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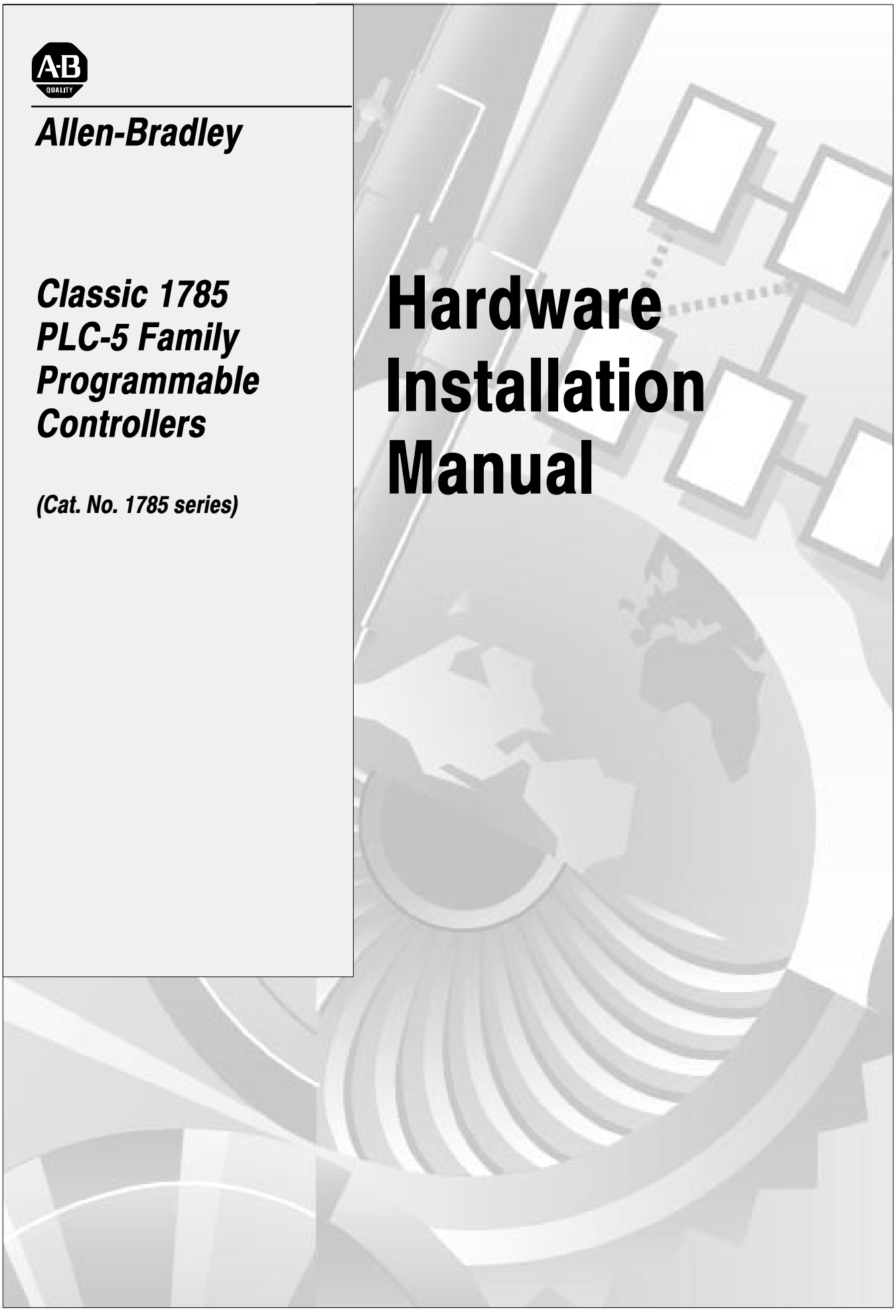

Allen-Bradley

Classic 1785
PLC-5 Family
Programmable
Controllers

(Cat. No. 1785 series)

Hardware Installation Manual

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Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

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

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

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Throughout this manual we use notes to make you aware of safety considerations:

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

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

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

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Summary of Changes

Summary of Changes

This release of the publication contains new and corrected information.

New and Corrected Information

For this new information	Refer to:
modified system connection diagram	chapter 1
added specifications for vibration, shock, and processor weight	appendix A
corrections to connection drawing for 1784-PCMK	appendix B
removed all information about enhanced PLC-5 processors instead, see the *Enhanced and Ethernet PLC-5 Programmable Controllers User Manual*, 1785-6.5.12	throughout

To help you find new and corrected information, we included change bars as shown to the left of this paragraph.

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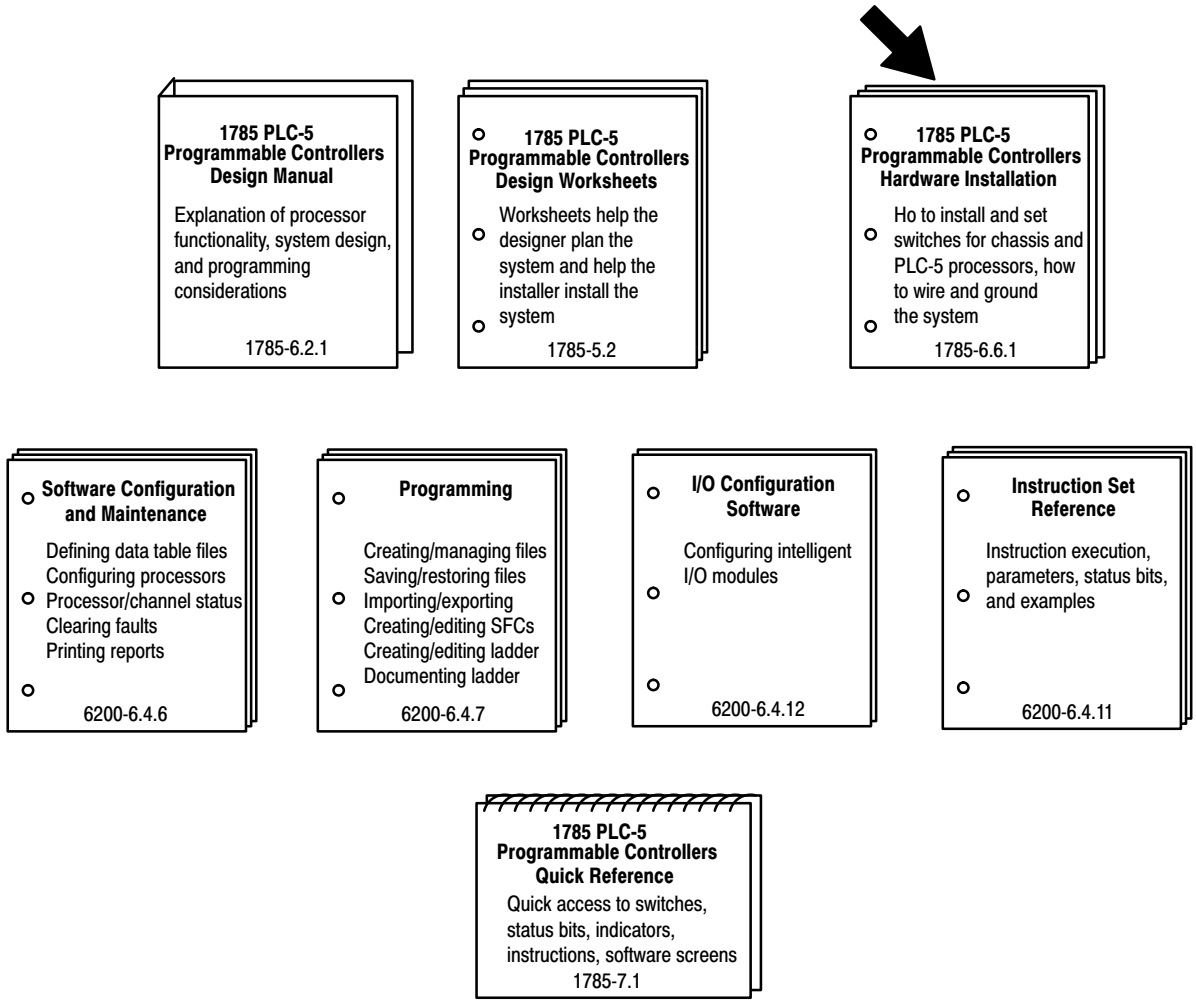
Using this Manual

How to Use Your Documentation

Your 1785 PLC-5® Programmable Controllers documentation is organized into manuals according to the tasks you perform. This organization lets you easily find the information you want without reading through information that is not related to your current task. The arrow points to the book you are currently in.

Figure 1.1
PLC-5 Programmable Controllers Documentation Library



For more information on 1785 PLC-5 programmable controllers or the above publications, contact your local sales office, distributor or system integrator.

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Preface

How to Use this Manual

At the beginning of each chapter, you will find a flowchart that maps the tasks you must perform as you install the PLC-5 processor system. The flowcharts guide you with questions about your system. Notice that underneath each chapter box is a checklist of the tasks contained within each chapter.

In addition to the 10 chapters shown in the flowchart, the manual contains these chapters and appendices:

For this information:	See:
LED indicator troubleshooting for the PLC-5 processor and adapter modules	chapter 11 — Troubleshooting
Processor specifications, battery specifications, additional quick reference information	appendix A — Processor Specifications
Cables for available programming terminals and cable pin assignments	appendix B — Cable Connections

For More Information

Also refer to these manuals:

For this information:	See:
Designing DH™, DH+™, DHII™, DH485 cable networks	1770-6.2.2
DH and DH+ protocol, commands, and network timing	1770-6.5.16
I/O modules and power supply installation	installation instructions for the individual component

For a list of publications with information about Allen-Bradley PLC-5 programmable controller products and other Allen-Bradley products, consult the Automation Group Publication Index, publication SD499.

Reporting Corrections and Suggestions

Use the Allen-Bradley Publication Problem Report, publication ICCG-5.21 to submit any corrections to or suggestions about this publication. This document is available through NEWlit and on the AB-POST system. You can help us improve the quality of customer documentation.

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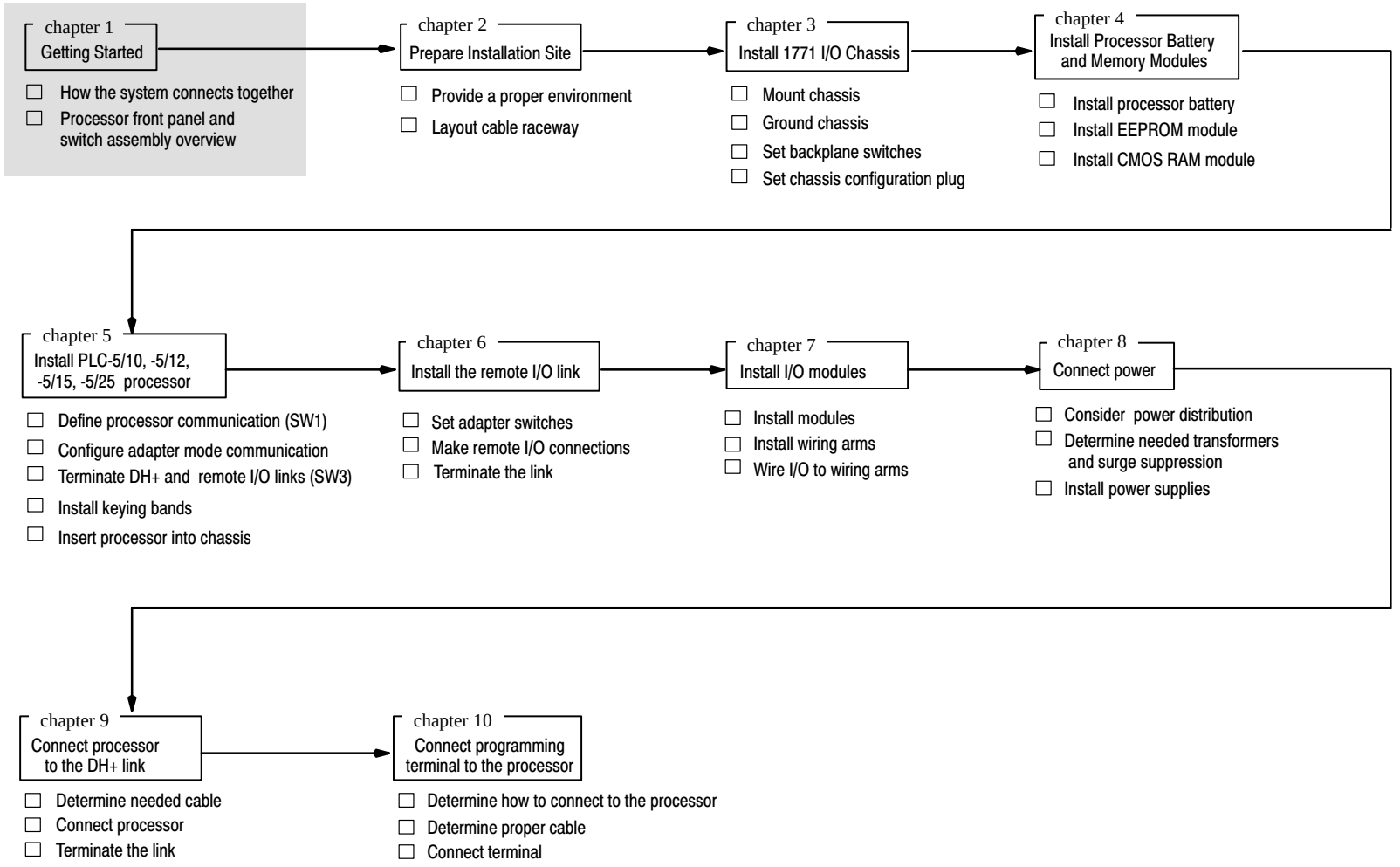

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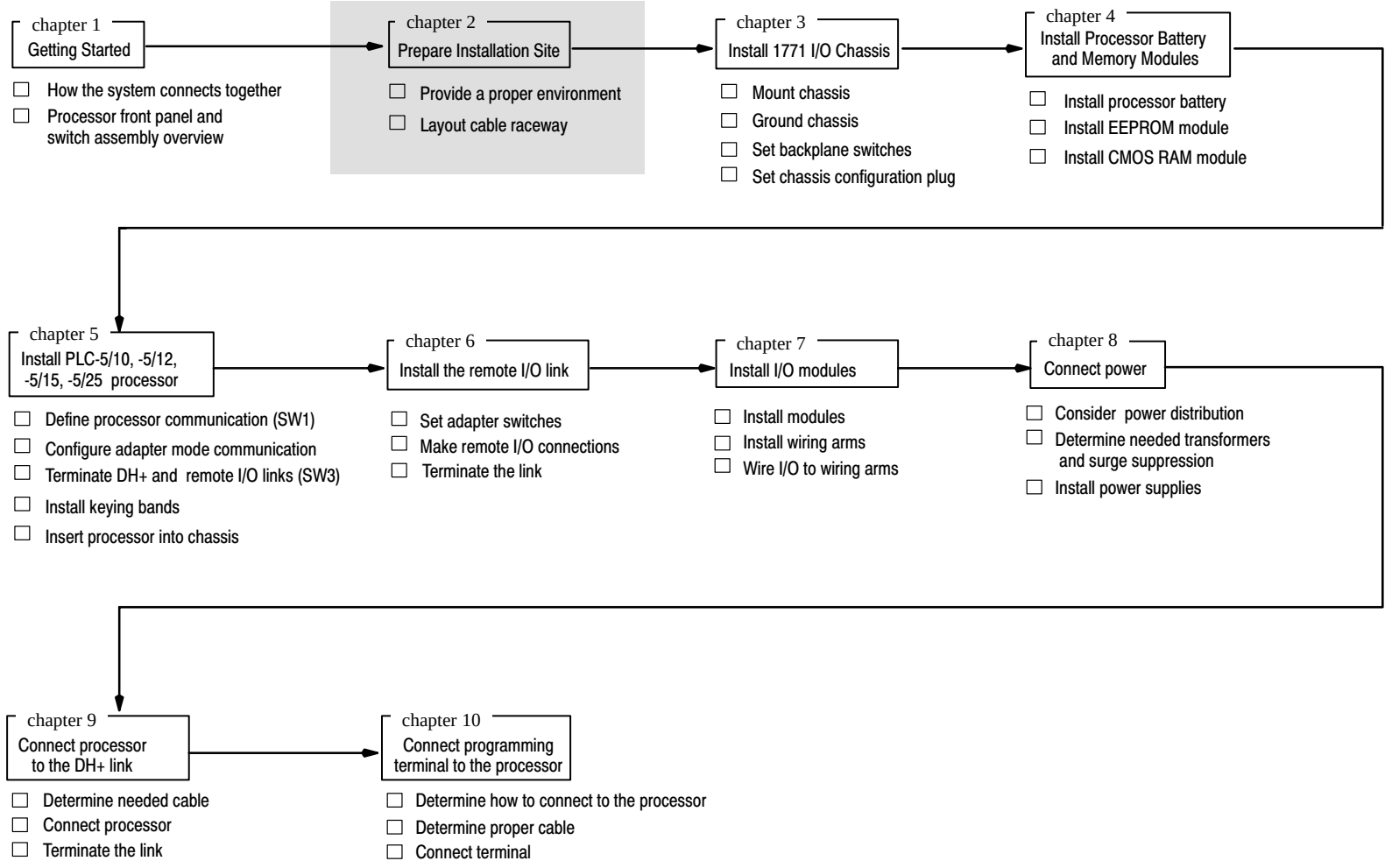

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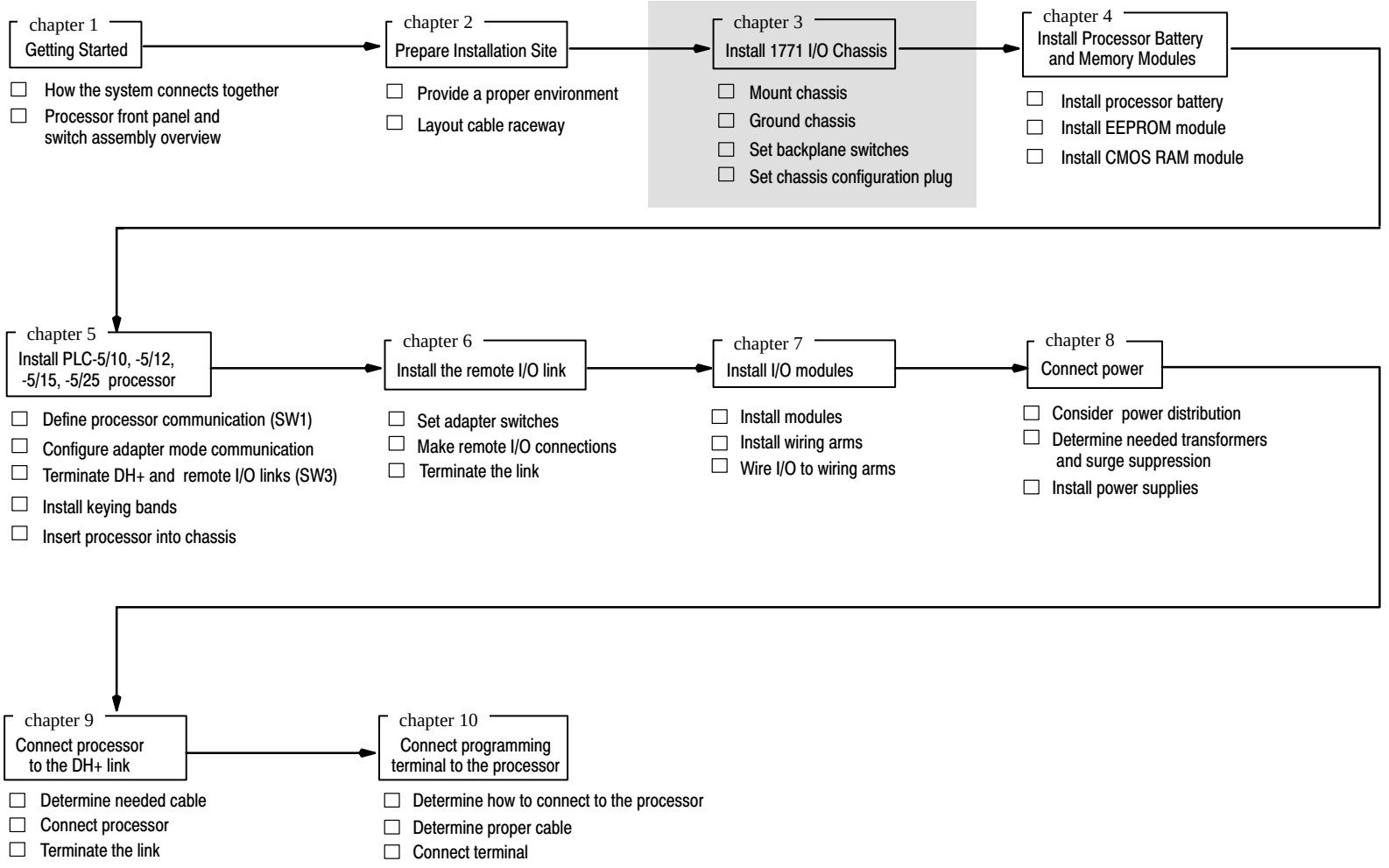

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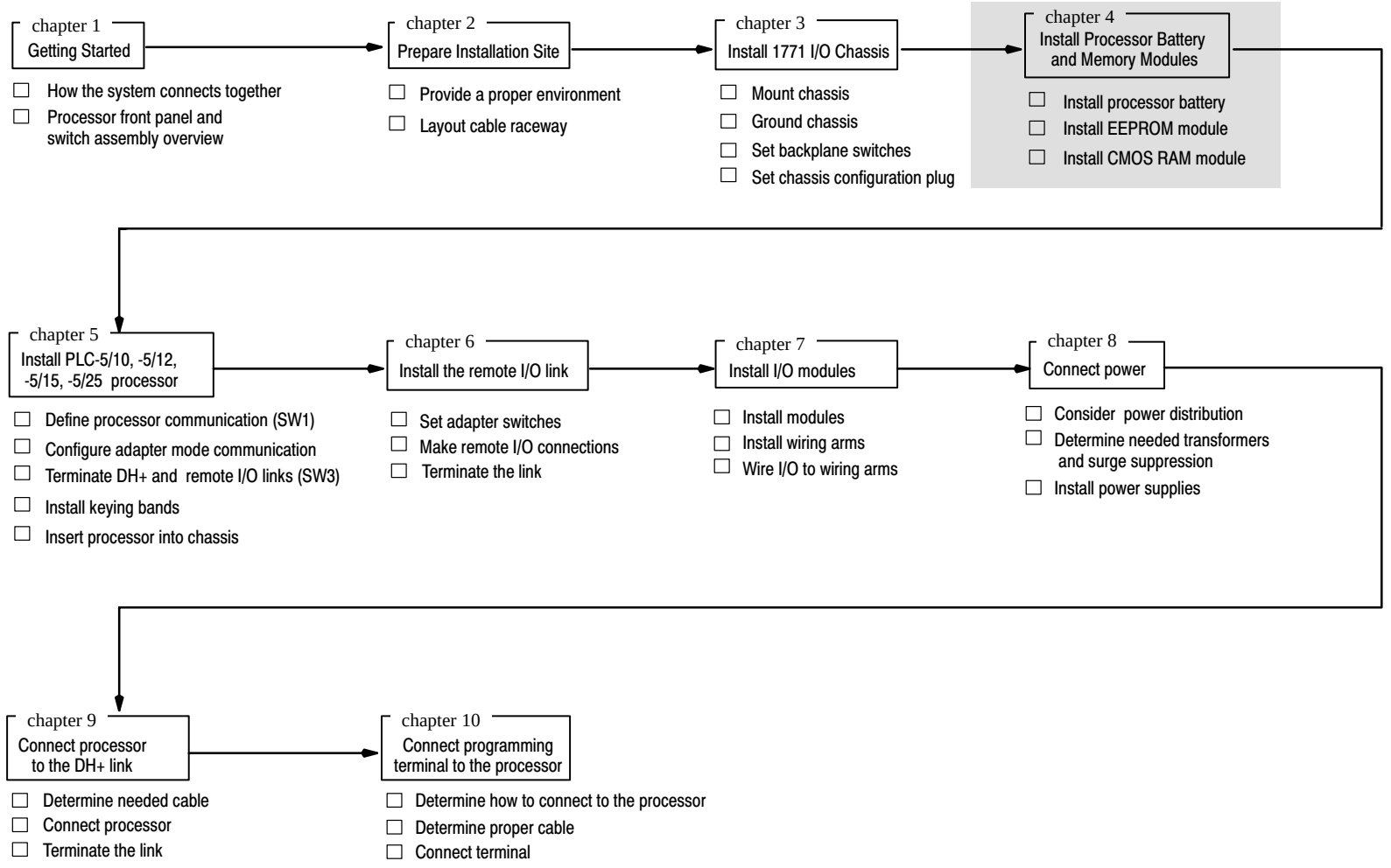

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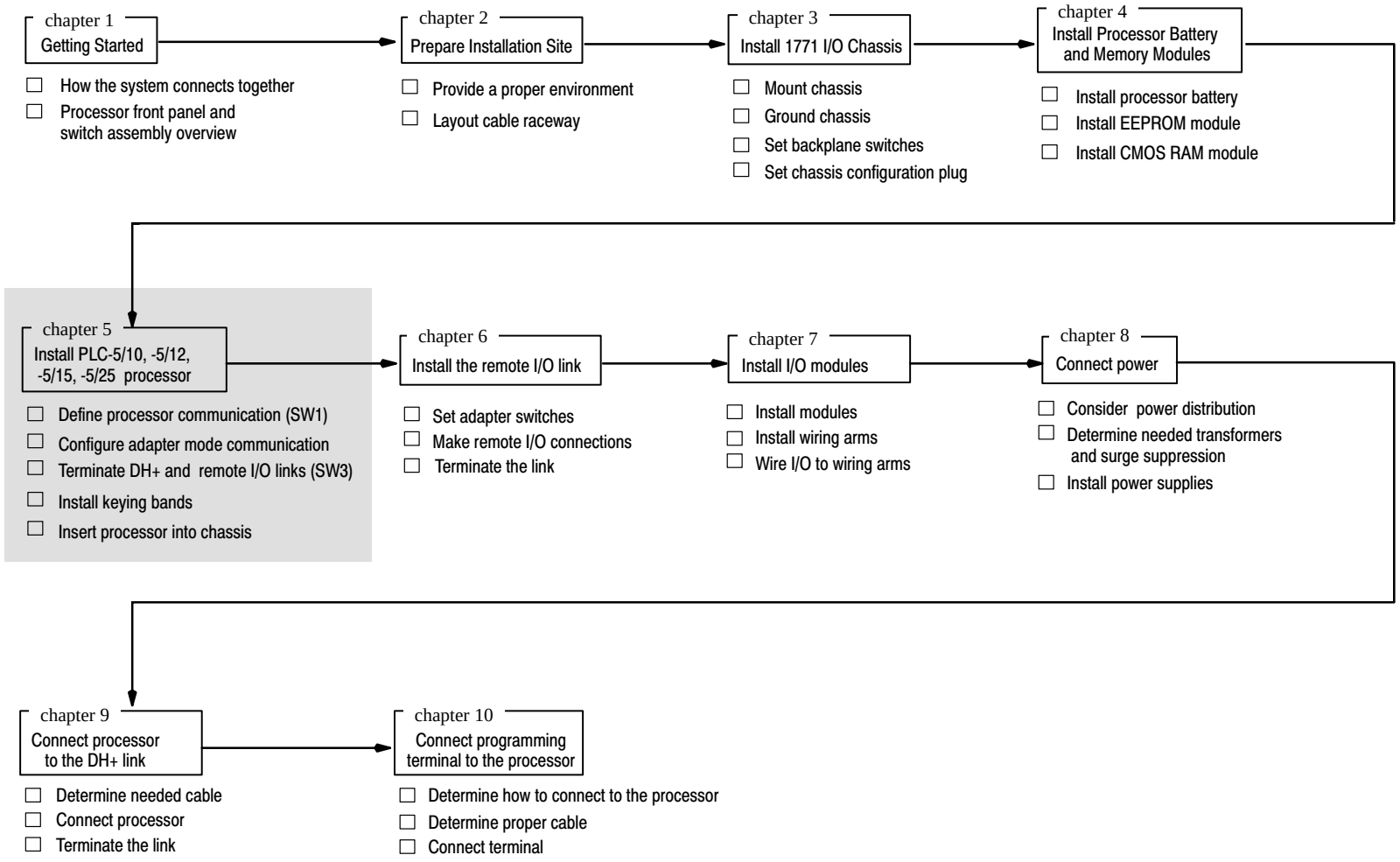

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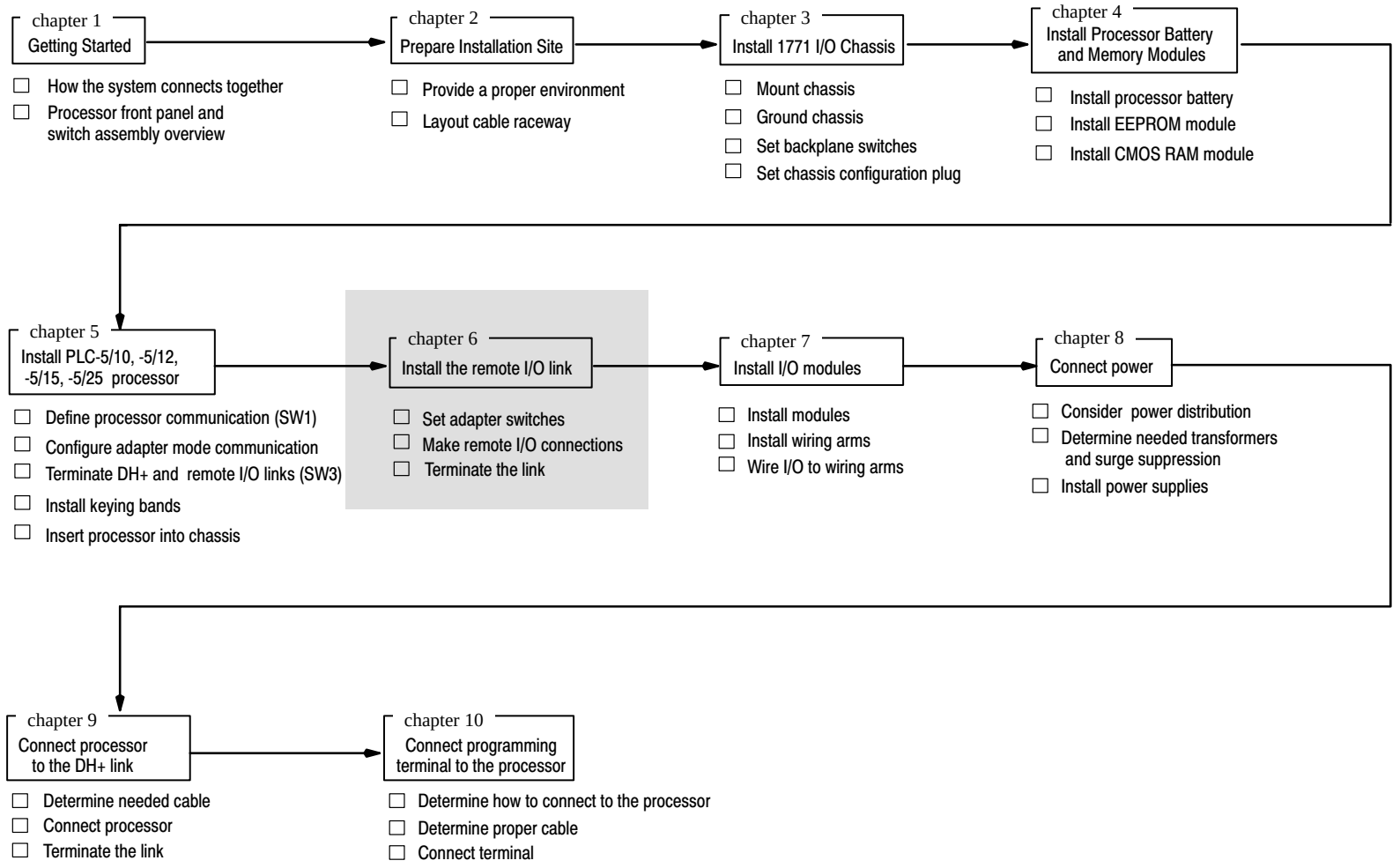

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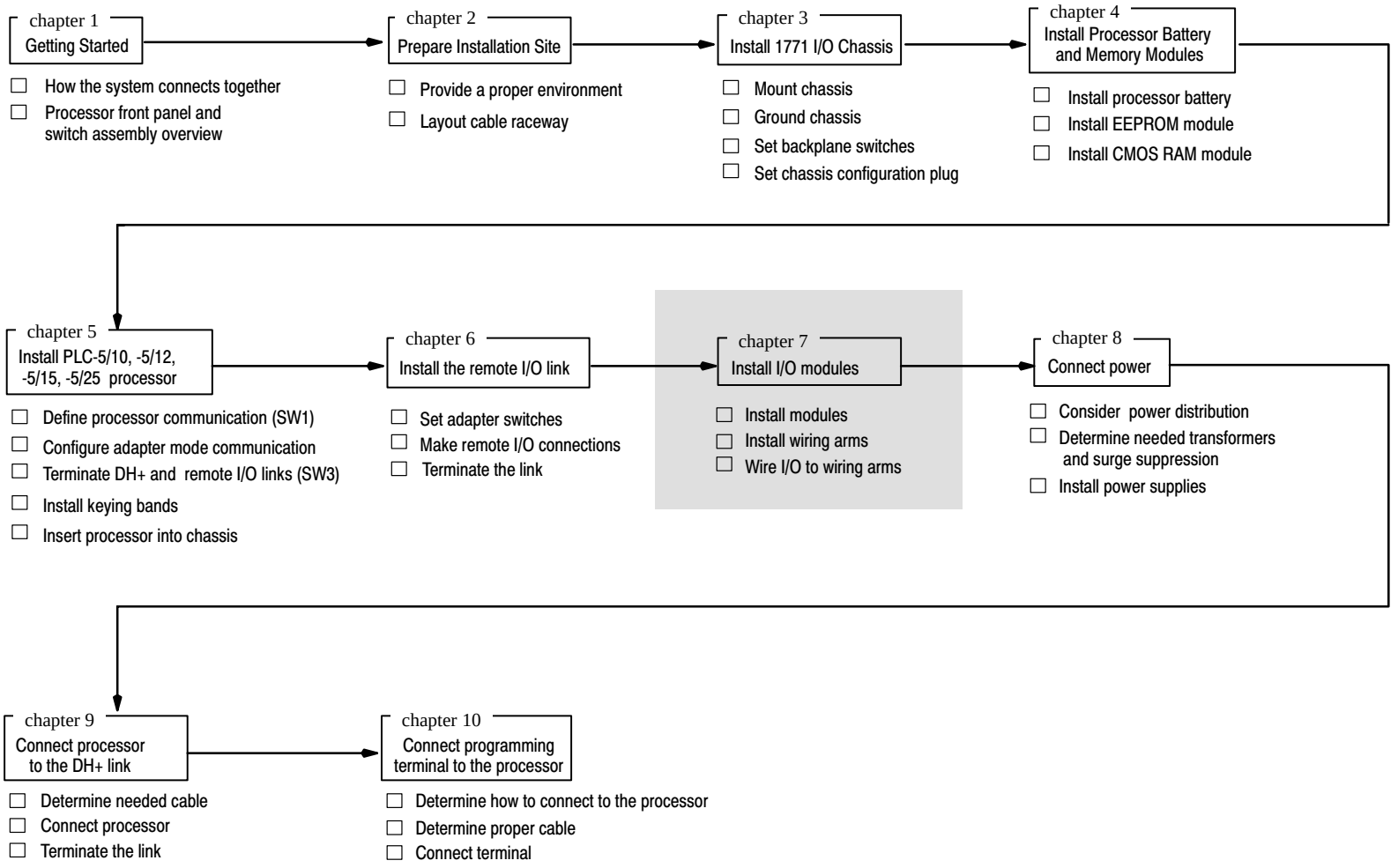

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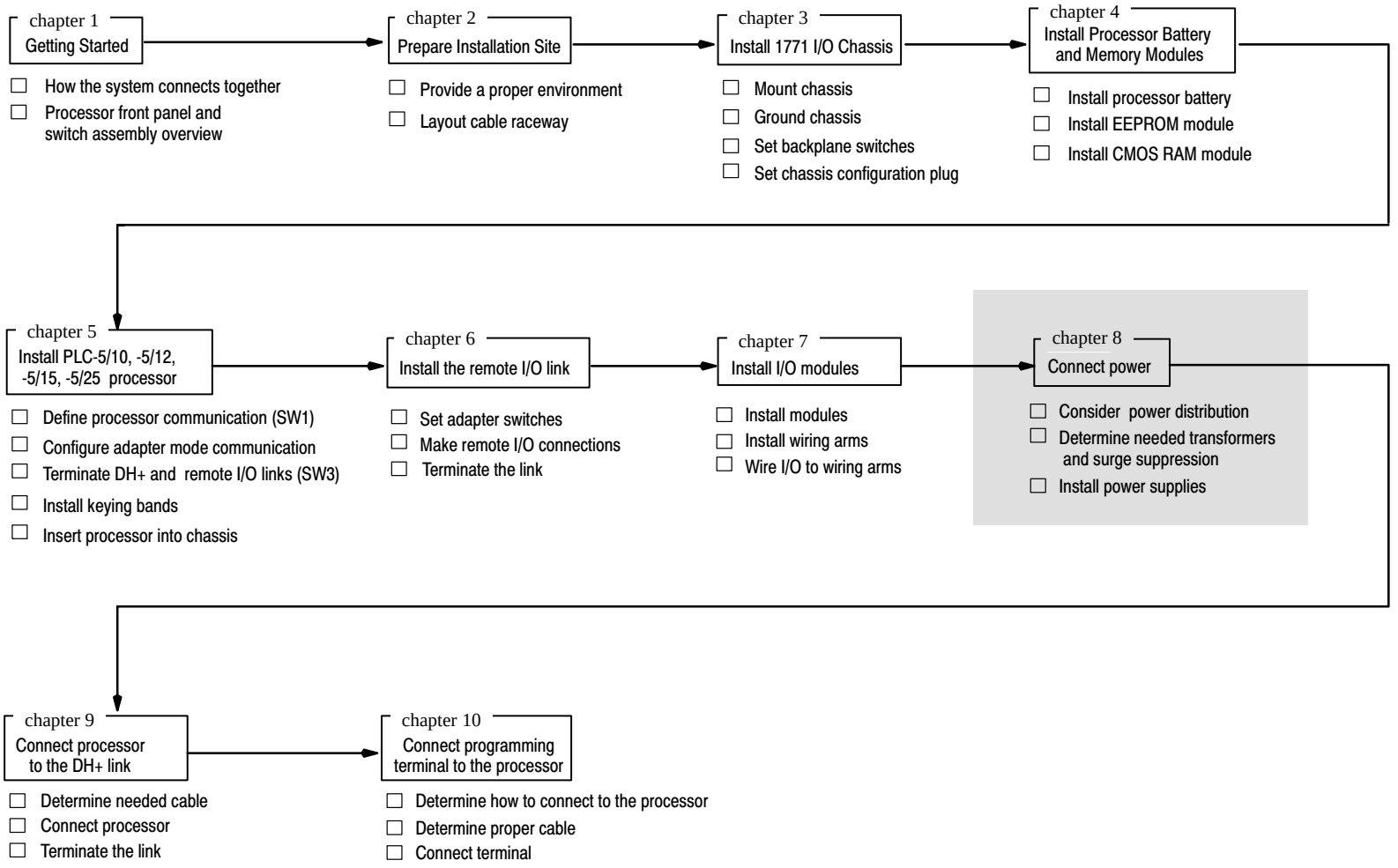

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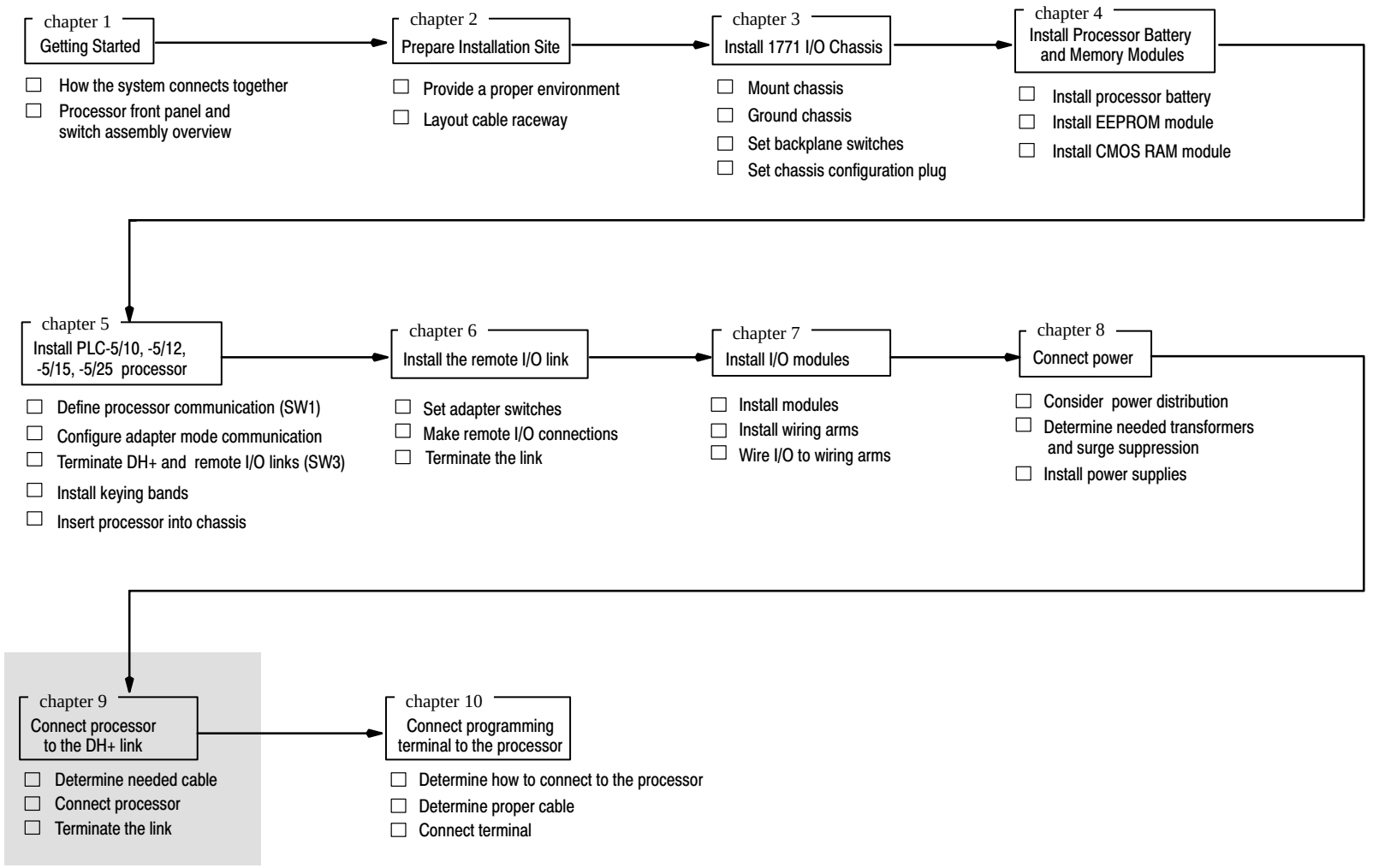

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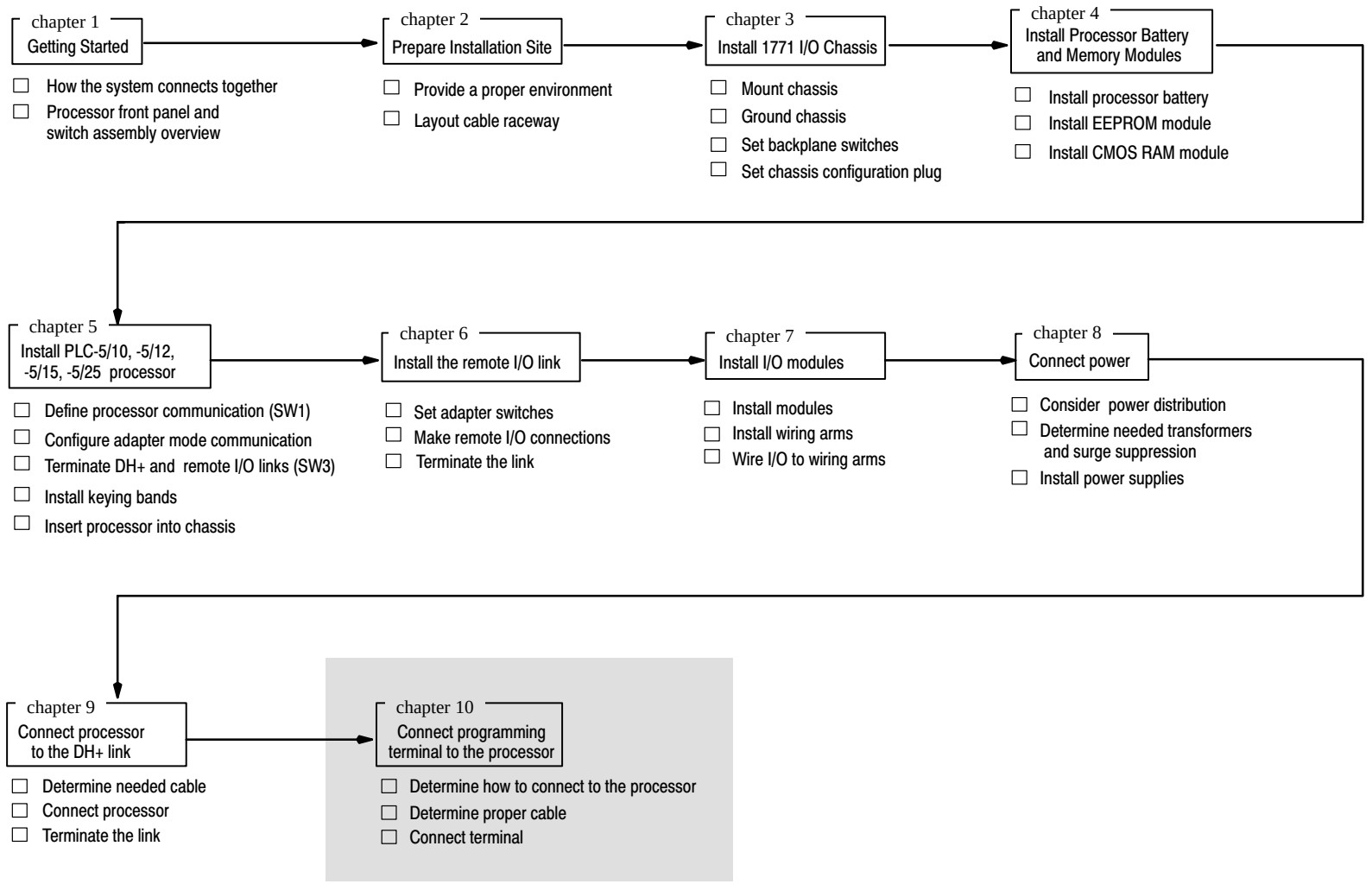

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Chapter 1

Getting Started

Chapter Objectives

Use this chapter to help you become acquainted with the PLC-5 system and the PLC-5 processor.

chapter 1
Getting Started

- ☐ How the system connects together
- ☐ Processor front panel and switch assembly overview

Use the chart on the left-hand page to help guide you through the installation procedures.

How the System Connects Together

A PLC-5 system consists of the following major components:

- PLC-5 processor

Processor:	Catalog Number:
PLC-5/10™	1785-LT4
PLC-5/12™	1785-LT3
PLC-5/15™	1785-LT
PLC-5/25™	1785-LT2

- adapter modules (remote I/O and extended-local I/O)
- I/O modules
- chassis
- power supplies
- programming terminals

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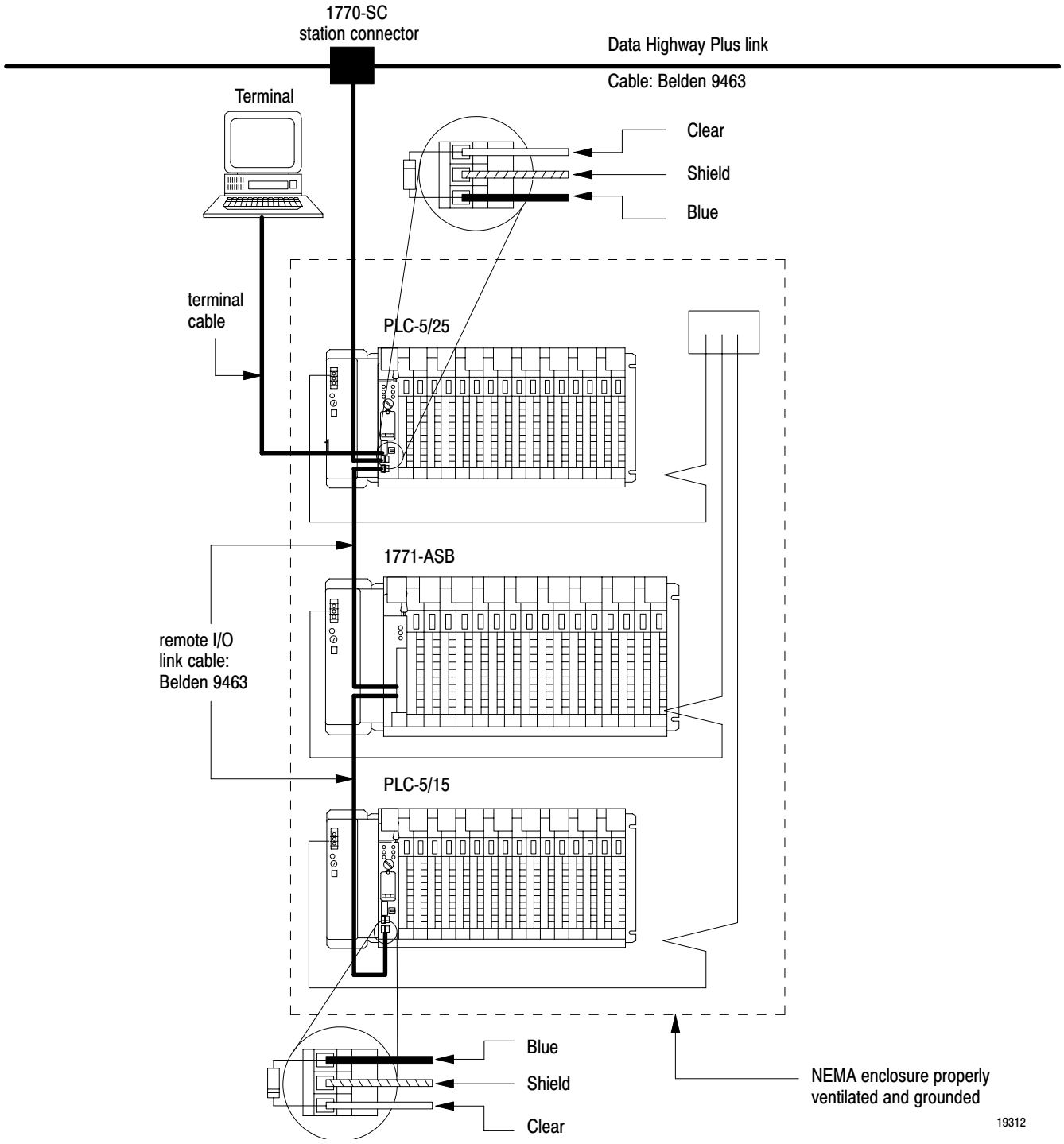
Figure 1.1
System Interconnection Overview



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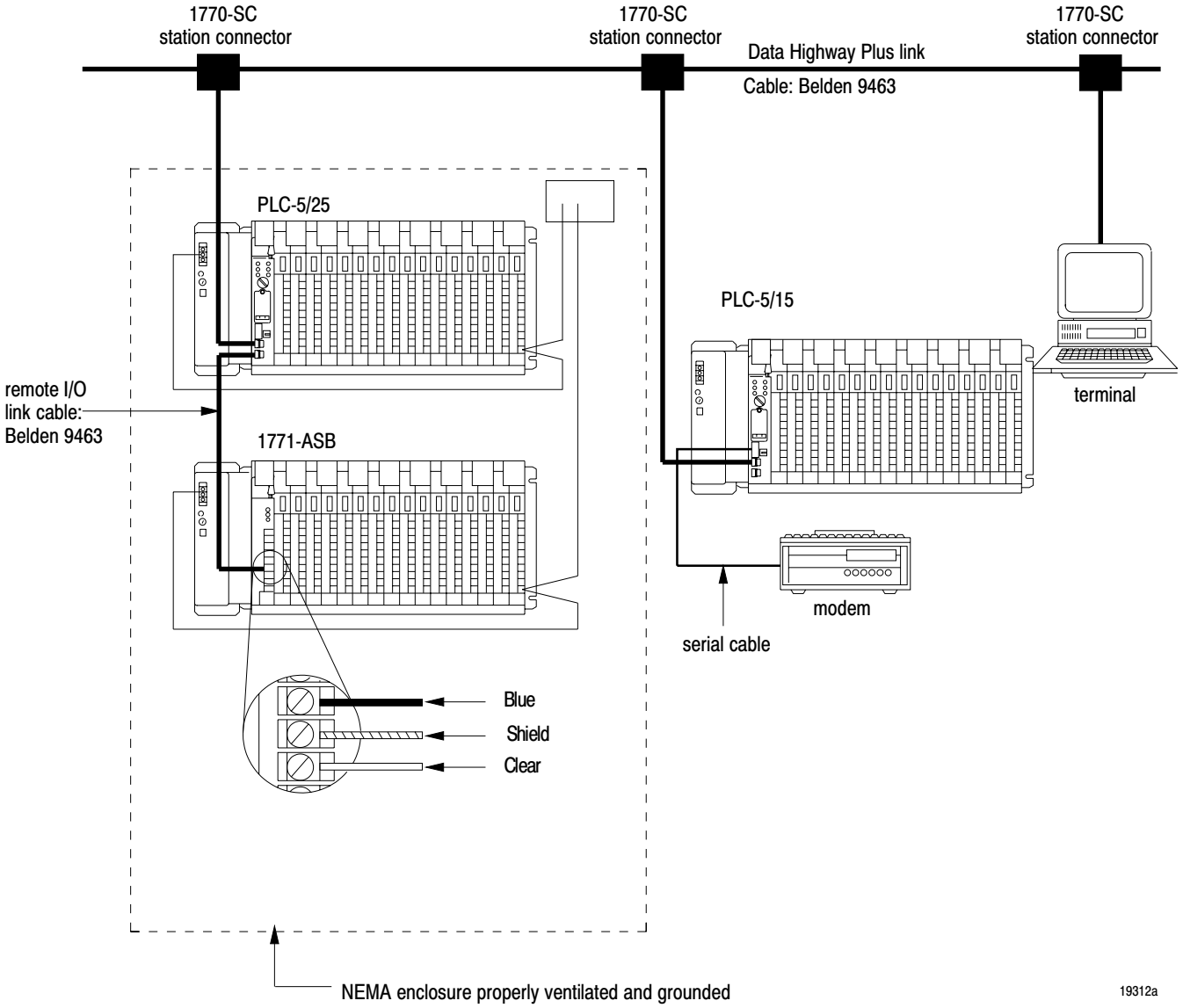

Processor Front Panel and Switch Assembly Overview

Use Figure 1.2 and Figure 1.3 to help identify and understand the processor's front panel components and the processor's switch assemblies.

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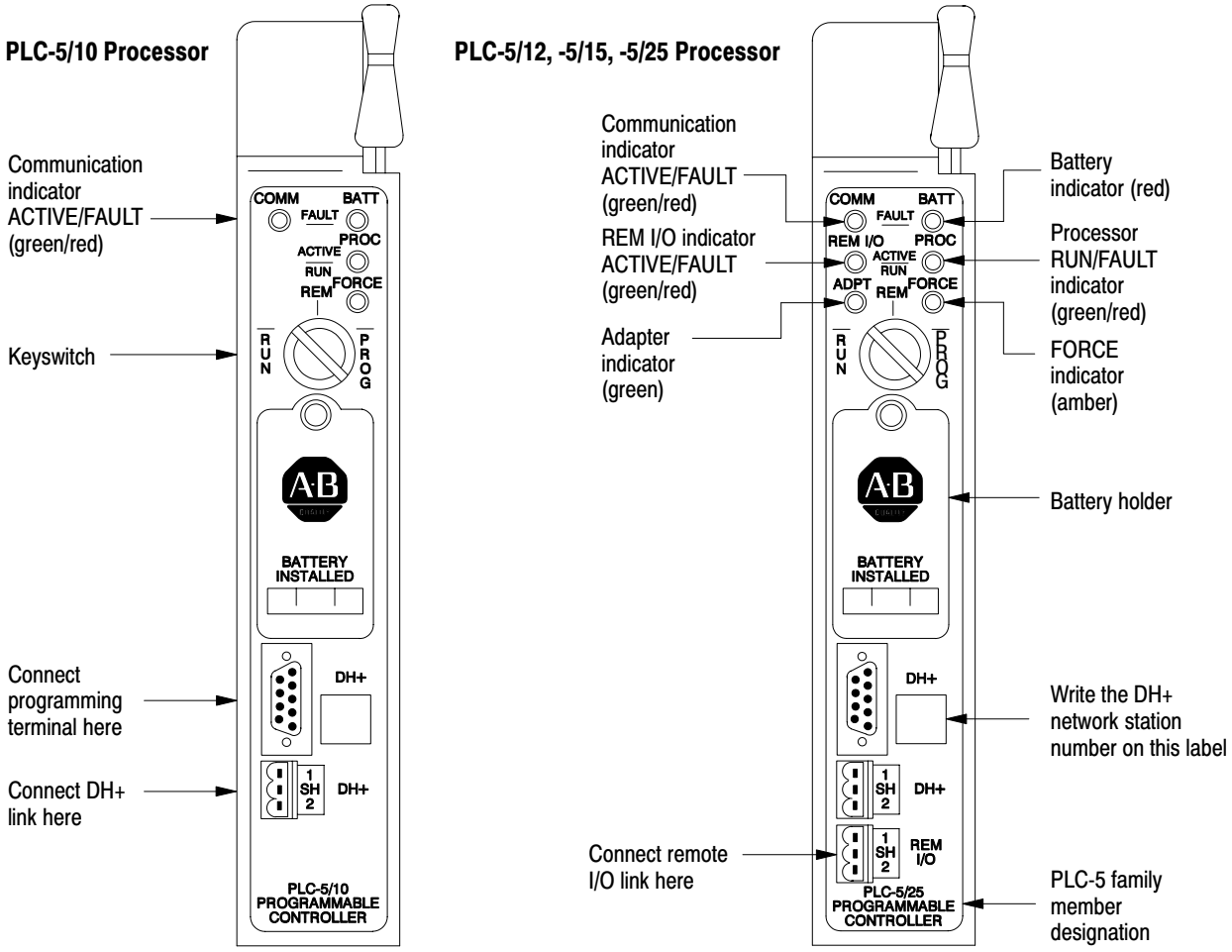
Figure 1.2
PLC-5/10, -5/12, -5/15, and -5/25 Processor Front Panels



Connector Name	Connector Type	Description
programming terminal	9-pin, D-shell	Use this connector to directly connect a programming terminal to the processor. This connector has a parallel connection with the 3-pin DH+ communications link connector.
DH+ communications link	3-pin	Use this connector to connect to DH+ communications link.
remote I/O	3-pin	Use this connector for the remote I/O link. (This connector is **not** available on a PLC-5/10 processor.)

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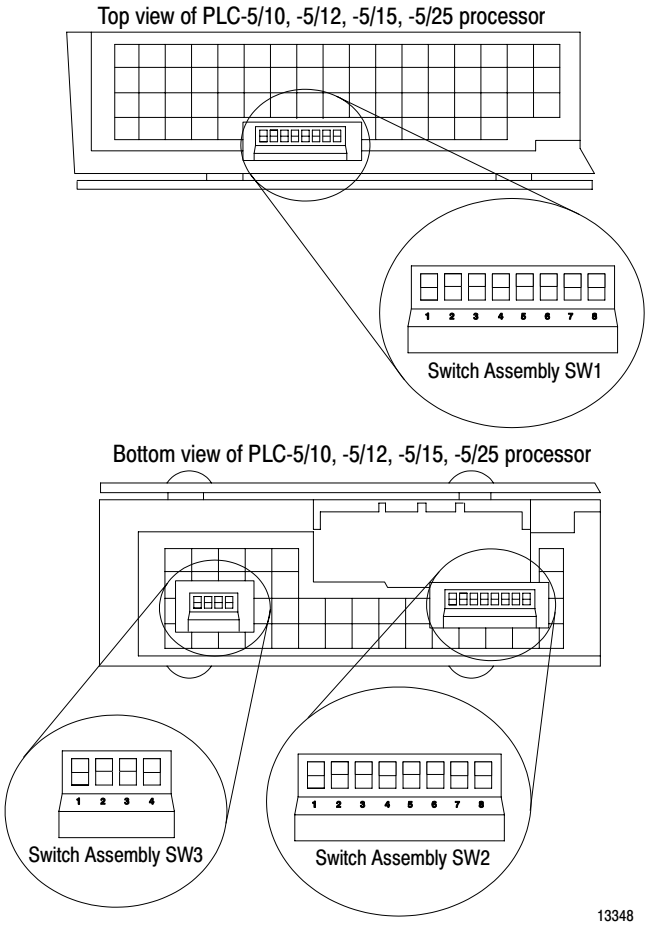
Figure 1.3
PLC-5/10, -5/12, -5/15, and -5/25 Processor Module Switch Assemblies



Use this Switch Assembly:	To:
SW1	• set the station number of the processor on the DH+ link • select the mode of operation (scanner or adapter) of the processor PLC-5/10 — resident I/O scanner only; PLC-5/12 — adapter only
SW2	• determine the number of data table words reserved for communication between a host processor and the PLC-5 processor when the PLC-5 processor is in adapter mode • determine the beginning I/O group number assigned to the PLC-5 processor when it is in adapter mode • determine the I/O rack number assigned to the PLC-5 processor when it is in adapter mode
SW3	• connect a termination resistor across the line at the processor when the processor is an end device on the DH+ or remote I/O link.

For more information about setting these switches, see chapter 6.

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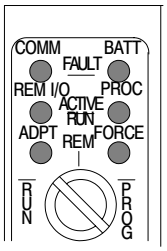
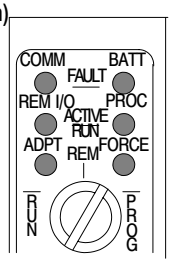
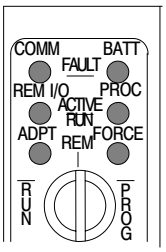
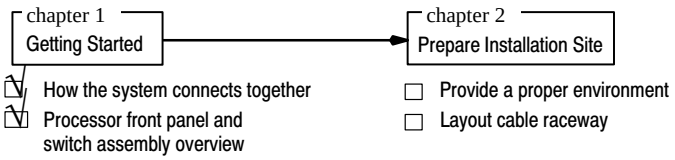
Understanding the Keyswitch

Use the keyswitch to change the mode in which a processor is operating. You receive keys for the keyswitch in the processor package. Refer to Table 1.A for information about the processor modes.

Table 1.A
Processor Operation Modes

To:	Turn the keyswitch to:
• Run your program, force I/O and save your programs to a disk drive. Outputs are enabled. (Equipment being controlled by the I/O addressed in the ladder program begin operation.) • Enable outputs. **Note:** You cannot create or delete a ladder file; create or delete data files; or change the modes of operation through the programming terminal or software while in RUN mode.	RUN 
• Disable outputs • Create, modify and delete ladder files or data files, download to an EEPROM module, and save/restore ladder programs. **Notes:** • The processor does not scan the program. • You cannot change the mode of operation through the programming terminal or software while in PROGram mode.	PROG (program) 
Change between remote program, remote test, and remote run modes through the programming terminal software. **Remote run** • Enable outputs • You can save and restore files as well as perform online editing. **Remote program** See program mode description above **Remote test** • Execute your ladder programs with outputs disabled. • You cannot create or delete ladder programs or data files.	REM (remote) 

What to Do Next



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Chapter 2

Prepare the Installation Site

Chapter Objectives

A well-planned layout and a well-prepared installation site are essential for the proper installation of your PLC-5 processor system. Use this chapter to help you prepare the installation site.

chapter 2
Prepare Installation Site

- ☐ Provide a proper environment
- ☐ Layout cable raceway

Provide the Proper Environment for the Processor

When installing your processor, consider the environment in which the processor will be operating. To operate properly and effectively, the processor should be in an environment with conditions that fall within the following guidelines (Table 2.A):

Table 2.A
Proper Environmental Conditions for Your Processor

Environmental condition:	Acceptable range:
operating temperature	0 to 60° C (32 to 140° F)
storage temperature	-40 to 85° C (-40 to 185° F)
relative humidity	5 to 95% (without condensation)

To achieve this environment, do the following:

- install the processor system in an enclosure
- provide convection cooling to the processor system

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Use an Enclosure

You provide the enclosure for your processor system. This enclosure protects your processor system from atmospheric contaminants such as oil, moisture, dust, corrosive vapors, or other harmful airborne substances. To help guard against EMI/RFI interference, we recommend a steel enclosure.

Mount the enclosure in a position that lets you open the doors fully. You need easy access to the processor, related components, and wiring so that troubleshooting is convenient.

When you choose the enclosure size, allow extra space for isolation transformers, fusing, disconnect switch, master control relay, and terminal strips.

Provide Convection Cooling

Separate your processor system from other equipment and plant walls to allow for convection cooling. Convection cooling draws a vertical column of air upward over the processor. This cooling air must not exceed 60° C (140° F) at any point immediately below the processor. If the air temperature exceeds 60° C, install fans (which circulate filtered air or recirculate internal air) inside the enclosure or air conditioning/heat exchanger units.

To allow for proper convection cooling in enclosures containing a processor-resident chassis, extended-local I/O and remote I/O chassis, follow the guidelines described by Figure 2.1.

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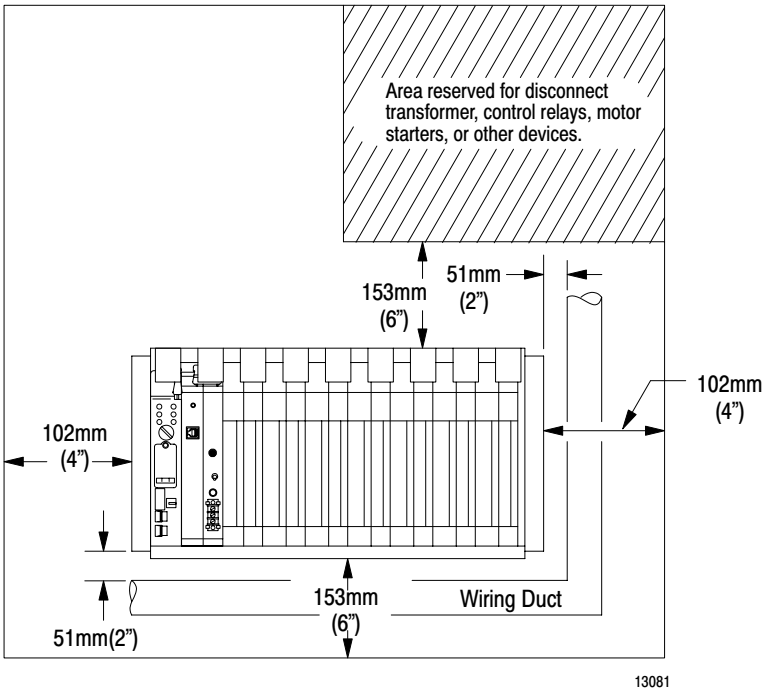
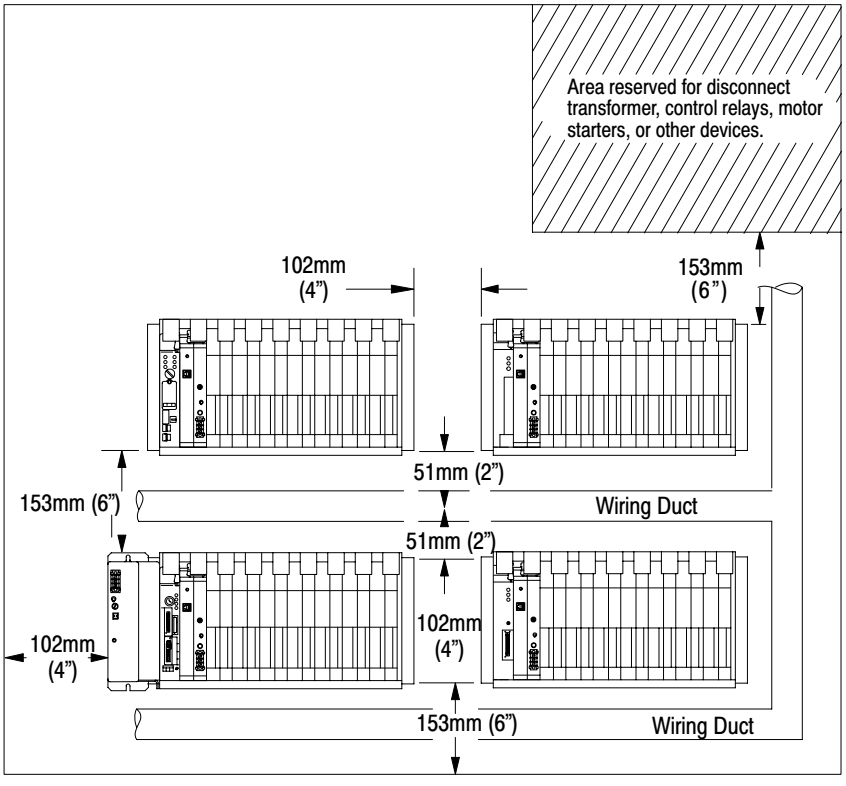
Figure 2.1
Ensure Proper Convection Cooling By Following These Minimum Component Spacing Guidelines



Minimum spacing requirements for a processor-resident chassis:

- Mount the I/O chassis horizontally.
- Allow 153 mm (6 in.) above and below the chassis.
- Allow 102 mm (4 in.) on the sides of each chassis.
- Allow 51 mm (2 in.) vertically and horizontally between any chassis and the wiring duct or terminal strips.
- Leave any excess space at the top of the enclosure where the temperature is the highest.



Minimum spacing requirements for extended-local and remote I/O chassis:

- Mount the I/O chassis horizontally.
- Allow 153 mm (6 in.) above and below all chassis. When you use more than one chassis in the same area, allow 152.4 mm (6 in) between each chassis.
- Allow 102 mm (4 in.) on the sides of each chassis. When you use more than one chassis in the same area, allow 101.6 mm (4 in) between each chassis.
- Allow 51 mm (2 in.) vertically and horizontally between any chassis and the wiring duct or terminal strips.
- Leave any excess space at the top of the enclosure where the temperature is the highest.

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Layout the Cable Raceway

The raceway layout of your processor system is related to where you place the different types of I/O modules in the I/O chassis. Before designing your raceway layout, refer to your system's chassis layout plans to determine the position of your I/O modules in their respective chassis.

To plan a raceway layout, do the following:

- categorize conductor cables
- route conductor cables

Categorize Conductors

Segregate all wires and cables into the following three categories (Table 2.B):

Table 2.B
Follow These Guidelines for Grouping Conductors

Group conductor cables fitting this description:	Into this category:	Examples:
high-power conductors that are more tolerant of electrical noise than category-2 conductors and may also generate more noise	Category 1	• ac power lines • high-power ac I/O lines – to connect ac I/O modules rated for high power and high noise immunity • high-power dc I/O lines – to connect dc I/O modules rated for high power or with input circuits with long time-constant filters for high noise rejection. They typically connect devices such as hard-contact switches, relays, and solenoids
low-power conductors that are less tolerant of electrical noise than category-1 conductors and should also generate less noise	Category 2	• serial communication cables – to connect between processors or to remote I/O adapter modules, programming terminals, computers, or data terminals • parallel communication cables – to connect extended local I/O chassis in multiple enclosures • low-power ac/dc I/O lines – to connect to I/O modules that are rated for low power such as low-power contact-output modules • low-power dc I/O lines – to connect to dc I/O modules that are rated for low power and have input circuits with short time-constant filters to detect short pulses. They typically connect to devices such as proximity switches, photo electric sensors, TTL devices, and encoders
interconnect the processor-system components within an enclosure	Category 3	• processor-system power cables – provide backplane power to the processor-system components • parallel communication cables – to connect to extended-local I/O chassis within the same enclosure • Processor-peripheral cables – connect processors to their communication interface modules

Refer to the installation instructions for each I/O module you are using for information about its classification.

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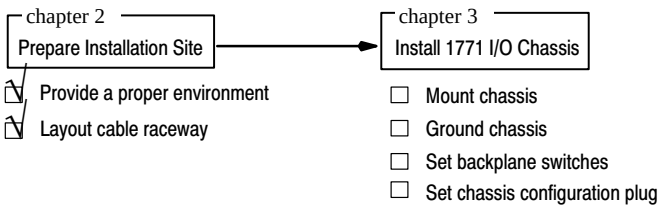
Route Conductors

To guard against coupling noise from one conductor to another, follow these general guidelines (Table 2.C) when routing wires and cables (both inside and outside of an enclosure):

Table 2.C
Follow These Guidelines for Routing Cables

Route this category of conductor cables:	According to these guidelines:
Category 1	These conductors can be routed with machine power conductors of up to 600V ac (feeding up to 100 hp devices) if this does not violate local codes. Article 300-3 of the National Electrical Code requires that all conductors (ac and/or dc) in the same raceway must be insulated for the highest voltage applied to any one of the conductors in the raceway.
Category 2	• Properly shield (where applicable) and route conductors in a separate raceway. • Cross power feed lines at right angles (if necessary). • Route at least 0.305m (1 ft) from 120V ac power lines; .610m (2 ft) from 240V ac power lines; 0.915m (3 ft) from 480V ac power lines. • Route at least 0.915m (3 ft) from any electric motors, transformers, rectifiers, generators, arc welders, induction furnaces, or sources of microwave radiation. If the conductor is in a metal raceway or conduit, that raceway or conduit must be well grounded along its entire length.
Category 3	Route conductors external to all raceways or in a raceway separate from any category-1 or category-2 conductors.

What to Do Next



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Chapter 3

Install the 1771 I/O Chassis

Chapter Objectives

Use this chapter to help you install a 1771 I/O chassis.

chapter 3
Install 1771 I/O Chassis

- ☐ Mount chassis
- ☐ Ground chassis
- ☐ Set backplane switches
- ☐ Set chassis configuration plug

For more information, refer to the installation instructions for the I/O chassis you are mounting.

Mount the Chassis

You can mount a chassis two ways:

- mount to a panel (chassis cat. no. 1771-A1B, -A2B, -A3B1, -A4B)
- mount to a rack or panel (chassis cat. no. 1771-A3B only)

To mount a chassis, do the following:

- Ensure that you have sufficient space to mount the chassis. Use the chassis mounting dimensions as a guide.
- Attach the chassis to the rack or panel

Ensure Sufficient Mounting Space

For component spacing and dimensions for series B chassis:

For this information	Refer to:
I/O chassis (series B) mounting dimensions	Figure 3.1 (page 3-2)
I/O chassis (series B) with 1771-P2 power supply mounting dimensions	Figure 3.2 (page 3-3)

See Appendix A for series A chassis spacing and dimensions.

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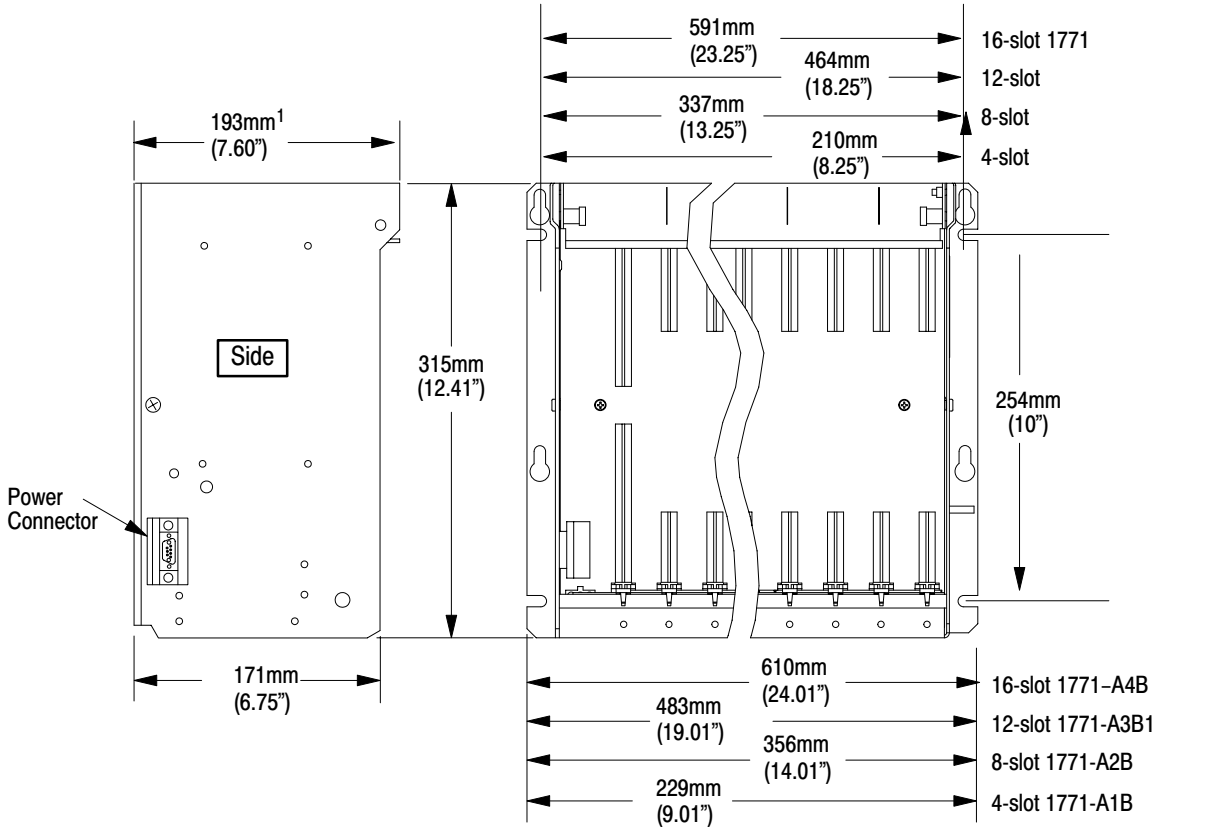
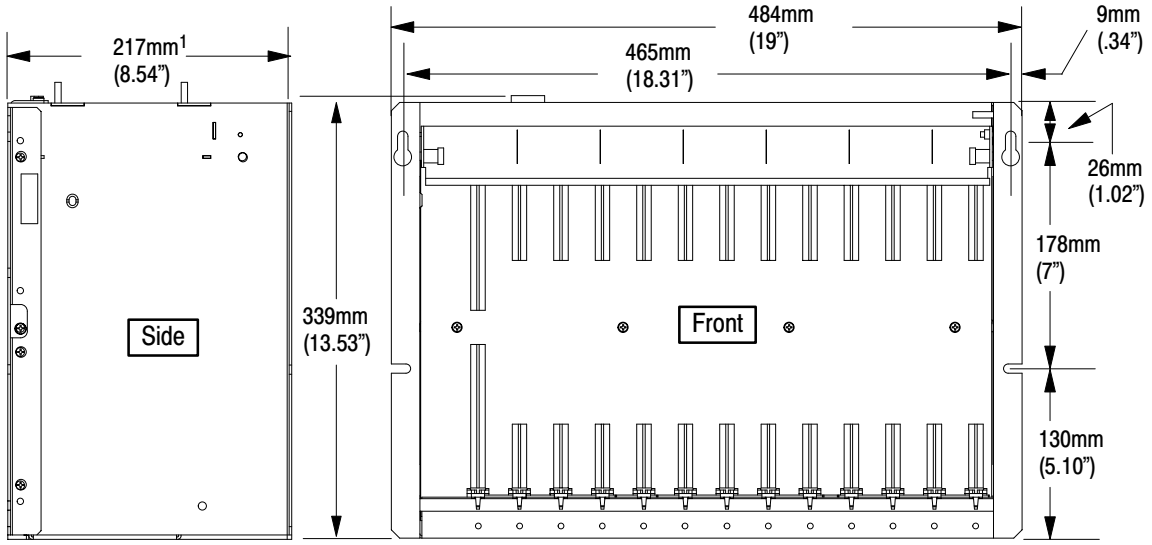
Figure 3.1
Chassis Dimensions (Series B)

1771-A1B
1771-A2B
1771-A3B1
1771-A4B



1771-A3B



[1]Total maximum depth dimension per installation depends on module wiring and connectors.

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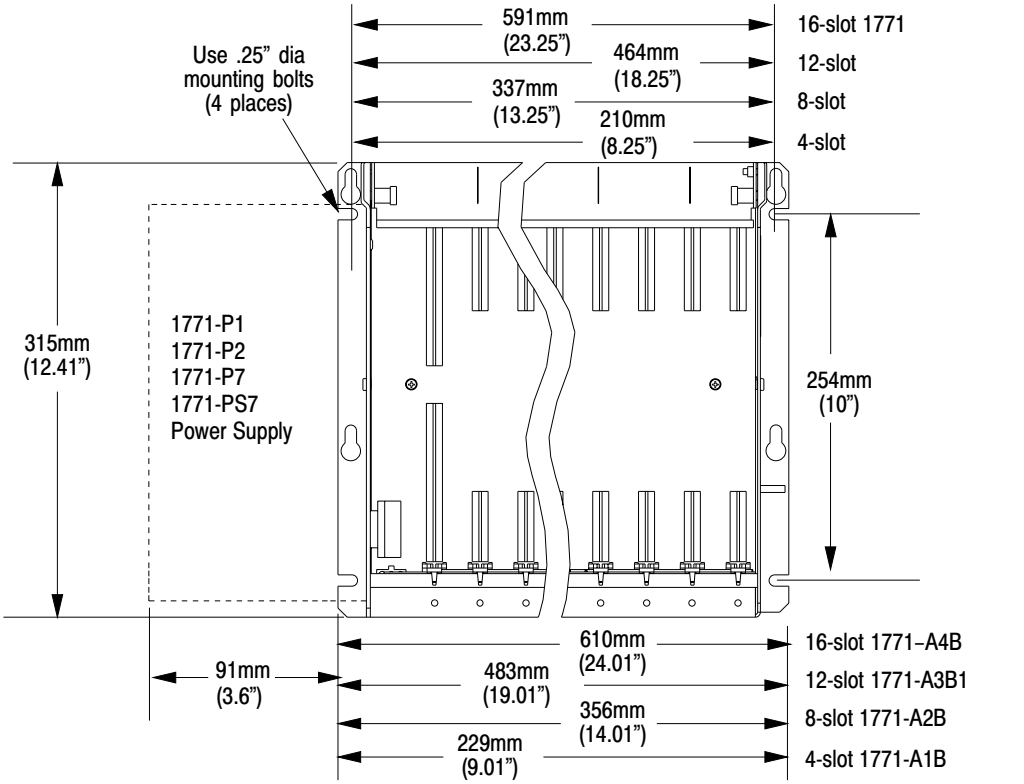
You can mount a 1771-P1, -P2, -P7, or -PS7 power supply on the left side plate of the I/O chassis, or up to 5 cable-feet from the I/O chassis.

Figure 3.2
1771-A1B, -A2B, -A3B1 and -A4B Mounting Dimensions with a Power Supply (Series B)



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Attach the Chassis to a Panel or Rack

Now that you have established and verified all layouts, begin mounting the chassis to a panel or rack. Use either bolts or welded studs to mount the chassis. If you are mounting a chassis to the back panel of an enclosure, use 6.35 mm (0.25 in) mounting bolts.

Refer to Figure 3.3 for the following mounting assembly details:

- stud mounting of a back-panel to the back wall of an enclosure
- bolt mounting of a chassis or ground bus to a back-panel
- stud mounting of a chassis or ground bus to a back-panel

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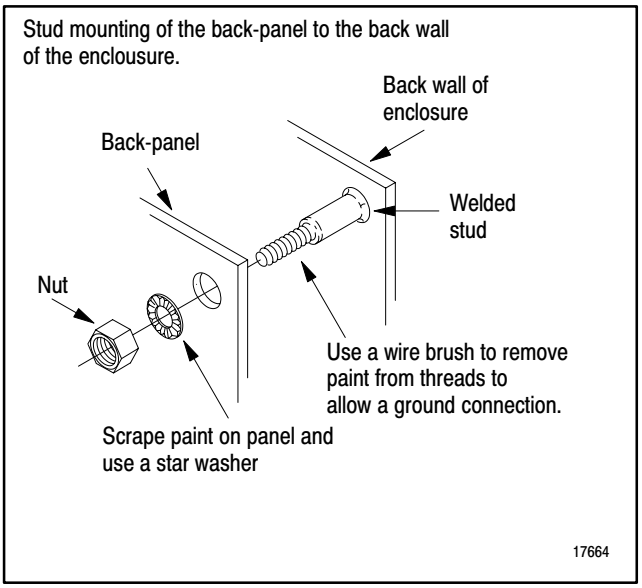
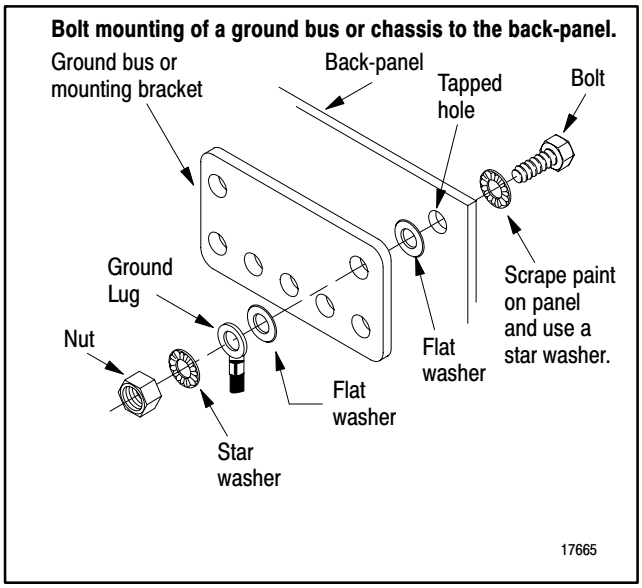
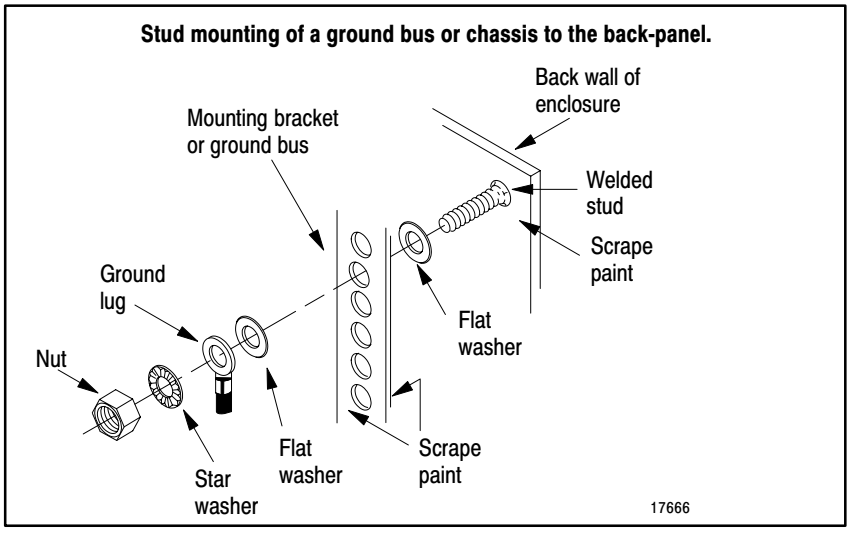
Figure 3.3
Use these Assembly Details to Mount and Ground a Chassis and/or Ground Busses







ATTENTION: If the mounting brackets of a chassis do not lay flat before the nuts are tightened, use additional washers as shims so that the chassis will not be warped by tightening the nuts. Warping a chassis could damage the backplane and cause poor connections.

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Make sure you have good electrical connections between each chassis, back-panel, and enclosure through each mounting bolt or stud. Wherever you make electrical contact, remove paint or other non-conductive finish from studs or tapped holes.

Ground the Chassis

To properly ground a chassis you must:

- verify that your system-design plans are using the correct system grounding configuration
- install a ground bus
- connect equipment grounding conductors
- connect a ground bus to the grounding electrode system
- ground shielded cables

Verify Grounding Configuration

For this grounding configuration:	Refer to:
remote I/O system grounding	Figure 3.4 (page 3-6)
extended-local I/O grounding	Figure 3.5 (page 3-6)

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Figure 3.4
Follow this Recommended Grounding Configuration for Remote I/O Systems

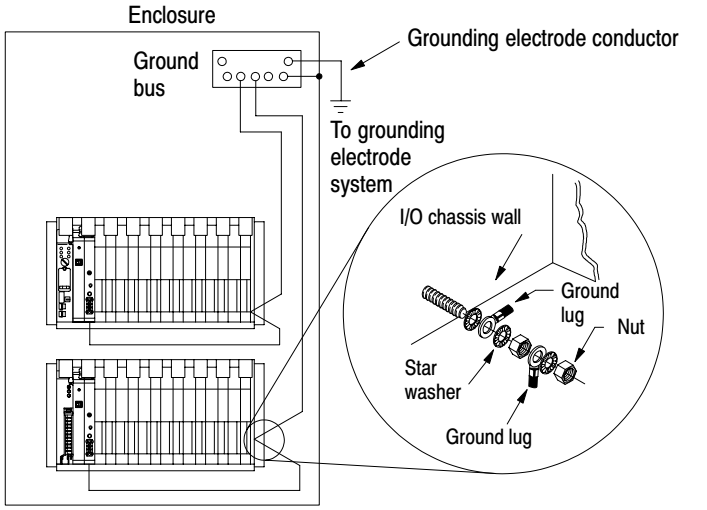
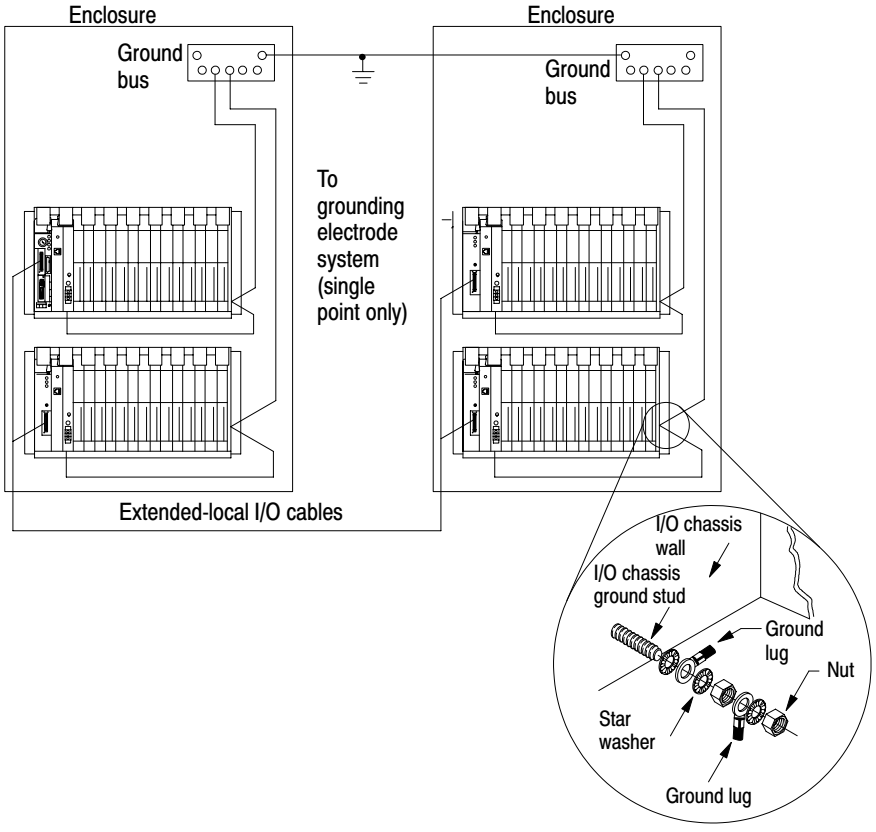


Figure 3.5
Follow this Required Grounding Configuration for Extended-Local I/O Systems



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ATTENTION: Use single-point grounding for extended-local I/O systems. The systems must be grounded properly to ensure proper performance.

Install Ground Bus

Each enclosure must contain a central ground bus. The ground bus is the common connection for each chassis within the enclosure and the enclosure itself. Mount a ground bus using either bolts or studs. Figure 3.3 (page 3-4) illustrates these mounting methods.

Connect Equipment Grounding Conductor

Use either 2.54cm (1-in.) copper braid or 8 AWG copper wire to connect each chassis, the enclosure, and a central ground bus mounted on the back-panel. Use a steel enclosure to guard against EMI. If the enclosure door has a viewing window, it should be a laminated screen or a conductive optical substrate to block EMI. Do not rely on the hinge for electrical contact between the door and the enclosure; install a bonding wire.

For information about connecting the equipment ground conductor to:	Refer to:
a ground bus	Figure 3.6 (page 3-8)
an enclosure wall	Figure 3.7 (page 3-8)

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Figure 3.6
Connecting Equipment Ground Connector to a Ground Bus

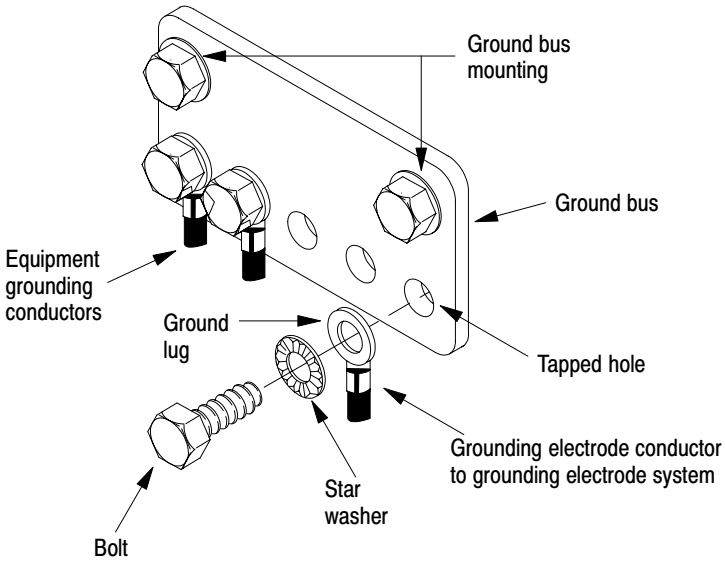
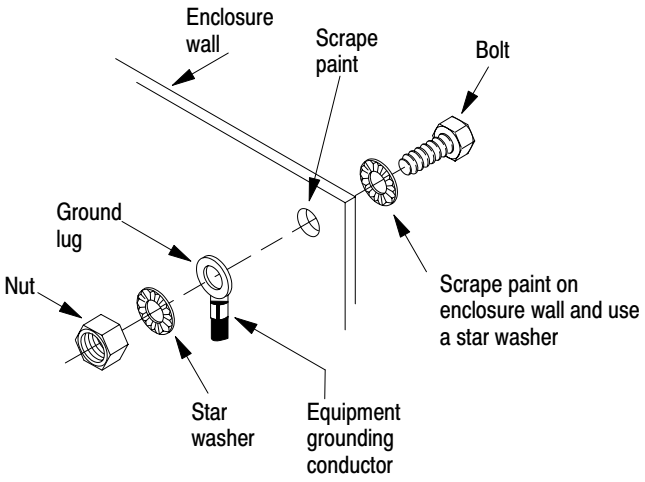


Figure 3.7
Connecting Equipment Ground Connector to an Enclosure Wall



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Connect an equipment grounding conductor directly from each chassis to an individual bolt on the ground bus.

For chassis with:	Connect the equipment grounding conductor using:
a ground stud	the ground stud
no ground stud	a mounting bolt

If the power supply has its own groundable chassis, do not connect the GND terminal of the power supply. However, when you connect power to a power supply without a groundable chassis (such as an ac input power-supply module), you must also use 14 AWG copper wire to connect its GND terminal to the ground stud or mounting bolt connected to the ground bus.

Do not lay one ground lug directly on top of the other; this type of connection can become loose due to compression of the metal lugs. Place the first lug between a star washer and a nut with a captured star washer. After tightening the nut, place the second lug between the first nut and a second nut with a captive star washer (Figure 3.4 or Figure 3.5).

Connect Ground Bus to Grounding-Electrode System

The grounding-electrode system is at earth-ground potential and is the central ground for all electrical equipment and ac power within any facility. Use a grounding-electrode conductor to connect the ground bus to the grounding-electrode system. Use a minimum of 8 AWG copper wire for the grounding-electrode conductor to guard against EMI. The National Electrical Code specifies safety requirements for the grounding-electrode conductor.

Ground Shielded Cables

Certain connections require shielded cables to help reduce the effects of electrical noise coupling. Ground each shield at one end only. A shield grounded at both ends forms a ground loop which could cause faulty PLC-5 processor operation.

Ground each shield at the end specified in the appropriate publication for the product.

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Avoid breaking shields at junction boxes. Many types of connectors for shielded conductors are available from various manufacturers. If you do break a shield at a junction box:

- connect only category-2 conductors in the junction box
- do not strip the shield back any further than necessary to make a connection
- connect the shields of the two cable segments to ensure continuity along the entire length of the cable

For more information about grounding the chassis, see Programmable Controller Wiring and Grounding Guidelines, publication 1770-4.1.

Setting the I/O Chassis Switches

Set the I/O chassis backplane switches. Use a ball-point pen to set each switch. (Do not use a pencil because the tip can break off and short the switch.)

Use this table to find the switch settings you need:

When installing this component in an I/O chassis:	Use this figure to set the chassis backplane switches:
PLC-5 processor	Figure 3.8 (page 3-11)
1771-AS, -ASB, or -ALX adapter module	Figure 3.9 (page 3-12)

For information about addressing concepts, see the 1785 PLC-5 Programmable Controller Design Manual, publication 1785-6.2.1.

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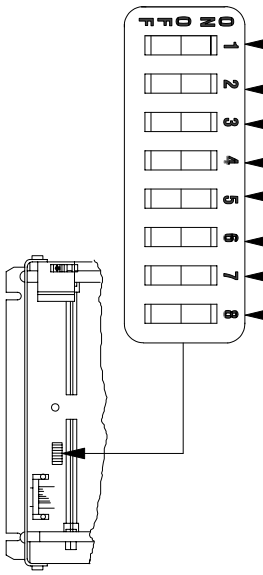
Figure 3.8
Set the I/O Chassis Backplane Switches Like This When Installing a PLC-5 Processor in an I/O Chassis



Always Off

Switch	Last State
1	
ON	Outputs of this I/O chassis remain in their last state when a hardware failure occurs. [1]
OFF	Outputs of this I/O chassis are turned off when a hardware failure occurs. [1]

Switches		Addressing
4	5	
OFF	OFF	2 – slot
OFF	ON	1 – slot
ON	OFF	1/2 – slot
ON	ON	Not allowed

Switches		EEPROM transfer
6	7	
OFF	OFF	EEPROM memory transfer to processor memory at powerup. [2]
ON	ON	EEPROM memory transfers to processor memory if processor memory not valid.
ON	OFF	EEPROM memory does not transfer to processor memory. [3]

Switch	RAM memory protection
8	
OFF	RAM memory protection disabled.
ON	RAM memory protection enabled. [4]

Pressed in at top ON (closed)

Pressed in at bottom OFF (open)

1. Regardless of this switch setting, outputs are reset when either of the following occurs:
   - processor detects a runtime error
   - an I/O chassis backplane fault occurs
   - you select program or test mode
   - you set a status file bit to reset a local rack
2. If an EEPROM module is not installed and processor memory is valid, the processor's PROC LED indicator blinks, and the processor sets S:11/9, bit 9 in the major fault status word.
3. A processor fault occurs if processor memory (solid red PROC LED) is not valid.
4. You cannot clear processor memory when this switch is on

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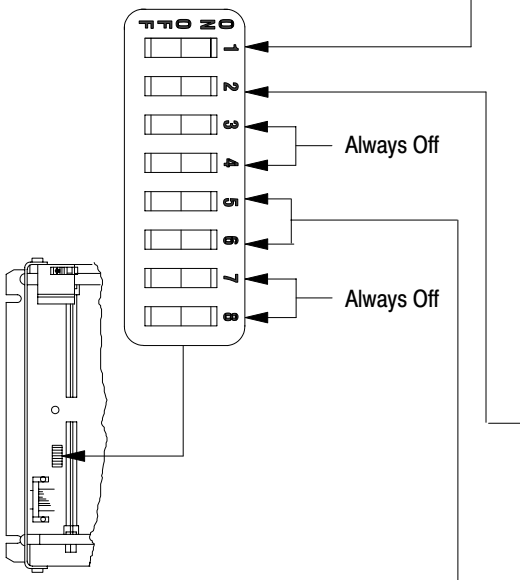
Figure 3.9
Set the I/O Chassis Backplane Switches Like This When Installing a 1771-AS, -ASB Remote I/O Adapter Module or 1771-ALX Extended-Local I/O Adapter Module in the I/O Chassis



Switch 1	Last State
ON	Outputs of this I/O chassis remain in their last state when a communication fault is detected by this I/O adapter. ATTENTION: We recommend that you set switch 1 to the OFF position to de-energize outputs wired to this chassis when a fault is detected. Also, if outputs are controlled by inputs in a different rack and a remote I/O rack fault occurs (in the inputs rack), the inputs are left in their last non–faulted state. The outputs may not be properly controlled and potential personnel and machine damage may result. If you want your inputs to be anything other than their last non-faulted state, then you need to program a fault routine.
OFF	Outputs of this I/O chassis are turned off when a communication fault is detected by this I/O adapter.

Switch 2	Processor Restart Lockout
ON	Processor can restart the I/O chassis after a communication fault. Set this switch to ON if you plan to use I/O rack auto-configuration.
OFF	You must manually restart the I/O chassis with a switch wired to the 1771-AS or -ASB, or with the pushbutton mounted in the 1771-ALX.

Switches 5	Switches 6	Addressing
OFF	OFF	2-slot
ON	OFF	1-slot [1]
OFF	ON	1/2 slot [1,2]
ON	ON	Not allowed

Pressed in at top ON (closed)

Pressed in at top OFF (open)

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1. The 1771-AS adapter does not support 1-slot or 1/2-slot addressing. When you use this adapter, set switches 5 and 6 to the OFF position.
2. The 1771-ASB series A adapter does not support 1/2-slot addressing.

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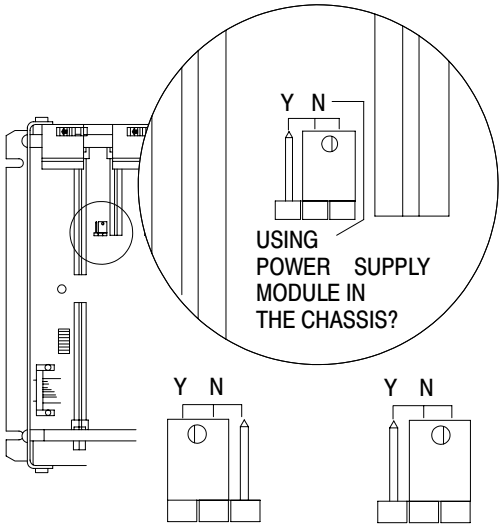
Setting the I/O Chassis Configuration Plug

Set the I/O chassis configuration plug according to whether you are using a power supply installed in the processor-resident chassis or an external power supply. To do this:



1. Locate the chassis configuration plug (between the first two left most slots of the chassis).
2. Set the I/O chassis configuration plug.

   The default setting is N (not using a power supply module in the chassis).

IMPORTANT: You cannot power a single I/O chassis with both a power supply module and an external power supply.

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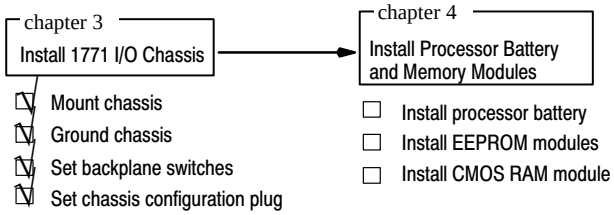
What to Do Next



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Chapter 4

Install and Remove Processor Batteries and Memory Modules

Chapter Objectives

Use this chapter to help you install batteries and memory modules.

chapter 4

Install Processor Battery and Memory Modules

- ☐ Install processor battery
- ☐ Install EEPROM module
- ☐ Install CMOS RAM module

Also, refer to this chapter when you must remove the processor's battery or memory module.

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Installing the Battery

The PLC-5/10, -5/12, -5/15, and -5/25 use the 1770-XY battery. This battery contains less than 1/2 gram of lithium. Refer to Allen-Bradley Guidelines for Lithium Battery Handling and Disposal, publication AG-5.4.

ATTENTION: Installing the battery requires handling the processor, which can cause electrostatic discharge. Electrostatic discharge can damage integrated circuits or semiconductors in the processor. Avoid damage from electrostatic discharge by using a grounding strap and observe these guidelines:

- Touch a grounded object to discharge yourself before handling the processor.
- Do not touch the backplane connector or connector pins.
- Keep the processor in its static-shield bag when not in use.

To install the battery, follow these steps:

1. Remove the processor from its static-shield bag.
2. Locate the processor's battery connector.
3. Install the battery according to Figure 4.1.

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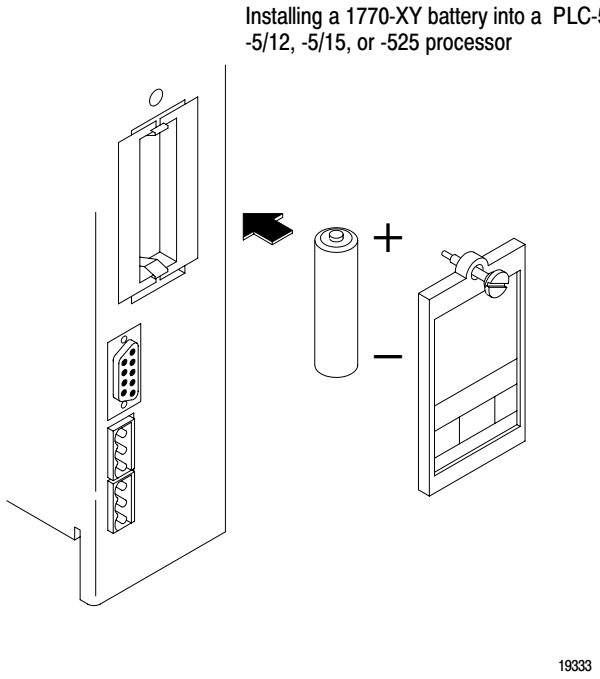
Figure 4.1
Installing a Processor Battery



a. Place the new battery in the holder.
b. Make sure that the positive (+) end of the battery contacts the positive (+) end of the battery holder and that the negative (–) end of the battery contacts the negative (–) end of the battery holder.

4. Place the battery cover over the installed battery; secure the battery cover with the thumb screw.

5. Write the date you installed the battery on the battery cover.

Replacing the Battery

We recommend that you replace the internal lithium battery every year or when the BATT status indicator is red. For estimated battery lifetimes, see Appendix A.

ATTENTION: The 1770-XY can be replaced by a 3.6V, “AA” size, Tadiran TL5104 type AEL/S lithium battery with pressure contact terminals.

If you replace the 1770-XY, the replacement battery must have the same specifications as the 1770-XY.

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Important: You can insert or remove the battery without powering down the processor. However, **if you do not want to lose your program,** make sure the processor is powered when replacing the battery**.**

Important: Memory in the CMOS RAM module is volatile memory. When you replace the battery in the processor during regular maintenance, make sure the processor is powered up; otherwise you will lose memory.

To replace a battery:

1. Loosen the thumb screw that secures the battery cover.
2. Remove the battery.
3. Follow the installation procedure.

Disposing of a Battery

Refer to Allen-Bradley Guidelines for Lithium Battery Handling and Disposal, publication AG-5.4.

Do not dispose lithium batteries in a general trash collection when their combined weight is greater than or equal to 1/2 gram. Check your state and local regulations that deal with the disposal of lithium batteries.

ATTENTION: Follow these precautions:

- Do not incinerate or expose the battery to high temperatures.
- Do not solder the battery or leads; the battery could explode.
- Do not open, puncture, or crush the battery. The battery could explode and toxic, corrosive, and flammable chemicals could be exposed.
- Do not charge the battery. An explosion might result or the cell might overheat and cause burns.
- Do not short positive or negative terminals together. The battery will heat up.

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Install the 1785-MJ and 1785-MK EEPROM Module

This table describes the EEPROM module you can use for the PLC-5/10, -5/12, -5/15, -5/25 processor:

For this processor:	Use this EEPROM module:	Size (words):
PLC-5/10, -5/12, -5/15	1785-MJ	8K
PLC-5/25	1785-MJ	8K
	1785-MK	16K

The EEPROM module has two plastic tracks on the bottom that correspond to grooves in the processor memory-module slot. To install the EEPROM module in a PLC-5/10, -5/12, -5/15, -5/25 processors, observe anti-static precautions and do the following:

1. Label the memory module to indicate the programs or processor you are backing-up.

2. Turn off power to the I/O chassis and processor.

ATTENTION: Do not insert or remove the EEPROM under power. Insertion or removal under power can result in loss of program memory and a processor fault.

3. Lift the latch of the I/O chassis that holds your processor; remove the processor from the chassis.

4. Place the processor on a clean flat surface with the bottom of the module facing you and the front of the processor to your right.

5. Position the memory module in the memory-module slot with its label facing upward. Insert and press firmly (Figure 4.2).

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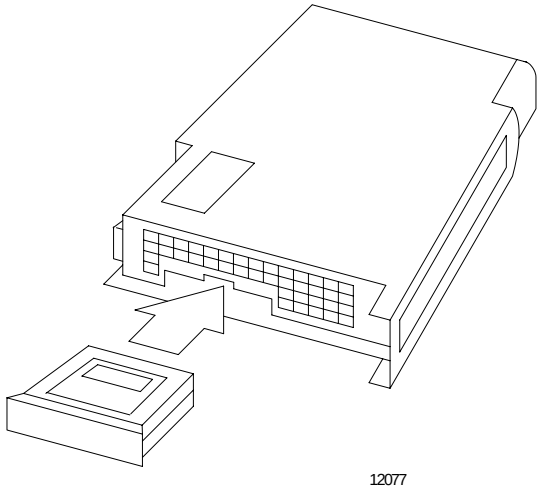
Figure 4.2
Inserting a Memory Module



6. Slide the processor into the I/O chassis and secure the I/O chassis latches.

7. Turn on system power.

Install the 1785-MR and -MS CMOS RAM Module (PLC-5/15, -5/25 processors)

This table describes the CMOS RAM modules you can use for your PLC-5/15 or -5/25 processor.

CMOS RAM module:	Size (words):
1785-MR	4K
1785-MS	8K

To install a CMOS RAM module, do the following:

1. Back-up your processor memory on a disk.

2. Turn off the incoming power source.

3. Lift the latch of the I/O chassis that holds your processor; remove the processor from the chassis.

4. Remove the battery from the processor.

5. Place the processor on a clean flat surface with the bottom of the module facing you and the front of the processor to your right.

6. Position the memory module in the memory-module slot with its label facing upward. Insert and press firmly (Figure 4.2).

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7. Replace the battery.
8. Slide the processor into the I/O chassis and secure the I/O chassis latches.
9. Turn on system power.
10. Clear memory.
11. Reload processor memory.

Processor memory is invalid when you initially insert a CMOS RAM module. Make sure you clear memory after inserting the CMOS RAM module for the first time.

Remove the EEPROM or CMOS RAM Modules (PLC-5/10, -5/12, -5/15, -5/25 processors)

To remove the EEPROM modules and/or the CMOS RAM modules from the PLC-5/10, -5/12, -5/15, -or 5/25 processors, do the following:

1. Follow the steps listed in this table:

For this memory module:	Do the following:
1785-MJ, -MK (EEPROM)	1. Turn off power to the I/O chassis and processor. 2. Lift the latch of the I/O chassis that holds your processor and remove the processor from the chassis. 3. Place the processor on a clean flat surface with the bottom of the module facing you and the front of the processor to your right (refer to Figure 4.2 on previous page).
1785-MR, -MS (CMOS RAM)	1. Back up your processor memory on a disk. 2. Turn off the incoming power source. 3. Lift the latch of the I/O chassis that holds your processor and remove the processor from the chassis. 4. Remove the battery from the processor. 5. Place the processor on a clean flat surface with the bottom of the module facing you and the front of the processor to your right (refer to Figure 4.2 on the previous page).

2. Insert a coin into the memory-module slot so that it engages the lip on the memory module.
3. Carefully rotate the coin upward to remove the memory module from its slot.
4. Grasp and remove the memory module.

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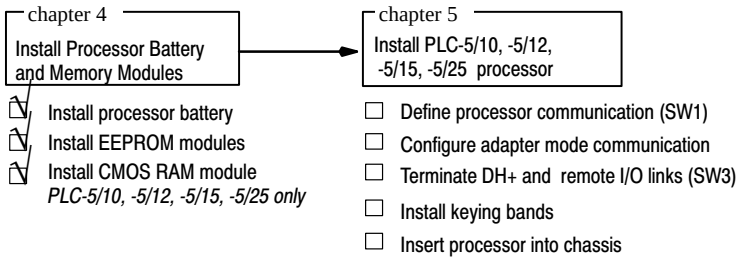
What to Do Next



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Chapter 5

Install or Remove a PLC-5/10, -5/12, -5/15, and -5/25 Processor

Chapter Objectives

Use this chapter to help you install and remove a PLC-5/10, -5/12, -5/15, or -5/25 processor.

chapter 5
Install PLC-5/10, -5/12, -5/15, -5/25 processor

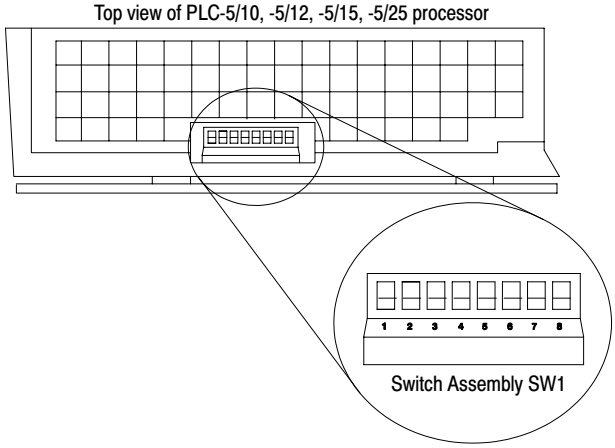
- ☐ Define processor communication (SW1)
- ☐ Configure adapter mode communication
- ☐ Terminate DH+ and remote I/O links (SW3)
- ☐ Install keying bands
- ☐ Insert processor into chassis

Configuring PLC-5/10, -5/12, -5/15 and -5/25 Processor Communication

Define the communication modes of a PLC-5/10, -5/12, -5/15, -5/25 processor by specifying DH+ station address, scanner mode or adapter mode. To do this, set the switches on switch assembly SW1 by following these steps:

1. Locate Switch Assembly SW1.

Figure 5.1
Switch Assembly SW1 on a PLC-5/10, -5/12, -5/15, -5/25 Processor



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2. Set the switches according to Table 5.A and Table 5.B.

Table 5.A
SW1 Settings

To select:	Set switch:	To:
DH+ station number	1 through 6	(see Table 5.B)
Switch 7 not used	7	off
scanner mode PLC-5/10 processors function in scanner mode only.	8	off
adapter mode PLC-5/12 processors function in adapter mode only. Switch 8 not used for PLC-5/10 processors.	8	on

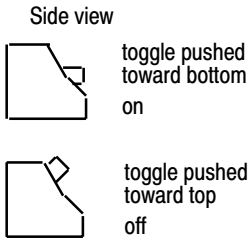

Table 5.B lists the available station numbers that you can select and the corresponding settings for switches 1 through 6.

Table 5.B
Station Number Selections for SW1

Station Number	Switch 1	2	3	4	5	6
0	on	on	on	on	on	on
1	off	on	on	on	on	on
2	on	off	on	on	on	on
3	off	off	on	on	on	on
4	on	on	off	on	on	on
5	off	on	off	on	on	on
6	on	off	off	on	on	on
7	off	off	off	on	on	on
10	on	on	on	off	on	on
11	off	on	on	off	on	on
12	on	off	on	off	on	on
13	off	off	on	off	on	on
14	on	on	off	off	on	on
15	off	on	off	off	on	on
16	on	off	off	off	on	on
17	off	off	off	off	on	on
20	on	on	on	on	off	on
21	off	on	on	on	off	on
22	on	off	on	on	off	on
23	off	off	on	on	off	on
24	on	on	off	on	off	on
25	off	on	off	on	off	on
26	on	off	off	on	off	on
27	off	off	off	on	off	on
30	on	on	on	off	off	on
31	off	on	on	off	off	on
32	on	off	on	off	off	on
33	off	off	on	off	off	on
34	on	on	off	off	off	on
35	off	on	off	off	off	on
36	on	off	off	off	off	on

Station Number	Switch 1	2	3	4	5	6
37	off	off	off	off	off	on
40	on	on	on	on	on	off
41	off	on	on	on	on	off
42	on	off	on	on	on	off
43	off	off	on	on	on	off
44	on	on	off	on	on	off
45	off	on	off	on	on	off
46	on	off	off	on	on	off
47	off	off	off	on	on	off
50	on	on	on	off	on	off
51	off	on	on	off	on	off
52	on	off	on	off	on	off
53	off	off	on	off	on	off
54	on	on	off	off	on	off
55	off	on	off	off	on	off
56	on	off	off	off	on	off
57	off	off	off	off	on	off
60	on	on	on	on	off	off
61	off	on	on	on	off	off
62	on	off	on	on	off	off
63	off	off	on	on	off	off
64	on	on	off	on	off	off
65	off	on	off	on	off	off
66	on	off	off	on	off	off
67	off	off	off	on	off	off
70	on	on	on	off	off	off
71	off	on	on	off	off	off
72	on	off	on	off	off	off
73	off	off	on	off	off	off
74	on	on	off	off	off	off
75	off	on	off	off	off	off
76	on	off	off	off	off	off
77	off	off	off	off	off	off

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Configuring Adapter Mode Communication

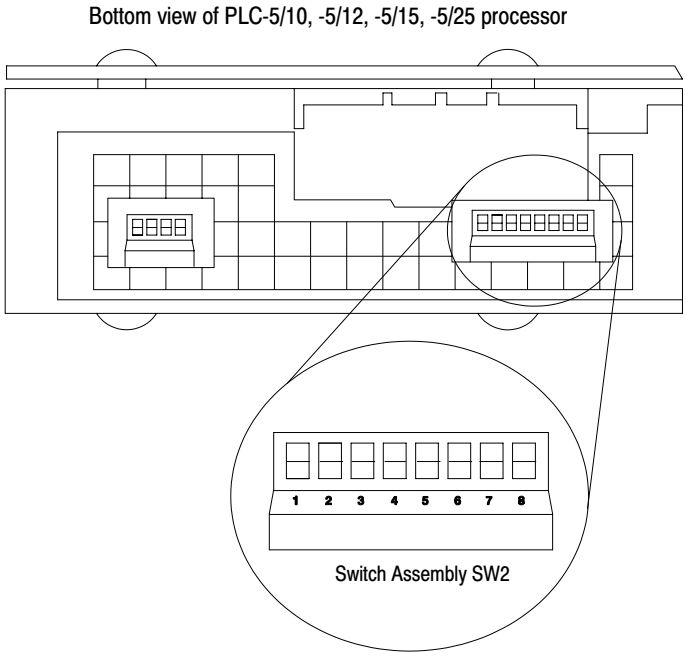
Configure adapter mode communication by defining:

- I/O rack number of the processor operating in adapter mode
- beginning I/O group assigned to the processor operating in adapter mode
- number of words exchanged between the supervisory processor and the processor operating in adapter mode

Use switch assembly SW2 to define adapter mode communication following these steps:

1. Locate switch assembly SW2.

Figure 5.2
Switch Assembly SW2



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2. Set SW2 according to your use of the processor as an adapter in one of these systems:

For switch settings for a PLC-5 processor as an adapter in a:	See page:
PLC-5 processor acting as a scanner, Q-bus I/O scanner module, IBM PC I/O scanner module, VME-bus I/O scanner module, or VME/PLC-5 controller remote I/O system	5-4
PLC-2/20, PLC-2/30, or Sub I/O Scanner Module remote I/O system	5-5
PLC-3 or PLC-5/250 remote I/O system, 8-word groups	5-6
PLC-3 or PLC-5/250 remote I/O system, 4-word groups	5-7

PLC-5 Processor as an Adapter in a PLC-5 Processor, Scanner Module, or VME System

Set SW2 according to Table 5.C and Table 5.D.

Table 5.C
SW2 Settings for a PLC-5 Processor as an Adapter in a PLC-5 Processor, Scanner Module, or VME System

If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off
the host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off
the host processor to use **4 words** to communicate with the adapter PLC-5 processor **(8 or 4 words** are being transferred)	2	on
first I/O group to be 0 (**8 words** are being transferred)	3	on
first I/O group to be 4	3	off
select the I/O rack number of the adapter PLC-5 processor	4 through 8	see able 5.D

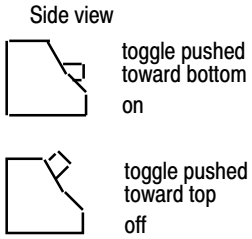

Table 5.D lists the available rack numbers you can use and the corresponding switch settings. Note that the processor-resident rack is rack 0 by default.

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Table 5.D
I/O Rack Number Selections for a PLC-5 Remote I/O System

To select rack:	Set switch: 4	5	6	7	8
01	on	on	on	on	off
02	on	on	on	off	on
03	on	on	on	off	off
04	on	on	off	on	on
05	on	on	off	on	off
06	on	on	off	off	on
07	on	on	off	off	off

PLC-5/11 processors can scan remote I/O rack 03
PLC-5/15 processors can scan remote I/O racks 01-03
PLC-5/25 processors can scan remote I/O racks 01-07

PLC-5 Processor as an Adapter in a PLC-2™/20, -2/30 , or Sub I/O Scanner Module Remote I/O System

Set SW2 according to Table 5.E and Table 5.F:

Table 5.E
SW2 Settings for a PLC-5 Processor as an Adapter in a PLC-2/20, -2/30, or Sub I/O Scanner Module Remote I/O System

If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off
the host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off
the host processor to use **4 words** to communicate with the adapter PLC-5 processor	2	on
first I/O group to be 0	3	on
first I/O group to be 4	3	off
select the I/O rack number of the adapter PLC-5 processor	4 through 8	see Table 5.F

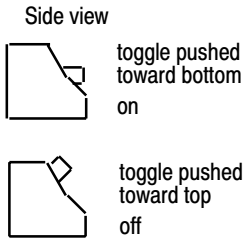

Table 5.F lists the I/O rack numbers and corresponding switch settings for SW2 in a PLC-2 system.

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Table 5.F
I/O Rack Number Selections for a PLC-2 System

To select rack:	Set switch:				
	4	5	6	7	8
01	on	on	on	on	on
02	on	on	on	on	off
03	on	on	on	off	on
04	on	on	on	off	off
05	on	on	off	on	on
06	on	on	off	on	off
07	on	on	off	off	on

PLC-5 Processor as an Adapter in a PLC-3™ or PLC-5/250™ System (8-word groups)

Set SW2 according to Table 5.G and Table 5.H:

Table 5.G
SW2 Settings for a PLC-5 Processor as an Adapter in a PLC-3 or PLC-5/250 System (8-word groups)

If You Want:	Set switch:	To:
Switch 1 is always unused.	1	off (open)
the host processor to use **8 words** to communicate with the adapter PLC-5 processor	2	off (open)
select the I/O rack number of the adapter PLC-5 processor	3 through 8	see Table 5.H

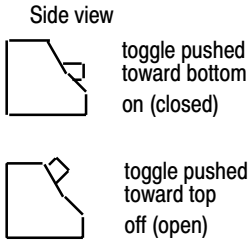

Table 5.H lists the I/O rack numbers and corresponding switch settings for SW2 in a PLC-3 or PLC-5/250 system (8 words).

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Table 5.H
I/O Rack Number Selections for a PLC-3 or PLC-5/250 System (8 words)

Station Number	Switch 3	4	5	6	7	8
0	on	on	on	on	on	on
1	on	on	on	on	on	off
2	on	on	on	on	off	on
3	on	on	on	on	off	off
4	on	on	on	off	on	on
5	on	on	on	off	on	off
6	on	on	on	off	off	on
7	on	on	on	off	off	off
10	on	on	off	on	on	on
11	on	on	off	on	on	off
12	on	on	off	on	off	on
13	on	on	off	on	off	off
14	on	on	off	off	on	on
15	on	on	off	off	on	off
16	on	on	off	off	off	on
17	on	on	off	off	off	off
20	on	off	on	on	on	on
21	on	off	on	on	on	off
22	on	off	on	on	off	on
23	on	off	on	on	off	off
24	on	off	on	off	on	on
25	on	off	on	off	on	off
26	on	off	on	off	off	on
27	on	off	on	off	off	off
30	on	off	off	on	on	on
31	on	off	off	on	on	off
32	on	off	off	on	off	on
33	on	off	off	on	off	off
34	on	off	off	off	on	on
35	on	off	off	off	on	off
36	on	off	off	off	off	on
37	on	off	off	off	off	off
40	off	on	on	on	on	on
41	off	on	on	on	on	off
42	off	on	on	on	off	on
43	off	on	on	on	off	off
44	off	on	on	off	on	on
45	off	on	on	off	on	off
46	off	on	on	off	off	on
47	off	on	on	off	off	off
50	off	on	off	on	on	on
51	off	on	off	on	on	off
52	off	on	off	on	off	on
53	off	on	off	on	off	off
54	off	on	off	off	on	on
55	off	on	off	off	on	off
56	off	on	off	off	off	on
57	off	on	off	off	off	off
60	off	off	on	on	on	on
61	off	off	on	on	on	off
62	off	off	on	on	off	on
63	off	off	on	on	off	off
64	off	off	on	off	on	on
65	off	off	on	off	on	off
66	off	off	on	off	off	on
67	off	off	on	off	off	off
70	off	off	off	on	on	on
71	off	off	off	on	on	off
72	off	off	off	on	off	on
73	off	off	off	on	off	off
74	off	off	off	off	on	on
75	off	off	off	off	on	off
76	off	off	off	off	off	on

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PLC-5 Processor as an Adapter in a PLC-3 or PLC-5/250 System (4-word groups)

Set SW2 according to Table 5.I and Table 5.J:

Table 5.I
SW2 Settings for a PLC-5 Processor as an Adapter in a PLC-3 or PLC-5/250 System (4-word groups)

If You Want:	**Set switch:**	**To:**
Switch 1 is always unused.	1	off
the host processor to use **4 words** to communicate with the adapter PLC-5 processor	2	on
first I/O group to be 0	3	on
first I/O group to be 4	3	off
select the I/O rack number of the adapter PLC-5 processor	4 through 8	see Table 5.J

Side view

toggle pushed toward bottom
on

toggle pushed toward top
off

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Table 5.J lists the I/O rack numbers and corresponding switch settings for SW2 in a PLC-3 or PLC-5/250 system (4 words).

Table 5.J
I/O Rack Number Selections for a PLC-3 or PLC-5/250 System (4 words)

I/O Rack Number	Switch				
	4	5	6	7	8
0	on	on	on	on	on
1	on	on	on	on	off
2	on	on	on	off	on
3	on	on	on	off	off
4	on	on	off	on	on
5	on	on	off	on	off
6	on	on	off	off	on
7	on	on	off	off	off
10	on	off	on	on	on
11	on	off	on	on	off
12	on	off	on	off	on
13	on	off	on	off	off
14	on	off	off	on	on
15	on	off	off	on	off
16	on	off	off	off	on
17	on	off	off	off	off
20	off	on	on	on	on
21	off	on	on	on	off
22	off	on	on	off	on
23	off	on	on	off	off
24	off	on	off	on	on
25	off	on	off	on	off
26	off	on	off	off	on
27	off	on	off	off	off
30	off	off	on	on	on
31	off	off	on	on	off
32	off	off	on	off	on
33	off	off	on	off	off
34	off	off	off	on	on
35	off	off	off	on	off
36	off	off	off	off	on
37	off	off	off	off	off

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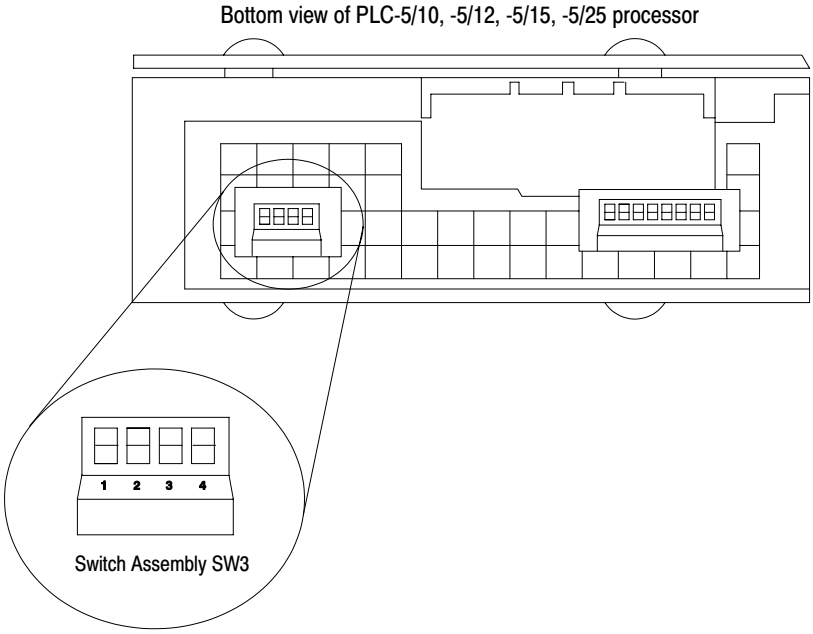
Connecting Termination Resistors

If a PLC-5/10, -5/12, -5/15, or -5/25 processor is an end device on either a DH+ or remote I/O network, terminate the link by setting switch assembly SW3, which connects a terminator across the line. Follow these steps:

1. Locate switch assembly SW3.

Figure 5.3
PLC-5/10, -5/12, -5/15, -5/25 Processor Switch Assembly SW3



2. Set SW3 according to Table 5.K:

Table 5.K
PLC-5/10, -5/12, -5/15, -5/25 Processor Switch Assembly SW3 Settings

If the processor is:	Set switch:	To:
an end device on the remote I/O link	1	on
not an end device on the remote I/O link	1	off
an end device on the DH+ link	2	on
not an end device on the DH+ link	2	off
switch 3 unused	3	off
switch 4 unused	4	off

Side view

toggle pushed toward bottom
on

toggle pushed toward top
off

For more information about terminating links, refer to chapter 7 and chapter 11.

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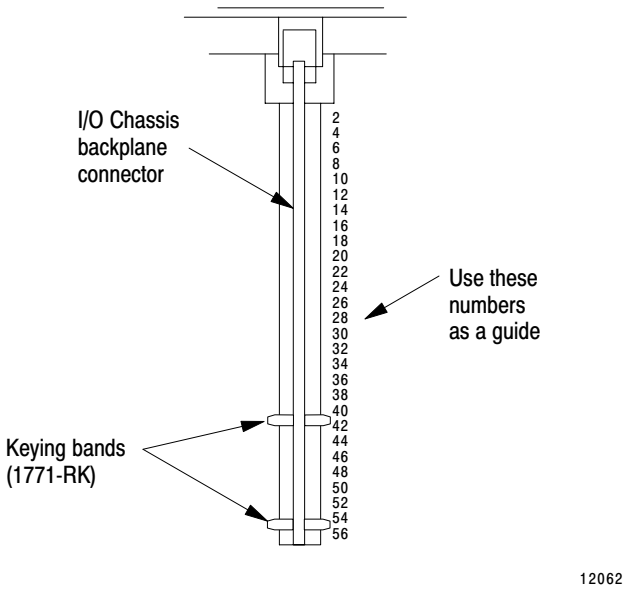
Installing the Keying Bands

You receive plastic keying bands with each I/O chassis. Insert two keying bands in the top backplane sockets of the I/O chassis. Place a keying band in the left-most slot between the following pins (see Figure 5.4):

- 40 and 42
- 54 and 56

Figure 5.4
PLC-5 Processor Keying Band Positions



Use the numbers to the right of the backplane socket as a guide when positioning the keying bands.

ATTENTION: A module inserted into a wrong slot could be damaged by improper voltages connected through the wiring arm. Use keying bands to prevent damage to the module.

Inserting the Processor into the Chassis

To insert the processor into the chassis, do the following:

1. Slide your processor into the left-most slot of the I/O chassis.
2. Snap the module-locking latch over the processor.

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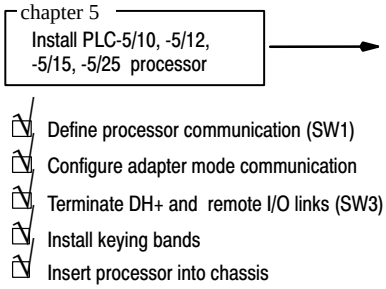
Removing the Processor from the Chassis

To remove the processor from the chassis, do the following:

1. Back-up processor memory
2. Remove power to the processor-resident chassis.
3. Disconnect all cables from the processor's ports.
4. Lift the locking latch and slide the processor from the chassis.

What to Do Next

The system component you install next depends upon your system design.



To do the following:	See:
Install a remote I/O link	chapter 6
Install I/O modules	chapter 7

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Chapter 6

Install the Remote I/O Link

Chapter Objectives

Use this chapter to help you install a remote I/O link. We recommend that you perform the listed tasks in the order they are shown.

chapter 6
Install remote I/O link

- ☐ Set adapter switches
- ☐ Make remote I/O connections
- ☐ Terminate the link

Set Remote I/O Adapter Switches

Set the switches on the 1771-AS or 1771-ASB (series B, C, and D) remote I/O adapter module according to your use of chassis-to-chassis complementary I/O. Use the table below to find the appropriate switch setting information and information about how to set the adapter switches.

For this switch setting information:	Refer to:	Page:
Adapter **not** in a complementary I/O system		
Adapter switches settings when not used in a complementary I/O system	Figure 6.1	6-2
Available I/O rack numbers	Table 6.A	6-3
Available starting I/O group numbers	Table 6.B	6-4
Adapter in a complementary I/O system		
Adapter switches when used in a complementary I/O system	Figure 6.2	6-5
Available I/O rack numbers	Table 6.C	6-6
Available starting I/O group numbers	Table 6.D	6-6

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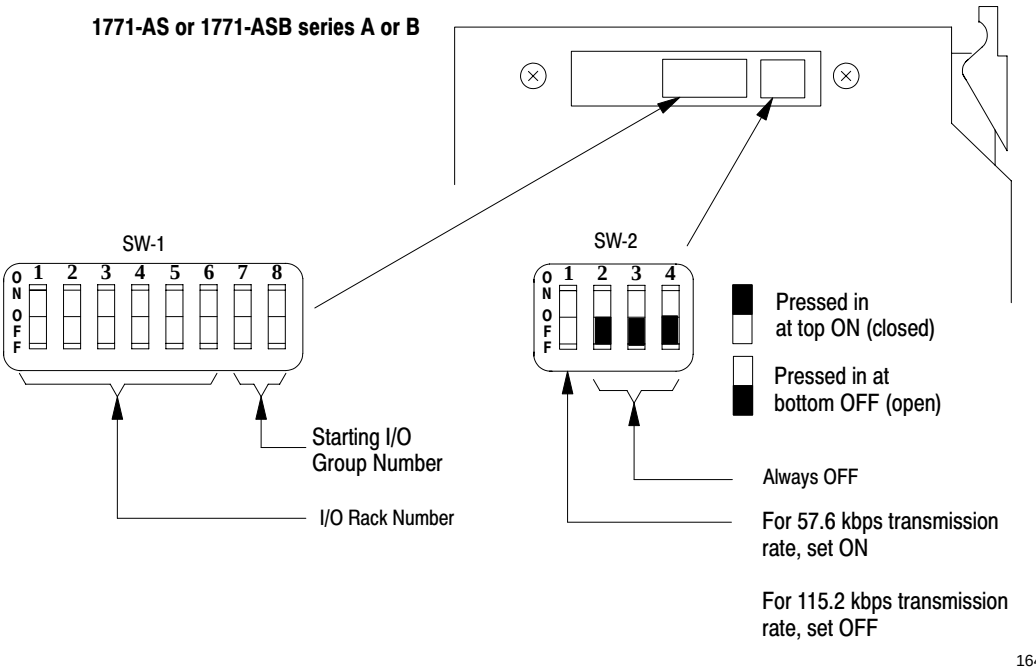
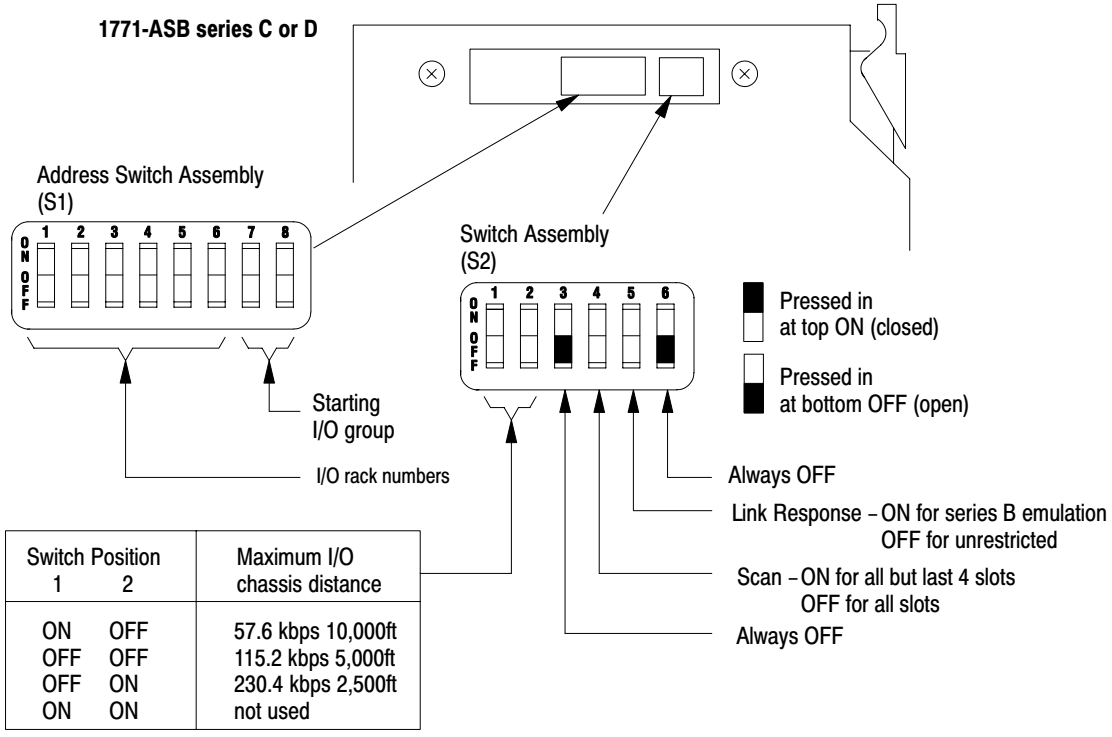
Figure 6.1
Switch Settings for a 1771-ASB Remote I/O Adapter Module Not in a Complementary I/O System





Switch Position 1	Switch Position 2	Maximum I/O chassis distance
ON	OFF	57.6 kbps 10,000ft
OFF	OFF	115.2 kbps 5,000ft
OFF	ON	230.4 kbps 2,500ft
ON	ON	not used

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Table 6.A
Available Remote I/O Rack Numbers for Adapter Modules Not in a Complementary I/O System

To select rack:	Set switch: 1	2	3	4	5	6
01	on	on	on	on	on	off
02	on	on	on	on	off	on
03	on	on	on	on	off	off
04	on	on	on	off	on	on
05	on	on	on	off	on	off
06	on	on	on	off	off	on
07	on	on	on	off	off	off

PLC-5/11 processors can scan remote I/O rack 03

PLC-5/15 and -5/20 processors can scan remote I/O racks 01-03

PLC-5/25, -5/30 processors can scan remote I/O racks 01-07

10	on	on	off	on	on	on
11	on	on	off	on	on	off
12	on	on	off	on	off	on
13	on	on	off	on	off	off
14	on	on	off	off	on	on
15	on	on	off	off	on	off
16	on	on	off	off	off	on
17	on	on	off	off	off	off
20	on	off	on	on	on	on
21	on	off	on	on	on	off
22	on	off	on	on	off	on
23	on	off	on	on	off	off
24	on	off	on	off	on	on
25	on	off	on	off	on	off
26	on	off	on	off	off	on
27	on	off	on	off	off	off

PLC-5/40 processors can scan remote I/O racks 01-17

PLC-5/60 and PLC-5/80 processors can scan remote I/O racks 01-27

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Table 6.B
Available Starting I/O Group Numbers for Adapter Modules Not in a Complementary I/O System

For Starting I/O Group Number:	Set switch	
	7	8
0	on	on
2	on	off
4	off	on
6	off	off

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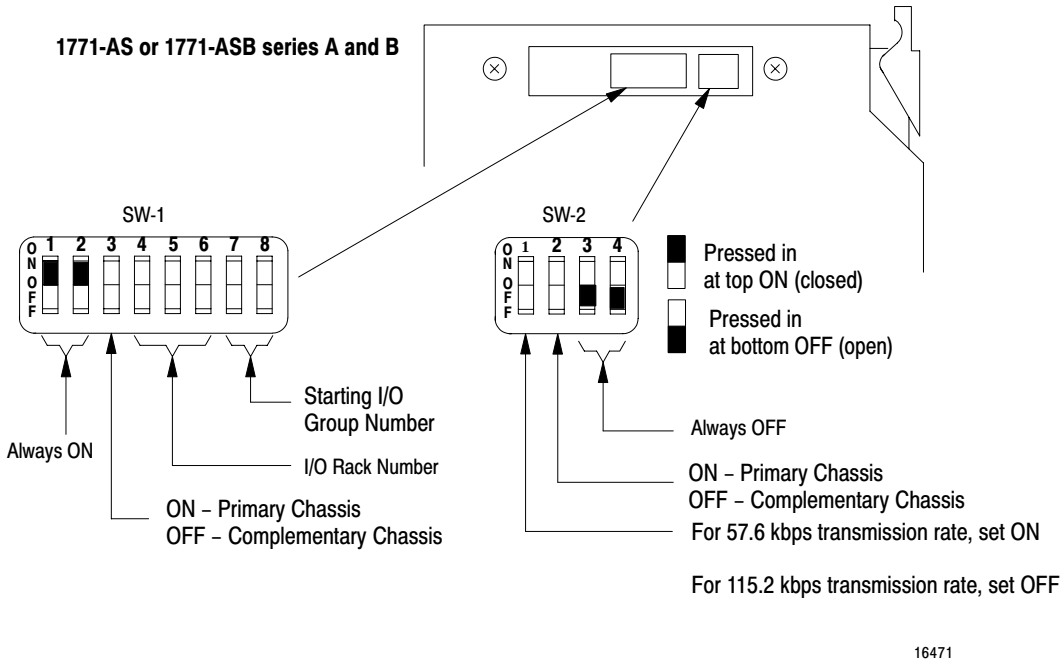
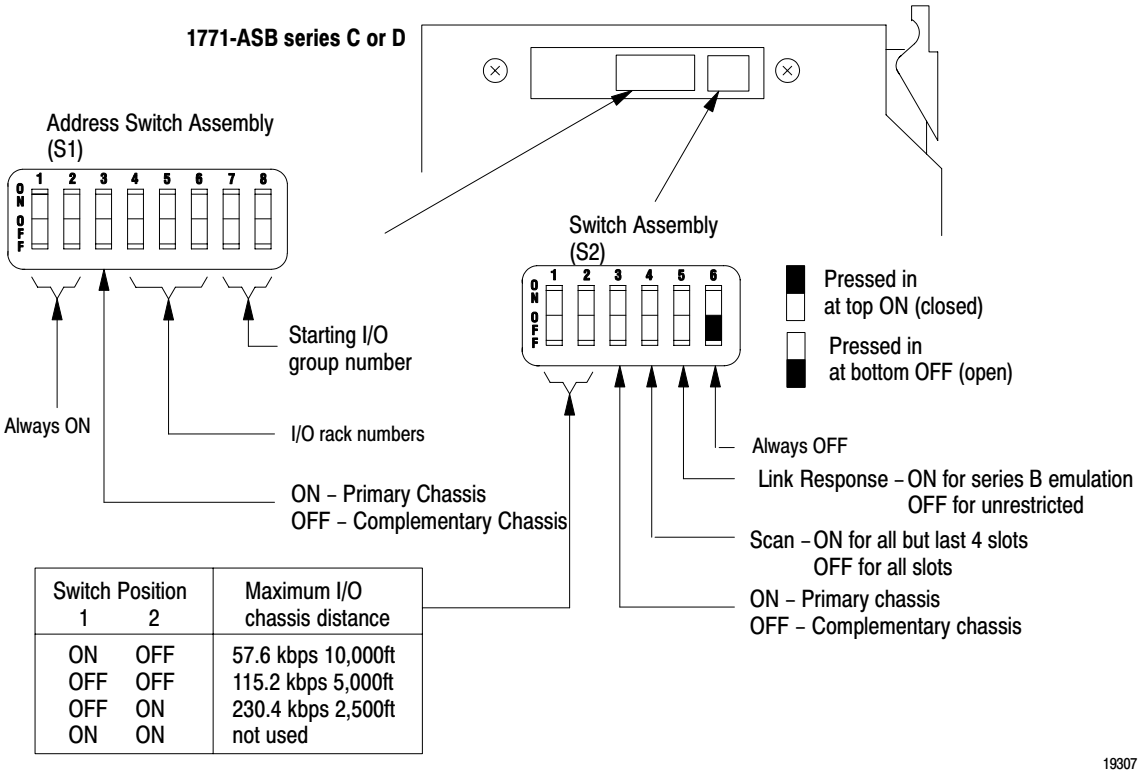
Figure 6.2
Switch Settings for a Remote I/O Adapter Module in a Complementary I/O System





Switch Position 1	Switch Position 2	Maximum I/O chassis distance
ON	OFF	57.6 kbps 10,000ft
OFF	OFF	115.2 kbps 5,000ft
OFF	ON	230.4 kbps 2,500ft
ON	ON	not used

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Important: Only racks 1-7 can be complemented in a PLC-5 system.

You can complement seven (1-7) racks and use the remaining racks for non-complementary I/O when you are using a PLC-5/40, -5/40L, -5/60, or -5/60L series B (or later) processor or a PLC-5/80 series C (or later) processor as a remote I/O scanner. You can complement only racks 1-7. These complemented I/O racks can be split among scanner channels as long as each selected scanner channel is configured for complementary I/O. A channel configured for complementary I/O cannot scan racks 10-17 or 20-27. You can scan these racks on a remote I/O scanner channel that is not configured for complementary I/O.

Table 6.C
Available Remote I/O Rack Numbers in a Complementary I/O System

To select rack:	Set switch:		
	4	5	6
1 [1]	on	on	off
2 [1]	on	off	on
3 [1,2]	on	off	off
4	off	on	on
5	off	on	off
6	off	off	on
7	off	off	off

[1] PLC-5/15 and -5/20 processors can access only racks 1, 2, and 3.

[2] PLC-5/11 processors can only access one remote rack (rack 3)

Table 6.D
Available Starting I/O Group Numbers for Adapter Modules in a Complementary I/O System

For starting I/O group number:	Set switch	
	7	8
0	on	on
2	on	off
4	off	on
6	off	off

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Install the Adapter Module

Install the adapter module in the first slot of the remote I/O chassis according to the installation procedure in the Remote I/O Adapter Module Installation Manual, publication 1771-6.5.8. Follow all electrostatic discharge prevention recommendations.

Connect Remote I/O Link

Use Belden 9463 twin-axial cable, cat. no.1770-CD, to connect devices to a remote I/O link. To connect a remote I/O link, do the following:

- ensure the cables are the correct length
- prepare the cable
- make the remote I/O connections

Ensure Correct Cable Lengths

Verify that your system's design plans specify remote I/O cable lengths within allowable measurements.

Important: The maximum cable length for remote I/O depends on the transmission rate.

A remote I/O link using this communication rate:	Cannot exceed this cable length:
57.6 kbps	3,048 m (10,000 ft)
115.2 kbps	1,524 m (5,000 ft)
230.4 kbps	762 m (2,500 ft)

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Important: The following products (Table 6.E) cannot be on a link using 82Ω termination resistors:

Table 6.E
I/O Link Devices that Do Not Support 82-Ω Termination Resistors

Device Type	Cat. No.	Series
Scanners	1771-SN 1772-SD, -SD2 1775-SR 1775-S4A, -S4B 6008-SQH1, -SQH2	all
Adapters	1771-AS	
	1771-ASB	A
	1771-DCM	all
Miscellaneous	1771-AF	

Prepare the Cable

Cut the cable according to the lengths you need. Route the cable to the devices.

Make Remote I/O Connections

Use Figure 6.3 when connecting the remote I/O cable to PLC-5 processors and remote I/O adapter modules.

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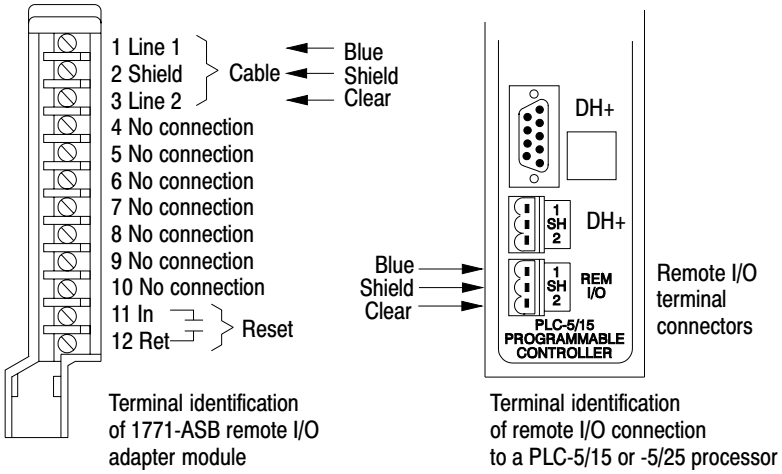
Figure 6.3
Remote I/O Terminal Connectors

Connect a 1771-ASB to a PLC-5/15 or -5/25 processor like this:



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To connect remote I/O cable, do the following:

1. Run the cable (1770-CD) from the processor to each remote I/O adapter module or processor in the remote I/O system.
2. Connect the signal conductor with blue insulation to the 3-pin connector terminal labeled 1 on the processor and to each remote I/O adapter module (or PLC-5 adapter) in the remote I/O system.
3. Connect the signal conductor with clear insulation to the 3-pin connector terminal labeled 2.
4. Connect the shield drain wire to the 3-pin terminal labeled SH.
5. Tie wrap the remote I/O network cable to the chassis to relieve strain on the cable.

Terminate the Link

You must terminate both ends of a remote I/O link to ensure proper operation. Use Table 6.F to determine how to terminate the link.

Table 6.F
Terminating the Remote I/O Link

If this device is an end device of a remote I/O link:	Terminate the link by:
PLC-5/15 or -5/25 processor	setting switch 1 of switch assembly SW3 to ON. Refer to chapter 6 for more information on setting this switch
remote I/O adapter module	connecting a terminator resistor between the remote I/O terminals labeled 1 and 2. Refer to Figure 6.4. Use either a 150-Ohm or 82-Ohm terminator. However, you can only use an 82-Ohm resistor when either of the following conditions are met: • The remote I/O link is operating at 230.4 kbps (terminator must be connected at both the scanner and adapter.) • The remote I/O link is operating at 57.6 kbps or 115.2 kbps and none of the devices on the link are listed in Table 6.E.

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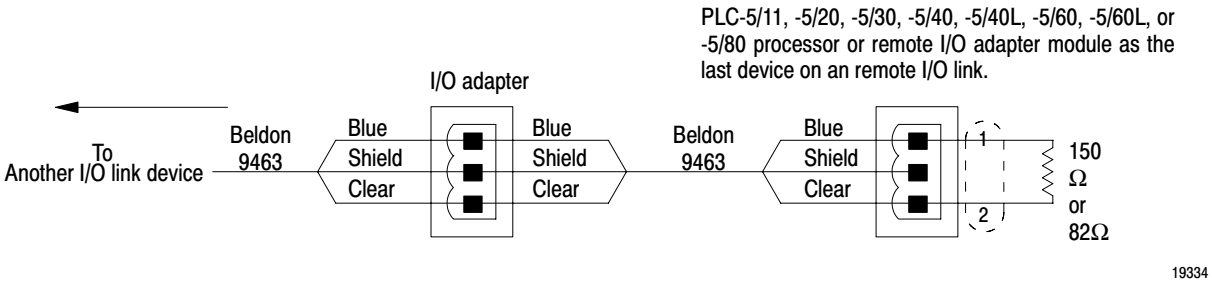
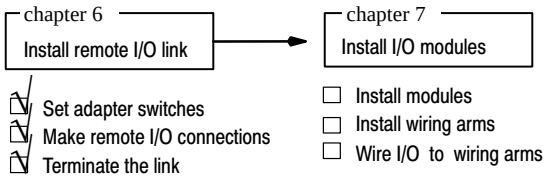
Figure 6.4
Terminating a Remote I/O Link Using a Resistor



What to Do Next

The system component you install next depends upon your system design.



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Chapter 7

Install I/O Modules

Chapter Objectives

Use this chapter to help you install I/O modules.

chapter 7
Install I/O modules

- ☐ Install modules
- ☐ Install wiring arms
- ☐ Wire I/O to wiring arms

Install Modules

Before installing I/O modules, remove power from the I/O chassis backplane and wiring arm.

ATTENTION: Remove power from the 1771 I/O chassis backplane and wiring arm before installing or removing an I/O module.

- Failure to remove power from the backplane or wiring arm could cause module damage, degradation of performance, or personal injury.
- Failure to remove power from the backplane could cause injury or equipment damage due to possible unexpected operation.

Insert each I/O module into its corresponding keyed slot by sliding it onto the plastic tracks of the I/O chassis. Snap the module locking latch over the I/O module.

ATTENTION: Do not force an I/O module into a backplane connector. Forcing an I/O module can damage the backplane connector and/or the I/O module.

Because power-supply modules have a controlled “soft start” feature to enhance power supply reliability, some output modules can momentarily change operating state during power-up or power-down of the power-supply modules. Table 7.A lists these output modules.

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Table 7.A
Output Modules Affected by the Power Supply Soft-Start Feature

Catalog Number	Module	Series
1771-OD	Isolated ac (120V) Output Module	A or B [1]
1771-OY	Contact Output Module	A or B [1]
1771-OZ	Contact Output Module	A or B [1]
1771-OR	Isolated ac (220V) Output Module	A [1]

[1] later series output modules are not affected

If you are using these modules in your plant, observe the following warning when powering-up or powering-down the chassis that contains these modules.

ATTENTION: Disconnect all power from devices controlled by these I/O modules that can cause damage to equipment or injure people during power-up and power-down of the power-supply modules.

For more information on these power supplies, refer to the appropriate publication, as listed in the Allen-Bradley Publications Index, publication SD499.

Install Wiring Arms

Snap each wiring arm onto the horizontal bar of the I/O chassis (Figure 7.1). When I/O modules are in place, the wiring arm connects to the module.

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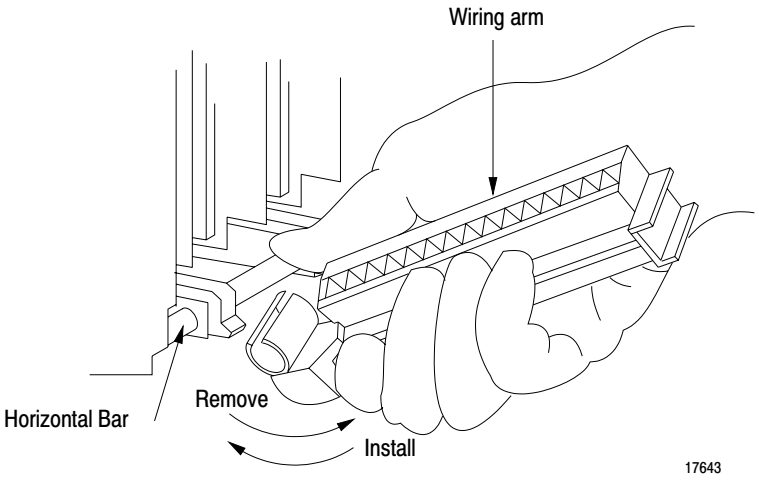
Figure 7.1
Installing Wiring Arms



Wire I/O to Wiring Arms

Your I/O devices (sensors, actuators, etc.) connect to the I/O module's wiring arm. Before wiring your I/O devices, choose the proper cable for the I/O modules you are using. Refer to the specific I/O module installation instructions for this information and for connection diagrams.

Choose the Proper Cable

You can wire your I/O devices using:

- single-conductor cable

  A single-conductor cable has one wire strand enclosed in a casing or outer jacket. We recommend using copper wire.

- multi-conductor cable

  A multi-conductor cable has many single-conductor wires enclosed in a casing or outer jacket.

- multi-conductor shielded cable

  Multi-conductor shielded cable can be Belden type 9463. It consists of twisted pairs of conductor wires wrapped in a foil shield. The number of I/O terminals determines the number of conductor wires that you need within the cable. Figure 7.2 shows each component of this cable:

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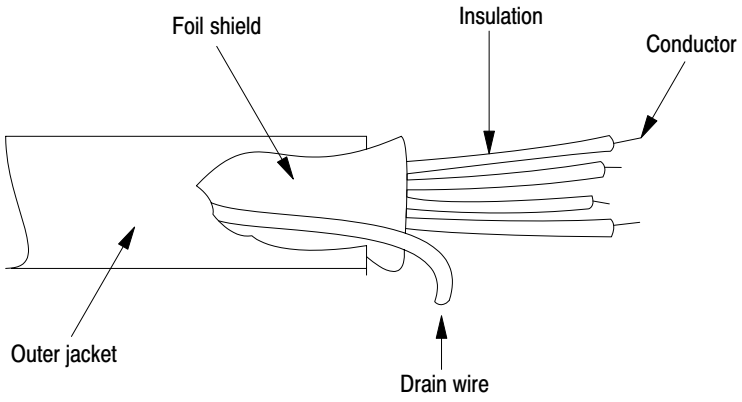
Figure 7.2
Components of a Multi-conductor Shielded Cable



These I/O modules:	Require this cable:
intelligent I/O	multi-conductor shielded cable
low voltage dc (discrete) I/O	
analog I/O	either single- or multi-conductor cable
remaining discrete I/O	

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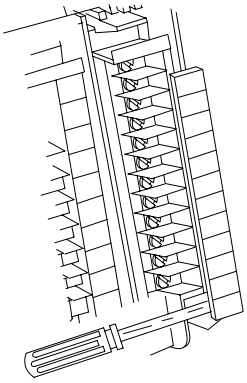
Connect I/O to Wiring Arm

To wire your I/O devices, do the following:



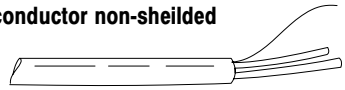
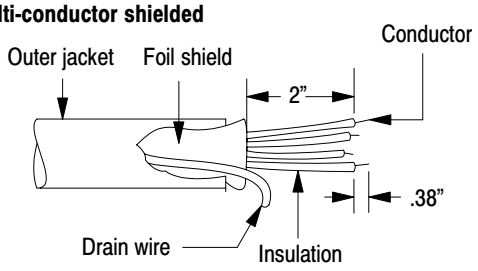
1. Remove the wiring arm's terminal cover using a flat-head screwdriver.

2. Prepare cable.

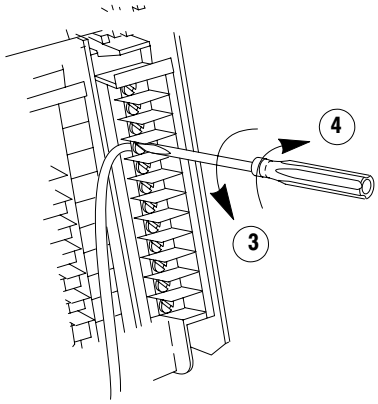
   a. Measure the wire distance from your I/O devices to the wiring arm terminals. This distance plus 3 ft is the amount of wire you need.

   b. Cut the wire.

   c. Refer to the table below.

If you are using this type of cable:	Then do the following:
Multi-conductor non-sheilded 	Expose the individual wires by stripping some casing from the end of the cable that connects to the wiring arm
Multi-conductor shielded 	1. Strip insulation from the end of the cable that connects to the wiring arm and expose the foil. You may need to insulate the bare drain wire with tape or shrink tubing along areas where it might otherwise come in contact with wiring arm terminals. 2. Bend the drain wire back to separate it from the conductor wiring. 3. Trim the insulated wires to 5.08cm (2-in) lengths.

   d. Strip about 3/8 inch insulation to expose the end of the wire.



3. Loosen a terminal screw and place the wire under the pressure plate of the terminal screw.

4. Secure the terminal screw.

5. Repeat steps 2 through 4 for all I/O devices.

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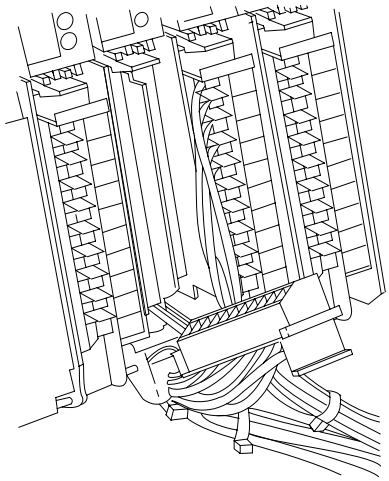
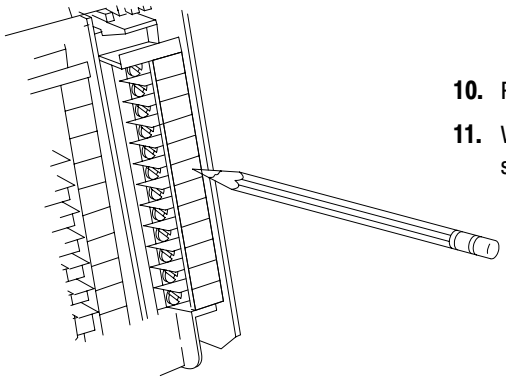


6. Connect the drain wire to ground at the I/O chassis only.
7. Gather all similar wires and bundle them using tie wraps.
8. Label all of your wires at each wire connection at the wiring arm.
9. Make sure that the wiring arm pivots freely.



10. Replace the wiring arm's terminal cover.
11. Write terminal numbers on the labels next to the terminal's status indicator and on the terminal cover.

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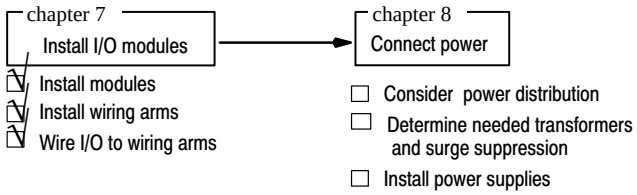
Refer to chapter 3 for more information about grounding shielded cables and connecting drain wires to the chassis grounding system.

What to Do Next



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Chapter 8

Connect Power

Chapter Objectives

Use this chapter to help you connect the proper power system to your processor system.

chapter 8
Connect power

- ☐ Consider power distribution
- ☐ Determine needed transformers and surge suppression
- ☐ Install power supplies

For more information, see Programmable Controller Wiring and Grounding Guidelines, publication 1770-4.1.

About the Power Supplies You Can Use

You can use two types of power supplies:

- power-supply modules — located in the same chassis with the processor
- power supplies — located external to the chassis

Powering a Chassis Containing a PLC-5 Processor

Table 8.A lists the power-supply modules you can use **in** a chassis with a PLC-5 processor and the power supplies you can use **external to** a chassis.

Table 8.A
Power Supply Modules in a Chassis (containing a PLC-5 processor)

Power Supply	Input Power	Output Current (in Amps)	Output Current (in amps) When Parallel With:							Power Supply Location
			P3	P4	P4S	P4S1	P5	P6S	P6S1	
1771-P3	120V ac	3	6	11	11					slot
1771-P4	120V ac	8	11	16	16					slot
1771-P4S	120V ac	8	11	16	16					slot
1771-P4S1	100V ac	8				16				slot
1771-P4R	120V ac	8/16/24 [2]								slot
1771-P5	24V dc	8					16			slot
1771-P6S	220V ac	8						16		slot
1771-P6S1	200V ac	8							16	slot
1771-P6R	220V ac	8/16/24 [2]								slot
1771-P7	120/220V ac	16								external [1]
1771-PS7	120/220V ac	16								external [1]

[1] You cannot use an external power supply and a power supply module to power the same chassis; they are not compatible.

[2] See publication 1771-2.136 for more information.

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Powering a Remote I/O Chassis Containing a 1771-AS or 1771-ASB or an Extended-Local I/O Chassis Containing a 1771-ALX.

Table 8.B lists the power-supply modules you can use:

- **in** a remote I/O chassis with a 1771-AS or -ASB
- **in** an extended local I/O chassis with a 1771-ALX
- **external to** a remote I/O chassis.
- **external to** an extended local I/O chassis.

Table 8.B
Power Supplies in a Remote Chassis (containing a 1771-AS or -ASB) or an Extended Local I/O Chassis (containing a 1771-ALX)

Power Supply	Input Power	Output Current (in Amps)	Output Current (in amps) When Parallel With:							Power Supply Location
			P3	P4	P4S	P4S1	P5	P6S	P6S1	
1771-P3	120V ac	3	6	11	11					slot
1771-P4	120V ac	8	11	16	16					slot
1771-P4S	120V ac	8	11	16	16					slot
1771-P4S1	100V ac	8				16				slot
1771-P4R	120V ac	8/16/24 [2]								slot
1771-P5	24V dc	8					16			slot
1771-P6S	220V ac	8						16		slot
1771-P6S1	200V ac	8							16	slot
1771-P6R	220V ac	8/16/24 [2]								slot
1771-P1	120/220V ac	6.5								external [1]
1771-P2	120/220V ac	6.5								external [1]
1771-P7	120/220V ac	16								external [1]
1771-PS7	120/220V ac	16								external [1]
1777-P2	120/220V ac	9								external [1]
1777-P4	24V dc	9								external [1]

[1] You cannot use an external power supply and a power supply module to power the same chassis; they are not compatible.

[2] See publication 1771-2.136 for more information.

Distributing Power

Connect a separate transformer between the ac power source and the processor power supply to provide dc isolation from other equipment. To connect a transformer, do the following:

1. Connect the transformer primary to the ac source.

2. Connect the high side of the transformer secondary to the L1 terminal of the power supply.

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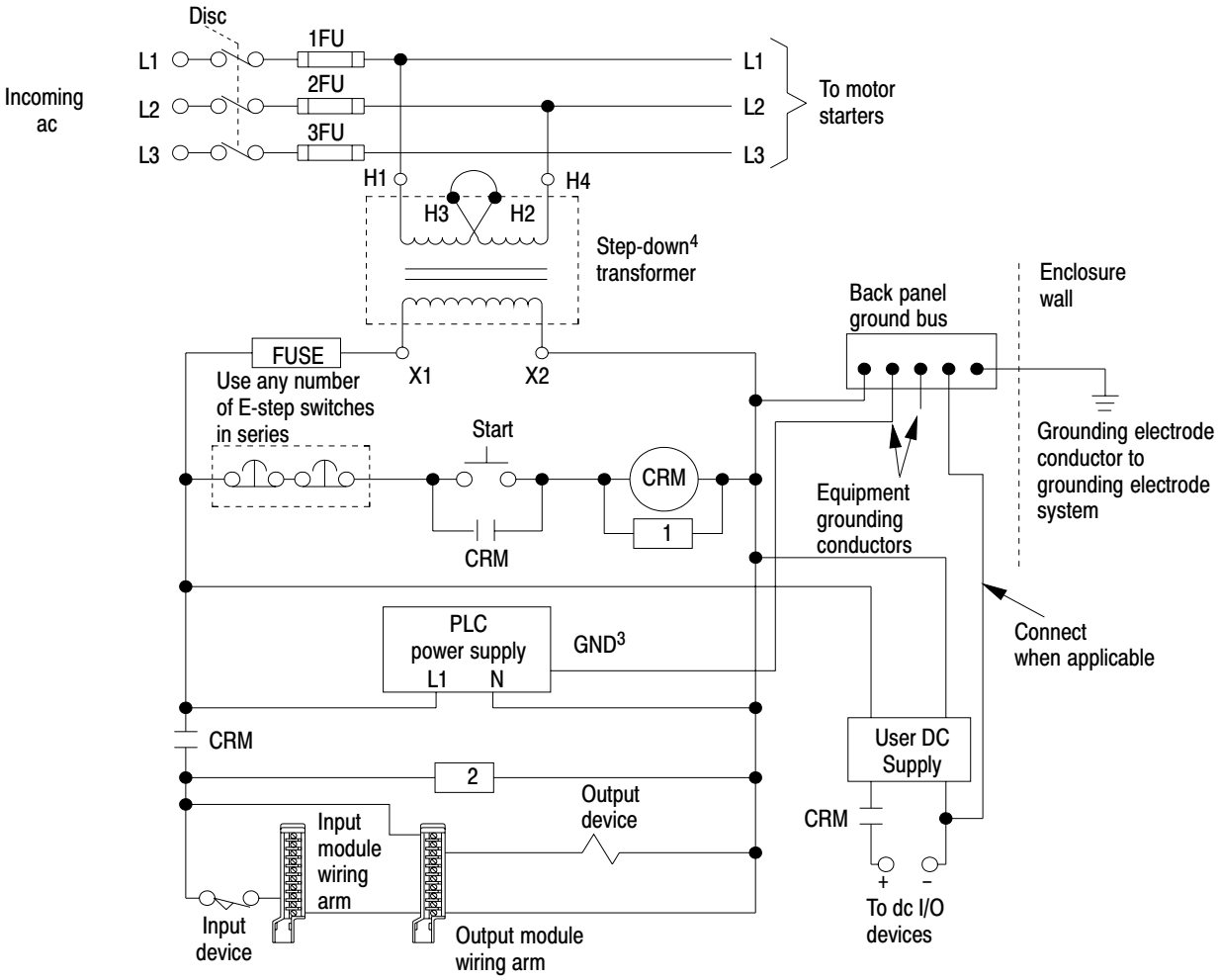
3. Connect the low side of the transformer secondary to the neutral (common) terminal of the power supply.

Figure 8.1 and Figure 8.2 illustrates the proper power distribution.

Figure 8.1
Grounded ac Power Distribution System with Master Control Relay



Notes:

1. To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 700–N24; for 220/240V AC, use cat. no. 599–KA04.

2. To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 599–K04; for 220/240V AC, use cat. no. 599–KA04.

3. For a power supply with a groundable power supply chassis, this represents connection to the power supply chassis only. For a power supply without a groundable power supply chassis, this represents connection to the GND terminal.

4. In many applications, a second transformer provides power to the input circuits and power supplies for isolation from the output circuits.

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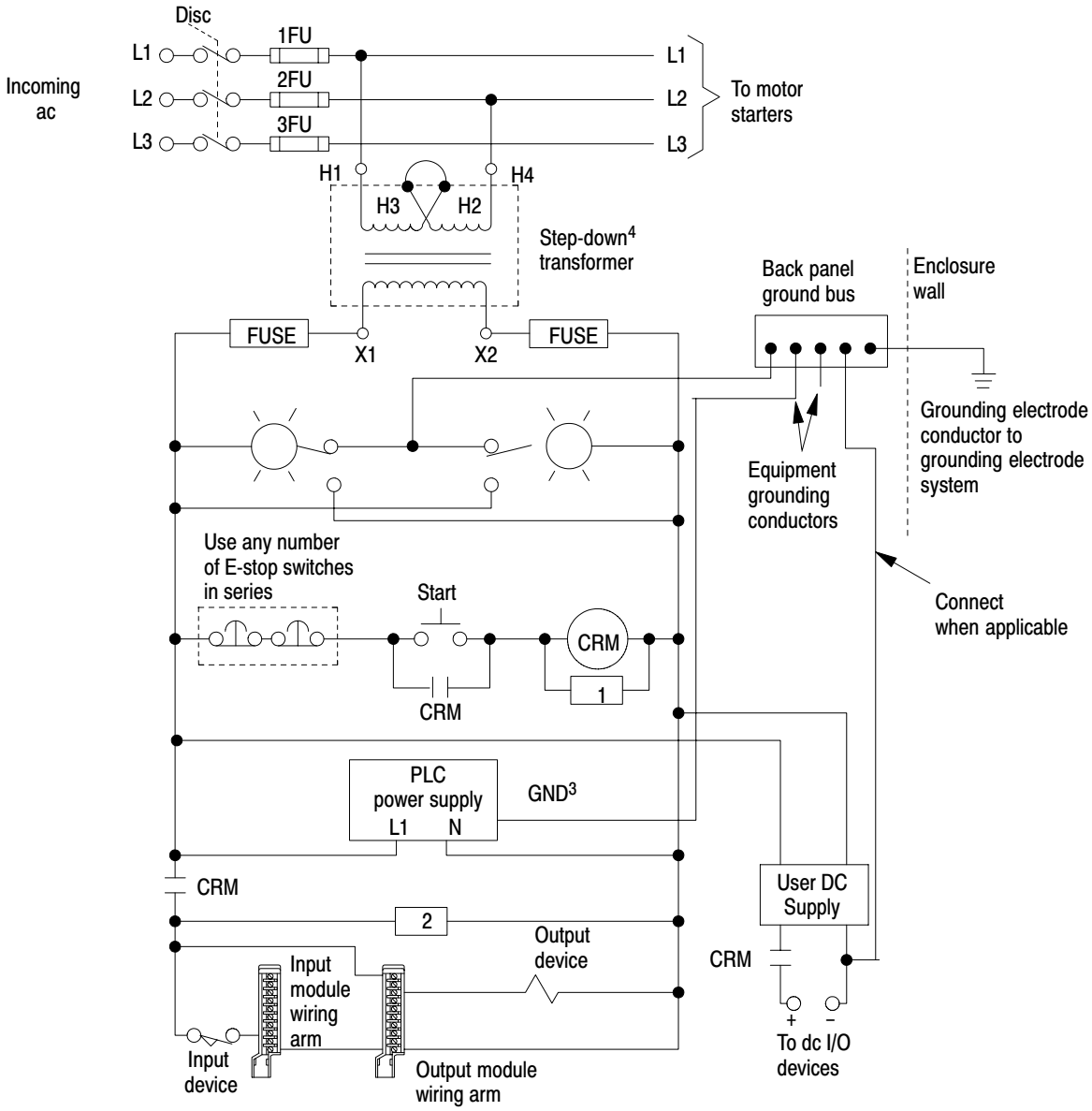
Figure 8.2
Ungrounded ac Power Distribution System with Master Control Relay



Notes:

1. To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 700–N24; for 220/240V AC, use cat. no. 599–KA04.

2. To minimize EMI generation, you should connect a suppression network: for 120V AC, use Allen-Bradley cat. no. 599–K04; for 220/240V AC, use cat. no. 599–KA04.

3. For a power supply with a groundable power supply chassis, this represents connection to the power supply chassis only. For a power supply without a groundable power supply chassis, this represents connection to the GND terminal.

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4. In many applications, a second transformer provides power to the input circuits and power supplies for isolation from the output circuits.

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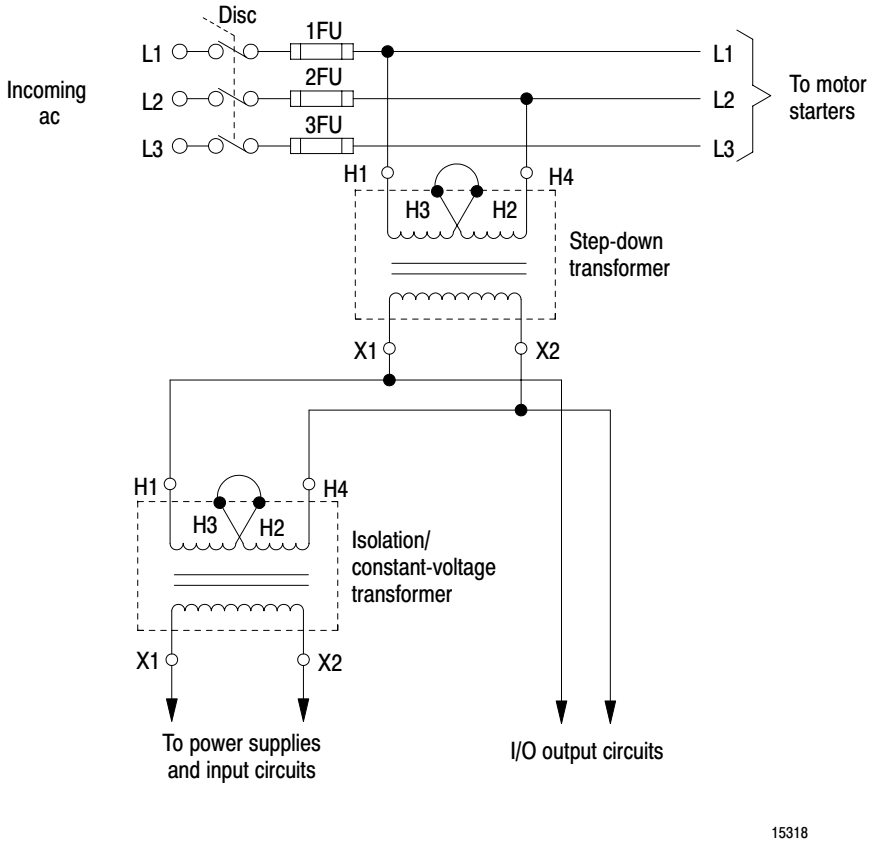
Using a Second Transformer

To guard against output transients from being induced into inputs and power supplies, isolate output circuits from power supplies and input circuits. Use a separate transformer to provide power to the input circuits and power supplies. Refer to Figure 8.3.

Figure 8.3
Power Supplies and Input Circuits Receiving Power through a Separate Transformer



Depending upon your application, you may choose to use a second transformer, such as the following:

- isolation transformer
- constant voltage transformer

The following sections describe the uses of these transformers.

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Using an Isolation Transformer

Allen-Bradley power supplies have circuits that suppress electromagnetic interference from other equipment. However, for installations near particularly excessive electrical noise generators, using an isolation transformer provides further suppression of electromagnetic interference from other equipment. The output devices being controlled should draw power from the same ac source as the isolation transformer, but not from the secondary of the isolation transformer (Figure 8.3).

Using a Constant Voltage Transformer

In applications where the ac power source is especially “soft” and subject to unusual variations, a constant-voltage transformer can stabilize the ac power source to the processor, thereby minimizing shutdowns. However, the constant-voltage transformer must provide a sinusoidal output.

If you use a constant-voltage transformer to provide power to the processor-resident chassis, then the input devices connected to the I/O chassis must also receive their ac power through the same constant-voltage transformer. If the inputs receive their ac power through another transformer, the ac source voltage could go low enough that incorrect input data enters memory while the constant-voltage transformer prevents the power supply from shutting down the processor.

The output devices being controlled should draw power from the same ac source as the constant-voltage transformer, but not from the secondary of the constant-voltage transformer (Figure 8.3).

Determining the Rating of the Transformer

To determine the required rating of the transformer, add the external-transformer rating for the power supply and all other power requirements (input circuits, output circuits). The power requirements must take into consideration the surge currents of devices controlled by the controller. Choose a transformer with the closest standard transformer rating above the calculated requirements.

For example, the external-transformer rating of a 1771-P4S power-supply module at maximum back-plane load is 140 VA. A 140 VA transformer could be used if a 1771-P4S power-supply module were the only load. A 500 VA transformer should be used if there were 360 VA of load in addition to that of the 1771-P4S power-supply module.

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Each power supply is designed to generate a shutdown signal whenever the ac line voltage drops below its lower voltage limit, and to allow the processor to resume operation when the line voltage reaches the lower voltage limit again. A shutdown is necessary in that situation to ensure that only valid data is stored in memory.

Choosing properly sized transformers is important because:

- If the transformer is too small, it will clip the peak of the sine wave. When the voltage is still above the lower voltage limit, the power supply will sense this as a low voltage and shut down the processor prematurely.
- If the transformer is too large, it will not provide as much isolation as a transformer of proper size.

Important: Note that the external-transformer rating (in VA) is 2.5 times the power supply input power requirement (in Watts). This is necessary because of the design feature that lets the power supply maintain its output during loss of input power for up to a half cycle.

Grounding the Power Supply

When bringing ac power into the enclosure, do not connect its raceway through an equipment-grounding conductor to the ground bus on the back-panel. The raceway should be grounded elsewhere. Connecting the raceway to the ground bus will cause a ground loop.

Ground loops may introduce objectionable ground currents causing faulty operation of the processor. Refer to Article 250-21 of the National Electrical Code for recommended methods of reducing the objectionable ground current.

When ac power is supplied as a separately derived system through an isolation/step-down transformer, you can connect it as a grounded ac system or an ungrounded ac system.

For this type of ac system:	Connect:
grounded	one side of the transformer secondary to the ground bus. Refer to Figure 8.1 (page 8-3).
ungrounded	one side of each test switch for the ground-fault-detector lights to the ground bus. Refer to Figure 8.2 (page 8-4).

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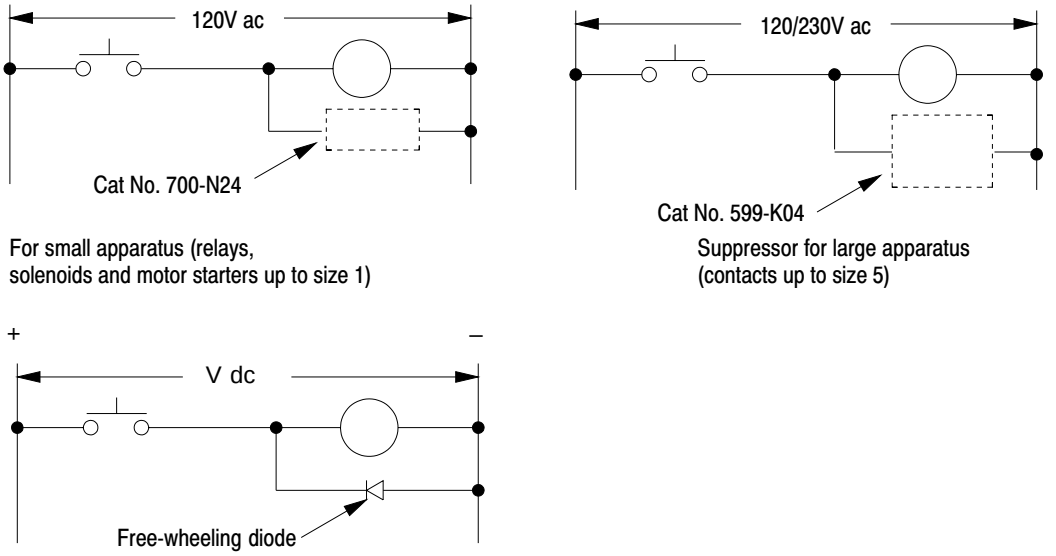
Protecting Against EMI

Electromagnetic interference (EMI) can be generated whenever inductive loads such as relays, solenoids, motor starters, or motors are operated by "hard contacts" such as pushbuttons or selector switches. Following the proper wiring and grounding practices guards the processor system against the effects of EMI. However, in some cases you can use suppression networks to suppress EMI at its source.

Inductive loads controlled only by solid-state output devices alone do not cause comparable EMI generation. However, inductive loads of ac output modules that are in series or parallel with hard contacts require suppression networks to protect the module output circuits as well as to suppress EMI.

Connect suppression networks at the inductive loads. If you connect them at the switching devices, the wires connecting the switching devices to the inductive loads will act as antennas to radiate EMI. Figure 8.4 shows typical suppression circuitry for different types of loads.

Figure 8.4
Typical Suppression Networks



Allen-Bradley bulletin 700 relays and bulletin 509, 709 motor starters have surge suppressors available as an option. Table 8.C lists these Allen-Bradley products and their suppressors.

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Table 8.C
Allen-Bradley Suppressors

Allen-Bradley Equipment:	Suppressor Catalog Number:
Motor Starter Bulletin 509	599-K04 [1] 599-KA04
Motor Starter Bulletin 709	1401-N10 [1]
Relay Bulletin 700 Type N or P	700-N24 [2]
Miscellaneous	700-N24 [3]

[1] For starters with 120V ac coils

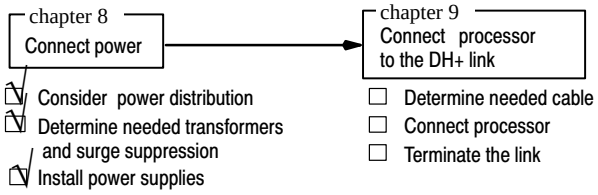
[2] Maximum coil voltage 150V ac or dc

[3] The 700-N24 is a universal surge suppressor. You can use it on electromagnetic devices with the limitations of 35 sealed VA, 150V.

Install the Power Supplies

Install the power supplies according to the instructions contained in the power supply's installation data.

What to Do Next



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Chapter 9

Connect Processors to a DH+ Link

Chapter Objectives

Use this chapter to help you connect a processor to a DH+ link.

chapter 9
Connect processor to the DH+ link

- ☐ Determine needed cable
- ☐ Connect processor
- ☐ Terminate the link

For additional DH+ link wiring information, refer to the Data Highway/ Data Highway Plus/Data Highway II/Data Highway-485 Cable Installation Manual, publication 1770-6.2.2.

Determine the Needed Cable

Consult the system diagram for your plant. Determine the following:

- Is your processor connecting to the DH+ link using a daisychain or trunkline/dropline configuration?
- If you are installing a trunkline/dropline, what station connectors do you need?
- Use Belden 9463 twinaxial cable (cat. no.1770-CD) cable to connect to the DH+ link. What cable lengths do you need?

Follow these guidelines while installing DH+ communication links:

- at a DH+ communication rate of 57.6 kbps, do not exceed these cable lengths:
  - trunkline cable length — 3,044 m (10,000 cable-ft)
  - drop cable length — 30.4 m (100 cable-ft)
- no more than 64 stations can be on a single DH+ link

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Connect the Processor to the DH+ Link

Use the 3-pin connector on the processor to connect a DH+ link. The connector's port must be configured to support a DH+ communication link. To connect a processor to a DH+ link, refer to Figure 9.1 and Table 9.A.

Figure 9.1
Connecting Processors to a DH+ Link

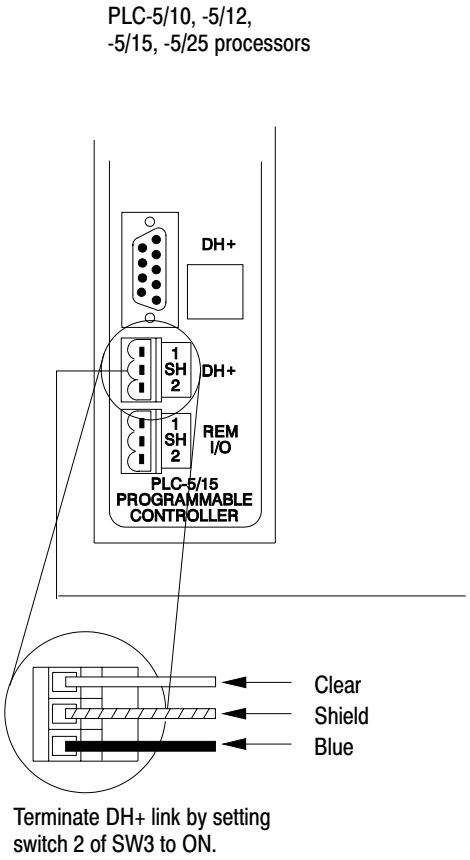

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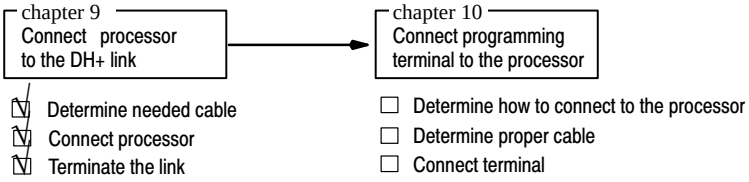
Table 9.A
Connecting a PLC-5 Processor to a DH+ Link

If you are installing this DH+ link configuration:	Connect the 1770-CD cable:	By doing the following:
trunkline/dropline	from the dropline to the connector screw terminals on the DH+ connectors of the processor	1. Connect the signal conductor with **CLEAR** insulation to the 3-pin connector terminal 1 at each end of each cable segment. 2. Connect the **SHIELD** drain wire to the 3-pin connector SH terminal at both ends of each cable segment. 3. Connect the signal conductor with **BLUE** insulation to the 3-pin connector terminal 2 at each end of each cable segment.
daisychain	to the connector screw terminals on the DH+ connectors of the processor	

Terminate the Link

You must terminate the DH+ link on both ends. On PLC-5/10, -5/12, -5/15, and -5/25 processors, set switch 2 of Assembly SW3 on (closed).

What to do Next



For information about:	See:
programming data transfer between PLC-5 processors.	1785 PLC-5 Programmable Controllers Design Manual (1785-6.2.1) PLC-5 Programming Software Instruction Set (6200-6.4.11) Enhanced and Ethernet PLC-5 Programmable Controllers User Manual (1785-6.5.12)

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Chapter 10

Connect a Programming Terminal to the Processor

Chapter Objectives

Use this chapter to help you connect a programming terminal to a PLC-5 processor.

chapter 10
Connect programming terminal to the processor

- ☐ Determine how to connect to the processor
- ☐ Determine proper cable
- ☐ Connect terminal

Determine How You Want to Connect a Programming Terminal

You can connect a programming terminal to a processor in several ways.

Connect a programming terminal to the processor using:	See:
remote link connection (DH+ to DH to DH+)	10-4
remote connection to DH+ through an interface to the terminal's serial port	10-4

Connecting through a Local DH+ Link

The processor has electrically-parallel DH+ connectors. They are electrically identical, and connecting to either one provides access to the same communication link. The PLC-5/10,-5/12, -5/15, -5/25 processors have one of each:

- 9-pin D-shell DH+ connector
- 3-pin DH+ connector

Once you connect the programming device through a local DH+ link to one processor, the device can communicate with each PLC-5 processor on the link. You can also communicate with PLC-2, PLC-3 and PLC-5/250 processors connected to the link provided you have the appropriate programming software installed.

To connect a programming terminal to a processor using a local DH+ link, do the following:

- determine the communication board used in your programming terminal
- determine the correct cable
- connect the programming terminal to the processor

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Determine the Communication Board Used in Your Programming Terminal

Use Table 10.A to help you determine the communication board that your programming terminal uses.

Table 10.A
Programming Terminals and Their Communication Boards

This programming terminal:	Uses this communication card to access a DH+ link:
1784-T50 IBM® or compatible	1784-KT, -KT2 or 1784-KTK1
6160-T53 6160-T60 6160-T70	1784-KT
1784-T45	1784-KL
1784-T47	1784-KL/B

Determine the Correct Cable

Choose the correct cable to use to connect to the processor based upon the communication board Table 10.B.

Table 10.B
Processor to Communication Board Interconnect Cables

If You Have This Communication Board:	Use This Cable:
1784-KT, -KT2	1784-CP
1784-KL, -KL/B	
1784-KTK1	1784-CP5
1784-PCMK	1784-PCM5

For information about connecting a processor and a programming device, refer to Appendix B.

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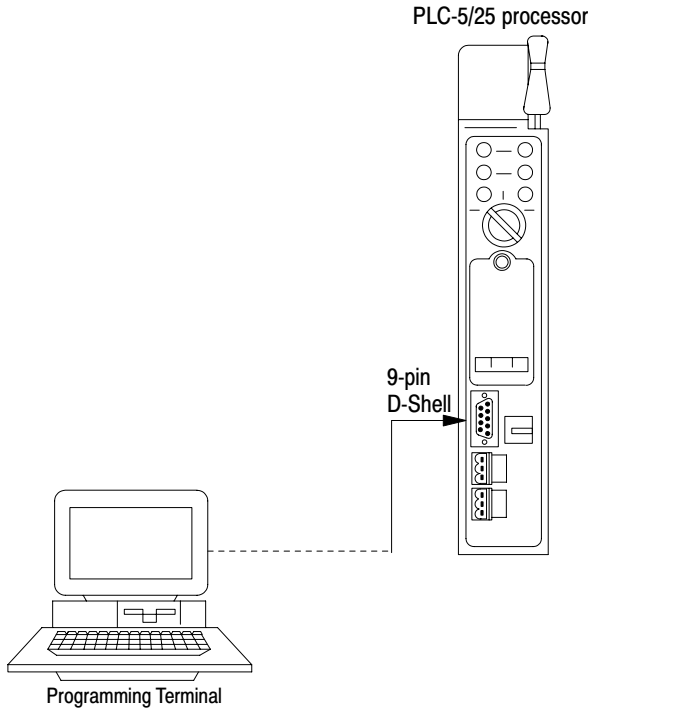
Connect the Programming Terminal

Using the correct interconnect cable, connect the programming terminal. Refer to Figure 10.1.

Figure 10.1
Connecting the Programming Terminal



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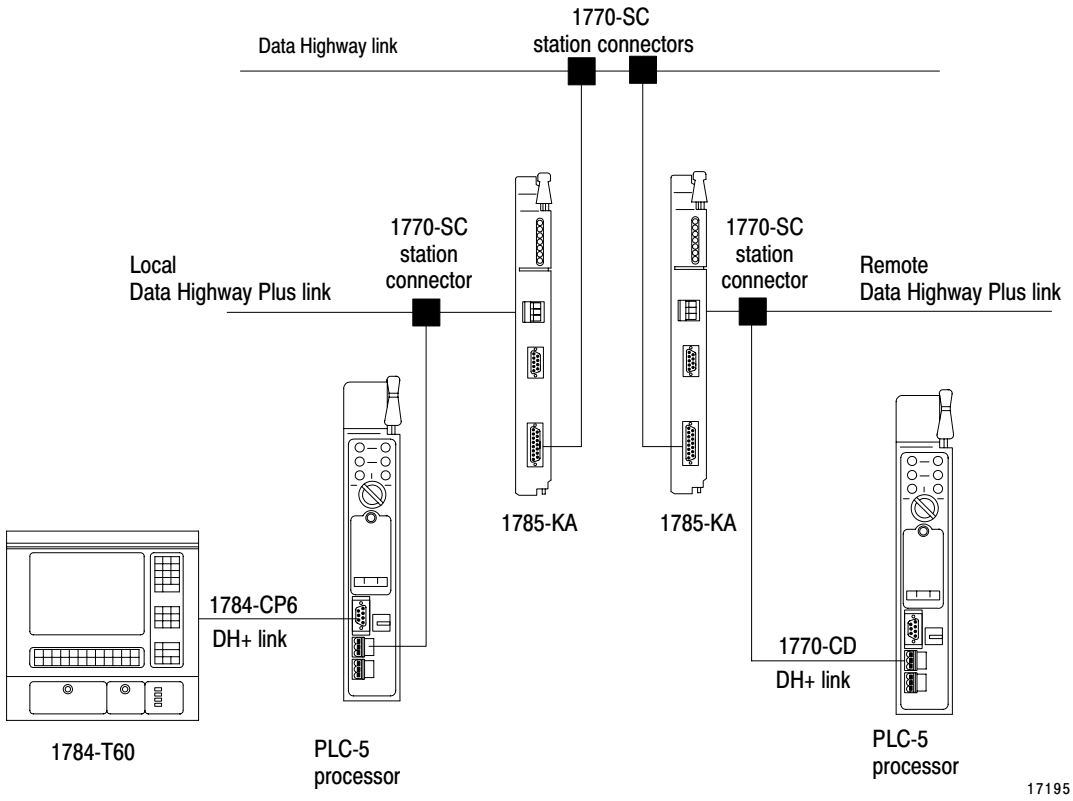
Connecting to a Remote DH+ Link

The remote programming configurations available with the 1784-KT, 1784-KL, and 1784-KL series B boards let you communicate with processors on other DH+ links to expand the range of processors you can use for program development (Figure 10.2).

Figure 10.2
Example DH+ to DH to DH+ Network Configuration



Connecting to a DH+ Link through an Interface to the Terminal's Serial Port

To connect a DH+ link through a terminal's serial port (COM1 or COM2) use one of the following communications modules:

- 1785-KE series A or series B Communication Interface Module (residing in a 1771 I/O rack)
- 1770-KF2, series B Communication Interface Module (desktop unit)

Important: The serial port communication driver of 6200 PLC-5 Programming Software is interrupt-driven; the serial port must support hardware interrupts. On most DOS-based machines, COM1 and COM2 support these interrupts.

Hardware configurations for each of the computers that PLC-5 processors support are listed in Appendix B.

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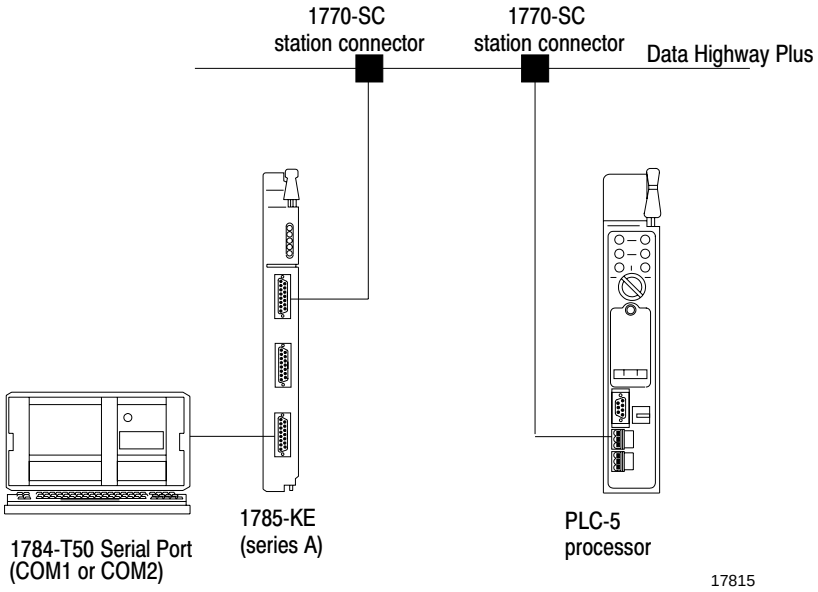
Using the 1785-KE Communication Interface Module

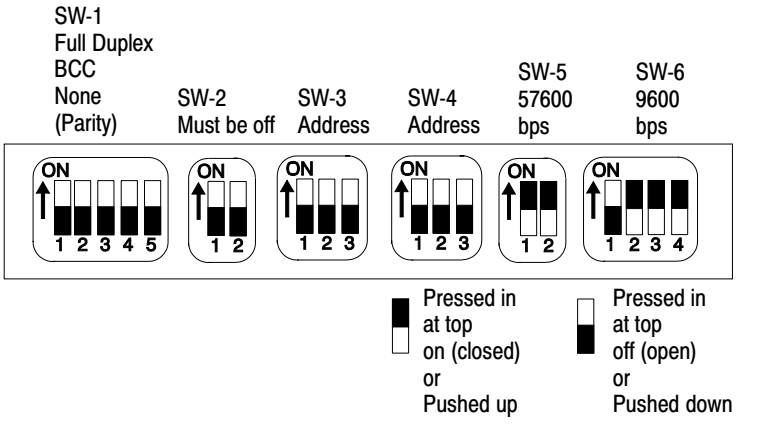
If you have a series A 1785-KE module, see Figure 10.3 for connection information through a serial port. If you have a series B 1785-KE module, see Figure 10.5 for connection information.

Figure 10.3
1785-KE (Series A) Connection through a Serial Port



Refer to Figure 10.4 (on page 10-5) for an explanation of the switch assemblies and an example switch setting.

Figure 10.4
1785-KE (series A) Switch Assemblies



Switch Assembly:	Function:
SW1	Asynchronous link features
SW2, SW3, SW4	Station address
SW5	Data Highway communication rate
SW6	Asynchronous link communication rate

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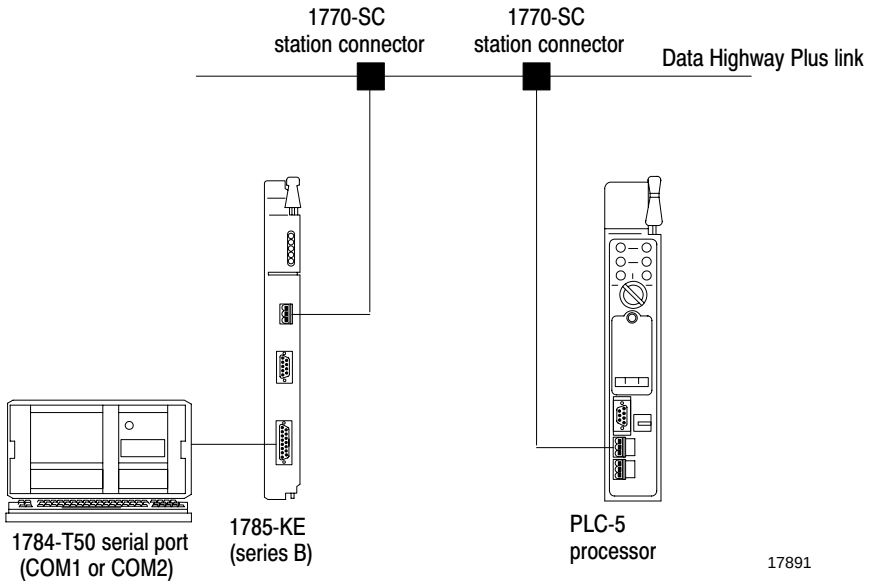
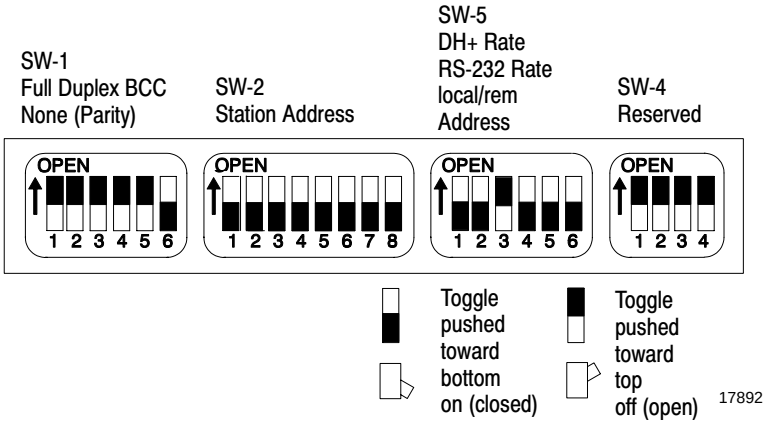
Figure 10.5
1785-KE (Series B) Connection through a Serial Port



Refer to Figure 10.6 (on page 10-6) for an explanation of the switch assemblies and an example switch setting.

Figure 10.6
Example of a 1785-KE (series B) Switch Setting



Switch Assembly:	Function:
SW1	Asynchronous link features
SW2	Station address
SW3	Data Highway communication rate, RS-232C communication rate, Local/Remote addressing
SW4	Reserved

For more information on series A or series B modules, refer to the 1785-KE Communication Interface Module User Manual, publication 1785-6.5.2.

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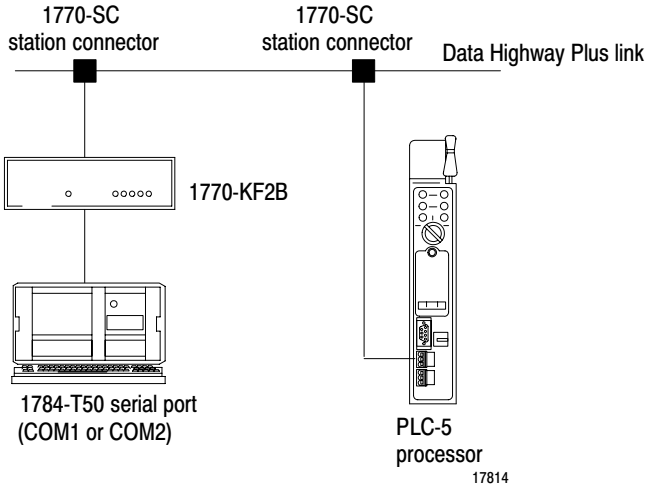
Using a 1770-KF2B Communication Interface Module

See Figure 10.7 for a 1770-KF2 series B connection through a serial port.

Figure 10.7
1770-KF2B Connection through a Serial Port



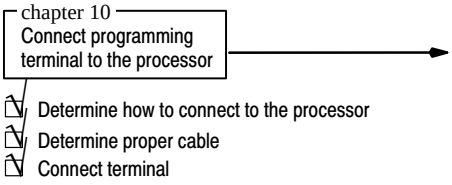
Refer to Figure 10.8 an explanation of the switch assemblies and an example switch setting.

Figure 10.8
Example of a 1770-KF2series B Switch Setting

Switch Assembly:	Function:
SW1	Asynchronous link features
SW2, SW3, SW4	Station address
SW5	Data Highway communication rate
SW6	Asynchronous link communication rate
SW7	DH or DH+ selection
SW8	RS-232C or RS-422A compatible selection

For more information, refer to the 1770-KF2B Communication Interface Module User Manual, publication 1770-6.5.13.

What To Do Next



For this information:	See:
Processor and adapter troubleshooting	chapter 11
Specifications	appendix A
Cable diagrams and pinouts	appendix B

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Chapter 11

Troubleshooting

Chapter Objectives

Use this chapter to help you troubleshoot your PLC-5 system using the processor and adapter modules LED indicators (Table 11.A).

Table 11.A
LED Status Indicator Troubleshooting Guide

Type of Problem:	Table Number:	On Page:
PLC-5/10, -5/12, -5/15, -5/25 processors		
• general	Table 11.B	11-2
• in adapter mode	Table 11.C	11-3
• in scanner mode	Table 11.D	11-3
• DH+ link	Table 11.E	11-4
1771-ASB module		
• series B	Table 11.G	11-7
• series C and D	Table 11.F	11-5

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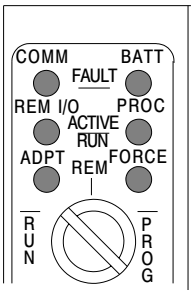
Troubleshooting PLC-5/10, -5/12, -5/15, and -5/25 Processors

Use Table 11.B, Table 11.C, Table 11.D, and Table 11.E to troubleshoot your PLC-5/10, -5/12, -5/15, and -5/25 processor.

Table 11.B
PLC-5/10, -5/12, -5/15, -5/25 General Problems



Indicator	Color	Description	Probable Cause	Recommended Action
PROC	green (steady)	processor in RUN mode and fully operational	normal operation	no action required
	green (blinking)	Processor memory being transferred to EEPROM	normal operation	no action required
	red (blinking)	major fault	run-time error	Check major fault bit in status file (S:11) for error definition. Clear fault bit, correct problem, and return to RUN mode.
	red (steady)	major fault	• user RAM has checksum error • memory module error	• Clear memory and reload program. • Check backplane switch settings and/or insert correct memory module.
	off	processor in program load or TEST mode or is not receiving power		Check power supply and connections.
PROC REM I/O	all red (steady)		internal diagnostics have failed	Power down, reseat processor and power up. Then, clear memory and reload your program. Replace EEPROM with new program. Then, if necessary, replace the processor.
FORCE	amber (steady)	forces enabled	normal operation	no action required
	amber (blinking)	forces present, but not enabled	normal operation	no action required
	off	no forces present	normal operation	no action required
BATT	red (steady)	battery low		Replace battery within 1-2 days (typical).
	off	battery is good	normal operation	no action required
ADPT	green (steady)	processor is in adapter mode	normal operation	no action required
	off	processor is in scanner mode	normal operation	no action required

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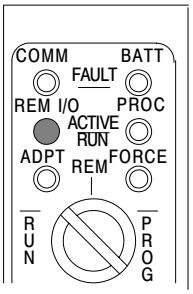
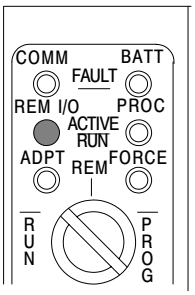
Table 11.C
PLC-5/12, -5/15, -5/25 Processor in Adapter Mode



Indicator	Color	Description	Probable Cause	Recommended Action
REM I/O	green (steady)	active remote I/O link	normal operation	no action required
	green (blinking)	remote I/O active and host processor is in program load or TEST mode	normal operation	no action required
	red (steady)	no communication with host processor	duplicate station address selected	Correct station address.
	green (sporadic)	bad communication with host processor		Check connections.
	off	no communication with host processor		no action required

Table 11.D
PLC-5/15, -5/25 Processor in Scanner Mode



Indicator	Color	Description	Probable Cause	Recommended Action
REM I/O	green (steady)	active remote I/O link	normal operation	no action required
	red (steady)	remote I/O link fault	wiring, adapter module(s)	• Check all connections, check adapter module(s). • If you have 6200 programming software, put the processor in PROG mode and do an autoconfigure for remote racks (see the 6200 PLC-5 Programming Software Configuration Manual, 6200-6.4.6).
	green/red (blinking)	partial remote I/O link fault	one or more remote I/O chassis faulted	• Check status bits in status file (element #7) to identify faulted chassis number; check wiring, adapter module(s), power supplies. • If you have 6200 programming software, put the processor in PROG mode and do an auto configure for remote racks (see 6200 PLC-5 Programming Software Configuration Manual, 6200-6.4.6).
	off	no remote I/O selected		no action required

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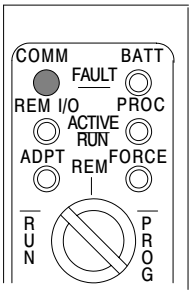
Table 11.E
PLC-5/10, -5/12, -5/15, -5/25 DH+ Link



Indicator	Color	Description	Probable Cause	Recommended Action
COMM	green (blinking rapidly or slowly)	processor is transmitting or receiving on DH+ link	normal operation	no action required
	red (steady)	watchdog timeout	hardware error	Turn power off, then on. Check that the software configurations match the hardware set-up. Replace the processor.
	red (sporadic)	bad communication on DH+ link	duplicate station address selected	Correct station address.
	off	• If directly connected to processor, no communication on DH+ link • If last processor on DH+ link, no communication on DH+ link		• no action required • Check DH+ wiring connections.

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Troubleshooting Information for 1771-ASB Module

Use Table 11.F and Table 11.G to help you troubleshoot your remote I/O system.

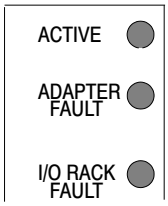

Table 11.F
Remote I/O System Troubleshooting Guide for the 1771-ASB series C or D Adapter Module

Indicators					
Active	**Adapter Fault**	**I/O Rack**	**Description**	**Probable Cause**	**Recommended Action**
On	Off	Off	Normal indication; remote adapter is fully operational		
Off	On	Off		RAM memory fault watchdog timeout	Replace module.
On	Blink	Off	Module placement error	I/O module in incorrect slot	Place module in correct slot in chassis.
Blink in unison		Off	Incorrect starting I/O group number	Error in starting I/O group number or I/O rack address	Check switch settings.
On	On	On	Module not communicating	Incorrect transmission rate setting	Check switch setting.
Off	On	On	Module not communicating	Scan switch set for “all but last four slots” in 1/4 rack	Reset scan switch setting.
Blink	Off	Off	Remote adapter not actively controlling I/O (scanner to adapter communication link is normal)[4]	Processor is in program or test mode Scanner is holding adapter module in fault mode	Fault should be cleared by I/O scanner.
LEDs sequence on/off from top to bottom			Module not communicating	Another remote I/O adapter with the same address is on the link	Correct the address.
Blink alternately		Off	Adapter module not actively controlling I/O[2] Adapter module in processor restart lockout mode (adapter to scanner link is normal)	Processor restart lockout switch on chassis backplane switch assembly[1]	Press reset button to clear lockout feature or cycle power; if after repeated attempts indicators are still blinking, check: • pushbutton not wired properly to field wiring arm. • wiring arm not connected to adapter module. • adapter module was reset by processor/scanner, then immediately faulted.

[1] You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1771-SD, -SD2.

[2] The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

[3] Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfer from the chassis.

[4] If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

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Indicators					
Active	**Adapter Fault**	**I/O Rack**	**Description**	**Probable Cause**	**Recommended Action**
Off	Off	On	I/O chassis fault.[2] No communication on link.	Problem exists between: • adapter and module in chassis; the module will stay in fault mode until fault is corrected • shorted printed circuit board runs on backplane or I/O module	Cycle power to the chassis to clear a problem resulting from high noise.[3] • remove and replace all I/O modules one at a time. • if problem does not clear, something is wrong in chassis or I/O module.
Blink	Off	On	Communication on link. Possible shorted backplane	• noise on backplane • shorted circuit board runs • faulty card in chassis	• Eliminate noise. • Isolate noise. • Add surge suppression. • Replace chassis. • Replace defective card in chassis.
Blink	On	Off	Module identification line fault	Excessive noise on backplane	Verify power supply and chassis grounding.
Off	Off	Off	Module not communicating	Power supply fault Wiring from scanner to adapter module disrupted Scanner not configured properly One faulted chassis within a rack group address causing scanner/distribution panel to fault all chassis in rack group address (when in disable search mode)	Check power supply, cable connections, and make sure adapter module is fully seated in chassis. Correct cable and wiring defects. Refer to publication 1772-2.18 for scanner configuration. Check sequentially from the first module to the last module to pinpoint fault; correct any faults and proceed to the next chassis.

[1] You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1771-SD, -SD2.

[2] The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

[3] Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

[4] If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

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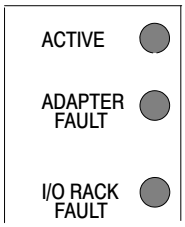

Table 11.G
Remote I/O System Troubleshooting Guide For the 1771-ASB Series B Module

Indicators					
Active	**Adapter Fault**	**I/O Rack**	**Description**	**Probable Cause**	**Recommended Action**
On	Off	Off	Normal indication; adapter is fully operational		
On or Off	On	On or Off	Remote adapter fault[2]	Remote adapter not operating; it will stay in fault mode until fault is corrected	Cycle power to the chassis to clear the adapter fault..[3] Replace adapter if fault does not clear.
On or Off	Off	On	I/O chassis fault[2]	Problem exists between: • adapter and module in chassis; the module will stay in fault mode until fault is corrected • shorted printed circuit board runs on backplane or I/O module	Cycle power to the chassis to clear a problem resulting from high noise.[3] • Remove and replace all I/O modules one at a time. • Replace adapter. • If problem does not clear, something is wrong in chassis or I/O module.
Blinking	Off	Off	Remote adapter not actively controlling I/O (scanner to adapter communication link is normal)[4]	Processor is in program or test mode Scanner is holding adapter module in fault mode	none Fault should be cleared by I/O scanner.
Blinking alternately		Off	Adapter module not actively controlling I/O[2] Adapter module in processor-restart-lockout mode (adapter to scanner link is normal)	Processor-restart-lockout switch on chassis backplane switch assembly[1]	Press reset button to clear lockout feature or cycle power; if after repeated attempts indicators are still blinking, check: • pushbutton not wired properly to field wiring arm. • wiring arm not connected to adapter module. • adapter module was reset by processor/scanner, then immediately faulted.

[1] You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1772-SD, -SD2.

[2] The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

[3] Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

[4] If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

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Indicators					
Active	**Adapter Fault**	**I/O Rack**	**Description**	**Probable Cause**	**Recommended Action**
Off	Off	Off	If remote I/O scanner/distribution panel (1772-SD, -SD2) is in disable search mode, then response is normal[2]	Power supply fault	Check power supply, cable connections, and make sure adapter module is fully seated in chassis.
				Wiring from scanner to adapter module disrupted	Correct cable and wiring defects.
				Scanner not configured properly	Refer to publication 1772-2.18 for scanner configuration.
				One faulted chassis within a rack group address causing scanner/distribution panel to fault all chassis in rack group address (when in disable search mode)	Check sequentially from the first module to the last module to pinpoint fault; correct any faults and proceed to the next chassis.
Blinking	On	On	Module identification line fault	Excessive noise on backplane	Verify power supply and chassis grounding.
On	Blinking	Off	Module placement error in remote I/O chassis	Incorrect placement of high-density modules	Verify addressing modes and switch settings.
Flashing in unison		Off	Incorrect starting I/O group number for chassis size	Error in starting I/O group number or I/O rack address	Check switch settings.

[1] You must select the operating mode of the remote I/O adapter module as outlined in the publication furnished with the remote I/O scanner/distribution panel, remote I/O scanner-program interface module, or I/O scanner-message handling module. Pay close attention to the disable search mode in the 1772-SD, -SD2.

[2] The I/O chassis is in faulted mode as selected by the last state switch on the chassis backplane.

[3] Cycling power clears the block-transfer request queue. All pending block transfers are lost. Your program must repeat the request for block transfers from the chassis.

[4] If a fault occurs and the processor is in the run mode but is actually operating in the dependent mode, the chassis fault response mode is selected by the last state switch on the chassis backplane.

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Appendix A

Processor Specifications

General

This table lists general specifications of the PLC-5/10, -5/12, -5/15, and -5/25 processors.

Weight	PLC-5/10 (1785-LT4) 1336 g (47.12 oz.) PLC-5/12 (1785-LT3) 1337 g (42.15 oz.) PLC-5/15 (1785-LT) 1339 g (47.23 oz.) PLC-5/25 (1785-LT2) 1337 g (42.15 oz.)
Backplane Current	2.5A
Environmental Conditions:	
operating temperature	0° to 60° C (32° to 140° F)
storage temperature	-40° to 85° C (-40° to 185° F)
relative humidity	5 to 95% (without condensation)
Vibration (operating and non-operating)	1 g @ 10 to 500 Hz 0.012 inches peak-to-peak displacement
Shock	
operating	30 g peak acceleration for 11±1 ms duration
non-operating	50 g peak acceleration for 11±1 ms duration
Time-of Day Clock and Calender	
maximum variations at 60° C	± 3 min per month
typical variations at 20° C	± 20 s per month
timing accuracy	one program scan
Typical Discrete I/O Scan	• 1ms/local I/O rack • 10 ms/remote I/O adapter communication at 57.6 kbps
I/O Modules	Bulletin 1771 I/O including 8-, 16-, 32-pt., and intelligent modules
Hardware Addressing:	
2-slot	• any mix of 8-pt modules • 16-pt modules must be I/O pairs • no 32-pt modules
1-slot	• any mix of 8- or 16-pt modules • 32-pt modules must be I/O pairs
1/2-slot	any mix of 8-,16-, or 32-pt modules
Communication	• DH+ 3,048 cable-m (or 10,000 cable-ft) max • DH using 1785-KA
Location	1771-I/O chassis, left-most slot
Keying	• between 40 and 42 • between 54 and 56
Agency Certification (when product is marked)	• CSA certified • CSA Class I, Division 2, Groups A, B, C, D • UL listed

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Processor Specific

This table lists specifications of each PLC-5 family processor.

Processor	Maximum Local Racks Supported	Maximum Remote Racks Supported	I/O Capacity	Memory (Words)	Program Scan Time	Communication	Memory Modules (optional)	Battery
PLC-5/10	4 (1 resident chassis)	none	• 128 I/O with 8-pt modules [1] • 256 I/O with 16-pt modules [1] • 512 I/O with 32-pt modules [1]	6 K	2 ms/K words (bit logic) 8 ms/K words (typical)	standalone DH+	8K EEPROM (1785-MJ)	1770-XY
PLC-5/12	4 (1 resident chassis)	none	• 128 I/O with 8-pt modules [1] • 256 I/O with 16-pt modules [1] • 512 I/O with 32-pt modules [1]			standalone, adapter DH+	8K EEPROM (1785-MJ)	
PLC-5/15	4 (1 resident chassis)	3 (up to 12 physical devices)	• 512 I/O [1] • 512 inputs and 512 outputs using 16- or 32-pt modules [2]	6K (expands to 14K)		standalone scanner (local and remote I/O) adapter DH+	• 4K RAM expansion, 1785-MR • 8 K RAM expansion, 1785-MS • 8K EEPROM (1785-MJ)	
PLC-5/25	4 (1 resident chassis)	7 (up to 28 physical devices)	• 1024 I/O [1] • 1024 inputs and 1024 outputs using 16- or 32-pt modules [2]	13 K (expands to 21K)	2 ms/K words (bit logic) 8 ms/K words (typical)	standalone scanner (local and remote I/O) adapter DH+	• 4K RAM expansion (1785-MR) • 8 K RAM expansion (1785-MS) • 8K EEPROM (1785-MJ) • 16K EEPROM backup, 1785-MK	

[1] Any mix of I/O.
[2] Maximum I/O possible using 16-pt modules with 2-slot addressing or 32-pt modules with 1-slot addressing. Modules must alternate IOIOIO in the chassis slots.

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Addressing Concept Summary

This table summarizes the relationship among chassis size, addressing mode and the I/O module density.

If You are Using this Chassis Size:	And 2-slot addressing	Or 1-slot addressing	Or 1/2-slot addressing
4-slot	1/4 rack	1/2 rack	1 rack
8-slot	1/2 rack	1 rack	2 racks
12-slot	3/4 rack	1-1/2 racks	3 racks
16-slot	1 rack	2 racks	4 racks

For more information, see the 1785 PLC-5 Family Programmable Controllers Design Manual, publication 1785-6.2.1.

Battery Specifications

Battery Type

This processor:	Uses this battery:
PLC-5/10, -5/12, -5/15, -5/25	1770-XY , contains less than 1/2-gram of lithium 3.6V, “AA” size, Tadiran TL5104 type AEL/S lithium battery with pressure contact terminals.

Average Battery Lifetime Specifications

Battery used in this processor:	At this temperature:	Power off 100%:	Power off 50%:
PLC-5/10, -5/12, -5/15, -5/25	60°C	329 days	1.4 yrs
	25°C	2 yrs	3.3 yrs

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Compatible Remote I/O Link Devices

This table lists devices compatible with a PLC-5 processor.

Supervisory Processors	• PLC-2/30 processor • PLC-3, -3/10 processor • PLC-5/15, -5/25 processor • PLC-5/250 processor • PLC-5/11, -5/20, -5/30, -5/40, -5/60, and -5/80 processor • PLC-5/40L and -5/60L processor
I/O Adapters	• Remote I/O Adapter Module (1771-ASB) • Extended-Local I/O Adapter Module (1771-ALX), used with PLC-5/40L and -5/60L processors • Any PLC-5 processor in adapter mode • PLC-5/250 Remote Scanner (5150-RS2) in adapter mode • Direct Communication Module (1771-DCM) • PLC Interface Module (3500–NA1) for digital ac and dc drives • Remote I/O Adapter for Bulletin 1336 drives (1336-MOD-G2) • Serial Port Connector (MOD-S1) • RediPANEL™ Pushbutton and Keypad Modules (bulletin 2705) • Option Module (1784-F30D) for the T30 Plant-Floor Terminal • 8600 CNC with remote I/O adapter option (8600-2058K) • CVIM™ set for adapter mode (5370-CVIM) • Pro-Spec™ 6000 Fastening System with the remote I/O adapter option (1860-CPUC)

Programming and Instruction Capabilities

This table lists the type of programming and instructions supported by the PLC-5 processor.

Programming	• ladder diagram (all) • sequential function chart (all) • I/O configuration (all) • selectable timed interrupt (all)
Instruction Set	• relay-type through advanced (all) • PID control (all) • machine diagnostics (all)

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Programming Software Available Packages

Operating system/media:		Catalog number:	Description:
DOS and WIndows	3.5" 1.4 Mbyte disks	9321-PLC5	PLC-5 programming software on line only
		9323-PLC5	PLC-5 programming software on line and off line
		9321-ST5P	PLC-5 programming software on line only and PLC-5 structured text
		9323-ST5P	PLC-5 programming software on line and off line and PLC-5 structured text
	3.5" 720 Kbyte disks	9313-ST5	PLC-5 structured text option (requires 9321-PLC5 or 9323-PLC5)

Software Release Needed for Your Processor

If You Have This Processor:	You Must Use This Software Release:
PLC-5/10	3.21 or later
PLC-5/12, -5/15, -5/25	any release

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System Requirements

	DOS environment:	Windows environment:
Computer hardware	• 13 Mbytes hard disk space for 6200 software • optional 600 Kbytes hard disk space for block transfer programming examples • optional 800 Kbytes hard disk space for Remote Software Support • 551 Kbytes (564,000 bytes) free RAM • recommended additional 384 Kbytes extended or expanded memory to program off line • high-density, 1.44 M disk drive (3 1/2") • monochrome or color monitor	same as DOS environment, plus • 384 Kbytes expanded memory • 551 Kbytes (564,000 bytes) free RAM after loading INTERCHANGE
Programming terminal	**Minimum** • Allen-Bradley DOS-based • IBM® XT, AT, 80386 or compatible **Recommended** • IBM 80486 or compatible	**Minimum** • IBM 80386SX, 16MHz or compatible **Recommended** • IBM 80486, 33MHz or better or compatible
Operating system	• DOS 3.2, 3.3, 4.x, 5.0, 6.0, or 6.2 • DOS 4.01 (1784-T47)	same as DOS environment, plus • Windows 3.1 or later
Printer interface	• parallel or serial • 80, 132, or 255 columns	same as DOS environment
Communication	• 1784-KL/B (DH+) • 1784-KT (DH+) • 1784-KT2 (DH+) • 1784-KTK1 (DH+) • 1784-PCMK (DH+) • 1784-KTX, -KTXD (DH+) • 1770-KF2/B (serial to DH+) • 1785-KE (serial to DH+, serial to DH) • 1771-KE (serial to DH)	**Requires INTERCHANGE multisession drivers to be loaded before starting Windows** • 1784-KL/B (DH+) • 1784-KT (DH+) • 1784-KT2 (DH+) • 1784-PCMK (DH+) • 1784-KTX, -KTXD (DH+)

I/O Chassis Mounting Dimensions (series A)

For component spacing and dimensions for series A chassis:

For this information	Refer to:
I/O chassis (series A) mounting dimensions	Figure A.1 (page A-7)
I/O chassis (series A) with 1771-P2 power supply mounting dimensions	Figure A.2. (page A-8)

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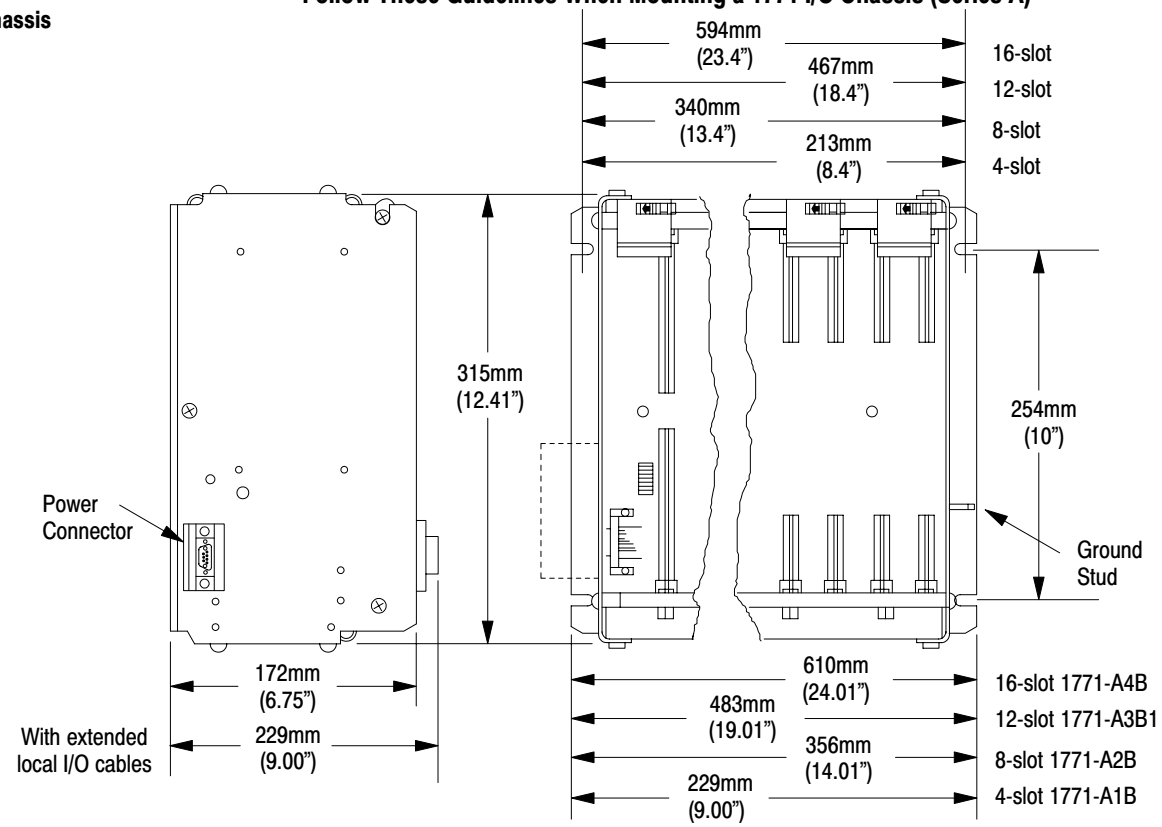
Figure A.1
Follow These Guidelines When Mounting a 1771 I/O Chassis (Series A)

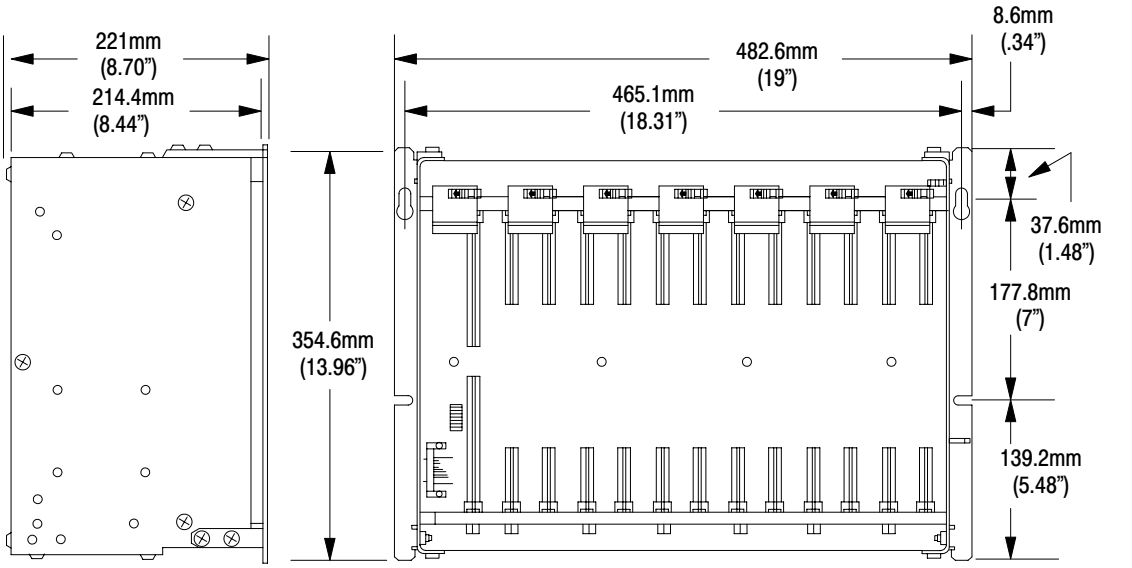
Panel Mount Chassis



Cat No. 1771-A1B, -A2B, -A3B1, -A4B I/O Chassis

16468

Rack or Panel Mount Chassis



12-slot I/O Chassis (Cat. No. 1771-A3B)

13408

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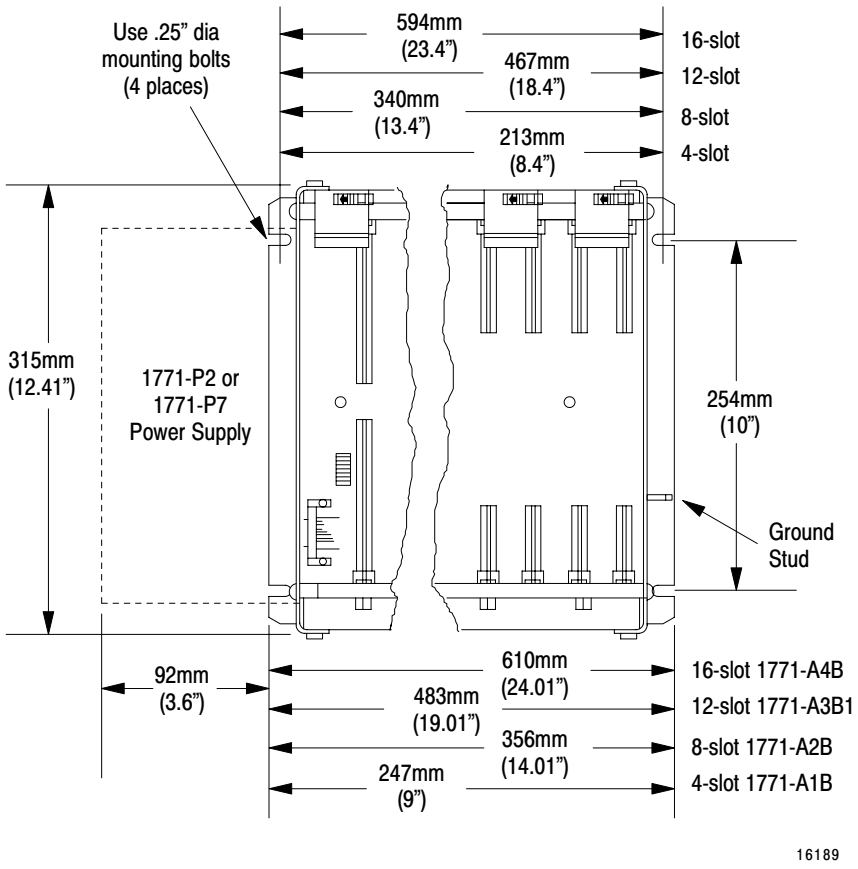
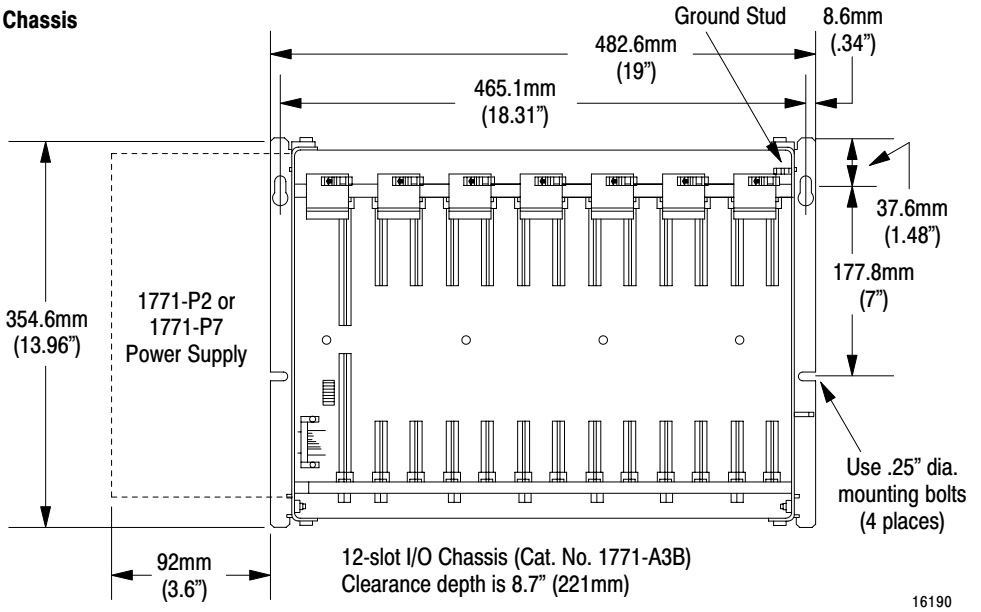
Figure A.2
Follow These Guidelines When Mounting a 1771 I/O Chassis with 1771-P2 Power Supply (Series A)

Panel Mount Chassis



Rack or Panel Mount Chassis



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Appendix B

Cable Connections

Cable Connections for Communication Boards

Table B.A lists the cables you use if you have an Allen-Bradley communication board in your programming terminal.

Table B.A
Allen-Bradley Communication Board Cables

If You Have This Processor:	And You Have This Communication Board:	Use This Cable:
PLC-5/10, -5/12, -5/15, -5/25	1784-KT, -KT2	1784-CP
	1784-KL, -KL/B	
	1784-KTK1	1784-CP5
	1784-PCMK	1784-PCM5

For pinouts for these A-B cables, see pages B-7 and B-8.

Cable Connections for Serial Port Communications

The diagrams in this section show the cable connections for serial port communications.

For these wiring diagrams:	See page:
cables 1 through 6	B-3
Allen-Bradley cables	B-4

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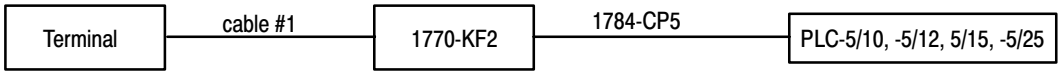
9-Pin Serial Port

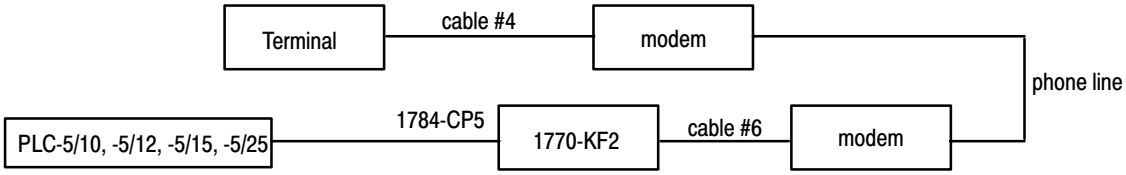
1784-T35
1784-T50
6160-T53
6160-T60
6160-T70
IBM AT™
Compaq® Portable 2
Compaq Portable 286
Compaq Deskpro 286
Compaq Deskpro 386



11942-I

1785-KE series A uses 1784-CP5 with PLC-5/10, -5/12, -5/15, -5/25 processors.

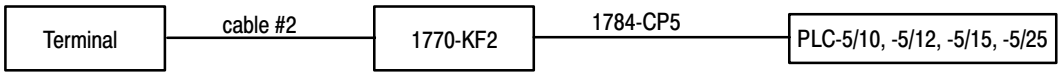
11943-I



11945-I

25-Pin Serial Port

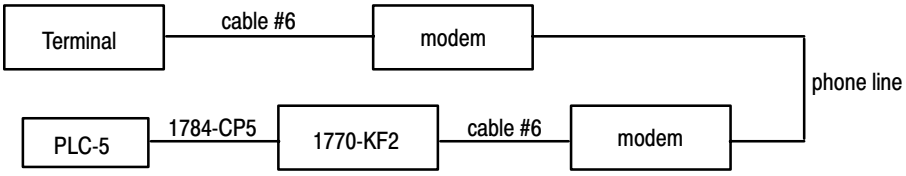
1784-T45
1784-T47
IBM XT™
IBM PS/2™ Model 30
IBM PS/2 Model 60



11947-I

1785-KE series A uses 1784-CP5 with PLC-5/10, -5/12, -5/15, -5/25 processors.

11948-I



11940-I

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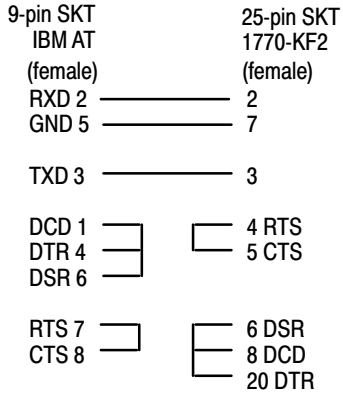
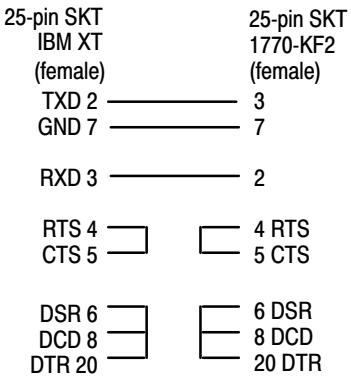
Cable Pin Assignments

The following diagrams show the pin assignments for the cables you need for serial port communications.

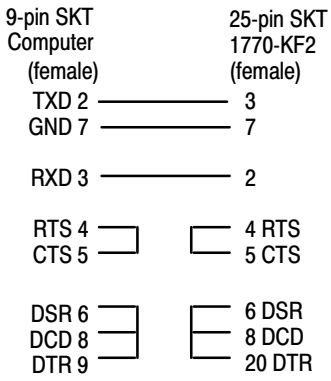
Cable #1



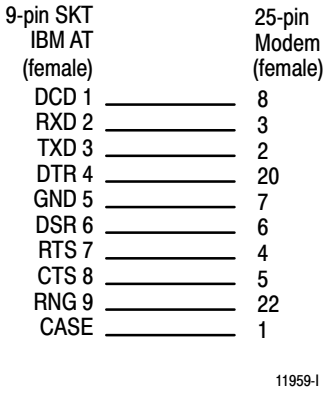
Cable #2



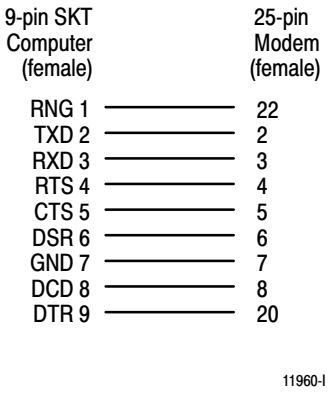
Cable #3



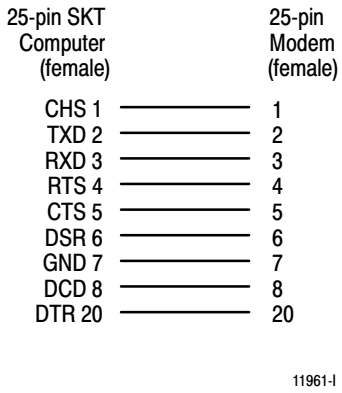
Cable #4



Cable #5



Cable #6



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Cable Specifications

The specifications for each Allen-Bradley cable used for communications are shown on the following pages. See Table B.B.

Table B.B
Cable Specifications

For:	To:	Use This Cable:	See Page:
1784-T50 6160-T60 1784-T35 6160-T53 6160-T70 IBM PC AT Compaq	1785-KE	1784-CAK	B-5
1784-T45 IBM PC XT	1785-KE	1784-CXK	B-6
PLC-5/10, -5/12, -5/15, -5/25 Processor	Terminal (using a 1784-KTK1)	1784-CP5	B-7
	Terminal (using a 1784-KT, -KT2, or -KL, -KL/B)	1784-CP	B-8
	Terminal (using 1784-PCMK)	1784-PCM5	B-9

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Figure B.1
Interconnect Cable – 1784-CAK
1784-T50, -T35, 6121, IBM AT, Compaq to 1785-KE

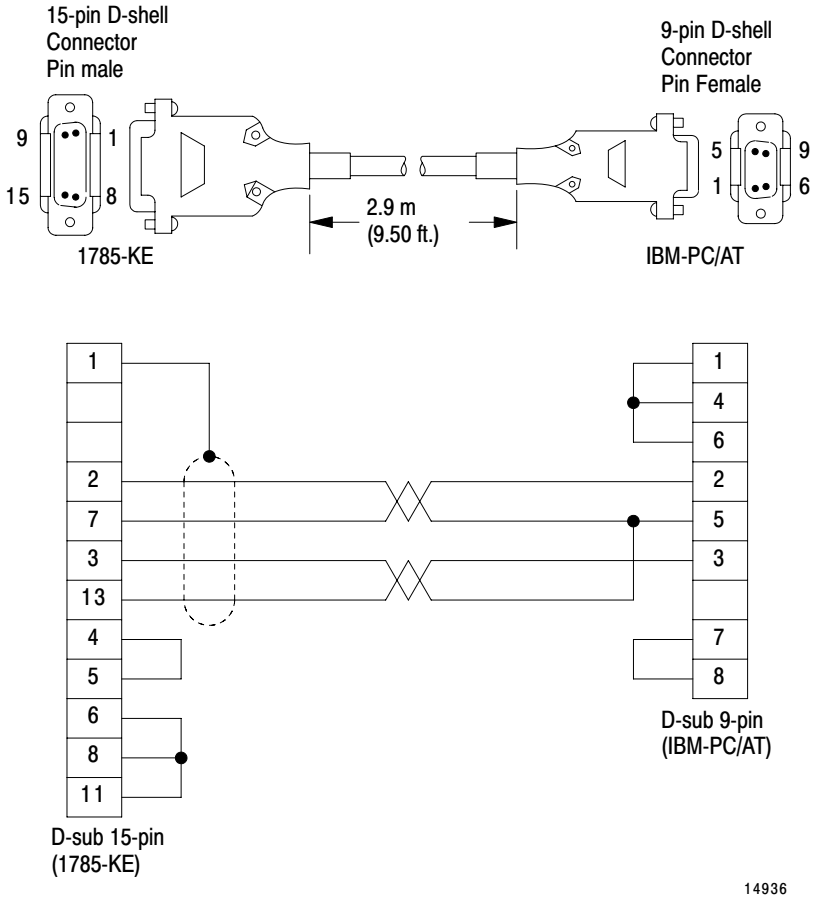

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Figure B.2
Interconnect Cable – 1784-CXK
1784-T45, IBM XT to 1785-KE

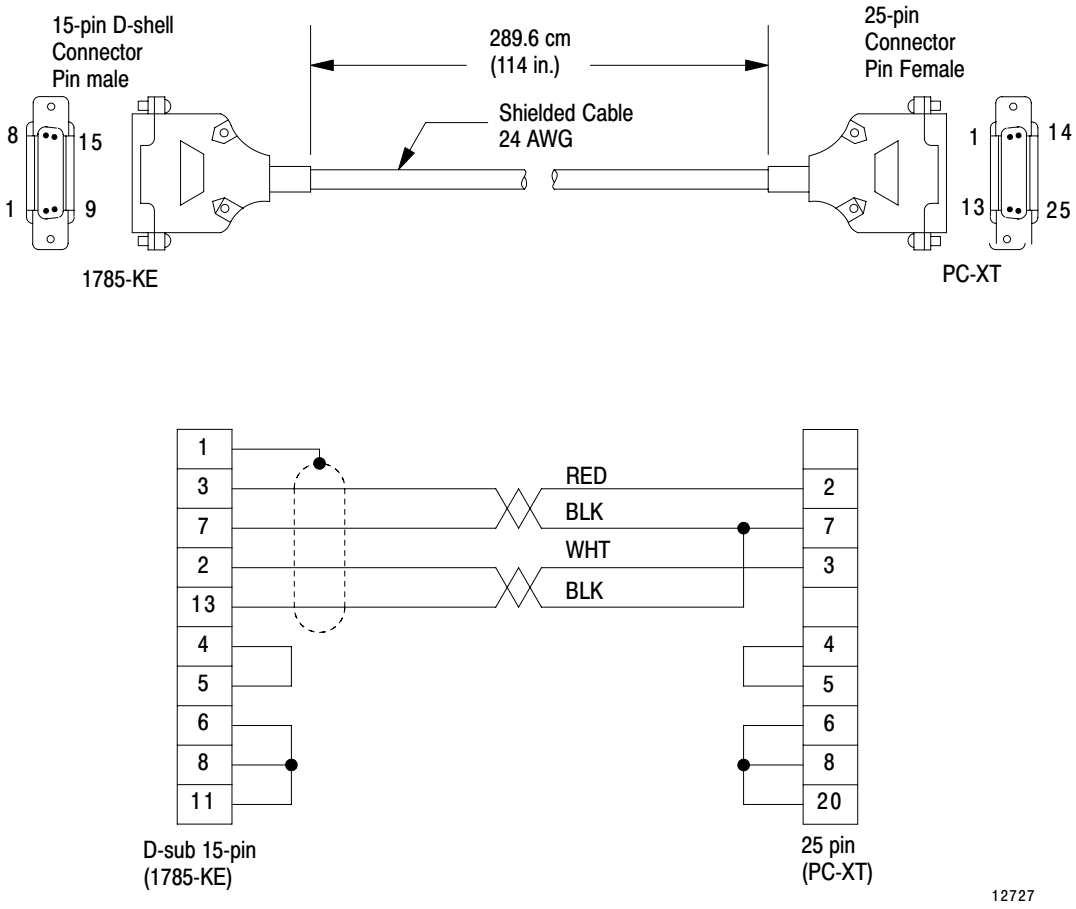

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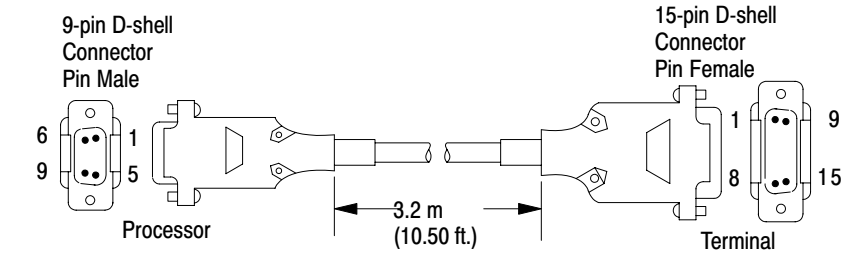
Figure B.3
Interconnect Cable – 1784-CP5
Processor to Terminal (using a 1784-KTK1)



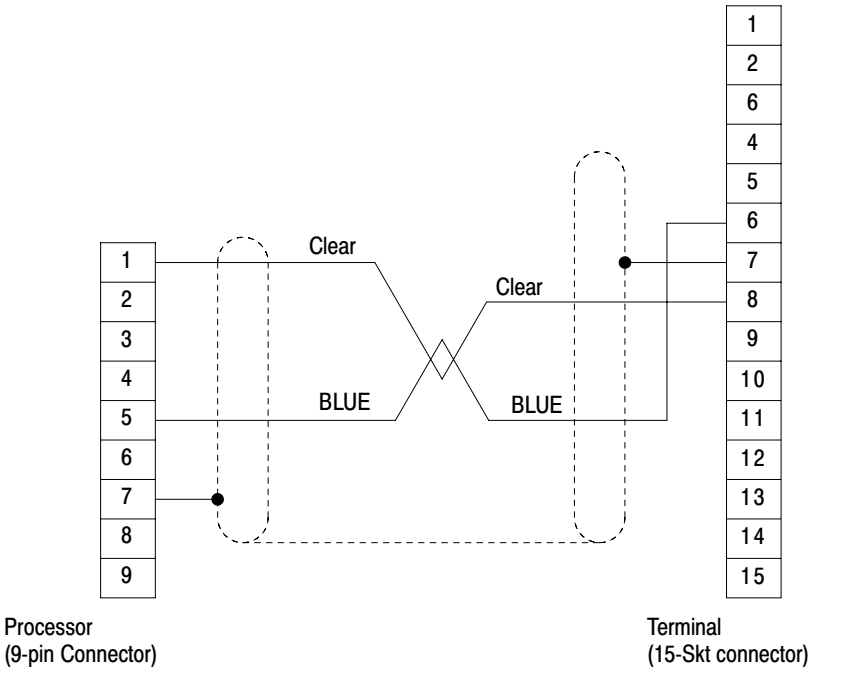


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Figure B.4
Interconnect Cable – 1784-CP Processor to Terminal (using a 1784-KT, 1784-KL, 1784-KL/B, or 1784-KT2)

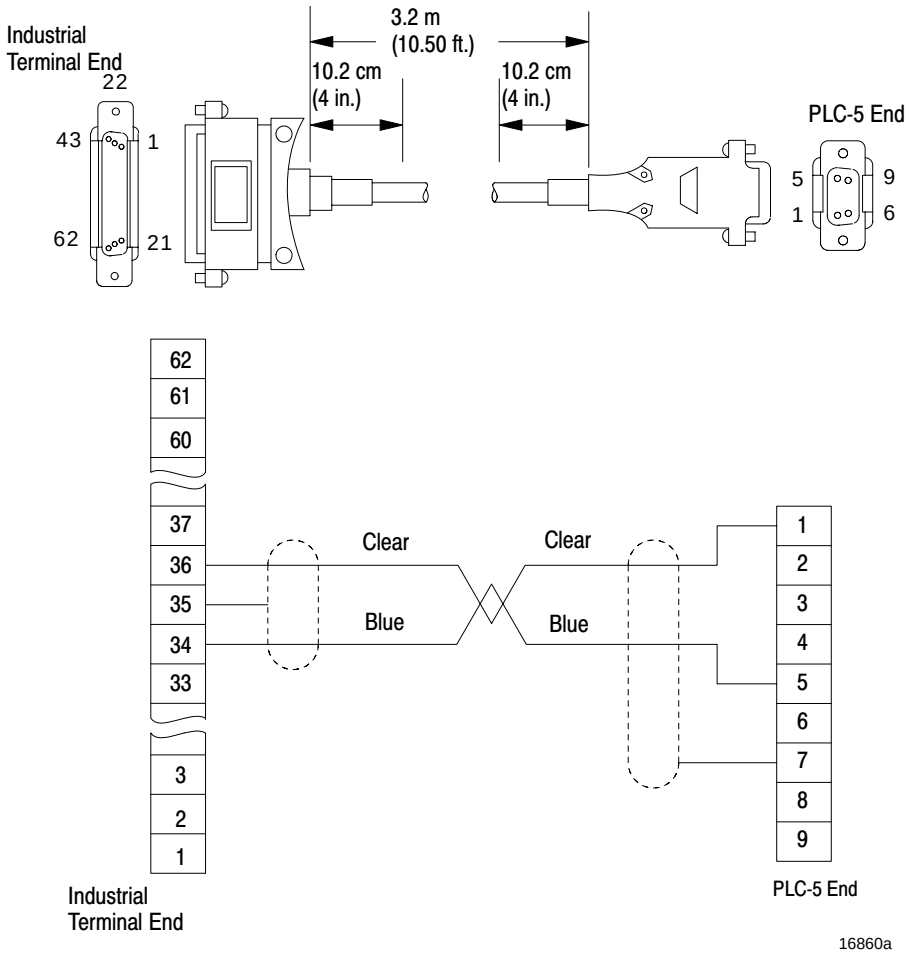

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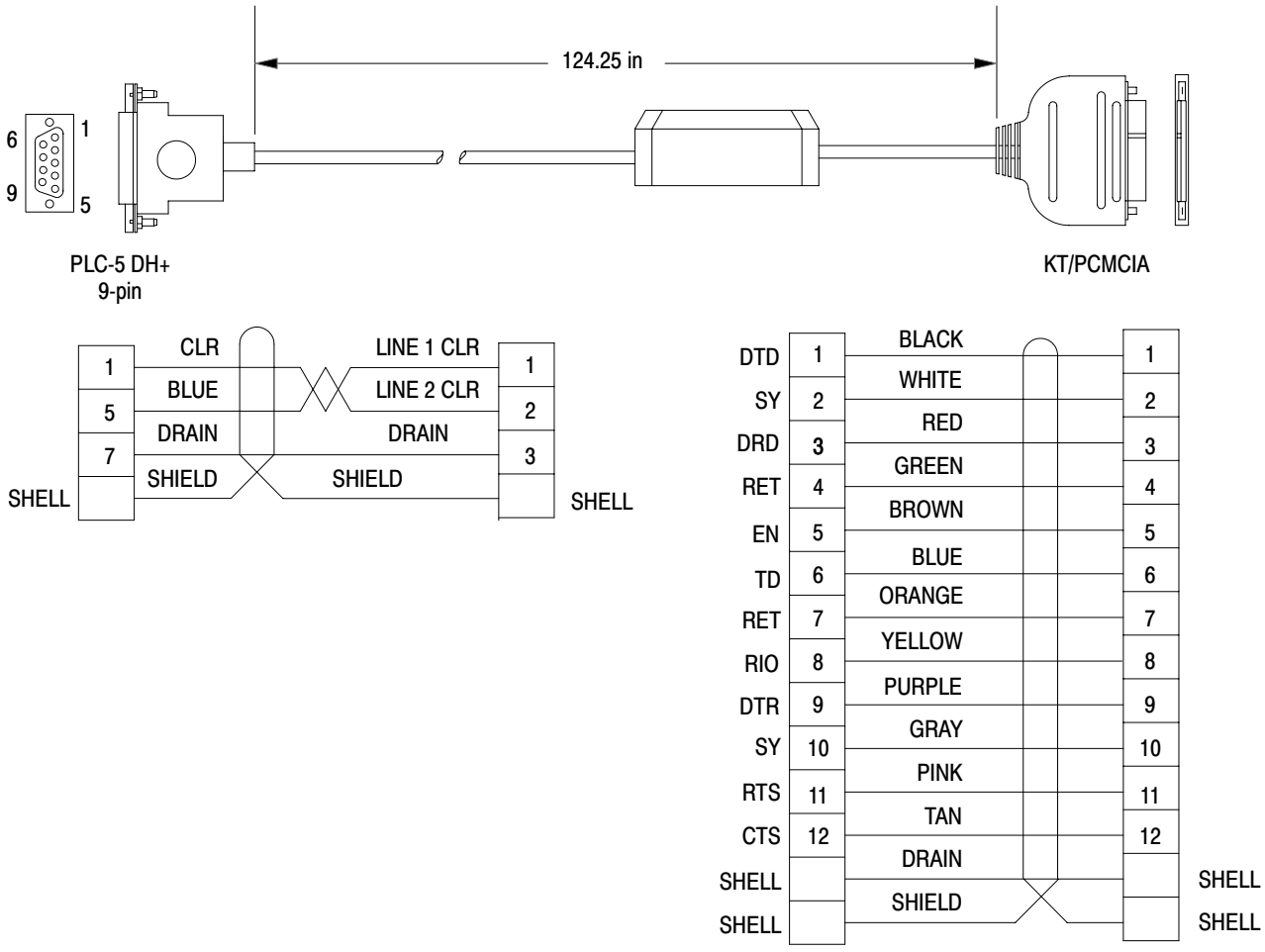
Figure B.5
Interconnect Cable – 1784-PCM5
Processor to Terminal (using a 1784-PCMK)



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Publication 1785-6.6.1 September 1995
Supersedes 1785-6.6.1 July 1994

PN 955122-47
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