User Manual

Allen-Bradley

# Kinetix 3 Component Servo Drives

Catalog Numbers 2071-AP0, 2071-AP1, 2071-AP2, 2071-AP4, 2071-AP8, 2071-A10, 2071-A15

## Important User Information

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

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

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

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

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

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

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited.

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

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

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

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

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

## New and Updated Information

This table contains the changes made to this revision.

| Topic | Page |
|---|---|
| Added Kinetix™ 3 system components to work with Connected Components Workbench software | 12 |
| Added Kinetix 3 system components to figures that work with Connected Components Workbench software | 13…14 |
| Added I/O interface diagram | 33 |
| Added information to Digital Inputs and Digital Output tables | 40…44 |
| Updated Table 30 - 2090-CFBM6DF-CBAAxx Feedback Cable | 72 |
| Added reset drive procedure | 83 |
| Added Chapter 6 Configure Drive for Communication | 85 |
| Added Chapter 7 Configure Your Drive for Communication with a Personal Computer Running Connected Components Workbench Software | 91 |
| Added Reset Drive to Default Values by Using Ultraware Software | 102 |
| Added Kinetix 3 to MicroLogix™ and Micro800™ controller interconnect diagrams for PTO | 127 |

## Notes:

## Preface



## Start

### Chapter 1



## Install the Kinetix 3 Drive System

### Chapter 2



## Kinetix 3 Drive Connector Data

### Chapter 3

## Chapter 4

**Connect the Kinetix 3 Drive**



## Chapter 5

**Using the Keypad Interface**



## Chapter 6

**Configure Your Drive for Communication**



## Chapter 7

**Configure Your Drive for Communication with a Personal Computer Running Connected Components Workbench Software**

## Chapter 8

**Using Ultraware Software to Configure the Drive**



## Chapter 9

**Maintain and Troubleshoot Your Kinetix 3 Servo Drive**



## Appendix A

**Interconnect Diagrams**

## Notes:

## About This Publication

This manual provides detailed installation instructions for mounting, wiring, and troubleshooting your Kinetix 3 drive, and system integration for your drive/motor combination with a MicroLogix controller.

## Who Should Use This Manual

This manual is intended for engineers or technicians directly involved in the installation and wiring of the Kinetix 3 drive and programmers directly involved in operation, field maintenance, and integration of the Kinetix 3 drive.

If you do not have a basic understanding of the Kinetix 3 drive, contact your local Rockwell Automation sales representative for information on available training courses.

## Additional Resources

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

| Resource | Description |
|---|---|
| Kinetix 3 Component Servo Drive Installation Instructions, publication 2071-IN001 | Information on installing your Kinetix 3 drive system. |
| Kinetix 3 I/O Breakout Board Installation Instructions, publication 2071-IN002 | Information on installing and wiring the Kinetix 3 I/O breakout board. |
| Kinetix 3 Feedback Breakout Board Installation Instructions, publication 2071-IN003 | Information on installing and wiring the Kinetix 3 feedback breakout board. |
| Serial Communication Cables Installation Instructions, publication 2090-IN019 | Information on installing and schematics for the serial communication cables used with Kinetix 3 drive. |
| MicroLogix 1100 Programmable Controllers User Manual, publication 1763-UM001 | Information on how to install, wire, and troubleshoot your controller. |
| MicroLogix 1400 Programmable Controllers User Manual, publication 1766-UM001 | |
| Micro830™ and Micro850™ Programmable Controllers User Manual, publication 2080-UM002 | |
| Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1 | Provides general guidelines for installing a Rockwell Automation™ industrial system. |
| Kinetix 3 Component Servo Drive Serial Host Command Reference Manual, publication 2071-RM001 | Information on the serial communication commands, both ASCII and ModBus-RTU, for interfacing a motion controller with the Kinetix 3 drive. |
| Micro800 and Connected Components Workbench Getting Started Guide, publication 2080-QR001 | Provides information on basic Micro800™ controller and Connected Components Workbench software functions. |
| Micro800 and Connected Components Workbench Application Guide, publication 2080-QR002 | Provides procedures for completing basic tasks in Connected Components Workbench software and for using Connected Components Workbench software with component-class products. |
| Ultraware Software User Manual, publication 2098-UM001 | Information on Ultraware software used to configure and operate Kinetix 3 drives, or when designing, testing or running C language programs or cam tables on these drives. |
| System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001 | Information, examples, and techniques designed to minimize system failures caused by electrical noise. |
| Motion Analyzer CD, download at http://www.ab.com/motion/software/analyzer_download.html | Drive and motor sizing with application analysis software. |
| Rockwell Automation Product Certification, website http://www.rockwellautomation.com/products/certification | For declarations of conformity (DoC) currently available from Rockwell Automation. |
| National Electrical Code, published by the National Fire Protection Association of Boston, MA | An article on wire sizes and types for grounding electrical equipment. |
| 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.rockwellatuomation.com/literature. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

# Start

## About the Kinetix 3 Drive System

The Kinetix 3 component servo drive is designed to provide a solution for applications with output power requirements between 0.6...9.9A rms (50...1500 W).

**Table 1 - Kinetix 3 Drive System Overview**

| Kinetix 3 System Component | Cat. No. | Description |
|---|---|---|
| Kinetix 3 component servo drive | 2071-A*xxx* | Kinetix 3 component servo drives are available with 230V AC input power. |
| AC line filters | 2090-XXLF-TC316 and 2090-XXLF-TC116 | 2090-XXLF-TC316 three-phase or 2090-XXLF-TC116 single-phase AC line filters are required to meet CE and available for use in 230V systems. |
| Limited I/O adaptor board | 2071-TBIO | 24-pin breakout board. Use with the Kinetix 3 drives (IOD connector) or for control interface connections it accesses 24 of the 50 pins of the I/O connector. |
| Full Breakout I/O Cable | 2090-DAIO-D50 | 50-pin full breakout I/O cable with flying-leads. Use with the Kinetix 3 drives (IOD connector) or for control interface connections it accesses 50 of the 50 pins of the I/O connector. This Full Breakout I/O Cable is required for Pulse Train Output (PTO) drive control. |
| Motor feedback adaptor board | 2071-TBMF | 20-pin breakout board. Use with the Kinetix 3 drives (MF connector) or for motor feedback connections. |
| Ultraware software | 2098-UWCPRG | Ultraware Version 1.80 or higher provides a method to configure Kinetix 3 drives. |
| Connected Component Workbench™ software | 9328 | Connected Component Workbench software environment a method for configuring or programming Micro800 controllers, PanelView™ Component terminals, Kinetix 3 drives, and other component level products. |
| 3.6V Battery | Customer supplied | 3.6 Volt lithium battery necessary for absolute positioning with the TL-Series™ motors. |
| Rotary servo motors | TL-Series | TL-Series motors are available for use with the Kinetix 3 drive. Important: Other motors can be used with a Kinetix 3 drive, as long as they include incremental encoder feedback and Hall signals). |
| Linear actuators | MP-Series™ and TL-Series | Compatible actuators include MP-Series direct drive 230V integrated linear stages and TL-Series electric cylinders. |
| Linear motors | LDC-Series™ and LDL-Series™ | Compatible linear motors include LDC-Series and LDL-Series 230V linear motors. |
| Cables | TL-Series motor power, feedback, and brake cables | Motor power, feedback, and brake cables include quick connect/quick-release connectors at the motor. Power and brake cables have flying leads on the drive end connectors that connect to servo motors. Standard feedback cables have angled, molded connectors on the drive end and connectors that connect to servo motors. Drive mounted connector kits are also available. |
| Micro830 and Micro850 controllers | 2080-LC30-xxxxx<br>2080-LC50-xxxxx | Micro800 programmable logic controllers with USB let you do simple PLC-based motion solutions with the Kinetix 3 drive. In addition Micro830 and Micro850 programmable logic controllers with pulse train outputs (PTO) can be used. |
| MicroLogix 1100/1200/1400/1500 controllers | 1763-L16*xxx*<br>1766-L32*xxx*<br>1762-L24*xxx*<br>1762-L40*xxx*,<br>1764-24*xxx*<br>1764-28*xxx* | The MicroLogix 1100/1200/1400/1500 controller can perform simple motion control with pulse train outputs (PTO). The MicroLogix 1100/1400 also have the ability to control the drive with Modbus-RTU, increasing functionality |
| RSLogix™ 500 software | 9324-RL0300ENE | RSLogix 500 provides support for programming, commissioning, and maintaining the SLC 500 and MicroLogix controller families. |
| Serial communication cables | 2090-CCMPCDS-23AAxx<br>2090-CCMCNDS-48AAxx<br>2090-CCMDSDS-48AAxx<br>2090-CCMUSDS-48AAxx | Serial communication cables provide an interface between your system components by using RS-232 or RS-485 protocols. |
| 1203-USB Converter | 1203-USB | The 1203-USB converter provides a Drive Serial Interface (DSI) communication between a computer and Kinetix 3 drive. |

**Figure 1 - Micro800 Configuration - Kinetix 3 Servo Drive System**

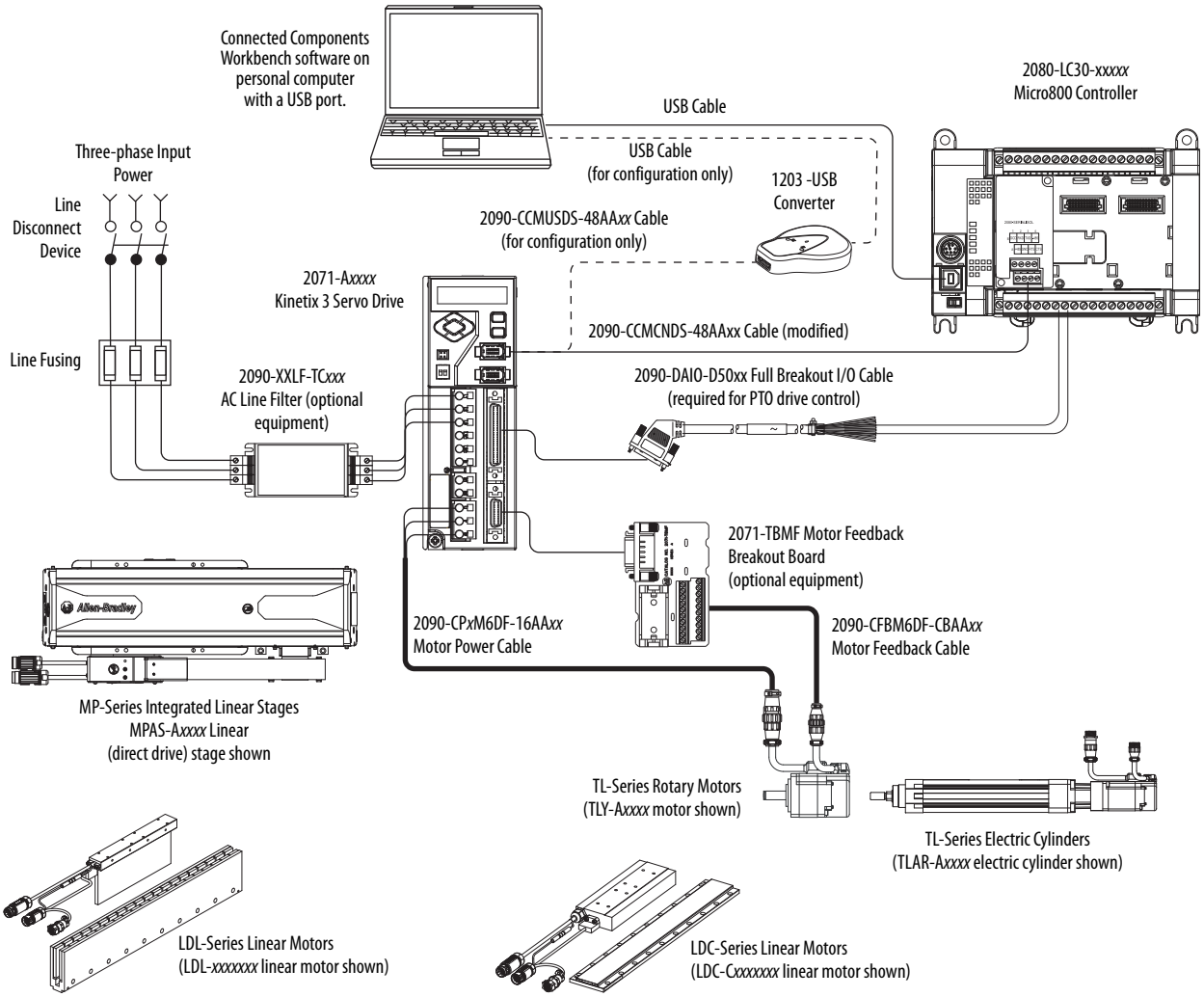



**Figure 2 - MicroLogix Controller Configuration - Kinetix 3 Servo Drive System**

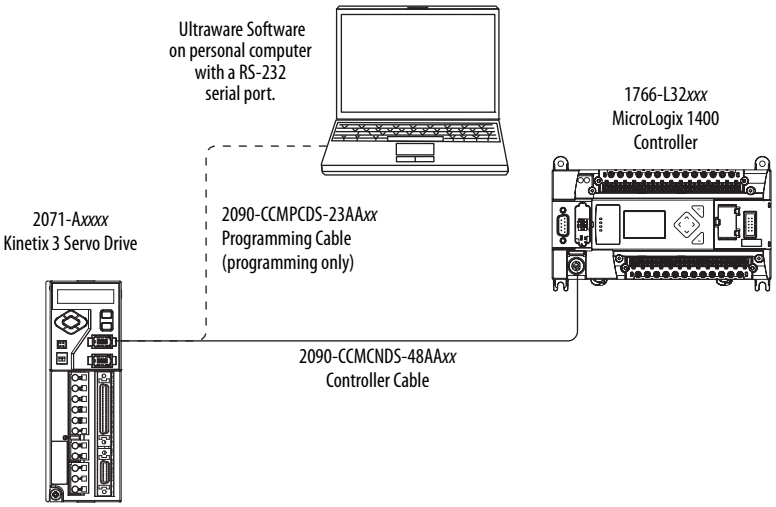
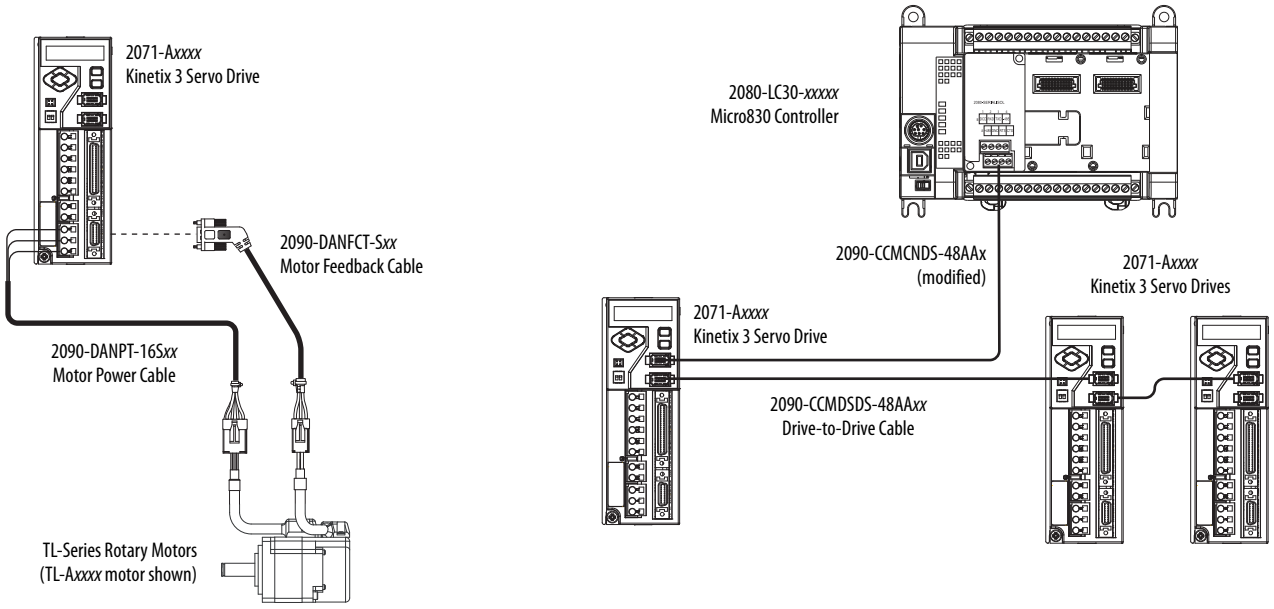


**Figure 3 - Typical Configuration - Kinetix 3 Servo Drive System (alternate configurations)**




## Catalog Number Explanation

Kinetix 3 drive catalog numbers and descriptions are listed in the table.

**Table 2 - Kinetix 3 Drive Catalog Numbers**

| Cat. No. | Component Servo Drives |
|---|---|
| 2071-AP0 | Kinetix 3, 230V AC, 1 Ø, 0.6 A |
| 2071-AP1 | Kinetix 3, 230V AC, 1 Ø, 1.1 A |
| 2071-AP2 | Kinetix 3, 230V AC, 1 Ø, 1.7 A |
| 2071-AP4 | Kinetix 3, 230V AC, 1 Ø, 3.3 A |
| 2071-AP8 | Kinetix 3, 230V AC, 1 or 3 Ø, 5.0 A |
| 2071-A10 | Kinetix 3, 230V AC, 3 Ø, 7.0 A |
| 2071-A15 | Kinetix 3, 230V AC, 3 Ø, 9.9 A |

## Agency Compliance

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

**ATTENTION:** Meeting CE requires a grounded system, and the method of grounding the AC line filter and drive must match. Failure to do this renders the filter ineffective and can cause damage to the filter.
For grounding examples, refer to Grounding Your Kinetix 3 Drive on page 59.

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

To meet CE requirements, these requirements apply:

- Install an AC line filter (catalog number 2090-XXLF-TC*xxx*) as close to the drive as possible.
- Use 2090 series motor power cables and terminate the cable shields to the drive or subpanel.
- Use 2090 series motor feedback cables and properly terminate the feedback cable shield. Drive-to-motor feedback cables must not exceed 30 m (98.4 ft). Drive-to-motor power cables must not exceed 30 m (98.4 ft).
- Install the Kinetix 3 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.

Refer to Appendix A on page 123 for interconnect diagrams, including input power wiring and drive/motor interconnect diagrams.

## Notes:

# Install the Kinetix 3 Drive System



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

## System Design Guidelines

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

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

### System Mounting Requirements

- To comply with UL and CE requirements, the Kinetix 3 system must be enclosed in a grounded conductive enclosure offering protection as defined in standard EN 60529 (IEC 529) to IP55 such that they are not accessible to an operator or unskilled person. A NEMA 4X enclosure exceeds these requirements providing protection to IP66.
- The panel you install inside the enclosure for mounting your system components must be on a flat, rigid, vertical surface that is not be subjected to shock, vibration, moisture, oil mist, dust, or corrosive vapors.
- Size the drive enclosure so as not to exceed the maximum ambient temperature rating. Consider heat dissipation specifications for all drive components.

- Segregate input power wiring and motor power cables from control wiring and motor feedback cables. Use shielded cable for power wiring and provide a grounded 360° clamp termination.
- Use high-frequency (HF) bonding techniques to connect the 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 terminate the feedback cable shield. Drive-to-motor feedback cables must not exceed 30 m (98.4 ft). Drive-to-motor power cables must not exceed 30 m (98.4 ft).

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

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

## Fuse Selection

The Kinetix 3 drives use internal solid-state motor short-circuit protection and, when protected by suitable branch circuit protection, are rated for use on a circuit capable of delivering up to 100,000 A. Fuses or circuit breakers, with adequate withstand and interrupt ratings, as defined in NEC or applicable local codes, are permitted.

Refer to Fuse/Contactor Specifications on page 19 for recommended fuses.

Refer to Kinetix Servo Drives Specifications Technical Data for input current and inrush current specifications for your Kinetix 3 drive.

## Fuse/Contactor Specifications

Make sure the selected components are properly coordinated and meet acceptable codes including any requirements for branch circuit protection.

The following fuse examples are recommended for use with Kinetix 3 drives.

**Table 3 - Fuse and Contactor Specifications**

| Drive Cat. No. | AC Input Power (1) (2) (3) Recommended Fuse | Control Power (2) (4) Recommended Fuse | Contactor (5) |
|---|---|---|---|
| 2071-AP0 | FNQ-R-7 | FRS-R-2-1/2<br>FNQ-R-7-1/2<br>LPJ-6 | 100-K05xy |
| 2071-AP1 | | | |
| 2071-AP2 | | | 100-K09xy |
| 2071-AP2 | FNQ -R-10 | | 100-K12xy |
| 2071-AP8 | FNQ-R-20<br>LPJ-20 | | 100-C16*xy* |
| 2071-A10 | | | |
| 2071- A15 | FNQ-R-30<br>LPJ-30 | | 100-C23*xy* |

(1) Fuses specified are Bussmann fuses.
(2) FNQ-R fuses are described as time-delay fuses, Class CC.
(3) LPJ fuses are described as dual-element time-delay fuses, Class J.
(4) FRS-R fuses are described as dual-element time-delay fuses, Class RK5.
(5) For contactors: *x* represents coil voltage, *y* represents the number of contacts.

## Sizing the Enclosure

This example is provided to assist you in sizing an enclosure for your Bulletin 2071 drive system. You need heat dissipation data from all components planned for your enclosure to calculate the enclosure size. See Power Dissipation Specifications on page 21 for the Kinetix 3 drive power dissipation.

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

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

If the maximum ambient rating of the Kinetix 3 system is 50 °C (122 °F) and if the maximum environmental temperature is 30 °C (86 °F) then Q=416 and T=20 in the equation below.

$$A = \frac{0.38(416)}{1.8(20)\text{ -}1.1} \sim 4.5\ m^2$$

In this example, the enclosure must have an exterior surface of 4.53 $m^2$. If any portion of the enclosure is not able to transfer heat, it do not be included in the calculation.

Because the minimum cabinet depth to house the 230V drive (selected for this example) is 200 mm (7.9 in.), then the cabinet needs to be approximately 2000 mm (high) x 850 mm (wide) x 200 mm (deep).

$$2 \times (0.2 \times 0.85) + 2 \times (0.2 \times 2.0) + 2 \times (0.85 \times 2.0) = 4.54 m^2$$

Because this cabinet size is considerably larger than what is necessary to house the system components, it can be more efficient to provide a means of cooling in a smaller cabinet. 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 3 drive system

| Drive Cat. No. | Usage as% of Rated Power Output (watts) | | | | |
|---|---|---|---|---|---|
| | **20%** | **40%** | **60%** | **80%** | **100%** |
| 2071-AP0 | 19.29 | 20.0 | 20.6 | 21.3 | 22.0 |
| 2071-AP1 | 20.14 | 21.6 | 23.1 | 24.6 | 26.2 |
| 2071-AP2 | 21.70 | 24.6 | 27.6 | 30.6 | 33.7 |
| 2071-AP4 | 25.59 | 31.9 | 38.4 | 45.2 | 52.2 |
| 2071-AP8 | 26.36 | 32.3 | 38.6 | 45.1 | 52.0 |
| 2071-A10 | 30.87 | 40.2 | 50.1 | 60.6 | 71.5 |
| 2071-A15 | 37.37 | 50.1 | 63.8 | 78.4 | 94.0 |

## Minimum Clearance Requirements

This section provides information to assist you in sizing your cabinet and positioning your Kinetix 3 drive system components.

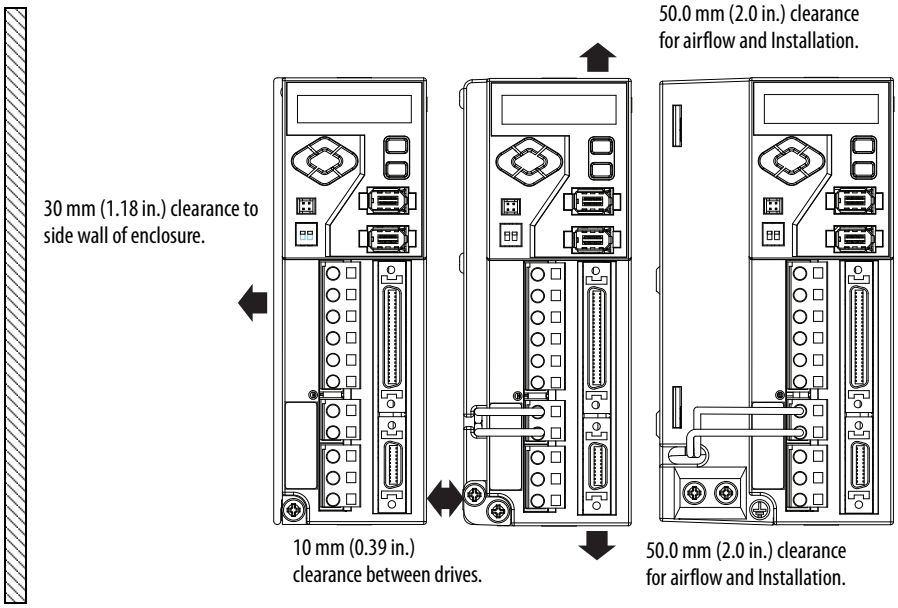
| **IMPORTANT** | Mount the module in an upright position as shown. Do not mount the module on its side. |
|---|---|

Figure 4 illustrates minimum clearance requirements for proper airflow and installation:

- Additional clearance is required depending on the accessory items installed.
- Additional clearance is required for the cables and wires connected to the front of the drive.
- An additional 150 mm (6.0 in.) is required when the drive is mounted adjacent to noise sensitive equipment or clean wireways.

See Kinetix Servo Drives Specifications Technical Data, publication GMC-TD003 for Kinetix 3 drive dimensions.

**Figure 4 - Minimum Clearance Requirements**




Refer to page 21 for power dissipation specifications.

# Electrical Noise Reduction

This section outlines best practices that minimize the possibility of noise-related failures as they apply specifically to Kinetix 3 system installations. For more information on the concept of high-frequency (HF) bonding, the ground plane principle, and electrical noise reduction, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

## Bonding Drives

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

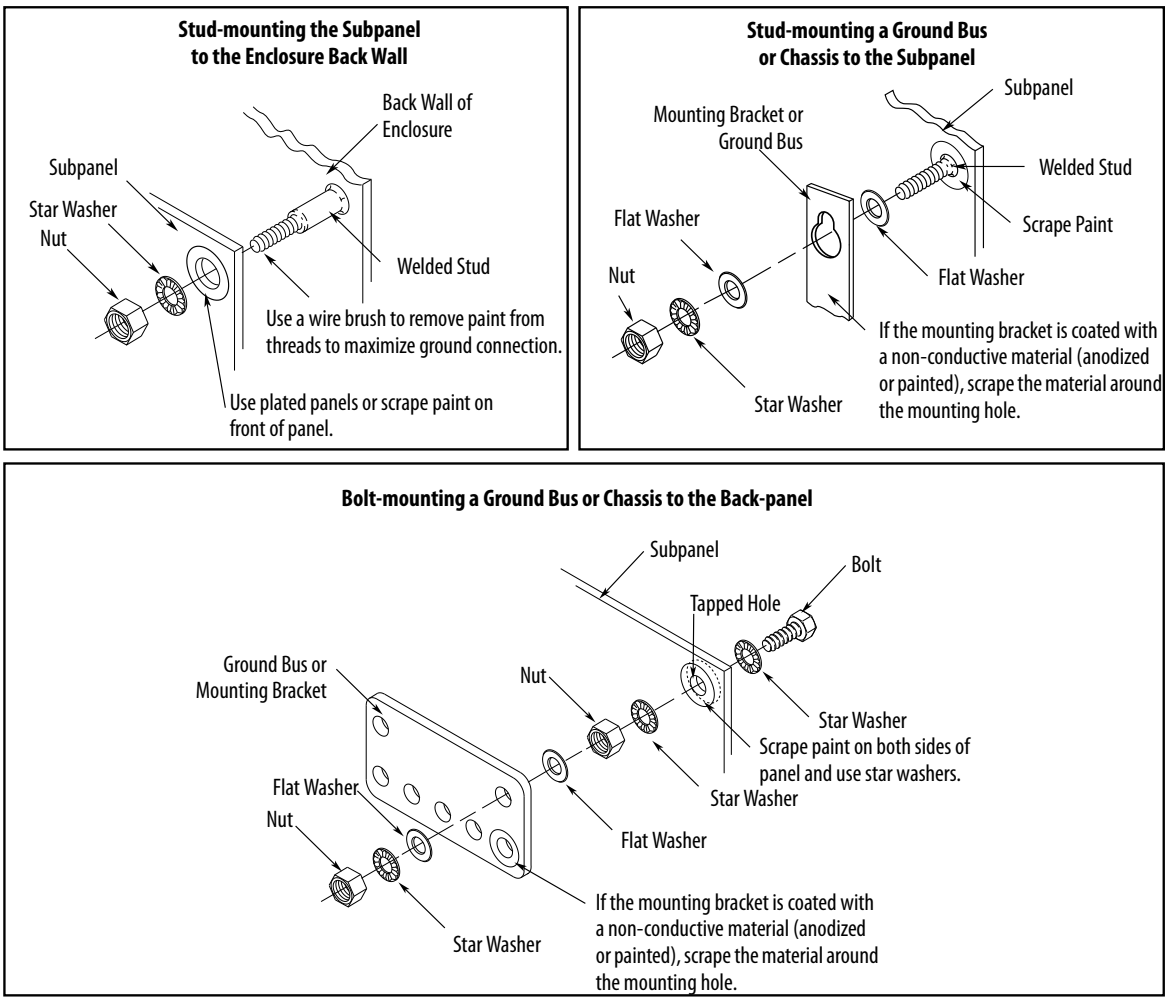
Unless specified, most paints are not conductive and act as insulators. To achieve a good bond between drive and the subpanel, surfaces need to be paint-free or plated. Bonding metal surfaces creates a low-impedance return path for high-frequency energy

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

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

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

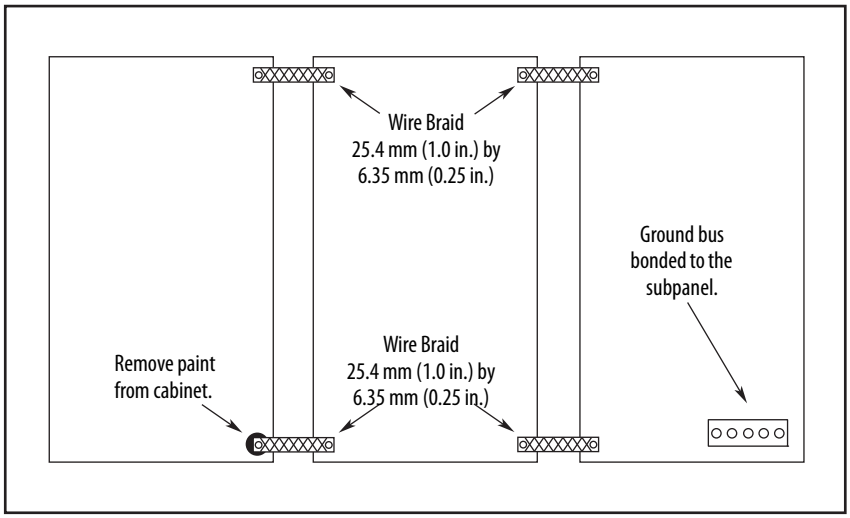
**Figure 5 - Recommended Bonding Practices for Painted Panels**



## 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 can not share a common low impedance path. This difference in impedance can affect networks and other devices that span multiple panels.

**Figure 6 - Multiple Subpanels and Cabinet Recommendations**

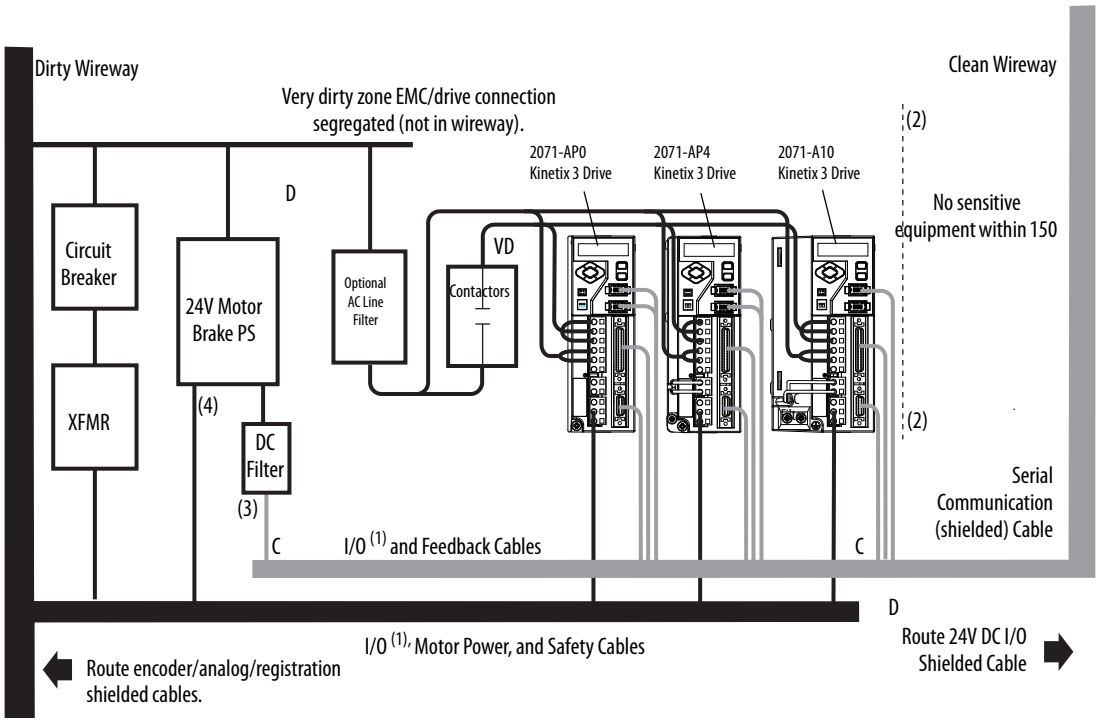


## Establishing Noise Zones

When the several components such as AC line filter, contactors, circuit breaker, and transformer are used in the Kinetix 3 system, observe these guidelines when laying out your panel:

- The clean zone (C) is beneath the Kinetix 3 drives and includes the I/O wiring, feedback cable, serial communication cable, and DC filter (grey wire way).
- The dirty zone (D) is above the Kinetix 3 drives (black wire way) and includes the circuit breakers, transformer, 24V DC power supply, contactors, AC line filter, and motor power cables.
- The very dirty zone (VD) is limited to where the AC line (EMC) filter VAC output connects to the Kinetix 3 drives. Shielded cable is required only if the very dirty cables enter a wire way.

**Figure 7 - Noise Zones for Installations With Bulletin 2090 AC Line Filter**




(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, refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001.

(3) This is a clean 24V DC available for any device that requires it. The 24V enters the clean wireway and exits to the 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 3 Drive Components

This table shows the zoning requirements of cables connecting to the Kinetix 3 drive components.

**Table 4 - Kinetix 3 Drive Components**

| Wire/Cable | Connector | Zone | | | Method |
|---|---|---|---|---|---|
| | | Very Dirty | Dirty | Clean | Shielded Cable |
| L1, L2, L3, L1C, L2C (unshielded cable) | IPD | X | | | |
| U, V, W (motor power) | MP | | X | | X |
| Motor feedback | MF | | | X | X |
| Analog outputs | IOD | | | X | X |
| Others | | | X | | |
| Analog output | A.out | | | X | |
| Serial Communication | Comm0A Comm0B | | | X | X |

## Noise Reduction Guidelines for Drive Accessories

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

### *AC Line Filters*

Observe these guidelines when mounting your AC line filter:

- If you use Bulletin 2090 AC line filter, mount the filter on the same panel as the Kinetix 3 drive and as close to drive as possible.
- Good HF bonding to the panel is critical. For painted panels, refer to the examples on page 24.
- Segregate input and output wiring as far as possible.

### *Motor Brake*

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

Refer to Kinetix 3 Drive/Rotary Motor Wiring Examples beginning on page 124 for the interconnect diagram of your drive/motor combination.

## Mount Your Kinetix 3 Drive

The procedures in this section assume you have prepared your panel and understand how to bond your system. For installation instructions regarding other equipment and accessories, refer to the instructions that came with each of the accessories for their specific requirements.

**ATTENTION:** This drive contains electrostatic discharge (ESD) sensitive parts and assemblies. You are required to follow static control precautions when you install, test, service, or repair this assembly. If you do not follow ESD control procedures, components can be damaged. If you are not familiar with static control procedures, refer to 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 3 drive.

1. Layout the position for the Kinetix 3 and accessories in the enclosure (refer to Establishing Noise Zones on page 26 for panel layout recommendations).

   Mounting hole dimensions for the Kinetix 3 are shown in Kinetix Servo Drives Specifications Technical Data, publication GMC-TD003.

2. Attach the Kinetix 3 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 screw torqued to 1.1 N•m (9.8 lb•in). Observe bonding techniques as described in Bonding Drives on page 23.

**IMPORTANT** To improve the bond between the Kinetix 3 drive and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

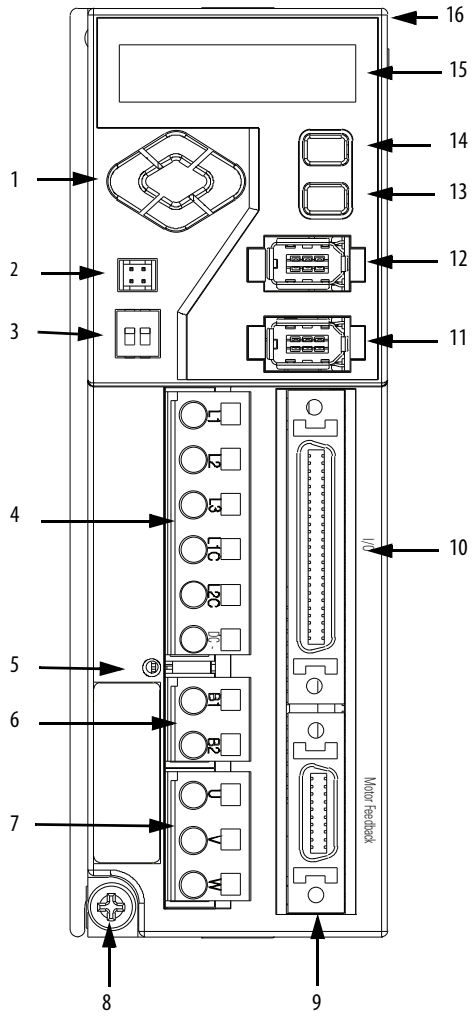
3. Tighten all mounting fasteners.

# Kinetix 3 Drive Connector Data

## Kinetix 3 Drive Connectors and Indicators

Although the physical size of the higher current drives is larger, the location of the connectors and indicators is identical.

**Figure 8 - Kinetix 3 Drive Connector and Indicators**




| Item | Description |
|---|---|
| 1 | Left/right and up/down keys |
| 2 | Analog output (A.out) connector |
| 3 | RS-485 communication termination switch |
| 4 | Input power (IPD) connector |
| 5 | Main power indicator |
| 6 | Shunt resistor (BC) connector |
| 7 | Motor power (MP) connector |
| 8 | Ground lug(1) |

| Item | Description |
|---|---|
| 9 | Motor feedback (MF) connector |
| 10 | Input/output (IOD) connector |
| 11 | Serial interface (Comm0B) (down) port |
| 12 | Serial interface (Comm0A) (up) port |
| 13 | Enter key |
| 14 | Mode/set key |
| 15 | 7-segment status indicator |
| 16 | 2071-AP0 Kinetix 3 drive shown |

(1) 2071-AP4 Kinetix 3 drives and larger have two ground screws.

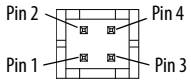
**Table 5 - Kinetix 3 Drive Connectors**

| Designator | Description | Connector |
|---|---|---|
| A.out | Analog output | 4-pin connector header |
| IPD | AC and control power input | 6-pin quick-connect terminal block |
| BC | Shunt power | 2-pin quick-connect terminal block |
| MP | Motor power | 3-pin quick-connect terminal block |
| Comm0A | Serial interface up | 6-pin IEEE 1394 connector |
| Comm0B | Serial interface down | 6-pin IEEE 1394 connector |
| IOD | I/O | 50-pin mini-D connector |
| MF | Motor feedback | 20-pin mini-D connector |

**Table 6 - Analog Output (A.out) Connector**

| A.out Pin | Description | Signal |
|---|---|---|
| 1 | Analog output #1 | AOUT1 |
| 2 | Analog output #1 ground | ACOM |
| 3 | Analog output #2 | AOUT2 |
| 4 | Analog output #2 ground | ACOM |

**Figure 9 - Pin Orientation for 4-pin Header (A.out) Connector**

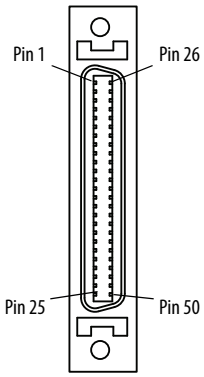


# I/O (IOD) Connector Pinout(1)

| IOD Pin | Description | Signal |
|---|---|---|
| 1 | Digital input common | 24V COM |
| 2 | Digital input common | 24V COM |
| 3 | Digital input 1 (/SV-ON) | INPUT1 |
| 4 | Digital input 2 (P-OT) | INPUT2 |
| 5 | Digital input 3 (N-OT) | INPUT3 |
| 6 | Digital input 4 (/P-CON) | INPUT4 |
| 7 | Digital input 5 (A-RST) | INPUT5 |
| 8 | Digital input 6 (/N-TL) | INPUT6 |
| 9 | Digital input 7 (/P-TL) | INPUT7 |
| 10 | ESTOP (default: disable) | ESTOP |
| 11 | Follower input A+ | PLUS + |
| 12 | Follower input A- | PLUS - |
| 13 | Follower input B+ | SIGN + |
| 14 | Follower input B- | SIGN - |
| 15 | High frequency pulse input A+ | HF_PULS + |
| 16 | High frequency pulse input A- | HF_PULS - |
| 17 | Encoder z-pulse | Z-PULSE+ |
| 18 | Encoder z-pulse | Z-PULSE- |
| 19 | Velocity command input+ | VCMD+ |
| 20 | Velocity command input- | VCMD- |
| 21 | Current command input+ | ICMD+ |
| 22 | Current command input- | ICMD- |
| 23 | High frequency pulse input B+ | HF_SIGN + |
| 24 | High frequency pulse input B- | HF_SIGN - |
| 25 | O/C for sign of 24V level | 24V_SIGN + |

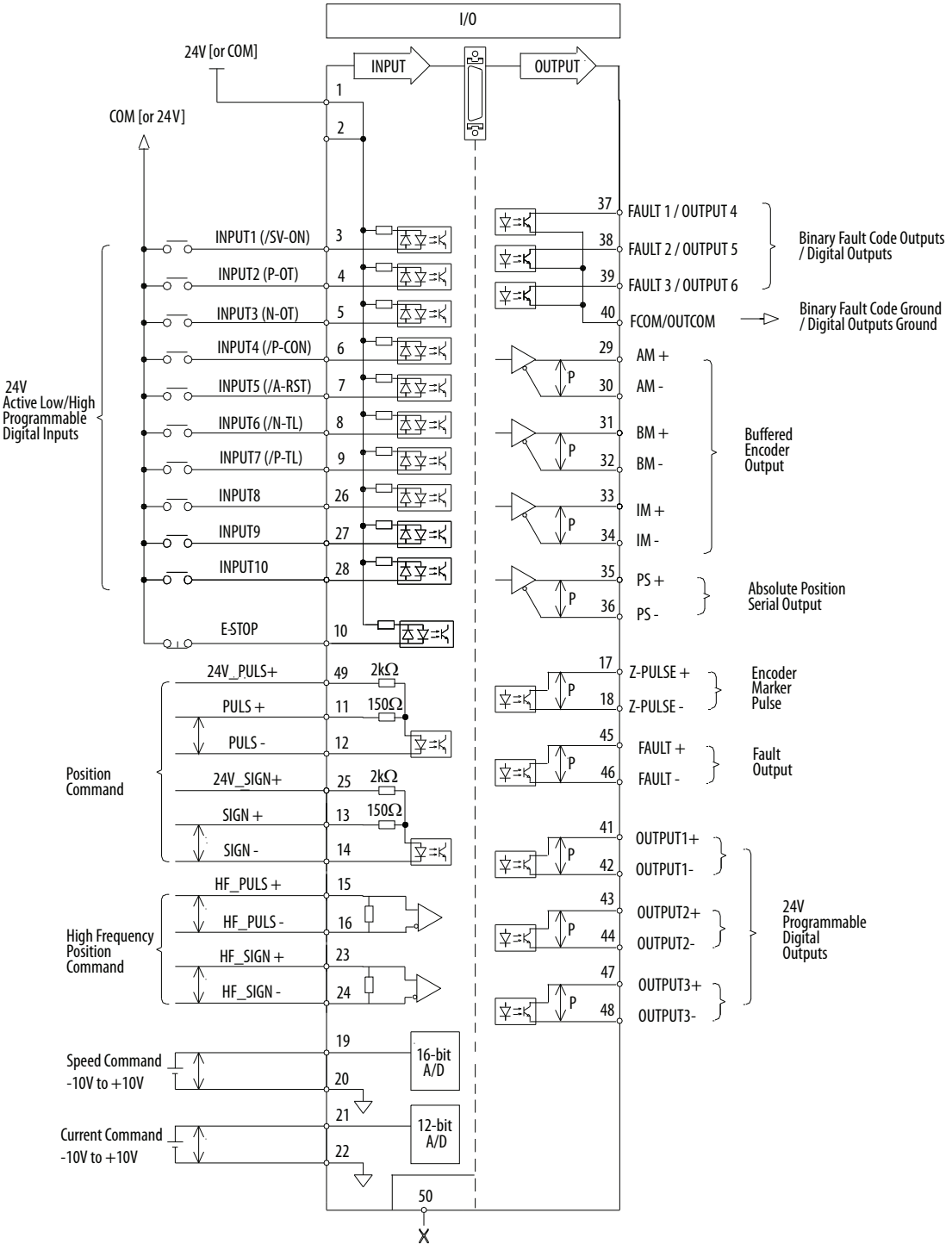
| IOD Pin | Description | Signal |
|---|---|---|
| 26 | Digital input 8 | INPUT8 |
| 27 | Digital input 9 | INPUT9 |
| 28 | Digital input 10 | INPUT10 |
| 29 | Buffered encoder channel A+ | AM+ |
| 30 | Buffered encoder channel A- | AM- |
| 31 | Buffered encoder channel B+ | BM+ |
| 32 | Buffered encoder channel B- | BM- |
| 33 | Buffered encoder channel Z+ | IM+ |
| 34 | Buffered encoder channel Z- | IM- |
| 35 | Serial data of absolute encoder | PS+ |
| 36 | Serial data of absolute encoder | PS- |
| 37 | Alarm output 1<br>Digital output4 | FAULT1<br>OUTPUT4 |
| 38 | Alarm output 2<br>Digital output5 | FAULT2<br>OUTPUT5 |
| 39 | Alarm output 3<br>Digital output6 | FAULT3<br>OUTPUT6 |
| 40 | Alarm output<br>Digital outputs ground | FCOM<br>OUT COM |
| 41 | Digital output 1 + (P_COM+) | OUTPUT1+ |
| 42 | Digital output 1 – (P_COM-) | OUTPUT1- |
| 43 | Digital output 2 + (TG_ON+) | OUTPUT2+ |
| 44 | Digital output 2 – (TG_ON-) | OUTPUT2- |
| 45 | Servo alarm + | FAULT+ |
| 46 | Servo alarm - | FAULT- |
| 47 | Digital output 3 + (BK+) | OUTPUT3+ |
| 48 | Digital output 3 – (BK-) | OUTPUT3- |
| 49 | O/C for pulse of 24V level | 24V_PULS + |
| 50 | Reserved | — |

**Figure 10 - Pin Orientation for 50-pin I/O (IOD) Connector**




(1) The default settings for configurable digital inputs and outputs are shown in parenthesis.

# I/O Interface Diagram



## Motor Feedback (MF) Connector Pinout

| MF Pin | Description | Signal |
|---|---|---|
| 1 | Encoder power ground | ECOM |
| 2 | Thermal sensor input(1) | TS |
| 3 | A positive differential input | A+ |
| 4 | A negative differential input | A- |
| 5 | B positive differential input | B+ |
| 6 | B negative differential input | B- |
| 7 | Index positive differential input | I+ |
| 8 | Index negative differential input | I- |
| 9 | Negative limit sensor input | LMT- |
| 10 | Serial positive<br>Hall feedback S1 | SD+<br>S1 |

| MF Pin | Description | Signal |
|---|---|---|
| 11 | Reserved | — |
| 12 | Reserved | — |
| 13 | Serial negative | SD- |
| 14 | Hall feedback S2 | S2 |
| 15 | Reserved | — |
| 16 | Hall feedback S3 | S3 |
| 17 | Positive limit sensor input | LMT+ |
| 18 | BAT+ for motor side | — |
| 19 | BAT- for motor side | — |
| 20 | Encoder +5 input power | EPWR |

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

**Figure 11 - Pin Orientation for 20-pin Motor Feedback (MF) Connector**

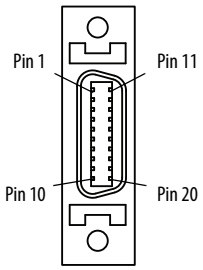
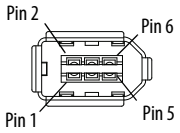



**Table 7 - Serial Interface (Comm0A and Comm0B) Connector**

| Comm0A or Comm0B Pin | Description | Signal |
|---|---|---|
| 1 | RS-232 transmit | XMT |
| 2 | RS-232 receive | RCV |
| 3 | +5V power | +5V DC |
| 4 | +5V power ground | GND |
| 5 | RS-485 + | DX+ |
| 6 | RS-485 - | DX- |

**Figure 12 - Pin Orientation for 6-pin Serial Interface (Comm0A and Comm0B) Connector**



## Input Power Connector Pinout

**Table 8 - Input Power (IPD) Connector**

| IPD Pin | Description | Signal |
|---|---|---|
| L1 | Main AC power | L1 |
| L2 | Main AC power | L2 |
| L3 | Main AC power | L3 |
| L1C | L1C - Control power | L1C |
| L2C | L2C - Control power | L2C |
| DC | DC bus negative (not supported) | DC- |

## Shunt Resistor Connector Pinout

**Table 9 - Shunt Resistor (BC) Connector**

| BC Pin | Description | Signal |
|---|---|---|
| B1 | Shunt resistor +<br>DC bus positive (not supported) | B1 |
| B2 | Shunt resistor - | B2 |

## Motor Power Connector Pinout

**Table 10 - Motor Power (MP) Connector**

| MP Pin | Description | Signal |
|---|---|---|
| U | Motor power U | U |
| V | Motor power V | V |
| W | Motor power W | W |

## Motor Feedback Specifications

The Kinetix 3 drive accepts motor feedback signals from these types of encoders with these general specifications.

**Table 11 - Motor Feedback General Specifications**

| Attribute | Motor Feedback |
|---|---|
| Feedback device support | • Generic TTL incremental<br>• Generic TTL incremental with Hall and thermistor sensors<br>• 17-bit Serial |
| Power supply voltage (EPWR5V) | 5.08…5.45V |
| Power supply current (EPWR5V) | 300 mA, max |
| Thermostat | Single-ended, under 1.6 kΩ = no fault, over 3.2 kΩ = fault |

## Replacement Battery Specifications

The 3.6V lithium battery, when installed in a Kinetix 3 drive, provides multi-turn encoder operation to TL-Series (Bulletin TL, TLY, and TLAR) motors and actuators.

Lithium batteries have special storage, shipping, and disposal requirements. Review and comply with all relevant local, state, and country regulations dealing with the handling and disposal of these materials.

**Table 12 - Replacement Battery Specifications**

| Attribute | Value |
|---|---|
| International size reference | 1/2AA, ER14252 |
| Nominal capacity @ 0.5 mA, to 2V | 1.2 Ah |
| Rated Voltage | 3.6V |
| Max Recommended continuous current | 50 mA |

## Motor Feedback Specifications

The Kinetix 3 drives support multiple types of feedback devices by using the 20-pin (MF) motor feedback connector and sharing connector pins in many cases.

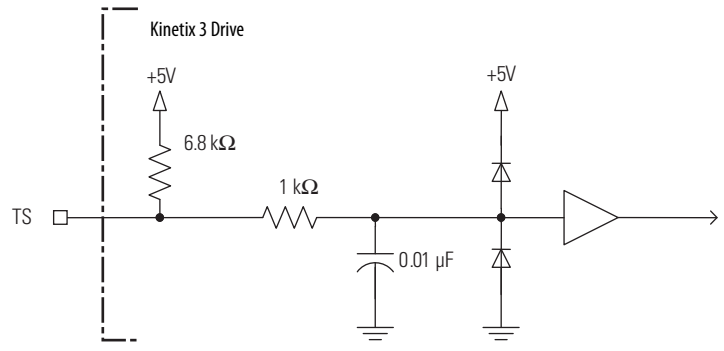
**Table 13 - Motor Feedback Signals by Device Type**

| MF Pin | Generic TTL Incremental with Hall | Tamagawa 17-bit Serial |
|---|---|---|
| 1 | ECOMM | ECOMM |
| 2 | TS+(1) | – |
| 3 | AM+ | – |
| 4 | AM- | – |
| 5 | BM+ | – |
| 6 | BM- | – |
| 7 | IM+ | – |
| 8 | IM- | – |
| 9 | -LIMIT | – |
| 10 | S1 | DATA+ |
| 11 | – | – |
| 12 | – | – |
| 13 | – | DATA- |
| 14 | S2 | – |
| 15 | – | – |
| 16 | S3 | – |
| 17 | +LIMIT | – |
| 18 | – | BAT+ |
| 19 | – | BAT- |
| 20 | EPWR | EPWR |

(1) If thermal sensor is used.

This is the motor thermostat interface schematic. Although the thermostat signal is shown for all feedback types, some motors do not support this feature.

**Figure 13 - Motor Thermostat Interface**



| State | Resistance at TS |
|---|---|
| No Fault | 1.6 kΩ |
| Fault | 3.2 kΩ |

**Table 14 - 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) | 0.5…2.5V |
| DC current draw (AM, BM, and IM) | 30 mA, max |
| Input signal frequency (1) (AM, BM, and IM) | 3.5 MHz, max |
| Edge separation (1) (AM and BM) | 50 ns min., between any two edges |
| Hall inputs (S1, S2, and S3) | 0.5…2.5V, Single-ended, TTL, open collector, or none |

(1) Propagation time differences in cables reduce the edge separation by 0.2 ns per meter. Both the propagation time differences and the edge separation can reduce the maximum attainable input signal frequency.

**Figure 14 - Generic TTL Incremental, AM, BM and IM Signals**

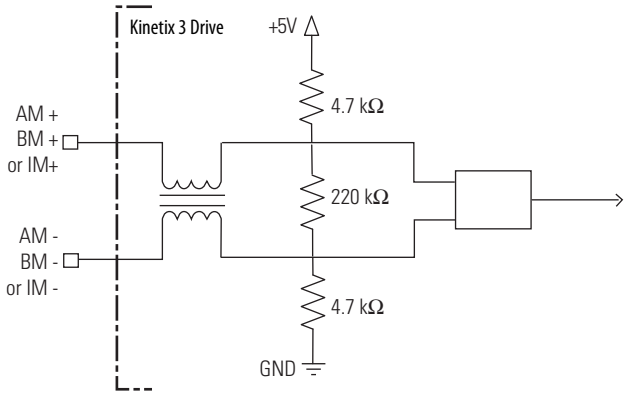



**Figure 15 - Generic TTL Interface, S1, S2, or S3 Signals**

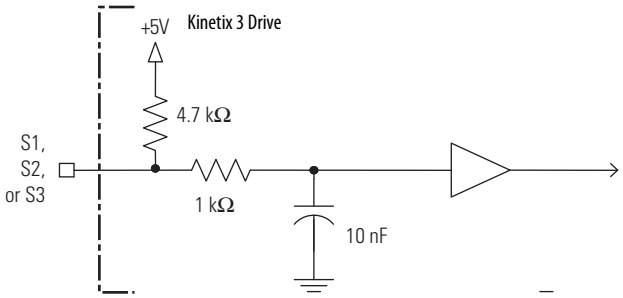


**Table 15 - 17-Bit Serial Specifications**

| Attribute | Value |
|---|---|
| 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, external to drive on the breakout board |

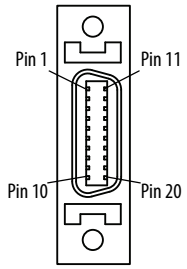
## Feedback Power Supply

The Kinetix 3 drive generates +5V DC for motor feedback power. Short circuit protection and separate common mode filtering for each channel are included.

**Table 16 - Motor Feedback Power Specifications**

| Attribute | | Value |
|---|---|---|
| Signal | | EPWR |
| Voltage | min | 5.08 |
| | nominal | 5.25 |
| | max | 5.45 |
| Current, mA | min | 10 |
| | max | 300 |

**Figure 16 - Pin Orientation for 20-pin Motor Feedback (MF) Connector**



# Control Signal Specifications

This section provides a description of the Kinetix 3 drive I/O (IOD) connector, analog output (A.out) connector, and serial interface (Comm0A and Comm0B) ports.

## Digital Inputs

The Kinetix 3 drive contains 10 assignable digital inputs, INPUT1...INPUT10, sharing a common power supply, 24V COM. These functions can be associated with an assignable digital input.

**Table 17 - Digital Inputs**

| Input | Input | States |
|---|---|---|
| Alternate Gain Select | </G-SEL> | When two sets of gains are used, turning this input ON switches to the second group of gains. Turning the bit OFF returns gain settings to the first group. |
| Current Limit – Negative | </N-TL> | When this input is set to ON, the negative torque is limited by parameter [Pr4.04 - Negative External Current Limit]. |
| Current Limit – Positive | </P-TL> | When this input is set to ON, the positive torque is limited by parameter [Pr4.03 - Positive External Current Limit]. |
| Drive Enable | </SV-ON> | When this input is turned ON, voltage is applied to the motor and when the input is turned OFF, voltage is cut off at the drive. |
| Fault Reset | </A-RST> | When this input is turned ON, faults that can be cleared are removed from the display of the drive. |
| Integrator Inhibit | </P-CON> | When this input is ON, the speed regulator is switched from Proportional/Integral control to Proportional control only. It can be used to suppress overshoot and complete a faster step response. |
| Operation Mode Override | </C-SEL> | When this input is ON, the secondary control mode is used for command. When this input is OFF, the primary control mode is used for command. |
| Overtravel – Negative | </N-OT> | When this input is OFF, it prohibits the motor from being commanded in the negative direction. |
| Overtravel – Positive | </P-OT> | When this input is OFF, it prohibits the motor from being commanded in the forward direction. |
| Pause Follower | </INHIB> | The follower pulse inputs are ignored when this input is ON. |
| Position Strobe | </ABS-DT> | When it is set to ON, the absolute position is transmitted through the AM and BM output signals. |
| Velocity Direction | </C-DIR> | The bitwise combination of the three preset inputs lets seven non-zero speeds to be selected, and zero speed is selected when all of the inputs are OFF. In addition the speeds, the Velocity Direction can be used to change the direction of rotation. The speeds are set with [Pr2.05 through Pr2.11 - Preset Velocity n]. |
| Preset Select 1 | </C-SP1> | |
| Preset Select 2 | </C-SP2> | |
| Preset Select 3 | </C-SP3> | |
| Moving Enable | </START> | When this input is OFF in the applicable modes, no motion is commanded. When this input is ON, motion can be commanded. |
| Reset Multiturn Data | </R_ABS> | When this input is ON, the encoder multi-turn data is reset to zero. Single-turn position is still valid. |
| Zero Speed Clamp Enable | </Z-CLP> | When the input is ON, the analog speed command is ignored (and set to zero instead) if the commanded speed is below [Pr5.05 - Zero Clamp]. |
| Position Clear | </PCLR> | When this input is ON, the position command, position feedback, and position error are cleared. |

**Table 17 - Digital Inputs (continued)**

| Input | Input | States |
|---|---|---|
| Analog Speed Command Enable | </A-CL> | When this input is ON, the drive uses the analog velocity input instead of the preset. |
| 2nd Electronic Gear Bank Selection | </GEAR> | When the input is ON, the drive uses the second gear ratio, defined by [Pr3.05 - 2nd Gear Ratio, Follower Counts] and by [Pr3.06 - 2nd Gear Ratio, Master Counts]. |
| Home Sensor | </H_SENS> | When this input is ON, it indicates that the homing sensor has been triggered. This is an essential part of the Home to Sensor feature. |
| Start Homing | </SHOME> | When activated, the system starts returning to home. |
| Start Indexing | </START_I> | Starts Indexing when it is set to ON. |
| Stop Homing | </H_STOP> | Stops Homing operation when it is set to ON. |
| Stop Indexing | </STOP> | When activated, index movement ends. |
| Pause Indexing | </PAUSE> | When activated, it decelerates until it stops and pauses the index sequence. It decides whether to stop or to continue the motion by constantly monitoring the input status. |
| Index Select 0 | </I_SEL0> | The bitwise combination of these inputs selects which of the indexes is used (0…63). |
| Index Select 1 | </I_SEL1> | |
| Index Select 2 | </I_SEL2> | |
| Index Select 3 | </I_SEL3> | |
| Index Select 4 | </I_SEL4> | |
| Index Select 5 | </I_SEL5> | |
| Gain Bank Select | </BANK_SEL> | Uses the 3rd and the 4th Gain Bank when this input is set to ON. |

All digital inputs can be active low or active high and depend on wiring method. Active low, PNP, current sourcing-means connecting the input to the ground turns on the input. Active high, NPN, current sinking - means that connecting the input to the IO power turns on the input. This table lists specifications for the digital inputs.

The digital inputs are optically isolated and can be setup for PNP sourcing or NPN sinking. Electrical details are shown in Table 18, Digital Input Specifications. The inputs can be set up for PNP sourcing or NPN sinking.

**Figure 17 - Digital Inputs (PNP sourcing configuration)**

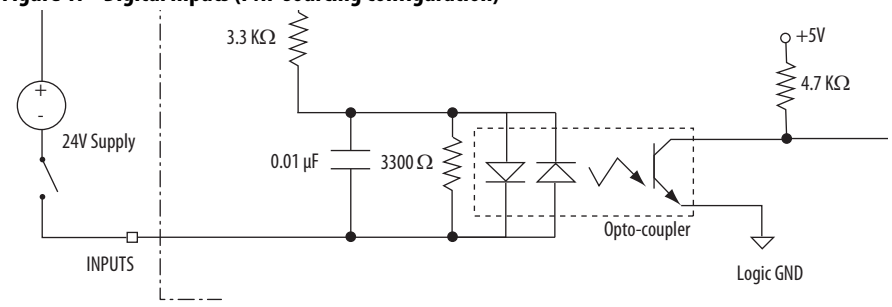


**Figure 18 - Digital Inputs (NPN sinking configuration)**

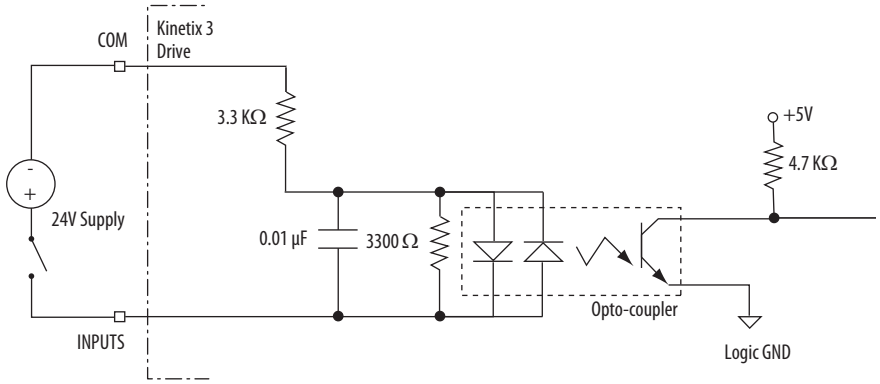



**Table 18 - Digital Input Specifications**

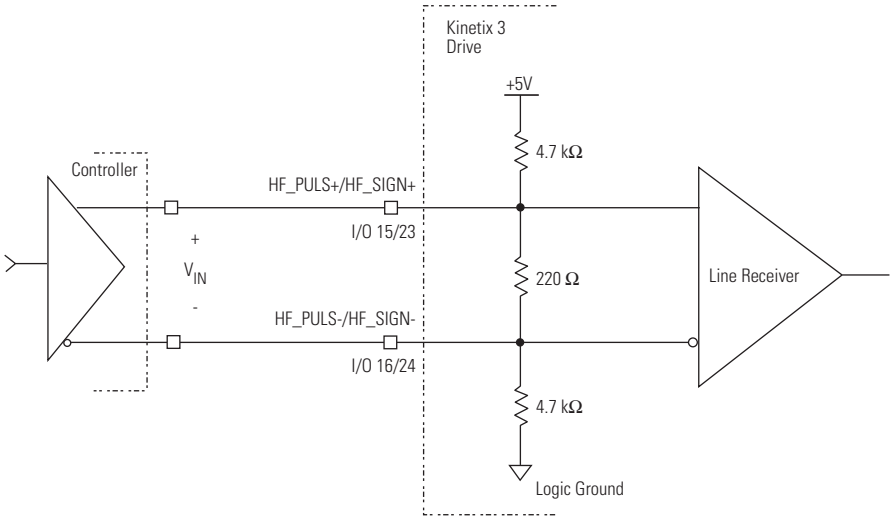
| Parameter | Value |
|---|---|
| 24V power supply | 21.6…26.4V DC |
| On-state voltage range | 14…26.4V DC |
| On-state current at min voltage | 6.3 mA |
| On-state current at max voltage | 7.71 mA |
| Off-state voltage, max | -1V |
| Off-state current, max | 0 mA |
| Hardware delay, off to on | 8.4 µs |
| Hardware delay, on to off | 50.1 µs |

## High Frequency Pulse Command

**Table 19 - High Frequency Pulse Command Specifications**

| Parameter | Description | Min | Max |
|---|---|---|---|
| On-state input voltage | Input voltage difference between the + input and the - input that is detected as an On-state. | 2.8V | 3.7V |
| Off-state input voltage | Input voltage difference between the + input and the - input that is detected as an Off-state. | 1V | -3V |
| Signal frequency (high frequency differential driver input drive) | Input frequency of the HF_PULS or HF_SIGN inputs. Count frequency is four times this frequency for A/B type inputs, and equal to this frequency for Step/Direction and Step Up/Down inputs. | — | 3 MHz |

**Figure 19 - High Frequency Pulse Command Differential Circuit**



## Digital Outputs

There are three digital outputs, OUTPUT1...OUTPUT3 available on the IOD connector. Outputs are optically isolated open collector/emitter and are fully isolated from the drive circuits. Each output, OUTPUT1...OUTPUT3, can be assigned to one of these functions.

| Output | Function | States |
|---|---|---|
| Fault | </S_ALM> | This output is not configurable. It is ON when the drive is healthy, and OFF when the drive has a fault condition. |
| Within Position Window | </P-COM (+, -)> | This output turns ON when the position error is less than [Pr5.00 - In Position Size]. |
| Up to Speed | </TG-ON (+, -)> | This output turns ON when the motor velocity feedback is greater than [Pr5.04 - Up to Speed]. |
| Brake | <BK (+, -)> | This output controls the brake installed inside or outside of the servo motor. |
| Within Speed Window | </V-COM (+, -)> | This output turns ON when the velocity error is less than [Pr5.03 - Speed Window]. |
| Current Limited | </T-LMT (+, -)> | This output turns to ON when torque reaches the set value of the torque limit. |
| Velocity Limited | </V-LMT (+, -)> | This output turns to ON when speed reaches the set value of the speed limit. |
| Within Near Position | </NEAR (+, -)> | This output turns ON when the position error is less than [Pr5.02 - Near Position Size]. |
| Warning | </WARN (+, -)> | This output turns ON when the drive encounters a condition that generates a warning. |
| Absolute Position Valid | </A_VLD> | This output turns ON when the drive has a motor with an absolute encoder attached, and the drive has properly read the position from the motor. |
| Ready | </RDY> | This output turns ON when the drive is not faulted, and can be enabled. |
| In Motion | </IMO (+, -)> | This output turns ON while the axis is being actively controlled by an index and the motor is moving. |
| In Dwell | </I_DW> | This output turns ON when the axis is actively controlled by an index, but is not moving. This occurs during the stand-by time for each index (if configured). |
| Axis Homed | </HOMC (+,-)> | This output turns ON after completion of the homing routine. |
| Index Select 0 Output | </0_ISEL0> | Use this to output the index number in use in the selected indexing operation. |
| Index Select 1 Output | </1_ISEL0> | |
| Index Select 2 Output | </2_ISEL0> | |
| Index Select 3 Output | </3_ISEL0> | |
| Index Select 4 Output | </4_ISEL0> | |
| Index Select 5 Output | </5_ISEL0> | |
| End of Sequence | </E_SEQU> | Turns to ON when the index movement is complete. |

The fault outputs, FAULT1...FAULT3, can be reassigned through the parameter setting giving you three additional digital outputs, OUTPUT4...OUTPUT6.

The drive contains four alarm outputs. The four alarm outputs include the alarm signals FAULT+ and FAULT- and three bits of fault information, FAULT1...FAULT3.

When the alarm signal is active there is a fault. If the three alarm outputs are decoded they indicate the eight different fault types that are active.

**Table 20 - Fault Codes**

| Fault Group | Fault Code Output State | | | Possible Faults |
|---|---|---|---|---|
| | FAULT3 | FAULT2 | FAULT1 | |
| 0 | ON | ON | ON | No Faults |
| 1 | ON | ON | OFF | E.005 IPM Fault<br>E.054 Current Feedback Offset Fault<br>E.057 PWM Hardware Fault<br>E.079 Shunt Circuit Over Current Fault<br>E.114 Motor Phase Over Current |
| 2 | ON | OFF | ON | E.004 Motor Over temperature Fault<br>E.022 Motor Continuous Current Overload Fault<br>E.023 Drive Overload Fault<br>E.036 Drive Over temperature Fault<br>E.075 Shunt Over load Protection Fault<br>E.101 Motor Power Cable Open Fault<br>E.102 Motor Instantaneous Current Overload Fault<br>E.103 Motor Mismatch Fault |
| 3 | ON | OFF | OFF | E.028 Encoder Data Range Fault<br>E.030 Encoder Cable Open Fault<br>E.031 Encoder Data Parameter Fault<br>E.083 Absolute Encoder Battery Fault<br>E.084 Absolute Encoder Overspeed<br>E.085 Absolute Multi-turn CountFault<br>E.105 Encoder Type Mismatch Fault<br>E.106 Encoder Communication Fault |
| 4 | OFF | ON | ON | E.009 Bus Undervoltage Fault<br>E.010 Bus Overvoltage Fault<br>E.037 AC Line Loss Fault |
| 5 | OFF | ON | OFF | E.018 Motor Overspeed Fault<br>E.019 Excess Position Error Fault<br>E.056 Watchdog Timeout Fault<br>E.108 Position Command Frequency Fault<br>E.112 Emergency Stop |
| 6 | OFF | OFF | ON | E.053 User Parameter Initialization Fault<br>E.055 User Parameter Checksum Fault<br>E.058 User Parameter Range Fault<br>E.107 Serial Communication Fault<br>E.113 Indexing Position Range Overflow |
| 7 | OFF | OFF | OFF | E.012 Home Search Failed<br>E.027 Axis Not Homed<br>E.060 Drive Initialization Fault<br>E.100 Drive Setup Fault |

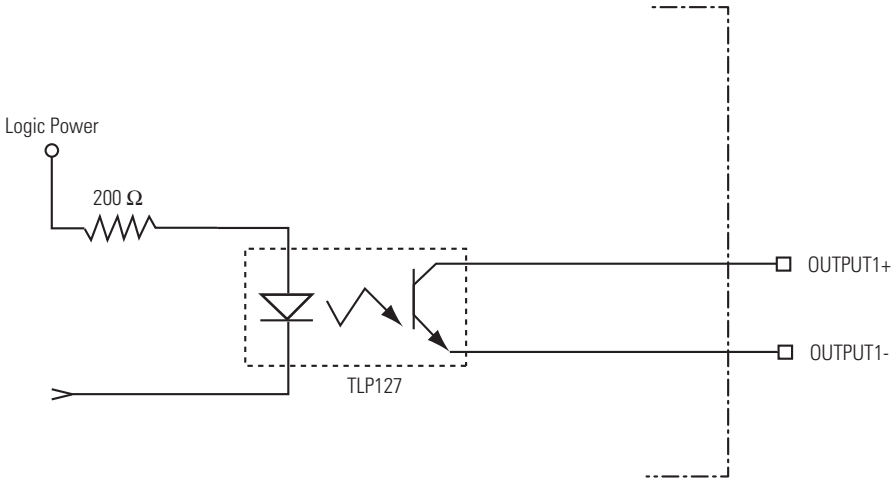
Digital and fault outputs are grounded through FCOM/OUT COM.

All digital outputs are active low, current sinking.

**Table 21 - Digital Output Signal Specifications**

| Parameter | Value |
|---|---|
| Output voltage range | 0…50V DC |
| Output current rating @ 50 °C (122 °F) | 50 mA |
| Minimum load current | 0.1 mA |
| Maximum on-state voltage drop @ 50 mA | 1.2 mV DC |
| Hardware delay, off to on, max | 2.36 ms |
| Hardware delay, on to off, max | 310 ms |

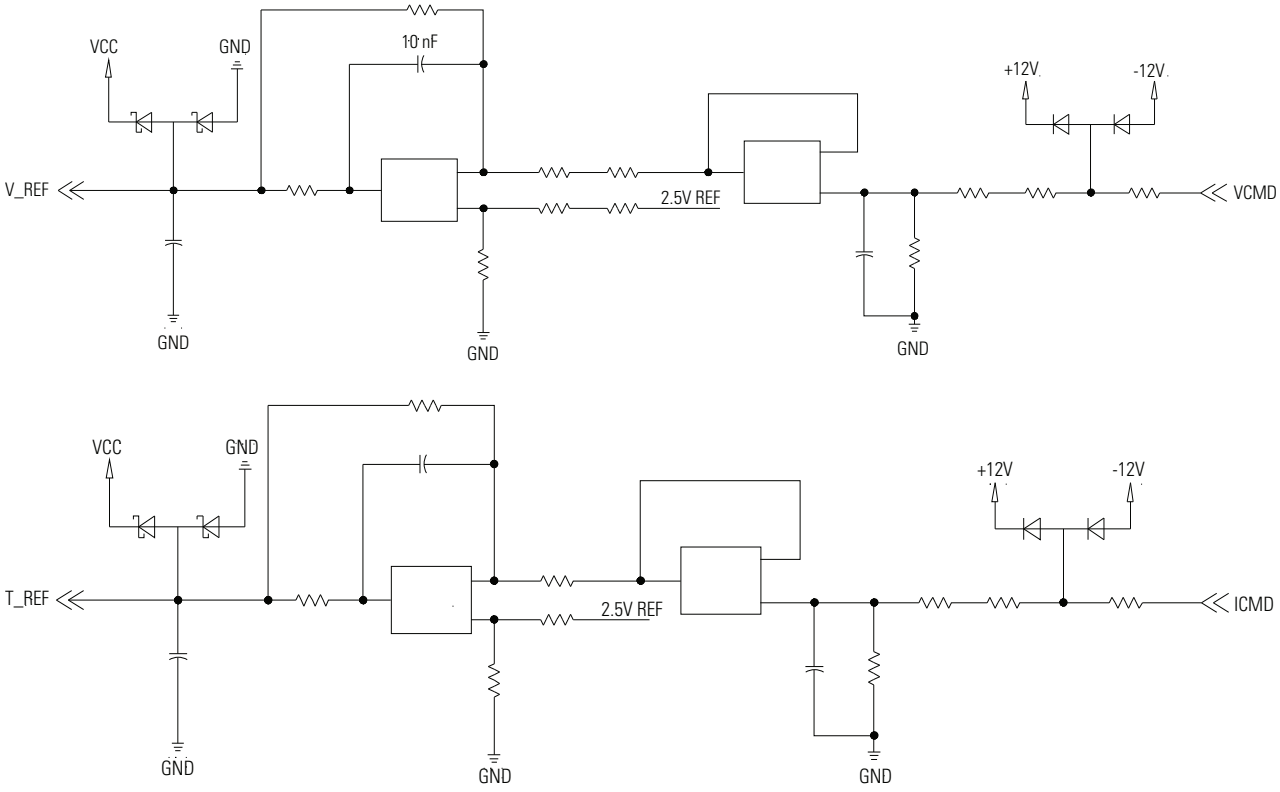
**Figure 20 - Digital Outputs**



## Analog Inputs

The Kinetix 3 drive has two single-ended analog inputs. One is dedicated as the command input for Analog Velocity mode, and the second is dedicated as the command input for Analog Current mode. Figure 21 shows the configuration of the analog input.

**Figure 21 - Analog Input Configuration**




This table provides a description of the analog input specifications.

| Parameter | Description | Min | Max |
|---|---|---|---|
| VCMD Resolution | Number of states that the input signal is divided into, [2(to the number of bits)]. | 16 bits | — |
| ICMD Resolution | | 12 bits | — |
| Input Impedance | Open circuit impedance measured between the positive (+) input and analog common. | 10 kΩ | — |
| Input Signal Range | Voltage applied to the input. | -10V | +10V |

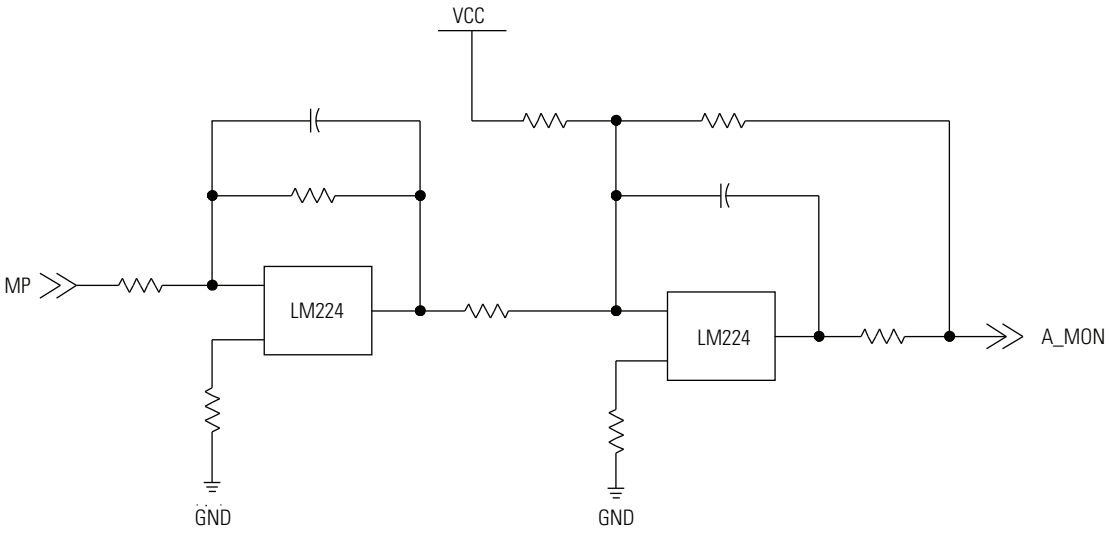
## Analog Outputs

The Kinetix 3 drive contains two analog outputs (A.out) that can be configured through Ultraware software to represent internal drive variables. These variables can be assigned to an analog output:

- Motor Feedback Position
- Master Position
- Follower Position
- Position Error
- Position Command Count Frequency
- Velocity Command
- Velocity Feedback
- Velocity Error
- Current Command
- Current Feedback
- U Phase Current
- V Phase Current
- W Phase Current
- Commutation Angle
- Mechanical Angle
- Shunt Power Limit Ratio
- Instantaneous Shunt Power
- Drive Utilization
- Absolute Rotations
- Bus Voltage
- Velocity Command Offset
- Current Command Offset
- Motor Temperature
- Analog Command – Velocity
- Analog Command – Current

Figure 22 shows the configuration of the analog outputs.

**Figure 22 - Analog Output Configuration**




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

This table provides a description of the analog output specifications.

| Parameter | Description | Min | Max |
|---|---|---|---|
| Resolution | Number of states that the output signal is divided into, $2^{(\text{to the number of bits})}$. | 12 Bits | — |
| Output Current | Current capability of the output. | -10 mA | +10 mA |
| Output Signal Range | Range of the output voltage. | -10V | +10V |

## Serial Interface Connection

The IEEE-1394 connectors (Comm0A and Comm0B) are provided on the Kinetix 3 drive.

This table provides the drive's default serial port configuration. This configuration is used for communication between a drive and personal computer with Connected Component Workbench software.

**Table 22 - USB Communication Specification**

| Attribute | Value |
|---|---|
| Communication Protocol | RS-485 |
| Baud | 192,000 |
| Data bits | 8 |
| Parity | None |
| Stop bit | 1 |
| Operator interface bit pattern | 1102 |
| Cabling | Catalog numbers 2090-CCMUSDS with 1203-USB |
| Node address | 248 |

This table provides the drive's default serial port configuration. This configuration is used for communication between a drive and personal computer with Ultraware software.

**Table 23 - RS-232 Serial Communication Specifications**

| Attribute | Value |
|---|---|
| Communication Protocol | RS-232 |
| Baud | 57,600 |
| Data bits | 8 |
| Parity | None |
| Stop bit | 1 |
| Operator interface bit pattern | 0005 |
| Cabling | Catalog number 2090-CCMPCDS |

This table provides the configuration is used for communication between a drive and programmable logic controller and drive-to-drive communication. You can change the serial communication protocol by using front panel input keys.

**Table 24 - RS-485 Serial Communication Specifications**

| Attribute | Value |
|---|---|
| Communication Protocol | RS-485 |
| Baud | 192,000 |
| Data bits | 8 |
| Parity | None |
| Stop bit | 1 |
| Operator interface bit pattern | 1102 |
| Cabling | Catalog numbers 2090-CCMCNDS and 2090-CCMDSDS |

## Notes:

# Connect the Kinetix 3 Drive



## Understanding Basic Wiring Requirements

This section contains basic wiring information for the Kinetix 3 drive.

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

**SHOCK HAZARD:** To avoid hazard of electrical shock, perform all mounting and wiring of the Bulletin 2071 drive prior to applying power. Once power is applied, connector terminals can have voltage present even when not in use.

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

## Building Your Own Cables

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

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

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

## Routing 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. This can cause system faults and communication anomalies.

Refer to Electrical Noise Reduction on page 23 for examples of routing high and low voltage cables in wireways. Refer to the System Design for Control of Electrical Noise Reference Manual, publication GMC-RM001, for more information.

## Determining Your Type of Input Power

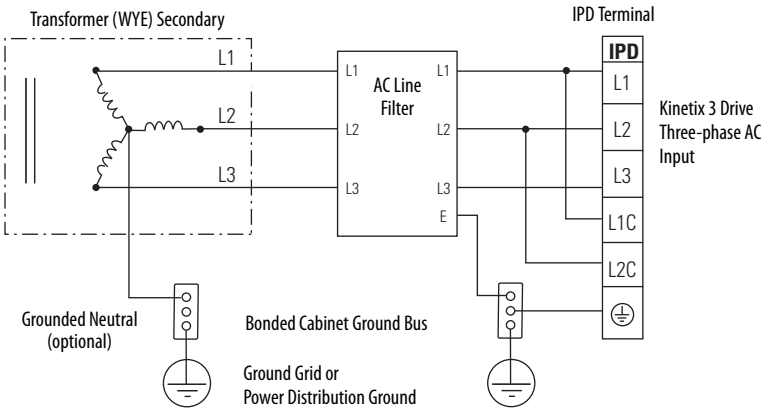
On the following pages are examples of typical single-phase and three-phase facility input power wired to single-phase and three-phase Kinetix 3 drives.

The Kinetix 3 drive is designed to operate in both grounded and ungrounded environments. The grounded power configuration lets you ground your single-phase or three-phase power at a neutral point. The ungrounded power configuration does not have a neutral ground point.

## Three-phase Power Wired to Three-phase Drives

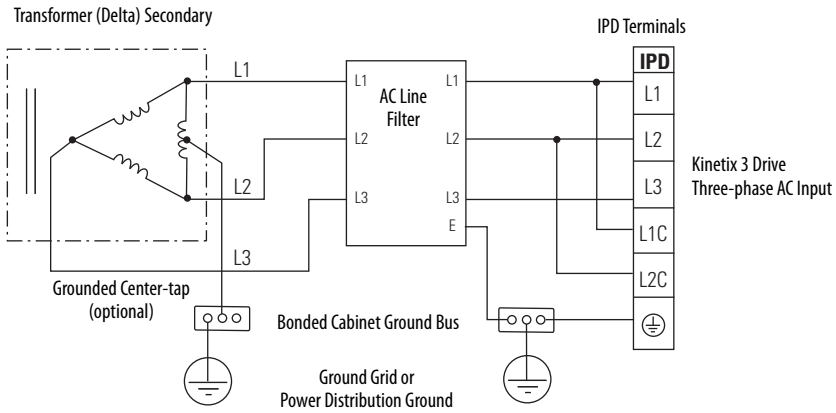
These examples illustrate grounded three-phase power wired to three-phase Kinetix 3 drives when phase-to-phase voltage is within drive specifications. The ungrounded power configuration does not include the ground connection labeled as 'optional' in these figures.

**Figure 23 - Three-phase Power Configuration (WYE Secondary)**



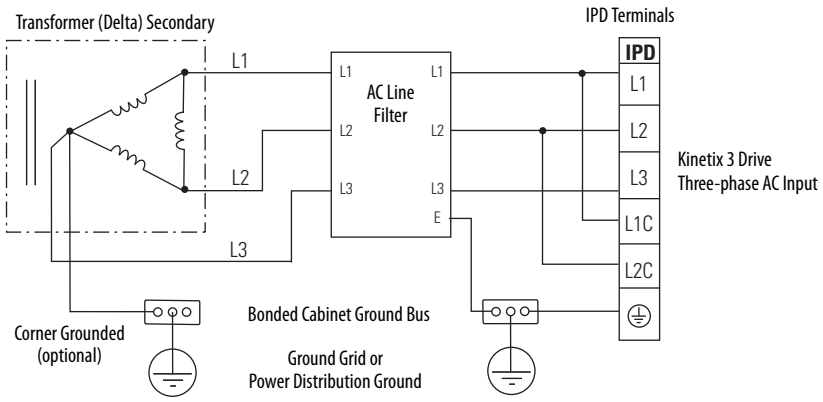

Feeder and branch short circuit protection is not illustrated.

**Figure 24 - Three-phase Power Configuration (Delta secondary)**




Feeder and branch short circuit protection is not illustrated.

**Figure 25 - Three-phase Power Configuration (Delta secondary)**

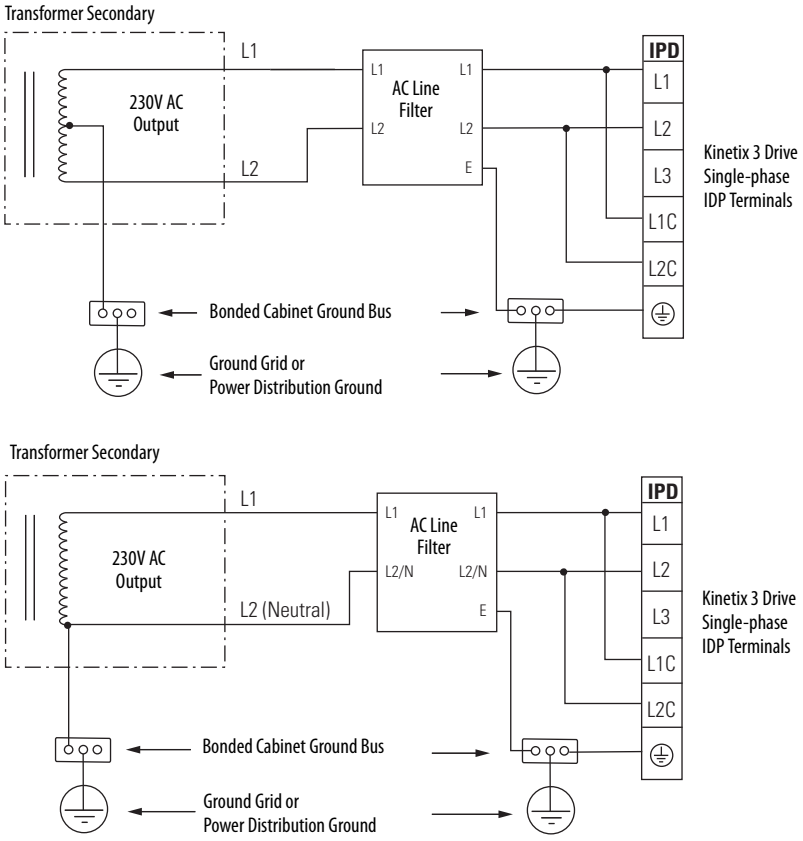



Feeder and branch short circuit protection is not illustrated.

## Single-phase Power Wired to Single-phase Drives

These examples illustrate grounded single-phase power wired to single-phase Kinetix 3 drives when phase-to-phase voltage is within drive specifications. The ungrounded power configuration does not include the ground connection labeled as 'optional' in these figures.

**Figure 26 - Single-phase Grounded Power Configurations**




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

## Isolation Transformer in Grounded Power Configurations

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

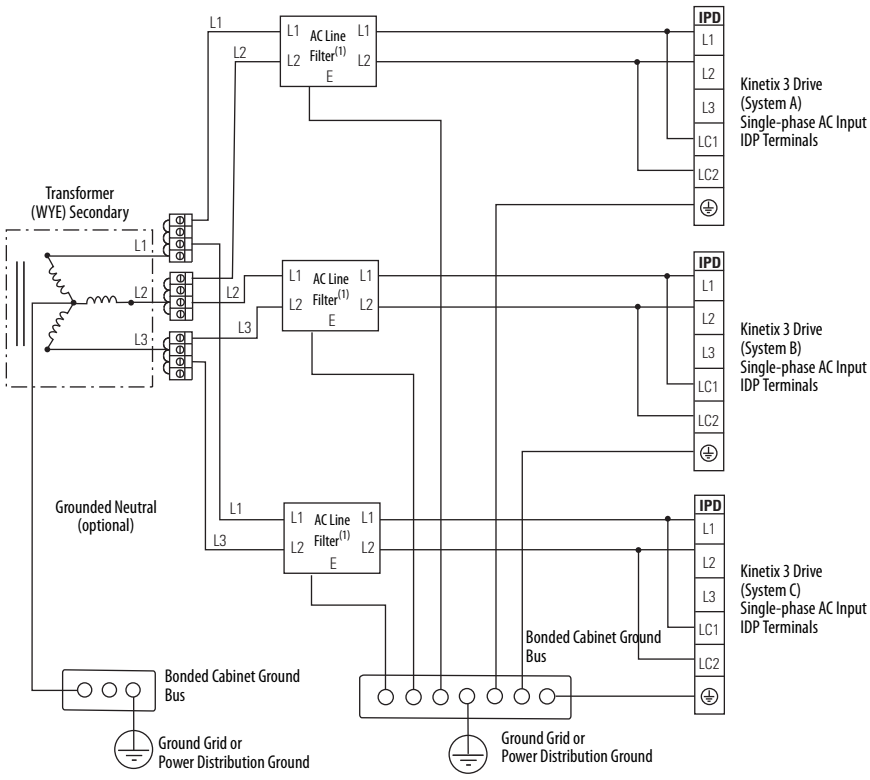
- Prevents the system from floating and thereby avoids any high voltages that can otherwise occur, for example due to static electricity.
- Provides a solid earth path for fault conditions.

**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 adding another creates a short circuit.

## Three-phase Power Wired to Single-phase Drives

This example illustrates grounded three-phase power wired to single-phase Kinetix 3 drives when phase-to-phase voltage is within drive specifications. The optional grounded neutral is omitted on ungrounded systems.

**Figure 27 - Single-phase Amplifiers on Three-phase Power (WYE)**




(1) AC line filter is optional, but is required for CE compliance.

Feeder short circuit protection is not illustrated.

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

# Grounding Your Kinetix 3 Drive

All equipment and components of a machine or process system must have a common earth ground point connected to their chassis. A grounded system provides a safety ground path for short circuit protection.

**IMPORTANT** Grounding your drives and panels minimizes 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 grounding requirements, refer to Agency Compliance in Chapter 1.

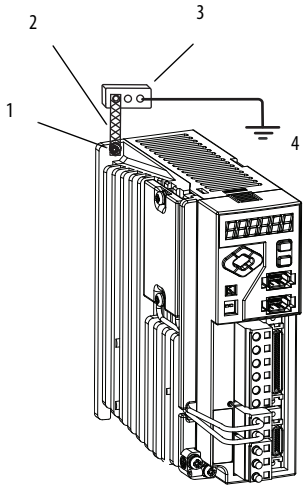
**IMPORTANT** To improve the bond between the Kinetix 3 drive and subpanel, construct your subpanel out of zinc plated (paint-free) steel.

## Grounding Your System to the Subpanel

**ATTENTION:** The National Electrical Code contains grounding requirements, conventions, and definitions. Follow all applicable local codes and regulations to safely ground your system. Refer to the illustration below for details on grounding your Kinetix 3 drive. Refer to Appendix A for the power wiring diagram for your Kinetix 3 drive.

If the Kinetix 3 drive is mounted on a painted subpanel, ground 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.

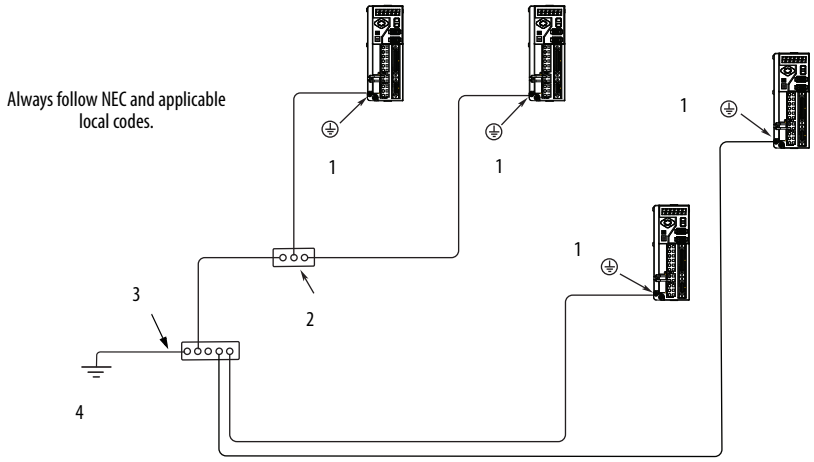
**Figure 28 - Connecting the Braided Ground Strap Example**




See Kinetix Servo Drives Specifications Technical Data, publication GMC -TD003, for Kinetix 3 drive dimensions

| Item | Description |
|---|---|
| 1 | Mounting screw |
| 2 | Braided ground strap |
| 3 | Bonded cabinet ground bus |
| 4 | Ground grid or power distribution ground |

**Figure 29 - Chassis Ground Configuration (multiple Kinetix 3 drives on one panel)**

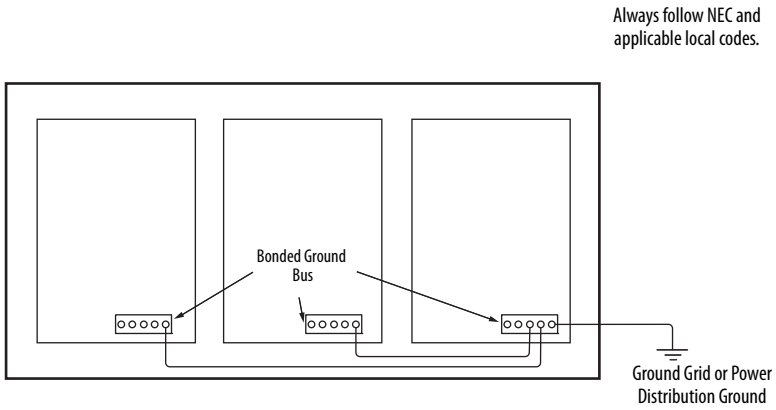



| Item | Description |
|---|---|
| 1 | Chassis ground |
| 2 | Bonded ground bar (optional) |
| 3 | Bonded cabinet ground bus |
| 4 | Ground grid or power distribution ground |

## Grounding Multiple Subpanels

To ground multiple subpanels, refer to the figure below. HF bonding is not illustrated. For information, refer to Bonding Multiple Subpanels on page 25.

**Figure 30 - Subpanels Connected to a Single Ground Point**



## Power Wiring Requirements

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

Refer to Power Wiring Examples on page 123 for interconnect diagrams.

| Cat. No. | Description | Terminals | | Recommended Wire Size mm² (AWG) | Strip Length mm (in.) | Torque Value N•m (lb•in) |
|---|---|---|---|---|---|---|
| | | Pin | Signal | | | |
| 2071-AP0<br>2071-AP1<br>2071-AP2<br>2071-AP4 | AC Input and control power | IPD-L1<br>IPD-L2<br>IPD-L1C<br>IPD-L2C | L1<br>L2<br>L1C<br>L2C | 2.5 (14) | 8 (0.3) | N/A |
| | | Ground screw | Ground | | | 1.25 (11) |
| 2071-AP8 | | IPD-L1<br>IPD-L2<br>(IPD-L3)<br>IPD-L1C<br>IPD-L2C | L1<br>L2<br>(L3)<br>L1C<br>L2C | | | N/A |
| | | Ground screw | Ground | | | 1.25 (11) |
| 2071-A10<br>2071-A15 | | IPD-L1<br>IPD-L2<br>IPD-L3<br>IPD-L1C<br>IPD-L2C | L1<br>L2<br>L3<br>L1C<br>L2C | | | N/A |
| | | Ground screw | Ground | | | 1.25 (11) |
| 2071-*xxx* | Motor power | MP-U<br>MP-V<br>MP-W | U<br>V<br>W | | | N/A |
| | | Ground screw | GND | | | 1.25 (11) |
| 2071-*xxx* | Shunt resistor (1) | BC-B1<br>BC-B2 | B1<br>B2 | | | N/A |

(1) Use for only shunt resistor connection.

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

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

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

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

### Shunt Resistor Power Wiring Requirement

The B1 and B2 terminals are used to connect a shunt resistor. On the four largest drives, the built-in shunt resistor is connected to B1 and B2. Because 2071-AP0, 2071-AP1, and 2071-AP2 models do not support shunt resistors, do not make terminations to the B1 and B2 terminals.

## Wiring Guidelines

Use these guidelines as a reference when wiring the connectors on your Kinetix 3 drive.

| | |
|---|---|
| **IMPORTANT** | For connector locations of the Kinetix 3 drives, refer to Kinetix 3 Drive Connectors and Indicators on page 30.<br>When removing insulation from wires, refer to the table on 61 for strip lengths. |

| | |
|---|---|
| **IMPORTANT** | To improve system performance, run wires and cables in the wireways as established in Establishing Noise Zones on page 26. |

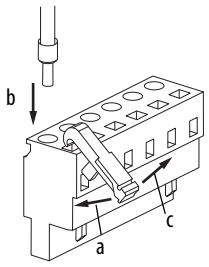
Follow these steps when wiring the connectors on your Kinetix 3 drive.

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

   We recommended using ferrules to reduce risk of electrical shorts between stranded wires.

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

2. Route the cable or wires to your Kinetix 3 drive.
3. Follow these steps to attach wires to connectors.
   a. Open terminal locking clamp with connector tool.
   b. Insert wire.
   c. Release tool.

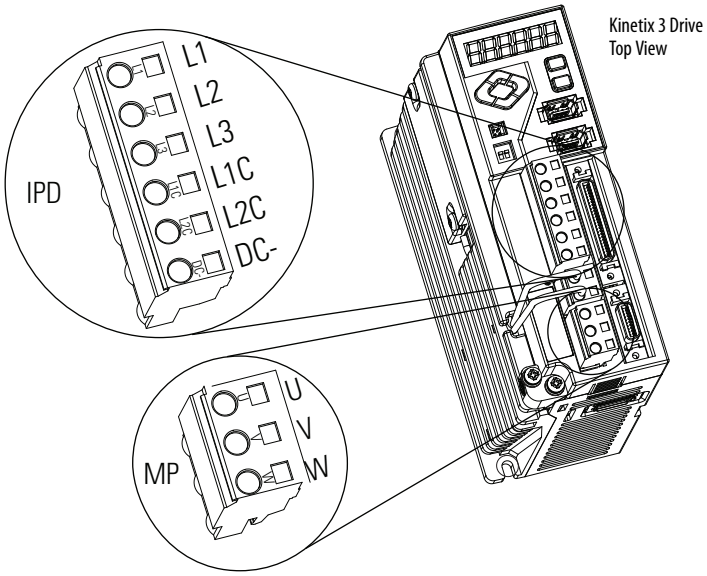
   Refer to connector pinout tables in Chapter 3 or the interconnect diagrams in Appendix A.
4. Gently pull on each wire to make sure it does not come out of its terminal; reinsert and tighten any loose wires.
5. Insert the connector plug into the drive connector.

# Wiring the Kinetix 3 Drive Connectors

This section provides examples and wiring tables to assist you in making connections to the Kinetix 3 drive.

## Wire the Input Power (IPD) and Motor Power (MP) Connectors

**Figure 31 - Kinetix 3 Drive (IPD) and (MP) connector**




The IPD is used for input power to the drive and the control circuits. The MP connector is used to connect output power to the motor. Use 2.5 $mm^2$ (14 AWG) wire for all connections. Connect ground to ground screw and torque to 1.25 N•m (11 lb•in) Follow procedure in Wiring Guidelines on page 62.

### *Cable Shield Terminations*

Factory-supplied motor power cables for MP-Series (Bulletin MPAS), TL-Series (Bulletin TLY and TLAR), LDC-Series, and LDL-Series motors and actuators are shielded. The braided cable shield must terminate 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, ensure shielded power cables are grounded at a minimum of one point for safety.

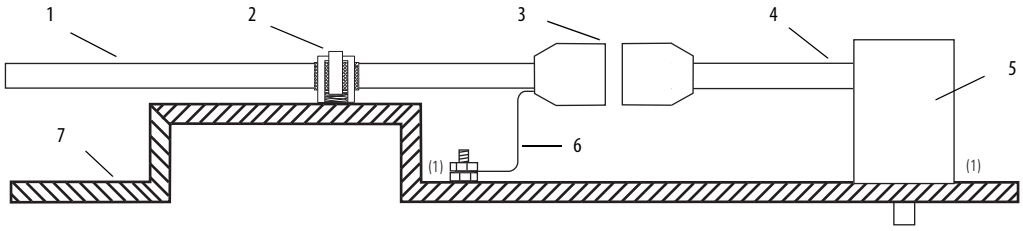
**IMPORTANT** For TL-Series motors, also connect the 152 mm (6.0 in.) termination wire to the closest earth ground.

Refer to Pigtail Terminations on page 64 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 in addition to 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 32 - Pigtail Terminations**




| Item | Description |
|---|---|
| 1 | Motor power cable |
| 2 | Cable braid clamped to machine frame(1) |
| 3 | Connectors |
| 4 | Pigtail cable |
| 5 | TL-Series motor |
| 6 | 150 mm (6.0 in.) termination |
| 7 | Machine frame |

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

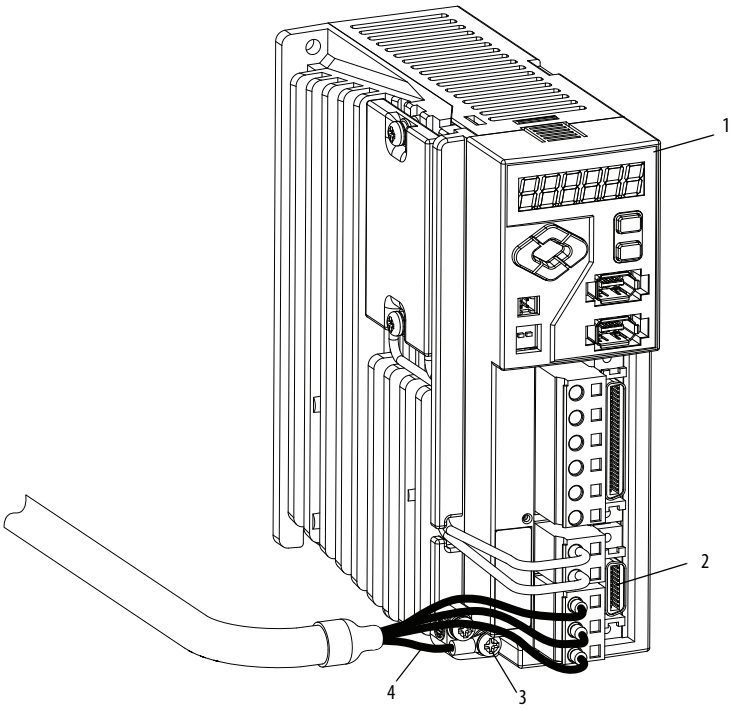
**Table 25 - Motor and Actuator Power Cable Compatibility**

| Motor/Actuator | Connector | Motor/Actuator Cat. No. | Motor Power Cables (with brake wires) | Motor Power Cables (without brake wires) |
|---|---|---|---|---|
| LDC-Series (Bulletin LDC) | Circular DIN | LDC-C*xxxxxx-xxx*T*x*1 | Not applicable | 2090-CPWM7DF-*xx*AF*xx* (continuous-flex) |
| LDL-Series (Bulletin LDL) | | LDL-*xxxxxxx-xxx*T*x*1 | | |
| MP-Series (Bulletin MPAS) | | MPAS-A*xxxx* | 2090-XXNPMF-*xx*S*xx* (standard) or 2090-CPBM4DF-*xx*AF*xx* (continuous-flex) | 2090-CPWM4DF-*xx*AF*xx* (continuous-flex) |
| TL-Series (Bulletin TL) | Rectangular plastic | TL-A*xxxx*-B | 2090-DANPT-16S*xx* for power 2090-DANBT-18S*xx* for brake | 2090-DANPT-16S*xx* |
| 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 TL-Series (Bulletin TL) motors that have no brakes. Thermal switch wires are included in the feedback cable.

Refer to Kinetix 3 Drive/Rotary Motor Wiring Examples beginning on page 124 for interconnect diagrams.

**Figure 33 - Motor Power Terminations (Bulletin TL three-phase wires only)**

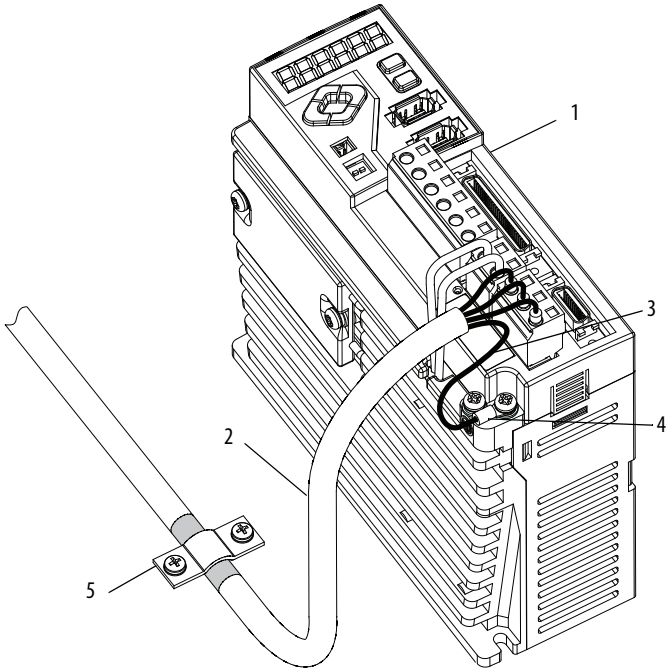



| Item | Description |
|---|---|
| 1 | 2071-AP4 Kinetix 3 drive shown |
| 2 | Motor power (MP) connector plug |
| 3 | Drive ground screw |
| 4 | Motor cable ground wire |

Cable shield is tied to the ground wire in the cable. No further grounding is required with motor power cable, catalog number 2090-DANPT-16Sxx.

This diagram shows an example of three-phase power wires for MP-Series (Bulletin MPAS), TL-Series (Bulletin TLY and TLAR), LDC-Series, and LDL-Series motors and actuators that have no brakes. Thermal switch wires are included in the feedback cable.

**Figure 34 - Motor Power Terminations (Bulletin TLY, TLAR, MPAS, LDC-Series, and LDL-Series three-phase wires only)**



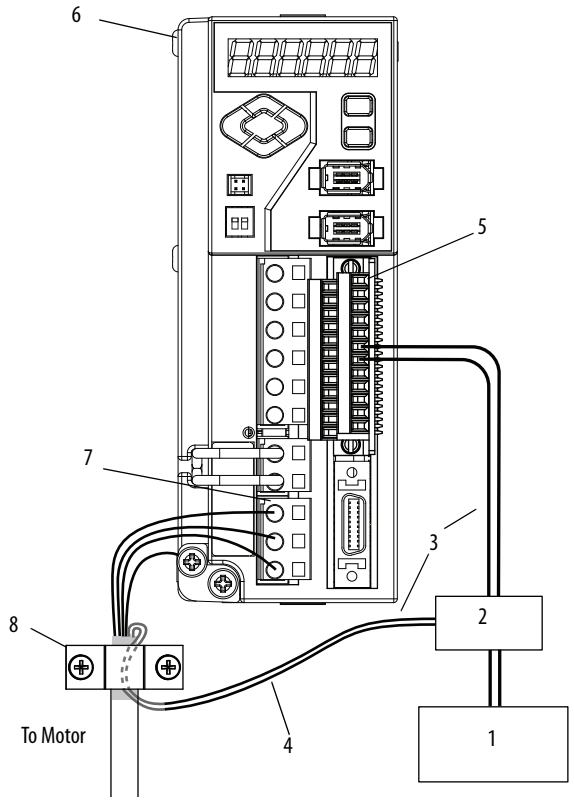

| Item | Description |
|---|---|
| 1 | 2071-AP4 Kinetix 3 drive shown |
| 2 | Motor power cable |
| 3 | Ground wire |
| 4 | Ground lug - user supplied |
| 5 | Cable shield clamp |

Ground and secure the motor power cable in your system following instructions on page 70.

This diagram shows an example of wiring with three-phase power wires and brake wires by using motor power cable, catalog numbers 2090-XXNPMF-*xx*S*xx*, 2090-CPBM4DF-*xx*AF*xx,* or 2090-CPBM6DF-16AA*xx* cables. The brake wires have a shield braid (shown below as gray) that folds back under the cable clamp before the conductors are attached to the motor brake circuit. Thermal switch wires are included in the feedback cable.

Refer to Kinetix 3 Drive/Rotary Motor Wiring Examples beginning on page 124 for interconnect diagrams.

**Figure 35 - Motor Power Terminations (Bulletin TLY, TLAR, MPAS, LDC-Series, and LDL-Series 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 | Brake wires |

| Item | Description |
|---|---|
| 5 | I/O (IOD) connector with Kinetix 3 I/O breakout board installed (2) |
| 6 | 2071-A*xx* Kinetix 3 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 129.

(2) Configure one emitter and collector pair from the Digital Outputs, OUTPUT1… OUTPUT3, pins 41…44 or pins 47 and 48, as Brake+ and Brake - through one of the recommended configuration methods. 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, refer to page 44.

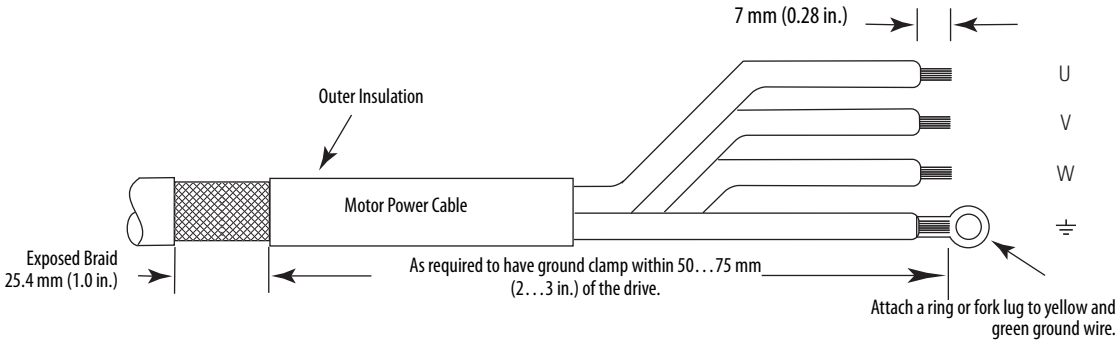
(3) Diode 1N4004 rated 1.0A @ 400V DC. See Power Wiring Examples beginning on page 124.

(4) Exposed shield under clamp and place within 50…75 mm (2…3 in.) of drive, see page 70 for details.

The cable shield clamp shown above is mounted to the subpanel. Ground and secure the power cable in your system following instructions on page 70.

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. The recommended wire size 2.5 $mm^2$ (14 AWG).

**Figure 36 - Cable Shield and Lead Preparation**




Refer to Kinetix 3 Drive/Rotary Motor Wiring Examples beginning on page 124 for interconnect diagrams.

**Table 26 - Motor Power (MP) Connector**

| Servo Motor | MP Connector | |
|---|---|---|
| **MP-Series, TL-Series** | **MP Pin** | **Signal** |
| U / Brown | 1 | U |
| V / Black | 2 | V |
| W / Blue | 3 | W |

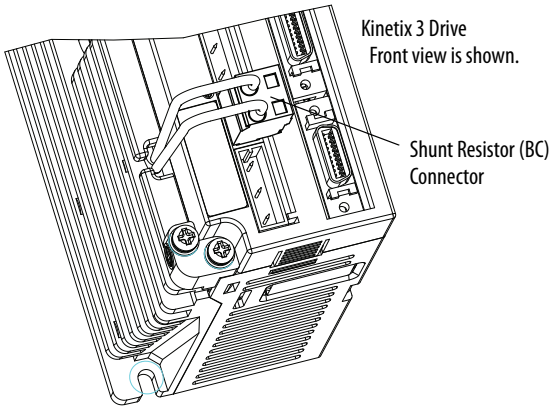
Green/yellow ground wire with ring lug is connected to the screw provided on the drive. Shown Figure on page 70.

## Shunt Resistor

The B1 and B2 terminals are used to connect the shunt resistor. On the 2071-AP4, 2071-AP8, 2071-A10, and 2071-A15 Kinetix 3 drives, the built-in shunt resistor is pre-wired to B1 and B2 at the factory. On the 2071-AP0, 2071-AP1, and 2071-AP2 Kinetix 3 drives, shunt resistors are not supported; no terminations can be made to the B1 and B2 terminals for these drives.

**IMPORTANT** The information supplied here is for reference only. There are no adjustments or user serviceable parts associated with the shunt resistor.

**Figure 37 - Shunt Resistor (BC) Connector**

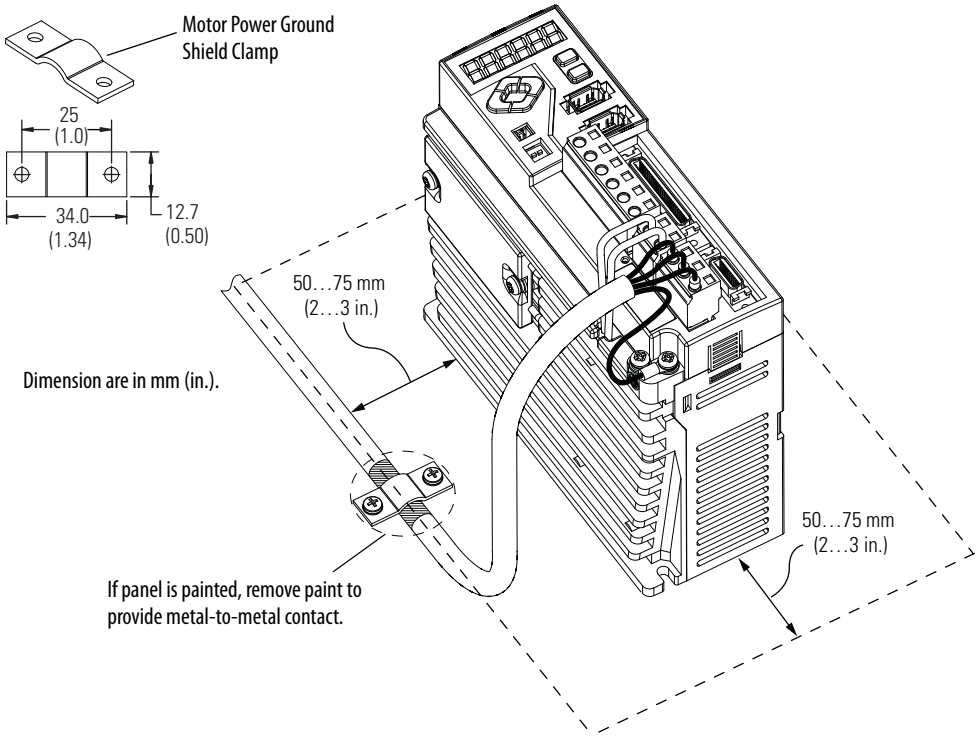


## Apply the Motor Cable Shield Clamp

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

Follow these steps to apply the motor cable shield clamp.

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




2. Lay out and drill holes for the cable clamp.

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

3. Locate the position on the motor power cable that comes under the clamp and remove about an 25.4 mm (1.0 in.) 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 with the clamp and two #6-32 x 1 screws provided.
6. Repeat steps 1...5 for each Kinetix 3 drive you are installing.

# Feedback and I/O Cable Connections

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

**Table 27 - Options for Connecting Motor Feedback and I/O**

| Connection Option | Cat. No. | Cable | Using This Type of Cable |
|---|---|---|---|
| Premolded connectors | N/A | Motor feedback | Refer to the table below for the premolded motor feedback cable available for your motor. |
| Feedback terminal block | 2071-TBMF | Feedback interface | Refer to the table below for the flying-lead motor feedback cable available for your motor. |
| I/O cable | 2090-DIAO-D50xx | I/O Interface | — |
| I/O terminal block | 2071-TBIO | I/O interface | User-supplied flying-lead cable. |

**Table 28 - Motor/Actuator Feedback Cables for Specific Motor/Feedback Combinations**

| Motor/Actuator Cat. No. | Feedback Type | Feedback Cable | | Pinout |
|---|---|---|---|---|
| | | Premolded | Flying-lead | |
| MPAS-A*xxxx*-ALMx2C | Incremental encoder | N/A | 2090-XXNFMF-S*xx* (standard)<br>2090-CFBM4DF-CDAF*xx* (continuous-flex) | page 72 |
| LDC-C*xxxxxx* | | | 2090-XXNFMF-S*xx* (standard)<br>2090-CFBM7DF-CDAF*xx* (continuous-flex) | |
| LDL-*xxxxxxx* | | | | |
| TLY-A*xxxx*-B | High-resolution encoder | N/A | 2090-CFBM6DF-CBAA*xx* (standard) | page 72 |
| TLAR-A*xxxxx* | | | | |
| TLY-A*xxxx*-H | Incremental encoder | | | |
| TL-A*xxxx*-B | High-resolution encoder | 2090-DANFCT-Sxx | 2090-DANFCT-Sxx(1) | page 73 |

(1) Remove the premolded connector on the drive end and use Feedback Breakout Board, catalog number 2071-TBMF.

## Flying-lead Feedback Cable Pinouts

**Table 29 - 2090-XXNFMF-S*xx* or 2090-CFBM*x*DF-CDAF*xx* Feedback Cable**

| Motor/Actuator Connector Pin | Motor/Actuator Signal Name | Drive Signal Name | Drive MF Connector Pin |
|---|---|---|---|
| 6 | BAT + | BAT + | 18 |
| 13 | DATA + | SD + | 10 |
| 14 | DATA - | SD - | 13 |
| 22 | EPWR 5V | EPWR | 20 |
| 23 | ECOM / BAT - (internally connected) | ECOM<br>BAT - | 1<br>19 |
| 24 | SHIELD | GND | 11 |

**Table 30 - 2090-CFBM6DF-CBAA*xx* Feedback Cable**

| Motor/Actuator Connector Pin | Motor/Actuator Signal Name | Drive Signal Name | Drive MF Connector Pin |
|---|---|---|---|
| 9 | AM + | A + | 3 |
| 10 | AM - | A - | 4 |
| 11 | BM + | B + | 5 |
| 12 | BM - | B - | 6 |
| 13 | IM + | I + | 7 |
| 14 | IM - | I - | 8 |
| 15 | S1 + | S1 | 10 |
| 16 | S1 - | — | — |
| 17 | S2 + | S2 | 14 |
| 18 | S2 - | — | — |
| 19 | S3 + | S3 | 16 |
| 20 | S3 - | — | — |
| 22 | EPWR 5V | EPWR | 20 |
| 23 | ECOM | ECOM | 1 |
| 24 | SHIELD | GND | 11 |

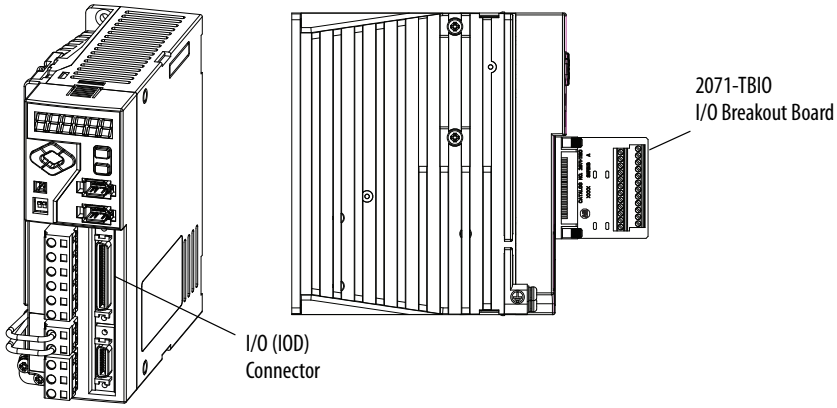
**Table 31 - 2090-DANFCT-Sxx Feedback Cable**

| Motor Connector Pin | Motor Signal Name | Drive Signal Name | Drive MF Connector Pin |
|---|---|---|---|
| 7 | EPWR | EPWR | 20 |
| 8 | ECOM/BAT - (internally connected) | ECOM<br>BAT- | 1<br>19 |
| 9 | SHIELD | GND | 11 |
| 12 | DATA + | SD + | 10 |
| 13 | DATA - | SD - | 13 |
| 14 | BAT + | BAT + | 18 |

## Wiring the I/O Connector

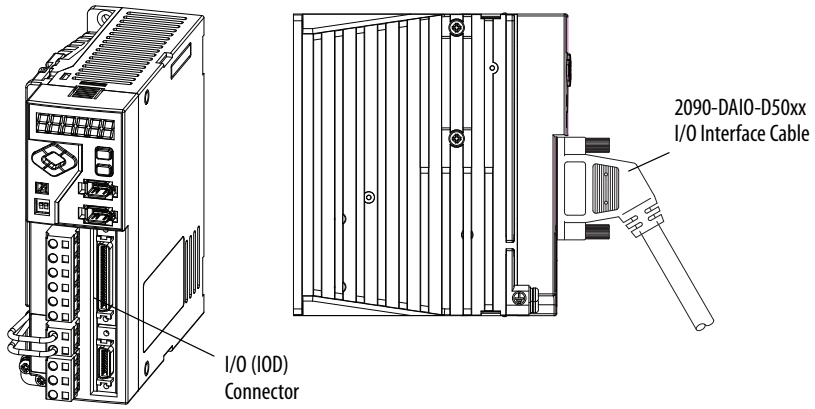
Connect your I/O wires to the IOD connector by using catalog number 2071-TBIO, I/O Breakout Board. Refer to publication 2071-IN002.

**Figure 38 - Kinetix 3 Drive (IOD connector and I/O Breakout Board)**




I/O interface cable, catalog number 2090-DAIO-D50*xx* provides access to all 50 pins of I/O.

**Figure 39 - Kinetix 3 Drive (IOD connector and I/O Interface cable)**



# Wiring the Feedback Connector

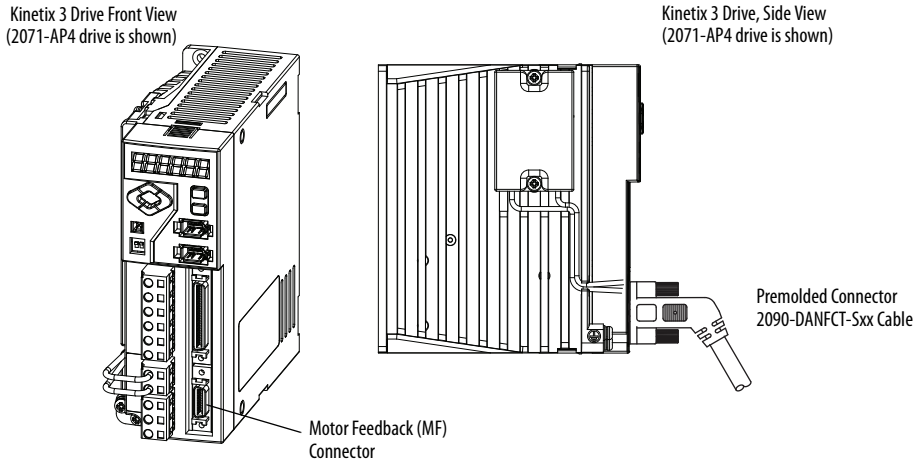
These procedures assume you have mounted your Kinetix 3 drive, completed all power wiring, and are ready to connect your feedback.

## Connecting Premolded Motor Feedback Cables

The motor feedback cables with premolded connectors plug directly into the 20-pin motor feedback (MF) connectors on the Kinetix 3 drive, no wiring is necessary.

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

**Figure 40 - Kinetix 3 Drive (MF connector)**



## Wiring the Feedback Breakout Board

The 2071-TBMF Feedback breakout board is suitable for terminating flying-lead motor feedback cables. Use it with the Kinetix 3 drive and all motors with incremental or high-resolution feedback. It has a 20-pin, male, mini D-sub connector and is compatible with all Bulletin 2090 feedback cables.

The TLY-A*xxxx*-B high-resolution motors with 17-bit encoder require a 3.6V battery, purchased separately, see Replacement Battery Specifications on page 36.

**Figure 41 - Kinetix 3 Drive (MF connector)**

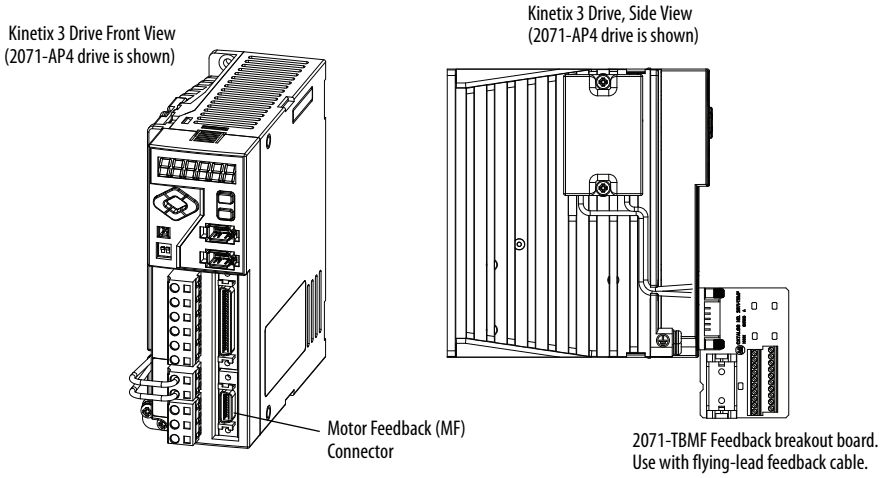
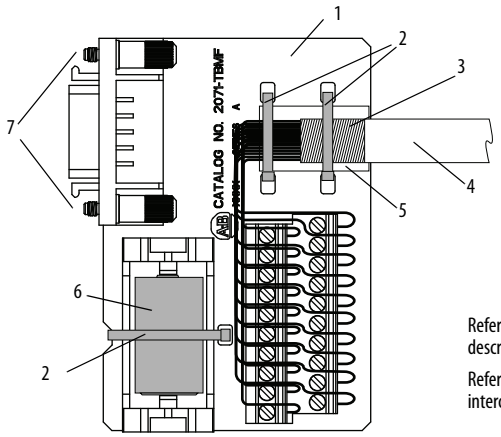


**Figure 42 - Wiring 2071-TBMF Feedback Breakout Board**




Refer to Chapter 3 for feedback signal descriptions.

Refer to page 124 for the motor feedback interconnect drawing for your application.

| Item | Description |
|---|---|
| 1 | 2071-TBMF Kinetix 3 feedback breakout board |
| 2 | Tie wrap |
| 3 | 13 mm (0.5 in.) exposed cable shield |
| 4 | Bulletin 2090 feedback cable, catalog numbers<br>2090-XXNFMF-Sxx, 2090-CFBMxDF-CDAFxx, 2090-CFBM6DF-CBAAxx, or 2090-DANFCT |
| 5 | Ground pad |
| 6 | 3.6V battery(1) |
| 7 | Mounting screws |

(1) Battery required if absolute position must be stored.

## Notes:

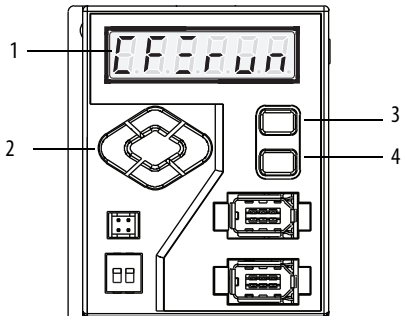
# Using the Keypad Interface



## Keypad Input

The operator interface provides immediate access to the Kinetix 3 drive status displays and monitoring, parameter settings, and functional commands. The features of the Kinetix 3 drive operator interface are identified in Figure 44 and described below.

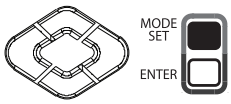
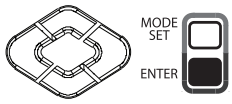
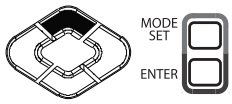
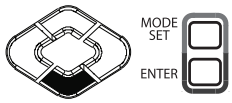
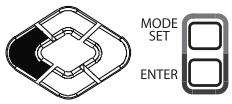
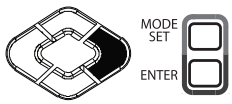
**Figure 44 - Kinetix 3 Operator Interface**




| Item | Description |
|---|---|
| 1 | 7-segment status indicator |
| 2 | Up, down, left, and right directional keys |
| 3 | Mode/Set key |
| 4 | Enter key |

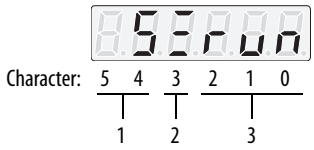
- The 7-segment status indicator displays status, parameters, function commands, and provides drive monitoring.
- The Control Power illuminates when the drive's control electronics are powered by application of 200...230V power to the L1C, and L2C Control Power pins.
- The Mode/Set, and Enter keys provide the operator with access to drive functions. The directional keys (Up, Down, Left, and Right) edit drive function settings. These keys let the operator monitor and change the drive's program.

The following briefly explains the Mode/Set, Enter, and directional keys and their use.

| Key | Name | Function | Example |
|---|---|---|---|
|  | Set | Saves the current value of the setting in memory. | To save any change:<br>• Press and hold Set until the display blinks. |
| | Mode | Toggles the display between the four modes.<br><br>Important: The Status mode is the default display at powerup. | To advance the display through the various mode displays:<br>1. Press Mode to advance from the Status mode (default display) to Set Parameter mode,<br>2. Press Mode again to advance to Monitor mode.<br>3. Press Mode again to advance to the Function mode.<br>4. Press Mode once more to return to the Status mode. |
|  | Enter | Enter or exit a display containing the settings for the selected mode.<br><br>Important: Before exiting the display, Set must be pressed and held until the display blinks to save any modified value to memory. | To access the settings for Pr-0.00 from the Status mode:<br>1. Press Mode to advance to the initial Parameter display (PR-0.00).<br>2. Then press Enter to access the parameter's value (01 is the default setting). |
|  | Up | Increments the value to a larger integer.<br><br>A non-functional key in the Status mode. | In any Parameter Setting, Monitor, or Function mode:<br>• Press and hold the UP key to scroll to the maximum value. |
|  | Down | Decrements the value to a smaller integer.<br><br>A non-functional key in the Status mode. | In any Parameter Setting, Monitor, or Function mode:<br>• Press and hold the DOWN key to scroll to the minimum value. |
|  | Left | Shifts the active digit to the left.<br><br>An invalid key for the Status mode. | In the Set Parameter mode:<br>1. Press Left to move from least to the most significant digit in parameters (PR-x.x**X** to PR-x.**X**x).<br>2. Press LEFT again to move to the groups digit (PR-**X**.xx). |
|  | Right | Shifts the active digit to the right.<br><br>An invalid key for the Status mode. | In the Set Parameter mode:<br>1. Press RIGHT to move from least significant digit in parameters to the groups digit (PR-x.x**X** to PR-**X**.xx).<br>2. Press RIGHT again to move to the most significant digit in Parameters (Pr-x.**X**x). |

## Status Display/Operation Mode

Operation mode - When the drive is powered up, if there are no faults, this is the default status screen. It shows the Control mode, status indicators, and whether the drive is enabled.




| Item | Description | |
|---|---|---|
| 1 | Control Mode: Characters 4 and 5 | F = Follower<br>S = Analog Velocity Input<br>C = Analog Current Input<br>SF = Analog Velocity Input/Follower<br>CF = Analog Current Input /Follower<br>CS = Analog Current Input/Analog Velocity Input<br>P = Preset Velocity<br>PF = Preset Velocity/Follower<br>PS = Present Velocity/Analog Velocity Input<br>PC = Present Velocity/Analog Current Input<br>I = Indexing |
| 2 | Row Display: Character 3 | Top Row = Inactive for any Current mode.<br>Active if Velocity mode and Velocity Error is within velocity window.<br>Active if Follower mode and Position Error is within following error setting.<br>Middle Row = Active if velocity exceeds Up To Speed parameter.<br>Bottom Row = Active for Hall start-up motors once the commutation angle is set. |
| 3 | Status: Characters 0…2 | rdy = Drive is disabled, but ready to be enabled.<br>run = Drive is enabled and motor is under control. |

### *Error Display*

If the drive is faulted, the drive does not show the Operation Mode screen. Instead the drive alternates between the Error Description and the Error Number. For an Emergency Stop error, this is what it looks like.

**Figure 45 - Error Descriptor**

**Figure 46 - Error Number**

### *Parameter Edit*

From this screen, scroll through the general parameter groups (before the period) and then pick the parameter you wish to view or edit (after the period).

**Figure 47 - Parameter Edit**

*Index Edit*

From this screen, scroll through the indexing parameter groups (before the period) and then pick the parameter you wish to view or edit (after the period).

**Figure 48 - Index Edit**

*Display Mode*

The Display mode displays numerical data about drive and motor functions of twenty four parameters. Follow these steps to access the data.

1. Enter the Display mode by pressing the Mode key.

   The display indicates the selected function by displaying  where *nn* is a display attribute number shown in Table 32.

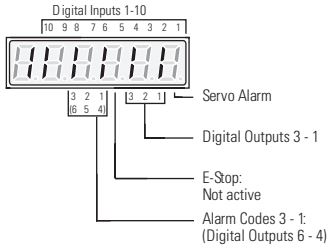
2. By using either the Up, Down, Right, or Left keys, select a display attribute number.
3. Press the Enter key.

   The value of the attribute appears.

**Table 32 - Display Mode**

| Display Attribute Number | Attribute | Unit |
|---|---|---|
| 00 | Velocity Feedback | rpm or mm/s |
| 01 | Velocity Command | rpm or mm/s |
| 02 | Velocity Error | rpm or mm/s |
| 03 | Current Command | 0.1% of motor rated continuous torque |
| 04 | Follower Position | counts |
| 05 | Master Position | counts |
| 06 | Position Error | counts |
| 07 | Position Command Count Frequency | 0.1 kcounts/s |
| 08 | Commutation Angle | $0.1^{o}$ |
| 09 | Mechanical Angle | $0.1^{o}$ |
| 10 | Shunt Power Limit Ratio | % |
| 11 | Bus Voltage | V |
| 12 | Absolute Rotations | revolutions |

**Table 32 - Display Mode (continued)**

| Display Attribute Number | Attribute | Unit |
|---|---|---|
| 13 | Velocity Command Offset | mV |
| 14 | Current Command Offset | mV |
| 15 | Input and Output State |  |
| 16 | Error History | Up to eight alarms stored in numerical order where most recent =1, to oldest =8, with error code number:<br>Most significant digit is alarm number (1–8),<br>Least significant six digits are the error code number referenced in the Error Displays beginning on page 116.<br>For example; 1-E004 = most recent error is a Motor Overtemp |
| 17 | Firmware Revision | For Example; vEr*x.yy* where *x* = version, *yy* = revision |
| 18 | Motor Model | – |
| 19 | Analog Velocity Command Voltage | 0.01V |
| 20 | Analog Current Command Voltage | 0.01V |
| 21 | Drive Rated Output Power | W |
| 22 | Absolute Single-Turn | – |
| 23 | Motor Position | – |

*Run*

The Run mode is reserved for future use. Only the reset procedure in the next section uses one parameter from this screen; otherwise, there are no user-accessible commands or information available.

## Reset Drive to Default Value

Use keypad input if an Ultraware software or Connected Components Workbench software connection is not available.

1. Use the keypad to verify that parameter Pr0.32 is set to 0x00 or 0x01.

   This disables the MODBUS Run Function Control bit.
2. Use the keypad to navigate to the parameter run-12 and then press Enter.
3. At the prompt, start the reset by pressing Set, or cancel by pressing Enter.

   When finished, the drive displays -donE-.

## Notes:

# Configure Your Drive for Communication

## Apply Power to Your Kinetix 3 Drive

This procedure assumes that you have completed the following:

- Wired your Kinetix 3 system
- Verified the wiring
- Are ready to begin establishing communication to the drive

To apply power to your Kinetix 3 drive, follow these steps.

1. Disconnect any load to the motor.

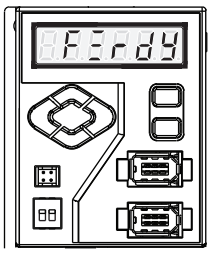
| **IMPORTANT** | Be sure that the motor is free of all linkages when initially applying power to the system. |
|---|---|

2. Apply main and control input power to the Kinetix 3 drive, and observe the operator interface on the front of the drive.

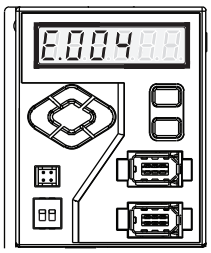
   The drive enters a normal startup, as outlined below and shown in below.

| If the Main Power Status Indicator is | Then |
|---|---|
| ON | Go to step 3. |
| OFF | Check your input power connections and repeat step 2. |

Startup Normal




Error Detected during Startup




3. Verify the status of the drive startup, as outlined below and shown in above.

| If the Six Characters on the 7-segment Display Indicator | Then |
|---|---|
| rdY in the three least significant characters | The drive is ready. |
| E. in the most significant character followed by a text string or error code number | Refer to Error Displays on page 116 to troubleshoot the fault condition.<br>IMPORTANT: If a 17-bit serial motor is not connected or a 17-bit serial motor is installed without a battery backup, a fault condition occurs. |

# Configure Your Kinetix 3 Drive for USB Communication with a Personal Computer

Use the 1203-USB converter to connect your drive to your personal computer if you are using Connected Components Workbench software to configure your drive.

## Download Connected Components Workbench Software

1. Open your Internet browser.
2. Navigate to http://ab.rockwellautomation.com/Programmable-Controllers/Connected-Components-Workbench-Software.

Consult Micro800 and Connected Components Workbench Getting Started Guide, publication 2080-QR001, for details on the download process.

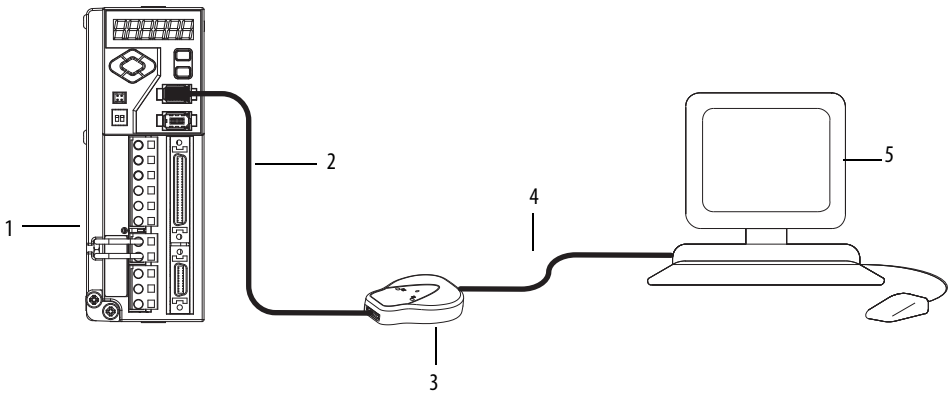
To configure the Kinetix 3 drive communication port for USB communication, follow these steps.

1. Use the keypad on the front of the drive to set the following parameters.

   See Status Display/Operation Mode for keypad operation.

| Parameter Name | Parameter | Setting |
|---|---|---|
| Drive Address | Pr0.07 | 248 |
| Serial Port Configuration | Pr0.09 | 1102<br>where, 2 - 19,200 Kbps Baud Rate<br>0 - 8 Data Bits, No Parity, 1 Stop Bit<br>1 - Modbus-RTU protocol<br>1 - RS-485 |

2. Use the USB cable to connect your personal computer with the 1203-USB converter.
3. Connect the1203-USB converter to the Kinetix 3 drive with the 2090-CCMUSDS-48AA*xx* communication cable.



| Item | Description |
|---|---|
| 1 | Kinetix 3 drive |
| 2 | 1203-USB converter cable, catalog number 2090-CCMUSDS-48AAxx |
| 3 | 1203-USB converter |
| 4 | USB cable |
| 5 | Personal computer with Connected Components Workbench software |

For information on the serial communication cables, refer to Serial Communication Cables Installation Instructions, publication 2090-IN019.

4. Proceed with Chapter 7, Configure Your Drive for Communication with a Personal Computer Running Connected Components Workbench Software, on page 91.

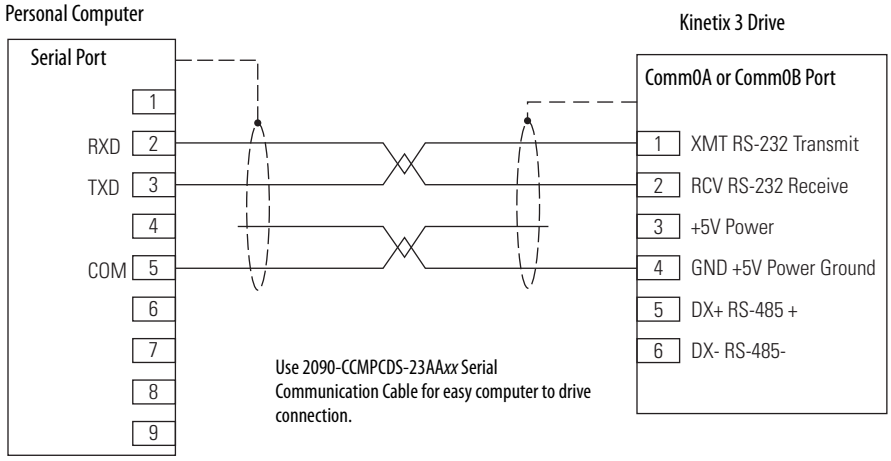
## Configure Your Kinetix 3 Drive for RS-232 Communication with a Personal Computer

The Kinetix 3 drive communication port, Comm0A and Comm0B, can be configured for RS-232 communication. Use RS-232 communication when you plan to communicate with the drive by using your personal computer and Ultraware software.

**IMPORTANT** Changing between RS-232 and RS-485 Modbus-RTU requires different cabling and serial port configurations.

The following schematic shows the cable pinouts for RS-232 communication. If you are not using the pre-made RS-232 Serial Communication Cable, catalog number 2090-CCMPCDS-23AA*xx*, use this schematic to make your own cable.

**Figure 49 - RS-232 Connection with a Personal Computer**



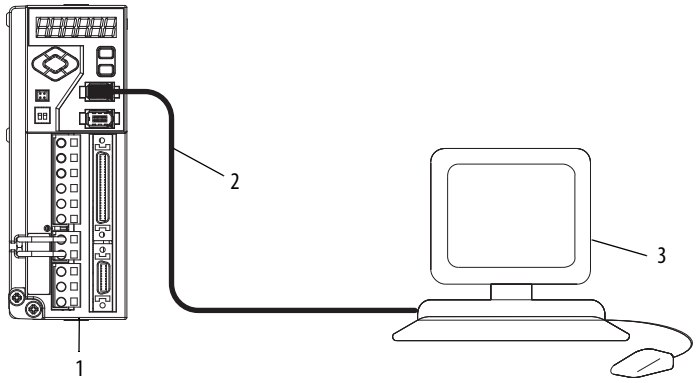
To configure the Kinetix 3 drive communication port for RS-232/ASCII communication follow these steps.

1. Use the keypad on the front of the drive to set the following parameters.

   See Status Display/Operation Mode for keypad operation.

| Parameter Name | Parameter | Setting |
|---|---|---|
| Drive Address | Pr0.07 | Required address (1 - Default) |
| Serial Port Configuration | Pr0.09 | 0005 - Default<br>where, 5 - 57,600 Kbps Baud Rate<br>0 - 8 Data Bits, No Parity, 1 Stop Bit<br>0 - ASCII protocol<br>0 - RS-232 |

2. Connect to your personal computer with the RS-232 serial communication cable, catalog number 2090-CCMPCDS-23AA*xx*.




| Item | Description |
|---|---|
| 1 | Kinetix 3 drive |
| 2 | RS-232 serial communication cable, catalog number 2090-CCMPCDS-23AA |
| 3 | Personal computer with Ultraware software |

   For information on the serial communication cables, refer to Serial Communication Cables Installation Instructions, publication 2090-IN019

3. Proceed with Chapter 8, Using Ultraware Software to Configure the Drive, on page 101.

## Notes:

# Configure Your Drive for Communication with a Personal Computer Running Connected Components Workbench Software



## Download Connected Components Workbench Software

Use this procedure to download your Connected Components Workbench Software.

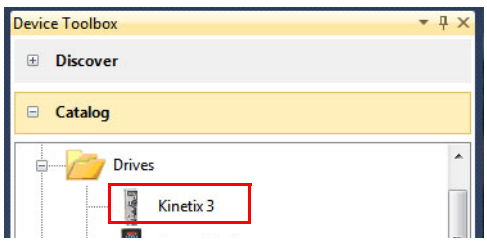
1. Open your Internet browser.
2. Navigate to http://ab.rockwellautomation.com/Programmable-Controllers/Connected-Components-Workbench-Software.

Consult Micro800 and Connected Components Workbench Getting Started Guide, publication 2080-QR001, for details on the download process.

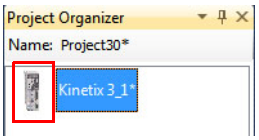
## Add Your Device to the Connected Components Workbench Project

Use this procedure to add your Kinetix 3 drive to your Connected Components Workbench project.

1. Start the Connected Components Workbench software.
2. From the Device Toolbox, expand Drives, click Kinetix 3 and drag to it to the Project Organizer.

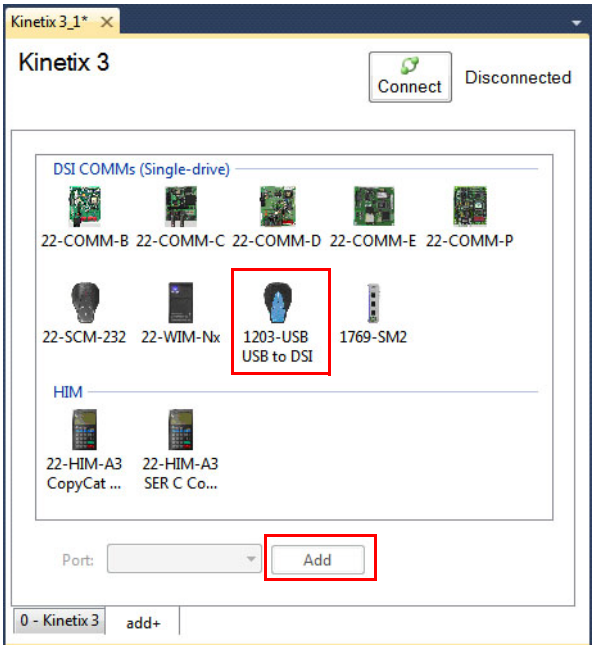


3. From the Project Organizer, double-click the Kinetix 3 icon.

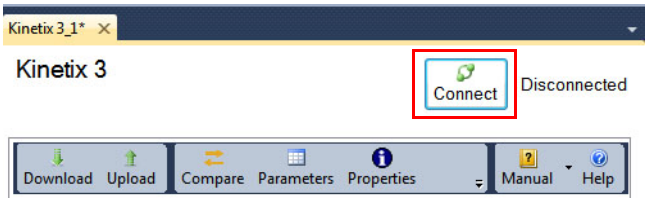



4. From the Kinetix 3 pane, click the Add+ tab.

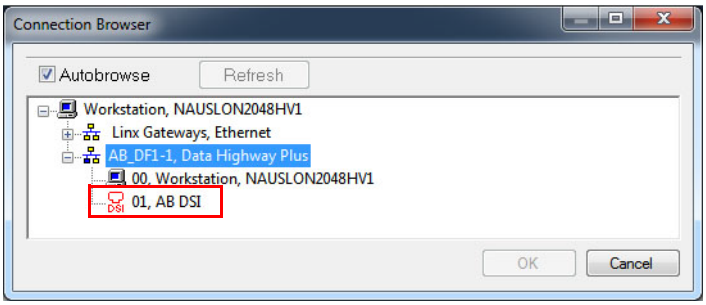
5. Click the1203-USB USB to DSI icon, then click Add.




6. Click the 0-Kinetix 3 tab, then click Connect.

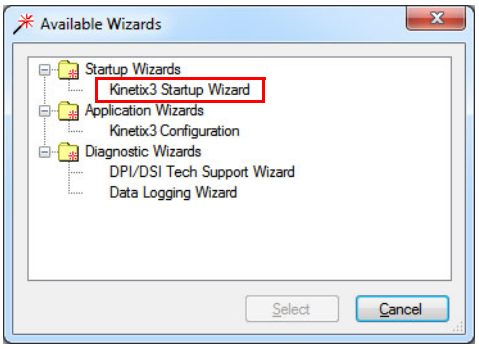



7. Expand AB_DF1, Data Highway Plus, and click 01, AB DSI.

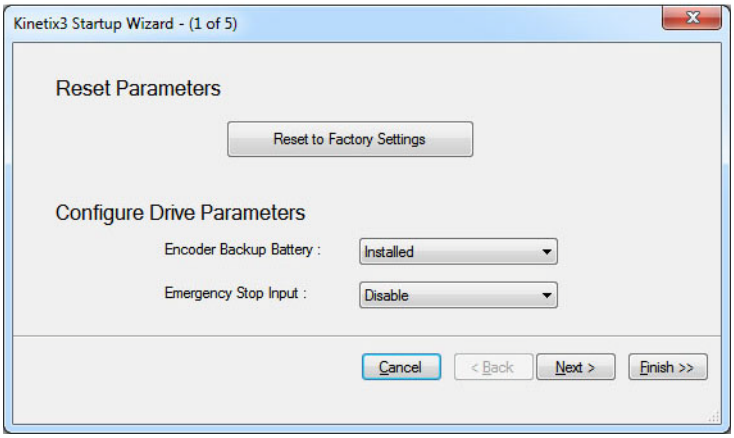



8. Click OK.
9. From the menu bar, click the Wizards icon.

10. From the Available Wizards dialog box, select Kinetix 3 Startup Wizard.



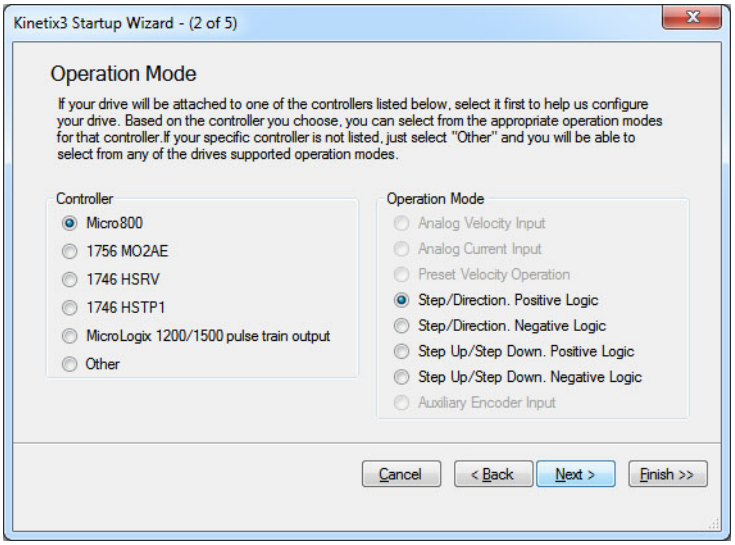

11. Click Reset to Factory Settings, then choose the options for Encoder Backup Battery and Emergency Stop Input.



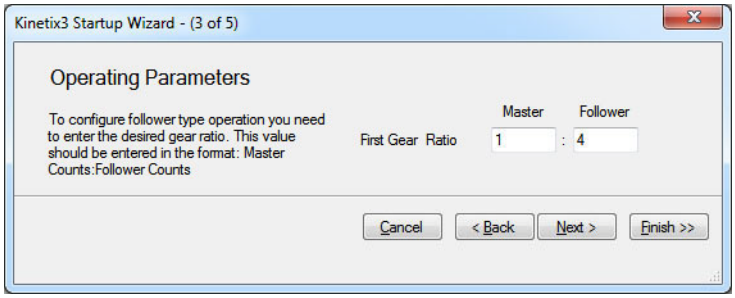

**TIP** You can also reset drive default values from the Kinetix 3 Configuration Wizard see page 100

12. Click Next.

13. Choose the appropriate options for your Controller and Operation Mode.
14. Click Next.



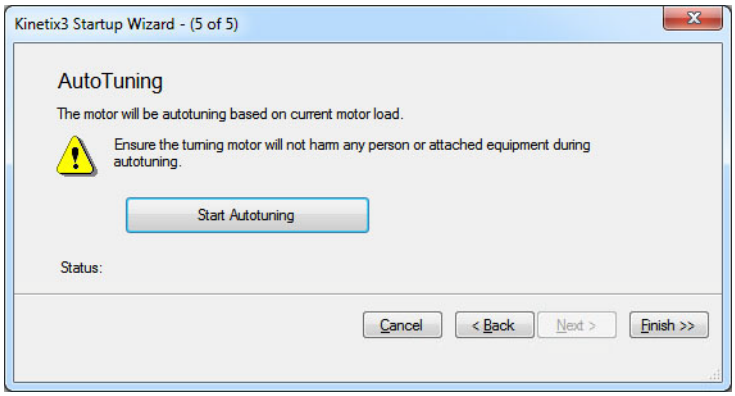

15. Enter the First Gear Ratio.
16. Click Next.




17. Verify your motor has been identified correctly.
18. Click Next.

    Your motor catalog string can be different.

19. Click Start Autotuning.



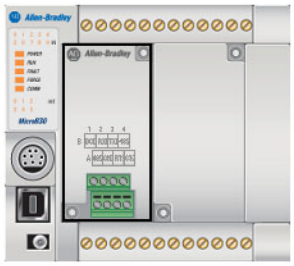

Status displays Autotuning Now then Autotuning Successful.

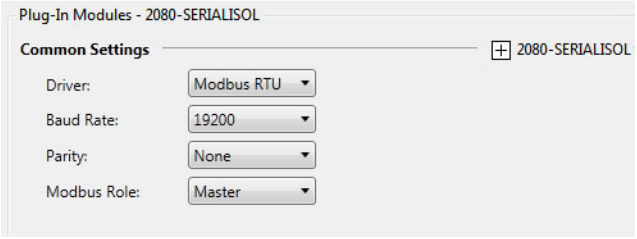
20. Click Finish.
21. From the File menu, choose Save.
22. Create a project name.

## Configure the Plug in Serial Port on the Micro830 or Micro850 Controller

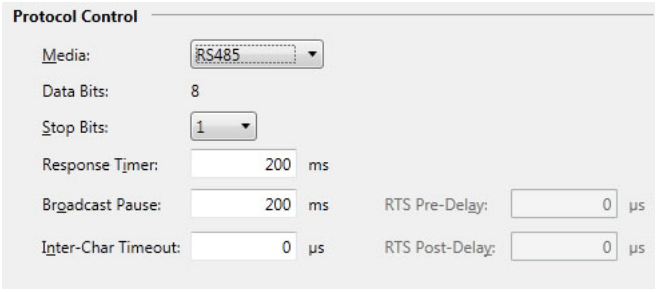
1. Under Plug-In Modules right-click the first empty slot and choose Communication>2080-SERIALISOL.
2. Under Common Settings, from the Driver pull-down menu, choose Modbus RTU.

   If necessary, change the other properties to match the dialog box below.






3. Under Protocol Control settings, from the Media pull-down menu, choose RS485.



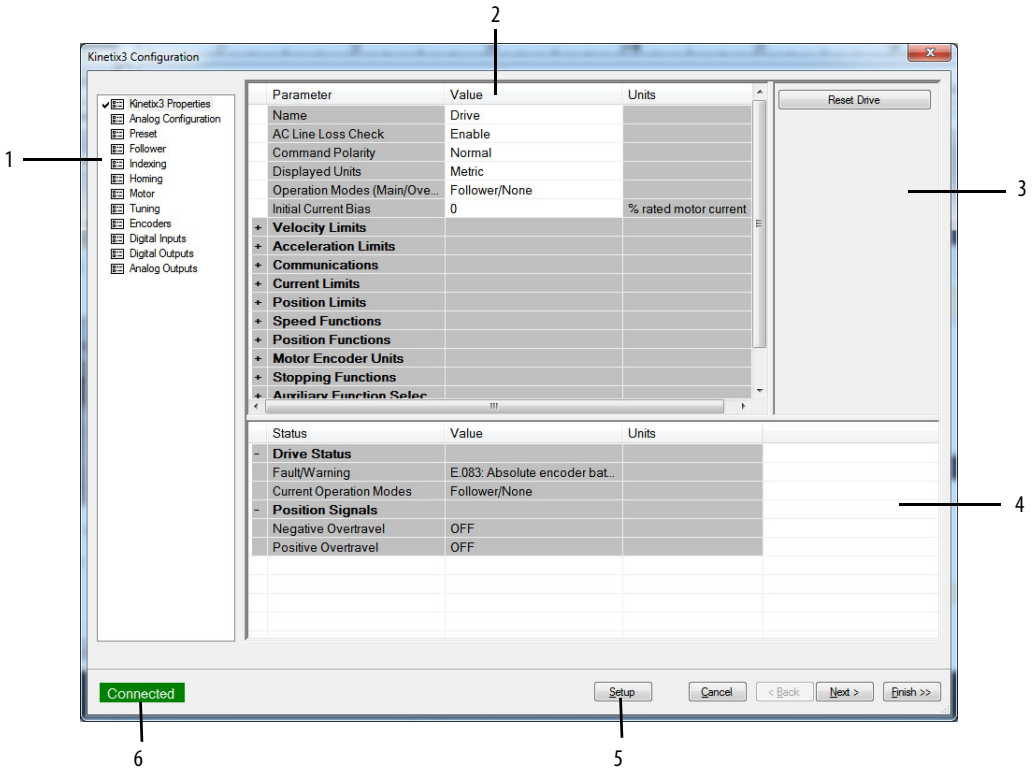

4. Right-click the controller icon and choose Build.

## Program the Controller for Modbus Communication with a Kinetix 3 Drive

Please refer to Kinetix 3 Motion Control Indexing Device Building Block Quick Start, publication CC-QS025 and Micro800 Programmable Controllers General Instructions Reference Manual, publication 2080-RM001 for information about Modbus messaging and programming the Micro800 controllers and Kinetix 3 drive.

# Kinetix 3 Configuration Wizard

This section provides a description of the Connected Components Workbench workspace and the drive panes. Use this wizard to make advanced configuration changes.




| Item | Feature |
|---|---|
| 1 | Parameter group selection |
| 2 | Parameters for the associated group |
| 3 | Functions associated with the displayed parameters |
| 4 | Displays selected statuses |
| 5 | Opens the status selection dialog |
| 6 | Drive connection status |

**Table 33 - Connected Components Workbench Workspace Pane Uses**

| Pane | Use the Pane to |
|---|---|
| Kinetix 3 Properties | • Configure the drive properties for an offline or an online drive<br>• Monitor parameters of an online drive<br>• Execute commands that save current working values as power-up values<br>• Execute commands that restore the drives original default settings |
| Analog Configuration | • Set Analog Velocity or Analog Current Command Input drive parameters for an online or offline drive<br>• Monitor the status of the incoming Analog Command for an online drive<br>• Execute commands that remove Velocity and Current Input Offsets for an online drive |
| Preset | • Configure up to seven preset velocity values<br>• Preset parameters control drive operation when the Operating mode is set to Preset Velocity in the Drive properties pane<br>• The drive uses the preset velocity value selected by the Preset Select 1, 2 and 3, as set in the Digital Inputs group |

**Table 33 - Connected Components Workbench Workspace Pane Uses**

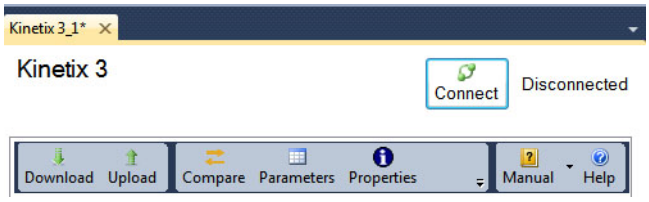
| Pane | Use the Pane to |
|---|---|
| Follower | • Configure the Follower parameters<br>• Follower parameters control drive operation when the Operating mode is set to Follower in the Drive properties pane<br>• The Follower page has no associated statuses |
| Indexing | • Configure up to 64 indexes (0…63)<br>• Open the Indexing Control Panel where you can do the following:<br>– Start and stop execution of the index command<br>– Start and stop homing<br>– Enable or disable a drive<br>– Monitor the execution of an index |
| Homing | • Configure the type of homing operation the drive performs<br>• Homing pane has no associated statuses |
| Motor | • Select a motor for the associated online or offline Kinetix 3 drive. Once you select a motor, the status/parameters values associated with the selected motor appears in the Parameters window<br>• Monitor the statuses that relate to the selected motor |
| Tuning | • Configure Velocity, Position, and Current Regulator Gains<br>• Configure and execute autotuning<br>• Configure an alternate set of gains that can be activated by a digital input<br>• Monitor Velocity, Position, and Current loop statuses |
| Encoders | • Configure the motor encoder<br>• Execute a command that resets an absolute encoder position to zero |
| Digital Inputs | • Assign functionality to digital inputs<br>• Monitor the status of digital inputs |
| Digital Outputs | • Assign functionality to digital outputs<br>• Set both active and inactive brake delays<br>• Monitor the status of digital outputs |
| Analog Outputs | • Assign drive signals to analog outputs<br>• The Analog Outputs page has no statuses |

## Alternate Method to Reset the Drive

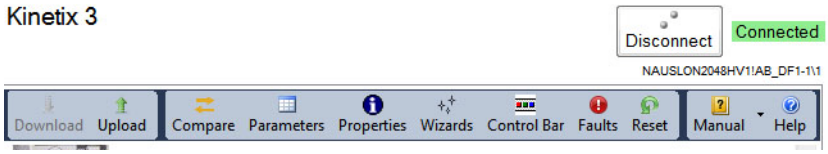
In addition to resetting the drive from the Startup Wizard, you can also reset the drive from the Kinetix 3 Configuration Wizard.

Follow these steps to reset the drive from the Kinetix 3 Startup Wizard.

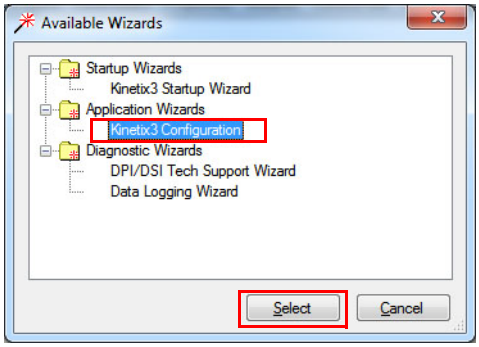
1. Start the Connected Components Workbench software.
2. Click the Kinetix 3 tab, then click Connect.



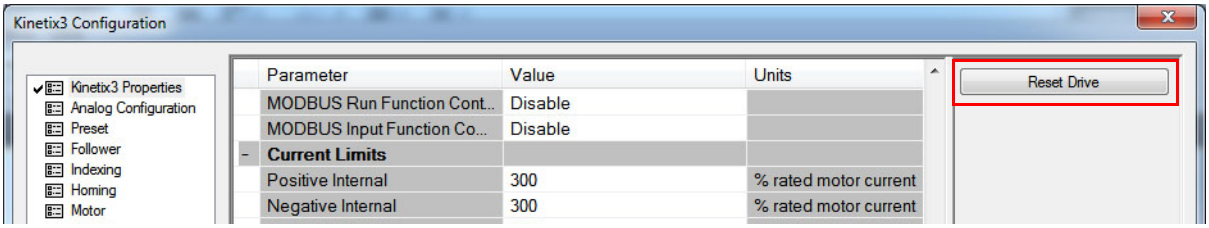

3. From the menu bar, click the Wizards icon.




4. From the Available Wizards dialog box, select Application Wizard>Kinetix 3 Configuration and click Select.




5. From the rightmost section of the pane, click Reset Drive.




6. Click Yes to confirm.

# Using Ultraware Software to Configure the Drive



## Download Ultraware Software

To communicate and configure your Kinetix 3 drive by using serial communication from a personal computer, download and install Ultraware software on your personal computer. To get the latest Ultraware software follow these steps.

1. Start an Internet browser.
2. Navigate to http://www.ab.com/motion/software/get/Ultraware_1_80.exe.
3. Click Run.

## Detect Your Kinetix 3 Drive

This procedure assumes you have successfully applied power to your drive. These steps are designed to make sure that your Kinetix 3 drive is communicating with your Ultraware software.

Follow these steps to detect your Kinetix 3 drive.

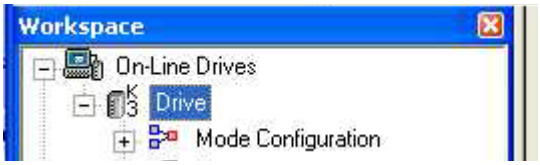
1. Start your Ultraware software.

   Refer to the Ultraware User Manual, publication 2098-UM001, for more information on starting the Ultraware software.
2. Create a new file.

   The software scans for online drives.

3. Click Stop Scanning when your drive is detected or wait for the scanning to time out.
4. Look for the Kinetix 3 icon under the On-Line Drives tree.

   The Kinetix 3 icon indicates that your drive is detected.




5. Click the [+] next to the Kinetix 3 icon to expand the branch menu.

| If Your Kinetix 3 Drive | Then |
|---|---|
| Is detected and listed under the On-Line Drives tree. | 1. The software and hardware are communicating and the system is ready.<br>2. Go to Select a Motor on page 104. |
| Is not detected. | 1. Check your serial cable connections.<br>2. Use Recover Communication (in Ultraware) to establish a connection.<br>3. Go to main step 1 of this section.<br>4. Verify no other program such as RSLinx is using the serial port. |

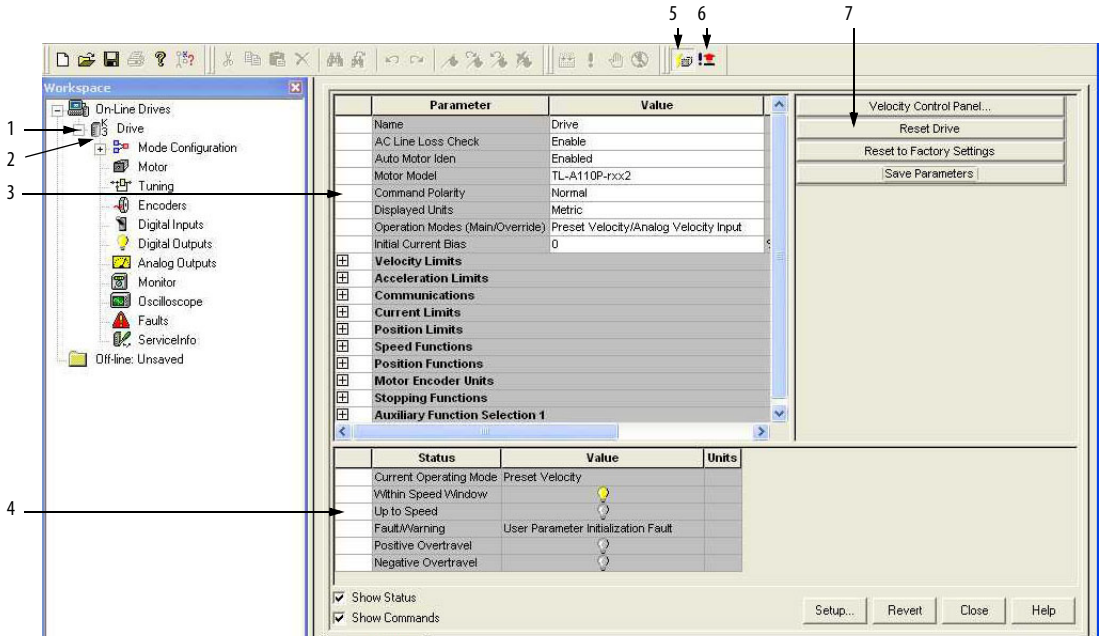
## Reset Drive to Default Values with Ultraware Software

Follow these steps to reset your drive with Ultraware software.

1. Start the Ultraware software.
2. Establish a connection to the drive.
3. Navigate to the main drive dialog box.
4. Click Reset to Defaults.

# Understanding the Workspace and Drive Branches

This section provides a description of the Ultraware workspace and various drive branches.




| Item | Description |
|---|---|
| 1 | Click the [+] next to K3 Drive to expand the parameter group. |
| 2 | Double-click the K3 Drive icon in the Ultraware workspace to display the various drive branches. |
| 3 | Configure drive parameters for an online drive. |
| 4 | Monitor the status of an online drive. |
| 5 | Software Enable icon. |
| 6 | Disable All Drives icon. |
| 7 | Execute commands to clear faults, reset the drive, or reset the EEPROM. |

### *Mode Configuration Branch*

Click the [+] next to Mode Configuration to select the drive's command source.

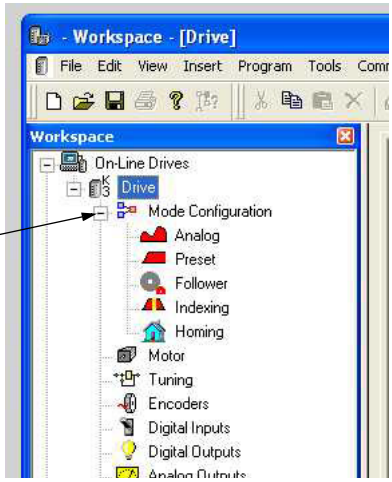


**Table 34 - Branch Descriptions**

| Branch | Use the Motor Branch to |
|---|---|
| Motor | • Select a motor for the associated online or offline Kinetix 3 drive. Once you select a motor, the status values associated with the selected motor appear in the Status pane of this dialog box.<br>• Monitor the status as related to the selected motor.<br>• Perform diagnostics on the motor. |
| Tuning | • Configure Velocity and Position Regulator Gains that are used in tuning.<br>• Monitor Velocity, Position, and Current loop status.<br>• Open dialog boxes where you can execute commands for autotuning, manual position tuning, and manual velocity tuning. |
| Encoders | • Configure the motor encoder. |
| Digital Inputs | • Assign functionality to digital inputs.<br>• Monitor the status of digital inputs. |
| Digital Outputs | • Assign functionality to digital outputs.<br>• Set both active and inactive brake delays.<br>• Monitor the status of digital outputs and the digital relay. |
| Analog Outputs | • Assign drive signals to analog outputs.<br>• Monitor the status of analog outputs. |
| Monitor | • View a collection of statuses.<br>• Open the Monitor Setup dialog box where you can select the collection of statuses to display in this dialog box.<br>• Load a monitor previously saved.<br>• Save a monitor for later use. |
| Oscilloscope | • Configuring the oscilloscope by selecting the drive signal to trace.<br>• Executing commands that run the oscilloscope's tracing function continuously or in response to the configured trigger.<br>• Monitoring the oscilloscope as it traces the selected drive signal. |
| Faults | • Set fault limits.<br>• Monitor fault status.<br>• Execute the Clear Faults command.<br>• Open a dialog box where you can review the drive's fault history. |
| Service Information | • Display and monitor service information about the drive.<br>• Display the firmware revision of the drive. |

## Select a Motor

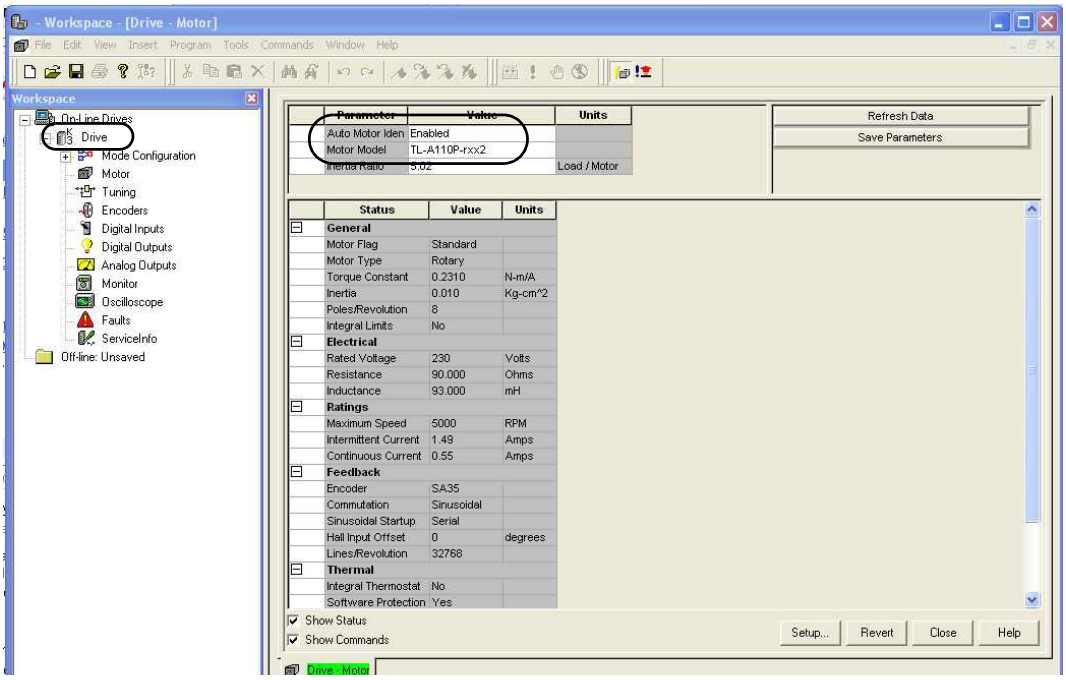
This procedure assumes you have power applied to your drive and the drive is detected by the Ultraware software.

Refer to the Ultraware User Manual, publication 2098-UM001, for more information on selecting a motor.

Follow these steps to select a motor.

1. Double-click the Kinetix 3 icon under the On-Line Drives tree.

The Kinetix 3 Drive properties dialog box appears.




Actual values depend on your application. Auto Motor Iden default value is Enabled and remains Enabled if a motor with intelligent encoder is detected or selected. Value changes to Disabled if a motor without intelligent encoder is selected.

2. Check the Motor Model parameter value.

| If motor is | Value (motor cat. no.) | Go To |
|---|---|---|
| An Allen-Bradley motor with intelligent encoder | Is recognized by the Ultraware software | Assign Digital Inputs on page 105. |
| | Is not recognized by the Ultraware software | Go to Fault Codes in Chapter 9 and refer to troubleshooting for E30. |
| Not an Allen-Bradley motor with intelligent encoder | | Step 3. |

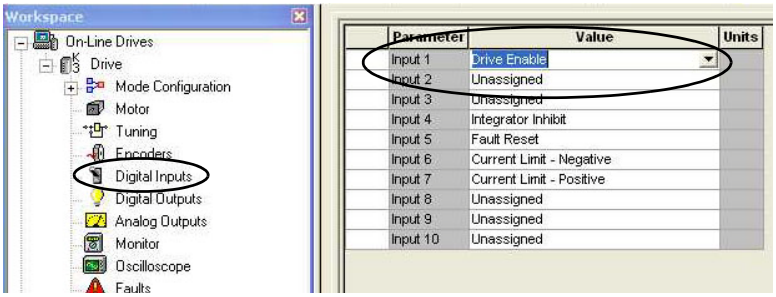
3. From the Motor Model pull-down menu, choose your motor.

### *Assign Digital Inputs*

Follow these steps to assign Digital Inputs.

1. Double-click the Digital Inputs branch.

The Digital Inputs properties dialog box appears.




2. Verify that Input 1 value is set to Drive Enable (this is default).

   The Drive Enable switch can be removed from the digital inputs, but can lead to immediate motion upon drive powerup.

**ATTENTION:** To avoid fault action or damage to the drive due to improper sequencing of input power and the Drive Enable signal, assign one of the ten inputs as Drive Enable (Input 1 is the default setting).

3. Configure remaining digital inputs as required by your application.
4. Close the Digital Inputs properties dialog box.

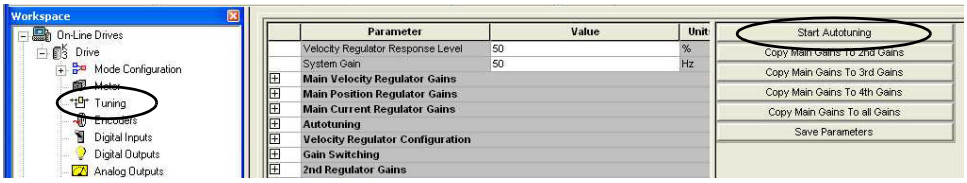
## Tune Your Motor

This procedure assumes your drive is detected and you have selected a motor. In this procedure you autotunes your motor.

Follow these steps to autotune your motor.

1. Double-click the Tuning branch.

   The Tuning properties dialog box appears.



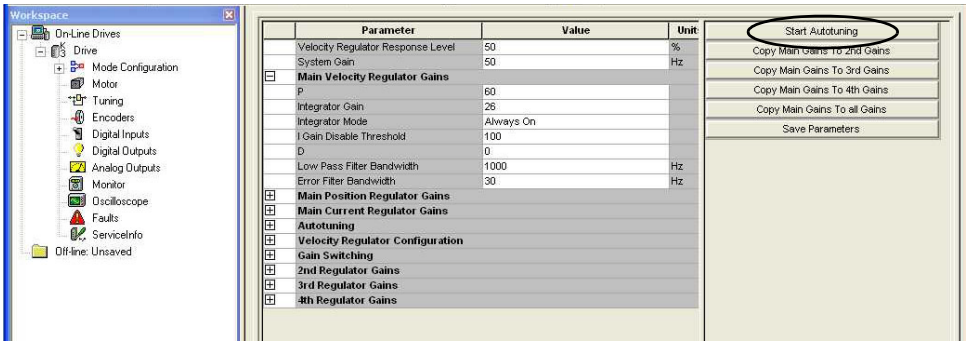
2. Click Start Autotuning.

   The Autotuning warning dialog box appears.

> **ATTENTION:** Autotuning begins even if the drive is disabled.

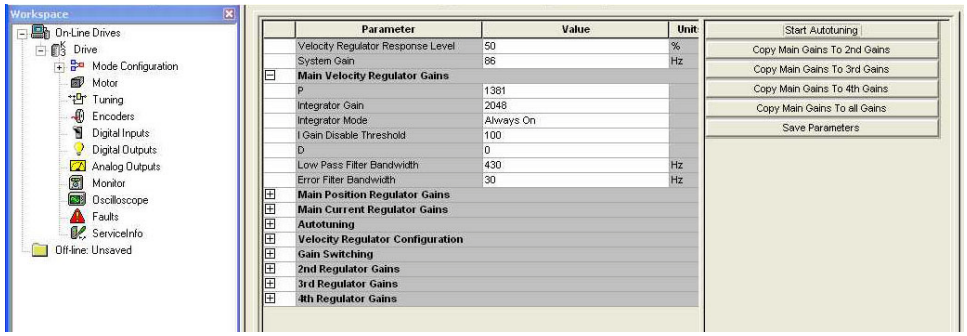
3. If you are ready to Autotune, Click Ok.

   The default Autotune dialog box appears.




4. Click Start Autotune.

   The motor responds and the tuning process is complete. Actual values depend on your application.



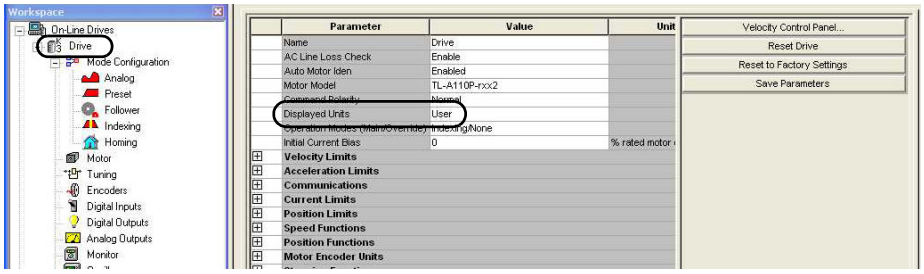

5. Copy the Main Gains to alternate gains as needed, repeat, and then close the Tuning properties dialog box.

## Configure Displayed Units

The default value setting for Displayed Units is metric. English units are also an option. For values of your own choosing, select User. User units is similar to setting up an application conversion constant. This is useful when the application requires the use of a transmission or other equipment. For example, if motor encoder activity is being measured in counts and the number of revolutions (rpm) is more meaningful, you can change counts to rpm.

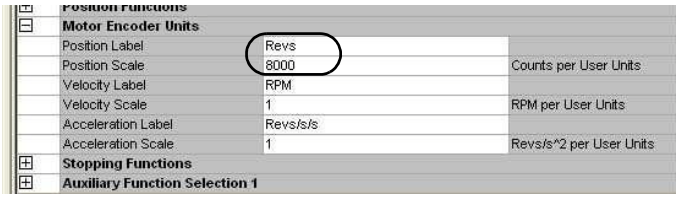
1. Double-click the Kinetix 3 icon under the On-Line Drives tree.

The Kinetix 3 Drive properties dialog box appears.

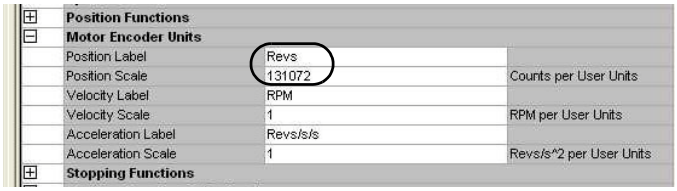



2. Click the Value field next to Display Units and choose User.
3. Click the [+] next to Motor Encoder Units.

Use these parameter settings for an incremental encoder.




Use these parameter settings for a 17-bit serial encoder.




The Indexing parameters now list the position as revs and acceleration/deceleration as revs/sec/sec as defined above. These examples are for rotary motors directly coupled to the machine.

## Test Your Motor (non-indexing move)

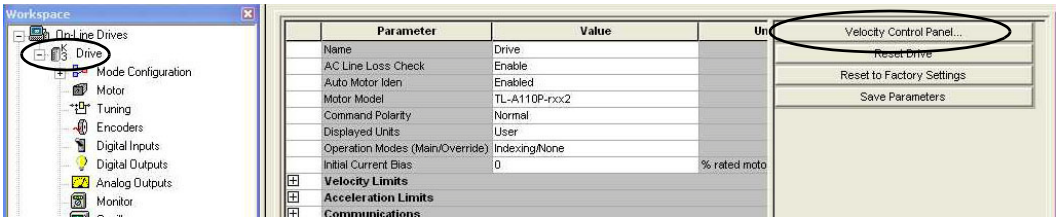
This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, and you have selected a motor. In this procedure you enable the drive and set the motor velocity to test the motor.

Refer to the Ultraware User Manual, publication 2098-UM001, for more information on using the velocity control panel.

Follow these steps to jog the motor at a constant speed.

1. Double-click the Kinetix 3 icon.

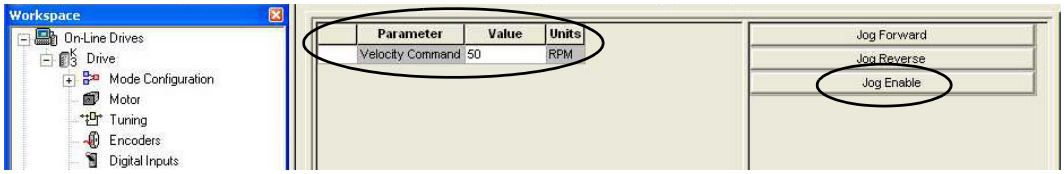
The drive properties dialog box appears.




2. Click Velocity Control Panel.

   The velocity control panel dialog box appears.

3. Click Jog Enable.




4. In the Velocity Command box, enter an appropriate low speed.
5. Press Jog Forward.

   The motor begins turning at the velocity you entered in step 4.

6. Click Disable All.

   The motor stops.

7. Close the velocity control panel.

   The drive is software disabled and the enable icon in the tool bar is no longer illuminated.

## Test Your Motor (indexing move)

This procedure assumes you have applied power to your drive, the Ultraware software is running, the drive is detected, the drive is set to user defined units of Revs, and you have selected a motor. In this procedure you enable the drive and make an incremental move to test the motor. The drive needs to be in indexing mode for testing an indexing move.

Refer to the Ultraware Software User Manual, publication 2098-UM001, for more information on using the indexing control panel.

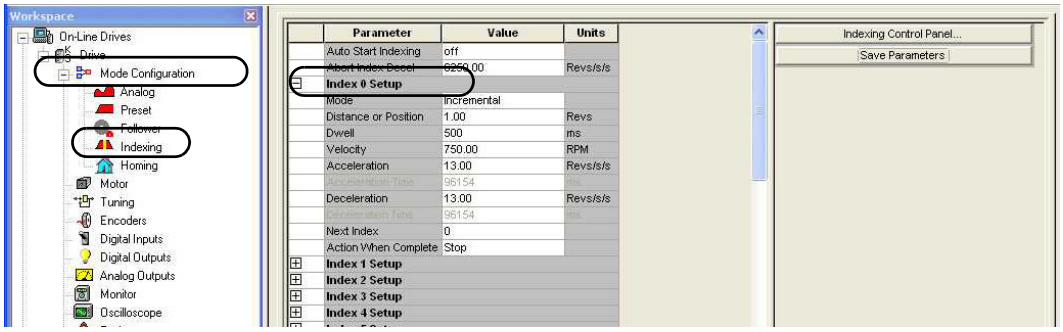
Follow these steps to test your motor.

1. Double-click the Kinetix 3 icon.

   The drive properties dialog box appears.

2. Expand the Mode Configuration branch and double-click Indexing.

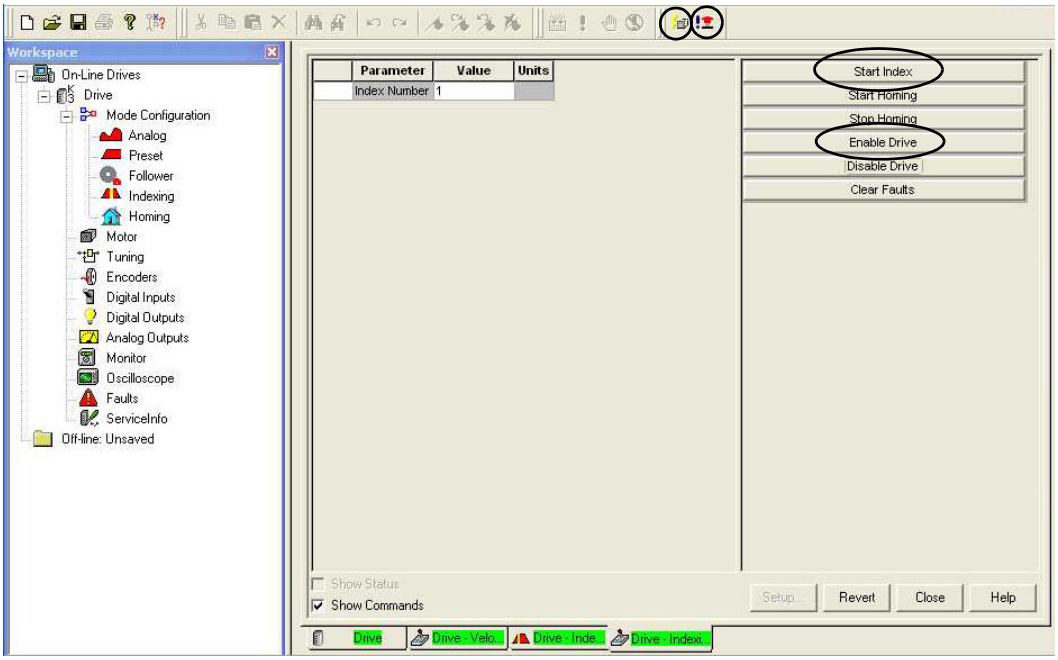
The Indexing Setup dialog box appears.




3. Expand Index 0 Setup.
4. Configure your incremental move with these values for Index 0:
   - Mode = Incremental
   - Distance = 1.0 Revs
   - Dwell = 500 ms
   - Velocity = 750 rpm
   - Acceleration = 13 Rev/s$^2$
   - Deceleration = 13 Rev/s$^2$
   - Next Index = 0
   - Action When Complete = Stop

   In this example, the Bulletin TL motor uses a 17-bit serial encoder, with 131,072 counts per revolution. Because the user units were already defined as 131,072 units per revolution, the distance here can be entered as 1.0 Revs. If you use a Bulletin TLY motor with an incremental encoder use 8,000 counts per revolution.

5. Click Indexing Control Panel in the drive properties dialog box.




6. Click Enable Drive.
7. Click Software Enable to the depressed position.
8. Click Start Index.
9. Close the indexing control panel dialog box.

   The drive is software disabled and the tool bar Enable icon is no longer on.
10. Close the Indexing mode dialog box.

## Notes:

# Maintain and Troubleshoot Your Kinetix 3 Servo Drive



## Safety Precautions

Observe the following safety precautions when troubleshooting your Kinetix 3 drive

**SHOCK HAZARD:** DC bus capacitors can retain hazardous voltages after input power has been removed. Before working on the drive, measure the DC bus voltage to verify it has reached a safe level or wait the full time interval listed on the drive warning label. Failure to observe this precaution could result in severe bodily injury or loss of life.

**ATTENTION:** Do not attempt to defeat or override the drive fault circuits. You must determine the cause of a fault and correct it before you attempt to operate the system. 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.

**SHOCK HAZARD:** 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.

## Maintaining Your Kinetix 3 Drive

The Kinetix 3 is designed to function with a minimum of maintenance.

Consider these guidelines to maintain your Kinetix 3 drive:

- Clean the drive periodically, by using an OSHA approved nozzle that provides compressed air under low pressure, less than 20 kPa (30 psi), to blow the exterior surface and the vents clean.
- Visually inspect all cables for abrasion.
- Inspect cable connectors for proper seating and signal continuity end-to-end.

## General Troubleshooting

Refer to the Fault Codes section below to identify anomalies, potential causes, and appropriate actions to resolve the anomalies. If anomalies persist after attempting to troubleshoot the system, please contact your Allen-Bradley representative for further assistance. To determine if your Kinetix 3 drive has an error, refer to the table immediately below.

| If the Main Power and Control Power Status Indicators are ON and the Status Display on the Drive is | Then |
|---|---|
| Displays 'rdy' in the three right-most characters. | The Kinetix 3 drive is ready. |
| Displays 'Pot' or 'not'. | The Kinetix 3 drive encountered an Overtravel Condition and motion restrictions are in effect. |
| Displays a three-digit warning message. | The Kinetix 3 drive is functional, but a drive warning appears.<br>Proceed to the section Warning Messages. |
| Alternates between a three-digit error code and a six-digit text message. | An Kinetix 3 drive error has occurred.<br>Proceed to the section Error Displays. |

### Overtravel Condition

Overtravel displays (see the following table) occur if the drive detects an overtravel condition.

| Overtravel Display | Possible Cause | Action/Solution |
|---|---|---|
|  <br>Positive Overtravel | A Positive Overtravel condition is detected. | Apply motion in a negative direction to move off of overtravel limit switch. |
|  <br>Negative Overtravel | A Negative Overtravel condition is detected. | Apply motion in a positive direction to move off of overtravel limit switch. |

# Fault Codes

The following list of assigned error codes is designed to help you resolve anomalies.

## Warning Messages

Warnings are drive abnormalities that let motor control to continue. Warnings appear on the drive's Status display by using the last three segments of the display to show an abbreviated title.

| Warning Display | Possible Cause | Action/Solution |
|---|---|---|
|  Absolute Encoder Counter Overflow | The Absolute Encoder has exceeded its rotational limit. | Reset the absolute encoder. |
|  Absolute Encoder Battery | Low battery warning, less than 3.2V is being supplied. | Replace battery or verify external power supply. (1) |
|  Power Up Overspeed | Control power is applied to the drive while the motor is in motion. | After verifying motor has stopped, recycle control power. |
|  Over Current Command | Improper setting of analog current scale. | Verify scaling parameter corresponds to analog signal range. |
| | System cannot meet motion profile. | • Verify velocity loop tuning.<br>• Verify system sizing. |
| | Incorrect current limit settings. | Verify current limits do not restrict current to less than system capabilities. |
|  Over Speed Command | Improper setting of analog velocity scale. | Verify scaling parameter corresponds to analog signal range. |
| | System cannot meet motion profile. | • Verify position loop tuning.<br>• Verify system sizing. |
|  Digital I/O Assignment | Inappropriate assignment of digital inputs or outputs. | • If operated in preset mode, verify presets are assigned.<br>• If operated in a normal/override mode, verify the override function is assigned. |
|  Motor Over Rated Output Power | Motor rating larger than drive rating. | Match motor and drive sizing. |

(1) Battery replacement causes loss of absolute position. Homing can be necessary.

## Error Displays

Errors are serious abnormalities that cause loss of motor control. The Error display alternates between a three-digit error code and a six-digit text message. The error displays repeat until the anomaly is cleared.

**Table 35 - Error Displays**

| Error Code | Text Message | Possible Cause | Action/Solution |
|---|---|---|---|
| E.0004 | E.MtrOt | Motor thermal switch trips due to:<br>• High motor ambient temperature.<br>• Excessive current. | • Operate within (not above) the continuous torque rating for the ambient temperature.<br>• Lower ambient temperature, or increase motor cooling. |
| Motor Overtemperature | | Motor wiring error. | Check motor wiring. |
| | | Incorrect motor selection. | Verify the proper motor has been selected. |
| E.0005 | E.IPMFt | Motor power cables shorted. | Verify continuity of motor power cable and connector. |
| IPM Error | | Motor winding shorted internally. | Disconnect motor power cables from the motor. If the motor is difficult to turn by hand, it can need to be replaced. |
| | | Operation above continuous power rating. | • Verify ambient temperature is not too high.<br>• Operate within the continuous power rating.<br>• Reduce acceleration rates. |
| | | Drive has a bad IPM output, short circuit, or overcurrent. | Remove all power and motors connections, then perform a continuity check from the DC bus to the U, V, and W motor terminals. If continuity exists, check for wire strands between terminals, or replace the drive. |
| E.0009 | E.UduLG | Low AC line/AC power input. | • Verify voltage level of the incoming AC power.<br>• Check AC power sources for glitches or line drop.<br>• Install uninterruptible power supply (UPS) on the AC input. |
| Bus Undervoltage | | Attempted to enable drive without main power active. | Apply main power before enabling drive. |
| E.0010 | E.OvoltG | Excessive regeneration of power (that is when the motor is driven by an external mechanical force, it can regenerate too much peak energy through the drive's power supply and the drive faults to save itself from an overload.) | • Verify shunt circuit.<br>• Adjust motion profile to stay within the range of the regenerative resistor.<br>• Replace regenerative transistor.<br>• Replace the drive. |
| Bus Overvoltage | | Excessive AC input voltage. | Verify input is within specification. |
| E.0012 | E.HFAIL | Homing is not complete within the time defined in Homing time limit (IN-01.11) is elapsed. | • Increase the time defined in Homing time limit (IN-01.11).<br>• Set a value other than '0' in Homing Velocity (IN-01.02) and Creep Velocity (IN-01.03).<br>• Check if there is any obstacle that disturbs Homing.<br>• Check mechanical parts and parameter settings for Homing. |
| Home Search Failed | | | |
| E.0018 | E.OvSPd | Motor speed exceeds maximum. | • Confirm encoder wiring.<br>• Retune drive system.<br>• Verify input gain of external speed or torque command. |
| Motor Overspeed | | | |
| E.0019 | E.PoSEr | Position error exceeds permitted value. | • Increase following error limit.<br>• Check position loop tuning. |
| Excess Position Error | | | |

**Table 35 - Error Displays (continued)**

| Error Code | Text Message | Possible Cause | Action/Solution |
|---|---|---|---|
| E.022 | E.CnoL | The internal filter protecting the motor from overheating has tripped. | • Reduce acceleration rates.<br>• Reduce duty cycle (ON/OFF) of commanded motion.<br>• Increase time permitted for motion.<br>• Use larger drive and motor.<br>• Check tuning. |
| Motor Continuous Current Overload | | | |
| E.023 | E.drvoL | The motion application requires average drive current in excess of rated capability. | • Reduce acceleration rates.<br>• Reduce duty cycle (ON/OFF) of commanded motion.<br>• Increase time permitted for motion.<br>• Use larger drive and motor.<br>• Check tuning. |
| Drive Overload | | | |
| E.028 | E.EnCdE | Encoder not programmed correctly. | Replace motor. |
| Encoder Data Range Error | | Encoder memory corrupted. | |
| E.030 | E.EnCoP | Communication not established with an intelligent encoder. | • Verify motor selection if it does not support automatic identification.<br>• Verify the motor supports automatic<br>• identification.<br>• Verify encoder wiring. |
| Encoder Cable Open | | Hall error. | |
| E.031 | E.EnCPE | Encoder not programmed correctly. | Replace motor. |
| Encoder Data Parameter Error | | Encoder memory corrupted. | |
| E.036 | E.drvot | Excessive heat exists in the drive. | • Verify cooling fan operation (catalog numbers 2071-AP8, 2071-A10, and 2071-A15 only).<br>• Check tuning.<br>• Reduce acceleration rate.<br>• Reduce duty cycle (ON/OFF) of commanded motion.<br>• Increase time permitted for motion.<br>• Use larger drive and motor. |
| Drive Overtemperature | | | |
| E.037 | E.ACoFF | Poor quality power. | • Increase Ride Through time. |
| AC Line Loss | | Attempted to enable drive without main power active. | • Apply main power before enabling drive. |
| | | Phase connection missing. | • Remove power and verify all physical connections. |
| | | Fault Delay parameter is set too short. | • Increase the Fault Delay parameter setting. |
| E.053 | E.PiniT | Error in parameter memory storage. | • Reinitialize parameter.<br>• Reset drive to factory defaults. |
| User Parameter Initialization Error | | | |
| E.054 | E.oFSEt | Defective hardware. | Replace the drive. |
| Current Feedback Offset | | | |
| E.055 | E.CHSUM | Checksum error. | • Confirm and reset parameter.<br>• Reset drive to factory defaults. |
| User Parameter Checksum Error | | | |
| E.056 | E.CPUFt | Excessive electrical noise. | Verify wiring, grounding and bonding. |
| Watchdog Timeout | | Defective hardware. | Replace the drive. |
| E.057 | E.HWArE | Defective hardware. | Replace the drive. |
| PWM Hardware Error | | | |

**Table 35 - Error Displays (continued)**

| Error Code | Text Message | Possible Cause | Action/Solution |
|---|---|---|---|
| E.0058 | E.rAnGE<br>User Parameter Range Error | Range of parameter is invalid. | • Enter parameter with a value or values within range.<br>• Reset drive to factory defaults. |
| E.0060 | E.dInIt<br>Drive Initialization Error | Hardware error. | Replace the drive. |
| E.0075 | E.SHtoL<br>Shunt Overload Protection | Power at regenerative resistor exceeds the permitted value. | Adjust motion profile to stay within the range of the regenerative resistor. |
| | | Shunt resistor is disconnected or damaged. | • Verify resistor connection.<br>• Verify resistance of shunt resistor. |
| E.0079 | E.SHtoC<br>Shunt Overcurrent Protection | Shunt current exceeded allowable instantaneous value. | • Verify shunt is not shorted or damaged.<br>• Verify load energy is not excessive during deceleration. |
| E.0083 | E.AbSbE<br>Absolute Encoder Battery Error | Encoder Backup Battery parameter is set to installed, but a battery is not installed. | Set Encoder Backup Battery parameter to Not Installed. |
| | | Battery voltage is sensed below 2.7V DC. | • Confirm battery voltage and connection.<br>• Replace battery. |
| E.0084 | E.AbSoS<br>Absolute Encoder Overspeed | Battery powered encoder is mechanically rotated at high speed while drive is powered down. | • Mechanically disengage motor from system.<br>• Cycle power to drive and reset alarm. |
| E.0085 | E.AbSCE<br>Absolute Encoder Multi-turn Count Error | Electrical noise in the encoder. | Cycle power to drive and reset alarm. |
| | | Defective encoder. | Replace motor. |
| E.1001 | E.SEtUP<br>Drive Set Up | The drive operating mode and motor selection are incompatible. | Change the operating mode and/or the motor selection, and reset the drive. |
| E.1017 | E.CAbLE<br>Motor Power Cable Open | Motor cable open. | Verify power connection between motor and drive. |
| E.1021 | E.InSOL<br>Motor Instantaneous Current Overload | Motion profile requires a peak current for an excessive time interval. | • Verify motor wiring.<br>• Adjust accel/decel time.<br>• Confirm motor selection. |
| | | Defective current feedback sensing. | Verify phase currents. |
| E.1031 | E.MAtCH<br>Motor Mismatch | Dynamic braking current of the selected motor exceeds twice the drive peak current rating. | Install a different motor. |
| E.1051 | E.EnCtP<br>Encoder Type Mismatch | Motor encoder signals do not match drive configuration. | Verify motor selection. |
| | | Defective encoder. | Replace motor. |
| E.1056 | E.EnCCE<br>Encoder Communication Error | Wiring between drive and encoder is faulty or disconnected, or EMI (noise) disrupts encoder signals. | • Verify encoder wiring. |
| E.1071 | E.SErCE<br>Special Communication Error | Communication error between host and drive (noise). | • Verify serial cable.<br>• Check for noise on serial communication interface. |
| E.1081 | E.CJFrE<br>Position Command Frequency Error | Input frequency limit exceeded. | • Verify hardware type selected in the drive matches the physical hardware.<br>• Change from open collector to line drive.<br>• Reduce the speed command.<br>• Apply gearing. |

**Table 35 - Error Displays (continued)**

| Error Code | Text Message | Possible Cause | Action/Solution |
|---|---|---|---|
| E.112 | E.EStoP<br>Emergency Stop | Emergency stop (E-STOP) signal detected. | • Remove Emergency stop conditions.<br>• Clear E-STOP. |
| E.113 | E.IrAnG<br>Index Position Range Overflow | The value of a Position Parameter for indexing is out of the range. | • Use a value within the range of $-2^{31}\ldots+2^{31}$. |
| E.114 | E.ouCUr<br>Motor Phase Over Current | • Anomaly with control or main power circuitry if this error occurs when power is turned on.<br>• Excessive current to the motor if this error occurs during operation (current more than 300% of the rated current to the motor more than 10 ms). | • Check wiring and power.<br>• Check power and set/adjust acceleration/ decceleration time. |
| E.027 | E.notHM<br>Axis Not Homed | A user tries any indexing without Homing operation completed. | Complete homing before indexing |

## Notes:

# Interconnect Diagrams

This appendix provides wiring examples and system block diagrams for your Kinetix 3 drive system components.

## Interconnect Diagram Notes

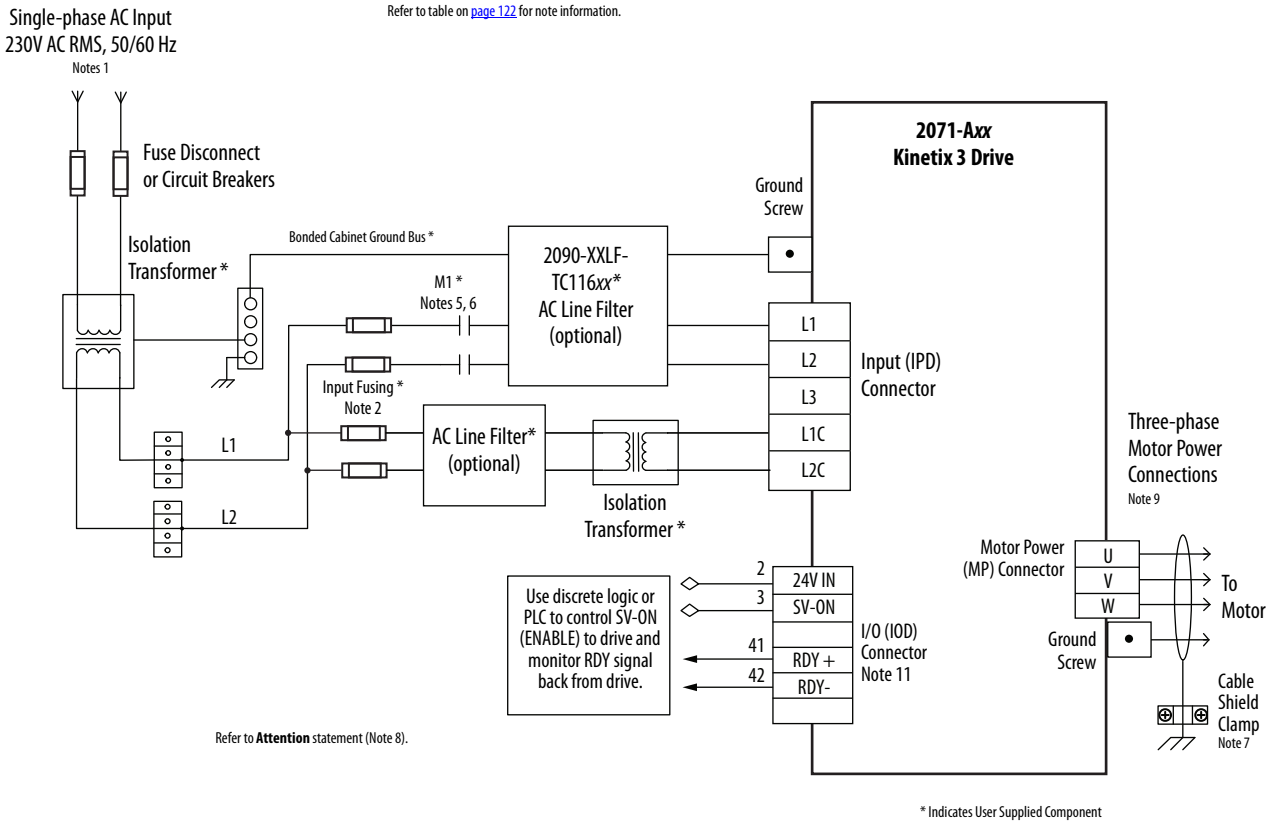
This appendix provides wiring examples to assist you in wiring the Kinetix 3 system. The notes below apply to the wiring examples on the pages that follow.

| Note | Information |
|---|---|
| 1 | For power wiring specifications, refer to Power Wiring Requirements on page 61. |
| 2 | For input fuse sizes, refer to Fuse/Contactor Specifications 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, refer to Kinetix Servo Drives Specifications Technical Data, publication GMC-TD003. |
| 4 | Terminal block is required to make connections. Configure one pair from the Digital OUTPUT1. . . OUTPUT3, pins 41. . .44 or pins 47 and 48, as Brake in Ultraware software. For Digital Output specifications, refer to page 44. |
| 5 | Contactor coil (M1) needs integrated surge suppressors for AC coil operation. Refer to Fuse/Contactor Specifications on page 19. |
| 6 | 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. |
| 7 | Cable shield clamp must be used to meet CE requirements. No external connection to ground is required. |
| 8 |  **ATTENTION:** Implementation of safety circuits and risk assessment is the responsibility of the machine builder. Please reference international standards EN 1050 and EN 954 estimation and safety performance categories. For more information refer to Understanding the Machinery Directive, publication SHB-900. |
| 9 | For motor cable specifications, refer to the Kinetix Motion Control Selection Guide, publication GMC-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 | Digital Input 1 configured as SV-ON (Enable), Digital Output 1 configured as RDY (Ready). |

## 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.

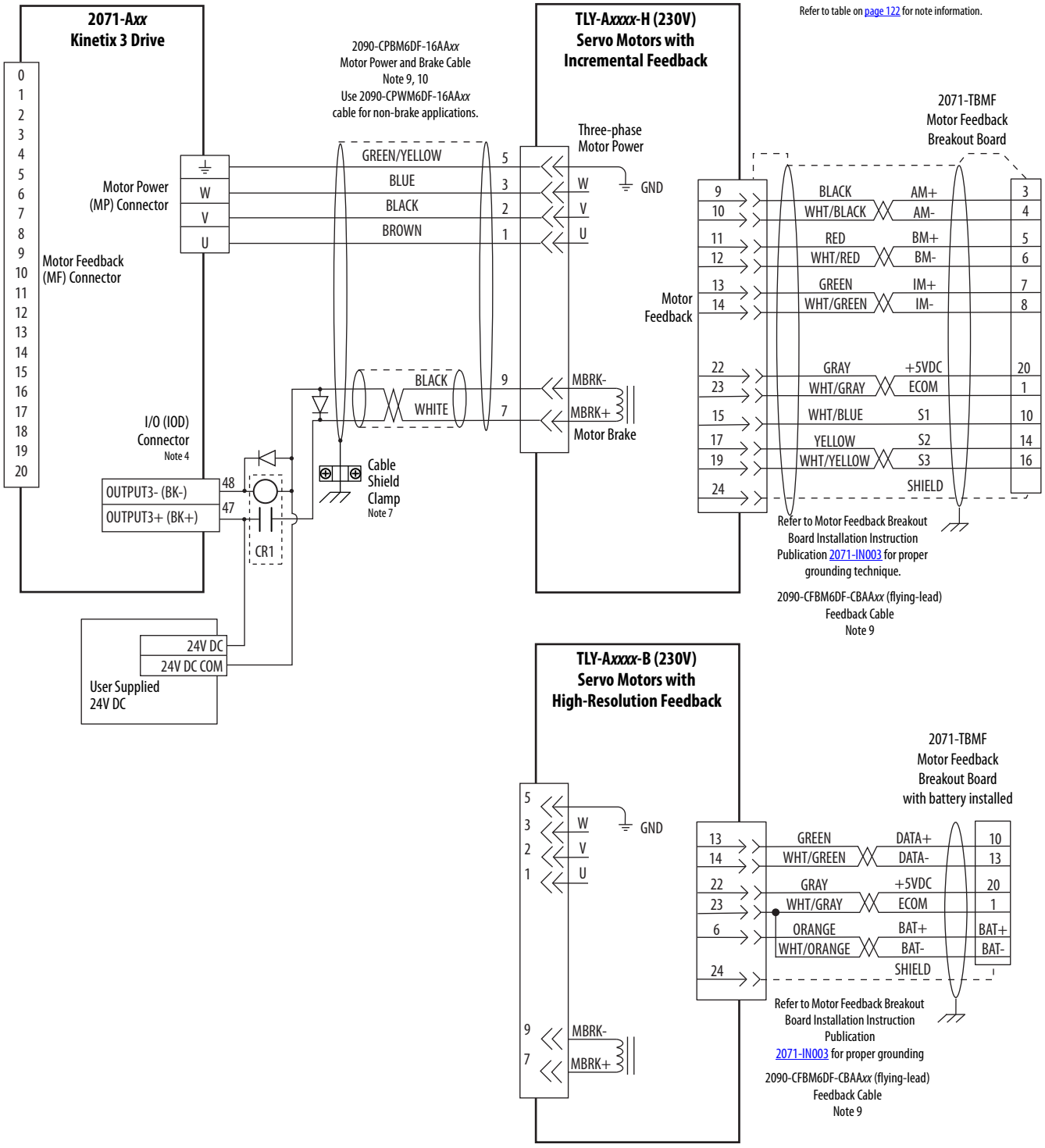
**Figure 50 - Kinetix 3 Drive Wiring Example (230V single-phase input power)**



# Kinetix 3 Drive/Rotary Motor Wiring Examples

These wiring diagrams apply to Kinetix 3 drives with compatible rotary motors.

**Figure 51 - Kinetix 3 Drive (230V) Wiring Example with TL-Series (TLY-A) Motors**



## Kinetix 3 Drive/Linear Motor and Actuator Wiring Examples

These wiring diagrams apply to Kinetix 3 drives with compatible actuators and linear motors.

**Figure 52 - Kinetix 3 Drive (230V) Wiring Example with MP-Series (Bulletin MPAS-A) Linear Stages, LDAT-Series Linear Actuators, and LDC-Series, LDL-Series Linear Motors**

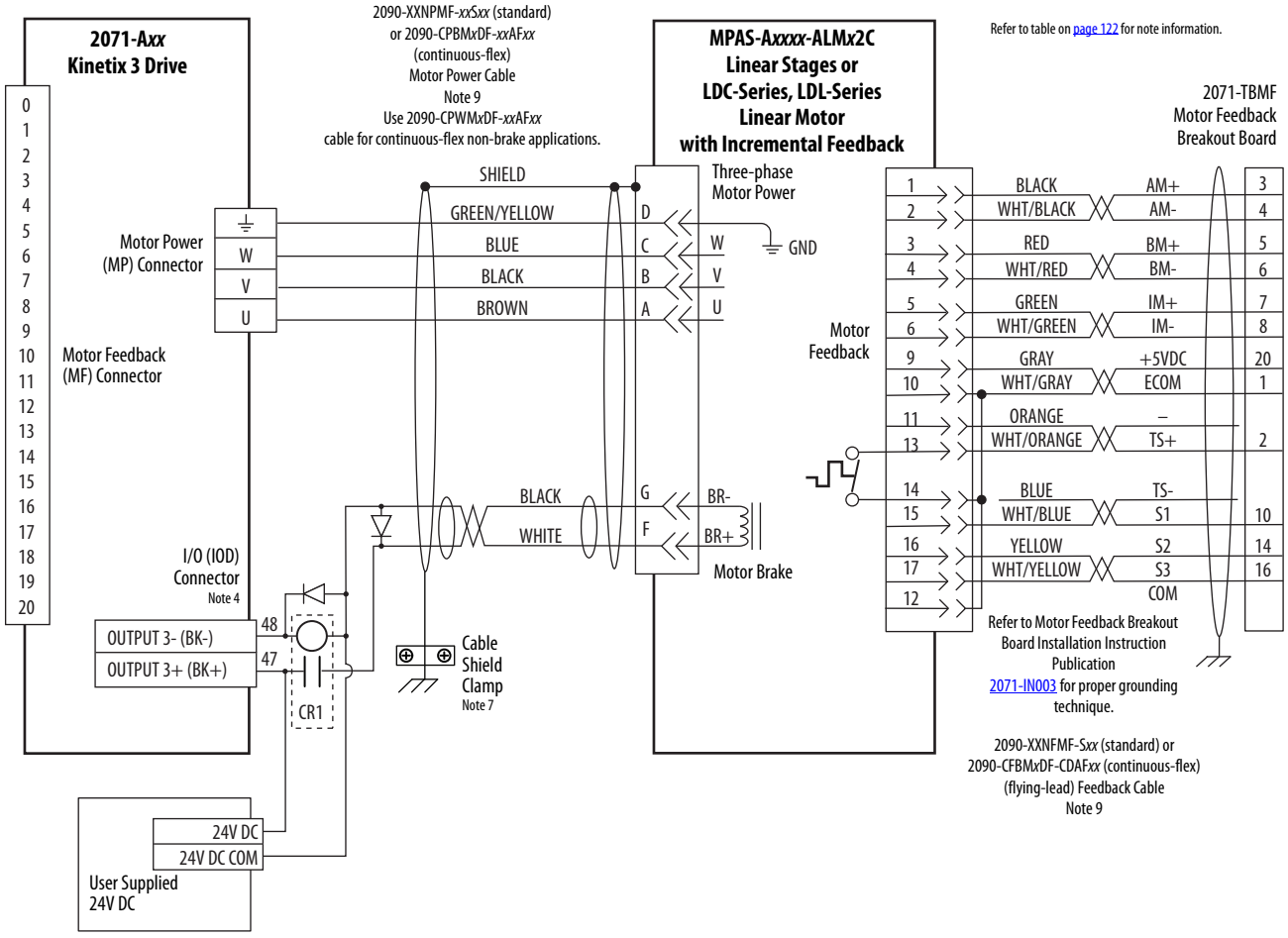
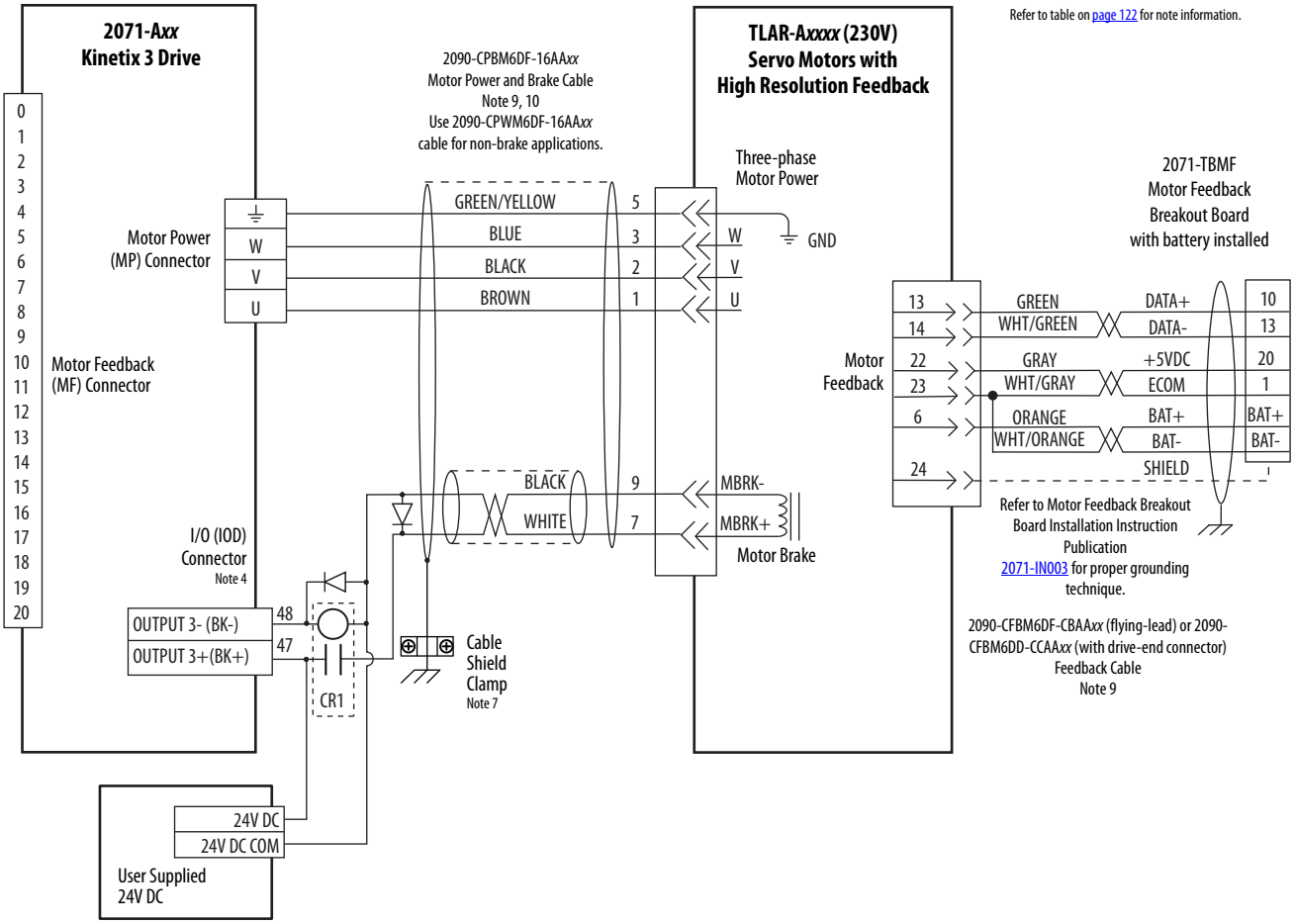


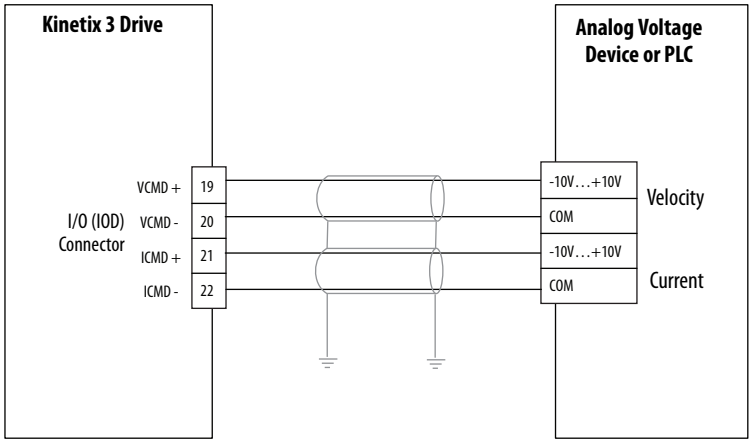
**Figure 53 - Kinetix 3 Drive (230V) Wiring Example with TL-Series (TLAR) Electric Cylinders**



## Kinetix 3 Drive and MicroLogix Controller Wiring Examples

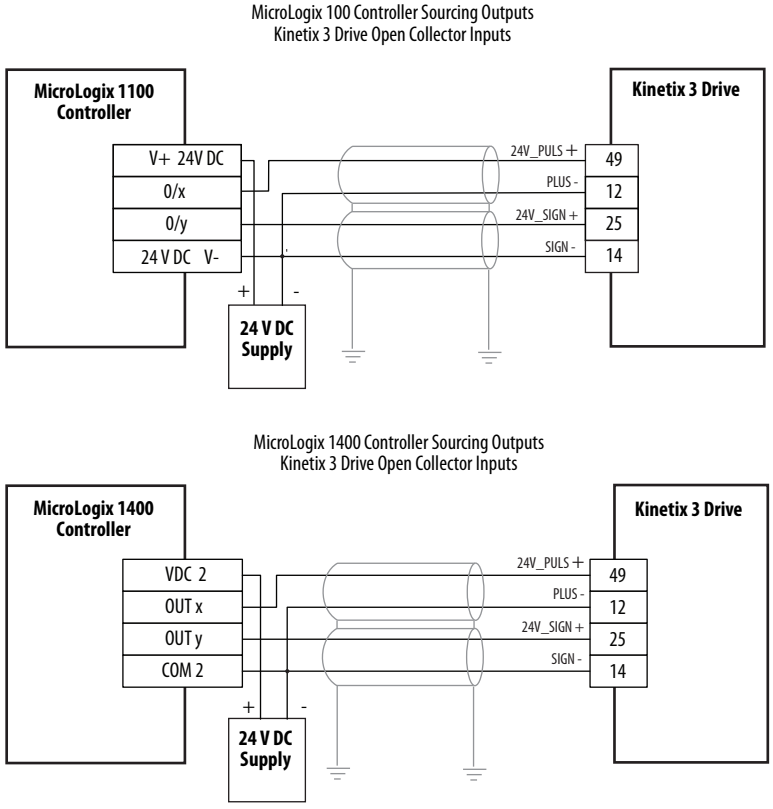
The Kinetix 3 drive accepts unipolar or bipolar inputs.

**Figure 54 - Kinetix 3 Drive Wiring Example to Analog Voltage Device**



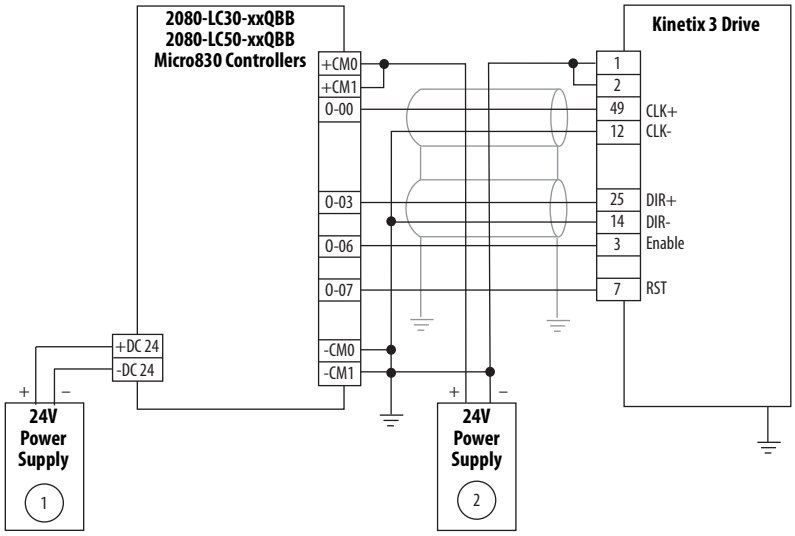

Commons must not be tied together. Use one control at a time. Choose either velocity or current control.

**Figure 55 - Kinetix 3 Drive Wiring for Pulse Train Output**



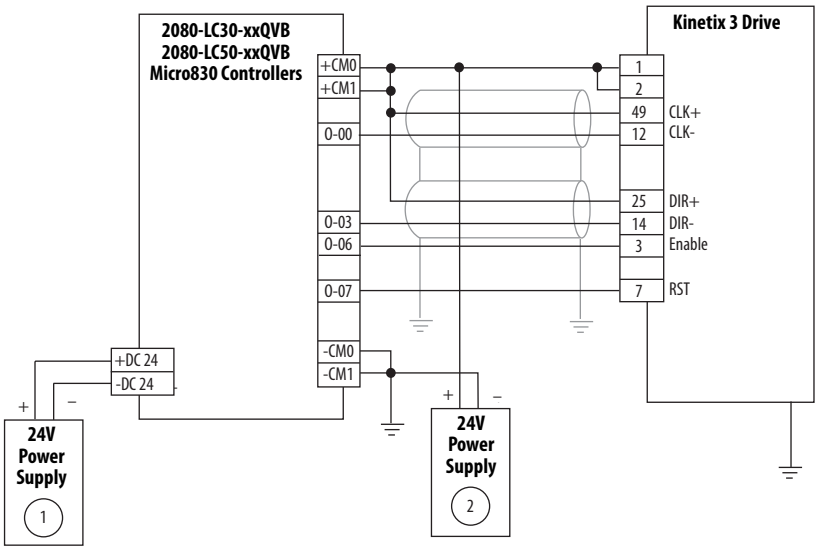
# Kinetix 3 Drive and Micro830 Controller Wiring Examples

**Figure 56 - Kinetix 3 Drive and 2080-LCxx-xxQBB Micro830 Controller**




Drive Enable (Pin 3) and Reset Drive (Pin 7) operates as sinking inputs when (Pin 1, 2) connected to + of the Power Supply 2.
Drive Enable (Pin 3) and Reset Drive (Pin 7) operate as sourcing inputs when (Pin1,2) connected to – of the Power Supply 2.
To help you configure Kinetix 3 drive parameters so the drive can communicate and be controlled by a Micro830 or Micro850 controller, see publication CC-QS025.

**Figure 57 - Kinetix 3 Drive and 2080-LCxx-xxQBB Micro830 Controller**




Drive Enable (Pin 3) and Reset Drive (Pin 7) operates as sinking inputs when (Pin 1, 2) connected to + of the Power Supply 2.
Drive Enable (Pin 3) and Reset Drive (Pin 7) operates as sourcing inputs when (Pin1,2) connected to – of the Power Supply 2.
To help you configure Kinetix 3 drive parameters so the drive can communicate and be controlled by a Micro830 or Micro850 controller, see publication CC-QS025.

## Motor Brake Currents

Use these values to size the interposing relay required for your application.

**Table 36 - Motor Brake Coil Currents Rated at < 1.0 A**

| Compatible Brake Motors/Actuators | Coil Current |
|---|---|
| TL/TLY-A110, TL/TLY-A120, and TL/TLY-A130 | 0.18…0.22 A |
| TL/TLY-A220 and TL/TLY-A230 | 0.33…0.41 A |
| TL/TLY-A2530, TL/TLY-A2540, and TL/TLY-A310 | 0.35…0.43 A |

## Notes:

## Symbols



## Numerics



## A



## B



## C



## D



## E



## F



## G

## H



## I



## K



## L



## M



## N



## P



## R



## S

## T



## U



## W

## Rockwell Automation Support

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

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

### Installation Assistance

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

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

### New Product Satisfaction Return

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

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

## Documentation Feedback

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

Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

**www.rockwellautomation.com**

**Power, Control and Information Solutions Headquarters**

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 2071-UM001E-EN-P - November 2013
Supersedes Publication 2097-UM001D-EN-P - October 2013