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CompactBlock I/O CompactBlock LDX I/O

SELECTION GUIDE



1790 SERIES
1791 SERIES



	Preface	
	About This Selection Guide	5
	Additional Resources	5
	Chapter 1	
IP 20 Block I/O Overview	Introduction	7
	General Features	8
	Space-efficient	8
	Cost-effective	8
	Meets Industrial Standards	8
	Allows Flexibility in I/O Selection	8
	Easy to Install and Configure	8
	Offers Built-in Network Connectivity	9
	Supports Localized Control (CompactBlock I/O system only)	9
	Easy to Maintain	9
	Product-specific Features	11
	CompactBlock LDX I/O System (1790D/1790P)	11
	CompactBlock I/O System (1791D/1791P/1791R)	12
	Feature Comparison	13
	Product Specifications for CompactBlock LDX I/O	14
	Product Specifications for CompactBlock I/O Modules	18
	Chapter 2	
Specify a 1790 CompactBlock LDX I/O System	What This Chapter Contains	23
	Step 1: Select a Communication Network	24
	CompactBlock LDX I/O on the DeviceNet Network	24
	CompactBlock LDX I/O on the PROFIBUS DP Network	25
	Step 2: Select Base and Expansion Modules	26
	Possible Configurations for CompactBlock LDX I/O on the DeviceNet Network	26
	Possible Configurations for CompactBlock LDX I/O on the PROFIBUS DP Network	27
	Termination Type	27
	CompactBlock LDX I/O Base and Expansion Modules	29
	Step 3: Select Optional Accessories	30
	Chapter 3	
Specify a CompactBlock I/O System	What This Chapter Contains	31
	Step 1: Select a Communication Network	32
	CompactBlock I/O Modules on the DeviceNet Network	32
	CompactBlock I/O Modules on the PROFIBUS DP Network	36
	CompactBlock I/O Modules on Remote I/O	37
	Step 2: Select Base and Expansion Modules	38
	Possible Configurations for CompactBlock I/O Modules on DeviceNet, PROFIBUS DP, and Remote I/O Networks	38
	Termination Type	38
	CompactBlock I/O Base and Expansion Modules	39
	Step 3: Select Optional Accessories	40

Network Specifications

Chapter 4

What This Chapter Contains 41

DeviceNet Network. 41

 DeviceNet Communication. 41

 Software and EDS File Requirements 42

 Power Supply Requirements 42

PROFIBUS DP Network. 43

 PROFIBUS DP Communication 43

 System Configuration and Device Types. 44

 Operating Modes and System Status. 45

 Cyclic Data Transmission 46

 Configuration and GSD File Requirements 47

 Base Module to Expansion Interface. 47

 Power the Module. 47

Remote I/O

(1791 CompactBlock I/O only) 48

 Remote I/O Module Communication 48

 Power Supply Requirements 50

 Base Module to Expansion Interface. 50

 Power the Module. 50

About This Selection Guide

This publication aims to guide you through the selection process of Rockwell Automation in-cabinet block I/O products, namely CompactBlock LDX I/O and CompactBlock I/O, for your control applications.

Additional Resources

The publications listed in this table contain more information on CompactBlock LDX I/O modules.

Related Publications for CompactBlock LDX I/O Modules

Pub. Title	Pub. Number
1790 CompactBlock LDX I/O Product Profile	<u>1790-PP002</u>
CompactBlock LDX Analog Modules User Manual	<u>1790-UM001</u>
CompactBlock LDX I/O for DeviceNet Technical Data	<u>1790D-TD001</u>
CompactBlock LDX I/O for PROFIBUS DP Technical Data	<u>1790P-TD001</u>
CompactBlock LDX RTD/Resistance Input Module User Manual	<u>1790-UM002</u>
CompactBlock LDX I/O Thermocouple Modules User Manual	<u>1790-UM003</u>
DeviceNet Analog Base D-Shell CompactBlock LDX I/O Installation Instructions	<u>1790-IN004</u>
DeviceNet Analog Base Terminal Block CompactBlock LDX I/O Installation Instructions	<u>1790-IN002</u>
DeviceNet Digital Base D-Shell Block CompactBlock LDX I/O Installation Instructions	<u>1790-IN007</u>
DeviceNet Digital Base D-shell Block CompactBlock LDX I/O Series B Installation Instructions	<u>1790-IN013</u>
DeviceNet Digital Base Terminal Block CompactBlock LDX I/O Series A Installation Instructions	<u>1790-IN006</u>
DeviceNet Digital Base Terminal Block CompactBlock LDX I/O Series B Installation Instructions	<u>1790-IN012</u>
Digital Expansion Terminal Block CompactBlock LDX I/O Installation Instructions	<u>1790-IN005</u>
Profibus DP Digital Base Terminal Block CompactBlock LDX I/O Installation Instructions	<u>1790-IN009</u>

The publications listed in this table contain more information on CompactBlock I/O modules.

Related Publications for CompactBlock I/O Modules

Pub. Title	Pub. Number
1791D CompactBlock I/O Product Profile	1791D-PP002
CompactBlock I/O for DeviceNet Technical Data	1791D-TD001
CompactBlock I/O for Profibus DP Technical Data	1791P-TD001
CompactBlock I/O on Remote I/O Technical Data	1791R-TD001
CompactBlock Distributed I/O on PROFIBUS DP Series D Installation Instructions	1791P-IN002
CompactBlock Distributed I/O on Remote I/O Series D Installation Instructions	1791R-IN002
CompactBlock I/O Analog Combination Input/Output Expansion Module Installation Instructions	1791D-IN002
CompactBlock I/O for DeviceNet Modules Series D Installation Instructions	1791D-IN003
CompactBlock Distributed I/O on Remote I/O Installation Instructions	1791R-IN001

You can view or download publications at <http://literature.rockwellautomation.com>. To order paper copies of technical documentation, contact your local Rockwell Automation distributor or sales representative.

IP 20 Block I/O Overview


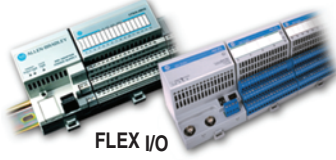



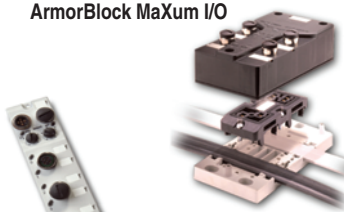

Introduction

Rockwell Automation offers a wide selection of distributed I/O products for use in your control system. Distributed I/O can be mounted in-cabinet (IP 20) requiring an enclosure for protection from the environment, or as an On-Machine configuration (IP 67) not requiring an additional enclosure.

Both in-cabinet and On-Machine distributed I/O types are offered in modular and block I/O styles. Modular I/O is a system of interface cards and communication adapters that interface directly with the sensors and actuators of the machine or process, and communicate their status to the controller via a communication network. It allows the system designer to mix and match I/O interfaces and communication adapters. Block I/O is a complete assembly of sensor and actuator interface points including a network adapter.

This publication will guide you in the selection of in-cabinet block I/O products, namely CompactBlock I/O and CompactBlock LDX I/O.

Distributed I/O Product Matrix

		In-Cabinet	On-Machine		
Modular		<p>POINT I/O</p>  <p>FLEX I/O</p> 	 <p>ArmorPoint I/O</p>		Modular
		<p>CompactBlock I/O</p>  <p>CompactBlock LDX I/O</p> 	<p>ArmorBlock MaXum I/O</p>  <p>ArmorBlock I/O</p> 		
		In-Cabinet	On-Machine		

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General Features

This section discusses the general features of Rockwell Automation products in the in-cabinet block I/O category.

Space-efficient

A small form factor allows the distributed I/O products to be mounted into shallow enclosures and confined areas, thus saving cabinet space.

Cost-effective

The in-cabinet block I/O platform is a cost-effective solution for automation applications that exist in less-rigorous IP 20 environments.

The compact size of the products reduces your need for large enclosures, and the fact that the I/O is distributed means that extensive wiring is greatly reduced. Having single bus cabling also helps to ease maintenance work.

Meets Industrial Standards

All modules are tested to meet the most stringent industrial requirements to withstand electromagnetic (EM) interference, vibration, and shock.

Allows Flexibility in I/O Selection

A wide variety of base and expansion combinations lets you eliminate unnecessary I/O points.

In addition, CompactBlock LDX I/O modules, including digital (24V dc, 120V ac, and relay), analog (current and voltage), and temperature (resistance temperature detector and thermocouple), are compatible with a variety of sensors.

Easy to Install and Configure

Modular electronic data sheet (EDS) or generic station description (GSD) files, rotary switches, and auto-baud rate detection provide easy commissioning.

Offers Built-in Network Connectivity

Built-in network adapters offer direct network connectivity. DeviceNet and PROFIBUS DP networks are supported on CompactBlock LDX I/O and CompactBlock I/O systems. In addition, remote I/O is supported on the CompactBlock I/O system.

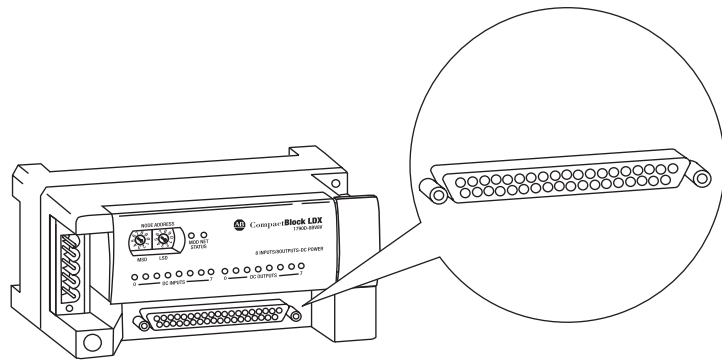
Supports Localized Control (CompactBlock I/O system only)

DeviceLogix smart-component technology on DeviceNet blocks enable localized, simple control functions for faster sense-to-actuation time.

Easy to Maintain

CompactBlock LDX I/O on the DeviceNet network has two termination types, namely D-shell connector and fixed-screw terminal block. The D-shell connector allows for simple, fast connections and easy maintainability.

D-shell Connector



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Product-specific Features

This section discusses the features specific to the CompactBlock LDX I/O and CompactBlock I/O systems.

CompactBlock LDX I/O System (1790D/1790P)

The CompactBlock LDX I/O system offers you a compact, cost-effective, and diverse distributed I/O solution for automation solutions. Offering 24V dc, 120V ac, relay, analog, and temperature modules, CompactBlock LDX I/O supports a wide breadth of field devices and is compatible on both DeviceNet and PROFIBUS DP networks.

CompactBlock LDX I/O is especially suitable where low cost and confined space are coupled with less-stringent IP 20 environmental requirements.

- CompactBlock LDX I/O has universal sink/source inputs that reduce the number of components to stock and allows flexibility of input types.
- The digital base modules support up to 3 digital expansion modules and up to 80 points of I/O for the DeviceNet network and 64 points of I/O for the PROFIBUS DP network.
- The analog base modules, both current and voltage, support two additional modules of up to 32 points of digital I/O. The resistance temperature detector (RTD) and thermocouple base modules do not support any expansion.
- CompactBlock LDX I/O is compatible with a broad range of sensors (Type 3 for dc, Type 1 for ac).
- The node address switches and auto-baud rate detection ease network commissioning.

CompactBlock LDX I/O offers the leading, lowest-cost, device-level communication network, the DeviceNet network, to translate simple messages from the controller to the plant floor.

- By using modular EDS files, it is easy to connect and configure CompactBlock LDX I/O.
- Cyclic and change-of-state messaging increase network throughput, thus helping to increase productivity.
- ODVA conformance improves the level of interoperability with other DeviceNet products.
- CompactBlock LDX I/O for the DeviceNet network works with any available DeviceNet scanner.

CompactBlock LDX I/O is also available on another network, PROFIBUS DP.

- Configure by using GSD files and any PROFIBUS DP configuration package.
- CompactBlock LDX I/O for the PROFIBUS DP network works with any available PROFIBUS DP scanner.

CompactBlock I/O System (1791D/1791P/1791R)

The CompactBlock I/O system provides you with an easy-to-use, compact, and cost-effective distributed I/O solution. Handling 24V dc and analog applications on three networks, it can be distributed throughout your plant for applications such as material handling, conveyors, packaging, or where space is limited.

CompactBlock I/O products provide higher performance and more benefits than other block I/O products.

- IEC/NEMA Type 3+ inputs offer the widest range of compatible sensors.
- 10...30V dc device power accommodates a broad range of applications.
- Digital base modules range from 4...16 points per module, with each module containing a built-in network adapter. Each digital expansion module contains 16 points.
- Analog expansion module provides 4 inputs and 2 outputs for either 0...20 mA, 4...20 mA, or 0...10V dc with each channel configurable by wiring.
- Address switches and auto baud ease network commissioning.
- Hardware Watchdog function secures state of I/O modules in case of a failure.
- Output short-circuit protection protects outputs in case of accidental miswiring.
- Having removable terminal blocks on all modules saves maintenance costs.

The CompactBlock I/O system offers the leading, lowest-cost, device-level communication network, the DeviceNet network, to translate simple messages from the controller to the plant floor, giving you better diagnostic capabilities.

- A single bus cable is used for reduced wiring costs.
- Retention screws prevent cable disconnection from challenging environments.

- Cyclic or change-of-state operation increases network bandwidth by sending I/O messages only when necessary.
- ODVA conformance improves the level of interoperability with other DeviceNet products.
- DeviceLogix smart component technology is included. This feature enables localized, simple control functions for faster sense-to-actuation times.

The CompactBlock I/O system for the DeviceNet network works with any available DeviceNet scanner.

CompactBlock I/O products are also available on remote I/O (RIO) and PROFIBUS DP networks.

- RIO block configuration is accomplished via DIP switches, and no software is needed.
- Configure by using GSD files and any PROFIBUS DP configuration package.
- All base modules are compatible with all expansion modules (except for the 1791D-4BO module which is not expandable).

Feature Comparison

This table provides a summarized comparison of the main features of CompactBlock LDX I/O products with those of CompactBlock I/O products.

Feature Comparison

Features	CompactBlock LDX I/O	CompactBlock I/O
Network	<ul style="list-style-type: none"> • DeviceNet • PROFIBUS 	<ul style="list-style-type: none"> • DeviceNet • PROFIBUS • Remote I/O
Base type	<ul style="list-style-type: none"> • 16-channel • 32-channel 	<ul style="list-style-type: none"> • 16-channel
Termination	<ul style="list-style-type: none"> • Fixed terminal block • Removable D-shell 	<ul style="list-style-type: none"> • Removable terminal block
Local control	—	DeviceLogix
I/O type	<ul style="list-style-type: none"> • Digital • Analog • Thermocouple • RTD 	<ul style="list-style-type: none"> • Digital • Analog
Expansion	Up to 3 expansion modules	Up to 1 expansion module

Product Specifications for CompactBlock LDX I/O

This table contains specifications that are common to all of the 1790 base and expansion modules. Individual module-connection sizes, word/bit definitions, schematics, wiring diagrams, and specifications can be found in their respective Technical Data publications as listed in Related Publications for CompactBlock LDX I/O Modules on page 5.

Environmental Specifications

Temperature, operating	0...55 °C (32...131 °F) 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)
Temperature, storage	-40...85 °C (-40...185 °F) IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)
Relative humidity	5...90% non-condensing IEC 60068-2-30 (Test Db, Unpackaged Nonoperating)
Operating altitude	2000m
Vibration	5g @ 10...500 Hz IEC60068-2-6 (Test Fc, Operating)
Shock, operating Shock, nonoperating	10g IEC60068-2-27 Test Ea, (Unpackaged Shock) 30g IEC60068-2-27 Test Ea, (Unpackaged Shock)
Emissions	Group 1, Class A CISPR 11
ESD immunity	8 kV air discharges IEC 61000-4-2
Radiated RF immunity	10V/m with 1 kHz sine-wave 80%AM from 80...1000 MHz 10V/m with 200Hz 50% Pulse 100%AM @ 900 MHz IEC 61000-4-3
EFT/B immunity	±1 kV @ 5 kHz on power ports ±2 kV @ 5 kHz on signal ports ±2 kV @ 5 kHz on communication ports IEC 61000-4-4
Surge transient immunity	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports ±2 kV line-earth (CM) on shielded ports IEC 61000-4-5
Conducted RF immunity	10V rms with 1 kHz sine-wave 80%AM from 150 kHz...80 MHz IEC 61000-4-6
Enclosure type rating	IP 20

Environmental Specifications (Continued)

Mounting	DIN rail or panel mount
Dimensions (HxWxD), approx.	16ch DeviceNet version: 52 x 104 x 42 mm (2.03 x 4.07 x 1.64 in.) 32ch DeviceNet version: 52 x 176 x 42 mm (2.03 x 6.93 x 1.64 in.) 16ch PROFIBUS version: 52 x 118.5 x 42 mm (2.03 x 4.62 x 1.64 in.)
Weight, approx.	16ch version: 0.1 kg (0.3 lb) 32ch version: 0.3 kg (0.9 lb)

DeviceNet Specifications for 1790D CompactBlock LDX I/O

Network protocol	I/O Slave messaging: - Poll command, Bit Strobe command, Cyclic command, COS command
Network length, thick cable	500 m (1600 ft) @ 125 Kbps 200 m (600 ft) @ 250 Kbps 100 m (330 ft) @ 500 Kbps
Network length, flat media	420 m (1230 ft) @ 125 Kbps 200 m (490 ft) @ 250 Kbps 75 m (245 ft) @ 500 Kbps
Communication rate	Auto-baud rate selection: 125, 250, 500 Kbps
Indicators	1 red/green module status, 1 red/green network status
Number of nodes	64 max - rotary-switch type node address setting

General Specifications for 1790D CompactBlock LDX I/O

Isolation voltage	50V dc (continuous), Reinforced Insulation Type Tested at 1250V dc for 60 s, I/O to system
Wire size	0.25...2.5 mm ² (22...14 AWG) solid or stranded copper wire rated at 75 °C or greater 1.2 mm (3/64 in.) insulation max
Wiring category ⁽¹⁾	2 - on signal ports 2 - on power ports 2 - on communication ports

General Specifications for 1790D CompactBlock LDX I/O (Continued)

Product certifications ⁽²⁾ (when product or packaging is marked)	c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. 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	European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD, compliant with: EN61131-2; Programmable Controllers
	C-Tick	Australian Radiocommunications Act, compliant with AS/NZS CISPR11; Industrial Emissions
	ODVA	Open DeviceNet Vendor Association (ODVA) conformance tested to DeviceNet specifications

⁽¹⁾ Use this wiring category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

⁽²⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

PROFIBUS DP Specifications for 1790P CompactBlock LDX I/O

Network protocol	PROFIBUS-DP (EN50170) <ul style="list-style-type: none"> • Communication of the slave with a Class 1 master • Communication of the slave with a Class 2 master
Implementation type	DPC31
Station type	Slave
Freeze mode	Supported
Sync mode	Supported
Auto baud rate	Supported
Fail safe mode	Supported ⁽¹⁾
FMS support	Not supported
Redundancy	Not supported
Repeater control signal	RS485 signal

PROFIBUS DP Specifications for 1790P CompactBlock LDX I/O (Continued)

Network length/ communication rate	1000 m (3280 ft) @ 9.6 kbps 1000 m (3280 ft) @ 19.2 kbps 1000 m (3280 ft) @ 45.45 kbps 1000 m (3280 ft) @ 93.75 kbps 1000 m (3280 ft) @ 187.5 kbps 400 m (1312 ft) @ 500 kbps 200 m (656 ft) @ 1.5 Mbps 100 m (328 ft) @ 3 Mbps 100 m (328 ft) @ 6 Mbps 100 m (328 ft) @ 12 Mbps
Indicators	1 red/green module status 1 red/green network status
Number of nodes	100 max - rotary-switch type node address setting (0-99)

⁽¹⁾ Dependant upon the scanner module being used. For example, the SST scanner (catalog number SST-PFB-SLC) does not fully support Fail Safe mode as it only resets outputs to 0. You cannot define behavior such as Hold Last State or Fault Value with the SST scanner.

General Specifications for 1790P CompactBlock LDX I/O

Isolation	Type test 1250V ac rms for 60 s between field power and the PROFIBUS DP network (I/O to logic)
Wire size	0.25...2.5 mm ² (22...14 AWG) solid or stranded copper wire rated at 75 °C or greater 1.2 mm (3/64 in.) insulation max
Wiring category	2 ⁽¹⁾
Product certifications (when product or packaging is marked)	c-UL-us UL Listed for Class I, Division 2 Group A,B,C,D Hazardous Locations, certified for U.S. and Canada FM FM Approved Equipment CE ⁽²⁾ European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers C-Tick ³ Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions

⁽¹⁾ Use this wiring category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

⁽²⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

Product Specifications for CompactBlock I/O Modules

This table contains specifications that are common to all of the 1791 base and expansion modules. Individual module-connection sizes, word/bit definitions, schematics, wiring diagrams, and specifications can be found in their respective Technical Data publications as listed in Related Publications for CompactBlock I/O Modules on page 6.

Environmental Specifications

Temperature, operating	0...60 °C (32...140 °F) 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)
Temperature, storage	-40...85 °C (-40...185 °F) IEC 60068-2-1 (Test Ab, Unpackaged Nonoperating Cold), IEC 60068-2-2 (Test Bb, Unpackaged Nonoperating Dry Heat), IEC 60068-2-14 (Test Na, Unpackaged Nonoperating Thermal Shock)
Relative humidity	5-95 % non-condensing IEC 60068-2-30 (Test Db, Unpackaged Nonoperating)
Operating altitude	2000 m
Vibration	5g @ 10...500 Hz IEC60068-2-6 (Test Fc, Operating)
Shock, operating Shock, nonoperating	30g 50g IEC60068-2-27 Test Ea, (Unpackaged Shock)
Emissions	Group 1, Class A CISPR 11
Radiated RF immunity	10V/m with 1 kHz sine-wave 80%AM from 80...1000 MHz 10V/m with 200 Hz 50% Pulse 100%AM @ 900 MHz IEC 61000-4-3
EFT/B immunity	±1 kV @ 5 kHz on power ports ±2 kV @ 5 kHz on signal ports ±2 kV @ 5 kHz on communication ports IEC 61000-4-4
Surge transient immunity	±1 kV line-line (DM) and ±2 kV line-earth (CM) on power ports ±1 kV line-line (DM) and ±2 kV line-earth (CM) on signal ports ±2 kV line-earth (CM) on shielded ports IEC 61000-4-5
Conducted RF immunity	10V rms with 1 kHz sine-wave 80%AM from 150 kHz...80 MHz IEC 61000-4-6
Enclosure type rating	IP 20
Mounting	DIN rail or panel mount

DeviceNet Specifications for 1791D CompactBlock I/O

Network protocol	I/O Slave messaging: - Poll command, Bit Strobe command, Cyclic command, COS command
Network length, thick cable	500 m (1600 ft) @ 125 Kbps 200 m (600 ft) @ 250 Kbps 100 m (330 ft) @ 500 Kbps
Network length, flat media	420 m (1230 ft) @ 125 Kbps 200 m (490 ft) @ 250 Kbps 75 m (245 ft) @ 500 Kbps
Communication rate	Auto-baud rate selection: 125, 250, 500 Kbps
Indicators	1 red/green for module/network status, 1 green for logic status, 1 yellow for I/O status
Number of nodes	64 max - rotary-switch type node address setting

General Specifications for 1791D CompactBlock I/O

Isolation voltage: I/O to DeviceNet I/O group-to-group I/O group-to-logic	500V ac 500V ac 500V ac
DeviceNet power	11...25V dc
Wiring category	2 ⁽¹⁾
Wire size	2 mm ² (14 gauge) stranded maximum (3/64 in. insulation max)
Product certifications (when product or packaging is marked)	c-UL-us UL Listed Industrial Control Equipment, certified for U.S. 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. FM FM Approved Equipment CE ⁽²⁾ European Union 89/336/EEC EMC Directive, compliant with: EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity EN 61000-6-4; Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with: EN 61131-2; Programmable Controllers

General Specifications for 1791D CompactBlock I/O (Continued)

Product certifications (when product or packaging is marked)	C-Tick ³	Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions
(continued)	ODVA	Open DeviceNet Vendor Association (ODVA) conformance tested to DeviceNet specifications

⁽¹⁾ Use this wiring category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

⁽²⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

PROFIBUS DP Specifications for 1791P CompactBlock I/O

Network protocol	PROFIBUS-DP (EN50170) <ul style="list-style-type: none"> • Communication of the slave with a Class 1 master • Communication of the slave with a Class 2 master
Implementation type	DPC31
Station type	Slave
Freeze mode	Supported
Sync mode	Supported
Auto baud rate	Supported
Fail safe mode	Supported ⁽¹⁾
FMS support	Not supported
Redundancy	Not supported
Network length/ communication rate	1000 m (3280 ft) @ 9.6 kbps 1000 m (3280 ft) @ 19.2 kbps 1000 m (3280 ft) @ 45.45 kbps 1000 m (3280 ft) @ 93.75 kbps 1000 m (3280 ft) @ 187.5 kbps 400 m (1312 ft) @ 500 kbps 200 m (656 ft) @ 1.5 Mbps 100 m (328 ft) @ 3 Mbps 100 m (328 ft) @ 6 Mbps 100 m (328 ft) @ 12 Mbps
Indicators	1 red/orange/green module status 1 yellow network status
Number of nodes	100 max - rotary-switch type node address setting (0-99)

⁽¹⁾ Dependant upon the scanner module being used. For example, the SST scanner (catalog number SST-PFB-SLC) does not fully support Fail Safe mode as it only resets outputs to 0. You cannot define behavior such as Hold Last State or Fault Value with the SST scanner.

General Specifications for 1791P CompactBlock I/O

Isolation voltage	Auxiliary I/O power to PROFIBUS: 500V ac I/O group-to-group: 500V ac I/O group-to-PROFIBUS: 500V ac
PROFIBUS DP power	18...26.4V dc
Wiring category	2 ⁽¹⁾
Wire size	2 mm ² (14 gauge) stranded maximum (3/64 in. insulation max)
Product certifications (when product is marked)	<p>c-UL-us UL Listed Industrial Control Equipment, certified for U.S. and Canada</p> <p>c-UL-us UL Listed for Class I, Division 2, Group A,B,C,D Hazardous Locations, certified for U.S. and Canada.</p> <p>CE⁽²⁾ European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity</p> <p>C-Tick³ Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions</p>

⁽¹⁾ Use this wiring category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1.

⁽²⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

Remote I/O Specifications for 1791R CompactBlock I/O

Network protocol	Remote I/O
Network length/ communication rate	3048 m (10000 ft) max @ 57.6 kbps, 1524 m (5000 ft) max @ 115.2 kbps, 762 m (2500 ft) max @ 230.4 kbps
Indicators	1 red/orange/green module status, 1 green comm status
Number of nodes	Processor-dependent. Refer to processor manual.

General Specifications for 1791R CompactBlock I/O

Isolation voltage	Power supply to Remote I/O: 500V ac I/O group-to-Remote I/O: 500V ac I/O group-to-logic: 500V ac								
Remote I/O power	18...26.4V dc								
Wiring category	2 ⁽¹⁾								
Wire size	2 mm ² (14 gauge) stranded maximum (3/64 in. insulation max)								
Product certifications (when product is marked)	<table border="0"> <tr> <td>c-UL-us</td> <td>UL Listed Industrial Control Equipment, certified for U.S. and Canada</td> </tr> <tr> <td>c-UL-us</td> <td>UL Listed for Class I, Division 2, Group A,B,C,D Hazardous Locations, certified for U.S. and Canada.</td> </tr> <tr> <td>CE⁽²⁾</td> <td>European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; Industrial Emissions EN 50082-2; Industrial Immunity EN 61326; Meas./Control/Lab., Industrial Requirements EN 61000-6-2; Industrial Immunity</td> </tr> <tr> <td>C-Tick³</td> <td>Australian Radiocommunications Act, compliant with: AS/NZS 2064; Industrial Emissions</td> </tr> </table>	c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. 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 ⁽²⁾	European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; 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 2064; Industrial Emissions
c-UL-us	UL Listed Industrial Control Equipment, certified for U.S. 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 ⁽²⁾	European Union 89/336/EEC EMC Directive, compliant with: EN 50081-2; 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 2064; Industrial Emissions								

⁽¹⁾ Use this wiring category information for planning conductor routing. Refer to Industrial Automation Wiring and Grounding Guidelines, publication [1770-4.1](#).

⁽²⁾ See the Product Certification link at <http://www.ab.com> for Declarations of Conformity, Certificates, and other certification details.

Specify a 1790 CompactBlock LDX I/O System

What This Chapter Contains This chapter guides you in specifying a CompactBlock LDX I/O system.

Step 1: Select a Communication Network **page**
24

CompactBlock LDX I/O on the DeviceNet Network..... page 24



Step 2: Select Base and Expansion Modules **page**
26

Possible Configurations for CompactBlock LDX I/O on the
PROFIBUS DP Network..... page 27
Possible Configurations for CompactBlock LDX I/O on the
DeviceNet Network page 26



Step 3: Select Optional Accessories **page**

Step 1: Select a Communication Network

Using this table as a guide, select the communication network that is most suitable. This will determine the type of CompactBlock LDX I/O products you will need.

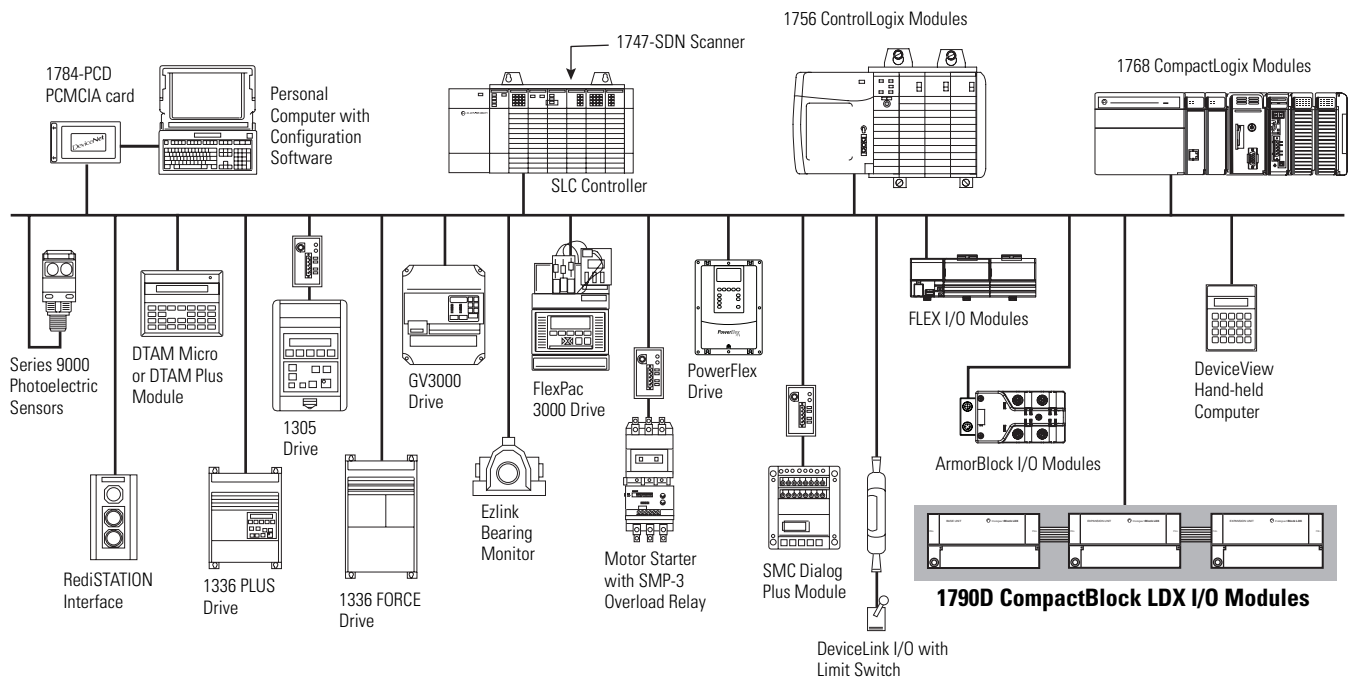
Select a Communication Network

Application requirements	Select this network	Select this type of CompactBlock LDX I/O
<ul style="list-style-type: none"> • Connections of low-level devices directly to plant-floor controllers • Data sent as needed • Diagnostics for improved data collection and fault detection • Less wiring and reduced start-up time than a traditional, hard-wired system 	DeviceNet	1790D-xxx
<ul style="list-style-type: none"> • Connecting to an existing PROFIBUS DP network 	PROFIBUS DP	1790P-xxx

CompactBlock LDX I/O on the DeviceNet Network

This illustration shows how CompactBlock LDX I/O modules fit into a typical DeviceNet system.

CompactBlock LDX I/O Modules in a DeviceNet System



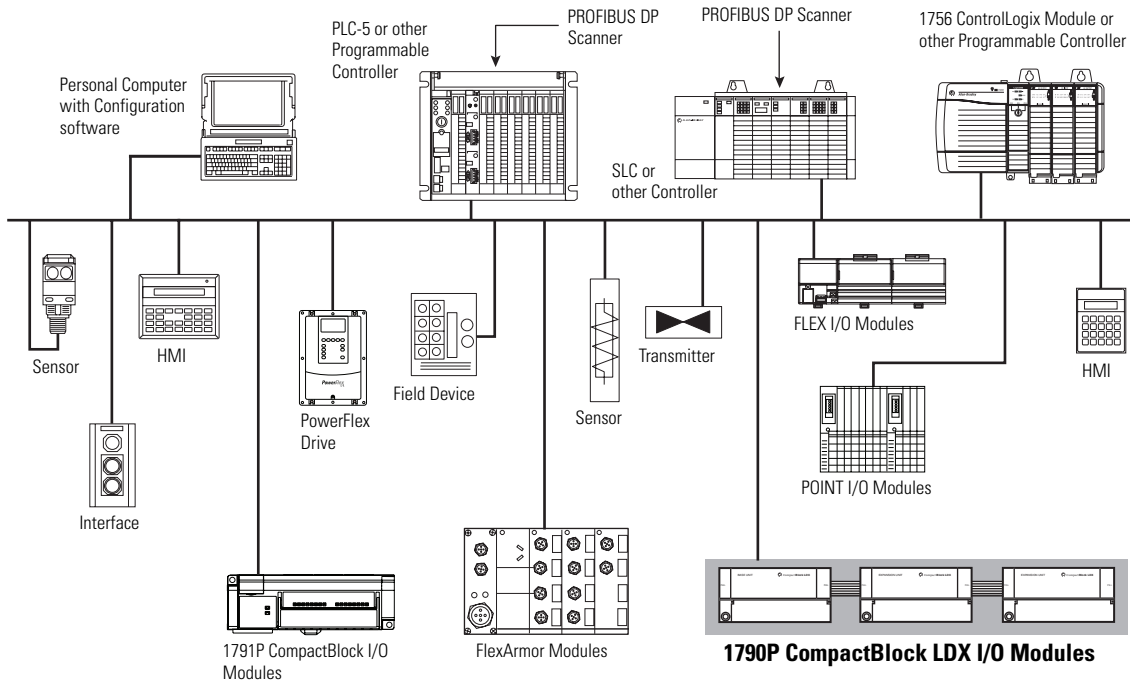
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See Chapter 4 for DeviceNet network specifications.

CompactBlock LDX I/O on the PROFIBUS DP Network

This illustration shows how CompactBlock LDX I/O fits into a typical PROFIBUS DP system.

CompactBlock LDX I/O Modules in a PROFIBUS DP System



44413

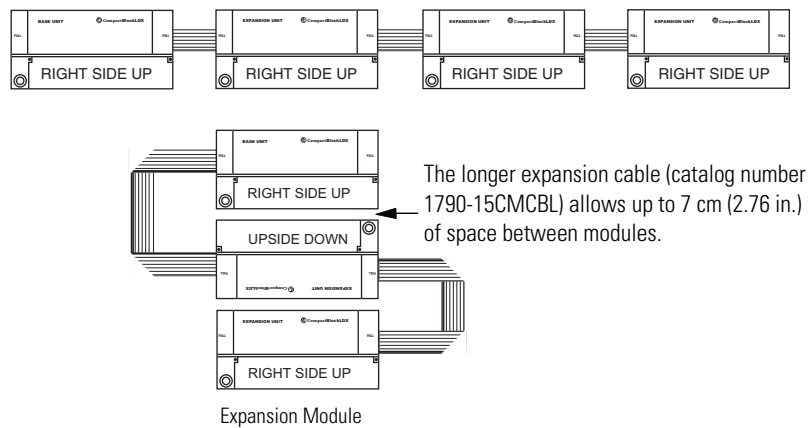
See Chapter 4 for PROFIBUS DP network specifications.

Step 2: Select Base and Expansion Modules

Determine the number of I/O inputs and outputs required and their mix.

Possible Configurations for CompactBlock LDX I/O on the DeviceNet Network

Both digital and analog base modules support up to three expansion modules. Beginning with the base module, you can mount the modules either horizontally or vertically as shown in the figure.

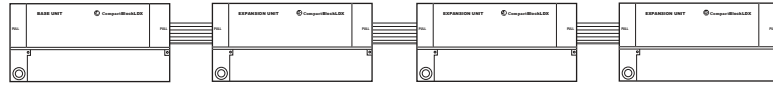


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Possible Configurations for CompactBlock LDX I/O on the PROFIBUS DP Network

Digital and analog base modules support up to three or two expansion modules respectively. However, RTD and thermocouple base modules do not support expansion modules.

Digital Base Module **1** or **2** or **3** Digital Expansion Modules



Analog Base Module **1** or **2** Digital Expansion Modules



RTD or Thermocouple Base Module



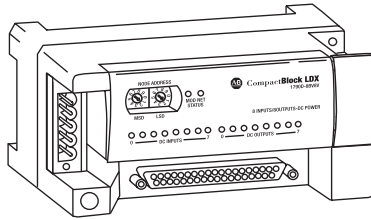
0 Digital Expansion Modules

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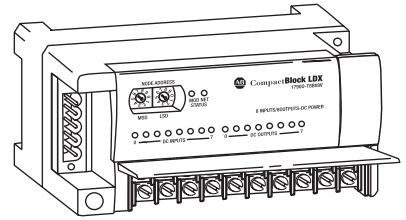
Termination Type

There are two termination types available, the D-shell connector and fixed-screw termination. The D-shell connector is available only for CompactBlock LDX I/O on the DeviceNet network.

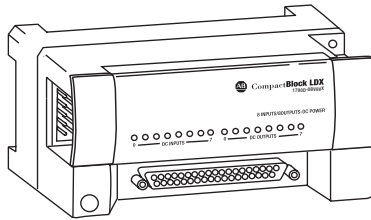
Termination Types for CompactBlock LDX I/O



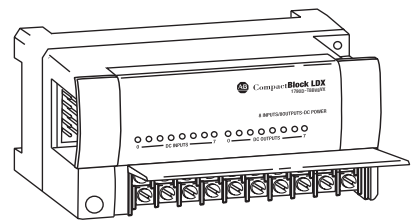
Base Module with D-shell Connector⁽¹⁾



Base Module with Screw Terminations



Expansion Module with D-shell Connector⁽¹⁾



Expansion Module with Screw Terminations

⁽¹⁾ Available only for CompactBlock LDX I/O on the DeviceNet network.

CompactBlock LDX I/O Base and Expansion Modules

This table lists the catalog numbers for the CompactBlock LDX I/O base modules.

CompactBlock LDX I/O Base Modules

I/O Mix	DeviceNet		PROFIBUS DP
	D-shell	Terminal Block	Terminal Block
	1790D- <i>xxx</i>	1790D-T <i>xxx</i>	1790P-T <i>xxx</i>
Discrete I/O			
8 input, 120V ac	—	1790D-T8A0	—
8 universal in/8 source out	1790D-8BV8B	1790D-T8BV8B	1790P-T8BV8B
8 universal in/8 sink out	1790D-8BV8V	1790D-T8BV8V	1790P-T8BV8V
16 universal in	1790D-16BV0	1790D-T16BV0	—
16 universal in/16 sink out	—	1790D-T16BV16V	—
16 universal in/16 source out	—	1790D-T16BV16B	—
32 universal in	—	1790D-T32BV0	—
6 output, 120V ac	—	1790D-T0A6	—
6 relay output	1790D-0W6	1790D-T0W6	1790P-T0W6
16 sinking output	1790D-0V16	1790D-T0V16	—
16 sourcing output	1790D-0B16	1790D-T0B16	—
32 sinking output	—	1790D-T0V32	—
32 sourcing output	—	1790D-T0B32	—
Analog I/O			
4 input current	1790D-N4C0	1790D-TN4C0	1790P-TN4C0
4 input voltage	1790D-N4V0	1790D-TN4V0	—
4 input RTD	1790D-4R0	1790D-T4R0	1790P-T4R0
4 input thermocouple	1790D-4T0	1790D-T4T0	1790P-T4T0
2 output current	1790D-N0C2	1790D-TN0C2	1790P-TN0C2
2 output voltage	1790D-N0V2	1790D-TN0V2	—

This table lists the catalog numbers for the CompactBlock LDX I/O expansion modules.

CompactBlock LDX I/O Expansion Modules

I/O Mix	D-shell	Terminal Block
	1790-xxx	1790-Txxx
8 input, 120V ac	—	1790-T8A0X
8 relay out	1790-0W8X	1790-T0W8X
8 univ in/8 sink out	1790-8BV8VX	1790-T8BV8VX
8 univ in/8 source out	1790-8BV8BX	1790-T8BV8BX
16 universal in	1790-16BV0X	1790-T16BV0X
8 output, 120V ac	—	1790-T0A8X
16 sink out	1790-0V16X	1790-T0V16X
16 source out	1790-0B16X	1790-T0B16X

For detailed specifications of the modules, refer to the respective Technical Data publications as listed in Related Publications for CompactBlock LDX I/O Modules on page 5.

Step 3: Select Optional Accessories

This table lists the optional components for CompactBlock LDX I/O modules.

Optional Components for CompactBlock LDX I/O

Optional Component	Catalog No.
LDX I/O replacement ribbon cable, 7 cm (2.76 in.), in lots of 5	1790-7CMCBL
LDX I/O longer ribbon cable, 15 cm (5.90 in.), in lots of 5	1790-15CMBL
Five-position open-style plug for the DeviceNet network	1799-DNETCON
Five-position open-style plug/locking screws for the DeviceNet network	1799-DNETSCON
DeviceNet five-position plug to five-pin micro male connector, straight, in lots of five	1799-DNC5MMS

Specify a CompactBlock I/O System

What This Chapter Contains This chapter guides you in specifying a CompactBlock I/O system.

Step 1: Select a Communication Network **page 32**

CompactBlock I/O Modules on the DeviceNet Network ... page 32
CompactBlock I/O Modules on the PROFIBUS DP Network page 36
CompactBlock I/O Modules on Remote I/O page 37



Step 2: Select Base and Expansion Modules **page 38**

Possible Configurations for CompactBlock I/O Modules on DeviceNet, PROFIBUS DP, and Remote I/O Networks page 38



Step 3: Select Optional Accessories **page**

Step 1: Select a Communication Network

Using this table as a guide, select the communication network that is most suitable. This will determine the type of CompactBlock I/O products you will need.

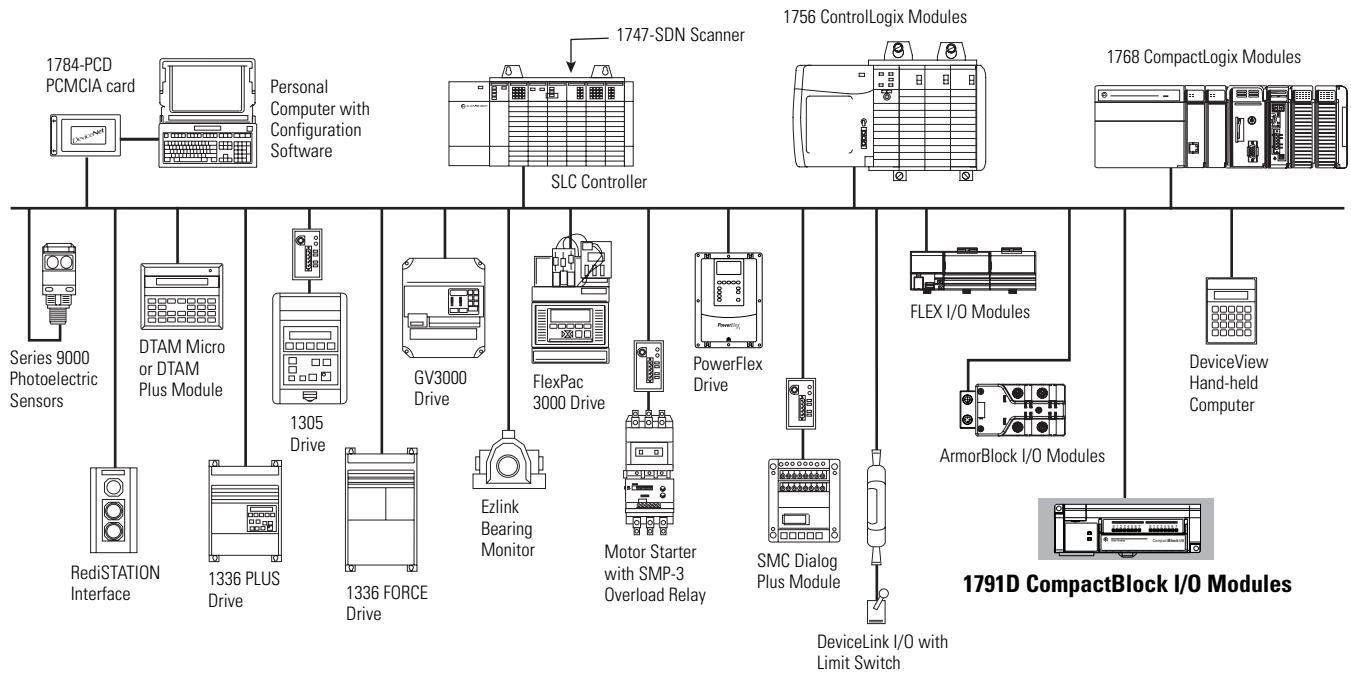
Select a Communication Network

Application Requirements	Network	Select
<ul style="list-style-type: none"> • Connections of low-level devices directly to plant-floor controllers, without interfacing them • Data sent as needed • More diagnostics for improved data collection and fault detection • Less wiring and reduced start-up time than a traditional, hard-wired system 	DeviceNet	1790D-xxx
<ul style="list-style-type: none"> • Connecting to an existing PROFIBUS DP 5 m (16.4 ft) bus, 12 MB network 	PROFIBUS	1790P-xxx
<ul style="list-style-type: none"> • Connecting to an existing Allen-Bradley remote I/O network 	Remote I/O	1790R-xxx

CompactBlock I/O Modules on the DeviceNet Network

This graphic shows how CompactBlock I/O modules fit into a typical DeviceNet system.

CompactBlock I/O Modules in a DeviceNet System



44423

See Chapter 4 for DeviceNet network specifications.

In addition, CompactBlock I/O modules on the DeviceNet network have these features:

- Input Filtering
- Idle and Fault Mode Selection
- DeviceLogix Functionality
- Optional I/O Assemblies

Input Filtering

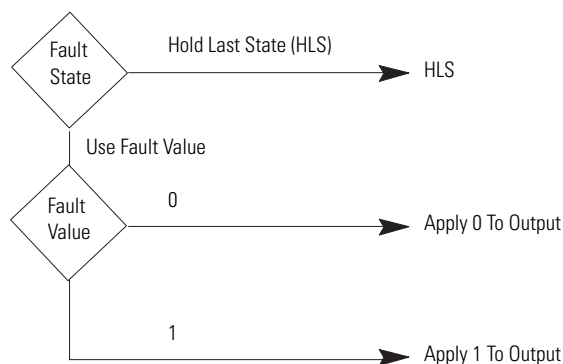
Input filtering limits the effect of voltage transients caused by contact bounce and/or electrical noise. If not filtered, voltage transients could produce false data.

To configure an input filter, an input signal delay is set to turn off-to-on or on-to-off for nominal amounts of time. The mode and filter time is set through RSNetworkx for DeviceNet software, or a similar configuration tool.

Idle and Fault Mode Selection

When the PLC, SLC, or PC-based programmable controller is in Program mode, the DeviceNet scanner puts the CompactBlock module in an **idle state**. If the DeviceNet scanner drops off the network, the module goes to a **fault state**.

In both idle and fault states, the module resets its outputs by default. You can use RSNetworkx for DeviceNet software or a similar configuration tool to change the default and set the module to save the last received outputs.



Fault state can be set to HLS or use fault value. The fault value can be set to 0 or 1. The same logic applies for idle conditions.

42455

DeviceLogix Functionality

The CompactBlock I/O family also offers modules that have DeviceLogix capability, a local logic that provides you with the ability to control outputs and manage status information locally, within the device. DeviceLogix capability is configured through a function block editor that is accessed through RSNetWorx for DeviceNet software. This editor lets you create local logic by using boolean operators, such as AND and OR, set and reset latches, as well as a variety of timers and counters. User support for the editor can be found in the DeviceLogix Ladder Editor User Manual, publication ACIG-UM002, and online help.

CompactBlock products that support DeviceLogix technology have some device-specific capabilities and capacities, which are identified in this table.

Capability/Capacity	CompactBlock I/O Modules
Function blocks supported	<ul style="list-style-type: none"> • Boolean - AND, OR, XOR, NOT, NAND, NOR, XNOR • Latches - RSL and SRL • Timers - PUL, OND, and OFD • Counters - UPC and UPD
Number of function blocks included in a configuration, max	48
Function block processing time	1 ms/24 blocks 2 ms/48 blocks
Network input bits	32
Network output bits	8
Available status bits	<ul style="list-style-type: none"> • Explicit message connection • Polled connection • Change-of-state/cyclic connection • Network fault • Minor module fault • Polled connection fault • Polled connection idle • Change-of-state/cyclic connection fault
Logic status indication	<ul style="list-style-type: none"> • Logic disabled - none • Logic enabled - solid green • Local forces are applied and local logic is enabled - flashing green

Optional I/O Assemblies

The DeviceLogix-capable versions of CompactBlock I/O modules give you the ability to choose how much data the modules produce or consume over the DeviceNet network. Two new parameters have been added to the EDS file that let you select the amount of data that will be transmitted or received.

Produced I/O Assembly

These three options are for Produced Data:

- **Default assembly** - Produces the device's input data and any fault/status data the device has.
- **Input only assembly** - Produces only the state of the device's inputs. This lets those who do not make use of the Diagnostic bits reduce their network traffic.
- **DeviceLogix assembly** - Produces all of the standard information from the Default assembly plus the data that is available as a result of invoking DeviceLogix technology.

These new DeviceLogix data are available:

- **Logic Enabled bit** - This bit is high when the DeviceLogix configuration is running on a device and has been enabled. This can be used, for example, in the PLC program or on a DeviceNet MMI to indicate the presence of local logic control.
- **Network Output bits** - These bits are used in the DeviceLogix configuration to send information back over the network. For example, the output of any function block can be connected to a network output bit.
- **Hardware Output bits** - The DeviceLogix configuration lets you locally control the state of hardware outputs. Therefore these bits are produced by the device so that the state of the outputs can be sent back to the network master. If an output in the device is not under DeviceLogix control, its status is still controlled by the normal consumed data.

Please refer to the CompactBlock I/O for DeviceNet Technical Data, publication, [1791D-TD001](#). The assemblies for CompactBlock I/O devices are listed in the publication, in the sections that contain specific module information.

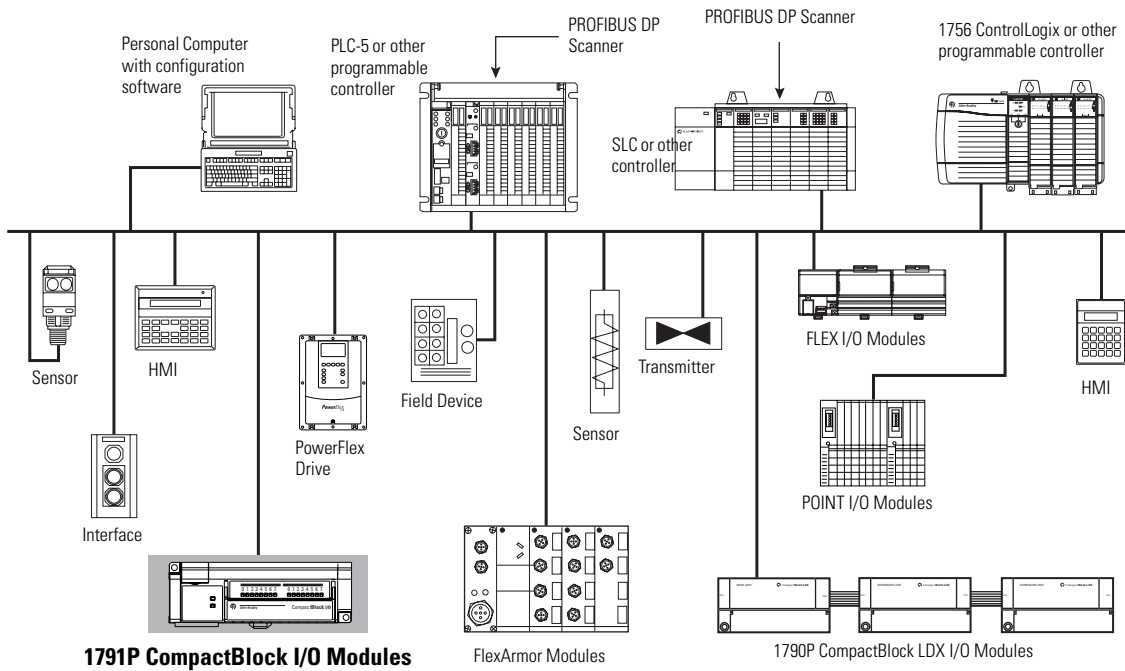
Consumed I/O Assembly

DeviceLogix technology provides the device the ability to consume data from the DeviceNet master other than the normal state of the hardware outputs. This data is called Network Input Bits. Up to 32 of these bits can be consumed by the device. Five options exist for the variable amount of consumed data: 0, 1, 2, 3, or 4 bytes. A standard 16-output CompactBlock I/O module, for instance, consumes 16 bits (2 bytes). With DeviceLogix technology, you can choose to consume an additional 2 bytes of Network Inputs. If a hardware output is controlled by local logic, its state is no longer consumed and that bit becomes available to be used as a Network Input. For more on this concept, please refer to the DeviceLogix Ladder Editor User Manual, publication [ACIG-UM002](#).

CompactBlock I/O Modules on the PROFIBUS DP Network

This illustration shows how CompactBlock I/O modules fit into a typical PROFIBUS DP system.

CompactBlock I/O Modules in a PROFIBUS DP System



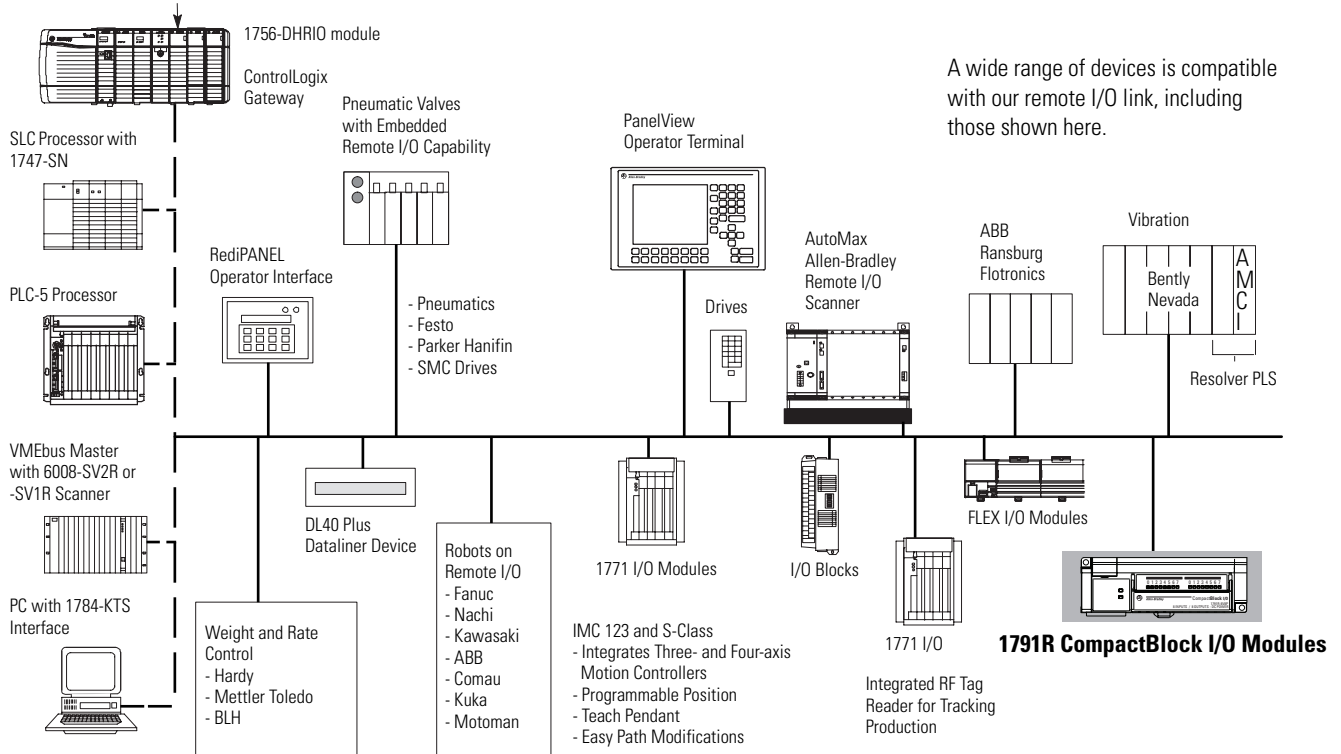
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See Chapter 4 for PROFIBUS DP network specifications.

CompactBlock I/O Modules on Remote I/O

This graphic shows how your CompactBlock I/O modules fit into a typical remote I/O system.

CompactBlock I/O Modules in a Remote I/O System



44424

See Chapter 4 for remote I/O network specifications.

CompactBlock I/O Base and Expansion Modules

This table lists the catalog numbers for all the CompactBlock I/O base modules.

CompactBlock I/O Base Modules

I/O mix	DeviceNet	PROFIBUS DP	Remote I/O
	1791D-xxx	1791P-xxx	1791R-xxx
4 in sink (not expandable)	1791D-4B0	—	—
4 in sink/4 out source	1791D-4B4P	1791P-4B4P	1791R-4B4P
8 in sink/8 out source	1791D-8B8P	1791P-8B8P	1791R-8B8P
8 in source/8 out sink	1791D-8V8P	1791P-8V8P	1791R-8V8P
8 out source	1791D-0B8P	—	—
16 in sink	1791D-16B0	1791P-16B0	1791R-16B0
16 in source	1791D-16V0	—	—
16 out sink	1791D-0V16P	—	—
16 out source	1791D-0B16P	1791P-0B16P	1791R-0B16P

This table lists the catalog numbers for all the CompactBlock I/O universal expansion modules. These modules function with DeviceNet, RIO, and PROFIBUS bases. Use one expansion per base module.

CompactBlock I/O Expansion Modules

I/O Mix	Catalog No.
24V dc CompactBlock I/O expansion, 16 out source	1791D-0B16PX
24V dc CompactBlock I/O expansion, 16 out sink	1791D-0V16PX
24V dc CompactBlock I/O expansion, 16 in sink	1791D-16B0X
24V dc CompactBlock I/O expansion, 16 in source	1791D-16V0X
Analog CompactBlock I/O expansion, 4 inputs, 2 outputs	1791D-N4CV2X

For detailed specifications of the modules, refer to the respective Technical Data publications as listed in Related Publications for CompactBlock I/O Modules on page 6.

Step 3: Select Optional Accessories

This table lists the optional components for CompactBlock I/O modules.

Optional Components for CompactBlock I/O Modules

Optional Component	Catalog No.
24V dc block I/O longer ribbon cable, 15 cm	1791D-15CMCBL
24V dc block I/O long cable, 30 cm	1791D-30CMBL
24V dc block I/O replacement ribbon cable, 4 cm	1791D-4CMCBL
Block I/O replacement terminal block, 21-pin NEMA	1791D-RTBN21
RIO six-position connector, lock screws	1791R-RIOSCON

Network Specifications

What This Chapter Contains This chapter contains the general specifications for these networks:

- DeviceNet Network
- PROFIBUS DP Network
- Remote I/O (1791 CompactBlock I/O only)

DeviceNet Network

CompactBlock LDX I/O and CompactBlock I/O modules are compatible with PLC, SLC, ControlLogix, CompactLogix, MicroLogix1500 or SoftLogix programmable controllers when used with DeviceNet scanners.

DeviceNet Communication

The distributed I/O module (CompactBlock LDX I/O or CompactBlock I/O) acts as a slave in a master/slave environment. I/O data is exchanged with the master through a polled, cyclic, or change-of-state connection. This selection is made in the DeviceNet scanner module's configuration.

Polled

When configured as a polled device, a master initiates communication by sending its polled I/O message to the distributed I/O module.

Cyclic

When using cyclic operation, the master sends data only to the distributed I/O module and receives only data from the module at a preconfigured time interval.

Change-of-state

When the distributed I/O module is configured for change-of-state, the master sends output data only when:

- the user's control program wants to update the module's output.
- the time period for communication has expired.

The distributed I/O module's input data is sent to the master only when:

- an input changes.
- the time period for communication has expired.

With change-of-state, the master does not have to request input data from the slave. It is sent automatically when data changes. In addition, an adjustable "heartbeat" is produced periodically by the distributed I/O module to let the consuming device know that the module connection is alive and ready to communicate.

Software and EDS File Requirements

CompactBlock LDX I/O and CompactBlock I/O modules require RSNetWorx for DeviceNet software, version 3.0 or later. We recommend the use of RSNetworx for DeviceNet software, version 7.0 or later. Additionally, current functions of CompactBlock LDX I/O modules require current, modular EDS files for RSNetWorx for DeviceNet software.

These files are easy to install and are available online at <http://www.ab.com/networks/eds/>.

EDS files for modules with matching catalog numbers (for D-shell and terminal block versions) are the same. On the website or in RSNetWorx for DeviceNet software, you can see only one catalog number listed for both versions.

Power Supply Requirements

The DeviceNet network supplies power to the CompactBlock I/O base and expansion modules. Inputs and outputs are powered by an external 24V dc source that is independent of the network.

PROFIBUS DP Network

CompactBlock LDX I/O and CompactBlock I/O modules are compatible with any PROFIBUS DP scanner.

PROFIBUS DP Communication

Optimized for high speed and inexpensive installation, the PROFIBUS DP network (decentralized periphery) is designed especially for communication between programmable controllers (PLCs) and distributed I/O at the device level. Data exchange is mainly cyclic with field devices such as I/O, valves, drives, and measuring transducers. The primary controller (master) reads the input information from the field devices (slaves) and sends the output information back to the slaves.

The communication functions required for this are highlighted in this table and are defined by the PROFIBUS standard.

Basic PROFIBUS DP Functions

Bus access	<ul style="list-style-type: none"> • Token passing procedure between masters and master-slave procedure between master and slaves • Mono-master or multi-master system possible • Master and slave devices, maximum 126 stations on one bus
Communication	<ul style="list-style-type: none"> • Peer-to-peer (user data communication) or multicast (control commands) • Cyclic master-slave user data communication
Operating states	<ul style="list-style-type: none"> • Operate - cyclic transmission of input and output data • Clear - inputs are read, outputs remain in secure state • Stop - diagnostics and parameterization, no user data transmission
Synchronization	<ul style="list-style-type: none"> • Control commands allow the synchronization of inputs and outputs • Sync mode - outputs are synchronized • Freeze mode - inputs are synchronized
Functions	<ul style="list-style-type: none"> • Cyclic user-data transfer between DP master and slave • Dynamic activation or deactivation of individual slaves • Checking the configuration of the slaves • Powerful diagnostic functions, three hierarchical levels of diagnostic messages • Synchronization of inputs and/or outputs • Address assignment for slaves optionally possible via the bus • Maximum of 244 bytes input and output data possible for each slave

Basic PROFIBUS DP Functions (Continued)

Protective functions	<ul style="list-style-type: none"> • All messages are transmitted at a hamming distance of HD=4 • Watchdog control of DP slave detects failure of the assigned master • Access protection for inputs/outputs of slaves • Monitoring of user data communication with adjustable monitoring timer in the master
Device types	<ul style="list-style-type: none"> • DP master Class 2 (DPM2), for example engineering or diagnostics tool • DP master Class 1 (DPM1), for example central programmable controllers such as PLC, SLC, PC • DP slave, for example devices with binary or analog inputs/outputs, drives, valves

Data communication is monitored on both the master and slave sides.

Speed

The PROFIBUS DP network requires about 1 ms at 12 Mbps to transmit 512 bits of input data and 512 bits of output data to 32 stations.

Diagnostics

Diagnostic messages are transmitted over the network and collected at the master and are classified into these three types:

- **Station-related** - Status of the device (for example, low voltage or over temperature, depending on the device).
- **Module-related** - Indicates if any of the connected I/O modules report errors. More detailed information of the error can be found by evaluating the channel-related diagnostic message.
- **Channel-related** - Provides information on channel errors of the I/O modules and expands on the module-related diagnostics.

System Configuration and Device Types

The PROFIBUS DP network consists of mono-master or multi-master systems. This allows flexibility during system configuration. A maximum of 126 master or slave devices can connect to one network. System configuration specifications define:

- the number of stations.
- assignment of station addresses to the I/O addresses.
- data consistency of the I/O data.

- format of the diagnostic messages.
- bus parameters.

Each PROFIBUS DP system consists of these three different types of devices:

- **DP Master Class 1 (DPM1)** - This is a central controller that cyclically exchanges information with the distributed stations (slaves) in a defined message cycle. This device is typically the PLC.
- **DP Master Class 2 (DPM2)** - This is a configuration or operating device used for commissioning, maintenance, or diagnostics. It also evaluates measured values and parameters and requests device status. This device is typically the scanner or adapter.
- **Slave** - This is a peripheral I/O field device such as an HMI, drive, relay, or sensor. Depending on the type, the slave device collects input information and sends output information to the peripherals.
The maximum amount of input and output information is 244 bytes of input and 244 bytes of output.

Mono-master systems contain only one PLC on the network. The field devices are decentrally linked to the PLC via the transmission medium. These systems offer the shortest communication time.

Multi-master systems contain several PLCs on one network. These systems can be configured either with independent subsystems each consisting of one DPM1 master and its assigned slaves, or with additional configuration and diagnostic devices. Input and output information of the slaves can be read by all masters, however only one master can write-access the outputs.

Operating Modes and System Status

In addition to the cyclic data exchange that is executed automatically by the master, the master can send control commands to a single slave, a group of slaves, or all slaves simultaneously. These control commands are transmitted as multicast commands and permit use of Sync and Freeze modes for event-controlled synchronization of the slaves.

Sync/Freeze

The slave begins **Sync mode** when it receives a sync command from the assigned master. The output channels of all I/O modules are then frozen in their current state. During subsequent user-data transmission, the output data is stored in the scanner, but the output states remain unchanged. The stored output data is not sent to the

outputs until the sync command is received. Sync mode is concluded with the unsync command.

Similarly, a freeze control command causes the adapter to assume **Freeze mode**. In this operating mode, the states of the input channels of all I/O modules are frozen at the current value. Input data is not updated again until the master sends the next freeze command. Freeze mode is concluded with the unfreeze command.

General system behavior is determined by the operating status of the master. These are the three main states:

- **Stop** - No data transmission occurs between the master and the slaves.
- **Operate** - The master is in the data transfer phase. In cyclic data communication, inputs of the slaves are read and output information is written to the slaves.
- **Clear** - The master reads the information of the slaves and sets the outputs to an idle state.

The system reaction to an error during the data transfer phase of the master (such as a slave failure) is determined by the **autoclear** configuration parameter. If this parameter is set to true, the master switches the outputs of all assigned slaves to fail-safe state as soon as a slave is no longer ready for user data transmission. The master then changes to the **clear** state. If this parameter is false, the master remains in operate state even when a fault occurs with the user specifying the proper system reaction.

Cyclic Data Transmission

Data transmission between the master and its slaves is executed automatically by the master in a defined, recurring order.

When configuring the network, the user defines the assignment of a slave to the master. At this time, the user also defines which slaves are to be included or excluded from the cyclic user data communication.

This transmission of data is divided into three categories:

- parameterization
- configuration
- data transfer

Before a slave enters the data transfer phase, it is checked in the parameterization and configuration phases to determine whether the planned configuration matches the actual device configuration.

During this check, the device type, format and length information and the number of inputs and outputs must agree. These checks offer reliable protection against parameterization errors. In addition to the user data transfer

which is executed automatically by the master, new parameterization data can be sent to the slaves at the user's request.

Configuration and GSD File Requirements

You can configure CompactBlock I/O modules using GSD files and any PROFIBUS DP configuration package. The GSD files are available online at: www.ab.com/networks/gsd/

Base Module to Expansion Interface

The base module is linked to the expansion module with an 8-bit parallel bus, control lines, Vcc and ground connections, a reset/initialization line, and an expansion presence line. The 8-bit bus is multiplexed so that 16 bits of data (1 for each I/O point) can be transmitted/received with two transfers. The reset/initialization line is used during initialization of the module. The presence line is used for the detection of an expansion module at power up and for a period of each data transfer. Module ID is read over this bus at power up.

1791P modules supply expansion power via expansion bus as follows:

Expansion power voltage	5V dc
Expansion power current	100 mA

Power the Module

An external power supply for the PROFIBUS network is required for CompactBlock I/O and CompactBlock LDX I/O base modules. Inputs and outputs are powered by an external 24V dc source which is independent of the network.

Remote I/O (1791 CompactBlock I/O only)

CompactBlock I/O modules are compatible with PLC, SLC or SoftLogix programmable controllers when used with Remote I/O scanners.

Remote I/O Module Communication

This section covers the following aspects of remote I/O communication:

- DIP Switch Settings
- Baud Rates for Your Remote I/O Connection
- I/O Image Word/Bit Definitions

DIP Switch Settings

The 1791R DIP switches are described in the following tables.

DIP Switch	No.	Description	Starting Quarter		
			SW1-2	SW1-2	Module Group
SW1	1	Starting Quarter	SW1-2	SW1-2	Module Group
	2	Starting Quarter	0	0	0 (1st)
			0	1	2 (2nd)
			1	0	4 (3rd)
			1	1	6 (4th)

Starting Quarter: Position in Rack Address with 1/4 rack size data.

DIP Switch	No.	Description	
SW1	3	Rack Address	See table of Rack Addresses in the CompactBlock Distributed I/O on Remote I/O Installation Instructions, publication no., 1791R-IN001 .
	4	Rack Address	
	5	Rack Address	
	6	Rack Address	
	7	Rack Address	
	8	Rack Address	
SW2	1	Comm Rate	00=57.6 K, 01=115.2 K
	2	Comm Rate	10=230.4 K, 11=230.4 K
	3	N/A	
	4	Hold Last State	Hold Last State
	5	Processor Restart/Lockout	Lockout
	6	Last I/O	Last Rack
	7	Filter Speed Setting	00=2 ms, 10=4 ms
	8	Filter Speed Setting	01=8 ms, 11=16 ms

Rack Address (6 bit): Position in scanner data mapping.

Baud Rates for Your Remote I/O Connection

The baud rate is set before you power up the module using the DIP switches. The baud rate specifications are listed below.

Baud Rate	Cable Length
57.6 Kbps	3048 m
115.2 Kbps	1524 m
230.4 Kbps	762 m

I/O Image Word/Bit Definitions

The smallest portion of a scanner's I/O image that can be allocated to a single RIO device is two logical groups or 1/4 logical rack. A device's starting group must begin at even group numbers (0, 2, 4, or 6). See your scanner documentation for further details.

All combinations of 1791R base and expansion modules will fit in the space allocated by 1/4 logical rack.

Power Supply Requirements

Two sets of VDC+ and GND power pins are located on each terminal (one for each bank of 8 points) except on the 1791R-4B4P module. Input and Output wiring use up to 14 AWG (2 mm³) stranded (Cu) with 3/64 inch insulation.

Base Module to Expansion Interface

The base module is linked to the expansion module with an 8-bit parallel bus, control lines, Vcc and ground connections, a reset/initialization line, and an expansion presence line. The 8-bit bus is multiplexed so that 16 bits of data (1 for each I/O point) can be transmitted/received with two transfers. The reset/initialization line is used during initialization of the module.

The presence line is used for the detection of an expansion module at power up and for a period of each data transfer. Module ID is read over this bus at power up. 1791R modules supply expansion power via expansion bus as follows:

- Expansion power voltage - 5V dc
- Expansion power current - 100 mA

Power the Module

An external power supply for the Remote I/O network is required for CompactBlock I/O base modules. Inputs and outputs are powered by an external 24V dc source which is independent of the network.

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