# Series One™ Programmable Controllers

Series One/One Plus
User's Manual

## GE Fanuc Automation

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**WARNING**

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**NOTE**

Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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The purpose of this manual is to provide information for the user to install, program and implement the family of Series One™ family of Programmable Controllers (PCs) into a control system. The Series One family of PCs includes the Series One, Series One Model E, Series One Plus and Series One Plus 3.7K PCs, which are described in this manual. The Series One Junior PC is described in a separate User's Manual, GEK-90503.

The Series One PC provides the user with the capability of developing and programming a control system using the familiar ladder diagram logic approach. The Series One Plus includes the same ladder diagram function plus a group of data operation functions, which includes data moves, math functions, conversion, and fault diagnosis.

**Chapter 1, Introduction**, is an introduction to the Series One and Series One Plus PCs, with emphasis on features and capabilities. A summary of terms common to PCs is provided at the end of this chapter as an aid to first-time PC users.

**Chapter 2, Physical Equipment Configuration**, provides a detailed description of the hardware components of the PC. This chapter provides an understanding of the components of a Series One or Series One Plus PC system and how they are related to the overall system.

**Chapter 3, Installation**, provides the specifications and instructions required for installation of your Programmable Control system.

**Chapter 4, PC Operation**, describes the operation of the Series One and Series One Plus PCs, including features and functions of the programmer used for entering new programs, editing existing programs, monitoring the status of inputs or outputs, displaying timer or counter accumulated values, and displaying register contents. The last part of this chapter describes operation of peripheral devices which may be used with both Programmable Controllers. Peripherals include an audio cassette tape recorder for recording your program after it has been entered in order to have a permanent record of that program, a PROM Writer Unit, which allows a non-volatile means of program storage within the PC, and a Printer Interface Unit to allow documenting of your programs.

**Chapter 5, Programming**, provides the basic information required in order to develop, enter, and implement your programs. A description of each function is provided, including examples of using each function. Three sections are included: Programming, Basic Instructions, and Data Operation Instructions.

**Chapter 6, I/O Specifications and Wiring**, is a guide to the specifications of the input and output (I/O) modules and their physical connections to field devices.

**Chapter 7, Maintenance**, is a guide to basic maintenance of your system, should it be needed. Reliability of the Series One family of PCs is excellent and other than changing the Lithium back-up battery, when required, there should be little maintenance required of your PC. This chapter includes troubleshooting procedures and information on replacing components.

**Chapter 8, Applications**, provides several typical Applications using the capabilities of the Series One and Series One Plus PCs. This chapter should be especially helpful to first-time users of a programmable controller.

**Appendices A through D** contain a summary of Related Documentation, a Glossary of Programmable Controller Terms, a guide to the compatibility of the Series One family of Programmable Controllers, and a Description of other GE Fanuc Automation North America, Inc. Programmable Controllers. A comprehensive index is included as an aid to the location in the manual of particular items of interest.

*All references to Series One in this manual for hardware and programming apply to both the Series One and Series One Model E PCs, except where specifically noted in the text. Similarly, all references to Series One Plus apply to both the Series One Plus and Series One Plus 3.7K PCs.*

Should further information be required, contact your salesperson or GE Fanuc Automation North America, Inc., P. O. Box 8106, Charlottesville, Virginia 22906.

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**NOTE**

The Series One/Series One Plus and associated modules have been tested and found to meet or exceed the requirements of FCC Rule, Part 15, Subpart J. The following note is required to be published by the FCC.

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

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GEK-90842

## History of Programmable Controllers

The factory with a future is here today, with machine and process controls provided by modern electronic devices. Today's automated factory can provide improved system reliability, product quality, information flow, reduced costs, efficiency, and flexibility. One of the basic building blocks of such a factory is an electronic device called a Programmable Controller. This device was first introduced in 1970 and has been refined every 4-7 years as newer electronic components, such as microprocessors, are made available. Today's Programmable Controllers are designed using the latest in microprocessor designs and electronic circuitry which provide reliable operation in industrial applications where many hazards such as electrical noise, high temperature, unreliable AC power, and mechanical shock exist. Here is where the Programmable Controller is in its element; it was designed for the industrial environment from its conception.

### Advantages Over Other Control Devices

Programmable Controllers, or PCs or PLCs as they are frequently referred to, offer many advantages over other control devices such as relays, electrical timers and counters, and drum type mechanical controllers. These advantages should be considered beyond just price when selecting any control device:

- Improved reliability
- Smaller space required
- Easier to maintain
- Reusable
- Reprogrammable if requirements change
- More flexible-performs more functions

### Series One Programmable Controllers

A complete Series One PC contained in one 5-slot rack can have over 1700 words of user logic, up to 64 timer/counters, and up to 64 I/O points in a panel surface area of only 54 square inches. That is less space than four 4-pole relays might occupy. An available 10-slot rack can contain up to 120 I/O points. By adding additional racks (up to a total of three), the I/O can be expanded up to a total of 112 I/O points in a Series One PC or 168 points in a Series One Plus PC. Modules can be replaced individually without disturbing adjacent modules or their field wiring. The I/O can be intermixed in many configurations, limited only by the module types available (either 4, 8, or 16 circuits per module - see Chapter 6). Users need only purchase those modules required for their application; there is no fixed mix such as 12 in/8 out or 20 in/12 out.

The hand-held programmer can be fixed onto the CPU for quick reference, removed and carried in a pocket for future use, connected to the CPU via a 5 foot (1.5m) cable for flexible temporary use or mounted on the outside of a panel or console. It is a simple pushbutton and display unit designed for easy transportation and rugged use. Programming can also be done with the Portable Programmer or with a Workmaster Industrial computer using Logicmaster 1 application software for Series One or Logicmaster 1F application software for Series One Model E, Series One Plus and Series One Plus 3.7K.

The Series One and Series One Plus PCs are designed to be very cost effective relay or other sequential control replacements. Despite the low cost, there is a lot of capability within the Series One and Series One Plus PCs.

The advantages and features offered by the Series One and Series One Plus PCs include:

| | |
|---|---|
| • Small size - (64 I/O points in a 5-slot rack) | 54 $in^2$ panel space, 5 1/2 in. maximum depth, 250 $in^3$ total volume |
| • Large Memory Capacity - | Up to 1724 words of CMOS or PROM |
| • Timers/Counters - | Up to 64 (4 digit, 9999 maximum preset) |
| • Programming Language- | Boolean Based Relay Ladder Data Operations (Series One Plus Only) |
| • Maximum I/O - | 112 (Series One) - 168 (Series One Plus) |
| • Latching relays | 28 total |
| • 16-bit Data Registers | 64 (Series One Plus), 124 with TC references |
| • Flexible I/O - | Any mix in groups of 4, 8 or 16 |
| • Replaceable I/O Modules | |
| • Portable Programmer- | Weight only 7 ozs. |
| • Personal Password Security | Series One Plus and Series One Model E (Permits only Authorized Access To User's Programs) |

- Internal and external indication of low battery
- Reliable operation without fan from 0° to 60° C (convection cooling)
- Retentive counters
- Shift Registers (128) Built-in
- Sequencers Standard - Up to 64, each with up to 1000 steps
- Meets or exceeds NEMA ICS3-304 for noise rejection
- Self Diagnostics
- Internal Power for 24 V dc Inputs
- Inexpensive
- High Speed Counter
- Remote I/O - Saves installation and wiring cost

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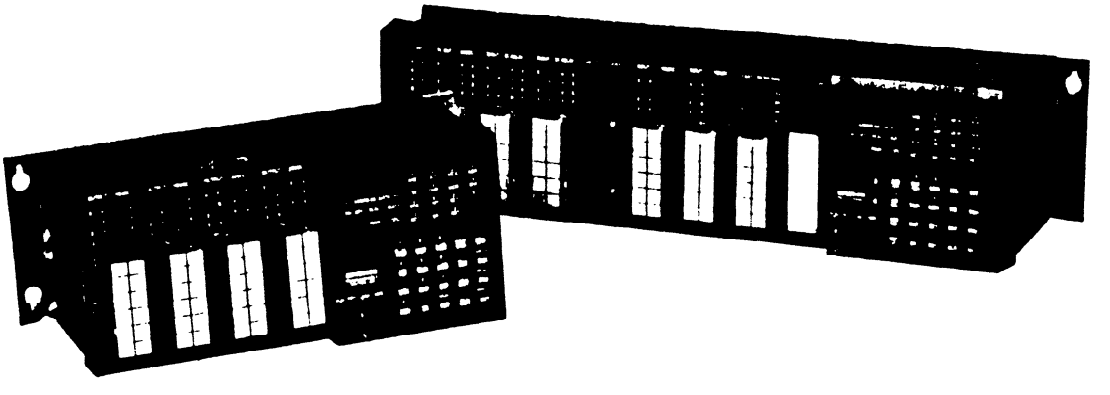

**Figure 1-1. Series One/Series One Plus Programmable Controllers**

### Series One Model E Programmable Controller

The Series One Model E PC is an enhanced version of the Series One PC that offers more capability while retaining all of the features and functions of the Series One PC. *The Model E requires an IC610CPU104 CPU module.* The additional features of the Series One Model E are:

- **Faster Scan Rate.**Typical scan times are:
  8 mSec for a 0.5K word program
  12 mSec for a 1.0K program
  15 mSec for a 1.7K word program

- **Password Protection.**As with the Series One Plus PC, this is a valuable feature in that it permits only authorized access to user programs stored in the PC memory. A unique 4-digit password is entered by the user and thereafter access to all functions (except monitor functions) is gained through a LOG ON sequence entered by the operator. After completion of required operations, a LOG OUT sequence returns the PC to password protection.

- **Faster Data Communications.**The Series One Model E PC requires the IC610CCM105 Data Communications Unit to communicate with external devices. Communications speed is noticeably faster when communicating with external devices, such as a host computer, than with a Series One PC using either the older version IC610CCM100 or the IC610CCM105 Data Communications Unit. Program upload or download time, and access time to I/O, and timer/counter data is reduced during communications sessions.

### Series One Plus 3.7K

The Series One Plus 3.7K PC is an enhancement of the Series One Plus PC which offers greater memory capability, while retaining all other features and functions of the Series One Plus PC. The Series One Plus 3.7K PC uses an IC610CPU106 CPU module that provides 3700 words of CMOS RAM or optional PROM memory (compared to 1700 words of memory available with a Series One Plus with an IC610CPU105 CPU module). A typical scan time for a 3.7K word program is 36 milliseconds.

This additional memory capability allows the Series One Plus 3.7K PC to more fully take advantage of programming with the data operations since those ladder logic programs that require numerous data operations also require more memory than do programs using the basic functions. The additional memory in a Series One Plus 3.7K PC provides the user with a great deal of capability in a small package.

An additional feature of the Series One Plus 3.7K PC is that timers can be programmed to be .01 second timers instead of .1 second. This is done by setting output 770 (SET 770) to the ON condition. The timer preset range with a .01 second duration selected is 0.01 to 99.99 seconds. When selecting timers to be .01 in this manner, care must be exercised to prevent your program from resetting coil 770, since this would cause all timers programmed to then be .1 second timers. Timer durations cannot be mixed, they can all only be .1 second or .01 second in the same program. Any Timer/Counter accumulate registers not being used for a Timer/Counter can be accessed and used as data registers as with the Series One Plus PC. Table 1-1 provides a summary of general specifications for both PCs.

## Table 1-1. Series One Family General Specifications

| | |
|---|---|
| **Operating Temperature** | 0° to 60°C (32° to 140°F) |
| **Storage Temperature** | -10° to 70°C (14° to +158°F) |
| **Humidity (non-condensing)** | 5 to 95% |
| **AC Power Required:** | |
| **IC610CHS101/110/130 Rack** | |
| **Voltage** | 115V/230 V ac 15% |
| **Frequency** | 47-63 Hz |
| **Maximum Load** | 30 VA (CHS101/110)<br>36.7 VA (CHS130) |
| **Output Current, Maximum Individual** | 1.4 A at 5 V dc, (0.4 A, CHS101)<br>0.8 A at 9 V dc, CHS110<br>(1.7 A, CHS130), (0.6 A, CHS101)<br>0.5 A at 24 V dc, (0.2 A, CHS101) |
| **DC Power Required** | |
| **IC610CHS114/134 Rack** | |
| **Voltage** | 20.5 - 30 V dc (100% of capacity used)<br>18 - 30 V dc (90% of capacity used) |
| **Ripple** | 10% of Input Voltage |
| **Output Current** | 1.4 A at 5 V dc |
| **Maximum Individual** | 0.8 A at 9 V dc, CHS114<br>(1.7 A, CHS134)<br>0.4 A at 24 V dc, CHS114<br>(0.5 A, CHS134) |
| **Maximum, Total (All Voltages)** | 2.2 A, CHS114 (2.3 A, CHS134) |
| **Typical Battery life * (loaded)** | 2-5 years |
| **shelf life * (no load)** | 8-10 years |
| ***Depends upon operating temperature** | |
| **Memory Size and Type (16-bit words)** | 700 words (CMOS) or<br>1724 words (CMOS or EPROM)<br>3700 words (Series One Plus 3.7K (CMOS or EPROM) |
| **Typical Scan Time per K of Memory)** | |
| **(Only memory programmed is scanned)** | Series One: 20 mSec (0.5K), 40 mSec (1.0K), 65 msec (1.7K) |
| **Overhead time must be added to the logic solution for total real scan, time overhead is typically 4 to 5 mSec.** | Series One Plus and Model E One Plus 3.7K: 8 mSec (0.5K), 12 mSec (1.0K), 15 mSec (1.7K), 36 mSec (3.7K) |
| **Maximum I/O** | 112 (Series One)<br>168 (Series One Plus) |
| **Internal Coils** | 144 |
| **Special Function Coils** | 4 |
| **Retentive Coils (Latches)** | 28 |
| **Timer/Counters** | 64 (4-digit) |
| **Shift Register Stages** | 128 |
| **Sequencers** | 64 at 1000 steps each |
| **Data Registers (Series One Plus and Series One Plus 3.7K)** | 64 (16-bit), up to 124 with unused T/C references |

## Programmable Controller Concepts

When using a new product for the first time, there are always new concepts and terms to become familiar with. Although PC's are relatively easy to install, program, and apply, there are some simple principles to follow. Figure 1-2 illustrates a general block diagram of a Programmable Controller. Specific hardware components to illustrate this diagram will be described in Chapter 2.

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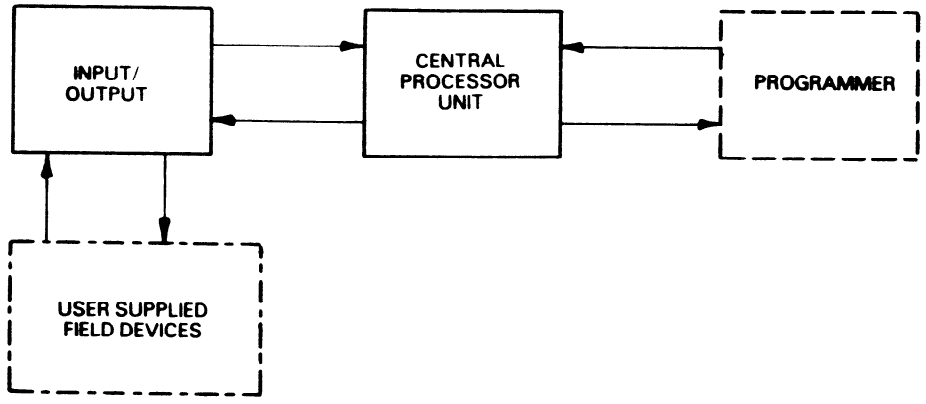


**Figure 1-2. Basic PC Block Diagram**

## Programming the Series One and Series One Plus PCs

The programming devices are used to enter the specific logic the user desires the PC to follow. This logic, to be described in detail in Chapter 5 is what makes the user's PC a unique unit, different from all others unless the identical logic is entered into another unit. Recording and reloading logic from one PC to another or to itself is also a standard feature with the programmers.

### Hand-Held Programmer

The programmer can display any previously entered logic, allow the user to edit it (make changes, add or delete portions of the logic), or display the current value of any internal timer or counter. It is a very valuable and powerful piece of peripheral equipment, for entry of logic, control system checkout, and troubleshooting. It can be permanently connected to the CPU or removed without disturbing the operation of the CPU. If removed, one programmer can service several CPUs. The exact quantity of CPUs is dependent upon the expected rate of usage but typically is between 5 and 20 CPUs.

### Portable Programmer

The portable programmer uses a liquid crystal display (LCD) screen to allow ladder logic programming for both the Series One and Series One Plus PCs. New programs can be created, previously entered ladder logic displayed and existing logic edited. An on-line monitor function is available when the Portable Programmer is used with the Series One Plus. Programs can be transferred to the PCs or stored

on cassette tape. The program can be printed using a standard parallel or Centronics compatible printer through the printer port located on the rear of the Portable Programmer. For detailed information refer to GEK-90846, which is the Portable Programmer User's Manual.

### Logicmaster 1 Family Application Software

Another option available for programming the Series One Family of PCs is the Workmaster industrial computer with Logicmaster 1 Family application software. This software allows you to write, edit, display, and print programs in ladder diagram format. You can view up to 7 lines of your ladder diagram program on one screen. Programs can be annotated by assigning names and nicknames to program elements, assigning labels to coils and adding explanations of program rungs or segments. Many programs can be stored on a single 3 inch diskette and each program can be assigned a unique name. For detailed information on using the Workmaster industrial computer with Logicmaster 1 application software refer to GFK-0075, which is the Logicmaster 1 Family Programming and Documentation Software User's Manual.

### Series One Plus Program Protection

The Series One Plus and Series One Model E PCs allow the user to enter a unique password with the hand-held programmer or the LCD Portable Programmer, which prevents unauthorized users or inadvertent program access. When a password is entered, all programmer functions are disabled except the I/O, T/C accumulated value and register monitor functions. In order to have access to all programmer functions when a password has been entered, a log on sequence must be entered.

### Function of the Central Processing Unit

The next element of the PC is the Central Processor Unit (CPU). The CPU is the "brain" behind all logical decision making. It reads in the status of the control system, makes decisions based upon the logic it has been provided, and then provides decisions to the actuating portion of the control system. The CPU also performs self checking of its internal operation to ensure reliable operation. If an error is detected, it will shut itself down. The logic entered by the programmer is actually stored in the CPU along with storage for the operation of timers and counters.

### Memory Word Length

The memory provided for this storage function is normally measured in K words, where K is an abbreviation for kilo or 1024. Typically, one word is required storage for each function such as a relay contact, timer preset or timer storage. These words can be of various lengths such as 16 bits, 8 bits, or even 4 bits, wherein a bit is the most elementary measurement and can have only two states (on or off). The word length is much like a ruler used to measure wire, sheet steel, or fabric. It can be a yard long (16 bits) or a foot (8 bits) or an inch (4 bits). Numerical values are for illustrative purposes only and do not represent exact ratios. Thus when quoting memory in K words (1K, 2K, 4K, etc.) always check to verify the word length. The Series One and Series One Plus PCs use the most common measurement, 16 bits per word.

## Types of Memory for Program Storage

There are several types of memory used in PCs to store both logic and data. The two used in the Series One and Series One Plus PCs are CMOS and PROM. CMOS or CMOS RAM, which is an acronym for Complimentary Metal-oxide Semiconductor, Random Access Memory, provides a fast, low cost, low power memory that can be both examined (read) and also changed (written) easily. However, it is volatile, which means that it can lose its content if power is removed. To avoid reloading memory (and losing counts and system status) every time power is turned off, the CMOS memory is usually provided (as it is in Series One and Series One Plus) with a back-up battery to maintain its content (not system operation) when power fails. Due to the low power drain of CMOS technology, a single new lithium battery can maintain memory without application of power for up to 2 to 5 years. The battery is not used when the power is applied and the system is operating normally. Its storage or shelf life is many years, typically 8 to 20 years.

The second memory is PROM(Programmable Read only Memory) that again is fast, relatively low cost, and retentive upon loss of power. However, this memory cannot be easily changed. It can be examined (read) at anytime, but to change (write) it requires some special action on the part of the user. In this system, the PROM must be cleared of all previous contents (new PROM, or erased with an intense ultraviolet light) and then placed into a special loader. A previous logic program developed in CMOS is then written into the PROM. Finally, the PROM is removed from the loader and placed into the CPU.

## Function of the Input/Output Circuitry

The final element of the PC is the Input/output section. Electrical noise such as spikes on the power lines, inductive "kick-back" from loads, or interference picked up from field wiring is very prevalent in industrial applications. Since the CPU operates at relatively low voltage levels (typically 5 volts), this noise would have serious impact on its operation if allowed to reach the internal circuits of the CPU.

The I/O section, both inputs and outputs, protects the CPU from electrical noise entering via the I/O modules or wiring. The I/O section is where status signals are filtered to remove noise, voltage levels are validated, and where decisions made by the CPU are put into operation. Inputs provide their status to a storage area within the CPU and outputs are driven from similar stored status in the CPU.

In general, the I/O section is modular in design and can accommodate a variety of signals. A complete discussion of the types and capacities available for both the Series One and Series One Plus PCs is provided in Chapter 6. The specific type of module (e.g. 115 V ac or 24 V dc) is usually determined by the field device the user selects. Decisions such as number of 115 V ac solenoids, 24 V dc solenoids, motor starters, limit switches (their voltages), control panel lamps (what voltage), pushbuttons, and external relays have a major impact on the configuration of any PC. These parameters should be established as early as possible in the overall design of the control system. Of course, being a flexible device, the PC configuration either on paper or in hardware, can be changed if requirements change. Typically, the user provides the field devices, wires them to the I/O section, and provides the power source to operate them.

## UL Listed Products

Several Series One family products are available that have been tested and approved by the Underwriters Laboratory (UL). These UL listed products should be used in installations where UL listed products are required. The UL listed products include the Series One CPU (IC610CPU101, revision C), 5-slot

rack (IC610CHS111), 115 V ac Input module (IC610MDL135), Relay Output module (IC610MDL181), and a 115 V ac Output module (IC610MDL185). Specifications and wiring information for the UL listed modules can be found in chapter 6 of this manual.

*When installing a system requiring UL approval, do not mix non UL listed products with the UL listed products.*

## Communicating With Other Devices

An available Data Communications Unit (DCU) allows the Series One and Series One Plus to communicate with external devices. The Series One PC uses the IC610CCM100 DCU, while the Series One Model E, Series One Plus and Series One Plus 3.7K PCs use the IC610CCM105 DCU. These devices can be other programmable controllers, computers, or other smart devices. User programs and I/O information in a Series One or Series One Plus PC can be uploaded and downloaded to or from any master device that supports the Series Six CCM2 protocol as defined in the Series Six Data Communications Manual, GEK-25364. For detailed information on how to use a DCU in a Series One or Series One Plus PC system, refer to the Series One Data Communications Manual, GEK-90477.

## Remote I/O for Series One and Series One Plus

Another option available for a Series One or Series One Plus PC system is Remote I/O. By using Remote I/O, I/O modules can be located in a rack convenient to the input sensors or the output devices being controlled by the PC at a distance of up to .6 miles (1 km) from the PC. This is accomplished by installing a Link Local module in the CPU rack, a Link Remote module in the distant I/O rack and connecting them through a single twisted-pair cable. For detailed information on using Remote I/O in a Series One or Series One Plus PC system, refer to the Series One Remote I/O Manual, GEK-90507.

## PC Terminology

To summarize the preceding discussion of Programmable Controller concepts, table 1-2 provides a definition of terms discussed above that you should be familiar with, relating to PCs. A more complete list of terms is provided in a glossary at the end of this manual.

**Table 1-2. Common PC Terminology**

| TERM | DEFINITION |
|---|---|
| PC | Programmable Controller or Programmable Logic Controller. An industrial control device using microprocessor technology to perform logic decision making with relay ladder diagram based programming. |
| Programmer | A device for entry, examination and alteration of the PC's memory including logic and storage areas. |
| Logic | A fixed set of responses (outputs) to various external conditions (inputs). All possible situations for both synchronous and non-synchronous activity must be specified by the user. Also referred to as the program. |
| CPU | Central Processor Unit - the physical unit in which the PC's intelligence resides. Decision making is performed here. |
| Memory | A physical place to store information such as programs and/or data. |

## Table 1-2. Common PC Terminology - Continued

| TERM | DEFINITION |
|---|---|
| **K** | An abbreviation for kilo or exactly 1024 in the world of computers. Usually related to 1024 words of memory. |
| **Word** | A measurement of memory usually 16, 8, or 4 bits long. |
| **CMOS** | A read/write memory that requires a battery to retain content upon loss of power. |
| **PROM** | A read only memory that requires a special method of loading, but is inherently retentive upon power loss. |
| **I/O** | Input/Output - that portion of the PC to which field devices are connected. Isolates the CPU from electrical noise. |
| **Noise** | Undesirable electrical disturbances to normal signals generally of high frequency content. |
| **Inputs** | A signal, typically ON or OFF, that provides information to the PC. |
| **Outputs** | A signal typically ON or OFF, that originates from the PC with user supplied power that controls external devices based upon commands from the CPU. |
| **Modules** | A replaceable electronic subassembly usually plugged in and secured in place but easily removable in case of fault or system redesign. |
| **Field Devices** | User supplied devices typically providing information to the PC (Inputs: pushbutton, limit switches, relay contacts etc.) or performing PC tasks (Outputs: motor starters, solenoids, indicator lights, etc.). |

## Rack Description

The Series One and Series One Plus PCs are provided as a family of racks into which modules can be inserted. Each rack contains a power supply to the right and space for up to either 5 or 10 modules (see figure 2-1). Racks are available in 6 versions, 5 or 10-slot that accept 115/230 V ac input power, 5 or 10-slot that accept 24 V dc, a UL listed 5-slot rack, IC610CHS111 which accepts only a 115 V ac power source, and a low-cost 5-slot rack (IC610CHS101) that does not include an expansion part, 24 V dc terminals for external use, or a RUN relay. Each supplies internal power to the modules inserted into the rack. Mounting is provided by the brackets each with two keyholes at the rear of the rack. All racks are similar. The differences being the function of the rack as determined by the placement of modules by the user, the number of modules which may be inserted into a rack, and the input power required. Figure 2-2 illustrates typical modules for the Series One Family of PCs, illustrating in hardware, the block diagram concept of figure 1-1.

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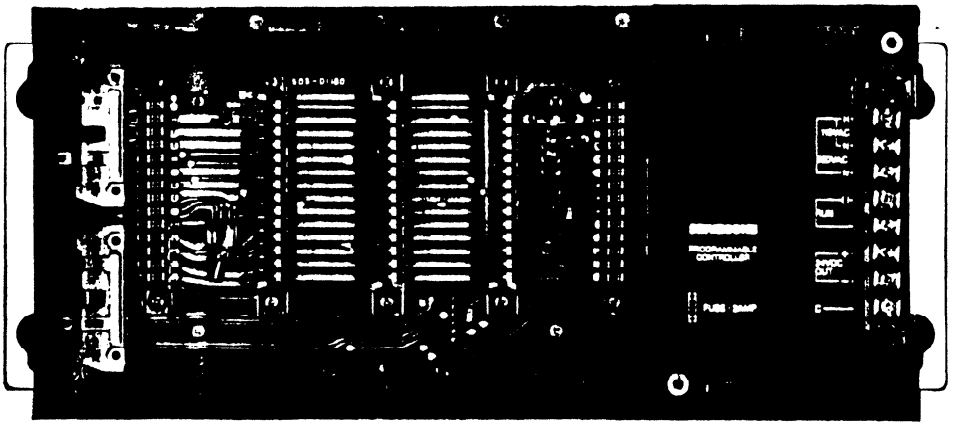

**Figure 2-1. Typical Rack**

### Module Location in Rack

The CPU module is always placed adjacent to the power supply in the first rack; it contains the microprocessor and required memory storage. There is a connector on the CPU to which the programmer is attached when mounted on the rack. As an option, between the CPU and programmer a 5 foot (1.5m) cable can be installed for more flexible operation. The remaining slots can contain I/O modules in any mix of inputs versus outputs or voltage levels desired by the user for his particular application. All modules as well as the programmer are secured to the rack by two snap-locks which can be released by squeezing the module top and bottom toward the center (see Chapter 3 for additional installation details).

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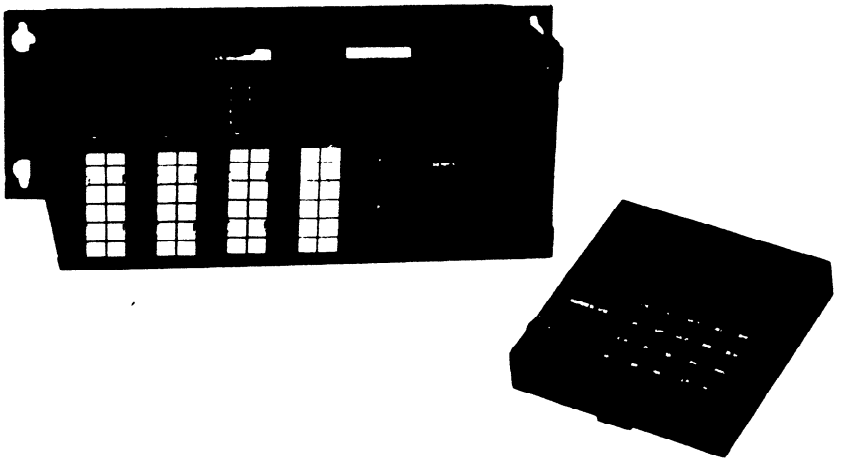

**Figure 2-2. Typical Hardware**

## Heat Dissipation

The rack is designed to dissipate internal heat through convection cooling only and does not require a fan for forced air cooling. However, to ensure efficient operation, free air flow should not be inhibited at the top and bottom of the unit. A minimum of 3 inches (75mm) is recommended at the top and 4 inches (100mm) at the bottom with 6 inches (150mm) between racks. Both sides should be free of obstacles to allow easy removal of the unit, approximately 3 inches (75 mm) from each side excluding the mounting brackets is recommended. Furthermore, the unit should be mounted horizontally as shown in figure 2-3 and not inverted nor rotated 90°. If not oriented as shown, derating of the maximum ambient temperature specification would need to be considered. Placements of other sources of large volumes of heat near the units should also be avoided, especially directly below the rack. For reliable operation, the air entering the bottom of the rack should not be at a higher temperature than 60°C (140°. Wiring to the I/O modules and the power supplies should be placed so as to avoid blocking the air flow, yet provide a suitable service loop to allow easy removal of modules with wiring attached. Wires should be tied to maintain their order in the event they must be disconnected during module replacement.

## Adding Racks

If more I/O points are required than one rack can contain, additional racks can be installed similar to the first unit previously discussed (IC610CHS101 cannot be used as an expansion rack). At the left of each rack are two connectors used to connect to additional I/O. An 18 inch (460mm) cable is available to connect the rack containing the CPU module to the first I/O expansion rack. The ends of this cable are marked "CPU" and "EXP" (Expander). The CPU end is plugged into the bottom connector at the first rack and the EXP end similarly connected to the second rack using the top connector (see figure 2-5). If a third rack is used, another cable links the second rack to the third rack, the CPU end is inserted into the bottom connector on the second rack and the EXP end into the top connector on the last rack. Within these added racks, I/O modules can be inserted in any order desired, up to five modules in a 5-slot rack and up to 10 modules in a 10-slot rack. No additional CPU modules can be installed, nor are required.

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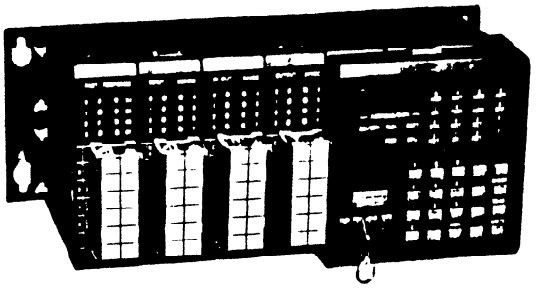

**Figure 2-3. Typical (5 Slot) Rack**

## 10-Slot Rack

The 10-slot rack provides in a single housing, as shown in figure 2-4, the same number of I/O module slots as two 5-slot racks. An added advantage of the 10-slot rack is easier and less expensive installation since fewer racks have to be mounted and wired. A system can be configured in many ways to contain various quantities of I/O. Refer to Appendix B, which contains examples of valid I/O rack configurations.

## Rack Mount Brackets

Rack mount brackets (IC610CHS191) are available to adapt the 10-slot racks for mounting in 19 inch racks. With the brackets assembled on either version of a 10-slot rack, the rack can be mounted on standard mounting rails in 19 inch cabinets and consoles.

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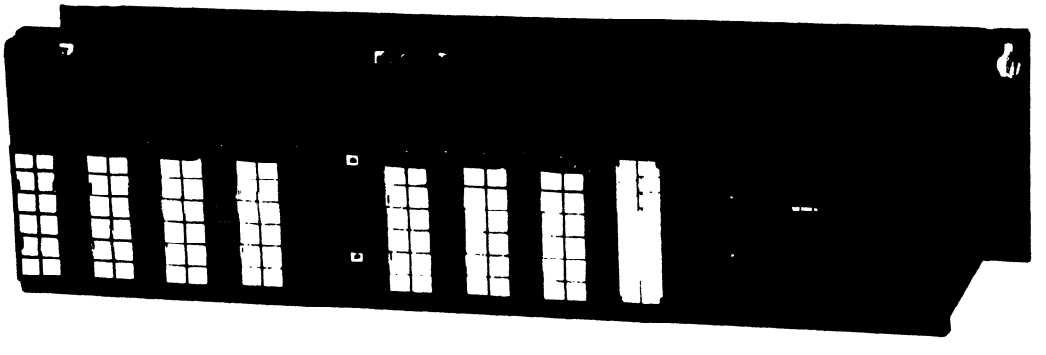

**Figure 2-4. Typical (10 Slot) Rack**

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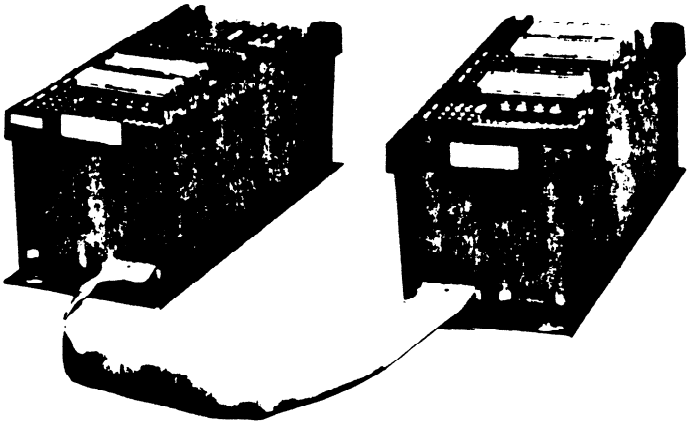

**Figure 2-5. Expander Cable Installation**

## Programmer Tape Port

The hand-held programmer, when installed on the CPU module, provides an auxiliary tape port for memory transfers to peripheral devices. Tape recordings of user programs can be made on virtually any audio cassette recorder and once made can be used to initialize any CPU to that program. Thus programs can be made once and transported to other CPUs without manually being re-entered. Of course, once entered they can be edited if additional tailoring is required. In the unlikely event that a CPU fails, a replacement can be installed and quickly reloaded to perform specifically the task its predecessor was accomplishing, if a tape record was made. The tape recorder functions are discussed in detail in Chapter 4, PC Operation.

### Programmer Mount Assembly

A Programmer Mount Assembly (IC610PRG190) is available that can be used to mount and protect the hand-held programmer on the outside of a panel or console. A hand-held programmer, when mounted externally, can be used as an operator interface unit to change timer or counter presets, monitor timer or counter current values, monitor 16 consecutive I/O points, monitor the entire contents of the user program, and, with a Series One Plus PC, monitor register contents. The programmer mount assembly includes a mounting bezel, a clear plastic cover, and a cable fastener. In addition to the mounting assembly, a shielded, round CPU/Programmer cable (Catalog No. IC610CBL102), designed specifically for mounting the hand-held programmer away from the CPU rack must be ordered separately for use when installing the hand-held programmer in this manner.

The Programmer Mount Assembly bezel installs on the outside of a panel or console with only four screws. The hand-held programmer snaps into the bezel using its two snap-locks. A clear plastic cover then fits over the bezel and programmer, thereby protecting it from its industrial environment. The Programmer Mount Assembly can also be used as a table top stand for the hand-held programmer by

mounting four rubber feet, which are included with the assembly, on the reverse side of the bezel using the panel mounting holes.

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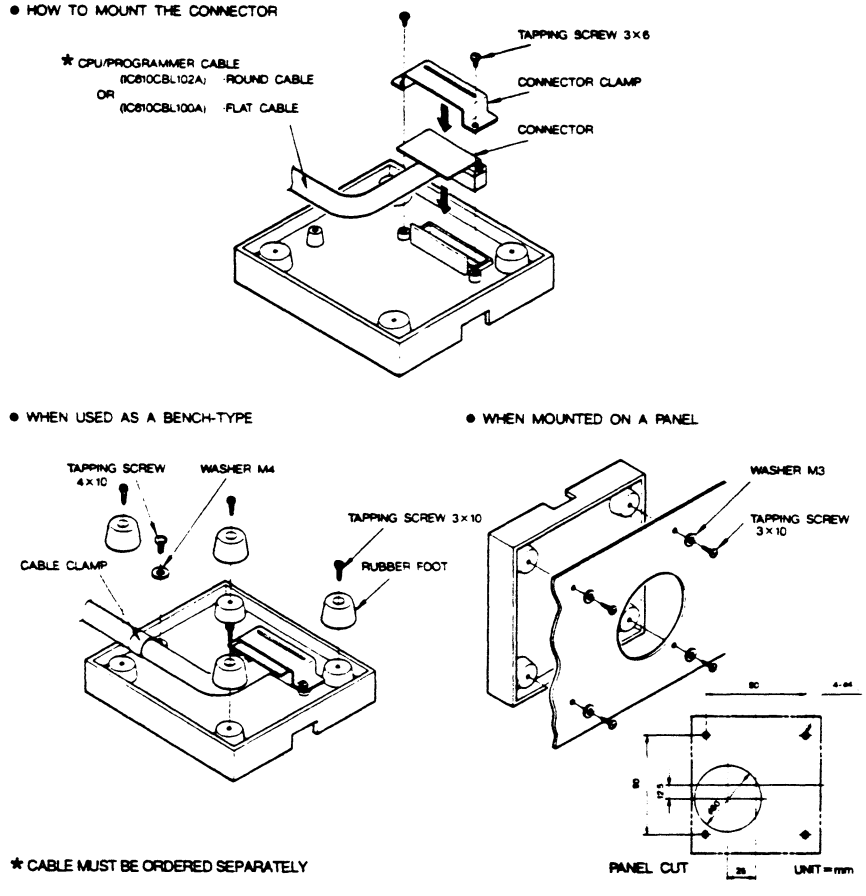


**Figure 2-6. Programmer Mount Assembly**

Table 2-1 lists the Series One/Series One Plus PC catalog numbers and nomenclature for the various modules, cables, peripherals, and accessories. For detailed information on I/O module specifications and wiring diagrams, see Chapter 6.

**Table 2-1. Series One/Series One Plus Catalog Numbers**

| DESCRIPTION | CATALOG NUMBER |
|---|---|
| CPU, Series One (700 words of CMOS Memory, standard) Version C is UL listed | IC610CPU101 |
| CPU, Series One Model E (Enhanced Version of CPU101) | IC610CPU104 |
| CPU, Series One Plus (700 words of CMOS Memory, std) | IC610CPU105 |
| CPU, Series One Plus 3.7K (3700 words of CMOS Memory) | IC610CPU106 |
| I/O Expander Cable | IC610CBL101 |
| Programmer with Keylock | IC610PRG100 |
| Programmer w/Keylock (Required for Series One Plus) | IC610PRG105 |
| CPU to Programmer Cable, 5' (1.5m) | IC610CBL100 |

## Table 2-1. Series One/Series One Plus Catalog Numbers - Continued

| DESCRIPTION | CATALOG NUMBER |
|---|---|
| Rack, 115/230 V ac Power Source, 5-slot | IC610CHS110 |
| Rack, 115/230 V ac Power Source, 5-slot (no expansion, 24 V dc Terminals, or Run Relay) | IC610CHS101 |
| Rack 115 V ac Power Source, 5-slot, UL listed | IC610CHS111 |
| Rack w/24 V dc Power Source, 5-slot | IC610CHS114 |
| Rack, 115/230 V ac Power Source, 10-slot | IC610CHS130 |
| Rack, w24 V dc Power Source, 10-slot | IC610CHS134 |
| Filler Module | IC610MDL100 |
| 24 V dc Sink Input, 8 Circuits | IC610MDL101 |
| 24 V dc Input/Output, 4 Inputs/4 Outputs | IC610MDL103 |
| 24 V dc Sink Input/Relay Output, 4 Inputs/4 Outputs | IC610MDL104 |
| Thumbwheel Interface | IC610MDL105 |
| 24 V dc Sink Input, 16 Circuits w/LEDs | IC610MDL106 |
| I/O Interface Cable 10' (3m) | IC610CBL105 |
| 24 V dc Sink Load Input, 16 Circuits | IC610MDL107 |
| 24 V ac/dc Source Input, 8 Circuits | IC610MDL111 |
| 24 V ac/dc Source Input, 16 Circuits | IC610MDL112 |
| 115 V ac Input, 8 Circuits | IC610MDL125 |
| 115 V ac Isolated Input, 4 Circuits | IC610MDL126 |
| 230 V ac Input, 8 Circuits | IC610MDL127 |
| 115 V ac Input, 6 Circuits (UL listed) | IC610MDL135 |
| 24 V dc Sink Output, 8 Circuits | IC610MDL151 |
| 24 V dc 2 Amp Sink Output, 4 Circuits | IC610MDL153 |
| 24 V dc 2 Amp Sink/Source Output, 4 Circuits | IC610MDL154 |
| 24 V dc Source Output, 8 Circuits | IC610MDL155 |
| 24 V dc Sink Output, 16 Circuits w/LEDs | IC610MDL156 |
| 24 V dc Sink Output, 16 Circuits | IC610MDL157 |
| 24 V dc Source Output, 16 Circuits | IC610MDL158 |
| 115/230 V ac Output, 8 Circuits | IC610MDL175 |
| 115/230 V ac Isolated Output, 4 Circuits | IC610MDL176 |
| Relay Output, 8 Circuits | IC610MDL180 |
| Relay Output, 5 Circuits (UL listed) | IC610MDL185 |
| Relay Output, 16 Circuits | IC610MDL182 |
| 115 V ac Output, 6 Circuits (UL listed) | IC610MDL181 |
| High Speed Counter | IC610MDL110 |
| I/O Interface Cable (High Speed Counter) | IC610CBL107 |
| Fast Response I/O | IC610MDL115 |
| I/O Simulator, 8 Inputs | IC610MDL124 |
| Printer Interface Unit | IC610PER151 |
| PROM Writer Unit | IC610PER154 |
| Accessory Kit | IC610ACC120 |
| Lithium Battery | IC610ACC150 |
| PROM Memory (4 Chips), Series One, Series One Junior | IC610ACC151 |
| CMOS Memory (4 Chips), Series One | IC610ACC152 |
| PROM Memory (4 Chips), Series One Plus | IC610ACC155 |
| CMOS Memory (4 Chips), Series One Plus | IC610ACC156 |
| Rack Mount Brackets | IC610CHS191 |
| Programmer Mount Assembly | IC610PRG190 |

**Table 2-1. Series One/Series One Plus Catalog Numbers - Continued**

| DESCRIPTION | CATALOG NUMBER |
|---|---|
| Remote CPU/Programmer Cable | IC610CBL102 |
| Data Communications Unit | IC610CCM105 |
| I/O Link Local | IC610CCM110 |
| I/O Link Remote | IC610CCM111 |

## Hardware Requirements

The Series One and Series One Plus PCs are an excellent relay and timer/counter replacer or substitute for other sequential type control devices, such as drum or stepping switch based systems. However, one question always arises - how much hardware do I need to buy? The answer varies extensively based upon different applications and their attendant complexities. Areas of concern include amount of memory, mix of inputs versus outputs, voltages of I/O, and physical size of the Series One or Series One Plus PC system. The following steps are guides to estimate the requirements of the Series One or Series One Plus PC system. With a little experience, estimating required components will become second nature. If you require assistance, please contact your local GE Fanuc Automation distributor who handles the Series One Family of PCs.

**NOTE**

CPU Module IC610CPU101A is different from 101B and 101C in that 101A has a 3 digit preset for Timers and Counters, while the updated modules, 101B and 101C have a 4 digit preset. The 101A method of monitoring the accumulated value of Timers and Counters is also different. With the 101A module, each individual Timer or Counter must be accessed by using the sequence SHF, 6XX, MON for each Timer/Counter to be monitored. With the 101B or the 101C CPU module, the keys NXT or PRV will move the monitor display to the next or previous Timer or Counter.

## System Estimating

The Series One and Series One Plus PCs are provided with 700 words of CMOS memory as a standard feature. Expansion to 1724 words is possible by adding a CMOS memory chip. If the unit is to be PROM based, the program can be up to 1724 words. The Series One Plus 3.7K PC provides the user with 3700 words of CMOS memory as a standard feature. For average complexity relay replacement, 700 words should be adequate for up to 64 I/O, and the 1724 should be adequate for up to 168 I/O. If the logic is considered more complex than that used as examples in this manual, a representative sample (10 to 15%) of the logic should be programmed. From the amount of memory (on paper) the sample requires, the total memory requirements can be estimated. If in doubt, obtain the optional memory with your unit to ensure simple system design.

The key to many of the answers (cost, physical size, memory requirements, etc.) is the I/O structure. If a design exists such as shown in figure 2-7, assume that all the relays and timers are enclosed within a box; these are the elements to be replaced. This figure is for illustrative purposes only; no indication is given that it performs any real functions. Passing through this box are wires from switches, auxiliary contacts, overload relays, etc.; these are inputs to the control system. There are wires connecting to loads or actuating devices such as solenoid valves, motor starters, indicator lights, etc.; these are outputs

from the control system. The power lines (e.g., 115 V ac and 24 V dc) are not considered I/O, but are important to estimating the number of I/O modules required.

Use the following steps to estimate rack and module requirements; figure 2-7 is used as an example:

1. Add total number of inputs and outputs separating them by type and voltage. (e.g. (4) 115 V ac and (5) 24 V dc inputs plus (3) 115 V ac and (1) 24 V dc output).

2. Divide each separate category by 8 (assume 8 circuit modules), (e.g. (1) 115 V ac and (1) 24 V dc input modules and (1) 115 V ac and (1) 24 V dc output modules). See Chapter 6 for I/O that uses 4 or 16 circuits per module.

3. Add total I/O modules (e.g. 4 I/O modules). One 5-slot rack is required for 1-4 I/O modules, two 5-slot racks for 5-9, and three 5-slot racks for 10-14.

4. If 10-slot racks are used one 10-slot rack is required for 1-9 I/O modules, two 10-slot racks or a 10-slot and a 5-slot rack will contain 1-14 I/O modules.

5. Each additional rack also requires an I/O expander cable. Empty slots should be covered by blank filler plates.

6. Estimate memory requirements as follows:

| Total I/O Points | Estimated Memory |
|---|---|
| 1-64 | Basic Unit with 700 words |
| 65-168 | Add 1K Memory Chip |

7. The following optional hardware is available and should be considered when configuring a system:

| | |
|---|---|
| Hand-Held Programmer | PROM Writer Unit |
| Portable Programmer | Printer Interface Unit |
| Extender Cable | Thumbwheel Interface Unit |
| Programmer Mount Assembly | Timer/Counter Setpoint Unit (Series One Plus) |

If the system has not yet been designed, the same basic technique can be used. Inputs are signals the PC will require to perform its assigned functions. Any device or person regardless of intelligence can not respond to events it does not know occurred. Plan to provide the PC all the information you would require to perform the same function. Make a list of those inputs, including source and voltage level (if currently defined). Outputs, on the other hand, are devices the PC will use to perform its functions. Again, even if the PC knows it must do something, if it is not given control over these actuating devices, it can not maintain proper control. Make a list of these devices including their voltage levels and current/power requirements. Use the above steps with the list of I/O devices. In any case, when

estimating system requirements, review the following standard features as discussed in later chapters to define their impact on your control needs:

- Up to 64 Timers and Counters (4 digits each)
- 128 Stage Shift Register
- Up to 64 Sequencers Each With Up to 1000 Steps
- 28 Latched Relays
- Data Operations (Series One Plus and Series One 3.7K)
- 64 Sixteen Bit Data Registers (Series One Plus and Series One 3.7K)
  - Up to 124 Data Registers are possible when unused T/C references are used as Data Registers.

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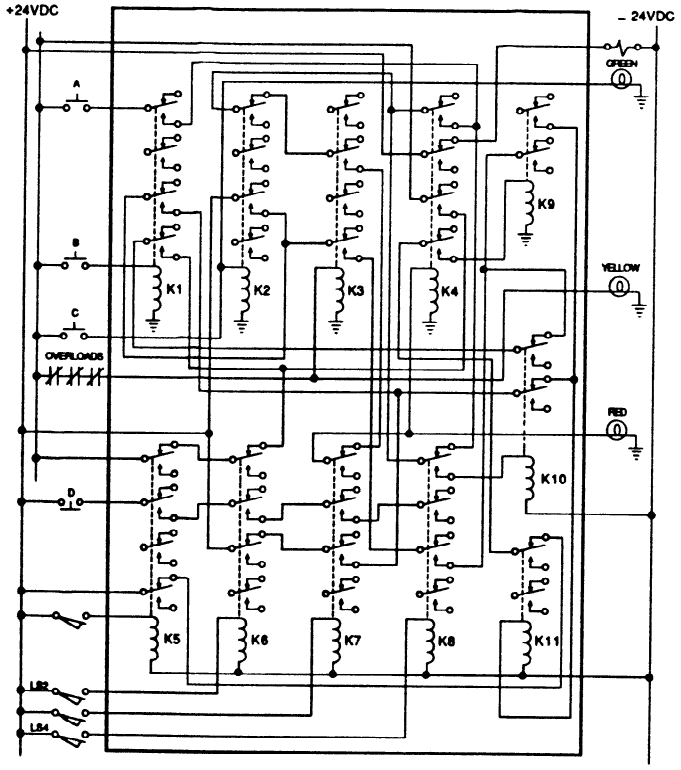


**Figure 2-7. Example of Relay Control**

## Peripheral Devices Supporting Series One Family of PCs

Several peripheral units are available to support a Series One or Series One Plus Programmable Controller. A basic description of these units is provided in the following paragraphs. For a more detailed description of the use and operation of these units, refer to Chapter 4, Operation, in this manual.

## Data Communications Unit

The Data Communications Unit (DCU), IC610CCM100/105, provides the ability for external devices to communicate with the Series One, Series One Model E, Series One Plus or Series One Plus 3.7K PC. Series One Model E, Series One Plus and Series One Plus 3.7K PCs require the CCM105 DCU. These devices function as a host to the Series One or One Plus PC and can be other programmable controllers, computers, or other smart devices. User programs and I/O information in the Series One or One Plus PC can be uploaded and downloaded to or from any master device that supports the Series Six CCM2 (Communications Control Module, Version 2) master/slave protocol as defined in GEK-25364, which is the Series Six Data Communications Manual. The Series One or Series One Plus can only function as a slave device during a communications session.

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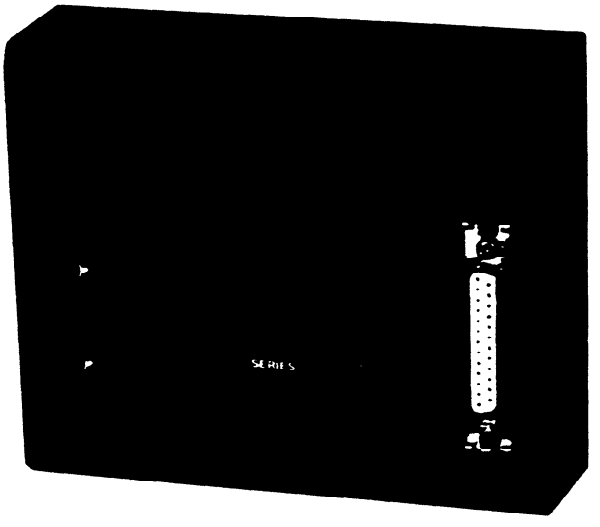

**Figure 2-8. Data Communications Unit**

### Printer Interface Unit

The Printer Interface Unit, IC610PER151, is a compact, easy to use device that attaches to the Series One, One E, One Plus or One Plus 3.7K PC in the same manner as the programmer. This peripheral interfaces to many readily available personal computer printers and provides a means of obtaining a hard-copy printout of the user program in either boolean or ladder diagram format. Version B works with Series One, One E and One Plus PCs. A higher revision will be available that will also work with the Plus 3.7K PC.

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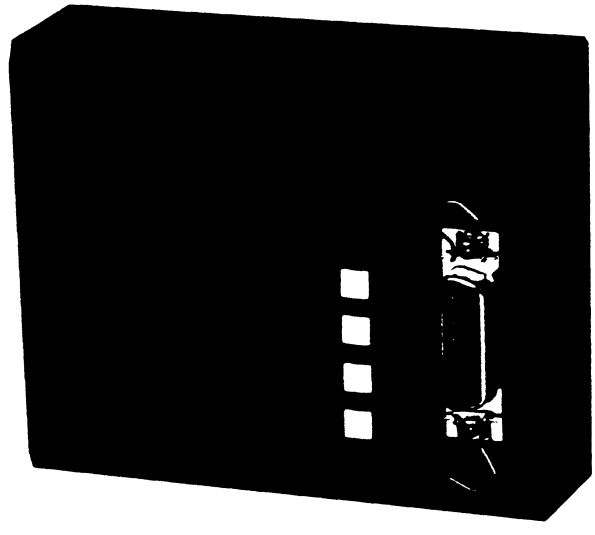

**Figure 2-9. Printer Interface Unit**

## PROM Writer Unit

Also available is a PROM Writer unit, IC610PER154, which allows the user program in CMOS memory to be transferred to PROM memory, thereby providing a convenient method of non-volatile (permanent) storage for those programs. The PROM Writer unit is a compact, easy to use unit which attaches directly to the PC in the same manner as the programmer. In addition to providing a means of non-volatile storage, an added advantage of PROM memory is that several PROMs can be programmed, each containing a different program, for use as required. Version B of this unit replaces version A and can be used with a Series One Plus PC as well as Series One and Series One Junior PCs. Version B will not work with the Series One Plus 3.7K PC. A revised version will be available that can be used for all Series One Family PCs.

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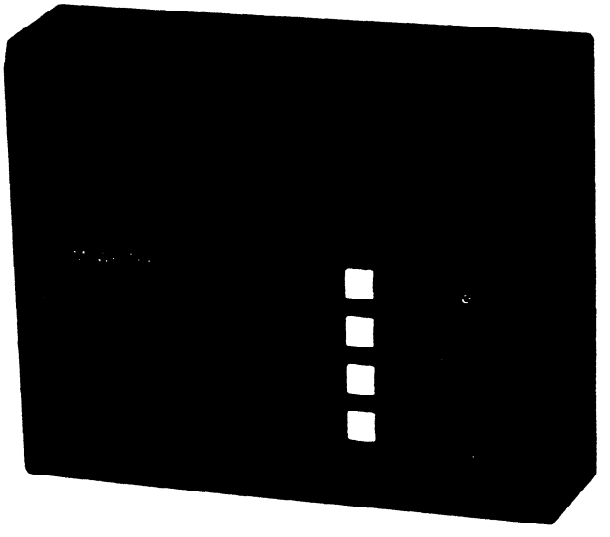

**Figure 2-10. Prom Writer Unit**

| PROGRAMMABLE CONTROLLER | PROM |
|---|---|
| Series One/One E | 2732A-2 |
| Series One Plus/3.7K | 27256-25 |

## Specifications for Installation

The Series One and Series One Plus PC can be easily installed in any NEMA panel or similar metal surface. Figure 3-1 provides details on the mounting of up to three racks except for input voltage requirements to form a single PC system. Since a completed 5-slot rack weighs less than five pounds (10-slot rack, less than 7 pounds), it can be easily installed by one technician. Table 3-1 provides specifications to be met during installation.

**Table 3-1. Series One Installation Specifications**

| | |
|---|---|
| **Rack Size** | |
| **5-slot** | 11.4" x 4.7" x 5.5" (290 x 120 x 140mm) |
| **10-Slot** | 18.3" x 4.7" x 5.5" (465 x 120 x 140mm) |
| **Completed Rack Weight (less wiring)** | 4.5 lbs (2.0 Kg), 5-Slot<br>6.5 lbs (2.9 Kg), 10-slot |
| **Ambient Temperature** | 0° to 60°C (32° to 140°F) |
| **Storage Temperature** | -10° to 70°C (14° to 158°F) |
| **Humidity** | 5-95% (Non-Condensing) |
| **AC Power Required: IC610CHS101/110/130 Rack** | |
| **Voltage** | 115V/230 V ac 15% |
| **Frequency** | 47-63 Hz |
| **Maximum Load** | 30 VA, CHS101/110 (70 VA, CHS130) |
| **Output Current** | 1.4 A at 5 V dc (0.4 A CHS101) |
| **Maximum Individual** | 0.8 A at 9 V dc, CHS110 (0.6 A, CHS101; 1.7 A, CHS130)<br>0.5 A at 24 V dc, (0.2 A, CHS101) |
| **DC Power Required IC160CHS114/134** | |
| **Voltage** | 20.5 - 30 V dc (100% of capacity used)<br>18 - 30 V dc (90% of capacity used) |
| **Ripple** | 10% of Input Voltage |
| **Output Current** | 1.4 A at 5 V dc |
| **Maximum Individual** | 0.8 A at 9 V dc, CHS114 (1.7 A, CHS134)<br>0.4 A at 24 V dc, CHS114 (0.5 A, CHS134) |
| **Maximum, Total (All voltages)** | 2.2 A, CHS114 (2.9 A, CHS134) |
| **Run relay** | 250 V, 4 amp, Resistive Load<br>(Not Present on CHS101) |
| **Vibration** | Meets JIS C 0911 IIB Class 3<br>Tested to MIL STD 810C Method 514.2 |
| **Shock** | Meets JIS C 0912 |
| **Noise Immunity** | Meets NEMA ICS3-304 |

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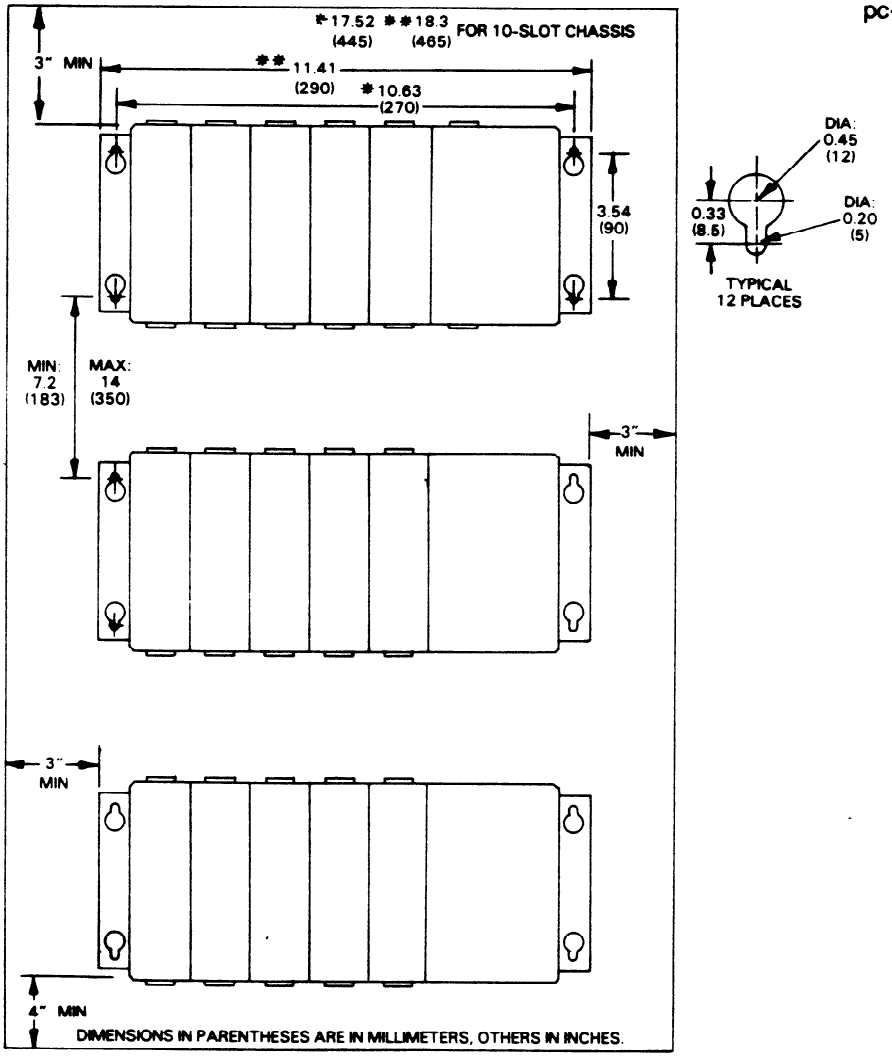


**Figure 3-1. Rack Mounting Dimensions for Proper Heat Dissipation**

## Installation

Unpack each unit carefully and retain any instructions shipped with the units. Two spare fuses are attached to the top of each rack; they should be removed and retained for future use. The racks can be installed either with no modules or with modules installed. The following steps will assist in organizing and simplifying the installation of a Series One or Series One Plus PC System.

### Racks

1. Using the rack as a template, mark where mounting holes are to be drilled.
2. Drill the four mounting holes (1/4" (6mm) if using pass through bolts, or 3/16" (5mm) if using tapped holes).
3. Insert top 2 bolts (3/16" X 1-1/2" or 5mm X 40mm), put unit in place, and loosely secure with washers, lock washers and nuts.

OR

4. Tap holes and insert top two bolts. Place unit onto mounting bolts and loosely secure.

**NOTE**

When inserting the 2 top bolts, attach the green jumper as shown in figure 3-2. This jumper wire is packed with each rack and provides a method of grounding the rack when an earth ground (such as the shield or hard wire in the power cord) is also connected to a mounting bolt.

5. The power supply ground connection is made to one of the mounting bolts (step 3 or 4 above). A jumper wire is included with each rack to interconnect the mounting brackets. The "C" terminals on the power supplies are interconnected when more than one rack is used. Otherwise, the "C" terminal is not connected to anything in a single rack system.

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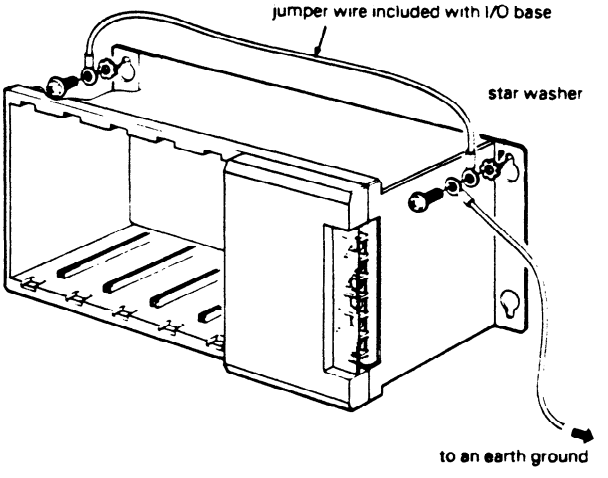


**Figure 3-2. Recommended Rack Grounding**

6. Complete the installation of the bottom two bolts and tighten all mounting hardware. Power supplies are shipped installed in each base.
7. If additional racks are to be used, repeat steps 1-4 above. If only one base unit is used, go to step 15.

**NOTE**

When drilling or tapping holes ensure that metal chips do not enter unit already installed. Clear work area before installing base units.

8. Obtain flat ribbon cable used to interconnect racks. Locate end marked "To CPU", remove dust cover from bottom connector of first (CPU) rack, and insert cable connector (see figure 3-4) fully into receptacle until locking tabs capture connector.
9. Fold cable as shown on figure 3-7. Remove dust cover from top connector of second rack and insert opposite end of cable marked "To Expander."
10. Secure cable in place with wire wraps or cable ties.

11. If a third rack is used, repeat steps 8-10 with CPU end of cable in bottom connector on second rack and Expander end in top connector of third and last rack.
12. If a 10-slot rack (IC610CHS130 or IC610CHS134)) is to be included in a system, it can be mounted on standard mounting rails in 19 inch cabinets and consoles by attaching the rack mount brackets. Two adapter brackets and hardware required for assembly are included in the bracket package, IC610CHS191.

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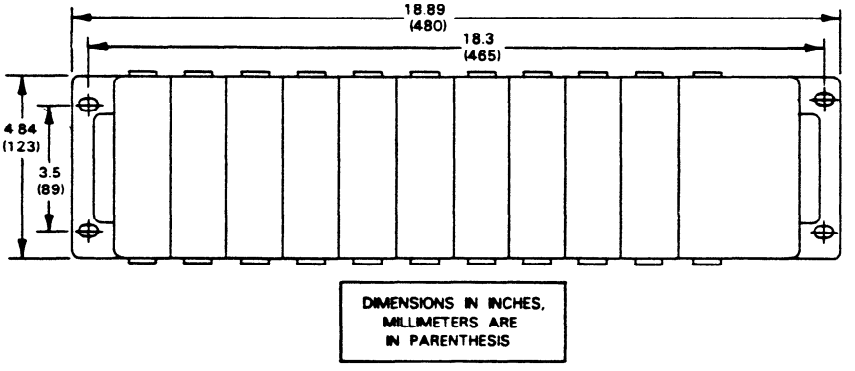


**Figure 3-3. 10 Slot Rack, 19 Inch Mounting Dimensions**

a40280

**Figure 3-4. I/O Expansion Cable Connection**

13. Unused rack connectors such as at the top of the CPU unit and the bottom of the last rack should retain their dust covers.

14. Inside each 5-slot rack at the rear of the leftmost module slot is a two position switch. On the CPU unit, this switch must be positioned towards the left. On the first expander it must be towards the right. If a third rack is used, the switch must be towards the left again. An exception to the described switch settings is when a 5-slot rack is used as an expansion rack in a Series One Plus system, where the CPU rack is a 10-slot rack. In this case, the switch must be positioned to the left. This switch is not included in the IC610CHS101 rack, since it cannot be used as an expansion rack.

**CAUTION**

**All switches must be set properly. The Series One or Series One Plus PC may not function correctly if any switch is not in the correct position.**

15. The 10-slot racks, IC610CHS130/134 have two bridge connectors on the back plane which must be configured. Bridge connector SW1, located between slots 3 and 4, has 2 positions EXP and CPU. The jumper must be positioned on the corresponding pins to specify whether the rack is a CPU rack or an Expansion rack. Bridge connector SW2, located between slots 9 and 10, selects the address to be assigned to slot 10 and the expansion rack slots. The selections are either 100 EXP or 700. Figure 3-5 shows the location of SW1 and SW2.

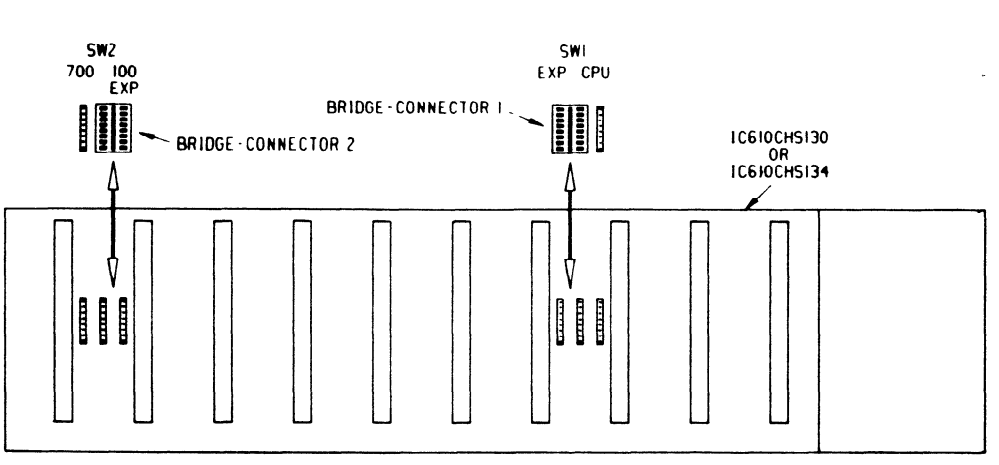


**Figure 3-5. I/O Addressing Switches in Series One Plus 10 Slot Racks**

16. Example of SW1 and SW2 settings are shown below in figure 3-6.

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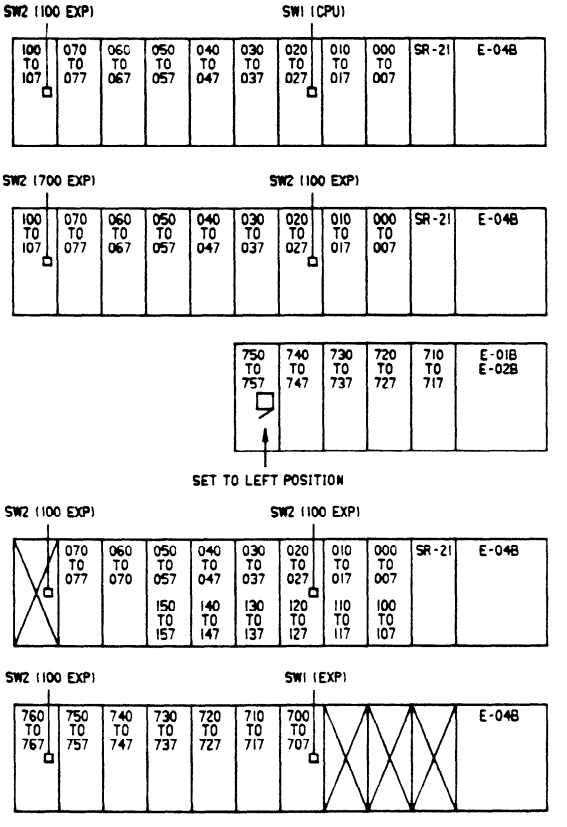


**Figure 3-6. Examples of Rack Configuration Switch Setting Series One Plus**

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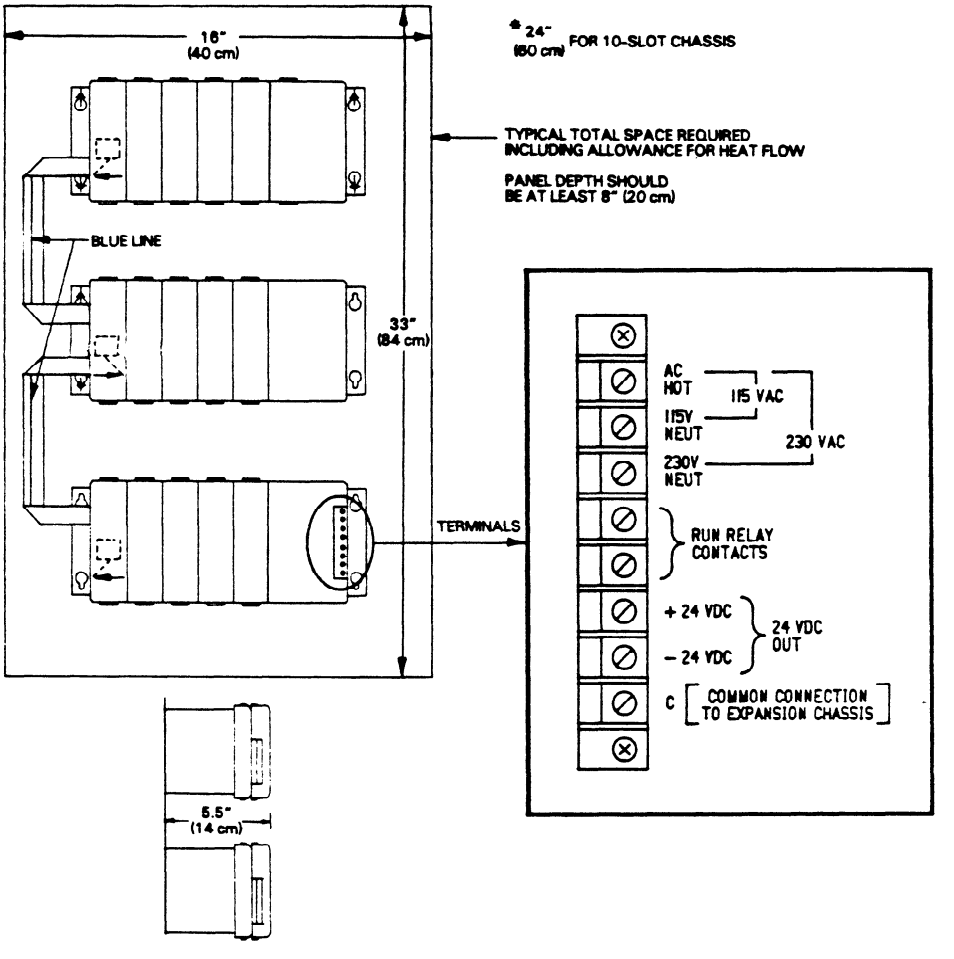


**Figure 3-7. Typical Installation Dimensions**

**NOTE**

Ground Connection should be made to mounting bracket, not to the terminal strip.

## CPU

17. Locate the CPU module (see figure 3-8) and set switches and shorting bridge connectors per table 3-2. If additional CMOS or PROM memory is to be installed, now is the time to do it. For detailed instructions, see Chapter 7.
18. The CPU module must be installed adjacent to the power supply in the first or topmost rack.

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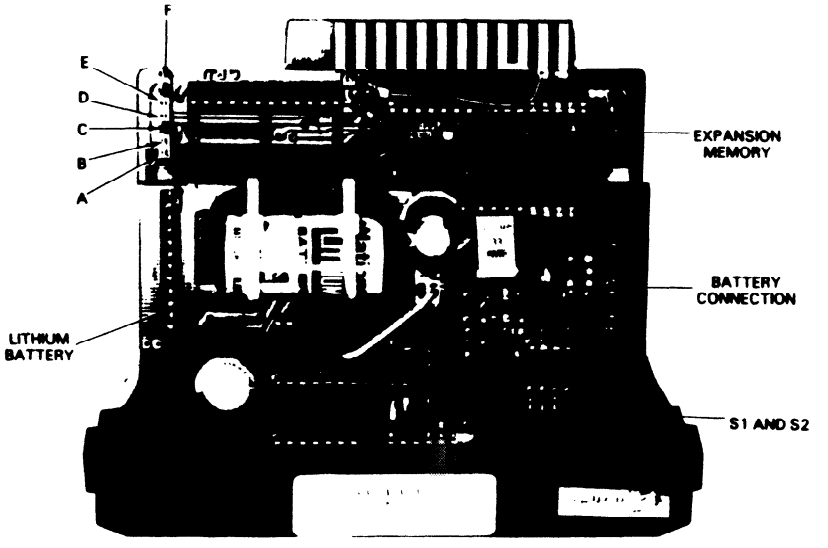


**Figure 3-8. CPU Module**

**Table 3-2. CPU Option Settings**

| SWITCH 1 - POWER UP FUNCTIONS | | SWITCH 2 - MEMORY TYPE | |
|---|---|---|---|
| OFF | Clear Coils | OFF | PROM |
| ON | Retain Coils | ON | CMOS |

**NOTE**

ON is Towards the Faceplate. Factory setting is: Clear Coils and Select CMOS memory. Retain Coils affects 340-373 only. Counters and Shift Registers are always retentive.

**Table 3-3. Memory Size**

| MEMORY SIZE | CONNECT JUMPERS BETWEEN PINS |
|---|---|
| 700 Words CMOS | $\overline{A\ B}$ and $\overline{D\ E}$ |
| 1724 Words CMOS | $\overline{B\ C}$ and $\overline{E\ F}$ |
| 1724 Words PROM | $\overline{A\ B}$ and $\overline{D\ E}$ |

**CAUTION**

**Remove jumper $\overline{E\ F}$ before installing PROM. Battery will discharge in a very short time if $\overline{E\ F}$ is not disconnected.**

**NOTE**

Pin A is towards the faceplate. Factory setting is: 700 words CMOS, 1724 words PROM (same Setting)

a40282

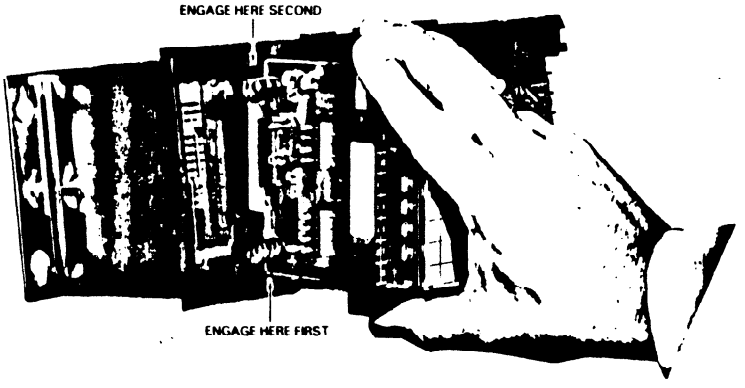


**Figure 3-9. Proper Module Insertion**

19. Tilt the module approximately 10° as shown in figure 3-9. Insert bottom of the large printed circuit board into the bottom card slot.
20. When the bottom slot is engaged, rotate the module to engage top slot. Slide module into base unit until it is firmly seated and snap locks engage.

## I/O

21. Other modules are installed into racks at slot locations as determined by installation plans. Follow steps 19 and 20 above for each I/O module.
22. To remove a module, squeeze the snap locks top and bottom (see figure 3-10) towards the center and pull the module straight out. Squeeze force should be approximately 10 pounds (5 Kg) and pull force 8-12 pounds (4-5 Kg).

a40283

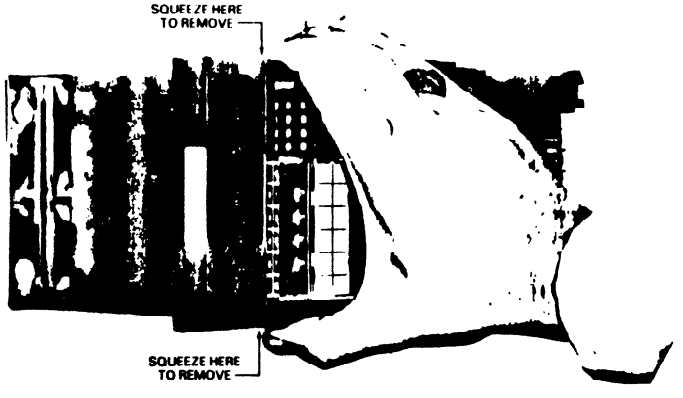


**Figure 3-10. Proper Module Removal**

## Power Connections

23. AC or DC power connections are made to the terminal strip on the far right of each unit. See table 3-1 for power requirements. The minimum recommended wire size for power connections is AWG No. 18 (1mm).

24. Strip 0.4 ± 0.1 inches (10 ± 2mm) of insulation from each wire (hot, neutral, and ground or + and -) or place a No. 6 insulated lug (ringed or forked) onto each wire.

25. Remove plastic cover over terminal strip and retain. Connect the hot wire to the top terminal. The neutral is connected to either the next (second) terminal for 115 V ac operation or the third terminal for 230 V ac operation as marked on the base unit. For 24 V dc racks, connect the + and - terminals to the DC power source.

**WARNING**

**Do not use the top screw for power connections; it secures the terminal block. Verify connections before applying power.**

26. Connect an earth ground wire to the rack mounting bracket as shown in figure 3-2. (Typically this ground wire is the green wire from the ac power source.)

**WARNING**

**Ensure that all exposed wiring is either under the screw-down plate of the terminals or insulated by shrink tubing or sleeves.**

27. The terminals labeled +24 V dc and -24 V dc provide 24 V dc @ 100 mA for connection to an external sensor (not on IC610CHS101).

28. The two remaining terminals are used with the RUN indicator. Use of this standard feature on all racks is optional. It can be used to drive an external indication of the functional state of this rack. The Run relay is closed when the CPU is scanning (not on IC610CHS101).

29. If the Run indication is desired, it can be wired separately to an external indicator (light, bell, whistle, etc.) or in series with other racks. Follow steps 24-25 above for guidance on connecting these wires. Then replace the plastic cover.

## I/O Field Wiring

30. Recommended wire size for connection to the I/O modules is stranded AWG No. 12 (0.65-2mm) wire. Two wires per terminal are possible with AWG No. 14 (0.65-1.6mm) wire.

31. Strip 0.3 ± 0.05 inches (8 ± 1.5mm) from each wire to be connected to the I/O modules or install a No. 6 insulated lug (ringed or forked). Bare wire connections are recommended for multiple wire connections to one terminal.

32. Carefully remove plastic covers over I/O terminal connections by lifting top or bottom leg and sliding it to right or left.

33. Starting with the lower terminals, connect the field wires to all I/O terminals. Power connections such as those to commons (C) should be made last. No connections are required to unused circuits; however, screws on unused terminals should be tightened.

34. For 16 point I/O modules that connect to I/O through a connector on the faceplate, secure the connector on the I/O Interface cable to the connector on the module.

**WARNING**

**Ensure that wires to the top set of terminals do not extend beyond the screw-down plate. Any wire exposed before the terminal plate must be covered by shrink tubing or sleeves.**

35. Wires should be laced together to leave a service loop adequate for removal of I/O modules without disconnecting wires. See figure 3-11. After testing of I/O wiring, replace plastic covers.

a40017

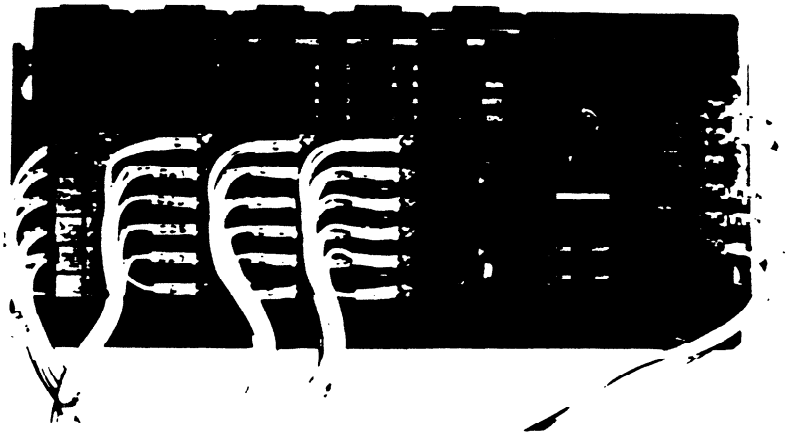

**Figure 3-11. Typical Routing of I/O Wiring**

## Programmer

36. The hand-held programmer (catalog no. IC610PRG100 or IC610PRG105) can be placed over the CPU and power supply for permanent or temporary mounting. Its connector fits into the receptacle on the CPU and it snap locks onto the power supply.
37. If an extender cable is used with the programmer, it should be installed next or when required. One end of the cable has a push tab (see figure 3-12). This end is connected to the programmer (see figure 3-13). The other end is connected to the 26-pin connector on the CPU. Both ends are keyed for proper installation. The red edge of the ribbon cable is installed up at both ends.

a40163

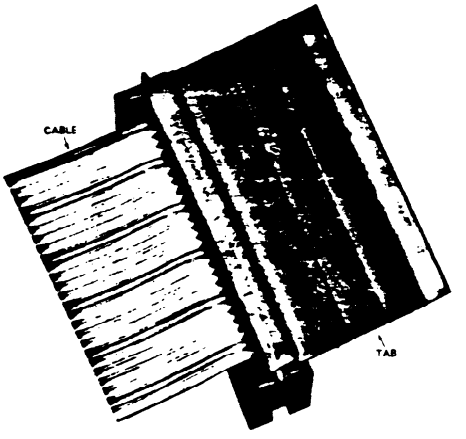


**Figure 3-12. Pull Tab on Programmer Cable**

**NOTE**

For proper noise immunity, it is recommended that the extender cable be used on a temporary basis and not permanently installed with the programmer.

38. To install the programmer directly onto the CPU, align the programmer on the outside dimensions of the power supply and gently push down to engage snap locks.

**CAUTION**

**To ensure proper CPU operation, it is recommended that the programmer not be connected nor disconnected with ac power applied.**

83-pc-35mm-4-3-31a

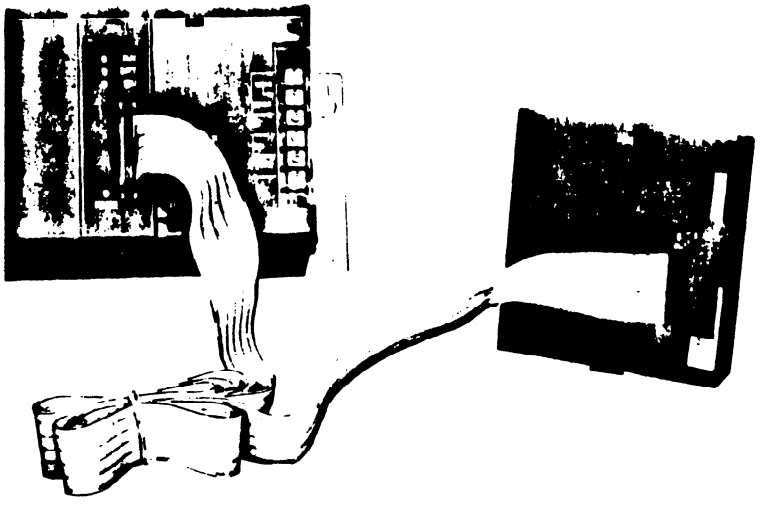

**Figure 3-13. Installation of Programmer Cable**

39. The Programmer Mount Assembly (catalog no. IC610PRG190) can be used when installing the hand-held programmer on the outside of a panel or console, or can be used as a table top stand for the programmer. Figure 3-14 shows how to install the mounting assembly. *The CPU/Programmer cable must be ordered separately.*

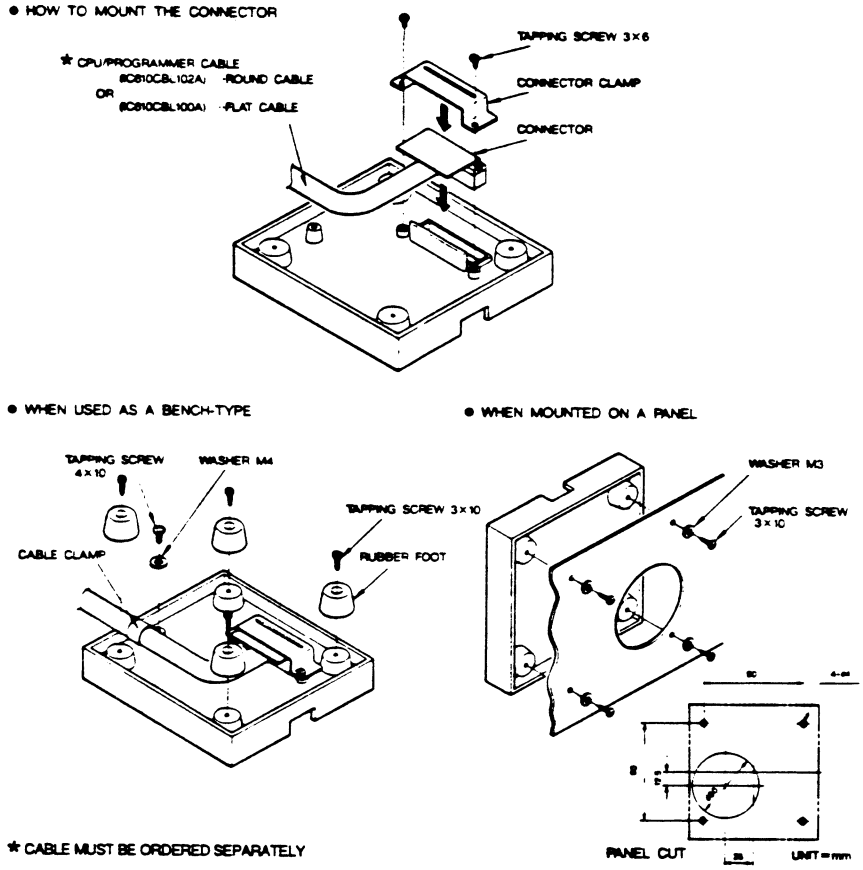


**Figure 3-14. Programmer Mount Assembly**

## Power Supply Limitations for Racks

If the power supply in either a CPU or expansion rack should become overloaded, unpredictable system operation may occur. To ensure that this does not happen, the total current capabilities of the modules placed in the rack must not exceed the current carrying capabilities of the rack power supply.

### Units of Load

The power used by each module is expressed in (units of load), where 1 unit equals 10 mA. Calculations are based on the worst case condition with all inputs and outputs on. Table 3-4 list the units of load supplied by each rack, and table 3-5 is a list of units of load used by each module. When configuring a rack, note the units of load supplied, then add the total units of load used by the modules you have selected. The total units of load for the modules must not exceed the total units of load supplied by the rack. If they do, the system should be redesigned.

## Table 3-4. Units of Load Supplied by Rack

| CATALOG NUMBER | RACK DESCRIPTION | POWER SUPPLIED IN UNITS OF LOAD | | | |
|---|---|---|---|---|---|
| | | +5 V | +9 V | +24 V | +24 V External |
| IC610CHS101 | 5-slot, 115/230 V ac | 40 | 60 | 20 | - |
| IC610CHS110 | 5-slot, 115/230 V ac | 140 | 80 | 40* | 10 |
| IC610CHS111 | 5-slot, 115 V ac, UL | 140 | 80 | 50 | 10 |
| IC610CHS114 | 5-slot w/24 V dc P/S | 140 | 80 | 40 | - |
| IC610CHS130 | 10-slot, 115/230 V ac | 140 | 170 | 50* | 10 |
| IC610CHS134 | 10-slot w/24 V dc P/S | 140 | 170 | 50 | - |

*If an external sensor is connected to the 24 V + and - terminals on the power supply, the current used by the sensor (up to the maximum of 100 mA), should be deducted from the available listed units of load.

## Table 3-5. Units of Load Used by Modules

| CATALOG NUMBER | MODULE DESCRIPTION | POWER USED IN UNITS OF LOAD | | |
|---|---|---|---|---|
| | | +5 V | +9 V | +24 V |
| IC610CPU101 | CPU | 25 | - | - |
| IC610CPU104 | CPU25 | - | - | |
| IC610CPU105 | CPU | 25 | - | - |
| IC610CPU106 | CPU | 25 | - | - |
| IC610PRG100 | Programmer | 6 | 5 | - |
| IC610PRG105 | Programmer | 6 | 5 | - |
| IC610MDL101 | 24 V dc Sink Input (8) | - | 1 | 10 |
| IC610MDL103 | 24 V dc In/Out (4/4) | - | 2 | 7 |
| IC610MDL104 | 24 V dc In/Relay Out (4/4) | - | 20 | 6 |
| IC610MDL105 | Thumbwheel Interface | - | 1 | 9 |
| IC610MDL106 | 24 V dc Sink In w/LEDs (16) | - | 3 | 24 |
| IC610MDL107 | 24 V dc Sink Load In (16) | - | 3 | 23 |
| IC610MDL110 | High Speed Counter | - | 7 | - |
| IC610MDL111 | 24 V dc ac/dc Input (8) | - | 1 | - |
| IC610MDL112 | 24 V ac/dc Source In (16) | - | 13 | - |
| IC610MDL115 | Fast Response I/O (4/2) | - | 8 | 6 |
| IC610MDL124 | I/O Simulator (8) Inputs | - | 1 | 11 |
| IC610MDL125 | 115 V ac Input (8) | - | 1 | 1 |
| IC610MDL126 | 115 V ac Isolated Input (4) | - | 1 | - |
| IC610MDL127 | 230 V ac Input (8) | - | 1 | - |
| IC610MDL135 | UL, 115 V ac Input (6) | - | 1 | - |
| IC610MDL151 | 24 V dc Sink Output (8) | - | 2 | 3 |
| IC610MDL153 | 24 V dc 2A Sink Out (4) | - | 1 | 1 |
| IC610MDL154 | 24 V dc Sink/Source Out (4) | - | 1 | 10 |
| IC610MDL155 | 24 V dc Source Output (8) | - | 3 | - |
| IC610MDL1[illegible] | 24 V dc Sink Out w/LEDs (16) | - | 4 | 0 |
| IC610MDL157 | 24 V dc Sink Out w/LEDs (16) | - | 4 | 10 |

**Table 3-5. Units of Load Used by Modules - Continued**

| CATALOG NUMBER | MODULE DESCRIPTION | POWER USED IN UNITS OF LOAD | | |
|---|---|---|---|---|
| | | +5 V | +9 V | +24 V |
| IC610MDL158 | 24 V dc Source Out w/LEDs (16) | - | 20 | - |
| IC610MDL175 | 115/230 V ac Output (8) | - | 16 | - |
| IC610MDL176 | 115/230 V ac Isolated OUT (4) | - | 16 | - |
| IC610MDL180 | Relay Output (8) | - | 34 | - |
| IC610MDL181 | UL, Relay Output (5) | - | 23 | - |
| IC610MDL182 | Relay Output (16) | - | 48 | - |
| IC610MDL185 | UL, 115 V ac Output (6) | - | 12 | - |
| IC610CCM105 | Data Communications Unit | 30 | - | - |
| IC610CCM110 | I/O Link Local | 60 | - | - |
| IC610CCM111 | I/O Link Remote | 60 | - | - |
| IC610PER151 | Printer Interface Unit | 26 | - | - |
| IC610PER154 | PROM Writer Unit | 50 | - | - |
| IC609CTU100 | Timer/Counter Setpoint Unit | 4 | 1 | - |

1 unit of load = 10 mA. Calculations are based on the worst case, that is, all inputs and outputs on.

## Safety Considerations

When planning the layout of a system, safety should be a prime consideration. System planning should include procedures and methods to ensure the physical safety of personnel, the Series One or One Plus system and the equipment or process being controlled. Those personnel who are involved in the planning and installation of a system should be familiar with all local and national electrical codes as well as installation instructions in this manual.

All practices should be followed that are specified by the IEEE (Institute of Electrical and Electronic Engineers) Standard 510 which includes tray and conduit spacing and wiring procedures. A copy of this standard can be obtained by writing:

*Institute of Electrical and Electronic Engineers*
*345 East 47th Street*
*New York, NY 10017*

## Recommended Field Wiring Procedures

The following procedures are recommended when running field wiring:

- Low-level signal wires should be separated from other field wiring.
- AC power wiring should be separated from DC field wiring.
- Wiring should not be routed near devices causing electrical interference.
- If severe noise problems are present, additional power supply filtering or an isolation transformer may be required. Contact your GE Fanuc Automation sales representative if assistance is required.
- Proper grounding should be provided to minimize hazards to personnel.
- Label all I/O wires. Circuit numbers or other identification can also be marked on the cover over the wire terminals on each I/O module.
- I/O wires should be no larger than No. 12 AWG.