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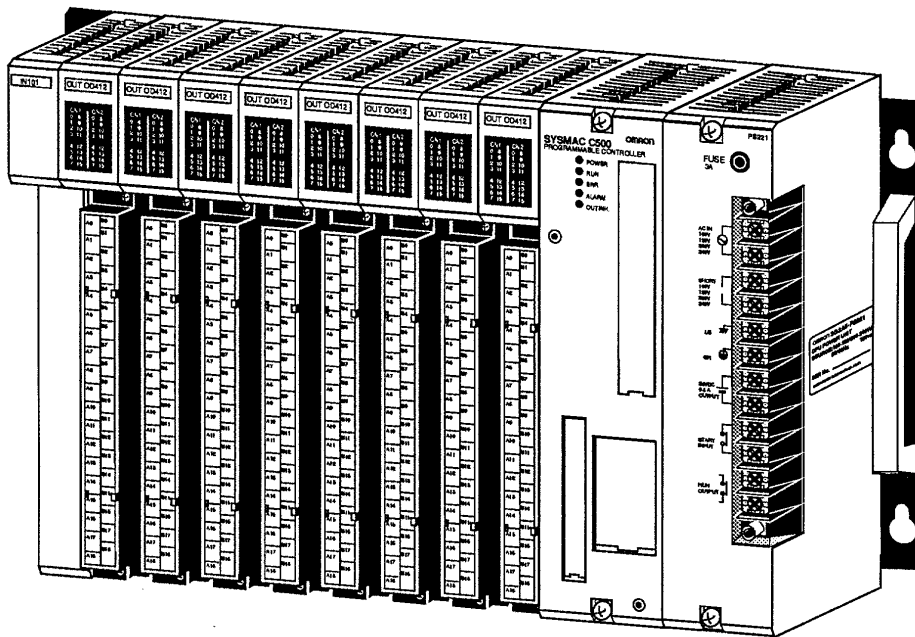
Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



C500 Programmable Controller

Installation Guide

Revised May 2000



Notice:

OMRON products are manufactured for use according to proper procedures by a qualified operator and only for the purposes described in this manual.

The following conventions are used to indicate and classify precautions in this manual. Always heed the information provided with them. Failure to heed precautions can result in injury to people or damage to the product.



DANGER

Indicates information that, if not heeded, is likely to result in loss of life or serious injury.



WARNING

Indicates information that, if not heeded, could possibly result in loss of life or serious injury.



Caution

Indicates information that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation.

OMRON Product References

All OMRON products are capitalized in this manual. The word “Unit” is also capitalized when it refers to an OMRON product, regardless of whether or not it appears in the proper name of the product.

The abbreviation “Ch,” which appears in some displays and on some OMRON products, often means “word” and is abbreviated “Wd” in documentation in this sense.

The abbreviation “PC” means Programmable Controller and is not used as an abbreviation for anything else.

Visual Aids

The following headings appear in the left column of the manual to help you locate different types of information.

Note Indicates information of particular interest for efficient and convenient operation of the product.

1, 2, 3... 1. Indicates lists of one sort or another, such as procedures, checklists, etc.

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No patent liability is assumed with respect to the use of the information contained herein. Moreover, because OMRON is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, OMRON assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

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About this Manual:

This manual describes the installation of the C500 Programmable Controller and includes the sections described below.

Please read this manual carefully and be sure you understand the information provided before attempting to install and operate the C500 Programmable Controller. **Be sure to read the following section before operating the C500 Programmable Controller.**

Section 1 is an introduction to Programmable Controllers. General information about what a Programmable Controller can do and how a Programmable Controller works is provided.

Section 2 provides a description of all the components of the C500. The names of all the individual parts of each Unit are given.

Section 3 explains how to assemble the C500. A detailed description of how to mount each Unit is provided.

Section 4 outlines the system connections involved in installing a C500 Programmable Controller Systems.

Section 5 contains the requirements for the installation environment of the C500. Suggestions for preventing electrical noise are included.

Section 6 explains the power considerations involved in installing the C500.

Section 7 lists safety considerations that should be kept in mind while installing the C500.

Appendixes, a **Glossary**, and an **Index** are also included.



WARNING

Failure to read and understand the information provided in this manual may result in personal injury or death, damage to the product, or product failure. Please read each section in its entirety and be sure you understand the information provided in the section and related sections before attempting any of the procedures or operations given.

PRECAUTIONS

This section provides general precautions for using the Programmable Controller (PC) and related devices.

The information contained in this section is important for the safe and reliable application of the PC. You must read this section and understand the information contained before attempting to set up or operate a PC system.

- 1 Intended Audience
- 2 General Precautions
- 3 Safety Precautions
- 4 Operating Environment Precautions
- 5 Application Precautions

1 Intended Audience

This manual is intended for the following personnel, who must also have knowledge of electrical systems (an electrical engineer or the equivalent).

- Personnel in charge of installing FA systems.
- Personnel in charge of designing FA systems.
- Personnel in charge of managing FA systems and facilities.


2 General Precautions

The user must operate the product according to the performance specifications described in the operation manuals.




Before using the product under conditions which are not described in the manual or applying the product to nuclear control systems, railroad systems, aviation systems, vehicles, combustion systems, medical equipment, amusement machines, safety equipment, and other systems, machines, and equipment that may have a serious influence on lives and property if used improperly, consult your OMRON representative.

Make sure that the ratings and performance characteristics of the product are sufficient for the systems, machines, and equipment, and be sure to provide the systems, machines, and equipment with double safety mechanisms.




This manual provides information for programming and operating OMRON PCs. Be sure to read this manual before attempting to use the software and keep this manual close at hand for reference during operation.

-  **WARNING** It is extremely important that a PC and all PC Units be used for the specified purpose and under the specified conditions, especially in applications that can directly or indirectly affect human life. You must consult with your OMRON representative before applying a PC System to the abovementioned applications.

3 Safety Precautions



-  **WARNING** Do not attempt to take any Unit apart while the power is being supplied. Doing so may result in electric shock.
-  **WARNING** Do not touch any of the terminals or terminal blocks while the power is being supplied. Doing so may result in electric shock.
-  **WARNING** Do not attempt to disassemble, repair, or modify any Units. Any attempt to do so may result in malfunction, fire, or electric shock.

4 Operating Environment Precautions

-  **Caution** Do not operate the control system in the following locations:
- Locations subject to direct sunlight.
 - Locations subject to temperatures or humidity outside the range specified in the specifications.
 - Locations subject to condensation as the result of severe changes in temperature.
 - Locations subject to corrosive or flammable gases.
 - Locations subject to dust (especially iron dust) or salts.
 - Locations subject to exposure to water, oil, or chemicals.
 - Locations subject to shock or vibration.
-  **Caution** Take appropriate and sufficient countermeasures when installing systems in the following locations:
- Locations subject to static electricity or other forms of noise.
 - Locations subject to strong electromagnetic fields.
 - Locations subject to possible exposure to radioactivity.
 - Locations close to power supplies.
-  **Caution** The operating environment of the PC system can have a large effect on the longevity and reliability of the system. Improper operating environments can lead to malfunction, failure, and other unforeseeable problems with the PC system. Be sure that the operating environment is within the specified conditions at installation and remains within the specified conditions during the life of the system.

5 Application Precautions

Observe the following precautions when using the PC system.

-  **WARNING** Always heed these precautions. Failure to abide by the following precautions could lead to serious or possibly fatal injury.
- Always ground the system to 100 Ω or less when installing the Units. Not connecting to a ground of 100 Ω or less may result in electric shock.
 - Always turn OFF the power supply to the PC before attempting any of the following. Not turning OFF the power supply may result in malfunction or electric shock.
 - Mounting or dismounting I/O Units, CPU Units, Memory Units, or any other Units.
 - Assembling the Units.
 - Setting DIP switches or rotary switches.
 - Connecting cables or wiring the system.
 - Connecting or disconnecting the connectors.
-  **Caution** Failure to abide by the following precautions could lead to faulty operation of the PC or the system, or could damage the PC or PC Units. Always heed these precautions.
- Fail-safe measures must be taken by the customer to ensure safety in the event of incorrect, missing, or abnormal signals caused by broken signal lines, momentary power interruptions, or other causes.

- Interlock circuits, limit circuits, and similar safety measures in external circuits (i.e., not in the Programmable Controller) must be provided by the customer.
- Always use the power supply voltages specified in this manual. An incorrect voltage may result in malfunction or burning.
- Take appropriate measures to ensure that the specified power with the rated voltage and frequency is supplied. Be particularly careful in places where the power supply is unstable. An incorrect power supply may result in malfunction.
- Install external breakers and take other safety measures against short-circuiting in external wiring. Insufficient safety measures against short-circuiting may result in burning.
- Do not apply voltages to the Input Units in excess of the rated input voltage. Excess voltages may result in burning.
- Do not apply voltages or connect loads to the Output Units in excess of the maximum switching capacity. Excess voltage or loads may result in burning.
- Disconnect the functional ground terminal when performing withstand voltage tests. Not disconnecting the functional ground terminal may result in burning.
- Be sure that all the mounting screws, terminal screws, and cable connector screws are tightened to the torque specified in this manual. Incorrect tightening torque may result in malfunction.
- Leave the label attached to the Unit when wiring. Removing the label may result in malfunction if foreign matter enters the Unit.
- Remove the label after the completion of wiring to ensure proper heat dissipation. Leaving the label attached may result in malfunction.
- Double-check all wiring and switch settings before turning ON the power supply. Incorrect wiring may result in burning.
- Wire correctly. Incorrect wiring may result in burning.
- Mount Units only after checking terminal blocks and connectors completely.
- Be sure that the terminal blocks, Memory Units, expansion cables, and other items with locking devices are properly locked into place. Improper locking may result in malfunction.
- Check the user program for proper execution before actually running it on the Unit. Not checking the program may result in an unexpected operation.
- Confirm that no adverse effect will occur in the system before attempting any of the following. Not doing so may result in an unexpected operation.
 - Changing the operating mode of the PC.
 - Force-setting/force-resetting any bit in memory.
 - Changing the present value of any word or any set value in memory.
- Resume operation only after transferring to the new CPU Unit the contents of the DM Area, HR Area, and other data required for resuming operation. Not doing so may result in an unexpected operation.
- Do not pull on the cables or bend the cables beyond their natural limit. Doing either of these may break the cables.
- Do not place objects on top of the cables or other wiring lines. Doing so may break the cables.
- Use crimp terminals for wiring. Do not connect bare stranded wires directly to terminals. Connection of bare stranded wires may result in burning.
- When replacing parts, be sure to confirm that the rating of a new part is correct. Not doing so may result in malfunction or burning.
- Before touching a Unit, be sure to first touch a grounded metallic object in order to discharge any static built-up. Not doing so may result in malfunction or damage.

SECTION 1

Introduction

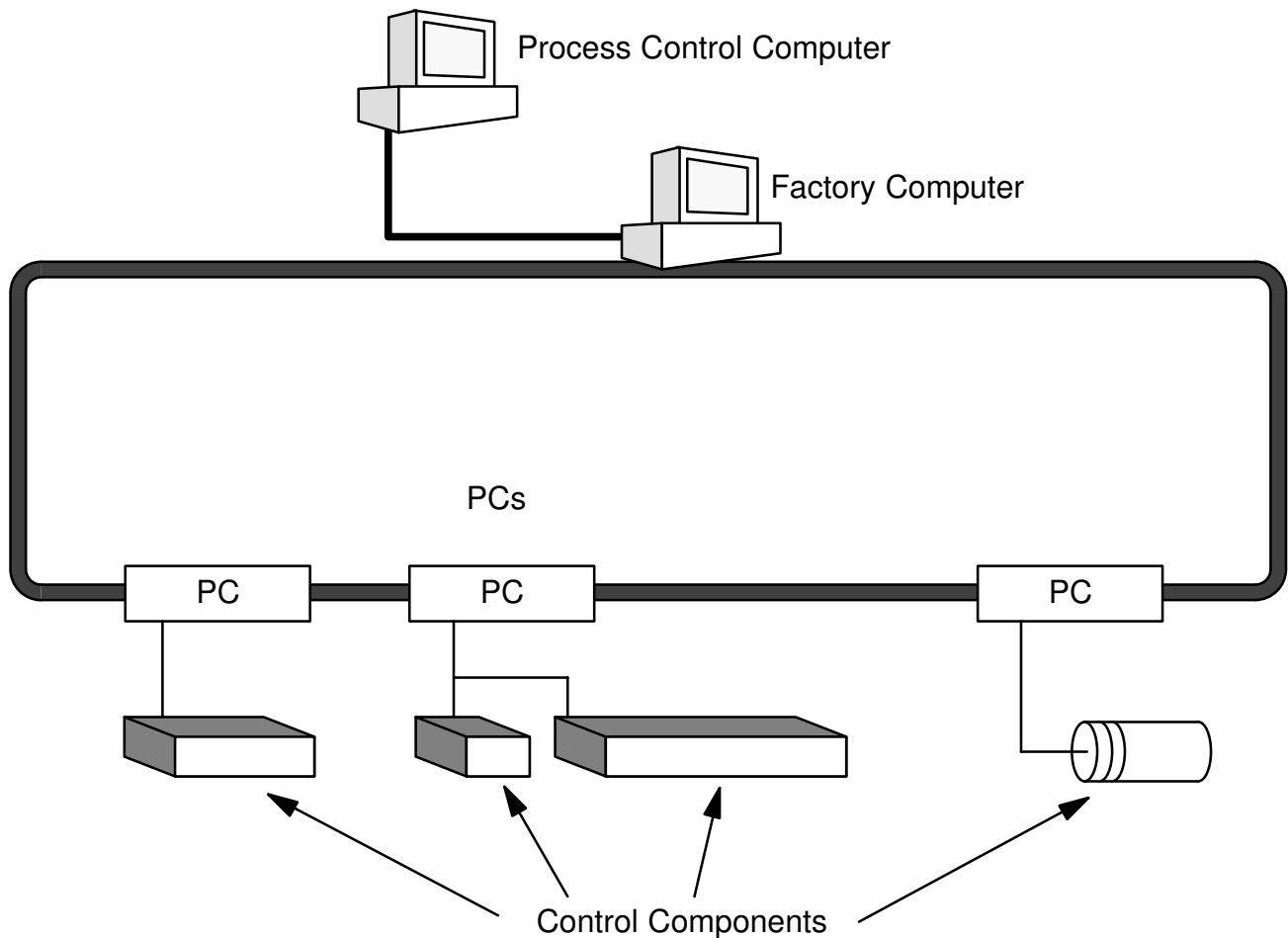
1-1	What is a Control System?
1-2	The Role of the PC
1-2-1	Input Devices
1-2-2	Output Devices
1-3	How Does a PC Work?

Introduction

This section provides general information about Programmable Controllers (Systems) and how they fit into a Control System.

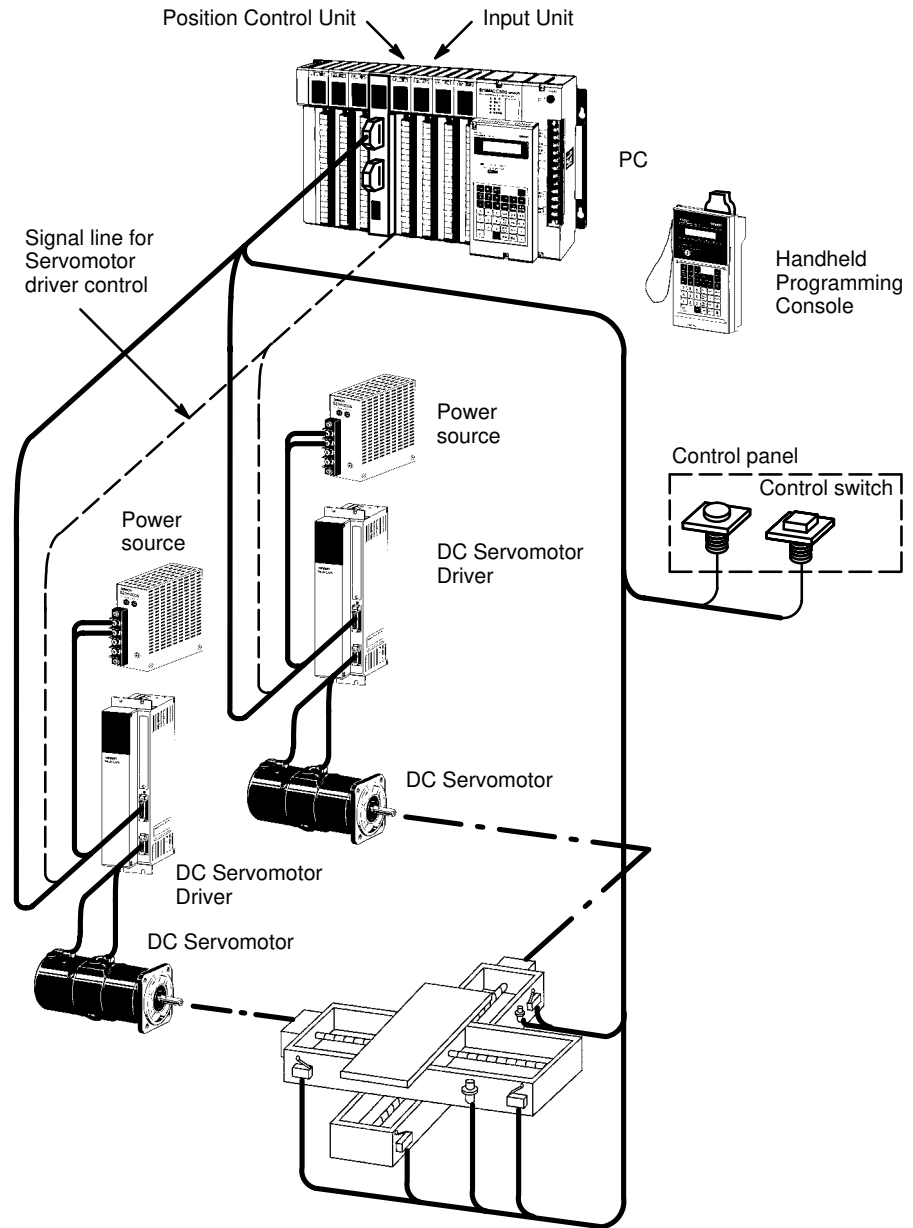
1-1 What is a Control System?

A Control System is the electronic equipment needed to control a particular process. It may include everything from a process control computer, if one is used, to the factory computer, down through the PCs (and there may be many of them networked together), and then on down through the network to the control components: the switches, stepping motors, solenoids, and sensors which monitor and control the mechanical operations.



A Control System can involve very large applications where many different models of PC are networked together or it could be an application as small as a single PC controlling a single output device.

Position Control System



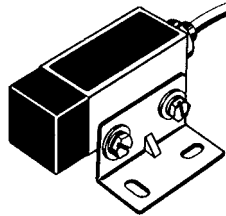
In the typical Control System example shown above, a PC controls the movement of the workpiece bed across two horizontal axes using Limit Switches and Servomotors to monitor and control movement.

1-2 The Role of the PC

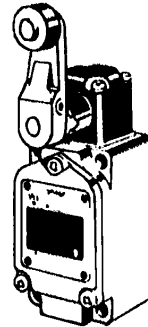
The PC is the part of the Control System that directly controls the manufacturing process. According to the program stored in its memory, the PC accepts data from the input devices connected to it, and uses this data to monitor the controlled system. When the program calls for some action to take place, the PC sends data to the output devices connected to it to cause that action to take place. The PC may be used to control a simple, repetitive task, or it may be connected to other PCs, or to a host computer in order to integrate the control of a complex process.

1-2-1 Input Devices

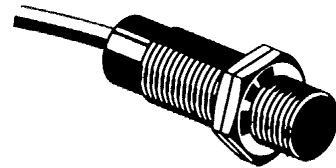
PCs can receive input from either automated or manual devices. The PC could receive data from the user via a pushbutton switch, keyboard, or similar device. Automated input could come from a variety of devices: micro-switches, timers, encoders, photosensors, and so on. Some devices, like the Limit Switch shown below, turn ON or OFF when the equipment actually makes contact with them. Other devices, like the Photoelectric Switch and Proximity Switch shown below, use other means, such as light or inductance, in order to get information about the equipment being monitored.



Photoelectric Switch



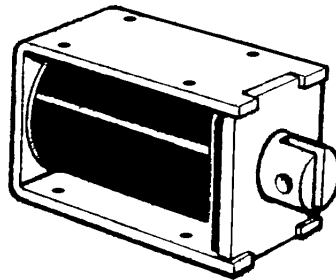
Limit Switch



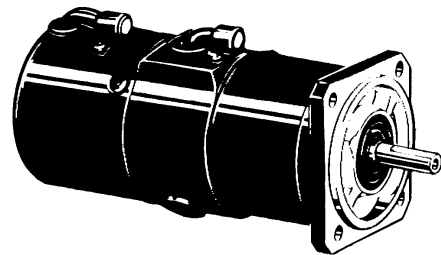
Proximity Switch

1-2-2 Output Devices

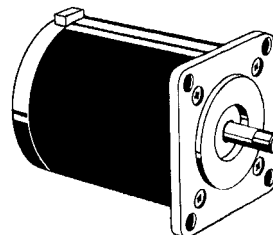
A PC can output to a myriad of devices for use in automated control. Almost anything that you can think of could be controlled (perhaps indirectly) by a PC. Some of the most common devices are motors, Solenoids, Servomotors, Stepping Motors, valves, switches, indicator lights, buzzers, and alarms. Some of these output devices, such as the motors, Solenoids, Servomotors, Stepping Motors, and valves, affect the controlled system directly. Others, such as the indicator lights, buzzers, and alarms, provide output to notify personnel.



Solenoid



Servomotor

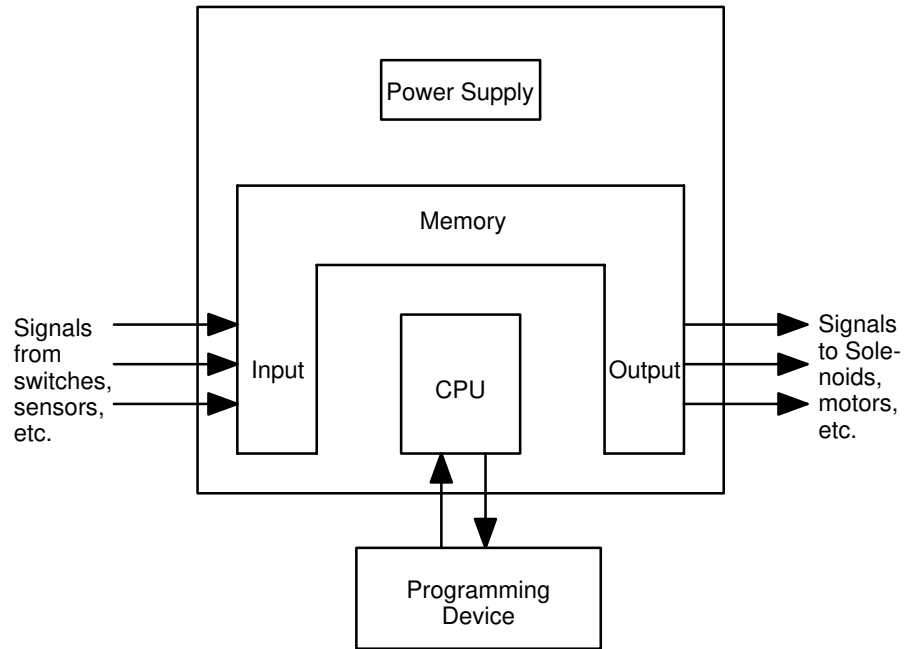


Stepping Motor

1-3 How Does a PC Work?

PCs operate by monitoring input signals and providing output signals. When changes are detected in the signals, the PC reacts, through the user-programmed internal logic, to produce output signals. The PC continually cycles the program in its memory to achieve this control.

Block Diagram of PC



A program for your applications must be designed, and stored in the PC. This program is then executed as part of the cycle of internal operations of the PC.

Scanning Cycle

When a PC operates, that is, when it executes its program to control an external system, a series of operations are performed inside the PC. These internal operations can be broadly classified into the following four categories:

1. Common (or overseeing) processes, such as watchdog timer operation and testing the program memory.
2. Data input and output.
3. Instruction execution.
4. Peripheral device servicing.

Cycle Time

The total time required for a PC to perform all these internal operations is called the cycle time. The flowchart and diagram on page 7 illustrate these internal operations for a typical PC.

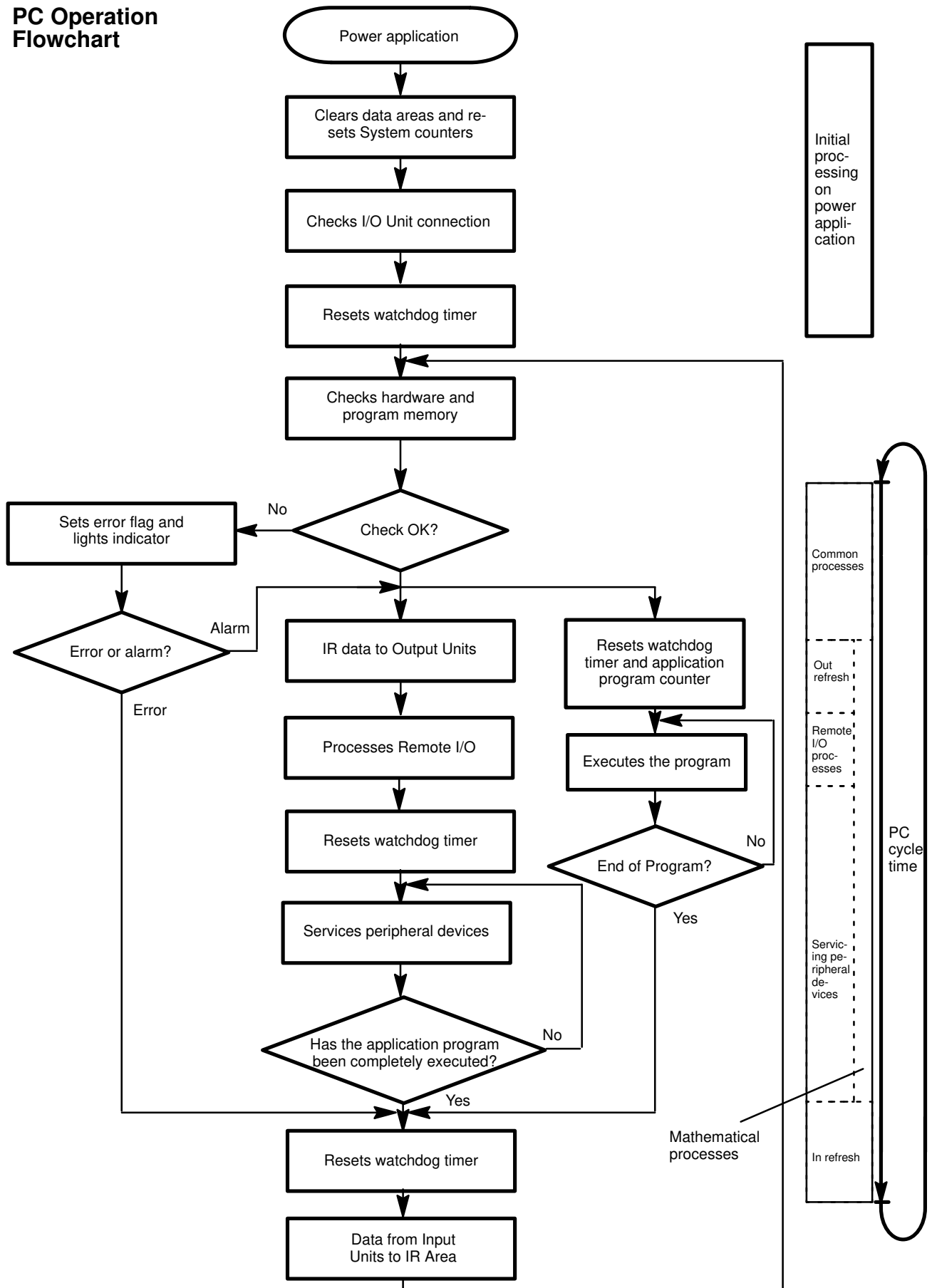
Timing is one of the most important factors in designing a Control System. For accurate operations, it is necessary to have answers to such questions as these:

- How long does it take for the PC to execute all the instructions in its memory?

- How long does it take for the PC to produce a control output in response to a given input signal?

The cycle time of the PC can be automatically calculated and monitored, but it is necessary to have an understanding of the timing relationships within the PC for effective System design and programming.

PC Operation Flowchart



SECTION 2

Description of All Components

2-1	CPU Rack
2-2	CPU Power Supply
2-3	Expansion I/O Backplane
2-4	I/O Power Supply
2-5	I/O Control Unit
2-6	I/O Interface Unit
2-7	I/O Units
2-8	Memory Packs

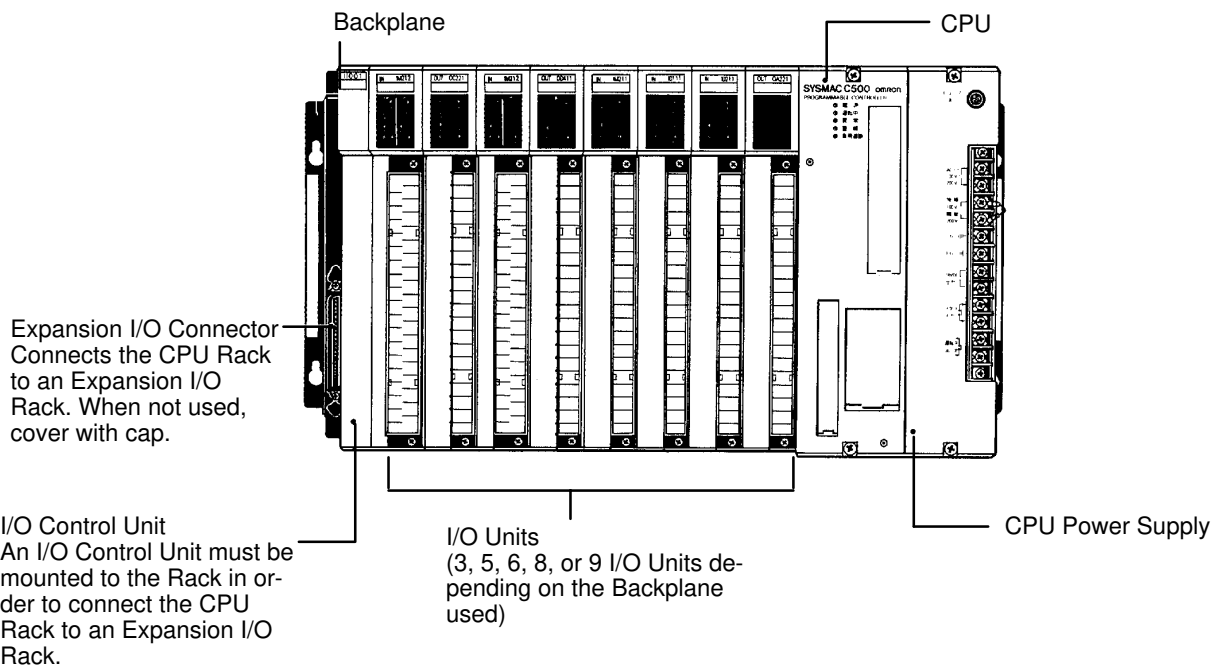
Introduction

This section provides information about the individual Units that make up the C500 PC. First the names of all the parts of the PC are given, followed by any details that apply to the Units that make up the PC. For a description of how the Units fit together to become a PC, refer to *3-3 System Configurations*. For information about the model numbers of any of the parts described in this section, refer to *Appendix C Standard Models*.

2-1 CPU Rack

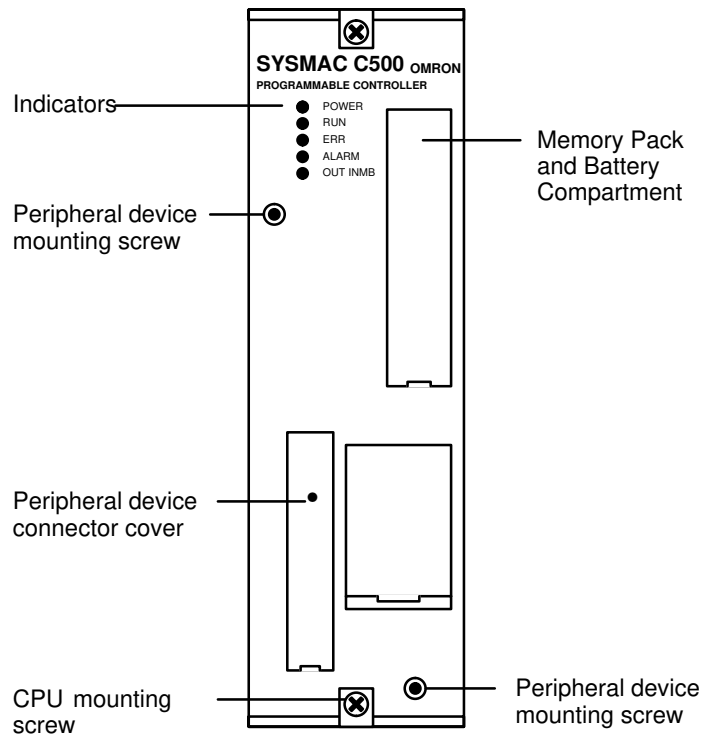
The following figure shows the names of all the parts of the CPU Rack.

There are seven models of CPU Racks available for the C500 PC. Choose a Backplane with 3, 5 (2 models), 6, 8 (2 models), or 9 I/O slots, depending on your application. Connect the CPU Backplane to an Expansion I/O Rack via the Expansion I/O Connector.



CPU

The CPU executes the user program. The model available for the C500 PC does not have a built-in Power Supply or Memory Pack. Choose the Power Supply and memory pack suitable for your application. A peripheral device connector and a memory pack compartment are provided.



Peripheral Device Connector

The CPU is equipped with one connector for peripheral devices. A peripheral device, such as the CPU-Mounting Programming Console, can be mounted directly to the CPU and does not require a connecting cable. To mount the CPU-Mounting Programming Console or any other peripheral device directly to the CPU, follow these steps:

1. Detach the cover of the peripheral device connector with a standard screwdriver.
2. Connect the CPU-Mounting Programming Console to the peripheral device connector.
3. To ensure a positive connection, secure the Programming Console to the CPU by tightening the mounting screws located on the surface of the CPU.

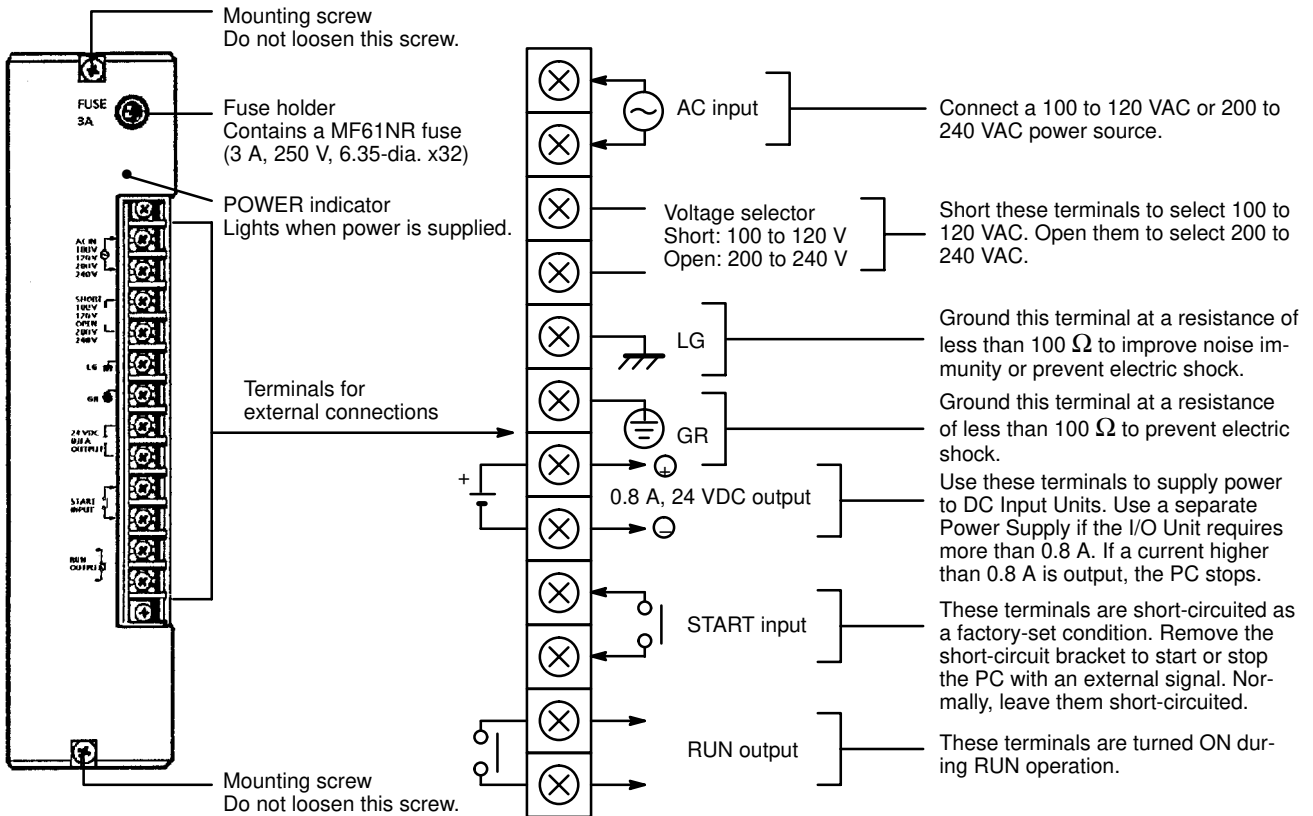
2-2 CPU Power Supply

The CPU Power Supply is mounted to the rightmost slot of the CPU Rack. Three models of Power Supplies are available: 100 to 120 VAC, 200 to 240 VAC, and 24 VDC. The following table summarizes the output capacity of the three models and the current available for I/O Units mounted on the CPU Rack.

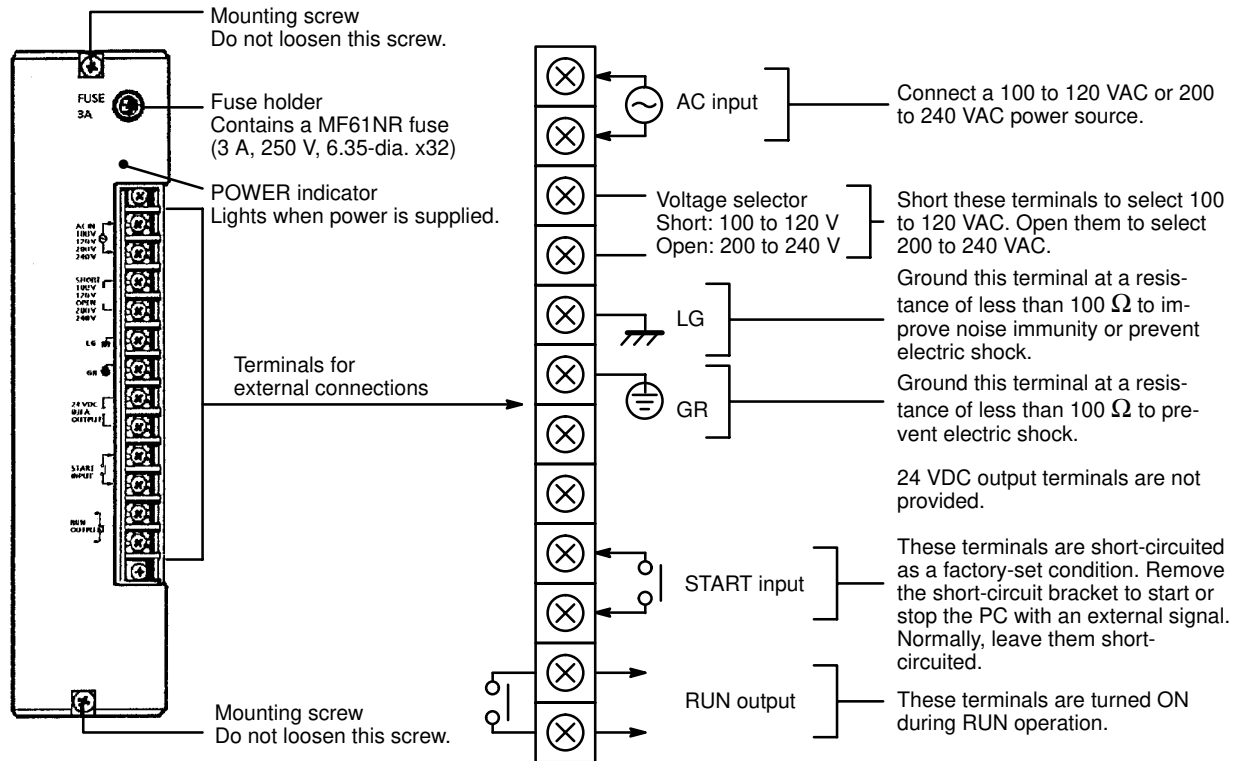
Model	Supply Voltage	Output Capacity	Available Current for I/O Units	24 VDC Output Terminal
3G2A5-PS221-E	100 to 120/ 200 to 240 VAC (selectable)	7 A 5 VDC	5 A	Provided
3G2A5-PS223-E		12 A 5 VDC	10 A	Not provided
3G2A5-PS213-E	24 VDC	9 A 5 VDC	5 A	Not provided

Note Be sure to keep the total power consumed by all the Units mounted on a Rack within the value stated in the table above. For example, do not mount I/O Units with a total current consumption of 6 A to a Rack supplied by a 7 A Power Supply. As shown in the table above, the available current for I/O Units is only 5 A. For details concerning current consumption, refer to *Section 4 System Connections*.

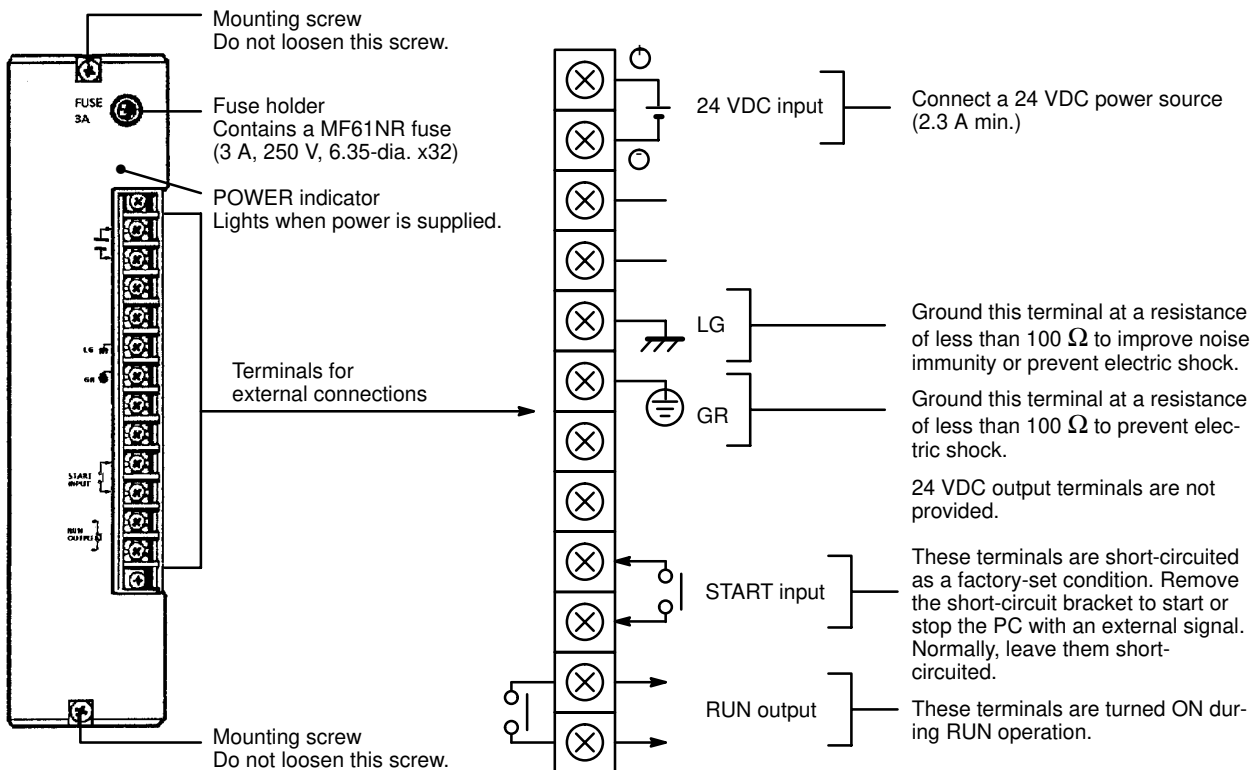
3G2A5-PS221-E



3G2A5-PS223-E

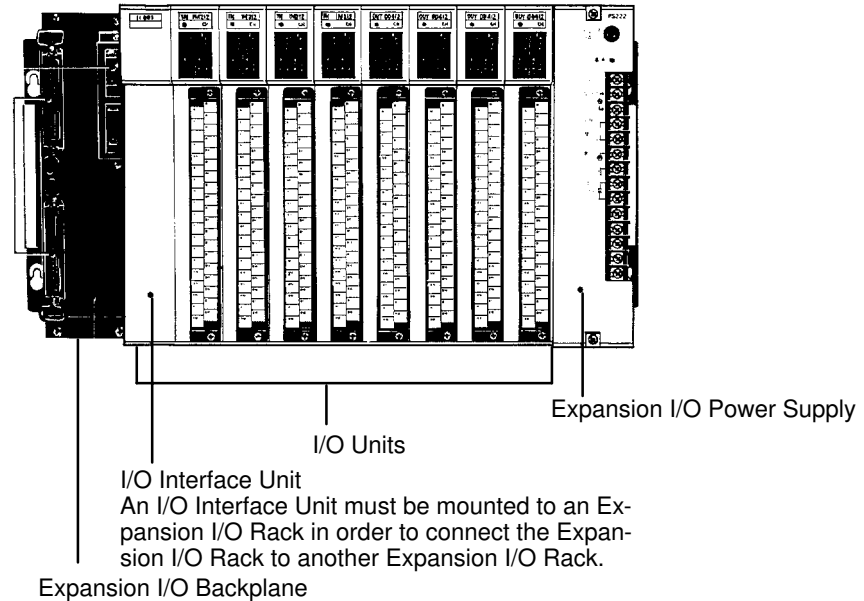


3G2A5-PS213-E



2-3 Expansion I/O Backplane

The Expansion I/O Backplane shown in the following diagram, can be used to expand the C500 PC. An Expansion I/O Rack is just like a CPU Rack, except a CPU is not mounted. However, a Power Supply is needed for each Expansion I/O Rack. There are three models of Expansion I/O Backplane available.



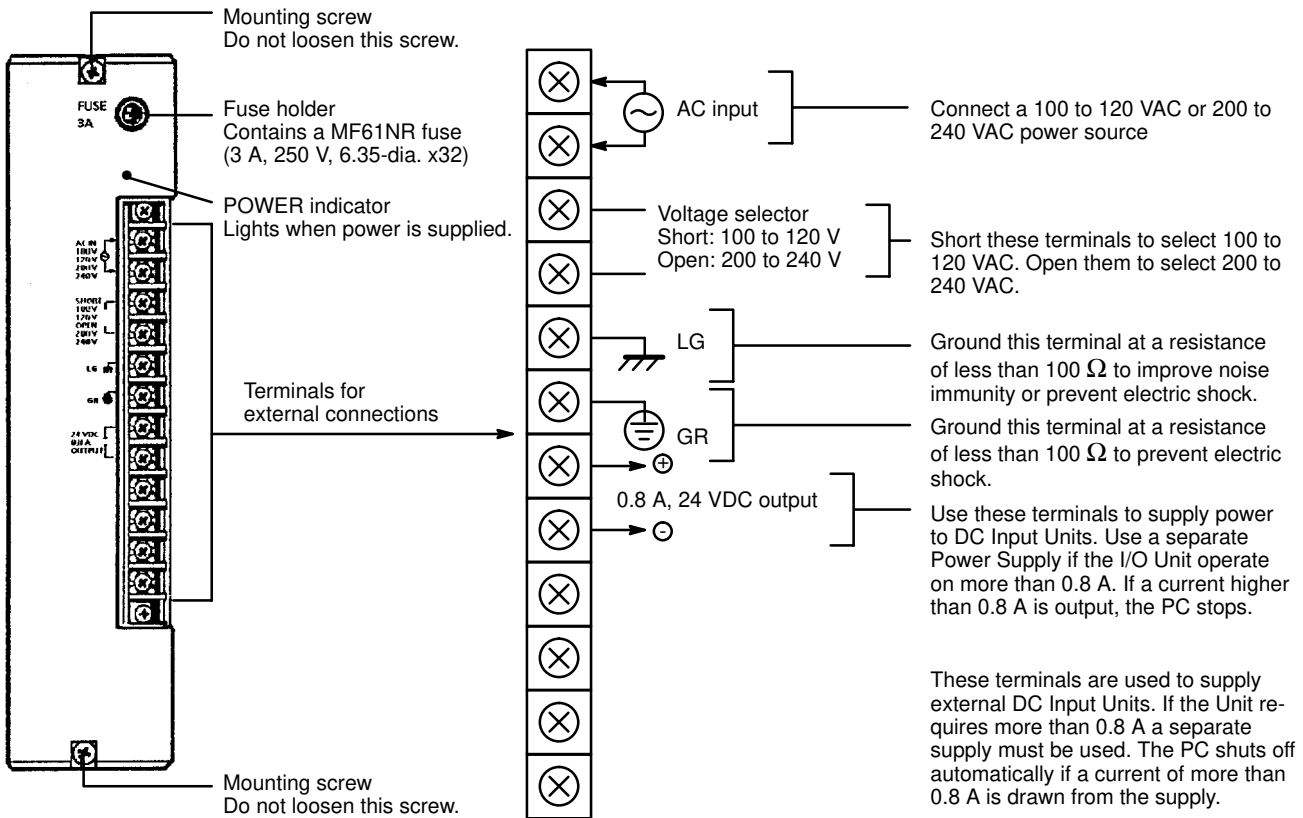
2-4 I/O Power Supply

Just as a Power Supply must be mounted to the CPU Rack, a Power Supply must also be mounted to each Expansion I/O Backplane. There are two Power Supplies available; 100 to 120/200 to 240 VAC and 24 VDC, both of which are explained below. For details, refer to *Appendix B Specifications*.

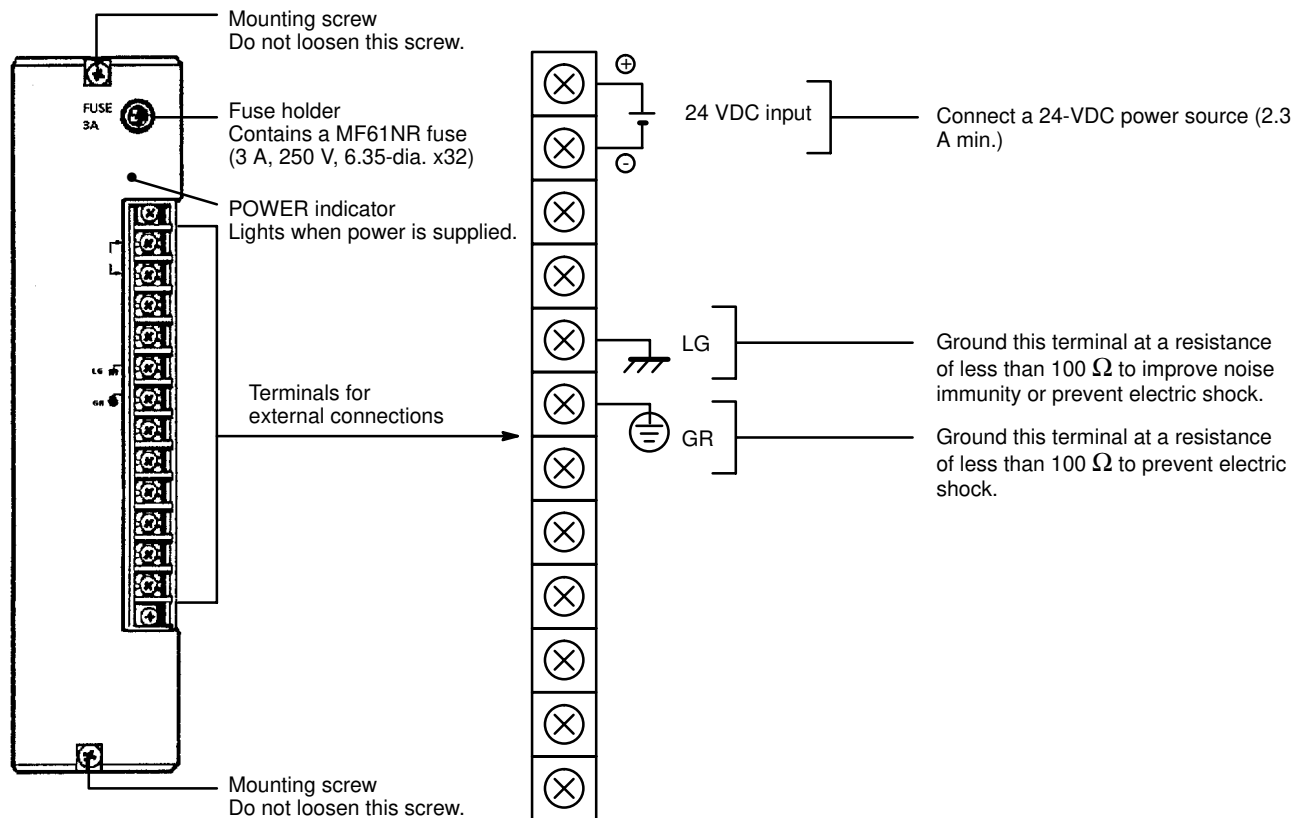
Model	Supply Voltage	Output Capacity	Available Current for I/O Units	240 VDC Output Terminal
3G2A5-PS222-E	100 to 120/200 to 240 VAC (selectable)	7A 5 VDC	6.5 A	Provided
3G2A5-PS212-E	24 VDC	7 A 5 VDC	6.5 A	Not provided

Note Be sure to keep the total power consumed by all the Units mounted on a Rack within the value stated in the table above. For example, do not mount I/O Units with a total current consumption of 7A to a Rack supplied by a 7 A Power Supply. As shown in the table above, the available current for I/O Units is only 6.5 A. For details concerning current consumption, refer to *Section 4 System Connections*.

3G2A5-PS222-E



3G2A5-PS212-E



2-5 I/O Control Unit

An I/O Control Unit must be mounted to the CPU Rack in order to connect the CPU Rack to an Expansion I/O Rack. An I/O Control Unit can be mounted even if no Expansion I/O Rack is used.

2-6 I/O Interface Unit

An I/O Interface Unit is needed on each Expansion I/O Rack, in order to expand the PC. If there is not an I/O Interface Unit on each Expansion I/O Rack, data communication cannot take place. The I/O Interface Unit is mounted to the leftmost I/O position on the Expansion I/O Backplane.

2-7 I/O Units

I/O Units come in 5 shapes; A-shape, B-shape, C-shape, D-shape, and E-shape. Refer to *Appendix B Specifications* for the dimensions of each Unit.

A-shape

