

## Kinetix Safe Torque-off Feature

Catalog Numbers 2094-ACxx-Mxx-S, 2094-BCxx-Mxx-S, 2094-AMxx-S, 2094-BMxx-S, 2099-BMxx-S



Original Instructions

## Important User Information

Solid-state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (publication [SGI-1.1](#) available from your local Rockwell Automation® sales office or online at <http://www.rockwellautomation.com/literature/>) describes some important differences between solid-state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid-state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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

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

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



**WARNING:** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



**ATTENTION:** Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.



**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.

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**IMPORTANT**

Identifies information that is critical for successful application and understanding of the product.

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This manual contains new and updated information.

### New and Updated Information

This revision includes changes for the Kinetix 6000 series C servo drives.

Topic	Page
Updated references to safe-off (SO) as safe torque-off (STO), per EN 61800-5-2.	Throughout this manual
Replaced references to EN 954-1 with EN ISO 13849-1.	
Updated safe torque-off descriptive text, including certification, description of operation, and PFD/PFH definitions and data.	9...12
Updated European Union Directives and moved from chapter 3 to chapter 1.	10
Updated Safe Torque-off Interface Cables table with 1202-C30, 3 m (9.8 ft) cable.	20
Added Safe Torque-off Headers table.	
Added safe torque-off specifications for Kinetix 6000 (series C) drives.	30
Added EC Certifications appendix that includes examination certificate and declaration of conformity for Kinetix 6000 and Kinetix 7000 drives.	43

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## About This Publication

This manual provides detailed installation instructions for wiring and troubleshooting your Kinetix 6000 and Kinetix 7000 safe torque-off drives. Included are interconnect diagrams with Allen-Bradley safety relays, GuardLogix controllers, and GuardPLC controllers.

## Audience

This manual is intended for engineers or technicians directly involved in the installation and wiring of the Kinetix 6000 and Kinetix 7000 drives, and programmers directly involved in the operation, field maintenance, and integration of the Kinetix 6000 and Kinetix 7000 drives in a safe torque-off application.

If you do not have a basic understanding of the Kinetix 6000 and Kinetix 7000 drives, contact your local Rockwell Automation sales representative for information on available training courses.

## Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.
- **Bold** type is used for emphasis.

## Terminology

This table defines acronyms used throughout this manual.

Acronym	Full Term	Definition
EN	European Norm	European Standards (EN specifications) developed by the European Committee for Standardization for the European Union.
ISO	International Organization for Standardization	Voluntary organization whose members are recognized authorities on standards, each one representing a different country.
IEC	International Electrotechnical Commission	Non-profit, non-governmental international standards organization that prepares and publishes international standards for all electrical, electronic, and related technologies, collectively known as electrotechnology.
PL	Performance Level	EN ISO 13849-1 safety rating.
SIL	Safety Integrity Level	The measure of a products ability to lower the risk that a dangerous failure could occur.
PFD	Probability of Failure on Demand	The average probability of a system to fail to perform its design function on demand.
PFH	Probability of Failure per Hour	The probability of a system to have a dangerous failure occur per hour.
HFT	Hardware Fault Tolerance	Equals N, where N+1 faults could cause the loss of the safety function. A hardware fault tolerance of 1 means that 2 faults are required before safety is lost.
STO	Safe Torque-off	Functional safety feature that complies with IEC 61800-5-2.
IGBT	Insulated Gate Bi-polar Transistors	Typical power switch used to control main current.

## Additional Resources

These documents contain additional information concerning related Rockwell Automation products.

Resource	Description
Kinetix 6000 Multi-axis Servo Drive User Manual, publication <a href="#">2094-UM001</a>	Detailed mounting, wiring, setup with RSLogix 5000 software, applying power, and troubleshooting information, with appendices to support firmware upgrades, common bus applications, and Bulletin 2090 resistive brake module (RBM) applications.
Kinetix 7000 High Power Servo Drive User Manual, publication <a href="#">2099-UM001</a>	Detailed mounting, wiring, setup with RSLogix 5000 software, applying power, and troubleshooting information, with an appendix to support firmware upgrades.
DeviceNet Modules in Logix5000 Control Systems User Manual, publication <a href="#">DNET-UM004</a>	Information on controlling devices on the DeviceNet network.
DeviceNet Safety User Manual, publication <a href="#">1791DS-UM001</a>	Information on installing and configuring the 1791DS Series modules.
System Design for Control of Electrical Noise Reference Manual, publication <a href="#">GMC-RM001</a>	Information, examples, and techniques designed to minimize system failures caused by electrical noise.
EMC Noise Management DVD, GMC-SP004	
Rockwell Automation Configuration and Selection Tools website, website <a href="http://ab.com/e-tools">http://ab.com/e-tools</a>	Online product selection and system configuration tools, including AutoCAD (DXF) drawings.
Rockwell Automation Product Certification, website <a href="http://rockwellautomation.com/products/certification">http://rockwellautomation.com/products/certification</a>	For declarations of conformity (DoC) currently available from Rockwell Automation.
Safety Products Catalog, website <a href="http://ab.com/catalogs">http://ab.com/catalogs</a>	Information regarding Allen-Bradley safety products.
Application Considerations for Solid-State Controls, publication <a href="#">SGI-1.1</a>	A description of important differences between solid-state programmable controller products and hard-wired electromechanical devices.
Safety of Machinery - Safety Related Parts of Control Systems, standard EN 954-1	Safety requirements and guidance on the principles for the design of safety related parts of control systems.
Functional Safety of Electrical/Electronic/Programmable Electronic Safety-related Systems, standard IEC 61508	Aspects to be considered when electrical/electronic/programmable electronic systems are used to carry out safety functions.
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 <a href="#">AG-7.1</a>	A glossary of industrial automation terms and abbreviations.

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



## Safety Concept and Troubleshooting

This chapter introduces you to how the safe torque-off feature meets the requirements of Performance Level e (PLe) and safety category 3 (CAT 3) per EN ISO 13849-1 and SIL 3 per IEC 61508, EN 61800-5-2 and EN 62061.

This chapter also provides a troubleshooting table and flowchart for understanding the Safe Torque-off mode.

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### Certification

The TÜV Rheinland group has approved the Kinetix 6000 and Kinetix 7000 servo drives for use in safety-related applications up to EN ISO 13849-1 Performance Level e (PLe) and category 3, SIL 3 per IEC 61508, EN 61800-5-2 and EN 62061, in which removing the motion-producing power is considered to be the safe state.

To view the certificate, refer to [EC Type - Examination Certificate](#) on [page 43](#).

### Important Safety Considerations

You are responsible for the following:

- Validation of any sensors or actuators connected to the system
- Completing a machine-level risk assessment
- Certification of the machine to the desired EN ISO 13849-1 performance level or EN 62061 SIL level
- Project management and proof testing

## Category 3 Requirements According to EN ISO 13849-1

Safety-related parts are designed with these attributes:

- A single fault in any of these parts does not lead to the loss of the safety function.
- A single fault is detected whenever reasonably practicable.
- Accumulation of undetected faults can lead to the loss of the safety function, which results in failure to remove motion-producing power from the motor.

## Stop Category Definition

Stop category 0 as defined in EN 60204 or Safe Off as defined by EN 61800-5-2 is achieved with immediate removal of motion-producing power to the actuator.

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

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## European Union Directives

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

### CE Conformity

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

### EMC Directive

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

- EN 61800-3 - Adjustable Speed Electrical Power Drive Systems, Part 3 - EMC Product Standard including specific test methods
- EN 61326-3-1 EMC - Immunity requirements for safety-related systems

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

CE Declarations of Conformity are available online at <http://www.rockwellautomation.com/products/certification> and in [EC Declaration of Conformity](#) on [page 178](#).

## Low Voltage Directive

These units are tested to meet Council Directive 2006/95/EC Low Voltage Directive. The EN 60204-1 Safety of Machinery-Electrical Equipment of Machines, Part 1-Specification for General Requirements standard applies in whole or in part. Additionally, the standard EN 61800-5-1 Electronic Equipment for use in Power Installations apply in whole or in part.

Refer to the Kinetix Servo Drives Specifications Technical Data, publication [GMC-TD003](#), for environmental and mechanical specifications.

## Description of Operation

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

Under normal operation, the safe torque-off inputs are energized. If either of the safety-enable inputs are de-energized, then all of the output power transistors will turn off. The safe torque-off response time is less than 25 ms.



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

## PFD and PFH Specifications

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

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

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

## PFD and PFH Data

These PFD and PFH calculations are based on the equations from IEC 61508 and show worst-case values. [Table 1](#) provides test data and demonstrates the worst-case effect of various configuration changes on the data.

**Table 1 - PFD and PFH Proof Test Interval**

Attribute	Kinetix 6000 Drives	Kinetix 7000 Drives
PFH	0.26 (e-9)	0.38 (e-9)
PFD	0.045 (e-3)	0.027 (e-3)
Proof test interval (years)	20	15

Determination of safety parameters is based on the assumption that the system operates in High Demand mode and that the safety function is requested at least once a year.

PFH and PFD determination was performed without considering external wiring failure modes, as described in EN ISO 13849-2. Depending on the application, consider taking measures to exclude these failure modes.

To proof test the safe torque-off function, you must interrupt power to the safe torque-off function inputs (STO-5 and STO-7) and verify the drive is in the disabled state. Refer to the Safe Torque-off Connector Pinout on [page 15](#), for signal descriptions and pinouts.

## Troubleshooting

The safe-off fault (E49) is detected upon demand of the safe-off function.

**Table 2 - Kinetix 6000 and Kinetix 7000 Safe Torque-off Troubleshooting**

Error Code	Fault Message RSLogix (HIM)	Problem or Symptom	Potential Cause	Possible Resolution
E49	<b>DriveHardFault</b> (Safe-off HW Flt)	Safe-off function mismatch. Drive will not allow motion.	<ul style="list-style-type: none"> <li>Loose wiring at safe torque-off (STO) connector.</li> <li>Cable/header not seated properly in safe torque-off (STO) connector.</li> <li>Safe-off circuit missing +24V DC.</li> </ul>	<ul style="list-style-type: none"> <li>Verify wire terminations, cable/header connections, and +24V.</li> <li>Reset error and run proof test.</li> <li>If error persists, return the drive to Rockwell Automation.</li> </ul>



**ATTENTION:** After troubleshooting, a proof test must be performed to verify correct operation.

## Understanding the Safe Torque-off Condition vs Drive Fault

When both inputs de-energize within 100 ms, a fault does not occur (E49 is not displayed), however, a safe torque-off state is entered within the 25 ms response time. The safe torque-off condition occurs through normal drive operation.

A mismatch occurs when one input is de-energized while the other input is energized after 100 ms. This causes the E49 error code to display and the drive begins a shutdown sequence. Causes for a mismatch include:

- wiring anomalies at the Safe Torque-off (STO) connector, pins STO-5 and STO-7, or the external monitoring relay.
- input anomalies associated with the Safe Torque-off (STO) connector, pins STO-5 and STO-7.
- sequencing errors in the program.
- EMI interference.

To determine if you have a safe torque-off fault or condition, you must examine the `Axis_Servo_Drive` status bit in RSLogix 5000 software.

- If bit status is 0, then no safe torque-off condition or fault exists.
- If bit status is 1, then a safe torque-off condition or fault does exist.

**Figure 1 - RSLogix 5000 Software, Version 15 Safe Torque-off Status Bit**

safe_test2.DriveStatus.11	0	Decimal
safe_test2.DriveStatus.12	0	Decimal
safe_test2.DriveStatus.13	1	Decimal
safe_test2.DriveStatus.14	0	Decimal
safe_test2.DriveStatus.15	0	Decimal

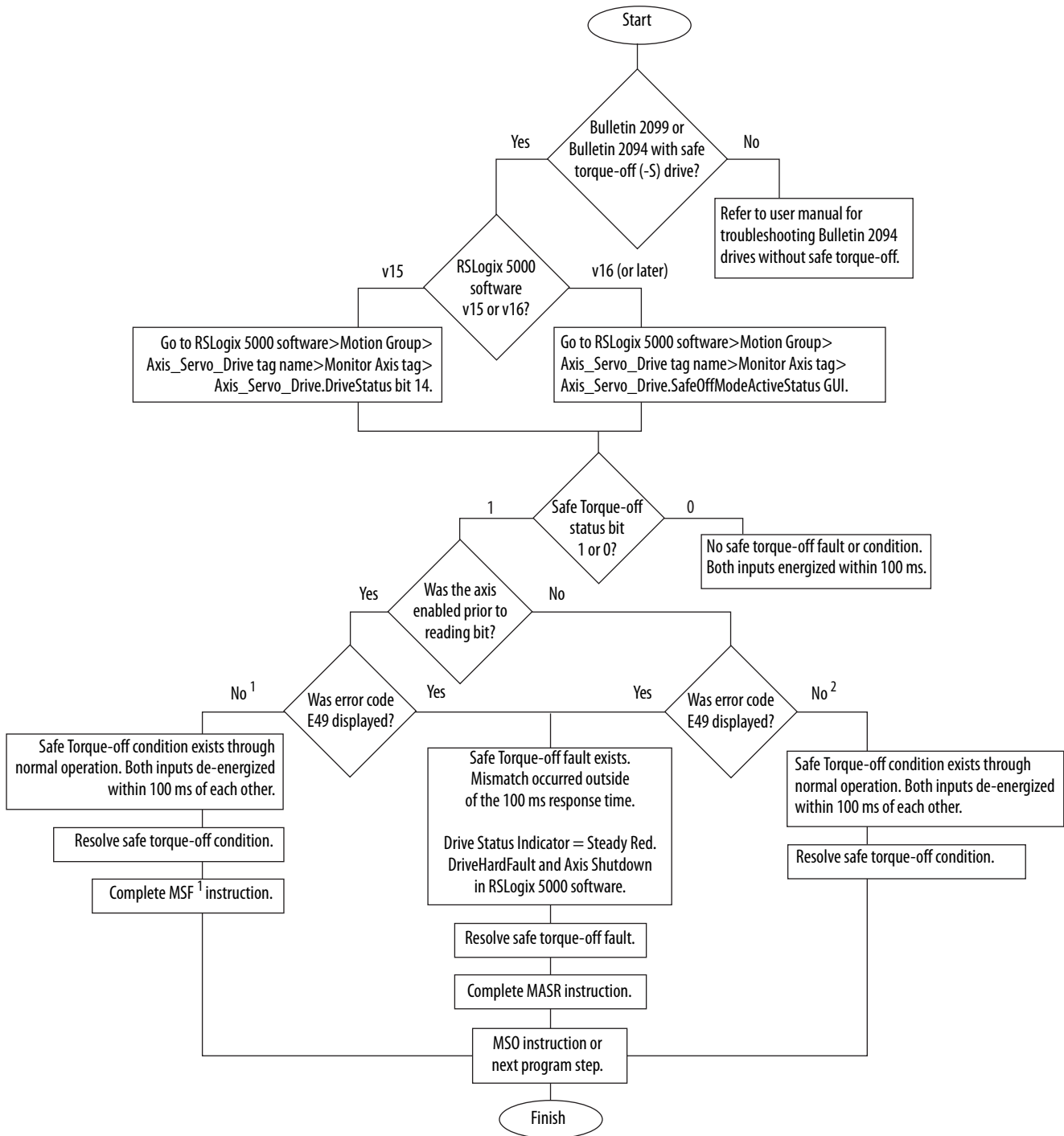
In the RSLogix 5000, version 15 example, the `axis.DriveStatus.14` bit is set to 0, indicating the drive is not in Safe Torque-off mode. No safe torque-off condition or fault exists.

**Figure 2 - RSLogix 5000 Software, Version 16 (or later) Safe Torque-off Status Bit**

safe_test2.NegOvertravellInputStatus	0	Decimal
safe_test2.EnableInputStatus	0	Decimal
safe_test2.AccellLimitStatus	0	Decimal
safe_test2.AbsoluteReferenceStatus	0	Decimal
safe_test2.SafeOffModeActiveStatus	0	Decimal

In the RSLogix 5000, version 16 example, the `axis.SafeOffModeActiveStatus` bit is set to 0, indicating the drive is not in Safe Torque-off mode. No safe torque-off condition or fault exists.

Figure 3 - Advanced Safe Torque-off Troubleshooting Flowchart



- (1) This is a safe torque-off condition because the safe torque-off status bit is set to 1 without an E49 error code. After the condition is fixed, the motion planner must be signaled that the position loop has opened in the condition state with a Motion Servo Off (MSF) instruction before the next Motion Servo On (MSO) instruction can take place. The MSF instruction is necessary because the drive is enabled and running.
- (2) This is also a safe torque-off condition (the safe torque-off status bit is set to 1 without an E49 error code). The safe torque-off condition must be resolved, but because the drive is not enabled and running the MSF instruction is not necessary.

## Safe Torque-off Connector Data

This chapter provides safe torque-off (STO) connector, header, and interface cable information for the Kinetix 6000 and Kinetix 7000 safe torque-off drives.

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### Safe Torque-off Connector Pinout

Headers are available to extend the 9-pin safe torque-off (STO) connector signals for use in wiring single and multiple safe torque-off drive configurations, or to defeat (not use) the safe torque-off function.

**Table 3 - 9-pin Safe Torque-off (STO) Connector**

Safe Torque-off (STO) Connector Pin	Also Applies to These STO Connector Headers	Description	Signal
1	<ul style="list-style-type: none"> <li>Wiring plug header used in single-drive applications</li> <li>First-drive wiring header (2090-XNSM-W) used in multiple-drive applications</li> </ul>	One side of the normally-closed monitoring contact of relay 2	FDBK2+
2		Other side of the normally-closed monitoring contact of relay 2	FDBK2-
3		One side of the normally-closed monitoring contact of relay 1	FDBK1+
4		Other side of the normally-closed monitoring contact of relay 1	FDBK1-
5		Safety enable 2 input	SAFETY ENABLE2+
6		Return for safety enable power (both inputs)	SAFETY ENABLE-
7		Safety enable 1 input	SAFETY ENABLE1+
8	<ul style="list-style-type: none"> <li>Wiring plug header</li> <li>Motion-allowed jumper</li> </ul>	Output power for continuous enable of the safety function, 500 mA, max	24V+
9		Output power return used for continuous enable of safety function	24V_COM

**IMPORTANT** Pins STO-8 (internal 24V+ supply) and STO-9 (24V\_COM) are used only by the motion-allowed jumper to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

Figure 4 - 9-pin Safe Torque-off (STO) Connector - Kinetix 6000 Drive

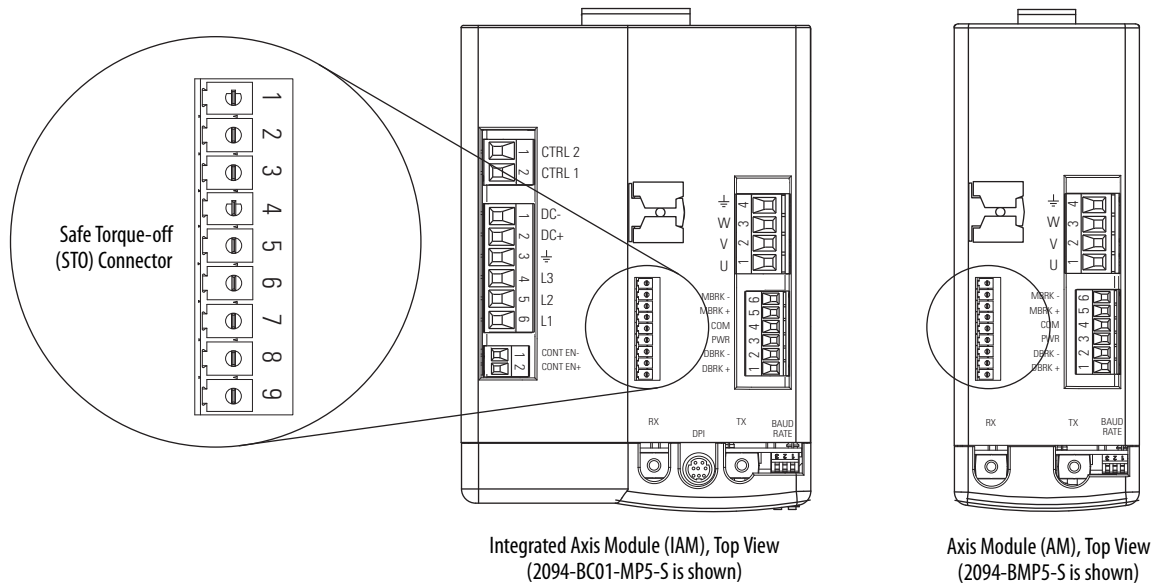
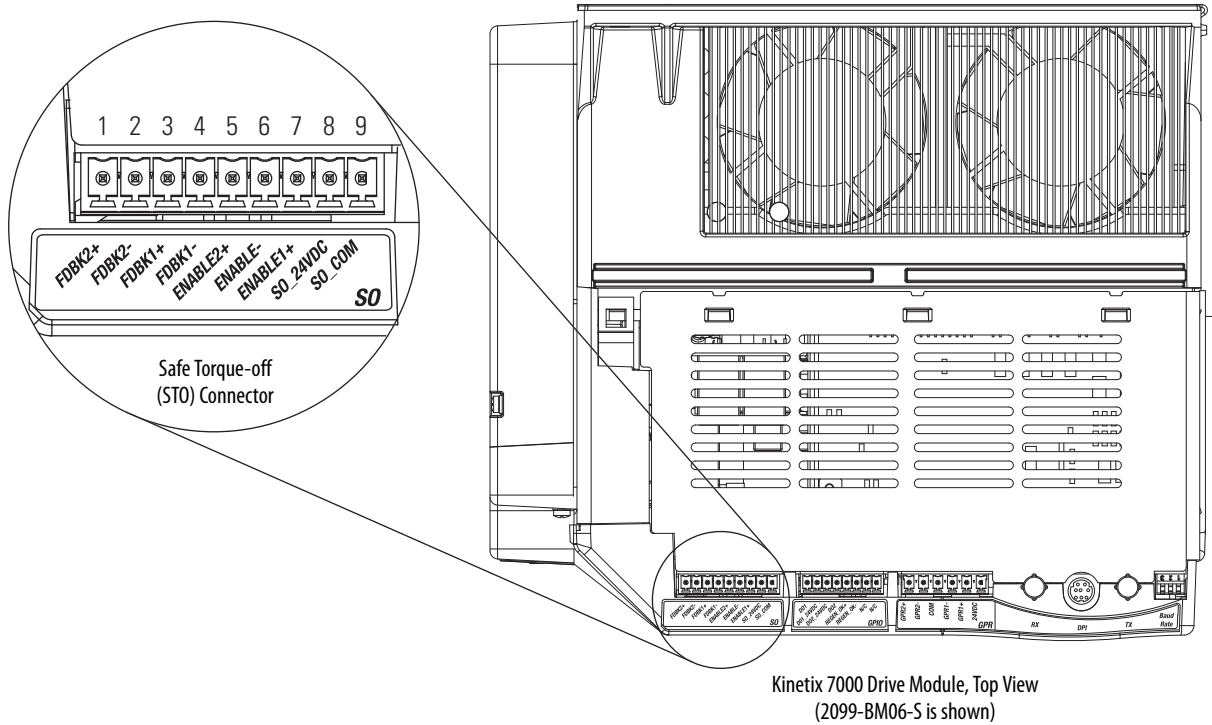


Figure 5 - 9-pin Safe Torque-off (STO) Connector - Kinetix 7000 Drive



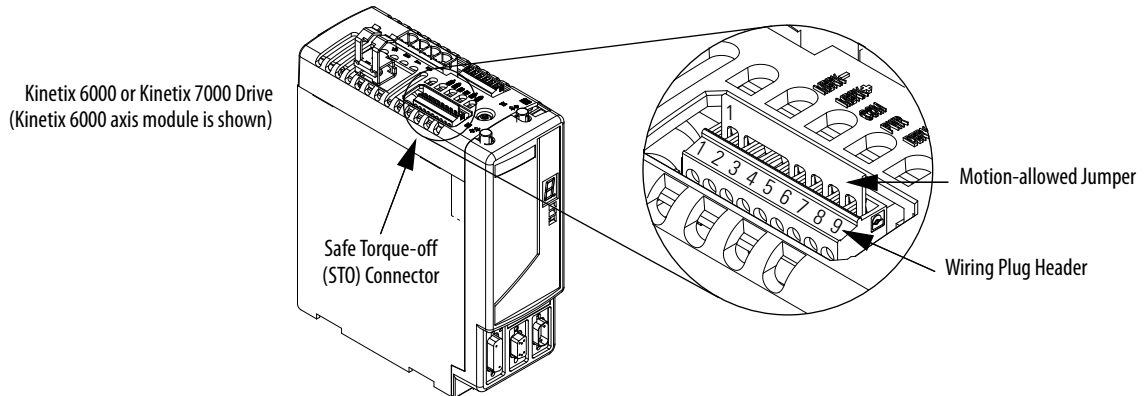


## Safe Torque-off Header Configurations

The safe torque-off function can be implemented in a single-drive or extended in up to eight drives in a multiple safety-drive configuration. The connector can also be jumpered to effectively remove the safe torque-off function.

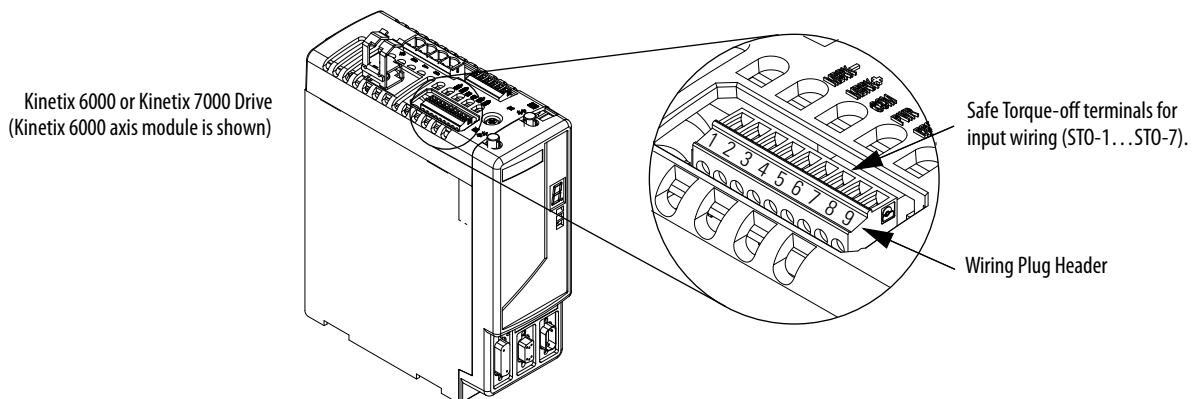
In this example, the Kinetix 6000 axis module is shown with the motion-allowed jumper installed in the wiring plug header. This header/jumper combination (default configuration) ships with each Kinetix 6000 and Kinetix 7000 drive and enables drive operation without external safety-circuit connections.

**Figure 6 - Motion-allowed Jumper**



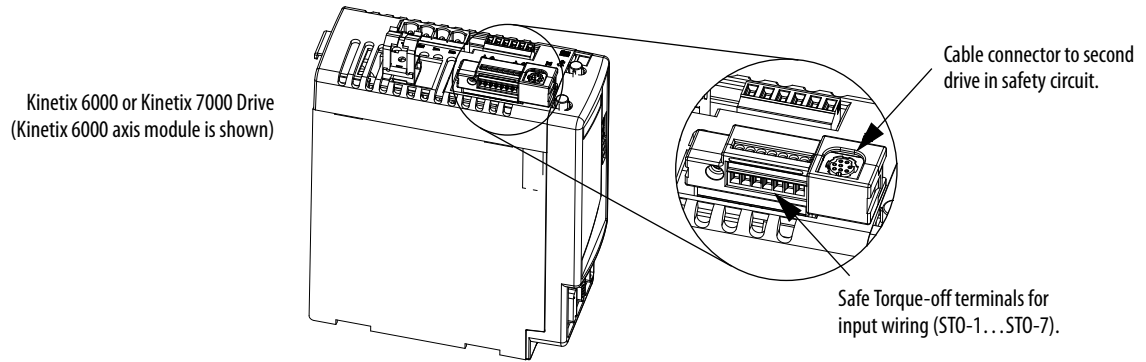
In this example, the Kinetix 6000 axis module is shown with a wiring plug header. The motion-allowed jumper has been removed. Use the wiring plug header alone for wiring Kinetix 6000 and Kinetix 7000 single drive safe torque-off applications.

**Figure 7 - Single Drive Wiring Header**



In this example, the Kinetix 6000 axis module is shown with a first-drive wiring header (catalog number 2090-XNSM-W). Kinetix 6000 and Kinetix 7000 first-drive modules use this header in multiple safe torque-off drive configurations for wiring to a safety control circuit and extending the safe torque-off circuitry to another drive.

**Figure 8 - First-drive Wiring Header (2090-XNSM-W)**

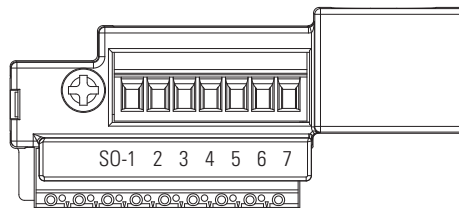


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**IMPORTANT** Do not use the first-drive (2090-XNSM-W) wiring header in single-drive applications.

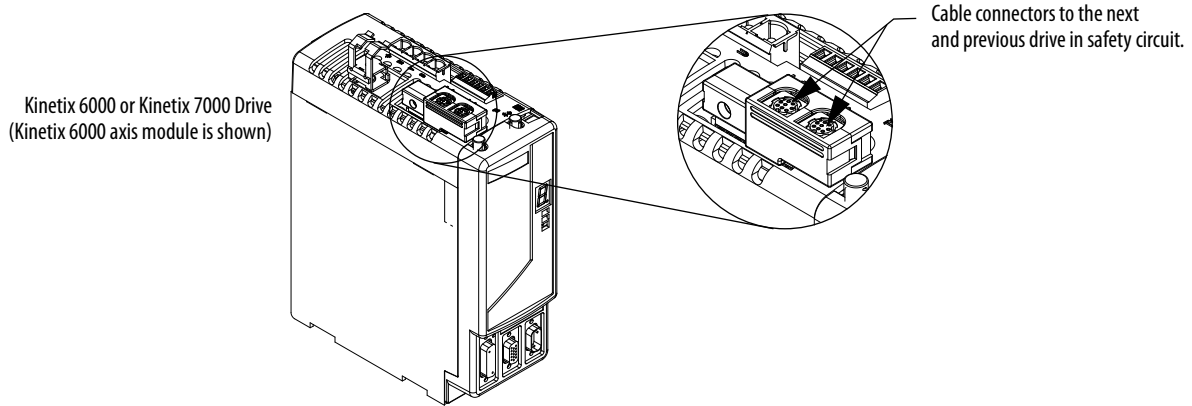
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**Figure 9 - First-drive Wiring Header Pin Assignment**



In this example, the Kinetix 6000 axis module is shown with a drive-to-drive middle header (catalog number 2090-XNSM-M). Kinetix 6000 and Kinetix 7000 drive modules, in safe torque-off drive configurations of three or more, use this header for making the safe torque-off connections between drives.

**Figure 10 - Middle Drive Header (2090-XNSM-M)**



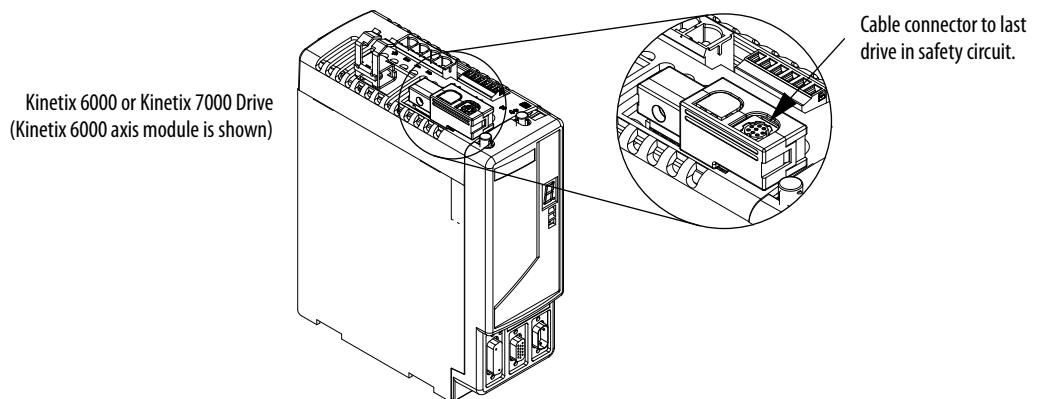

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**IMPORTANT** Next and previous drive cable connection to the middle header (catalog number 2090-XNSM-M) is arbitrary. Input and output is not specified.

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In this example, the Kinetix 6000 axis module is shown with a last-drive terminating header (catalog number 2090-XNSM-T). Kinetix 6000 and Kinetix 7000 drive modules use this header in multiple safe torque-off drive configurations for making safe torque-off connections to the last drive.

**Figure 11 - Last Drive Header (2090-XNSM-T)**



## Safe Torque-off Accessories

An assortment of headers, when wired and plugged into the safe torque-off (STO) connector, make implementation possible, as described in this table.

**Table 4 - Safe Torque-off Headers**

Description	Cat. No.
Safe Torque-off wiring header for the first drive in multiple safety drive configurations (optional).	2090-XNSM-W
Safe Torque-off middle header for drive-to-drive connections in multiple safety drive configurations with three or more drives (optional).	2090-XNSM-M
Safe Torque-off terminating header for the last drive in multiple safety drive configurations (optional).	2090-XNSM-T

Safe Torque-off interface cables are required for making connections with 2090-XNSM-W, 2090-XNSM-M, and 2090-XNSM-T safe torque-off headers.

**Table 5 - Safe Torque-off Interface Cables**

Cat. No.	Description
1202-C02	Drive-to-drive safety cable, 200 mm (7.9 in.) for connecting single-wide Kinetix 6000 axis modules.
1202-C03	Drive-to-drive safety cable, 350 mm (13.8 in.) for connecting double-wide Kinetix 6000 axis modules.
1202-C10	Drive-to-drive safety cable, 1050 mm (41.3 in.) for connections between: <ul style="list-style-type: none"> <li>• Kinetix 6000 power rail and Kinetix 7000 drive.</li> <li>• Two Kinetix 6000 power rails.</li> <li>• Two Kinetix 7000 drives.</li> </ul>
1202-C30	Drive-to-drive safety cable, 3 m (9.8 ft) for any connections requiring additional cable length within the system enclosure.

**IMPORTANT** Due to the current capacity limitation of the safe torque-off interface cable connectors, multiple safe torque-off drive configurations must not exceed eight Kinetix 6000 and Kinetix 7000 drive modules.

A replacement (STO) header with jumper is included in connector sets for the Kinetix 6000 and Kinetix 7000 safe torque-off drives.

**Table 6 - Replacement Connector Sets**

Cat. No.	Drive Module	Drive Cat. No.	Description
2094-XNINV-1	Kinetix 6000 IAM and AM Modules	2094-AC05-Mxx-S, 2094-AC09-M02-S, 2094-AMP5-S, 2094-AM01-S, 2094-AM02-S	Includes motor power (MP), motor/resistive brake (BC), and safe torque-off (STO) replacement connectors for the IAM (inverter) and AM modules.
2094-ANINV-2		2094-AC16-M03-S, 2094-AC32-M05-S, 2094-AM03-S, 2094-AM05-S, 2094-BC04-M03-S, 2094-BM03-S	
2094-XNINV-1		2094-BC01-Mxx-S, 2094-BC02-M02-S, 2094-BMP5-S, 2094-BM01-S, 2094-BM02-S	
2094-BNINV-2		2094-BC07-M05-S, 2094-BM05-S	
2099-K7KCK-1	Kinetix 7000 High Power Drives	2099-BMxx-S	Includes safe torque-off (STO), general purpose I/O (GPIO), general purpose relay (GPR), and control power (CP) replacement connectors for Kinetix 7000 drives.

## Wiring Your Kinetix Safe Torque-off Drive

This chapter provides guidelines for wiring your Kinetix 6000 and Kinetix 7000 safe torque-off drive connections.

Topic	Page
Wire the Safe Torque-off Circuit	21
Safe Torque-off Wiring Requirements	22
Safe Torque-off Feature	23

### Wire the Safe Torque-off Circuit

This section provides guidelines for wiring your Kinetix 6000 and Kinetix 7000 safe torque-off drive connections.

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

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**IMPORTANT** To improve system performance, run wires and cables in the wireways as established in [Establishing Noise Zones](#) beginning on [page 33](#).

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**IMPORTANT** Pins STO-8 (internal 24V+ supply) and STO-9 (24V\_COM) are used only by the motion-allowed jumper to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

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## Safe Torque-off Wiring Requirements

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

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

**Table 7 - Safe Torque-off (STO) Connector**

Safe Torque-off (STO) Connector		Recommended Wire Size		Strip Length mm (in.)	Torque Value N·m (lb·in)
Pin	Signal	Stranded Wire with Ferrule mm <sup>2</sup> (AWG)	Solid Wire mm <sup>2</sup> (AWG)		
STO-1 STO-2 STO-3 STO-4 STO-5 STO-6 STO-7 STO-8 STO-9	FDBK2+ FDBK2- FDBK1+ FDBK1- SAFETY ENABLE2+ SAFETY ENABLE- SAFETY ENABLE1+ 24V + 24V_COM	0.75 (18)	1.5 (16)	7.0 (0.275)	0.235 (2.0)

**IMPORTANT** Pins STO-8 (internal 24V+ supply) and STO-9 (24V\_COM) are used only by the motion-allowed jumper to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

**IMPORTANT** To be sure of system performance, run wires and cables in the wireways as established in the user manual for your drive.  
Refer to [Additional Resources](#) on [page 8](#) for the appropriate publication.

Refer to [Appendix B](#) beginning on [page 31](#) for Kinetix 6000 and Kinetix 7000 interconnect diagrams with other Allen-Bradley safety products.

## Safe Torque-off Feature

The safe torque-off circuit, when used with suitable safety components, provides protection according to EN ISO 13849-1 (PLe), Cat3 or according to EN 62061 (SIL3). The safe torque-off option is just one safety control system. All components in the system must be chosen and applied correctly to achieve the desired level of operator safeguarding.

The safe torque-off circuit is designed to safely turn off all of the output-power transistors. You can use the safe torque-off circuit in combination with other safety devices to achieve the stop and protection-against-restart as specified in IEC 60204-1.



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



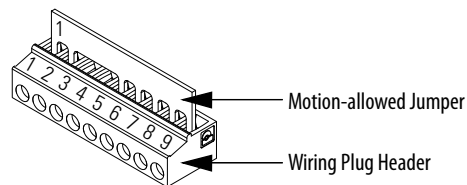
**SHOCK HAZARD:** In Safe Torque-off mode, hazardous voltages may still be present at the drive. To avoid an electric shock hazard, disconnect power to the system and verify that the voltage is zero before performing any work on the drive.

The Kinetix 6000 and Kinetix 7000 drives do not operate without a safety circuit or safety bypass wiring. For applications that do not require the safe torque-off feature you must install jumper wires to bypass the safe torque-off circuitry.

## Safe Torque-off Feature Bypass

Each Kinetix 6000 and Kinetix 7000 safe torque-off drive ships with the (9-pin) wiring plug header and motion-allowed jumper. With this wiring header/jumper combination installed in the safe torque-off (STO) connector (default configuration), the safe torque-off feature is not used.

**Figure 12 - Wiring Plug Header with Motion-allowed Jumper**

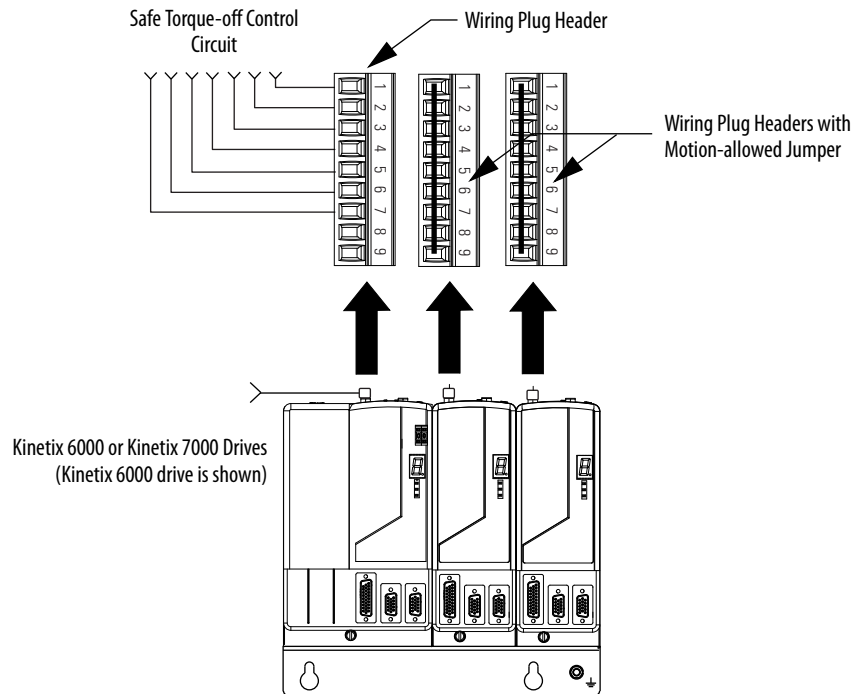


## Safe Torque-off Connection Examples

Typical safe torque-off connections for the Kinetix 6000 and Kinetix 7000 drives are shown in the figures below.

In this example, a single Kinetix 6000 safe torque-off drive is shown using the wiring plug header. The second and third drives do not use the safe torque-off feature, so the motion-allowed jumpers remain installed.

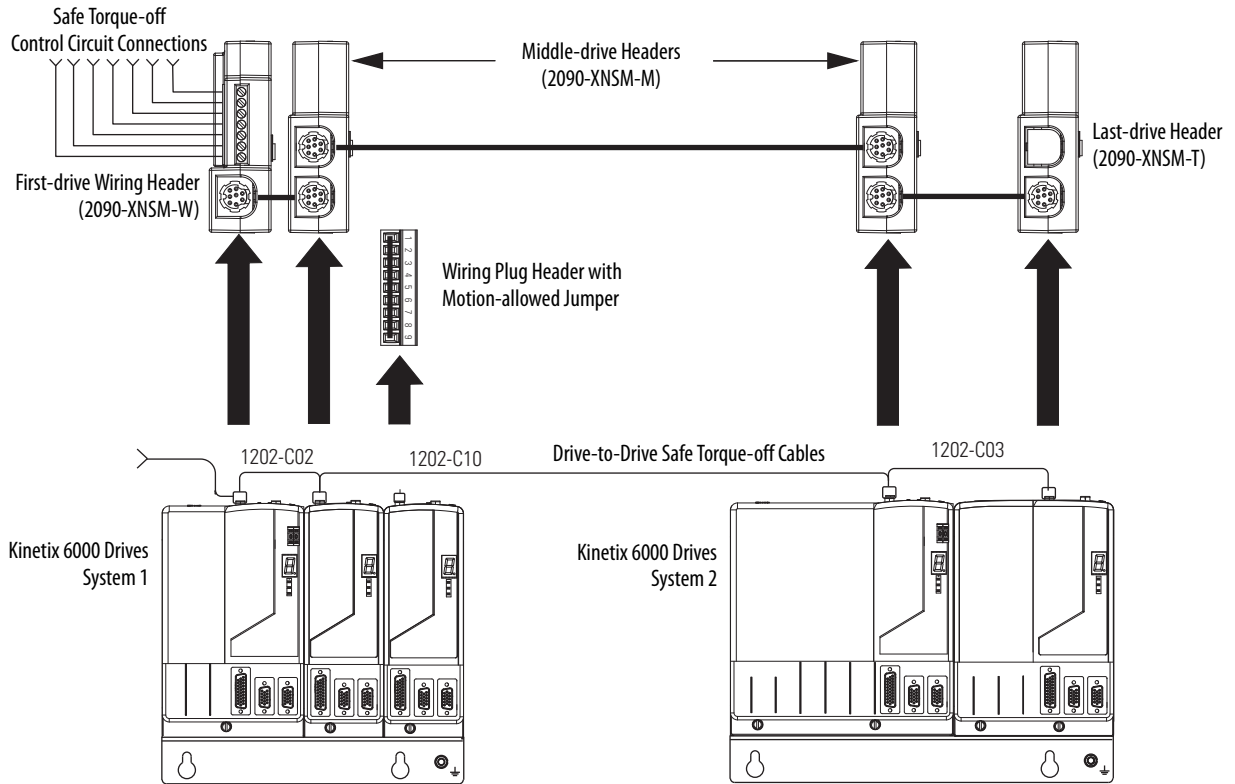
**Figure 13 - Typical Single Drive Safe Torque-off Configuration**





In this example, system 1 contains two (single-wide) Kinetix 6000 drives using the safe torque-off feature wired with two (double-wide) Kinetix 6000 drives in system 2. The wiring headers with motion-allowed jumpers have been replaced as shown. The third axis in system 1 does not use the safe torque-off feature, so the wiring header and motion-allowed jumper remain installed.

**Figure 14 - Typical Kinetix 6000 Safe Torque-off Configuration**

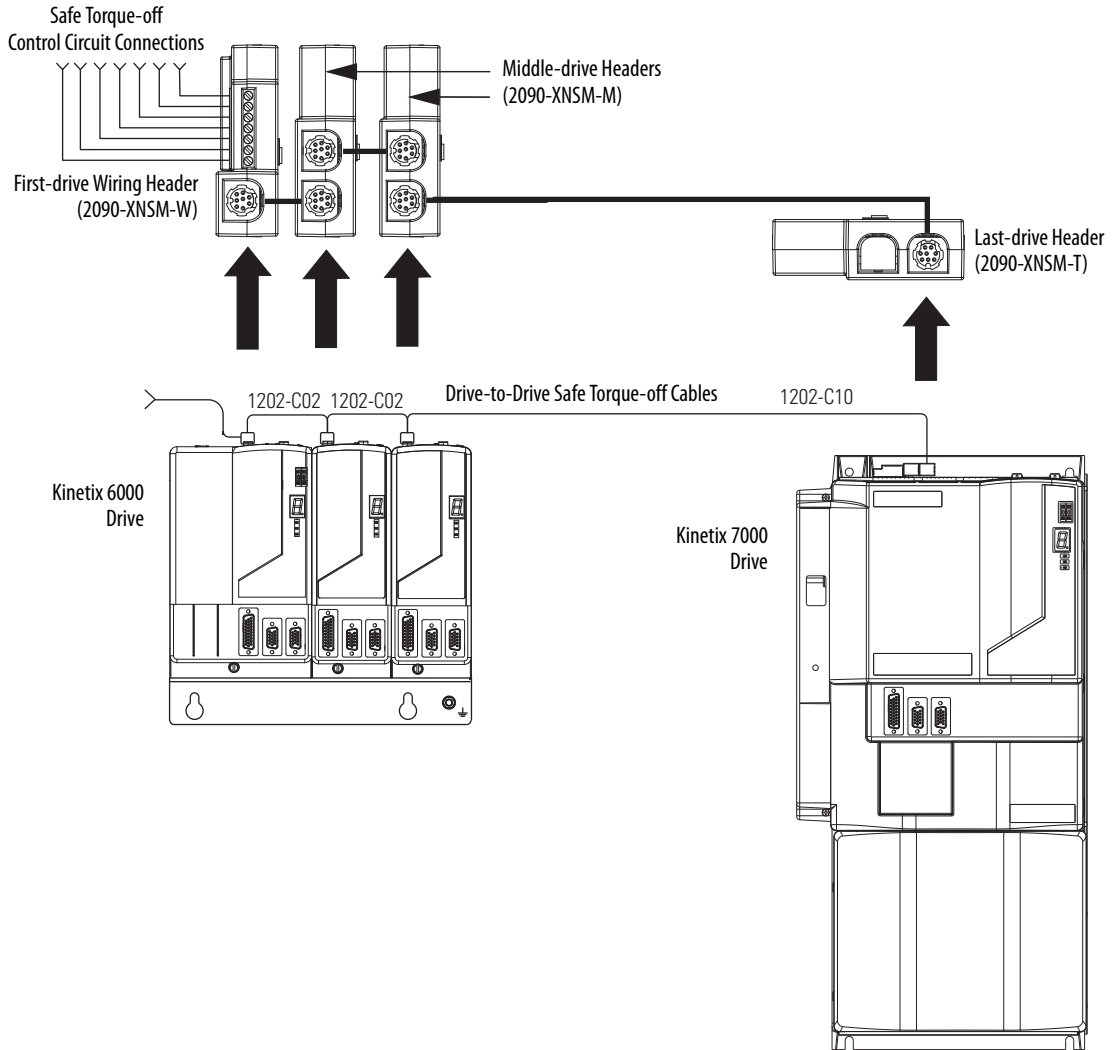


**IMPORTANT** Due to the current capacity limitation of the safe torque-off cable connectors, multiple safe torque-off drive configurations must not exceed eight Kinetix 6000 or Kinetix 7000 drive modules.

Cable connections to middle-drive headers (catalog number 2090-XNSM-M) can be made to either connector. Input and output is not specified.

In this example, the Kinetix 6000 power rail contains three (single-wide) drives using the safe torque-off feature and wired with one Kinetix 7000 drive. The wiring headers and motion-allowed jumpers have been replaced as shown.

**Figure 15 - Typical Kinetix 6000 to Kinetix 7000 Safe Torque-off Configuration**



**IMPORTANT** Due to the current capacity limitation of the safe torque-off cable connectors, multiple safe torque-off drive configurations must not exceed eight Kinetix 6000 or Kinetix 7000 drive modules.

Cable connections to middle-drive headers (catalog number 2090-XNSM-M) can be made to either connector. Input and output is not specified.

### Safe Torque-off Wiring Examples for SIL 3 Applications

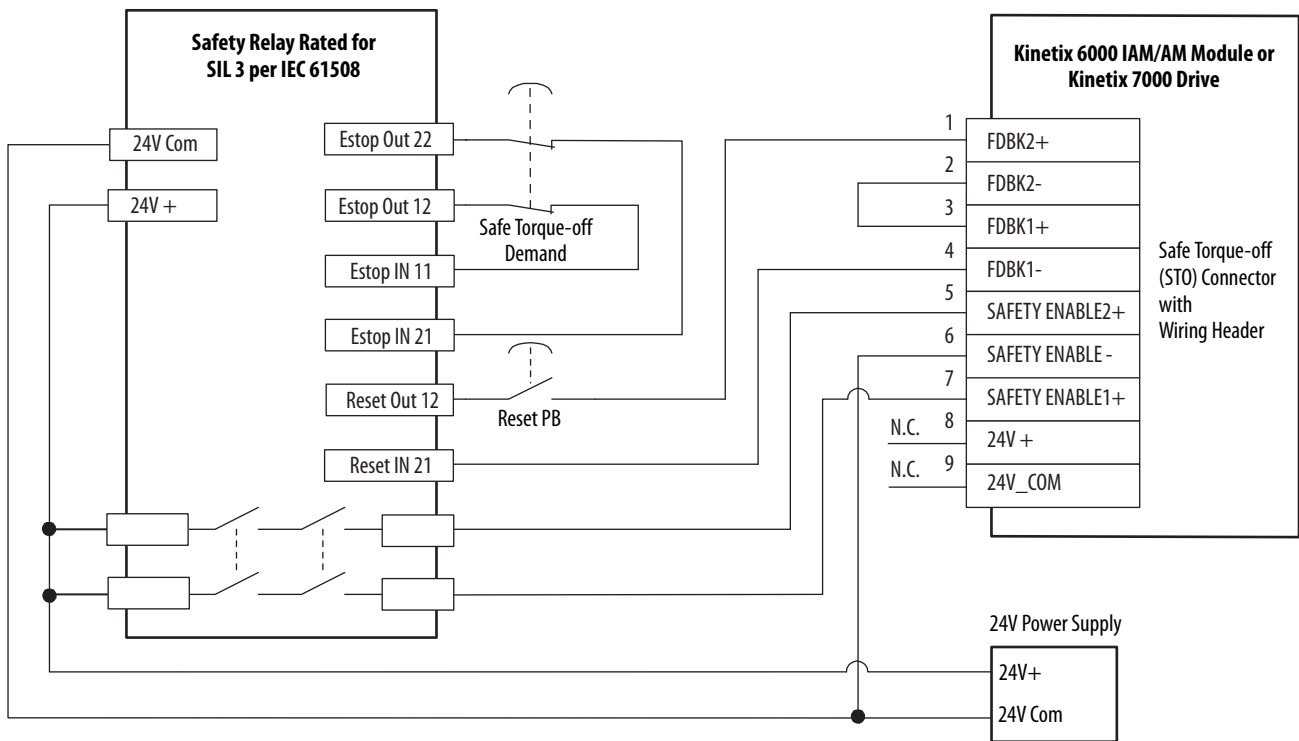
The following illustrations show typical wiring diagrams for the Kinetix 6000 and Kinetix 7000 safe torque-off drives:

- Typical single drive (stop category 0) configuration
- Typical single drive (stop category 1) configuration



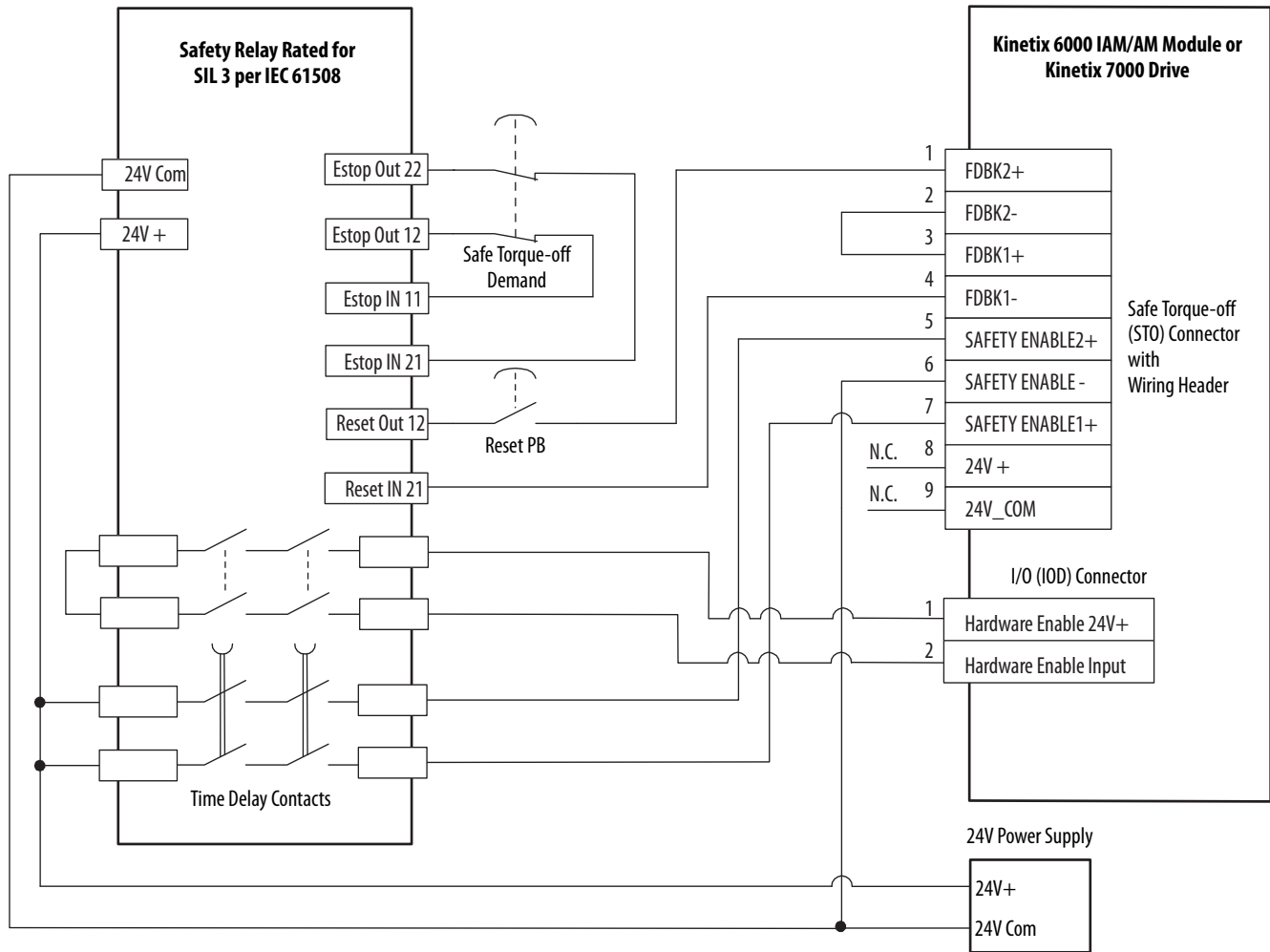
**ATTENTION:** Category 1 (controlled stop) must be used and zero speed verified, prior to engaging the motor holding (parking) brake. Disabling the output by any means and engaging the holding brake with the motor in motion will result in premature failure of the brake.

**Figure 16 - Single Drive (Stop Category 0) with Safety Relay Configuration**



**IMPORTANT** Pins STO-8 (internal 24V+ supply) and STO-9 (24V\_COM) are used only by the motion-allowed jumper to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

Figure 17 - Single Drive (Stop Category 1) with Safety Relay Configuration



**IMPORTANT** Pins STO-8 (internal 24V+ supply) and STO-9 (24V\_COM) are used only by the motion-allowed jumper to defeat the safe torque-off function. When the safe torque-off function is in operation, the 24V supply must come from an external source.

## Specifications

This chapter provides safe torque-off feature specifications for your Kinetix 6000 and Kinetix 7000 drives.

Topic	Page
Safe Torque-off Response Time Specifications	29
Safe Torque-off Signal Specifications	29

### Safe Torque-off Response Time Specifications

The system reaction time is the amount of time from a safety-related event as input to the system until the system is in the safe state. Faults within the system can also have an effect upon the reaction time of the system. The safe torque-off response time for the Kinetix 6000 and Kinetix 7000 safe torque-off drives is 25 ms. This is the time from change of state at the drive input to change of state at the drive output.



**ATTENTION:** The safe torque-off response time is typical of drive performance. Actual system response time will vary depending on your application.

### Safe Torque-off Signal Specifications

To maintain safety rating, Kinetix 6000 and Kinetix 7000 drives must be installed inside protected control panels or cabinets appropriate for the environmental conditions of the industrial location. The protection class of the panel or cabinet should be IP54 or higher.

### Kinetix 6000 (series A and B) and Kinetix 7000 Servo Drives

**Table 8 - Relay Coil Specifications for the ENABE Signals**

Attribute	Nom	Min	Max
Pull-in Voltage	24V	18V	26.4V
Drop-out Voltage	—	0V	2.4V
Coil Resistance	720 $\Omega$	648 $\Omega$	792 $\Omega$
Coil Current	33.3 mA	—	55.0 mA
Pull-in Time	25 ms	—	—
Drop-out Time	20 ms	—	—

**Table 9 - Relay Contact Specifications for the FDBK Signals**

Attribute	Value
Contact Resistance (1 A, 24V DC)	$\leq 100 \text{ m}\Omega$
Contact Resistance (10 mA, 5V DC)	$\leq 20 \Omega$
Contact Load (min)	10 mA, 5V DC
Rated Current	5 A
Rated Voltage	240V ac
Breaking Capacity, ac (max) for resistive loads	1250VA

## Kinetix 6000 (series C) Servo Drives

**Table 10 - Safe Torque-off Signal Specifications**

Attribute	Value
Input current	< 10 mA
Input ON voltage range	18...26.4V DC
Input OFF voltage, max	5V DC
Input OFF current	2 mA @ $V_{in} < 5V \text{ DC}$
Pulse rejection width	700 $\mu\text{s}$
External power supply	SELV/PELV
Input type	Optically isolated and reverse voltage protected

For additional information regarding Allen-Bradley safety products, including safety relays, light curtain, and gate interlock applications, refer to the Safety Products Catalog, website <http://www.ab.com/catalogs>.

## Kinetix Safe Torque-off Wiring Diagrams

This appendix provides typical wiring diagrams for the Kinetix 6000 and Kinetix 7000 safe torque-off drives with other Allen-Bradley safety products.

Topic	Page
Kinetix Safe Torque-off/Safety Relay Configurations	32
Kinetix Safe Torque-off/GuardLogix Configurations	35
Kinetix Safe Torque-off/GuardPLC Configurations	39

For additional information regarding Allen-Bradley safety products, including safety relays, light curtains, and gate interlock applications, refer to the Safety Products Catalog, website <http://ab.com/catalogs>.



**ATTENTION:** Category 1 (controlled stop) must be used and zero speed verified, prior to engaging the motor holding (parking) brake. Disabling the output by any means and engaging the holding brake with the motor in motion will result in premature failure of the brake.

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# Kinetix Safe Torque-off/ Safety Relay Configurations

In the diagrams beginning below, the Kinetix 6000 and Kinetix 7000 drive safe torque-off connector is shown wired to an Allen-Bradley safety relay.

Figure 18 - Single-axis Relay Configuration (Stop Category 0)

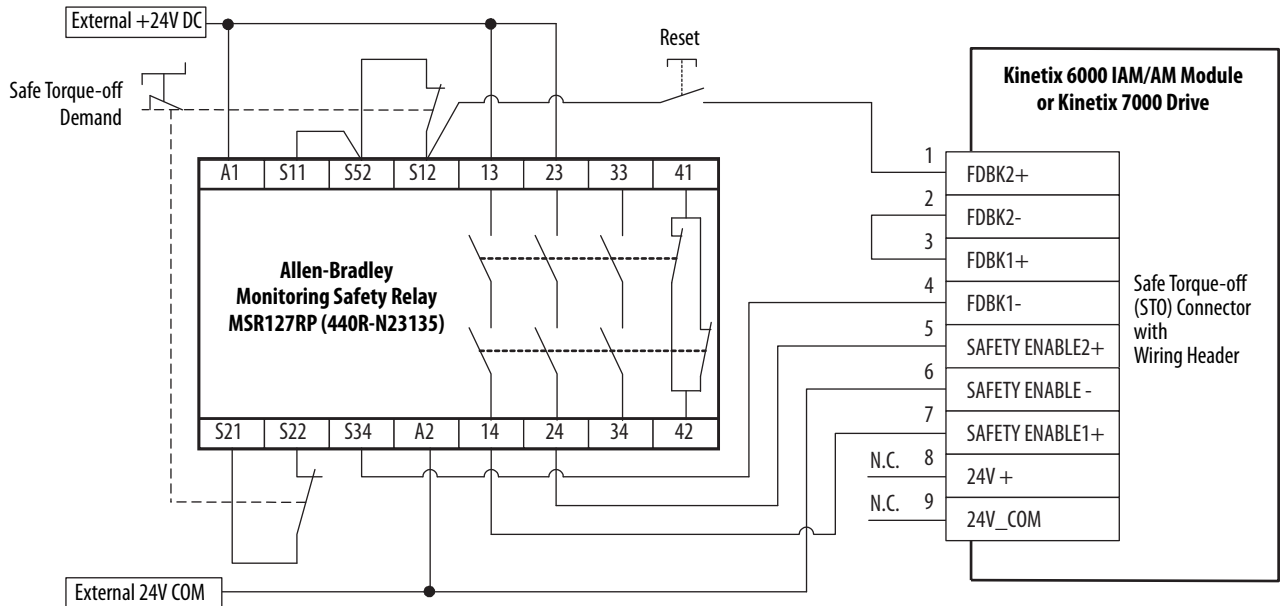
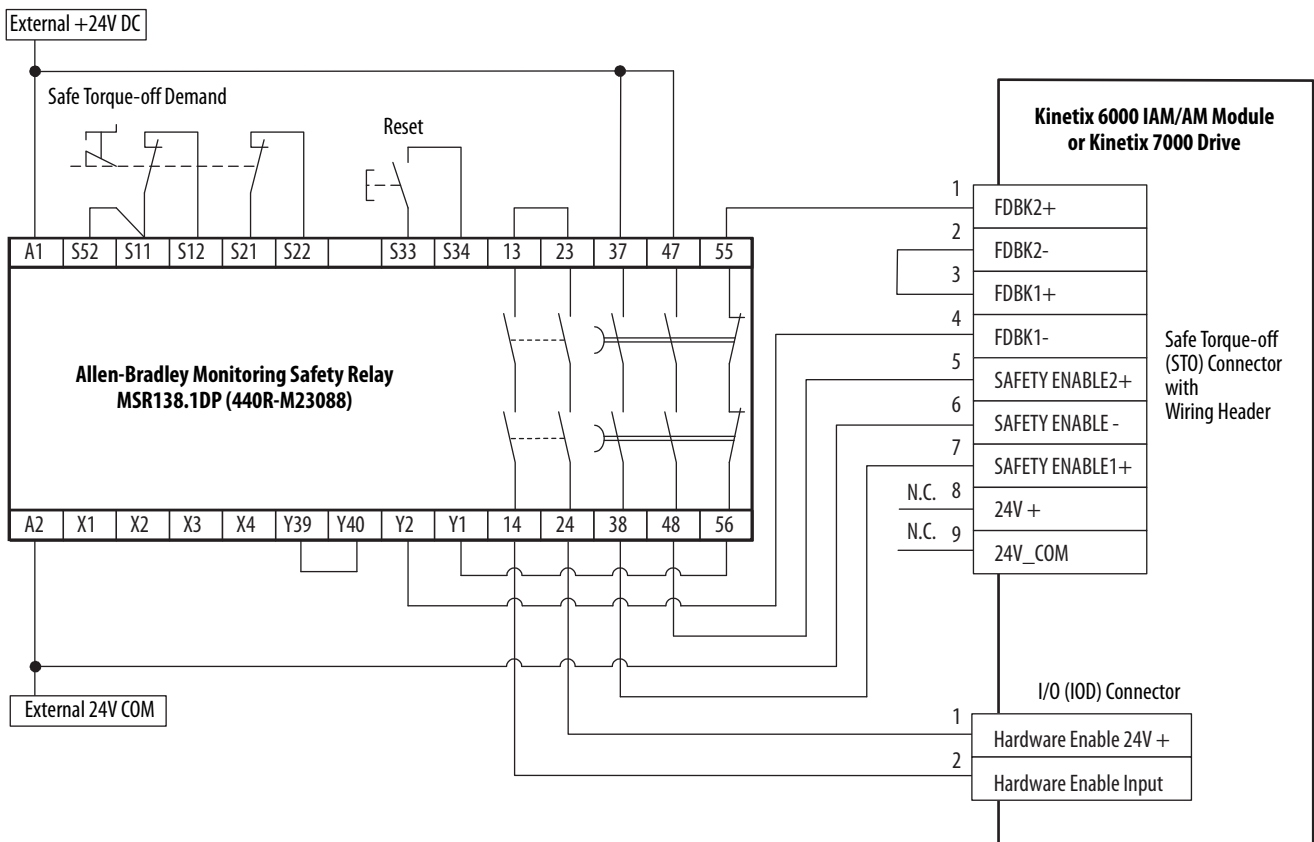


Figure 19 - Single-axis Relay Configuration (Stop Category 1)





**Figure 20 - Multi-axis Relay Configuration (Stop Category 0)**

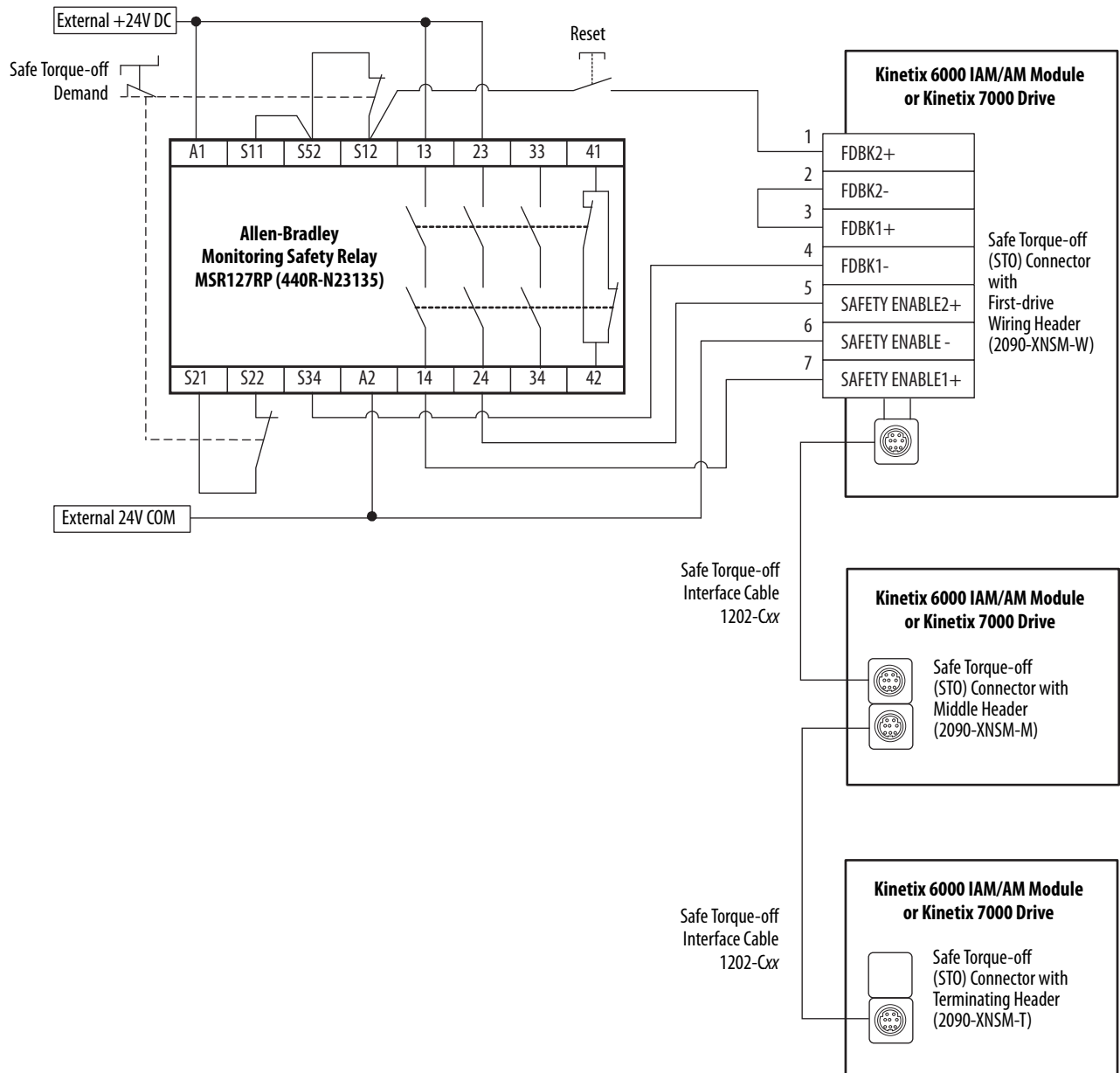
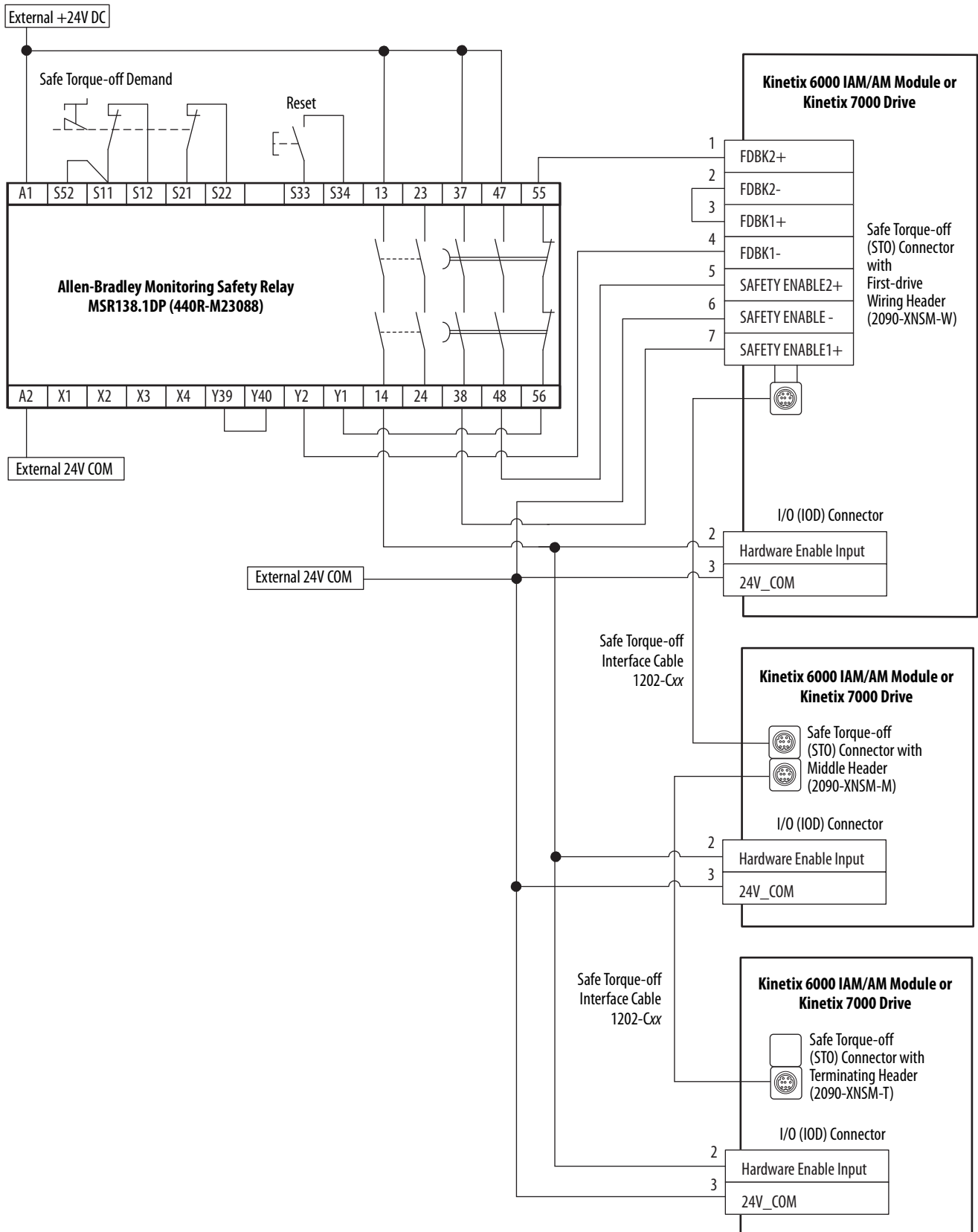


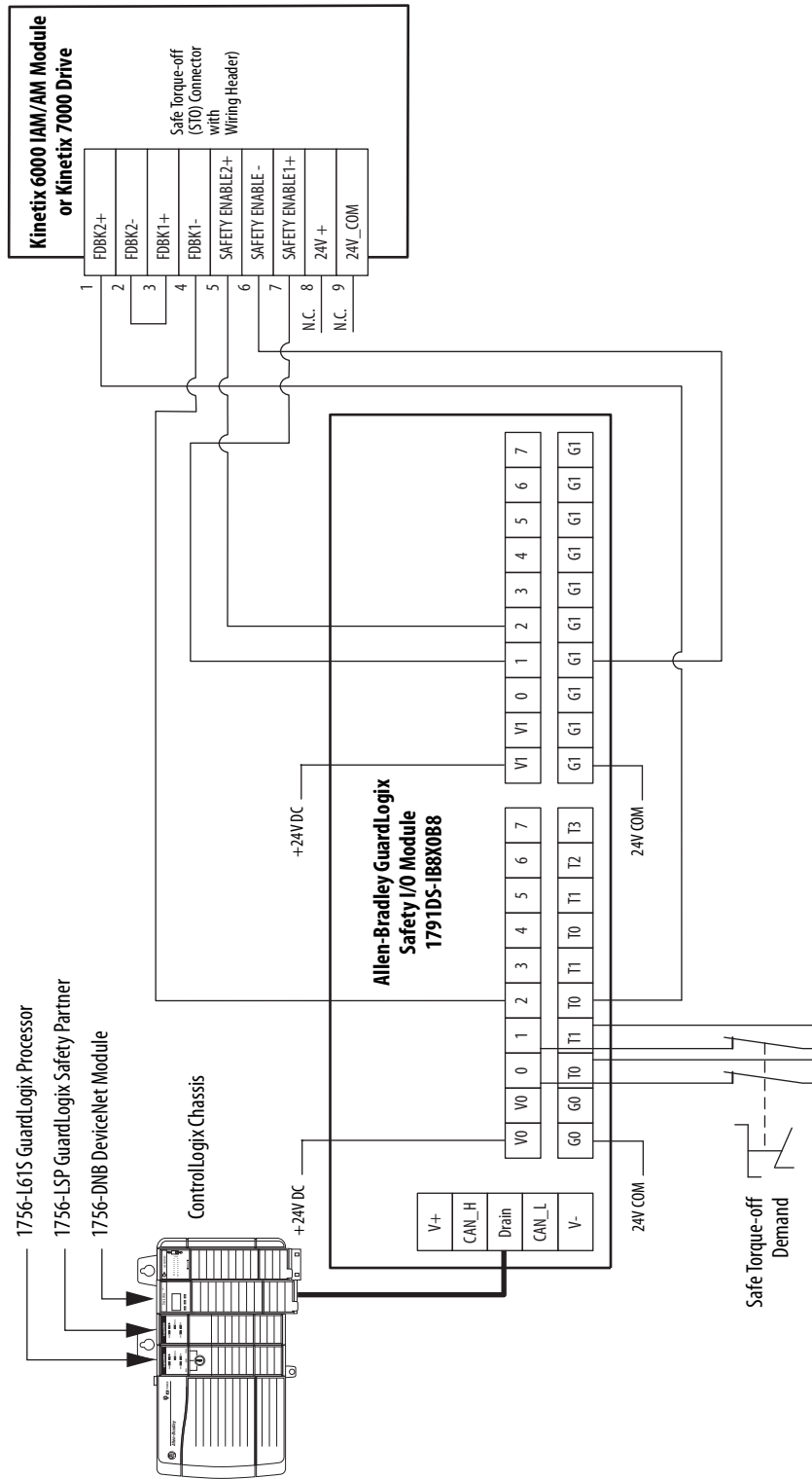
Figure 21 - Multi-axis Relay Configuration (Stop Category 1)



# Kinetix Safe Torque-off/ GuardLogix Configurations

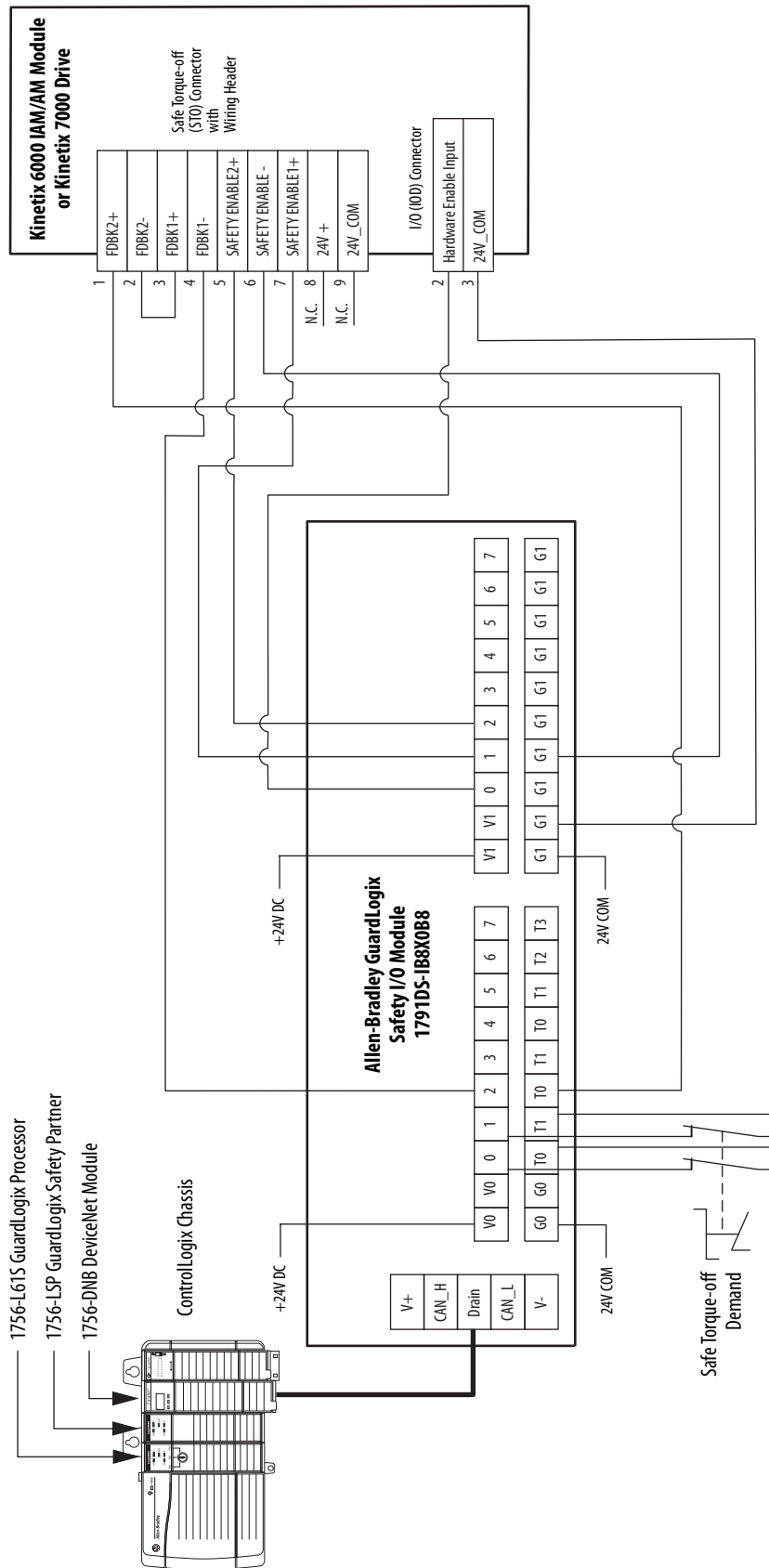
In these diagrams, the Kinetix 6000 and Kinetix 7000 drive safe torque-off connector is shown wired to an Allen-Bradley GuardLogix controller.

**Figure 22 - Single-axis GuardLogix Configuration (Stop Category 0)**



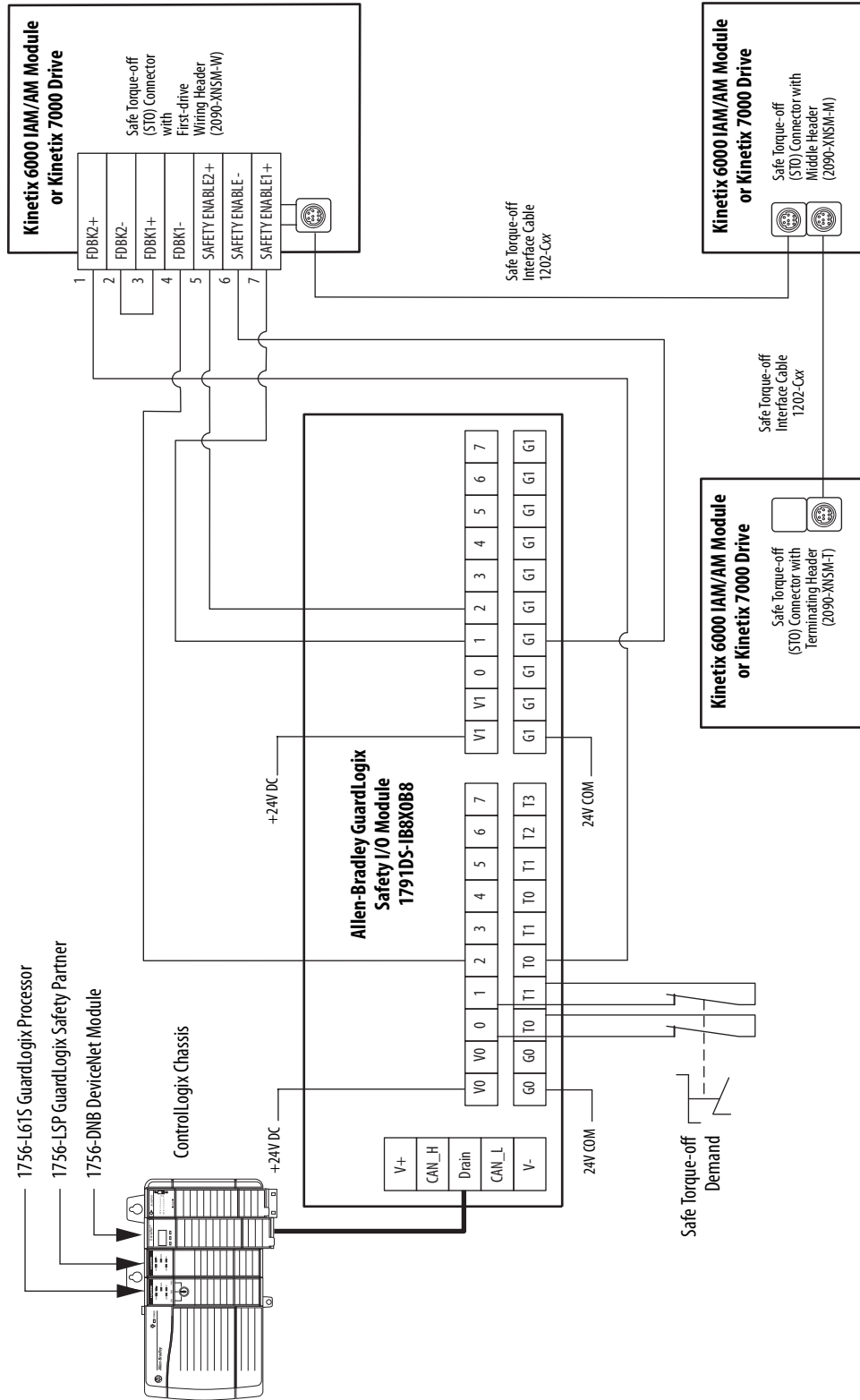
**IMPORTANT** Proper logic and commissioning of the safety controller must be configured. Refer to the DeviceNet Modules in Logix5000 Control Systems User Manual, publication [DNET-UM004](#), and the DeviceNet Safety User Manual, publication [1791DS-UM001](#), for more information.

Figure 23 - Single-axis GuardLogix Configuration (Stop Category 1)



**IMPORTANT** Proper logic and commissioning of the safety controller must be configured. Refer to the DeviceNet Modules in Logix5000 Control Systems User Manual, publication [DNET-UM004](#), and the DeviceNet Safety User Manual, publication [1791DS-UM001](#), for more information.

**Figure 24 - Multi-axis GuardLogix Configuration (Stop Category 0)**



**IMPORTANT** Proper logic and commissioning of the safety controller must be configured. Refer to the DeviceNet Modules in Logix5000 Control Systems User Manual, publication [DNET-UM004](#), and the DeviceNet Safety User Manual, publication [1791DS-UM001](#), for more information.

Figure 25 - Multi-axis GuardLogix Configuration (Stop Category 1)

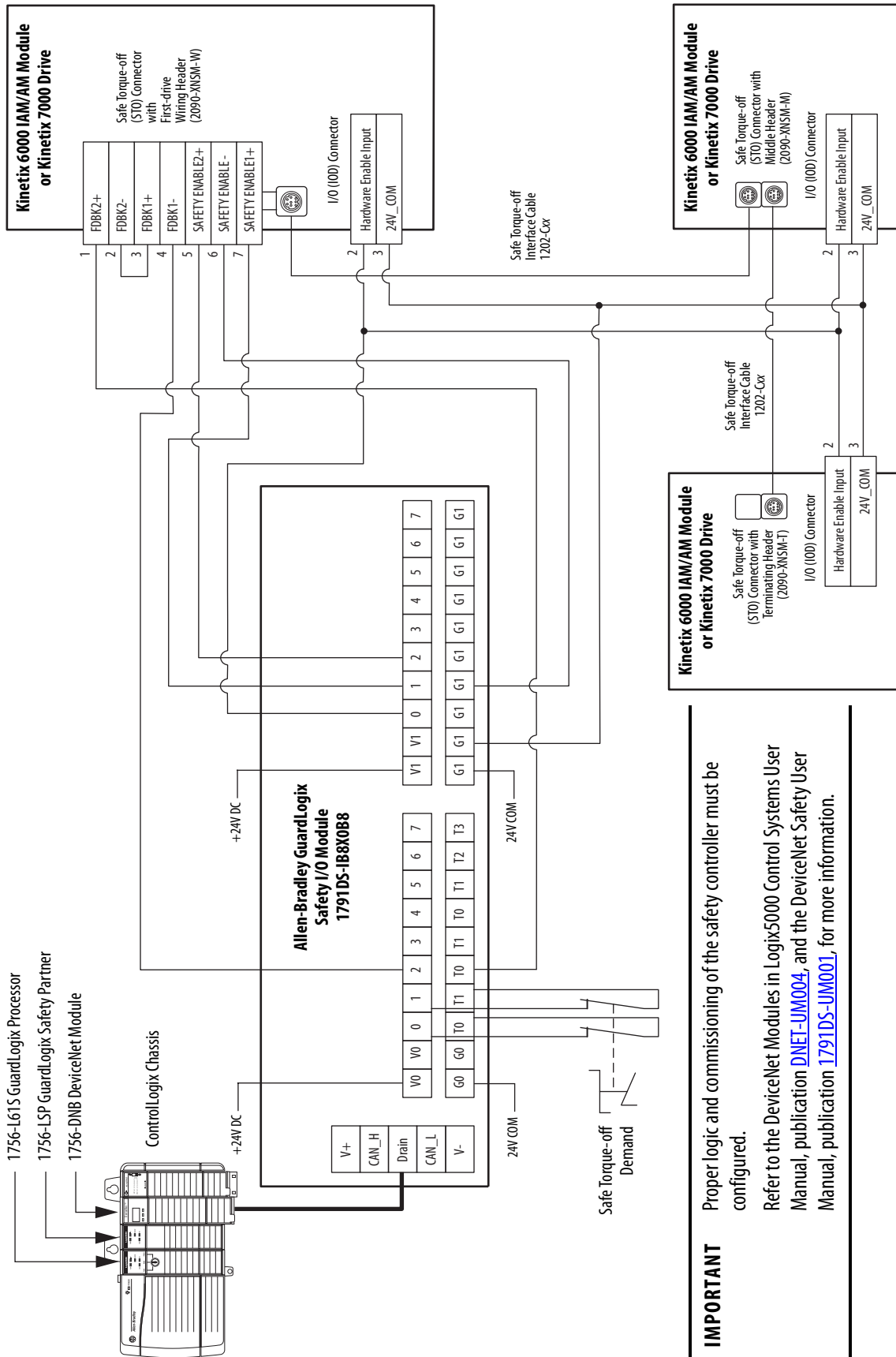
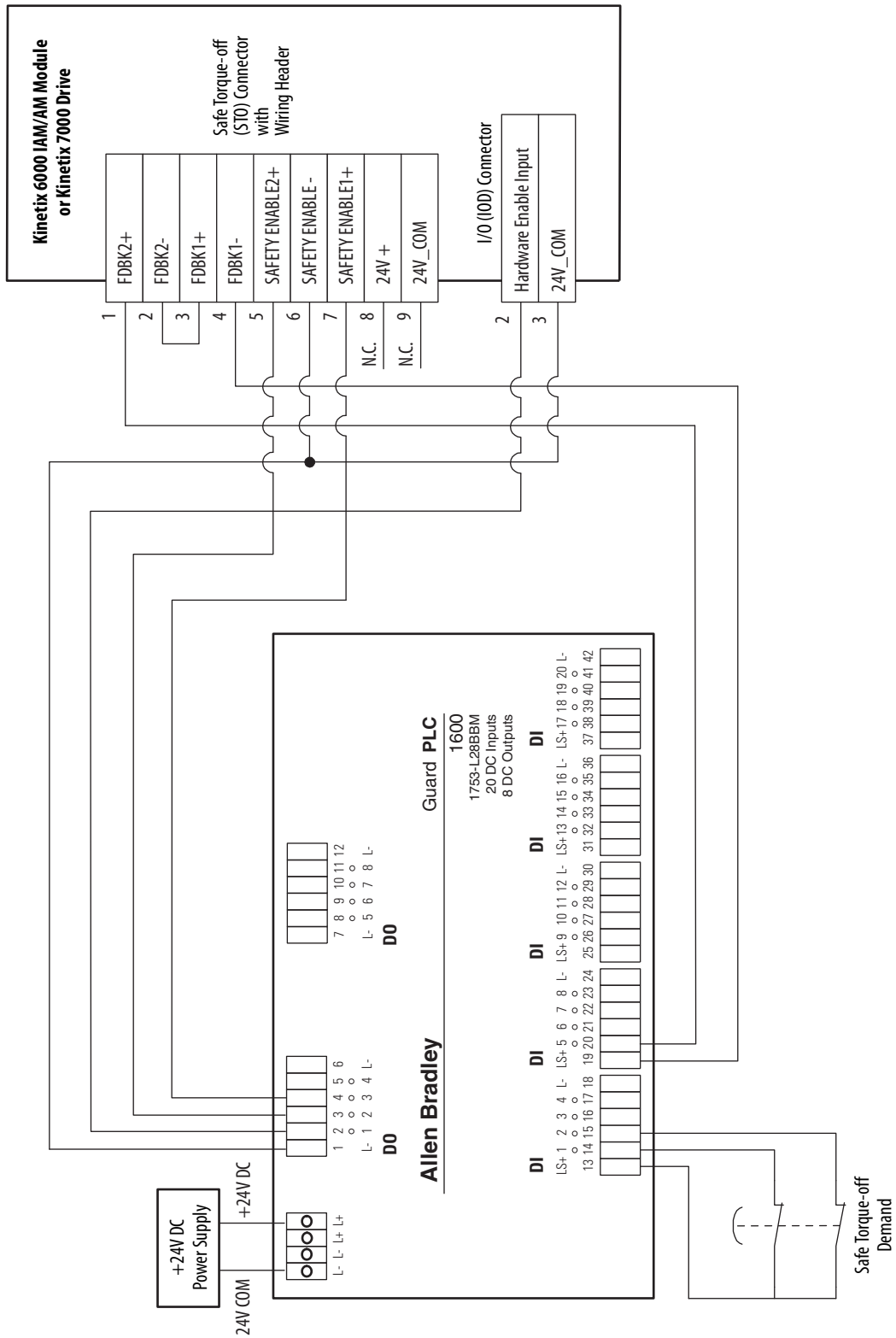




Figure 27 - Single-axis GuardPLC Configuration (Stop Category 1)





**Figure 28 - Multi-axis GuardPLC Configuration (Stop Category 0)**

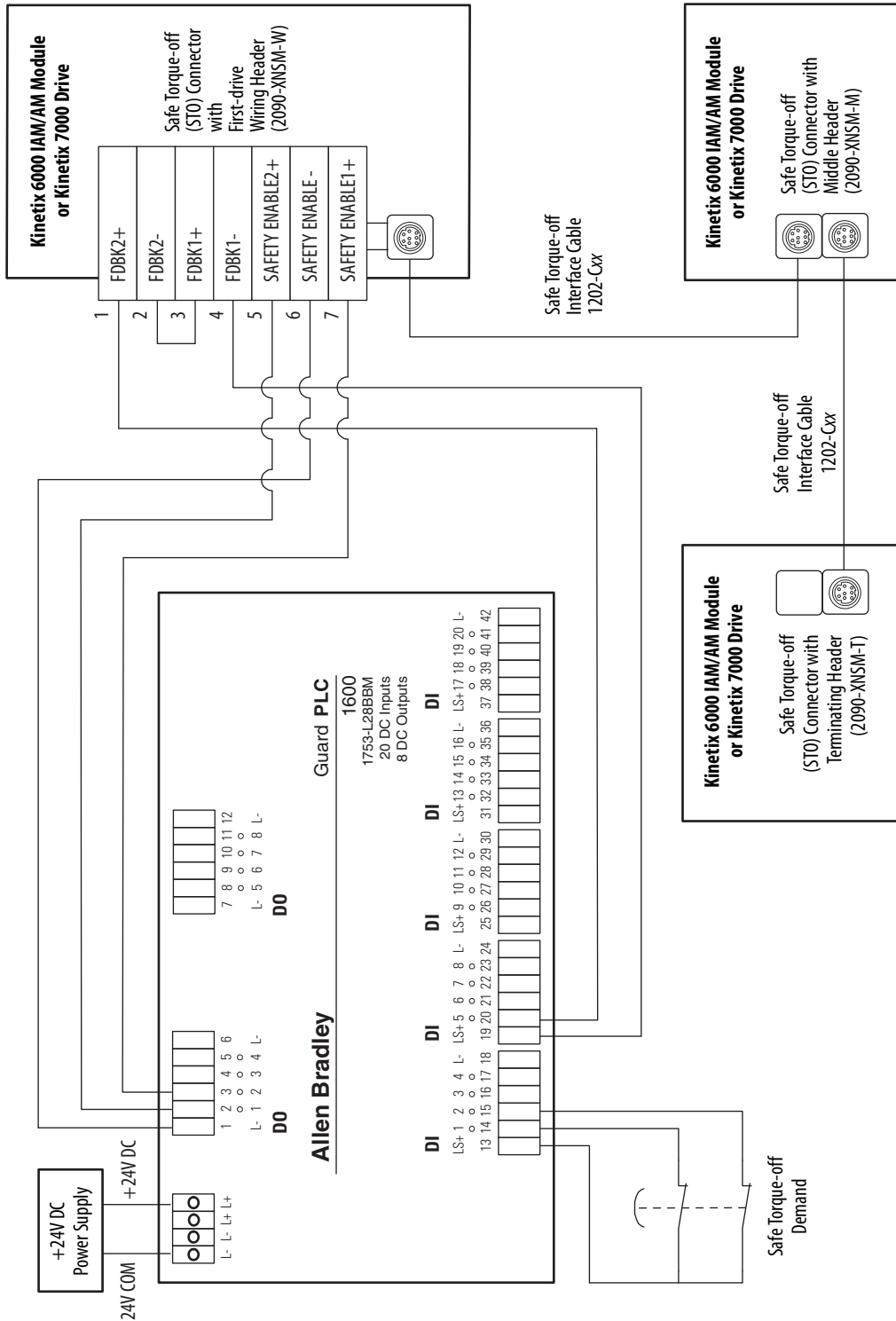
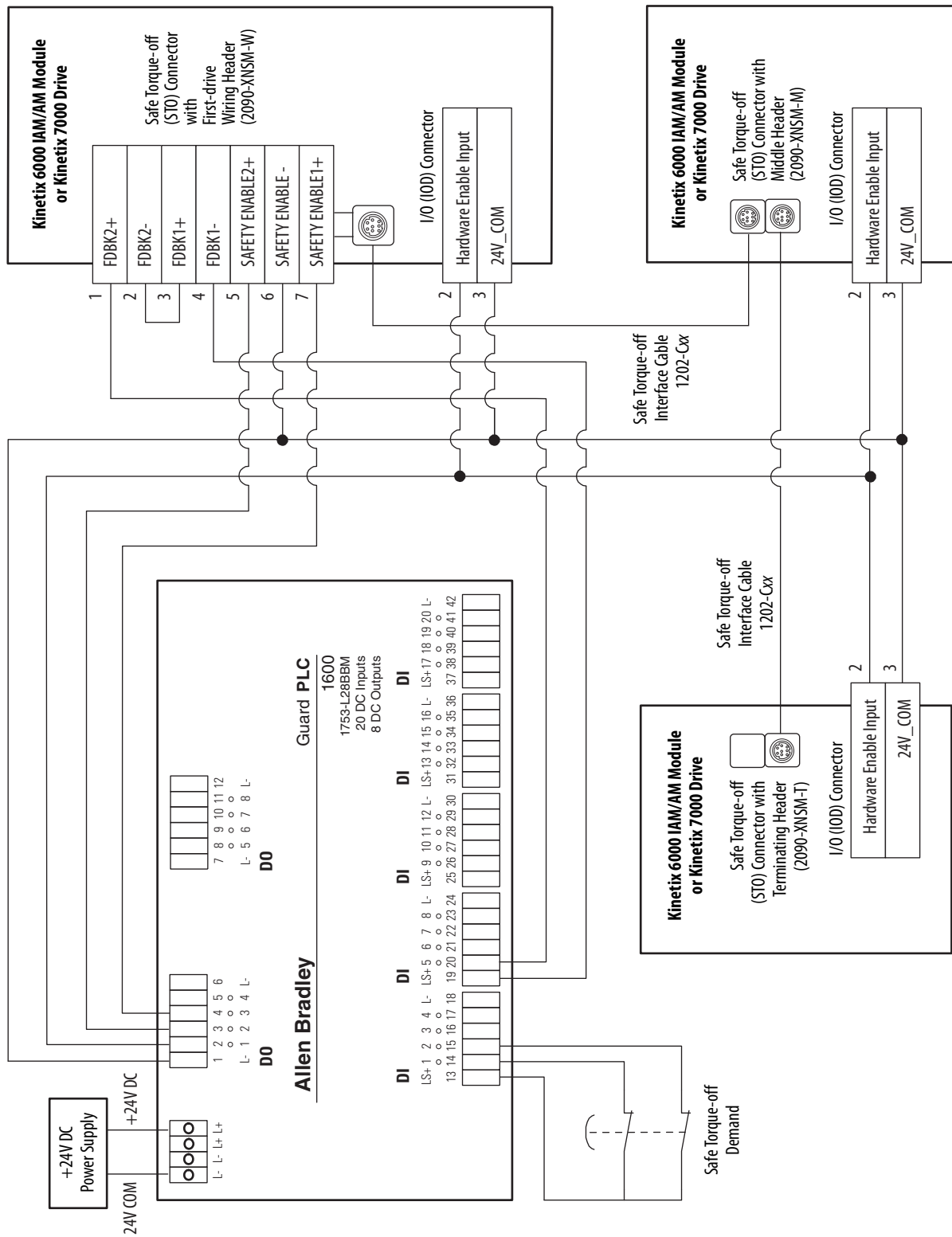


Figure 29 - Multi-axis GuardPLC Configuration (Stop Category 1)



## EC Certifications

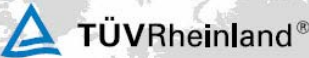
This appendix provides Kinetix 6000 and Kinetix 7000 servo drive certification information.

Topic	Page
EC Type - Examination Certificate	43
EC Declaration of Conformity	45

### EC Type - Examination Certificate


For complete product certifications currently available from Rockwell Automation, go to <http://www.rockwellautomation.com/products/certification>.

Figure 30 - Kinetix 6000 Servo Drives Certificate



**ZERTIFIKAT**      **EC Type-Examination Certificate**  
**CERTIFICATE**      **Reg.-No.: 01/205/5287/13**


<b>Product tested</b>	Safety Function "Safe Torque Off" (STO) within the adjustable Frequency AC Drives	<b>Certificate holder</b>	Rockwell Automation 6400 West Enterprise Drive Mequon, WI 53092 USA
<b>Type designation</b>	Kinetix 6000 (series C) Safe Off AC Servo Drive Integrated Axis Modules Converter and Inverter Combined and Axis Modules Inverter Only 450 V Family: 2094-BC01-MP5-S, 2094-BC01-M01-S, 2094-BC02-M02-S, 2094-BC07-M05-S, 2094-BC04-M03-S, 2094-BMP5-S, 2094-BM01-S, 2094-BM02-S, 2094-BM03-S, 2094-BM05-S 230 V Family: 2094-AC05-MP5-S, 2094-AC05-M01-S, 2094-AC09-M02-S, 2094-AC16-M03-S, 2094-AC32-M05-S, 2094-AMP5-S, 2094-AM01-S, 2094-AM02-S, 2094-AM03-S, 2094-AM05-S	<b>Manufacturer</b>	see certificate holder
<b>Codes and standards forming the basis of testing</b>	EN 61800-5-2:2007 EN 61800-5-1:2007 (in extracts) EN 61800-3:2004 EN ISO 13849-1:2008 + AC:2009		EN 62061:2005 + AC:2010 EN 60204-1:2006 + A1:2009 + AC:2010 (in extracts) IEC 61508 Parts 1-7:2010
<b>Intended application</b>	The integrated safety function "Safe Torque Off" within the Frequency AC Drives Kinetix 6000 complies with the requirements of the relevant standards (Cat. 3/ PL 0 acc. to EN ISO 13849-1, SILCL 3 acc. to EN 62061/ EN 61800-5-2/ IEC 61508) and can be used in applications up to Cat. 3/ PL d acc. to EN ISO 13849-1, SIL 2 acc. to EN 62061/ IEC 61508.		
<b>Specific requirements</b>	The instructions of the associated Installation and Operating Manual shall be considered.		
It is confirmed, that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.			
This certificate is valid until 2018-02-14.			




**Functional Safety Type Approved**

The issue of this certificate is based upon an examination, whose results are documented in report-no.: 908/EZ 205.04/13 dated 2013-02-14.

The holder of a valid licence certificate for the product tested is authorized to affix the test mark shown opposite to products, which are identical with the product tested.



**TÜVRheinland**  
DIN EN ISO 9001  
DIN EN ISO 14001



**E. A.**

Berlin, 2013-02-14      Certification Body for Machinery, NB 0035      Dipl.-Ing. Eberhard Frejno

TÜV Rheinland Industrie Service GmbH, Albrecht 115, 50133 Köln, Germany  
Tel: +49 201 7903-10017, Fax: +49 201 7903-1370, E-Mail: industrie-service@tuev.com



# EC Declaration of Conformity

For complete declarations of conformity (DoC) currently available from Rockwell Automation, go to <http://www.rockwellautomation.com/products/certification>.

**Figure 32 - Kinetix 6000 Servo Drives EC DoC**



## EC Declaration of Conformity

<p><i>The undersigned, representing the manufacturer</i></p> <p><b>Rockwell Automation, Inc.</b>  <b>6400 W. Enterprise Drive</b>  <b>Mequon, WI 53092</b>  <b>U.S.A.</b></p>	<p><i>and the authorized representative established within the Community</i></p> <p><b>Rockwell Automation B.V.</b>  <b>Rivium Promenade 160</b>  <b>2909 LM Capelle aan den IJssel</b>  <b>The Netherlands</b></p>
---	---

herewith declare that the Products **Digital Servo Drives and Accessories Kinetix 6000/6200/6500/6000M**

Product identification (brand and catalogue number/part number): **Allen-Bradley Bulletin 2094**  
*(reference the attached list of catalogue numbers)*

Product Safety Function: **Safe Standstill (Kinetix6000-S products)**  
**Safe Torque-Off (Kinetix6200/6500-S0, Kinetix6000M-S products)**  
**Safe Speed Monitor Option (Kinetix6200/6500-S1 products)**

*are in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:*

2006/95/EC	Low Voltage Directive
2004/108/EC	EMC Directive
2006/42/EC	Machinery Directive

*and that the standards and/or technical specifications referenced below have been applied:*

EN 50178:1997	Electronic equipment for use in power installations
EN 61800-5-1:2007	Adjustable speed electrical power drive system – Part 5-1: Safety requirements – Electrical, thermal and energy.
EN 61800-5-2:2007	Adjustable speed electrical power drive systems – Part 5-2: Safety requirements – Functional
EN 61800-3:2004	Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods
EN 60204-1:2006/A1:2009	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN 60034-1:2004	Rotating electrical machines – Part 1: Rating and performance (TL, MPF, MPG, MPL, MPM, MPS, MPAS and RD only)
EN 61508: Part 1-7:2000 <sup>11</sup>	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN ISO 13849-1:2008 <sup>11</sup>	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

Year of CE Marking: 2002

Manufacturer: *Thomas Van Groll* Authorized Representative in the Community: *Viktor Schiffer*

**Signature**  
**Name:** Thomas Van Groll  
**Position:** Director Engineering  
**Date:** 14-May-2012

**Signature**  
**Name:** Viktor Schiffer  
**Position:** Engineering Manager  
**Date:** 15-May-2012



Catalogue number	Series <sup>3</sup>	Description	Directive <sup>10</sup>		
			EMC	LVD	MD
Bulletin 2094 Servo Drives <sup>1,6,11,12,13</sup>					
2094-BC01-MP5		460 Volt Integrated Axis Module 6 kW Inverter 2.8 Amp	Yes	Yes	Yes
2094-BC01-M01		460 Volt Integrated Axis Module 6 kW Inverter 6.1 Amp	Yes	Yes	Yes
2094-BC02-M02		460 Volt Integrated Axis Module 15 kW Inverter 10.3 Amp	Yes	Yes	Yes
2094-BC04-M03		460 Volt Integrated Axis Module 28 kW Inverter 21.2 Amp	Yes	Yes	Yes
2094-BC07-M05		460 Volt Integrated Axis Module 45 kW Inverter 34.6 Amp	Yes	Yes	Yes
2094-AC05-MP5		230 Volt Integrated Axis Module 3 kW Inverter 3.7 Amp	Yes	Yes	Yes
2094-AC05-M01		230 Volt Integrated Axis Module 3 kW Inverter 6.0 Amp	Yes	Yes	Yes
2094-AC09-M02		230 Volt Integrated Axis Module 6 kW Inverter 10.6 Amp	Yes	Yes	Yes
2094-AC16-M03		230 Volt Integrated Axis Module 11 kW Inverter 17.3Amp	Yes	Yes	Yes
2094-AC32-M05		230 Volt Integrated Axis Module 23 kW Inverter 34.6 Amp	Yes	Yes	Yes
2094-BMP5		460 Volt Axis Module 2.8 Amp	Yes	Yes	Yes
2094-BM01		460 Volt Axis Module 6.1 Amp	Yes	Yes	Yes
2094-BM02		460 Volt Axis Module 10.3 Amp	Yes	Yes	Yes
2094-BM03		460 Volt Axis Module 21.2 Amp	Yes	Yes	Yes
2094-BM05		460 Volt Axis Module 34.6 Amp	Yes	Yes	Yes
2094-AMP5		230 Volt Axis Module 3.7 Amp	Yes	Yes	Yes
2094-AM01		230 Volt Axis Module 6.0 Amp	Yes	Yes	Yes
2094-AM02		230 Volt Axis Module 10.6 Amp	Yes	Yes	Yes
2094-AM03		230 Volt Axis Module 17.3Amp	Yes	Yes	Yes
2094-AM05		230 Volt Axis Module 34.6 Amp	Yes	Yes	Yes
2094-SE02F-M00-S0		Kinetix 6200, CM, SERCOS, safe torque-off	Yes	Yes	Yes
2094-SE02F-M00-S1		Kinetix 6200, CM, SERCOS, safe speed monitoring	Yes	Yes	Yes
2094-EN02D-M01-S0		Kinetix 6500, CM, CIP, safe torque-off	Yes	Yes	Yes
2094-EN02D-M01-S1		Kinetix 6500, CM, CIP, safe speed monitoring	Yes	Yes	Yes
2094-SEPM-B24-S		Kinetix 6000M, SERCOS, 460 Volt IDM Power Interface Module, safe torque-off	Yes	Yes	Yes
2094-PRF		Power Rail Slot Filler, no electrical ratings apply	Yes	Yes	N/R
2094-PR1		1 Axis Power Rail	Yes	Yes	N/R
2094-PR2		2 Axis Power Rail	Yes	Yes	N/R
2094-PR4		4 Axis Power Rail	Yes	Yes	N/R
2094-PR6		6 Axis Power Rail	Yes	Yes	N/R
2094-PR8		8 Axis Power Rail	Yes	Yes	N/R
2094-PRS1		1 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS2		2 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS3		3 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS4		4 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS5		5 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS6		6 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS7		7 Axis Slim Power Rail	Yes	Yes	N/R
2094-PRS8		8 Axis Slim Power Rail	Yes	Yes	N/R

**Figure 33 - Kinetix 7000 Servo Drives EC DoC**



**EC Declaration of Conformity**

<p><i>The undersigned, representing the manufacturer</i></p> <p><b>Rockwell Automation, Inc.</b>  <b>6400 W. Enterprise Drive</b>  <b>Mequon, Wisconsin 53092 – USA</b></p>	<p><i>and the authorised representative established within the Community</i></p> <p><b>Rockwell Automation BV</b>  <b>Rivium 1e Straat, 23</b>  <b>2909 LE Capelle aan den IJssel</b>  <b>Netherlands</b></p>
---	---

*herewith declare that the Products*      **Digital Servo Drive and accessories Kinetix 7000**

*Product identification (brand and catalogue number/part number):*      **Allen-Bradley Bulletin 2099**  
*(reference the attached list of catalogue numbers)*

---

*Product Safety Function:*      **Safe Torque Off**

---

*are in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:*

2006/95/EC	Low Voltage Directive
2004/108/EC	EMC Directive
2006/42/EC	Machinery Directive

---

*and that the standards and/or technical specifications referenced below have been applied:*

EN 60034-1:2004	Rotating electrical machines – Part 1: Rating and performance
EN 60204-1:2006	Safety of machinery – Electrical equipment of machines – Part 1: General requirements
EN 61800-3:2004	Adjustable speed electrical power drive systems – Part 3: EMC requirements and specific test methods
EN 50178:1997	Electronic equipment for use in power installations
IEC 61508 Part 1-7:2000	Functional safety of electrical/electronic/programmable electronic safety-related systems
EN ISO 13849-1:2008	Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design

---

*Year of CE Marking*      2006

---

*Manufacturer:*      *Authorised Representative in the Community:*

**Signature**  
*Name:*      Tom Van Groll  
*Position:*      Director Engineering  
*Date:*      16-Dec-2010

**Signature**  
*Name:*      Viktor Schiffer  
*Position:*      Engineering Manager  
*Date:*      17-Dec-2010

---



<i>Catalogue number</i> <sup>2</sup>	<i>Series</i> <sup>1</sup>	<i>Description</i>
<b>Note:</b> <i>The following motor/drive combinations are permitted for the purposes of this declaration.</i>		
<b>Bulletin 2099 Drives:</b>		
2099-BM06-S		30 HP Servo drive
2099-BM07-S		40 HP Servo drive
2099-BM08-S		50 HP Servo drive
2099-BM09-S		75 HP Servo drive
2099-BM10-S		100 HP Servo drive
2099-BM11-S		150 HP Servo drive
2099-BM12-S		200 HP Servo drive
<b>Bulletin 2099 and Bulletin 2090 Filters and Accessories</b>		
2090-XXLF-TC336		Line filter, 3 phase, 36 Ampere
2090-XXLF-TC350		Line filter, 3 phase, 50 Ampere
2090-XXLF-TC365		Line filter, 3 phase, 65 Ampere
2090-XXLF-TC3100		Line filter, 3 phase, 100 Ampere
2090-XXLF-TC3150		Line filter, 3 phase, 150 Ampere
2090-XXLF-TC3200		Line filter, 3 phase, 200 Ampere
2090-XXLF-TC3250		Line filter, 3 phase, 250 Ampere
<b>Cables</b>		
2090-XXNFMP-Sxx		Motor feedback cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system
2090-UXNFBMP-Sxx		Motor feedback cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system
2090-XXNPMP-zzSxx		Motor power cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system
2090-MCNPMP-zzSxx		Motor power cable for MPL-B960D or -B980D motors
2090-UXNBMP-18Sxx		Motor brake cable
2090-XXTFMP-Sxx		Continuous Flex Motor feedback cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system
2090-XXTPMP-YYSSL		Continuous Flex Motor Power cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system, YY = wire gauge, LL = length in meters
2090-UXTBMP-18SLL		Continuous Flex Motor brake cable, motors using the MP connector system, LL = length in meters
2090-XXNFMF-Sxx		Motor feedback cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system
2090-XXNPMF-zzSxx		Motor power cable, for MPL motors or 1326AB motors or 8720SM motors using the MP connector system



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## 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 manuals, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools. You can also visit our Knowledgebase at <http://www.rockwellautomation.com/knowledgebase> for FAQs, technical information, support chat and forums, software updates, and to sign up for product notification updates.

For an additional level of technical phone support for installation, configuration, and troubleshooting, we offer TechConnect<sup>SM</sup> support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/support/>.

## 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 <a href="http://www.rockwellautomation.com/rockwellautomation/support/overview.page">Worldwide Locator</a> at <a href="http://www.rockwellautomation.com/rockwellautomation/support/overview.page">http://www.rockwellautomation.com/rockwellautomation/support/overview.page</a> , 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.

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