply File to directly apply safety configuration settings from a previously saved file to the drive's safety circuitry. The safety circuitry must be unlocked before a safety configuration can be applied.	–	X	–	X
Refresh	Click Refresh to update the page after reading the safety configuration signature from the safety processor. This makes sure that the page does not show a stale value that was cached when the web page was first opened. Depending on the web browser in use, you might have to click the Refresh the very first time this page is opened to populate to values.	–	X	–	X
Lock and Unlock	Click Lock or Unlock to change the lock status of the safety circuitry, prompting for the Lock/Unlock password, if necessary. The safety circuitry must be unlocked before a safety configuration can be applied.	–	X	–	X

Safety Configuration

The 2094-SE02F-M00-S1 and 2094-EN02D-M01-S1 control modules require a safety configuration. For an example of how to configure the safety functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Multi-axis Servo Drives Safety Reference Manual, publication 2094-RM001.

Figure 142 - Safety Tab



The Java-script running in the web browser prepares an HTML request containing the safety configuration assembly, the safety configuration ID, and the date and time. If the drive is enabled when it receives this request, a response is sent indicating that the drive is enabled, and must be disabled to apply the safety configuration. The web server puts the drive in an inhibit state while applying the safety configuration. While inhibited, the drive cannot be enabled by the controller. The web server releases the inhibit after applying the safety configuration. For this sequence to complete successfully, you must first make sure that the safety circuitry is unlocked. If it is locked, the configuration attempt fails, and an appropriate response is generated.

The web server creates a data file containing the configuration settings within the safety circuitry, including the Safety Configuration ID, and the date and time it was applied. This file can be downloaded from the web server to your personal computer by using a standard browser file-download mechanism. The web server can also upload a previously saved file, and apply the configuration settings it contains to the safety circuitry.

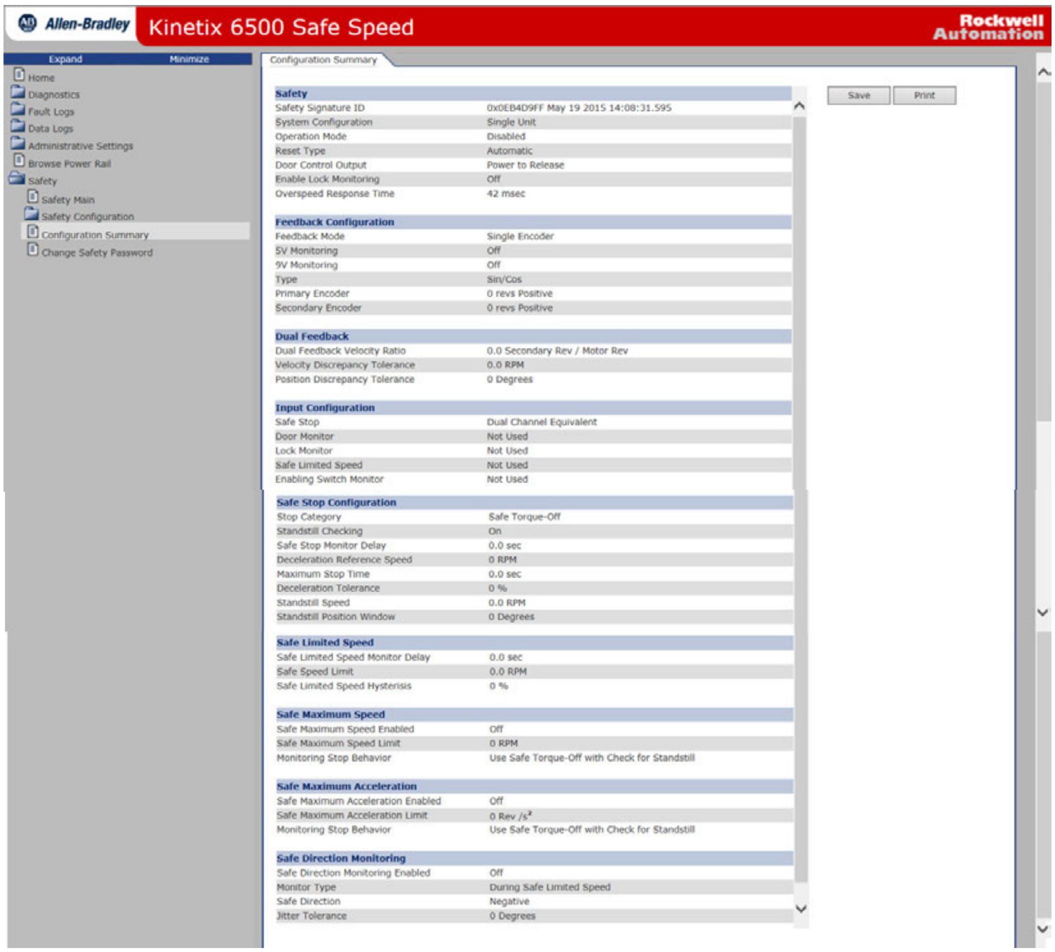
When you apply a safety configuration by uploading a previously saved file, the web server recalculates the Safety Configuration ID based on the configuration data in the file. This calculated ID is compared to the original Safety Configuration ID stored in the file, and if they do not match, the web server reports an error. A mismatch could be caused by manually editing the configuration file, which is not allowed. After the configuration is successfully applied from the file, the drive redisplays the main web page, with the safety signature information defined by the file. The date and time portions of the safety signature are the same date and time as the original drive that was used to generate the configuration file.

Configuration Summary

Use the Configuration Summary tab to verify the configuration or manually compare the configuration with a previously saved or printed summary report. The reports can be saved or printed from within the Configuration Summary page.

For more information on how to configure the safety functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Multi-axis Servo Drives Safety Reference Manual, publication 2094-RM001.

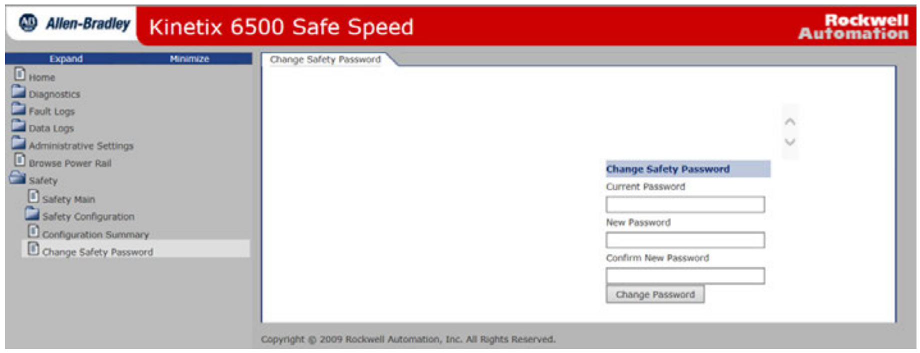
Figure 143 - Configuration Summary Tab



Change Safety Password

From the Change Safety Password page you can send a request to the web server to change the safety password. You must provide the old password and the new password. The web page requires you to enter the new password twice, and compares the two entries to minimize the risk of setting the password to something other than what you intended.

Figure 144 - Change Safety Password Tab



For more information on how to configure the safety functions, refer to the Kinetix 6200 and Kinetix 6500 Safe Speed Monitoring Multi-axis Servo Drives Safety Reference Manual, publication 2094-RM001.

Changing the Default IDN Parameter Values

This appendix provides a procedure, specific to the Kinetix 6200 (sercos) drive systems, for changing IDN parameter values to non-default values when your application does not match the default configuration. The procedure also applies when one or more Kinetix 6000M IDM systems are present.

Before You Begin

The Logix5000™ processor contains a motion planner that sends real-time and non real-time data to the drive. This drive communication is performed via a set of sercos interface telegrams. Each telegram has an identification or Ident (IDN) number. All parametric data, such as scaling and loop gains, and real-time loop closure information is configured this way.

Table 144 - IDN Instruction Format in the IEC Standard Document

<table>
<tr><td rowspan="3">IDN Number</td><td colspan="4">Name</td></tr>
<tr><td colspan="4">Function/Description</td></tr>
<tr><td>Length in bytes</td><td>Minimum input value/
Maximum input value</td><td>Scaling/resolution</td><td>Units</td></tr>
</table>

There are default parameters in the Logix5000-to-Kinetix 6200 drive product structure you can reconfigure when the default configuration does not match the Integrated Architecture™ machine configuration.

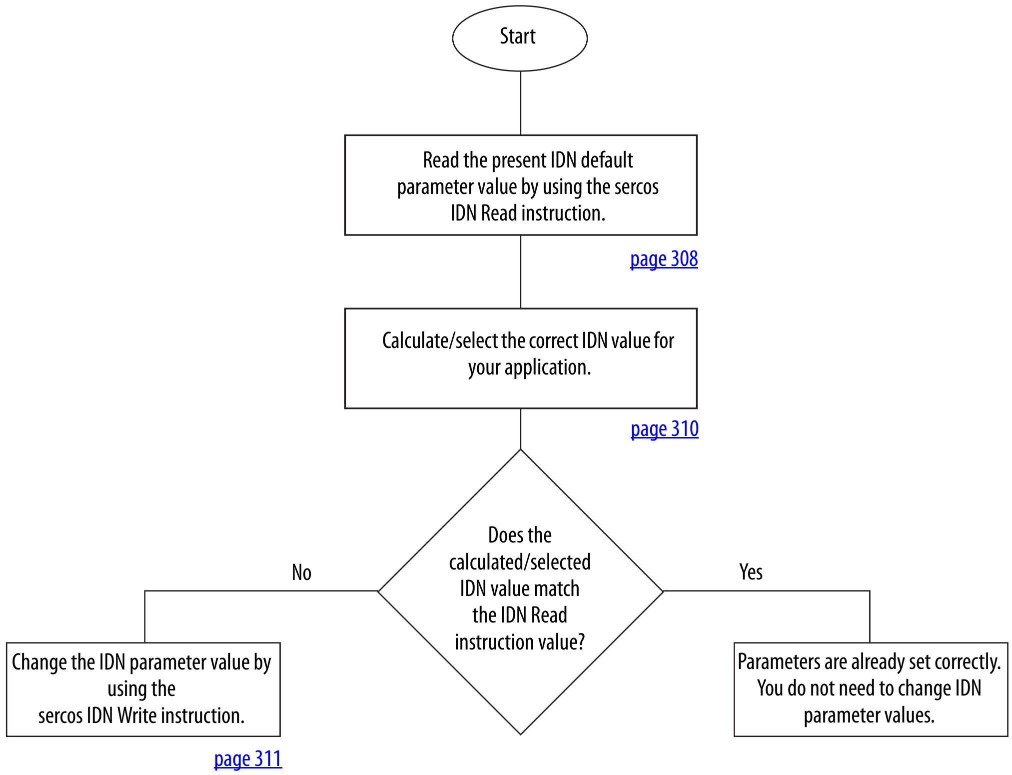
The drive functions you can change by using this procedure include:

- Additional bus capacitance in common-bus configurations
  - With RSLogix 5000® software, version 20.00 or greater, or the Logix Designer application, you can configure bus capacitance values from I/O configuration>Sercos module>Drive module properties>Power tab (refer to Chapter 6)
- Digital input assignments for I/O configurations

IMPORTANT	IDN values return to default settings whenever the sercos ring phases up. If your program includes a message instruction to change default IDN values, you must re-execute that instruction during phase-up to maintain those values.

Use this flowchart to determine if changing your default configuration is required.

Figure 145 - Configuration Flowchart



Change IDN Parameter Values

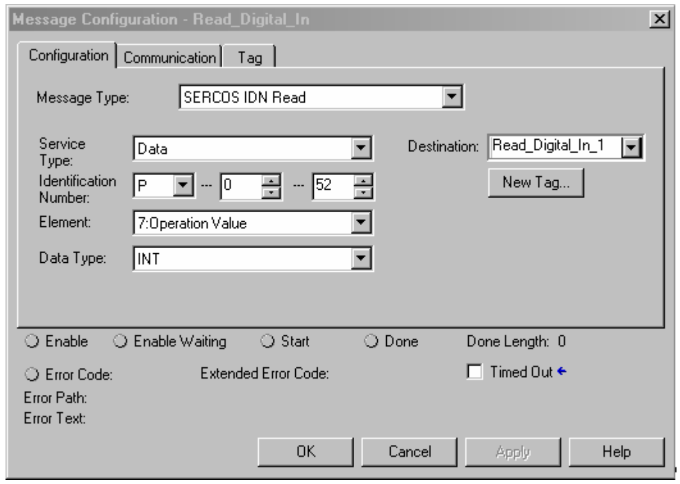
In this section you follow the Configuration Flowchart on page 308 to determine if you need to use the sercos IDN Write instruction in the Logix Designer application to change the IDN parameter values.

Read the Present IDN Parameter Value

Follow these steps to read the present IDN value.

1. Start your Logix Designer application program.
2. Configure a Message Configuration (MSG) instruction to read your present IDN parameter values.

In this example, the Message Configuration (MSG) instruction is set to read the digital input assignments of your control module.

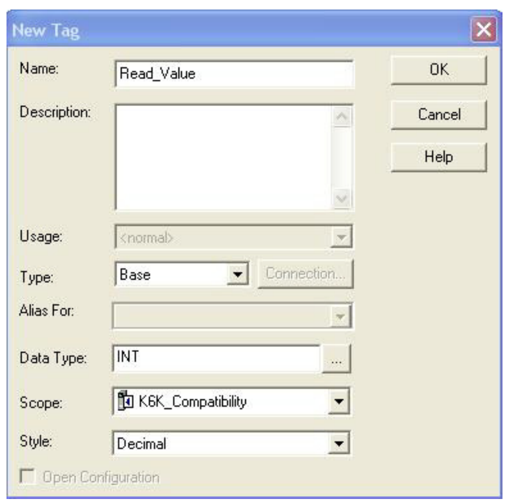


a. From the Message Type pull-down menu, choose sercos IDN Read.

b. From the Identification Number pull-down menus, choose P-0-052.

This example is for reading the assignment for IOD-41 (Enable is the default setting, 1 is the Enable IDN value). Refer to Digital Inputs on page 69 for other digital input IDN assignments and values.

3. Click New Tag.
4. The New Tag dialog box opens.



5. Type the name of your Destination tag.

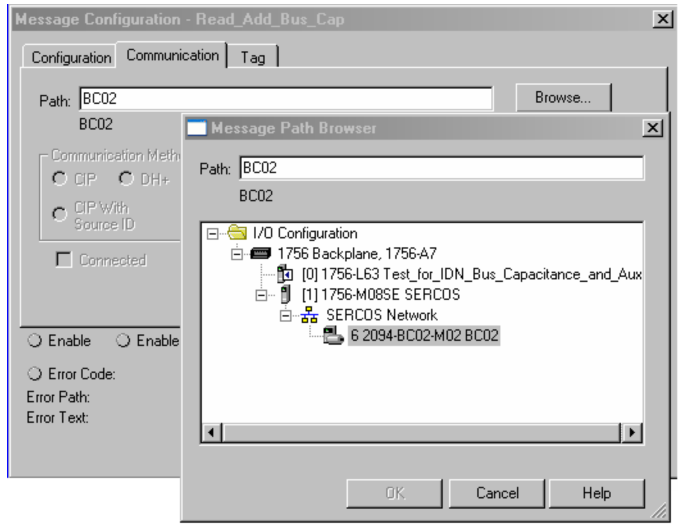
   In this example, the tag name is Read_Value.

6. Click OK.

   In this example, the MSG instruction reads the P-0-052 IDN value, which is tied to digital input 1 (IOD-41), and places it in the destination as specified by the new tag.

7. Click the Communication tab.

8. Click Browse.



9. Select the Bulletin 2094 module to read the MSG instruction.
10. Click OK.

Calculate/Select the New IDN Value

Changing the additional bus capacitance value requires calculations. Determine the sum of all capacitance values for the follower IAM module, each AM module, and each IPIM module on the follower IAM power rail.

Refer to Calculate Additional Bus Capacitance on page 269 for more information.

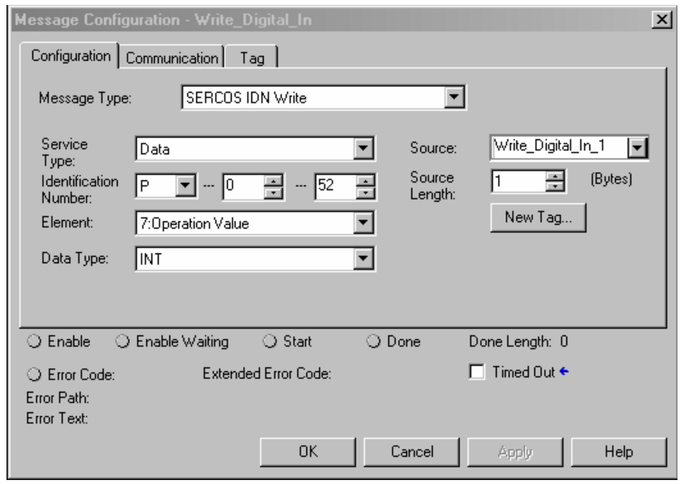
Changing the digital input assignments does not require calculations, only the selection of new values.

Write the New IDN Parameter Value

Follow these steps to write the new IDN parameter value.

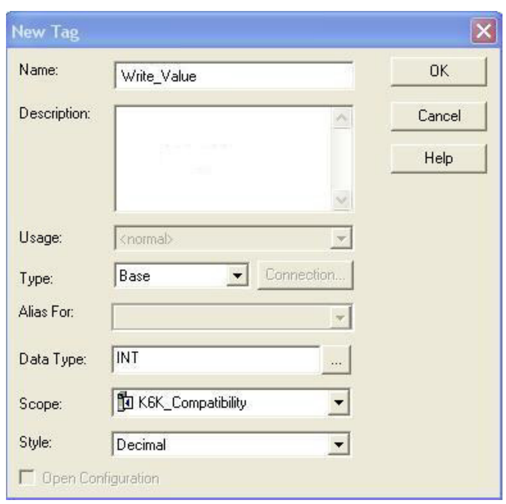
1. Configure a Message Configuration (MSG) instruction to write the IDN parameter value required for your application.

   In this example, the Message Configuration (MSG) instruction is set to write the digital input assignments of your control module.



   a. From the Message Type pull-down menu, choose sercos IDN Write
   b. From the Identification Number pull-down menus, choose P-0-052.

2. Click New Tag.
3. The New Tag dialog box opens.



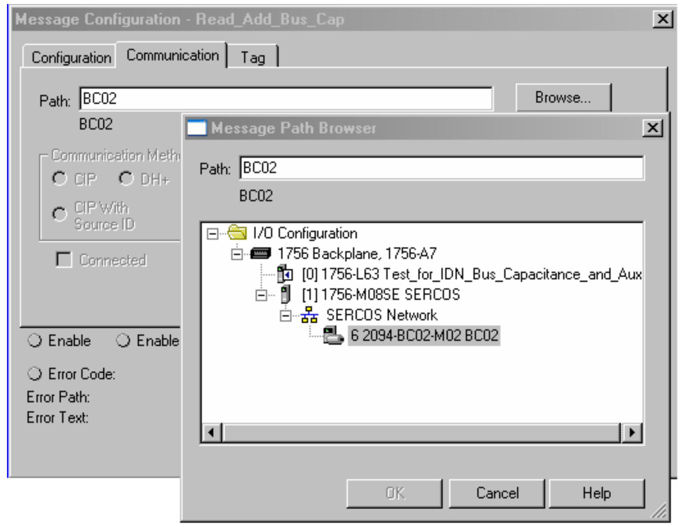
4. Type the name of your Source tag.

   In this example, the tag name is Write_Value.
5. Click OK.

In this example, the new tag creates a source value (that you entered) that the MSG instruction uses to overwrite the existing P-0-052 IDN value and is tied to digital input 1 (IOD-41).

6. Click the Communication tab.

   The Communication tab opens.



7. Click Browse.
8. Select your Bulletin 2094 module.
9. Click OK.

   The MSG instruction writes the new IDN value to your drive.

   TIP To verify your sercos IDN Write instruction was successful, you can perform another sercos IDN Read instruction for the IDN in question.

10. Click OK to close the Message Configuration dialog box.

RBM Module Interconnect Diagrams

This appendix provides Bulletin 2090 Resistive Brake Module (RBM) interconnect diagrams specific to Kinetix 6200 and Kinetix 6500 modular servo-drive systems.

Before You Begin

These procedures assume you have installed your RBM module with the Kinetix 6200 or Kinetix 6500 servo-drive system. For RBM module installation instructions, refer to the Resistive Brake Module Installation Instructions, publication 2090-IN009.

ATTENTION: Use the interconnection diagrams as a general recommendation of how the control circuit can be implemented. Actual applications can vary due to requirements based on the machine builders risk assessment. The machine builder must perform a risk assessment and determine a category level of safety that must be applied to the machine.

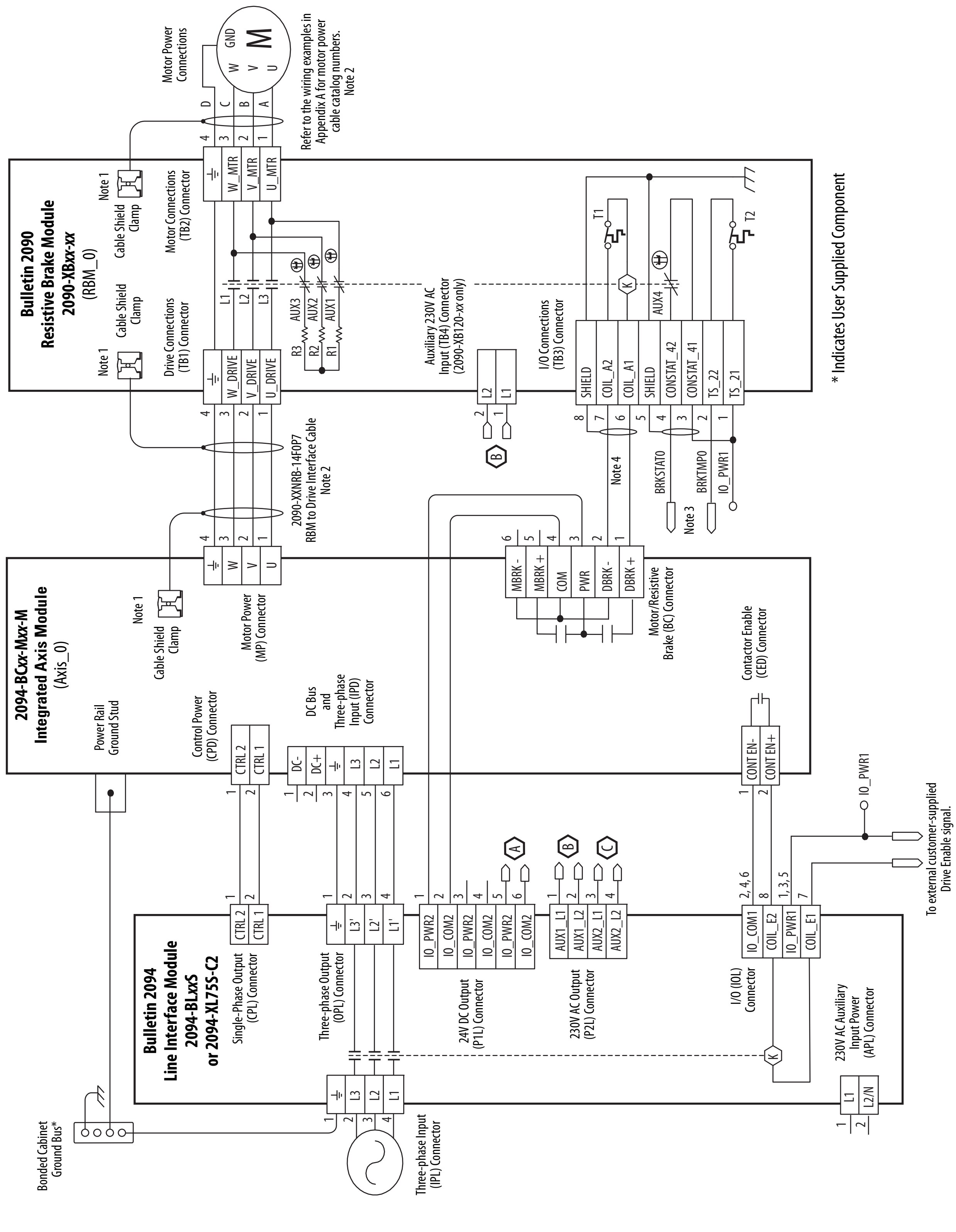
For Kinetix 6200 drive systems, you can set the delay time for your RBM module in the Logix Designer application. Refer to Configure Axis Properties on page 157.

For Kinetix 6500 drive systems, you can set the delay time for your RBM module in the Logix Designer application. Refer to Configure Axis Properties on page 184.

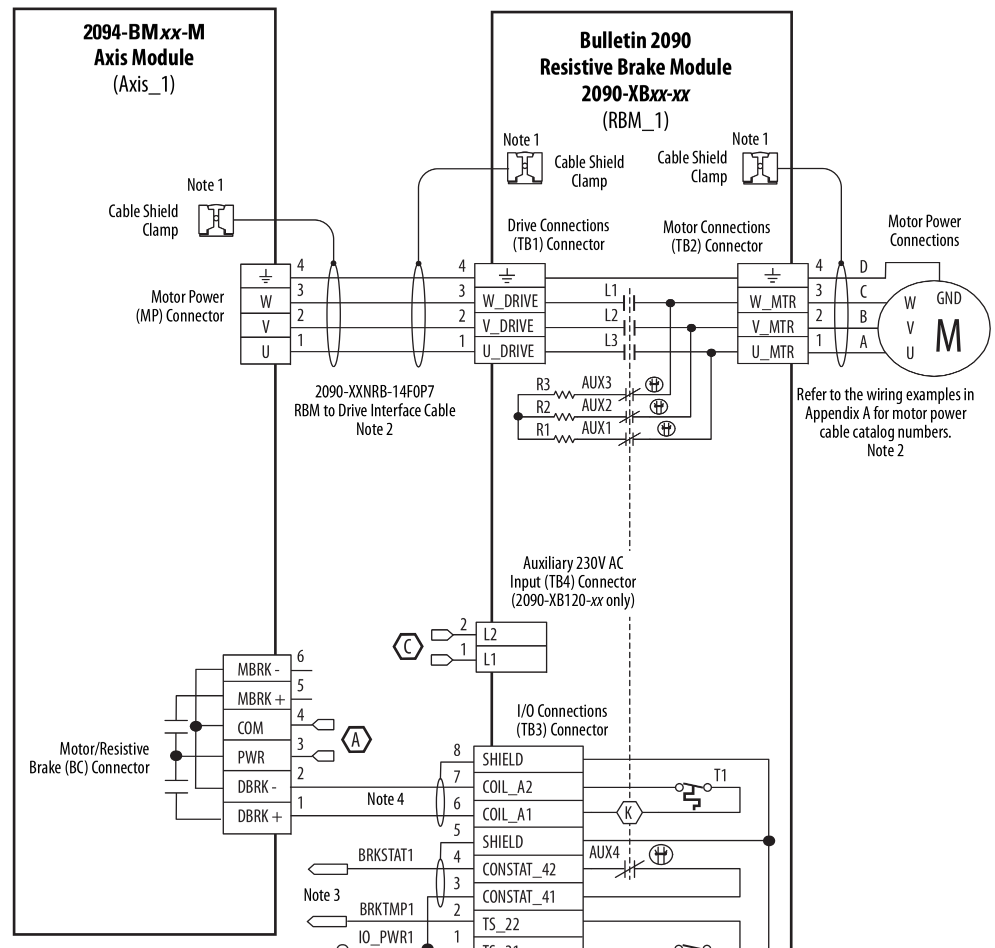
RBM Module Wiring Examples

This example diagram shows 2094-BC*xx*-M*xx*-M and 2094-BM*xx*-M drives and 2094-BL*xx*S or 2094-XL75S LIM modules wired with the Bulletin 2090 RBM module.

Figure 146 - RBM Wiring Example



RBM Module Example (continued)



* Indicates User Supplied Component

ATTENTION: The National Electrical Code and local electrical codes take precedence over the values and methods provided. Implementation of these codes is the responsibility of the machine builder.

Note	Information
1	Cable shield clamp must be used to meet CE requirements. No external connection to ground required.
2	For motor cable specifications, refer to the Kinetix Rotary Motion Specifications Technical Data, publication GMC-TD001.
3	The BRKTMP0 signal can be wired to a ControlLogix® input as overtemp warning in user program.
4	The safety relay time delay should be set beyond the time required to stop and disable the axis when running at full speed.

Notes:

EC Certifications

This appendix provides Kinetix 6200 and Kinetix 6500 servo drive certification information.

EC Type - Examination Certificate

For product certifications currently available from Rockwell Automation®, go to http://www.rockwellautomation.com/products/certification.

Figure 147 - Safe Torque Off Certificate

EC Type-Examination Certificate

Functional Safety Type Approved

TÜVRheinland CERTIFIED

www.tuv.com ID 0600000000

Reg.-No.: 01/205/0709.01/15

Product tested	Safety function "Safe Torque Off (STO)" within the Adjustable Frequency AC Drives	**Certificate holder**	Rockwell Automation 6400 West Enterprise Drive Mequon, WI 53092 USA
Type designation	Kinetix 6200: 2094-SE02F-M00-S0, Kinetix 6500: 2094-EN02D-M01-S0		
Codes and standards	EN 61800-5-2:2007 EN 61800-3:2004 + A1:2012 EN 61800-5-1:2007 (in extracts) EN 62061:2005 + AC:2010 + A1:2013		EN ISO 13849-1:2008 + AC:2009 EN 60204-1:2006 + A1:2009 + AC:2010 (in extracts) IEC 61508 Parts 1-7:2010
Intended application	The safety function "Safe Torque Off" (STO) within the adjustable Frequency AC Drives Kinetix 6200 and Kinetix 6500 complies with the requirements of the relevant standards (Cat. 4 / PL e acc. to EN ISO 13849-1 , SIL CL 3 acc. to EN 61800-5-2 / EN 62061 / IEC 61508) and can be used in applications up to PL e acc. to EN ISO 13849-1 and SIL 3 acc. to EN 62061 / IEC 61508.		
Specific requirements	The instructions of the associated Installation and Operating Manual shall be considered.		

It is confirmed, that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

Valid until 2020-01-19

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/M 239.04/15 dated 2015-01-19.
This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

Berlin, 2015-01-19 | Certification Body for Machinery, NB 0035 | Dipl.-Ing. Eberhard Frejno

0035 Notified Body

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Figure 148 - Safe Speed Monitor Certificate

EC Type-Examination Certificate

Functional Safety Type Approved

TÜVRheinland CERTIFIED

www.tuv.com ID 0600000000

Reg.-No.: 01/205/0639.01/14

Product tested	Adjustable Frequency AC Drive with integrated safety functions, "Safe Speed Monitor Option - S1"	**Certificate holder**	Rockwell Automation 6400 West Enterprise Drive Mequon, WI 53092 USA
Type designation	Kinetix 6200 2094-SE02F-M00-S1, Kinetix 6500 2094-EN02D-M01-S1		
Codes and standards	EN 61800-5-2:2007 EN 61800-3:2004 + A1:2012 EN 61800-5-1:2007 (in extracts) EN 62061:2005 + AC:2010 + A1:2013	EN ISO 13849-1:2008 + AC:2009 IEC 61508 Parts 1-7:2010 EN 60204-1:2006 + A1:2009 + AC:2010 (in extracts)	
Intended application	The "Safe Speed Monitor Option - S1" used within the adjustable Frequency Drive Kinetix 6200 and Kinetix 6500 complies with the requirements of the relevant standards (Cat. 4 / PL e acc. to EN ISO 13849-1, SIL CL 3 acc. to EN 61800-5-2 / EN 62061 / IEC 61508) and can be used in applications up to PL e acc. to EN ISO 13849-1 and SIL 3 acc. to EN 62061 / IEC 61508.		
Specific requirements	The instructions of the associated Installation and Operating Manual shall be considered.		

It is confirmed, that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

Valid until 2019-11-24

The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/EZ 377.04/14 dated 2014-11-24.
This certificate is valid only for products which are identical with the product tested. It becomes invalid at any change of the codes and standards forming the basis of testing for the intended application.

0035 Notified Body

Berlin, 2014-11-24 | Certification Body for Machinery, NB 0035 | Dipl.-Ing. Eberhard Frejno

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Tel.: +49 30 7562-1557, Fax: +49 30 7562-1370, E-Mail: industrie-service@de.tuv.com

EC Declaration of Conformity

For all declarations of conformity (DoC) currently available from Rockwell Automation, go to http://www.rockwellautomation.com/rockwellautomation/certification/overview.page.

Rockwell Automation

EU Declaration of Conformity

Product:	*Kinetix 6000/6200/6500/6000M Digital Servo Drives and Accessories*

Name and address of the manufacturer: *Rockwell Automation, Inc.* *6400 W. Enterprise Drive* *Mequon, Wisconsin 53092* *USA*	*Name and address of the authorised representative:* *Rockwell Automation B.V.* *Rivium Promenade 160* *2909 LM Capelle aan den Ijssel* *The Netherlands*

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration:	*Allen-Bradley Bulletin 2094* *(reference the attached list of catalogue numbers)*

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

2006/95/EC	*Low Voltage Directive*	*(LVD)*
2004/108/EC	*EMC Directive*	*(EMC)*
2006/42/EC	*Machinery Directive*	*(MD)*

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

EN 61800-5-1:2007	*Adjustable speed electrical power drive system – Part 5-1: Safety requirements – Electrical, thermal and energy.*
EN 61800-5-2:2007	*Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional*
EN 61800-3:2004 + A1:2012	*Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods*
EN 60204-1:2006 + A1:2009	*Safety of machinery – Electrical equipment of machines – Part 1: General requirements*
EN 61508: Part 1-7:2010 [1]	*Functional safety of electrical/electronic/programmable electronic safety-related systems*
EN ISO 13849-1:2008 [1]	*Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*
EN 62061:2005 + A1:2013	*Safety of machinery –Functional safety of safety-related electrical, electronic and programmable electronic control systems*

Notified Body:	*TÜV Rheinland, Am Grauen Stein, 51105 Koln (NB 0035)*
performed:	*EC Type Examination*
and issued the certificate:	*01/205/5287/13 (Kinetix 6000-S)*
	01/205/5214/12 (Kinetix 6000 IPIM/IDM)
	01/205/0709.01/15 (Kinetix 6200/6500 S0)
	01/205/0639.01/14 (Kinetix 6200/6500 S1)

Additional information:

Year of CE Marking (LVD):	*2002*
Person authorised to compile the technical file (MD):	*Authorised representative (see details above).*
Product Safety Function (MD):	*Safe Standstill (Kinetix6000-S products)*
	Safe Torque-Off (Kinetix6200/6500-S0, Kinetix6000M-S products)
	Safe Speed Monitor Option (Kinetix6200/6500-S1 products)

Signed for and on behalf of the above named manufacturer:

Place and date of issue:	*Mequon, WI USA 16-Feb-2015*
Name, function:	*Thomas Van Groll, Director Engineering*
Signature:	

Document Control Number: IMC-0011-Y-EN 1 / 9

Rockwell Automation

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Bulletin 2094 Servo Drives[1,6,11,12,13]					
2094-BC01-MP5		*460 Volt Integrated Axis Module 6 kW Inverter 2.8 Amp*	*Yes*	*Yes*	*Yes*
2094-BC01-M01		*460 Volt Integrated Axis Module 6 kW Inverter 6.1 Amp*	*Yes*	*Yes*	*Yes*
2094-BC02-M02		*460 Volt Integrated Axis Module 15 kW Inverter 10.3 Amp*	*Yes*	*Yes*	*Yes*
2094-BC04-M03		*460 Volt Integrated Axis Module 28 kW Inverter 21.2 Amp*	*Yes*	*Yes*	*Yes*
2094-BC07-M05		*460 Volt Integrated Axis Module 45 kW Inverter 34.6 Amp*	*Yes*	*Yes*	*Yes*
2094-AC05-MP5		*230 Volt Integrated Axis Module 3 kW Inverter 3.7 Amp*	*Yes*	*Yes*	*Yes*
2094-AC05-M01		*230 Volt Integrated Axis Module 3 kW Inverter 6.0 Amp*	*Yes*	*Yes*	*Yes*
2094-AC09-M02		*230 Volt Integrated Axis Module 6 kW Inverter 10.6 Amp*	*Yes*	*Yes*	*Yes*
2094-AC16-M03		*230 Volt Integrated Axis Module 11 kW Inverter 17.3Amp*	*Yes*	*Yes*	*Yes*
2094-AC32-M05		*230 Volt Integrated Axis Module 23 kW Inverter 34.6 Amp*	*Yes*	*Yes*	*Yes*
2094-BMP5		*460 Volt Axis Module 2.8 Amp*	*Yes*	*Yes*	*Yes*
2094-BM01		*460 Volt Axis Module 6.1 Amp*	*Yes*	*Yes*	*Yes*
2094-BM02		*460 Volt Axis Module 10.3 Amp*	*Yes*	*Yes*	*Yes*
2094-BM03		*460 Volt Axis Module 21.2 Amp*	*Yes*	*Yes*	*Yes*
2094-BM05		*460 Volt Axis Module 34.6 Amp*	*Yes*	*Yes*	*Yes*
2094-AMP5		*230 Volt Axis Module 3.7 Amp*	*Yes*	*Yes*	*Yes*
2094-AM01		*230 Volt Axis Module 6.0 Amp*	*Yes*	*Yes*	*Yes*
2094-AM02		*230 Volt Axis Module 10.6 Amp*	*Yes*	*Yes*	*Yes*
2094-AM03		*230 Volt Axis Module 17.3Amp*	*Yes*	*Yes*	*Yes*
2094-AM05		*230 Volt Axis Module 34.6 Amp*	*Yes*	*Yes*	*Yes*
2094-SE02F-M00-S0		*Kinetix 6200, CM, SERCOS, safe torque-off*	*Yes*	*Yes*	*Yes*
2094-SE02F-M00-S1		*Kinetix 6200, CM, SERCOS, safe speed monitoring*	*Yes*	*Yes*	*Yes*
2094-EN02D-M01-S0		*Kinetix 6500, CM, CIP, safe torque-off*	*Yes*	*Yes*	*Yes*
2094-EN02D-M01-S1		*Kinetix 6500, CM, CIP, safe speed monitoring*	*Yes*	*Yes*	*Yes*
2094-SEPM-B24-S		*Kinetix 6000M, SERCOS, 460 Volt IDM Power Interface Module, safe torque-off*	*Yes*	*Yes*	*Yes*
2094-PRF		*Power Rail Slot Filler, no electrical ratings apply*	*Yes*	*Yes*	*N/R*
2094-PR1		*1 Axis Power Rail*	*Yes*	*Yes*	*N/R*
2094-PR2		*2 Axis Power Rail*	*Yes*	*Yes*	*N/R*
2094-PR4		*4 Axis Power Rail*	*Yes*	*Yes*	*N/R*
2094-PR6		*6 Axis Power Rail*	*Yes*	*Yes*	*N/R*
2094-PR8		*8 Axis Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS1		*1 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS2		*2 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS3		*3 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS4		*4 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS5		*5 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS6		*6 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS7		*7 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*
2094-PRS8		*8 Axis Slim Power Rail*	*Yes*	*Yes*	*N/R*

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Bulletin 2094 and Bulletin 2090 Filters and Accessories[1]					
2090-UXLF-HV323		*Line Filter 3 Phase 23 Ampere*	*Yes*	*Yes*	*N/R*
2090-XXLF-X330B		*Line Filter 3 phase 30 Ampere*	*Yes*	*Yes*	*N/R*
2090-XXLF-350		*Line Filter 3 phase 50 Ampere*	*Yes*	*Yes*	*N/R*
2090-XXLF-375		*Line Filter 3 phase 75 Ampere*	*Yes*	*Yes*	*N/R*
2090-XXLF-375B		*Line Filter 3 phase 75 Ampere*	*Yes*	*Yes*	*N/R*
2090-XXLF-3100		*Line Filter 3 phase 100 Ampere*	*Yes*	*Yes*	*N/R*
2094-AL09		*230 Volt Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-AL15S		*230 Volt 15 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-AL25S		*230 Volt 25 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-AL50S		*230 Volt 50 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-AL75S		*230 Volt 75 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-BL02		*460 Volt Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-BL10S		*460 Volt 10 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-BL25S		*460 Volt 25 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-BL50S		*460 Volt 50 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-BL75S		*460 Volt 75 Ampere Line Interface Module*	*Yes*	*Yes*	*N/R*
2094-XL75S-C1		*230/460 75 Ampere Line Interface Module 110 Volt Aux*	*Yes*	*Yes*	*N/R*
2094-XL75S-C2		*230/460 75 Ampere Line Interface Module 230 Volt Aux*	*Yes*	*Yes*	*N/R*
Shunts					
2094-BSP2		*230/460 Volt Shunt Module*	*Yes*	*Yes*	*N/R*
2090-SR120-09[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
2090-SR040-09[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
2090-SR040-18[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
2090-SR025-09[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
2090-SR025-18[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
2090-SR020-36[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
1394-SR9A[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
1394-SR9AF[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
1394-SR36A[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
1394-SR36AF[7]		*External Shunt Resistor Assembly*	*Yes*	*Yes*	*N/R*
Resistive Brake Modules					
2090-XB120-01		*120 A, 1 Ohm, Resistive Brake Module*	*Yes*	*Yes*	*N/R*
2090-XB120-03		*120 A, 3 Ohm, Resistive Brake Module*	*Yes*	*Yes*	*N/R*
2090-XB120-06		*120 A, 6 Ohm, Resistive Brake Module*	*Yes*	*Yes*	*N/R*
2090-XB33-16		*33 A, 16 Ohm, Resistive Brake Module*	*Yes*	*Yes*	*N/R*
2090-XB33-32		*33 A, 32 Ohm, Resistive Brake Module*	*Yes*	*Yes*	*N/R*

Rockwell Automation

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Motor Compatibility[1,2,6]					
1326AB-Bxxxx-yyy[8]		*460 Volt High Resolution Feedback Servo Motor*	*Yes*	*Yes*	*N/R*
MPF-Bxxxx-yyyyy[8]		*460 Volt Food Grade High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPF-Axxxx-yyyyy[8]		*230 Volt Food Grade High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPG-Bxxxx-yyyyy[8]		*460 Volt Integrated Gear High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPG-Axxxx-yyyyy[8]		*230 Volt Integrated Gear High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPS-Axxxx-yyyy[8]		*230V Stainless Steel High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPS-Bxxxx-yyy[8]		*460V Stainless Steel High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPL-Bxxxx-yyyyy[8]		*460 Volt High Resolution Feedback High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPL-Axxxx-yyyyy[8]		*230 Volt High Resolution Feedback High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPM-Bxxxxxx-yyyyy[8]		*460 Volt High Resolution Feedback High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
MPM-Axxxxxx-yyyyy[8]		*230 Volt High Resolution Feedback High Performance Servo Motor*	*Yes*	*Yes*	*N/R*
F-xxxx-yyyy[9]		*230 Volt F Family Servo Motor*	*Yes*	*Yes*	*N/R*
H-xxxx-yyyy[9]		*230 Volt H Family Servo Motor*	*Yes*	*Yes*	*N/R*
N-xxxx-yyyy[9]		*230 Volt N Family Servo Motor*	*Yes*	*Yes*	*N/R*
Y-xxxx-yyyy[9]		*230 Volt Y Family Servo Motor*	*Yes*	*Yes*	*N/R*
MPAS-Axxxxx-VxxSxA[8]		*230 Volt MP-Series Integrated Linear Stage (Ballscrew)*	*Yes*	*Yes*	*N/R*
MPAS-Bxxxxx-VxxSxA[8]		*460 Volt MP-Series Integrated Linear Stage (Ballscrew)*	*Yes*	*Yes*	*N/R*
MPAS-Axxxxx-ALMxxC[8]		*230 Volt MP-Series Integrated Linear Stage (Direct Drive)*	*Yes*	*Yes*	*N/R*
MPAS-Bxxxxx-ALMxxC[8]		*460 Volt MP-Series Integrated Linear Stage (Direct Drive)*	*Yes*	*Yes*	*N/R*
MPMA-AAxxxxxx-xxx[8]		*230 Volt MPMA Series Multi-Axis Stage Center Stacked XY*	*Yes*	*Yes*	*N/R*
MPMA-BAxxxxxx-xxx[8]		*460 Volt MPMA Series Multi-Axis Stage Center Stacked XY*	*Yes*	*Yes*	*N/R*
MPMA-ABxxxxxx-xxx[8]		*230 Volt MPMA Series Multi-Axis Stage Center Stacked XZ*	*Yes*	*Yes*	*N/R*
MPMA-BBxxxxxx-xxx[8]		*460 Volt MPMA Series Multi-Axis Stage Center Stacked XZ*	*Yes*	*Yes*	*N/R*
MPMA-ACxxxxxx-xxx[8]		*230 Volt MPMA Series Multi-Axis Stage Cantilever Stacked XY*	*Yes*	*Yes*	*N/R*
MPMA-BCxxxxxx-xxx[8]		*460 Volt MPMA Series Multi-Axis Stage Cantilever Stacked XY*	*Yes*	*Yes*	*N/R*
RDB-Bxxxxx-xxxxxx[8]		*480 Volt Bearlingless Housed Direct Drive Servo Motor*	*Yes*	*Yes*	*N/R*
TLa-Axxxx-yyyy[8]		*230V Volt servo motor*	*Yes*	*Yes*	*N/R*

Rockwell Automation

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Motor Compatibility[1,2,6]					
MPAR-Axxxxx-yyy[8]		*230 Volt MP-Series Electric Cylinder*	*Yes*	*Yes*	*N/R*
MPAR-Bxxxxx-yyy[8]		*460 Volt MP-Series Electric Cylinder*	*Yes*	*Yes*	*N/R*
MPAI-Axxxxxxxxx yyy[8]		*230 Volt MP-Series Heavy Duty Electric Cylinder*	*Yes*	*Yes*	*N/R*
MPAI-Bxxxxxxxxx-yyy[8]		*460 Volt MP-Series Heavy Duty Electric Cylinder*	*Yes*	*Yes*	*N/R*
LDC-Cxxxxxx-yyyyy[8]		*460 Volt Iron Core Linear Servo Motor*	*Yes*	*Yes*	*N/R*
LDL-xxxxxxx-yyyyy[8]		*230 Volt Ironless Linear Servo Motor*	*Yes*	*Yes*	*N/R*
Cable Compatibility[1,2,6]					
2090-XXNPMP-YYSLL		*Power Cable for MP or 1326AB motor using the MP connector system, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNFMP-SLL		*Feedback Cable for MP or 1326AB motor using the MP connector system, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-UXNFBMP-SLL		*Feedback Cable for MP or 1326AB motor using the MP connector system, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNPMF-YYSLL		*MPF-motor power cable, non-flex, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNFMF-SLL		*MPF-encoder feedback cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXTPMP-YYSLL		*Continuous Flex Motor power cables for MP family motors, YY = gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXTFMP-SLL		*Continuous Flex Motor feedback cables for MP family motors, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPWM4E2-YYTR		*Motor power transition cables for use with MP family motors. YY = gauge. (From Bayonet Style to DIN Style Connectors)*	*N/R*	*N/R*	*N/R*
2090-CPBM4E2-YYTR		*Motor power with brake transition cables for use with MP motors, YY = wire gauge (From Bayonet Style to DIN Style Connectors)*	*N/R*	*N/R*	*N/R*
2090-CFBM4E2-CATR		*Motor feedback transition cable for use with MP family motors (From Bayonet Style to DIN Style Connectors)*	*N/R*	*N/R*	*N/R*
2090-CPWM4DF-YYAFLL		*Continuous Flex Motor power cable for MP or 1326AB motor, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPBM4DF-YYAFLL		*Continuous Flex Motor power with brake cable for MP or 1326AB motor, with SPEEDTEC connector, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM4DF-CDAFLL		*Continuous Flex Motor feedback cable for MP or 1326AB motor, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPWM6DF-YYAALL		*Power Cable for TL motor, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPBM6DF-YYAALL		*Power / Brake Cable for TL motor system, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM6DF-CBAALL		*Feedback Cable for TL motor LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM6DD-CCAALL		*Feedback Cable for TL motor LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CDNFDMP-SLL		*Motor Resolver feedback cable, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM4DF-CEAALL		*Motor Resolver feedback cable, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM7DF-CDAFLL		*Continuous Flex Motor feedback cable for MP or 1326AB motor, with SPEEDTEC connectors, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPWM7DF-YYAFLL		*Continuous Flex Motor power cable for MP or 1326AB motor, with SPEEDTEC connector, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPBM7DF-YYAFLL		*Continuous Flex Motor power with brake cable for MP or 1326AB motor, with SPEEDTEC connector, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Cable Compatibility[1,2,6]					
2090-CFBM7E7-CDAFLL		*Continuous Flex Motor feedback extension cable for MP or 1326AB motor, with SPEEDTEC connectors, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPBM7E7-YYAFLL		*Continuous Flex Motor power with brake extension cable for MP or 1326AB motor, with SPEEDTEC connectors, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPWM7DF-YYAALL		*Power Cable for MP, RD or 1326AB motor with SPEEDTEC connector, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CPBM7DF-YYAALL		*Power with Brake Cable for MP, RD or 1326AB motor with SPEEDTEC connector, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM7DF-CEAALL		*Feedback Cable for MP motor using the MP connector system, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM7DD-CEAALL		*Feedback Cable with D-sub connector for MP motor using the MP connector system, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-CFBM7DF-CEAFLL		*Continuous Flex Motor feedback cable, LL = length in meter*	*N/R*	*N/R*	*N/R*
2090-CFBM7DD-CEAFLL		*Continuous Flex Motor feedback cable with D-sub connector, LL = length in meter*	*N/R*	*N/R*	*N/R*
2090-CFBM7E7-CEAFLL		*Continuous Flex Motor extension feedback cable, LL = length in meter*	*N/R*	*N/R*	*N/R*
2090-XXNPY-YYSLL[4]		*Power Cable for Y motor, YY = wire gauge, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-UXNFBY-SLL[4]		*Y-encoder feedback cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNFBY-SLL[4]		*Y-encoder feedback cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNFY-SLL[4]		*Feedback Cable for Y motor, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-zzNPH-aaSxx[4]		*Power Cable for H motor*	*N/R*	*N/R*	*N/R*
2090-XXNFHF-SLL[4]		*Feedback Cable for H or F motor, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-UXNFBHF-SLL[4]		*F&H-encoder feedback cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-XXNPHF-YYSLL[4]		*Power Cable for H or F motor, YY = wire gauge, LL = length*	*N/R*	*N/R*	*N/R*
2090-XXNPT-YYSLL		*TL-motor power cable, non-flex, YY = wire gauge, LL = length*	*N/R*	*N/R*	*N/R*
2090-XXNFT-SLL		*TL-encoder feedback cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-UXNBMP-18SLL		*MP motor brake cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-UXTBMP-18SLL		*MP motor brake cable, flex, LL = length in meters*	*N/R*	*N/R*	*N/R*
2090-DANBT-18SLL		*TL motor brake cable, non-flex, LL = length in meters*	*N/R*	*N/R*	*N/R*

Catalogue number	*Series* [3]	*Description*	*Directive* [10]		
			EMC	*LVD*	*MD*
Connector Kits and Miscellaneous Accessories[2]					
2090-SCEPL-L		*SERCOS plastic cables for use in enclosure, L-L = length*	*N/R*	*N/R*	*N/R*
2090-SCVPL-L		*SERCOS plastic cables for use outside enclosure, L-L = length*	*N/R*	*N/R*	*N/R*
2090-SCNPL-L		*SERCOS glass cables for use inside enclosure, L-L = length*	*N/R*	*N/R*	*N/R*
2090-SCVGL-L		*SERCOS glass cables for use outside enclosure, L-L = length*	*N/R*	*N/R*	*N/R*
2090-S-BLHD		*SERCOS bulkhead adapter*	*N/R*	*N/R*	*N/R*
1202-C02		*Drive-to-drive safety cable for single-wide modules*	*N/R*	*N/R*	*N/R*
1202-C03		*Drive-to-drive safety cable for double-wide modules*	*N/R*	*N/R*	*N/R*
1202-C10		*Drive-to-drive safety cable for two power rails*	*N/R*	*N/R*	*N/R*
2090-XNSS-MA		*Safe-Off motion allowed jumper*	*N/R*	*N/R*	*N/R*
2090-XNSS-WP		*Safe-Off wiring plug header for single axis drive*	*N/R*	*N/R*	*N/R*
2090-XNSM-W		*Safe-Off wiring header for first drive in multi-axis drives*	*N/R*	*N/R*	*N/R*
2090-XNSM-M		*Safe-Off middle header for multi-axis drives*	*N/R*	*N/R*	*N/R*
2090-XNSM-T		*Safe-Off terminating header for multi-axis drives*	*N/R*	*N/R*	*N/R*
2090-XXNRB-YYFOPL		*Resistive Brake Module (RBM) to drive interface cable, YY = wire gauge, L = length*	*N/R*	*N/R*	*N/R*
2090-K6CK-D26M		*Low-Profile Connector Kit, 26-pin high density D-shell*	*N/R*	*N/R*	*N/R*
2090-K6CK-D15M		*Low-Profile Connector Kit, 15-pin male high density D-shell*	*N/R*	*N/R*	*N/R*
2090-K6CK-D15MF		*Low-Profile Connector Kit, 15-pin male high density D-shell with filter*	*N/R*	*N/R*	*N/R*
2090-K6CK-D15F		*Low-Profile Connector Kit, 15-pin female high density D-shell*	*N/R*	*N/R*	*N/R*
2090-K6CK-D44M		*Low-Profile Connector Kit, 44-pin male high density D-shell*	*N/R*	*N/R*	*N/R*
2090-K6CK-KENDAT		*Heidenhain EnDAT Module*	*Yes*	*Yes*	*N/R*
2090-K6CK-D44S0		*Low-Profile Connector Kit, 44-pin high density D-shell, Cascading Safe Torque-Off*	*N/R*	*N/R*	*N/R*
2090-CS0DSDS-AAxx		*Safe torque-off cascading cable, xx = length in meters*	*N/R*	*N/R*	*N/R*

1) *Only the following motor and cable families are compatible with the 2094 servo drive (excluding Kinetix6000M system) and total output cable length, with the 460 Volt Systems, power or feedback attached to the drive must not exceed 240 meters. Any one cable may not exceed 90 meters*
2) *The following letters are used in the compatibility matrix to indicate model number description fields that do not affect this DoC; a, x, y, z. These fields may be filled with any number or letter indicating motor or cable options which do not impact this DoC*
3) *If no series number is given, then all series are covered*
4) *For use with the 230 Volt Systems*
5) *For use with the 460 Volt Systems*
6) *The total cable length for a 230 Volt System is limited to 160 meters.*
7) *External Shunt Resistor Assembly ships with fuse for use with 460 volt systems. User installation manual specifies replacement fuse for use with 230 volt systems.*
8) *These motors comply with EN 61800-3, EN 60034-1 and EN 60204-1*
9) *These motors comply with EN 61800-3, EN 60034-1 and EN 60204-1 clause 15 only.*
10) *Legend as follows:*
    No = Product is not certified to this directive.
    Yes = Product is certified to this directive.
    N/R = this directive is not required for this product
11) *EN ISO 13849-1 Category 3 and IEC 61508 Safety Integrity Level 3 apply only to Kinetix6000 drives with the suffix "-S" appended to the model number. Installation must be in accordance with the reference manual "Kinetix Safe-Off Feature". System integrator must consider the entire safety string not just the rating of the drive component when designing the machine safety function.*
12) *Catalogue model numbers may have "-S" appended to the number to indicate safe-off functions are included in the drive function*
13) *Catalogue model numbers may have "-M" appended to the number to indicate modularity*

Notes:

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Notes:

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

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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