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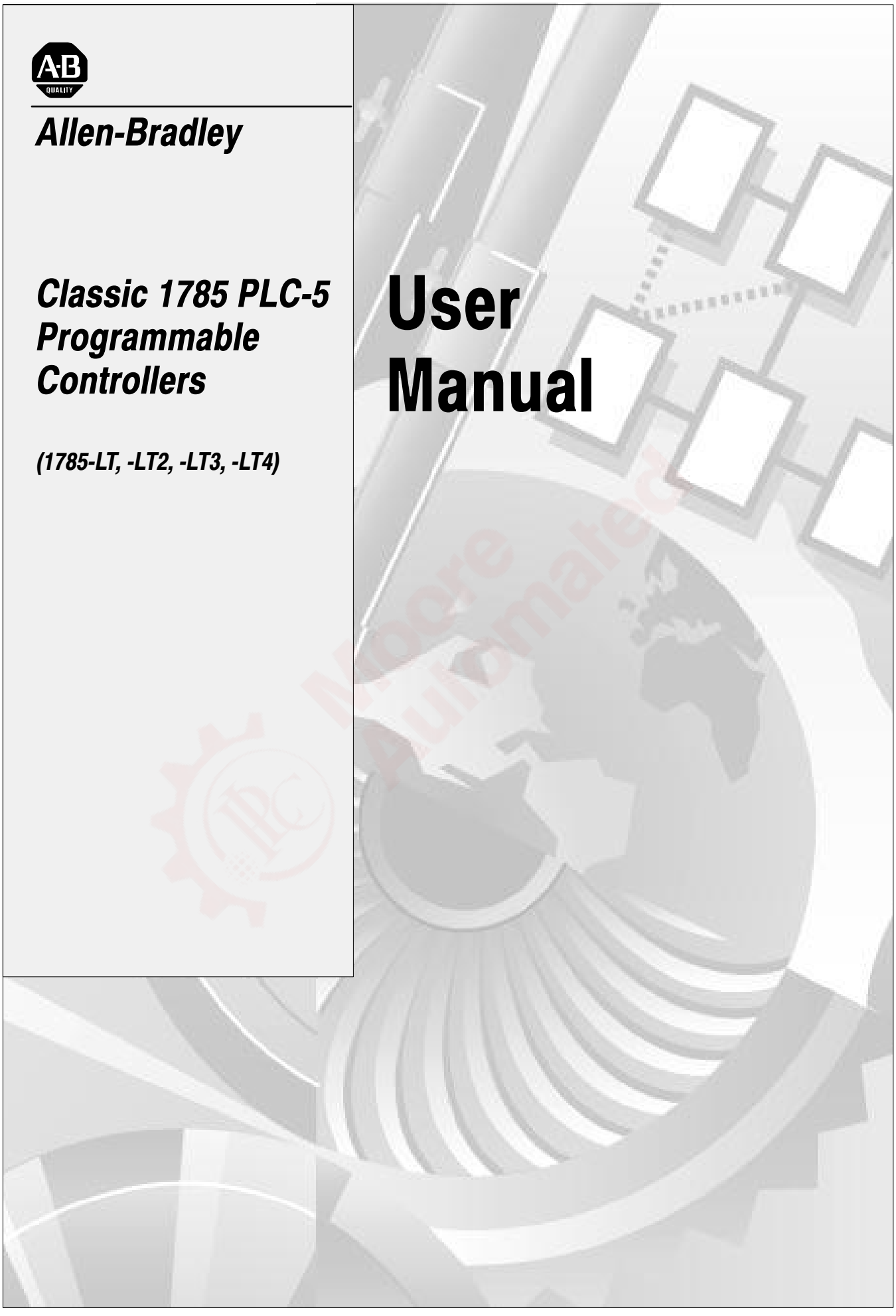


Allen-Bradley

Classic 1785 PLC-5 Programmable Controllers

(1785-LT, -LT2, -LT3, -LT4)

User Manual

Chapter 1

Understanding Your System

Using this Chapter

Understanding the Terms Used in this Chapter

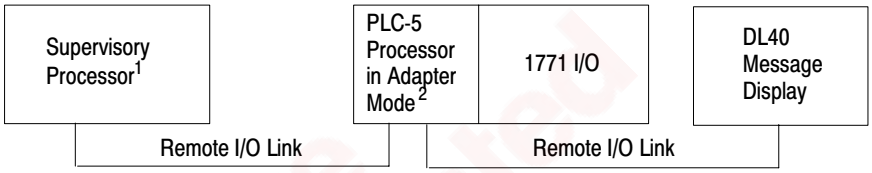
Become familiar with the following terms and their definitions.

Term	Definition
Processor-resident local I/O chassis	the I/O chassis in which the PLC-5 processor is installed
Processor-resident local I/O	I/O modules located in the same chassis as the PLC-5 processor
Remote I/O link	a serial communication link between a PLC-5 processor port in scanner mode and an adapter as well as I/O modules that are located remotely from the PLC-5 processor
Remote I/O chassis	the hardware enclosure that contains an adapter and I/O modules that are located remotely on a serial communication link to a PLC-5 processor in scanner mode
Discrete-transfer data	data (words) transferred to/from a discrete I/O module
Block-transfer data	data transferred, in blocks of data up to 64 words, to/from a block-transfer I/O module (for example, an analog module)

Using the Classic PLC-5 Processor as a Remote I/O Adapter

Use a Classic PLC-5 processor (except the PLC-5/10 processor) in adapter mode when you need predictable, real-time exchange of data between a distributed control PLC-5 processor and a supervisory processor. You connect the processors via the remote I/O link (see Figure 1.3). You can monitor status between the supervisory processor and the adapter-mode PLC-5 processor at a consistent rate (i.e., the transmission rate of the remote I/O link is unaffected by programming terminals and other non-control-related communications).

Figure 1.3
Adapter-Mode Communication



[1] The following programmable controllers can operate as supervisory processors:

PLC-2/20™ and PLC-2/30™ processors
PLC-3™ and PLC-3/10™ processors
PLC-5/11, -5/15, -5/20, -5/25, and -5/30 processors as well as PLC-5/VME™ processors
PLC-5/40, -5/40L, -5/60, -5/60L, and -5/80 processors as well as PLC-5/40BV™ and PLC-5/40LV™ processors
PLC-5/20E™, -5/40E™
PLC-5/250™

[2] All PLC-5 family processors, **except the PLC-5/10**, can operate as remote I/O adapter modules.

The PLC-5 processor in adapter mode acts as a remote station to the supervisory processor. The adapter-mode PLC-5 processor can monitor and control its processor-resident local I/O while communicating with the supervisory processor via a remote I/O link.

The supervisory processor communicates with the PLC-5/12, -5/15, or -5/25 adapter with either eight or four I/O image table words.

A PLC-5 processor transfers I/O data and status data using discrete transfers and block transfers. You can also use block-transfer instructions to communicate information between a supervisory processor and an adapter-mode processor. The maximum capacity per block transfer is 64 words.

Chapter 2

Choosing Hardware

Chapter Objectives

Use this chapter to guide you in the selection of system hardware for your application.

To select:	Go to page:
I/O modules	2-1
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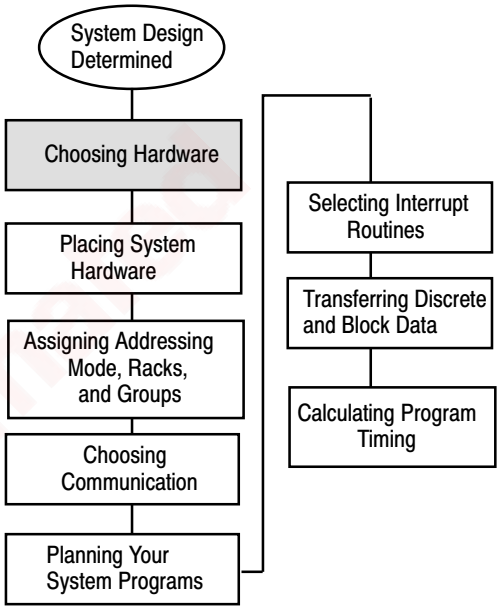
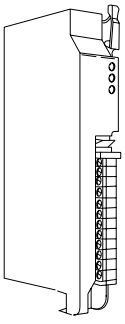


Selecting I/O Modules



You select I/O modules to interface your PLC-5 processor with machines or processes that you have previously determined.

Use the following list and Table 2.A as guidelines for selecting I/O modules and/or operator control interface(s).

- How much I/O is required to control the process(es)?
- Where will you concentrate I/O points for portions of an entire process (when an entire process is distributed over a large physical area)?
- What type of I/O is required to control the process(es)?
- What is the required voltage range for each I/O module?
- What is the backplane current required for each I/O module?
- What are the noise and distance limitations for each I/O module?
- What isolation is required for each I/O module?

Table 2.A
Guidelines for Selecting I/O Modules

Choose this type of I/O module:	For these types of field devices or operations (examples):	Explanation:
Discrete input module and block I/O module[1]	Selector switches, pushbuttons, photoelectric eyes, limit switches, circuit breakers, proximity switches, level switches, motor starter contacts, relay contacts, thumbwheel switches	Input modules sense ON/OFF or OPENED/CLOSED signals. Discrete signals can be either ac or dc.
Discrete output module and block I/O module[1]	Alarms, control relays, fans, lights, horns, valves, motor starters, solenoids	Output module signals interface with ON/OFF or OPENED/CLOSED devices. Discrete signals can be either ac or dc.
Analog input module	Temperature transducers, pressure transducers, load cell transducers, humidity transducers, flow transducers, potentiometers	Convert continuous analog signals into input values for PLC processor.
Analog output module	Analog valves, actuators, chart recorders, electric motor drives, analog meters	Interpret PLC processor output to analog signals (generally through transducers) for field devices.
Specialty I/O modules	Encoders, flow meters, I/O communication, ASCII, RF type devices, weigh scales, bar-code readers, tag readers, display devices	Are generally used for specific applications such as position control, PID, and external device communication.

[1] A 1791 block I/O module is a remote I/O device that has a power supply, remote I/O adapter, signal conditioning circuitry, and I/O connections. A block I/O module does not require a chassis mount. It is used to control concentrated discrete remote I/O such as control panels, pilot lights, and status indications.

Important: Determine addressing in conjunction with I/O module selection. The selection of addressing and the selection of I/O module density are mutually dependent.

Selecting I/O Module Density

The density of an I/O module is the number of processor input or output image table bits to which it corresponds. A bidirectional module with 8 input bits and 8 output bits has a density of 8. Table 2.B provides guidelines for selecting I/O module density.

Table 2.B
Guidelines for Selecting I/O Module Density

Choose this I/O density:	If you:
8-point I/O module	• currently use 8-point modules • need integral, separately-fused outputs • want to minimize cost per module
16-point I/O module	• currently use 16-point modules • need separately fused outputs with a special wiring arm
32-point I/O module	• currently use 32-point modules • want to minimize number of modules • want to minimize the space required for I/O chassis • want to minimize cost per I/O point

Master/Expander I/O Modules

Some I/O modules (called “masters”) communicate with their expanders over the backplane. These master/expander combinations either:

- **can** time-share the backplane, or
- **cannot** time-share the backplane

For masters that **can** time-share the backplane, you can use two masters in the same chassis. For a master/expander combination that **cannot** time-share the backplane, you cannot put another master/expander combination in the same I/O chassis.

Example: The stepper-controller module (cat. no. 1771-M1, part of a 1771-QA assembly) and the servo-controller module (cat. no. 1771-M3, part of a 1771-QC assembly) always act as masters and cannot time-share the backplane. Therefore, you cannot put a second master module in the same chassis with either of these modules.

Table 2.C summarizes the compatibility of master modules within a single I/O chassis.

Table 2.C
Compatibility of Master Modules within a Single I/O Chassis

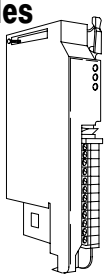
1st Master Module	2nd Master Module				
	1771-IX[1]	1771-IF[1]	1771-OF[1]	1771-M1	1771-M3
1771-IX[1]		Valid[2]	Valid[2]		
1771-IF[1]	Valid[2]	Valid[2]	Valid[2]		
1771-OF[1]	Valid[2]	Valid[2]	Valid[2]		
1771-M1					
1771-M3					

1 These modules have been superseded by 1771-IXE, -IFE, and OFE master modules that do not exhibit the master/expander conflict in a chassis as 1771-IX, -IF, and OF master modules shown in this table.

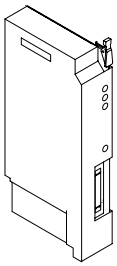
2 These are the only master combinations that you can use in a single I/O chassis. These combinations are valid with or without the module’s associated expanders (1771-M1 and -M3 have expander modules). You can use a maximum of two masters in the same chassis; you can use any other intelligent I/O modules not shown here with these masters.

Important: Density is not relevant to an expander module because it communicates only with its master; an expander module does not communicate directly with an adapter.

Selecting I/O Adapter Modules



ASB



ALX

Select I/O adapter modules to interface your PLC-5 processor with I/O modules. Use Table 2.D as a guide when you select I/O adapter modules.

Table 2.D
Guidelines for Selecting Adapter Modules

Choose:	When your requirements are:
1771-AS or 1771-ASB[1] Remote I/O Adapter Module (or 1771-AM1, -AM2 chassis with integral power supply and adapter module)	a remote I/O link with: • 57.6 kbps with a distance of up to 10,000 cable feet **or** • timing that isn't critical enough to place I/O modules in a processor local I/O chassis or an extended-local I/O chassis
1771-ALX Extended-Local I/O Adapter Module	an extended-local I/O link with timing that is critical and all extended-local I/O chassis are located within 100 ft of the processor.

[1]1771-ASB series C and later have 230.4 kbps communication rate in addition to 57.6 kbps and 115.2 kbps.

1771-AS/ASB Remote I/O Adapter Modules

Table 2.E shows the I/O density per module and addressing modes you can use with I/O chassis and remote I/O adapter modules.

Table 2.E
I/O Chassis/Adapter Module Combinations

Remote I/O Adapter Module Cat. No.	I/O Density per Module	Addressing		
		2-Slot	1-Slot	1/2-Slot
1771-AS	8	Yes	No	No
	16	--[1]	No	No
	32	No	No	No
1771-ASB Series A	8	Yes	Yes	No
	16	--[1]	Yes	No
	32	No	--[1]	No
1771-ASB Series B, C, and D	8	Yes	Yes	Yes
	16	--[1]	Yes	Yes
	32	No	--[1]	Yes
1771-AM2	8	--	Yes	Yes
	16	--	Yes	Yes
	32	--	--[1]	Yes

[1] Conditional module placement; you must use an input module and an output module in two adjacent slots (even/odd pair) of the I/O chassis beginning with slot 0. If you cannot pair the modules this way, leave the adjacent slot empty.

Using the 1771-ASB Series C or D adapter module, you can choose one of three communication rates: 57.6 kbps, 115.2 kbps, or 230.4 kbps.

1771-ALX Extended-Local I/O Adapter Module

Table 2.F shows the I/O density per module and addressing modes you can use with I/O chassis and extended-local I/O adapter modules.

Table 2.F
I/O Chassis/Extended -Local I/O Adapter Module Combinations

Module Cat. No.	I/O Density per Module	Addressing		
		2-Slot	1-Slot	1/2-Slot
1771-ALX Series A	8	Yes	Yes	Yes
	16	--[1]	Yes	Yes
	32	No	--[1]	Yes

[1] Conditional module placement; you must use an input module and an output module in two adjacent slots (even/odd pair) of the I/O chassis beginning with slot 0. If you cannot pair the modules this way, leave the adjacent slot empty.

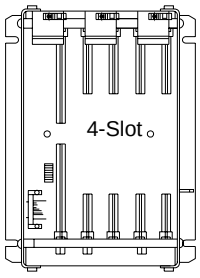
Other Devices on an I/O Link

Other devices that you can use on a remote I/O link are:

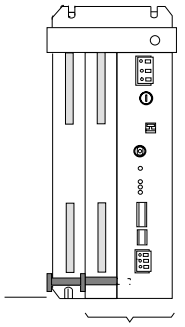
- PLC-5 processor in adapter mode
- PLC-5/250 remote scanner in adapter mode
- PLC interface module for digital ac and dc drives
- remote I/O adapter for Bulletin 1336 drives
- RediPANEL™ pushbutton and keypad modules
- Dataliner™
- PanelView (see operator interface)
- F30D option module (for T30 plant-floor terminal)
- 8600 or 9/SERIES CNC with remote I/O adapter option
- CVIM™ in adapter mode
- Pro-Spec™ 6000 Fastening System with remote I/O adapter option
- 1747-DCM module (to SLC-500 rack)
- 1771-DCM module
- 1771-GMF robot (remote I/O interface module)

See the appropriate Allen-Bradley product catalog for more information on these devices.

Selecting I/O Chassis



1771-A1B



An I/O chassis is a single, compact enclosure for the processor, power-supply modules, remote and extended-local I/O adapter modules, and I/O modules. The left-most slot of the I/O chassis is reserved for the processor or adapter module. Consider the following when selecting a chassis:

- When you determine the maximum number of I/O in your application, allow space for the I/O slots dedicated to power-supply modules, communication modules, and other intelligent I/O modules.
- You must use series B or later chassis with 16- and 32-point I/O modules.
- Allow space for future addition of I/O modules to chassis.

I/O chassis available are:

- 4-slot (1771-A1B)
- 8-slot (1771-A2B)
- 12-slot—rack mount (1771-A3B), panel mount (1771-A3B1)
- 16-slot (1771-A4B)

You can also choose a chassis with an integral power supply and remote I/O adapter (show at left). The two types are:

- 1-slot (1771-AM1)
- 2-slot (1771-AM2)

Selecting an Operator Interface

PanelView and ControlView are operator interface products or packages that communicate with a PLC-5 processor. Use Table 2.G as a guideline when selecting either PanelView or ControlView for your PLC-5 programmable controller system. Use Table 2.H for a comparison of PanelView and ControlView features.

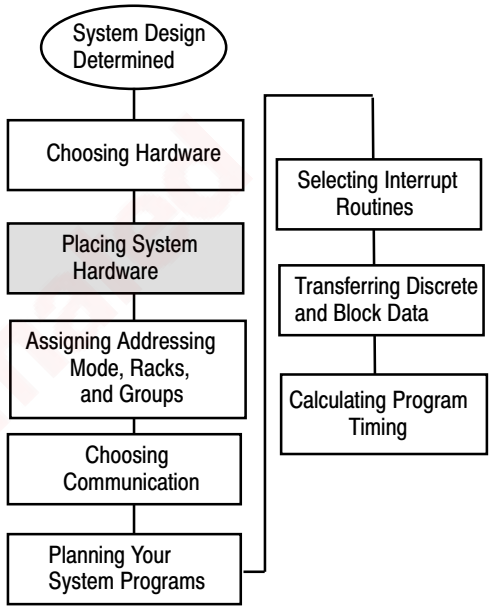
Chapter 3

Placing System Hardware

Chapter Objectives

A well-planned layout is essential to the proper installation of your Classic PLC-5 programmable controller system. Read this chapter for information on placing hardware.

If you want to read about:	Go to page:
Proper environment	3-1
Protecting your system	3-4
Avoiding electrostatic damage	3-4
Planning your raceway layout	3-4
Planning your cabling	3-6
Grounding your system	3-7



Determining the Proper Environment

Place the processor in an environment with conditions that fall within the guidelines described in Table 3.A.

Table 3.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)

Separate your programmable controller 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 that bring in filtered air or recirculate internal air inside the enclosure, or install air-conditioning/heat-exchanger units.

Protecting Your Processor

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, we recommend a steel enclosure.

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

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

Avoiding Electrostatic Damage

ATTENTION: Under some conditions, electrostatic discharge can degrade performance or damage the processor module. Read and observe the following precautions to guard against electrostatic damage.

- Wear an approved wrist strap grounding device when handling the processor module.
- Touch a grounded object to discharge yourself before handling the processor module.
- Do not touch the backplane connector or connector pins.
- When not handling the processor module, keep it in its protective packaging.

Laying Out Your Cable Raceway

The raceway layout of a system reflects where the different types of I/O modules are placed in I/O chassis. Therefore, you should determine I/O-module placement prior to any layout and routing of wires. When planning your I/O-module placement, however, segregate the modules based on the conductor categories published for each I/O module so that you can follow these guidelines. These guidelines coincide with the guidelines for “the installation of electrical equipment to minimize electrical noise inputs to controllers from external sources” in IEEE standard 518-1982.

To plan a raceway layout, do the following:

- categorize conductor cables
- route conductor cables

Categorize Conductors

Segregate all wires and cables into categories as described in the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1. See the installation data for each I/O module that you are using for information about its classification.

Route Conductors

To guard against coupling noise from one conductor to another, follow the general guidelines for routing cables described in the Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1. You should follow the safe grounding and wiring practices called out in the National Electrical Code (NEC, published by the National Fire Protection Association, in Quincy, Massachusetts), and local electrical codes.

Planning Cabling

DH+ Link Cabling

At a DH+ transmission rate of 57.6 kbps, do not exceed 3,048 cable-m (10,000 cable-ft) for a trunkline cable length or 30.5 cable-m (100 cable-ft) for a dropline cable length.

Remote I/O Link Cabling

Refer to Table 3.B for remote I/O link trunkline cable length restrictions.

Table 3.B
Maximum Cable Lengths per Communication Rate

Transmission Rate	Maximum Cable Length
57.6 kbps	3,048 m (10,000 ft)
115.2 kbps	1,524 m (5000 ft)
230.4 kbps	762 m (2500 ft)

Important: All devices on the remote I/O link must be communicating at the same transmission rate.

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