User Manual

Original Instructions

Allen-Bradley

Kinetix 300 EtherNet/IP Indexing Servo Drives

Catalog Numbers 2097-V31PR0, 2097-V31PR2, 2097-V32PR0, 2097-V32PR2, 2097-V32PR4, 2097-V33PR1, 2097-V33PR3, 2097-V33PR5, 2097-V33PR6, 2097-V34PR3, 2097-V34PR5, 2097-V34PR6

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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.

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

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

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

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

Chapter 4

Connecting the Kinetix 300 Drive System

Chapter 5

MotionView Software Configuration

Chapter 6

Configure and Start Up the Kinetix 300 Drive

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

Topic	Page
Updated Logix controller descriptions and added the Micro850 controller option	13
Added the Studio 5000 Logix Designer application to Table 1 and throughout	
Updated Circuit Breaker/Fuse Selection description text	19
Added Table 11 - Enable Truth Table (configured for Run)	40
Added Table 12 - Enable Truth Table (configured for Inhibit)	40
Added Table 13 - Homing Truth Table	41
Added Table 14 - Indexing Truth Table	42
Updated Buffered Encoder Outputs support	48
Added a reference to Appendix F	58
Changed the IMPORTANT statement to an ATTENTION statement and added a reference to Appendix F	59
Updated Master Counts Range values, ID 79 and 80	88, 90
Updated the definition of Analog Input (current scale), ID 35	94, 203
Corrected the definition of Speed Window and At Speed, ID 50 and 60	95, 203
Added footnote about Clear Fault History being password protected	100
Corrected the limits of Master Gearing, ID 79 and 80	150, 204
Added Shock Hazard and ATTENTION statement	155
Updated Interconnect Diagram Notes	176
Corrected cable catalog numbers and encoder footnote details	180, 181, 184, 185
Updated drive connector pinout and signal names on Figure 97 - Analog Velocity (or Current) Control Mode,	187
Updated buffered encoder outputs support information to master gearing wiring example	188
Added Appendix F - Leakage Current Specifications	225

Notes:

This manual provides detailed installation instructions for mounting, wiring, and troubleshooting your Kinetix® 300 drive; and system integration for your drive/motor combination with a Logix controller.

This manual is intended for engineers and technicians that are directly involved in the installation and wiring of the Kinetix 300 drive and programmers who are directly involved in operation, field maintenance, and integration of the Kinetix 300 drive.

If you do not have a basic understanding of the Kinetix 300 drive, contact your local Rockwell Automation sales representative for information on available training courses.

Conventions

These conventions are used throughout this manual:

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

Additional Resources

These documents contain more information that concern related products from Rockwell Automation.

Resource	Description
Kinetix Rotary Motion Specifications Technical Data, publication KNX-TD001	Specifications for Kinetix rotary motion products.
Kinetix Linear Motion Specifications Technical Data, publication KNX-TD002	Specifications for Kinetix linear motion products.
Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003	Specifications for Kinetix servo drive motion control products.
Kinetix 300 Shunt Resistor Installation Instructions, publication 2097-IN002	Information on how to install and wire the Kinetix 300 shunt resistors.
Kinetix 300 AC Line Filter Installation Instructions, publication 2097-IN003	Information on installing and wiring the Kinetix 300 AC line filter.
Kinetix 300 I/O Terminal Expansion Block Installation Instructions, publication 2097-IN005	Information on how to install and wire the Kinetix 300 I/O terminal expansion block.
Kinetix 300 Memory Module Installation Instructions, publication 2097-IN007	Information on how to install the Kinetix 300 memory module.
Kinetix 300 Memory Module Programmer Quick Start, publication 2097-QS001	Information on how to use the memory module programmer to duplicate the memory module.
CompactLogix™ System User Manual, publication 1769-UM011	Information on how to plan, mount, wire, and troubleshoot your CompactLogix system.
ControlLogix® Controllers User Manual, publication 1756-UM001	Information on how to install, configure, program, and operate a ControlLogix system.
ControlFLASH™ Firmware Upgrade Kit User Manual, publication 1756-QS105	For ControlFLASH information not specific to any drive family.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation® industrial system.
System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001	Information, examples, and techniques that are designed to minimize system failures that are caused by electrical noise.
Product Certifications website, http://www.rockwellautomation.com/global/certification/overview.page	For declarations of conformity (DoC) currently available from Rockwell Automation.
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.

Start

About the Kinetix 300 Drive System

The Kinetix® 300 EtherNet/IP indexing servo drive is designed to provide a solution for applications with output power requirements between 0.4...3.0 kW (2...12 A rms).

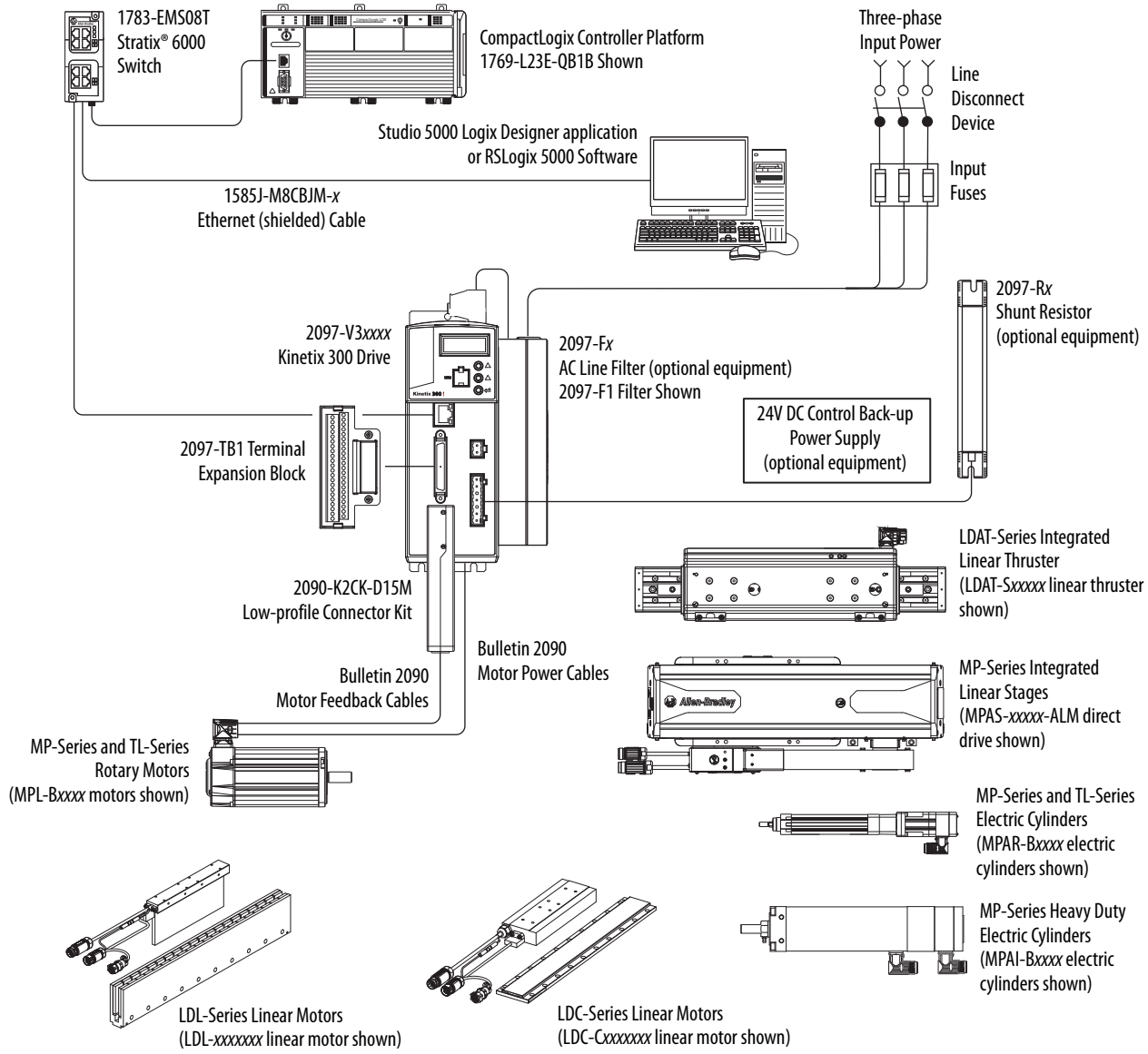
Table 1 - Kinetix 300 Drive System Overview

Kinetix 300 System Component	Cat. No.	Description
Kinetix 300 EtherNet/IP Indexing Servo Drive	2097-V3*x*PR*x*	Kinetix 300 EtherNet/IP indexing drives with Safe Torque-off feature are available with 120/240V or 480V AC input power.
AC Line Filters	2090 2097-F*x*	Bulletin 2090 and Bulletin 2097-F*x* AC line filters are required to meet CE with Kinetix 300 drives without an integrated line filter. Bulletin 2097 filters are available in foot mount and side mount.
Shunt Module	2097-R*x*	Bulletin 2097 shunt resistors connect to the drive and provide shunt capability in regenerative applications.
Terminal block for I/O connector	2097-TB1	50-pin terminal block. Use with IOD connector for control interface connections.
Memory Module Programmer	2097-PGMR	The EPM programmer is used to duplicate the memory and configuration of the Kinetix 300 drives.
Memory Modules 12 Pack	2097-MEM	These memory modules are removable and the drive to store parameters in them.
Logix PAC® Controller Platforms	Bulletin 5069 Bulletin 1768 and 1769	EtherNet/IP networking with CompactLogix™ 5370 and CompactLogix 5380 controllers with embedded dual port. 1769-L3*x* controllers with embedded single port. 1768-L4*x* controller and 1768-L4*x*S safety controller with 1768-ENBT EtherNet/IP communication module.
	1756-EN2T, 1756-EN2TR, and 1756-EN3TR module	EtherNet/IP network communication modules for use with ControlLogix® 5570 and ControlLogix 5580 controllers.
Logix PLC Controller Platforms	MicroLogix™ 1100 and 1400 controllers provide communications ports, an isolated combination RS-232/485 communication port, an Ethernet port, and (MiroLogix 1400 only) a non-isolated RS-232 communication port. Micro850® controllers with embedded inputs/outputs can accommodate from two to five plug-in modules and up to four expansion I/O modules.	
Studio 5000® Environment or RSLogix 5000® Software	N/A	RSLogix 5000 software (version 20 or earlier) and the Studio 5000 Logix Designer® application (version 21 or later) are used to program, commission, and maintain the Logix family of controllers.
Rotary Servo Motors	MP-Series™, TL-Series™	Compatible rotary motors include the MP-Series (Bulletin MPL, MPM, MPF, and MPS) and TL-Series motors.
Linear Stages	MP-Series	Compatible stages include MP-Series (Bulletin MPAS) Integrated Linear Stages.
Linear Actuators	LDAT-Series	Compatible actuators include LDAT-Series (Bulletin LDAT) Integrated Linear Thrusters.
Linear Motors	LDC-Series™, LDL-Series™	Compatible linear motors include LDC-Series and LDL-Series (Bulletin LDC and LDL) Linear Motors.

Table 1 - Kinetix 300 Drive System Overview (continued)

Kinetix 300 System Component	Cat. No.	Description
Electric Cylinders	MP-Series, TL-Series	Compatible electric cylinders include MP-Series and TL-Series (Bulletin MPAR, TLAR, and MPAI) Electric Cylinders.
Cables	Motor/brake and feedback cables	Motor power/brake and feedback cables include SpeedTec and threaded DIN connectors at the motor. Power/brake cables have flying leads on the drive end and straight connectors to servo motors. Feedback cables have flying leads that wire to connector kits on the drive end and straight connectors on the motor end.
	Communication cables	1585J-M8CBJM-*x* (shielded) Ethernet cable.

Figure 1 - Typical Kinetix 300 Drive Installation



Catalog Number Explanation

Kinetix 300 drive catalog numbers and descriptions are listed in these tables.

Table 2 - Kinetix 300 Drives (single-phase)

Cat. No.	Input Voltage	Continuous Output Current A (0-pk)	Features
2097-V31PR0	120/240V, 1 Ø	2.8	• 120V Doubler mode • Safe Torque-off
2097-V31PR2		5.7	
2097-V32PR0	240V, 1 Ø	2.8	• Integrated AC line filter • Safe Torque-off
2097-V32PR2		5.7	
2097-V32PR4		11.3	

Table 3 - Kinetix 300 Drives (single/three-phase)

Cat. No.	Input Voltage	Continuous Output Current A (0-pk)	Features
2097-V33PR1	120V, 1 Ø 240V, 1 Ø 240V, 3 Ø	2.8	Safe Torque-off
2097-V33PR3		5.7	
2097-V33PR5		11.3	
2097-V33PR6		17.0	

Table 4 - Kinetix 300 Drives (three-phase)

Cat. No.	Input Voltage	Continuous Output Current A (0-pk)	Features
2097-V34PR3	480V, 3 Ø	2.8	Safe Torque-off
2097-V34PR5		5.7	
2097-V34PR6		8.5	

Table 5 - Kinetix 300 Drive Accessories

Cat. No.	Drive Components
2097-F*x*	AC line filters
2097-TB1	Terminal block for I/O connector
2097-R*x*	Shunt resistors
2097-PGMR	Memory module programmer
2097-MEM	Memory modules 12 pack

Agency Compliance

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

ATTENTION: To meet CE requirements requires a grounded system, and the method to ground the AC line filter and drive must match. Failure to do to match systems ground makes the filter ineffective and can damage the filter. For ground examples, see Ground Your Kinetix 300 Drive System on page 64.

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

CE Requirements

To meet CE requirements, these requirements apply:

- Install an AC line filter (Bulletin 2090 or 2097) as close to the drive as possible.
- Use 2090 series motor-power cables or use connector kits and connect the cable shields to the subpanel with clamp provided.
- Use 2090 series motor-feedback cables or use connector kits and properly connect the feedback cable shield. Drive-to-motor power and feedback cables must not exceed 20 m (65.6 ft).
- Install the Kinetix 300 system inside an enclosure. Run input power wiring in conduit (grounded to the enclosure) outside of the enclosure. Separate signal and power cables.
- 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.

See Appendix A on page 175 for interconnect diagrams, including input power wiring and drive/motor interconnect diagrams.

Installing the Kinetix 300 Drive System

ATTENTION: Plan the installation of your system so that you can cut, drill, tap, and weld 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 you design your enclosure and plan to mount your system components on the panel.

For online product selection and system configuration tools, including AutoCAD (DXF) drawings of the product, see http://www.rockwellautomation.com/global/support/selection.page.

System Mounting Requirements

- To comply with UL and CE requirements, the Kinetix® 300 system must be enclosed in a grounded conductive enclosure that offers protection as defined in standard EN 60529 (IEC 529) to IP4X. The enclosures must be not accessible to an operator or unskilled persons. A NEMA 4X enclosure exceeds these requirements providing protection to IP66.
- The panel that you install in the enclosure for mounting your system components must be on a flat, rigid, vertical surface that is not 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.
- Segregate input power wire and motor power cables from control wires and motor feedback cables. Use shielded cable for power wires and provide a grounded 360° clamp termination.
- Use high-frequency (HF) techniques for bonding to connect the enclosure, machine frame, and motor housing, and to provide a low-impedance return path for high-frequency (HF) energy and reduce electrical noise.
- Use 2090 series motor-feedback cables or use connector kits and properly connect the feedback cable shield. Drive-to-motor power and feedback cables must not exceed 20 m (65.6 ft).

IMPORTANT System performance was tested at these cable length specifications. These limitations are also a CE requirement.

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

Transformer Selection

The Kinetix 300 drive 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, see Circuit Breaker/Fuse Selection on page 19 and Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003.

IMPORTANT	If you use 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 single and three-phase power (where form factor is used to compensate for transformer, drive, and motor losses, and to account for utilization in the intermittent operating area of the torque speed curve). For example, size a transformer to the voltage requirements of catalog number 2097-V34PR6 = 3 kW continuous x 1.5 = 4.5 KVA transformer.

Circuit Breaker/Fuse Selection

The Kinetix 300 drives use internal solid-state motor short-circuit protection and, when connected to a suitable branch circuit protection, are rated for use on a circuit that can deliver up to 100,000 A (fuses) or 65,000 A (circuit breakers).

IMPORTANT	Do not use circuit protection devices on the output of an AC drive as an isolating disconnect switch or motor overload device. These devices are designed to operate on sine wave voltage and the drive's PWM waveform does not allow it to operate properly. As a result, damage to the device occurs.

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

See the Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003, for input current and inrush current specifications for your Kinetix 300 drive.

See Fuse and Circuit Breaker (CB) Specifications on page 20 for recommended circuit breakers and fuses.

Table 6 - Fuse and Circuit Breaker (CB) Specifications

Drive Cat. No.	Drive Voltage	Phase	UL Applications			IEC (non UL) Applications		
			Fuses (Bussmann)	Miniature CB (1) Cat. No.	Motor Protection CB (1) (2) Cat. No.	DIN gG Fuses Amps, max	Miniature CB (1) Cat. No.	Motor Protection CB (1) Cat. No.
2097-V31PR0	120V	Single-phase (voltage doubler)	KTK-R-20 (20 A)	1489-A1C200	140M-D8E-C20	20	1492-SP1D200	140M-D8E-C20
	120/240V	Single-phase	KTK-R-10 (10 A)	1489-A1C100	140M-C2E-C10	10	1492-SP1D100	140M-C2E-C10
2097-V31PR2	120V	Single-phase (voltage doubler)	KTK-R-30 (30 A)	1489-A1C300	140M-F8E-C32	32	1492-SP1D300	140M-F8E-C32
	120/240V	Single-phase	KTK-R-20 (20 A)	1489-A1C200	140M-D8E-C20	20	1492-SP1D200	140M-D8E-C20
2097-V32PR0	240V	Single-phase	KTK-R-15 (15 A)	1489-A1C150	140M-D8E-C16	16	1492-SP1D150	140M-D8E-C16
2097-V32PR2			KTK-R-20 (20 A)	1489-A1C200	140M-D8E-C20	20	1492-SP1D200	140M-D8E-C20
2097-V32PR4			KTK-R-30 (30 A)	1489-A1C300	140M-F8E-C32	32	1492-SP1D320	140M-F8E-C32
2097-V33PR1	120/240V	Single-phase	KTK-R-20 (20 A)	1489-A1C200	140M-D8E-C20	20	1492-SP1D200	140M-D8E-C20
	240V	Three-phase	KTK-R-15 (15 A)	1489-A3C150	140M-D8E-C16	16	1492-SP3D150	140M-D8E-C16
2097-V33PR3	120/240V	Single-phase	KTK-R-20 (20 A)	1489-A1C200	140M-D8E-C20	20	1492-SP1D200	140M-D8E-C20
	240V	Three-phase	KTK-R-15 (15 A)	1489-A3C150	140M-D8E-C16	16	1492-SP3D150	140M-D8E-C16
2097-V33PR5	120/240V	Single-phase	KTK-R-30 (30 A)	1489-A1C300	140M-F8E-C32	32	1492-SP1D300	140M-F8E-C32
	240V	Three-phase	KTK-R-20 (20 A)	1489-A3C200	140M-D8E-C20	20	1492-SP3D200	140M-D8E-C20
2097-V33PR6	120/240V	Single-phase	LPJ-40SP	N/A	140M-F8E-C32	40	N/A	140M-F8E-C32
	240V	Three-phase	KTK-R-30 (30 A)	1489-A3C300		32	1492-SP3D300	
2097-V34PR3	480V	Three-phase	KTK-R-10 (10 A)	1489-A3C100	140M-C2E-C10	10	1492-SP3D100	140M-C2E-C10
2097-V34PR5			KTK-R-10 (10 A)	1489-A3C100	140M-C2E-C10	10	1492-SP3D100	140M-C2E-C10
2097-V34PR6			KTK-R-20 (20 A)	1489-A3C200	140M-D8E-C20	20	1492-SP3D200	140M-D8E-C20

(1) Bulletin 1492 and 1489 circuit protection devices have lower short-circuit current ratings than Bulletin 140M devices.
Refer to http://ab.rockwellautomation.com/allenbradley/productdirectory.page? for product literature with specific short-circuit ratings.

(2) For UL applications, Bulletin 140M devices are applied as self-protected combination motor controllers.

Enclosure Selection

This example is provided to assist you in size selection for an enclosure for your Bulletin 2097 drive system. You need heat dissipation data from all components that are planned for your enclosure to calculate the enclosure size. See Power Dissipation Specifications on page 22 for the Kinetix 300 drive power dissipation.

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

Metric	Standard English
$A = \frac{0.38Q}{1.8T - 1.1}$	$A = \frac{4.08Q}{T - 1.1}$
Where T is temperature difference between inside air and outside ambient (°C), Q is heat that is 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 that is 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.

If the maximum ambient rating of the Kinetix 300 drive system is 40 °C (104 °F) and if the maximum environmental temperature is 20 °C (68 °F), then T=20. In this example, the total heat dissipation is 416 W (sum of all components in enclosure). So, in the equation below, T=20 and Q=416.

$$A = \frac{0.38\,(416)}{1.8\,(20) - 1.1} = 4.53\ m^2$$

In this example, the enclosure must have an exterior surface of at least 4.53 m^2. If any portion of the enclosure is not able to transfer heat, exclude that part in the calculation.

Because the minimum cabinet depth to house the Kinetix 300 system (selected for this example) is 332 mm (13 in.), choose a cabinet approximately 2000 x 700 x 332 mm (78.7 x 27.6 x 13.0 in.) HxWxD.

$$2 \times (0.332 \times 0.70) + 2 \times (0.332 \times 2.0) + 2 \times (0.70 \times 2.0) = 4.59\ m^2$$

Because this cabinet size is considerably larger than what is necessary to house the system components. The choice of a smaller cabinet than can be more efficient to cool. Contact your cabinet manufacturer for options available to cool your cabinet.

Power Dissipation Specifications

Use this table to size an enclosure and calculate required ventilation for your Kinetix 300 drive system.

Cat. No.	Power Dissipation, W
2097-V31PR0	28
2097-V31PR2	39
2097-V32PR0	28
2097-V32PR2	39
2097-V32PR4	67
2097-V33PR1	28
2097-V33PR3	39
2097-V33PR5	67
2097-V33PR6	117
2097-V34PR3	39
2097-V34PR5	58
2097-V34PR6	99

Minimum Clearance Requirements

This section provides information to assist you in making the choice of the size of your cabinet and position of your Kinetix 300 system components.

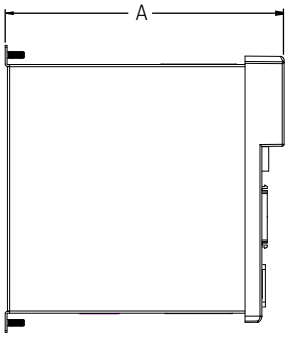
IMPORTANT Mount the module in an upright position as shown. Do not mount the drive module on its side.

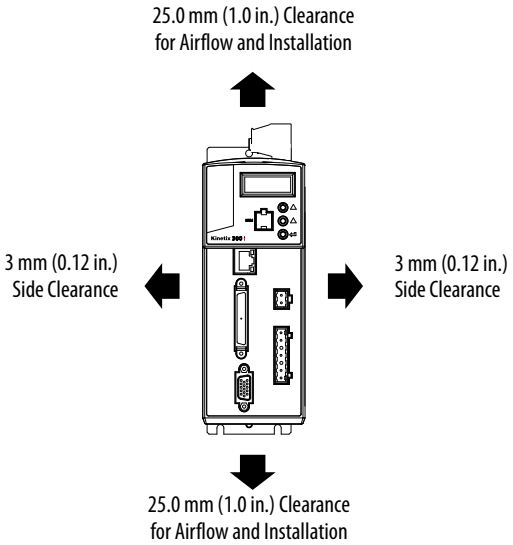
Figure 2 illustrates minimum clearance requirements for proper airflow and installation:

- Extra clearance is required depending on the accessory items installed.
- An extra 9.7 mm (0.38 in.) clearance is required left of the drive if the I/O expansion terminal block is used.
- An extra 26 mm (1.0 in.) clearance is required right of the drive when the heatsink is present.
- An extra 36 mm (1.42 in.) is required right of the drive when the side-mount line filter is present. An extra 50 mm (2.0 in.) is required behind the drive when the rear-mount line filter is present.
- An extra 5.0 mm (0.19 in.) clearance is required in front of the drive when the 2090-K2CK-D15M feedback connector kit is used.
- Extra clearance is required for the cables and wires that are connected to the top, front, and bottom of the drive.
- An extra 150 mm (6.0 in.) is required when the drive is mounted near noise sensitive equipment or clean wireways.

See Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003 for Kinetix 300 drive dimensions.

Figure 2 - Minimum Clearance Requirements





Drive Cat. No.	A
2097-V31PR0	185 (7.29)
2097-V31PR2	185 (7.29)
2097-V32PR0	230 (9.04)
2097-V32PR2	230 (9.04)
2097-V32PR4	230 (9.04)
2097-V33PR1	185 (7.29)
2097-V33PR3	185 (7.29)
2097-V33PR5	185 (7.29)
2097-V33PR6	230 (9.04)
2097-V34PR3	185 (7.29)
2097-V34PR5	185 (7.29)
2097-V34PR6	230 (9.04)

Electrical Noise Reduction

This section outlines best practices that minimize the possibility of noise-related failures as they apply specifically to Kinetix 300 system installations. For more information on the concept of high-frequency (HF) bonding, the ground plane principle, and electrical noise reduction, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Bonding Drives

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

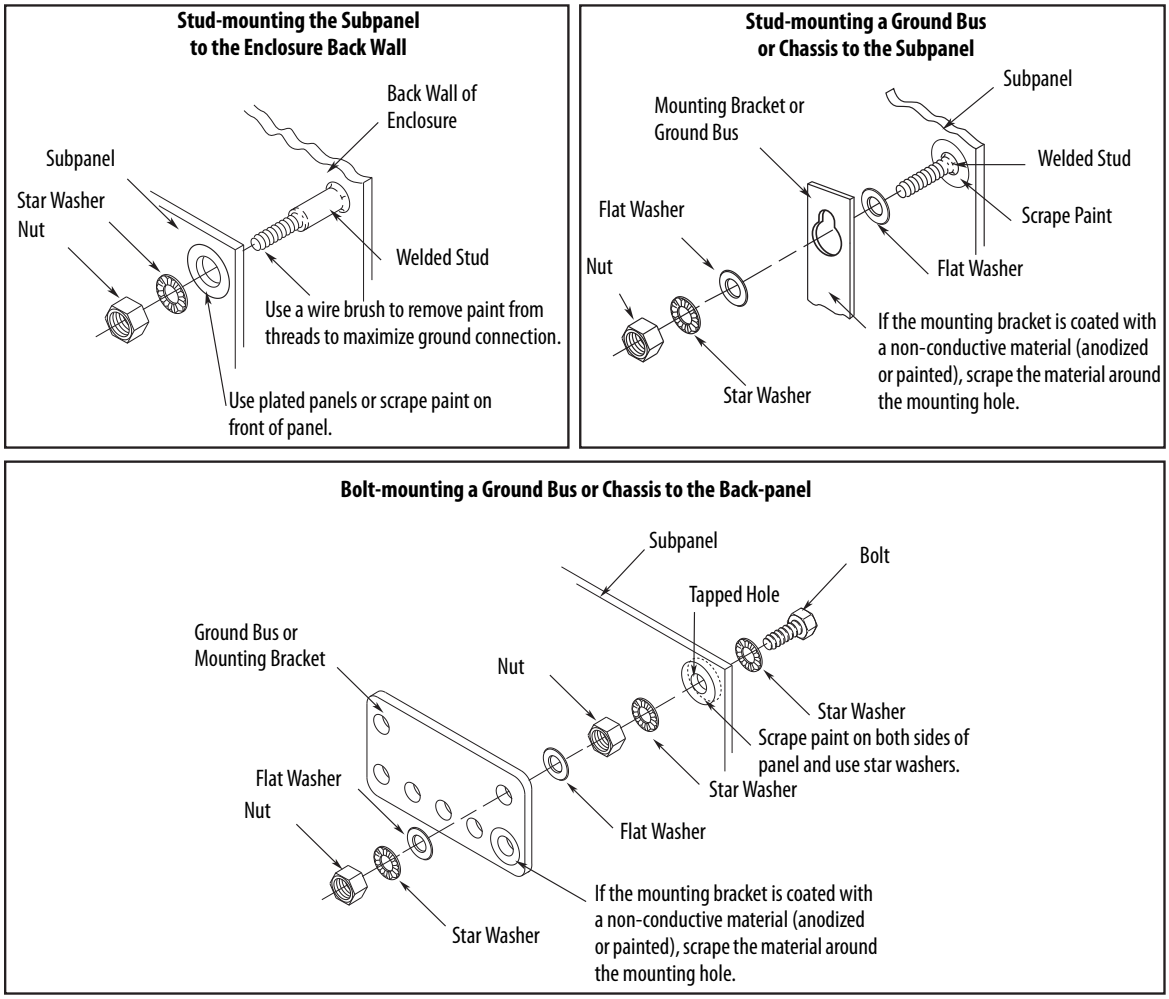
Unless specified, most paints are not conductive and act as insulators. To achieve a good bond between drive and the subpanel, surfaces must be paint-free or plated. Bonding the metal surfaces creates a low-impedance return path for high-frequency energy.

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

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

These illustrations show recommended practices for bonding the painted panels, enclosures, and brackets.

Figure 3 - Recommended Bonding Practices for Painted Panels

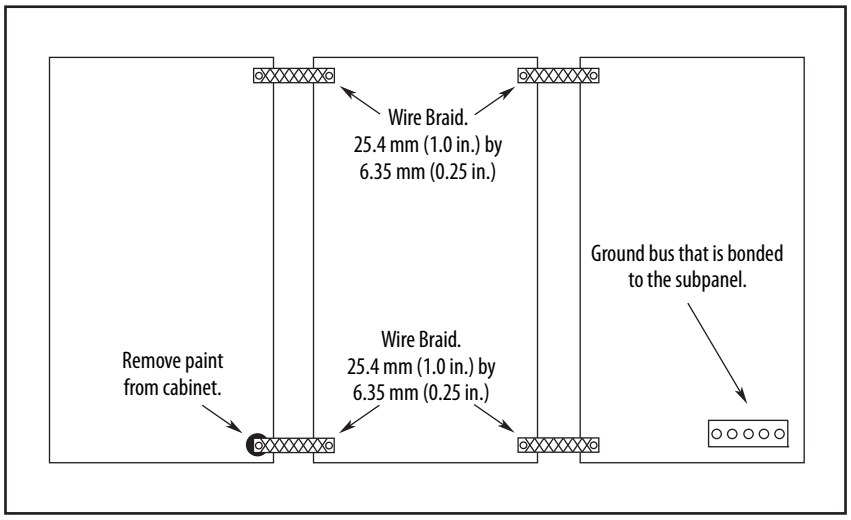


Bonding Multiple Subpanels

Bonding multiple subpanels creates a common low-impedance exit path for the high frequency energy inside the cabinet. Subpanels that are not bonded together do not necessarily share a common low-impedance path. This 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 4 - Multiple Subpanels and Cabinet Recommendations

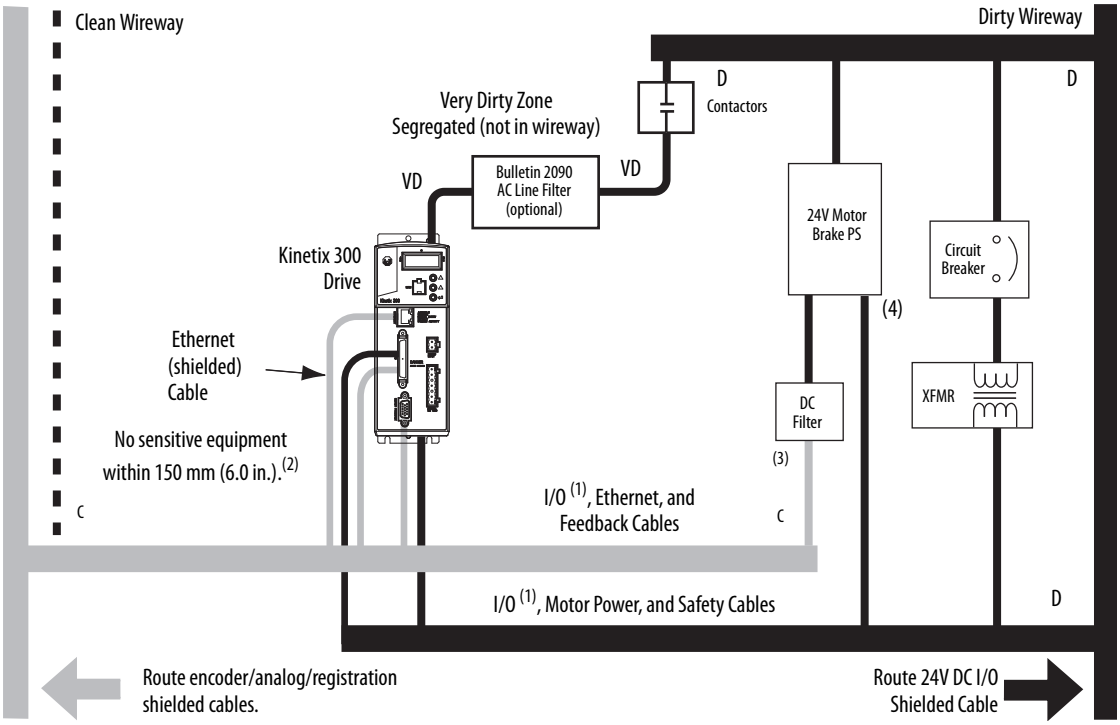


Establishing the Noise Zones

Observe these guidelines when individual input-power components are used in the Kinetix 300 system:

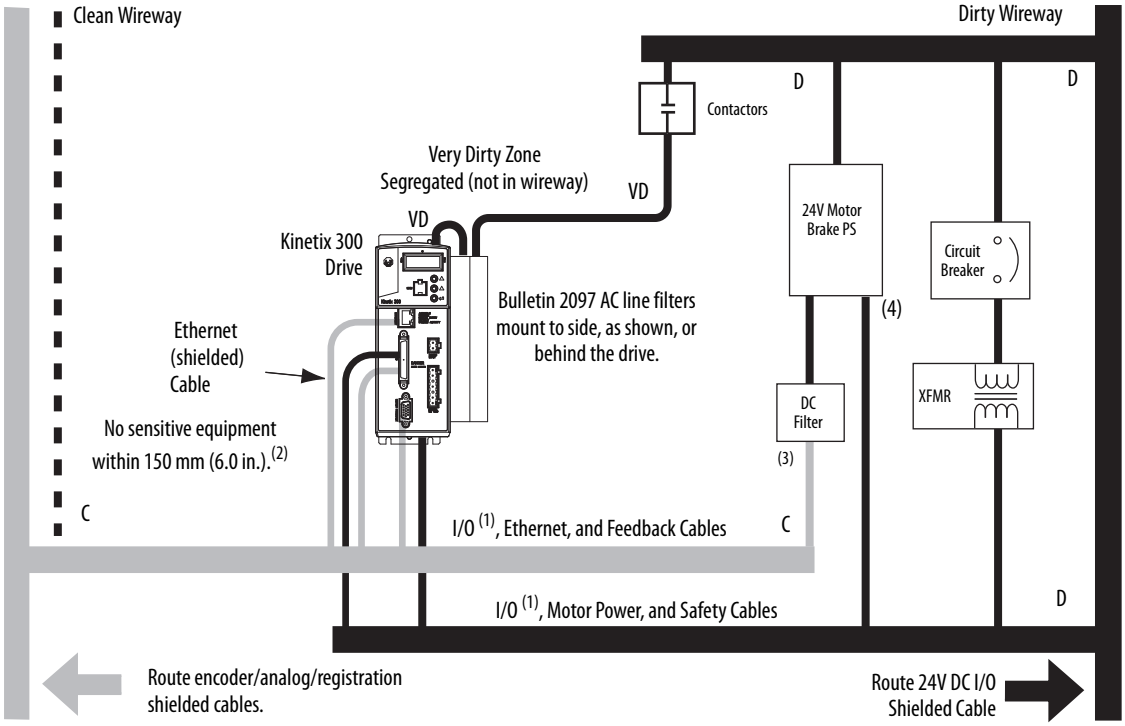
- The clean zone (C) exits left of the Kinetix 300 system and includes the I/O wiring, feedback cable, Ethernet cable, and DC filter (gray wireway).
- The dirty zone (D) exits right of the Kinetix 300 system (black wireway) and includes the circuit breakers, transformer, 24V DC power supply, contactors, AC line filter, motor power, and safety cables.
- The very dirty zone (VD) is limited to where the AC line (EMC) filter VAC output jumpers over to the drive. Shielded cable is required only if the very dirty cables enter a wireway.

Figure 5 - Noise Zones (Bulletin 2090 AC line filters)



(1) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.
(2) For tight spaces, use a grounded steel shield. For examples, see 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 left.
(4) This is a dirty 24V DC available for motor brakes and contactors. The 24V enters the dirty wireway and exits to the right.

Figure 6 - Noise Zones (Bulletin 2097 AC line filters)



(1) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.
(2) For tight spaces, use a grounded steel shield. For examples, see 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 left.
(4) This is a dirty 24V DC available for motor brakes and contactors. The 24V enters the dirty wireway and exits to the right.

Cable Categories for Kinetix 300 Drive Components

Table 7 indicates the zoning requirements of cables that connect to the Kinetix 300 drive components.

Table 7 - Kinetix 300 Drive Components

Wire/Cable	Connector	Zone			Method	
		Very Dirty	Dirty	Clean	Ferrite Sleeve	Shielded Cable
L1, L2, L3 (unshielded cable)	IPD	X				
U, V, W (motor power)	MP		X			X
+, -, SH (shunt resistor)	BC		X			
24V DC	BP			X		
Control COM, 24V DC control, safety enable, and feedback signals for safe-off feature	STO		X			
Motor feedback	MF			X		X
Registration and analog outputs	IOD			X		X
Others			X			
Ethernet	Port 1			X		X

Noise Reduction Guidelines for Drive Accessories

See this section when mounting an AC line filter or shunt resistor module for guidelines that are designed to reduce system failures caused by excessive electrical noise.

AC Line Filters

Observe these guidelines when mounting your AC line filter:

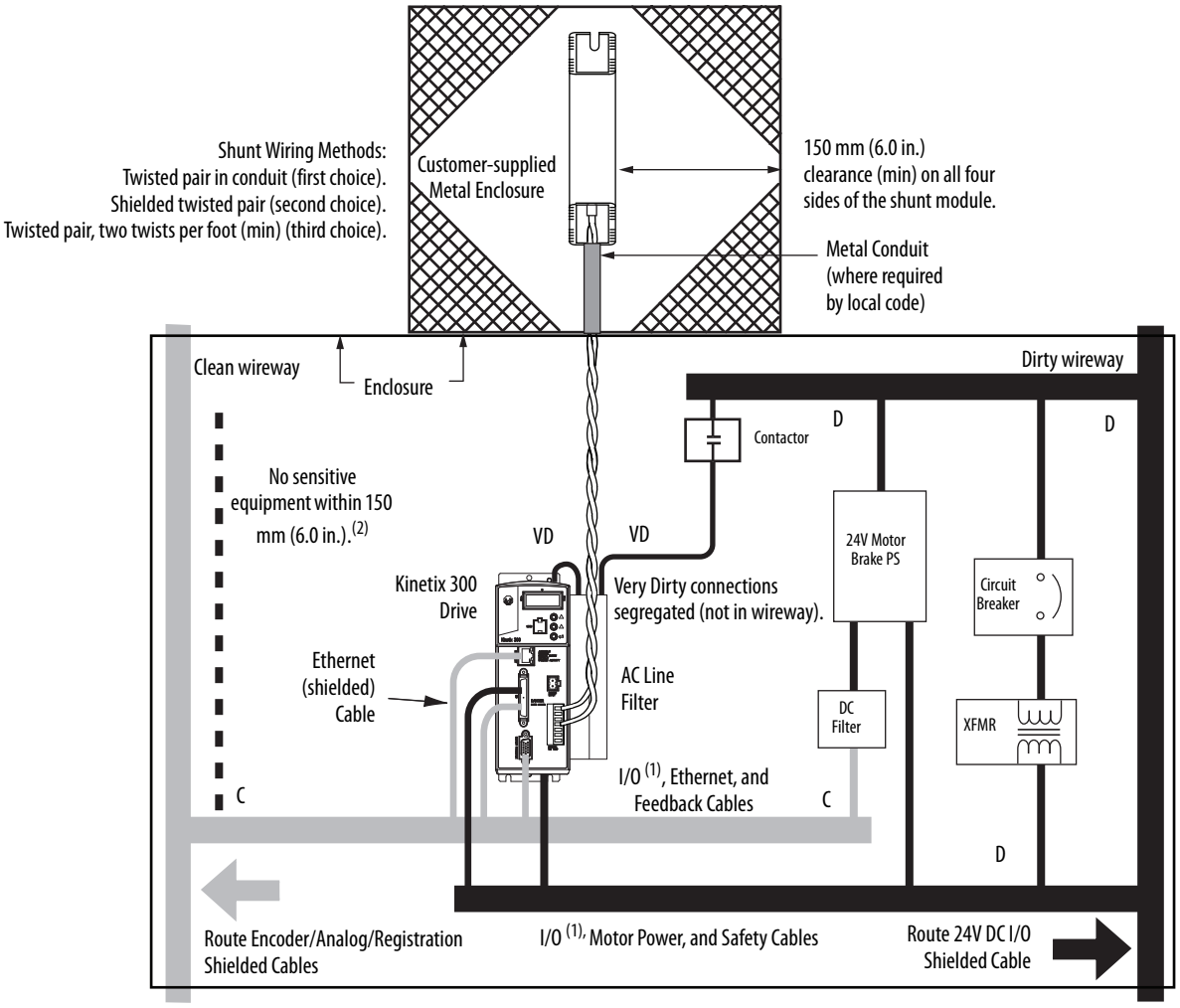
- If you are using a Bulletin 2090 line filter, mount the filter on the same panel as the Kinetix 300 drive, and as close to the drive as possible.
- Good HF bonding to the panel is critical. For painted panels, see the examples on page 25.
- Segregate input and output wiring as far as possible.

Shunt Resistors

Observe these guidelines when mounting your shunt resistor outside the enclosure:

- Mount shunt resistor and wiring in the very dirty zone or in an external shielded enclosure.
- Mount resistors 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.

Figure 7 - Shunt Resistor Outside the Enclosure



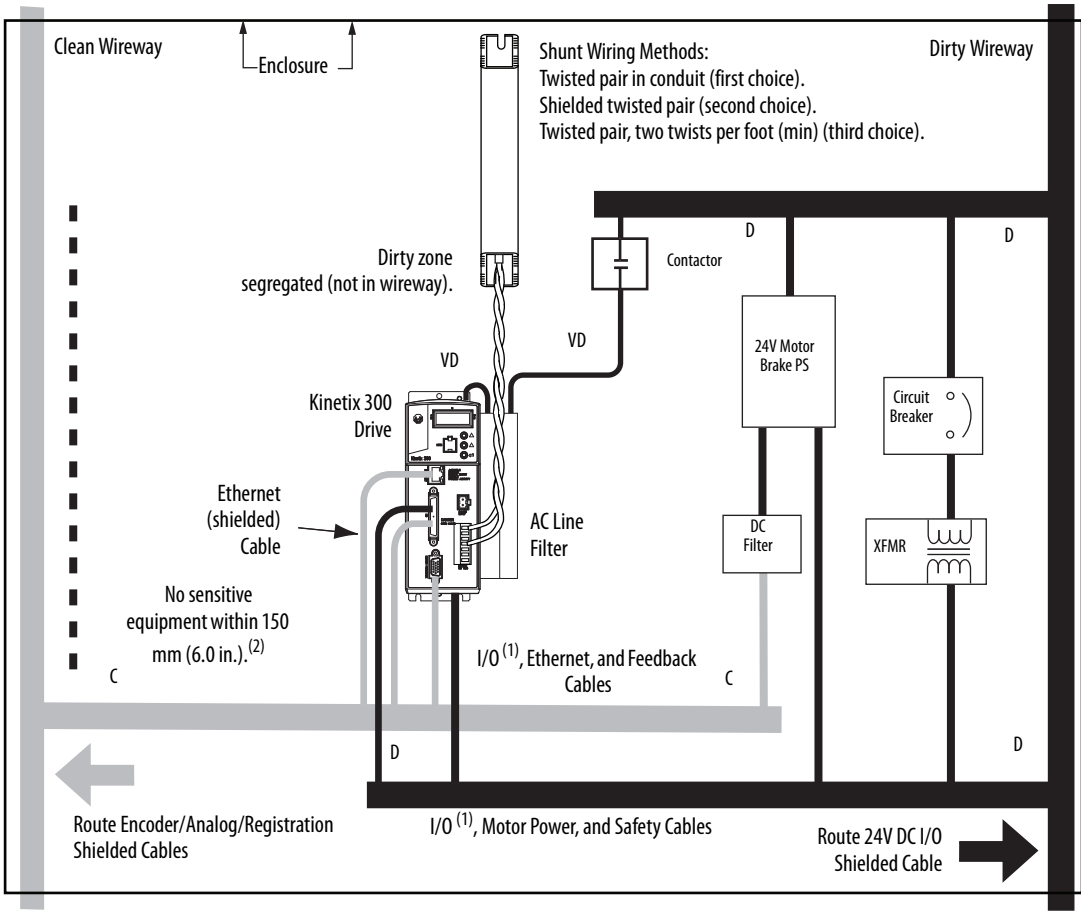
(1) If drive system I/O cable contains (dirty) relay wires, route cable in dirty wireway.

(2) When space does not permit 150 mm (6.0 in.) clearance, install a grounded steel shield between the drive and clean wireway. For examples, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

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

- Mount the shunt resistor anywhere in the dirty zone, but as close to the Kinetix 300 drive as possible.
- Shunt wires can be run with motor power cables.
- Keep unshielded wiring as short as possible. Keep shunt wiring as flat to the cabinet as possible.
- Separate shunt wires from other sensitive, low-voltage signal cables.

Figure 8 - Shunt Resistor Inside the Enclosure



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

(2) When space does not permit 150 mm (6.0 in.) clearance, install a grounded steel shield between the drive and clean wireway. For examples, see the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

Motor Brake

The brake is mounted inside the motor and how you connect to the drive depends on the motor series.

See Kinetix 300 Drive/Rotary Motor Wiring Examples beginning on page 180 for the interconnect diagram of your drive/motor combination.

Mount Your Kinetix 300 Drive

This procedure assumes that you have prepared your panel and understand how to bond your system. For installation instructions regarding other equipment and accessories, see the instructions that came with those products.

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, see Allen-Bradley® publication 8000-4.5.2, Guarding Against Electrostatic Damage or any other applicable ESD Protection Handbook.

Follow these steps to mount your Kinetix 300 drive.

1. Lay out the position for the Kinetix 300 drive and accessories in the enclosure.

   See Establishing the Noise Zones on page 27 for panel layout recommendations. Mounting hole dimensions for the Kinetix 300 drive are shown in Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003.

2. Attach the Kinetix 300 drive to the cabinet, first by using the upper mounting slots of the drive and then the lower.

   The recommended mounting hardware is M4 (#6-32) steel machine screws torqued to 1.1 N•m (9.8 lb•in). Observe bonding techniques as described in Bonding Drives on page 24.

   IMPORTANT To improve the bond between the Kinetix 300 drive and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

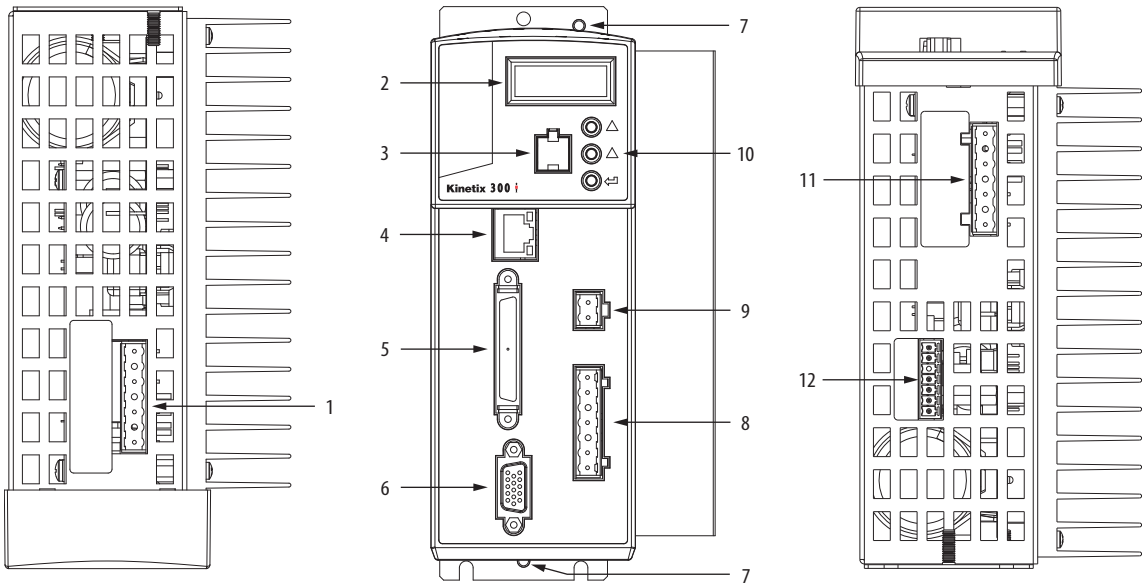
3. Tighten all mounting fasteners.

Kinetix 300 Drive Connector Data and Feature Descriptions

Kinetix 300 Drive Connectors and Indicators

Although the physical sizes of the Kinetix® 300 drives vary, the location of the connectors and indicators is identical.

Figure 9 - Kinetix 300 Drive Connector and Indicators



Kinetix 300 Drive, Top View
(2097-V33PR5 drive is shown)

Kinetix 300 Drive, Front View
(2097-V33PR5 drive is shown)

Kinetix 300 Drive, Bottom View
(2097-V33PR5 drive is shown)

Item	Description
1	Mains (IPD) connector
2	Status and diagnostic display
3	Memory module socket
4	Ethernet communication port (Port 1)
5	I/O (IOD) connector
6	Motor feedback (MF) connector

Item	Description
7	Ground lug
8	Shunt resistor and DC bus (BC) connector
9	Back-up power (BP) connector
10	Display control push buttons (3)
11	Motor power (MP) connector
12	Safe Torque-off (STO) connector

Table 8 - Kinetix 300 Drive Connectors

Designator	Description	Connector
IPD	AC input power	3-position or 4-position plug/header
PORT1	Ethernet communication port	RJ45 Ethernet
IOD	I/O	SCSI 50-pin high-density connector
MF	Motor feedback	15-pin high-density D-shell (male)
CPD	Back-up power	2-pin quick-connect terminal block
BC	Shunt Resistor and DC Bus	7-pin quick-connect terminal block
MP	Motor power	6-pin quick-connect terminal block
STO	Safe Torque-off (STO) terminal	6-pin quick-connect terminal block

Safe Torque-off Connector Pinout

The Kinetix 300 drive ships with the (6-pin) wiring-plug header that connects your safety circuit to the Kinetix 300 drive Safe Torque-off (STO) connector. If your system does not use the Safe Torque-off feature, follow instructions in Safe Torque-off Feature Bypass that begin on page 170 to wire the drive with motion-allowed jumpers.

Figure 10 - Safe Torque-off Connector

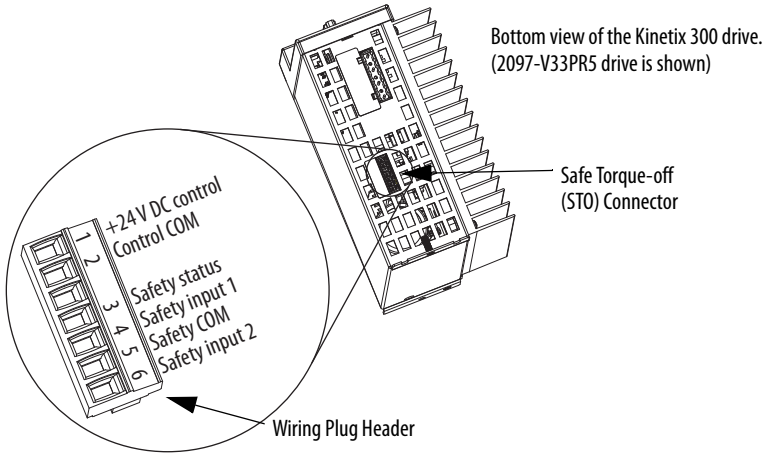


Table 9 - Kinetix 300 Drive Safe Torque-off Connector Pinout

STO Pin	Description	Signal
1	+24V DC output from the drive	+24V DC control
2	+24V DC output common	Control COM
3	Safety status	Safety Status
4	Safety input 1 (+24V DC to enable)	Safety Input 1
5	Safety common	Safety COM
6	Safety input 2 (+24V DC to enable)	Safety Input 2

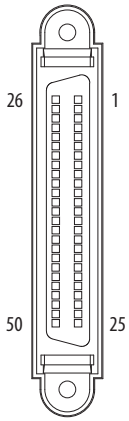
IMPORTANT Use Pins STO-1 (+24V DC Control) and STO-2 (Control COM) only for the motion-allowed jumpers to defeat the Safe Torque-off function. When the Safe Torque-off function is in operation, the 24V supply must come from an external source.

I/O Connector Pinout

IOD Pin	Description	Signal
1	Master encoder A+/Step+ input	MA+
2	Master encoder A-/Step- input	MA-
3	Master encoder B+/Direction+ input	MB+
4	Master encoder B-/Direction- input	MB-
5	Reserved	—
6	Reserved	—
7	Buffered encoder output: channel A+	BA+
8	Buffered encoder output: channel A-	BA-
9	Buffered encoder output: channel B+	BB+
10	Buffered encoder output: channel B-	BB-
11	Buffered encoder output: channel Z+	BZ+
12	Buffered encoder output: channel Z-	BZ-
13…21	Reserved	—
22	Analog common	ACOM
23	Analog output (max 10 mA)	AO
24	Positive (+) of analog signal input	AIN1+
25	Negative (-) of analog signal input	AIN1-
26	Digital input group ACOM terminal	IN_A_COM
27	Negative trave- limit switch	IN_A1
28	Positive travel limit switch	IN_A2
29	Inhibit/enable input	IN_A3

IOD Pin	Description	Signal
30	Digital input A4	IN_A4
31	Digital input group BCOM terminal	IN_B_COM
32	Digital input B1	IN_B1
33	Digital input B2	IN_B2
34	Digital input B3	IN_B3
35	Digital input B4	IN_B4
36	Digital input Group CCOM Terminal	IN_C_COM
37	Digital input C1	IN_C1
38	Digital input C2	IN_C2
39	Registration input sensor	IN_C3
40	Digital input C4	IN_C4
41	Ready output collector	RDY+
42	Ready output emitter	RDY-
43	Programmable output #1 collector	OUT1-C
44	Programmable output #1 emitter	OUT1-E
45	Programmable output #2 collector	OUT2-C
46	Programmable output #2 emitter	OUT2-E
47	Programmable output #3 collector	OUT3-C
48	Programmable output #3 emitter	OUT3-E
49	Programmable output #4 collector	OUT4-C
50	Programmable output #4 emitter	OUT4-E

Figure 11 - Pin Orientation for 50-pin SCSI I/O (IOD) Connector



Motor Feedback (MF) Connector Pinout

MF Pin	Description	Signal
1	Sine differential input+ AM+ differential input+	SIN+ AM+
2	Sine differential input- AM- differential input-	SIN- AM-
3	Cosine differential input+ BM+ differential input+	COS+ BM+
4	Cosine differential input- BM- differential input-	COS- BM-
5	Data differential input + Index pulse+	DATA+ IM+
6	Common	ECOM
7	Encoder power (+9V)	EPWR_9V (2)
8	Single-ended 5V Hall effect commutation	S3

MF Pin	Description	Signal
9	Reserved	—
10	Data differential input - Index pulse-	DATA- IM-
11	Motor thermal switch (normally closed) (1)	TS
12	Single-ended 5V Hall effect commutation	S1
13	Single-ended 5V Hall effect commutation	S2
14	Encoder power (+5V)	EPWR_5V (2)
15	Reserved	—

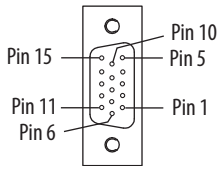
(1) Not applicable unless motor has integrated thermal protection.

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

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

IMPORTANT Drive-to-motor power and feedback cable length must not exceed 20 m (65.6 ft). System performance was tested at these specifications and also applies when meeting CE requirements.

Figure 12 - Pin Orientation for 15-pin Motor Feedback (MF) Connector

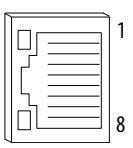


Ethernet Communication Connector Pinout

Port 1 Pin	Description	Signal
1	Transmit Port (+) Data Terminal	+ TX
2	Transmit Port (-) Data Terminal	- TX
3	Receive Port (+) Data Terminal	+ RX
4	—	—

Port 1 Pin	Description	Signal
5	—	—
6	Receive Port (-) Data Terminal	- RX
7	—	—
8	—	—

Figure 13 - Pin Orientation for 8-pin Ethernet Communication Port



AC Input Power Connector Pinout

IPD Designator	Description (2097-V31PR*x* drives)	Signal
L2/N	AC Power In (non-doubler operation)	L2/N
L1	AC Power In	L1
N	AC Power Neutral (120V doubler only)	N
PE	Protective Earth (ground)	PE

IPD Designator	Description (2097-V32PR*x* drives)	Signal
L2	AC Power In	L2
L1	AC Power In	L1
PE	Protective Earth (ground)	PE

IPD Designator	Description (2097-V33PR*x*, and 2097-V34PR*x* drives)	Signal
L3	AC Power In (three-phase models)	L3
L2	AC Power In	L2
L1	AC Power In	L1
PE	Protective Earth (ground)	PE

Back-up Power Connector Pinout

BP Designator	Description	Signal
+24V	Positive 24V DC	+24V DC
-24V	24V DC power supply return	Return

Shunt Resistor and DC Bus Connector Pinout

BC Designator	Description	Signal
+	Positive DC bus/Shunt resistor	+
+		+
SH	Shunt Resistor	SH
-	Negative DC bus	-
-		-

Motor-Power Connector Pinout

MP Designator	Description	Signal
PE	Protective Earth (ground)	PE
W	Motor power out	W
V	Motor power out	V
U	Motor power out	U

Control Signal Specifications

This section provides a description of the Kinetix 300 drive I/O (IOD), communication, shunt resistor, and DC bus (BC), and back-up power (BP) connectors.

Digital Inputs

The Kinetix 300 drive has 12 digital inputs. They can be used for travel limit switches, proximity sensors, push buttons, and hand shake with other devices. Each input can be assigned an individual de-bounce time via MotionView software or Explicit Messaging.

The inputs are separated into three groups: A, B, and C. Each group has four inputs and share one common: ACOM, BCOM, and CCOM respectively.

Travel limit switches, the inhibit/enable input, and registration input have dedicated inputs as shown in Table 10. For more information on the overtravel inputs, see Appendix E on page 221.

Table 10 - Digital Input Assignments

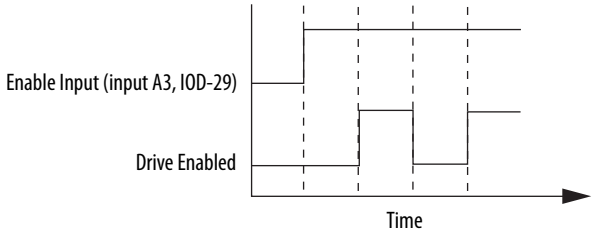
Digital Input	Function
IN_A1	Negative travel-limit switch
IN_A2	Positive travel-limit switch
IN_A3	Inhibit/enable input
IN_A4	N/A
IN_B1	N/A
IN_B2	N/A
IN_B3	N/A
IN_B4	N/A
IN_C1	N/A
IN_C2	N/A
IN_C3	Registration input sensor
IN_C4	N/A

You can configure the inputs that are listed as N/A for any of these functions.

- Abort Homing
- Abort Index
- Start Homing
- Start Index
- Fault Reset
- Home Sensor
- Index Select

Some of the digital inputs exercise control over functions under the control of the Output Assembly. When a digital input is mapped to the same function as exists in the Output Assembly, the following timing diagrams apply.

Figure 14 - Enable Timing Diagram (enable switch function that is configured for Run)



IMPORTANT Do not use the EtherNet/IP network for control and for configuring the Enable switch function for Run.

Table 11 - Enable Truth Table (configured for Run)

Drive Input	Value	
Enable Input	Off	Move to On
Drive Enable bit in Output Assembly (1)	–	On
Resulting Drive State	Disabled	Enabled

(1) Applicable only if EtherNet/IP External Reference mode.

Figure 15 - Enable Timing Diagram (enable switch function that is configured for Inhibit)

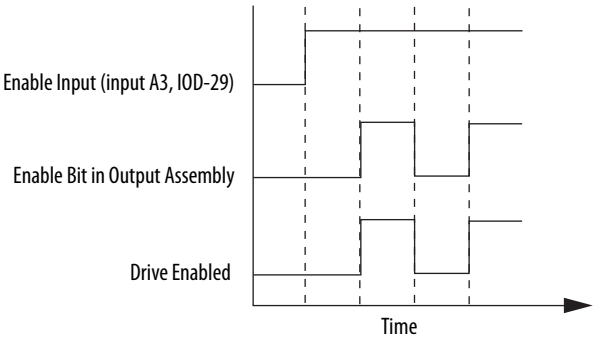


Table 12 - Enable Truth Table (configured for Inhibit)

Drive Input	Value		
Enable Input	On	On	Off
Drive Enable bit in Output Assembly	Move to On	Move to Off	–
Resulting Drive State	Enabled	Disabled	Disabled

Figure 16 - Homing Timing Diagram

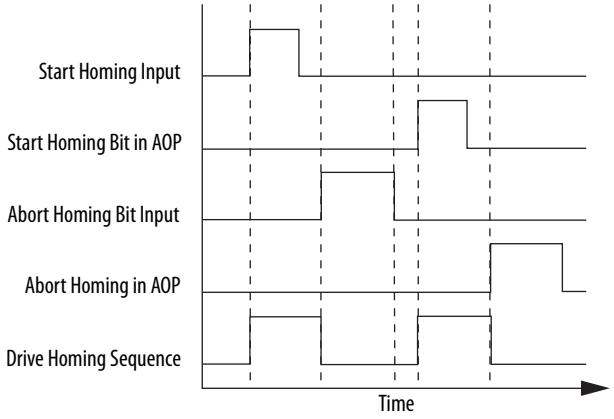
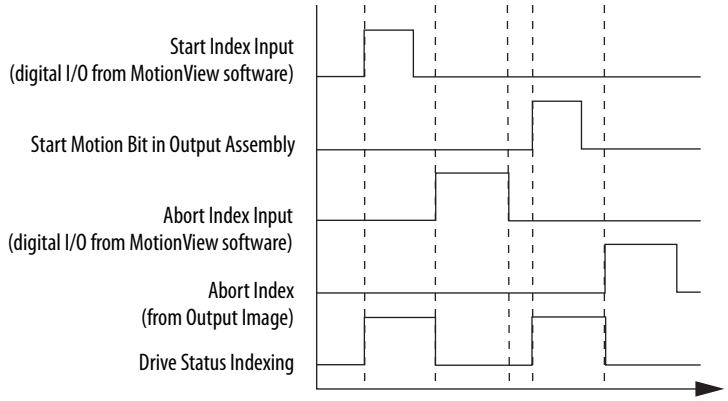


Table 13 - Homing Truth Table

Drive Input	Value					
Start Homing Input	—	—	Move to On	—	—	—
Start Homing bit in Output Assembly	—	—	—	Move to On	—	—
Abort Homing Input	On	—	Off	Off	Move to On	—
Abort Homing bit in Output Assembly	—	On	Off	Off	—	Move to On
Previous Drive State	Enabled	Enabled	Enabled	Enabled	Homing	Homing
Resulting Drive State	Will not home	Will not home	Starts homing	Starts homing	Aborts homing	Aborts homing

Figure 17 - Indexing Timing Diagram



TIP The drive must be enabled for homing and indexing mode.

Table 14 - Indexing Truth Table

Drive Input	Value					
Start Index Input	—	—	Move to On	—	—	—
Start Motion bit in Output Assembly	—	—	—	Move to On	—	—
Abort Index Input	On	—	Off	Off	Move to On	—
Abort Index bit in Output Assembly	—	On	Off	Off	—	Move to On
Previous Drive State	Enabled	Enabled	Enabled	Enabled	Indexing	Indexing
Resulting Drive State	Will not index	Will not index	Starts indexing	Starts indexing	Aborts indexing	Aborts Indexing

The digital inputs are optically isolated and sink up to 24V DC. Electrical details are shown in Table 15 on page 43. You can configure the inputs for PNP sourcing or NPN sinking.

Figure 18 - Sourcing of Digital Inputs

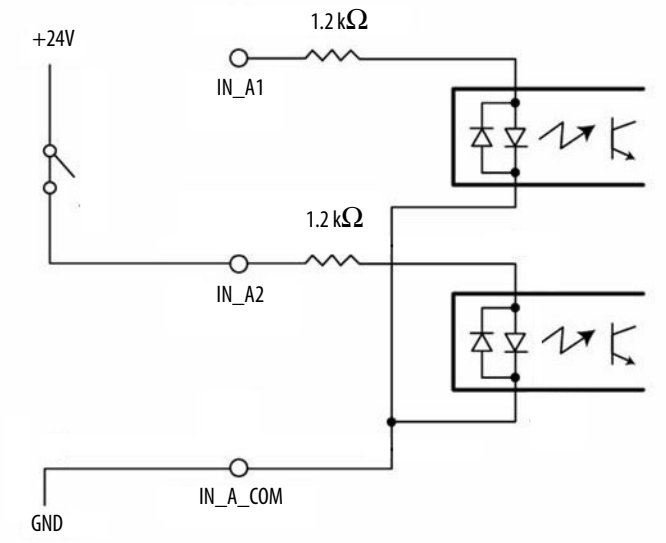


Figure 19 - Sinking of Digital Inputs

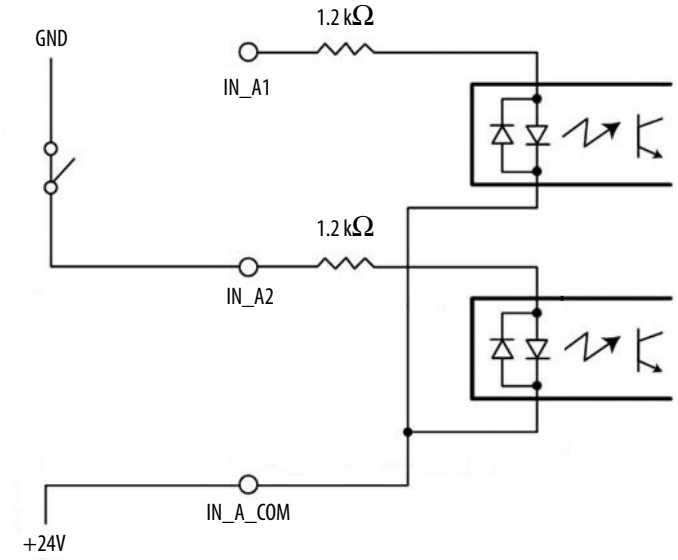


Table 15 - Digital Input Signal Specifications

Parameter	Value
Scan time	500 µs
Current, max	9 mA, typical
Input impedance	1.2 kΩ, typical
Voltage range	5…24V DC

Digital Outputs

There are five digital outputs, OUT1...OUT4 and RDY, available on the IOD connector. Outputs are optically isolated open collector/emitter and are fully isolated from the drive circuits. Each output, OUT1...OUT4, can be assigned to one of these functions:

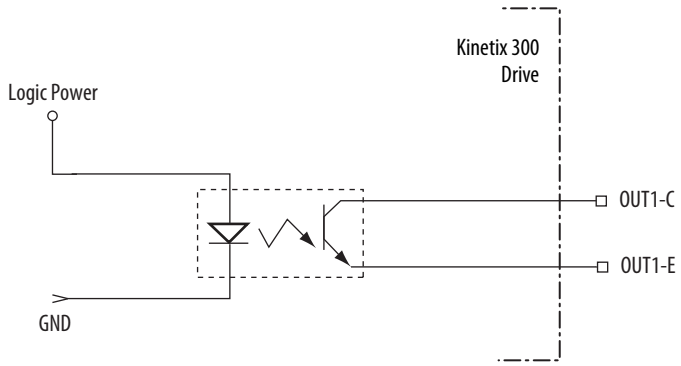
- Not assigned
- Zero speed
- In-speed window
- Current limit
- Runtime fault
- Ready
- Brake (motor brake release)

The Ready Output has a fixed function that becomes active when the drive is enabled and the output power transistors become energized.

Table 16 - Digital Output Signal Specifications

Parameter	Value
Scan time	500 µs
Current, max	100 mA
Voltage, max	30V DC

Figure 20 - Digital Output Circuit



Analog Reference Input

The analog reference input AIN1+ and AIN1- (IOD-24 and IOD-25) accepts up to a ±10V DC analog signal as shown in Table 17. The analog signal is converted to a digital value with 12-bit resolution (11 bit plus sign). The total reference voltage as seen by the drive is the voltage difference between AIN1+ and AIN1-. If used in Single-ended mode, one of the inputs must be connected to a voltage source while the other one must be connected to Analog Common (ACOM). If used in Differential mode, the voltage source is connected across AIN1+ and AIN1- and the driving circuit common, if available, is connected to the drive Analog Common (ACOM) terminal.

Table 17 - Analog Signal Input Specifications

Parameter	Value
Scan time	0.0625 ms
Current, max	Depend on load
Input impedance	47 kΩ, typical
Voltage range	-10…10V DC

Analog Output

The analog output (AO) on pin IOD-23 has a 10-bit resolution. The analog output is a single-ended signal and referenced to Analog Common (ACOM) that can be the following motor data:

- Not Assigned
- RMS Phase Current
- RMS Peak Current
- Motor Velocity
- Phase Current U
- Phase Current V
- Phase Current W
- Iq Current
- Id Current

IMPORTANT Output values can vary during powerup until the specified power supply voltage is reached.

MotionView software refers to Phase Current U, V, and W as R, S, and T respectively.

Figure 21 - Analog Output Circuit

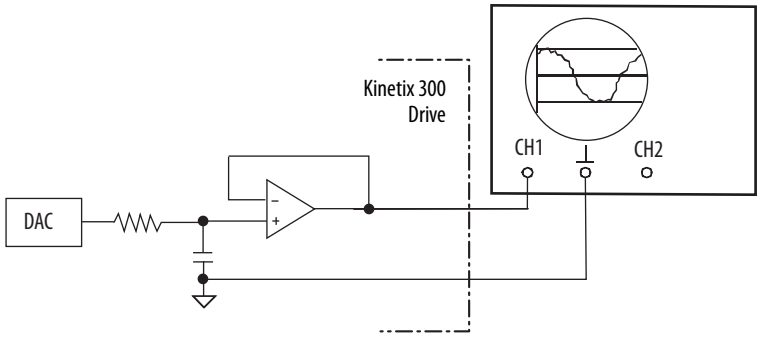


Table 18 - Analog Output Specifications

Parameter	Value
Scan time	0.0625 ms
Current, max	10 mA
Voltage range	-10…10V DC

For configuration/setup of the analog outputs, see Configure the Drive Parameters and System Variables beginning on page 147.

Master Gearing/Step and Direction Inputs

You can connect a master encoder with quadrature outputs to the Kinetix 300 drive and control position in the Master Gearing operating mode.

You can connect a step and direction signal pair to the Kinetix 300 drive and control position in the Step and Direction operating mode.

These inputs are optically isolated from the rest of the drive circuits and from each other. Both inputs can operate from any voltage source in the range of 5...24V DC and do not require extra series resistors for normal operation.

IMPORTANT Master gearing inputs must be incremental encoders with TTL outputs.

Figure 22 - Step and Direction Timing Diagram

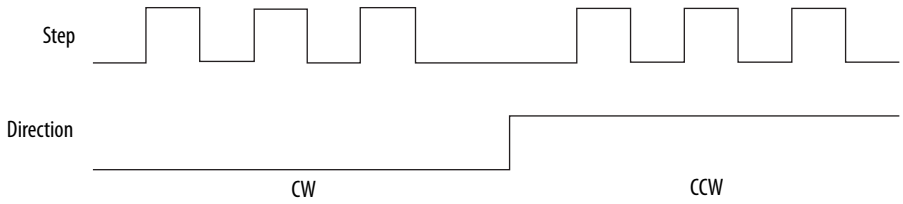


Figure 23 - Master Encoder Timing Diagram

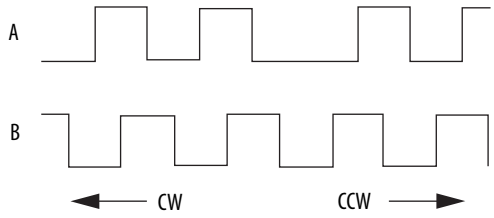
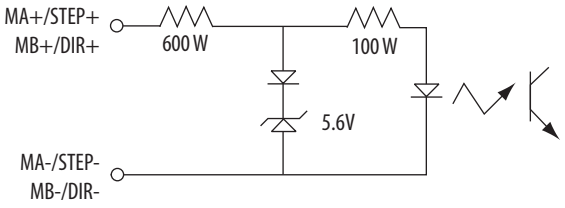


Table 19 - Input Type and Output Compatibility

Attribute	Value
Recommended voltage	5…24V DC
Input frequency, max	2 MHz
Pulse width (negative or positive)	500 ns
Input impedance	700 Ω

Figure 24 - Master Gearing/Step and Direction Input Circuit Diagram



Differential signal inputs are preferred when using master gearing/step and direction. When using differential signal inputs, sinking or sourcing outputs can be used. Single-ended inputs can be used but are not recommended. Sinking type outputs cannot be used if single-ended inputs are used. The function of the master gearing/step and direction inputs is software selectable. Use the MotionView software, General category, to choose the desirable function.

An external pulse-train signal (step) supplied by an external device, such as a PLC or stepper indexer, can control the speed and position of the servo motor. The frequency of the step signal controls the speed of the motor. The number of pulses that are supplied to the Kinetix 300 drive determines the position of the servo motor. Direction input controls direction of the motion.

Buffered Encoder Outputs

There are many applications where it is desired to close the feedback loop to an external device. This feature is accessible through the buffered encoder output connections (IOD-7...IOD-12) for TTL differential line encoder types. A master drive that powers a motor with a SICK-Stegmann high-resolution encoder generates buffered-encoder outputs for master gearing to a slave drive. However, a Tamagawa high-resolution encoder does not.

IMPORTANT The buffered encoder outputs are not supported with Tamagawa high-resolution motor feedback.

If a motor with encoder feedback is being used, the A+, A-, B+, B-, Z+, and Z- signals are passed directly through drive pins IOD-7...IOD-12 with no filtering, up to a speed of 2 MHz. The encoder pass through delay is approximately 100 ns.

Ethernet Connections

An RJ45 Ethernet connector (port 1) is provided on the Kinetix 300 drive.

Table 20 - Ethernet Communication Specifications

Attribute	Value
Communication	100BASE-TX, full-duplex
Cyclic update period	2 ms, min
Auto MDI/MDIX crossover detection/correction	Yes
Cable	CAT5E or CAT6, unshielded, or shielded, 100 m (328 ft)

24V DC Back-up Power

The Kinetix 300 drive can use an external power supply to power the logic and communication circuits. If an independent 24V (@ 1 A) power supply is connected to the BP connector, the logic and communication circuits remain active during a mains input-power loss.

Table 21 - 24V DC Back-up Power Specifications

Attribute	Value
Input voltage	20…26V DC
Current	500 mA
Inrush, max	30 A

Motor Feedback Specifications

The Kinetix 300 drive accepts motor feedback signals from the following types of encoders with these general specifications.

Table 22 - Motor Feedback General Specifications

Attribute	Motor Feedback
Feedback device support	• SICK-Stegmann Hiperface • Generic TTL Incremental • Tamagawa 17 bit Serial
Power supply voltage (EPWR5V)	5.13…5.67V
Power supply current (EPWR5V)	400 mA, max (1) (2)
Power supply voltage (EPWR9V)	8.3…9.9V
Power supply current (EPWR9V)	275 mA, max (2)(3)
Thermostat	Single-ended, under 500 Ω = no fault, over 10 kΩ = fault

(1) 400 mA on the 5V supply with no load on the 9V supply.
(2) 300 mA on the 5V supply with 150 mA on the 9V supply.
(3) 275 mA on the 9V supply with no load on the 5V supply.

TIP Auto-configuration is possible by using the Kinetix 300 drive MotionView OnBoard software for Allen-Bradley® motors.

Motor Feedback Specifications

The Kinetix 300 drives support multiple types of feedback devices by using the 15-pin (MF) motor feedback connector and by sharing connector pins in many cases.

Table 23 - Motor Feedback Signals by Device Type

MF Pin	SICK-Stegmann Hiperface	Generic TTL Incremental	Tamagawa 17 bit Serial
1	SIN+	AM+	—
2	SIN-	AM-	—
3	COS+	BM+	—
4	COS-	BM-	—
5	DATA+	IM+	DATA+
6	ECOM	ECOM	ECOM
7	EPWR9V	—	—
8	—	S3	—
9	—	—	—
10	DATA-	IM-	DATA-
11	TS	TS	—
12	—	S1	—
13	—	S2	—
14	—	EPWR5V	EPWR5V
15	—	—	—

Figure 25 is the motor-thermostat interface schematic. Although the thermostat signal is shown for all feedback types, some motors do not support this feature because it is not part of the feedback device.

Figure 25 - Motor Thermostat Interface

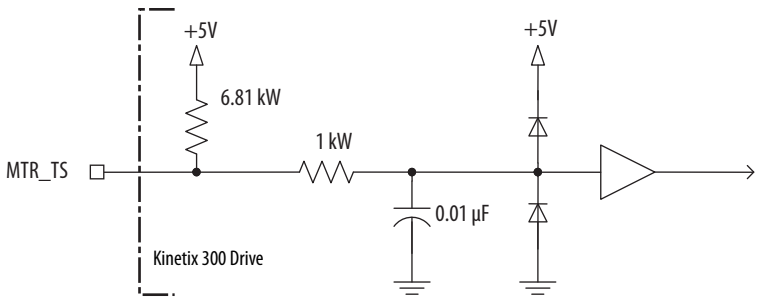


Table 24 - Motor Thermostat State Specifications

State	Resistance at TS
No Fault	500 Ω
Fault	10 kΩ

Table 25 - SICK-Stegmann Hiperface Specifications

Attribute	Value
Protocol	Hiperface
Memory support	Not programmed, or programmed with Allen-Bradley motor data
Hiperface data communication	RS-485, 9600 communication, 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, which is measured at the drive inputs
Line loss detection (AM/BM)	Average ($sin^2 + cos^2$) > constant

Figure 26 - SICK-Stegmann Hiperface Interface, SIN and COS Signals

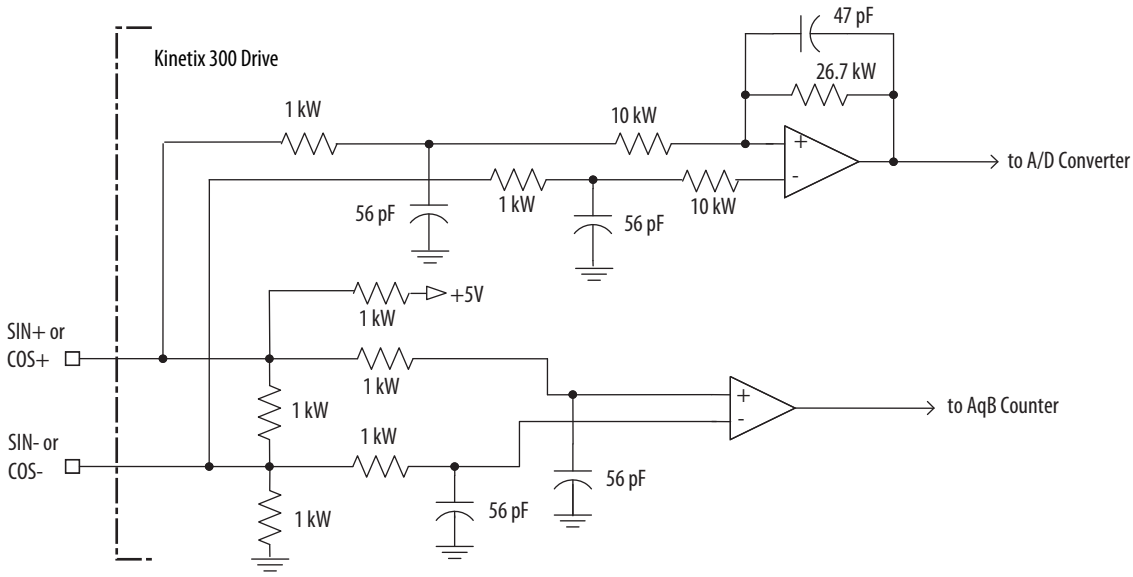


Figure 27 - SICK-Stegmann Hiperface Interface, DATA Signals

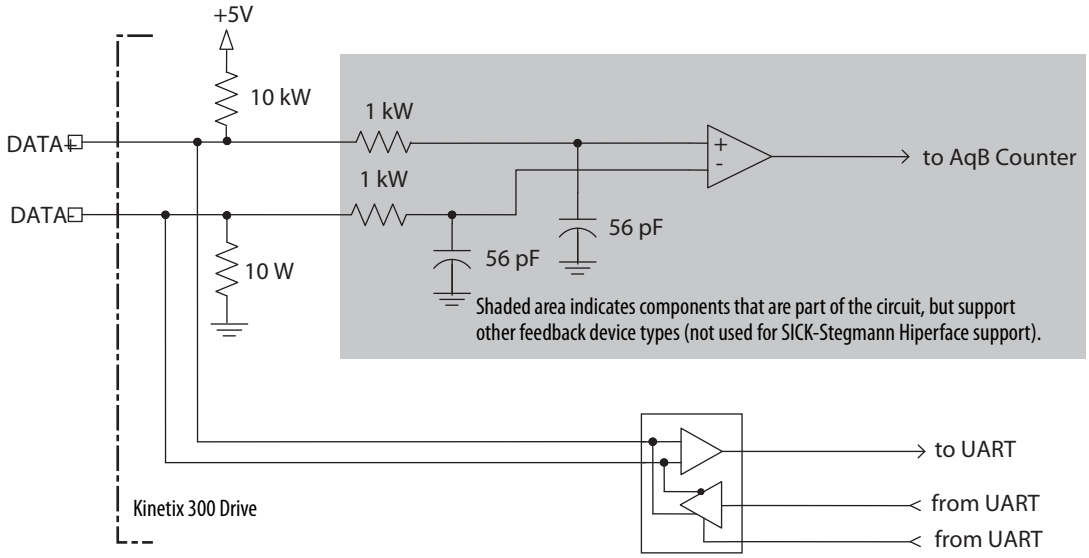


Table 26 - Generic TTL Incremental Specifications

Attribute	Value
TTL incremental encoder support	5V, differential A quad B
Quadrature interpolation	4 counts/square wave period
Differential input voltage (AM, BM, and IM)	1.0…7.0V
DC current draw (AM, BM, and IM)	30 mA, max
Input signal frequency (AM, BM, and IM)	5.0 MHz, max
Edge separation (AM and BM)	42 ns min, between any two edges
Line loss detection (AM and BM)	Average ($AM^2 + BM^2$) > constant
Hall inputs (S1, S2, and S3)	Single-ended, TTL, open collector, or none

Figure 28 - Generic TTL Incremental, AM and BM Signals

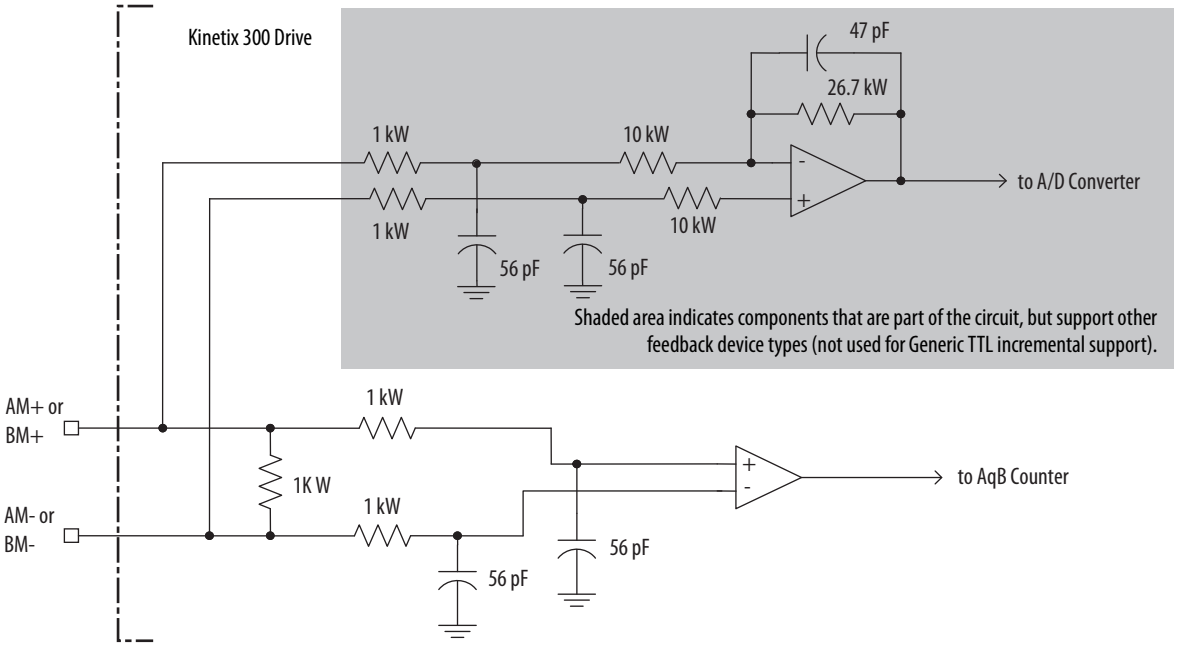


Figure 29 - Generic TTL Interface, IM Signals

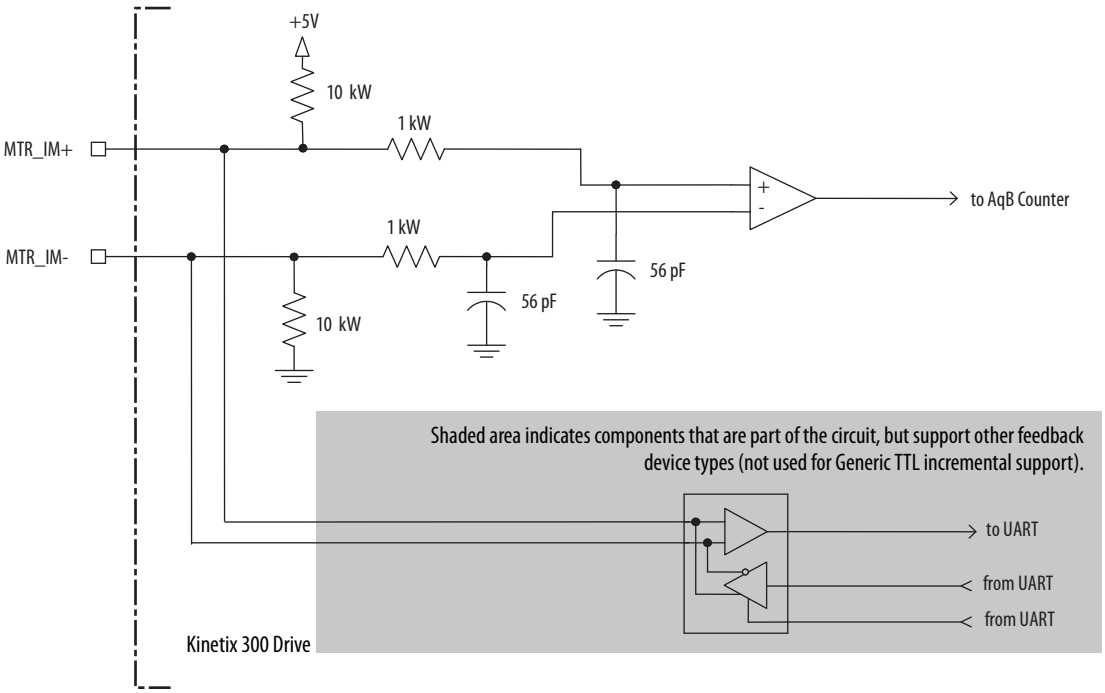


Figure 30 - Generic TTL Interface, S1, S2, or S3 Signals

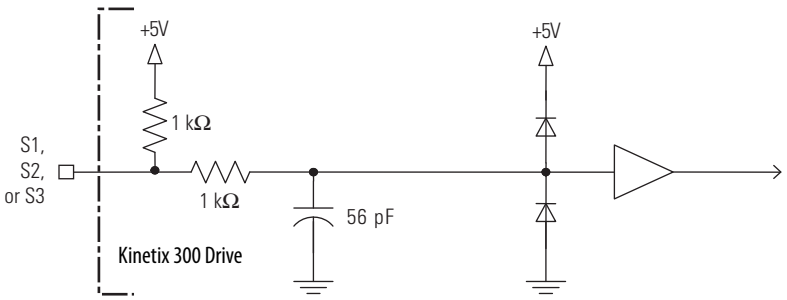


Table 27 - Tamagawa 17-bit Serial Specifications

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

See Figure 27 for the Tamagawa 17-bit serial interface schematic. It is identical to the SICK-Stegmann Hiperface (DATA) signals schematic.

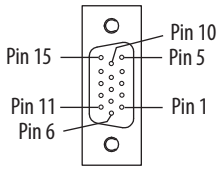
Feedback Power Supply

The Kinetix 300 drive generates +5V and +9V DC for motor feedback power. Short circuit protection and separate common mode filtering for each channel is included.

Table 28 - Motor Feedback Power Specifications

Supply	Reference	Voltage			Current mA	
		Min	Nominal	Max	Min	Max
+5V DC	EPWR_5V	5.13	5.4	5.67	0	400
+9V DC	EPWR_9V	8.3	9.1	9.9	0	275

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



Notes:

Connecting the Kinetix 300 Drive System

Basic Wiring Requirements

This section contains basic information on how to wire the Kinetix® 300 drive.

ATTENTION: Plan the installation of your system so that you can cut, drill, tap, and weld 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, mount and wiry the Bulletin 2097 drive before you apply power. Once power is applied, connector terminals can have voltage present even when not in use.

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

Build Your Own Cables

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

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

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

Route Power and Signal Wiring

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. Radiated noise can cause system faults and communication anomalies.

See Electrical Noise Reduction on page 24 for examples of routing high and low voltage cables in wireways. See the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, for more information.

Determine the Input Power Configuration

This section contains examples of typical single-phase and three-phase facility input power that is wired to single-phase and three-phase Kinetix 300 drives.

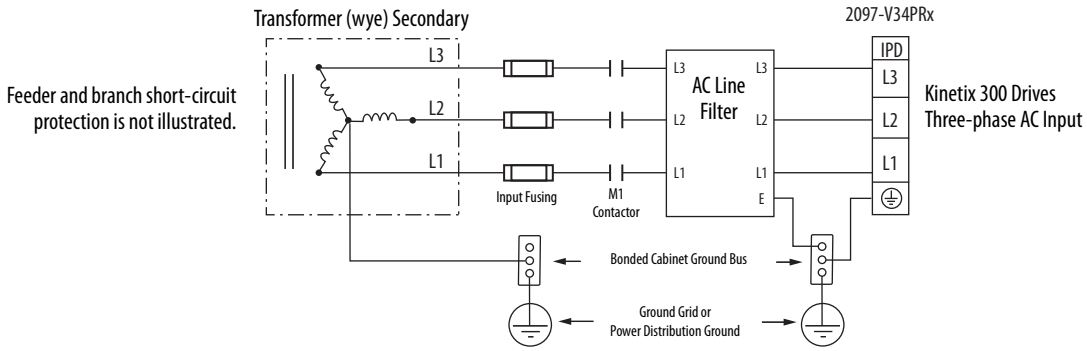
The grounded power configuration lets you ground your single-phase or three-phase power at a neutral point. Match your secondary to one of the examples and be certain to include the grounded neutral connection.

See Table 93 on page 226 on for more information on leakage current.

Three-phase Power Wired to Three-phase Drives

These examples illustrate grounded three-phase power that is wired to three-phase Kinetix 300 drives when phase-to-phase voltage is within drive specifications.

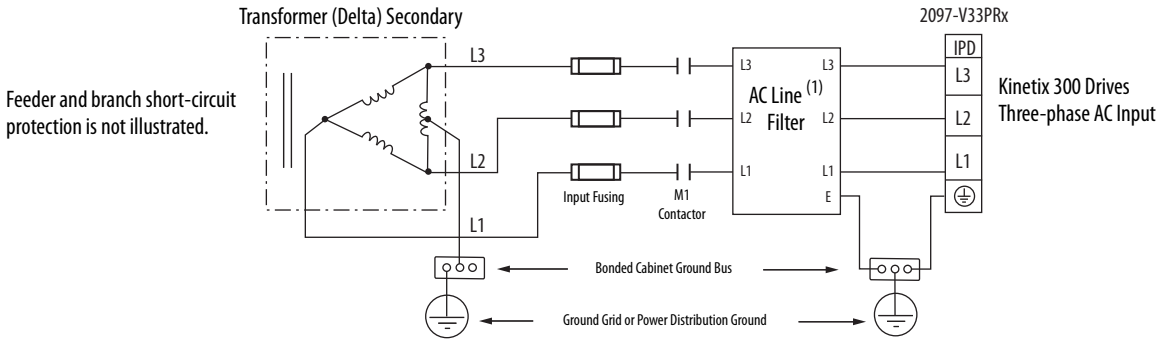
Figure 32 - Three-phase (400/480V) Power Configuration (wye secondary)



ATTENTION: For the 480V Kinetix 300 drives to meet proper voltage creepage and clearance requirements, each phase voltage to ground must be less than or equal to 300V AC rms. This means that the power system must use center grounded wye secondary configuration for 400/480V AC mains.

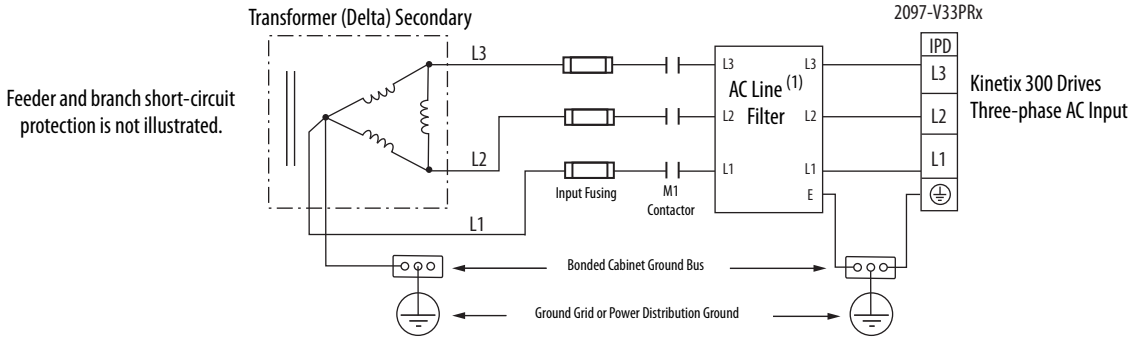
See Table 93 on page 226 for leakage currents.

Figure 33 - Three-phase (240V) Power Configuration (delta secondary)



(1) Leakage current from the line filter, in this configuration, typically is higher than a balanced (center ground) configuration.

Figure 34 - Three-phase (240V) Power Configuration (delta secondary)



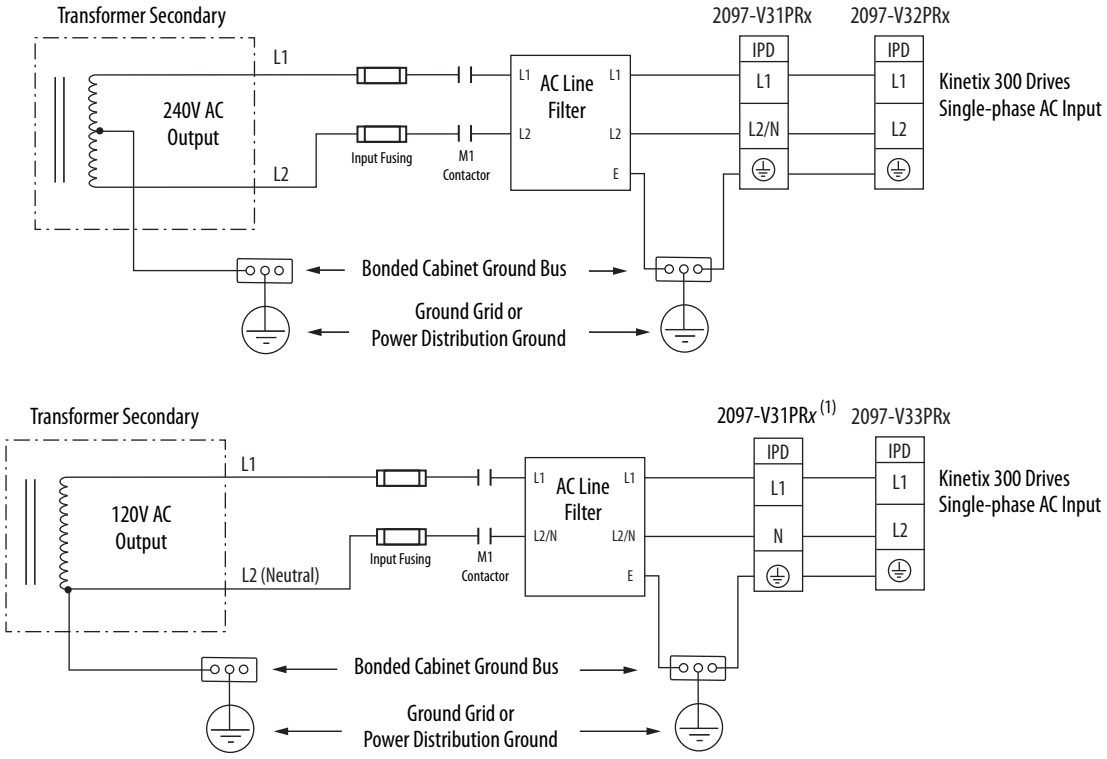
(1) Leakage current from the line filter, in this configuration, typically is higher than a balanced (center ground) configuration.

Single-phase Power Wired to Single-phase Drives

These examples illustrate grounded single-phase power that is wired to single-phase Kinetix 300 drives when phase-to-phase voltage is within drive specifications.

IMPORTANT The 2097-V32PRx models have integrated AC line filters and do not require the AC line filter that is shown in this diagram.

Figure 35 - Single-phase Grounded Power Configurations



(1) This configuration applies to voltage-doubler operation for 2097-V31PR*x* drives.

Reducing the transformer output reduces motor speed. Feeder and branch short-circuit protection is not illustrated.

Voltage Doubler Operation

You can wire the 2097-V31PR*x* drives with 120V input power and achieve twice the output voltage at half the output current, while maintaining the same output power. To use the voltage-doubler circuit, connect the 120V single-phase input power to the IPD-L1 and IPD-N terminals.

For Kinetix 300 drive power specifications, see Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003. For Kinetix 300 drive-input wiring diagrams, see Power Wiring Examples on page 177.

Isolation Transformer in Grounded Power Configurations

When using an isolation transformer, attach a chassis ground wire to the neutral connection. This grounded neutral connection does the following:

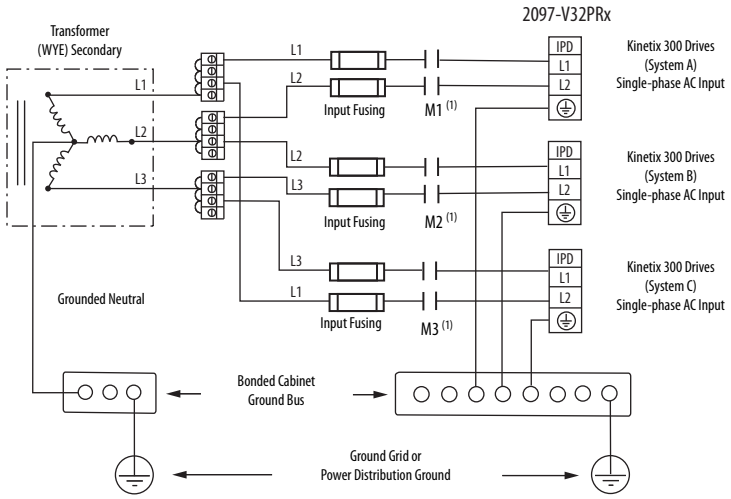
- Prevents the system from floating and avoids any high voltages that can otherwise occur, for example due to static electricity
- Provides a solid earth path for fault conditions

ATTENTION: If the supply transformer is an auto transformer (not recommended), a chassis earth ground must not be added. A chassis earth ground must already be included elsewhere in the system and if you add another it would create a short.

Three-phase Power Wired to Single-phase Drives

This example illustrates grounded three-phase power that is wired to single-phase Kinetix 300 drives when phase-to-phase voltage is within drive specifications.

Figure 36 - Single-phase Amplifiers on Three-phase Power (WYE)



(1) Contactors (MI, M2, and M3) can be optional. For more information, see Understanding the Machinery Directive, publication SHB-900. AC line filter is optional, but is required for CE compliance.

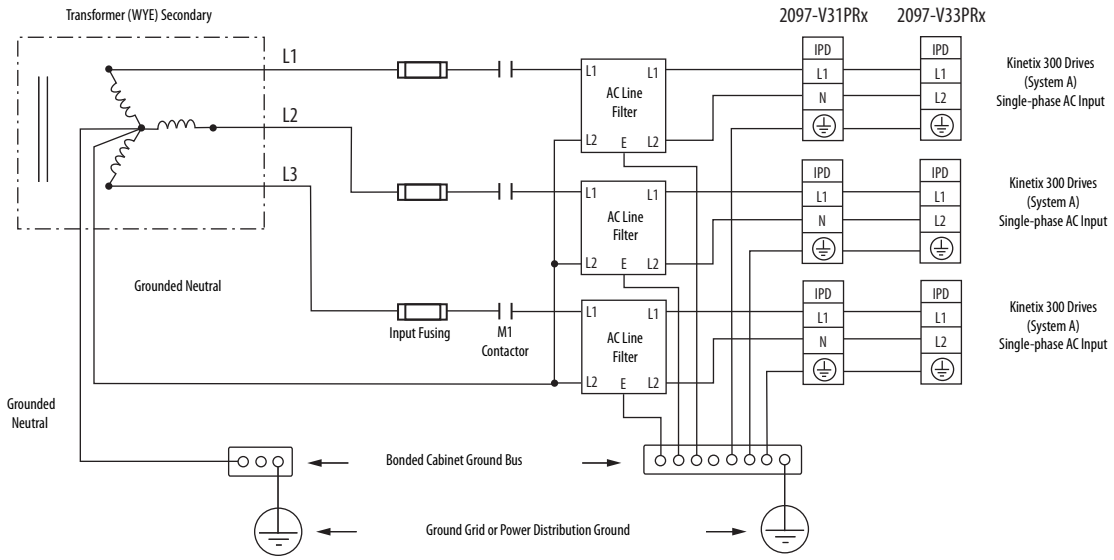
Feeder short-circuit protection is not illustrated.

This example illustrates grounded three-phase power that is wired to single-phase Kinetix 300 drives when phase-to-phase voltage exceeds drive specifications.

A neutral must be connected when single-phase drives are attached to a three-phase isolating transformer secondary. It is not necessary that all three-phases be loaded with drives, but each drive must have its power return via the neutral connection.

ATTENTION: Failure to connect the neutral can result in supply voltage swings at the individual drives. Voltage swings occur when the neutral point moves in a vectorial as a result of load variations that experienced by the individual drives. The supply voltage swing can cause undervoltage and overvoltage trips on the drives, and the drive can be damaged if the overvoltage limit is exceeded.

Figure 37 - Single-phase Amplifiers (one AC line filter per drive)



Feeder and branch short-circuit protection is not illustrated.

IMPORTANT An EMC line filter for each drive is the preferred configuration, and required for CE compliance.

If a three-phase line filter is used to feed multiple single-phase drives (not recommended), it is important that the filter is on a neutral connection as shown in Figure 37. The neutral connection applies if three-phase is brought directly into the filter and no isolating transformer is present.

Voiding of CE Compliance

The three-phase and neutral in-line filter applications that are described in Figure 37 cannot be adequate from an EMC aspect for CE compliance. Therefore, EMC validity and CE Mark by Rockwell Automation is voided when three-phase and neutral in line filters are used.

ATTENTION: The three-phase isolation transformer and neutral in-line filter applications that are described in this document have not been tested for EMC by Rockwell Automation and products that are used in such installations are not considered CE Marked by Rockwell Automation.

If this three-phase isolation transformer and neutral in-line filter application is used, the responsibility for EMC validation and CE Mark of the system lies with the user.

If CE compliance is a customer requirement, single-phase line filters, tested by Rockwell Automation, and specified for the product must be used. See Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003 for catalog numbers.

Ground Your Kinetix 300 Drive System

All equipment and components of a machine or process system must have a common earth ground point that is connected to their chassis. A grounded system provides a safety ground path for short circuit protection. Ground your modules and panels to minimize shock hazard to personnel and damage to equipment caused by short circuits, transient overvoltages, and accidental connection of energized conductors to the equipment chassis. For CE ground requirements, see CE Requirements on page 16.

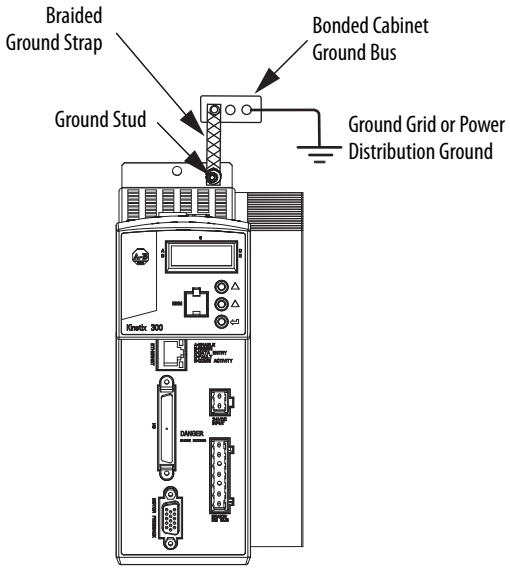
IMPORTANT To improve the bond between the Kinetix 300 drive and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

Ground Your Drive to the System Subpanel

ATTENTION: The National Electrical Code contains ground requirements, conventions, and definitions. Follow all applicable local codes and regulations to ground your system safely. See the illustration Figure 38 for details on how to ground your Kinetix 300 drive. See Appendix A on page 175 for the power wiring diagram for your Kinetix 300 drive.

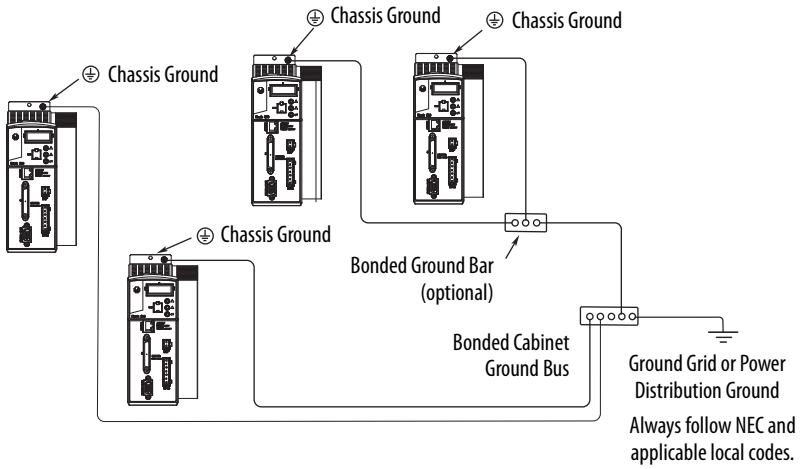
If the Kinetix 300 drive is mounted on a painted subpanel, ground the drive to a bonded cabinet ground bus by using a braided ground strap or 4.0 mm^2 (12 AWG) solid copper wire 100 mm (3.9 in.) long.

Figure 38 - Connect the Braided Ground Strap - Example



For drive dimensions, See Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003.

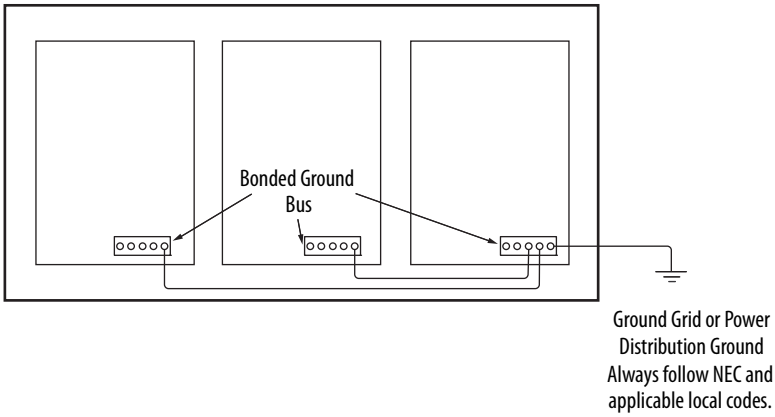
Figure 39 - Chassis Ground Configuration (multiple Kinetix 300 drives on one panel)



Ground Multiple Subpanels

To ground multiple subpanels, see Figure 40. HF bonding is not illustrated. For information, see Bonding Multiple Subpanels on page 26.

Figure 40 - Subpanels Connected to a Single Ground Point



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 improve safety and proper operation.

See Power Wiring Examples on page 177 for interconnect diagrams.

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

Table 29 - Kinetix 300 Drive-Power Wiring Requirements

Cat. No.	Description	Terminals				Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
		Pins	Signals					
2097-V31PR0 2097-V32PR0 2097-V32PR2 2097-V33PR1 2097-V33PR3 2097-V34PR3 2097-V34PR5 2097-V34PR6	Mains input power (IPD connector)		L3 L2 L1 PE (1)	L2/N L1 N PE (2)	L2 L1 PE (3)	2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V32PR4 2097-V33PR5						4.0 (12)	7 (0.28)	0.5 (4.5)
2097-V31PR2 2097-V33PR6						6.0 (10)	7 (0.28)	0.56…0.79 (5.0…7.0)
2097-V31PR0 2097-V31PR2 2097-V32PR0 2097-V32PR2 2097-V32PR4 2097-V33PR1 2097-V33PR3 2097-V33PR5 2097-V34PR3 2097-V34PR5 2097-V34PR6	Motor power (MP connector)		PE W V U			2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V33PR6						4.0 (12)	7 (0.28)	0.5 (4.5)
2097-V31PR0 2097-V31PR2 2097-V32PR0 2097-V32PR2 2097-V32PR4 2097-V33PR1 2097-V33PR3 2097-V33PR5 2097-V34PR3 2097-V34PR5 2097-V34PR6	Shunt /DC Bus (4) (BC connector)		+ + SH - -			2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V33PR6						4.0 (12)	7 (0.28)	0.5 (4.5)
2097-V3*x*PR*x*	Control back-up power (BP connector)		+24V DC -24V DC					
2097-V3*x*PR*x*	Safe Torque-off (STO connector)	STO-1 (5) STO-2 (5) STO-3 STO-4 STO-5 STO-6	+24V DC Control Control COM Safety Status Safety Input 1 Safety COM Safety Input 2			1.5 (16)	6 (0.25)	0.5 (4.5)

(1) Applies to 2097-V33PR*x*, and 2097-V34PR*x* drive modules.

(2) Applies to 2097-V31PR*x* drive modules.

(3) Applies to 2097-V32PR*x* drive modules.

(4) Use for shunt resistor connection only.

(5) Use for bypassing the STO circuit only.

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

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

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

Wiring Guidelines

Use these guidelines as a reference when wiring the connectors on your Kinetix 300 drive power modules.

IMPORTANT For connector locations of the Kinetix 300 drives, see Kinetix 300 Drive Connectors and Indicators on page 34.

When you tighten screws to secure the wires, see the tables beginning on page 65 for torque values.

When you remove insulation from wires, see the tables beginning on page 65 for strip lengths.

IMPORTANT To improve system performance, run wires and cables in the wireways as established in Establishing the Noise Zones on page 27.

Follow these steps when wiring the connectors on your Kinetix 300 drive 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 Kinetix 300 drive.
3. Insert wires into connector plugs.

   See connector pinout tables in Chapter 3 or the interconnect diagrams in Appendix A.
4. Tighten the connector screws.
5. Gently pull on each wire to make sure that 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 Kinetix 300 Drive Connectors

This section provides examples and wiring tables to assist you in while you make connections to the Kinetix 300 drive.

Wire the Safe Torque-off (STO) Connector

For the Safe Torque-off (STO) connector pinouts, feature descriptions, and wiring information, see Chapter 8 on page 163.

Wire the Back-up Power (BP) Connector

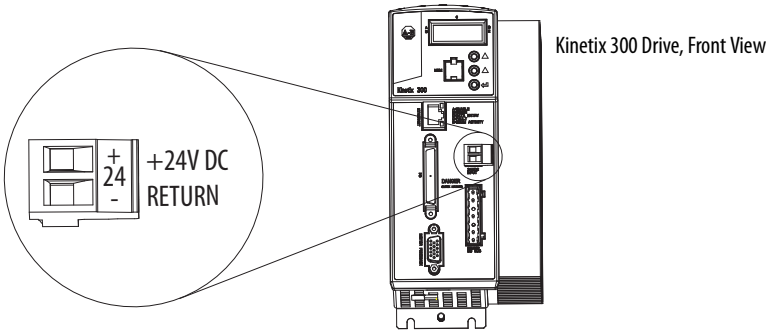


Table 30 - Back-up Power (BP) Connector

Drive Cat. No.	Terminals	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2097-V3*x*PR*x*	+24V DC	1.5 (16)	6 (0.25)	0.5 (4.5)
	-24V DC			

Wire the Input Power (IPD) Connector

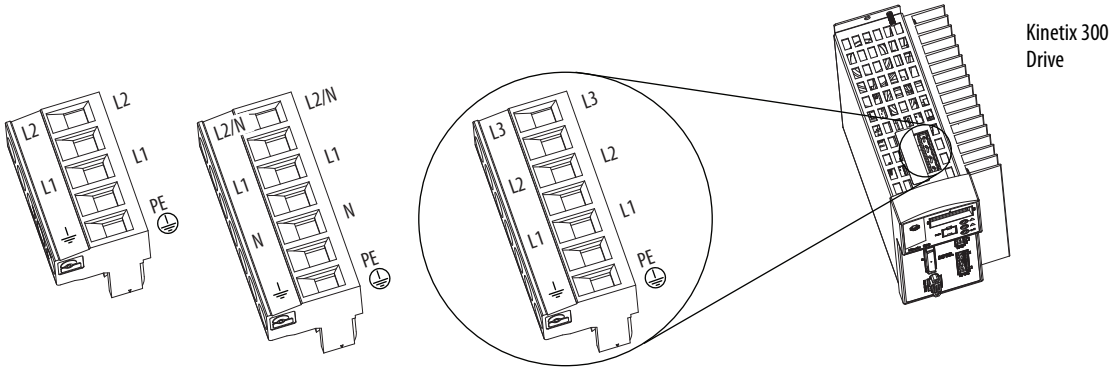


Table 31 - Input Power (IPD) Connector

Drive Cat. No.	Terminals			Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2097-V31PR0 2097-V32PR0 2097-V32PR2 2097-V33PR1 2097-V33PR3 2097-V34PR3 2097-V34PR5 2097-V34PR6	L3 L2 L1 PE (1)	L2/N L1 N PE (2)	L2 L1 PE (3)	2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V32PR4 2097-V33PR5				4.0 (12)	7 (0.28)	0.5 (4.5)
2097-V31PR2 2097-V33PR6				6.0 (10)	7 (0.28)	0.56…0.79 (5.0…7.0)

(1) Applies to 2097-V33PR*x*, and 2097-V34PR*x* drive modules.

(2) Applies to 2097-V31PR*x* drive modules.

(3) Applies to 2097-V32PR*x* drive modules.

Wire the Motor Power (MP) Connector

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

Figure 41 - Motor Power (MP) Connector

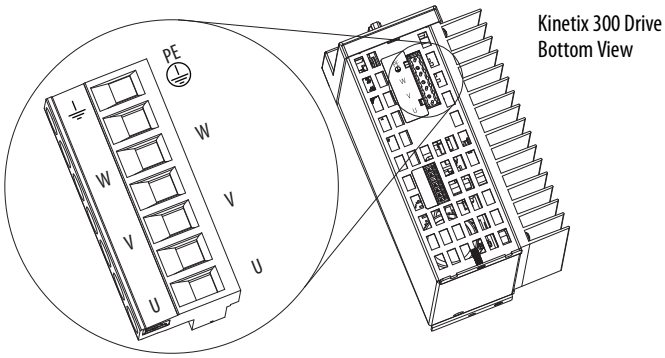


Table 32 - Motor Power (MP) Termination Specifications

Drive Cat. No.	Terminals	Recommended Wire Size mm^2 (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2097-V31PR0 2097-V31PR2 2097-V32PR0 2097-V32PR2 2097-V32PR4 2097-V33PR1 2097-V33PR3 2097-V33PR5 2097-V34PR3 2097-V34PR5 2097-V34PR6	PE W V U	2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V33PR6		4.0 (12)		

Cable Shield Terminations

Factory-supplied motor power cables for MP-Series™ and TL-Series™ motors and actuator are shielded. The braided cable shield must end near the drive during installation. Remove small portion of the cable jacket to expose the shield braid and clamp the exposed shield to the panel.

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

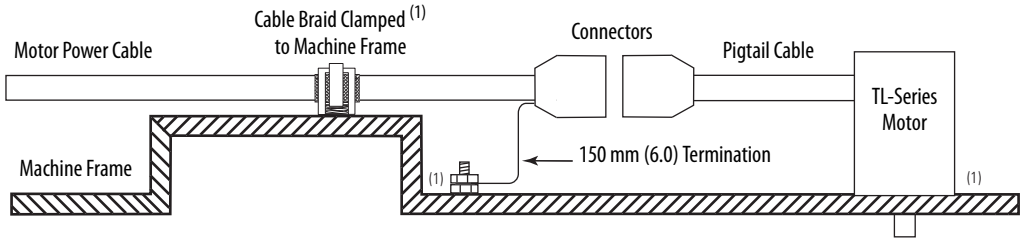
IMPORTANT For TL-Series motors, also connect the 152 mm (6.0 in.) termination wire to the closest earth ground.

See Pigtail Terminations on page 71 for more information.

Pigtail Terminations

TL-Series motors have a short pigtail cable that connects to the motor, but is not shielded. The preferred method for grounding the TL-Series power cable on the motor side is to expose a section of the cable shield and clamp it directly to the machine frame. The motor power cable also has a 150 mm (6.0 in.) shield termination wire with a ring lug that connects to the closest earth ground. Use this method and the cable clamp. The termination wire can be extended to the full length of the motor pigtail if necessary, but it is best to connect the supplied wire directly to ground without lengthening.

Figure 42 - Pigtail Terminations



(1) Remove paint from machine frame to be sure of proper HF-bond between machine frame and motor case, shield clamp, and ground stud.

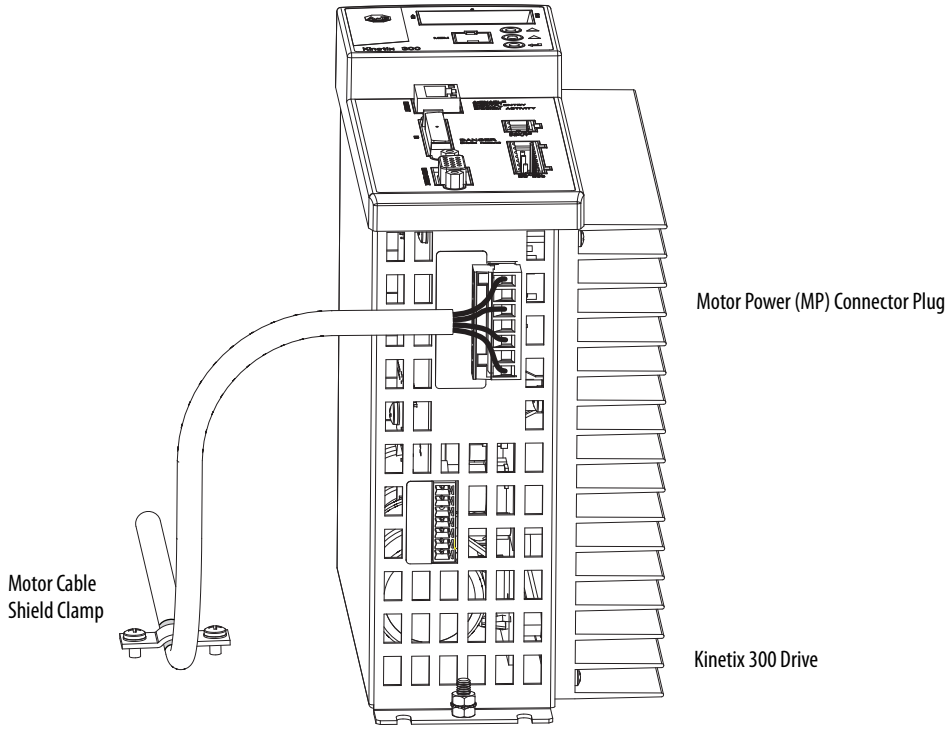
Table 33 - Motor-Power Cable Compatibility

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-A/B15*xxx*-4*x*AA and MPL-A/B2*xxx*-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-A/B*xxxx*		
MP-Series (Bulletin MPAS)		MPAS-A/B*xxxx*		
MP-Series (Bulletin MPAR)		MPAR-A/B1*xxx* and MPAR-A/B2*xxx* (Series A)		
MP-Series (Bulletin MPL)	Circular (Speedtec) DIN	MPL-A/B15*xxx*-7*x*AA, MPL-A/B2*xxx*-7*x*AA, MPL-A/B3*xxx*-7*x*AA, MPL-A/B4*xxx*-7*x*AA, and MPL-A/B45*xxx*-7*x*AA	2090-CPBM7DF-xxAAxx (standard) or 2090-CPBM7DF-xxAFxx (continuous-flex)	2090-CPWM7DF-xxAAxx (standard) or 2090-CPWM7DF-xxAFxx (continuous-flex)
MP-Series (Bulletin MPM)		MPM-A/B*xxxx*		
MP-Series (Bulletin MPF)		MPF-A/B*xxxx*		
MP-Series (Bulletin MPAR)		MPAR-A/B3*xxx*, MPAR-A/B1xxx and MPAR-A/B2xxx (series B)		
MP-Series (Bulletin MPAI)		MPAI-A/B3*xxxx*		
LDC-Series™		LDC-C*xxxx*		
LDL-Series™		LDL-*xxxxxxx*		
LDAT-Series		LDAT-S*xxxxxxxx*		
TL-Series (Bulletin TLY)	Circular Plastic	TLY-A*xxxx*	2090-CPBM6DF-16AA*xx* (standard)	2090-CPWM6DF-16AA*xx* (standard)
TL-Series (Bulletin TLAR)		TLAR-A*xxxx*		

This diagram shows an example of three-phase power wires for motors/actuators that have no brakes. Thermal switch wires are included in the feedback cable.

See Kinetix 300 Drive/Rotary Motor Wiring Examples beginning on page 180 for interconnect diagrams.

Figure 43 - Motor Power Terminations (three-phase wires only)

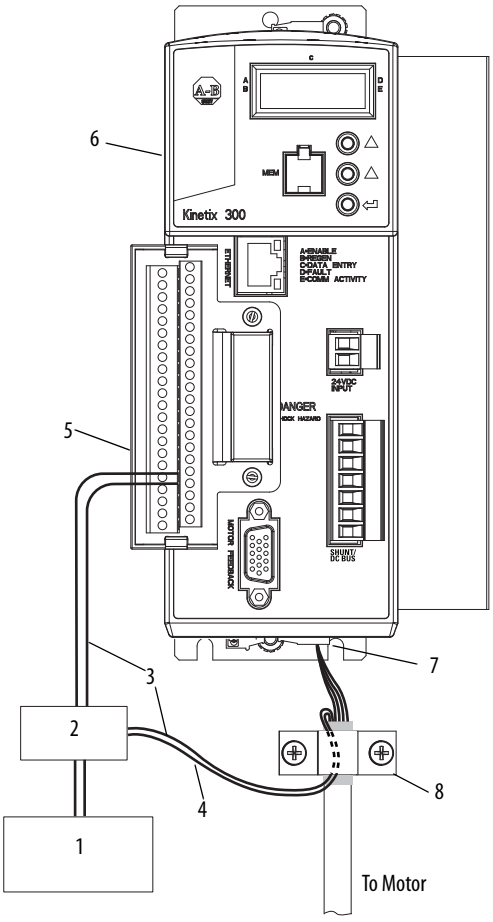


The cable shield clamp that is shown in Figure 43 is mounted to the subpanel. Ground and secure the motor power cable in your system following instructions on page 75.

This diagram shows an example of wiring with three-phase power wires and brake wires. The brake wires have a shield braid (shown in Figure 44 as gray) that folds back under the cable clamp before the conductors are attached to the motor brake circuit. Thermal switch wires are included in the feedback cable.

See Kinetix 300 Drive/Rotary Motor Wiring Examples beginning on page 180 for interconnect diagrams.

Figure 44 - Motor Power Terminations (three-phase and brake wires)



Item	Description
1 (1)	24V power supply
2 (1)	Relay and diode assembly (3)
3	Minimize unshielded wires in brake circuit
4	MP-Series cable brake wires

Item	Description
5	I/O (IOD) connector (2)
6	2097-V3*x*PR*x* Kinetix 300 drive
7	Motor power (MP) connector
8	Cable clamp (4)

(1) User supplied. Size as required by motor brake, See Motor Brake Currents on page 189.

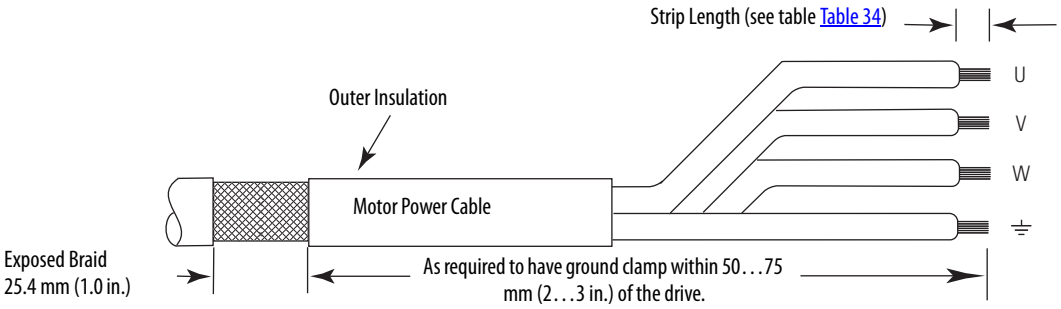
(2) Configure one emitter and collector pair from the Digital Outputs, OUT-1… OUT-4, pins 43…50, as Brake+ and Brake - by using MotionView software. Wire the output as sourcing and set brake engage and disengage times for motor selected. Motor brake is active on enable. For Digital Output specifications, see page 44

(3) Diode 1N4004 rated 1.0 A @ 400V DC. See Interconnect Diagram Notes beginning on page 176.

(4) Exposed shield under clamp and place within 50…75 mm (2…3 in.) of drive, see page 75 for details.

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 45 - Cable Shield and Lead Preparation



See Shunt-Resistor Wiring Example beginning on page 179 for interconnect diagrams.

Table 34 - Motor Power (MP) Connector

MP-Series or TL-Series Servo Motor	Terminal
U / Brown	U
V / Black	V
W / Blue	W
⏚ Green/Yellow	⏚

Table 35 - Motor Power (MP) Termination Specifications

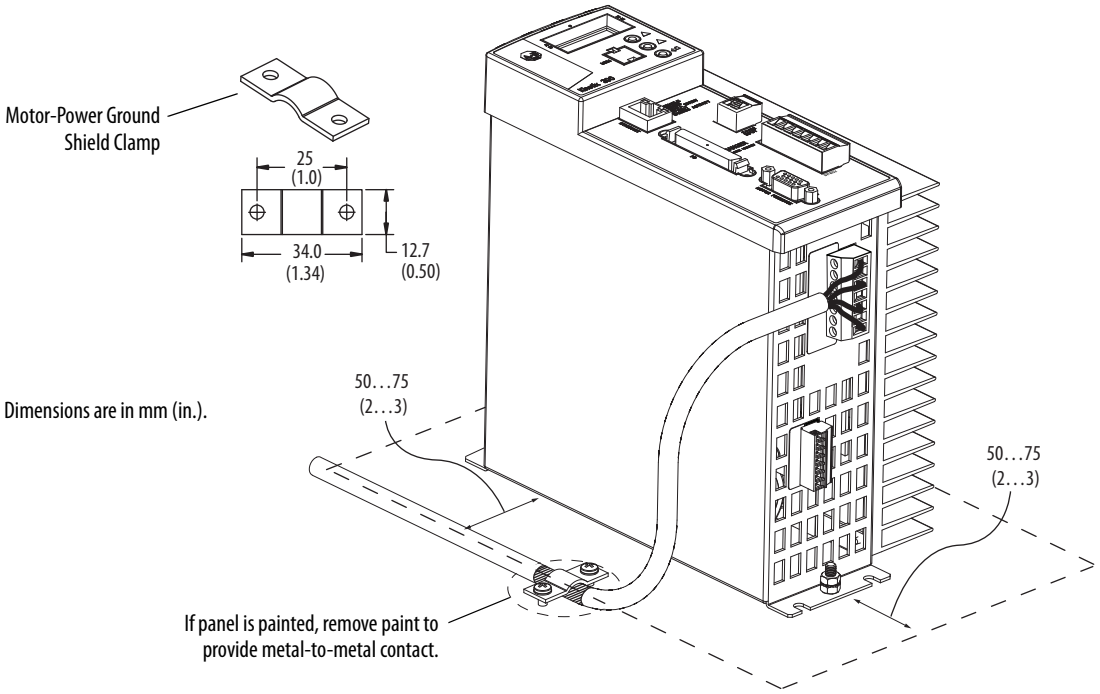
Drive Cat. No.	Terminals	Recommended Wire Size mm² (AWG)	Strip Length mm (in.)	Torque Value N•m (lb•in)
2097-V31PR0 2097-V31PR2 2097-V32PR0 2097-V32PR2 2097-V32PR4 2097-V33PR1 2097-V33PR3 2097-V33PR5 2097-V34PR3 2097-V34PR5 2097-V34PR6	PE W V U	2.5 (14)	7 (0.28)	0.5 (4.5)
2097-V33PR6		4.0 (12)		

Apply the Motor-Cable Shield Clamp

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

Follow these steps to apply the motor-cable shield clamp.

1. Locate a suitable position to install cable shield clamp within 50...75 mm (2...3 in.) of the drive.



2. Lay out and drill holes for cable clamp.

ATTENTION: Plan the installation of your system so that you can cut, drill, tap, and weld 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.

3. Locate the position on the motor power cable that comes under the clamp and remove about an inch of the cable jacket to expose the shield braid.
4. Position the exposed portion of the cable braid directly in line with the clamp.
5. Clamp the exposed shield to the panel by using the clamp and 2 #6-32 x 1 screws provided.
6. Repeat step 1...step 5 for each Kinetix 300 drive you are installing.

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 36 - Options for Connecting Motor Feedback and I/O

Connection Option	Cat. No.	Cable	Using This Type of Cable
Premolded connectors	N/A	Motor feedback	See Table 37 for the premolded motor feedback cable available for your motor.
Low Profile connector	2090-K2CK-D15M	Motor feedback	See Table 37 for the flying-lead cable available for your motor.
I/O Terminal Block	2097-TB1	I/O interface for Master Gearing mode	User-supplied flying-lead cable.

Table 37 - Motor Feedback Cables for Specific Motor/Feedback Combinations

Motor Cat. No.	Connector Type	Feedback Type	Feedback Cable		Pinout
			Premolded	Flying-lead	
MPL-A/B15*xxx*-H*x*4*x*AA, MPL-A/B2*xxx*-H*x*4*x*AA	Circular (threaded) DIN	Incremental encoder	N/A	2090-XXNFMF-S*xx* (standard) 2090-CFBM4DF-CDAF*xx* (continuous-flex)	page 77
MPL-A/B15*xxx*-V/E*x*4*x*AA, MPL-A/B2*xxx*-V/E*x*4*x*AA		High-resolution encoder			
MPAR-A/B3*xxxx* MPAR-A/B1*xxxx* and MPAR-A/B2*xxxx* (series A)					
MPAI-A/B*xxxx*					
MPS-A/B*xxxx*-M/S					
MPAS-A/B*xxxx*-V/A					
MPL-A/B15*xxx*-V/E*x*7*x*AA, MPL-A/B2*xxx*-V/E*x*7*x*AA	Circular (Speedtec) DIN			2090-XXNFMF-S*xx* (standard) 2090-CFBM7DF-CDAF*xx* (continuous-flex)	
MPL-A/B15*xxx*-H*x*7*x*AA, MPL-A/B2*xxx*-H*x*7*x*AA		Incremental encoder			
MPL-A/B3*xxx*-H*x*7*x*AA, MPL-A/B4*xxx*-H*x*7*x*AA, MPL-A/B45*xxx*-H*x*7*x*AA LDAT-S*xxxxxx*B*x*					
MPL-A/B3*xxx*-M/S*x*7*x*AA, MPL-A/B4*xxx*-M/S*x*7*x*AA, MPL-A/B45*xxx*-M/S*x*7*x*AA		High-resolution encoder			
MPM-A/B*xxxxx*-M/S					
MPF-A/B*xxxx*-M/S					
MPAR-A/B1*xxxx* and MPAR-A/B2*xxxx* (series B)					
LDAT-S*xxxxxx*-*x*D*x*		Absolute Linear Encoder Feedback		2090-CFBM7DF-CEAA*xx* or 2090-CFBM7DD-CEAA*xx* (standard, non-flex) 2090-CFBM7DF-CEAF*xx* 2090-CFBM7DD-CEAF*xx* (continuous-flex)	
TLY-A*xxxx*-B	Circular Plastic	High-resolution encoder		2090-CFBM6DF-CBAA*xx* (standard)	page 77
TLAR-A*xxxxx*					
TLY-A*xxxx*-H		Incremental encoder	2090-CFBM6DD-CCAA*xx*		

Flying-lead Feedback Cable Pinouts

Table 38 - 2090-XXNFMF-S*xx* or 2090-CFBM*x*DF-CDAF*xx* Feedback Cable

Connector Pin	High-resolution Feedback		Incremental Feedback	Drive MF Connector Pin
	9V Encoder	5V Encoder	5V Encoder	
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
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

Table 39 - 2090-CFBM6DF-CBAA*xx* Feedback Cable

Connector Pin	High Resolution	Incremental Feedback	Drive MF Connector Pin
	TLY-A*xxxx*-B TLAR-A*xxxxx*	TLY-A*xxxx*-H	
6	BAT+	Reserved	BAT+
9	Reserved	AM+	1
10		AM-	2
11		BM+	3
12		BM-	4
13	DATA+	IM+	5
14	DATA-	IM-	10
15	Reserved	S1	12
17		S2	13
19		S3	8
22	EPWR 5V	EPWR 5V	14
23	ECOM and BAT-	ECOM	6
24	Shield	Shield	Connector housing

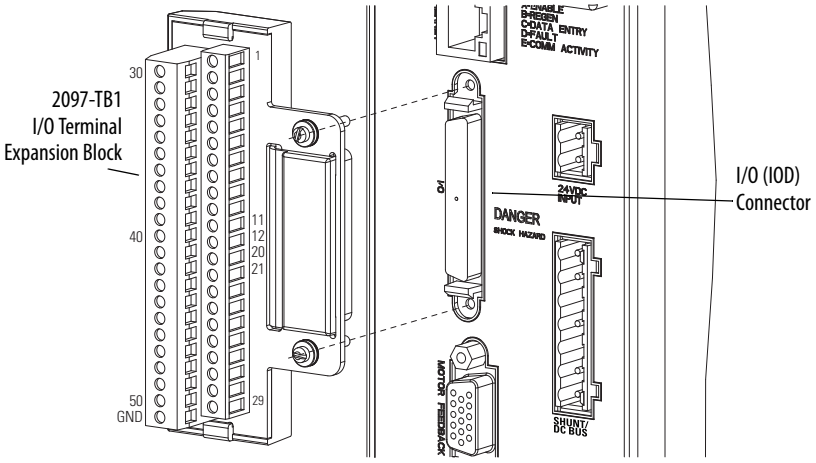
Wiring the Feedback and I/O Connectors

These procedures assume that you have mounted your Kinetix 300 system, completed the power wiring, and are ready to connect motor feedback.

Wire the I/O Connector

Connect your I/O wires to the IOD connector by using the 2097-TB1 I/O Terminal Expansion Block. See the Kinetix 300 I/O Terminal Expansion Block Installation Instructions, publication 2097-IN005.

Figure 46 - Kinetix 300 Drive (IOD connector and terminal block)



Wire the Low Profile Connector Kit

The 2090-K2CK-D15M Low Profile connector kit is suitable for ending flying-lead motor feedback cables. Use it with the Kinetix 300 drive and all motors with incremental or high-resolution feedback. It has a 15-pin, male, D-sub connector and is compatible with all Bulletin 2090 feedback cables.

TLY-A*xxxx*-B rotary motors and TLAR-A*xxxxx* electric cylinders also require the 2090-DA-BAT2 battery to back up the high-resolution encoder.

Figure 47 - Kinetix 300 Drive (MF connector)

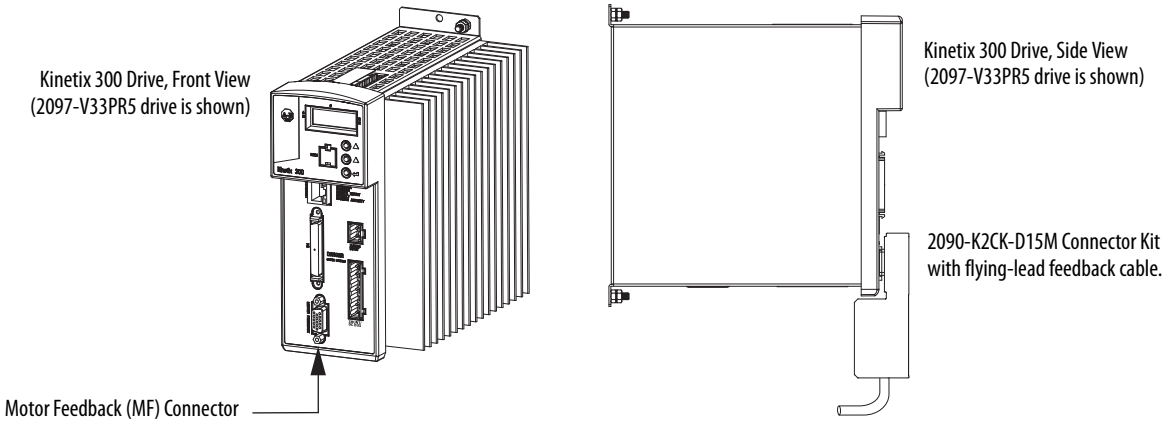
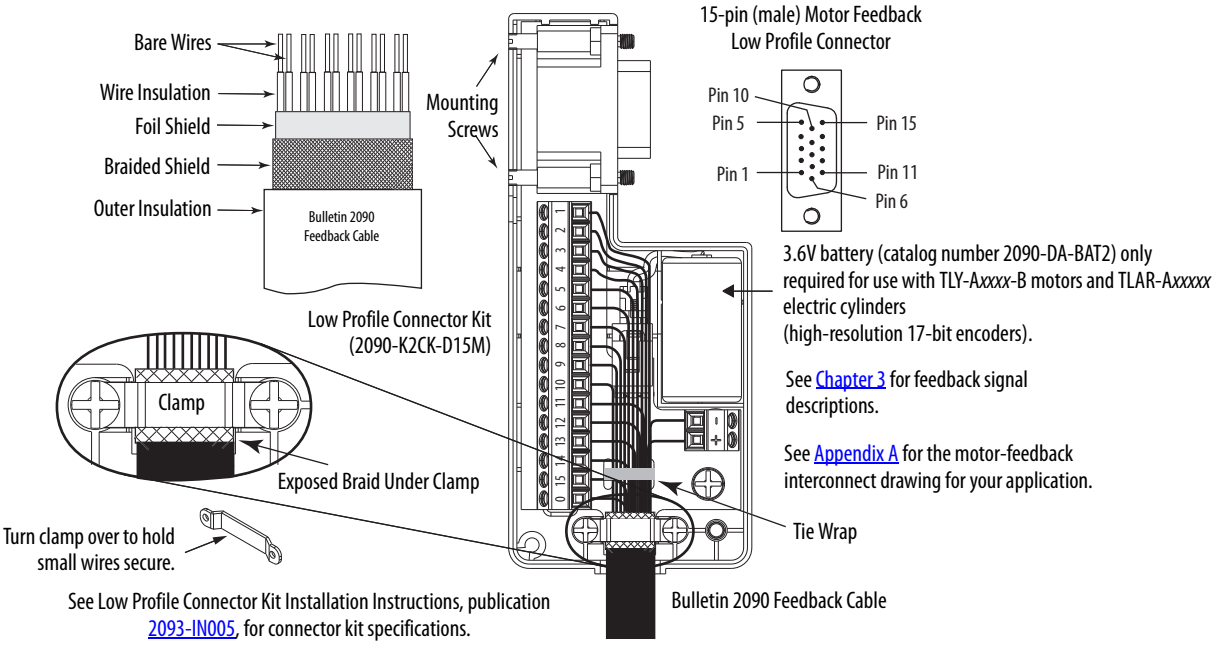


Figure 48 - Wiring (15-pin) Flying-lead Feedback Cable Connections 2090-K2CK-D15M Connector Kit



Shunt Resistor Connections

Follow these guidelines when wiring your 2097-R*x* shunt resistor.

IMPORTANT When you tighten screws to secure the wires, see the tables beginning on page 65 for torque values.

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

- See Shunt Resistors on page 30 for noise zone considerations.
- See Shunt-Resistor Wiring Example on page 179.
- See the installation instructions that are provided with your Bulletin 2097 shunt resistor, publication 2097-IN002.

Figure 49 - Shunt/DC Bus (BC) Connector

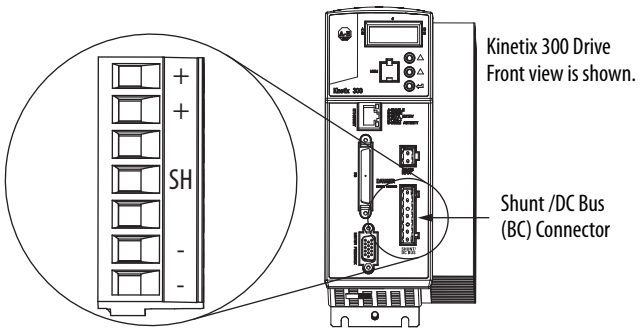


Table 40 - Shunt-Resistor Power Wiring Requirements

Accessory	Description	Connects to Terminals	Recommended Wire Size mm^2 (AWG)	Torque Value N•m (lb•in)
2097-R*x*	Shunt Resistor	+	2.5 (14)	0.5 (4.5)
		SH		

Ethernet Cable Connections

This procedure assumes that you have your Logix EtherNet/IP module and Kinetix 300 drive that is mounted and ready to connect the network cables.

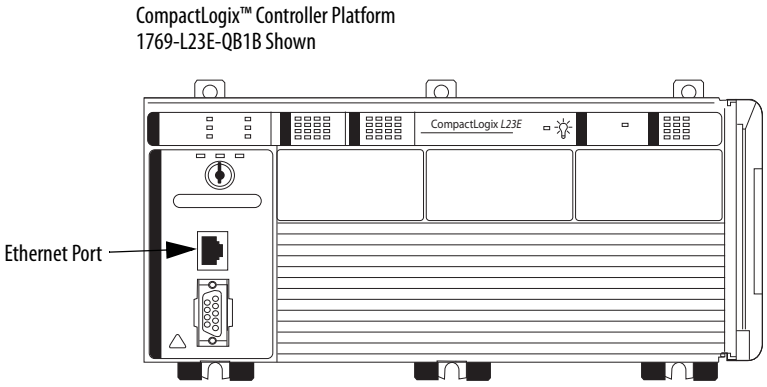
The EtherNet/IP network is connected by using the Port 1 connector. See page 34 to locate the Ethernet connector on your Kinetix 300 drive. See the figure below to locate the connector on your Logix communication module.

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 use the following equation for calculating maximum length:

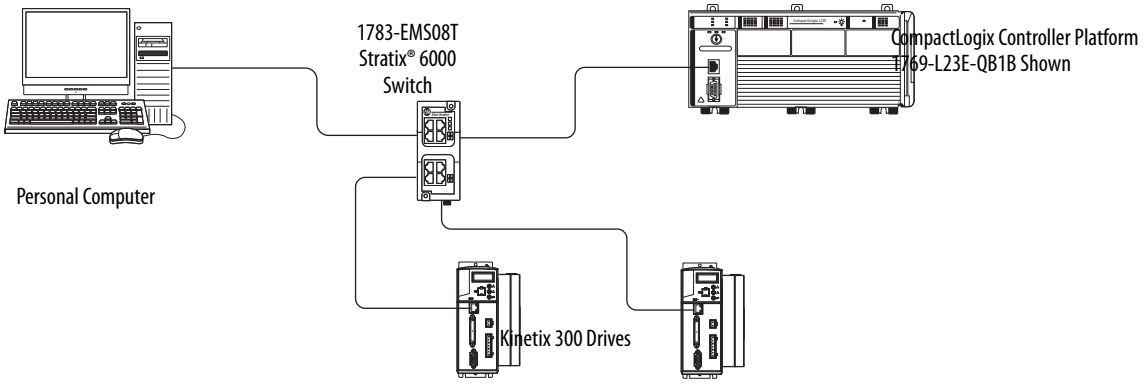
Maximum Length = (113-2N)/y, meters
where N = the number of connections in the channel
and y = the loss factor that is compared to fixed cable (typically 1.2...1.5).

Figure 50 - CompactLogix Ethernet Port Location



The Port 1 Ethernet connection is used for connecting to a web browser and configuring your Logix module.

Figure 51 - Ethernet Wiring Example - External Switch



Notes:

MotionView Software Configuration

Drive Organizer and Identification

On the left side of MotionView software is the Drive Organizer. The Drive Organizer displays the node address for the drives that are currently connected to the software and lists the categories for each drive under the drive node address. This section contains a description of the parameters that are displayed in each category that is listed in the Drive Organizer.

Drive Identification displays the drive IP address and status. The dialog box displays drive identification information such as catalog number and firmware version. In this window, you can assign the Drive Name and the Group ID.

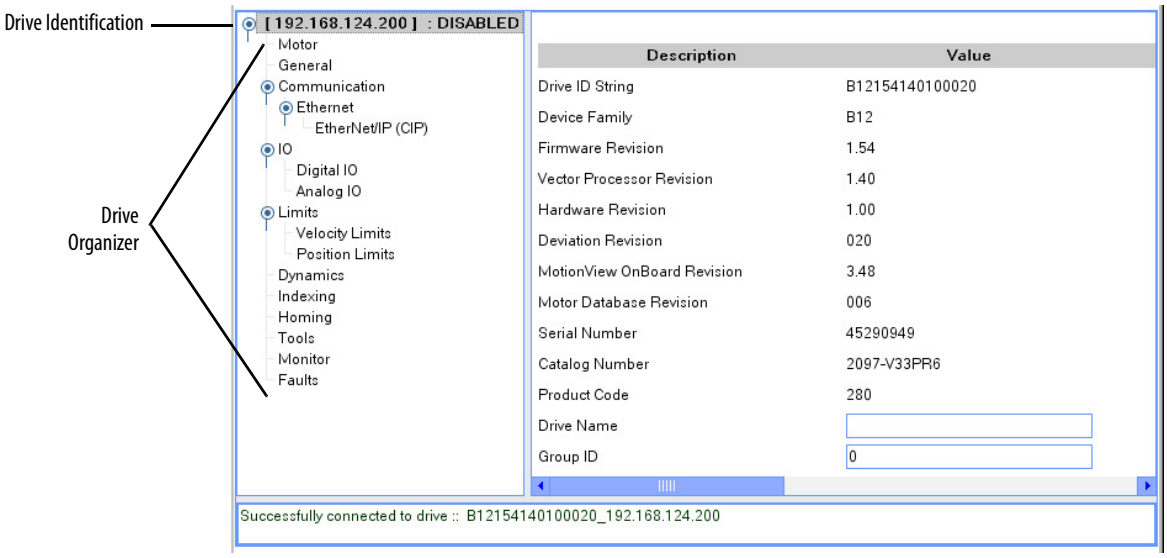
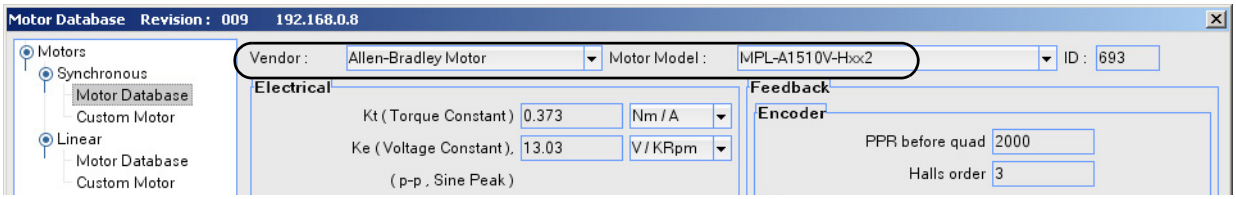


Table 41 - Drive Identification Category

ID	Parameter Name	Description	Value/Notes
1	Drive ID String	Drive identification string	B12 (Device Family) 154 (Firmware Revision) 140 (Vector Processor Revision) 100 (Hardware Revision) 020 (Deviation Revision)
2	Drive Name	Drive symbolic name	Up to 20 user-defined characters
3	Serial Number	Drive serial number	Unique number that is assigned to drive at the factory
57	Group ID	Network group ID. Allows the assignment of different drives into logical groups.	Range: 1…32767
N/A	Motor Database Revision	The motor database resides in the drive firmware.	006 in this example

Motor Category

Allen-Bradley® motors and actuators with intelligent feedback devices are automatically populated into the motor configuration. In this example, the MPL-A1510V-H*xx*2 servo motor is attached to the drive.



Synchronous Motor Database

For Allen-Bradley synchronous motors and actuators with incremental encoders, click Change Motor and choose the device from the Synchronous>Motor Database. In this example, the MPL-A1510V-H*xx*2 motor is configured.

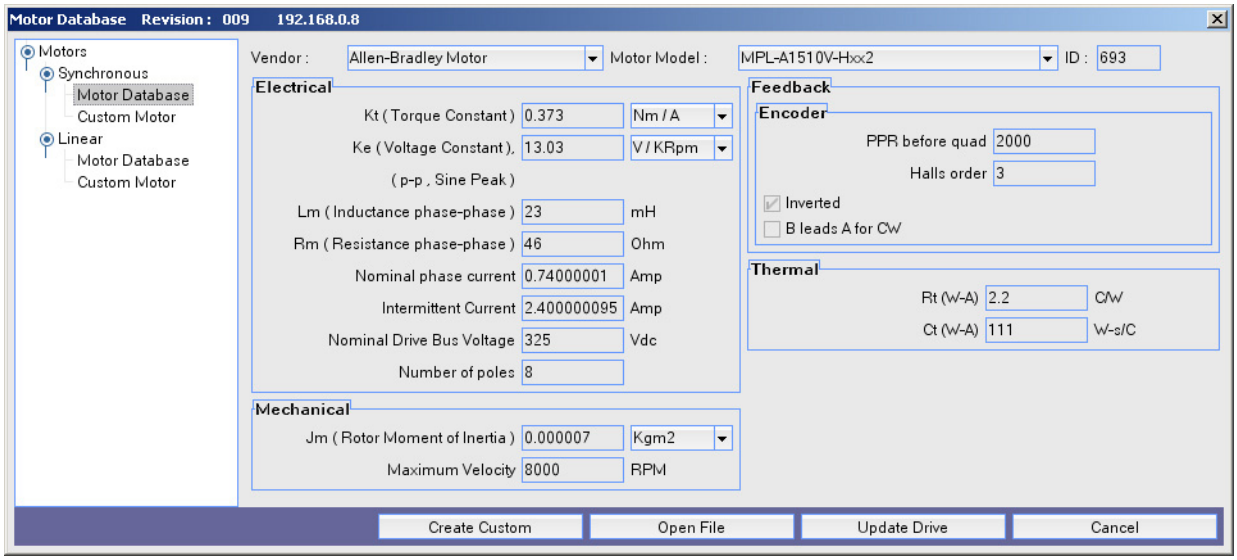


Table 42 - Motor Category

ID	Parameter Name	Description	Value/Notes
10	Motor ID	Motor serial number (for Rockwell Automation® motor)	
11	Motor Model	Motor catalog number (for Rockwell Automation motor)	
12	Motor Vendor	Rockwell Automation	
14	Halls Order	Hallcode index	Range: 0…5
18	Jm	Motor moment of inertia	Range: 0…0.1 Kg-m^2
19	Ke	Motor voltage or back EMF constant	Range: 1…500V/K rpm
20	Kt	Motor torque or force constant	Range: 0.01…10 N•m/A
21	Lm	Motor phase-to-phase inductance	Range: 0.1…500 mH
22	Rm	Motor phase-to-phase resistance	Range: 0.01…500 Ω
23	Nominal Phase Current	Motor max current (RMS)	Range: 0.5…50 A
24	Maximum Velocity	Motor max velocity	Range: 500…20,000 rpm
25	Number Of Poles	Motor number of poles	Range: 2…200
26	PPR Before Quad	Encoder resolution	Range: 256 to (65536 x12/Npoles) expressed in PPR
27	Nominal Drive Bus Voltage	Nominal motor-terminal voltage	Range: 50…800V
646	Rt	Thermal resistance	Range: 0…10000000 C/W
647	Ct	Thermal capacitance	Range: 0…10000000 W-s/C

Linear Motor Database

For Allen-Bradley motors and actuators with incremental encoders, click Change Motor and choose the device from the Linear>Motor Database. In this example, the LCD-C030100-DHT*xx*A linear motor is configured.

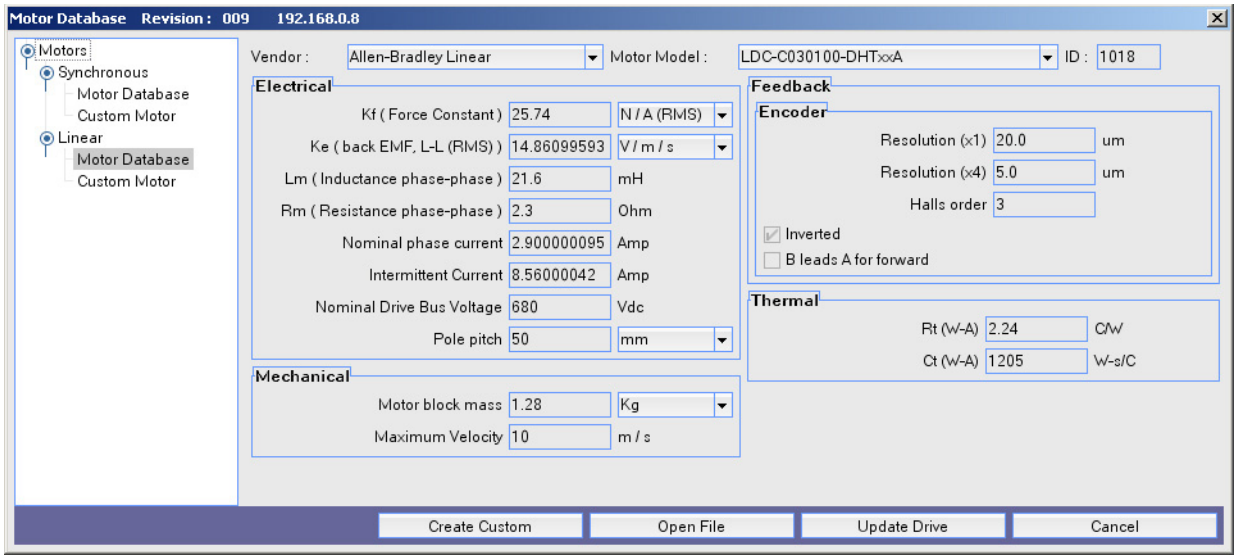


Table 43 - Linear Motor Category

ID	Parameter Name	Description	Value/Notes
10	Motor ID	Motor serial number (for Allen-Bradley motor)	
11	Motor Model	Motor catalog number (for Allen-Bradley motor)	
12	Motor Vendor	Allen-Bradley	
14	Halls Order	Hallcode index	Range: 0…5
243	Motor Block Mass	Motor block mass	Range: 0…100 kg
244	Kf	Linear motor force constant	Range: 1…1000 N/A rms
245	Ke	Motor voltage or back EMF constant	Range: 1…500V rms/m/s
21	Lm	Motor phase-to-phase inductance	Range: 0.1…500 mH
22	Rm	Motor phase-to-phase resistance	Range: 0.01…500 Ω
23	Nominal Phase Current	Motor max current (RMS)	Range: 0.5…50 A
24	Maximum Velocity	Motor max velocity	Range: 0…10 m/s
240	Pole Pitch	Pole pitch	Range: 2…200 mm
246	Resolution (x1)	Linear encoder resolution	Range: 0.4…40 µm
27	Nominal Drive Bus Voltage	Nominal motor-terminal voltage	Range: 50…800V
650	Intermittent Current	Intermittent current	Range: 0…100 A
646	Rt	Thermal resistance	Range: 0…10000000 C/W
647	Ct	Thermal capacitance	Range: 0…10000000 W-s/C

General Category

The General category provides access to the basic configuration of motion. The parameters that are displayed depend on the motor type that is chosen in the Motor Category.

Figure 52 - General Category for Synchronous Motors

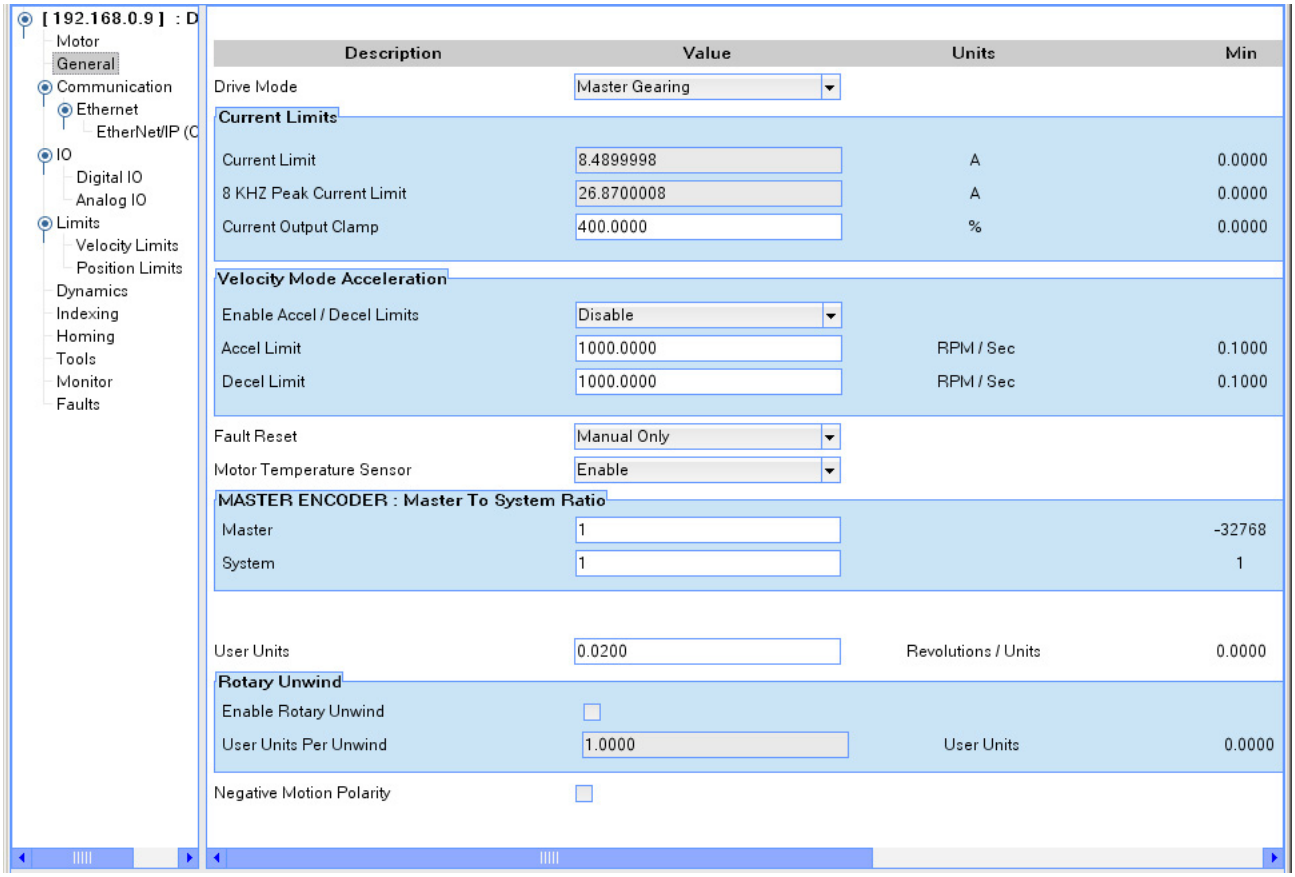


Table 44 - General Category for Synchronous

ID	Parameter Name	Description	Value/Notes
30 (1)	Current Limit	Continuous RMS current for motor selected	You can lower this value. It lets you trigger a motor current alarm. However, the drive cannot limit the actual current to the motor. The actual RMS current limit to the motor is not configurable.
32 (1)	8 kHz Peak Current Limit	Peak current limit for 8 kHz operation (based on motor that is selected)	You can lower this peak value to limit current to motor. Do not set below the RMS Current for motor (tag #30).
39	Motor Temperature Sensor	Motor thermal-protection function	0 = Disable 1 = Enable
75 (2)	Enable Accel/Decel Limits	Enable Accel/Decel function/limits for Velocity mode	0 = Disable 1 = Enable
76 (2)	Accel Limit	Accel value for Velocity mode	Range: 0.1…5,000,000 rpm/s
77 (2)	Decel Limit	Decel value for Velocity mode	Range: 0.1…5,000,000 rpm/s
78	Fault Reset	Reset fault configuration	Manual Only On Disable
79	Master	Master to system ratio (numerator)	Master counts range: -32768…+32768
80	System	Master to system ratio (denominator)	System counts range: 1…32768
266	Drive Mode	Sets the mode of operation for the drive	0 = Autotune 1 = EtherNet/IP External Reference 2 = Master Gearing 3= Step and Direction 4 = Analog Velocity Input 5 = Analog Current Input 6 = Indexing
181	User Units	User units	Revolutions of motor per user unit
672	Current output clamp	Value to clamp output current, measured in percentage of motor rated current	Range: 0…400%
670	Enable rotary unwind	Enable rotary unwind for rotary motors. When rotary unwind is used with a motor with an absolute encoder, the position is restored with in the unwind cycle. These modes are available as Index Types in indexing mode or as a Reference Source in EtherNet/IP operation mode.	0 = Unchecked = Disable 1 = Checked = Enable Rotary Unwind is designed only for these modes: • Rotary Absolute • Rotary Incremental • Rotary Shortest Path • Rotary Positive • Rotary Negative Rotary unwind mode with Blended or Registered moves is not supported. Attempting to use these move options without having configured rotary unwind results in a drive fault.
671	User units per unwind	Number of revolutions in one user unit.	Range: 0…1000000
8	Negative motion polarity	Inverts the motion polarity	0 = Unchecked =Normal 1 = Checked =Reverse Step and Direction and Gear-based modes and position-based moves, such as incremental, absolute, and velocity-based jogs obey the motion polarity. Current based operating modes do not obey the motion polarity. The drive must be disabled to change the motion polarity.

(1) By default, these values are set based on the configured motor. If these values are set lower than the motor capabilities, the drive reports CurrentLimitStatus in the EtherNet/IP Input assembly at the new value, but does not clamp the current output until it reaches the motor peak current.

(2) These values apply only if the drive is in Velocity mode over EtherNet/IP External Reference. In Indexing mode, the limits within the individual indexes apply. In Positioning mode, over EtherNet/IP External Reference, the limits in the Output Assembly apply.

Figure 53 - General Category for Linear Motors

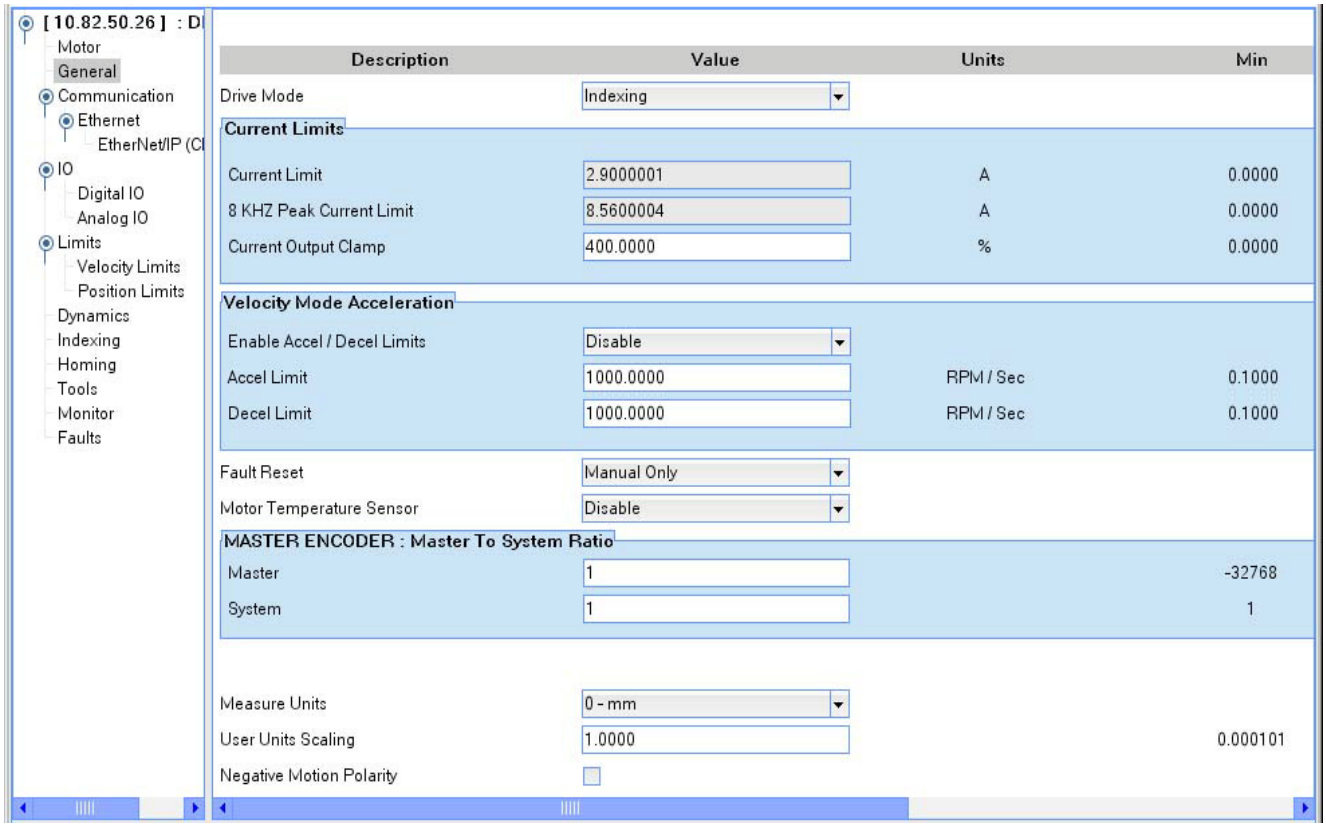


Table 45 - General Category for Linear Motors

ID	Parameter Name	Description	Value/Notes
30 (1)	Current Limit	Continuous RMS current for motor selected	You can lower this value. It lets you trigger a motor current alarm. However, the drive cannot limit the actual current to the motor. The actual RMS current limit to the motor is not configurable.
32 (1)	8 kHz Peak Current Limit	Peak current limit for 8 kHz operation (based on motor that is selected)	You can lower this peak value to limit current to motor. Do not set below the RMS Current for motor (tag #30).
39	Motor Temperature Sensor	Motor thermal-protection function	0 = Disable 1 = Enable
75 (2)	Enable Accel/Decel Limits	Enable Accel/Decel function/limits for Velocity mode	0 = Disable 1 = Enable
76 (2)	Accel Limit	Accel value for Velocity mode	Range: 0.1…5,000,000 m/s^2
77 (2)	Decel Limit	Decel value for Velocity mode	Range: 0.1…5,000,000 m/s^2
78	Fault Reset	Reset fault configuration	Manual Only On Disable
79	Master	Master to system ratio (numerator)	Master counts range: -32768…+32768
80	System	Master to system ratio (denominator)	System counts range: 1…32768
266	Drive Mode	Sets the mode of operation for the drive	0 = Autotune 1 = EtherNet/IP External Reference 2 = Master Gearing 3= Step and Direction 4 = Analog Velocity Input 5 = Analog Current Input 6 = Indexing
672	Current Output Clamp	Value to clamp output current, measured in percentage of motor rated current	Range: 0…400%
676	User Units Scaling	Shows how many user units in one Measure unit	Range: 1…1000000
678	Measure Units	Measure units	0 = µm 1 = m 2 = in.
8	Negative Motion Polarity	Inverts the motion polarity	0 = Unchecked =Normal 1 = Checked =Reverse Step and Direction and Gear-based modes and position-based moves, such as incremental, absolute, and velocity-based jogs obey the motion polarity. Current based operating modes do not obey the motion polarity. The drive must be disabled to change the motion polarity.

(1) By default, these values are set based on the configured motor. If these values are set lower than the motor capabilities, the drive reports CurrentLimitStatus in the EtherNet/IP Input assembly at the new value, but does not clamp the current output until it reaches the motor peak current.

(2) These values apply only if the drive is in Velocity mode over EtherNet/IP External Reference. In Indexing mode, the limits within the individual indexes apply. In Positioning mode, over EtherNet/IP External Reference, the limits in the Output Assembly apply.

Communication Categories

The communication categories provide access to setting the IP address for your drive and object parameters that are used in the Input and Output Assembly EtherNet/IP data links.

Ethernet Communication

The Ethernet category provides access to the IP address configuration. You can configure your drive to obtain the IP address automatically (by using DHCP) or set the values manually.

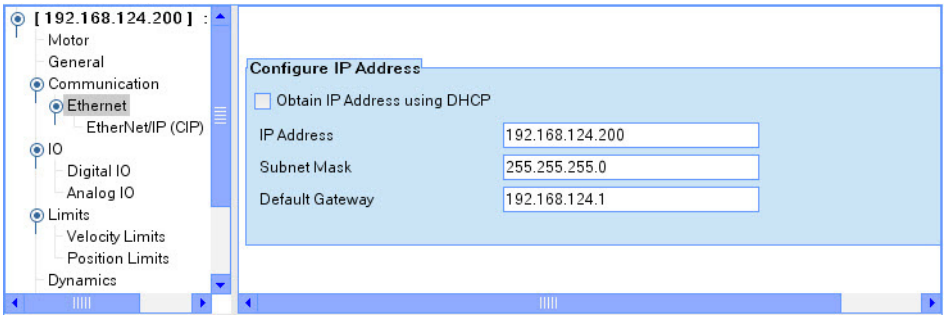
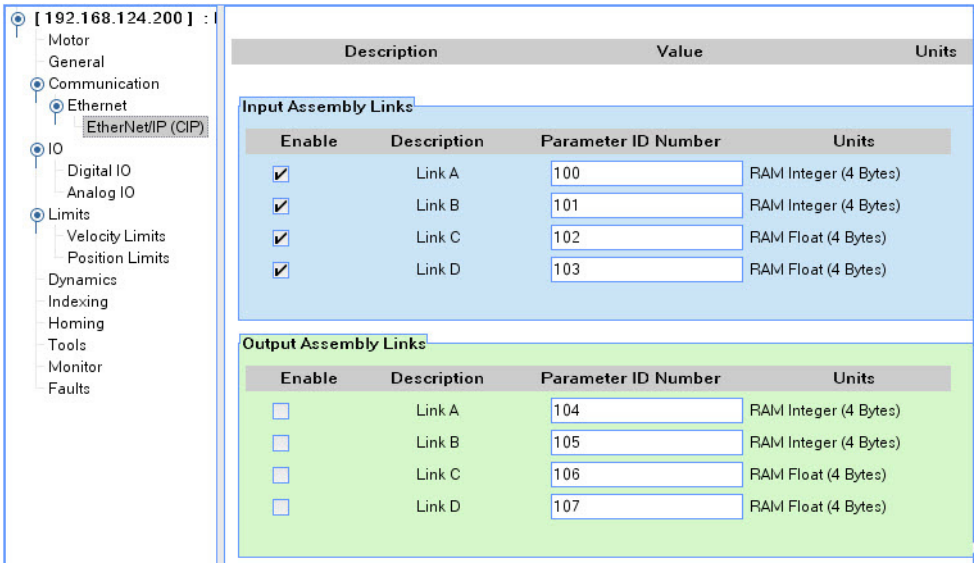


Table 46 - Ethernet Communication Category

ID	Parameter Name	Description	Value/Notes
67	IP address	EtherNet/IP address	IP address changes at next powerup. 32-bit value.
68	Subnet Mask	EtherNet/IP NetMask	Mask changes at next powerup. 32-bit value.
69	Default Gateway	Ethernet Gateway IP address	Address changes at next powerup. 32-bit value.
70	Obtain IP address using DHCP	Use DHCP	Checked = Use DHCP service Unchecked = Manual

EtherNet/IP (CIP) Communication

The EtherNet/IP (CIP) category provides access to the modifiable drive object parameters that are used in the Input and Output Assembly EtherNet/IP data links.



The Enable parameters determine if the parameter is copied into or out of the assembly.

Table 47 - EtherNet/IP (CIP) Communication Category

ID	Parameter Name	Description	Value/Notes
249	Enable - Input Assembly Links	Datalink A for input assembly	UserDefinedIntegerData0
250		Datalink B for input assembly	UserDefinedIntegerData1
251		Datalink C for input assembly	UserDefinedIntegerReal0
252		Datalink D for input assembly	UserDefinedIntegerReal1
253	Enable - Output Assembly Links	Datalink A for output assembly	UserDefinedIntegerData0
254		Datalink B for output assembly	UserDefinedIntegerData1
255		Datalink C for output assembly	UserDefinedIntegerReal0
256		Datalink D for output assembly	UserDefinedIntegerReal1

Input/Output Categories

The Input/Output categories provide access to the configuration of the modifiable Digital I/O and Analog I/O parameters.

Digital I/O

IMPORTANT Drive object parameters of type DINT can be used only in the RAM integer data links, parameters of type REAL can be used only in the RAM float data links.

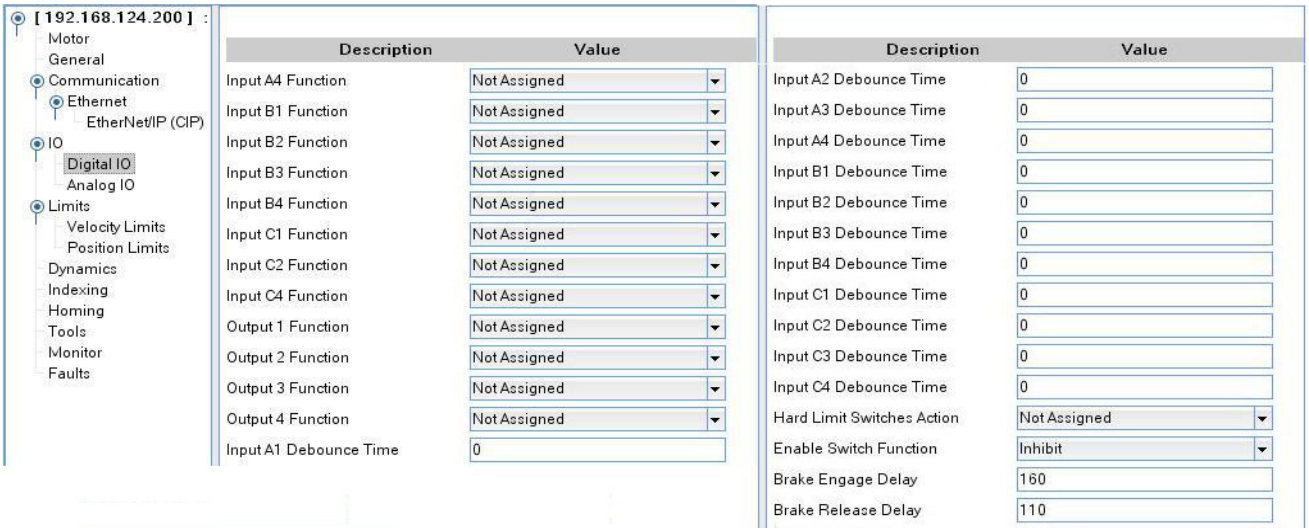


Table 48 - Digital I/O Category

ID	Parameter Name	Description
29	Enable Switch Function	Configuration of the enable digital input A3. 0 = Inhibit only. Must be asserted before the drive can be enabled. 1 = Run. Enables drive when asserted.
84	Hard Limit Switches Action	Configuration of the action to take when the limit switches are asserted. 0 = Not used 1 = Disable and coast 2 = Ramped Decel and Disable
189 … 192	Input A1…A4 de-bounce time	Debounce time (0…1000 ms) of the individual digital inputs.
193 … 196	Input B1…B4 de-bounce time	
197 … 200	Input C1…C4 de-bounce time	
201	Output 1 Function (OUT1)	Configuration of the specific function for the individual digital outputs. 0 = Not Assigned 1 = Zero Speed 2 = In Speed Window 3 = Current Limit 4 = Runtime fault 5 = Ready 6 = Brake 7 = In position
202	Output 2 Function (OUT2)	
203	Output 3 Function (OUT3)	
204	Output 4 Function (OUT4)	

ID	Parameter Name	Description
624	Input A4 Function	Configuration of the specific function for the individual digital inputs, pre-assigned inputs such as Enable and Registration are not configurable. 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9 = Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4 Configure Home Sensor input from Homing Category.
625 … 628	Input B1…B4 Function	
629	Input C1 Function	
630	Input C2 Function	
631	Input C4 Function	
651	Brake Engage Delay	Time (ms) from when the drive is disabled to the time that motion is stopped and brake is engaged.
652	Brake Release Delay	Time (ms) from when the drive is enabled to the time that motion is allowed to begin (brake is released).

Analog I/O

Table 49 - Analog I/O Category

ID	Parameter Name	Description	Value/Notes
35	Analog Input (current scale)	Analog input #1 current reference scale	Range: - X…X Amps/Volt X = drive peak output current/10
36	Analog Input (velocity scale)	Analog input #1 velocity reference scale	Range: -10,000…10,000 rpm/Volt
85	Analog Output	Analog output function	0 = Not assigned 1 = Phase Current (RMS) 2 = Phase Current (Peak Value) 3 = Motor Velocity 4 = Phase Current U 5 = Phase Current V 6 = Phase Current W 7 = Iq current 8 = Id current
86	Analog Output (velocity scale)	Analog output scale for velocity quantities	Range: 0…10 mV/rpm
87	Analog Output (current scale)	Analog output scale for current related quantities	Range: 0…10 V/A
89	Analog Input deadband	Analog input #1 deadband. Applied when used as current or velocity reference	Range: 0…100 mV
90	Analog Input Offset	Analog input #1 offset. Applied when used as current/velocity reference	Range: -10,000…+10,000 mV

Limits Categories

The Limits categories provide access to the configuration of the modifiable velocity and position limit parameters.

Velocity Limits

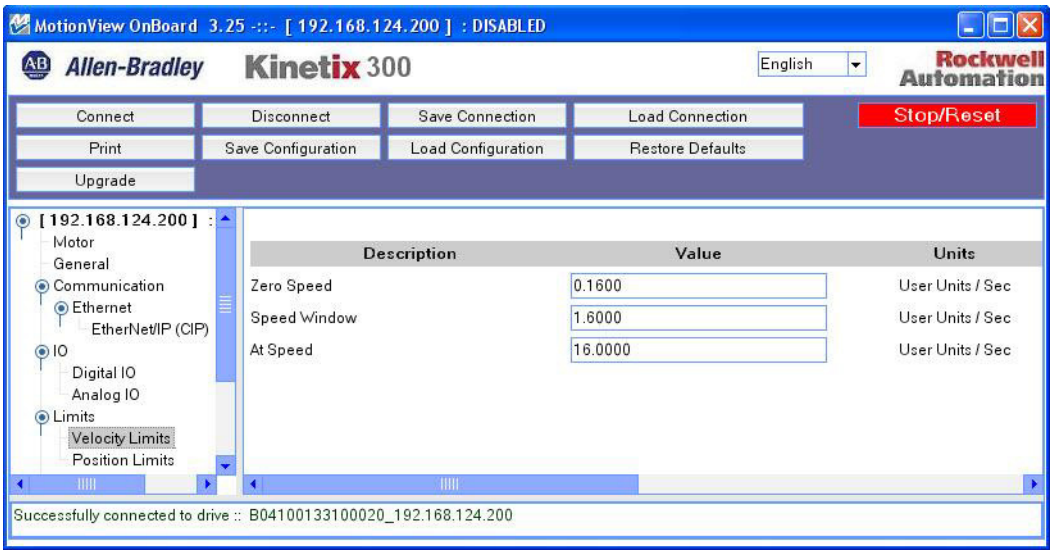


Table 50 - Velocity Limits Category

ID	Parameter Name	Description	Value/Notes
58	Zero Speed	Value in user units/s below which the drive sets the Zero Speed Digital Output (if configured) and the VelocityStandstillStatus bit in the EtherNet/IP Input Assembly.	Range: 0…100 rpm
59	Speed Window	The range in user units/s around the At Speed for setting the In-Speed Window Digital Output (if configured) and the VelocityLockStatus bit in the EtherNet/IP Input Assembly.	Range: 10…10000 rpm
60	At Speed	Value in user units/s for the target velocity for which the drive sets the In-Speed Window Digital Output (if configured) and the VelocityLockStatus bit in the EtherNet/IP Input Assembly.	Range: -10000…+10000 rpm

Position Limits

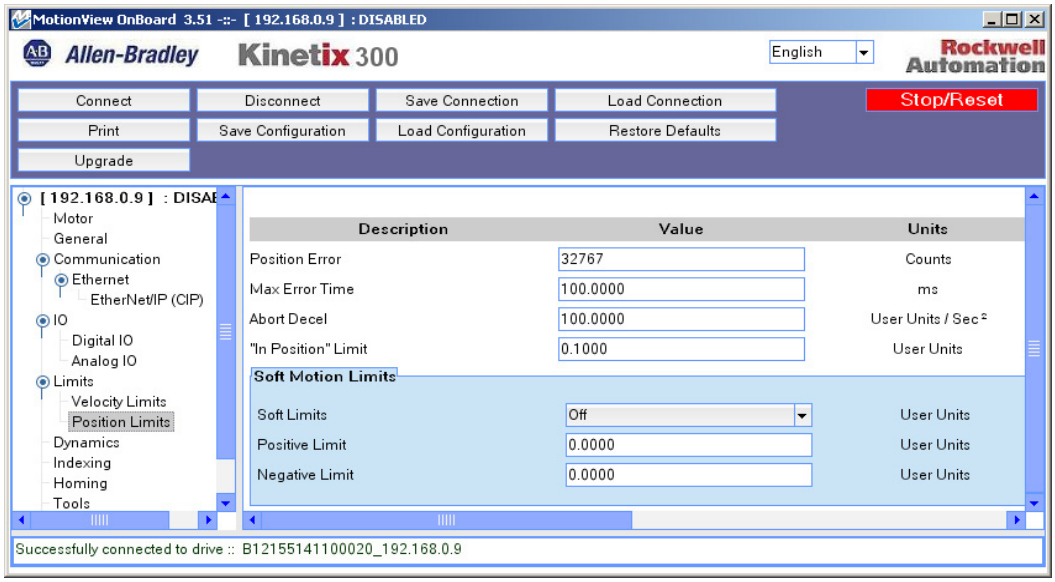


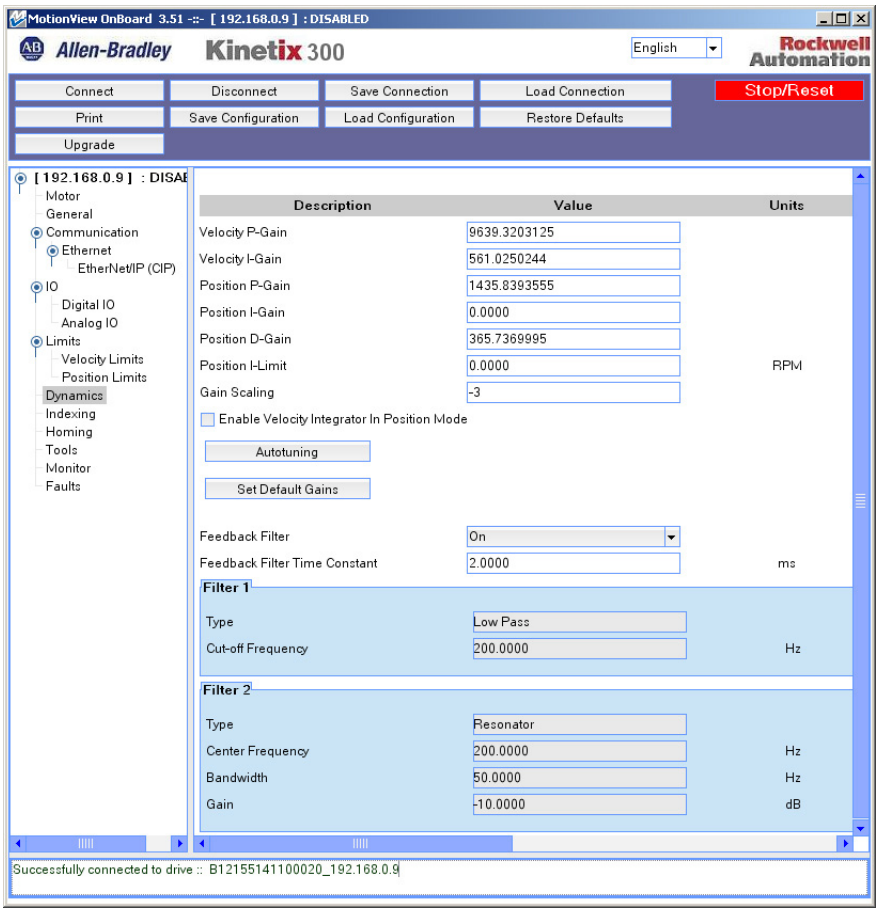
Table 51 - Position Limits Category

ID	Parameter Name	Description	Value/Notes
62	Max Error Time	The amount of time that the drive can be outside of the Position Error before the drive asserts an Excess Position Error Fault.	Range: 0.25…8000 ms
178	Abort Decel	The deceleration rate that the drive uses to bring the motor to a stop when either the Abort Homing or Abort Index Digital Inputs is asserted (if configured) or either the AbortIndex or AbortHoming bit is set in the EtherNet/IP Output Assembly.	User units/s^2
179	Position Limit	The tolerance around the commanded position inside of which the drive sets the PositionLockStatus bit in the EtherNet/IP Input Assembly.	User units
217	Position Error	The tolerance around the commanded position outside of which the drive asserts an Excess Position Error Fault when the Max Error Time is exceeded.	Encoder counts
218	Soft Limits (1)	Off or On depending if software travel limits are used.	0 = Off 1 = Disable and Coast 2 = Ramped Decel and Disable
219	Positive Limit	If Soft Limits are On, the position that when reached, the drive asserts a Software Overtravel fault.	User units
220	Negative Limit		User units

(1) Soft Limits parameters can only be used in Positioning mode.

Dynamics Category

The Dynamics category provides access to the configuration of the modifiable dynamics parameters.



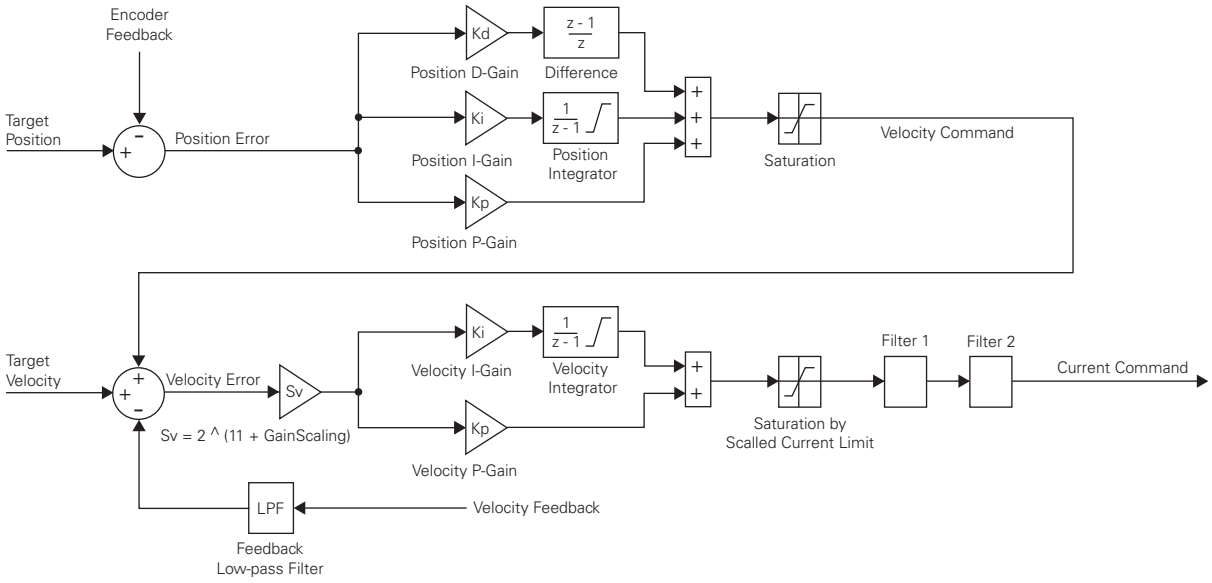
Click Autotuning to begin autotuning.

Table 52 - Dynamics Category

ID	Parameter Name	Description	Value/Notes
44	Velocity P-Gain	The proportional and integral gain (respectively) of the velocity loops. Gains are based on counts as the fundamental units and they are not physical units.	Range: 0…32767
45	Velocity I-Gain		Range: 0…32767
46	Position P-Gain	The proportional, integral, and derivative gain (respectively) of the position loops. Gains are based on counts as the fundamental units and they are not physical units.	Range: 0…32767
47	Position I-Gain		Range: 0…16383
48	Position D-Gain		Range: 0…32767
49	Position I-Limit	A clamping limit on the position loop I-gain compensator to prevent excessive torque overshooting from an over accumulation of the I-Gain.	Range: 0…20000
51	Gain Scaling	A 2x factor that is applied to the gains in the velocity loop useful for scaling the gains when using encoders with a high number of counts per revolution.	Range: -16…4

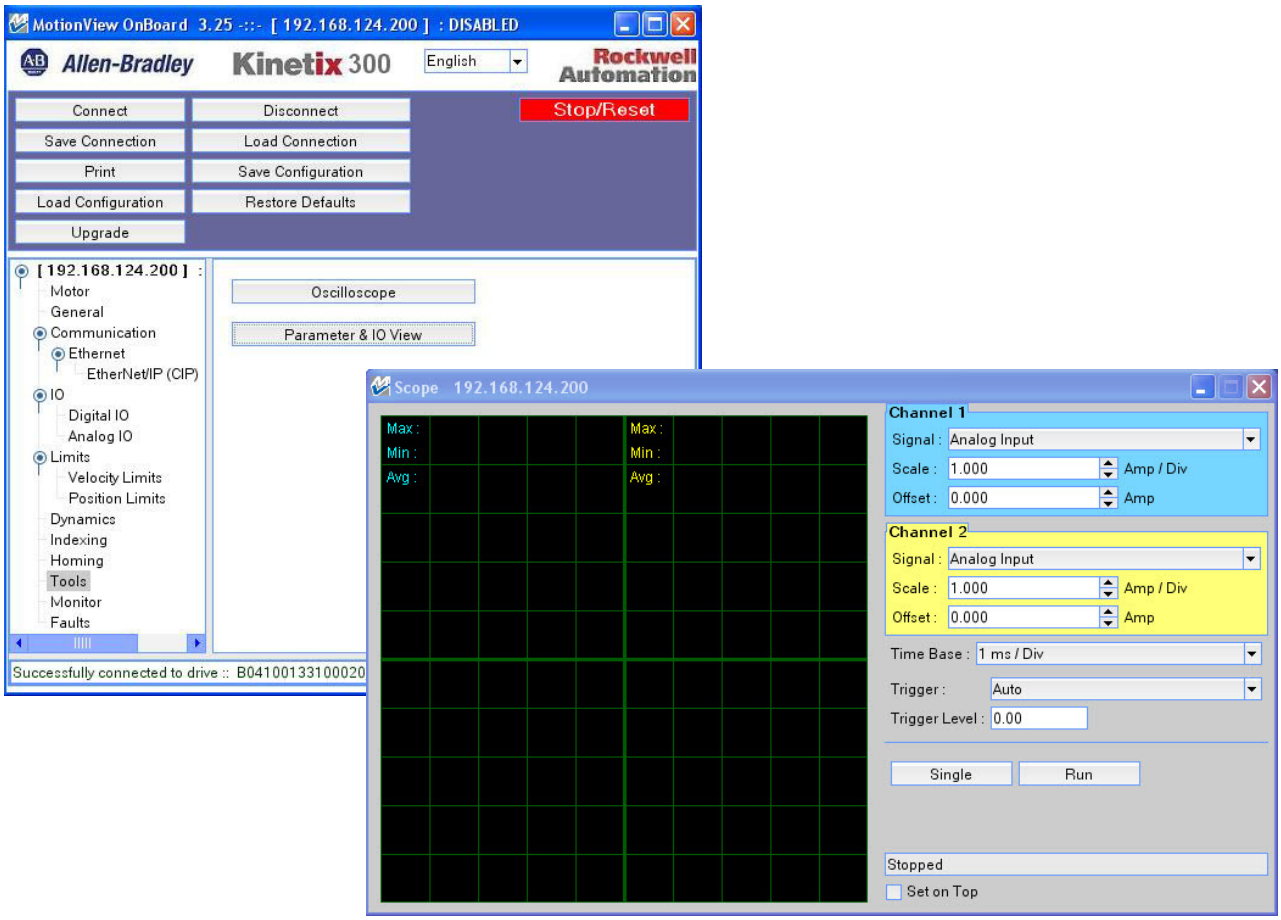
See the Servo Loop diagram on page 98 for more information on these parameters.

Figure 54 - Servo Loop Diagram



Tools Category

The tools category provides access to the oscilloscope and digitally monitor drive performance parameters.



Monitor Category

The monitor category provides access to pre-configured status information for the drive. This information is displayed in a floating window that updates in real time.

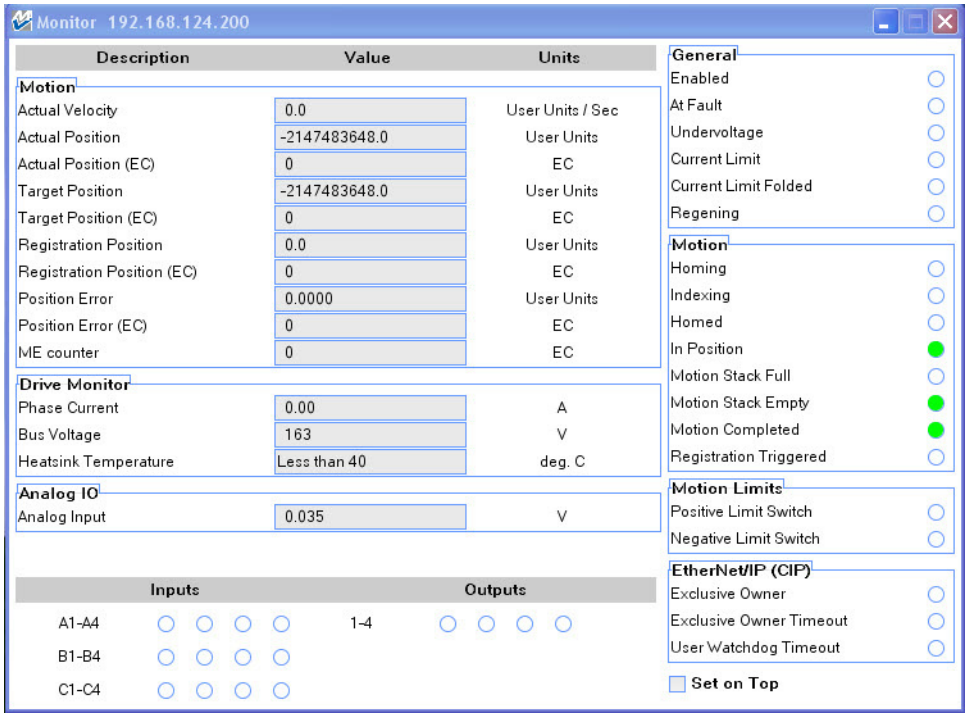


Table 53 - Monitor Category

ID	Parameter Name	Description	Value/Notes
7	Actual Velocity	Actual measured motor velocity	UU/s
65	Inputs	Digital inputs states	A1 Input = Bit 0 A2 Input = Bit 1 A3 Input = Bit 2 A4 Input = Bit 3 B1 Input = Bit 4 B2 Input = Bit 5 B3 Input = Bit 6 B4 Input = Bit 7 C1 Input = Bit 8 C2 Input = Bit 9 C3 Input = Bit 10 C4 Input = Bit 11
66	Outputs	Digital outputs states. Writing to these variables sets or resets digital outputs that have not been assigned to a special function.	Output 1 = Bit 0 Output 2 = Bit 1 Output 3 = Bit 2 Output 4 = Bit 3
71	Analog Input	Analog Input AIN1 value	Volts
73	Bus Voltage	Measured Bus voltage	
74	Heatsink Temperature	Heatsink temperature	0 = Temperatures < 40 °C (104 °F) Actual heat sink temperature = Temperatures > 40 °C (104 °F)
182	ME Counter	Master Encoder (ME) input counter-value, reset by writing zero or other value to the parameter.	Counts
183	Phase Current	Phase current	Amps
184	Target Position (EC)	Target position	Encoder pulses

Table 53 - Monitor Category (continued)

ID	Parameter Name	Description	Value/Notes
185	Actual Position (EC)	Actual position	Encoder pulses
186	Position Error (EC)	Position error	Encoder pulses
207	Registration Position (EC)	Registration position	Encoder counts
208	Registration Position	Registration position	User units
209	Target Position	Target position	User units
210	Actual Position	Actual position	User units
211	Position Error	Position error	Encoder counts

Faults Category

The Faults category provides access to the configuration of the modifiable fault parameters.

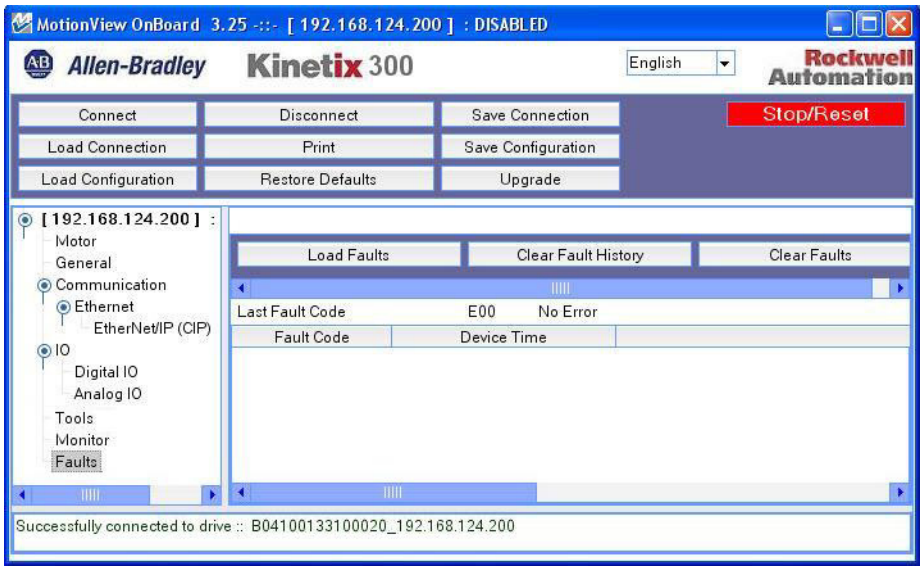


Table 54 - Faults Category

ID	Parameter Name	Description	Value/Notes
653	Last Fault Code	Fault E-code	Same fault code that is displayed on the servo drive display.
N/A	Device Time	The time since powerup of the drive that the fault occurred.	N/A
N/A	Load Faults	Recall the last 15 faults the drive reported.	N/A
N/A	Clear Fault History(1)	Clear the fault history of the drive.	N/A
N/A	Clear Faults	Clear the current fault in the drive.	N/A

(1) Clear Fault History is password protected for quality assurance purposes. You can not use this function.

Indexing Category

The software for the onboard indexing operation is accessed via the MotionView software and is also configurable over the EtherNet/IP connection by using Explicit Messaging in RSLogix 5000® and RSLogix 500® software or the Studio 5000 Logix Designer® application.

In Indexing mode, the Kinetix® 300 drive begins execution of indexes after either a command is received over the EtherNet/IP connection or immediately upon assertion of the hardware enable signal.

Table 55 - Indexing Category

ID	Parameter Name	Description	Value/Notes
267	AutoStart Index	Enable Auto Start index function for Indexing mode when drive becomes enabled	0 = Disable 1 = Enable
632	Start Index	Indexing starts from index that is specified	0…31
637	Current Index	Index currently executing. This tag is valid only in Indexing mode.	0…31

An index controls drive operation when Drive mode is set to Indexing in the General category. The drive starts indexing at the index whose number (0…31) is reflected in the cumulative binary values of the Index Select 0, 1, 2, 3, and 4 that are selected in the Digital Inputs category.

The digital input Index Select binary values are as follows:

- Index Select 0 = 1 if active, 0 if not.
- Index Select 1 = 2 if active, 0 if not.
- Index Select 2 = 4 if active, 0 if not.
- Index Select 3 = 8 if active, 0 if not.
- Index Select 4 = 16 if active, 0 if not.

If an Index Select is not assigned to a digital input, the Index Select is considered inactive.

When the Kinetix 300 drive is in Indexing mode the drive performs the required index-based position move, for each index, according to the parameters shown in Table 56. The Kinetix 300 drive supports up to 32 indexes.

The drive validates the index table before execution. During validation, if the drive encounters an error such as index entries that contain invalid values, the drive issues a fault. The fault does not allow execution of the index table until the anomaly has been corrected.

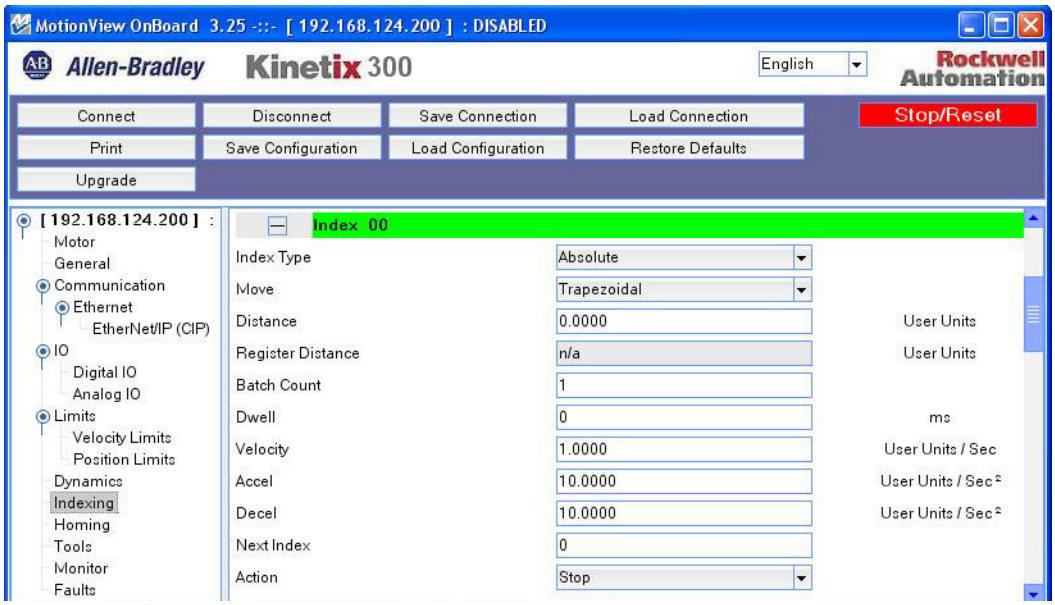


Table 56 - Index 00…31

ID (1)	Parameter Name	Description	Value/Notes (2)
272	Index Type	Absolute with and without registration, incremental with and without registration, or blended incremental.	0 = Absolute 1 = Incremental 2 = Registration absolute 3 = Registration incremental 4 = Blended 5 = Rotary absolute 6 = Rotary incremental 7 = Rotary shortest path 8 = Rotary positive 9 = Rotary negative 10 = Current
273	Move	Trapezoidal or S-curve.	0 = Trapezoidal 1 = S-curve
274	Distance	The incremental distance to move or target position, which is based on the Index Type.	1…268435.4560 User Units
275	Register Distance		
276	Batch Count	How many times to execute index before moving on to the next index.	1…2147483647
277	Dwell	The time to remain at position before moving on to the next index. It is not applied between batches. If Index Type is Current, then Dwell is amount of time current level is applied.	0…65535 ms
278	Velocity	The target speed when moving towards the new position. If the acceleration rate is too low, the axis cannot actually reach the target velocity. If Index type is Current, then Velocity is % rated current applied.	0.0000…10,000,000.0000 User Units/s
279	Accel	The rate to accelerate towards the configured velocity.	0.0000…10,000,000.0000 User Units/s
280	Decel	The rate to decelerate towards zero-velocity from configured-velocity.	0.0000…10,000,000.0000 User Units/s
281	Next Index	The next index to execute after the current index completes.	0…31
282	Action	What to do when current index is complete.	0 = Stop 1 = Wait for start 2 = Next index

(1) ID tag numbers in this example is for Index 00. See Table 61 on page 112 and Table 62 on page 112.

(2) Numerical values (0 =, 1=, 2=, for example) for menu choices appear only in explicit messages that are sent when using RSLogix 5000 and RSLogix 500 software or the Logix Designer application.

Index Type Parameter

You can set the Index Type parameter to any of the following:

- Absolute
- Incremental
- Registration Absolute
- Registration Incremental
- Blended
- Rotary Absolute
- Rotary Incremental
- Rotary Shortest Path
- Rotary Positive
- Rotary Negative
- Current

Absolute

Moves from its starting position to the specified Position. The axis must be homed before the drive can execute an absolute index otherwise an E27 fault is asserted.

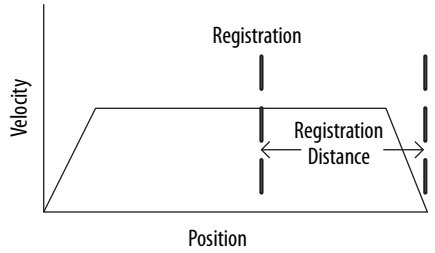
Incremental

Moves from its starting position the specified Distance.

Registration Distance

Registration Distance is the relative distance that the motor travels beyond the position when a registration digital input is detected. If the indexing configuration Type is set to Registration Absolute or Registration Incremental, also configure the Registration Distance parameter. In Registration Indexing mode, the drive moves the motor from its starting position the specified Distance, provided the registration sensor input is not detected. If the registration sensor input is detected, the move is adjusted such that the Registration Distance setting determines the end position.

Figure 55 - Registration Index Type

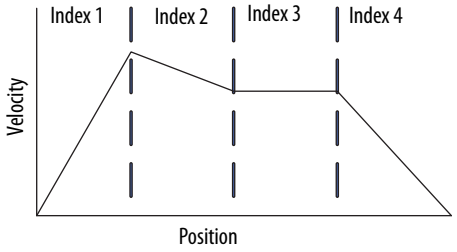


Blended

If the indexing configuration Type is set to Blended, the acceleration and deceleration parameters are not programmable. Instead, the drive calculates the parameters based the on distance and the velocity between the two points of the move. The index table contains the position and velocities necessary to assemble the profile.

IMPORTANT The full profile is assembled by stitching together a sequence of positions and velocities rather than complete move operations.

Figure 56 - Example of Blended Indexing



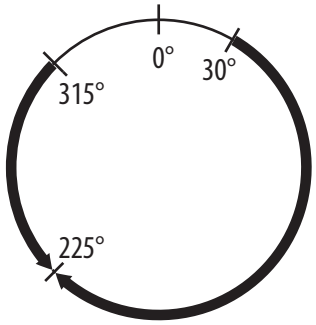
Rotary Absolute

With a Rotary Absolute based move, the direction of travel depends on the current position of the motor and is not necessarily the shortest path to the end position. For start positions less than the end position, within the unwind, the result is motion in the positive direction; while start positions greater than the end position, within the unwind, results in motion in the negative direction.

The command position can be greater than the unwind value. Negative position values are equivalent to their corresponding positive values and are useful when rotating the axis through 0. For example, -90° is the same as +270°. When the position is greater than or equal to the unwind value, the axis moves through multiple revolution of the unwind before stopping at an absolute position. The actual position on each revolution through the unwind starts at zero regardless of the number of revolutions performed.

Rotary Absolute mode is only possible when Rotary Unwind mode is configured in the General category.

Figure 57 - Rotary Absolute Move



Rotary Incremental

With a Rotary Incremental based move, the direction of travel depends on polarity of the commanded position. Positive commands result in motion in the positive direction and negative commands result in motion in the negative direction.

The command position can be greater than the unwind value. When the position is greater than or equal to the unwind value, the axis moves through multiple revolution of the unwind before stopping. The actual position on each revolution through the unwind starts at zero regardless of the number of revolutions performed.

If your system has an absolute encoder, home the axis before initiating an absolute move otherwise the drive will fault with an E27.

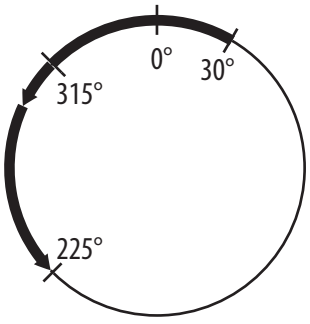
Rotary Incremental mode is only possible when Rotary Unwind mode is configured in the General category.

Rotary Shortest Path

The Rotary Shortest Path move is a special type of Absolute move. The motor is moved to the commanded position within the unwind in whichever direction of travel is the shortest, moving through 0° if necessary. With Rotary Shortest Path, the motor does not do multiple revolutions of unwind before stopping at an absolute position.

Rotary Shortest Path mode is only possible when Rotary Unwind mode is configured in the General category.

Figure 58 - Rotary Shortest Path Absolute Move

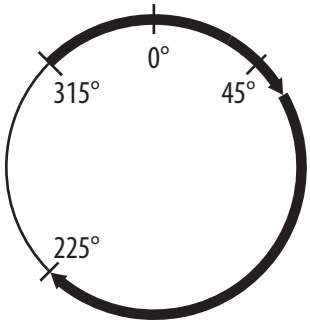


Rotary Positive

The Rotary Positive move is a special type of Absolute move where the motor is moved to the commanded position within the unwind in the positive direction of travel moving through 0° if necessary. With Rotary Positive, move the motor does not do multiple revolutions of unwind before stopping at an absolute position.

Rotary Positive mode is only possible when Rotary Unwind mode is configured in the General category.

Figure 59 - Rotary Positive Absolute Move

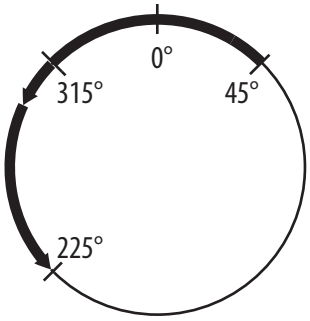


Rotary Negative

The Rotary Negative move is a special type of Absolute move where the motor is moved to the commanded position within the unwind in the negative direction of travel moving through 0° if necessary. With Rotary Negative, the motor cannot be moved multiple revolution of unwind before stopping at an absolute position.

Rotary Negative mode is only possible when Rotary Unwind mode is configured in the General category.

Figure 60 - Rotary Negative Absolute Move



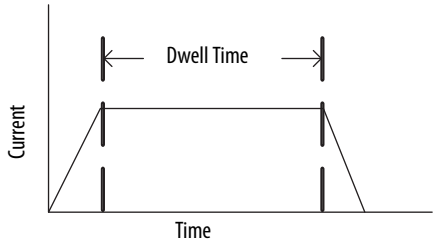
Current

The Kinetix 300 drive has a special-indexing configuration type of Current that supplies a specified current for a fixed time as part of executing the index table. You are able to transition to this type of index without disabling the drive. When in this mode, the position and velocity loops do not engage. When transitioning from Current mode to Position or Velocity mode, the drive begins to track commands with the current position or velocity of the drive. The drive does not attempt to correct for the movement of the motor while in Current mode.

When using Current Mode distance, velocity, acceleration, deceleration, and batch count parameters are not programmable.

In this type of index, the drive applies the specified current for the Dwell parameter number of milliseconds. All thermal protections continue to be active if the specified current exceeds the continuous current rating of the drive or motor. Figure 61 shows an example of a current index.

Figure 61 - Current Indexing



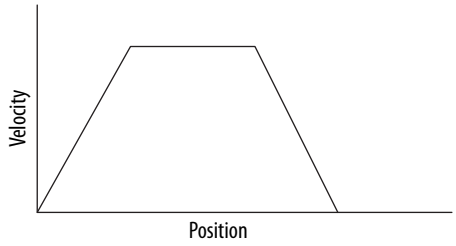
Action Parameter

You can set the Action parameter to Stop, Wait for Start, or Next Index.

Stop

This action stops and holds zero velocity while remaining enabled. Upon assertion of the Start Index digital input or the Start Motion bit in the EtherNet/IP Output Assembly, the drive begins executing the index in the Index system parameter.

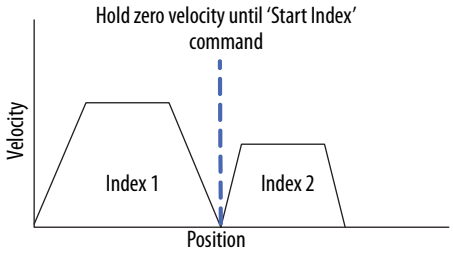
Figure 62 - Example of Stop and Hold Index Action



Wait for Start

This action waits for either the Start Motion bit to transition in the EtherNet/IP Output Assembly or for the Start Index configured digital input to perform an active transition.

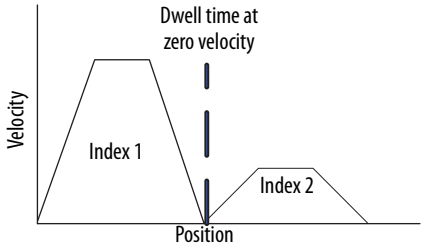
Figure 63 - Example of Wait for Start Index Action



Next Index

This action immediately moves to the next index as defined by the Next Index parameter.

Figure 64 - Example of Next Index Action



Start Index

During powerup the Kinetix 300 drive does one of the following:

- Automatically start the indexing program upon enabling of the drive.
- Waiting for a digital input transition before starting the index.
- Waiting for a software signal over EtherNet/IP network before starting the index.

When the drive is configured for AutoStart Index, the drive begins executing the configured index immediately after the drive enables.

If the drive is not configured for AutoStart Indexing, the drive does not begin executing the configured index until either the Start Motion bit transitions in the EtherNet/IP Output Assembly or the digital input that is configured for Start Index is transitioned to an active state.

The configuration for Start Index requires setting the following parameters either over EtherNet/IP Explicit Messaging or through the MotionView software interface.

Table 57 - Start Index Configuration

ID	Parameter Name	Description	Value/Notes
N/A	Drive Mode	Set to [Indexing]	N/A
267	AutoStart Index	Enable Auto Start index function for Indexing mode when drive becomes enabled	0 = Disable 1 = Enable
632	Start Index	Indexing starts from index that is specified	0…31
29	EnableSwitchType	Enable switch function	0 = Inhibit only 1 = Run

Abort Indexing

An active state ends an indexing sequence by decelerating to a stop and holding zero velocity while remaining enabled. No further indexing is executed until commanded by you or the controller.

The configuration for Abort Index can be set in the Add-on Profile or through MotionView software interface as a digital input.

Reset Index

Reset Index sets the current index to the Start Index.

Explicit Messages for Indexing

The Kinetix 300 drive provides an EtherNet/IP assembly for configuring all parameters that are associated with one index from within one Explicit Message. To make one Explicit Message, make a User-Defined type in the RSLogix 5000 or RSLogix 500 software program, or Studio 5000 Logix Designer application that follows the structure that is shown in Figure 65. Send the User-defined type in a Set Attribute Single Explicit Message to class 4, instance 115 and attribute 3.

Figure 65 - Message Assembly Example

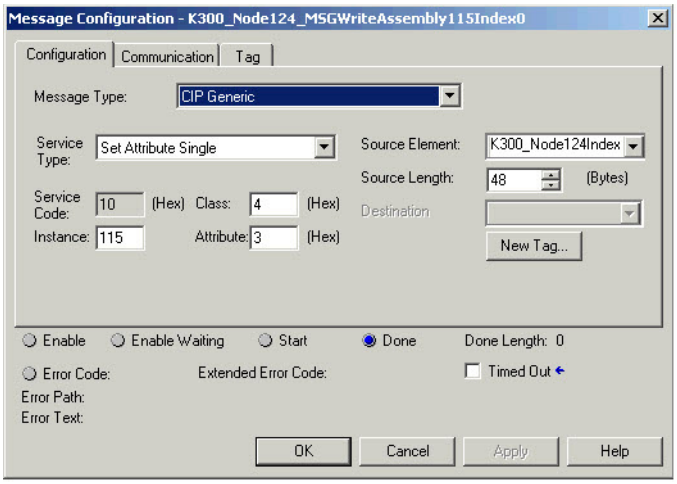


Table 58 - Explicit Messaging for Indexing

RSLogix 5000 or Logix Designer Field	Description
Index Number	This DINT contains the index number that is being modified.
Index Type	This DINT contains the type of the index, absolute, incremental, registration, or blended incremental.
Index Move Type	This DINT contains the move type of the index Trapezoidal or S-curve.
Index Distance	This REAL contains the move distance of the index.
Index Batch Count	This DINT contains the number of times the index executes before moving to the next index.
Index Dwell	This DINT contains the number of milliseconds the axis remains at position before moving to the next index.
Index Velocity	This REAL contains the velocity that the axis moves at while moving the specified distance.
Index Maximum Acceleration	This REAL contains the maximum acceleration that the axis used in reaching the index velocity.
Index Maximum Deceleration	This REAL contains the maximum deceleration that the axis uses in when approaching the target position.
Index Next Index	This DINT contains the next index that the drive begins executing after completing this index.
Index Action	This DINT contains the action that the drive takes once this index is complete.
Index Registration Distance	This REAL contains the displacement from the registration position the axis moves to if a registration index is used.

Table 59 - Index Configuration Assembly Instance

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0…3	Index Number (DINT)							
4…7	Index Type (DINT)							
8…11	Index Move Type (DINT)							
12…15	Index Distance (REAL)							
16…19	Index Batch Count (DINT)							
20…23	Index Dwell (DINT)							
24…27	Index Velocity (REAL)							
28…31	Index Maximum Acceleration (REAL)							
32…35	Index Maximum Deceleration (REAL)							
36…39	Index Next Index (DINT)							
40…43	Index Action (DINT)							
44…47	Index Registration Distance (REAL)							

In this Index Configuration Assembly example, the parameter Index Number with a range of 0...3 bytes is expanded to show the low, low middle, high middle, and high bytes. These values are typical for each parameter in Table 59.

Table 60 - Index Configuration Assembly Example

Byte	Parameter Value
0	Index Number - Low byte
1	Index Number - Low middle byte
2	Index Number - High middle byte
3	Index Number - High byte

Table 61 - ID Tag Numbers for Indexes 00…15

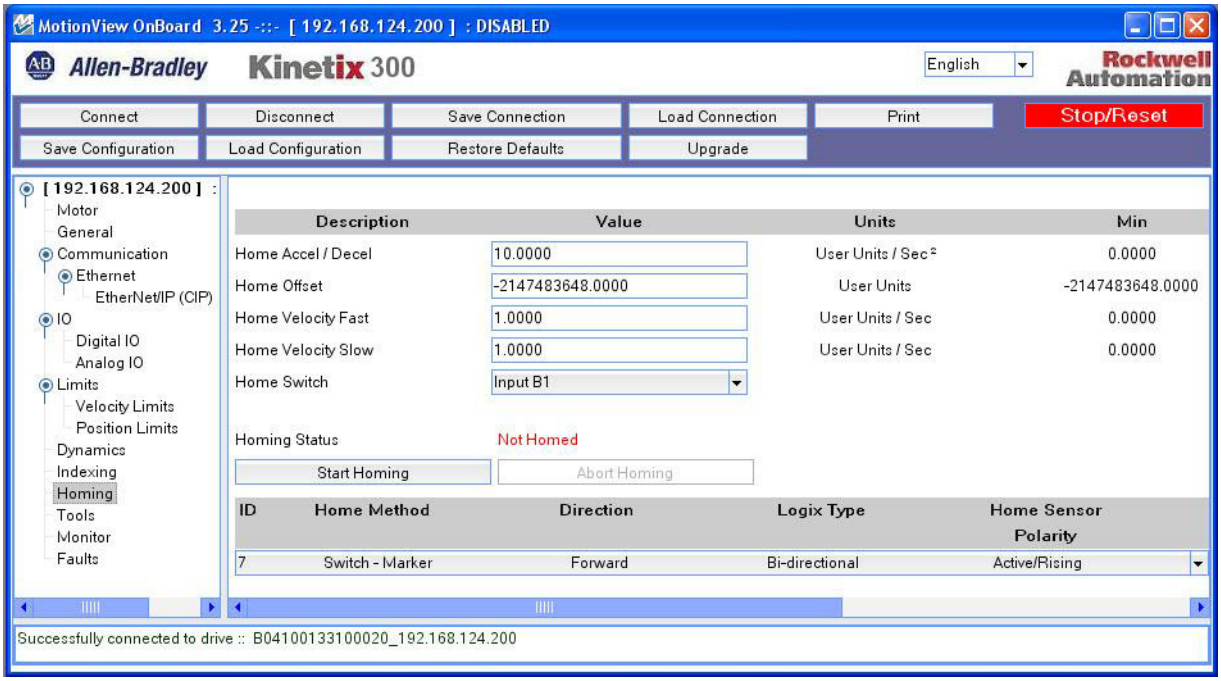
Parameter Name	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Index Type	272	283	294	305	316	327	338	349	360	371	382	293	404	415	426	437
Move	273	284	295	306	317	328	339	350	361	372	383	294	405	416	427	438
Distance	274	285	296	307	318	329	340	351	362	373	384	295	406	417	428	439
Register Distance	275	286	297	308	319	330	341	352	363	374	385	296	407	418	429	440
Batch Count	276	287	298	309	320	331	342	353	364	375	386	297	408	419	430	441
Dwell	277	288	299	310	321	332	343	354	365	376	387	298	409	420	431	442
Velocity	278	289	300	311	322	333	344	355	366	377	388	299	410	421	432	443
Accel	279	290	301	312	323	334	345	356	367	378	389	400	411	422	433	444
Decel	280	291	302	313	324	335	346	357	368	379	390	401	412	423	434	445
Next Index	281	292	303	314	325	336	347	358	369	380	391	402	413	424	435	446
Action	282	293	304	315	326	337	348	359	370	381	392	403	414	425	436	447

Table 62 - ID Tag Numbers for Indexes 16…31

Parameter Name	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Index Type	448	459	470	481	492	503	514	525	536	547	558	569	580	591	602	613
Move	449	460	471	482	493	504	515	526	537	548	559	570	581	592	603	614
Distance	450	461	472	483	494	505	516	527	538	549	560	571	582	593	604	615
Register Distance	451	462	473	484	495	506	517	528	539	550	561	572	583	594	605	616
Batch Count	452	463	474	485	496	507	518	529	540	551	562	573	584	595	606	617
Dwell	453	464	475	486	497	508	519	530	541	552	563	574	585	596	607	618
Velocity	454	465	476	487	498	509	520	531	542	553	564	575	586	597	608	619
Accel	455	466	477	488	499	510	521	532	543	554	565	576	587	598	609	620
Decel	456	467	478	489	500	511	522	533	544	555	566	577	588	599	610	621
Next Index	457	468	479	490	501	512	523	534	545	556	567	578	589	600	611	622
Action	458	469	480	491	502	513	524	535	546	557	568	579	590	601	612	623

Homing Category

The Kinetix 300 drives have a predefined (firmware-based) homing functionality. The supported homing methods include limit switches at the ends of travel, a dedicated home switch, an index pulse, or zero reference from the motor feedback device, or a combination of all.



The configuration for Homing requires setting these parameters either over EtherNet/IP Explicit Messaging or through the embedded software interface.

Table 63 - Homing Category

ID	Parameter Name	Description	Value/Notes
227	Home Accel/Decel	Homing acceleration/deceleration rate	Range 0…10,000,000 UU per second [2].
228	Home Offset	The new position of the motor after the homing sequence is complete. All subsequent absolute moves are taken relative to this new zero position.	Range: -32767…32767 user units.
230	Home Velocity Fast	For homing methods that use one velocity setting, this tag is used as the velocity.	Range: -10,000…10,000 UU/sec.
231	Home Velocity Slow	For homing methods that use two velocity settings (fast and slow), this tag is used as the slow velocity. Typically, this tag is used to creep to a homing position.	
232	Home Method	Defines the type of homing to be performed. See Table 64 on page 115.	N/A
234	Home Switch	The digital input that is used as a home switch for appropriate homing method.	Do not assign to A1, A2, A3, or C3 as these inputs have predefined functions.

Homing Methods

To use homing methods involving Motor Index Pulse (zero pulse), the index pulse of the motor must be connected to the drive input. When the drive has been homed, it asserts the Homed bit in the EtherNet/IP Output Assembly.

The drive indicates whether the homing completed successfully or not. Once homing has been initiated, the Homing Active status bit in the EtherNet/IP Input Assembly is set. If the Homing Active status bit is no longer set and the Homed status bit is also not set, then an error has occurred in the homing and the drive is not homed.

If the drive has not been homed or the stored absolute position information from an absolute home is no longer valid, any absolute position moves generate a fault. Incremental position moves do not generate a fault.

Absolute homing is the only method that is retained after power cycles. With any other homing method, the Homed bit is not set following a power cycle until the homing has been repeated.

The absolute position information within the drive (if absolute homed) is cleared and the Homed bit cleared if any of these events occur:

- A change of motor encoder is detected.
- A change of motion polarity is made.
- The absolute position information within the motor nonvolatile memory does not match the absolute position information within the drive nonvolatile memory (if absolute homed).
- A feedback-related fault has occurred.
- At power-up drive is reporting a battery error.

If your drive is set to Indexing mode and you are not using a controller, a home switch is required to automatically home your incremental encoder at power-up.

IMPORTANT All homing methods write to the nonvolatile memory in the drive, which is limited to 1 million write cycles. The drive must not be homed more often than 1 million times.

Table 64 - Homing Methods Summary

Home Method (1) (2)		Direction	Homing Type	Home Sensor Polarity
7	Switch-Marker	Forward	Bi-directional	Active/Rising
8	Switch-Marker	Forward	Uni-directional	Active/Rising
9	Switch-Marker	Forward	Bi-directional	Active/Falling
10	Switch-Marker	Forward	Uni-directional	Active/Falling
11	Switch-Marker	Reverse	Bi-directional	Active/Rising
12	Switch-Marker	Reverse	Uni-directional	Active/Rising
13	Switch-Marker	Reverse	Bi-directional	Active/Falling
14	Switch-Marker	Reverse	Uni-directional	Active/Falling
23	Switch-Fast	Forward	Home to sensor	Active/Rising
25	Switch-Slow	Forward	Home to sensor	Active/Falling
27	Switch-Slow	Reverse	Home to sensor	Active/Falling
29	Switch-Fast	Reverse	Home to sensor	Active/Rising
33	Marker	Reverse	Home to marker	N/A
34	Marker	Forward	Home to marker	N/A
35	Immediate	N/A	N/A	N/A

(1) All other values of [HomeMethod] are not used for the Kinetix 300 drive and attempts to use those values can result in a drive fault.
(2) Home-to-torque is not available.

Immediate Homing

The immediate home operation on the drive defines the current position of the motor to be the home and the position set to the [HomeOffset] parameter. The drive must be in Indexing mode or EtherNet/IP Positioning mode and the drive must be enabled.

Absolute Homing

The absolute homing on the drive behaves similarly to the Immediate Homing operation. The homing does not induce shaft motion on the motor. The current position of the motor is the home position and the position is set to the [HomeOffset] parameter.

The difference between the absolute position in the encoder and the [HomeOffset] parameter is stored in nonvolatile memory so that all absolute motion is relative to the current position. After a power cycle, the drive continues to operate as though it was homed.

For absolute homing on motors with absolute encoders, execute an Immediate Home.

Home to Marker

On incremental encoders, the drive uses the marker pulse that generated by the encoder as the marker for active homing.

On absolute encoders without a marker pulse, the drive synthesizes (internal to the drive firmware only) a marker pulse that is a consistent position once per mechanical rotation of the motor. The drive uses the generated marker pulse as the marker for active homing of an absolute encoder.

Home Offset

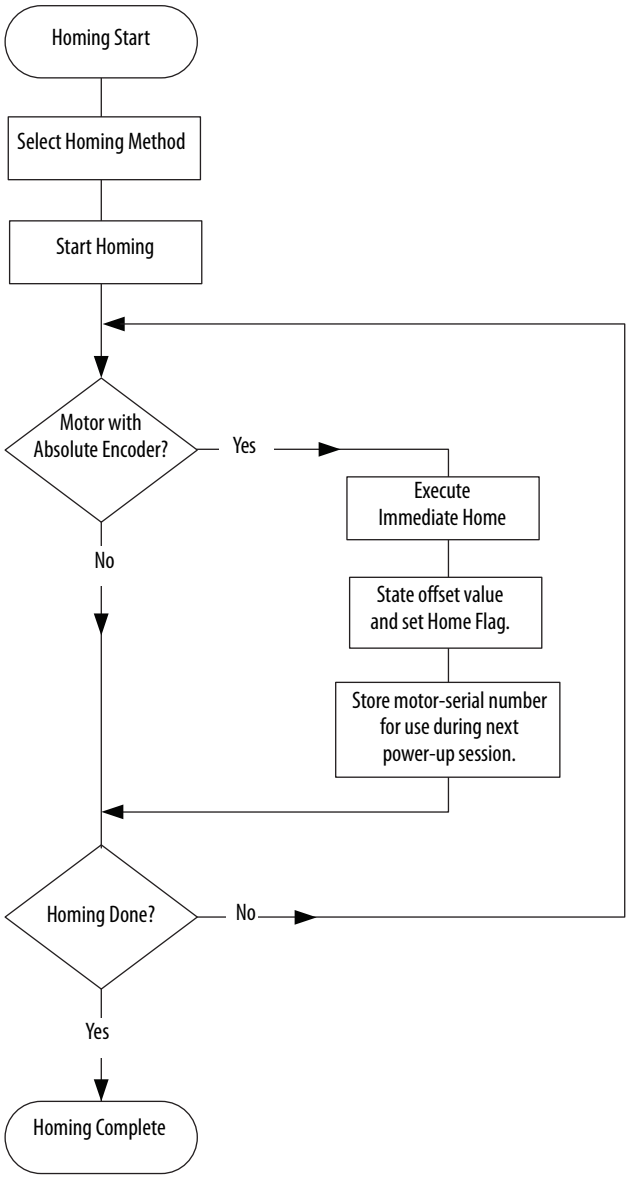
The home offset parameter is the difference between the zero-position for the application and the machine home-position (found during homing). Once homing is completed, the zero-position is offset from the home-position by adding the home-offset to the home position. All subsequent absolute moves are taken relative to this new zero position.

Homing Switch

The homing switch tag enables you to select the drive input that is used for the Home Switch connection. The Homing Switch Input Assignment range is 0...11. Inputs A1...A4 are assigned 0...3 respectively; inputs B1...B4 are assigned 4...7 respectively; and inputs C1...C4 are assigned 8...11 respectively. Do not assign to A1, A2, A3, or C3 as these inputs have predefined functions.

Homing Firmware Algorithm

Figure 66 - Homing Algorithm Flowchart



Homing Methods Timing Diagrams

For a summary of the homing methods, see Table 64 on page 115.

Homing Methods 7…14

Homing methods 7...14 use a home switch that is active over only a portion of the travel. In effect, the switch has a momentary action as the axis position sweeps past the switch. Using methods 7...10, the initial direction of movement is forward and by using methods 11...14, the initial direction of movement is reverse. Except if the home switch is active at the start of motion, in this case, the initial direction of motion is dependent on the edge being sought. The home position is at the index pulse on either side of the rising or falling edges of the home switch, as shown in the following two diagrams. If the initial direction of movement leads away from the home switch, the drive must reverse on encountering the relevant limit switch. All of these methods use the fast acceleration parameter.

Figure 67 - Homing Methods 7…10 (forward initial move)

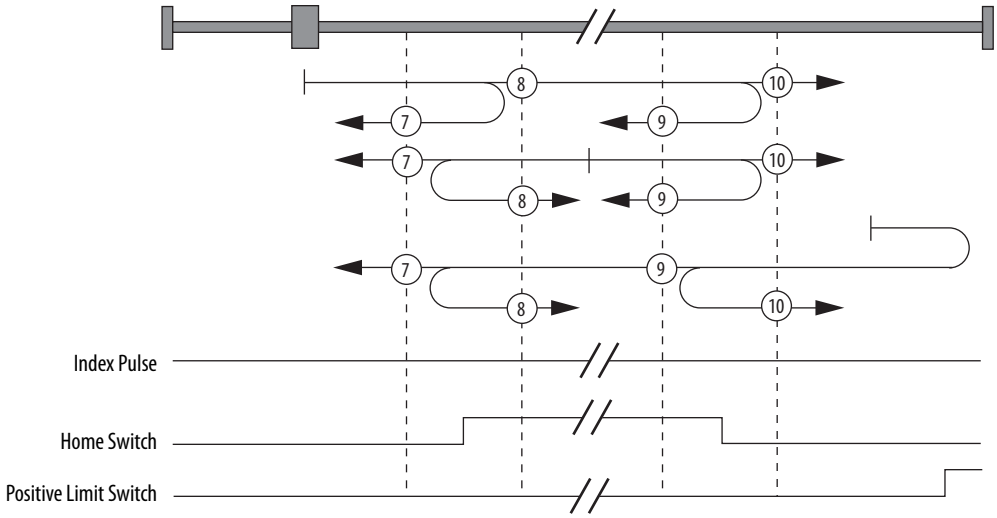
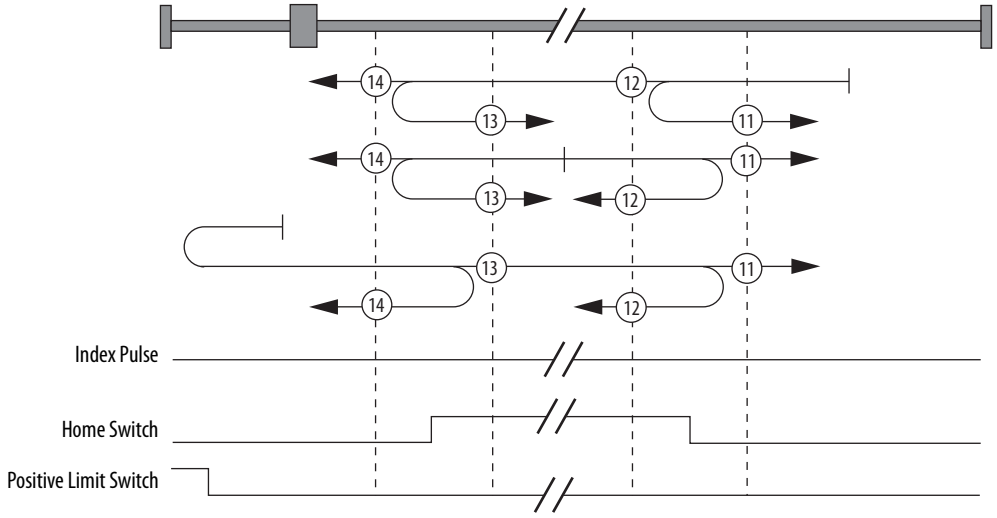


Figure 68 - Homing Methods 11…14 (reverse initial move)



Homing Method 23

Using this method, the initial direction of movement is forward (if the homing switch is inactive). The home position is the leading edge of the homing switch.

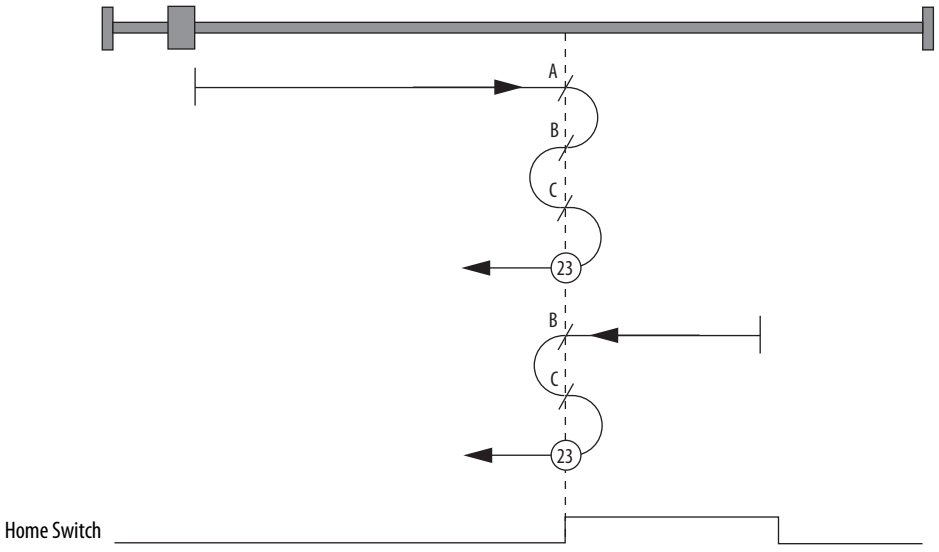
The axis accelerates to fast-homing velocity in the forward direction and motion continues until the homing switch is activated (rising edge) shown at position A. The axis decelerates to zero velocity.

If the homing switch is already active when the homing routine commences, then this initial move is not executed.

The axis accelerates to fast-homing velocity in the reverse direction and motion continues until the falling-edge of the homing switch is detected (position B), where the axis decelerates to 0 velocity. The axis accelerates to slow-homing velocity in the forward direction and motion continues until the rising-edge of the homing switch is detected (position C), where the axis decelerates to 0 velocity. The axis accelerates to slow-homing velocity in the reverse direction and motion continues until the falling-edge of the homing switch is detected (position 23). Position 23 is the home position (excluding offset).

TIP If the axis is on the wrong side of the homing switch when homing is started, the axis moves forward until it contacts the positive limit switch. Upon activating the positive limit switch the axis changes direction (reverse), following the procedure that is detailed in Homing Method 23, but ignoring the initial move in the forward direction.

Figure 69 - Homing Method 23



Homing Method 25

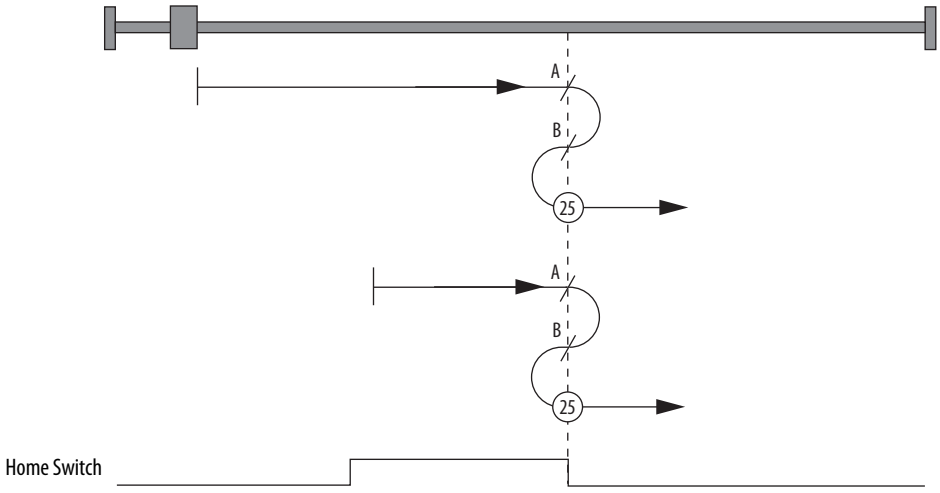
Using this method, the initial direction of movement is forward. The home position is the falling-edge of the homing switch.

The axis accelerates to fast-homing velocity in the forward direction and motion continues until the homing switch is deactivated (falling edge) shown at position A. The axis decelerates to zero velocity.

The axis accelerates to slow-homing velocity in the leftward direction. Motion continues until the rising-edge of the homing switch is detected (position B), where the axis decelerates to 0 velocity. The axis accelerates to slow-homing velocity in the rightward direction. Motion continues until the falling-edge of the homing switch is detected (position 25). Position 25 is the home position (excluding offset).

TIP If the axis is on the wrong side of the homing switch when homing is started, the axis moves forward until it contacts the positive limit switch (A2). Upon activating the positive limit switch, the axis changes direction (reverse) and continue motion until it sees the rising edge of the homing switch. The axis stops and follows the procedure as detailed Homing Method 25.

Figure 70 - Homing Method 25



Homing Method 27

Using this method, the initial direction of movement is reverse. The home position is the falling-edge of the homing switch.

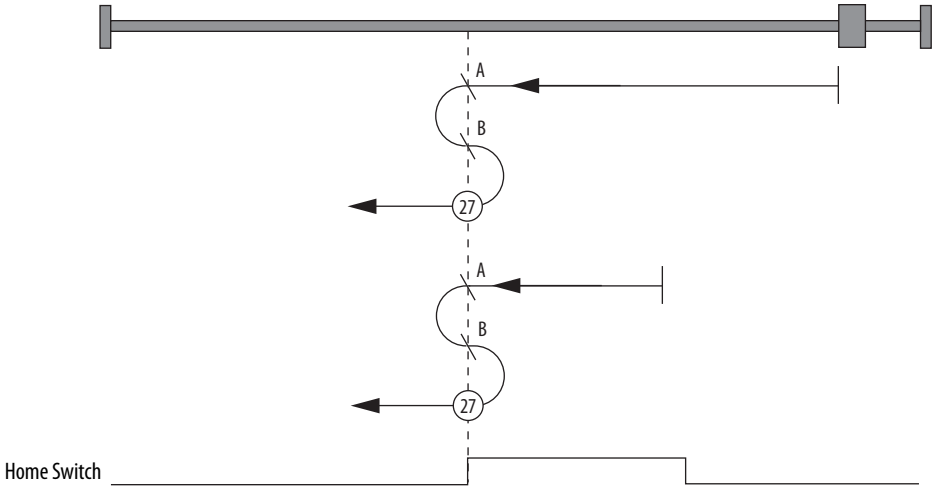
The axis accelerates to fast-homing velocity in the reverse direction and motion continues until homing switch is deactivated (falling edge) shown at position A. The axis decelerates to zero velocity.

The axis accelerates to slow-homing velocity in the forward direction. Motion continues until the rising-edge of the homing switch is detected (position B), where the axis decelerates to 0 velocity.

The axis accelerates to slow-homing velocity in the reverse direction. Motion continues until the falling-edge of the homing switch is detected (position 27). Position 27 is the home position (excluding offset).

TIP If the axis is on the wrong side of the homing switch when homing is started, then the axis moves reverse until it contacts the negative limit switch (A1). Upon activating the negative limit switch, the axis changes direction (forward) and continues motion until it sees the rising-edge of the homing switch. The axis stops and follows the procedure as detailed Homing Method 27.

Figure 71 - Homing Method 27



Homing Method 29

Using this method, the initial direction of movement is reverse (if the homing switch is inactive). The home position is the leading edge of the homing switch.

The axis accelerates to fast-homing velocity in the leftward direction and continues until the homing switch is activated (rising edge) shown at position A. The axis decelerates to zero velocity. If the homing switch is already active when the homing routine commences, then this initial move is not executed.

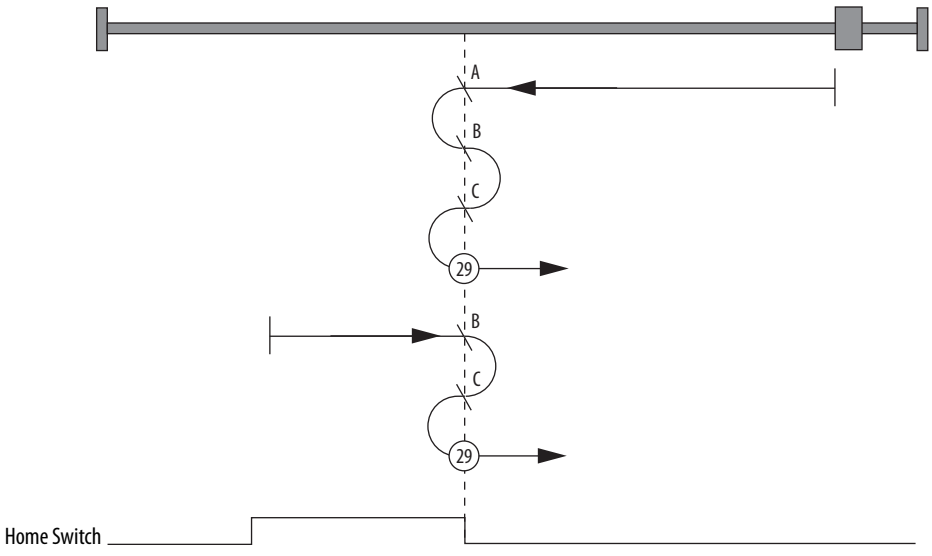
The axis accelerates to fast-homing velocity in the forward direction. Motion continues until the falling-edge of the homing switch is detected (position B), where the axis decelerates to 0 velocity.

The axis accelerates to slow-homing velocity in the reverse direction. Motion continues until the rising-edge of the homing switch is detected (position C), where the axis decelerates to 0 velocity.

The axis accelerates to slow-homing velocity in the rightward direction. Motion continues until the falling-edge of the homing switch is detected (position 29). Position 29 is the home position (excluding offset).

TIP If the axis is on the wrong side of the homing switch when homing is started, the axis moves reverse until it contacts the negative limit switch (A1). Upon activating the negative limit switch, the axis changes direction (forward) following the procedure as detailed in Homing Method 29, but ignoring the initial move in the reverse direction.

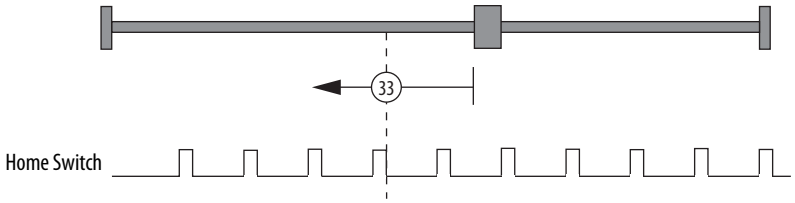
Figure 72 - Homing Method 29



Homing Method 33

Using this method, the initial direction of movement is reverse. The home position is the first index pulse past the shaft starting position. The axis accelerates to fast-homing velocity in the reverse direction and continues until the rising-edge of the first index pulse (position 33) is detected.

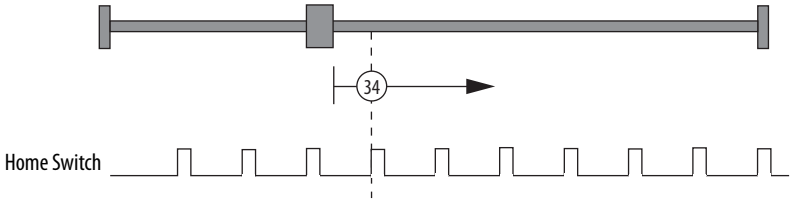
Figure 73 - Homing Method 33



Homing Method 34

Using this method, the initial direction of movement is forward. The home position is the first index pulse past the shaft starting position. The axis accelerates to fast-homing velocity in the forward direction and continues until the rising-edge of the first index pulse (position 34) is detected.

Figure 74 - Homing Method 34



Homing Method 35

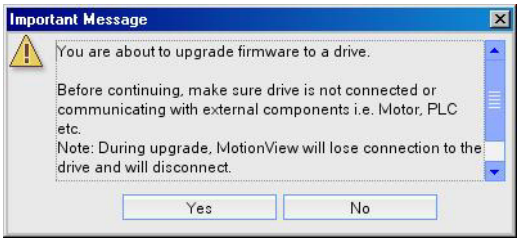
Using this method, the current position is assumed to be the home position. There is no motion of the motor shaft during this procedure. Any offset specified is added to the stored home position.

Upgrade Firmware

Follow these steps to upgrade the firmware in your Kinetix 300 drive.

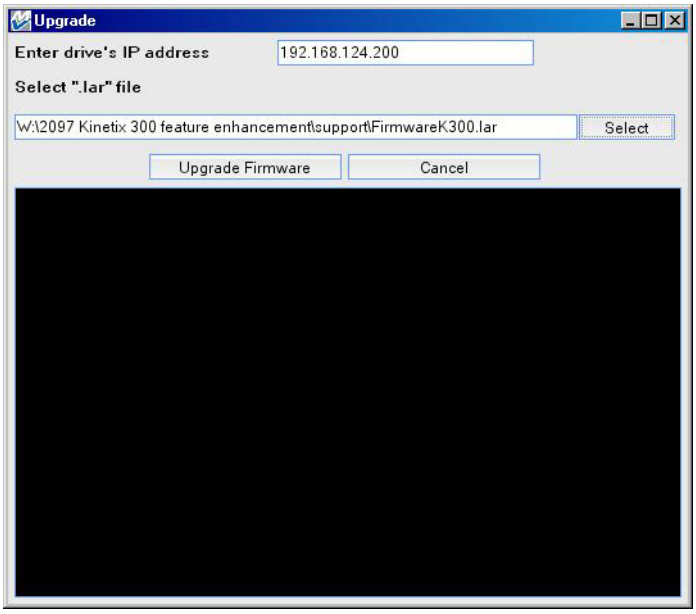
1. Obtain the latest firmware from http://compatibility.rockwellautomation.com/Pages/home.aspx.
2. Run the MotionView software.
3. Click Upgrade.

   This dialog box appears.



4. Comply with dialog box requests and click yes.

   This dialog box appears.



5. Enter the IP address of the Kinetix 300 drive you intend to upgrade.
6. Navigate to the .lar file that you downloaded in step 1.
7. Click Upgrade Firmware.

   Do not turn off power to the computer or the drive.
8. When the upgrade is finished, restart the drive.

Access the upgraded MotionView software by entering the drives IP address in a web browser.

Configure and Start Up the Kinetix 300 Drive

Keypad Input

The Kinetix® 300 drive is equipped with a diagnostic status indicator and three push buttons that are used to select displayed information and to edit a limited set of parameter values. You can scroll the parameters by using ▲▼. To view a value, press ↵. To return to Scroll mode press ↵ again.

When you press ↵ on editable parameters, the yellow status indicator (C) blinks, the blinking indicates that the parameter value can be changed. Use ▲▼ to change the value. To store the new setting and return to Scroll mode press ↵ .

Table 65 - Status Display Information

Status Indicator	Description
StAt	Current drivRee status - run = drive running, diS = drive disabled, EXX = Drive fault, where XX is the fault code.
Hx.xx	Hardware revision. For example, H2.00.
Fx.xx	Firmware version. For example, F2.06.
FLtS	Stored fault history. You can scroll through stored faults E0XX…E7XX, where XX is the fault code.
Ht	Heatsink temperature. Heatsink temperature is shown °C if greater than 40 °C. Otherwise 'LO (low) is displayed.
EnC	Encoder activity. Primary encoder counts are displayed for encoder diagnostics.
buS	Displays drive DC bus voltage.
Curr	Displays motor phase current (RMS). Shows current value if drive is enabled, otherwise shows DiS.
boot	0 = autostart disabled, 1 = autostart enabled.
dHCP	Ethernet DHCP Configuration: 0=dHCP is disabled; 1=dHCP is enabled.
IP_1	First octet of the IP address.
IP_2	Second octet of the IP address.
IP_3	Third octet of the IP address.
IP_4	Fourth octet of the IP address (changeable).

Status Indicators

The Kinetix 300 drive has five status indicators around the periphery of the front panel display as shown in Figure 75. These status indicators that are used to monitor the system status, activity, and troubleshoot faults.

Figure 75 - Front Panel Display

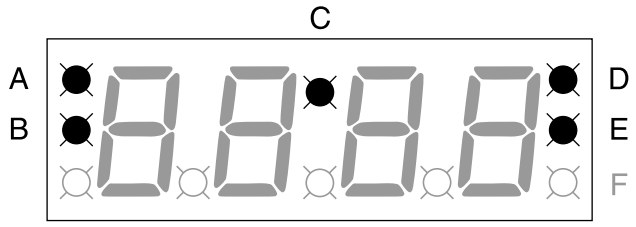


Figure 76 - Status Indicators

Status Indicator	Function	Description
A	Enable	Orange status indicator means that the drive is enabled (running).
B	Regen	Yellow status indicator means the drive is in Regeneration mode.
C	Data entry	Yellow status indicator flashes when changing.
D	Drive fault	Red status indicator illuminates upon a drive fault.
E	Comm activity	Green status indicator flashes to indicate communication activity.

Configure the Kinetix 300 Drive EtherNet/IP Address

This section offers guidance on how to configure your Ethernet connection to the Kinetix 300 drive.

TIP To run MotionView OnBoard on a Mac OS, run the personal-computer emulation tool first.

Ethernet Connection

Configuration, programming, and diagnostics of the Kinetix 300 drive are performed over the standard 10/100 Mbps Ethernet communication port by using the MotionView OnBoard software that is contained within the drive itself.

To access the MotionView OnBoard software, the Kinetix 300 drive and your personal computer must be configured to operate on the same Ethernet network. The IP addresses of the Kinetix 300 drive, the personal computer, or both drive and personal computer can require configuring to enable Ethernet communication between the two devices.

IMPORTANT Any changes that are made to Ethernet communication settings on the Kinetix 300 drive do not take effect until the drive is powered off and powered on again. The drive continues to use the previous settings until power is cycled.

TIP For personal computers with an Ethernet port that is used for a specific purpose, such as email or web browsing, it can more convenient for you to add an Ethernet port.

Install a USB/Ethernet dongle or a PCMCIA Ethernet card to gain an extra port for communication to the Kinetix 300 drive.

Kinetix 300 Drive Ethernet Port Configuration

The IP address of the Kinetix 300 drive is composed of four sub-octets separated by three dots to conform to the Class C Subnet structure. Valid configurations for sub-octets are between 001...254. The default IP address for any Kinetix 300 drive is 192.168.124.200.

There are two methods to change the current IP address. An address can be assigned to the drive automatically (dynamic IP address) when the drive is connected to a DHCP (Dynamic Host Configuration Protocol) enabled server, or you can assign the drive IP address manually (static IP address). Both methods to configure the drives IP address are shown here.

Current IP Address Ethernet Setting

The current Ethernet setting and IP address of the Kinetix 300 drive can be obtained from the drive display and keypad. Press  on the display and use  to access parameters IP_1, IP_2, IP_3 and IP_4. Each of these parameters contains one sub-octet of the full IP address, for example in the case of the drive default (factory set) address parameters:

- IP_1 = 192
- IP_2 = 168
- IP_3 = 124
- IP_4 = 200

By accessing these four parameters, the full IP address on the drive can be obtained.

If parameters IP_1, IP_2, IP_3 and IP_4 all contain '----' rather than a numerical values it means that the drive has DHCP enabled and the DHCP server is yet to assign the drive its dynamic IP address. When DHCP server assigns an IP address, the drive displays the assigned address in the IP_x parameters. See Configure the IP Address Automatically (dynamic address) on page 131.

Configure the IP Address Manually (static address)

When connecting directly from the Kinetix 300 drive to the personal computer without a server or when connecting to a private network, where all devices have static IP addresses, assign the IP address of the Kinetix 300 manually.

To assign the address manually, disable the DHCP mode by using the drive keypad and following these steps.

1. Press  .
2. Use  to access parameter DHCP.
3. Verify DHCP parameter is set to a value of 0.

   If the DHCP parameter is set to 1, use  and  to change the value to 0.
4. Cycle power to the drive.

   The change takes effect.

When DHCP is disabled and the drive power is cycled, The IP address reverts to the previous static IP address.

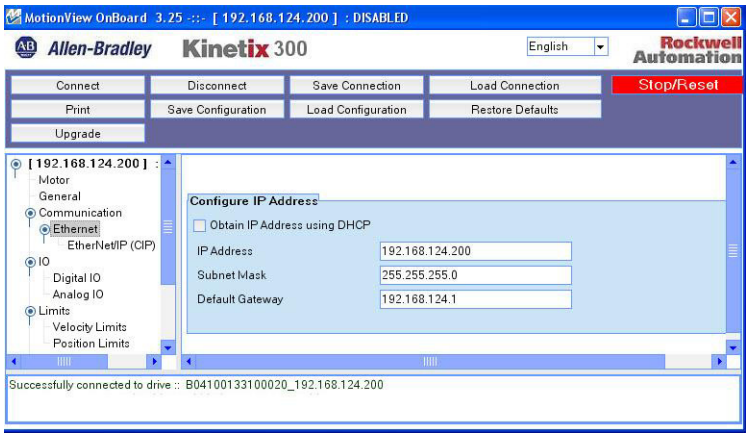
If you are connecting multiple drives to the personal computer, create a unique IP address for each drive by using the keypad on each drive. Change the IP_4 parameter. IP_4 is the only octet that can be changed via the keypad. IP_1, IP2, and IP_3 are read-only accessed this way. The drive power must be cycled for changes to take effect.

To configure the Kinetix 300 drive for a specific subnet or change its full IP address, use the MotionView configuration tool.

1. Run a Java enabled web browser.
2. Enter the current IP address of the drive into the browser.

   MotionView OnBoard dialog box opens.
3. Click Run.
4. Click Connect.
5. Enter the IP address of the drive.
6. Click Connect.
7. From the Drive Organizer, select Communications>Ethernet.

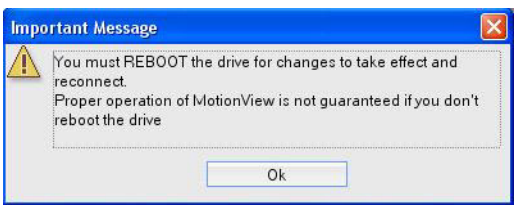
   The IP address, subnet mask, and default gateway address can be edited in this screen. If the text turns red when entered, the values or format that is used are invalid and they are not applied.



8. Check Obtain IP Address by using DHCP, to enable DHCP.

   To disable DHCP, Clear Obtain IP Address by using DHCP.
9. To make changes to take effect, cycle power.

The first time that you change an Ethernet parameter, the following dialog box opens. Click OK and cycle power for changes to take effect.



Configure the IP Address Automatically (dynamic address)

When connecting a Kinetix 300 drive to a network domain with a DHCP enabled server, the IP address of the Kinetix 300 drive is assigned automatically. To automatically assign the address, the drive must have its DHCP mode enabled. Follow these steps by using the drive keypad and display.

1. Press .
2. Use to access parameter DHCP.
3. Check this parameter is set to 1.
4. If the DHCP parameter is set to 0, use and to change the parameter setting to 1.
5. Cycle the drive power to effect the change.

When the Kinetix 300 drive is waiting for an IP address to be assigned by the server it displays '----' in each of the four octet parameters (IP_1, IP_2, IP_3, and IP_4). Once the address is assigned, it appears in IP_x parameters. If the parameters continues to display '----', then it is likely that a connection between the drive and server has not been established, or the server is not DHCP enabled.

DHCP can be enabled through the MotionView software. If you choose to configure the drive by using a manual (static) IP address, you can switch over to an automatic (dynamic) address once configuration is complete. See Current IP Address Ethernet Setting on page 129 for information on enabling DHCP from within the MotionView software.

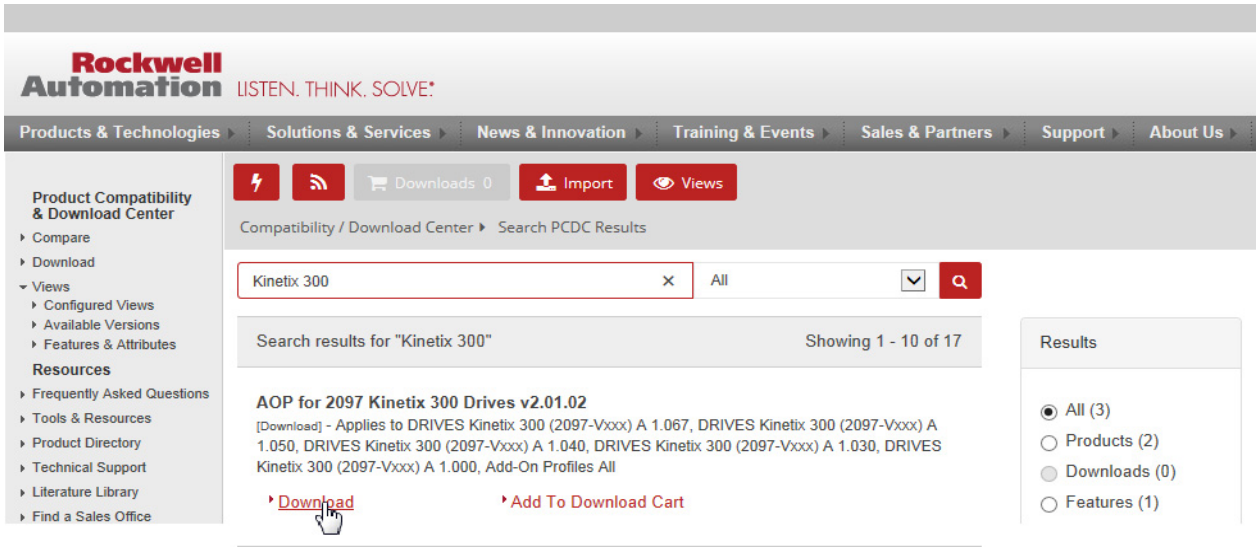
TIP A useful feature of the MotionView software and communication interface to the Kinetix 300 drive is the ability to assign the drive a name (text string). This name can then be used to discover the drives IP address and is useful when the drive has its IP address automatically assigned by the server.

Install the Kinetix 300 Add-on Profile

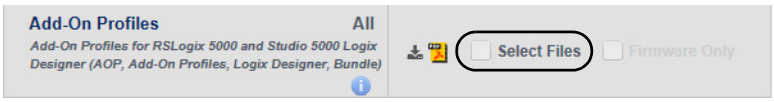
To select Kinetix 300 drives in RSLogix 5000® software, version 17, the Kinetix 300 Add-On Profile (AOP) is required. The AOP is available from the Product Compatibility Download Center (PCDC) website: http://compatibility.rockwellautomation.com/Pages/home.aspx. If you are using RSLogix 5000 software, version 18 or later, or the Studio 5000 Logix Designer® application you do not need the AOP.

Follow these steps to download the Kinetix 300 drives Add-On Profile.

1. Go to the Product Compatibility Download Center and enter Kinetix 300 in the Search PCDC window.
2. Click AOP for 2097 Kinetix 300 Drives v2.01.02.
3. Click Download.



4. Scroll down to Add On Profiles and check Select Files.



5. Scroll down and check AOP for 2097 Kinetix 300 Drives v2.01.02.

6. Click Downloads.
7. Continue with the AOP download.

Configuring the Logix EtherNet/IP Module

This procedure assumes that you have wired your Kinetix 300 drive.

IMPORTANT For the Kinetix 300 drive to communicate with the Ethernet network module you must be using RSLogix 5000 software (version 17 or later) or the Studio 5000 Logix Designer application.

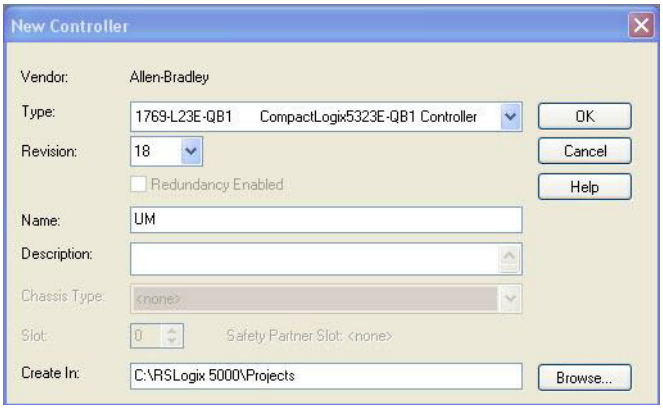
For help using RSLogix 5000 software or the Studio 5000 Logix Designer application to configure the ControlLogix®, CompactLogix™, or SoftLogix™ EtherNet/IP modules, See Additional Resources on page 12.

Configure the Logix Controller

Follow these steps to configure the Logix controller.

1. Apply power to your Logix chassis that contains the Ethernet interface module/PCI card and open your RSLogix 5000 software or the Logix Designer application.
2. From the File menu, choose New.

   The New Controller dialog box opens.



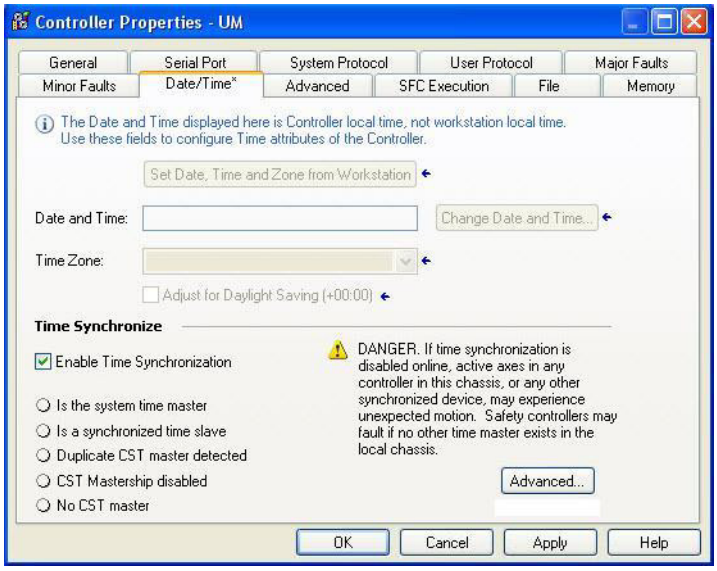
3. Configure the new controller.
   a. From the Type pull-down menu, choose your controller type.

      In this example, the CompactLogix L23E-QB1 controller is chosen.
   b. Enter your RSLogix 5000 software or the Logix Designer application version.
   c. From the Chassis Type pull-down menu, choose your chassis.

      This step applies only for ControlLogix controllers.
   d. Enter the slot where your module resides (leftmost slot = 0).

      This step applies only for ControlLogix controllers.
   e. Name the file.
4. Click OK.
5. From the Edit menu, choose Controller Properties.

The Controller Properties dialog box opens.



6. Click the Date and Time tab.
7. Check the box Make this controller the Coordinated System Time master.

IMPORTANT	You can assign only one ControlLogix controller as the Coordinated System Time master.

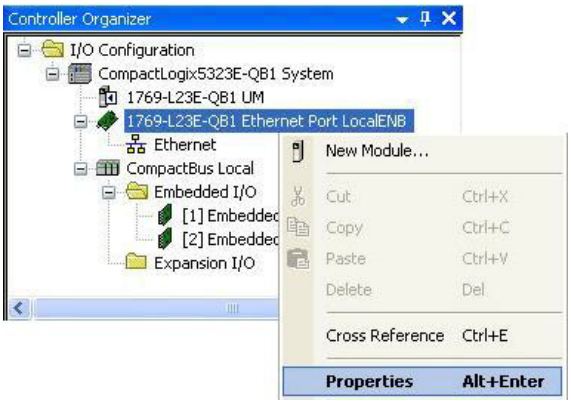
8. Click OK.

Configure the Ethernet Port

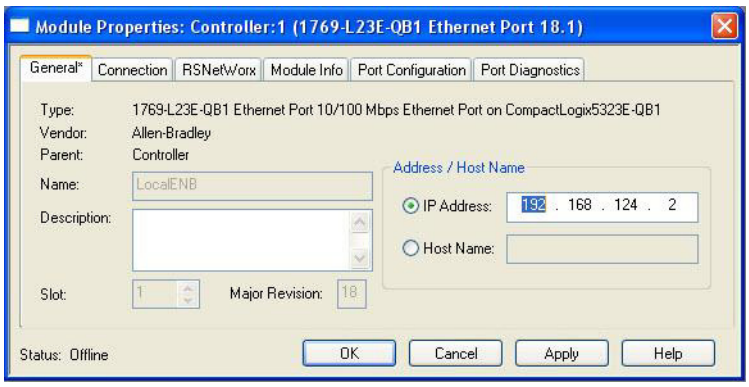
This section applies when the CompactLogix controller, catalog number 1769-L23E-QB1, is used.

Follow these steps to configure the Ethernet port.

1. Right-click the embedded 1769-L23E-QB1 Ethernet port and choose Properties.



The Module Properties dialog box opens.



2. Enter the IP address of the Ethernet port.

   In this example, the IP address 192.168.124.2. is the controller Ethernet address, not the drive Ethernet address.

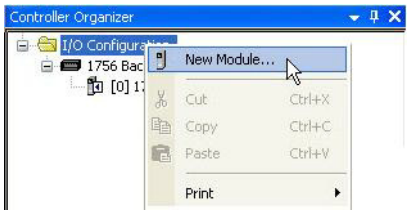
3. Click OK.

Configure the Ethernet Module

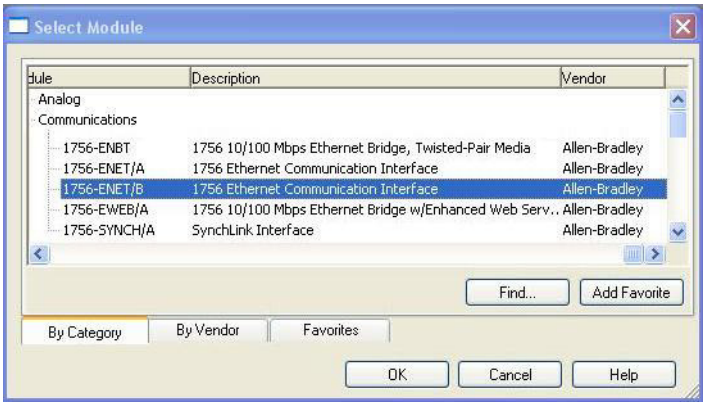
This section applies when the ControlLogix controller, catalog number 1756-ENET/B, is used.

Follow these steps to configure the Ethernet module.

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



The Select Module dialog box opens.

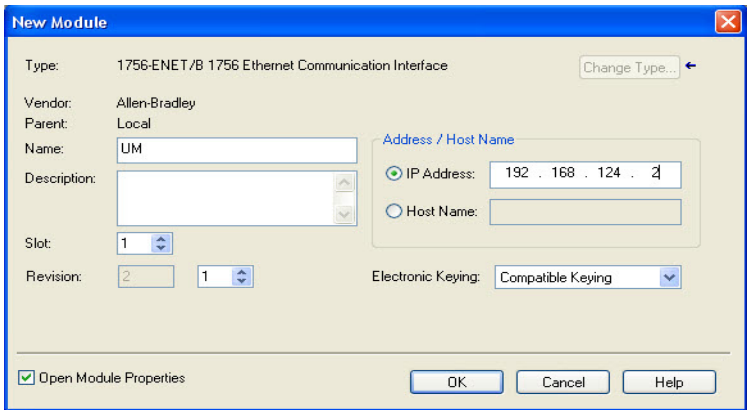


2. Expand the Communications category and select 1756-E*xx*/*x* appropriate for your actual hardware configuration.

   In this example, the 1756-ENET/B module is chosen.

3. Click OK.

   The New Module dialog box opens.



4. Configure the new module.

   a. Name the module.

   b. Enter the IP address of the Ethernet module.

      In this example, the IP address 192.168.124.2. is the controller Ethernet address, not the drive Ethernet address.

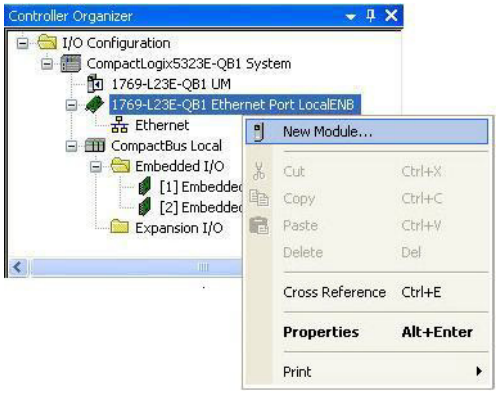
   c. Enter the slot where your module resides (leftmost slot = 0).

5. Click OK.

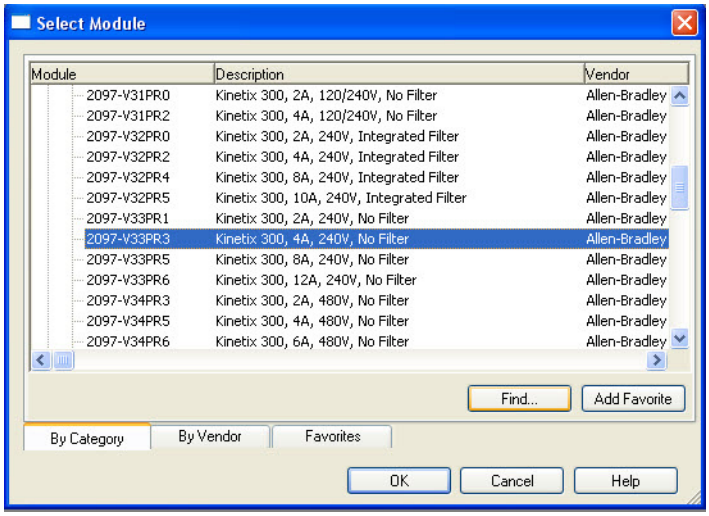
Configure the Kinetix 300 Drive

Follow these steps to configure the Kinetix 300 drive.

1. Right-click the embedded 1769-L23E Ethernet port and choose New Module.



The Select Module dialog box opens.

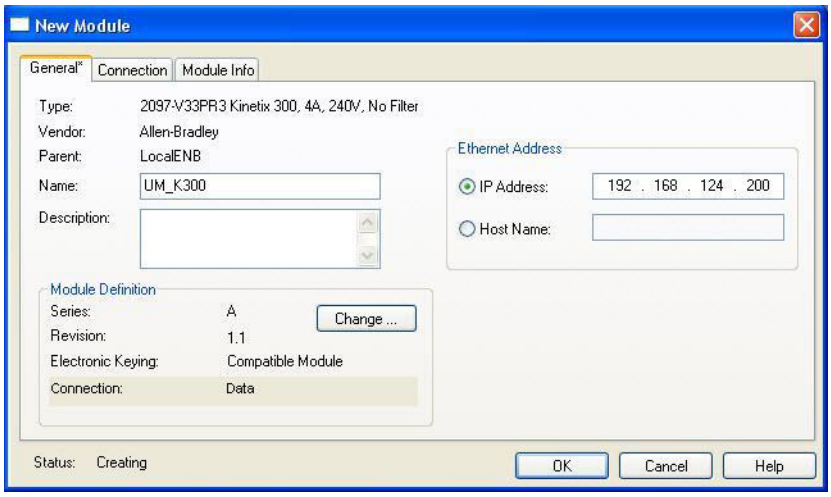


2. Expand the Drives category and select your Bulletin 2097 drive as appropriate for your actual hardware configuration.

   In this example, the 2097-V33PR3 drive is selected.

3. Click OK.

   The New Module dialog box opens.



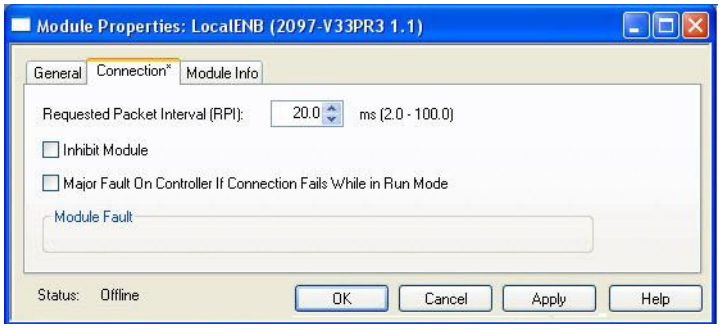
4. Configure the new module.

   a. Name the module.

   b. Set the drive Ethernet address.

   Set the Ethernet address in the software to match the Ethernet address scrolls on the drive. See Current IP Address Ethernet Setting on page 129.

5. Click the Connection tab.



6. Configure the Requested Packet Interval (RPI) for your application.

   The default setting is 20 ms. Yours could be different.

7. Click Ok.

Download the Program

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

Apply Power to the Kinetix 300 Drive

This procedure assumes that you have wired and configured your Kinetix 300 drive system and your EtherNet/IP interface module.

To avoid hazard of electrical shock, mount and wire the Bulletin 2097 drive before you apply power. Once power is applied, connector terminals can have voltage present even when not in use.

Follow these steps to apply power to the Kinetix 300 drive system.

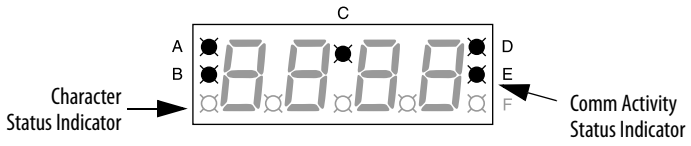
1. Disconnect the load to the motor.

   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 you apply power to the system.

2. Determine the source of the drive logic power.

If Your Logic Power	Then
Is from (24V DC) back-up power	Apply (24V DC) back-up power to the drive (BP connector).
Is from Mains input power	Apply mains input power to the drive (IPD connector).

3. Apply mains input power to the Kinetix 300 drive IPD connector.
4. Observe the four character status indicator.



If the status indicator is	Then
diS	Go to step 5
Blank	Return to main step 2

5. Determine the source of logic power.

If Your Logic Power	Then
Is from (24V DC) back-up power	Apply mains input power to the drive (IPD connector)
Mains input power	Go to step 6

6. Verify that Hardware Enable Input signal IOD connector pin 29 is at 0V.

7. Observe the status indicator on the front of the Kinetix 300 drive.

Status Indicator	Condition	Status	Do This
Drive Fault	Off	Normal condition	Observe the Comm Activity, status indicator E.
	Steady red	Drive has a fault	Go to Status Indicators on page 127.
Comm Activity	Flashes	Communication is ready	Go to Test and Tune the Axis on page 140.
	Off	No communication	Go to Status Indicators on page 127.

Test and Tune the Axis

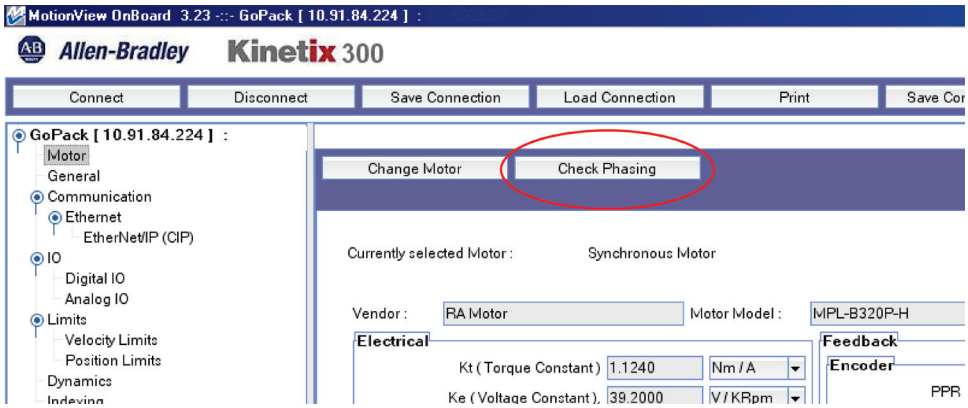
This procedure assumes that you have configured your Kinetix 300 drive, your Logix Ethernet module, and applied power to the system.

IMPORTANT Before you test and tune your axis, verify that the Kinetix 300 drive status indicators are operating as described in step 7 on page 140.

Test the Axis

This procedure applies only to motors with incremental encoders. When using motors with absolute encoders skip, to Tune the Axis. Follow these steps to test the axis.

1. Verify the load was removed from each axis.
2. Run the MotionView OnBoard software.
3. Select the Motor category.
4. Click Check Phasing.



5. Apply Enable Input signal (IOD-29) for the axis you are testing.

ATTENTION: To avoid personal injury or damage to equipment, apply Enable Input (IOD-29) only to the axis you are testing.

6. Click Start Autophasing.

7. Determine if your test completed successfully.

If	Then
Your test has completed successfully and dialog box opened that states motor is phased correctly.	1. Click Ok. 2. Remove Enable Input signal. 3. Go to Tune the Axis on page 141.
Your test did not complete successfully.	1. Click Ok. 2. Verify that the Enable Input signal is applied to the axis you are testing. 3. Verify the motor feedback is wired as required. 4. Return to main step 6 and run the test again.

Tune the Axis

Follow these steps to tune the axes.

1. Verify the load is removed from the axis you want to tune.

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

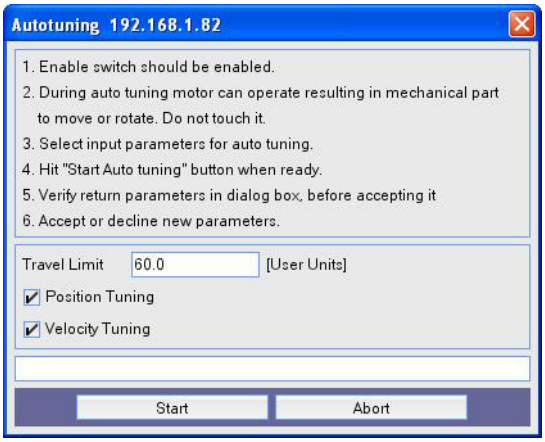
2. Run the MotionView OnBoard software.
3. Select General.
4. From the Drive Mode pull-down menu, choose Auto Tune.
5. Select Dynamics.

   The current velocity and position gains, position limit, and scaling are displayed.
6. If you are using a linear incremental encoder with a resolution greater than 1 μm, do the following. Otherwise continue with the next step.
   a. Set FeedBack Filter to Yes.
   b. Set the time constant to 1 ms.

TIP To reduce the audible noise when a LDAT-Series linear thruster with an absolute encoder option is under servo control, we recommend that you use a low-pass filter with the cut-off frequency set to 150 Hz. You can configure the filter in the Dynamics category.

7. Click Autotuning.

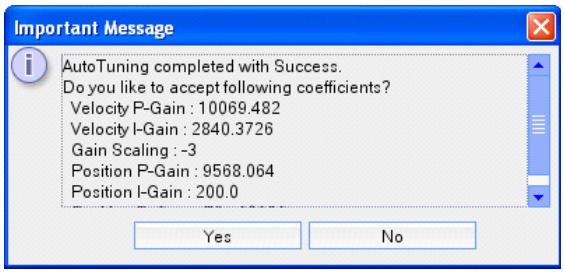
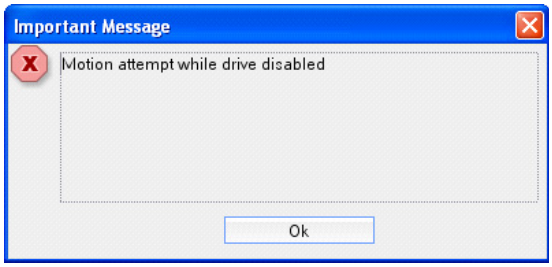
The Autotuning dialog box opens.



8. Check desired Tuning boxes (Velocity/Position or both).
9. Enter the Travel Limit.

   The Travel Limit is the maximum distance in User Units that the motor shaft or actuator can safely travel during the tuning procedure
10. Apply Enable Input signal for the axis you are tuning.
11. To enable the axis, set the DriveEn bit in RSLogix 5000 software or the Logix Designer application for the axis being tuned.
12. Click Start.

    The Tune gains dialog box opens.
13. Click Yes.
14. Determine if your test completed successfully.

If	Then
Your test completed successfully, this dialog box opens. 	1. Click Yes. 2. Remove Enable Input signal. 3. Go to step 16.
Your test did not complete successfully, this dialog box opens. 	1. Click Ok. 2. Verify that the Enable Input signal is applied to the axis you are testing. 3. Verify the motor feedback is wired as required. 4. Verify the safe torque-off is wired correctly. 5. Return to main step 6 and run the test again.

15. Check that the Position Error is in the range of 25...40 mm for safest operation
16. Select General.
17. From the Drive Mode pull-down menu, choose the mode that you desire.

TIP If motion performance is not what you expected after tuning the drive, several filters are available to improve performance. These filters are configured from the Dynamics view of the MotionView software and their placement within the servo loops are shown in the figure on page 98.

Select Drive Operating Mode

This procedure assumes that you have configured your Kinetix 300 drive, your Logix Ethernet module, and applied power to the drive.

The drive operating mode determines the command source for the drive. You can configure the drive from MotionView software or by Explicit Messaging, instance 266, to the drive object.

Follow these steps to select the drive operating mode by using MotionView software.

1. Verify the load was removed from each axis.
2. Run the MotionView software.
3. From the Drive Organizer, select General.
4. From the Drive Mode pull-down menu, choose your drive mode.

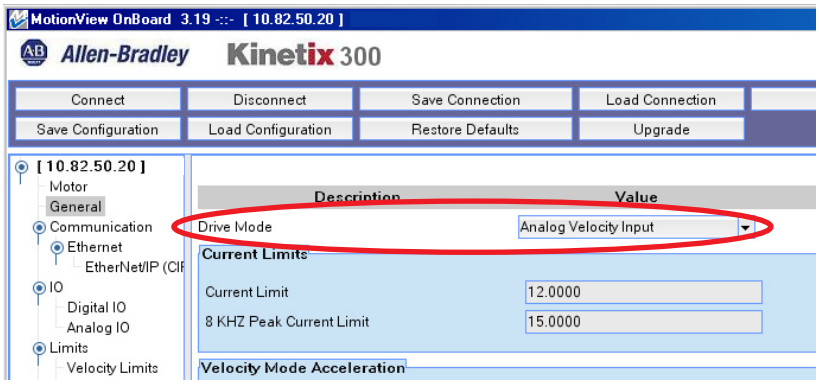


Table 66 - Available Drive Modes

Mode	Drive Object Value
Auto Tune	0
EtherNet/IP External Reference	1
Master Gearing	2
Step and Direction	3
Analog Velocity Input	4
Analog Current Input	5
Indexing	6

Master Gearing Mode Examples

When using a Bulletin MPL encoder for master gearing, the Kinetix 300 planner treats the 128 and 1024 pulse encoders as having 262,144 interpolated counts per revolution for the calculation of the gearing ratios.

User units in the MotionView software, General category, is not used in Master Gearing mode, therefore any transmission ratio besides 1:1 must be configured in the master-to-system units.

Master Gearing Example 1

A Bulletin MPL multi-turn motor is connected to the slave drive and outputs 128 pulses per revolution (ppr). A master encoder outputs 128 ppr TTL to the master gearing inputs on the Kinetix 300 slave drive. A 1:1 master encoder to motor revolution is required.

The drive interpolated counts are 262,144 counts/rev and the master encoder is 128 x 4 (512) counts/rev. The [Master] parameter is 1 and the [System] parameter is 262,144/512 or 512.

Master Gearing Example 2

A Bulletin MPL multi-turn motor is connected to the slave drive and outputs 1024 ppr. A master encoder outputs 2048 ppr TTL to the master gearing inputs on the Kinetix 300 slave drive. A 1:1 master encoder to motor revolution is required.

The drive interpolated counts are 262,144 counts/rev and the master encoder is 2048 x 4 (8192) counts/rev. The [Master] parameter is 1 and the [System] parameter is 262,144/8192 or 32.

Master Gearing Example 3

The same configuration as used in example 2 exists, however, the slave motor that generates the 1024 ppr is connected to a 5:1 gear box. Therefore, one revolution of the gear box requires five motor revolutions.

The drive interpolated counts are 262,144 counts/rev x 5 motor rev/1 output gear box revolution. The master encoder is 2048 x 4 (8192) counts/rev. The [Master] parameter is 1 and the [System] parameter is 262,144 x 5/8192 or 160.

Configure Master Gearing Mode

This procedure assumes that you have configured your Kinetix 300 drive for Master Gearing mode, configured your Logix Ethernet module, and applied power to the system.

Follow these steps to configure the master gearing ratio.

1. Run the MotionView software.
2. From the Drive Organizer, click General.

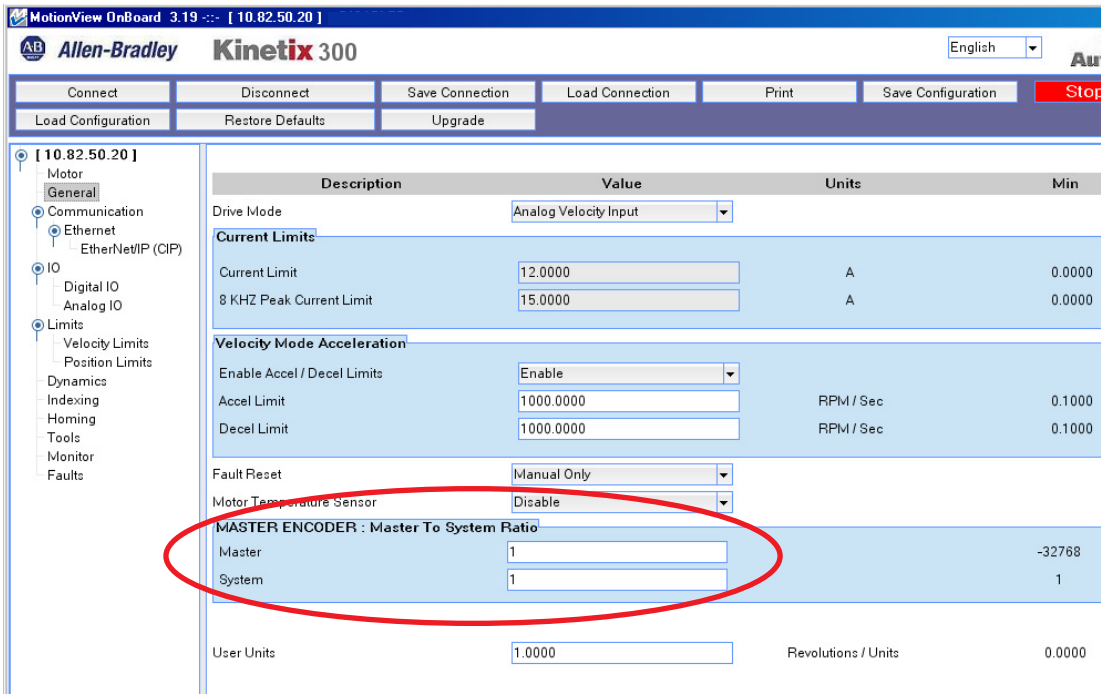
IMPORTANT The buffered output is supported only for use with incremental encoder motor feedback. SICK-Stegmann or Tamagawa high-resolution motor feedback must not be used on the master drive because they cannot generate buffered encoder output pulses. Conversely, the master gearing input supports only incremental encoder inputs.

3. Determine the ratio of buffered encoder output counts to the number of system motor counts.

   See the examples on page 145.

4. Enter the values into the Master and System ratio fields.

   Use a negative value in the Master field to reverse the relative direction of the drive relative to the master.



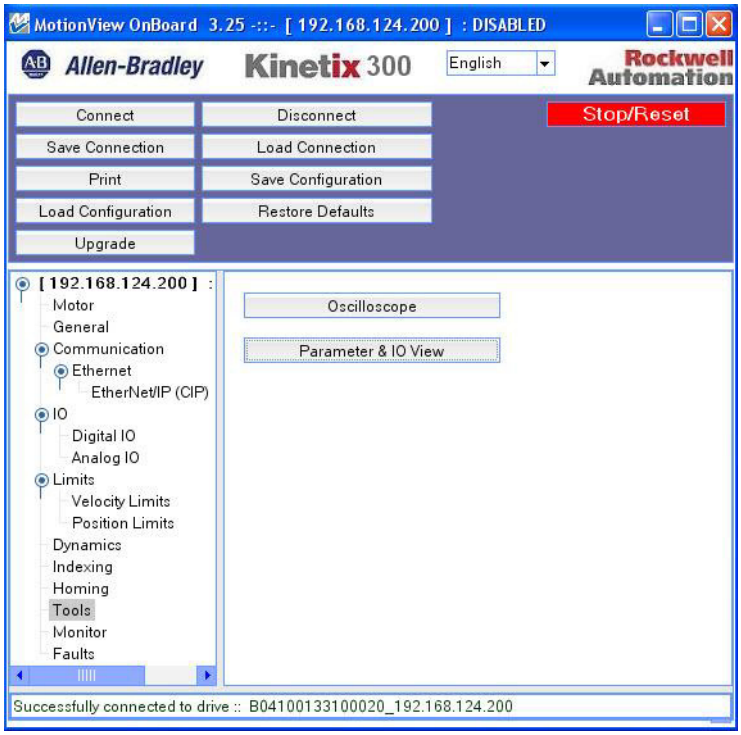
Configure the Drive Parameters and System Variables

This section provides information for you to access and change parameters not accessible through RSLogix 5000 software or the Studio 5000 Logix Designer application.

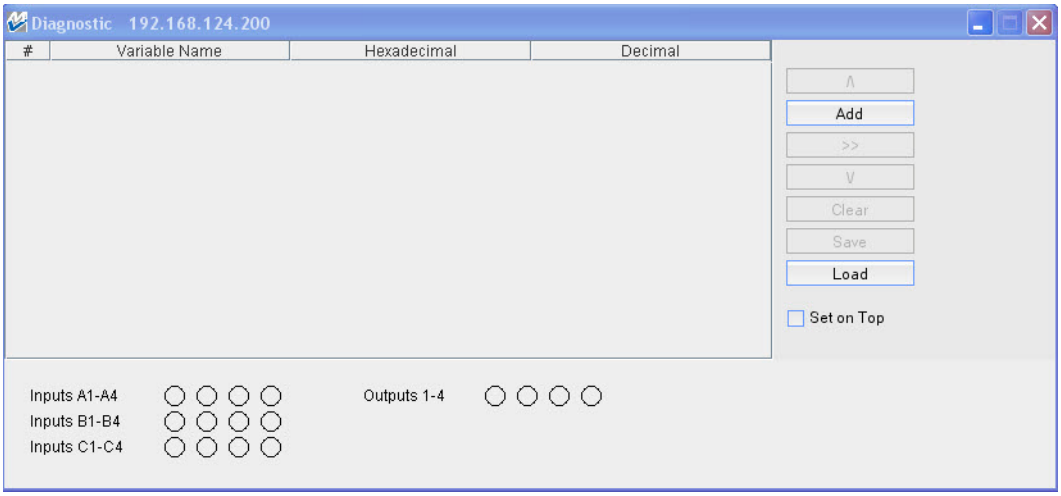
Tools for Viewing Parameters

Follow these steps to view parameters.

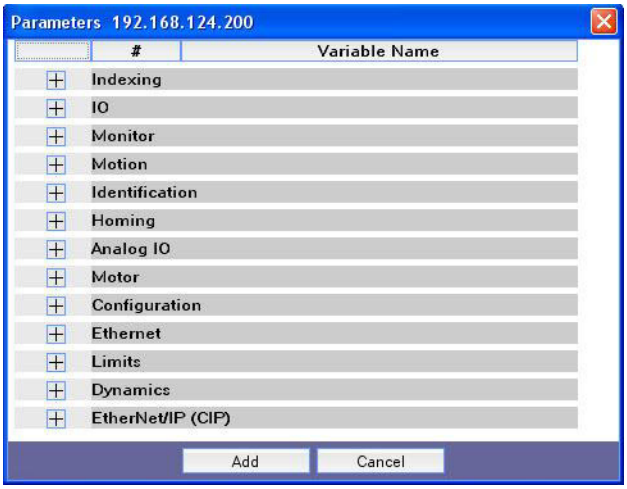
1. From MotionView software, click Tools.



2. Click Parameter>IO View.



3. Click Add to add a parameter to the viewer.



4. Select a parameter from within the tree structure.

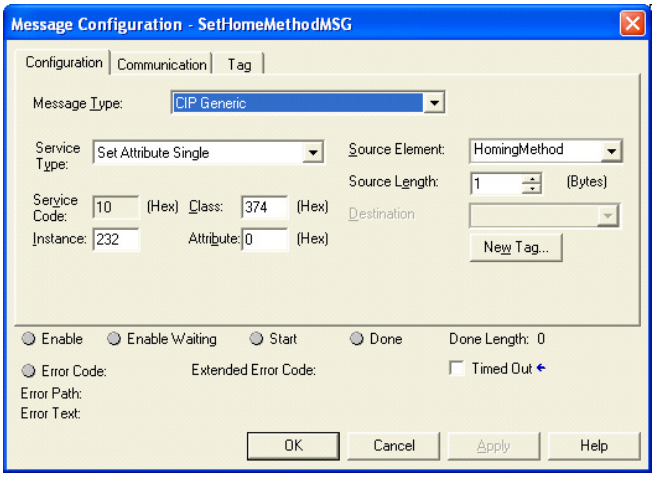
5. Click Add.

Tools for Changing Parameters

Some parameters are accessible through RSLogix 5000 software or the Studio 5000 Logix Designer application. The alternative is to use Explicit Messaging from the Ethernet module.

Follow these steps to change parameters by using Explicit Messaging.

1. Create a Set Attribute Single MSG instruction in the ladder logic program.



2. Use a Class value of 374 (Hex).
3. Use the ID of the parameter as listed in Appendix C as the Instance.
4. Use the Attribute value to reflect the format of the value and the nonvolatile status of the value.

Attribute	Format	Memory Stored In
0	32-bit integer	Volatile
1	32-bit integer	Nonvolatile
2	32-bit floating point	Volatile
3	32-bit floating point	Nonvolatile
4	String	Volatile
5	String	Nonvolatile

Configure Drive Mode with Explicit Messaging

These Kinetix 300 drive modes can be set via explicit messaging:

- Master Gearing
- Step and Direction
- Analog Velocity
- Analog Current
- Indexing

Set the drive mode by entering the parameters from the appropriate table via EtherNet/IP Explicit Messaging or through the MotionView software. For Indexing mode, see page 101.

Table 67 - Master Gearing

ID	Parameter Name	Description	Value
266	Drive Mode	Set to Master Gearing	2
79	M2SRatioMaster	Master to system ratio (master counts)	Range: -32768…+32768
80	M2SRatioSystem	Master to system ratio denominator (system counts)	Range: 1…32768
29	EnableSwitchType	Enable switch function	0 = Inhibit only 1 = Enable as soon as asserted

IMPORTANT Do not set parameter 80 to 0 or unexpected motion will occur.

Table 68 - Step and Direction

ID	Parameter Name	Description	Value
266	Drive Mode	Set to Step and Direction	3
79	M2SRatioMaster	Master to system ratio numerator (master counts)	Range: -32768…+32768
29	EnableSwitchType	Enable switch function	0 = Inhibit only 1 = Enable as soon as asserted

Table 69 - Analog Velocity

ID	Parameter Name	Description	Value
266	Drive Mode	Set to Analog Velocity	4
36	VelocityScale	Analog input velocity reference scale: Velocity = Vinput x VelocityScale	Range: -10000…10000 rpm/V
76	AccelLimit	Accel value for Velocity mode	Range: 0.1…5,000,000 UU/s
77	DecelLimit	Decel value for Velocity mode	Range: 0.1…5,000,000 UU/s
75	EnableVelAccDec	Enable Accel/Decel function for Velocity mode	0 = Disable 1 = Enable
89	AnalogInput1Deadband	Analog input dead-band. Applied when used as a velocity reference.	Range: 0…100 mV
90	AnalogInput1Offset	Analog input offset. Applied when used as current/velocity reference.	Range: -10.000…10.000
85	AnalogOutFunction	Analog output function	0 = Not assigned 1 = Phase current (rms) 2 = Phase current (peak value) 3 = Motor velocity 4 = Phase current R 5 = Phase current S 6 = Phase current T 7 = Iq current 8 = Id current
86	AnalogOutVelocityScale	Analog output scale for velocity quantities	Range: 0…10 mV/rpm
29	EnableSwitchType	Enable switch function	0 = Inhibit only 1 = Enable as soon as asserted

Table 70 - Analog Current

ID	Parameter Name	Description	Value
266	Drive Mode	Set to Analog Current	5
35	CurrentScale	Current scale	Range: -*X*…+*X* Amps/Volt *X* = drive peak output current/10
89	AnalogInput1Deadband	Analog input dead-band. Applied when used as a velocity reference.	Range: 0…100 mV
90	AnalogInput1Offset	Analog input offset. Applied when used as current/velocity reference.	Range: -10,000…10,000
85	AnalogOutFunction	Analog output function	0 = Not assigned 1 = Phase current (rms) 2 = Phase current (peak value) 3 = Motor velocity 4 = Phase current R 5 = Phase current S 6 = Phase current T 7 = Iq current 8 = Id current
87	AnalogOutCurrentScale	Analog output scale for current related quantities.	Range: 0…10V/A
29	EnableSwitchType	Enable switch function	0 = Inhibit only 1 = Enable as soon as asserted

Configure Drive for Linear Motors and Direct Drive Stages

Use this section to configure your Kinetix 300 drive for use with linear motor and linear stages.

Motor Temperature Sensor

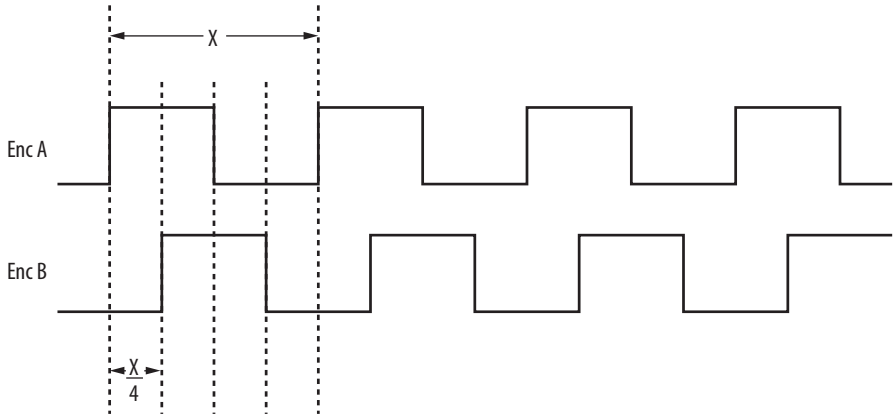
For LDAT-Series linear thrusters, LDL-Series™ and LDC-Series™ linear motors and MPAS-Series linear stages, do the following.

1. Run MotionView software.
2. Click General Category.
3. Set Motor Temperature Sensor to Enable.

Understanding Encoder Resolution Setting

Figure 77 shows the relationship of Resolution (x1) and Resolution (x4).

Figure 77 - Relationship between Resolution (1x) and Resolution (4x)



Here is a simple example.

EXAMPLE If Resolution (x1) = 4 µm, then Resolution (x4) = 1 µm

Change the Encoder Resolution for an Incremental Encoder

The encoder resolution defaults to 5 μm per encoder count. If you must change the resolution, do the following.

1. Run the MotionView software.
2. From the Drive Organizer, click Motor.
3. Click Change Motor.
4. Click Custom Motor.
5. Click Create Custom.
6. Create a Vendor Name.

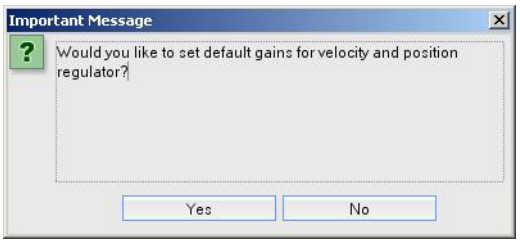
EXAMPLE AB Custom

7. Create a Motor Model.

EXAMPLE LDC-c030100DHT1u

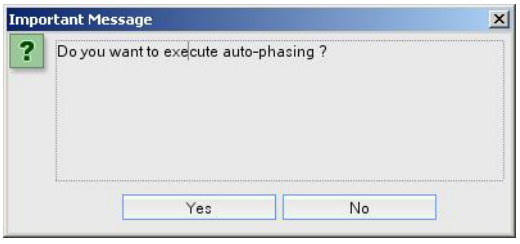
8. Enter either the Resolution (x1) or the Resolution (x4) value.
9. Click Save File.
10. Enter <filename>.cmt.xml.
11. Click Update Drive.

    This important message appears.



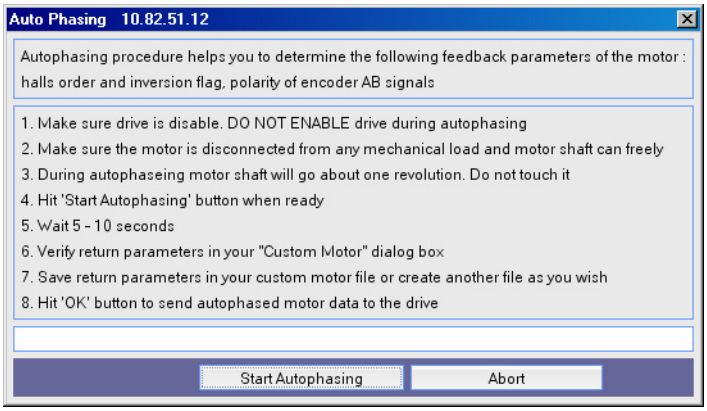
12. Answer yes or no according to your motor needs.

    This important message appears.



IMPORTANT We recommended that you do auto-phasing when you wire and commission new motors.

If you choose auto phasing, the following appears.



13. Follow the instructions in the dialog box.

If your system is wired by using one of the interconnect diagrams in Appendix A, then you get the following results.

Table 71 - Feedback Parameters

Parameter	Value
Resolution (x1)	20 µm
Resolution (x4)	5 µm
Halls order	3
Inverted	Checked
B lead A for forward	Unchecked

Troubleshooting the Kinetix 300 Drive System

Safety Precautions

Observe the following safety precautions when troubleshooting your Kinetix® 300 drive.

ATTENTION: DC bus capacitors 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 listed on the drive warning label. Failure to observe this precaution could result in severe bodily injury or loss of life.

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. If you do not correct a drive or system malfunction, it could result in personal injury and/or damage to the equipment as a result of uncontrolled machine system operation.

Test equipment (such as an oscilloscope or chart recorder) must be properly grounded. Failure to include an earth ground connection could result in a potentially fatal voltage on the oscilloscope chassis.

SHOCK HAZARD: Capacitors retain charge for approximately 300 s after power is removed. Disconnect incoming power and wait at least five minutes before touching the drive. Failure to observe this precaution could result in severe bodily injury or loss of life.

RISQUE DE CHOC: Les condensateurs restent sous charge pendant environ 300 secondes après une coupure de courant. Couper l'alimentation et patienter pendant au moins 5 minutes avant de toucher l'entraînement. Le non-respect de cette précaution peut entraîner des blessures corporelles graves ou la mort.

WARNING: The opening of branch-circuit protective device can be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, parts that carry current and other components of the controller must be examined and replaced if damaged.

AVERTISSEMENT: Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés. En cas de grillage de l'élément traverse par le courant dans un relais de surcharge, le relais tout entier doit être remplacé.

General Troubleshooting

See Error Codes on page 157 to identify anomalies, potential causes, and appropriate actions to resolve the anomalies. If anomalies persist after attempting to troubleshoot the system, contact your Allen-Bradley representative for further assistance. To determine if your Kinetix 300 drive has an error, see the table below.

Display Behavior

By default, if there is no activity on the input keypad for 30 seconds, the Kinetix® 300 drive continuously scrolls the drives' IP address.

Upon powerup, the display shows its status: diS (disabled) or run (enabled), then after 30 seconds, the drive alternately scrolls the drives' IP address along with its status.

If the Kinetix 300 drive is faulted, the drive displays the fault code (non-scrolling). Then after 30 seconds, the drive alternately scrolls the drives' IP address along with its fault code.

Error Codes

The following list is designed to help you resolve anomalies.

When a fault is detected, the status indicator displays an E and a two-digit error code until the anomaly is cleared.

Table 72 - Error Codes

Error Code	Anomaly	Possible Cause	Action/Solution
–	Status indicator not displaying any messages.	No AC power or back-up power.	Verify AC power or back-up power is applied to the Kinetix 300 drive.
		Internal power supply malfunction.	Call your Allen-Bradley representative.
–	Motor jumps when first enabled.	Motor wiring error.	Check motor wiring.
		Incorrect motor chosen.	Verify the proper motor is selected.
E04	Motor overtemperature.	Motor thermostat trips due to: • High motor ambient temperature. • Excessive current.	• Operate within (not above) the continuous torque rating for the ambient temperature 40 °C (104 °F) maximum). • Lower ambient temperature, increase motor cooling.
		Motor wiring error.	Check motor wiring.
		Incorrect motor selection.	Verify the proper motor has been selected.
E06	Hardware overtravel.	Dedicated overtravel input is inactive.	• Check wiring. • Verify motion profile.
E07	Feedback lost.	The feedback wiring is open, shorted, or missing.	• Check motor encoder wiring. • Make sure that the motor is recognized from drive's Web-based configuration motor screen.
E09	Bus undervoltage.	Low AC line/AC power input.	• 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.
E10	Bus overvoltage.	Excessive regeneration of power. When the motor is driven by an external mechanical power source, it may regenerate too much peak energy through the Kinetix 300 drives power supply. The system faults to save itself from an overload.	• Change the deceleration or motion profile. • Use a larger system (motor and Kinetix 300 drive). • Use a resistive shunt. • If a shunt is connected, verify the wiring is correct.
		Excessive AC input voltage.	Verify input is within specifications.
E11	Illegal Hall state.	Incorrect phasing.	Check the Hall phasing.
		Bad connections.	• Verify the Hall wiring. • Verify 5V power supply to the encoder.
E12	Home search failed.	Home sensor and/or marker is outside the overtravel limits.	• Check wiring. • Reposition the overtravel limits or sensor.
E14	Ethernet I/O connection lost.	Ethernet I/O Connection lost.	Check wiring and Ethernet cables and routing. Check controller program to be sure that I/O is scanned at correct RPI rate.
E16	Software overtravel.	Programmed overtravel limit has been exceeded.	• Verify motion profile. • Verify overtravel settings are appropriate.
E18	Overspeed fault.	Motor speed has exceeded 125% of maximum rated speed.	• Check cables for noise. • Check tuning.
E19	Excess position error.	Position error limit was exceeded.	• Increase following error limit or time. • Check position loop tuning.

Table 72 - Error Codes (continued)

Error Code	Anomaly	Possible Cause	Action/Solution
E23	Drive Thermal Protection	The internal filter algorithm protecting the drive from overheating has tripped.	• Reduce acceleration rates. • Reduce duty cycle (ON/OFF) of commanded motion. • Increase time permitted for motion. • Use larger Kinetix 300 drive and motor. • Check tuning.
E26	Index parameter out of range.	Parameters specified in the index table are beyond system capabilities.	Verify index parameters, such as position and velocity.
E27	Absolute move fault	Initiated move without being homed.	When using an absolute encoder home the axis before attempting an absolute move.
E30	Encoder communication fault.	Communication was not established with an intelligent encoder.	• Verify motor selection. • Verify the motor supports automatic identification. • Verify motor encoder wiring.
E31	Encoder data.	Encoder data is corrupted.	Replace the motor/encoder.
E39	Safe torque-off while enabled.	The safety circuit was opened while drive was enabled or while attempting to enable.	Check safety circuit.
E43	Drive enable input.	An attempt was made to enable the axis through software while the Drive Enable hardware input was inactive.	Verify that Drive Enable hardware input is active whenever the drive is enabled through software.
		The Drive Enable input transitioned from active to inactive while the axis was enabled.	
E44	Controller changed to PROG mode.	Program downloaded or turned key on logix controller to program position.	Place controller back in RUN mode, clear faults.
E67	Operating system failed.	Hardware or configuration failure.	• Cycle power. • Check configuration settings to be sure that drive tags setting are valid. • Check your program to ensure there are not explicit messages to internal drive variables which have been noted as unpublished or reserved.
E70	Memory module error.	Bad memory module	Replace memory module
E72	Drive temperature too high. The heat sink temperature sensor has detects an overtemperature condition.	Improper airflow/environmental temperature exceeds specifications or an application anomaly .	Check for clogged vents or defective fan. Make sure cooling is not restricted by insufficient space around the unit. Check ambient temperature in enclosure. Reduce acceleration rates. Reduce duty cycle (ON/OFF) of commanded motion. Increase time permitted for motion.
E74	Drive has exceeded peak current limit. Drive cannot regulate current properly.	Motor cables shorted.	Verify continuity of motor power cables and connector.
		Motor winding shorted internally.	Disconnect motor power cables form the motor. If the motor is difficult to turn by hand, it must be replaced.
		The machine duty cycle requires an RMS current exceeding the continuous rating of the controller.	Change the command profile to reduce speed or increase time.
		Operation above continuous power rating and/or product environmental rating.	Verify ambient temperature is not too high. Operate within the continuous power rating. Reduces acceleration rates.
		The Kinetix 300 drive has a short circuit overcurrent, or failed component.	Remove all power and motor connections and preform a continuity check form the DC bus to the U, V, and W motor outputs. If a continuity exists, check for wire fibers between terminal or send drive in for repair.

Table 72 - Error Codes (continued)

Error Code	Anomaly	Possible Cause	Action/Solution
E76	Blank memory module.	A Blank MEM module has been inserted into the drive.	Push and hold the drive's enter key (bottom most red button) on the drive's front display until the drive shows "bUSY". This will make the drive format the blank memory module for usage with the drive.
E91	User watchdog has timed out.	Ladder program error.	• Not writing to WatchDogKick Tag frequently enough to prevent timeout. • Watchdog timeout period set to too low a value. Increase timeout period or change controller application to kick watchdog more frequently.
E92	Bad battery.	• Tamagawa absolute feedback battery voltage low or missing. • A battery error is set at drive powerup when main power to the encoder is not present or the battery voltage is below 2.75V.	Replace battery.
E93	Motion set-up parameters calculate an acceleration value above or below the drive capability.	Check indexing profiles or motion set-up profiles.	Increase or decrease acceleration profile. Increase or decrease permitted time for motion.
E94	Motor or motor feedback cable.	Motor or feedback device malfunction.	• Check motor power/feedback wiring. • Replace motor or encoder.
		Recommenced grounding, per installation instructions, has not been followed.	• Verify grounding. • Route feedback cables away from noise sources. • See System Design for Control of Electric Noise Reference Manual, publication GMC-RM001.
E95	Wrong Indexing Mode	Index Type or ReferenceSource not supported in configured Linear/Rotary Unwind mode.	• Change the Index Type or ReferenceSource to values that are supported by selecting Linear or Rotary Unwind mode

Clearing Faults

This section provides methods for clear faults in the Kinetix 300 drive. You can clear drive faults by using digital inputs or drive parameters.

Use Digital Inputs to Clear Faults

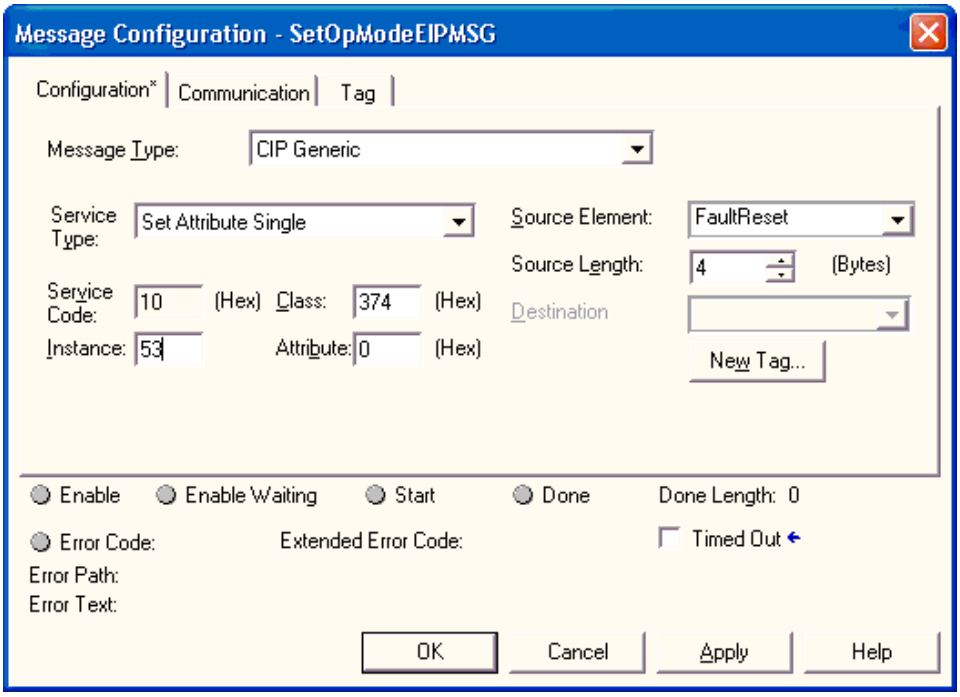
You can use MotionView software to clear faults by configuring a digital input as Fault Reset. To clear faults by using this input, you must make the input active until the fault clears and then deactivate it.

Use Drive Parameters to Clear Faults

You can use the Kinetix 300 drive parameter to reset faults by using Explicit Messaging or UserDefinedDataLink.

Explicit Messaging

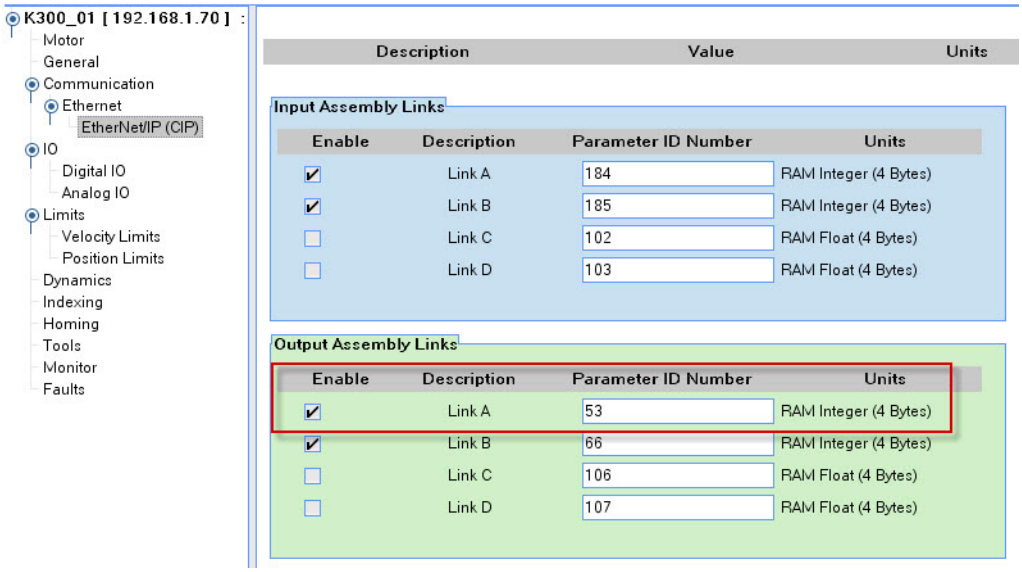
Send Explicit Messages from within the RSLogix 5000® software or the Studio 5000 Logix Designer® application to Class 374 (hex) Instance 53, Attribute 0 to set it to a 1 and then back to a 0 when the fault is cleared.



UserDefinedDataLink

Drive parameters used in the Explicit Messaging section can be mapped into the integer UserDefinedDataLink by using MotionView software. Then the parameter can be toggled by using the UserDefinedIntegerData0 or UserDefinedIntegerData1 tags within RSLogix 5000 software or the Logix Designer application.

Figure 78 - UserDefinedDataLink Example Using Parameter 53



Drive Enable

The drive clears runtime faults if the drive enable command from RSLogix 5000 software or the Logix Designer application is cycled and the fault reset in the MotionView software is configured for On Disable. For the drive to be enabled, the DriveEn bit in the Output Assembly needs to be set to 1. By changing that from 1 back to 0, the fault clears as the drive disables.

Notes:

Kinetix 300 Drive Safe Torque-off Feature

This appendix introduces you to how the safe torque-off feature meets the requirements for ISO 13849-1 performance level d (PLd) safety category 3.

Certification

The safe torque-off circuit is type-approved and certified for use in safety applications up to and including ISO 13849-1 performance level d (PLd) safety category 3.

The TÜV Rheinland group has approved the Kinetix® 300 drives for use in safety-related applications up to ISO 13849-1 performance level d (PLd) safety category 3, in which the de-energized state is considered to be the safe state. All of the examples related to I/O included in this manual are based on achieving de-energization as the safe state for typical machine safety systems.

Important Safety Considerations

The system user is responsible for the following:

- Validation of any sensors or actuators connected to the drive system
- Completing a machine-level risk assessment
- Certification of the machine to the desired EN ISO 13849-1 performance level
- Project management and proof testing
- Programming the application software and the device configurations in accordance with the information in this safety reference manual and the drive product manual

Safety Category 3 Requirements

Safety-related parts are designed with these attributes:

- A single fault in any of these parts does not lead to the loss of the safety function
- A single fault is detected whenever reasonably practicable
- Accumulation of undetected faults can lead to the loss of the safety function, which results in an uncontrolled coast to stop

Stop Category Definition

Stop category 0 is achieved with immediate removal of power to the actuator.

IMPORTANT In the event of drive or control failure, the most likely stop category is category 0. When designing the machine application, timing and distance should be considered for a coast to stop. For more information regarding stop categories, see EN 60204-1.

Performance Level and Safety Integrity Level (SIL) CL3

For safety-related control systems, Performance Level (PL), according to EN ISO 13849-1, and SIL levels, according to EN 61508 and EN 62061, include a rating of the systems ability to perform its safety functions. All of the safety-related components of the control system must be included in both a risk assessment and the determination of the achieved levels.

See the EN ISO 13849-1, EN 61508, and EN 62061 standards for complete information on requirements for PL and SIL determination.

Description of Operation

The safe torque-off feature provides a method, with sufficiently low probability of failure on demand, to force the power-transistor control signals to a disabled state. When disabled, or any time power is removed from the safety enable inputs, all of the drives output-power transistors are released from the ON state, effectively removing motive power generated by the drive. This results in a condition where the motor is in a coasting condition (stop category 0). Disabling the power transistor output does not provide mechanical isolation of the electrical output, which may be required for some applications.

Under normal drive operation, the safe torque-off switches are energized. If either of the safety enable inputs are de-energized, the gate control circuit is disabled. To meet EN ISO 13849-1 (PLd) both safety channels must be used and monitored.

ATTENTION: Permanent magnet motors may, in the event of two simultaneous faults in the IGBT circuit, result in a rotation of up to 180 electrical degrees.

Functional Proof Tests

The functional safety standards require that functional proof tests be performed on the equipment used in the system. Proof tests are performed at user-defined intervals, not to exceed one year, and are dependent upon PFD and PFH values.

IMPORTANT Users specific applications determine the time frame for the proof test interval, but it must not exceed one year due to the use of switches internal to the drive, as required by EN ISO 13849-1.

To proof test the safe torque-off function, you must interrupt power to the inputs of the safe torque-off function at pins STO-4 and STO-6 and verify that the drive is in the disabled state.

Table 73 - Proof Test Truth Table

Safety Function State	Safety Input 1 (STO-4)	Safety Input 2 (STO-6)	Safety Status Output (STO-3)	Drive Status Indication(1)
Normal operation	Energized	Energized	Energized	Run
Safe torque-off mismatch	Energized	De-energized	Energized	E39
	De-energized	Energized	Energized	E39
Safe torque-off function engaged	De-energized	De-energized	De-energized	E39

(1) Drive display changes to condition shown on enable of the drive (IN_ A3 Enable).

Normal operation of the safe torque-off function, if monitored and verified, constitutes the proof test. A safe torque-off mismatch results in error code E39.

Troubleshooting the Safe Torque-off Function

Error Code	Fault Message RSLogix (HIM)	Anomaly	Potential Cause	Possible Resolution
E39	**DriveHardFault** (safe torque-off HW Flt)	Safe torque-off function mismatch. Drive will not allow motion.	• Loose wiring at safe torque-off (STO) connector. • Cable/header not seated properly in safe torque-off (STO) connector. • Safe torque-off circuit missing +24V DC.	• Verify wire terminations, cable/header connections, and +24V. • Reset error and run proof test. • If error persists, return the drive to Rockwell Automation.

ATTENTION: The safe torque-off fault (E39) is detected upon demand of the safe torque-off function. After troubleshooting, a proof test must be performed to verify correct operation.

PFD and PFH Definitions

Safety-related systems can be classified as operating in either a Low Demand mode, or in a High Demand/Continuous mode:

- Low Demand mode: where the frequency of demands for operation made on a safety-related system is no greater than one per year or no greater than twice the proof-test frequency.
- High Demand/Continuous mode: where the frequency of demands for operation made on a safety-related system is greater than once per year or greater than twice the proof test interval.

The SIL value for a low demand safety-related system is directly related to order-of-magnitude ranges of its average probability of failure to satisfactorily perform its safety function on demand or, simply, average probability of failure on demand (PFD). The SIL value for a High Demand/Continuous mode safety-related system is directly related to the probability of a dangerous failure occurring per hour (PFH).

PFD and PFH Data

These PFD and PFH calculations are based on the equations from EN 61508 and show worst-case values.

This table provides data for a 20-year proof test interval and demonstrates the worst-case effect of various configuration changes on the data.

Table 74 - PFD and PFH for 20-year Proof Test Interval

Attribute	Value
PFH [1e-9]	5.9
PFD [1e-3]	1.0

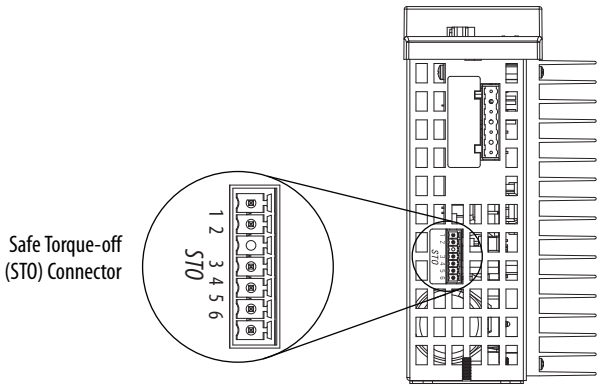
Safe Torque-off Connector Data

This section provides safe torque-off (STO) connector and header information for the Kinetix 300 drive safe torque-off.

STO Connector Pinouts

Headers extend the STO connector signals for use in wiring or to defeat (not use) the safe torque-off function.

Figure 79 - Safe Torque-off (STO) Connector



Kinetix 300 Drive, Bottom View
(2097-V32PR4 is shown)

STO Pin	Description	Signal
1	+24V DC output from the drive	+24V DC control
2	+24V DC output common	Control COM
3	Safety status	Safety Status
4	Safety input 1 (+24V DC to enable)	Safety Input 1
5	Safety common	Safety COM
6	Safety input 2 (+24V DC to enable)	Safety Input 2

Wiring Your Safe Torque-off Circuit

This section provides guidelines for wiring your Kinetix 300 safe torque-off drive connections.

European Union Directives

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

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

EMC Directive

This unit is tested to meet Council Directive 2004/108/EC Electromagnetic Compatibility (EMC) by using these standards, in whole or in part:

- EN 61800-3 - Adjustable Speed Electrical Power Drive Systems, Part 3 - EMC Product Standard including specific test methods
- EN 61000-6-4 EMC - Emission Standard, Part 2 - Industrial Environment
- EN 61000-6-2 EMC - Immunity Standard, Part 2 - Industrial Environment

The product described in this manual is intended for use in an industrial environment.

CE Conformity

Conformity with the Low Voltage Directive and Electromagnetic Compatibility (EMC) Directive is demonstrated by using harmonized European Norm (EN) standards published in the Official Journal of the European Communities. The safe torque-off circuit complies with the EN standards when installed according instructions found in this manual.

CE Declarations of Conformity are available online at: www.rockwellautomation.com/products/certification/ce.

Low Voltage Directive

These units are tested to meet Council Directive 2006/95/EC Low Voltage Directive. The EN 60204-1 Safety of Machinery-Electrical Equipment of Machines, Part 1-Specification for General Requirements standard applies in whole or in part. Additionally, the standard EN 50178 Electronic Equipment for use in Power Installations apply in whole or in part.

Safe Torque-off Wiring Requirements

These are the safe torque-off (STO) wiring requirements. Wire should be copper with 75 °C (167 °F) minimum rating.

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

IMPORTANT Stranded wires must terminate with ferrules to prevent short circuits, per table D7 of EN 13849.

Figure 80 - Safe Torque-off (STO) Terminal Plug

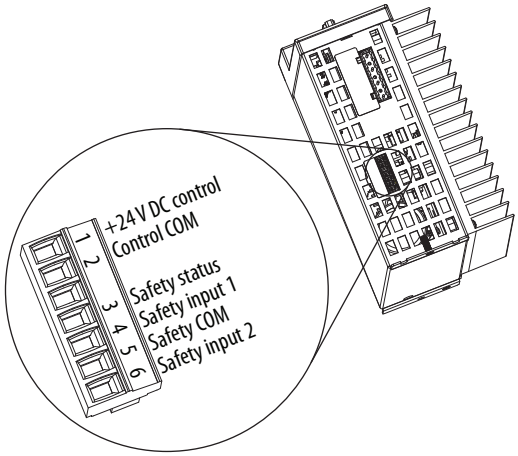


Table 75 - Safe Torque-off (STO) Terminal Plug Wiring

Safe Torque-off (STO) Connector		Recommended Wire Size		Strip Length mm (in.)	Torque Value N•m (lb•in)
Pin	**Signal**	**Stranded Wire with Ferrule** mm^2 (AWG)	**Solid Wire** mm^2 (AWG)		
STO-1 STO-2 STO-3 STO-4 STO-5 STO-6	+24V DC Control Control COM Safety Status Safety Input 1 Safety COM Safety Input 2	0.75 (18)	1.5 (16)	6 (0.25)	0.2 (1.8)

IMPORTANT Pins STO-1 (+24V DC Control) and STO-2 (Control COM) are used only by the motion-allowed jumpers to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

IMPORTANT To be sure of system performance, run wires and cables in the wireways as established in the user manual for your drive.

Kinetix 300 Drive Safe Torque-off Feature

The safe torque-off circuit, when used with suitable safety components, provides protection according to EN ISO 13849-1 (PLd). The safe torque-off option is just one safety control system. All components in the system must be chosen and applied correctly to achieve the desired level of operator safeguarding.

The safe torque-off circuit is designed to safely remove power from the gate firing circuits of the drives output power devices (IGBTs). This prevents them from switching in the pattern necessary to generate AC power to the motor.

You can use the safe torque-off circuit in combination with other safety devices to meet the stop and protection-against-restart requirements of EN ISO 13849-1.

ATTENTION: This option is suitable for performing mechanical work on the drive system or affected area of a machine only. It does not provide electrical safety.

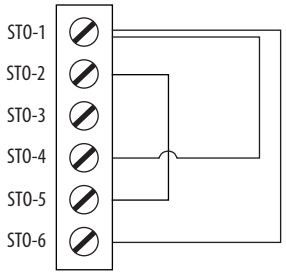
SHOCK HAZARD: In Safe Torque-off mode, hazardous voltages may still be present at the motor. To avoid an electric shock hazard, disconnect power to the motor and verify that the voltage is zero before performing any work on the motor.

Safe Torque-off Feature Bypass

The drive is supplied from the factory with the safe torque-off circuit enabled. The drive is not operational until +24V is present at terminals STO-4 and STO-6. When safety connections are not required, the drive can be operated with the safety circuit disabled.

Use jumper wires, as shown, to defeat the safe torque-off function.

Figure 81 - STO Motion-allowed Jumpers



IMPORTANT Pins STO-1 (+24V DC Control) and STO-2 (Control COM) are used only by the motion-allowed jumpers to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

Kinetix 300 Drive Safe Torque-off Wiring Diagrams

This section provides typical wiring diagrams for the Kinetix 300 drive safe torque-off feature with other Allen-Bradley safety products.

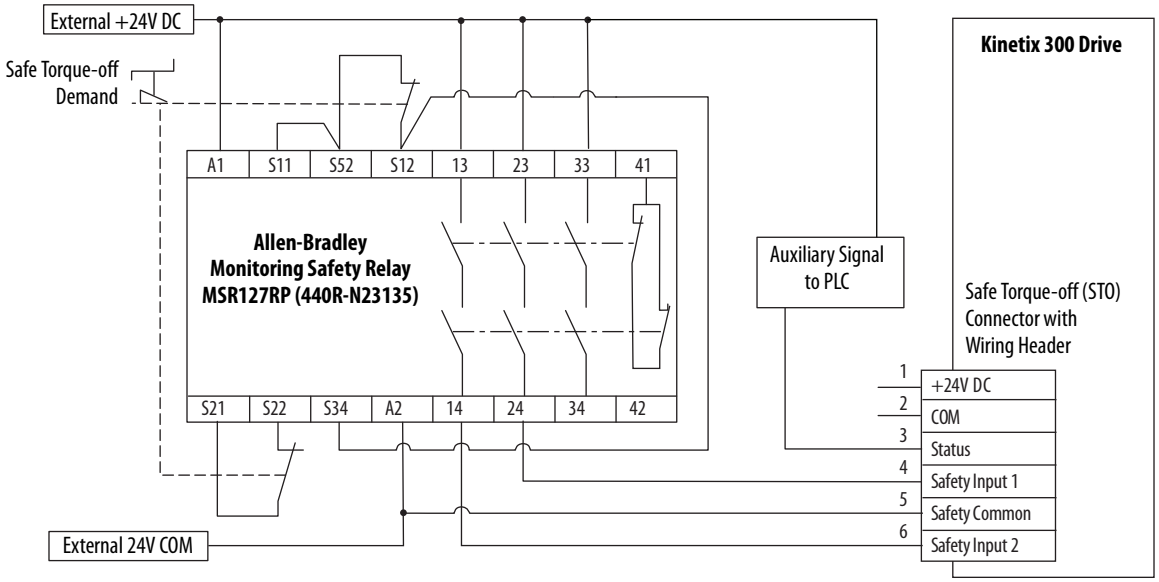
For additional information regarding Allen-Bradley® safety products, including safety relays, light curtain, and gate interlock applications, see the Safety Products Catalog, website http://www.rockwellautomation.com/global/catalogs/overview.page.

The drive is shown in a single-axis relay configuration for both category 0 and category 1 stops per EN-60204-1 Safety of Machinery Directive. These are examples, however, and user applications can differ based on the required overall machine performance level requirements.

IMPORTANT The Kinetix 300 drive has been qualified and rated as a component to meet EN ISO 13849-1 performance level d (PLd), safety-level category 3. Dual inputs and drive monitoring of the safe torque-off circuit, ST0-4 and ST0-6, are done to prevent drive enable should either or both of these inputs not function.

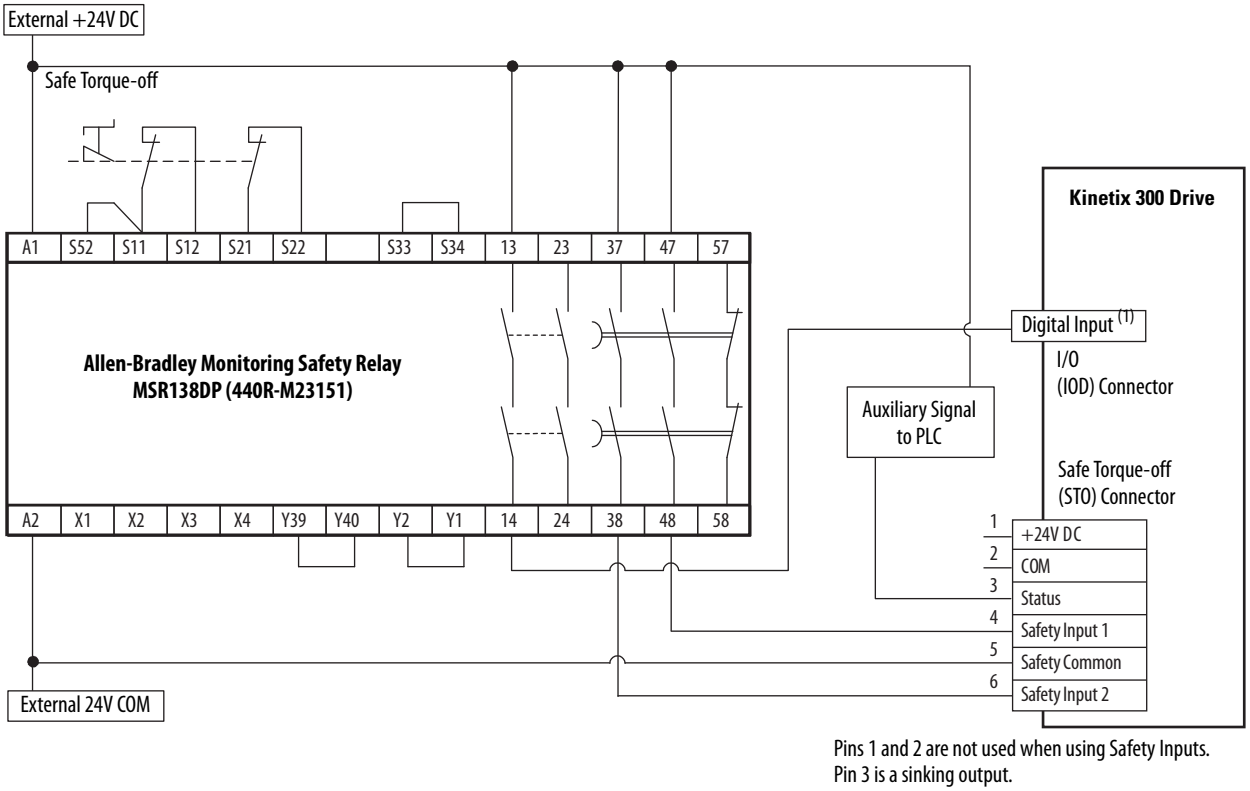
It is suggested to evaluate the entire machine performance level required with a risk assessment and circuit analysis. Contact your local distributor or Rockwell Automation Sales for more information.

Figure 82 - Single-axis Relay Configuration (Stop Category 0) with Automatic Reset



Pins 1 and 2 are not used when using Safety Inputs.
Pin 3 is a sinking output.

Figure 83 - Single-axis Relay Configuration (Stop Category 1) with Automatic Reset



(1) The digital input, configured for Abort Index in MotionView software, must be active-high when the safety function is requested, so an interposing relay may be required to invert the signal. Digital input common (IN_*x*_COM) must be used in this signal activation/de-activation transition.

You can also bring this input into a PLC where you can use an AOP (add on profile) or assembly object to activate the recommended digital input (abort index).

Safe Torque-off Signal Specifications

This table provides specifications for the safe torque-off signals used in the Kinetix 300 servo drives.

Attribute	Value
Safety inputs (1)	Insulated, compatible with single-ended output (+24V DC)
	Enable voltage range: 20…24V DC
	Disable voltage range: 0…1.0V DC
Input impedance	6.8 k Ω
Safety status	Isolated Open Collector (Emitter is grounded.)
Output load capability	100 mA
Digital outputs max voltage	30V DC

(1) Safety inputs are not designed for pulse testing.

Safety Input and Output Schematics

The following are generic safety input and output schematics for the Kinetix 300 drive.

Figure 84 - Safety Input

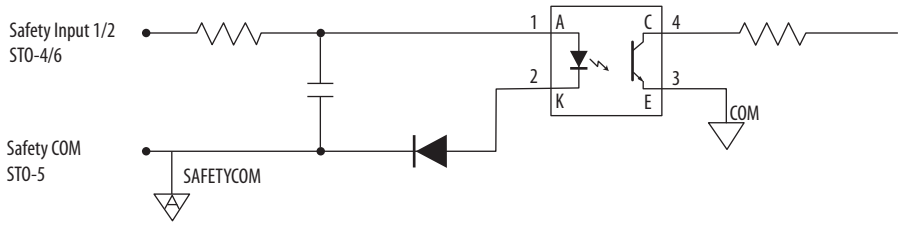
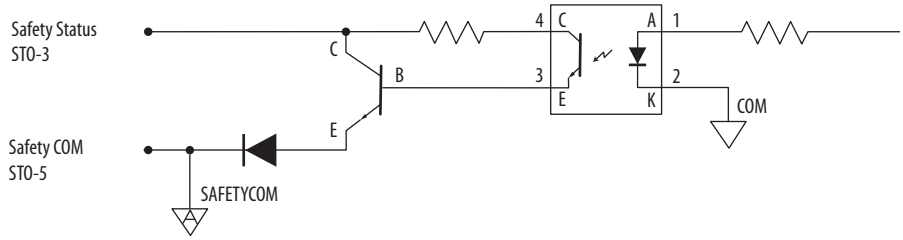


Figure 85 - Safety Status Output - Sinking Type



Notes:

Interconnect Diagrams

Interconnect Diagram Notes

This appendix provides wiring examples to assist you in wiring the Kinetix® 300 system. The notes below apply to the wiring examples on the pages that follow.

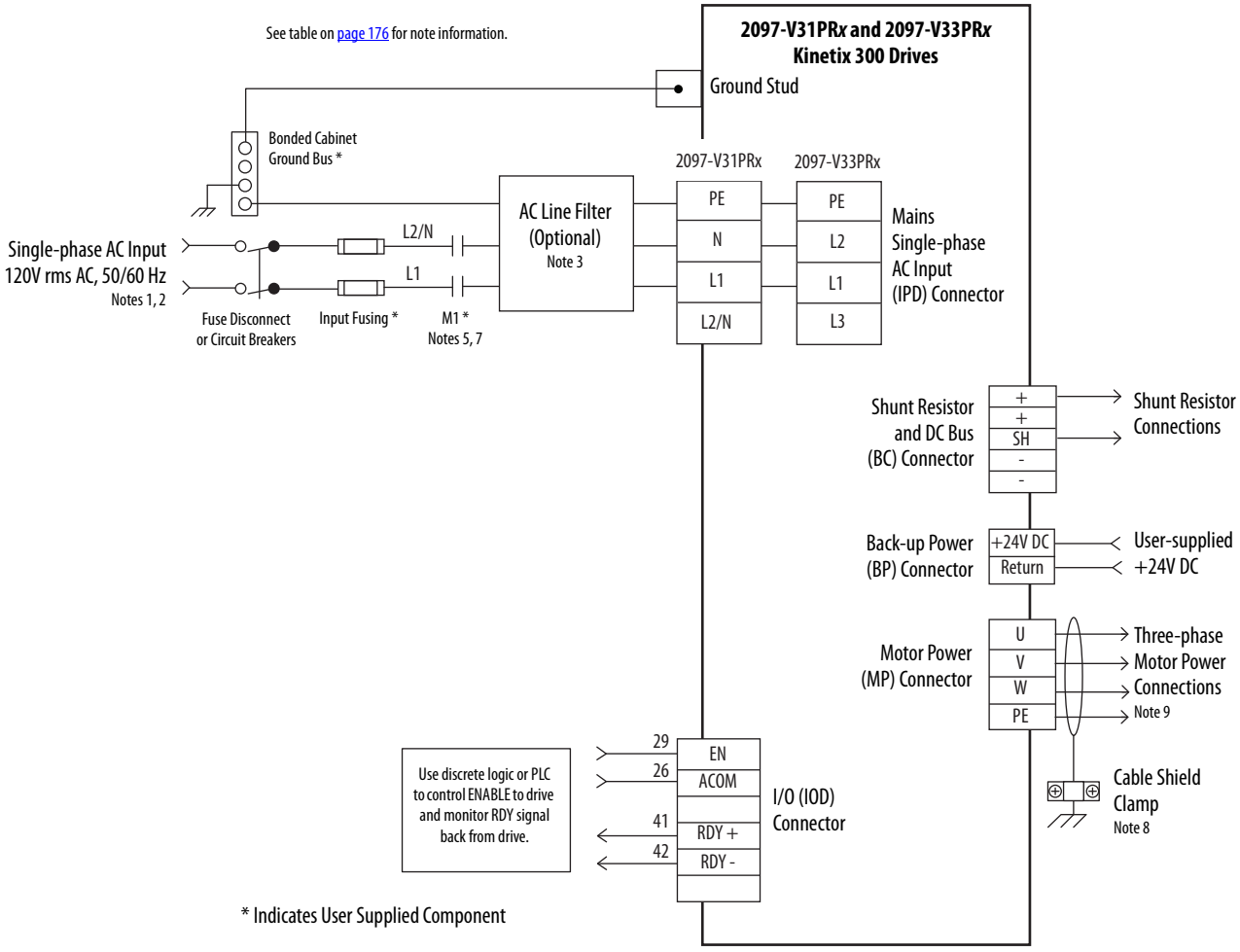
Note	Information
1	For power wiring specifications, see Power Wiring Requirements on page 65.
2	For input fuse and circuit breaker sizes, see Circuit Breaker/Fuse Selection on page 19.
3	Place the AC (EMC) line filters as close to the drive as possible and do not route very dirty wires in the wireway. If routing in wireway is unavoidable, use shielded cable with shields grounded to the drive chassis and filter case. For AC line filter specifications, see Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003. This filter does not apply to 2097-V32PR*x* drives because they have integrated AC line filters.
4	Terminal block is required to make connections. Configure one pair from the Digital OUT-1… OUT-4, pins 43…50, as Brake in MotionView software. For Digital Output specifications, see Digital Outputs on page 44.
5	Contactor coil (M1) needs integrated surge suppressors for AC coil operation. See Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003.
6	See the Motor Brake Currents table on page 189 to size the interposing relay for your application.
7	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.
8	Cable shield clamp must be used to meet CE requirements. No external connection to ground is required.
9	For motor cable specifications, see the Kinetix Motion Control Selection Guide, publication KNX-SG001.
10	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.
11	MPL-A*xxx* and MPL-B15*xxx*-H…MPL-B45*xxx*-H, MPM-A*xxx*, MPF-A*xxx,* MPS-A*xxx*, LDAT-S*xxxxxx-x*B*x*, MPAR-A*xxx,* MPAI-A*xxx*, MPAS-A*xxx,* and MPAS-B*xxx* (direct drive) encoders use the +5V DC supply.
12	MPL-B15*xxx*-S/M…MPL-B45*xxx*-S/M, MPM-B*xxx,* MPF-B*xxx*, MPS-B*xxx*, LDAT-S*xxxxxx-x*D*x*, MPAR-B*xxx*, MPAI-Bxxx, and MPAS-B*xxx* (ballscrew) encoders use the +9V DC supply.
13	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.
14	LDAT-Series linear thrusters do not have a brake option, so only the 2090-CPWM7DF-*xx*AA*xx* or 2090-CPWM7DF-*xx*AF*xx* motor power cables apply.

Power Wiring Examples

You must supply input power components. The single-phase and three-phase line filters are wired downstream of fusing and the M1 contactor.

In this example, the 2097-V31PR*x* drives are wired to use the voltage doubling circuit. The 120V input voltage provides 240V output to motors. The 2097-V33PR*x* drives are wired for single-phase 120V operation.

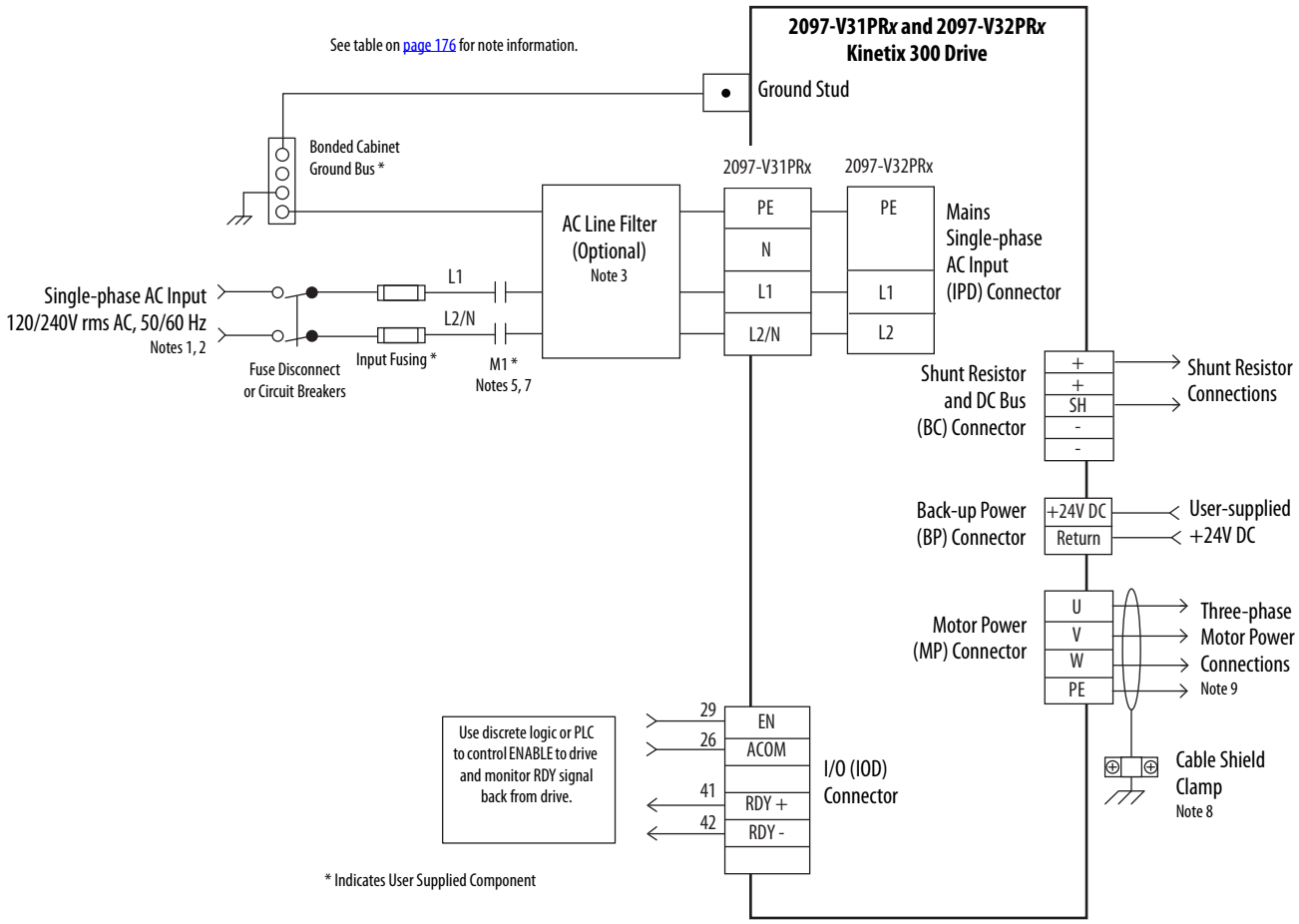
Figure 86 - Kinetix 300 Drive (120V single-phase input power)



In this example, single-phase 240V AC is applied to 2097-V31PR*x* and 2097-V32PR*x* drives.

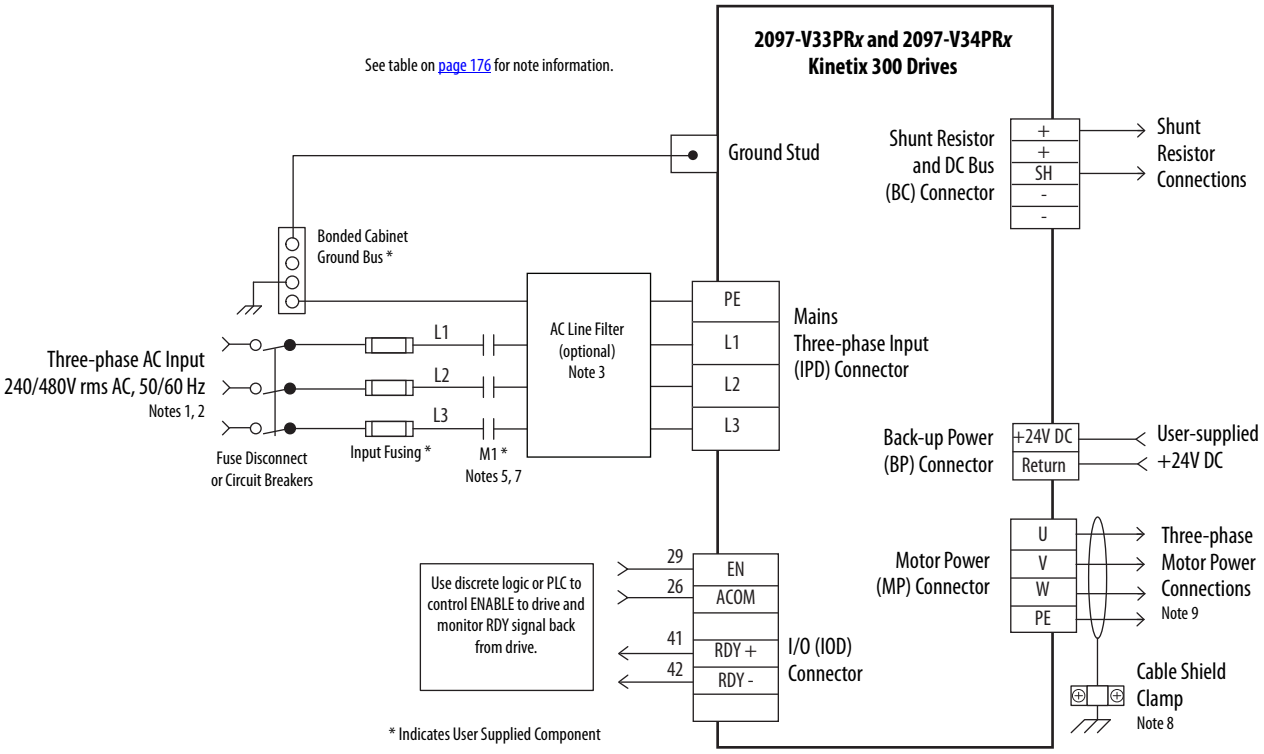
IMPORTANT The 2097-V32PRx models have integrated AC line filters and do not require the AC line filter that is shown in this diagram.

Figure 87 - Kinetix 300 Drives (240V single-phase input power)



In this example, three-phase 240V AC is applied to 2097-V33PR*x* drives and 480V AC is applied to 2097-V34PR*x* drives.

Figure 88 - Kinetix 300 Drive (240/480V three-phase input power)

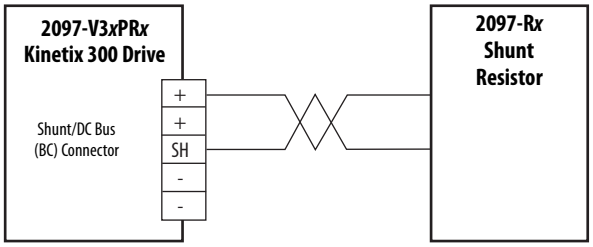


IMPORTANT For the 480V Kinetix 300 drives to meet EN ISO 13849-1 (PLd) spacing requirements, each phase voltage to ground must be less than or equal to 300V AC rms. To meet the requirement the power system must use center grounded wye secondary configuration for 400/480V AC mains.

Shunt-Resistor Wiring Example

See the Kinetix Servo Drives Specifications Technical Data, publication KNX-TD003, for the Bulletin 2097-R*x* shunt resistors available for the Kinetix 300 drives. See the Kinetix 300 Shunt Resistor Installation Instructions, publication 2097-IN002, for more installation information.

Figure 89 - Shunt-Resistor Wiring Example

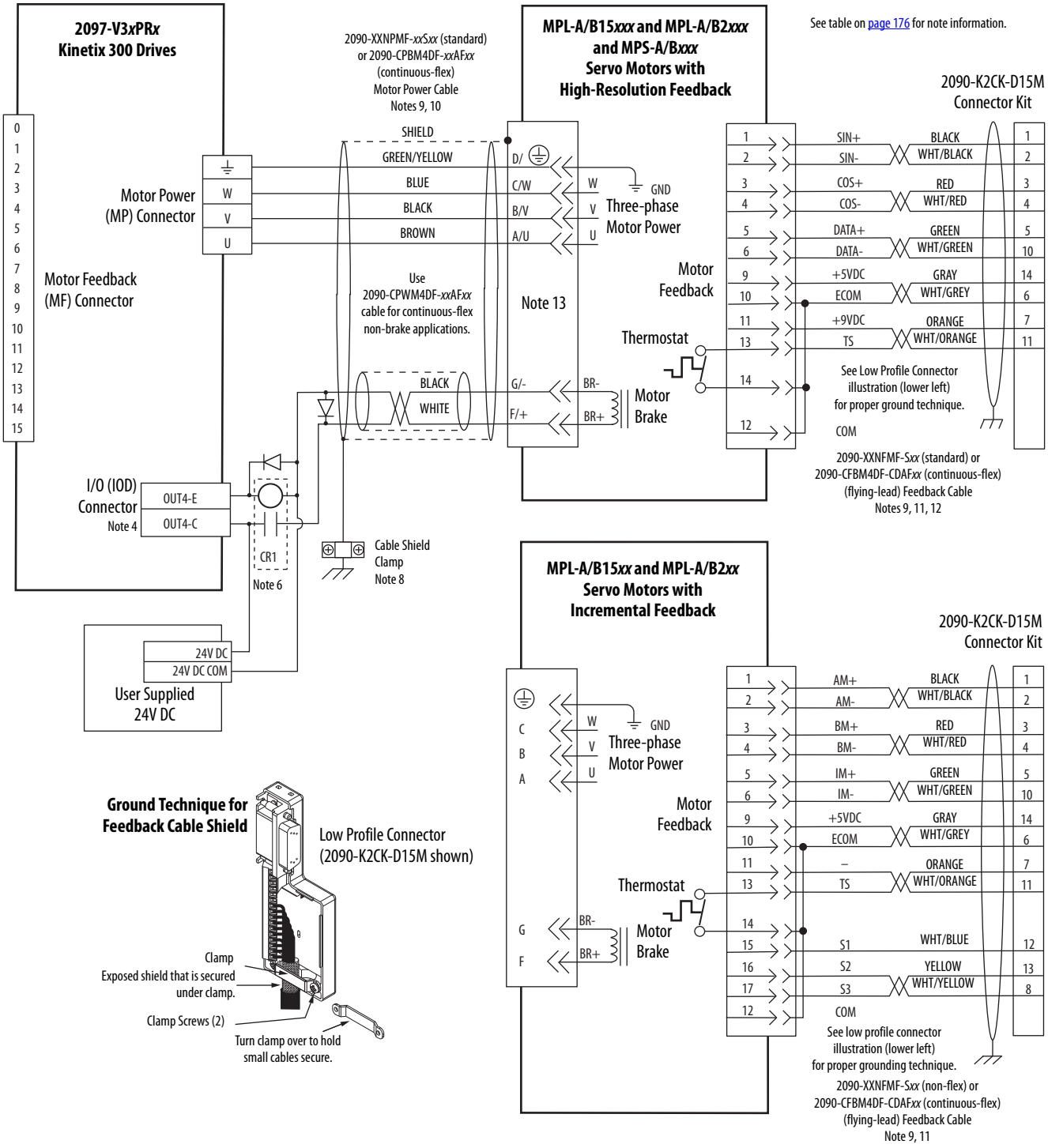


Kinetix 300 Drive/Rotary Motor Wiring Examples

These wiring diagrams apply to Kinetix 300 drives with compatible rotary motors.

IMPORTANT The MP-Series™ motor wiring examples on this page apply to motors equipped with circular DIN (threaded) connectors.

Figure 90 - MP-Series (Bulletin MPL-A/B and MPS-A/B) Motors



IMPORTANT The MP-Series motor wiring examples on this page apply to motors equipped with circular DIN (SpeedTec) connectors.

Figure 91 - MP-Series (Bulletin MPL-A/B, MPM-A/B, MPF-A/B, and MPS-A/B) Motors

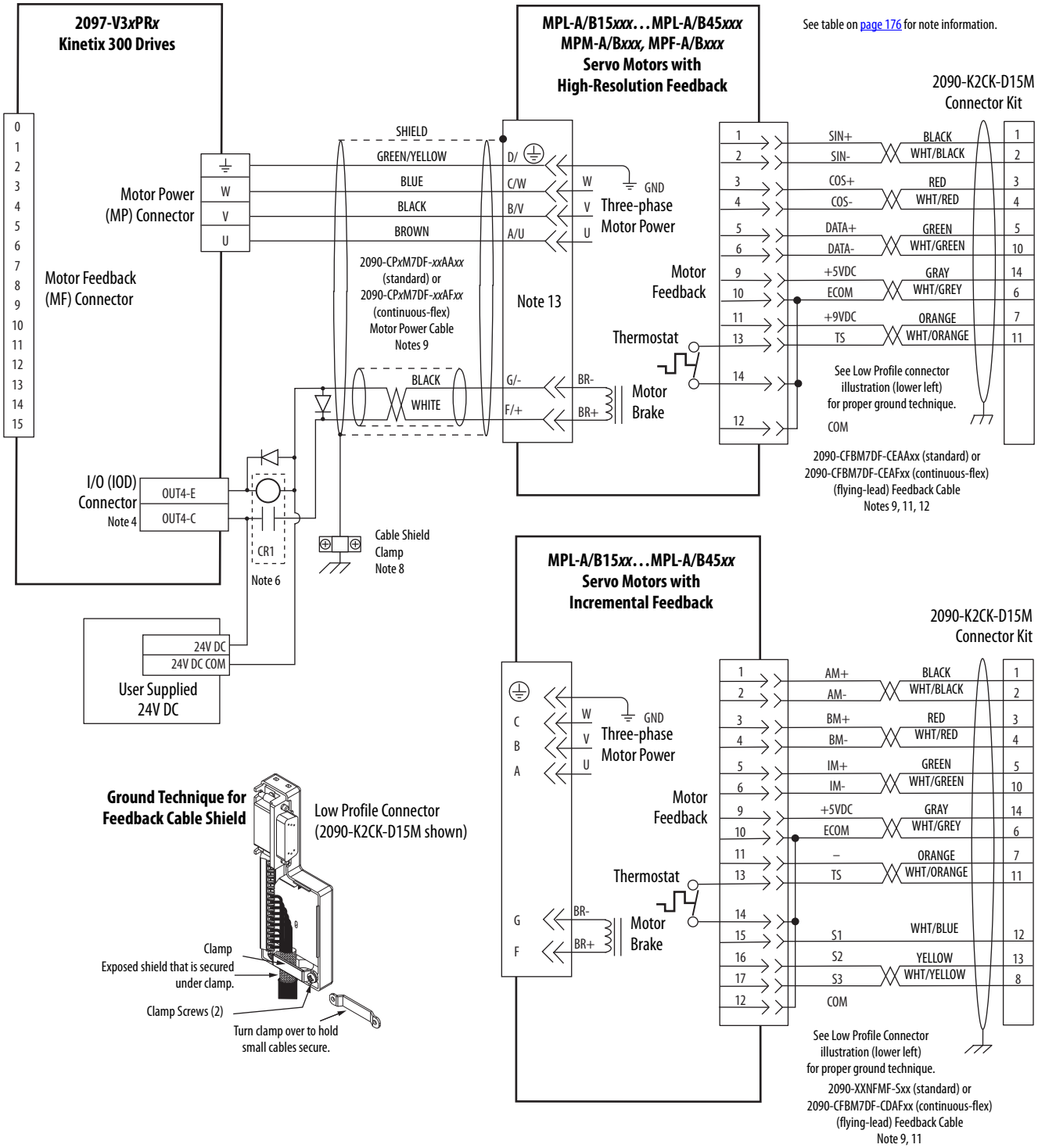
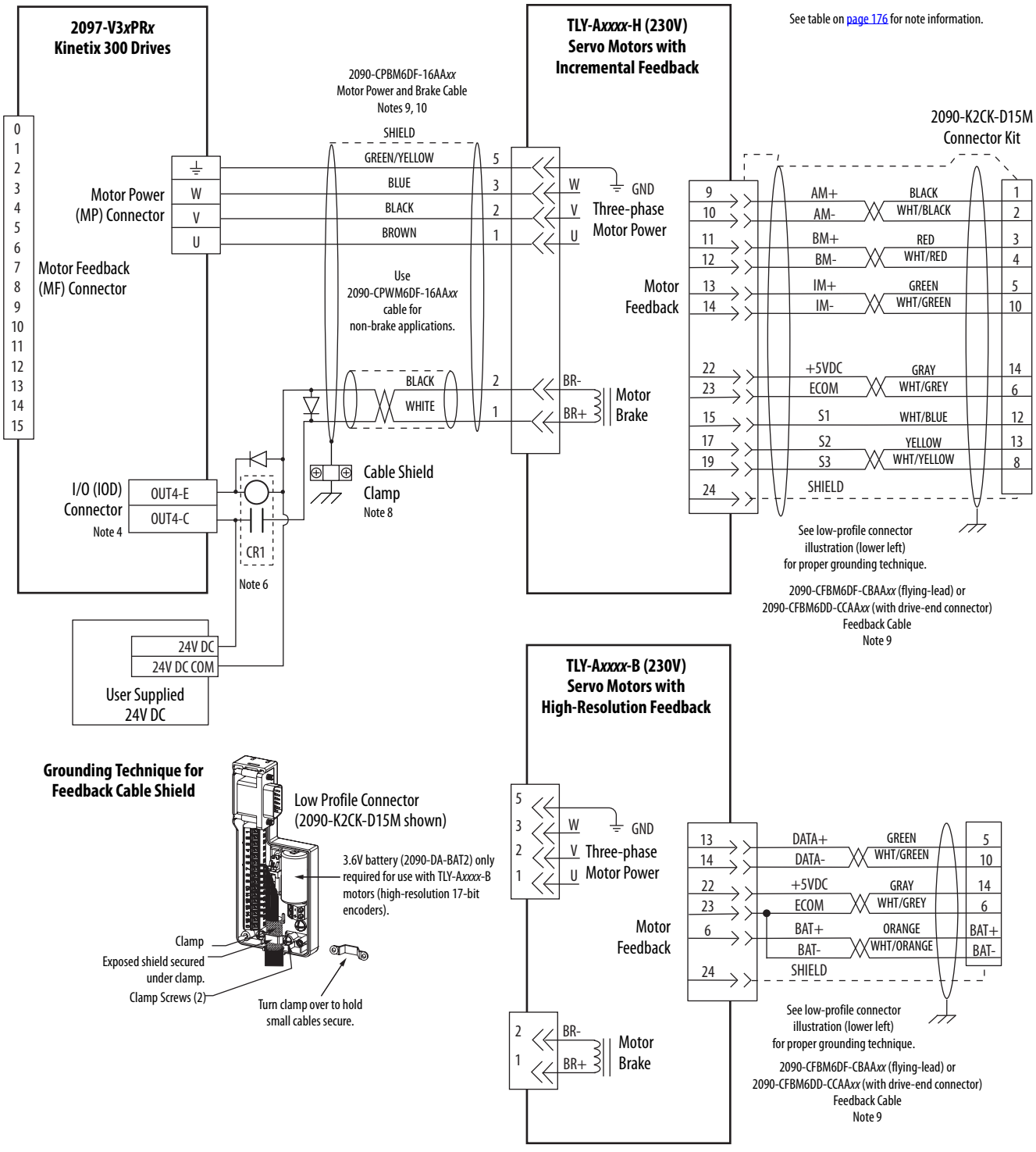


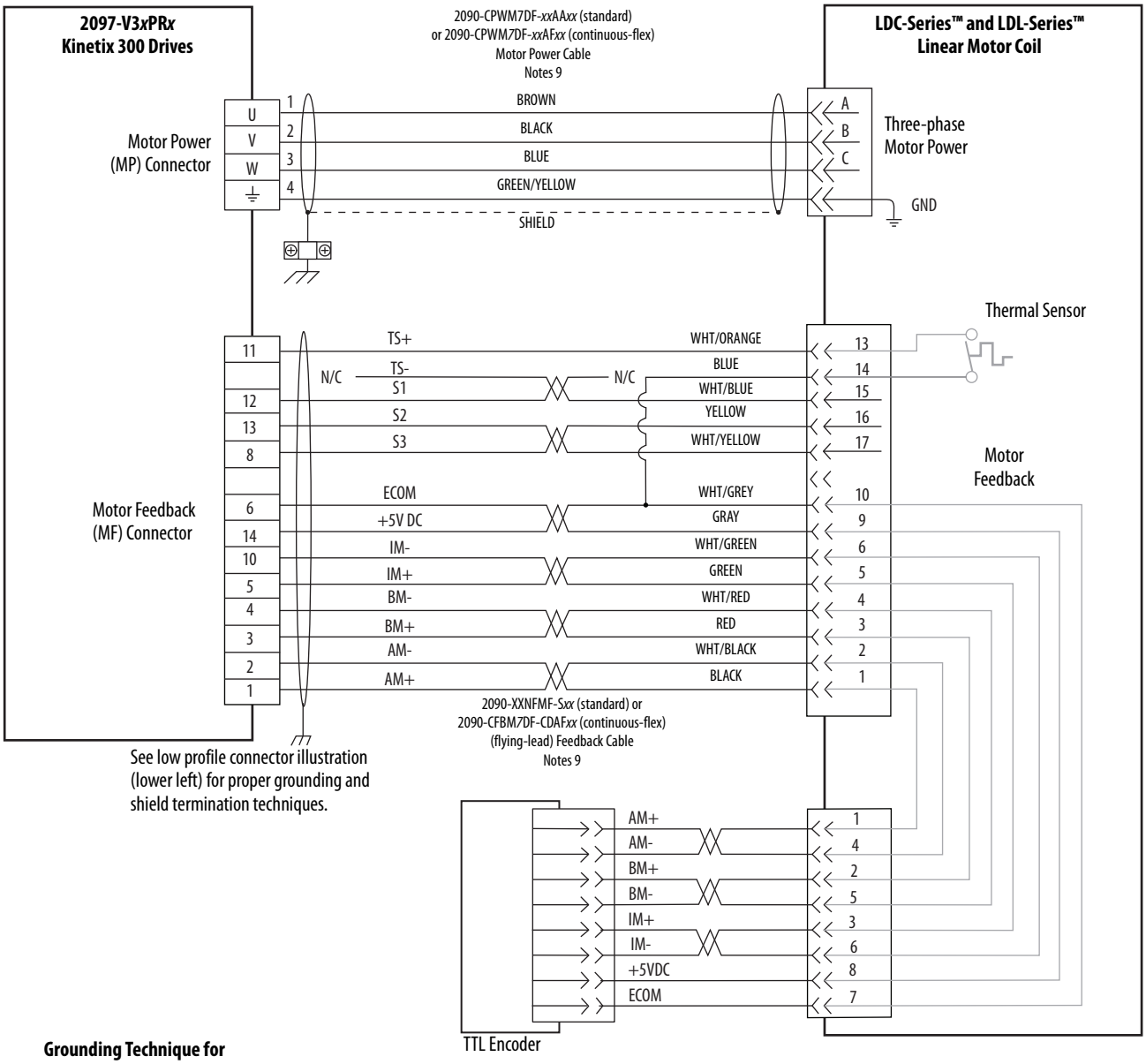
Figure 92 - Kinetix 300 Drive with TL-Series™ (TLY-A) Motors



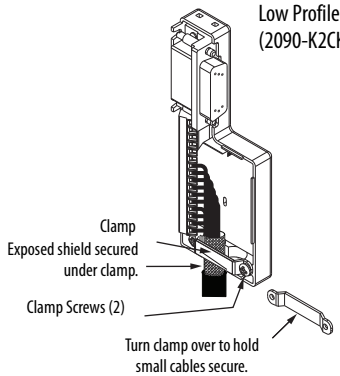
Kinetix 300 Drive/Linear Motor Wiring Examples

These wiring diagrams apply to Kinetix 300 drives with compatible linear motors.

Figure 93 - Kinetix 300 Drive with LDC-Series and LDL-Series Linear Motors



Grounding Technique for Feedback Cable Shield



Kinetix 300 Drive/Actuator Wiring Examples

These wiring diagrams apply to Kinetix 300 drives with compatible linear actuators.

Figure 94 - Kinetix 300 Drive with MP-Series (Bulletin MPAS) Linear Stages and LDAT-Series Linear Thrusters

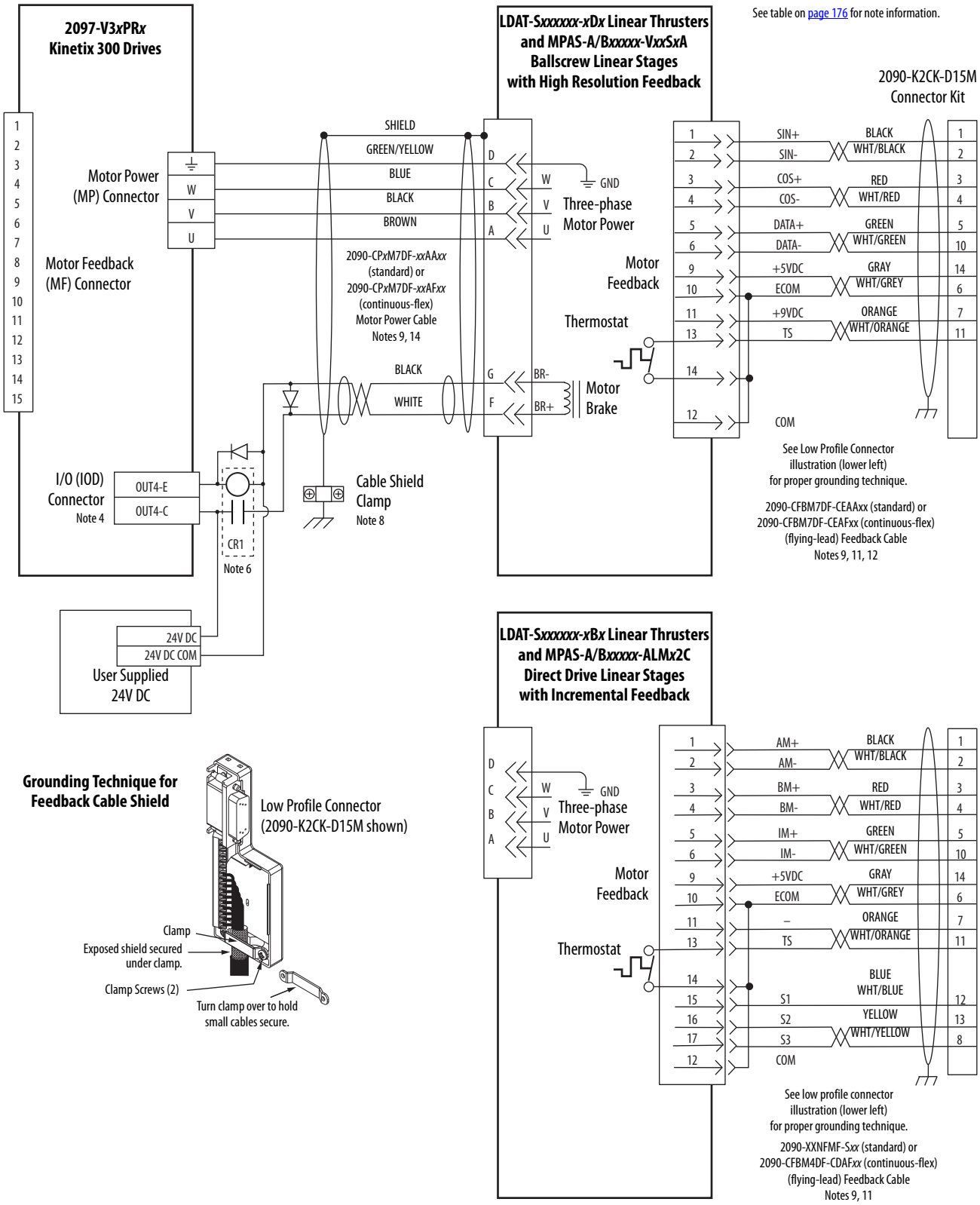
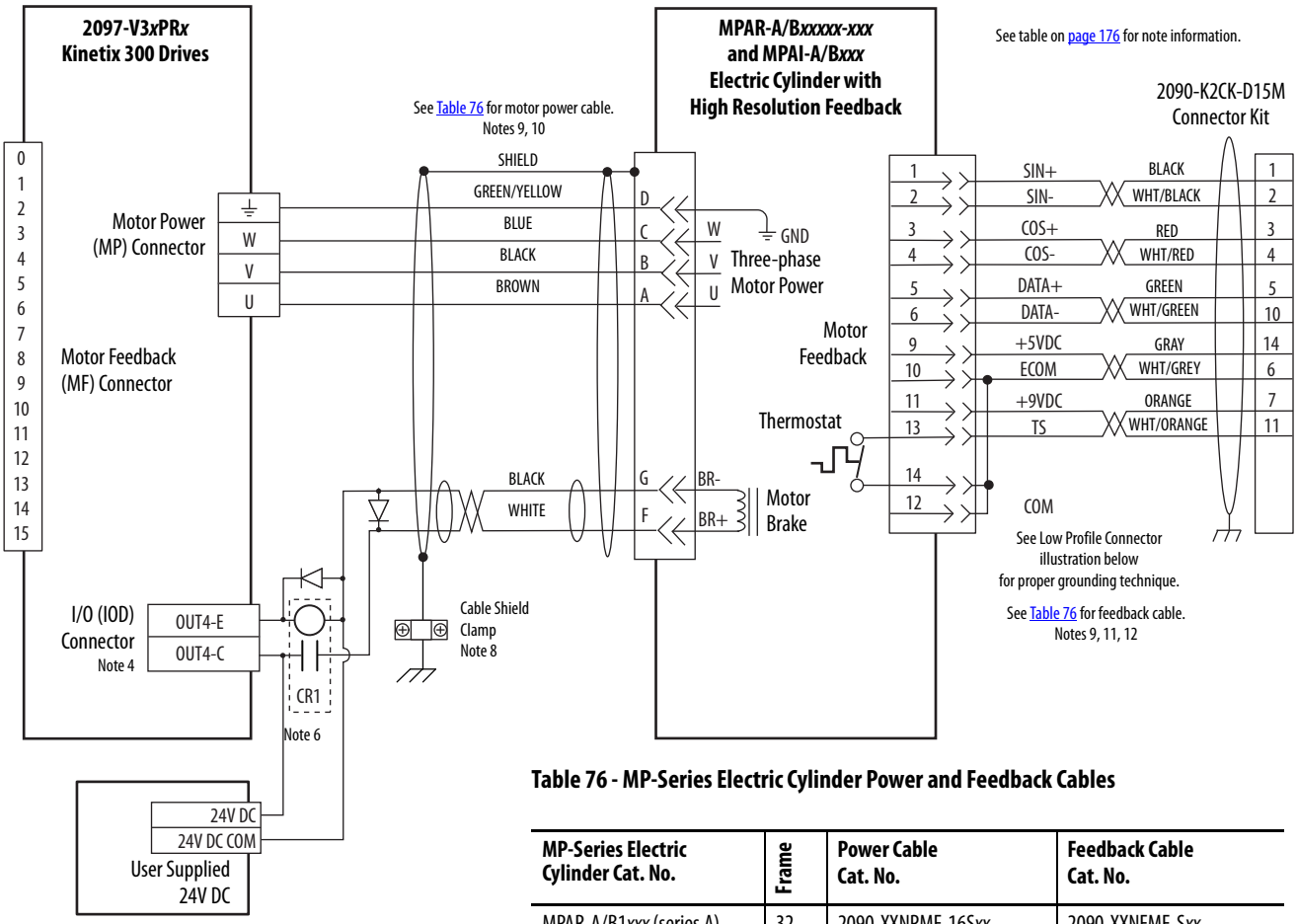
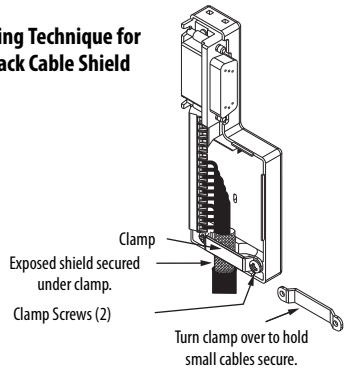


Figure 95 - Kinetix 300 Drive with MP-Series (Bulletin MPAR and MPAI) Electric Cylinders



Grounding Technique for Feedback Cable Shield

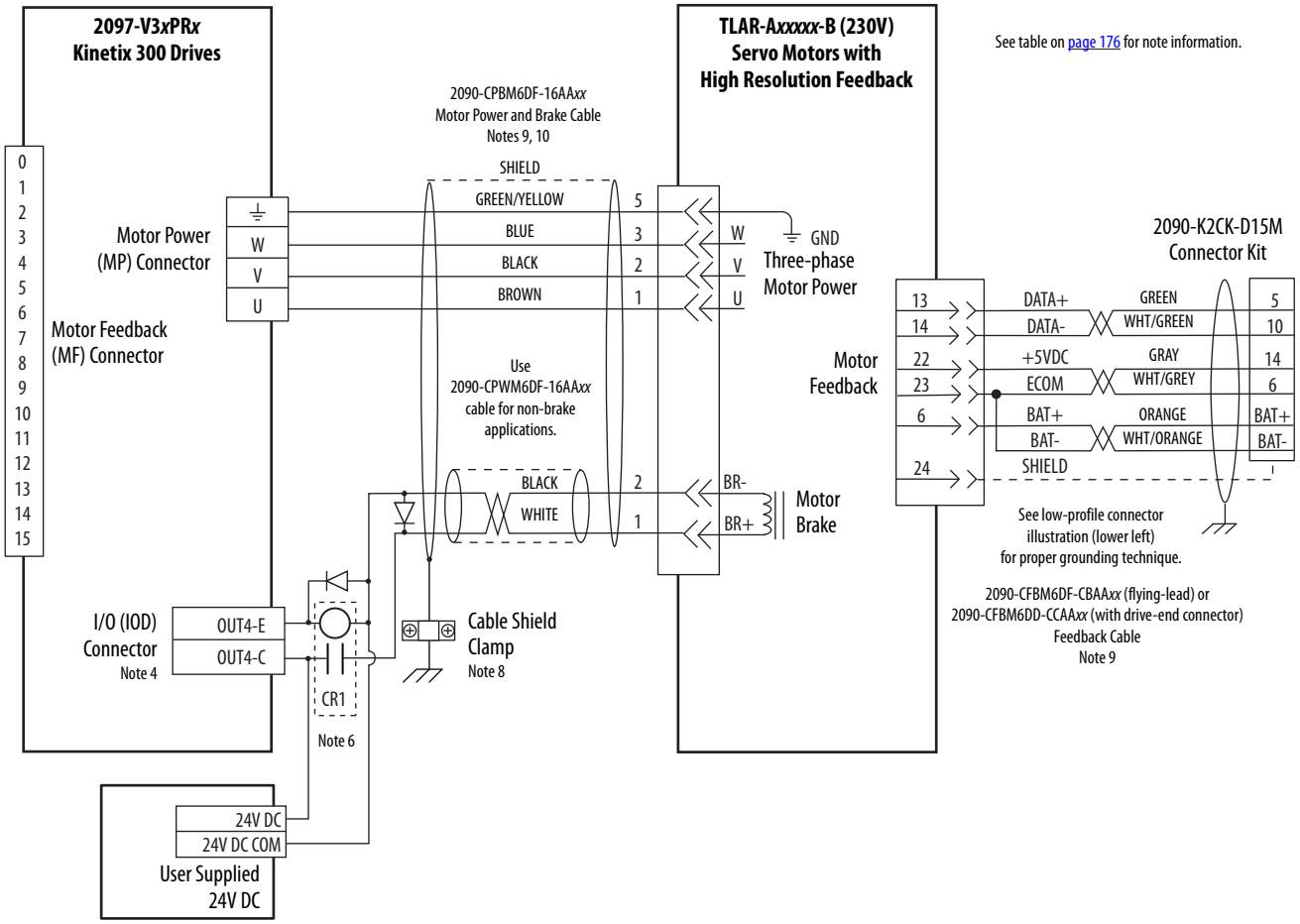


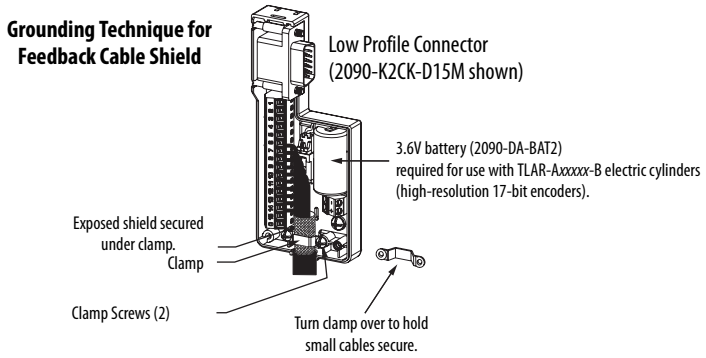
Low Profile Connector
(2090-K2CK-D15M shown)

Table 76 - MP-Series Electric Cylinder Power and Feedback Cables

MP-Series Electric Cylinder Cat. No.	Frame	Power Cable Cat. No.	Feedback Cable Cat. No.
MPAR-A/B1*xxx* (series A)	32	2090-XXNPMF-16S*xx* (standard) 2090-CP*x*M4DF-16AF*xx* (continuous-flex)	2090-XXNFMF-S*xx* (standard) 2090-CFBM4DF-CDAF*xx* (continuous-flex)
MPAR-A/B2*xxx* (series A)	40		
MPAR-A/B1*xxx* (series B)	32	2090-CP*x*M7DF-16AA*xx* (standard) 2090-CP*x*M7DF-16AF*xx* (continuous-flex)	2090-CFBM7DF-CEAA*xx* (standard) 2090-CFBM7DF-CEAF*xx* (continuous-flex)
MPAR-A/B2*xxx* (series B)	40		
MPAR-A/B3*xxx*	63		
MPAI-A/B2*xxxx*	64		
MPAI-A/B3*xxxx*	83		
MPAI-A/B4*xxxx*	110		
MPAI-B5*xxxx*	144		
MPAI-A5*xxxx*		2090-CP*x*M7DF-14AA*xx* (standard) 2090-CP*x*M7DF-14AF*xx* (continuous-flex)	

Figure 96 - Kinetix 300 Drive with TL-Series (Bulletin TLAR) Electric Cylinders

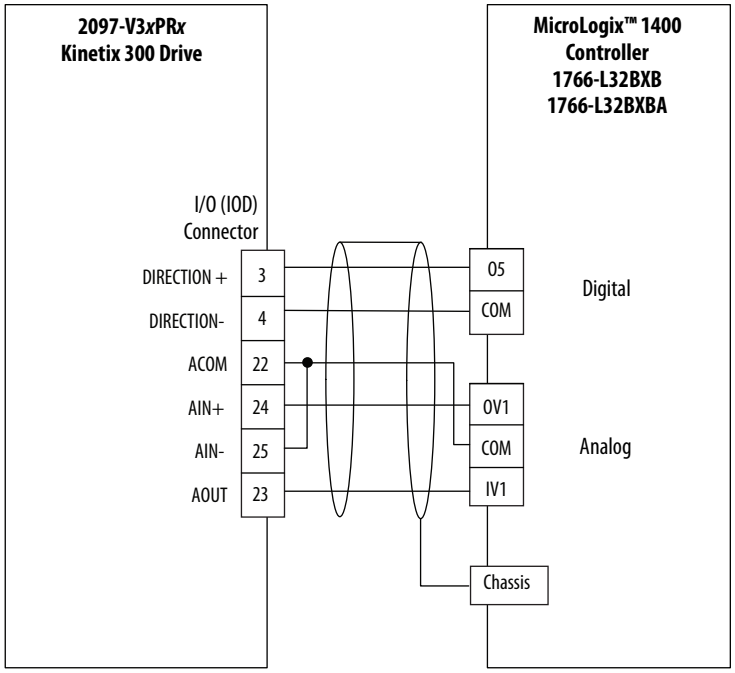




Kinetix 300 Drive to MicroLogix Controller Wiring Examples

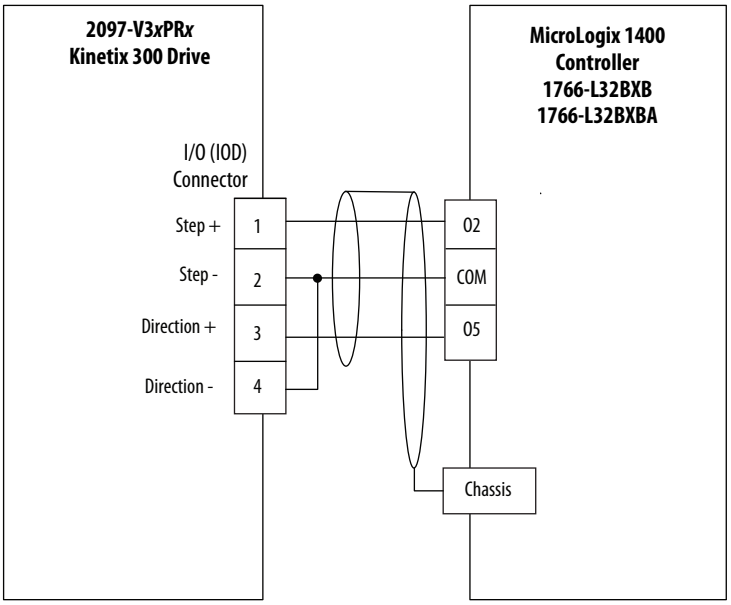
The Kinetix 300 drive accepts unipolar or bipolar inputs.

Figure 97 - Analog Velocity (or Current) Control Mode



Use twisted pair shielded cables for analog signals. Route analog signals in clean wireways away from motor power cables.

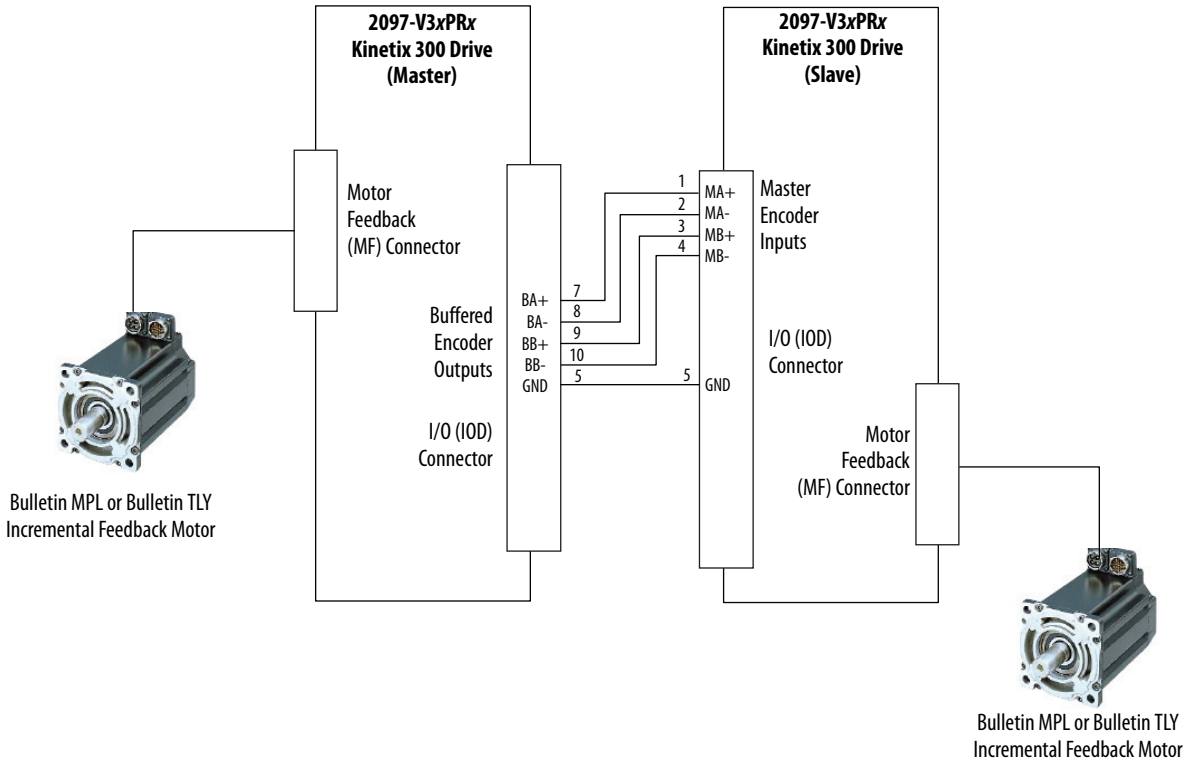
Figure 98 - Step and Direction



Kinetix 300 Drive Master Gearing Wiring Example

A master drive that powers a motor with a SICK-Stegmann high-resolution encoder generates buffered-encoder outputs for master gearing to a slave drive. However, a Tamagawa high-resolution encoder does not.

Figure 99 - Kinetix 300 Master Gearing Example



IMPORTANT The buffered encoder outputs are not supported with Tamagawa high-resolution motor feedback.

Motor Brake Currents

Use these coil current values to size the interposing relay required for your application. See the interconnect diagram for your Kinetix 300 drive/motor beginning on page 180 for typical motor brake circuitry.

Table 77 - Motor Brake Coil Currents

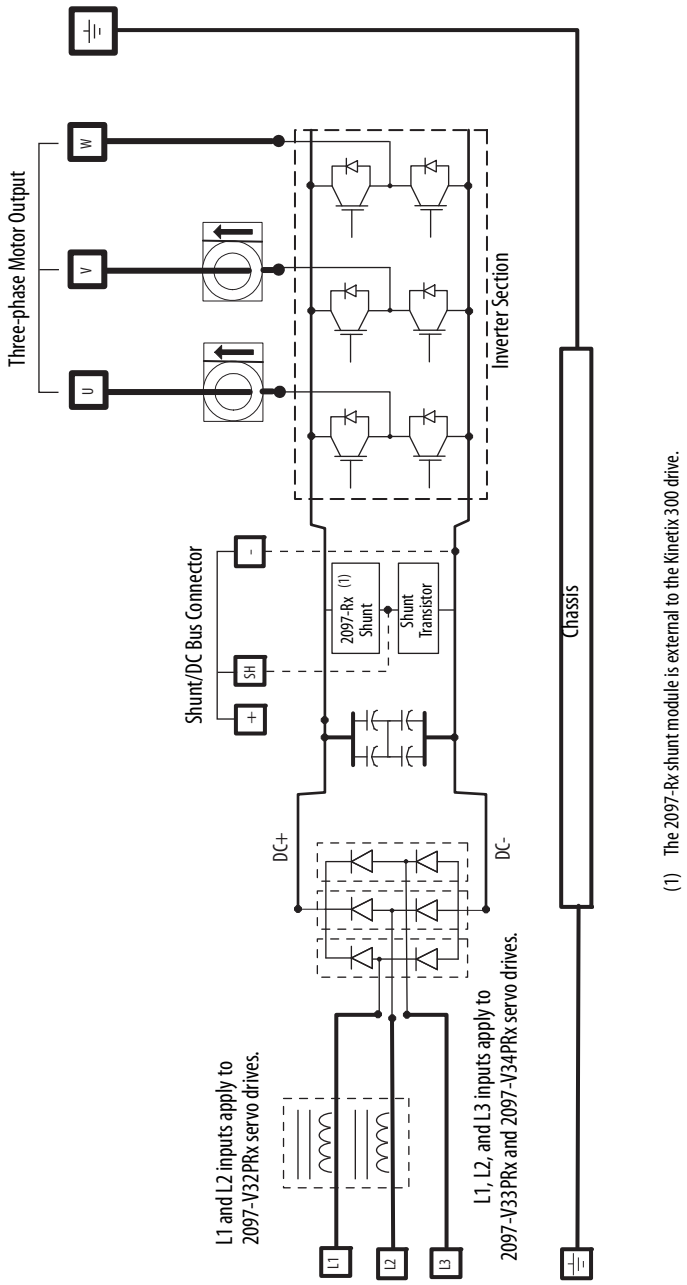
Compatible Brake Motors/Actuators (1)	Coil Current
MPL-*x*1510, MPL-*x*1520, MPL-*x*1530	0.43…0.53 A
MPL-*x*210, MPL-*x*220, MPL-*x*230	0.46…0.56 A
MPL/MPF-*x*310, MPL/MPF-*x*320, MPL/MPF-*x*330	0.45…0.55 A
MPM-*x*115	
MPS-*x*330	
MPL-*x*420, MPL-*x*430, MPL-*x*4520, MPL-*x*4530, MPL-*x*4540, MPL-B4560	0.576…0.704 A
MPM-*x*130	
MPF-*x*430, MPF-*x*4530, MPF-*x*4540	
MPS-*x*4540	
TLY-A110T, TLY-A120T, and TLY-A130T	0.18…0.22 A
TLY-A220T and TLY-A230T	0.333…0.407 A
TLY-A2530P, TLY-A2540P, and TLY-A310M	0.351…0.429 A

(1) Use of the variable x indicates this specification applies to 230V and 460V motors.

System Block Diagrams

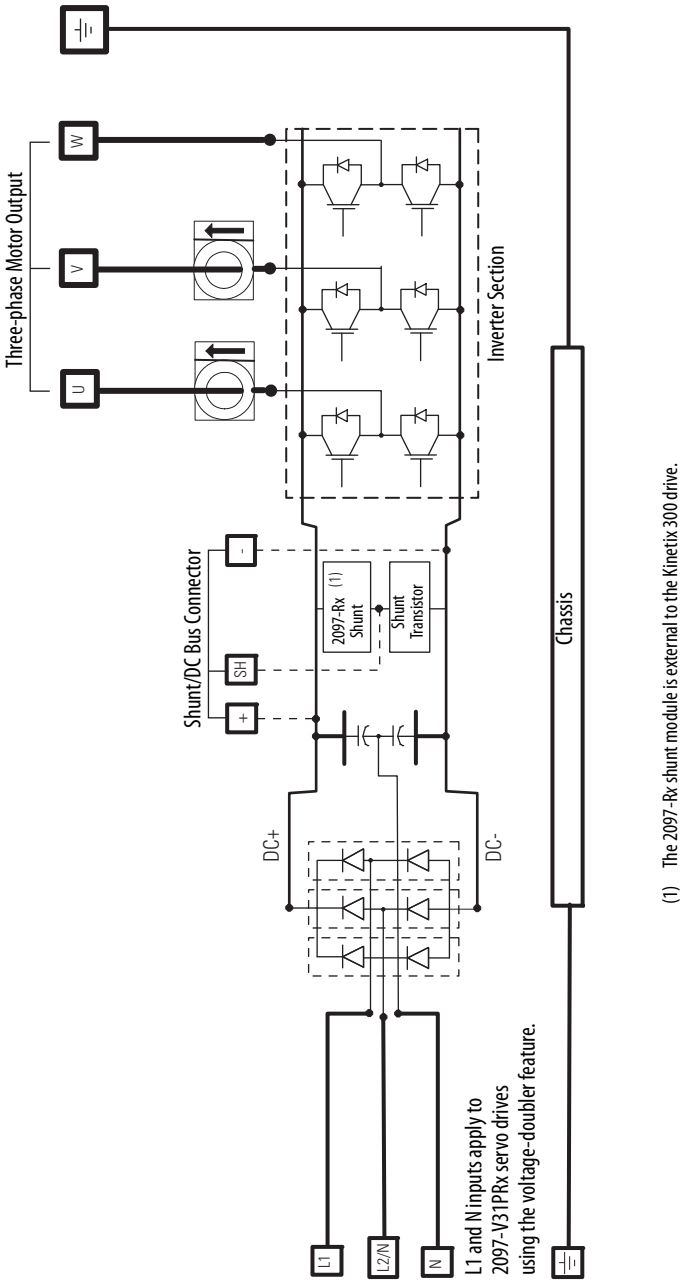
This power block diagram applies to 2097-V32PR*x*, 2097-V33PR*x*, and 2097-V34PR*x* servo drives.

Figure 100 - Power Block Diagram



This power block diagram applies to 2097-V31PR*x* servo drives. The voltage-doubler circuitry lets the drives with 120V input power get full performance from 240V motors.

Figure 101 - Voltage Doubler Block Diagram



Notes:

Input and Output Assembly

Input and Output Assembly

The terms input and output refer to the point of view of the scanner device. Output data is produced by the scanner and consumed by the adapter. Input data is produced by the adapter and consumed by the scanner. The Kinetix® 300 drive is an adapter device and the controller, by using RSLogix 5000® software or the Studio 5000 Logix Designer® application, is a scanner device.

The drive contains EtherNet/IP Assembly Object Instances that pertain to these RSLogix 5000 software or the Logix Designer application connection parameters:

- Input (actual values such as actual velocity, actual position)
- Output (enable and reference value going to the drive)
- Index Configuration (see Indexing Category on page 101)

Assembly instances are accessible by using Class 3 explicit messages as well as the Class 1 I/O messaging.

You can modify Kinetix 300 drive parameters by using Explicit Messaging.

Table 78 - Drive Object Attributes

Attribute	Value	Comment
Service type	Get Attribute Single	Service code 0x0E (hex)
	Set Attribute Single	Service code 0x10 (hex)
Class	374	Hex
Instance	ID tag from Appendix C	–
Attribute	0	DINT, RAM
	1	DINT, MEM
	2	REAL, RAM
	3	REAL, MEM
	4	String, RAM
	5	String, MEM

When a Kinetix 300 drive parameter is changed by using explicit messaging, the Set Attribute Single message instruction is directed at this class, the instance is the identifier of the actual parameter and the attribute depends upon the type of data being written.

IMPORTANT If power is removed from the drive, data stored in RAM is lost. Data stored in the memory module remains through power cycles.

IMPORTANT Memory module writes are limited to 1,000,000 per device. Make sure that all writes targeted at the memory module are necessary and not done as part of a background or cyclic task.

Table 79 - Input Assembly

RSLogix 5000 or Logix Designer Tags	Description
Fault	A non-zero value in this field means the connection to the drive is not operational and no other fields in the Input Assembly should be used.
DriveEn	A non-zero value in this field means the drive is currently enabled and the servo loops are closed.
PhysicalAxisFault	A non-zero value in this field means the drive has faulted.
PositionLockStatus	A non-zero value in this field means the drive is within the position tolerance window of the commanded position.
CurrentLimitStatus	A non-zero value in this field means the drive has reached the current limit. This does not mean the drive is limiting current if the current limit was set to a lower value than the drive or motor supports.
RegistrationEventStatus	A non-zero value in this field means the drive has captured a registration event and position.
IndexingStatus	A non-zero value in this field means the drive is currently operating out of the indexing table within the drive.
MotionComplete	A non-zero value in this field means the drive has completed a position based move. This bit does not apply when in Indexing Current mode.
PositiveOvertravelInput	A non-zero value in this field means the positive overtravel input to the drive has been asserted.
NegativeOvertravelInput	A non-zero value in this field means the negative overtravel input to the drive has been asserted.
HomingStatus	A non-zero value in this field means the drive is currently homing as configured by the Homing section of the MotionView software.
AxisHomedStatus	A non-zero value in this field means the drive has been successfully homed.
VelocityStandstillStatus	A non-zero value in this field means the drive is within the configured tolerance for being at zero velocity.

Table 79 - Input Assembly (continued)

RSLogix 5000 or Logix Designer Tags	Description
VelocityLockStatus	A non-zero value in this field means the drive is within the configured tolerance around the commanded velocity.
PowerStructureEn	A non-zero value in this field means the drive power structure is currently enabled and providing current to the motor.
DigitalInputA1Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputA2Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputA3Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputA4Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputB1Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputB2Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputB3Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputB4Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputC1Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputC2Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputC3Status	A non-zero value in this field means this digital input on the drive is currently asserted.
DigitalInputC4Status	A non-zero value in this field means this digital input on the drive is currently asserted.
ActiveIndex	This field indicates the currently executing index from within the indexing table in the drive.
ActualVelocity	This field indicates the current velocity of the motor controlled by the drive.
ActualPosition	This field indicates the current position of the motor controlled by the drive.
PositionCommand	This field indicates the position the drive is moving the motor towards.
PositionError	This field indicates the error between the current command position and the actual position.
MotorCurrent	This field indicates the average RMS current being applied to the motor.
RegistrationPosition	This field indicates the position the motor was at when the registration input was asserted.
UserDefinedIntegerData0	This field is a copy of the current value of whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerData1	This field is a copy of the current value of whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerReal0	This field is a copy of the current value of whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerReal1	This field is a copy of the current value of whatever parameter it was configured to be in the MotionView software (Data Link).

Table 80 - Input Assembly Instance (Assembly 113)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Reserved	Registration EventStatus	Current LimitStatus	Reserved	Reserved	Position LockStatus	Physical AxisFault	DriveEn
1…3	Reserved							
4	Reserved	Axis Homed Status	Homing Status	Negative Overtravel Input	Positive Overtravel Input	Reserved	Motion Complete	Indexing Status
5…7	Reserved							
8	Reserved					Power Structure En	Velocity LockStatus	Velocity Standstill Status
9…11	Reserved							
12	Digital Input B4Status	Digital Input B3Status	Digital Input B2Status	Digital Input B1Status	Digital Input A4Status	Digital Input A3Status	Digital Input A2Status	Digital Input A1Status
13…15	Reserved							
16	Reserved				Digital Input C4Status	Digital Input C3Status	Digital Input C2Status	Digital Input C1Status
17…19	Reserved							
20…23	ActiveIndex (DINT)							
24…27	ActualVelocity (REAL)							
28…31	ActualPosition (REAL)							
32…35	PositionCommand (REAL)							
36…39	PositionError (REAL)							
40…43	MotorCurrent (REAL)							
44…47	RegistrationPosition (REAL)							
48…51	UserDefinedIntegerData0 (DINT)							
52…55	UserDefinedIntegerData1 (DINT)							
56…59	UserDefinedIntegerReal0 (REAL)							
60…64	UserDefinedIntegerReal1 (REAL)							

In this Input Assembly example, the parameter ActiveIndex with a range of 24...27 bytes is expanded to show the low byte, low middle byte, high middle byte, and high byte. These values are typical for each parameter in Table 80.

Table 81 - Input Assembly Example

Byte	Parameter Value
20	ActiveIndex - Low byte
21	ActiveIndex - Low middle byte
22	ActiveIndex - High middle byte
23	ActiveIndex - High byte

Table 82 - Output Assembly

RSLogix 5000 or Logix Designer Tags	Description
AbortIndex	Upon transition from 0 to 1 of this field the drive aborts the current index or position based move the drive is executing and decel to zero velocity.
StartMotion	Upon transition from 0 to 1 of this field the drive begins moving towards the position in the CommandPosition field below assuming the drive is enabled.
DefineHome	Upon transition from 0 to 1 of this field the drive defines the current position of the motor to be home.
AbortHoming	Upon transition from 0 to 1 of this field the drive aborts (decel to zero velocity) the homing operation.
StartHoming	Upon transition from 0 to 1 of this field the drive begins homing as configured by the Homing section of the MotionView software assuming the drive is enabled.
DriveEn	Upon transition from 0 to 1 of this field the drive enables, it turns on power structure, closes servo loops, tracks commands.
StartingIndex	This field defines the first index the drive should execute if the drive is operating in Indexing mode.
ReferenceSource	This field defines the type of control being exerted over EtherNet/IP network (0 = current, 1 = velocity, 2 = incremental position, 3 = absolute position, 4 = incremental registration, 5 = absolute registration, 6=Rotary Absolute, 7=Rotary Incremental, 8=Rotary Shortest Path, 9=Rotary Positive, 10=Rotary Negative).
AccelerationLimit	This field defines the maximum acceleration the drive uses in accelerating towards the commanded position.
DecelerationLimit	This field defines the maximum deceleration the drive uses in accelerating towards the commanded position.
CommandCurrentOrVelocity	This field defines the commanded current (Amps RMS) or Velocity (User Units/s) if the ReferenceSource is 0 or 1 respectively and the drive is enabled.
VelocityLimit	This field defines the maximum velocity the drive uses in the profile towards the commanded position.
CommandPosition	This field defines the next position command the drive should move the motor towards, takes effect only upon 0 to 1 transition of StartMotion field above.
RegistrationOffset	This field defines the offset from the registration event the drive should move to during an incremental or absolute registration based move.
UserDefinedIntegerData0	The value in this field is written to whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerData1	The value in this field is written to whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerReal0	The value in this field is written to whatever parameter it was configured to be in the MotionView software (Data Link).
UserDefinedIntegerReal1	The value in this field is written to whatever parameter it was configured to be in the MotionView software (Data Link).

Table 83 - Output Assembly Instance (Assembly 114)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Drive En	Reserved	Start Homing	Abort Homing	Define Home	Start Motion	Reserved	Abort Index
1	Reserved							
2	Reserved							
3	Reserved							
4…7	StartingIndex (DINT)							
8…11	ReferenceSource (DINT)							
12…15	AccelerationLimit (REAL)							
16…19	DecelerationLimit (REAL)							
20…23	CommandCurrentOrVelocity (REAL)							
24…27	VelocityLimit (REAL)							
28…31	CommandPosition (REAL)							
32…35	RegistrationOffset (REAL)							
36…39	UserDefinedIntegerData0 (DINT)							
40…43	UserDefinedIntegerData1 (DINT)							
44…47	UserDefinedIntegerReal0 (REAL)							
48…51	UserDefinedIntegerReal1 (REAL)							

In this Output Assembly example, the parameter StartingIndex with a range of 4...7 bytes is expanded to show the low byte, low middle byte, high middle byte, and high byte. These values are typical for each parameter in Table 83.

Table 84 - Output Assembly Example

Byte	Parameter Value
4	StartingIndex - Low byte
5	StartingIndex - Low middle byte
6	StartingIndex - High middle byte
7	StartingIndex - High byte

The Attribute Values in this example only apply to Class 374 and not to Class 4 (Assembly Objects).

Output Assembly Examples

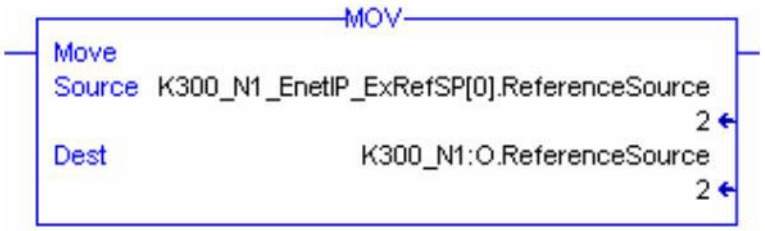
This section provides examples of various motion profiles by showing which tags in the Output Assembly to manipulate.

You can manage the values in the Output Assembly by manipulating them in ladder code or by editing the tag directly in the tag structure.

IMPORTANT The Kinetix 300 drive must be in EtherNet/IP External Reference mode.

This is an example of moving a value into the .ReferenceSource of the Output Assembly.

Figure 102 - Set Value of Output Assembly Tag



This is an example of latching-on the .StartMotion bit of the Output Assembly.

Figure 103 - Turn-on the Output Assembly Tag

This is an example of turning on the .StartMotion bit of the Output Assembly by editing the tag directly.

Figure 104 - Changing a Value in the Output Assembly Tag Structure

Name	Value
+K300_N1:I	{...}
-K300_N1:O	{...}
K300_N1:O.AbortIndex	0
K300_N1:O.StartMotion	1
K300_N1:O.DefineHome	0
K300_N1:O.AbortHoming	0

Incremental Position Point-to-Point Profile

To execute an incremental position move, set these tag values as shown.

Table 85 - Output Assembly Tags

RSLogix 5000 or Logix Designer Tags	Value
ReferenceSource	Set value to 2.
CommandPosition	Configure the motion profile by setting tags to the desired values.
VelocityLimit	
AccelerationLimit	
DecelerationLimit	
DriveEn	Enable the drive by turning tag on.
StartMotion	Start profile by turning tag on.

Velocity Motion Profile

To execute a velocity move, set these tag values as shown.

Table 86 - Output Assembly Tags

ID Tag	RSLogix 5000 or Logix Designer Tags	Value
N/A	ReferenceSource	Set value to 1.
N/A	CommandCurrentOrVelocity	Set the velocity value.
75 (1)	Enable Accel/Decel function/limits for Velocity mode	• Use internal defaults for Accel/Decel (ID 75 set to 0 = Disable). • Set Accel/Decel values by writing to ID 76 and 77 by using explicit messaging (See Appendix D on page 215). Tag 75 must be set to 1 = Enabled, for the values to be used.
76 (1)	Accel value for Velocity mode	
77 (1)	Decel value for Velocity mode	
N/A	DriveEn	Enable the drive by turning tag on.

(1) You can also set these parameters by using MotionView software, General category>Velocity Mode Acceleration.

Kinetix 300 Drive ID Tag Numbers

Tag Number Descriptions

To change these parameters by using an Explicit Message you configure the message to target class 374. The instance corresponds to the ID tag number in Table 87. The attribute is defined by the Drive Object Attributes table on page 194.

IMPORTANT Memory module writes are limited to 1,000,000 per device. Make sure that all writes targeted at the memory module are necessary and not done as part of a background or cyclic task.

Table 87 - Kinetix® 300 Drive Tag Numbers

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
1	String	R	Drive identification string	See Table on page 84	X															
2	String	R/W	Drive symbolic name	Up to 20 user-defined characters	X															
3	String	R	Drive serial number	Unique number assigned to drive at the factory	X															
7	REAL	R	Actual measured motor velocity	in UU/sec															X	
8	DINT	R/W	Negative Motion Polarity	Range: 0 = Positive, 1 = Negative				X	X											
10	String	R	Motor ID	Motor serial number (for Allen-Bradley® motor)		X	X													
11	String	R	Motor model	Motor catalog number (for Allen-Bradley motor)		X	X													
12	String	R	Motor vendor	Allen-Bradley		X	X													
14	DINT	R	Hallcode index	Range: 0…5		X	X													
18	DINT	R	Motor moment of inertia, Jm	Range: 0…0.1 Kg-m^2		X														
19	DINT	R	Motor voltage or back EMF constant, Ke	Range: 1…500 V/K rpm		X														
20	DINT	R	Motor torque or force constant, Kt	Range: 0.01…10 N•m/A		X														
21	DINT	R	Motor phase-to-phase inductance, Lm	Range: 0.1…500 mH		X	X													
22	DINT	R	Motor phase-to-phase resistance, Rm	Range: 0.01…500 Ω		X	X													
23	DINT	R	Motor max current (RMS)	Range: 0.5…50 A		X	X													
24	DINT	R	Motor max velocity	Range: 500…20,000 rpm		X	X													
25	DINT	R	Motor number of poles	Range: 2…200		X														
26	REAL	R	Encoder resolution	Range: 256 to (65536 x 12/Npoles) expressed in PPR		X														
27	DINT	R	Nominal Motor terminal voltage	Range: 50…800V		X	X													
29	DINT	R/W	Enable switch function	0 = Inhibit only 1 = Run								X								
30	REAL	R/W	Continuous RMS current for motor selected	User may lower this value. This lets you trigger a motor current alarm. However, the drive will not limit the actual current to the motor. The actual RMS current limit to the motor is not configurable.				X	X											
32	REAL	R/W	Peak current limit for 8 kHz operation (based on motor selected)	User may lower this peak value to limit current to motor. Do not set below the RMS Current for motor (tag #30).				X	X											

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
35	REAL	R/W	Analog input #1 current reference scale	Range: Range: - X…+X Amps/Volt X = drive peak output current/10									X							
36	REAL	R/W	Analog input #1 velocity reference scale	Range: -10,000…+10,000 rpm/Volt									X							
39	DINT	R/W	Motor thermal protection function:	0 = Disabled 1 = Enabled				X	X											
44	DINT	R/W	Velocity loop proportional gain	Range: 0…32767												X				
45	DINT	R/W	Velocity loop integral gain	Range: 0…32767												X				
46	DINT	R/W	Position loop proportional gain	Range: 0…32767												X				
47	DINT	R/W	Position loop integral gain	Range: 0…16383												X				
48	DINT	R/W	Position loop differential gain	Range: 0…32767												X				
49	DINT	R/W	Position loop integral gain limit	Range: 0…20000												X				
51	DINT	R/W	Gains scaling coefficient	Range: -16…+4												X				
53	DINT	R/W	Drive reset	0 = No action 1 = Reset drive																
57	DINT	R/W	Network group ID. Allows the assignment of different drives into logical groups.	Range: 1…32767	X															
58	REAL	R/W	Absolute value in user units/s below which the drive will set the Zero Speed Digital Output (if configured) and the VelocityStandstillStatus bit in the EtherNet/IP Input Assembly.	Range: 0…100 rpm										X						
59	REAL	R/W	The range in user units/s around the At Speed for setting the In-Speed Window Digital Output (if configured) and the VelocityLockStatus bit in the EtherNet/IP Input Assembly.	Range: 10…10000 rpm										X						
60	REAL	R/W	Value in user units/s for the target velocity for which the drive will set the In-Speed Window Digital Output (if configured) and the VelocityLockStatus bit in the EtherNet/IP Input Assembly.	Range: -10000…+10000 rpm										X						
61	DINT	R/W	Position error	Range: 1…32767 encoder counts											X					
62	REAL	R/W	The amount of time that the drive can be outside of the Position Error before the drive asserts an Excess Position Error Fault.	Range: 0.25…8000 ms											X					

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
65	DINT	R	Digital inputs states	A1 Input = Bit 0 A2 Input = Bit 1 A3 Input = Bit 2 A4 Input = Bit 3 B1 Input = Bit 4 B2 Input = Bit 5 B3 Input = Bit 6 B4 Input = Bit 7 C1 Input = Bit 8 C2 Input = Bit 9 C3 Input = Bit 10 C4 Input = Bit 11															X	
66	DINT	R/W	Digital outputs states. Writing to these variables sets/resets digital outputs that have not been assigned to a special function.	Output 1 = Bit 0 Output 2 = Bit 1 Output 3 = Bit 2 Output 4 = Bit 3															X	
67	DINT	R/W	Ethernet IP address	IP address changes at next powerup. 32 bit value.						X										
68	DINT	R/W	Ethernet IP NetMask	Mask changes at next powerup. 32 bit value.						X										
69	DINT	R/W	Ethernet Gateway IP address	Address changes at next powerup. 32 bit value.						X										
70	DINT	R/W	Use DHCP	0 = Manual 1 = Use DHCP service						X										
71	REAL	R	Analog Input AIN1 value	Volts															X	
73	REAL	R	Measured Bus voltage																X	
74	REAL	R	Heatsink temperature	0 = Temperatures < 40 °C (104 °F) Actual heat sink temperature = Temperatures >40 °C (104 °F)															X	
75	DINT	R/W	Enable Accel/Decel function/limits for Velocity mode	0 = Disabled 1 = Enabled				X	X											
76	REAL	R/W	Accel value for Velocity mode	Range: 0.1…5000000 rpm/s				X	X											
77	REAL	R/W	Decel value for Velocity mode	Range: 0.1…5000000 rpm/s				X	X											
78	DINT	R/W	Reset fault configuration	0 = On activation of Enable/Inhibit input (A3) 1 = On deactivation of Enable/Inhibit input (A3)				X	X											
79	DINT	R/W	Master to system ratio (numerator)	Master counts range: -32768…+32768				X	X											
80	DINT	R/W	Master to system ratio (denominator)	System counts range: 1…32768				X	X											

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
84	DINT	R/W	Configuration of the action-to-take when the hardware limit switches are asserted.	0 = Not used 1 = Disable and coast 2 = Ramped Decel and Disable								X								
85	DINT	R/W	Analog output function	0 = Not assigned 1 = Phase Current (RMS) 2 = Phase Current (Peak Value) 3 = Motor Velocity 4 = Phase Current U 5 = Phase Current V 6 = Phase Current W 7 = Iq current 8 = Id current									X							
86	REAL	R/W	Analog output scale for velocity quantities	Range: 0…10 mV/rpm									X							
87	REAL	R/W	Analog output scale for current related quantities	Range: 0…10 V/A									X							
88	REAL	W	Analog output value. Allows control of analog output through this tag value. Used if tag #85 is set to 0.	Range: 0…10V															X	
89	REAL	R/W	Analog input #1 dead-band. Applied when used as current or velocity reference.	Range: 0…100 mV									X							
90	REAL	R/W	Analog input #1 offset. Applied when used as current/ velocity reference	Range: -10,000…+10,000 mV									X							
178	REAL	R/W	The deceleration rate that the drive will use to bring the motor to a stop when either the Abort Homing or Abort Index Digital Inputs is asserted (if configured) or either the AbortIndex or AbortHoming bit is set in the EtherNet/IP Output Assembly.	User units per seconds^2											X					
179	DINT	R/W	The tolerance in user units around the commanded position inside of which the drive will set the PositionLockStatus bit in the EtherNet/IP Input Assembly.	User units											X					
181	REAL	R/W	User units	Revolutions of motor per user unit				X												
182	DINT	R/W	Encoder input counter value, reset by writing zero or other value to the parameter.	Counts															X	
183	REAL	R	Phase current	Amps															X	
184	DINT	R/W	Target position	Encoder pulses															X	
185	DINT	R/W	Actual position	Encoder pulses															X	
186	DINT	R	Position error	Encoder pulses															X	

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
189	DINT	R/W	Input A1 de-bounce time	Range: 0…1000 ms								X								
190	DINT	R/W	Input A2 de-bounce time	Range: 0…1000 ms								X								
191	DINT	R/W	Input A3 de-bounce time	Range: 0…1000 ms								X								
192	DINT	R/W	Input A4 de-bounce time	Range: 0…1000 ms								X								
193	DINT	R/W	Input B1 de-bounce time	Range: 0…1000 ms								X								
194	DINT	R/W	Input B2 de-bounce time	Range: 0…1000 ms								X								
195	DINT	R/W	Input B3 de-bounce time	Range: 0…1000 ms								X								
196	DINT	R/W	Input B4 de-bounce time	Range: 0…1000 ms								X								
197	DINT	R/W	Input C1 de-bounce time	Range: 0…1000 ms								X								
198	DINT	R/W	Input C2 de-bounce time	Range: 0…1000 ms								X								
199	DINT	R/W	Input C3 de-bounce time	Range: 0…1000 ms								X								
200	DINT	R/W	Input C4 de-bounce time in mS	Range: 0…1000								X								
201	DINT	R/W	Programmable Output Function: OUT1	0 = Not Assigned 1 = Zero Speed 2 = In Speed Window 3 = Current Limit 4 = Run time fault 5 = Ready 6 = Brake 7 = In position								X								
202	DINT	R/W	Programmable Output Function: OUT2	0 = Not Assigned 1 = Zero Speed 2 = In Speed Window 3 = Current Limit 4 = Run time fault 5 = Ready 6 = Brake 7 = In position								X								
203	DINT	R/W	Programmable Output Function: OUT3	0 = Not Assigned 1 = Zero Speed 2 = In Speed Window 3 = Current Limit 4 = Run time fault 5 = Ready 6 = Brake 7 = In position								X								

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used																
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
204	DINT	R/W	Programmable Output Function: OUT4	0 = Not Assigned 1 = Zero Speed 2 = In Speed Window 3 = Current Limit 4 = Run time fault 5 = Ready 6 = Brake 7 = In position								X								
205	DINT	R	Current hall code	Bit 0 = Hall 1 Bit 1 = Hall 2 Bit 2 = Hall 3																
206	DINT	R	Primary encoder current value	Encoder counts																
207	DINT	R	Registration position	Encoder counts															X	
208	REAL	R	Registration position	User units															X	
209	REAL	R/W	Target position	User units															X	
210	REAL	R/W	Actual position	User units															X	
211	REAL	R	Position error	Encoder counts															X	
216	DINT	R/W	The tolerance around the commanded position outside of which the drive will assert a Excess Position Error Fault when the Max Error Time is exceeded.	Encoder counts (positive)											X					
217	DINT	R/W		Encoder counts (negative)											X					
218	DINT	R/W	Off or On depending if software travel limits should be used.	0 = Off 1 = Disable and Coast 2 = Ramped Decel and Disable											X					
219	REAL	R/W	If Soft Limits are On, the position that when reached, the drive will assert a Software Overtravel fault.	User units (positive)											X					
220	REAL	R/W		User units (negative)											X					
227	REAL	R/W	Homing acceleration/deceleration rate	Range 0…10,000,000 UU per second ^{2}.														X		
228	REAL	R/W	The new position of the motor after the homing sequence is complete. All subsequent absolute moves are taken relative to this new zero position.	Range: -32767…+32767 user units.														X		
229	DINT	R/W	Homing mode: Home Position Offset	Range: +/- 2,147,418,112 encoder counts.																

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
230	REAL	R/W	For homing methods that use one velocity setting, this tag is used as the velocity.	Range: -10,000…+10,000 UU/sec.														X		
231	REAL	R/W	For homing methods that use two velocity settings (fast and slow), this tag is used as the slow velocity. Typically, this tag is used to creep to a homing position.															X		
232	DINT	R/W	Defines the type of homing to be performed. See Table 64 on page 115.	See Homing Category on page 113.														X		
234	DINT	R/W	The digital input that should be used as a home switch for appropriate homing method.	Do not assign to A1, A2, A3, or C3 as these inputs have predefined functions.														X		
247	DINT	R	Status register for the TL-Series™ absolute encoder and battery.	Bit 7 indicates battery level has fallen to 3.1V DC or less. Bit 6 indicates battery level has fallen to 2.5V DC or less and absolute data may not be valid.																
240	REAL	R/W	Pole pitch	Range: 2…200 mm			X													
242	REAL	R/W	Linear speed	Range: 0…10 m/s																
243	REAL	R/W	Motor block mass	Range: 0…100 kg			X													
244	REAL	R/W	Linear motor force constant, Kf	Range: 1…1000 N/A rms			X													
245	REAL	R/W	Linear motor voltage or back EMF constant, Ke	Range: 1…500V rms/m/s			X													
246	REAL	R/W	Linear encoder resolution	Range: 0.4…40 µm			X													
249	DINT	R/W	Datalink A for input assembly	UserDefinedIntegerData0							X									
250	DINT	R/W	Datalink B for input assembly	UserDefinedIntegerData1							X									
251	DINT	R/W	Datalink C for input assembly	UserDefinedIntegerReal0							X									
252	DINT	R/W	Datalink D for input assembly	UserDefinedIntegerReal1							X									
253	DINT	R/W	Datalink A for output assembly	UserDefinedIntegerData0							X									
254	DINT	R/W	Datalink B for output assembly	UserDefinedIntegerData1							X									
255	DINT	R/W	Datalink C for output assembly	UserDefinedIntegerReal0							X									
256	DINT	R/W	Datalink D for output assembly	UserDefinedIntegerReal1							X									
264	DINT	R/W	TCP reply delay value	Maximum delay time before sending an acknowledgement to a TCP segment						X										

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
266	DINT	R/W	Sets the mode of operation for the drive	0 = Auto Tune 1 = EtherNet/IP External Reference 2 = Master Gearing 3 = Step and Direction 4 = Analog Velocity 5 = Analog Current 6 = Indexing				X	X											
267	DINT	R/W	Enable Auto Start index function for Indexing mode when drive becomes enabled	0 = Disable 1 = Enable													X			
268	DINT	R/W	Upon transition from 0 to 1 the drive will begin executing index.	0 to 1 transition = Executes indexing 1 to 0 transition = No effect on indexing																
269	DINT	W	Value in this tag must change before time-out time is reached, otherwise the fault action is initiated. Function can be used with EtherNet/IP explicit messaging control.	Cycle this tag value between 0 and 1 before the time-out period is reached to prevent a watchdog time-out and fault.																
270	DINT	R/W	Enables the communication watchdog function. Function can be used with EtherNet/IP explicit messaging control.	A value of 1 enables the watchdog mechanism.																
271	DINT	R/W	Time-out value. Function to be used with EtherNet/IP explicit messaging control. This tag sets the window of time before the time-out occurs and the fault is generated.	Range: 10 . . . 1000 ms																
624	DINT	R/W	Programmable input assignment for input A4	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
625	DINT	R/W	Programmable input assignment for input B1	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								
626	DINT	R/W	Programmable input assignment for input B2	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								
627	DINT	R/W	Programmable input assignment for input B3	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
628	DINT	R/W	Programmable input assignment for input B4	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								
629	DINT	R/W	Programmable input assignment for input C1	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								
630	DINT	R/W	Programmable input assignment for input C2	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
631	DINT	R/W	Programmable input assignment for input C4	0 = Not Assigned 1 = Abort Index 2 = (Reserved) 3 = Start Index 4 = Define Home 5 = Abort Homing 6 = Start Homing 7 = Fault Reset 8 = Index Select 0 9= Index Select 1 10 = Index Select 2 11 = Index Select 3 12 = Index Select 4								X								
632	DINT	W	Indexing starts from index specified	0…31													X			
633	DINT	R	Aborts index in progress	Uses the AbortDecel parameter (#178) to go to zero velocity																
634	DINT	R	Aborts homing in progress	Uses the AbortDecel parameter (#178) to go to zero velocity																
637	DINT	R	Index currently executing. This tag is valid only in Indexing mode.	0…31													X			
646	REAL	R/W	Thermal resistance, Rt	Range: 0…10000000 C/W		X	X													
647	REAL	R/W	Thermal capacitance, Ct	Range: 0…10000000 W-s/C		X	X													
650	REAL	R/W	Intermittent current	Range: 0…100 A			X													
651	DINT	R/W	For the digital output that has been assigned to the brake function, this is the delay from when the drive is disabled to the time that motion is stopped and brake is engaged.	Motor brake engage delay, ms								X								
652	DINT	R/W	For the digital output that has been assigned to the brake function, this is the delay from when the drive is enabled to the time that motion is allowed to begin (brake is released).	Motor brake release delay, ms								X								
653	DINT	RO	Fault E-code	Same fault code that is displayed on the servo drive display																X
654	DINT	WO	Reset ABS encoder error method	Writing a non-zero value to this field resets encoder detected faults on TL-Series (Bulletin TLY) motors without having to perform a power cycle once the failure condition is corrected.																
668	DINT	W	Overtravel Input Polarity (1). Controls the active level of the exception on the overtravel inputs.	0 = Normally open input (active high) 1 = Normally closed input (active low)								X								

Table 87 - Kinetix® 300 Drive Tag Numbers (continued)

ID	Data Type	Access	Description	Value/Notes	MotionView Page Used															
					Top Level	Motor-Synchronous	Motor-Linear	General -Synchronous	General -Linear	EtherNet	EtherNet/IP (CIP)	Digital I/O	Analog I/O	Velocity Limits	Position Limits	Dynamics	Indexing	Homing	Monitor	Faults
667	DINT	W	Registration Arming (1) A 0-to-1 transition of this parameter arms the registration capture if the drive is not currently in a registration based move.	When the registration digital input becomes asserted, the motor position is captured, copied into the Registered Position field in the Input Assembly, and the Registration Captured bit in the Input Assembly transitions from 0 to 1.																
670	DINT	R/W	Enable rotary unwind.	0 = Disable 1 = Enable Rotary Unwind is designed only for these modes: Rotary Absolute Rotary Incremental Rotary Shortest Path Rotary Positive Rotary Negative Rotary unwind mode in conjunction with Blended or Registered moves is not supported. Attempting to use these move options without having configured rotary unwind will result in a drive fault.				X												
671	REAL	R/W	User units per unwind.	Range: 0…1000000				X												
672	REAL	R/W	Current output clamp.	Range: 0…400%				X												
676	REAL	R/W	User units scaling.	Range: 1…1000000			X													
678	DINT	R/W	Measure units.	0 = µm 1 = m 2 = in.			X													

(1) The hardware overtravel configuration in the MotionView OnBoard software has been enhanced to allow the configuration of the inputs as normally open or normally closed when this firmware is used on hardware revision 1B. The hardware revision can be found by reading the last four digits of the Type field on the carton label.

Index Base Addressing

There are 11 tags per index and 32 indexes total.

Table 88 - Index Base Address

Index *x* = Base Address (B)	Index *x* = Base Address (B)
Index 0 = 272	Index 16 = 448
Index 1 = 283	Index 17 = 459
Index 2 = 294	Index 18 = 470
Index 3 = 305	Index 19 = 481
Index 4 = 316	Index 20 = 492
Index 5 = 327	Index 21 = 503
Index 6 = 338	Index 22 = 514
Index 7 = 349	Index 23 = 525
Index 8 = 360	Index 24 = 536
Index 9 = 371	Index 25 = 547
Index 10 = 382	Index 26 = 558
Index 11 = 393	Index 27 = 569
Index 12 = 404	Index 28 = 580
Index 13 = 415	Index 29 = 591
Index 14 = 426	Index 30 = 602
Index 15 = 437	Index 31 = 613

Table 89 - Indexing Tag Numbers

ID	Data Type	Access	Description	Value/Notes
B+0	DINT	R/W	Index move type of absolute, incremental, registration or blended incremental for index 0…31.	0 = Absolute 1 = Incremental 2 = Registered Absolute 3 = Registered Incremental 4 = Blended
B+1	DINT	R/W	Trapezoidal or S-curve move for index 0…31.	0 = Trapezoidal 1 = S-Curve
B+2	DINT	R/W	Maximum distance to move for index 0…31.	Distance (how far to move)
B+3	DINT	R/W	Relative distance to move after registration event for registration types for index 0…31.	Move distance after registration
B+4	DINT	R/W	Batch count. Number of times to repeat index before executing for index 0…31.	Range: 0…1000 counts
B+5	DINT	R/W	Dwell time to remain at current position before executing for index 0…31	Range: 0…10,000 ms
B+6	DINT	R/W	Maximum velocity in UU while in motion for index 0…31	Velocity (speed when moving towards new position)
B+7	DINT	R/W	Maximum acceleration in UU while in motion for index 0…31	Acceleration (how quickly towards configured velocity)
B+8	DINT	R/W	Maximum deceleration in UU while in motion for index 0…31	Deceleration (how quickly towards zero velocity from configured velocity)
B+9	DINT	R/W	Next index to execute if action so indicates for index 0…31	Next Index (next index to execute if any)
B+10	DINT	R/W	Action to execute upon completing motion for index 0…31	0 - Stop 1 = Wait for Start 2 = Next Index

MicroLogix Explicit Messaging

You can use MicroLogix™ CIP Generic (MSG) instructions, also known as explicit messages, to read and write to the drive ID tags over the EtherNet/IP network. This capability is present in the MicroLogix 1100 Series B and MicroLogix 1400 controllers. You can write to read/write (R/W) ID tags, however, read (R) ID tags are read-only. For the complete list of Kinetix® 300 ID tags, see Appendix C on page 201.

Explicit Messaging Data Types

ID tags are designated as either DINT, REAL, or string data types. The MicroLogix controller uses long file elements, such as L12:0 for DINT data types, floating point file elements, such as F13:0, for Real data types, and string file elements, such as ST14:0 for string data types.

The attribute value is used to designate the data format as DINT, REAL, string, and the memory location as volatile or nonvolatile.

Table 90 - Data Type Attributes

Attribute	Format	Memory Stored In
0	DINT	Volatile
1	DINT	Nonvolatile
2	REAL	Volatile
3	REAL	Nonvolatile
4	String	Volatile
5	String	Nonvolatile

Explicit messaging lets DINT data types to be read into and written from long file elements directly and Real data types to be read into and written from floating point file elements directly. String data types must be read into integer file elements, such as N11:0, by the MSG instruction and then copied into a string file element. Similarly strings must be copied into integer file elements first before being written by the MSG instruction.

IMPORTANT For each CIP Generic message (MSG) instruction, you must use both a unique message file element, for example MG9:0 and a unique extended routing information file element, for example RIX10:0. The routing information file element stores not only the path to the destination Kinetix 300 drive IP address, but also the specific Class/Instance/Attribute settings.

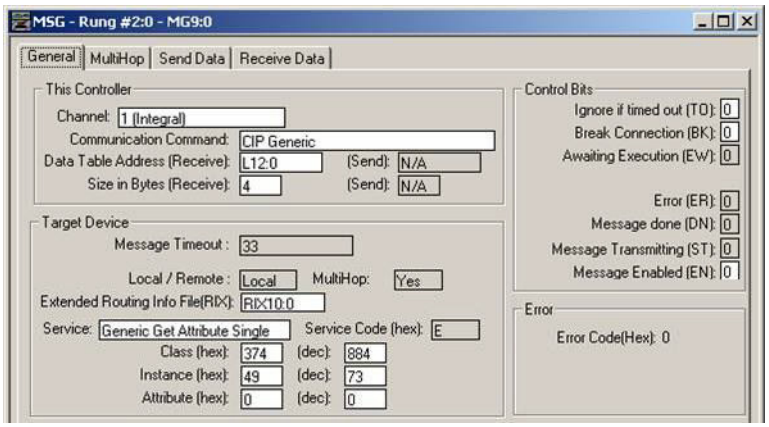
Explicit Messaging Data Type Examples

This section provides examples for DINT, REAL, and String data types.

DINT Data Type Examples

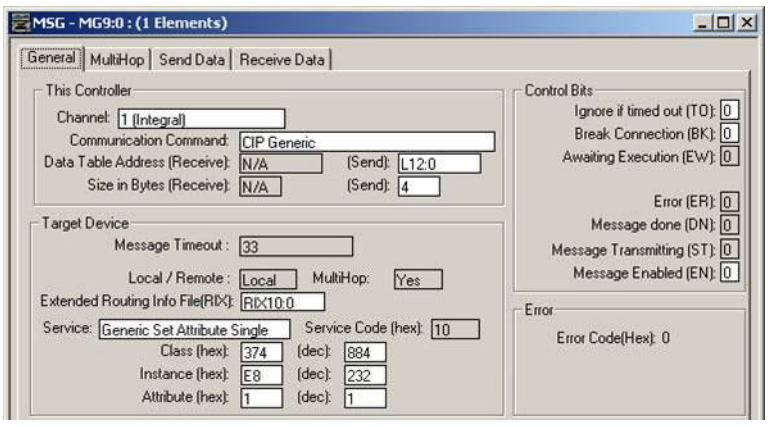
In this example, the instance decimal is ID tag 73 (bus voltage).

Figure 105 - Reading DINT from Volatile Memory



In this example, the instance decimal is ID tag 232 (homing method).

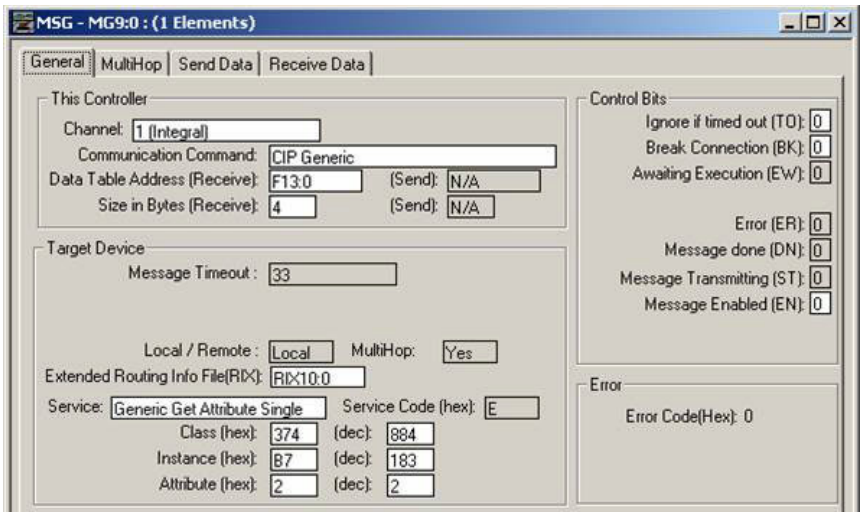
Figure 106 - Writing DINT into Nonvolatile Memory



REAL Data Type Examples

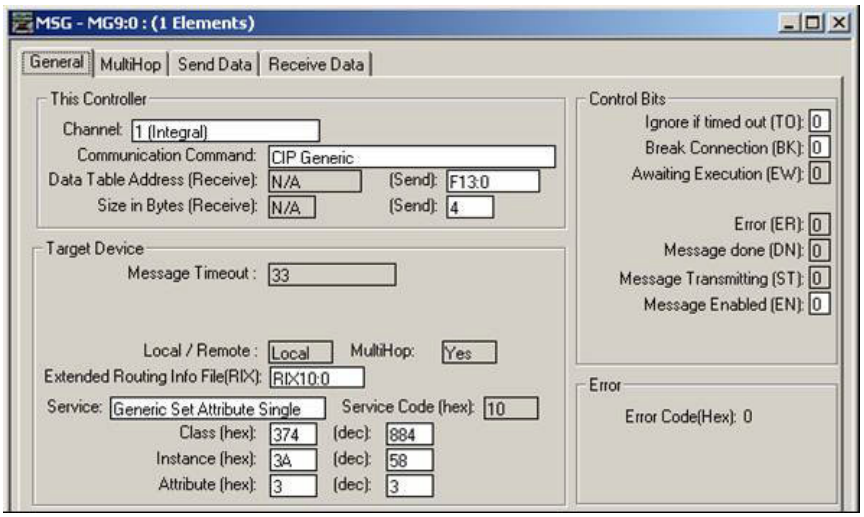
In this example, the instance decimal is ID tag 183 (phase current).

Figure 107 - Reading REAL from Volatile Memory



In this example, the instance decimal is ID tag 58 (zero speed window).

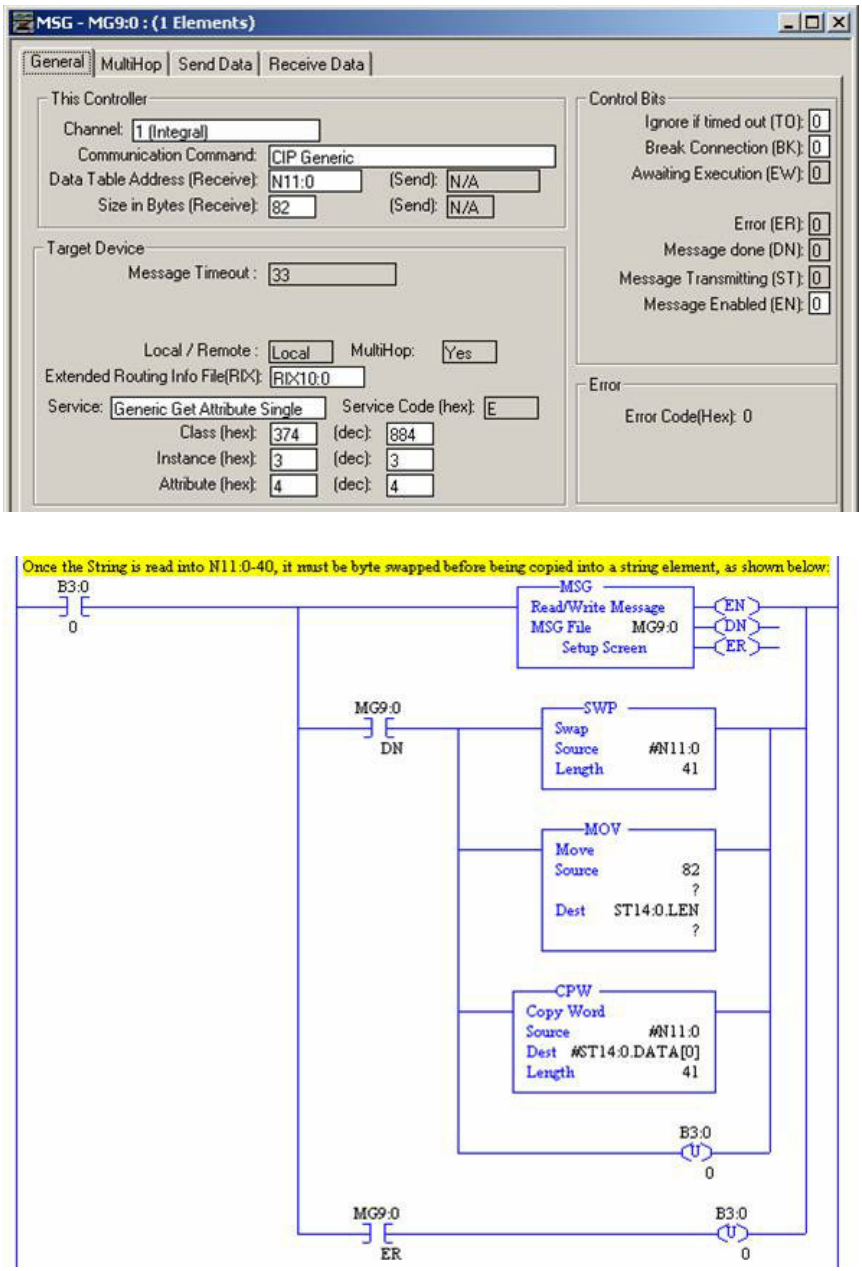
Figure 108 - Writing REAL into Nonvolatile Memory



String Data Type Examples

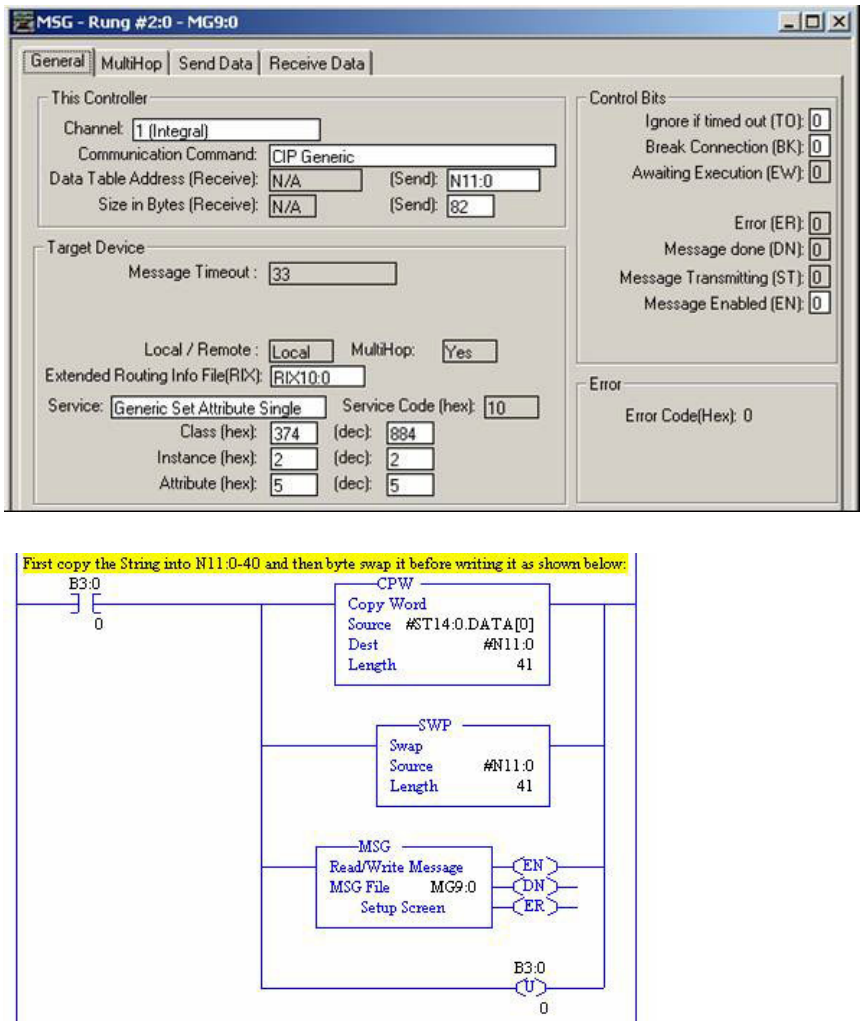
In this example, the instance decimal is ID tag 3 (drive serial number).

Figure 109 - Reading String from Volatile Memory



In this example, the instance decimal is ID tag 2 (drive symbolic name).

Figure 110 - Writing String into Nonvolatile Memory



Notes:

Overtravel Inputs

The Kinetix® 300 drive has built-in hardware overtravel inputs. These digital inputs are positive and negative relative to the direction of movement on your axis. The overtravel limits are switches wired to the drive's inputs and mounted at the physical extremes (positive/negative) of your axis to indicate a no-movement condition for your axis.

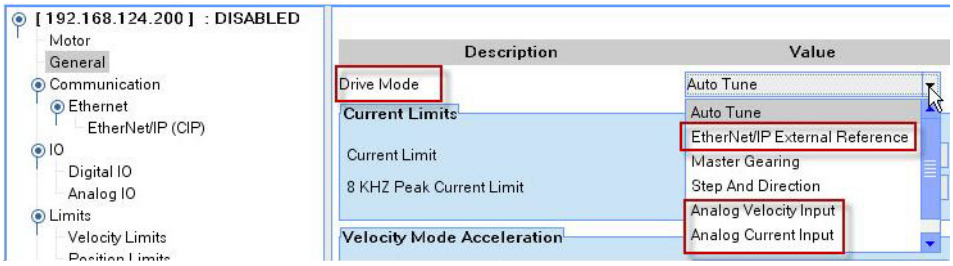
Modes of Operation

The operation of the Kinetix 300 drives overtravel limits is only applicable in Positioning mode. You can also use non-positioning modes, but they must work in conjunction with an external controller or PLC.

Table 91 - Overtravel Input Modes of Operation

Positioning Modes	Non-positioning Modes
Indexing mode	EtherNet/IP External Reference mode 0 = Current (torque) Reference 1 = Velocity Reference
EtherNet/IP External Reference mode 2 = Incremental Position 3 = Absolute Position 4 = Incremental Registration 5 = Absolute Registration	Analog Velocity Input mode
Jog Profiler mode	Analog Current Input mode

Figure 111 - Modes of Operation in MotionView Software



Overtravel Hardware Inputs

Overtravel inputs are dedicated inputs and cannot be used for anything else.

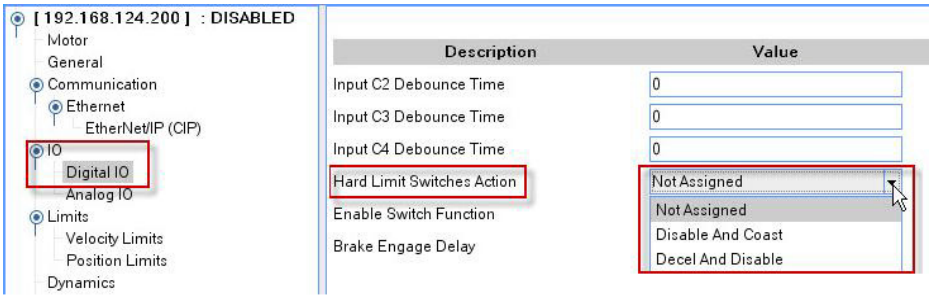
Table 92 - Overtravel Pin Assignments

IOD Pin	Description	Signal
IOD-28	Positive overtravel input	IN_A2
IOD-27	Negative overtravel input	IN_A1

The overtravel inputs are edge triggered and once the overtravel limit is exceeded, the drive will perform the configured shutdown. Overtravel checking is configured via MotionView software under DriveIP >IO > Digital IO > Hard Limit Switches Action.

Overtravel inputs can be programed for normally open or normally closed operation. Use EtherNet/IP Explicit Messaging tag ID 668 to modify this parameter.

Figure 112 - Overtravel Configuration in MotionView Software



The default action is Not Assigned. These actions are configured via the pull-down menu:

- Disable and Coast - immediately disables the drive upon detecting an overtravel condition. Disable and Coast is the only stopping action available when overtravel is tripped in Analog Velocity Mode.
- Decel and Disable - uses the Abort Decel rate to stop the servo and then disable the drive. Decel and Disable is not available for Analog Velocity Mode.

Operation

If the drive is in a position operating mode, the overtravel limits are functional and will generate an error when the overtravel is reached. The drive will not allow axis movement in the direction of the overtravel limit until after the overtravel fault is reset. Only movement in the opposite direction is allowed.

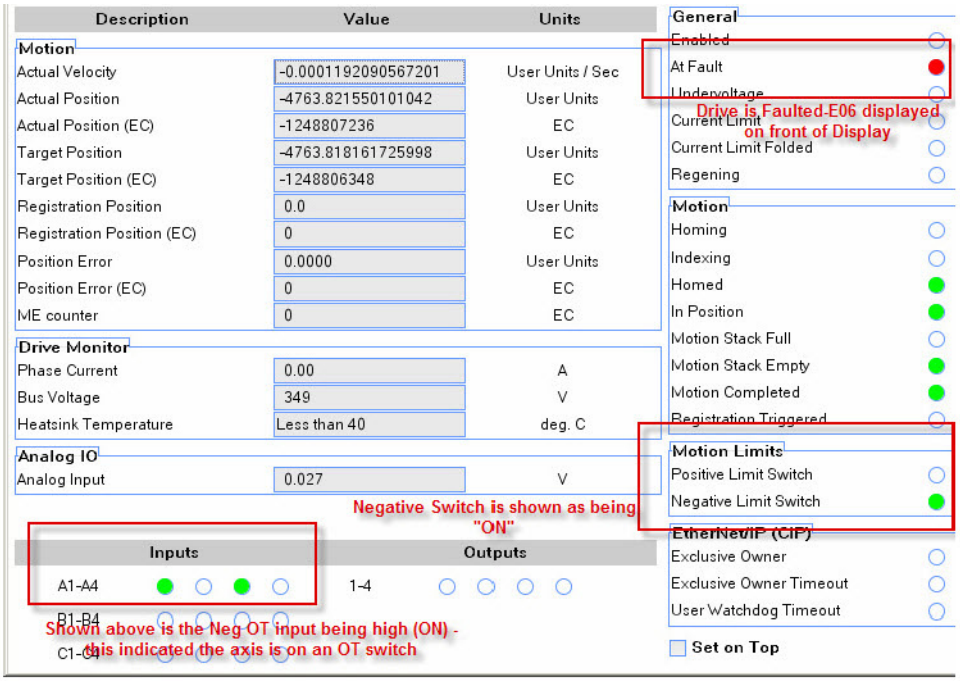
If the drive is in a non-positioning mode of operation, the overtravel limits are functional and will generate an error when the overtravel is reached. However, it is up to the controller (via programming) to manage recovery and axis position after an overtravel fault. The drive will not limit axis movement once the fault has been cleared.

IMPORTANT If an overtravel fault is reset and the drive is enabled while the axis is on or beyond the overtravel limit, a runaway condition could occur when using the overtravel limits in a non-positioning mode.

An overtravel fault registers when the drive is enabled and motion causes the axis to pass the overtravel switch. Once the overtravel is triggered, the drive performs the configured Hard Limit Switches Action and drive is disabled.

An example of this is if the drive was in EtherNet/IP drive mode, had an overtravel fault, and the overtravel fault is reset. If a value still exists in the CommandCurrentOrVelocity parameter of the drive Add-on Profile, and that value is in the incorrect direction, the axis will continue to move in that direction regardless of overtravel condition.

Figure 113 - MotionView Monitor Category



Overtravel Fault Recovery

Follow these steps to recover from an overtravel fault condition while in a Positioning mode.

1. Reset the drive to clear the overtravel fault, either through MotionView software or via logic.

   Typically, the overtravel input is still active after the reset, because the axis is still on the limit switch.

2. Enable the servo.
3. Move the axis off the limit switch.

   The drive allows a position-based move in the direction opposite the limit switch. For example, if the axis is on a positive limit switch, it can move in a negative direction or if the axis is on a negative limit switch, it can move in a positive direction.

   Once the axis is moved off the limit switch, the input goes low and the motion routine can begin again.

Follow these steps to recover from an overtravel fault condition while in a non-positioning mode.

1. Change the motion command reference (velocity or current) to a value opposite the axis overtravel is on (set to a negative value if on the positive limit and vice-versa if on the negative limit).

   IMPORTANT The drive will not limit motion in the direction of the overtravel when in a non-positioning mode, provided the overtravel input is still active and the initial overtravel fault has been reset.

2. Reset the drive to clear the overtravel fault, either through MotionView software or via logic.

   Typically, the overtravel input is still active after the reset, because the axis is still on the limit switch.

3. Enable the servo.

   IMPORTANT With a non-zero command reference, motion begins immediately upon Enable when in a current or velocity mode of operation.

4. Verify that the user program code permits continued axis motion and manages the motion routine.

Leakage Current Specifications

This appendix contains leakage current specifications to be expected for center-grounded wye and corner-grounded delta input power configurations for Kinetix® 300 drives when installed with or without a mains AC line filter.

Table 93 - Leakage Current Specifications

					Mains Input - Nominal Line Typical Leakage (Calculated)				Mains Input - High Line (Nominal +10%) Fault Leakage (Calculated)			
					Single-phase	Three-phase			Single-phase	Three-phase		
					Center Ground WYE			Corner Ground Delta	Center Ground WYE			Corner Ground Delta
Cat. No.	Drive Description	AC Input Voltage (rms)	Continuous Output Current (rms)	Number of Phases	No External Filter		With External Filter	No External Filter	No External Filter		With External Filter	No External Filter
2097-V31PR0	120/240V, single-phase, doubler	120V	2 A	1	7 mA pk	—	—	—	7 mA pk	—	—	—
		240V			7 mA pk	—	—	—	8 mA pk	—	—	—
2097-V31PR2		120V	4 A		6 mA pk	—	—	—	7 mA pk	—	—	—
		240V			7 mA pk	—	—	—	8 mA pk	—	—	—
2097-V32PR0	208/240V, single-phase, with integrated filter	240V	2 A		27 mA pk	—	—	—	29 mA pk	—	—	—
2097-V32PR2			4 A		26 mA pk	—	—	—	28 mA pk	—	—	—
2097-V32PR4			8 A		26 mA pk	—	—	—	29 mA pk	—	—	—
2097-V33PR1	208/240V, single/three-phase	240V	2 A	1	18 mA pk	—	—	—	20 mA pk	—	—	—
				3	—	2 mA pk	—	—	—	2 mA pk	—	—
					—	—	1 mA pk	—	—	—	1 mA pk	—
					—	—	—	29 mA pk	—	—	—	31 mA pk
2097-V33PR3			4 A	1	18 mA pk	—	—	—	19 mA pk	—	—	—
				3	—	2 mA pk	—	—	—	3 mA pk	—	—
					—	—	1 mA pk	—	—	—	1 mA pk	—
					—	—	—	28 mA pk	—	—	—	31 mA pk
2097-V33PR5			8 A	1	17 mA pk	—	—	—	19 mA pk	—	—	—
				3	—	2 mA pk	—	—	—	3 mA pk	—	—
					—	—	2 mA pk	—	—	—	2 mA pk	—
					—	—	—	28 mA pk	—	—	—	30 mA pk
2097-V33PR6			12 A	1	19 mA pk	—	—	—	20 mA pk	—	—	—
				3	—	3 mA pk	—	—	—	3 mA pk	—	—
					—	—	12 mA pk	—	—	—	13 mA pk	—

Table 93 - Leakage Current Specifications (continued)

					Mains Input - Nominal Line Typical Leakage (Calculated)				Mains Input - High Line (Nominal +10%) Fault Leakage (Calculated)			
					Single-phase	Three-phase			Single-phase	Three-phase		
					Center Ground WYE			Corner Ground Delta	Center Ground WYE			Corner Ground Delta
Cat. No.	**Drive Description**	**AC Input Voltage** (rms)	**Continuous Output Current** (rms)	**Number of Phases**	**No External Filter**		**With External Filter**	**No External Filter**	**No External Filter**		**With External Filter**	**No External Filter**
2097-V34PR3	400/480V, three-phase	480V	2 A	3	—	16 mA pk	—	—	—	17 mA pk	—	—
					—	—	5 mA pk	—	—	—	5 mA pk	—
2097-V34PR5			4 A		—	15 mA pk	—	—	—	17 mA pk	—	—
					—	—	3 mA pk	—	—	—	4 mA pk	—
2097-V34PR6			6 A		—	16 mA pk	—	—	—	18 mA pk	—	—
					—	—	4 mA pk	—	—	—	5 mA pk	—

Notes:

Numerics

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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

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