



Allen-Bradley

SLC 500 Modular Hardware Style

Catalog Numbers

**1747-L511, 1747-L514, 1747-L524,
1747-L531, 1747-L532, 1747-L533,
1747-L541, 1747-L542, 1747-L543,
1747-L551, 1747-L552, 1747-L553**

User Manual

**Rockwell
Automation**

Preface

Who Should Use This Manual.....	13
Purpose of This Manual.....	13
Additional Resources.....	14
Common Techniques Used in This Manual.....	14

Chapter 1

Quick Start for Experienced Users

Required Tools and Equipment.....	16
Procedures.....	16

Chapter 2

Selecting Your Hardware Components

European Union Directive Compliance.....	28
EMC Directive.....	28
Low Voltage Directive.....	28
Overview of Your Modular Control System.....	29
Principles of Machine Control.....	30
Selecting Modular Processors.....	31
Processor Features.....	31
Processor Communication Options.....	32
Selecting Discrete I/O Modules.....	36
Selecting Specialty I/O Modules.....	36
Selecting Power Supplies.....	36
1746-P7 Current Capacity.....	37
Example for Selecting Power Supplies.....	37
Example Worksheet for Selecting a 1746 Power Supply.....	38
Selecting Enclosures.....	40
Selecting Operator Interfaces.....	40
Programming with a Personal Computer.....	40
AIC+ Advanced Interface Converter (1761-NET-AIC).....	40
1747-PIC RS-232/DH485 Interface Converter.....	40
1747-UIC USB to DH485 Interface Converter.....	41
Monitoring with a Data Table Access Module.....	41
Monitoring with a PanelView or PanelView Plus Operator Terminal.....	41
Selecting a Memory Module for the SLC 5/01 and SLC 5/02 Processors.....	42
EEPROM Memory Modules.....	42
Memory Backup for the 1747-L511, SLC 5/01 Processor.....	43
Selecting a Memory Module for SLC 5/03, SLC 5/04, and SLC 5/05 Processors.....	43
EEPROM Burning Options.....	44
Selecting Isolation Transformers.....	46
Special Considerations.....	47
Class I, Division 2 Applications.....	47
Selecting Contact Protection.....	50

**System Installation
Recommendations****Chapter 3**

System Overview	56
Environment and Enclosure	56
Hazardous Location Considerations	57
Typical Installation	58
Spacing Your Controller	58
Preventing Excessive Heat	60
Grounding Guidelines	61
Connect Equipment Grounding Conductor to Ground Bus	61
Connect Ground Bus to Grounding-Electrode System	62
Special Grounding Considerations for dc Applications using 1746-P3 (previous to revision B)	64
Determining the Date of the SLC 500 Series A Chassis	66
Master Control Relay	66
Emergency-Stop Switches	67
Power Considerations	68
Common Power Source	68
Isolation Transformer	68
Grounded ac Power-Distribution System with Master-Control Relay	69
Power Supply Required Input Voltage Characteristics	69
Loss of Power Source	70
Input States on Power Down	70
Power Supply Undervoltage Operation	70
SLC 500 Operation with 24V dc User Power Overcurrent Condition	71
Safety Considerations	72
Disconnecting Main Power	72
Safety Circuits	72
Power Distribution	72
Periodic Tests of Master Control Relay Circuit	72
Preventive Maintenance	73

Chapter 4**Mounting Your SLC 500 Control
System**

Mounting Modular Hardware Style Units	75
4-slot Modular Chassis	75
7-slot Modular Chassis	76
10-slot Modular Chassis	76
13-slot Modular Chassis	77
Link Coupler (AIC)	78
Data Table Access Module (DTAM, DTAM Plus, and DTAM Micro)	79
AIC+ Advanced Interface Converter (1761-NET-AIC)	
DeviceNet Interface (1761-NET-DNI)	
Ethernet Interface (1761-NET-ENI)	80

Identifying the Components of Your Processor	Chapter 5 SLC 5/01 Processor Hardware Features. 81 SLC 5/02 Processor Hardware Features. 83 SLC 5/03 Processor Hardware Features. 86 SLC 5/04 Processor Hardware Features. 89 SLC 5/05 Processor Hardware Features. 92 Keyswitch for the SLC 5/03, SLC 5/04, and SLC 5/05 Processors. . 95 RUN Position. 95 PROG Position 95 REM Position. 96
Installing Your Hardware Components	Chapter 6 Compliance to European Union Directives 97 EMC Directive. 97 Low Voltage Directive. 98 Install Your Chassis 98 Installing Your Processor. 101 Install Modules. 102 Install Your Memory Module 103 Remove the Memory Module 104 Install Your Power Supply. 104 Install Your Chassis Interconnect Cable. 108
Wiring Your I/O Modules	Chapter 7 Defining Sinking and Sourcing 111 Contact Output Circuits — ac or dc. 112 Solid-State dc I/O Circuits 112 Preparing Your Wiring Layout 114 Recommendations for Wiring I/O Devices. 115 Features of an I/O Module 116 Wiring Your I/O Module 116 Octal Label Kit Installation 117 Apply the Octal Filter Label 117 Apply the Octal Door Label 117 Octal Kit and I/O Module Information. 118 Using the Removable Terminal Block (RTB). 119 Remove the RTB 119 Install the RTB. 120
Starting Up Your Control System	Chapter 8 Procedures for Starting the Control System 121 1. Inspect Your Installation 122 2. Disconnect Motion-Causing Device 122 3. Initialize and Test Your Processor 123 4. Test Your Inputs 125

Read this preface to familiarize yourself with the rest of the manual. It provides information concerning:

- who should use this manual.
- the purpose of this manual.
- related documentation.
- conventions used in this manual.

Who Should Use This Manual

Use this manual if you are responsible for designing, installing, programming, or troubleshooting control systems that use SLC 500 programmable controllers.

You must have a basic understanding of electrical circuitry and familiarity with relay logic.

Purpose of This Manual

This manual describes the procedures you use to install, wire, and troubleshoot your controller. This manual:

- explains how to install and wire your controllers.
- gives you an overview of the SLC 500 programmable controller system.

Refer to the SLC 500 Instruction Set reference manual, publication 1747-RM001, for the SLC 500 instruction set and for application examples to show the instruction set in use. Refer to your programming software user documentation for more information on programming your SLC 500 programmable controller.

Quick Start for Experienced Users

This chapter can help you to get started using the SLC 500 Modular Processors. We base the procedures here on the assumption that you have an understanding of SLC 500 products. You should understand electronic process control and be able to interpret the ladder logic instructions required to generate the electronic signals that control your application.

Because it is a start-up guide for experienced users, this chapter does not contain detailed explanations about the procedures listed. It does, however, reference other chapters in this book where you can get more information.

If you have any questions or are unfamiliar with the terms used or concepts presented in the procedural steps, always read the referenced chapters and other recommended documentation before trying to apply the information.

This chapter:

- tells you what tools and equipment you need.
- lists how to install your chassis.
- lists how to install and wire your power supply.
- lists how to install and apply power to your processor.
- lists how to establish communication with the processor.
- describes how to return the SLC 5/03, SLC 5/04, and SLC 5/05 processors to initial factory conditions if required.

Required Tools and Equipment

Have the following tools and equipment ready:

- Medium blade screwdriver
- Programming equipment
- Compatible communication cable and/or interface (The table below indicates with an X, which cables are compatible with the SLC 5/01 through 5/05 processors.)

Network Interface	Processor				
	SLC 5/01	SLC 5/02	SLC 5/03	SLC 5/04	SLC 5/05
1747-UIC	X ⁽¹⁾	X ⁽¹⁾	X ⁽¹⁾⁽⁴⁾	X ⁽⁴⁾	X ⁽⁴⁾
1747-PIC	X	X	X		
1747-CP3			X	X	X
1784-PKTX(D)	X ⁽²⁾	X ⁽²⁾	X ⁽²⁾	X	
1784-PCMK	X ⁽³⁾	X ⁽³⁾	X ⁽³⁾	X ⁽⁵⁾	
10/100Base-T Ethernet					X

⁽¹⁾ Requires 1747-C13 cable.

⁽²⁾ Requires 1784-CP14 cable.

⁽³⁾ Requires 1784-PCM4 cable.

⁽⁴⁾ Requires 1747-CP3 cable.

⁽⁵⁾ Requires 1784-PCM6 cable.

Procedures

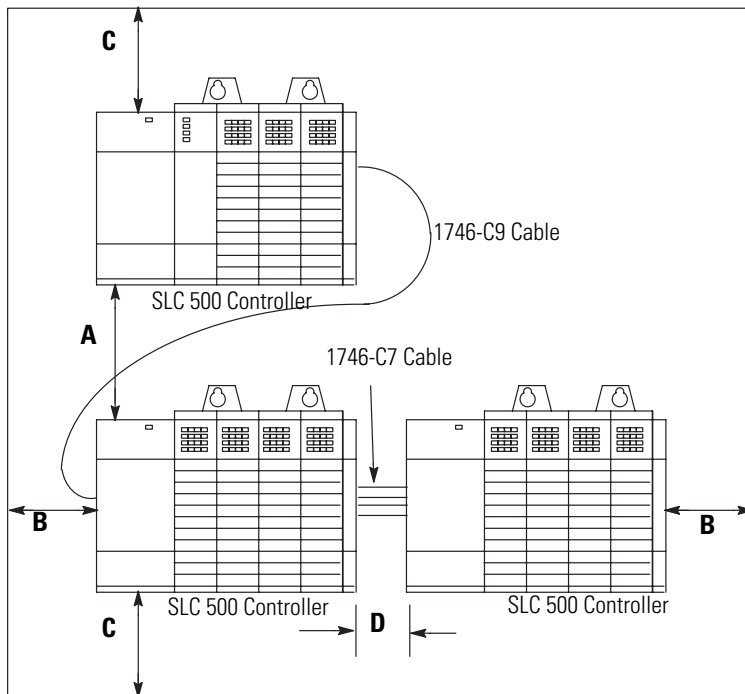
1.	Check the contents of the shipping box.	Reference
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Unpack the shipping boxes making sure that the contents include:

- SLC 500 modular processor
 - installation instructions (publication 1747-IN009)
- SLC 500 modular chassis (catalog numbers 1746-A4, 1746-A7, 1746-A10, or 1746-A13)
 - installation instructions (publication 1746-IN016)
- SLC 500 modular power supplies (catalog numbers 1746-P1, 1746-P2, 1746-P3, 1746-P4, 1746-P5, 1746-P6, or 1746-P7)
 - installation instructions (publication 1746-IN004)

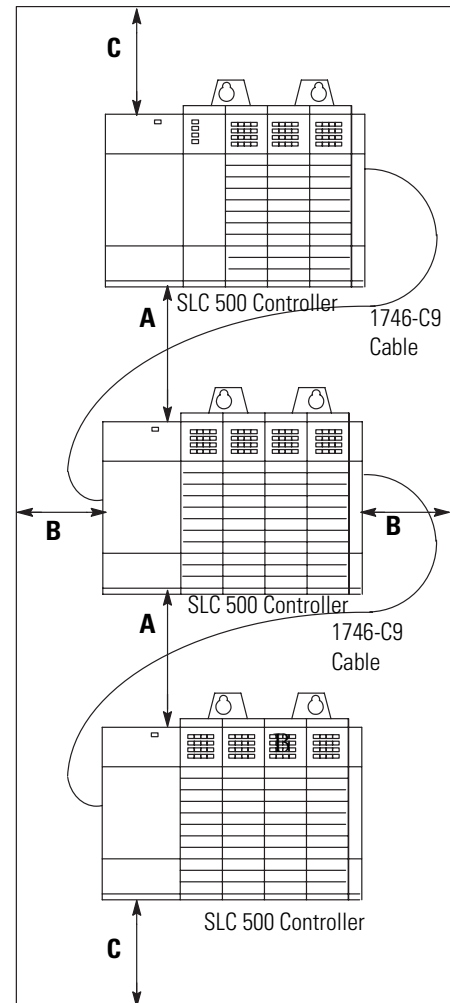
If the contents are incomplete, call your local Rockwell Automation representative for assistance.

2.	Install the chassis.	Reference
	1. Determine the amount of spacing required for mounting your system.	Chapter 3 (System Installation Recommendations)



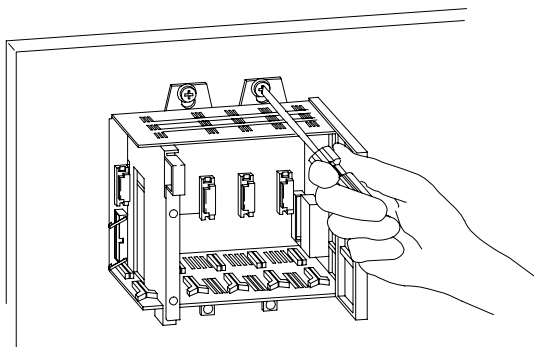
Recommended Spacing

- A.** 15.3...20.0 cm (6...8 in.) when using the 1746-C9 cable. If you mount two 13-slot chassis above each other, the distance cannot exceed 10.2...12.7 cm (4...5 in.).
- B.** Greater than 10.2 cm (4 in.).
- C.** Greater than 15.3 cm (6 in.).
- D.** 6.35...10.2 cm (2.5...4 in.) when using the 1746-C7 cable. If you are using a 1746-P4 power supply, your maximum spacing is 6.35 cm (2.5 in.).



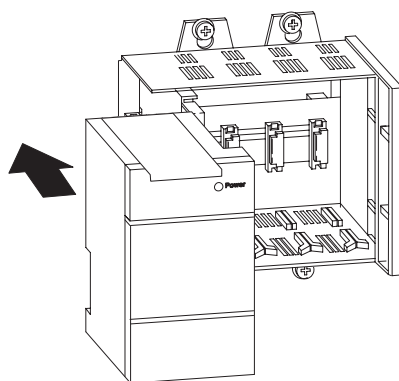
2. Drill holes in the backpanel of your enclosure and install the top mounting hardware. Use M4 or M5 (#10 or #12) phillips screw and star washer (or SEM screw).
3. Scrape off the paint from the backpanel between the chassis and backpanel.
4. Slide the chassis over the installed hardware and tighten the screws.

Chapter 6
(Installing Your
Hardware Components)

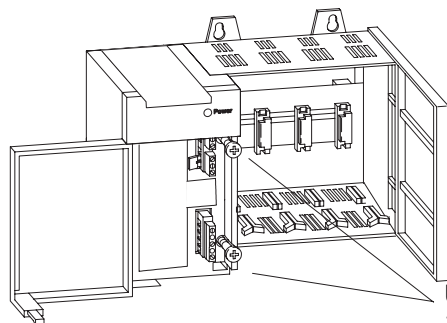


5. Install the remaining tab hardware.

3.	Install the power supply.	Reference
	<ol style="list-style-type: none"> 1. Align the circuit board of the power supply with the card guides on the left side of the chassis, and slide the power supply in until it is flush with the chassis. 	<p>Chapter 6 (Installing Your Hardware Components)</p>



2. Fasten the power supply to the chassis.



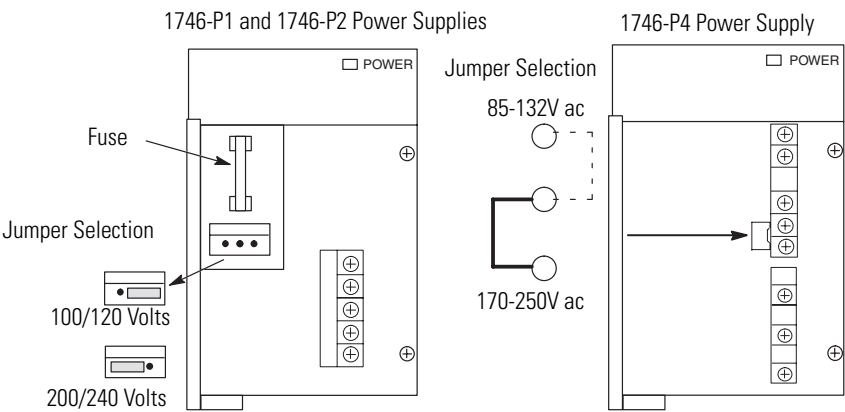
Use these screws to fasten the power supply to the chassis.
1.2 Nm (11 lb-in) Maximum Torque

4.	Make jumper selection for 120/240V ac on 1746-P1, 1746-P2, and 1746-P4 power supplies.	Reference
Place the input voltage jumper to match the input voltage. This does not apply to the 1746-P3, 1746-P5, 1746-P6, or 1746-P7 power supplies which do not have jumpers.		Chapter 6 (Installing Your Hardware Components)

ATTENTION



Set the input jumper before applying power. Hazardous voltage is present on exposed pins when power is applied; contact with the pin may cause injury to personnel.



5.	Wire power to the power supply.	Reference
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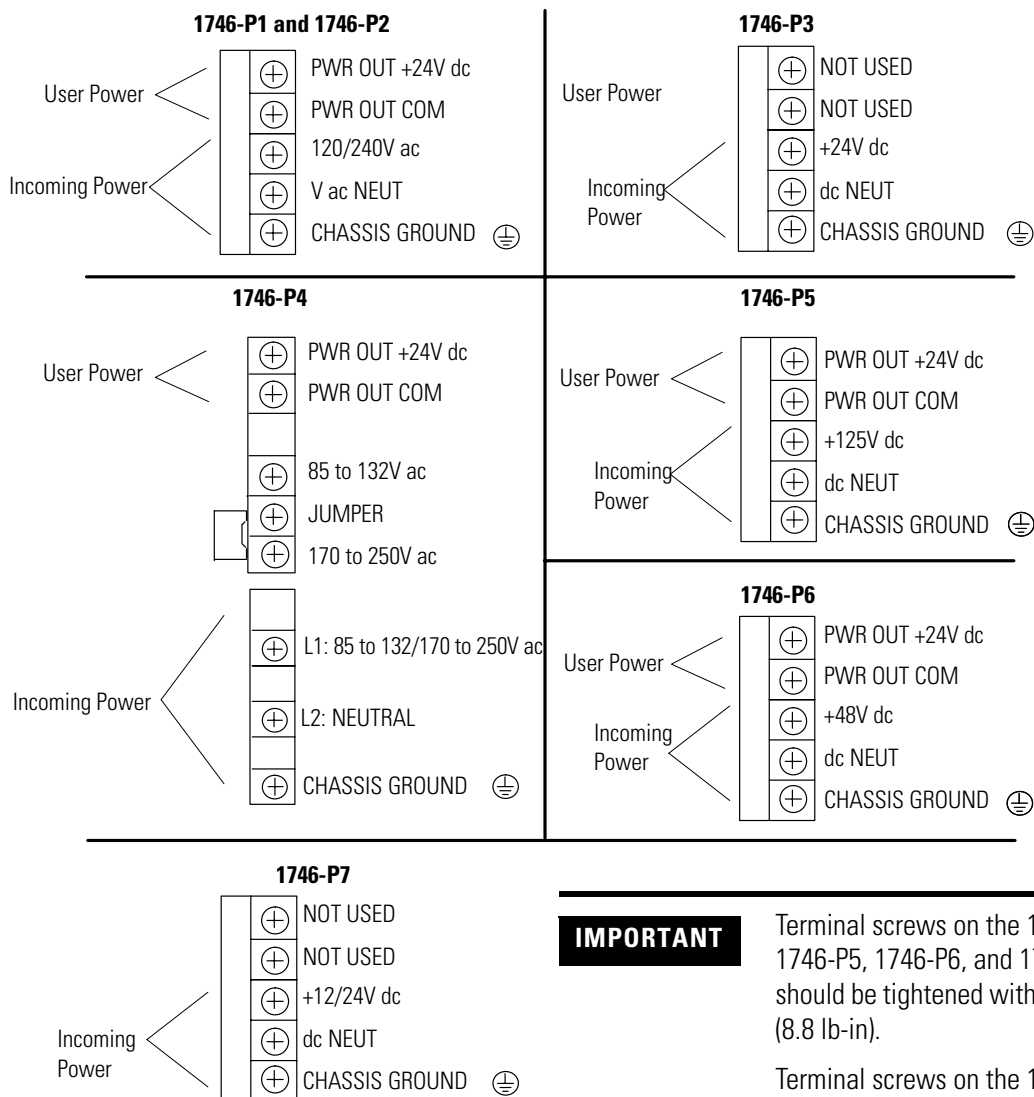
Chapter 6
(Installing Your
Hardware
Components)

ATTENTION



Turn off incoming power before connecting wires. Failure to do so could cause injury to personnel and/or equipment.

Connect incoming power.



IMPORTANT

Terminal screws on the 1746-P1, 1746-P2, 1746-P3, 1746-P5, 1746-P6, and 1746-P7 power supplies should be tightened with a maximum torque of 1 Nm (8.8 lb-in).

Terminal screws on the 1746-P4 power supply should be tightened with a max torque of 0.8 Nm (7 lb-in).

6.	Install the processor.	Reference
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IMPORTANT

If your processor has a battery — the battery is an option for the SLC 5/01 (1747-L511) processor — make sure it is connected before installing your processor into the chassis. This provides memory backup for your processor should the controller power supply fail.

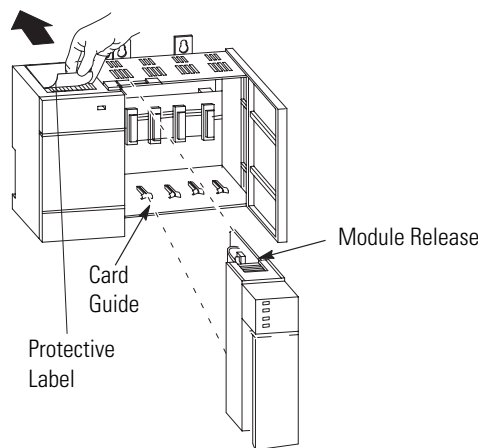
Chapter 2
(Selecting Your
Hardware
Components)

Chapter 6
(Installing Your
Hardware
Components)

Make sure system power is off. Then insert the processor into the 1746 chassis.

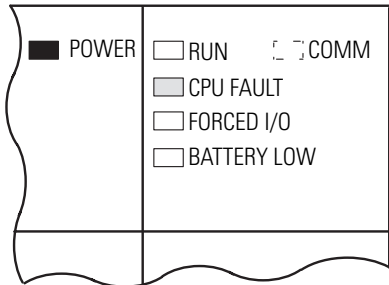
IMPORTANT

The SLC 500 modular processor must be inserted into the left slot (slot 0), as shown below. Remove the protective label on the power supply after installing the processor.



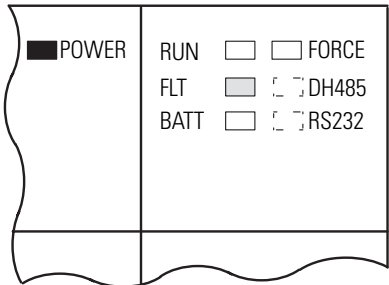
7.	Apply power to the processor.	Reference
1.	Energize the chassis power supply.	Chapter 8 (Starting Up Your Control System) Chapter 10 (Troubleshooting)
2.	Check the chassis power supply and processor status indicators. The power status indicator on the power supply should be on and the fault status indicator on the processor should be flashing.	

Power supply and SLC 5/01 and SLC 5/02 processor status indicators



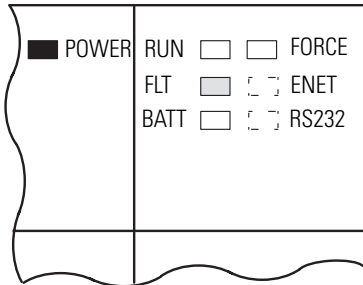
The RUN status indicator on the SLC 5/01 processor is actually labeled PC RUN. Also, the SLC 5/01 processor does not have a COMM status indicator.

Power supply and SLC 5/03 and SLC 5/04 processor status indicators



The DH485 status indicator on the SLC 5/03 processor is labeled DH+ on the SLC 5/04 processor.

Power supply and SLC 5/05 processor status indicators



Refer to the following key to determine the status of the status indicators:

- Indicates the status indicator is off.
- Indicates the status indicator is on.
- Indicates the status indicator is FLASHING.
- Status of status indicator does not matter.

8.	Load your software.	Reference
Refer to your software package's documentation.		—

9.	Establish communication to the processor.	Reference
	Refer to the following to establish communication between the processor and your personal computer.	Chapter 8 (Starting Up Your Control System)

Processor	Procedure
SLC 5/01	Connect 1747-PIC interface from the processor to your personal computer serial port or connect 1747-UIC interface from the processor to your personal computer USB port, or use a 1784-PKTX(D) or 1784-PMCK interface.
SLC 5/02	Connect 1747-PIC interface from the processor to your personal computer serial port or connect 1747-UIC interface from the processor to your personal computer USB port, or use a 1784-PKTX(D) or 1784-PMCK interface.
SLC 5/03	Connect the 1747-PIC interface from the processor to your personal computer serial port or connect the 1747-UIC interface from the processor to your personal computer USB port to the processor by using the 1747-C13 or 1747-CP3 cable. You can also use a 1784-PKTX(D) or 1784-PCMK interface, or a 1747-CP3 cable from channel 0 of the processor to the personal computer serial port.
SLC 5/04	Connect a 1747-CP3 cable from channel 0 of the processor to the personal computer serial port or connect the 1747-UIC interface from channel 0 of the processor to your personal computer USB port, or use a 1784-PKTX(D) or 1784-PCMK interface.
SLC 5/05	Connect a 1747-CP3 cable from channel 0 of the processor to the personal computer serial port, or connect the 1747-UIC interface converter from channel 0 of the processor to your personal computer USB port. For Ethernet connection, connect channel 1 of the processor and the PC Ethernet card to an Ethernet hub by using 10/100Base-T compatible cable. ⁽¹⁾

⁽¹⁾ EtherNet/IP address must first be set via BOOTP or an RS-232 connection. See appendix C for more information.

Set the communication parameters of software to match the default parameters of the processor.

Comms Channel	Channel 0 Configuration	Channel 1 Configuration		
SLC 5/01 and 5/02	SLC 5/03, 5/04, and 5/05	SLC 5/03	SLC 5/04	SLC 5/05
DH-485: <ul style="list-style-type: none"> 19.2 Kbaud node address = 1 	DF1 Full-duplex: <ul style="list-style-type: none"> no handshaking 19.2 Kbaud CRC Error Check duplicate packet, detect on no parity 	DH-485: <ul style="list-style-type: none"> 19.2 Kbaud node address = 1 	DH+: <ul style="list-style-type: none"> 57.6 Kbaud node address = 1 	Ethernet: BOOTP enabled

10.	(Optional) Return the SLC 5/03, SLC 5/04, or SLC 5/05 processor to initial factory conditions.	Reference
	Use this procedure if the communication channels are shut down due to configuration parameters, or if you absolutely cannot establish communication with the processor.	Chapter 10 (Troubleshooting)

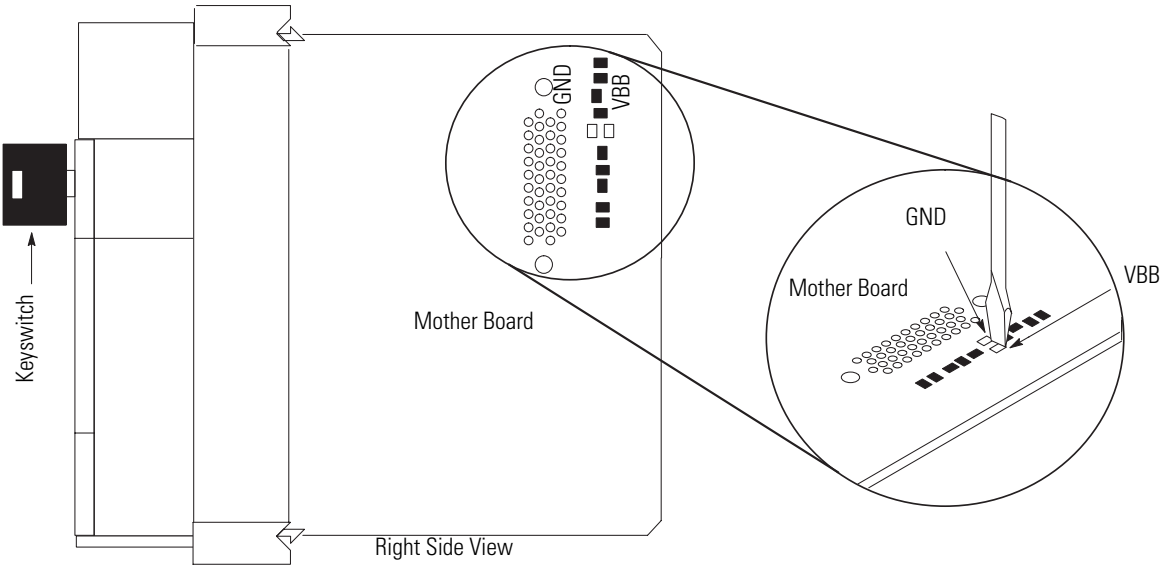
ATTENTION



If you return the processor to the initial factory conditions, the communication configurations are returned to their default settings and the user program is cleared.

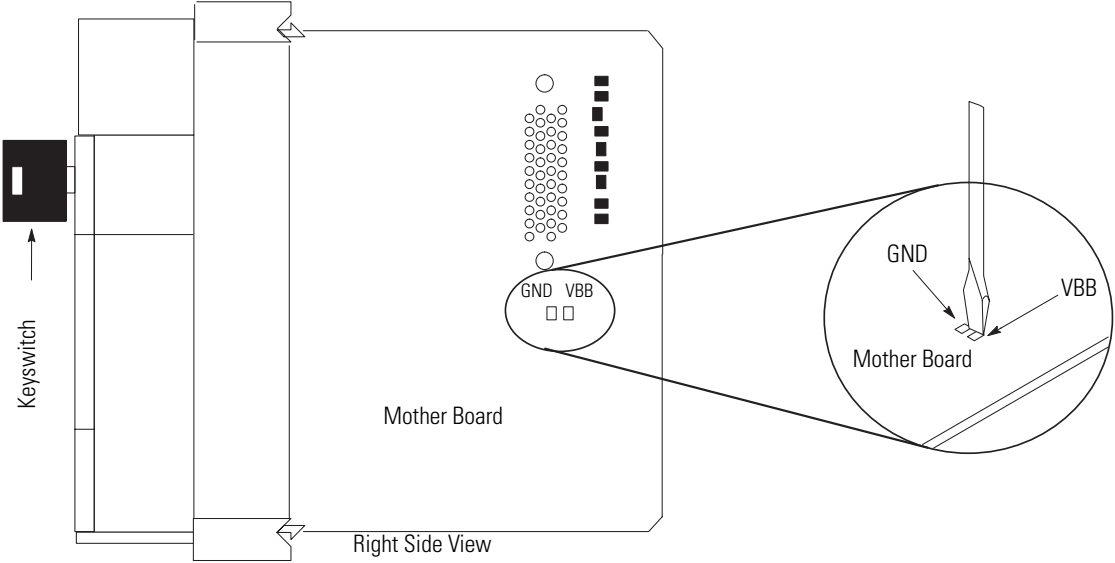
1. Remove power from the SLC 500 power supply.
2. Remove the processor from the chassis.
3. Disconnect the battery by removing the battery connector from its socket.
4. Locate the VBB and GND connections on the right side of the motherboard.
5. Place a small bladed screwdriver across the VBB and GND connections and hold for 60 seconds. This returns the processor to the initial factory conditions.

SLC 5/03 Processors (1747-L531, 1747-L532, and 1747-L533)



SLC 5/04 Processors (1747-L541, 1747-L542, and 1747-L543)

SLC 5/05 Processors (1747-L551, 1747-L552, and 1747-L553)



Selecting Your Hardware Components

This chapter provides general information on what your SLC 500 controller can do, an overview of the modular control system, and special considerations for controller installations. It also explains how to select:

- chassis.
- modular processors.
- discrete I/O modules.
- specialty I/O modules.
- power supplies.
- enclosures.
- operator interfaces.
- memory modules.
- isolation transformers.

This chapter does not provide you with all the information that you need to select a complete SLC 500 control system. To do this, we recommend that you use the latest version of the system overview, SLC 500 Programmable Controllers and I/O Modules, publication 1747-SG001.

European Union Directive Compliance

If this product has the CE mark it is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2
EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2
EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

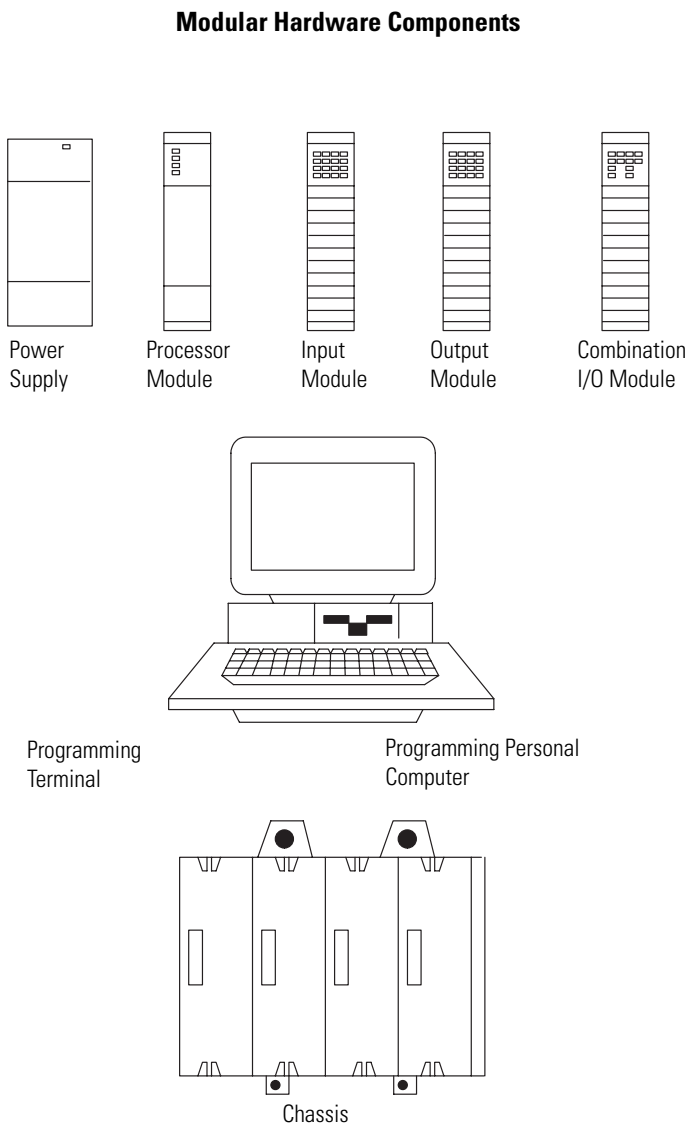
Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 – Equipment Requirements and Tests.

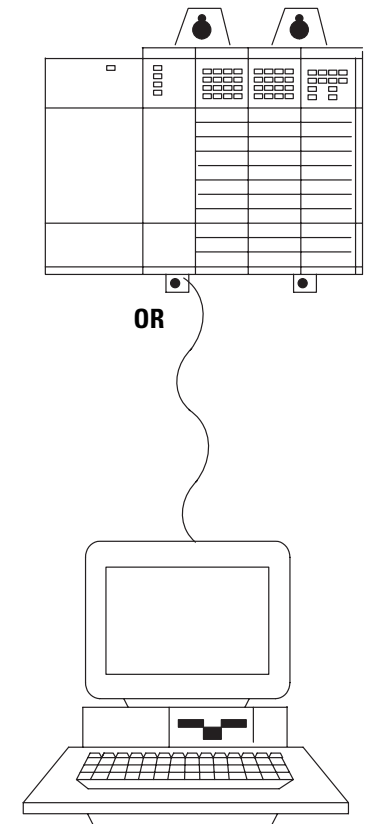
For specific information required by EN61131-2, see the appropriate sections in this publication, as well as the Industrial Automation Wiring and Grounding Guidelines for Noise Immunity, publication 1770-4.1.

Overview of Your Modular Control System

The basic modular controller consists of a chassis, power supply, processor (CPU), Input/Output (I/O modules), and an operator interface device for programming and monitoring. The figure below shows typical hardware components for a modular controller.



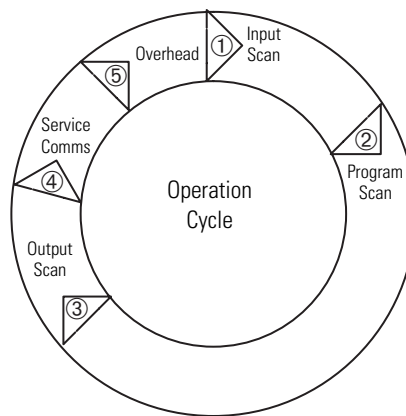
Modular Controller



Principles of Machine Control

You enter a ladder logic program into the controller by using the software. The logic program is based on your electrical relay print diagrams. It contains instructions that direct control of your application.

With the ladder logic program entered into the controller, placing the controller in the Run mode initiates an operating cycle. The controller's operating cycle consists of a series of operations performed sequentially and repeatedly, unless altered by your ladder logic program.



1. Input scan - The time required for the controller to scan and read all input data; typically accomplished within a few milliseconds.
2. Program scan - The time required for the processor to execute the instruction in the program. The program scan time varies depending on the instruction used and each instruction's status during the scan time.

IMPORTANT

Subroutine and interrupt instructions within your logic program may cause deviations in the way the operating cycle is sequenced.

3. Output scan - The time required for the controller to scan and write all output data; typically accomplished within a few milliseconds.
4. Service communication - The part of the operating cycle in which communication takes place with other devices, such as an HHT or a personal computer.
5. Housekeeping and overhead - The time spent on memory.

Selecting Modular Processors

SLC 500 modular processors are designed to meet a wide range of applications, from small stand-alone to large distributed systems and from simple to complex applications.

Processor Features

Memory size - The SLC 500 modular processors memory is user configurable for either data storage or program storage. Memory size is 1 K...64 K.

I/O points - The SLC 5/01 processor supports addressing of up to 3940 I/O. The SLC 5/02, SLC 5/03, SLC 5/04, and SLC 5/05 processors support addressing of 4096 I/O. The SLC 500 modular processors are supported by over 60 different I/O modules including digital, analog, and intelligent I/O.

Performance - The SLC 500 modular processors are designed with throughput performance in mind. The program scan time for a typical instruction mix are 0.9 ms/K...8.0 ms/K depending on the processor. I/O scan times are 0.25 ms...2.6 ms depending on the processor and I/O installed in the system.

Advanced instruction support - The instructions available depends on the processor used. The following table lists the instructions supported by the SLC 500 modular processors.

Instruction Support	SLC 5/01	SLC 5/02	SLC 5/03	SLC 5/04	SLC 5/05
Bit	•	•	•	•	•
Timer and Controller	•	•	•	•	•
Comparison	•	•	•	•	•
Basic Math	•	•	•	•	•
Move, Copy, and Bit Shift	•	•	•	•	•
Sequencer	•	•	•	•	•
Jump and Subroutine	•	•	•	•	•
Messaging		•	•	•	•
STI		•	•	•	•
FIFO/LIFO		•	•	•	•
PID		•	•	•	•
Advanced Math and Trig			•	•	•

Instruction Support	SLC 5/01	SLC 5/02	SLC 5/03	SLC 5/04	SLC 5/05
Indirect Addressing			•	•	•
Floating Point Math			•	•	•
ASCII			•	•	•

Processor Communication Options

The SLC 500 processors support several communication options. The following sections describe the available physical connections and protocol options used by the SLC 500 processors.

Physical Connection Options

Ethernet (10/100Base-T) channel offers:

- 10/100 Mbps communication rate.
- ISO/IEC 8802-3STD 802.3 (RJ45) connector for 10/100Base-T media.
- TCP/IP communication protocol.
- built-in isolation.

Data Highway Plus (DH+) channel offers:

- communication rates of 57.6 Kbaud, 115.2 Kbaud, and 230.4 Kbaud.
- maximum network length of 3048 m (10,000 ft) at 57.6 Kbaud
- Belden 9463 (blue hose) cable connection between nodes (daisy chain connection).
- built-in isolation.

DH-485 channel offers:

- configurable isolation via the 1747-AIC or 1761-NET-AIC interfaces.
- maximum network length of 1219 m (4000 ft).
- RS-485 electrical specifications.
- Belden 9842 or Belden 3106A cable connection between nodes (daisy-chain connection).

RS-232 channel offers:

- communication rates up to 19.2 Kbaud (38.4 Kbaud SLC 5/04 and SLC 5/05 processors).
- maximum distance between devices is 15.24 m (50 ft).

- RS-232C (EIA-232) electrical specifications.
- modem support.
- built-in isolation.

Processor Channel Connections

Processor		Physical Communication Channel			
		DH-485	RS-232	DH+	Ethernet
SLC 5/01 and SLC 5/02		DH-485 protocol	—	—	—
SLC 5/03	channel 0	—	DH-485 ⁽¹⁾ , DF1 full-duplex, DF1 half-duplex master/slave, ASCII, DF1 radio modem, and Modbus RTU Master protocols	—	—
	channel 1	DH-485 protocol	—	—	—
SLC 5/04	channel 0	—	DH-485 ⁽¹⁾ , DF1 full-duplex, DF1 half-duplex master/slave, ASCII, DF1 radio modem, and Modbus RTU Master protocols	—	—
	channel 1	—	—	DH+ protocol	—
SLC 5/05	channel 0	—	DH-485 ⁽¹⁾ , DF1 full-duplex, DF1 half-duplex master/slave, ASCII, DF1 radio modem, and Modbus RTU Master protocols	—	—
	channel 1	—	—	—	EtherNet TCP/IP protocol

⁽¹⁾ An 1761-NET-AIC interface is required when connecting to a DH-485 network.

Protocol Options

EtherNet TCP/IP Protocol - Standard Ethernet, utilizing the TCP/IP protocol, is used as the backbone network in many office and industrial buildings. Ethernet is a local area network that provides communication between various devices at 10/100 Mbps. This network provides the same capabilities as DH+ or DH-485 networks, plus:

- SNMP support for Ethernet network management.
- optional dynamic configuration of IP addresses by using a BOOTP/DHCP utility.
- SLC 5/05 Ethernet data rate up to 40 times faster than SLC 5/04 DH+ messaging.
- ability to message entire SLC 5/05 data files.
- much greater number of nodes on a single network possible compared to DH-485 (32) and DH+ (64).

Data Highway Plus (DH+) Protocol - The Data Highway Plus protocol is used by the PLC-5 family of processors and the SLC 5/04 processor. This protocol is similar to DH-485, except that it can support up to 64 devices (nodes) and runs at faster communication (baud) rates.

DH-485 Protocol - The SLC 500 processors have a DH-485 channel that supports the DH-485 communication network. This network is a multi-master, token-passing network protocol capable of supporting up to 32 devices (nodes). This protocol allows:

- monitoring data and processor status, along with program uploading and downloading of any device on the network from one location.
- SLC processors to pass data to each other (peer-to-peer communication).
- operator interface devices on the network to access data from any SLC processor on the network.

DF1 full-duplex protocol - DF1 full-duplex protocol (also referred to as DF1 point-to-point protocol) lets two devices communicate with each other at the same time. This protocol allows:

- transmission of information across modems (dial-up, leased line, radio, or direct cable connections).
- communication to occur between Allen-Bradley products and third-party products.

DF1 half-duplex protocol (master and slave) - DF1 half-duplex protocol provides a multi-drop single master/multiple slave network capable of supporting up to 255 devices (nodes). This protocol also provides modem support and is ideal for SCADA (Supervisory Control and Data Acquisition) applications because of the network capability.

ASCII protocol - The ASCII protocol provides connection to other ASCII devices, such as bar code readers, weigh scales, serial printers, and other intelligent devices.

DF1 radio modem protocol - The DF1 radio modem protocol, optimized for use with radio modem networks, is a hybrid between DF1 full-duplex protocol and DF1 half-duplex protocol. DF1 radio modem:

- supports Store and Forward capability.
- uses a node address (0...254) on channel 0.

Modbus RTU (Remote Terminal Unit) transmission mode Master protocol - The Modbus RTU Master protocol provides communication between Modbus RTU devices through a multi-drop single-master/multiple-slaves network. This protocol is capable of supporting up to 247 slave devices (nodes).

SLC Communication Options

Communication Protocol	Processor				
	SLC 5/01	SLC 5/02	SLC 5/03	SLC 5/04	SLC 5/05
DH-485 peer-to-peer	receive only	receive and initiate	receive and initiate	—	—
DH-485 via RS232 port	—	—	receive and initiate ⁽⁹⁾	receive and initiate ⁽⁹⁾	receive and initiate ⁽⁹⁾
DF1 via RS232 port (full-duplex or half-duplex master or slave)	receive only ⁽¹⁾	receive only ⁽¹⁾	receive and initiate	receive and initiate	receive and initiate
ASCII via RS232 port	—	—	receive and initiate	receive and initiate	receive and initiate
Data Highway Plus (DH+)	receive only ⁽²⁾	receive only ⁽²⁾	receive and initiate ⁽⁵⁾	receive and initiate	receive and initiate ⁽⁵⁾
Ethernet	—	—	receive and initiate ⁽⁶⁾	receive and initiate ⁽⁶⁾	receive and initiate
DeviceNet	—	receive and initiate ⁽³⁾	receive and initiate ⁽³⁾⁽⁷⁾	receive and initiate ⁽³⁾⁽⁷⁾	receive and initiate ⁽³⁾⁽⁷⁾
ControlNet	—	receive and initiate ⁽⁴⁾	receive and initiate ⁽⁴⁾⁽⁸⁾	receive and initiate ⁽⁴⁾⁽⁸⁾	receive and initiate ⁽⁴⁾⁽⁸⁾
Modbus RTU Master	—	—	initiate only	initiate only	initiate only

⁽¹⁾ A 1747-KE or 1770-KF3 interface is required to bridge from DF1 (full-duplex or half-duplex slave only) to DH485 network.

⁽²⁾ A ControlLogix gateway with a 1746-DHRIO interface and a 1756-DH485 interface is required to bridge from DH+ to DH-485 network.

⁽³⁾ A 1747-SDN module is required for scanning I/O and for explicit messaging on DeviceNet network.

⁽⁴⁾ A 1747-SCNR module is required for scanning I/O and for explicit messaging on ControlNet network.

⁽⁵⁾ The SLC 5/04's channel-to-channel passthru feature may be used to bridge between DH+ and DH-485 network or between DH+ and DF1 full-duplex network (DH+ to DF1 full-duplex passthru available starting with QS401). Another option is to use the 1785-KE interface to bridge between DH+ and DF1 full-duplex or DH+ and DF1 half-duplex master/slave network.

⁽⁶⁾ A 1761-NET-ENI interface is required to bridge from DF1 full-duplex to Ethernet network.

⁽⁷⁾ A 1761-NET-DNI interface is required to bridge from DF1 to DeviceNet network.

⁽⁸⁾ A 1747-KFC15 module or 1770-KFC15 interface is required to bridge from DF1 to ControlNet network.

⁽⁹⁾ If using 1747-AIC interface for isolation, connect to DH-485 network using 1747-PIC interface. If using a 1761-NET-AIC interface for isolation, connect directly to DH-485 network with 1747-CP3 serial cable (or equivalent RS-232 null-modem cable).

TIP

The 1785-KE module requires the use of a 1771 series chassis and power supply.

Selecting Discrete I/O Modules

There are three types of discrete I/O modules: input, output, and combination. They are available in a wide variety of densities including 4, 8, 16, and 32 point and can interface to ac, dc, and TTL voltage levels. Output modules are available with solid-state ac, solid-state dc, and relay contact type outputs.

For a complete listing of discrete I/O modules and specifications, contact your Allen-Bradley sales office for the latest selection guide, publication 1747-SG001.

Selecting Specialty I/O Modules

The SLC 500 family offers specialty I/O modules that enhance your control system. Modules range in function from analog interface to motion control, from communication to high-speed counting.

For a complete listing of specialty I/O modules and their specifications, contact your Allen-Bradley sales office for the latest selection guide, 1747-SG001.

Selecting Power Supplies

To select a power supply, you need:

- power supply specifications.
- power supply worksheet, one for each chassis.
- SLC 500 Systems Selection Guide, publication 1747-SG001.

When configuring a modular system, you must have a power supply for each chassis. Careful system configuration will result in the best performance. Excessive loading of the power supply outputs can cause a power supply shutdown or premature failure.

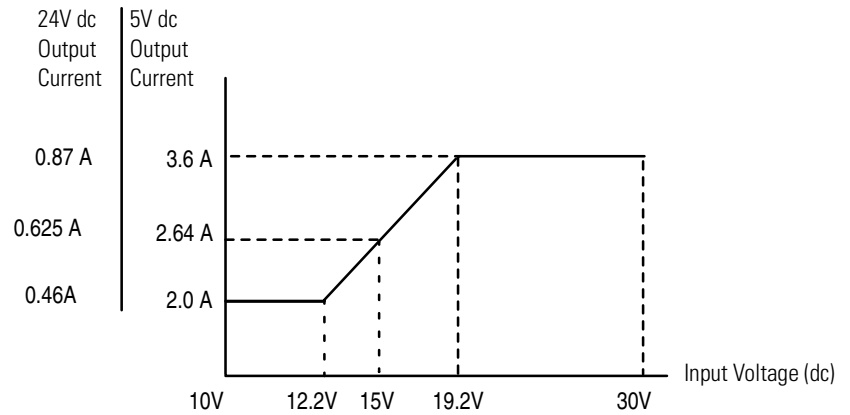
There are three different ac power supplies and four dc power supplies. For ac power supplies, the 120/240V selection is made by a jumper. Place the jumper to match the input voltage.

ATTENTION

Ensure that the power supply jumper is in the correct position before supplying power to the SLC 500 system or personal injury or damage to the system may result.

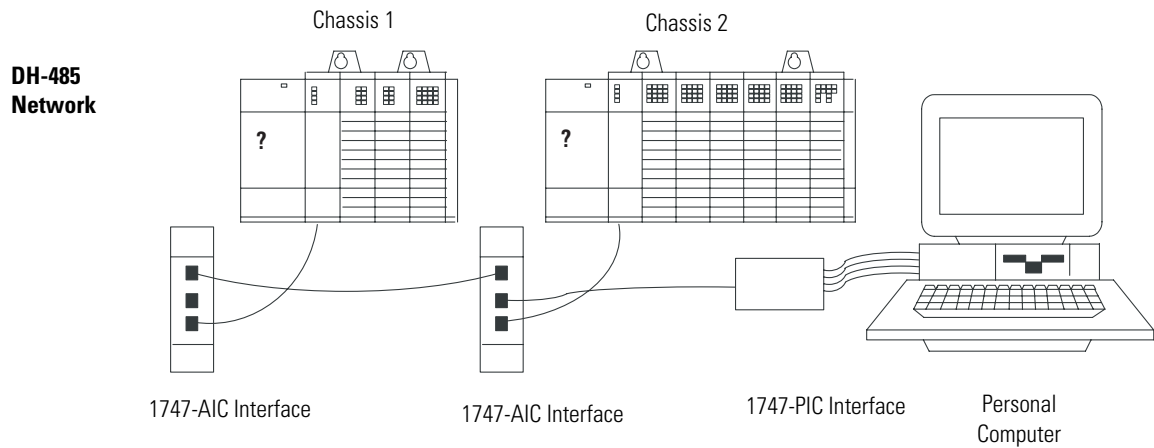
SLC power supplies have an status indicator that illuminates when the power supply is functioning properly.

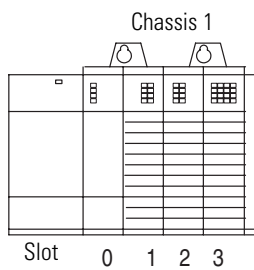
1746-P7 Current Capacity



Example for Selecting Power Supplies

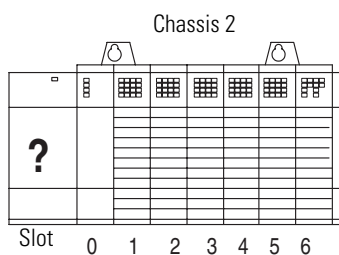
Select a power supply for chassis 1 and chassis 2 in the control system below.





Slot Numbers	Description	Cat. No.	Power Supply at 5V dc (Amps)	Power Supply at 24V dc (Amps)
0	Processor unit	1747-L511	0.090	0.000
1	Input module	1747-IV8	0.050	0.000
2	Transistor output module	1746-OB8	0.135	0.000
3	Triac output module	1746-OA16	0.370	0.000
Peripheral device	Isolated link coupler	1747-AIC	0.000	0.085
Total Current:			0.645	0.085 ⁽¹⁾

⁽¹⁾ The 1746-P1 power supply is sufficient for Chassis #1. The internal current capacity for this power supply is 2 A at 5V dc, 0.46 A at 24V dc.



Slot Numbers	Description	Cat. No.	Power Supply at 5V dc (Amps)	Power Supply at 24V dc (Amps)
0	Processor unit	1747-L514	0.090	0.000
1	Output module	1746-OW16	0.170	0.180
2	Combination module	1746-IO12	0.090	0.070
3, 4, 5, 6	Analog output modules	1746-NO4I	0.220 (4 x 0.055)	0.780 (4 x 0.195)
Peripheral device	Isolated link coupler	1747-AIC	0.000	0.085
Peripheral device	Interface converter	1746-PIC	Not applicable	Not applicable
Total Current:			0.570	1.115 ⁽¹⁾

⁽¹⁾ The 1746-P4 power supply is sufficient for Chassis #2. The internal current capacity for this power supply is 10 A at 5V dc, 2.88 A at 24V dc; not to exceed 70 W.

Example Worksheet for Selecting a 1746 Power Supply

If you have a multiple chassis system, make copies of the Power Supply Worksheet found on page 230.

For a detailed list of device load currents, refer to the SLC 500 Modular Chassis and Power Supplies Technical Data, publication 1746-TD003.

TIP

Consider future system expansion when selecting a power supply.

Procedure									
1. For each slot of the chassis that contains a module, list the slot number, the catalog number of the module, and its 5V and 24V maximum currents. Also include the power consumption of any peripheral devices that may be connected to the processor other than a DTAM or PIC device—the power consumption of these devices is accounted for in the power consumption of the processor.									
Chassis Number		1	Maximum Currents		Chassis Number		2	Maximum Currents	
Slot Number		Cat. No.	at 5V dc	at 24V dc	Slot Number		Cat. No.	at 5V dc	at 24V dc
Slot	0	1747-L511	0.090 A	0.000 A	Slot	0	1747-L514	0.090 A	0.000 A
Slot	1	1746-IV8	0.050 A	-	Slot	1	1746-OW16	0.170 A	0.180 A
Slot	2	1746-OB8	0.135 A	-	Slot	2	1746-NO4I	0.055 A	0.195 A
Slot	3	1746-OA16	0.370 A	-	Slot	3	1746-NO4I	0.055 A	0.195 A
Slot					Slot	4	1746-NO4I	0.055 A	0.195 A
Slot					Slot	5	1746-NO4I	0.055 A	0.195 A
Slot					Slot	6	1746-IO12	0.090 A	0.070 A
Slot					Slot				
Peripheral Device		1747-AIC	-	0.085 A	Peripheral Device		1747-AIC	-	0.085 A
Peripheral Device					Peripheral Device				
2.Add the loading currents of all the system devices at 5 and 24V dc to determine the Total Current .			0.645 A	0.085 A	2.Add the loading currents of all the system devices at 5 and 24V dc to determine the Total Current .			0.570 A	1.115 A
3.For 1746-P4 power supplies, calculate the total power consumption of all system devices. If you are not using a 1746-P4 power supply, go to step 4.									
Current			Multiply by	= Watts	Current			Multiply by	= Watts
Total Current at 5V dc		0.645 A	5V	3.225 W	Total Current at 5V dc		0.570 A	5V	2.850 W
Total Current at 24V dc		0.085 A	24V	2.040 W	Total Current at 24V dc		1.115 A	24V	26.76 W
User Current at 24V dc		0.500 A	24V	12.00 W	User Current at 24V dc		0.500 A	24V	12.00 W
Add the Watts values to determine Total Power (cannot exceed 70 Watts)				17.26 W	Add the Watts values to determine Total Power (cannot exceed 70 Watts)				41.61 W
4.Choose the power supply from the list of catalog numbers shown below. Compare the Total Current required for the chassis with the Internal Current capacity of the power supplies. Be sure that the Total Current consumption for the chassis is less than the Internal Current Capacity for the power supply, for both 5V and 24V loads.									
Cat. No.		Internal Current Capacity		Cat. No.	Internal Current Capacity				
		at 5V dc	at 24V dc		at 5V dc	at 24V dc			
1746-P1		2.0 A	0.46 A	1746-P1		2.0 A	0.46 A		
1746-P2		5.0 A	0.96 A	1746-P2		5.0 A	0.96 A		
1746-P3		3.6 A	0.87 A	1746-P3		3.6 A	0.87 A		
1746-P4 (see step 3)		10.0 A	2.88 A	1746-P4 (see step 3)		10.0 A	2.88 A		
1746-P5		5.0 A	0.96 A	1746-P5		5.0 A	0.96 A		
1746-P6		5.0 A	0.96 A	1746-P6		5.0 A	0.96 A		
1746-P7 ⁽¹⁾	12V dc input	2.0 A	0.46 A	1746-P7 ⁽¹⁾	12V dc input	2.0 A	0.46 A		
	24V dc input	3.6 A	0.87 A		24V dc input	3.6 A	0.87 A		
Required Power Supply		1746-P1		Required Power Supply		1746-P4			

(1) See 1746-P7 current capacity graph on page 37.

Selecting Enclosures

The enclosure protects the equipment from atmospheric contamination. Standards established by the National Electrical Manufacturer's Association (NEMA) define enclosure types, based on the degree of protection an enclosure will provide. Use a fan to circulate the air of sealed enclosures that use convection cooling to dissipate heat. Select a NEMA-rated enclosure that suits your application and environment. The enclosure should be equipped with a disconnect device. To calculate the heat dissipation of your controller, see appendix H.

Selecting Operator Interfaces

Use an operator interface to program and/or monitor your SLC 500 controller. You can choose from several Allen-Bradley operator interface devices.

Programming with a Personal Computer

Contact Rockwell Software or your local Allen-Bradley distributor for specifications and availability of software packages available to program the SLC 500 Modular Controllers.

AIC+ Advanced Interface Converter (1761-NET-AIC)

The AIC+ advanced interface converter provides communication links between various networked devices. It has three communication ports: one for DH-485 and two for RS-232. The AIC+ converter is compatible with a variety of SLC and MicroLogix controllers and peripherals.

1747-PIC RS-232/DH485 Interface Converter

For communication with a SLC 5/01, SLC 5/02, or SLC 5/03 processor, you can use an RS-232/DH-485 interface converter (catalog number 1747-PIC) between the computer and SLC controller. The converter includes a 279.4 mm (11 in.) ribbon cable, already attached to the converter, for connection to the computer serial port and a catalog number 1746-C10 cable for connection to the controller.

If you are using an SLC 5/03, SLC 5/04, or SLC 5/05 processor, you do not need the 1747-PIC interface. You can program via the RS-232 channel using DF1 full-duplex protocol or DH485 protocol and RS-232 program cable (catalog number 1747-CP3).

1747-UIC USB to DH485 Interface Converter

For communication with an SLC 5/01 through SLC 5/05 processor, you can connect the 1747-UIC interface between the computer's USB port and the SLC controller. The 1747-UIC interface features an RS-232 port for communication with SLC 5/03 and later processors and an RS-485 port for communication with SLC 5/03 and previous processors.

Monitoring with a Data Table Access Module

The Data Table Access Module (DTAM) is a plant floor device that lets you access data file information, change operating modes, monitor and clear processor faults, and transfer the user program between RAM and an EEPROM memory module with any SLC 5/01, SLC 5/02, or SLC 5/03 (except for the 1747-L533 processor) processor. You cannot use it to create new programs. Important features of DTAM include:

- shorthand addressing, which provides easier access to data files.
- display prompts in six, user-selectable languages: English, French, German, Italian, Spanish, and Japanese.
- UL listed to US and Canadian Safety Standards.
- NEMA type 12 and 13 enclosures.
- point-to-point interface to an SLC family processor, or as a network device on a DH-485 network.

Monitoring with a PanelView or PanelView Plus Operator Terminal

The PanelView or PanelView Plus operator terminals provide operator interface capabilities in space-saving, flat-panel designs. Offering optimum viewing angles, these electronic operator interfaces feature pixel graphics and high-performance functionality in both color and monochrome displays. The PanelView operator terminals let you enter input by using function keys or a touch screen, depending upon the model.

All PanelView and PanelView Plus operator terminals are available with DF1 or DH-485 (RS-232) communication capability, letting them communicate directly with channel 0 on an SLC 5/03, SLC 5/04, or SLC 5/05 processor. The larger versions also offer DH-485 (RJ-45), DH+, Remote I/O, Ethernet, DeviceNet, and ControlNet network connectivity.

Selecting a Memory Module for the SLC 5/01 and SLC 5/02 Processors

You can plug these optional EEPROM (Electrically Erasable Programmable Read Only Memory) memory modules into the SLC 500 controller. With a memory module, you can:

- save the contents of the processor RAM for storage purposes.
- load the contents of the EEPROM memory into the processor RAM.

Adapter sockets (catalog number 1747-M5) are required when inserting EEPROMs or UVPROMs into the programming and erasing equipment.

To program a memory module, see your programming software user manual.

EEPROM Memory Modules

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

You can store (save) your program in the EEPROM by inserting it into the processor and programming software to download the program.

You can use an EEPROM module as a master, or you can use an archived processor file as the source by using the software PROM translator utility.

Adapter sockets are required when inserting memory modules into commercially available PROM programmer. The memory module fits into the adapter socket and then into a PROM programmer.

ATTENTION



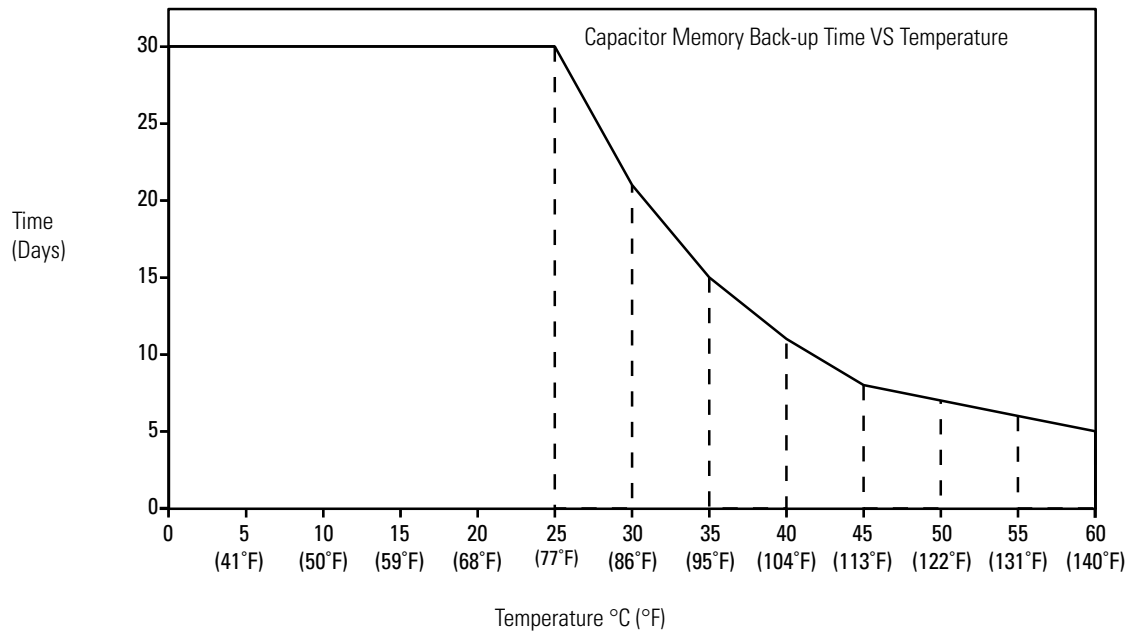
Make sure the adapter is inserted properly into the programming equipment or damage could result.

Memory Module Compatibility

Cat. No.	Description	Use with this processor type		
		SLC 5/01		SLC 5/02
		1747-L511	1747-L514	1747-L524
1747-M1	1 K User Words EEPROM	X	X	X
1747-M2	4 K User Words EEPROM	X	X	X
1747-M5	Adapter Socket	X	X	X

Memory Backup for the 1747-L511, SLC 5/01 Processor

The curve below illustrates the ability of the memory back-up capacitor to maintain the contents of the RAM in a 1747-L511 processor. To back up the memory for a longer period of time, a lithium battery, catalog number 1747-BA, is required.




Selecting a Memory Module for SLC 5/03, SLC 5/04, and SLC 5/05 Processors

The memory module for the SLC 5/03, SLC 5/04, and SLC 5/05 processors is called Flash EPROM (Flash Erasable Programmable Read Only Memory). Flash EPROMs combine the programming versatility of EEPROMs with the security precautions of UVPROMs. This means that you have the option of leaving your EPROM programs write-protected or unprotected. Write-protect the EPROM by using either your software or a PROM programmer.

The memory modules consist of a Flash EPROM mounted on a circuit board with a connector and plastic housing.

Adapter sockets (catalog number 1747-M15) are required when inserting memory modules into commercially available PROM

programmer. The 1747-M15 Series B adapter socket **is required** for use with the memory module (catalog number 1747-M13).

ATTENTION


Make sure the adapter is inserted properly in the programming equipment or damage could result.

See the table below for details on the Flash EPROM and adapter socket.

Memory Module Compatibility

Cat. No.	Description	Use with this processor type		
		SLC 5/03	SLC 5/04	SLC 5/05
		1747-L531, 1747-L532, 1747-L533	1747-L541, 1747-L542, 1747-L543	1747-L551, 1747-L552, 1747-L553
1747-M13	Supports up to 64 K of user-memory backup	X (Series C OS302 or later)	X (Series C OS401 or later)	X (Series C OS501 or later)

To program a memory module, refer to your programming software user manual or help resource. Follow this procedure to program a memory module.

1. Set the memory module configuration bits (S:1/10 to S:1/12) in your offline program file. Refer to SLC 500 Instruction Set Reference Manual, publication 1747-RM001, for details on the Memory Module Configuration Bits.
2. Download your program file to your processor.
3. Go online with the processor and burn the program to the EEPROM memory module (per the instructions outlined in your programming software user manual or help resource).

EEPROM Burning Options

You can burn a program into an EEPROM memory module using a processor that is the same or different from the one used to run the program. When burning EEPROMs, keep the following conditions in mind:

- The processor burning the EEPROM must be of the same type and have the same OS version or lower than the target processor.

- The program size cannot exceed the processor memory size. For instance, an SLC 5/01 4 K processor can burn an EEPROM for a SLC 5/01 1 K processor as long as the program does not exceed 1 K.
- The I/O and chassis configuration of the burning processor does not have to match the I/O configuration of the program being burned.
- You do not have to enter the Run mode before burning an EEPROM. If the run mode is entered and the chassis configuration does not match, a major fault will occur. If you burn an EEPROM while in the fault mode, the fault will also be saved in the EEPROM.

The following table summarizes the above conditions as to the type of processor you can use to burn EEPROMs for other processors.

EEPROM Burning Options

To burn EEPROMs for these processors												
Use these processors	SLC 5/01 (1K)	SLC 5/01 (4K)	SLC 5/02 (4K)	SLC 5/03 (8K)	SLC 5/03 (16K)	SLC 5/03 (32K)	SLC 5/04 (16K)	SLC 5/04 (32K)	SLC 5/04 (64K)	SLC 5/05 (16K)	SLC 5/05 (32K)	SLC 5/05 (64K)
SLC 5/01 (1K)	•	1 K max										
SLC 5/01 (4K)	1 K max	•										
SLC 5/02 (4K)			•									
SLC 5/03 (8K)				•	8 K max	8 K max						
SLC 5/03 (16K)				8 K max	•	16 K max						
SLC 5/03 (32K)				8 K max	16 K max	•						
SLC 5/04 (16K)							•	16 K max	16 K max			
SLC 5/04 (32K)							16 K max	•	32 K max			
SLC 5/04 (64K)							16 K max	32 K max	•			
SLC 5/05 (16K)										•	16 K max	16 K max
SLC 5/05 (32K)										16 K max	•	32 K max
SLC 5/05 (64K)										16 K max	32 K max	•

• valid combination

Selecting Isolation Transformers

If there is high frequency conducted noise in or around your distribution equipment, use an isolation transformer in the ac line to the power supply. This type of transformer provides isolation from your power distribution system and is often used as a step down transformer to reduce line voltage. Any transformer used with the controller must have a sufficient power rating for its load. This power rating is generally expressed in voltamperes (VA).

To select an appropriate isolation transformer, calculate the power required by the chassis power supply (or supplies if more than one chassis in system) and any input circuits and output loads that are connected through this transformer.

You can find the power requirement (VA rating) for the chassis power supplies in the specifications starting on page 177. The power requirement for the input circuits is determined by the number of inputs, the operating voltage, and the nominal input current. The power requirement for output loads is determined by the number of outputs, the load voltage, and load current.

For example, if you have a 1746-P1 power supply, a 16-point ac input module, catalog number 1746-IA16, (12 mA at 120V ac) and a 16-point ac triac output module, catalog number 1746-OA16, (0.5A at 120V ac), the power consumed would be:

$$135\text{VA} + (16)(120\text{V})(0.012\text{ A}) + (16)(120\text{V})(0.5\text{ A}) = 1118\text{VA}$$

IMPORTANT

In this case, 0.5 A is the maximum rating of the triac output at 30 °C (86 °F). If the load draws less than 0.5 A, this figure may be reduced accordingly. The output portion of the VA calculation should reflect the current requirements of selected loads.

In general, we recommend that the transformer is oversized to provide some margin for line voltage variations and other factors. Typically a transformer that is 25% larger than the calculated VA is sufficient.

Most industrial environments are susceptible to power transients or spikes. To help insure fault-free operation and protection of equipment, use suppression devices on power line to the equipment in addition to the isolation equipment.

Special Considerations

The recommendations given previously provide favorable operating conditions for most controller installations. Some applications may involve adverse conditions, such as excessive line voltage variations and/of excessive noise, as described below. Additional measures can be taken to minimize the effect of these conditions.

Class I, Division 2 Applications

IMPORTANT

When installing peripheral devices (for example, push buttons, lamps) into a hazardous environment, ensure that they are Class I, Division 2 certified, or determined to be safe for the environment.

Excessive Line Voltage Variations

The best solution for excessive line voltage variation is to correct any feeder problems in your distribution system. Where this does not solve the line variation problem, or in certain critical applications, use a constant voltage transformer. If you require a constant voltage transformer, connect it to the power supply **and** all input devices connected to the SLC 500 controller.

Connect output devices on the same power line, but their connection along the power line is normally made before the constant voltage transformer. A constant voltage transformer must have a sufficient power rating for its load.

Excessive Noise

When operating the SLC 500 controller in an environment with a high amount of electrical noise, give special consideration to the possibility of electrical interference.

The following reduces the effect of electrical interference.

- SLC 500 controller design features
- Proper mounting of controller within an enclosure
- Proper equipment grounding
- Proper routing of wires (power, communication, control lines)
- Proper suppression added to noise generating devices

Potential sources of noise include inductive loads, such as relays, solenoids, and motor starters when operated by hard contacts like push buttons or selector switches. Suppression may be necessary

when such loads are connected as output devices or when connected to the same supply line that powers the controller.

Lack of surge suppression on inductive loads may contribute to processor faults and sporadic operation. RAM can be corrupted (lost) and I/O modules may appear to be faulty or reset themselves.

For extremely noisy environments, use a memory module and program it for auto-loading on processor fault or power cycle for quick recovery.

Selecting Surge Suppressors

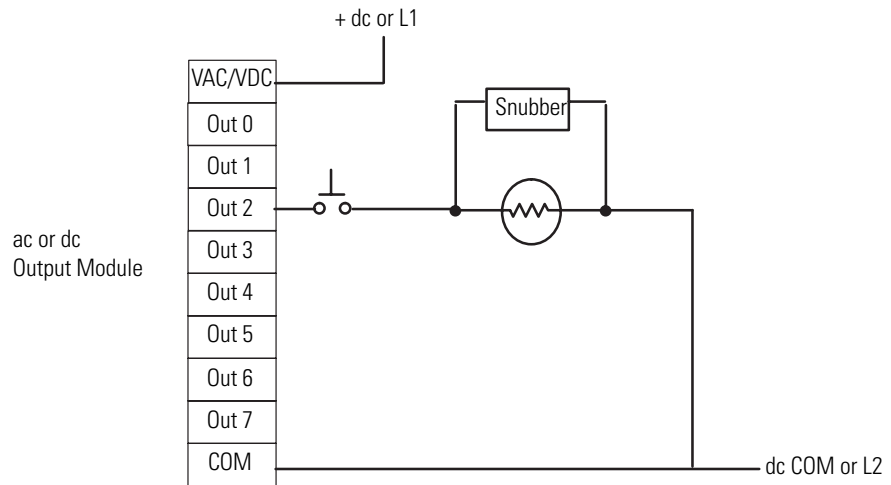
Most output modules have built-in surge suppression to reduce the effects of high voltage transients. However, you should use an additional suppression device if an output module is being used to control an inductive device such as:

- relays.
- motor starters.
- solenoids.
- motors.

Additional suppression is especially important if your inductive device is in series with or parallel to a hard contact such as:

- push buttons.
- selector switches.

By adding a suppression device directly across the coil of an inductive device, you reduce the effects of voltage transients caused by interrupting the current to that inductive device and prolong the life of the switch contacts. You also prevent electrical noise from radiating into system wiring. The diagram below shows an output module with a suppression device.

Surge Suppression Diagram

If you connect an SLC 500 controller triac output to control an inductive load, use varistors to suppress noise. Choose a varistor that is appropriate for the application. We recommend the following surge suppressors for triac outputs when switching 120V ac inductive loads:

- Harris MOV, part number V220 MA2A
- Allen-Bradley MOV, catalog number 599-K04 or 599-KA04, Series C or later.

Consult the varistor manufacturer's data sheet when selecting a varistor for your application.

ATTENTION

Damage could occur to SLC 500 triac outputs if you use suppressors having RC networks and the triac load current is 15 mA or less.

Allen-Bradley surge suppressors recommended for use with Allen-Bradley relays, contactors, and starters are shown in the table below.

Devices Requiring Surge Suppression

Device	Coil Voltage	Suppressor Cat. No.
Bulletin 509 Motor Starter	120V ac	599-K04 ⁽¹⁾
Bulletin 509 Motor Starter	240V ac	599-KA04 ⁽¹⁾
Bulletin 100 Contactor	120V ac	199-FSMA1 ⁽²⁾ , 199-GSMA1 ⁽¹⁾
Bulletin 100 Contactor	240V ac	199-FSMA2 ⁽²⁾
Bulletin 709 Motor Starter	120V ac	1401-N10 ⁽²⁾
Bulletin 700 Type R, RM Relays	ac coil	none required

Devices Requiring Surge Suppression

Bulletin 700 Type R Relay	12V dc	199-FSMA9
Bulletin 700 Type RM Relay	12V dc	
Bulletin 700 Type R Relay	24V dc	199-FSMA9
Bulletin 700 Type RM Relay	24V dc	
Bulletin 700 Type R Relay	48V dc	199-FSMA9
Bulletin 700 Type RM Relay	48V dc	
Bulletin 700 Type R Relay	115-125V dc	199-FSM10
Bulletin 700 Type RM Relay	115-125V dc	
Bulletin 700 Type R Relay	230-250V dc	199-FSMA11
Bulletin 700 Type RM Relay	230-250V dc	
Bulletin 700 Type N, P, or PK Relay	150V max, ac or dc	700-N24 ⁽²⁾
Miscellaneous electromagnetic devices limited to 35 sealed VA	150V max, ac or dc	700-N24 ⁽²⁾

⁽¹⁾ Varistor

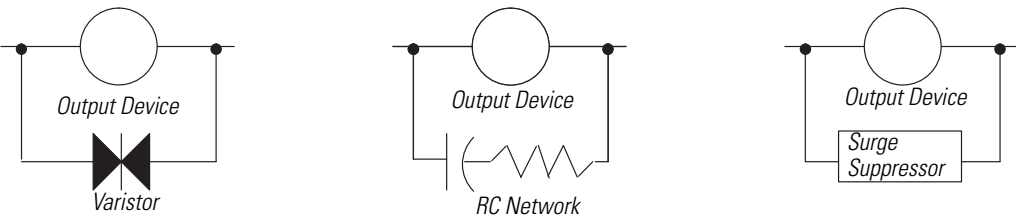
⁽²⁾ RC Type – Damage could occur with SLC 500 triac outputs if you use suppressors having RC networks and the load current is 15 mA or less.

Selecting Contact Protection

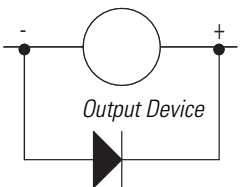
Inductive load devices such as motor starters and solenoids may require the use of some type of surge suppression to protect the controller output contacts. Switching inductive loads without surge suppression can significantly reduce the lifetime of relay contacts.

Surge Suppression for Inductive Load Devices

Surge Suppression for Inductive ac Load Devices



Surge Suppression for Inductive DC Load Devices



Diode (A surge suppressor can also be used.)

Contact protection methods for inductive ac and DC output devices.

These surge suppression circuits connect directly across the load device. This reduces arcing of the output contacts. (High transient can cause arcing that occurs when switching off an inductive device.)

Suitable surge suppression methods for inductive ac load devices include a varistor, an RC network, or an Allen-Bradley surge suppressor. These components must be appropriately rated to suppress the switching transient characteristic of the particular inductive device.

For inductive dc load devices, a diode is suitable. A diode, catalog number 1N4004, is acceptable for most applications.

A surge suppressor can also be used. See the table on page 49.

Locate the suppression device as close as possible to the load device.

Transistor Output Transient Pulses

This section applies to the following SLC 500 fixed I/O processors and SLC 500 I/O modules that have transistor outputs.

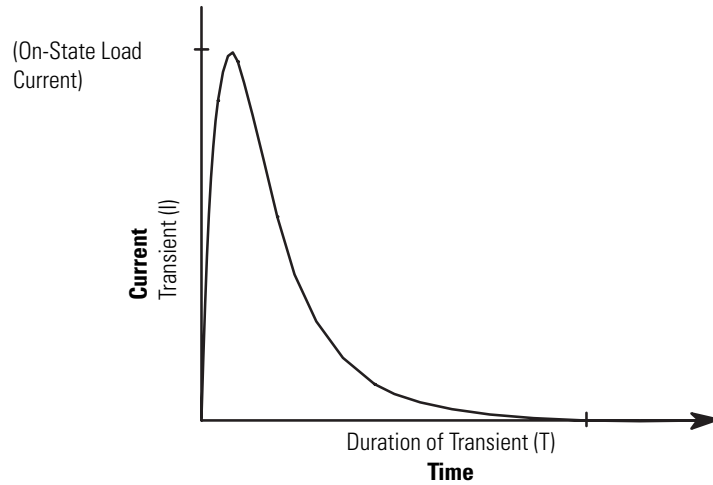
Fixed I/O processors with transistor outputs	I/O modules with transistor outputs	
<ul style="list-style-type: none"> • 1747-L20E • 1747-L20G • 1747-L20L • 1747-L20N • 1747-L30L • 1747-L40E • 1747-L40L 	<ul style="list-style-type: none"> • 1746-OB8 • 1746-OBP8 • 1746-OV8 • 1746-OB16 • 1746-OB16E • 1746-OB16EI 	<ul style="list-style-type: none"> • 1746-OBP16 • 1746-OV16 • 1746-OVP16 • 1746-OB32 • 1746-OB32E • 1746-OV32

For the SLC 500 products listed above, the maximum duration of the transient pulse occurs when minimum load is connected to the output. However, for most applications the energy of the transient pulse is not sufficient to energize the load.

ATTENTION



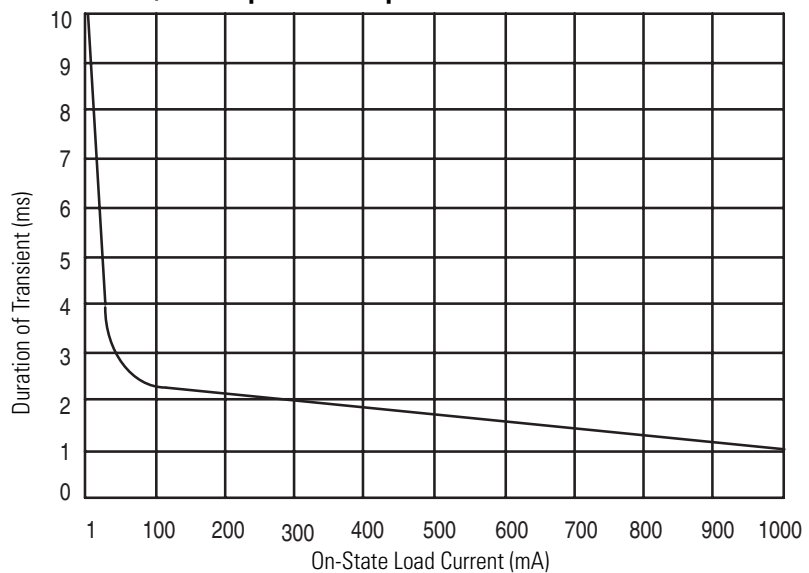
A transient pulse occurs in transistor outputs when the external dc supply voltage is applied to the common output terminals (for example, via the master control relay). The sudden application of voltage creates this transient pulse. (See the following graph.) This condition is inherent in transistor outputs and is common to solid state devices. A transient pulse can occur regardless of the processor having power or not.

Transient Pulse

To reduce the possibility of inadvertent operation of devices connected to transistor outputs, adhere to the following guidelines:

- Either ensure that any programmable device connected to the transistor output is programmed to ignore all output signals until after the transient pulse has ended,
- Add an external resistor in parallel to the load to increase the on-state load current. The duration of the transient pulse is reduced when the on-state load current is increased.

The duration of the transient pulse is proportional to the load impedance. This is illustrated in the following graph.

Transient Pulse/Load Impedance Graph

EXAMPLE

Increasing the load current by 100 mA decreases the transient time from approximately 7 ms to less than 2.5 ms. To calculate the size of the resistor added in parallel to increase the current, use the following information:

24V = your applied voltage

Need 100 mA of load current to reduce the transient to <2.5 ms. (taken from graph).

$$R (W) = V (Volts) / I (Amps)$$

$$\text{Resistor value (Ohms)} = \text{Applied voltage (Volts)} / \text{Desired current (Amps)} = 24 / 0.1 = 240 W$$

$$P (Watts) = I^2 (Amps) \times R (W)$$

$$\text{Actual Power (Watts)} = (\text{Desired Current})^2 \times \text{Resistor Value} = (0.1)^2 \times 240 = 2.4 (Watts)$$

$$\text{Resistor size} = 2 \times \text{Actual power (Watts)} = 4.8 W = \text{approximately } 5 W$$

Use a resistor rated for 240 W at 5 W to decrease the transient time from approximately 7 ms to less than 2.5 ms.

Mounting Your SLC 500 Control System

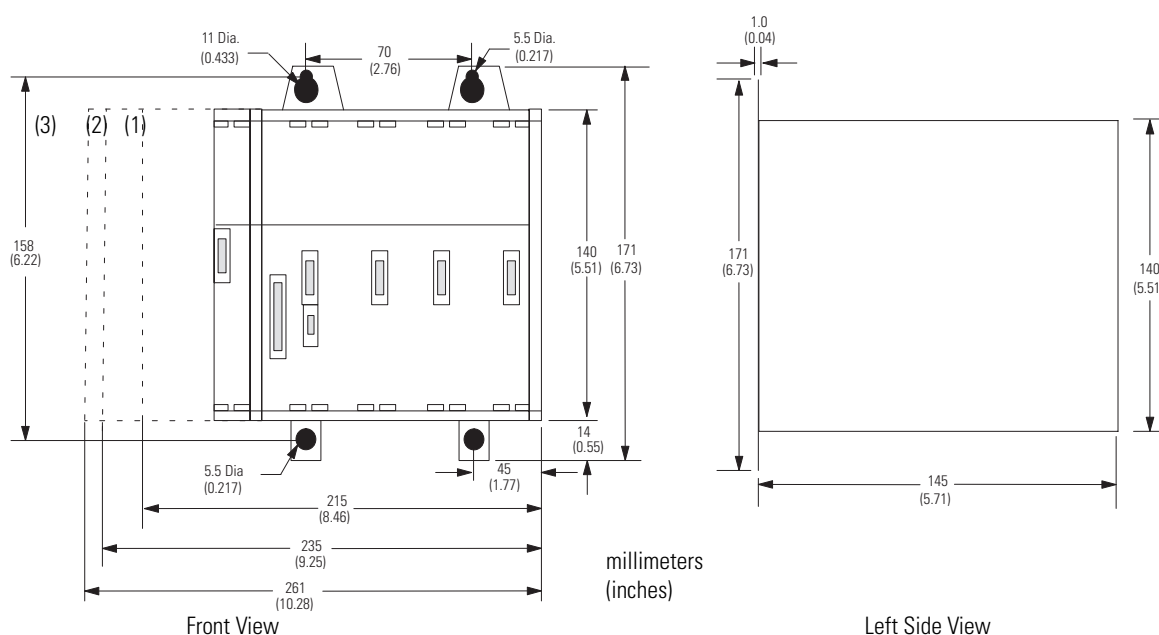
This chapter provides mounting dimensions for:

- 4, 7, 10, and 13-slot chassis.
- link coupler (AIC).
- Data Terminal Access Module (DTAM).
- DTAM Plus Operator Interface.
- DTAM Micro Operator Interface.
- AIC+ Advanced Interface Converter.
- DNI DeviceNet Network Interface.
- ENI EtherNet Network Interface.

Mounting Modular Hardware Style Units

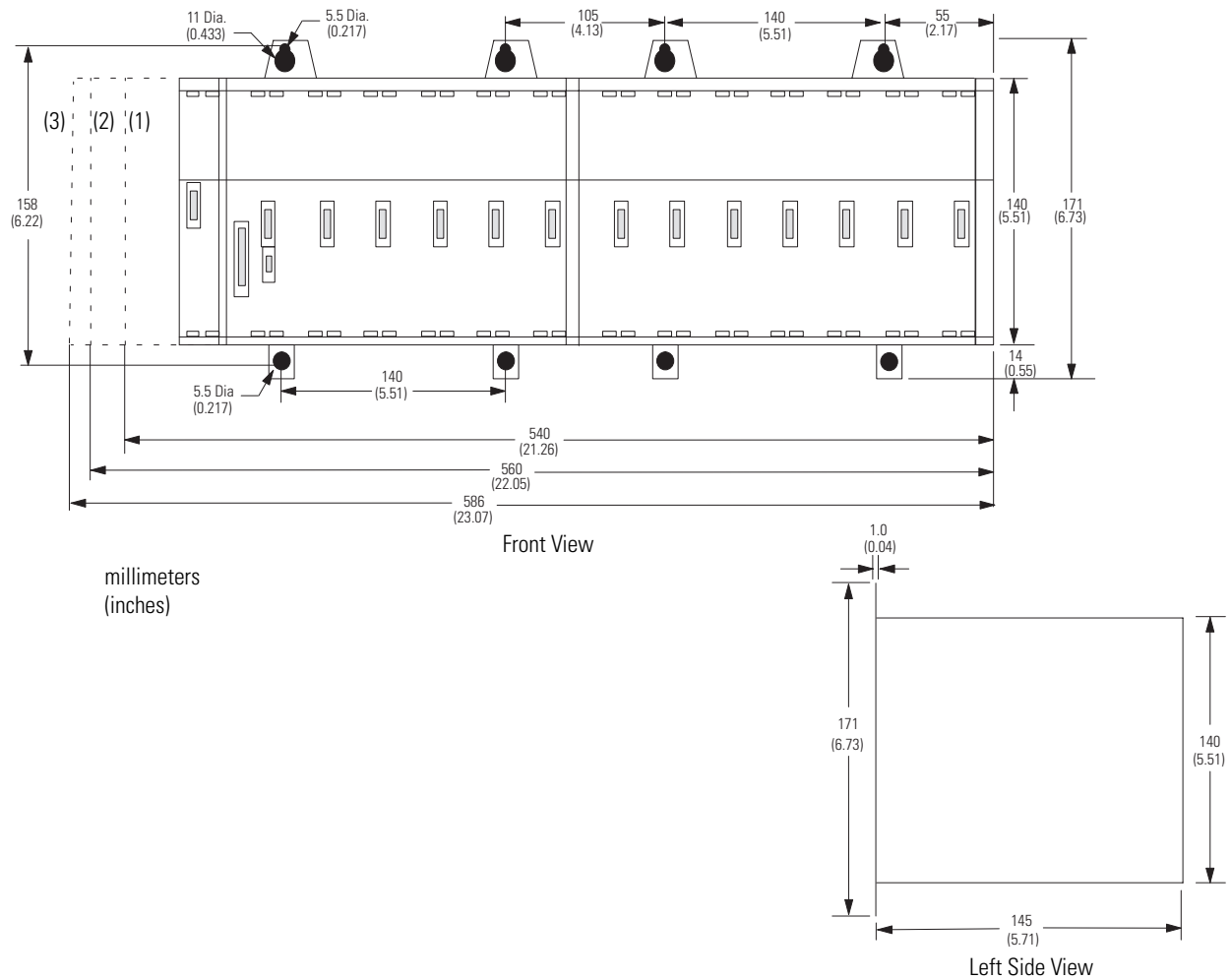
You can mount the modular hardware style units directly to the back panel of your enclosure using the mounting tabs and #10 or #12 screws. The torque requirement is 3.4 Nm (30 lb-in) maximum.

4-slot Modular Chassis



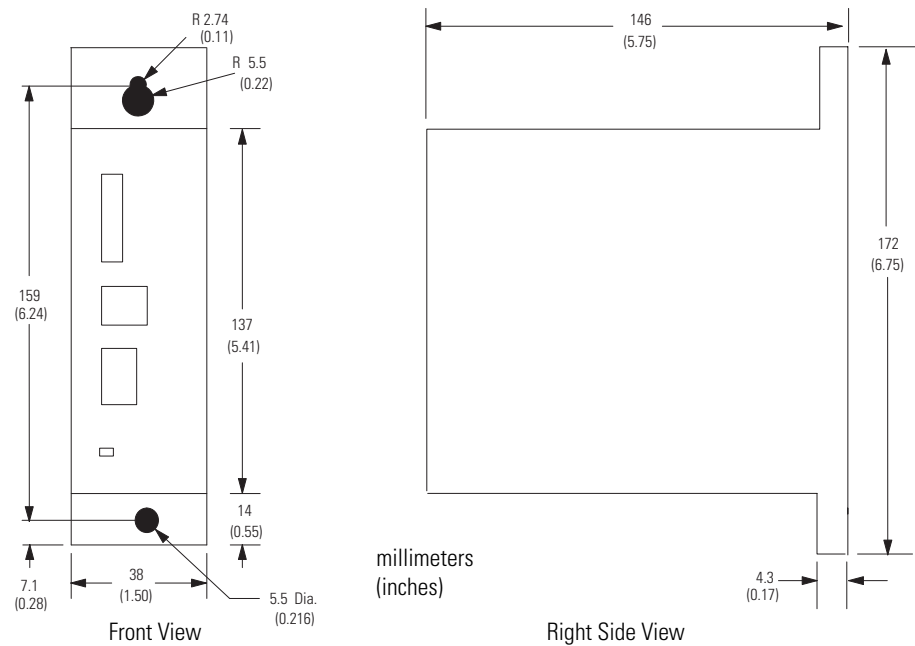
- (1) Dimensions for 1746-P1 power supply.
- (2) Dimensions for 1746-P2, 1746-P3, 1746-P5, 1746-P6, and 1746-P7 power supplies.
- (3) Dimensions for 1746-P4 power supply.

13-slot Modular Chassis

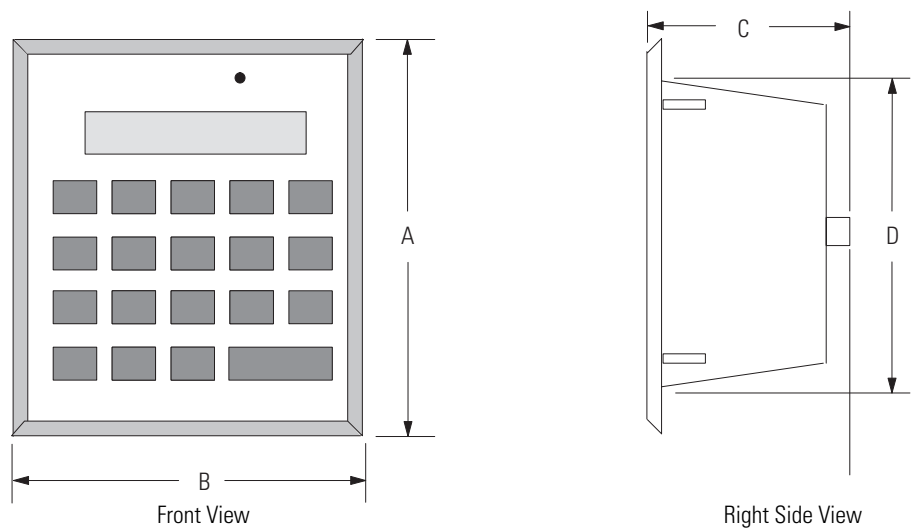


- (1) Dimensions for 1746-P1 power supply.
- (2) Dimensions for 1746-P2, 1746-P3, 1746-P5, 1746-P6, and 1746-P7 power supplies.
- (3) Dimensions for 1746-P4 power supply.

Link Coupler (AIC)

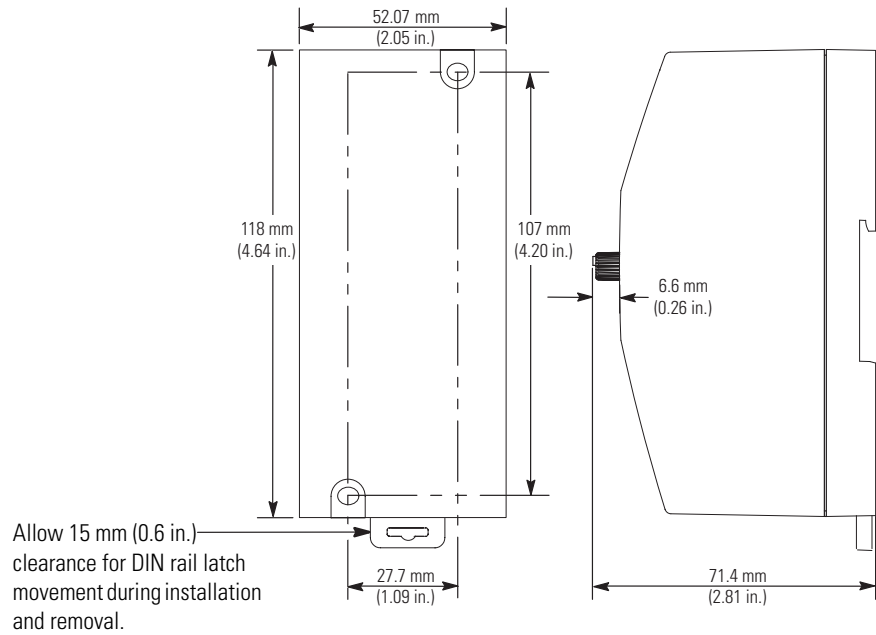


Data Table Access Module (DTAM, DTAM Plus, and DTAM Micro)



Data Table Access Module	Dimensions in millimeters (inches)			
	A	B	C	D
DTAM	152 (6.0)	140 (5.5)	69 (2.76)	127 (5.0)
DTAM Plus	215.9 (8.5)	165.1 (6.5)	45.7 (1.8)	193 (7.6)
DTAM Micro	137.2 (5.4)	175.3 (6.9)	45.7 (1.8)	99.1 (3.9)

AIC+ Advanced Interface Converter (1761-NET-AIC)
DeviceNet Interface (1761-NET-DNI)
Ethernet Interface (1761-NET-ENI)



Identifying the Components of Your Processor

This chapter covers the following:

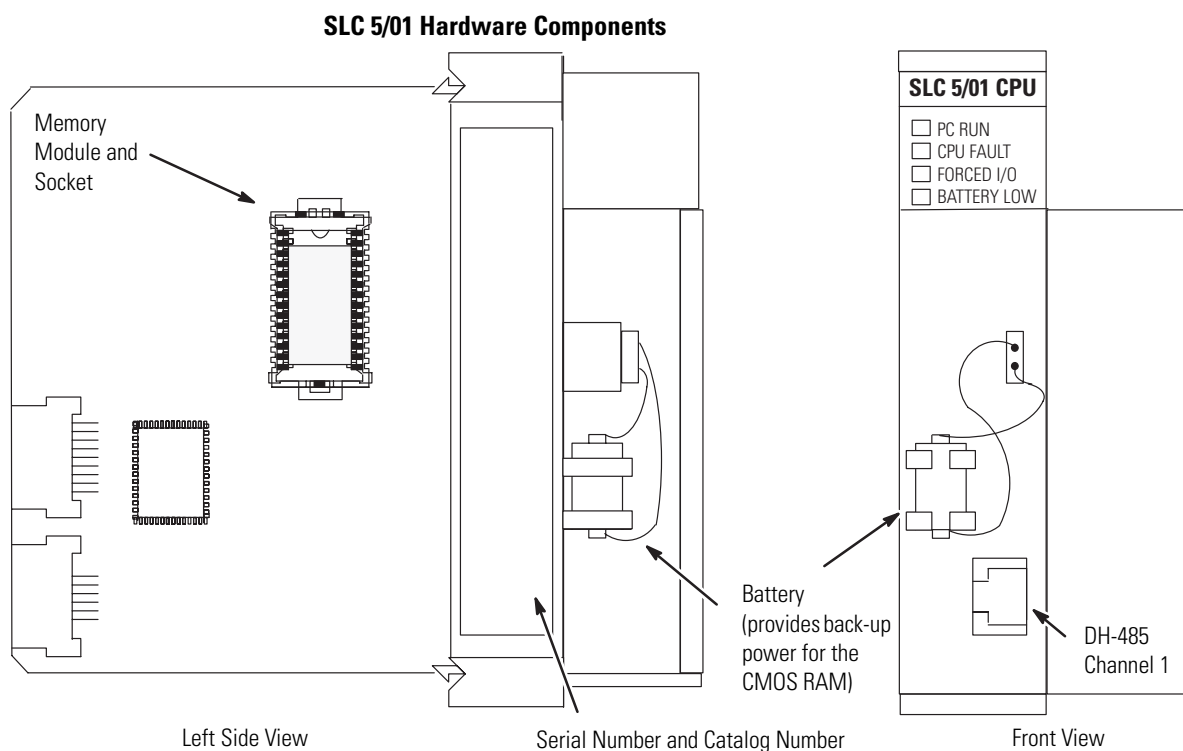
- SLC 5/01 hardware features
- SLC 5/02 hardware features
- SLC 5/03 hardware features
- SLC 5/04 hardware features
- SLC 5/05 hardware features
- Keyswitch for the SLC 5/03, SLC 5/04, and SLC 5/05 processors

SLC 5/01 Processor Hardware Features

The SLC 5/01 processor provides:

- two choices of program memory size - 1 K or 4 K instructions.
- control of up to 3840 input and output points.
- powerful ladder logic programming instruction set.
- subroutines.
- a DH-485 communication channel (peer-to-peer communication response to message commands only).
- capacitor backup for the 1747-L511 module; battery backup for the 1747-L514 module.
- program using your programming software.
- UL listed to US and Canadian Safety Standards, CE compliant, C-Tick marked.

The figure on page 82 shows the hardware components of the SLC 5/01 processor (1747-L511 and 1747-L514).



The table below provides a general explanation of the SLC 5/01 processor status indicators.

SLC 5/01 Status Indicators

Processor Status Indicator ⁽¹⁾	When It Is	Indicates that
PC RUN (Color: red)	On (steady)	The processor is in the Run mode.
	Off	The processor is in a mode other than Run.
CPU FAULT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, chassis or memory.
	On (steady)	A fatal error is present (no communication).
	Off	There are no errors.
FORCED I/O (Color: red)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.
BATTERY LOW (Color: red)	On (steady)	The battery voltage has fallen below a threshold level or the battery and the battery jumper are missing.
	Off	The battery is functional, or the battery jumper is present.

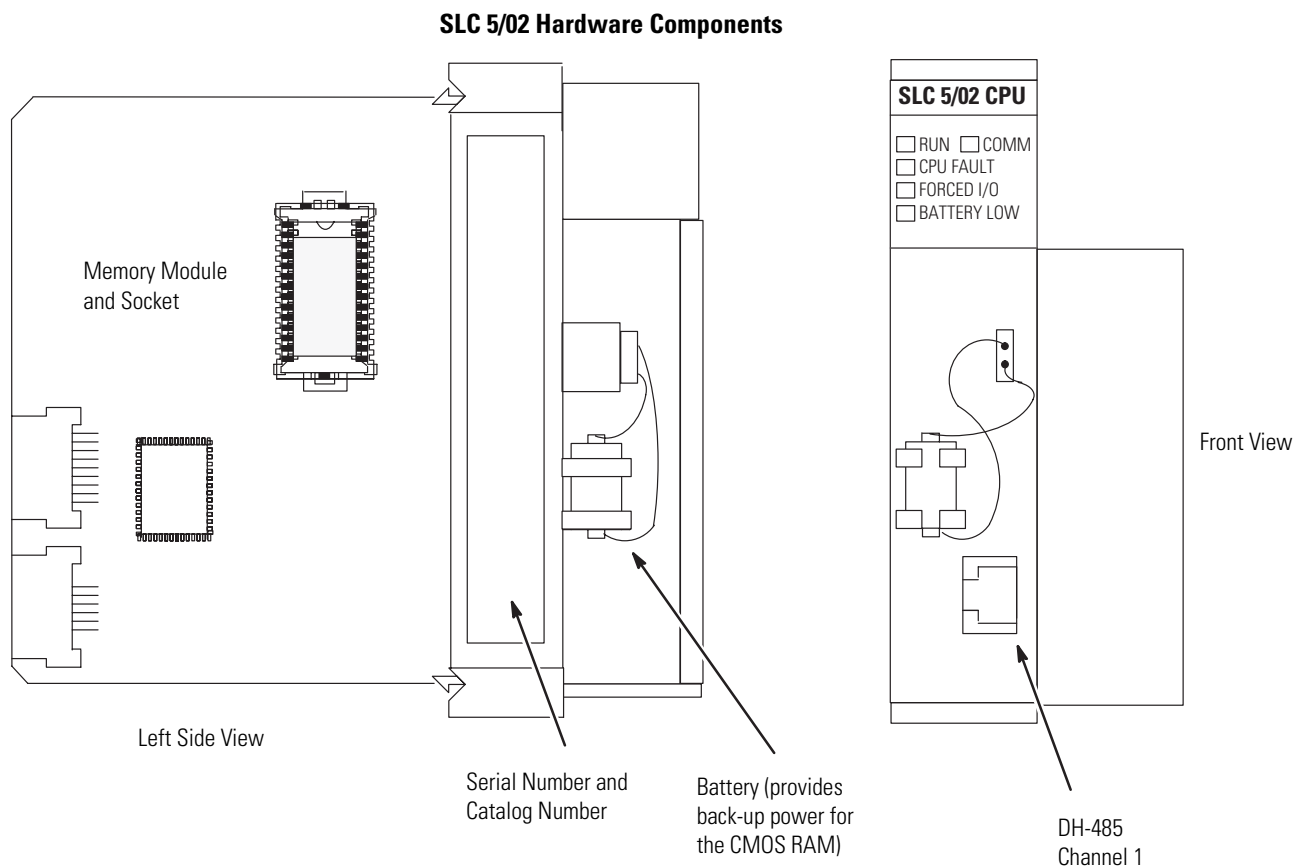
⁽¹⁾ See chapter 10 for more information on status indicator status.

SLC 5/02 Processor Hardware Features

The SLC 5/02 processor offers an enhanced instruction set, increased diagnostic capabilities, and expanded communication capabilities beyond the SLC 5/01 processors and fixed controllers. The SLC 5/02 processor provides:

- program memory size of 4 K instructions.
- control of up to 4096 input and output points.
- PID - used to provide closed loop process control.
- indexed addressing.
- interrupt capability.
- user fault routines.
- ability to handle 32-bit signed math functions.
- built-in DH-485 communication channel (initiation of peer-to-peer communication).
- battery-backed RAM.
- communication status indicator; when on, the status indicator indicates that there is communication activity on the DH-485 network.
- program using your programming software.
- UL listed to US and Canadian Safety Standards, CE compliant, C-Tick marked.

The figure on page 84 shows some of the hardware components of the SLC 5/02 processor.



The table below provides a general explanation of each processor status indicator (for both the SLC 5/02 series B and C processor).

SLC 5/02 Status Indicators

Processor Status Indicator ⁽¹⁾	When It Is	Indicates that
RUN (Color: red)	On (steady)	The processor is in the Run mode.
	Off	The processor is in a mode other than Run.
CPU FAULT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, expansion chassis or memory.
	On (steady)	A fatal error is present (no communication).
	Off	There are no errors.
FORCED I/O (Color: red)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.

Processor Status Indicator⁽¹⁾	When It Is	Indicates that
BATTERY LOW (Color: red)	On (steady)	The battery voltage has fallen below a threshold level or the battery is missing or not connected.
	Off	The battery is functional.
COMM (Color: red)	On (steady)	The SLC 5/02 processor is connected to an active DH485 network.
	Off	The SLC 5/02 processor is not receiving data.

⁽¹⁾ See chapter 10 for more information on status indicator status.

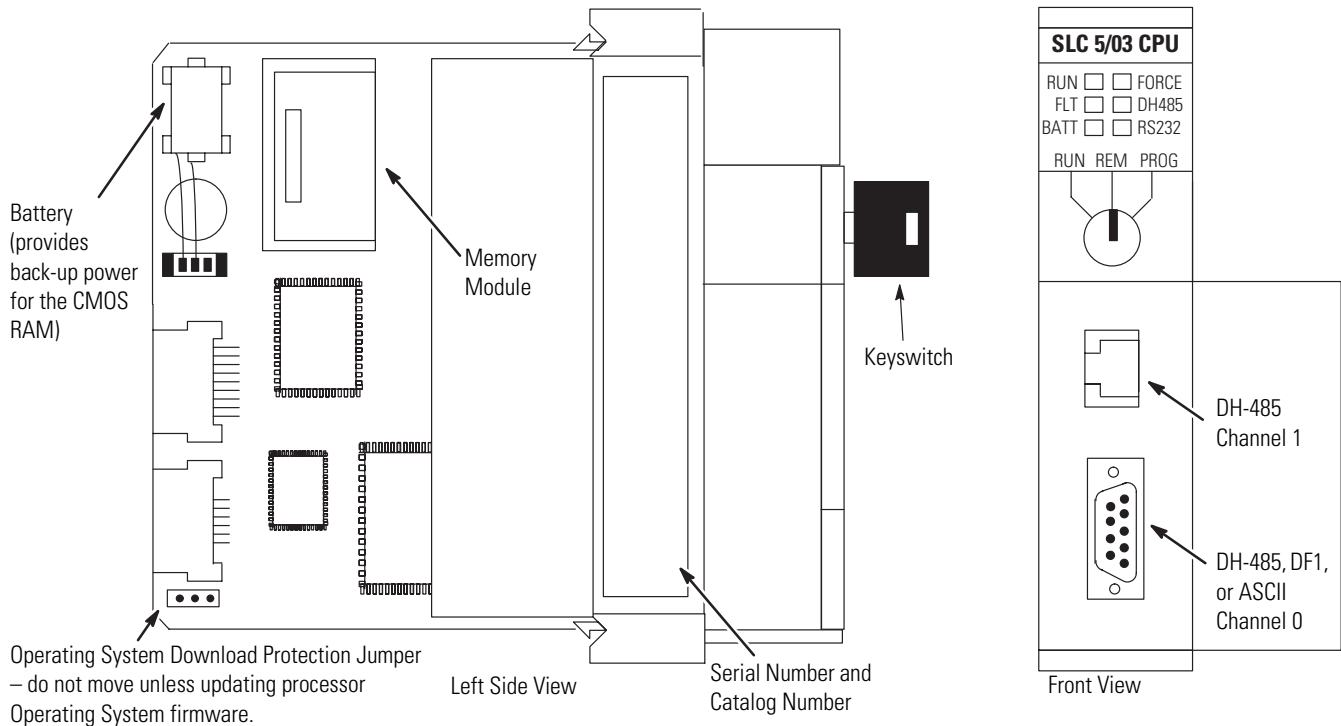
SLC 5/03 Processor Hardware Features

The SLC 5/03 processor offers:

- program memory size of 8 K, 16 K, 32 K.
- control of up to 4096 input and output points.
- online programming (includes runtime editing).
- built-in DH-485 channel.
- built-in RS-232 channel, supporting:
 - DF1 full-duplex for point-to-point communication; remotely via a modem, or direct connection to programming or operator interface devices. (Use a 1747-CP3 cable for direct connection.).
 - DF1 radio modem for radio modem (peer-to-peer) communication.
 - DF1 half-duplex master/slave for SCADA type (point-to-multipoint) communication.
 - DH-485 (Serves as a second DH-485 channel. Use a 1761-NET-AIC interface with a 1747-CP3, 1761-CBL-AC00, or 1761-CBL-AP00 cable to connect to the DH-485 network.).
 - Modbus RTU Master communication with Modbus RTU slave devices.
 - ASCII I/O for connection to other ASCII devices, such as bar code readers, serial printers, and weigh scales.
- channel-to-channel passthru (DH-485 to DF1 full-duplex, DF1 half-duplex Master, DF1 radio modem, or DH-485).
- remote I/O passthru.
- DeviceNet passthru.
- built-in real-time clock/calendar.
- 2 ms Selectable Timed Interrupt (STI).
- 0.50 ms Discrete Input Interrupt (DII).
- advanced math features - trigonometric, PID, exponential, floating-point, and the compute instruction.
- indirect addressing.
- logical ASCII addressing in PLC-5 type messages.
- flash PROM provides firmware upgrades without physically changing EPROMS.
- optional flash EPROM memory module available.
- keyswitch - RUN, REMote, PROGram (clear faults).
- battery-backed RAM.
- additional instructions such as swap and scale with parameters (SLC 5/03 OS302 processor or later).
- multi-point list (SLC 5/03 OS302 processor or later).
- UL listed to US and Canadian Safety Standards, CE compliant, C-Tick marked.

The figure on page 87 shows some of the hardware components of the SLC 5/03 processors (1747-L531, 1747-L532, and 1747-L533).

SLC 5/03 Hardware Components



The table below provides a general explanation of each processor status indicator on the SLC 5/03 processor.

SLC 5/03 Status Indicators

Processor Status Indicator ⁽¹⁾⁽²⁾	When It Is	Indicates that
RUN (Color: green)	On (steady)	The processor is in the Run mode.
	Flashing (during operation)	The processor is transferring a program from RAM to the memory module.
	Off	The processor is in a mode other than Run.
FLT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, chassis or memory.
	On (steady)	A fatal error is present (no communication).
	Off	There are no errors.
BATT (Color: red)	On (steady)	The battery voltage has fallen below a threshold level, or the battery is missing or not connected.
	Off	The battery is functional.

Processor Status Indicator⁽¹⁾⁽²⁾	When It Is	Indicates that
FORCE (Color: amber)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.
DH-485 (Color: green)	On (steady)	The Communication Active bit (S:1/7) is set in the System Status file and the processor is actively communicating on the DH-485 network.
	Flashing	The processor is trying to establish communication, but there are no other active nodes on the DH-485 network.
	Off	A fatal error is present (no communication).
RS-232 (Color: green)	On (flashing) DF1/Modbus RTU Master/ASCII mode	The SLC 5/03 processor is transmitting on the network.
	Off DF1/Modbus RTU Master/ASCII mode	The SLC 5/03 processor is not transmitting on the network.
	On (steady) DH-485 mode	The Communications Active bit (S:33/4) is set in the System Status file and the processor is actively communicating on the DH-485 network.
	Flashing DH-485 mode	The processor is trying to establish communication, but there are no other active nodes on the DH-485 network.
	Off DH-485 mode	A fatal error is present (no communication).

⁽¹⁾ If the status indicators on the SLC 5/03 processor turn on in a predefined sequence, the SLC 5/03 processor is in the process of downloading a new operating system.

⁽²⁾ See chapter 10 for more information on status indicator status.

SLC 5/04 Processor Hardware Features

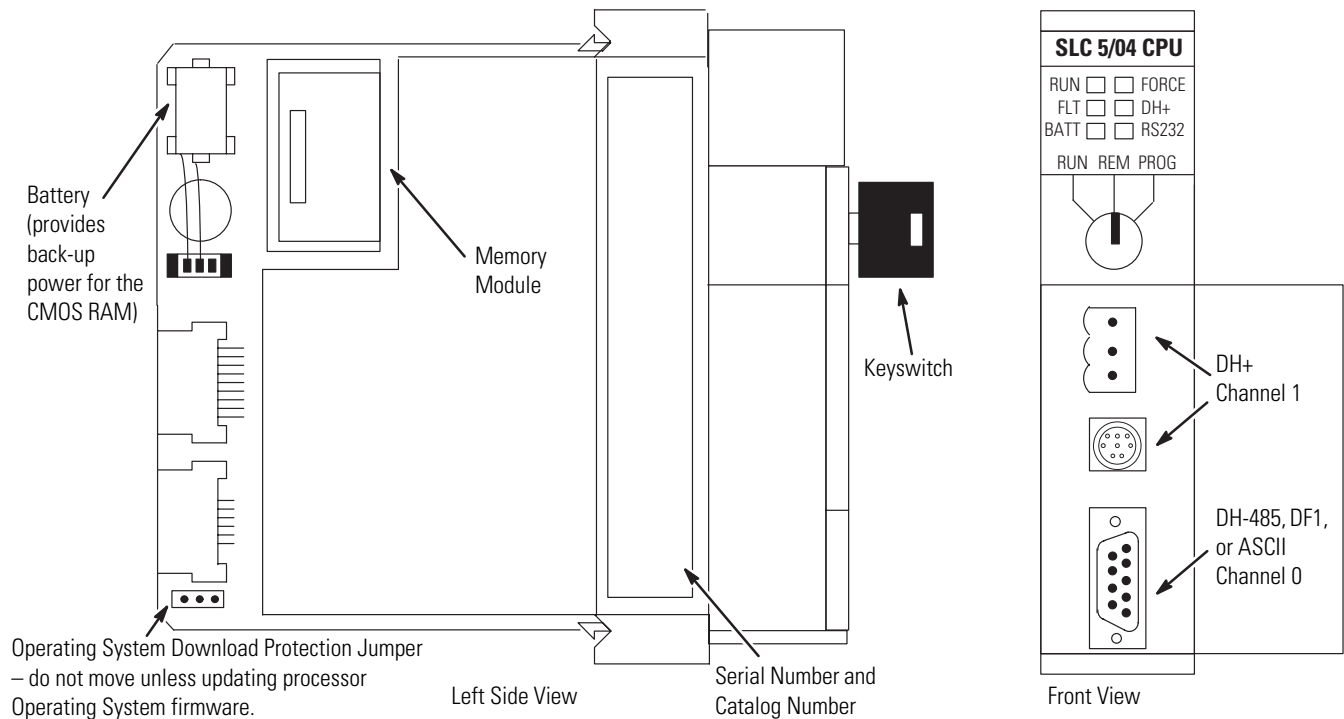
The SLC 5/04 processors offer:

- program memory sizes of 16 K, 32 K, or 64 K.
- high-speed performance - 0.90 ms/K typical.
- control of up to 4096 input and output points.
- online programming (includes runtime editing).
- built-in DH+channel, supporting:
 - high-speed communication (57.6 Kbaud, 115.2 Kbaud, and 230.4 Kbaud).
 - messaging capabilities with SLC 500, PLC-2, PLC-5, and ControlLogix processors.
- built-in RS-232 channel, supporting:
 - DF1 full-duplex for point-to-point communication; remotely via a modem, or direct connection to programming or operator interface devices. (Use a 1747-CP3, 1761-CBL-AC00, or 1761-CBL-AC00 cable for direct connection.).
 - DF1 radio modem for radio modem (peer-to-peer) communication.
 - DF1 half-duplex Master/Slave for SCADA type (point-to-multipoint) communication.
 - DH-485 (Use a 1761-NET-AIC with a 1747-CP3 cable to connect to the DH-485 network.).
 - Modbus RTU Master communication with Modbus RTU slave devices.
 - ASCII I/O for connection to other ASCII devices, such as bar code readers, serial printers, and weigh scales.
- channel-to-channel passthru (DH+ to DF1 full-duplex, DF1 half-duplex Master, DF1 radio modem, or DH-485).
- remote I/O passthru.
- DeviceNet passthru.
- built-in real-time clock/calendar.
- 1 ms Selectable Timed Interrupt (STI).
- 0.50 ms Discrete Input Interrupt (DII).
- advanced math features - trigonometric, PID, exponential, floating point, and the compute instruction.
- indirect addressing.
- logical ASCII addressing in PLC-5 type messages.
- flash PROM provides firmware upgrades without physically changing EPROMS.
- optional flash EPROM memory module available.
- keyswitch - RUN, REMote, PROGram (clear faults).
- battery-backed RAM.
- additional instructions such as swap and scale with parameters.

- multi-point list.
- UL listed to US and Canadian Safety Standards, CE compliant, C-Tick marked.

This figure below shows some of the hardware components of the SLC 5/04 processors (1747-L541, 1747-L542, or 1747-L543).

SLC 5/04 Hardware Components



The table below provides a general explanation of each processor status indicator on the SLC 5/04 processors.

SLC 5/04 Status Indicators

Processor Status Indicator ⁽¹⁾⁽²⁾	When It Is	Indicates that
RUN (Color: green)	On (steady)	The processor is in the Run mode.
	Flashing (during operation)	The processor is transferring a program from RAM to the memory module.
	Off	The processor is in a mode other than Run.
FLT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, chassis, or memory.
	On (steady)	A fatal error is present (no communication).
	Off	There are no errors.

Processor Status Indicator⁽¹⁾⁽²⁾	When It Is	Indicates that
BATT (Color: red)	On (steady)	The battery voltage has fallen below a threshold level, or the battery is missing or not connected.
	Off	The battery is functional.
FORCE (Color: amber)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.
DH+ (Color: green or red)	On (steady)	The Communications Active bit (S:1/7) is set in the System Status file and the processor is actively communicating on the DH+ network.
	Flashing green	The processor is trying to establish communication, but there are no other active nodes on the DH+ network.
	Flashing red	There are duplicate nodes on the link with the same node address.
RS-232 (Color: green)	On (steady) DF1/Modbus RTU Master/ASCII mode	The SLC 5/04 processor is transmitting on the network.
	Off DF1/Modbus RTU Master/ASCII mode	The SLC 5/04 processor is not transmitting on the network.
	On (steady) DH-485 mode	The Communications Active bit (S:33/4) is set in the System Status file and the processor is actively communicating on the DH-485 network.
	Flashing DH-485 mode	The processor is trying to establish communication, but there are no other active nodes on the DH-485 network.
	Off DH-485 mode	A fatal error is present (no communication).

⁽¹⁾ If the status indicators on the SLC 5/04 processor turn on in a predefined sequence, the SLC 5/04 processor is in the process of downloading a new operating system.

⁽²⁾ See chapter 10 for more information on status indicator status.

SLC 5/05 Processor Hardware Features

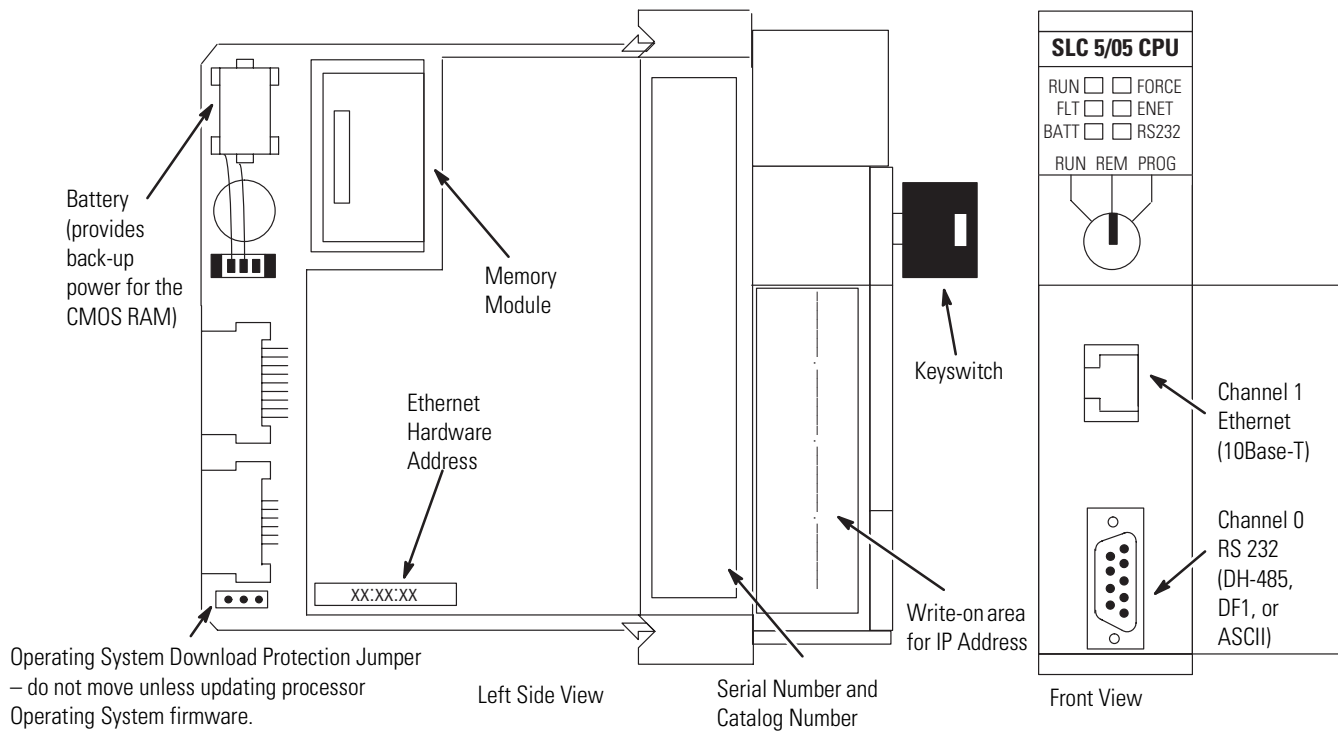
The SLC 5/05 processors offer:

- program memory sizes of 16 K, 32 K, or 64 K.
- high-speed performance - 0.90 ms/K typical.
- control of up to 4096 input and output points.
- online programming (includes runtime editing).
- built-in 10/100Base-T Ethernet channel, supporting:
 - high-speed computer communication using TCP/IP.
 - messaging capabilities with SLC 5/05, PLC-5, and ControlLogix processors on Ethernet.
 - SNMP for standard Ethernet network management.
 - BOOTP for optional dynamic IP address assignment.
- built-in RS-232 channel, supporting:
 - DF1 full-duplex for point-to-point communication; remotely via a modem, or direct connection to programming or operator interface devices. (Use a 1747-CP3, 1761-CBL-AC00, or 1761-CBL-AP00 cable for direct connection.)
 - DF1 radio modem for radio modem (peer-to-peer) communication.
 - DF1 half-duplex master/slave for SCADA type (point-to-multipoint) communication.
 - DH-485 (Use a 1761-NET-AIC with a 1747-CP3 cable to connect to the DH-485 network.)
 - Modbus RTU Master communication with Modbus RTU slave devices.
 - ASCII I/O for connection to other ASCII devices, such as bar code readers, serial printers, and weigh scales.
- Channel-to-channel passthru (Ethernet to DF1 full-duplex, DF1 half-duplex Master, DF1 radio modem, or DH-485).
- remote I/O and DeviceNet passthru.
- built-in real-time clock/calendar.
- 1 ms Selectable Timed Interrupt (STI).
- 0.50 ms Discrete Input Interrupt (DII).
- advanced math features - trigonometric, PID, exponential, floating point, and the compute instruction.
- indirect addressing.
- logical ASCII addressing in PLC-5 type messages.
- flash PROM provides firmware upgrades without physically changing EPROMS through the Ethernet port.
- optional flash EPROM memory module available.
- keyswitch - RUN, REMote, PROGram (clear faults).
- battery-backed RAM.
- additional instructions such as swap and scale with parameters

- multi-point list.
- UL listed to US and Canadian Safety Standards, CE compliant, C-Tick marked.

The figure below shows some of the hardware components of the SLC 5/05 processors (1747-L551, 1747-L552, and 1747-L553).

SLC 5/05 Hardware Components



The table below provides a general explanation of the processor status indicators.

SLC 5/05 Status Indicators

Processor Status Indicator	When It Is	Indicates that
RUN (Color: green)	On (steady)	The processor is in the Run mode.
	Flashing (during operation)	The processor is transferring a program from RAM to the memory module.
	Off	The processor is in a mode other than Run.
FLT (Color: red)	Flashing (at power up)	The processor has not been configured.
	Flashing (during operation)	The processor detects a major error either in the processor, chassis, or memory.
	On (steady)	A fatal error is present (no communication).
	Off	There are no errors.

Processor Status Indicator	When It Is	Indicates that
BATT (Color: red)	On (steady)	The battery voltage has fallen below a threshold level, or the battery is missing or not connected.
	Off	The battery is functional.
FORCE (Color: amber)	Flashing	One or more input or output addresses have been forced to an On or Off state but the forces have not been enabled.
	On (steady)	The forces have been enabled.
	Off	No forces are present or enabled.
ENET Channel 1 (Color: green or red)	Solid green	The Ethernet port is functioning properly and is connected to an active Ethernet network.
	Flashing green	The Ethernet port is functioning properly, connected to an active Ethernet network, and is transmitting packets.
	Flashing red	A hardware or software fault has occurred and is being reported via a code. Contact Allen-Bradley for assistance.
	Off	No Ethernet connection or processor halted.
RS-232 Channel 0 (Color: green)	On (steady) DF1/Modbus RTU Master/ASCII mode	The SLC 5/05 processor is transmitting on the network.
	Off DF1/Modbus RTU Master/ASCII mode	The SLC 5/05 processor is not transmitting on the network.
	On (steady) DH-485 mode	The Channel 0 Communications Active bit (S:33/4) is set in the System Status file and the processor is actively communicating on the network.
	Flashing DH-485 mode	The processor is trying to establish communication, but there are no other active nodes on the DH-485 network.
	Off DH-485 mode	A fatal error is present (no communication).

Keyswitch for the SLC 5/03, SLC 5/04, and SLC 5/05 Processors

The SLC 5/03, SLC 5/04, and SLC 5/05 processors include a 3-position keyswitch on the front panel that lets you select one of three modes of operation: RUN, PROGram, and REMote. You can remove the key in each of the three positions.

ATTENTION



Depending on the size of your user program, the processor can take up to 2.5 s to change modes when you change the position of the keyswitch from RUN to PROG or to REM. Do not use the keyswitch in place of a hardwired master control relay or an emergency-stop switch.

IMPORTANT

The SLC 5/01 and SLC 5/02 processors do not have a keyswitch. Therefore, all modes must be changed via the communication channels.

RUN Position

This position places the processor in the Run mode. The processor scans/executes the ladder program, monitors input devices, energizes output devices, and acts on enabled I/O forces. You can only change the processor mode by changing the keyswitch position. You cannot perform online program editing.

To change the processor mode to Run, toggle the keyswitch from PROG or REM to RUN. When the keyswitch is left in the RUN position, you cannot use a programmer/operator interface device to change the processor mode.

PROG Position

This position places the processor in the Program mode. The processor does not scan/execute the ladder program, and the controller outputs are de-energized. You can perform online program editing. You can only change the processor mode by changing the keyswitch position.

To change the processor mode to Program, toggle the keyswitch from REM or RUN to PROG. When the keyswitch is left in the PROG position, you cannot use a programmer/operator interface device to change the processor mode.

REM Position

This position places the processor in the Remote mode: either the REMote Run, REMote Program, or REMote Test mode. You can change the processor mode by changing the keyswitch position or by changing the mode from a programmer/operator interface device. You can perform online program editing in this position.

To change the processor mode to REM, toggle the keyswitch from RUN or PROG to REM. When the keyswitch is in the REM position, you can use a programmer/operator interface device to change the processor mode.

Wiring Your I/O Modules

This chapter describes how to wire your I/O modules. It covers the following:

- Defining sinking and sourcing
- Preparing your wiring layout
- Features of an I/O module
- Recommendations for wiring I/O devices
- Wiring your I/O modules
- Octal label kit installation
- Using removable terminal blocks

Defining Sinking and Sourcing

Sinking and sourcing are terms used to describe a current signal flow relationship between field input and output devices in a control system and their power supply.

- Field devices connected to the positive side (+V) of the field power supply are sourcing field devices.
- Field devices connected to the negative side (dc Common) of the field power supply are called sinking field devices.

To maintain electrical compatibility between field devices and the programmable controller system, this definition is extended to the input/output circuits on the discrete I/O modules.

- Sourcing I/O circuits supply (source) current to sinking field devices.
- Sinking I/O circuits receive (sink) current from sourcing field devices.

Europe: dc sinking input and sourcing output module circuits are the commonly used options.

Contact Output Circuits — ac or dc

Relays can be used for either ac or dc output circuits and accommodate either sinking or sourcing field devices. These capabilities are a result of the output switch being a mechanical contact closure, not sensitive to current flow direction and capable of accommodating a broad range of voltages.

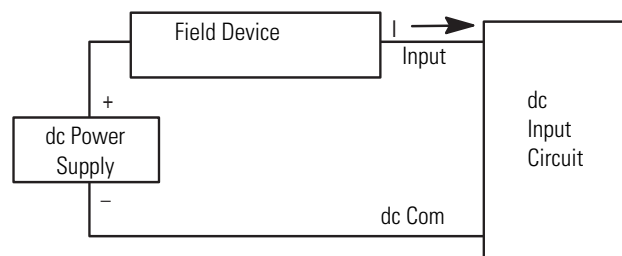
This high degree of application flexibility makes contact output modules very popular and useful in control environments with a broad mix of electrical I/O circuit requirements.

Solid-State dc I/O Circuits

The design of dc field devices typically requires that they be used in a specific sinking or sourcing circuit depending on the internal circuitry of the device. DC input and output field circuits are commonly used with field devices that have some form of internal solid state circuitry that need a dc signal voltage to function.

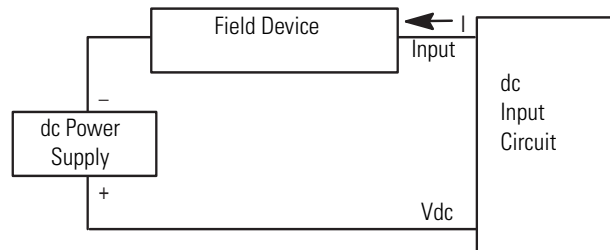
Sourcing Device with Sinking Input Module Circuit

The field device is on the positive side of the power supply between the supply and the input terminal. When the field device is activated, it sources current to the input circuit.



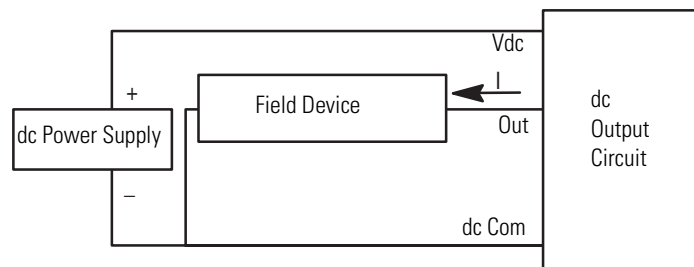
Sinking Device with Sourcing Input Module Circuit

The field device is on the negative side of the power supply between the supply and the input terminal. When the field device is activated, it sinks current from the input circuit.



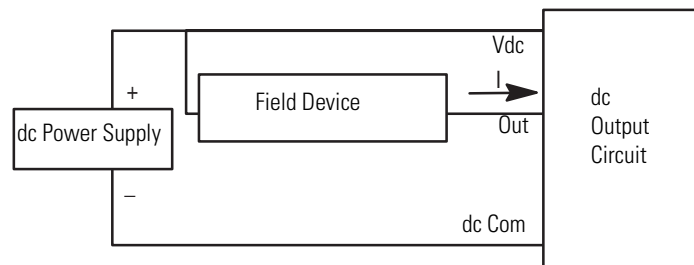
Sinking Device with Sourcing Output Module Circuit

The field device is on the negative side of the power supply between the supply and the output terminal. When the output is activated, it sources current to the field device.



Sourcing Device with Sinking Output Module Circuit

The field device is on the positive side of the power supply between the supply and the output terminal. When the output is activated, it sinks current from the field device.



Preparing Your Wiring Layout

Careful wire routing within the enclosure helps to cut down electrical noise between I/O lines. Follow these rules for routing your wires.

- Route incoming power to the controller by a separate path from wiring to I/O devices. Where paths must cross, their intersection should be perpendicular.

IMPORTANT

Do not run signal or communication wiring and power wiring in the same conduit.

- If wiring ducts are used, allow for at least 50.8 mm (2 in.) between I/O wiring ducts and the controller. If the terminal strips are used for I/O wiring, allow for at least two inches between the terminal strips and the controller.
- Limit the cable length for the TTL input module to 15.24 m (50 ft) per point and 3.05 m (10 ft) per point for the TTL output module. Use low power dc I/O wiring even though it is less tolerant to electrical noise.

ATTENTION

Handle the TTL module by its ends, not metallic surfaces. Electrostatic discharges can damage the module. Do not expose the TTL module to electrostatic charges.

- Segregate I/O wiring by signal type. Bundle wiring with similar electrical characteristics together.

Wires with different signal characteristics should be routed into the enclosure by separate paths. Refer to Allen-Bradley Programmable Controller Grounding and Wiring Guidelines, publication 1770-4.1.

ATTENTION

If the controller is being installed within a potentially hazardous environment (that is, Class I, Division 2), all wiring must comply with the requirements stated in the National Electrical Code 501-4 (b).

Recommendations for Wiring I/O Devices

The following are general recommendations for wiring I/O devices.

ATTENTION



Before you install and wire I/O devices, disconnect power from the controller and any other source to the I/O devices.

- Use acceptable wire gauge. The I/O wiring terminals are designed to accept two wires per terminal (maximum) of the following size wire:
 - *Europe*: 2 mm² cross section or smaller
 - *United States*: 14 AWG or smaller stranded wires
- See diagram on page 116 for maximum torque values for wiring terminal screws and terminal block screws.
- Label wiring to I/O devices, power sources, and ground. Use tape, shrink-tubing, or other dependable means for labeling purposes. In addition to labeling, use colored insulation to identify wiring based on signal characteristics. For example, you may use blue for dc I/O wiring and red for ac I/O wiring.
- Route the wires down and away from the module, securing them with the cable tie.
- Bundle wiring for each similar I/O device together. If you use ducts, allow at least 5 cm (2 in.) between the ducts and the controller so there is sufficient room to wire the devices.
- Terminal cover plates have a write-on area for each terminal. Use this area to identify your I/O devices. Label the removable terminal block if you have not already.

ATTENTION

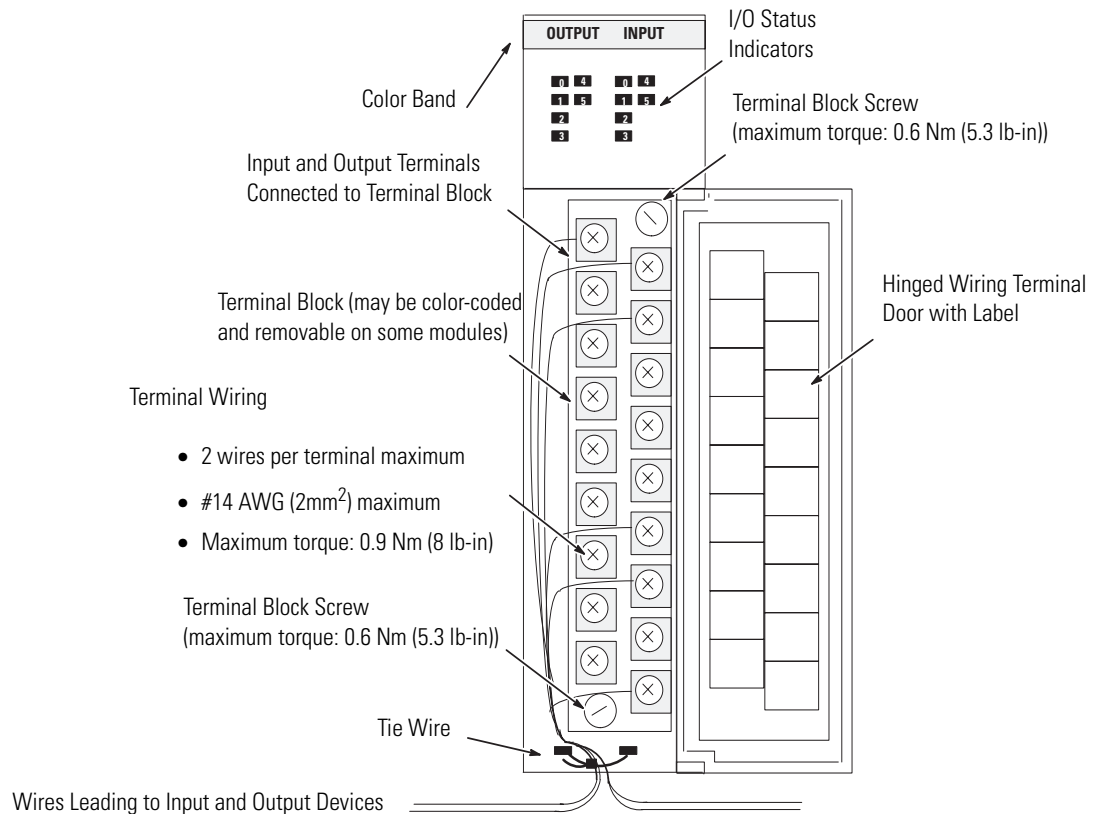


Calculate the maximum possible current in each power and common wire. Observe all local electrical codes dictating the maximum current allowable for each wire size. Current above the maximum ratings may cause wiring to overheat, which can cause damage.

Capacitors on input modules have a stored charge that can cause a non-lethal shock. Avoid mounting the controller in a position where installation or service personnel would be in danger from startle reaction.

Features of an I/O Module

Below is an example of a combination I/O module.



Wiring Your I/O Module

Terminals on the modules have self-lifting pressure plates that accept two 2 mm² (14 AWG) wires. Series B 12-point and 16-point and analog modules are equipped with removable terminal blocks for ease of wiring. The plug for the removable terminals is also color coded:

- red (ac)
- blue (dc)
- orange (relay)
- green (specialty).

Status indicators on the front of each module display the status of each I/O point. The status indicators illuminate when the proper signal to an input terminal is applied or when the processor commands an output to be energized.

To locate the I/O module wiring diagrams, contact your Rockwell Automation sales office for the latest selection guide, publication 1747-SG001. Or, locate the installation instruction sheet that was sent with your I/O module. It also includes I/O wiring diagrams.

1. Install a tie wire to secure your wiring and keep it neat. (If you feed the tie into one hole, it is routed back out through the other.)
2. Cover any unused slots with card slot fillers (catalog number 1746-N2) to keep the chassis free from debris and dust.

Octal Label Kit Installation

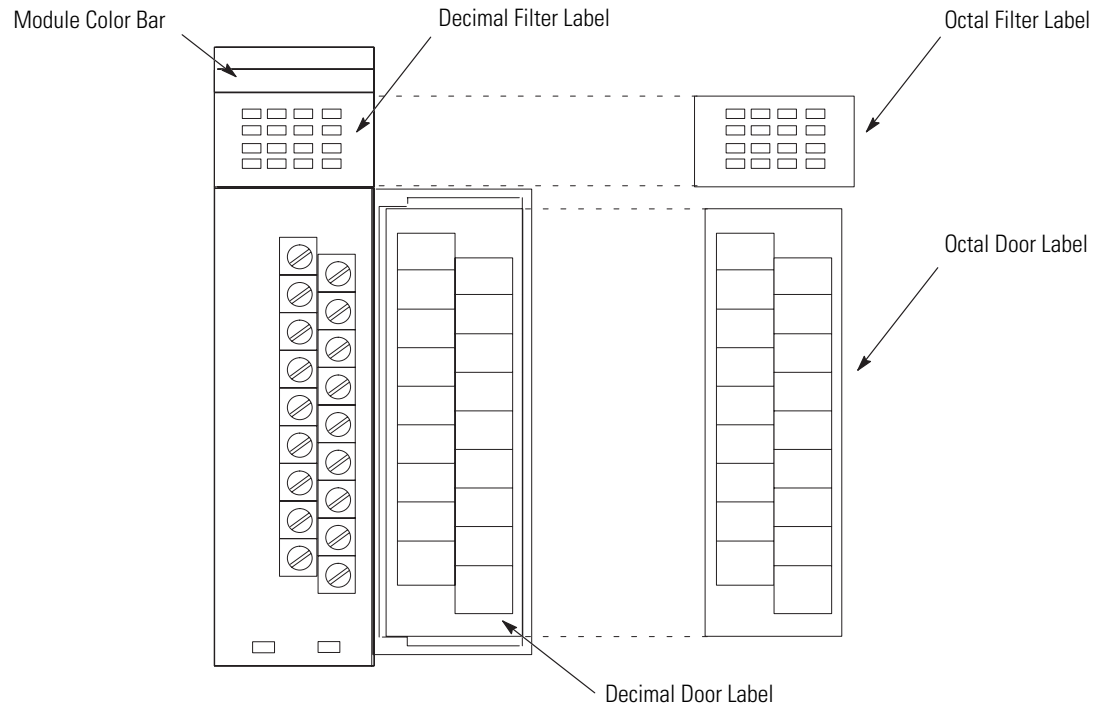
The octal label kit consists of an octal filter label and a door label. Use these octal labels to replace the decimal labels that are attached to the I/O modules. The kits can be obtained through your Allen-Bradley distributor. (The octal label kit is applicable when using 1746 I/O with PLC-5 processors via a 1747-ASB Remote I/O Adapter.)

Apply the Octal Filter Label

1. Remove the octal filter label from its paper carrier.
2. Align the octal filter label numbers horizontally to the module color bar and over the decimal filter numbers, as shown in the illustration below.
3. Apply the octal label to the filter.
4. Press firmly to ensure proper adhesion of the label.

Apply the Octal Door Label

1. Remove the octal door label from its paper carrier.
2. Align it over the decimal door label on the inside of the door.
3. Press firmly to ensure proper adhesion of the label.



Octal Kit and I/O Module Information

I/O Module Cat. No.	Octal Kit Cat. No.	I/O Module Cat. No.	Octal Kit Cat. No.
1746-IA16	1746-RL40	1746-OV16	1746-RL53
1746-IB16	1746-RL41	1746-OW16	1746-RL54
1746-IG16	1746-RL42	1746-OBP16	1746-RL55
1746-IM16	1746-RL43	1746-OVP16	1746-RL56
1746-IN16	1746-RL44	1746-OAP12	1746-RL57
1746-IV16	1746-RL45	1746-IC16	1746-RL58
1746-ITB16	1746-RL46	1746-IH16	1746-RL59
1746-ITV16	1746-RL47	1746-IB32	1746-RL60
1746-OA16	1746-RL50	1746-IV32	1746-RL61
1746-OB16	1746-RL51	1746-OB32 1746-OB32E	1746-RL70
1746-OG16	1746-RL52	1746-OV32	1746-RL71
		1746-OB16E	1746-RL72