



Installation Instructions

CompactBlock I/O for DeviceNet Modules Series D

(Cat. No. 1791D-16B0, -16V0, -0V16P, -0B16P, -16B0X, -16V0X, -0B16PX, -0V16PX, -8B8P, -4B0, -4B4P, -0B8P, -8V8P)

1791D CompactBlock™ I/O modules are stand-alone 24V dc Block I/O products that communicate via a DeviceNet™ link. Each DeviceNet node consists of either one base module or one base module coupled with one expansion module.

NOTE: The 1791D-4B0 module cannot be expanded.

CompactBlock I/O modules must be installed in a secondary enclosure. Base modules are equipped with 4 to 16 points and expansion modules are equipped with 16 I/O points.

Sinking or sourcing inputs are 24V dc IEC Type 3 compatible. Sinking or sourcing self-protected 24V dc outputs can provide up to 0.5 amp each.

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards. In no event will Rockwell Automation be responsible or liable for indirect or consequential damage resulting from the use or application of these products.

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Any illustrations, charts, sample programs, and layout examples shown in this publication are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control* (available from your local Rockwell Automation office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this publication, notes may be used to make you aware of safety considerations. The following annotations and their accompanying statements help you to identify a potential hazard, avoid a potential hazard, and recognize the consequences of a potential hazard:

WARNING

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

ATTENTION

Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

IMPORTANT

Identifies information that is critical for successful application and understanding of the product.

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 meters 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.

ATTENTION

This equipment is supplied as "enclosed" equipment. It should not require additional system enclosure when used in locations consistent with the enclosure type ratings stated in the Specifications section of this publication. Subsequent sections of this publication may contain additional information regarding specific enclosure type ratings, beyond what this product provides, 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 Allen-Bradley publication 1770-4.1 ("Industrial Automation Wiring and Grounding Guidelines"), for additional installation requirements pertaining to this equipment.

Installing CompactBlock I/O

Follow these steps, to install the 1791D I/O module:

1. Set the Node Address on the Base Module.
2. Mount the Block(s).
3. Connect the Input/Output Wires to the Block.
4. Connect the DeviceNet Cable.
5. Remove the terminal block.
6. Insert the terminal block.
7. Communicate with the 1791D Module.

These steps are explained in detail in the following procedures.

Preventing 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:



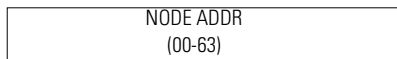
- Touch a grounded object to discharge potential static.
 - Wear an approved grounding wriststrap.
 - Do not touch connectors or pins on component boards.
 - Do not touch circuit components inside the equipment.
 - If available, use a static-safe workstation.
 - When not in use, store the equipment in appropriate static-safe packaging.
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Set the Node Address on the Base Module

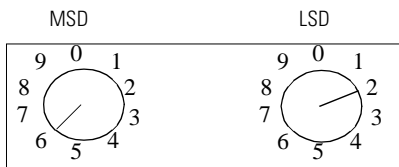
Each 1791D base module comes with its internal program set for node address 63. To reset the node address, adjust the switches located behind the door on top of the module. The two switches are most significant digit (MSD) and least significant digit (LSD).

The switches can be set between 00 and 63. Use the node adjusting tool provided in the package, or a small bladed screwdriver to rotate the switches.

The rotary switches are read at module power up only. Switch settings between 64 and 99 cause the module to use the last valid node address stored internally.



Example: Node Address
is set at 62



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The node address may also be set through RSNetWorx for DeviceNet™, DeviceNetManager™ or a similar configuration tool. When software configuration is used for the node address, the switches must be set between 64 and 99.

Mount the Block(s)

The base and expansion modules mount to a panel or DIN rail, which must be grounded before installing the module(s).

Base Module Mounting

You can install the Compact**Block** base module on a panel or DIN rail.

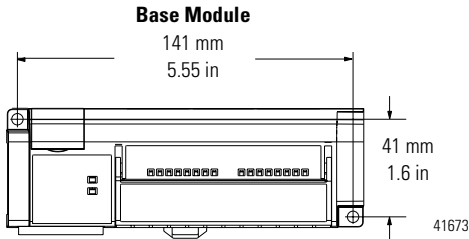
WARNING



When used in a Class I, Division 2, hazardous location, this equipment must be mounted in a suitable enclosure with proper wiring method that complies with the governing electrical codes.

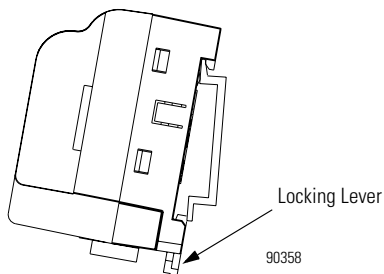
Panel Mounting

1. Place the module against the panel where you want to mount it.
2. Drill holes in the panel that are aligned with mounting holes on the module.
3. Place screws through each of the 2 mounting holes and tighten the screws until the module is firmly in place.



DIN Rail Mounting

1. Hook top of slot over the DIN Rail.
2. Pull down on the locking lever while pressing the block against the rail.



3. Push up on the locking lever to secure the block to the rail when block is flush against the rail.

Connecting an Expansion Module to a Base Module

ATTENTION



Expansion blocks should not be installed when power is applied to the base.

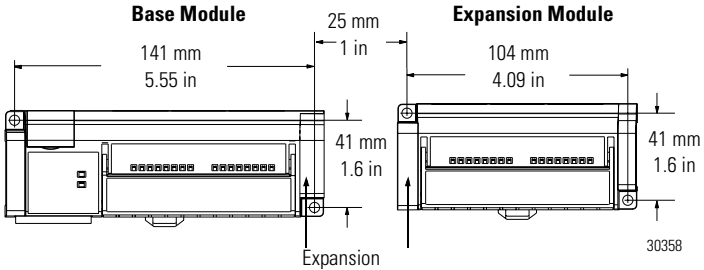
IMPORTANT

Make sure you carefully read the section “Communicate With the 1791D Module” on page 15 to change produce and consume data sizes.

NOTE: 1791D-4B0 cannot be connected to expansion modules.

1. Remove the expansion covers from both the base and expansion modules.

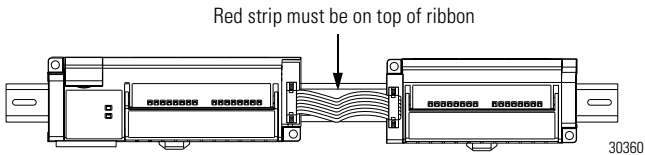
2. Position the expansion block with the proper spacing. See the illustration below.



3. Mount expansion module using panel or DIN rail mounting, as described in the previous section.
4. Plug the expansion cable into both the base and expansion modules.

IMPORTANT

The expansion cable can only be connected to the modules such that the red stripe on the cable is on top as shown below.



5. Replace the expansion covers on both modules.

Connect the Input/Output Wires to the Block

Two sets of VDC+ and GND power pins are located on each terminal (one for each bank of 8 points) except on the 1791D-4B0, -4B4P, and -0B8P modules. The following figures show the wiring information for both sinking and sourcing wiring. Refer to the following table for the proper cable to use for your application.

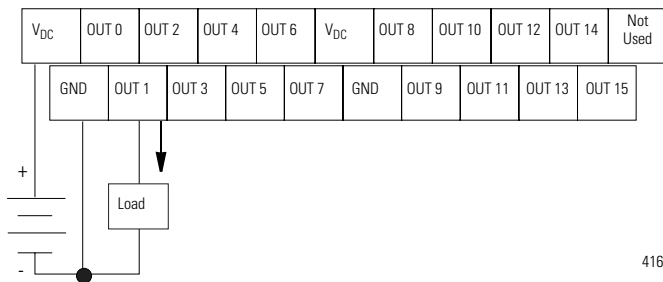
WARNING



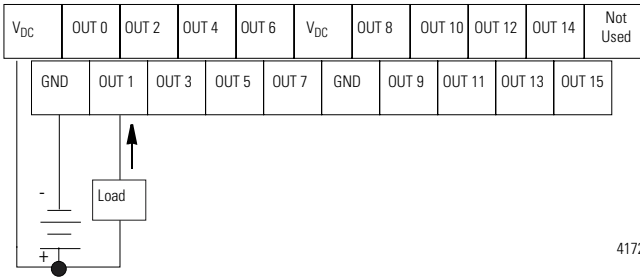
Use supply wires suitable for 30°C above surrounding ambient.

Use	Cable type
Input and output wiring	Up to 14AWG (2mm ²) stranded (Cu) with 3/64 inch insulation

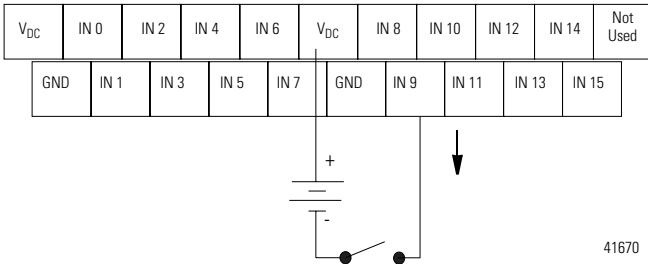
Output Wiring Diagram for 1791D-0B16P and 1791D-0B16PX Modules



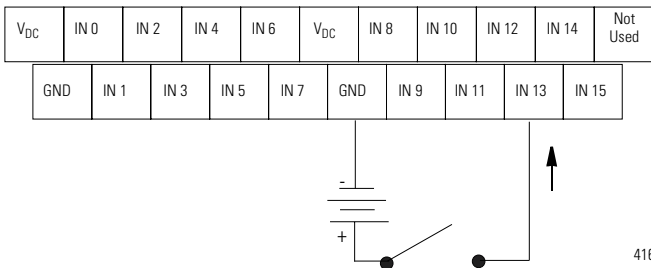
Output Wiring Diagram for 1791D-0V16P and 1791D-0V16PX Modules

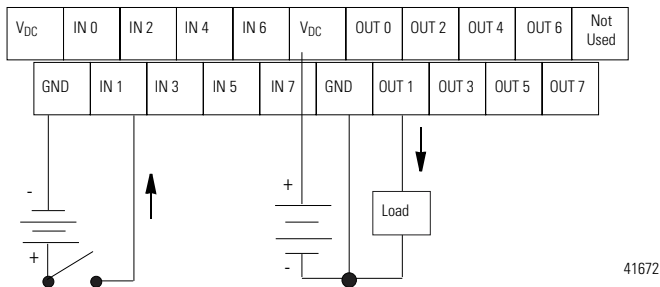
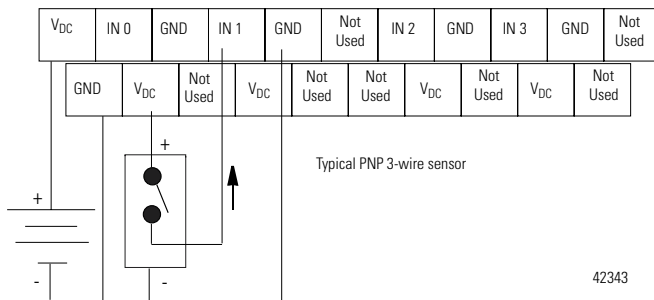
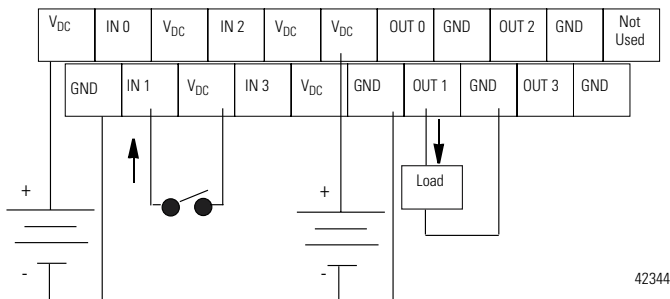


Input Wiring Diagram for 1791D-16V0 and 1791D-16V0X Modules

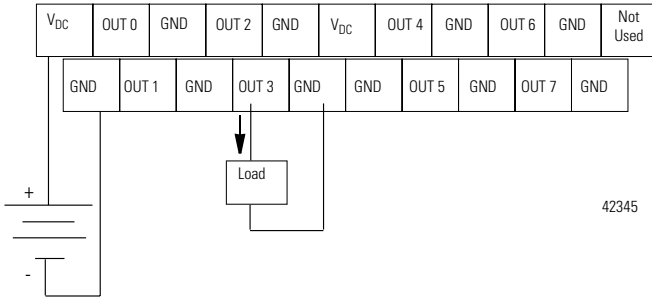


Input Wiring Diagram for 1791D-16B0 and 1791D-16B0X Modules

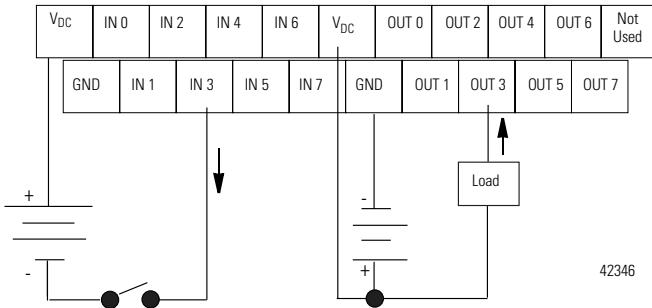


Wiring Diagram for the 1791D-8B8P Module**Wiring Diagram for the 1791D-4B0 Module****Wiring Diagram for the 1791D-4B4P Module**

Wiring Diagram for the 1791D-0B8P Module



Wiring Diagram for the 1791D-8V8P Module



Connect the DeviceNet Cable

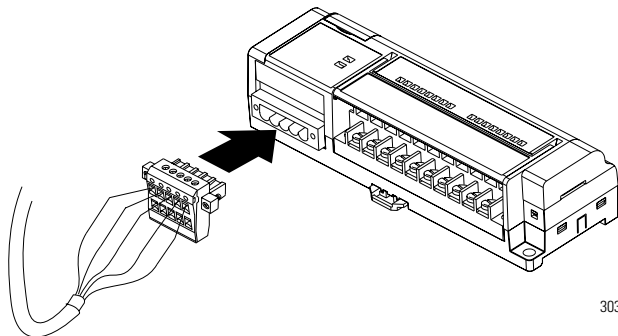
Refer to the following information when connecting the DeviceNet wire to the 1791D block I/O.

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.

1. Connect the DeviceNet cable (drop line) to the unsealed DeviceNet terminal connector as shown below.



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2. Connect the terminal connector to the Block. Use the side screws on the terminal connector to fasten it to the Block.

IMPORTANT

DeviceNet cable connections must match the color bars on the blocks. Refer to the table below.

Pin Number:	Wire Color:	Abbreviation:	Description:
1	black	V-	power return
2	blue	CAN_L	data line (CAN Low)
3	clear	shield	between cable jacket and wire
4	white	CAN_H	data line (CAN High)
5	red	V+	positive voltage (hot)

Remove the Terminal Block

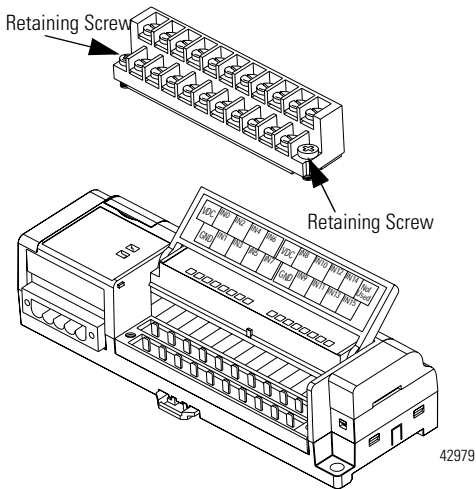
Follow the directions below to remove the CompactBlock terminal block.

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.

1. Unscrew the two retaining screws on the side of the terminal block.
2. Lift the terminal block out of the base.



Insert the Terminal Block

To insert the CompactBlock terminal block.

1. Insert the terminal block by aligning it and pushing it back until it rests against the back of the module.
2. Tighten the screws on each side of the terminal block until the terminal block is firmly in place.

Communicate With the 1791D Module

Determine the Baud Rate for Your DeviceNet Connection

All 1791D CompactBlock I/O for DeviceNet modules contain the autobaud feature. Autobaud lets the modules automatically detect the baud rate for the network upon connection to the live network.

The 1791D base modules' I/O is exchanged with the master through a polled, cyclic or change of state connection.

Polled - master initiates communication by sending its polled I/O message to the 1791D module. The module consumes the message, updates any outputs, and produces a response. If inputs are present, the response contains the input data.

Cyclic - allows configuration of the block as an I/O client. The block will produce and consume its I/O cyclically at the rate configured.

Change of state - production occurs when an input changes. If no input change occurs within the expected packet time, a heartbeat production occurs. This heartbeat production tells the scanner module that the 1791D I/O module is alive and ready to communicate. Consumption occurs when data changes and the master produces new output data to the I/O block.

The module produces 1 byte for every 8 inputs. Similarly, the module consumes 1 byte for every 8 outputs. When an expansion module is connected, an additional byte will be returned indicating the health of the expansion module.

IMPORTANT

When installing an expansion module, refer to the table below to see how many bytes are produced and consumed by the modules.

Remember, though, when configuring your Compact**Block** I/O application, these values are entered as bytes received (R_x) and bytes transmitted (T_x) by the scanner.

For example, a Base input module produces 2 bytes and consumes 0 bytes. In such a case, the scanner connected to the Base Input module will receive (R_x) 2 bytes and transmit (T_x) 0 bytes.

Word/Bit Definitions

The following table lists the combination of input and output modules and the input and output bytes produced and consumed.

Digital Expander				
Base	Expansion	I/O Points	Produced (input bytes)	Consumed (output bytes)
16 input		16 in	2	0
16 output		16 out	0	2
8 in / 8 out		8 in / 8 out	1	1
4 in		4 in	1	0
4 in / 4 out		4 in / 4 out	1	1
8 out		8 out	0	1
16 input	16 input	32 input	5	0
16 input	16 output	16 in / 16 out	3	2
16 output	16 input	16 in / 16 out	3	2

Digital Expander				
Base	Expansion	I/O Points	Produced (input bytes)	Consumed (output bytes)
16 output	16 output	32 out	1	4
8 in / 8 out	16 input	24 in / 8 out	4	1
Digital Expander				
Base	Expansion	I/O Points	Produced (input bytes)	Consumed (output bytes)
8 in / 8 out	16 output	8 in / 24 out	2	3
4 in / 4 out	16 input	20 in / 4 out	3	1
4 in / 4 out	16 output	4 in / 20 out	1	3
8 out	16 input	16 in / 8 out	3	1
8 out	16 output	24 out	1	3
Analog Expander				
Base	Expansion	I/O Points	Produced (input bytes)	Consumed (output bytes)
16 input	analog	16 input digital 4 in / 2 out analog	14	4
16 output	analog	16 output digital 4 in / 2 out analog	12	6
8 in / 8 out	analog	8 in / 8 out digital 4 in / 2 out analog	12	6
4 in / 4 out	analog	4 in / 4 out digital 4 in / 2 out analog	12	6

The table below is an example of the word/bit definitions for an 8 in/8 out combination module.

Bit	07	06	05	04	03	02	01	00
Produces	I7	I6	I5	I4	I3	I2	I1	I0
Consumes	O7	O6	O5	O4	O3	O2	O1	O0

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The table below is an example of the word/bit definitions for an 8 in/8 out combination module that uses a 16 input expansion module.

Bit	07	06	05	04	03	02	01	00
Produces 0	I7	I6	I5	I4	I3	I2	I1	I0
Produces 1	I15	I14	I13	I12	I11	I10	I9	I8
Produces 2	I23	I22	I21	I20	I19	I18	I17	I16
Produces 3	ES	Reserved						
Consumes 0	O7	O6	O5	O4	O3	O2	O1	O0

ES = Expansion Status

The table below describes input and output bits used in both of the example tables above.

Byte	Bit	Description
Produces 0-2	00-07	Input Status bits - when the bit is set (1), the input is on. Bit 00 corresponds to input I0, bit 01 corresponds to input I1, bit 02 corresponds to input I2, and so forth.
Produces 3	07	If Expansion Status (ES) bit is set, the expansion module is not functioning properly or missing.
Consumes 0	00-07	Output bits - when the bit is set (1), the output will be turned on. Bit 00 corresponds to output O0, bit 01 corresponds to output O1, bit 02 to output O2, and so forth.

The DeviceNet Network uses advanced network technology, producer/consumer communication, to increase network functionality and throughput. Visit our web site at <http://www.ab.com/networks> for producer/consumer technology information and updates.

Troubleshoot with the Indicators

The 1791D I/O module has the following indicators:

- Mod/Net status indicator - base only
- Logic status indicator - base only
- I/O status indicators - base and expansion

Mod/Net Status Indicator

Indication:	Status:
Off	No power or auto bauding
Flashing Green/Off	On line but not connected
Solid Green	On line, link OK, connected
Flashing Red	Recoverable fault - (expansion module fault or module configuration error)
	I/O connection fault - one or more I/O connections in the timed-out state

Mod/Net Status Indicator (continued)

Indication:	Status:
Solid Red	Unrecoverable fault
	Communication failure - duplicate node address present or incorrect baud rate
Green to Red to Off	At powerup only - LED test

Logic Status Indicator

Indication:	Status:
Off	Logic is disabled
Solid Green	Logic is enabled
Flashing Green	Local forces are applied and local logic is enabled

I/O Status Indicators			
Function:	LED Color:	Module Illumination:	Condition:
Outputs	Each output: Yellow	None Yellow	Output not energized Output energized
Inputs	Each Input: Yellow	None Yellow	No valid input Valid input

Specifications

Sinking or Sourcing Input Specifications	
Inputs per block	groups of 4 or 8
Off-state Voltage	5V dc maximum
On-state Voltage	30V dc @ 40°C maximum 25V dc @ 60°C maximum 10V dc minimum
Off-state Current	1.5mA minimum
On-state Current	11mA @ 30V dc maximum 2mA @ 10V dc minimum
Outputs per block	groups of 4 or 8
On-state Voltage Range	10 - 30V dc
On-state Voltage Drop	0.5V dc @ rated current
On-state Current	0.5A maximum
Off-state Leakage	1.0mA maximum
Module Current (per output)	0.5A maximum
Surge Current - for 10 mS repeatable every 2 S	1.0A maximum
Indicators	Mod/Net status - red/green Logic status - red/green I/O status - yellow

General Specifications

Communication Rate Thick Cable	125Kbps @ 500m (1600ft) 250Kbps @ 200m (600ft) 500Kbps @ 100m (330ft)
Flat Media	125Kbps @ 420m (1230ft) 250Kbps @ 200m (490ft) 500Kbps @ 75m (245ft)
Isolation Auxiliary I/O power to DeviceNet I/O group-to-group I/O group-to-DeviceNet	500V ac/60s 500V ac/60s 500V ac/60s
DeviceNet Power Voltage Current	11 - 25V dc 200mA maximum (with expansion) (for the 1791D-4B0, 150mA)
Expansion Power Voltage Current	5V dc 100mA
Auxiliary Power Inputs Voltage Current	10-30V dc 88mA each group of 8
Auxiliary Power Outputs Voltage Current	10-30V dc 4A each group of 8
Base Module Dimensions	150mm X 50mm X 38mm 5.91in X 1.97in X 1.5in
Expansion Module Dimensions	115mm X 50mm X 38mm 4.4in X 1.97in X 1.5in
Field Wiring Tightening Torque	5-7lb-in. (0.5-0.6 Nm)
Operating Temperature	IEC 60068-2-1 (Test Ad, Operating Cold), IEC 60068-2-2 (Test Bd, Operating Dry Heat), IEC 60068-2-14 (Test Nb, Operating Thermal Shock): 0 to 60°C (32 to 140°F)
Storage Temperature	IEC 60068-2-1 (Test Ab, Un-packaged Non-operating Cold), IEC 60068-2-2 (Test Bb, Un-packaged Non-operating Dry Heat), IEC 60068-2-14 (Test Na, Un-packaged Non-operating Thermal Shock): -40 to 85°C (-40 to 185°F)

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General Specifications	
Relative Humidity	IEC 60068-2-30 (Test Db, Un-packaged Non-operating Damp Heat): 5-95% non-condensing
Shock	IEC60068-2-27 (Test Ea, Unpackaged shock): Operating 30g Non-operating 50g
Emissions	CISPR 11: Group 1, Class A
Vibration	IEC60068-2-6 (Test Fc, Operating): 5g @ 10-500Hz
Conductors Wire Size Category	14 gauge (2mm ²) stranded maximum 3/64 inch insulation maximum 2 ^{1, 2}
ESD Immunity	IEC 61000-4-2: 6kV contact discharges 8kV air discharges
Radiated RF Immunity	IEC 61000-4-3: 10V/m with 1kHz sine-wave 80%AM from 80MHz to 1000MHz 10V/m with 200Hz 50% Pulse 100%AM at 900Mhz
EFT/B Immunity	IEC 61000-4-4: ±2kV at 5kHz on signal ports ±2kV at 5kHz on communications ports
Surge Transient Immunity	IEC 61000-4-5: ±1kV line-line(DM) and ±2kV line-earth(CM) on signal ports ±2kV line-earth (CM) on shielded ports
Conducted RF Immunity	IEC 61000-4-6: 10Vrms with 1kHz sine-wave 80%AM from 150kHz to 80MHz

General Specifications (continued)



Certifications: (when product is marked)	UL	UL Listed Industrial Control Equipment
	UL	UL Listed for Class I, Division 2 Group A, B, C, D Hazardous Locations
	c-UL-us	UL Listed Industrial Control Equipment, certified for US and Canada
	c-UL-us	UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada
	CE ³	European Union 89/336/EEC EMC Directive, compliant with: EN 61000-6-4; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity
	C-Tick ³	Australian Radiocommunications Act, compliant with: AS/NZS CISPR 11; Industrial Emissions
	ODVA	ODVA conformance tested to DeviceNet specifications
Enclosure Type Rating	Meets IP20	

- 1 You use this conductor category information for planning conductor routing as described in the system level installation manual.
- 2 See publication 1770-4.1, "Programmable Controller Wiring and Grounding Guidelines."
- 3 See the Product Certification link at www.ab.com for Declarations of Conformity, Certificates, and other certification details.

IMPORTANT

Input and output wiring must be in accordance with Class I, Division 2 wiring methods and in accordance with the authority having jurisdiction.

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations:	Informations sur l'utilisation de cet équipement en environnements dangereux :		
<p>Products marked "CL I, 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.</p>	<p>Les produits marqués "CL I, 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.</p>		
<p>WARNING</p> 	<p>EXPLOSION HAZARD</p> <ul style="list-style-type: none"> Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. 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. Substitution of components may impair suitability for Class I, Division 2. If this product contains batteries, they must only be changed in an area known to be nonhazardous. 	<p>AVERTISSEMENT</p> 	<p>RISQUE D'EXPLOSION</p> <ul style="list-style-type: none"> Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. 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. La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. S'assurer que l'environnement est classé non dangereux avant de changer les piles.

This product has been tested at an Open DeviceNet Vendor Association, Inc. (ODVA) authorized independent test laboratory and found to comply with ODVA Conformance Test. Please contact the ODVA website (<http://www.odva.org>) for listing of products tested by ODVA independent test labs for further details.

Notes:

Compact**Block** and DeviceNetManager are trademarks of Rockwell Automation, Inc.
DeviceNet is a trademark of Open DeviceNet Vendor Association.
RSNetWorx for DeviceNet is a trademark of Rockwell Software, Inc.

Rockwell Automation Support

Rockwell Automation provides technical information on the web to assist you in using our products. At <http://support.rockwellautomation.com>, you can find technical manuals, a knowledge base of FAQs, technical and application notes, sample code and links to software service packs, and a MySupport feature that you can customize to make the best use of these tools.

For an additional level of technical phone support for installation, configuration and troubleshooting, we offer TechConnect Support programs. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://support.rockwellautomation.com>.

Installation Assistance

If you experience a problem with a hardware module within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your module up and running:

United States	1.440.646.3223 Monday – Friday, 8am – 5pm EST
Outside United States	Please contact your local Rockwell Automation representative for any technical support issues.

New Product Satisfaction Return

Rockwell tests all of our products to ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned:

United States	Contact your distributor. You must provide a Customer Support case number (see phone number above to obtain one) to your distributor in order to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for return procedure.

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

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