SECTION 3
SYSTEM INSTALLATION

The MICRO 84 Programmable Controller mainframe is easily installed in a standard 8" deep NEMA rack. Figure 3-1 illustrates a typical system layout, providing mounting dimensions of all major components. Figure 3-2 provides mounting hole dimensions. For proper heat flow, all units should be mounted vertically. This allows natural air flow and removal of heat by way of the heavy duty housing fins. For Class I operating environments where air tight explosion-proof enclosures are employed, a minimum of six inches is necessary for heat dissipation between the top, bottom, sides, and front of the MICRO 84 and the enclosure.

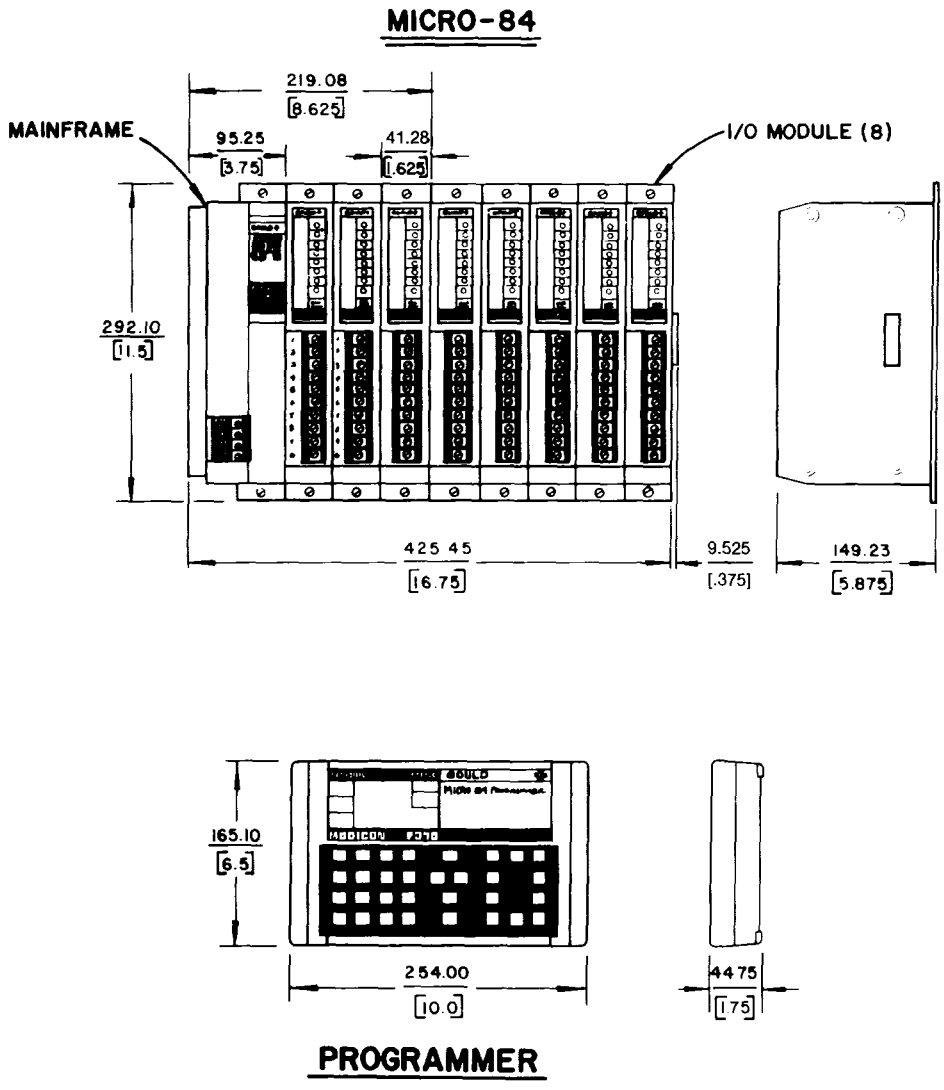

Figure 3-1. Typical System Installation

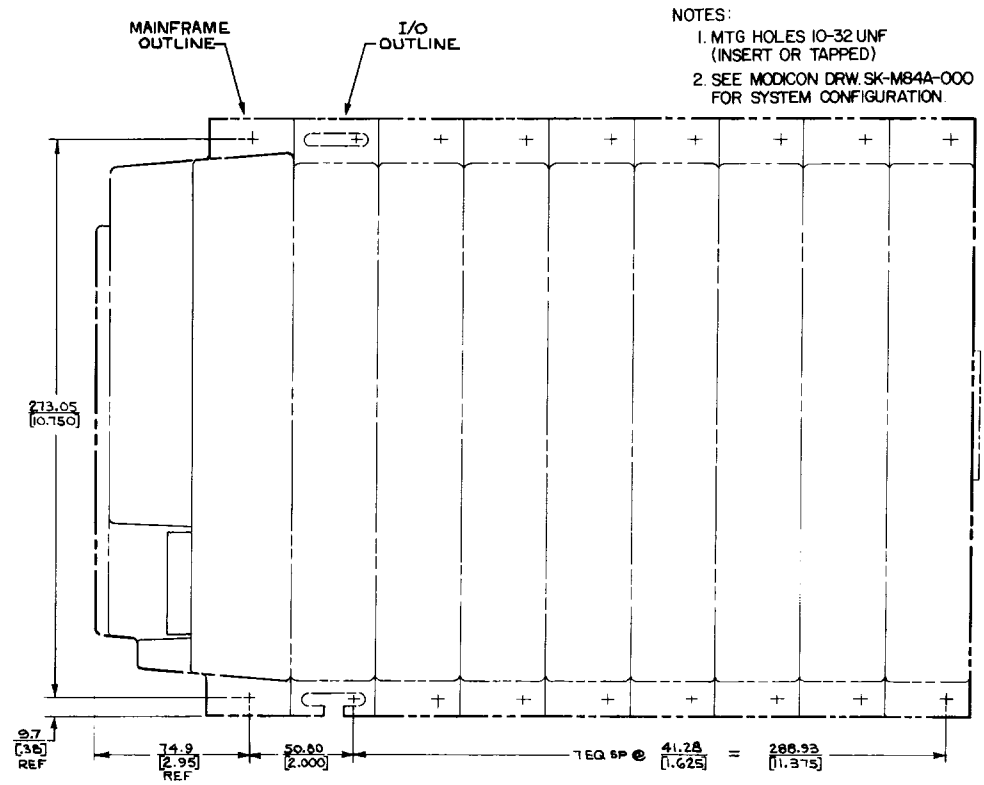

Figure 3-2. MICRO 84 Mounting Dimensions

3.1 SYSTEM REQUIREMENTS

Each MICRO 84 Programmable Controller requires an M84A mainframe unit (controller) containing the processor, user memory, and power supply, a combination of up to fourteen input and output modules for user equipment connections, and a P370 Programmer to allow communication between the user and the system. The MICRO 84 is available with one of two memory sizes. The memory size determines the number of networks that can be programmed into the controller (see Table 3-1).

Table 3-1. System Memory Sizes

MODEL	I/O MODULES*	NETWORKS
M84A-001 (1K)	8 (basic system)	9
M84A-002 (2K)	14 (expanded system)	18
*Each module can be connected by a maximum of 8 input or output points.		

3.2 SYSTEM SPECIFICATIONS

Table 3-2 contains the specification for the various components of the MICRO 84 Programmable Controller system:

Dimensions (WxHxD):	
Mainframe (w/Power Supply)	3.75 in. X 11.50 in. X 5.875 in. (95.25mm X 299.10mm X 149.23mm)
Single I/O Module	1.625 in. X 11.50 in. X 5.875 in. (53.95mm X 292.10mm X 149.23mm)
P370 Programming Panel	10.00 in. X 6.50 in. X 1.75 in. (254.00mm X 165.10mm X 44.75mm)
Program Pack	2.88 in. X 1.50 in. X 5.00 in. (73.15mm X 38.10mm X 127.00mm)
Weight:	
Mainframe (w/Power Supply)	5 lbs., 6 oz. (2.44 kg)
Single I/O Module, output	1 lb., 13 oz. (0.82 kg)
Single I/O Module, input	1 lb. (0.45 kg)
Programming Panel	1 lb., 10 oz. (0.74 kg)
Program Pack	8 oz. (0.23 kg)
Power Requirements, AC:	
Voltage Range	115 or 220 VAC, ±15% 47 to 63 Hz, 50 watts max.
NOTE: The 220 VAC option requires the removal of a jumper on the external power terminals.	
Power Requirements, DC:	
Voltage Range	24 VDC, +20%, −15% (20.4 to 28.8 VDC)
Polarity Reversal	Polarity reversal to the external power terminals will blow the power supply fuse. No damage will occur to the power supply, controller, or I/O modules.
Current Draw	3A max. .5A operating
Fuse	5A
Environmental Requirements:	
Ambient (Room) Temperature, mainframe	0° to 60°C
Ambient (Room) Temperature programming panel	0° to 40°C
Relative Humidity	0% to 95% (non-condensing)
Shock	10 G for 11 msec.
Vibration	.625 G, 50 to 500 Hz
EMI (electromagnetic Interference)	MIL-STD 461 B
MI (magnetic interference)	HELM HOLTZ Co.1
RFI (radio frequency interference)	FCC Class A
SWC (surge withstand capability	IEEE 472-1974 & ANSI C37.90A

Table 3-2. MICRO 84 Specifications

3.3 CONTROLLER

The MICRO 84 controller (Model M84A) is contained within a rugged metal housing that is designed to screw mount into a standard 8" deep NEMA rack. The controller can also be screw mounted onto a wood mounting panel.

Located on the housing front is a five screw terminal strip and two indicating lights. The terminal strip is used to connect external AC power to the MICRO 84 system. The upper indicating light, (POWER), is illuminated when external AC power is applied to the power supply. The lower indicating light, (RUN), is on when the processor is solving the logic networks. Refer to Figure 3-3.

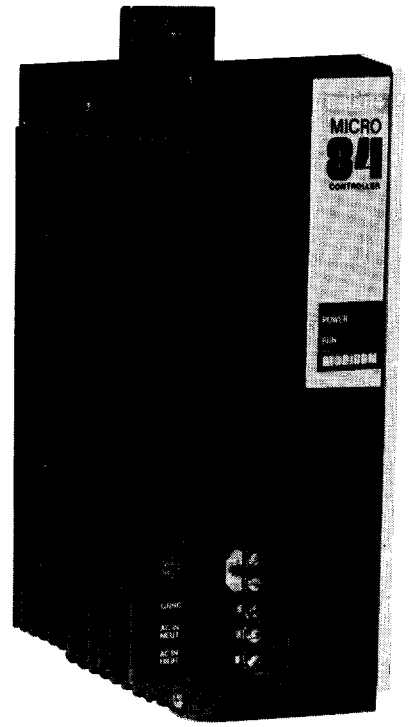

Figure 3-3. MICRO 84 Controller

Located on the bottom of the controller are two female sockets that are used in connecting peripheral (user interface) devices to the controller. The socket closest to the front of the controller is for the P370 Programmer and the other is for the P371 Program Pack (see Figure 3-4).

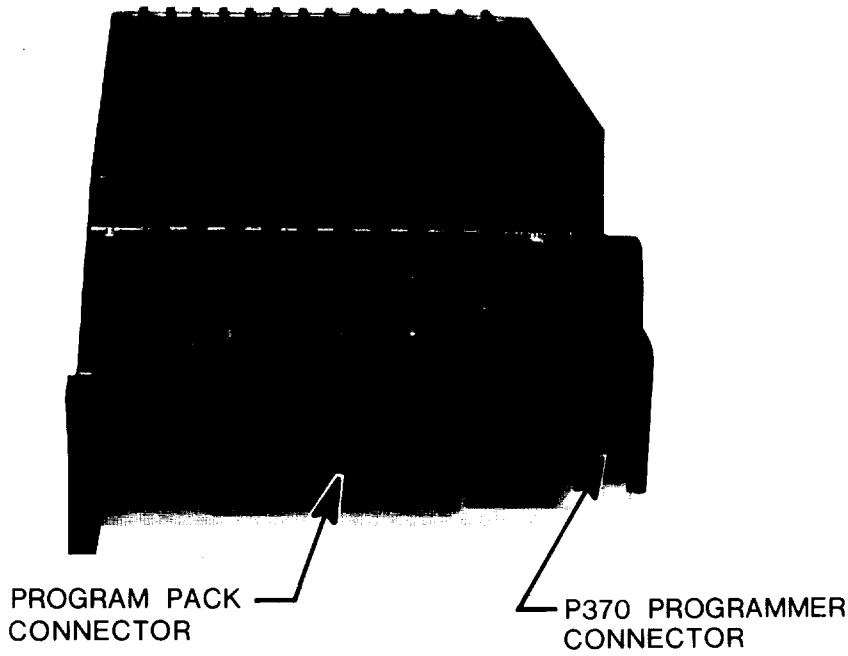

Figure 3-4. Bottom of MICRO 84 Controller

A female socket is located on the right side of the controller housing. This socket is the link between the controller unit and the input/output and register modules. A terminator plug, supplied with the controller, must be inserted into the rightmost I/O module during system operation. Programs can be generated in the MICRO-84 without any I/O modules as long as the terminator plug is inserted into this socket.

3.4 INPUT/OUTPUT MODULES

The B300 Series modules are contained in rugged plastic housings that can be screw mounted into a standard 8" deep NEMA rack. Located on the housing front are circuit indicating lights that turn on to indicate when a particular circuit is active. Screw terminals connect the MICRO 84 to the user's equipment. An interconnecting socket is located on each side of the I/O housing. The left side socket allows communication between the I/O module and the controller and the right side socket allows communication between additional I/O modules and the controller. The last I/O module must have the terminator cap, shipped with the controller, inserted in the right side socket.

All user control devices that provide input to the MICRO 84 are connected to the screw terminals located on the input modules. All user devices that are controlled by the MICRO 84 are connected to the screw terminals located on the output modules. Refer to Figure 3-5.

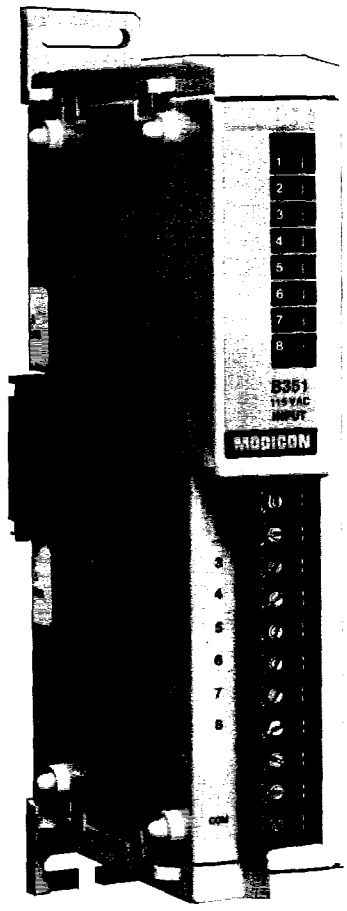

Figure 3-5. Typical Discrete I/O Module

3.5 COMPONENT MOUNTING

The MICRO 84 controller (M84A) unit is secured to the mounting surface using two screws, one top and one bottom. See Figure 3-1. After securing the controller unit, the first input/output module is plugged into the controller using the connector located on the right side of the controller unit. Use the tabs (mating protrusions) on the left side of the module to assure proper alignment of the module with the controller. Each module has upper and lower sliding interlocks. Both should be pulled out before installing and pushed in after the module is properly mated to the adjacent module. Once positioned and secured to the controller, the module can then be fastened to the mounting surface using two mounting screws. Position I/O mounting screws at the rightmost side of the slotted holes so that the modules can slide to the right for easy removal. Refer to Figure 3-6. Additional modules can then be added and fastened in the same way. Care should be exercised not to overtighten the screws used to mount the I/O modules.

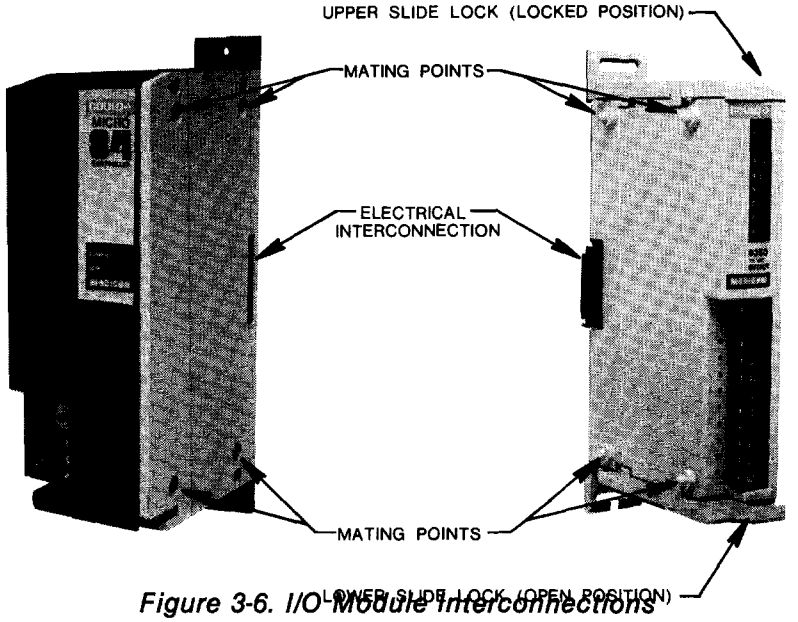

Figure 3-6. I/O Module Interconnections

3.6 SYSTEM WIRING

After properly mounting the MICRO 84 Controller and I/O modules, the external AC power and I/O wiring connections can be made. It is recommended that separate sources of power be used for the controller and I/O modules.

3.6.1 Power Connection

The Micro 84 system can operate on AC or DC power. Always check to see which type of power supply is being used before wiring the controller.

On AC power supplies, the presence or absence of a jumper between the upper two terminals determines the voltage. Remove the jumper for 220 VAC operation. Refer to Figure 3-7 for the proper wiring connection.

On DC power supplies, the top two terminals are not connected. The middle terminal is the ground connection. The bottom two terminals are used to connect the negative (–) and positive (+) DC inputs. Refer to Figure 3-7 for the proper wiring connection.

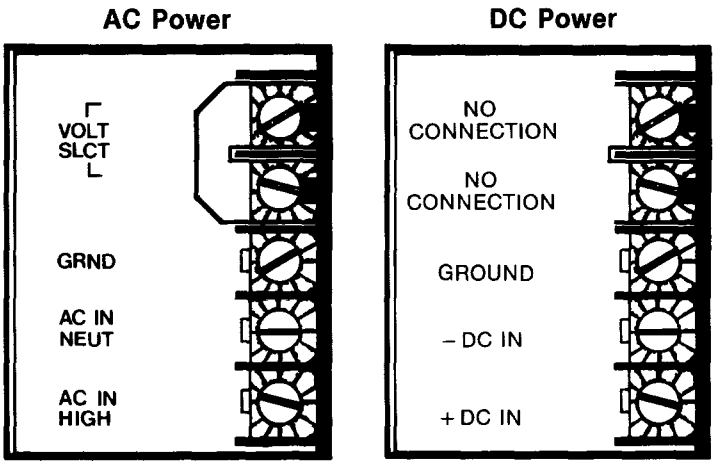

Figure 3-7. Connection of External Power to MICRO 84

3.6.2 I/O Wiring

The I/O module wiring information included in this paragraph is specifically for the B351, 115 VAC Input module and the B350, 115 VAC Output Module. Wiring information, and other technical information, for these modules and all other MICRO 84 I/O Modules are contained in Appendix D.

A discrete control device is assigned automatically to an internal memory address according to which screw terminal the device is connected. On both the input and the output modules, screw terminals 1 through 8 connect the MICRO 84 to specific user control devices. Input addresses range from 1001 through 1032 (1064 for the M84A-002) while output addresses range from 0001 through 0032 (0064 for the M84A-002). Refer to Figures 3-8 and 3-9 for the wiring scheme for input and output modules.

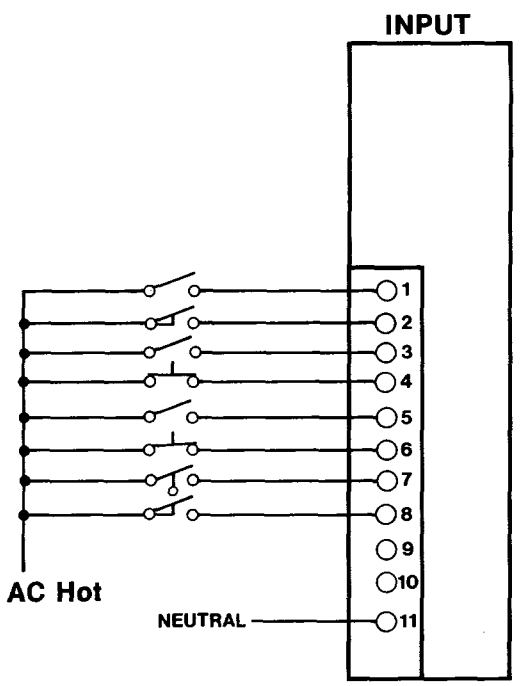

Figure 3-8. Input Module Wiring

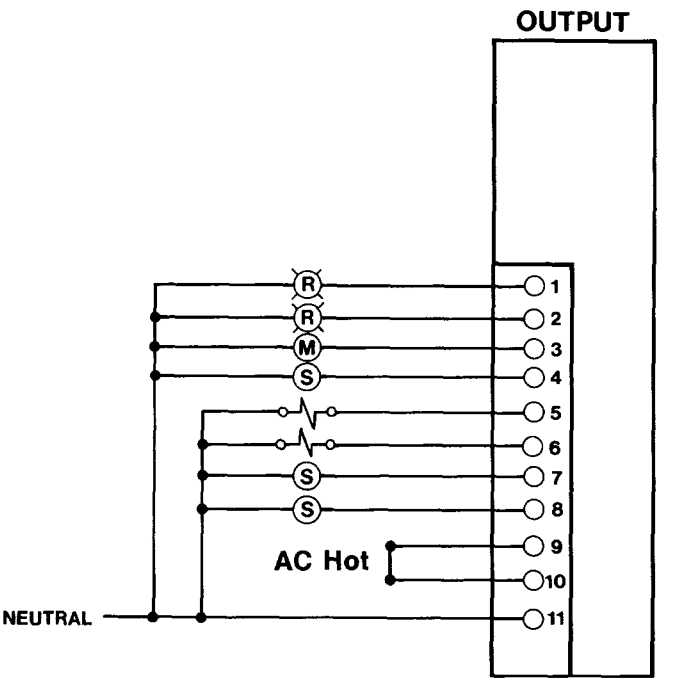

Figure 3-9. Output Module Wiring

3.6.3 I/O Module Addressing

The proper addressing of the I/O modules is accomplished automatically by the controller. The closer to the controller, the lower the I/O module's address. This allows for the installation of additional I/O modules without disturbing the existing I/O module/addressing sequence. Refer to Figure 3-10.

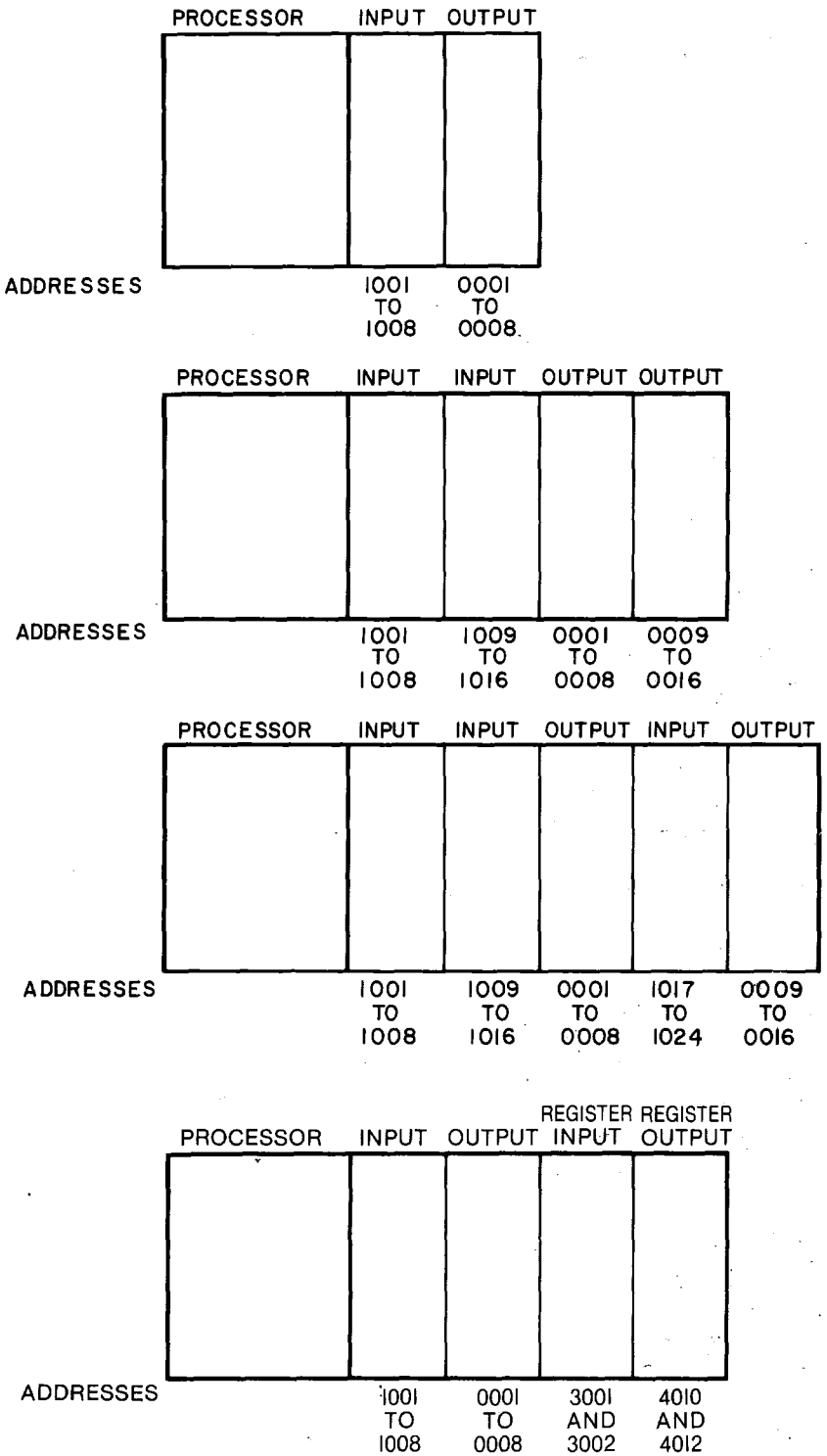

Figure 3-10. I/O Addressing

SECTION 4
SYSTEM CHECKOUT

4.1 CONTROLLER OPERATION

After securing the MICRO 84 controller using the two mounting screws and ensuring proper external AC power connections are made, AC power can be applied to the controller. When AC power is applied, the controller POWER light illuminates indicating the power supply is fully operational. The RUN light does not illuminate unless the controller has been started and the terminator plug is in the right-hand connector. The controller is started initially using Supervisory Code 2 which is entered from the P370 Programming Panel.

The controller is started also when using the program pack to load a program into the controller. If power is applied (power light on) and the controller is not running, the second push of the program pack pushbutton starts the controller. (See Section 8.) Also, if the controller was running when power was removed, it will be running when power is once again reapplied.

Once started, the processor's memory is fully operational.

CAUTION

During the power up sequence, AC output modules may cause the false triggering of certain loads for one-half cycle. The loads that are most susceptable are:

Latching relays
Fast-acting solenoids
(Hydraulic/pneumatic valves)
Latching circuits
(Motor starter with seal contact)

Special circuit designs have been incorporated into the AC output modules to minimize this false triggering. However, applications using fast reacting or latching devices that initiate mechanical action may be a hazard due to false triggering.

4.1.1 Power-Up Sequence

During the power up sequence, the processor logic executes a program of diagnostic tests to ensure that all system hardware is functioning properly.

If an error is detected during the power-up sequence, the system halts. If the P370 Programmer is connected, an error code is displayed on the panel. If the programmer is not connected, no external indication of the error is available but the error code is stored in a location in the controller memory. When the P370 Programmer is reconnected to the controller, the error code that has been stored will be displayed on the panel.

If all tests pass, the following sequence occurs:

1. All coils are set OFF with the exception of latched coils and coils which were disabled when power was last removed. These coils retain their latched or disabled state.

2. All inputs are read including input registers.

3. If the controller has been started, the RUN light on the controller is illuminated and the unit starts solving logic at network 1.

When power is applied to the mainframe, the power supply begins producing DC power. There is a slight delay between the time the DC voltages are within regulation and the processor begins operating. This delay allows sufficient power to be stored to ensure that proper power-down procedures can be performed by the processor when external power is removed.

Upon an indication of power failure, appropriate information is stored to permit an orderly start-up, the RUN light is extinguished, and all outputs turned OFF.

4.1.2 Power-Down Sequence

When power is removed, the controller continues to operate using the power stored during the power-up sequence. If power is not restored within 1/10th of a second, the controller executes an orderly power-down sequence. The controller can operate for a longer time depending upon the devices (Programmer, I/O modules, etc.) that are connected to the mainframe at the time of power-down. Prior to actual loss of DC power, a warning signal is provided from the power supply to the processor. This warning signal causes the processor to stop solving logic wherever it is in the scanning process, and to begin the power-down sequence.

The power-down sequence is performed to completion even if power is restored. The power-down sequence requires less than 1/10th of a second.

During the power-down sequence, the controller calculates and stores a value for the contents of the random access memory. This value is used during power up to verify the content of memory. In addition, all outputs are turned OFF. The status of coils and the contents of registers are retained for use during the power-up.

If it is necessary to remove power from the unit, remove power from the controller first. Removing power from the I/O first, or at the same time as the controller, can cause incorrect data to be stored during the power-down sequence (if the controller was running at the time power was removed).

4.2 P370 PROGRAMMER OPERATION

Plugging the P370 Programmer into the mainframe supplies power to the programming panel and enables the processor to initiate a diagnostic test of the Programmer circuits. The COMM-OK status display should illuminate. During this sequence, scan time is increased significantly.

All liquid crystal display segments turn on allowing the user to visually verify that all the segments are operating (turned on). Refer to Figure 4-1 for an illustration of the P370 displays.

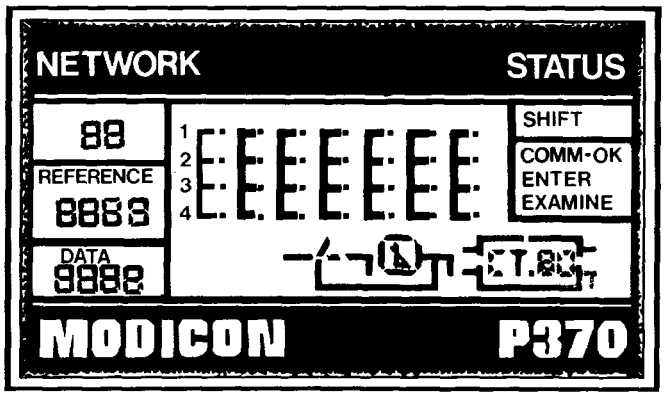

Figure 4-1. P370 Programmer With All Display Segments Lit

The display segments remain on for approximately 2.5 seconds and then turn off. After another 2.5 seconds, network 1 is displayed with the cursor at row 1, column 1. If the internal diagnostic tests detect an error between the controller and the programming panel, the error code will be displayed in the DATA area. Refer to Appendix A for an explanation of the error code. When not actively using the P370, it should be removed from the controller and stored in an appropriate environment.

4.3 SYSTEM CHECKOUT AND MAINTENANCE

The Disable function (see Section 6) can be used during the checkout and maintenance of the control system.

In checking out a system, the disable function can be used to verify the proper wiring and operation of all discrete output coils. Each output is displayed on the P370 Programmer and then disabled. The coil can be cycled ON-OFF-ON-OFF, etc., and proper operation of the discrete device observed. It is recommended that the coil be enabled before the next output is tested to prevent unwanted functions from occurring in the control system.

During control system maintenance, a particular "real-world" device can be removed from MICRO 84 control by disabling either all the inputs (discrete and register) or the logic coil associated with the device. The device can then be repaired or replaced without affecting MICRO 84 operation. When maintenance is complete, the device can be cycled by toggling it on and off from the P370 Programmer. After a successful checkout, the device can be put back on line by enabling the disabled logic element.

The disabled state of a coil or discrete input is retained after the P370 Programming Panel is removed. This provides the ability to use this capability without leaving the programmer connected permanently.

SECTION 5
THEORY OF OPERATION

The MICRO 84 system controls user equipment by means of a program stored in the user memory and by communication with the I/O section as illustrated in Figure 5-1.

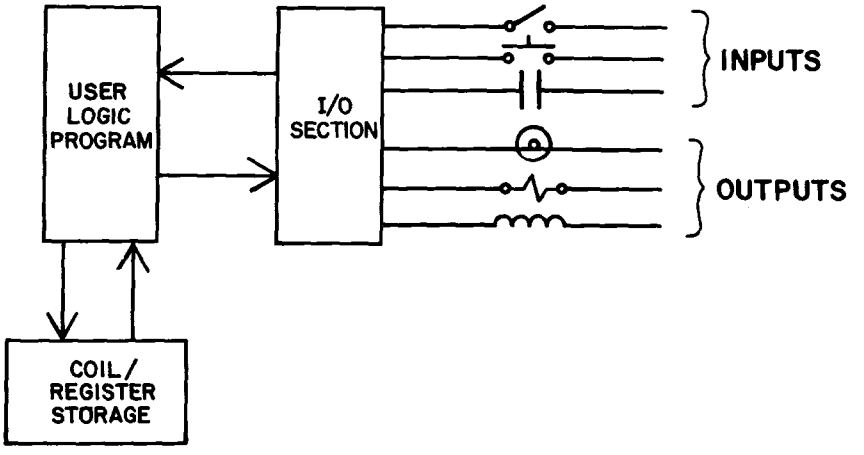

Figure 5-1. System Block Diagram

5.1 SCAN

The MICRO 84 Programmable Controller solves each network (see Section 7) in their numeric sequence. A network is a group of logic elements that are connected together to perform a specific function (for example, a motor starter control circuit). Network 1 is the first network to be solved, followed by network 2, 3, etc., until all networks are solved. The controller then returns to solve network 1 again. The time it takes from the completion of solving any network on one scan until that network is again solved on the next scan is the "scan time" of the controller.

Within each network, logic elements are solved from the left rail towards the right rail and on a column by column basis.

The numeric contents of a register, once updated, can be used by all subsequent logic elements in a network (in the same or next column). All inputs and outputs are updated only at the end of each scan.

Scan time varies depending upon the amount and type of logic entered.

5.2 INPUT/OUTPUT (I/O) MODULES

The MICRO 84 input/output modules isolate the internal processor from the external user-supplied devices. This isolation prevents electrical noise from affecting processor operation. The processor responds to the condition of an external device (on, off, or numeric value). There are two major groupings of I/O modules:

- Discrete I/O
- Register I/O

5.2.1 Discrete I/O Modules

Each discrete I/O module can be connected to a maximum of 8 discrete devices. A discrete device is one that can be either ON or OFF.

Type of Device	Reference Numbers	Processor
Input (Pushbutton switches, Limit switches, etc.)	1001-1032 1001-1064	(M84A-001) (M84A-002)
Output (Lights, motor starters, etc.)	0001-0032 0001-0064	(M84A-001) (M84A-002)

5.2.2 Register Modules

Register modules provide the capability of handling numeric values (000-999) within the Micro 84 Programmable Controller. These values are represented either in binary coded decimal (BCD) or as an analog voltage or current. These numeric values can be either received from an external device or sent to an external device.

The following list describes the type of register module and its associated reference numbers:

Type of Device	Reference Numbers	Processor
Input, (Thumbwheel, Panel meter, Temperature, Pressure, and Flow transducers, etc.)	3001-3004	Both
Output, (Digital display, Valves, positioning devices, etc.)	4010, 4012, 4014, 4016	M84A-001
	4010, 4012, 4014, 4016, 4018, 4020, 4022, 4024	M84A-002