



# CompactBlock Safety I/O Modules on DeviceNet Series 1791DS

Catalog Number 1791DS-IB12, 1791DS-IB8XOB8, 1791DS-IB4XOW4

## Use These Installation Instructions

These installation instructions describe precautions to follow as you install and operate the product. Read these instructions before operating the product. These instructions cover the following.

- DeviceNet Safety Input Module, catalog number 1791DS-IB12
- DeviceNet Safety Input and Solid-state Output module, catalog number 1791DS-IB8XOB8
- DeviceNet Safety Input and Relay Output Module, catalog number 1791DS-IB4XOW4

Keep these instructions for reference. For safe and correct use of the product, also read these publications, available from your Rockwell Automation sales office or at <http://literature.rockwellautomation.com>.

- DeviceNet Modules in Logix5000 Control Systems User Manual, publication DNET-UM004
- DeviceNet Safety 1791DS Series User Manual, publication 1791DS-UM001

### 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.

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

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

**WARNING** Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



**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.
- recognize the consequence.

## North American Hazardous Location Approval

The following are hazardous location approved.

1791DS-IB12 and 1791DS-IB8XOB8

The following information applies when operating this equipment in hazardous locations:	Informations sur l'utilisation de cet équipement en environnements dangereux :
Products marked CL 1, DIV 2, GP A, B, C, D are suitable for use in Class I, Division 2 Groups A, B, C, D Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest T number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.	Les produits marqués CL 1, DIV 2, GP A, B, C, D ne conviennent qu'à une utilisation en environnements de Classe I, Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.

WARNING	EXPLOSION HAZARD	AVERTISSEMENT	RISQUE D'EXPLOSION
	<ul style="list-style-type: none"> <li>• Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous.</li> <li>• Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product.</li> <li>• Substitution of components may impair suitability for Class I, Division 2.</li> <li>• If this product contains batteries, they must only be changed in an area known to be nonhazardous.</li> </ul>		<ul style="list-style-type: none"> <li>• Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement.</li> <li>• Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit.</li> <li>• La substitution de composants peut rendre cet équipement inadéquat à une utilisation en environnement de Classe I, Division 2.</li> <li>• S'assurer que l'environnement est classé non dangereux avant de changer les piles.</li> </ul>

**WARNING** When you connect or disconnect the Removable Terminal Block (RTB) with field side power applied, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.



**ATTENTION** If you connect or disconnect wiring while the field-side power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Be sure that power is removed or the area is nonhazardous before proceeding.



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



**ATTENTION** **Prevent Electrostatic Discharge**  
This equipment is sensitive to electrostatic discharge, which can cause internal damage and affect normal operation. Follow these guidelines when you handle this equipment.

- Touch a grounded object to discharge potential static.
- Wear an approved grounding wriststrap.
- Do not touch connectors or pins on component boards.
- Do not touch circuit components inside the equipment.
- Use a static-safe workstation if available.
- Store the equipment in appropriate static-safe packaging when not in use.



**ATTENTION** **Environment and Enclosure**  
This equipment is intended for use in a Pollution Degree 2 industrial environment, in overvoltage Category II applications, as defined in IEC publication 60664-1, at altitudes up to 2000 m (6561.6 ft) without derating.

This equipment is considered Group 1, Class A industrial equipment according to IEC/CISPR Publication 11. Without appropriate precautions, there may be potential difficulties ensuring electromagnetic compatibility in other environments due to conducted as well as radiated disturbance.



This equipment is supplied as open type equipment. It must be mounted within an enclosure that is suitably designed for those specific environmental conditions that will be present and appropriately designed to prevent personal injury resulting from accessibility to live parts. The interior of the enclosure must be accessible only by the use of a tool. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings that are required to comply with certain product safety certifications.

See NEMA Standards publication 250 and IEC publication 60529, as applicable, for explanations of the degrees of protection provided by different types of enclosure. Also, see the appropriate sections in this publication, as well as the Industrial Automation Wiring and Grounding Guidelines, Allen-Bradley publication 1770-4.1, for additional installation requirements pertaining to this equipment.

**WARNING** If you connect or disconnect the communications cable with power applied to this module or any device on the network, an electrical arc can occur. This could cause an explosion in hazardous location installations.



## 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 will be 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 has been 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 Correct Use

The following information is related to operating directions. Refer to this information after reading DeviceNet Safety 1791DS Series User Manual, publication 1791DS-UM001. Do not use the unit in locations subject to the following.

- Direct sunlight
- Temperatures or humidity beyond the ranges noted in the Specifications section
- Condensation as the result of severe changes in temperature
- Corrosive or flammable gases
- Dust (especially iron dust) or salts
- Water, oil, or chemicals
- Shock or vibration beyond range in specifications

## Mount

Remember the following when mounting the module.

- Use DIN rail that is 35 mm (1.38 in.) wide for placing the module in the control panel.
- Mount the module to DIN rails with endcap attachments, so that vibration will not cause it to fall.
- Leave at least 50 mm (1.97 in.) above and below the module to allow adequate ventilation and room for wiring.

## Wire

Remember the following when wiring the module.

- Do not share communication lines and input/output lines with high voltage lines.
- Wire correctly after confirming the signal names of all terminals.
- Do not remove the label from a unit before wiring. Always remove label after completing wiring to ensure proper heat dispersion.
- Stranded wire should be processed with insulation-covered bar terminal (DIN 46228-4 standard compatible type) at its ends before using for connection.
- Mount screw for communication and I/O connectors correctly at 0.25 to 0.3 Nm (2.21 to 2.65 lb-in).

## Follow Precautions for Safe Use

The following are precautions for safe use of the 1791DS module.

- Use the module within an enclosure with IP54 protection or higher of EN 60529.
- Wire conductors correctly and verify operation of the module before commissioning system in which the module is incorporated. Note that incorrect wiring may lead to loss of safety function.
- Do not apply DC voltages exceeding rated voltages to the module.
- Use DC supply satisfying the following requirements to prevent electric shock.
  - DC power supply with double or reinforced insulation, for example, according to IEC/EN60950 or EN50178 or a transformer according to IEC/EN61558
  - 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.
- Do not use test outputs as any safety output, noting that test outputs are note safety outputs.

# Installation Instructions

- Do not dismantle, repair, or modify the module. This may lead to loss of its safety function.
- Use only appropriate components or devices complying with relevant safety standards corresponding to the required level of safety categories (safety integrity level). Conformity to requirements of safety category (safety integrity level) is determined as an entire system. We recommend you consult a certification body regarding assessment of conformity to required safety level.
- Disconnect the module from the power supply when wiring.
- Be cautious not to get fingers caught when attaching terminal sockets to the plugs on the module.
- Qualified personnel should confirm installation and conduct test operations and maintenance after installation of the module.
- Personnel familiar with machinery where the module is to be installed should conduct and verify installation.
- The customer is responsible for compliance with applicable standards for the entire system.

**ATTENTION** Safety state of the module is defined as the off status of safety output and off status of network output. Use the module only in applications where the safe status of the module produces the safe status.

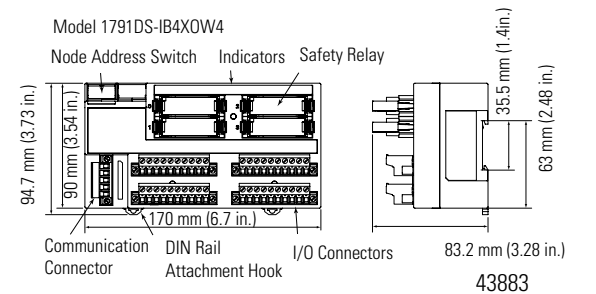
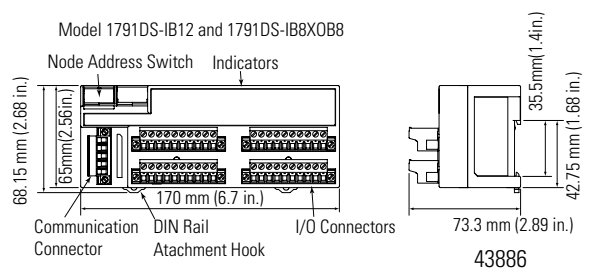


- Do not connect loads beyond the rated value of the safety outputs. Serious injury can occur due to breakdown of safety outputs.
- Wire the module properly so that supply voltages or voltages for loads do not touch the safety outputs accidentally or unintentionally. Serious injury can occur due to loss of required safety functions.
- Connect a load across the output terminal and the 0V line (PNP output).
- For the 1791DS-IB4XOW4 module, 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. Confirm fuse selection with the fuse manufacturer, dependant on the connected load characteristics.
- Use appropriate devices referring to the following Controlling Devices Requirements Table. Serious injury can occur due to loss of safety functions.

## Controlling Devices Requirements Table

Device	Requirement
Emergency stop switch	Use approved devices with direct opening mechanism complying with IEC/EN 60947-5-1.
Door interlocking switch limit switch	Use approved devices with direct opening mechanism complying with IEC/EN 60947-5-1 and capable of switching microloads of 24V dc 5mA.
Safety sensor	Use approved devices complying with the relevant product standards, regulations and rules in the country where used.
Relay with forcibly guided contacts	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 5mA.
Other devices	Evaluate whether devices used are appropriate to satisfy requirements of safety category levels.

## Functions and Dimensions

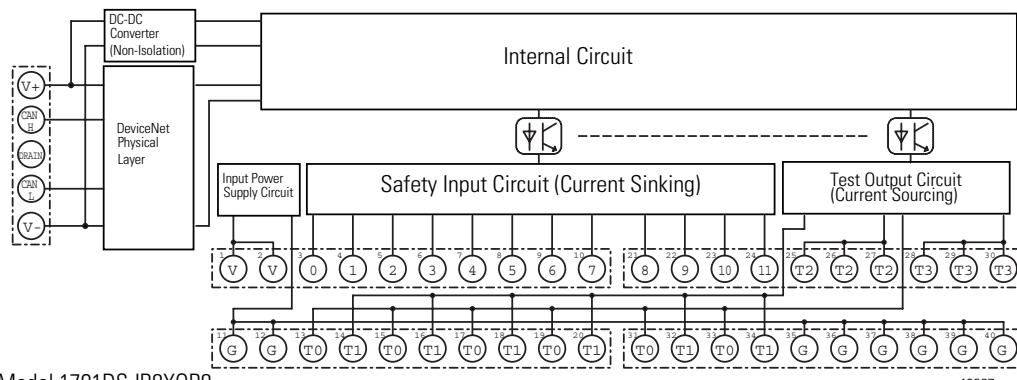


## Certifications and Compliances

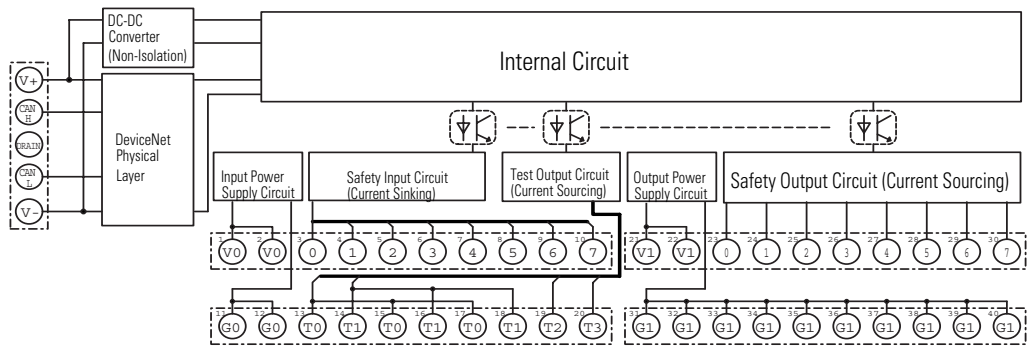
Attribute	Value	
Certifications (when product is marked) <sup>1</sup>	c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada (all models)
	c-UL-us	UL Listed for Class I, Division 2, Groups A,B,C,D Hazardous Locations, certified for US and Canada (IB12 and IB8XOB8)
CE	European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions EN 61131-2; Programmable Controllers (Clause B, Zone A & B) European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers (Clause 11) (IB4XOW4)	
C-Tick	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions	
ODVA	ODVA tested to DeviceNet specifications	
TUV	Functional Safety, Compliant with IEC 61508 (SIL3) and EN 954-1 (Category 4)	
UL	UL Certified for Functional Safety	

<sup>1</sup> See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

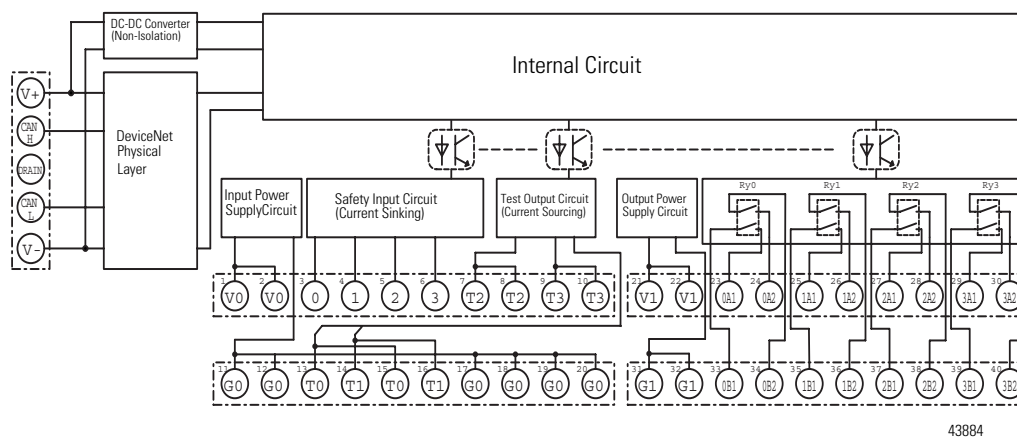
Model 1791DS-IB12



Model 1791DS-IB8XOB8



Model 1791DS-IB4XOW4



### Terminal Positions

Function for Model 1791DS-IB8XOB8

1,2	V0	Power terminal for external input devices Wire Plus side (24V)
11, 12	G0	Power terminal for external input devices Wire Minus side (0V)
3...10	0...7	Terminal for safety input
13...20	T0...T3	Terminal for test output
21,22	V1	Power terminal for external output devices Wire Plus side (24V)
31,32	G1	Power terminal for external output devices Wire Minus side (0V)
23...30	0...7	Terminal for safety output
33...40	G1	Common terminal for external devices Terminal No. 31...40 are connected internally

Function for Model 1791DS-IB4XOW4

1,2	V0	Power terminal for external input devices and internal relay feedback monitor. Wire Plus side (24V)
11, 12	G0	Power terminal for external input devices and internal relay feedback monitor. Wire Minus side (0V)
17...20	G0	Common terminal for external devices Terminal No. 11, 12 and 17...20 are connected internally
3...6	0...3	Terminal for safety input
7...10, 13...16	T0...T3	Terminal for test output
21, 22	V1	Power terminal for internal relay drive Wire Plus side (24V)
31,32	G1	Power terminal for internal relay drive Wire Minus side (0V)
23...30 33...40	0A1...3A2 0B1...3B2	Terminal for safety output

Function for Model 1791DS-IB12

1,2	V	Power terminal for external input devices Wire Plus side (24V)
11, 12	G	Power terminal for external input devices Wire Minus side (0V)
35...40	G	Common terminal for external devices Terminal 11,12 and 35...40 are connected internally
3...10, 21...24	0...11	Terminal for safety input
13...20, 25...30, 31...34	T0...T3	Terminal for test output

### LED Indicators

LED	Status	Indicates
MS	Green	Lit: Device operational
		Flashing: Waiting for safety connection
	Red	Lit: Unrecoverable fault
		Flashing: Minor fault
	Green/Red	Flashing: Device self testing or configuring
	-	Not lit: No power
NS	Green	Lit: Online/connected
		Flashing: Online/not connected
	Red	Lit: Critical link failure
		Flashing: Connection timed out
	-	Not lit: Not powered/not online
LOCK	Yellow	Lit: Normal configuration data, locked status
		Flashing: Normal configuration data, but not locked status
	-	Not lit: Configuration has not been performed
IN PWR OUTPWR	Green	Lit: Power supply is on
	-	Not lit: No power
IN 0... n *1	Yellow	Lit: Safety input on
		Not lit: Safety input off
	Red	Lit: An error occurs in an input circuit part
OUT 0... n *1	Yellow	Lit: Safety output on
		Not lit: Safety output off
	Red	Lit: An error occurs in an output circuit part
	Flashing: When dual channel is set, an error occurs in the redundant channel	

\*1: n indicates a terminal's number.

### Specifications

#### I/O Connectors

Attribute	Value
Wire type	Copper Use the following to wire 1791DS. <ul style="list-style-type: none"> <li>0.2...2.5 mm<sup>2</sup> (AWG 24...12) Solid wire</li> <li>0.34...1.5 mm<sup>2</sup> (AWG 22...16) Standard (flexible) wire with insulation-covered bar terminal</li> </ul>

### Environmental Specifications

Attribute	Value
Communications power supply voltage	11...25V dc (supplied from communications power supply)
Communications current consumption	110 mA at 24V dc
I/O power supply voltage	20.4...26.4V dc (24V dc, -15...+10%)
Operational temperature	-10...55 °C (14...131 °F)
Storage temperature	-40...70 °C (-40...158 °F)
Relative humidity	10...95% non-condensing (1791DS-IB12, -IB8XOB8) 10...85% non-condensing (1791DS-IB4XOW4)
Vibration	0.35 mm (0.01 in.) at 10...57 Hz 5 g at 57...150 Hz
Operating shock	15 g (1791DS-IB12, 1791-IB8XOB8) 10 g (1791DS-IB4XOW4)
Operating environment	No corrosive gases
Overvoltage category	II (per IEC 61131-2:4.4.2)
Weight	420 g (0.93 lb) - 1791DS-IB12, 1791-IB8XOB8 600 g (1.32 lb) - 1791DS-IB4XOW4
Enclosure Type Rating	None (open-style)
Wiring Category <sup>1</sup>	2 - on signal ports 2 - on power ports 2 - on communications ports

<sup>1</sup> Use this Conductor Category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

### Safety Input Specifications

Attribute	Value
Inputs type	Current sinking
ON voltage	11V dc min
OFF voltage	5V dc max
OFF current	1 mA max
Input current	6 mA

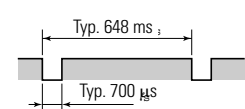
### Test Output Specifications

Attribute	Value
Output type	Current sourcing
Rated output current	0.7 A
Residual voltage	1.2V max
Leakage current	0.1 mA max

### Safety Output Specifications

Attribute	Value
Output type	Current sourcing
Rated output current	0.5 A
Residual voltage	1.2V max
Leakage current	0.1 mA max

Signal Sequence



While safety outputs are in an on state, the signal sequence shown in the figure is output continuously for fault diagnosis. Confirm response time of device connected to safety outputs so the device does not malfunction due to this off pulse.

### Safety Output (Relay) Specifications

Attribute	Value
Relay type	G7SA-2A2B EN50205 Class A
Minimum permissible load	5V dc, 1mA
Resistive load	240V ac 2A 30V dc 2A
Inductive load	240V ac 2A (cos $\Phi$ = 0.3) 24V dc 1A
Durability (mechanical)	5,000,000 operations min (at approximately 7,200 operations/hr)
Durability (electrical)	100,000 operations min (at approximately 1,800 operations/hr)

### Reaction Time

Attribute	Value
Max input reaction time	16.2 ms + set values of on/off delays
Max output reaction time	6.2 ms + (20 ms) relay response time, 1791DS-IB4XOW4 only

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