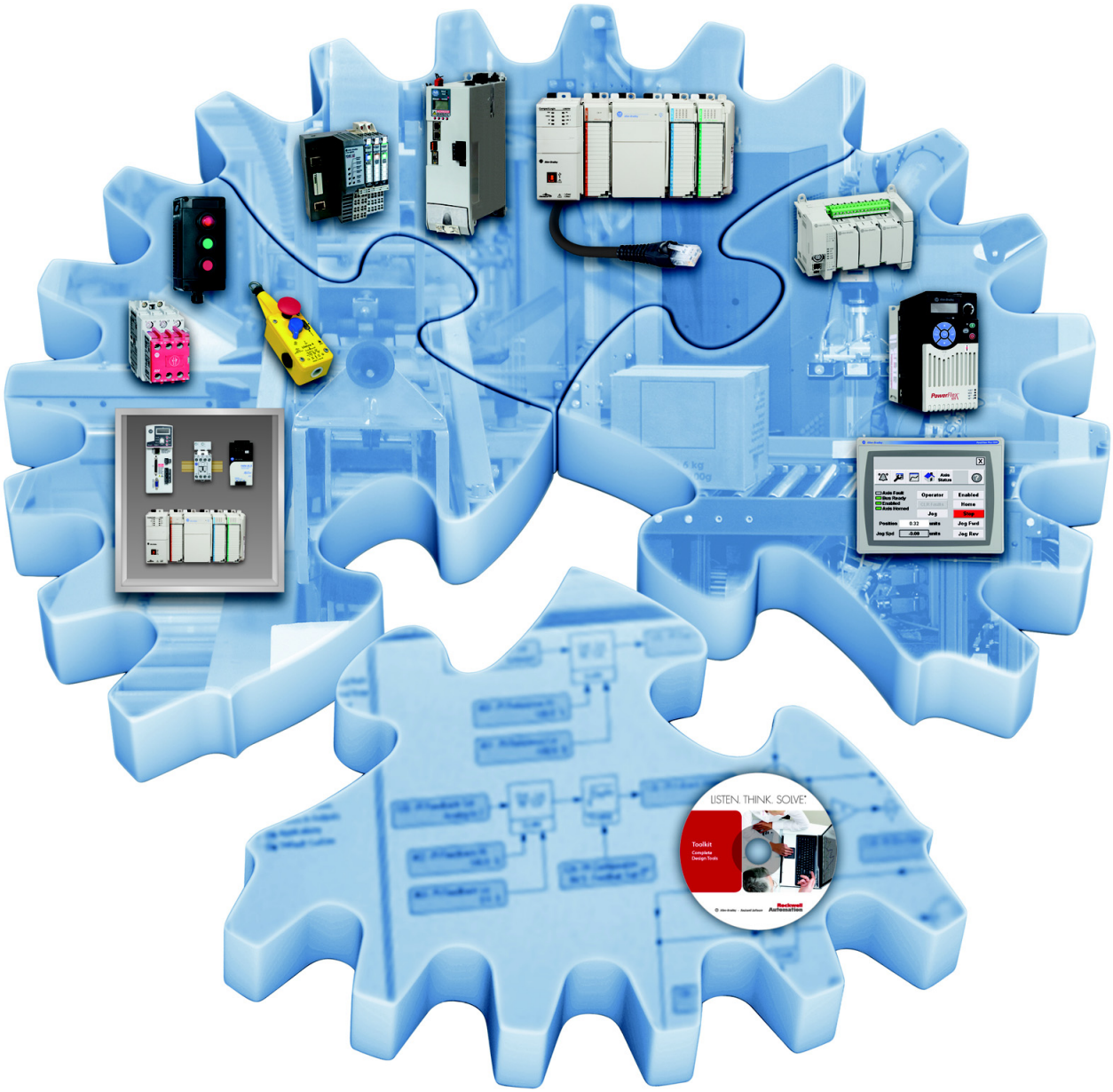
Quick Start

Original Instructions

Safety Accelerator Toolkit

Catalog Numbers 1756-L61S, 1756-L62S, 1756-L63S, 1756-LSP, 1756-L71S, 1756-L72S, 1756-L73S, 1756-L7SP, 1756-L73SXT, 1756-L7SPXT, 1768-L43S, 1768-L45S, 1756-L72EROMS, 1769-L30ERMS, 1769-L33ERMS, 1769-L36ERMS



Important User Information

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

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

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

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

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

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

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

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

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

Chapter 3

GuardLogix® Controllers Logic Integration

Chapter 4

SmartGuard™ 600 Controllers Logic Integration

Chapter 5

FactoryTalk® View ME Software Integration

Chapter 6

Safety System Application Guide

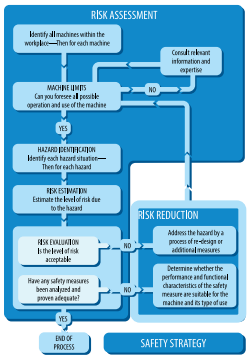
This manual contains new and updated information as indicated in this table.

Topic	Page
Revised available catalog numbers.	Front cover
Added LogixDesigner row to Software Requirements table.	11
Added publication 1769-UM022 to the Additional Resources table.	12
Revised title to publication 1756-RM099 in Additional Resources table.	12
Added Compact GuardLogix® 5370 information row to Table 6.	29
Revised instructions and graphics in Access Other Allen-Bradley® CAD Drawings section.	45
Added LogixDesigner software version information to What You Need section.	47
Updated website URL for Safety Accelerator Toolkit in What You Need section.	47
Added publication 1769-UM022 to What You Need section.	47
Revised information and graphic in third bullet point.	53
Added information to step 14.	55
Revised information in step 6 and added step 7.	74
Revised information in step 12.	81
Revised information in step 6 and added step 7.	85
Added Compact GuardLogix 5370 controller to What You Need section.	161

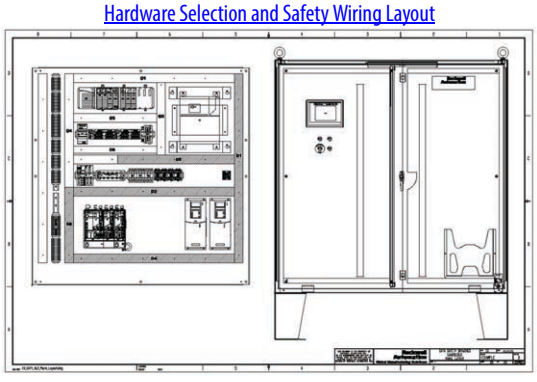
Notes:

Follow this path to complete your safety application.

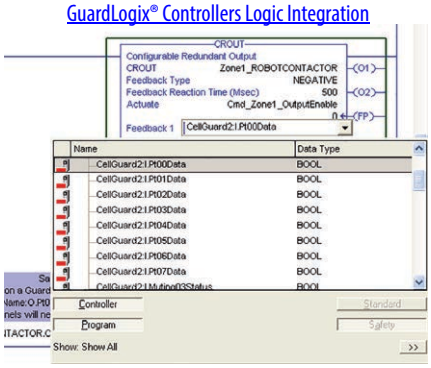
Chapter 1
Risk Assessment and System Design



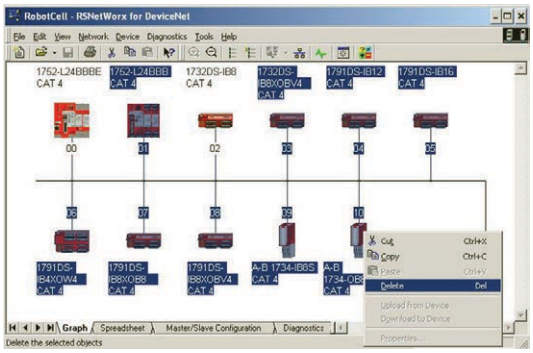
Chapter 2
Hardware Selection and Safety Wiring Layout



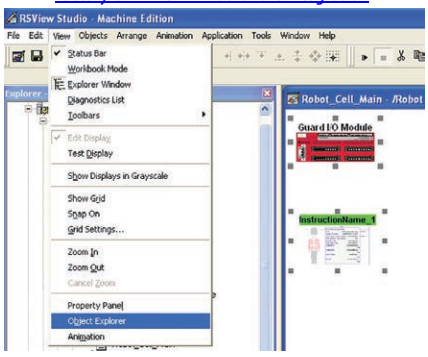
Chapter 3
GuardLogix® Controllers Logic Integration



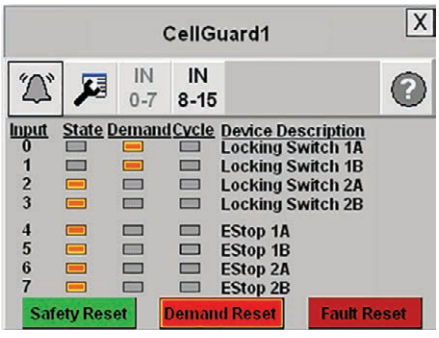
Chapter 4
SmartGuard™ 600 Controllers Logic Integration



Chapter 5
FactoryTalk® View ME Software Integration



Chapter 6
Safety System Application Guide



Notes:

About This Publication

This quick start provides a framework to develop safety applications. Each section guides you through the tasks that you need to perform to design, program, and monitor your safety application.

To assist in the design and installation of your system, application files and other information are provided on the Safety Accelerator Toolkit, SAFETY-CL002. The DVD provides CAD drawings for components, wiring diagrams, logic routines, and more. With these tools and the built-in best-practices design, you can focus on the design of your system and not on design overhead tasks.

IMPORTANT Before you use this quick start and the CD, read the Terms and Conditions on the CD.

Each chapter begins with the following information. Read these sections carefully before you begin work in each chapter.

- **Before You Begin** - This section lists the steps that must be completed and decisions that must be made before you start that chapter. The chapters in this quick start do not have to be completed in the order in which they appear, but this section defines the minimum amount of preparation required before you complete the current chapter.
- **What You Need** - This section lists the tools that are required to complete the steps in the current chapter. This includes, but is not limited to, hardware and software.
- **Follow These Steps** - This illustrates the steps in the current chapter and identifies which steps are required to complete the examples.

Software Requirements

You need these software to use this toolkit.

Rockwell Automation® Software	Version
RSLogix 5000®	16 or later for 1756 GuardLogix® controllers 18 or later for 1768 GuardLogix controllers
Studio 5000® environment	28.00.00 or later for 5370 Compact GuardLogix controllers
FactoryTalk® View Machine Edition	6.1 or later
RSNetWorx™ for DeviceNet	9.1 or later for 1752-L24BBBE SmartGuard™ 600 controller
RSLinx® Classic	2.55 or later for 1756 and 1768 GuardLogix controllers 3.80 or later for 5370 Compact GuardLogix controllers

Additional Resources

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

Resource	Description
GuardLogix Controllers User Manual, publication 1756-UM020	Provides information to configure and program the 1756 GuardLogix system in RSLogix 5000 software.
GuardLogix 5570 Controllers User Manual, publication 1756-UM022	Provides information to configure and program the 1756 GuardLogix system in the Studio 5000 environment.
Compact GuardLogix Controllers User Manual, publication 1768-UM002	Provides information to configure and program the 1768 Compact GuardLogix controller system.
Compact GuardLogix 5370 Controllers User Manual, publication 1769-UM022	Provides information to configure and program the Compact GuardLogix 5370 controller system.
GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093	Contains detailed requirements to achieve and maintain SIL 3 with the GuardLogix controller system and RSLogix 5000 software.
GuardLogix 5570 and Compact GuardLogix 5370 Controller Systems Safety Reference Manual, publication 1756-RM099	Contains detailed requirements to achieve and maintain SIL 3 with the GuardLogix and Compact GuardLogix controller systems, and the Studio 5000 environment.
SmartGuard 600 Controller Installation Instructions, publication1752-IN001	Provides information to install the SmartGuard 600 controller.
SmartGuard 600 Controllers User Manual, publication 1752-UM001	Provides information to configure and program the SmartGuard 600 controller system.
SmartGuard 600 Controllers Safety Reference Manual, publication 1752-RM001	Contains detailed requirements to achieve and maintain SIL 3 with the SmartGuard 600 controller system.
CompactBlock™ Guard I/O™ DeviceNet Safety Module Installation Instructions, publication 1791DS-IN002	Provides information to install CompactBlock Guard I/O DeviceNet Safety modules.
Guard I/O DeviceNet Safety Modules User Manual, publication 1791DS-UM001	Provides information to use Guard I/O™ DeviceNet Safety modules.
Guard I/O EtherNet/IP Safety Modules Installation Instructions, publication 1791ES-IN001	Provides information to install CompactBlock Guard I/O EtherNet/IP Safety modules.
Guard I/O EtherNet/IP Safety Modules User Manual, publication 1791ES-UM001	Provides information to use Guard I/O EtherNet/IP Safety modules.
POINT Guard I/O™ Safety Module User Manual, publication 1734-UM013	Provides information to install, configure, and operate POINT Guard I/O Safety Modules.
Safety Products Catalog available at http://www.ab.com/catalogs/	Provides selection and specification information for Rockwell Automation safety products.
CompactLogix™ System User Manual, publication 1769-UM007	Provides information to configure, operate, and troubleshoot systems with 1769-L20 or 1769-L30 CompactLogix controllers.
1769-L20, 1769-L30 CompactLogix Controllers Installation Instructions, publication 1769-IN047	Provides information to install 1769-L20 or 1769-L30 CompactLogix controllers.
1769 CompactLogix Controllers User Manual, publication 1769-UM011	Provides information to configure, operate, and troubleshoot systems with 1769-L31, 1769-L32C, 1769-L32CR, 1769-L32E, or 1769-L35E CompactLogix controllers.
1769-L31 CompactLogix Controller Installation Instructions, publication 1769-IN069	Provides information to install 1769-L31 CompactLogix controllers.
1769-L32C, 1769-L32CR CompactLogix Controller Installation Instructions, publication 1769-IN070	Provides information to install 1769-L32C and 1769-L32CR CompactLogix controllers.
CompactLogix Controller Installation Instructions, publication 1769-IN020	Provides information to install 1769-L32E and 1769-L35E CompactLogix controllers.
Logix Common Procedures Programming Manual, publication 1756-PM001	Provides information to program Logix5000 controllers, which includes how to manage project files, organize tags, program and test routines, and handle faults.
Rockwell Automation Configuration and Selection Tools, available at http://www.rockwellautomation.com/en/e-tools/	These online tools install on your personal computer so that you can quickly access information on our products: • CrossWorks™ • Industrial Computer Selector • Operator Interface Selection Tool • Programmable Controller Family Selector

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.

Risk Assessment and System Design

Introduction

The GuardLogix® controller offers you the capability to integrate safety and standard control in the same system. Safety functions supported by the system include:

- Determine specifically which gate has been opened or E-stop device has been pressed
- Perimeter and point-of-operation guarding
- Zone control

In this chapter, you learn the fundamentals of safety strategy development, see examples of risk assessment and estimation worksheets and safety system design, and learn how Rockwell Automation can help.

In subsequent chapters of this toolkit, you'll create a bill of materials based on the functional requirements identified by a risk assessment. Once you've determined which safety components you'll need, you'll learn how to use the Safety Accelerator Toolkit to layout your system wiring, integrate logic routines in your safety application program, and use faceplates designed to facilitate HMI.

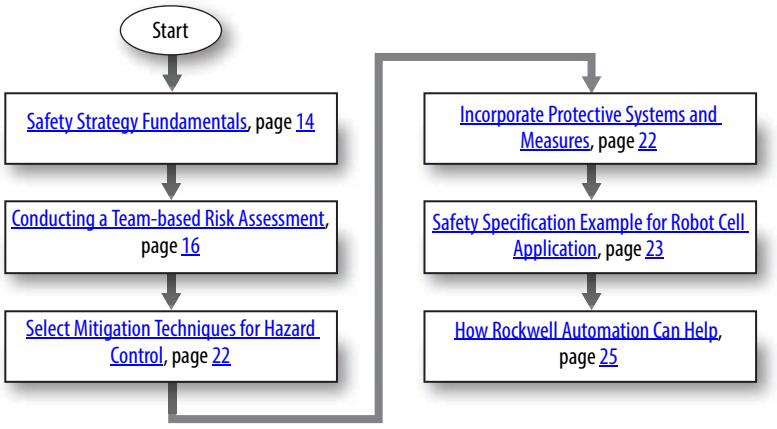
Before You Begin

Become familiar with the local, national, and international standards, including consensus standards that govern machine safety.

The safety standards that would be applied for safeguarding a work cell, like the example shown in this quick start, are extensive.

- National Standards
- Safeguarding Application Standards
- Personal Protective Equipment Standards
- Energy Isolation Standards for Routine, Repetitive And Routine Tasks
- Risk Assessment Standards
- Controller Application Standards
- Standards pertaining to Awareness Means
- Standards relating to validation and maintenance associated with the verification of the system performance on a regular basis
- Robotic Standards
- Electrical System Design Standards
- Energy Isolation Standards for Maintenance Tasks

Follow These Steps



Safety Strategy Fundamentals

IMPORTANT The information in this section is not advocated as the definitive method. Individual circumstances may dictate a different approach. It is intended as a general guideline to encourage a methodical and documented structure.

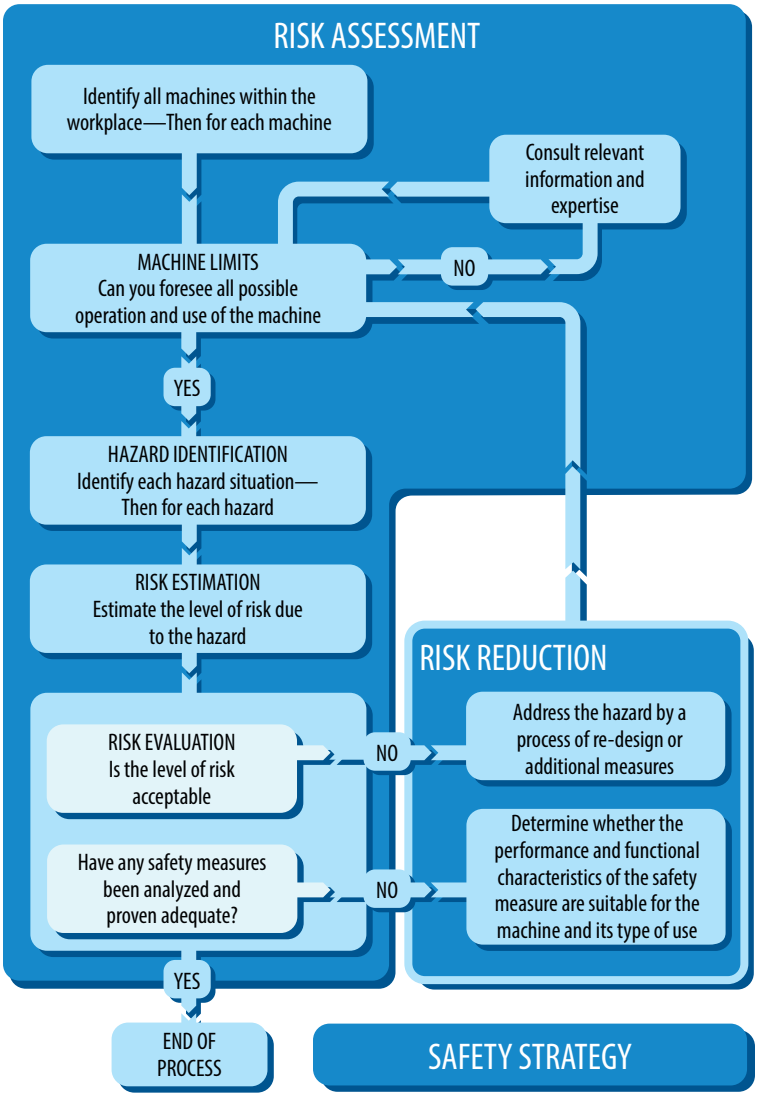
To devise a proper safety strategy, these steps must be addressed.

1. **Risk Assessment:** based on a clear understanding of the machine limits and functions and the tasks that may be required to be performed throughout its life.
2. **Risk Reduction:** performed if necessary with safety measures selected and implemented based on the performance requirements dictated by the risk assessment methodology.

   Risk Assessment Methodologies dictate that the hierarchy of safety controls be followed, implementing system redesign measures, if possible, to totally eliminate the risk.

   A hazard control technique must be defined for each hazardous motion, including each mode of operation (such as Automatic, Jog, or Cycle Stop) and each demand on the safety system (such as E-stop device activated or safety gate opened). This is essential so that the energy source is properly controlled in all interactions with the machine and all demand scenarios on the safety system.

The manner in which risk assessment and risk reduction are performed is the basis of the safety strategy for the machine.



3. **Functional Safety Specification:** performed to identify the required functionality of the total system. The functional safety specification includes identification of:
   - the interconnections between standard control and the safety control system.
   - all of the safety devices (input, output, and logic-solving).
   - the requirements for integrating devices into the existing system.
   - the sequence of events due to various demands on the safety system for each mode of machine operation.
   - diagnostic requirement.
   - any other items related to the system design.
4. Design, building, and installation of the system.
5. **Final Risk Assessment:** conducted to make sure that no new hazards have been introduced into the system.
6. **Administrative Requirements and Training:** develop and implement administrative requirements, as well as operator, technician, and affected personnel training.
7. **Validation:** performed prior to production release to verify that the safety system meets the requirements set forth by the risk assessment and performs at the proper level of fault tolerance prescribed by the chosen methodology.

Conducting a Team-based Risk Assessment

A formal team-based risk assessment is a task-by-task evaluation of the hazards that operators, technicians, and other personnel may come in contact with. The results of a risk assessment help designers identify a more complete list of hazards that can be addressed and mitigated by following a formal process.

The formal process embraces a hierarchy of measures for risk reduction that includes system redesign, engineered guarding, administrative and training requirements, awareness means, and personal protective equipment (PPE) identification. This leads to a systematic approach to reducing risk, not a guarding bandage approach.

Risk assessments include a risk rating system for identifying the risk level for each task and hazard combination. Once the hazards are understood, mitigation techniques are applied to lower the risk to an acceptable level. A system designer who uses a formal risk assessment methodology, based on safety standards, shows due diligence in the safety system design. Some formal processes and standards also provide steps to identify the residual risk after the mitigation techniques have been applied and provide guidelines on what is an acceptable level of residual risk.

Overall, the risk assessment process establishes the appropriate level of safety guarding, so that you don't over- or under-design but apply the right level of risk mitigation to the hazard.

Task and Hazard Identification

All of the hazards at the machine must be identified and listed in terms of their nature and location. Examples of hazards include crushing, shearing, entanglement, part ejections, fumes, radiation, heat, noise, and more.

For each hazard, be sure to identify the energy source and component that could cause the injury, such as a crushed arm due to powered robot motion or a crushed hand due to uncontrolled vertical motion from the potential energy of a gantry.

The results of a task analysis should be compared with the results of hazard identification to show where there are possibilities for the convergence of a hazard and a hazardous situation.

Risk Estimation

Any machine that has the potential for hazardous situations presents a risk of a hazardous event, that is, causing physical harm, property or environmental damage. The greater the risk, the more important it becomes to do something about it. To make a decision on how to respond to the risk, you need to be able to quantify it.

Risk is often thought of solely in terms of the severity of injury at an accident. Both the severity of potential harm and the probability of its occurrence have to be taken into account to estimate the amount of risk present. Probability of occurrence comprises two factors: the frequency of exposure and the possibility of avoidance. Risk estimation assigns values to each of these factors, which are then used to determine appropriate risk reduction measures that are feasible, realistic, and cost-effective.

ISO 13849-1 provides methods and guidance on how to specify a safety-related control system that is providing a protective measure or safety function.

These two risk estimation flow charts are typical methods of defining risk for machinery safety. Other methods are available for process safety. In fact, many of these types of tools are available. It's important to use these types of processes to help define the level of risk.

Figure 1 - Risk Graph for Performance Level for a Safety Function (ISO 13849-1:2006

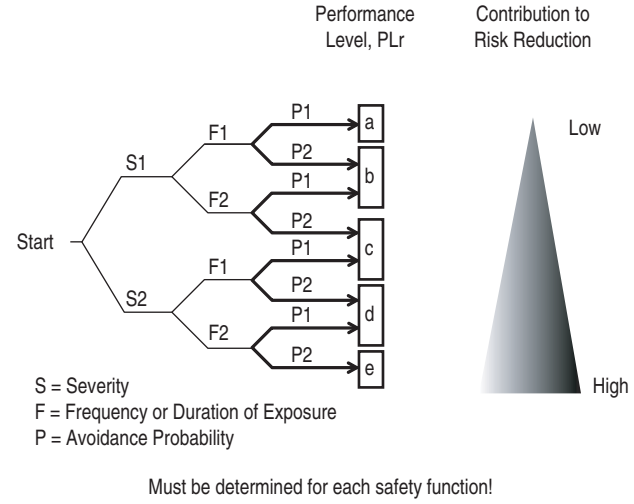
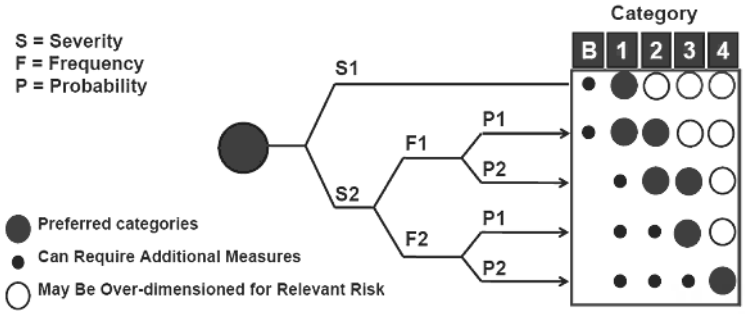


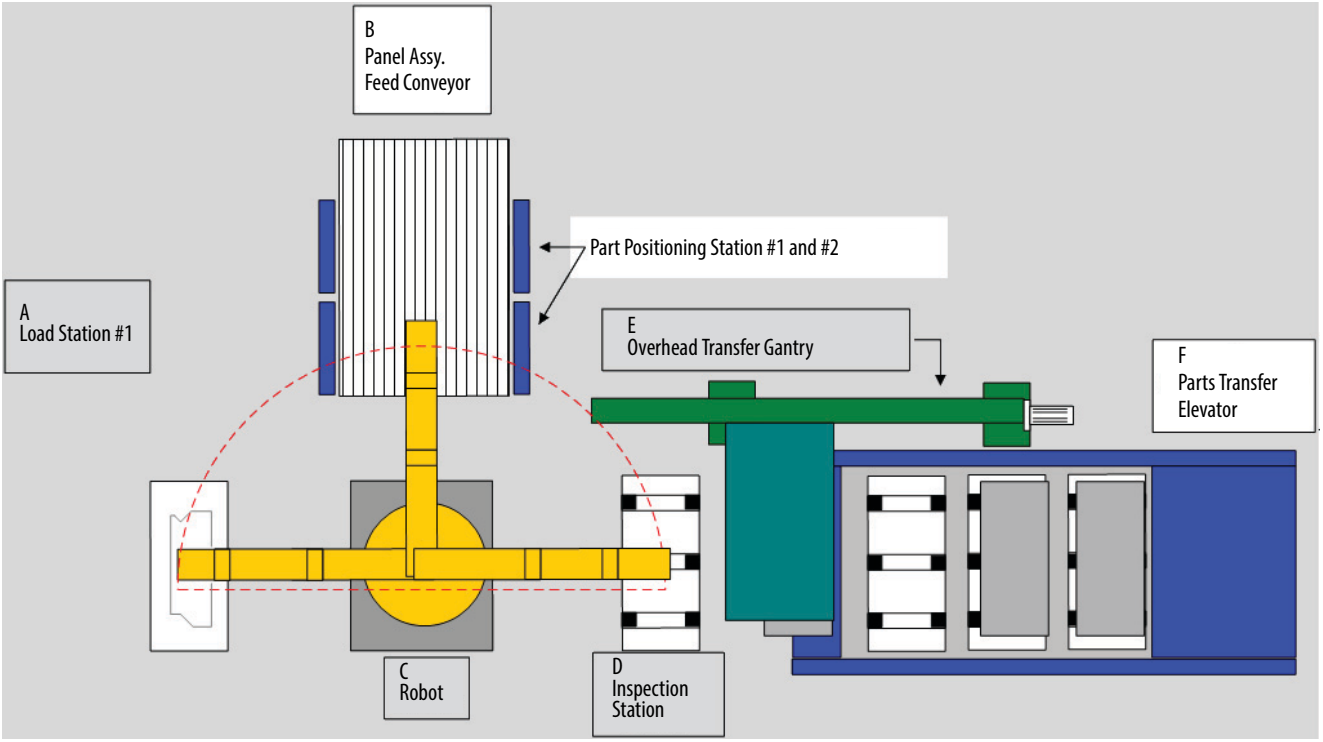
Figure 2 - Risk Graph for ISO13849-1:2006 Category Determination



Risk Assessment Example for Robot Cell Application

The following is an example of a robot cell risk assessment worksheet including both task and hazard identification and risk estimation.

Figure 3 - Line Name: XYZ Assembly and Inspection Station



This application consists of an assembly and inspection station with this equipment.

- Manual Loading Station #1 (A)
- Panel Assembly Feed Conveyor (B)
- 6-axis Servo Robot (C)
- Automated inspection station (D)
- Overhead Transfer Gantry (E)
- Finished Part Transfer Elevator (F)

The application follows this sequence of operation.

1. The Panel Assembly Feed Conveyor (B) indexes the panel into Panel Position Station #2.
2. The operator loads the part at Station #1 (A).
3. The operator initiates a part ready sequence to activate the robot.
4. Robot (C) picks part from Station #1 (A).
5. The robot inserts the part from Station #1 into a panel on the Panel Assembly Feed Conveyor.
6. The robot picks the assembly from Panel Assembly Feed Conveyor (B) and places it into the Inspection Station (D).
7. The Overhead Transfer Gantry (E) transfers the assembly to the Transfer Elevator (F).
8. The Transfer Elevator (F) indexes one position to complete the cycle.

The machine operating modes, as defined by the operators, are Automatic, Manual, and Jog with gates open. The Jog mode operation is required for the movement of the following equipment.

Equipment	Movement
Robot (C)	5 axis End of Arm (EOA) tooling
Overhead Transfer Gantry (E)	X-axis Y-axis End of Arm (EOA) tooling
Parts Transfer Elevator (F)	Index

Table 1 - Key for Risk Assessment Worksheet

Category	Rating	Description
S = Severity of injury	S1	Slight (normally reversible)
	S2	Serious (normally irreversible including death)
F = Frequency or exposure to hazard	F1	Seldom to less often and/or the exposure time is short
	F2	Frequent to continuous and/or the exposure time is long
P = Possibility of avoiding the hazard or limiting the harm	P1	Possible under specific conditions
	P2	Scarcely possible

Table 2 - Risk Assessment Worksheet - Load Part at Load Station #1

		Prior to Safeguards						With Safeguards			
Steps	**Potential Incidents or Accidents**	**Severity of Injury**	**Frequency (Exposure)**	**Avoidance**	**Risk Reduction Category(1)**	**Current Safeguards**	**Recommendations**	**Severity of Injury**	**Frequency (Exposure)**	**Avoidance**	**Residual Risk<Footnote>(1)**
1. Remove part from the transfer rack.	Ergonomic exposure due to part pick location.	S2	F2	A2	R1		Evaluate cart design for pick elevation and modify, if necessary. Train workers on proper lifting technique. Job rotation. Awareness posters on proper lifting technique.	S1	F2	A1	R3A
	Cuts to hands or arms due to sharp edges on parts.	S2	F2	A2	R1		PPE: Hand and arm protection such as protective gloves and sleeves.	S1	F1	A1	R4
	Crushing or cuts due to cart tip-over hazard.	S2	F1	A2	R2B		Evaluate cart design for stability and correct if required. Verify that the cart does not move while unloaded.	S1	F1	A1	R4
2. Move part to loading station on stacklight indication: OK to load.	Slips or tripping due to debris on the floor.	S2	F2	A1	R2A		Enforce housekeeping procedures for floor cleaning.	S2	F1	A1	R3B
	Slips or tripping due to raised edges or floor discontinuity.	S2	F2	A1	R2A		Verify that the floor area does not have any discontinuities higher than 3/16 in.	S2	F1	A1	R3B
3. Place part into loading fixture. Part loading is complete upon stacklight indication: Part position OK.	Mechanical impact: Pinch or Crush hazard due to robot motion.	S2	F2	A2	R1		Inhibit robot motion while person is in the hazardous area. a. Use hard guards to reduce hazardous area. b. Use floor mat, light curtain, area scanner, or automatic gate to sense when a person is in the hazardous area or prevent exposure to the hazardous area. c. Implement robot zone control with annunciation to allow for part loading when robot does not present a hazard. Use base safety limit switches to define the zone. d. Install a properly-rated safety control system.	S1	F1	A1	R4
	Eye injury due to compressed air or airborne debris from the environment.	S2	F1	A2	R2B		PPE: Safety glasses to protect eyes.	S1	F1	A1	R4

(1) Risk Ratings of R1, R2A, R2B, R3, R4 correspond to the Safety Control Circuit Performance requirements of ANSI/RIA R15.06-1999. An R1 rating represents a control reliable circuit with continuous checking for electrical and fluid power circuits. See the standard for a complete definition of performance requirements for the related risk ratings.

Table 3 - Risk Assessment Worksheet - Panel Assembly Feed Conveyor

		Prior to Safeguards						With Safeguards			
Steps	**Potential Incidents or Accidents**	**Severity of Injury**	**Frequency (Exposure)**	**Avoidance**	**Risk Reduction Category(1)**	**Current Safeguards**	**Recommendations**	**Severity of Injury**	**Frequency (Exposure)**	**Avoidance**	**Residual Risk <Footnote>(1)**
Tasks in the general area of the work cell where a person may be tempted to enter the hazardous area.	Mechanical impact: Pinch or crush hazard due to robot motion.	S2	F2	A2	R1		Safeguarding: a. Use hard guards to prevent access to the hazardous area. b. Use a light curtain to prevent access to guarded area, such as workers climbing on the conveyor. c. Install a properly-rated safety control system.	S1	F1	A1	R4
	Mechanical impact: Pinch or crush hazard due to conveyor power transmission.	S2	F2	A1	R2A		Hard-guarding: a. Make sure that the power transmission equipment and belts or pulleys are properly guarded. b. Install awareness signs to communicate that equipment must not be operated without guards. c. Verify that the training covers what guards are in place and that safety inspections validate that guards are present.	S1	F1	A1	R4

(1) Risk Ratings of R1, R2A, R2B, R3, R4 correspond to the Safety Control Circuit Performance requirements of ANSI/RIA R15.06-1999. An R1 rating represents a control reliable circuit with continuous checking for electrical and fluid power circuits. See the standard for a complete definition of performance requirements for the related risk ratings.

Select Mitigation Techniques for Hazard Control

These basic methods should be considered and applied in the order shown.

1. Eliminate or reduce the risks as far as possible using inherently safe machine design and construction.
2. Install the necessary protective systems and measures in relation to risks that cannot be eliminated by design.
3. Implement the administrative, awareness means, Personal Protective Equipment (PPE), and training requirements.
4. Inform the affected personnel of the controlled and residual risks after the mitigation techniques have been implemented. Indicate whether any additional training is required and specify any need to provide PPE.

Each measure from the hierarchy should be considered starting from the top and used where possible. This usually results in a combination of measures.

Incorporate Protective Systems and Measures

If access to a hazardous area is not required, the solution may be to safeguard it within the body of the machine or by some type of fixed enclosing guard. If access is required, it is necessary to make sure that access can only be gained while the machine is in a safe state. Protective measures such as interlocked guard doors or trip systems may be required. The choice of protective devices or systems should be heavily influenced by the operating characteristics of the machine. The safety of the operator depends on the proper application and correct operation of the protective system even under fault conditions.

A safety-related system may contain many elements, including the protective device, wiring, power switching device, and sometimes parts of the machine's operational control system. All these elements of the safety system should have suitable performance characteristics relevant to their design principles, technology and safety functional requirements.

Safety Specification Example for Robot Cell Application

To adequately describe the system, its equipment, sequence of operation, operating modes, and the detailed functional and physical specifications of each station must be documented.

Load Station #1

An analysis of Load Station #1 yields the following information.

Part weight: 3 lbs

Loading Frequency: 8...12 parts per minute

Task: The operator removes parts from the transfer rack and places the part into Load Station #1 (A). When the part is in position, the operator initiates the part ready sequence. The operator is also responsible for repositioning any miss-picked parts, moving empty racks out of the way, and moving full racks into position for loading. Maintenance personnel adjust and repair fixtures, as needed.

The part fixture has sensors to indicate that the part is loaded properly. A stack light annunciates proper part loading with a green light and improper loading with a red light.

Table 4 - Proposed Architecture for Load Station #1

Components	Standard Inputs	Safety Inputs	Safety Outputs	Comments
Floor mat		2		
E-stop device		2		
Robot safety enable 2		2		
Robot safety contactors		1 or 2	2	for contactor feedback
Total:		7	2	

Panel Assembly Feed Conveyor (B)

Analysis of the Panel Assembly Feed Conveyor (B) yields the following information.

Part weight: 12 lbs

Indexing frequency: 8...12 parts per minute

Drive: 3 HP PowerFlex® 70 Variable Frequency Drive, 460V, 3-phase

Two mechanical brakes: power to release, spring to hold (fail to safe)
Top speed: 12 in./s (30 cm/s)
Tested stop time: 0.3 s
Index time: 2...3 s

Pneumatic clamp actuator: pneumatic cylinder, 80 psi (5.6 kg/cm) required
Top speed: 32 in./s (81 cm/s)
Tested stop time: 0.35 s

Task: The operator realigns parts in the part locators at Positioning Station #1 and Positioning Station #2 of the Panel Assembly Feed Conveyor. Maintenance personnel adjust tool positioning at both stations and lubricate and repair equipment as needed.

The Panel Assembly Feed Conveyor has sensors to indicate when a part is in position at Positioning Station #1 for rough alignment and at Positioning Station #2 for final alignment and part holding for assembly. A stack light annunciates proper part positioning with a green light and improper loading with a red light.

The Panel Assembly Feed Conveyor is loaded automatically upstream of this station.

Table 5 - Proposed Architecture for Panel Assembly Feed Conveyor

Components	Standard Inputs	Safety Inputs	Safety Outputs	Comments
Drive enable	1			The standard input is the output of the control system into the safety logic to initiate the drive motion.
Safety enable 1			1	Enable to the PowerFlex 70 Drive
Safety enable 2			1	Enable to the PowerFlex 70 Drive
Feedback 1		1		Drive Safety System Feed Back #1
Feedback 2		1		(Feedback can be wired in series)
Pneumatic safety valve #1			1	…
Pneumatic safety valve #2			1	…
Pneumatic safety valve feedback		1		…
Total:	1	2 or 3	4	

How Rockwell Automation Can Help

Many formal and informal methodologies exist for assessing risk. Formal methodologies include ANSI, ISO, IEC, RIA, MIL Spec and other standards. Informal methodologies include job hazard analysis (JHA), job safety analysis (JSA), process hazard analysis (PHA), or other assessment tools a company may have developed internally. Regardless of the method selected, the system engineer must determine the method and type of safety protection for the identified hazards.

Rockwell Automation recommends you follow a formal Risk Assessment process. Rockwell Automation currently uses the ANSI RIA R15.06-1999 model as our standard risk assessment methodology, and options for ISO and IEC based risk assessments.

For hazard assessment, risk assessment, safety circuit analysis, safety system validation, or safety consulting, contact Rockwell Automation through your local Rockwell Automation® distributor or Rockwell Automation Customer Support and Maintenance Sales team or your Rockwell Automation representative.

Notes:

Hardware Selection and Safety Wiring Layout

Introduction

In this chapter, you will create a bill of materials and access CAD drawings from the safety accelerator toolkit to lay out your system wiring. You will also use two worksheets to document your devices in preparation for developing application logic.

Before You Begin

Complete a risk assessment and safety system specification as recommended in Chapter 1.

Make sure that you have installed the required software and have access to the Internet if you are not using the Safety Accelerator Toolkit DVD.

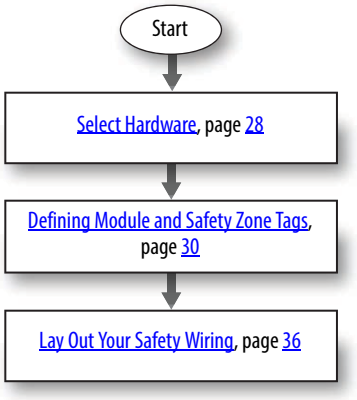
What You Need

- Personal computer with internet access for downloading software and files
- AutoCAD program to open the .dwg files or Adobe Acrobat Reader software to open .pdf files.

  TIP Use AutoCAD Electrical to take advantage of advanced features.

- Safety Accelerator Toolkit, DVD SAFETY-CL002, or visit the Integrated Architecture® Tools and Resources website at http://www.ab.com/go/iatools to download toolkit files
- Safety Products catalog, available at http://www.ab.com/catalogs/
- Microsoft Excel software

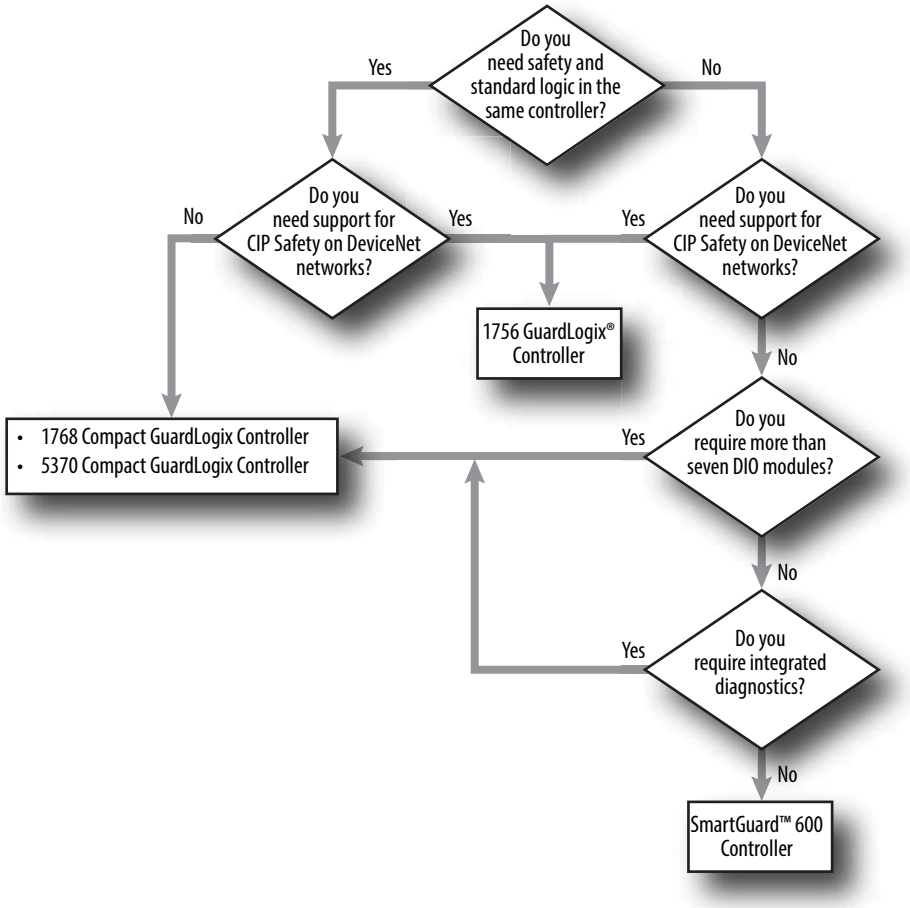
Follow These Steps



Select Hardware

To determine the hardware required for your application, follow these steps.

1. List the inputs and outputs required for your application and derived from your safety system specification, described in Chapter 1.
2. Use this decision tree to determine your safety controller platform.



3. Consult the table below for additional capabilities and performance to further select your safety controller platform.

   This toolkit supports 1756 GuardLogix, 1768 Compact GuardLogix, 5370 Compact GuardLogix, and 1752 SmartGuard 600 controllers.

Table 6 - Capabilities and Performance

Controller Platform	Capacity	Functionality	Performance
GuardLogix (1756)	Up to 125 nodes (max)	• Safety and standard control logic • Extensive suite of safety application instructions • CIP Safety on Ethernet, ControlNet, and DeviceNet • Superior ease of use	• High performance integrated safety • Use GuardLogix calculator and estimating tools to calculate performance.
Compact GuardLogix (1768)	Up to 64 nodes (max)	Same as GuardLogix, except CIP Safety only on Ethernet	Similar performance to GuardLogix
Compact GuardLogix (5370)	Up to 48 nodes (max)	Same as GuardLogix, except CIP Safety only on Ethernet	Similar performance to GuardLogix
SmartGuard 600 (1752)	• 16 safety inputs • 8 safety outputs • 4 standard inputs • 6…8 networked safety expansion modules (practical performance limits) • 254 configurable function blocks	Only Safety logic	Cost-effective safety retrofit to existing systems

4. Refer to the Safety Products Catalog, available at http://www.ab.com/catalogs/, to determine which safety devices meet your functional requirement specification.
5. Refer to the Safety Products Catalog, available at http://www.ab.com/catalogs/, to select Guard I/O™ modules that fit your network specifications and number of required inputs and outputs.

Defining Module and Safety Zone Tags

A safety zone in this toolkit is defined as an area of the machine that controls a single logical safety function based on the status of safety-related input devices. This single logical safety function may control one or more safety-related output devices. The safety function is identified and defined by your risk assessment.

IMPORTANT	For each of the safety zones and I/O modules in your safety application, use the Safety Zone Configuration and Safety Module Configuration worksheets found on the safety accelerator toolkit CD to document names for your safety zones, modules, and devices so that you can customize the predefined logic in the toolkit. The worksheet helps make sure that you import the proper input and output safety logic, and name your tags correctly and consistently.

For examples that show the completed worksheets, see the Robot Cell Module and Safety Zone Configuration in Appendix A, which is used throughout this Quick Start.

Fill Out the Safety Zone Configuration Worksheet

The Safety Zone Configuration worksheet lists key items in the safety project. To complete the Safety Zone Configuration worksheet, follow these steps.

1. Determine the number of zones in your application.

   You need to fill out a Safety Zone Configuration worksheet for each zone in your application.

2. Browse to the Guard I/O and SmartGuard Modules directory in the toolkit.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Modules.

3. Make a copy of the Safety_Zone_Configuration.xls file for each safety zone in your application and name them using the *ZoneName*, for example Zone1.xls.

	A	B	C
1	**Safety Zone Configuration Worksheet**		
2			
3	**Zone Name**	**Zone1**	
4			
5	**Zone Modules & Tags**	**Name**	
6	Safety Module 1	CellGuard1	
7	Safety Module 2	CellGuard2	
8	Safety Module 3		
9	Safety Module 4		
10	Safety Module 5		
11	Safety Module 6		
12	Standard I/O Fault Reset Tag		
13	Standard HMI Fault Reset Tag	{#1.Cmd_FaultReset}	
14	Safety Fault Reset Tag	Cmd_Zone1_FaultReset	
15	Standard I/O Safety Reset Tag		
16	Standard HMI Safety Reset Tag	{#1.Cmd_SafetyReset}	
17	Safety Safety Reset Tag	Cmd_Zone1_SafetyReset	
18	Inputs OK Tag	Sts_Zone1_InputsOK	
19			

4. Open your newly created Safety Zone Configuration worksheet and enter a Zone Name.

   For this example, we entered Zone1. The ZoneName will be inserted in many of the Zone Tags listed in the worksheet. You will use the tag names in this worksheet in your application logic, developed in Chapter 3 for GuardLogix Controllers, and Chapter 4 for SmartGuard 600 controllers.

5. Type a Safety Module Name for each module used in the Safety Zone and save the file.

   For this example, we entered CellGuard1 and CellGuard2 for Safety Module 1 and 2, respectively.

Fill Out the Safety Module Configuration Worksheet

The documentation of how each safety I/O module is identified is a critical step that will make using the toolkit to develop your application logic more efficient. To complete the Safety Module Configuration worksheets for your safety application, follow these steps.

1. Browse to the Guard I/O and SmartGuard Modules directory in the toolkit.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Modules.

2. Select the safety module configuration file that corresponds to your first safety I/O module, make a copy, and name it using the *ModuleName* listed in the Safety Zone Configuration Worksheet.

Safety I/O Module Type	Safety Module Configuration File Name
Guard I/O Module used with GuardLogix Controller	GLX Guard IO Configuration.xls
Guard I/O Module used with SmartGuard 600 Controller	SG Guard IO Configuration.xls
SmartGuard 600 Local I/O	SG Local IO Configuration.xls

   For this example, we selected GLX Guard IO Configuration.xls, copied the file, and named it CellGuard1.xls

3. Open your newly-copied safety module configuration file.

4. Type the zone name and module name of your module that you entered in the Safety Zone Configuration worksheet.

GuardLogix Guard IO Configuration Worksheet

Zone Name	Module Name	Module Cat No./ Safety Category
Zone1	CellGuard1	1791ES-IB16/CAT4

Digital Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00				CellGuard1:I.Pt00Data	Sts_Zone1_InputOK
Input 01				CellGuard1:I.Pt01Data	Sts_Zone1_InputOK
Input 02				CellGuard1:I.Pt02Data	Sts_Zone1_InputOK
Input 03				CellGuard1:I.Pt03Data	Sts_Zone1_InputOK
Input 04				CellGuard1:I.Pt04Data	Sts_Zone1_InputOK
Input 05				CellGuard1:I.Pt05Data	Sts_Zone1_InputOK
Input 06				CellGuard1:I.Pt06Data	Sts_Zone1_InputOK
Input 07				CellGuard1:I.Pt07Data	Sts_Zone1_InputOK
Input 08				CellGuard1:I.Pt08Data	Sts_Zone1_InputOK
Input 09				CellGuard1:I.Pt09Data	Sts_Zone1_InputOK
Input 10				CellGuard1:I.Pt10Data	Sts_Zone1_InputOK
Input 11				CellGuard1:I.Pt11Data	Sts_Zone1_InputOK
Input 12				CellGuard1:I.Pt12Data	Sts_Zone1_InputOK
Input 13				CellGuard1:I.Pt13Data	Sts_Zone1_InputOK
Input 14				CellGuard1:I.Pt14Data	Sts_Zone1_InputOK
Input 15				CellGuard1:I.Pt15Data	Sts_Zone1_InputOK

Digital Test Outputs	Device Name			Test Output Tag Name
Output 00				CellGuard1:O.Test00Data
Output 01				CellGuard1:O.Test01Data
Output 02				CellGuard1:O.Test02Data
Output 03				CellGuard1:O.Test03Data
Output 04				CellGuard1:O.Test04Data
Output 05				CellGuard1:O.Test05Data
Output 06				CellGuard1:O.Test06Data
Output 07				CellGuard1:O.Test07Data
Output 08				CellGuard1:O.Test08Data
Output 09				CellGuard1:O.Test09Data
Output 10				CellGuard1:O.Test10Data
Output 11				CellGuard1:O.Test11Data
Output 12				CellGuard1:O.Test12Data
Output 13				CellGuard1:O.Test13Data
Output 14				CellGuard1:O.Test14Data
Output 15				CellGuard1:O.Test15Data

Digital Safety Outputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Output Enable Tag Name	CROUT Tag Name	Output Tag Name
Output 00				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt00Data
Output 01				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt01Data
Output 02				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt02Data
Output 03				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt03Data
Output 04				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt04Data
Output 05				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt05Data
Output 06				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt06Data
Output 07				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt07Data

Analog Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00				CellGuard1:I.Ch0Data	Sts_Zone1_InputOK
Input 01				CellGuard1:I.Ch1Data	Sts_Zone1_InputOK
Input 02				CellGuard1:I.Ch2Data	Sts_Zone1_InputOK
Input 03				CellGuard1:I.Ch3Data	Sts_Zone1_InputOK

For this example, we typed Zone1 as the Zone Name and CellGuard1 as a module name.

The zone name and module name will be automatically inserted in the input and output tags listed in the worksheet.

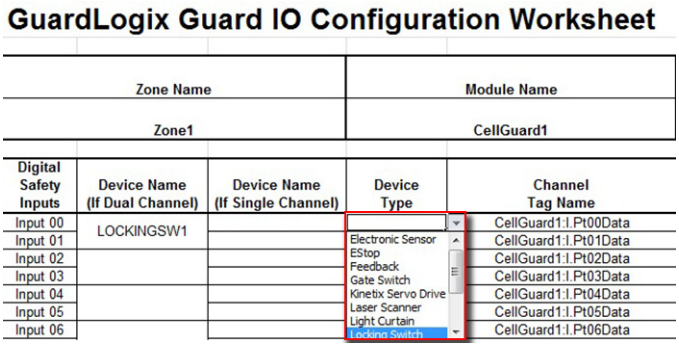
5. You may also enter the module catalog number and safety category although it is not critical for toolkit use.
6. Fill in the Device Name for each input on your module.

   If your application requires Category 3 or Category 4, each device typically requires two inputs and both input channels will have the same Device Name. Use the dual channel column.

If your application is Category 2, each input (single-channel) has its own name. Use the single channel column.

See the Robot Cell Module and Safety Zone Configuration in Appendix A for example worksheets that show CAT 4 devices.

7. Use the pull-down list to enter the Device Type.



GuardLogix Guard IO Configuration Worksheet

Zone Name			Module Name	
Zone1			CellGuard1	
Digital Safety Inputs	**Device Name (If Dual Channel)**	**Device Name (If Single Channel)**	**Device Type**	**Channel Tag Name**
Input 00	LOCKINGSW1			CellGuard1:I.Pt00Data
Input 01				CellGuard1:I.Pt01Data
Input 02				CellGuard1:I.Pt02Data
Input 03				CellGuard1:I.Pt03Data
Input 04				CellGuard1:I.Pt04Data
Input 05				CellGuard1:I.Pt05Data
Input 06				CellGuard1:I.Pt06Data

Electronic Sensor
EStop
Feedback
Gate Switch
Kinetix Servo Drive
Laser Scanner
Light Curtain
Locking Switch

8. For any test outputs, fill in the Device Name field.
9. For safety outputs, fill in the Device Name and use the pull-down list to choose the Device Type.

   Category 3 or Category 4 outputs typically require either two devices with one output channel each or a single device with dual-channel outputs. Use the dual channel column.

   For Category 2, each output (single-channel) has its own name. Use the single channel column.

TIP The device names will be automatically inserted in the input and output tags listed in the worksheet. You will use the tag names in this worksheet in your application logic, developed in 3 for GuardLogix Controllers and 4 for SmartGuard 600 controllers.

The following example illustrates a completed worksheet for a CAT 4 safety input module.

GuardLogix Guard IO Configuration Worksheet

Zone Name	Module Name	Module Cat No./ Safety Category
Zone1	CellGuard1	1791ES-IB16/CAT4

Digital Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00	LOCKINGSW1		Locking Switch	CellGuard1:I.Pt00Data	Sts_Zone1_LOCKINGSW1InputOK
Input 01			Locking Switch	CellGuard1:I.Pt01Data	Sts_Zone1_LOCKINGSW1InputOK
Input 02	LOCKINGSW2		Locking Switch	CellGuard1:I.Pt02Data	Sts_Zone1_LOCKINGSW2InputOK
Input 03			Locking Switch	CellGuard1:I.Pt03Data	Sts_Zone1_LOCKINGSW2InputOK
Input 04	ESTOP1		EStop	CellGuard1:I.Pt04Data	Sts_Zone1_ESTOP1InputOK
Input 05			EStop	CellGuard1:I.Pt05Data	Sts_Zone1_ESTOP1InputOK
Input 06	ESTOP2		EStop	CellGuard1:I.Pt06Data	Sts_Zone1_ESTOP2InputOK
Input 07			EStop	CellGuard1:I.Pt07Data	Sts_Zone1_ESTOP2InputOK
Input 08	ESTOP3		EStop	CellGuard1:I.Pt08Data	Sts_Zone1_ESTOP3InputOK
Input 09			EStop	CellGuard1:I.Pt09Data	Sts_Zone1_ESTOP3InputOK
Input 10	ESTOP4		EStop	CellGuard1:I.Pt10Data	Sts_Zone1_ESTOP4InputOK
Input 11			EStop	CellGuard1:I.Pt11Data	Sts_Zone1_ESTOP4InputOK
Input 12	LC1		Light Curtain	CellGuard1:I.Pt12Data	Sts_Zone1_LC1InputOK
Input 13			Light Curtain	CellGuard1:I.Pt13Data	Sts_Zone1_LC1InputOK
Input 14				CellGuard1:I.Pt14Data	Sts_Zone1_InputOK
Input 15				CellGuard1:I.Pt15Data	Sts_Zone1_InputOK

Digital Test Outputs	Device Name			Test Output Tag Name
Output 00				CellGuard1:O.Test00Data
Output 01				CellGuard1:O.Test01Data
Output 02				CellGuard1:O.Test02Data
Output 03				CellGuard1:O.Test03Data
Output 04				CellGuard1:O.Test04Data
Output 05				CellGuard1:O.Test05Data
Output 06				CellGuard1:O.Test06Data
Output 07				CellGuard1:O.Test07Data
Output 08				CellGuard1:O.Test08Data
Output 09				CellGuard1:O.Test09Data
Output 10				CellGuard1:O.Test10Data
Output 11				CellGuard1:O.Test11Data
Output 12				CellGuard1:O.Test12Data
Output 13				CellGuard1:O.Test13Data
Output 14	LOCKINGSW1SOLENOID			CellGuard1:O.Test14Data
Output 15	LOCKINGSW2SOLENOID			CellGuard1:O.Test15Data

Digital Safety Outputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Output Enable Tag Name	CROUT Tag Name	Output Tag Name
Output 00				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt00Data
Output 01				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt01Data
Output 02				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt02Data
Output 03				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt03Data
Output 04				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt04Data
Output 05				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt05Data
Output 06				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt06Data
Output 07				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt07Data

Analog Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00				CellGuard1:I.Ch0Data	Sts_Zone1_InputOK
Input 01				CellGuard1:I.Ch1Data	Sts_Zone1_InputOK
Input 02				CellGuard1:I.Ch2Data	Sts_Zone1_InputOK
Input 03				CellGuard1:I.Ch3Data	Sts_Zone1_InputOK

Lay Out Your Safety Wiring

The toolkit includes wiring diagrams, available in DWG, DXF, and PDF file formats, to assist you in planning the layout of your system. The files are organized by safety category (Cat. 2, Cat. 3, Cat. 4) and include safety I/O, safety device, and various project drawings. The diagrams include power and control wiring.

If you do not have CAD software, use the PDF files to build your system drawing.

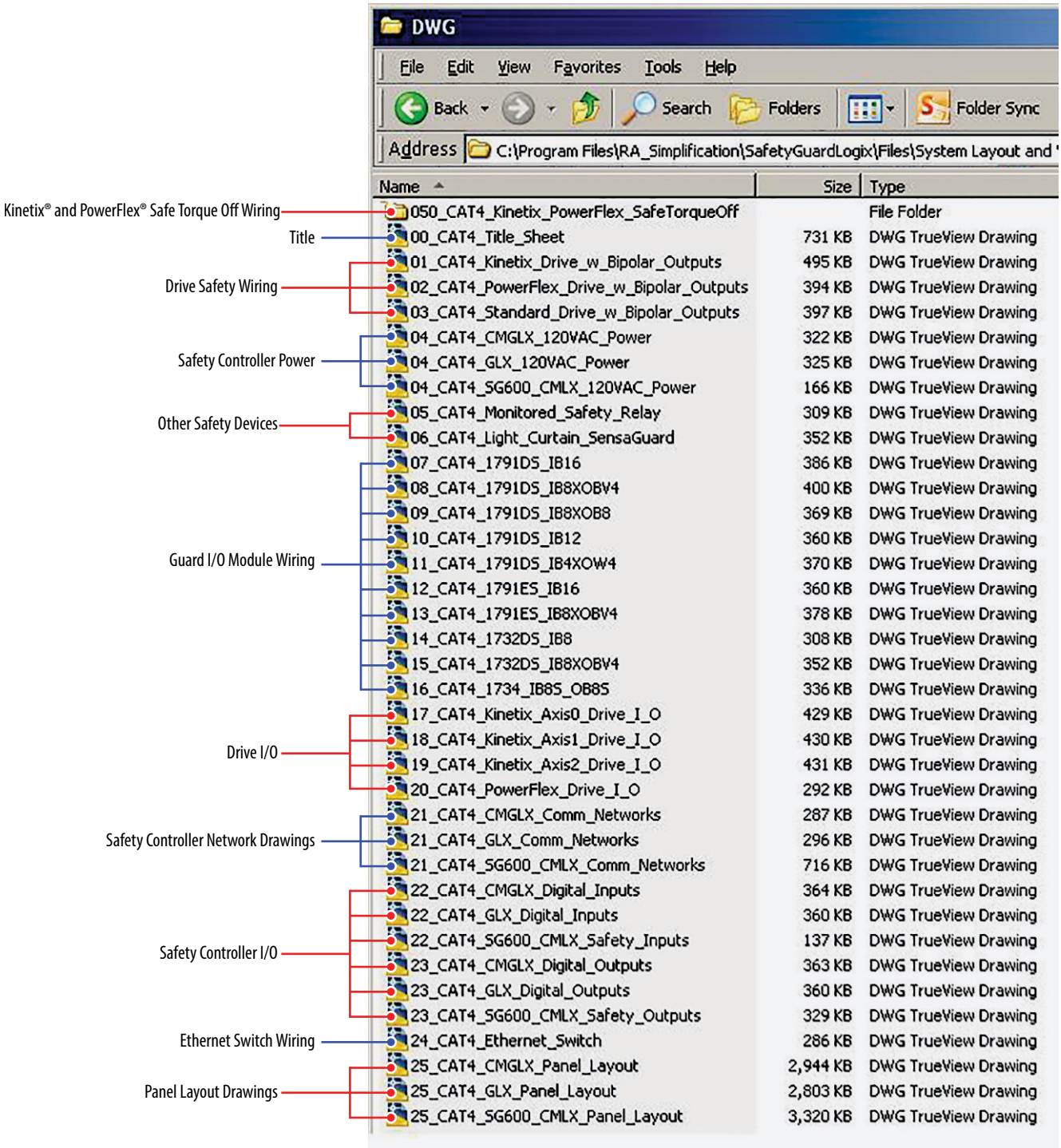
Access and Gather Drawings from Toolkit

Refer to your bill of materials and follow these steps to access the safety system drawings.

1. Browse to the System Wiring Diagrams directory in the toolkit.

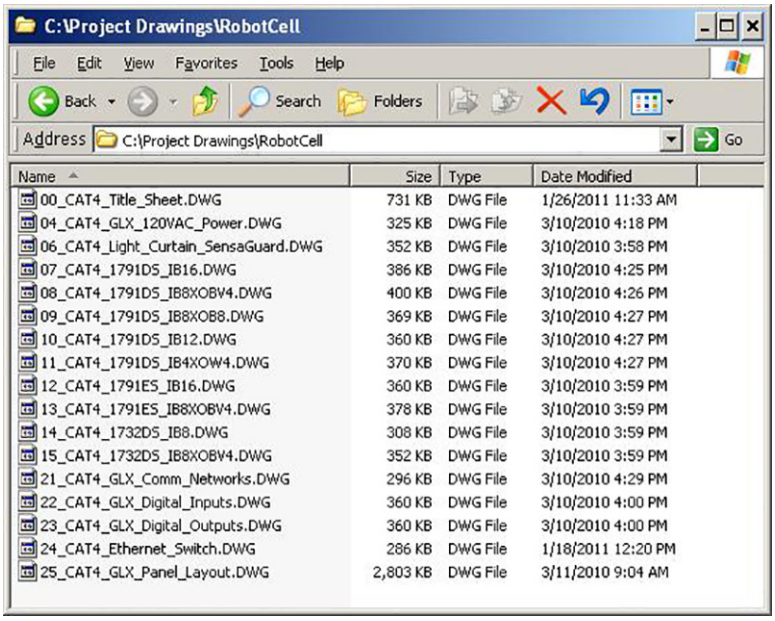
   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\System Layout and Wiring Diagrams.

2. Navigate to the desired file directory based on your safety category (Analog, CAT2, CAT3, or CAT4) and the desired file format (DXF, DWG, or PDF).



For this example, the CAT4\DWG directory was chosen. A number of drawings for different devices, I/O and controllers, are included.

3. Copy desired drawing files into a project folder.



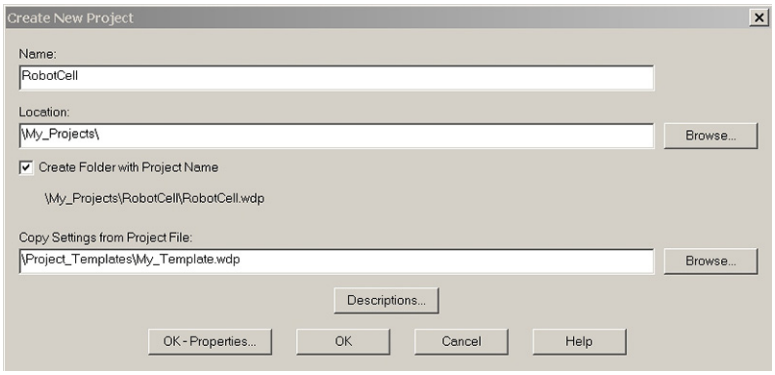
The Guard I/O module drawings include a wide variety of safety devices but not all on each module drawing. So it is recommended you copy most of the Guard I/O module drawings into your project.

For this Robot Cell example, GuardLogix power, networks, I/O, and layout drawings were gathered along with light curtain and Guard I/O drawings.

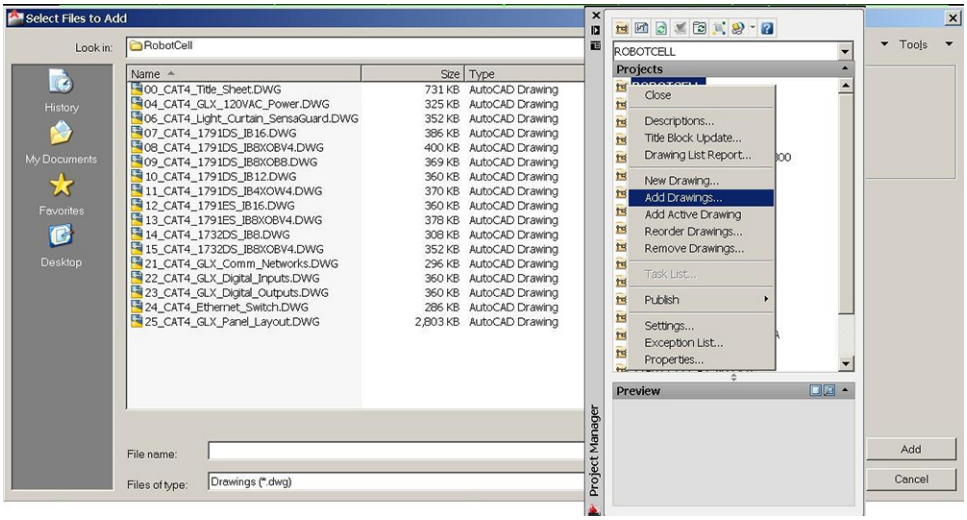
Edit Project Drawing Set

These steps provide general instructions for how to maximize the use of the toolkit's drawing library in creating a safety system layout and wiring drawing set. AutoCAD or AutoCAD Electrical software is recommended to take full advantage of the drawing editing steps included in this chapter and the library's device wiring references and attributes that move with the devices as you edit your project drawing set. Some of the initial project creation steps are illustrated using AutoCAD Electrical software, but most are generic and can be used with a variety of software drawing packages.

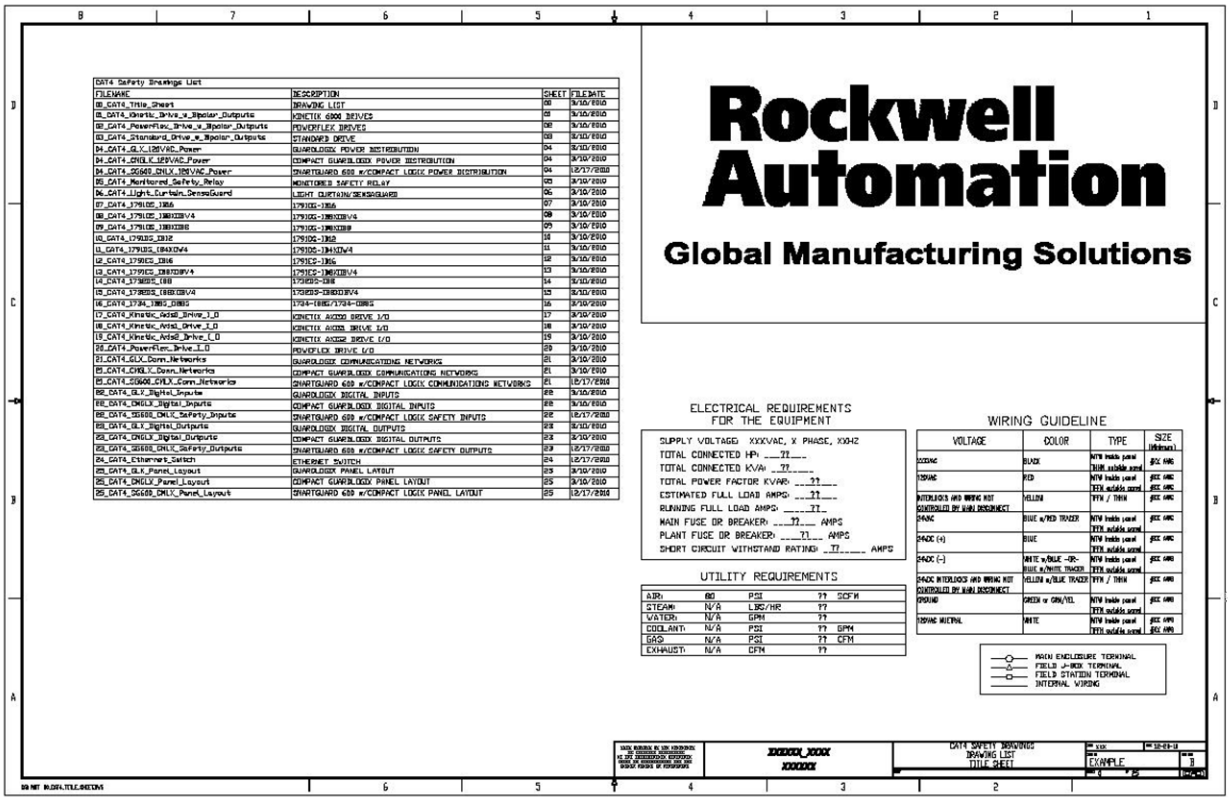
1. Open your drawing software.
2. Create and name your new project.



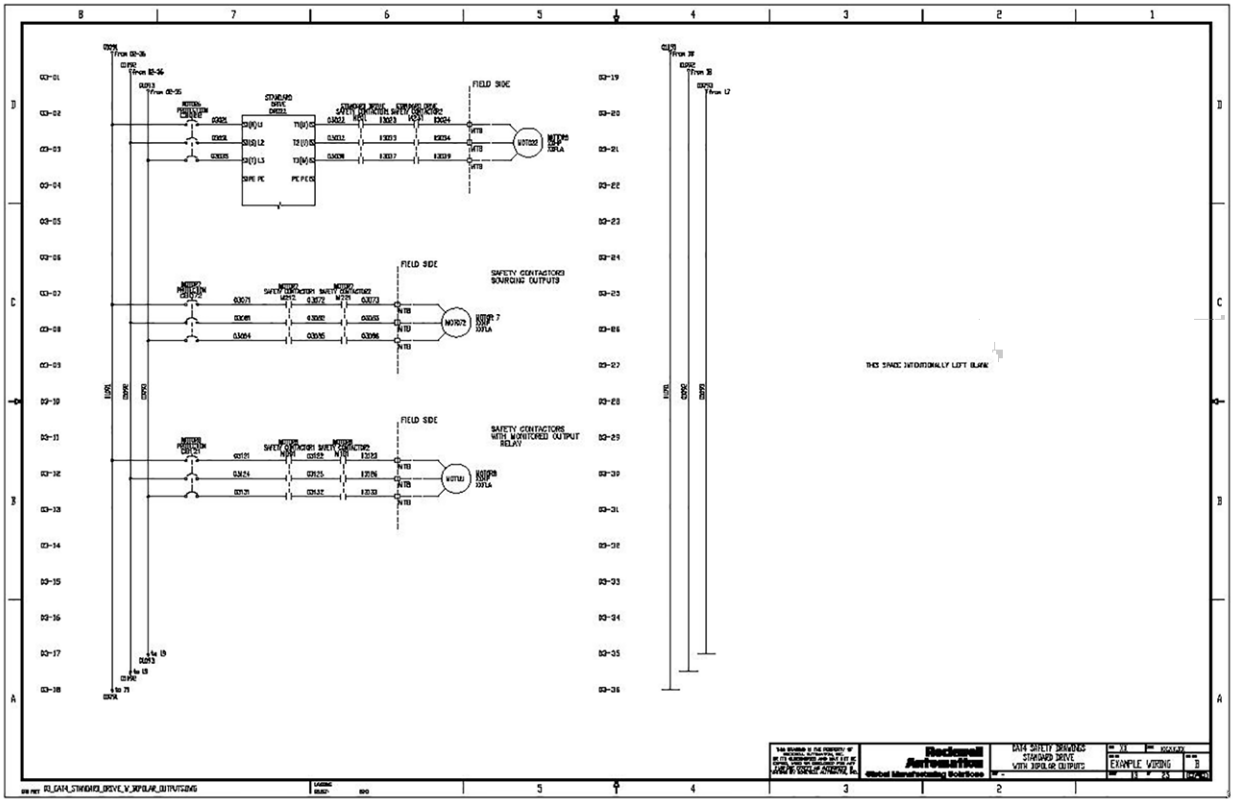
3. Add and select the toolkit library drawings you copied in the previous section.



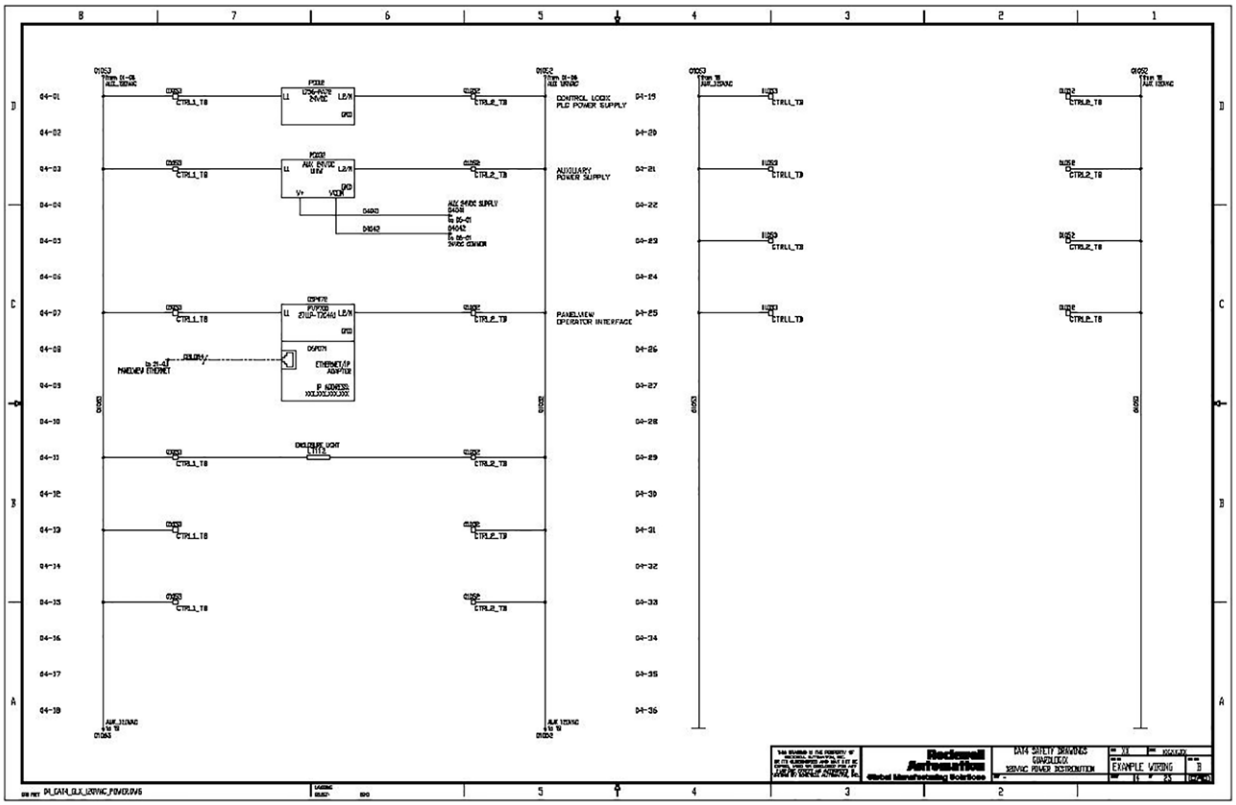
4. Open the original Title Sheet drawing and edit the drawing list and title blocks specific to your applications.



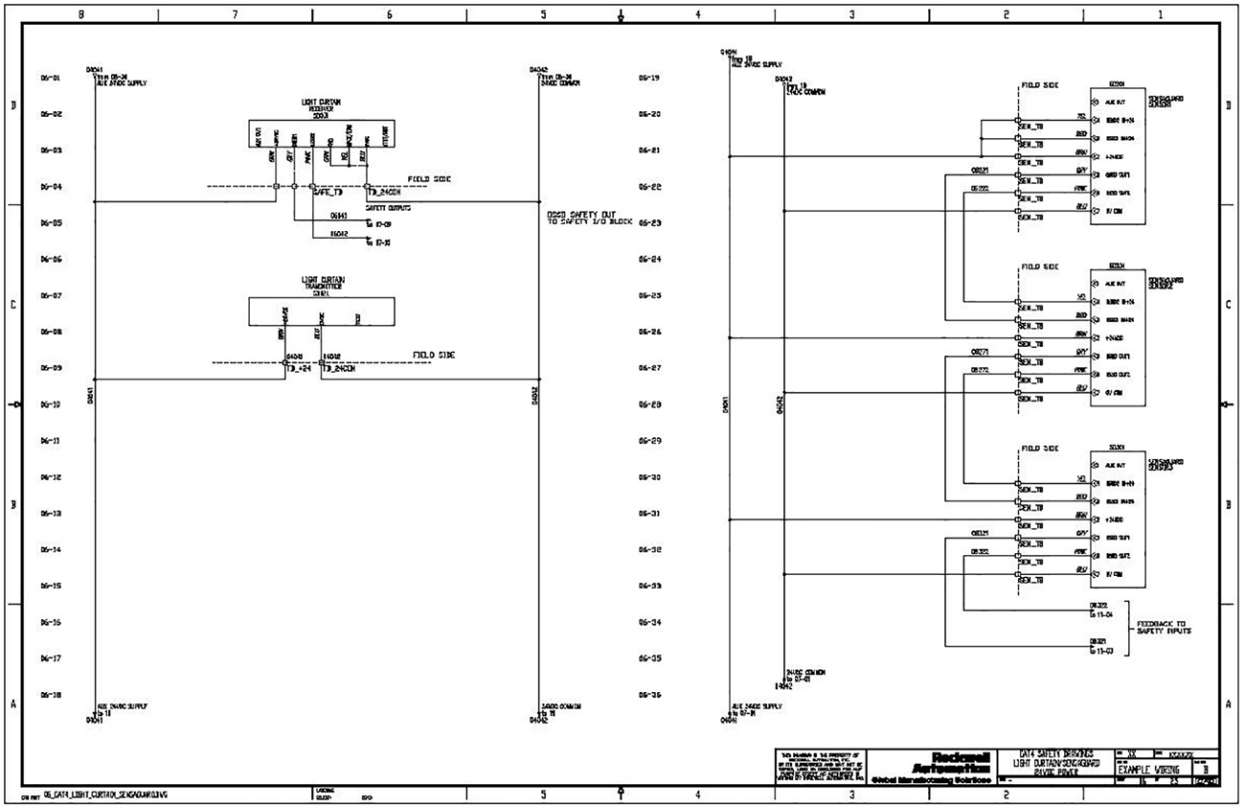
5. Open Drive or Drive Safety Torque Off Wiring Drawings and edit drawings specific to your application.



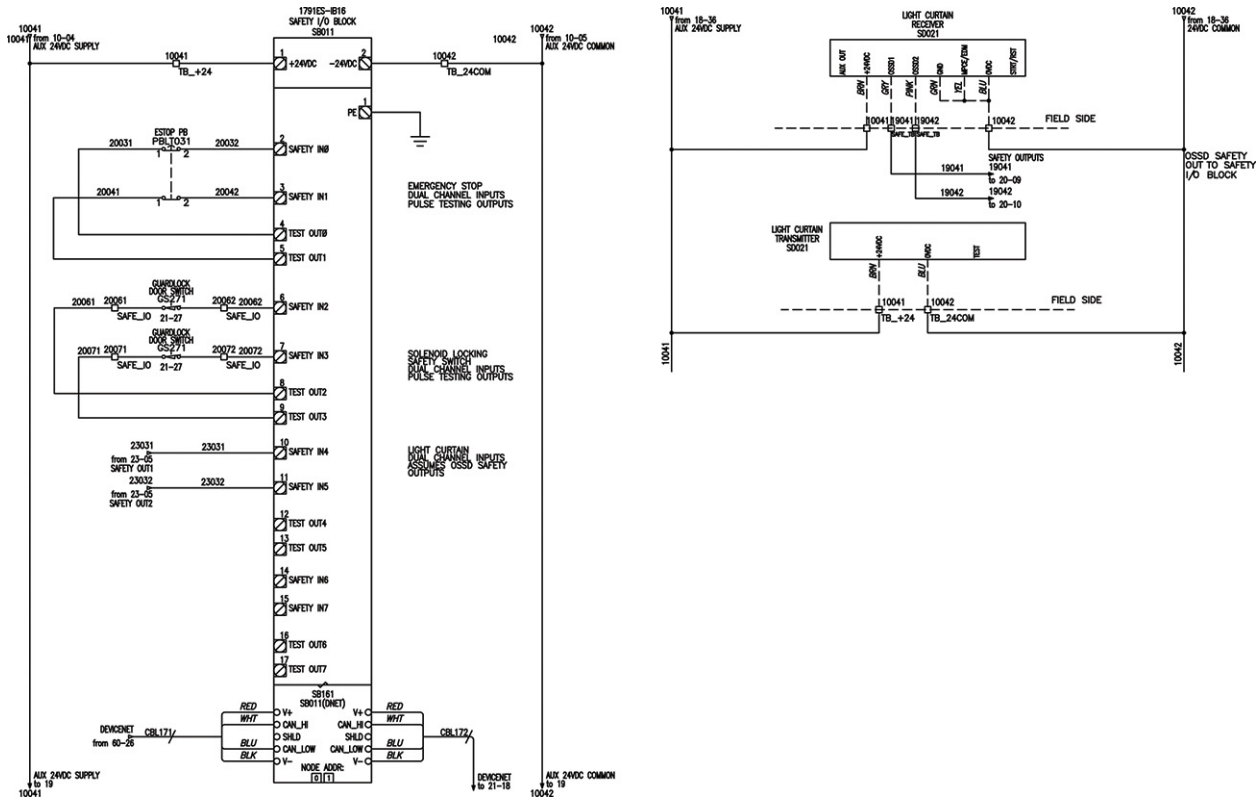
6. Open your Safety Controller Power Drawing and edit controller connections and edit or add other device power supply connections.



7. Open other Safety Device Drawings and edit drawings specific to your application.

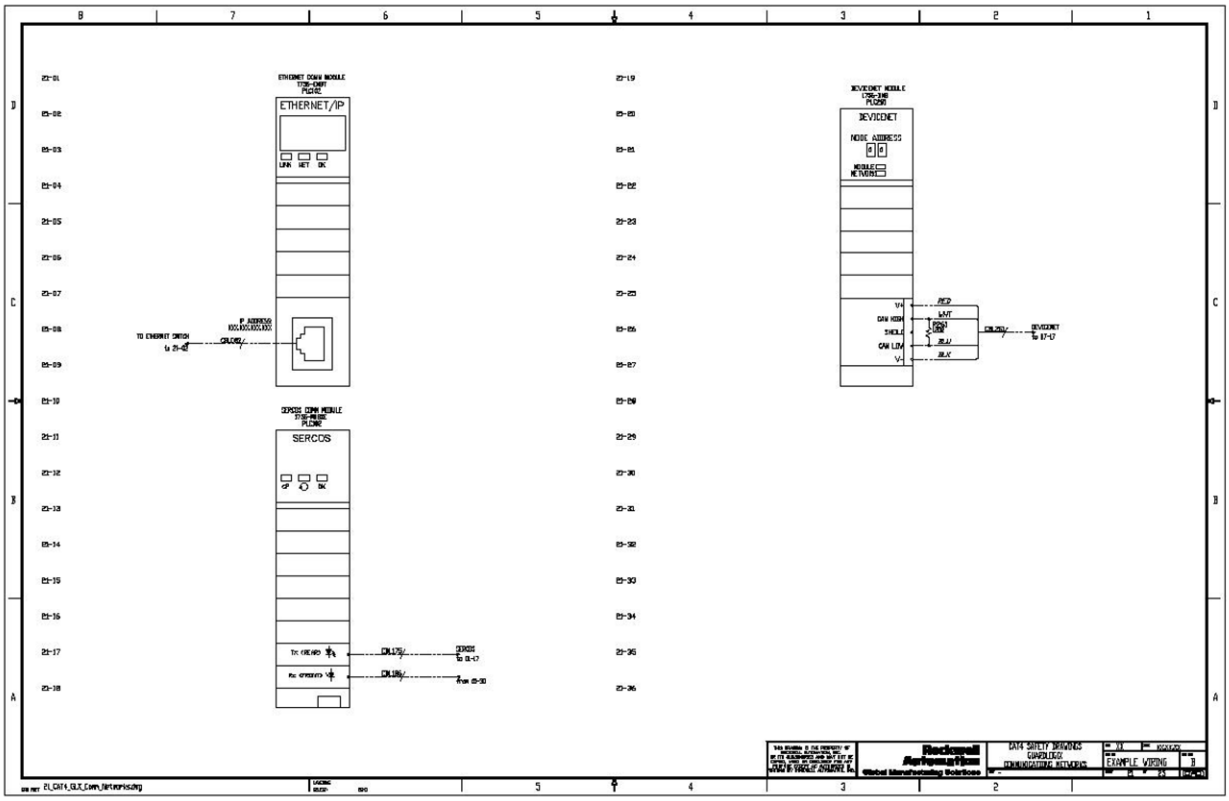


8. Open Guard I/O and/or SmartGuard 600 Safety Input and Output Drawings. Copy and paste safety devices that represent your specific safety I/O configuration from one sheet to another.

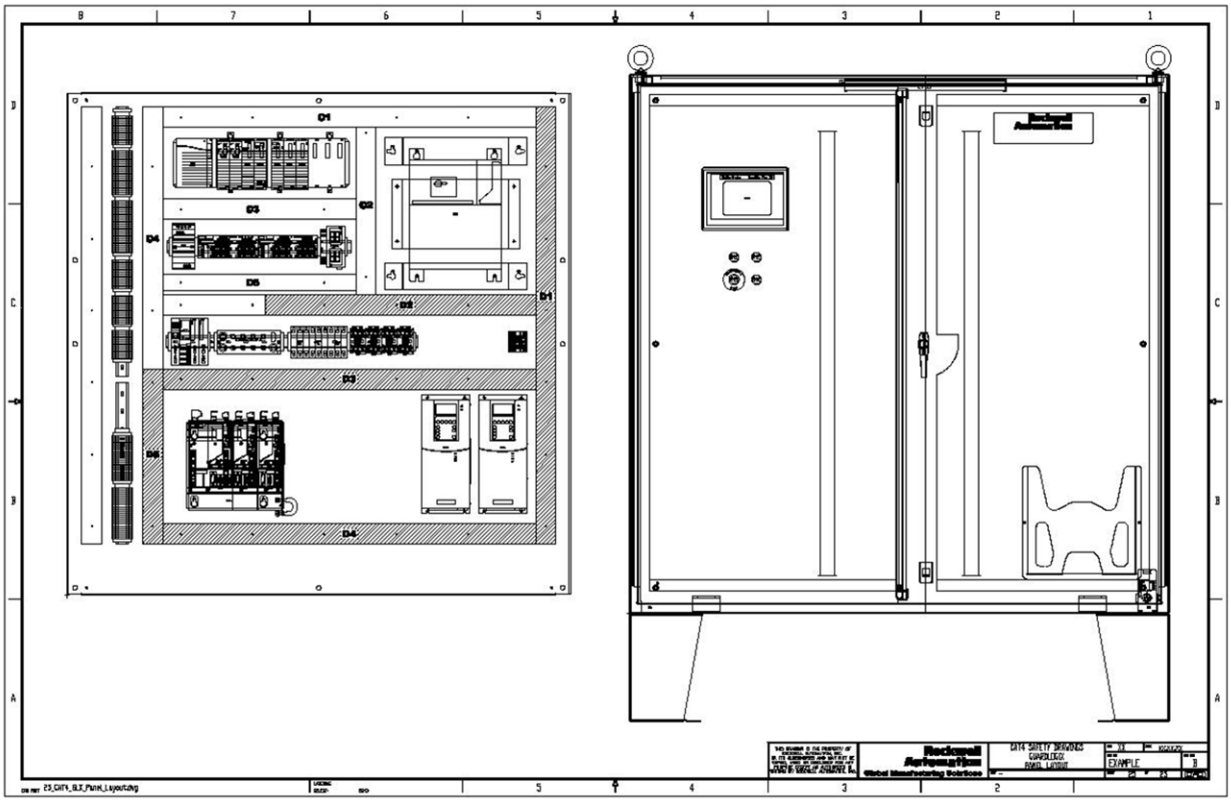


This example shows Cat. 4 drawings for a 1791ES-IB16 module and a light curtain device.

9. Open Safety Controller Network and/or Ethernet Switch Drawings and modify your application.



10. Open Panel Layout Drawings and edit drawings specific to your application.



This example shows a GuardLogix System Panel Layout including Guard I/O, Kinetix, PowerFlex, PanelView™ Plus and power distribution devices.

Considerations for Safety Drawings

The drawings were created with AutoCAD Electrical. The project files are included in the DWG directory. The path references in the project file are the default AutoCAD Electrical installation path.

Some safety input devices, such as Electronic Sensors (Cat. 2 and Cat. 3 only), have safety category restrictions, so they are not included on every category Guard I/O module drawing.

Toolkit drawings for Kinetix, PowerFlex, and Standard drives use bipolar outputs requiring two output channels even in Cat. 2 examples.

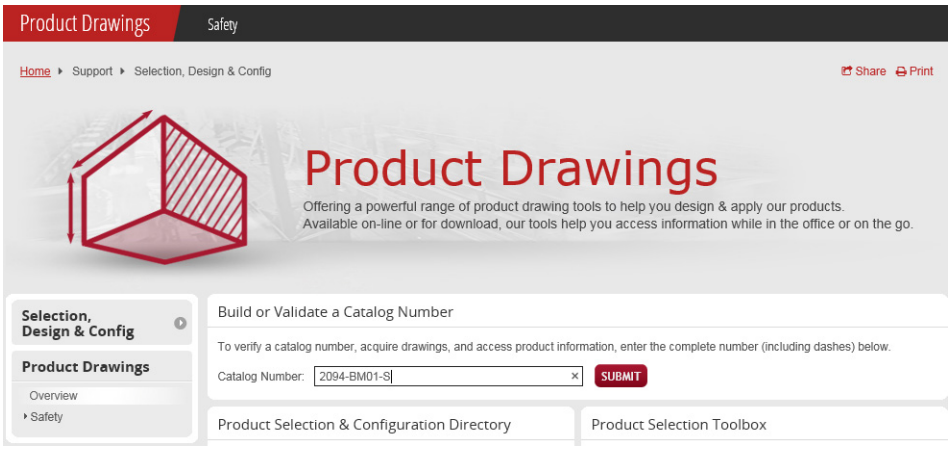
Access Other Allen-Bradley® CAD Drawings

Follow these steps to download other Allen-Bradley product CAD drawings.

1. Open your browser and go to http://www.rockwellautomation.com/global/support/select-design-configure.page?.

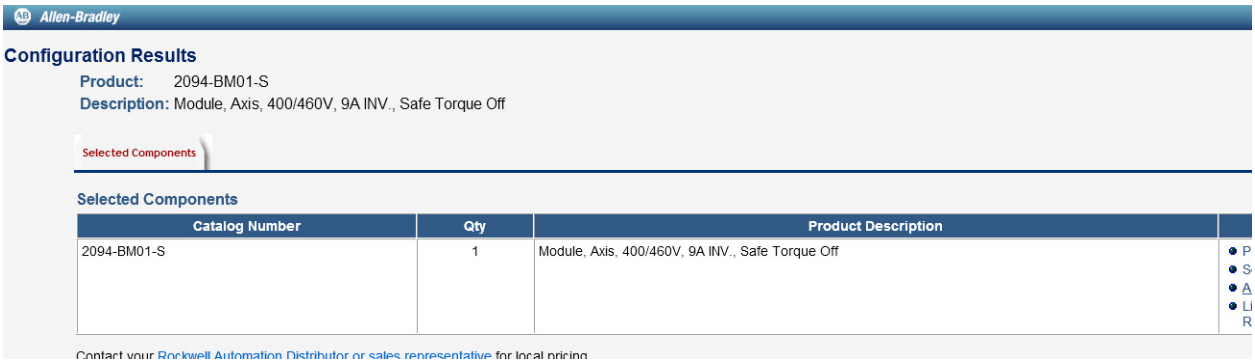
   On the home page, click Product Drawings.

2. Enter the catalog number of the product.



3. Click Submit.

   The Configuration Results window opens, showing what documents are available for that catalog number.



4. Click AutoCad Drawing 2D (DXF).
5. Download the drawing to a destination of your choice.

Notes:

GuardLogix® Controllers Logic Integration

Introduction

In this chapter, you configure your Guard I/O™ modules using pre-defined configurations, and assemble your safety and faceplate logic by importing pre-configured safety device logic rungs for your GuardLogix Systems.

Before You Begin

Complete your risk assessment and functional specification. Create a bill of materials based on your application needs. Complete your Safety Zone Configuration and Safety Module Configuration worksheets as described in Chapter 2.

Load RSLogix 5000® or Studio 5000® and FactoryTalk® View Machine Edition software on your personal computer or workstation.

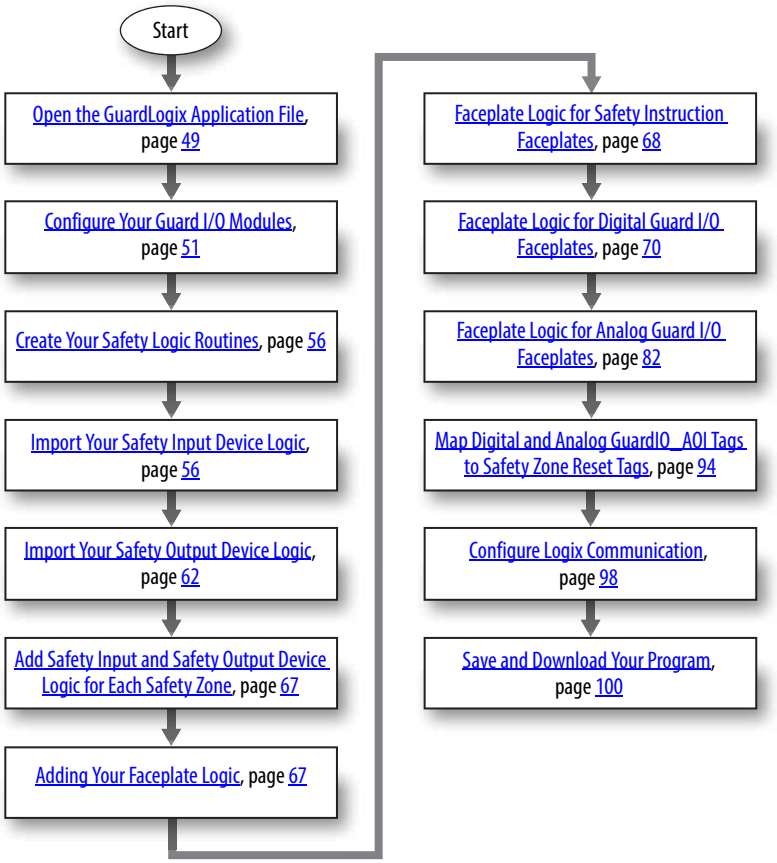
We assume you are starting with an existing control application that contains a configured safety controller and communication module to interface with your Guard I/O modules.

TIP The steps in this chapter show a 1756 GuardLogix controller and the 1756 backplane software configuration screens. The 1768 Compact GuardLogix controller configuration is nearly identical, except for the controller and backplane naming. The steps in this chapter also show RSLogix 5000 screen captures, although Studio 5000 configuration screens are very similar.

What You Need

- Software versions to use this toolkit; see Software Requirements on page 11
- Safety Accelerator Toolkit, DVD SAFETY-CL002 or visit the Integrated Architecture® Tools and Resources website at http://www.rockwellautomation.com/global/products-technologies/integrated-architecture/tools/overview.page
- Product manuals:
  - GuardLogix Controllers User Manual, publication 1756-UM020
  - Compact GuardLogix Controllers User Manual, publication 1768-UM002
  - Compact GuardLogix 5370 Controllers User Manual, publication 1769-UM022
  - GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093
  - Guard I/O DeviceNet Safety Modules User Manual, publication 1791DS-UM001
  - Guard I/O EtherNet/IP Safety Modules User Manual, publication 1791ES-UM001
  - POINT Guard I/O Safety Modules User Manual, publication 1734-UM013
  - Logix Common Procedures Programming Manual, publication 1756-PM001, if you are not familiar with programming Logix controllers with RSLogix 5000 software

Follow These Steps



Open the GuardLogix Application File

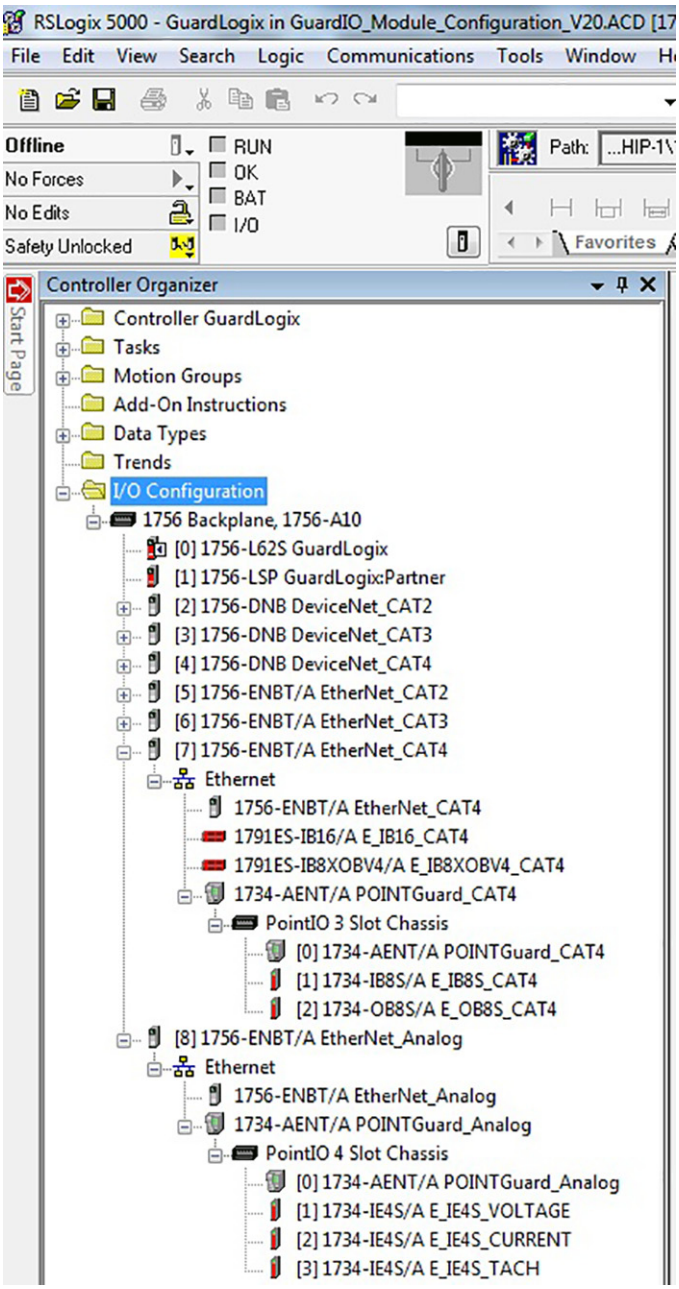
TIP The steps in this chapter show a 1756 GuardLogix controller and the 1756 backplane software configuration screens. The 1768 Compact GuardLogix controller configuration is nearly identical with the exception of the controller and backplane naming. The steps in this chapter also show RSLogix 5000 screen captures, although Studio 5000 configuration screens are very similar.

Follow these steps to access the GuardLogix application file from the toolkit.

1. Open your existing GuardLogix controller RSLogix 5000 ACD file.
2. Browse to the Guard I/O module configurations in the toolkit and open either the RSLogix 5000 version 16 or version 17 ACD file:
   - GuardIO_Module_Configuration_V16.ACD
   - GuardIO_Module_Configuration_V17.ACD
   - GuardIO_Module_Configuration_V20.ACD

If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard™ Modules.

These application files include pre-configured Guard I/O module configurations based on network and safety category type to assist you in configuring your safety I/O modules.


RSLogix 5000 - GuardLogix in GuardIO_Module_Configuration_V20.ACD [17
File Edit View Search Logic Communications Tools Window H
Offline
No Forces
No Edits
Safety Unlocked
RUN
OK
BAT
I/O
Path: ...HIP-1\
Favorites
Start Page
Controller Organizer
Controller GuardLogix
Tasks
Motion Groups
Add-On Instructions
Data Types
Trends
I/O Configuration
1756 Backplane, 1756-A10
[0] 1756-L62S GuardLogix
[1] 1756-LSP GuardLogix:Partner
[2] 1756-DNB DeviceNet_CAT2
[3] 1756-DNB DeviceNet_CAT3
[4] 1756-DNB DeviceNet_CAT4
[5] 1756-ENBT/A EtherNet_CAT2
[6] 1756-ENBT/A EtherNet_CAT3
[7] 1756-ENBT/A EtherNet_CAT4
Ethernet
1756-ENBT/A EtherNet_CAT4
1791ES-IB16/A E_IB16_CAT4
1791ES-IB8XOBV4/A E_IB8XOBV4_CAT4
1734-AENT/A POINTGuard_CAT4
PointIO 3 Slot Chassis
[0] 1734-AENT/A POINTGuard_CAT4
[1] 1734-IB8S/A E_IB8S_CAT4
[2] 1734-OB8S/A E_OB8S_CAT4
[8] 1756-ENBT/A EtherNet_Analog
Ethernet
1756-ENBT/A EtherNet_Analog
1734-AENT/A POINTGuard_Analog
PointIO 4 Slot Chassis
[0] 1734-AENT/A POINTGuard_Analog
[1] 1734-IE4S/A E_IE4S_VOLTAGE
[2] 1734-IE4S/A E_IE4S_CURRENT
[3] 1734-IE4S/A E_IE4S_TACH

Configure Your Guard I/O Modules

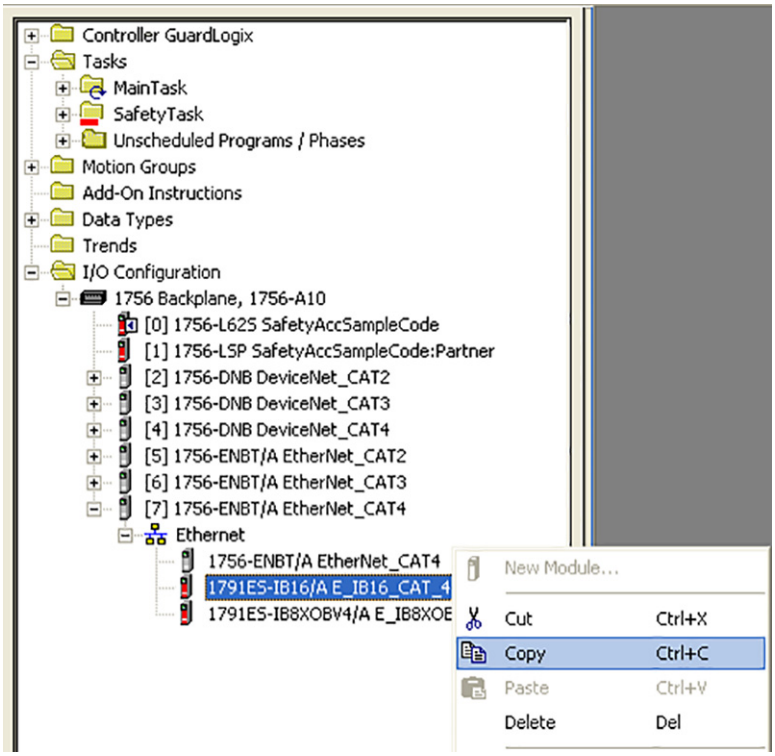
IMPORTANT The 1756 GuardLogix controller and 1756 communication modules support both Guard I/O EtherNet/IP and DeviceNet modules.

The 1768 Compact GuardLogix controller and 1768-ENBT communication module support Guard I/O EtherNet/IP safety modules. The 1769-SDN communication module does not support Guard I/O DeviceNet safety modules. However, the 1769-SDN can be used with the 1768 Compact GuardLogix controller for standard DeviceNet communication.

Follow these steps to configure your Guard I/O modules.

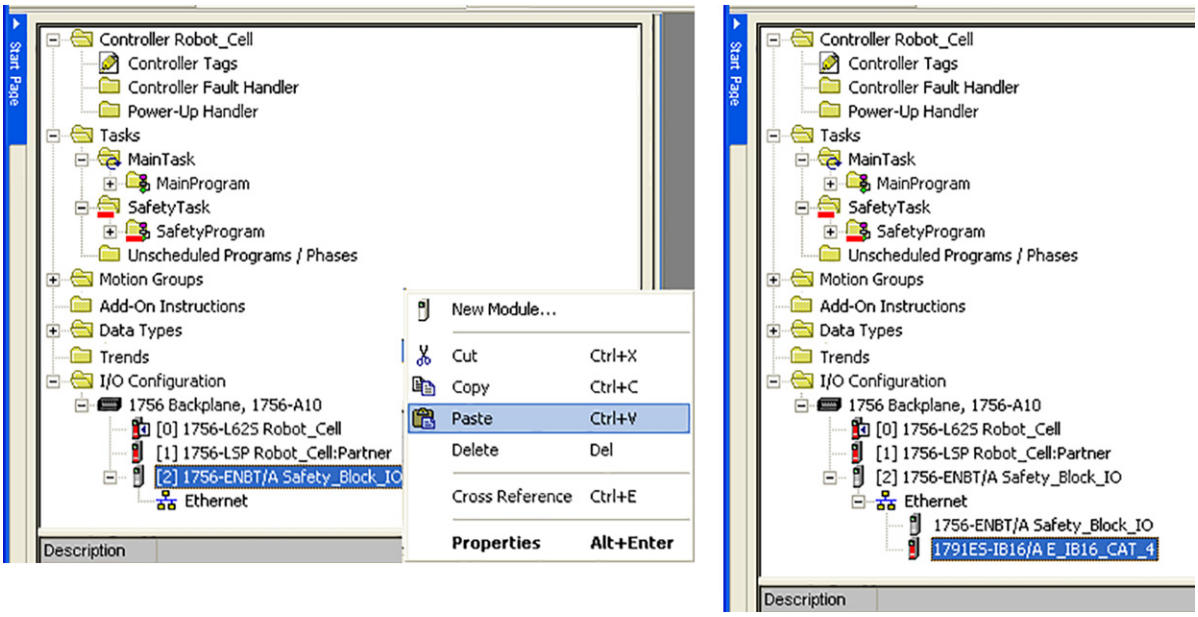
1. From the I/O Configuration within GuardIO_Module_Configuration_V1*x*.ACD, browse to the Ethernet or DeviceNet communication module with the appropriate safety rating for your application.
2. Referring to the Safety Module Configuration worksheets you created in Chapter 2, choose your Guard I/O module to match the catalog number and safety category.

   This example shows a 1791ES-IB16 in a Cat. 4 Ethernet application.
3. Right-click the module and choose Copy.

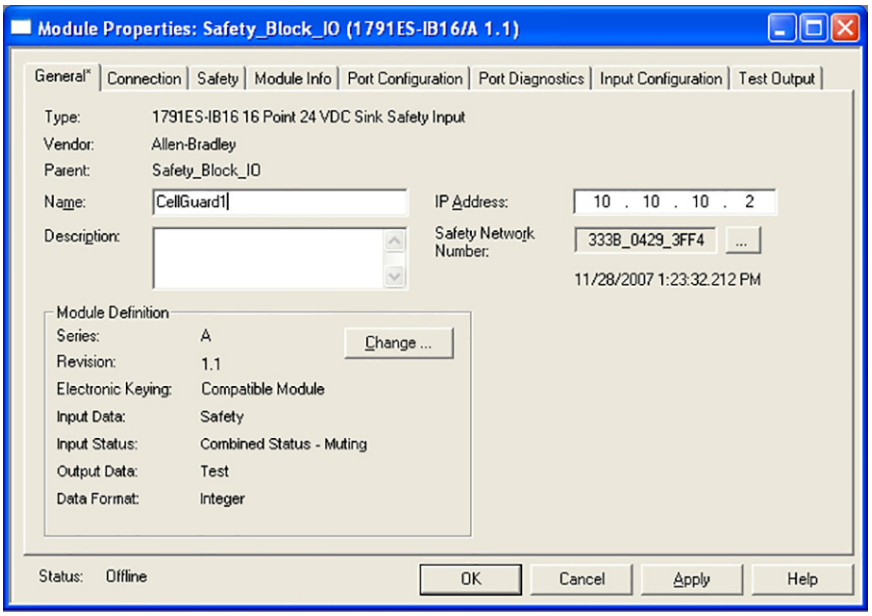


4. Paste the module configuration under the appropriate network in the I/O Configuration of your application file.

   This example uses an EtherNet/IP network. Yours could be a DeviceNet or EtherNet/IP network.



5. To edit module properties for your application, right-click the I/O module and choose Properties.
6. Rename the I/O module according to your Fill Out the Safety Module Configuration Worksheet, which you created in Chapter 2.



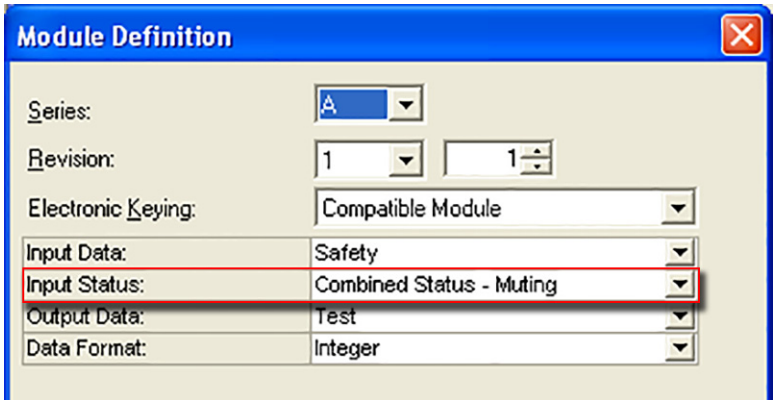
7. Change the IP Address (EtherNet/IP networks) or Node Address (DeviceNet networks).

8. Check the module definition by clicking Change.

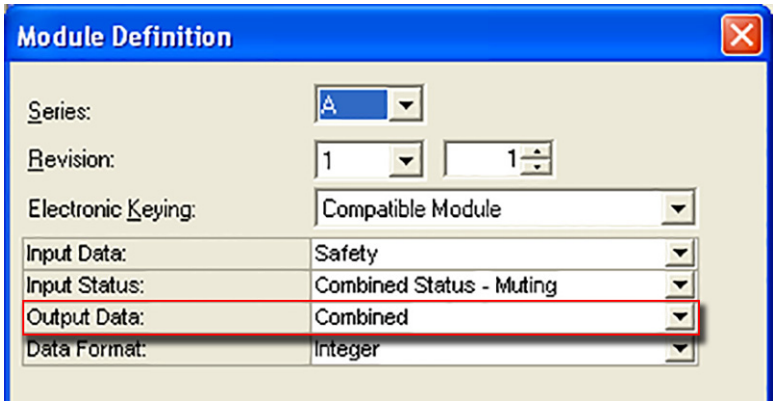
   The pre-configured Guard I/O module configurations that you added in steps 1...4 include the settings required to work with the Guard I/O faceplates and AOI instructions.

   These required **digital** I/O configuration settings include:

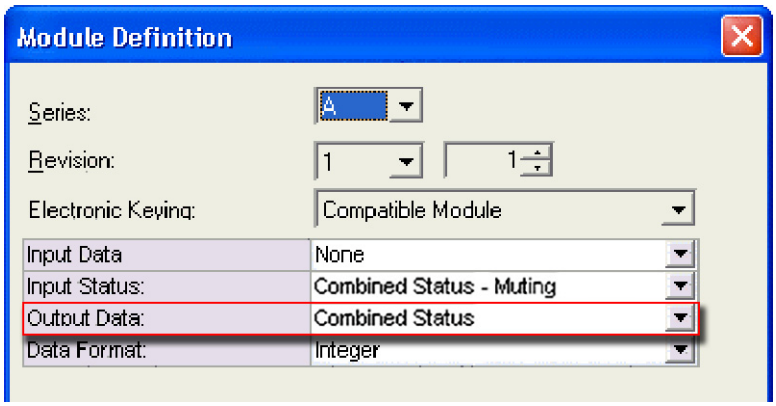
   - Set Input Status to 'Combined Status - Muting' for all modules



   - Set Output Data to 'Combined' for all modules with both safety inputs and outputs

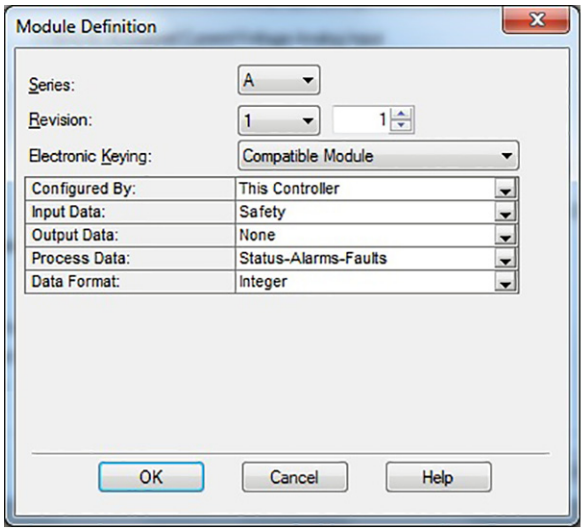


   - Set Output Data to 'Combined Status' for all modules with only safety outputs

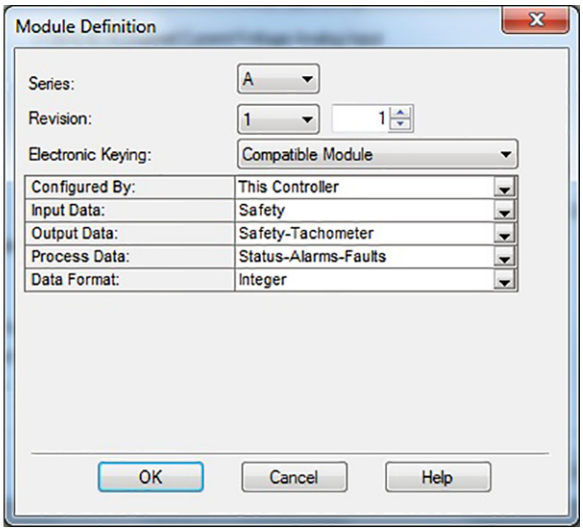


For **analog** I/O configuration settings, see the module definition examples below:

Analog Current and Voltage Only Modules



Analog Tachometer, Current, and/or Voltage Module

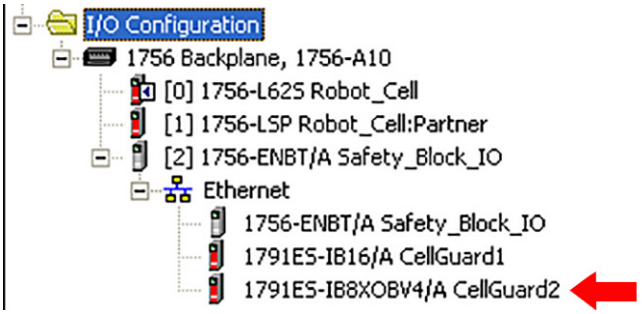


For more information on module definitions, refer to these manuals:

- Guard I/O DeviceNet Safety Modules User Manual, publication 1791DS-UM001
- Guard I/O EtherNet/IP Safety Modules User Manual, publication 1791ES-UM001
- POINT Guard I/O Safety Modules User Manual, publication 1734-UM013

9. Repeat these steps for all of the I/O modules in your application.

   This example includes an additional module, a 1791ES-IB8XOBV4 module named CellGuard2.



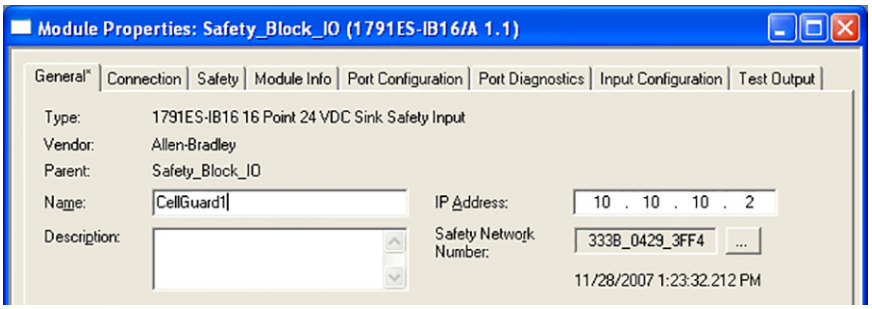
10. Check your Safety Network Numbers (SNN).

IMPORTANT If you have more than one communication bridge module in your application, you must make sure that each subnet that contains Guard I/O modules has a unique Safety Network Number (SNN).

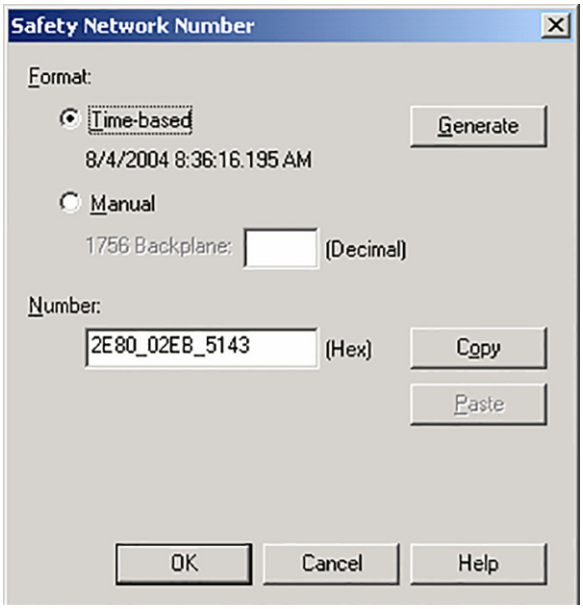
The copy and paste module configuration procedure can create Guard I/O modules with the same SNNs on different bridge modules. Follow steps 11...15 to create a unique SNN for the Guard I/O modules on each communication bridge module.

11. To change the SNN, right-click the Guard I/O module and choose Properties.

12. In the Module Properties dialog box, click ... next to the SNN field to open the Safety Network Number dialog box.



13. Click Generate to generate a new time-based SNN.

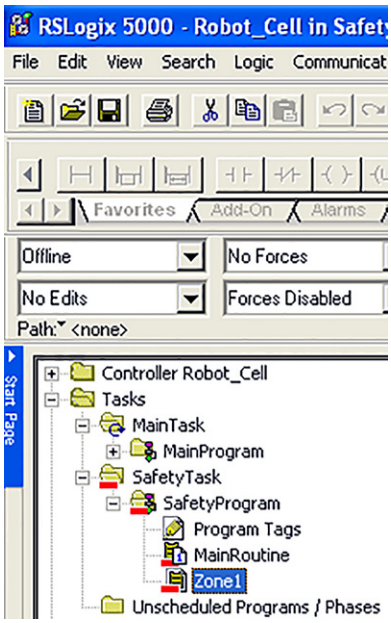


14. When the new SNN appears in the Number field, click Copy.
15. Paste the new SNN to all other Guard I/O modules under the same communication bridge module.

Create Your Safety Logic Routines

To add the safety routines needed for your application, right-click your SafetyProgram and choose New Routine.

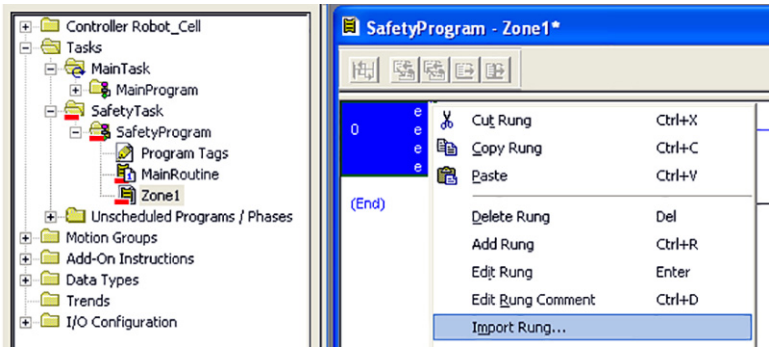
Create routines for each of the safety zones you documented in your Safety Zone Configuration worksheet from Chapter 2. This example shows a single routine named Zone1.



Import Your Safety Input Device Logic

Follow these steps to add safety input logic for each safety input device in each zone.

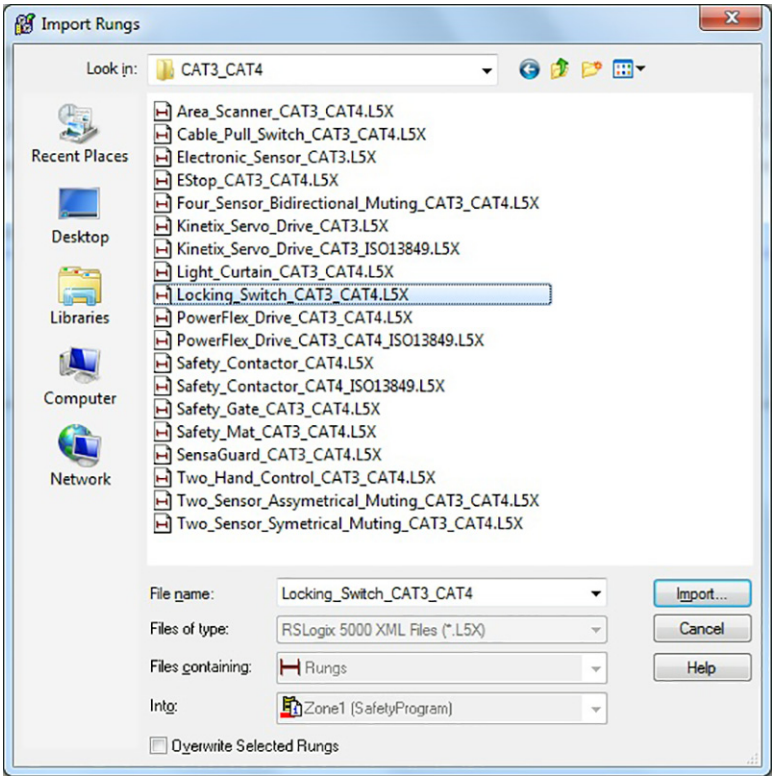
1. Open your safety zone routine.
2. Right-click the initial rung and choose Import Rung.



3. Browse to the Safety Device Routines>RSL5k_V16_or_Later, RSL5k_V17_or_Later, or RSL5k_V20_or_Later directory in the toolkit and select the CAT2 or CAT3_CAT4 subdirectory based on your digital input device safety category requirements. Select the Analog subdirectory for your analog input device routines.

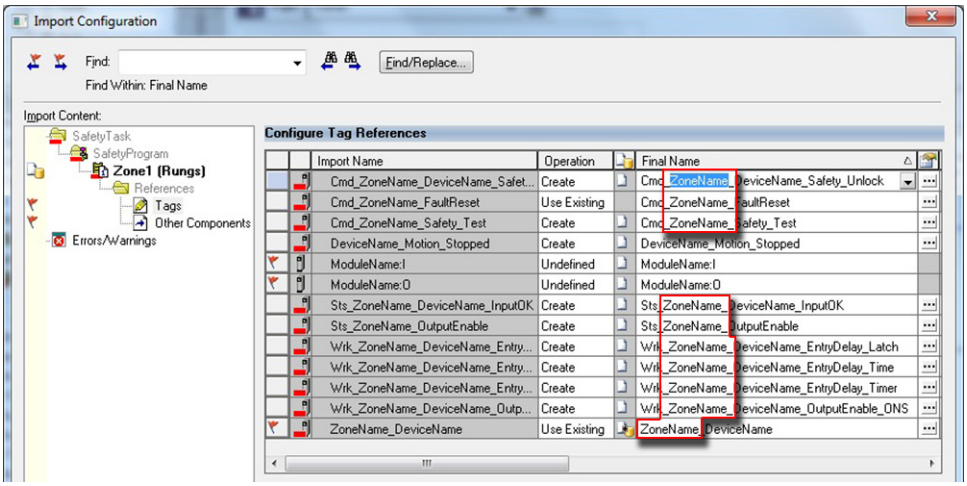
If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Safety Device Routines\RSL5k_V*xx*_or _Later

4. Select the XML file based on the device type of the first input device listed on your first Safety Module Configuration worksheet, and click Import.



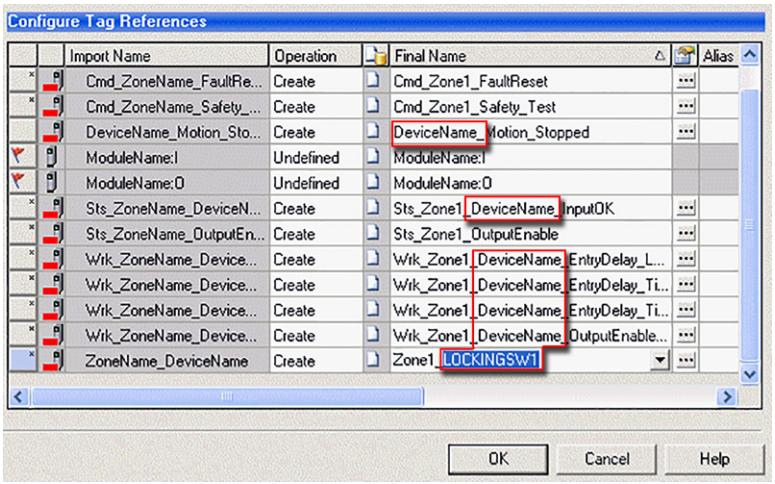
ISO 13849-1 requires that manual reset functions must occur on falling edge signals. If compliance with this standard is required, select safety device logic that is followed by the ISO 13849 designation.

5. Type the *ZoneName* from your Safety Zone Configuration worksheet into the tagnames on the Import Configuration dialog box.



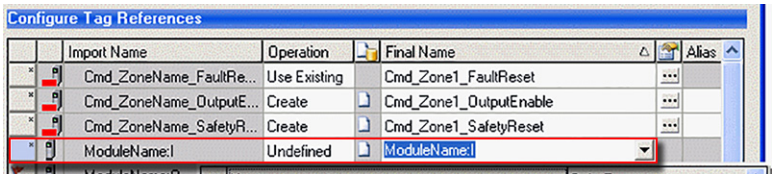
Any 'none' tags listed in the import configuration are used as placeholders for unused tags. Refer to the rung comments for more information.

6. Type the *DeviceName* from your Safety Module Configuration worksheet into the tag names on the Import Configuration dialog box.



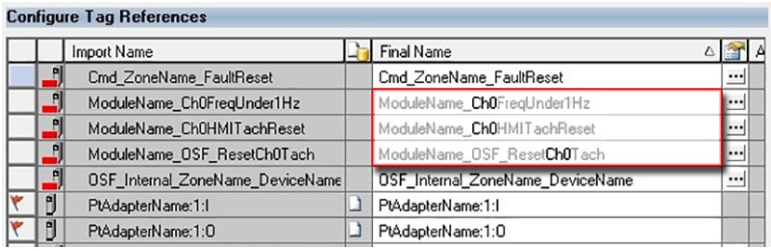
In addition, for a dual channel analog input logic import, type the *ModuleName* of the Analog Module into the ModuleName_Ch0Ch1_InputStatus tag.

7. Select the *ModuleName:I* or *PtAdapterName:SlotNumber* field.

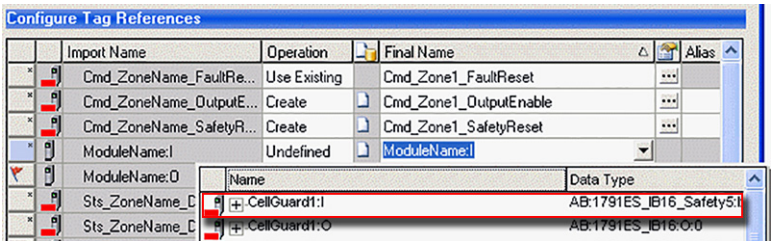


8. Click the pull-down arrow to browse to the Guard I/O module or Point I/O Ethernet Adapter and Slot number of the module to which this input device is connected.

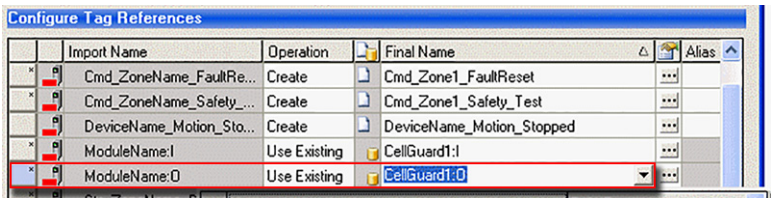
   Some analog input device imports include “Ch0” references that must be updated to specific channel for that input.



9. Double-click the Guard I/O module input tag.

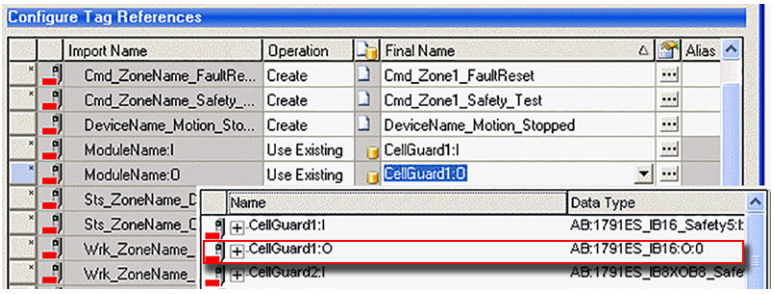


10. If the input device has a *ModuleName:O* output tag, select the *ModuleName:O* field.

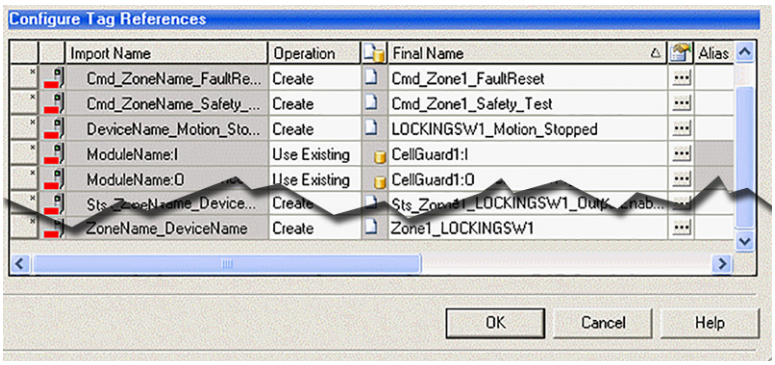


11. Click the pull-down arrow to browse to the Guard I/O module to which this input device is connected.

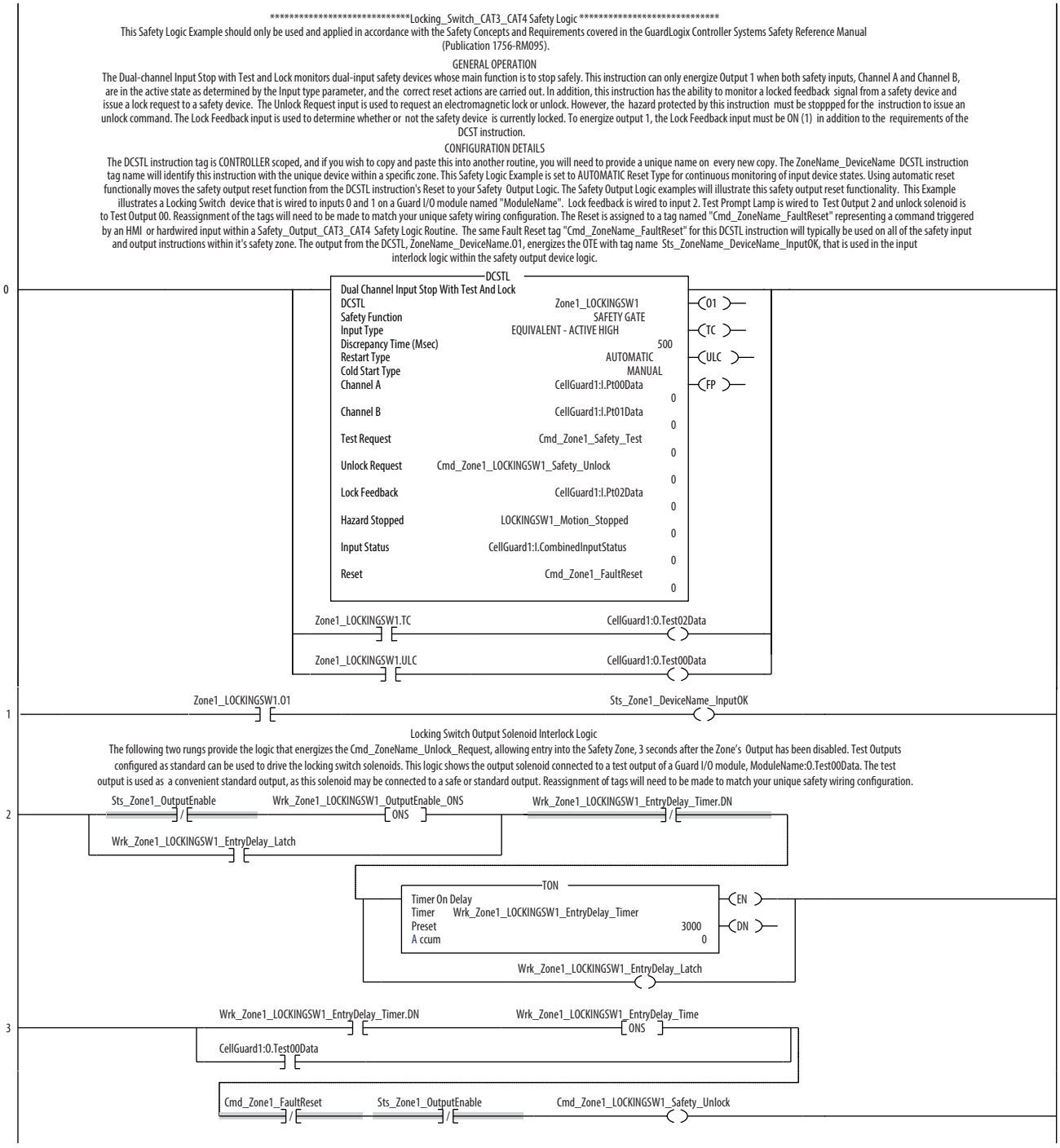
12. Double-click the Guard I/O module output tag.



13. Click OK to complete the import.

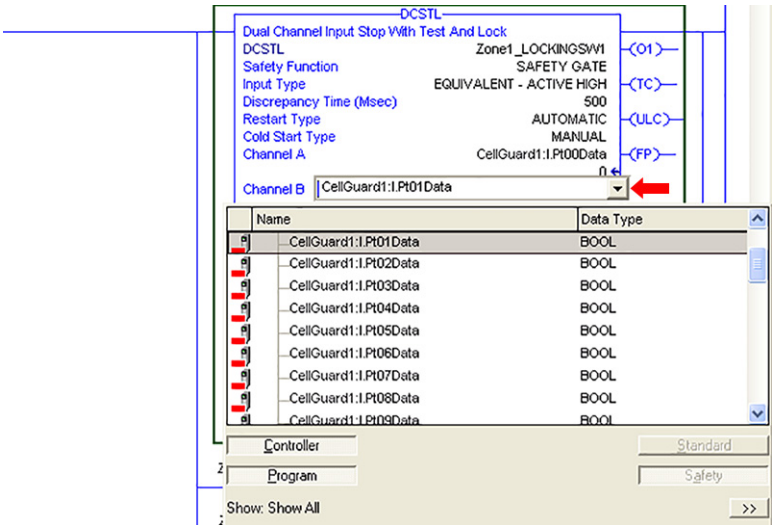


14. Review the imported rung comments on the next page to understand the general operation and configuration details.

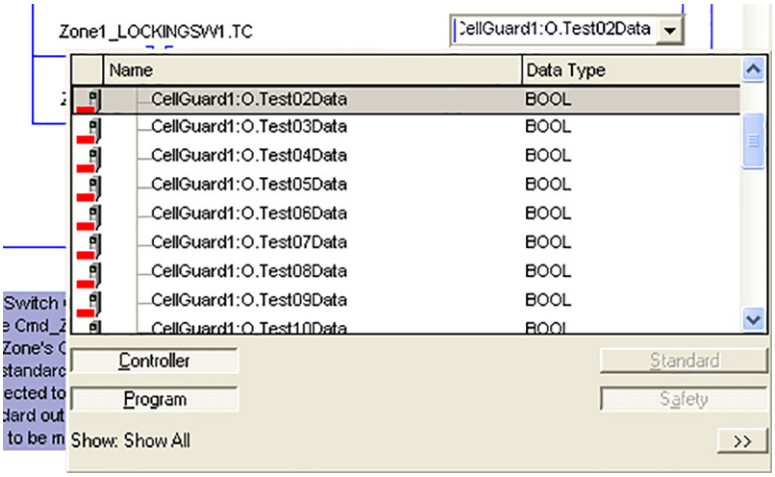


Refer to the GuardLogix Instruction Set Reference Manual, publication 1756-RM095, for additional information and configuration of the instructions required for your application.

15. After the import is complete, double-click the Channel A and Channel B tags on the main safety instruction and browse to the associated Channel Tags for the first device listed on your first Safety Module Configuration worksheet.



16. Double-click each of your other module input or output tags within your safety logic and browse to the associated input and output tags listed in your Safety Module Configuration worksheet.



17. Repeat the Import Your Safety Input Device Logic steps, on pages 56...61, for each safety input device listed in the first zone of the Safety Zone Configuration worksheet you created in Chapter 2.

See Appendix A for the completed input logic for the Robot_Cell Application example used in this toolkit.

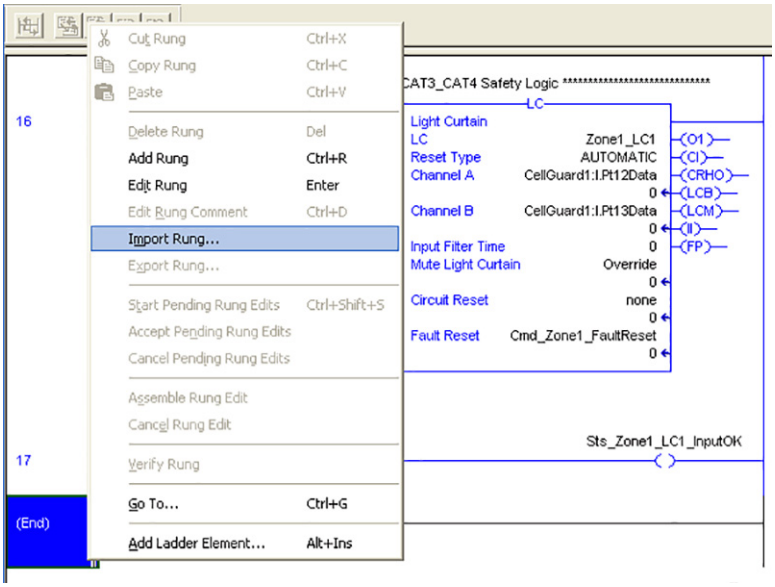
Import Your Safety Output Device Logic

Follow these steps to add safety output logic.

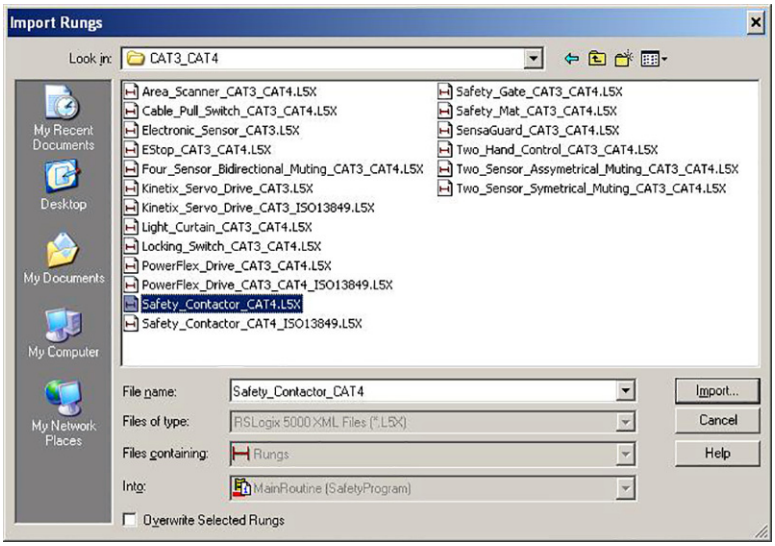
1. Go to your first safety zone routine.

   Add your output logic after the input logic in your safety routine.

2. Right-click the end rung and choose Import Rung.



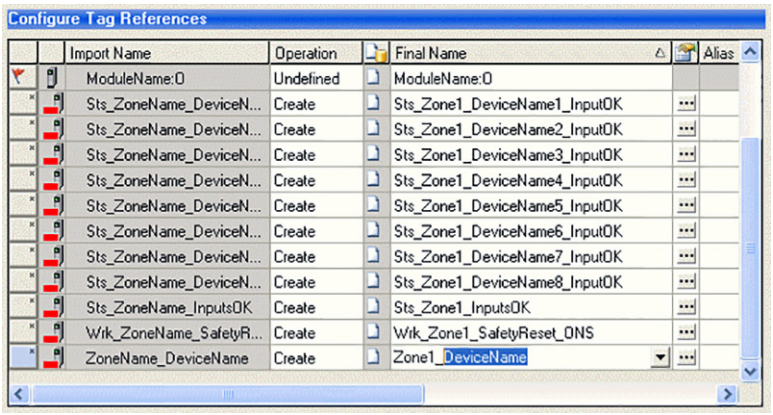
3. Browse to the Safety Device Routines> RSL5k_V16_or_Later, RSL5k_V17_or_Later, or RSL5k_V20_or_Later directory in the toolkit and select the CAT2 or CAT3_CAT4 subdirectory based on your output device safety category requirements.



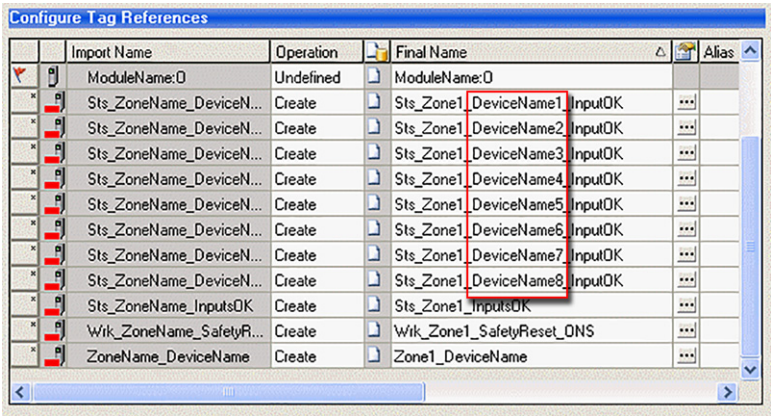
4. Select the device type of the first output device listed on your first Safety Module Configuration worksheet and click Import.

   ISO 13849-1 requires that manual reset functions must occur on falling edge signals. If compliance with this standard is required, select safety device logic that is followed by the ISO 13849 designation.

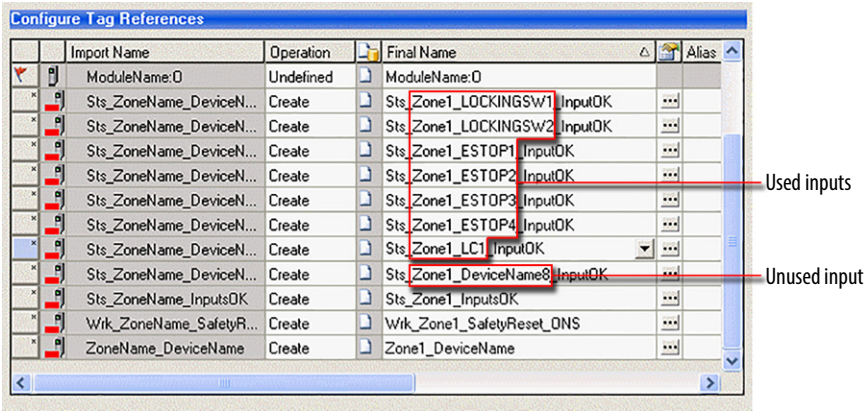
5. Type the *ZoneName* from your Safety Zone Configuration worksheet into the tagnames on the Import Configuration dialog box.
6. Type the *DeviceName* of the first output device from your Safety Module Configuration worksheet into the tagnames on the Import Configuration dialog box.



7. In the *DeviceName1* through *DeviceName8* tags, type the *DeviceNames* for the input devices that control this output in this zone.

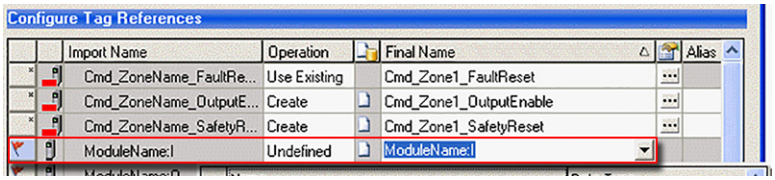


If you do not have 8 input devices, leave the unused *DeviceName* tag fields as is. This example shows 7 inputs.

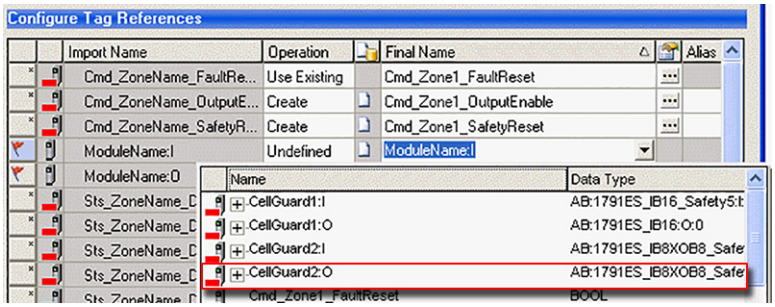


If you have more than 8 input devices, you need to add more instructions after the import is complete.

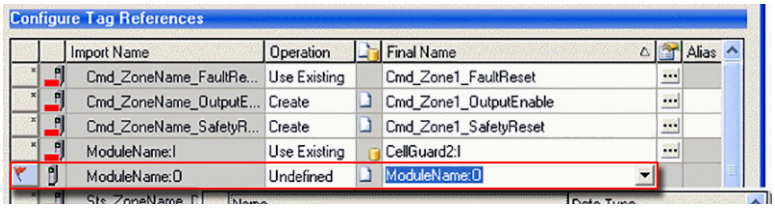
8. Click *ModuleName:I* field.
9. Click the pull-down arrow to browse to the Guard I/O module to which this safety output is connected.



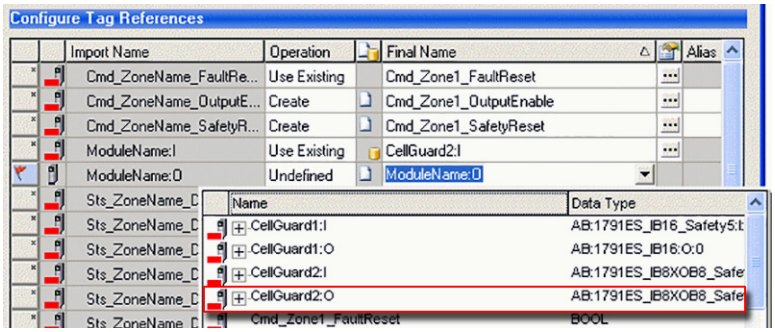
10. Double-click the module's input tag.



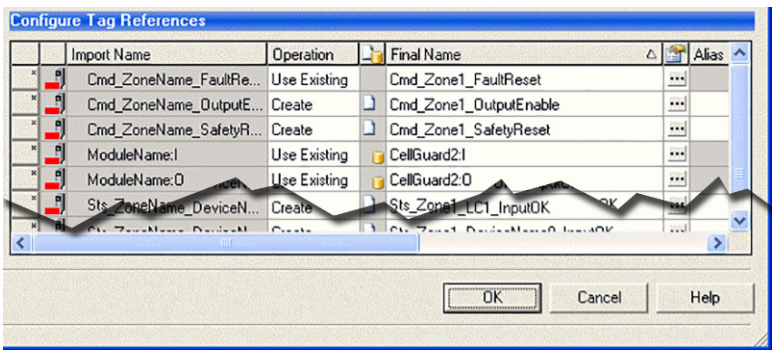
11. Click *ModuleName:O* field.



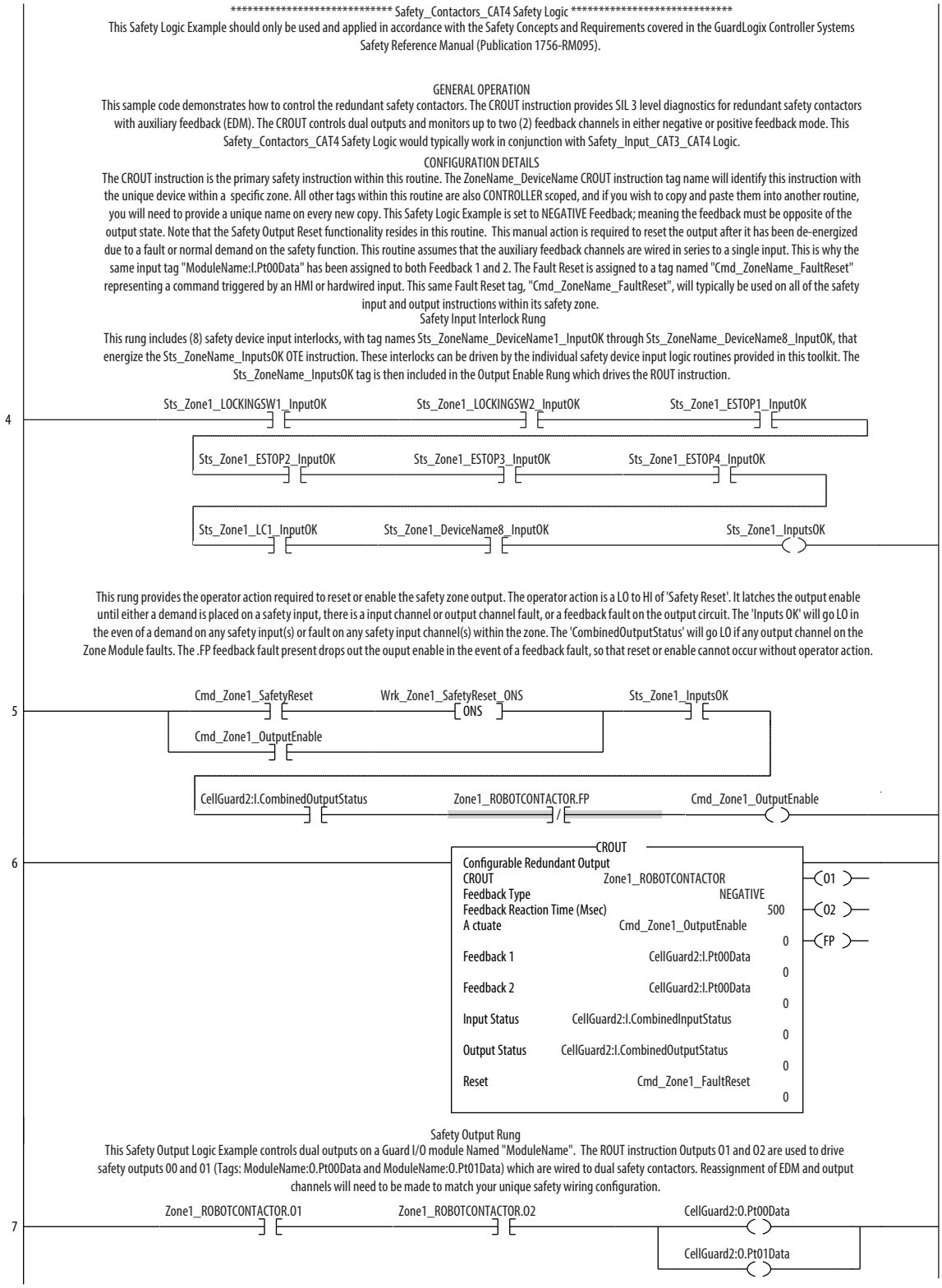
12. Click the pull-down arrow to browse to the Guard I/O module to which this safety output is connected.
13. Double-click the module's output tag.



14. Click OK to complete the import.

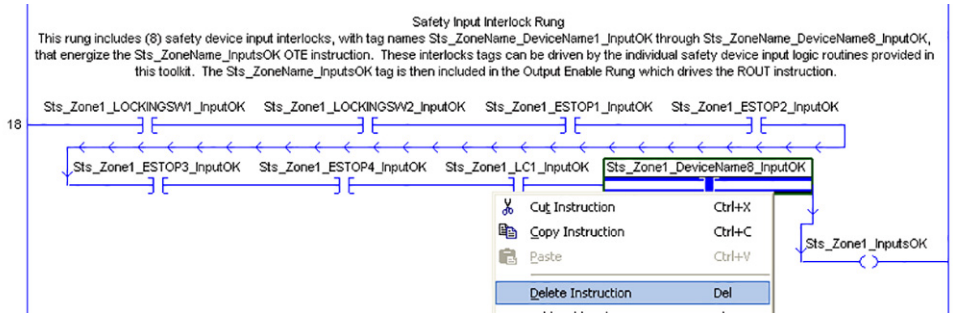


15. Review the imported rung comments to understand the general operation and configuration details.

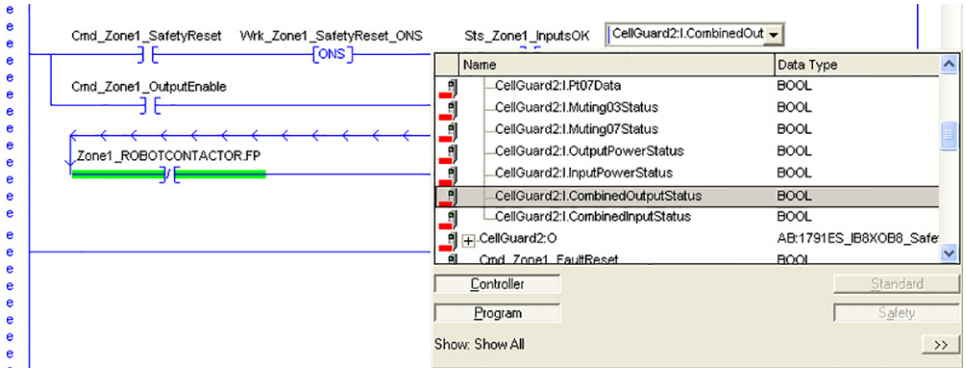


Refer to the GuardLogix Instruction Set Reference Manual, publication 1756-RM095, for additional information and configuration of the instructions required for your application.

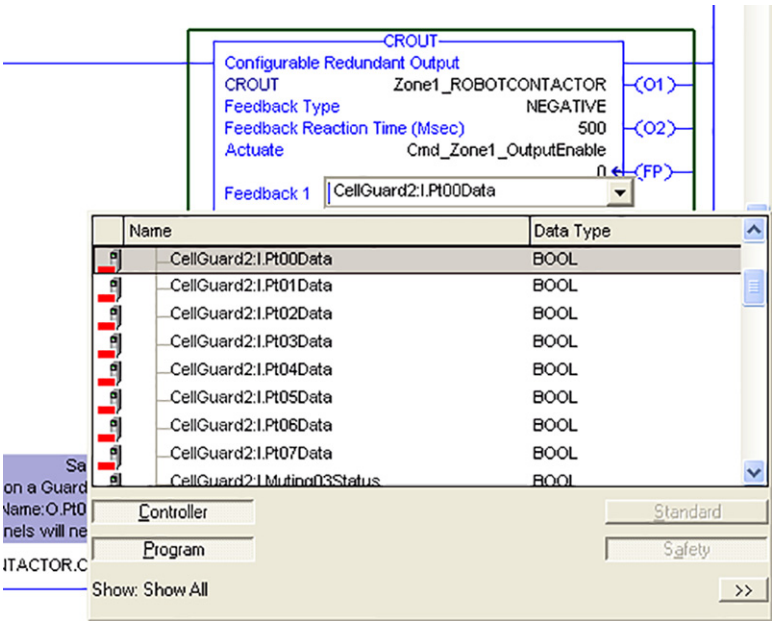
16. After the import is complete, right-click any unused input device instructions in the safety input interlock rung and choose Delete Instruction.



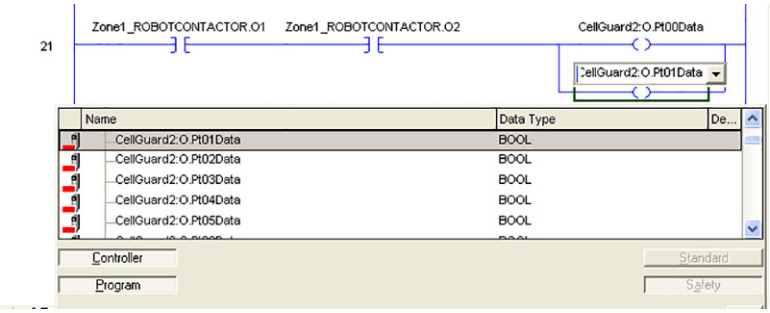
17. If your Guard I/O module is a 1791DS-IB4XOW4, 1791DS-IB8XOB8, 1791DS-IB8OXBV4, or 1732DS-IB8XOBV4, then double-click *ModuleName:I.OutputStatus* in the Output Enable Rung and choose *ModuleName:I.CombinedOutputStatus* tag from the pull-down list.



18. Double-click the Feedback 1 and Feedback 2 tags on the CROUT safety output instruction and browse to the Guard I/O module input tags assigned to the feedback of the safety output device controlled by this CROUT instruction.



19. Double-click the Guard I/O module output tags and browse to the Guard I/O module output tags assigned to the safety output device controlled by this CROUT instruction.



20. If your zone has multiple output devices requiring separate safety output instructions, then see Appendix B for an example of how to modify the output logic.

Add Safety Input and Safety Output Device Logic for Each Safety Zone

Repeat the Import Your Safety Input Device Logic and Import Your Safety Output Device Logic steps on pages 56...66 for each zone listed on your Safety Zone Configuration worksheet from Chapter 2.

See Appendix A for the completed input and output logic for the Robot_Cell Application example used in this toolkit.

Adding Your Faceplate Logic

The toolkit features three pre-configured faceplates.

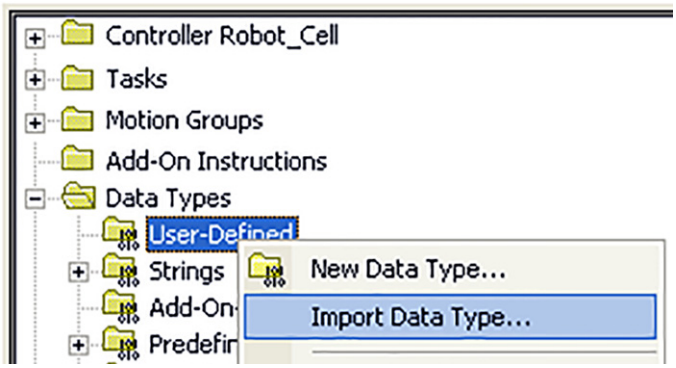
- The digital Guard I/O module faceplate lets you view the status of the safety circuits and logic, and provides diagnostics for safety demands and faults. You will need to add one Guard I/O Add-On Instruction (AOI) for each digital I/O module in your zone.
- The Guard I/O Analog module faceplate lets you view the status of the analog safety circuits and logic, and provides diagnostics for safety demands and faults. You will need to add one Guard I/O Analog AOI and one Guard I/O Analog AOI Safety for each analog module in your zone.
- The safety instruction faceplate lets you monitor the status and diagnostic information of a safety instruction. To use the safety instruction faceplate, you must first import the required user-defined data type and create a tag using that data type.

Faceplate Logic for Safety Instruction Faceplates

Import User-defined Data Type for Safety Instruction Faceplates

Follow these steps to import the required user-defined data type.

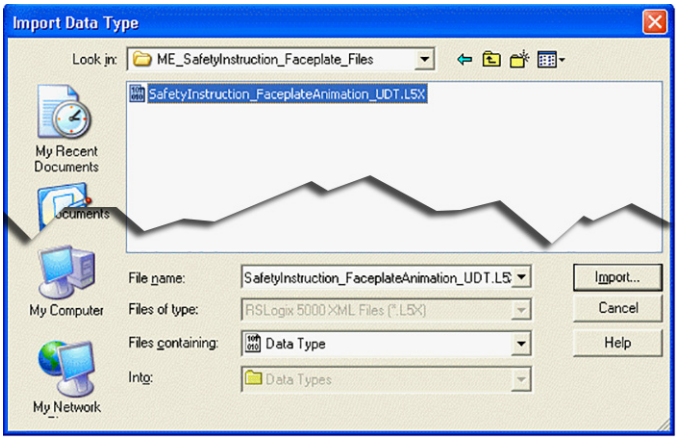
1. Under Data Types in RSLogix 5000 software, right-click User-Defined and choose Import Data Type.



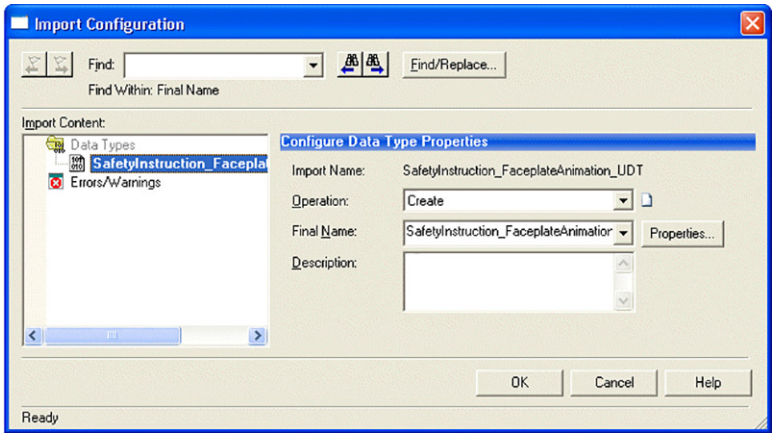
2. Browse to the Safety Instruction Faceplate files in the toolkit and open the ME_Safety_Faceplate_Files folder.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Safety Instruction Faceplate Files \ME_SafetyInstruction_Faceplate_Files

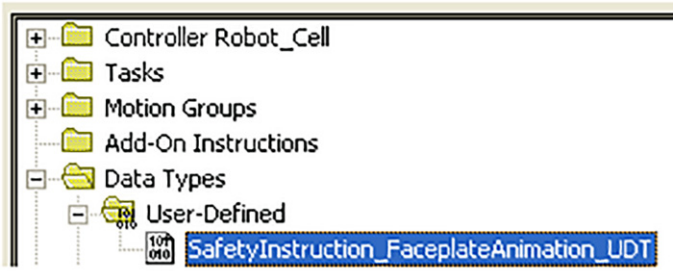
3. Select the SafetyInstruction_FaceplateAnimation_UDT file and click Import.



4. On the Import Configuration dialog box, click OK.



The SafetyInstruction_FaceplateAnimation_UDT appears in your project's User-Defined data type folder.

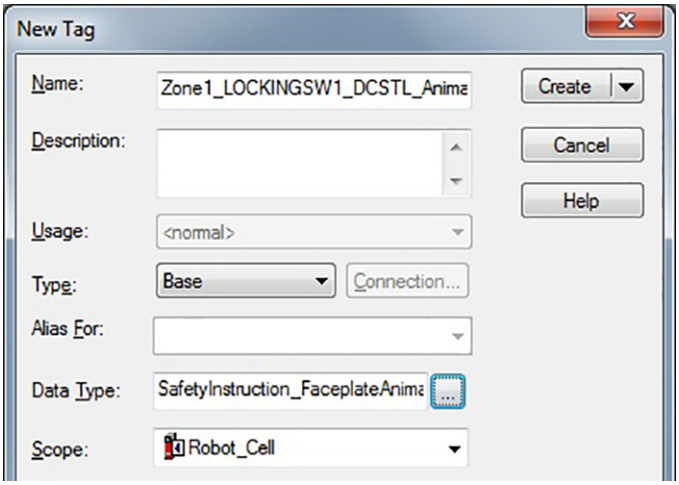


Create Faceplate Animation Tags for Safety Instruction Faceplates

When you create an HMI safety instruction faceplate that corresponds to a safety instruction, you also need to create a tag that stores the animation information for that faceplate. This tag will have the same data type you imported in the last section. Follow these steps to create an animation tag.

1. Expand your controller folder.
2. Right-click Controller Tags and choose New Tag.

3. In the New Tag dialog box, type the tag name based on the safety instruction you will be monitoring.



4. Choose the SafetyInstruction_FaceplateAnimation_UDT Data Type.

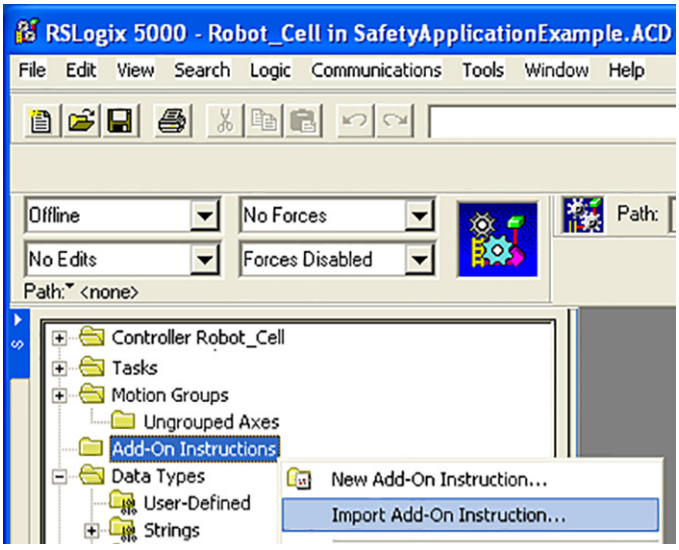
   The Class for these tags must be Standard. You will create a faceplate animation tag for every safety instruction you wish to monitor.

Faceplate Logic for Digital Guard I/O Faceplates

Import Add-On Instruction for Digital Guard I/O Faceplate

Follow these steps to load the Add-On Instruction logic that will let you use these digital Guard I/O faceplates.

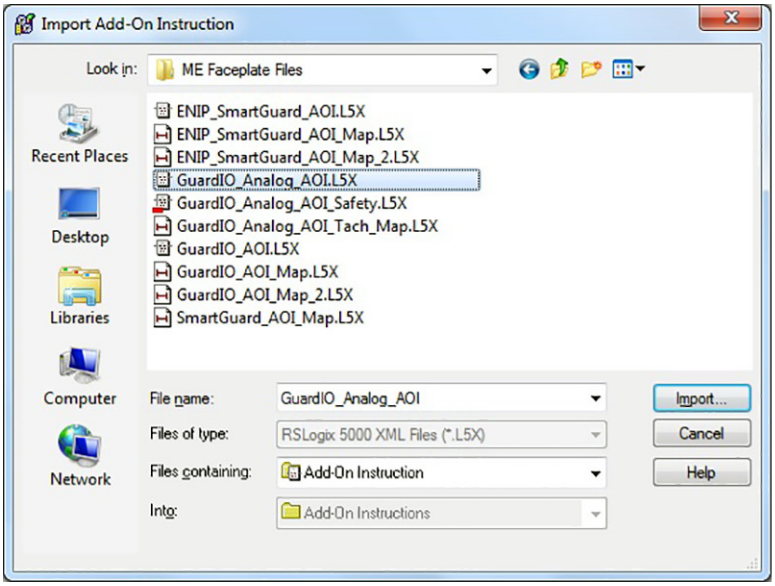
1. In your RSLogix 5000 application file, right-click Add-On Instructions and choose Import Add-On Instruction.

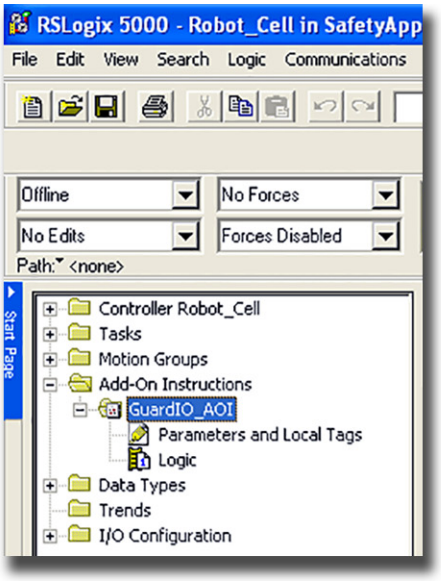


2. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate Files directory in the toolkit.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

3. Choose the GuardIO_AOI file and click Import.





The Guard I/O Add-On Instruction appears in your project's Add-On Instruction folder.

Create Controller Tags for Digital Guard I/O Faceplate

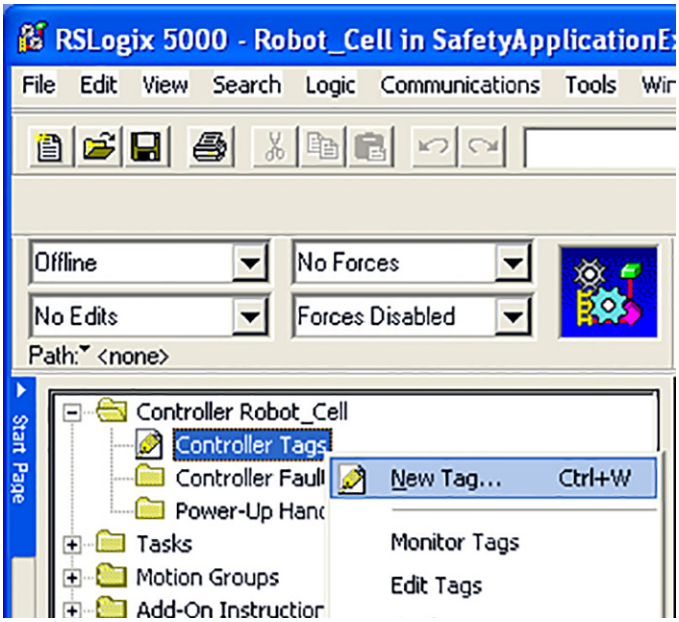
Prior to creating an instance of the digital GuardIO_AOI, you must create tags within the controller application. You need to add these six tags for each of your digital Guard I/O modules, which you listed in your Safety Zone Configuration worksheet from Chapter 2.

Table 7 - Guard I/O Module Tags

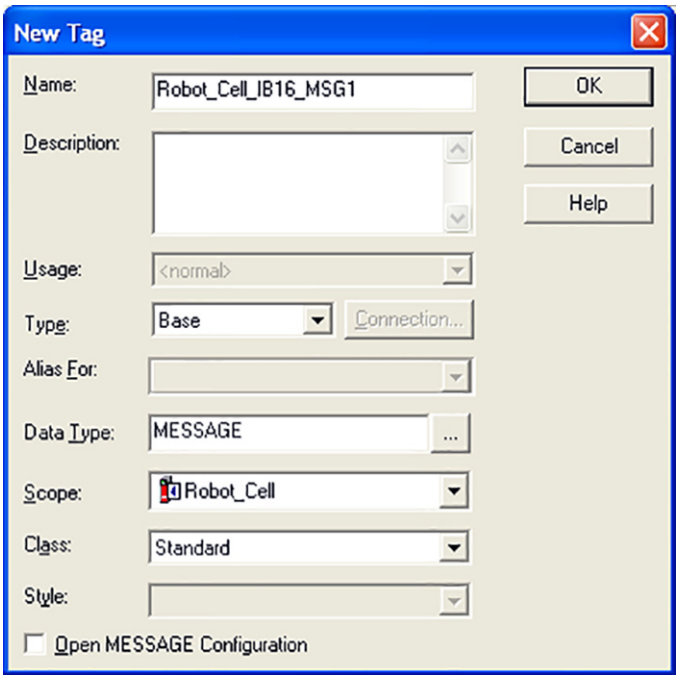
Tag Name	Data Type	Tag Scope
[*ModuleName*]_MSG1	Message	Controller
[*ModuleName*]_MSG2	Message	Controller
[*ModuleName*]_ExtendedData	DINT[2]	Controller or program
[*ModuleName*]_InputData	DINT[2]	Controller or program
[*ModuleName*]_OutputData	DINT	Controller or program
[*ModuleName*]_ErrorCode	DINT	Controller or program

Follow these steps to create a controller tag.

1. Expand your controller folder.
2. Right-click Controller Tags and choose New Tag.



3. In the New Tag dialog box, type the tag name, based on the Guard I/O Module Tags table on page 71 and enter the *ModuleName* for the associated Guard I/O module found on the Safety Zone Configuration worksheet you completed in Chapter 2.

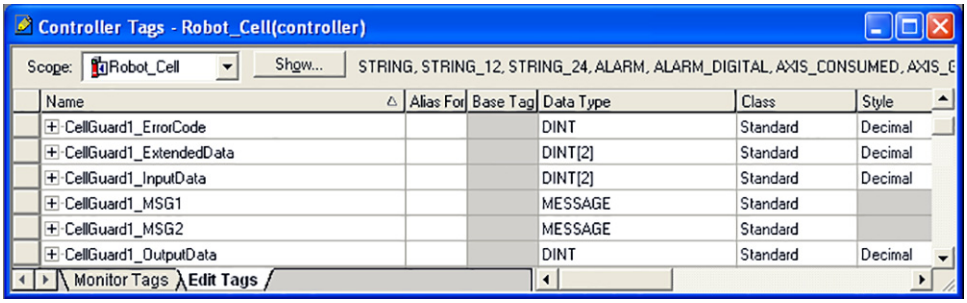


4. Choose the appropriate data type and scope for each tag based on the Guard I/O Module Tags table on page 71.

   The Class for these tags must be Standard.

5. Click OK to complete the controller tag assignment.

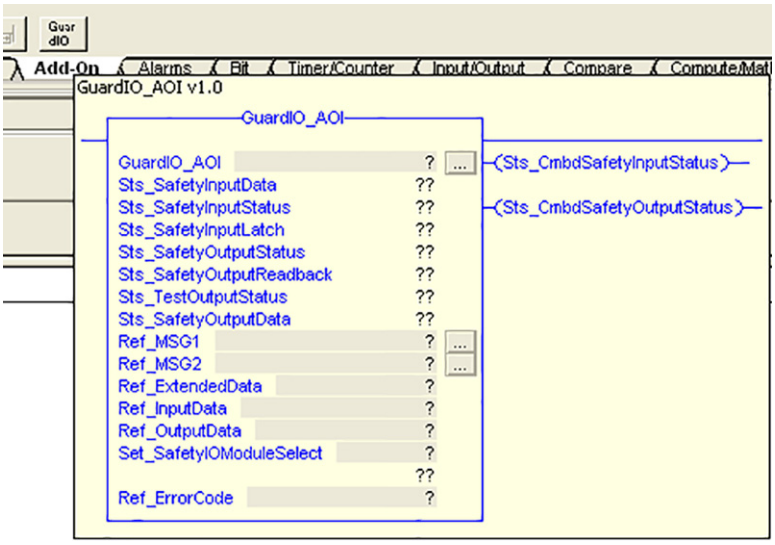
   The tags shown here represent a set of tags for a module named CellGuard1.



Create GuardIO_AOI Instances in Standard Program Routines for Each Digital Guard I/O Faceplate

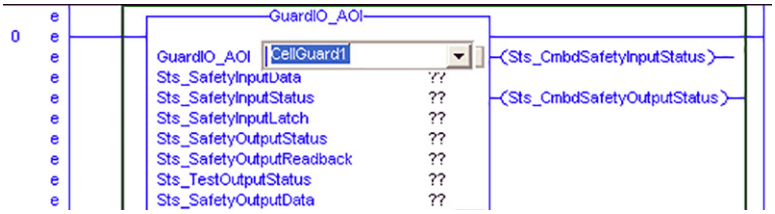
You must create a GuardIO_AOI instance for each Guard I/O module in your application.

1. Open the intended standard program routine and add a rung.
2. Select the GuardIO_AOI from the Add-On Instructions tab.

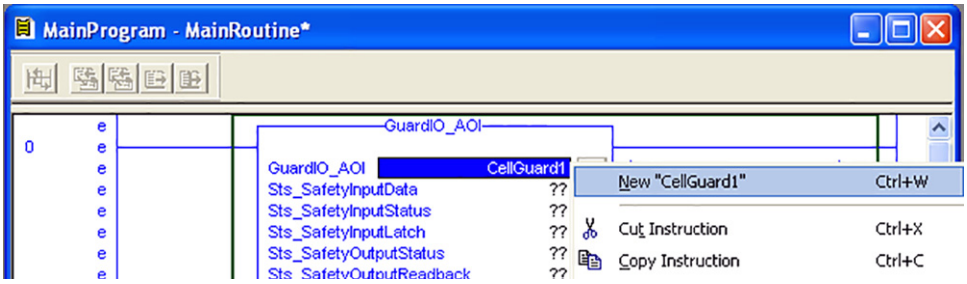


3. Double-click the GuardIO_AOI tag name field.
4. Type the *ModuleName* of the first Guard I/O module from your Safety Module Configuration worksheet.

   This example shows an Add-On Instruction named CellGuard1 that is associated with a Guard I/O module of the same name.

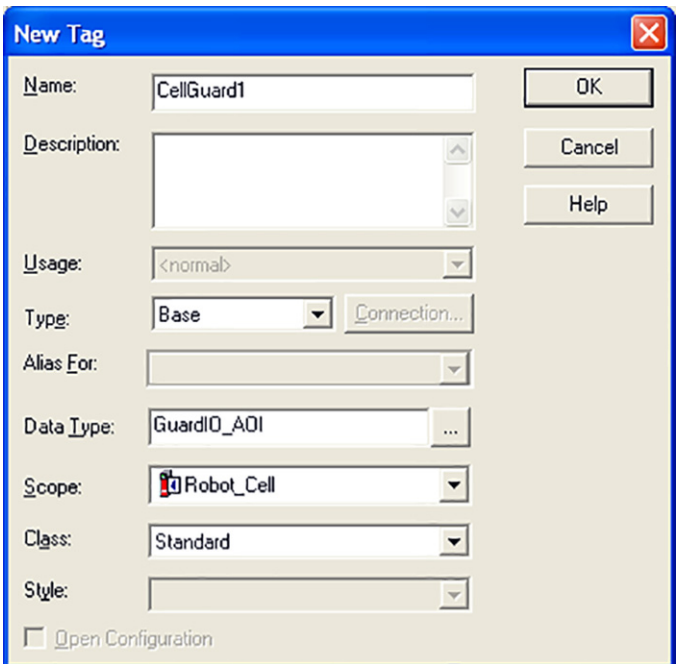


5. Right-click in the tag name field and choose New *tag name*, where *tag name* is the name you typed.



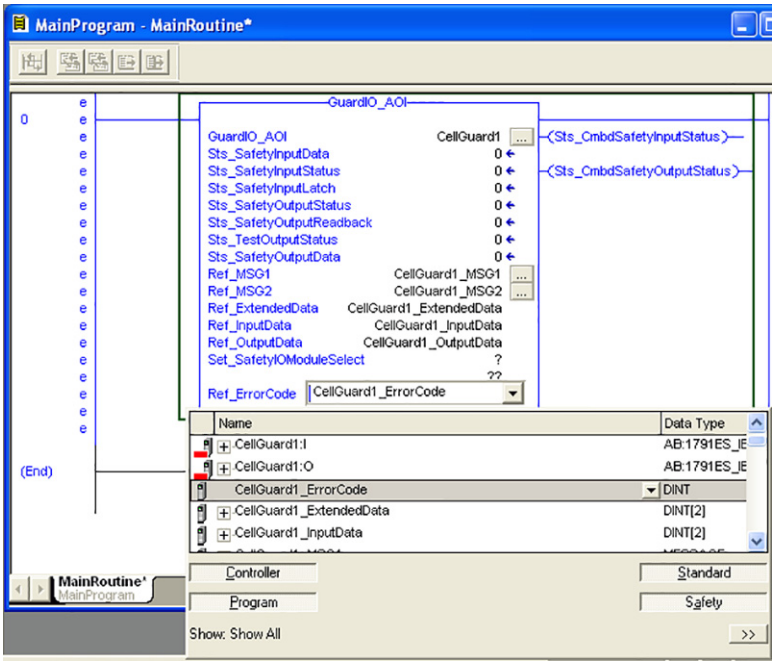
6. In the New Tag dialog box, verify that your settings match what is shown below.

   Change where needed to match.



7. Click OK.

8. Assign the remaining required tags you defined from the Guard I/O Module Tags table on page 71.

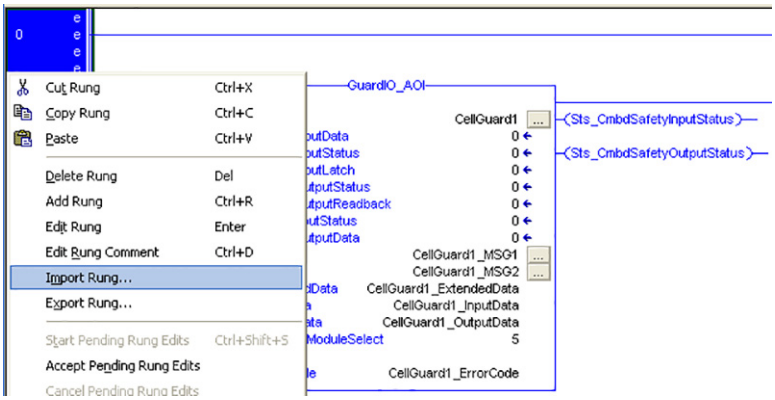


9. Double-click each Ref_*Tag* and click the pull-down arrow to browse to and select the appropriate controller tags, which you created in the Create Controller Tags for Digital Guard I/O Faceplate section of this chapter.
10. Double-click the *Set_SafetyIOModuleSelect* field and type in the value that matches your module catalog number, as shown in this table.

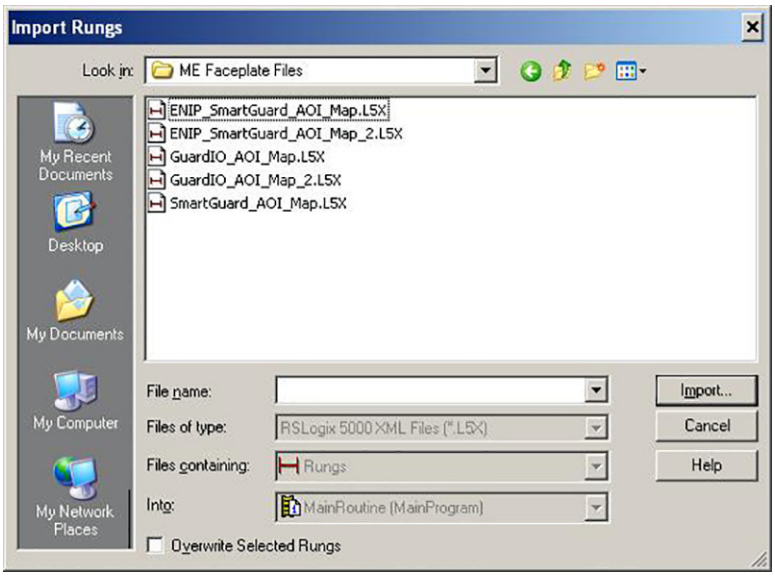
Table 8 - Set Safety I/O Module Type

Set_SafetyIOModuleSelect Value	Guard I/O Module Catalog Number
1	1791DS-IB8XOB8
2	1791DS-IB12
3	1791DS-IB4XOW4
4	1791DS-IB8XOBV4
5	1791DS-IB16
6	1732DS-IB8XOBV4
7	1732DS-IB8
8	1791ES-IB8XOBV4
9	1791ES-IB16
10	1734-OB8S
11	1734-IB8S
12	1752-L24BBB

11. Insert a rung before the GuardIO_AOI rung.



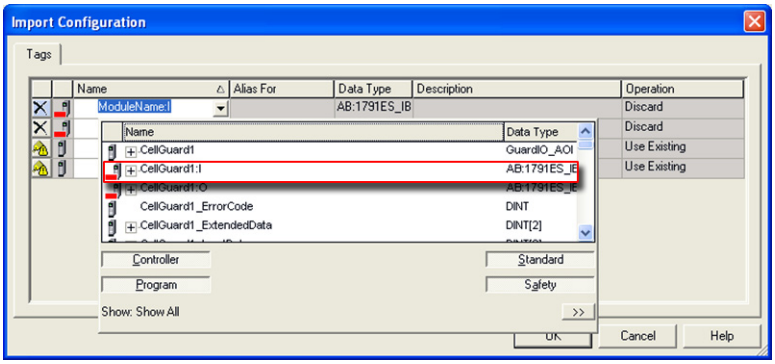
12. Right-click the rung and choose Import Rung.
13. Browse to the ME Faceplate files folder within the Guard I/O and SmartGuard Faceplate Files toolkit directory.



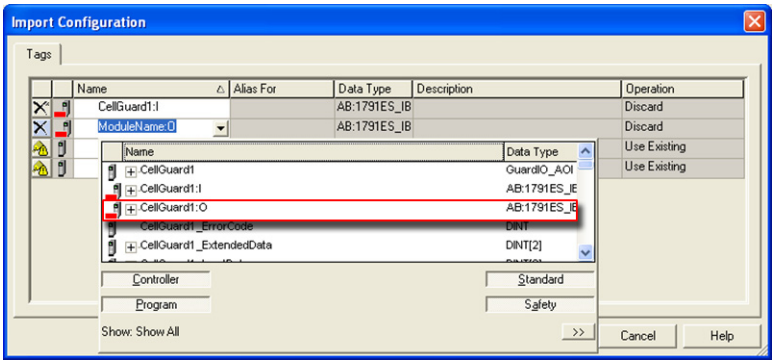
If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

14. Select the GuardIO_AOI_Map file and click Import.
15. Click the *ModuleName:I* field.
16. Click the pull-down arrow to browse to your first Guard I/O module.

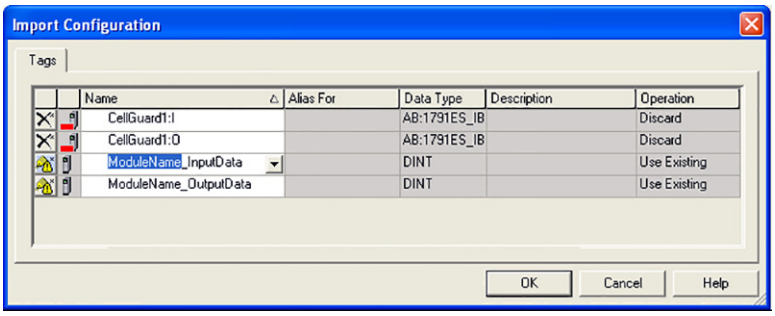
17. Double-click the module's input tag.



18. Click the *ModuleName:O* field.
19. Click the pull-down arrow to browse to your first Guard I/O module.
20. Double-click the module's output tag.

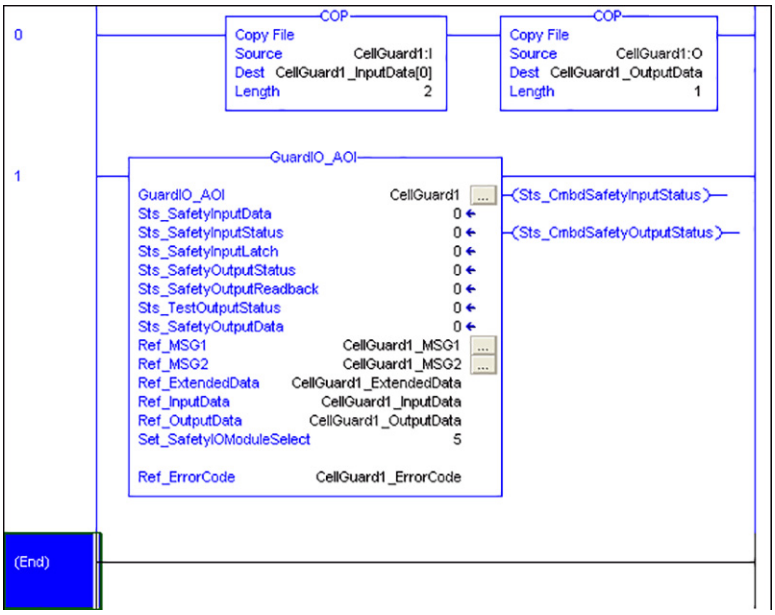


21. Type the *ModuleName* of the first Guard I/O module listed in your Safety Zone Configuration worksheet into both the *ModuleName*_InputData and *ModuleName*_OutputData tags.



22. Click OK to complete the import.

23. If the import was successful, the Guard_AOI mapping and Guard_AOI rungs should appear without errors similar to the example shown here.



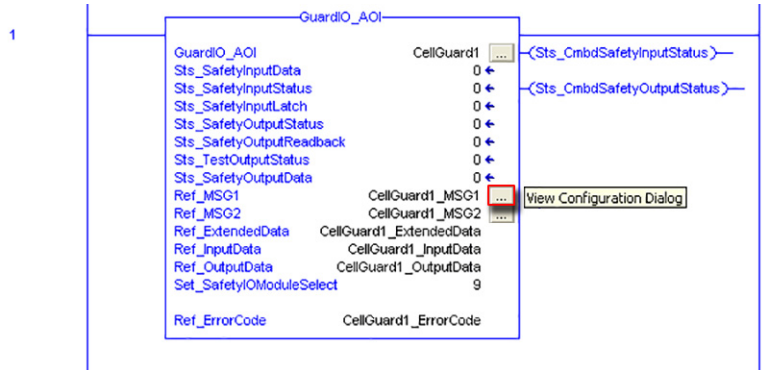
The example illustrates the GuardIO_AOI instance and mapping logic for a module named CellGuard1.

24. Repeat the Create GuardIO_AOI Instances in Standard Program Routines for Each Digital Guard I/O Faceplate steps 1...23, on pages 73...78, for each of the Guard I/O modules you wish to use with the pre-configured faceplate.

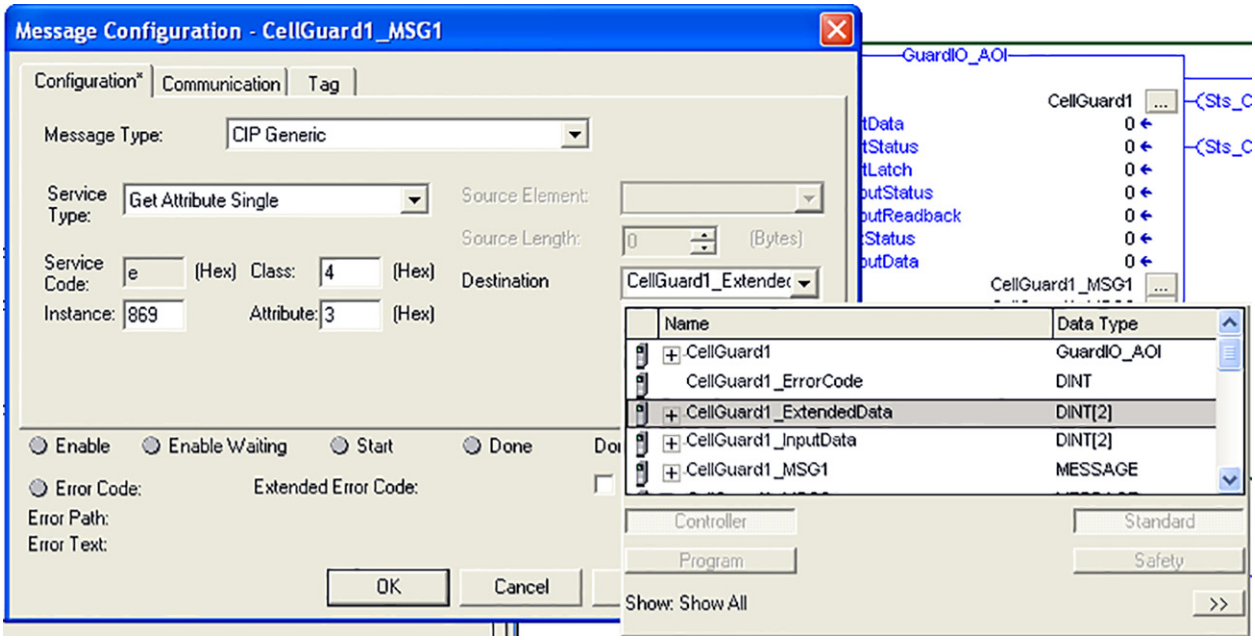
Configure Guard I/O Module Add-On Instruction Message Instructions for each Digital Guard I/O Faceplate

For each of your module Add-On Instructions, configure the MSG_1 instruction to return status information from the I/O module and the MSG_2 instruction to return specific error status from a failed I/O point.

1. To configure MSG_1, click the message instruction dialog button.



2. Set the Destination as the ExtendedData tag you created for your I/O module.

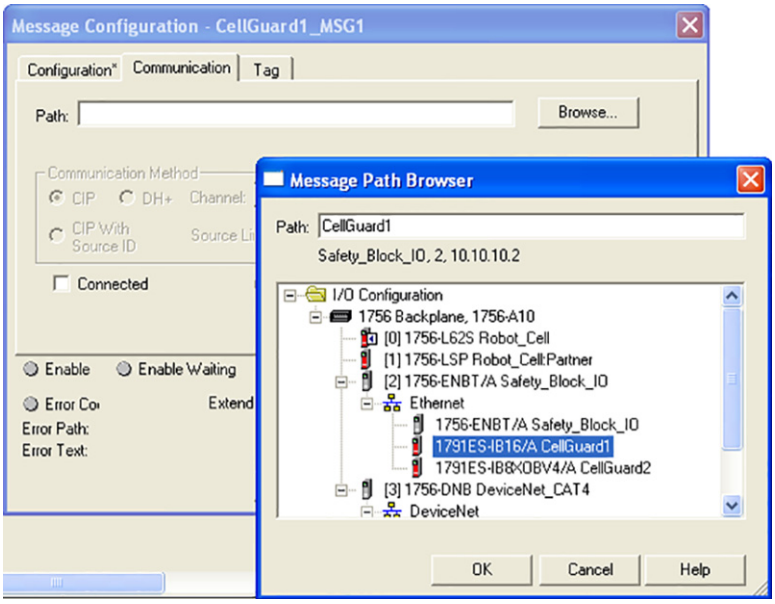


3. Configure the Service Type as Get Attribute Single, which results in a Service Code of 'e'.
4. Fill in the Class, Instance, and Attribute fields using this table.

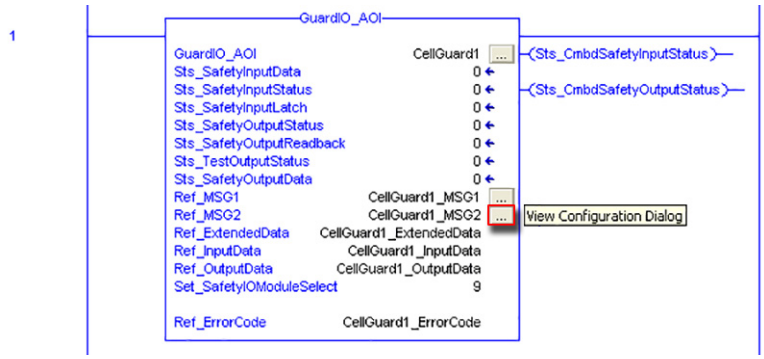
Table 9 - Guard I/O Module Configuration Data

Guard I/O Module	Class	Instance	Attribute
1791DS-IB8XOB8	4	803	3
1791DS-IB12	4	786	3
1791DS-IB4XOW4	4	819	3
1791DS-IB8XOBV4	4	884	3
1791DS-IB16	4	869	3
1732DS-IB8XOBV4	4	884	3
1732DS-IB8	4	868	3
1791ES-IB8XOBV4	4	884	3
1791ES-IB16	4	869	3
1734-OB8S	4	1028	3
1734-IB8S	4	868	3
1752-L24BBB	39	1	6e

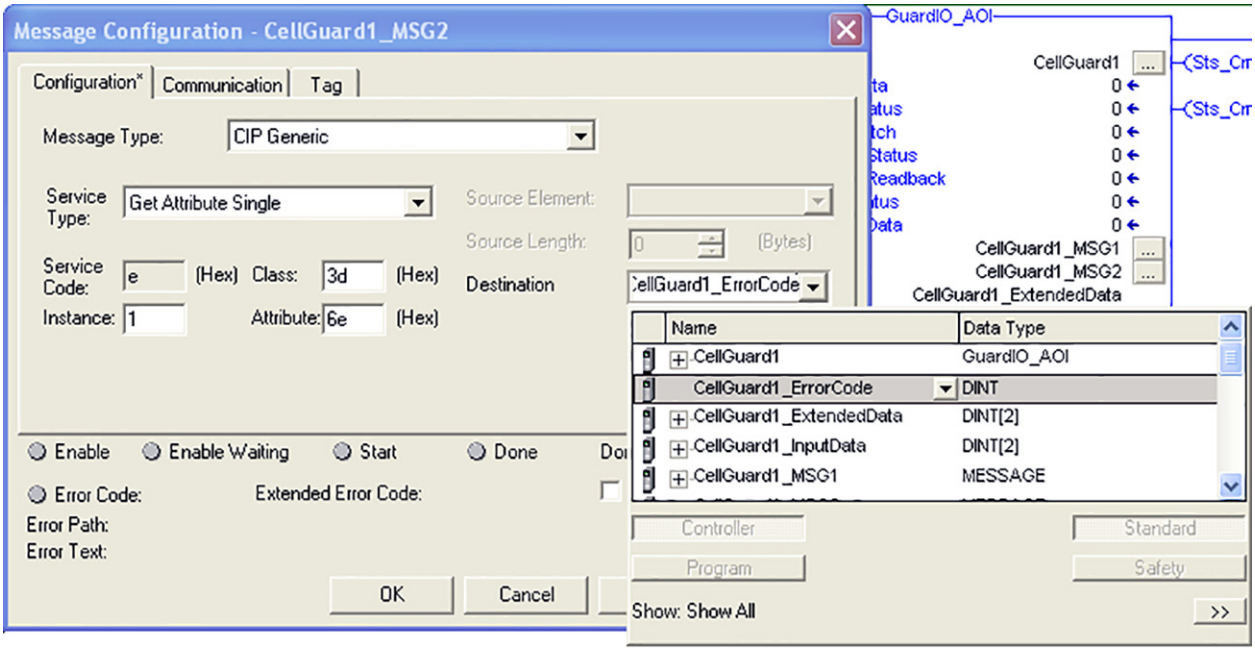
5. To access Message communication, select the Communication tab on the Message Configuration dialog box.
6. Set the Message Path by clicking Browse and choosing the intended Guard I/O module from the I/O Configuration tree.



7. Click OK to accept the message path.
8. Click OK on the Message Configuration dialog box to accept the MSG1 configuration.
9. To configure the MSG_2 instruction, click the message instruction dialog button for MSG_2.

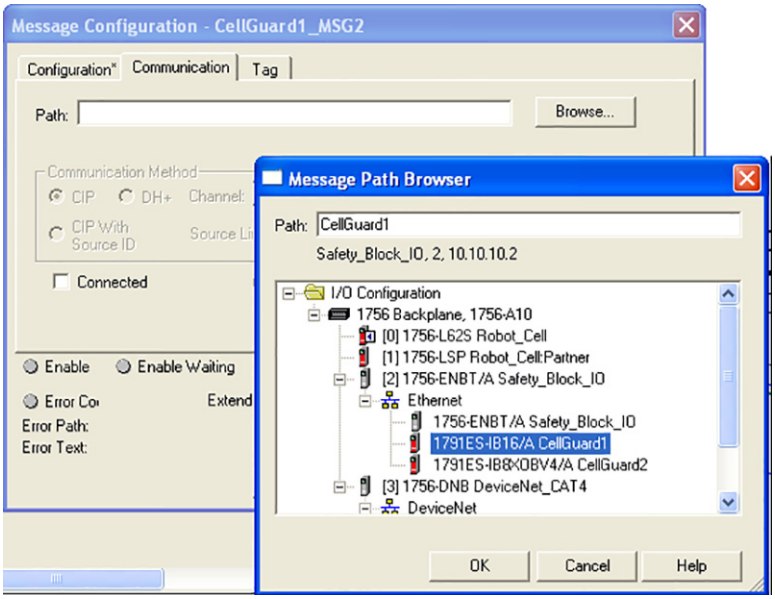


10. Set the Destination as the ErrorCode tag you created for your I/O module.



11. Configure the Service Type as Get Attribute Single, which results in a Service Code of 'e'.
12. Fill in the Class, Instance, and Attribute fields to match what is shown in the above example.

    Logic within the GuardIO_AOI modifies the Class, Instance, and Attribute, depending upon the module selected and which Guard I/O point faults.
13. To access Message communication, select the Communication tab on the Message Configuration dialog box.



14. Set the Message Path by clicking Browse and choosing the intended Guard I/O module from the I/O Configuration tree.
15. Click OK to accept the message path.
16. Click OK on the Message Configuration dialog box to accept the MSG2 configuration.

Refer to these manuals for additional diagnostic information that is available from Guard I/O Modules:

- Guard I/O DeviceNet Safety Modules User Manual, publication 1791DS-UM001
- Guard I/O EtherNet/IP Safety Modules User Manual, publication 1791ES-UM001
- POINT Guard I/O Safety Modules User Manual, publication 1734-UM013

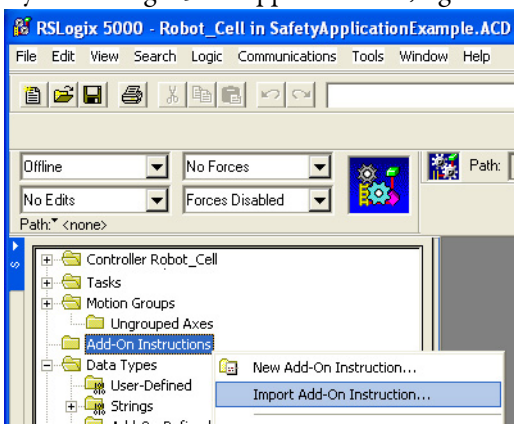
17. Repeat the Configure Guard I/O Module Add-On Instruction Message Instructions for each Digital Guard I/O Faceplate steps 1...16, on pages 78...81 for each of the GuardIO_AOI instructions in your application.

See Appendix A for the completed faceplate logic for the Robot Cell Module and Safety Zone Configuration used in this toolkit.

Faceplate Logic for Analog Guard I/O Faceplates

Import Add-On Instructions for Analog Guard I/O Faceplates

1. In your RSLogix 5000 application file, right-click Add-On Instructions and choose Import Add-On Instruction.

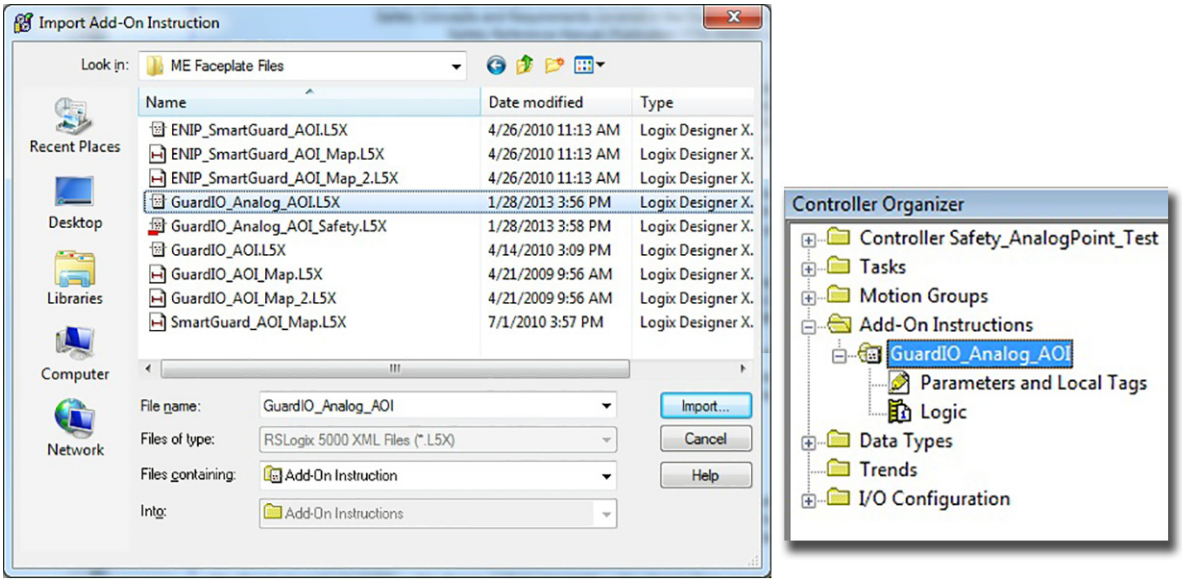


2. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate Files directory in the toolkit.

   If the toolkit has been loaded onto your personal computer, the hard drive path is: C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

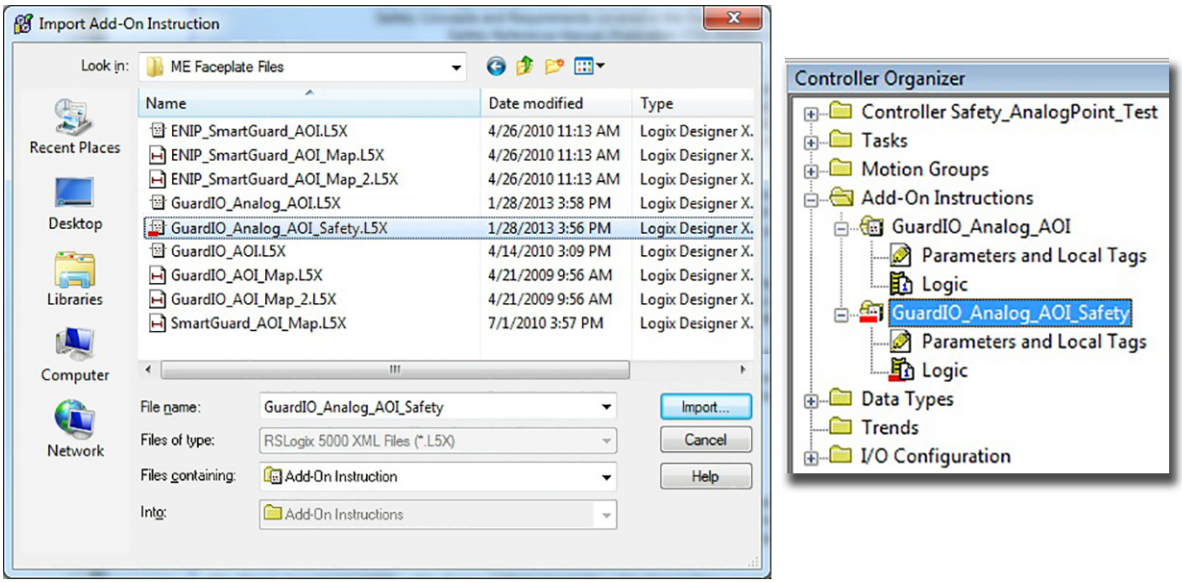
3. Choose the GuardIO_Analog_AOI file and click Import.

   The Guard I/O Add-On Instruction appears in your project's Add-On Instruction folder.



4. To choose GuardIO_Analog_Safety_AOI file, follow steps 1 through 3 and click Import.

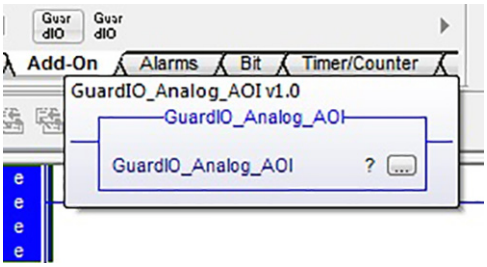
   The Guard I/O Analog Add-On Instruction should also appear in your project's Add-On Instruction folder.



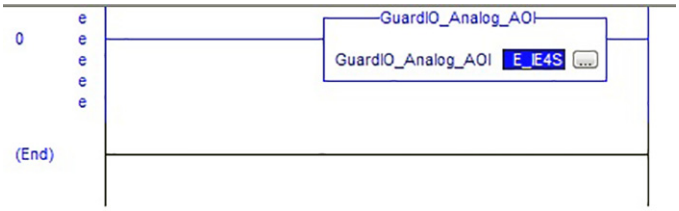
Create a GuardIO_Analog_AOI Instance in a Standard Program Routine

You must create a Standard GuardIO_Analog_AOI instance for each Guard I/O module in your application.

1. Open the intended standard program routine and add a rung.
2. Select the GuardIO_Analog_AOI from the Add-On Instructions tab.



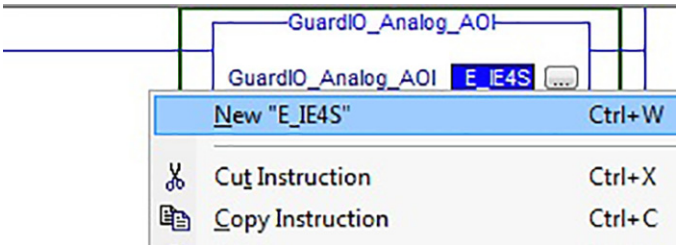
3. Double-click the GuardIO_Analog_AOI tag name field.



4. Type the ModuleName of the first Analog Guard I/O module from your Safety Module Configuration worksheet.

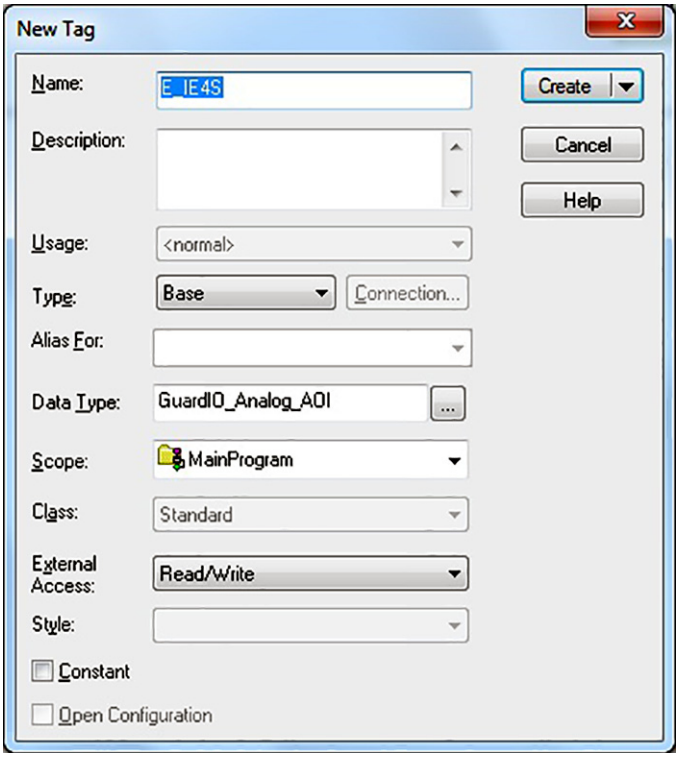
   This example shows an Add-On Instruction named E_IE4S that is associated with a Analog Guard I/O module of the same name.

5. Right-click in the tag name field and choose New tag name, where tag name is the name you typed.



6. In the New Tag dialog box, verify that your settings match what is shown below.

   Change where needed to match.

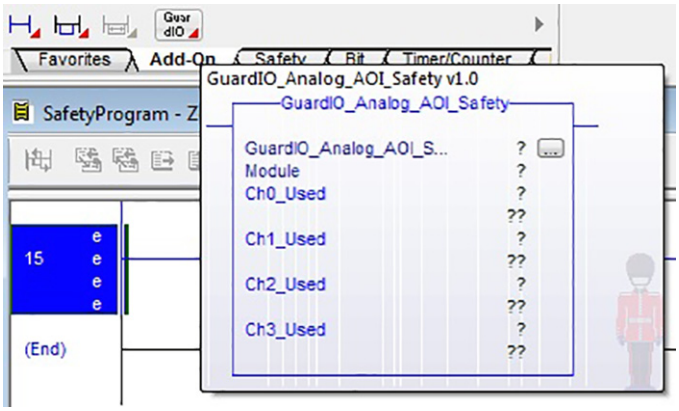


7. Click OK.
8. Repeat steps 1...6 for each safety analog module in your system.

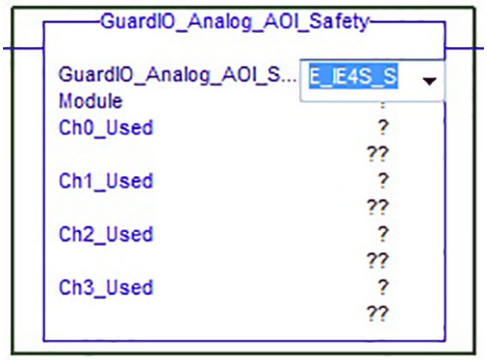
Create a GuardIO_Analog_AOI_Safety Instance in a Safety Program Routine

You must also create a GuardIO_Analog_AOI_Safety instance for each Guard I/O module in your application.

1. Open the intended Safety program routine and add a rung. This will most likely be the program routine for the safety zone that this module will be used for.
2. Select the GuardIO_Analog_Safety_AOI from the Add-On Instructions tab.



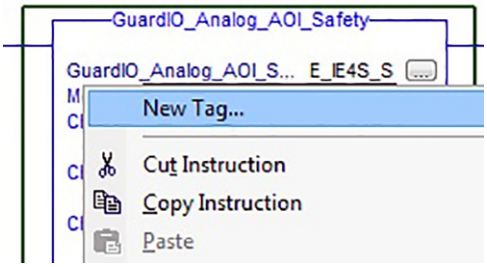
3. Double-click the GuardIO_Analog_AOI_Safety tag name field.



4. Type the ModuleName_S of the first Analog Guard I/O module from your Safety Module Configuration worksheet.

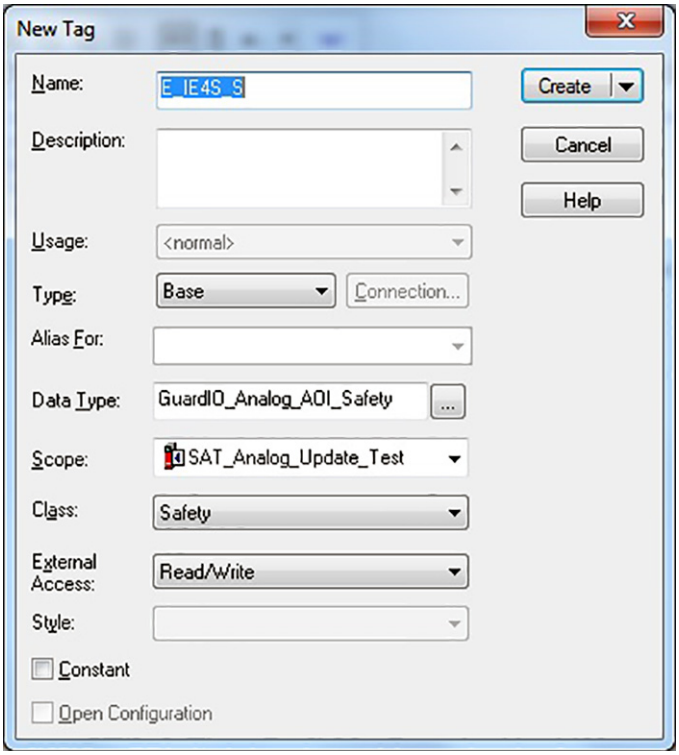
   This example shows an Add-On Instruction named E_IE4S_S that is associated with a Analog Guard I/O module named E_IE4S.

5. Right-click in the tag name field and choose New tag name, where tag name is the name you typed.

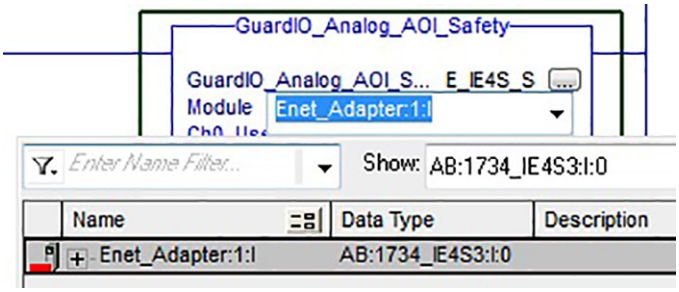


6. In the New Tag dialog box, verify that your settings match what is shown below.

   Change where needed to match.

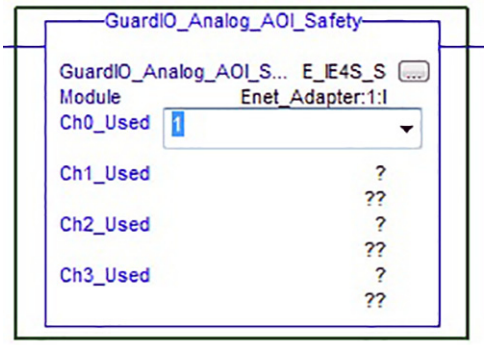


7. Click OK.
8. Assign the Safety Analog Input Module's input tag to the Safety Analog GuardIO_AOI Module field.

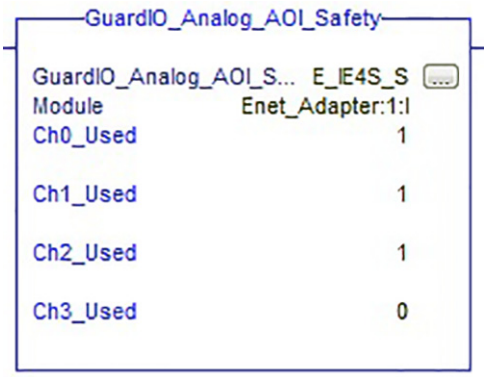


   The Module assignment in this example is Enet_Adapter:1:I which is the input tag of the IE4S module in slot 1 of the Point I/O chassis.

9. Double click each of the Chx_User tags and enter value of 1 if the channel on the module is being used or a value of 0 if the channel is not used.



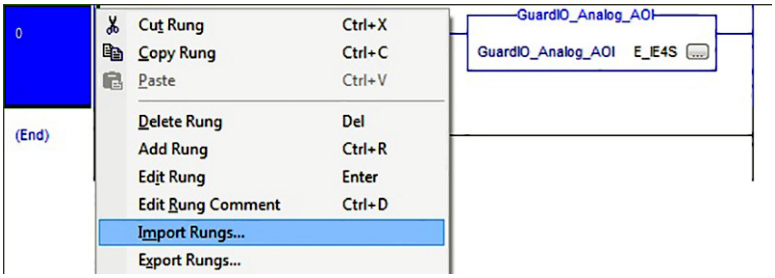
The channel assignment in this example show channels 0, 1, and 2 being used and channel 3 not used.



Map Standard Tachometer Reset Tags to Safety Reset Tags

If any of your analog inputs are tachometers then you need to map the associated ModuleName.Cmd_ChxTachReset and ModuleName_Cmd_ChxFreqUnder1Hz standard tags to their corresponding ModuleName_ChxHMITachReset and ModuleName_ChxFreqUnder1Hz safety tags.

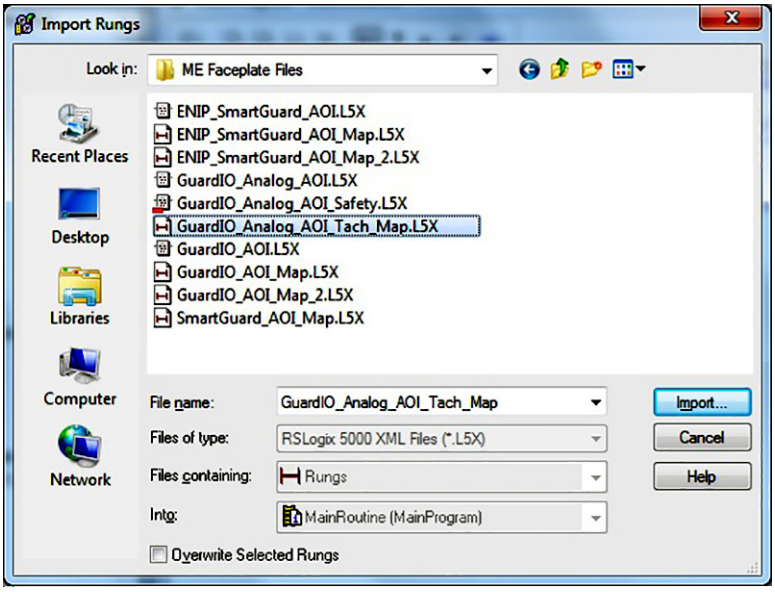
1. Select the Analog GuardIO_AOI instance rung in your Standard Task for the safety analog module that includes a tachometer input.
2. Right-click your Analog GuardIO_AOI instance rung and chose Import Rung.



3. Browse to the ME Faceplate files folder within the Guard I/O and SmartGuard Faceplate Files toolkit directory.

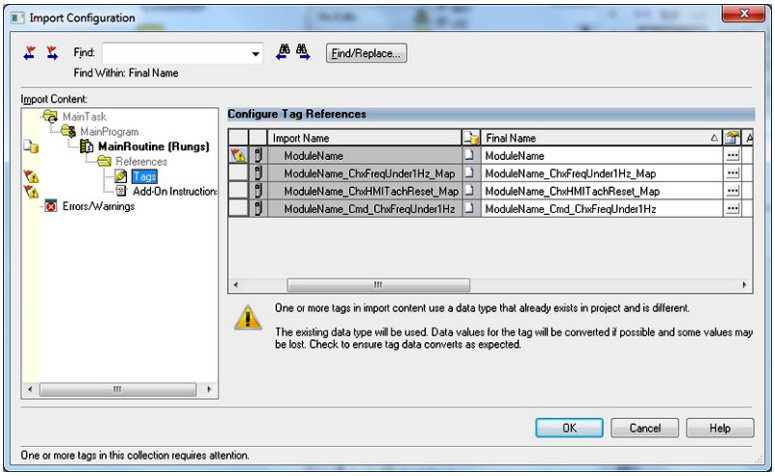
   If the toolkit has been loaded onto your personal computer, the hard drive path is: C:\\ProgramFiles\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

4. Select the GuardIO_Analog_AOI_Tach_Map file and click Import.



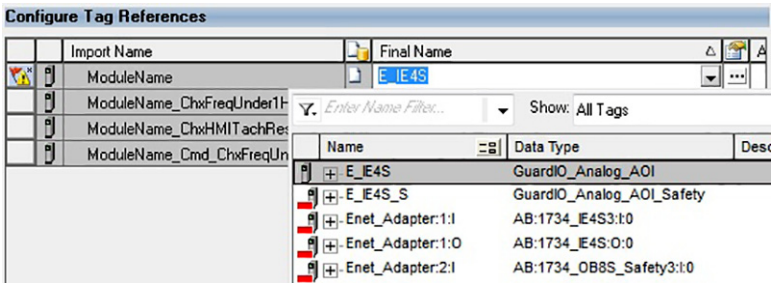
   The import configuration dialog appears.

5. Select Tags from Import Content Tree.



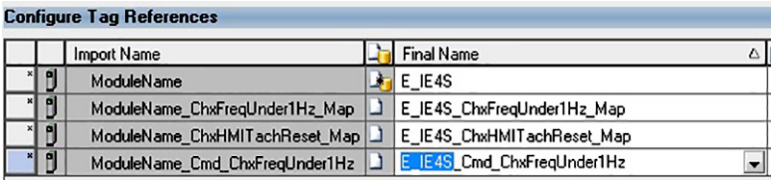
6. Select the first tag ModuleName within the Final Names column and click the arrow key to browse to the Analog GuardIO_AOI instance tag.

   For this example, the Analog GuardIO_AOI tag named E_IE4S was selected.



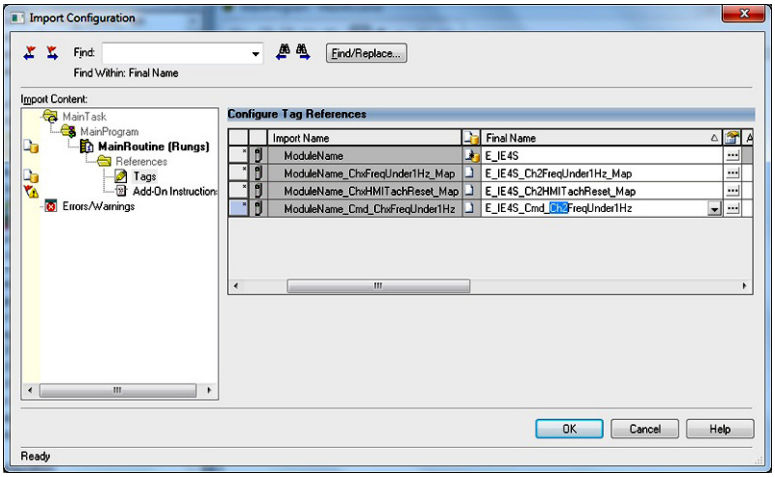
7. Select each of the remaining tags in the Final Names column and replace ModuleName text with the same name as the Analog GuardIO_AOI tag name.

   For this example, ModuleName was replaced with E_IE4S in each of the remaining tags.



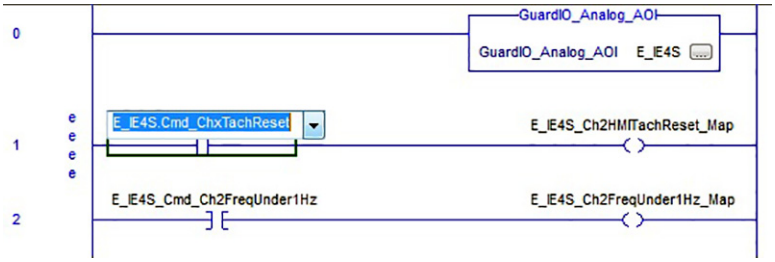
8. Select each of the remaining tags in the Final Names column and replace Chx text with the tachometer channel you are mapping.

   For this example, Ch2 was entered to map the tachometer channel 2 tags of the analog input module.



9. Click OK to complete tachometer reset mapping tag rungs.

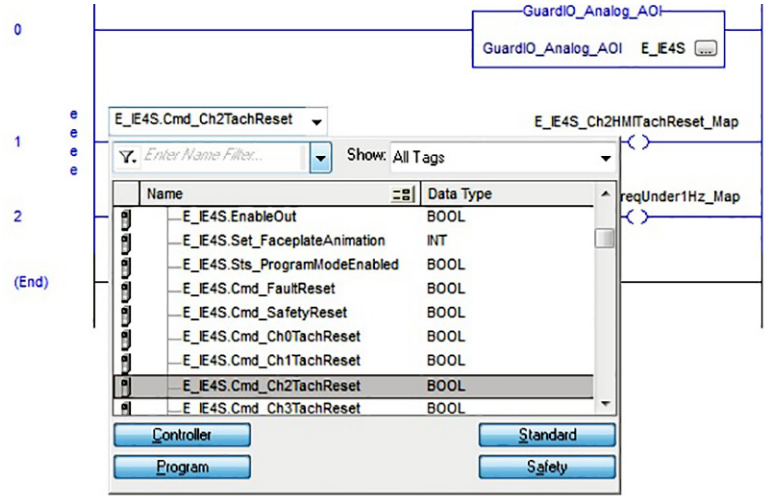
   Two rungs appear just below the Analog GuardIO_AOI instance rung.



10. Double click the E_IE4S.Cmd_ChxTachReset tag on the XIC instruction of the first rung and click the drop down arrow.

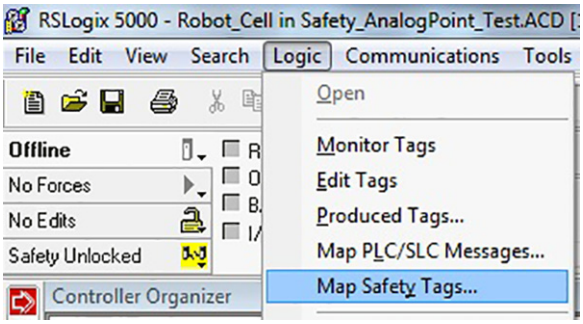
11. Browse to and select the Analog GuardIO_AOI's Cmd_ChxTachReset tag.

    For this example, E_IE4S.Cmd_Ch2TachReset tag was selected, representing the reset tag that is assigned to the faceplate tachometer reset button for channel 2.



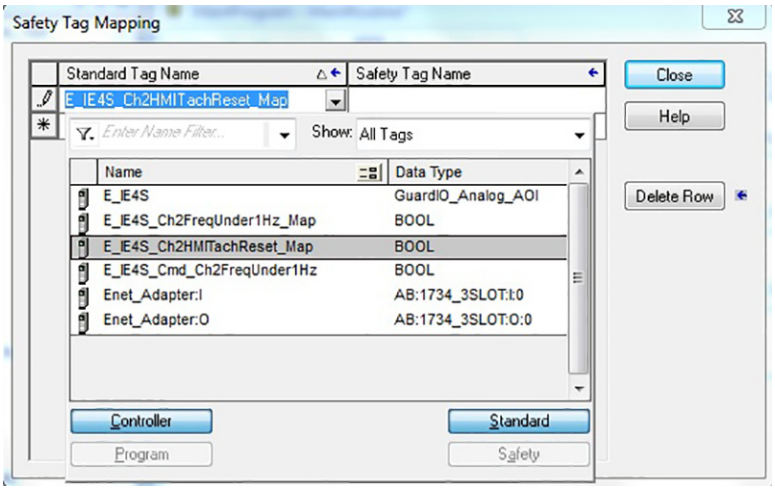
The tachometer reset mapping rungs are now complete and your Analog GuardIO_AOI and mapping rungs should look similar to the following rungs.

12. Choose Logic>Map Safety Tags to map the associated standard controller tachometer reset tags to the safety tachometer reset tags.



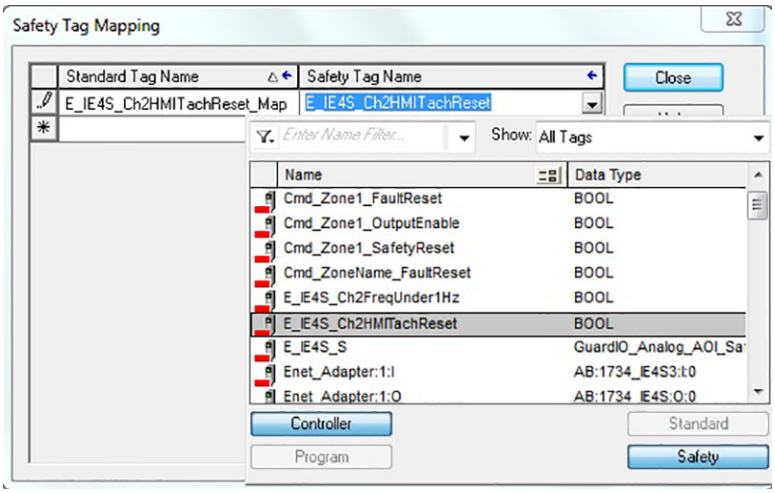
13. Select the standard tag name field and click the pull-down arrow.
14. Locate the ModuleName_ChxHMITachReset_Map output tag of the first rung you imported in the previous steps and double click to place in the standard tag name field.

    For this example, E_IE4D_Ch2HMITachReset_Map was selected.



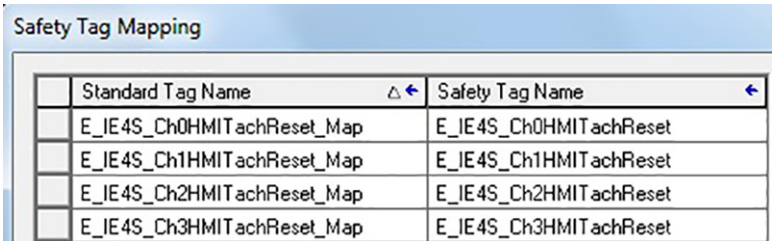
15. Select the safety tag name field and click the pull-down arrow.
16. Locate the associated ModuleName_ChxHMITachReset safety tag and double click to place in the safety tag name field.

    For this example, E_IE4S_Ch2HMITachReset safety tag was selected.



17. Repeat steps 1...16 for all of the tachometer analog channels of each module.

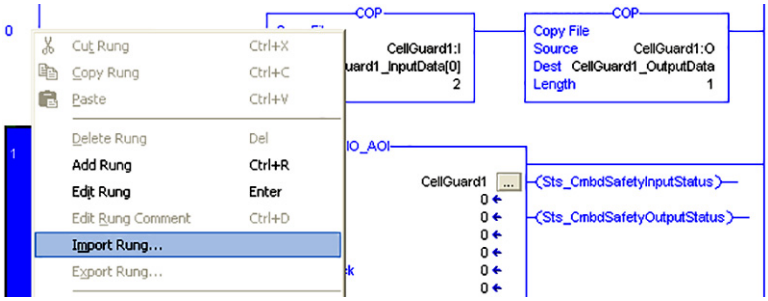
    The following is an example of mapping four tachometer channels from an analog module named E_IE4S.



Map Digital and Analog GuardIO_AOI Tags to Safety Zone Reset Tags

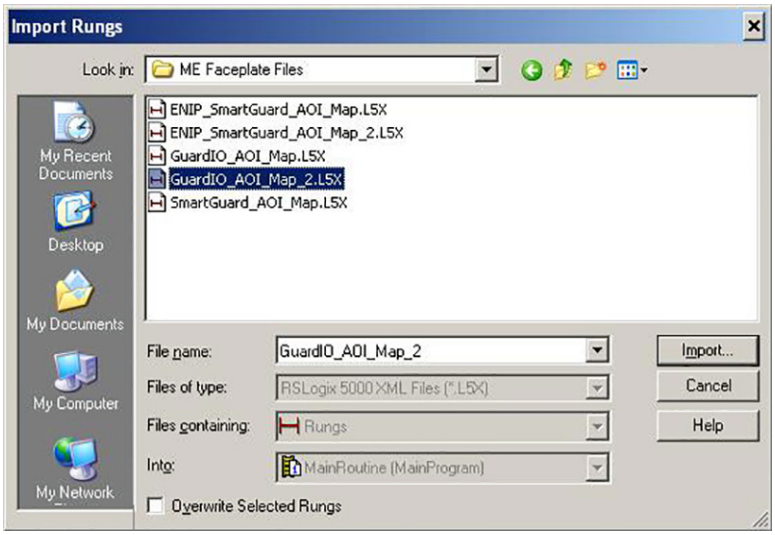
You must create ladder logic to map Digital and Analog GuardIO_AOI module reset tags to controller safety tags. This enables the faceplate reset buttons to execute safety and fault resets.

1. Add a rung directly after your last Digital or Analog GuardIO_AOI instance rung for each of your safety zones.



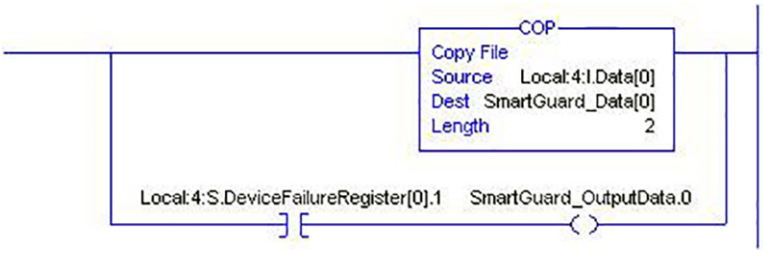
2. Right-click your last Digital or Analog GuardIO_AOI instance rung and choose Import Rung.
3. Browse to the ME Faceplate files folder within the Guard I/O and SmartGuard Faceplate Files toolkit directory.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.
4. Select the GuardIO_AOI_Map_2 file and click Import.

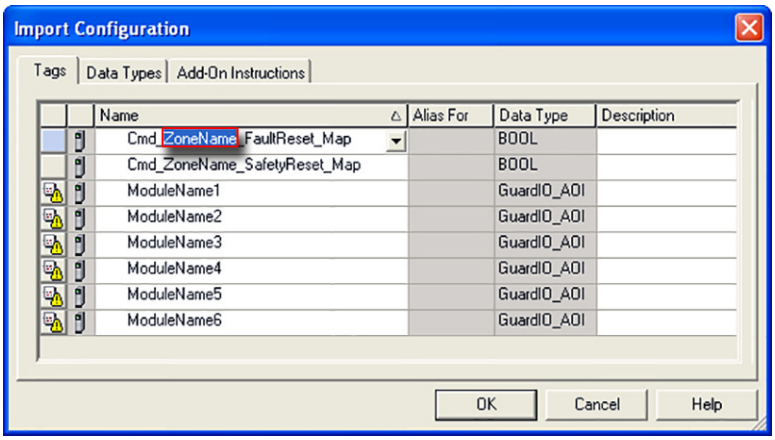


   Alternatively, if the safety I/O module you are configuring is a SmartGuard 600 controller (1752-L24BBB), then import SmartGuard_AOI_Map instead of the GuardIO_AOI_Map_2.

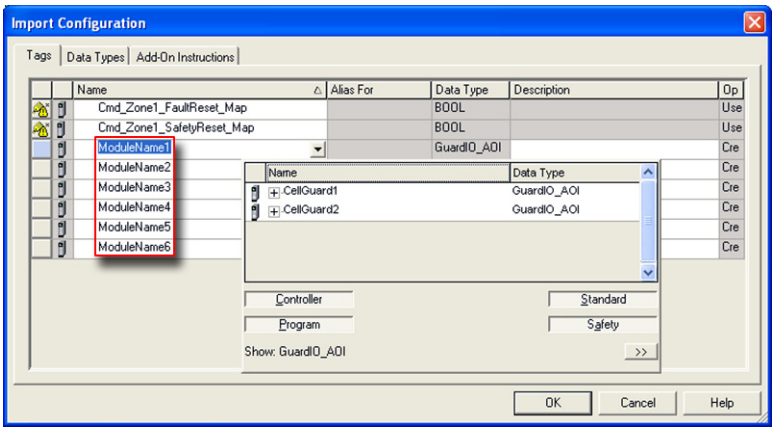
   You must also set the copy instruction source tag to the corresponding SmartGuard 600 mapping in the 1756-DNB module and set the DeviceFailureRegister bit to correspond with the SmartGuard DeviceNet node as shown here.



5. Type the *ZoneName* from your Safety Zone Configuration worksheet into the two map tags on the Import Configuration dialog.



6. For the *ModuleName1* through *ModuleName6* Add-On Instruction tags, click *ModuleName* and then click the pull-down arrow to browse to your configured GuardIO_AOI tags as listed in your Safety Zone configuration worksheet.

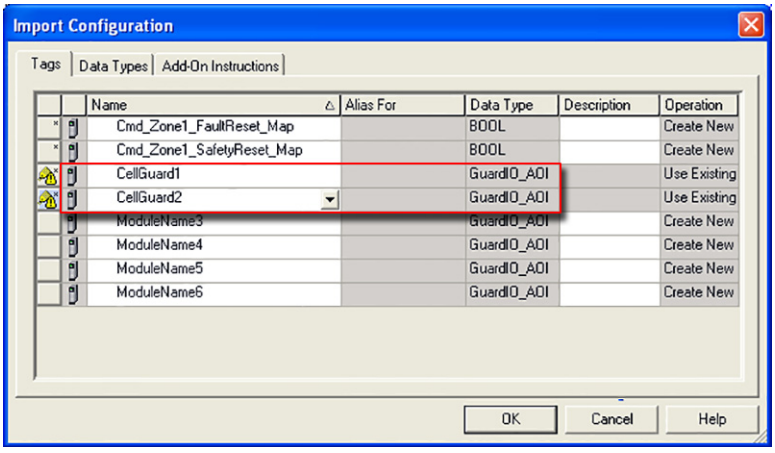


7. Double-click the GuardIO_AOI tag to select it.

   If your zone has less than 6 safety modules, leave any unused tags names as is.

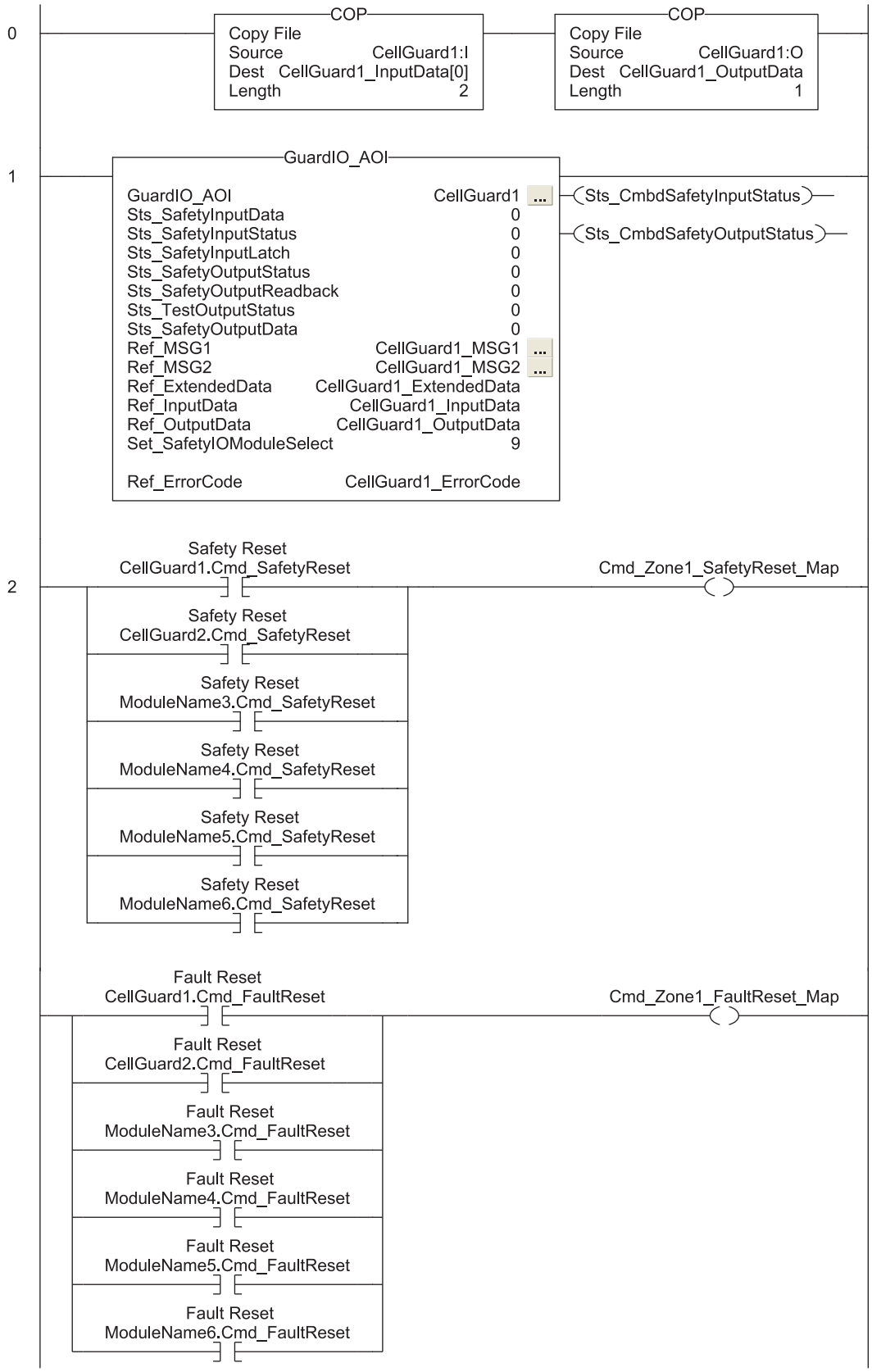
   If your zone has more than 6 safety modules, you will need to add more instructions after the import is complete.

   This examples shows two Guard I/O modules configured with *ModuleNames* 'CellGuard1' and 'CellGuard2'

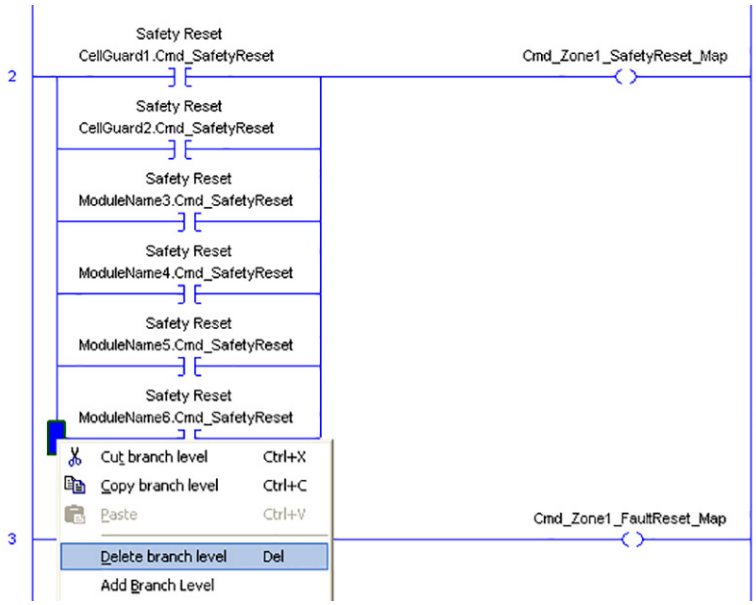


8. Click OK to complete the import.

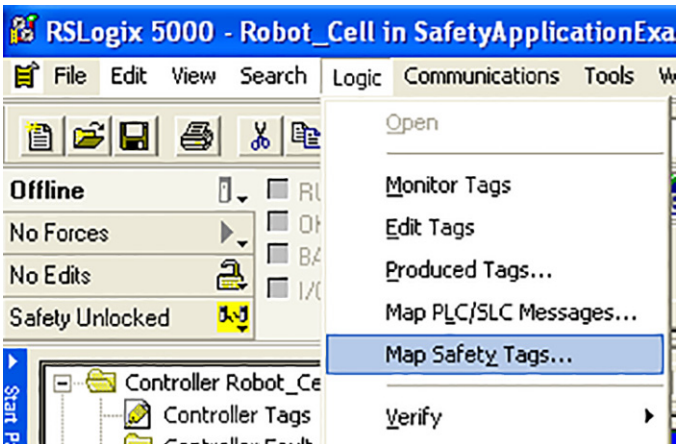
9. After the import is complete, the imported safety reset and fault reset logic rungs should look similar to rungs 2 and 3 in the example shown here.



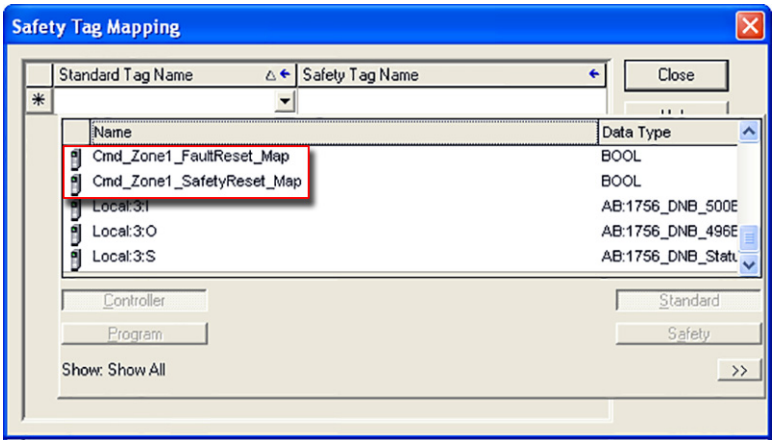
10. Delete all Safety Reset and Fault Reset Rung instruction branches that are not assigned GuardIO_AOI tags, by right-clicking the branch and choosing Delete branch level.



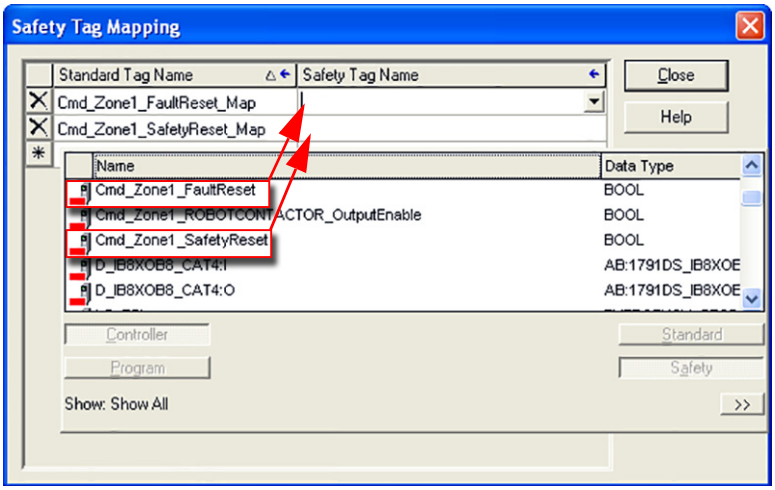
11. Choose Logic>Map Safety Tags to map the associated standard controller tags to the safety tags.



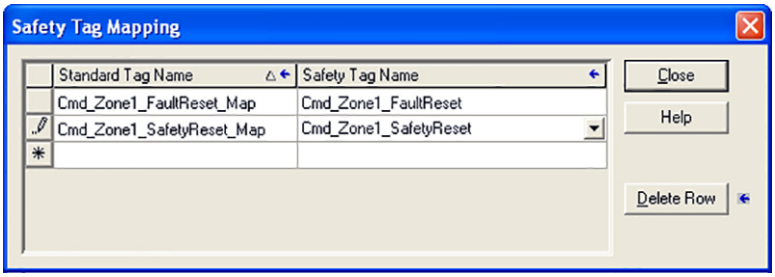
12. Select the standard name field and click the pull-down arrow.
13. Select both the Cmd_*ZoneName*_FaultReset_Map and Cmd_*ZoneName*_SafetyReset_Map tags.



14. Select the safety tag name field and click the pull-down arrow.
15. Select the corresponding Cmd_*ZoneName*_FaultReset and Cmd_*ZoneName*_SafetyReset safety tags.



16. Click Close to complete safety tag mapping.



17. Repeat the Map Digital and Analog GuardIO_AOI Tags to Safety Zone Reset Tags steps 1...17, on pages 94...98 for each of the zones you wish to use 1the pre-configured faceplates for.

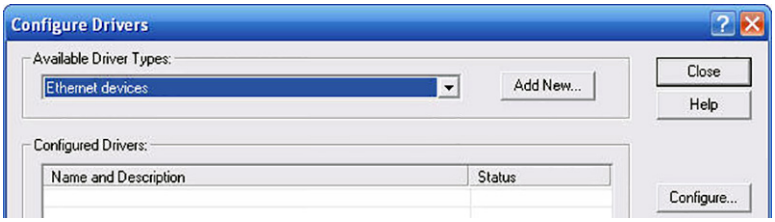
Configure Logix Communication

This procedure assumes that your communication method to the GuardLogix controller is via the Ethernet protocol and that your Logix Ethernet module has already been configured. For additional information, refer to the GuardLogix Controllers User Manual, publication 1756-UM020 or the Compact GuardLogix Controllers User Manual, publication 1768-UM002.

Follow these steps to configure Logix Communication.

1. Open RSLinx® Classic software and select Configure Drivers... in the Communication menu.
2. Select the Ethernet Devices driver from the pull-down list.

3. Click the Add New... button.



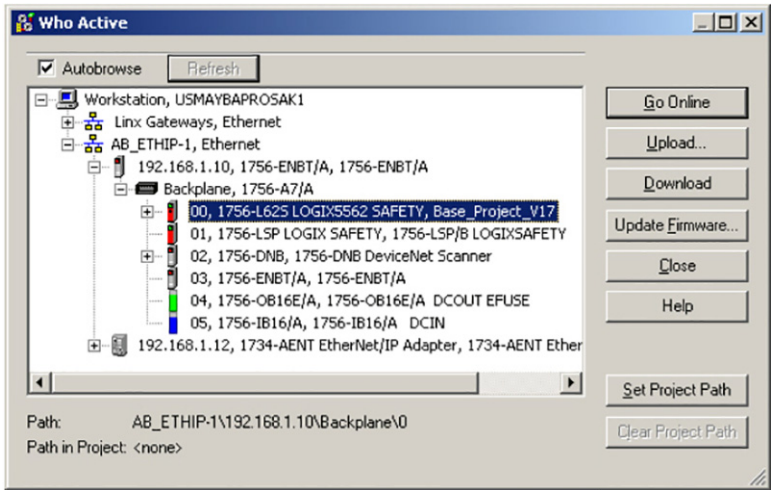
4. In the Add New RSLinx Classic Driver dialog box, name the new driver and click OK.

5. In the Configure driver dialog box, type the IP address of your Logix Ethernet module and click OK.

   The IP address shown is an example. Yours will be different.

TIP If your Logix Ethernet module is already configured, the IP address is displayed on the module.

6. Click Close.
7. Select RSWho from the Communication menu.
8. In the RSWho window, expand the Ethernet communication module until your controller is visible.



9. Verify that you can browse to your Logix controller.
10. Minimize the RSLinx application window and return to your RSLogix 5000 project window.

Save and Download Your Program

Follow these steps to save your program and download it to your GuardLogix controller.

1. Save the program by choosing File>Save from the menu bar.
2. Turn the keyswitch on the controller to REM.
3. Define the path to the controller by clicking Who Active  and selecting the controller.
4. Click Download.

   The software compares the following information in the offline project and the controller.
   - Controller serial number (if project to controller match is selected)
   - Firmware major and minor revisions
   - Safety status between the primary controller and safety partner
   - Safety task signature (if one exists)
   - Safety-lock status
5. Follow the directions in this table to complete the download based on the software's response.

If the software indicates	Then
Download to the controller.	Choose Download. The project downloads to the controller and RSLogix 5000 software goes online.
Unable to download to the controller. Mismatch between the offline project and the controller serial number. Selected controller may be the wrong controller.	Connect to the correct controller or verify that this is the correct controller. If it is the correct controller, select the Update project serial number checkbox to allow the download to proceed. The project serial number is modified to match the controller serial number.
Unable to download to the controller. The major revision of the offline project and the controller's firmware are not compatible.	Choose Update Firmware. Choose the required revision and click Update. Confirm your selection by clicking Yes.
Unable to download to controller. The safety partner is missing or unavailable.	Cancel the download process. Install a compatible safety partner before attempting to download.
Unable to download to controller. The firmware revision of the safety partner is not compatible with the primary controller.	Update the firmware revision of the safety partner. Choose Update Firmware. Choose the required revision and click Update. Confirm your selection by clicking Yes.
Unable to download to controller. Safety partnership has not been established.	Cancel this download process and attempt a new download.
Unable to download to controller. Incompatible safety task signature cannot be deleted while the project is safety-locked.	Cancel the download. To download the project, you must safety-unlock the offline project, delete the safety task signature, and download the project. **IMPORTANT:** The safety system requires revalidation.
Cannot download in a manner that preserves safety task signature. Controller's firmware minor revision is not compatible with safety task signature in offline project.	• If the firmware minor revision is incompatible, to preserve the safety task signature, update the firmware revision in the controller to exactly match the offline project. Then download the offline project. • To proceed with the download despite the safety task signature incompatibility, click Download. The safety task signature is deleted. **IMPORTANT:** The safety system requires revalidation.
Unable to download to controller. Controller is locked. Controller and offline project safety task signatures do not match.	Choose Unlock. The Safety Unlock for Download dialog box appears. If the Delete Signature checkbox is selected and you choose Unlock, you must confirm the deletion by selecting Yes.
A non-recoverable safety fault will occur in the safety controller. No designated Coordinated System Time (CST) master exists.	Check Enable Time Synchronization and click Download to proceed.

SmartGuard™ 600 Controllers Logic Integration

Introduction

In this chapter, you configure your SmartGuard controller and I/O modules by using pre-defined configurations, and create your safety logic by leveraging pre-configured safety function block logic. In addition, you import faceplate logic for use with a Logix controller.

Before You Begin

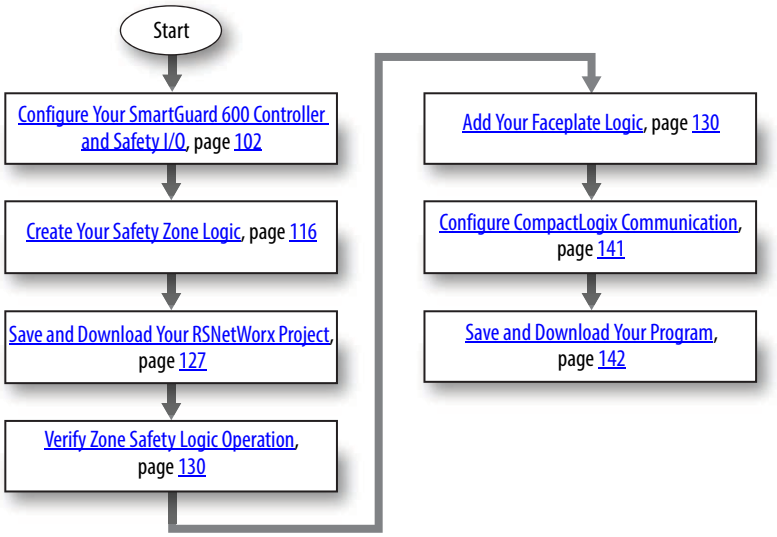
Complete your risk assessment and functional specification. Create a bill of materials based on your application needs.

Load RSNetWorx™ for DeviceNet, RSLogix 5000®, RSLinx® Classic, and FactoryTalk® View Machine Edition software on your personal computer or workstation.

What You Need

- RSLogix 5000 software
- RSNetWorx for DeviceNet software
- RSLinx software
- Safety Accelerator Toolkit DVD, SAFETY-CL002 or visit the Integrated Architecture® Tools and Resources website at http://www.ab.com/go/iatools
- Product manuals:
  - SmartGuard 600 Controllers User Manual, publication 1752-UM001
  - 1769 CompactLogix™ Controllers User Manual (for catalog numbers 1769-L31, 1769-L32C, 1769-L32CR, 1769-L32E, or 1769-L35E), publication 1769-UM011
  - CompactLogix System User Manual (for catalog numbers 1769-L20, 1769-L30), publication 1769-UM007
  - Logix Common Procedures Programming Manual, publication 1756-PM001, if you are not familiar with programming Logix controllers with RSLogix 5000 software

Follow These Steps



Configure Your SmartGuard 600 Controller and Safety I/O

Follow these steps to access the pre-configured RSNetWorx application file from the toolkit and configure both the SmartGuard 600 and safety I/O connections for your specific application.

Select and Save Pre-configured Configuration File

1. Browse to the Guard I/O™ and SmartGuard Modules directory in the toolkit.

   If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Modules.

The directory includes three RSNetWorx application files based on the safety category level:

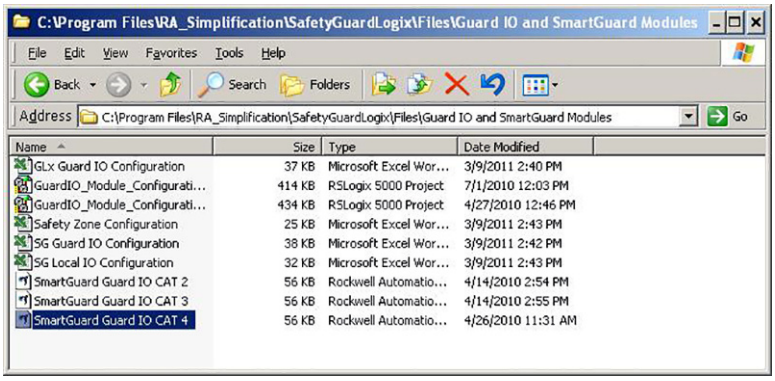
- SmartGuard IO CAT 2
- SmartGuard Guard IO CAT 3
- SmartGuard IO CAT 4

Open the RSNetWorx DNT file appropriate for your application's safety category level.

2. Double-click the DNT file to launch RSNetWorx for DeviceNet application file.

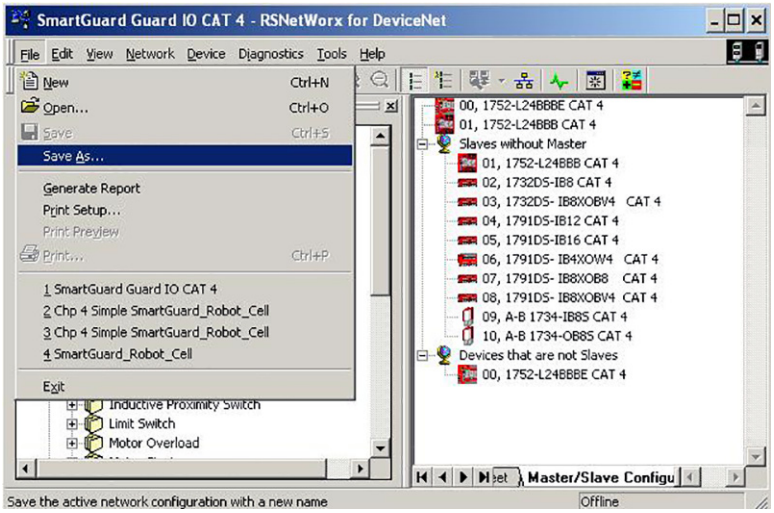
   If RSNetWorx for DeviceNet does not launch, make sure that RSNetWorx for DeviceNet software has been installed and is at version 9.1 or later.

   For this example, we opened SmartGuard Guard IO CAT 4.dnt.



3. Save the file before you make edits.

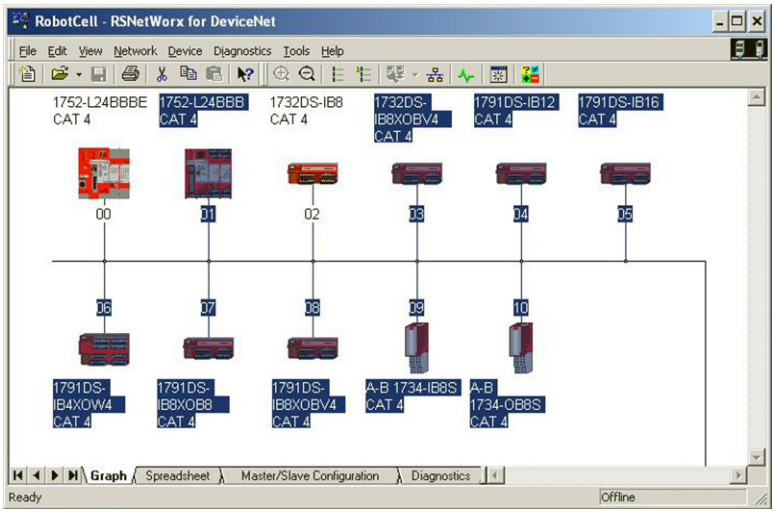
   For this example, the file was saved as RobotCell.dnt.



Delete, Add, and Configure SmartGuard 600 Controller and Guard I/O Modules

Each file contains all of the Guard I/O modules and both the SmartGuard 600 controller (1752-L24BBB) and the SmartGuard 600 controller with EtherNet/IP (1752-L24BBBE).

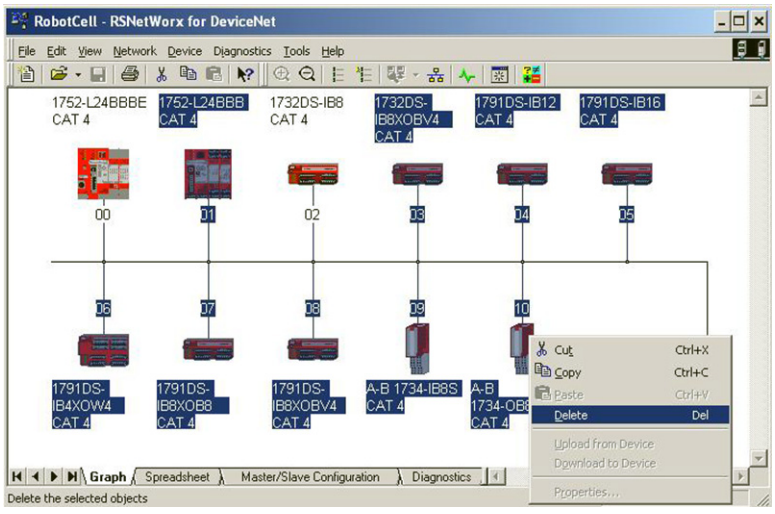
1. Select the Graph tab at the bottom of the spreadsheet to view controllers and modules in a graphical form.



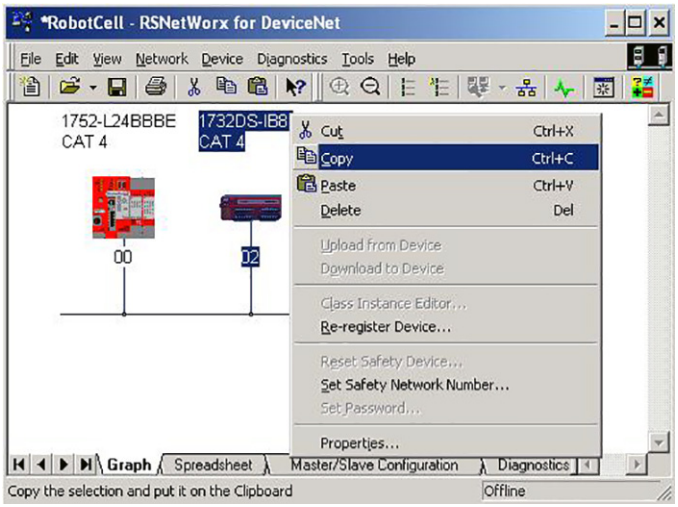
2. Reference your Safety Zone Configuration spreadsheet and select all of the controllers and Guard I/O modules that are not in your application. Use the Ctrl key and left mouse button to select the individual controllers and modules.

   For this example, all modules except one SmartGuard 600 Controller and 1732DS-IB8 were selected.

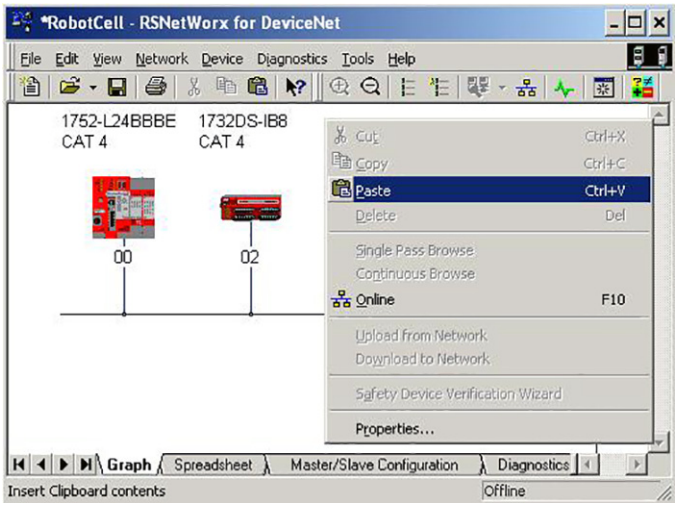
3. Right-click one of the modules in the group and choose Delete from the pull-down menu to delete all the selected modules.



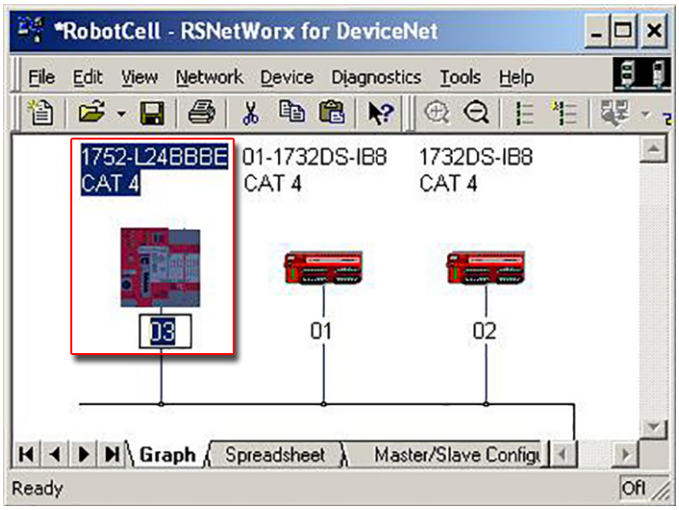
4. For systems with more than one Guard I/O module of the same type, right-click the Guard I/O module and select Copy.



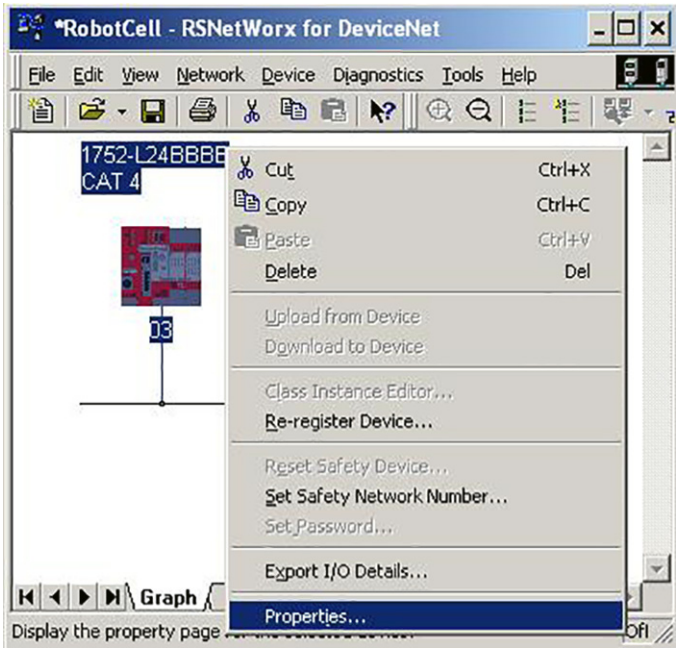
5. Right-click in the Graphic view and choose Paste to add additional modules to your system.



6. Double-click the node number below each device and type the desired DeviceNet node number.

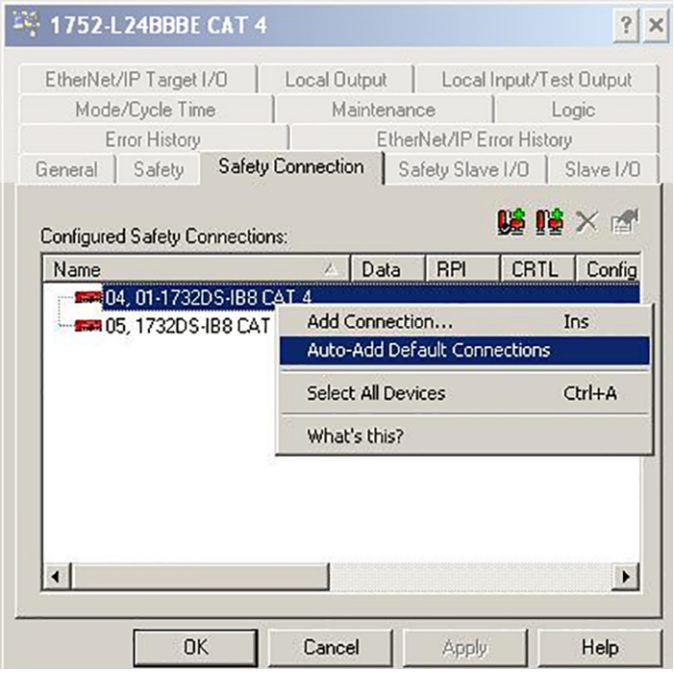


7. To configure the controller's safety connections, right-click the SmartGuard 600 controller, and choose Properties.



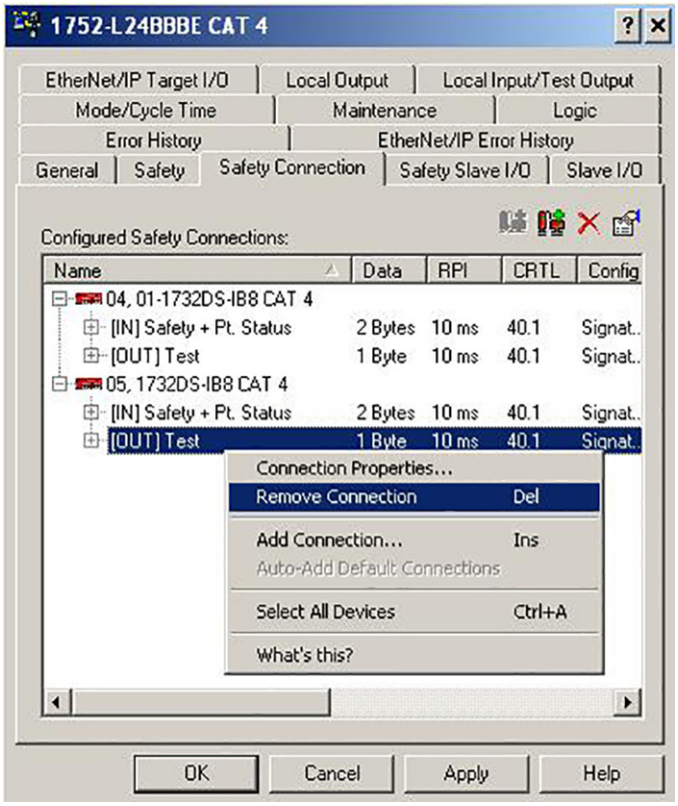
8. Select the Safety Connection tab.

9. To auto-configure the Guard I/O modules, right-click each Guard I/O module and choose Auto-Add Default Connections.



10. For a Cat. 2 application or for a Cat. 4 input-only Guard I/O module, remove the Test Output connection that is created with the Auto-Add Default connections, as it is not required.

    For this example, the Test Output connection for 1732DS-IB8 CAT 4 is removed.



Configure SmartGuard 600 Local Inputs and Test Outputs

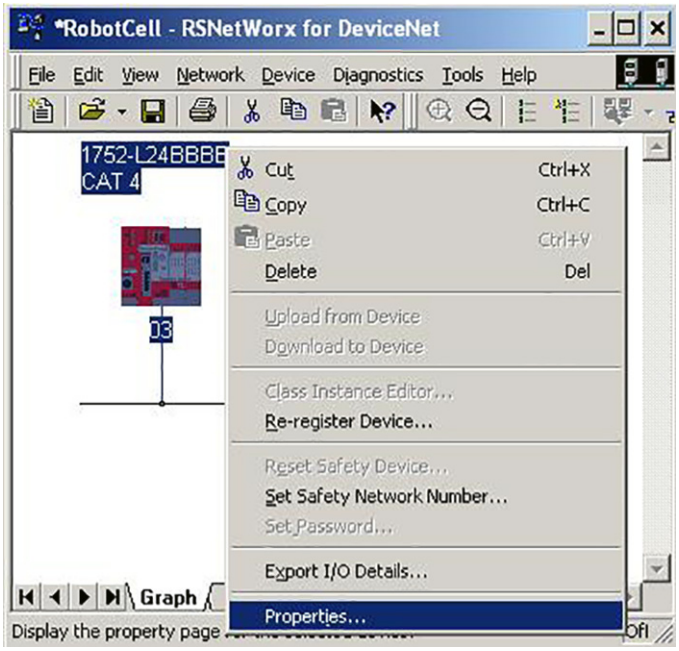
The SmartGuard 600 local input and test output configuration is dependent on the input device type, input relationship, and fault detection requirements. All the inputs and test outputs are pre-configured for volt-free contact devices to perform the diagnostics necessary to achieve the safety category level indicated by the pre-configured *.dnt file name. Use the following steps and table recommendations to configure the safety inputs and test outputs.

Table 10 - Typical Safety Input Device Configuration Parameters

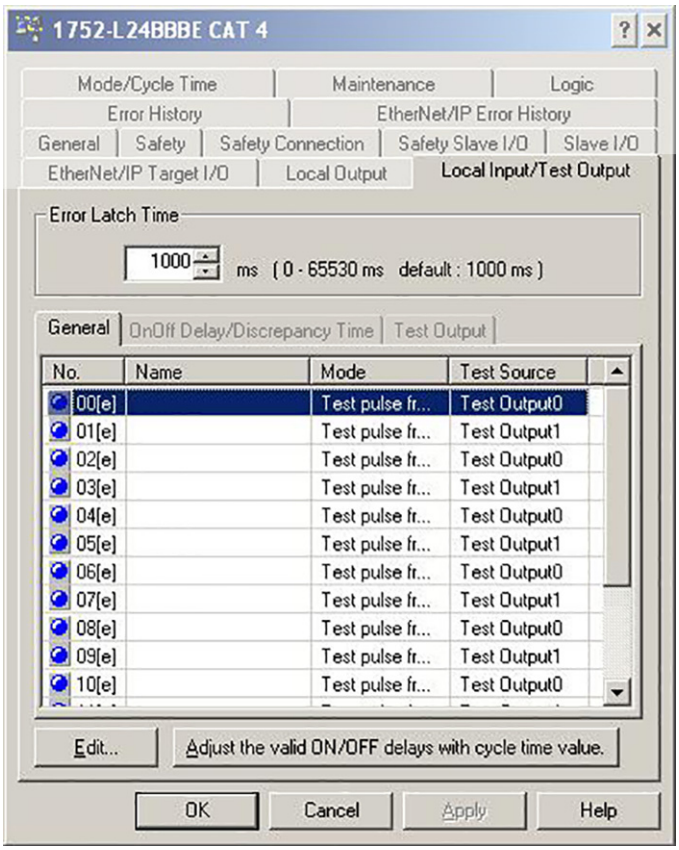
Input Device Type	Category	Channel Mode	Test Source	On-Off Delay Time	Off-On Delay Time	Dual Channel Mode	Discrepancy	Time Error Latch Time	Test Output Mode
Volt-free contacts (2 Normally Closed)	4	Test pulse from test output	Ch A: Test Output(x), Ch B: Test Output(x+1)(1)	Cycle Time x 2(2)	Cycle Time x 2	Dual Channel Equivalent	100	1000	Safety Pulse Test
	3	Used as safety input	Not Used	Cycle Time x 2	Cycle Time x 2	Dual Channel Equivalent	100	1000	Safety
Volt-free contacts (1 Normally Closed, 1 Normally Open)	4	Test pulse from test output	Ch A: Test Output(x), Ch B: Test Output(x+1)(1)	Cycle Time x 2	Cycle Time x 2	Dual Channel Equivalent	100	1000	Safety Pulse Test
	3	Used as safety input	Not Used	Cycle Time x 2	Cycle Time x 2	Dual Channel Equivalent	100	1000	Safety
Volt-free contacts (1 Normally Closed)	2	Test pulse from test output	Test Output(x)	Cycle Time x 2	Cycle Time x 2	Single Channel	N/A	1000	Safety Pulse Test
2 channel OSSD (Output Signal Switch Device)	4(3)	Used as safety input	Not Used	0	0	Dual Channel Equivalent	0	1000	Not Used
	3(4)	Used as safety input	Not Used	0	0	Dual Channel Equivalent	0	1000	Not Used
1 channel OSSD	2(5)	Used as safety input	Not Used	0	0	Single Channel	N/A	1000	Not Used

(1) Dual channels require different test sources.
(2) Time must be multiple of cycle-time.
(3) Must be a Cat. 4 capable OSSD.
(4) Must be a Cat. 3 capable OSSD.
(5) Must be a Cat. 2 capable OSSD.

1. To access SmartGuard 600 local input and test output properties, right-click the SmartGuard controller and choose Properties.

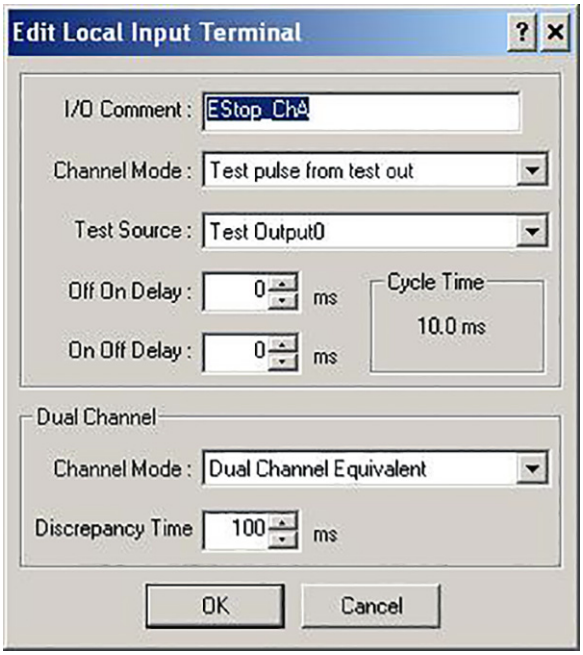


2. On the Properties dialog box, choose the Local Input/Test Output tab.
3. On the General tab, select each of the inputs (00...15) and click Edit to access the individual local input configuration dialog box.

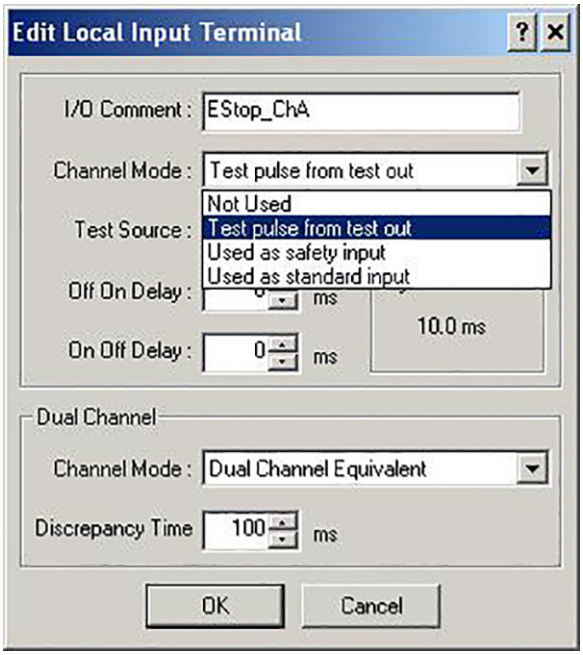


4. Type the input name into the I/O Comment field.

   For this example, we typed EStop ChA.



5. Select the Channel Mode from the pull-down list based on the table below.

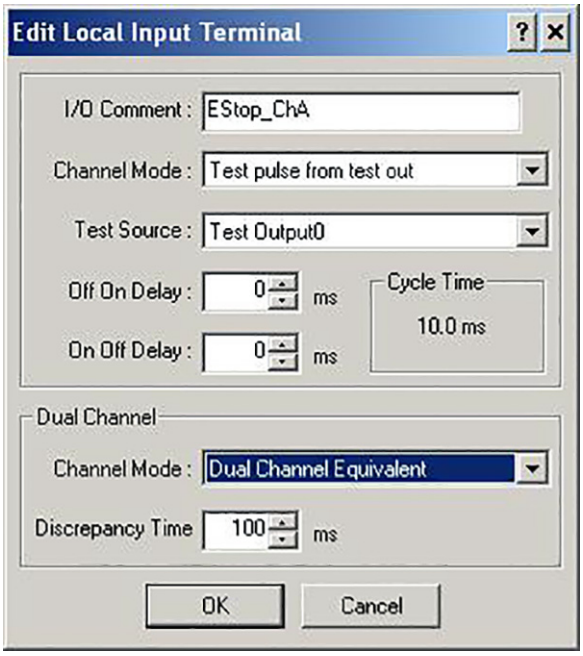


Channel Mode	Description
Not Used	The input channel is not connected to an external device. This is the default.
Test pulse from test output	Use this mode when you are achieving a Category 4 input circuit. This mode assumes that you have connected your input device to a Pulse Test Source, and then wired to this input terminal. This enables detection of short circuits with the power supply line (positive side), earth faults, and short circuits with other input signal lines (channel-to-channel shorts). The controller must know that the input signal is being pulse-tested, or nuisance trips may occur.
Used as a safety input	Use this mode to connect to a safety device with a semiconductor output, such as a light curtain.
Used as a standard input	Use this mode to connect to a standard (non-safety) device.

6. If you set the Channel Mode to Test pulse from test output, choose the test output to use in combination with the safety input by selecting it from the Test Source pull-down list.
7. Set the ON Delay and OFF Delay time for the safety input. The setting range is 0 ...128 ms. Setting the input ON and OFF delays helps reduce the influence of chattering and external noise. When setting the value for ON and OFF Delay, consider the following:

   - The ON Delay and OFF Delay time value must be an integral multiple of the controller's cycle time. Make sure to check the displayed cycle time value before you set the value for ON and OFF Delay time.
   - The optimal value for the cycle time is automatically calculated based on the parameter settings and the program. Therefore, the ON and OFF Delay time must be set last.

8. Set the Dual Channel mode and Discrepancy Time for the safety input.

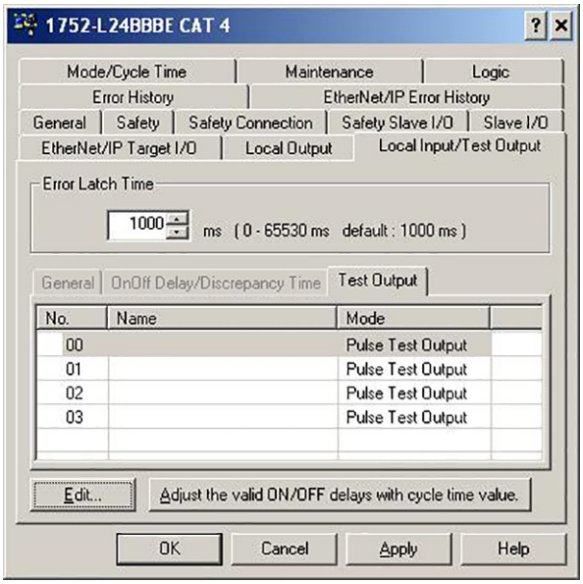


Setting Dual Channel mode enables the status of two inputs to be evaluated and reflected in I/O tags. The Discrepancy Time between changes in the status of two inputs can also be evaluated. The combinations that can be set are pre-defined. The Discrepancy Time can be set between 0 and 65530 ms in 10 ms increments. Both inputs must change state within the Discrepancy Time or an error occurs.

Channel Mode	Description
Single Channel	The safety input terminal is used independently. The two channels are independent of each other. The module will not detect discrepancy faults.
Dual Channel Equivalent	The safety input terminal is used as a Dual Channel Equivalent with a paired safety input terminal. The channels are dependent on each other. The active state is when both channels are high. The module will detect discrepancy faults between channels.
Dual Channel Complementary	The safety input terminal is used as a Dual Channel Complement with a paired safety input terminal. The channels are dependent on each other. This setting is typically used for devices with diverse inputs. Active state is when one channel (first channel) is high the other (second channel) is low. The module will detect discrepancy faults between channels.

9. Click OK to save the local safety input configuration.

10. Select the Test Output tab on the Local Input/Test Output tab to access the Test Output configuration.



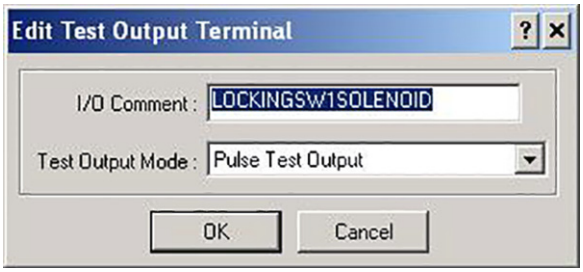
11. Set the Error Latch Time. The Error Latch Time applies to all safety inputs and test outputs, and sets the time to latch the error state when an error occurs in an input or output.

    Even if the error is removed, the error state is always latched for the configured error latch time. The Error Latch Time is set from 0...65530 ms in 10-ms increments. The default is 1000 ms.

12. Select each of the Test Outputs and click Edit to access the individual Test Output configuration dialog box.

13. Type the test output name into the I/O Comment field.

    For this example, we typed LOCKINGSW1SOLENOID.



14. From the Test Output Mode pull-down list, choose a Test Output Mode based on the following table.

Test Output Mode	Description
Not Used	The corresponding Test Output is not used.
Standard Output	Select this mode if you are connecting to the input from a muting lamp or programmable logic controller. This output is used as a monitor output.
Pulse Test Output	Select this mode if you are connecting a device with a contact output in combination with a safety input.
Power Supply Output	Select this mode if you are connecting to the power supply terminal of a safety sensor. The voltage supplied from the test output terminal to the I/O power supply (V,G) is output.
Muting Lamp Output	Select this mode to specify a muting lamp output. This setting is supported only on the T3 terminal. When the output is ON, disconnection of the muting lamp can be detected.

15. Click OK on the Test Output Configuration dialog box to accept the test output configuration.

16. Click OK on the overall Local Input/Test Output dialog box to save the local input and test output configuration.

17. Repeat Steps 1 through 14 to configure each input and test output in your system.

Configure SmartGuard 600 Local Outputs

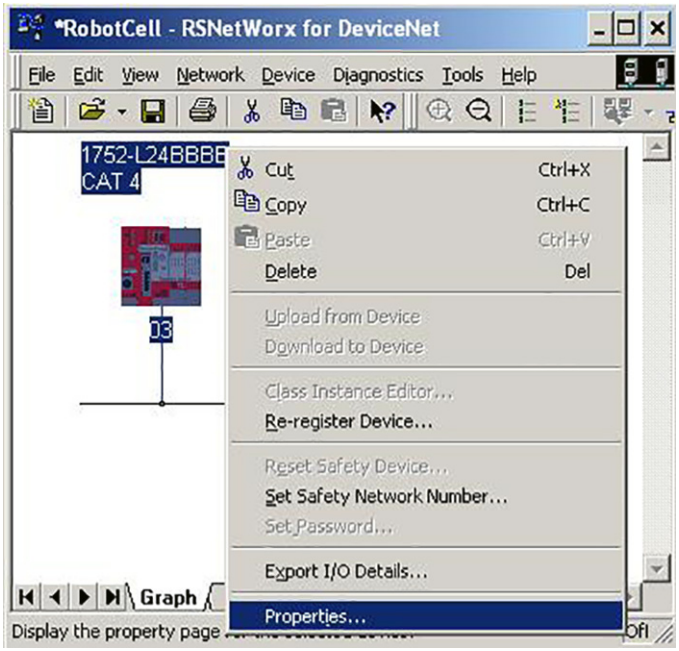
The SmartGuard 600 local output configuration is dependent on the output device type, output relationship, and fault detection requirements. All of the outputs are pre-configured for coil devices to perform the diagnostics necessary to achieve the safety category level indicated by the pre-configured .dnt file name. Use the following steps and table recommendations to configure the safety outputs.

Table 11 - Typical Safety Output Configuration Parameters

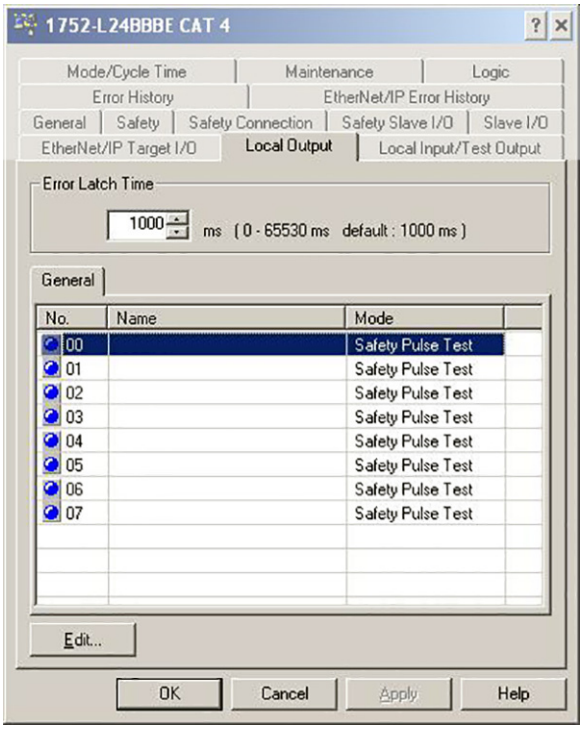
Output Device Type	Category	Channel Mode	Dual Channel Mode
Coil	4	Safety Pulse Test	Dual Channel
	3	Safety	Dual Channel
	2	Safety Pulse Test	Single Channel
Solid-state actuators (non-reactive to pulse testing)	4(2)	Safety Pulse Test	Dual Channel
	3(3)	Safety	Dual Channel
	2(4)	Safety Pulse Test	Single Channel
Solid-state actuators (reactive to pulse testing)(1)	4(2)	Safety	Dual Channel
	3(3)	Safety	Dual Channel
	2(4)	Safety	Single Channel

(1) For example, Kinetix® 300 or Kinetix 350 drives.
(2) Must be a Category 4 capable device.
(3) Must be a Category 3 capable device.
(4) Must be Category 2 capable device.

1. To access SmartGuard 600 local output properties, right-click the SmartGuard controller and choose Properties.

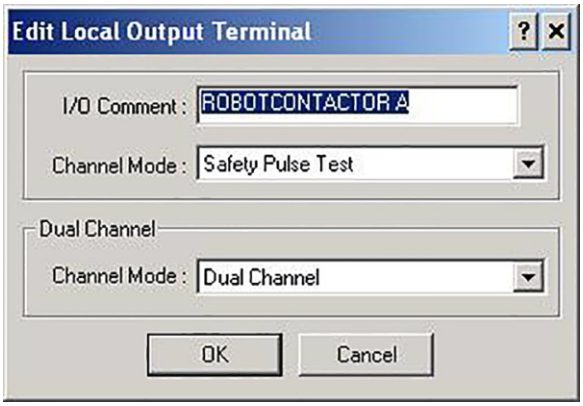


2. On the Properties dialog box, choose the Local Output tab
3. Select each of the outputs (00...07) and click Edit to access the individual local input configuration dialog boxes.

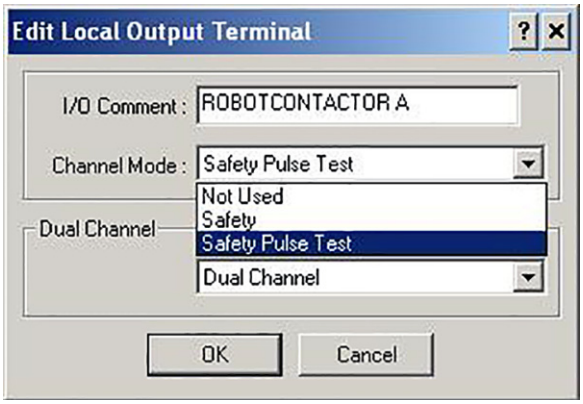


4. Type the output name into the I/O Comment field.

   For this example, we typed ROBOTCONTACTOR A.



5. Select the Channel Mode from the pull-down list based on table below.



Channel Mode	Description
Not Used	The output terminal is not connected to an output device.
Safety	A test pulse is not sent when the output is on. When the output is off, short-circuits with the power supply line (positive side) can be detected. Ground faults can also be detected.
Safety Pulse Output	A test pulse is sent when the output is on. This enables detection of short circuits with the power supply line (positive side) whether the output is on or off. Ground faults and short circuits between output signals can also be detected.

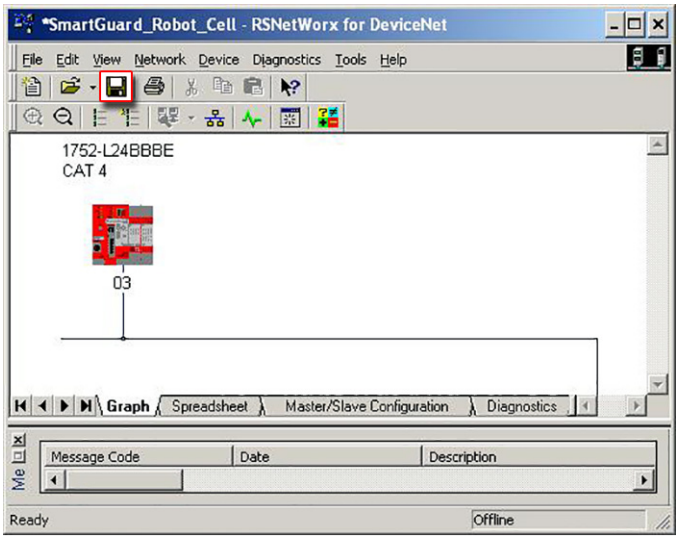
IMPORTANT If a safety pulse output is set, an off pulse signal (pulse width 580 µs) is output to diagnose the output circuit when the safety output turns ON. Check the input response time of the control device to make sure this output pulse will not cause malfunctions.

6. Set the Dual Channel mode for the safety output from the pull-down list based on table below. Setting Dual Channel mode enables an error to be detected if the two outputs from a user program are not equivalent. If an error is detected in one of two outputs circuits, both outputs to the device become inactive.

Channel Mode	Description
Single Channel	The safety output terminal is used independently.
Dual Channel	The safety output terminal is paired with another output terminal. The output can be turned ON when both the output and the paired safety output are consistent.

7. Repeat Steps 1 through 5 to configure each output in your system.

8. Save your RSNetWorx application file.

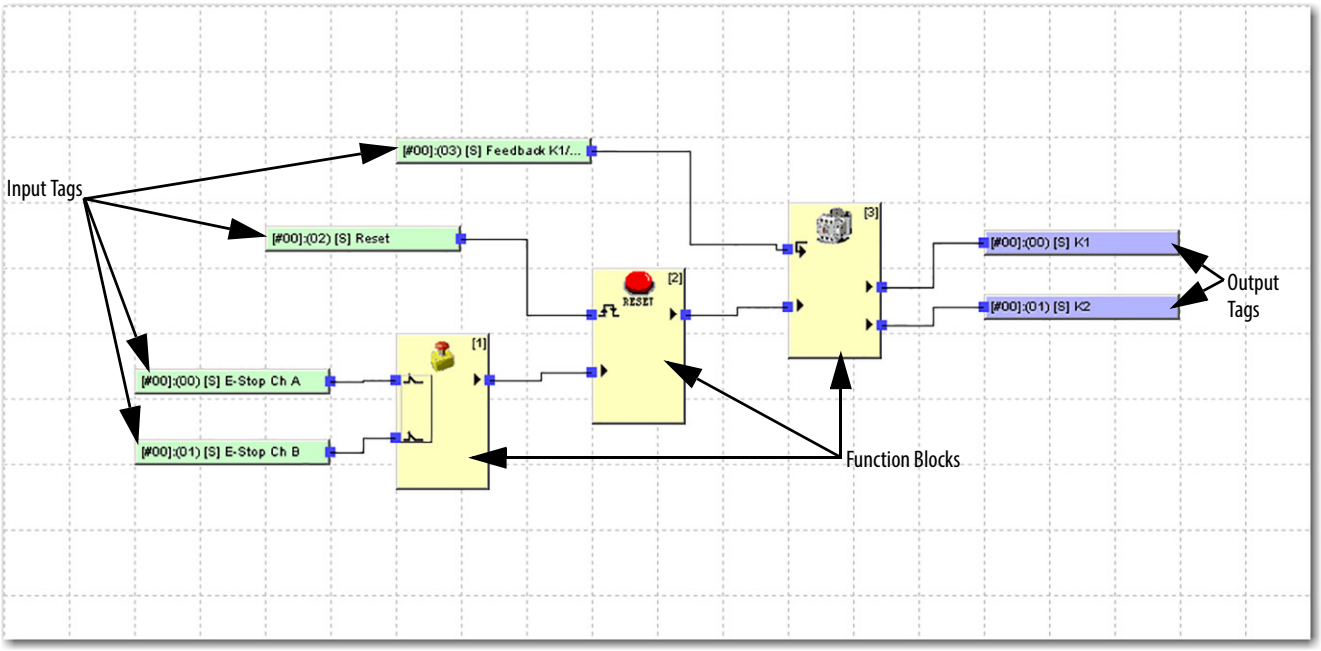


Create Your Safety Zone Logic

The Logic Editor consists of a Function List, where function blocks, I/O tags, and other programming elements are listed, and a workspace where programming is performed.

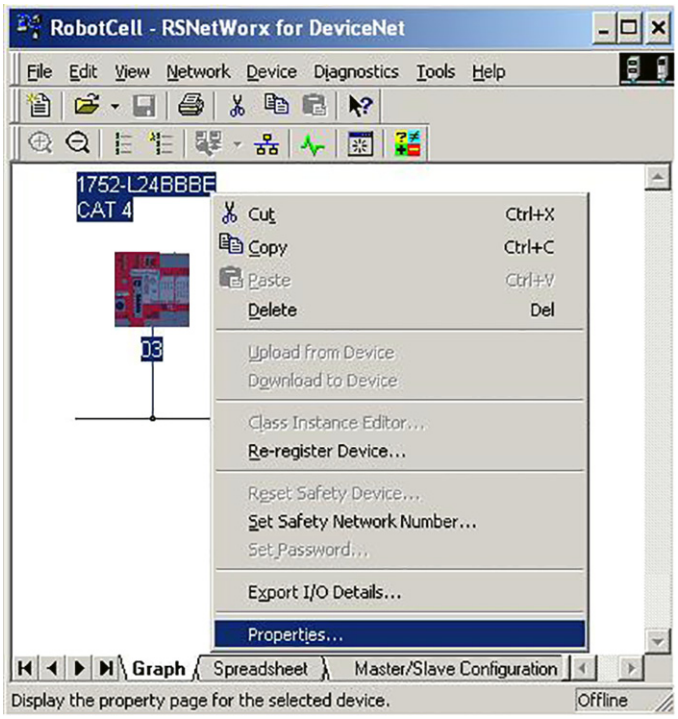
Programs are created from function blocks, input tags, and output tags. The basic elements are dragged from the Function List to the workspace and placed where you desire them. The I/O are connected with connection lines.

A maximum of 254 logic functions and function blocks can be used on maximum of 32 pages. You can create custom blocks made up of predefined blocks, but ALL blocks within the custom blocks count toward the 254 maximum.

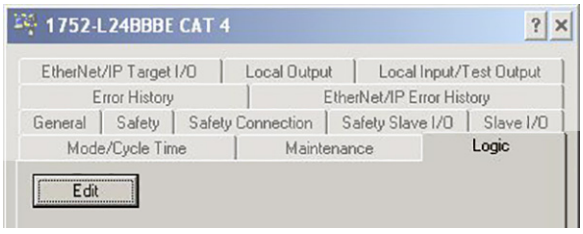


Select Zone Inputs

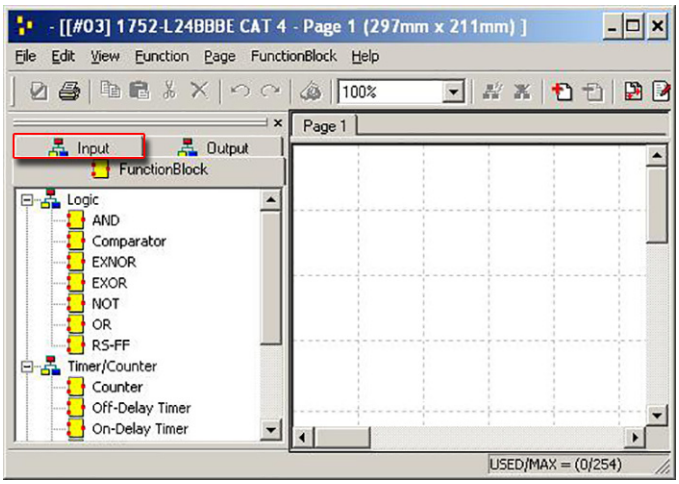
1. To access the Logic Editor, right-click the SmartGuard controller and choose Properties.



2. In the SmartGuard Properties dialog box, select the Logic tab and click Edit to open the Logic Editor.

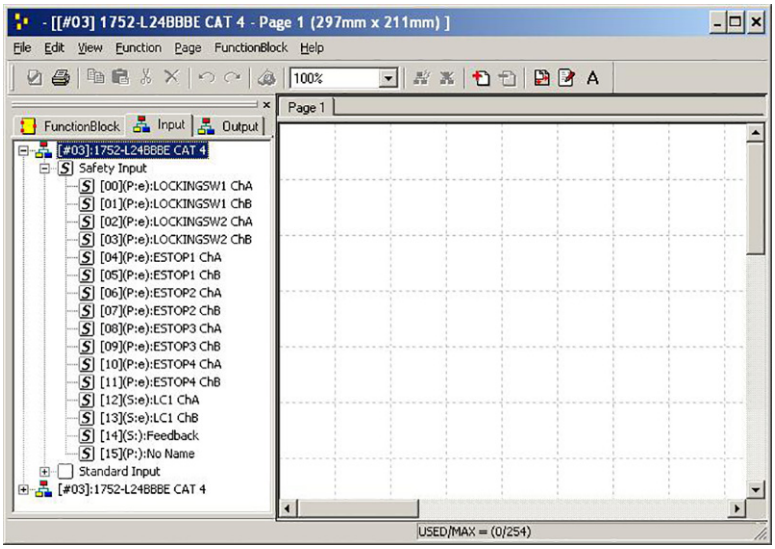


3. Select the Input tab within the Logic Editor to access the inputs.



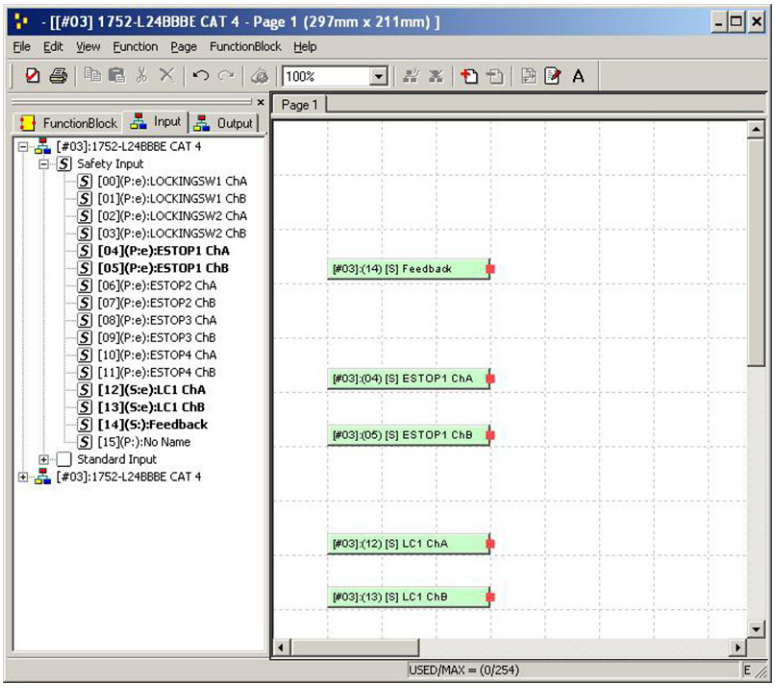
4. Expand the first instance of your safety controller so it displays the safety inputs that you configured in the previous section.

   The inputs shown are for the Robot Cell Example; yours will be specific to your application.

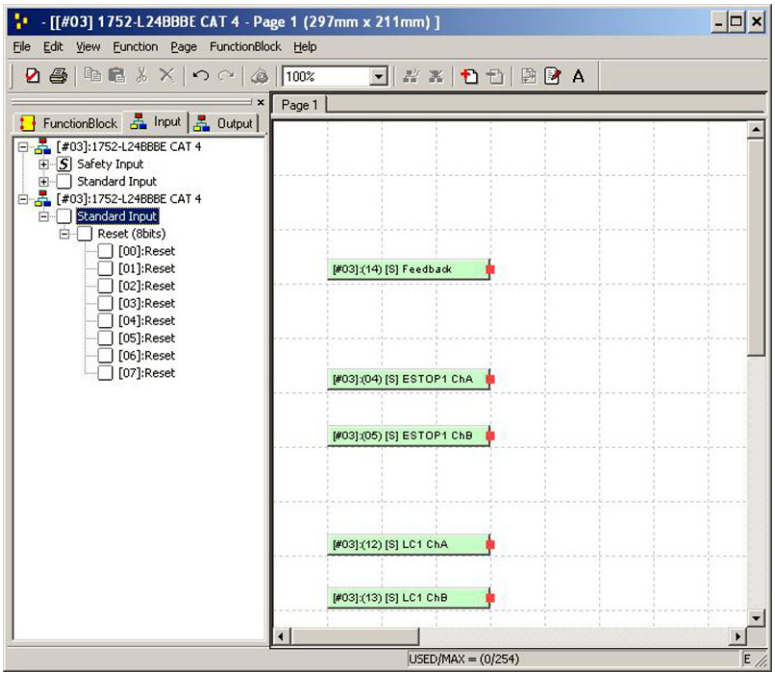


5. Select and drag all of the safety inputs required for your initial zone control onto the Logic Editor Page 1.

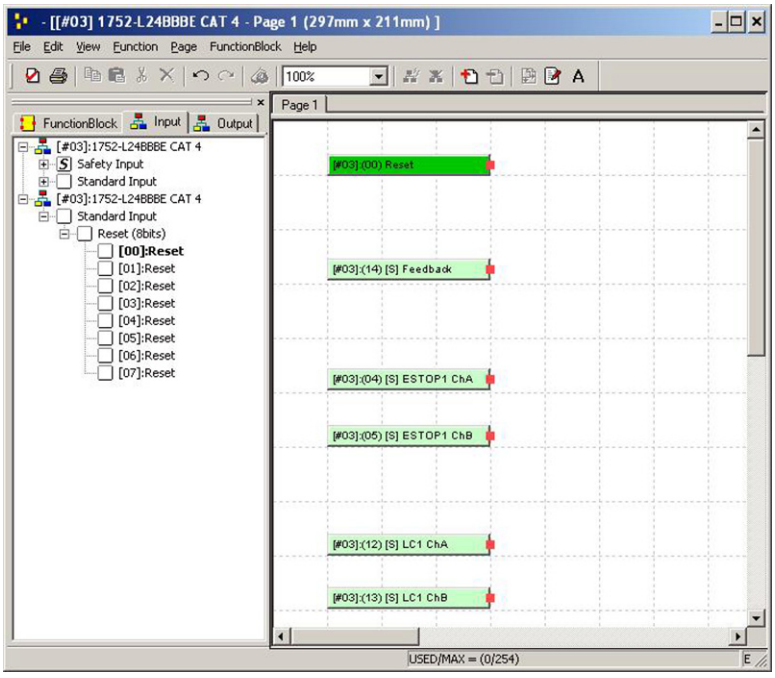
   Two E-stop, two light curtains, and one feedback safety input are used in this simple zone control example. Group safety input channels as shown for easier function block connections later on in editing process.



6. Expand the second instance of your safety controller to display any standard reset inputs needed for your application.



For this example, eight standard reset inputs are listed.

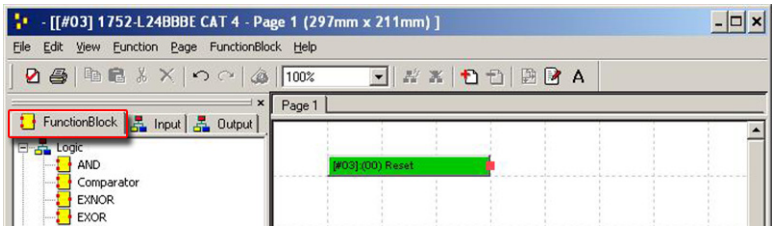


7. Select and drag any standard reset inputs required for your initial zone control onto the Logic Editor, Page 1.

   Reset bit 0 is used in this simple zone control example.

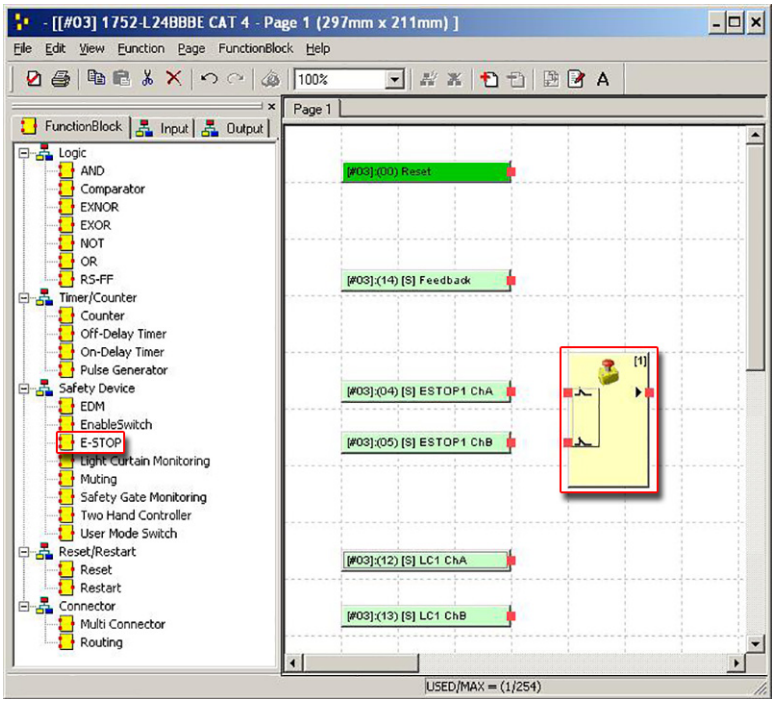
Select Safety Device Function Blocks and Connect Inputs

1. Within the Logic Editor, select the FunctionBlock tab to access device and logic function blocks.

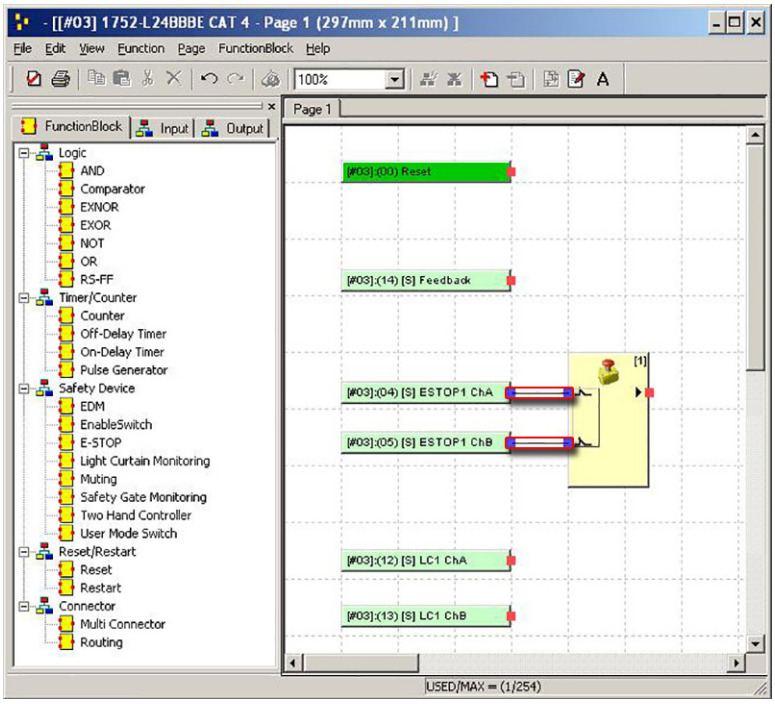


2. Select and drag the associated Safety Device function block for your initial safety input pair to the right of the inputs on the Logic Editor page.

   For this example, we added the E-STOP safety device block to the Logic Editor page.

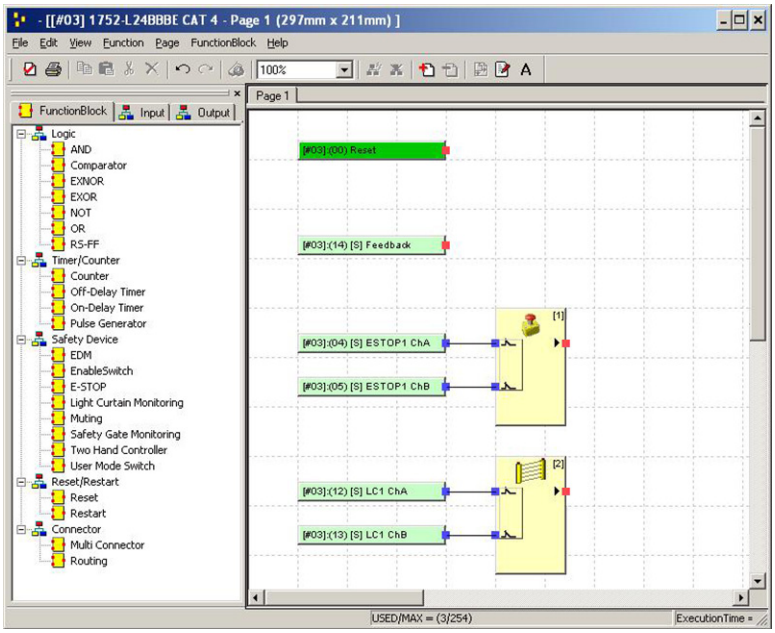


3. Click, drag, and drop safety input channels onto the associated Safety Device function block.



4. Repeat steps 1 through 3 for all safety inputs.

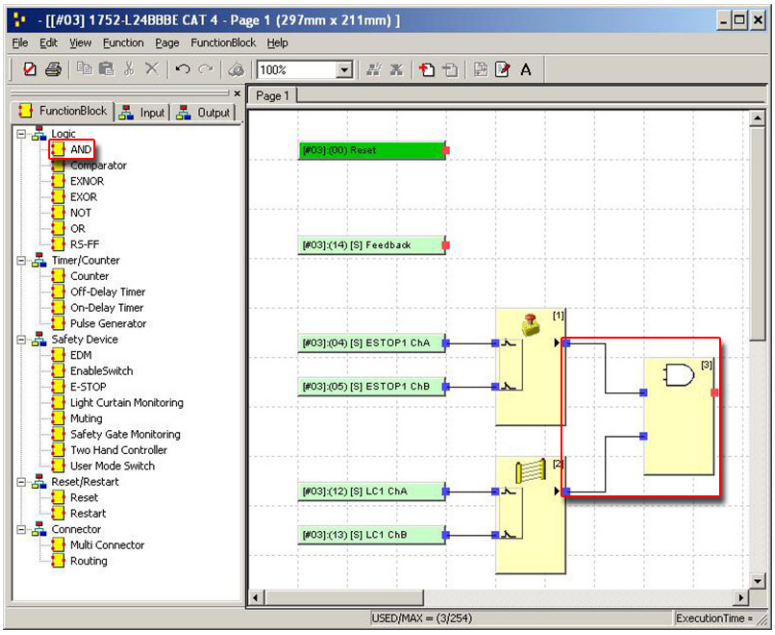
   For this example, the Light Curtain Monitoring function block was also added and connected to the safety inputs.



Select Input Logic Function Blocks and Connect Inputs

1. Identify paired Safety Device blocks, and select and drag the associated Logic function blocks to the right of the Safety Device blocks.

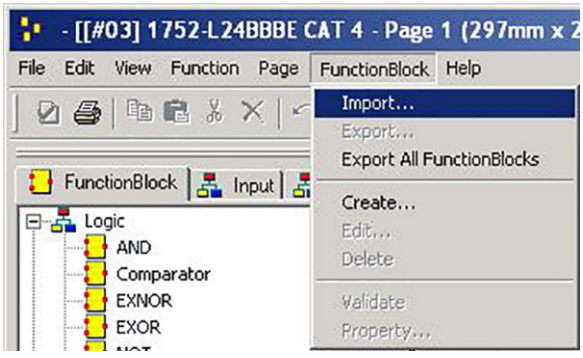
   For this example, an AND logic block was added to provide safety logic allowing outputs when both ESTOP and Light Curtain inputs are OK.



2. Click, drag, and drop Safety Device output pins onto the associated Logic function blocks.
3. Repeat steps 1 and 2 for all paired Safety Device blocks.

Import Zone Function Block and Connect Inputs

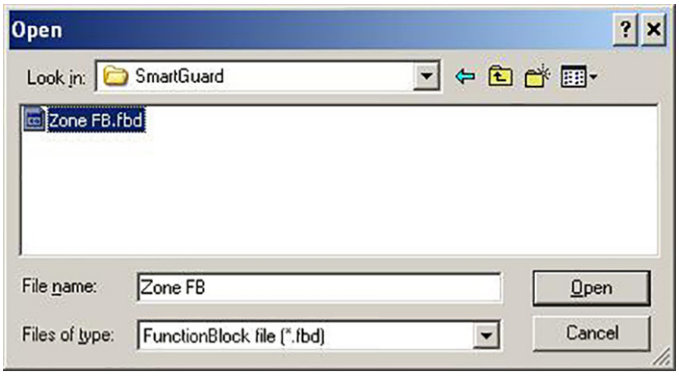
1. Within the Logic Editor, choose Import from the FunctionBlock menu.



2. Browse to the Files\Safety Device Routines\SmartGuard directory in the toolkit and select ZoneFB.fbd.

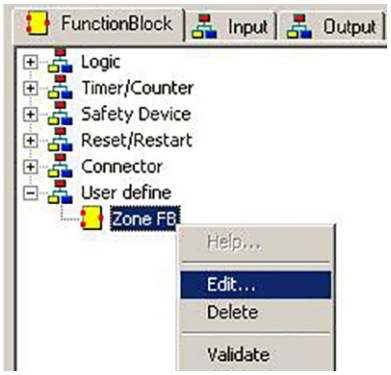
   If you loaded the toolkit onto your personal computer's hard drive, the default path is C:\ProgramFiles\RA_Simplification\SafetyGuardLogix\Files\Safety Device Routines\SmartGuard.

3. Click Open to initiate the Zone Function Block import.

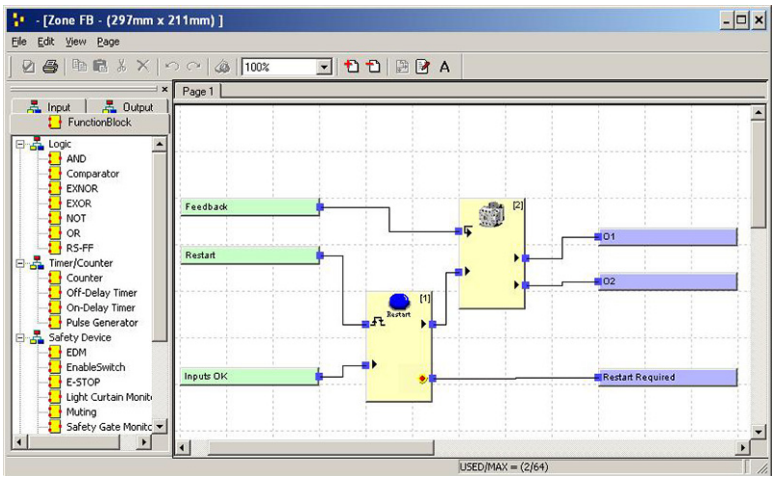


The Zone Function Block appears in the User define directory of the FunctionBlock tree.

4. Right-click Zone FB and choose Edit.



The Zone FB appears in the Logic Editor, Page 1.

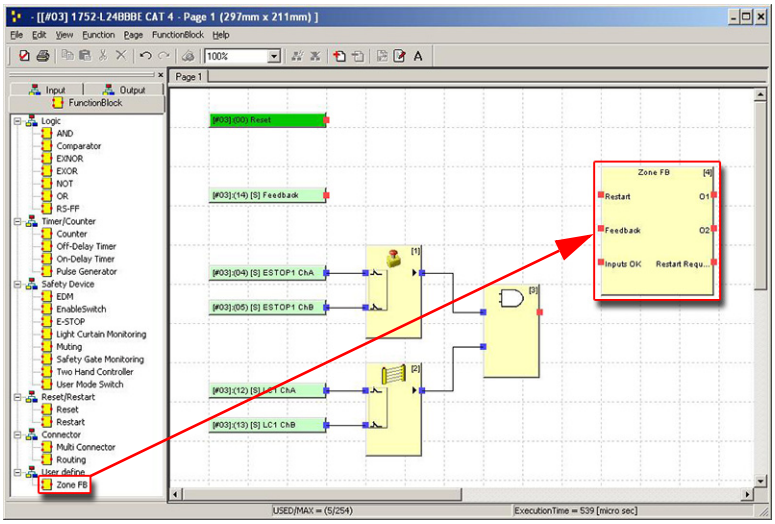


The Zone FB controls a single safety zone. A zone is a group of all of the monitored safety inputs, such as E-stops, light curtains, or gate switches, that must have a status of OK to energize a set of safety outputs.

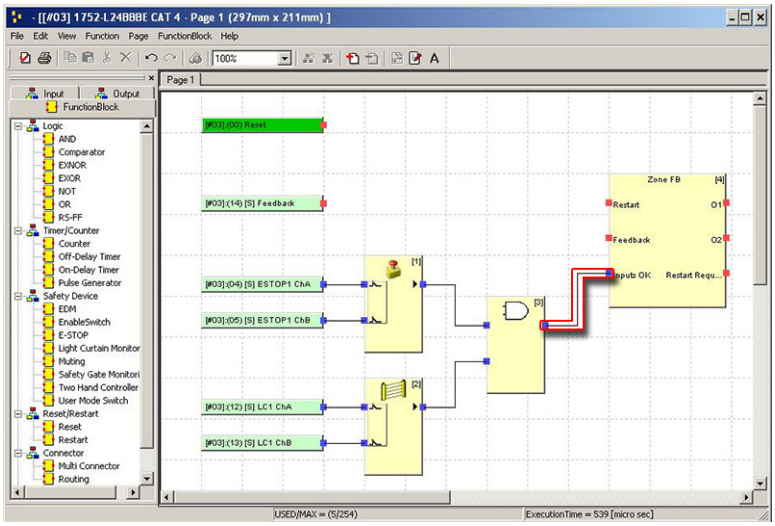
Inside the logic of the Zone FB, an Inputs OK input represents a summation of all of the monitored safety inputs. The Restart block monitors this import. If the input is OK, a low-high-low transition of the Restart input energizes the output of the Restart block.

If the output of the Restart block is OK, the External Device Monitoring (EDM) block turns ON the safety outputs, 01 and 02. The EDM block also monitors the feedback input and turns OFF the outputs if the feedback does not switch in a predefined time.

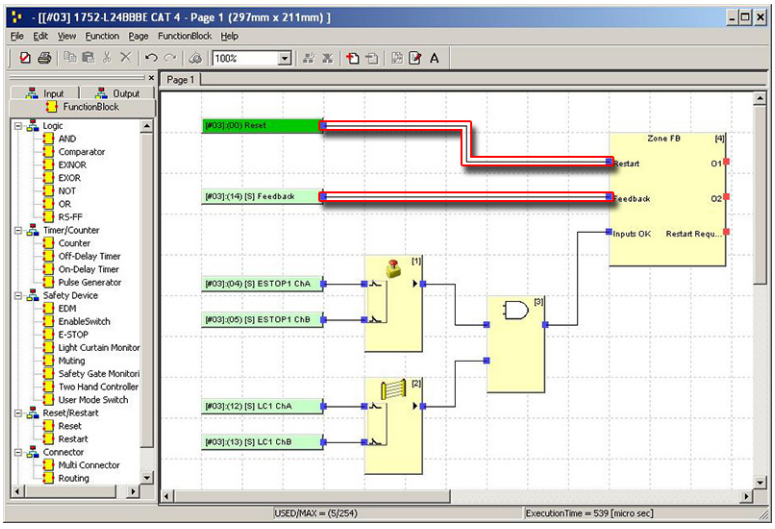
5. Close the Zone FB Logic Editor.
6. Select and drag the Zone FB block to the right of the input blocks on the Logic Editor page.



7. Click, drag, and drop the Safety Input Logic Block output pin onto the Zone FB's Inputs OK input pin.



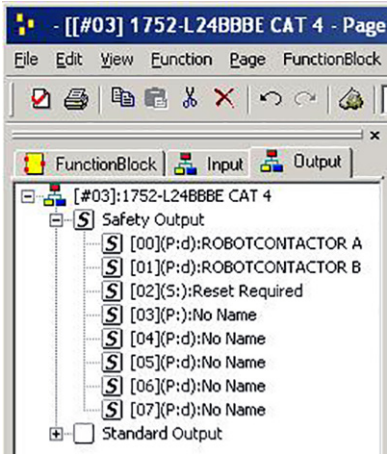
8. Click, drag, and drop Reset and Feedback Input pins onto the Zone FB's Restart and Feedback input pins, respectively.



Select Zone Outputs and Connect to Zone Function Block

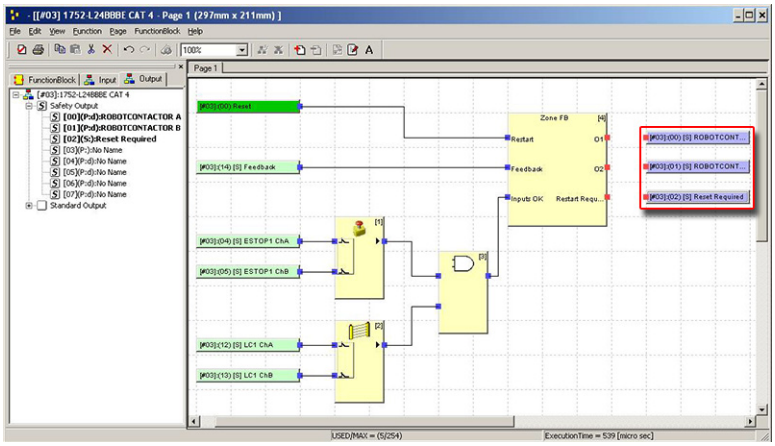
1. To access your zone outputs, select the Output tab in the Logic Editor.
2. Expand your safety controller to display the safety outputs you configured in the previous section.

   The safety outputs shown here are for the Robot Cell example. Your outputs will be specific to your application.

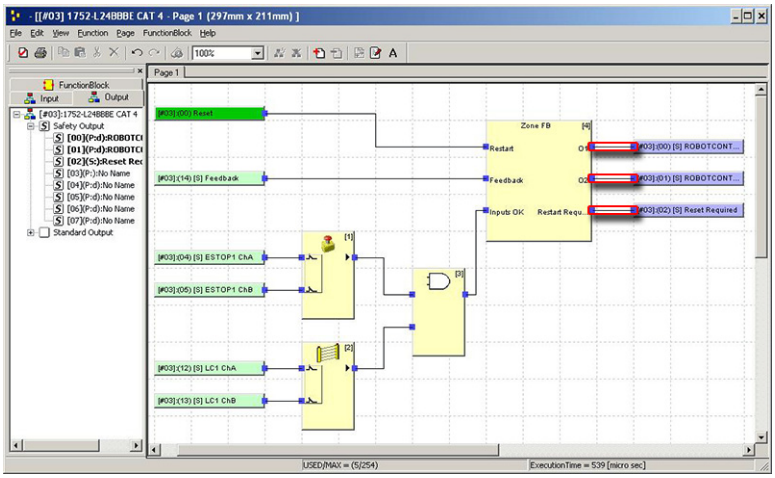


3. Select and drag all of the safety outputs required for you initial zone control onto the Logic Editor, Page 1.

   Two safety contactors, A and B, and a safety reset output were selected for use in this simple zone control example.

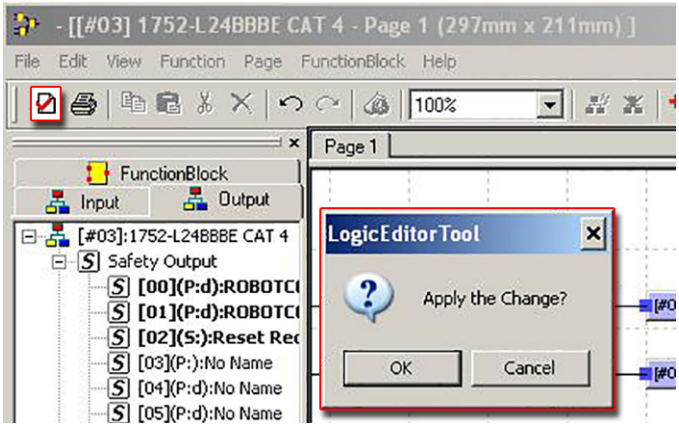


4. Click, drag, and drop safety output pins onto the associated Zone FB output pins.

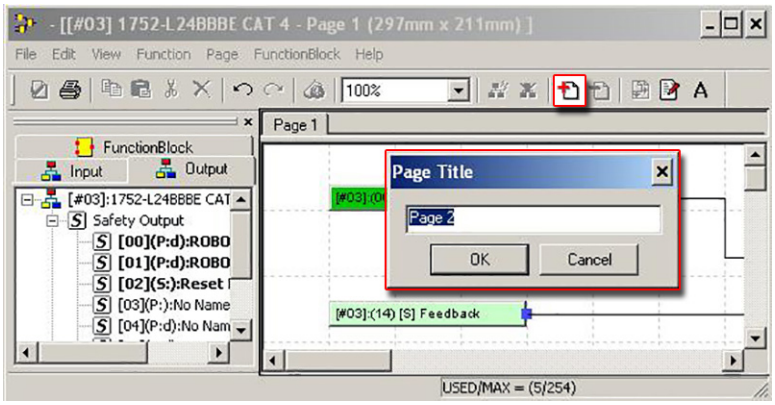


   For this example, the Zone FB outputs 01 and 02 are connected to SmartGuard 600 safety outputs to control Cat. 4 dual-safety contactors for the robots. For Cat. 2, only one actual output is required, so an unconnected or unnamed safety output may be connected to the second Zone output pin. The Zone FB Restart Required output is also connected to the SmartGuard 600 safety output to provide power to a safety reset-required indicator.

5. Click the Apply icon to apply the logic changes and then click OK to confirm.

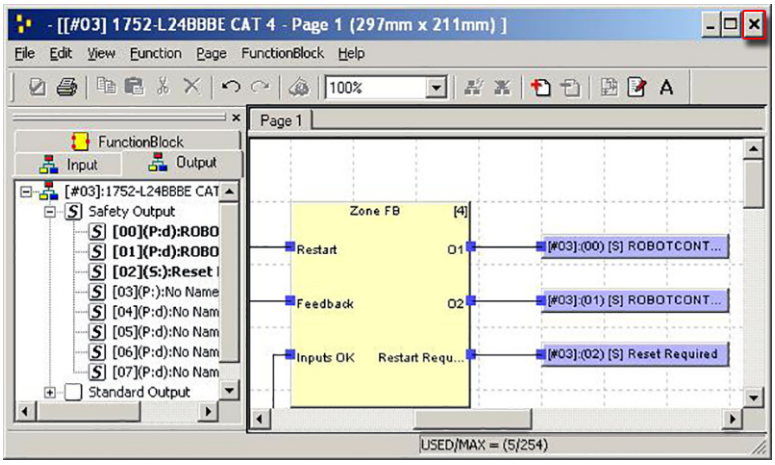


6. To create additional zone logic for your application, click Add Page and OK and repeat all of the Create Your Safety Zone Logic steps starting on page 116.

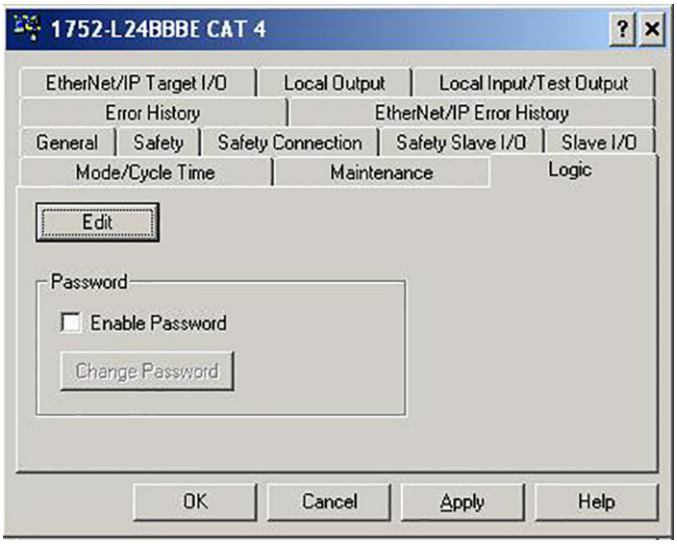


Save and Download Your RSNetWorx Project

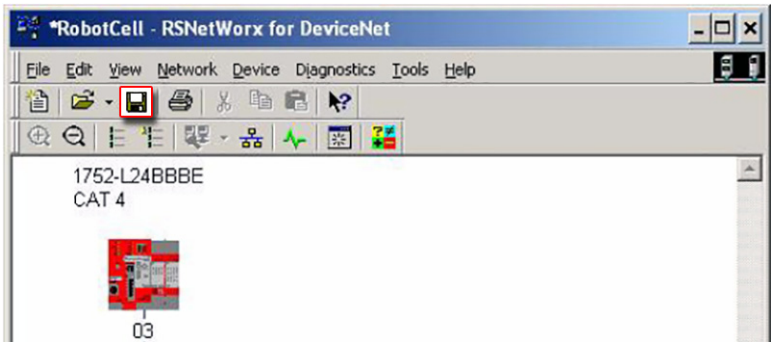
1. Close the Logic Editor.



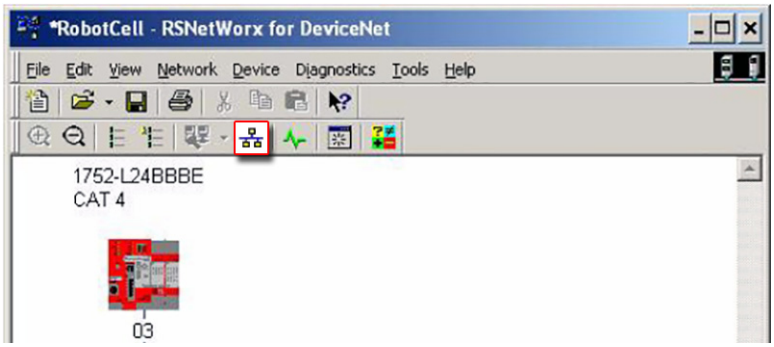
2. Click Apply and then OK to close the Properties dialog box.



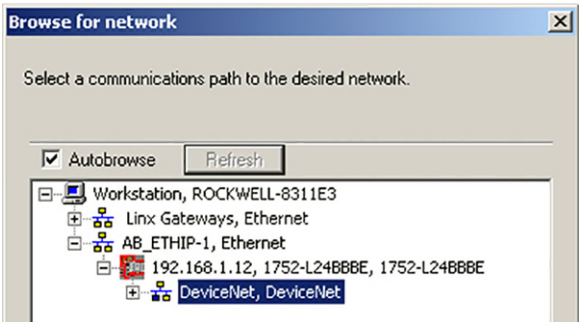
3. Click Save to save the RSNetWorx project.



4. Click Online to go online to the DeviceNet network.

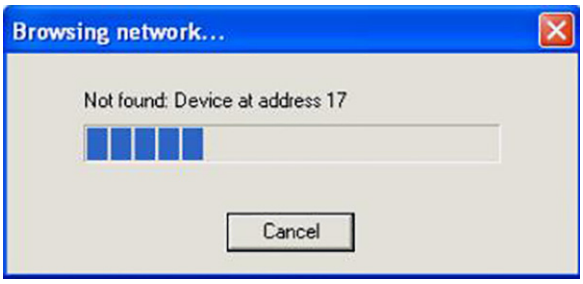


5. On the Browse for Network dialog box, navigate to your DeviceNet network under your SmartGuard controller and click OK.

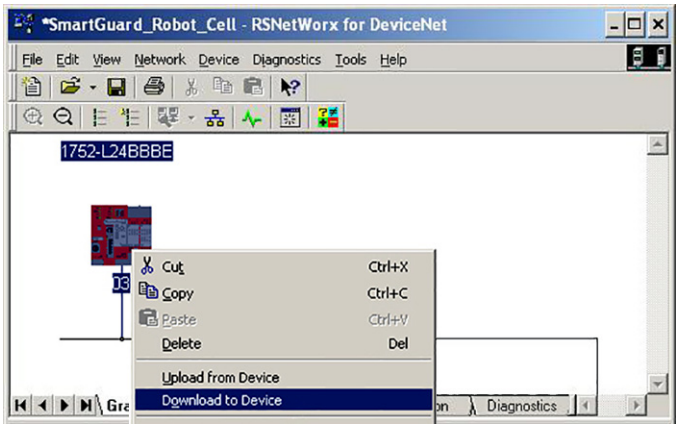


The software browses for all nodes on the network.

6. Click Cancel after your highest node has been found.

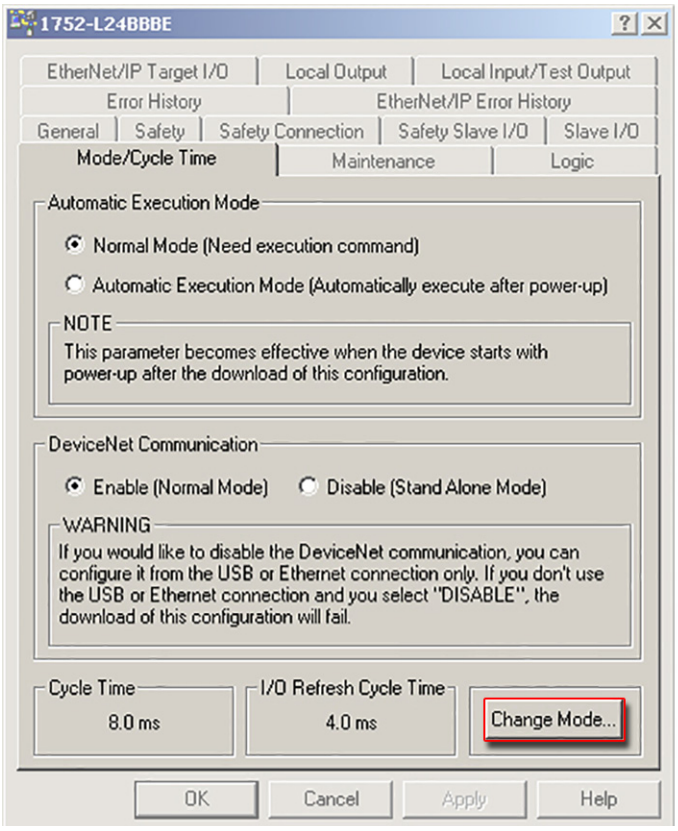


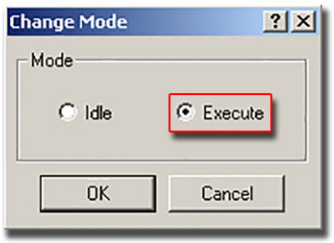
7. Right-click your SmartGuard controller node and choose Download to Device.



The software notifies you when the download has completed successfully.

8. Double-click your SmartGuard controller node to open the Properties dialog box.
9. Select the Mode/Cycle Time tab.
10. Click Change Mode.





11. Select Execute and click OK.

Verify Zone Safety Logic Operation

1. Check that all safety input devices in your initial zone are in the safe or OK state.
2. Energize the Restart input and verify that the zone safety outputs energize.
3. Trip one of the zone safety inputs and verify that the zone safety outputs de-energize.
4. Place the safety input back into its safe state, re-energize the Restart input, and verify that the safety outputs energize.
5. Repeat steps 3 and 4 for each zone safety input.
6. Repeat steps 1...5 for each safety zone in your system.

Add Your Faceplate Logic

Because SmartGuard 600 controllers process only safety logic, they are typically used in conjunction with CompactLogix™ controllers to process the standard control logic and communicate safety status and diagnostic information to PanelView™ Plus terminals.

The toolkit includes SmartGuard 600 and Guard I/O HMI faceplates that provide status of the safety circuits and logic, and provide diagnostics for safety demands and faults. To support these faceplates, standard logic needs to be added to your CompactLogix or GuardLogix controller.

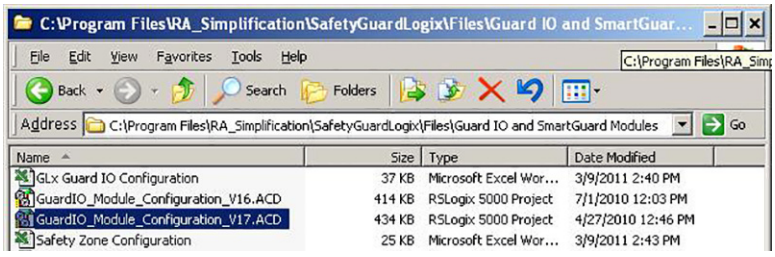
If you are using a SmartGuard 600 controller with EtherNet/IP capabilities (1752-L24BBBE), use the steps in Copy SmartGuard 600 Module Configuration to Your Logix Controller Project on page 130 to add the required logic to support the SmartGuard 600 controller faceplate.

If your SmartGuard 600 controller has only DeviceNet communication capability (1752-L24BBB), follow the steps in Adding Your Faceplate Logic on page 67.

Copy SmartGuard 600 Module Configuration to Your Logix Controller Project

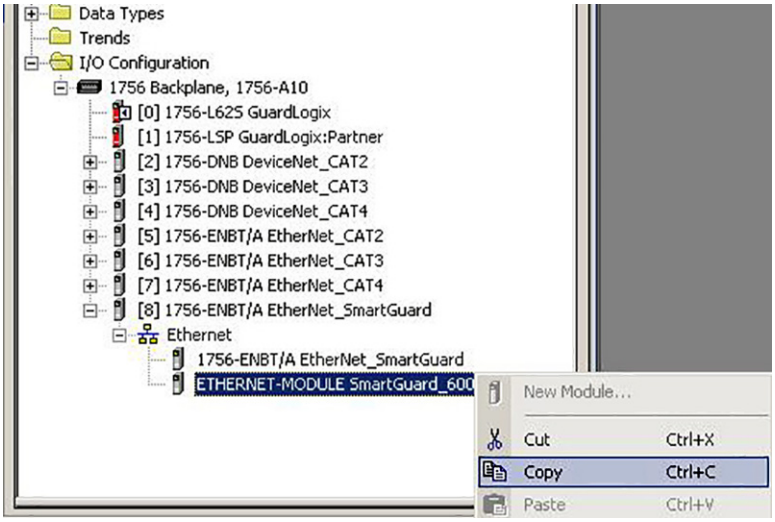
The toolkit includes a generic Ethernet module that has been pre-configured for access to status and diagnostic data assemblies in the SmartGuard 600 controller that the SmartGuard 600 faceplate can use. Follow these steps to use the generic module.

1. Navigate to the Guard I/O and SmartGuard Modules directory in the toolkit and open the RSLogix 5000 project named GuardIO_Module_Configuration_V17.ACD.



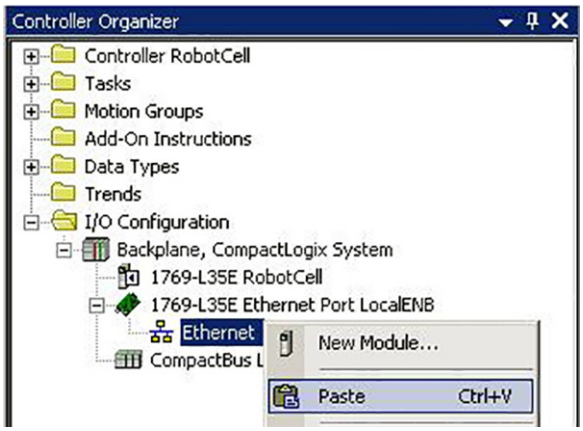
If you loaded the toolkit image onto your personal computer's hard drive, the default path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Modules.

2. In the Controller Organizer, navigate to the I/O Configuration folder.
3. Right-click ETHERNET-MODULE SmartGuard_600 and choose Copy.

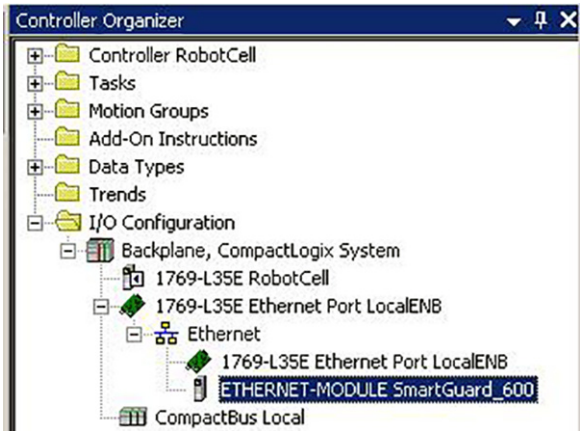


4. Open your existing Logix controller project and paste the ETHERNET-MODULE SmartGuard_600 module into your I/O Configuration.

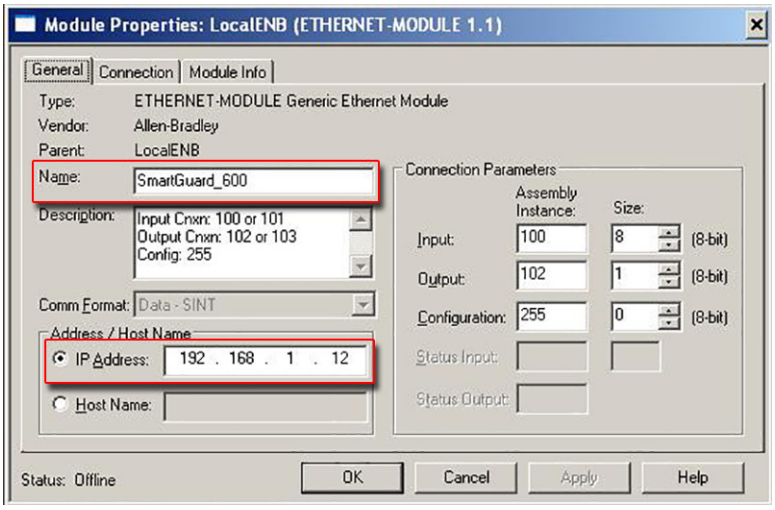
   For this example, the SmartGuard 600 modules was added to the network of the CompactLogix L35E Local Ethernet port.



5. Double-click the SmartGuard 600 module to open it's Properties dialog box.



6. Edit the name and IP address specific to your application.

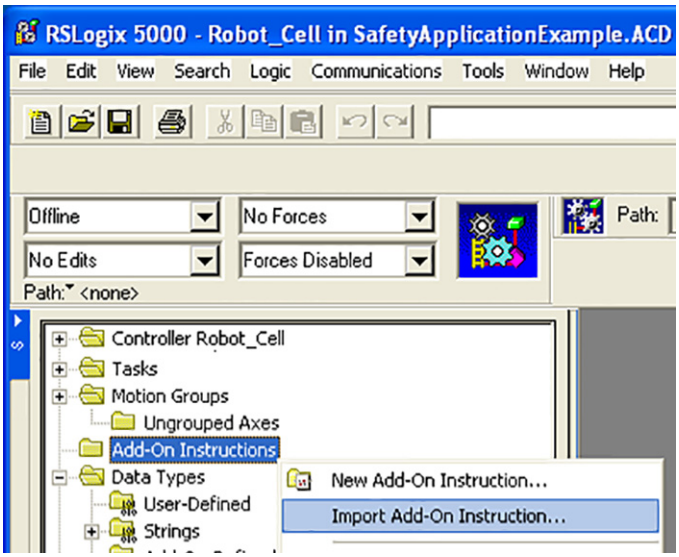


7. Click OK to close the SmartGuard 600 Properties dialog box.

Import SmartGuard 600 Faceplate Add-On Instruction and Logic Rungs to Your Logix Controller Project

The toolkit includes pre-configured logic for the SmartGuard 600 faceplate as well.

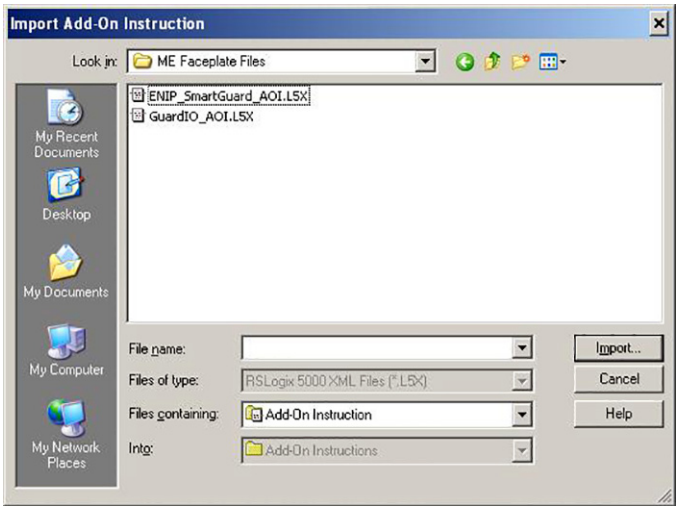
1. Right-click Add-On Instructions and choose Import Add-On Instruction.



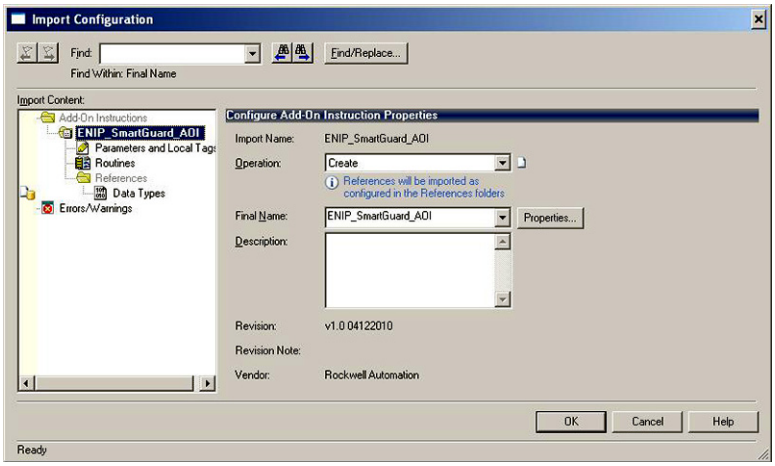
2. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate Files toolkit directory.

   If the toolkit has been loaded onto your personal computer, the path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

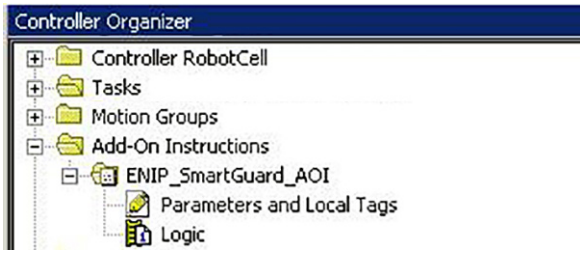
3. Select the Add-On Instruction file named ENIP_SmartGuard_AOI.L5X, and click Import.



4. Click OK on the Import Configuration dialog box to execute the import.

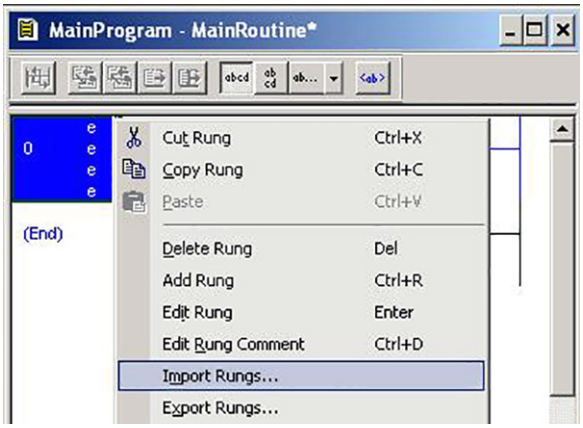


The ENIP_SmartGuard_AOI appears in the Add-On Instruction folder of your Logix controller.



5. Double-click your Main Routine or the routine in which you want to use the faceplate logic.

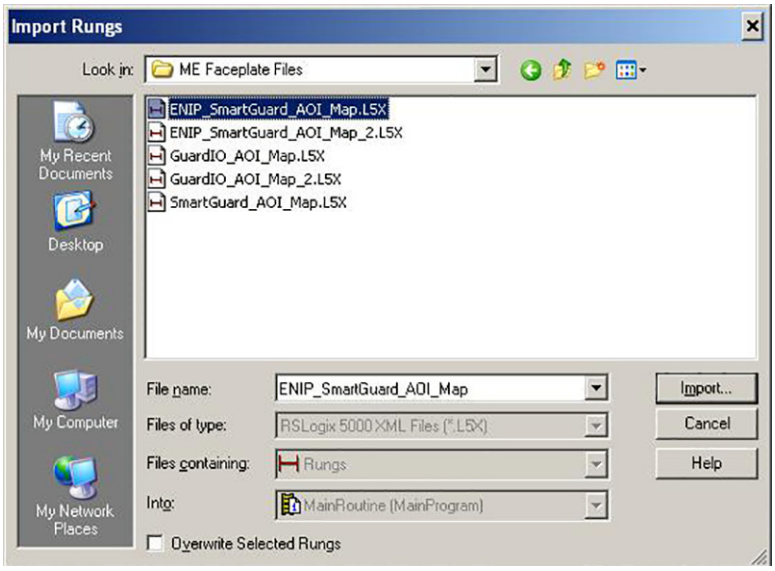
6. Right-click a rung insertion location and choose Import Rungs.



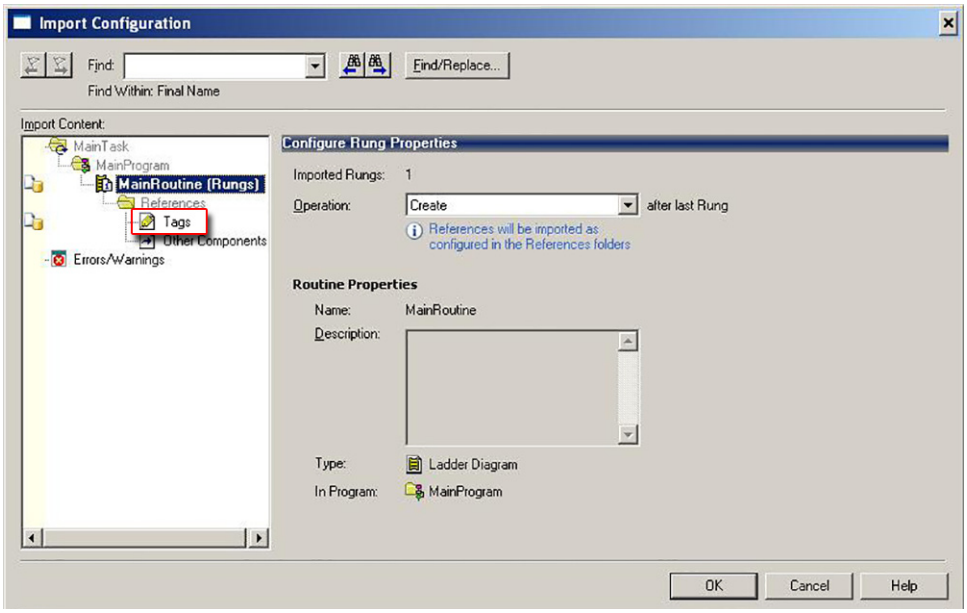
7. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate Files toolkit directory.

   If the toolkit has been loaded onto your personal computer, the path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

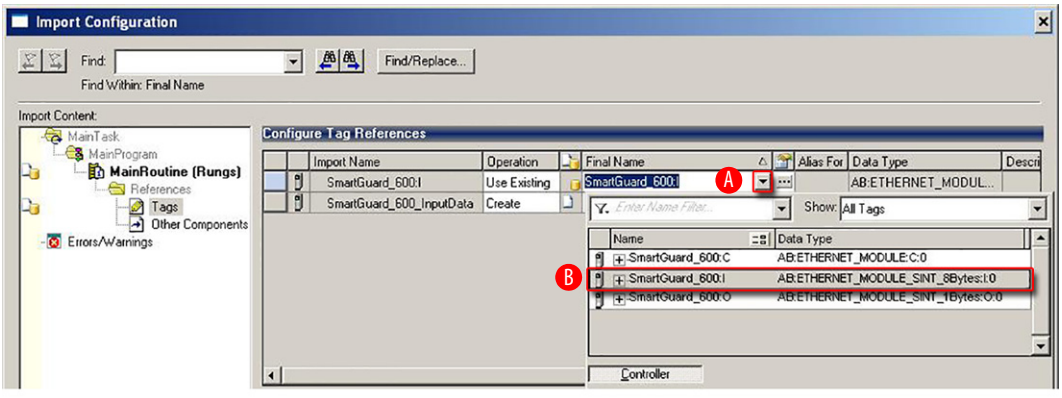
8. Select the Add-On Instruction file named ENIP_SmartGuard_AOI_Map.L5X, and click Import.

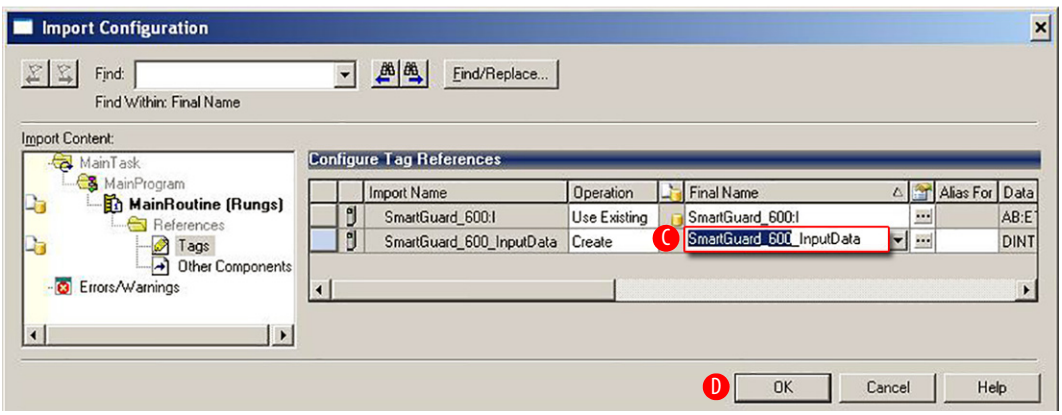


9. Select Tags from the Import Content organizer on the Import Configuration dialog box.



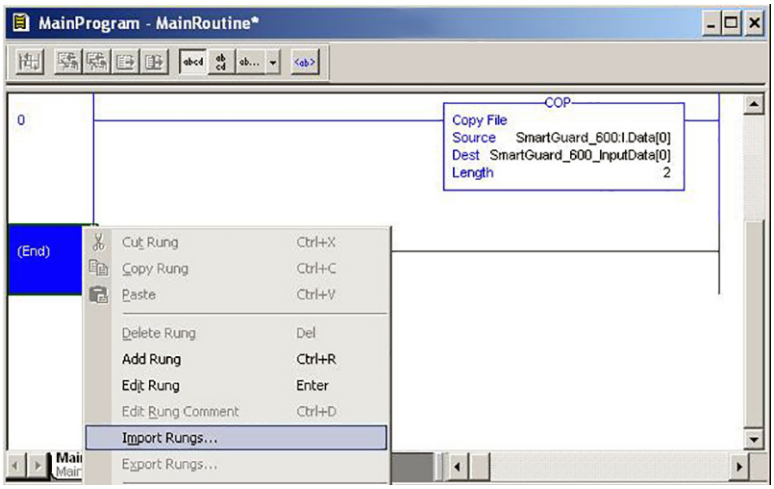
10. If you did not use the default SmartGuard 600 name for your SmartGuard Ethernet module, then rename both the SmartGuard_600:I tag and the SmartGuard_600_InputData tag; otherwise skip this step.
    a. Click the pull-down arrow next to the SmartGuard_600:I input tag in the Final Name column (A).
    b. In the pull-down menu, browse to your SmartGuard 600 Ethernet module input tag and select it (B).
    c. Select the SmartGuard_600_InputData tag in the Final Name column and type over the existing name with the name of your SmartGuard 600 Ethernet module (C).
    d. Click OK to complete the rung import (D).





The imported rung appears in your routine.

11. Right-click the end rung and choose Import Rungs to import output tag mapping rungs.



12. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate Files directory.

    If the toolkit has been loaded onto your personal computer, the path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

13. Select ENIP_SmartGuard_AOI_Map_2.L5X and click Import to import the additional SmartGuard 600 faceplate rungs.

14. Select Tags from the Import Content organizer on the Import Configuration dialog box.

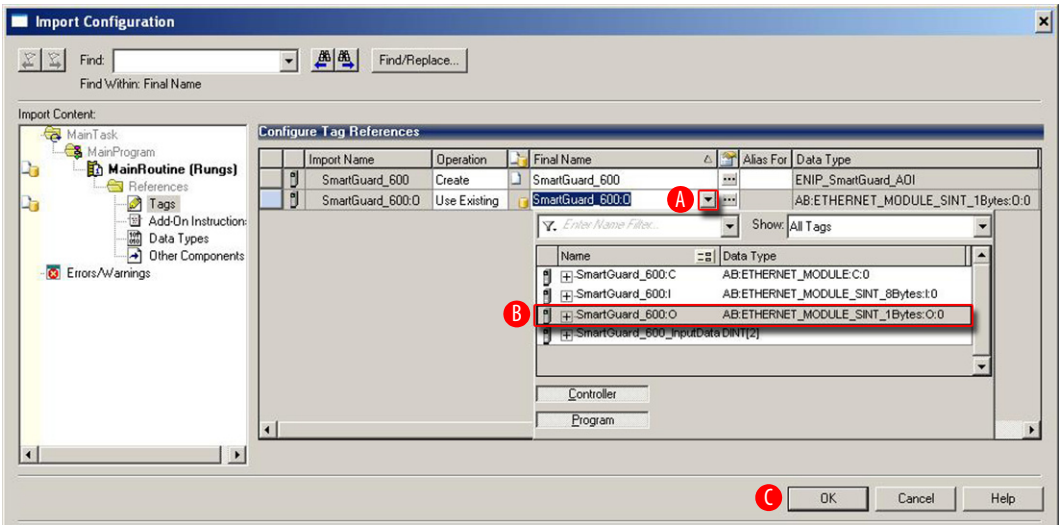
15. If you did not use the default SmartGuard 600 name for your SmartGuard Ethernet module, then rename the SmartGuard_600:O tag as follows:

    a. Click the pull-down arrow next to the SmartGuard_600:O input tag in the Final Name column (A).

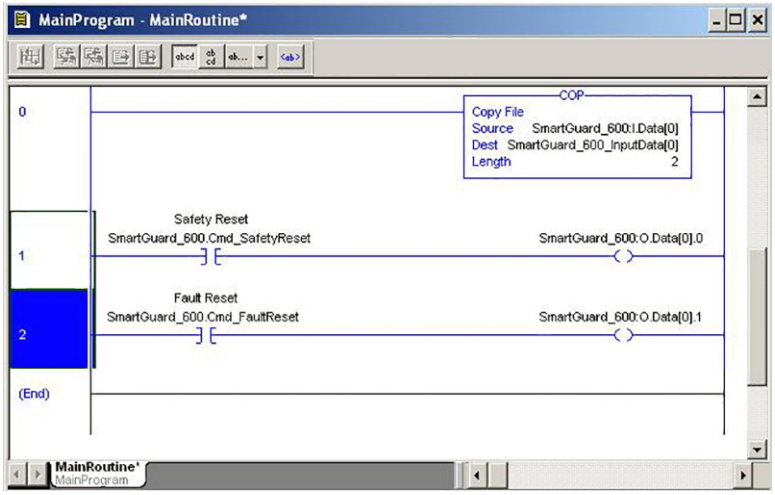
    b. In the pull-down menu, browse to your SmartGuard 600 Ethernet module output tag and select it.

    In this example, we selected the SmartGuard 600 Ethernet module tag named SmartGuard _600:O (B).

    c. Click OK to complete the rung import (C).

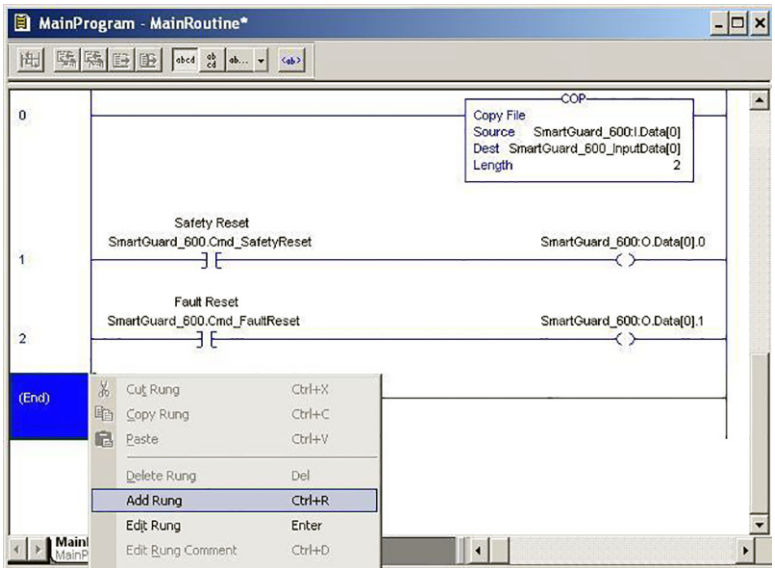


The additional two imported rungs will appear in your routine.

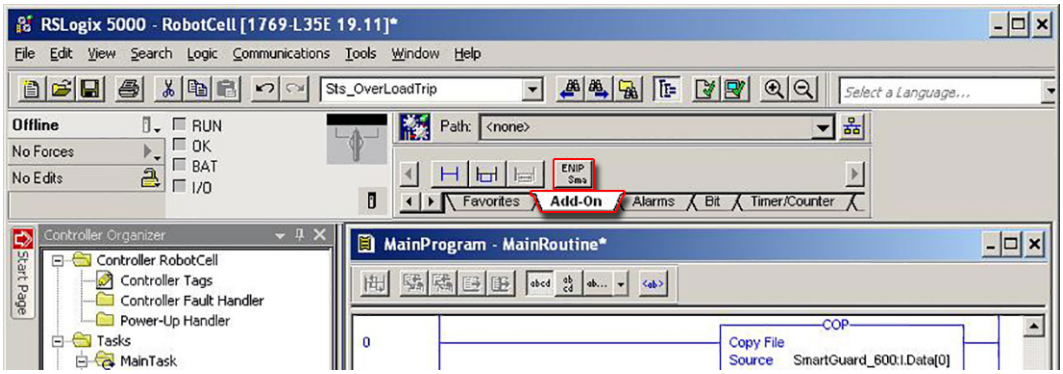


Create an Instance of Your SmartGuard 600 Faceplate Add-On Instruction in Your CompactLogix Project Routine

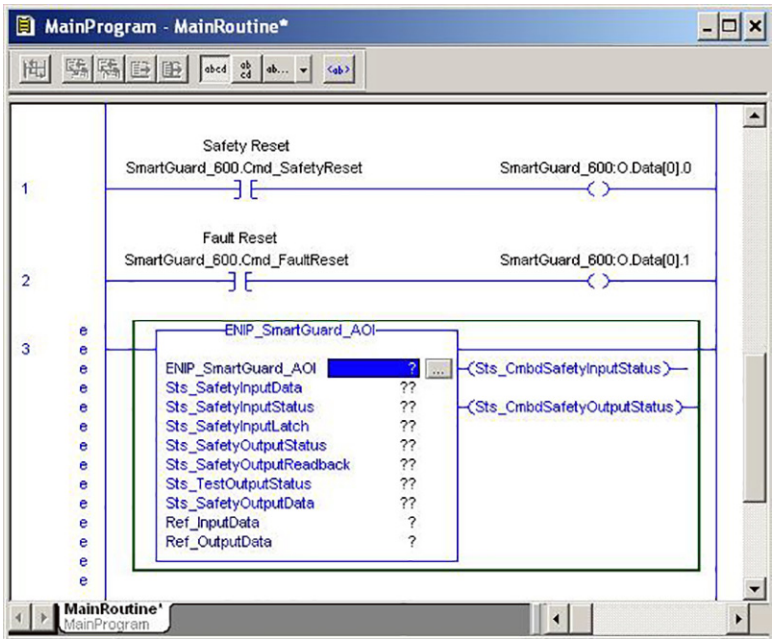
1. Right-click on the rung just after the imported output tag mapping rungs within you project routine and choose Add Rung.



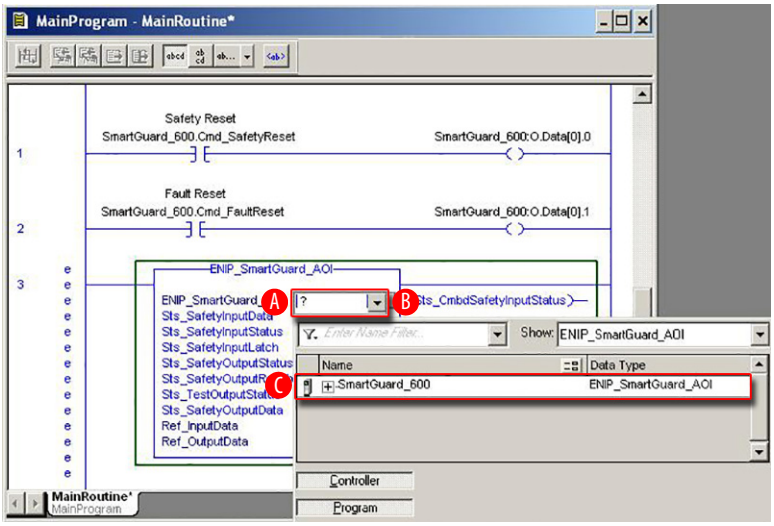
2. Select the Add-On element group tab and click the ENIP_SmartGuard_AOI instruction button.



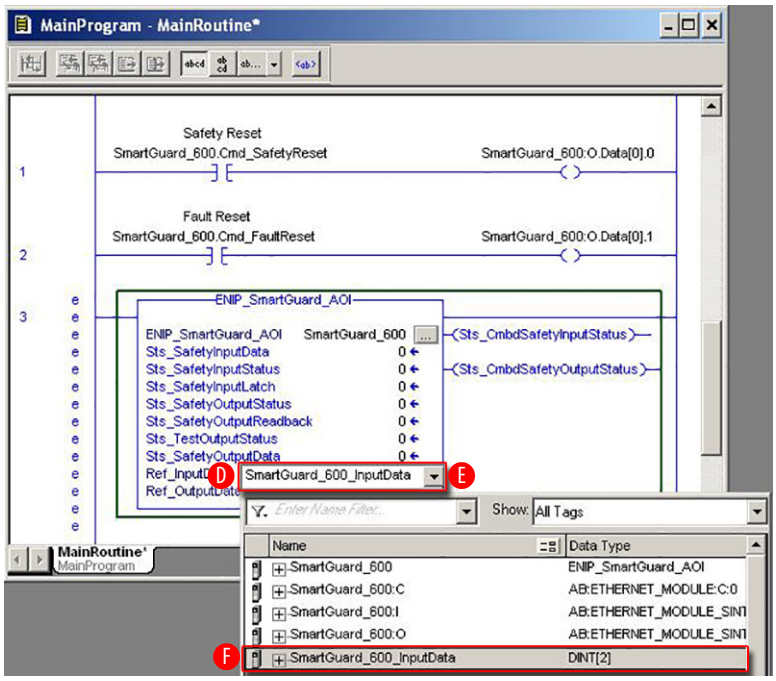
An instance of the ENIP_SmartGuard_AOI instruction appears in the rung.



3. Assign the ENIP_SmartGuard_AOI to the SmartGuard 600 module that you configured in the previous section.
   a. Double-click the ENIP_SmartGuard_AOI tag entry field (A).
   b. Select the pull-down arrow (B).
   c. Double-click on the SmartGuard 600 Ethernet module tag within the pull-down dialog box.
   In this example, we selected the SmartGuard 600 Ethernet module tag named SmartGuard_600 (C).



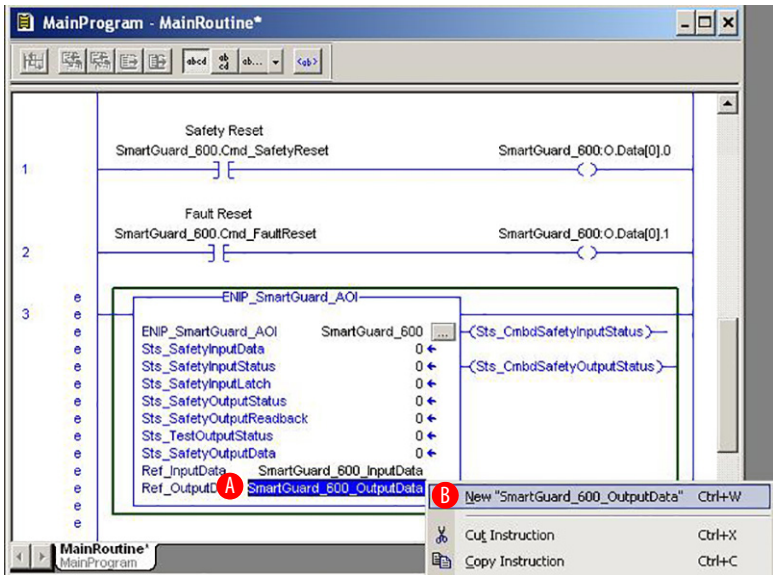
4. Assign the Ref_input Data tag.
   a. Double-click the Ref_Input Data tag entry field (D).
   b. Click the pull-down arrow (E).
   c. Double-click the SmartGuard 600 InputData tag in the pull-down dialog box.
   In this example, we chose the SmartGuard 600 input data tag named SmartGuard_600_InputData (F).
   Be sure to select the input data tag that you configured in the previous section if you did not use the default name.



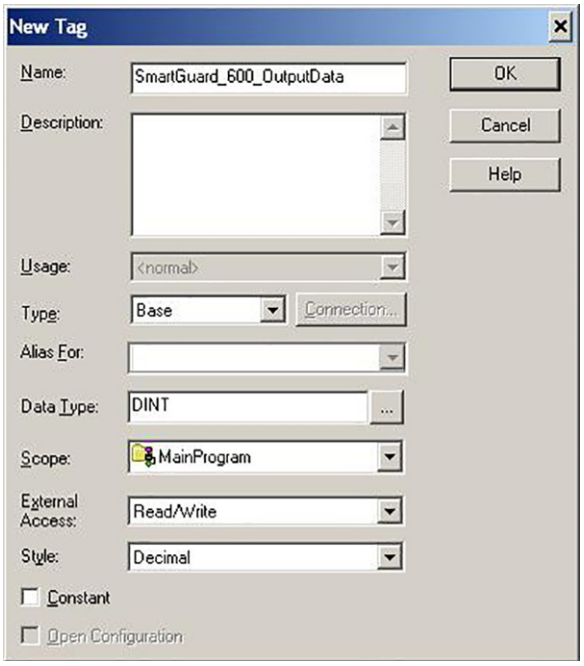
5. Assign the Ref_OutputData tag.
   a. Select the Ref_OutputData tag entry field and type SmartGuard_600_OutputData (A).

      If you did not use the default SmartGuard 600 Ethernet module tag, enter 'Your SmartGuard 600 Ethernet Module Name_OutputData'.

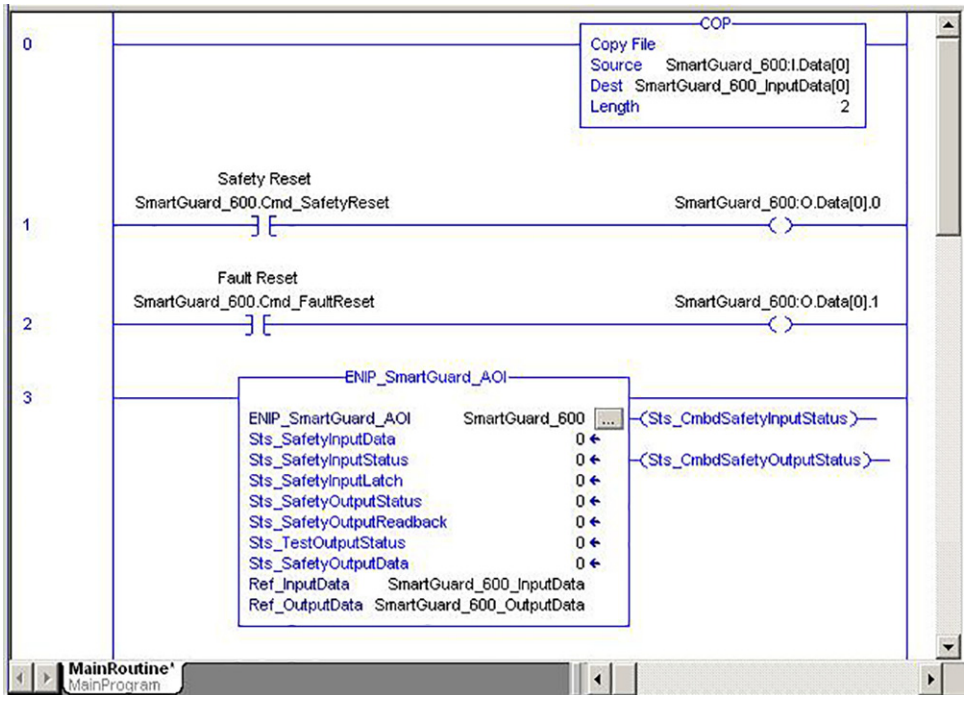
   b. Right-click the entered output data tag and select the tag name you typed in the previous step to open the New Tag dialog box (B).



   c. Click OK to create the new tag.



If the instance of your SmartGuard 600 Faceplate Add-On Instruction was configured correctly, then the rung should display with no errors.



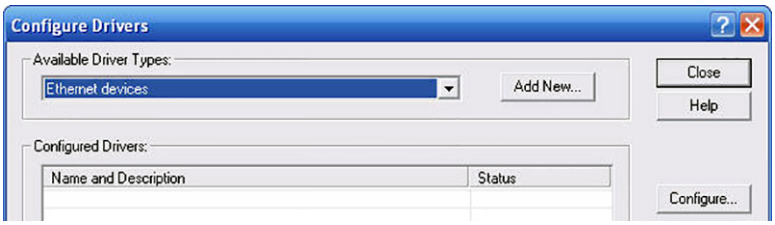
Configure CompactLogix Communication

This procedure assumes that your communication method to the CompactLogix controller is via the Ethernet protocol and that your Logix Ethernet module has already been configured. For additional information, refer to these publications:

- 1769 CompactLogix Controllers User Manual (for catalog numbers 1769-L31, 1769-L32C, 1769-L32CR, 1769-L32E, or 1769-L35E), publication 1769-UM011
- CompactLogix System User Manual (for catalog numbers 1769-L20, 1769-L30), publication 1769-UM007

Follow these steps to configure Logix Communication.

1. Open RSLinx Classic software and select Configure Drivers... in the Communication menu.
2. Select the Ethernet Devices driver from the pull-down list.
3. Click the Add New... button.



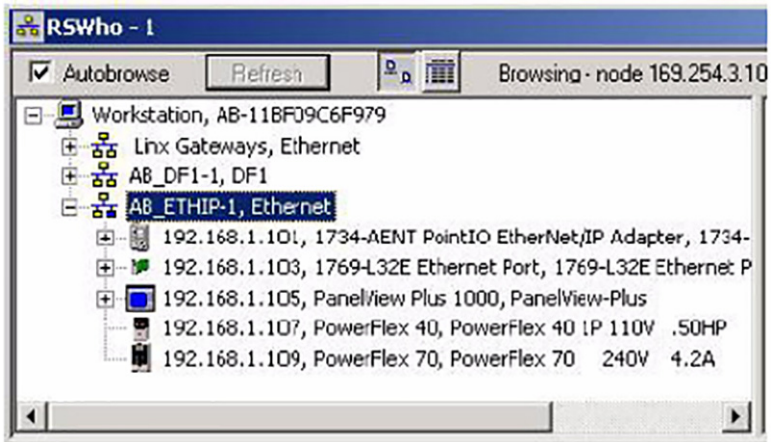
4. In the Add New RSLinx Classic Driver dialog box, name the new driver and click OK.

5. In the Configure driver dialog box, type the IP address of your Logix Ethernet module and click OK.

   The IP address shown is an example. Yours will be different.

TIP If your Logix Ethernet module is already configured, the IP address is displayed on the module.

6. Click Close.
7. Select RSWho from the Communication menu.
8. In the RSWho window, expand the Ethernet communication module until your controller is visible.



9. Verify that you can browse to your CompactLogix controller.
10. Minimize the RSLinx application window and return to your RSLogix 5000 project window.

Save and Download Your Program

Follow these steps to save your program and download it to your CompactLogix controller.

1. Save the program by choosing File>Save from the menu bar.
2. Turn the keyswitch on the controller to REM.
3. To define the path to the controller, click Who Active  and select the controller.
4. Click Download.

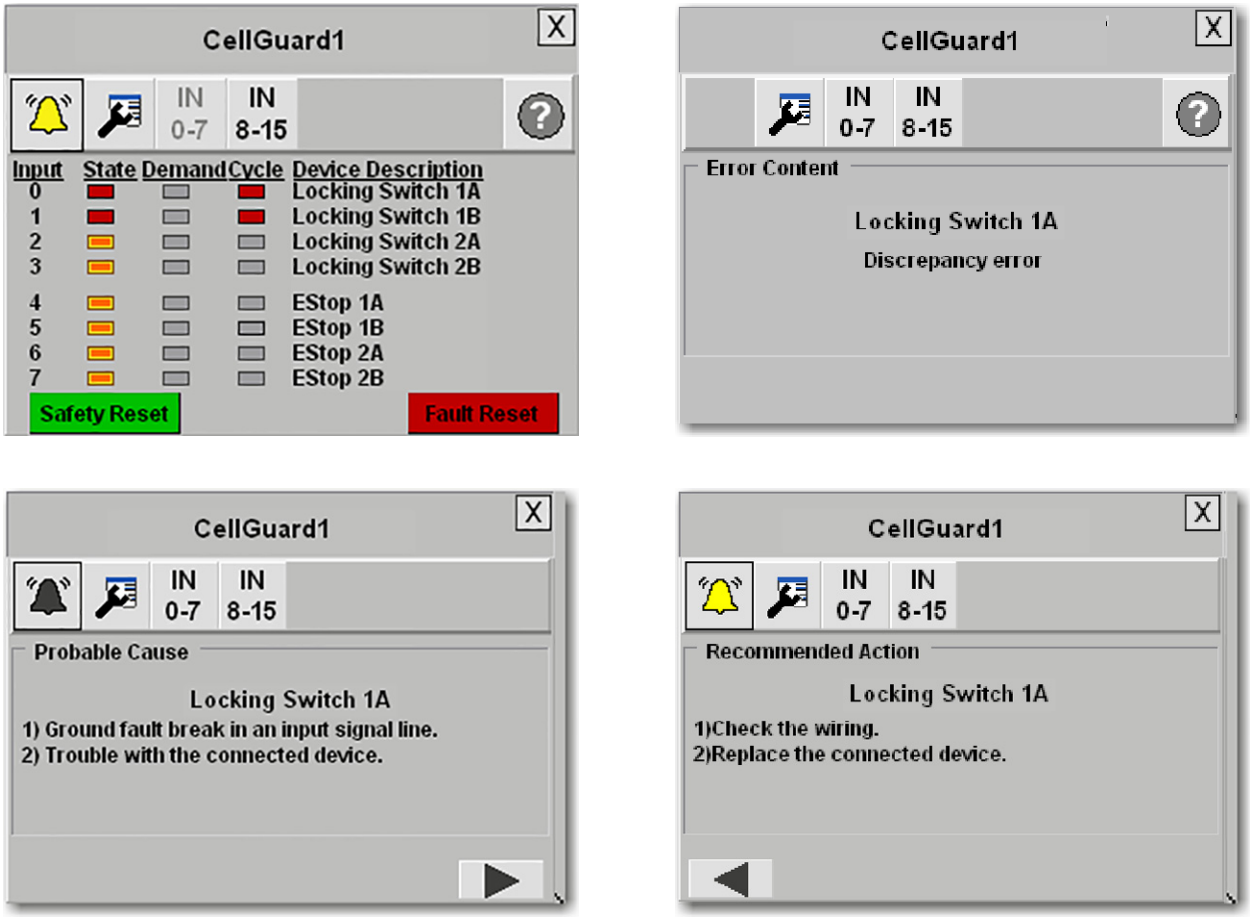
FactoryTalk® View ME Software Integration

Introduction

The Safety Accelerator Toolkit contains faceplates that let you create displays in FactoryTalk View Machine Edition software. Use safety I/O module faceplates for displays that let you control and monitor your Guard I/O™ modules or SmartGuard™ 600 I/O. Use safety instruction faceplates for displays that monitor the status and diagnostic information of GuardLogix® controller safety application instructions.

This example shows a pre-configured Guard I/O Goto display button that can launch the on-top display or faceplate for the particular Guard I/O module. The faceplate includes status and diagnostic views controlled by its own toolbar buttons.

Figure 4 - Guard I/O Module Faceplate Views



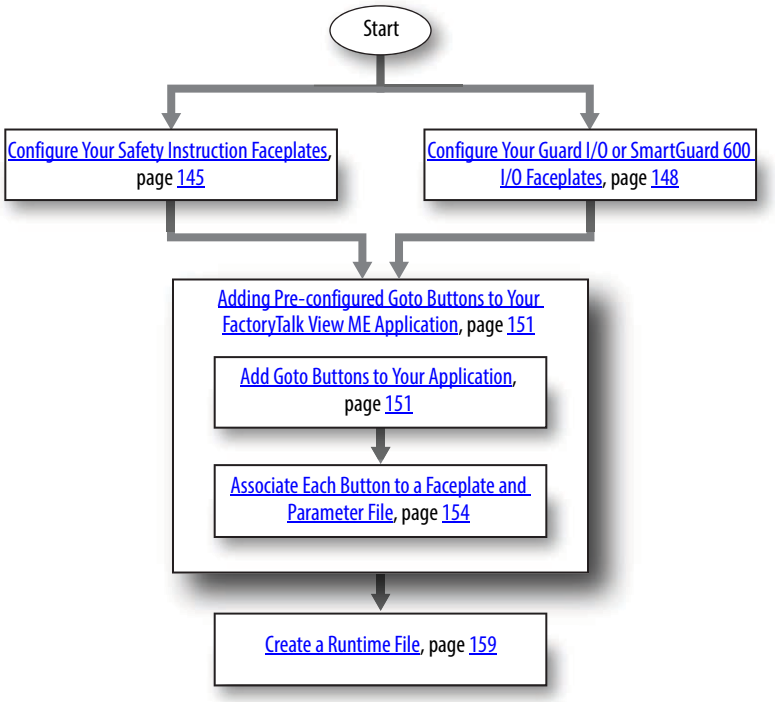
Before You Begin

Complete the Logix integration steps in Chapter 3 or Chapter 4 to prepare your project. Make sure FactoryTalk View ME software is installed on your personal computer.

What You Need

- FactoryTalk View Machine Edition software, version 6.1 or later
- Safety Accelerator Toolkit, DVD SAFETY-CL002 or visit the Integrated Architecture® Tools and Resources website at http://www.ab.com/go/iatools

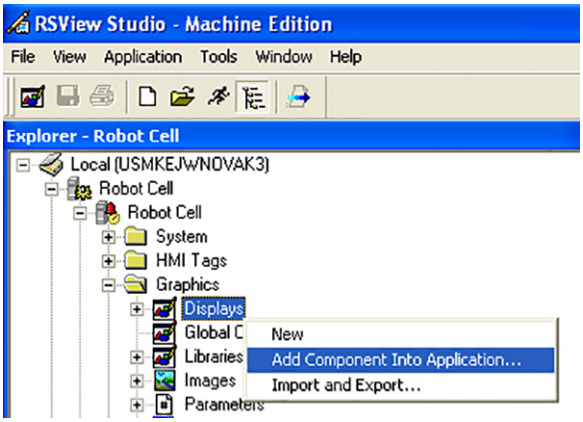
Follow These Steps



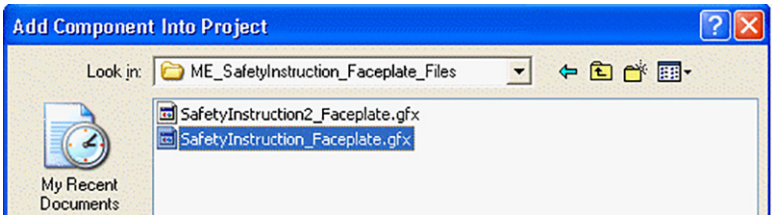
Configure Your Safety Instruction Faceplates

Safety Instruction faceplates are used only with 1756 GuardLogix and 1768 Compact GuardLogix controllers.

1. Open your existing FTViewME application to which you want to add the faceplates.
2. Right-click on Displays and choose Add Component Into Application.

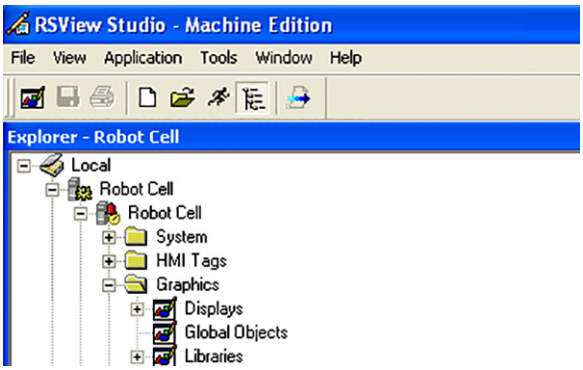


3. Browse to the Safety Instruction Faceplate files in the toolkit and open the ME_SafetyInstruction_Faceplate_Files folder.
4. Select the SafetyInstruction_Faceplate.gfx.

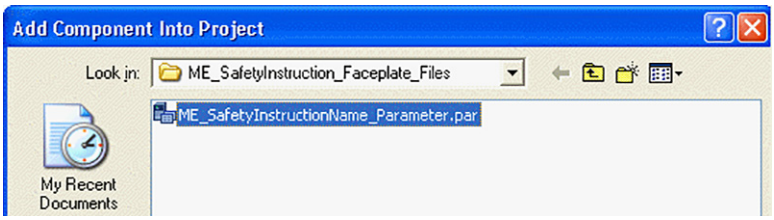


IMPORTANT If you are using the CPM, CBIM, CBSSM, or CBCM instructions, choose SafetyInstruction2_Faceplate.gfx instead.

5. Add the faceplate parameter file by right-clicking on Parameters and choosing Add Component Into Application.

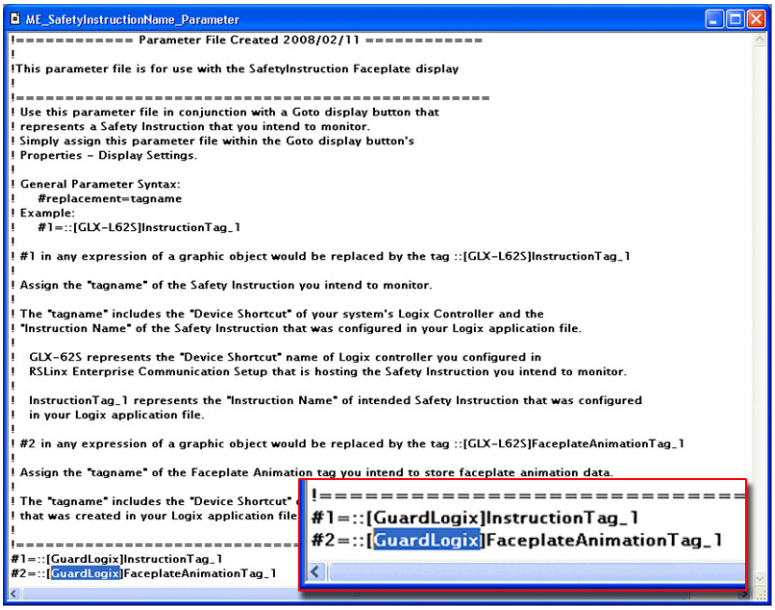


6. Browse to the SafetyInstruction Faceplate files in the toolkit and open the ME_SafetyInstruction_Faceplate_Files folder.



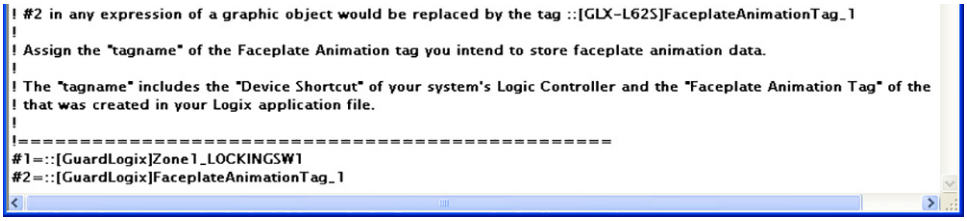
7. Select the ME_SafetyInstruction_Parameter file.
8. Double-click the parameter file you just added to open it.
9. Edit the Device Shortcut name to match the GuardLogix controller that you configured for both parameter 1 and parameter 2.

   This example shows a shortcut name for a controller named 'GuardLogix'.



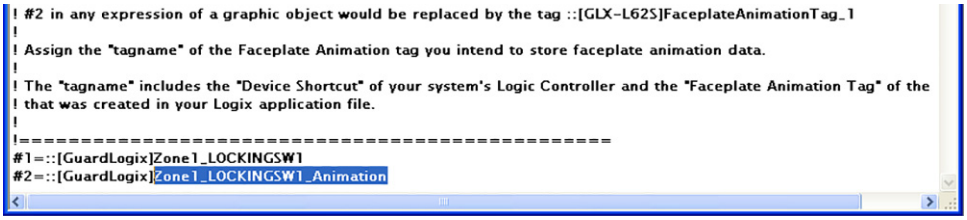
10. Type the Safety Instruction tag name for the safety instruction you want to monitor.

    This example shows a safety instruction tag named 'Zone1_LOCKINGSW1'.

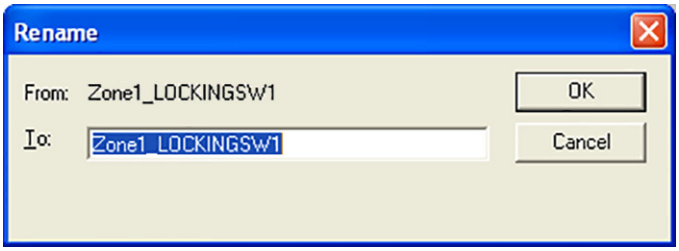


11. Type the name of the user-defined tag for the user-defined data type that you created for your corresponding safety instruction.

This example shows a tag named 'Zone1_LOCKINGSW1_Animation'.



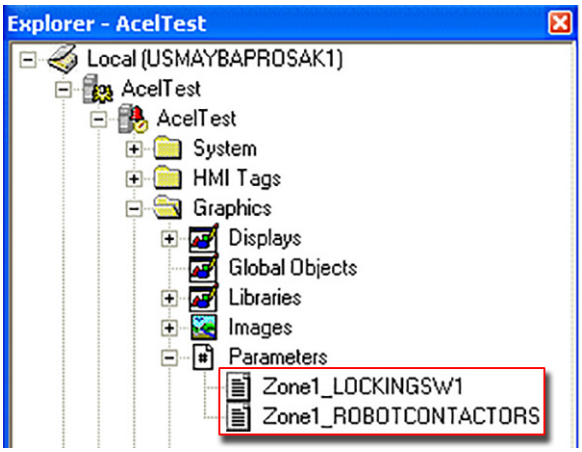
12. Close the parameter file.
13. Rename the parameter file by right-clicking the file, choosing Rename, and typing the new parameter file name.



It is recommend that you use the safety instruction name from within the parameter.

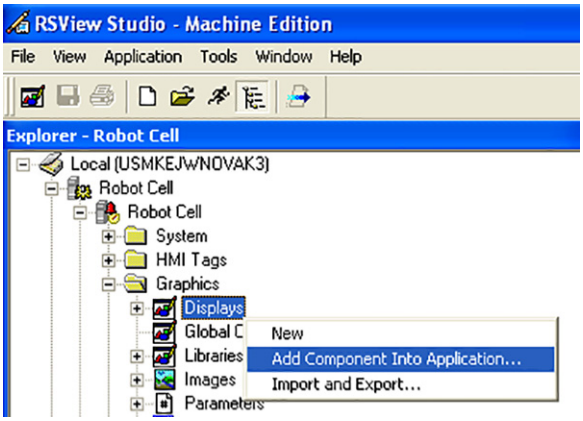
14. Create a separate parameter file for each safety instruction.

This example shows two parameter files configured for the safety instruction named 'Zone1_LOCKINGSW1' and the safety instruction named 'Zone1_ROBOTCONTACTORS'.



Configure Your Guard I/O or SmartGuard 600 I/O Faceplates

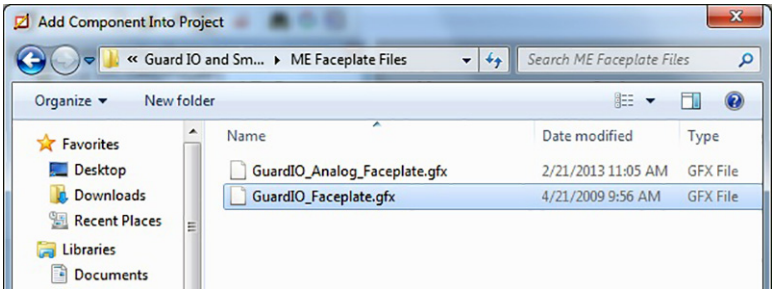
1. Open your existing FTViewME application to which you want to add the faceplates.
2. Right-click on Displays and choose Add Component Into Application.



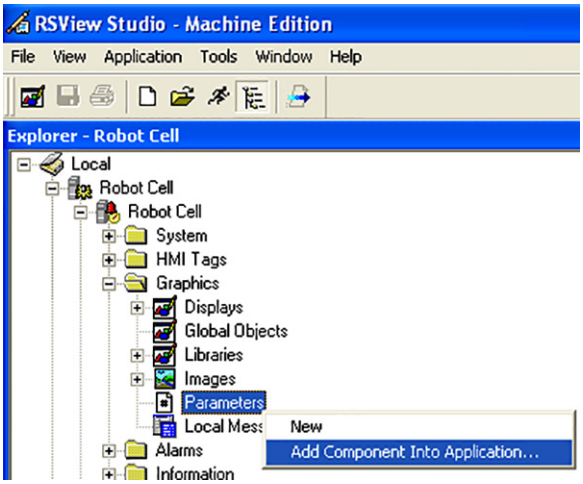
3. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate files directory.

If the toolkit has been loaded onto your personal computer, the hard drive path is C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Guard IO and SmartGuard Faceplate Files\ME Faceplate Files.

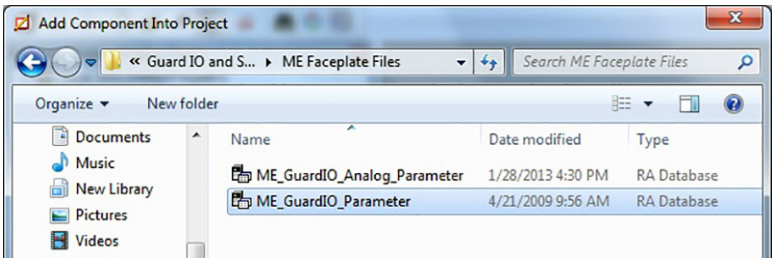
4. Select the GuardIO_Faceplate.gfx for Guard I/O digital modules or select GuardIO_Analog_Faceplate.gfx for Guard I/O analog modules.



5. Add the faceplate parameter file by right-clicking on Parameters and choosing Add Component Into Application.

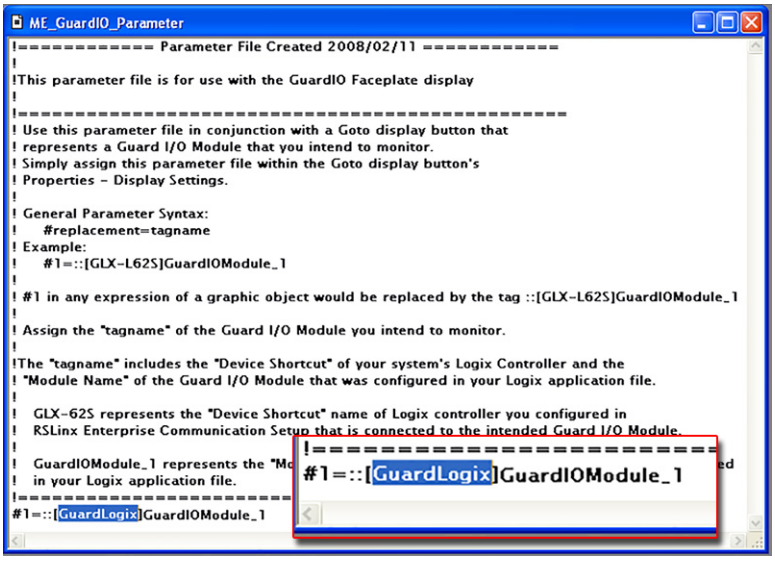


6. Browse to the ME Faceplate Files folder within the Guard I/O and SmartGuard Faceplate files directory.



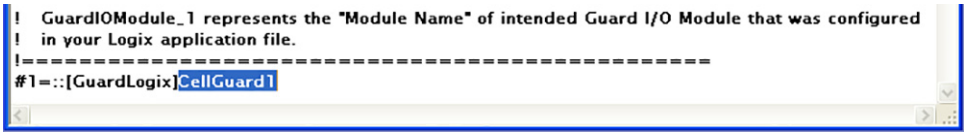
7. Select the ME_GuardIO_Parameter file for Guard I/O digital modules or select GuardIO_Analog_Parameter for Guard I/O analog modules.
8. Double-click the parameter file you just added to open it.
9. Edit the Device Shortcut name to match the GuardLogix controller that you configured or the CompactLogix™ controller to which your SmartGuard 600 controller is attached.

   This example shows a shortcut name for a controller named 'GuardLogix'.



10. Type the GuardIO_AOI or ENIP_SmartGuard_AOI *ModuleName* of the module you want to control and monitor.

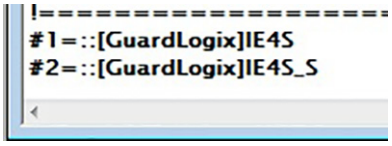
    This example shows a module named 'CellGuard1'.



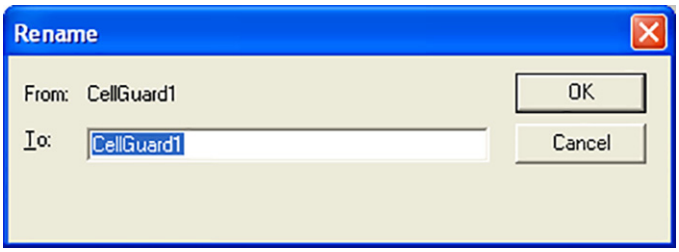
    For the ME_GuardIO_Analog_Parameter there are two parameters.

    - First parameter name should be the name of the standard GuardIO_Analog_AOI, typically the *AnalogModuleName*.
    - Second parameter name should be the name of the safety GuardIO_Analog_AOI_Safety AOI, typically the *AnalogModuleName_S*.

    This example shows a parameter for an analog module name IE4S.



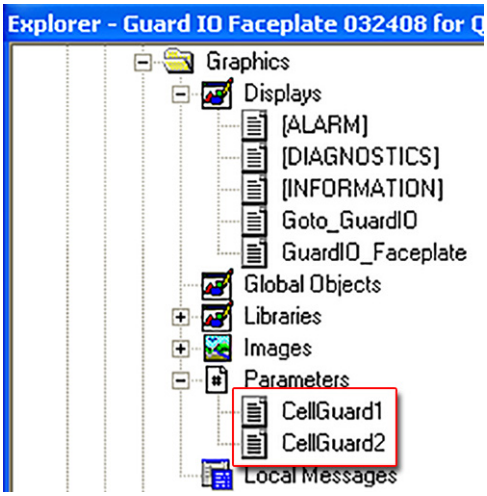
11. Close the parameter file.
12. Rename the parameter file by right-clicking the file, choosing Rename, and typing the new parameter file name.



    Using the *ModuleName* from within the parameter is recommended.

13. Create a separate parameter file for each Guard I/O or SmartGuard 600 module.

    This example shows two parameter files configured for two Guard I/O modules named CellGuard1 and CellGuard2.



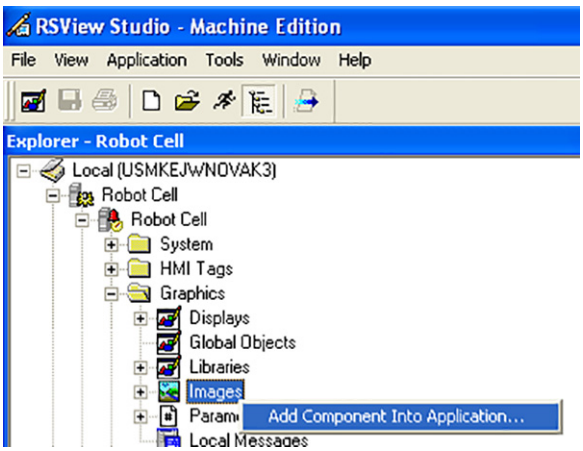
Adding Pre-configured Goto Buttons to Your FactoryTalk View ME Application

Goto buttons launch the faceplates for the individual safety instructions, Guard I/O modules, or SmartGuard 600 I/O in your application. First you need to add the Goto button graphics and objects to your application. Then, associate the individual Goto Display buttons to the appropriate faceplate and specific parameter file.

Add Goto Buttons to Your Application

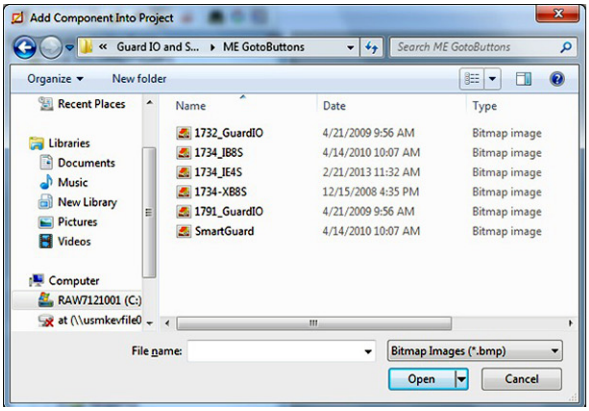
Follow these steps to add the Goto buttons to your application.

1. Add the safety instruction, Guard I/O, or SmartGuard bitmap images into your FTViewME application by right-clicking Images and choosing Add Component Into Application.

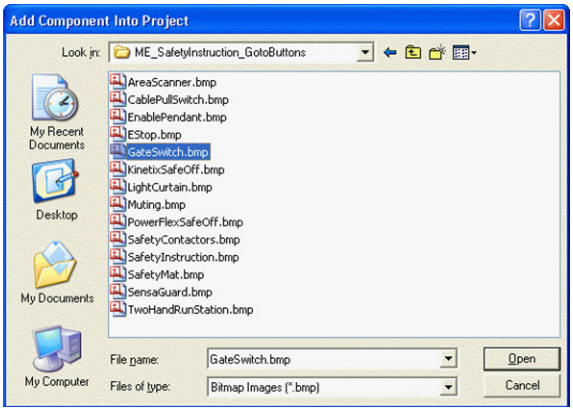


2. Browse to the appropriate faceplate files on the toolkit DVD and open the desired folder:

For these	Browse to
Guard I/O Goto Button images	C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\ Guard I/O and SmartGuard Faceplate File\ME_GotoButtons
Safety Instruction Goto Button images	C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Safety Instruction Faceplate Files\ME_SafetyInstruction_GotoButtons



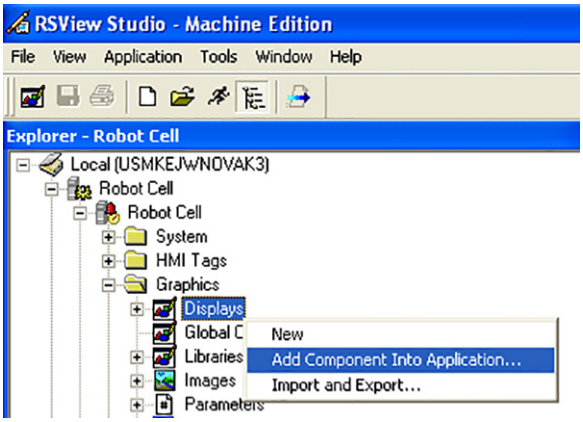
or



3. Select the Bitmap images you need for the type of I/O module or safety instruction that you have and click Open.

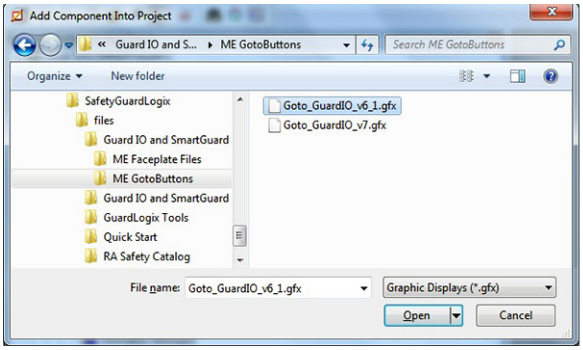
   Choose the generic safety instruction bitmap if none of the other instruction bitmaps match your application.

4. Add the Goto Displays by right-clicking Display and choosing Add Component into Application.

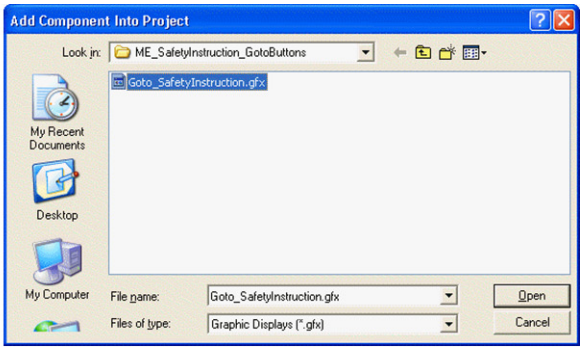


5. Browse to the appropriate faceplate files on the toolkit DVD and open the desired folder:

For these	Browse to
Guard I/O Goto Button Display	C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\ Guard I/O and SmartGuard Faceplate File\ME_GotoButtons
Safety Instruction Goto Button Display	C:\Program Files\RA_Simplification\SafetyGuardLogix\Files\Safety Instruction Faceplate Files\ME_SafetyInstruction_GotoButtons



or

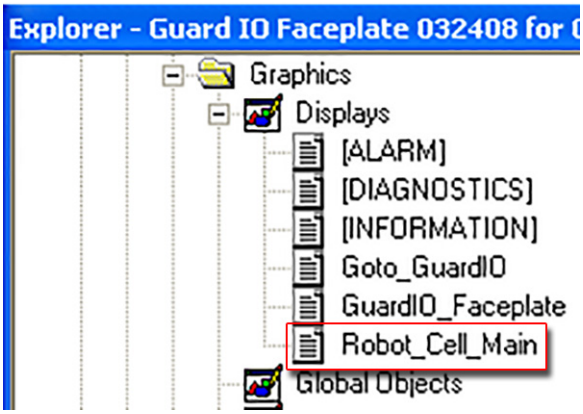


6. Select the desired '.gfx' file and click Open.

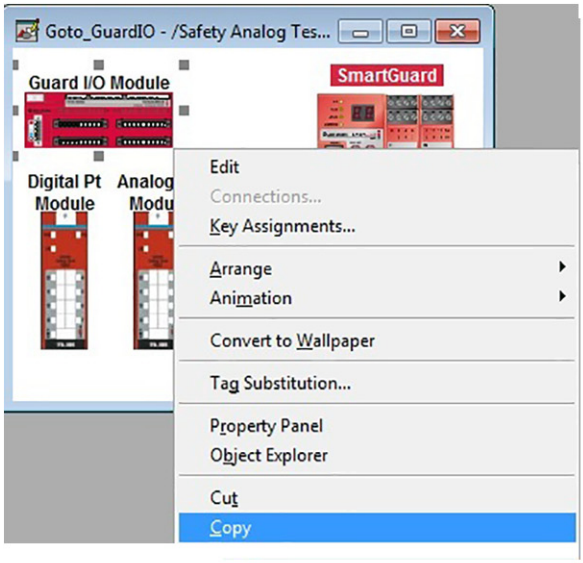
   The selected display appears under Displays in your application.

7. Create a new Display or open your existing system display.

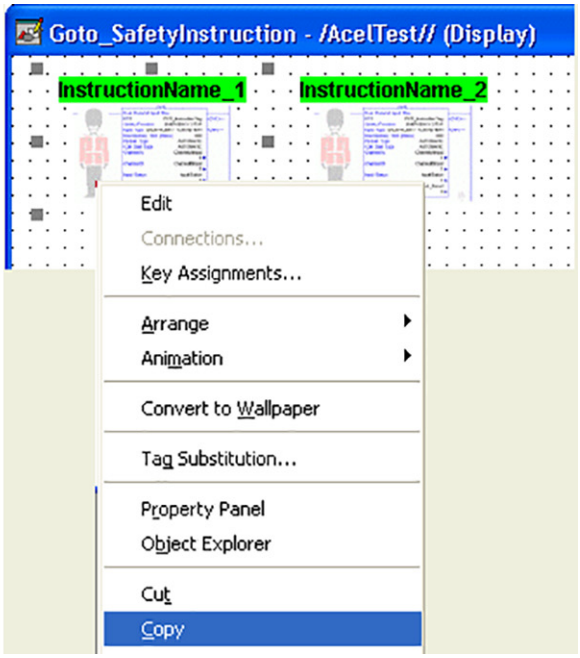
   This example shows a new display named Robot_Cell_Main.



8. Open the Goto_SafetyInstruction or Goto_GuardIO display and copy your desired GotoDisplay button objects.

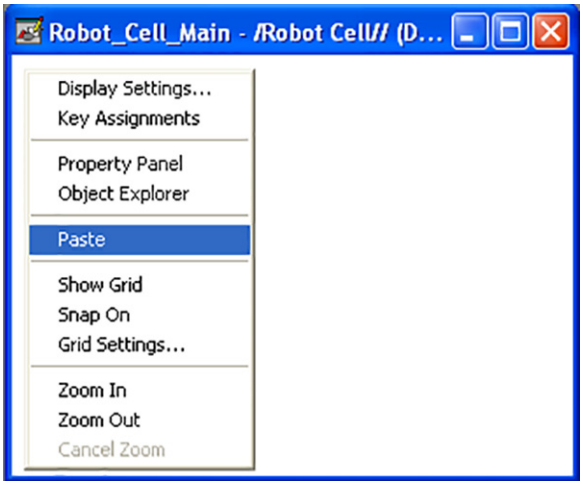


or



Copy InstructionName2 if you are using the CBIM, CPM, CBSSM, or CBCM instructions.

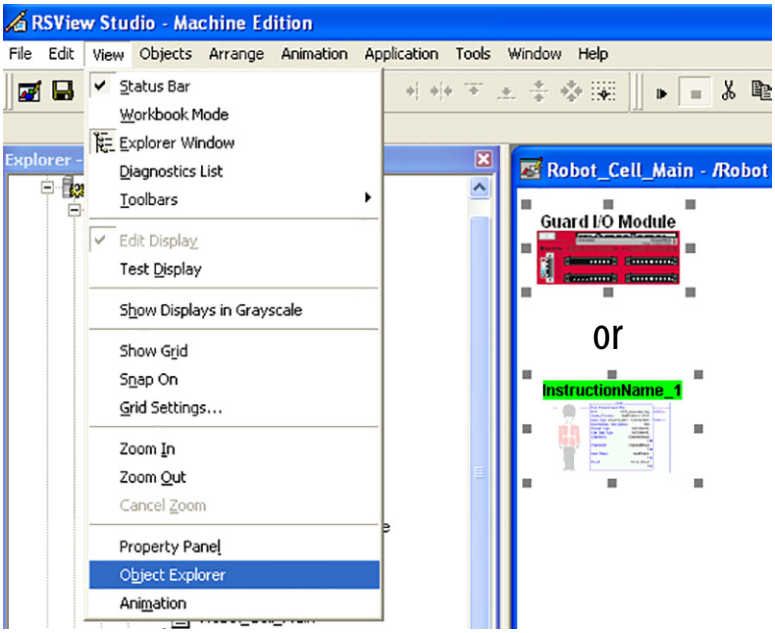
9. Open your system display.
10. Right-click Display and choose Paste.



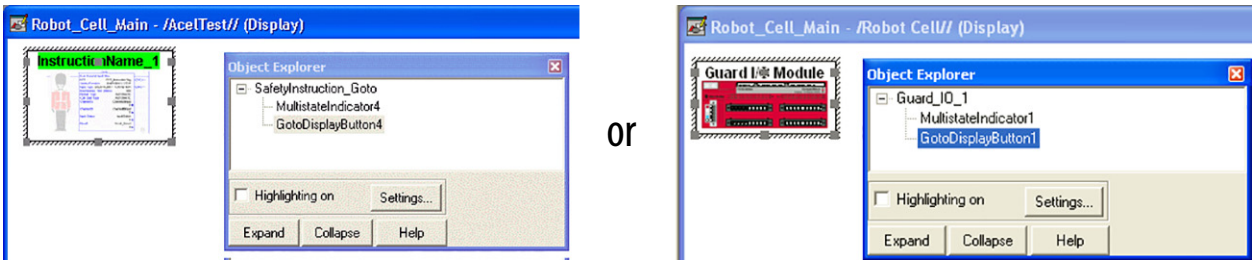
11. Repeat steps 8...10 for each safety instruction, Guard I/O, or SmartGuard module in your application.

Associate Each Button to a Faceplate and Parameter File

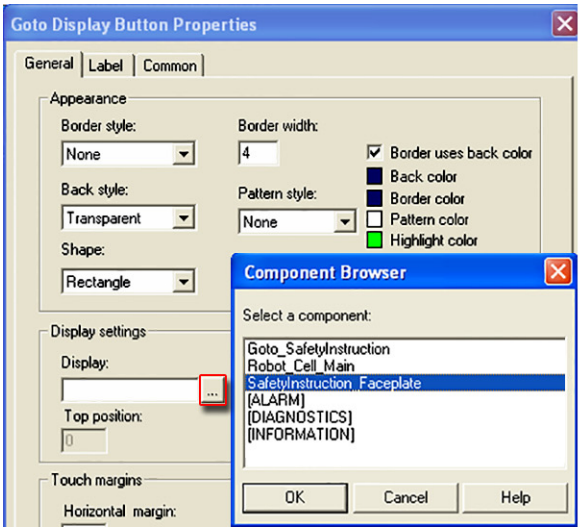
1. Click the copied Goto Display button and select View>Object Explorer.



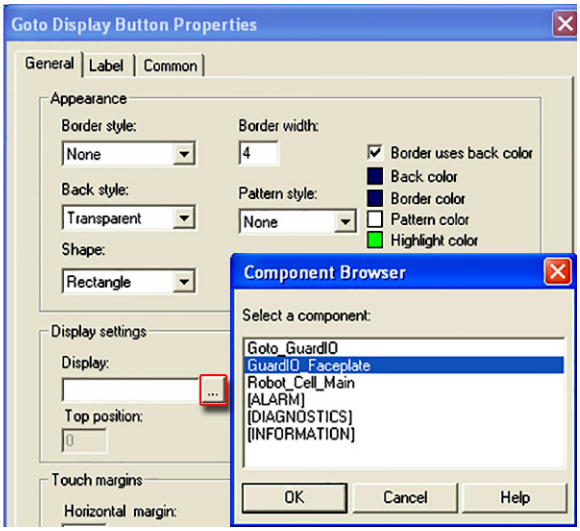
2. In the Object Explorer, double-click the Goto Display button to open the Goto Display Button Properties dialog.



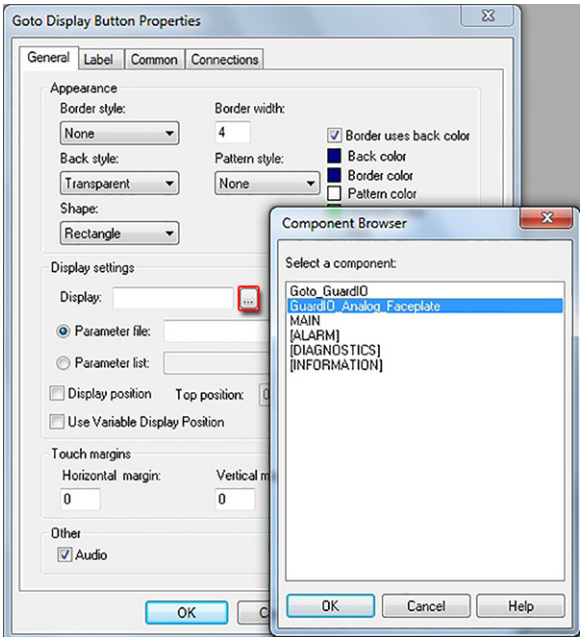
3. On the General tab, click ... next to the Display field.
4. In the Component Browser display box, select the desired faceplate display and click OK.



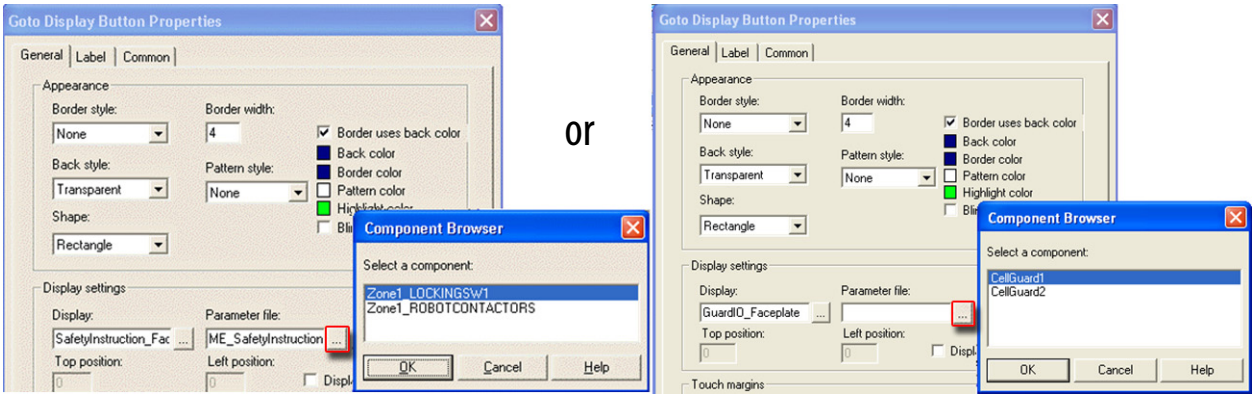
or



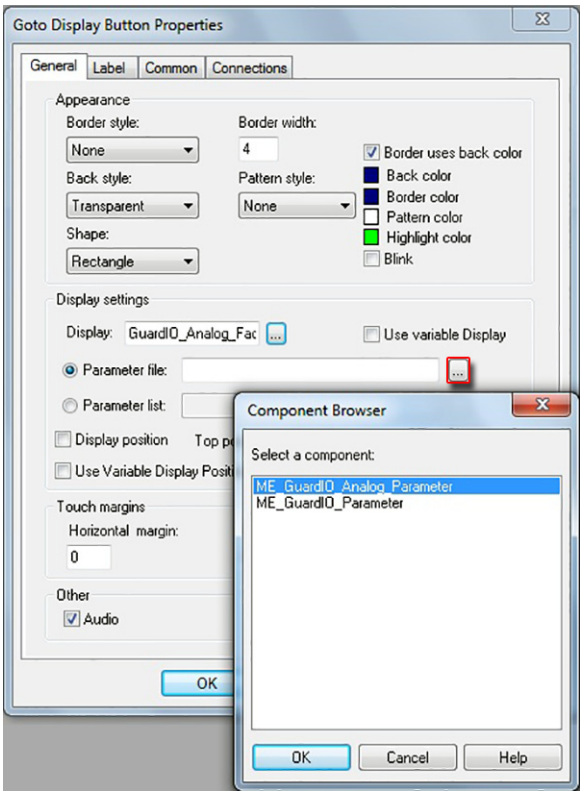
or



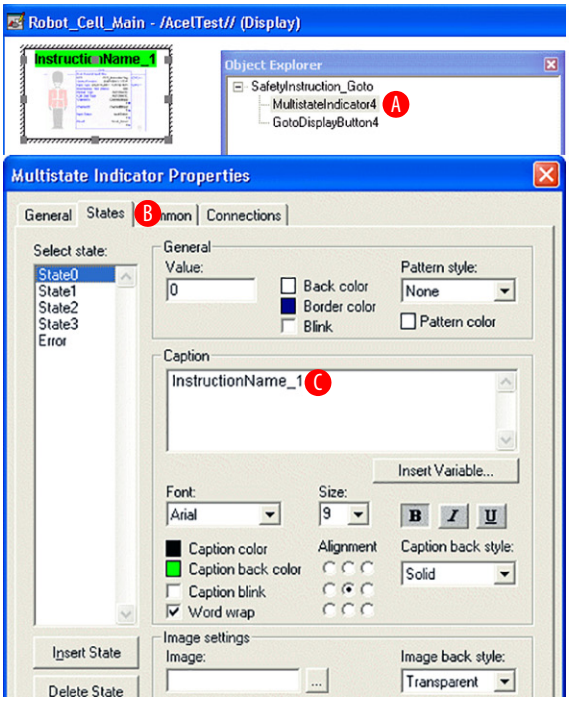
5. Click ... next to the Parameter file field.
6. Select the associated parameter file and click OK.



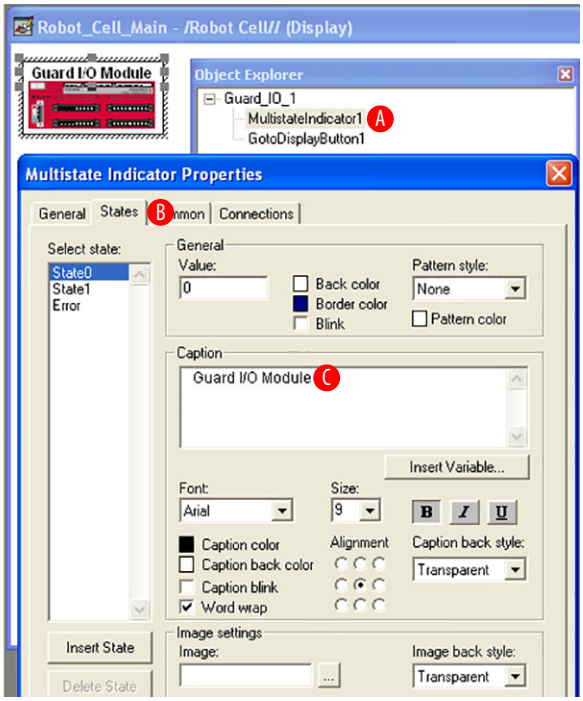
or



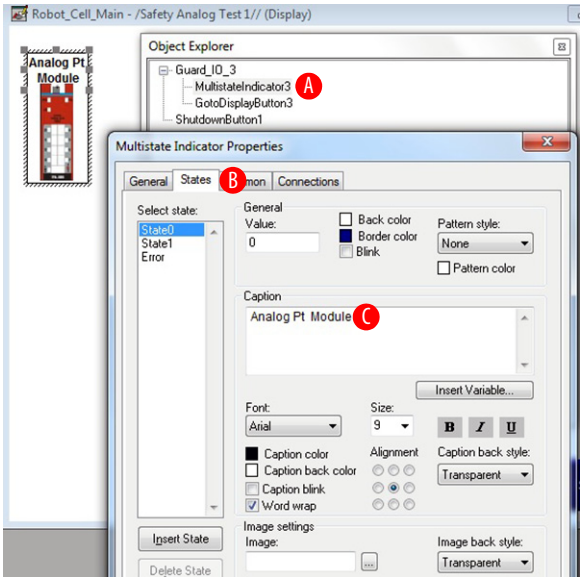
7. To rename the Goto Display buttons, double-click the MultistateIndicator object in the Object Explorer (A).
8. Select the States tab on the Multistate Indicator Properties dialog (B).



or

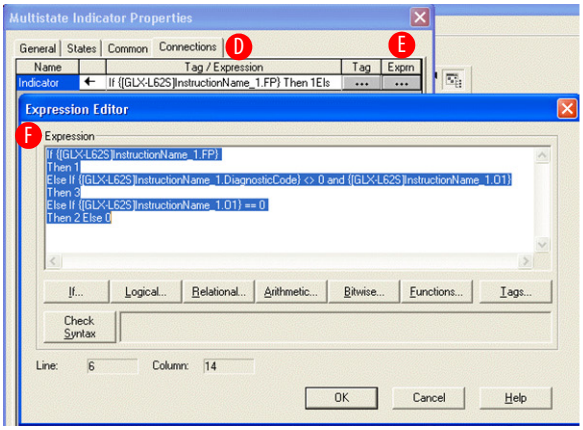


or



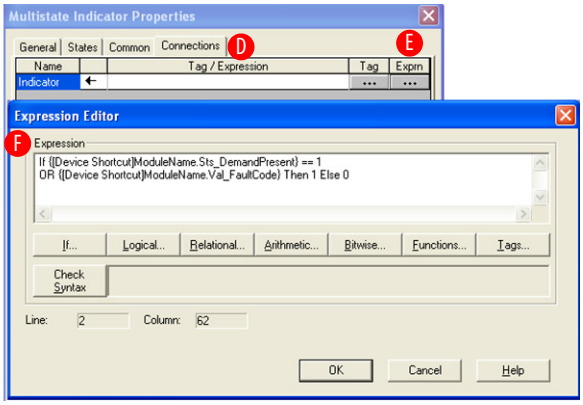
9. To assign the Expression for the blinking MultistateIndicator object Caption, select the Connections tab on the Multistate Indicator Properties dialog (D).
10. Click Exprn (E).
11. Create the Expression (F) as shown:
    - Replace InstructionName_1 with the name of the instruction or
    - Replace ModuleName with the name of the Guard I/O module that this Goto Display button object represents or
    - Replace ModuleName with the name of the Analog Module's GuardIO_Analog_AOI_Safety instance tag name, typically ModuleName_S.

Safety Instruction Expression



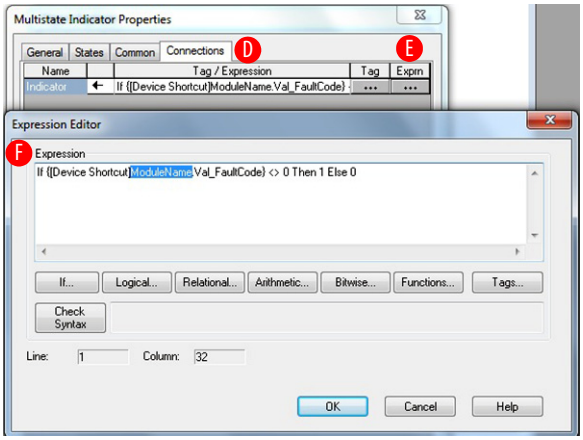
or

Guard I/O Expression



or

Analog Guard Input Expression



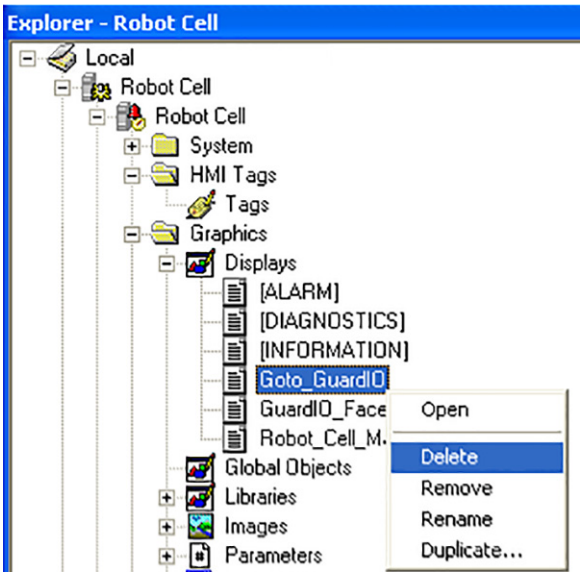
12. Replace the *Device Shortcut* with the Device Shortcut name you configured in this FactoryTalk View ME application for your GuardLogix controller.

    This expression causes the caption to blink when a demand or fault code is present on the module.

13. Repeat steps 1...12 for each Goto Display button you require.

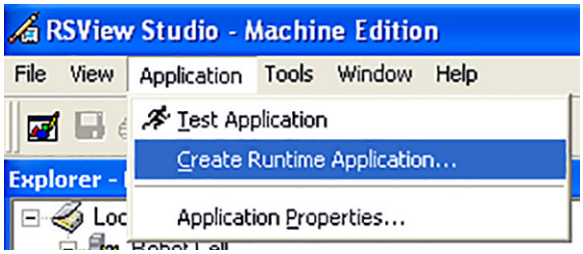
    See Chapter 6, Safety System Application Guide, which illustrates a System Display with two Goto Display buttons, one for each of the Guard I/O modules in that system.

14. When you have copied all the objects you need for your display, you can delete the Goto Display file from your application by right-clicking the file and choosing Delete.



Create a Runtime File

Create a runtime file to test and download your FactoryTalk View ME application by choosing Application>Create Runtime Application.



Notes:

Safety System Application Guide

Introduction

This chapter guides you through the pre-configured FactoryTalk® View ME Guard I/O™ Faceplate that interfaces with the pre-configured GuardLogix® Guard I/O and Guard I/O Safety Add-On Instructions, SmartGuard™ 600 Add-On Instructions, and Safety Device Routines. It also provides information about the Safety Instruction Faceplate. You will be guided through the faceplate views, which provide the information you need to monitor your safety system and quickly diagnose, take action, and restart your system.

Before You Begin

Complete both the Logix and FactoryTalk View ME software integration of your safety system, including download and test.

What You Need

- Hardware installation and wiring complete with power applied
- Logic application file downloaded to your 1756 GuardLogix, 1768 Compact GuardLogix, or 5370 Compact GuardLogix controllers, or your SmartGuard 600 controller
- Controllers are set to Run mode
- FactoryTalk View ME runtime application file downloaded to the PanelView™ Plus terminal with Run Application activated on the terminal

Follow These Steps

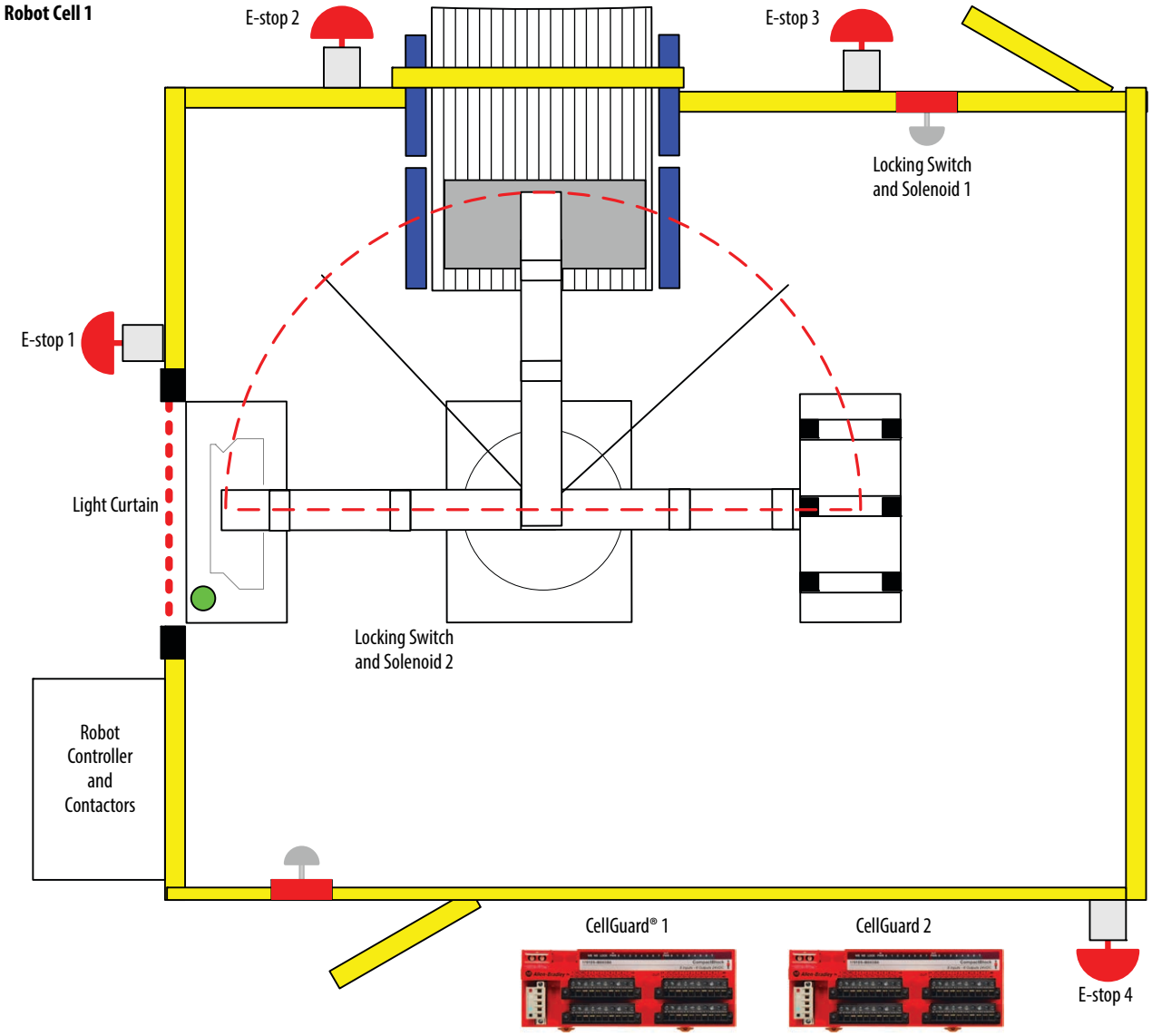
Complete these display overview steps to run the pre-configured safety logic and faceplates to gain an understanding of how to use these tools in your specific application.

Launching Your Faceplates from Your System Overview Display

Although your system overview display is unique to your specific application, you may use the Goto Display buttons provided in this toolkit to launch the faceplates. Our simplified robot cell application example includes a main display that shows the layout of the safety devices in the system along with the CellGuard1 and CellGuard2 Goto Display buttons.

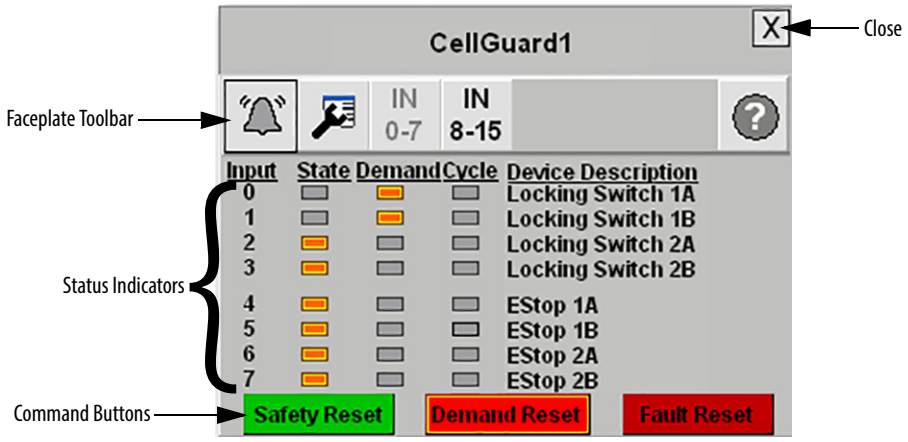
Safety System Overview Display

The Goto Display buttons provided in the toolkit include a multi-state indicator text object to which you may have assigned a tag to provide status of whether the assigned Guard I/O module has faulted or has a demand on one of the inputs. The display below illustrates that the CellGuard1 module is in a faulted or demand state (red indicator text) and the CellGuard2 module is in a normal state.



To access the CellGuard1 module's status and diagnostic faceplate, simply press the CellGuard1 Goto Display button.

Digital Guard I/O Module Faceplate Overview



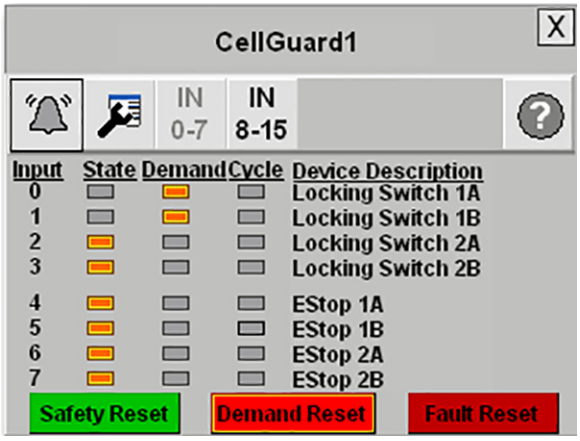
The faceplate toolbar includes these buttons:

- The **Alarm** button indicates a Guard I/O module fault condition and activates the Error Content view. A black bell indicates normal status, with no faults. A yellow-black flashing bell indicates a fault condition.
- The **Configuration** button lets you edit the Guard I/O faceplate name or Device Descriptions.
- The **Input/Output Selector** buttons let you select which view is shown.
- The **Help** button let you select Help information for the view.

To close the faceplate, click the Close button in the upper right corner of the display.

Digital Guard I/O Module Faceplate Input Status View – Demand Indication

This Guard I/O faceplate view illustrates a 16-point Guard I/O module's 0...7 input channel status. The IN 0-7 button is lighter to confirm this view. The faceplate provides State, Demand, and Cycle indication for each input.



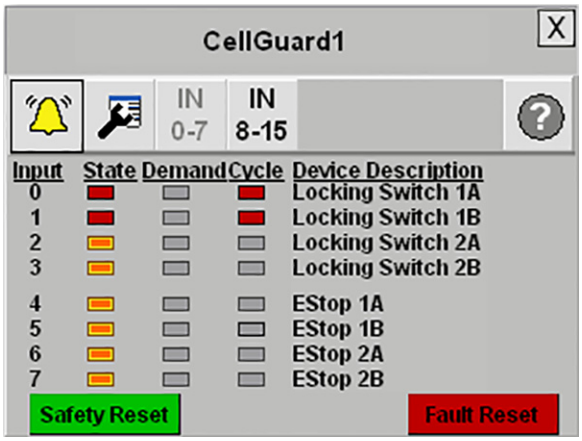
Indicator	Color	Description	Action Required
State	Gray	De-energized (OFF)	None
	Orange	Energized (ON)	None
	Red	Faulted	Clear the Input/Output (device) fault.
Demand	Gray	No Demand on input	None
	Orange	Input in Demand(1)	Set inputs (devices) to active state, if necessary. Press Demand Reset.

(1) A high-to-low transition of the input causes a demand.

This Guard I/O faceplate view illustrates two locking switches and two E-stop buttons with two channels each (A and B). Locking switch 1A and 1B indicators are gray, indicating that both inputs are de-energized (OFF), but are in Demand (orange Demand indicators). This initiates a stop action on the Robot_Cell safety outputs. All other locking switch and E-stop indicators show that the associated inputs are energized (State indicators are orange) and not in Demand (demand indicators are gray). This condition requires the operator to set indicated inputs to active state (close locking switch), press the Demand Reset button on the faceplate.

Digital Guard I/O Module Faceplate Input Status View – Fault Indication

This Guard I/O faceplate view illustrates a fault of locking switch 1A and 1B inputs. When inputs or outputs are in a fault state, both the State and Cycle indicators for that input are red. The Alarm button on the toolbar flashes yellow-black. This condition typically requires the operator to correct the input or output fault, cycle the input or output, and press Fault Reset to reset the associated safety instruction. Finally, the operator must press the Safety Reset button to reset the safety module's and zone's safety logic.

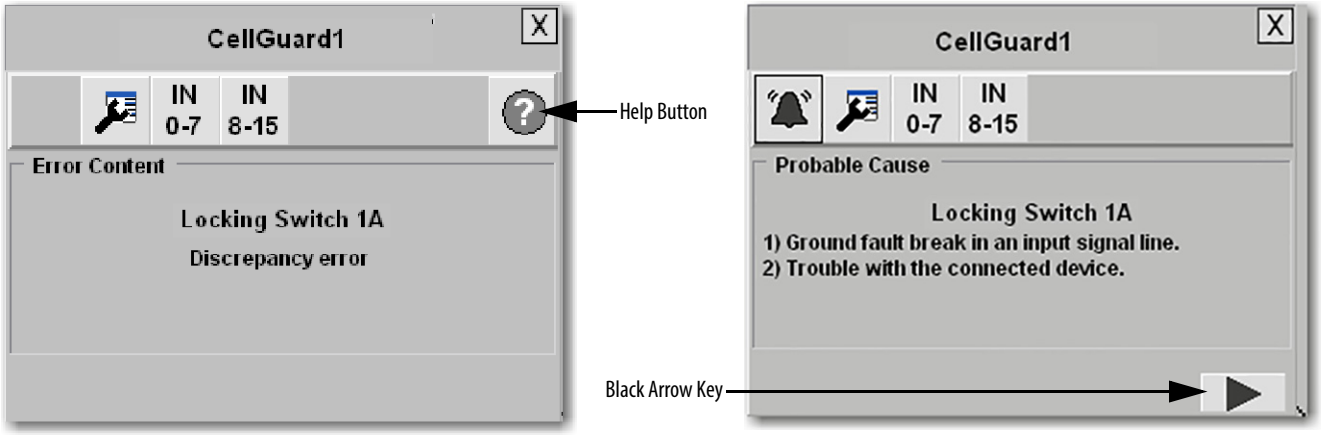


Indicator	Color	Description	Action Required
State	Gray	De-energized (OFF)	None
	Orange	Energized (ON)	None
	Red	Faulted	Clear the Input/Output (device) fault.
Cycle	Gray	Input/Output not faulted.	None
	Red	Input/Output faulted.	Clear the Input/Output (device) fault. Cycle Input/Output. Press Fault Reset. Press Safety Reset.

To access the specific Fault/Error information and Recommended actions, press the Alarm button on the toolbar.

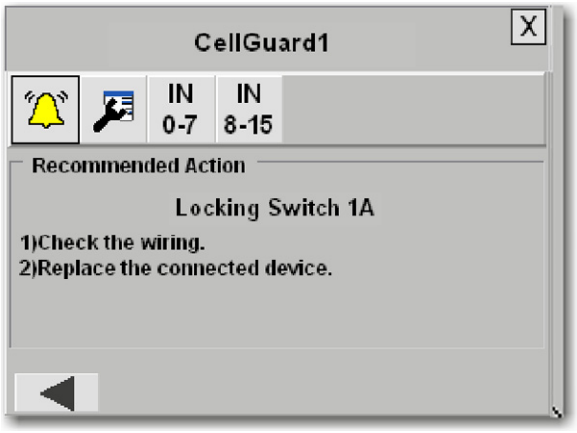
Error Content, Probable Cause, and Recommended Actions

When you press the Alarm button on the toolbar, the Error Content view is displayed, indicating the specific error being reported by the module.



To access the probable cause of the reported error, press the Help button on the toolbar. For further diagnostic help, press the black arrow key at the bottom of the view to access Recommended Action information.

This diagnostic information is triggered by the reported module error code. The input and output error code information provided is in accordance with the Guard I/O and SmartGuard I/O information represented in the tables on the following page.

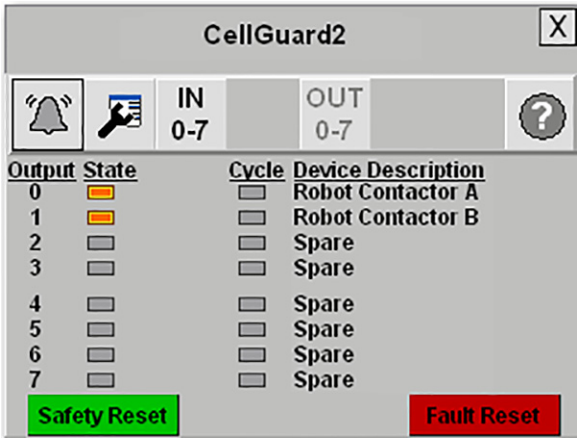


Code (hex)	Error Content	Probable Cause	Recommended Action
01	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02	External test signal error	1. The power source (positive side) is in contact with the input signal line. 2. Short-circuit between input signal lines. 3. Trouble with the connected device.	1. Check the wiring. 2. Replace the connected device.
03	Internal input error	Trouble with the internal circuit.	Replace the module.
04	Discrepancy error	1. Ground fault or break in an input signal line. 2. Trouble with the connected device.	1. Check the wiring. 2. Replace the connected device.
05	Error in the other dual channel input	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.

Code (hex)	Error Content	Probable Cause	Recommended Action
01	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02	Over current detected	Trouble with the connected device.	Replace the connected device.
03	Short-circuit detected	Ground fault of the output signal line.	Check the wiring.
04	Output ON error	1. The power source (positive side) is in contact with the output signal line. 2. Trouble with the internal circuit.	1. Check the wiring. 2. Replace the module.
05	Error in the other dual channel output	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.
06	Internal-relay output circuit error	Trouble with the internal circuit (1791DS-IB4X0W4 module only).	Replace the module.
07	Relay error	Trouble with the relay (1791DS-IB4X0W4 module only).	Replace the relay.
08	Output data error	Wrong setting for output data.	Check the program.
09	Short-circuit detected in output	Short-circuit between output signal lines.	Check the wiring.

Digital Guard I/O Module Faceplate Output Status View

The Guard I/O Faceplate Output Status view operates identically to the Input Status view except it does not have Demand associated with it.



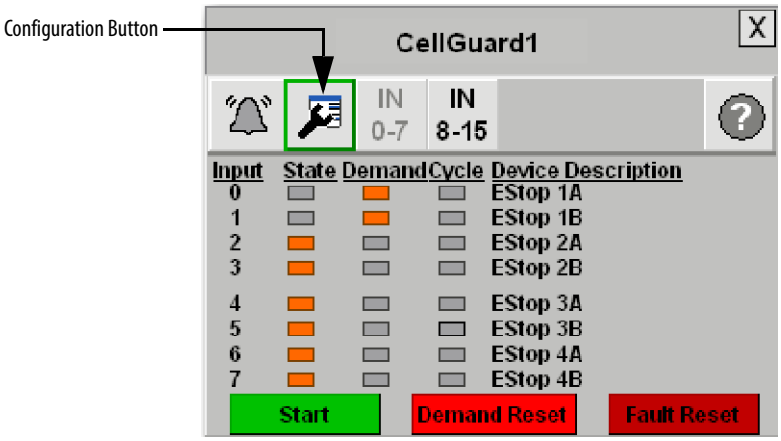
The following table provides the indicator descriptions, color codes, and required actions.

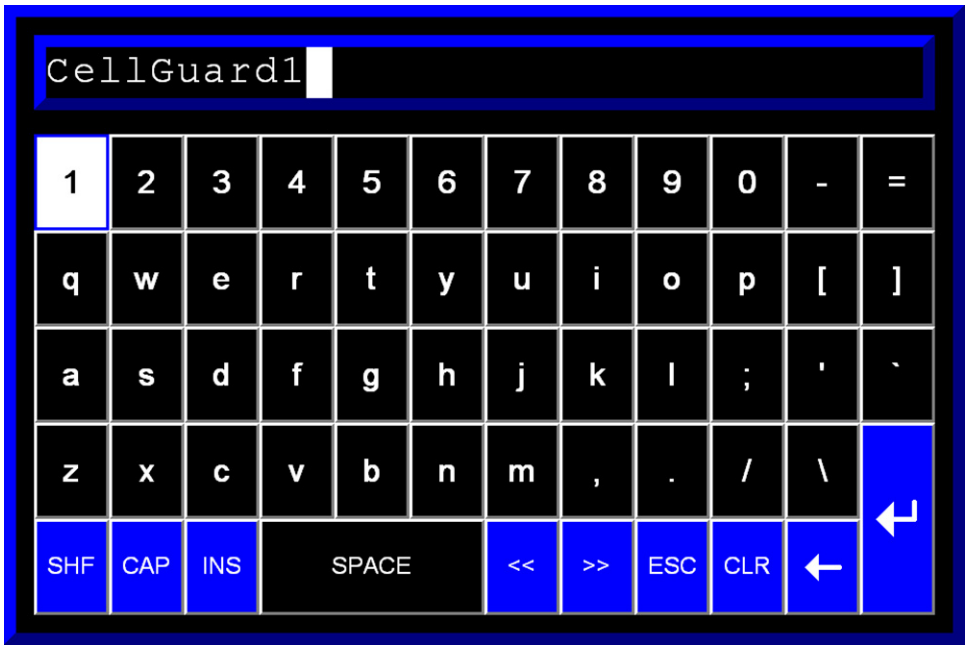
Indicator	Color	Description	Action Required
State	Gray	De-energized (OFF)	None
	Orange	Energized (ON)	None
	Red	Faulted	Clear the Input/Output (device) fault.
Cycle	Gray	Input/Output not faulted.	None
	Red	Input/Output faulted.	Clear the Input/Output (device) fault. Cycle Input/Output. Press Fault Reset. Press Safety Reset.

Digital Guard I/O Module Faceplate – Online Configuration Options

The Guard I/O Faceplate lets you modify the Faceplate Titles and Device Descriptions specific to your application. Follow these steps to modify this information.

1. Press the Configuration button on the toolbar so that the button border is highlighted.





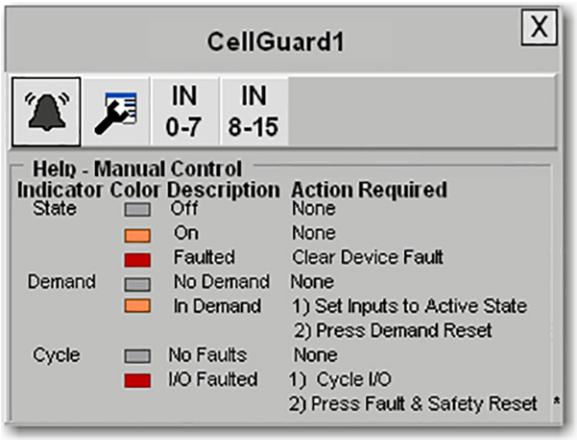
2. Then press the title or device description you desire to update.

   The popup keyboard appears.

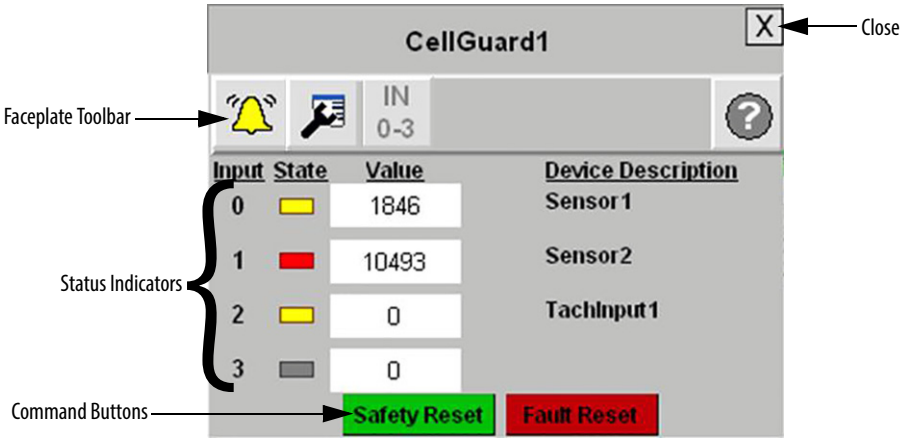
3. Type the desired text and press Enter.

Digital Guard I/O Module Faceplate – Online Help Options

Press the Help button on any view to access help information.



Analog Guard I/O Faceplate Overview



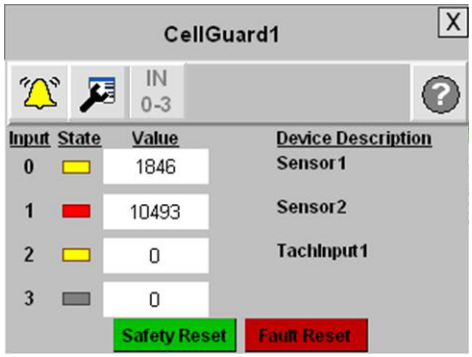
The faceplate toolbar includes these buttons:

- The **Alarm** button indicates a Analog Guard I/O module fault condition and activates the Error Content view. A black bell indicates normal status, with no faults. A yellow-black flashing bell indicates a fault condition.
- The **Configuration** button lets you edit the Analog Guard I/O faceplate name or Device Descriptions.
- The **Input/Output Selector** buttons let you select which view is shown.
- The **Help** button let you select Help information for the view.

To close the faceplate, click the Close button in the upper right corner of the display.

Analog Guard I/O Module Faceplate Input Status View – Fault Indication

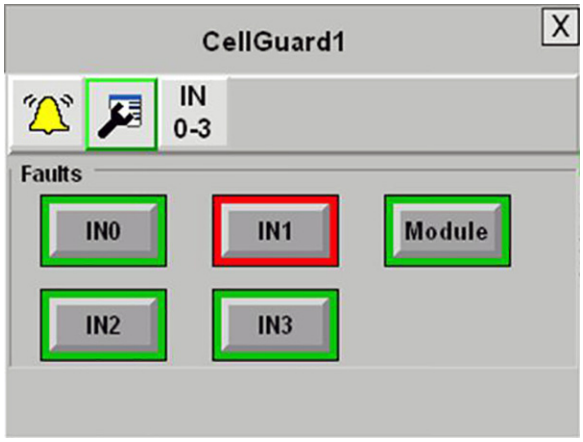
This Analog Guard I/O faceplate view illustrates a fault of analog Sensor 2 input. When inputs are in a fault state the state indicator for that input is red. The Alarm button on the toolbar flashes yellow-black. This condition typically requires the operator to correct the input fault, press the Fault Reset button to reset the associated safety instruction and press the Safety Reset button to reset the safety module's and zone's safety logic.



Indicator Color	Description		Action Required
State	Gray	Non-Used	None
	Orange	Operational	None
	Red	Faulted	Clear the input (device) fault

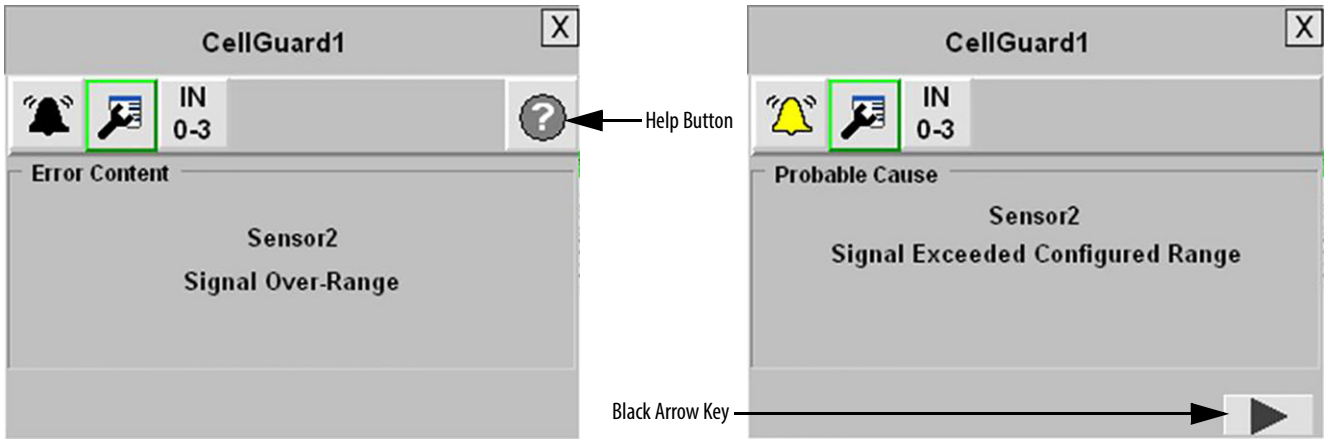
To access the specific Fault/Error Channel and Module information, press the Alarm button on the toolbar.

This Channel and Module fault view illustrates a fault of analog input Channel 1. When channel inputs or module are in a fault state the border of the indicators are red. The Alarm button on the toolbar flashes yellow-black. To access the specific input channel or module faults, press the input or module buttons.



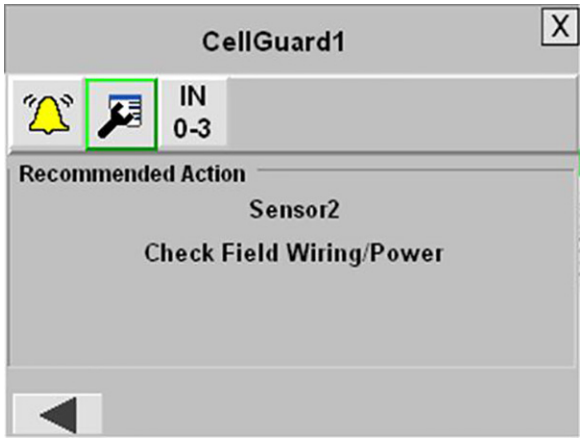
Error Content, Probable Cause, and Recommended Actions

When you press the Alarm button on the toolbar, the Error Content view is displayed, indicating the specific error being reported by the input or module.



To access the probable cause of the reported error, press the Help button on the toolbar. For further diagnostic help, press the black arrow key at the bottom of the view to access Recommended Action information.

This diagnostic information is triggered by the reported module error code. The input and module error code information provided is in accordance with the Analog Guard I/O information represented in the following table.

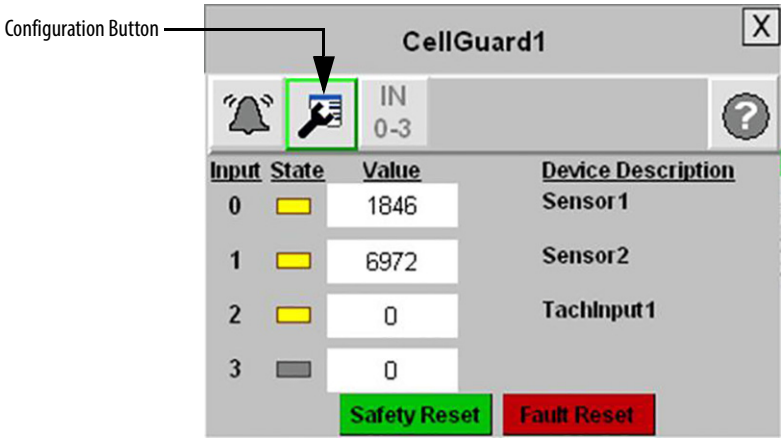


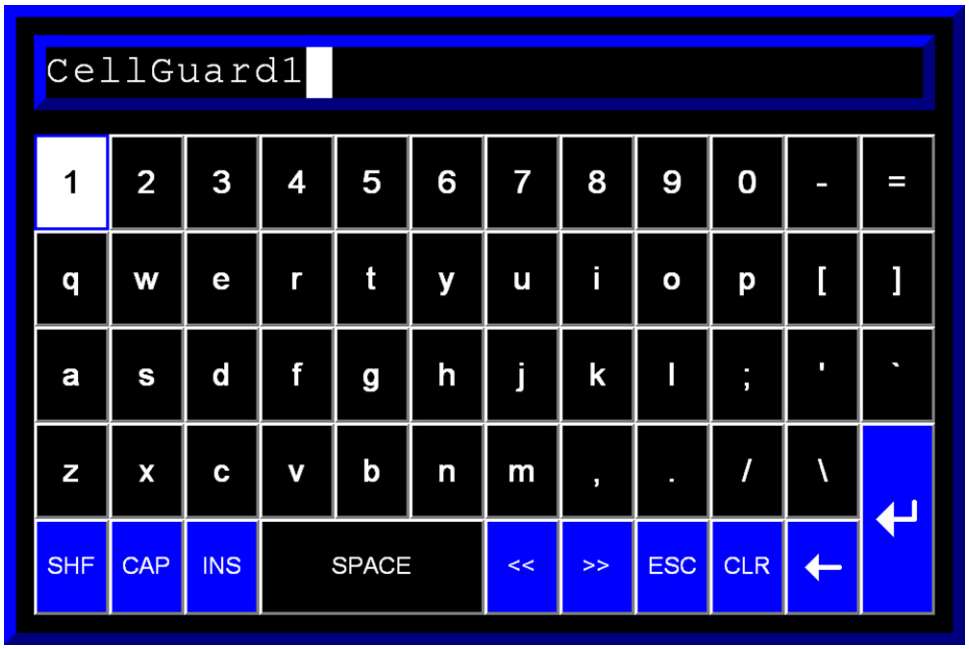
Code (hex)	Error Content	Probable Cause	Recommended Action
00	Reserved		
01	No error		
02	Signal over-range	Signal Exceeded Configured Range	Check Field Wiring/Power
03	Signal under-range	Signal Below Configured Range	Check Field Wiring/Power
04	Signal test failure	Undefined Error for IE4S	If Problem Persists, Replace Module
05	Dual-channel discrepancy	Exceeded Tolerance Between Dual Channels	Check Field Sensors to for Discrepancy
06	Error in the other dual-channel input	Partner Channel Faulted	Troubleshoot Partner Channel Fault
08	Reserved		
100	Sensor supply overcurrent	Exceeded Specification	Check Field Wiring/Sensor Power Draw
101	Sensor supply undercurrent	Too Little Current Drawn from Sensor Power	Check Field Wiring/Sensor Power Draw
102	ADC or CPU Timing Fault	ADC Missed a Clock, Failed a Sync or Watchdog	If Problem Persists, Replace Module
103	3.3V undervoltage	3.3V Supply Voltage was Detected Too Low	If Problem Persists, Replace Module
104	3.3V overvoltage	3.3V Supply Voltage was Detected Too High	If Problem Persists, Replace Module
105	CPU fault	ADC Failed Register, Instruction, or Flag Diag	If Problem Persists, Replace Module
106	Flash fault	FLASH Test Detected Bit Errors	If Problem Persists, Replace Module
107	RAM fault	RAM Test Detected Bit Errors	If Problem Persists, Replace Module
108	Single-channel discrepancy	Dual Measurements of Single Channel Disagree	If Problem Persists, Replace Module
109	Tach Dual Low	Both Channels LOW at the Same Time	Check Sensor Signal Timing
110	Undefined error		If Problem Persists, Replace Module
111	Flash enable fault	ADC's FLASH Memory Drawing Too Much Current	If Problem Persists, Replace Module
112	Serial pattern fault	Serial Communication Pattern Errors Detected	Check Field Wiring for Proper Grounding/Shielding. Verify that Temperature Within Enclosure is not Excessive. If Problem Persists, Replace Module
113	Channel uniqueness fault	Pulse Testing Revealed Improper Channel	If Problem Persists, Replace Module
114	Watchdog fault	ADC Watchdog Timed Out	If Problem Persists, Replace Module
115	Sync timeout fault	ADC Conversion Out of Sync	If Problem Persists, Replace Module
116	Missing clock fault	ADC Detected a Missing Clock	If Problem Persists, Replace Module
117	SCI Tx fault	Serial Communication Bit Errors Detected	Check Field Wiring for Proper Grounding/Shielding. Verify that Temperature Within Enclosure is not Excessive.
118	ADC fault	ADC Test Pattern Failure	If Problem Persists, Replace Module
119	ADC neighbor 1.8V fault	ADC Detected Out-of-Range Voltage on its Partner	If Problem Persists, Replace Module
120	ADC channel configuration mismatch	Dual ADCs are Not Configured the Same	If Problem Persists, Replace Module
121	SPI sequence number mismatch	Serial Comm State Machines are Out of Sync	If Problem Persists, Replace Module
122	Runtime 3.3V over-under-voltage error	3.3V Supply Voltage was Too High or Too Low	If Problem Persists, Replace Module
123	Reserved		
124	Reserved		
125	Field I/O power is missing	24V Power is not Within Specification	Check Field Power Supply and Wiring
126	Startup 3.3V over-under-voltage error	OV-UV Detector Failed Startup Test	If Problem Persists, Replace Module
127	Sensor power/input wiring error	Sensor Power to Input Signal Violation Detected	Check Field Wiring

Analog Guard I/O Module Faceplate – Online Configuration Options

The Analog Guard I/O Faceplate lets you modify the Faceplate Titles and Device Descriptions specific to your application. Follow these steps to modify this information.

1. Press the Configuration button on the toolbar so that the button border is highlighted.





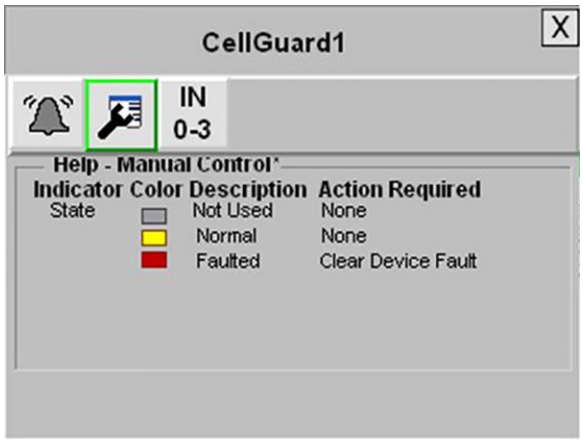
2. Then press the title or device description you desire to update.

   The popup keyboard appears.

3. Type the desired text and press Enter.

Analog Guard I/O Module Faceplate – Online Help Options

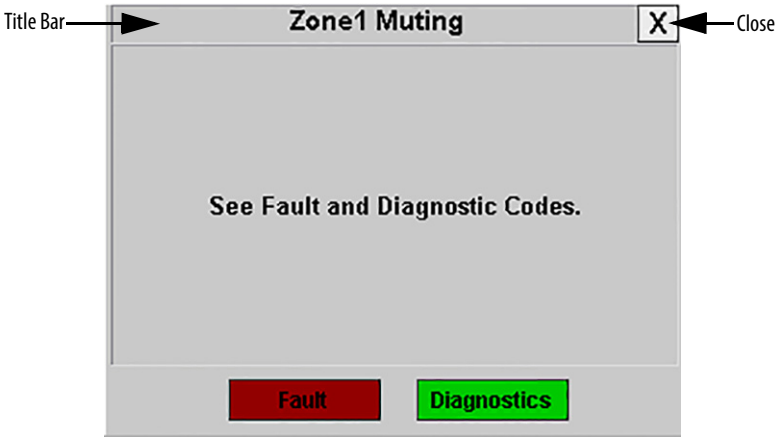
Press  on any view to access help information.



Safety Instruction Faceplate Overview

Safety instruction faceplates are used only with GuardLogix controllers.

The faceplate includes these buttons:



- The **Fault** button launches the fault Probable Cause and Recommended Actions views.
- The **Diagnostics** button launches the diagnostic Probable Cause and Recommended Actions views.

To rename the faceplate, click in the title bar, type the new name by using the popup keyboard, and press Enter.

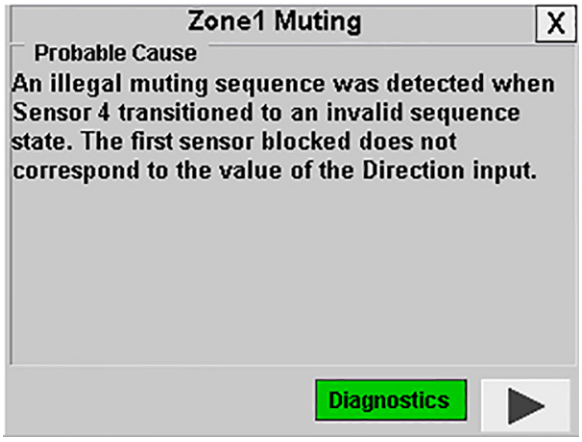
To close the faceplate, click the Close button in the upper right corner of the display.

The GuardLogix Safety Application Instruction Set Safety Reference Manual, publication 1756-RM095, provides error code and diagnostic information for safety application instructions.

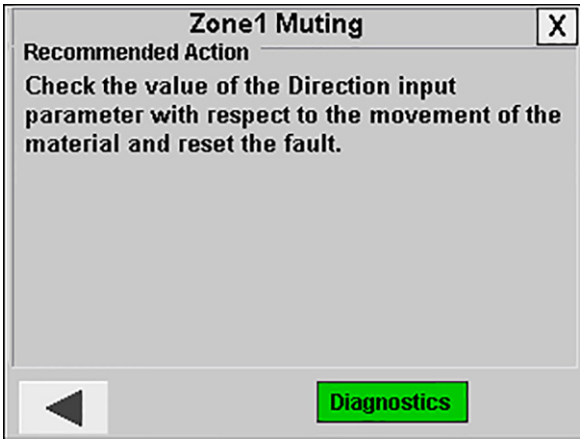
Safety Instruction Faceplate – Fault Views

The Probable Cause view explains the likely cause of the fault. Click the arrow to move to the Recommended Actions view.

Probable Cause View



Recommended Action View

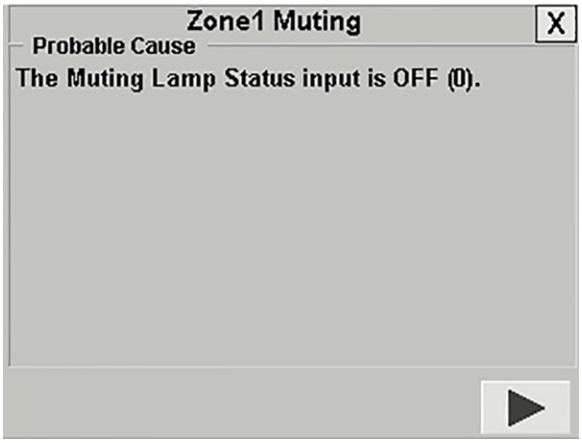


The Recommended Actions view shows a possible solution for the problem. Click the arrow to return to the Probable Cause view.

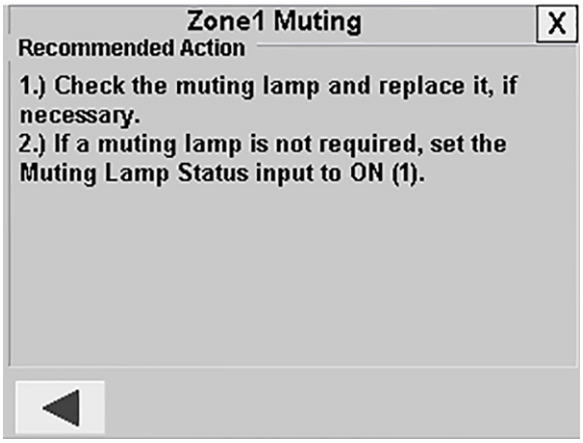
Safety Instruction Faceplate – Diagnostic Views

The Probable Cause view explains the diagnostic. Click the arrow to move to the Recommended Actions view.

Probable Cause View



Recommended Action View



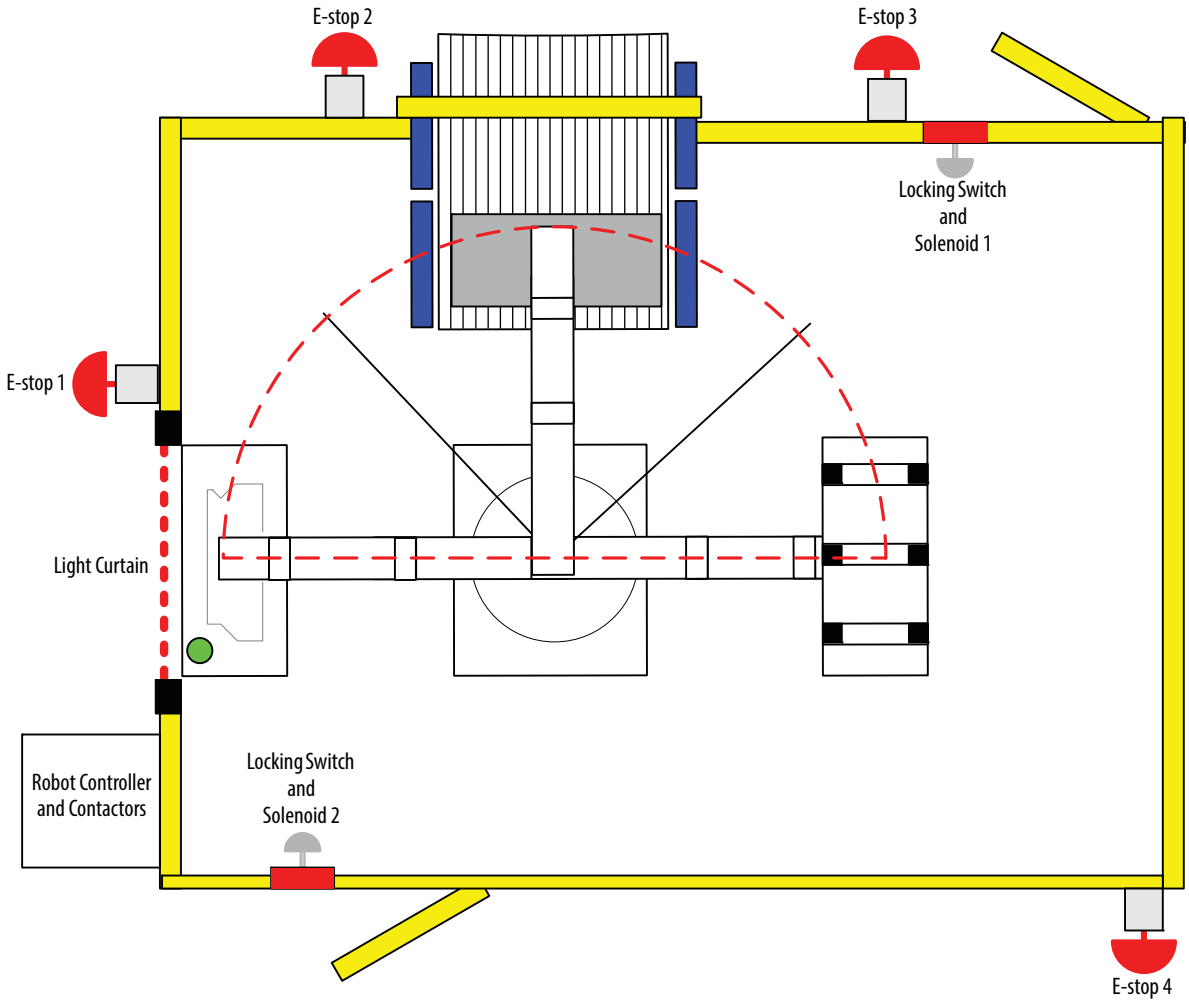
The Recommended Actions view provides steps for clearing the diagnostic. Click the arrow to return to the Probable Cause view.

Notes:

Robot Cell Application Example with GuardLogix® or SmartGuard™ 600 Controller

Introduction

As hardware selection is dependent upon specific application requirements, this quick start references this robot cell guarding application example to guide you through the hardware selection, Logix integration, and FactoryTalk® View ME integration steps in this quick start.



The safety zone in this example is comprised of these guarding devices (inputs): four E-stop buttons, two locking switch/solenoid devices, and a light curtain. The zone features two safety contactors (outputs) for powering the robot control. Communication with the Guard I/O™ modules is over an EtherNet/IP network.

Robot Cell Module and Safety Zone Configuration

The example has one safety zone that could be configured on a GuardLogix controller with two Guard I/O modules, a 1791ES-IB16 and 1791ES-IB8XOBV4, or it could be configured on a SmartGuard 600 controller with local I/O. The following worksheets illustrate how the Zone and Guard I/O modules or the SmartGuard 600 local I/O could be configured.

GuardLogix System Safety Zone Configuration Worksheet

Zone Name	Zone1

Zone Modules & Tags	Name
Safety Module 1	CellGuard1
Safety Module 2	CellGuard2
Safety Module 3	
Safety Module 4	
Safety Module 5	
Safety Module 6	
Standard I/O Fault Reset Tag	
Standard HMI Fault Reset Tag	{#1.Cmd_FaultReset}
Safety Fault Reset Tag	Cmd_Zone1_FaultReset
Standard I/O Safety Reset Tag	
Standard HMI Safety Reset Tag	{#1.Cmd_SafetyReset}
Safety Safety Reset Tag	Cmd_Zone1_SafetyReset
Inputs OK Tag	Sts_Zone1_InputsOK

SmartGuard 600 System Zone Configuration Worksheet

Zone Name	Zone1

Zone Modules & Tags	Name
Safety Module 1	SmartGuard
Safety Module 2	
Safety Module 3	
Safety Module 4	
Safety Module 5	
Safety Module 6	
Standard I/O Fault Reset Tag	
Standard HMI Fault Reset Tag	{#1.Cmd_FaultReset}
Safety Fault Reset Tag	Cmd_SmartGuard_FaultReset
Standard I/O Safety Reset Tag	
Standard HMI Safety Reset Tag	{#1.Cmd_SafetyReset}
Safety Safety Reset Tag	Cmd_SmartGuard_SafetyReset
Inputs OK Tag	Sts_SmartGuard_InputsOK

The completed worksheet for the 1791ES-IB16 module is shown below.

GuardLogix Guard IO Configuration Worksheet

Zone Name	Module Name	Module Cat No./ Safety Category
Zone1	CellGuard1	1791ES-IB16/CAT 4

Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00	LOCKINGSW1		Locking Switch	CellGuard1:I.Pt00Data	Sts_Zone1_LOCKINGSW1InputOK
Input 01			Locking Switch	CellGuard1:I.Pt01Data	Sts_Zone1_LOCKINGSW1InputOK
Input 02	LOCKINGSW2		Locking Switch	CellGuard1:I.Pt02Data	Sts_Zone1_LOCKINGSW2InputOK
Input 03			Locking Switch	CellGuard1:I.Pt03Data	Sts_Zone1_LOCKINGSW2InputOK
Input 04	ESTOP1		EStop	CellGuard1:I.Pt04Data	Sts_Zone1_ESTOP1InputOK
Input 05			EStop	CellGuard1:I.Pt05Data	Sts_Zone1_ESTOP1InputOK
Input 06	ESTOP2		EStop	CellGuard1:I.Pt06Data	Sts_Zone1_ESTOP2InputOK
Input 07			EStop	CellGuard1:I.Pt07Data	Sts_Zone1_ESTOP2InputOK
Input 08	ESTOP3		EStop	CellGuard1:I.Pt08Data	Sts_Zone1_ESTOP3InputOK
Input 09			EStop	CellGuard1:I.Pt09Data	Sts_Zone1_ESTOP3InputOK
Input 10	ESTOP4		EStop	CellGuard1:I.Pt10Data	Sts_Zone1_ESTOP4InputOK
Input 11			EStop	CellGuard1:I.Pt11Data	Sts_Zone1_ESTOP4InputOK
Input 12	LC1		Light Curtain	CellGuard1:I.Pt12Data	Sts_Zone1_LC1InputOK
Input 13			Light Curtain	CellGuard1:I.Pt13Data	Sts_Zone1_LC1InputOK
Input 14				CellGuard1:I.Pt14Data	Sts_Zone1_InputOK
Input 15				CellGuard1:I.Pt15Data	Sts_Zone1_InputOK

Test Outputs	Device Name			Test Output Tag Name
Output 00				CellGuard1:O.Test00Data
Output 01				CellGuard1:O.Test01Data
Output 02				CellGuard1:O.Test02Data
Output 03				CellGuard1:O.Test03Data
Output 04				CellGuard1:O.Test04Data
Output 05				CellGuard1:O.Test05Data
Output 06				CellGuard1:O.Test06Data
Output 07				CellGuard1:O.Test07Data
Output 08				CellGuard1:O.Test08Data
Output 09				CellGuard1:O.Test09Data
Output 10				CellGuard1:O.Test10Data
Output 11				CellGuard1:O.Test11Data
Output 12				CellGuard1:O.Test12Data
Output 13				CellGuard1:O.Test13Data
Output 14	LOCKINGSW1SOLENOID			CellGuard1:O.Test14Data
Output 15	LOCKINGSW2SOLENOID			CellGuard1:O.Test15Data

Safety Outputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Output Enable Tag Name	CROUT Tag Name	Output Tag Name
Output 00				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt00Data
Output 01				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt01Data
Output 02				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt02Data
Output 03				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt03Data
Output 04				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt04Data
Output 05				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt05Data
Output 06				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt06Data
Output 07				Cmd_Zone1_OutputEnable	Zone1_	CellGuard1:O.Pt07Data

The completed worksheet for the 1791ES-IB8XOBV4 module is shown below.

Safety Module Configuration Worksheet

Zone Name	Module Name	Module Cat No./Safety Category
Zone1	CellGuard2	1791ES-IB8XOBV4/CAT 4

Safety Inputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Channel Tag Name	Input Interlock Tag Name
Input 00		CONTACTORFB*	Feedback	CellGuard2 :I.Pt00Data	**Not Used
Input 01				[ModuleName]:I.Pt01Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 02				[ModuleName]:I.Pt02Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 03				[ModuleName]:I.Pt03Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 04				[ModuleName]:I.Pt04Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 05				[ModuleName]:I.Pt05Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 06				[ModuleName]:I.Pt06Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 07				[ModuleName]:I.Pt07Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 08				[ModuleName]:I.Pt08Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 09				[ModuleName]:I.Pt09Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 10				[ModuleName]:I.Pt10Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 11				[ModuleName]:I.Pt11Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 12				[ModuleName]:I.Pt12Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 13				[ModuleName]:I.Pt13Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 14				[ModuleName]:I.Pt14Data	Sts_[ZoneName]_[DeviceName].InputOK
Input 15				[ModuleName]:I.Pt15Data	Sts_[ZoneName]_[DeviceName].InputOK

* The auxiliary feedback contacts on both ROBOTCONTACTOR outputs are wired in series to a single safety output.

** Contactor feedback only used in ROUT instruction.

Test Outputs	Device Name			Test Output Tag Name
Output 00				[ModuleName]:O.Test00Data
Output 01				[ModuleName]:O.Test01Data
Output 02				[ModuleName]:O.Test02Data
Output 03				[ModuleName]:O.Test03Data
Output 04				[ModuleName]:O.Test04Data
Output 05				[ModuleName]:O.Test05Data
Output 06				[ModuleName]:O.Test06Data
Output 07				[ModuleName]:O.Test07Data
Output 08				[ModuleName]:O.Test08Data
Output 09				[ModuleName]:O.Test09Data
Output 10				[ModuleName]:O.Test10Data
Output 11				[ModuleName]:O.Test11Data
Output 12				[ModuleName]:O.Test12Data
Output 13				[ModuleName]:O.Test13Data
Output 14				[ModuleName]:O.Test14Data
Output 15				[ModuleName]:O.Test15Data

Safety Outputs	Device Name (If Dual Channel)	Device Name (If Single Channel)	Device Type	Enable Tag Name	ROUT Tag Name	Output Tag Name
Output 00	ROBOTCONTACTOR		Safety Contactor	Cmd_ ZONE1_ OutputEnable	Zone1_ROBOTCONTACTOR	CellGuard2 :O.Pt00Data
Output 01			Safety Contactor	†	‡	CellGuard2 :O.Pt01Data
Output 02				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt02Data
Output 03				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt03Data
Output 04				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt04Data
Output 05				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt05Data
Output 06				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt06Data
Output 07				Cmd_[ZoneName]_OutputEnable	[ZoneName]_[DeviceName]	[ModuleName]:O.Pt07Data

† All safety outputs in the same zone have the same output enable tag name.

‡ Dual contactors for a single device are controlled by a single ROUT instruction.

The completed worksheet for the SmartGuard 600 local I/O is shown below.

SmartGuard 600 Local I/O Configuration Worksheet

Node Number	Module Cat No./ Safety Category
03	CAT 4

Safety Inputs	Device Type	I/O Comment	Channel Tag Name
Input 00	Locking Switch	LOCKINGSW1 ChA	[#03]:(00) [S] LOCKINGSW1 ChA
Input 01	Locking Switch	LOCKINGSW1 ChB	[#03]:(01) [S] LOCKINGSW1 ChB
Input 02	Locking Switch	LOCKINGSW2 ChA	[#03]:(02) [S] LOCKINGSW2 ChA
Input 03	Locking Switch	LOCKINGSW2 ChB	[#03]:(03) [S] LOCKINGSW2 ChB
Input 04	EStop	ESTOP1 ChA	[#03]:(04) [S] ESTOP1 ChA
Input 05	EStop	ESTOP1 ChB	[#03]:(05) [S] ESTOP1 ChB
Input 06	EStop	ESTOP2 ChA	[#03]:(06) [S] ESTOP2 ChA
Input 07	EStop	ESTOP2 ChB	[#03]:(07) [S] ESTOP2 ChB
Input 08	EStop	ESTOP3 ChA	[#03]:(08) [S] ESTOP3 ChA
Input 09	EStop	ESTOP3 ChB	[#03]:(09) [S] ESTOP3 ChB
Input 10	EStop	ESTOP4 ChA	[#03]:(10) [S] ESTOP4 ChA
Input 11	EStop	ESTOP4 ChB	[#03]:(11) [S] ESTOP4 ChB
Input 12	Light Curtain	LC1 ChA	[#03]:(12) [S] LC1 ChA
Input 13	Light Curtain	LC1 ChB	[#03]:(13) [S] LC1 ChB
Input 14	Feedback	CONTACTORFB	[#03]:(14) [S] CONTACTORFB
Input 15			[#03]:(15) [S]

Test Outputs		I/O Comment	Test Output Tag Name
Output 00			[#03]:
Output 01			[#03]:
Output 02		LOCKINGSW1SOLENOID	[#03]:LOCKINGSW1SOLENOID
Output 03		LOCKINGSW2SOLENOID	[#03]:LOCKINGSW2SOLENOID

Safety Outputs	Device Type	I/O Comment	Output Tag Name
Output 00		ROBOTCONTACTOR A	[#03]:(00) [S] ROBOTCONTACTOR A
Output 01		ROBOTCONTACTOR B	[#03]:(01) [S] ROBOTCONTACTOR B
Output 02		Reset Required	[#03]:(02) [S] Reset Required
Output 03			[#03]:(03) [S]
Output 04			[#03]:(04) [S]
Output 05			[#03]:(05) [S]
Output 06			[#03]:(06) [S]
Output 07			[#03]:(07) [S]

Robot Cell Safety Logic Examples

Figure 5 - GuardLogix Safety Logic

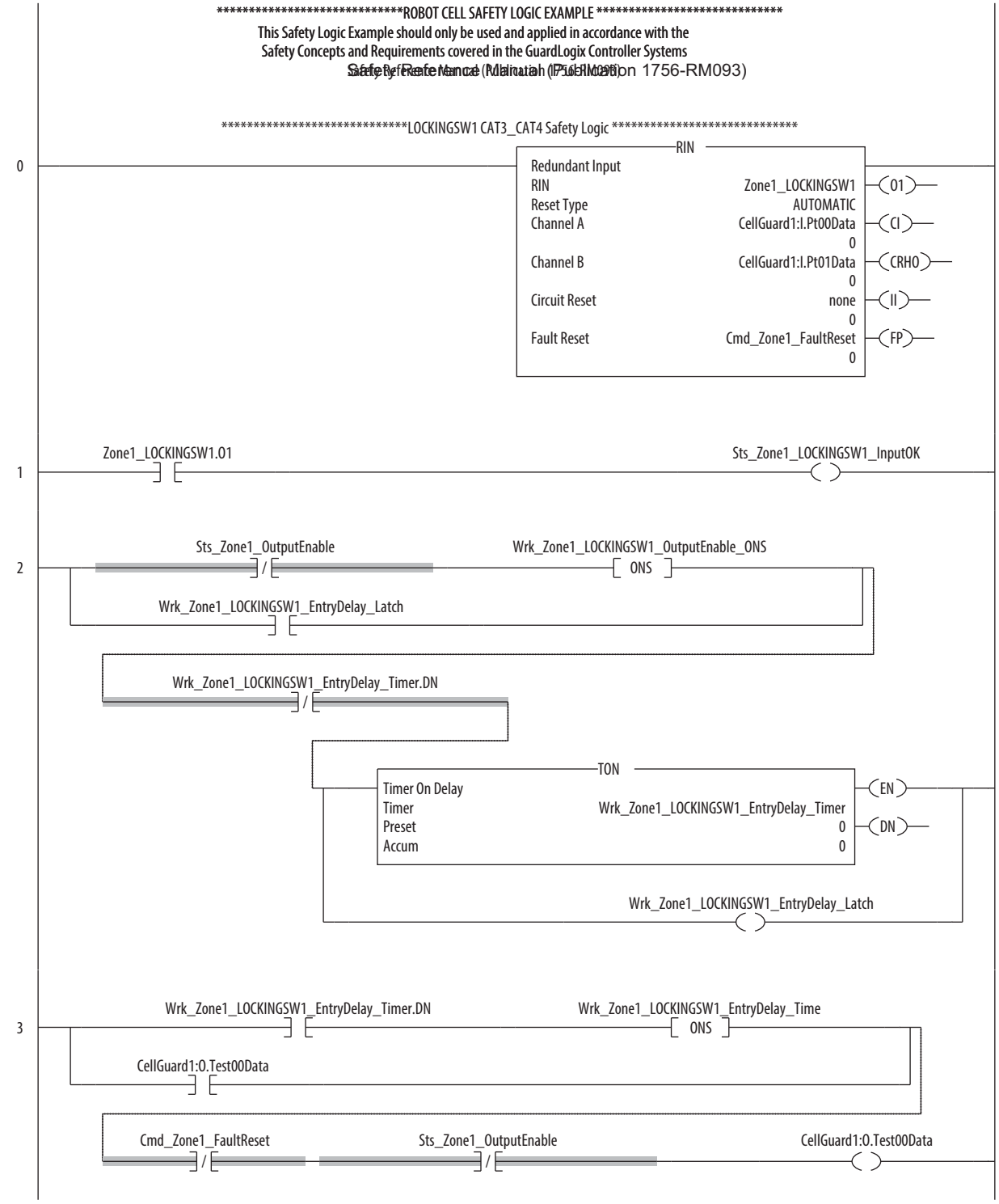


Figure 5 - GuardLogix Safety Logic (continued)

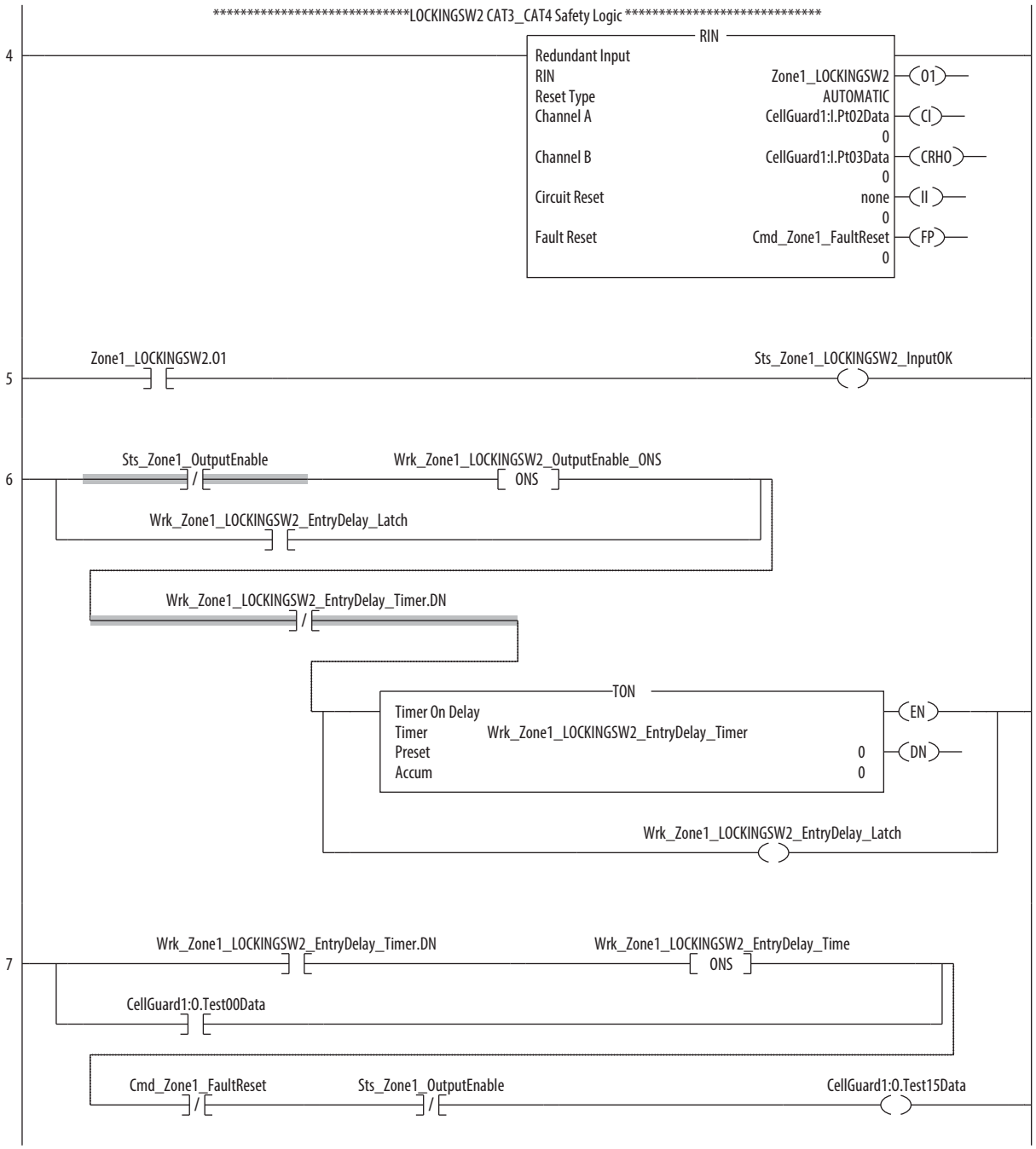


Figure 5 - GuardLogix Safety Logic (continued)

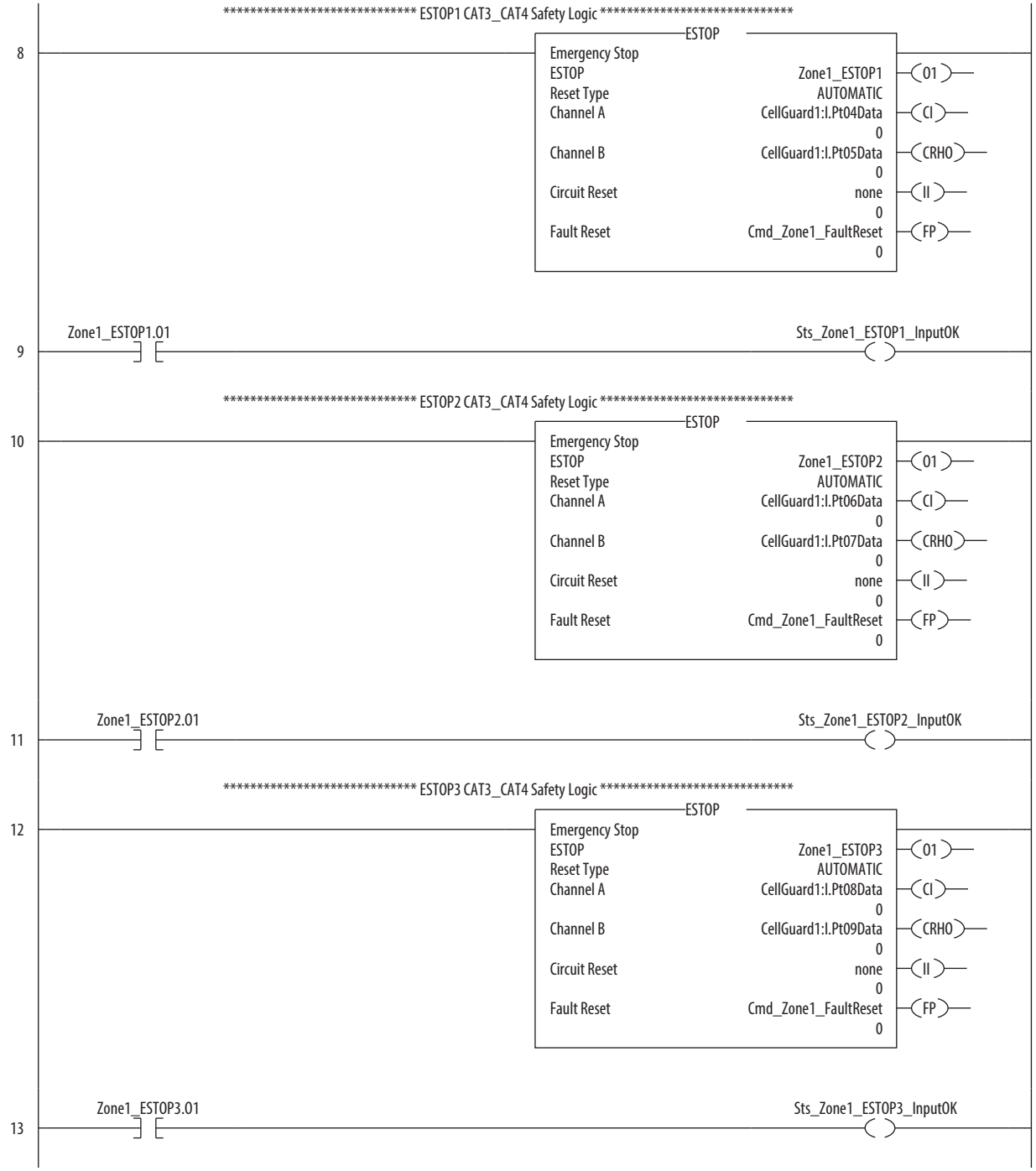


Figure 5 - GuardLogix Safety Logic (continued)

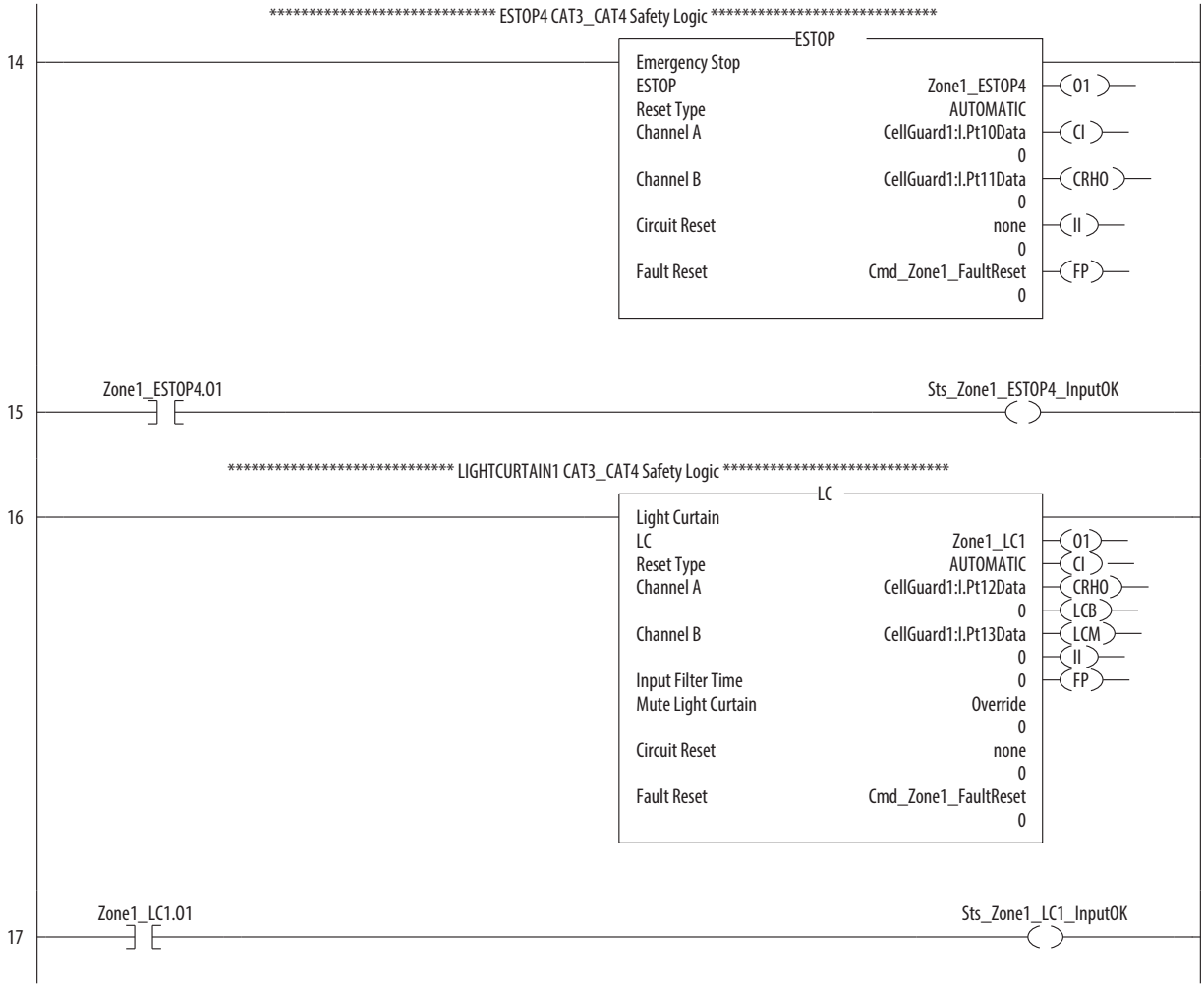


Figure 5 - GuardLogix Safety Logic (continued)

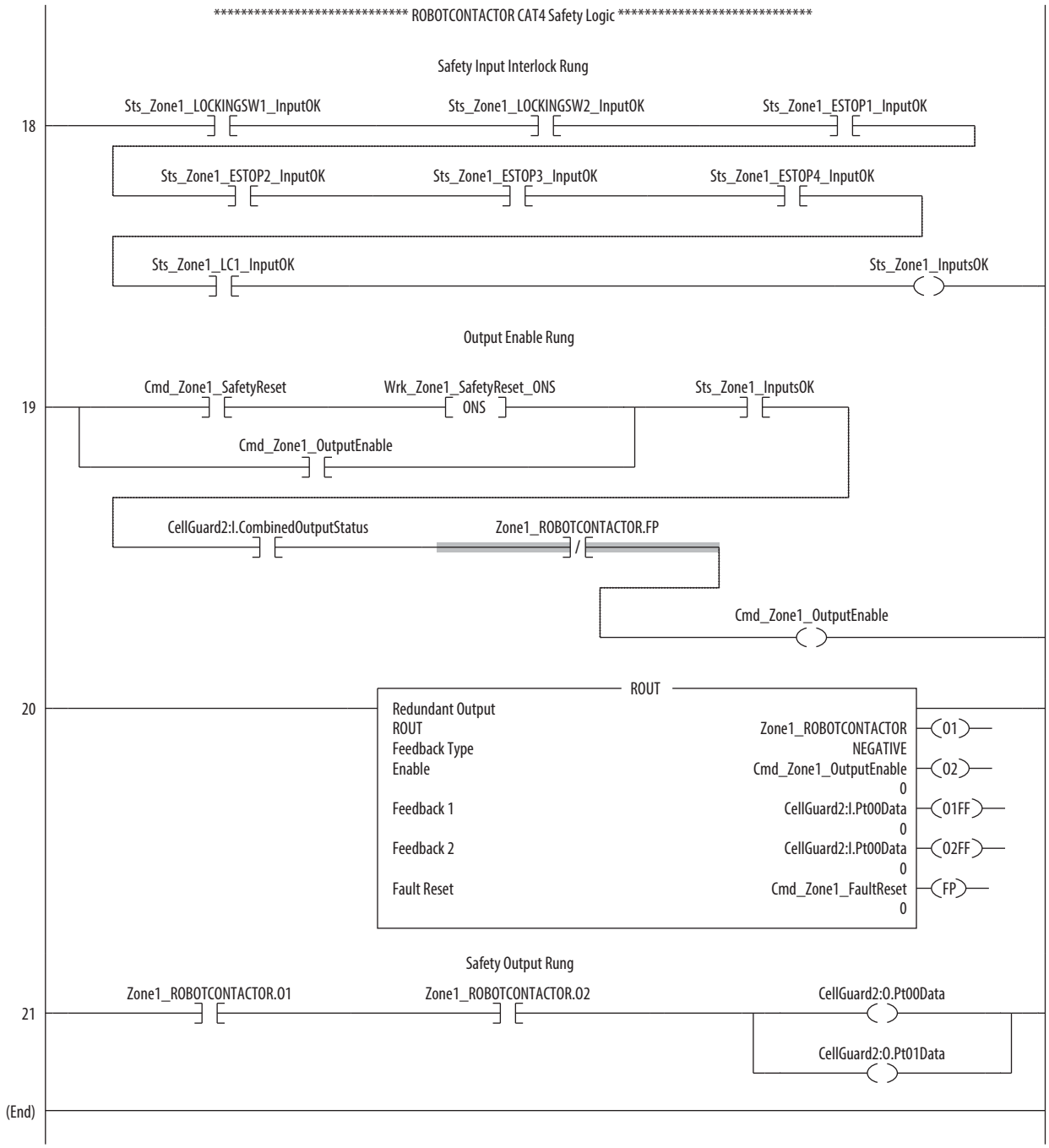
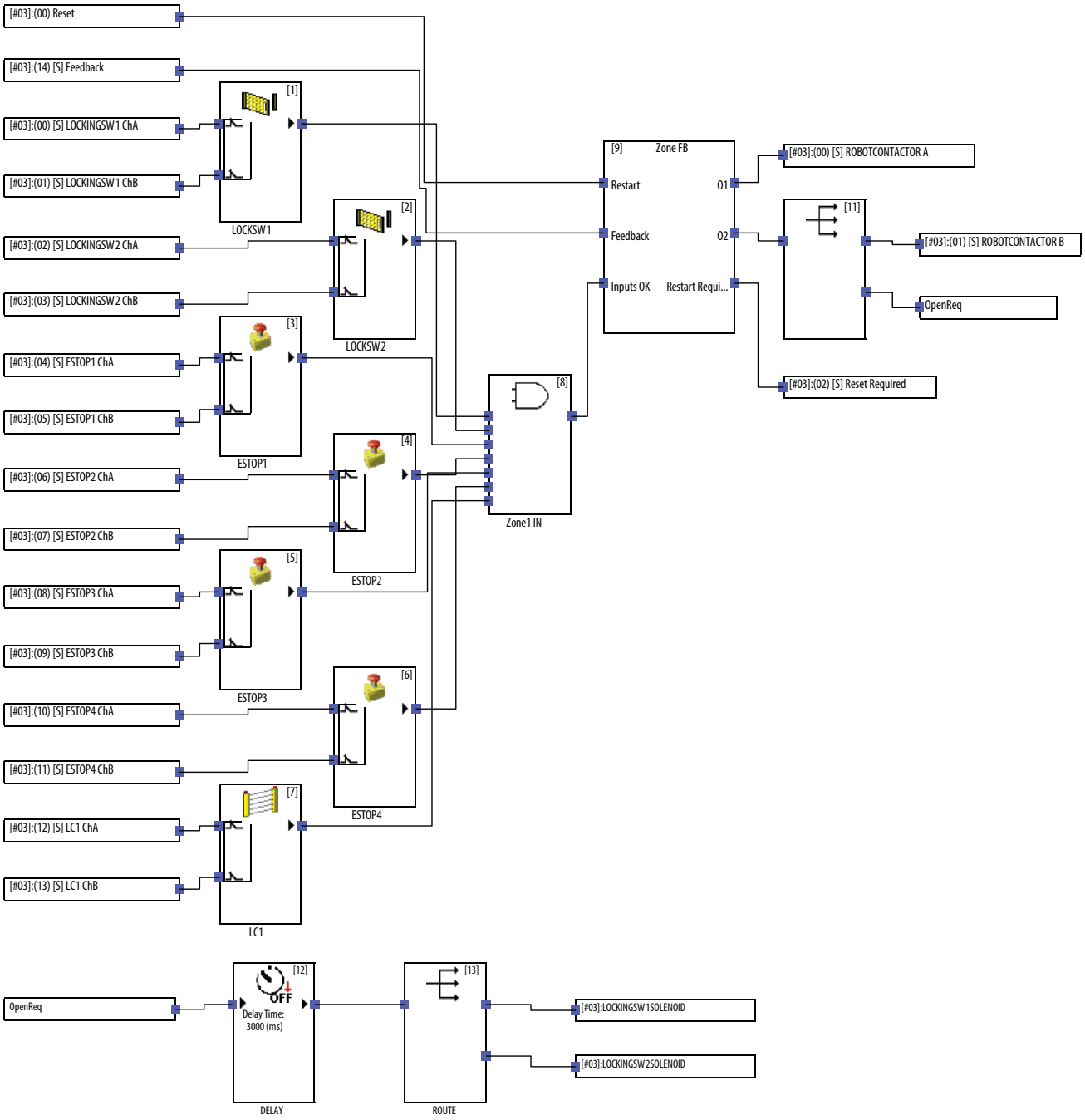


Figure 6 - SmartGuard 600 Safety Logic



Robot Cell Faceplate Logic Examples

Figure 7 - GuardLogix Faceplate Logic

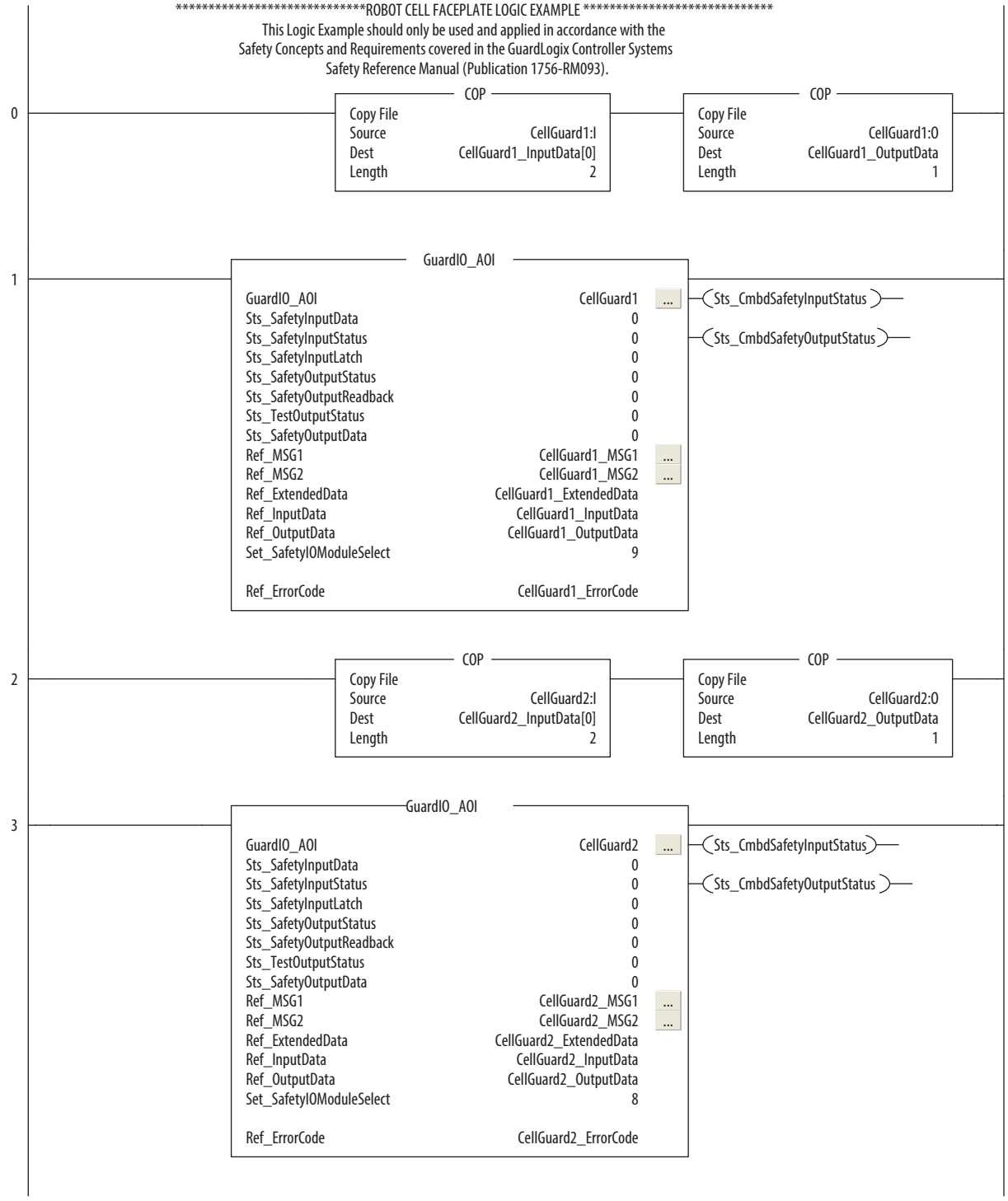


Figure 7 - GuardLogix Faceplate Logic (continued)

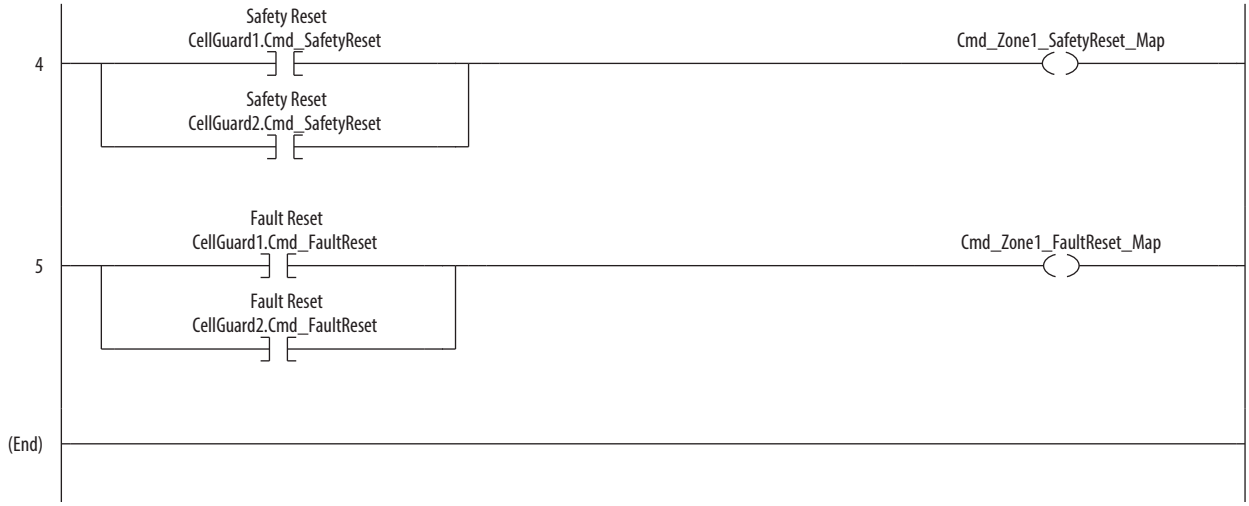
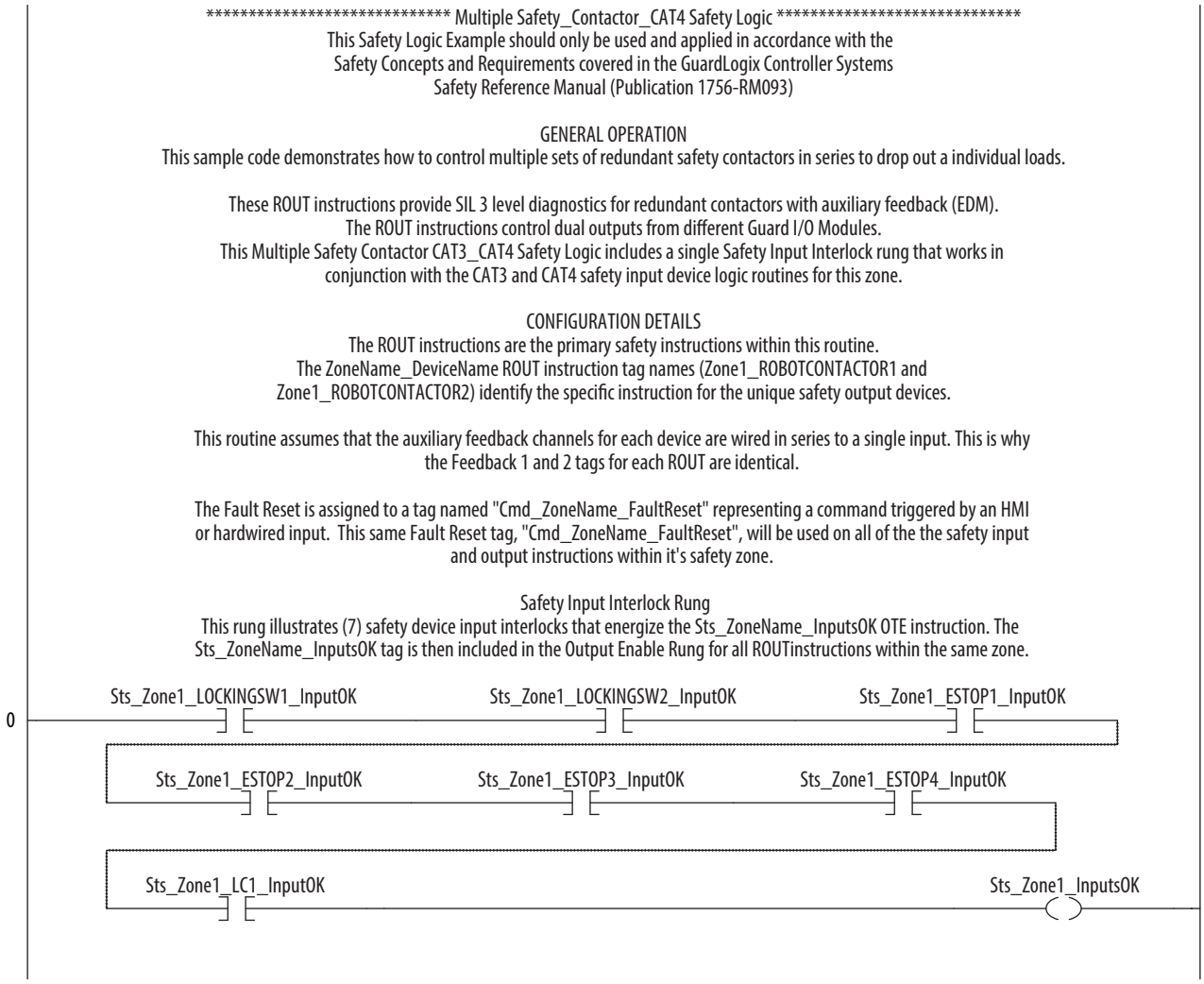


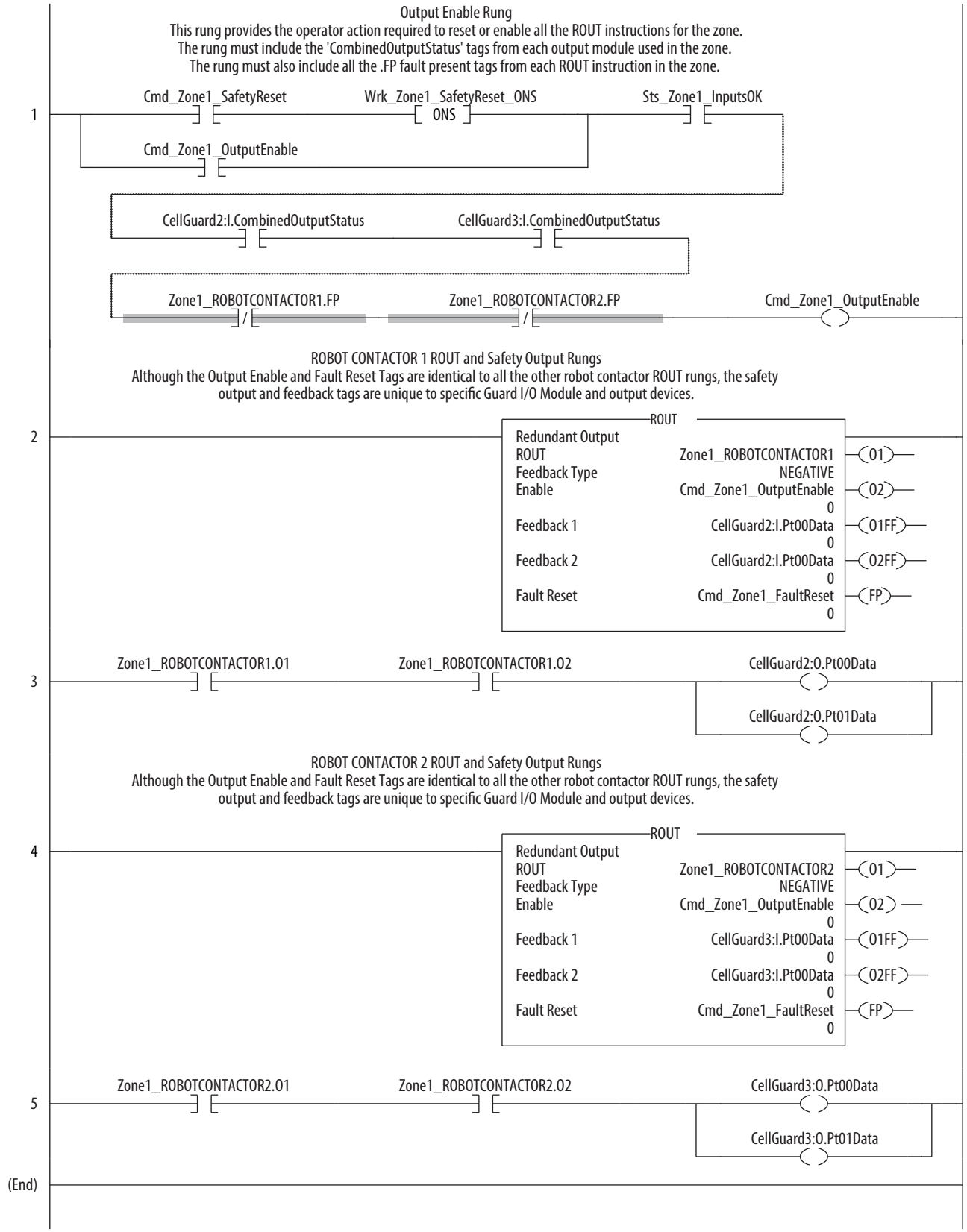
Figure 8 - Ethernet SmartGuard 600 Faceplate Logic

Notes:

Safety Output Logic Example for Multiple Output Devices

This GuardLogix® safety logic example illustrates the output logic for a safety zone that has two dual-channel devices that require separate safety ROUT output instructions.



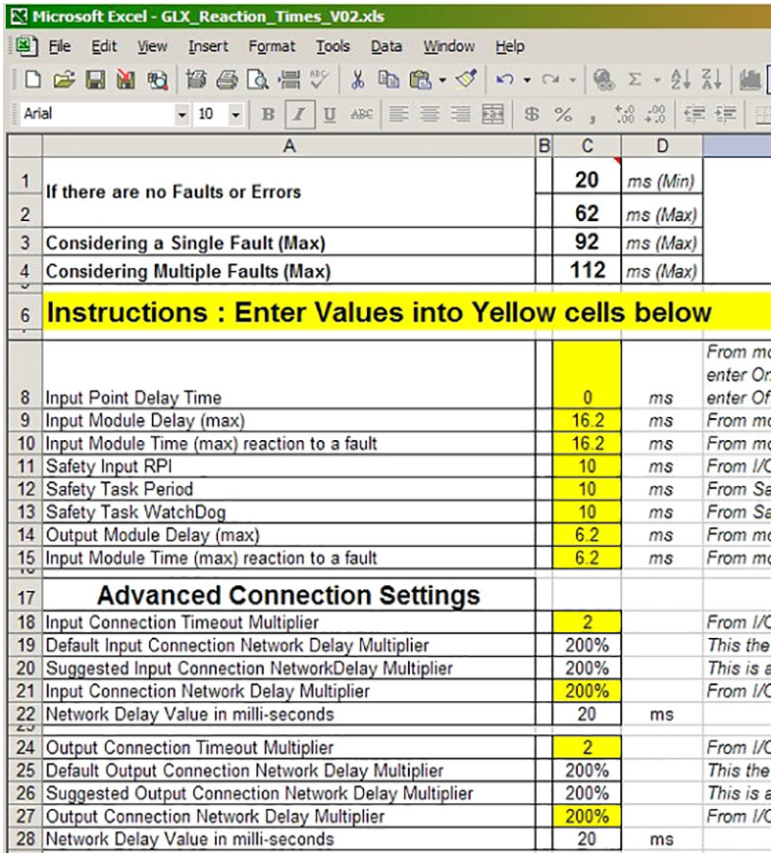

Output Enable Rung
This rung provides the operator action required to reset or enable all the ROUT instructions for the zone.
The rung must include the 'CombinedOutputStatus' tags from each output module used in the zone.
The rung must also include all the .FP fault present tags from each ROUT instruction in the zone.
1
Cmd_Zone1_SafetyReset
Wrk_Zone1_SafetyReset_ONS
ONS
Sts_Zone1_InputsOK
Cmd_Zone1_OutputEnable
CellGuard2:I.CombinedOutputStatus
CellGuard3:I.CombinedOutputStatus
Zone1_ROBOTCONTACTOR1.FP
Zone1_ROBOTCONTACTOR2.FP
Cmd_Zone1_OutputEnable
ROBOT CONTACTOR 1 ROUT and Safety Output Rungs
Although the Output Enable and Fault Reset Tags are identical to all the other robot contactor ROUT rungs, the safety output and feedback tags are unique to specific Guard I/O Module and output devices.
2
ROUT
Redundant Output
ROUT
Zone1_ROBOTCONTACTOR1
01
Feedback Type
NEGATIVE
Enable
Cmd_Zone1_OutputEnable
02
0
Feedback 1
CellGuard2:I.Pt00Data
01FF
0
Feedback 2
CellGuard2:I.Pt00Data
02FF
0
Fault Reset
Cmd_Zone1_FaultReset
FP
0
3
Zone1_ROBOTCONTACTOR1.01
Zone1_ROBOTCONTACTOR1.02
CellGuard2:O.Pt00Data
CellGuard2:O.Pt01Data
ROBOT CONTACTOR 2 ROUT and Safety Output Rungs
Although the Output Enable and Fault Reset Tags are identical to all the other robot contactor ROUT rungs, the safety output and feedback tags are unique to specific Guard I/O Module and output devices.
4
ROUT
Redundant Output
ROUT
Zone1_ROBOTCONTACTOR2
01
Feedback Type
NEGATIVE
Enable
Cmd_Zone1_OutputEnable
02
0
Feedback 1
CellGuard3:I.Pt00Data
01FF
0
Feedback 2
CellGuard3:I.Pt00Data
02FF
0
Fault Reset
Cmd_Zone1_FaultReset
FP
0
5
Zone1_ROBOTCONTACTOR2.01
Zone1_ROBOTCONTACTOR2.02
CellGuard3:O.Pt00Data
CellGuard3:O.Pt01Data
(End)

GuardLogix® Tools

For many safety applications, especially those applications that require the safety system to monitor and react, the performance of the safety system needs to be estimated early in the design of the system. With safety systems that use safety networks and distributed safety devices, this can be difficult. Rockwell Automation has developed two software tools to help you estimate how a system will perform.

GuardLogix Safety Calculator

The first tool, called the GuardLogix Calculator, uses a spreadsheet that provides three worst-case performance estimates based on how the GuardLogix controller, specifically the safety task, and the safety I/O was configured and distributed on DeviceNet networks.


Microsoft Excel - GLX_Reaction_Times_V02.xls

File Edit View Insert Format Tools Data Window Help

Arial 10

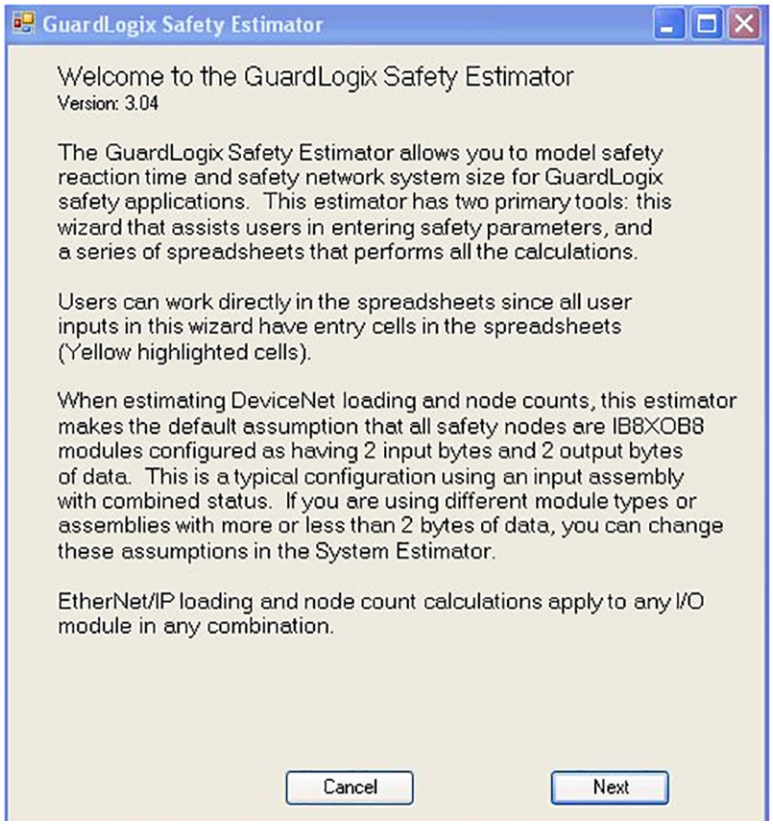
	A	B	C	D	
1	If there are no Faults or Errors		20	ms (Min)	
2			62	ms (Max)	
3	Considering a Single Fault (Max)		92	ms (Max)	
4	Considering Multiple Faults (Max)		112	ms (Max)	
6	Instructions : Enter Values into Yellow cells below				
8	Input Point Delay Time		0	ms	From mo enter Or enter Of
9	Input Module Delay (max)		16.2	ms	From mo
10	Input Module Time (max) reaction to a fault		16.2	ms	From mo
11	Safety Input RPI		10	ms	From I/C
12	Safety Task Period		10	ms	From Sa
13	Safety Task WatchDog		10	ms	From Sa
14	Output Module Delay (max)		6.2	ms	From mo
15	Input Module Time (max) reaction to a fault		6.2	ms	From mo
17	Advanced Connection Settings				
18	Input Connection Timeout Multiplier		2		From I/C
19	Default Input Connection Network Delay Multiplier		200%		This the
20	Suggested Input Connection NetworkDelay Multiplier		200%		This is a
21	Input Connection Network Delay Multiplier		200%		From I/C
22	Network Delay Value in milli-seconds		20	ms	
24	Output Connection Timeout Multiplier		2		From I/C
25	Default Output Connection Network Delay Multiplier		200%		This the
26	Suggested Output Connection Network Delay Multiplier		200%		This is a
27	Output Connection Network Delay Multiplier		200%		From I/C
28	Network Delay Value in milli-seconds		20	ms	

The GuardLogix safety calculator was the original spreadsheet used when GuardLogix controllers were introduced in 2005 and is a limited-functionality performance calculator used to estimate the performance of a single safety loop.

The calculator is compatible with Microsoft Excel software.

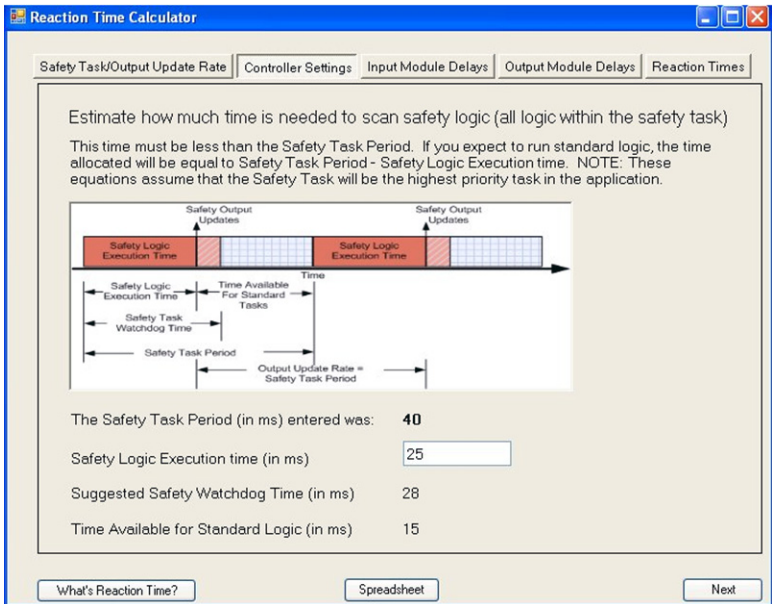
GuardLogix Estimator

The second tool, the GuardLogix Safety Estimator was based on the initial calculator and was expanded to provide a more intuitive interface through a wizard. This tool also provides multiple network functionality within the application, adding Ethernet communication to the original DeviceNet-only implementation.



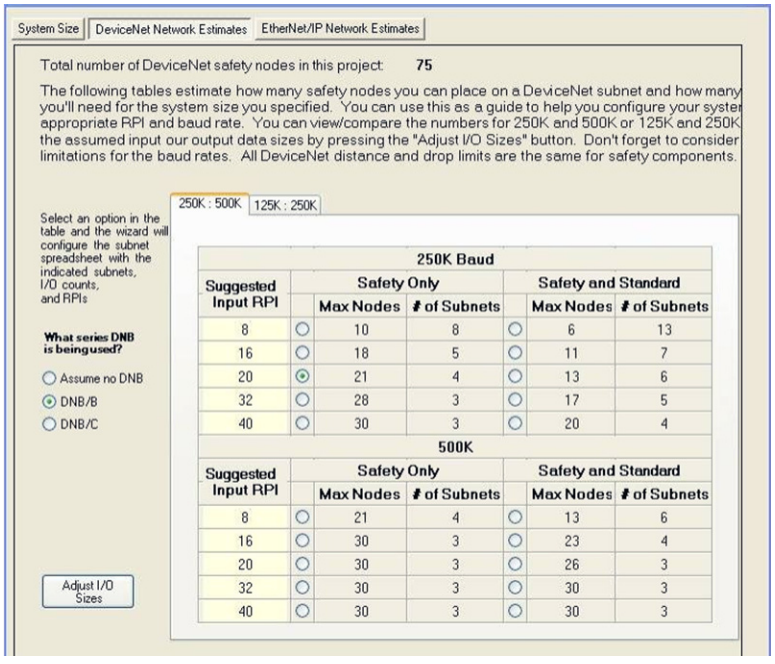
Safety reaction-time performance is based on how the safety task is configured in the GuardLogix controller, and the settings for the safety I/O modules used in the GuardLogix project. The wizard interface in the GuardLogix Estimator lets you move forward or backward to change values and evaluate how those changes impact system behavior.

Each of the tabs in the estimator lets you enter system settings. Enter safety task settings on the Controller Settings tab.



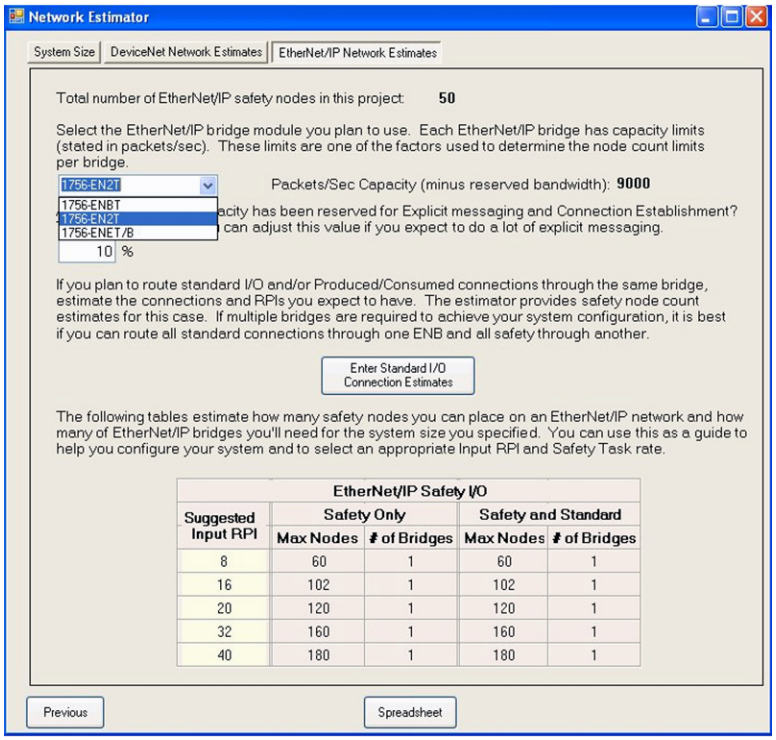
Use the Input Module Delays and Output Module Delays tabs to enter settings for your safety I/O modules.

Based on the settings you enter and the network configurations you plan to use, the estimator provides a series of examples to choose from.

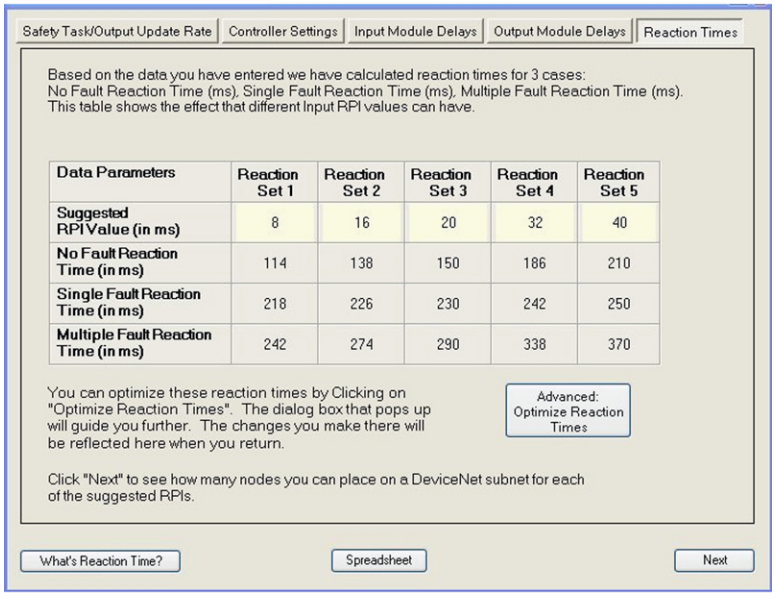


These examples let you evaluate the effects of different settings and network configurations.

You can select DeviceNet, EtherNet/IP, or a combination of DeviceNet and EtherNet/IP networks.



The estimator provides three performance numbers to consider for use.



No-fault Reaction Time (ms)

This value is the worst-case performance of the system when it is running normally without errors or faults.

Single-fault Reaction Time (ms)

This value is the worst-case performance of the system when it encounters a single fault or error. This type of error would not cause the controller to fault or shutdown, but could cause a delay in performance. An example would be if a communications packet is corrupted and a retry is needed. During this sequence, controller performance for that fault is affected. As another example, if an error occurred with a communication from an I/O module, the data from the module is delayed by one RPI period of that module, so any downstream logic, including a safety output, would be delayed by the RPI period.

Multiple-fault Reaction Time (ms)

This value is the calculated worst-case performance of the system. An example of this type of fault could be a controller hard fault, this number would be the absolute worst-case delay before a safety output would transition to a safe state.

Which Reaction Time to Use?

Only you can determine which reaction time meets the requirements of your specific safety application. Safety systems are intended to minimize the risk of a hazard, not eliminate all of the risk. Some safety systems will use the no-fault reaction time because a risk assessment of the application indicates it is sufficient. In an example light curtain application where an operator is loading material, the safety system lets the load occur only at a non-hazardous phase of machine operation. Since the operator knows when to load material, it's unlikely that they would try to load during a hazardous phase. The chances of the operator attempting to load at the wrong time, and the system having a fault at that same time, is considered to be remote. Another consideration is that the possible injury would likely be medically recoverable and not more severe. The resulting decision was to use no-fault performance.

Other application criteria may result in the use of single-fault performance. The decision on which number to use is up to the user to decide based on their risk assessment criteria.

Safety Estimator Installation Information

The wizard feature of the Rockwell Automation® Safety Estimator works only in MSExcel 2003 or MSExcel 2007.

- Microsoft Office Professional Edition 2003 software
- Microsoft Office Professional Enterprise Edition 2003 software
- Microsoft Office Excel 2003 (standalone) software
- Microsoft Office Professional Edition 2003 Trial software
- Microsoft Office System Evaluation 2003 Enterprise Edition software
- All suite editions of the 2007 Microsoft Office system
- Microsoft Office Excel 2007 (standalone) software

NOTE: Microsoft Office Standard Edition 2003 software does not support the wizard.

Macro Security in Microsoft Excel 2007

The wizard in the Safety Estimator spreadsheet uses macros and document-level extensions. When MSExcel 2007 has macro security turned on, neither of these will run. Macro security is turned on by default when MSExcel 2007 is installed. There are two ways to work around this.

- Turn off macro security entirely. This the most expedient method but may leave you open to future macro viruses.
- Add the Safety Estimator certificate to the certificate store on your machine and configure your MSExcel software to trust all content from that source. This is the preferred method. For directions, please read the MSWord document, Macro Security Settings in Excel 2007.pdf, included with the GuardLogix tools.

Microsoft Excel 2003

If you have MSExcel 2003 installed, follow these steps to install the wizard.

1. Run set up.exe to install all the necessary components.

   The set up program installs all of the required files in the default directory or the directory you designate.
2. After the installation is complete, launch Safety Estimator.xls *from your subdirectory*. When it loads in MSExcel software, the wizard runs automatically. Click the button on the spreadsheet to restart the wizard whenever you want to.

Using Other Versions of Microsoft Excel Software

If you don't have MSExcel 2003 or MSExcel 2007 installed, don't run the set up program. Instead, move these files to a convenient folder.

- Safety Estimator.xls
- Safety Estimator Walk through.doc

The walk-through document will instruct you on using the spreadsheet without the help of the wizard.

Rockwell Automation Support

Use the following resources to access support information.

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

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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.

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