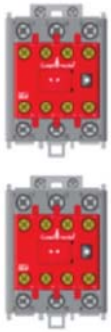
Allen-Bradley

Safety Function: GuardLogix Controller Connected to a Series of Dual-channel E-stop Buttons

Products: Compact GuardLogix Controller, POINT Guard I/O Module, Dual-channel E-stop Button

Safety Rating: CAT. 3, PLd to ISO 13849-1: 2008



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Important User Information

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

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

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

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

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

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

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

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

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

General Safety Information

IMPORTANT This application example is for advanced users and assumes that you are trained and experienced in safety system requirements.

Risk Assessments

ATTENTION: Perform a risk assessment to make sure that all task and hazard combinations have been identified and addressed. The risk assessment can require additional circuitry to reduce the risk to a tolerable level. Safety circuits must consider safety distance calculations, which are not part of the scope of this document.

Contact Rockwell Automation to learn more about our safety-risk assessment services.

Safety Distance Calculations

ATTENTION: While safety distance or access time calculations are beyond the scope of this document, compliant safety circuits must often consider a safety distance or access time calculation.

A complementary device cannot be the only device guarding a hazard. The safety system must include separating and or non-separating safeguards. Appropriate safety calculations must be performed for these safeguards as well. Publications that offer guidance for calculating compliant safety distances for safety systems that use non-separating safeguards, such as light curtains, scanners, two-hand controls, or safety mats, include the following:

EN ISO 13855:2010 (Safety of Machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body)

ANSI B11:19 2010 (Machines – Performance Criteria for Safeguarding)

Separating safeguards monitor a moveable, physical barrier that guards access to a hazard. Publications that offer guidance for calculating compliant access times for safety systems that use separating safeguards, such as gates with limit switches or interlocks (including SensaGuard™ switches), include the following:

EN ISO 14119:2013 (Safety of Machinery – Interlocking devices associated with guards - Principles for design and selection)

EN ISO 13855:2010 (Safety of Machinery – Positioning of safeguards with respect to the approach speeds of parts of the human body)

ANSI B11:19 2010 (Machines – Performance Criteria for Safeguarding)

In addition, consult relevant national or local safety standards to assure compliance.

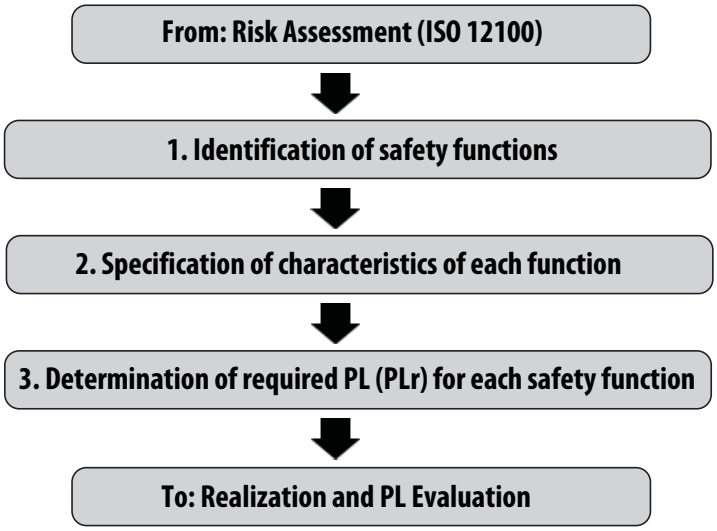
Introduction

This safety function application technique explains how to wire, configure, and program a Compact GuardLogix® controller and POINT Guard I/O™ module to monitor a series of dual-channel safety E-stop devices. If any of the E-stops is actuated, or a fault is detected in the monitoring circuit, the GuardLogix® controller de-energizes the final control device, in this case, a redundant pair of 100S contactors.

This example uses a Compact GuardLogix controller, but is applicable to any GuardLogix controller. The SISTEMA calculations shown later in this document would have to be recalculated using the actual products.

Safety Function Realization: Risk Assessment

The required performance level is the result of a risk assessment and refers to the amount of the risk reduction to be carried out by the safety-related parts of the control system. Part of the risk reduction process is to determine the safety functions of the machine. In this application, the performance level required (PLr) by the risk assessment is Category 3, Performance Level d (CAT. 3, PLd), for each safety function. A safety system that achieves CAT. 3, PLd, or higher, can be considered control reliable. Each safety product has its own rating and can be combined to create a safety function that meets or exceeds the PLr.



Emergency Stop Safety Function

This application technique includes one safety function: Emergency stop by actuation of an E-stop button.

Safety Function Requirements

Pressing any one of the series-wired E-stops stops and prevents hazardous motion by removing power to the motor. When the E-stop button is reset, hazardous motion and power to the motor do not resume until a secondary action (start button depressed) occurs. Faults at the E-stop button, wiring terminals, or safety controller are detected before the next safety demand. This emergency stop function is complementary to any other safeguards on the machine and shall not reduce the performance of other safety-related functions. The safety function in this example is capable of connecting and interrupting power to motors rated up to 9 A, 600V AC.

The safety function in this application technique meets or exceeds the requirements for Category 3, Performance Level d (CAT. 3, PLd), per ISO 13849-1 and control reliable operation per ANSI B11.19.

Functional Safety Description

Hazardous motion is interrupted or prevented by actuation of any emergency-stop button (ES1, ES2, or ES3). Each E-stop is considered a separate safety function. The E-stop buttons are connected in series to a pair of safety inputs of a safety input module (SI1). The safety contactors (K1 and K2) are connected to a pair of safety outputs of a safety output module (SO1). The I/O modules are connected via CIP Safety™ over an EtherNet/IP™ network to the safety controller (SC1). The safety code in SC1 monitors the status of the E-stop buttons using a pre-certified safety instruction named

Dual Channel Input Stop (DCS). When all conditions are satisfied, no faults are detected on the input modules, and the reset button is pressed, a second certified function block called Configurable Redundant Output (CROUT) checks the status of the final control devices, a pair of 100S redundant contactors. The controller then issues an output signal to the safety output module (SO1) to switch ON a pair of outputs to energize the safety contactors.

Bill of Material

This application technique uses these products.

Cat. No.	Description	Quantity
800FM-MT34MX02	800F Non-illuminated mushroom operators, twist-to-release, 30 mm (1.18 in.), round metal, red, metal latch mount, two N.C. contacts	3
800FM-G611MX10	800F Reset push button, metal, guarded, blue, R, metal latch mount, one N.O. contact, standard	2
100S-C09ZJ23C	Bulletin 100S-C - safety contactors	2
1768-ENBT	CompactLogix™ EtherNet/IP bridge module	1
1768-L43S	Compact GuardLogix processor, 2.0 MB standard memory, 0.5 MB safety memory	1
1768-PA3	Power supply, 120/240 V AC Input, 3.5 A @ 24V DC	1
1769-ECR	Right end cap/terminator	1
1734-AENT	24V DC Ethernet adapter	1
1734-TB	Module base with removable IEC screw terminals	4
1734-IB8S	POINT Guard safety input module	1
1734-OB8S	POINT Guard safety output module	1
1783-US05T	Stratix 2000™ unmanaged Ethernet switch	1

Setup and Wiring

For detailed information on how to install and wire, refer to the publications listed in the Additional Resources.

System Overview

The 1734-IB8S input module monitors the inputs from the E-stops, which are connected in series. This method conserves the number of inputs that are used, but reduces the granularity of system diagnostics. Typically, E-stops are not operated as often as a safety gate, for example. Therefore, the need to connect each E-stop contact into its own dedicated input is reduced.

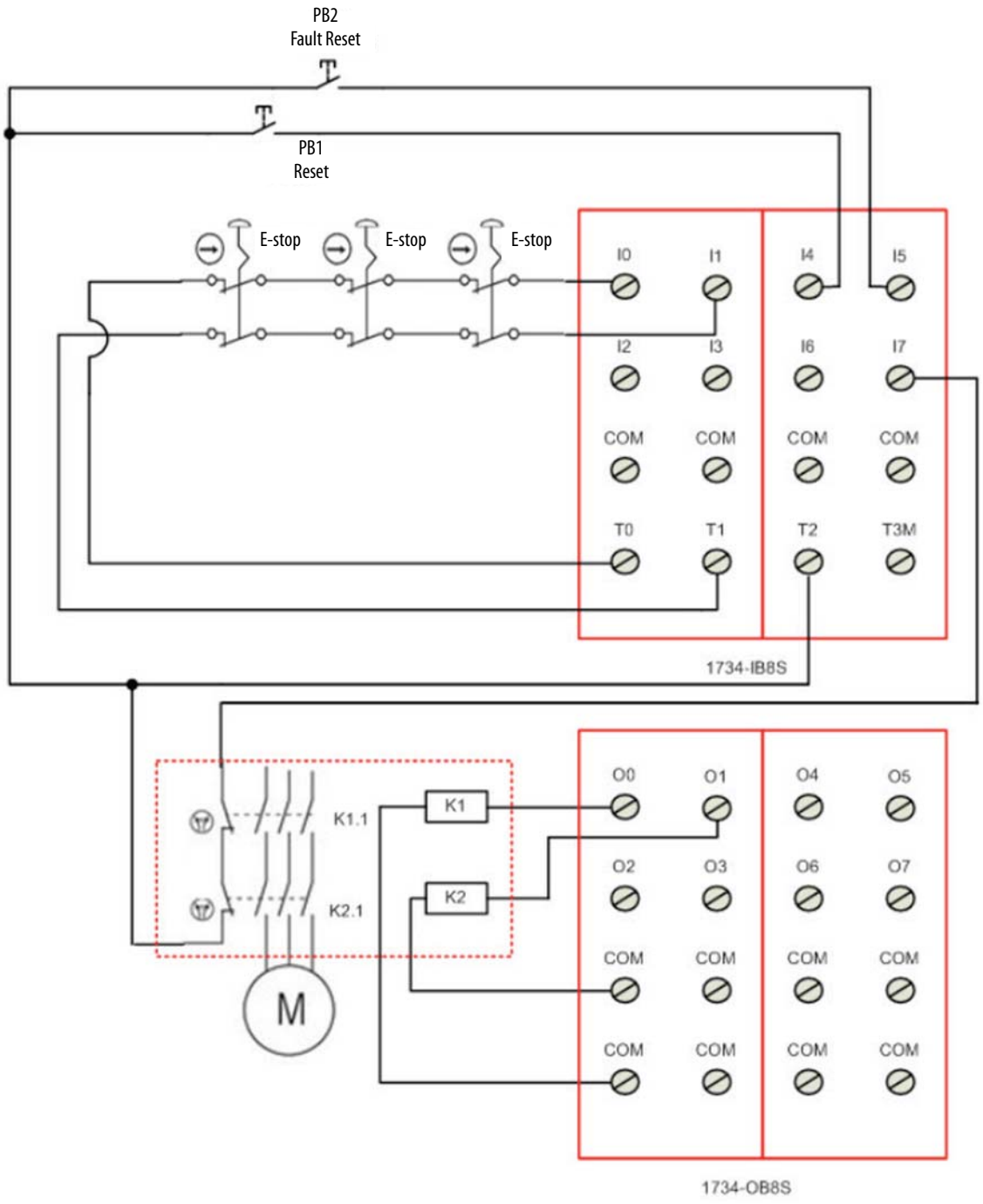
See ISO 13850 Safety of machinery – Emergency stop function – Principles for design, for more information on the use of E-stops. An E-stop is considered to be a complementary safety device. E-stop devices are typically used for unintended motion.

The circuit is tested by using test pulses (T0 and T1) on the inputs, I0 and I1. These test pulses source the 24V DC for the circuit. By periodically dropping the 24V DC to OV DC, it is possible to detect cross-channel faults and shorts to an external 24V DC. Shorts to 0V DC are seen as an open circuit by the input and are detected by either the hardware, if configured to detect discrepancy errors, or by the appropriate safety function block in the application code.

The final control device, in this case, is a pair of 100S safety contactors, K1 and K2. The contactors are controlled by a 1734-OBS safety output module. These contactors are wired in a redundant configuration and are tested on start-up for

faults. The start-up test is accomplished by using a CROUT instruction to monitor the feedback circuit into input 7 (I7) before the contactors are energized. The system is reset with the momentary push button, PB1.

Electrical Schematic



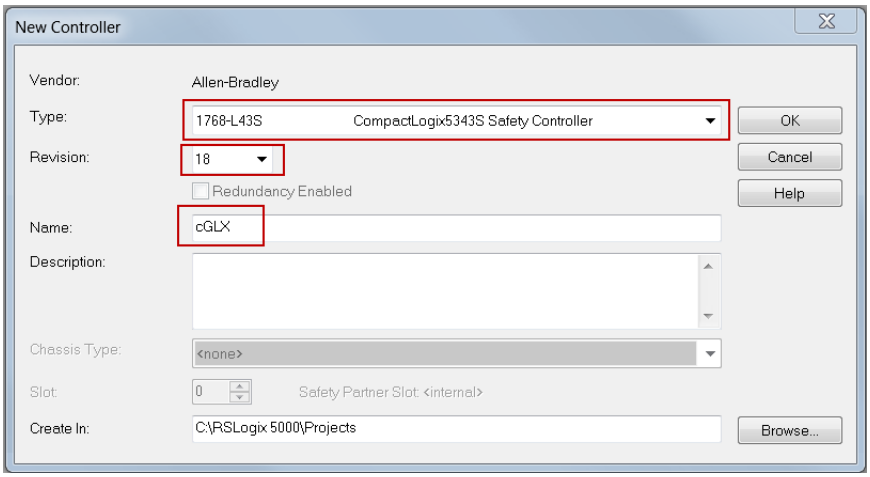
Configuration

The Compact GuardLogix controller is configured by using RSLogix 5000® software, version 17 or later. You must create a project and add the I/O modules. Then, configure the I/O modules for the correct input and output types. A detailed description of each step is beyond the scope of this document. Knowledge of the RSLogix™ programming environment is assumed.

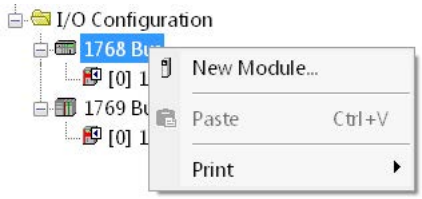
Configure the Controller and Add I/O Modules

Follow these steps to configure the controller.

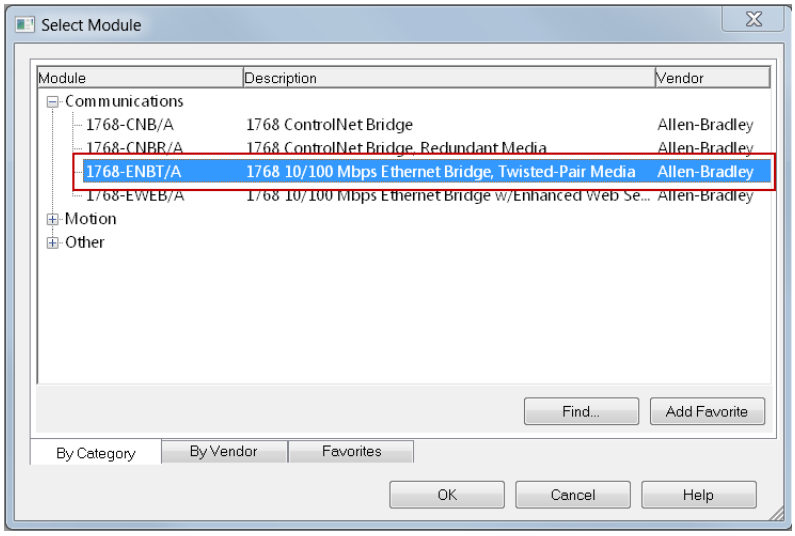
1. In RSLogix 5000 software, create a project.



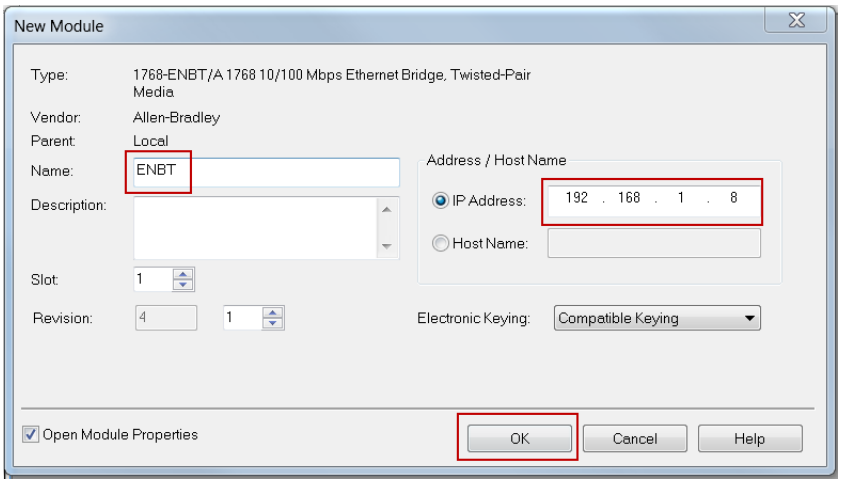
2. In the Controller Organizer, add the 1768-ENBT module to the 1768 Bus.



3. Select the 1768-ENBT module, and click OK.

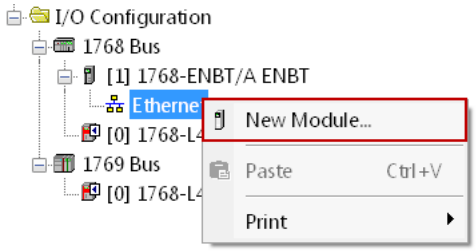


4. Name the module, type its IP address, and click OK.

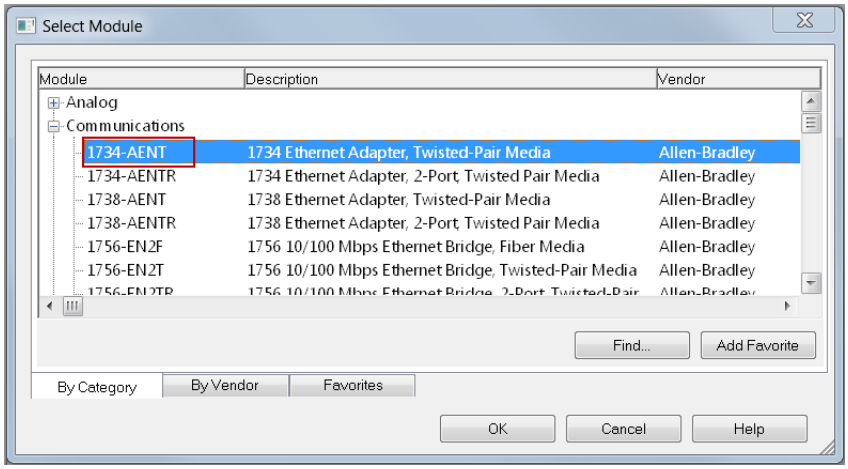


We used 192.168.1.8 for this application example. Yours may be different.

5. Add the 1734-AENT adapter by right-clicking the 1768-ENBT module in the Controller Organizer, and choose New Module.



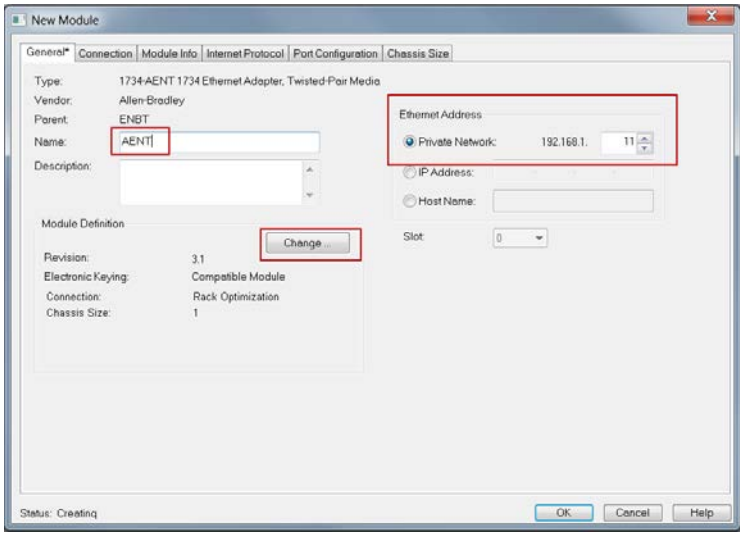
6. Select the 1734-AENT adapter, and click OK.



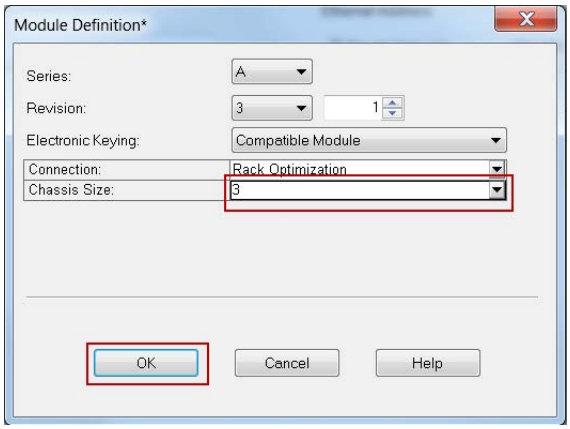
7. Name the module, type its IP address, and click OK.

   We used 192.168.1.11 for this application example. Yours may be different.

8. Click Change.

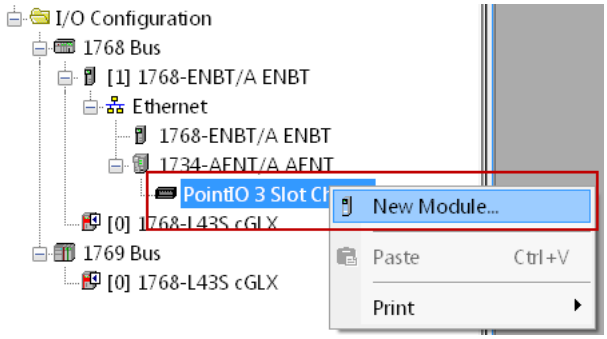


9. Set the Chassis Size as 3 for the 1734-AENT adapter, and click OK.

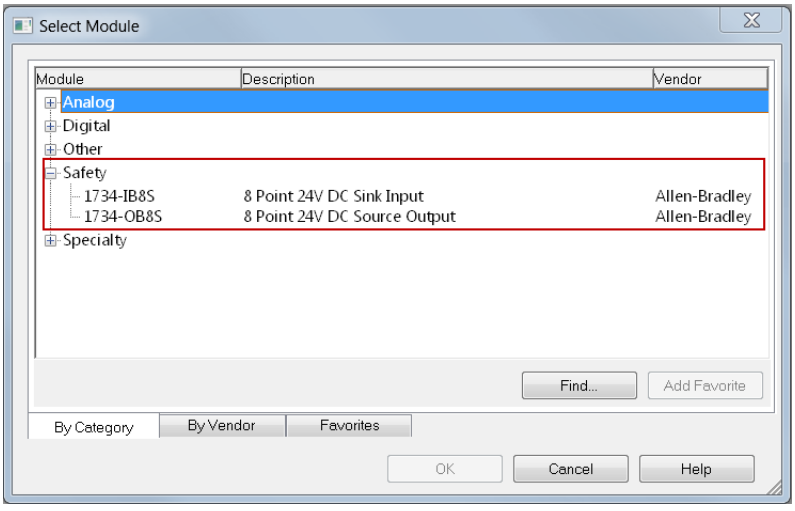


Chassis size is the number of modules that are inserted in the chassis. The 1734-AENT adapter is considered to be in slot 0, so for one input and one output module, the chassis size is 3.

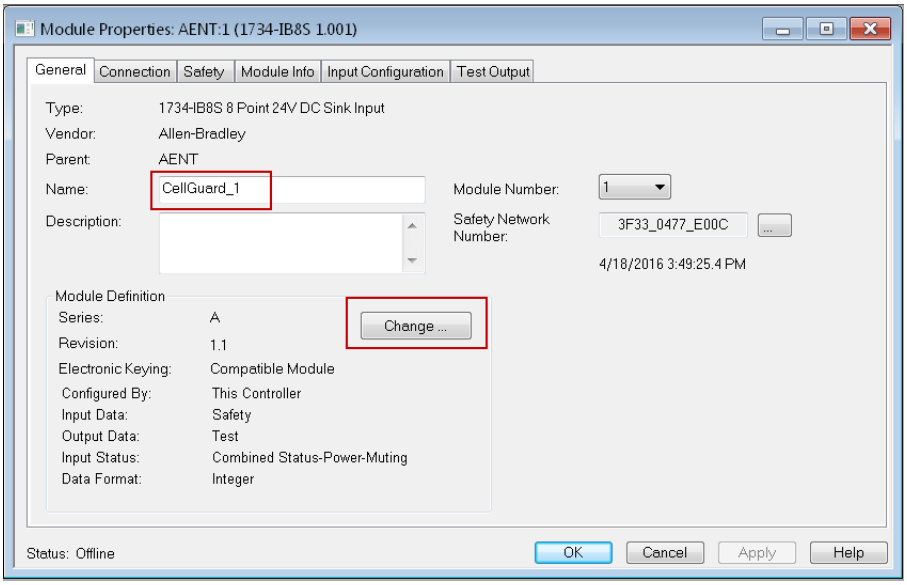
10. In the Controller Organizer, right-click the 1734-AENT adapter, and choose New Module.



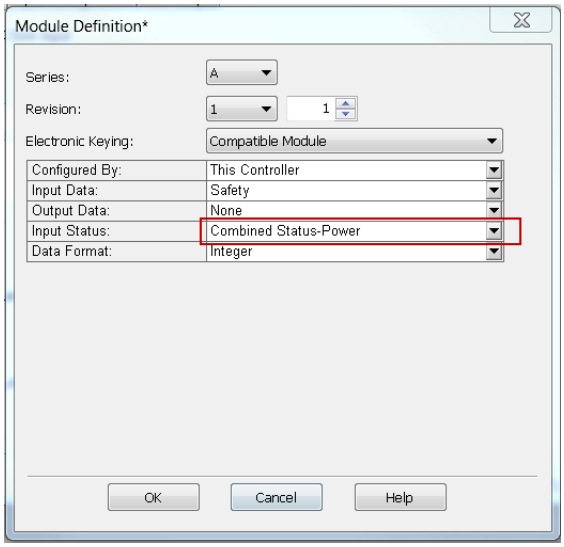
11. Expand Safety, select the 1734-IB8S module, and click OK.



12. In the New Module dialog box, name the device CellGuard_1, and click Change.



13. When the Module Definition dialog box opens, change the Output Data to None and the Input Status to Combined Status-Power, and click OK.

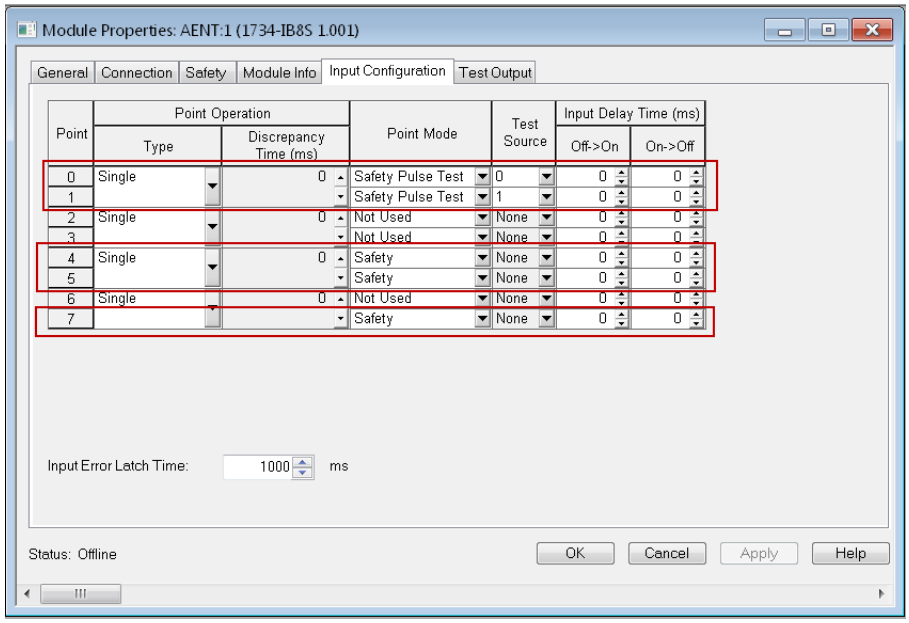


14. Close the Module Properties dialog box by clicking OK.
15. Repeat steps 10...14 to add the 1734-OB8S safety output module.

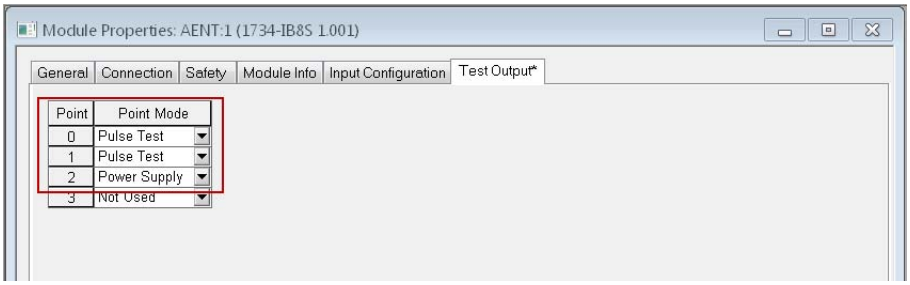
Configure the I/O Modules

Follow these steps to configure the POINT Guard I/O modules.

1. In the Controller Organizer, right-click the 1734-IB8S module, and choose Properties.
2. Click Input Configuration and configure the module as shown.

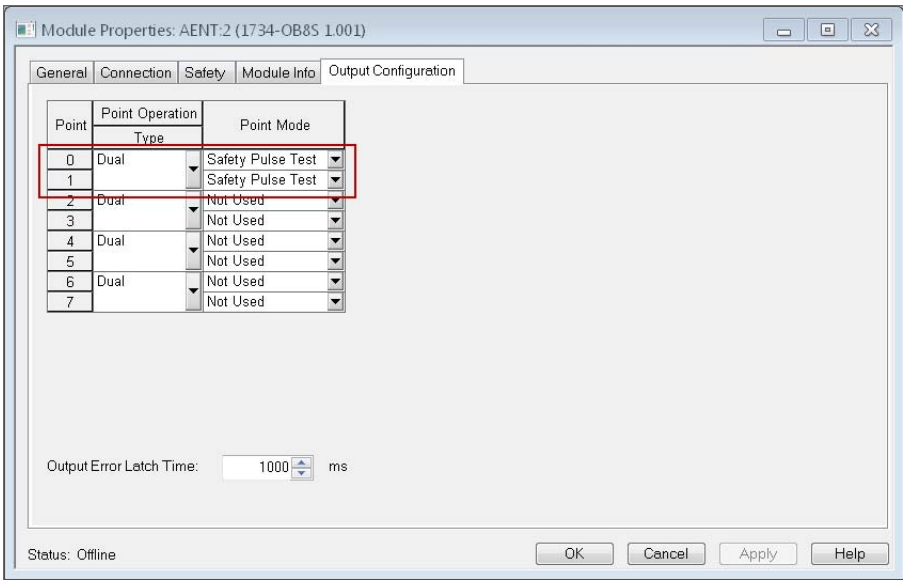


3. Click Test Output and configure the module as shown.



4. Click OK.
5. In the Controller Organizer, right-click the 1734-OB8S module, and choose Properties.

6. Click Output Configuration and configure the module as shown.



7. Click OK.

Programming

The Dual Channel Input Stop (DCS) instruction monitors dual-input safety devices whose main function is to stop a machine safely, for example, an E-stop, light curtain, or safety gate. This instruction can only energize Output 1 when both safety inputs, Channel A and Channel B, are in the active state as determined by the Input Type parameter, and the correct reset actions are implemented. The DCS instruction monitors dual-input channels for consistency (Equivalent – Active High) and detects and traps faults when the inconsistency is detected for longer than the configured Discrepancy Time (ms).

The Configurable Redundant Output (CROUT) instruction controls and monitors redundant outputs. The reaction time for output feedback is configurable. The instruction supports positive and negative feedback signals.

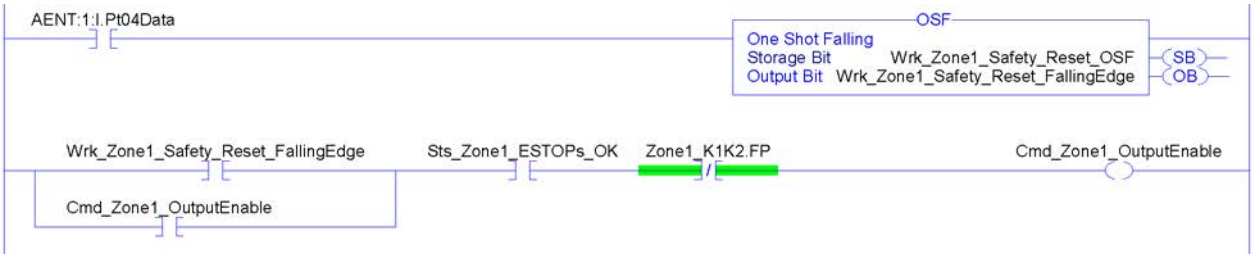
The safety application code prevents the outputs from restarting due to the required manual restart action, even if the safety input permissive resets automatically. Anti-tiedown functionality for the safety circuit reset is provided via the ONS (rising edge) or OSF (trailing edge).

The Input OK status is used as a permissive in the safety output routines.

Falling Edge Reset

ISO 13849-1 stipulates that instruction reset functions must occur on falling edge signals. To comply with this requirement, add a One Shot Falling instruction to the rung immediately preceding the Cmd_Zone1_OutputEnable rung. Then use the OSF instruction Output Bit tag as the reset bit for the following rung. The Cmd_Zone1_OutputEnable is then used to Enable the CROUT instruction.

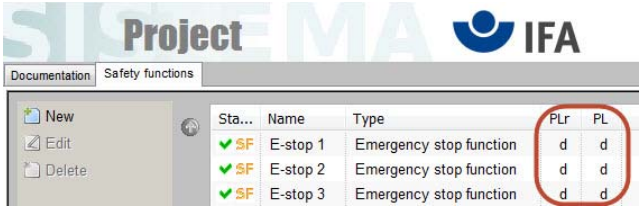
Modify the reset code as shown in the graphic.



Calculation of the Performance Level

When properly implemented, this safety function can achieve a safety rating of Category 3, Performance Level d (CAT. 3, PLd), according to ISO 13849-1: 2008, as calculated by using the Safety Integrity Software Tool for the Evaluation of Machine Applications (SISTEMA).

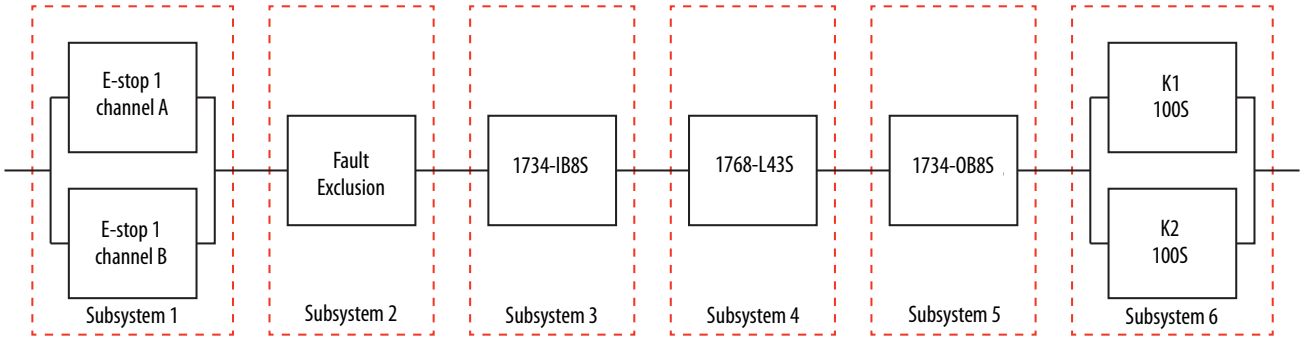
The functional safety specifications of the project call for a Performance Level of PLd (minimum) and a structure of CAT. 3 (minimum). A PFHd of less than 1.0 E-06 for the overall safety function is required for PLd.



When modeled in SISTEMA, each safety E-stop string is treated as an individual safety function and can be modeled as follows. This diagram shows one E-stop safety function.

Calculations are based on one operation of the E-stop per month, with 12 operations per year. Because there are three E-stops in this safety function, there are 36 operations of the contactors per year.

The emergency stop safety function can be modeled as follows.



Because the E-stop and contactors are electromechanical devices, certain data must be considered, including the following:

- Mean Time to Failure, dangerous (MTTFd)
- Diagnostic Coverage (DCavg)
- Common Cause Failure (CCF)

The functional safety evaluations of electromechanical devices include the following:

- How frequently they are operated
- Whether they are effectively monitored for faults
- Whether they are properly specified and installed

Because the E-stops are electromechanical devices, a fault exclusion must be considered when calculating a safety rating. A fault exclusion subsystem is added to SISTEMA to reflect this configuration. Because EN-ISO 13849-2:2012, Annex D allows a fault exclusion for mechanical aspects of emergency stop devices in accordance with IEC 60947-5-5, and because the estimated maximum number of E-stop operations is not considered to be excessive, this fault exclusion itself has no effect on the category or performance level achieved by the E-stop safety functions. To reflect this configuration in the SISTEMA project, the category and performance level of the fault exclusion subsystem were manually entered as Category 4 and Performance Level e.

The emergency stop function is a complementary protective measure that is intended to be used with other safeguarding measures and protective devices to sufficiently reduce risk. The emergency stop function shall be designed not to impair the effectiveness of the other protective devices or safety functions. For emergency stop devices in accordance with IEC 60947-5-5, a fault exclusion for mechanical aspects is allowed up to PLd if the maximum number of operations is considered. However, the actual number of operations (NOP) is used for the purposes of the MTTFd calculation in this document.

SISTEMA calculates the MTTFd by using B10d data provided for the contactors, along with the estimated frequency of use, entered during the creation of the SISTEMA project.

The DCavg (60 %) for the E-stop was entered manually to take into account that the E-stops are connected in series. Masking, due to series connection, reduces the ability of the system to detect faults.

The DCavg (99 %) for the contactors is selected from the Output Device table of ISO 13849-1 Annex E, Direct Monitoring.

Verification and Validation Plan

Verification and validation play important roles in the avoidance of faults throughout the safety system design and development process. ISO 13849-2 sets the requirements for verification and validation. The standard calls for a documented plan to confirm that all of the safety functional requirements have been met.

Verification is an analysis of the resulting safety control system. The Performance Level (PL) of the safety control system is calculated to confirm that the system meets the required Performance Level (PLr) specified. The SISTEMA software is typically used to perform the calculations and assist with satisfying the requirements of ISO 13849-1.

Validation is a functional test of the safety control system to demonstrate that the system meets the specified requirements of the safety function. The safety control system is tested to confirm that all of the safety-related outputs respond appropriately to their corresponding safety-related inputs. The functional test includes normal operating conditions in addition to potential fault injection of failure modes. A checklist is typically used to document the validation of the safety control system.

Prior to validating the GuardLogix safety system, confirm that the safety system and safety application program have been designed in accordance with the GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093 for GuardLogix 5560 or 1768 Compact GuardLogix, or the GuardLogix Safety Application Instruction Set Safety Reference Manual, publication 1756-RM095.

Verification and Validation Checklist

General Machinery Information			
Machine Name/Model Number			
Machine Serial Number			
Customer Name			
Test Date			
Tester Name			
Schematic Drawing Number			
Controller Name			
Safety Signature ID			
Safety Network Number			
RSLogix 5000 Software Version			
Safety Control System Modules	**GuardLogix Modules**		**Firmware Revision**
GuardLogix Safety Controller	1768-L43S		
CompactLogix Ethernet Bridge	1768-ENBT		
POINT I/O™ Ethernet Adapter	1734-AENT		
POINT I/O Input Modules	1734-IB8S		
POINT I/O Output Modules	1734-OB8S		
GuardLogix Safety System Wiring and Configuration Verification			
Test Step	**Verification**	**Pass/Fail**	**Changes/Modifications**
1	Verify that the safety system is designed in accordance with the GuardLogix Control Systems Safety Reference Manual listed in the Additional Resources.		
2	Verify that the safety application program is designed in accordance with the GuardLogix Safety Application Instruction Set Safety Reference Manual, publication 1756-RM095.		

Verification and Validation Checklist

3	Visually inspect the safety system and verify that the network and I/O is wired as documented in the schematics.		
4	Visually inspect the RSLogix 5000 program to verify that the safety system network and I/O module configuration is configured as documented.		
5	Visually inspect the RSLogix 5000 application program to verify that suitable safety-certified instructions are used. Verify that the logic is readable, understandable, and testable with the aid of clear comments.		
6	Verify that all input devices are qualified by cycling their respective actuators. Monitor the status in the RSLogix 5000 Controller Tags window.		
7	Verify that all output devices are qualified by cycling their respective actuators. Monitor the status in the RSLogix 5000 Controller Tags window.		
Normal Operation Verification - The GuardLogix safety system responds properly to all normal Start, Stop, Enabling, and Reset inputs.			
Test Step	**Verification**	**Pass/Fail**	**Changes/Modifications**
1	Initiate a Start command. Both contactors energize for a normal machine run condition. Verify proper machine status indication and safety application program indication.		
2	Initiate a Stop command. Both contactors de-energize for a normal machine Stop condition. Verify proper machine status indication and safety application program indication.		
3	While the system continues to run, press the E-stop button. Both contactors remain de-energized and open for a normal, safe condition. Verify proper machine status indication and safety application program indication. Repeat for all E-stop buttons.		
4	While the system is stopped, press the E-stop button and initiate a Start command. Both contactors remain de-energized and open for a normal, safe condition. Verify proper machine status indication and safety application program indication. Repeat for all E-stop buttons.		
5	Initiate a Reset command. Both contactors remain de-energized. Verify proper machine status indication and safety application program indication.		
Validation of Safe Response to Abnormal Operation - The GuardLogix safety system responds properly to all foreseeable faults with corresponding diagnostics.			
E-stop Input Tests			
Test Step	**Validation**	**Pass/Fail**	**Changes/Modifications**
1	While the system continues to run, remove the channel 1 wire from safety I/O. Both contactors de-energize. Verify proper machine status indication and safety application program indication. Restore channel 1 and repeat for channel 2.		
2	While the system continues to run, short channel 1 of the safety I/O to 24V DC. Both contactors de-energize. Verify proper machine status indication and safety application program indication. Verify that the system cannot be reset and restarted with the fault. Restore channel 1 and repeat for channel 2.		
3	While the system continues to run, short channel 1 of the safety I/O to 0V DC. Both contactors de-energize. Verify proper machine status indication and safety application program indication. Restore channel 1 and repeat for channel 2.		
4	While the system continues to run, short channels 1 and 2 of the safety I/O. Both contactors de-energize. Verify proper machine status indication and safety application program indication. Restore channel 1 and 2 wiring.		
Validation of Safe Response to Abnormal Operation - The safety system responds properly to all foreseeable faults with corresponding diagnostics.			
GuardLogix Controller and Network Tests			
Test Step	**Validation**	**Pass/Fail**	**Changes/Modifications**
1	While the system continues to run, remove the Ethernet network connection between the safety I/O and the controller. All contactors de-energize. Verify proper machine status indication and I/O connection status in the safety application program.		

Verification and Validation Checklist

2	Restore the safety I/O module network connection and allow time to re-establish communication. Verify the Connection Status Bit in the safety application program. Repeat for all safety I/O connections.		
3	While the system continues to run, switch the controller out of Run mode. All contactors de-energize. Return the key switch to Run mode. All contactors remain de-energized. Verify proper machine status indication and safety application program indication.		
Validation of Safe Response to Abnormal Operation - The safety system responds properly to all foreseeable faults with corresponding diagnostics.			
Safety Contactor Output Tests			
Test Step	**Validation**	**Pass/Fail**	**Changes/Modifications**
1	Initiate a Start command. Both contactors energize for a normal machine run condition. Verify proper machine status indication and safety application program indication.		
2	While the system continues to run, remove the contactor feedback from the safety I/O. All contactors remain energized. Initiate a Stop command and attempt a Reset command. The system does not Restart or Reset. Verify proper machine status indication and safety application program indication.		
3	While the system continues to run, short the contactor feedback to the safety I/O. All contactors remain energized. Initiate a Stop command and attempt a Reset command. The system does not Restart or Reset. Verify proper machine status indication and safety application program indication.		

Additional Resources

These documents contain more information about related products from Rockwell Automation.

Resource	Description
Compact GuardLogix Controllers User Manual, publication 1768-UM002	Provides information on how to configure, operate, and maintain Compact GuardLogix controllers.
POINT Guard I/O Safety Modules User Manual, publication 1734-UM013	Provides information on how to install, configure, and operate POINT Guard I/O modules.
GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093	Contains detailed requirements on how to achieve and maintain safety ratings with the GuardLogix 5560 or 1768 Compact GuardLogix controller system.
GuardLogix Safety Application Instruction Set Safety Reference Manual, publication 1756-RM095	Provides detailed information on the GuardLogix safety application instruction set.
GuardLogix 5570 and Compact GuardLogix 5370 Controller Systems Safety Reference Manual, publication 1756-RM099	Describes the GuardLogix 5570 controller system. Provides instructions on how to develop, operate, or maintain a GuardLogix 5570 controller-based safety system that uses the Studio 5000 Logix Designer application.
Safety Accelerator Toolkit Quick Start, publication IASIMP-QS005	Provides a step-by-step guide on how to use the design, programming, and diagnostic tools in the Safety Accelerator Toolkit.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines on how to install a Rockwell Automation® industrial system.
Safety Products Catalog, publication S117-CA001 Website http://www.rockwellautomation.com/rockwellautomation/catalogs/overview.page	Provides information about Rockwell Automation safety products.
Product Certifications Website, http://www.rockwellautomation.com/global/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

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

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	www.rockwellautomation.com/knowledgebase
Local Technical Support Phone Numbers	Locate the phone number for your country.	www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	www.rockwellautomation.com/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

For more information on Safety Function Capabilities, visit:

http://marketing.rockwellautomation.com/safety/en/safety_functions

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

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