



# FLEX 5000 I/O Standard and Safety Frequency Input Modules

Catalog Numbers 5094-IJ2I, 5094-IJ2IXT, 5094-IJ2IS, 5094-IJ2ISXT



***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.

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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.

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.

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**Notes:**

## About This Publication

This manual describes how to use FLEX 5000® I/O frequency input standard and safety modules in Logix 5000® control systems.

Make sure that you are familiar with the following:

- Use of a controller in a Logix 5000 control system
- Use of an EtherNet/IP™ network, if the I/O modules are installed in a remote location from the controller that is accessible via the EtherNet/IP network
- Use of safety systems
- Studio 5000 Logix Designer® environment

## Manual Conventions

Within this manual, we simplified product names for your ease of use.

We use **standard** module to indicate a module that does not have functional safety capability. We use **safety** module to indicate a module with functional safety capability (catalog numbers ending in "S" or "SXT").

Throughout this publication, the term Logix 5000 controller refers to the controllers with which you can use FLEX 5000 I/O modules in a given capacity. The term does not refer to all Logix 5000 controllers.

## Download Firmware, AOP, EDS, and Other Files

Download firmware, associated files (such as Add-on Profiles and Electronic Data Sheets), and access product release notes from the Product Compatibility and Download Center at [rok.auto/pcdc](http://rok.auto/pcdc).

## Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Updated template	throughout
Added 5094-IJ2I standard module	throughout
Updated trademarks	7
Added Connections for Standard I/O Modules section	21
Added Listen Only Mode section	27
Added an important note in the Module Data Quality Reporting section	29
Added For safety input modules only in the Fault Tag section	30
Added For Standard Modules example in the Uncertain tag section	30
Added Disable Keying feature	32
Moved the Safety Application Suitability Levels section	34
Added For Safety Modules Only section	37
Added chapter 4 - Configure Standard I/O Modules	45
Added standard modules to the troubleshooting chapter	71...74
Added important note in the Channel Diagnostics section	77
Added For safety module only in the module tag tables	80...84
Added standard module catalog numbers to the important note for Chxx.DirectionValid	82

## Feature Support

### Applies to these modules:

5094 Standard Modules

5094 Safety Modules

Throughout this manual, the table at left indicates the I/O modules that support the feature that is described in that chapter or section.

- If both standard and safety modules support a feature, both module types are in the table. Any difference in operation between the modules for that feature is communicated in the text in the chapter or section.
- If only one type of module, standard or safety, supports a feature, only that module type appears in the table.

## Terminology

This table defines terms that are used in this manual. Throughout this publication, the term Logix 5000 controller refers to the controllers with which you can use FLEX 5000 I/O modules in a given capacity. The term does not refer to all Logix 5000 controllers.

### Terminology

Abbreviation	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 Sync™	Common Industrial Protocol Synchronization	CIP Sync provides the increased control coordination that is needed for control applications where absolute time synchronization is vital to achieve real-time synchronization between distributed intelligent devices and systems.
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 masters and slaves.
CL	Claim Limit	The maximum safety integrity level (SIL) that can be achieved.
DC	Diagnostic Coverage	The ratio of the detected failure rate to the total failure rate.
EDS	Electronic Data Sheet	A template that is used in RSNetWorx™ software to display the configuration parameters, I/O data profile, and connection-type support for a given I/O module. RSNetWorx software uses these simple text files to identify products and commission them on a network.
EN	European Norm.	The official European Standard.
ESS	Energy Storage System	Used for backup for memory retention at powerdown on controllers. The ESS is inside the controller and cannot be removed.
GSV	Get System Value	A ladder logic instruction that retrieves specified controller status information and places it in a destination tag.
MTTF	Mean time to failure	The length of time that a device or other product is expected to remain reliable in operation.
—	Multicast	The transmission of information from one sender to multiple receivers.
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 are established for the promotion of CIP networks.
PC	Personal computer	Computer that is used to interface with and control a Logix-based system via the Studio 5000® environment.
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.
—	Safety (devices)	Devices or portions of devices that have functional safety capability.
SIL	Safety Integrity Level	A relative level of risk-reduction provided by a safety function, or to specify a target level of risk reduction.
SNN	Safety Network Number	A unique number that identifies a section of a safety network.
SRT	Safety Reaction Time	A consideration of delays or latencies within the safety system.
SSV	Set System Value	A ladder logic instruction that sets controller system data.
—	Standard (devices)	Devices or portions of devices that do not have functional safety capability.
—	Unicast	The transmission of information from one sender to one receiver.

## Additional Resources

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

Resource	Description
FLEX 5000 Modules Specifications Technical Data, publication <a href="#">5094-TD001</a>	Provides specifications for FLEX 5000 EtherNet/IP adapters and FLEX 5000 modules.
FLEX 5000 EtherNet/IP Adapters with RJ45 Ports Installation Instructions, publication <a href="#">5094-IN001</a>	Describes how to install and wire the 5094-AENTR, 5094-AENTRXT, 5094-AEN2TR, and 5094-AEN2TRXT EtherNet/IP adapters.
FLEX 5000 EtherNet/IP Adapters with SFP Support Installation Instructions, publication <a href="#">5094-IN002</a>	Describes how to install and wire the 5094-AENSFPRXT and 5094-AEN2SFPRXT EtherNet/IP adapters.
FLEX 5000 Terminal Base Assembly Modules Installation Instructions, publication <a href="#">5094-IN010</a>	Describes how to install and wire the terminal base assemblies for the FLEX 5000 system.
FLEX 5000 I/O Analog Modules User Manual, publication <a href="#">5094-UM002</a>	Describes how to configure, operate, and troubleshoot FLEX 5000 analog I/O modules.
FLEX 5000 I/O Frequency 2-channel Isolated Safety Input Modules Installation Instructions, publication <a href="#">5094-IN019</a>	Describes how to install and wire the 5094-IJ2IS and 5094-IJ2ISXT safety input modules.
FLEX 5000 I/O Frequency 2-channel Isolated Input Modules Installation Instructions, publication <a href="#">5094-IN029</a>	Describes how to install and wire the 5094-IJ2I and 5094-IJ2IXT safety input modules.
CompactLogix 5380 and Compact GuardLogix 5380 Controllers User Manual, publication <a href="#">5069-UM001</a>	Describes how to configure, operate, and troubleshoot CompactLogix™ and Compact GuardLogix® 5380 controllers.
ControlLogix 5580 and GuardLogix 5580 Controllers User Manual, publication, <a href="#">1756-UM543</a>	Describes how to configure, operate, and troubleshoot ControlLogix® and GuardLogix 5580 controllers.
GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Safety Reference Manual, publication <a href="#">1756-RM012</a>	Contains detailed requirements for achieving and maintaining SIL 2/PLd and SIL 3/PLe with the GuardLogix 5580 and Compact GuardLogix 5380 controller systems, using the Studio 5000 Logix Designer application.
EtherNet/IP Network Devices User Manual publication <a href="#">ENET-UM006</a>	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP network.
Integrated Architecture and CIP Sync Configuration Application Technique, publication <a href="#">IA-AT003</a>	Provides information about CIP Sync technology and how to synchronize clocks within the Rockwell Automation Integrated Architecture® system.
Electronic Keying in Logix 5000 Control Systems Application Technique, publication <a href="#">LOGIX-AT001</a>	Describes how to use electronic keying in Logix 5000 control system applications.
Logix 5000 Controllers Tasks, Programs, and Routines Programming Manual, publication <a href="#">1756-PM005</a>	Provides more information on event tasks and event task configuration.
Position-based Output Control with the MAOC Instruction, publication <a href="#">1756-AT017</a>	Describes how to configure time-scheduled output control with the MAOC instruction.
Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, <a href="http://rok.auto/certifications">rok.auto/certifications</a>	Provides declarations of conformity, certificates, and other certification details.
Safety Automation Builder and SISTEMA Library, <a href="http://rok.auto/sistema">rok.auto/sistema</a>	<p>Download Safety Automation Builder® software to help simplify machine safety design and validation, and reduce time and costs. Integration with our risk assessment software provides you with consistent, reliable, and documented management of the Functional Safety Lifecycle.</p> <p>The SISTEMA tool, also available for download from the Safety Automation Builder page, automates calculation of the attained Performance Level from the safety-related parts of a machine's control system to (EN) ISO 13849-1.</p>

You can view or download publications at [rok.auto/literature](http://rok.auto/literature).

**Notes:**

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## FLEX 5000 Frequency Input Module Operation in a Logix 5000 Control System

Logix 5000 controllers use FLEX 5000 I/O standard and safety modules to control devices in a control system:

- The modules are used as remote I/O modules over an EtherNet/IP network. The modules are installed to the right of a FLEX 5000 EtherNet/IP adapter.
- The modules use terminal base (TB) assemblies to connect field-side wiring.
- You use Studio 5000 Logix Designer application software version 33 later to configure and program the safety modules.
- You use Studio 5000 Logix Designer application software version 34 later to configure and program the standard modules.
- The 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.

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**IMPORTANT** You cannot use FLEX 5000 I/O modules with all Logix 5000 controllers:

- You can use standard modules with CompactLogix 5380 and ControlLogix 5580 controllers.
- You can use FLEX 5000 I/O standard and safety modules with Compact GuardLogix 5380 and GuardLogix 5580 controllers.
- You **cannot** use FLEX 5000 I/O standard or safety modules with CompactLogix 5370, Compact GuardLogix 5370, ControlLogix 5570, or GuardLogix 5570 controllers.
- You can use FLEX 5000 I/O modules with Logix 5000 controllers as remote I/O modules only.

Throughout this publication, the term **Logix 5000 controller** refers to the controllers with which you can use FLEX 5000 I/O modules in a given capacity. The term does not refer to all Logix 5000 controllers.

For the most current information on the Logix 5000 controllers with which you can use FLEX 5000 I/O modules, see the product description at [rok.auto/flex5000IO](http://rok.auto/flex5000IO).

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Figure 1 shows a standard controller with standard I/O modules. The 5094-IJ2I is a standard I/O module.

Figure 1 - FLEX 5000 I/O Standard Modules in a Logix 5000 Control System

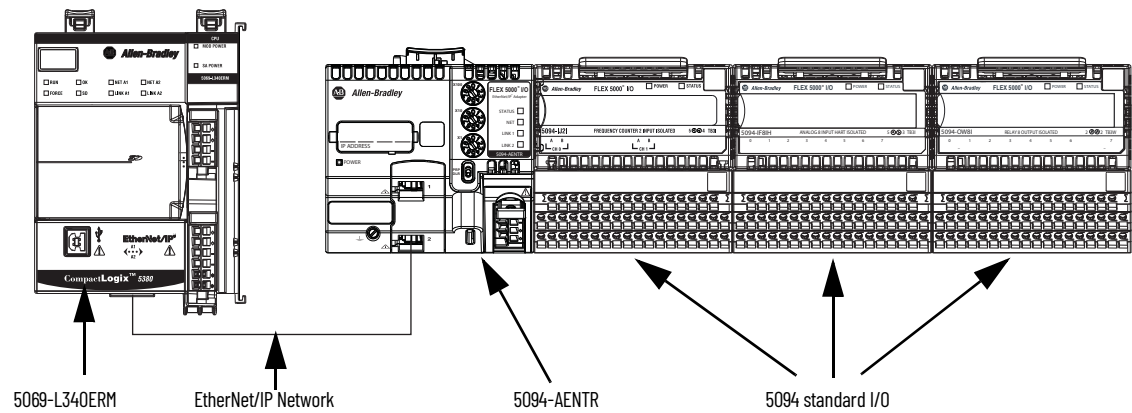
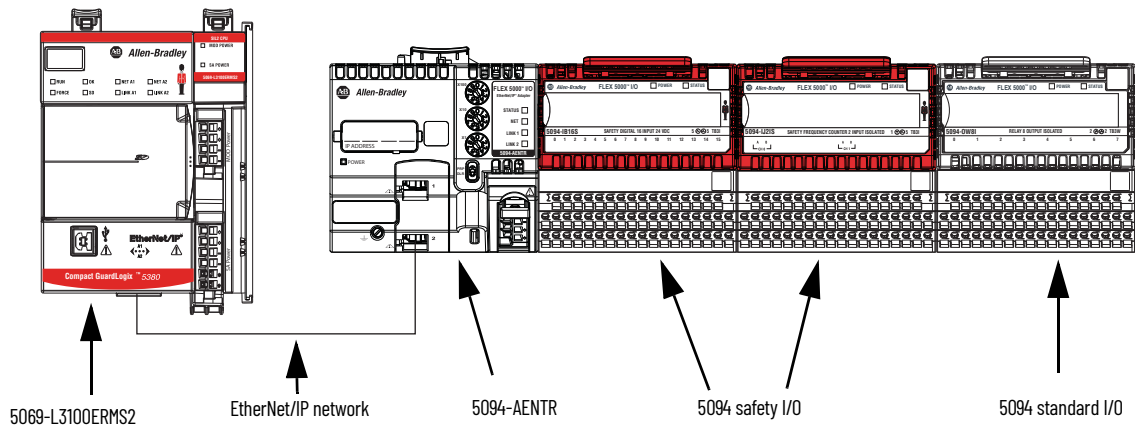


Figure 2 shows a safety controller with standard and safety I/O modules. Safety controllers support both standard and safety I/O modules. The 5094-IJ2IS is a safety I/O module.

Figure 2 - FLEX 5000 I/O Safety Modules in a Logix 5000 Control System



# The 5094-IJ2I and 5094-IJ2IS Modules

<b>Applies to these modules:</b>	
5094 Standard I/O Modules	
5094 Safety I/O Modules	

The frequency input module performs high-speed frequency algorithms. The module measures and reports frequency, rate of change (acceleration) and direction. Two input channels for frequency (A) or direction (B) inputs, supports use of magnetic inputs, vortex flowmeter, and 24V DC IEC type 3 inputs.

The primary use of the module is accurate frequency measurement. A high-speed internal clock is synchronized with the frequency input to count over a user-selected sampling time or a user-defined number of frequency input pulses.

Communication between the safety module and the safety controller occurs via CIP Safety over EtherNet/IP and the module provides safety-related diagnostics.

Figure 3 shows the parts of an example FLEX 5000 I/O frequency input standard module. Figure 4 on page 13 shows the parts of an example FLEX 5000 I/O frequency input safety module.

Figure 3 - Example FLEX 5000 I/O Standard Frequency Input Module

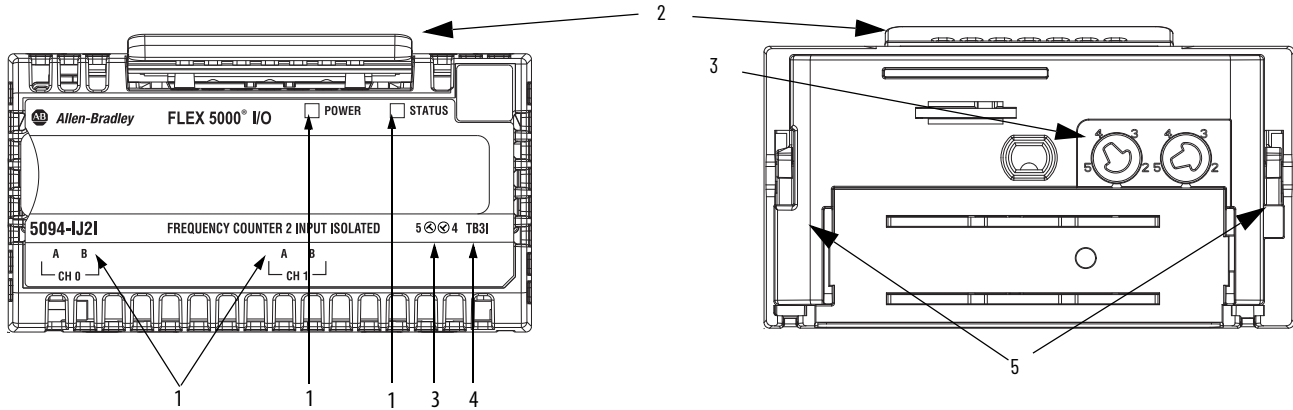


Figure 4 - Example FLEX 5000 I/O Safety Frequency Input Module

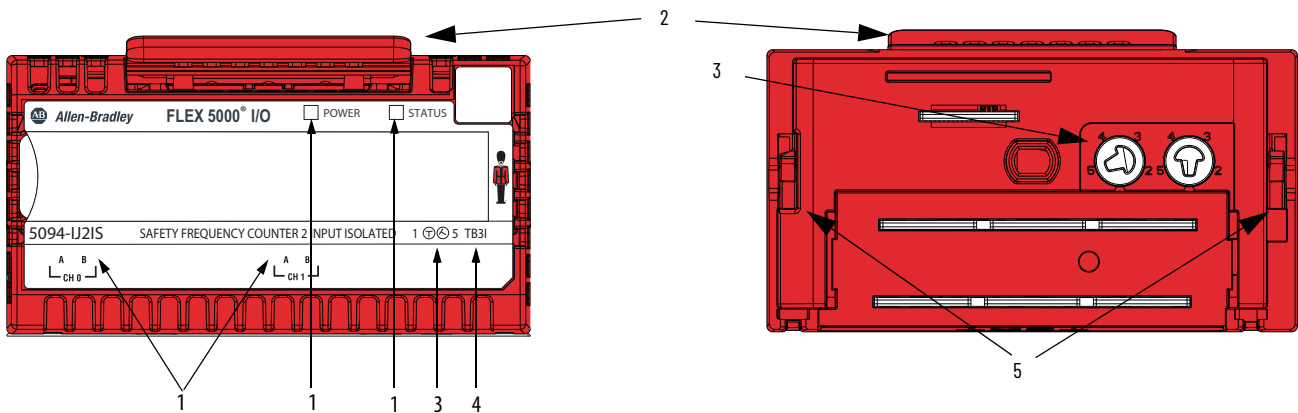


Table 1 - FLEX 5000 I/O Standard and Safety Module Parts

Item	Description
1	<b>Status indicators</b> - Displays the status of communication, module health, and input/output devices. Indicators help with troubleshooting anomalies.
2	<b>Release lever</b> - Disengages the latching hooks to allow removal of the module from the terminal base assembly.
3	<b>Module keying</b> - Indicates the keying position that the terminal base assembly must be configured to before installing the module.
4	<b>Terminal base</b> - Indicates the type of terminal base assembly to use with the module.
5	<b>Latching hooks</b> - Securely installs FLEX 5000 modules on the terminal base assembly.

## Firmware and Software Compatibility

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

[Table 2](#) describes the module compatibility requirements when you use FLEX 5000 I/O standard and safety modules with Logix 5000 controllers.

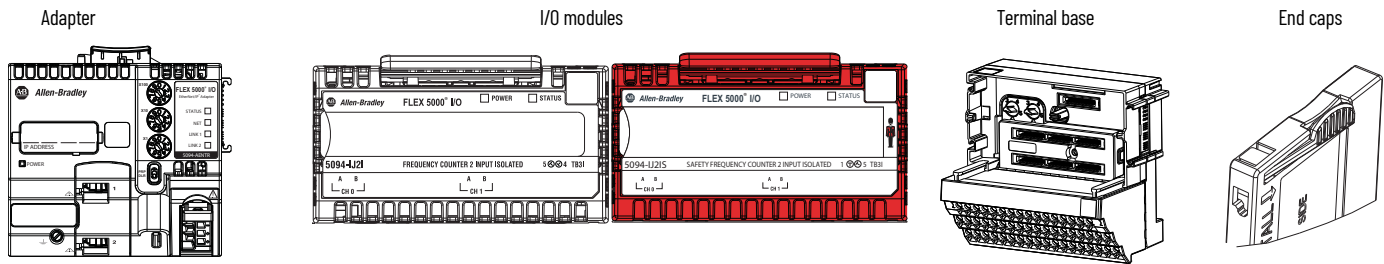
**IMPORTANT** You must use adapter firmware revision 3.011 or later with standard I/O and adapter firmware revision 2.011 with safety I/O modules.

Table 2 - FLEX 5000 I/O Standard and Safety Modules Controller and Software Compatibility Requirements

Modules	Controllers	Studio 5000 Logix Designer Application Version
	System	
<b>Standard Module</b> 5094-IJ2I, 5094-IJ2IXT	CompactLogix 5380 Compact GuardLogix 5380 ControlLogix 5580 GuardLogix 5580	34.00.00 or later
<b>Safety Module</b> 5094-IJ2IS, 5094-IJ2ISXT	Compact GuardLogix 5380 GuardLogix 5580	33.00.00 or later

Construct a FLEX 5000 I/O System

FLEX 5000 I/O is a small, modular I/O system for distributed applications that performs all functions of rack-based I/O. The FLEX 5000 I/O system contains the components that are pictured here.



- Adapter – Transfers read and write configuration data to and from the I/O module.
- Terminal base – Contains a terminal strip to end wiring for two- or three-wire devices.
- I/O modules – Contains the bus interface and circuitry that must perform specific functions that are related to your application.
- End cap – Basically a dust cap for the last module in a rack.

FLEX 5000 I/O System Power



**ATTENTION:** Power to this equipment and all connected I/O must be supplied from a source that is isolated from Mains power via an approved isolating transformer that is constructed with basic insulation.

FLEX 5000 I/O modules receive the following power types:

- System-side power that powers the system and lets modules transfer data and execute logic. System-side power is also known as Backplane power.
- Field-side power that powers field-side devices that are connected to some modules. Field-side power is also known as SA power.

System-side power begins at the FLEX 5000 EtherNet/IP adapter and passes across the FLEX 5000 I/O module internal circuitry via the terminal base power bus, that is, backplane power.

Field-side power (SA power), begins at the first terminal base assembly and can be daisy chained to the next terminal base assembly on the right. You can also install a separate field-side power source to each terminal base assembly.

For more information on how to power FLEX 5000 I/O modules, FLEX 5000 EtherNet/IP Adapter User Manual, publication [5094-UM005](#).

#### *FLEX 5000 I/O SA Field-Side Power*

- FLEX 5000 I/O modules use terminal base (TB) assemblies to connect field-side wiring.
- SA field-side power source is connected to the terminal base (TB) assemblies via SA power terminals.
- With DC voltage for SA power, you must limit the SA field-side power source to 10 A, max, at 18...32V DC.
- Confirm that the external module power supply is adequately sized for the total SA field-side power current draw in the module.

For example, if the total module power current draw, including current inrush requirements, is 5 A, you can use a module power supply that is limited to 5 A.

- You must use SELV-listed power supplies for module power if there are functional safety modules that are connected to the FLEX 5000 I/O system.
- Not all power supplies are certified for use in all applications, for example, nonhazardous and hazardous environments.

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**IMPORTANT** We recommend that you use separate external power supplies for the adapter and the adjacent terminal base. This practice can help prevent unintended consequences that can result if you use one supply.

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For more information, see the publications that are listed in Additional Resources on [page 9](#).

## Secure Access to the System

To secure access to the [device] by authorized users only, consider these options:

- Password helps protect the source and execution of the control program.
- Remove the key from the controller.
- Implement physical barriers, such as locked cabinets.

To secure access to the system, consider these options:

- Follow industry best practices to harden your personal computers and servers, including anti-virus/anti-malware and application whitelisting solutions.

The recommendations are published at the Rockwell Automation technical support center in Knowledgebase article *Rockwell Automation Customer Hardening Guidelines*, [#546987](#). The technical support center is available at: [rok.auto/knowledgebase](http://rok.auto/knowledgebase).

- Develop and deploy backup and disaster recovery policies and procedures. Test backups on a regular schedule.
- Minimize network exposure for all control system devices and systems, and confirm that they are not accessible from the Internet.
- Locate control system networks and devices behind firewalls and isolate them from the business network.
- Subscribe to the Knowledgebase article *Industrial Security Advisory Index*, [#KB54102](#), so you have access to information about security matters that affect Rockwell Automation products.

Follow recommended network practices for products with network interfaces, such as communication ports or web servers. These practices help minimize risk or exposure by unauthorized activity or users. For more information, see:

- Deploying a Resilient Converged Plantwide Ethernet (CPwE) Architecture Design and Implementation Guide, publication [ENET-TD010](#).
- EtherNet/IP Network Devices User Manual, publication [ENET-UM006](#).
- Configure System Security Features User Manual, publication [SECURE-UM001](#).

## Before You Begin

Before you use your I/O module, you must complete the following:

- Install a FLEX 5000 EtherNet/IP adapter.
- Install the FLEX 5000 I/O modules to the right of the adapter.
- Install an EtherNet/IP network.
- Install the Logix 5000 controller that accesses the FLEX 5000 I/O modules via an EtherNet/IP network.
- Install an end cap after the last module in the rack.

Make sure that you have enough FLEX 5000 terminal base (TB) assemblies to satisfy your application needs. For more information, see the FLEX 5000 Terminal Base Assembly Modules Installation Instructions, publication [5094-IN010](#).

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**IMPORTANT** Terminal bases are not included with your module and are not available for purchase. A terminal base consists of a mounting base (MB) and removable terminal block (RTB). You must purchase MBs and RTBs separately and assemble them together.

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For adapter information, see the FLEX 5000 EtherNet/IP Adapters with RJ45 Ports Installation Instructions, publication [5094-IN001](#), and the FLEX 5000 EtherNet/IP Adapters with SFP Support Installation Instructions, publication [5094-IN002](#).

## Considerations for Safety I/O Modules

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### Applies to these modules:

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5094 Safety I/O Modules

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These restrictions apply to the 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.

Restrictions are based on the standards that are current at the time of certification.

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**IMPORTANT** TÜV Rheinland has approved GuardLogix 5580 and Compact GuardLogix 5380 controller systems for use in safety-related applications where the de-energized state is always considered to be the safe state.

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**IMPORTANT** Functional safety certification and performance of FLEX 5000 I/O safety 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 the module operating conditions adhering to the ambient operating temperature specification.

For more information on the maximum ambient operating temperature specification for FLEX 5000 I/O safety modules, see the FLEX 5000 Modules Specifications Technical Data, publication [5094-TD001](#).

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## Single-channel or Dual-channel Mode

You can use FLEX 5000 I/O safety 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 two channels is evaluated. Based on the status on both channels, safety input data and safety input status can be off or on.

You use safety instructions in the safety controller ladder logic with two single channels, that is, one even and one odd.

## 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 FLEX 5000 I/O safety modules.



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

- 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.
- 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 FLEX 5000 I/O safety modules as shown in the FLEX 5000 Module Specifications Technical Data, publication [5094-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 starting system operation.
- Do not disassemble, repair, or modify the module. This can result in loss of safety functions.

Install and Replace Modules



**ATTENTION:**

- Clear previous configuration data before connecting devices to the network or connecting 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.

Module Firmware

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

**IMPORTANT Safety Consideration**

You must inhibit a safety I/O module before updating its firmware with ControlFLASH™ software.

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

Firmware information for I/O devices is available at the Rockwell Automation [Product Compatibility and Download Center](#) (PCDC).

At the PCDC, you can use the module catalog number to check for firmware updates. If the catalog number is not available, then no updates exist.

Verify that the firmware revision of the FLEX 5000 I/O modules that you use is correct before commissioning the system.

**IMPORTANT** Only download firmware and access product release notes from the Rockwell Automation PCDC.  
Do not download firmware from non-Rockwell Automation sites.



**ATTENTION: Safety Function During Firmware Update**

The FLEX 5000 I/O safety 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.

Safety Application Requirements

**Applies to these modules:**

5094 Safety I/O Modules

Safety application requirements include evaluating the following:

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

Creating, recording, and verifying that the safety signature is also a required part of the safety application development process. 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 safety network number (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](#).

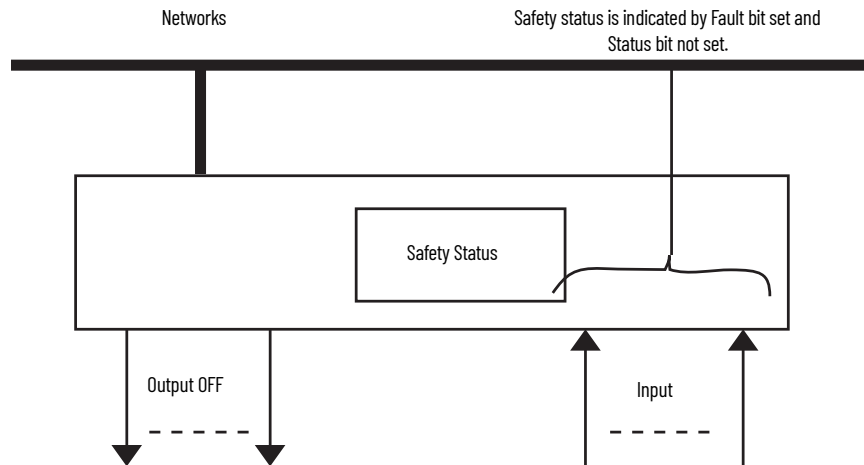
You must read, understand, and fulfill the requirements that are described in this publication before you operate a safety system that uses FLEX 5000 I/O safety modules.

## Safe State



**ATTENTION:** The channel safe state is defined as Chxx.Fault is 1 and Chxx.Status is 0. You must validate the data using the safety status before use.

Figure 5 - Safety Status



**IMPORTANT** If you inhibit a safety 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 module from transitioning to a safe state.

## Configuration Signature and Ownership

Every FLEX 5000 I/O safety 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 the following:

- ID number
- Date
- Time

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

**IMPORTANT** The signature can only be considered "verified" (and configuration locked) after user testing.

Configuration Ownership

The connection between the owner-controller and the FLEX 5000 I/O safety module is based on the following:

- FLEX 5000 I/O safety module slot number
- FLEX 5000 I/O safety 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 FLEX 5000 I/O safety module
- Configuration signature

If any differences are detected, the connection between the owner-controller and the FLEX 5000 I/O safety 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 Logix Designer application for any listening controller must match the one in the owner-controller project.



If the safety module is configured for inputs only, you can copy and paste the configuration signature from one project to the other.  
If the safety module has safety outputs, for example, the 5094-0B16S module, the configuration signature parameter is disabled.

Reset FLEX 5000 I/O Safety Modules to Out-of-Box State

If a FLEX 5000 I/O safety 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 to its out-of-box state.

When a FLEX 5000 I/O safety module is in the out-of-box state, its configuration is not owned by a controller.

The Safety category on the Module Properties dialog box displays the module Configuration Ownership. The Logix Designer application project must be online to check.

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

For information on how to reset the module in the Logix Designer application, see [Reset to Out-of-Box Configuration on page 65](#).

You cannot reset the module to its out-of-box state if either of the following conditions is true:

- Pending edits to the module properties exist
- Safety signature exists in the controller project

Ownership

Applies to these modules:
5094 Standard I/O Modules
5094 Safety I/O Modules

Every I/O module in a Logix 5000 control system must be owned by a controller, also known as the owner-controller. When the FLEX 5000 I/O modules are used in a Logix 5000 control system, the owner-controller performs the following:

- Stores configuration data for every module that it owns.

- Can reside in a location that differs from the modules.
- Sends the module configuration data to define module behavior and begin operation in the control system.

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

Typically, each I/O module in a FLEX 5000 I/O system has only one owner-controller. Output modules are limited to one owner-controller.

## Configuration Via the Logix Designer Application

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

You must create a Logix Designer application project for the Logix 5000 controller that owns the FLEX 5000 standard and safety I/O modules. The project includes module configuration data for the FLEX 5000 I/O modules.

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

The FLEX 5000 I/O modules can operate immediately after receiving the configuration data.

## Connections for Standard I/O Modules

### Applies to these modules:

5094 Standard I/O Modules

### IMPORTANT

This section shows some Logix Designer application screens that are used when you configure FLEX 5000 I/O safety modules. For a complete description of how to configure the modules, see [Configure and Replace Safety I/O Modules on page 55](#).

During module configuration, you must define the module. Among the Module Definition parameters with FLEX 5000 I/O standard modules, you must decide how the module is configured.

The choice depends on whether the project is downloaded to the controller that owns the module configuration, that is, the owner-controller, or to a controller that is listening to input modules 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 module configuration to a controller, the controller attempts to establish a connection to each module in the configuration.

Because part of module configuration includes a slot number in the remote FLEX 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 the following 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 prevents normal operation.

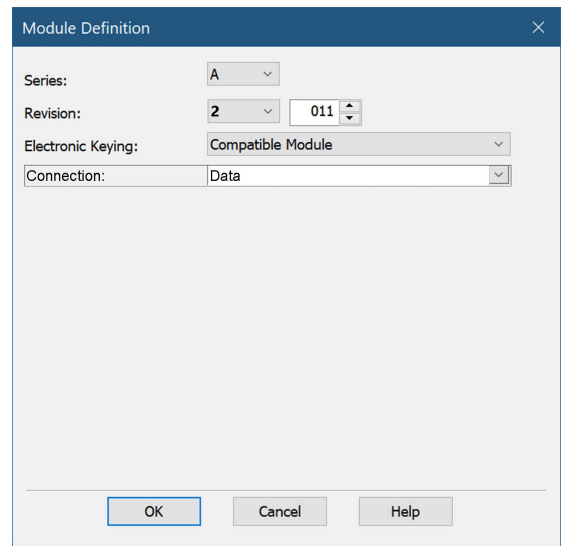
The owner-controller monitors its connection with a module. Any break in the connection, for example, the loss of power to a remote FLEX 5000 I/O system, causes a fault. The Studio 5000 Logix Designer application monitors the fault status tags to indicate when a fault occurs on a module.

## Connection Types Available with FLEX 5000 I/O Standard Modules

When configuring a FLEX 5000 I/O standard module, you must define the module. Connection is a required parameter in the Module Definition. The choice determines what data is exchanged between the owner-controller and the module.

For more information on configuring the I/O modules, see [Configure Standard I/O Modules on page 45](#).

[Table 3](#) describes the connection types that you can use with FLEX 5000 I/O standard modules.



The screenshot shows a 'Module Definition' dialog box with the following fields and values:

- Series: A
- Revision: 2
- Electronic Keying: Compatible Module
- Connection: Data

At the bottom are buttons for OK, Cancel, and Help.

**Table 3 - Connections – 5094-IJ2I Modules**

Connection Type	Description
Data	The module returns the following to the owner-controller: <ul style="list-style-type: none"><li>• General fault data</li><li>• Input data</li></ul>
Listen Only	When a Listen Only data connection is used, another controller owns the module. A controller that makes a Listen Only connection to the module does not write configuration for the module. It merely listens to the data exchanged with the owner-controller. IMPORTANT: If a controller uses a Listen Only connection, the connection must use the Multicast option. For more information on Listen Only connections, see <a href="#">Listen Only Mode on page 27</a> . In this case, all other connections to the module, for example, the connection to the owner-controller must also use the Multicast option.

## Data Types Available with FLEX 5000 I/O Standard 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 the 5094-IJ2I module, Data is the only choice.

For more information on the Connection and Data parameter choices available with FLEX 5000 I/O modules, see the Studio 5000 Logix Designer application.

## 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.

The valid RPI values for FLEX 5000 I/O standard modules are 0.2...750 ms.

- 
- IMPORTANT** If you change the RPI while the project is online, however, the connection to the module is closed and reopened in one of the following 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 specifying RPI rates, see the following:

- FLEX 5000 I/O standard modules - page [50](#)
- Logix 5000 Controllers Design Considerations Reference Manual, publication [1756-RM094](#).

## Connection Over an EtherNet/IP Network

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### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

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During module configuration, you must configure the Connection over EtherNet/IP parameter. The configuration choice dictates how input data is broadcast over the network.

The FLEX 5000 I/O frequency input standard and safety modules use one of the following methods to broadcast data:

- Multicast - Data is sent to all network devices in a multicast group
- Unicast - Data is sent to a specific controller depending on the module configuration

Unicast is the default setting. We recommend that you use Unicast because it reduces network bandwidth usage.

## Connections for Safety I/O Modules

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### Applies to these modules:

5094 Safety I/O Modules

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- 
- IMPORTANT** This section shows some Logix Designer application screens that are used when you configure FLEX 5000 I/O safety modules. For a complete description of how to configure the modules, see [Configure and Replace Safety I/O Modules on page 55](#).
-

During module configuration, you must define the module. Among the Module Definition parameters with FLEX 5000 I/O safety modules, you must decide how module is configured.

The choice depends on whether the project is downloaded to the controller that owns the module configuration, that is, the owner-controller, or to a controller that is listening to input modules 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 module configuration to a controller, the controller attempts to establish a connection to each module in the configuration.

Because part of module configuration includes a slot number in the remote FLEX 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 the following 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 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 prevents normal operation.

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

‘Configured By’ Options for Safety I/O Modules

The ‘Configured By’ choice determines what data is exchanged between the owner-controller and the module. This is an example Module Definition dialog box, and available Connection choices, for FLEX 5000 I/O safety modules.

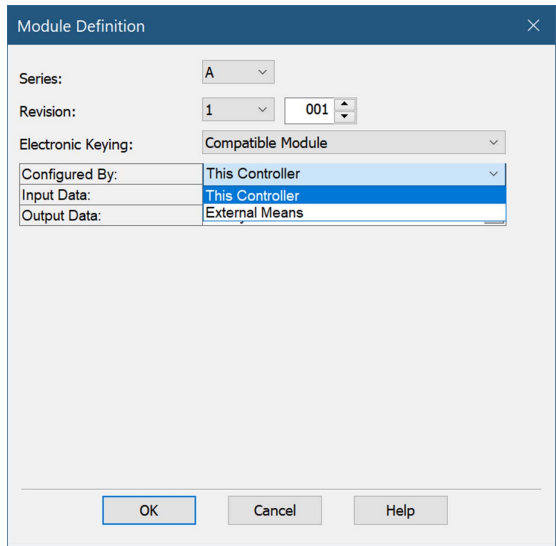


Table 4 describes the connection types that you can use with FLEX 5000 I/O safety modules.

Table 4 - Configured By Choices - FLEX 5000 I/O Safety Modules

Configured by Choice	Description	
	FLEX 5000 I/O Safety Input Module	FLEX 5000 I/O Safety Output Module
This controller	The module returns the following to the owner-controller: <ul style="list-style-type: none"> <li>• General fault data</li> <li>• Safety input data</li> <li>• Safety output data</li> </ul>	The module exchanges the following with the owner-controller: <ul style="list-style-type: none"> <li>• General fault data</li> <li>• Safety input data</li> <li>• Safety output data</li> </ul>
External means	When the External Means option is chosen, another controller owns the module. A controller that chosen this option does not write configuration for the module. It merely listens to the data exchanged with the owner-controller. That is, it receives Safety input data.	

## Data Types Available with FLEX 5000 I/O Safety Modules

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

The module type and Connection choice determine the available Input Data or Output Data choices. For the 5094-IJ2IS module, Safety Data is the choice.

For more information on the Connection and Data parameter choices available with FLEX 5000 I/O modules, see the Logix Designer application.

Module Definition

Series: A

Revision: 1 001

Electronic Keying: Compatible Module

Configured By: This Controller

Input Data: Safety Data

Output Data: Safety Data

OK Cancel Help

## 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.

The valid RPI values for FLEX 5000 I/O safety modules are 2...500 ms. Safety output connection RPI is configured via the safety task period, and you cannot set the safety task period to values outside of the 2...500 ms range.

---

**IMPORTANT** For safety applications, you can change the RPI while the project is online only if the safety application does not have a generated safety signature. If the safety application has a generated safety signature, you cannot change the RPI while the project is online.

Safety output connection RPI is configured via the Safety task period. The safety task period cannot be set to values outside of the 2...500 ms range.

If you change the RPI while the project is online, however, the connection to the module is closed and reopened in one of the following 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.

---

### *Connection Reaction Time Limit With FLEX 5000 I/O safety Modules*

Setting the RPI on FLEX 5000 I/O safety modules is not as straightforward as setting it on FLEX 5000 I/O standard modules. With FLEX 5000 I/O safety modules, the Connection Reaction Time Limit configuration affects the RPI that is used for a module.

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 for safety input connection.

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

---

**IMPORTANT** To determine what is appropriate, 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 input RPI, and an output connection reaction time limit of 3 times the output RPI.

Changes to these parameters must be approved only after a thorough review by a safety administrator.

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For more information on specifying RPI rates, see the following:

- FLEX 5000 I/O safety modules - page [60](#)
- Logix 5000 Controllers Design Considerations Reference Manual, publication [1756-RM094](#)

## **Connection Over an EtherNet/IP Network**

During module configuration, you must configure the Connection over EtherNet/IP parameter. The configuration choice dictates how input data is broadcast over the network.

The FLEX 5000 frequency input safety I/O modules use one of the following methods to broadcast data:

- Multicast - Data is sent to all network devices in a multicast group
  - Unicast - Data is sent to a specific controller depending on the module configuration
- Unicast is the default setting. We recommend that you use Unicast because it reduces network bandwidth usage.

## Input Module Operation

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

Logix 5000 controllers do not poll the FLEX 5000 I/O frequency input modules for input data. Instead, the input modules send their input data that is channel and status data, at the RPI.

The modules reside in a FLEX 5000 I/O system that is accessible to a Logix 5000 controller over an EtherNet/IP network. A FLEX 5000 EtherNet/IP adapter is the first component in a FLEX 5000 I/O system and connects the system to the EtherNet/IP network.

The modules communicate input data to the FLEX 5000 EtherNet/IP adapter at the defined RPI. The input data consists of channel and status data.

At the RPI, the following events occur.

1. The remote frequency input module scans its channels for input data.
2. The module sends the data to the FLEX 5000 EtherNet/IP adapter.
3. The FLEX 5000 EtherNet/IP adapter in the FLEX 5000 I/O system sends the data over the EtherNet/IP network.
4. One of the following:
  - If the controller is directly connected to the EtherNet/IP network, it receives the input data immediately.
  - If the controller is connected to the EtherNet/IP network through another communication module, the module sends the data to its backplane and the controller receives it.

Any controller in the system can listen to the data from an I/O module. An owner-controller, as described in [Ownership on page 20](#), exchanges data with I/O modules.

Other controllers can use a Listen Only connection with the I/O module. In this case, the 'listening' controller can only listen to input data or output readback data. The listening controller does not own the module configuration or exchange other data with the module.

During the I/O configuration process, you can specify a Listen Only connection. For more information on Connection options, see [Module Definition on page 49](#).

### IMPORTANT Remember the following:

- If a controller uses a Listen Only connection, the connection must use the Multicast option. In this case, all other connections to the module, for example, the connection of the owner-controller, must also use the Multicast option.
- If a controller attempts to use a Listen Only connection to a module but the owner-controller connection uses the Unicast option, the attempt at a Listen Only connection fails.  
The 'Listen Only' controller receives data from the module as long as a connection between an owner-controller and module is maintained.
- If the connection between an owner-controller and the module is broken, the module stops sending data and connections to all 'listening controllers' are also broken.

## Listen Only Mode

### Applies to these modules:

5094 Standard I/O Modules

## Protected Operations

To maintain the secure operation of your FLEX 5000 I/O module, operations that can disrupt module operation are restricted based on the module operating mode. [Table 5](#) describes the restrictions.

Table 5 - Protected Operations on FLEX 5000 I/O Modules

Current Module Operation	Activity						
	Firmware Update Request	Module Reset Request	Connection Request	Configuration Change	Connection or Data Format Change	Electronic Keying Change	RPI Change
Connection not running	Accepted						
Connection running	Rejected		Accepted <sup>(1)</sup>	Accepted <sup>(2)</sup>	Not allowed <sup>(3)</sup>	Accepted <sup>(4)</sup>	
Firmware update is in process	Rejected						

(1) Only requests for Listen Only connections are accepted.

(2) Configuration change is accepted in the following scenarios:

- Changes are made in the Module Properties dialog box and you select Apply.
- Changes are made in the Configuration tags and you send a Reconfigure Module MSG to the module.

(3) The difference between Rejected and Not allowed is that rejected activities can be attempted in the Logix Designer application but do not take effect. The activities that are not allowed, that is, attempts to change the Connection or Data Format used, do not occur in the Logix Designer application.

For example, if you attempt to reset a module that is connected to the owner-controller, the Logix Designer application executes the request and alerts you that it was rejected. If you attempt to change the data format on a module that is connected to an owner-controller, the Logix Designer application does not execute the attempted change. The application only alerts you that the change is not allowed. In the case, if the change is attempted online, the Module Definition dialog box field that changes the data format is disabled.

(4) The change occurs after the connection is closed and reopened. You can close and reopen the connection in the following ways:

- Change the project while it is offline and download the updated project before going online again.
- Change the project while it is online and select Apply or OK in the Module Properties dialog box. In this case, before the change is made, a dialog box alerts you of the ramifications before the change is made.

## Common FLEX 5000 I/O Features in the Frequency Input Modules

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

### Producer/Consumer Communication

This chapter provides a description of the application and capabilities of the FLEX 5000 I/O frequency input standard and safety modules. Sections that pertain only to safety or only to standard modules are labeled under the headings.

FLEX 5000 I/O modules use the Producer/Consumer communication model to produce data without a controller polling 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 eliminates the need for one controller to send the data to other controllers.

**IMPORTANT** Keep in mind, **only one controller** can own the I/O module. The FLEX 5000 I/O modules do not support multiple owners of the same module. Other controllers must use a Listen Only connection to the module.

### Module Data Quality Reporting

The FLEX 5000 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.

We recommend that you monitor the tags in your program to make sure that the application is operating as expected with accurate channel input data.

**IMPORTANT**

- **For standard modules:** 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. Keep in mind that in some system configurations, the tag is not reset immediately after the condition is removed. The tag typically resets after a small delay.
- **For safetyinput modules:** see: [Safety Input Fault Reset on page 42](#) and [Fault and Status Reporting on page 43](#).

### Fault Tag

The module input tag *I.Chxx.Fault* 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.

A fault is reported if any of these conditions exist:

- Frequency is > 55, 000 Hz
- Critical frequency is > 60, 000 Hz
- Open Wire condition

- Discrepancy fault (**For safety input modules only**)
- Field Power Loss condition
- Direction Fault (**For safety input modules only**)



We recommend that you troubleshoot the module for the typical causes first.

## Uncertain Tag

The module input tag *I.Chxx.Uncertain* 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 tag is set to 1, you know that the data can be inaccurate. You must troubleshoot the module to discover what degree of inaccuracy exists.

### For Standard Modules

Example causes of uncertain data include the following:

Frequency data is < 1.5 Hz or > 51,000 Hz

### For Safety Modules

Example causes of uncertain data include the following:

- Over temperature reported
- Critical temperature reported
- Frequency data is < 1.5 Hz or > 51,000 Hz

---

**IMPORTANT** Your application must monitor the Uncertain bit for the 5094-IJ2IS module.

---

## Rolling Time Stamp of Data

The rolling time stamp is a continuously running, 15-bit rolling time stamp that counts in milliseconds from 0...32,767 ms. The rolling time stamp value is reported in the *I.Chxx.RollingTimestamp* tag. The rolling time stamp value is updated only when new frequency values are produced.

## Software Configurable

You use the Logix Designer application to configure the module, monitor system operation, and troubleshoot issues. You can also use the Logix Designer application to retrieve the following 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.

## Fault and Status Reporting

The FLEX 5000 I/O modules report fault and status data along with channel data. Fault and status data is reported in the following ways:

- Studio 5000 Logix Designer application
- Module status indicators

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

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For more information on fault reporting, see the individual module feature chapters and [Troubleshoot Your Module on page 71](#).

## Field Power Loss Detection

The Field Power Loss Detection feature monitors for the loss of power at an input module channel. When field power to the module is lost, a channel-level fault is sent to the controller to identify the exact channel faulted.

Field Power Loss Detection has a corresponding tag that can be examined in the user program if this fault occurs. For information on module tags, see [Module Tag Definitions on page 79](#).

## Module Inhibiting

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

---

**IMPORTANT** You cannot inhibit a connection when the safety controller is safety-locked or a safety signature exists for the controller.

---



### ATTENTION: Safety Consideration

If you inhibit the I/O module from going to the safe state when it detects a loss in communication to the network or the controller, you are responsible for making sure that your application has other means to maintain a safe state.

---

You can use module inhibiting in the following ways:

- You write a configuration for an I/O module but 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.
- In your application, a controller already owns a module, has downloaded the configuration to the module, and is exchanging data over the connection between the devices.  
In this case, you can inhibit the module and the connection to the module does not exist.

You can use module inhibiting in these instances:

- You want to update an I/O module, for example, update the module firmware revision. Use the following procedure.
  - a. Inhibit the module.
  - b. Perform the update.
  - c. Uninhibit the module.
- You use a program that includes a module that you do not physically possess yet. You do not want the controller to look for a module that does not yet exist. In this case, you can inhibit the module in your program until it physically resides in the proper slot.

To inhibit standard modules, see [Chapter 4, Connection Category on page 50](#).

To inhibit safety modules, see [Chapter 5, Connection Category on page 59](#).

## 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, 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

The following Electronic Keying options are available.

Keying Option	Description
Compatible Module	Lets the installed device accept the key of the device that is defined in the project when the installed device can emulate the defined device. With Compatible Module, you can typically replace a device with another device that has the following characteristics: <ul style="list-style-type: none"><li>• Same catalog number</li><li>• Same or higher Major Revision</li><li>• Minor Revision as follows:<ul style="list-style-type: none"><li>– If the Major Revision is the same, the Minor Revision must be the same or higher.</li><li>– If the Major Revision is higher, the Minor Revision can be any number.</li></ul></li><li>• Non-XT and XT version as follows:<ul style="list-style-type: none"><li>– You can use an XT version of the module in place of a non-XT module.</li><li>– You <b>cannot</b> use a non-XT version of the module in place of an XT module.</li></ul></li></ul>
Disable Keying	Indicates that the keying attributes are not considered when attempting to communicate with a device. With Disable Keying, communication can occur with a device other than the type specified in the project. <b>ATTENTION:</b> Be extremely cautious when using Disable Keying; if used incorrectly, this option can lead to personal injury or death, property damage, or economic loss. We <b>strongly recommend</b> that you <b>do not use</b> Disable Keying. If you use Disable Keying, you must take full responsibility for understanding whether the device being used can fulfill the functional requirements of the application. <b>IMPORTANT:</b> This option is not available for safety applications.
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 selecting one.

<b>IMPORTANT</b>	Changing Electronic Keying parameters online interrupts 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 Electronic Keying in Logix 5000 Control Systems Application Technique, publication [LOGIX-AT001](#).

Use CIP Sync Time with I/O Modules

The I/O modules use CIP Sync for time stamps. CIP Sync is a CIP implementation of the IEEE 1588 PTP (Precision Time Protocol). CIP Sync provides accurate real-time (Real-World 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 timestamping, sequence of events recording, distributed motion control, and increased control coordination.

The modules are CIP Sync slave-only devices. There must be another module on the network that functions as a master clock. For more information on how to use CIP Sync technology, see the Integrated Architecture and CIP Sync Configuration Application Technique, publication [IA-AT003](#).

I/O modules can be used to capture time stamps. The advantage is that CIP Sync is system-wide, so time stamp values are consistent across all modules in the system.

Alarm Latching

When enabled, Alarm Latching lets you latch a module alarm in the set position once the alarm is triggered. The alarm remains set even if the condition causing it to occur disappears, until the alarm is unlatched.

Alarm latching is available on a per channel basis. You can latch the following alarms:

- Input modules - Process and Rate alarms
- Output modules - Clamp and Rate alarms

For more information on latching alarms on the I/O modules, see [Frequency Input Module Operation on page 35](#).

## Enable Latching

You can enable alarm latching on the Module Properties dialog box *Alarms* category.

For more information on how to use the Module Properties dialog box for standard modules, see [Edit the Module Configuration Common Categories on page 49](#).

For more information on how to use the Module Properties dialog box for safety modules, see [Edit the Module Configuration Common Categories on page 57](#).

## Unlatch Alarms

---

**IMPORTANT** Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

---

Once an alarm is latched, you must manually unlatch it. You can use the module tags to unlatch an alarm. The alarm type determines which module tag to change.

For more information on how to use the module tags, see [Module Tag Definitions on page 79](#).

## Scaling

When you scale a channel, you select two points that represent signal units, that is, a Low Signal and a High Signal. You also select two points that represent engineering units, that is, Low Engineering and High Engineering.

The Low Signal point equates to the Low Engineering point and the High Signal point matches the High Engineering point.

---

**IMPORTANT** In choosing two points for the low and high value of your application, you do not limit the range of the module. The module range remains constant regardless of how you scale it.

---

Scaling lets you configure the module to return data to the controller in signal units or in engineering units (listed as Percent of Full Scale in the Logix Designer application).

The returned value is indicated in the *I.Chxx.Frequency* tag.

You configure Scaling on the Chxx category in the Module Properties dialog box for each module. For more information on using the Module Properties dialog box, see Chapter5, [Configure and Replace Safety I/O Modules on page 55](#).

## Module Accuracy

[Table 6](#) shows the accuracy of the module.

Table 6 - 5094-IJ2I, 5094-IJ2IS, 5094-IJ2IXT, and 5094-IJ2ISXT Accuracy

Frequency Sample Time (ms)	Sampling Accuracy	Time Base Accuracy	Worst Case Total Accuracy	Deviation in Hz Due to Total Accuracy	
				Range (1 Hz...5 kHz)	Full Range (1 Hz...50 kHz)
2	± 0.02%	± 0.01%	± 0.03%	± 0.001...1.5	± 0.001...15
4	± 0.01%	± 0.01%	± 0.02%	± 0.001...1	± 0.001...10
6	± 0.008%	± 0.01%	± 0.018%	± 0.001...0.9	± 0.001...9
10	± 0.004%	± 0.01%	± 0.014%	± 0.001...0.7	± 0.001...7
20	± 0.002%	± 0.01%	± 0.012%	± 0.001...0.6	± 0.001...6
50	± 0.0008%	± 0.01%	± 0.0108%	± 0.001...0.54	± 0.001...5.4
100	± 0.0004%	± 0.01%	± 0.0104%	± 0.001...0.52	± 0.001...5.2
200	± 0.0002%	± 0.01%	± 0.0102%	± 0.001...0.51	± 0.001...5.1
500	± 0.00008%	± 0.01%	± 0.01008%	± 0.001...0.504	± 0.001...5.04
1000	± 0.00004%	± 0.01%	± 0.01004%	± 0.001...0.502	± 0.001...5.02

# Safety Application Suitability Levels

**Applies to these modules:**

5094 Safety I/O Modules

[Table 7](#) describes the safety application suitability levels for a FLEX 5000 I/O safety module.

**Table 7 - Safety Application Suitability for 5094-IJ2IS and 5094-IJ2ISXT Modules**

Suitability Level	Conditions	Notes
Applications that are rated up to, and including, SIL 3, PLe, Cat. 4, as defined in IEC 61508, IEC61551, IEC 62061, and ISO 13849-1	<ul style="list-style-type: none"><li>• Input is 24V DC IEC Type 3 or Magnetic/Inductive and has "Open Wire Detection" enabled.<ul style="list-style-type: none"><li>– use other measures against external wiring faults.</li></ul></li><li>• Input is Vortex Flowmeter<ul style="list-style-type: none"><li>– use other measures against external wiring faults (including open wire fault).</li></ul></li><li>• Use sheathed cable or cable trunk to separate channel wiring to mitigate short-circuit faults.</li></ul>	<p>Consider the following:</p> <ul style="list-style-type: none"><li>• To achieve SIL 3 single-channel, the sensor that is used must be SIL 3 single-channel as well.</li><li>• The safety module provides diagnostics to a specific Suitability Level with conditions. The larger safety system within which the safety module resides can provide the diagnostic necessary to achieve the stated Suitability Level without the conditions imposed by the safety module. To achieve the specific Safety Integrity Level, see <a href="#">Application/Wiring Examples for Safety I/O Modules on page 85</a>.</li></ul>

## Frequency Input Module Operation

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

The FLEX 5000 I/O frequency input standard and safety modules report frequency, rate of change (acceleration) and direction.

The module derives frequency and direction data based on the pulse information received. Pulses are continuously recorded as long as the module receives frequency input data, but the frequency calculation is made only once per the configured frequency sample time.

The module supports:

- Two channels: DC and AC inputs for frequency (A) and direction (B) per channel
- Three input types: 24V DC IEC type 3 inputs, Magnetic inputs, and Vortex inputs

## Frequency Calculation

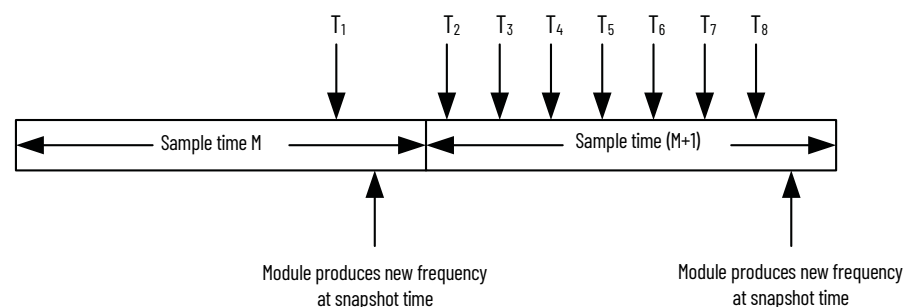
Frequency is determined by a general algorithm that can be modified by two user-defined parameters on the Chxx categories of the Module Properties dialog:

- **Frequency Sample Time:** This is the time that is used to collect the frequency samples before the frequency is calculated. The default is 2 ms, valid values are 2/4/6/10/20/50/100/200/500/1000 ms.
- **Pulses to Average Over:** Select Enable Pulses to Average Over, and enter a value of pulses (2...200, default is 100) to average over for calculating the frequency value.

The time for calculating the frequency is from the last pulse in the previous sampling window.

[Figure 6](#) shows an example frequency calculation. In Sample Time M+1 the calculated frequency in the new module will be  $7/(T_8-T_1)$ .

**Figure 6 - Frequency Calculation**



## Frequency Sample Time

You set the frequency sample time on the Chxx categories in the Module Properties dialog. The pulse information is continuously recorded, and pulses that have been recorded until the frequency sampling time elapses are used for frequency calculation in that module processing loop at the snapshot time. The calculated frequency is sent to the safety controller by the module.

To set the frequency sample time, see [Chxx Category on page 63](#).

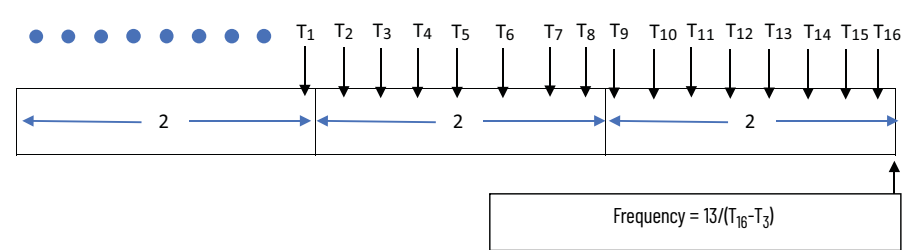
Pulses to Average Over

Pulses to Average Over enables the computation of the frequency of the input signal to be averaged over a specified number of pulses.

When this feature is enabled, the frequency is calculated every module processing loop time of 2 ms using the last recorded Pulses to Average pulses.

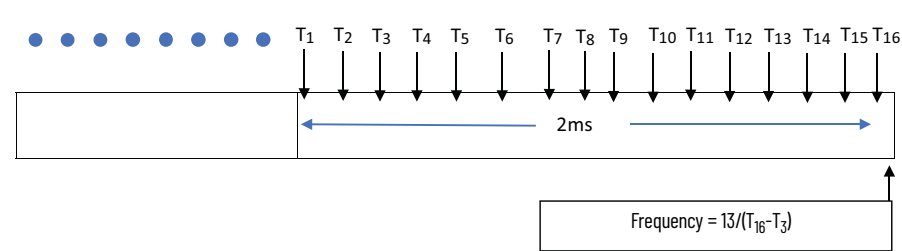
Example: Low input frequency

Assuming Pulses to Average is 13. When input frequency is low, there are fewer than 13 pulses in the 2 ms module processing loop. Some of the pulses from the previous loop are used for frequency calculation.



Example: High input frequency

Assuming Pulses to Average is 13. All 13 pulses are recorded in the current module processing loop.



To enable Pulses to Average Over, see [Chxx Category on page 63](#).

Rate of Change  
(Acceleration)



**ATTENTION:** The maximum rate of change that the 5094-IJ2I and 5094-IJ2IS modules support is 7500 Hz/s. You must not use the module in applications that has a greater maximum rate of change.

The module can provide rate of change information and frequency information simultaneously. Rate of change is reported in the module input tag *I.Chxx.Accel*.

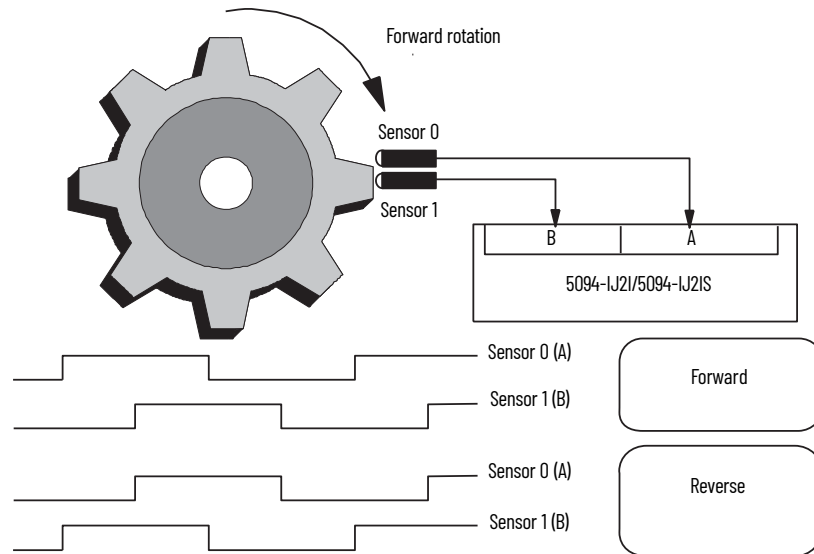
For more information on how to use the module tags, see Appendix B, [Module Tag Definitions on page 79](#).

## Direction

The input channel enables directional functionality for Magnetic Pickup and 24V DC IEC Type 3 inputs. It is not available for Vortex Flowmeter inputs.

Direction detection is accomplished by using the A input, B input, and two sensors. See [Direction Detection - Principle of Operation](#).

### Direction Detection - Principle of Operation



The input channel determines and reports direction via the module input tag *I.Chxx.Direction* if:

- Enable Direction Detection is selected on the Chxx category on the Module Properties dialog (see [Chxx Category on page 63](#)), and,
- The input frequency  $\leq 25$  KHz.

The quality of the direction data is indicated via the module input tag *I.Chxx.DirectionValid*.

### For Safety Modules Only

The channel reports fault in direction detection via the module input tag *I.Chxx.DirectionFault*. When this happens, one possible reason can be the sensors placement can be adjusted for better phase difference.



**ATTENTION:** Use *I.Chxx.Direction* only after evaluating *I.Chxx.DirectionValid*. The input channel stops direction detection and maintains the direction data for frequency above 25 KHz.

For more information on how to use the module tags, see [Module Tag Definitions on page 79](#).

## Discrepancy Limit

### Applies to these modules:

5094 Safety I/O Modules

At low frequencies, the low signal level (such as from Magnetic Pickup input) can cause a difference in the frequency that is calculated in the 1oo2 I/O circuitry of the channel. To handle this discrepancy, the safety I/O module provides allowable difference in frequency in the 1oo2 I/O circuitry to be specified via the module output tag *O.Chxx.DiscrepancyLimit*.

The Discrepancy Limit can be specified between 50...500 Hz. If the value set by the output tag is outside the allowable range, it is clipped to the minimum (50 Hz) or maximum (500 Hz).

When the difference in the frequency that is calculated in the 1oo2 I/O circuitry is greater than the specified limit, a fault is reported via the module input tag *I.Chxx.DiscrepancyFault*. See [Recoverable and Unrecoverable Faults on page 73](#).

A Discrepancy Limit of 500 Hz, for example, implies that when a channel's 1002 main path measures a value of X and diagnostic path measures a value of X+500, no channel fault is declared. The value that the channel's main path measures is then reported in the module input tag *I.Chxx.Frequency*.



**ATTENTION:** You must consider the impact of Discrepancy Limit to the safety function and employ other methods if necessary.

Missing Pulse Detection

Missing Pulse Detection detects when there are no new pulses coming in from the input signal. When no new pulse is detected for a specified duration of time since the last pulse was recorded, an alarm is generated via the module input tag *I.Chxx.MissingPulseAlarm*.

The duration of the missing pulse detection time is a function of 'Sample Time Multiplier' or 'Startup Sample Time Multiplier', depending on the module output tag *O.Chxx.Startup*, and the 'Frequency Sample Time'.

[Table 8](#) and [Table 9](#) illustrate the missing pulse detection time.

Table 8 - When *O.Chxx.Startup*=0

Sample Time Multiplier	Missing Pulse Alarm Detection Time Based On Sample Time Multiplier
None	2 seconds
2	Frequency Sample Time * 2
8	Frequency Sample Time * 8
32	Frequency Sample Time * 32

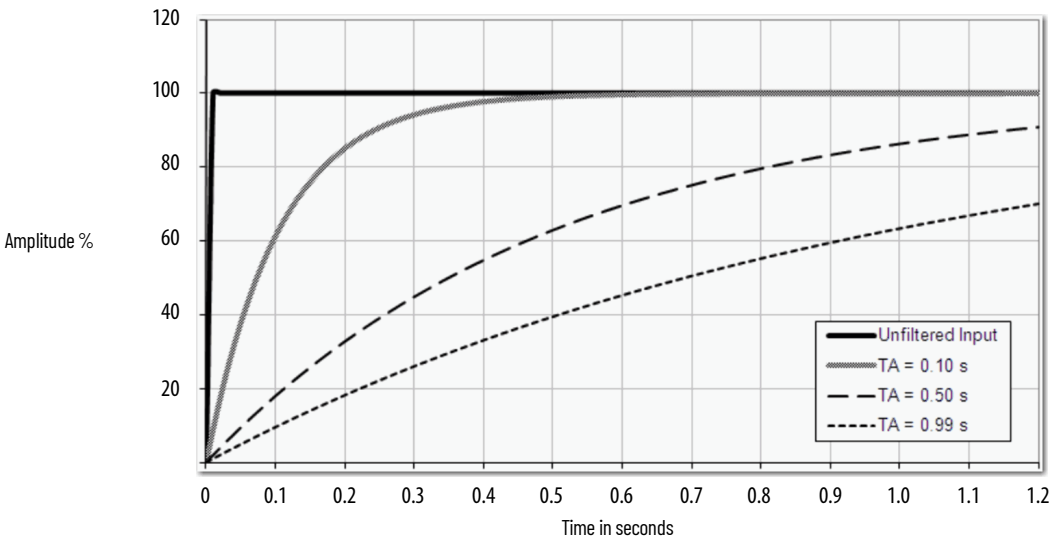
Table 9 - When *O.Chxx.Startup*=1

Startup Sample Time Multiplier	Missing Pulse Alarm Detection Time Based On Startup Sample Time Multiplier
None	2 seconds
2	(Frequency Sample Time * 2) + 2 Seconds
8	(Frequency Sample Time * 8) + 2 Seconds
32	(Frequency Sample Time * 32) + 2 Seconds

To set Missing Pulse Detection, see [Chxx Category on page 63](#).

Digital Filter

The Digital Filter is a first-order lag filter. It smooths input data noise transients on **each input channel**. This value specifies the time constant for a digital, first-order lag filter on the input. The input is 63% of the step change after the first-time constant elapses.



The filter value is specified in units of milliseconds. A value of 0 (zero) disables the filter. The digital filter equation is as shown.

$$Y_n = Y_{n-1} + \frac{\Delta t * (X_n - Y_{n-1})}{\Delta t + TA}$$

$Y_n$  = Present Output, Filtered Peak Voltage (PV)

$Y_{n-1}$  = Previous Output, Filtered PV

$\Delta t$  = Module Channel Update Time (seconds)

TA = Digital Filter time Constant (seconds)

$X_n$  = Present Input, Unfiltered PV

---

**IMPORTANT** Remember the following:

- Digital Filter input data changes only when new input data is collected.
  - If an Overrange or Underrange condition is detected before the Digital Filter input data is collected, the condition is indicated immediately. An immediate indication also applies to the Fault data for the input.
- 

To select a digital filter for the module, see [Chxx Category on page 63](#).

## Process Alarms

Process alarms alert you when the module has exceeded configured high or low limits for **each channel**. The following are the user-configurable, alarm trigger points:

- High High
- High
- Low
- Low Low

To use the Process Alarms, you must complete the following tasks:

- Enable the alarms
- Configure the trigger points

### *Enable Process Alarms*

When the module tags are created, the Process Alarm tags are disabled by default.

To enable Process Alarms for the module, see [Alarms Category on page 63](#).

### *Configure Alarm Trigger Points*

You must configure the Process Alarm with a trigger point. That is, set values in Engineering Units that, once the signal reaches the value, the alarm is triggered.

Process Alarm trigger points are related to the Scaling parameters that you configure for the channel. The Engineering Units that are established in Scaling determine the Process Alarm trigger points. That is, the available trigger point values can be in signal units or engineering units.

For example, consider a channel that uses signal range of 0...50,000 Hz, and scales the High and Low Engineering values of 100 and 0, respectively. The available Process Alarm values range from 0...100.

In this case, if the High Limit alarm is set to 50 EU, when the input signal reaches 25,000 Hz, the High Limit alarm is set. The alarm is set because Scaling was configured for Percentage of Full Scale and a signal value of 25,000 is 50% of the full scale of engineering units.

To set the Process Alarm trigger points for the module, see [Alarms Category on page 63](#).

### Latch Alarms

Check Latch Process Alarms on the *Alarms* category to latch the process alarms. To latch Process Alarms on the module, see [Alarms Category on page 63](#).

### Unlatch Alarms

---

**IMPORTANT** Before you unlatch an alarm, make sure the condition that triggered the alarm no longer exists.

---

Once an alarm is latched, you must manually unlatch it. To unlatch an alarm, change the output tag for that alarm.

For example, change the *O.Chxx.LAlarmUnlatch* tag for the low alarm that you want to unlatch from 0 to 1.

---

**IMPORTANT** After an alarm is unlatched, change the tag back from 1 to 0. You must change the tag from 0 to 1 to unlatch the alarm each time it is triggered. If you do not change the tag back to 0 and the alarm is latched again in the future, the alarm remains latched despite the Unlatch tag value being 1.

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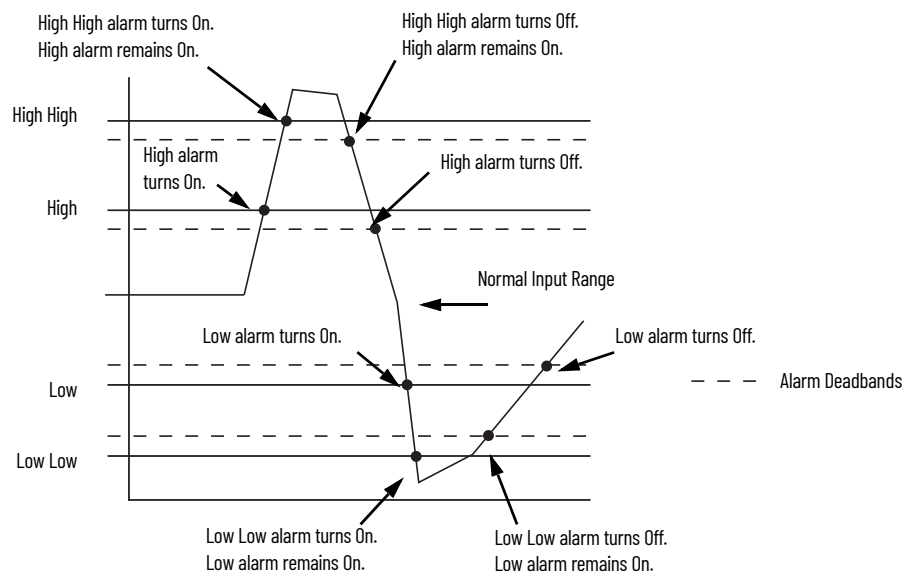
For more information on how to use the module tags, see Appendix B, [Module Tag Definitions on page 79](#).

### Alarm Deadband

You can configure an alarm deadband to work with these alarms. The deadband lets the process alarm status bit remain set, despite the alarm condition disappearing, as long as the input data remains within the deadband of the process alarm.

The following graphic shows input data that sets each of the four alarms at some point during module operation. In this example, latching is disabled; therefore, each alarm turns Off when the condition that caused it to set ceases to exist.

**Figure 7 - Alarm Deadband Alarm Settings**



To set the Alarm Deadband on the module, see [Alarms Category on page 63](#).

## Rate Alarms

The input channel reports acceleration and deceleration rate alarms via the module input tags *I.Chxx.AccelAlarm* and *I.Chxx.DecelAlarm* when each alarm is enabled and triggered.

To enable the Rate Alarm latching on the module, see [Alarms Category on page 63](#).

Once the Rate Alarms are latched, you can change the *O.Chxx.AccelAlarmUnlatch* and *O.Chxx.DecelAlarmUnlatch* tag from 0 to 1 to unlatch.

You can unlatch the alarm at any point in the system operation. If you change the unlatch tag to 1 and the triggering condition remains, the alarm is immediately latched again.

We suggest that you unlatch the Rate Alarm only after the rate of change between input samples has returned below the Rate Alarm Limit value.

For more information on how to use the module tags, see Appendix B, [Module Tag Definitions on page 79](#).

## Underrange/Overrange/ Critical Frequency Detection

Underrange, overrange, and critical frequency detection detect when the module is operating beyond limits of its input.

The module can read input outside its supported low and high frequency. Only when the signal is beyond a threshold is an underrange, overrange or critical frequency condition detected and indicated.

[Table 10](#) lists the thresholds when the module detects an Underrange, overrange, and critical frequency condition.

**Table 10 - Input Signal Threshold Frequencies**

Underrange Threshold	Overrange Threshold	Critical Frequency Threshold
< 1 Hz	> 55 KHz	> 60 KHz

Underrange/overrange/critical frequency conditions are indicated when the following tags change to 1:

- *I.Chxx.Underrange*
- *I.Chxx.Overrange*
- *I.Chxx.CriticalFrequency*

For more information on how to use the module tags, see Appendix B, [Module Tag Definitions on page 79](#).

## Open Wire Detection

Open Wire Detection detects when a wire is disconnected from the magnetic and DC IEC Type 3 inputs.

You must enable Open Wire Detection in the Chxx categories on the Module Properties dialog, see [Chxx Category on page 63](#).

The input channel reports an open-wire condition for the frequency input via *I.Chxx.DataAOpenWire*, or direction input via *I.Chxx.DataBOpenWire* when Open Wire Detection is enabled.

For a 24V DC IEC Type 3 input, the input channel reports an open-wire condition when the input loop current drops below 0.4 mA.

Enable Direction Detection must be enabled for Direction open-wire detection.

---

**IMPORTANT** The Disable All Alarms feature, does not disable the Open Wire Detection feature. The Disable All Alarms feature disables all alarms on the module. The Open Wire Detection feature is not an alarm. It is an indicator that a wire has been disconnected from the channel but does not trigger an alarm. To disable the Open Wire Detection feature, you must clear the Open Wire Detection checkbox in the module configuration.

---

## Over Temperature Detection

---

### Applies to these modules:

5094 Safety I/O Modules

---

The Over Temperature Detection feature indicates that the temperature of the conditions within which the module is operating are higher than the module operating limits.

When an Over Temperature condition exists, *OverTemperature* is set to 1 in the diagnostic assembly.

## Critical Temperature Detection

---

### Applies to these modules:

5094 Safety I/O Modules

---

The Critical Temperature Detection feature indicates that the temperature of the conditions within which the module is operating is outside the module operating limits and can result in an immediate module failure.

A critical temperature condition exists, *CriticalTemperature* is set to 1 in the diagnostic assembly.

## Safety Input Fault Reset

---

### Applies to these modules:

5094 Safety I/O Modules

---

The safety I/O channel supports a module-level user-configurable 'Latch Fault until reset via output tag' mode and recovers from these faults:

- Field Power Off Detection
- Input Open Wire Fault
- Discrepancy Fault
- Direction Fault

### Latch fault until reset via output tag' mode is Enabled

When Latch fault... mode is Enabled, the I/O channel holds safety input fault indications until it checks that the fault is removed. If the fault is removed, the channel clears the fault status only upon detecting that the *ResetFault* in its consume assembly channel sees a rising edge.

### 'Latch fault until reset via output tag' mode is Disabled

When Latch Fault... mode is Disabled (default), the I/O channel holds safety input fault indications for 1 second until it checks if the fault is removed. If the fault is removed, the channel clears the fault status. If not, the channel continues to check if the fault is removed.



#### ATTENTION:

- When disabled, the safe state could be exited once the fault is no longer present. 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.
  - When an overrange frequency detection occurs, the safe state could be exited once the fault is no longer present, as it is not subjected to 'Latch fault until reset via output tag'
-

## Fault and Status Reporting

The FLEX 5000 I/O frequency input standard and safety modules send fault and status data with channel data to the owner-controller and listening controllers. The data is returned via module tags that you can monitor in your Studio 5000 Logix Designer application.

With some exceptions, the module provides the fault and data status in a channel-centric format. The tag names in the following table that include **Chxx** represent channel-centric data. The **xx** represents channel number.

Table 11 - 5094-IJ2I and 5094-IJ2IS Module Input Tags

Type	Tag Name	Event
Fault	ConnectionFaulted <sup>(1)</sup>	The owner-controller loses its connection to the module.
	Chxx.Fault	The channel frequency quality is bad.
	Chxx.DataAOpenWire Chxx.DataBOpenWire	The signal wire is disconnected from the channel. Open Wire detection method: For 24V DC IEC Type 3, this is when the input loop current drops below 0.4 mA.
	Chxx.FieldPowerOff	Field power is not present on the channel.
	Chxx.CriticalFrequency	The input channel reports a critical frequency fault.
	Chxx.DirectionFault	Direction fault is present at the channel - <b>For safety modules only.</b>
	Chxx.Ovrerrange	The channel frequency is above the absolute maximum for this channel.
	Chxx.DiscrepancyFault	The input channel reports a discrepancy fault in safety I/O modules - <b>For safety modules only.</b>
Status	RunMode <sup>(1)</sup>	The module is in Run Mode.
	DiagnosticActive	Indicates if any diagnostics are active or if the prognostics threshold is reached.
	DiagnosticSequenceCount	A counter that increments when a diagnostic condition occurs or goes away. The counter is a rolling counter that skips 0 on rollovers.
	Chxx.Uncertain	The channel frequency can be imperfect but it is not known to what degree of inaccuracy.
	Chxx.DataA	Indicates if the channel data state is low or high.
	Chxx.DataB	Indicates if the channel data state is low or high.
	Chxx.Status	Indicates if the status of the channel is good or causing a fault - <b>For safety modules only.</b>
	Chxx.Underrange	Indicates if the channel data is beneath the underrange threshold or not.
	Chxx.LLAlarm	The following conditions exist: <ul style="list-style-type: none"> <li>The <i>I.Chxx.Frequency</i> tag value is less than the <i>C.Chxx.LLAlarmLimit</i> tag value or the alarm is latched.</li> <li>The <i>O.Chxx.LLAlarmEn</i> tag is set.</li> <li>Alarms are enabled for the channel.</li> </ul>
	Chxx.LAlarm	The following conditions exist: <ul style="list-style-type: none"> <li>The <i>I.Chxx.Frequency</i> tag value is less than the <i>C.Chxx.LAlarmLimit</i> tag value or the alarm is latched.</li> <li>The <i>O.Chxx.LAlarmEn</i> tag is set.</li> <li>Alarms are enabled for the channel.</li> </ul>
	Chxx.HAlarm	The following conditions exist: <ul style="list-style-type: none"> <li>The <i>I.Chxx.Frequency</i> tag value is greater than the <i>C.Chxx.HAlarmLimit</i> tag value or the alarm is latched.</li> <li>The <i>O.Chxx.HAlarmEn</i> tag is set.</li> <li>Alarms are enabled for the channel.</li> </ul>
	Chxx.HHAlarm	The following conditions exist: <ul style="list-style-type: none"> <li>The <i>I.Chxx.Frequency</i> tag value is greater than the <i>C.Chxx.HHAlarmLimit</i> tag value or the alarm is latched.</li> <li>The <i>O.Chxx.HHAlarmEn</i> tag is set.</li> <li>Alarms are enabled for the channel.</li> </ul>
	Chxx.AccelAlarm	The following conditions exist: <ul style="list-style-type: none"> <li>the change between consecutive channel samples divided by the period between when the samples were taken exceeds the <i>C.Chxx.AccelAlarmLimit</i> tag value or the alarm is latched.</li> <li>The <i>O.Chxx.AccelAlarmEn</i> tag is set.</li> <li>Alarms are enabled for the channel.</li> </ul>

Table 11 - 5094-IJ2I and 5094-IJ2IS Module Input Tags (Continued)

Type	Tag Name	Event
Status	Chxx.DecelAlarm	The following conditions exist: <ul style="list-style-type: none"><li>the change between consecutive channel samples divided by the period between when the samples were taken exceeds the <i>C.Chxx.AccelAlarmLimit</i> tag value or the alarm is latched.</li><li>The <i>O.Chxx.DecelAlarmEn</i> tag is set.</li><li>Alarms are enabled for the channel.</li></ul>
	Chxx.MissingPulseAlarm	The input channel reports missing pulse. The period of a pulse was greater than the missing pulse timeout.
	Chxx.Frequency	The channel frequency in scaled Engineering Units.
	Chxx.Accel	Indicates the channel-calculated acceleration value.
	Chxx.Direction	The input channel determines and reports direction.
	Chxx.DirectionValid	Indicates if the direction data is valid.
	Chxx.RollingTimestamp	A continuously running, 15-bit timer that counts in milliseconds and is not related to CIP Sync. Whenever a module scans its channels, it records the value of RollingTimestamp then. The controller program uses the last two rolling timestamp values to calculate the amount of time between the samples.

(1) This tag provides module-wide data and affects all channels simultaneously.

## Configure Standard I/O Modules

---

**Applies to these modules:**

---

5094 Standard I/O Modules

---

This chapter describes how to configure FLEX 5000 I/O standard modules in the Studio 5000 Logix Designer application project.

---

**IMPORTANT** You must use the Studio 5000 Logix Designer application, version 34 or greater with the standard modules.

---

This chapter does not explain the user-configurable parameters, or corresponding module features, in your Studio 5000 Logix Designer application project.

For detailed information about module features, see the following:

- [FLEX 5000 Frequency Input Module Operation in a Logix 5000 Control System on page 11](#)
- [Common FLEX 5000 I/O Features in the Frequency Input Modules on page 29](#)
- [Frequency Input Module Operation on page 35](#)

### Before You Begin

You must complete the following tasks before you can configure the module:

1. Create a Studio 5000 Logix Designer application project.
2. Add a FLEX 5000 I/O EtherNet/IP adapter to the project.

For more information on how to add a FLEX 5000 EtherNet/IP adapter to a Studio 5000 Logix Designer application project, see the FLEX 5000 EtherNet/IP Adapter User Manual, publication [5094-UM005](#).

Once the project is created and, the adapter is added, you can create a new module in the Studio 5000 Logix Designer application project.

### Create a New Module

I/O modules are installed in a system that includes a FLEX 5000 EtherNet/IP adapter that connects to an EtherNet/IP network. You can create a new FLEX 5000 I/O standard module using one of the following methods to add modules to the project.

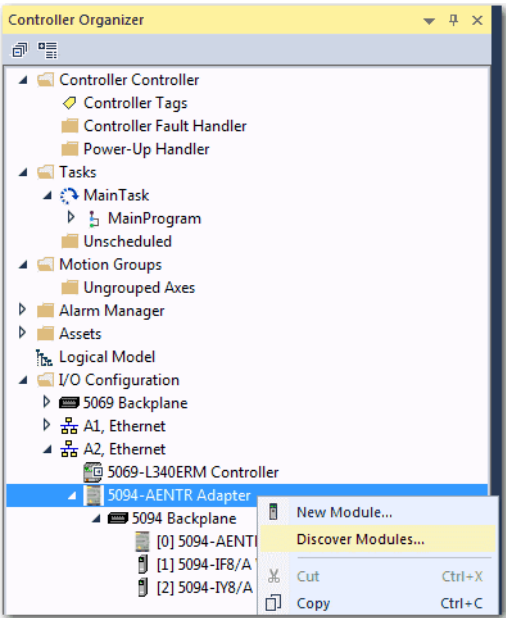
- Discover Modules
- New Module

### Discover Modules

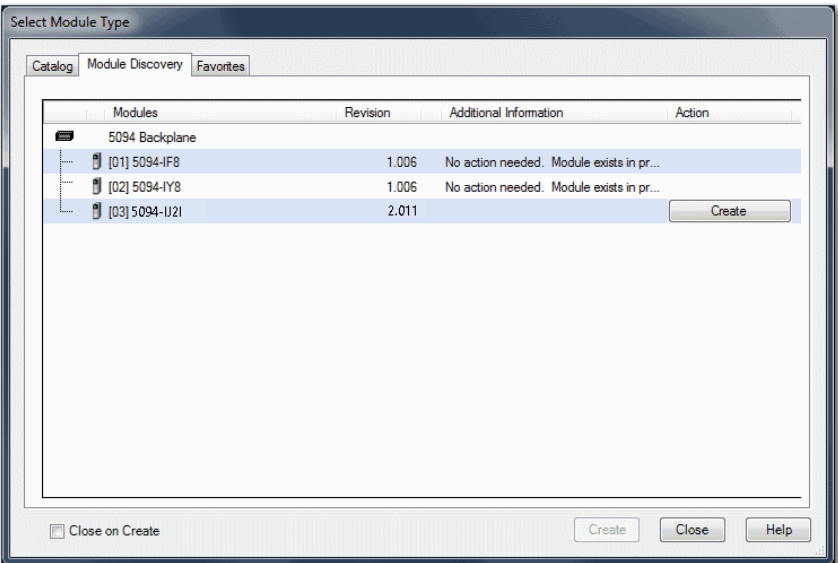
To use the Discover Modules method with FLEX 5000 I/O modules, complete these steps.

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

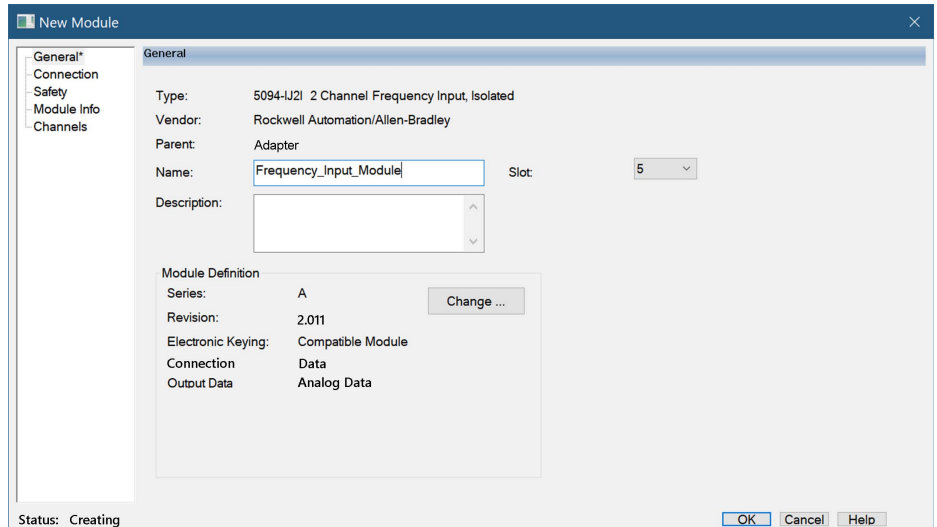
The Studio 5000 Logix Designer application automatically detects available modules that are connected to the backplane.



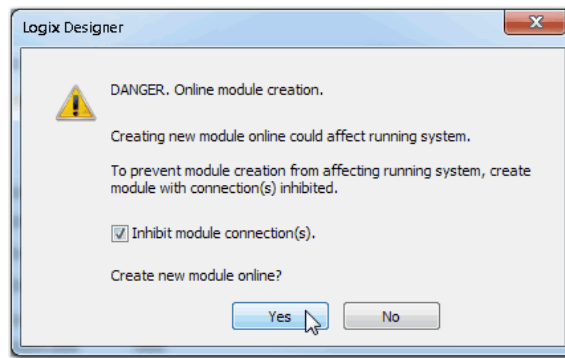
3. At the Select Module Type window, select Create to add the discovered module to your project.



4. At the New Module window, configure the module properties and select OK.



5. At the warning dialog box, make sure that Inhibit module connection is selected and select Yes.




---

**IMPORTANT** When you inhibit the connection to the module to make configuration changes, you must uninhibit the connection after applying the changes.

---

6. Close the Select Module Type dialog box.

To add additional I/O modules with this method, complete one of the following:

- If you cleared the Close on Create checkbox when you created the first I/O module, repeat steps [3...4](#).
- If you did not clear the Close on Create checkbox when you created the first I/O module, repeat steps [2...6](#).

## New Module

To create a new FLEX 5000 I/O module, complete these steps.

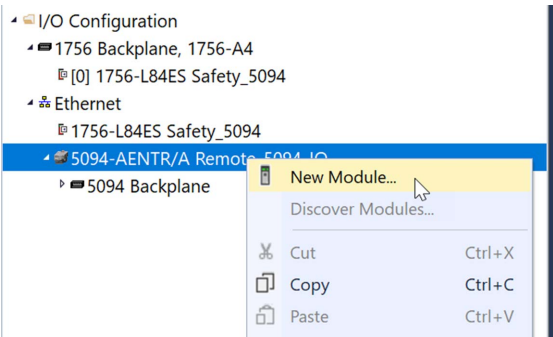


This example shows how to add an I/O module when the Studio 5000 Logix Designer application project is offline.

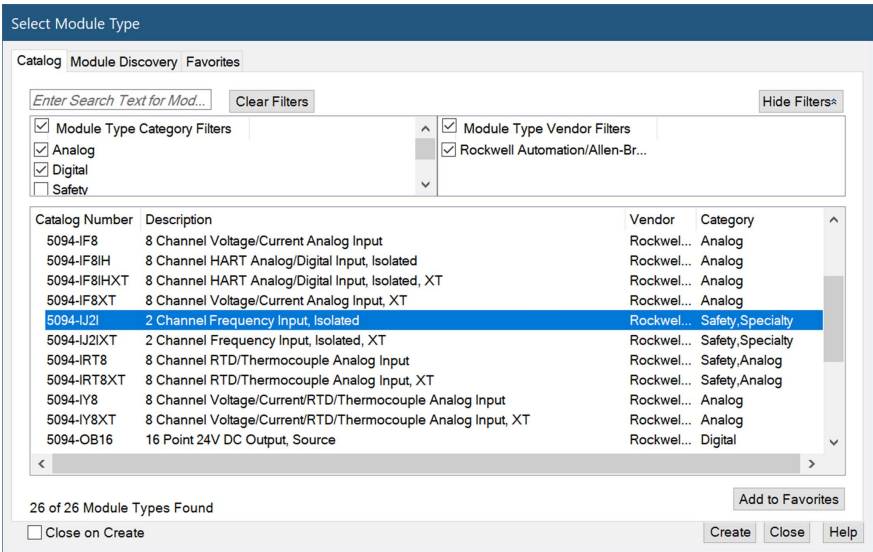
You can add new modules when the project is online, if desired. In this case, the steps are similar to the steps described in [Discover Modules on page 45](#). One exception is that, in step 1, you select New Module instead of Discover Modules.

1. Add a FLEX 5000 EtherNet/IP adapter to the project.  
This example uses a 5094-AENTR or 5094-AEN2TR adapter.

2. Right-click the FLEX 5000 EtherNet/IP adapter and select New Module.

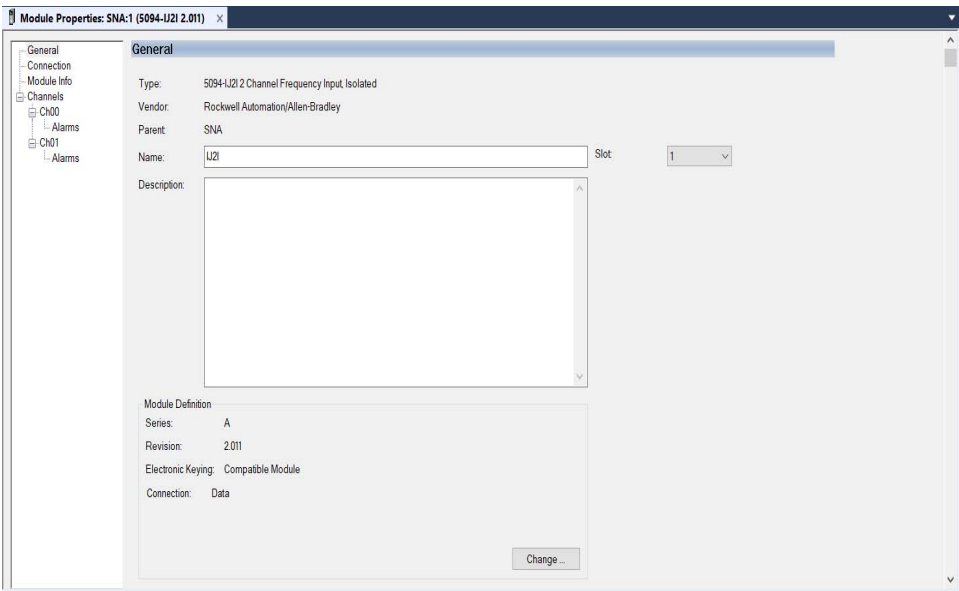


3. Select the module and select Create.



The New Module dialog box appears with a list of categories on the left side. The number and type of categories varies by module type.

4. You can select OK to use the default configuration as shown or edit the module configuration. The rest of this chapter describes how to edit module configuration categories.



## Edit the Module Configuration Common Categories

To add additional I/O modules with this method, complete one of the following:

- If you cleared the Close on Create checkbox when you created the first I/O module, repeat steps [3...4](#).
- If you did not clear the Close on Create checkbox when you created the first I/O module, repeat steps [2...4](#).

You select the category names in the New Module dialog box to view and change the configuration parameters. Before you edit the module configuration, consider the following:

- This chapter shows how to edit configuration when you add the module to the Studio 5000 Logix Designer application project.

If you access the module configuration after it is added to the project, the dialog box is named Module Properties. The same categories are displayed as the categories displayed on the New Module dialog box.

### General Category

The General category appears first when you create a module. The parameters in this category are the same for all FLEX 5000 I/O modules.

You use this category to complete the following tasks:

- Name the module.
- Assign a slot number (required).
- Describe the module.
- Access the Module Definition.

### Module Definition

Module Definition parameters are available on the General view of the Module Properties dialog box in the Logix Designer application project.

The screenshot shows the 'Module Definition' dialog box. It has a title bar with the text 'Module Definition' and a close button. The dialog contains the following fields and controls:

- Series:** A dropdown menu with 'A' selected.
- Revision:** A dropdown menu with '2' selected, followed by a text box containing '011'.
- Electronic Keying:** A dropdown menu with 'Compatible Module' selected.
- Connection:** A dropdown menu with 'Data' selected.

At the bottom of the dialog are three buttons: 'OK', 'Cancel', and 'Help'.

[Table 12 on page 50](#) describes the parameters that are available on the Module Definition dialog box.

Table 12 - Module Definition Parameters

Parameter	Definition	Available Choices
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 the following: <ul style="list-style-type: none"> <li>• <a href="#">Electronic Keying on page 31</a>.</li> <li>• Electronic Keying in Logix 5000 Control Systems Application Technique, publication <a href="#">LOGIX-AT001</a>.</li> </ul>	<ul style="list-style-type: none"> <li>• Exact Match</li> <li>• Compatible Module</li> <li>• Disable Keying</li> </ul>
Connection	Determines the following for the module type that you configure: <ul style="list-style-type: none"> <li>• Available configuration parameters.</li> <li>• Data type transferred between the module and the controller.</li> <li>• Which tags are generated when configuration is complete.</li> </ul>	<ul style="list-style-type: none"> <li>• Data</li> <li>• Listen Only</li> </ul>

## Connection Category

The Connection category lets you complete the following tasks:

- Set the RPI rate. For more information on the RPI, see [Data Types Available with FLEX 5000 I/O Standard Modules on page 22](#).
- Set the connection type to use on the EtherNet/IP network.
- For more information on unicast and multicast connections, see the FLEX 5000 EtherNet/IP Adapter User Manual, publication [5094-UM005](#).
- Before you inhibit the module, make sure that you are aware of the impact it has on your application. For more information on inhibiting the module, see [Module Inhibiting on page 31](#).
- Enable Automatic Diagnostics.

The screenshot shows the 'Module Properties' dialog box with the 'Connection' tab selected. The left sidebar contains links for General, Connection, Module Info, and Channels. The main area displays a table for connection settings:

Name	Requested Packet Interval (RPI) (ms)	Connection over EtherNet/IP
Data	80.0 ± 0.2 - 750.0	Unicast

Below the table, there are three checkboxes:

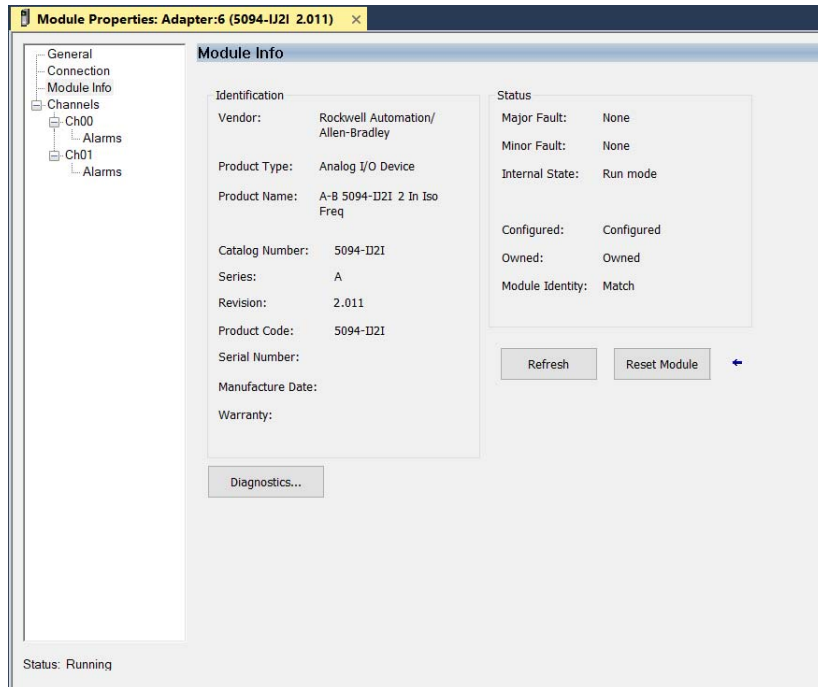
- ☐ Inhibit Module
- ☐ Major Fault On Controller If Connection Fails While in Run Mode
- ☒ Enable Automatic Diagnostics

A blue tooltip icon is next to the 'Enable Automatic Diagnostics' checkbox, with text: 'Disabling this feature will prevent this device from publishing diagnostics to FactoryTalk Alarms and'. Below these options is a 'Module Fault' section with a text area.

## Module Info Category

The Module Info category displays module and status information about the module when the project is online. You can use this category to complete the following:

- Determine the identity of the module.
- Access module diagnostics.
- Refresh the data on the screen.
- Reset the module.



## Edit Module Channels Configuration

In addition to the General, Connection, and Module Info categories, the following categories are available when you configure the module:

- [Channels Category](#)

---

**IMPORTANT** If you use the Listen Only connection type, the Channels Category does not appear.

---

## Channels Category

The Channels category shows an overview of the configuration values for all module channels. The values for each parameter indicate how that particular channel is configured on that channel's category.

Channel	Disable Channel	Sensor Type	Threshold Voltage	Digital Filter(ms)	Open Wire Detection	Disable Alarms	Diagnostics
0	<input checked="" type="checkbox"/>	Magnetic / Inductive Pickup	500 mV AC	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...
1	<input checked="" type="checkbox"/>	Magnetic / Inductive Pickup	500 mV AC	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...

**IMPORTANT** You can edit the fields on the Channels category dialog box. We recommend that you change channel configuration on the specific channel categories as described in the rest of this section. Use this view to monitor configuration for all channels on the module.

For information on the configuration options, select Help to open the online help.

## Chxx Category

The Chxx category, where xx represents the channel number, shows the configuration options available for the channel. The Scaling and Filter options correspond to the input type and range for the channel.

**Ch00**

☒ Disable Channel

Sensor Type: Magnetic / Inductive Pickup

Threshold Voltage: 500 mV AC

☐ Enable Direction Detection

Frequency Sample Time: 2 ms

☐ Enable Pulses to Average Over

Pulses to Average: 100

**Missing Pulse Detection**

Sample Time Multiplier: None

Detection Time: 2000 ms

Startup Sample Time Multiplier: None

Startup Detection Time: 2000 ms

Diagnostics...

**Scaling**

Engineering Units: Hz

High Signal: 50000.0 Hz = High Engineering: 50000.0 Hz

Low Signal: 0.0 Hz = Low Engineering: 0.0 Hz

**Filters**

Digital Filter: 0 ms

**Diagnostics**

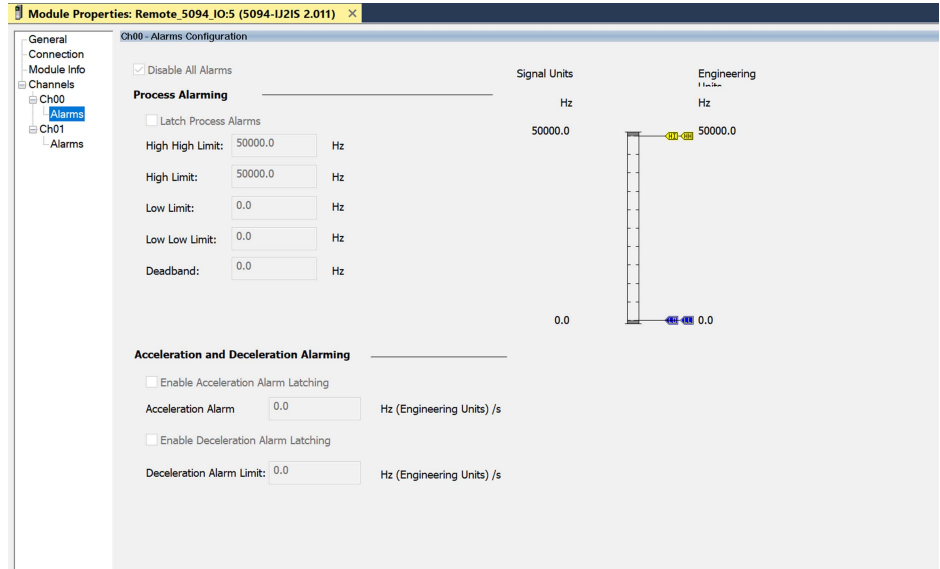
☒ Open Wire Detection

If desired, you can disable the channel on this dialog box.

For information on the configuration options, select Help to open the online help.

## Alarms Category

Each channel on the module has an Alarms category with which it is associated. The Signal Units correspond to the input type and range for the channel.



If desired, you can disable alarms on this dialog box.

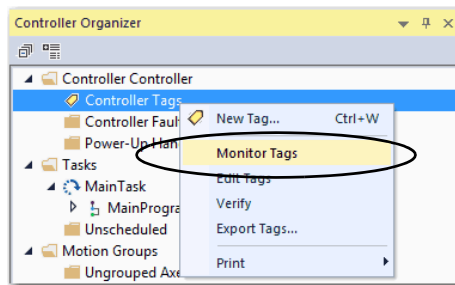
For information on the configuration options, select Help to open the online help.

## View 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 the following steps to access the module tags.

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



The Controller Tags dialog box appears with data.

2. To view module tags, click the ► symbols.

Controller Tags - Safety_5094(controller)						
Scope: Safety_5094 Show: All Tags						
Name	Value	Style	Data Type	Class	Description	Constant
Remote_5094_IO:5:O	{...}		AB:5000...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:O.Ch01	{...}		CHANN...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:O.Ch00	{...}		CHANN...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I	{...}		AB:5000...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.RunMode	0 Decimal		BOOL	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.DiagnosticSequenceCount	0 Decimal		SINT	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.DiagnosticActive	0 Decimal		BOOL	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.ConnectionFaulted	1 Decimal		BOOL	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.Ch01	{...}		CHANN...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.Ch00	{...}		CHANN...	Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.Ch00	{...}		CHANN...	Safety		<input type="checkbox"/>

For more information on module tags, see [Module Tag Definitions on page 79](#).

**Notes:**

## Configure and Replace Safety I/O Modules

---

### Applies to these modules:

---

5094 Safety I/O Modules

---

This chapter describes how to configure FLEX 5000 I/O safety modules in the Studio 5000 Logix Designer application project. Sections that pertain only to safety or only to standard modules are labeled under the headings.

---

**IMPORTANT** You must use the Studio 5000 Logix Designer application, version 33 or greater with the modules.

---

This chapter does not explain the user-configurable parameters, or corresponding module features, in your Studio 5000 Logix Designer application project.

For detailed information about module features, see the following:

- [FLEX 5000 Frequency Input Module Operation in a Logix 5000 Control System on page 11](#)
- [Common FLEX 5000 I/O Features in the Frequency Input Modules on page 29](#)
- [Frequency Input Module Operation on page 35](#)

---

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

You must configure each channel that is used in a safety application.

---

### Before You Begin

You must complete the following tasks before you can configure the module:

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

For more information on how to add a FLEX 5000 EtherNet/IP adapter to a Studio 5000 Logix Designer application project, see the FLEX 5000 EtherNet/IP Adapter User Manual, publication [5094-UM005](#).

Once the project is created and, if necessary, the adapter is added, you can create a new module in the Logix Designer application project.

### Create a New Module

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

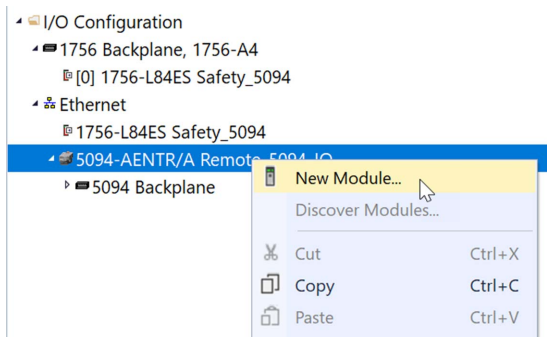
You can create a new FLEX 5000 I/O safety module. I/O modules are installed in a system that includes a FLEX 5000 EtherNet/IP adapter that connects to an EtherNet/IP network.

### New I/O Module

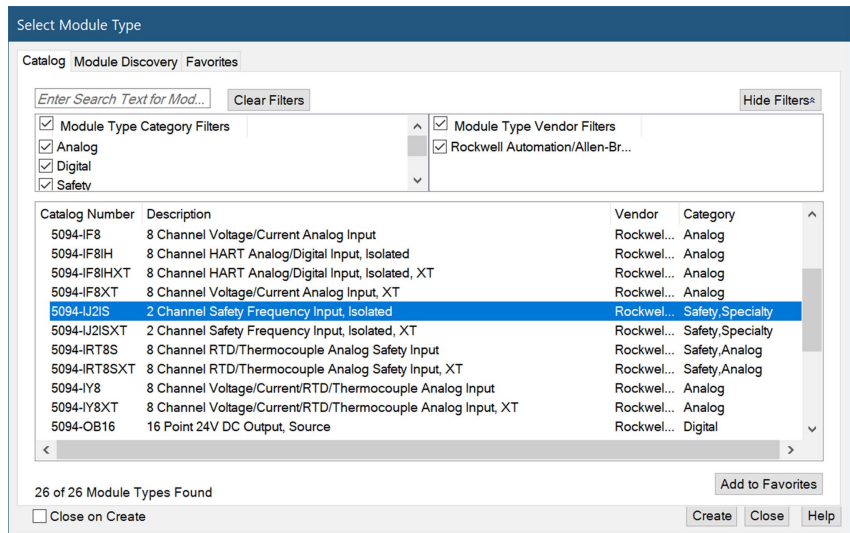
To create a new FLEX 5000 I/O safety module, complete these steps.

1. Add a FLEX 5000 EtherNet/IP adapter to the project.  
This example uses a 5094-AENTR or 5094-AEN2TR adapter.

- Right-click the FLEX 5000 EtherNet/IP adapter and select New Module.

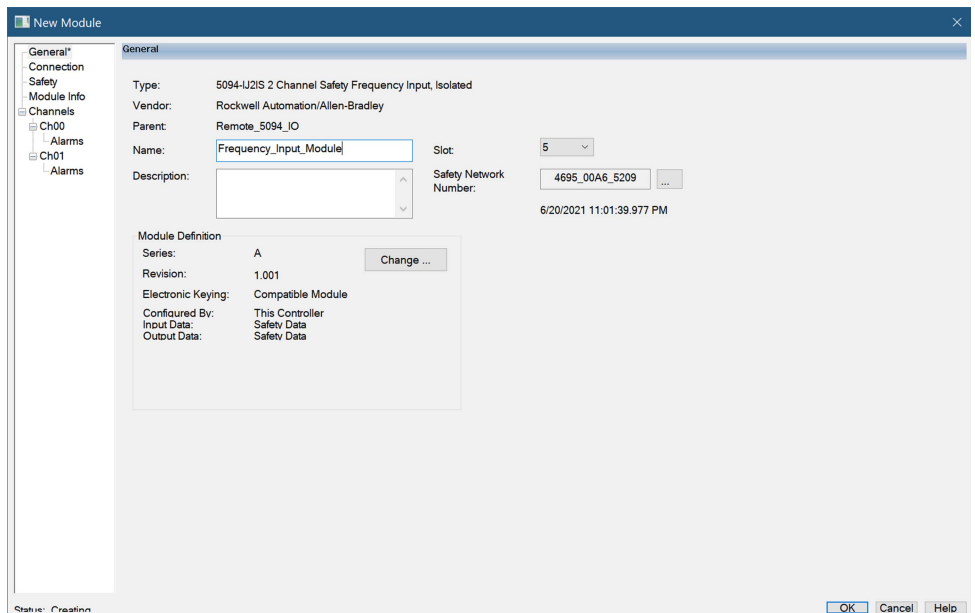


- Select the module and select Create.



The New Module dialog box appears with a list of categories on the left side. The number and type of categories varies by module type.

- You can select OK to use the default configuration as shown or edit the module configuration. The rest of this chapter describes how to edit module configuration categories.



## Edit the Module Configuration Common Categories

To add additional I/O modules with this method, complete one of the following:

- If you cleared the Close on Create checkbox when you created the first I/O module, repeat steps [3...4](#).
- If you did not clear the Close on Create checkbox when you created the first I/O module, repeat steps [2...4](#).

You select the category names in the New Module dialog box to view and change the configuration parameters. Before you edit the module configuration, consider the following:

- This chapter shows how to edit configuration when you add the module to the Logix Designer application project.

If you access the module configuration after it is added to the project, the dialog box is named Module Properties. The same categories are displayed as the categories displayed on the New Module dialog box.

### General Category

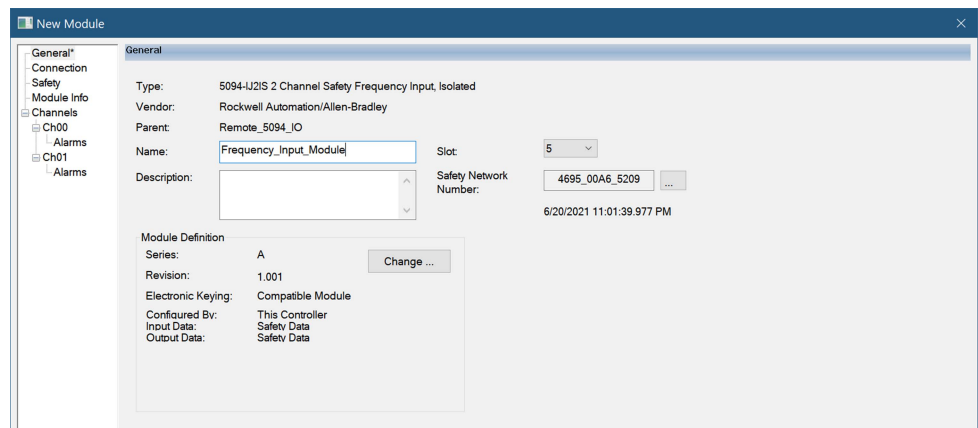
The General category appears first when you create a module. The parameters in this category are the same for all FLEX 5000 I/O modules.

You use this category to complete the following tasks:

- Name the module.
- Assign a node number.
- Describe the module.
- Access the Module Definition.

### Safety Network Number

The Logix Designer application automatically assigns a Safety Network Number (SNN) to FLEX 5000 I/O safety modules as they are added to the project.



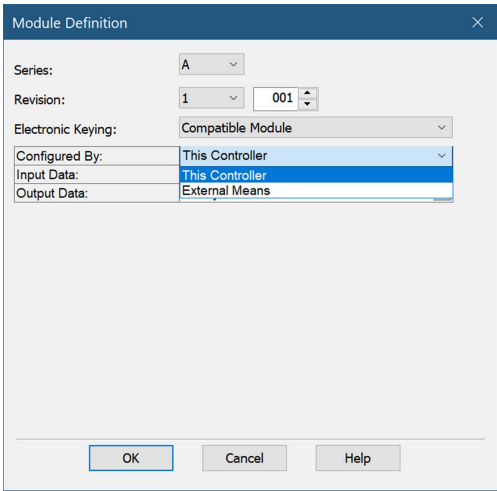
The SNN is a time-based number that uniquely identifies subnets across all networks in the safety system. All FLEX 5000 I/O safety modules in a same system use the same SNN and are automatically assigned the same SNN by default.

The Logix Designer application assigns an SNN to the first safety module that is added to a remote system. The application assigns the same SNN to additional safety 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 Reference Manual, publication [1756-RM012](#).

## Module Definition

Module Definition parameters are available on the General tab of the Module Properties dialog box in the Logix Designer application project.



[Table 13](#) describes the parameters that are available on the Module Definition dialog box.

**Table 13 - Module Definition Parameters**

Parameter	Definition	Available Choices
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 the following: <ul style="list-style-type: none"><li>• <a href="#">Electronic Keying on page 31</a></li><li>• Electronic Keying in Logix 5000 Control Systems Application Technique, publication <a href="#">LOGIX-AT001</a></li></ul>	<ul style="list-style-type: none"><li>• Exact Match</li><li>• Compatible Module</li></ul>
Configured By	Determines the following for the module type that you configure: <ul style="list-style-type: none"><li>• Which controller tags are generated when configuration is complete</li></ul>	<ul style="list-style-type: none"><li>• This Controller</li><li>• External Means<sup>(1)</sup></li></ul>
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.	Safety data
Output Data	Determines what type of output data is exchanged between the module and the controller. The available choices are dictated by the Configured By parameter choice.	Safety data

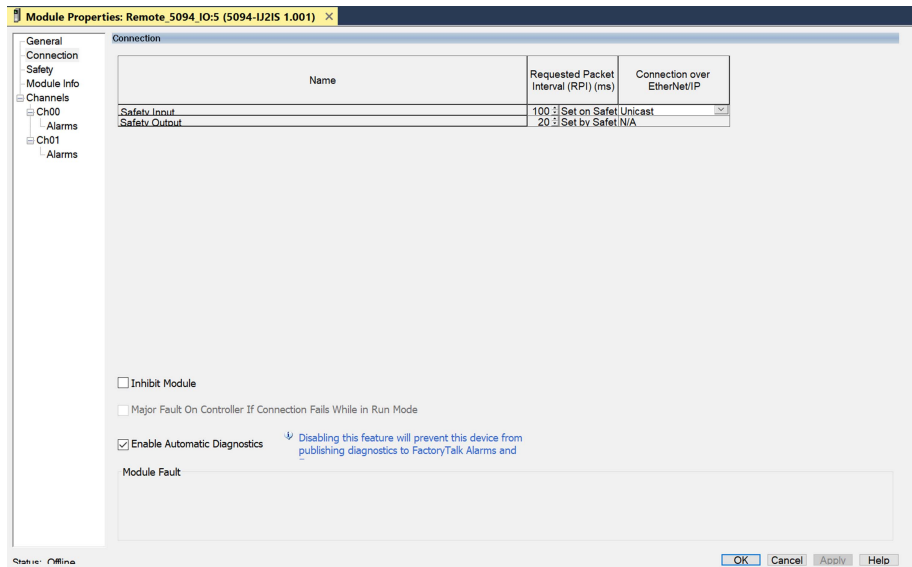
(1) Controller and module establish communication without the controller sending any configuration or output data to the module. A full input data connection is established but depends on the connection between the owner-controller and the module.

## Connection Category

The Connection category lets you 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 on inhibiting the module, see [Module Inhibiting on page 31](#).

**IMPORTANT** Unlike FLEX 5000 standard I/O modules, you cannot set the RPI for FLEX 5000 I/O safety modules on the Connections category. For FLEX 5000 I/O safety modules, you set the RPI on the Safety category.



### Connection Over the EtherNet/IP Network

Remote FLEX 5000 I/O safety modules support the Connection over EtherNet/IP parameter.

- With safety input data, you can select Unicast or Multicast.
- With safety output data, you **must** select Unicast.

For more information on unicast and multicast connections, see the FLEX 5000 EtherNet/IP Adapter User Manual, publication [5094-UM005](#).

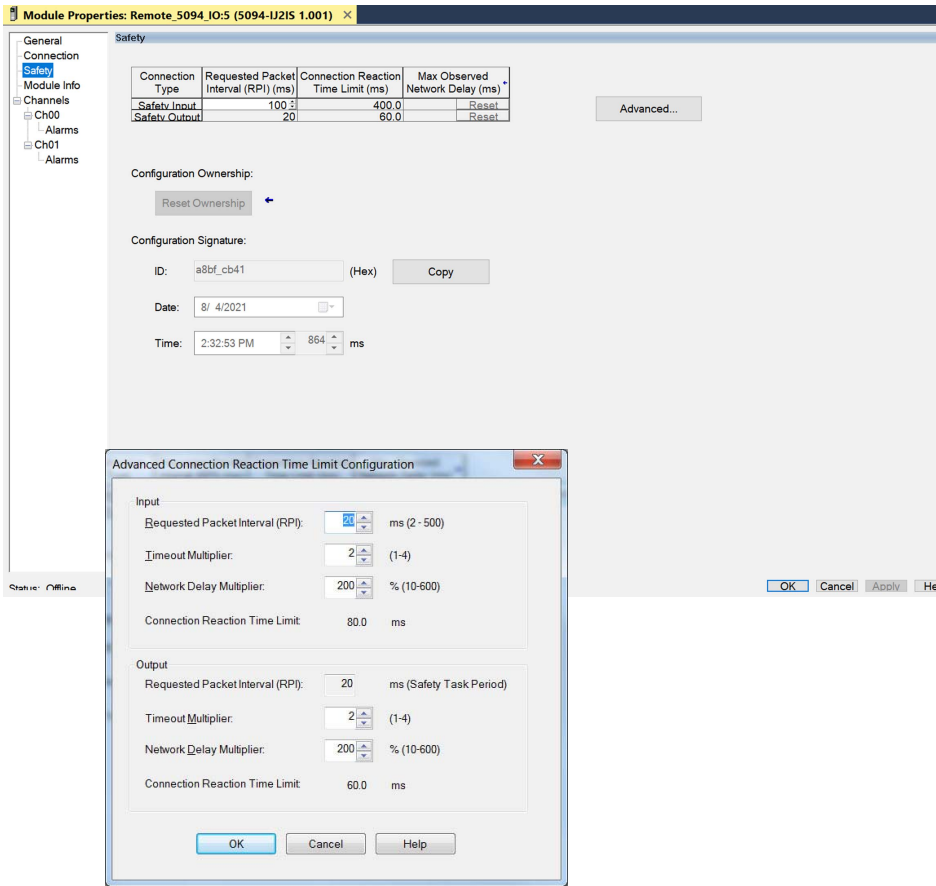
## Safety Category

The Safety category lets you set the RPI rate.

To change the Connection Reaction Time Limit configuration, select Advanced.

**IMPORTANT**

Remember, the Safety Task period determines the 5094-IJ2IS module safety output connection RPI.

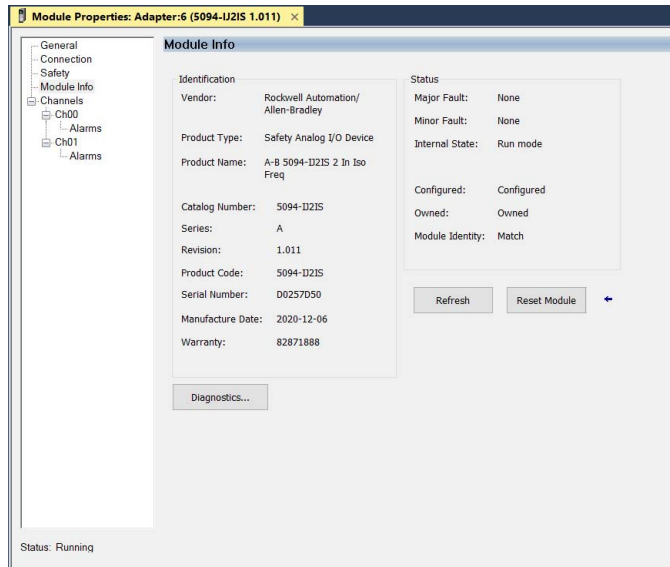


For more information on the RPI and the Connection Reaction Time Limit parameters, see [Requested Packet Interval on page 25](#).

## Module Info Category

The Module Info category displays module and status information about the module when the project is online. You can use this category to complete the following:

- Determine the identity of the module.
- Access module diagnostics.
- Refresh the data on the screen.
- Reset the module.



## Edit Module Channels Configuration

In addition to the General, Connection, and Module Info categories, the following categories are available when you configure the module:

- [Channels Category](#)

---

**IMPORTANT** If you use the Listen Only connection type, the Channels Category does not appear.

---

## Channels Category

The Channels category shows an overview of the configuration values for all module channels. The values for each parameter indicate how that particular channel is configured on that channel's category.

Module Properties: Remote\_5094\_IO:5 (5094-IJ2IS 1.001) X

General

Connection

Safety

Module Info

Channels

Ch00

Alarms

Ch01

Alarms

Channels

	Channel	Disable Channel	Sensor Type	Threshold Voltage	Digital Filter(ms)	Open Wire Detection	Disable Alarms	Diagnostics
	0	<input checked="" type="checkbox"/>	Magnetic / Inductive Pickup	500 mV AC	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...
	1	<input checked="" type="checkbox"/>	Magnetic / Inductive Pickup	500 mV AC	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>	...

☐ Latch fault until reset via output tag

State: Offline

OK Cancel Apply H

IMPORTANT

You can edit the fields on the Channels category dialog box.

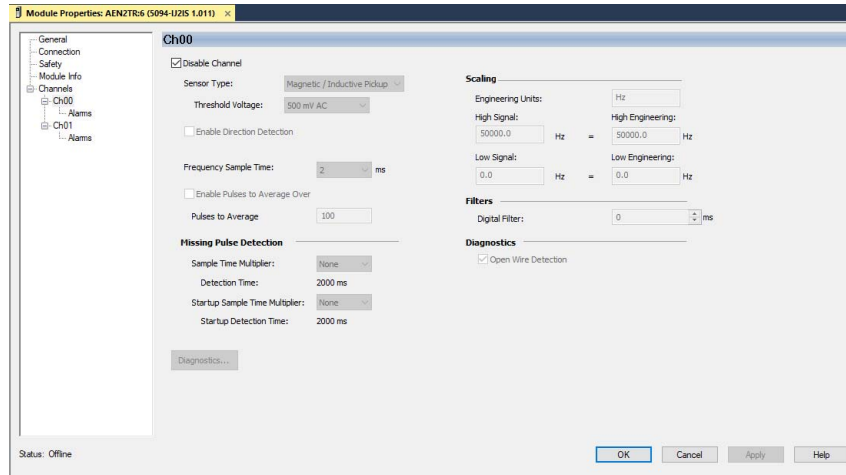
We recommend that you change channel configuration on the specific channel categories as described in the rest of this section.

Use this view to monitor configuration for all channels on the module.

For information on the configuration options, select Help to open the online help.

## Chxx Category

The Chxx category, where xx represents the channel number, shows the configuration options available for the channel. The Scaling and Filter options correspond to the input type and range for the channel.

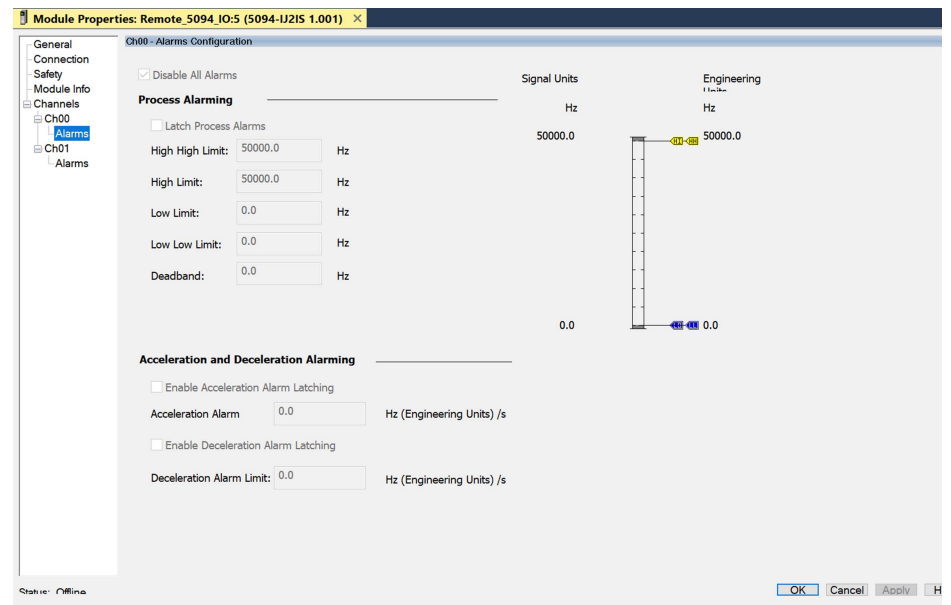


If desired, you can disable the channel on this dialog box.

For information on the configuration options, select Help to open the online help.

## Alarms Category

Each channel on the module has an Alarms category with which it is associated. The Signal Units correspond to the input type and range for the channel.



If desired, you can disable alarms on this dialog box.

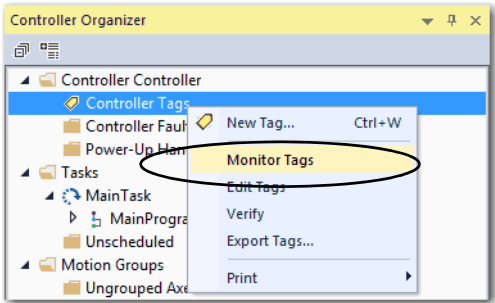
For information on the configuration options, select Help to open the online help.

# View Module Tags

When you create a module, the 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 the following steps to access the module tags.

- 5. In the Controller Organizer, right-click Controller Tags and select Monitor Tags.



The Controller Tags dialog box appears with data.

- 6. To view module tags, select the ► symbols.

A screenshot of the 'Controller Tags - Safety\_5094(controller)' dialog box. The 'Scope' is set to 'Safety\_5094' and 'Show' is set to 'All Tags'. The table below lists various tags with columns for Name, Value, Style, Data Type Class, Description, and Constant.

Name	Value	Style	Data Type Class	Description	Constant
Remote_5094_IO:5:O		(...)	AB:5000...Safety		<input type="checkbox"/>
Remote_5094_IO:5:O.Ch01		(...)	CHANN... Safety		
Remote_5094_IO:5:O.Ch00		(...)	CHANN... Safety		
Remote_5094_IO:5:I		(...)	AB:5000...Safety		<input type="checkbox"/>
Remote_5094_IO:5:I.RunMode	0	Decimal	BOOL Safety		
Remote_5094_IO:5:I.DiagnosticSequenceCount	0	Decimal	SINT Safety		
Remote_5094_IO:5:I.DiagnosticActive	0	Decimal	BOOL Safety		
Remote_5094_IO:5:I.ConnectionFaulted	1	Decimal	BOOL Safety		
Remote_5094_IO:5:I.Ch01		(...)	CHANN... Safety		
Remote_5094_IO:5:I.Ch00		(...)	CHANN... Safety		
Remote_5094_IO:4:O		(...)	AB:5000...Safety		<input type="checkbox"/>

For more information on module tags, see [Module Tag Definitions on page 79](#).

# Replace a Module

Replacing a safety module that sits on a CIP Safety network is more complicated than replacing 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 also to devices on the subnet.

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

However, each FLEX 5000 I/O safety modules require a unique identifier within the same subnet. A *DeviceID* is used to identify uniquely each safety module. The SNN and module slot number constitute the *DeviceID* of the safety module.

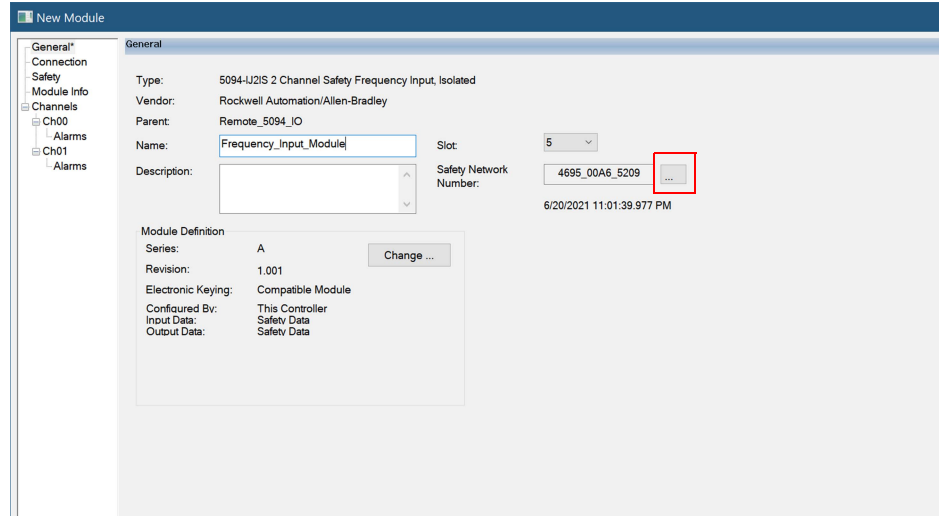
## Setting the SNN Manually

The SNN is used to provide integrity on the initial download to a FLEX 5000 I/O safety module.

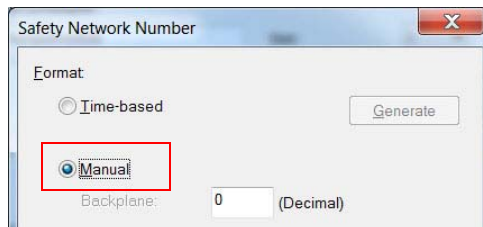
If a safety signature exists, the FLEX 5000 I/O safety module must have a *DeviceID* that matches the module in the safety controller project, before it can receive its configuration.

To maintain integrity, the module SNN must be set manually.

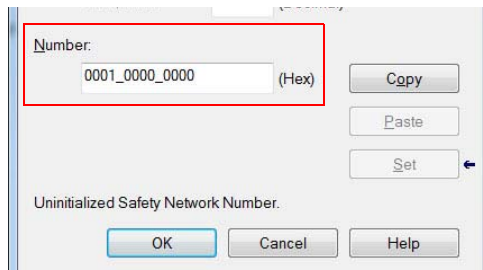
1. On the General category of the Module Properties dialog box, select the ellipsis next to the Safety Network Number.



2. On the Safety Network Number dialog box, select Manual.



3. Enter the SNN in the Number field and select OK.



4. On the Module Properties dialog box, select OK.

## Reset to Out-of-Box Configuration

When the Logix Designer application is online, the Safety tab of the Module Properties dialog box displays the current configuration ownership. When the opened project owns the configuration, Local is displayed.

When a second device owns the configuration, Remote is displayed, along with the SNN, and node address or slot number of the configuration owner. Communication error is displayed if the module read fails.

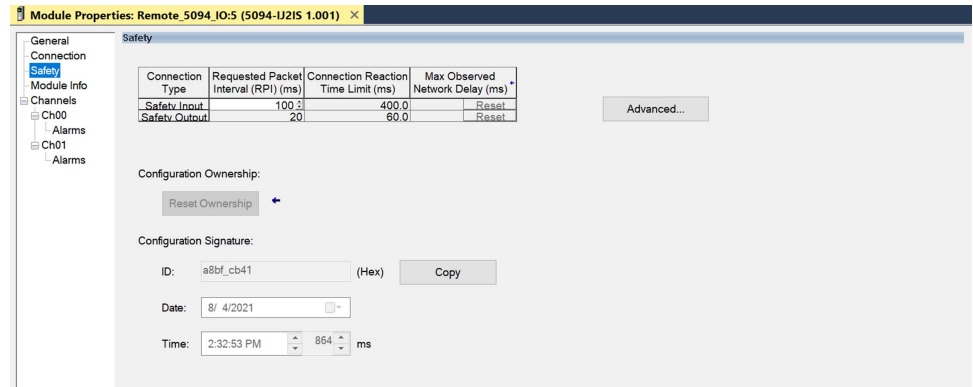
If the connection is Local, you must inhibit the module connection before you reset ownership.

To inhibit the module, follow these steps.

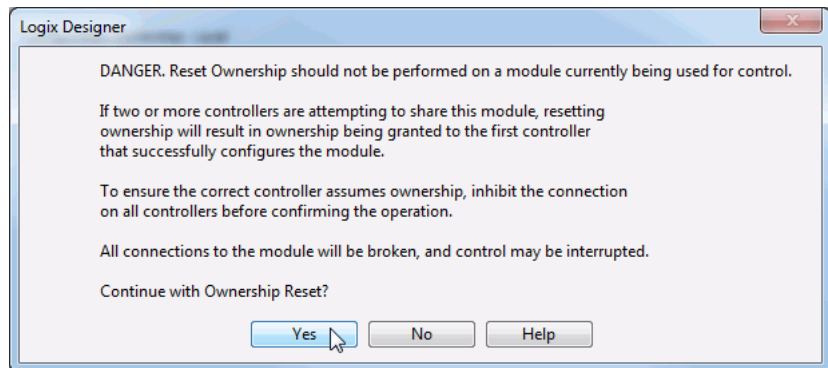
1. Right-click the module and select Properties.
2. On the Connection tab, select Inhibit module.
3. Select Apply and then OK.

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

4. Right-click the module and select Properties.
5. On the Safety tab, select Reset Ownership.



6. When a dialog box appears asking if you want to continue with the reset, read it and select Yes.



## Replace a Module in a Logix 5000 System

Consider the following conditions before you replace a FLEX 5000 I/O safety 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 use the Configure Only When No Safety Signature Exists feature.
- 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 use the Configure Always feature.

### *Replacement with 'Configure Only When No Safety Signature Exists' Enabled*

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 to replace a FLEX 5000 I/O safety module.

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

**Table 14 - Replace a FLEX 5000 I/O Safety Module**

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 <a href="#">Setting the SNN Manually on page 64</a> .
Yes	Different SNN from original safety task configuration	1. <a href="#">Reset to Out-of-Box Configuration on page 65</a> . 2. <a href="#">Setting the SNN Manually on page 64</a> .
No		1. <a href="#">Reset to Out-of-Box Configuration on page 65</a> . 2. Follow your company-prescribed procedures to functionally test the replaced I/O device and system and to authorize the system for use.

Replacement with 'Configured Always' Enabled



**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 following this replacement procedure.

- When the 'Configure Always' feature is enabled, the controller automatically checks for and connects to a replacement module that meets the following 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 for 'Configure Always', follow the appropriate steps to replace a FLEX 5000 I/O safety module.

1. Remove the old I/O module and install the new module.

If	Then
The module is in out-of-box condition	Go to <a href="#">step 6</a> . No action is needed for the controller to take ownership of the module.
An SNN mismatch error occurs	Go to the next step to reset the module to out-of-box condition.

2. Right-click your I/O module and select Properties.
3. Select the Safety tab.
4. Select Reset Ownership.
5. Select OK.
6. Follow your company-prescribed procedures to functionally test the replaced I/O module and system and to authorize the system for use.

## Notes:



## Troubleshoot Your Module

The I/O modules use the following status indicators:

- SA Power Indicator
- Module Status Indicator
- I/O Status Indicator

### Applies to these modules:

5094 Standard I/O Modules

5094 Safety I/O Modules

## SA Power Indicator

[Table 15](#) describes the SA power indicator on the I/O modules.

Table 15 - SA Power Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Complete the following actions: 1. Confirm that the system is powered. 2. Confirm that the module is installed properly.
Steady green	There is SA power to the module.	None
Steady red	There is no SA power to the module. SA power voltage is not in the valid range (18...32V).	Complete the following actions: 1. Confirm that the SA power wiring on the terminal base is installed properly. 2. Check the following: <ul style="list-style-type: none"> <li>- Confirm that there is sufficient voltage that is supplied to the module.</li> <li>- If an external power supply is used, confirm that the power supply is turned on.</li> <li>- If power is daisy chained from the previous terminal base, confirm that the wiring on the previous terminal base is installed properly.</li> <li>- Check that the SA voltage is in the correct range (18...32V).</li> </ul>

## Module Status Indicator

[Table 16](#) describes the module status indicator on the I/O modules.

Table 16 - Module Status Indicator

Indicator State	Description	Recommended Action
Off	The module is not powered.	Complete the following actions: 1. Confirm that the system is powered. 2. 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 the following conditions exists: <ul style="list-style-type: none"> <li>• The module has powered up successfully.</li> <li>• The module does not have a connection to the controller.</li> </ul> No connection can result from missing, incomplete, or incorrect module configuration. <b>For safety modules only</b> - A connection can be established with the controller, but initial time coordination exchange is not complete.	Complete the following actions: <ul style="list-style-type: none"> <li>• Troubleshoot your Studio 5000 Logix Designer application to determine what is preventing a connection from the module to the controller and correct the issue.</li> <li>• Confirm that the system conditions require the controller to be in Remote Run mode or Run mode, transition the controller to one of those modes.</li> </ul>
Steady red	The module experienced a nonrecoverable fault.	Complete the following actions: 1. Cycle power to the module. 2. If the status indicator remains in the steady red state, replace the module.

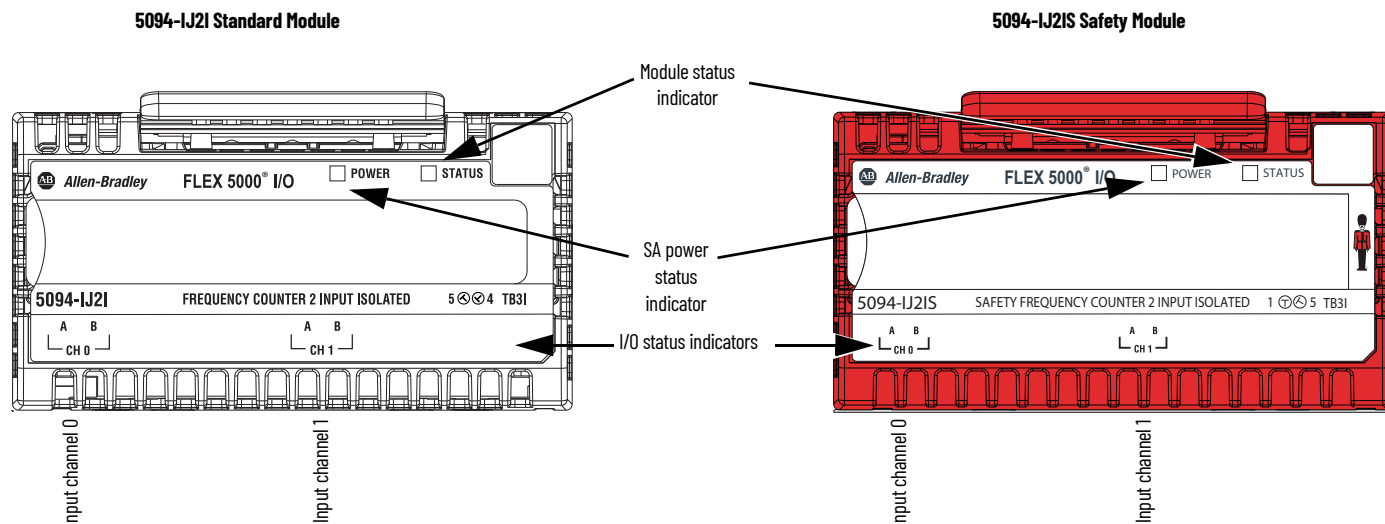
Table 16 - Module Status Indicator (Continued)

Indicator State	Description	Recommended Action
Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> <li>A module firmware update is in progress.</li> <li>A module firmware update attempt failed.</li> <li>The device has experienced a recoverable fault.</li> <li>A connection to the module has timed out.</li> </ul>	Complete one of the following: <ul style="list-style-type: none"> <li>Let the firmware update progress complete.</li> <li>Reattempt a firmware update after one fails.</li> <li>Use the Studio 5000 Logix Designer application to determine the cause of the module fault. The Connection and Module Info categories of the modules configuration indicate the fault type. To clear a recoverable fault, complete one of the following: <ul style="list-style-type: none"> <li>Cycle module power.</li> <li>Select Reset Module in the Logix Designer application via the Module Info category of the Module Properties dialog box. If the fault does not clear after cycling power and selecting Reset Module, contact Rockwell Automation Technical Support.</li> </ul> </li> <li>Use the Logix Designer application to determine if a connection has timed out. The Connection category in the Module Properties for the module indicates the module state, including if a connection has timed out. If a connection has timed out, determine the cause and correct it. For example, a cable failure can cause a connection timeout.</li> </ul>
Flashing red/green	<b>For safety modules only</b> - This pattern indicates that a UNID for the safety device needs to be configured.	Commission the UNID on the device. For more information on the UNID, see the GuardLogix 5580 and Compact GuardLogix 5380 Controller Systems Reference Manual, publication <a href="#">1756-RM012</a> .

## Module Status Indicators

[Figure](#) shows the standard and safety module status indicators.

Figure 8 - FLEX 5000 I/O Standard and Safety Input Module Status Indicators



[Table 17](#) describes the I/O status indicators.

Table 17 - Standard and Safety Module Status Indicators

Indicator State	Description	Recommended Action
Off	One of the following conditions exists: <ul style="list-style-type: none"> <li>The module is not powered.</li> <li>The module is powered but no connection from the controller to module has been established.</li> <li>The module is powered, but the input channel is disabled.</li> </ul>	Complete one of the following: <ul style="list-style-type: none"> <li>None - If your application does not use the input channel.</li> <li>If you expect the module to be powered but it is not, complete the following: <ul style="list-style-type: none"> <li>Confirm that the system is powered.</li> <li>Confirm that the module is installed properly.</li> </ul> </li> <li>If the module is powered but the channel is not operating as expected, use the Logix Designer application to confirm that the channel is not disabled and has a connection to the controller. The Connection category in the Module Properties for the module indicates if the module is running or faulted. If the module is faulted, the Connection category indicates error information affecting the state of the module.</li> </ul>
Steady yellow	The input channel is operating normally.	None

Table 17 - Standard and Safety Module Status Indicators (Continued)

Indicator State	Description	Recommended Action
Steady red	An issue has occurred that is internal to the module. The following are example issues that can cause the status indicator to be steady red: <ul style="list-style-type: none"> <li>The module has experienced a fault.</li> <li>There is no SA power to the module, or SA power voltage is not in the valid range (18...32V).</li> </ul>	Complete one of the following: <ul style="list-style-type: none"> <li>If the indicator is in the steady red state following the initial power-up sequence and remains in that state, replace the module.</li> <li>If the indicator remains in the steady red state after you cycle power, replace the module.</li> <li>To return the module to the specified operating temperature range, check the temperature at the module installation location and lower it if necessary.</li> <li>Check the wiring at the SA terminals to make sure that 24V DC power is present and in the valid range (18...32V). If 24V DC power is not present, troubleshoot the SA power connection.</li> <li>Module specifications are available in the FLEX 5000 Modules Specifications Technical Data, publication <a href="#">5094-TD001</a>.</li> </ul>
Flashing red	One of the following conditions exists: <ul style="list-style-type: none"> <li>The input signal is overrange. The signal range is set in your Logix Designer application project.</li> <li>An Open Wire condition, that is, a wire is disconnected from the input channel.</li> <li>The A and B inputs are not maintaining the correct phase difference.</li> <li>A Discrepancy fault condition - <b>For safety modules only.</b></li> <li>A Critical Frequency condition.</li> <li>A Direction Fault condition - <b>For safety modules only.</b></li> </ul>	Complete one of the following: <ul style="list-style-type: none"> <li>Check the input signal to determine if it is overrange. If so, make changes to return the input signal to within the range limits.</li> <li>Check the wiring at the input channel. If necessary, reconnect the wire.</li> <li>Check the A and B input sensor fixture is maintaining close to 90 degrees phase difference for direction detection.</li> <li>The input channel reports a discrepancy fault when there is discrepancy in the I/O circuitry greater than the Discrepancy Limit.</li> </ul>

## Recoverable and Unrecoverable Faults

List of recoverable and nonrecoverable faults for the standard and safety modules:

Fault Type	Hz	Recoverable	Note
Overrange of frequency	> 55000	Y	Autorecovery as soon as possible.
Critical Frequency	> 60000	Y	Only recoverable by <i>CriticalFrequencyUnlatch</i> (on rising edge)
DataA Open Wire	—	Y	Recovery behavior depends on <i>FaultResetMode</i> <sup>(1)(2)</sup>
DataB Open Wire	—	Y	Recovery behavior depends on <i>FaultResetMode</i> <sup>(1)(2)</sup>
Field Power Off	—	Y	Recovery behavior depends on <i>FaultResetMode</i> <sup>(1)(2)</sup>
Discrepancy Fault <sup>(2)</sup>	—	Y	Recovery behavior depends on <i>FaultResetMode</i> <sup>(1)(2)</sup>
Direction Fault <sup>(2)</sup>	—	Y	Recovery behavior depends on <i>FaultResetMode</i> <sup>(1)(2)</sup>
Other faults	—	N	Module power cycle required.

(1) For more information, see [Safety Input Fault Reset on page 42](#).

(2) For safety modules only.

## Use the Studio 5000 Logix Designer Application for Troubleshooting

In addition to the status indicator display on the module, the Studio 5000 Logix Designer application indicates the presence of fault conditions.

Fault conditions are reported in the following ways:

- [Warning Signal in the I/O Configuration Tree](#)
- [Status and Fault Information in the Module Properties Categories](#)
- [Studio 5000 Logix Designer Application Tag Editor](#)

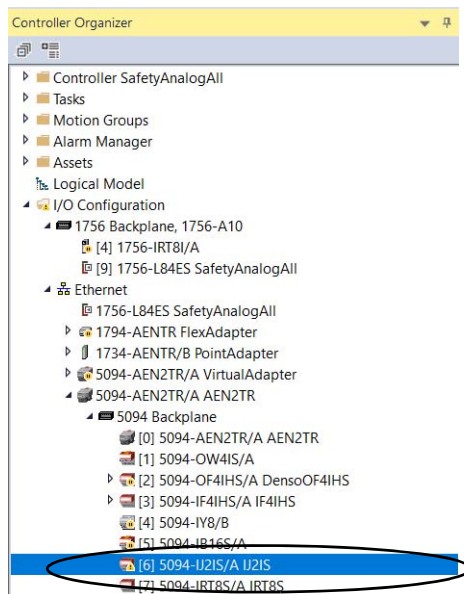
## Warning Signal in the I/O Configuration Tree

As shown in [Figure 9](#), a warning icon appears in the I/O Configuration tree when a fault occurs.



The warning icons, status, and fault information appear the same way for both standard and safety modules. The examples in this section show the 5094-IJ2IS safety module.

**Figure 9 - Warning Signal in Controller Organizer**



## Status and Fault Information in the Module Properties Categories

The Module Properties section in the Studio 5000 Logix Designer applications includes a series of categories. The number and types of categories varies by module type.

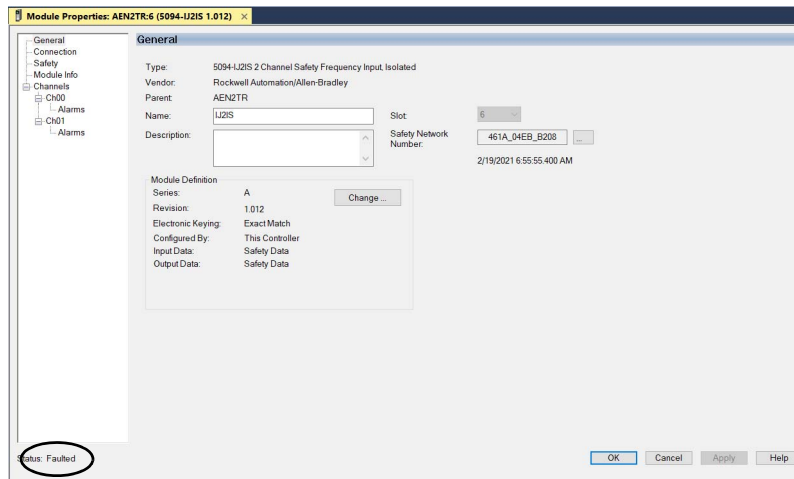
Each category includes options to configure the module or monitor the module's status. The following are ways to monitor a module's state for faults:

- [Module Status on General Category](#)
- [Module Fault Descriptions on Connection Category](#)
- [Module Fault Descriptions on Module Info Category](#)
- [Module Diagnostics Dialog Box](#)
- [Channel Diagnostics](#)

## Module Status on General Category

As shown in [Figure 10](#), the status of a module is indicated on the General category of the Modules Properties.

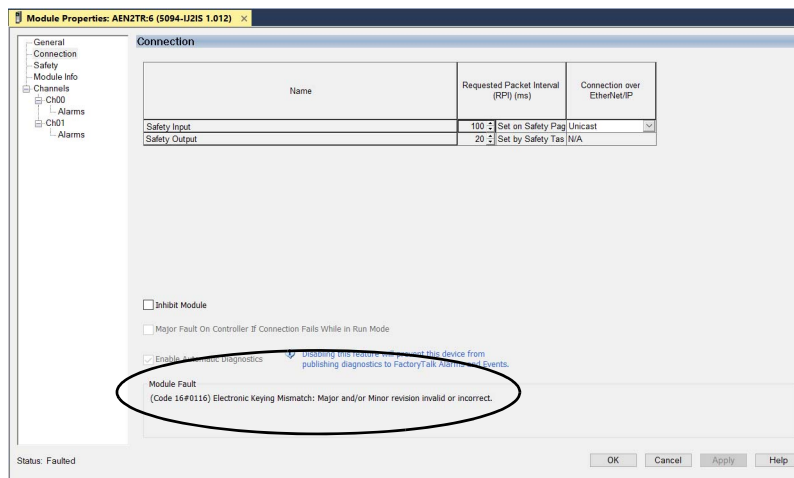
**Figure 10 - Fault Message in Status Line**



## Module Fault Descriptions on Connection Category

As shown in [Figure 11](#), a module fault description that includes an error code that is associated with the specific fault type is listed on the Connection category.

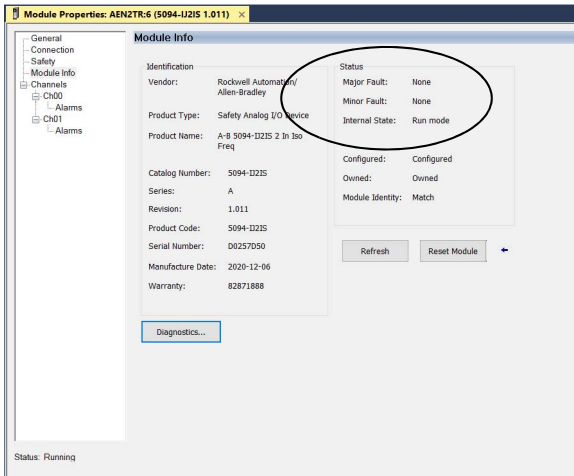
**Figure 11 - Fault Description with Error Code**



Module Fault Descriptions on Module Info Category

As shown in [Figure 12](#), major and minor fault information is listed on the Module Info category.

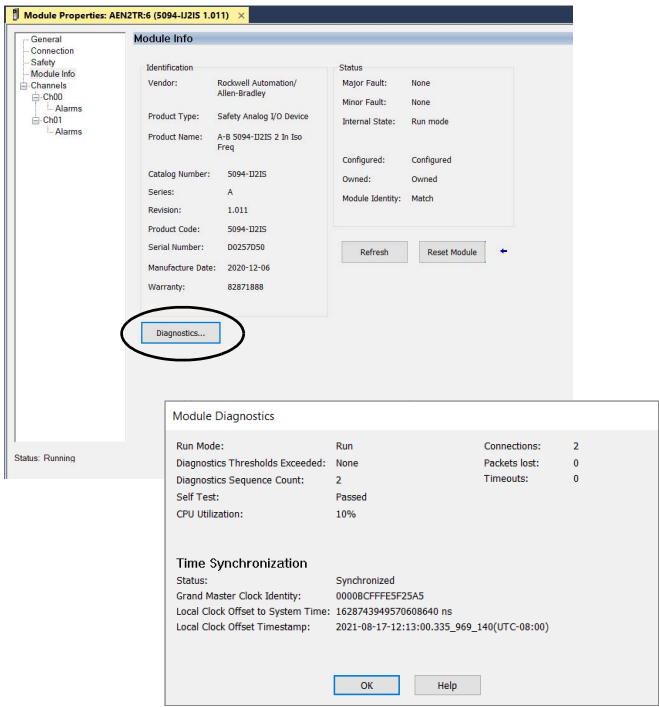
Figure 12 - Major and Minor Fault Information



Module Diagnostics Dialog Box

Module Diagnostics are accessible from the Module Properties dialog box, as shown in [Figure 13](#).

Figure 13 - Module Diagnostics

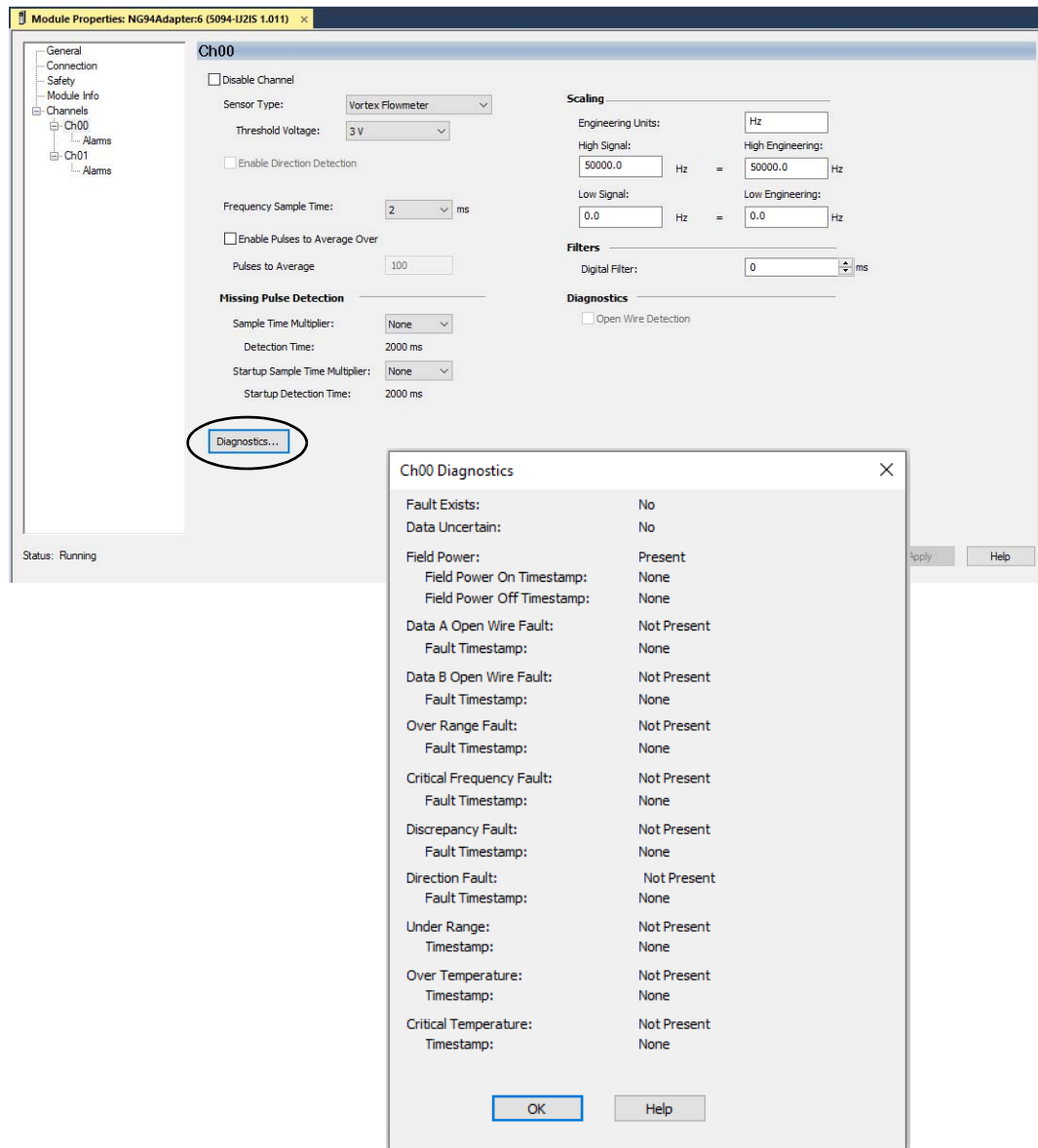


## Channel Diagnostics

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

Channel diagnostics provide information on an individual channel basis. To open the channel diagnostics, select Diagnostics...

**Figure 14 - Channel Diagnostics**



**IMPORTANT** Discrepancy, Direction, Over Temperature, and Critical Temperature faults are only available for safety modules.

# Studio 5000 Logix Designer Application Tag Editor

Figure 15 shows how fault conditions are indicated in the controller tags for the module.

Figure 15 - Fault Indication in Controller Tags

Controller Tags - AOP4dot1dot29SanityCheck(controller) X

Scope: B:AOP4dot1do29Ssar Show: All Tags Enter Name Filter...

Name	Value	Force Mask	Style	Data Type	Class
Adapter:6i	[...]			AB:5000_SFIZH0	Safety
Adapter:6i.RunMode	1		Decimal	BOOL	Safety
Adapter:6i.ConnectionFaulted	0		Decimal	BOOL	Safety
Adapter:6i.DiagnosticActive	1		Decimal	BOOL	Safety
Adapter:6i.DiagnosticSequenceCount	7		Decimal	SINT	Safety
Adapter:6i.Ch00	[...]			CHANNEL_SFIDL	Safety
Adapter:6i.Ch01	[...]			CHANNEL_SFIDL	Safety
Adapter:6i.Ch01.Fault	1		Decimal	BOOL	Safety
Adapter:6i.Ch01.Uncertain	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.DataAOpenWire	1		Decimal	BOOL	Safety
Adapter:6i.Ch01.DataBOpenWire	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.FieldPowerOff	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.DataA	1		Decimal	BOOL	Safety
Adapter:6i.Ch01.DataB	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.Status	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.CriticalFrequency	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.Underrange	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.Overrange	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.LLAlarm	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.LAlarm	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.HAlarm	0		Decimal	BOOL	Safety
Adapter:6i.Ch01.HHAlarm	0		Decimal	BOOL	Safety

## Module Tag Definitions

### Applies to these modules:

5094 Standard I/O Modules
5094 Safety I/O Modules

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

The set of module tags that are associated with a module depends on the module type and Module Definition choices that are made during module configuration. For example, if you use a Listen Only Connection in the Module Definition, the Studio 5000 Logix Designer application creates only Input tags for that module.

The following types of tags are available with FLEX 5000 I/O standard and safety modules:

- Input
- Output

The tables contained in this section list all tags available with a module. Not all tags in the list are used when that module type is added to a project. Tag use varies by module configuration.

## Tag Name Conventions

The module tag names use defined naming conventions. The conventions are as follows:

Example tag name = Adapter:1:I.Ch00.Data

- Adapter = name of the FLEX 5000 EtherNet/IP adapter in the FLEX 5000 I/O system
- 1 = slot number
- I = tag type

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

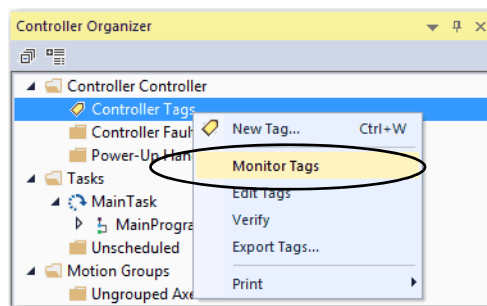
- Ch00 = module channel number
- Data = tag function

In this case, Data represents the input data that is returned to the owner-controller.

## Access the Tags

You view tags from the Tag Editor.

1. Open your Logix Designer application project.
2. Right-click Controller Tags and select Monitor Tags.



## 3. Open the tags as necessary to view specific tags.

Controller Tags - Safety_5094(controller)				
Scope: Safety_5094		Show: All Tags		
Name	Value	Style	Data Type Class	Descrip
Remote_5094_IO:5:O	{...}		AB:5000_... Safety	
Remote_5094_IO:5:O.Ch01	{...}		CHANN... Safety	
Remote_5094_IO:5:O.Ch00	{...}		CHANN... Safety	
Remote_5094_IO:5:I	{...}		AB:5000_... Safety	
Remote_5094_IO:5:I.RunMode	0 Decimal		BOOL Safety	
Remote_5094_IO:5:I.DiagnosticSequenceCount	0 Decimal		SINT Safety	
Remote_5094_IO:5:I.DiagnosticActive	0 Decimal		BOOL Safety	
Remote_5094_IO:5:I.ConnectionFaulted	1 Decimal		BOOL Safety	
Remote_5094_IO:5:I.Ch01	{...}		CHANN... Safety	
Remote_5094_IO:5:I.Ch00	{...}		CHANN... Safety	
Remote_5094_IO:4:O	{...}		AB:5000_... Safety	

## Module Tags

This section describes the tags that are associated with both the standard and safety modules.

### Input Tags

[Table 18](#) describes the module input tags.

**Table 18 - 5094-IJ2I and 5094-IJ2IS Modules - Input Tags**

Name	Data Type	Definition	Valid Values
RunMode	BOOL	Module's operating state.	<ul style="list-style-type: none"> <li>0 = Idle</li> <li>1 = Run</li> </ul>
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.	<ul style="list-style-type: none"> <li>0 = Connection running</li> <li>1 = Connection not running</li> </ul>
DiagnosticActive	BOOL	Indicates if any diagnostics are active or if the prognostics threshold is reached.	<ul style="list-style-type: none"> <li>0 = No diagnostics active</li> <li>1 = One or more diagnostics are active or the prognostics threshold is reached</li> </ul>
DiagnosticSequenceCount	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.
Chxx.Fault	BOOL	<ul style="list-style-type: none"> <li>Indicates that channel data is inaccurate and <b>cannot be trusted</b> for use in the application. If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. For more information, see <a href="#">Module Data Quality Reporting on page 29</a>.</li> <li>The channel is disabled.</li> </ul>	<ul style="list-style-type: none"> <li>0 = Good</li> <li>1 = Bad, causing fault</li> </ul> The typical causes of fault are: <ul style="list-style-type: none"> <li>Overrange of frequency</li> <li>Critical frequency condition</li> <li>Open wire condition</li> <li>Field power off condition</li> <li>Discrepancy fault condition - <b>for safety module only</b></li> <li>Direction fault condition- <b>for safety module only</b></li> <li>Channel is disabled</li> </ul> We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.Uncertain	BOOL	Indicates that the channel data can be inaccurate but the <b>degree of inaccuracy is not known</b> . If the tag is set to 1, you must troubleshoot the module to correct the cause of the inaccuracy. <b>IMPORTANT:</b> Once the condition that causes the tag to change to 1 is removed, the tag automatically resets to 0.	<ul style="list-style-type: none"> <li>0 = Good data</li> <li>1 = Uncertain data</li> </ul> The typical causes of uncertain data are the following: <ul style="list-style-type: none"> <li>Data signal outside the channel operating range</li> <li>The channel is over temperature - <b>for safety module only</b></li> <li>Critical temperature detected- <b>for safety module only</b></li> </ul> We recommend that you first troubleshoot the module to see if the typical causes exist.
Chxx.DataAOpenWire	BOOL	The signal wire is disconnected from the channel. Open Wire detection method: For 24V DC IEC Type 3, this is when the input loop current drops below 0.4 mA.	<ul style="list-style-type: none"> <li>0 = Open Wire condition does not exist or Open Wire Detection is disabled</li> <li>1 = Open Wire condition exists. That is, a signal wire is disconnected from the channel.</li> </ul>
Chxx.DataBOpenWire	BOOL	The signal wire is disconnected from the channel. Open Wire detection method: For 24V DC IEC Type 3, this is when the input loop current drops below 0.4 mA.	<ul style="list-style-type: none"> <li>0 = Open Wire condition does not exist or Open Wire Detection is disabled</li> <li>1 = Open Wire condition exists. That is, a signal wire is disconnected from the channel.</li> </ul>

Table 18 - 5094-IJ2I and 5094-IJ2IS Modules - Input Tags (Continued)

Name	Data Type	Definition	Valid Values
Chxx.FieldPowerOff	BOOL	Indicates that a field power loss condition exists on the channel.	<ul style="list-style-type: none"> <li>0 = No field power off condition</li> <li>1 = Field power off condition</li> </ul>
Chxx.DataA	BOOL	Channel data state.	Low or High
Chxx.DataB	BOOL	Channel data state.	Low or High
Chxx.Status <sup>(1)</sup>	BOOL	<b>For safety module only</b> Indicates the status of the channel.	<ul style="list-style-type: none"> <li>0 = Bad, causing a fault</li> <li>1 = Good</li> </ul>
Chxx.CriticalFrequency	BOOL	The input channel reports critical frequency for all signal frequencies > 60 KHz.	<ul style="list-style-type: none"> <li>0 = Input signal is below critical frequency</li> <li>1 = Input signal is above critical frequency</li> </ul>
Chxx.Underrange	BOOL	The input channel declares underrange for all signal frequencies < 1 Hz.	<ul style="list-style-type: none"> <li>0 = Channel data is not beneath the underrange threshold</li> <li>1 = Channel data is beneath the underrange threshold</li> </ul>
Chxx.Ovrange	BOOL	The input channel declares overrange for all signal frequencies > 55 kHz.	<ul style="list-style-type: none"> <li>0 = Channel data is not above the overrange threshold</li> <li>1 = Channel data is above the overrange threshold</li> </ul>
Chxx.LLAlarm	BOOL	Triggered when the input data value is less than the Low Low alarm value. If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is greater than the Low Low limit and the Alarm Deadband.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.LAlarm	BOOL	Triggered when the input data value is less than the Low alarm value. If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is greater than the Low limit and the Alarm Deadband.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.HAlarm	BOOL	Triggered when the input data value is greater than the High alarm value. If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is less than the High limit and the Alarm Deadband.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.HHAlarm	BOOL	Triggered when the input data value is greater than the High High alarm value. If latching is enabled, this alarm remains triggered until unlatched. If latching is not enabled, the alarm clears after the input data value is less than the High High limit and the Alarm Deadband.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.AccelAlarm	BOOL	Triggered when the change between consecutive channel samples divided by the period of time between when the samples were taken exceeds the Accel Alarm. If latched, this tag remains set until it is unlatched.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.DecelAlarm	BOOL	Triggered when the change between consecutive channel samples divided by the period of time between when the samples were taken exceeds the Decel Alarm. If latched, this tag remains set until it is unlatched.	<ul style="list-style-type: none"> <li>0 = Alarm is not triggered</li> <li>1 = Alarm is triggered</li> </ul>
Chxx.MissingPulseAlarm	BOOL	The input channel reports missing pulse. The period of a pulse was greater than the missing pulse timeout.	<ul style="list-style-type: none"> <li>0 = Normal</li> <li>1 = Missing</li> </ul>
Chxx.DiscrepancyFault <sup>(1)</sup>	BOOL	<b>For safety module only</b> The input channel reports a discrepancy fault when there is discrepancy in the 1002 I/O circuitry greater than the Discrepancy Limit.	<ul style="list-style-type: none"> <li>0 = Normal</li> <li>1 = Discrepancy Fault</li> </ul>
Chxx.Frequency	REAL	The input channel measures and reports the instantaneous input signal frequency in engineering units.	The instantaneous frequency of the input signal.
Chxx.Accel	REAL	The input channel measures and reports the rate of change of the input signal frequency (the instantaneous rate of change in engineering units per second from the previous sample to the current sample).	Channel calculated acceleration value.
Chxx.Direction	BOOL	The input channel determines and reports direction.	<ul style="list-style-type: none"> <li>0 = Forward</li> <li>1 = Reverse</li> </ul>

Table 18 - 5094-IJ2I and 5094-IJ2IS Modules - Input Tags (Continued)

Name	Data Type	Definition	Valid Values
Chxx.DirectionValid	BOOL	Indicates if the direction data is valid.	<ul style="list-style-type: none"><li>0 = Direction is not available or not valid</li><li>1 = Direction is valid</li></ul> <b>IMPORTANT:</b> 5094-IJ2I/5094-IJ2IXT/5094-IJ2IS/5094-IJ2ISXT stops direction detection when input frequency is greater than 25 KHz. Verify DirectionValid bit, and use Direction data only when DirectionValid bit is 1.
Chxx.DirectionFault <sup>(1)</sup>	BOOL	<b>For safety module only</b> Direction fault is present at the channel.	<ul style="list-style-type: none"><li>0 = No Direction Fault exists</li><li>1 = Direction Fault exists</li></ul>
Chxx.RollingTimestamp	INT	Continuously running 15-bit timer that counts in milliseconds. Whenever an input module scans its channels, it also records the value of <i>RollingTimestamp</i> at that time. The user program can then use the last two <i>RollingTimestamp</i> values and calculate the interval between receipt of data or the time when new data has been received.	0 ...32767

(1) The Chxx.Status, Chxx.DiscrepancyFault, and Chxx.DirectionFault tags are for safety modules only.

## Output Tags

Table 19 describes the module output tags.

Table 19 - 5094-IJ2I and 5094-IJ2IS Module - Output Tags

Name	Data Type	Definition	Valid Values
Chxx.Startup	BOOL	Initiate Startup Select – Alerts a channel that if process startup is in progress to defeat the missing pulse alarm for a time determined by the missing pulse delay multiplier.	<ul style="list-style-type: none"> <li>0 = Normal Run Mode</li> <li>1 = Startup Mode – defeat/delay Missing Pulse Alarm</li> <li>Default = 0 – Normal Run Mode</li> </ul>
Chxx.ResetFault <sup>(1)</sup>	BOOL	<b>For safety module only</b> When 'Latch fault until reset via output tag' mode is Enabled, the I/O channel holds the safety input fault indications until it checks that the fault is removed. If the fault is removed, it clears only the fault status upon detecting that the ResetFault bit in its channel sees a rising edge.	Rising edge: the fault status is released if the fault has been removed.
Chxx.DecelAlarmEn	BOOL	Enable the Deceleration alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.LLAlarmEn	BOOL	Enables the Low Low alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.LAlarmEn	BOOL	Enables the Low alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.HAlarmEn	BOOL	Enables the High alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.HHAlarmEn	BOOL	Enables the High High alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.AccelAlarmEn	BOOL	Enable the Acceleration alarm. <b>IMPORTANT:</b> To use this alarm, you must not only set the tag to 1. You must also make sure the <i>Chxx.AlarmDisable</i> configuration tag for the same channel is set to 0. If the <i>Chxx.AlarmDisable</i> configuration tag is set to 1, that is, alarms are disabled, this alarm does not work regardless of the tag value.	<ul style="list-style-type: none"> <li>0 = Alarm is disabled</li> <li>1 = Alarm is enabled</li> </ul>
Chxx.LLAlarmUnlatch	BOOL	Unlatches a latched Low Low Alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> <li>0 = Low Low Alarm remains latched</li> <li>1 = Low Low Alarm unlatches</li> </ul>
Chxx.LAlarmUnlatch	BOOL	Unlatches a latched Low Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> <li>0 = Low Alarm remains latched</li> <li>1 = Low Alarm unlatches</li> </ul>
Chxx.HAlarmUnlatch	BOOL	Unlatches a latched High Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> <li>0 = High Alarm remains latched</li> <li>1 = High Alarm unlatches</li> </ul>
Chxx.HHAlarmUnlatch	BOOL	Unlatches a set High High Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> <li>0 = High High Alarm remains latched</li> <li>1 = High High Alarm unlatches</li> </ul>
Chxx.CriticalFrequencyUnlatch	BOOL	Unlatches a critical frequency alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> <li>0 = Critical frequency Alarm remains latched</li> <li>1 = Critical frequency Alarm unlatches</li> </ul>

**Table 19 - 5094-IJ2I and 5094-IJ2IS Module - Output Tags (Continued)**

<b>Name</b>	<b>Data Type</b>	<b>Definition</b>	<b>Valid Values</b>
Chxx.AccelAlarmUnlatch	BOOL	Unlatches a set Accel Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> <li>• 0 = Accel Alarm remains latched</li> <li>• 1 = Accel Alarm unlatched</li> </ul>
Chxx.DecelAlarmUnlatch	BOOL	Unlatches a set Decel Alarm at the first instance of the bit transition from 0 to 1.	<ul style="list-style-type: none"> <li>• 0 = Decel Alarm remains latched</li> <li>• 1 = Decel Alarm unlatches</li> </ul>
Chxx.MissingPulseAlarmUnlatch	BOOL	Unlatches a missing pulse alarm at the first instance of the bit transitioning from 0 to 1.	<ul style="list-style-type: none"> <li>• 0 = Missing pulse alarm remains latched.</li> <li>• 1 = Missing pulse alarm unlatches.</li> </ul>
Chxx.DiscrepancyLimit <sup>(1)</sup>	INT	<b>For safety module only</b> Sets the discrepancy limit that is used to declare a Discrepancy Fault. The default is 100 Hz.	<ul style="list-style-type: none"> <li>• Valid range 50...500 Hz.</li> </ul>

(1) The Chxx.ResetFault and Chxx.DiscrepancyLimit tags are for safety modules only.

## Application/Wiring Examples for Safety I/O Modules

### Applies to these modules:

5094 Safety I/O Modules

This appendix provides example wiring diagrams for the FLEX 5000 I/O safety modules that can be used in functional safety applications.

**IMPORTANT** Do not connect unused input terminals.

The wiring configuration affects the safety application level to which a FLEX 5000 I/O safety module is suitable.

**IMPORTANT** Conformity to requirements of the safety category and safety integrity level must be determined **for the entire system**.  
You must consider fault exclusion that is specified in each of the wiring configurations.

### 5094-IJ2IS and 5094-IJ2ISXT Module Wiring Diagrams

The following wiring diagrams show the input modules for 24V DC IEC Type 3 Input.

**IMPORTANT** The Safety level shown in [Figure 16](#), [Figure 17](#), and [Figure 18](#) is applicable to the module itself with "Open Wire Detection" enabled. Connected devices must have their own status monitoring to achieve application safety level.

Figure 16 - SIL 3, PL<sub>e</sub>, Cat. 4 24V DC IEC Type 3 Input (2-wire)

**SIL and Category: Up to SIL 3, PL<sub>e</sub>, Cat. 4**

**Fault Exclusion: External Wiring Fault**

Sensor Type: 24V DC IEC Type 3

Other: Use suitable qualified sensor.

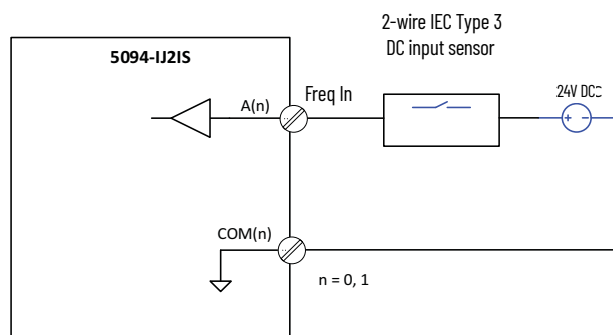


Figure 17 - SIL 3, PLe, Cat. 4 24V DC IEC Type 3 Input (3-wire)

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
Sensor Type: 24V DC IEC Type 3  
Other: Use suitable qualified sensor.

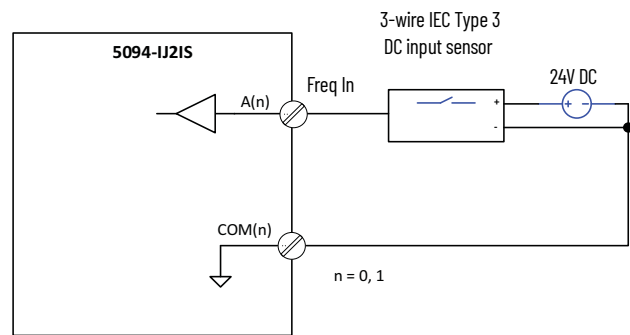
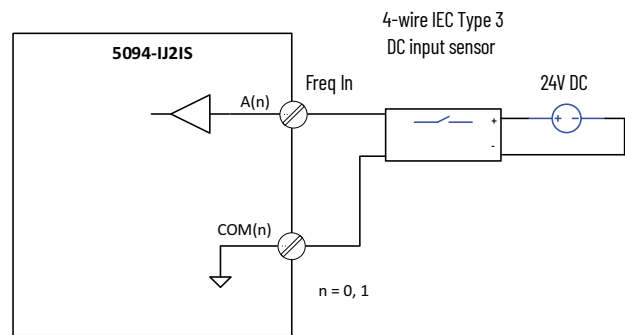


Figure 18 - SIL 3, PLe, Cat. 4 24V DC IEC Type 3 Input (4-wire)

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
Sensor Type: 24V DC IEC Type 3  
Other: Use suitable qualified sensor.



The following wiring diagrams show the input modules for 24V DC IEC Type 3 Input (Direction Enabled).

**IMPORTANT** The Safety level shown in [Figure 19](#), [Figure 20](#), and [Figure 21](#) is applicable to the module itself with “Open Wire Detection” enabled and “Enable Direction Detection” enabled. Connected devices must have their own status monitoring to achieve application safety level

Figure 19 - SIL 3, PLe, Cat. 4 24V DC IEC Type 3 Input (2-wire) - Direction Enabled

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
Sensor Type: 24V DC IEC Type 3  
Other: Use suitable qualified sensor.

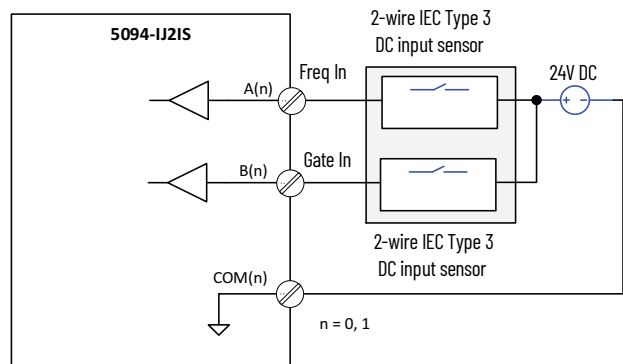


Figure 20 - SIL 3, PLe, Cat. 4 24V DC IEC Type 3 Input (3-wire) - Direction Enabled

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
 Sensor Type: 24V DC IEC Type 3  
 Other: Use suitable qualified sensor.

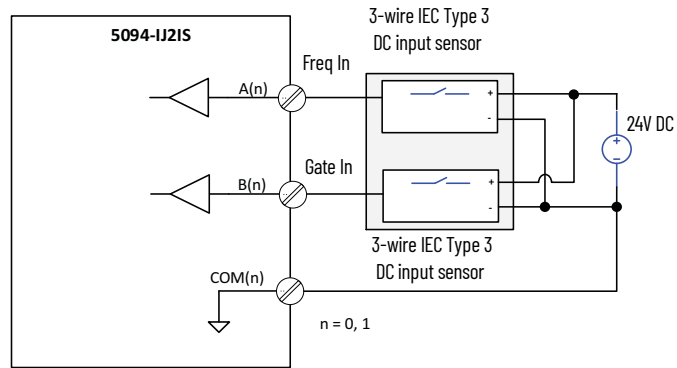
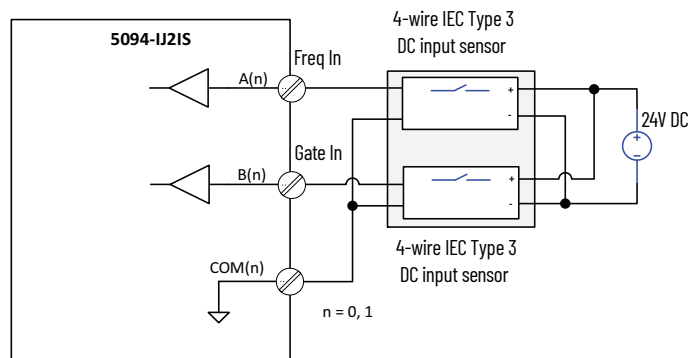


Figure 21 - SIL 3, PLe, Cat. 4 24V DC IEC Type 3 Input (4-wire) - Direction Enabled

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
 Sensor Type: 24V DC IEC Type 3  
 Other: Use suitable qualified sensor.

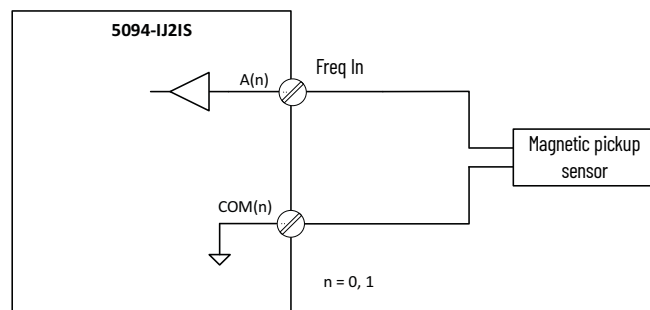


The following wiring diagrams show the input module for Magnetic Pickup Input.

**IMPORTANT** The Safety level that is shown in [Figure 22](#) is applicable to the module itself with "Open Wire Detection" enabled. Connected devices must have their own status monitoring to achieve application safety level.

Figure 22 - SIL 3, PLe, Cat. 4 Magnetic Pickup Input

**SIL and Category:** Up to SIL 3, PLe, Cat. 4  
**Fault Exclusion:** External Wiring Fault  
 Sensor Type: Magnetic Pickup  
 Other: Use suitable qualified sensor.



**IMPORTANT** The Safety level that is shown in [Figure 23](#) is applicable to the module itself with "Open Wire Detection" enabled and "Enable Direction Detection" enabled. Connected devices must have their own status monitoring to achieve application safety level.

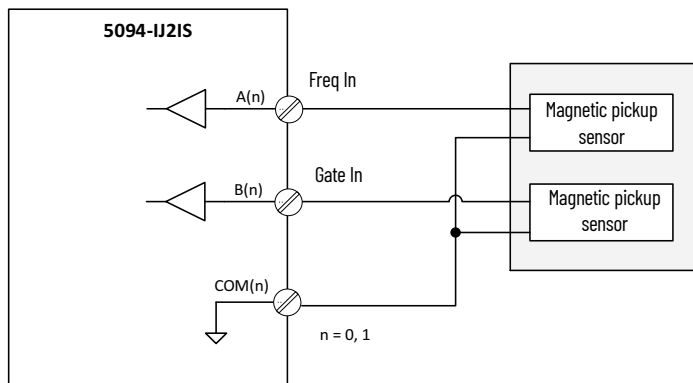
Figure 23 - SIL 3, PLe, Cat. 4 Magnetic Pickup Input (Direction Enabled)

**SIL and Category:** Up to SIL 3, PLe, Cat. 4

**Fault Exclusion:** External Wiring Fault

Sensor Type: Magnetic Pickup

Other: Use suitable qualified sensor.



The following wiring diagram shows the input module for Vortex Flowmeter Input.

#### IMPORTANT

- The Safety level that is shown in [Figure 24](#) is applicable to the module itself.
- You must monitor for open wire faults by monitoring *I.Chxx.MissingPulseAlarm* tag and/or apply other external appropriate measures.
- The default duration to detect missing pulse is 2 seconds.
- Connected devices must have their own status monitoring to achieve application safety level.
- To use the module as functional safety module, the Vortex flowmeter cable length must be no longer than 3 meters.

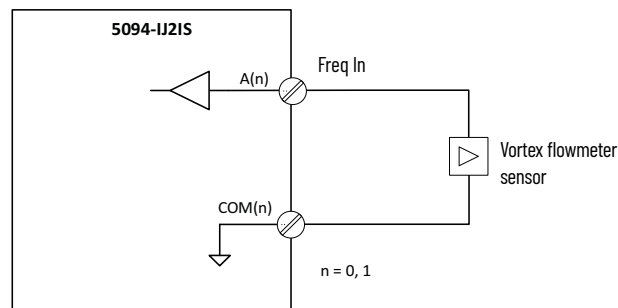
Figure 24 - SIL 3, PLe, Cat. 4 Vortex Flowmeter Input

**SIL and Category:** Up to SIL 3, PLe, Cat. 4

**Fault Exclusion:** External Wiring Fault

Sensor Type: Vortex Flowmeter

Other: Use suitable qualified sensor.



## Safety Data for Safety I/O Modules

### Applies to these modules:

5094 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 [Module Safety Data on page 89](#)

You must be responsible for following the requirements of ISO 13849-1:2015, to assess Performance Levels in their safety system.

You must functionally test every I/O module by individually varying each input channel and also verify that the controller detects it within the safety reaction time (SRT).

For more information, see the safety controller manuals that are listed in [Additional Resources on page 9](#).

## Module Safety Data

[Table 20](#) lists the safety data for the 5094-IJ2IS and 5094-IJ2ISXT modules.

**Table 20 - 5094-IJ2IS and 5094-IJ2ISXT Safety Parameter Data**

Attribute	Channel Operation Type	
	Single Channel	Dual Channel
Total Failure Rate ( $\lambda$ , (safety related))	1.715E-06	2.508E-06
Safe Failure Fraction (SFF)	99.98%	99.99%
Safe Failure Rate ( $\lambda_S$ )	1.020E-06	1.427E-06
Diagnostic Coverage (DC)	99.94%	99.98%
Safe Detected Failure Rate ( $\lambda_{SD}$ )	1.020E-06	1.426E-06
Safe Undetected Failure Rate ( $\lambda_{SU}$ )	5.997E-10	3.054E-10
Dangerous Failure Rate ( $\lambda_D$ )	6.944E-07	1.081E-06
Dangerous Detected Failure Rate ( $\lambda_{DD}$ )	6.940E-07	1.081E-06
Dangerous Undetected Failure Rate ( $\lambda_{DU}$ )	4.080E-10	2.315E-10
Diagnostic Test Interval (hours)	4	4
Hardware Fault Tolerance (HFT)	0	1
Spurious Trip Rate (STR)	4.708E-06	7.641E-06
Mean Time to Failure, Spurious (MTTF-spurious), (hours)	212417	130874
PFH (1/hours)	4.081E-10	2.315E-10
PFD <sub>AVE</sub> at Mission Time of 20 years	3.575E-05	2.028E-05
Safety Reaction Time (SRT), (millisecond)	10	10

## Module Safety Reaction Time

The safety reaction time (SRT) is a consideration of delays or latencies within the safety system.

- **SRT on Demand** is the response time interval between a signal change on the input terminal and producing or providing the safety packet on the backplane.

- **SRT on Fault** is the response time between the occurrence of an internal fault in the channel/module and the channel/module going into a safe state.
- **SRT on External Wiring Fault** is the response time between the occurrence of an external wiring fault and the channels going into a safe state.

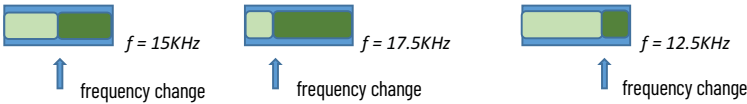
Table 21 - Safety Reaction Time<sup>(1)(2)</sup>

SRT (Safety Demand Rate less than once per 2 s)	
on Demand <sup>(3)</sup>	10 ms
on Fault	10 ms
on Open Wire detected <sup>(4)</sup>	10 + 4000/f(Hz) ms

Note:

1. Timing is subjected to an RPI of 2 ms, Frequency Sample Time of 2 ms, input frequency  $f > 1000$  Hz and maximum rate of frequency change of  $< 7.5\text{KHz/s}$ .
2. Additional considerations for SRT:
  - For different RPI, extend the timing by the RPI value.
  - For different Frequency Sample Time, extend by  $2 \times (\text{Frequency Sample Time} - 2)$  ms.
  - For input frequency  $f \leq 1000$  Hz, extend by  $2000/f(\text{Hz})$  ms.
  - For Number of Pulse to Average, also consider the number to average and the incoming frequency.
3. Produced frequency data is what is measured on the input terminal within the specified Frequency Sample Time duration. So, depending on the point in time within the Frequency Sample Time duration where there is a demand change, the produced frequency is the average value of the frequency before and after the demand change over the Frequency Sample Time duration.

For example, blue is 2 ms Frequency Sample Time, Light green is 10 KHz signal, Dark green is 20 KHz signal.



4. Open wire detection is not available on Vortex inputs. For additional information, see [SIL 3, PLe, Cat. 4 Vortex Flowmeter Input on page 88](#).

## Numerics

### 5094-IJ2I module 12

- acceleration 36
- alarm latching 32
- alarms category 53
- channels category 52
- Chxx category 52
- CIP Sync 32
- configure 45
- connection category 50
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- digital filter 38
- direction 37
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AMERICAS: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

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ASIA PACIFIC: Rockwell Automation SEA Pte Ltd., 2 Corporation Road, #04-05, Main Lobby, Corporation Place, Singapore 618494, Tel: (65) 6510-6608, Fax: (65) 6510-6699

UNITED KINGDOM: Rockwell Automation Ltd., Pitfield, Kiln Farm, Milton Keynes, MK11 3DR, United Kingdom, Tel: (44)(1908) 838-800, Fax: (44)(1908) 261-917