

Compact 5000 Digital I/O Modules

Catalog Numbers
5069-IA16, 5069-IB8S, 5069-IB8SK, 5069-IB16, 5069-IB16F, 5069-IB16K, 5069-IB32, 5069-IB6F-3W, 5069-OA16, 5069-OB8, 5069-OBV8S, 5069-OBV8SK, 5069-OB16, 5069-OB16F, 5069-OB16K, 5069-OB32, 5069-OW4I, 5069-OW16, 5069-OX4I

Allen-Bradley
by ROCKWELL AUTOMATION

User Manual

Original Instructions

Important User Information

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

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

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

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

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

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

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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.

These 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).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

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Common Compact 5000 Digital I/O Module Features

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About This Publication

This manual describes how to use Compact 5000® digital I/O modules in Logix 5000® control systems.

Make sure that you are familiar with these items.

- Use of a controller in a Logix 5000 control system.
- Use of an EtherNet/IP™ network, if the digital I/O modules are used remotely.
- Use of safety systems.
- Use Studio 5000 Logix Designer® application.

IMPORTANT This manual uses these conventions.

- standard I/O module = a Compact 5000 standard digital I/O module
- safety I/O module = a Compact 5000 safety digital I/O module
- Compact 5000 digital I/O module = both standard and safety digital I/O modules

Rockwell Automation recognizes that some of the terms that are currently used in our industry and in this publication are not in alignment with the movement toward inclusive language in technology. We are proactively collaborating with industry peers to find alternatives to such terms and making changes to our products and content. Please excuse the use of such terms in our content while we implement these changes.

Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes from the Product Compatibility and Download Center at rok.auto/pcdc.

Summary of Changes

This publication contains this new or updated information. This list includes substantive updates only and is not intended to reflect all changes. Throughout this manual, changes are marked with change bars.

Topic	User Manual Revision	Page
Updated the Limit Access to the System section	G	18
Updated the Protected Operations section	G	35
Updated the Field Power Loss Detection section with 5069-OW16 Series C information	G	60
Safety information reverted to previous values	H	Throughout
Added the 5069-IB32 and 5069-OB32 modules	H	Throughout
Added the 5069-IB16F and 5069-IB6F-3W modules to Field Power Loss Detection section	H	55
Updated the I/O Status Indicators table with Field Power Loss information	H	115

Terminology

This table defines terms that are used in this manual.

Acronym	Full Term	Definition
1oo2	One out of Two	Identifies the programmable electronic controller architecture.
CIP™	Common Industrial Protocol	An industrial communication protocol that is used by Logix 5000-based automation systems on EtherNet/IP, ControlNet®, and DeviceNet® communication networks.
CIP Safety™	Common Industrial Protocol – Safety Certified	SIL-rated version of CIP.
—	Connection	Logical communication channel for communication between nodes. Connections are maintained and controlled between leaders and followers.
CL	Claim Limit	The max safety integrity level (SIL) that can be achieved.
DC	Diagnostic Coverage	The ratio of the detected failure rate to the total failure rate.
EN	European Norm.	The official European Standard.
GSV	Get System Value	A ladder logic instruction that retrieves specified controller status information and places it in a destination tag.
—	Multicast	The transmission of information from one sender to multiple receivers.
MTTF	Mean Time to Failure	The length of time that a device or other product is expected to provide excellent reliability in operation.
NAT	Network Address Translation	The translation of an Internet Protocol (IP) address to another IP address on another network.
ODVA	Open DeviceNet Vendor Association	A nonprofit association of vendors that is established for the promotion of CIP networks.
PFD	Probability of a dangerous failure on demand	The average probability of a system to fail to perform its design function on demand.
PFH	Average frequency of a dangerous failure per hour	The probability of a system to have a dangerous failure occur per hour.
PL	Performance Level	ISO 13849-1 safety rating.
—	Proof test	Periodic test that detects failures in a safety-related system so that, if necessary, the system can be restored to an as-new condition or as close as practical to this condition.
SC	Systematic Capability	A confidence that the systematic safety integrity meets the requirements of the specified safety integrity level (SIL). (from IEC 61508-4)
SFF	Safe Failure Fraction	The sum of safe failures plus the sum of dangerous detected failures that are divided by the sum of all failures.
SIL	Safety Integrity Level	A relative level of risk-reduction that is provided by a safety function, or to specify a target level of risk reduction.
SIL CL	SL Claim Limit	The max safety integrity level (SIL) that can be achieved.
SNN	Safety Network Number	Safety network number, which uniquely identifies a network across all networks in the safety system. You are responsible for assigning a unique number for each safety network or safety subnet within a system.
SRT	Safety Reaction Time	A consideration of delays or latencies within the safety system.
—	Standard	Devices or portions of devices that do not participate in the safety function.
—	Unicast	The transmission of information from one sender to one receiver.

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation. You can view or download publications at rok.auto/literature.

Resource	Description
Compact 5000 Installation Instructions	Describes how to install and wire these Compact 5000 I/O and Specialty Modules.
Publication 5069-IN001	5069-FPD
Publication 5069-IN002	5069-ARM
Publication 5069-IN003	5069-AENTR
Publication 5069-IN004	5069-IB16, 5069-IB16F, 5069-IB16K
Publication 5069-IN006	5069-IB6F-3W
Publication 5069-IN007	5069-OB16, 5069-OB16F, 069-OB16K
Publication 5069-IN008	5069-OW4I
Publication 5069-IN009	5069-OX4I
Publication 5069-IN010	5069-IF8
Publication 5069-IN011	5069-IY4, 5069-IY4K
Publication 5069-IN012	5069-OF4, 5069-OF4K, 5069-OF8
Publication 5069-IN015	5069-IA16
Publication 5069-IN016	5069-OA16
Publication 5069-IN017	5069-OB8
Publication 5069-IN018	5069-OW16
Publication 5069-IN020	5069-IB8S, 5069-IB8SK
Publication 5069-IN021	5069-OBV8S, 5069-OBV8SK
Publication 5069-IN025	5069-IF4IH
Publication 5069-IN026	5069-OF4IH
Publication 5069-IN027	5069-IB32
Publication 5069-IN028	5069-OB32
Compact 5000 I/O and Specialty Modules Specifications, publication 5069-TD001	Provides specifications, wiring diagrams, and module block diagrams for Compact 5000 modules.
CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, publication 5069-UM001	Describes how to configure, operate, and troubleshoot CompactLogix® 5380 and Compact GuardLogix® 5380 controllers.
CompactLogix 5480 Controllers User Manual, publication 5069-UM002	Describes how to configure, operate, and troubleshoot CompactLogix 5480 controllers.
Compact 5000 Analog I/O Modules User Manual, publication 5069-UM005	Describes how to configure, operate, and troubleshoot Compact 5000 analog I/O modules.
Compact 5000 High-speed Counter Module User Manual, publication 5069-UM006	Describes how to use Compact 5000 high-speed counter modules.
Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007	Describes how to use the 5069-AENTR and 5069-AEN2TR EtherNet/IP adapters.
Position-based Output Control with the MAOC Instruction, publication 1756-AT017	Describes how to configure time-scheduled output control with the MAOC instruction.
Logix 5000 Controllers Tasks, Programs, and Routines Programming Manual, publication 1756-PM005	Provides more information on event tasks and event task configuration.
GuardLogix and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012	Describes requirements for achieving and maintaining Safety Integrity Level (SIL) 2 and Performance Level (PL) d requirements with the GuardLogix 5580 controller system, with the Studio 5000 Logix Designer application.
ControlLogix 5580 and GuardLogix 5580 Controllers User Manual, publication 1756-UM543	Describes how to configure, operate, and troubleshoot ControlLogix® 5580 and GuardLogix 5580 controllers.
System Security Design Guidelines Reference Manual, publication SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
SISTEMA Performance Level Calculator, available for download at: SISTEMA	The SISTEMA tool automates calculation of the attained Performance Level from the safety-related parts of a machine's control system to (EN) ISO 13849-1.
Electronic Keying in Logix 5000 Control Systems Application Technique, publication LOGIX-AT001	Describes how to use electronic keying in Logix 5000 control system applications.
Integrated Architecture® and CIP Sync Configuration Application Technique, publication IA-AT003	Provides information about CIP Sync technology and how to synchronize clocks within the Rockwell Automation® Integrated Architecture system.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications	Provides declarations of conformity, certificates, and other certification details.

Notes:

Digital I/O Module Operation in a Control System

This chapter describes features that are common to all Compact 5000® digital I/O modules unless otherwise noted.

Logix 5000® controllers use Compact 5000 digital I/O modules to control devices in a control system.

Compact 5000 digital I/O modules use removable terminal blocks (RTBs) to connect field-side wiring. Use the Studio 5000 Logix Designer® application to configure the modules.

IMPORTANT Controller and programming software compatibility requirements apply when you use Compact 5000 digital I/O modules.

For more information about controller and software compatibility, see Controller and Software Compatibility on page 12.

Compact 5000 digital I/O modules use the Producer/Consumer network communication model. This communication is an intelligent data exchange between modules and other system devices in which each module produces data without first being polled.

Controller and Software Compatibility

Controller and programming software compatibility requirements apply when you use Compact 5000 digital I/O modules.

- Compatibility between Logix 5000 controllers and Compact 5000 digital I/O modules varies based on whether the module is local or remote.
- Standard I/O modules are supported in the Studio 5000 Logix Designer application, version 28 or greater. However, the Logix 5000 controllers that are compatible with the I/O modules support different minimum versions of the Studio 5000 Logix Designer application.
- Safety I/O modules are supported in the Studio 5000 Logix Designer application, version 32 or later.

IMPORTANT The Compact 5000 Serial module is compatible only with these controllers:

- CompactLogix® 5380
- Compact GuardLogix® 5380
- CompactLogix 5480
- ControlLogix® 5580
- GuardLogix 5580

This table describes the module compatibility requirements when you use Compact 5000 digital I/O modules with Logix 5000 controllers. Consider the different device requirements when you design your system.

Compact 5000 Digital I/O Modules Controller and Software Compatibility Requirements

Location	Controller		Studio 5000 Logix Designer Application Version	
	System	Catalog Numbers	Standard I/O	Safety I/O
Local	CompactLogix 5380	5069-L320ER, 5069-L320ERMK, 5069-L330ERMK, 5069-L340ERM, 5069-L350ERMK	28.00.00 or later	–
		5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ERMK, 5069-L310ER-NSE, 5069-L310ERS2, 5069-L320ERM, 5069-L320ERMK, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L330ERMK, 5069-L340ER, 5069-L340ERP	29.00.00 or later	
		5069-L350ERM, 5069-L350ERMK, 5069-L380ERM, 5069-L3100ERM	30.00.00 or later	
	CompactLogix 5480	5069-L46ERMW	32.00.00 or later	
		5069-L430ERMW, 5069-L450ERMW, 5069-L4100ERMW, 5069-L4200ERMW	32.01.00 or later	
	Compact GuardLogix 5380	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2	31.00.00 or later	32.00.00 or later
Remote	CompactLogix 5380	5069-L320ER, 5069-L340ERM	28.00.00 or later	–
		5069-L306ER, 5069-L306ERM, 5069-L310ER, 5069-L310ERM, 5069-L310ERMK, 5069-L310ER-NSE, 5069-L310ERS2, 5069-L320ERM, 5069-L320ERP, 5069-L330ER, 5069-L330ERM, 5069-L340ER, 5069-L340ERP	29.00.00 or later	
		5069-L350ERM, 5069-L380ERM, 5069-L3100ERM	30.00.00 or later	
	CompactLogix 5480	5069-L46ERMW	32.00.00 or later	
		5069-L430ERMW, 5069-L450ERMW, 5069-L4100ERMW, 5069-L4200ERMW	32.01.00 or later	
	Compact GuardLogix 5380	5069-L306ERS2, 5069-L306ERMS2, 5069-L310ERS2, 5069-L310ERMS2, 5069-L320ERS2, 5069-L320ERS2K, 5069-L320ERMS2, 5069-L320ERMS2K, 5069-L330ERS2, 5069-L330ERS2K, 5069-L330ERMS2, 5069-L330ERMS2K, 5069-L340ERS2, 5069-L340ERMS2, 5069-L350ERS2, 5069-L350ERS2K, 5069-L350ERMS2, 5069-L350ERMS2K, 5069-L380ERS2, 5069-L380ERMS2, 5069-L3100ERS2, 5069-L3100ERMS2	31.00.00 or later	32.00.00 or later
	ControlLogix 5580	1756-L83E, 1756-L85E	28.00.00 or later	–
		1756-L81E, 1756-L82E, 1756-L84E	29.00.00 or later	
	GuardLogix 5580	1756-L81ES, 1756-L82ES, 1756-L83ES, 1756-L84ES	31.00.00 or later	32.00.00 or later

Types of Modules

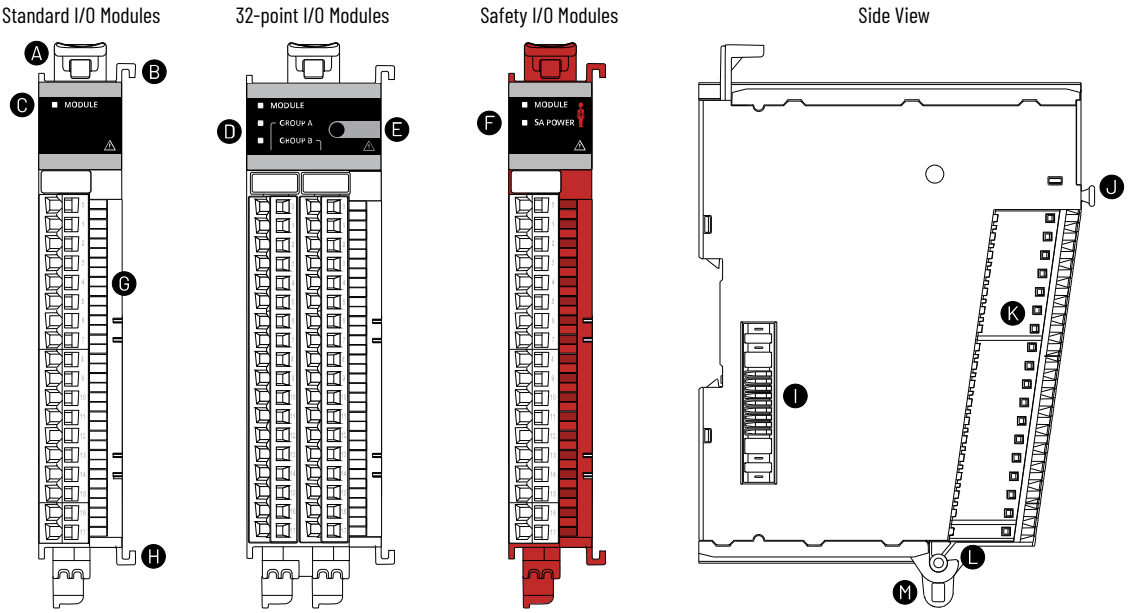
This table describes the Compact 5000 digital I/O modules.

Module Type	Cat. No.	Description
Standard	5069-IA16	79...264V AC 16-point, input module
	5069-IB16	10...32V DC 16-point, sinking input module
	5069-IB16K	10...32V DC 16-point, conformal coated sinking input module
	5069-IB16F	10...32V DC 16-point, sinking fast input module
	5069-IB6F-3W	10...32V DC 6-point, 3-wire, sinking fast input module
	5069-IB32	10...32V DC 32-point, sinking input module
	5069-OA16	85...264V AC 16-point, output module
	5069-OB8	10...32V DC 8-point, sourcing high-current output module
	5069-OB16	10...32V DC 16-point, sourcing output module
	5069-OB16K	10...32V DC 16-point, conformal coated sourcing output module
	5069-OB16F	10...32V DC 16-point, sourcing fast output module
	5069-OB32	10...32V DC 32-point, sourcing output module
	5069-OW4I	5...264V AC /125V DC 4-point, isolated normally open relay output module
	5069-OW16	5...264V AC/125V DC 16-point, normally open relay output module
	5069-OX4I	5...264V AC /125V DC 4-point, isolated normally open/normally closed relay output module
Safety[1]	5069-IB8S	18...32V DC 8-point, safety sinking input module
	5069-IB8SK	18...32V DC 8-point, conformal coated safety sinking input module
	5069-OBV8S	18...32V DC 8-point, safety output module that can be used as follows: • Bipolar output module • Sourcing output module
	5069-OBV8SK	18...32V DC 8-point, conformal coated safety output module that can be used as follows: • Bipolar output module • Sourcing output module

(1) You can use the safety I/O modules in applications that are rated up to, and including, SIL CL 3, PLe, Cat. 4 as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.

Module Overview

This figure identifies the parts of Compact 5000 digital I/O modules.



A	DIN rail latch	H	Bottom interlocking piece
B	Top interlocking piece	I	MOD and SA power bus connectors, isolated from each other internally
C	Module status indicator	J	RTB handle
D	Group A and Group B indicators(1)	K	RTB
E	Group A or Group B push button(1)	L	RTB tabs
F	SA power status indicator	M	Cable tie hooks
G	I/O status indicators		

(1) The I/O status indicators on the 32-point modules show status for one group of 16 I/O channels at a time. The Group A or Group B indicator (D) shows which group is selected. To change which group's status is shown, press the button (E).

Local I/O Modules or Remote I/O Modules

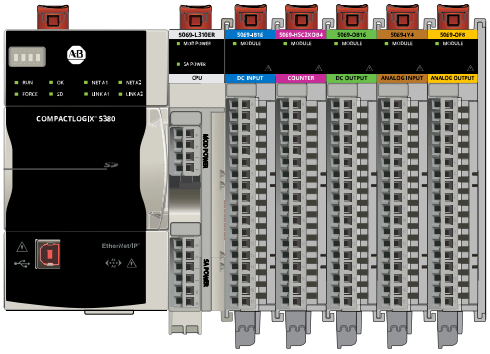
You can use Compact 5000 digital I/O modules as local or remote I/O modules, with some restrictions that are based on the module and controller type. For compatibility requirements, see Controller and Software Compatibility on page 12.

Local I/O Modules

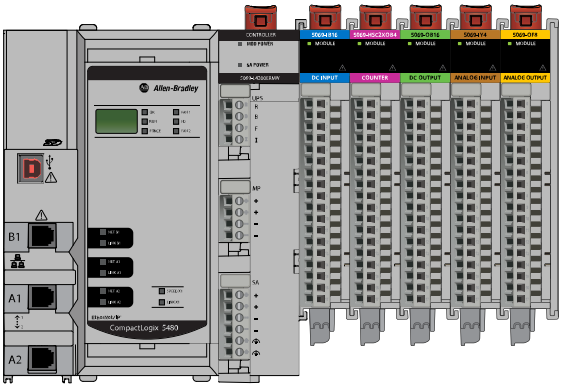
When Compact 5000 digital I/O modules reside in the same system as the controller, the modules are local I/O modules.

Local I/O modules are installed to the right of the controller and exchange data with the controller over the system backplane.

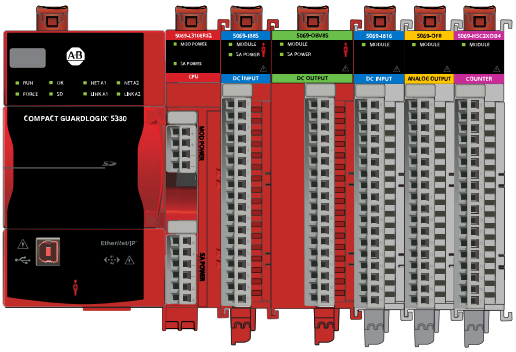
CompactLogix 5380 Controller Local Compact 5000 I/O Modules



CompactLogix 5480 Controller Local Compact 5000 I/O Modules



Compact GuardLogix 5380 Controller Local Compact 5000 I/O Modules



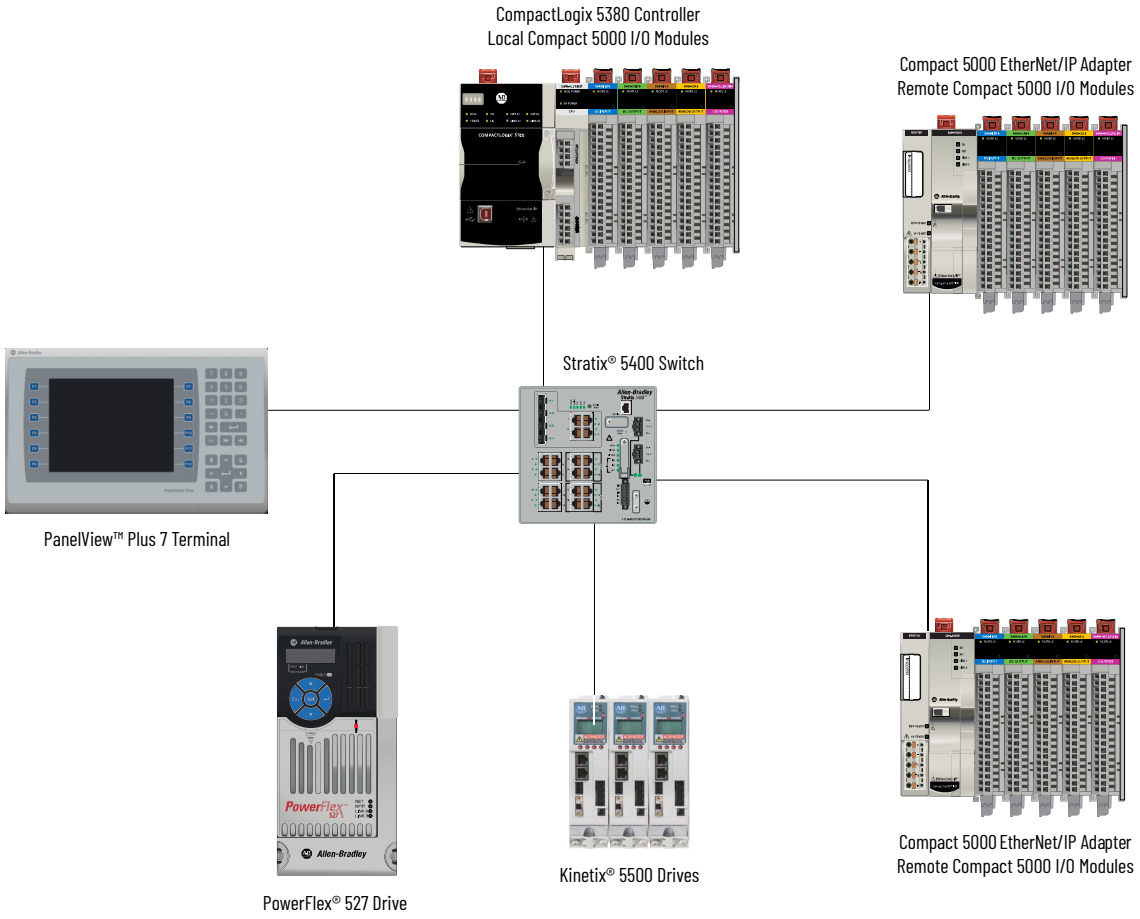
Remote I/O Modules

When Compact 5000 digital I/O modules reside in a separate location from Logix 5000 controllers, they are remote I/O modules. Remote Compact 5000 digital I/O modules are accessible over an EtherNet/IP™ network via a Compact 5000 EtherNet/IP adapter.

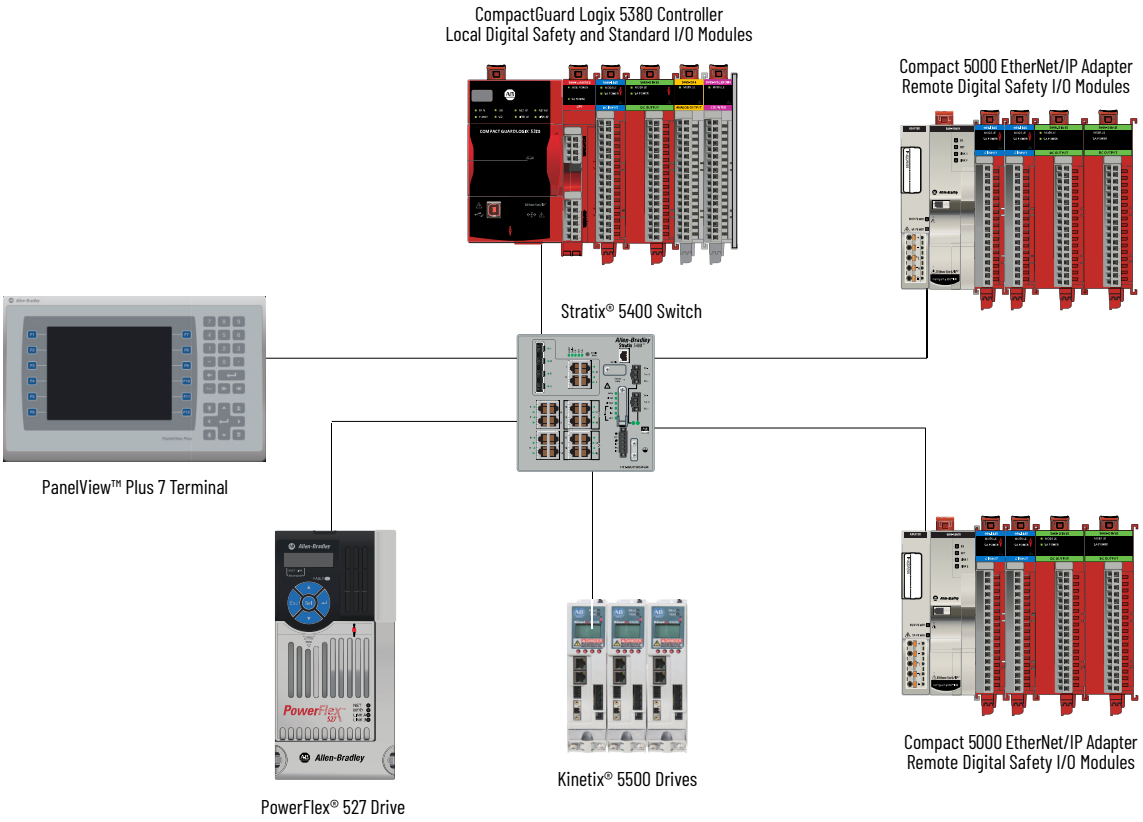
The modules are installed to the right of the adapter and exchange data across the remote system backplane. The data is then exchanged with the controller over the EtherNet/IP network.

IMPORTANT Remember, some restrictions apply when you use the I/O modules remotely. For example, you can use Compact 5000 safety I/O modules as remote I/O modules only in Compact GuardLogix 5380 or GuardLogix 5380 control systems.

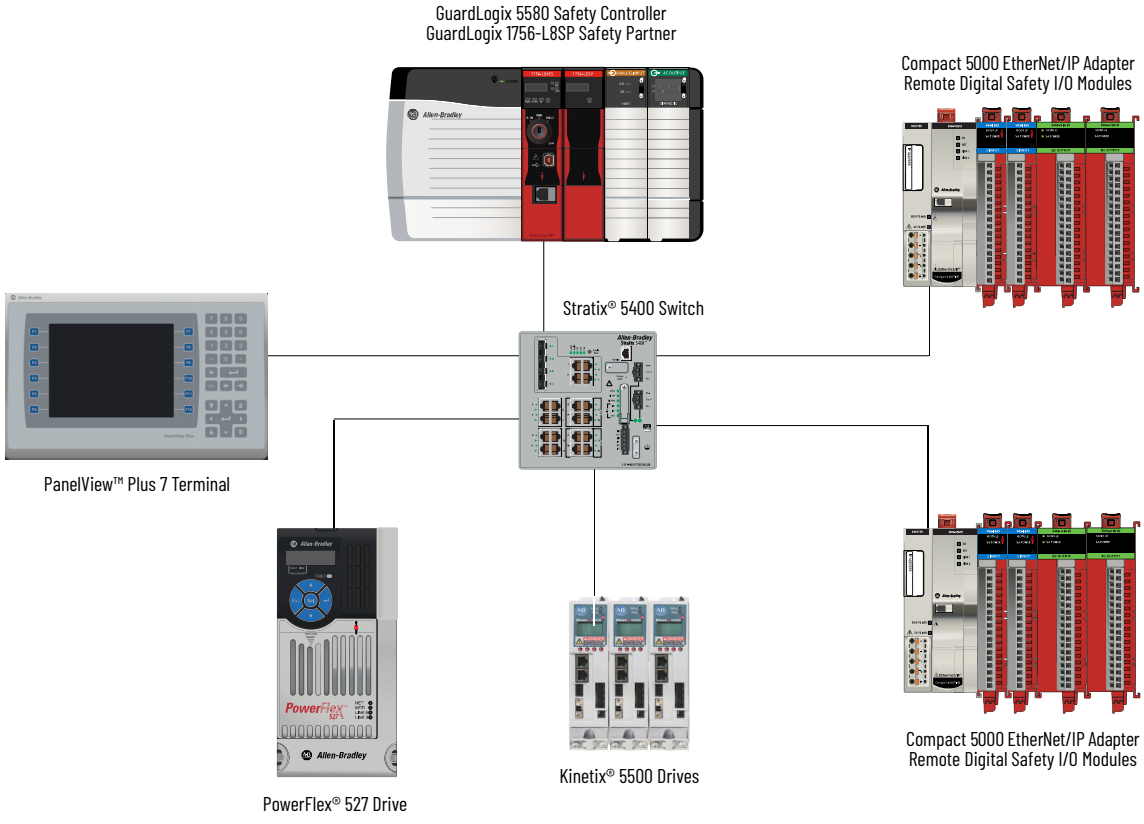
Remote Compact 5000 Standard I/O Modules in a CompactLogix 5380 Control Applications



Remote Compact 5000 Safety I/O Modules in a Compact GuardLogix 5380 Control Application



Remote Compact 5000 Safety I/O Modules in a GuardLogix 5580 Control Application



Limit Access to the System

To limit access to a Logix 5000 controller, Compact 5000 EtherNet/IP adapter, or I/O module, consider these options.

- Follow the guidelines provided in the System Security Design Guidelines Reference Manual, publication SECURE-RM001.
- Password protect the source and execution of the control program.
- Use EtherNet/IP devices in accordance with recommended architectures and concepts. See the Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001.
- Implement physical barriers, such as locked cabinets.

To limit access to the system, consider these options.

- Follow industry best practices to harden your PCs and servers, including antivirus/anti-malware and application solutions for whitelisting.

  The recommendations are published in the Rockwell Automation Customer Hardening Guidelines, Knowledgebase Document ID PN767.
- Develop and use backup and disaster recovery policies and procedures. Test backups on a regular schedule.
- Minimize network exposure for all control system devices and systems, and make sure that they are not accessible from the Internet.
- Locate control system networks and devices behind firewalls and isolate them from the business network.
- For access to information about security matters that affect Rockwell Automation products, visit the Rockwell Automation Security Advisories website and sign up for alerts.

Ownership

A controller must own every I/O module in a Logix 5000 control system, also known as the owner-controller. When a Compact 5000 digital I/O module is used in a Logix 5000 control system, the owner-controller can reside in a location that differs from the Compact 5000 digital I/O modules and it performs these actions.

- Stores configuration data for every module that it owns.
- Sends the I/O module configuration data to define module behavior and begin operation in the control system.

Each Compact 5000 digital I/O module must continuously maintain communication with its owner-controller during normal operation.

IMPORTANT These modules are restricted to one owner-controller.

- Compact 5000 standard output modules
- Compact 5000 safety I/O modules

Multiple Owners of Compact 5000 Standard Input Modules

Multiple Logix 5000 controllers can connect to Compact 5000 standard input modules as owner-controllers.

If multiple controllers are connected, these conditions must exist.

- The controllers maintain the same configuration.
- The configuration in each controller uses a Data connection to the input module.
- The first controller to make a connection to the input module is the only controller that can change the connection. Therefore, it is 'owns' the module configuration.

IMPORTANT If the controller that owns the module configuration changes the configuration, the other controllers are not notified of the changes.

For more information, see Configuration Changes in a Standard Input Module with Multiple Owners on page 19.

- The controllers that do maintain, but do not 'own', the module configuration are similar to listen-only controllers.

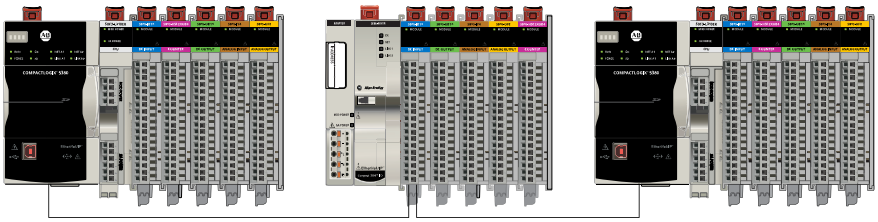
  The difference between the controllers is that the controllers that maintain, but do not own, the module configuration can use a Multicast or Unicast connection over the EtherNet/IP network.

  For more information on Listen-only controllers, see Listen Only Connections on page 33.

Configuration Changes in a Standard Input Module with Multiple Owners

Applies to these modules:
Standard I/O modules

You must be careful when changing the configuration data of an input module in a multiple-owner scenario. If the configuration data is changed in owner A and sent to the module, the changed configuration data is accepted as the new configuration for the module. Owner B continues to listen, unaware that any changes have been made in the behavior of the input module, as shown.



Controller A sends a new configuration to the module.

Controller B is unaware of the configuration changes.

IMPORTANT A message in the Studio 5000 Logix Designer application alerts you to the possibility of a multiple owner-controller situation and lets you inhibit the connection before changing the module configuration. When changing the configuration for a module with multiple owners, we recommend that you inhibit the connection.

To help prevent other owner-controllers from receiving potentially erroneous data, use these steps to change the configuration of a module in a multiple-owner scenario while online.

1. For each owner-controller, inhibit the connection to the module either on the Connection page or on the warning that alerts you of the multiple-owner condition.
2. Make the appropriate configuration data changes in the software.

   For more information, see Configure a Standard I/O Module on page 85.
3. Repeat steps 1...2 for all owner-controllers, to make the same changes in each.
4. Clear the Inhibit checkbox in each owner-controller configuration.

Construct a System

Before you use your Compact 5000 digital I/O modules, you must complete tasks that are based on whether the modules are local or remote I/O modules.

Local I/O Modules

To use your modules as local I/O, complete these steps.

1. Install a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 controller.

IMPORTANT You must use a Compact GuardLogix 5380 controller if the local Compact 5000 digital I/O modules includes safety I/O modules.

For more information on controller compatibility, see Controller and Software Compatibility on page 12.

2. Install the modules to the right of the controller.
3. Install the end cap on the last module in the local system.

IMPORTANT The end cap in a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 control system covers the exposed interconnection on the last module on the DIN rail.

If you do not install an end cap on the last module on the DIN rail, equipment damage or injury can occur.

Remote I/O Modules

To use your modules as remote I/O, complete these steps.

1. Install a controller that is compatible with the remote Compact 5000 digital I/O modules to be used in the application via an EtherNet/IP network.

IMPORTANT Remember, you must use a Compact GuardLogix 5380 controller or GuardLogix 5580 controller if the set of remote Compact 5000 digital I/O modules include safety modules.

For more information on controller compatibility, see Controller and Software Compatibility on page 12.

2. Install an EtherNet/IP network.
3. Connect the controller to the network.
4. Install a Compact 5000 EtherNet/IP adapter.
5. Connect the adapter to the network.
6. Install the Compact 5000 digital I/O modules to the right of the adapter.
7. Install the end cap on the last module in the local system.

IMPORTANT The end cap in a CompactLogix 5380, CompactLogix 5480, or Compact GuardLogix 5380 control system covers the exposed interconnection on the last module on the DIN rail.

If you do not install an end cap on the last module on the DIN rail, equipment damage or injury can occur.

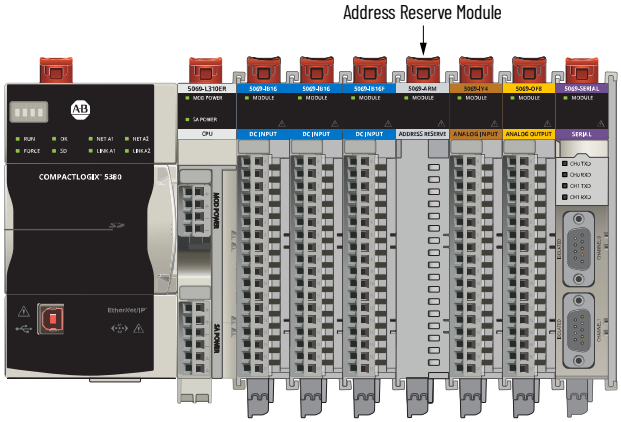
For information on how to install compatible controllers, adapters, and Compact 5000 I/O modules, see the publications that are listed in the Additional Resources on page 9.

Reserve a Node Address

Every Compact 5000 digital I/O module has a unique node address in a system. As modules are installed, the node addresses increase accordingly. The Studio 5000 Logix Designer project includes modules in the I/O Configuration that correspond to the physical modules.

If a module is not available during initial system installation and operation, you can use a 5069-ARM module to reserve the node address. The address reserve module remains installed until the functional I/O module is available.

To reserve the node address in the Studio 5000 Logix Designer project, when you add modules to the I/O Configuration tree in the project, add a 5069-ARM module at the node address that matches the physical module location.



When the I/O module becomes available, complete these tasks.

1. Remove the 5069-ARM module from the system.
2. Install the I/O module in the slot that previously contained the 5069-ARM module.
3. Replace the 5069-ARM module entry in the I/O Configuration section of the Studio 5000 Logix Designer project with the new I/O module.

   Verify that the I/O module has the same node address as the 5069-ARM module that it is replacing.

For more information on how to use a 5069-ARM module in a Studio 5000 Logix Designer project, see Reserve an I/O Module Slot on page 92.

Power the Modules

Compact 5000 digital I/O modules receive these power types from the controller or adapter.

Power Type	Location	Description
MOD power	System-side	• Powers the system and lets modules transfer data and execute logic. • Provided through the Module (MOD) power connector and passed to modules as they are added to the system. **IMPORTANT**: A system has only one MOD power bus.
SA power	Field-side	• Powers field-side devices that are connected to some Compact 5000 I/O digital modules. • Provided through the sensor actuator (SA) power connector and passed to modules as they are added to the system. **IMPORTANT**: A system can have multiple SA power buses. Use a 5069-FPD field potential distributor to establish new, isolated SA power buses in the same system. For more information, see Establish a New or Isolated SA Power Bus on page 23.

Power begins at the leftmost device in the system and passes across the I/O module internal circuitry via power buses. The MOD power bus and SA power bus are isolated from each other. The leftmost device is either a controller or an EtherNet/IP adapter.

IMPORTANT For Compact GuardLogix 5380 controllers only:

- You must use an SELV/PELV-listed power supply to provide MOD power and SA power to the controller.
- Additional requirements exist when you power a functional safety application that includes safety I/O modules.
  For more information on these requirements, see Power Requirements for Compact 5000 I/O Safety Modules on page 24.

IMPORTANT **DC-type modules** and **AC-type modules** must be on **separate SA power buses**.

These modules are **DC-type** modules.

- 5069-IB8S
- 5069-IB8SK
- 5069-IB16
- 5069-IB16F
- 5069-IB16K
- 5069-IB32
- 5069-IB6F-3W
- 5069-OB8
- 5069-OBV8S
- 5069-OBV8SK
- 5069-OB16
- 5069-OB16F
- 5069-OB16K
- 5069-OB32
- 5069-OW4I
- 5069-OW16
- 5069-OX4I

These modules are **AC-type** modules.

- 5069-IA16
- 5069-OA16

For information on how to establish new SA power buses, see Establish a New or Isolated SA Power Bus on page 23.

For more information on how to power local Compact 5000 digital I/O modules, see these resources.

- CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, publication 5069-UM001
- CompactLogix 5480 Controller User Manual, publication 5069-UM002

For more information on how to power remote Compact 5000 digital I/O modules, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.

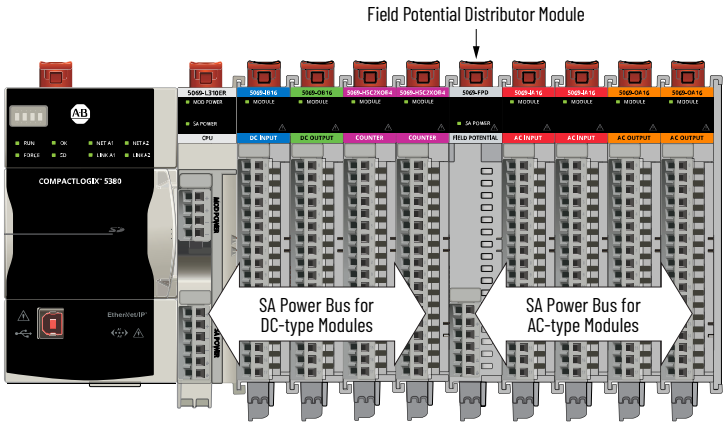
Establish a New or Isolated SA Power Bus

The 5069-FPD field potential distributor breaks the field-side power distribution in a Compact 5000 I/O system and creates a new SA power bus from which additional modules draw current. The 5069-FPD module passes MOD power bus signals to the next module in the system, and does not occupy a logic slot in the controller program.

These application conditions require a 5069-FPD module:

- AC-type modules and DC-type modules must be isolated from each other. A 5069-FPD module must be installed between the two groups to end one type of SA power bus and start a new type of SA power bus.
- A system requires additional SA power bus current because the I/O modules collectively draw more than 10 A current from the SA power bus. A 5069-FPD module can be added to provide more power.
- The Compact GuardLogix 5380 controller does not supply AC SA power, so AC-type modules cannot be installed directly next to the controller. A 5069-FPD module must be installed in between the controller and an AC module.
- Passes MOD power bus signals through to the next module in the system.

Isolated SA Power Buses



IMPORTANT If you install modules in a system that uses both DC SA power and AC SA power, you must isolate SA power buses by type with a 5069-FPD field potential distributor. To create separate SA power buses, complete these steps.

1. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller. This is the first SA power bus.
2. To create a second SA power bus, install the 5069-FPD field potential distributor to the right of these modules.
3. Install the modules that use the other type of SA power, for example AC, to the right of the 5069-FPD module.

Additional requirements apply when you use a 5069-FPD field potential distributor in a local or remote system with Compact 5000 safety I/O modules. For more information, see Power Requirements for Compact 5000 I/O Safety Modules on page 24.

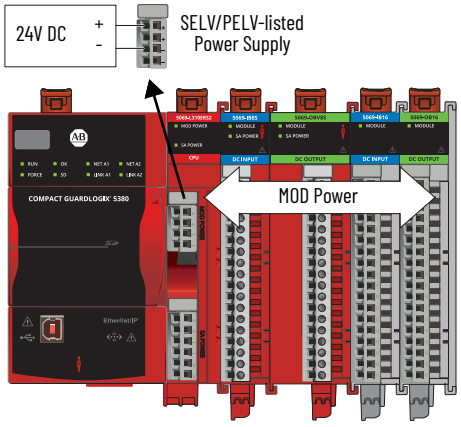
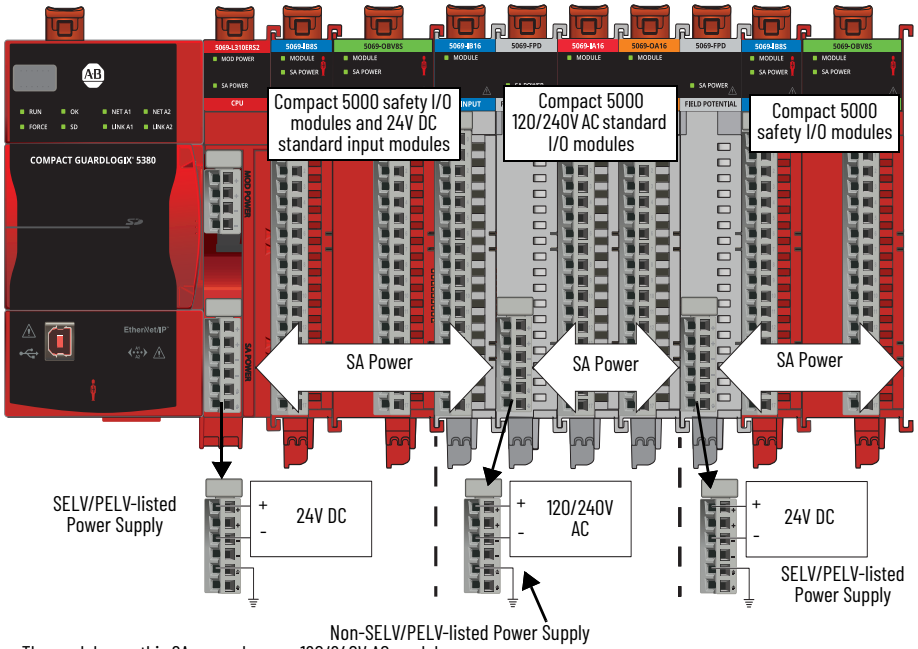
Applies to these modules:
Safety I/O modules

Power Requirements for Compact 5000 I/O Safety Modules

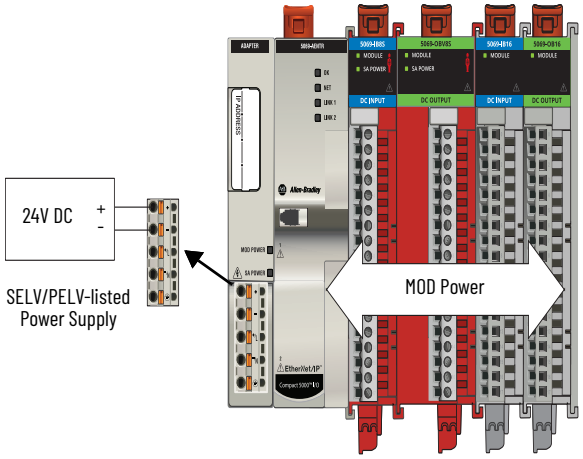
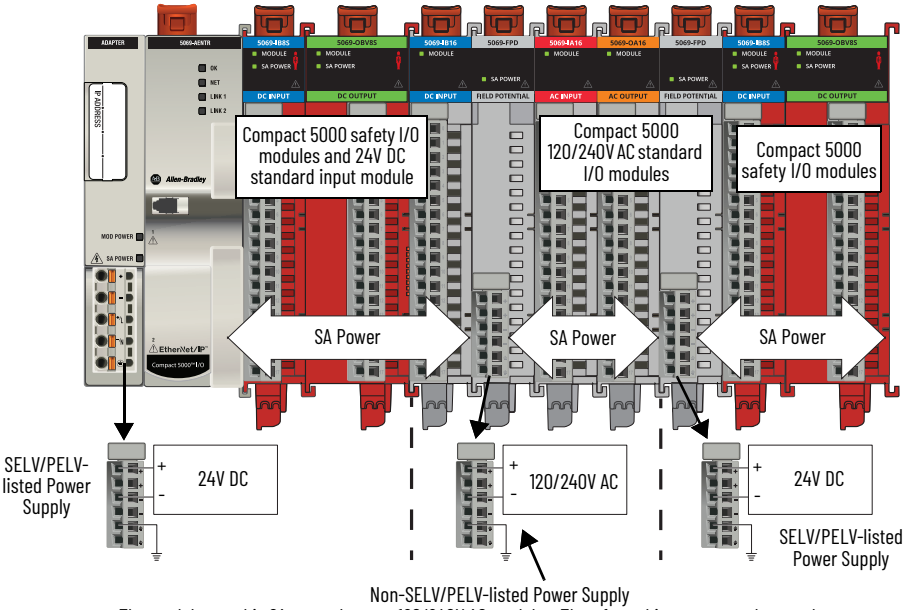
This section describes the requirements that apply when you connect MOD power and SA power to a system that includes both types of Compact 5000 digital I/O modules.

There is some variation in the requirements based on whether the safety I/O modules are used as local or remote I/O modules. That is, if the modules are installed in a Compact GuardLogix 5380 system or a Compact 5000 I/O system accessible over an EtherNet/IP network.

Connect Power to a Compact GuardLogix 5380 System with Compact 5000 Standard and Safety I/O Modules

Power Type	Requirements	Example System
MOD Power	• You must use an SELV/PELV-listed 24V DC power supply to provide MOD power to the controller. • The total continuous current draw across the MOD power bus must not be more than 5 A max at 18...24V DC. We recommend that you calculate the total MOD power bus current draw as you install the modules.	
SA Power	• You must use an SELV/PELV-listed power supply to provide SA power to the controller. • You must use a 24V DC power supply to provide SA power to the controller. • The total continuous current draw across an SA power bus must not be more than 10 A max at 18...24V DC. • You can install only Compact 5000 I/O safety I/O modules and non-relay DC-type standard I/O modules next to the safety controller. **IMPORTANT**: This requirement is related to the controller, not the I/O modules. However, you can install safety I/O modules and non-relay DC-type modules to the right of a 5069-FPD field potential distributor. • If you install safety I/O modules to the right of a field potential distributor, you must use an SELV/PELV-listed power supply to provide SA power. • You must isolate these groups of modules on **separate** SA power buses. – Safety and non-relay DC-type standard I/O modules – Relay DC-type modules – AC-type modules • If you install AC-type modules, you must install them to the right a field potential distributor. The 120/240V AC power supply that provides SA power is not required to be SELV/PELV-listed. • If you install relay DC-type standard I/O modules, you must install them to the right of a field potential distributor. The 24V DC power supply that provides SA power is not required to be SELV/PELV-listed.	 • The modules on this SA power bus are 120/240V AC modules. • This power supply can also be a non-SELV/PELV-listed 24V DC power supply, if necessary, based on system configuration. • The SA Power to adjacent SA Power electrical isolation that the 5069-FPD field potential distributor provides has a rating of 240V AC (continuous) reinforced insulation type.

Connect Power to a Remote Compact 5000 System with Standard and Safety I/O Modules

Power Type	Requirements and Example Systems	Example System
MOD Power	• You must use an SELV/PELV-listed power supply to provide MOD power to the controller. • The total continuous current draw across the MOD power bus must not be more than 10 A max at 18...24V DC. We recommend that you calculate the total MOD power bus current draw as you install the modules.	
SA Power	• You must use an SELV/PELV-listed power supply to provide SA power to the adapter. • You must use a 24V DC power supply to provide SA power to the adapter. • The total continuous current draw across an SA power bus must not be more than 10 A max at 18...24V DC. • If you install safety I/O modules to the right of a field potential distributor, you must use an SELV/PELV-listed power supply to provide SA power. • You must isolate these groups of modules on **separate** SA power buses. – Safety and non-relay DC-type standard I/O modules – Relay DC-type modules – AC-type modules • If you install AC-type modules, you must install them to the right a field potential distributor. The 120/240V AC power supply that provides SA power is not required to be SELV/PELV-listed. • If you install relay DC-type standard I/O modules, you must install them to the right of a field potential distributor. The 24V DC power supply that provides SA power is not required to be SELV/PELV-listed.	 • The modules on this SA power bus are 120/240V AC modules. Therefore, this power supply must be 120/240V AC. However, it can be a non-SELV/PELV-listed power supply because there are no safety I/O modules on the SA Power bus. • The SA Power to adjacent SA Power electrical isolation that the 5069-FPD field potential distributor provides has a rating of 240V AC (continuous) reinforced insulation type.

Configure the Modules

You must create a Studio 5000 Logix Designer project for the controller that owns the Compact 5000 digital I/O modules. The project includes module configuration data for the module.

The Studio 5000 Logix Designer application transfers the project to the owner-controller during the program download. Data is then transferred to the I/O modules either across the backplane or over an EtherNet/IP network.

The I/O modules can operate immediately after receiving the configuration data.

IMPORTANT This section shows Studio 5000 Logix Designer screens; it is not a complete description of how to configure a module.

- For more information on how to use the Studio 5000 Logix Designer application to configure Compact 5000 standard I/O modules, see Configure a Standard I/O Module on page 85.
- For more information on how to use the Studio 5000 Logix Designer application to configure Compact 5000 safety I/O modules, see Configure and Replace Safety I/O Modules on page 99.

Connections with Standard I/O Modules

Applies to these modules:
Standard I/O modules

During module configuration, you must define the module. Among the Module Definition parameters with Compact 5000 digital I/O modules, you must choose a connection type for the module. A connection is a real-time data transfer link between the owner-controller and the module that occupies the slot that the configuration references.

When you download the module configuration to a controller, the controller attempts to establish a connection to each module in the configuration.

Because part of the module configuration includes a slot number in the local or remote system, the owner-controller checks for the presence of a module there. If a module is detected, the owner-controller sends the configuration and one of these actions occurs.

- If the configuration is appropriate to the module detected, a connection is made and operation begins.
- If the configuration is not appropriate to the module detected, the data is rejected and the Studio 5000 Logix Designer application indicates that an error occurred.

  The configuration can be inappropriate for many reasons. For example, a mismatch in electronic keying that helps prevent normal operation.

The owner-controller monitors its connection with a module. Any break in the connection, for example, the loss of power to the system, causes a fault. The Studio 5000 Logix Designer application monitors the fault status tags to indicate when a fault occurs on a module.

Connection Types Available with the Standard I/O Modules

The Connection choice determines what data is exchanged between the owner-controller and the module. This table shows the available Connection choices for the standard I/O modules.

Connection Types - Compact 5000 Standard I/O Modules

Connection Type	Description	
	Compact 5000 Standard Input Modules	**Compact 5000 Standard Output Modules**
Data	The module returns this information to the owner-controller. • General input data • General fault data • Counter data - Not available with all modules	The module returns this information to the owner-controller. • General fault data • Output data
Data with Events[1]	The module returns this information to the owner-controller. • General input data • General fault data • Input data time stamp • Event input data time stamp • Event fault data • Event input data • Event output data • Counter data - Not available with all modules. With the modules that can provide counter data, they only provide it based on the Input Data selection.	–
Listen Only Data	When a Listen Only Data connection is used, the controller that makes the connection does not own the module configuration. The 'listen-only controller' merely listens to the data exchanged between the module and the owner-controller, that is, general input data and general fault data. For more information, see Listen Only Connections on page 33.	

(1) Data with events is available on only the 5069-IB16F and 5069-IB6F-3W standard input modules.

To configure the Connection Type, see Module Definition on page 94.

Data Types Available with the Standard I/O Modules

The Module Definition includes a Data parameter that matches the module type. Standard input modules use Input Data, and standard output modules use Output Data.

The module type and Connection choice determine the available Input Data or Output Data choices. For example, you can configure a 5069-IB16F input module to use the Connection choice Data with Events. The resulting Input Data choices are Data with Events include Data, Packed Data, or Timestamped Data, as shown.

The 5069-IB16 input module does not support the Connection choice Data with Events, however. As a result, the Input Data choice Timestamped Data is not available.

For more information on how to use the Module Definition parameters with Compact 5000 digital I/O modules, see these resources.

- Module Definition on page 94
- Studio 5000 Logix Designer application online help

Connections with the Safety I/O Modules

Applies to these modules:
Safety I/O modules

During module configuration, you must select the connection type. The choice depends on whether the project is downloaded to an owner controller, that owns the module configuration, or to a listen-only controller, that includes the module in a project. A real-time data transfer link is established between the controller and the module that occupies the slot that the configuration references.

When you download the module configuration to a controller, the controller attempts to establish a connection to each module in the configuration. Because part of the module configuration includes a slot number in the local Compact GuardLogix 5380 controller system or the remote Compact 5000 I/O system, the owner-controller checks for the presence of a module there. If a module is detected, the owner-controller sends the configuration. One of these actions occurs.

- If the configuration is appropriate to the module detected, a connection is made and operation begins.
- If the configuration is not appropriate to the module detected, the data is rejected and the Studio 5000 Logix Designer application indicates that an error occurred.

  The configuration can be inappropriate for many reasons. For example, a mismatch in electronic keying that helps prevent normal operation.

The owner-controller monitors its connection to a module. Any break in the connection causes a fault, like the loss of power to a remote Compact 5000 I/O system. The Studio 5000 Logix Designer application monitors the fault status tags to indicate when a module fault occurs.

Configured By Options Available with the Safety I/O Modules

The Configured By selection determines what data is exchanged between the owner-controller and the safety I/O module.

Configured By Options - Compact 5000 Safety I/O Modules

Configured By Option	Description	
	Compact 5000 I/O Safety Input Module	**Compact 5000 I/O Safety Output Module**
This Controller	This choice directs the controller to configure the module. The module returns this information to the owner-controller. • General fault data • Safety input data • Muting lamp points	The module returns this information to the owner-controller. • General fault data • Safety input data • Safety output data **IMPORTANT**: When you choose This Controller, you must define the output mode that the module uses, that is, sourcing or bipolar output mode.
External Means	This choice directs the controller to establish only a safety input connection. When the External Means is chosen, another controller owns the module. A controller that uses this option does not write the configuration for the module or control the Test Outputs. It merely listens to the data exchanged with the owner-controller. That is, it receives Safety input data. For more information, see External Means on page 34. In this case, all other connections to the module, for example, the connection to the owner-controller must also use the Multicast option.	

To select the Configured By options, see Module Definition on page 105.

Data Types Available with the Safety I/O Modules

This table describes the data types that are available for the safety I/O modules.

Data Types - Compact 5000 Safety I/O Modules

Catalog Number	Supported Data Types	Data Type Choices
5069-IB8S, 5069-IB8SK(1)	Input Data	Safety Data Safety Packed Data
	Output Data	There is not an Output Data field in the Module Definition parameters for the 5069-IB8S module. However, if you enable Muting on points 02 and/or 03, output data is available in module output tags. For more information, see Module Tags on page 121.
5069-OBV8S, 5069-OBV8SK(1)	Input Data	Safety Data Safety Packed Data
	Output Data	Safety Data Safety Packed Data None **IMPORTANT**: This field is automatically set based on how you configure the Configured By and Input Data parameters in the Module Definition parameters. For example, if you configure a 5069-OBV8S module to use the Configured By parameter of This Controller and the Input Data parameter of Safety Data, the Output Data field is automatically set to Safety Data and no other choices are available.

(1) The conformal coated module catalog numbers are not available in the Studio 5000 Logix Designer application. If your application uses a conformal coated module, you choose the non-conformal coated catalog number when you add the module to the project.

To set the Data Type, see Module Definition on page 105.

Muting Lamp Points Available with the Safety Input Modules

The Muting Lamp Points parameter defines what output points on the module, if any, are connected to muting lamps.

There is a corresponding test output point configuration when an output is configured as a muting lamp output. The output drives a muting lamp. For more information, see Muting Lamp Operation on page 76.

IMPORTANT If the Configured By parameter is External Means, the Muting Lamp Points parameter is disabled. It is automatically set to None.

To set the Muting Lamp Points, see Module Definition on page 105.

Output Mode Available with the Safety Output Modules

The Output Mode parameter defines whether the module is operating in Sourcing or Bipolar mode.

IMPORTANT If the Configured By parameter is External Means, the Output Mode parameter is disabled. It is automatically set to None.

For more information on the Module Definition parameters that are available with Compact 5000 digital I/O modules, see the Studio 5000 Logix Designer application.

To set the Output Modes, see Module Definition on page 105.

Requested Packet Interval

The Requested Packet Interval (RPI) is a configurable parameter that defines a rate at which the owner-controller and the module exchange data.

You set the RPI value during initial module configuration and can adjust it as necessary after module operation has begun. These are the valid RPI values.

- Compact 5000 standard I/O modules - 0.2...750 ms
- Compact 5000 safety I/O modules - 2...500 ms

IMPORTANT You can change the RPI while the project is online. If you change the RPI while the project is online, however, the connection to the module is closed and reopened in one of these ways.

- You inhibit the connection to the module, change the RPI value, and uninhibit the connection.
- You change the RPI value. In this case, the connection is closed and reopened immediately after you apply the change to the module configuration.

For more information on how to specify RPI rates, see these resources.

- Compact 5000 standard I/O modules - Connection on page 93
- Compact 5000 safety I/O modules - Connection on page 103
- Logix 5000 Controllers Design Considerations Reference Manual, publication 1756-RM094

Connection Reaction Time Limit with Compact 5000 Safety I/O Modules

The Connection Reaction Time Limit defines the predicted period of safety packets on the associated connection. If the Max Network Delay exceeds the Connection Reaction Time Limit, a connection fault occurs. By default, the Connection Reaction Time Limit is four times the RPI.

Use the default values for Timeout Multiplier (2) and Network Delay Multiplier (200). The Network Delay Multiplier value is in terms of percentage.

IMPORTANT To determine the appropriate selections, analyze each safety channel. The default Timeout Multiplier of 2 and Network Delay Multiplier of 200 creates a worst-case input connection reaction time limit of 4 times the RPI, and an output connection reaction time limit of 3 times the RPI.

A safety administrator must thoroughly review and approve the changes to these parameters.

Connection Over an EtherNet/IP Network

When you configure a remote Compact 5000 digital I/O module, you must configure the Connection over EtherNet/IP parameter in the configuration for the remote adapter that connects the I/O modules to the network. The configuration choice dictates how input data is transmitted over the network.

The Compact 5000 digital I/O modules use one of these methods to transmit data.

- Multicast - Data is sent to all network devices.

  If you are using the I/O modules in a redundancy system, you must use Multicast.
- Unicast - Data is sent to one or more controllers depending on module configuration.

  Unicast is the default setting.

Input Module Data

Logix 5000 controllers do not poll the Compact 5000 digital input modules for input data.

At the RPI, the module sends input data, like channel and status data, to the controller and the controller sends data to the module inputs. For example, the controller sends data that unlatches or enables alarms.

The data exchange occurs over the system backplane for local modules, and over an EtherNet/IP network for remote modules.

Data Transmission Type	Events that Occur at RPI
Local Input Module to Controller	1. The input module scans its channels for input data. 2. The module sends the data to the system backplane. 3. The controller receives the data immediately.
Controller to Local Input Module	1. The controller broadcasts the data to the system backplane. 2. The module receives the data from the backplane and behaves as dictated by its configuration.
Remote Input Module to Controller	1. The input module scans its channels for input data. 2. The module sends the data to the remote system backplane. 3. The Compact 5000 I/O EtherNet/IP adapter sends the data over the EtherNet/IP network. 4. One of these events. – If the controller is connected directly to the EtherNet/IP network, it receives the input data immediately. – If the controller is connected to the EtherNet/IP network through an adapter, the module sends the data to its backplane and the controller receives it.
Controller to Remote Input Module	1. One of these events. – If the controller is connected directly to the EtherNet/IP network, it broadcasts the data to the network. Skip to step 3. – If the controller is connected to the EtherNet/IP network via an EtherNet/IP communication module, the controller transmits the data to its backplane. Continue to step 2. 2. The EtherNet/IP communication module transmits the data to the EtherNet/IP network. 3. The Compact 5000 I/O EtherNet/IP adapter receives the data from the network and transmits it to the remote system backplane. 4. The Compact 5000 digital input module receives the data from the backplane and behaves as dictated by its configuration.

IMPORTANT Use an EtherNet/IP communication module **only** if a ControlLogix 5580 or GuardLogix 5580 controller owns the I/O module.

CompactLogix 5380, CompactLogix 5480, and Compact GuardLogix 5380 controllers do not support the use of an EtherNet/IP communication module in the local system.

Trigger Events

IMPORTANT Compact 5000 I/O safety input modules cannot trigger events.

Some standard input modules can trigger an event, like the Event task. The event task lets you execute a section of logic immediately when an event, or receipt of new data, occurs.

These changes can trigger events.

- An input state change.
- A counting input done bit change.
- A pattern of input state changes on multiple module inputs.

For more information on how to use a Compact 5000 I/O standard input module to trigger an event, see Events on page 51.

Output Module Data

Logix 5000 controllers send data to Compact 5000 digital output modules at the RPI or after an Immediate Output (IOT) instruction is executed.

- The RPI defines when the controller sends data to an output module and when the module sends data to the controller. For example, when the output module sends the channel data quality.

IMPORTANT The RPI for a safety output module is the Safety Task period. Safety output data is sent at the completion of the Safety Task scan.

- The IOT instruction sends new data to an output module whenever it is produced.

IMPORTANT Only CompactLogix 5380 and CompactLogix 5480 controllers can send data to Compact 5000 digital output modules when an IOT instruction is executed.

Compact GuardLogix 5380 controllers **cannot** send data when an IOT instruction is executed. You cannot use IOT instructions in safety programs.

Compact 5000 digital output modules receive output data from a controller and send data to the controller. Data is handled differently depending on the type of transmission.

Output Module to Controller	Controller to Output Module
• When a local Compact 5000 digital output module receives new data and the requested data value is present on the RTB, the output module sends, or echoes, a data value back to the controller and to the rest of the control system. The data value corresponds to the signal present at its terminals. This feature is called Data Echo, see page 60. • The output module also sends other data to the controller at the RPI. For example, the module alerts the controller if a short circuit condition exists on the module.	• The controller broadcasts data to its local backplane at one of the following: – RPI – An IOT instruction is executed. **IMPORTANT**: An IOT instruction sends data to the output module immediately, and resets the RPI timer. • Based on the RPI rate and the length of the controller program scan, the output module can receive and send data multiple times during one program scan. • When the RPI is less than the program scan length, the output channels can change values multiple times during a program scan. The program scan does not need to be complete before the owner-controller sends data.

The data exchange occurs over the system backplane for local modules, and over an EtherNet/IP network for remote modules.

Data Transmission Type	Events that Occur when Data is Sent
Local Output Module to Controller	1. The module sends the data to the system backplane. 2. The controller receives the data immediately.
Controller to Local Output Module	1. The controller sends data to the system backplane at the RPI or when an IOT instruction is executed. 2. The module receives the data from the system backplane and behaves as dictated by its configuration.
Remote Output Module to Controller	1. The module sends the data to the remote system backplane. 2. The Compact 5000 I/O EtherNet/IP adapter sends the data over the EtherNet/IP network. 3. One of these events. – If the controller is connected directly to the EtherNet/IP network, it receives the input data immediately. – If the controller is connected to the EtherNet/IP network through an adapter, the module sends the data to its backplane and the controller receives it.
Controller to Remote Output Module	1. One of these events. – If the controller is connected directly to the EtherNet/IP network, it broadcasts the data to the network. Skip to step 3. – If the controller is connected to the EtherNet/IP network via an EtherNet/IP communication module, the controller transmits the data to its backplane. Continue to step 2. 2. The EtherNet/IP communication module transmits the data to the EtherNet/IP network. 3. The Compact 5000 EtherNet/IP adapter receives the data from the network and transmits it to the remote system backplane. 4. The module receives the data from the backplane and behaves as dictated by its configuration.

IMPORTANT Use an EtherNet/IP communication module **only** if a ControlLogix 5580 or GuardLogix 5580 controller owns the I/O module.

CompactLogix 5380, CompactLogix 5480, and Compact GuardLogix 5380 controllers do not support the use of an EtherNet/IP communication module in the local system.

Listen Only Connections

Applies to these modules:
Standard I/O modules

The owner-controller, as described in the Ownership on page 18 section, exchanges data with I/O modules. The owner-controller owns the module configuration in its Studio 5000 Logix Designer project.

Other controllers, which do not own the module or exchange data with it, can listen to input data or echoed output data. While the listen-only controller does not own the module configuration, the module is included in the listen-only controller's Studio 5000 Logix Designer project.

IMPORTANT Listen-only connections include these restrictions.

- The connection type is only available with Compact 5000 standard I/O modules.
- The I/O modules must reside in a remote system. Controllers cannot make listen-only connections to local I/O modules.

For more information, see Connection Types Available with the Standard I/O Modules on page 27.

Connection Over EtherNet/IP

You must set the Connection Over EtherNet/IP parameter when you configure a remote Compact 5000 I/O module. The available choices are Unicast and Multicast.

To establish a Listen Only connection from a listen-only controller, the Connection over EtherNet/IP must be Multicast in the Studio 5000 Logix Designer project for both the owner-controller and the listen-only controller.

To set the Connection Over EtherNet/IP parameter, see Connection on page 93.

Connection Request Errors

Module faults and connection request errors occur if the Connection Over EtherNet/IP connection is not Multicast in both Studio 5000 Logix Designer projects.

Information about the fault is available on the Connection on page 93 page.

Connection over EtherNet/IP Choice		Error Code
Owner-controller project	**Listen-only controller project**	
Multicast	Multicast	None - Connection established successfully
Multicast	Unicast	16#0106 Connection Request Error: Module owned and configured by another controller. Module may accept only one connection if Unicast is used.
Unicast	Unicast or Multicast	16#0108: Connection Request Error: Connection type (Multicast/Unicast) are not supported.
Inhibited or powered-down	Multicast	16#0119 Connection Request Error: Module not owned.

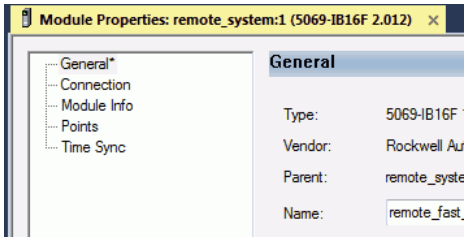
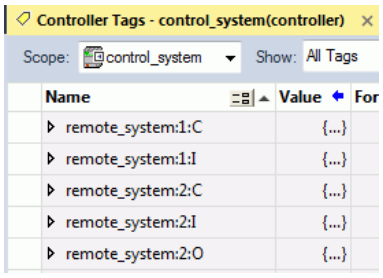
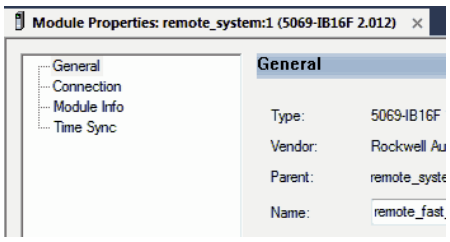
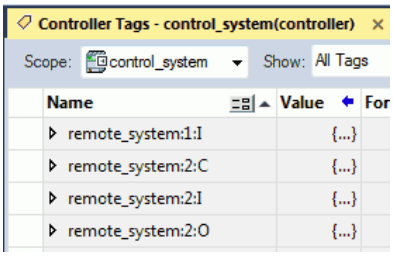
IMPORTANT:
In rare instances, the Studio 5000 Logix Designer application lets you configure a module with choices that result in connection request errors. However, the application does not alert you of the error until the project goes online. Verify the Connection Over EtherNet/IP choice in the listen-only controller project before you go online.

Additional Considerations With Listen-only Connections

Remember this information when you use listen-only connections.

- Listen-only controllers receive data from the module as long as the connection between the owner-controller and the module is maintained.

  If the connection between an owner-controller and the module is broken, the module does not send data and connections to all listen-only controllers are broken.
- When a controller uses a Listen Only Data connection, configurable categories in the Module Properties are not available. And only Input tags are created in the Module tags.

Controller Type	Module Properties Pages	Module Tags Created
Owner-controller Project		
Listen-only Controller Project	 Points page is not available.	 Only Input tags are created.

External Means

Applies to these modules:
Safety I/O modules

Any controller in the system can listen to the input data from a safety I/O module.

Use the External Means option to define the connection for a controller that does not own the module configuration or exchange information with it, but listens to the input data from the module.

When you use External Means to configure the module, you can disable the module configuration signature, which disables the configuration validation check when connections are made.

To set the External Means options, see Module Definition on page 105.

IMPORTANT
- If a controller uses External Means, the connection can be Multicast or Unicast.
- Once the owner-controller configures a module, External Means connections can be created and maintained regardless of the owner state.

Protected Operations

Operations that can disrupt the operation of a Compact 5000 digital I/O module are restricted based on the current module operating mode.

- When the connection is not established, all requests and changes are accepted.
- When the connection is established, the behavior depends on the request or change. See the Protected Operation Behavior in Protection Mode table on page 35.
- When a firmware update is in progress, all requests and changes are rejected.

A Compact 5000 digital I/O module enters Protection Mode as soon as connection to the module is established. The module exits Protection Mode as soon as connection to the module is stopped.

Protected Operation Behavior in Protection Mode

Request or Change	Protection Mode/Connection Established Behavior
Firmware Update request	**Rejected** - The Studio 5000 Logix Designer application attempts the request or change but it does not take effect, and you receive an alert that it is rejected.
Module Reset request	
Connection request	**Accepted** if it is a Listen Only connection request.
Configuration change	**Accepted** when you complete one of these actions. • Change the Module Properties parameters and click Apply. • Change the Configuration tags and send a Reconfigure Module MSG to the module.
Connection or Data Format change	**Not allowed** - The Studio 5000 Logix Designer application does not attempt the not allowed activities, and you receive an alert that it is not allowed. If you are online, the Connection or Data Format fields are disabled in the Module Definition parameters.
Electronic Keying change	**Accepted** - The change occurs after the connection is closed and reopened. You can close and reopen the connection in these ways. • Change the project while it is offline and download the updated project before you go online again. • Change the project while it is online and click Apply or OK in the Module Properties parameters. In this case, before the change is made, a warning alerts you of the ramifications before the change is made.
RPI change	

Considerations Specific to Safety I/O Modules

Applies to these modules:
Safety I/O modules

Compact 5000 safety I/O modules have additional items of which you must be aware. Type approval, certification, and suitability for use in safety applications vary by catalog number.

IMPORTANT Functional safety certification and performance of the safety I/O modules requires that the modules operate in conditions at or below the ambient operating temperature specification.

The probability of a dangerous failure on demand (PFD) and average frequency of a dangerous failure per hour (PFH) calculations for these modules are based on module operating conditions that adhere to the ambient operating temperature specification.

For more information on the maximum ambient operating temperature specification for Compact 5000 safety I/O modules, see the Compact 5000 I/O Modules and EtherNet/IP Adapter Technical Data, publication 5069-TD001.

This information applies to the safety I/O modules.

- Type-approved and certified for use in safety applications up to and including SIL 3 per IEC 61508
- Suitable for use in safety applications up to and including SIL CL 3 per IEC 62061
- Suitable for use in safety applications up to and including Performance Level e (PLe), category 4 per ISO 13849-1

IMPORTANT Requirements are based on the standards current at the time of certification.

For more information on safety application suitability levels with the Compact 5000 safety I/O modules, see Safety Input Module Features on page 72 or Safety Output Module Features on page 79.

Overall System Safety Function

The type of approval, certification, and suitability levels for safety I/O modules describe a system with an overall system safety function of SIL 3. However, you can use the safety I/O modules in safety applications with an overall system safety function that is less than SIL 3.

EXAMPLE
- Compact GuardLogix 5380 controllers are suitable for use in safety applications that are rated up to, and including, SIL CL 2, PLd, Cat. 3. In this case, the overall system safety function is SIL 2. You can use Compact 5000 safety I/O modules in this application even though the modules are rated for use in systems with a higher overall system safety function.
- GuardLogix 5580 controllers, when used with a safety partner are suitable for use in SIL 3 safety applications. You can use Compact 5000 safety I/O modules as remote I/O modules in these applications.

For more information on the suitability level of Logix 5000 safety controllers, see the GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012.

Single-channel or Dual-channel Mode

You can use safety I/O modules in single-channel mode or dual-channel configuration. The configuration affects the safety application suitability level for a module.

In single-channel mode, the signal status on one channel is evaluated. Based on that status, safety input data and safety input status can be off or on.

In dual-channel mode, the consistency between the signal status on the two channels is evaluated. Based on the status on both channels, safety input data and safety input status can be off or on.

Use safety instructions in the safety controller ladder logic with two single channels: one even and one odd.

If you use dual-channel safety instructions in the Safety Task, like the Dual Channel Input Stop (DCS) instruction, we recommend that you configure the channels for single-channel mode.

Determine Conformity

ATTENTION: Use only appropriate components or devices that comply with the relevant safety standards and meet the required safety integrity level or Performance Level and safety category.
- Conformity to the requirements of the relevant safety standards must be determined for the entire system by conducting a risk assessment.
- Use devices properly according to the installation environment, performance rating, and functions of the machine.
- Use devices within their specified ratings.
- We recommend that you consult a certification body regarding assessment of conformity to the required safety integrity level or Performance Level.

You are responsible for confirming compliance with the applicable standards for the entire system. You must read, understand, and fulfill the functional safety requirements of the standard applicable to your safety application.

Safety Precautions

ATTENTION: Personnel responsible for the application of safety-related programmable electronic systems (PES) shall be aware of the safety requirements in the application of the system and shall be trained in the use of the system.

Observe these precautions for the proper use of Compact 5000 safety I/O modules.

ATTENTION: As serious injury can occur due to loss of the required safety function, follow these safety precautions.

- Never use test outputs as safety outputs. Test outputs are not safety outputs.
- Do not use standard I/O data or explicit message data as safety data.
- Do not use light-emitting diode (LED) status indicators on the I/O modules for safety operations.
- Do not connect loads beyond the rated value to the safety outputs.
- Apply properly specified voltages to the module. Applying inappropriate voltages can cause the module to fail to perform its specified function, which could lead to loss of safety functions or damage to the module.
- Wire the Compact 5000 safety I/O modules as shown in the Compact 5000 I/O Modules and EtherNet/IP Adapters Technical Data, publication 5069-TD001.
- Set unique network node addresses before connecting devices to the network.
- Perform testing to confirm that device wiring, configuration, and operation is correct before you start system operation.
- Do not disassemble, repair, or modify the module as these actions can result in the loss of safety functions.

For more information about safety precautions, see Limit Access to the System on page 18.

Safety Function During Firmware Update

The Compact 5000 safety I/O modules are not safety-capable when a firmware update is in process. You must use other methods to maintain the safety function during the update process.

Install and Replace Modules

ATTENTION:

- Clear previous configuration data before you connect devices to the network or you connect input or output power to the device.
- Configure the replacement device properly and confirm that it operates correctly.
- After installation of the module, a safety administrator must confirm the installation and conduct trial operation and maintenance.

Limit Access to the System

For information on how to limit access to the system, see Limit Access to the System on page 18.

Safety Application Requirements

Safety application requirements include evaluating these items.

- Probability of failure rates (PFD and PFH)
- System reaction time settings
- Functional verification tests that fulfill appropriate safety-level criteria

Other required parts of the safety application development process are when you create, record, and verify the safety signature. The safety controller creates the safety signatures. The safety signature consists of an identification number, date, and time that uniquely identifies the safety portion of a project. This number includes all safety logic, data, and safety I/O configuration.

For safety system requirements, including information on the SNN, verifying the safety signature, functional verification test intervals, system reaction time, and PFD/PFH calculations, see the GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012.

You must read, understand, and fulfill the requirements that are described in this publication before you operate a safety system that uses Compact 5000 safety I/O modules.

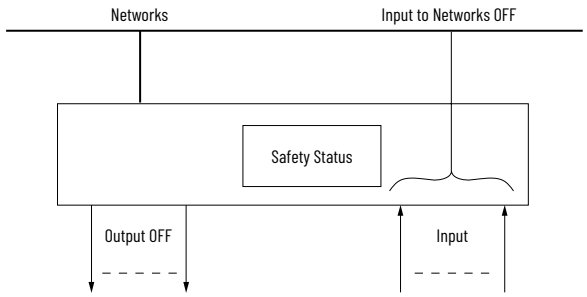
Safe State

ATTENTION:
- The safe state of the outputs is defined as the off state.
- The safe state of the module and its data is defined as the off state.
- Use the Compact 5000 safety I/O modules only in applications where the off state is the safe state.

These are the safe states of the safety I/O modules.

- Safety outputs: OFF
- Safety input data to network: OFF

Safety Status



The modules are designed for use in applications where the safe state is the off state.

IMPORTANT If you inhibit a safety I/O module from transitioning to a safe state when a fault occurs because an I/O connection is lost, you accept responsibility for any consequences that result from your decision to inhibit.

We recommend that you use other means to maintain the safe state if you inhibit the safety I/O module from transitioning to a safe state.

Configuration Signature and Ownership

Every Compact 5000 safety I/O module in a system has a configuration signature and configuration ownership.

Configuration Signature

Each safety device has a unique configuration signature that defines the module configuration. The configuration signature includes this information.

- ID number
- Date
- Time

The configuration signature is used to verify a module's configuration.

Configuration Ownership

The connection between the owner-controller and the Compact 5000 safety I/O module is based on this information.

- Compact 5000 safety I/O module node number
- Compact 5000 safety I/O module safety network number
- Controller node or slot number

IMPORTANT If the owner-controller is a Compact GuardLogix 5380 controller, the controller has a node number.

If the owner-controller is a GuardLogix 5580 controller, the controller has a slot number.

- Controller safety network number
- Path from the controller to the Compact 5000 safety I/O module
- Configuration signature

If any differences are detected, the connection between the owner-controller and the Compact 5000 safety I/O module is lost, the yellow yield icon appears in the controller project tree.

Different Configuration Owner

When a controller owns the I/O module configuration, other controllers can listen to the input module. In this case, the module configuration signature in the Studio 5000 Logix Designer project for any listen-only controller must match the one in the owner-controller project.

If the safety I/O module is configured for inputs only, you can copy and paste the configuration signature from one project to the other.

If the safety I/O module has safety outputs, for example, the 5069-OBV8S module, the configuration signature parameter is disabled.

Reset Safety I/O Modules to Out-of-Box State

If a safety I/O module was used previously, you must clear the configuration ownership before you can install it on a safety network. That is, you must return the module configuration to its out-of-box state.

When a safety I/O module is in the out-of-box state, a controller does not own its configuration.

The Safety page in the Module Properties displays the module Configuration Ownership. The Studio 5000 Logix Designer project must be online to check.

If the module configuration is owned, the Safety page displays whether the controller for the opened project owns the module configuration or another controller owns it.

For more information, see Reset to Out-of-Box Configuration on page 109.

You cannot reset the module to its out-of-box configuration if any of these conditions exist.

- There are pending edits to the module properties.
- A safety signature exists in the controller project.

Common Compact 5000 Digital I/O Module Features

This chapter describes features that are common to all Compact 5000® digital I/O modules unless otherwise noted.

Some features are supported on all I/O modules and other features are specific to module types. The differences are indicated in the feature descriptions.

Input Module Compatibility

Compact 5000 digital input modules interface to sensing devices and detect whether they are On or Off.

The input modules convert DC On/Off signals from user devices to the appropriate logic level for use in the controller. Typical input devices include these switches.

- Proximity
- Limit
- Selector
- Float
- Push button

When you design systems with Compact 5000 digital input modules, consider these factors.

- Voltage necessary for your application
- Current leakage
- Whether you need a solid-state device
- Whether your application uses sinking or sourcing wiring

Output Module Compatibility

Compact 5000 digital output modules can be used to drive output devices. These are the typical devices that are compatible with the output modules.

- Motor starters
- Solenoids
- Indicators

When you design systems with Compact 5000 digital output modules, follow these guidelines.

- Make sure that the output modules can supply the necessary surge and continuous current for proper operation.
- Make sure that the surge and continuous current are not exceeded. Damage to the module could result.

When you size output loads, refer to the documentation supplied with the output device for the surge and continuous current necessary to operate the device.

Software Configurable

Use the Studio 5000 Logix Designer® application to configure the modules, monitor system operation, and troubleshoot issues. You can also use the Studio 5000 Logix Designer application to retrieve this information from any module in the system:

- Serial number
- Firmware revision information
- Product code
- Vendor
- Error and fault information
- Diagnostic information

By minimizing the need for tasks, such as setting hardware switches and jumpers, the software makes module configuration easier and provide excellent reliability.

Module Data Quality Reporting

The Compact 5000 digital I/O modules indicate the quality of channel data that is returned to the owner-controller. Data quality represents accuracy. Levels of data quality are reported via module input tags.

These input tags indicate the level of data quality.

Input Tag	Data Quality Description	Example Causes	Recommendation
I.Ptxx.Fault	This tag indicates that the reported channel data is inaccurate and cannot be trusted for use in your application. Do not use the reported channel data for control. If the tag is set to 1, you cannot trust the data reported. You must troubleshoot the module to correct the cause of the inaccuracy.	• Field Power Loss condition (output modules) • No Load condition (standard output modules only) • Short Circuit condition (output modules)	• Troubleshoot the module for the typical causes first. • Monitor the tags in your program to make sure that the application is operating as expected with accurate channel input data.
I.Ptxx.Uncertain	This tag indicates that the reported channel data can be inaccurate but the degree of inaccuracy is unknown. We recommend that you do not use the reported channel data for control. If the module sets this tag to 1, this indicates that the data can be inaccurate. You must troubleshoot the module to discover what degree of inaccuracy exists.	• Module is operating outside its designed operating range • Data is under manual or override control	

IMPORTANT
Once the condition that causes the Fault or Uncertain tag to change to 1 is removed, the tag automatically resets to 0. The Studio 5000 Logix Designer application controls the tags. You cannot change the status of the tags.
Remember that in some system configurations, the tag is not reset immediately after the condition is removed. The tag typically resets after a small delay.

Fault and Status Reporting

The Compact 5000 digital I/O modules report fault and status data along with channel data. Fault and status data is reported in these ways.

- Studio 5000 Logix Designer application
- Module status indicators
- I/O status indicators

IMPORTANT Do not use the module status indicators or I/O status indicators on Compact 5000 safety I/O modules for safety operations.

For more information, see:

- Input modules - Fault and Status Reporting on page 58
- Output modules - Fault and Status Reporting on page 70
- Troubleshoot the Module on page 111

Inhibit a Module

When you inhibit a module you indefinitely suspend a connection, including Listen Only connections, between an owner-controller and a digital module without removing the module from the configuration. This process lets you temporarily disable a module, such as to perform maintenance.

This table explains when to use the Inhibit Module feature.

Inhibit the Module	Description	Example
Before the controller connects to a module	You can write a configuration for a module and inhibit the module to help prevent it from communicating with the owner-controller. The owner does not establish a connection and the configuration is not sent to the module until the connection is uninhibited.	If you write a program that includes a module that is not installed yet. Inhibit the module until it is installed so the controller does not look for it.
After the controller connects to the module	Your controller already owns a module, has downloaded the configuration to the module, and is exchanging data over the connection between the devices. When you inhibit the module, the owner-controller behaves as if the connection to the module does not exist.	To update the firmware on a module, use this procedure. 1. Inhibit the module. 2. Perform the update. 3. Uninhibit the module.

IMPORTANT When you inhibit an output module that has ProgMode enabled, it enters Program mode, and all outputs change to the state configured for Program mode.

For example, if an output module is configured so that the state of the outputs transition to zero during Program mode, whenever that module is inhibited, the outputs transition to zero.

To inhibit a module, see these sections.

- Compact 5000 standard I/O modules - Connection on page 93
- Compact 5000 safety I/O modules - Connection on page 103

Electronic Keying

Electronic Keying reduces the possibility that you use the wrong device in a control system. It compares the device that is defined in your project to the installed device. If keying fails, a fault occurs. These attributes are compared.

Attribute	Description
Vendor	The device manufacturer.
Device Type	The general type of the product, for example, digital I/O module.
Product Code	The specific type of the product. The Product Code maps to a catalog number.
Major Revision	A number that represents the functional capabilities of a device.
Minor Revision	A number that represents behavior changes in the device.

These Electronic Keying options are available.

Keying Option	Description
Compatible Module	Allows the installed device to accept the key of the device that is defined in the project when the installed device can emulate the defined device. With the Compatible Module option, you can typically replace a device with another device that has these characteristics. • Same catalog number • Same or higher Major Revision • Minor Revision as follows: – If the Major Revision is the same, the Minor Revision must be the same or higher. – If the Major Revision is higher, the Minor Revision can be any number.
Disable Keying	Indicates that the keying attributes are not considered when attempting to communicate with a device. With this option, communication can occur with a device other than the type that is specified in the project. **IMPORTANT**: Do not use this option in Safety applications. **ATTENTION**: Be cautious when you use the Disable Keying option; if it is used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We **strongly recommend** that you **do not use** Disable Keying. If you use Disable Keying, you take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application.
Exact Match	Indicates that all keying attributes must match to establish communication. If any attribute does not match precisely, communication with the device does not occur.

Carefully consider the implications of each keying option when you select one.

IMPORTANT If you change the Electronic Keying parameters while the project is online, you interrupt connections to the device and any devices that are connected through the device. Connections from other controllers can also be broken.

If an I/O connection to a device is interrupted, the result can be a loss of data.

For more detailed information on Electronic Keying, see the Logix 5000® Control Systems Application Technique, publication LOGIX-AT001.

Module Firmware

The Compact 5000 digital I/O modules are manufactured with module firmware installed. If updated module firmware revisions are available in the future, you can update the firmware.

Updated firmware revisions are made available for various reasons, for example, to correct an anomaly that existed in previous module firmware revisions.

IMPORTANT Verify that the module firmware revisions for the Compact 5000 safety I/O modules that you use are correct before you commission your system.

Download updated firmware files from the Rockwell Automation® Product Compatibility and Download Center (PCDC) at rok.auto/pcdc.

Do not download firmware from non-Rockwell Automation sites.

Producer/Consumer Communication

Compact 5000 digital I/O modules use the Producer/Consumer communication model to produce data without a controller that polls them first. The modules produce the data and the controllers consume it. That is, the owner-controller and controllers with a Listen Only connection to the module can consume it.

When an input module produces data, the controllers can consume the data simultaneously. Simultaneous data consumption minimizes the need for one controller to send the data to other controllers.

Use CIP Sync Time with Fast I/O Modules

Applies to these modules:
Standard I/O modules

These standard I/O modules use CIP Sync™ for time stamps and scheduling.

- 5069-IB16F
- 5069-IB6F-3W
- 5069-OB16F

CIP Sync is a CIP™ implementation of the IEEE 1588 PTP (Precision Time Protocol). CIP Sync provides accurate Real-World Time (real-time) or Universal Coordinated Time (UTC) synchronization of controllers and devices that are connected over CIP networks. This technology supports highly distributed applications that require time stamps, a sequence of recorded events, distributed motion control, and increased control coordination.

The 5069-IB16F, 5069-IB6F-3W, and 5069-OB16F modules are CIP Sync follower-only devices. There must be another module on the network that functions as a leader clock. For more information on how to use CIP Sync technology, see the Integrated Architecture® System and CIP Sync Configuration Application Technique, publication IA-AT003.

You can use fast Compact 5000 digital I/O modules to capture time stamps and schedule outputs while providing these advances.

- Fast I/O modules have a higher precision than other modules.
- Inputs have time stamps by point, so multiple inputs can be configured for COS without the loss of time stamp data.
- CIP Sync is system-wide, so time stamp and schedule values are consistent across all modules in the system.

  For example, if you use time stamps on a 5069-IB16F module to schedule outputs on a 5069-OB16F module, the controller, input module, and output module are not required to reside in the same local system. The I/O modules can reside in a remote I/O system.
- Output modules use all 64 bits of the time stamp to schedule, so there are no limits on schedule ranges.

CIP Sync Time Stamps

Applies to these modules:
Standard I/O modules

The control system uses a 64-bit system clock. The modules support CIP Sync time stamps by using the 1588 protocol that is passed throughout the system. The 1588 protocol is defined in the IEEE 1588-2002 standard, publication Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems.

IMPORTANT The safety I/O modules do not support time stamps.

Each input channel scan or new output application is stamped with a CIP Sync time stamp. One time stamp is returned to the controller for the module with the input data transfer.

You can use this feature for these tasks.

- To identify the sequence of events in fault conditions or during normal operation.

  You can use the system clock between multiple modules in the same chassis or throughout a system in which a common time grandmaster is used.
- To measure the change between samples and detect when a new sample is available for processing via the logic. The change between samples likely correlates closely with the RPI if no samples are missed in the logic.

You can also use the 1588 Protocol to synchronize sampling for modules across the entire system. By using the Synchronized Sampling feature, you can configure multiple modules to coordinate their input samples precisely with each other by using the same RPI.

Synchronized Sampling lets you configure a test stand, for example, and take many measurements simultaneously across many modules, if needed, while still precisely coordinating the sampling. With these modules, the synchronized sampling coordinates within approximately ± 10 µs.

Time Stamp Options

Option	Description	
Time stamp for a sequence of events	You can use CIP Sync to establish a sequence of events occurring at a particular input module point with time stamps of the input data. To determine a sequence of events, you must complete these actions. • Set the format of the input module to Timestamped Input Data. • Enable COS for the input where a sequence occurs, and disable COS for all other points on the module.	
		If you configure multiple inputs for COS, your module generates a unique time stamp each time any of those inputs change state if the changes do not occur within 500 µs of each other. If multiple inputs are configured for COS change state within 500 µs of each other, one time stamp is generated for all state changes. As a result, it appears as if they changed simultaneously.
Time stamps with scheduled outputs	You can time stamp with the scheduled outputs feature, so that after input data changes state and a time stamp occurs, an output point actuates at a specific time. You can schedule outputs into the future. Outputs that are sent in one packet can differ by approximately 2 seconds. Send in multiple messages to allow greater space between schedules. When you use time stamps of inputs and scheduled outputs, you must complete these actions. • Choose a connection format for each input and output module that enables the time stamps. • Disable COS for all input points on the input module except the point being timestamped.	
		For scheduled outputs to work most effectively, remember this information. • The schedule fires when it is configured to. You must make sure that there is enough time for the schedule to plan ahead. If you are using an MAOC instruction, you cannot control the schedule. • A system-level Grandmaster synchronizes the times of the I/O modules.

Input Module Features

This chapter describes features that are supported on all Compact 5000® I/O digital input modules unless otherwise noted.

IMPORTANT Remember this information.

- These modules also have features that apply to all Compact 5000 digital I/O modules that are described in Common Compact 5000 Digital I/O Module Features on page 41 and Safety I/O Module Features on page 71.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure a Standard I/O Module on page 85 and Configure and Replace Safety I/O Modules on page 99.

Input Module Types

The Compact 5000 digital I/O module family offers these input modules. Modules that end in a 'K' are conformally coated.

Module	Description
5069-IA16	AC standard input module
5069-IB16, 5069-IB16K, 5069-IB32	DC standard input modules
5069-IB16F, 5069-IB6F-3W	DC standard fast input modules
5069-IB8S, 5069-IB8SK	DC safety input modules

Data Transfer at RPI or Change of State

Compact 5000 digital input modules always send data at the RPI, but they send data at a change of state only if the COS feature is enabled.

This table describes the two ways in which a module sends data to the owner-controller.

Method	Description
RPI	A user-defined rate at which the module updates the information that is sent to its owner-controller.
COS	A configurable feature that, when enabled, instructs the module to update its owner-controller with new data whenever a specified input point transitions from On to Off and Off to On. The data is sent at the RPI rate when there is no change of state. By default, this setting is always enabled for input modules.

You set the RPI on the Connection page of the Module Properties.

Software Configurable Input Filters and Delays

You can increase the time that it takes for an input point to transition from On to Off and Off to On for Compact 5000 digital input modules. The increase in time is a delay of the signal from the module to the controller.

The increase in the time to transition from one state to another improves noise immunity within a signal.

Standard Input Modules

For standard input modules, the configurable parameter is Input Filter Time. This table describes how to use this feature with most of the standard input modules.

Module	Valid Filter Value Range	Default Value
5069-IB16, 5069-IB16K	0 µ...50 ms	1 ms
5069-IB6F-3W		0 µs
5069-IB16F		
5069-IB32		1 ms

The input signal that is connected to the 5069-IA16 input module dictates the valid input filter values that you can use.

Input Signal Value	Filter Time: Off to On - Valid Values	Filter Time: On to Off - Valid Values
120V AC	• 1 ms	• 10 ms • 20 ms
240V AC	• 1 ms • 2 ms • 5 ms	• 5 ms • 10 ms • 20 ms

IMPORTANT The Studio 5000 Logix Designer application lets you choose filter time values that are invalid for some input signals.

For example, the only valid Off to On filter value when a 120V AC signal is connected to the module is 1 ms. However, you can choose 1 ms, 2 ms, or 5 ms.

Make sure that you select a valid input filter value when you configure the module. If you select an invalid input filter value, the module can read signal levels incorrectly.

To set the input filter values, see Module-specific Parameters on page 95.

Compact 5000 I/O Safety Input Modules

For Compact 5000 I/O safety input modules, the configurable parameter is **Input Delay Time**. This table describes how to use this feature with the safety input modules. For more information, see Safety Input Delay Time on page 75.

Modules	Valid Filter Value Range	Default Value
5069-IB8S, 5069-IB8SK	0 ms...50 ms	0 ms

To set the Input Delay Time on the 5069-IB8S or 5069-IB8SK modules, see Module-specific Parameters on page 106.

Input Filter with Compact 5000 I/O Fast Input Modules

IMPORTANT
- This description applies to the 5069-IB16F, 5069-IB6F-3W, 5069-IB32 modules, and to any 5069-IB16 module that uses firmware revision 2.011 or earlier.
- The input filters work the same whether the transition is a simple state transition or when the state transition triggers an Event.

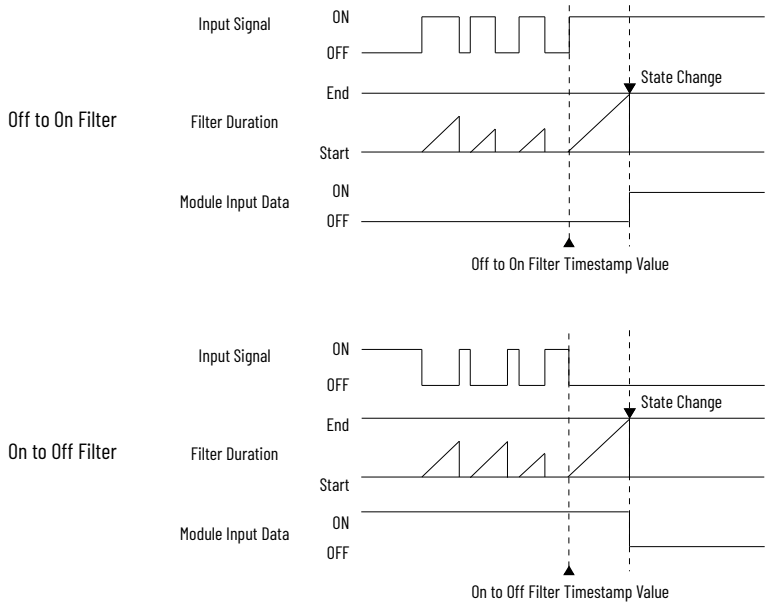
On the Compact 5000 I/O fast input modules, the input filter not only helps to improve noise immunity in a signal but also to help prevent rapid changes of the input data due to contact bounce.

The input filter time defines how long an input signal transition must remain in the new state before the transition is valid and the input changes state. Input and Event time stamps are only recorded with valid transitions.

A transition is only valid if the input signal remains in the new state for the entirety of the filter duration. If the input changes state again before the chosen input filter time elapses, the transition is not valid.

In this figure, the first three signal transitions--both On to Off and Off to On-- remain the same state until the filter time elapses and are not valid.

Input Filter Usage on Compact 5000 I/O Fast Input Modules



Simple Count Mode

Applies to these modules:
Standard I/O modules

Simple Count mode is used to count input pulses.

IMPORTANT These Compact 5000 I/O standard input modules support Simple Count mode.
- 5069-IB16, 5069-IB16K
- 5069-IB16F
- 5069-IB6F-3W
- 5069-IB32

When using the simple counter function, the module counts input pulses up to these frequencies.

Module	Simple Counter Maximum Frequency	Inverse Period	Maximum Number of Counters	Channels that Can Be Configured as Counters
5069-IB16, 5069-IB16K, 5069-IB32	500 Hz	2 ms	8	0...7
5069-IB16F	30 kHz	33.3 µs	8	0...7
5069-IB6F-3W			4	0...3

The modules compare the total count to the previously programmed values and then can activate an associated output. The modules provide for count up functionality and counter overflow.

Sequence of Events Per Point Time Stamps

Applies to these modules:
Standard I/O modules

Time stamps record a time reference when a change in input data occurs. CIP Sync™ is used to time stamp.

IMPORTANT These Compact 5000 I/O standard input modules support per point time stamps.
- 5069-IB16F
- 5069-IB6F-3W

The 5069-IB16F and 5069-IB6F-3W DC input modules offer submillisecond time stamps on a per point basis. Time stamp values have ±10 µs accuracy and ±1 ns resolution.

You can use CIP Sync to establish a sequence of events occurring at an input module point through input data time stamps. To determine a sequence of events, you must perform these actions.

- In the Module Definition parameters, set the Input Data parameter to Timestamp Data.
- Enable COS for the input point where a sequence occurs, and disable COS for all other points on the module.

  You can enable COS in these ways.

Location in Studio 5000 Logix Designer Application	Action
Module Properties > Points page > Ptxx page	Check the input transition type where you must latch short-duration pulses. For example, to latch short-duration pulses for Off to On transitions, check Off -> On Input Transition.
Module tags	One or both of these actions. • Change the C.Ptxx.CaptureOffOnEn tag to 1. • Change the C.Ptxx.CaptureOnOffEn tag to 1.

For more information, see CIP Sync Time Stamps. To set the time stamp, see Ptxx on page 97.

Chatter Detection

Applies to these modules:
Standard I/O modules

Chatter Detection is a feature that is directly related to time stamps. Use this feature to detect when a device that is connected to an input module causes chatter.

Chatter occurs when the device causes the inputs to transition falsely many times in a relatively short period. As a result, the module time stamps invalid input transitions.

You can configure these chatter parameters.

- Chatter count - Determines the number of acceptable input transitions that can occur in a given time period before considering the input to be chatter.

  Valid chatter count values range from 2...127.
- Chatter Time - Determines the amount of time within which the number of input transitions are counted.

  Valid chatter time values range from 1...10000 ms.

To set the Chatter Detection options, see Ptxx on page 97.

Events

Applies to these modules:
Standard I/O modules

You can use the Events feature to trigger events.

IMPORTANT These Compact 5000 I/O standard input modules support the Events feature.
- 5069-IB16F
- 5069-IB6F-3W

The modules support up to four event configurations.

These changes can trigger events.

- An input state change.
- A counting input done bit change.
- A pattern of input state changes on multiple module inputs.

You must use the Data with Events connection type in the Module Definition to use the Events feature.

Event Definition

When you define an event, remember:

- The event definition parameters are shown on the Events*xx* page in the Module Properties. The parameters are read-only on this page.
- The event definition parameters are configured in the Event Outputs as shown in this example.

For more information, see Events on page 97.

This table describes the tasks that are included in the event definition.

Task	Event Output Tag to Change	Valid Values
Enable the event.	EO.Eventxx.En	• 0 = Event is disabled. • 1 = Event is enabled.
Choose if an input state change or a pattern of input state changes triggers the event.	EO.Eventxx.IndependentConditionTriggerEn	• 0 = Pattern of input state changes triggers the event. • 1 = Single input state change triggers the event.
Select at least one point on the module to participate in the event.	The tag name changes based on the input function. These names are available. • EO.Eventxx.PtxxDataSelect - This tag appears for any point on the module if no counters are used. • EO.Eventxx.CounterxxSelect - These tags begin at point00 and continue based on the number of counters that the module uses.	• 0 = Point does not participate in the event trigger. • 1 = Point participates in the event trigger.
For all points that participate in the event, choose what constitutes an event state.	The tag name changes based on the input function. These names are available. • EO.Eventxx.PtxxDataValue - This tag appears for any point on the module if no counters are used. • EO.Eventxx.CounterxxValue - The tags begin at point00 and continue based on the number of counters that the module uses.	• 0 = On to Off state transition • 1 = Off to On state transition
Choose which edge of the event triggers the event. • Rising edge • Falling edge • Either edge	Both of these tags. • EO.Eventxx.EventRisingEn • EO.Eventxx.EventFallingEn	The combination of the tag settings determines which edge triggers the event. • Set a rising edge trigger: – EO.Eventxx.EventRisingEn = 1 – EO.Eventxx.EventFallingEn = 0 • Set a falling edge trigger: – EO.Eventxx.EventRisingEn = 0 – EO.Eventxx.EventFallingEn = 1 • Set either edge triggers: – EO.Eventxx.EventRisingEn = 1 – EO.Eventxx.EventFallingEn = 1
Latch the event. This task is optional.	EO.Eventxx.LatchEn	• 0 = Event is not latched. • 1 = Event is latched.

Independent Point Trigger

An input state change that triggers an event is known as an independent point trigger.

To use this type of trigger, you must enable the Independent Point Trigger option in the event definition. You set the EO.Eventxx.IndependentConditionTriggerEn tag to 1.

Pattern Match Trigger

When a pattern of input state changes triggers an event, multiple points participate in the event trigger. To use this type of trigger, you must disable the Independent Point Trigger option in the event definition. You set the EO.Eventxx.IndependentConditionTriggerEn tag to 0.

Every point that participates in an event trigger is configured separately. Depending on the event definition, the collective status of all points triggers the event. The table describes event triggers.

Trigger	Definition
Enter pattern match state	If the event is configured to trigger on the rising edge, the event is triggered when a state change on any participating point results in all point configuration conditions being met. On the Eventxx page, Trigger Event displays 'On input transition to match pattern'.
Leave pattern match state	If the event is defined to trigger on the falling edge, the event is triggered when a state change on any participating point results in all point configuration conditions no longer being met. On the Eventxx page, Trigger Event displays 'On input transition do not match pattern'.
Enter or leave pattern match state	If the event is defined to trigger on the rising or falling edge, the event is triggered when a state change on any participating point results in all point configuration conditions being met or no longer being met. On the Eventxx page, Trigger Event displays 'On input transition do not match pattern'.

Additional Event Considerations

When you use the Events feature, also consider this information.

- An Event task only actuates if an event occurs.

  IMPORTANT Make sure that you link the Event task to the Event Input tag, not the Input tag.

  Keep in mind that when the Event task executes, the input tag data can have the same data that was sent at the last RPI.

- An event is recognized only when it maintains the same state for at least the duration of the input filter time specified.
- Configure the event at a rate that stops task overlap conditions. If you enable COS for multiple points, a task overlap of the event can occur.
- Configure the event at a rate that is likely to succeed. A 2 ms signal width is the minimum pulse width that can be used at which the event succeeds.
- After the event executes, it does not execute again until the event occurs again.
- For more information on event tasks, see the Logix 5000® Controllers Tasks, Programs, and Routines Programming Manual, publication 1756-PM005.

To use the Events feature, see Events on page 97.

Pulse Latching

Applies to these modules:
Standard I/O modules

Use Pulse Latching to detect or latch short-duration pulses. The module can detect incoming pulses with a duration as short as 10 µs if the frequency is under 4 kHz (period of 250 µs).

IMPORTANT These Compact 5000 I/O standard input modules support Pulse Latching:
- 5069-IB16F
- 5069-IB6F-3W

Pulse Latching is supported via the Timestamping feature and Timestamp Latching. To use Pulse Latching, you must complete these actions:

- In the Module Definition parameters, set the Input Data parameter to Timestamp Data.
- Enable COS for the input point where a latch of short duration pulses is needed. You can enable COS in these ways. COS is disabled by default on all points.

Location in Studio 5000 Logix Designer Project	Action
Module Properties > Points page > Ptxx-page	Check the input transition type where you must latch short-duration pulses. For example, for short-duration pulses that are latched for Off to On transitions, check Off -> On Input Transition.
Module tags	One or both of these actions. • Change the C.Ptxx.CaptureOffOnEn tag to 1. • Change the C.Ptxx.CaptureOnOffEn tag to 1.

When the module detects a short-duration pulse at an input point, these changes occur.

Input Transition Type Where Pulse Is Captured	Change in Studio 5000 Logix Designer Project
Off to On	• The I.Ptxx.TimestampOffOnNumber tag increments. • The time stamp is recorded in the I.Ptxx.TimestampOffOn tag.
On to Off	• The I.Ptxx.TimestampOnOffNumber tag increments. • The time stamp is recorded in the I.Ptxx.TimestampOnOff tag.

When subsequent short-duration pulses are detected at the same input point, the Latching configuration dictates what changes, if any, occur in the Studio 5000 Logix Designer project.

Latching Configuration	Input Transition Type Where Pulse Is Captured	Change in Studio 5000 Logix Designer Project
Disabled (default) These conditions disable Timestamp Latching. • The Enable Timestamp Latching checkbox on the PTxx page is empty • The C.Ptxx.TimestampLatchEn tag = 0	Off to On	The I.Ptxx.TimestampOffOnNumber tag increments. The new time stamp is recorded in the I.Ptxx.TimestampOffOn tag, which overwrites the previous time stamp.
	On to Off	The I.Ptxx.TimestampOnOffNumber tag increments. The new time stamp is recorded in the I.Ptxx.TimestampOnOff tag, which overwrites the previous time stamp.
Enabled These conditions enable Timestamp Latching. • The Enable Timestamp Latching checkbox on the PTxx page is checked • The C.Ptxx.TimestampLatchEn tag = 1	Off to On	The I.Ptxx.TimestampOffOnNumber and I.Ptxx.TimestampOffOn tags remain latched until the last captured pulse is acknowledged. In other words, the tag values remain the same until the last captured pulse is acknowledged.
	On to Off	The I.Ptxx.TimestampOnOffNumber and I.Ptxx.TimestampOnOff tags remain latched until the last captured pulse is acknowledged. In other words, the tag values remain the same until the last captured pulse is acknowledged.

To acknowledge the last captured pulse, set the output tag of the last input pulse as follows:

- Off to On transition - Set the O.Ptxx.TimestampOffOnNumberAck tag = I.Ptxx.TimestampOffOnNumber tag.
- On to Off transition - Set the O.Ptxx.TimestampOnOffNumberAck tag = I.Ptxx.TimestampOnOffNumber tag.

Once a pulse latch is acknowledged for an input point, the next pulse at that point increments the corresponding I.Ptxx.TimestampOffOnNumber and records the time stamp in I.Ptxx.TimestampOffOn.

You can change tag values in program logic while normal module operation continues or through the Studio 5000 Logix Designer application tag editor. For more information, see Module Tags on page 121.

Field Power Loss Detection

The Field Power Loss Detection feature monitors for the loss of field-side power on an SA power bus.

IMPORTANT These Compact 5000 I/O input modules support Field Power Loss Detection.

- 5069-IB16F
- 5069-IB6F-3W
- 5069-IB8S
- 5069-IB8SK

When power is lost from an SA power bus, the Compact 5000 I/O safety input modules detect the loss of field power and all points on the module fault. Fault data is then sent to the controller.

These tables describe what happens when a field power loss condition is detected and when field power is restored. To correct the issue, reapply field power to the test output.

Field Power Loss - Standard Input Modules

Attribute	Field Power Loss Detected	Field Power Restored
I.Ptxx.Fault tag value	1	0
FieldPowerOff diagnostic value	1	0
I/O Status Indicator	Flashing red	Off

Field Power Loss - Safety Input Modules

Attribute	Field Power Loss Detected	Field Power Restored
Test Output Behavior	• Faults • Turns off	Restarts in the commanded state **IMPORTANT:** To complete the recovery, the module can require an additional 1 s after the Input Error Latch Time.
I.Testxx.FieldPowerOff tag value	1	0
I.Testxx.Fault tag value	1	0
FieldPowerOff diagnostic value	1	0
SA Status Indicator	Off	Steady green
I/O Status Indicator	Steady red	Off

If a fault occurs, there is a corresponding Field Power Loss tag that you can examine in the application program. For more information, see Module Tags on page 121.

You can also monitor a point for the presence of a field power loss via the diagnostics that are available in the Module Properties.

IMPORTANT

- Field Power Loss detection is specific to the SA power bus.
- If separate external power supplies are used for each SA power bus, the loss of field power from one SA power bus does not affect modules on a different SA power bus.
- You can use 5069-FPD field potential distributors to establish new SA power buses that are separate from the one that the controller or adapter establishes.

Short Circuit Protection

Applies to these modules:
Safety I/O modules

Short Circuit Protection helps prevent damage to a test output on a 5069-IB8S or 5069-IB8SK module that can result when more current is present at the output than it can handle.

IMPORTANT The 5069-IB8S and 5069-IB8SK are the only Compact 5000 I/O input modules that support Short Circuit Protection.

The diagnostic is supported on all Test Output and the Test Output/Muting Output points.

This table describes what happens when a short circuit is detected and when the short is removed.

Attribute	Short Circuit Detected	Short Circuit Removed
Test Output Behavior	• Faults • Turns off	Restarts in the commanded state
I.Testxx.ShortCircuit tag value	1	0
I.Testxx.Fault tag value	1	0
Short Circuit diagnostic value	1	0
I/O Status Indicator	Flashing red	Turns off if there is no longer a load that is connected to the output.

For more information on the maximum current that you can apply to an output, see the Compact 5000 I/O and Specialty Modules Technical Data, publication 5069-TD001.

Muting Lamp Fault and Short Circuit Diagnostics Triggered

The conditions that are described in this section can trigger the Muting Lamp Fault and Short Circuit diagnostics on a 5069-IB8S or 5069-IB8SK module test output point.

This table describes the conditions in which the muting lamp fault and short circuit diagnostics are triggered and what happens when they are corrected. In each of the examples, these conditions are also present.

- Muting Lamp Points in the Module Definition = Point 02, Point 03, or Point 02 and 03
- Test Output Point Mode = Muting Lamp
- Test Output Data tag = 1

Attribute	Test Output Point Shorted to:			Issue Corrected
	24V DC	Another Test Output Point	Ground	
Test Output Behavior	• Faults • Turns off	• Faults - only the test output point that is affected • Turns off	• Faults • Turns off	Restarts in the commanded state
I.Testxx.ShortCircuit tag value	1	1	1	0
I.Testxx.Fault tag value	1	1	1	0
Muting Lamp Fault diagnostic value	1	1	–	–
Short Circuit diagnostic value	1	1	1	0
Short Circuit to Ground diagnostic value	–	–	1	0
I/O Status Indicator	Flashing red	Flashing red	Flashing red	Turns off if there is no longer a load that is connected to the output.

The diagnostics on the fault test output point are triggered in succession; the Muting Lamp Fault diagnostic changes to 1 and then the Short Circuit diagnostic is triggered.

Test Output Recovery After Overload or Short Circuit to Ground Condition

This table describes test output recovery after overload or short circuit to ground conditions occur. In each of the examples, these conditions are also present.

- Test Output Point Mode = Pulse Test, Power Supply, or Muting Lamp
- Test Output Data tag = 1

Attribute	Overload Condition	Short Circuit to Ground Condition
Module Operating Condition	Overload current ≥ 0.7 A	Test output is connected directly to ground
Correction	Remove the load from the test output point.	One of these actions. • If the Point Mode for the test output is Pulse Test or Power Supply when the Short Circuit condition is detected, you can correct the condition, but you cannot set the test output to a safe state. • If the Point Mode for the test output is Muting Lamp and the output is on when the Short Circuit condition is detected, the ShortToHigh is detected as a muting fault.
Recovery Time	After the condition is corrected, and the test output is returned to the safe state, it recovers in whichever of these times are higher. • 10 seconds • Input Error Latch Time To set the Input Error Latch Time, see Input Data on page 105.	

Thermal Shutoff

Applies to these modules:
Safety I/O modules

Thermal Shutoff helps prevent damage to a test output on the 5069-IB8S or 5069-IB8SK module that can result when an output gets hotter than it can handle.

IMPORTANT The 5069-IB8S and 5069-IB8SK are the only Compact 5000 I/O input modules that support Thermal Shutoff.

This feature is directly related to Short Circuit Protection feature. The increased temperature at the output results from an excessive load at the output. That is, a load with high current is applied to the output. The high current heats the output beyond an acceptable temperature and the output turns off.

This table describes what happens when a thermal shutoff condition is detected and when it is corrected.

Attribute	Thermal Shutoff Detected	Thermal Shutoff Corrected
Test Output Behavior	• Faults • Turns off	Returns to the commanded state **IMPORTANT**: The commanded state must be Off.
I.Testxx.ShortCircuit tag value	1	0
Short Circuit diagnostic value, if shorted to 24V DC	1	0
Overload diagnostic value, if shorted to ground	1	0
I/O Status Indicator	Steady red	Off - if there is no longer a load that is connected to the output.

For more information, see Module Tags on page 121.

Fault and Status Reporting

The Compact 5000 digital input modules multicast fault and status data with channel data to the owner-controller and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the input modules provide the fault and data status in a point-specific format. In this table, the tag names that include Ptxx represent channel-specific data, where xx is the channel number. Not all tags that are listed in these tables apply to all modules.

Fault Tags - Standard Digital Input Modules

Tag Name	Trigger Event
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Counterxx.Fault	The counter data quality is bad.
Ptxx.Fault	The point data quality is bad.
Eventx.CounterxxFault	The corresponding counter had a fault that indicated when the event occurred.
Eventx.Fault	The signal connection is lost.
Eventx.Ptxx.Fault	The event data quality is bad.

Status Tags - Standard Digital Input Modules

Tag Name	Trigger Event
RunMode	The module is in Run Mode.
DiagnosticActive	Indicates if any diagnostics are active or if the prognostic threshold is reached.
DiagnosticSequenceCount	The count increases each time that a diagnostic condition is detected or removed.
Counterxx.Data	The point input status is 0 or 1.
Counterxx.Uncertain	The counter data can be imperfect.
Eventx.PtxxData	The point input status is 0 or 1.
Eventx.Uncertain	The event data can be imperfect.
Ptxx.Data	The point input status is 0 or 1.
Ptxx.Uncertain	The point data can be imperfect.
Uncertain	The module is operating outside its designed operating range if data is under manual or override control. This tag provides module-wide data and affects all channels simultaneously.

Fault Tags - Safety Input Modules

Tag Name	Triggering Event
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Ptxx.Fault	The point data quality is bad or the channel is set to Not Used.
Ptxx.ShortCircuit	A short circuit condition exists on the point.
Testxx.Fault	The point data quality is bad or the channel is set to Not Used.
Testxx.ShortCircuit	A short circuit condition exists on the test point.
Testxx.FieldPowerOff	A field power lost condition exists on the test point.

Status Tags - Safety Input Modules

Tag Name	Triggering Event
RunMode	The module is in Run Mode.
DiagnosticActive	Indicates if any diagnostics are active or if the prognostic threshold is reached.
DiagnosticSequenceCount	The count increases each time that a diagnostic condition is detected or removed.
Ptxx.Data	The current data at the point.
Ptxx.Uncertain	The point data can be imperfect because an Over temperature or Critical Temperature condition exists.
Ptxx.Status	The point state transitions from normal to faulted or faulted to normal.
Testxx.Readback	A 24V DC power is present at the test output.

Output Module Features

This chapter describes features that are supported on all Compact 5000® digital output modules unless otherwise noted.

IMPORTANT Remember this information.

- These modules also have features that apply to all Compact 5000 digital I/O modules that are described in Common Compact 5000 Digital I/O Module Features on page 41 and Safety I/O Module Features on page 71.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure a Standard I/O Module on page 85 and Configure and Replace Safety I/O Modules on page 99.

Output Module Types

The Compact 5000 digital I/O module family offers these output modules. Modules that end in a 'K' are conformally coated.

Module	Description
5069-OA16	AC output module
5069-OB8, 5069-OB16, 5069-OB16K, 5069-OB32	DC output modules
5069-OB16F	DC fast output module
5069-OW4I, 5069-OW16, 5069-OX4I	Relay output modules
5069-OBV8S, 5069-OBV8SK	DC safety output modules

Data Echo

Data Echo automatically sends channel data values that match the digital value that was sent to the module's screw terminals.

At the RPI, the output module sends fault and status data, and returns a value that was sent to it by the owner-controller. The echoed value is indicated in the I.Chxx.Data and is represented in engineering units.

For more information, see Local Output Module to Controller on page 32.

Field Power Loss Detection

The Field Power Loss Detection feature monitors for the loss of field power, either from the SA power bus or, for some modules, from the LA power terminals.

IMPORTANT	These modules support Field Power Loss Detection and receive field power from the **SA power bus**: • 5069-OA16 • 5069-OW16, Series A and Series B The 5069-OW16 Series C module does not support Field Power Loss Detection because it does not draw current from the SA power bus.	These modules support Field Power Loss detection and receive field power from **LA power terminals**: • 5069-OB8 • 5069-OB16/B, 5069-OB16K/B • 5069-OB16F/B • 5069-OB32 • 5069-OBV8S, 5069-OBV8SK These modules do not draw current from the SA power bus.

When field power is lost, Compact 5000 digital output modules detect the loss of field power and all points on the module fault. Fault data is then sent to the controller.

These tables describe what happens when a field power loss condition is detected and when field power is restored. To correct the issue, reapply field power to the output module.

Field Power Loss - Standard Output Modules

Attribute	Field Power Loss Detected	Field Power Restored
Output Behavior	• Faults • Turns off	Restarts in the commanded state. If the commanded state is On, the output turns on 100 ms after the Field Power Loss condition is resolved. **IMPORTANT:** To complete the recovery, the module can require an additional 1 s after the Output Error Latch Time.
I.Ptxx.Fault tag value	1	0
FieldPowerOff diagnostic value	1	0
I/O Status Indicator	Flashing red	Off

Field Power Loss - Safety Output Modules

Attribute	Field Power Loss Detected	Field Power Restored
Output Behavior	• Faults • Turns off	Restarts in the commanded state. If the commanded state is On, the output turns on 100 ms after the Field Power Loss condition is resolved. **IMPORTANT** To complete the recovery, the module can require an additional 1 s after the Output Error Latch Time.
I.Ptxx.Fault tag value	1	0
I.Ptxx.FieldPowerOff tag value	1	0
FieldPowerOff diagnostic value	1	0
I/O Status Indicator	Steady red	Off

IMPORTANT For the 5069-OBV8S and 5069-OBV8SK modules, Field Power Loss detection also detects an undervoltage or overvoltage condition on the SA power bus where the module resides. If the SA power bus uses a level of power that is outside the supported voltage range for the module, the conditions that are described in the previous table occur.

Undervoltage or overvoltage conditions on the SA power bus can be detected whether field power is connected to the LA terminals or not.

If a fault occurs, there is a corresponding Field Power Loss tag that you can examine in the application program. For more information, see Module Tags on page 121.

You can also monitor a point for the presence of a field power loss via the diagnostics that are available in the Module Properties in the Studio 5000 Logix Designer application.

IMPORTANT
- Field Power Loss detection is specific to the SA power bus.
- If separate external power supplies are used for each SA power bus, the loss of field power from one SA power bus does not affect modules on a different SA power bus.
- You can use 5069-FPD field potential distributors to establish new SA power buses that are separate from the one that the controller or adapter establishes.

No Load Detection

The No Load Detection feature detects when a wire is disconnected from an output channel or a load is missing for each output channel.

IMPORTANT	These Compact 5000 digital output modules support No Load Detection. • 5069-OB8 • 5069-OB16, 5069-OB16K • 5069-OB16F • 5069-OB32 • 5069-OBV8S, 5069-OBV8SK

No Load Detection in Standard Output Modules

A No Load condition occurs if a connected load draws less than 0.5 mA, and is detected only when the output is in the Off state for a minimum of 250 ms. If the output is in the On state, a No Load condition can exist, but it is not detected. The status indicators and the Studio 5000 Logix Designer project indicate that the module is in normal operation.

No Load Detection is disabled by default in the standard output modules.

To Enable No Load Detection	To Monitor for a No Load Condition
Complete one of these actions. • Select the Enable No Load Diagnostic checkbox on the Points page. • Change the C.Outputxx.NoLoadEn tag to 1 in the Standard Output Module Tags.	• View the Module Tags in your Studio 5000 Logix Designer project. • Access the channel diagnostics available on the Ptxx page. • Observe the Status Indicators - Compact 5000 Digital Output Modules.

This table describes what happens when a No Load condition is detected and when it is corrected on a standard output module. To correct the issue, reconnect the disconnected wires or correct the load to the output.

Attribute	No Load Detected	No Load Corrected
I.Ptxx.NoLoad tag value	1	0
No Load diagnostic value	1	0
I/O Status Indicator	Flashing red	Off

No Load Detection in Safety Output Modules

A No Load condition occurs if a connected load draws less than 10 mA, and is detected only when the output is in the Off state for a minimum of 250 ms. If the output is in the On state, a No Load condition can exist, but it is not detected. The status indicators and the Studio 5000 Logix Designer project indicate that the module is in normal operation.

No Load Detection is enabled by default in the safety output modules.

To Disable No Load Detection	To Monitor for a No Load Condition
• For modules with firmware revision 2.011 or later and AOP version 2.01 or later, clear the Enable No Load Diagnostic checkbox on the Points page. **IMPORTANT:** This feature cannot be disabled on modules with firmware revision 1.011 and the default configuration profile.	• View the Module Tags in your Studio 5000 Logix Designer project. I.Ptxx.NoLoad = 1 when a No Load Condition is detected. • Access the channel diagnostics available on the Ptxx page. • Observe the Status Indicators - Compact 5000 Digital Output Modules.

For information on how the I/O status indicator responds in different load conditions, see I/O Status Indicators on page 115.

Short Circuit Protection

Short Circuit Protection helps prevent damage to the output that can result when more current is present at the output than it can handle.

IMPORTANT	These Compact 5000 digital output modules support Short Circuit Detection. • 5069-OB8 • 5069-OB16, 5069-OB16K • 5069-OB16F • 5069-OB32 • 5069-OBV8S, 5069-OBV8SK

Short Circuit Protection in Standard Output Modules

This table describes what happens when a short circuit is detected and when it is corrected on standard Compact 5000 digital output modules.

Attribute	Short Circuit Detected	Short Circuit Removed
Output Behavior	• Faults • Turns off	Restarts in the commanded state
I.Ptxx.ShortCircuit tag value	1	0
Short Circuit diagnostic value	1	0
I/O Status Indicator	Flashing red	Steady Yellow

For more information on the maximum current that you can apply to an output, see the Compact 5000 I/O and Specialty Modules Technical Data, publication 5069-TD001.

Short Circuit Protection in Safety Output Modules

Short Circuit Detection generates a test pulse to the Safety Output in Safety Mode.

ATTENTION: Short Circuit Detection is required when you use the safety output module in Functional Safety applications.

This table describes what happens when a short circuit is detected and when it is corrected on the Compact 5000 safety output modules.

Attribute	Short Circuit Detected when Shorted to:		Short Circuit Removed
	24V DC	Ground	
Output Behavior	• Faults • Turns off		Restarts in the commanded state
I.Ptxx.ShortCircuit tag value	1	–	0
Short Circuit diagnostic value	1	–	0 **IMPORTANT**: You must cycle power to the module to reset the diagnostic when the output point is shorted to 24V DC.
Short Circuit to Ground diagnostic value	–	1	0
I/O Status Indicator	Flashing red	Off	Turns off if there is no longer a load that is connected to the output.

For more information on the maximum current that you can apply to an output, see the Compact 5000 I/O and Specialty Modules Technical Data, publication 5069-TD001.

Short Circuit Tag and Diagnostic Value Combinations

This table describes the possible tag and diagnostic value combinations that can indicate a short circuit. In each of the examples, these conditions are present.

Attribute	Output Conditions		
	1 Module Output Output Point Shorted to 24V DC	Module Output Pair Either Output Point Shorted to 24V DC	Module Output Pair Output Points Shorted to Each Other
Output Mode	Sourcing		
Point Operation Type	Single	Dual	
Point Mode	Safety Pulse Test		–
O.Ptxx.Data tag value	1	1 - Either output point in the pair	1 - Both output points in the pair
Possible Tag and Diagnostic Combinations	These values occur on the faulted output point and all associated group points.		Combination 1 These values occur on both output points in the pair. • I.Ptxx.ShortCircuit tag = 1 • Short Circuit diagnostic = 1 • I.Ptxx.Fault tag = 1
	Combination 1 • I.Ptxx.ShortCircuit tag = 1 • Short Circuit diagnostic = 1 • I.Ptxx.Fault tag = 1	Combination 1 • I.Ptxx.ShortCircuit tag = 1 • I.Ptxx.Fault tag = 1 • Short Circuit diagnostic = 1 • Internal Fault diagnostic = 1	
	Combination 2 • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1		Combination 2 These values occur on the faulted output point and all associated group points. • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1
	Combination 3 • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1 • Overload Fault diagnostic = 1	Combination 2 • I.Ptxx.Fault tag = 1 • Internal Fault diagnostic = 1	
Output Behavior	• Faults • Turns off		
I/O Status Indicator	The indicator for the faulted output point turns off.		

Disable Short Circuit Detection for Safety I/O Modules

Short Circuit Detection is enabled by default and can only be disabled for modules with firmware revision 3.011 or later and AOP version 3.01 or later. Follow these steps to disable Short Circuit Detection.

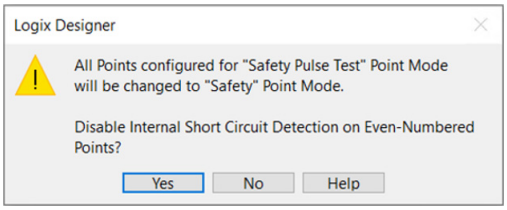
IMPORTANT You can disable Short Circuit Detection only when Output Mode = Sourcing, and Point Mode ≠ Safety Pulse Test.

Internal Short Circuit Detection is enabled or disabled in Point groups.

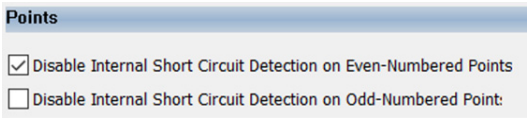
- Even-numbered points - Points 0, 2, 4, and 6
- Odd-numbered points - Points 1, 3, 5, and 7

1. Verify that the Output Mode is Sourcing in the Module Definition on the General page.
2. Verify that the Point Modes are either Safety or Not Used for the group of points on which you want to disable detection.

   If one or more Point Modes in the group are set to Safety Pulse Test, a warning opens.

   Click Yes, to change the corresponding Point Modes to Safety.
3. On the Points page, select the Disable Internal Short Circuit Detection checkbox for the desired group of points.

Output Recovery After Overload Condition or Short Circuit to Ground Condition

This table describes test output recovery after overload conditions or short circuit to ground conditions occur.

Cause of Fault	Module Operating Conditions	Correction	Recovery Time
Overload Condition	• Output Point Mode = Safety or Safety Pulse Test. • Output Data tag = 1. • Overload current ≥ 1.5 A	Remove the load from the output point. For a remote safety output module, the connection to the Compact 5000 EtherNet/IP™ adapter can break. When a cable break occurs and then recovers, the load recovers if the command state of the output point is still high, even if it did not return to the safe state in the program.	After the condition is corrected, and the output is returned to the safe state, it recovers in whichever of these times is higher. • 10 seconds • Output Error Latch Time To set the Output Error Latch Time, see Output Data on page 105.
Short Circuit to Ground Condition	• Output Point Mode = Safety or Safety Pulse Test. • Output Data tag = 1. • Output is connected directly to ground.	Remove the output connection to ground and set the output to a safe state.	

Thermal Shutoff

Thermal Shutoff helps prevent damage to the output that can result when an output gets hotter than it can handle.

IMPORTANT	These Compact 5000 digital output modules support Thermal Shutoff. • 5069-OB8 • 5069-OB16, 5069-OB16K • 5069-OB16F • 5069-OB32 • 5069-OBV8S, 5069-OBV8SK

This feature is directly related to Short Circuit Protection feature. The increased temperature at the output results from an excessive load at the output. That is, a load with high current is applied to the output. The high current heats the output beyond an acceptable temperature and the output turns off.

Thermal Shutoff with Standard Output Modules

This table describes what happens when a thermal shutoff condition is detected and when it is corrected on standard Compact 5000 digital output modules.

Attribute	Thermal Shutoff Detected	Thermal Shutoff Corrected
Output Behavior	• Faults • Turns off	Restarts in the commanded state
I.Ptxx.ShortCircuit tag value	1	0
I/O Status Indicator	Flashing red	Off - if a load is no longer connected to the output

For more information, see Module Tags on page 121.

Thermal Shutoff with a Safety Output Module

This table describes what happens when a thermal shutoff condition is detected and when it is corrected on standard Compact 5000 digital output modules.

Attribute	Thermal Shutoff Detected when Shorted to:		Thermal Shutoff Corrected
	24V DC	Ground	
Output Behavior	• Faults • Turns off		Remains in the off state
I.Ptxx.ShortCircuit tag value	1	–	0
Overload diagnostic value	–	–	0 **IMPORTANT**: You must cycle power to the module to reset the diagnostic when the output point is shorted to 24V DC.
ShortCircuitGround diagnostic value	–	1	0
I/O Status Indicator	Steady red	Steady red	Off - if a load is no longer connected to the output

For more information, see Module Tags on page 121.

Output State Change Time

Applies to these modules:
Standard I/O modules

This table lists the time that it takes for outputs to change state after a command on standard Compact 5000 digital output modules.

Module	Time
5069-OA16	1/2 cycle, typical For example, if the input uses a 50 Hz AC wave, 1 cycle = 1/50 or 20 ms. Because the typical time for the module output to change state is 1/2 cycle, in this example, the time is 10 ms.
5069-OB8	100 µs
5069-OB16, 5069-OB16K	100 µs
5069-OB16F	10 µs
5069-OB32	100 µs
5069-OW4I	10 ms
5069-OW16	10 ms
5069-OX4I	15 ms
The times that are listed in this table are from the time the module receives the message.	

Configurable Channel-level Output State in Program Mode or Fault Mode

Applies to these modules:
Standard I/O modules

You can configure individual output channels to specific states when the module is in Program mode or Fault mode. These output states are available.

- Off
- On
- Hold last state

To configure the output states in Program mode or Fault mode, see Points on page 96.

Connection Fault Handling

Applies to these modules:
Standard I/O modules

You can configure the standard Compact 5000 digital output module behavior when a connection fault occurs, that is, the connection breaks between the owner-controller and the output module.

You must define this information.

- Immediate Output behavior when the connection breaks.
- Length of time that the output behaves as defined.
- Output behavior if the connection remains broken when the length of time that is defined previously expires.

This table describes the parameters that you can configure.

Behavior	Description	Available Values
Output state immediately after a fault	If a connection fault occurs, the output state changes to the selected option.	• Turn off - Default • Transition to a specific, user-defined value. • Hold Last State - The output remains at that value until these actions occur. – The connection to the owner-controller is re-established. – The output returns to normal operation, as defined in the module configuration. – User Defined Value - The output transitions to the set value.
Fault state duration after a fault	• The output state remains as commanded if Fault State Duration is set to Forever. • If the Fault State Duration is set to a value other than Forever, the output state changes to the user-defined Final Fault State after the specified time period elapses.	• Forever • One second • Two seconds • Five seconds • Ten seconds
Final fault state value		User-defined - Set the final fault state value in the C.Ptxx.FaultFinalState tag. For more information, see Module Tags on page 121.

Once the connection between the owner-controller and output module is re-established, the output resumes normal operation.

To set the Connection Fault Handling parameters, see Points on page 96.

Forces

Applies to these modules:
Standard I/O modules

Use a force to override data that your logic either uses or produces.

- Test and debug your logic.
- Temporarily maintain normal system operations when an input device has failed.

IMPORTANT Use forces only as a temporary measure. They are not intended to be a permanent part of your application.

ATTENTION: Forces can cause unexpected machine motion that could injure personnel. Before you use a force, determine how the force affects your machine or process and keep personnel away from the machine area.
- If you enable I/O or SFC forces, your machine or process goes to another state or phase.
- If you remove forces, they can remain in the enabled state.

If forces are enabled and you install a force, the new force immediately takes effect.

Enable or Disable Forces

This table explains when and how you can enable or disable forces.

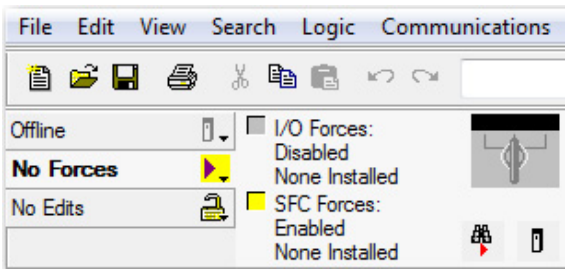
Force	Requirements
Enable	• You can only enable forces at the controller level. • You can enable I/O forces and SFC forces separately or simultaneously. • You cannot enable or disable forces for a specific module, tag collection, or tag element.
Disable	• To allow your project to execute as it is programmed, remove the force. • You can only disable forces at the controller level. • You can disable or remove I/O and SFC forces simultaneously or separately. • When you remove a force on an alias tag, you also remove the force on the base tag.

ATTENTION: Changes to forces can cause unexpected machine motion that could injure personnel. Before you enable or disable forces, determine how the change affects your machine or process and keep personnel away from the machine area.

Force Status

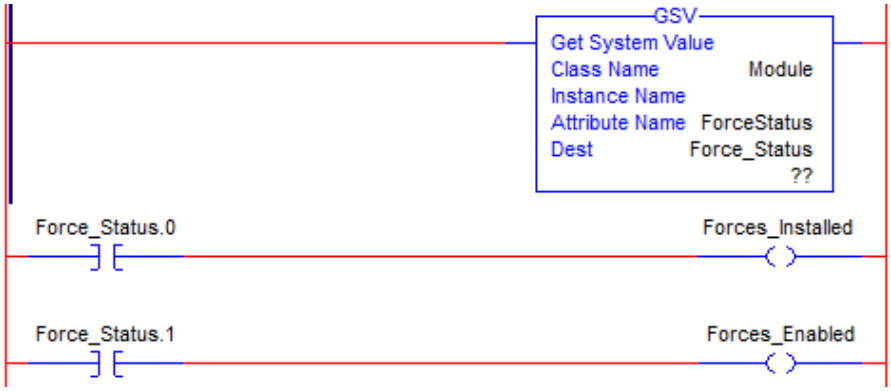
Before you use a force, determine the status of forces for the controller.

The Online toolbar shows the status of forces. The Forces tab shows the status of I/O Forces and SFC Forces separately.

Example	Forces Tab Status	Description
	Enabled	• If the project contains any forces of this type, they override your logic. • If you add a force of this type, the new force immediately takes effect.
	Disabled	Forces of this type are inactive. If the project contains any forces of this type, they do not override your logic.
	Installed	At least one force of this type exists in the project.
	None Installed	No forces of this type exist in the project.

GSV Instruction

You can also view the I/O force status in the GSV instruction. This example shows how to use a GSV instruction to view the status of forces. In this example, Force_Status is a DINT tag.

Example	If	This Bit	Is This Value
	Forces are installed	0	1
	No forces are installed	0	0
	Forces are enabled	1	1
	Forces are disabled	1	0

Time-scheduled Output Control

Applies to these modules:
5069-OB16F

You can schedule times for module outputs to turn On or Off. The time schedules use units in nanoseconds.

The timing of scheduled outputs for the 5069-OB16F module is as follows:

- ±10 µs accuracy
- 1 ns resolution

The module must be time-synced or schedules are not applied.

Time-scheduled output control is used with the Motion Arm Output Cam (MAOC) instruction. The MAOC instruction enables position-based output control in these ways.

- Uses the position of any motion axis in a Logix 5000® control system as the position reference
- Updates the outputs based on the motion axis position at the motion group coarse update rate, typically 1...32 ms.

The instruction can update standard output modules at the coarse update rate. However, some high-speed applications require a higher degree of accuracy.

The 5069-OB16F scheduled output module improves the accuracy of the MAOC instruction with the ability to schedule output On and Off times. Complete all scheduling configuration for the On and Off times through the MAOC instruction. The instruction updates values in the outputs of the module that define the scheduled output behavior.

5069-OB16F Output Module Schedule Parameters

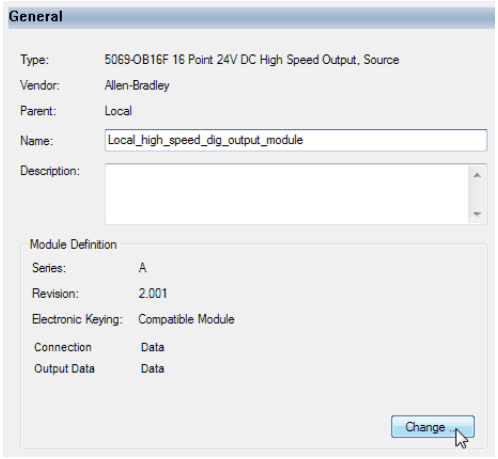
Feature	5069-OB16F
Number of schedules	32
Output points available for scheduling	16, points 0...15
Remote operation	–
Minimum schedule interval	100 µs For schedules output the MAOC instruction, you can use 50 µs.
The MAOC limits the minimum schedule interval (minimum pulse width) to 1/16 of the coarse update period.	

Use an MAOC Instruction with a 5069-OB16F Module

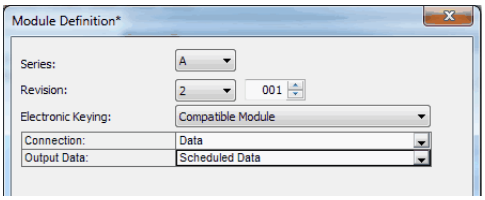
To use an MAOC instruction with schedule outputs on a 5069-OB16F output module in your controller project, complete these steps. The module can be a local I/O module or a remote I/O module.

IMPORTANT Before you complete the steps, make sure that Time Synchronization is enabled in the controller and, if applicable, the EtherNet/IP adapter, to use scheduled outputs.

1. On the General page in the Module Properties, click Change.

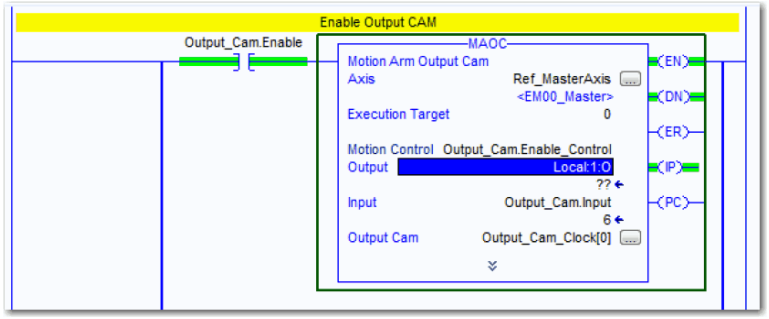


2. In the Module Definition parameters, select Scheduled Data for the Output Data and click OK.



3. To close the Module Properties, click OK.
4. Add an MAOC instruction to your logic.
5. In the MAOC instruction, use the module output tag in the Output operand. In this example the output tag is Local:1:O.

   The tag value correctly displays as '??'.



For more information on how to use an MAOC instruction, see the one of these manuals.

- Logix 5000 Controllers Motion Instructions Reference Manual, publication MOTION-RM002
- Position-based Output Control with the MAOC Instruction Application Technique, publication 1756-AT017

Isolated and Non-isolated Output Modules

Applies to these modules:
Standard I/O modules

Only the 5069-OW4I and 5069-OX4I modules provide point-to-point wiring isolation.

All standard output modules maintain internal electrical isolation between the system-side and field-side power buses.

Fault and Status Reporting

The Compact 5000 digital output modules multicast fault and status data with channel data to the owner-controller and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the output modules provide the fault and data status in a point-specific format. In this table, the tag names that include Ptxx represent channel-specific data, where xx is the channel number. Not all tags that are listed in these tables apply to all modules.

Fault Tags - Standard Digital Output Modules

Tag Name	Trigger Event
ConnectionFaulted	The owner-controller loses its connection to the module.
Ptxx.Fault	The point data quality is bad.
Ptxx.NoLoad	A no load condition exists on the point.
Ptxx.ShortCircuit	A short circuit condition exists on the point.
Ptxx.FieldPowerOff	A field power lost condition exists on the point.
IMPORTANT: For the 5069-OB16, 5069-OB16K, and 5069-OB16F modules only, an output must remain in the On state for a minimum of 250 ms before an overload or short circuit is detected. If there is a long-term short circuit condition, it is detected as long as the output switches at a rate of 1 ms or less.	

Status Tags - Standard Digital Output Modules

Tag Name	Trigger Event
RunMode	The module is in Run Mode.
DiagnosticActive	Indicates if any diagnostics are active or if the prognostic threshold is reached.
DiagnosticSequenceCount	The count increments each time that a diagnostic condition is detected or removed.
Ptxx.Data	The point input status is 0 or 1.
Ptxx.Uncertain	The point data can be imperfect.
Uncertain	The module is operating outside its designed operating range if data is under manual or override control. This tag provides module-wide data and affects all channels simultaneously.

Fault Tags - Safety Output Modules

Tag Name	Trigger Event
ConnectionFaulted	The owner-controller loses its connection to the module. This tag provides module-wide data and affects all channels simultaneously.
Ptxx.Fault	The point data quality is bad or the channel is set to Not Used.
Ptxx.NoLoad	A no load condition exists on the point.
Ptxx.ShortCircuit	A short circuit condition exists on the point.
Ptxx.FieldPowerOff	A field power lost condition exists on the point.

Status Tags - Safety Output Modules

Tag Name	Trigger Event
RunMode	The module is in Run Mode.
DiagnosticActive	Indicates if any diagnostics are active or if the prognostic threshold is reached.
DiagnosticSequenceCount	The count increments each time that a diagnostic condition is detected or removed.
Ptxx.Readback	A 24V DC power source is connected to the output circuit.
Ptxx.Data	The current data at the point.
Ptxx.Uncertain	The point data can be imperfect.

Safety I/O Module Features

This chapter describes features that are specific to the Compact 5000™ safety I/O modules.

IMPORTANT Remember this information.

- These modules also have features that apply to:
  - All Compact 5000 digital I/O modules, see Common Compact 5000 Digital I/O Module Features on page 41.
  - Compact 5000 digital input modules, see Input Module Features on page 47.
  - Compact 5000 digital output modules, see Output Module Features on page 59.
- You can configure the features that are described in this chapter with the Studio 5000 Logix Designer® application. For information on how to configure the module, see Configure and Replace Safety I/O Modules on page 99.

Safety Input Module Features

This section describes the features that are available on the Compact 5000 safety digital input modules. The 5069-IB8S and 5069-IB8SK modules are 8-point safety sinking input modules that use eight safety inputs and four test outputs. The 5069-IB8SK module offers conformal coating.

Safety Application Suitability Levels

This table describes the safety application suitability levels for a 5069-IB8S and 5069-IB8SK module.

Suitability Level	Conditions	Notes
Safety applications that are rated up to, and including, SIL CL 3, PLd, Cat. 3 as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.(1)	• The module uses single-channel mode. • Point Mode is Safety Pulse Test.	Consider this information. • The channel mode type, single or dual, effects Performance Level and Category. You can use the modules in SIL CL 3 applications regardless of channel mode type. The determining factor to whether a Compact 5000 safety I/O module resides in a SIL CL 3, PLe, Cat. 4 safety application is that the overall safety architecture is a dual-channel system. • To achieve SIL CL 3 single-channel, the sensor that is used must be SIL CL 3 single-channel as well. • The requirement that Point Mode is Safety Pulse Test assumes that only the safety I/O modules provide diagnostics to a specific Suitability Level. The larger safety system within which the safety I/O modules reside can provide the diagnostics necessary to achieve the stated Suitability Level without the requirement that Point Mode is Safety Pulse Test.
Safety applications that are rated up to, and including, SIL CL 3, PLe, Cat. 4 as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.	• The module uses dual-channel mode.(2) • Point Mode is Safety Pulse Test.	

(1) Single channel could not be verified to PLe, Cat. 4 without at least one channel sensor that is PLe, Cat. 4 rated.
(2) You cannot configure the module to use dual-channel mode in the Module Properties. Use a safety instruction to configure the module to use dual-channel mode.

This information applies to the safety inputs.

- You can connect safety devices, such as Emergency Stop Push Button, gate switches, and safety light curtains.
- Evaluate an input signal, that is, input data, in single-channel mode or dual-channel mode.
- An external wiring short circuit check is possible when inputs are wired in combination with test outputs. When this function is used, you must wire the module in combination with test outputs.
- Independently adjustable on and off delays are available per channel.

This information applies to the test standard outputs.

- Separate test outputs are provided for short circuit detection of a safety input (or inputs).
- They can supply 24V DC power to devices, such as safety sensors.
- You can use as many as two specific test outputs for broken-wire detection of a muting lamp.

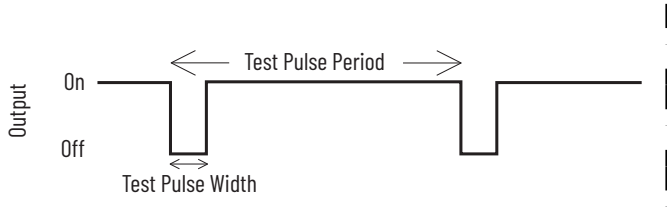
Use Test Output with a Safety Input

You can use a test output in combination with a safety input for short circuit and cross-channel fault detection. In this case, Point Mode must be Safety Pulse Test. Safety input pairs must be associated with different Test Output sources.

The test output can also be configured as a power supply to source 24V DC to an external device, for example, a light curtain.

For wiring examples and information, see Wiring Diagrams - 5069-IB8S, 5069-IB8SK on page 137.

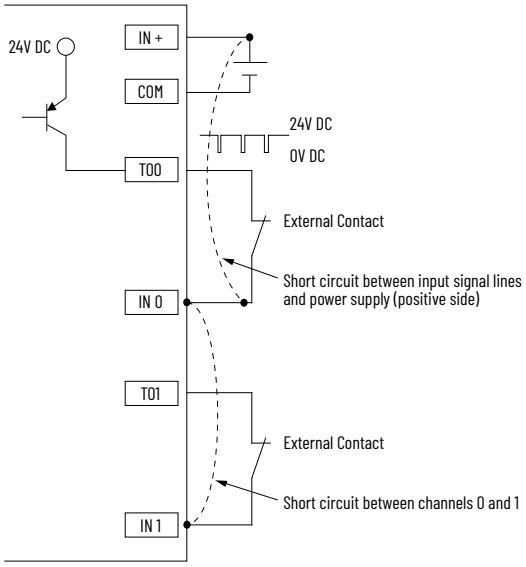
Test Pulse in a Cycle - 5069-IB8S, 5069-IB8SK



On the 5069-IB8S or 5069-IB8SK module, the test pulse width is < 700 µs and the test pulse period is < 100 ms.

When the external input contact is closed, a test pulse is output from the test output terminal to diagnose the field wiring and input circuitry. By using this function, short-circuits between inputs and 24V power, and between input signal lines can be detected.

Short Circuit Between Input Signal Lines - 5069-IB8S, 5069-IB8SK

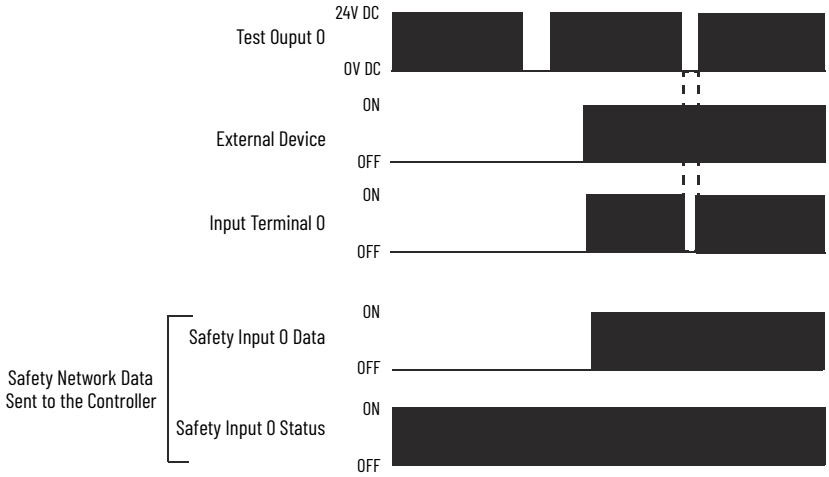


Single-channel Mode

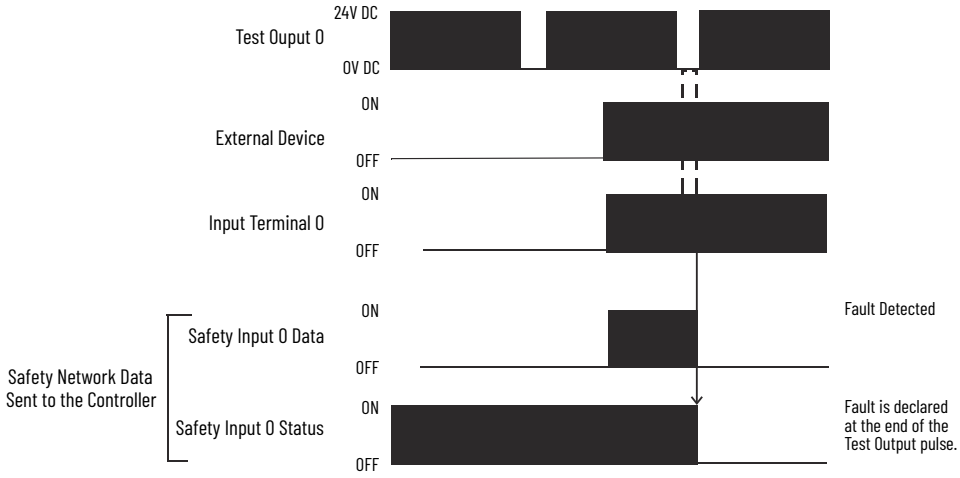
If an error is detected on the input channel, Safety Input Data and Safety Input Status turn off.

For information on how the use of single-channel mode with a 5069-IB8S or 5069-IB8SK module affects the safety application suitability level, see Safety Application Suitability Levels on page 72.

Normal Operation in Single-channel Mode (Not to Scale) - 5069-IB8S, 5069-IB8SK



Fault Detection in Single-channel Mode (Not to Scale) - 5069-IB8S, 5069-IB8SK



Safety Input Fault Recovery

If an error is detected, the safety input data remains in the OFF state. To activate the safety input data again, complete these steps.

1. Remove the cause of the error.
2. Place the affected safety inputs into the safe state.
3. Allow the Input Error Latch Time to elapse.

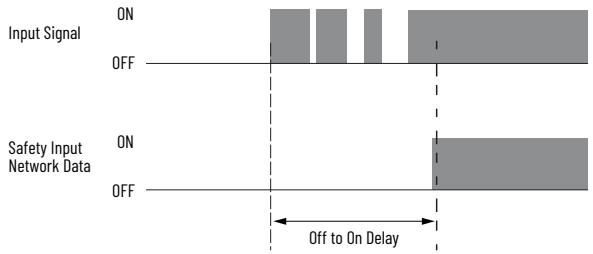
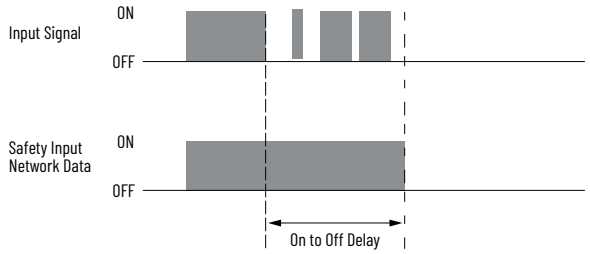
After the steps are completed, the I/O indicator turns off. The input data is now active.

Safety Input Delay Time

You can increase the time that it takes for an input point to transition from On to Off and Off to On on the 5069-IB8S or 5069-IB8SK module. The increase in time is a delay of the signal from the module to the controller.

The delay time is added to the RPI. For example, if you set the RPI at 10 ms and use an input delay time of 2 ms, the signal from the module to the controller is 12 ms.

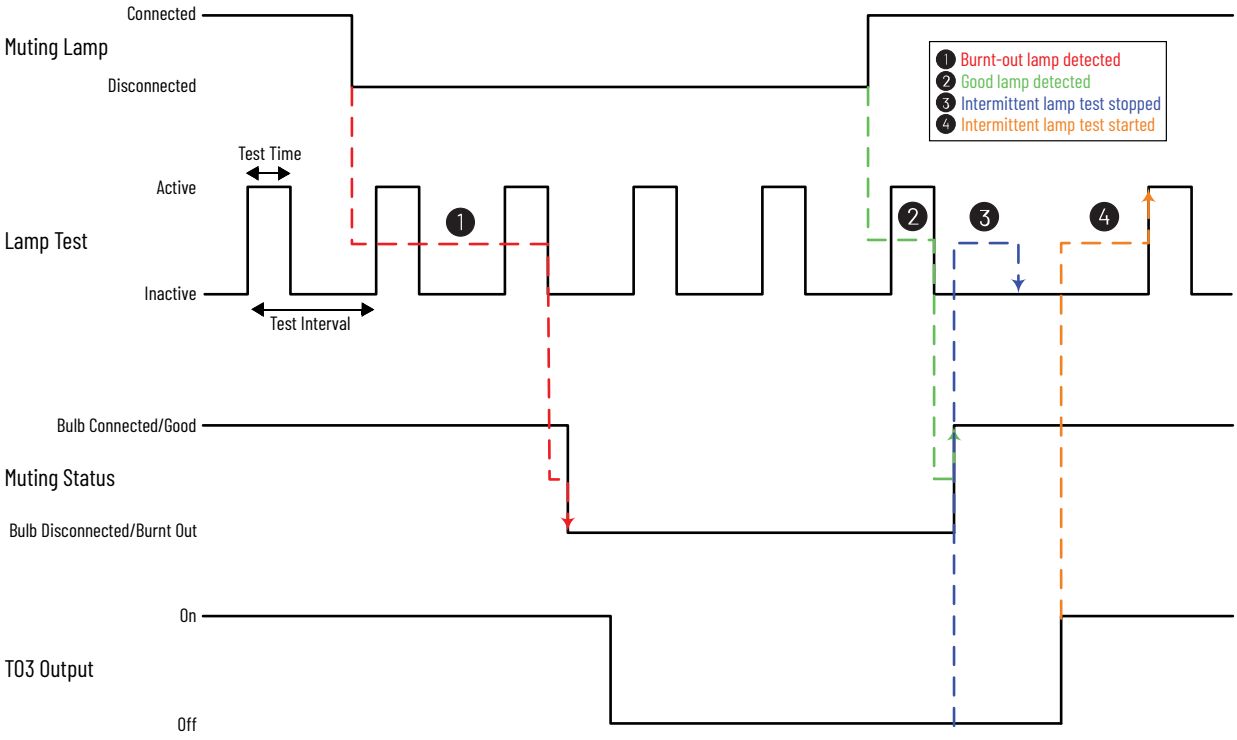
When chattering or low frequency noise coupling is present on the input signal, an increase in the time it takes to transition from one state to another improves noise immunity within a signal.

Delay Type	Description	Transition Delay Times	Diagram
Off to On	An input signal is treated as Logic 0 during the Off to On delay time after the rising edge of the input contact. The input turns on only if the input contact remains on after the Off to On delay time has elapsed. This setting help prevent rapid changes of the input data due to contact bounce.	• 0 ms (default) • 1 ms • 2 ms • 5 ms • 10 ms • 20 ms • 50 ms	
On to Off	An input signal is treated as Logic 1 during the On to Off delay time after the falling edge of the input contact. The input turns off only if the input contact remains off after the On to Off delay time has elapsed. This setting helps to prevent rapid changes of the input data due to contact bounce.	• 0 ms (default) • 1 ms • 2 ms • 5 ms • 10 ms • 20 ms • 50 ms	

Muting Lamp Operation

Your controller program controls test outputs 2...3 to illuminate a muting lamp. Muting lamp status is monitored with a test that runs periodically during every test interval to detect a burned-out lamp. The test runs repeatedly when the test output is commanded On or commanded Off and a fault is detected.

This figure shows how muting lamp operation, status, and fault detection are monitored.



The lamp test interval is 3 seconds. Two consecutive failed lamp tests are required to declare a burned-out lamp condition.

The lamp test does not always run immediately after the test output is energized. It starts at the next 3-second interval. To allow time for two consecutive test intervals, program a minimum Test Output On Time of 6 seconds.

This table shows the expected behavior of the muting status for test outputs T02M and T03M.

Muting Status Bit Operation

Test Output Commanded State	Lamp Condition	Muting Status Bit	Required Action
ON	Bad (open circuit)	0	Repair the lamp.
ON	Good	1	None, normal condition, the lamp is operating properly.
OFF	Bad (open circuit)	0	If the lamp remains OFF after T1/T3 output is cycled, repair the lamp.
OFF	Good	1	None, normal condition, the lamp is operating properly.

- When power is applied to the 5069-IB8S or 5069-IB8SK module, and T2 or T3 remains commanded off, the muting status defaults to On.
  This bit operation is designed to help prevent erroneous muting instruction faults from the owner-controller. This bit status is not always the true indication of a burned-out lamp.
  IMPORTANT: Before you check the state of the corresponding muting status, be sure that the test output is commanded on. Once the test output is commanded on, a maximum time of 6 seconds is required for the module to detect a burned-out lamp.
- If a muting lamp circuit is open when power is applied to the module, the condition is detected when the test output is commanded on.
- When a lamp burns out and is replaced, the fault (muting status bit) returns to the normal condition, independent of the state of the test output.

Discrepancy

This section describes these discrepancy features.

- Single Channel SIL 3 and Discrepancy Fault
- Transition Time Limit
- Fault Indication

Single Channel SIL 3 and Discrepancy Fault

The 5069-IB8S and 5069-IB8SK modules are certified to a single-channel SIL 3 input design. The design creates internal dual-channel signals. The module takes the signal from one input channel terminal and creates two independent input paths inside its circuitry. The internal signals, one on each independent path, are then evaluated for consistency.

The Discrepancy feature lets the module compare the states of the two internal signals.

If the time of the discrepancy between the two internal signals exceeds the configured Transition Time Limit, 2...500 ms, the safety input data and the individual-safety input status for the input channel turn off. The safety input is in the safe state.

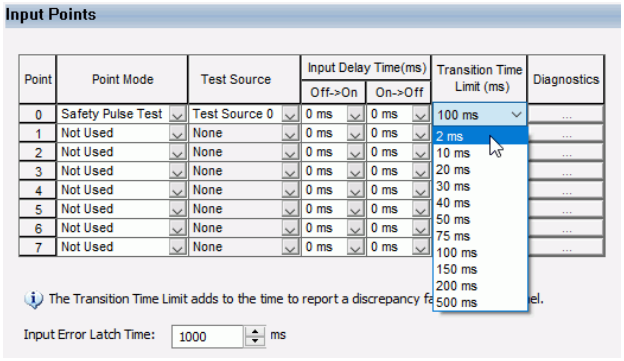
However, a discrepancy can exist for a period of time before the safety input data fault is generated.

- If the discrepancy is resolved before the time expires, there is no fault.
- If the discrepancy remains when the time expires, a fault occurs.

Transition Time Limit

The Transition Time Limit (TTL) is a new configuration in firmware revision 2.011 that defines the time duration that a 5069-IB8S or 5069-IB8SK module lets a discrepancy due to the input voltage rise or fall time variance exist and does not report a fault. Modules with firmware revision 1.011, which is the initial revision, have a fixed TTL of 2 ms.

After the transition, the 5069-IB8S or 5069-IB8SK module continues to check the two internal signals for the TTL value, which is user-configurable from 2...500 ms. You must install Add-On Profile, version 2.01 to see the dropdown menu when you configure the module.



When the transition occurs in one of the internal signals before the transition of the second internal signal, a discrepancy occurs. The threshold voltages for the signals are slightly different.

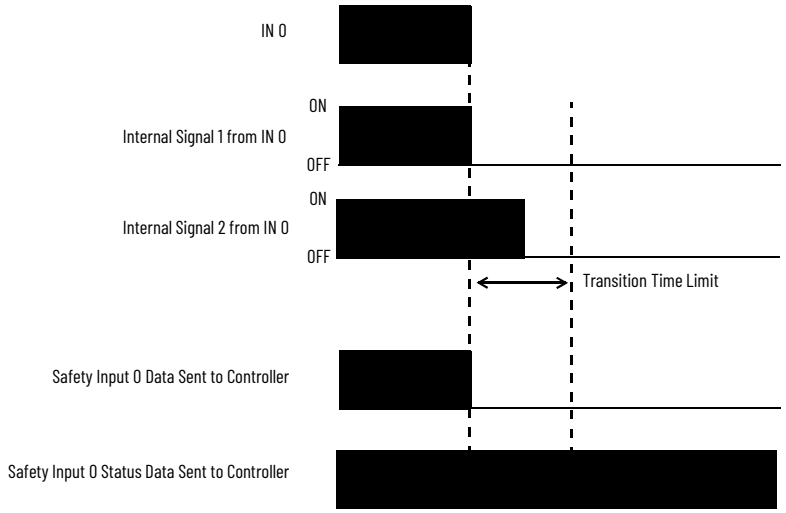
- If the second internal signal transitions to the same state before the Transition Time Limit elapses, the internal inputs are considered equivalent.

  In this case, no error is detected.
- If the second internal signal transition does not occur before the Transition Time Limit elapses, the channel faults.

  In the fault state, the input and status for the input channel is set low (OFF).

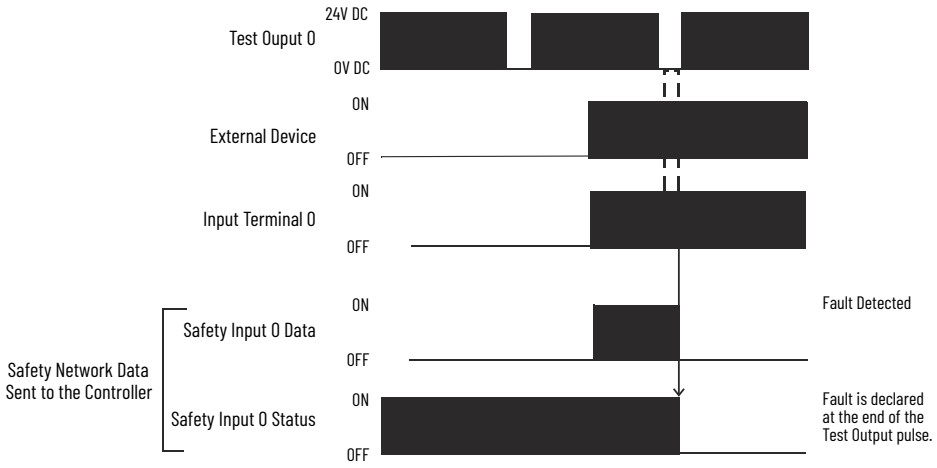
This graphic shows conditions in which a discrepancy occurs. By the end of the TTL, the discrepancy is resolved and a fault does not occur. The module continues to send safety input to the controller.

Normal Operation with Transition Time Limit (Not to Scale) - 5069-IB8S, 5069-IB8SK



This graphic shows conditions in which a discrepancy occurs. By the end of the TTL, the discrepancy is not resolved and a fault occurs. Safety input data and status data are sent to the controller. The input is in the safe state, and the status is fault.

Fault Detection with Transition Time Limit (Not to Scale) - 5069-IB8S, 5069-IB8SK



Fault Indication

When a discrepancy fault occurs, the 5069-IB8S or 5069-IB8SK module indicates that a fault exists. However, there is no actual discrepancy fault bit provided in the I/O tag structure, it only uses Fault = 1.

When the fault occurs, I.Ptxx.Data = 0 and I.Ptxx.Fault = 1.

To clear the fault and return the module to normal operations, reset the module. That is, cycle power to the module.

Safety Output Module Features

This section describes features that are available on the Compact 5000 I/O safety output modules. The 5069-OBV8S and 5069-OBV8SK modules are safety output modules that have eight safety outputs. You use the outputs in one of these ways.

- Sourcing/sinking outputs in Bipolar Output mode
- Sourcing outputs in Sourcing Output mode

The 5069-OBV8SK module offers conformal coating.

Safety Application Suitability Levels

This table describes the safety application suitability levels for the safety output modules.

Suitability Level	Conditions	Notes
Safety applications that are rated up to, and including, SIL CL 3, PLd, Cat. 3 as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.	• Output Mode is Sourcing. • The module uses single-channel mode. • Point Mode is Safety Pulse Test.	Consider this information. • The channel mode type, single or dual, effects Category. You can use the modules in SIL CL 3, PLe applications regardless of channel mode type. The determining factor to whether a Compact 5000 safety I/O module resides in a SIL CL 3, PLe, Cat. 4 safety application is that the overall safety architecture is a dual-channel system. • The requirement that Point Mode is Safety Pulse Test assumes that only the safety I/O modules provide diagnostics to a specific Suitability Level. The larger safety system within which the safety I/O module resides can provide the diagnostics necessary to achieve the stated Suitability Level without the requirement that Point Mode is Safety Pulse Test.
Safety applications that are rated up to, and including, SIL CL 3, PLe, Cat. 4 as defined in IEC 61508, IEC 61511, IEC 62061, and ISO 13849-1.	• Output Mode is Bipolar. • Point Mode is Safety Pulse Test Or • The module uses single-channel mode. • Output Mode is Sourcing. • Point Mode is Safety Pulse Test. • The channel is connected to an IEC 60947 certified actuator or contactor. Additionally, you must use a shielded cable or cable trunk to mitigate short circuit faults on the channel. Or • The module uses dual-channel mode. • Output Mode is Sourcing. • Point Mode is Safety Pulse Test.	

- Solid-state outputs
- Single-channel mode uses one output signal, that is, data from an output channel, to provide control.

IMPORTANT Single-channel mode is only certified for functional safety applications with process safety times greater than or equal to 200 ms; or, applications with demand rates less than or equal to 3 demand per minute.

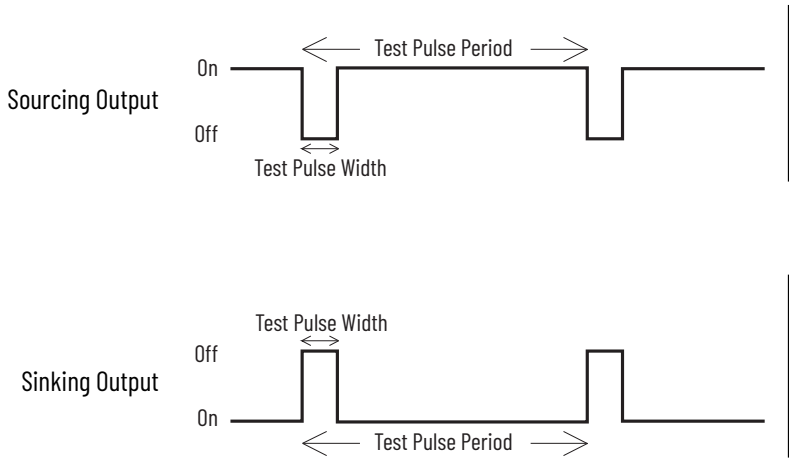
- Dual-channel mode uses two output signals, that is, data from two output channels to provide redundant control.
- You can pulse test safety outputs to detect field wiring short-circuits to 24V DC.

Safety Output with Test Pulse

When the safety output is on, the safety output can be configured to pulse test the safety output channel. By using this function, you can continuously test the ability of the safety output to remove power from the output terminals of the module.

If an error is detected, the safety output data and individual safety output status turn off.

Test Pulse in a Cycle - 5069-OBV8S, 5069-OBV8SK



On the 5069-OBV8S or 5069-OBV8SK module, the test pulse width is < 700 µs, and the test pulse period is < 100 ms.

To help prevent the test pulse from causing the connected device to malfunction, pay careful attention to the input response time of the output device.

An open wire test and internal short circuit test can generate a test pulse on a safety output even in safety mode. To remove a test pulse from a safety output in Safety Mode, you can configure open wire test and internal short circuit test. For more information, see No Load Detection in Safety Output Modules on page 62 and Disable Short Circuit Detection for Safety I/O Modules on page 64.

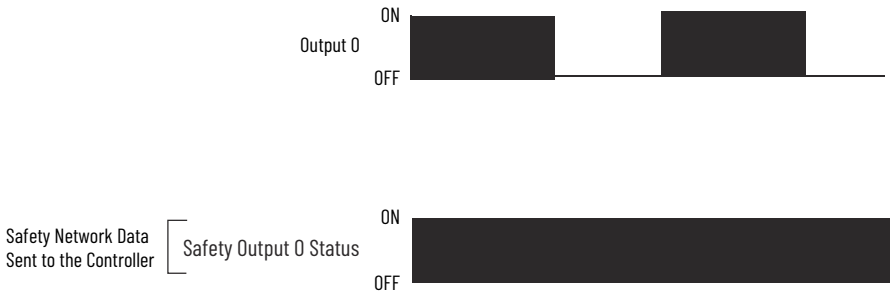
Two successive safety output pulses are required to determine if a short circuit fault exists. As a result, the effective pulse period is 200 ms, maximum

Single-channel Mode

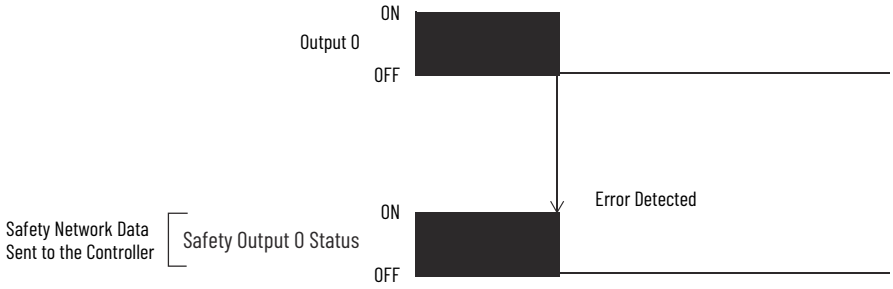
When the output channel is in the On state and has no faults, the safety outputs turned on and the status is normal. If a fault is detected on the output channel, the safety output data and individual safety output status turn off.

For information on how single-channel mode with a 5069-OBV8S or 5069-OBV8SK module affects the safety application suitability level, see Safety Application Suitability Levels on page 79.

Normal Operation in Single-channel Mode (Not to Scale) - 5069-OBV8S, 5069-OBV8SK



Fault Detected in Single-channel Mode (Not to Scale) - 5069-OBV8S, 5069-OBV8SK



Dual-channel Mode

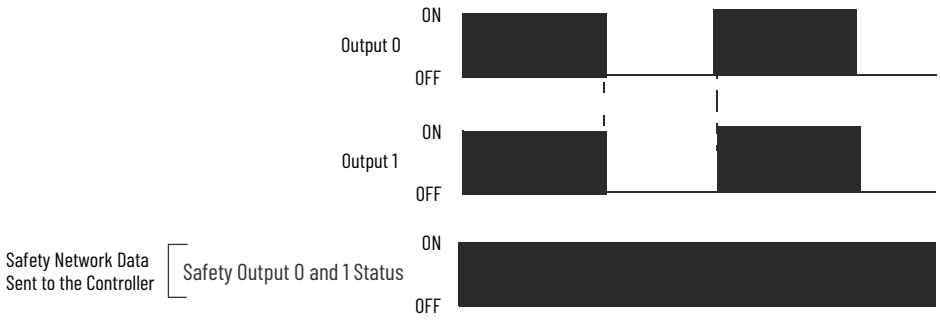
IMPORTANT Dual-channel mode is only available if the module is configured with Output Mode = Sourcing.

When you use dual-channel mode, output channels function as connection pairs. The paired channels are 0 and 1, 2 and 3, 4 and 5, and 6 and 7.

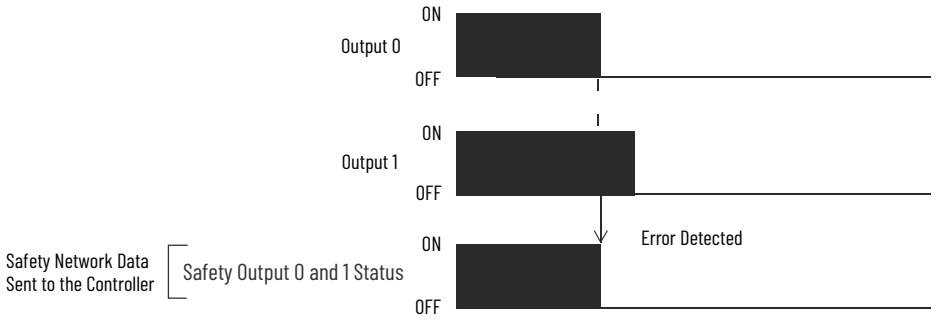
When both output channels in a connection pair are in the On state and have no faults, the safety outputs are turned on.

For information on how the use of dual-channel mode with a safety output module affects the safety application suitability level, see Safety Application Suitability Levels on page 79.

Normal Operation in Dual-channel Mode (Not to Scale) - 5069-OBV8S, 5069-OBV8SK



Fault Detected in Dual-channel Mode (Not to Scale) - 5069-OBV8S, 5069-OBV8SK



Safety Output Fault Recovery

If a fault is detected, the safety outputs are switched off and remain in the off state. Follow this procedure to activate the safety output data again.

1. Remove the cause of the error.
2. Command the safety output (or safety outputs) into the safe state.

   The safety output (or outputs) can be commanded low in any of these ways.

   - The controller sets the Ptxx.Data tag to 0.
   - The module is reset.
   - Power is cycled to the module.
   - The controller transitions to Program mode.
   - A controller or Safety task fault occurs.
   - A communications fault occurs on the module.
   - The connection to the module is inhibited.
3. Let the Output Error Latch Time elapse.

   After the steps are completed, the I/O indicator (red) turns off. The output data can now be controlled.

If module outputs experience persistent high faults, you can cycle power to the module to clear the error.

IMPORTANT The module can require up to an additional 1 second after the Output Error Latch Time to complete the recovery.

Fault and Status Reporting

The Compact 5000 safety I/O modules multicast fault and status data with channel data to the owner and listen-only controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

For information on how to use module tags to monitor faults and report status, see these sections.

- 5069-IB8S or 5069-IB8SK module - Fault and Status Reporting on page 58
- 5069-OBV8S or 5069-OBV8SK module - Fault and Status Reporting on page 70
- Troubleshoot the Module on page 111

Notes:

Configure a Standard I/O Module

This chapter describes how to configure your Compact 5000® standard I/O modules in a Studio 5000 Logix Designer® project. You can use the default module configuration or edit the module configuration.

For detailed information about module features, see these sections.

- Common Compact 5000 Digital I/O Module Features on page 41
- Input Module Features on page 47
- Output Module Features on page 59
- Safety I/O Module Features on page 71

For information about the tags created when you configure the modules, see Module Tags on page 121.

Before You Begin

You must complete these tasks before you can configure the module.

1. Create a Studio 5000 Logix Designer application project.
2. If you use the standard I/O modules as remote modules, add a Compact 5000 EtherNet/IP™ adapter to the project.

   For information about how to add a Compact 5000 EtherNet/IP adapter to a Studio 5000 Logix Designer project, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.

Create a New Module

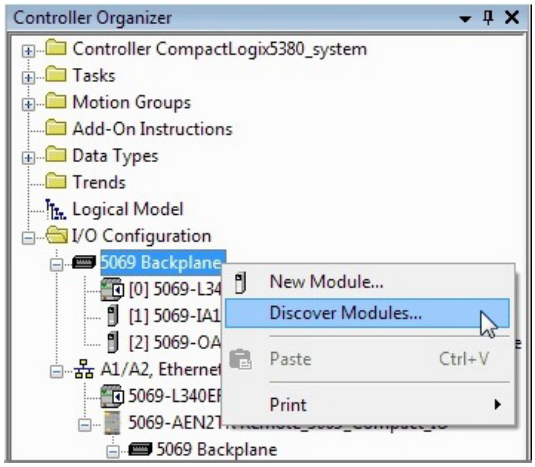
After you complete the steps in Before You Begin, use one of these methods to add modules to the project.

- Go Online and Discover Local I/O Modules
- Remain Offline and Add New Local I/O Modules
- Go Online and Discover Remote I/O Modules
- Remain Offline and Add New Remote I/O Modules

Go Online and Discover Local I/O Modules

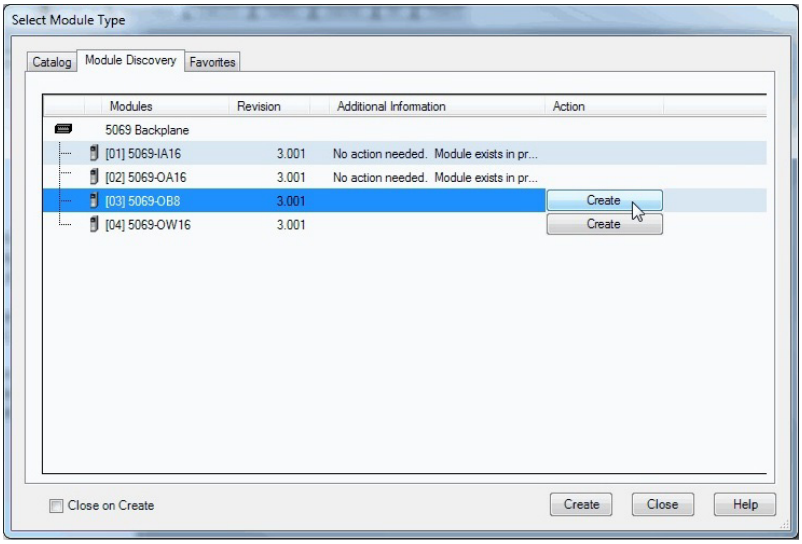
To use the Discover Modules method with local I/O modules, complete these steps.

1. Go online with your Logix Designer application.
2. Right-click the 5069 Backplane and select Discover Modules.



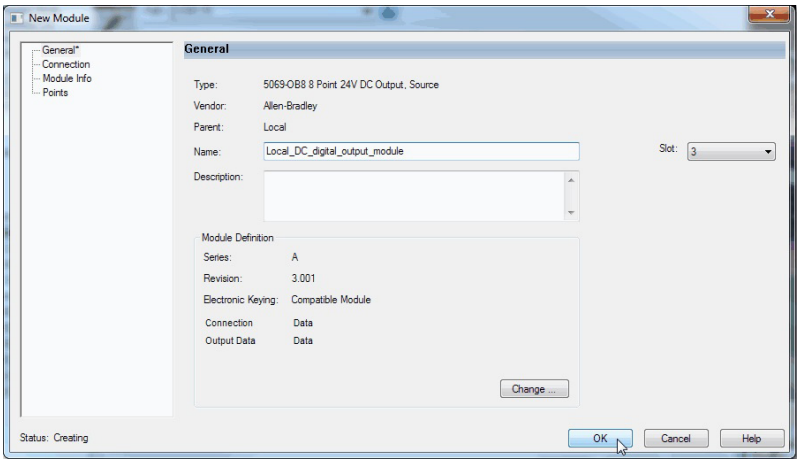
The Logix Designer application automatically detects available modules that are connected to the backplane and the Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.

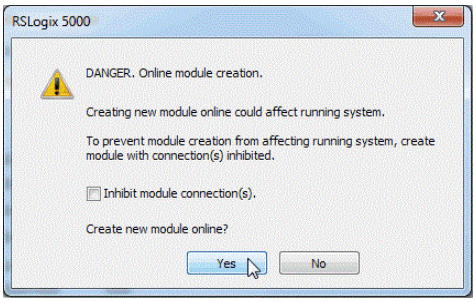


3. To add the discovered module to your project, click Create.

4. At the New Module dialog, configure the module properties and click OK.



A warning opens.



5. Verify that the Inhibit module connection(s) checkbox is selected and click Yes.

When you inhibit the module connection, you must remember to uninhibit the connection later.

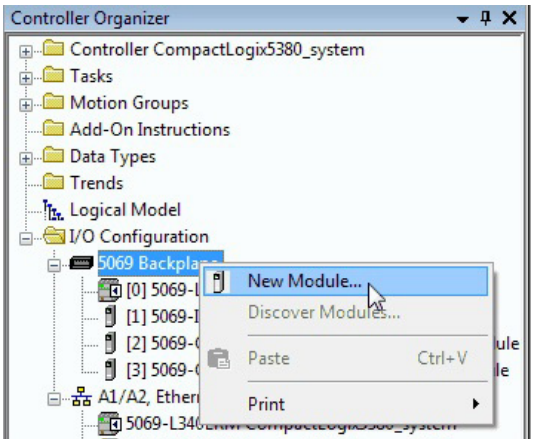
6. To add additional local I/O modules with this method, repeat steps 3...5.

Remain Offline and Add New Local I/O Modules

To add local I/O modules when the Logix Designer application project is offline, complete these steps.

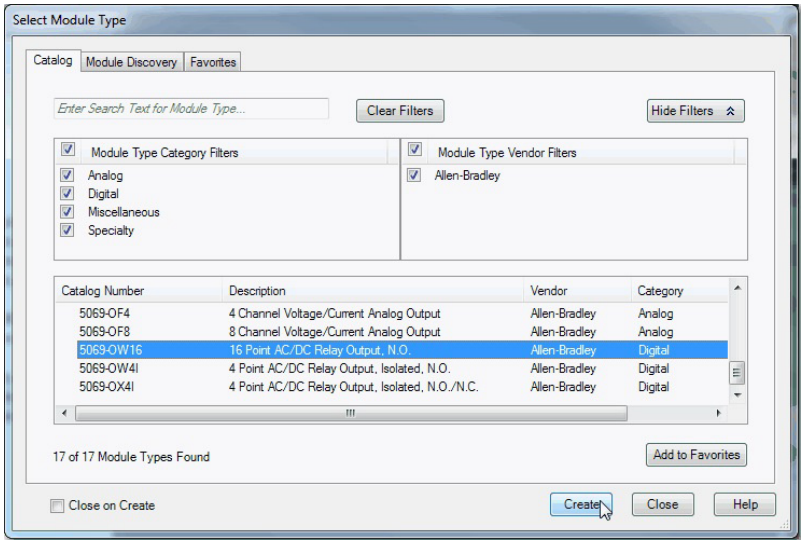
To add new local I/O modules when the project is online, complete the steps in Go Online and Discover Local I/O Modules, but select New Module instead of Discover Modules.

1. Right-click the 5069 Backplane and select New Module.

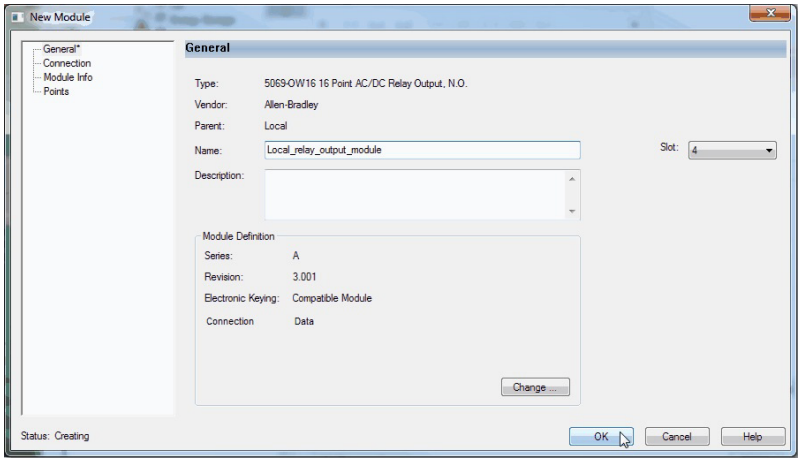


The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.
3. At the New Module dialog, configure the module properties and click OK.

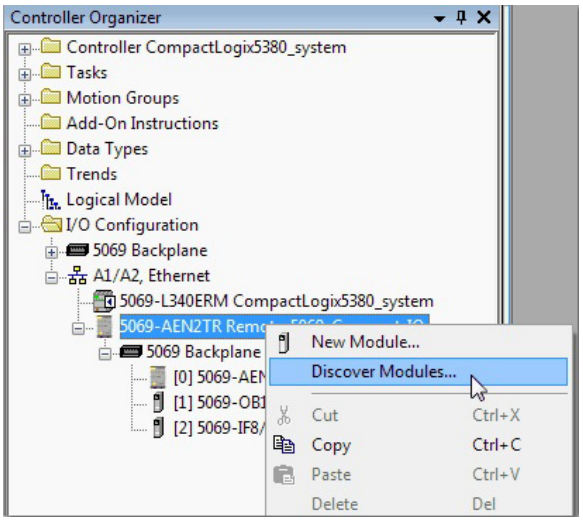


4. To add additional local I/O modules with this method, repeat steps 2...3.

Go Online and Discover Remote I/O Modules

To use the Discover Modules method with remote I/O modules, complete these steps.

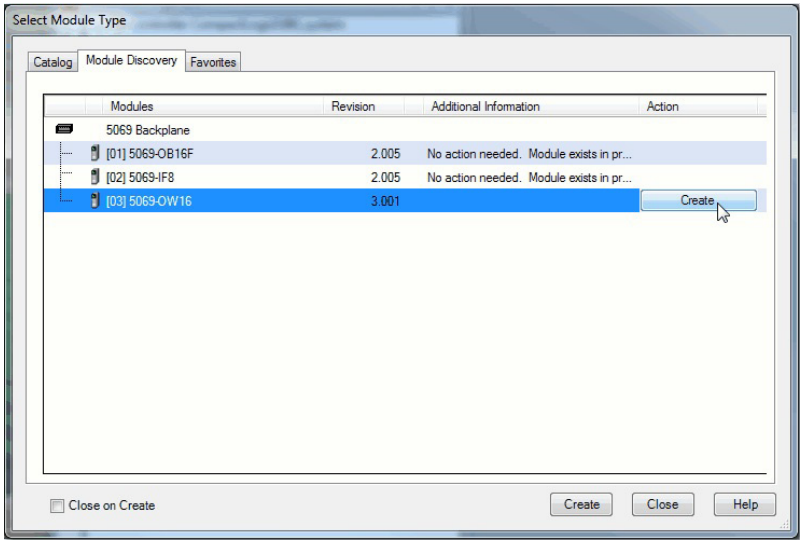
1. Go online with your Logix Designer application.
   The project must include a Compact 5000 EtherNet/IP adapter.
2. Right-click the Compact EtherNet/IP adapter and choose Discover Modules.



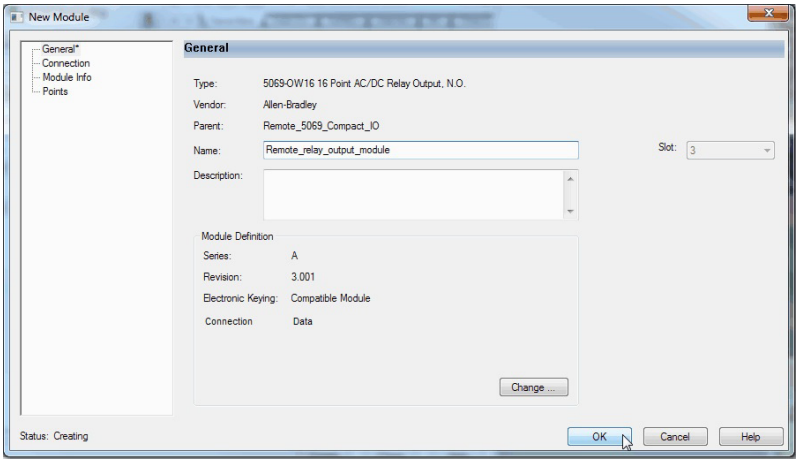
The Logix Designer application automatically detects available modules that are connected to the adapter and the Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.

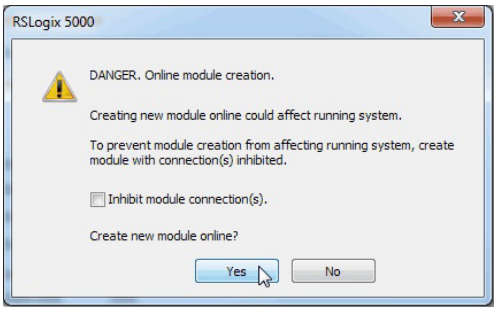
3. At the Select Module Type dialog, click Create to add the discovered module to your project.



4. At the New Module dialog, configure the module properties and click OK.



A warning opens.



5. Verify that the Inhibit module connection(s) checkbox is selected and click Yes.

When you inhibit the module connection, you must remember to uninhibit the connection later.

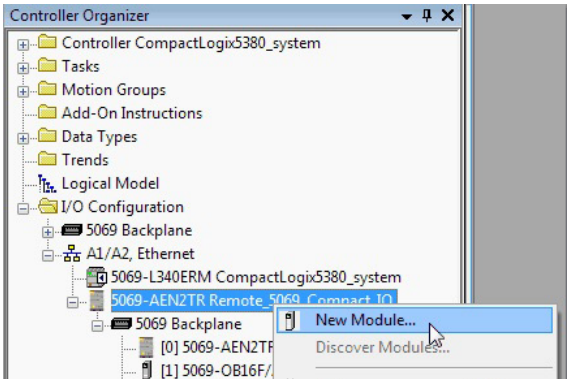
6. To add additional local I/O modules with this method, repeat steps 3...5.

Remain Offline and Add New Remote I/O Modules

To add remote I/O modules when the Logix Designer application project is offline, complete these steps.

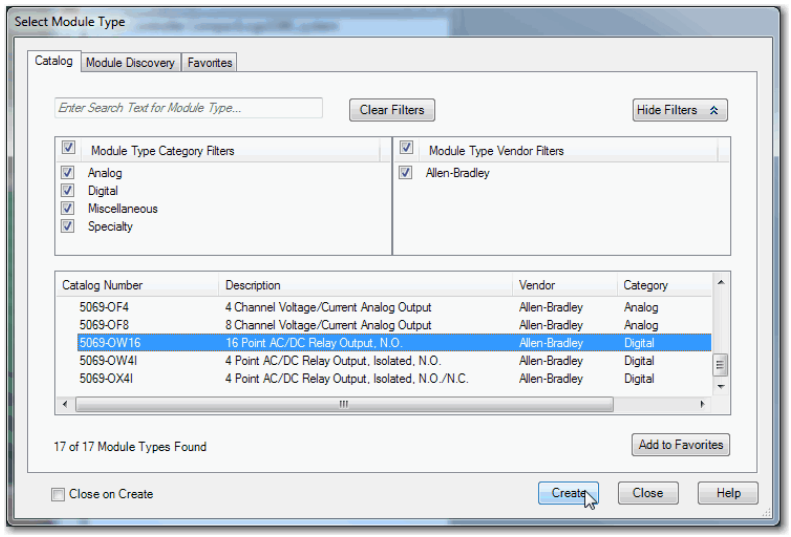
To add new remote I/O modules when the project is online, complete the steps in Go Online and Discover Remote I/O Modules, but select New Module instead of Discover Modules.

1. Right-click the Compact 5000 EtherNet/IP adapter and choose New Module.

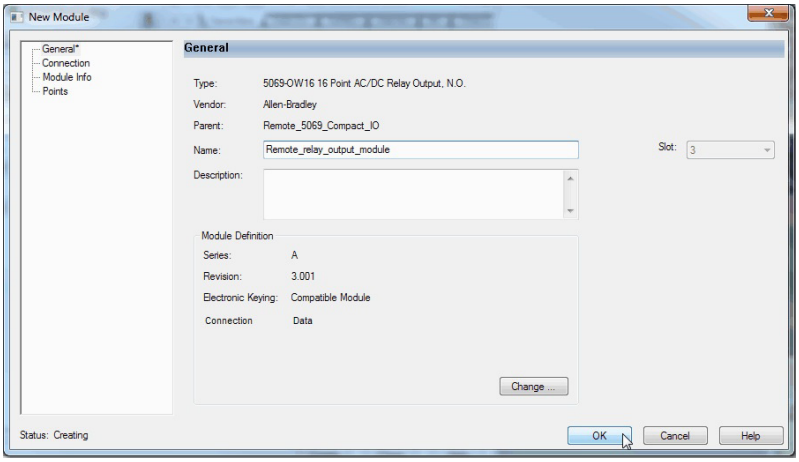


The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.
3. At the New Module dialog, configure the module properties and click OK.



4. To add additional local I/O modules with this method, repeat steps 2...3.

Reserve an I/O Module Slot

As described in Reserve a Node Address on page 21, the 5069-ARM address reserve module reserves a module slot in the physical system and in the Logix Designer application project that is configured for the system.

Add the 5069-ARM Module to the Project

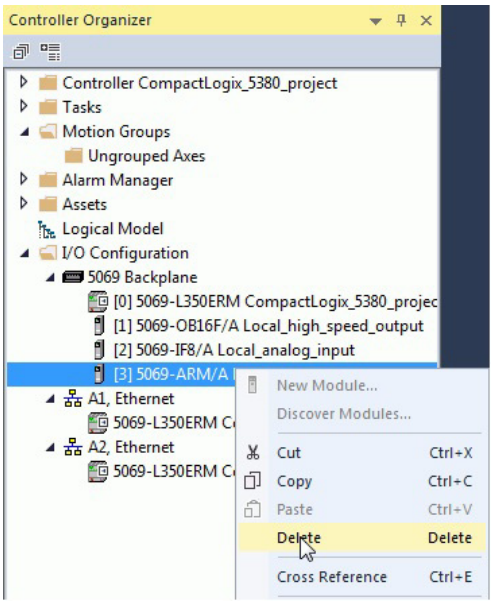
To add an address reserve module to the project, use one of the methods in Create a New Module on page 86.

Delete the 5069-ARM Module From the Project

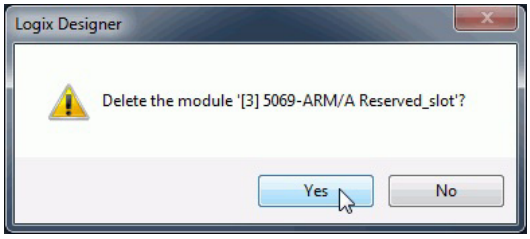
When you remove the 5069-ARM module from the system and install the Compact 5000 digital I/O module that is intended for that node address, you must also change the Logix Designer application project.

You must delete the 5069-ARM module from the project as follows.

1. Right-click the module name and choose Delete.



2. Click Yes.



3. To add the Compact 5000 I/O digital module that uses the node address that the 5069-ARM module reserved, follow the steps that are described in Create a New Module on page 86.

Configure the Module Parameters

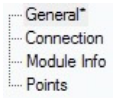
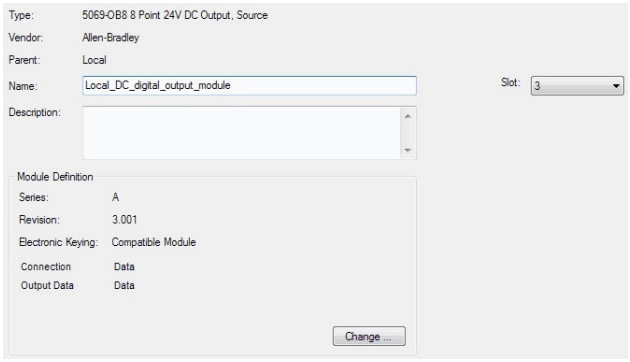
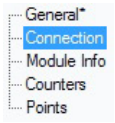
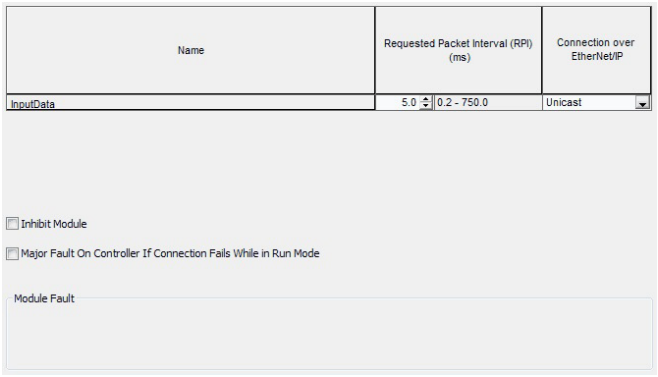
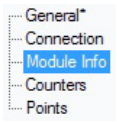
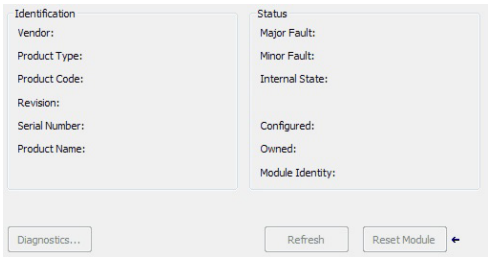
Click the parameter pages in the New Module dialog box to view and change the parameters that are associated with that module.

IMPORTANT This chapter shows how to configure the parameters as you add the module to the Logix Designer application project in the New Module dialog box.

If you access the parameters after the module has been added to the project, the dialog box is named Module Properties.

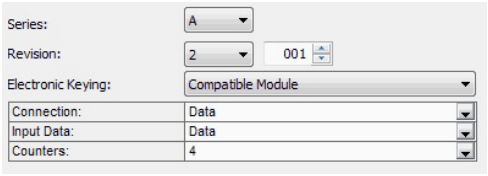
Common Module Parameters

These parameters apply to all Compact 5000 standard digital I/O modules.

Parameter Page	Available Actions	Configurable Parameters
General 	• Name the module • Assign a slot number (required) • Describe the module • Access the Module Definition For more information, see the Module Definition table on page 94.	
Connection 	• Set the RPI rate For more information, see Requested Packet Interval on page 30. • Set the connection type to use on the EtherNet/IP network • Inhibit the module For more information, see Inhibit a Module on page 43. • Select if a major or minor fault occurs when there is a connection failure while the controller is in Run mode **TIP:** Use the Module Fault box to help troubleshoot the module when the project is online.	
Module Info 	These actions are available when the project is online. • View module information and status • Access module diagnostics • Refresh the data on the screen • Reset the module	

Module Definition

Click Change... on the General parameters page to access the configurable module definition parameters.



Parameter	Description	Available Selections[1]
Series	Module hardware series	Module-specific
Revision	Module firmware revision, including major and minor revision levels	Module-specific
Electronic Keying	Software method by which you reduce the possibility of using the wrong device in a control system. For more information, see these resources. • Electronic Keying on page 44 • Electronic Keying in Logix 5000® Control Systems Application Technique, publication LOGIX-AT001	• Exact Match • Compatible Module • Disable Keying
Connection	Determines this information for the module type that you select. • Available configuration parameters • Data type transferred between the module and the controller • Which tags are generated when the configuration is complete	• Data • Data with Events • Listen Only[2]
Input Data - Input modules only	All available configuration, input, and output data for the input module that is being defined.	• Data • Timestamped Data • Packed Data
Counters - Input modules only	Determines the number of counters that are used for the module type.	• None • 2 • 4 • 8
Output Data - Output module only	All available configuration, input, and output data for the output module that is being defined.	• Data • Scheduled Data • Packed Data

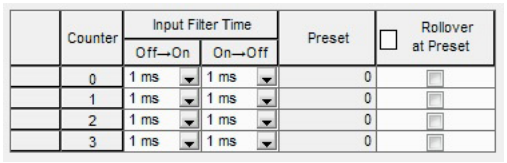
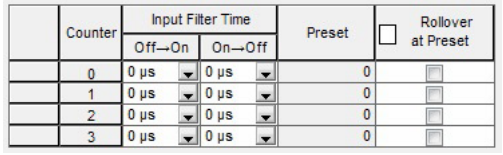
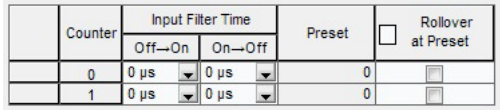
(1) The range of available choices varies by module type.
(2) The controller establishes communication with the module but does not send any configuration or output data to the module. A full input data connection is established but relies on the connection between the owner-controller and the module.

Module-specific Parameters

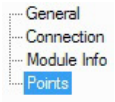
Some parameters are specific to the module type. This table describes the additional parameters and the modules to which these parameters apply.

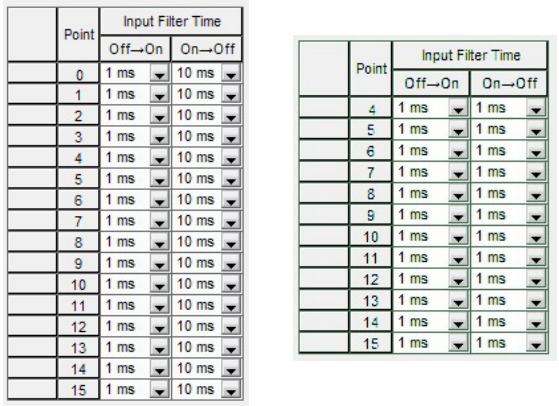
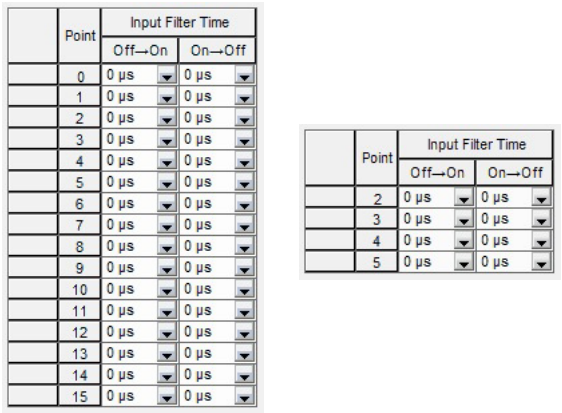
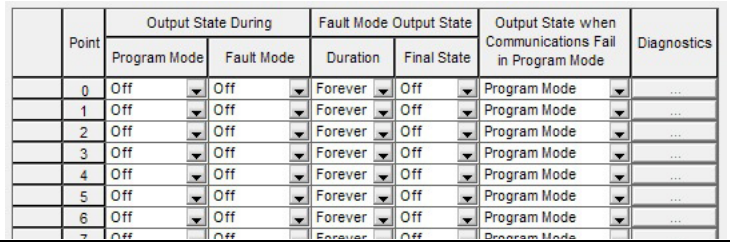
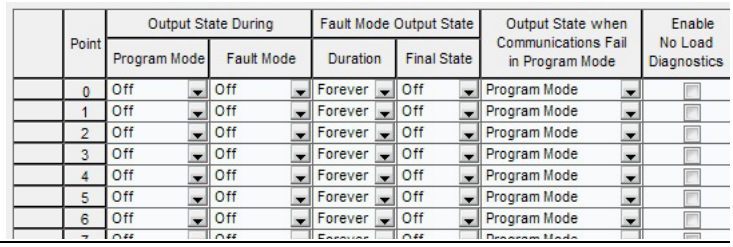
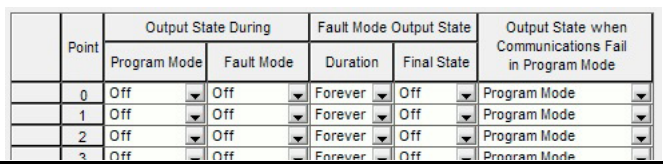
IMPORTANT If you use the Listen Only connection type, the Counters and Points pages are not available.

Module-specific Parameters

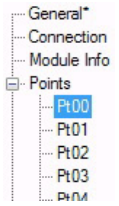
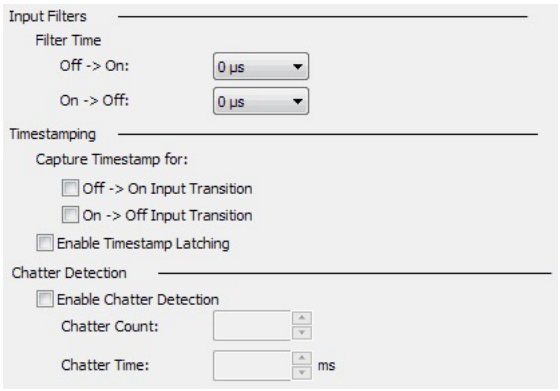
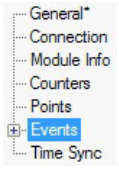
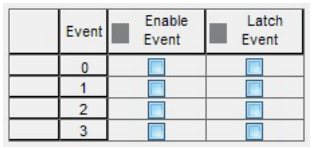
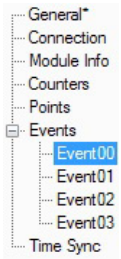
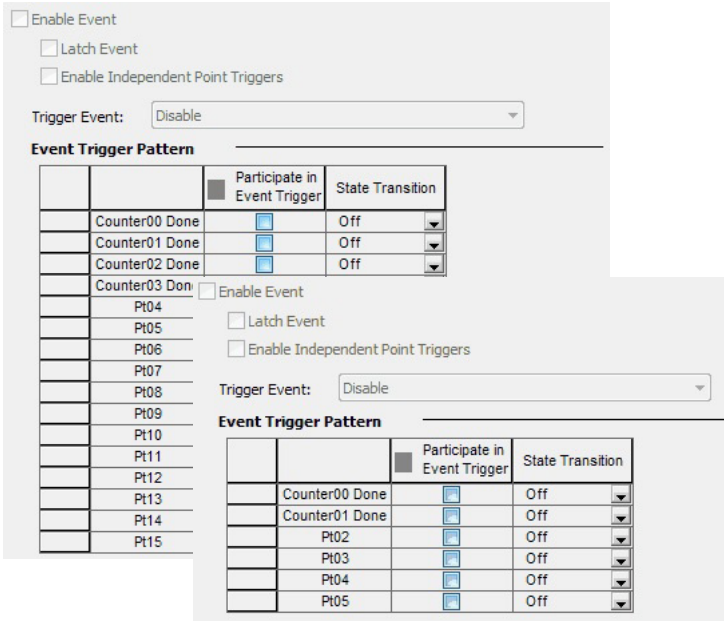
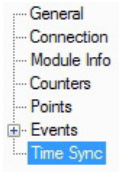
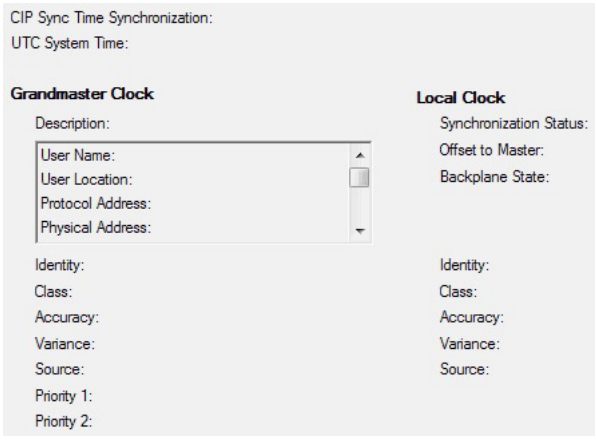
Parameter Page	Description	Modules	Configurable Parameters
Counters General* Connection Module Info Counters Points	The Counters page shows the configuration options available for each counter. Based on your Input Filter Time selections, the Input Filter Time Off>On and On>Off times change. You can also configure the counter Preset value and enable Rollover at Preset. The Counters page is only available if you choose a value for Counters in the Module Definition parameters. **IMPORTANT**: The total number of Counters is subtracted from the available number of Points. For example, if you configure a 5069-IB16 module to use four counters, the first four terminals are not available to use as points. The number of points available on the module is 12 or points 4...15. The maximum number of counters that can be configured is eight channels or counters 0...7.	5069-IB16, 5069-IB32	
		5069-IB16F	
		5069-IB6F-3W	The 5069-IB6F-3W module offers no more than four counters. 

Module-specific Parameters

<table>
<tr><th>Parameter Page</th><th>Description</th><th>Modules</th><th>Configurable Parameters</th></tr>
<tr><td rowspan="3">Points
  </td><td rowspan="2">Shows the available input filter time values for the module points.

For more information, see Software Configurable Input Filters and Delays on page 48.</td><td>5069-IA16,
5069-IB16,
5069-IB32</td><td>  </td></tr>
<tr><td>5069-IB16F,
5069-IB6F-3W</td><td>  </td></tr>
<tr><td>Shows the configuration options available for each point.</td><td>5069-OA16</td><td>  </td></tr>
<tr><td>5069-OB8,
5069-OB16,
5069-OB16F,
5069-OB32</td><td>  </td></tr>
<tr><td>5069-OW4I,
5069-OW16,
5069-OX4I</td><td>  </td></tr>
</table>

Module-specific Parameters

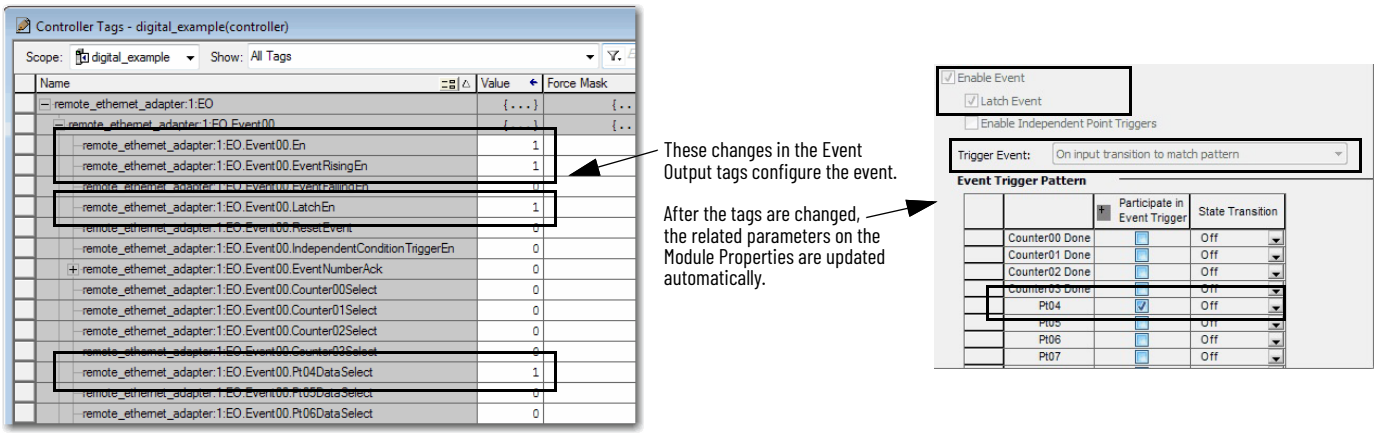
Parameter Page	Description	Modules	Configurable Parameters
Ptxx 	The Ptxx page shows the configuration options available when you use Timestamping on a point. You must select Timestamped Data for Input Data on the Module Definition page, to expand the Points. For more information, see these sections. • Software Configurable Input Filters and Delays on page 48 • Sequence of Events Per Point Time Stamps on page 50 • Chatter Detection on page 51	5069-IB16F, 5069-IB6F-3W	
Events 	Shows which events are enabled or latched.	5069-IB16F, 5069-IB6F-3W	
Eventxx 	Shows the configuration parameters for events. **IMPORTANT**: You cannot configure events in the Module Properties. The parameters that are displayed are read-only. You must use the Event Output tags to configure an event. For more information, see Configure an Event in the Event Output Tags on page 98.	5069-IB16F, 5069-IB6F-3W	
Time Sync 	The Time Sync page displays and status information about the module when the project is online.	5069-IB16F, 5069-IB6F-3W	

Configure an Event in the Event Output Tags

To configure an event, you must change the Event Output tags for the affected module via the Tag Monitor in the Logix Designer application. When you change the tags, the change is reflected on the Module Properties page.

These figures show how tag values are reflected on the Module Properties. These conditions are shown.

- Event is enabled
- Point 4 is configured to trigger the event
- Event is latched
- Trigger Event is On Input transition to match pattern



For more information, see these sections.

- Module Tags on page 121
- Events on page 51

Configure and Replace Safety I/O Modules

This chapter describes how to configure your Compact 5000® safety I/O modules in a Studio 5000 Logix Designer® project.

IMPORTANT You must use the Studio 5000 Logix Designer application, version 32 or greater with the safety I/O modules.

By default, all safety input and output channels on Compact 5000 safety I/O modules are disabled. You must configure each point that is used in a safety application.

For detailed information about module features, see these sections.

- Common Compact 5000 Digital I/O Module Features on page 41
- Input Module Features on page 47
- Output Module Features on page 59
- Safety I/O Module Features on page 71

For information about the tags created when you configure the modules, see Module Tags on page 121.

Before You Begin

You must complete these tasks before you can configure the module.

1. Create a Studio 5000 Logix Designer project.
2. If you use the safety I/O modules as remote I/O modules, add a Compact 5000 EtherNet/IP™ adapter to the project.

   For information about how to add a Compact 5000 EtherNet/IP adapter to a Studio 5000 Logix Designer project, see the Compact 5000 EtherNet/IP Adapters User Manual, publication 5069-UM007.

Create a New Module

Unlike Compact 5000 standard I/O modules, you cannot add a Compact 5000 safety I/O module to a Studio 5000 Logix Designer project while the project is online. The project must be offline to add Compact 5000 safety I/O modules to it.

Local I/O modules are installed in the same system as the Compact GuardLogix® 5380 controllers. Remote I/O modules are installed in a system that includes a Compact 5000 EtherNet/IP adapter.

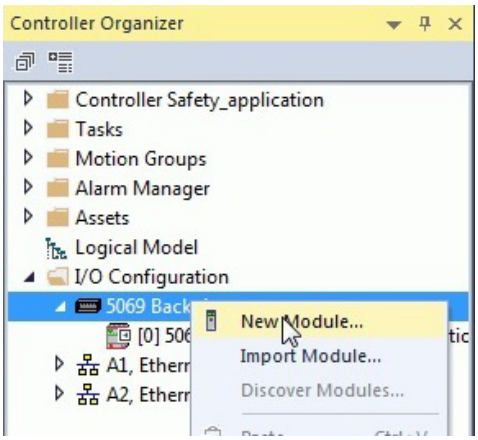
After you complete the steps in Before You Begin, use one of these methods to add modules to the project.

- Remain Offline and Add New Local Safety I/O Modules
- Remain Offline and Add New Remote Safety I/O Modules

Remain Offline and Add New Local Safety I/O Modules

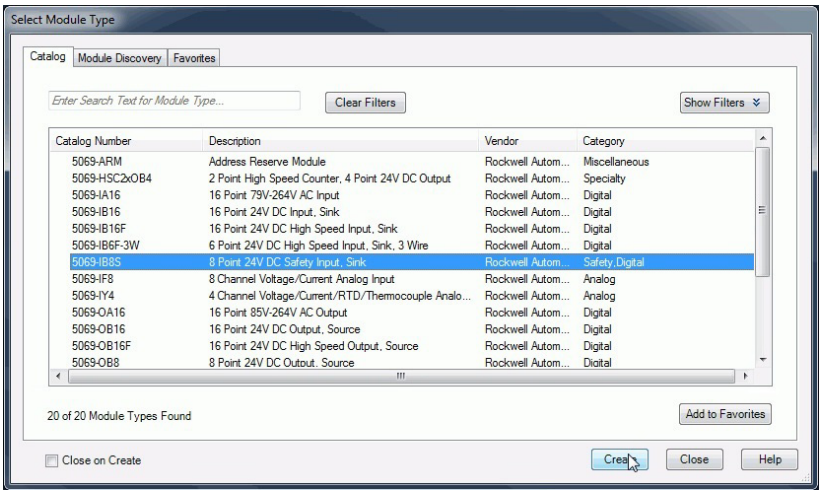
To add local I/O modules when the Studio 5000 Logix Designer project is offline, complete these steps.

1. Right-click the 5069 Backplane and select New Module.



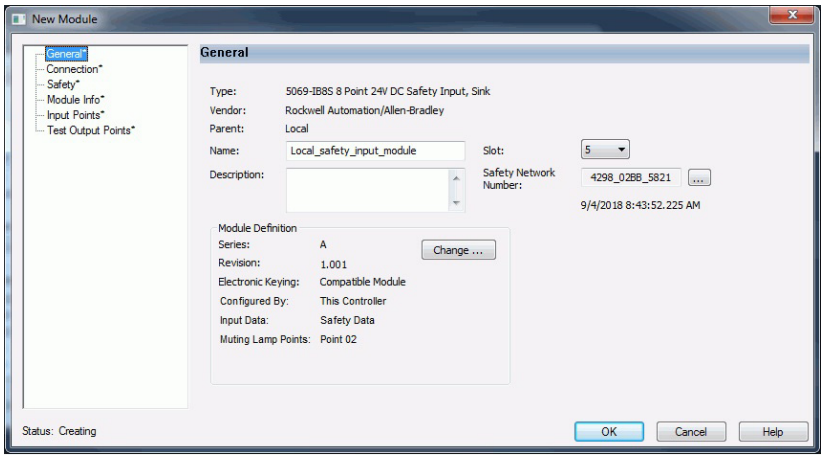
The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.

3. At the New Module dialog, configure the module properties and click OK.

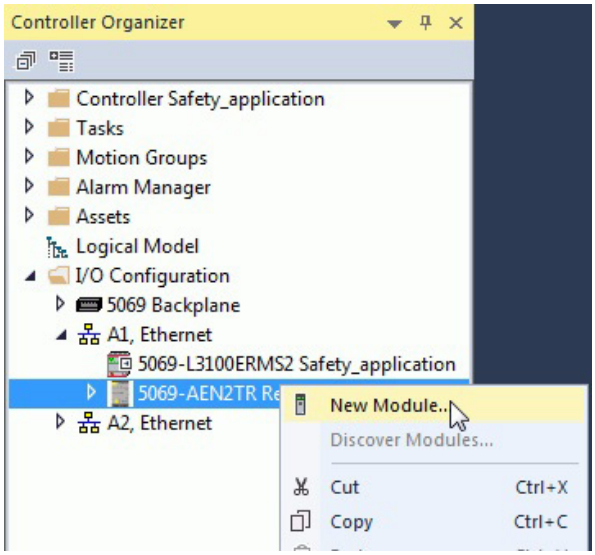


4. To add additional local I/O modules with this method, repeat steps 2...3.

Remain Offline and Add New Remote Safety I/O Modules

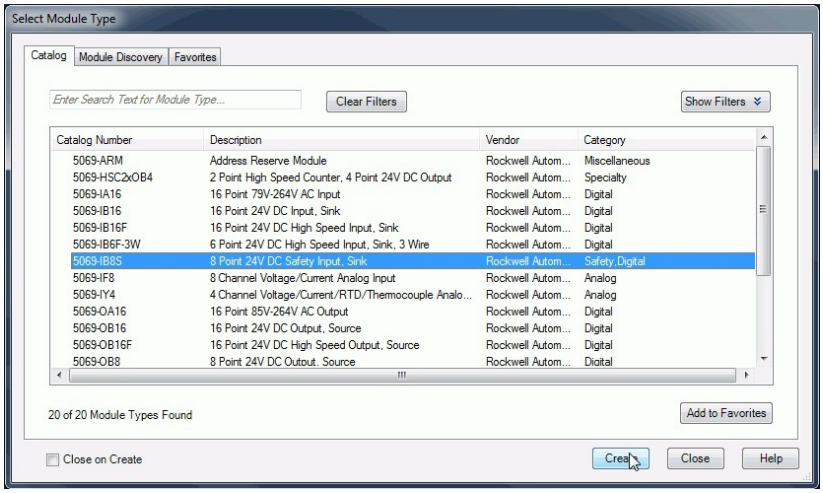
To add remote I/O modules when the Studio 5000 Logix Designer project is offline, complete these steps.

1. Right-click the Compact 5000 EtherNet/IP adapter and choose New Module.

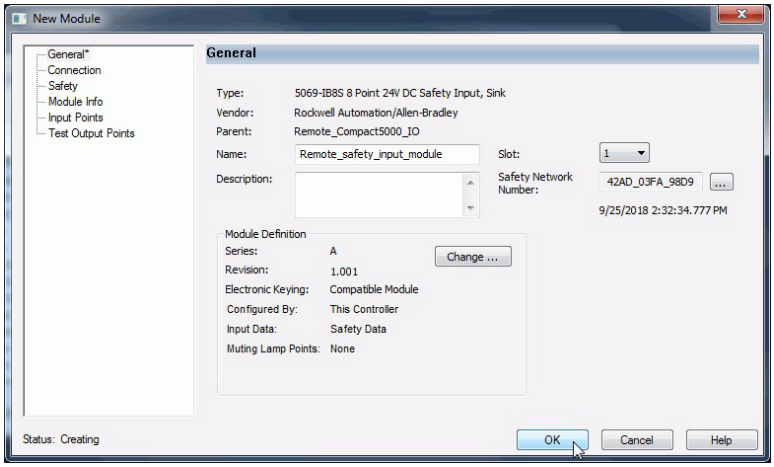


The Select Module Type dialog opens.

If you have more than one module to add, **do not** select the Close on Create checkbox.



2. Navigate to the catalog number for the module that you are adding, and click Create.
3. At the New Module dialog, configure the module properties and click OK.



4. To add additional local I/O modules with this method, repeat steps 2...3.

Configure the Module Parameters

Click the parameter pages in the New Module dialog box to view and change the parameters that are associated with that module.

IMPORTANT This chapter shows how to configure the parameters as you add the module to the Studio 5000 Logix Designer project in the New Module dialog box.

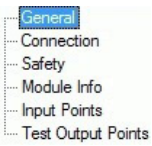
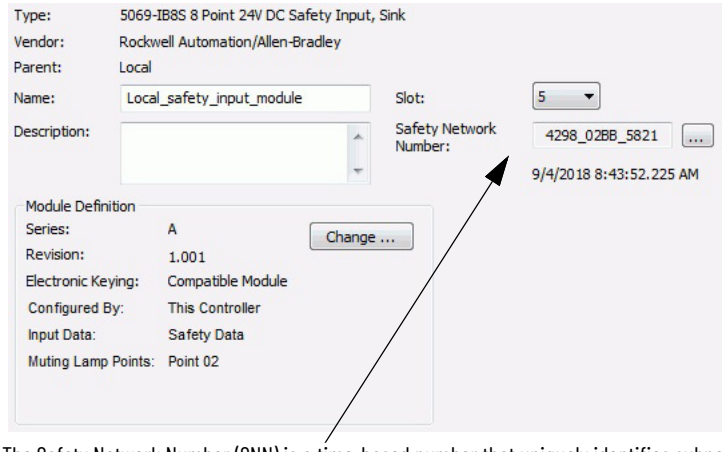
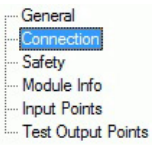
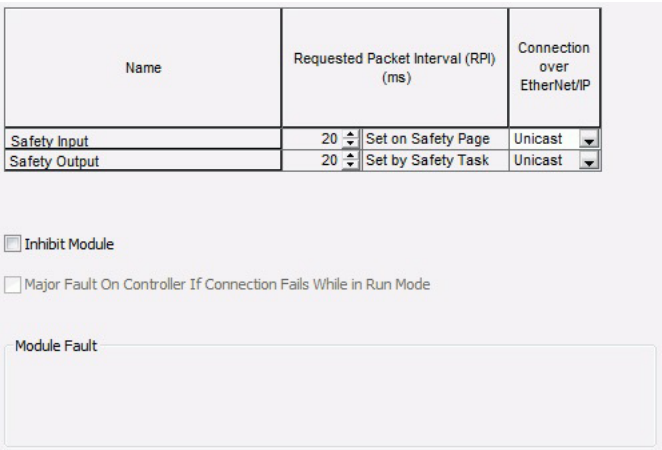
If you access the parameters after the module is added to the project, the dialog box is named Module Properties.

IMPORTANT By default, all safety input and output channels on Compact 5000 safety I/O modules are disabled.

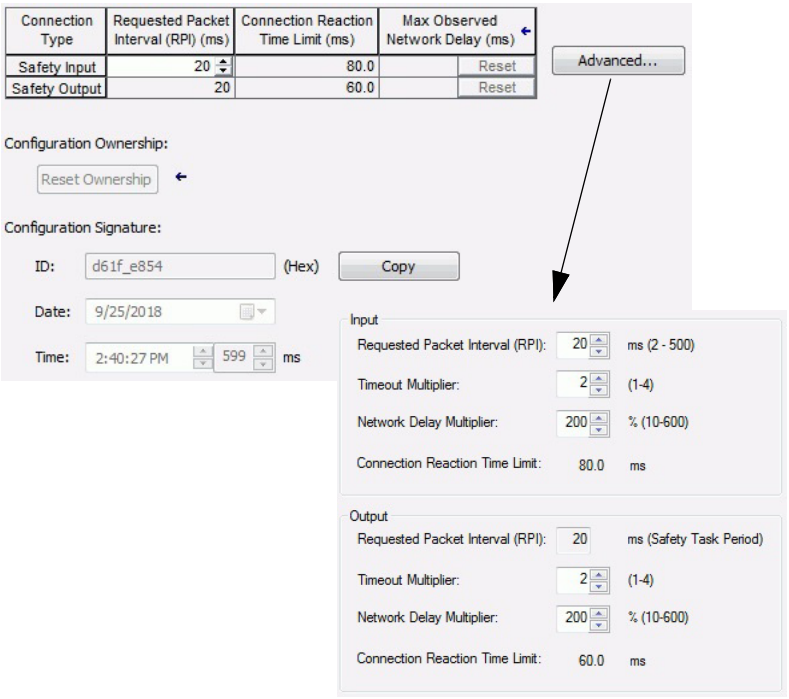
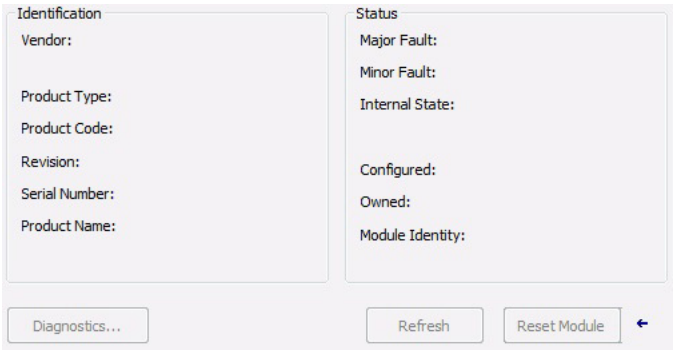
You must configure each point that is used in a Safety application.

These parameters apply to all Compact 5000 safety digital I/O modules.

Common Safety I/O Module Parameters

Parameter Page	Available Actions	Configurable Parameters
General 	• Name the module • Assign a slot number (required) • Describe the module • Access the Module Definition For more information, see the Module Definition table on page 105.	 The Safety Network Number (SNN) is a time-based number that uniquely identifies subnets across all networks in the safety system. All Compact 5000 safety I/O modules in a same system use the same SNN by default. Local Compact 5000 safety I/O modules are automatically assigned the same SNN as the 5069 Backplane SSN in the controller configuration. Remote Compact 5000 safety I/O modules are automatically assigned the same SNN. The Studio 5000 Logix Designer application assigns an SNN to the first safety I/O module that is added to a remote system. The application assigns the same SNN to additional safety I/O modules that are added to this remote I/O system. For more information on Safety Network Numbers, see the GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication 1756-RM012.
Connection 	• Set the connection type to use on the EtherNet/IP network Remote Compact 5000 safety I/O modules support the Connection over EtherNet/IP parameter. With safety input data, you can choose Unicast or Multicast. With safety output data, you must use Unicast. For more information, see Connection Over an EtherNet/IP Network on page 30. • Inhibit the module Before you inhibit the module, make sure that you are aware of the impact it has on your application. For more information, see Inhibit a Module on page 43. **IMPORTANT**: You cannot set the RPI for Compact 5000 safety I/O modules on the Connections page. For Compact 5000 safety I/O modules, you set the RPI on the Safety page.	

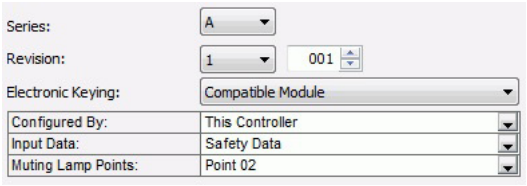
Common Safety I/O Module Parameters

Parameter Page	Available Actions	Configurable Parameters
Safety General Connection Safety Module Info Input Points Test Output Points	• The Safety page lets you set the RPI rate. • Click the Advanced button to change the Connection Reaction Time Limit configuration. **IMPORTANT**: The Safety Task period determines the RPI for the 5069-OBV8S or 5069-OBV8SK modules.	
Module Info General Connection Safety Module Info Input Points Test Output Points	These actions are available when the project is online. • View module information and status • Access module diagnostics • Refresh the data on the screen • Reset the module	

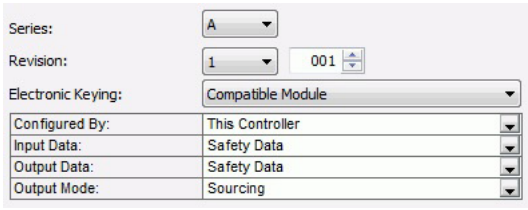
Module Definition

Click Change... on the General parameters page to access the configurable module definition parameters.

5069-IB8S, 5069-IB8SK Modules



5069-OBV8S, 5069-OBV8SK Modules

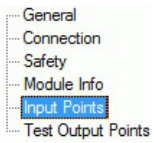
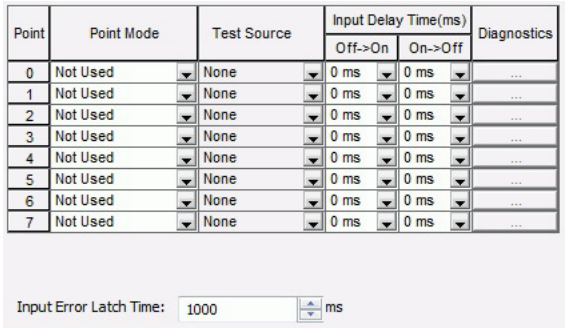
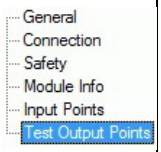
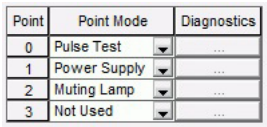
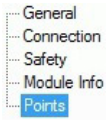
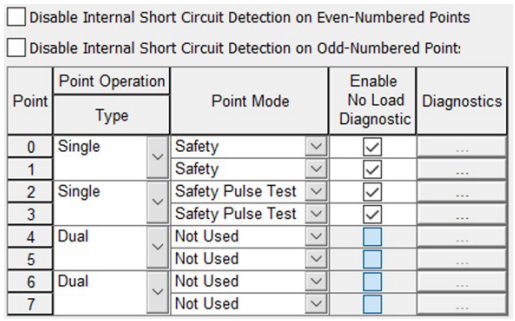


Parameter	Description	Available Selections[1]
Series	Module hardware series	Module-specific
Revision	Module firmware revision, including major and minor revision levels	Module-specific
Electronic Keying	Software method by which you reduce the possibility of using the wrong device in a control system. For more information, see these resources. • Electronic Keying • Electronic Keying in Logix 5000® Control Systems Application Technique, publication LOGIX-AT001	• Exact Match • Compatible Module • Disable Keying We **strongly recommend** that you use Exact Match or Compatible Module in Safety applications.
Configured By	Determines these items for the module type that you select. • Which controller tags are generated when configuration is complete • If you can select an Output Data type (output module only) • If you can select an Output Mode (output module only) • If you can use muting lamp points (input module only)	• This Controller • External Means[2]
Input Data	Determines what type of input data is exchanged between the module and the controller. Creates all controller tags specific to the module type being used. **IMPORTANT**: The 5069-OBV8S and 5069-OBV8SK output modules exchange input data with the controller.	• Safety data • Safety packed data
Muting Lamp Points 5069-IB8S or 5069-IB8SK modules only	Determines which input channels, if any, are connected to muting lamps.	• None • Point 02 • Point 03 • Point 02 and 03
Output Data 5069-OBV8S or 5069-OBV8SK modules only	Determines what type of output data is exchanged between the module and the controller. The Configured By parameter determines the available choices.	• None - If Configured By is External Means. • Safety data and Safety packed data - If Configured By is This Controller.
Output Mode 5069-OBV8S or 5069-OBV8SK modules only	Determines how the outputs are used. • Sourcing outputs. In this case, you connect the external device to only the sourcing point on an output channel. • As connection pairs. In this case, you connect the external device to both the sourcing and sinking points on an output channel.	• Sourcing • Bipolar

(1) The range of available choices varies by module type.
(2) The controller establishes communication with the module but does not send any configuration or output data to the module. A full input data connection is established but relies on the connection between the owner-controller and the module.

Module-specific Parameters

Some parameters are specific to the module type. This table describes the additional parameters and the modules to which these parameters apply.

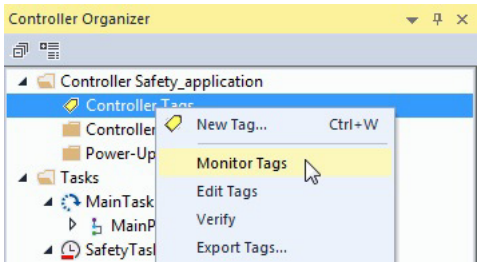
Parameter Page	Description	Modules	Configurable Parameters
Input Points 	The Input Points page is only available if you choose This Controller for the Configured By parameter on the Module Definition dialog. You must configure each point to use it in a Safety application. The inputs are disabled by default. **IMPORTANT**: The Studio 5000 Logix Designer project limits the number of Safety Pulse tests to which you can map a test source. For example, you can map Test Source 0 to a maximum of two Safety Pulse tests. For more information, see Software Configurable Input Filters and Delays on page 48.	5069-IB8S, 5069-IB8SK	
Test Output Points 	The Test Output Points page is only available if you choose This Controller for the Configured By parameter on the Module Definition dialog. You must configure each point to use it in a Safety application. The outputs are disabled by default.	5069-IB8S, 5069-IB8SK	
Points 	The Points page is only available if you choose This Controller for the Configured By parameter in the Module Definition parameters. You must configure each point to use it in a Safety application. The outputs are disabled by default.	5069-OBV8S, 5069-OBV8SK	

View the Module Tags

When you create a module, the Studio 5000 Logix Designer application creates a set of tags that you can view in the Tag Editor. Each configured feature on your module has a distinct tag that is available for use in the controller program logic.

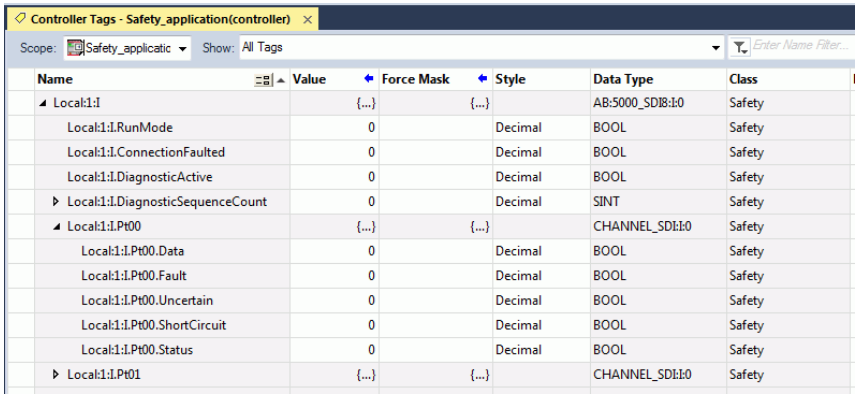
Complete these steps to access the tags for a module.

1. In the Controller Organizer, right-click Controller Tags and choose Monitor Tags.



   The Controller Tags appear with data.

2. To expand the tags, click the triangles.



For more information, see Module Tags on page 121.

Replace a Safety I/O Module

It is more complicated to replace a safety I/O module that sits on a CIP Safety™ network than to replace standard devices because of the Safety Network Number (SNN).

Safety devices require this more complex identifier to make sure that module numbers that are duplicated on separate subnets across all networks in the application do not compromise communication between the correct safety devices.

The SNN is a unique identifier that is automatically assigned to each subnet in a safety application. The same SNN is assigned to all devices on the subnet.

For example, when a Compact 5000 EtherNet/IP adapter is used in a safety application, the Studio 5000 Logix Designer project assigns it an SNN. All Compact 5000 digital I/O modules that are installed with that adapter are automatically assigned the same SNN.

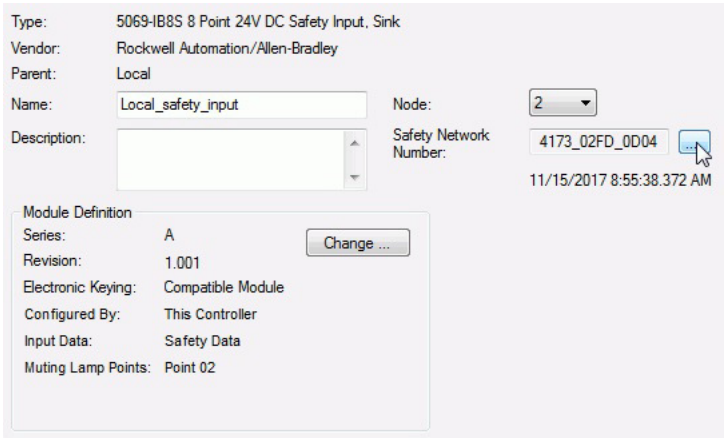
Each Compact 5000 safety I/O module requires a unique identifier within the same subnet that is called a DeviceID. The SNN and module slot number are combined to create the DeviceID of the safety I/O module.

Set the SNN Manually

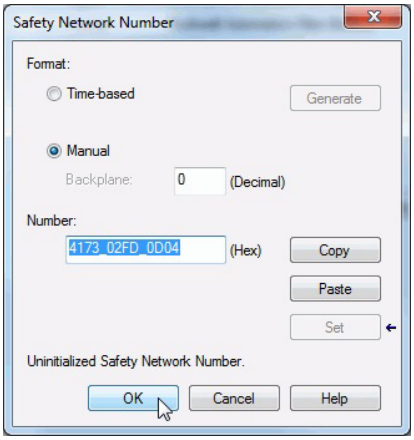
The SNN is used to provide integrity on the initial download to a safety I/O module. To maintain integrity, the module SNN must be set manually.

If a safety signature exists, the Compact 5000 safety I/O module must have DeviceID that matches the module in the safety controller project, before it is able to receive its configuration.

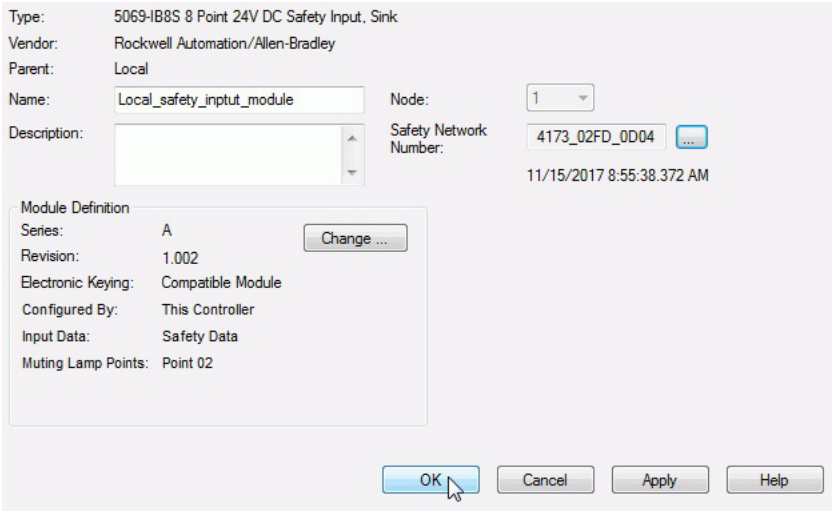
1. On the General page of the Module Properties, click the ellipsis button next to the Safety Network Number.



2. On the Safety Network Number dialog box, select Manual, type the SNN, and click OK.



3. On the Module Properties dialog box, click OK.



Reset to Out-of-Box Configuration

When the Studio 5000 Logix Designer application is online, the Safety page of the Module Properties displays the current configuration ownership.

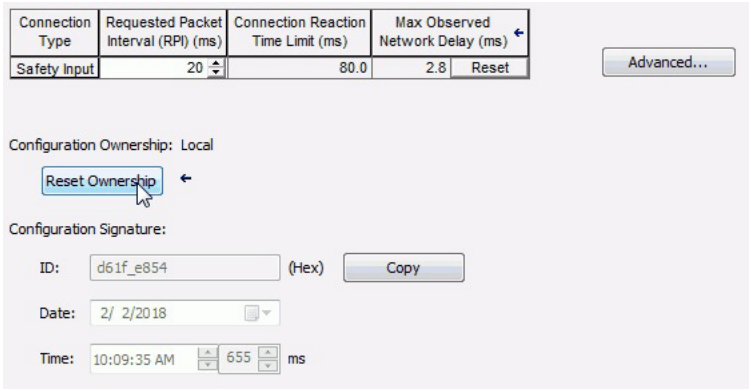
- If the current project owns the configuration, Local is displayed.
- If a second device owns the configuration, these items are displayed.
  - Remote
  - The SNN
  - The node address or slot number of the configuration owner.
- If the module read fails, Communication error is displayed.

If the connection is Local, you must inhibit the module connection before you reset ownership. To inhibit the module:

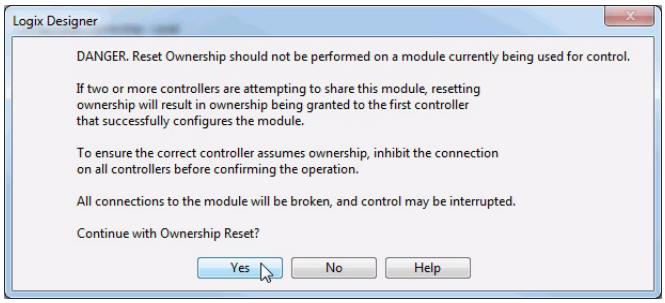
1. Right-click the module and choose Properties.
2. On the Connection page, click Inhibit module.
3. Click Apply and then OK.

Complete these steps to reset the module to its out-of-box configuration when online.

1. Right-click the module and choose Properties.
2. On the Safety tab, click Reset Ownership.



A warning opens.



3. Click Yes.

Replace a Module in a Logix 5000 System

Consider these conditions before you replace a Compact 5000 safety I/O module in a Logix 5000 system.

- If you rely on a portion of the CIP Safety™ system to maintain SIL 3 behavior during module replacement and functional testing, you must enable Configure Only When No Safety Signature Exists on page 110.
- If you rely on the entire routable CIP Safety control system to maintain SIL 3/PL (d or e) during the replacement and functional testing of a module, you can enable Configured Always on page 110.

Configure Only When No Safety Signature Exists

When a module is replaced, the configuration is downloaded from the safety controller if the DeviceID of the new module matches the original. The DeviceID is updated whenever the SNN is set. If the project is configured with Configure Only When No Safety Signature Exists enabled, follow the appropriate instructions in to replace a Compact 5000 safety I/O module.

After you complete the steps, the DeviceID matches the original. This match enables the safety controller to download the proper module configuration, and re-establish the safety connection.

Controller Safety Signature Exists	Replacement Module Condition	Action Required
No	No SNN (Out-of-box)	None. The module is ready for use.
Yes or No	Same SNN as original safety task configuration	None. The module is ready for use.
Yes	No SNN (Out-of-box)	Complete the steps in Set the SNN Manually on page 108.
Yes	Different SNN from original safety task configuration	
No		

Configured Always

ATTENTION: Enable the Configure Always feature only if the entire CIP Safety Control System is not being relied on to maintain SIL 3 behavior during the replacement and functional testing of a module.

Do not place modules that are in the out-of-box condition on a CIP Safety network when the Configure Always feature is enabled, except while you complete this replacement procedure.

When Configure Always is enabled, the controller automatically checks for and connects to a replacement module that meets all of these requirements.

- The controller has configuration data for a compatible module at that network address.
- The module is in out-of-box condition or has an SNN that matches the configuration.

If the project is configured as Configure Always, follow the appropriate steps to replace a Compact 5000 safety I/O module.

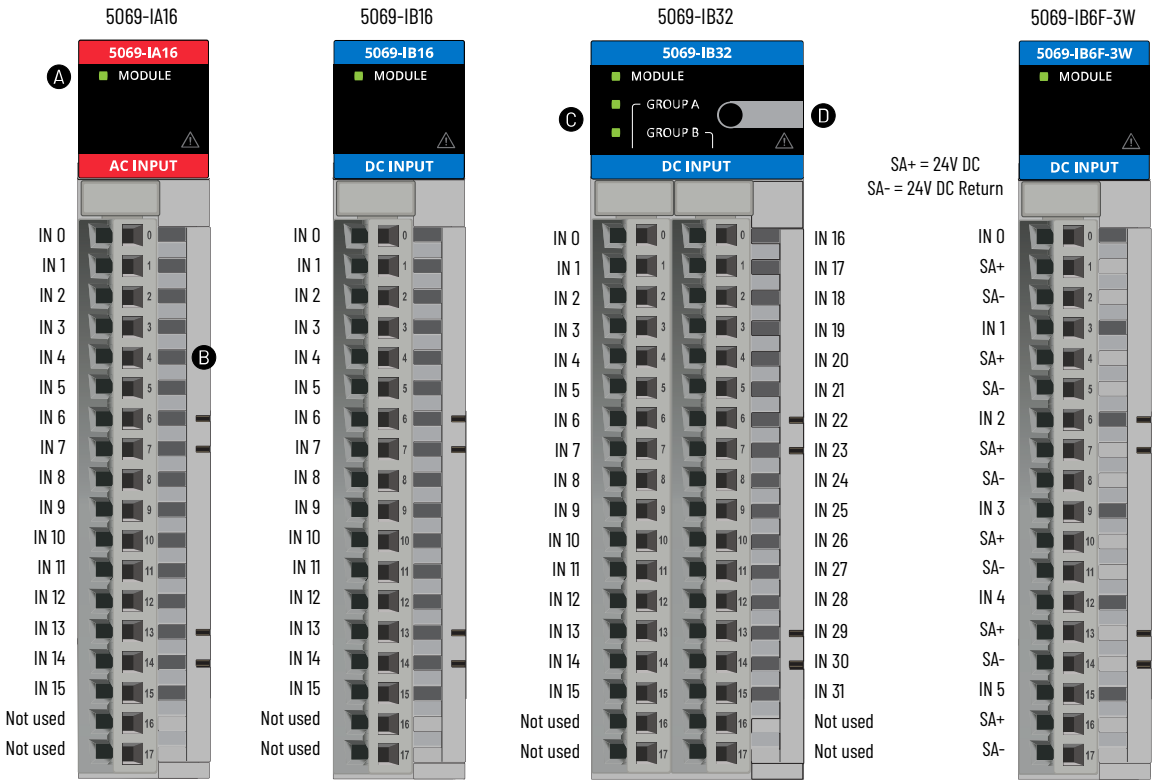
1. Remove the old I/O module and install the new module.
   - If the module is in out-of-box condition, skip to step 5.
     No action is needed for the controller to take ownership of the module.
   - If the module is not in out-of-box condition, or an SNN mismatch error occurs, go to step 2 to reset the module.
2. Right-click your I/O module and choose Properties.
3. On the Safety page, click Reset Ownership.
4. Click OK.
5. To authorize the system, functionally test the replaced I/O module and system.

Troubleshoot the Module

Troubleshoot with the Status Indicators

Use this information to troubleshoot with the status indicators.

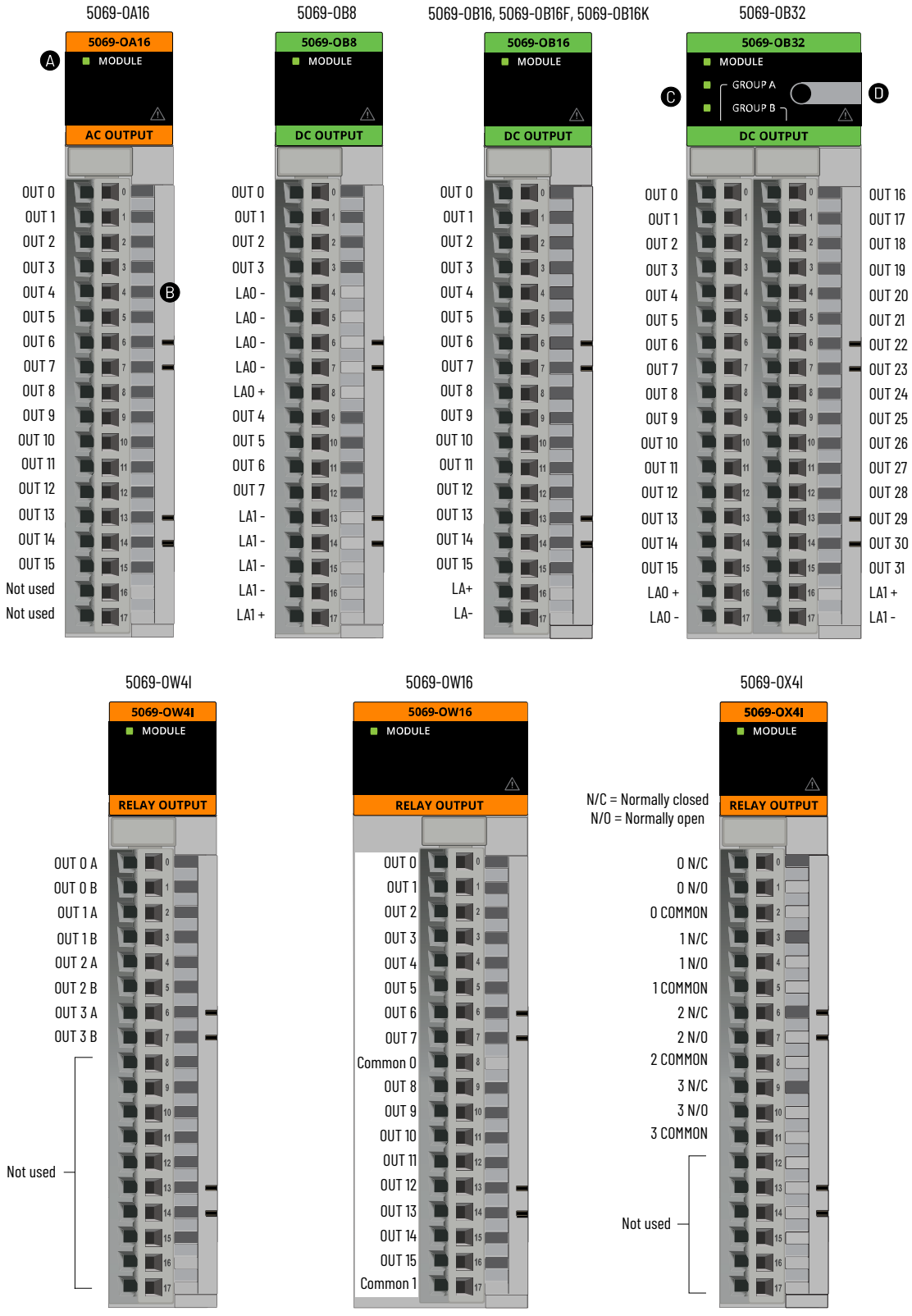
Status Indicators - Compact 5000 Digital Input Modules



A	Module status indicator	C	Group A and Group B indicators(1)
B	I/O status indicators	D	Group A or Group B push button(1)

(1) The I/O status indicators on the 32-point module show status for one group of 16 I/O channels at a time. The Group A or Group B indicator (C) shows which group is selected. To change which group's status is shown, push the button (D).

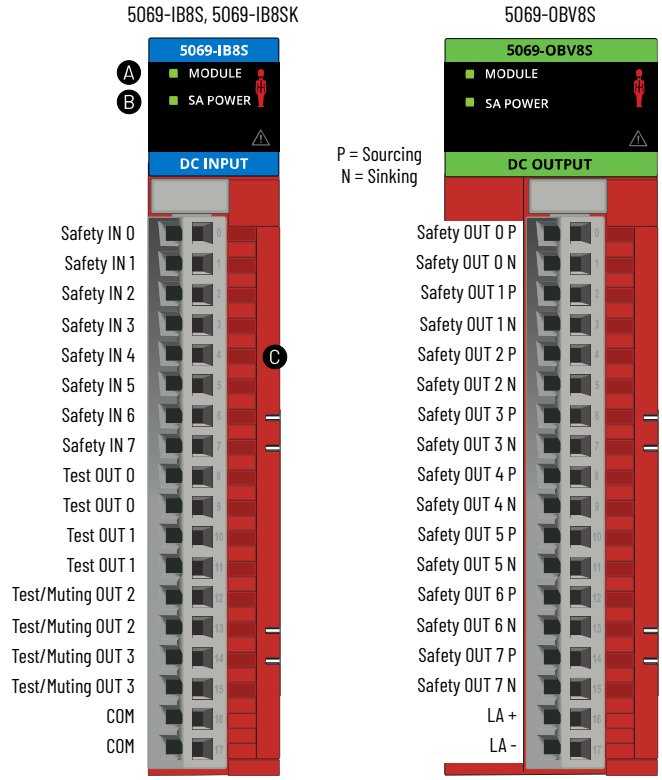
Status Indicators - Compact 5000 Digital Output Modules



A	Module status indicator	C	Group A and Group B indicators[1]
B	I/O status indicators	D	Group A or Group B push button[1]

(1) The I/O status indicators on the 32-point module show status for one group of 16 I/O channels at a time. The Group A or Group B indicator (C) shows which group is selected. To change which group's status is shown, push the button (D).

Status Indicators - Compact 5000 Digital Safety I/O Modules



A	Module status indicator
B	SA power status indicator
C	I/O status indicators

SA Power Status Indicator - Safety I/O Modules

This table describes the SA status indicator for the Compact 5000 safety I/O modules.

Indicator State	Description	Recommended Action
Off	One of these conditions exists. • No SA power is applied • The status of the SA power is unknown • The SA power is below the valid range as defined by the module • During a safety critical fault, SA power was turned off	Check the power source and address any issues
Steady green	SA power is in a valid range as defined by the module	None
Steady red	The SA power is outside the valid range as defined by the module The power can be off, too low, or too high	Asses and correct the amount of SA power that is applied

Module Status Indicator

This table describes the module (MOD) status indicator on Compact 5000 digital I/O modules.

Indicator State	Description	Recommended Action
Off	Power is not applied	If your application uses the module, complete one of these actions • Confirm that the system is powered • Confirm that the module is installed properly
Steady green	The module has a connection to the owner-controller and is operating normally	None
Flashing green	One of these conditions exists • The module does not have a connection to the controller, this can result from missing, incomplete, or incorrect module configuration • Compact 5000 safety I/O modules only: A connection can be established with the controller, but the Validator has not completed an initial Time Coordination exchange	Use the Studio 5000 Logix Designer project to determine what is preventing a connection from the module to the controller and correct the issue
Steady red	The module experienced a nonrecoverable fault	Complete these steps 1. Cycle power to the module 2. If the status indicator remains in the steady red state, replace the module
Flashing red	One of these conditions exists • A module firmware update is in progress • A module firmware update attempt failed • The device has experienced a recoverable fault • A connection to the module has timed out	Complete one of these actions • Let the firmware update finish • If the firmware update fails, attempt the update again • View the cause of the module fault on the Connection and Module Info pages To clear a recoverable fault, complete one of these actions – Cycle module power – Click Reset Module on the Module Info page If the fault does not clear after you cycle power and click Reset Module, contact Rockwell Automation® Technical Support • To determine if a connection has timed out, view the Connection page If a connection has timed out, determine the cause and correct it For example, a cable failure can cause a connection timeout
Flashing red and green	Compact 5000 safety I/O modules only: The UNID is not commissioned in the module	Commission the UNID in the module

Group A and Group B Indicators - 32-point Modules

This table describes the Group A and Group B indicators on Compact 5000 32-point digital I/O modules when power is applied and the module is installed properly.

Indicator State	Description	Recommended Action
Off	The I/O status indicators ARE NOT showing status for this group of channels	To show status for this group, press the Group A or Group B button
Steady yellow	The I/O status indicators ARE showing status for this group of channels and there are no faults on these channels	None
Flashing red and yellow	The I/O status indicators ARE showing status for this group of channels and there is at least one fault on these channels	To troubleshoot the fault, see the I/O Status Indicators table
Flashing red	The I/O status indicators ARE NOT showing status for this group of channels but there is at least one fault on the channels that are not shown	To determine what channel has a fault, press the Group A or Group B button To troubleshoot the fault, see the I/O Status Indicators table

IMPORTANT If the I/O status indicators are not showing the status of a group where there is a rising edge of fault detected on a channel, the status will automatically switch to the group where there is a rising edge of fault.

I/O Status Indicators

This table describes the I/O status indicators for the Compact 5000 digital I/O modules.

Type of Digital Module	Indicator State	Description	Recommended Action
AC input, DC input	Off	The input is Off or no module power is applied	None
	Steady yellow	The input is On	None
	Flashing red	5069-IB16F, 5069-IB6F-3W: A Field Power Loss condition exists	Locate and address the condition
AC output	Off	The output is Off, or no module power is applied	None
	Steady yellow	The output is On	None
	Flashing red	A Field Power Loss detection condition exists	Reconnect power to the input
DC output	Off	The output is Off, or no module power is applied	None
	Steady yellow	The output is On	None
	Flashing red	One of these conditions exist • A No Load or Short Circuit condition • 5069-OA16, 5069-OB8, 5069-OB16/B, 5069-OB16F/B, 5069-OB16K/B, 5069-OB32: A Field Power Loss condition	Locate and address the condition
Standard relay output	Off	The output is Off, or no module power is applied	None
	Steady yellow	The output is On	None
	Flashing red	5069-OW16, Series A and Series B: A Field Power Loss condition exists	Locate and address the condition
Safety input	Off	One of these conditions exists • The input is Off • The input is not configured • The input is not enabled • No module power is applied	Locate and address the condition
	Steady yellow	The input is On	None
	Flashing red	A Short Circuit condition exists	Locate and address the condition
	Steady red	One of these conditions exists • A Field Power Loss condition • A Overload condition on an output • A Short Circuit to Ground condition on an output • Another hardware fault, that is not previously listed, occurred on the module	Complete one of these actions • Locate and address the condition • If no condition is present, cycle module power If the status indicator remains in the steady red state after you cycle power, replace the module
Safety output	Off	One of these conditions exists • The output is Off • The output is not configured • The output is not enabled • No module power is applied	Locate and address the condition
	Steady yellow	The output is On and a load was detected in the Off state	None
	Flashing red	One of these conditions exists • The output is off and a there is a No Load condition • A Short Circuit condition	Locate and address the condition
	Steady red	One of these conditions exists • Field Power Loss condition • Overload condition on an output • Short Circuit to Ground condition on an output • Another hardware fault, that is not previously listed, occurred on the module	Complete one of these actions • Locate and address the condition • If no condition is present, cycle module power If the status indicator remains in the steady red state after you cycle power, replace the module
	Flashing red/yellow	A No Load condition was detected when the output was Off, the condition was not corrected and the output is now On	Locate and address the condition

Troubleshoot with the Studio 5000 Logix Designer Application

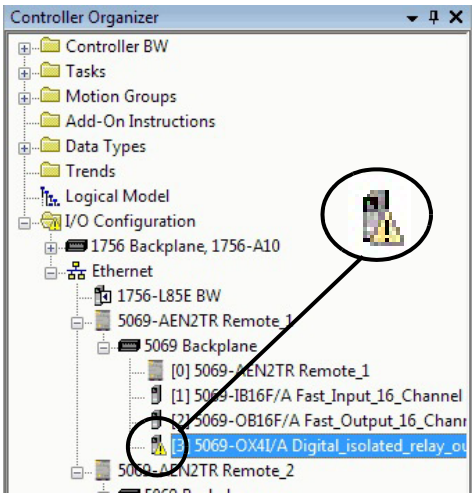
The Studio 5000 Logix Designer application indicates the presence of fault conditions.

Fault conditions are reported in these ways.

- Alert in the I/O Configuration Tree
- Status and Fault Information on the Parameter Pages
- Module and Point Diagnostics
- Studio 5000 Logix Designer Application Tag Editor

Alert in the I/O Configuration Tree

An alert appears in the I/O Configuration tree when a fault occurs.



Status and Fault Information on the Parameter Pages

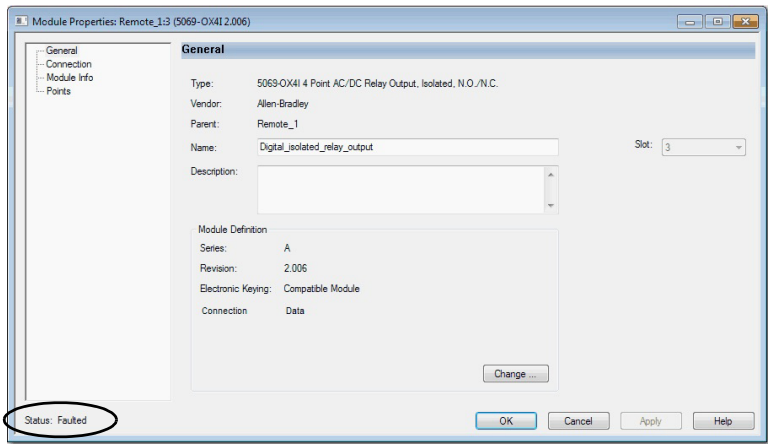
In the Studio 5000 Logix Designer® application, the Module Properties include a series of parameter pages. The numbers and types of pages varies by module type.

Each page includes options to configure the module or monitor the status of the module. You can monitor the state of a module for faults in these ways.

- Module Status on the General Page
- Module Fault Descriptions on the Connection Page
- Module Fault Descriptions on Module Info Page

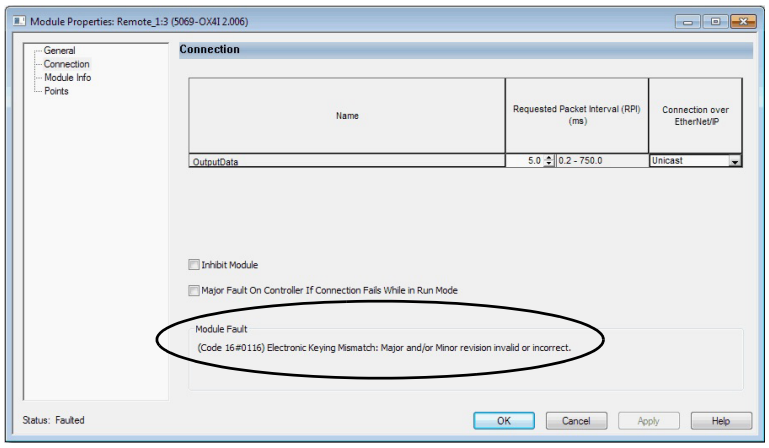
Module Status on the General Page

The module status is indicated on the General page of the Modules Properties.



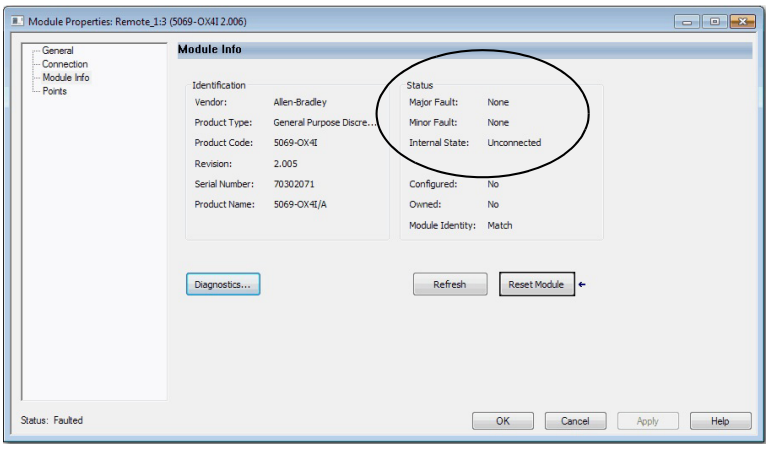
Module Fault Descriptions on the Connection Page

In the Module Fault box on the Connection page, a fault description is listed. The description includes an error code that is associated with the specific fault type.



Module Fault Descriptions on Module Info Page

Major and minor fault information is listed on the Module Info page in the Status box.



Module and Point Diagnostics

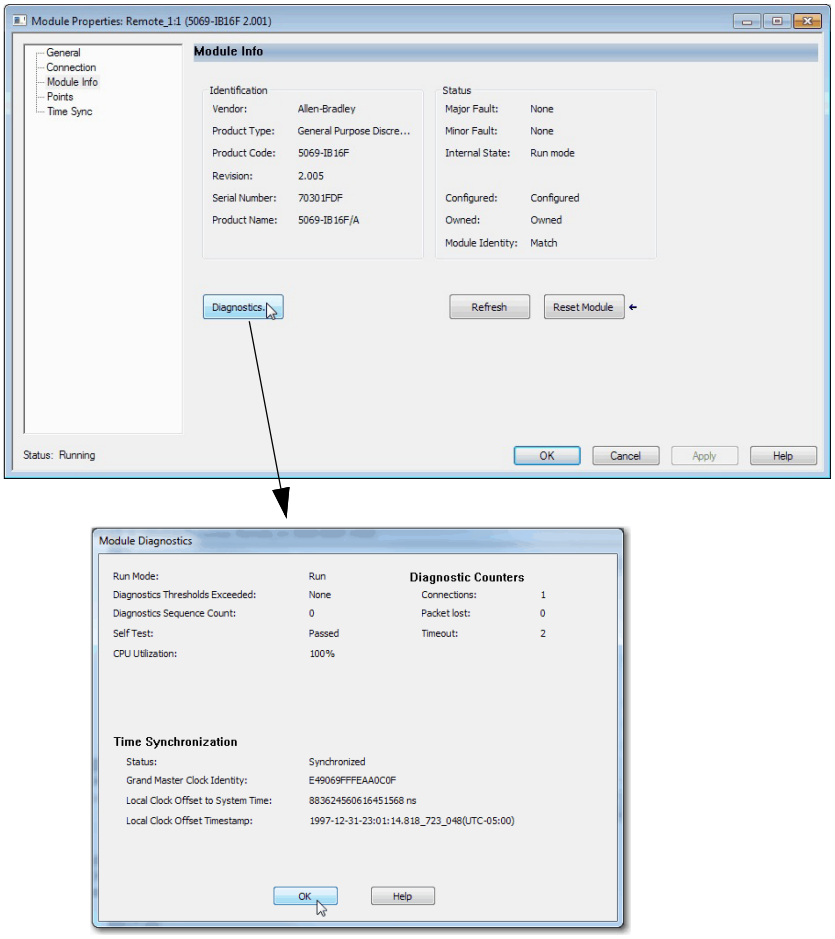
You can use diagnostics in a Studio 5000 Logix Designer project to monitor module or point operating conditions and to troubleshoot issues that affect a module or point. You can only use these diagnostics when the **project is online**.

- Module Diagnostics
- Point Diagnostics

Module Diagnostics

Module diagnostics provide information on a module-wide basis. For example, the Module Diagnostics dialog box indicates if the module is operating in, Run, Remote Run, Remote Program, or Program mode.

Access the Module Diagnostics from the Module Info page.

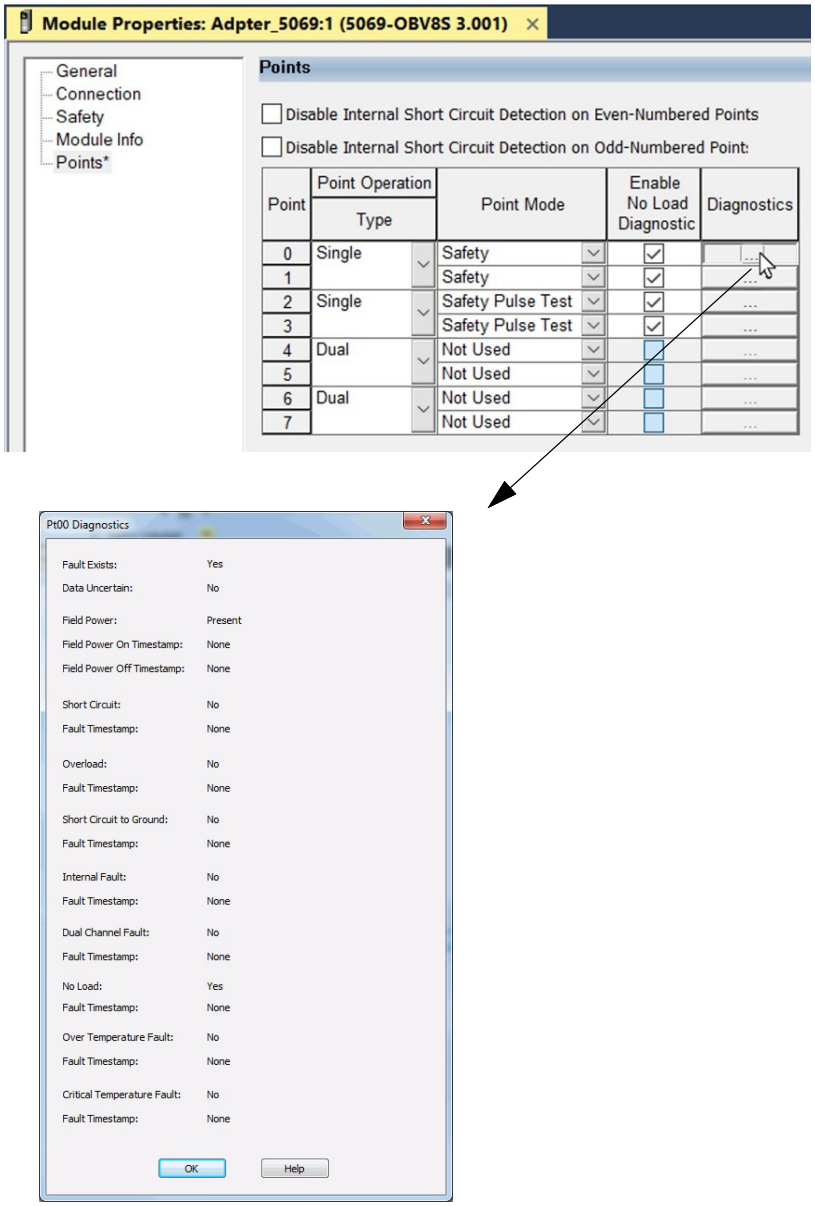


Point Diagnostics

Point diagnostics provide information on an individual point basis. For example, you can check individual points on a 5069-IB8S or 5069-IB8SK safety input module for the presence of a Short Circuit condition.

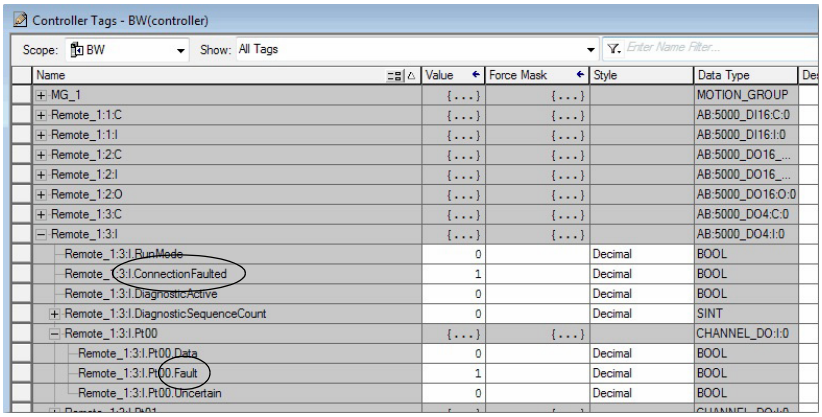
Remember this information.

- Not all Compact 5000 digital I/O modules provide point diagnostics.
- The point diagnostics that are available vary by module type and functionality.
- There are some differences between modules, but most commonly, you can access point diagnostics on the Points page.



Studio 5000 Logix Designer Application Tag Editor

Fault conditions are indicated in the controller tags for the module.



Internal Faults on a Safety Output Module

This table describes conditions that can trigger an InternalFault.

Conditions	Output Behavior	Tag Value	Diagnostic Value	I/O Status Indicator State
• Output Mode - Bipolar • Point Operation Type - Single • Point Mode - Safety • A load is connected between a sourcing output point and a sinking output point. • O.Ptxx.Data tag = 0 • An overload resistor shorts the sourcing output point to 0V DC	Faults	I.Ptxx.Fault tag = 1	InternalFault = 1	The I/O status indicator for the faulted output point is steady red.
• Output Mode - Bipolar • Point Operation Type - Single • Point Mode - Safety or Safety Pulse Test • A load is connected between a sourcing output point and a sinking output point. • O.Ptxx.Data tag = 0 • Either output point shorts to 0V DC	Faults	I.Ptxx.Fault tag = 1	InternalFault = 1	
• Output Mode - Sourcing • Point Operation Type - Single • Point Mode - Safety or Safety Pulse Test • O.Ptxx.Data tag = 1 • Output point shorts to 24V DC	Faults	I.Ptxx.Fault tag = 1 **IMPORTANT**: The tag value occurs on the faulted output point and all of its associated group points.	InternalFault = 1 **IMPORTANT**: The diagnostic value occurs on the faulted output point and all of its associated group points.	

When the conditions that trigger the diagnostics are corrected, the output faults are cleared, the tags and diagnostics reset to 0, and the I/O status indicators turn off.

Module Tags

Module tags are created when you add a module to the Studio 5000 Logix Designer® application project.

These tag types are available with the Compact 5000® I/O digital modules.

- Configuration
- Event Input - 5069-IB16F and 5069-IB6F-3W modules only
- Event Output - 5069-IB16F and 5069-IB6F-3W modules only
- Input
- Output

The set of module tags that are associated with a module depends on the module type and the parameters that you select during module configuration. For example, if you select a Listen Only connection, the Studio 5000 Logix Designer application creates only Input tags for that module.

The tables in this appendix list all tags available with each module. Not all tags in the list are available when a module is first added to a project. More tags are available as you configure the module.

Tag Name Conventions

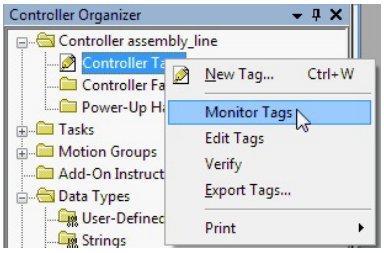
Attribute	Local System Modules	Remote System Modules
Example	Local:2:I.Pt01.Fault	remote_5069_adapter:1:C.Pt00.InputOffOnFilter
Location	Local	Remote
Slot Number	2	1
Tag Type	I	C
Channel or Point No.	Pt01	Pt00
Parameter	Fault	InputOffOnFilter

The possible Compact 5000 digital I/O tag types are configuration (C), input (I), and output (O).

View the Tags

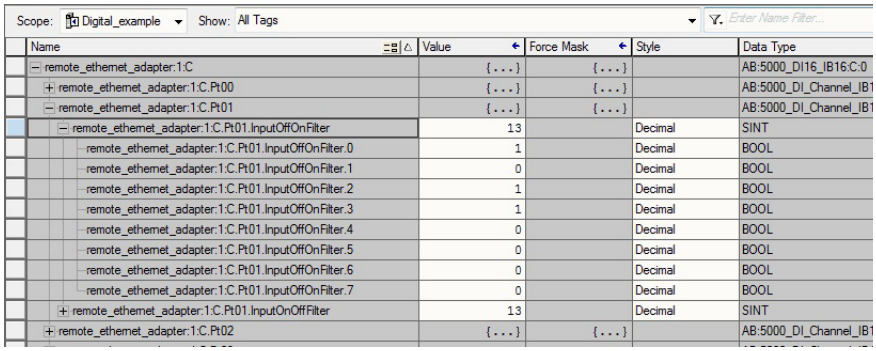
Complete these steps to view the tags.

1. In the Studio 5000 Logix Designer project, right-click Controller Tags and select Monitor Tags.



The Controller Tags window opens and displays the data.

2. To view the additional tags as shown, click the + symbols.



Standard Input Module Tags

This section describes the tags that are associated with the standard input modules.

For modules that have output tags, the output tags are only available if you enable counters on the Module Definition dialog.

Configuration Tags - Standard Input Modules

Name	Data Type	Description	Valid Values			
			5069-IA16	5069-IB16, 5069-IB32	5069-IB16F	5069-IB6F-3W
Counterxx.InputOffOn Filter	SINT	The amount of time that a signal must be in the on state before the input data indicates the on state. The amount of time is indicated using an enumeration. Not all products support all enumeration values.	–	• 9 = 0 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms	• 5 = 0 µs • 6 = 5 µs • 7 = 10 µs • 8 = 20 µs • 9 = 50 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms	
Counterxx.InputOnOff Filter		The amount of time that a signal must be in the off state before the input data indicates the off state. The amount of time is indicated using an enumeration. Not all products support all enumeration values.				
Counterxx.RolloverAt Preset	BOOL	Determines whether the simple counter rolls over to 0 when it reaches 0:Preset (1) or at 2147483647 (0).		• 0 = Maximum value • 1 = Preset value		
Ptxx.InputOffOnFilter	SINT	The amount of time that a signal must be in the on state before the input data indicates the on state. The amount of time is indicated using an enumeration. Not all products support all enumeration values. **IMPORTANT**: For the 5069-IA16, the Studio 5000 Logix Designer application lets you enter tag values for filter values that are invalid for some input signals. Make sure that you select a valid input filter value. If you select an invalid input filter value, the module can read signal levels incorrectly.	Input signal is 120V AC: • 13 = 1 ms Input signal is 240V AC: • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms	• 9 = 0 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms	• 5 = 0 µs • 6 = 5 µs • 7 = 10 µs • 8 = 20 µs • 9 = 50 µs • 10 = 100 µs • 11 = 200 µs • 12 = 500 µs • 13 = 1 ms • 14 = 2 ms • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms • 18 = 50 ms	
Ptxx.InputOnOffFilter	SINT	The amount of time that a signal must be in the off state before the input data indicates the off state. The amount of time is indicated using an enumeration. Not all products support all enumeration values.	Input signal is 120V AC: • 16 = 10 ms • 17 = 20 ms Input signal is 240V AC: • 15 = 5 ms • 16 = 10 ms • 17 = 20 ms			
Ptxx.ChatterTime	INT	A value from 1...10000 ms in whole ms increments.	–		1...10000	
Ptxx.ChatterCount	SINT	The number of input changes that are considered Chatter.			• 0 = Disabled • 2...127 = Enabled	
Ptxx.CaptureOffOnEn	BOOL	Enables capturing Off to On time stamps. If cleared, the point does not record Off to On time stamps.			• 0 = Capture disabled (default) for OFF to ON input transitions • 1 = Capture enabled for OFF to ON input transitions	
Ptxx.CaptureOnOffEn		Enables capturing On to Off time stamps. If cleared, the point does not record On to Off time stamps.			• 0 = Capture disabled (default) for ON to OFF input transitions • 1 = Capture enabled for ON to OFF input transitions	
Ptxx.TimestampLatchEn		When this bit is set, time stamps are latched; this means that a time stamp is not overwritten until acknowledged. All subsequent transitions on that point are ignored until acknowledged/reset. If the bit is not set, the new LO time stamp overwrites the first LO time stamp immediately, even if the controller has yet to extract that data. You can acknowledge the time stamp in these ways. • Off to On transition time stamp: – The Ptxx.TimestampOffOnNumber.x input tag value is written to the Ptxx.TimestampxxxxxNumberAck output tag value. – If time stamp Latching is enabled, the Ptxx.Timestampxxxx input tag remains the same until the next input Off to On transition occurs. Otherwise, the input tag value is cleared. • On to Off transition time stamp: – The Ptxx.TimestampOnOffNumber.x input tag value is written to the Ptxx.TimestampxxxxxNumberAck output tag value. – If time stamp Latching is enabled, the Ptxx.Timestampxxxx input tag remains the same until the next input On to Off transition. Otherwise, the input tag value is cleared.(1)			• 0 = time stamps are overwritten with each successive COS transition. • 1 = time stamps are latched until acknowledged.	

(1) In this case, the xxxxx in the tag names represents OffOn or OnOff tags based on what transition occurred. That is, a change in state from Off to On or On to Off.

Event Input Tags - 5069-IB16F, 5069-IB6F-3W

Name	Data Type	Description	Valid Values
			5069-IB16F, 5069-IB6F-3W
Eventx	BOOL	Indicates the number of the event.	0...3
Eventx.PtxxFault		Indicates that channel data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Bad data (Faulted) If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.
Eventx.Uncertain		Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Uncertain data If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.
Eventx.EventDropped		Indicates when an event has been discarded because events are occurring faster than they are being acknowledged.	• 0 = An event status has not been dropped. • 1 = An event status has been dropped.
Eventx.EventRising		Indicates whether an event is triggered when an input transition results in an event pattern being matched.	• 0 • 1
Eventx.EventFalling		Indicates whether an event is triggered when an input transition resulted in an event pattern no longer being matched.	• 0 • 1
Eventx.CIPSyncValid		Indicates whether the module is synced with a 1588 master.	• 0 = CIP Sync™ is not available • 1 = CIP Sync is available
Eventx.CIPSyncTimeout		Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.	• 0 = A valid time master has not timed out. • 1 = A valid time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.
Eventx.EventsPending	SINT	The number of events currently queued in the modules. A value greater than 0 indicates that the controller is not currently keeping up with the rate of events.	All positive values
Eventx.EventNumber	DINT	Continuous count of events, which increments by one each new time event. The originator sets the Event Number ACK to the Event Number to acknowledge receipt of the event. When the EventNumber reaches it maximum value and rolls over it is to roll over to 1, not 0.	All values
Eventx.EventTimestamp	LINT	The time the event occurred.	All positive values
Eventx.CounterxxDone	BOOL	When set, indicates if the corresponding counter Done bit (rising or falling dependent on configuration) triggered the event.	• 0 = Corresponding counter Done bit did not trigger the event • 1 = Corresponding counter Done bit triggered the event
Eventx.PtxxData		When set, indicates if the corresponding data value (rising or falling dependent on configuration) triggered the event.	• 0 = Corresponding data value did not trigger the event • 1 = Corresponding data value triggered the event
Eventx.CounterxxFault		When set, indicates if the corresponding counter had an indicated fault when the event occurred.	• 0 = Corresponding counter did not have an indicated fault when the event occurred • 1 = Corresponding counter did have an indicated fault when the event occurred
Eventx.Fault		Detects whether the signal is good data. The fault is set to 1 by the originator when the connection is lost.	• 0 = Good • 1 = Bad

Event Output Tags - 5069-IB16F, 5069-IB6F-3W

Name	Data Type	Description	Valid Values
			5069-IB16F, 5069-IB6F-3W
Eventxx.En	BOOL	When set, the corresponding event trigger definition is active and events are triggered when conditions match the definition.	• 0 = Event trigger definition is not active and events are not triggered when conditions match the definition • 1 = Event trigger definition is active and events are triggered when conditions match the definition
Eventxx.EventRisingEn		When set, an event triggers each time a condition change results in conditions that match the event trigger definition.	• 0 • 1
Eventxx.EventFallingEn		When set, an event triggers each time a condition change results in conditions that no longer match the event trigger definition.	• 0 • 1
Eventxx.LatchEn		When set, events are latched until acknowledged and a new event is lost if the previous event has not been acknowledged. When not set, new events overwrite old events.	• 0 = Not latched (default) • 1 = Latched
Eventxx.ResetEvent		When changed from 0 to 1, resets all events and clears the event queue on the channel.	• 0 = Events are not cleared. • 1 = Events are cleared when a rising edge occurs.
Eventxx.Independent ConditionTriggerEn		For events, determines whether each condition that is indicated in the trigger definition can initiate an event independently.	• 0 = When all selected conditions achieve the configured values, an event is triggered. • 1 = When any selected condition achieves the configured value, an event is triggered.
Eventxx.EventNumber Ack	DINT	The controller writes back the EI:Event[<n>].EventNumber into this EO:Event[<n>].EventNumberAck to indicate receipt of the event. All events with I:EventNumbers that occurred before EventNumberAck are acknowledged.	All values
Eventxx.Counterxx Select	BOOL	When set, indicates that the corresponding counter is to participate in the event trigger definition.	• 0 = Corresponding counter does not participate in the event trigger definition • 1= Corresponding counter participates in the event trigger definition
Eventxx.PtxxDataSelect		When set, indicates that the corresponding data value is to participate in the event trigger definition.	• 0 • 1
Eventxx.CounterxxValue		If the counter function is selected in the event trigger definition, this member indicates that value that is to trigger the event.	• 0 • 1
Eventxx.PtxxDataValue		Indicates the input value of the event point data.	• 0 = Input inactive • 1 = Input active

Input Tags - Standard Input Modules

Name	Data Type	Description	Valid Values			
			5069-IA16	5069-IB16, 5069-IB32	5069-IB16F	5069-IB6F-3W
RunMode	BOOL	Channel's operating state	• 0 = Idle • 1 = Run			
ConnectionFaulted		Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.	• 0 = Connection running • 1 = Connection not running			
DiagnosticActive		Indicates if any diagnostics are active or if the prognostic threshold is reached.	• 0 = No diagnostics active • 1 = One or more diagnostics are active or the prognostic threshold is reached			
CIPSyncValid		Indicates whether the module is synced with a 1588 master.	–		• 0 = CIP Sync is not available • 1 = CIP Sync is available	
CIPSyncTimeout		Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.	–		• 0 = A valid time master has not timed out. • 1 = A valid time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.	
Uncertain		Indicates if the module is operating outside its designed operating range of if data is under manual or override control.	–	• 0 = Good • 1 = Uncertain	–	• 0 = Good • 1 = Uncertain
DiagnosticSequence Count	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.	• -128...+127 The value of 0 is skipped except during module power-up.			
Counterxx.Data	BOOL	Indicates the current input value.	–	• 0 = Off • 1 = On		

Input Tags - Standard Input Modules (Continued)

Name	Data Type	Description	Valid Values			
			5069-IA16	5069-IB16, 5069-IB32	5069-IB16F	5069-IB6F-3W
Counterxx.Fault	BOOL	Indicates that counter data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42.	–	• 0 = Good data • 1 = Bad data (Faulted) If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.		
Counterxx.Uncertain		Indicates that the counter data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.		• 0 = Good data • 1 = Uncertain data If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.		
Counterxx.Done		When set, indicates the corresponding counter Done bit (rising or falling depending on configuration) triggered the event.		• 0 = Corresponding Done bit did not trigger the event • 1 = Corresponding Done bit triggered the event		
Counterxx.Rollover		The counter counts up to RolloverValue - 1 (for HSC) or Preset -1 (for simple counters) and then continues counting from the 0:Rollunder (for HSC) or 0:Reset (for simple counters). This bit clears when the 0:RolloverAck bit or 0 bit transitions from 0 to 1.		• 0 = Counter has not counted up to RolloverValue - 1 or Preset - 1 and continued counting from 0 • 1 = Counter counted up to RolloverValue - 1 or Preset - 1 and continued counting from 0		
Counterxx.Count	DINT	Counts the number of input transitions.		All values		
EventStatus[x].CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master.	–		• 0 = CIP Sync is not available • 1 = CIP Sync is available	
EventStatus[x].CIPSyncTimeout		Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.			• 0 = A valid time master has not timed out. • 1 = A valid time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.	
EventStatus[x].Event Dropped		Indicates when an event has been discarded because events are occurring faster than they are being acknowledged.			• 0 = An event status has not been dropped. • 1 = An event status has been dropped.	
EventStatus[x].Event Number	DINT	Continuous count of events, which increments by one each new time event. The originator sets the Event Number ACK to the Event Number to acknowledge receipt of the event. When the EventNumber reaches it maximum value and rolls over it is to roll over to 1, not 0.			All values	
EventStatus[x].Event Reset	BOOL	When EO.Event[<n>].ResetEvent transitions from 0 to 1, I.EventStatus[<n>].EventReset transitions to 1 to indicate that the reset was received and completed. It stays 1 until EO.Event[<n>].ResetEvent transition to zero.			• 0 = Do not reset • 1 = Reset	
EventStatus[x].Events Pending	SINT	The number of events currently queued in the modules. A value greater than zero indicates that the controller is not currently keeping up with the rate of events.			All positive values	
Ptxx.Data	BOOL	Indicates the current input value.	• 0 = Off • 1 = On			
Ptxx.Fault		Indicates that channel data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Bad data (Faulted) If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.			
Ptxx.Uncertain		Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Uncertain data If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.			
Ptxx.Chatter		Indicates if the input is chattering per the ChatterTime and ChatterCount settings.	–		• 0 = Normal operation • 1 = Input is chattering	
Ptxx.Timestamp OverflowOffOn		Indicates that an Off to On time stamp was lost in a discrete product. If TimestampLatchEn is set, a new time stamp was not recorded because one is already latched. If TimestampLatchEn is clear, a time stamp was overwritten.			• 0 • 1	
Ptxx.Timestamp OverflowOnOff		Indicates that an On to Off time stamp was lost in a discrete product. If TimestampLatchEn is set, a new time stamp was not recorded because one is already latched. If TimestampLatchEn is clear, a time stamp was overwritten.			• 0 • 1	
Ptxx.CIPSyncValid		Indicates whether the module is synced with a 1588 master.			• 0 = CIP Sync is not available • 1 = CIP Sync is available	

Input Tags - Standard Input Modules (Continued)

Name	Data Type	Description	Valid Values			
			5069-IA16	5069-IB16, 5069-IB32	5069-IB16F	5069-IB6F-3W
Ptxx.CIPSyncTimeout	BOOL	Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.	–		• 0 = A valid time master has not timed out. • 1 = A valid time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.	
Ptxx.TimestampOffOn Number	INT	A time stamp number for the Off to On transition for the most-recently produced time stamp. **IMPORTANT**: If time stamp Latching is enabled, when this tag value matches the Ptxx.TimestampOffOnNumberAck output tag value, the Pt.xxTimestampOffOn input tag remains the same until the next input Off to On transition. Otherwise, the input tag value is cleared.			All values	
Ptxx.TimestampOnOff Number		A time stamp number for the On to Off transition for the most-recently produced time stamp. **IMPORTANT**: If time stamp Latching is enabled, when this tag value matches the Ptxx.TimestampOnOffNumberAck output tag value, the Pt.xxTimestampOnOff input tag remains the same until the next input On to Off transition. Otherwise, the input tag value is cleared.			All values	
Ptxx.TimestampOffOn	LINT	A 64-bit time stamp that is recorded when an Off to On change of state occurs. **IMPORTANT**: This number clears when the value of the Pt.xx.TimestampOffOnNumber input tag matches the value of the Ptxx.TimestampOffOnNumberAck output tag.			All values	
Ptxx.TimestampOnOff		A 64-bit time stamp that is recorded when an On to Off change of state occurs. **IMPORTANT**: This number clears when the value of the Pt.xx.TimestampOnOffNumber matches the value of the Ptxx.TimestampOnOffNumberAck output tag.			All values	

Output Tags - Standard Input Modules

Name	Data Type	Description	Valid Values			
			5069-IA16	5069-IB16, 5069-IB32	5069-IB16F	5069-IB6F-3W
Counterxx.Reset	BOOL	When this bit transitions from 0 to 1 I:Count and I:Rollover are set to zero.	–	• 0 = I:Count and I:Rollover values are not set to 0 • 1 = I:Count and I:Rolloever values are set to 0		
Counterxx.RolloverAck		Clears the Rollover bit in the input tag when it transitions from 0 to 1.		• 0 = I:Rollover bit is not cleared • 1 = I:Rollover bit is cleared		
Counterxx.Preset	DINT	• If RolloverAtPreset is set, the counter counts to the Preset value and then rolls over to zero. • If RolloverAtPreset is not set, the counter sets the Done bit and continues counting up to Max DINT. • If C:RolloverAtPreset = 1, then if I:Count ≥ 0:Preset, I:Count=0, else I:Done bit is always = 0. Set the I:Rollover bit when I:Count transitions from 0:Preset – 1 to 0. • If C:RolloverAtPreset = 0, then if I:Count ≥ 0:Preset, I:Done = 1, else I:Done = 0. Set I:Rollover bit when I:Count transitions from 2,147,483,647 to 0.		0...2,147,483,647		
Ptxx.ResetTimestamps	BOOL	Erases all recorded time stamps for the input channel when it transitions from 0 to 1.	–		• 0 = time stamps are not erased. • 1 = time stamps are erased.	
Ptxx.TimestampOffOn NumberAck	INT	The controller writes an Off to On time stamp identifier to indicate that the time stamp has been seen and acted on. When Latching is enabled and the time stamp Number from the controller is updated, the module produces a new time stamp. When Latching is disabled and the time stamp Number from the controller is updated, the PtxxTimestampOffOn and the Ptxx.TimestampOverflowOffOn tags are cleared.			All values	
Ptxx.TimestampOnOff NumberAck		The controller writes an On to Off time stamp identifier to indicate that the time stamp has been seen and acted on. When Latching is enabled and the time stamp Number from the controller is updated, the module produces a new time stamp. When Latching is disabled and the time stamp Number from the controller is updated, the PtxxTimestampOnOff and the Ptxx.TimestampOverflowOnOff tags are cleared.			All values	

Standard Output Module Tags

This section describes the tags that are associated with the standard output modules.

Configuration Tags - Standard Output Modules

Name	Data Type	Description	Valid Values		
			5069-OA16	5069-OB8, 5069-OB16, 5069-OB16F, 5069-OB32	5069-OW4I, 5069-OW16, 5069-OX4I
Ptxx.FaultMode	BOOL	Selects the output channel behavior if a communication fault occurs.	• 0 = Hold last state • 1 = Go to a user-defined value		
Ptxx.FaultValue		Defines the discrete output value if a communication fault occurs when FaultMode = 1.	• 0 = Off • 1 = On		
Ptxx.ProgMode		Selects the output channel behavior when in Program mode.	• 0 = Hold last state • 1 = Go to a user-defined value		
Ptxx.ProgValue		Defines the output value if the connection transitions to Program mode when the ProgMode = 1.	• 0 = Output state is Off during Program mode • 1 = Output state is On during Program mode		
Ptxx.FaultFinalState		If FaultValueStateDuration is nonzero, this tag determines the final Output state after the configured FaultValueStateDuration time out occurs.	• 0 = Output state is Off after the FaultValueStateDuration time expires • 1 = Output state is On after the FaultValueStateDuration time expires		
Ptxx.ProgramToFaultEn		Determines if an output transitions to the Fault Mode when the connection faults while in Program Mode.	• 0 = Stay in Program Mode • 1 = Go to Fault mode		
Ptxx.NoLoadEn		Enables no load detection for output channels.	–	• 0 = Disable • 1 = Enable	–
Ptxx.FaultValueState Duration	SINT	This value determines the length of time the Fault Mode state is held before the FaultFinalState being applied.	• 0 = Hold forever (default) • 1, 2, 5, or 10 seconds		

Input Tags - Standard Output Modules

Name	Data Type	Description	Valid Values				
			5069-OA16	5069-OB8	5069-OB16, 5069-OB32	5069-OB16F	5069-OW4I, 5069-OW16, 5069-OX4I
RunMode	BOOL	Channel's operating state	• 0 = Idle • 1 = Run Mode				
ConnectionFaulted		Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.	• 0 = Connection running • 1 = Connection not running				
DiagnosticActive		Indicates if any diagnostics are active or if the prognostic threshold is reached.	• 0 = No diagnostics active • 1 = One or more diagnostics are active or the prognostic threshold is reached				
Uncertain		Indicates if the module is operating outside its designed operating range of if data is under manual or override control.	–		• 0 = Good • 1 = Uncertain		–
DiagnosticSequence Count	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.	-128...+127 The value of 0 is skipped except during module power-up.				
CIPSyncValid	BOOL	Indicates whether the module is synced with a 1588 master.	–			• 0 = CIP Sync is not available • 1 = CIP Sync is available	–
CIPSyncTimeout		Indicates that the module was once synced with a 1588 master, but is not now due to a timeout.				• 0 = A valid time master has not timed out. • 1 = A valid time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.	
Ptxx.Data		Indicates the current input value.	• 0 = Off • 1 = On				
Ptxx.Fault		Indicates that channel data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Bad data (Faulted) If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.				
Ptxx.Uncertain		Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Uncertain data If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.				

Input Tags - Standard Output Modules (Continued)

Name	Data Type	Description	Valid Values				
			5069-OA16	5069-OB8	5069-OB16, 5069-OB32	5069-OB16F	5069-OW4I, 5069-OW16, 5069-OX4I
Ptxx.NoLoad	BOOL	Indicates that the signal wire has been disconnected from one of its terminals or the RTB has been removed. Used with Output channels.	–	• 0 = No fault • 1 = Fault			–
Ptxx.ShortCircuit		Indicates an output short circuit or overcurrent.		• 0 = No short circuit • 1 = Short circuit or overcurrent			
Schedulex	SINT	Indicates which schedule to load from 32 available schedules.	–			• 1…32 = Valid schedule • 0, 129…255 = No schedule	
Schedulex.State		Current state of the Tagschedule at index x.	–			• 0 = Inactive • 1 = Active – schedule is next to be applied to any of the outputs. • 2 = Current – schedule that is currently applied to any of the outputs. • 3 = Expired – schedule has been applied. • 4 = Discarded – schedule was received but the mask was off, or the requested schedule was late (received after its scheduled application time) and a more recent schedule has been applied to that output point. • 5 = Late – received schedule its scheduled application time.	
Schedulex.Schedule Number		Echo of ScheduleNumber from the output image.				0…3	
LateScheduleCount	INT	Count of schedules that arrive after their scheduled application time. The counter rolls over every 65535 late updates. The output is still driven to the new state if this is the most recent schedule for that point. This count can indicate that network delays or losses are causing schedule issues.				All values	
LostScheduleCount		Count that increases when the schedule sequence number in the output tag skips a value, which can indicate a lost schedule. The counter rolls over every 65535 lost updates.				All values	

Output Tags - Standard Output Modules

Name	Data Type	Description	Valid Values		
			5069-OA16, 5069-OB8, 5069-OB16, 5069-OB32	5069-OB16F	5069-OW4I, 5069-OW16, 5069-OX4I
TimeBase	LINT	Indicates the TimeBase for all schedule times in a scheduled output consumed assembly or channel. The TimeBase + The Schedule[n].TimeOffset determines the time for the schedule. Base/Offset scheme that is used to fit enough schedules into the assembly.	–	Any positive value	–
Ptxx.Data	BOOL	Indicates the current output value.	• 0 = Off • 1 = On		
Ptxx.ScheduleEn		Specifies the use of normal output data or scheduled data.	–	• 0 = Normal output data • 1 = Scheduled data	–
Schedulex	SINT	Indicates which schedule to load from 32 available schedules.		• 1…32 = Valid schedule • 0, 129…255 = No schedule	
Schedulex.ID		There are 32 schedules available (for Neo R1 products). Indicates which schedule to load.		• 1…32 = Valid schedule • 0 or 129…255 = No schedule	
Schedulex.Sequence Number		Indicates that the schedule information is valid and to process this schedule.		All values	
Schedulex.OutputPoint Select		Selects the output point that this schedule applies to. 0xFF means no output point selected.	–	0…15	–
Schedulex.Data	BOOL	Output data that is applied at a time that is specified in the schedule.		• 0 • 1	
Schedulex.TimeOffset	DINT	Offset from schedule base time. Used for scheduled output consumed tags. Base/Offset scheme that is used to fit enough schedules in the assembly.		All values	

Safety I/O Module Tags

This section describes the tags that are associated with the safety I/O modules.

Input Tags - Safety I/O Modules

Name	Data Type	Description	Valid Values	
			5069-IB8S, 5069-IB8SK	5069-OBV8S, 5069-OBV8SK
RunMode	BOOL	Module's operating state	• 0 = Idle • 1 = Run	
ConnectionFaulted	BOOL	Indicates if a connection is running. The module sets this tag to 0 when connected. If the module is not connected, it changes the tag to 1.	• 0 = Connection running • 1 = Connection not running	
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostic threshold is reached.	• 0 = No diagnostics active • 1 = One or more diagnostics are active or the prognostic threshold is reached	
DiagnosticSequence Count	SINT	Increments for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.	-128...+127 The value of 0 is skipped except during module power-up.	
Ptxx.Data	BOOL	Indicates the current safety input value.	• 0 = Off • 1 = On	–
Ptxx.Readback	BOOL	Indicates that a 24V DC power source is connected to the output circuit	–	• 0 = Power is not present • 1 = Power is present
Ptxx.Fault	BOOL	One of these conditions exists. • The channel data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42. • The channel is set to Not Used.	• 0 = Good data • 1 = Bad data (faulted) or set to Not Used If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, you must complete the steps that are described in Safety Input Fault Recovery on page 74 to reset this tag to 0. If the tag is 1 because the channel is set to Not Used, no action is required.	
Ptxx.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data • 1 = Uncertain data This tag is set to 1 when the module has reached a critical operating temperature or is higher than the acceptable operating temperature. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	
Ptxx.NoLoad	BOOL	Indicates that the signal wire has been disconnected from one of its terminals or the RTB has been removed. Used with Output points.	–	• 0 = No Fault • 1 = Fault
Ptxx.ShortCircuit	BOOL	Indicates a short circuit.	• 0 = No short circuit • 1 = Short circuit	
Ptxx.Status	BOOL	Indicates the status of the channel.	• 0 = Bad, causes a fault • 1 = Good	
Testxx.Readback	BOOL	Indicates that a 24V DC power source is present at the test output.	• 0 = 24V DC power is not present • 1 = 24V DC power is present	
Testxx.Fault	BOOL	One of these conditions exists. • The channel data is inaccurate and cannot be trusted for use in the application. For more information, see Module Data Quality Reporting on page 42. • The channel is set to Not Used.	• 0 = Good data • 1 = Bad data (faulted) or set to Not Used If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, you must complete the steps that are described in Safety Input Fault Recovery on page 74 to reset this tag to 0. If the Point Mode for the test output is Pulse Test or Power Supply when the Short Circuit condition is detected, the condition can be corrected but you cannot set the test output to a safe state. If the tag is 1 because the channel is set to Not Used, no action is required.	–
Testxx.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the degree of inaccuracy is not known. For more information, see Module Data Quality Reporting on page 42.	• 0 = Good data 1 = Uncertain data This tag is set to 1 when the module has reached a critical operating temperature or is higher than the acceptable operating temperature. **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	
Testxx.ShortCircuit	BOOL	Indicates an output short circuit	• 0 = No short circuit • 1 = Short circuit	
Ptxx.FieldPowerOff	BOOL	Indicates that a field power loss condition exists on the channel.	–	• 0 = No field power off condition • 1 = Field power off condition
Testxx.FieldPower Off	BOOL	Indicates that a field power loss condition exists on the channel.	• 0 = No field power off condition • 1 = Field power off condition	–
Testxx.Status	BOOL	Indicates the channel status.	• 0 = Fault • 1 = Good	

Output Tags - Safety I/O Modules

Name	Data Type	Description	Valid Values	
			5069-IB8S, 5069-IB8SK	5069-OBV8S, 5069-OBV8SK
Mutingxx.Data	BOOL	Indicates the current muting value	• 0 = Off • 1 = On	–
Ptxx.Data	BOOL	Indicates the current output value.	–	• 0 = Off • 1 = On

Notes:

Application and Wiring Examples for Safety I/O Modules

This appendix provides example wiring diagrams for the Compact 5000® safety I/O modules that can be used in functional safety applications.

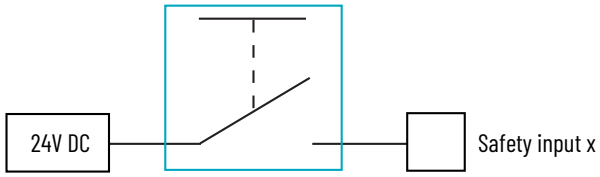
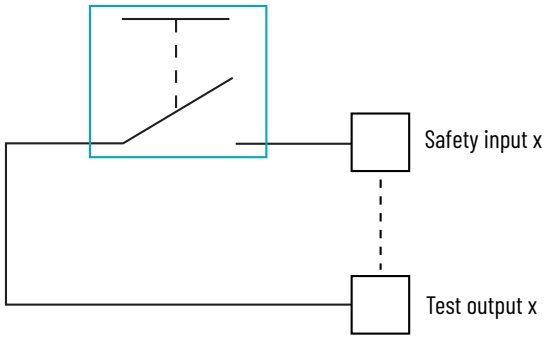
The wiring configuration affects the safety application level to which a safety I/O module is suitable.

Input Device Connection Details

These tables show the connection methods for different input devices, and their respective safety categories.

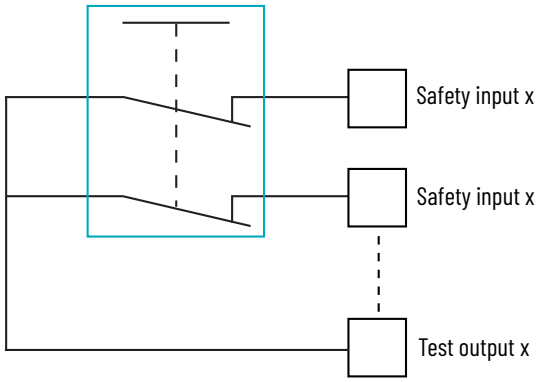
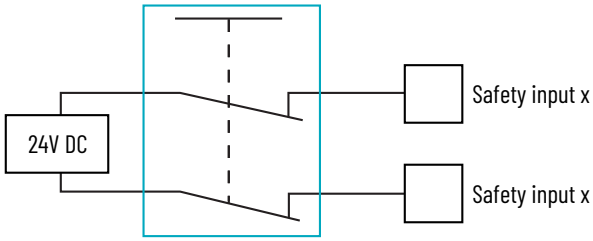
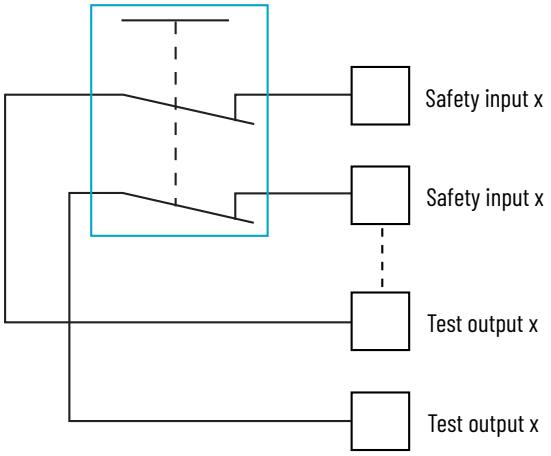
IMPORTANT You must use an SELV/PELV-listed power supply with the safety I/O modules.

Connection Methods - Push Button

Test Pulse from Test Output	Connection	Schematic Diagram[1]	Safety Category
No	Connect the device between a 24V DC power supply and the safety input.		1
Yes	Connect the device between the safety input and the test output. You must configure the test output as Safety Test Pulse.		2

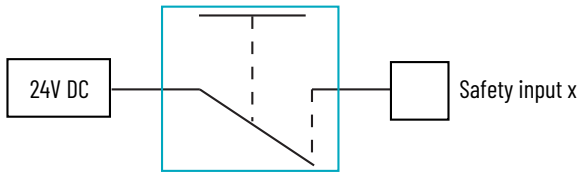
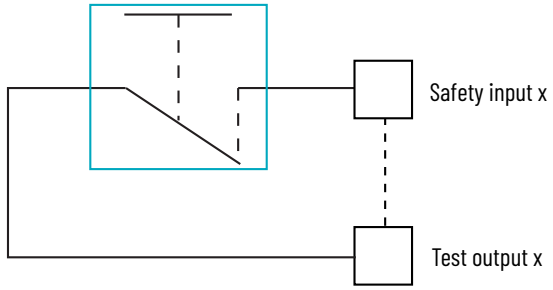
(1) x = the channel number

Connection Methods - Emergency Stop Button or Door Monitoring Switch

Test Pulse from Test Output	Connection	Schematic Diagram[1]	Safety Category
No	Connect devices between the safety inputs and a test output. The test output must be connected to a 24V DC power supply.		3
	Connect devices between a 24V DC SELV/PELV-listed power supply and the safety inputs.		
Yes	Connect devices between the safety inputs and the test outputs.		4

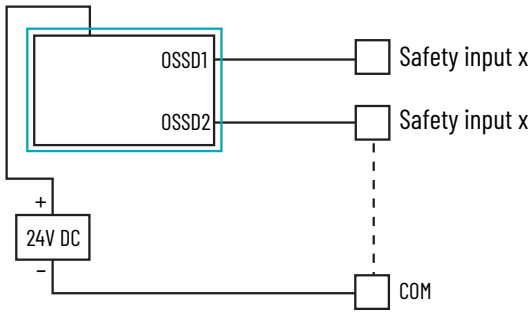
(1) x = the channel number

Connection Methods - Single-channel SIL 3 Device

Test Pulse from Test Output	Connection	Schematic Diagram(1)	Safety Category
No	Connect the device between a 24V DC power supply and the safety input.		3
Yes	Connect device between the safety inputs and a test output. The test output must be connected to a 24V DC power supply.		

(1) x = the channel number

Connection Methods - Light Curtain

Test Pulse from Test Output	Connection	Schematic Diagram(1)	Up to and Including Safety Category
Yes	Connect the light curtain to consecutive safety inputs, respectively. For example, Safety inputs 0 and 1. Connect the 24V DC SELV/PELV-listed power supply.		3 or 4 Dependent on the Light Curtain

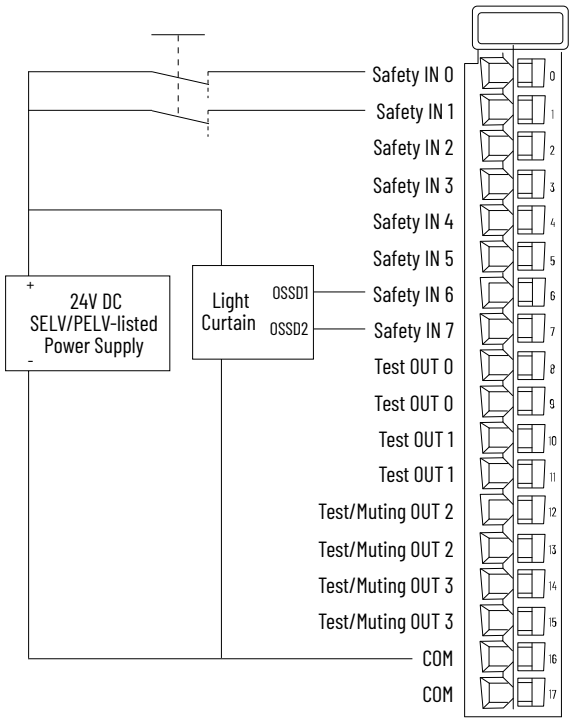
(1) x = the channel number

Wiring Diagrams - 5069-IB8S, 5069-IB8SK

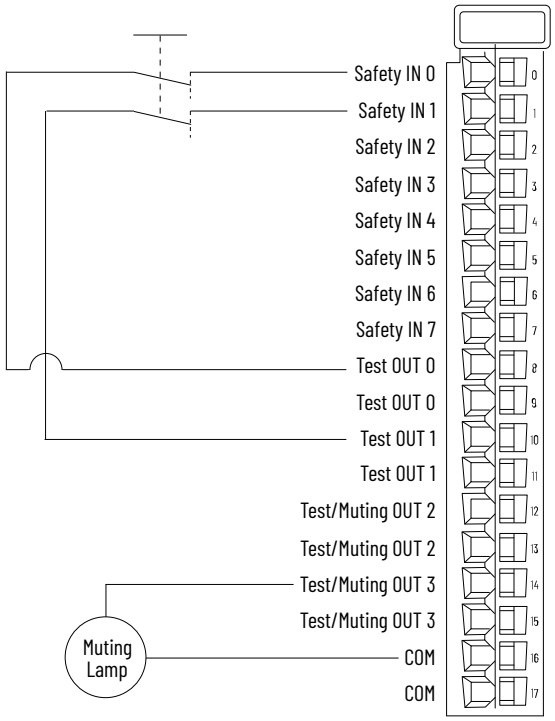
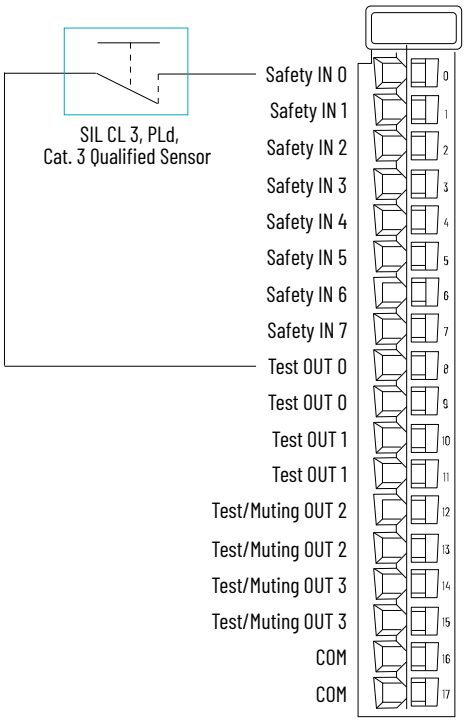
The information in this table applies to all 5069-IB8S and 5069-IB8SK wiring diagrams.

Channel Connections	The diagrams show devices that are connected to specific safety input and test output channels. You are not restricted to these channels. You can connect the devices to any safety input channel or combination of channels as needed.
SA Power Device List	Connect to an external SA power supply via the SA power RTB on one of these devices. • Compact GuardLogix® 5380 Controller • 5069-AENTR EtherNet/IP™ Adapter • 5069-FPD Field Potential Distributor
Isolate SA Power	The 5069-IB8S and 5069-IB8SK modules use DC SA power. You must connect DC power to the device that supplies SA power to the module. See the SA Power Device List on page 137. • If you install modules in a system that uses both AC SA power and DC SA power, you must isolate SA power buses by type with a 5069-FPD module. To create separate SA power buses, complete these steps. a. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller. This is the first SA power bus. b. To create a second SA power bus, install the 5069-FPD field potential distributor to the right of these modules. c. Install the modules that use the other type of SA power, for example AC, to the right of the 5069-FPD module. • The SA power to adjacent SA power electrical isolation that the 5069-FPD field potential distributor provides has a rating of 240V AC (continuous) reinforced insulation type.

Wiring Diagrams - 5069-IB8S, 5069-IB8SK

Example Wiring Diagram	Description
	**Single Channel with Switches and Light Curtain** When the module is wired as shown, it is suitable for applications that are rated up to, and including, Category 3 as defined in ISO 13849-1. **IMPORTANT** • The switches are suitable for applications that are rated up to, and including, SIL CL 3, PLe, Cat. 3. • The light curtain is suitable for applications that are rated up to, and including, SIL CL 3, PLe, Cat. 4. • The SA power to adjacent SA power electrical isolation that the 5069-FPD field potential distributor provides has a rating of 240V AC (continuous) reinforced insulation type.

Wiring Diagrams - 5069-IB8S, 5069-IB8SK (Continued)

Example Wiring Diagram	Description
	**Single Channel with Switches and Muting Lamp** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety input channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. Safety input pairs must be associated with different Test Output sources. **IMPORTANT** When the power supply and muting lamp are configured for a test output, you must connect the return wire on the device to a COM point on the module.
	**Single Channel with Sensor** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 3 as defined in ISO 13849-1. To achieve that suitability rating, you must meet these requirements. • Fault Exclusion = External Wiring fault. • Use a SIL CL 3, PLd, Cat. 3 qualified sensor. • One of these configuration combinations. – Input Point Mode = Safety Pulse Test – Test Output Mode = Pulse Test – Input Point Mode = Safety Test Output Mode = Power Supply We recommend that you connect even-numbered input points to even-numbered test output points and odd-numbered input points to odd-numbered test output points. This wiring practice can maximize diagnostic independence and separation. **IMPORTANT** When the power supply and muting lamp are configured for a test output, you must connect the return wire on the device to a COM point on the module.

Wiring Diagrams - 5069-OBV8S, 5069-OBV8SK

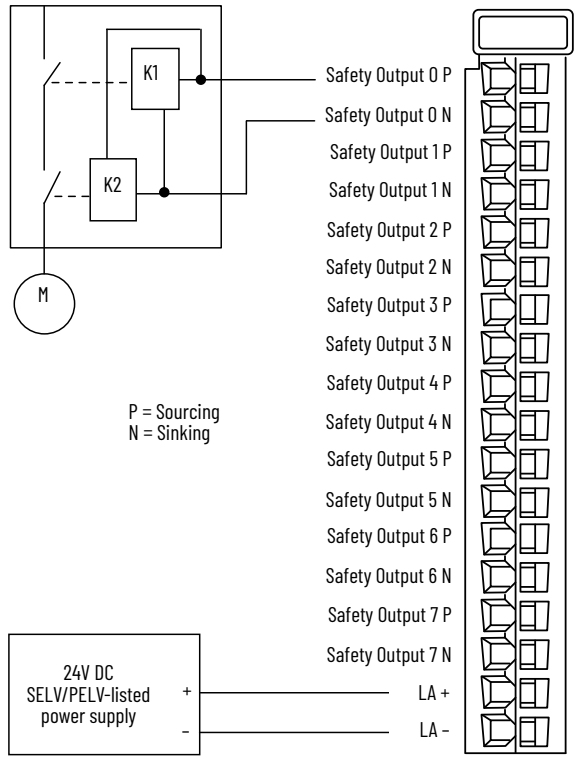
You can use the safety output modules in Bipolar mode or Sourcing mode.

Bipolar Mode

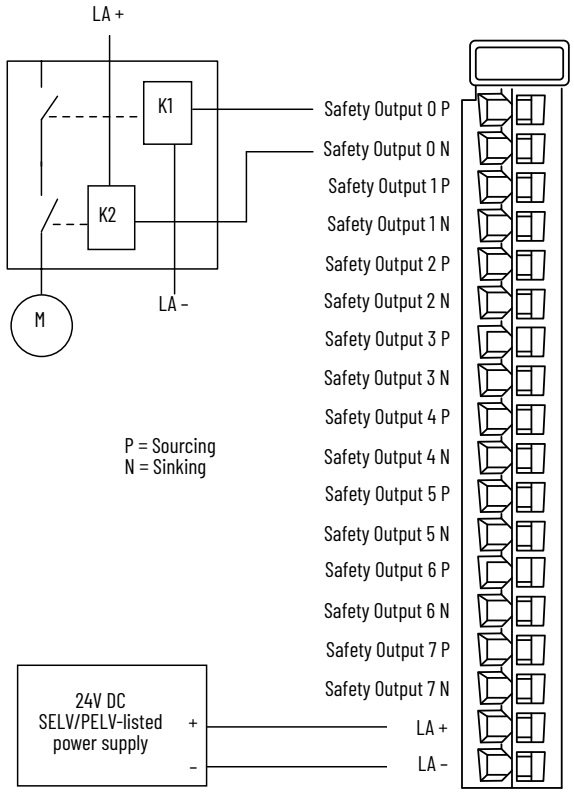
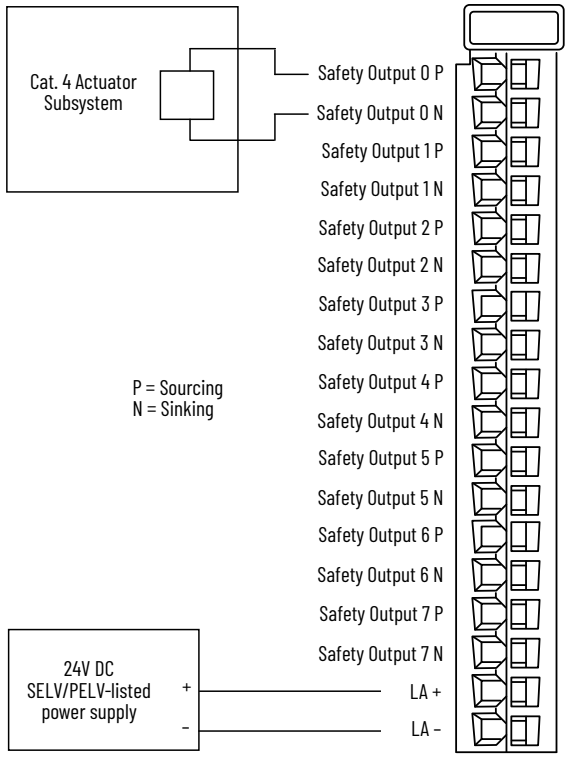
The information in this table applies to all 5069-OBV8S and 5069-OBV8SK Bipolar mode wiring diagrams.

Connection Pairs	The terminals for each channel function as a Bipolar connection pair when you use a 5069-OBV8S or 5069-OB8VSK module in Bipolar switching mode. For example, the Safety Output 0 P (Sourcing) terminal and the Safety Output 0 N (Sinking) terminal are a Bipolar or PN connection pair. When the module is in Bipolar switching mode, you must connect the device to both terminals.
Channel Connections	These wiring examples show connections to the PN pair for Safety Output 0. You are not limited to these channels. You can use all channel pairs as determined by your application.
LA Power	The Local Actuator (LA+ and LA –) power connections are used to supply field-side power to the module.
SA Power	The 5069-OBV8S and 5069-OBV8SK modules do not draw current from the SA power bus. The modules are DC-type modules, so you must install them on a DC SA power bus.
	• If you install modules in a system that uses both AC SA power and DC SA power, you must isolate SA power buses by type with a 5069-FPD module. To create separate SA power buses, complete these steps. a. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller. This is the first SA power bus. b. To create a second SA power bus, install the 5069-FPD field potential distributor to the right of these modules. c. Install the modules that use the other type of SA power, for example AC, to the right of the 5069-FPD module. • If you have a direct connection between the safety output module and an input module and those modules are powered by separate power supplies, we strongly recommend that you connect SA- and LA- together. This practice helps to reduce the risk of grounding float from disruptive diagnostics. • The SA power to adjacent SA power electrical isolation that the 5069-FPD field potential distributor provides has a rating of 240V AC (continuous) reinforced insulation type.

Bipolar Mode Wiring Diagrams - 5069-OBV8S, 5069-OBV8SK

Example Wiring Diagram	Description
	**Single Channel with Actuator** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. Configure the application so that a No Load fault can only be detected if the wires from both the P- terminal and the N- terminal are disconnected. For Category 4 applications, if the output is off and your application remains in a safe for a prolonged duration, we recommend that you take one of these actions. • Apply output monitoring at the actuator. The monitoring can be direct or indirect. • Limit the safe state to no more than 24 hours. • Conduct a functional test if the safe state dwell time increases.

Bipolar Mode Wiring Diagrams - 5069-OBV8S, 5069-OBV8SK (Continued)

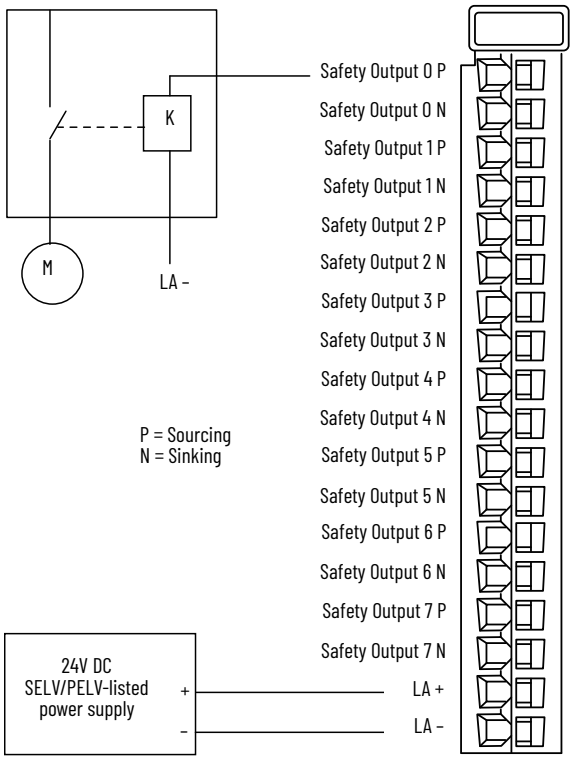
Example Wiring Diagram	Description
	**Single Channel with LA Powered Actuator** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. • We strongly recommend that you connect separate shielded cables to the P terminal and the N terminal to reduce the possibility of a wire short between the terminals. If a wire-short fault is detected across the PN pair, the module outputs turn off, but the actuator that is connected to the pair remains on. • Configure the application so that No Load and Overload conditions are only detectable at the P terminal. For Category 4 applications, if the output is off and your application remains in a safe for a prolonged duration, we recommend that you take one of these actions. • Apply output monitoring at the actuator. The monitoring can be direct or indirect. • Limit the safe state to no more than 24 hours. • Conduct a functional test if the safe state dwell time increases. **Actuator LA Power** - In this wiring configuration, you must connect the LA+ terminal to an SELV/PELV-listed power supply. The LA+ and LA- terminals on the actuator must be connected to the same power supply as the LA+ and LA- terminals on the module.
	**Single Channel with Actuator Subsystem** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. For Category 4 applications, if the output is off and your application remains in a safe for a prolonged duration, we recommend that you take one of these actions. • Apply output monitoring at the actuator. The monitoring can be direct or indirect. • Limit the safe state to no more than 24 hours. • Conduct a functional test if the safe state dwell time increases. • A qualified actuator must be installed, for example, in accordance with IEC 60947.

Sourcing Mode

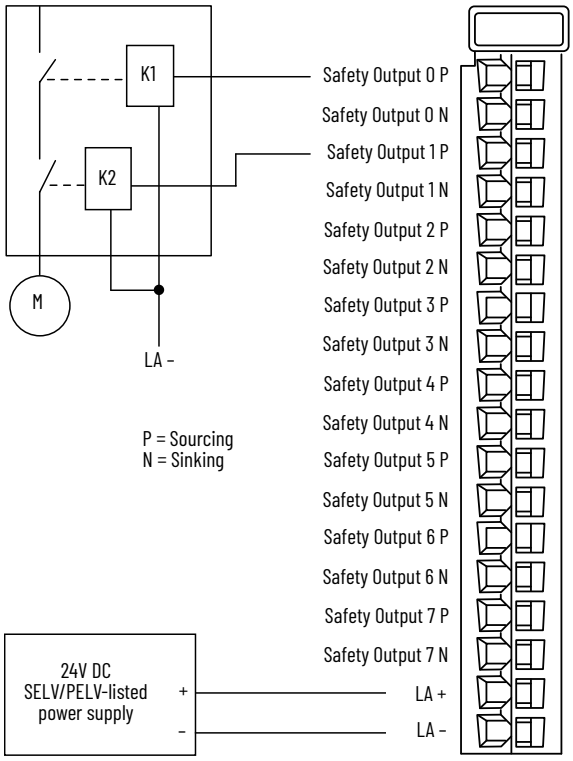
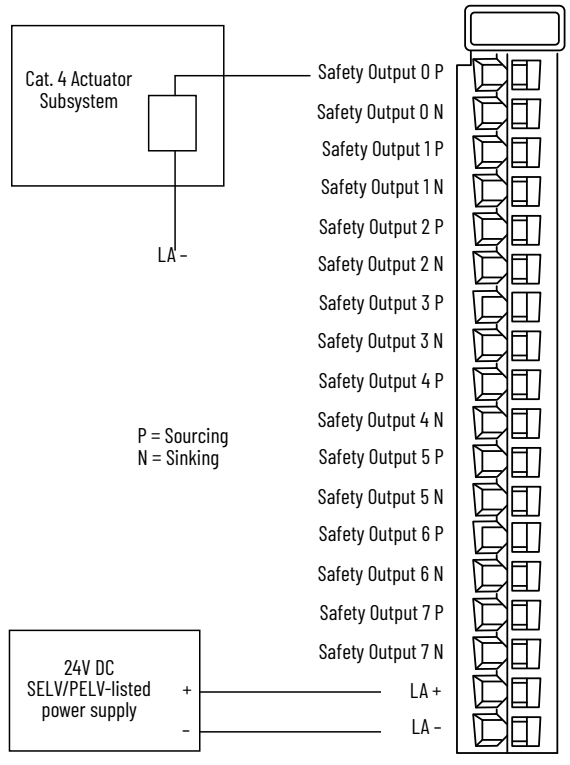
The information in this table applies to all 5069-OBV8S and 5069-OBV8SK Sourcing mode wiring diagrams.

Channel Connections	The wiring diagrams show connections to specific safety outputs or safety output pairs. You are not limited to these channels. You can use all channels as determined by your application.
LA Power	The Local Actuator (LA+ and LA –) power connections are used to supply field-side power to the module.
SA Power	The 5069-OBV8S and 5069-OBV8SK modules do not draw current from the SA power bus. The modules are DC-type modules, so you must install them on a DC SA power bus.
	• If you install modules in a system that uses both AC SA power and DC SA power, you must isolate SA power buses by type with a 5069-FPD module. To create separate SA power buses, complete these steps. a. Install the modules that use one type of SA power, for example DC, to the right of the adapter or controller. This is the first SA power bus. b. To create a second SA power bus, install the 5069-FPD field potential distributor to the right of these modules. c. Install the modules that use the other type of SA power, for example AC, to the right of the 5069-FPD module. • If you have a direct connection between the safety output module and an input module and those modules are powered by separate power supplies, we strongly recommend that you connect SA- and LA- together. This practice helps to reduce the risk of grounding float from disruptive diagnostics.

Sourcing Mode Wiring Diagrams - 5069-OBV8S, 5069-OBV8SK

Example Wiring Diagram	Description
	**Single Channel with Actuator** When the module is wired as shown, it is suitable for applications that are rated up to, and including, Category 2 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC.

Sourcing Mode Wiring Diagrams - 5069-OBV8S, 5069-OBV8SK (Continued)

Example Wiring Diagram	Description
	**Dual Channel with Actuator** When the module is wired as shown, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. For Category 4 applications, if the output is off and your application remains in a safe for a prolonged duration, we recommend that you take one of these actions. • Apply output monitoring at the actuator. The monitoring can be direct or indirect. • Limit the safe state to no more than 24 hours. • Conduct a functional test if the safe state dwell time increases. **Connection Pairs** - When you use dual-channel sourcing wiring on these modules, you must connect the devices to dual-channel connection pairs. These channels are dual-channel connection pairs: 0 and 1 (shown), 2 and 3, 4 and 5, 6 and 7.
	**Single Channel with Actuator Subsytem** When the module is wired as shown, and the listed requirements are met in the project of the safety controller, it is suitable for applications that are rated up to, and including, Category 4 as defined in ISO 13849-1. To achieve that suitability rating, diagnostic testing and monitoring of the safety function can be required. One diagnostic test method is to configure the safety output channel for Safety Pulse Test to test the circuit for short circuits to 24V DC. • All power source cables must be installed separately, for example, with a separate cable duct or shielded cable. Connect power source cables to the MOD+, SA+, or LA+ terminals. Otherwise, a Short Circuit condition between SA+ and P can be detected and the output is turned off but the connected actuator remains on. • You must connect two ground terminals. Otherwise, the maximum residual current at signal 0 cannot be maintained if only one ground line is connected and it is interrupted. For more information, see the Compact 5000 I/O Modules and EtherNet/IP Adapters Technical Data, publication 5069-TD001 • A qualified actuator must be installed, for example, in accordance with IEC 60947. For Cat.4 applications, if your application remains in a safe state, that is, the output is off, for a prolonged duration, we recommend that you take one of these actions. • Apply output monitoring at the actuator. The monitoring can be direct or indirect. • Limit the safe state to no more than 24 hours. • Conduct a functional test if the safe state dwell time increases.

Wiring Faults on Safety Modules

A number of conditions can cause wiring faults on safety I/O modules. We strongly recommend that you monitor your application to detect wiring faults as soon as they appear so you can troubleshoot and remedy the cause of the fault.

These examples can cause wiring faults.

- Field Power Loss condition
- No Load condition
- Wiring short to power
- Wiring short across outputs

Notes:

Safety Data for Safety I/O Modules

This appendix lists calculated values for probability of a dangerous failure on demand (PFD), average frequency of a dangerous failure per hour (PFH), and mean time to failure (MTTF). PFD and PFH calculations comply with IEC61508, edition 2, 2010.

PFD and PFH must be calculated for the devices within the system to comply with the SIL level that is required for application. For calculated values of PFD and PFH, see Compact 5000 Safety I/O Modules Safety Data on page 146.

You are responsible for these requirements of ISO 13849-1:20015, to assess Performance Levels in your safety system.

- You must functionally test every I/O module. To test the modules functionally, complete these tasks.
  - Input points - Toggle every input point, and verify that the system detects the input state change within the safety reaction time (SRT).
  - Output points - Use the controller to toggle every output point, and verify that the output point changes state.
- SRT must be a consideration of delays or latencies within the safety system.

For more information, see the GuardLogix® 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual (TÜV), publication 1756-RM012.

Compact 5000 Safety I/O Modules Safety Data

This table lists the safety data for the Compact 5000® safety I/O modules.

Attribute		Point Operation Type - 5069-IB8S, 5069-IB8SK		Output Mode[1] - 5069-OBV8S, 5069-OBV8SK		
		Single Channel	Dual Channel (at controller instruction level)	Sourcing		Bipolar
				Point Operation Type		Point Operation Type
				Single	Dual	Single
Safety Function Architecture		0	1	0	1	1
Safe Failure Rate (λ_S) [failures/hr]		1.16E-06	1.49E-06	1.17E-06	9.45E-07	9.63E-07
Dangerous Failure Rate (λ_D) [failures/hr]		7.38E-07	1.04E-06	9.13E-07	5.98E-07	6.25E-07
Dangerous Detected Failure Rate (λ_{DD}) [failures/hr]		7.37E-07	1.04E-06	9.12E-07	5.97E-07	6.24E-07
Dangerous Undetected Failure Rate (λ_{DU}) [failures/hr]		3.18E-10	2.54E-10	3.29E-10	3.15E-10	3.14E-10
Safety Reaction Time, SRT [millisecond]		6		4.5		
Automatic Diagnostic Test Interval (TD) [hr]		4		4		
Useful Life [yr]		20		20		
Systematic Capability (SC)		3		3		
Safe Failure Fraction (SFF) [%]		99.98%	99.99%	99.98%	99.98%	99.98%
PFH		3.18E-10	2.54E-10	3.29E-10	3.15E-10	3.14E-10
PFD_{AVE}	10 yrs	1.39E-05	1.11E-05	1.44E-05	1.38E-05	1.38E-05
Mission Time	20 yrs	2.78E-05	2.22E-05	2.89E-05	2.76E-05	2.75E-05
Diagnostic Coverage Average (DC_{AVE})		99.96%	99.98%	99.96%	99.95%	99.95%
Spurious Trip Rate (STR)		3.65E-06	4.52E-06	3.65E-06	2.34E-06	2.45E-06
MTTF [years]		60.05	45.25	54.91	74.01	71.89
$MTTF_D$ [years]		154.75	110.10	125.07	190.99	182.70

(1) The safety data that is provided in the table is with Safety Pulse Test mode.

Safety Reaction Time

Safety reaction time (SRT) of Compact 5000 safety I/O modules is defined as follows:

- SRT on Demand - The response time interval between a signal change on the input terminal and when a safety packet on the backplane is produced or provided.
- SRT on Fault - The response time between the occurrence of an internal fault in the channel/module and when the channel or module goes into a safe state.
- SRT on External Wiring Fault - If the channels are in Safety Pulse Test mode, the response time between an external wiring fault and when the channels go into a safe state.

This table lists SRT times for the Compact 5000 safety I/O modules.

Safety Reaction Time	5069-IB8S, 5069-IB8SK		5069-OBV8S, 5069-OBV8SK	
	Module is NOT used in continuous demand mode AND the safety demand rate is less than once per 1.5 s	Module is used in continuous demand mode OR the safety demand rate is more than or equal to once per 1.5 s	Module is NOT used in continuous demand mode AND the safety demand rate is less than once per 1 s	Module is used in continuous demand mode OR the safety demand rate is more than or equal to once per 1 s
On demand	6 ms		4 ms	
On fault	6 ms	14.3 ms	4.5 ms	8.3 ms
On external wiring fault	102 ms		200 ms	

The times in this table are subjected to an RPI of 2 ms, Input Delay of 0 ms and Number of Input connections of 1.

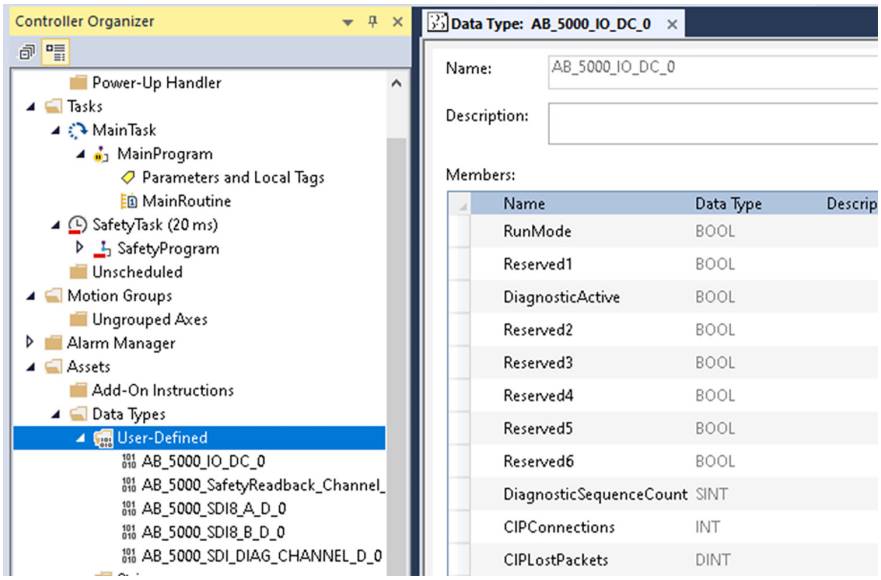
For different RPI values, extend the timing by the RPI value. For an additional number of Input connections, extend the timing by 0.14 ms for each addition.

Safety I/O Module Diagnostic Assembly

This appendix explains how to create and configure Diagnostic Assembly types for the Compact 5000® digital safety I/O modules.

Create User-defined Diagnostic Assembly Types

Use the Studio 5000 Logix Designer® application to create user-defined Diagnostic Assembly types for safety I/O modules.



IMPORTANT The members that are indicated in the tables are arranged according to the Data Alignment Rules of controllers. Strictly follow the Data Type and sequence of the members that are indicated in the Tables of this Appendix. If the Data Type and sequence are not followed, data misalignment can occur after a Get Attribute Single Message instruction.

Safety Input Module Diagnostics

From the Controller Organizer pane, expand Data Types and create user-defined data types for the module.

- The Reserved members act as padding to enable byte alignment and can be renamed.
- The Channel members need to be retrieved as part of the Diagnostic Assembly.

Diagnostic Counters Base I/O Assembly

DATATYPE: AB:5000_IO:DC:0
Instance ID: 0x301 (769)
Size = 16 bytes

Member	Data Type	Byte Size	Description and Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run
Reserved1			–
DiagnosticActive			0 = No diagnostics active 1 = One or more diagnostics are active or the prognostic threshold is reached
Reserved2...Reserved6			–
DiagnosticSequence Count	SINT	1	Increments from 0...255, for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 to 1 skipping zero.
CIPConnections	INT	2	Indicates the number of CIP™ connections currently open to and through the adapter, 0...32767.
CIPLostPackets	DINT	4	Indicates the continuous sum of the number of Sequenced Address Item Sequence Numbers that are skipped in Class 0 and Class 1 connections that the adapter and its connected modules consume, 0...2147483647.
CIPTimeouts			Indicates the continuous count of the number of connections that time out, both originated and targeted, to and through the adapter, 0...2147483647.
CPUUtilization	INT	2	Indicates the usage of the computer processor, 0%...100%.
Reserved7			–

Diagnostic Digital Safety 8 Point Assembly A - Input

DATATYPE: AB:5000_SDI8_A:D:0
Instance ID: 0x312 (786)
Size = 480 bytes

Member	Data Type	Byte Size	Description and Valid Values
RunMode	BOOL	1	0 = Idle 1 = Run
Reserved1			–
DiagnosticActive			0 = No diagnostics active 1 = One or more diagnostics are active or the prognostic threshold is reached
CIPSyncValid			0 = Module is not synced with a 1588 master 1 = Module is synced with a 1588 master
CIPSyncTimeout			0 = A valid 1588 time master has not timed out. 1 = A valid 1588 time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.
Reserved2			–
FieldPowerOff			0 = No field power off condition 1 = Field power off condition
Reserved3			–
DiagnosticSequence Count	SINT	1	Increments from 0...255 for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected.Set to zero by product reset or power cycle. Wraps from 255 to 1 skipping zero.
Reserved4			–
Reserved5			
Reserved6	SINT[4]	4	
LocalClockOffset	LINT	8	The offset from the local clock to the system time. This value helps to detect steps in time. This value updates when a PTP update is received.
LocalClockOffset Timestamp	LINT		Shows the time stamp of the local clock offset in YYYY-MM-DD-HH:mm:SS_mmm_uuu_nnn (UTC-00:00) format.
GrandMasterClockID	SINT[8]		The EUI-64 Identity of the CIP Sync™ Grandmaster clock to which the module is synced.
Point0_Diagnostic... Point7_Diagnostic	User defined	56	See Diagnostic Digital Diag Safety Channel - Input on page 149

Diagnostic Digital Safety 8 Point Assembly B - Input

DATATYPE: AB:5000_SDI8_B:D:0
Instance ID: 0x39F (927)
Size = 192 bytes

Member	Data Type	Byte Size	Description
Point0_SafetyReadback... Point3_SafetyReadback	User defined	48	See Diagnostic Safety Readback Channel - Output on page 150

Diagnostic Digital Diag Safety Channel - Input

DATATYPE: AB:5000_SDI_Diag_Channel:D:0
Size = 56 bytes

Member	Data Type	Byte Size	Description and Valid Values
Reserved1	BOOL	1	-
Fault			Indicates that counter data is inaccurate and cannot be trusted for use in the application. 0 = Good 1 = Bad, causes a fault **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
Uncertain			Indicates that the counter data can be inaccurate but the degree of inaccuracy is not known. 0 = Good data 1 = Uncertain data **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
Reserved2			-
ShortCircuit			0 = No Short Circuit condition exists 1 = Short Circuit or overcurrent fault condition exists
Reserved3			-
FieldPowerOff			0 = No field power off condition 1 = Field power off condition
Reserved4			-
Reserved5	SINT	1	
InternalFault	BOOL	1	0 = No internal fault found in the product 1 = One or more diagnostics indicate an internal fault in the product. If there is an internal fault, cycle power to the module. If the problem persists, contact Technical Support.
OverTemperature			0 = No fault, module is at a normal temperature 1 = Module is at a higher temperature than the rated operating limits.
CriticalTemperature			0 = No fault, module is at a normal temperature 1 = Module is above the critical temperature limit
Reserved6...Reserved10			-
Reserved11	SINT	1	
Reserved12	SINT[4]	4	
ShortCircuitTimestamp	LINT	8	Indicates the time stamp of the last output short circuit or overcurrent fault.
InternalFaultTimestamp			Indicates the time stamp of the last internal fault.
FieldPowerOnTimestamp			Indicates the time stamp of the last time field power turned on.
FieldPowerOffTimestamp			Indicates the time stamp of the last time field power turned off.
OverTemperatureTimestamp			Indicates the time stamp of the last over temperature fault.
CriticalTemperatureTimestamp			Indicates the time stamp of the last critical temperature fault.

Diagnostic Safety Readback Channel - Output

DATATYPE: AB:5000_SafetyReadback_Channel:D:0
Size = 48 bytes

Member	Data Type	Byte Size	Description
Reserved1	BOOL	1	–
Fault			Indicates that counter data is inaccurate and cannot be trusted for use in the application. 0 = Good 1 = Bad, causes a fault **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
Uncertain			Indicates that the counter data can be inaccurate but the degree of inaccuracy is not known. 0 = Good data 1 = Uncertain data **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
Reserved2			–
ShortCircuit			0 = No Short Circuit condition exists 1 = Short Circuit or overcurrent fault condition exists
Reserved3			–
FieldPowerOff			0 = No field power off condition 1 = Field power off condition
Reserved4			–
Reserved5	SINT	1	
InternalFault	BOOL	1	0 = No internal fault found in the product 1 = One or more diagnostics indicate an internal fault in the product. If there is an internal fault, cycle power to the module. If the problem persists, contact Technical Support.
Overload			• 0 = No Overload condition exists • 1 = Overload condition exists
Reserved6...Reserved11			–
Reserved12	SINT	1	
Reserved13	SINT[4]	4	
ShortCircuitTimestamp	LINT	8	Indicates the time stamp of the last output short circuit or overcurrent fault.
InternalFaultTimestamp			Indicates the time stamp of the last internal fault.
OverloadTimestamp			Indicates the time stamp of the last overload fault.
FieldPowerOnTimestamp			Indicates the time stamp of the last time field power turned on.
FieldPowerOffTimestamp			Indicates the time stamp of the last time field power turned off.

Safety Output Module Diagnostics

From the Controller Organizer pane, expand Data Types and create user-defined data types for the module.

- The Reserved members act as padding to enable byte alignment and can be renamed.
- The Channel members need to be retrieved as part of the Diagnostic Assembly.

Diagnostic Counters Base I/O Assembly

DATATYPE: AB:5000_IO:DC:0
Instance ID: 0x301 (769)
Size = 16 bytes

Member	Data Type	Byte Size	Description
RunMode	BOOL	1	0 = Idle 1 = Run
Reserved1			–
DiagnosticActive			0 = No diagnostics active 1 = One or more diagnostics are active or the prognostic threshold is reached
Reserved2...Reserved6			–
DiagnosticSequenceCount	SINT	1	Increments from 0...255 for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 to 1 skipping zero.
CIPConnections	INT	2	Indicates the number of CIP™ connections currently open to and through the adapter, 0...32767.
CIPLostPackets	DINT	4	Indicates the continuous sum of the number of Sequenced Address Item Sequence Numbers that are skipped in Class 0 and Class 1 connections that the adapter and its connected modules consume, 0...2147483647.
CIPTimeouts			Indicates the continuous count of the number of connections that time out, both originated and targeted, to and through the adapter, 0...2147483647.
CPUUtilization	INT	2	Indicates the usage of the computer processor, 0%...100%.
Reserved7			–

Diagnostic Digital Safety 8 Point Assembly A - Input

DATATYPE: AB:5000_SD08_A:D:0
Instance 0x313 (787)
Size = 384 bytes

Member	Data Type	Byte Size	Description
RunMode	BOOL	1	0 = Idle 1 = Run
Reserved1			-
DiagnosticActive			0 = No diagnostics active 1 = One or more diagnostics are active or the prognostic threshold is reached
CIPSyncValid			0 = Module is not synced with a 1588 master 1 = Module is synced with a 1588 master
CIPSyncTimeout			0 = A valid 1588 time master has not timed out. 1 = A valid 1588 time master was detected on the backplane, but the time master has timed out. The module is using its local clock and can be drifting away from the last known time master.
Reserved2			-
FieldPowerOff			0 = No field power off condition 1 = Field power off condition
Reserved3			-
DiagnosticSequenceCount	SINT	1	Increments from 0...255 for each time a distinct diagnostic condition is detected, and when a distinct diagnostic condition transitions from detected to not detected. Set to zero by product reset or power cycle. Wraps from 255 (-1) to 1 skipping zero.
Reserved4			-
Reserved5			
Reserved6	SINT[4]	4	
LocalClockOffset	LINT	8	The offset from the local clock to the system time. This value helps to detect steps in time. This value updates when a PTP update is received.
LocalClockOffsetTimestamp			Shows the time stamp of the local clock offset in YYYY-MM-DD-HH:mm:SS_mmm_uuu_nnn (UTC-00:00) format.
GrandMasterClockID	SINT[8]	8	The EUI-64 Identity of the CIP Sync™ Grandmaster clock the module is synced to.
Point0_Diagnostic... Point3_Diagnostic	User defined	88	See Diagnostic Digital Safety Diag 2 Input Channel - Output on page 152

Diagnostic Digital Safety 8 Output Point Assembly B - Input

DATATYPE: AB:5000_SD08_B:D:0
Instance ID: 0x31E (798)
Size = 352 bytes

Member	Data Type	Byte Size	Description
Point4_Diagnostic... Point7_Diagnostic	User defined	88	See Diagnostic Digital Safety Diag 2 Input Channel - Output on page 152

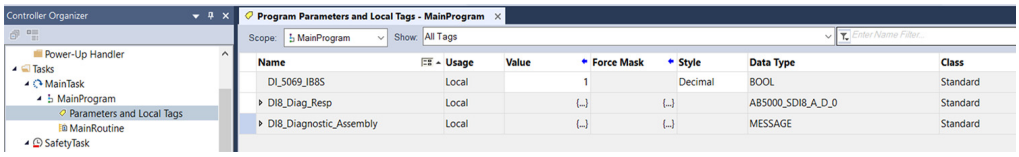
Diagnostic Digital Safety Diag 2 Input Channel - Output

DATATYPE: AB:5000_SD0_DIAG2_Channel:D:0
Size = 88 bytes

Member	Data Type	Byte Size	Description
Reserved1	BOOL	1	
Fault			Indicates that counter data is inaccurate and cannot be trusted for use in the application. 0 = Good 1 = Bad, causes a fault **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
Uncertain			Indicates that the counter data can be inaccurate but the degree of inaccuracy is not known. 0 = Good data 1 = Uncertain data **IMPORTANT**: Once the condition that causes the tag to change to 1 is removed, the bit automatically resets to 0.
NoLoad			0 = No Load condition does not exist 1 = No Load condition exists.
ShortCircuit			0 = No Short Circuit condition exists 1 = Short Circuit or overcurrent fault condition exists
Reserved2			-
FieldPowerOff			0 = No field power off condition 1 = Field power off condition
Reserved3			-
DualChannelFault			0 = No fault is present 1 = Fault is present
Reserved4...Reserved10			-
InternalFault			0 = No internal fault found in the product 1 = One or more diagnostics indicate an internal fault in the product. If there is an internal fault, cycle power to the module. If the problem persists, contact Technical Support.
Overload			0 = No Overload condition exists 1 = Overload condition exists
ShortCircuitGround			0 = No Short Circuit To Ground condition exists 1 = Short Circuit To Ground condition exists
OverTemperature			0 = No fault, module is at a normal temperature 1 = Module is at a higher temperature than the rated operating limits.
CriticalTemperature			0 = No fault, module is at a normal temperature 1 = Module is above the critical temperature limit
Reserved11...Reserved13			
Reserved14	SINT	1	-
Reserved15	SINT[4]	4	
NoLoadTimestamp	LINT	8	Shows the time stamp of the last no load fault in YYYY-MM-DD-HH:mm:SS.mmm (UTC-00:00) format.
ShortCircuitTimestamp			Indicates the time stamp of the last output short circuit or overcurrent fault.
DualChannelFaultTimestamp			Indicates the time stamp of the last dual channel fault.
InternalFaultTimestamp			Indicates the time stamp of the last internal fault.
OverloadTimestamp			Indicates the time stamp of the last overload fault.
ShortCircuitGroundTimestamp			Indicates the time stamp of the last short circuit to ground fault.
FieldPowerOnTimestamp			Indicates the time stamp of the last time field power turned on.
FieldPowerOffTimestamp			Indicates the time stamp of the last time field power turned off.
OverTemperatureTimestamp			Indicates the time stamp of the last over temperature fault.
CriticalTemperatureTimestamp			Indicates the time stamp of the last critical temperature fault.

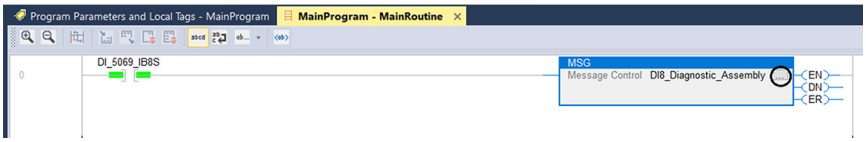
Configure the Message Type User Tags

Create Message type user tags for requests, and associated response user tags, for each of the new user-defined diagnostic assembly types.



From the Controller Organizer pane, select Tasks > MainTask > MainProgram

1. Create the Message type user tags for each request.
2. Create the associated response user tags for each new user-defined diagnostic assembly type.
3. Add the user tags to your ladder program.
4. Click the ... button to open the message configuration page.

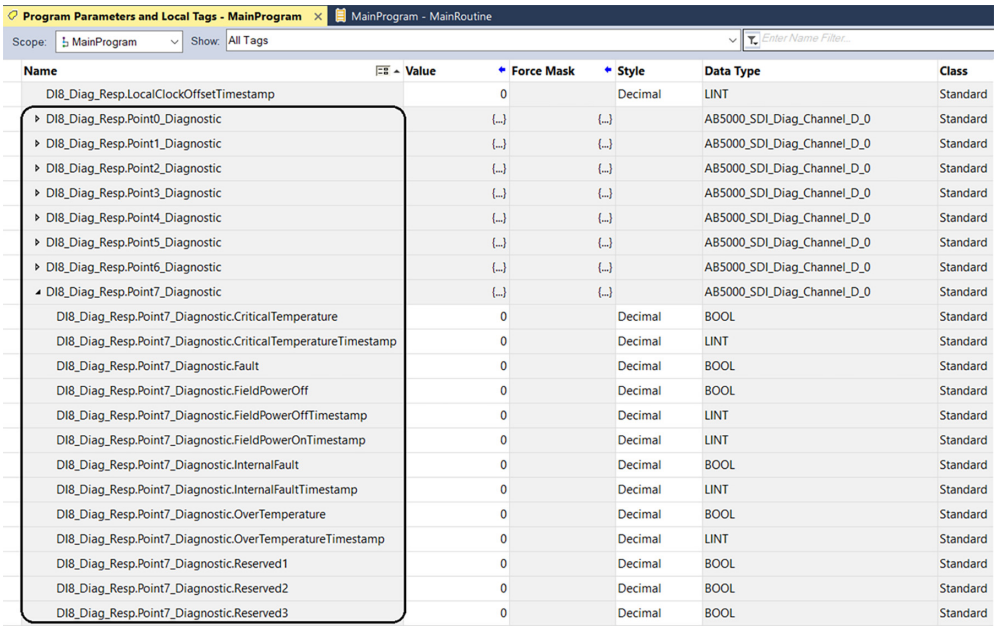


5. On the Configuration tab, select:

Service Type	Class	Attribute	Instance	Destination Element
Get Attribute Single	4	3	5069-IB8S, 5069-IB8SK: 769 (301h) Diagnostic Counters Base I/O Assembly 786 (312h) Diagnostic Digital Safety 8 Point Assembly A (input) 927 (39Fh) Diagnostic Digital Safety 8 Point Assembly B (input)	User-defined data type suitable for the instance entered
			5069-OBV8S, 5069-OBV8SK: 769 (301h) Diagnostic Counters Base I/O Assembly 787 (313h) Diagnostic Digital Safety 8 Output Point Assembly A (input) 798 (31Eh) Diagnostic Digital Safety 8 Output Point Assembly B (input)	

6. On the Communication tab, select the path to the module to which you wish to send the messages.
7. Download the project and set it to Run mode.

You can monitor the user-defined tag values from the Program Parameters and Local Tags window.



Notes:

Numerics

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Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, Knowledgebase, and product notification updates.	rok.auto/support
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Technical Documentation Center	Quickly access and download technical specifications, installation instructions, and user manuals.	rok.auto/techdocs
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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