



Allen-Bradley

DeviceNet Safety

**1732DS-IB8, 1732-IB8X0BV4,
1791DS-IB12, 1791DS-IB8X0B8,
1791DS-IB4X0W4,
1791DS-IB8X0BV4**

User Manual

**Rockwell
Automation**

Important User Information

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





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

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

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

WARNING 	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION 	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence
SHOCK HAZARD 	Labels may be located 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 located on or inside the equipment, for example, a drive or motor, to alert people that surfaces may be dangerous temperatures.

This publication contains new and revised information not in the last release.

New Information

See the table for a summary of the major additions to this manual to include 1791DS-IB8XOBV4, 1732DS-IB8, and 1732DS-IB8XOBV4 modules.

For Information About	See Page
Module identification for 1791DS-IB8XOBV4, 1732DS-IB8, and 1732DS-IB8XOBV4 modules	22
How to configure your module in RSLogix 5000 Software	41
Wiring examples for 1791DS-IB8XOBV4, 1732DS-IB8, and 1732DS-IB8XOBV4 modules	110
How to interpret LED indicators for 1791DS-IB8XOBV4, 1732DS-IB8, and 1732DS-IB8XOBV4 modules	105

Revised Information

We updated additional information, as necessary, to more fully explain certain procedures.

Change Bars

Change bars (as shown with this paragraph) show the areas in this manual that are different from previous editions and indicate the addition of new or revised information.



Notes:

Preface

What This Preface Contains	5
Who Should Use This Manual	5
Common Techniques Used in This Manual.	5
Additional Resources.	5
How To Use This Manual	6
About the Specifications and Dimensions in This Manual	6
Terminology	6

About the Modules**Chapter 1**

What This Chapter Contains	7
Before You Begin	7
Understand Suitability for Use	7
Follow Precautions for Use	8
Legislation and Standards	13
EC Directives	14
EMC Directive	14
Low-voltage Level Directive	14
Compliance with EC Directives.	14
Precautions to Mount, Wire, and Clean	16
Overview	17
About Catalog Numbers	18
About CIP Safety Over DeviceNet System Architecture	19
Identify Major Parts of the Modules	20

Understand Operation of Safety Functions**Chapter 2**

What This Chapter Contains	23
Safety I/O Modules	23
Self-diagnostic Functions	23
Configuration Lock	24
Safety Inputs.	24
Test Pulse from Test Output.	24
Set Dual-channel Mode and Discrepancy Time	27
Dual-channels, Equivalent	28
Dual-channels, Complementary	29
Fault Recovery	30
Input Delays	30
Safety Outputs	31
Safety Output with Test Pulse.	31
Dual-channel Setting	32
Fault Recovery.	33
I/O Status Data	33

	Chapter 3	
Complete General Procedures	What This Chapter Contains	35
	Install the Module	35
	Connect I/O Power and I/O Cables	37
	Connect Communications Connectors	39
	Set the Node Address	40
	Configure the Module	40
	Chapter 4	
Configure Your Module In RSLogix 5000 Software	What This Chapter Contains	41
	Use the Help Button	41
	Before You Begin	41
	About Parameter Groups	41
	Allocate Remote I/O	43
	Configure Your Module.	45
	Work with the General Dialog.	47
	Understand Electronic Keying Options	49
	Work with the Input Configuration Dialog	52
	Work with the Test Output Dialog.	54
	Work with the Output Configuration Dialog.	55
	I/O Data Supported by Each Model	56
	I/O Assembly and Reference Data	56
	Chapter 5	
Configure Modules in RSNetworkx for DeviceNet Software	What This Chapter Contains	57
	Set the Password.	57
	Set I/O Parameters	57
	Allocate Remote I/O	59
	Use the Help Button	61
	Work with the EDS Wizard	61
	Work with EDS Files	63
	Configure DeviceNet Nodes and Connections	67
	Configuration Signature.	67
	Configure DeviceNet Safety I/O Target Nodes	68
	1791DS DeviceNet Safety I/O Module Parameters	68
	Configure the DeviceNet Safety Scanner's Safety Connections	69
	Configure DeviceNet Standard Slave I/O Nodes	72
	Configure the DeviceNet Safety Scanner Standard Connections	72
	Standard Communication Properties	72
	Create a Scanlist.	74
	Configure Standard Inputs	76
	Configure Standard Outputs	77

	Configure GuardPLC Controller Settings	78
	I/O Data Supported by Each Model	80
	I/O Assembly and Reference Data	80
	Chapter 6	
Maintain Your Modules	What This Chapter Contains	81
	Troubleshoot	81
	Maintenance	84
	Clean the Modules	84
	Inspect the Modules	85
	Replace Modules	86
	Chapter 7	
Wiring Examples	What This Chapter Contains	87
	Examples of Wiring	89
	Chapter 8	
Interpret the LED Indicators	What This Chapter Contains	101
	1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4 Module LED Indicators	101
	1791DS-IB8XOBV4, 1732DS-IB8XOBV4, 1732DS-IB8 Module LED Indicators	105
	Appendix A	
DeviceNet Explicit Messages	What This Appendix Contains	107
	Basic Format of Explicit Messages	107
	Explicit Messages	109
	Appendix B	
Calculated Values for Probability of Failure and Probability of Failure per Hour	What This Appendix Contains	111
	Calculated Values of PFD and PFH	111
	Appendix C	
List of Functions	What This Appendix Contains	113
	List of Functions	113

**Configuration Reference
Information**

Index

Appendix D

What This Appendix Contains	117
Understand Parameter Groups	117
Allocate Remote I/O	119
I/O Data Supported by Each Module	121
1791DS-IB12 Modules	122
1791DS-IB8XOB8 Modules	123
1791DS-IB4XOW4 Modules	124
1791DS-IB8XOBV4 Modules	125
1732DS-IB8 Modules	126
1732DS-IB8XOBV4 Modules	127
I/O Assembly and Reference Data	128
1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4 Data	128
1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4	
Data	133

What This Preface Contains This preface describes how to use this manual.

Who Should Use This Manual This manual is intended for users of ArmorBlock Guard I/O and CompactBlock Guard I/O DeviceNet safety I/O modules.

Common Techniques Used in This Manual The following conventions are used throughout this manual:

- Numbered lists provide sequential steps.
- Bulleted lists provide information, not procedural steps.

Additional Resources Refer to the following as needed for additional help when setting up and using your modules.

Publication	Publication Number
DeviceNet Modules in Logix5000 Control Systems User Manual	DNET-UM004
GuardLogix Controller Systems Safety Reference Manual	1756-RM093
GuardLogix Controllers User Manual	1756-UM020
GuardLogix Safety Application Instructions Safety Reference Manual	1756-RM095
GuardPLC Controller Systems User Manual	1753-UM001
GuardPLC Safety Reference Manual	1753-RM002
DeviceNet Safety Scanner for GuardPLC Controllers	1753-UM002

Refer to the following for detailed specification information.

Publication	Publication Number
DeviceNet Safety I/O Modules Series 1791DS Installation Instructions - Catalog Number 1791DS-IB12, 1791DS-IB8XOB8, and 1791DSIB4XOW4	1791DS-IN001
DeviceNet Safety I/O Module Series 1791DS Installation Instructions - Catalog Number 1791DS-IB8XOBV4	1791DS-IN002
DeviceNet Safety I/O Module Series 1732DS Installation Instructions - Catalog Number 1732DS-IB128 and 1732DS-IB8XOBV4	1732DS-IN001

How To Use This Manual

Read and understand this manual before using the described products. Consult your Rockwell Automation representative if you have any questions or comments. This manual describes how to use modules.

About the Specifications and Dimensions in This Manual

Product specifications and accessories can change at any time based on improvements and other reasons. Consult with your Rockwell Automation representative to confirm actual specifications of purchased product. Dimensions and weights are nominal and are not for use for manufacturing purposes, even when tolerances are shown.

Terminology

Refer to the table for the meaning of common terms.

This Term	Means
Bus off	Indicates a status of very high error count occurrence on a communication cable. A bus off error is detected when the internal error counter counts more errors than the predetermined threshold value. (The error counter returns to zero when the master is started or restarted.)
Connection	Logical communication channel for communication between nodes. Connections are maintained and controlled between masters and slaves.
DeviceNet safety	An implementation of a safety protocol on a standard DeviceNet network.
EDS	Acronym for electronic data sheet, a template that RSNetworkx for DeviceNet software uses to display the configuration parameters, I/O data profile, and connection-type support for a given DeviceNet safety module. These are simple text files used by RSNetworkx for DeviceNet software for you to identify products and commission them on a network.
MTBF	Acronym for mean time between failure, the average time between failure occurrences.
ODVA	Acronym for Open DeviceNet Vendor Association, a nonprofit association of vendors established for the promotion of DeviceNet networks.
PFD	Acronym for probability of failure on demand, the average probability of a system to fail to perform its design function on demand.
PFH	Acronym for probability of failure per hour, the probability of a system to have a dangerous failure occur per hour.
Proof test	Periodic test performed to detect 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.
SNN	Acronym for safety network number, which uniquely identifies a network across all networks in the safety system. The end user is responsible for assigning a unique number for each safety network or safety sub-net within a system.
Standard	Devices or portions of devices that do not participate in the safety function.

About the Modules

What This Chapter Contains This chapter includes important overview information about the safety I/O modules that implement the DeviceNet safety protocol and include various features for a safety system.

Before You Begin Always observe the following when using a module, noting that in this manual we use safety administrator to mean a person qualified, authorized, and responsible to secure safety in the design, installation, operation, maintenance, and disposal of the machine.

- Make sure that a safety administrator who thoroughly understands the machine to be installed handles the module.
- Thoroughly read and understand this manual before installing and operating the module.
- Keep this manual in a safe place where the operator can refer to it when necessary.
- Use the module properly according to the installation environment, performance, and functions of the machine.
- Verify that a safety administrator conducts a risk assessment on the machine and determines module suitability before installation.
- Verify that the external power supply that provides power to the I/O modules is safety extra-low voltage (SELV) rated.
- Verify that the DeviceNet block safety I/O firmware version is correct prior to commissioning the safety system.

Understand Suitability for Use

Rockwell Automation is not responsible for conformity with any standards, codes, or regulations that apply to the combination of the products in the customer's application or use of the product. Take all necessary steps to determine the suitability of the product for the systems, machine, and equipment with which it is used. Know and observe all prohibitions of use applicable to this product.

Never use the products for an application involving serious risk to life or property without ensuring that the system as a whole was designed to address the risks and that the Rockwell Automation product is properly rated and installed for the intended use within the overall equipment or system.

Follow Precautions for Use

ATTENTION



Safety status of the module is defined as follows.

- Off status of safety output
- Off status of network output

Use the module in applications where the safe status for the module produces the safe status.

Serious injury may occur due to breakdown of safety outputs. Do not connect loads beyond the rated value to the safety outputs.

Serious injury may occur due to loss of required safety functions. Wire the module properly so that supply voltages or voltages for loads do **not** touch the safety outputs accidentally or inadvertently.

Connect loads across the output terminals and the 0V line (PNP outputs).

ATTENTION



Use appropriate devices as indicated in the Controlling Devices Sample Requirements table. Serious injury may occur due to loss of safety functions.

Controlling Devices Sample Requirements

Device	Requirement	Allen-Bradley Bulletin Safety Components
Emergency Stop Switches	Use approved devices with direct opening mechanisms complying with IEC/EN 60947-5-1.	Bulletin 800F, 800T
Door Interlocking Switches, Limit Switches	Use approved devices with direct opening mechanisms complying with IEC/EN 60947-5-1 and capable of switching microloads of 24V dc 5 mA.	Bulletin 440K, 440G, or 440H for interlock switch Bulletin 440P or 802T for limit switch
Safety Sensors	Use approved devices complying with the relevant product standards, regulations, and rules in the country where used.	Any Guardmaster product
Relays with Forcibly-Guided Contacts, Contactors	Use approved devices with forcibly-guided contacts complying with EN 50205. For feedback purposes, use devices with contacts capable of switching micro loads of 24V dc 5 mA.	Bulletin 700S, 100S
Other Devices	Evaluate whether devices used are appropriate to satisfy the requirements of safety category levels.	-

Follow these precautions for safe use.

- Wire conductors correctly and verify operation of the module before commissioning system in which the module is incorporated. Incorrect wiring may lead to loss of safety function.
- Do not apply dc voltages exceeding the rated voltages to the module.
- Use dc supply satisfying the following requirements to prevent electric shock.
 - A dc power supply with double or reinforced insulation, for example, according to IED/EN 60950 or EN 50178 or a transformer according to IEC/EN 61558
 - A dc supply satisfies requirement for class 2 circuits or limited voltage/current circuit stated in UL 508
- Apply properly specified voltages to the module inputs. Applying inappropriate voltages causes the module to fail to perform its specified function, which leads to loss of safety functions or damage to the module.
- Never use test outputs as safety outputs in any way. Test outputs are **not** safety outputs.
- Note that after installation of the module a qualified personnel must confirm the installation and conduct trial operation and maintenance.
- Note that a safety administrator familiar with the machine in which the module is to be installed must conduct and verify the installation.
- Do not disassemble, repair, or modify the module. This may result in loss of safety functions.
- Use only appropriate components or devices complying with relevant safety standards corresponding to the required safety category and safety integrity level.
 - Conformity to requirements of the safety category and safety integrity level must be determined for the entire system.
 - We recommend you consult a certification body regarding assessment of conformity to the required safety integrity level.

- Note that the customer must confirm compliance with the applicable standards for the entire system.
- Disconnect the module from the power supply before wiring. Devices connected to the module may operate unexpectedly if wiring is performed while power is supplied.
- Always conduct trial operation under actual conditions on the machine to which the module is being applied to confirm operation and use a switching frequency that does not exceed performance levels. The life of the module depends on switching conditions.
- Do not use the 1791DS-IB4XOW4 module in atmospheres subject to flammable or explosive gasses. Arcs or relay heating accompanying switching may cause a fire or explosion.

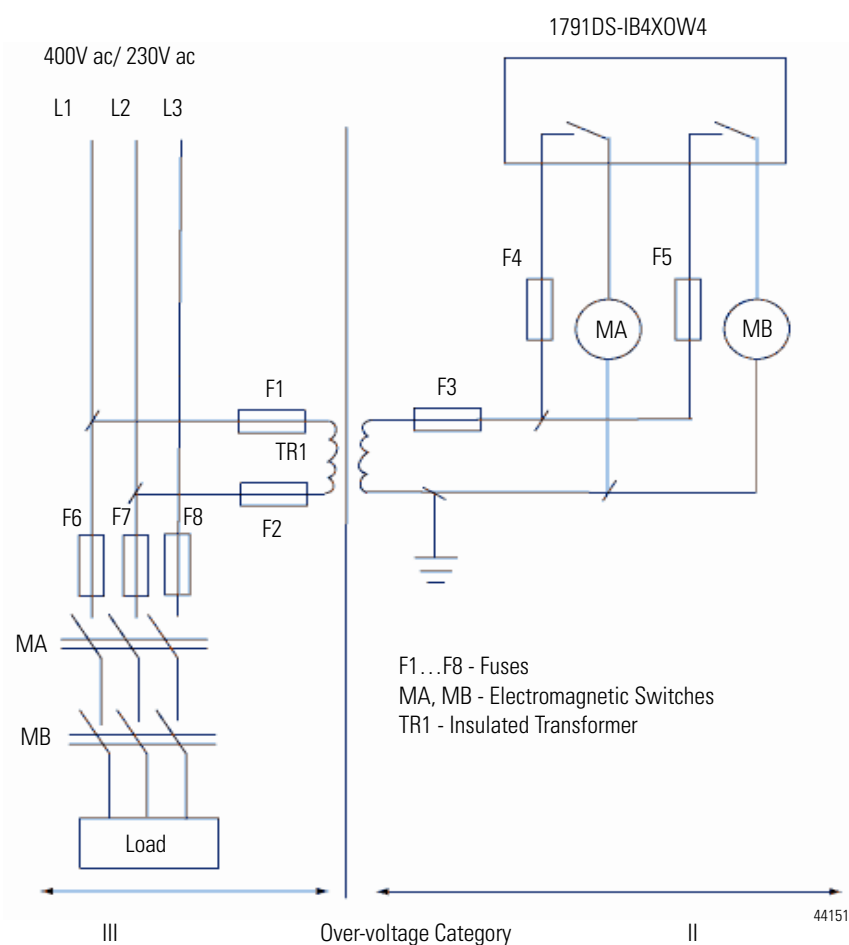
For 1791DS-IB4XOW4 modules, follow these instructions on isolating transformer use, referring to the figure.

- Use an isolating transformer to isolate between over-voltage category III and II, such as TR1, to conform to IEC 60742.
- Be sure the insulation between first input and secondary output satisfies at least basic insulation of over-voltage category III.
- Be sure one side of a secondary output of the isolating transformer is grounded to prevent electric shock to personnel due to a short to ground or short to the frame of the isolating transformer.
- Insert fuses, in case of a short to the frame, to protect the isolating transformer and prevent electric shock to personnel, per transformer specifications, at points such as F1, F2, and F3.

ATTENTION

For 1791DS-IB4XOW4 modules, apply only one ac line phase to the relay and insert a fuse at each output terminal whose current rating is less than 3.15 A to protect safety output contacts from welding closed.

Confirm fuse selection with the fuse manufacturer, dependant on the connected load characteristics.

Use of Isolating Transformer

ATTENTION

As serious injury may occur due to loss of required safety function, follow these safety precautions.

- Do not use test outputs of the modules as safety outputs.
 - Do not use DeviceNet standard I/O data or explicit message data as safety data.
 - Do not use LED indicators on the safety I/O modules for safety operations.
 - Do not connect loads beyond the rated value to the safety outputs.
 - Wire the safety I/O modules properly so that 24V dc line does not touch the safety outputs accidentally or unintentionally.
 - Ground the 0V line of the power supply for external output devices so that the devices do not turn on when the safety output line is grounded.
 - Clear previous configuration data before connecting devices to the network.
 - Set suitable node addresses before connecting devices to the network.
 - Perform user testing and confirm that all of the device configuration data and operation is correct before starting system operation.
 - When replacing a device, configure the replacement device suitably and confirm that it operates correctly.
-

Legislation and Standards

In Japan, type test requirements are provided in Article 44 of the Industrial Safety and Health Law. These requirements apply to complete systems and can not be applied to a module by itself. Accordingly, to use the module in Japan as a safety device for press machine or shearing tool pursuant to Article 42 of the above-mentioned law, it is necessary to apply for testing of the entire system.

In Europe, the module is subject to the European Union (EU) Machinery Directive Annex IV, B, Safety Components, items 1 and 2.

The type approval of TUV-Rheinland addresses the requirements of the following directives and standards.

- EU legislation
 - Machinery Directive 98/37/EC
 - Low Voltage Directive 73/23/EEC
 - EMC Directive 89/336/EEC
- European standards
 - EN 61508 (SIL1-3), EN 954-1 (Category 4, 3, 2, 1, B),
 - EN 61131-2, EN 418, EN 60204-1
- International standards
 - IEC 61508 (SIL1-3), IEC 61131-2, IEC 60204-1,
 - IEC 61000-6-2, IEC 61000-6-4
- U.S. standards
 - ANSI RIA15.06, ANSI B11.19

The modules are UL certified functionally safe and carry the NRGF label.

The modules received UL Listing to standards of USA and Canada including the following, when product is marked.

- UL 508, UL 1604, CSA 22.1 No.14, CSA 22.2 No. 213 for the following modules
 - 1791DS-IB12
 - 1791DS-IB8XOB8
 - 1791DS-IB8XOBV4
 - 1732-IB8XOBV4
 - 1732-IB8
- UL 508, CSA 22.1 No. 14 (for 1791DS-IB4XOW4 modules)

The modules received the following certification from ODVA, when product is marked.

- DeviceNet Conformance Test
- DeviceNet Safety Conformance Test

EC Directives

DeviceNet products conform to the EMC Directive and Low-voltage Directive.

EMC Directive

Rockwell Automation devices that comply with EC directives also conform to the related EMC standards so that they can more easily be built into other devices or the overall machine. The actual products have been checked for conformity to EMC standards. Whether they conform to the standards in the system used by the customer, however, must be confirmed by the customer.

EMC-related performance of Rockwell Automation devices that comply with EC directives vary depending on the configuration, wiring, and other conditions of the equipment or control panel in which the Rockwell Automation devices are installed. The customer must, therefore, perform the final check to confirm that devices and the overall machine conform to EMC standards.

Low-voltage Level Directive

Always be sure that devices operating at voltages of 50...1000V ac and 75...1500V dc meet the necessary safety standards for the controller (EN 61131-2).

Compliance with EC Directives

DeviceNet products that comply with EC directives must be installed as follows.

- As DeviceNet units are designed for installation inside control panels, all DeviceNet units must be installed within control panels.
- Use reinforced insulation or double insulation for the dc power supplies used for the communications power supply, internal circuit power supply, and the I/O power supplies.

- DeviceNet products that comply with EC directives also conform to the Common Emission Standard (EN 50081-2). Radiated emission characteristics (10-m regulations) may vary depending on the configuration of the control panel used, other devices connected to the control panel, wiring, and other conditions. You must confirm that the overall machine or equipment complies with EC Directives.
- DeviceNet products that comply with EC directives must have configurations with less than 30 m (98.43 ft) of I/O wiring and less than 10 m (32.81 ft) of power supply wiring.

The following examples show how to reduce noise.

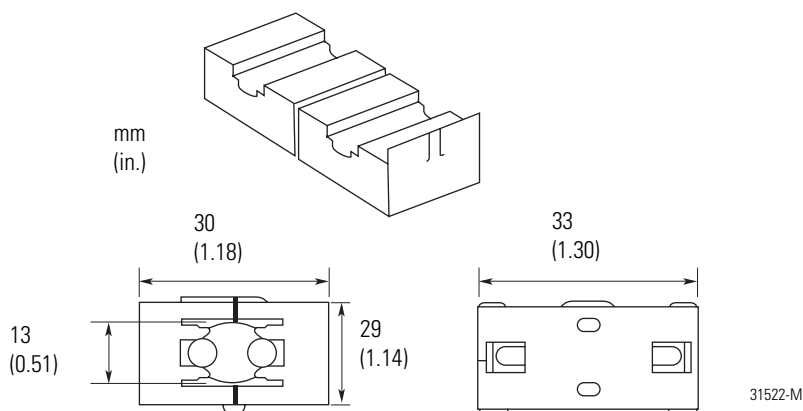
- Reduce electrical noise from the communications cable by installing a ferrite core on the communications cable within 10 cm (3.93 in.) of the DeviceNet master unit.

Ferrite Core (Data Line Filter)* LF130B
(manufactured by Easy Magnet Co.)

Impedance Specifications

Impedance	Value
25 MHz	100 MHz
156 Ω	250 Ω

Ferrite Core



- Wire the control panel with cables that are as short as possible and ground to 100 Ω or less.
- Keep DeviceNet communications cables as short as possible and ground to 100 Ω or less.

Precautions to Mount, Wire, and Clean

Observe these precautions to prevent operation failure, malfunctions, or undesirable effects on product performance.

When mounting modules, observe these precautions.

- Use DIN rail that is 35 mm (1.38 in.) wide to mount the module into the control panel.
- Mount modules to DIN rail so that the module does not fall off the DIN rail, for example, due to vibration.
- Leave at least 50 mm (1.96 in.) above and below the module to allow adequate ventilation and room for wiring.

When wiring modules, follow these instructions.

- Do not place communications lines and I/O lines in the same wiring duct or track as high voltage lines.
- Wire correctly after confirming the signal names of all terminals.
- Do not remove the shield from a module before wiring, but always remove the shield after completing wiring to ensure proper heat dispersion.
- Use insulated post terminals (DIN 46228-4 standard) for stranded wires before connecting the wires.
- Tighten screws on communications and I/O connectors securely using a tightening torque of 0.25 to 0.3 Nm (2.16 to 2.59 inch-pounds).

When cleaning modules, do not use the following.

- Thinner
- Benzene
- Acetone

Overview

The modules implement the CIP safety protocol extensions over DeviceNet networks and provide various features for a safety system.

Use the modules to construct a safety control network system that meets the requirements for Safety Integrity Level 3 (SIL 3) as defined in IEC 61508, Functional Safety of Electrical, Electronic, and Programmable Electronic Safety-related Systems, and the requirements for Safety Category 4 of the EN 954-1 standard.

Remote I/O communications for safety I/O data are performed through safety connections supporting CIP safety over a DeviceNet network, and data processing is performed in the safety controller.

The status and fault diagnostics of safety I/O modules is monitored by a safety PLC through a safety connection using a new or existing DeviceNet network.

Here is a list of features common to all DeviceNet safety I/O modules.

- CIP safety protocol conformance
- Safety inputs
 - Contact output devices such as emergency stop switches as well as emergency stop switches such as safety light curtain can be connected.
 - Dual-channel mode evaluates consistency between two output signals (channels), which allows use of the module for Safety Category 4.
 - The time of a logical discrepancy between two channels can be monitored using a discrepancy time setting.
 - An external wiring short-circuit check is possible by turning on an input (the module must be wired in combination with test outputs when this function is used).
 - Independently adjustable on and off delay is available per channel.
- Test outputs
 - Four separate test outputs are provided: T0, T1, T2, and T3.
 - Broken wires detection is supplied.
 - Power (24V) can be supplied to devices, such as safety sensors.
 - Test outputs can be set as standard outputs for use as monitor outputs.

- Safety outputs
 - Solid State outputs
 - Dual-channel mode evaluates consistency between two output signals (channels), which allows use of the module for Safety Category 4.
 - Relay Outputs
 - Dual-channel mode evaluates consistency between two output signals (channels), which allows use of the module for Safety Category 4.
 - Up to 2 A is provided per output point.
 - Safety relays can be replaced.
- I/O status data - In addition to I/O data, the module includes status data to check I/O circuits.
- Security - The configuration information of the module can be protected by a password.
- Removable I/O connectors - I/O connectors support mechanical keying.

About Catalog Numbers

See the table for a listing of the types of safety I/O modules.

Types of Safety I/O Modules

Catalog Number	Name	Enclosure Type Rating	Safety Inputs	Test Outputs ⁽¹⁾	Safety Outputs	
					Solid State	Relays
1732DS-IB8	Safety input module	Meets IP67	8	8	-	-
1732DS-IB8XOBV4	Safety I/O module with solid state outputs		8	8	4 bipolar pairs	-
1791DS-IB12	Safety input module	Meets IP20	12	4	-	-
1791DS-IB8XOB8	Safety I/O module with solid state outputs		8	4	8	-
1791DS-IB4XOW4	Safety I/O module with relay outputs		4	4	-	4
1791DS-IB8XOB4	Safety I/O module with solid state outputs		8	8	4 bipolar pairs	-

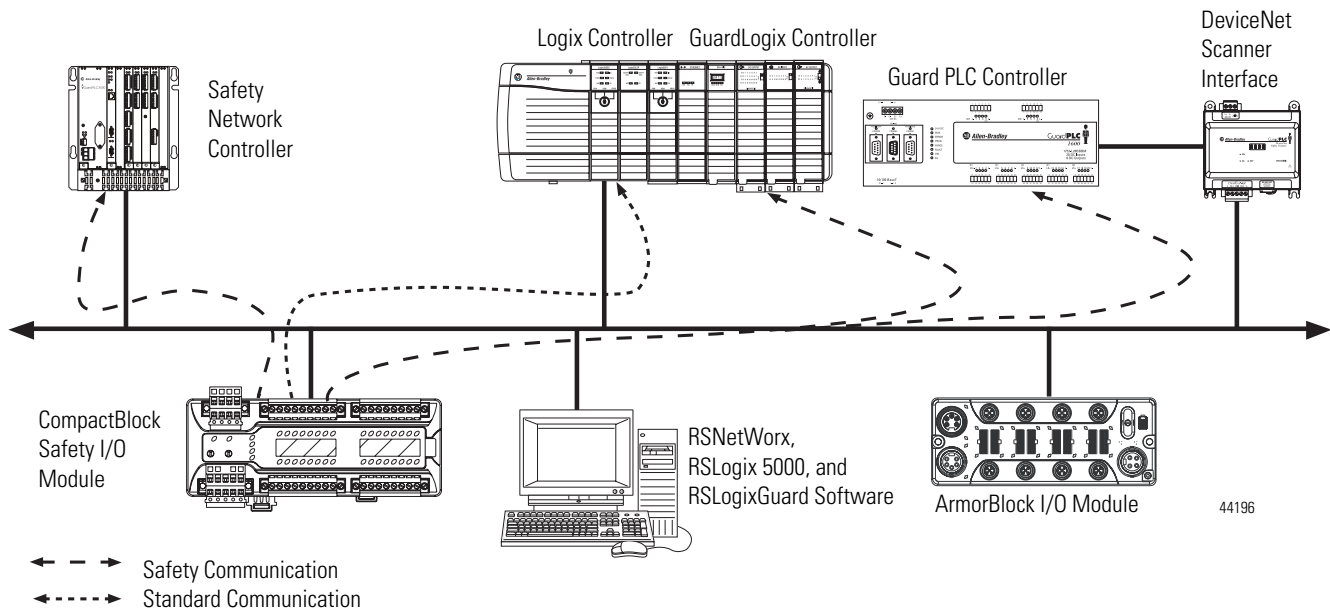
⁽¹⁾ Each test output can be set to function as a pulse test output or a standard output pulse. Test outputs are used in combination with a safety input. Broken wires in an external indicator can be detected for terminal T3 only.

About CIP Safety Over

Use Guard safety I/O modules in DeviceNet safety architectures as shown in the figure.

The Guard I/O family is a set of I/O modules that when connected to a DeviceNet safety network are suitable for applications up to SIL3, as defined in the IEC 61508 standard, and Safety Category 4, as defined in the EN 954-1 standard.

Guard I/O Modules in DeviceNet Safety Architectures



Safety input devices such as E-stop switches and safety output devices, such as safety contactors, can be connected to safety I/O blocks. Standard devices, such as proximity switches, push buttons, or lamps, can also be connected to safety I/O blocks.

PLC controllers or safety network controllers control the safety outputs. Safety PLC controllers, safety network controllers, or standard PLC controllers control the standard outputs.

The modules provide self-diagnostics to test the electronics within the module. The safety outputs provide a pulse test feature for diagnosing the external wiring of field actuators. Testing of input wiring is by connecting the field input devices to one of the pulse test outputs provided by the modules. Any pulse test outputs not used to test input wiring can be used as a standard output. At least one of these standard outputs is configurable with current monitoring to use it as a muting lamp.

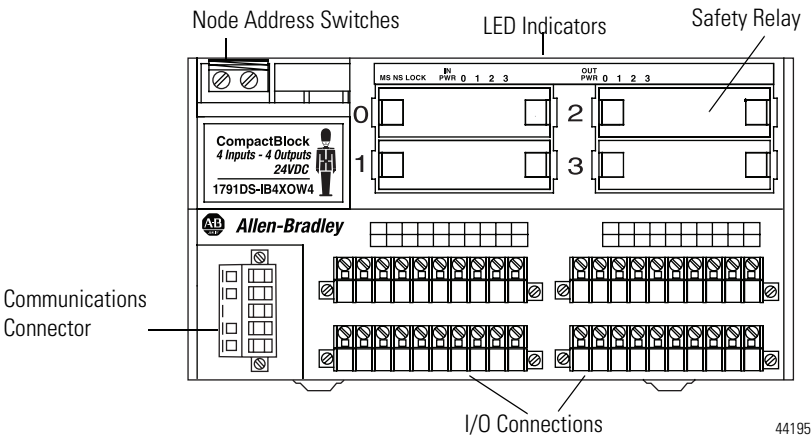
The modules also allow configuration of input points as dual inputs, and configuration of output points as dual outputs. The module performs internal diagnostics on I/O channels configured to operate in Dual mode.

Any discrepancy results in a safe state and status generated for the master. Configuration of DeviceNet block safety I/O modules is via software using either the network configuration tool, RSNetworkx for DeviceNet Safety software, or the PLC programming tool, RSLogix 5000 software.

Identify Major Parts of the Modules

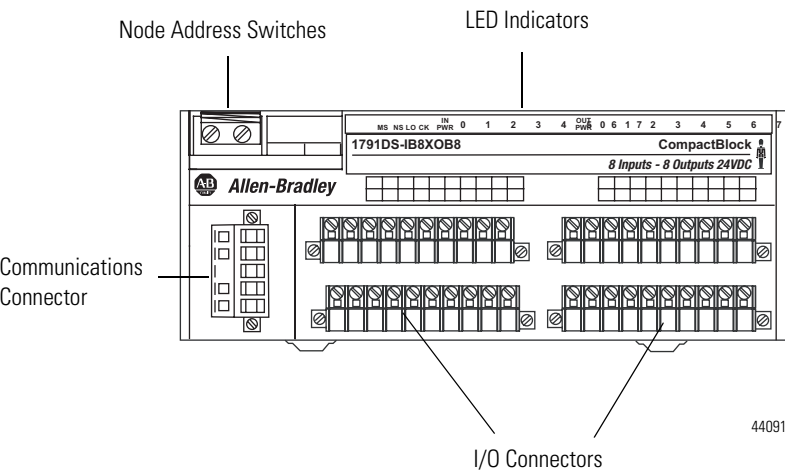
See the figures that show major parts of the modules.

1791DS-IB4XOW4 Module Identification



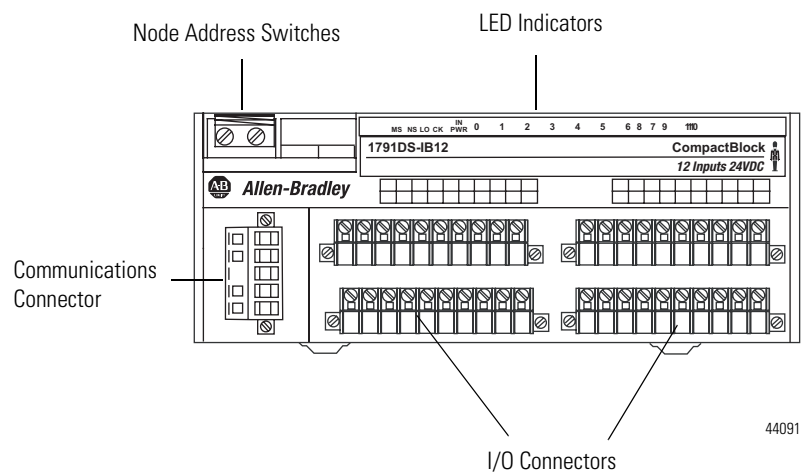
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1791DS-IB8XOB8 Module Identification

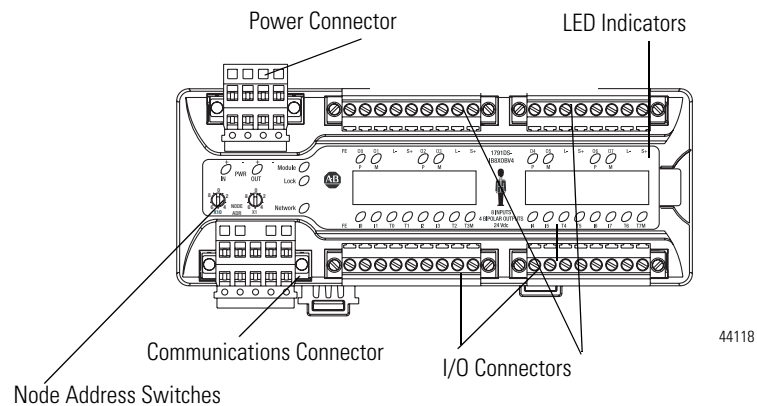


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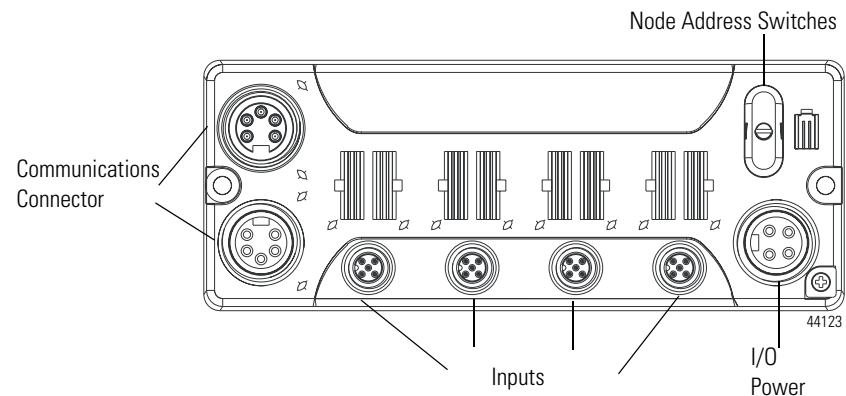
1791DS-IB12 Module Identification



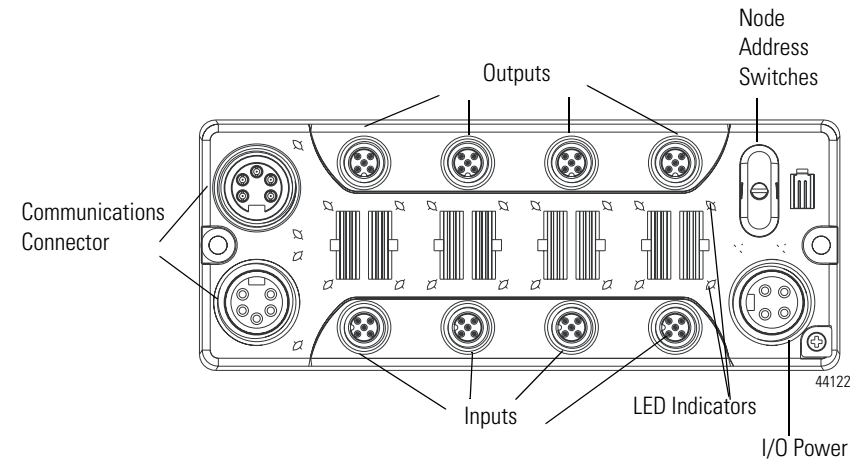
1791DS-IB8XOBV4 Module Identification



1732DS-IB8 Module Identification



1732DS-IB8X0BV4 Module Identification



Understand Operation of Safety Functions

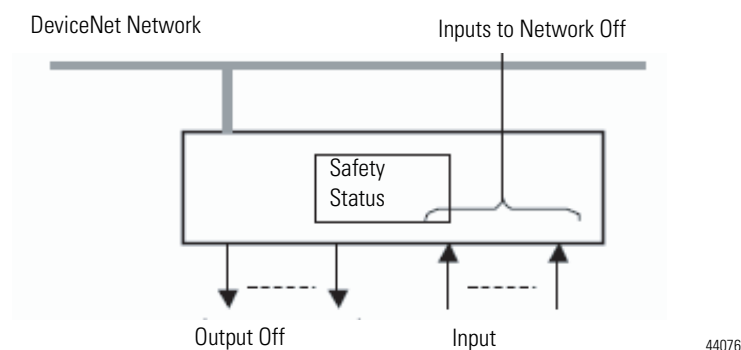
What This Chapter Contains Read this chapter for information about safety functions.

Safety I/O Modules

The following status is treated as the safe state by the safety I/O modules.

- Safety outputs: off
- Input data to network: off

Safety Status



The module is designed for use in applications where the safe state is when the outputs turn off.

Self-diagnostic Functions

Self-diagnostics are performed when the power is turned on and periodically during operation. If an error occurs, it is treated as a fatal error, the MS (module status) indicator lights in red, and the safety outputs and output data to the network turn off.

Configuration Lock

After configuration data has been downloaded and verified, the configuration data within the module can be protected either by using RSNetworx for DeviceNet or RSLogix 5000 software.

If the data is protected, the lock indicator on the front panel lights in yellow. If the data is not protected, the lock indicator on the front panel flashes in yellow.

Safety Inputs

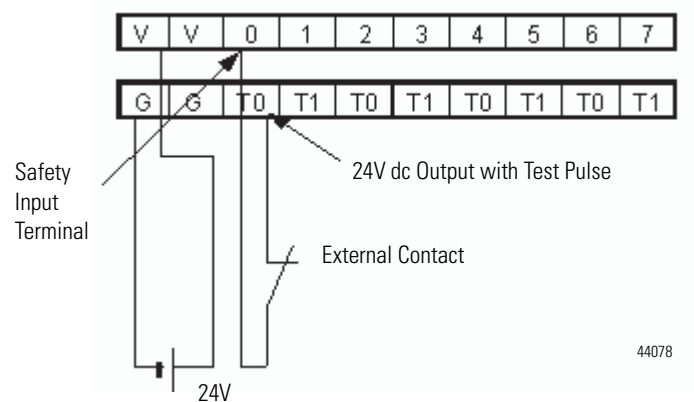
Read this section for information about safety inputs.

Test Pulse from Test Output

A test output is used in combination with a safety input. Specify the corresponding test output terminal to use as the test source.

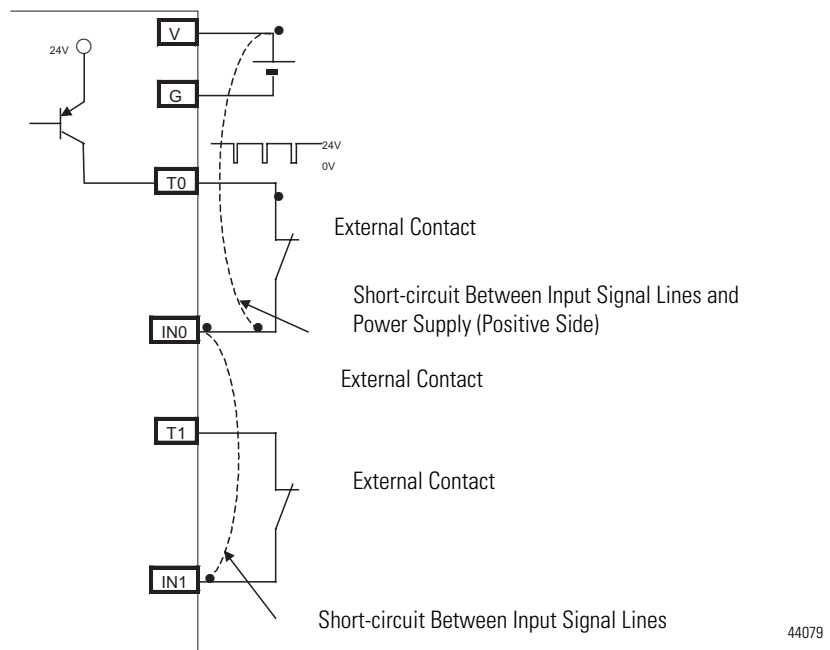
The test output terminal is also used as a power supply to source an external input device to the safety input terminal.

Example Use of a 1791DS-IB12 Module



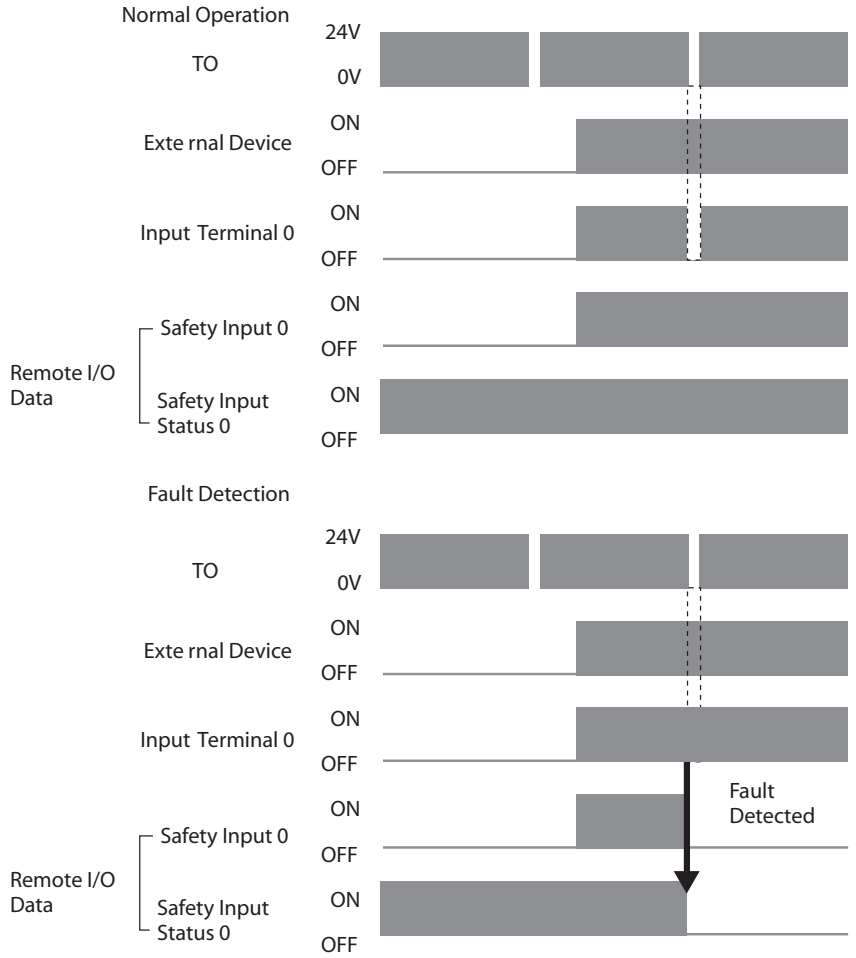
A test pulse is output from the test output terminal to diagnose the internal circuit when the external input contact turns on. Using this function, short-circuits between input signal lines and the power supply (positive side), and short-circuits between input signal lines can be detected.

Short-circuit Between Input Signal Lines



If an error is detected, safety input data and safety input status turn off.

Normal Operation and Fault Detection



Set Dual-channel Mode and Discrepancy Time

The consistency between signals on two channels can be evaluated. Either of the following settings can be selected. This function monitors the time during which there is a discrepancy in the logic between the two channels set as dual channels.

If the length of the discrepancy exceeds the set discrepancy time (0...65,530 ms in increments of 10 ms), the safety input data and the individual safety input status turns off for both inputs.

IMPORTANT

The dual-channel function is used with two consecutive inputs that start from even input numbers such as inputs 0 and 1, inputs 2 and 3, and inputs 4 and 5.

The following table shows the relation between terminal input status and remote I/O data.

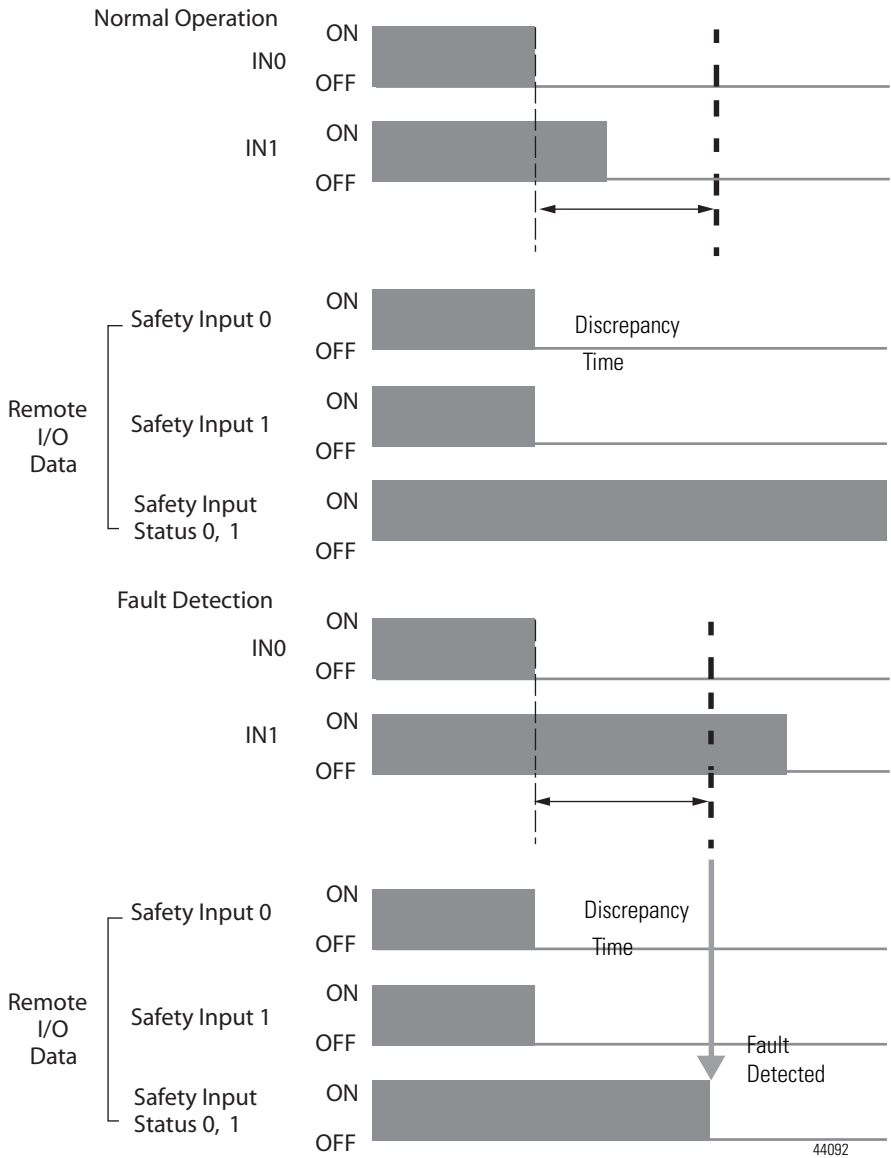
Terminal Input Status and Remote I/O Data

Dual-channel Mode	Input Terminal		Remote I/O Data				Meaning of Data and Status
	IN0	IN1	Safety Input 0	Safety Input 1	Status of Safety Input 0	Status of Safety Input 1	
Dual-channels, Equivalent	OFF	OFF	OFF	OFF	ON	ON	OFF, normal (OK)
	OFF	ON	OFF	OFF	OFF	OFF	OFF, fault
	ON	OFF	OFF	OFF	OFF	OFF	OFF, fault
	ON	ON	ON	ON	ON	ON	ON, normal (OK)
Dual-channels, Complementary	OFF	OFF	OFF	ON	OFF	OFF	OFF, fault
	OFF	ON	OFF	ON	ON	ON	OFF, normal (OK)
	ON	OFF	ON	OFF	ON	ON	ON, normal (OK)
	ON	ON	OFF	ON	OFF	OFF	OFF, fault

Dual-channels, Equivalent

The status is treated as normal (OK) when both channels are on or off. If one channel is on and the other channel is off, it is treated as a fault (alarm). In the fault (alarm) state the safety input data and individual safety input status turn off for both inputs.

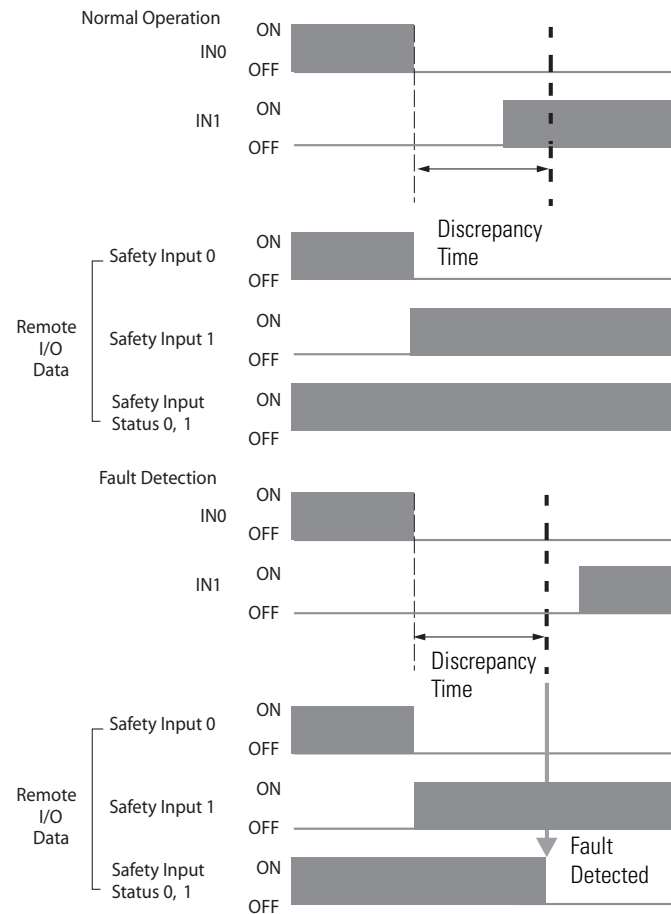
Normal Operation and Fault Detection



Dual-channels, Complementary

The status is treated as normal (OK) when one channel is on and the other channel is off. When both channels are on or both channels are off, it is treated as a fault (alarm). In the fault (alarm) state, safety input 0 is off and safety input 1 is off, and the safety input status turns off for both inputs.

Normal Operation and Fault Detection



44093

Fault Recovery

If an error is detected, the safety input data remains in the off state. The procedure for activating the safety input data again is as follows.

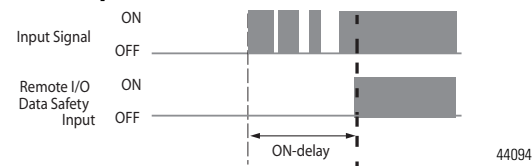
1. Remove the cause of the error.
2. Turn off the safety input.

The safety input status turns on after the input error latch time has elapsed. The I/O indicator (red) turns off. The input data can now be controlled.

Input Delays

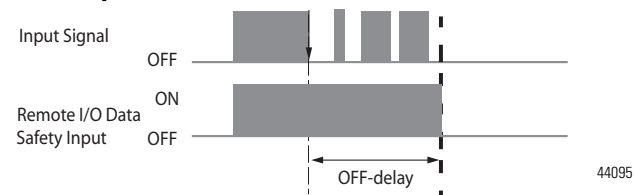
ON Delay - An input signal is treated as being off during the on delay setting time (0...126 ms, in increments of 6 ms) after the input contact's rising edge. The input turns on only if the input contact remains on after the on delay time has elapsed. This helps prevent chattering of the input contacts.

On-delay



OFF Delay - An input signal is treated as being on during the off delay setting time (0...126 ms, in increments of 6 ms) after the input contact's falling edge. The input turns off only in the input contact remains off after the off delay time has elapsed. This helps prevent chattering of the input contacts.

Off-delay



Safety Outputs

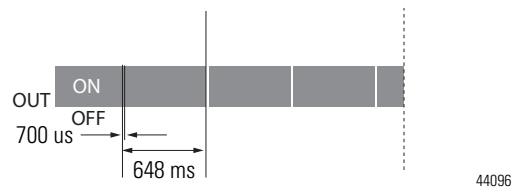
Read this section for information about safety outputs.

Safety Output with Test Pulse

When the output is on, the test pulse is turned off for 700 μs in a cycle of 648 ms.

Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected. If an error is detected, the safety output data and individual safety output status turns off.

Test Pulse in a Cycle



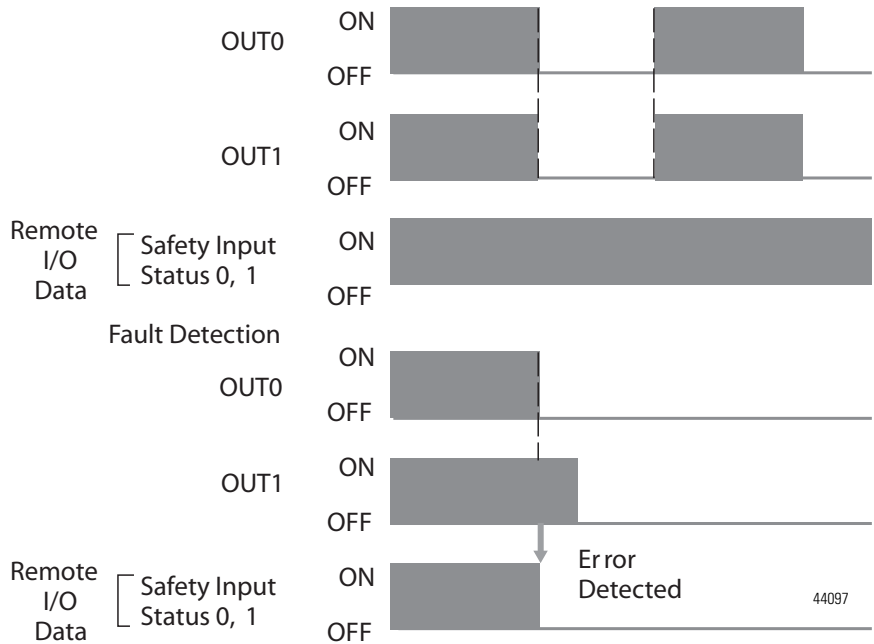
IMPORTANT

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

Dual-channel Setting

When the data of both channels is in the on state, and neither channel has an alarm, the outputs are turned on. The status is treated as OK when both channels are OK. If an alarm is detected for one channel, the safety output data and the individual safety output status turn off for both channels.

Dual-channel Setting



Fault Recovery

If a fault is detected, the safety output remains in the off state. The procedure for activating the safety output data again is as follows.

1. Remove the cause of the error.
2. Turn off the safety output or outputs.

The safety output status turns on when the output error latch time has elapsed. The I/O indicator (red) turns off. The output data can now be controlled.

I/O Status Data

In addition to I/O data, the module supports status data to check the I/O circuits. The status data includes the following data, which can be read by the PLC, controller, or controllers.

- Individual Point Input Status
(ON = Normal/OK, OFF = Fault/Alarm)
- Combined Input Status
(ON = Normal/OK, OFF = Fault/Alarm)
- Individual Point Output Status
(ON = Normal/OK, OFF = Fault/Alarm)
- Combined Output Status
(ON = Normal/OK, OFF = Fault/Alarm)
- Individual Output Readback
(actual ON/OFF state of the outputs)
- Individual Test Output Status
(ON = Normal/OK, OFF = Fault/Alarm)

Normal flags indicate whether each safety input, safety output, or test output is normal (normal status: ON, error (fault) status: OFF). For fatal errors communications connections may be broken, so the status of the normal flags then cannot be read.

Combined flags are provided for an AND of the status of all safety inputs or all safety outputs (when all inputs or outputs are normal: ON, when one or more of them has an error: OFF). This is known as the combined safety input/output status.

Output monitors indicate the actual ON/OFF status of each safety output.

Install and Connect Your Modules

What This Chapter Contains

This chapter explains the general procedures for using the modules to include the following.

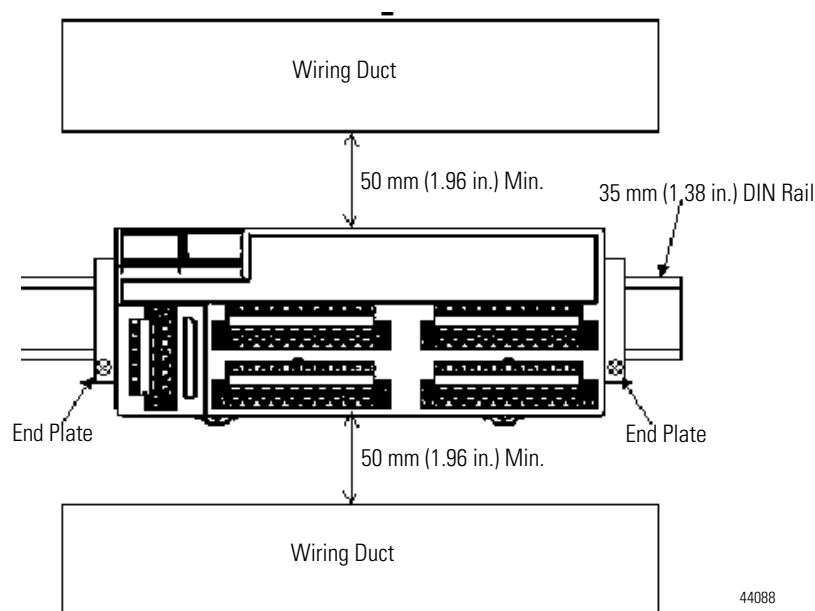
- Install the module in the control panel.
- Wire I/O power and cables.
- Connect communications connectors.
- Set the node address.
- Configure the system, making settings for the module.

The communication rate of the entire system is determined by the communication rate of the master unit. The baud rate does not need to be set for each module.

Install the Module

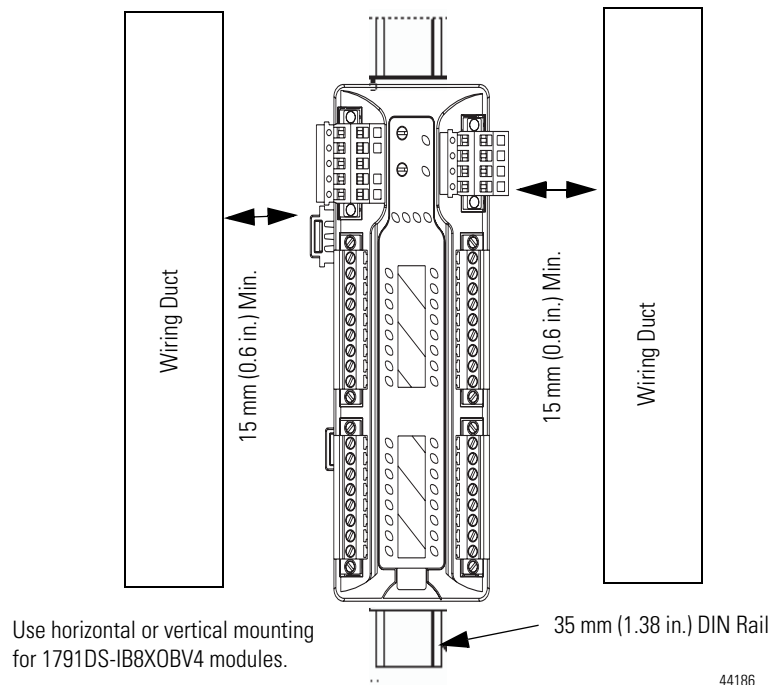
Use DIN rail that is 35 mm (1.38 in.) wide to install the module in the control panel. See the figures for required spacing.

Module Installation



44088

Module Installation for 1791DS-IB8X0BV4 Modules



IMPORTANT

When installing a module follow these instructions.

- Use the module in an environment that is within the general specifications.
- Use the module in an enclosure rated IP54 (IEC60529) or higher.
- Use DIN rail that is 35 mm (1.38 in.) wide to mount the module in the control panel.
- Always use an end plate on each end of the module to secure it for 1791DS-IB12, 1791DS-IB8X0B8, and 1791DS-IB4X0W4 modules.

Connect I/O Power and I/O Cables

See the table for a list of applicable wires that fit the I/O connector when using recommended post-crimp terminals.

Wire Type and Size

Wire Type	Wire Size
Solid wire	0.2...2.5 mm ² (AWG24...12)
Stranded wires	0.34...1.5 mm ² (AWG22...16)

For the terminal arrangement of the terminal block and wiring for external I/O, refer to the description of each individual module in this manual.

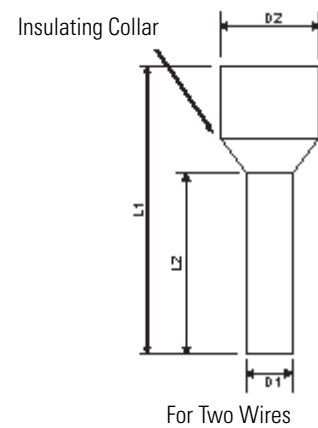
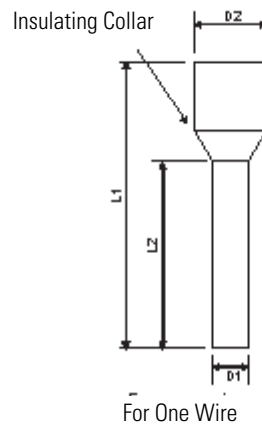
Use ferrules with plastic insulating collars conforming to DIN46228-4. Note that a ferrule with similar appearance but not conforming to the standard may not match the terminal block of the module. Confirm wire dimensions, noting that wire dimensions shown in the figure are rough dimensions.

IMPORTANT

Use wires of the same diameter for any two-wire ferrules that are used.

Reference Specifications (Product Specifications of Phoenix Contact)

Ferrule Model		Wire Dimensions		Ferrule Specifications					Dimensions
		Cross-sectional Area of Conductor (mm ²)	AWG	Removed Length of Insulation mm (in.)	Entire Length L1 mm (in.)	Length of Metal Part L2 mm (in.)	Inner Diameter of Conductor D1 mm (in.)	Inner Diameter of Insulation Cover D2 mm (in.)	
For One Wire	AI 0.34-8TQ	0.34	22	10 (0.39)	12.5 (0.49)	8 (0.31)	0.8 (0.03)	2.0 (0.08)	See figure for one wire.
	AI 0.5-8WH	0.5	20	10 (0.39)	14 (0.55)	8 (0.31)	1.1 (0.04)	2.5 (0.09)	
	AI 0.75-8GY	0.75	18	10 (0.39)	14 (0.55)	8 (0.31)	1.3 (0.05)	2.8 (0.11)	
	AI 1.0-8RD	1.0	18	10 (0.39)	14 (0.55)	8 (0.31)	1.5 (0.06)	3.0 (0.12)	
	AI 1.5-8BK	1.5	16	10 (0.39)	14 (0.55)	8 (0.31)	1.8 (0.07)	3.4 (0.13)	
For Two Wires	AI-TWIN 2 x 0.5-8WH	2 x 0.5	-	10 (0.39)	15 (0.59)	8 (0.31)	1.5 (0.06)	2.5/4.7 (0.09/0.18)	See figure for two wires.
	AI-TWIN 2 x 0.75-8GY	2 x 0.75	-	10 (0.39)	15 (0.59)	8 (0.31)	1.8 (0.07)	2.8/5.0 (0.11/0.19)	
	AI-TWIN 2 x 1-8RD	2 x 1	-	10 (0.39)	15 (0.59)	8 (0.31)	2.05 (0.080)	3.4/5.4 (0.13/0.21)	

Ferrule for One Wire and Two Wires

44089

Use a Phoenix Contact crimping tool (model CRIMPFOX UD6) for the ferrules.

IMPORTANT

When crimping connection cables, follow these instructions.

- Use ferrules when wiring cables.
- Note that I/O connectors are detachable.
- Tighten the screws on the I/O connector to 0.25...0.3 Nm (2.16...2.59 in-lb).
- Since the I/O connector has a structure that helps prevent incorrect wiring, make connections at the specified locations corresponding to the terminal numbers.
- Do not remove the shield from the module before wiring.
- Always remove the shield after completing wiring to ensure proper heat dispersion.

Connect Communications Connectors

Colored stickers on the communications connector match the colors of the wires to be inserted. Check that the colors of the wires and stickers match when wiring the connectors. The colors are as follows.

Colors and Signals

No.	Color	Signal
5	Red	Power cable positive side (V+)
4	White	High side of communications data (CAN_H)
3	-	Shield
2	Blue	Low side of communications data (CAN_L)
1	Black	Power cable negative side (V-)

IMPORTANT

When connecting a communication connector with the module, tighten the screws on the communications connector to 0.25...0.3 Nm (2.16...2.59 in-lb).

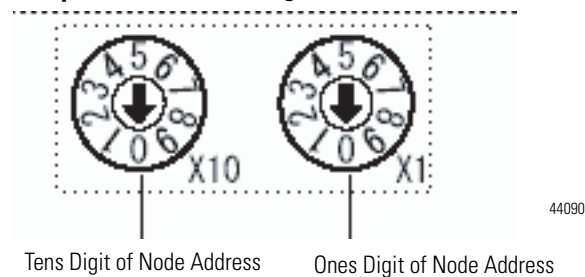
The internal power for the module is supplied from the communications power supply (V+, V-).

Set the Node Address

To set the node address, follow these procedures.

IMPORTANT

The node address setting rotary switches must be set while the communications power supply is turned off.

Sample Node Address Digits

1. Set the node address using the two rotary switches on the front panel of the module, noting that the default setting is 63 and a value between 00...63 is valid for proper use.
2. Use the left rotary switch to set the tens digit of node address (decimal).
3. Use the right rotary switch to set the ones digit.

If a node address from 64...99 is set, the node address can be set from RSNetworx for DeviceNet software.

Configure the Module

Configure the module using RSNetworx for DeviceNet or RSLogix 5000 software.

You can refer to the corresponding module configuration software tool and its help files in RSLogix 5000 or RSNetworx for DeviceNet software.

Configure Modules in RSLogix 5000 Software

What This Chapter Contains This chapter provides information about how to configure your modules in RSLogix 5000 software, including how to complete entries on the dialogs that correspond to tabs at the top of the dialog.

Use the Help Button At the bottom of a dialog, click Help for information about how to complete entries on the dialog. At the bottom of a warning dialog, click Help to get information about that specific error.

Before You Begin Read this section for information about setting I/O parameters and allocating remote I/O, which you do using RSLogix 5000 software.

About Parameter Groups

The module has these parameter groups.

- General parameters
- Safety input parameters
- Test output parameters
- Safety output parameters

See the tables for the settings in each parameter group. All parameters are set using RSLogix 5000 software.

IMPORTANT

Parameters directly related to safety are marked with an X in the left column.

General Parameters

Parameter Name ⁽¹⁾		Value	Description	Default
x	Safety Output Error Latch Time	0 ... 65,530 ms (in increments of 10 ms)	Safety output errors is latched for this time.	1,000 ms
x	Safety Input Error Latch Time	0 ... 65,530 ms (in increments of 10 ms)	Safety input or test output errors is latched for this time.	1,000 ms
	Test Output Idle State	Clear OFF or Keep output data	Definition of output data is in idle state.	Clear OFF

⁽¹⁾ Parameters directly related to safety are marked with an X in the left column.

Safety Input Parameters

Parameter Name ⁽¹⁾		Value	Description
x	Input Delay Time Off -> On	0 ... 126 ms (in increments of 6 ms)	Filter time for OFF to ON transition.
x	Input Delay Time On -> Off	0 ... 126 ms (in increments of 6 ms)	Filter time for ON to OFF transition.
x	Input Point Mode	Not Used	External input device is not connected.
		Safety Test Pulse	Use with a contact output device and in combination with a test output. Using this setting, short-circuits between input signal lines and the power supply (positive side) and short-circuits between input signal lines can be detected.
		Safety	A solid state output safety sensor is connected.
		Standard	A non-safety device, such as a reset switch, is connected.
x	Safety Input Test Source	Not used	The test output used with the input.
		Test Output 0	
		Test Output 1	
		Test Output 2	
		Test Output 3	
x	Input Point Operation Type	Single Channel	Use as single channel.
		Dual-channel Equivalent	Use as dual-channel. Normal (OK) when both channels are ON or OFF.
		Dual-channel Complementary	Use as dual-channel. Normal (OK) when one channel is ON and the other channel is OFF.

⁽¹⁾ Parameters directly related to safety are marked with an X in the left column.

IMPORTANT

If the test pulse from test output is set to the Safety Input Channel mode, the safety input test source and pulse test output of the test output must be set to the Test Output mode.

Test Output Parameters

Parameter Name ⁽¹⁾	Value	Description	Default
x	Test Output Mode	Not Used	Not Used
		Standard	
		Pulse Test	
		Power Supply	
		Muting Lamp Output (Terminal T3 only)	
	Test Output Fault Action	Clear OFF	Clear OFF
		Hold Last Data	

⁽¹⁾ Parameters directly related to safety are marked with an X in the left column.

Safety Output Parameters

Parameter Name ⁽¹⁾	Value	Description	Default
x	Output Point Mode	Not Used	Not Used
		Safety	
		Safety Pulse Test (Can be set for 1791DS-IB8XOB8 module only.)	
x	Output Point Operation Type	Single Channel	Dual-channel

⁽¹⁾ Parameters directly related to safety are marked with an X in the left column.

Allocate Remote I/O

Concerning I/O allocations, the module internally stores I/O data. To set connection paths use RSLogix 5000 software to allocate I/O data for the master unit. No settings are made by default. Be sure to set the required connection paths.

Concerning I/O data, the module stores the following data.

- SAFE: Information the controller can use in safety-related functions
- NON-SAFE: Additional information that must not be relied on for safety functions

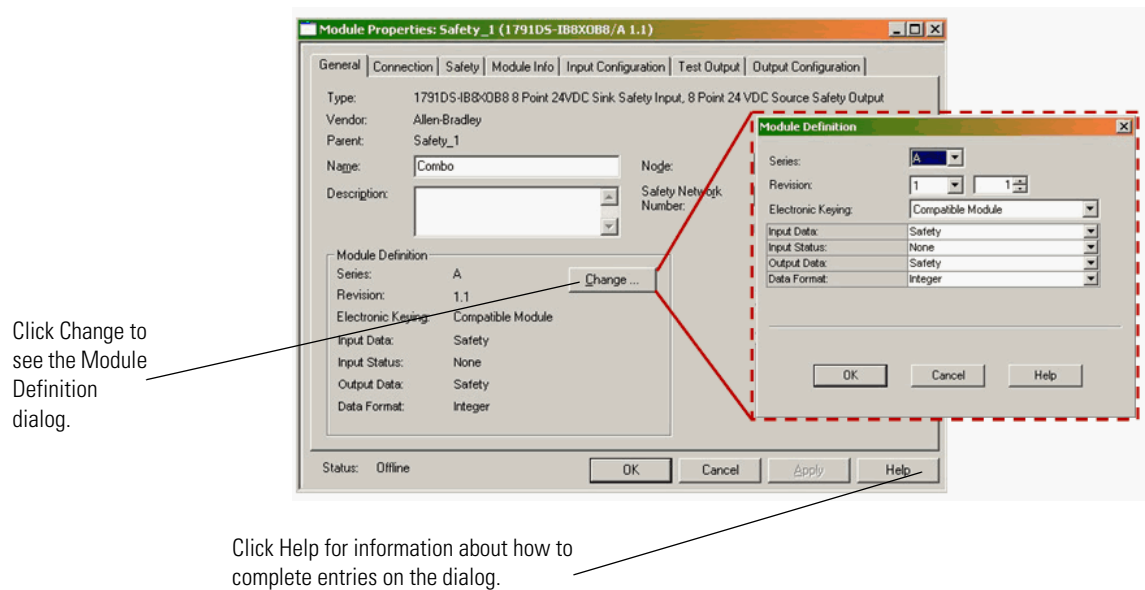
Data and Description

Data		Description
Input data	Safety Input Data SAFE	Indicates the ON/OFF status of each input terminal. • ON: 1 OFF: 0
	Combined Safety Input Status SAFE	An AND of the status of all input terminals. • All terminals are normal: 1 • An error was detected in one or more input terminals: 0
	Individual Safety Input Status SAFE	Indicates the status of each input terminal. • Normal (OK): 1 Fault (Alarm): 0
	Combined Safety Output Status SAFE	An AND of the status of all safety output terminals. • All terminals are normal: 1 • An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFE	Indicates the status of each safety output terminal. • Normal (OK): 1 Fault (Alarm): 0
	Muting Lamp Status SAFE	Indicates the status when terminal T3 is configured as the muting lamp output. • Normal (OK): 1 Fault (Alarm): 0
	Safety Output Monitor NON-SAFE	Monitors the outputs of the safety output terminals. • ON: 1 OFF: 0
	Individual Test Output Status NON-SAFE	Indicates the status of each of the test output terminals. • Normal (OK): 1 Fault (Alarm): 0
Output data	Safety Output Data SAFE	Controls the safety output. • ON: 1 OFF: 0
	Standard Output Data NON-SAFE	Controls the test output when test output mode is set to a standard output. • ON: 1 OFF: 0

Configure Your Module

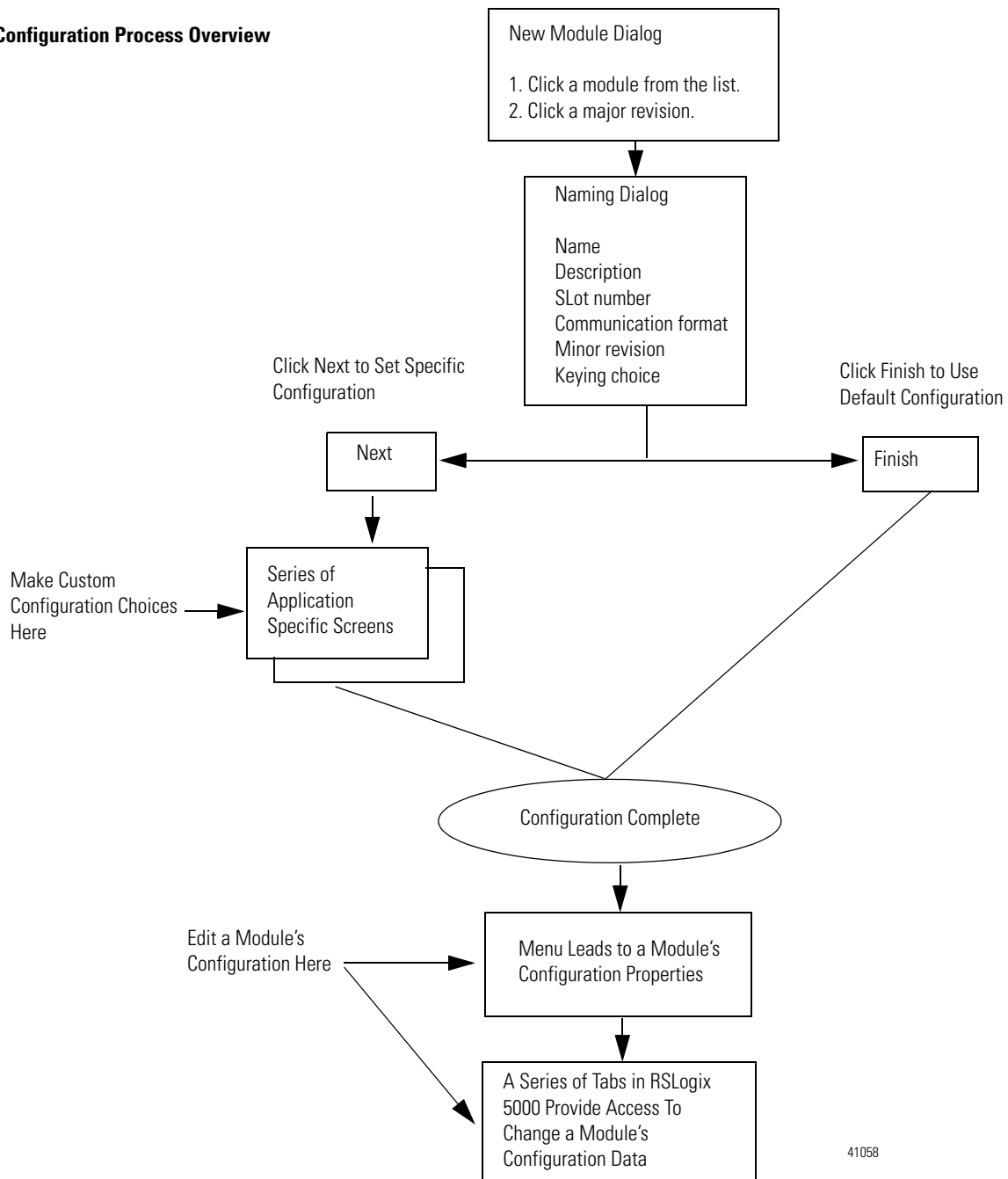
To configure your module in RSLogix 5000 software, complete the following steps.

1. Start the RSLogix 5000 software and configure as needed, referring to GuardLogix Controllers User Manual, publication number 1756-UM020.
2. Add a safety module, noting you see the Module Properties dialog.



3. From the General dialog, complete entries or click on a tab at the top of the dialog to display another dialog.

Configuration Process Overview

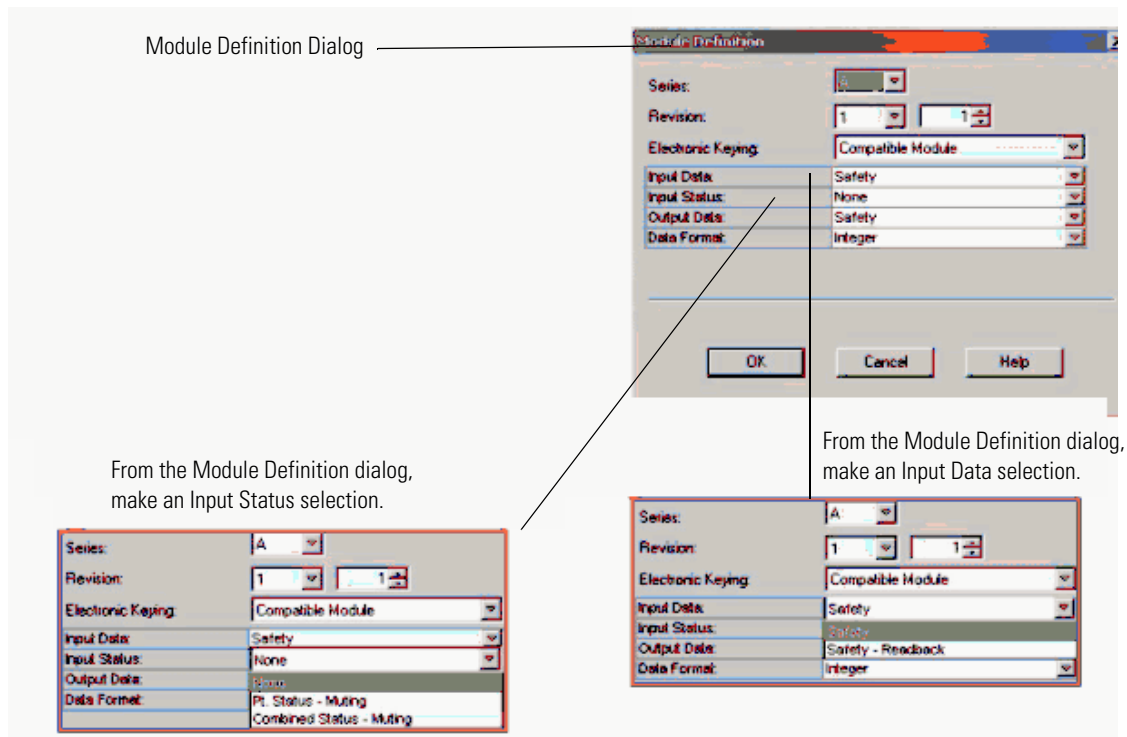


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Work with the General Dialog

Follow these procedures to complete entries on the General dialog.

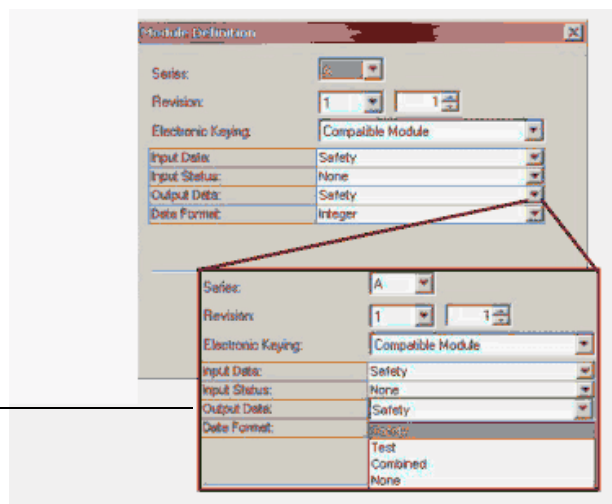
1. From the General dialog, complete the entry for Name, Description, Node, and Safety Network Number.
2. From the General dialog, click Change to see the Module Definition dialog.



3. From the Module Definition dialog, complete these entries and click OK, referring to the Understand Electronic Keying Options section of this manual and the figures that show input and output tags with various selections.

- Series
- Revision
- Electronic Keying
 - Compatible Module
 - Exact Match
 - Disable Keying
- Input data
 - Safety - input data
 - Safety - Readback - output status
- Input status
 - None - input status not returned with safety data
 - Pt. Status - Muting - granular data returned with safety I/O packet
 - Combined Status - Muting - module status, to understand a specific fault you must generate an explicit message or have the diagnostics mapped into the DNB scanner
- Output data
 - Safety - Normal digital output (includes +24V dc short detection)
 - Test - Output is tested during operation
 - Combined
 - None - Output is disabled
- Data format - Integer

From the Module Definition dialog, make an Output Data selection.



4. From the General dialog, click OK at the bottom of the dialog or another tab at the top of the dialog, such as Input Configuration.

Understand Electronic Keying Options

Instead of plastic mechanical backplane keys, with electronic keying the ControlLogix system controls what modules belong in the various slots of a configured system. During module configuration, click one of these.

- Exact Match
- Compatible Module
- Disable Keying

When the controller attempts to connect to and configure a module (for example, after program download), the module compares parameters before allowing the connection and configuration to be accepted.

The comparison is made between the keying information present in the module and the keying information in the controller's program, preventing the inadvertent operation of a system with the wrong module in the wrong slot.

ATTENTION



Be extremely cautious when using Disable Keying. If used incorrectly, this option can lead to personal injury or death, property damage, or economic loss.

For example, if you select Exact Match and a module with revision 1.2 is placed in a location configured for a module with revision 1.4, the controller does not make a connection to the new module because of the mismatched revisions.

Electronic Keying Options

Option	Definition
Exact Module	All parameters must match or the inserted module rejects a connection to the controller.
Compatible Module	<p>With the Compatible Match mode, the module determines whether it can emulate the module defined in the configuration sent from the controller. The module can emulate older revisions. The module accepts the configuration if the configuration's revision is less than or equal to the physical module's revision.</p> <p>For example, if the configuration contains a major.minor⁽¹⁾ revision of 1.7, the module inserted in the slot must have a firmware revision of 1.7 or higher for a connection to be made. When a module is inserted with a revision that is less than the revision for which the slot is configured (for example, the module has a revision of 1.6 and the slot is configured for a module with revision 1.8), no connection is made between the controller and the I/O module.</p> <p>We recommend using Compatible Match whenever possible. Remember with major revision changes, the module only works to the level of the configuration. If possible, we recommend you make sure configuration is updated to match the revision levels of all I/O modules. Failure to do so may prevent the application from working and can defeat the purpose of upgrading the revision level.</p>
Disable Keying	<p>The inserted module attempts to accept a connection to the controller regardless of its type.</p> <p>If keying is disabled, a controller makes a connection with most modules of the same type as that used in the slot configuration. For the module, if keying is disabled, the controller makes a connection only to a another module.</p> <p>A controller does NOT establish a connection if any of these conditions exist, even if keying is disabled.</p> <ul style="list-style-type: none"> • The slot is configured for one module type (for example, an input module) and a module of another type (for example, an output module) is inserted in the slot. • The module inserted into the slot cannot accept some portion of the configuration. For example, if a module is inserted into a slot configured for a diagnostic module, the controller cannot make a connection because the module does not accept the diagnostic configuration.

⁽¹⁾ Minor revisions increment by single counts, for example, major.minor revision 1.10 follows 1.9.

Input and Output Tags with Various Selections

Selections are in bold.

- Input Data
 - Safety**
 - Safety-Readback
- Input Status
 - None**
 - Point Status
 - Combined Status
- Output Data
 - Safety
 - Test**
 - Combined
 - None
- Data Format
 - Integer**

Input Tags and Output Tags are for the selections that appear in bold

Input Tags			
Name	Value	Style	Class
Safety_1 2pt_In:I.RunMode	0	Decimal	Safety
Safety_1 2pt_In:I.ConnectionFaulted	0	Decimal	Safety
Safety_1 2pt_In:I.Pt00Data	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:I.Pt11 Data	0	Decimal	Safety

Output Tags			
Name	Value	Style	Class
Safety_1 2pt_In:O.Test00Data	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:O.Test03Data	0	Decimal	Safety

Selections are in bold.

- Input Data
 - Safety**
 - Safety-Readback
- Input Status
 - None
 - Point Status**
 - Combined Status
- Output Data
 - Safety
 - Test**
 - Combined
 - None
- Data Format
 - Integer**

Input Tags and Output Tags are for the selections that appear in bold

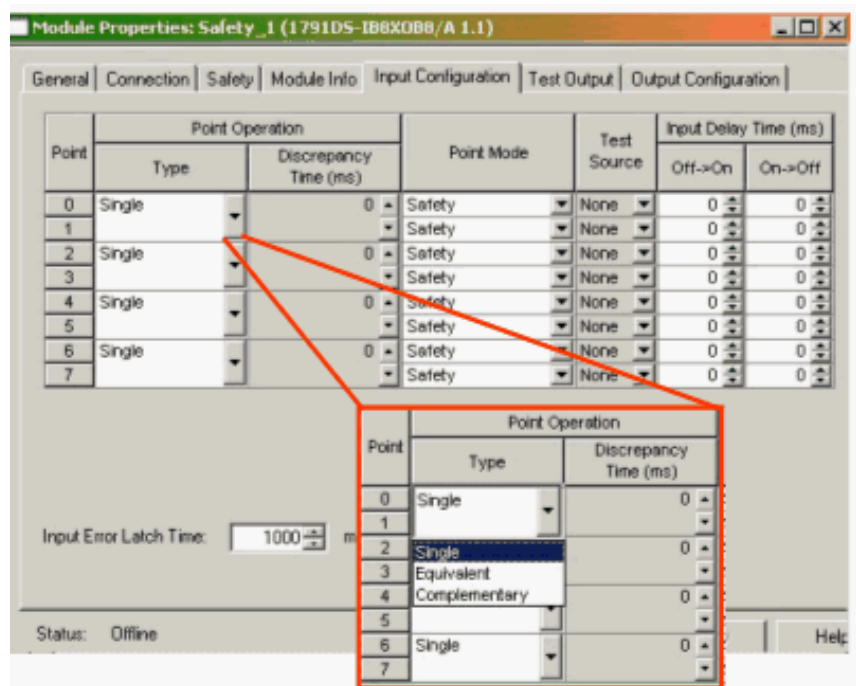
Input Tags			
Name	Value	Style	Class
Safety_1 2pt_In:I.RunMode	0	Decimal	Safety
Safety_1 2pt_In:I.ConnectionFaulted	0	Decimal	Safety
Safety_1 2pt_In:I.Pt00Data	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:I.Pt11 Data	0	Decimal	Safety
Safety_1 2pt_In:I.Pt00Status	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:I.Pt11 Status	0	Decimal	Safety
Safety_1 2pt_In:I.MutingStatus	0	Decimal	Safety
Safety_1 2pt_In:I.Pt00TestOutputStatus	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:I.Pt03TestOutputStatus	0	Decimal	Safety

Output Tags			
Name	Value	Style	Class
Safety_1 2pt_In:O.Test00Data	0	Decimal	Safety
↓	↓	↓	↓
Safety_1 2pt_In:O.Test03Data	0	Decimal	Safety

Work with the Input Configuration Dialog

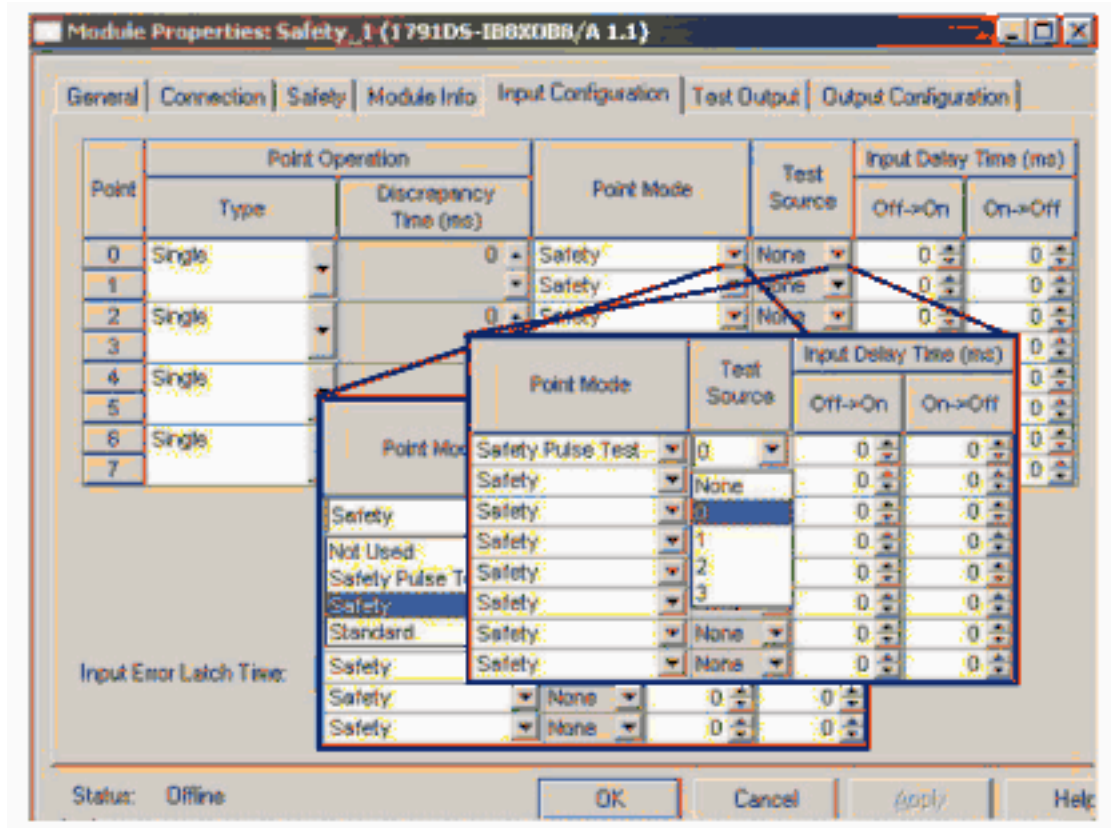
Follow these procedures to complete entries from the Input Configuration Dialog.

- For Point Operation, click one of these and click a value for Discrepancy Time.
 - Single - Inputs are treated as single channels.
 - Equivalent - Each channel requires two inputs. They must match within the discrepancy time or an error is generated.
 - Complementary - Each channel requires two inputs. They must be opposite states within the discrepancy time or an error is generated.



- For Point Mode, click one of these for each point.
 - Not Used
 - Safety Pulse Test
 - Safety
 - Standard
- For Test Source, click None, 0, 1, 2, or 3.
- For Input Delay Time (ms) make selections for these.
 - Off -> On
 - On -> Off

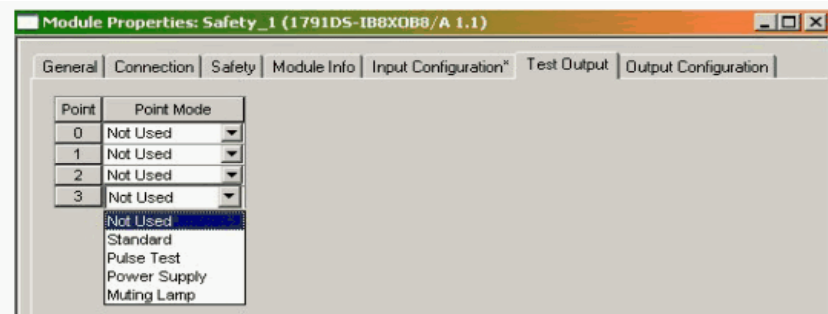
5. Click a value for Input Error Latch Time
6. Click OK at the bottom of the dialog or a tab at the top of the dialog.



Work with the Test Output Dialog

Follow these procedures to complete entries from the Test Output dialog.

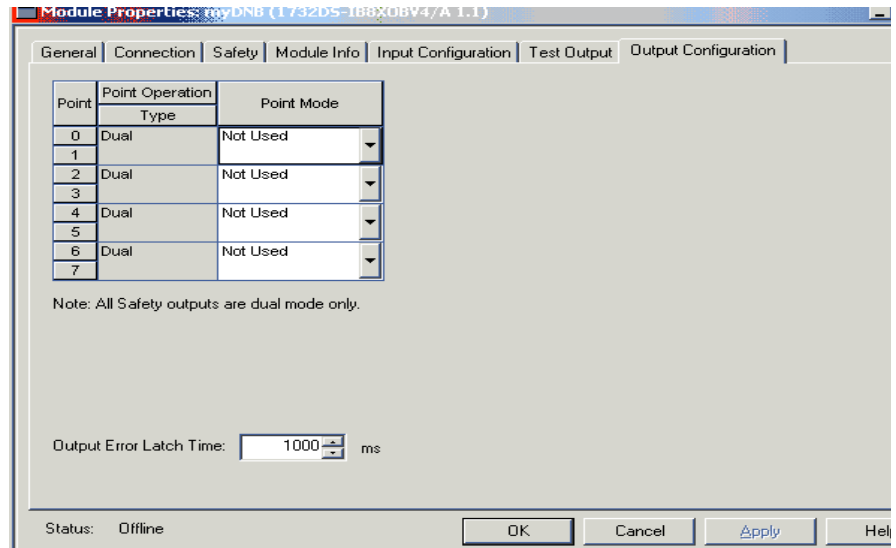
1. For each point click one of these.
 - Not Used
 - Standard
 - Pulse Test
 - Power Supply
 - Muting Lamp
2. Click OK at the bottom of the dialog or a tab at the top of the dialog.



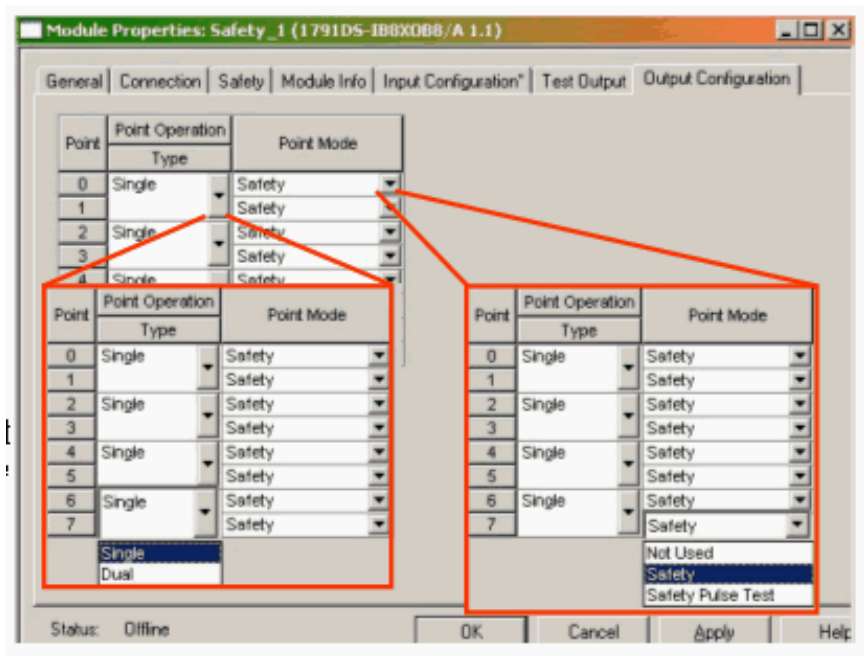
Work with the Output Configuration Dialog

Follow these procedures to complete entries from the Output Configuration dialog.

1. For Point Operation, click Single or Dual.



2. For Point Mode, click Not Used, Safety, or Safety Pulse Test.
3. Click a value for Output Error Latch Time.
4. Click Apply from the bottom of the dialog.



I/O Data Supported by Each Model

See the configuration reference information appendix for the tables that show the I/O data supported by each module.

Refer to I/O Assembly Data for data arrangements. For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

I/O Assembly and Reference Data

See the configuration reference information appendix for tables for I/O assembly and reference data and for information that defines the name associations for consistency with the programming software.

Configure Modules in RSNetworkx for DeviceNet Software

What This Chapter Contains

This chapter provides information about how to complete configuration settings in RSNetworkx for DeviceNet software. Refer to the corresponding software help files for network configurator operating procedures. This chapter covers configuration settings, general configuration procedures, and how to work with EDS files.

Set the Password

Set the password for Guard PLC and Smart Guard 600 controllers using RSNetworkx for DeviceNet software. A password is not set at the factory; be sure to set one. The password is required when performing I/O settings or when changing the password.

IMPORTANT

A safety administrator must manage the password. If you forget the password, consult your Rockwell Automation representative.

Set I/O Parameters

The module has the following parameter groups.

- General parameters
- Safety input parameters
- Test output parameters
- Safety output parameters

See the tables for the settings in each parameter group. All parameters are set using RSNetworkx for DeviceNet software.

IMPORTANT

Parameters directly related to safety are marked with an X in the left column.

General Parameters

Parameter Name	Value	Description	Default
x Safety Output Error Latch Time	0 ... 65,530 ms (in increments of 10 ms)	Safety output errors will be latched for this time.	1,000 ms
x Safety Input Error Latch Time	0 ... 65,530 ms (in increments of 10 ms)	Safety input or test output errors will be latched for this time.	1,000 ms
Test Output Idle State	Clear OFF or Keep output data	Definition of output data is in idle state.	Clear OFF

Safety Input Parameters

Parameter Name	Value	Description
x Input Delay Time Off -> On	0 ... 126 ms (in increments of 6 ms)	Filter time for OFF to ON transition
x Input Delay Time On -> Off	0 ... 126 ms (in increments of 6 ms)	Filter time for ON to OFF transition
x Input Point Mode	Not Used	External input device is not connected.
	Safety Test Pulse	Use with a contact output device and in combination with a test output. Using this setting, short-circuits between input signal lines and the power supply (positive side) and short-circuits between input signal lines can be detected.
	Safety	A solid state output safety sensor is connected.
	Standard	A non-safety device, such as a reset switch, is connected.
x Safety Input Test Source	Not used	The test output that is used with the input
	Test Output 0	
	Test Output 1	
	Test Output 2	
	Test Output 3	
x Input Point Operation Type	Single Channel	Use as single channel.
	Dual-channel Equivalent	Use as dual-channel. Normal (OK) when both channels are ON or OFF.
	Dual-channel Complementary	Use as dual-channel. Normal (OK) when one channel is ON and the other channel is OFF.

IMPORTANT

If the test pulse from test output is set to the Safety Input Channel mode, the safety input test source and pulse test output of the test output must be set to the Test Output mode.

Test Output Parameters

Parameter Name	Value	Description	Default
x	Test Output Mode	Not Used	Not Used
		Standard	
		Pulse Test	
		Power Supply	
		Muting Lamp Output (Terminal T3 only)	
	Test Output Fault Action	Clear OFF	Clear OFF
		Hold Last Data	

Safety Output Parameters

Parameter Name	Value	Description	Default
x	Output Point Mode	Not Used	Not Used
		Safety	
		Safety Pulse Test (Can be set for 1791DS-IB8XOB8 module only.)	
x	Output Point Operation Type	Single Channel	Dual-channel
		Dual-channel	

Allocate Remote I/O

Concerning I/O allocations, the module internally stores I/O data. To set connection paths use RSNetworkx for DeviceNet software to allocate I/O data for the master unit. No settings are made by default. Be sure to set the required connection paths.

Concerning I/O data, the module stores the following data.

- **SAFE:** Information the controller can use in safety-related functions
- **NON-SAFE:** Additional information that must not be relied on for safety functions

Data and Description

Data		Description
Input data	Safety Input Data SAFE	Indicates the ON/OFF status of each input terminal. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Combined Safety Input Status SAFE	An AND of the status of all input terminals. <ul style="list-style-type: none"> • All terminals are normal: 1 • An error was detected in one or more input terminals: 0
	Individual Safety Input Status SAFE	Indicates the status of each input terminal. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Combined Safety Output Status SAFE	An AND of the status of all safety output terminals. <ul style="list-style-type: none"> • All terminals are normal: 1 • An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFE	Indicates the status of each safety output terminal. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Muting Lamp Status SAFE	Indicates the status when terminal T3 is configured as the muting lamp output. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Safety Output Monitor NON-SAFE	Monitors the outputs of the safety output terminals. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Individual Test Output Status NON-SAFE	Indicates the status of each of the test output terminals. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
Output data	Safety Output Data SAFE	Controls the safety output. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Standard Output Data NON-SAFE	Controls the test output when test output mode is set to a standard output. <ul style="list-style-type: none"> • ON: 1 • OFF: 0

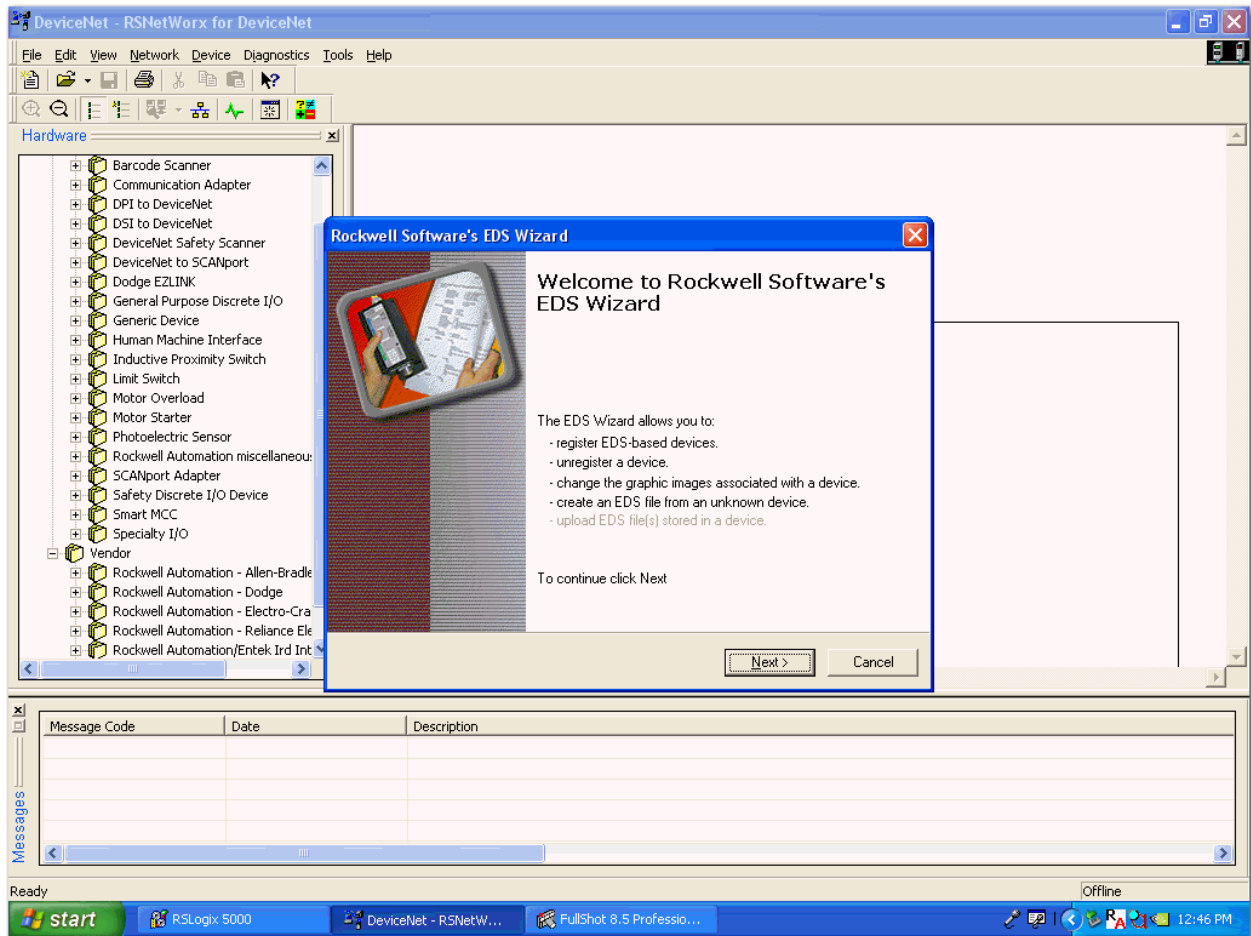
Use the Help Button

At the bottom of a dialog, click Help for information about how to complete entries on the dialog.

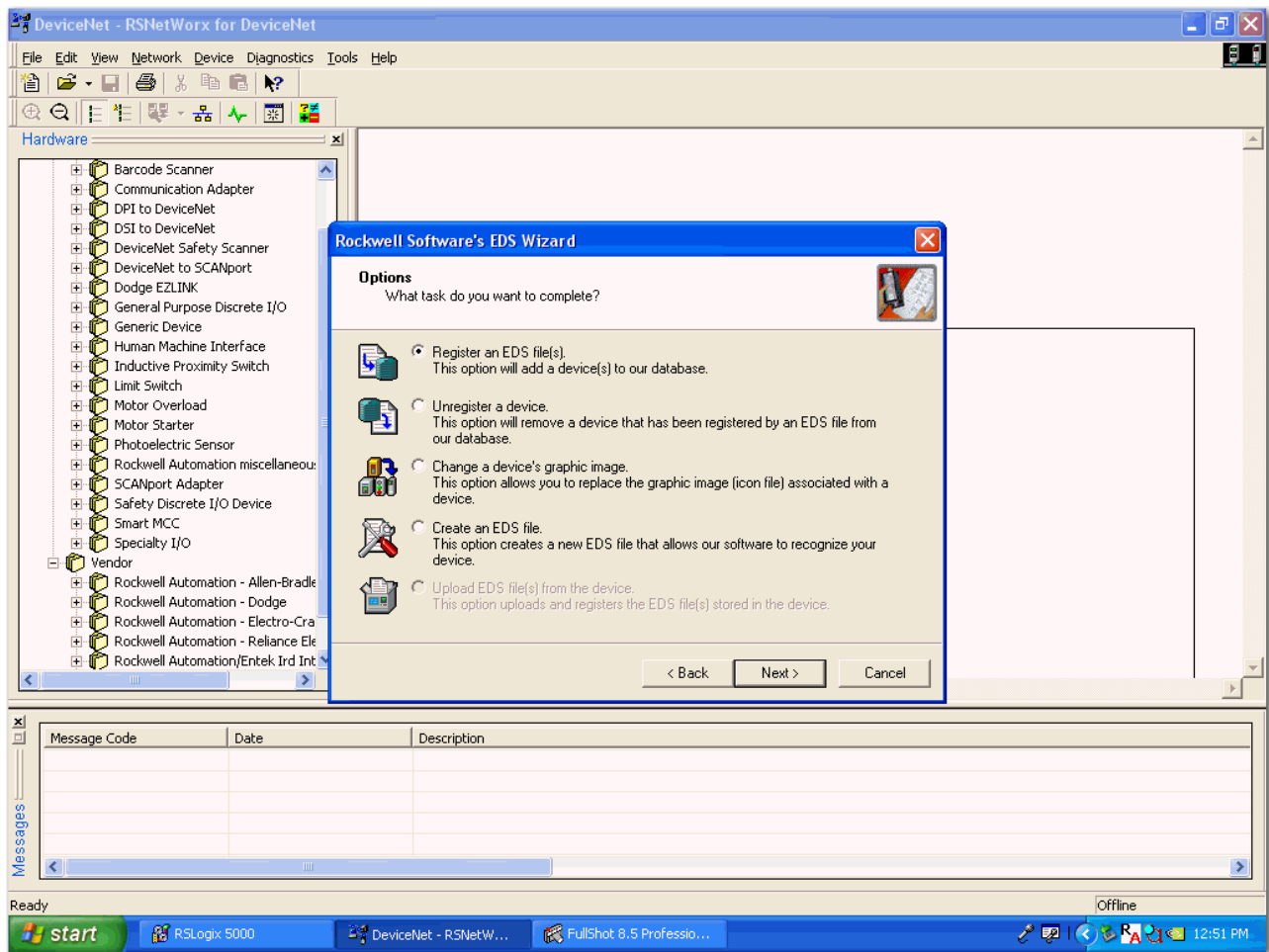
Work with the EDS Wizard

The EDS is a template that RSNetworx for DeviceNet software uses to display the configuration parameters, I/O data profile, and connection-type support for a given DeviceNet safety module. Use the EDS Wizard to complete related tasks. To access and use the EDS Wizard, follow these procedures.

1. From the top of the RSNetworx for DeviceNet dialog, click Tools and EDS Wizard to see the EDS Wizard dialog.



- From the EDS Wizard dialog, click Next to see the Options dialog.



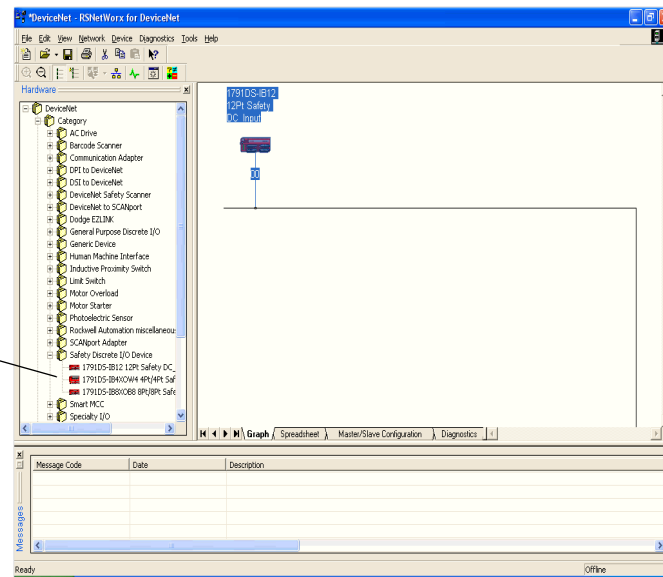
- From the Options dialog, click the following options, as needed, and follow the online directions.
 - Register an EDS file or files - to add a device or devices to the database.
 - Unregister a device - to remove a device registered by an EDS file from the database.
 - Change a device's graphic image - to replace the graphic image (icon file) associated with a device.
 - Create an EDS file - to create a new EDS file so that the software recognizes your device.
 - Upload an EDS file or files from the device - to upload and register the EDS file or files stored in the device.

Work with EDS Files

To work with EDS files use these steps.

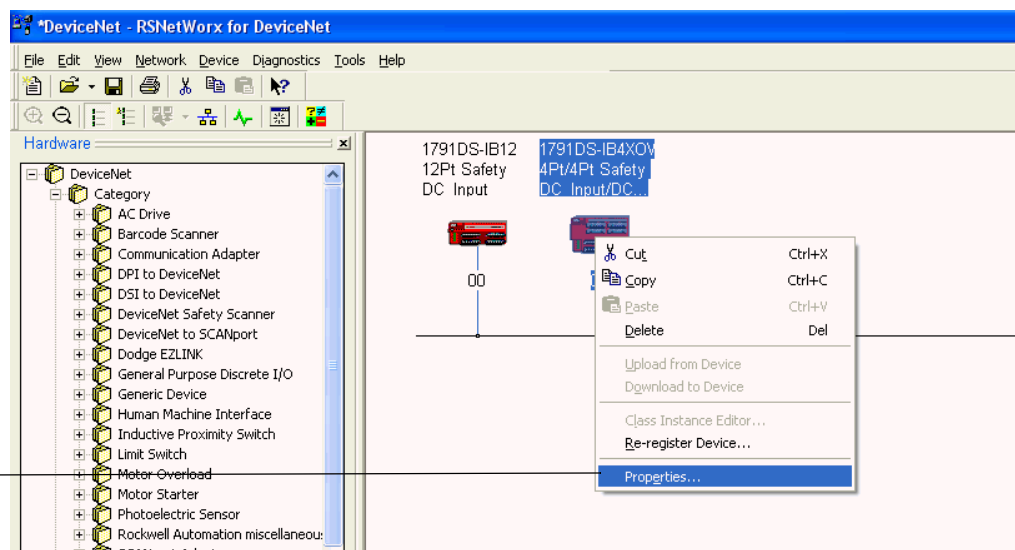
1. From the Category window, click the + next to the desired module, such as Safety Discrete I/O Device to see a list of available modules.
2. From the list of available modules, click a module to see the module in the graphic view.

From the list of available modules, click a module to see the module in the graphic view.

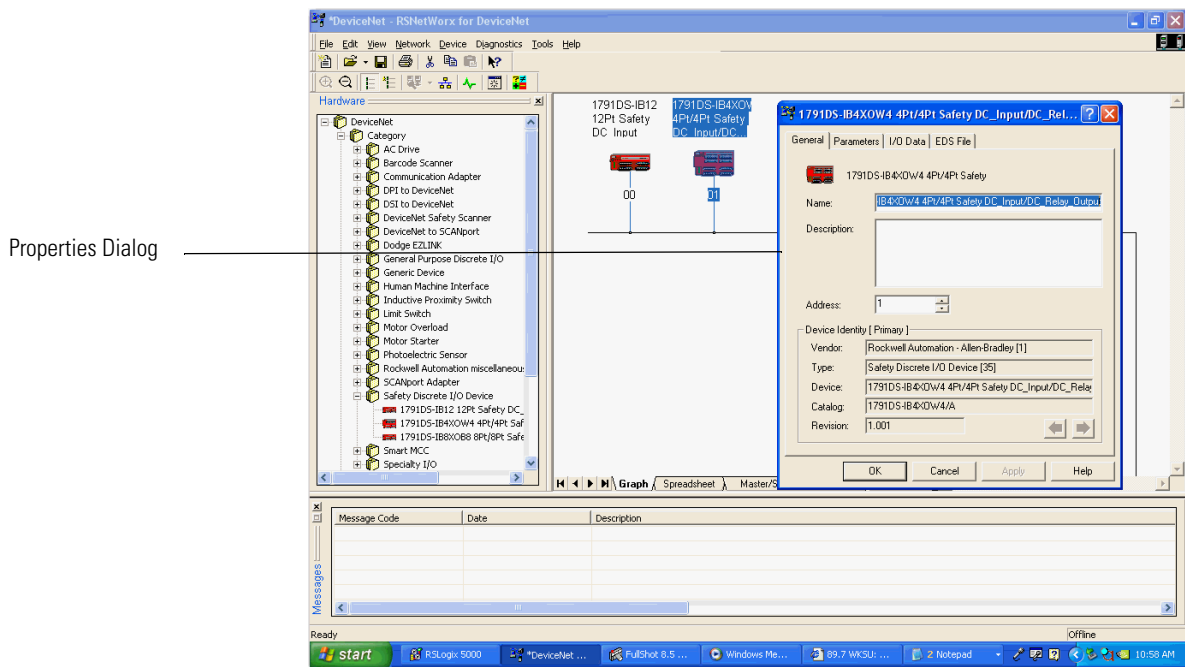


3. From the graphic view, double-click the module or right-click the module and click Properties to see the Properties dialog.

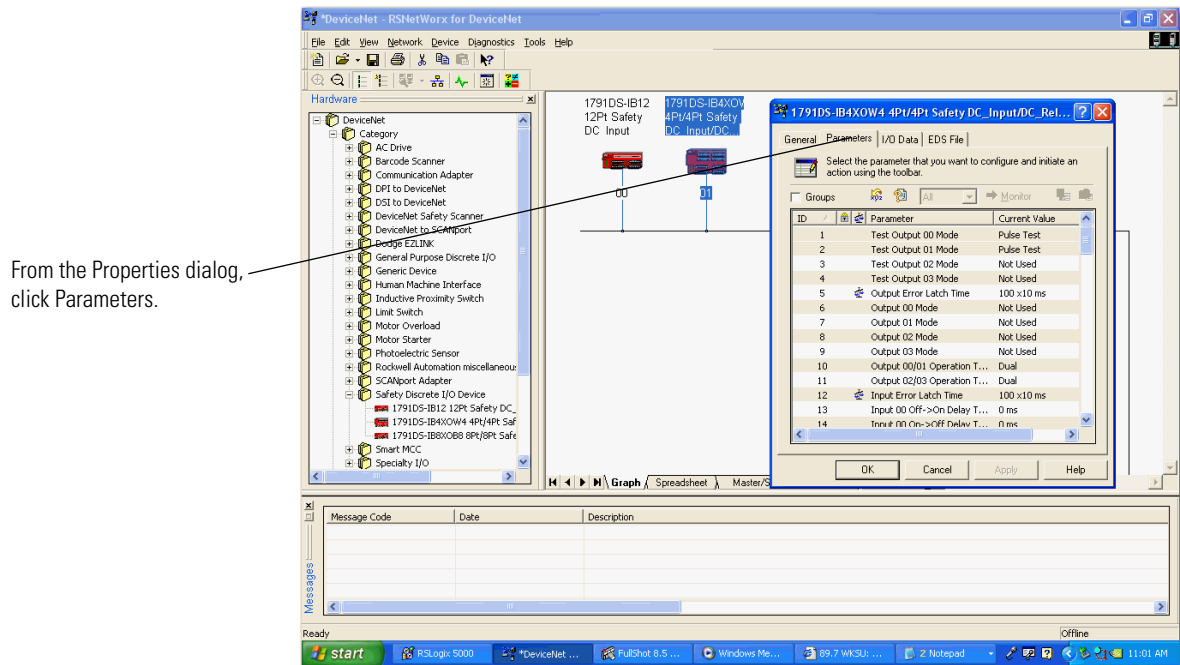
Click Properties to see the Properties dialog.



You see the Properties dialog.

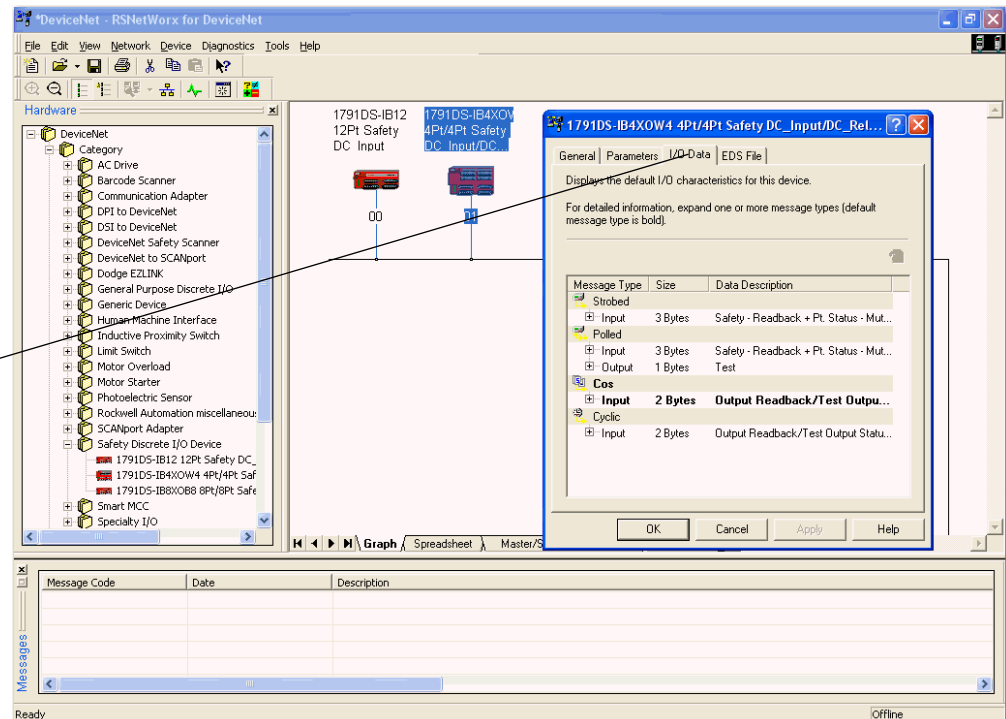


4. From the top of the Properties dialog, click Parameters, if desired, to see the list with ID, Parameters, and Current Value, as shown in the example.



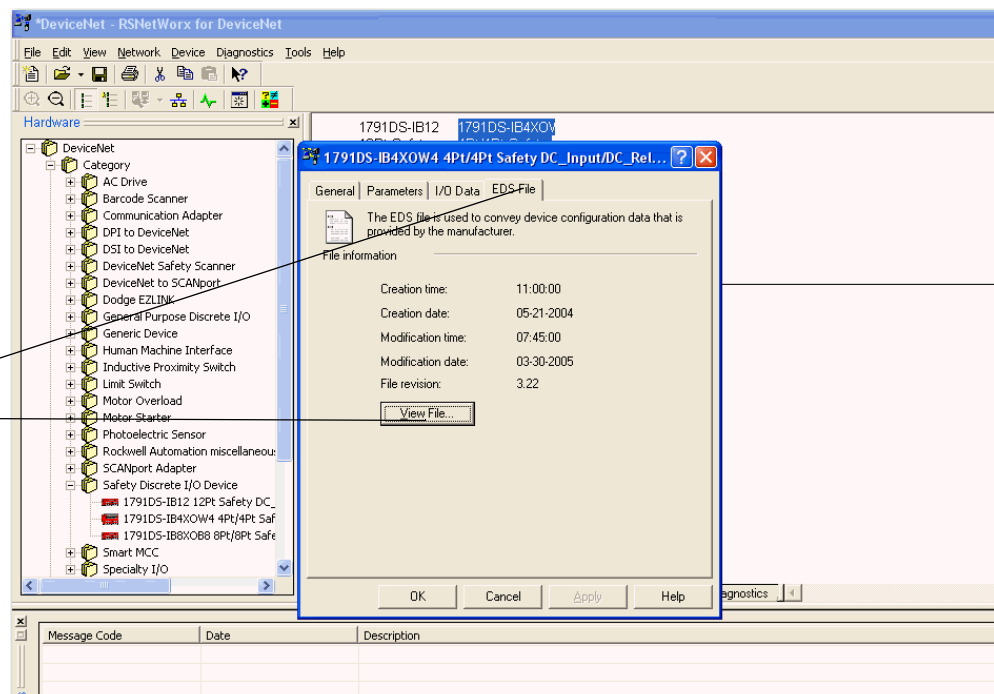
- From the top of the Properties dialog, click I/O Data, if desired, to see the list with Message Type, Size, and Data Description, as shown in the example.

From the Parameters dialog, click I/O Data.

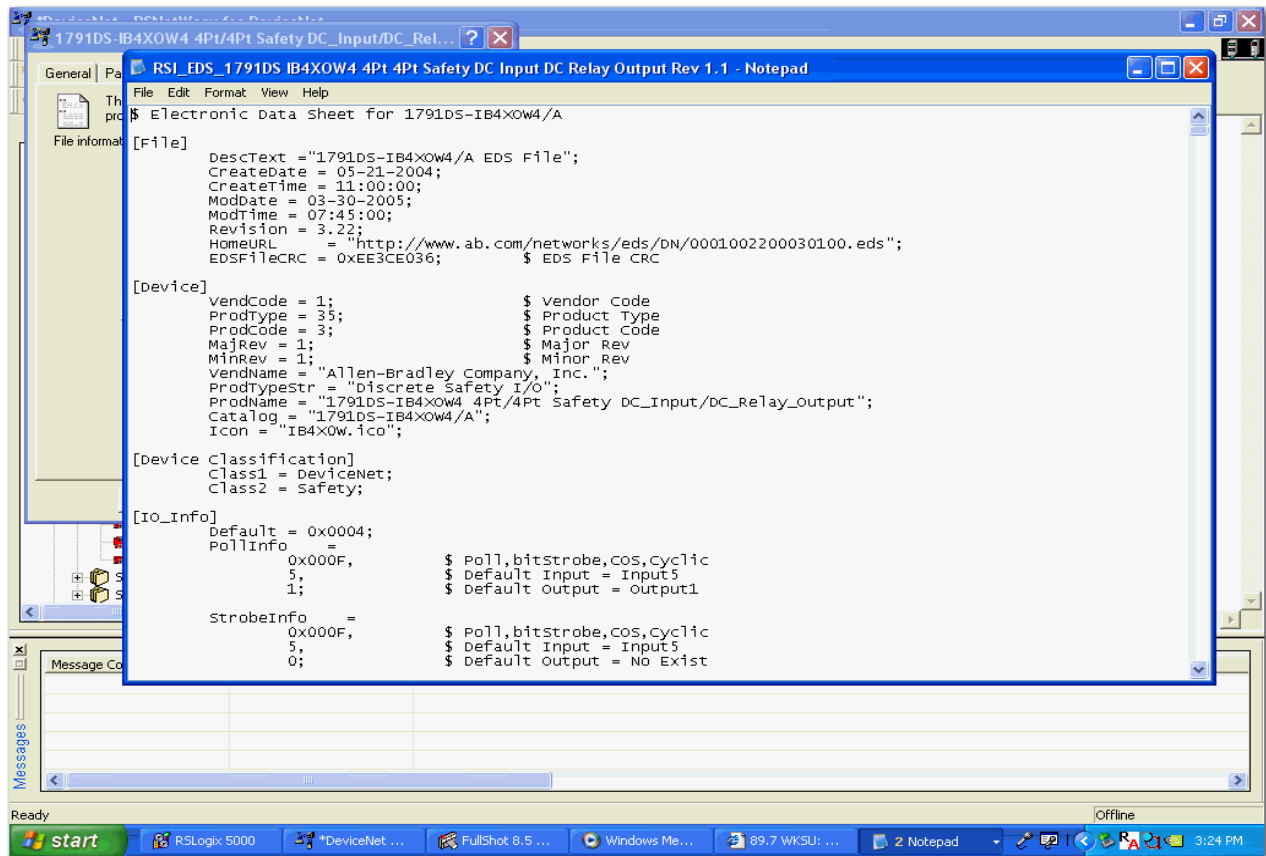


- From the top of the Properties dialog, click EDS File, if desired, to see the EDS dialog.

From the Properties dialog, click EDS File and View File to see the EDS file.



7. From the EDS dialog, click View File to see the EDS file.



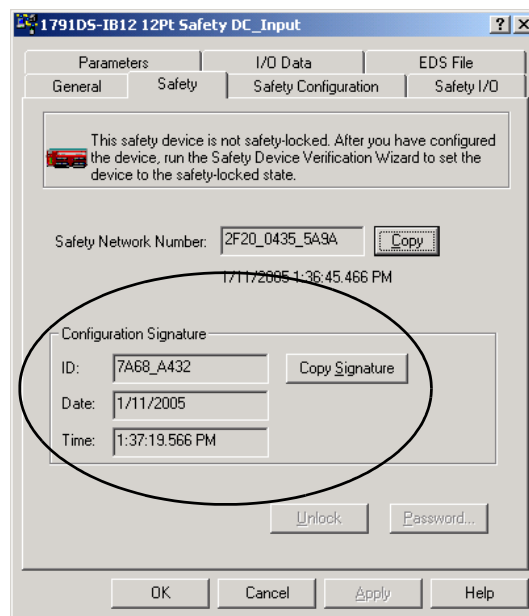
Configure DeviceNet Nodes and Connections

To configure standard, safety, and peer-to-peer connections, follow these procedures, in order.

1. Configure DeviceNet safety I/O target notes.
2. Configure DeviceNet safety scanner safety connections.
3. Configure DeviceNet standard slave I/O nodes.
4. Configure DeviceNet safety scanner standard connections.
5. Configure GuardPLC controller settings.

Configuration Signature

Each safety device has a unique Configuration Signature that identifies its configuration to ensure the integrity of configuration data during downloads, connection establishment, and module replacement. The Configuration Signature is composed of an ID number, a Date, and a Time. It is set automatically by RSNetWorx for DeviceNet software when a configuration update is applied to the device. From the top of the Device Properties dialog, click Safety to find Configuration Signature.



The Configuration Signature is read during each browse and whenever the Device Properties dialog is launched while the software is in Online mode. RSNetWorx for DeviceNet software compares the Configuration Signature in the software (offline) device configuration file to the Configuration Signature in the online device. If the Configuration Signatures do not match, you are prompted to upload the online device configuration or download the software device configuration to resolve the mismatch.

Configure DeviceNet Safety I/O Target Nodes

Read this section for information about how to configure DeviceNet Safety I/O target nodes.

1791DS DeviceNet Safety I/O Module Parameters

To configure your module, double-click the module in the graphic view or right-click the module and click Properties.

Safety Input, Output, and Test Parameters

Safety parameters are configured using the Safety Configuration tab on the Module Properties page.

1791DS-IB12 12Pt Safety DC_Input

Parameters

I/O Data

EDS File

General

Safety

Safety Configuration

Safety I/O

Select the parameter that you want to configure and initiate an action using the toolbar.

Groups

Monitor

ID	Parameter	Current Value
Input Points 00/01		
54	Input 00/01 Operation Type	Single
55	Input 00/01 Operation Disc...	0 x10 ms
8	Input 00 Mode	Not Used
9	Input 00 Test Source	None
6	Input 00 Off->On Delay Time	0 ms
7	Input 00 On->Off Delay Time	0 ms
12	Input 01 Mode	Not Used
13	Input 01 Test Source	None
10	Input 01 Off->On Delay Time	0 ms
11	Input 01 On->Off Delay Time	0 ms
Input Points 02/03		
Input Points 04/05		
Input Points 06/07		

Icon	Description
	Indicates that this parameter is read only.
	Indicates that this parameter is a scaled value.
	Indicates that this parameter is linked to another parameter in the parameter list.
	Indicates that this parameter is associated to a parameter above and/or below the selected parameter in the parameter list.

OK

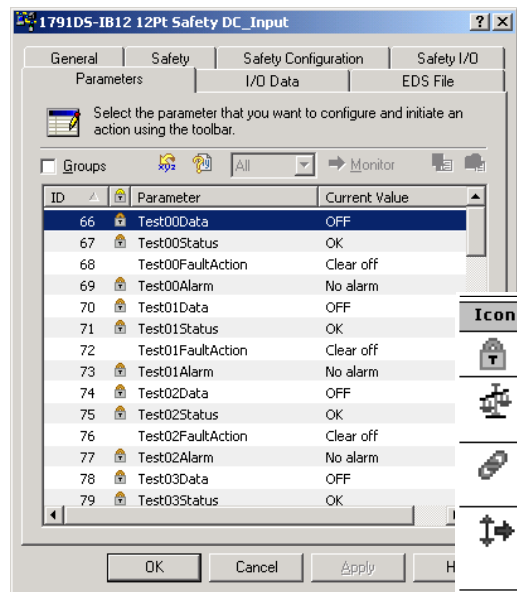
Cancel





Apply

Help

Standard Input and Output Parameters

1791DS modules support standard data as well as safety data. Configure standard input and output parameters using the Parameters tab on the module properties page.



Icon	Description
	Indicates that this parameter is read only.
	Indicates that this parameter is a scaled value.
	Indicates that this parameter is linked to another parameter in the parameter list.
	Indicates that this parameter is associated to a parameter above and/or below the selected parameter in the parameter list.

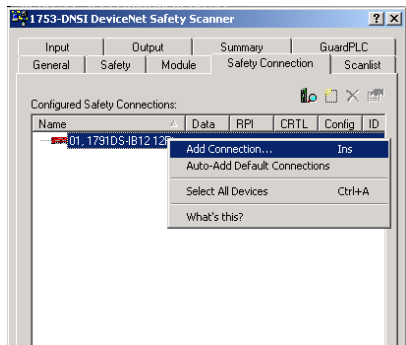
TIP

Other devices can have different configuration options. Consult the user manual for your device for more information.

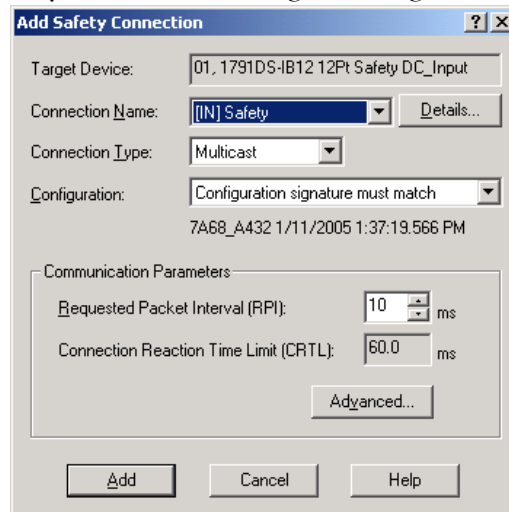
Configure the DeviceNet Safety Scanner's Safety Connections

Configure DeviceNet Safety communications by configuring the scanner's connections to safety targets.

On the Safety Connections tab, right-click the I/O module and select Add Connections to display all of the available connections.



Use the Add Safety Connection dialog to configure a connection.



1. Select the desired connection by clicking the Connection Name.
2. Click a type of connection, either Multicast (input connections only) or Point-to-point (input or output connections).
3. Click Configuration signature must match, which is a selection that directs the scanner to ensure that the target safety device contains the correct configuration before opening the safety connection.

IMPORTANT

If you do not choose Configuration signature must match, you are responsible for ensuring the safety integrity of your system by some other means.

4. Review the Connection Reaction Time Limit.

The Connection Reaction Time Limit is the maximum age of safety packets on the associated connection. If the age of the data used by the consuming device exceeds the Connection Reaction Time Limit, a connection fault occurs. Adjust the Connection Reaction Time Limit by changing the requested packet interval (RPI) or the Advanced Communication Properties as described in steps 5 and 6.

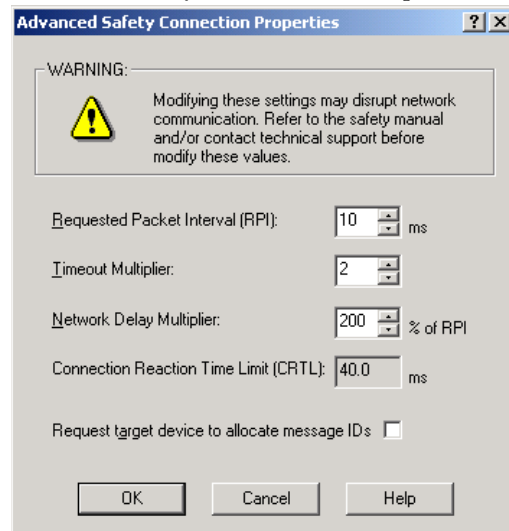
5. Set the RPI.

The RPI specifies the period at which data updates over a connection. The RPI is entered in 1 ms increments, and the scanner supports a valid range of 5...500 ms with a default of 10 ms. Other target devices can have more limited RPI constraints.

Consult the documentation for each type of target device to determine its supported range and incremental values.

Modifying the RPI affects the Connection Reaction Time Limit. For simple timing constraints, setting the RPI is usually sufficient. However, for more complex requirements, use the Advanced... button to further adjust the timing values affecting the Connection Reaction Time Limit as described in the following.

6. Set the Advanced Safety Connection Properties, if required.



- **Timeout Multiplier** – The Timeout Multiplier determines the number of RPIs to wait for a packet before declaring a connection timeout. This translates into the number of messages that can be lost before a connection error is declared.

For example, a Timeout Multiplier of 1 indicates that messages must be received during every RPI interval. A Timeout Multiplier of 2 indicates that 1 message can be lost as long as at least 1 message is received in 2 times the RPI (2 x RPI).

- **Network Delay Multiplier** – The Network Delay Multiplier defines the message transport time that is enforced by the communications protocol. The Network Delay Multiplier specifies the round trip delay from the producer to the consumer and back to the producer. You can use the Network Delay Multiplier to reduce or increase the Connection Reaction Time Limit in cases where the enforced message transport time is significantly less or more than the RPI.

Configure DeviceNet Standard Slave I/O Nodes

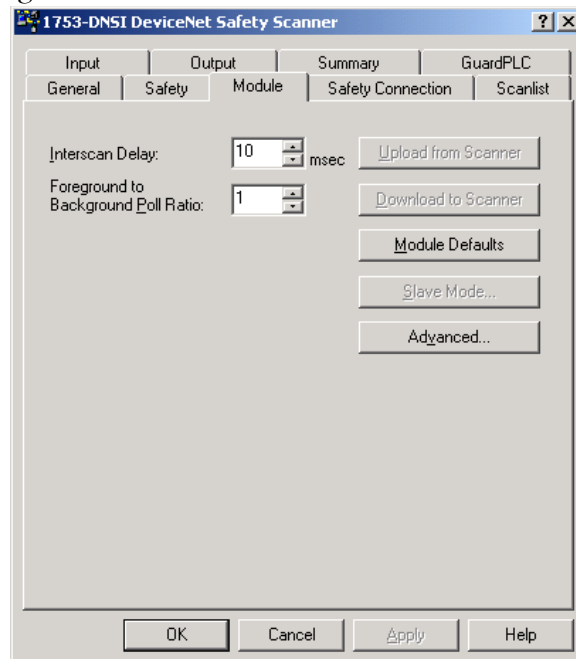
To configure your module, double-click the module in the graphic view or right-click the module and select Properties. Navigate through the available tabs to review and modify the module's configuration. Refer to the user manual for the module for additional information on how to set up the module's configuration.

Configure the DeviceNet Safety Scanner Standard Connections

To configure the safety scanner for standard communications, set up a scanlist and define the memory locations for the standard data of each device.

Standard Communication Properties

Configure the standard communication properties of the safety scanner on the Module tab of the Scanner Properties page. You can use the Module Defaults button to return the safety scanner to the default settings.



Interscan Delay

This parameter defines the delay time the scanner uses between scans of the DeviceNet network. If you have slave devices configured for Polled behavior in the scanner's scanlist, Interscan Delay (ISD) defines the amount of time the scanner waits between writing outputs to the polled devices.

Increasing the ISD time causes a longer network scan, which adversely affects overall input-to-output performance. However, the increase allows lower priority messages to get more network access. These lower priority messages include those used to do network browsing and configuration upload and download functions. If these network functions are sluggish on your system, increasing the ISD time is one way to make more bandwidth available for lower priority messages.

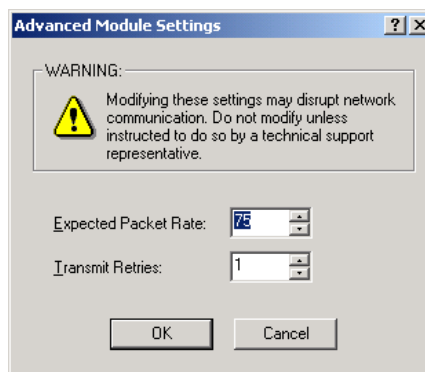
In addition, if the last node in your scan list produces a large amount of polled data, you can increase the ISD time to ensure that the entire response is received before the next poll request is sent to that node.

Foreground to Background Poll Ratio

Devices set for polled behavior can be polled on every I/O scan (foreground) or they can be polled less frequently (background). Setting a device for foreground or background behavior is done when you configure each device on the Scanlist tab, from the Edit I/O Parameters dialog. A ratio of 2 means that any nodes included on the background list are polled every other scan cycle. A ratio of 3 means they are polled on every third cycle, and so forth.

Advanced Module Settings

Click the Advanced... button to set the Expected Packet Rate (EPR) and the Transmit Retries.



- Expected Packet Rate (EPR) – When the scanner opens a polled or strobed I/O connection, it uses this value as a maximum timeout (Expected Packet Rate) with the device. If the device does not receive a packet from the scanner within 4 times the EPR value, the slave device drops the connection. If the scanner does not receive a packet from the slave within 4 times the EPR value, it drops the connection and periodically attempts to reopen the connection.

When a standard connection is dropped, status bits in the scanner identify that the slave is not online. Slave behavior when a connection is dropped is a function of the slave device. If the slave is an I/O device, the standard outputs are cleared, held at last state, or set to a fault condition (refer to the slave device's documentation for actual I/O behavior when a connection is dropped).

When an input connection is dropped, the scanner sets the corresponding data in the data tables sent to the GuardPLC controller via the HSP connection to the safety state (0).

The EPR default value is 75 ms.

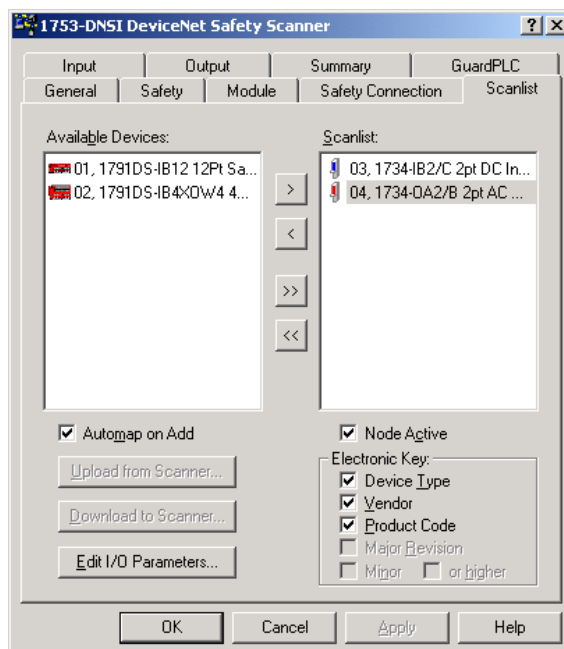
IMPORTANT

Changing the EPR number should be done carefully because it effects how long it takes the scanner to detect a missing device.

- Transmit Retries – Transmit Retries specifies the number of times the scanner attempts to retransmit a change of state or cyclic message that has not been acknowledged by the slave device before dropping the connection.

Create a Scanlist

The scanlist defines the standard devices (nodes) with which the scanner is configured to exchange I/O data.



Available Devices

These are the devices on the network that have the ability to be standard slave I/O devices. The DeviceNet Safety Scanner, as well as any other scanners that have been configured to support a standard slave-mode interface, also appear in this list. Slave-capable devices do not have to be used as slave I/O by a scanner. They can alternately be used as slave I/O by another scanner on the same network, or they can have dual functionality.

Scanlist

These devices have been assigned to be slave I/O to this scanner. The outputs of a slave device on DeviceNet networks can only be owned by one master at a time. Data mappings for each device in the scanlist are configured using the input and output tabs. Add an available device by selecting the device and clicking the add arrow >. The double-arrow >> adds all the available devices to the scanlist.

It is not necessary to enter safety nodes into the safety scanner's scan list. All safety connections are configured on the Safety Connections tab. You only need to put a safety device into the safety scanner's scanlist if you are communicating with that device via a standard connection and exchanging standard data with it.

Automap on Add

Automap allows a slave's I/O to be automatically mapped into the scanner's input or output image tables when the slave device is added to the scanlist. DO NOT check this box if you intend to map a slave device into a particular input or output memory location.

Edit I/O Parameters

These parameters vary depending upon the slave device. Information on configurable parameters is usually provided in the device's documentation.

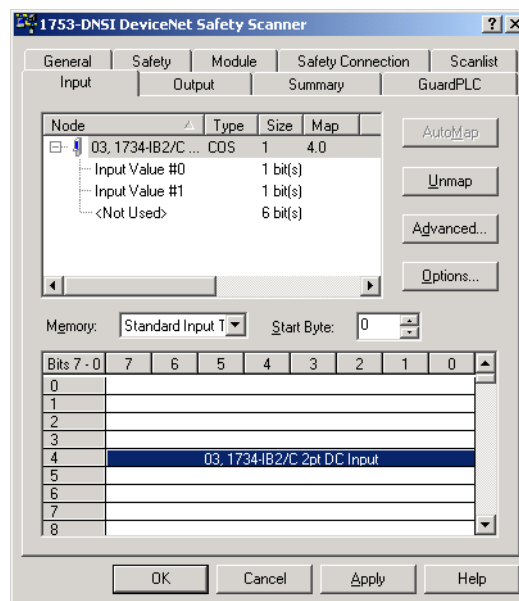
Electronic Key

The electronic key is used to ensure that a particular slave device always matches the intended device when the scanner initiates a connection to it. When one of the devices in the Scanlist section is highlighted, check a box to indicate to what extent the key parameters must match the actual device on the network. A match of just Device Type can be selected or the additional parameters of Vendor ID and Product Code can be incrementally added.

Should the scanner detect a mismatch with any of the key parameters checked, an Electronic Key failure (status code 73) occurs for that slave device and the scanner aborts the connection establishment process.

Configure Standard Inputs

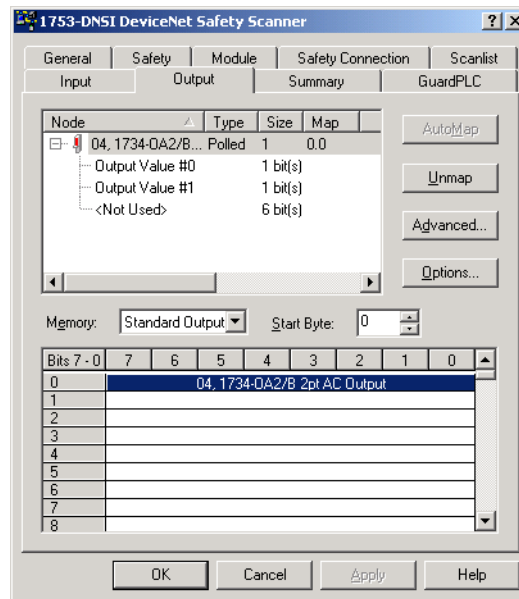
Use the Input tab to define how standard data from all of the scanner's slave devices are mapped into the input image of the controller.



The graphical window at the top shows each device's node number, catalog number, type of connection that is used between the scanner and the slave device (strobed, polled, cyclic, or change of state), the amount of data to be exchanged (in bytes), and the location of the data within the controller's scanner's standard input image.

Configure Standard Outputs

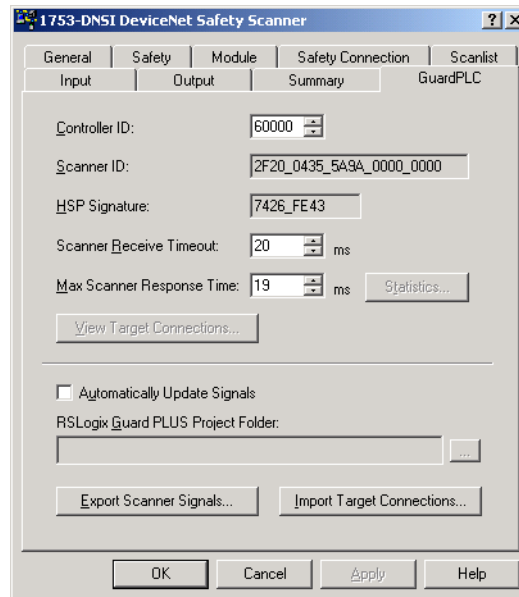
Use the Output tab dialog to define how data from the scanner is mapped to the outputs of the slave devices.



The graphical window at the top shows each device's node number, catalog number, type of connection that is used between the scanner and the slave device (strobed, polled, cyclic, or change of state), the amount of data to be exchanged (in bytes), and the location of the data within the controller scanner's standard output image.

Configure GuardPLC Controller Settings

Use the GuardPLC tab to configure the scanner's HSP connection parameters.



Controller ID

The Controller ID (SRS) uniquely identifies a particular GuardPLC controller within a network of controllers. Its use ensures that this configuration is applied to the correct controller. Specify the Controller ID of your selected GuardPLC controller, or this is automatically provided when you associate the scanner and controller as described in Chapter 7.

Scanner ID

The scanner ID is a read-only value that uniquely identifies the scanner and is required to connect the GuardPLC controller to the scanner. The scanner ID is automatically generated by RSNetWorx for DeviceNet software using the SNN and DeviceNet address of the scanner. It is exported in the Scanner Signals file and is viewable in the associated RSLogix Guard PLUS! project.

HSP Signature

The HSP Signature is a read-only value that is unique to each layout of the signals within the data exchanged between the GuardPLC controller and the 1753-DNSI module. The HSP Signature is calculated based on the scanner's configured safety and standard connections and any target connections defined in RSLogix Guard PLUS!. It is passed to RSLogix Guard PLUS! via the Scanner Signals File. The HSP signature changes only when a modification occurs in the layout of the signals exchanged between the controller and scanner.

Scanner Receive Timeout

The Scanner Receive Timeout is the amount of time (in ms) that the scanner waits for a request from the GuardPLC controller before timing out the HSP connection. If the scanner does not receive a message from the GuardPLC controller within this time, all output connections are transitioned to the idle state, causing the safety outputs to transition to the safety state and standard outputs to follow the behavior dictated by their configuration.

Set the Scanner Receive Timeout equal to the Watchdog Timeout specified on the Properties dialog of the controller resource in RSLogix Guard PLUS! Hardware Management. Refer to the GuardPLC Controller Systems User Manual, publication number 1753-UM001, for information on setting the Watchdog Time.

Max. Scanner Response Time

The Max Scanner Response Time is the maximum amount of time (in ms) allotted for the scanner to process an HSP request from the controller, and then format and send a proper response. If the scanner cannot respond within this time frame, then all output connections transition to the idle state, causing the safety outputs to transition to the safety state and standard outputs to follow the behavior dictated by their configuration.

Set the Max Scanner Response Time to a value that includes the maximum observed statistical scanner response time over several hours of operation, plus a Margin of Safety equal to 3 ms or 10% of the maximum observed scanner response time. When online, you can view the Minimum, Maximum, and Average Observed Scanner Response Times by selecting the Statistics... button.

I/O Data Supported by Each Model

See the configuration reference information appendix for the tables that show the I/O data supported by each module.

Refer to I/O Assembly Data for data arrangements. For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

I/O Assembly and Reference Data

See the configuration reference information appendix for tables for I/O assembly and reference data and for information that defines the name associations for consistency with the programming software.

For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

Maintain Your Modules

What This Chapter Contains This chapter includes information about troubleshooting and maintenance.

Troubleshoot I/O errors can be read out from safety input status, test output status, and safety output status.

- Status data when I/O is normal (OK): ON(1)
- Status data when a fault (Alarm) occurs I/O: OFF (0)

The details of errors can be read out by using explicit messages.

See the tables that show safety input errors, test output errors, and safety output errors.

IMPORTANT

For I/O error latch time settings, the OFF status is maintained for at least the error latch time (0...65,530 ms, in increments of 10 ms) when individual safety input status turns OFF.

Safety Input Error

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

Explicit Message For reading the Cause of the Safety Input Error

Explicit Message	Read/Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (1...4) specified by the instance ID ⁽¹⁾	0E	3D	01...0C	6E	-	0: No error 01: Configuration invalid 02: External test signal error 03: Internal input error 04: Discrepancy error 05: Error in the other dual-channel input

⁽¹⁾ The instance numbers for safety input 0...11 are 1...12 (0...0C Hex), respectively.

Test Output Error

Code	Error Content	Probable Cause	Recommended Action
01(hex)	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02(hex)	Overload detected	1) Ground fault or short-circuit of an output signal line. 2) Trouble with the connected device.	1) Check the wiring. 2) Replace the connected device.
05(hex)	Output ON error	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuits.	1) Check the wiring. 2) Replace the module.
06(hex)	Undercurrent detected for muting lamp	Trouble with the connected device.	Replace the connected device.

Explicit Message for Reading the Cause of the Test Output Error

Explicit Message	Read/Write	Function	Command					Response (hex)
			Service Code (hex)	Class ID (hex)	Instance ID (hex)	Attribute ID (hex)	Data Size	
Test Output Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (1...4) specified by the instance ID ⁽¹⁾	0E	09	01...04	76	-	0: No Error 01: Configuration invalid 02: Overload detected 05: Output ON error detected 06: Undercurrent detected for muting lamp

⁽¹⁾The instance numbers for test outputs 0...3 are 1...4 (01...04 hex), respectively.

Safety Output Errors

Code	Error Content	Probable Cause	Recommended Action
01(hex)	Configuration invalid	The configuration is invalid.	Configure the module correctly.
02(hex)	Over current detected	Trouble with the connected device.	Replace the connected device.
03(hex)	Short-circuit detected	Ground fault of the output signal line.	Check the wiring.
04(hex)	Output ON error	1) The power source (positive side) is in contact with the output signal line. 2) Trouble with the internal circuit.	1) Check the wiring. 2) Replace the module.
05(hex)	Error in the other dual channel output	Dual channels are set and an error occurred in the other channel.	Remove the error in the other channel.
06(hex)	Internal relay output circuit error	Trouble with the internal circuit 1791DS-IB4XOW4 module only.	Replace the module.
07(hex)	Relay error	Trouble with the relay 1791DS-IB4XOW4 module only.	Replace the relay.
08(hex)	Output data error	Wrong setting for output data.	Check the program.
09(hex)	Short-circuit detected in output	Short-circuit between output signal lines.	Check the wiring.

Explicit Message for Reading the Cause of the Safety Output Error

Explicit Message	Read/write	Function	Command					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Output Cause of Error Information Read	Read	Reads the cause for the normal (OK) flag (No. 1...8) specified by the Instance ID.** ⁽¹⁾	0E Hex	3B hex	0...08 hex	6E hex	-	0: No error 01 Hex: configuration invalid 02 Hex: overcurrent detected 03 Hex: short circuit detected 04 Hex: output ON error 05 Hex: error in the other dual channel output 06 Hex : internal relay output circuit error (replace module) 07 Hex : internal relay output circuit error (replace relay) 08 Hex: output data error 09 Hex: short-circuit detected in output

⁽¹⁾ The instance numbers for safety outputs 0...7 are 1...8 (01...08 hex), respectively.

Maintenance

Read this section for information about routine cleaning and inspection recommended as regular maintenance. Handling methods when replacing the module are also explained here.

Clean the Modules

Clean the module regularly using these guidelines to keep the network in optimal operating condition.

- Wipe the module with a dry, soft cloth for regular cleaning.
- When dust or dirt cannot be removed with a dry cloth, dampen the cloth with a neutral cleanser (2%), wring out the cloth, and wipe the module.
- When cleaning, remove smudges that remain on the module from gum, vinyl, or tape left on for a long time.

IMPORTANT

Never use volatile solvents such as paint thinner, or benzene, or chemical wipes to clean the module. These substances may damage the surface of the module.

Inspect the Modules

Inspect the system periodically to keep it in optimal operating condition. In general, inspect the system once every 6 or 12 months, but inspect more frequently if the system is used in high-temperature, humid, or dusty conditions.

Prepare the following equipment before inspecting the system.

- Equipment required for regular inspection
 - Phillips screwdriver
 - Flat-blade screwdriver
 - Screwdriver for connecting communications connectors
 - Tester (or digital voltmeter)
 - Industrial alcohol and clean cloth
- Other equipment that can be required
 - Synchroscope
 - Oscilloscope
 - Thermometer or hygrometer

Check the items indicated in the table and correct any condition that is below standard.

Inspection Items

Inspection Item	Details	Standard	Equipment
Environmental conditions	Are ambient and cabinet temperatures correct?	Refer to the specifications for each module	Thermometer
	Are ambient and cabinet humidity correct?	Refer to the specifications for each module	Hygrometer
	Has dust or dirt accumulated?	No dust or dirt	Visual inspection
Installation conditions	Are the Units installed securely?	No looseness	Phillips screwdriver
	Are the connectors of the communications cables fully inserted?	No looseness	Flat-blade screwdriver
	Are the external wiring screws tight?	No looseness	Flat-blade screwdriver
	Are the connecting cables undamaged?	No external damage	Visual inspection
Safety relays operation	Does the safety relay contact go to OFF state?	No welded contact	Visual inspection

ATTENTION



The maintenance interval for relay contacts must not exceed a period of 6 months to fulfill category 4 in accordance with EN 954-1.

G7SA-2A2B must be used when replacing safety relays.

Replace Modules

The network consists of the DeviceNet master unit and safety I/O modules. The entire network is affected when a safety I/O module is faulty, so a faulty module must be repaired or replaced quickly. We recommend having spare module available to restore network operation as quickly as possible.

Observe the following precautions when replacing a faulty module:

- After replacement, be sure there are no errors with the new module.
- When returning a module for repair, attach a detailed description of the problem and return the module to your Rockwell Automation representative.
- If there is a faulty contact, wipe the contact with a clean, lint-free cloth dampened with alcohol.

IMPORTANT

Perform a system test of the related safety function(s) after replacing a module.

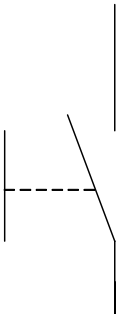
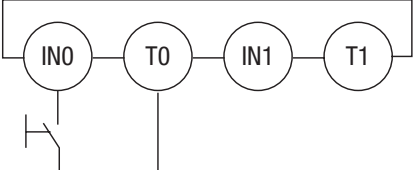
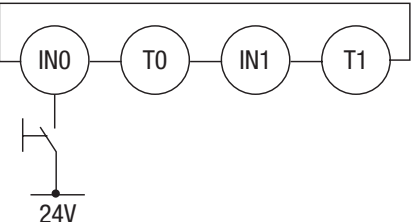
After replacing a module, set the new module's switches to the same settings that were on the old module. For related information see the following publications.

- GuardLogix Controllers User Manual, publication 1756-UM020, for information on replacing a module in the system
- GuardLogix Controller Systems Safety Reference Manual, publication 1756-RM093, for safety considerations when replacing I/O

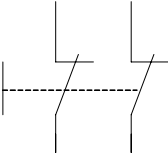
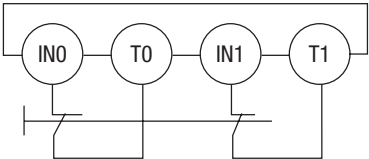
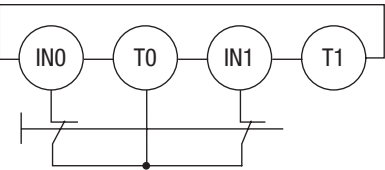
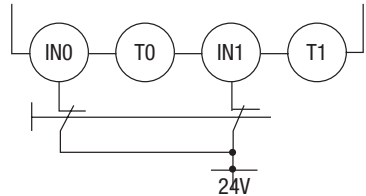
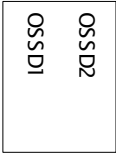
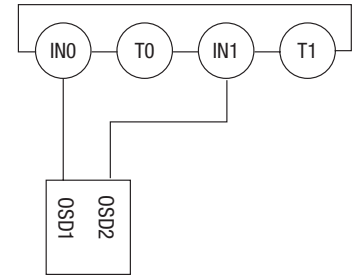
Wiring Examples

What This Chapter Contains Read this chapter for information about wiring and safety categories. See the tables that show input device connection methods and their safety categories.

Connected Device and Safety Category

Connected Device	Test Pulse from Test Output	Connection	Schematic Diagram	Safety Category
	No	Connect the switch between IN0 and T0.	 44098	-
		Connect the switch between 24V DC and IN0.	 44100	-

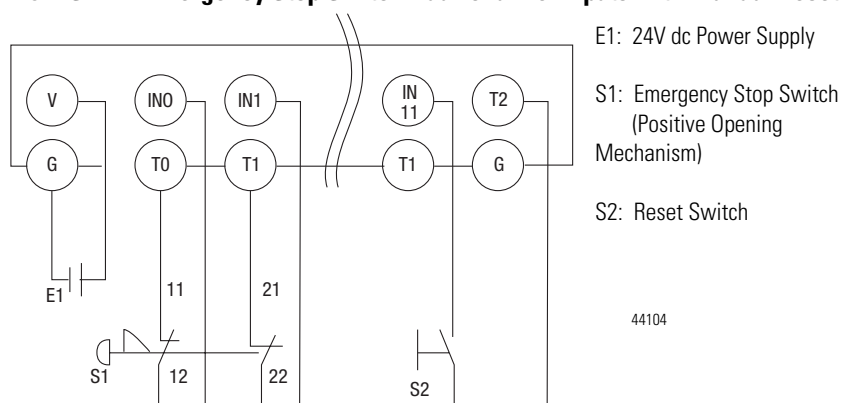
Connected Device and Safety Category

<div>Emergency stop switch</div> <div>Door monitor</div> <div></div>	Yes	Connect the switches between IN0 and T0, and IN1 and T1.	<div></div> <div>44101</div>	4
	No	Connect the switches between T0 and IN0, IN1.	<div></div> <div>44102</div>	4
		Connect the switches between 24V dc and IN0, IN1.	<div></div> <div>44135</div>	3
<div>Light Curtain</div> <div></div>	Yes	Connect the OSSD1 and OSSD2 to IN0 and IN1, respectively.	<div></div> <div>44103</div>	4

Examples of Wiring

Read this section for examples of wiring by application.

1791DS-IB12 Emergency Stop Switch Dual-channel Inputs with Manual Reset

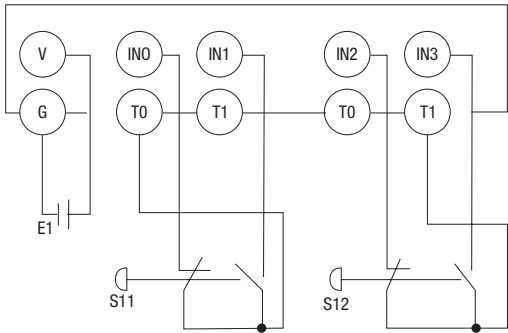


This example shows wiring and controller configuration when using the 1791DS-IB12 slave. If used in combination with the programs in a safety controller, this wiring is Safety Category 4 in accordance with EN 954-1 wiring requirements.

1791DS-IB12 Emergency Stop Switch Dual-channel Inputs with Manual Reset

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Equivalent
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 1
Safety Input 11	Safety Input 11 Channel Mode	Used as standard input
	Safety Input 11 Test Source	Not Used
	Dual-channel Safety Input 10/11 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output
Test Output 2	Test Output 2 Mode	Power Supply Output

1791DS-IB12 Two-hand Input



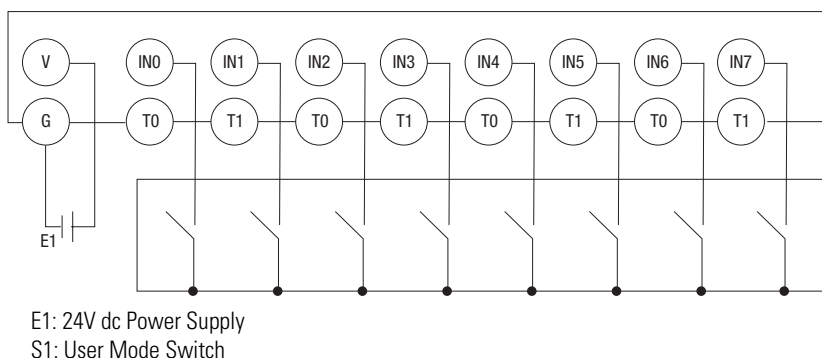
E1: 24V dc Power Source
S11, S12: Two-hand Control Switch

44105

This example shows wiring and controller configuration when using the 1791DS-IB12 module. If used in combination with the programs of a safety controller, the wiring is Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB12 Two-hand Input

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual Channel Safety Input 0/1 Mode	Dual Channel Complementary
	Dual Channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 0
Safety Input 2	Safety Input 2 Channel Mode	Test Pulse from Test Output
	Safety Input 2 Test Source	Test Output 1
	Dual Channel Safety Input 2/3 Mode	Dual Channel Complementary
	Dual Channel Safety Input 2/3 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 3	Safety Input 3 Channel Mode	Test Pulse from Test Output
	Safety Input 3 Test Source	Test Output 1
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output

1791DS-IB12 User-mode Switch Input

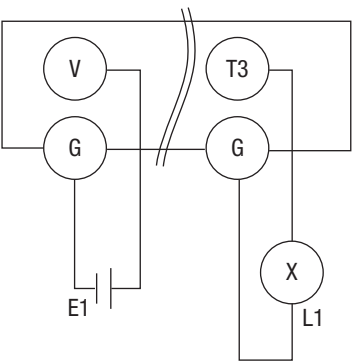
44132

This example shows wiring and configuration when using the 1791DS-IB12 module.

1791DS-IB12 User-mode Switch Input

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual Channel Safety Input 0/1 Mode	Single Channel
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 0
Safety Input 2	Safety Input 2 Channel Mode	Test Pulse from Test Output
	Safety Input 2 Test Source	Test Output 0
	Dual Channel Safety Input 2/3 Mode	Single Channel
Safety Input 3	Safety Input 3 Channel Mode	Test Pulse from Test Output
	Safety Input 3 Test Source	Test Output 0
Safety Input 4	Safety Input 4 Channel Mode	Test Pulse from Test Output
	Safety Input 4 Test Source	Test Output 0
	Dual Channel Safety Input 4/5 Mode	Single Channel
Safety Input 5	Safety Input 5 Channel Mode	Test Pulse from Test Output
	Safety Input 5 Test Source	Test Output 0
Safety Input 6	Safety Input 6 Channel Mode	Test Pulse from Test Output
	Safety Input 6 Test Source	Test Output 0
	Dual Channel Safety Input 6/7 Mode	Single Channel
Safety Input 7	Safety Input 7 Channel Mode	Test Pulse from Test Output
	Safety Input 7 Test Source	Test Output 0
Test Output 0	Test Output 0 Mode	Pulse Test Output

1791DS-12 Muting Lamp Output



E1: 24V dc Power Source
L1: External Muting Lamp

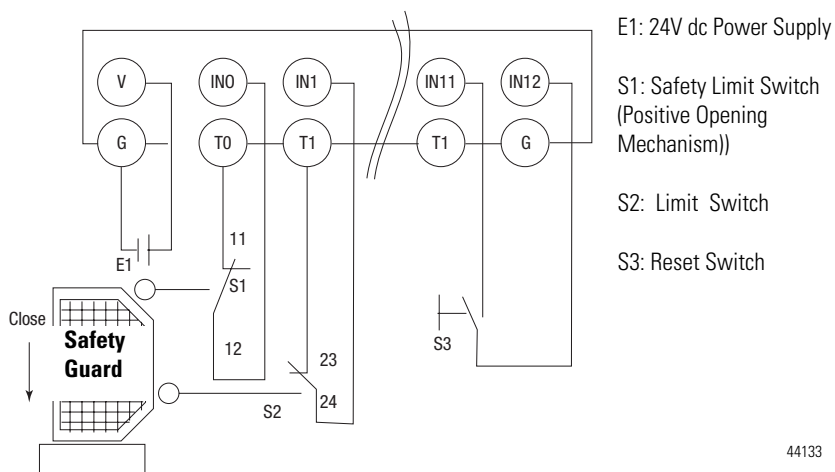
44107

This example shows wiring and configuration when using the 1791DS-IB 12 module.

1791DS-12 Muting Lamp Output

Controller Configuration	Parameter Name	Value
Test Output 3	Test Output 3 Mode	Muting Lamp Output

1791DS-IB12 Limit Switch Dual-channel Inputs and a Manual Reset

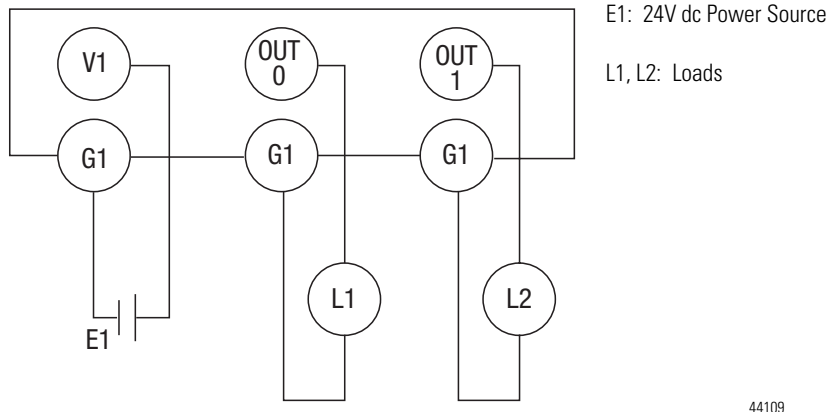


This example shows wiring and configuration when using the 1791DS-IB12 module with limit switch dual-channel inputs and a manual reset. If used in combination with the programs in a safety controller, this wiring is Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB12 Limit Switch Dual-channel Inputs and a Manual Reset

Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual-channel Safety Input 0/1 Mode	Dual-channel Equivalent
	Dual-channel Safety Input 0/1 Discrepancy Time	100 x 10 ms (application dependent)
Safety Input 1	Safety Input 1 Channel Mode	Test Pulse from Test Output
	Safety Input 1 Test Source	Test Output 1
Safety Input 11	Safety Input 11 Channel Mode	Used as Standard Input
	Safety Input 11 Test Source	Not Used
	Dual-channel Safety Input 10/11 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Test Output 1	Test Output 1 Mode	Pulse Test Output
Test Output 2	Test Output 2 Mode	Power Supply Output

1791DS-IB8XOB8 Solid State Outputs for Dual-channel Mode



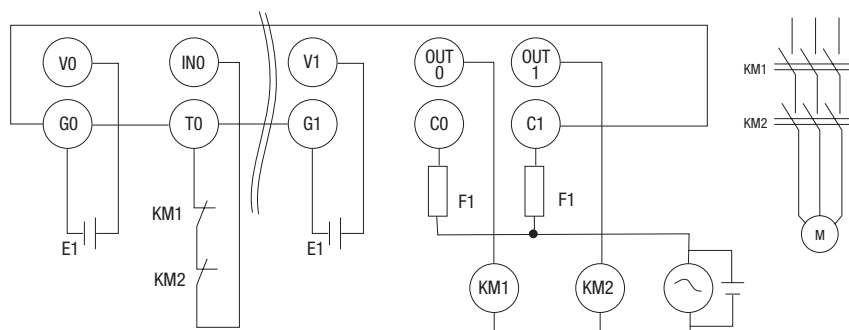
The example shows wiring and configuration when using the 1791DS-IB8XOB8 module with solid state outputs for Dual-channel mode.

If used in combination with the programs of the safety controller, this wiring is Safety Category 4 in accordance with EN954-1 wiring requirements.

1791DS-IB8XOB8 Solid State Outputs for Dual-channel Mode

Controller Configuration	Parameter Name	Value
Safety Output 0	Safety Output 0 Channel Mode	Safety Pulse Test
	Dual-channel Safety Output 0/1 Mode	Dual-channel
Safety Output 1	Safety Output 1 Channel Mode	Safety Pulse Test

1791DS-IB4X0W4 Relay Outputs with Dual-channel Mode and EDM Input



E1, E2: 24V dc Power Source
M: 3-phase Motor

KM1, KM2: Magnetic Contactors
F1, F2: Fuses

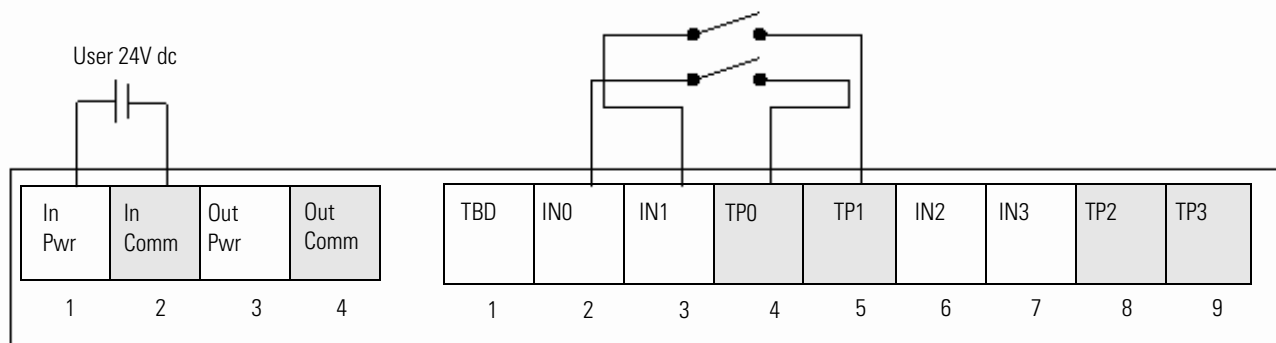
44110

The example shows wiring and configuration when using a 1791DS-IB4X0W4 module. When used in combination with the programs of the safety controller, this wiring is Category 4 accordance with EN954-1 wiring.

1791DS-IB4X0W4 Relay Outputs with Dual-channel Mode and EDM Input

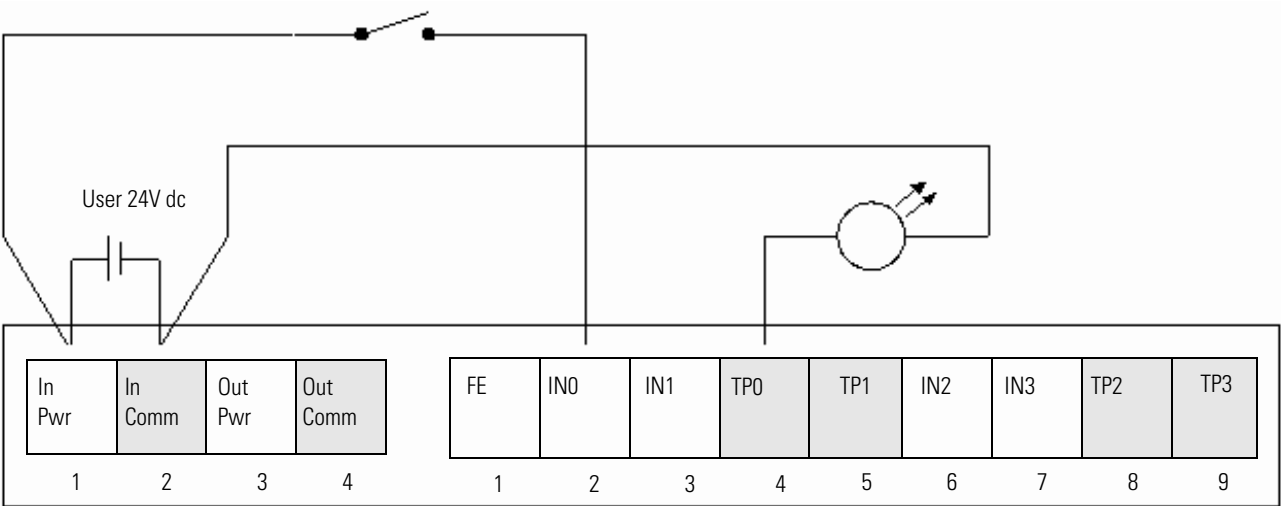
Controller Configuration	Parameter Name	Value
Safety Input 0	Safety Input 0 Channel Mode	Test Pulse from Test Output
	Safety Input 0 Test Source	Test Output 0
	Dual Channel Safety Input 0/1 Mode	Single Channel
Test Output 0	Test Output 0 Mode	Pulse Test Output
Safety Output 0	Safety Output 0 Channel Mode	Used
	Dual Channel Safety Output 0/1 Mode	Dual Channel
Safety Output 1	Safety Output 1 Channel Mode	Used

1791DS-IB8X0BV4 Dual Safety Inputs



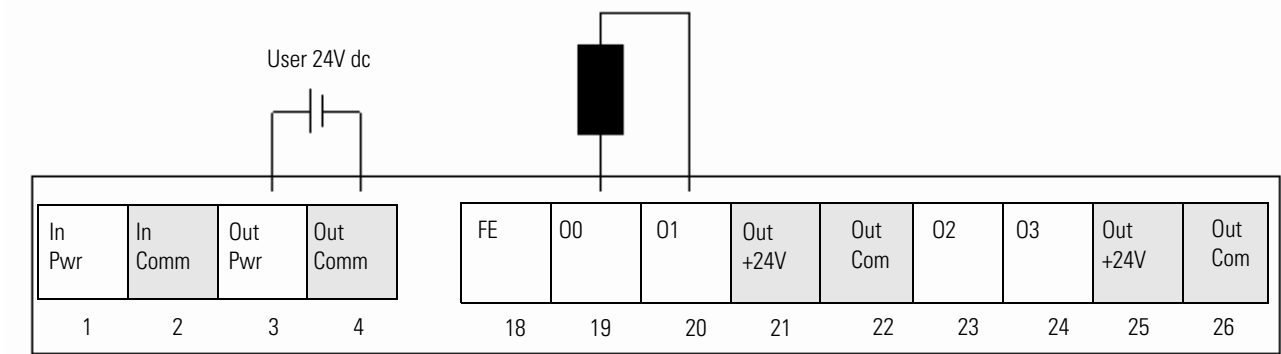
44124

1791DS-IB8X0BV4 Standard Inputs and Outputs

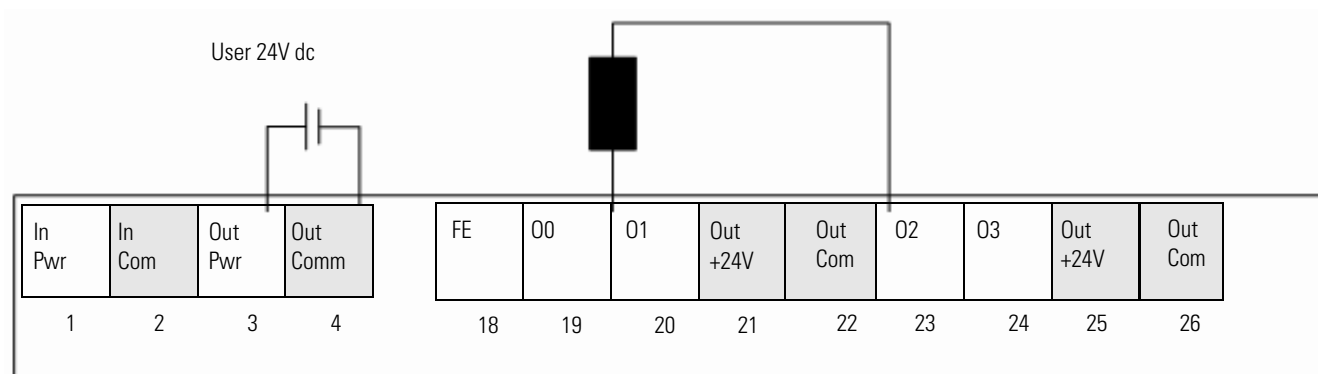


44125

1791DS-IB8X0BV4 Single Load Bipolar Outputs

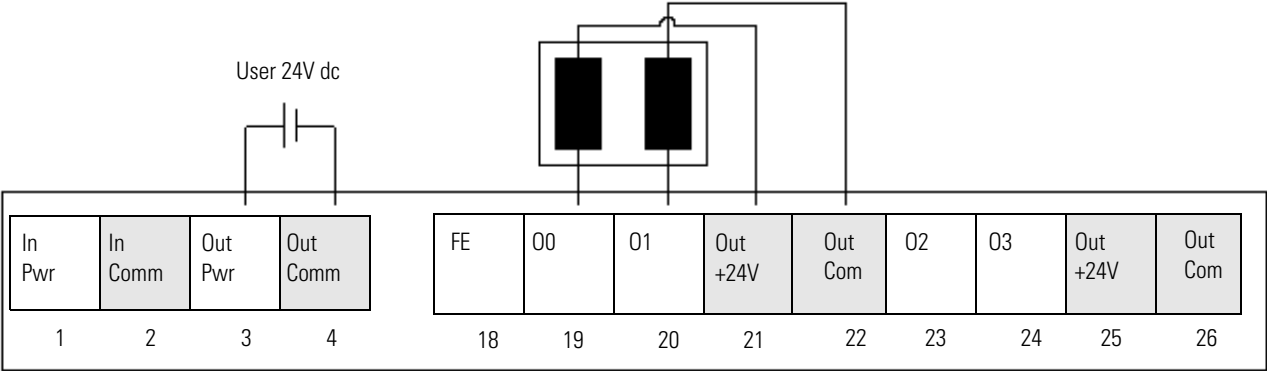


44126

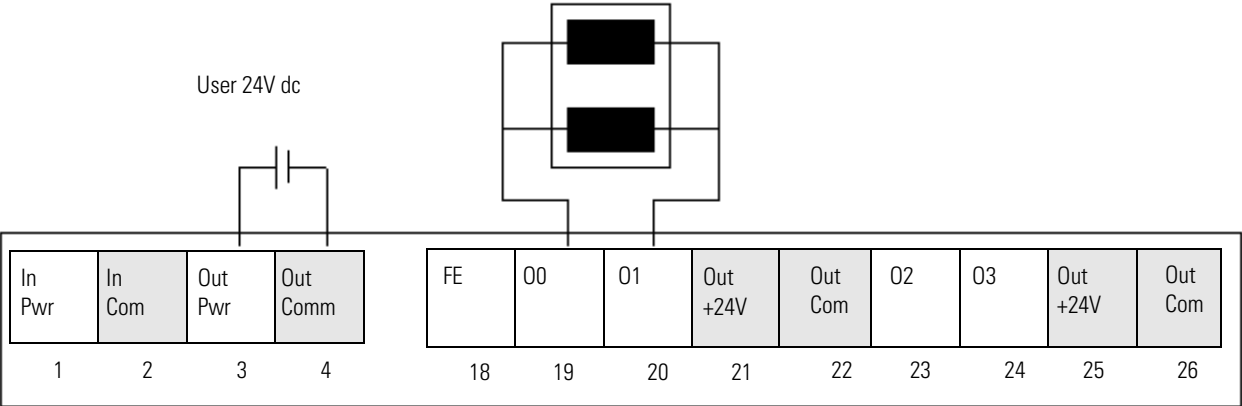
1791DS-IB8X0BV4 Single Ended Safety Outputs

44193

1791DS-IB8X0BV4 Dual Load Bipolar Outputs

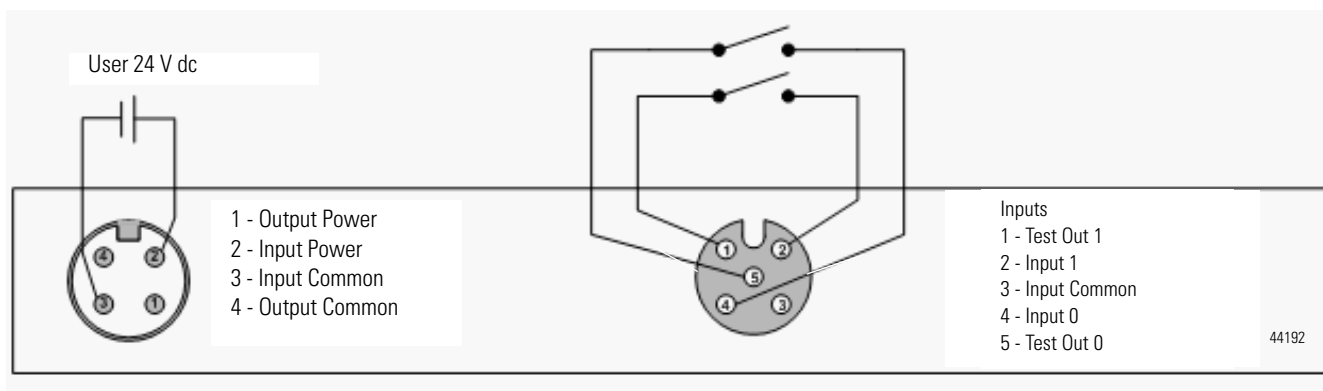


44127

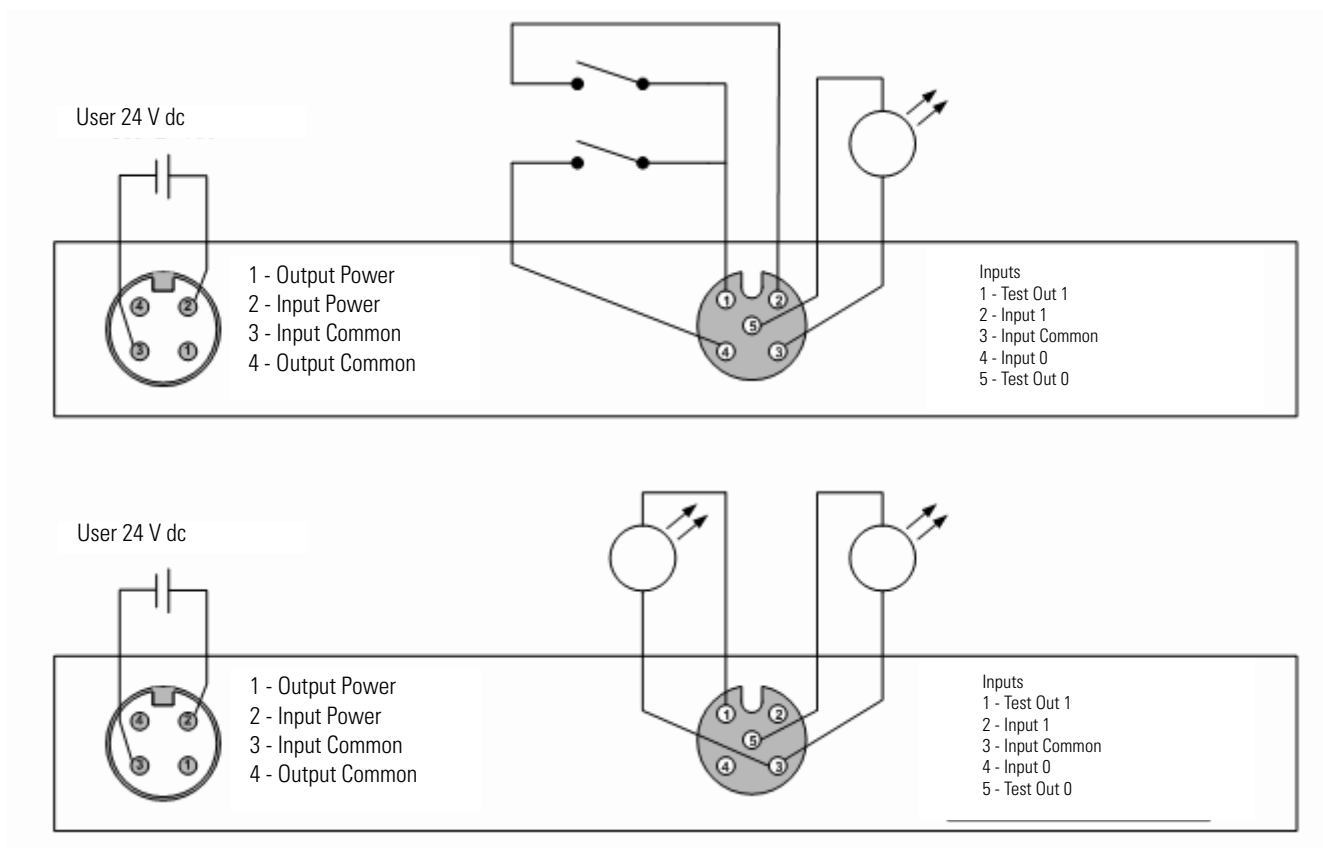


44194

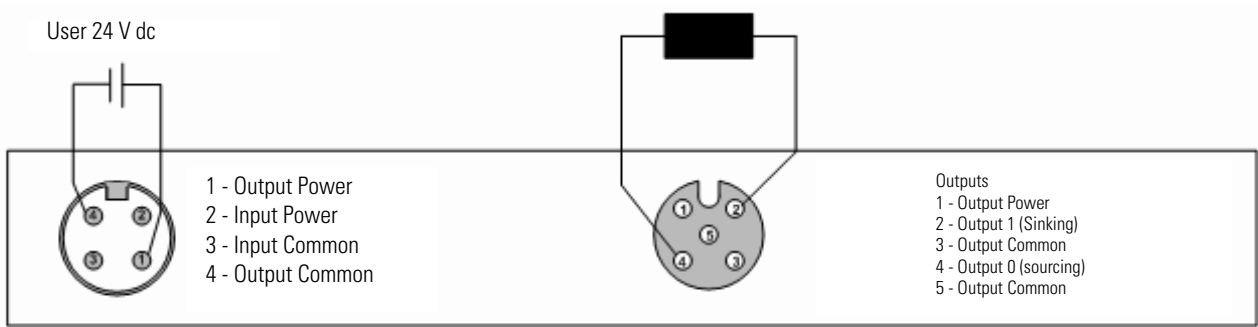
1732DS-IB8 and 1732-IB8X0BV4 Dual Safety Inputs



1732DS-IB8 and 1732-IB8X0BV4 Standard Inputs and Outputs

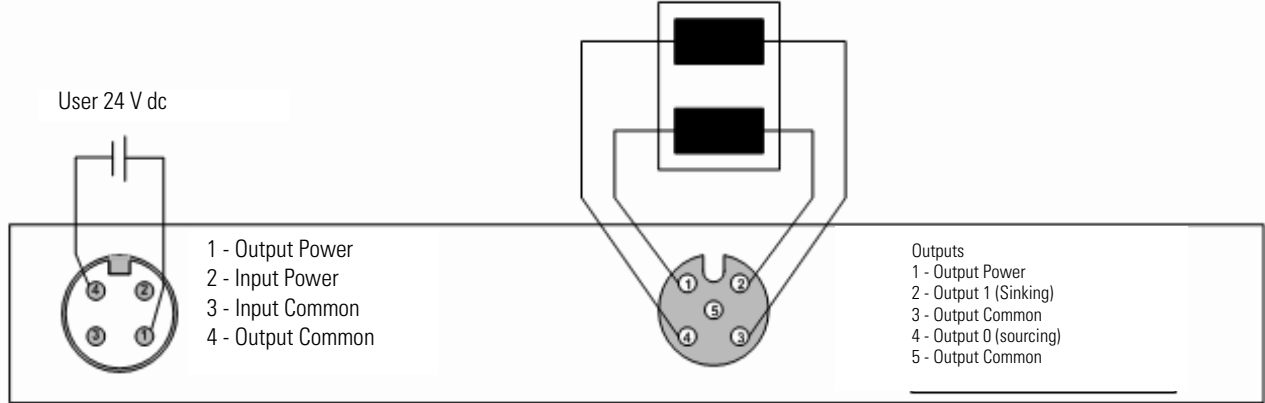


1732DS-IB8 and 1732-IB8X0BV4 Single Load Bipolar Outputs



44190

1732DS-IB8 and 1732-IB8X0BV4 Dual Load Bipolar Outputs



44189

Interpret the LED Indicators

What This Chapter Contains





















This chapter includes an explanation of the meaning of module indicators.




1791DS-IB12, 1791DS-IB8X0B8, 1791DS-IB4X0W4 Module LED Indicators

See this section for information on how to interpret these module indicators.

- MS/NS indicators - The MS (module status) indicator displays the status of a node on the network. The NS (network status) indicator displays the status of the entire network. The MS and NS indicators can be green or red and on, flashing, or off. See the table for meanings indicated by the combination of colors and status.
- Configuration lock indicators - The LOCK indicator indicates that the configuration data has been locked.
- IN PWR/OUT PWR indicators - The IN PWR and OUT PWR indicators indicate the status of I/O power supplied to the module.
- I/O indicators - The I/O indicators show the on/off and fault status of I/O modules..

MS/NS Indicators

State	Status	Description	Recommended Action
 Green  Green	Normal Operation Online/connected	Safety I/O communications in progress	None - normal status - safety I/O communications and standard I/O communications are being performed.
 Flashing Green  Green	Standby Online/connected	Standard I/O communications or message communications in progress	None - normal status - standard I/O communications and/or message communications are being performed.
 Flashing Green  Off	Standby Not Online Or Not Powered	Waiting for completion of node address duplication check at the master	If this indicator status occurred for only specific module terminals, check that the module baud rate settings are correct and restart the module.
 Flashing Green  Flashing Green	Standby Online/Not Connected	Waiting for safety or standard connection	None - wait for connection to complete.
 Flashing Green/Red  Off	Initialization Status Not Online or Not Powered	Module performing initialization process or waiting for configuration	None - wait for process or configuration to complete.
 Red)  Off	Fatal Fault Not Online or Not Powered	Watchdog timer error	Replace the module.
 Flashing Red  Off	Minor Fault Not Online or Not Powered	Switch settings are incorrect	Check the switch settings and restart the module.
 Flashing Green  Red	Standby Fatal Link Fault	Node address duplication	Reset the module so that it has a unique node address, and then restart the module.
 Flashing Green  Red	Standby Fatal Link Fault	BusOff status (communications stopped due to consecutive data errors)	Check the following items and restart the module. Do master and module baud rates match? Are lengths of cables (trunk and branch lines) correct? Are cables broken or loose? Are terminating resistors connected to both ends of the trunk line only? Is noise interference excessive?
 Flashing Green  Flashing Red	Standby Minor Communications Fault	Communications timeout	Check the following items and restart the module. Do master and module baud rates match? Are lengths of cables (trunk and branch lines) correct? Are cables broken or loose? Are terminating resistors connected to both ends of the trunk line only? Is noise interference excessive? Is the network grounded properly ?

 : Lit
 : Flashing
 : Not lit

MS/NS Indicators

Indicator	State	Status	Description	Recommended Action
MS	Green	Normal	Normal operating status	None - normal operation.
	Flashing Green	Standby	Waiting for safety communication from the safety controller	Wait for module to establish communications.
	Red	Fatal Fault	Hardware fault	Replace module.
	Flashing Red	Minor Fault	Switch settings incorrect	Correct switch settings.
	Flashing Green/Red	Initialization Status	The module is performing initialization process or waiting for configuration	Wait for configuration to complete.
	Off	No power	Power is not being supplied to the module Waiting for initial processing to start The module is being reset	Supply power to module. Wait for processing to start or module to reset.
NS	Green	Online/ connected	Network is operating normally (communications established)	None - normal operation.
	Flashing Green	Online/not connected	Network is operating normally, however, communications are not established	Verify your network and module configuration.
	Red	Fatal Link Failure	Communications fault - Module detected that network communications are not possible Node address duplication detected BusOff fault detected	Correct communications fault.
	Flashing Red	Minor Commu- nications Fault	Communications timeout	Correct communications fault.
	Off	Not Online Or Not Powered	Waiting for node address duplication check at the master or the power supply is off	Wait for check to complete or apply power.

Configuration Lock Indicator

Indicator	State	Description	Recommended Action
Lock	Yellow	Normal configuration, and configuration is locked.	None.
	Flashing Yellow	Normal configuration, but configuration is not locked in the module.	None.
	Off	Configuration has not been performed.	Perform configuration.

IN PWR/OUT PWR Indicators

Indicator	State	Description	Recommended Action
IN PWR	Green	Normal status of input power	None.
	Off	Input power is not supplied	Apply input power.
OUT PWR	Green	Normal status of output power	None.
	Off	Output power is not supplied Output power exceeds the upper/lower limit of power range	Supply output power. Correct output power.

IMPORTANT

The I/O indicators are not lit while the module is being configured.

I/O Indicators

Indicator	State	Description	Recommended Action
INO...INn ⁽¹⁾	Yellow	Safety input is on.	None.
	Off	Safety input is off.	None.
	Red	A fault occurred in an input circuit.	None.
	Flashing Red	When dual channels are set: a fault occurred in the other channel.	Correct fault in other channel.
OUTO...OUTn ⁽¹⁾	Yellow	Safety output is on.	None.
	Off	Safety output is off.	None.
	Red	A fault occurred in an output circuit.	Correct output circuit fault.
	Flashing Red	When dual channels are set: a fault occurred in the other channel.	Correct fault in other channel.

⁽¹⁾ n indicates the terminal number

1791DS-IB8X0BV4, 1732DS-IB8X0BV4, 1732DS-IB8 Module LED Indicators

See this section for information on how to interpret module indicators.

24V dc Input Power Indicator

State	Status	Description	Recommended Action
Off	No Power	No power is applied.	Apply power to this section.
Green	Normal Operation	The applied voltage is within specifications.	None.
Yellow	Input Power Out of Specification	The input power is out of specification.	Check your configuration, wiring, and voltages and apply the changes.

24V dc Output Power Indicator

State	Status	Description	Recommended Action
Off	No Power	No power is applied.	Apply power to this section.
Green	Normal Operation	The applied voltage is within specifications.	None.
Yellow	Output Power Out of Specification	The output power is out of specification.	Check your configuration, wiring, and voltages and apply the changes.

Module Status Indicator

State	Status	Description	Recommended Action
Off	No Power or Autobauding	No power is applied to the DeviceNet connector.	Apply power to this connector.
Green	Normal Operation	The module is operating normally.	None.
Red	Unrecoverable Fault	The module has detected an unrecoverable fault.	Replace the module.
Flashing Green	Module Needs Commissioning Due to Missing, Incomplete, or Incorrect Configuration	Module is unconfigured.	Reconfigure the module.
Flashing Red	Recoverable Fault	The module has detected a recoverable fault.	Cycle power to the module or reset the module.
Flashing Yellow	Module in Flash Update Mode	The module is performing an update to its flash memory.	Wait for the firmware update to finish.
Flashing Red and Green	Device in Self Test	The module is performing its power-up diagnostic tests.	Wait for the module to complete its power-up diagnostics.

Network Status Indicator

State	Status	Description	Recommended Action
Off	Module Not Online or No Power	The module is not online with the network.	Verify your network.
Flashing Green	Module Online With No Connections in Established State	The module has identified the baud rate of the network but no connections are established.	Verify your network and module configuration.
Green	Module online With Connections in Established State	The module is operating normally.	None.
Flashing Red	One or more I/O Connections in Timed-out State	The module has detected a recoverable network fault.	Verify your network and module configuration.
Red	Critical Link Failure	The module has detected an error that prevents it from communicating on the network.	Replace the module.

Network Status Indicator

Flashing Red and Green	Communication Faulted Module	The module has detected a network access error and is in communication faulted state. The module has received and accepted an Identity Communication Faulted Request-long protocol message.	Verify your network and module configuration.
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Safe Input Status Indicator

State	Status	Description	Recommended Action
Off	Safe Input Off Or Module Being Configured	The safe input is off or the module is being configured.	Turn the safe input on or wait for the module to be configured.
Yellow	Safe Input On	The safe input is on.	None.
Red	Internal Fault Detected	A fault in the input circuit was detected.	Replace the module.
Flashing Red	Partner Fault Detected	A fault in the partner input circuit of a dual input configuration was detected.	Check the field wiring and verify your configuration.
Flashing Red and Yellow	External Fault Detected	A fault external to the module was detected.	Check the field wiring and verify your configuration.

Test Output Status Indicator (1791DS-IB8X0BV4 only)

State	Status	Description	Recommended Action
Off	Test Output Off Or Module Being Configured	The test output is off or the module is being configured.	Turn the test output on or wait for the module to be configured.
Green	Test Output On	The test output is on.	None.
Yellow	Standard Output On	The Standard Output is on.	None.
Flashing Red and Yellow	External Fault Detected	A fault external to the module was detected.	Check the field wiring and verify your configuration.
Red	Internal Fault Detected	A fault internal to the module was detected.	Replace the module.

Safe Output Status Indicator

State	Status	Description	Recommended Action
Off	Safe Output Off Or Module Being Configured	The safe output is off or the module is being configured.	Turn the safe output on or wait for the module to be configured.
Yellow	Safe Output On	The safe output is on.	None.
Red	Internal Fault Detected	A fault in the output circuit was detected.	Replace the module.
Flashing Red	Partner Fault Detected	A fault in the partner output circuit of a dual output configuration was detected.	Check the field wiring and verify your configuration.

Configuration Lock Indicator

Indicator	State	Description	Recommended Action
Lock	Yellow	Normal configuration, and configuration is locked.	None.
	Flashing Yellow	Normal configuration, but configuration is not locked in the module.	None.
	Off	Configuration has not been performed.	Perform configuration.

DeviceNet Explicit Messages

What This Appendix Contains

This appendix lists DeviceNet explicit messages sent from the master unit to a safety I/O module that you can use to read or write any parameter of a specified safety I/O module. The safety I/O module processes the commands sent from the master and then returns responses.

Basic Format of Explicit Messages

The basic format of each command and response is as follows.

Command Block

Destination Node Address	Service code	Class ID	Instance ID	Attribute ID	Data
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- Destination Node Address - The node address of the module that is sending the explicit messages is specified with one hexadecimal byte.
- Service Code, Class ID, Instance ID, Attribute ID - The parameters used for specifying the command, processing object, and processing content.

IMPORTANT

The number of bytes designated for class ID, instance ID, and attribute ID depend on the master unit. When sent from a DeviceNet master, the class ID and instance ID are 2 bytes (4 digits) each, and the attribute ID is 1 byte (2 digits).

- Data - Data is not required when the read command is used.

Response block information is as follows.

Normal Response Block

Number of bytes receive	Source node address	Service code	Data
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Error Response Block

Number of bytes received 0004Hex (fixed)	Source node address	Service code	Error code
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- Number of Bytes Received - The number of bytes received from the source node address is returned in hexadecimal. When an error response is returned for an explicit message, the number of bytes is always 0004 Hex.
- Source Node Address - The node address of the node from which the command was sent is returned in hexadecimal.
- Service Code - For normal completions, the service code specified in the command with the leftmost bit turned ON is stored as shown in the following table.

Function, Command Service Code, and Response Service Code

Function	Command Service Code (hex)	Response Service Code (hex)
Read Data	10	90
Write Data	0E	8E
Reset	05	85
Save	16	96

When an error response is returned for an explicit message, the value is always 94 Hex.

- Data - Read data is included only when a read command is executed.
- Error code - The explicit message error code. For details, refer to the list of error codes in the following table.

Error Codes

Response Code	Error Name	Cause
08FF	Service not supported	The service code is incorrect.
09FF	Invalid attribute value	The specified attribute value is not supported. The data written was outside valid range.
16FF	Object does not exist	The specified Instance ID is not supported.
15FF	Too much data	The data is larger than the specified size.
13FF	Not enough data	The data is smaller than the specified size.
0CFF	Object state conflict	The specified command cannot be executed due to an internal error.
20FF	Invalid parameter	The specified operation command data is not supported.
0EFF	Attribute is not settable	An attribute ID supported only for reading has been executed for a write service code.
10FF	Device state conflict	The specified command cannot be executed due to an internal error.
14FF	Attribute not supported	The specified attribute is not supported.
19FF	Store operation failure	The data cannot be stored in memory.
2AFF	Group 2 only server general failure	The specified command or attribute is not supported or the attribute was not set.

Explicit Messages

Reading General Status

Explicit Message	Read/Write	Function	Command (hex)					Response
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
General Status Read	Read	Read the specified Slave's status flags (8 bits)	0E	95	01	65	-	1 byte Bit 0: input power error Bit 1: output power error Bit 2...7: reserved

Setting and Monitoring a Safety Input

Explicit Message	Read/Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Input Cause of Error Information Read	Read	Reads the cause for the normal flag (1...12) specified by the Instance ID turning OFF.	0E	3D	01...0C	6E	-	0: no error 01: configuration invalid 02: external test signal error 03: internal input error 04: discrepancy error 05: error in the other dual channel input

Setting and Monitoring a Safety Output

Explicit Message	Read/Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Output Cause of Error (Fault) Information Read	Read	Reads the cause for the normal flag (1...8) specified by the Instance ID turning OFF.	0E	3B	01...08	6E	-	0: no error 01 : configuration invalid 02 : over current detected 03 : short circuit detected 04 : output ON error 05 : error in the other dual channel output 06 : internal relay output circuit error (replace module) 07 : relay failure (replace relay) 08 : dual channel violation 09 : Short circuit detected at safety output

Setting and Monitoring the Test Output Point

Explicit Message	Read/Write	Function	Command (hex)					Response (hex)
			Service Code	Class ID	Instance ID	Attribute ID	Data Size	
Safety Output Cause of Error (Fault) Information Read	Read	Reads the cause for the normal flag (1...8) specified by the Instance ID turning OFF.	0E	09	01...04	6E	-	0 = no error 01 : configuration invalid 02 : overload detected 03 : cross circuit detected 05 : output ON error 06 : undercurrent detected for muting lamp

Setting Hold/Clear for Communications Errors (Test Output)

Explicit Message	Read/Write	Function	Command					Response (hex)
			Service Code (hex)	Class ID (hex)	Instance ID (hex)	Attribute ID (hex)	Data Size	
Setting for Output Status (Hold or Clear) after Communications Error	Read	Reads whether hold or clear is set as the output status after a communications error for an output (1...4) specified by the instance ID. The setting can be read for a specified number of points.	0E	09	01...04	05	-	1 byte 00 : clear 01 : hold
Setting for Output Status (Hold or Clear) after Communications Error	Write	Sets whether hold or clear as the output status after a communications error for an output (1...4) specified by the instance ID. The setting can be read for a specified number of points.	10	09	01...04	05	1 byte 00 : clear 01 : hold	

Calculated Values for Probability of Failure and Probability of Failure per Hour

What This Appendix Contains

This appendix lists calculated values for probability of failure on demand (PFD) and probability of failure per hour (PFH)

Calculated Values of PFD and PFH

Calculated values of PFD and PFH of safety I/O terminal are given in the following tables. These values must be calculated for the overall devices within the system to comply with the SIL level required for application.

Calculated PFD

Model	Proof Test Interval (Year)	PFD
1791DS-IB12	0.25	9.58E-07
	0.5	1.92E-06
	1	3.83E-06
	2	7.66E-06
1791DS-IB8XOB8	0.25	1.21E-06
	0.5	2.41E-06
	1	4.82E-06
	2	9.64E-06
1791DS-IB4XOW4	0.25	5.81E-06
	0.5	1.18E-05
1791DS-IB8XOBV4, 1732DS-IB8, 1732DS-IB8XOBV4		

IMPORTANT

The proof test interval of the 1791DS-IB4XOW4 must not exceed 0.5 years because the maintenance interval for the relay contacts must not exceed a period of 6 month to satisfy safety category 4 in accordance with EN954-1.

Calculated PFH

Model	Proof Test Interval (Year)	PFH
1791DS-IB12	0.25	8.75E-10
1791DS-IB8XOB8	0.25	1.11E-09
1791DS-IB4XOW4	0.25	5.24E-09
1791DS-IB8XOBV4, 1732DS-IB8, 1732-IB8XOBV4		

List of Functions

What This Appendix Contains

This appendix lists functions for the safety I/O modules including safety inputs, test outputs, and safety outputs.

List of Functions

Safety I/O Modules

Item	Description			
Self-diagnosis Function	Self-diagnosis is performed when power is turned ON and periodically during operation. When an error occurs, it is treated as a fatal error, the MS indicator lights in red, and all safety output and output data to the network turn OFF.			
Configuration Lock (Applies to RSNetworkx Software, Does not Apply to RSLogix 5000 Software)	After configuration data has been downloaded and verified, configuration data within the module can be protected. When the data is protected, the LOCK indicator on the front panel lights in yellow. When the data is not protected, the LOCK indicator on the front panel flashes in yellow.			
Automatic Baud Rate Detection	The module is automatically set to the baud rate of the network.			
Contents of Remote I/O Communications	I/O Data for Control	Safety Inputs	The ON/OFF state of each safety input terminal	1791DS -> DeviceNet master Safety Master
		Safety Outputs	The ON/OFF state of each safety output terminal	Safety Master -> 1791DS
		Standard Outputs	The ON/OFF state of each test output terminal (T0...T3)	DeviceNet Master or Safety Master -> 1791DS
	Output Readback	Safety Output Monitors	The actual On/OFF state of each safety output	1791DS -> DeviceNet Master Safety Master
	Status Data	Individual Safety Input Status	Individual Point Input Status (ON = OK, OFF = Fault)	
		Combined Safety Input Status	Combined Input Status (ON = OK, OFF = Fault)	
		Individual Safety Output Status	Individual Point Output Status (ON = OK, OFF = Fault)	
		Combined Safety Output Status	Combined Output Status (ON = OK, OFF = Fault)	
		Individual Test Output Status	Individual Test Output Status (ON = OK, OFF = Fault)	
		Muting Lamp Status	Muting Lamp Status of T3 (ON = OK, OFF = Fault) if T3 is configured for Muting Lamp operation	

Safety I/O Modules

Number of Connections	Safety I/O	4 (Single-cast, Multi-cast)
	Standard I/O	2 (Poll, Bit-Strobe, COS, and Cyclic)
Allocation Patterns of Remote I/O Communications-	1791DS-IB12 Module	<p>For remote I/O communications, you can select and allocate the following I/O data, for which there are 15 patterns when combined.</p> <ul style="list-style-type: none"> • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Muting Lamp Status • Individual Test Output Status • Standard Output Data
	1791DS-IB8XOB8 Module	<p>For remote I/O communications, you can select and allocate the following I/O data, for which there are 16 patterns when combined.</p> <ul style="list-style-type: none"> • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Combined Safety Output Status • Individual Safety Output Status, • Muting Lamp Status • Standard Output Data • Safety Output Readback • Individual Test Output Status
	1791DS-IB4XOW4 Module	<p>For remote I/O communications, you can select and allocate the following I/O data, for which there are 16 patterns when combined.</p> <ul style="list-style-type: none"> • Safety Input Data • Individual Safety Input Status • Combined Safety Input Status • Combined Safety Output Status • Individual Safety Output Status • Muting Lamp Status • Standard Output Data • Safety Output Monitor • Individual Test Output Status

Safety Inputs

Item	Description
Input Channel Mode	<p>Any of the following modes can be selected according to the external input device for each input.</p> <ul style="list-style-type: none"> • Not used - An external input device is not connected. • Safety pulse test - Used with a contact output device in combination with a test output. Using this setting, short circuits between input signal lines and the power supply (positive side) and short circuits between input signal lines can be detected. • Safety - A solid state output safety sensor is connected. • Standard - A non-safety device is connected, for example, a reset switch.
Dual Channel Mode	<p>The consistency between signals on two channels can be evaluated. The following settings can be selected. The discrepancy time is set for Dual-channel operation.</p> <ul style="list-style-type: none"> • Single channel - Used as a single channel. • Dual-channel equivalent - Used as a dual channel pair. Status is OK when both channels are ON or OFF. • Dual-channel complementary - Used as dual channel. Status is OK when one channel is ON and the other channel is OFF.
Input Delays	<p>ON delay - An input signal is treated as being OFF during the ON delay setting time (0...126 ms, in increments of 6 ms) after the input contact's rising edge. The input turns ON only if the input contact remains ON after the ON delay time has elapsed. This helps prevent chattering of the input contacts.</p> <hr/> <p>OFF delay - An input signal is treated as being ON during the OFF delay setting time (0...126 ms, in increments of 6 ms) after the input contact's falling edge. The input turns OFF only if the input contact remains OFF after the OFF delay time has elapsed. This helps prevent chattering of the input contacts.</p>
Input Error Latch Time	<p>An input or test output error is held for a minimum of this amount of time.</p> <p>This time should be set to ensure that the Safety Controller recognizes the error (0...65,530 ms, in increments of 10 ms).</p>

Test Outputs

Item	Description
Test Output Mode	Any of the following modes can be selected to accommodate the connected external device.
	Not used - An external device is not connected
	Standard output - The output is connected to a standard device.
	Pulse test output - A contact output device is connected and used in combination with a safety input.
	Power supply output - The power supply terminals of a safety sensor are connected. The voltage supplied to I/O power (V,G) is output from the test output terminal.
	Muting lamp output (terminal T3 only) - An indicator is connected. Unit is turned on to detect broken lines in an external indicator.
Output Status After Communications Error	A selection to hold or clear the previous value when a communications error occurs is available.
Short Circuit Detection	Supported.
Broken Wire Detection of External Indicator	Supported for muting output only.

Safety Output

Item	Description
Output Channel Mode	Any of the following Safety Output modes can be selected. <ul style="list-style-type: none"> • Not used - External output devices are not connected. • Safety - When the safety output is ON, the test pulse is not output (remains ON). • Safety pulse test - When the output is ON, the test pulse is turned OFF for 470 μs in a cycle of 648 ms. Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected.
Dual Channel Setting	The consistency between signals on two channels can be evaluated. Either of the following settings can be selected: <ul style="list-style-type: none"> • Single channel - used as single channel. • Dual-channel - when both channels are OK, outputs can be turned ON. If an error is detected on one of the channels, the other channel is also turned OFF.
Output Error Latch Time	A safety output error will be held for a minimum of this amount of time. This time should be set to ensure that the safety controller recognizes the error. (0...65,530 ms, in increments of 10 ms)
Short-circuit Detection	Supported.
Overcurrent Detection	Supported.

Configuration Reference Information

What This Appendix Contains

This appendix provides information about configuration settings.

Understand Parameter Groups

The modules have these parameter groups: general parameters, safety input, test output, safety output.

See the tables for the settings in each parameter group. All parameters are set using RSLogix 5000 or RSNetworkx for DeviceNet software.

IMPORTANT

Parameters directly related to safety are marked with an X in the left column.

General Parameters

Parameter Name		Value	Description	Default
x	Safety Output Error Latch Time	0...65,530 ms (in increments of 10 ms)	Safety output errors will be latched for this time.	1,000 ms
x	Safety Input Error Latch Time	0...65,530 ms (in increments of 10 ms)	Safety input or test output errors will be latched for this time.	1,000 ms
	Test Output Idle State	Clear OFF or Keep output data	Definition of output data is in idle state.	Clear OFF

Safety Input Parameters

Parameter Name		Value	Description
x	Input Delay Time Off -> On	0...126 ms (in increments of 6 ms)	Filter time for OFF to ON transition
x	Input Delay Time On -> Off	0...126 ms (in increments of 6 ms)	Filter time for ON to OFF transition
x	Input Point Mode	Not Used	External input device is not connected.
		Safety Test Pulse	Use with a contact output device and in combination with a test output. Using this setting, short-circuits between input signal lines and the power supply (positive side) and short-circuits between input signal lines can be detected.
		Safety	A solid state output safety sensor is connected.
		Standard	A non-safety device, such as a reset switch, is connected.
x	Safety Input Test Source	Not used	The test output that is used with the input
		Test Output 0	
		Test Output 1	
		Test Output 2	
		Test Output 3	
x	Input Point Operation Type	Single Channel	Use as single channel.
		Dual-channel Equivalent	Use as dual-channel. Normal (OK) when both channels are ON or OFF.
		Dual-channel Complementary	Use as dual-channel. Normal (OK) when one channel is ON and the other channel is OFF.

IMPORTANT

If the test pulse from test output is set to the Safety Input Channel mode, the safety input test source and pulse test output of the test output must be set to the Test Output mode.

Test Output Parameters

Parameter Name		Value	Description	Default
x	Test Output Mode	Not Used	An external device is not connected.	Not Used
		Standard	The output is connected to a standard device.	
		Pulse Test	A contact output device is connected. Use in combination with a safety input.	
		Power Supply	The power supply of a Safety Sensor is connected. The voltage supplied to I/O power (V, G) is output from the test output terminal.	
		Muting Lamp Output (Terminal T3 only)	An indicator is connected and turned ON to detect broken lines in an external indicator.	
	Test Output Fault Action	Clear OFF	Action to perform when a communications error is detected.	Clear OFF
		Hold Last Data		

Safety Output Parameters

Parameter Name	Value	Description	Default
x	Output Point Mode	Not Used	Not Used
		Safety	
	Safety Pulse Test (This can be set for 1791DS-IB8XOB8 modules only)	When the output is ON, the test pulse is not output (remains ON). When the output is ON, the test pulse is turned OFF for 470 μ s in a cycle of 648 ms. Using this function, short-circuits between output signal lines and the power supply (positive side) and short-circuits between output signal lines can be detected.	
x	Output Point Operation Type	Single Channel	Dual-channel
		Dual-channel	

Allocate Remote I/O

Concerning I/O allocations, the module internally stores I/O data. To set connection paths use RSLogix 5000 or RSNetworkx for DeviceNet software to allocate I/O data for the master unit. No settings are made by default. Be sure to set the required connection paths.

Concerning I/O data, the module stores the following data.

- SAFE: Information the controller can use in safety-related functions
- NON-SAFE: Additional information that must not be relied on for safety functions

Data and Description

Data		Description
Input data	Safety Input Data SAFE	Indicates the ON/OFF status of each input terminal. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Combined Safety Input Status SAFE	An AND of the status of all input terminals. <ul style="list-style-type: none"> • All terminals are normal: 1 • An error was detected in one or more input terminals: 0
	Individual Safety Input Status SAFE	Indicates the status of each input terminal. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Combined Safety Output Status SAFE	An AND of the status of all safety output terminals. <ul style="list-style-type: none"> • All terminals are normal: 1 • An error has been detected in one or more output terminals: 0
	Individual Safety Output Status SAFE	Indicates the status of each safety output terminal. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Muting Lamp Status SAFE	Indicates the status when terminal T3 is configured as the muting lamp output. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
	Safety Output Monitor NON-SAFE	Monitors the outputs of the safety output terminals. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Individual Test Output Status NON-SAFE	Indicates the status of each of the test output terminals. <ul style="list-style-type: none"> • Normal (OK): 1 • Fault (Alarm): 0
Output data	Safety Output Data SAFE	Controls the safety output. <ul style="list-style-type: none"> • ON: 1 • OFF: 0
	Standard Output Data NON-SAFE	Controls the test output when test output mode is set to a standard output. <ul style="list-style-type: none"> • ON: 1 • OFF: 0

I/O Data Supported by Each Module

See the table that shows a summary of default I/O data by module. s

Default I/O Data

Module	RSLogix 5000 Software		RSNetworkx for DeviceNet Software	
	Safety Connection	Instance	Standard Connection	Instance
1791DS-IB12	Safety	20C	Safety - Point Status - Muting Status - Test Output Status	312
1791DS-IB8XOB8	Safety	204 and 234	Safety - Readback - Point Status - Muting Status - Test Output Status	323
1791DS-IB4XOW4	Safety	203 and 233	Safety - Readback - Point Status - Muting Status - Test Output Status	333
1791DS-IB8XOBV4	Safety	204	Safety	234
1732DS-IB8	Safety Point Status	224	Safety	22
1732DS-IBXOBV4	Safety	204	Safety Safety - Readback - Point Status - Muting - Test Output	374

The tables show the I/O data supported by each module. Refer to I/O Assembly Data for data arrangements. For I/O data, safety connections for up to four items, including one output, can be allocated for the master unit, and standard connections for up to two items can be allocated for the master unit (scanner).

IMPORTANT

Communications with up to 15 safety controllers for each connection can be performed using multi-casting. When using four connections, a maximum of 30 safety controllers total can communicate with the module.

1791DS-IB12 Modules

The default I/O data is as follows.

- Safety connection: Safety (Instance No. 20C) - RSLogix 5000 software
- Standard connection: Safety - Point Status - Muting Status - Test Output Status (Instance No. 312) - RSNetworkx for DeviceNet software

1791DS-IB12 Modules

Safety Connection	Standard Connection	Configuration Software Setting (See Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	20C	x									
x	x	Small Safety - Point Status	224	x		x							
x	x	Safety - Point Status	22C	x		x							
x	x	Safety - Combined Status - Muting Status	310	x	x				x				
		Safety - Point Status - Muting Status	311	x		x			x				
x	x	Safety - Point Status - Muting Status - Test Output Status	312	x		x			x		x		
x	x	Test	21										x
	x	Test output status with general status assembly	340								x		

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

1791DS-IB8X0B8 Modules

The default I/O data is as follows:

- Safety connections: Safety (Instance No. 204 and 234) - RSLogix 5000 software
- Standard connection: Safety - Readback - Point Status - Muting Status - Test Output Status (Instance No. 323) - RSNetworkx for DeviceNet software

1791DS-IB8X0B8 Modules

Safety Connection	Standard Connection	Configuration Software Setting (See Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	204	x									
x	x	Safety - Combined Status - Muting Status	320	x	x		x		x				
x	x	Safety - Point Status - Muting Status	321	x		x		x	x				
x	x	Safety - Readback - Point Status - Muting Status	322	x		x		x	x	x			
x	x	Safety - Readback - Point Status - Muting Status - Test Output Status	323	x		x		x	x	x	x		
x	x	Test	21										x
x		Safety	234									x	
x		Combined	351									x	x
	x	Output Readback/test output status with general status assembly	341							x	x		

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

1791DS-IB4X0W4 Modules

The default I/O data is as follows.

- Safety connections: Safety (Instance No. 203 and 233) - RSLogix 5000 software
- Standard connection: Safety - Readback - Point Status - Muting Status - Test Output Status (Instance No. 333) - RSNetworx for DeviceNet software

1791DS-IB4X0W4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	203	x									
x	x	Safety - Combined Status - Muting Status	330	x	x		x		x				
x	x	Safety - Point Status - Muting Status	331	x		x		x	x				
x	x	Safety - Readback - Point Status - Muting Status	332	x		x		x	x	x			
x	x	Safety - Readback - Point Status - Muting Status - Test Output Status	333	x		x		x	x	x	x		
x	x	Test	21										x
x		Safety	233									x	
x		Combined	350									x	x
	x	Output Readback/test output status with general status assembly	342							x	x		

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

1791DS-IB8X0BV4 Modules

The default I/O data is as follows.

- Safety connections: Safety (Instance No. 204) - RSLogix 5000 software
- Standard connection: Safety (Instance No. 234) - RSNetworkx for DeviceNet software

1791DS-IB8X0BV4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	204	x									
x	x	Safety - Combined Status - Muting	324	x	x		x		x				
x	x	Safety - Point Status - Muting	344	x		x		x	x				
x	x	Safety - Readback - Point Status - Muting	354	x		x		x	x	x			
x	x	Safety - Readback - Point Status - Muting - Test Output	374	x		x		x	x	x	x		
x	x	Test	22										x
x		Safety	234									x	
x		Combined	2C4									x	x

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

1732DS-IB8 Modules

The default I/O data is as follows.

- Safety connections: Safety Point Status(Instance No. 224) - RSLogix 5000 software
- Standard connection: Safety (Instance No. 22) - RSNetworkx for DeviceNet software

1732DS-IB8 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	204	x									
x	x	Safety - Point Status - Muting Status	334	x		x		x	x				
x	x	Safety - Point Status - Muting - Test Output	364										
x	x	Safety - Combined Status - Muting	314	x	x		x		x				
x	x	Safety - Point Status	224	x		x							
x	x	Test	22										x

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

1732DS-IB8XOBV4 Modules

The default I/O data is as follows.

- Safety connections: Safety (Instance No. 204) - RSLogix 5000 software
- Standard connection: Safety Safety - Readback - Point Status - Muting - Test Output (Instance No. 374) - RSNetworkx for DeviceNet software

1732DS-IB8XOBV4 Modules

Safety Connection	Standard Connection	Configuration Software Setting (see Module Definition ⁽¹⁾)	Assembly Instance No.	Inputs								Outputs	
				Safety Input Data	Combined Safety Input Status	Individual Safety Input Status	Combined Safety Output Status	Individual Safety Output Status	Muting Lamp Status	Safety Output Readback	Individual Test Output Status	Safety Output Data	Standard Output Data
x	x	Safety	204	x									
		Safety - Combined Status - Muting	324	x	x		x		x				
x	x	Safety - Point Status - Muting	344	x		x		x	x				
x	x	Safety - Readback - Point Status - Muting	354	x		x		x	x	x			
x	x	Safety - Readback - Point Status - Muting - Test Output	374	x		x		x	x	x	x		
x	x	Test	22										x
x		Safety	234									x	
x		Combined	2C4									x	x

⁽¹⁾ Found in RSLogix5000 software, I/O Module Properties, General tab

I/O Assembly and Reference Data

See the tables for I/O assembly and reference data.

1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4 Data

The bits in the tag definitions of RSLogix 5000 and RSNetwork software are different than those shown in the following section. The following defines the name associations for consistency with the programming software.

Bit Definitions and RSLogix 5000 Tag Names

Bit Definitions	RSLogix 5000 Tag Name
Safety Input 0	Pt00Data
Safety Input 11	Pt11Data
Safety Input 0 Status	Pt00InputStatus
Safety Input 11 Status	Pt11InputStatus
Safety In Status	InputStatus
Muting Lamp Status	MutingStatus
Safety Output 0	Pt00Data
Safety Output 7	Pt07Data
Standard Output 0	Test00Data
Standard Output 3	Test03Data
Safety Output 0 Status	Pt00OutputStatus
Safety Output 7 Status	Pt07OutputStatus
Safety Out Status	OutputStatus
Safety Output 0 Monitor	Pt00Readback
Safety Output 7 Monitor	Pt07Readback
Test Output 0 Status	Pt00TestOutputStatus
Test Output 3 Status	Pt03TestOutputStatus

See these tables for reference data concerning input and output data.

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8X0B8, 1791DS-IB4X0W4)

Catalog Number	Instance (Hex)	Byte	Byte 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB4X0W4	203	0	Reserved				Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB4X0W4	204	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB12	20C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Reserved				Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
1791DS-IB4X0W4	224	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
1791DS-IB12	22C	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
1791DS-IB12, 1791DS-IB8X0B8, 1791DS-IB4X0W4	300	0	Reserved						Output Power Error	Input Power Error
1791DS-IB12	310	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Combined Safety In Status	Reserved		Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
1791DS-IB12	311	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
		3	Muting Lamp Status	Reserved						

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

1791DS-IB12	312	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 11	Safety Input 10	Safety Input 9	Safety Input 8
		2	Safety Input 11 Status	Safety Input 10 Status	Safety Input 9 Status	Safety Input 8 Status	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status
		3	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB8XOB8	320	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Combined Safety In Status	Combined Safety Out Status	Reserved				
1791DS-IB8XOB8	321	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Muting Lamp Status	Reserved						
1791DS-IB8XOB8	322	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Muting Lamp Status	Reserved						

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

1791DS-IB8XOB8	323	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB4XOW4	330	0	Muting Lamp Status	Combined Safety In Status	Combined Safety Out Status	Reserved	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
1791DS-IB4XOW4	331	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Muting Lamp Status	Reserved			Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
1791DS-IB4XOW4	332	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		2	Muting Lamp Status	Reserved						
1791DS-IB4XOW4	333	0	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		2	Muting Lamp Status	Reserved			Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB12	340	0	Reserved							
		1	Reserved				Test Output 3 Status	Test Output 2 Status	Output Power Error	Input Power Error

Input Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

1791DS-IB8XOB8	341	0	Reserved							
		1	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Output Power Error	Input Power Error
		2	Reserved				Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
1791DS-IB4XOW4	342	0	Reserved							
		1	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor

Output Data (Catalog Numbers 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4)

Catalog Number	Instance (Hex)	Byte	Byte 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4	21	0	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
1791DS-IB4XOW4	233	0	Reserved				Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOB8	234	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB4XOW4	350	0	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOB8	351	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
		1	Reserved				Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4 Data

The bits in the tag definitions of RSLogix 5000 and RSNetworkx software are different than those shown in the following section. The following defines the name associations for consistency with the programming software.

Bit Definitions and RSLogix 5000 Tag Names

Bit Definitions	RSLogix 5000 Tag Name
Safety Input 0...7	Module Name:I.Pt00Data - Pt15Data
Safety Input 0...7 Status	Module Name:I.Pt00InputStatus - Pt15InputStatus
Combined Safety In Status	Module Name:I.InputStatus
Muting Lamp Status	Module Name:I.MutingStatus
Safety Output 0...7	Module Name:O.Pt00Data - Pt07Data
Safety Output 0...7 Status	Module Name:I.Pt00OutputStatus - Pt07OutputStatus
Combined Safety Out Status	Module Name:I.OutputStatus
Safety Output 0...7 Monitor	Module Name:I.Pt00Readback - Pt07Readback
Test Output 0...7 Data	Module Name:I.Test00Data - Test07Data
Test Output 0...7 Status	Module Name:I.Pt00TestOutputStatus - Pt07TestOutputStatus

See these tables for reference data concerning input and output data.

Input Data (Catalog Number 1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4)

Catalog Number	Instance (Hex)	Byte	Byte 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	204	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
	224	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
1732DS-IB8	300	0	Reserved							Input Power Error
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	301	0	Reserved							Output Power Error
1732DS-IB8	314	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Reserved							Muting Lamp 7 Status

Input Data (Catalog Number 1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4)

1732DS-IB8XOBV4, 1791DS-IB8XOBV4	324	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Combined Safety In Status	Combined Safety Out Status	Reserved				Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	334	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	344	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
	354	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor
		4	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8, 1732DS-IB8XOBV4, 1791DS-IB8XOBV4	364	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status
		2	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status
		3	Reserved						Muting Lamp 7 Status	Muting Lamp 3 Status

Input Data (Catalog Number 1732DS-IB8, 1732DS-IB8XOBV4, and 1791DS-IB8XOBV4)

1732DS-IB8XOBV4, 1791DS-IB8XOBV4	374	0	Safety Input 7	Safety Input 6	Safety Input 5	Safety Input 4	Safety Input 3	Safety Input 2	Safety Input 1	Safety Input 0	
		1	Safety Input 7 Status	Safety Input 6 Status	Safety Input 5 Status	Safety Input 4 Status	Safety Input 3 Status	Safety Input 2 Status	Safety Input 1 Status	Safety Input 0 Status	
		2	Safety Output 7 Status	Safety Output 6 Status	Safety Output 5 Status	Safety Output 4 Status	Safety Output 3 Status	Safety Output 2 Status	Safety Output 1 Status	Safety Output 0 Status	
		3	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	
		4	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	
		5	Reserved							Muting Lamp 7 Status	Muting Lamp 3 Status
1732DS-IB8	384	0	Reserved								Input Power Error
		1	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	
1732DS-IB8XOBV4, 1791DS-IB8XOBV4	394	0	Reserved							Output Power Error	Input Power Error
		1	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	
	3A4	0	Reserved							Output Power Error	Input Power Error
		1	Safety Output 7 Monitor	Safety Output 6 Monitor	Safety Output 5 Monitor	Safety Output 4 Monitor	Safety Output 3 Monitor	Safety Output 2 Monitor	Safety Output 1 Monitor	Safety Output 0 Monitor	
		2	Test Output 7 Status	Test Output 6 Status	Test Output 5 Status	Test Output 4 Status	Test Output 3 Status	Test Output 2 Status	Test Output 1 Status	Test Output 0 Status	

Output Data (Catalog Number 1791DS-IB8XOBV4, 1732DS-IB8, and 1732-IB8XOBV4)

Catalog Number	Instance (Hex)	Byte	Byte 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
1791DS-IB8XOBV4, 1732DS-IB8, 1732-IB8XOBV4	22	0	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0
1791DS-IB8XOBV4, 1732-IB8XOBV4	234	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
1791DS-IB8XOBV4, 1732-IB8XOBV4	2C4	0	Safety Output 7	Safety Output 6	Safety Output 5	Safety Output 4	Safety Output 3	Safety Output 2	Safety Output 1	Safety Output 0
		1	Standard Output 7	Standard Output 6	Standard Output 5	Standard Output 4	Standard Output 3	Standard Output 2	Standard Output 1	Standard Output 0

A

about catalog numbers 18
add devices
 available devices list 75
administrator
 safety 7
advanced safety connection properties
 71
automap 75
available devices list 75
 add devices 75

B

bus off 6

C

catalog numbers 18
cleaning 84
colored stickers 39
configuration
 DeviceNet Safety I/O target nodes 68
 DeviceNet Safety Scanner safety
 connections 69
 DeviceNet Safety Scanner standard
 connections 72
 DeviceNet Standard slave nodes 72
 GuardPLC controller connections 78
 safety parameters 68
 standard inputs 76
 standard outputs 77
 standard parameters 69
 standard scanner inputs 76
configure the module 41
connecting
 communications connectors 39
connection reaction time limit 70
 and network delay multiplier 71
 DeviceNet Safety I/O 70
controller ID 78
**controlling devices sample
 requirements** 8
create a scanlist 74

D

data
 default I/O 121
default
 module defaults button 72
DIN rail 16

directives 13

E

EC directives 14
edit I/O parameters 75
EDS
 See electronic data sheet.
electronic data sheet 6, 61
 wizard 61
electronic key 75
EMC directives 14
EPR
 See expected packet rate.
expected packet rate 73
 default 74
explicit messages 81, 107

F

ferrite core 15

G

GuardPLC tab
 configure HSP connection 78

H

high-speed safety protocol
 signature 78

I

I/O parameters 57
input tab 76
inspection 85
installation 35
interscan delay 72
ISD
 See interscan delay.

L

LED indicators 101
legislation 13

M

maintenance interval
 for relay contacts 85
Max Scanner Response Time 79
mean time between failure 6

model types 18
module tab 72
mounting 16
MTBF
 See mean time between failure.
multicast connections 70

N

network delay multiplier 71
node address setting 40
noise 15

O

ODVA 6, 13
off-delay function 30
on-delay function 30
output tab 77

P

parameters tab 69
password 57
PFD
 See probability of failure on demand.
PFH
 See probability of failure per hour.
point-to-point 70
poll ratio 73
precautions for use 8
probability of failure on demand 6, 111
probability of failure per hour 6, 111
publications, related 5

R

related publications 5
remote I/O allocations 43, 59, 119
replace units 86
requested packet interval

and connection reaction time limit 71
 set 70

RPI

See requested packet interval.

RSLogix 5000 software 41

RSNetwork for DeviceNet software 57

S

safety configuration tab 68
safety connections tab 69
safety functions
 safety input 24
 safety output 31
safety network number 6
scanlist 74, 75
scanner ID 78
scanner receive timeout 79
set I/O parameters 57
SNN

See safety network number.

standards 13

statistics button 79

stickers

on communications connectors 39

T

timeout multiplier 71
transmit retries 73, 74
troubleshoot 81

V

ventilation 16
view scanner response times 79

W

who should use this manual 5
wiring examples 87



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