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# SLC 500 SYSTEMS
## SELECTION GUIDE

**BULLETIN 1746 AND 1747**

Allen-Bradley · Rockwell Software

**Rockwell Automation**

# Benefits

- **Powerful, yet affordable** - SLC 500 programmable controllers provide excellent value with extensive capabilities to address a broad range of applications including material handling, HVAC control, high speed assembly operations, small process control, simple motion control, and SCADA.

- **Modularity** - Modular processes, power supplies, I/O, memory options, and communication interfaces allow for a configurable and expandable system. Configure your system for the number of I/O, the amount of memory, and the communication networks needed. Later, you can expand the system by adding I/O, memory, or communication interfaces.

- **Advanced instruction set** - Includes indirect addressing, high level math capability, and a compute instruction.

- **Communication network versatility** - Choose from on-board Ethernet, DH+, or DH-485, as well as options for ControlNet, DeviceNet, or Remote I/O communications.

- **Broad selection of I/O** - Select from over 60 modules to control discrete, analog, and temperature signals. Third-party specialty modules are also available from Encompass partners to customize control solutions for your application needs.

- **Industrially hardened product** - Designed to withstand the vibrations, thermal extremes, and electrical noise associated with harsh industrial environments.

- **Windows programming software** - RSLogix 500 programming software maximizes productivity by simplifying program development and troubleshooting.

# SLC 500 System Overview

The Allen-Bradley SLC 500 is a small chassis-based family of programmable controllers, discrete, analog, and specialty I/O, and peripheral devices. The SLC 500 family delivers power and flexibility with a wide range of communication configurations, features, and memory options. The RSLogix 500 ladder logic programming package provides flexible editors, point-and-click I/O configuration, and a powerful database editor, as well as diagnostic and troubleshooting tools to help you save project development time and maximize productivity.

## Table of Contents    See:

## Typical Systems

With up to 64 K of configurable data/program memory available and over 60 types of I/O modules, as well as a choice of networking options, the SLC system provides a powerful solution for stand-alone or distributed industrial control.

## Local Systems

At minimum, a modular hardware SLC 500 control system consists of a processor module and I/O modules in a single 1746 chassis with a power supply.
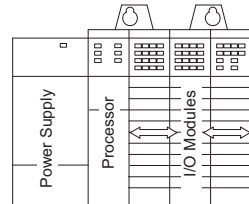


You can configure a system with one, two, or three local chassis, for a maximum total of 30 local I/O or communication modules. You connect multiple local chassis together with chassis interconnect cables to extend the backplane signal lines from one chassis to another.
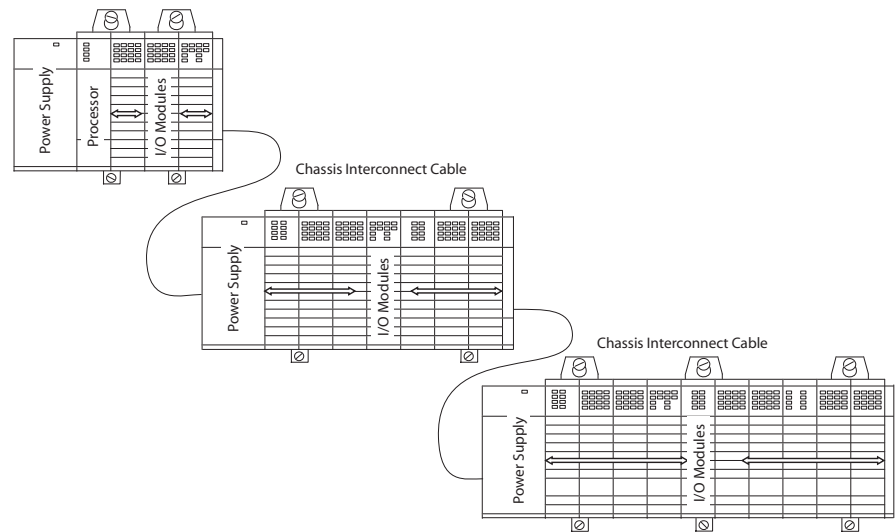


## Distributed Systems

More complex systems can use:

• distributed I/O.

• multiple controllers joined across networks.

• I/O in multiple platforms that are distributed in many locations and connected over multiple I/O links.

Choose the processor module with the on-board communication ports you need. You optionally add modules to provide additional communication ports for the processor. For I/O in locations remote from the processor, you can choose between a ControlNet, DeviceNet, or Univeral I/O link. A communication interface module is required in both the local and remote chassis.

Depending upon the communication ports available on your particular SLC control system, you can select operator interfaces that are compatible.
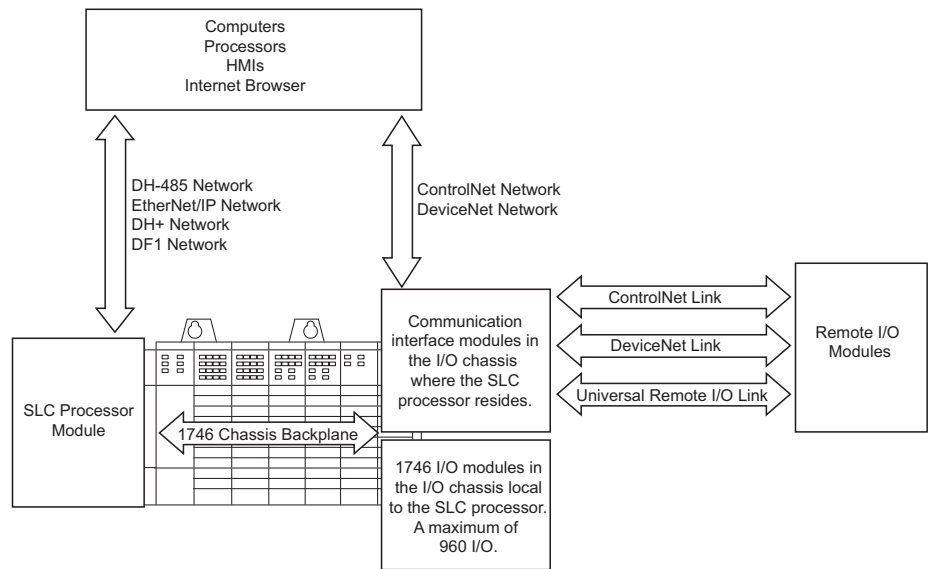


## Laying Out the System

Lay out the system by determining the amount of I/O necessary, the network configurations, and the placement of components in each location. Decide at this time whether each chassis will have it's own controller or a networked solution.

SLC 500 processors are available with a large range of memory sizes (1 K through 64 K) and can control up to 4096 input and 4096 output signals. All modular processors except the SLC 5/01 processor are capable of controlling remotely located I/O. By adding an I/O scanner module, you can use these processors to control/monitor these remotely located I/O across ControlNet, DeviceNet, and Universal Remote I/O links.

SLC 500 processors are single-slot modules that you place into the left-most slot of a 1746 I/O chassis. For I/O in a location remote from the processor, the I/O adapter is a single-slot module that you place in the left-most slot of the I/O chassis. SLC 500 modular systems provide separate power supplies which must be mounted directly on the left end of the 1746 I/O chassis.

The 1746 I/O chassis are designed for back-panel mounting and available in sizes of 4, 7, 10, or 13 module slots. The 1746 I/O modules are available in densities up to a maximum of 32 channels per module.

# Communications

Evaluate what communications need to occur. Knowing your communications requirements will help you determine which processor and which communications devices your application might require.

An SLC processor communicates across the 1746 backplane to 1746 I/O modules in the same chassis in which the processor resides. Various models of SLC processors have various on-board ports for communication with other processors or computers. Also, separate modules are available to provide additional communication ports for communication with other processors, computers, and remotely located I/O.

Each processor has one or two built-in ports for either EtherNet/IP, DH+, DH-485, or RS-232 (DF1, ASCII, or DH-485 protocol) communication.

In addition to the on-board ports available with SLC processors, you have the option of providing another communication port for an SLC processor by adding a communication module.

Adapter modules for 1746 I/O are available for ControlNet and Universal Remote I/O links. An I/O adapter module in a chassis with I/O modules interfaces the I/O modules with the I/O link for communication with a scanner port for a processor at another location.

# SLC 500 Common Specifications

The following specifications apply to all SLC 500 modular components unless noted.

| Description | Specification |
|---|---|
| Temperature | Operating: 0…60 °C (32…140 °F) |
| | Storage: -40…85 °C (-40…185 °F) |
| Humidity | 5…95% without condensation |
| Vibration | Operating: 1.0 g at 5…2000 Hz |
| | Non-operating: 2.5 g at 5…2000 Hz |
| Shock | Operating: 30 g (3 pulses, 11 ms) - for all modules except relay contact |
| | Operating: 10 g (3 pulses, 11 ms) - for relay contact modules 1746-OWx and 1746-IOx combo |
| | Non-operating: 50 g, 3 pulses, 11 ms |
| Free fall (drop test) | Portable, 2.268 kg (5 lb) or less at 0.762 m (30 in.), six drops |
| | Portable, 2.268 kg (5 lb) or less at 0.1016 m (4 in.), three flat drops |
| Safety | Dielectric Withstand: 1500V ac (Industry Standard - UL 508, CSA C22.2 No. 142) |
| | Isolation between Communication Circuits: 500V dc |
| | Isolation between Backplane and I/O: 1500V ac |
| | Flammability and Electrical Ignition: UL94V-0 |
| Certification✲ (when product or packaging is marked) | UL Listed Industrial Control Equipment for Class I, Division 2, Groups A, B, C, D Hazardous Locations |
| | C-UL Listed Industrial Control Equipment for Class I, Division 2, Groups A, B, C, D Hazardous Locations |
| | CE, European Union 89/336/EEC EMC Directive, compliant with: EN50082-2 Industrial Immunity EN50081-2 Industrial Emissions or EN61000-6-2 Industrial Immunity EN61000-6-4 Industrial Emissions European Union 73/23/EEC LVD Directive, compliant with safety-related portions of: EN61131-2 Programmable Controllers |
| | C-Tick, Australian Radio Communications Act, compliant with: AS/NZS 2064 Industrial Emissions |

✲ See the Product Certification link at http://ab.com for Declarations of Conformity, Certificates, and other certification details.

# SLC 500 System Selection Checklist

Use the following Checklist as a guide to completing your own system specification.

| ✓ | Step | See |
|---|---|---|
| | **1**      **Select I/O Modules** | page 8 |
| | • consider using an interface module or pre-wired 1492 cables | page 33 |
| | • use a spreadsheet to record your selections | page 85 |
| | **2**      **Select Communication Modules/Devices** | page 39 |
| | • determine your network communication requirements and select the necessary communication modules/devices | page 40 |
| | • include appropriate communication cables | page 58 |
| | • record your module/device selections on the system spreadsheet | page 85 |
| | **3**      **Select an SLC 500 Processor** | |
| | • choose a processor based on memory, I/O, performance, programming requirements, and communication options | page 59 |
| | **4**      **Select an SLC 500 Chassis** | |
| | • determine the number of chassis and any interconnect cables required based on the physical configuration of your system | page 64 |
| | **5**      **Select an SLC 500 Power Supply** | page 68 |
| | • use the power supply loading worksheet to ensure sufficient power for your system | page 88 |
| | • consider future system expansion when selecting a power supply | |
| | **6**      **Select Programming Software** | |
| | • select the appropriate package of RSLogix 500 Programming Software for your application | page 78 |

# Selecting an SLC 500 Processor

With SLC 500 Modular Hardware Style controllers, you select the processor, power supply, and I/O modules to fit your application. Modular style chassis are available in 4, 7, 10, and 13-slot versions. See Selecting an SLC 500 Chassis on page 64 for details.



SLC 5/01    SLC 5/02    SLC 5/03    SLC 5/04    SLC 5/05

## SLC 5/01

This processor offers a basic set of 51 instructions with the choice of 1K or 4K of memory in a modular hardware configuration. Modular I/O systems that include an SLC 5/01 processor can be configured with a maximum of three chassis (30 total slots) and from 4 I/O points to a maximum of 3940 I/O points.

## SLC 5/02

This processor offers additional complex instructions, enhanced communications, faster scan times than the SLC 5/01, and extensive diagnostics that allow it to function in more complex applications. Modular I/O systems can be configured with a maximum of 3 chassis (30 total slots) and from 4 I/O points to a maximum of 4096 I/O points.

## SLC 5/03

This processor provides 8 K, 16 K, or 32 K of memory. A built-in RS-232 channel gives you the flexibility to connect to external intelligent devices without the need for additional modules. Modular I/O systems can be configured with a maximum of 3 chassis (30 total slots) and from 4 I/O points to a maximum of 4096 I/O points.

## SLC 5/04

The standard DH-485 port has been replaced with a DH+ port, providing high-speed SLC 5/04-to-SLC 5/04 communications and direct connection to PLC-5 controllers. Modular I/O systems can be configured with a maximum of 3 chassis (30 total slots) and from 4 I/O points to a maximum of 4096 I/O points. The available memory options are 16 K, 32 K, or 64 K. In addition, there is an SLC 5/04P option, which is designed specifically for the Plastics Industry and contains ERC2 algorithms for Plastics Machinery Control.

## SLC 5/05

The SLC 5/05 processor provides the same functionality as the SLC 5/04 processor with standard Ethernet communications rather than DH+ communications. Ethernet communication occurs at 10 Mbps or 100 Mbps, providing a high performance network for program upload/download, online editing, and peer-to-peer messaging. Modular I/O systems can be configured with a maximum of 3 chassis (30 total slots) and from 4 I/O points to a maximum of 4096 I/O points.

# Controller Specifications

## SLC 500 Modular Controllers Specifications

| Specification | SLC 5/01 | | SLC 5/02 | SLC 5/03 | | | SLC 5/04 | | | SLC 5/05 ‡ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cat. No. 1747- | L511 | L514 | L524 | L531 | L532 | L533 | L541 | L542 | L543 | L551 | L552 | L553 |
| Memory Size (Words) | 1 K | 4 K | 4 K | 8 K | 16 K | 32 K | 16 K | 32 K | 64 K | 16 K | 32 K | 64 K |
| Backplane Current (mA) at 5V | 90 mA | | | 500 mA | | | 1000 mA | | | 1000 mA | | |
| Backplane Current (mA) at 24V | 0 mA | | | 175 mA | | | 200 mA※ | | | 200 mA | | |
| Digital I/O, Max. | 7880 | | 8192 | | | | | | | | | |
| Max. Local Chassis/Slots | 3/30 | | | | | | | | | | | |
| On-Board Communications | DH-485 Slave | | DH-485 | DH-485 and RS-232 | | | DH+ and RS-232 | | | Ethernet and RS-232 | | |
| Optional Memory Module | EEPROM | | | flash EEPROM | | | | | | | | |
| Programming | RSLogix 500 | | | | | | | | | | | |
| Programming Instructions | 52 | | 71 | 107 | | | | | | | | |
| Typical Scan Time ✳ | 8 ms/K | | 4.8 ms/K | 1 ms/K | | | 0.9 ms/K | | | | | |
| Program Scan Hold-up Time After Loss of Power | 20 ms…3 s (dependent on power supply loading) | | | | | | | | | | | |
| Bit Execution (XIC) | 4 µs | | 2.4 µs | 0.44 µs | | | 0.37 µs | | | | | |
| Clock/Calendar Accuracy | N/A | | | ±54 seconds/month @ 25 °C (77 °F) ±81 seconds/month @ 60 °C (140°F) | | | | | | | | |

✳ The scan times are typical for a 1K ladder logic program consisting of simple ladder logic and communication servicing. Actual scan times depend on your program size, instructions used, and the communication protocol.

※ SLC 5/04 processors manufactured prior to April 2002 draw 200 mA @ 24V dc. Check the label to verify your processor's current draw.

‡ The 5/05 Series C processors can communicate to 100 Mbps and support increased connections: 1747-L551 = 32 connections; 1747-L552 = 48 connections; 1747-L553 = 64 connections.

# SLC 500 Programming Instruction Set

The following table shows the SLC 500 instruction set listed within their functional groups.

### SLC Programming Instruction Set

| Functional Group | Description | Instruction(s) | SLC 5/01 | SLC 5/02 | SLC 5/03 | SLC 5/04 | SLC 5/05 |
|---|---|---|---|---|---|---|---|
| Bit | monitor and control status of bits | XIC, XIO, OTE, OTL, OTU, OSR | ✓ | ✓ | ✓ | ✓ | ✓ |
| Timer and Counter | control operations based on time or number of events | TON, TOF, TU, CTD, RTO, RES, RHC, TDF | ✓ | ✓ | ✓ | ✓ | ✓ |
| Compare | compare values using an expression or specific compare instruction | EQU, NEQ, LES, LEQ, GRT, GEQ, MEQ | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | LIM | | ✓ | ✓ | ✓ | ✓ |
| Compute | evaluate arithmetic operations using an expression or specific arithmetic instruction | ADD, SUB, MUL, DIV, DDV, CLR, NEG | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | SQR, SCL | | ✓ | ✓ | ✓ | ✓ |
| | | SCP, ABS, CPT, SWP, ASN, ACS, ATN, COS, LN, LOG, SIN, TAN, XPY, RMP | | | ✓ | ✓ | ✓ |
| Logical | perform logical operations on bits | AND, OR, XOR, NOT | ✓ | ✓ | ✓ | ✓ | ✓ |
| Conversion | perform conversion between integer and BCD values, and radian and degree values | TOD, FRD, DCD | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | DEG, RAD, ENC | | | ✓ | ✓ | ✓ |
| Move | move and modify bits | MOV, MVM, RPC | ✓ | ✓ | ✓ | ✓ | ✓ |
| File | perform operations of file data | COP, FLL, BSL, BSR | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | FFL, FFU, LFL, LFU, FBC, DDT | | ✓ | ✓ | ✓ | ✓ |
| Sequencer | monitor consistent and repeatable operations | SQO, SQC | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | SQL | | ✓ | ✓ | ✓ | ✓ |
| Program Control | change the flow of ladder program execution | JMP, LBL, JSR, SBR, RET, MCR, TND, SUS, IIM, IOM, END | ✓ | ✓ | ✓ | ✓ | ✓ |
| | | REF | | ✓ | ✓ | ✓ | ✓ |
| User Interrupt | interrupt your program based on defined events | STD, STE, STS, IID, IIE, RPI, INT | | ✓ | ✓ | ✓ | ✓ |
| Process Control | close-looped control | PID | | ✓ | ✓ | ✓ | ✓ |
| Communications | read or write data to another station | MSG, SVC, BTR, BTW, CEM, DEM, EEM (SLC 5/05 only) | | ✓ | ✓ | ✓ | ✓ |
| ASCII | read, write, compare, convert ASCII strings | ABL, ACB, ACI, ACL, ACN, AEX, AHL, AIC, ARD, ARL, ASC, ASR, AWA, AWT | | | ✓ | ✓ | ✓ |

# Controller Accessories

## Memory Modules

These optional memory modules provide non-volatile memory in convenient modular form. The modules plug into a socket on the processor.

### Memory Module Specifications

| Cat. No. | Description |
|---|---|
| 1747-M1 | 1 K, EEPROM Memory Module for SLC 5/01 Processors |
| 1747-M2 | 4 K, EEPROM Memory Module for SLC 5/01 and SLC 5/02 Processors |
| 1747-M13 | 64 K, Flash EPROM Memory Module for SLC 5/03, SLC 5/04, and SLC 5/05 Series C (or later) OS Firmware only |

## Adapter Sockets

Adapter sockets are required when using commercial PROM programmers to program and erase memory modules. The memory module fits into the adapter socket, and then the adapter socket fits into the zero insertion force (ZIF) socket on the PROM burner.

### Adapter Socket Descriptions

| Cat. No. | Description |
|---|---|
| 1747-M5 | SLC 5/01 and SLC 5/02 Adapter Socket - Five Sockets Per Package |
| 1747-M15 | SLC 5/03, SLC 5/04, and SLC 5/05  Adapter Socket for 1747-M13 |

## Program Storage Device

The 1747-PSD simplifies PLC program development, backup and upgrade shipping issues for SLC 5/03 and higher processors, as well as MicroLogix controllers. The PSD allows you to:

- upload and download to your industrial programming station using RSLogix 500 software.

- back up PLC programs without using a computer or programming software.

- make multiple copies of an installed program.

Before downloading a program, the PSD performs error-checking to ensure that the program is compatible with the target PLC. It also provides automatic baud rate detection, CRC or BCC error detection, and connection via a standard RS-232, 9-pin, D-shell connector. Stored programs are retained in Flash EPROM memory even if the batteries or the power supply fails.

### Program Storage Device Specifications

| Cat. No. | 1747-PSD |
|---|---|
| Compatible Controllers | SLC 5/03 and higher, MicroLogix 1000, 1100, 1200, and 1500 |
| Memory Size | 64K words maximum |
| Memory Type | Flash EPROM |
| Operating Power | (2) AAA batteries, or power supply (7…30V dc, 250 mA max) |
| Compatible Cables | 1747-CP3 and 1761-CBL-PM02 (not included) |

## Upgrade Kits

SLC 500 OS upgrade kits allow you to access the latest functional enhancements for your existing controller.

SLC 500 Upgrade Kit Descriptions

| Cat. No. | Description |
| --- | --- |
| 1747-OS302 | SLC 5/03 Upgrade Kit – includes 5 upgrade labels |
| 1747-OS401 | SLC 5/04 Upgrade Kit – includes 5 upgrade labels |
| 1747-DU501 | SLC 5/05 Flash Upgrade Kit – includes CD, instructions, and 5 upgrade labels |
| 1747-RL302 | SLC 5/03 Upgrade Kit Labels – includes 10 labels |
| 1747-RL401 | SLC 5/04 Upgrade Kit Labels – includes 10 labels |
| 1747-RL501 | SLC 5/05 Upgrade Kit Labels – includes 10 labels |

# 1747-BA Lithium Battery Assembly

Backup power for RAM is provided by a replaceable lithium battery. The lithium battery provides backup for approximately five years for the 1747-L511 and two years for the 1747-L514. It provides backup for approximately two years for SLC 5/02, 5/03, 5/04, and SLC 5/05, as well. A battery LED on the processor alerts you when the battery voltage is low.
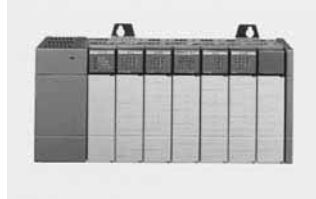
**Step 4 - Select:**

- *chassis with sufficient slots (consider possible expansion)*
- *card slot fillers for open slots*
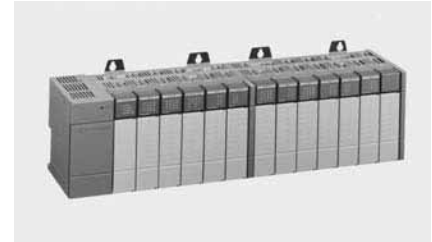- *interconnect cables*

# Selecting an SLC 500 Chassis
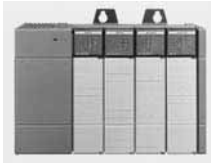


*4-Slot Chassis*



*7-Slot Chassis*



*13-Slot Chassis*

SLC modular chassis provide flexibility in system configuration. Four chassis sizes are available to suit your application needs. Choose from 4-slot, 7-slot, 10-slot, and 13-slot chassis based on your modular hardware component requirements. The SLC 1746 modular chassis houses the processor or I/O adapter module and the I/O modules.

Each chassis requires its own power supply, which mounts on the left side of the chassis. A maximum of 3 chassis can be connected with chassis interconnect cables (not included). If an interconnect cable is required, select a chassis interconnect cable from the following table.

**Chassis and Cable Descriptions**

| Cat. No. | Description |
|----------|-------------|
| 1746-A4 | 4-Slot Chassis |
| 1746-A7 | 7-Slot Chassis |
| 1746-A10 | 10-Slot Chassis |
| 1746-A13 | 13-Slot Chassis |
| 1746-C7 | Chassis Interconnect Cable – ribbon cable used when linking modular style chassis up to 152.4 mm (6 in.) apart in an enclosure. |
| 1746-C9 | Chassis Interconnect Cable – used when linking modular style chassis from 152.4 mm (6 in.) up to 914.4 mm (36 in.) apart in an enclosure. |
| 1746-C16 | Chassis Interconnect Cable – used when linking modular style chassis from 0.914 m (36 in.) up to 1.27 m (50 in.) apart in an enclosure. |

## 1746-N2 Card Slot Filler

Use the 1746-N2 card slot filler to protect unused slots in the chassis from dust and debris.