ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

Assembley and Installation Manual

Mini-PLC-2/05 Programmable Controller

Price: $25.00

Important User Information

Because of the variety of uses for the solid state equipment described herein, and because of the differences between it and electromechanical equipment, you must satisfy yourself as to its acceptability for each of your applications. In no event will Allen-Bradley Company be responsible or liable for indirect or consequential damages that may result from installation or use of this equipment.

The illustrations, charts, and layout examples shown in this manual are intended solely to help you understand the text, not to guarantee operation. Because of the many variables and requirements associated with any particular installation, Allen-Bradley Company will not assume responsibility for actual use based upon illustrations of applications.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this text.

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Chapter

1

Before You Begin

Important: Read this chapter before you install your Mini-PLC-2/05 processor module. It will tell you how to use this Assembly and Installation Manual properly and efficiently.

Save this manual for future reference.

Audience

We assume that you:

- are familiar with Allen-Bradley's programmable controllers similar to our PLC-2 family product line
- are a fully trained installer familiar with wiring and grounding local codes
- have access to our publications through a local sales engineer or distributor

This manual is procedure oriented. It tells you how to install your Mini-PLC-2/05 system. If you need to learn more about the Mini-PLC-2/05 system or about other Systems Division products, contact:

Allen-Bradley Training Center
105 Alpha Drive
Highland Heights, Ohio 44143
Telephone: (216) 449-0300

Vocabulary

To make this manual easier to read and understand, we avoid repeating product names and acronym definitions wherever possible. We refer to the:

- Mini-PLC-2/05 processor module as the "processor," or "Mini-PLC-2/05 processor"
- Electrically Erasable Programmable Read Only Memory as "EEPROM"
- Complementary Metal Oxide Semiconductor Random Access Memory as "CMOS RAM"
- Power supply module as "power supply"
- Binary Coded Decimal as "BCD"

Products with Their Catalog Numbers

We refer to products related to the Mini-PLC-2/05 processor throughout this manual. Table 1.A lists each product with its catalog number.

In text, catalog numbers are used only to clarify a specific product.

Table 1.A
Allen-Bradley Products with Catalog Numbers

Product	Catalog Number
Mini-PLC-2/05 Processor	1772-LS
Mini-PLC-2/05 Processor with Power Supply	1772-LSP
Industrial Terminal	1770-T3
Hand-Held Terminal	1770-T11
EEPROM Memory Module	1772-MJ
Power Supply Paralleling Cable	1771-CT
Battery Pack	1772-BB
PLC-2 Family Report Generation Module	1770-RG
Data Cartridge Recorder	1770-SB
Power Supply Modules	1771-P3, 1771-P4, 1771-P5
Interconnect Cable	1772-TC
Mini-Processor Transport Cable	1772-CD
Keying Bands	1777-RK
Module Group Label Set	1771-XL

Important Information

In this manual you'll see warnings and cautions.

- **WARNINGS-** inform you where personal injury may happen if you do not follow the written procedure.
- **CAUTIONS-** inform you where damage to your equipment may happen if you do not follow the written procedure.

Related Publications

To read more about the Mini-PLC-2/05 processors and related products, refer to:

- Mini-PLC-2/05 Processor Programming and Operations Manual (publication 1772-6.8.6)
- Industrial Terminal Systems User's Manual (publication 1770-805)
- Hand Held Terminal User's Manual (publication 1770-806)
- Data Cartridge Recorder product data (publication 1770-912)
- Programmable Controller Wiring and Grounding Guidelines (publication 1770-980)
- Applications Considerations for Solid-State Controls (publication SGI 1.1)

For a list of all Allen-Bradley publications, see the Publications Index (publication SD499). Request a copy from your local Allen-Bradley sales engineer or distributor.

Chapter

2

Mini-PLC-2/05: An Overview

Chapter Objectives

This chapter focuses on the complete Mini-PLC-2/05 processor system. In this chapter you will read about:

- major components
- general features
- hardware
- optional hardware

If you're already familiar with this material and want to know how to install your Mini-PLC-2/05 processor system, read chapter 3.

Purpose of the Mini-PLC-2/05 Processor

We designed the Mini-PLC-2/05 processor to be an addition to the PLC-2 family with added instructions. There are two versions of this product; one with an integral power supply and one without a power supply.

Major Components

A complete Mini-PLC-2/05 processor system consists of the following major components (figure 2.1):

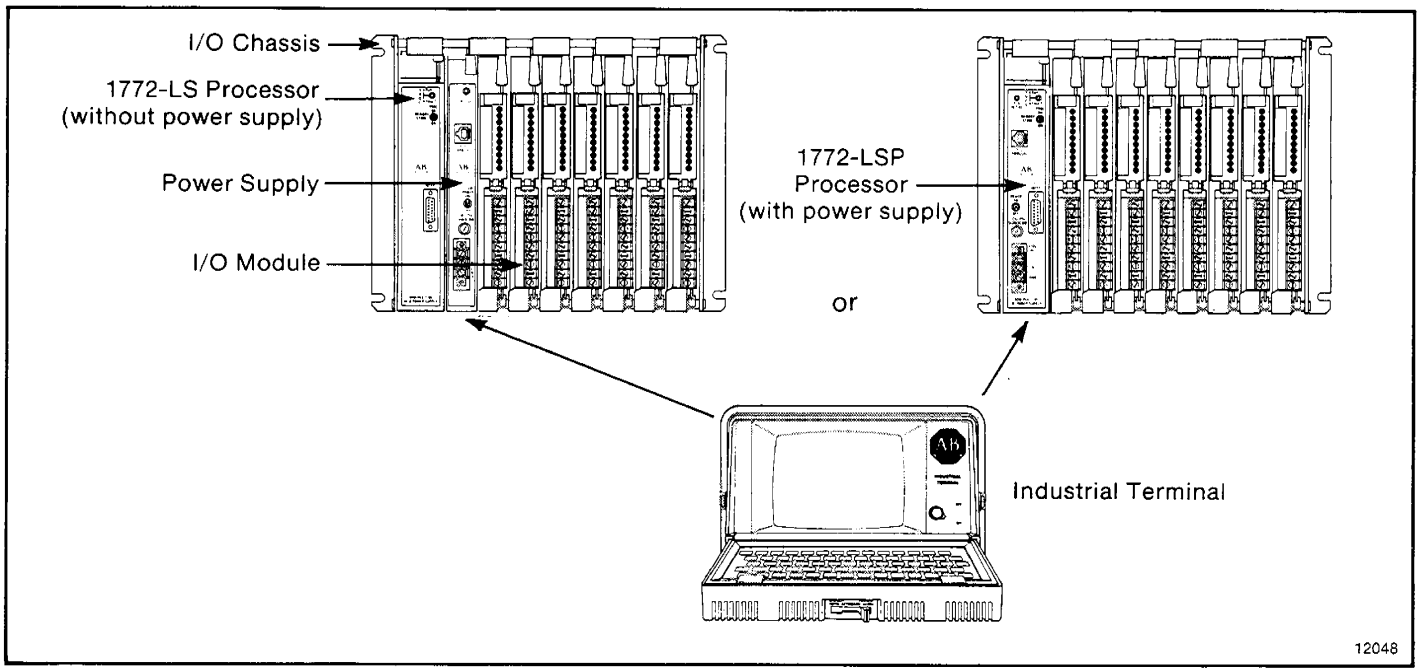


Figure 2.1 — Major Components for the Mini-PLC-2/05 Processor System

- Mini-PLC-2/05 processor
- I/O chassis
- power supply module(s)
- I/O modules
- industrial terminal system

General Features

The Mini-PLC- 2/05 processor system provides:

- 3K CMOS RAM memory
- 488 timers
- up to 2944-word data table
- the Mini-PLC-2/15 processor instruction set
- expanded math capabilities (+, -, x, ÷, $\sqrt{}$, BCD to binary conversions, binary to BCD conversions
- selectable timed interrupts
- internal battery for CMOS RAM backup
- remote mode selection
- on-line programming
- 2A for I/O modules (1772-LSP processor only)
- 128 I/O device capability
- full I/O forcing
- Data Highway compatibility

Hardware Features

Figure 2.2 shows the two Mini-PLC-2/05 processors. Table 2.A lists the hardware associated with each processor.

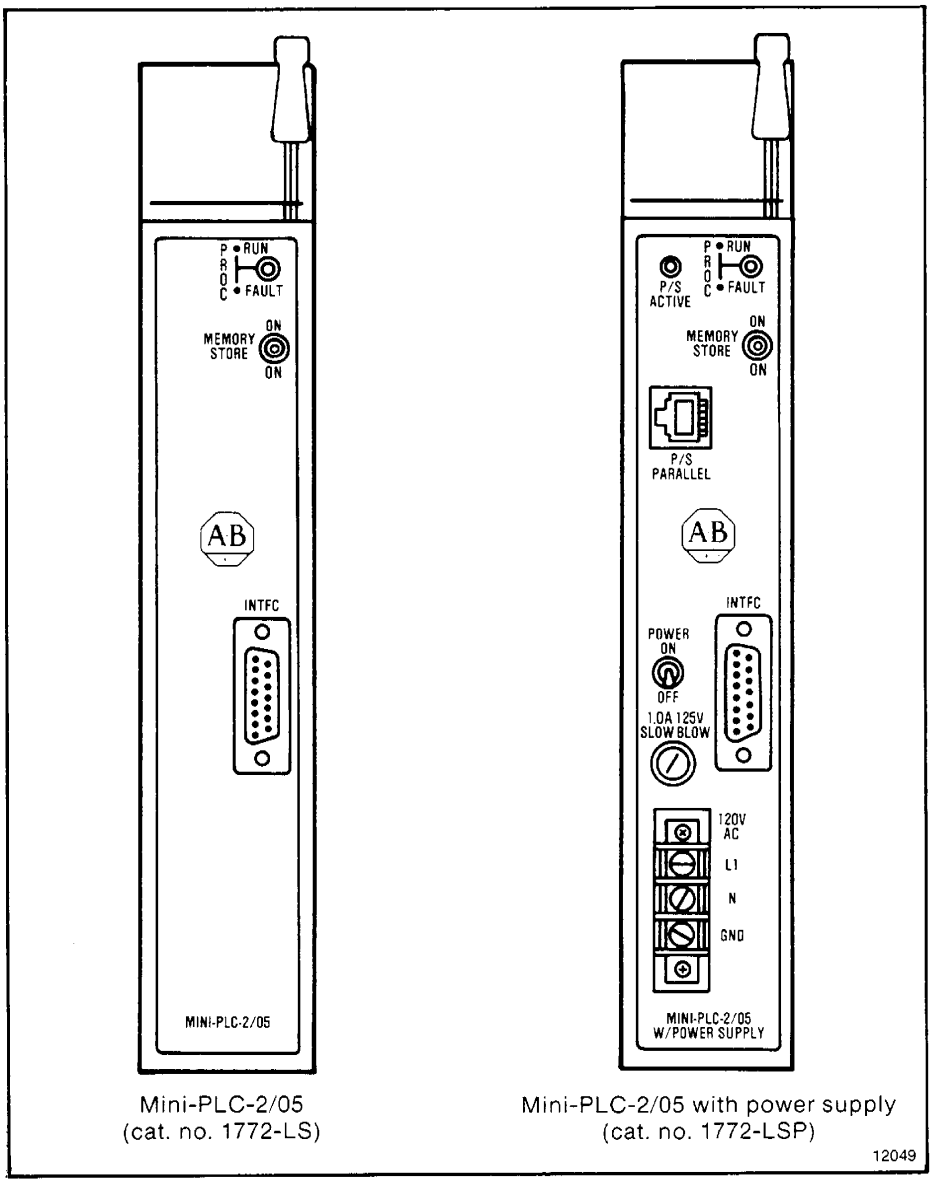


Figure 2.2 — Mini-PLC-2/05 Processor Modules

Table 2.A
Hardware for the Mini-PLC-2/05 Processor

Hardware Feature	1772-LSP	1772-LS
Status Indicators		
• PROC RUN/FAULT	X	X
• P/S ACTIVE	X	—
Connector Ports		
• INTFC	X	X
• P/S paralleling	X	—
Power Switch	X	—
Memory Store Switch	X	X
Fuse	X	—
Terminal Strip	X	—
Battery	X	X
Industrial Terminal	X	X

Status Indicators Two LED status indicators show:

Status Indicator:	If the color is:	Then the indication represents:
PROC RUN/FAULT	Green	Run/program mode
	Green for 2 seconds	EEPROM memory module being programmed.
	Off	The processor is either in remote program mode, remote test mode; or there is a run time error, memory error, or a program error.
	Red	The watchdog timer is timed out; therefore you should cycle power to reset the processor.
P/S ACTIVE	Green	AC or DC power is available.
	Off	AC or DC power **is not** available.

MEMORY STORE Switch If you have our optional memory module, this switch allows you to duplicate programmed memory from the processor's internal CMOS RAM in the memory module. You can duplicate memory only when the processor is operating in remote program mode.

P/S PARALLEL Connect the paralleling cable (cat. no. 1771-CT) between this port on the 1772-LSP processor and one power supply module in the same I/O chassis. Also, connect the paralleling cable between two power supply modules in the same I/O chassis when using the 1772-LS processor.

Chapter 3 describes connection information in detail.

INTFC Connector This 15-pin connector provides communication between:

Processor and:	Using:	Cable Cat. No.
Industrial terminal	PLC-2 Program Panel Interconnect Cable	1772-TC
Data Highway modules	Data Highway/Processor Cables	1771-CN, -CO, or -CR
PLC-2 report	PLC-2 Program Panel Interconnect Cable (you **must** use an external ground wire)	1772-TC

POWER Switch This is a toggle on/off switch which lets you provide power to your processor (if external power is connected).

Fuse We ship the processor with a 1-amp "slow-blow" fuse in the fuse holder for 120V AC operation.

Terminal Strip The 120V AC power source connects to this terminal strip (chapter 3) and provides connections for the power supply module. The terminal strip is labeled:

- L1 for the power line (hot)
- N for neutral
- GND for chassis ground

Battery

The processor includes an AA size lithium battery containing 0.5 gram of lithium. It retains the processor's memory after a power loss to the processor. A removable holder located at the rear of your processor (figure 2.3) houses this battery. This battery supports the processor's stored memory for up to two years even when AC power is not applied to your processor. You should write the date on the label at the side of the processor after you receive your processor so you'll know when to replace this battery every two years.

See chapter 4 for battery replacement instructions.

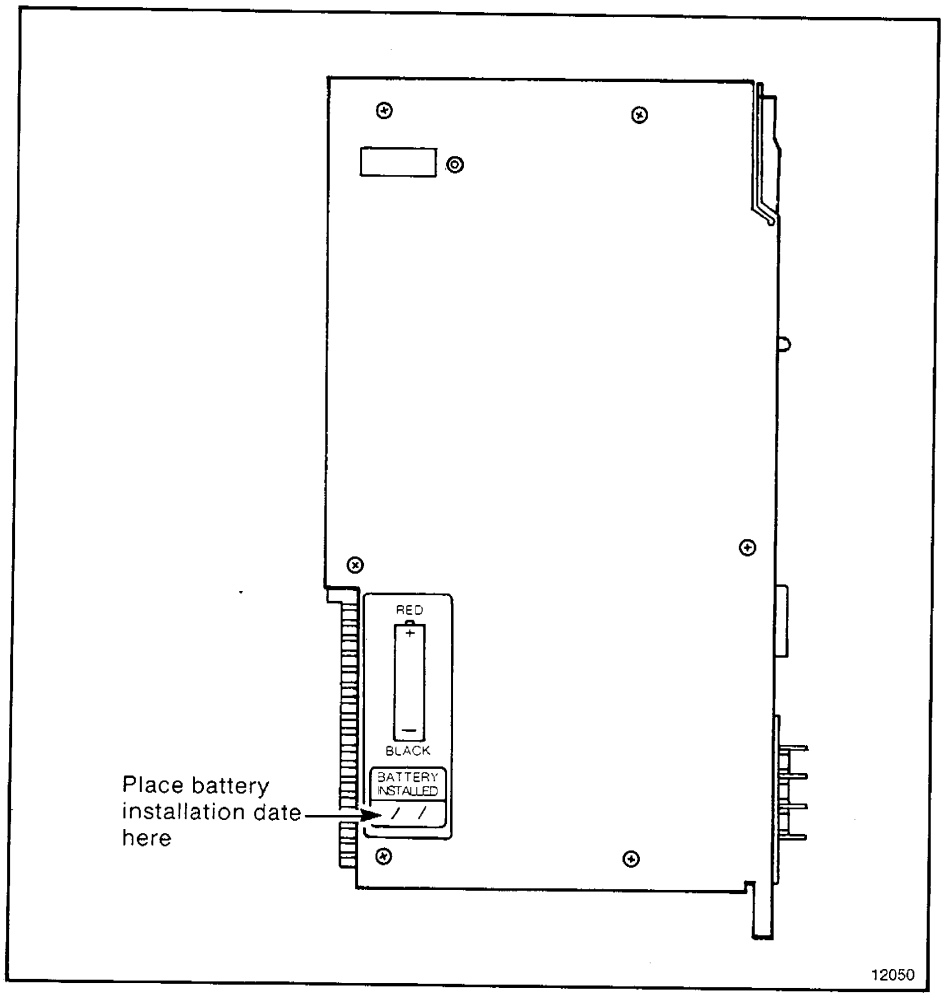


Figure 2.3 — Document the Battery's Installation Date on the Side of the Processor

Industrial Terminal

Use our industrial terminal (figure 2.4) to access the processor's different modes of operation.

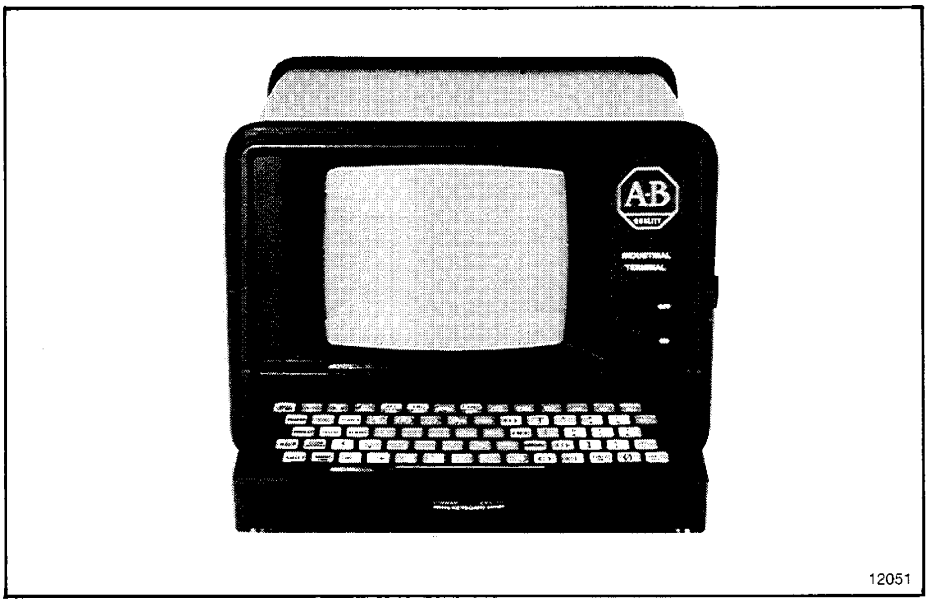


Figure 2.4 — Use the Industrial Terminal to Access the Processor's Different Modes of Operation

We define each mode of operation as:

Run/Program — This is the normal mode of operation. The outputs are controlled by the user program. You can edit your program and make on-line data changes when your processor is operating in this mode.

Remote Test — The program runs, the inputs are scanned, the outputs are disabled, and selected timed interrupts can be executed.

Remote Program — The processor stops scanning and executing its stored program and waits for your commands from the programmer. If an optional EEPROM memory module is installed, the processor must be in the remote program mode when transferring memory contents from the processor's RAM memory.

If the processor's power fails (after power up), and switch 6 is on, then the processor returns to the last programmed mode of operation. We discuss switch 6 in chapter 3.

Refer to the Mini-PLC-2/05 Processor Programming and Operations Manual (publication 1772-6.8.6) for instructions on how to program and operate your processor through the industrial terminal.

Optional Hardware

EEPROM Memory Module

Our EEPROM memory module (figure 2.5) houses an EEPROM chip that stores 3K words of memory. You can transfer your program into this EEPROM memory module for long-term program storage. To read about how to insert and remove the memory module, refer to chapter 4.

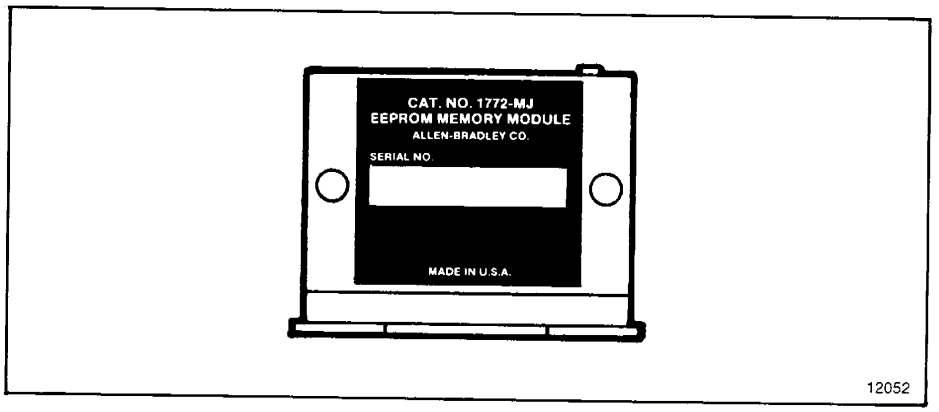


Figure 2.5 — Use the EEPROM Memory Module to Store Your Programs

Power Supplies

Table 2.B lists the power supplies used with the Mini-PLC-2/05 processors (figure 2.6).

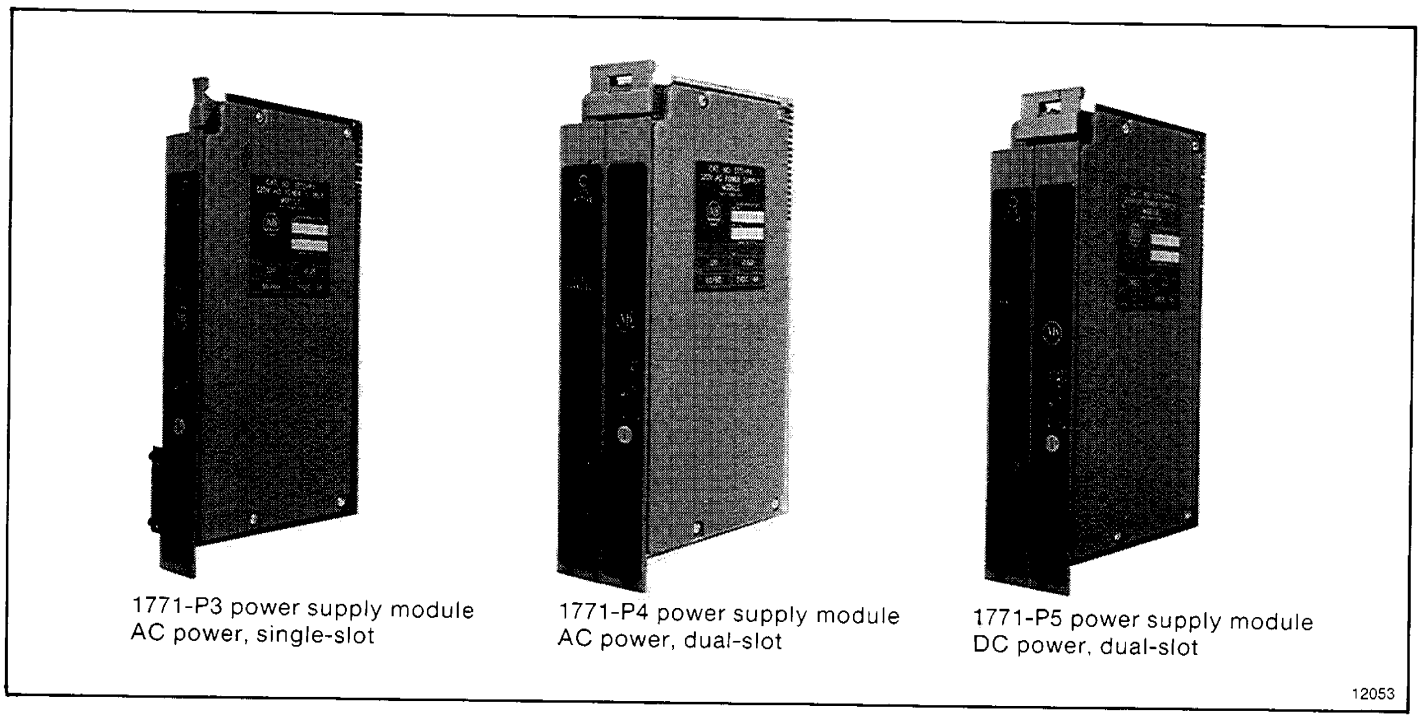


Figure 2.6 — Three Power Supply Modules Used with the Mini-PLC-2/05 Processors

You can **not** use the 1771-P1, -P2 power supplies with Mini-PLC-2/05 processors.

Table 2.B
Power Supplies Used with the Mini-PLC-2/05 Processors

Specification	1771-P3	1771-P4	1771-P5
Input source voltage	97 to 132V AC	97 to 132V AC	20.5 to 30V DC
Current available for I/O modules without processor	3A	8A	8A
Current available for I/O modules using the 1772-LS processor	1.75A	6.75A	6.75A
Current available for I/O modules using the 1772-LSP processor	5.00A	10.00A	We do not recommend using the 1771-P5 power supply with the 1772-LSP processor. *
Battery for CMOS RAM backup	No	No	No
I/O chassis slot space required	1	2	2

* The 1772-LSP processor itself provides 2A of current for the I/O modules.

PLC-2 Family Report Generation Module

The PLC-2 family report generation module (figure 2.7) provides bidirectional RS-232-C communication for report generation between a peripheral device and your Mini-PLC-2/05 processor.

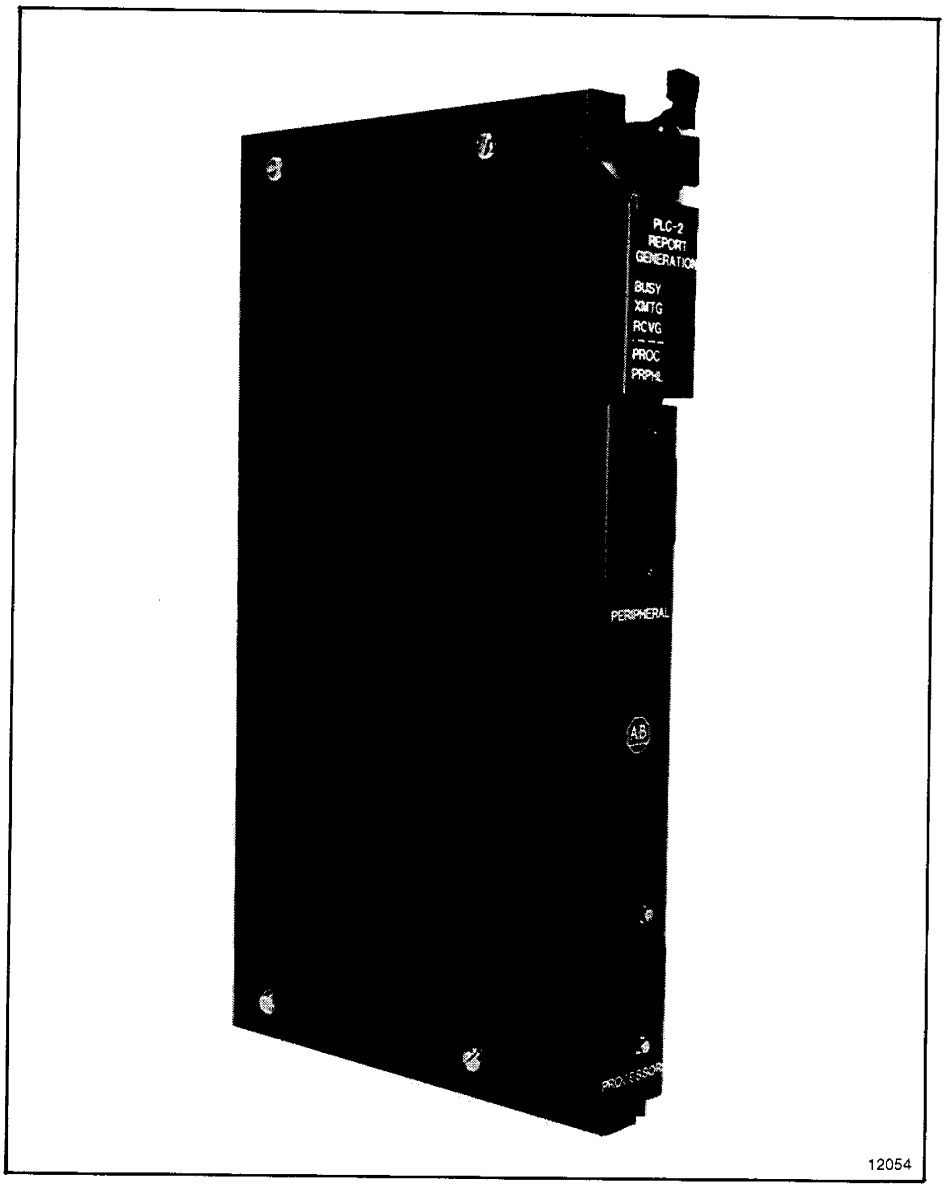


Figure 2.7 — Use the PLC-2 Family Report Generation Module to Display Messages Stored in the Processor's Memory

You can use this module to:

- enter messages into memory
- edit stored messages by a series of keystrokes from the keyboard of the peripheral device
- display messages stored in the processor's memory.

You can display messages either manually by a series of keystrokes (command mode) or automatically through your program (auto report mode).

Data Cartridge Recorder

The data cartridge recorder (figure 2.8) is a portable, high-speed recording device that stores programs. Its magnetic tape cartridge allows you to record, load, and verify the processor's total memory. Additional data cartridges can be ordered to maintain a library of programs for production requirements.

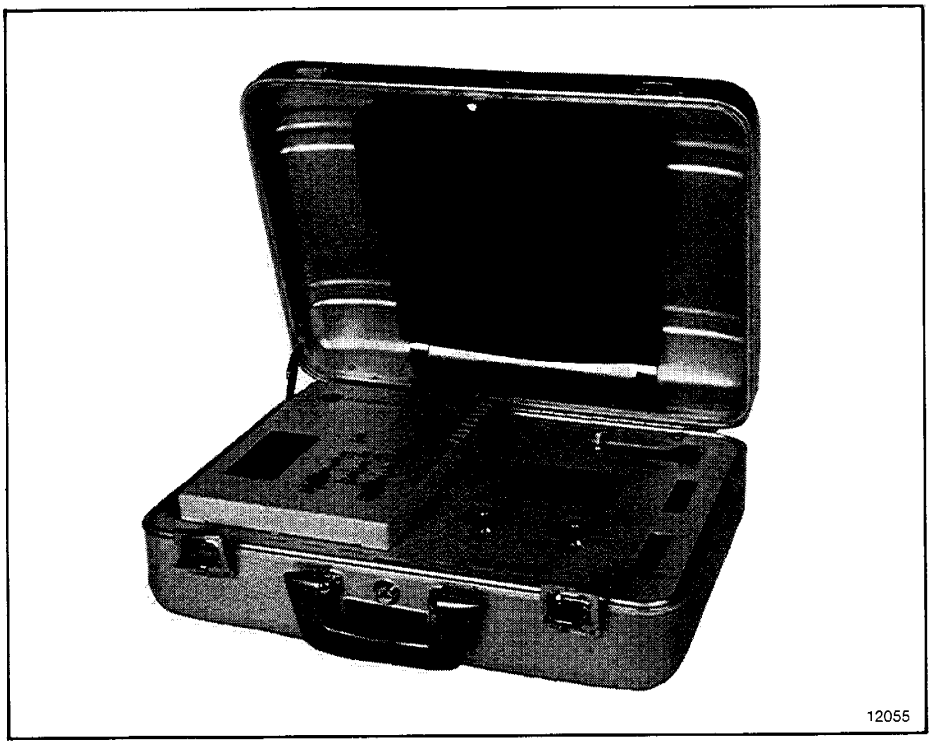


Figure 2.8 — Use the Data Cartridge Recorder to Record, Load and Verify the Processor's Total Memory

If you have our Digital Cassette Recorder (cat. no. 1770-SA), you can use it with the Mini-PLC-2/05 processor.

Hand-Held Terminal

The hand-held terminal (figure 2.9) lets you change, monitor, and force I/O bits stored in processor memory. You can access the following information:

Figure 2.9 — Use the Hand Held Terminal to Access Data Table Information Stored in the Processor's Memory

- status of actual and forced I/O bits
- accumulated and preset values for timers and/or counters
- results of math calculations
- diagnostic data
- bit values stored in block instructions' files

The hand-held terminal connects to the port labeled INTFC on the Mini-PLC-2/05 processor. You can use either the industrial terminal or hand-held terminal to access and/or monitor bits in the data table. However, if you need to access and/or monitor data at several remote sites, use the smaller hand-held terminal.

Battery Pack

Figure 2.10 shows the battery pack (cat. no. 1771-BB) consisting of:

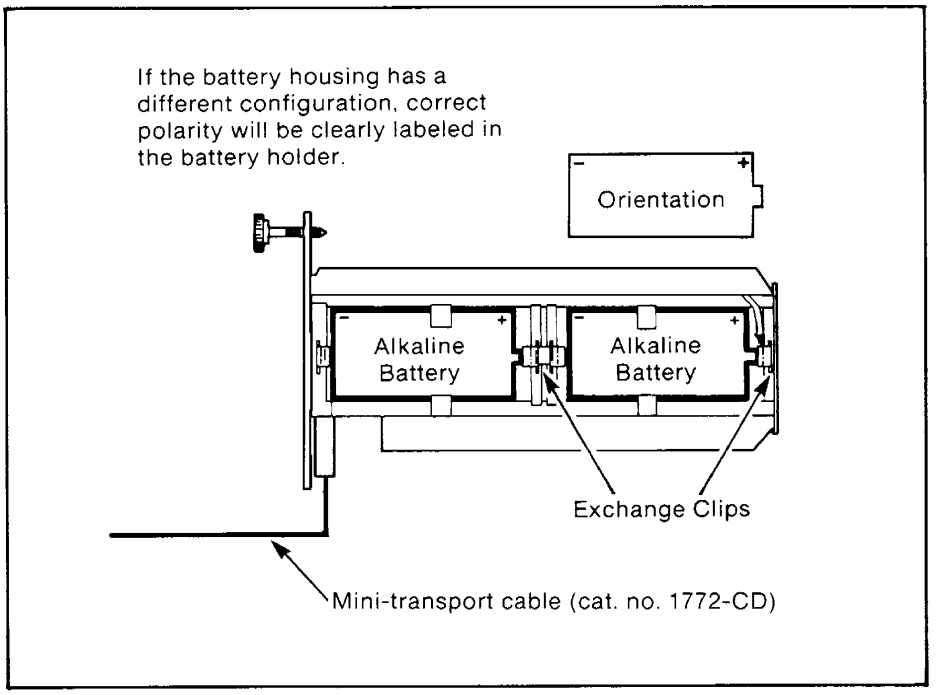


Figure 2.10 — Battery Pack with Two Alkaline Batteries Installed

- metal battery housing
- mounting hardware set
- two D-size alkaline batteries

The battery pack supports RAM memory. Use our mini-transport cable (cat. no. 1772-CD) to connect the battery pack when you replace the processor's internal battery (chapter 4).

Contact your local Allen-Bradley sales engineer or distributor for additional information on our optional hardware.

Chapter Summary

In this chapter you read about the hardware associated with your Mini-PLC-2/05 processor. In the next chapter, we describe how to install your processor system.

Chapter

3

Installing Your Processor System

Chapter Objectives

In this chapter you will read about:

- what hardware you need to install your processor system
- where to install your processor system
- how to install your processor system

To install and replace the Mini-PLC-2/05 processor's hardware, see chapter 4.

Related Hardware

Table 3.A lists the hardware needed to install your processor system.

Table 3.A
Hardware for Your Processor System

Allen-Bradley Hardware	Catalog Number
I/O Chassis	1771-A1, -A2, -A4
I/O Modules	1771 product line
Industrial Terminal	1770-T3
Power Supply Modules	1771-P3, -P4, -P5
Emergency Stop Switches	800 product line
Master Control Relay	700 product line
Disconnects	1494 product line
Suppression devices	599-K04, 700-N24, 1401-N10

Quantity of the hardware depends upon your application. Consult your local Allen-Bradley sales engineer or distributor for more information concerning these items.

In addition to our hardware, we recommend:

- a metal enclosure to protect your processor from EMI noise and airborne contaminants
- enclosure backpanel
- isolation transformers or constant-voltage transformers
- power supplies for I/O devices
- 6.35-mm (0.25-inch) mounting bolts
- equivalent to Belden cable 8761 (single twisted-pair shielded cable)
- power cable for AC input power
- electrical tape or shrink tubing
- tie wraps for wires

Where to Install Your Processor System

Refer to the Programmable Controller Wiring and Grounding Guidelines (publication 1770-980) before you begin actually installing hardware.

A well-planned layout is essential for the installation of the Mini-PLC-2/05 processor. You should consider the following factors when planning installation of the Mini-PLC-2/05 processor at your facility:

- where to locate your processor system
- how to integrate your processor system with other plant machinery
- how to protect your processor system

Let's look at each of these factors.

Location

Determining the proper environment should be your primary concern. We specify:

- 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)

We also recommend noise suppressors. Special considerations should be given to possible electrical noise interference.

Noise Generators

Potential noise generators include inductive devices such as relays, solenoids, motors and motor starters when they are operated by pushbuttons and selector switches. You'll need suppression for noise generators when inductive devices are connected:

- as output devices
- along the same AC power line that powers your processor

Figure 3.1 shows what suppressors you need to reduce electric noise. Table 3.B lists each suppressor that complements our equipment.

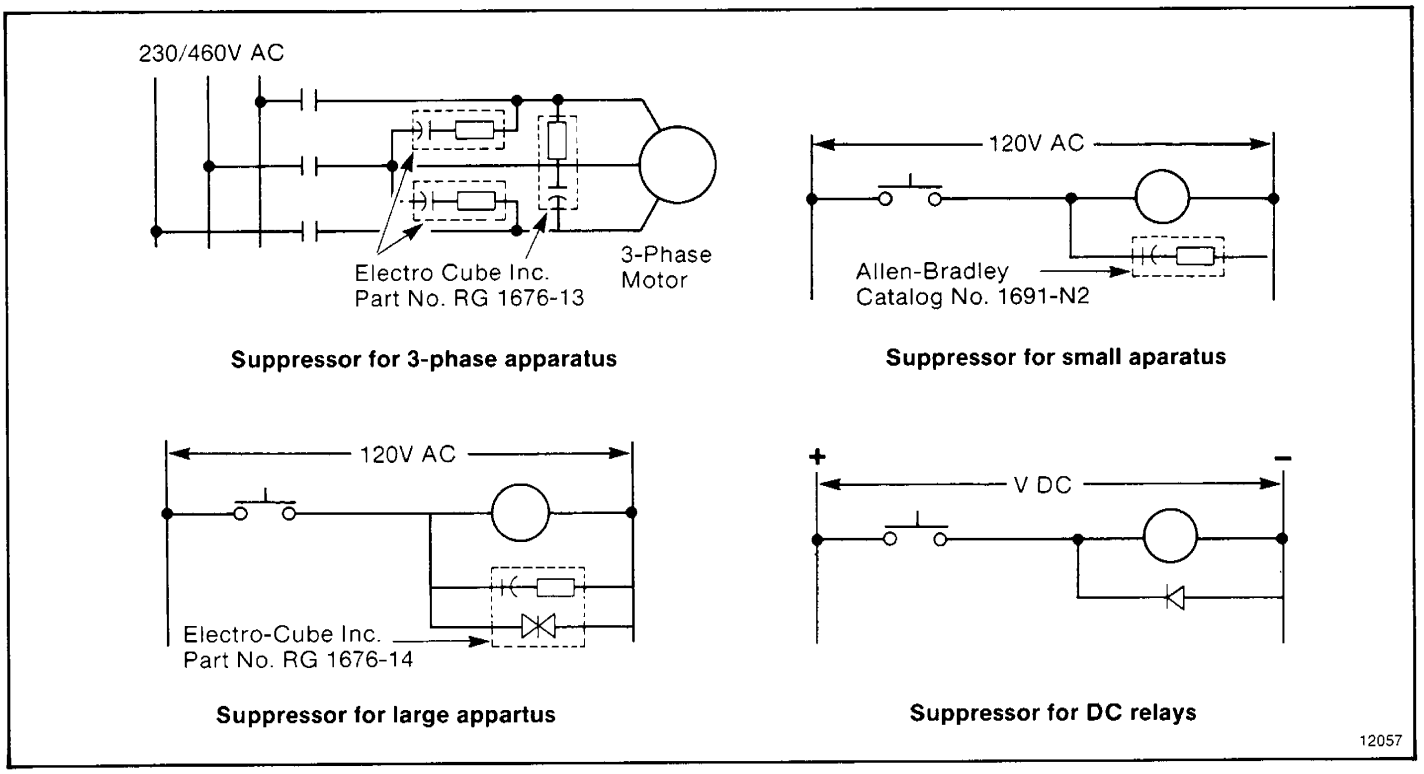


Figure 3.1 — Use the Noise Suppression Equipment to Reduce Electric Noise

Table 3.B

Allen-Bradley Suppressors

Suppressor Cat. No.	Allen-Bradley Equipment
599-K04*	Motor Starter 509
1401-N10**	Motor Starter 709
700-N24**	Relay 700 Type N or P
700-N24	Miscellaneous

*For starters with 120V AC coils.

**The 700-N24 is a universal surge suppressor. It can be used on electromagnetic devices with the limitation of 35 sealed VA, 150V.

Integration

The Mini-PLC-2/05 processor system should be separated 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 then install:

- fans (which bring in filtered air or recirculate internal air) inside the enclosure, or
- air conditioning/heat exchangers

Follow these guidelines when installing your processor system:

- Allow six vertical inches above and below all processor components. When you use more than one processor in the same area, allow six vertical inches between each processor.
- Allow four horizontal inches on the sides of each processor component. When you use more than one processor in the same area, allow six horizontal inches between each processor.
- Allow two inches (vertical and horizontal) between the processor and the wiring duct or terminal strips.
- Mount the I/O chassis **horizontally** to allow for convection cooling.

Protection

You provide the enclosure for your processor system. This enclosure is the primary means of protecting your processor system from atmospheric contaminants such as oil, moisture, dust, and corrosive materials, or other harmful airborne substances. We suggest that you use an enclosure that conforms to the National Electrical Manufacturer's Association (NEMA) standard.

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

When choosing the enclosure size, allow extra space for isolation transformers, fusing, disconnect switch, master control relay, and terminal strips. Your processor requires a minimum of eight inches of space from the rear of the chassis to the innermost surface of the enclosure.

How to Install Your Processor System

Now that you've planned your production site, you can install your new system. Figure 3.2 gives the names and shows location for each piece of hardware. This manual provides general installation guidelines. The input and output devices that control your manufacturing operations determine the specifics of your installation.

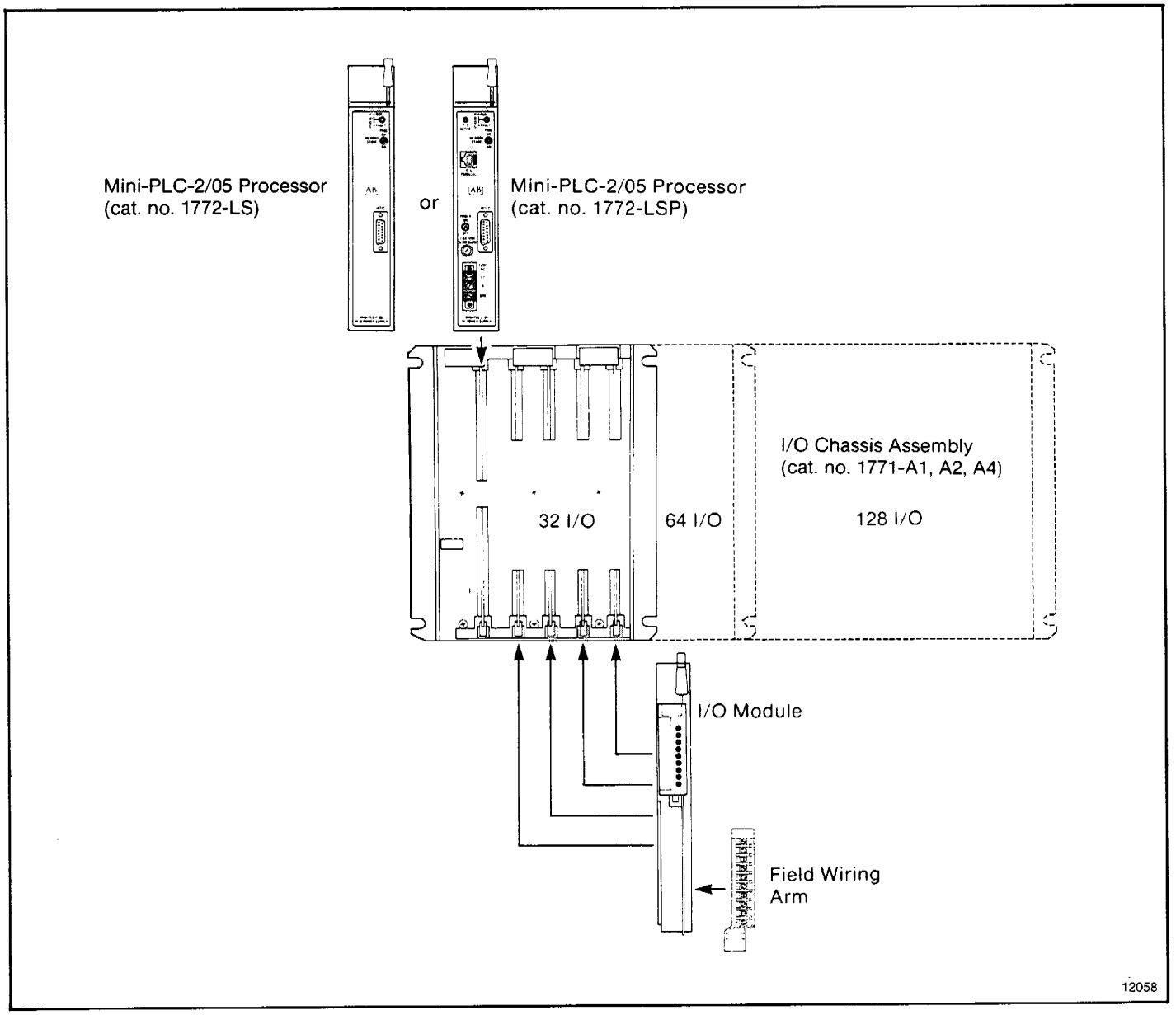


Figure 3.2 — I/O Chassis Location of the Mini-PLC-2/05 Processor System

Installing your processor involves ten tasks. Perform these tasks in order.

- Task 1- Mounting and grounding hardware to the backpanel
- Task 2- Setting the switches within the switch group assembly
- Task 3- Installing keying bands and field wiring arms
- Task 4- Installing I/O modules
- Task 5- Installing your processor
- Task 6- Installing your power supply(ies)
- Task 7- Mounting the backpanel
- Task 8- Wiring field wiring arms
- Task 9- Connecting the power cable to the terminal strip
- Task 10- Installing the industrial terminal

Task 1 Mounting and Grounding Hardware to the Backpanel

Use 6.35-mm or 0.25-inch mounting bolts to attach the I/O chassis to the enclosure backpanel. For component spacing and dimensions see figures 3.3 and 3.4.

Grounding is an important safety measure in electrical installations. It helps to reduce the effects of electromagnetic noise.

Before grounding your processor system, consult the following sources of information:

- Allen-Bradley Programmable Controller Wiring and Grounding Guidelines (publication 1770-980)
- National Electrical Code, published by the National Fire Protection Association of Boston, Massachusetts
- local codes and ordinances

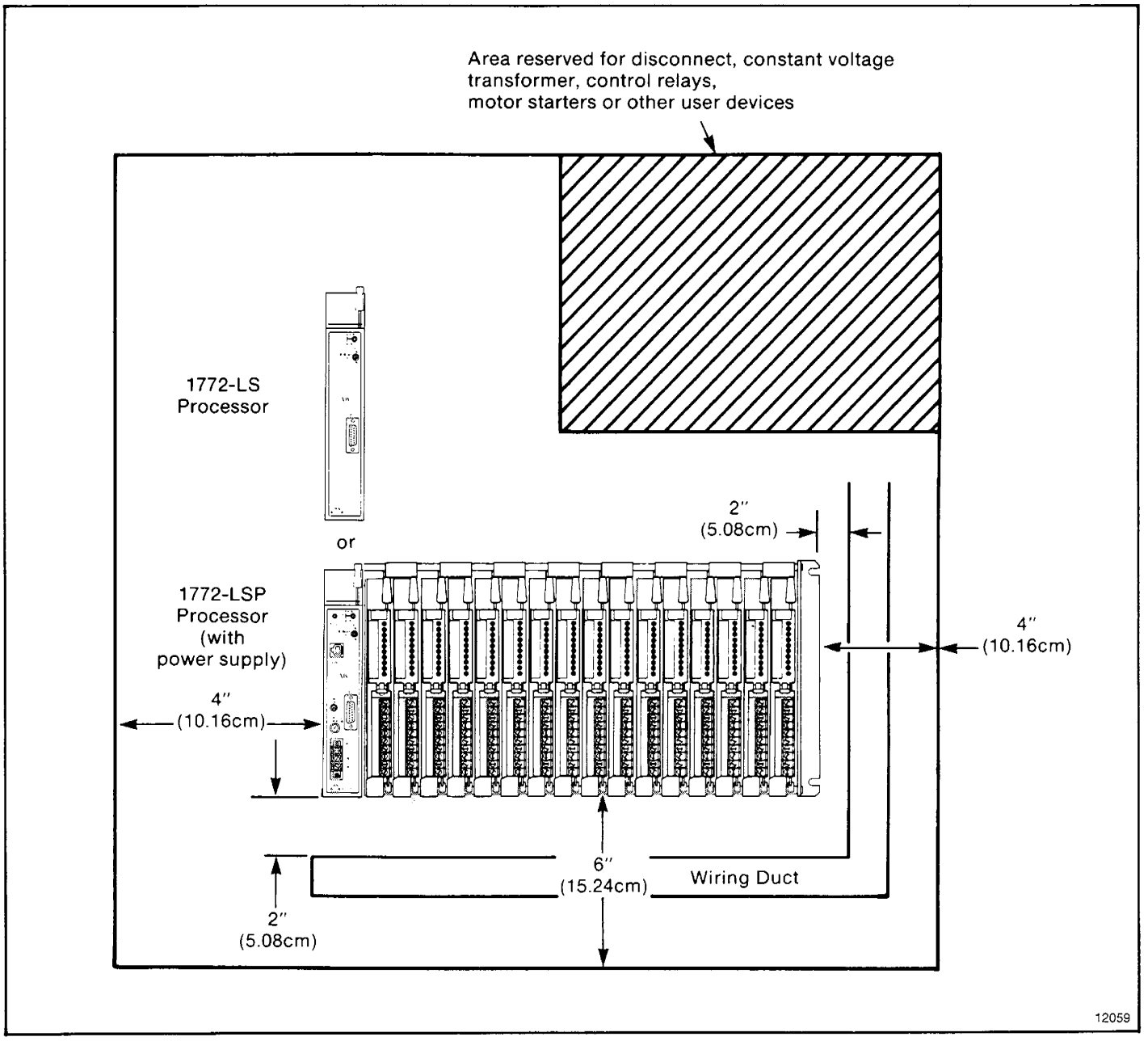


Figure 3.3 — Minimum Component Spacing for the Mini-PLC-2/05 Processor System

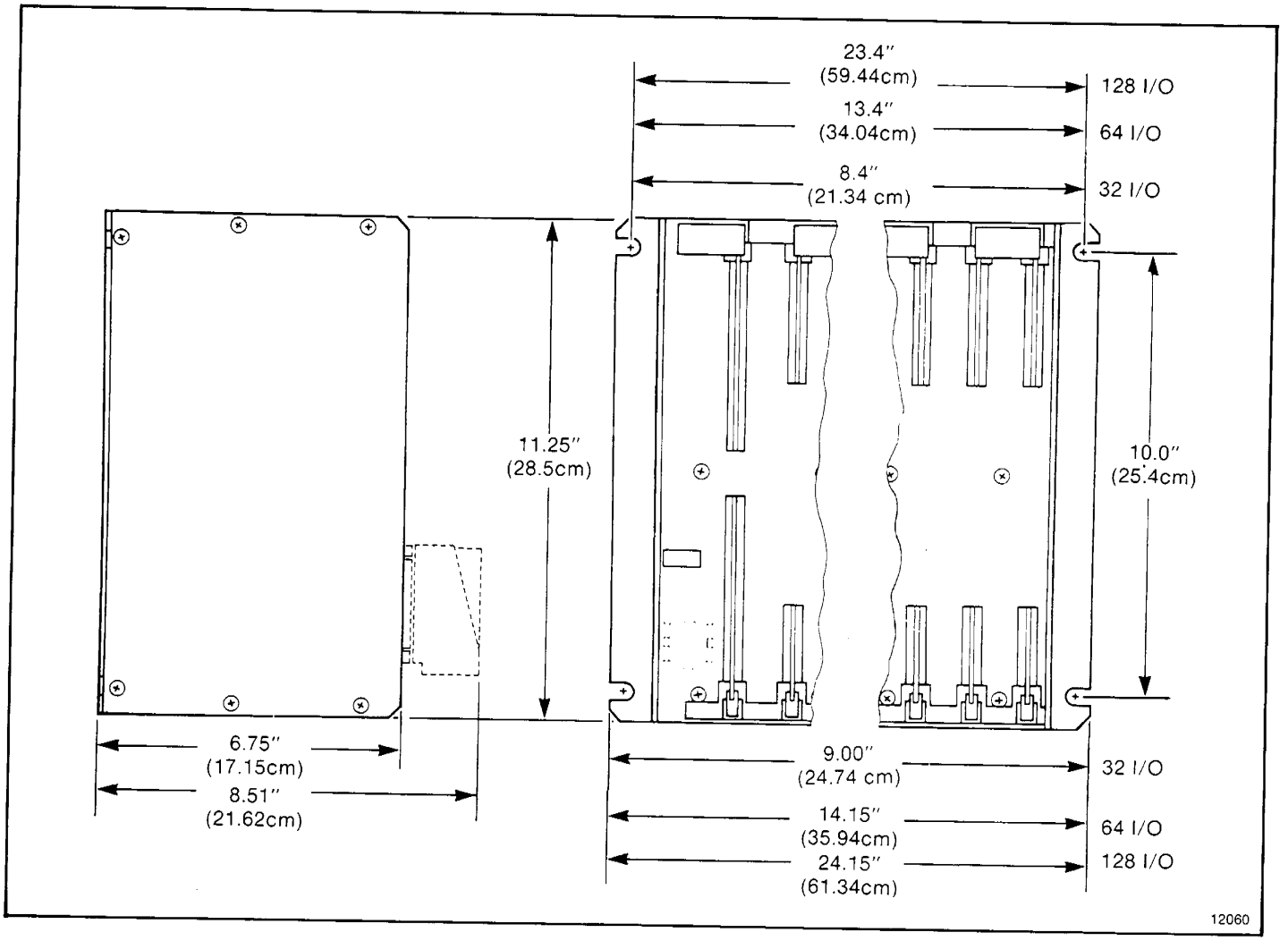


Figure 3.4 — Dimensions for I/0 Chassis (cat. no. 1771-A1, -A2, -A4)

Master Control Relay

You supply and install the master control relay and emergency stop switches. Place an emergency stop switch at each operator station and at an accessible point on the machine. Locate each emergency stop switch so it is easy for you to reach; wire them in series. Make certain that the master control relay contacts have sufficient rating for your particular application.

Any emergency stop switch should turn off all machine power, by turning off the master control relay.

WARNING: Do not program your processor to control the master control relay. Damage to your equipment or injury to your personnel can occur. Instead provide a hard-wired emergency stop circuit.

Every machine connected to your processor must have an emergency stop switch that stops machine motion whenever the master control relay de-energizes. The master control relay must be a backup circuit to the processor in every case where unexpected machine motion could damage machinery or injure personnel. If a failure occurs in the processor, this backup circuit must be able to stop machine motion.

The master control relay is **not** a substitute for a power disconnect device.Use the disconnect device to quickly de-energize your I/O devices. To replace any I/O modules, fuses, or when working on the equipment, turn off the power to your I/O chassis backplane as well as the power to the I/O circuits.

Task 2 Setting the Switches within the Switch Group Assembly

The eight switches in this assembly determine the processor's response for memory protection and power up sequence. This switch group is at the left side of the I/O chassis backplane (figure 3.5).

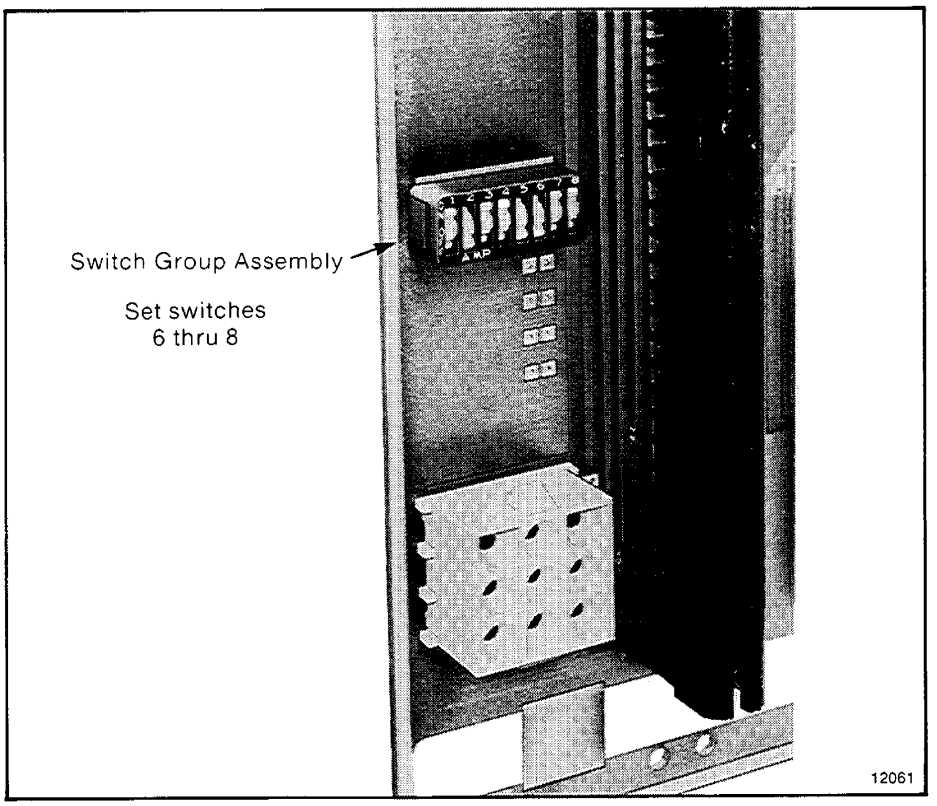


Figure 3.5 — The Backplane of the I/O Chassis Contains the Switch Group Assembly

Set these switches before you install the processor. This programs the processor to respond appropriately during a power failure.

Table 3.C explains how each switch is used with the processor. Switches 1, 2, 3, 4, and 5 are not used.

Table 3.C
Meaning of Switch Group Settings

If:	And:	Then:
Switch 6 is off	—	Contents of the EEPROM memory module are transferred to CMOS RAM, whether or not CMOS RAM is valid.
Switch 6 is on	Switch 7 is on	If CMOS RAM is valid, then EEPROM memory does not transfer to CMOS RAM. If CMOS RAM is not valid, then EEPROM memory does transfer to CMOS RAM.
Switch 6 is on	Switch 7 is off	Memory transfer **does not** occur. If CMOS RAM is **not** valid, a processor fault occurs.
Switch 8 is off	—	RAM Memory protect is disabled. *
Switch 8 is on	—	RAM Memory protect is enabled. *

* When memory protect is enabled, you can only change the status and values of the bits in the first 128 words (word addresses up to 177) of the processor's data table.

Use a ball-point pen to set each switch. **Do not** use a pencil because the tip can break off and jam the switch.

Task 3 Installing Keying Bands and Field Wiring Arms

We ship plastic keying bands with each I/O chassis. With your fingers, insert two keying bands in the top backplane sockets of the I/O chassis. For the processor, place one keying band in the **leftmost** slot between pins (figure 3.6):

- 40 and 42
- 54 and 56

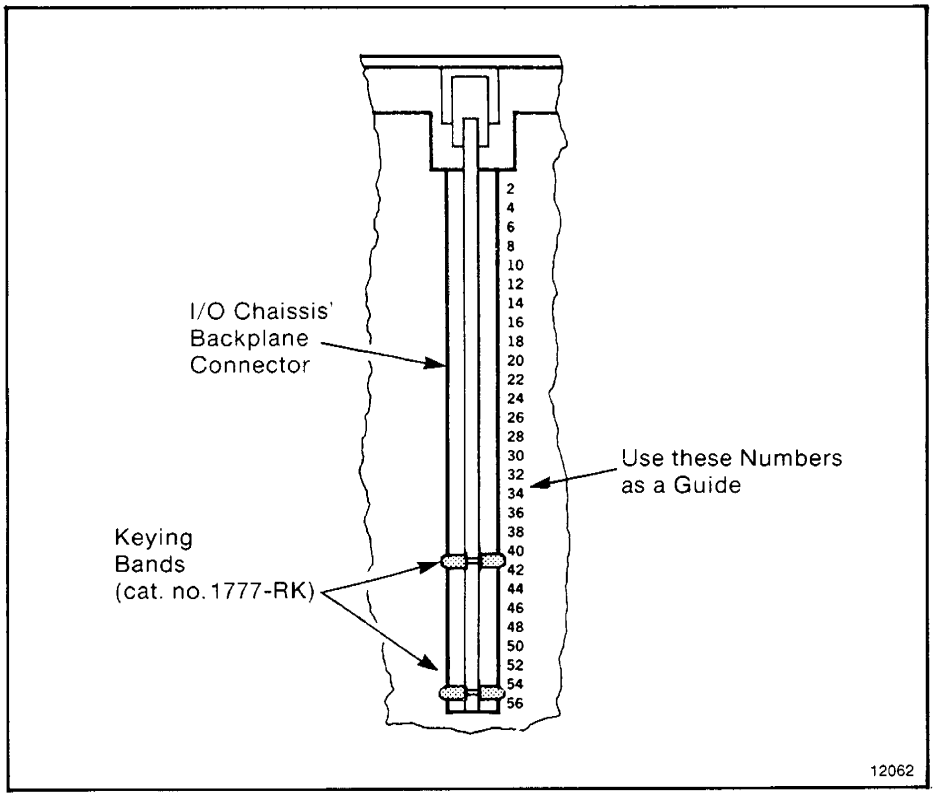


Figure 3.6 — Place the Keying Bands on the Backplane of the I/O Chassis

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

Refer to the individual product data publications for the keying position for each I/O module.

CAUTION: If keying bands are not installed, a module inserted into a wrong slot could be damaged by improper voltages connected through the wiring arm. Short circuits on the I/O module can result from misalignment if keying bands are not installed.

Snap each field wiring arm onto the lower horizontal bar of the I/O chassis (figure 3.7). When I/O modules are in place, the field wiring arm pivots and connects to the module.

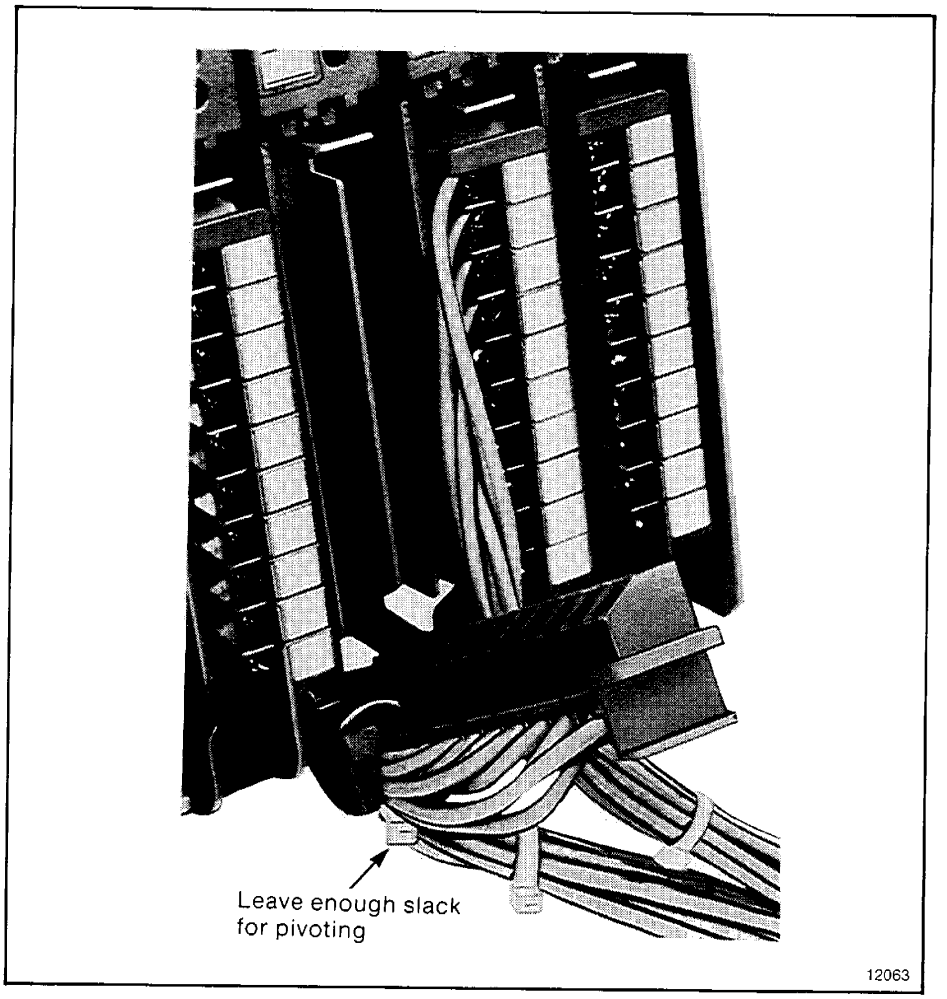


Figure 3.7 — Placement of Field Wiring Arm

Do not place any I/O modules in the leftmost slot. Your processor goes there.

Task 4
Installing I/O Modules

Insert each I/O module into its corresponding keyed slot by sliding it onto the plastic tracks of the I/O chassis (figure 3.8). Snap the module locking latch over the I/O module.

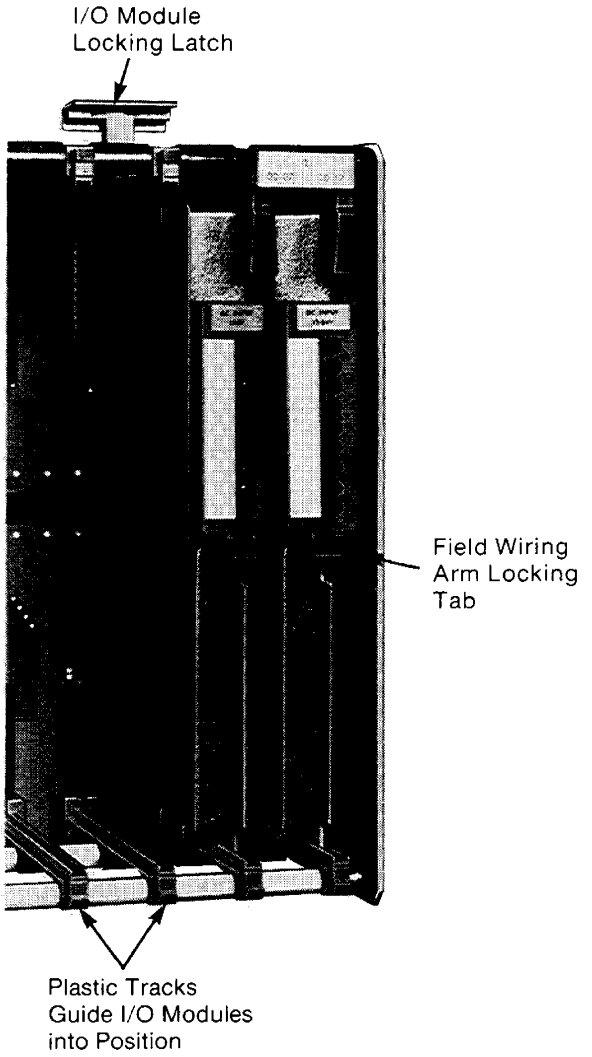


Figure 3.8 — Place each I/O Module into its Corresponding Keyed Slot in the I/O Chassis

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

Calculate the total current requirement for all installed modules to ensure that the sum does not exceed the limit of the I/O chassis' power supply. The 1772-LSP processor provides 2A to power the I/O modules. If you need additional power, we have three power supply modules that you can choose from:

Catalog Number	Input Voltage	Current
1771-P3	120V AC	3A
1771-P4	120V AC	8A
1771-P5	24V DC	8A

WARNING: In order to enhance power supply reliability, the processor supply modules, and 1772-LS processor use a controlled "soft start" power-up or power-down feature. During soft start, the following outputs can momentarily change state:

Catalog Number	Product	Series
1771-OD	Isolated AC (120V) Output Module Assembly	B or earlier
1771-OY	Contact Output Module Assembly	B or earlier
1771-OZ	Contact Output Module	B or earlier

Disconnect all power from apparatus that can cause damage to equipment or injure personnel during power-up and power down of the power supply modules and 1772-LS processor.

Products labeled Series C or later are not affected.

If you need more information on these power supplies, refer to the appropiate publication, or consult our Publications Index (publication SD499). Task 6 describes where to install your power supply within the I/O chassis.

Task 5
Installing Your Processor

Slide your processor into the left most slot of the I/O chassis (figure 3.9).

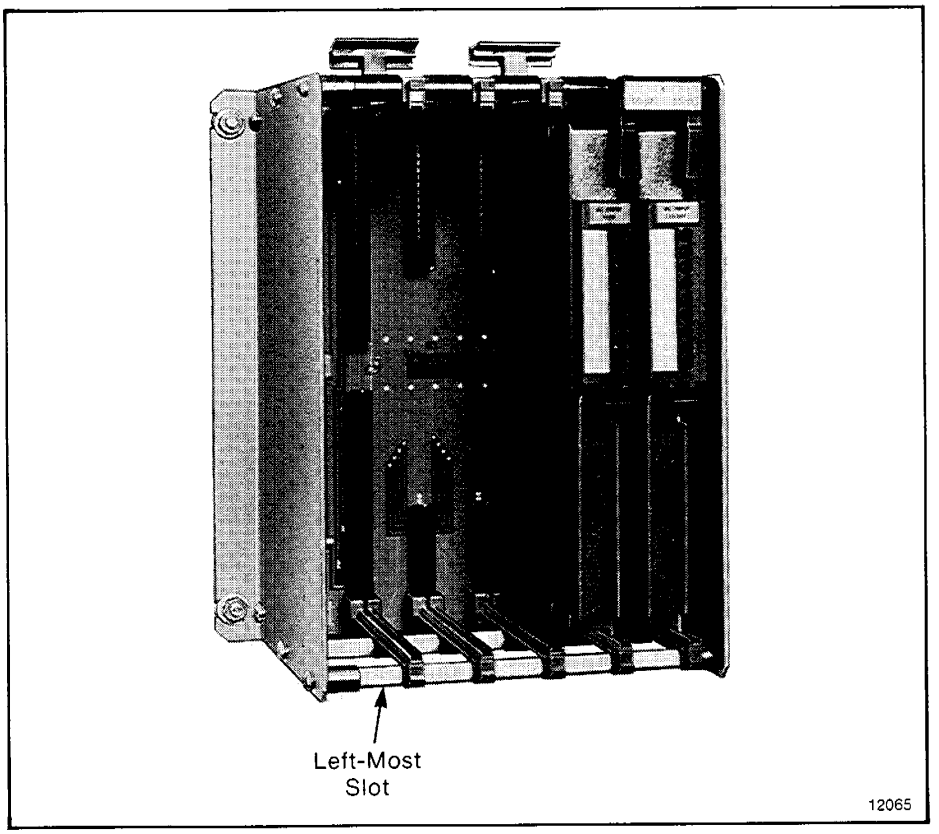


Figure 3.9 — Place the Mini-PLC-2/05 Processor(s) in the Left-Most Slot of the I/O Chassis

CAUTION: Do not place your processor in the I/O chassis without keying bands. Short circuits can result from misalignment.

Task 6 Installing Your Power Supply

Skip task 6 if you have a 1772-LSP processor and do not need additional current for your I/O modules.

Figures 3.10, 3.11, and 3.12 show you where to locate a power supply within the I/O chassis. Table 3.D summarizes their location within the I/O chassis. Location depends upon I/O chassis size, not the type of power supply.

We do not recommend using the 1771-P5 power supply with the 1772-LSP processor.

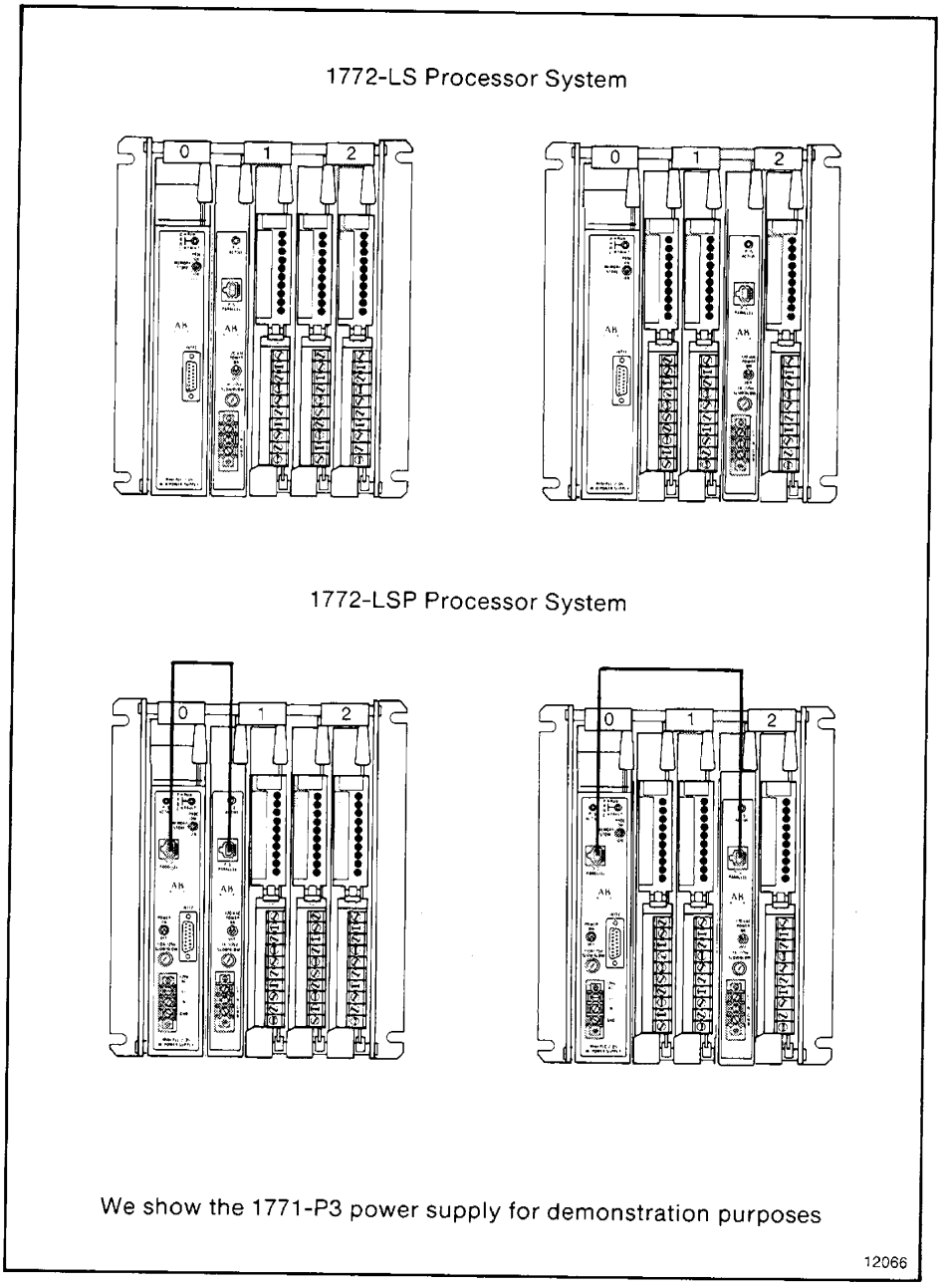


Figure 3.10 — Locating a Power Supply in the 1771-A1 I/O Chassis

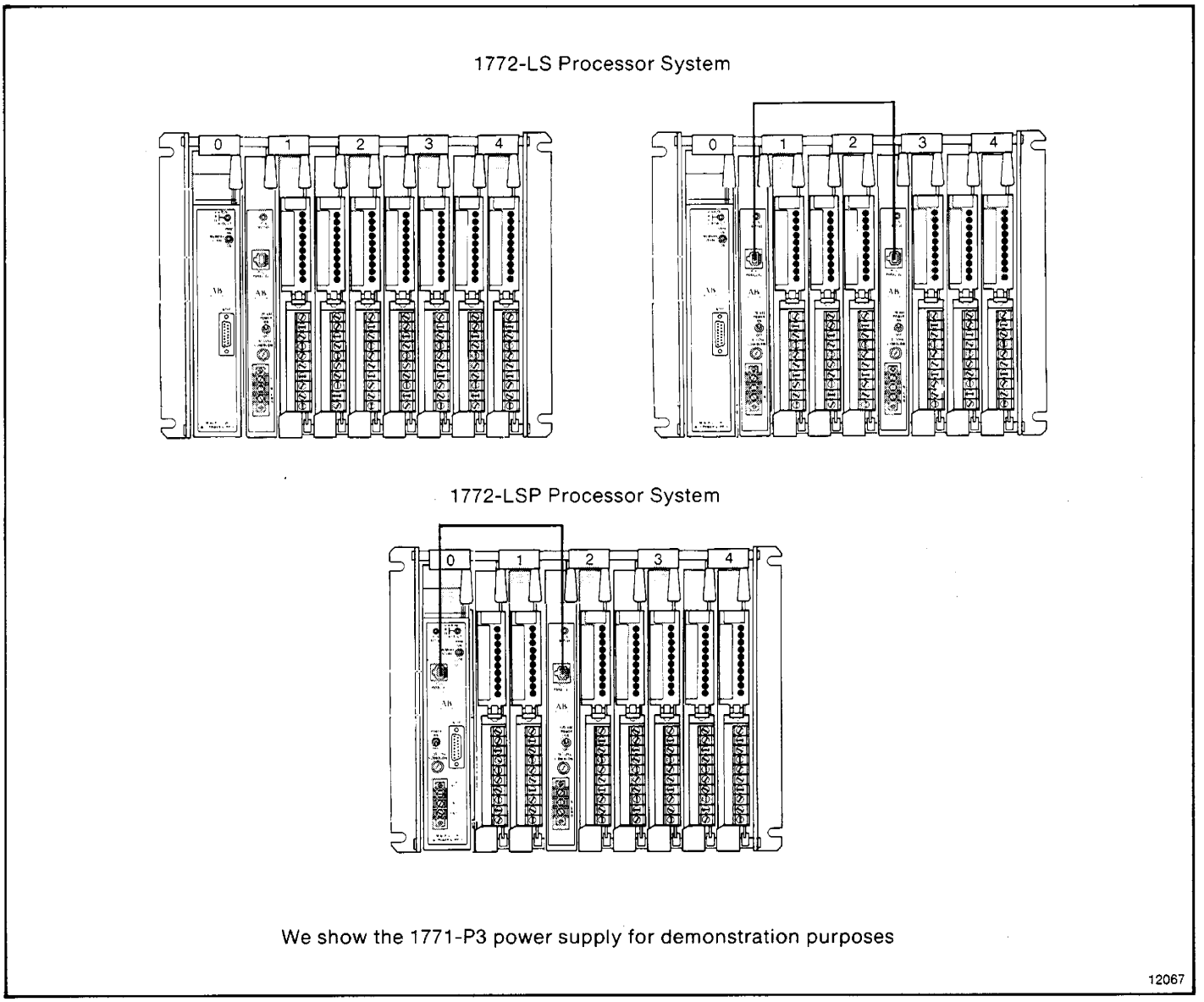


Figure 3.11 — Locating a Power Supply in the 1771-A2 I/O Chassis

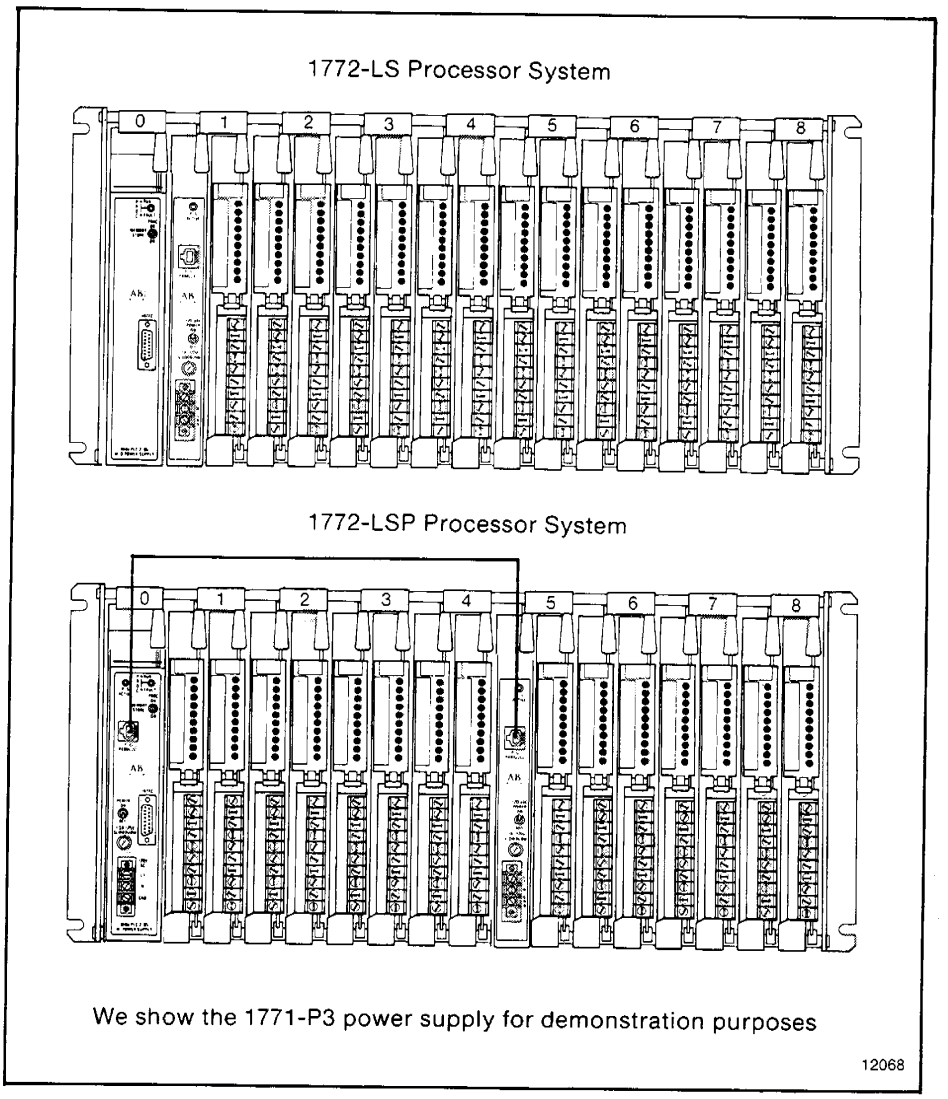


Figure 3.12 — Locating a Power Supply in the 1771-A4 I/O Chassis

Table 3.D
Location of the Power Supply in Each I/O Chassis

If You Have:	And:	And:	Then Slide the Power Supply in I/O Chassis in:
1772-LS processor	One power supply	1771-A1 I/O chassis	Any slot
1772-LS processor	One power supply	1771-A2 I/O chassis	Module Group 0
1772-LS processor	One power supply	1771-A4 I/O chassis	Module Group 0
1772-LS processor	Two power supplies	1771-A1 I/O chassis	Any slot
1772-LS processor	Two power supplies	1771-A2 I/O chassis	Module groups 0 and 2
1772-LS processor	Two power supplies	1771-A4 I/O chassis	Module groups 0 and 5
1772-LSP processor	One power supply	1771-A1 I/O chassis	Any slot
1772-LSP processor	One power supply	1771-A2 I/O chassis	Module group 2
1772-LSP processor	One power supply	1771-A4 I/O chassis	Module group 4

Task 7
Mounting the Backpanel

Figure 3.13 shows:

- stud mounting of a backpanel to the back wall of an enclosure
- bolt mounting of an I/O chassis or ground bus to the backpanel
- stud mounting of an I/O chassis or ground bus to the backpanel

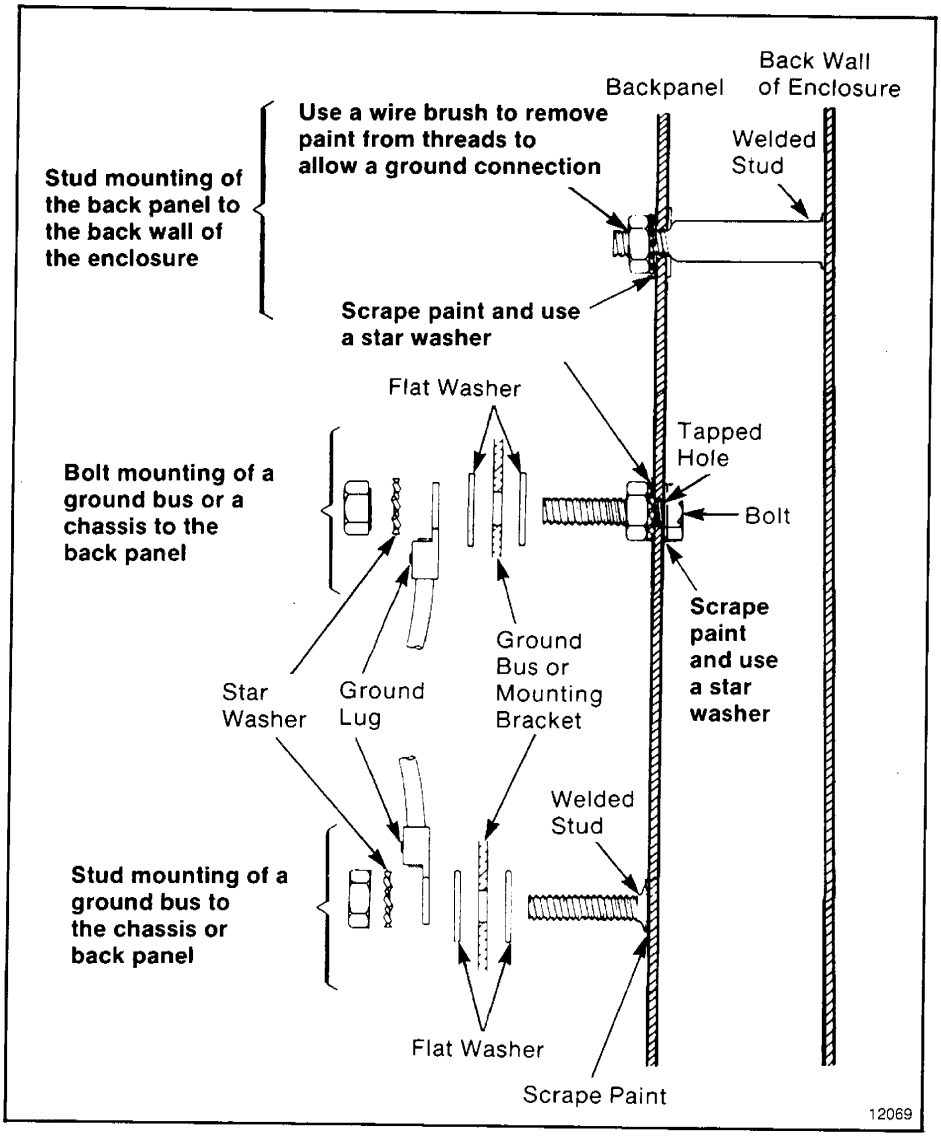


Figure 3.13 — Hardware Needed for Mounting the Backpanel Inside Your Enclosure

Remember these guidelines when mounting the I/O chassis on the backpanel:

- If the mounting brackets of an I/O chassis do not lie flat before the nuts are tightened, use additional washers as shims so that the chassis will not be warped by tightening the nuts.
- Warping an I/O chassis could damage the backplane and cause poor connections.
- Make good electrical connections between each I/O chassis, the back panel, and the enclosure.
- Remove paint or other nonconductive finish from studs and the back panel so that good electrical contact is made at each bolt or stud.

Use either copper braid or copper wire to connect between:

- each chassis
- backpanel
- enclosure
- ground bus

that connects to earth ground (the grounding electrode system) through a grounding electrode conductor.

We define earth ground as the central ground for all electrical equipment and AC power within any facility.

All ground connections must be permanent and continuous to provide a low-impedence path to earth ground for induced noise currents and fault currents. Remember, observe all applicable codes and ordinances when making these grounding connections. Figure 3.14 shows a ground bus connection through one mounting bracket of an I/O chassis.Here are some general guidelines when connecting a ground bus:

- connect the chassis in vertical groups
- connect each vertical group to a ground bus mounted on the back panel of the enclosure
- connect the ground bus to the grounding electrode system through a grounding electrode conductor

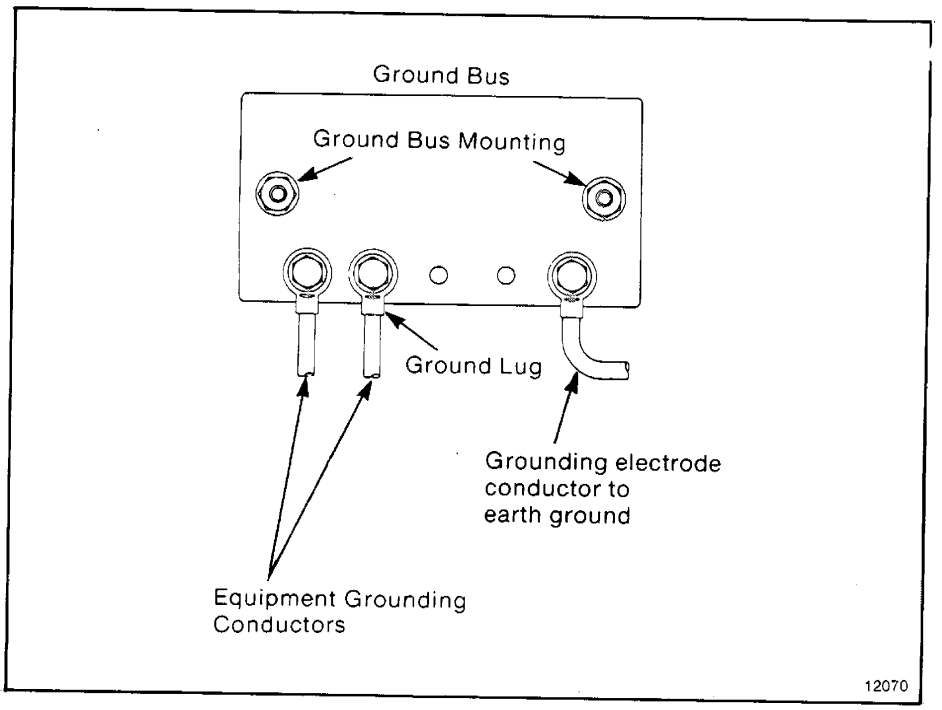


Figure 3.14 — Connecting a Ground Bus Through One Mounting Bracket of an I/O Chassis

CAUTION: Avoid connecting more than two lugs to any single bolt. The connection can become loose due to the compression of the metal lugs.

Task 8 Wiring Field Wiring Arms

Your I/O devices connect to the I/O module's field wiring arm. Every I/O module must be properly wired and every I/O connection must be made at the proper field wiring arm terminal. Refer to the specific I/O module publication for connection diagrams.

How to Wire Your I/O Devices to a Field Wiring Arm

There are three ways to wire your I/O devices, using:

- single-conductor wire
- multi-conductor cable
- multi-conductor shielded cable

Single-conductor wire and multi-conductor cable are similar to each other. The difference is that single-conductor wire has one wire strand and multi-conductor cable has many single-conductor wires enclosed in a casing or outer jacket. We recommend using copper wire for these connections.

Multi-conductor shielded cable can be Belden type 8761 or its equivalent. It consists of twisted pairs of conductor wires wrapped in two layers of shielding. Our wiring procedure shows one pair of conductor wires. The number of needed I/O terminals determines the number of conductor wires needed within the cable for your application. Figure 3.15 shows each component making up this cable. The components are:

- outer jacket
- braided shield
- drain
- foil shield
- insulation
- filler cord(s)
- blue conductor wire
- white conductor wire

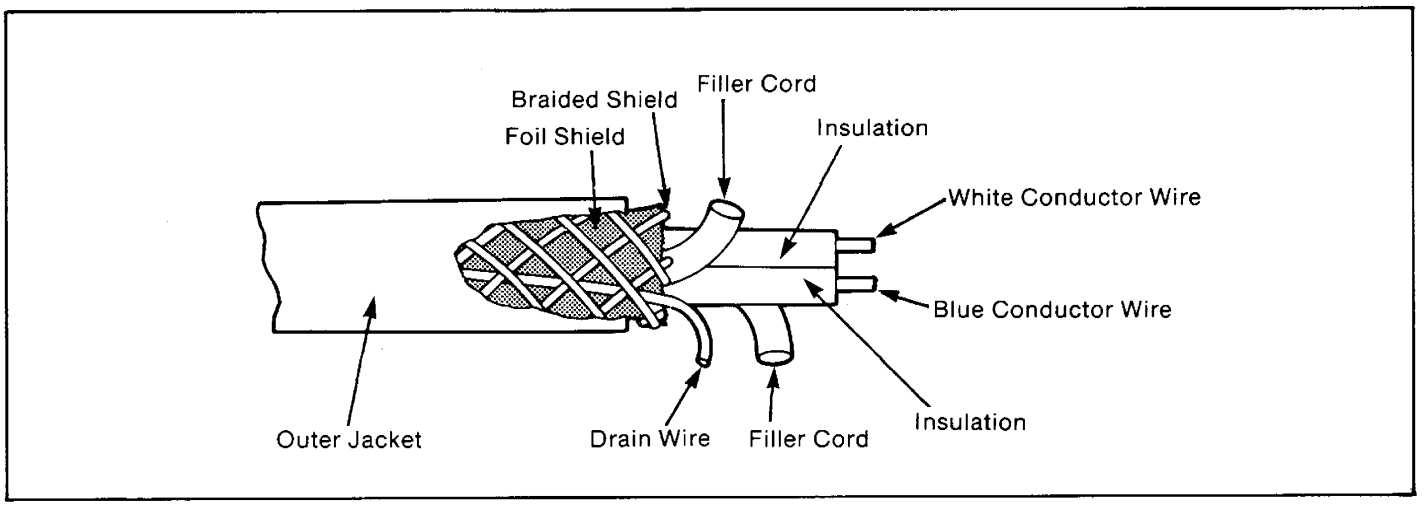


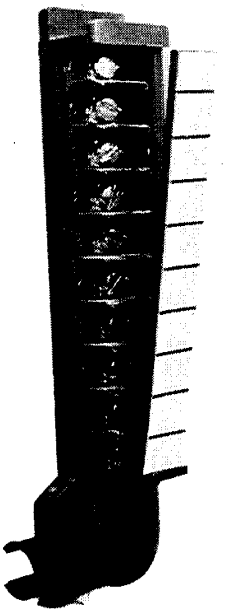
Figure 3.15 — Components Making up a Multi-Conductor Shielded Cable

Intelligent and low voltage DC (discrete) I/O modules require multi-conductor shielded cable.Analog and the remaining discrete I/O modules require either the single or multi-conductor wire.

Single-conductor Wire or Multi-conductor Cable

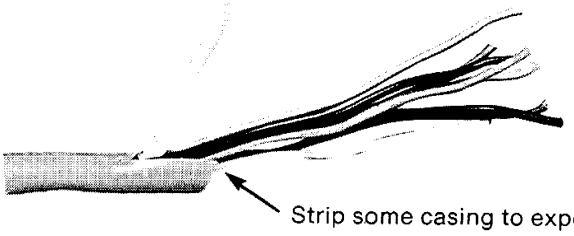
To wire your I/O devices:

Step 1 — Pry the field wiring arm's terminal cover off using a flat-head screwdriver.

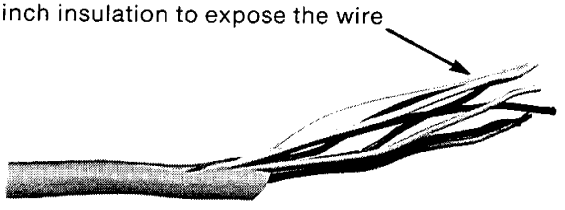


Step 2 — Measure the wire distance from your I/O devices to the field wiring arm terminals. This distance determines the amount of wire you need for your application.

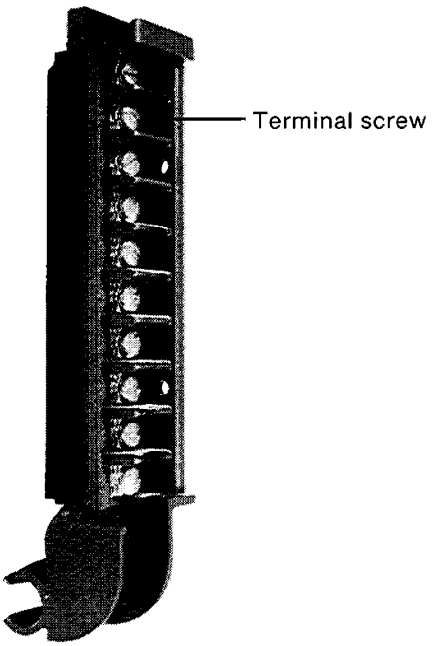
Step 3 — For multi-conductor cable, strip some casing (to expose the individual wires) from the end of the cable that connects to the field wiring arm.



Step 4 — Strip about 3/8 inch insulation to expose the end of the wire.

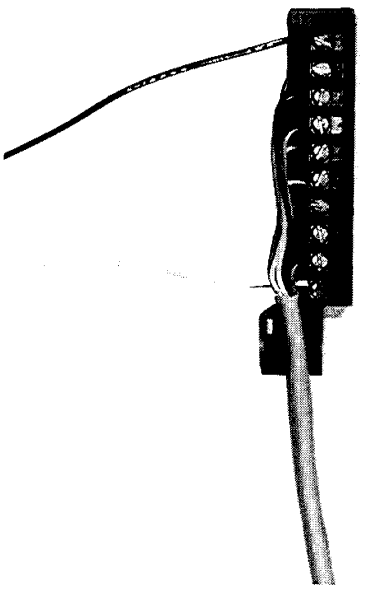


Step 5 — Loosen a terminal screw and place the wire under the pressure plate of the terminal.

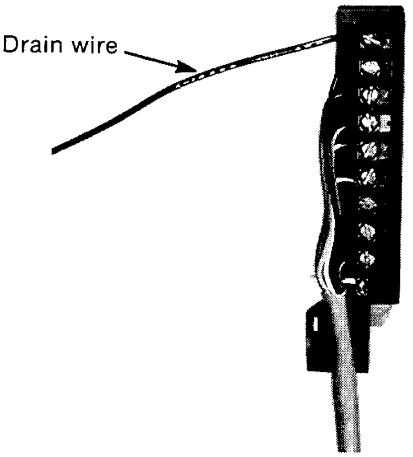


Step 6 — Secure the terminal screw.

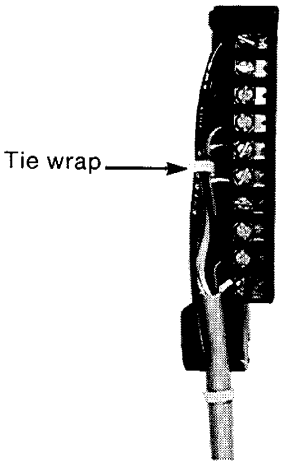
Step 7 — Repeat steps five and six until you wire the appropriate I/O devices to the field wiring arm.



Step 8 — Connect the drain wire to ground.



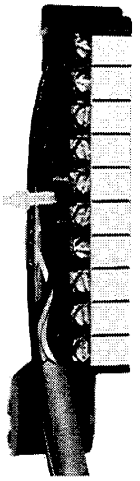
Step 9 — Gather all wires and neatly bundle them using tie wraps.



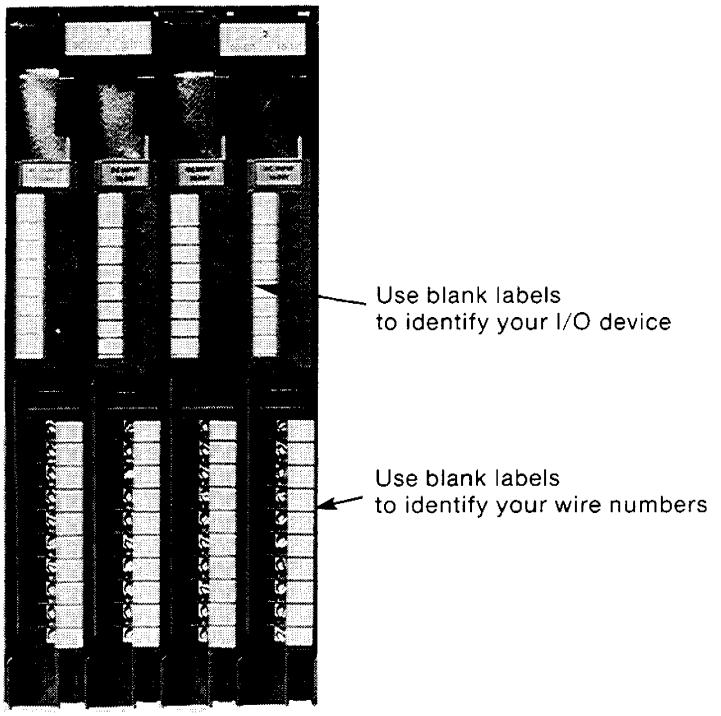
Step 10 — Label all wires with a 5-digit I/O address code at each wire connection. Chapter 5 describes I/O addressing.

Step 11 — Make sure that the field wiring arm pivots freely from vertical to horizontal.

Step 12 — Replace the field wiring arm's terminal cover.



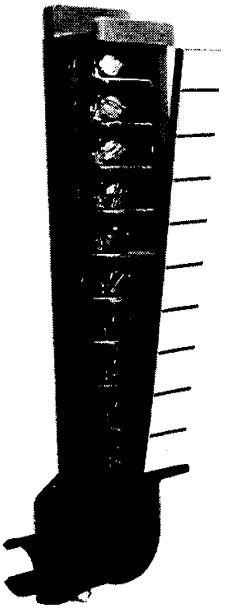
Step 13 — Write terminal numbers on the labels next to the terminal's status indicator and on the terminal cover. These notes aid you during system start-up (chapter 5) and troubleshooting (chapter 6).



Multi-conductor Shielded Cable

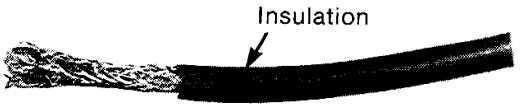
To wire your I/O devices:

Step 1 — Pry the field wiring arm's terminal cover off using a flat-head screwdriver.



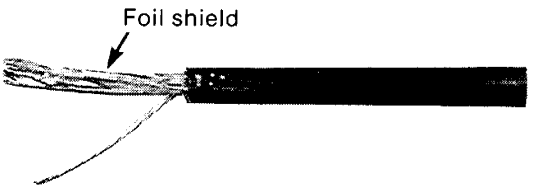
Step 2 — Measure the wire distance from your I/O devices to the field wiring arm terminals. This distance determines the amount of wire you need for your application.

Step 3 — Strip some insulation from the end of the cable that connects to the field wiring arm.

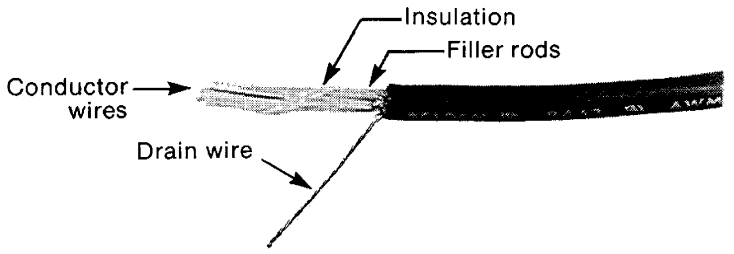


Step 4 — Cut the braided shield.

Step 5 — Remove the foil shield.

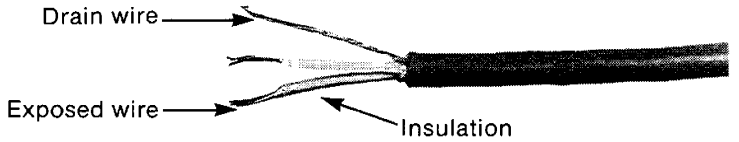


Step 6 — Cut the insulation and filler cords.

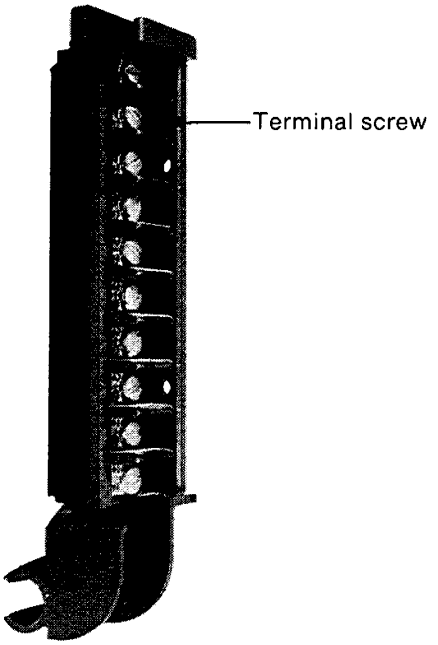


Step 7 — Fold the drain wire back to separate it from the conductor wires.

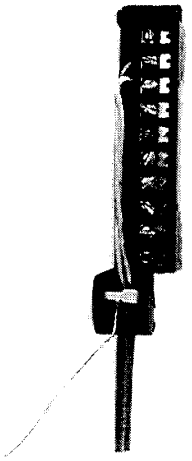
Step 8 — Strip about 3/8 inch insulation to expose the end of the wire.



Step 9 — Loosen a terminal screw and place the wire under the pressure plate of the terminal screw.

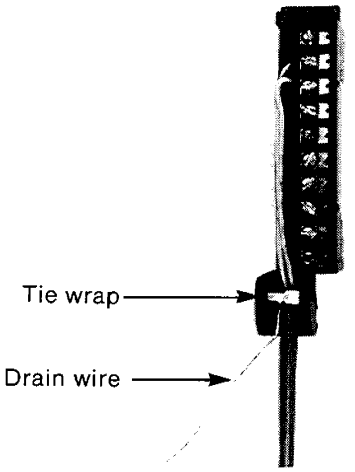


Step 10 — Repeat steps nine and ten until you wire the appropriate I/O devices to the field wiring arm.



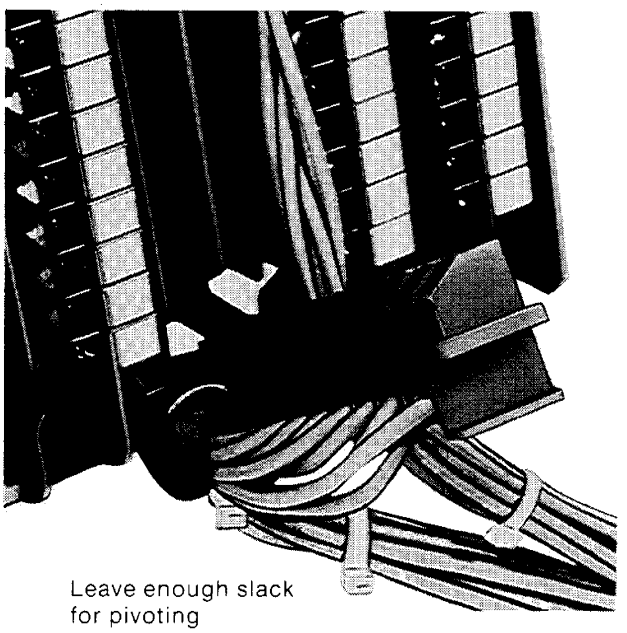
Step 11 — Connect the drain wire to ground.

Step 12 — Gather all of your wires and neatly bundle them using tie wraps.



Step 13 — Label all of your wires with a 5-digit I/O address code at each wire connection. Chapter 5 describes I/O addressing.

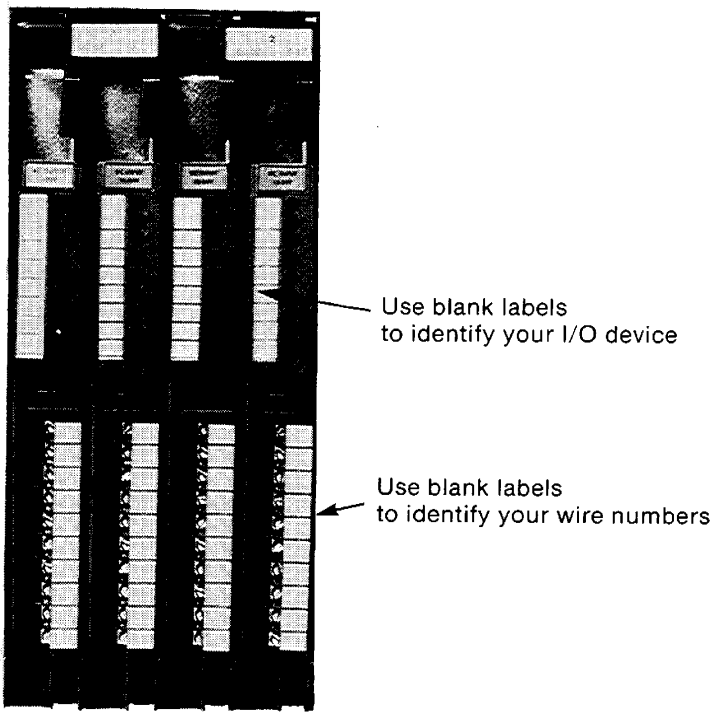
Step 14 — Make sure that the field wiring arm pivots freely from vertical to horizontal.



Leave enough slack for pivoting

Step 15 — Replace the field wiring arm's terminal cover.

Step 16 — Write terminal numbers on the labels next to the terminal's status indicator and on the terminal cover. These notes aid you during system start-up (chapter 5) and troubleshooting (chapter 6).



If your application uses many shielded cables connected to one I/O chassis, then:

- provide a ground bus to connect many wires
- solder several drain wires together at a field wiring arm so you route only one drain

Task 9 Connecting Power to the Processor or Power Supply

You provide the appropriate power cable to connect the 1772-LSP processor or 1771-P3, -P4, -P5 power supplies to their terminal strip. The 1772-LS processor receives its power from the backplane of the I/O chassis.

Connecting the Processor

To connect the wires to the 1772-LSP processor's terminal strip do the following:

Step 1 — Strip 3/8 inch insulation from the end of the wire.

Step 2 — Loosen each terminal screw and place the appropriate wire under the terminal screw (figure 3.16).

Step 3 — Secure each terminal screw.

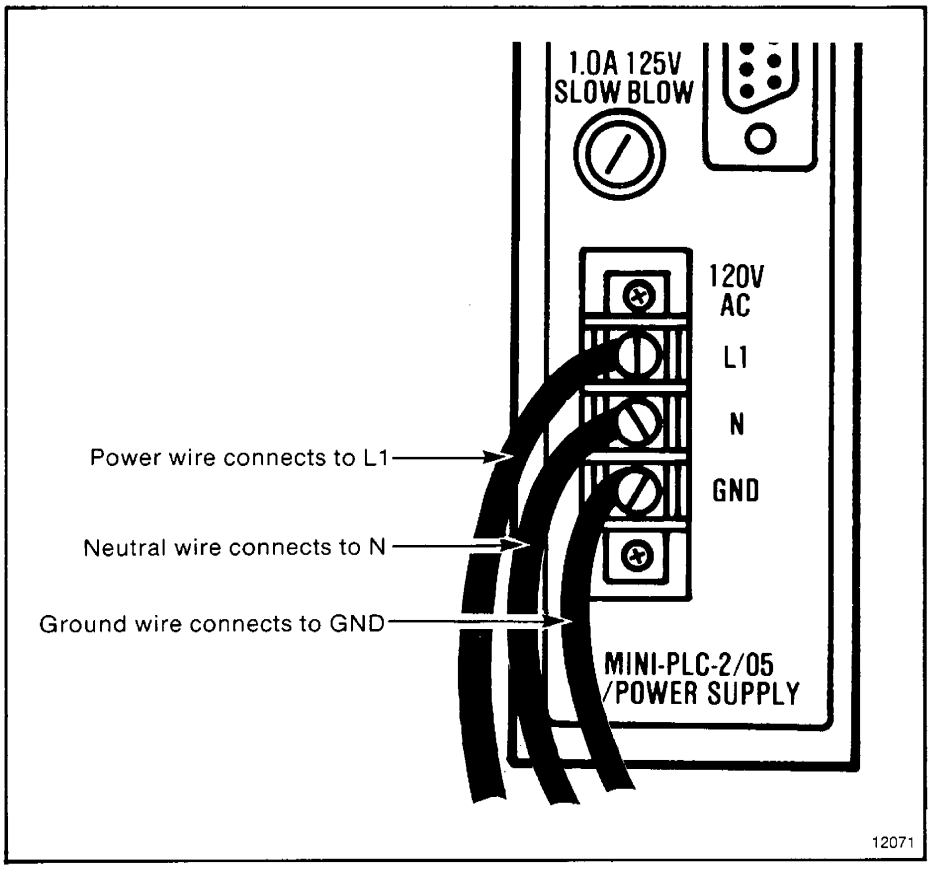


Figure 3.16 — Connect Your Power Cable to the 1772-LSP Processor's Terminal Strip

Connecting an AC Power Supply

To connect the wires to the 1771-P3, -P4 power supplies do the following:

Step 1 — Strip 3/8 inch insulation from the end of the wire.

Step 2 — Loosen each terminal screw and place the appropriate wire under it (figure 3.17).

Step 3 — Secure each terminal screw.

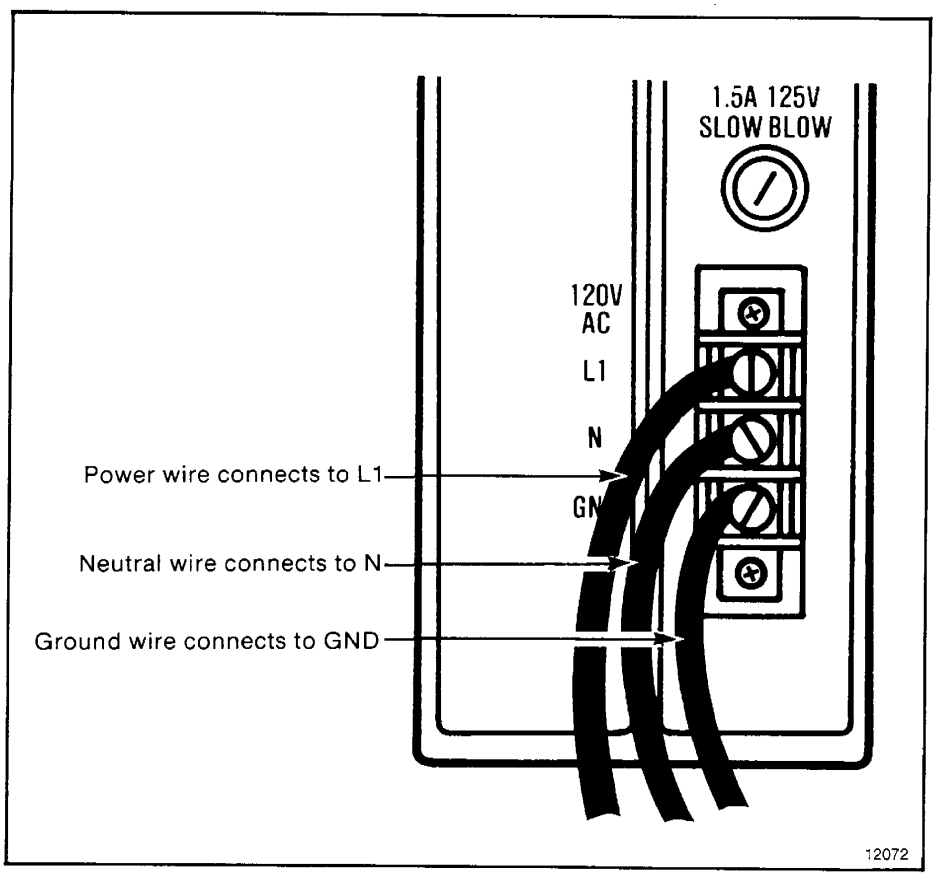


Figure 3.17 — Connect Your Power Cable to the AC Power Supply's Terminal Strip

Connecting a DC Power Supply

To connect the wires to the 1771-P5 power supply's terminal strip do the following:

Step 1 — Strip 3/8 inch insulation from the end of the wire.

Step 2 — Loosen each terminal screw and place the appropriate wire under it (figure 3.18).

Step 3 — Secure each terminal screw.

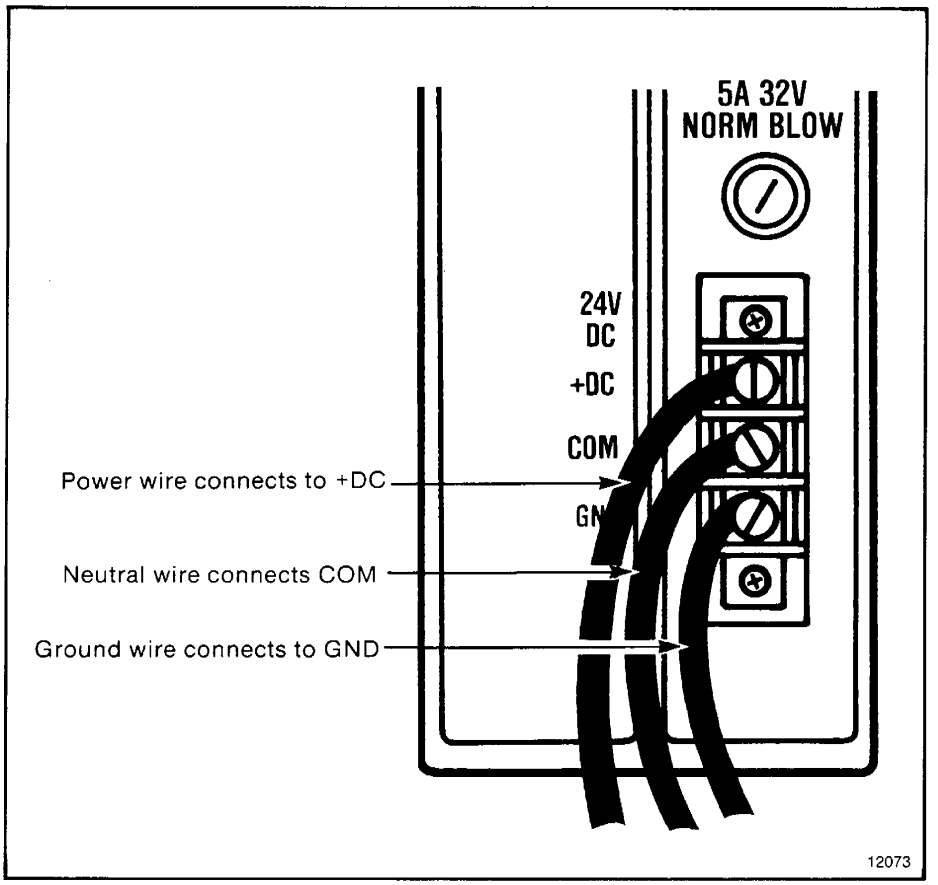


Figure 3.18 — Connect Your Power Cable to the DC Power Supply's Terminal Strip

Connecting More Than One Power Supply

When you use two power supplies (figure 3.19) connect the:

- paralleling cable between each power supply
- incoming power source to the terminal strip of the power supply

To easily remove your I/O modules that are between the two power supplies, place the paralleling cable across the top of the I/O chassis (figure 3.19).

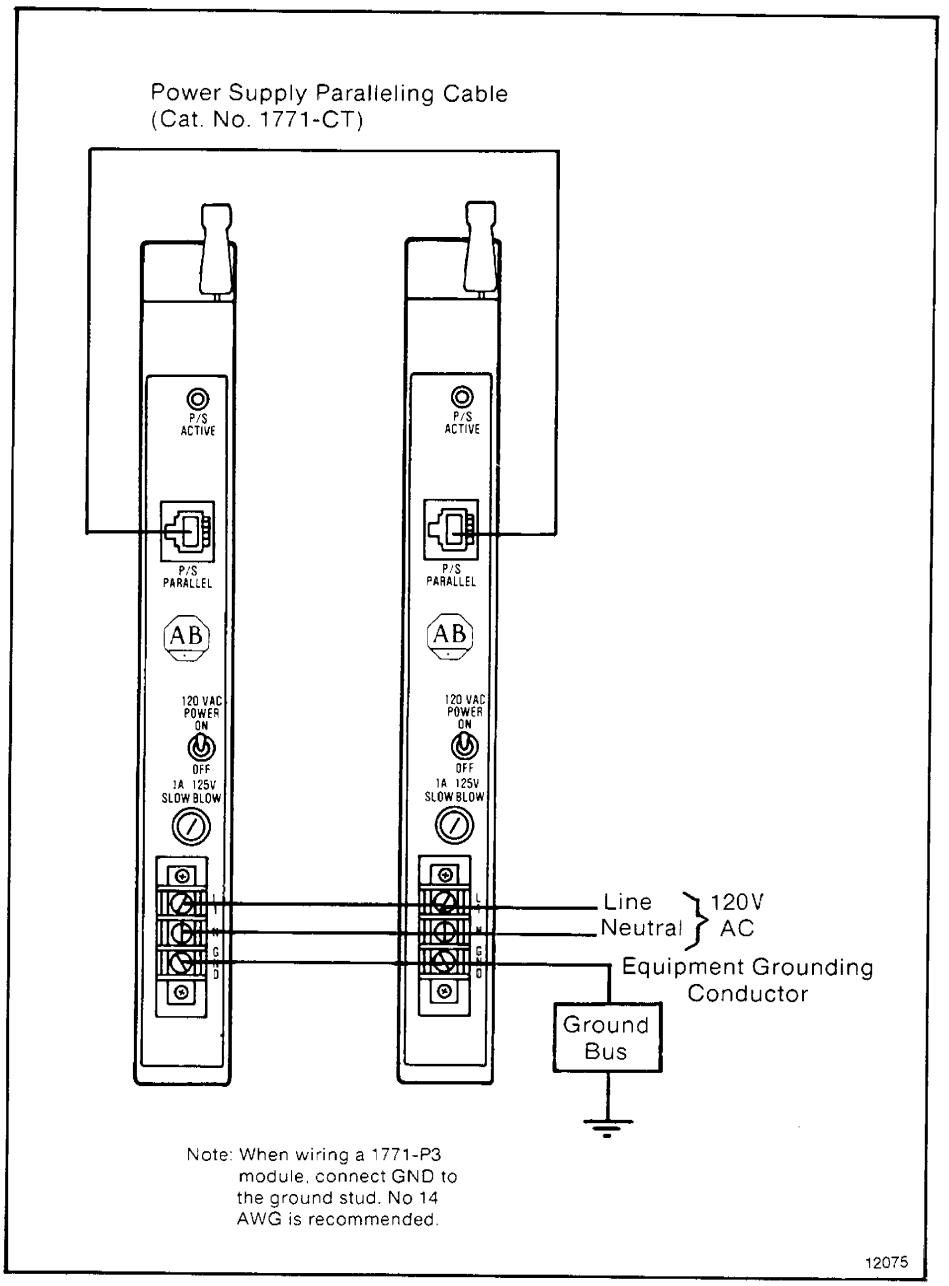


Figure 3.19 — Connecting More than One Power Supply

Task 10 Connecting the Industrial Terminal

To connect your industrial terminal to the processor do the following (figure 3.20):

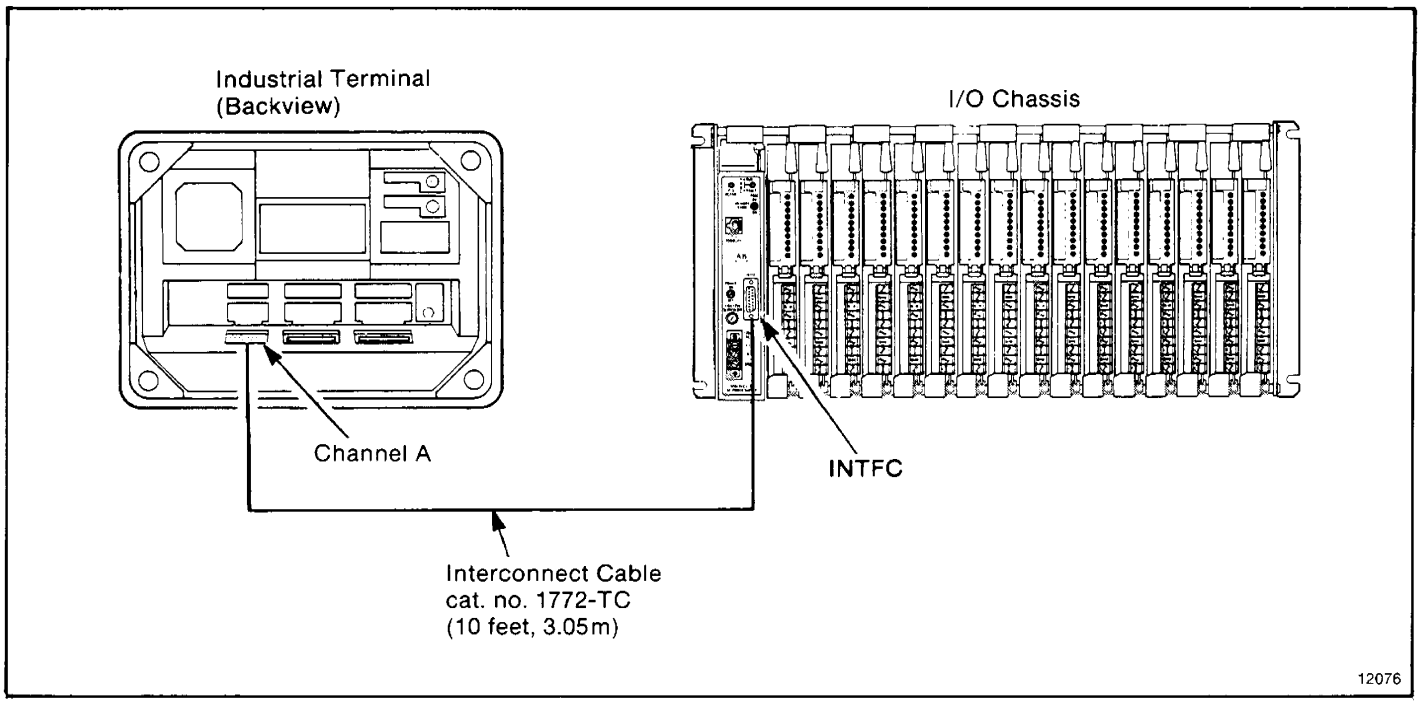


Figure 3.20 — Connecting the Industrial Terminal

Step 1 — Plug the AC power cord into the industrial terminal.

Step 2 — Plug the AC power cord from the industrial terminal into the incoming AC power source.

Step 3 — Connect one end of the PLC-2 program panel interconnect cable to CHANNEL A at the back of the industrial terminal.

Step 4 — Connect the other end of the cable to the socket labeled INTFC at the front of the processor.

Step 5 — Place the PLC-2 family keytop overlay onto the keyboard.

Step 6 — Turn the power switch on the front of the industrial terminal to the ON position.

Step 7 — Press the keys 1 1 on the industrial terminal keyboard.

Step 8 — Select your processor's mode of operation.

If you want this mode of operation:	Then press these keys:
Run/Program	SEARCH 590
Remote Test	SEARCH 591
Remote Program	SEARCH 592

Chapter Summary

In this chapter we described the various tasks you must perform when you install your Mini-PLC-2/05 processor system. In the next chapter, we describe how to install, connect, and replace the EEPROM memory module, battery pack, and battery.

Chapter

4

Installing and Replacing the Processor's Hardware

Chapter Objectives

In this chapter you will read how to:

- install the EEPROM memory module
- connect the battery pack
- replace the processor's battery

Chapter 6 describes troubleshooting your processor system.

How to Install Your EEPROM Memory Module

To install your EEPROM memory module do the following:

If you have a 1772-LSP processor, start at step 1. If you have a 1772-LS processor, start at step 5.

Step 1 - Move the POWER switch to the off position.

Step 2 — Turn off the incoming power source.

Step 3 — Disconnect the power cable from the terminal strip.

Step 4 — Remove the power cable from the processor.

Step 5 — Lift the latch of the I/O chassis that holds your processor.

Step 6 — Slide the processor out of the I/O chassis.

Step 7 — Place the processor on a clean flat surface with the bottom of the module facing you.

Step 8 — Position the EEPROM memory module in the memory module slot with its label facing upward. Insert and press firmly for proper connection (figure 4.1).

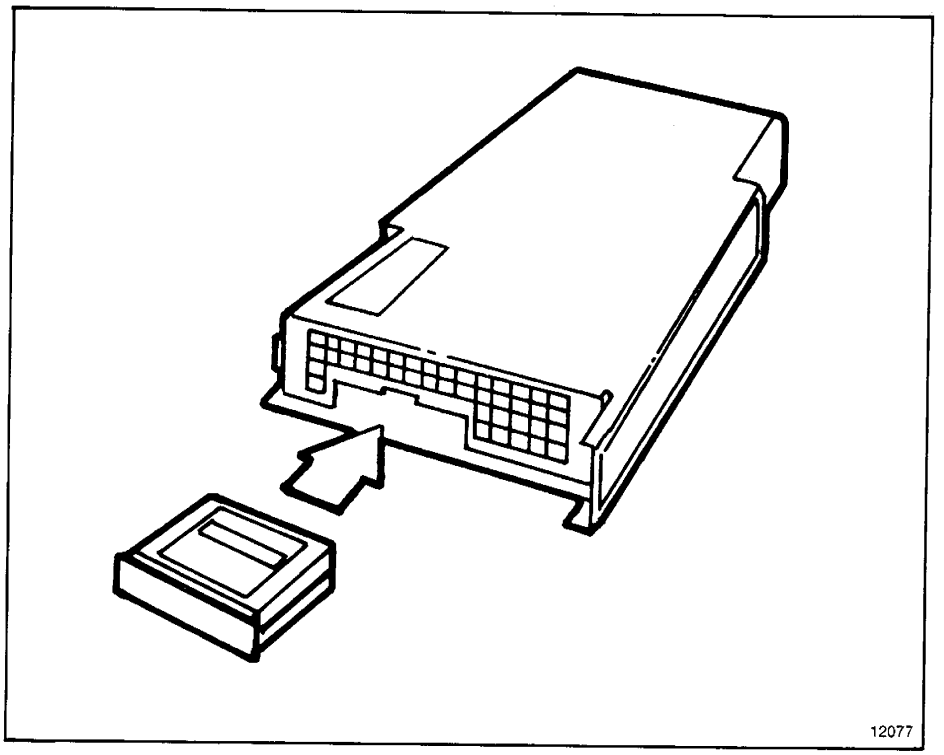


Figure 4.1 — Inserting the EEPROM Memory Module into the Processor

Step 9 — Slide the processor into the I/O chassis.

Step 10 — Secure the I/O chassis latches.

Step 11 — Connect the power cable to the terminal strip.

Step 12 — Apply power to the processor.

How to Remove the EEPROM Memory Module

Repeat steps 1 through 7 given in the previous procedure, then insert a coin into the slot so that it engages the lip on the EEPROM memory module. Carefully rotate the coin upward to start removing the EEPROM memory module from its slot (figure 4.2). Grasp and remove the EEPROM memory module.

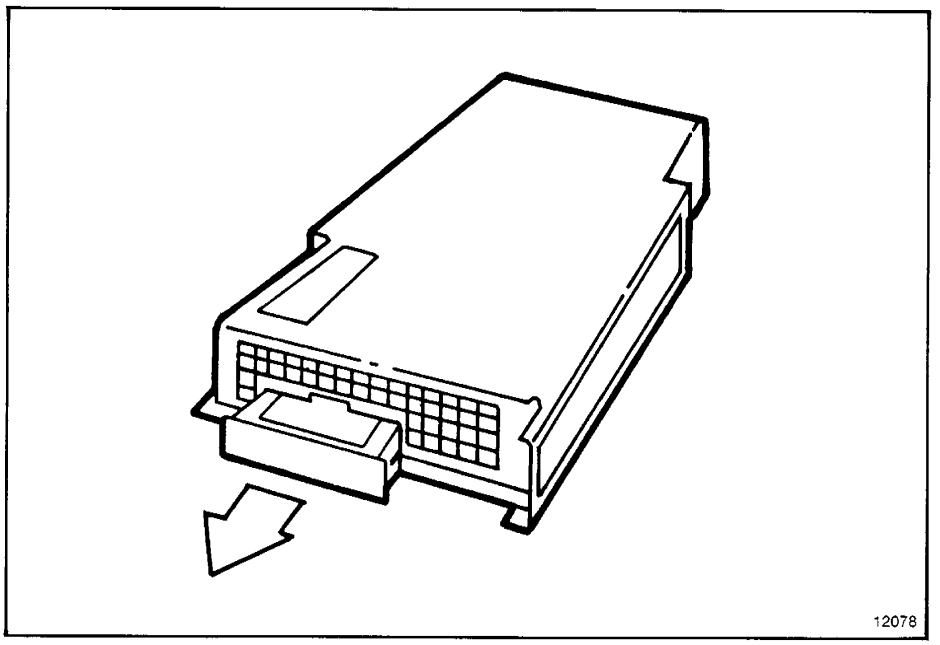


Figure 4.2 — Removing the EEPROM Memory Module from the Processor

How to Connect the Battery Pack

You should connect our battery pack to maintain memory contents when you install a new battery into the processor. To connect the battery pack do the following (figure 4.3):

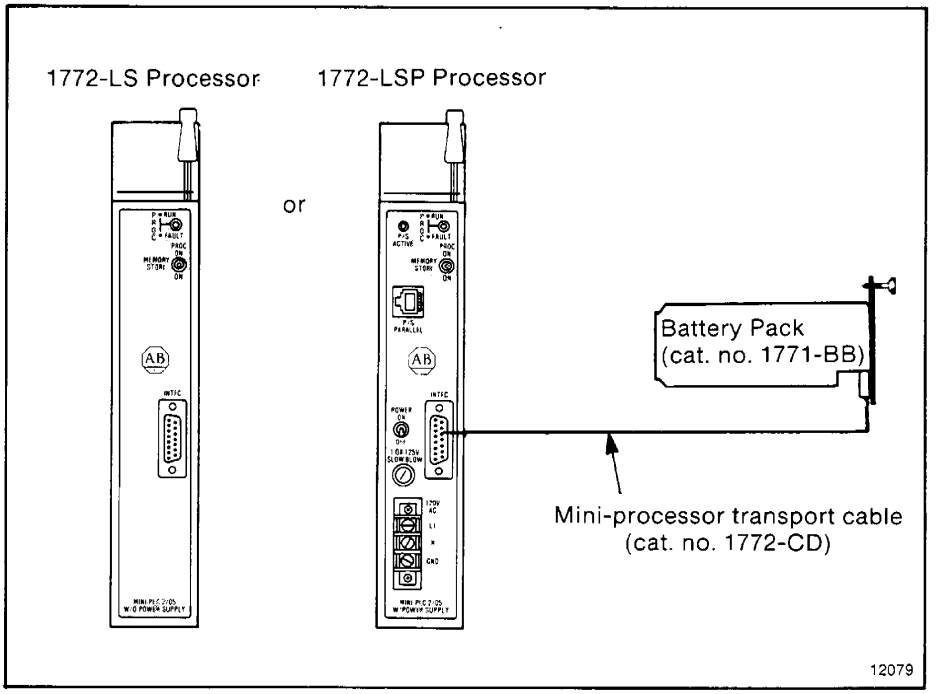


Figure 4.3 — Connect the External Battery Pack when Replacing the Processor's Battery

Step 1 — Connect one end of the mini-processor transport cable to the INTFC port of the processor.

Step 2 — Connect the other end of the cable to the battery pack port.

Step 3 — Remove the processor from the I/O chassis and set the processor and the battery pack onto a flat surface.

Now that the processor's memory contents are maintained, you can replace the battery.

How to Replace the Processor's Battery

Connect the 1771-BB external battery pack before replacing the battery.

The Mini-PLC-2/05 processor is a solid state device. There is virtually no maintenance required for this processor module. However, we recommend that you replace the internal lithium battery every two years.

To install a new battery do the following:

If you have a 1772-LSP processor, start at step 1. If you have a 1772-LS processor, start at step 5.

Step 1 — Move the POWER switch to the off position.

Step 2 — Turn off the incoming power source.

Step 3 — Disconnect the power cable from the terminal strip.

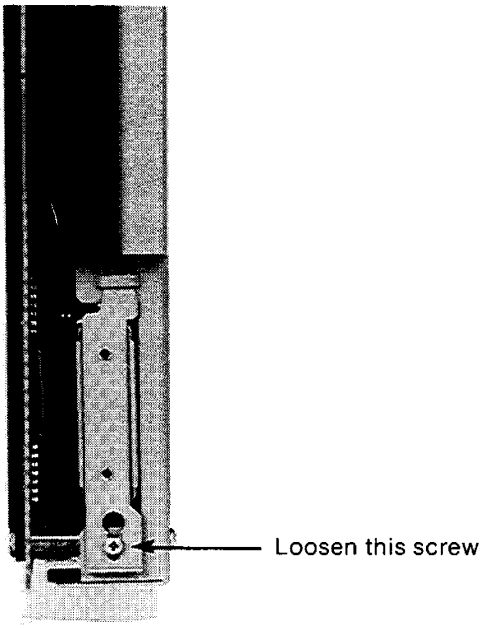
Step 4 — Remove the power cable from the processor.

Step 5 — Lift the I/O chassis latch that holds your processor.

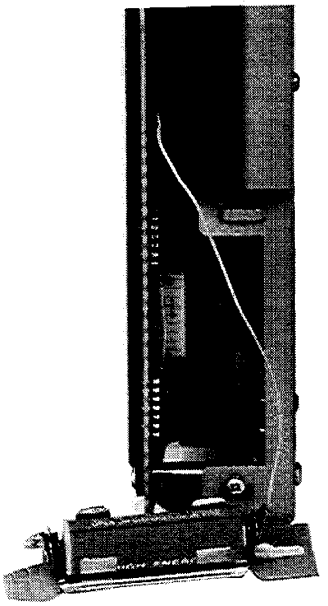
Step 6 — Slide the processor out of the I/O chassis.

Step 7 — Place your processor on a clean flat surface, such as a table.

Step 8 — Loosen the phillips screw that secures the battery holder.



Step 9 — Remove the battery holder from the processor.



Step 10 — Replace the battery in the battery holder. The positive (+) end of the battery should contact the positive (+) end of the battery holder. The negative (-) end of the battery should contact the negative (-) end of the battery holder.

Step 11 — Replace the battery holder.

Step 12 — Secure the screw.

Step 13 — Slide your processor into the I/O chassis.

Step 14 — Snap the I/O chassis latch onto the processor.

Step 15 — Connect the power cable to the terminal strip.

Step 16 — Apply power to the processor.

How to Dispose the Battery

We recommend the following procedures to ensure proper disposal of the processor's battery:

- Do not incinerate or expose the battery to high temperatures.
- Do not attempt to solder the battery or leads. An explosion could result.
- Do not open, puncture, crush, or mutilate the battery. A possibility of an explosion exists and/or toxic, corrosive, and flammable chemicals would be exposed.
- Do not charge the battery. An explosion could result or the cell could overheat causing burns.
- Do not short positive or negative terminals together. The battery will heat up.

Chapter Summary

Now that you read how to install and replace the Mini-PLC-2/05 processor's hardware, you're ready to start-up your processor system. We describe start-up in the next chapter.

Chapter

5

System Start-Up

Chapter Objectives

In this chapter you will read how to:

- document your Mini-PLC-2/05 processor system
- check the operation of the Mini-PLC-2/05 processor before you supply AC power
- test your output devices
- test your input devices
- test the operation of your ladder diagram program

Chapter 6 describes troubleshooting.

Author's Conventions

Conventions used in this chapter are:

Words enclosed in:	Indicate:
[ ]	key name, key symbol, or group of key symbols
< >	variable information you must provide, such as an instruction address

If you do not understand how to operate the industrial terminal to program your processor, refer to the Mini-PLC-2/05 Processor Programming and Operations Manual (publication 1772-6.8.6).

Verify Your System's Addresses

Verify your I/O devices and field wiring arms wire numbers using the Connection Diagram Addressing Worksheet (publication 5039). These worksheets are available upon request from your local Allen-Bradley distributor or sales engineer. Figure 5.1 shows a modified worksheet form.

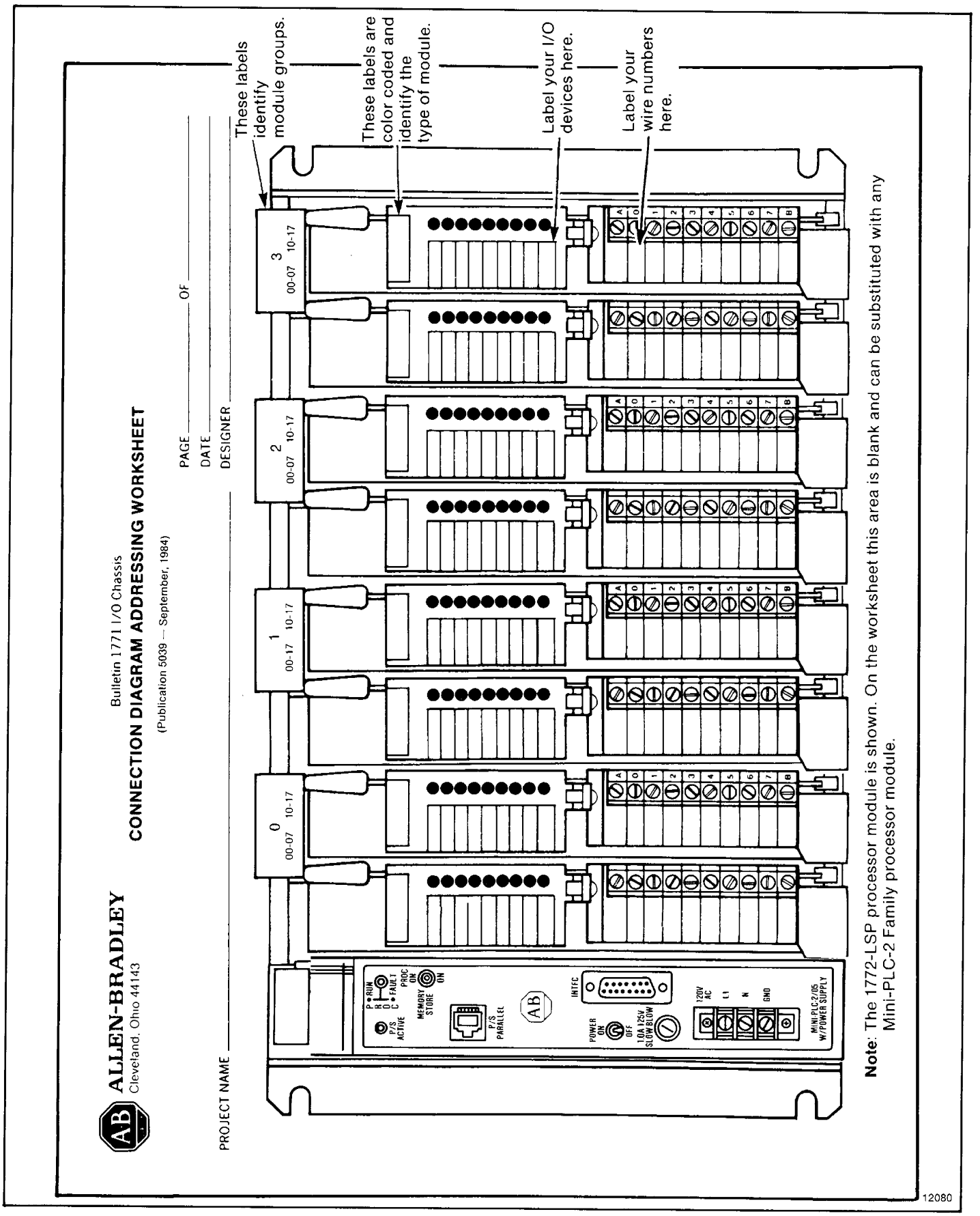


Figure 5.1 — Complete This Worksheet So Troubleshooting Will Be Easy

Status Indicators for I/O Modules

Most I/O modules have status indicators on the front panel. Each indicator corresponds with a terminal on the I/O module's field wiring arm (figure 5.2). These indicators on output modules light when the appropriate bit in memory is on. Status indicators on input modules light when the appropriate input device is on.

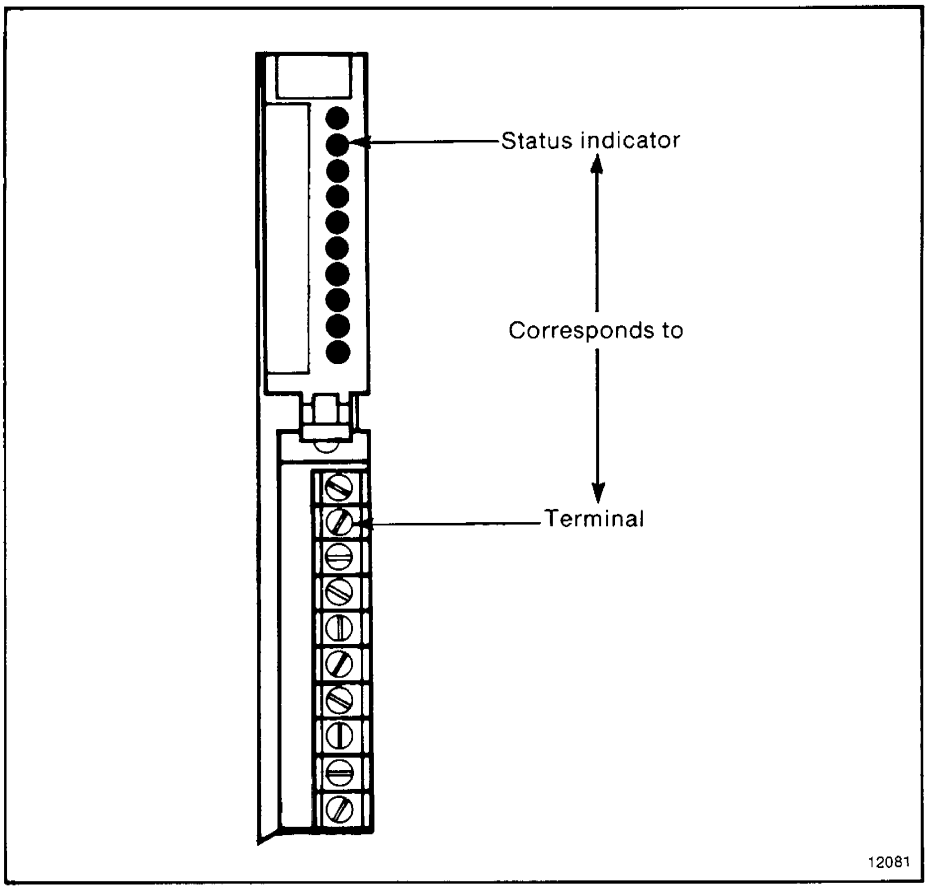


Figure 5.2 — Each I/O Module's Status Indicator Corresponds to the Field Wiring Arm's Terminal

Status indicators for the I/O modules help to isolate the source of a fault in your hardware. A hardware fault can originate from:

- improper I/O device operation
- wiring error
- loss of power from the I/O devices

The user's manual or product data for each I/O module explains the operation of the module's status indicators.

Module Group and Terminal Numbers

We number module groups in an I/O chassis from left to right. The first pair of slots is module group 0, the second pair is module group 1, and so on. Module group numbering for the three I/O chassis sizes is (figure 5.3):

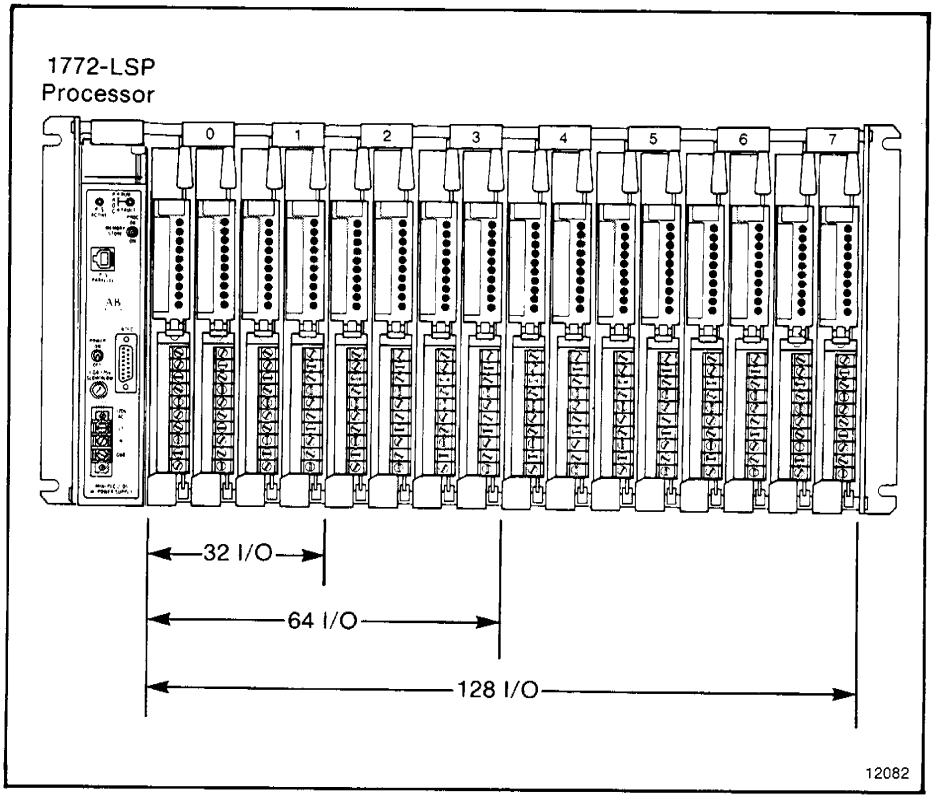


Figure 5.3 — I/O Chassis Expansion for Module Group Numbering

Size of I/O Chassis	Has	And are numbered
32	2 module groups	0 and 1
64	4 module groups	0 thru 3
128	8 module groups	0 thru 7

An I/O module group can contain either two single slot I/O modules or one dual-slot I/O module. Each module group generally contains 16 I/O terminal points. This organization parallels the 16 bit structure in the processor's memory (figure 5.4). Refer to the Mini-PLC-2/05 Controller Programming and Operations Manual (publication 1772-6.8.6) for additional information on processor memory organization.

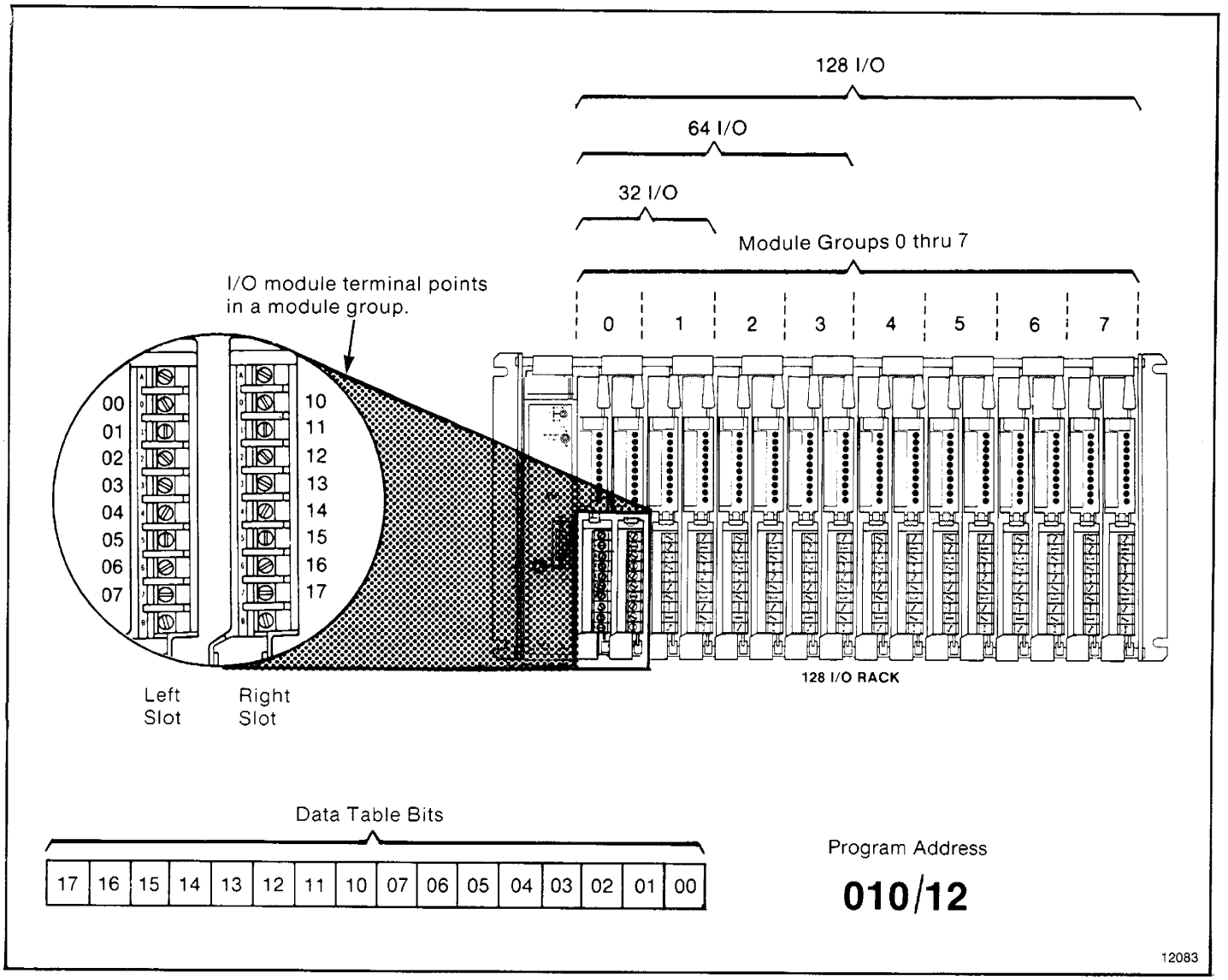


Figure 5.4 — Module Group and Terminal Numbers' Relationship to Your Program Address

The arrangement of I/O modules within a module group does not imply that both modules be the same the type, have the same voltage range, or AC or DC voltage. Module group designation is for the purpose of addressing inputs and/or outputs in your application program. However, for ease of addressing, we recommend that similar I/O modules be grouped together.

Addressing Your Hardware

You must properly address your hardware so that it relates to your ladder diagram program.

In the ladder diagram program, the input or output instruction address is associated with a particular I/O terminal and identified by a 5-digit address (figure 5.5).

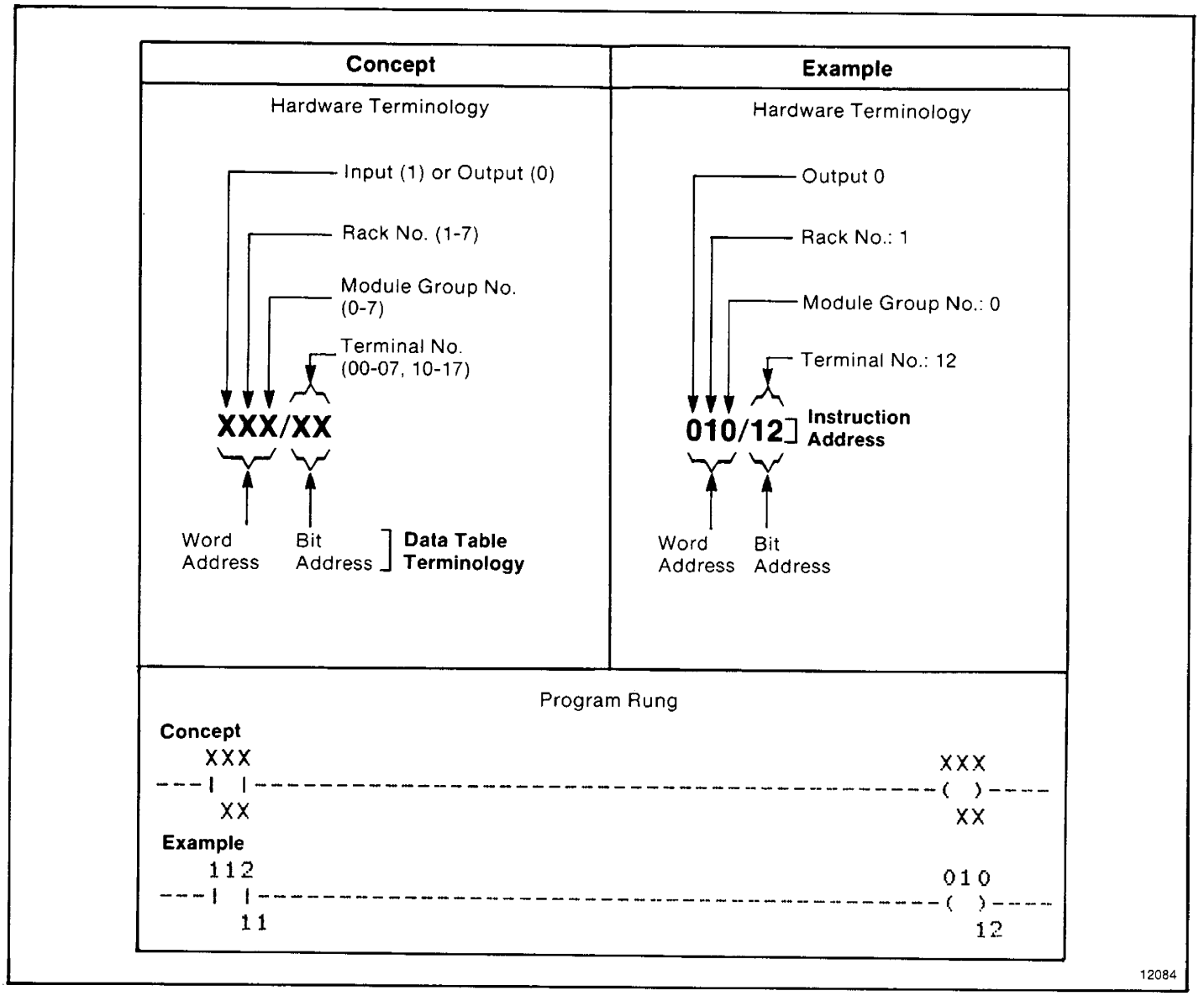


Figure 5.5 — Hardware Terminology Translated Into a Program Rung

Reading from left to right the:

- first number denotes the type of module:
  - 0 output
  - 1 input
- second number denotes the I/O chassis number and is always a one.
- third number denotes a module group (0 thru 7)
- fourth and fifth numbers denote a terminal point designation:
  - 00 thru 07 left slot of the module group
  - 10 thru 17 right slot of the module group

Before You Supply AC Power

> **WARNING:** Machine motion during system start-up can be hazardous to personnel. Disconnect any device that might cause machine motion to occur when it is energized.

Before you supply AC power to your processor do the following:

Step 1 — Measure the AC line voltage and make sure it corresponds to the system power supply.

Step 2 — Check wiring of:

- main disconnect switch or circuit breaker
- master control relay
- emergency stop switches

Step 3 — Check the power cable connections. Make sure plugs are securely held on their sockets.

Step 4 — Check the location and chassis positioning of each I/O module. All I/O chassis latches must be snapped down. All field wiring arms must be connected with their corresponding I/O modules.

Step 5 — Disconnect all motors to ensure that no power-driven machine can start when you first apply power to the processor; or disconnect the output device at its terminal strip.

Testing Output Devices

There are two ways to test output devices, using:

- a pushbutton (you supply the pushbutton)
- force functions (through the industrial terminal)

If you are unfamiliar with the industrial terminal, refer to the Mini-PLC-2/05 Processor Programming and Operations Manual (publication 1772-6.8.6).

Using Pushbuttons

CAUTION: Use only trained personnel to conduct this test. Have a trained person at appropriate emergency stop switches to de-energize output devices that could cause hazardous operation.

To test your output devices while using a pushbutton do the following:

Step 1 — Connect a normally-open/momentary-close pushbutton as an input device to an input module.

Step 2 — Connect the industrial terminal to your processor. Refer to chapter 3 for the procedure.

Step 3 — Press [SEARCH] 591 to select the test mode of operation.

Step 4 — Use an examine-on address corresponding to the address of the pushbutton. Use an energize address corresponding to the output device being tested. For example, enter a rung similar to this one:

```
! 111                                                  014   !
+-] [-------------------------------------------------(  )--+
!    14                                                 00   !
```

CAUTION: Test only one rung at a time. **Do not** program multiple rungs, unpredictable machine operation can occur.

Step 5 — Close the pushbutton and observe the following:

- output address instruction is intensified
- output module's status indicator lights

Address of the pushbutton

Address of your output device

```
! 111                                                  014   !
+-] [-------------------------------------------------(  )--+
!    14                                                 00   !
```

Step 6 — If the indicator does not light or the instruction does not intensify, then check the:

- processor
- output module

If there are no failures, then:

- repeat the test procedure
- call your Allen-Bradley sales engineer or distributor

Using Force Functions

Force functions are troubleshooting aids available when you use the industrial terminal.

There are two types of force functions:

- force on
- force off

You can use the force functions to selectively force an input bit or output terminal on or off. The processor must be operating in the remote test or run/program mode.

The on or off status of a forced bit appears beneath the bit instruction in the rung.

In all processor modes, a "FORCED I/O" message is displayed near the bottom of the screen when bits are forced on or off. In every mode except the program mode, the forced status "ON" or "OFF" is displayed below each forced instruction.

What Does the Force Functions Determine?

The force functions determine the on/off status of input bits and output terminals by overriding the I/O scan. You can force an input bit on or off regardless of the actual state of the corresponding input device. However, forcing an output terminal causes the corresponding output device to be on or off regardless of the rung logic or the status of the output image table bit.

When in remote test mode, the processor holds outputs in their last state regardless of attempts to force them on, even though the instruction address of the output bit is intensified on the CRT screen.

How to Use Force Functions

You can use force functions in either of two ways using:

- bit manipulation/monitor display of an I/O word
- ladder diagram display of user program

By pressing [SEARCH] 53 <key sequence of address>, on the industrial terminal, you can display the bit status and force status of the 16 corresponding input bits or output terminals of the desired word. Use the [→] and [←] key to cursor to the desired bit. Or, in the ladder diagram display, forcing can be applied by placing the cursor on an examine or energize instruction. In either case, after positioning the cursor, you can use any one of the following key sequences for inserting or removing a forced condition:

[FORCE ON][INSERT]

[FORCE OFF][INSERT]

[FORCE ON][REMOVE]

[FORCE OFF][REMOVE]

How to Remove Force Functions

You can remove all force on or force off functions at once ladder by pressing either of the following key sequences:

[FORCE ON][CLEAR MEMORY]

[FORCE OFF][CLEAR MEMORY]

How to Clear Force Functions

All force functions are cleared from the industrial terminal when:

- you disconnect the power cable or communications cable of the industrial terminal or processor
- you turn off the industrial terminal
- there is a power failure that shuts down the power supply that powers the processor.
- you press [MODE SELECT]

WARNING: Keep personnel away from the machine area when an energized output is being forced off. Accidental removal of force functions will instantly turn on the output device. Injury to personnel near the machine could result.

How to Display all Bit Addresses

The industrial terminal displays a complete list of bit addresses that are forced on or off when you press:

[SEARCH][FORCE ON]

[SEARCH][FORCE OFF]

If all the bits forced on or off cannot be displayed at one time, use the [SHIFT][↑] and [SHIFT][↓] keys to display additional forced bits.

Press [CANCEL COMMAND] to terminate the display.

How to Test with Force Functions

> **CAUTION:** Use only trained personnel to conduct this test. Have a trained person at appropriate emergency stop switches to de-energize output devices that could cause hazardous operation.

To test your output devices using force functions do the following:

Step 1 — Connect the industrial terminal to your processor. Refer to chapter 3 for the procedure.

Step 2 — Load your program into the industrial terminal.

Step 3 — Press [SEARCH] 591 to select the test mode of operation.

Step 4 — Position the cursor on the first output instruction.

Step 5 — Press [SELECT] [FORCE ON] [INSERT].

Step 6 — Make sure that the output module's status indicator lights. If the indicator does not light then check the:

- power source for the output device
- fuse on the output module

If there are no failures, then:

- repeat the test procedure
- call your Allen-Bradley sales engineer or distributor

Step 7 — Repeat steps five and six until you test all output devices.

During the next procedure, you will test input devices.

Testing Input Devices

> **CAUTION:** Use only trained personnel to conduct this test. Have a trained person at appropriate emergency stop switches to de-energize output devices that could cause hazardous operation.

To test your input devices ,using force functions, do the following:

> **WARNING: Do not** reach into a machine to actuate a switch since unexpected machine motion can occur. Use a wooden stock or other non-conductive device to guard against electrical shock.

Step 1 — Manually turn on one input device.

Step 2 — Make sure that the input module's status indicator lights. If the indicator does not light, check:

- power source for the input device
- wiring from the input device
- connection to the field wiring arm's terminal
- input device
- verify the address of the input device
- input terminal
- address of input device

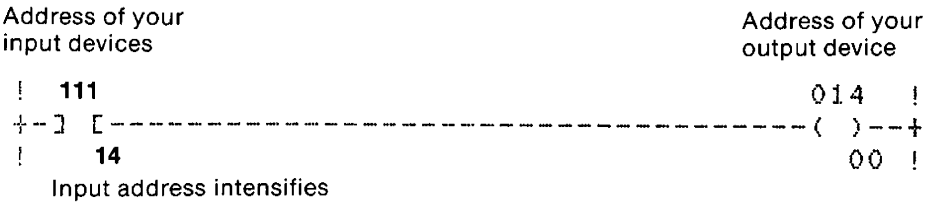
Step 3 — Connect the industrial terminal to your processor (refer to chapter 3).

Step 4 — Press [SEARCH] 591 to select the test mode of operation.

Step 5 — Use an examine-on address corresponding to your input device address. Use an address that is an internal storage bit. For example, enter a rung similar to this one:

Step 6 — Manually turn on one input device and observe:

- input instruction is intensified
- input module's status indicator lights



Step 7 — If the instruction does not intensify, then:

- repeat the test procedure
- check your input module
- call your Allen-Bradley sales engineer or distributor

Testing Your Program

This is the last phase of testing needed to help ensure proper start-up.

> **CAUTION:** Use only trained personnel to conduct this test. Have a trained person at appropriate emergency stop switches to de-energize output devices that could cause hazardous operation.

To test your program do the following:

Step 1 — Connect the industrial terminal to your processor (refer to chapter 3).

Step 2 — Press [SEARCH] 590 to select the run/program mode of operation.

Step 3 — Enter your program.

Step 4 — Press [SEARCH] 591 to select the remote test mode of operation.

Step 5 — Examine your entered program—making sure that no output device energizes unconditionally.

Step 6 — Restore the connection from an output module to a single device which causes machine motion.

Step 7 — Check the behavior of the connected output device. To do this, simulate the input conditions necessary to energize the output in the program while the processor is in the run/program mode of operation.

Step 8 — Disconnect the output device.

Step 9 — Restore the connection from an output module to the next single output device to be tested.

Step 10 — Repeat steps seven through nine until you test all outputs.

Step 11 — Restore the connection from output modules to all devices causing machine motion. Restore power to any machine that you disconnected for start-up.

Step 12 — Perform a first run of your processor program with all output devices enabled.

Chapter Summary

In this chapter we described how to test input devices, output devices, and your program. If you follow our procedures, you will be able to have a successful processor system start-up. Should problems develop, you'll have to troubleshoot your Mini-PLC-2/05 system. This is covered in the next chapter.

Chapter

6

Troubleshooting Your Processor System

Chapter Objectives

In this chapter you will read:

- how to troubleshoot your system
- troubleshooting aids for each Mini-PLC 2/05 processor

How to Troubleshoot Your System

To make your job troubleshooting the Mini-PLC-2/05 easier, be sure you:

- have followed instructions on mounting (chapter 3), wiring (chapter 3), and addressing (chapter 5)
- can interpret the meanings of status indicators (chapter 2 or individual I/O module's product data publications)

Troubleshooting Aids

Table 6.A lists symptoms, possible causes, and recommended action to correct.

Table 6.A
Troubleshooting Guide

Symptom	Possible Cause	Recommended Action
Processor's memory contents will transfer to the EEPROM memory module.	Backplane switch assembly is not set correctly.	Set backplane switch assembly. Refer to chapter 3.
Loss of processor's memory contents after a power failure.	Processor's battery is dead.	Replace processor's battery. Refer to chapter 4.
PROC RUN/FAULT indicator turns red.	There is a processor fault or the watchdog timer timed out.	• Cycle power to reset the processor. • Cycle power to reset the processor. • If the industrial terminal shows a run time error, correct the run time error. Refer to the Mini-PLC-2/05 Processor Programming and Operations Manual.
P/S ACTIVE indicator is off.	You did not connect an external power source.	Connect an external power source.
	POWER switch is defective.	Call your Allen-Bradley sales engineer or distributor.
	The 1772-LSP processor's terminal strip is not wired properly.	Wire the terminal strip properly. Refer to chapter 3.
	Power supply defective.	Call your Allen-Bradley sales-engineer or distributor.
	Fuse blown	Replace the fuse.
	AC or DC power is not available.	Provide AC or DC power.
	One or both power supplies are off.	Turn both POWER switches off at the same time, wait 15 seconds, then, turn both switches on at the same time.
	I/O modules current requirements is too large for power supply.	Measure the backplane current (1771-A1, -A2,, -A4); maximum current rating is 6.5 amps. Remove I/O modules until rating is within specification.
	Incoming AC power is not within specification.	Measure line voltage; its specification is: 97 to 132V AC.
	Power supply defective.	Call your Allen-Bradley sales engineer or distributor.
Output device did not turn on or off.	Improper wiring of field wiring arms and/or output devices.	Wire field wiring arms or output device properly. Refer to chapter 3.
	Program error	Verify all program rungs. Verify all instructions for their proper use.

Chapter Summary

If you have followed the installation and assembly procedures in earlier chapters, you'll have minimized the need to troubleshoot your Mini-PLC-2/05 system. However, should troubleshooting become necessary, the material in this chapter can help you diagnose and correct the fault.

Appendix

A

Glossary

This glossary defines terms pertaining to Allen-Bradley Mini-PLC-2/05 processors. For a broader glossary of programmable controller (PC) words, contact Allen-Bradley sales engineer or distributor for publication SD60.

AC Input Module: An I/O module that converts various AC signals originating at user devices to the appropriate logic level signal for use within the processor.

AC Output Module: An I/O module that converts the logic level signal of the processor to a usable output signal to control a user AC device.

Accumulated Value: The number of elapsed timed intervals or counted events.

Active: A diagnostic indicator on Allen-Bradley PC hardware that, when lit, signifies an operational condition.

Analog Input Module: A module that converts an analog input signal to a number that can be manipulated by the processor.

Analog Output Module: A module that outputs a signal proportional to a number transferred to the module from the processor.

Application: 1) A machine or process monitored and controlled by a PC. 2) The use of computer- or processor-based routines for specific purposes.

Arithmetic Capability: The ability to do addition, subtraction, multiplication, division, and other advanced math functions with the PC processor.

AWG: See American Wire Gauge.

Backplane: A printed circuit board, located in the back of a chassis, that contains a data bus, power bus, or mating connectors for modules to be inserted in the chassis.

Battery Backup: A battery or set of batteries that will provide power to processor memory only in case of a system power outage.

BCD: See Binary Coded Decimal.

Binary Coded Decimal (BCD): A numbering system used to express individual decimal digits (0 through 9) in four-bit binary notation.

Binary Word: A related group of ones and zeros that has meaning assigned by position, or by numerical value in the binary system of numbers.

Bit: Binary digit. The smallest unit of information in the binary numbering system. Represented by the digits 0 and 1. The smallest division of a PC word.

Byte: Equals eight consecutive bits.

Chassis: A hardware assembly used to house PC devices such as I/O modules, adapter modules, processor modules, power supplies, and processors.

CMOS: Complementary Metal Oxide Semiconductor circuitry. See MOS.

Data Highway: A baseband, half-duplex communications link that provides data communications between multiple stations such as PCs, computers, and data terminals. Data Highway is a registered trademark of the Allen-Bradley Company.

Decimal: Pertains to the base-10 numbering system.

EEPROM: Electrically Erasable PROM. A type of PROM that is programmed and erased by electrical pulses.

Environment: In a systems context, the environment is anything that is not a part of the system itself. Knowledge about the environment is important because of the affect it can have on the system or because of possible interactions between the system and the environment.

Force Off Function: A feature which allows the user to reset an input image table bit or de-energize an output, independent of the PC program.

Force On Function: A feature which allows the user to set an image table bit or energize an output, independent of the PC program.

Hard Contacts: Any type of physical switch contacts.

Hard Copy: Any form of a printed document such as a ladder diagram program listing, paper tape, or punched cards.

Hardware: The mechanical, electrical, and electronic devices that make up a programmable controller and its application.

Input Devices: Devices such as limit switches, pressure switches, push buttons, analog and/or digital devices, that supply data to a programmable controller.

Intelligent I/O Module: Microprocessor-based modules that perform processing or sophisticated closed-loop, application functions.

I/O: Input/Output.

I/O Chassis: See chassis.

I/O Module: A device that interfaces between the user devices and the PC.

I/O Rack: See rack.

Keying: Keying bands installed on backplane connectors to ensure that only one type of module can be inserted into a keyed connector.

Master Control Relay (MCR): A mandatory hardwired relay that can be de-energized by any series-connected emergency stop switch. Whenever the master control relay is de-energized, its contacts open to de-energize all application I/O devices.

MOS: Metal Oxide Semiconductor. A semiconductor device in which an electric field controls the conductance of a channel under a metal electrode called a gate.

Mode: A selected method of operation. Example: run, test, or program.

Module: An interchangable, plug-in item containing electronic components.

Module Addressing: A method of identifying the I/O modules installed in a chassis.

Module Group: Adjacent I/O modules which relate 16-I/O terminals to a single 16-bit image table word.

Module Slot: A location for installing an I/O module.

NEMA Standards: Consensus standards for electrical equipment approved by the members of the National Electrical Manufacturers Association (NEMA).

NEMA Type 12: A category of industrial enclosures intended for indoor use to provide a degree of protection against dust, falling dirt, and dripping non-corrosive liquids. They do not provide protection against conditions such as internal condensation.

Noise: Unwanted disturbances imposed upon a signal that tend to obscure its data content.

Output Devices: Devices such as solenoids and motor starters that receive data from the programmable controller.

PC: See Programmable Controller.

Peripheral Equipment: Units which communicate with the programmable controller, but are not part of the programmable controller. Example: a programming device or computer.

Port: A connection point on a processor or peripheral device.

PR: See Preset Value.

Preset Value (PR): The number of time intervals or events to be counted.

Processor: The decision making data and storage sections of a PC.

Programmable Controller: A solid-state control system which has a user-programmable memory for storage of instructions to implement specific functions such as I/O control, logic, timing, counting, report generation, Data Highway communication, arithmetic, data and file manipulation. A PC consists of a central processor, input/output interface, and memory. A PC is designed as an industrial control system.

Rack: An addressing concept equivalent to 128 discrete I/O.

RAM: Random Access Memory. The type of memory in which data access is independent of the data most recently accessed.

Remote I/O PC: A PC system where some or all of the I/O racks are remotely mounted from the PC. The location of remote I/O racks from the PC may vary depending on the application and the PC used. Also see Local I/O PC.

Remote Mode Selection: A feature which allows the user to select or change processor modes of operation with a peripheral device from a remote location.

Remote Programming: A method of performing PC programming by connecting the programming device to the network rather than to the PC.

Report Generation: The printing or displaying of user-formatted application data by means of a data terminal. Report generation can be initiated by means of either a user program or a data terminal keyboard.

ROM: Read Only Memory. A type of memory with data content that cannot be changed or is changed infrequently. In use, bits and words are read on demand, but not changed.

Suppression Device: A unit that attenuates the magnitude of electrical noise.

System: A set of one or more PCs, I/O devices and modules, computers, the associated software, peripherals, terminals, and communication networks, that together, provide a means of performing information processing for controlling machines or processes.

Watchdog Timer: A timer that monitors logic circuits controlling the processor. If the watchdog timer is not in its programmed time period, it will cause the processor to fault.

Word: A grouping or a number of bits in a sequence that is treated as a unit.

Word Length: The number of bits in a word. In PC, these are generally only data bits. One PC word = 16 data bits.

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ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

Programmable Controller Division
747 Alpha Drive, Cleveland, Ohio 44143

Publication 1772-6.6.6 — October, 1984

P/N 955095-32