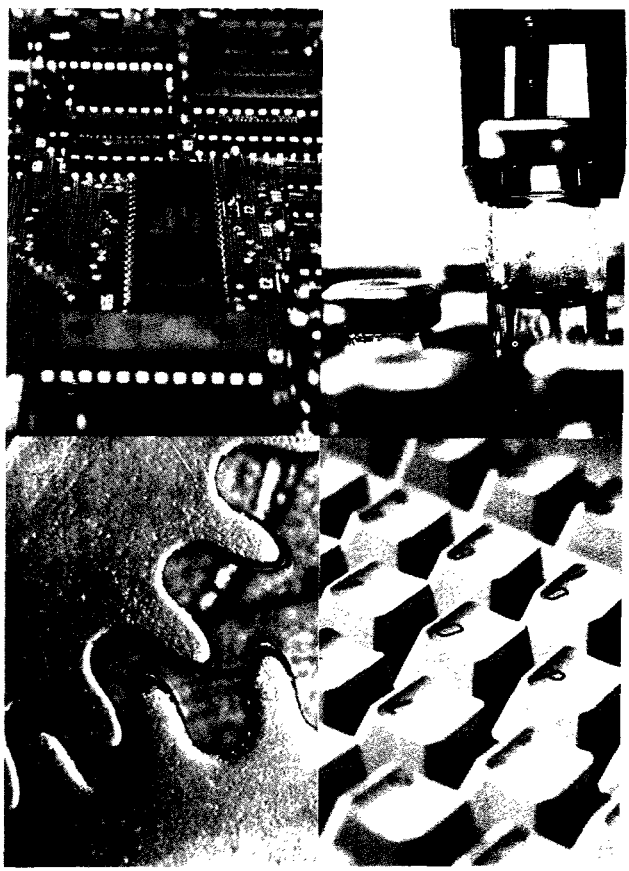
Models E984, D984 and K984-X8X Controllers

System Planning and Installation Guide

GM-0984-EDK Rev. B



GROUPE SCHNEIDER

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Modicon
System Planning and Installation Guide for 984–X8X Controllers Models E, D, and K

GM–0984–EDK Rev. B

August, 1995

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Preface

This guide describes the ten different yet similar 984 slot mount Programmable Logic Controllers and their available options, together with procedures for system planning and installation.

The major differences are identified up front for easy reference in Chapter 1. Throughout the manual a number of sections apply to all models, while others apply only to certain models as so noted.

Objectives

This manual will help you plan, configure, mount, wire, connect, check out, and troubleshoot your 984 ***slot–mount*** controller system, including 984/800 Series Remote I/O. After reading this book:

- A Control Engineer will be able to identify and physically plan the location and mounting of system components.
- A Plant Electrician/Installer will be able to install, power–up, and check out the system.
- A Maintenance Technician will be able to recognize, locate, identify, and resolve or report system failures.

How To Use This Manual

Chapter 1 describes the various controllers and their functions.

Chapter 2 offers information for planning your installation.

Chapter 3 is an installation procedure for your controller with local I/O and Remote I/O.

Appendix A gives system specifications.

Appendix B gives troubleshooting assistance.

Related Documents

The Documents listed go beyond the installation and orientation contained herein and are required for new users in programming environments:

GM–MSFT–001	Modsoft Programmer User Guide
840 USE 101	Modicon Ladder Logic Block Library
890 USE 101	Remote I/O Cable System Planning Guide
890 USE 100	Modbus Plus Network Planning and Installation Guide

Minimum Revision Levels

The minimum prom revision levels for the 685/785E (only) slot–mount controller options are:

Option	Exec Part Number	Rev. Level	Min. Prom Number
S908	AS–E908–131	H	1007
S911	AS–S911–801		
	Exec (AS–9490–022)	G	1006
S985	AM–S985–800	D	1004

The minimum revision levels for programming software diskettes are:

	Part Number	Version	Description	
PC Disks	SW–MS(X)D–9SA	2.0	Modsoft 2.0	(all models)

☞ **Note** In Hot Standby configuration both controllers and systems must be at the same hardware and firmware revisions. (Refer to the Redundancy 685/785 section located in Chapter One.)

Incoming Inspection Guidelines

Guidelines for Inspection

- Before you do anything, verify your shipment is complete and undamaged. If the shipment is incomplete or damaged, notify the carrier and your distributor.
- Remove everything from its packing and check for physical defects or damage. If the equipment is physically defective or damaged, notify your Modicon representative.

☞ **Note** Save shipping materials until installation is complete.

Sending Something Back?

- Whenever possible, use the original packing materials supplied by Modicon.
- All equipment should be firmly packed so that it cannot move around in its shipping container.
- All equipment should be protected against impact during shipment.
- All equipment should be clearly marked with its Return Authorization Number (RA#).

Table of Contents

Figures

Tables

Chapter 1
Introducing your Controller

- Programmable Logic Controllers (PLC)
- System Capacity
- Executive NV FLASH Memory and RAM
- Housings
- Status Indicators

Programmable Logic Controllers (PLC)

The Modicon 984–381E/385E/385D/480E/485E/485K/685E/785E/785D/785K Controllers are mid–range Programmable Logic Controllers in a modular, expandable, architecture. They employ Modicon 800 series housings, interfaces and I/O modules. These PLC's are supported by the same instruction set as the other 984 models, and are programmed by Modsoft panel software. All of these units have a built–in power supply. All of these units are fully compatible with the Modicon 984 PC instruction set, and solve user logic at a rate of from 1 ms to 2.5 ms per thousand nodes of user logic. The 785E/785D/785K are 24–bit CPU's and the rest are 16–bit CPU's.

These units have two, or three built–in Modbus ports for data transfer and remote programming. Through these ports, communication processing on the CPU board links the controller to multiple supervisory and programming devices such as a host computer or Modicon's programming panel. The two Modbus ports allow you to connect more than one Modbus device to the controller. Some models have both a single Modbus port and a second port for the Modbus Plus high speed Local Area Network. While others have two Modbus ports and one Modbus Plus port. The DIP switch for setting the Modbus Plus port address can be accessed through the bottom of the module's case.

User memory is backed up by a lithium battery which has a conservatively rated service life of one year. Once energized, the BATTERY LOW indicator will come ON when the battery has 14 days left before it will be effectively drawn down. The battery has a five–year shelf life.

☞ **Note** The 485K and 785K are the same has the 485E and 785E except the **K**'s have a memory protect **Key** Switch on the front of the unit.

☞ **Note** The 385D and 785D are the same has the 385E and 785E except the **D**'s operate on 125VDC rather than 115/230VAC.

Figure 1 is a perspective view of the 381E/385E/385D controllers. Certain physical features are noted.

Figure 2 is a perspective view of the 480E/485E. The 485K looks the same, except the 485K has a memory protect Key Switch. Certain physical features are noted.

Figure 3 is a perspective view of the 685E. The 785E/785D/785K looks the same, except the 785K has a memory protect Key Switch. Certain physical features are noted.

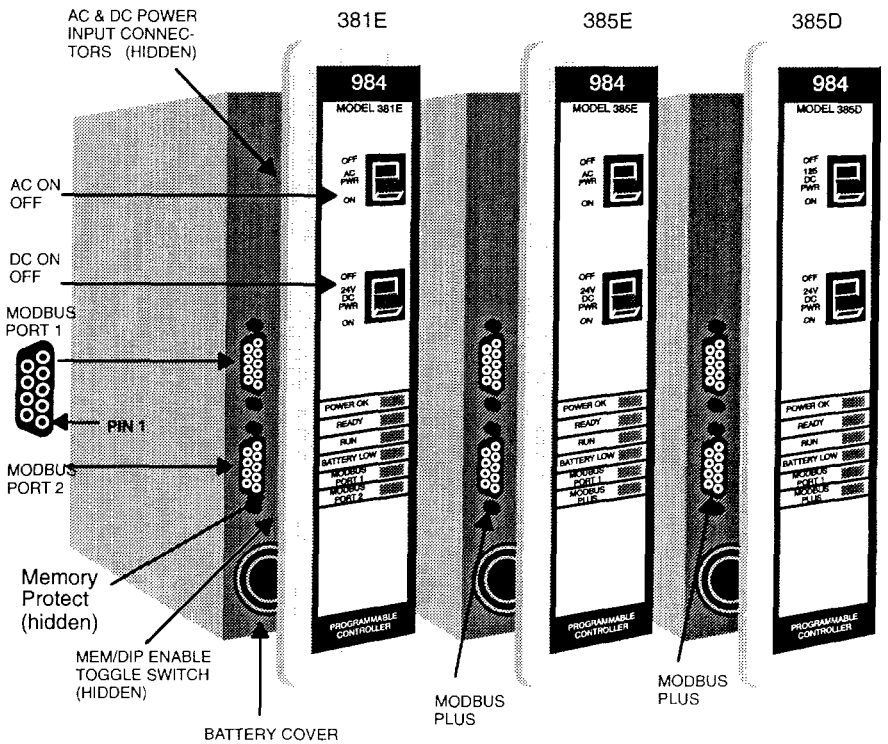


Figure 1 381E/385E/385D Perspective Drawing

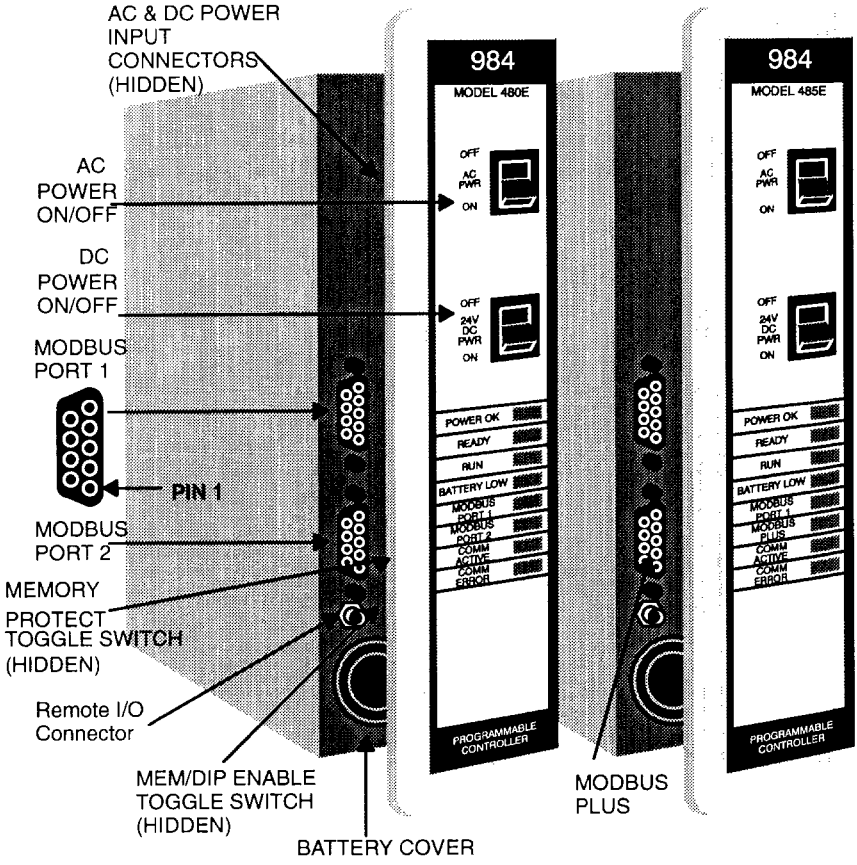


Figure 2 480E/485E Perspective Drawing

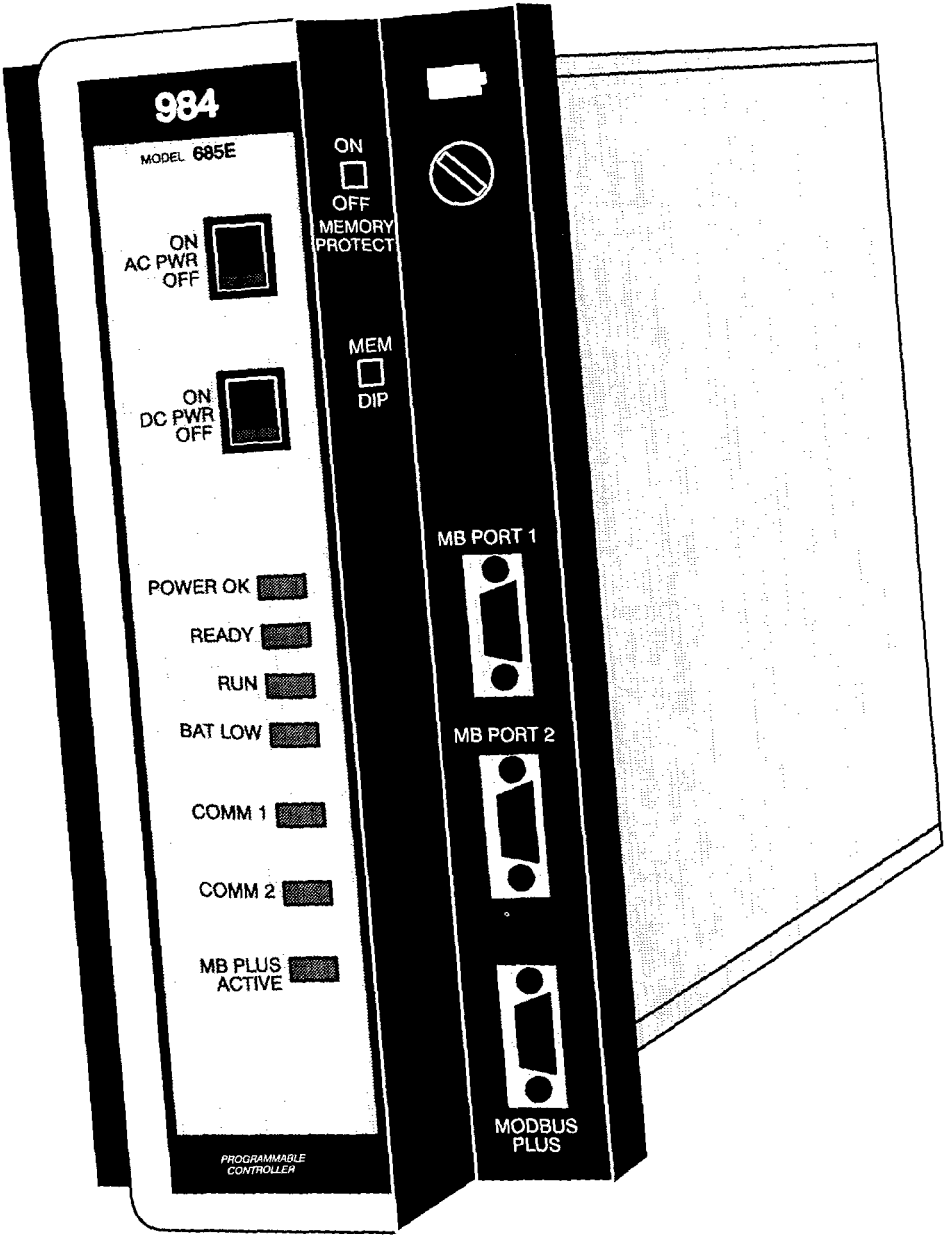


Figure 3 685E/785E Perspective Drawing

System Capacity

The system capacity for the various "E" controllers are described below.

Table 1 Memory Per Configuration

PLC Model	Total User Memory	State RAM	RI/O Drops	Total I/O Pts. per System (Discrete)	Max. Register Capacity	Max. Discrete Capacity	Comm Ports Total
381	16K	2K	0	512	2K	2048	2 Modbus
385	16K	2K	0	512	2K	2048	1 Modbus & 1 Modbus +
480	16K	2K	6	2048	2K	2048	2 Modbus
485	16K	2K	6	2048	2K	2048	1 Modbus & 1 Modbus +
685	16K	12.5K	16/31	16K	9999	16384	2 Modbus & 1 Modbus +
785*	32K	64K	16/31	16K**	57766	65520	2 Modbus & 1 Modbus +
785*	48K	32K	16/31	16K**	28640	65520	2 Modbus & 1 Modbus +

* Size defined during configuration procedures.
** Only the first 16383 (16K) of each type may be used for I/O through the Traffic Cop, and as control of the segment scheduler.

Buffer for .EXE loadables is 10X user logic size.

Note You should note that the physical State RAM size limits the maximums allowed for discretes and registers that will only be seen if the other maximums are set at a minimum. In a real configuration, the available references will be determined by the other references selected at configuration time.

Table 2 Memory Per Configuration Cont.

PLC Model	Extended Memory	Local Drop I/O Pts.	Other Drop Points up to Defined Max. I/O Pts.
381	None	512	N/A
385	None	512	N/A
480	None	512	512
485	None	512	512
685	None	1024	512 or 1024**
785*	96K	1024	512 or 1024**
785*	24K	1024	512 or 1024**

* Size defined during configuration procedures.
** Defined by S908 executive in use.

Optimize Mode (685E/785E ONLY)

The 685E/785E Controllers support an Optimize mode in addition to the Normal mode of solving ladder logic. As the controller scans in Optimize mode, it compiles an executable program that it stores in an execution buffer. The compiler uses the buffer space to produce executable code that can scan logic as efficiently as possible, reserving enough buffer space at start–up time to allow you to edit 2k of logic while the program is running in Optimize mode.

Note Because the execution buffer is of finite size, the compiler's ability to store the most efficient code is affected by both the size of your logic program and by the efficiency with which you use the program elements in the logic networks.

How Optimize Works

When you run the controller in Optimize mode, the compiler constructs inline code in the execution buffer that executes more efficiently than Normal–mode operations. The controller uses an algorithm to automatically calculate a higher level of optimization that does not exceed the execution buffer's capacity and that always reserves buffer space for 2k of logic editing while the controller is running in Optimize mode. Optimization is fully managed by the controller and is transparent to you during scanning.

The compiler places related contacts and coils in each network into node groups and then solves each group as an entity. Each node group consists of a set of connected contacts–with or without a coil–related to a common logic path that can be solved simultaneously. The compiler:

1. Searches each network

2. Locates connected nodes and paths in each network and solves them as a group

3. Skips the evaluation of nodes and paths that are known to be irrelevant within each group. That is, if input power for a series of contacts is not on, the executive will skip the logic solving of these contacts in a network.

By considering each node group as an entity, the compiler is able to reduce the scan time in ladder logic programs.

When you start to run the controller in Optimize mode, the compiler automatically reserves enough space in the execution buffer to support 2k of edits while the program is running. If your edits use up all the reserved buffer space, you may either continue to run the program in Optimize mode with no further editing permitted or stop and restart the controller with newly generated buffer space for another 2k edits.

Note System performance may be slowed when the compiler adjusts the buffer for on–line edits and creates the new buffer space for further edits.

Local I/O

All of the Controllers support one local I/O drop in the form of Modicon 800 series module housings. Local I/O processing is always Drop #1. Total Local I/O provides for Discrete points configured in any mix and registers, refer to Table 1 for memory configuration for each individual Controller.

Remote I/O

The 480E/485E/485K Controllers have up to 6 drops (one local and five remote) for a total I/O support capacity of 1024 discrete I/O points (any mix). The 480E/485E/485K also support up to 5 RI/O drops (using the built–in S908 Remote I/O Processor and optional J890/P890 RI/O Adapters) with a maximum of 512 more discrete I/O points on one drop or spread over them all. Also, the 480E/485E/485K support a maximum of 2 ASCII ports per drop, up to a total maximum of 12 using optional J892/P892 RI/O ASCII Adapters. Please refer to GM–0984–RIO *Modicon Remote I/O Cable System Planning Guide* for more details.

The 685E/785E/785D/785K require a separate RI/O Head module with a plug–in executive cartridge capable of supporting either 16/31 RI/O drops. The 16 RI/O drops (using the Executive Cartridge AS–E908–016 on the S908) have 1Kin/1Kout (I/O bits). It can also support 31 RI/O drops (using the Executive Cartridge AS–E908–131 on the S908) with each drop having a maximum of 512in/512out (I/O bits). While the total I/O capacity is 65536 bits, only the first 16K can be I/O mapped regardless of which S908 executive cartridge is used, (local I/O bits maximum is 1Kin/1Kout). The S908 Remote I/O Processor comes in two versions: a single cable (AS–S908–110), or dual cable (AS–S908–120). Please refer to GM–0984–RIO *Modicon Remote I/O Cable System Planning Guide*. These controllers also support a maximum of 2 ASCII ports per drop up to a total maximum of 32 using optional J892/P892 RI/O ASCII Adapters. Please refer to GM–0984–RIO *Modicon Remote I/O Cable System Planning Guide* for more details. Figure 4 is a perspective view of the RIOP module.

The RI/O interface will drive RI/O up to 5000 feet away (this distance can be increased depending upon the cable selection and certain other customer application considerations). Since the 5000 foot distance allows wide latitudes in system layout and installation, substantial economies can be realized from carefully planned layouts. Another planning requirement is to keep attenuation losses within the system's 35 dB dynamic range.

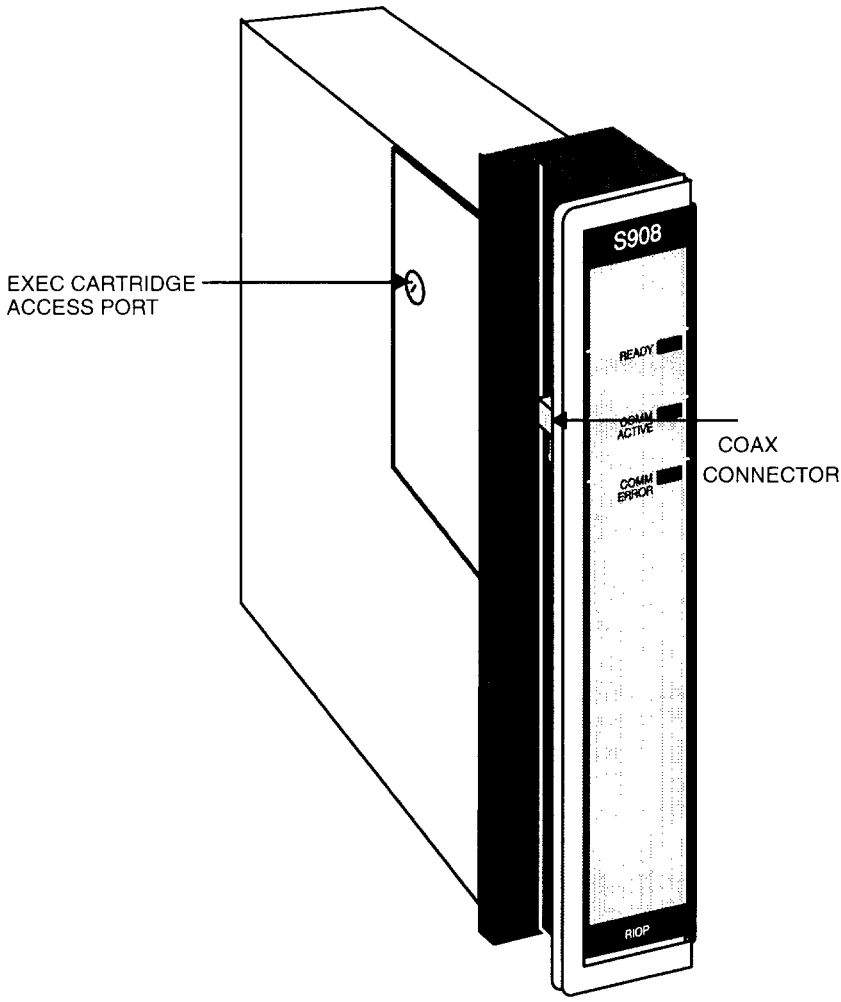


Figure 4 RI/O Head (S908) Module (S908–110)

Executive NV FLASH Memory and RAM

The PLC's feature executive firmware as two levels of memory which are referred to in this manual as executive and user memory. The executive is contained in Non–Volatile flash memory that can be upreved in the field if required, and the user memory is stored in battery backed RAM. (Refer to the Customer Service & Technical Assistance section located in Appendix B regarding upgrading NV FLASH Memory in the field.)

A controller bootable memory software is downloaded to a protected area of flash memory during the manufacturing process which is not accessible to the user.

Executive Functionality

- 381
  Executive ID of 813 (Hex), CPU Clock speed 12 Mhz.
  24 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT, and CKSM.
  Two standard Modbus ports, Time–of–Day clock, Local I/O only.

- 385
  Executive ID of 81E (Hex), CPU Clock speed 12 Mhz.
  24 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT and MSTR.
  (MSTR is the user interface to Modbus Plus. It replaces the CKSM function and uses its opcode.
  One Modbus port, One Modbus Plus Port, Time–of–Day clock, Peer Cop, Local I/O only.

- 480
  Executive ID of 822 (Hex), CPU Clock speed 12 Mhz.
  26 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT, READ, WRIT and CKSM.
  Two standard Modbus ports, Time–of–Day clock, Remote I/O.

- 485
  Executive ID of 82E (Hex), CPU Clock speed 12 Mhz.
  26 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT READ, WRIT and MSTR.
  (MSTR is the user interface to Modbus Plus. It replaces the CKSM function and uses the CKSM opcode.
  One Modbus port, One Modbus Plus Port, Time–of–Day clock, Peer Cop, Remote I/O.

- 685
  Executive ID of 80C (Hex), CPU Clock speed 16 Mhz.
  39 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT, CKSM, 16 BIT MATH (7), PCFL (18), and MSTR.
  Two standard Modbus ports, One Modbus Plus Port, Time–of–Day clock, Peer Cop, Remote I/O (via S908 module).

- 785
  Executive ID of 852 (Hex), CPU Clock speed 16 Mhz.
  39 DX functions:
  MOVE (8), MATRIX (8), JSR, RET, LAB, PID2, EMTH, TBLK, BLKT, CKSM, 16 BIT MATH (7), PCFL (18), and MSTR.
  Two standard Modbus ports, One Modbus Plus Port, Time–of–Day clock, Peer Cop, Remote I/O (via S908 module).

☞ **Note** Both the MSTR and CKSM may co–exist in the 685E/785E.

Redundancy 685/785

- At minimum these items are needed to support redundancy:
  HSBY Loadable Software, @ ≥ Rev 2.0
  Hot Standby Adapter, S911–801
  Remote I/O Adapter, S908 @ ≥ Rev 1007

☞ **Note** For the 685E/785E only, the first 10K of registers, and the first 8192 inputs and 8192 coils, are transfered on a switchover.

Housings

The PLC's systems use Modicon 800 series housings for its controller and I/O modules; specifically, a 19" primary housing which holds seven modules or a 27" primary housing which holds eleven modules.

Primary Enclosure – With the single–width controllers mounted in your primary enclosure, the 19' and 27" primary enclosures will hold up to 6 or 10 I/O modules respectively.

Secondary Enclosure – The remaining secondary housing will accommodate a one and one–half wide P810, P800 or P884 auxiliary power supply if a power supply expander is required. That is, the standard 19" or 27" secondary housings will accommodate five or nine I/O modules along with a one and one–half wide (two–slot) auxiliary power supply and a full seven or eleven I/O modules without the power supply.

The 19–inch primary housing with controller is shown in Figure 5. For simplicity's sake, the 27" housing is not shown in this manual except as required in the illustrations for panel mounting dimensions.

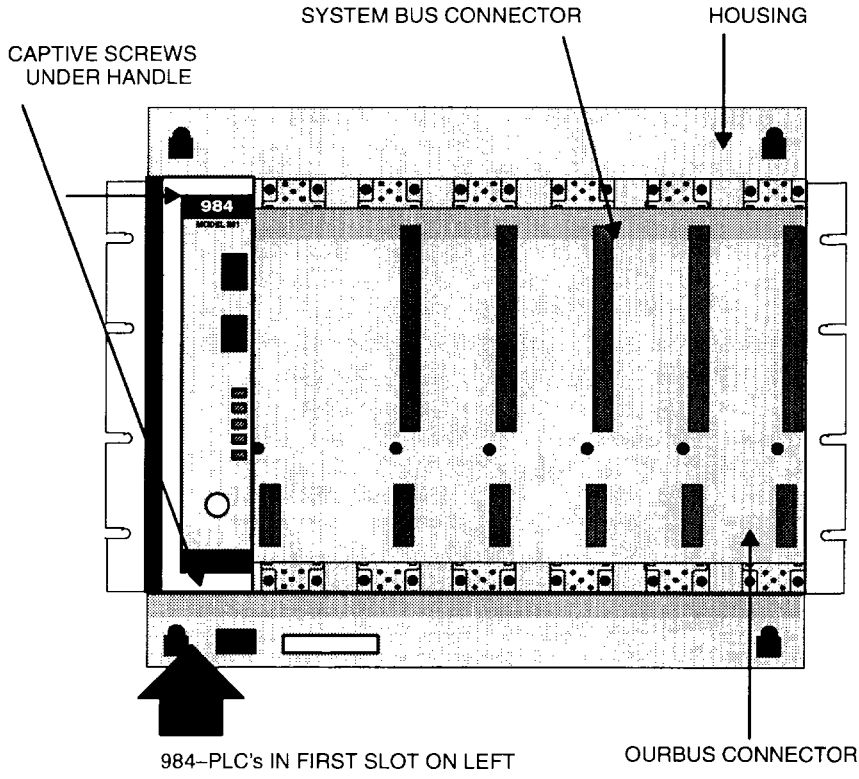


Figure 5 Controller Location in Primary Housing AS–H819–209

Remote I/O Enclosures

The remote I/O enclosures are the standard 800 series I/O enclosures; i.e., 19" and 27" enclosures accommodating seven and eleven modules respectively, as stated in Chapter 4, Remote I/O Installation.

Each RI/O drop would utilize one auxiliary power supply and a remote I/O adapter module in its primary housing. Up to four additional secondary housings can be configured.

Status Indicators

Status indicators on the Controller units are:

POWER OK — Green LED When ON, indicates input power OK and voltage outputs OK.

READY — Amber LED When ON and your I/O power is OK, indicates Controller passed power–up diagnostics. Remains ON in Stopped and Run modes as long as health status is OK. Indicator is OFF when an error condition is detected by diagnostics.

RUN — Green LED When ON, indicates Controller is in the RUN mode and solving logic. If memory checksum fails this light will blink 3 times for .5 seconds followed by a rest period of 2.5 seconds then the pattern repeats. The controller has detected a STOP ERROR CODE (refer to Table 10 in Appendix B) and may require either restarting, reloading of the user logic, or reloading of the executive firmware.

BATTERY LOW — Red LED When ON, indicates battery needs to be replaced (14 day holdup from initial indication).

MODBUS PORT 1 — Green LED When ON, indicates communication processor has unit address and communications are in progress.

MODBUS PORT 2 — Green LED When ON, indicates communication processor has unit address and communications are in progress.

Additionally, if you have a 385/485 the second port, or a 685/785, the third port will be:

MODBUS PLUS — Green LED This LED displays a flashing repetitive pattern to indicate the node status:

NORMAL flashes every 160 msec.

MONITOR NETWORK flashes at one second intervals. Is in offline state receive only.

NOT RECEIVING TOKEN flashes two times then is off for two seconds.

SOLE STATION flashes three times then is off for 1.7 seconds.

DUPLICATE NODE ADDRESS flashes four times then is off for 1.4 seconds.

With a 480/485 you have two additional indicators:

COMM ACTIVE Green LED When ON, indicates Remote I/O communication is in progress.

COMM ERROR Red LED When ON, indicates a Remote I/O comm error detected (example: CRC framing or missing physical drop)

Chapter 2
System Planning

- Planning
- Housing Installation Options
- Grounding
- Power Supply Function (AC and DC)
- Communications Processing Function

Planning

Overview

The PLC's are designed to work with your Modicon Programming panel software; Modicon 800 series housings, interfaces and I/O modules.

The site planner must also consider the peripheral equipment (such as a Programmer, CRT monitor, or printer) when preparing an installation plan for the site. Refer to the appropriate Modicon publications for site preparation procedures for related equipment.

Space Requirements

For the primary housing, allow 12 inch clearance to the left so installer can see power supply connectors. Allow 6 inches on the top and side of the housing for convection cooling in vertical mounting situations. Allow 12 inch of clearance at the bottom of the Controller for cable access.

For all other housings, allow 6 inches on the top and sides of each housing for unobstructed cooling airflow in vertical mounting situations.

Also consider installation and physical access for removal of the modules as well as subsequent service including the connection and detachment of signal and power cables when required.

The primary housing may be separated up to 12 feet from the secondary housing.

Primary Power Lines

In addition to service access, distance to power sources has to be considered in planning your controller installation. In addition to cable routing considerations, good practices dictate that the power lines be dedicated to the Controller installation to minimize problems that sometimes arise when sharing AC power with electrically noisy equipment.

Finally, plan to install a service loop and a cable restraint as the primary power cable connector is not locked in place.

Environmental Requirements

In planning for the PLC's installation, consideration should be given to the environment around the controller. Although designed for a harsh industrial environment and able to withstand factors that would harm other types of electronic equipment, problems can be avoided by not placing the controller and its related equipment in an operating area where there is high ambient temperature, acidic atmosphere, vibration, dust, and dirt if it can be avoided.

Mounting Hardware Requirements

After deciding on the final location of the Controller, its associated equipment and cables, you should plan for related mounting hardware. This would include such items as: nut and bolt combinations, flat and star washers, housings, mounting surface, ground straps and system ground connections.

Mounting bolts are NOT provided. The recommended mounting bolts are 0.312–24 UNF–2B (insert or tapped) stainless steel (#8–13–SS).

Housing Installation Options

The PLC's system housing can be panel/bulkhead mounted or rack mounted as described in the following text.

Panel or Bulkhead Mounting

As shown in Figure 6 and Figure 7 below, the housing has keyholes at the top and bottom of the housing for bulkhead mounting purposes. The keyholes are sized for 5/16–inch bolts. The recommended ground point is also shown.

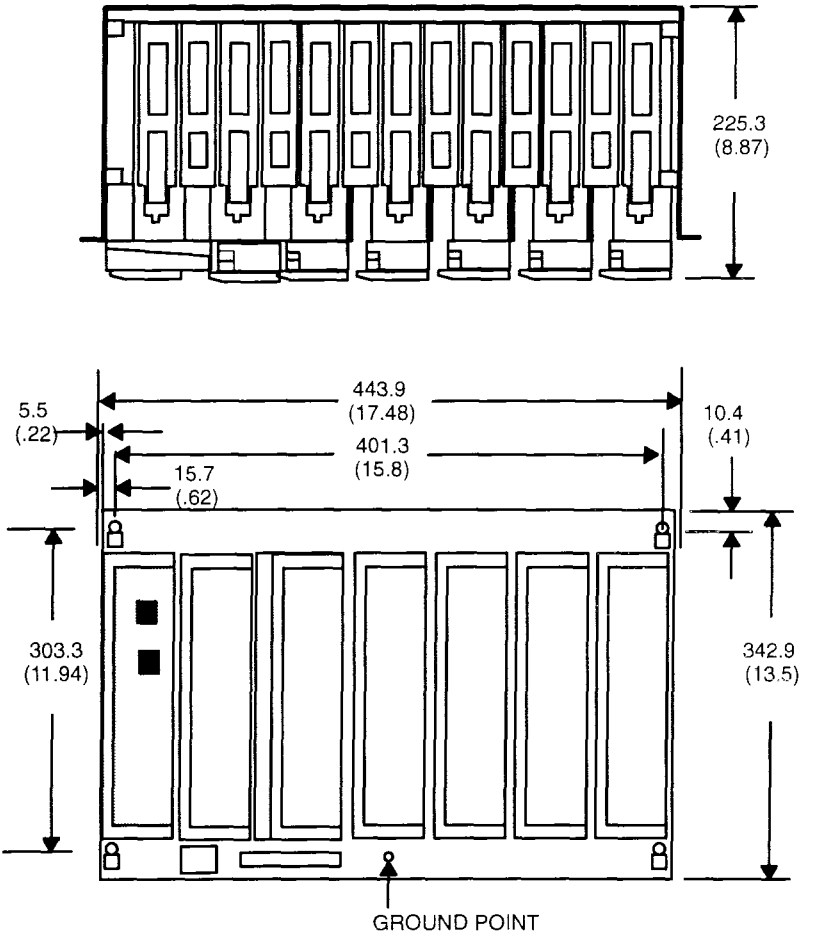


Figure 6 H819 Housing Panel or Bulkhead Mounting Dimensions

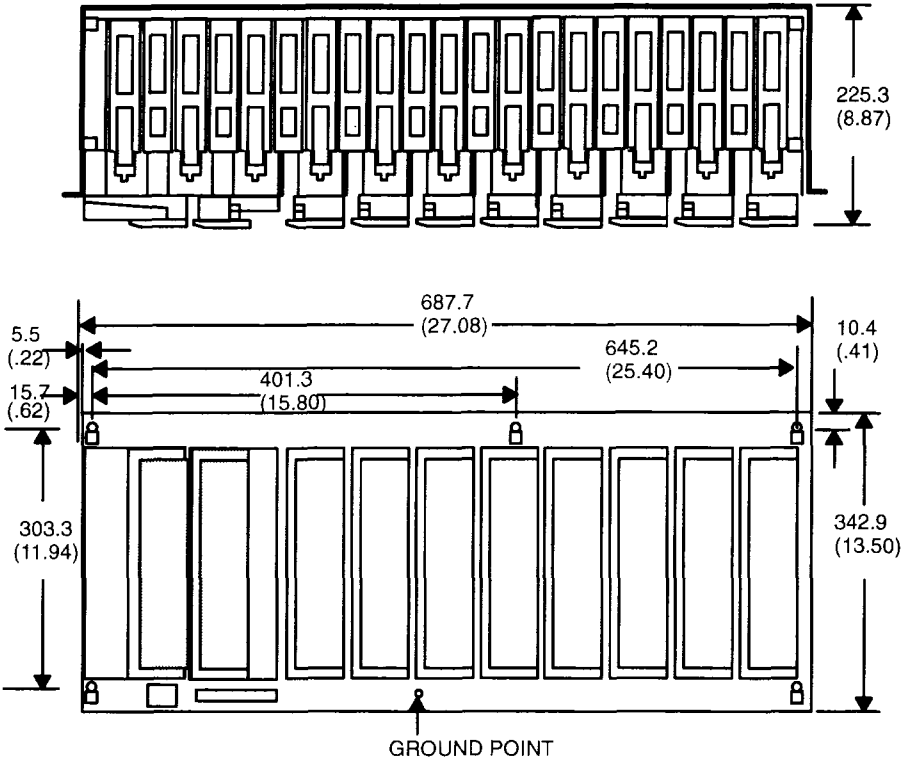


Figure 7 H827 Housing Panel or Bulkhead Mounting Dimensions

Rack Mounting

The H819 Module Housings can be mounted in a 19–inch standard (EIA) rack. Optional hardware can be supplied for installing the "rack adaptor – mounting flange kit".

Figure 8 shows dimensions for rack mounting RI/O housing. The following hardware is required for rack mounting each housing:

- (1) 19–inch Standard (EIA) rack
- (1) pair of rack mounting flanges
- (8) #10–32, Pan Head Machine Screws to mount the housing to the NEMA rack
- (8) #10–32 Flat Lock Nuts if mounting holes in rack's side rails rails are not threaded.
- (8) #8–32 Pan Head Machine Screws (supplied) to attach rack mount flanges to ends of housing
- (8) 1/4 bolts (supplied) to attach back of rack mount flanges back of housing

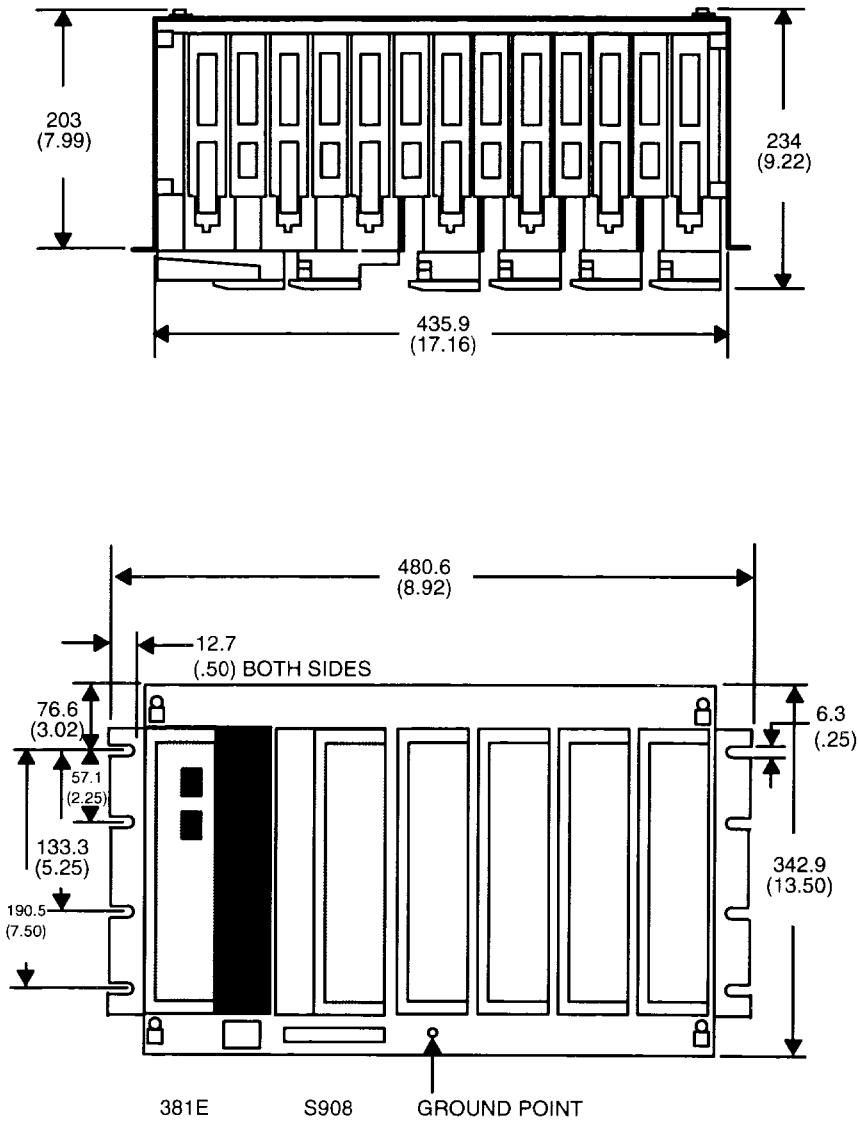


Figure 8 H819 Housing Rack Mount Dimensions

Some planning considerations common to rack mounting for 800 series I/O housings are:

1 Between housings, allow 12 inches below the primary housing for cable breakout, physical inspection and ventilation.

2 The cable length connecting the primary housing and secondary housing must not exceed 12 feet.

The modular chassis will fit in a 12–inch deep standard NEMA enclosure should this be required (e.g., an acidic atmosphere in the factory).

☞ **Note** The only cooling available to the PLC's is derived from natural convection air flow. If the Controller is placed within a NEMA enclosure, some provision for added cooling may be required. The controllers should also be mounted vertically to ensure adequate convection cooling of internal components.

Grounding Your Installation

For grounding purposes, your PLC housing(s) should be mounted on a suitably finished metal mounting plate capable of supporting its weight along with the other modules in the installation. An aluminum mounting plate with a chromate finish such as IRIDITE, ALODINE or OAKITE No.36 would provide a low frequency (AC) safety ground path and a low impedance shield path for EMI/RFI.

If a metal mounting plate (the preferred method) is not feasible, all PLC housings within each drop should be interconnected by a flat braided ground strap with a minimum width of 1 inch. The ground strap should be short and installed without loops and bends. Use stainless steel hardware including a flat washer to secure the braid strap to the housing.

Regardless of the housing–to–housing method of ground interconnection, the entire installation should be grounded by a 1" wide (min) flat, braided cable installed between the the primary housing ground connection point and a suitable factory ground. This ground strap should also be short and installed without loops and bends. The bulkhead and rack mounting illustrations show the housing's recommended grounding point.

Power Supply Function (AC and DC)

The PLC's come with a built–in power supply. The 381E/385E/480E/485E/485K Controllers run on 97 through 276 VAC (47 to 63 Hertz) and 24Vdc. As shown on Figure 9, Once connected, AC power is then switched ON/OFF with a front panel rocker switch.

The PLC will also operate continuously on 24Vdc as its an alternate or exclusive source. Figure 9 shows a primary power input connector for a customer supplied 24Vdc source. Once connected, DC power is then switched ON/OFF with a front panel rocker switch.

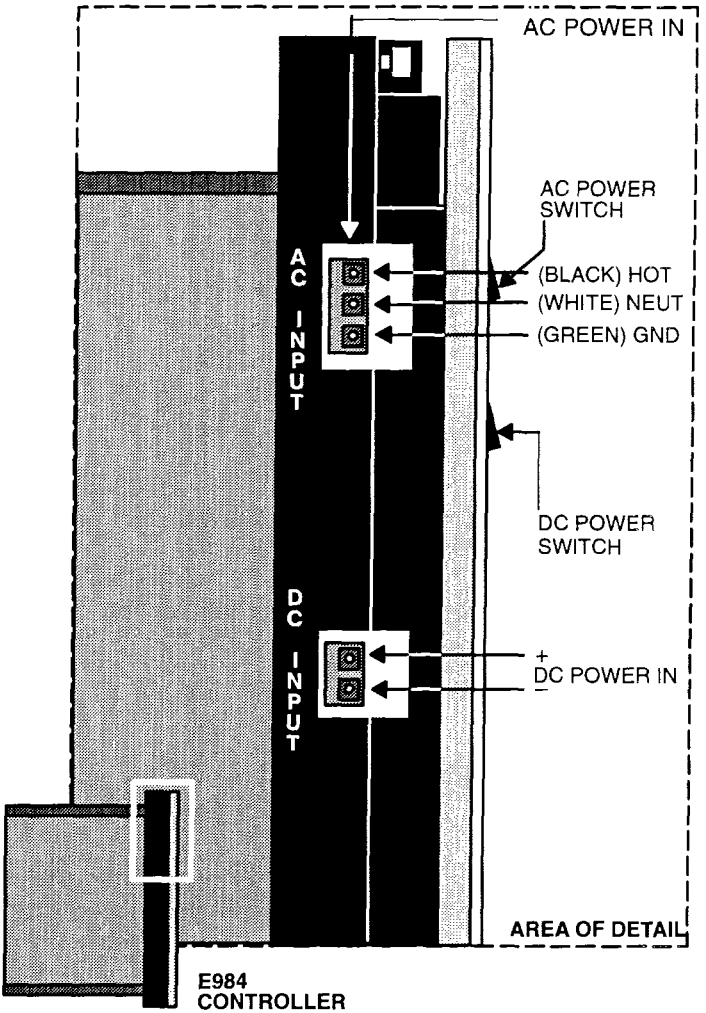


Figure 9 381E/385E/480E/485E/485K Primary Power Input Conn.

As shown in Figure 10, the 685E/785E/785K runs on 115 or 230VAC (47 to 63Hz) and/or 24VDC. The AC input, primary power variable is selected by means of a customer installed jumper. The primary power input connector is located at the front left side of the unit and shown on the drawing as "115V operation jumper". Once connected, AC or DC POWER is switched ON/OFF with a front panel rocker switch.

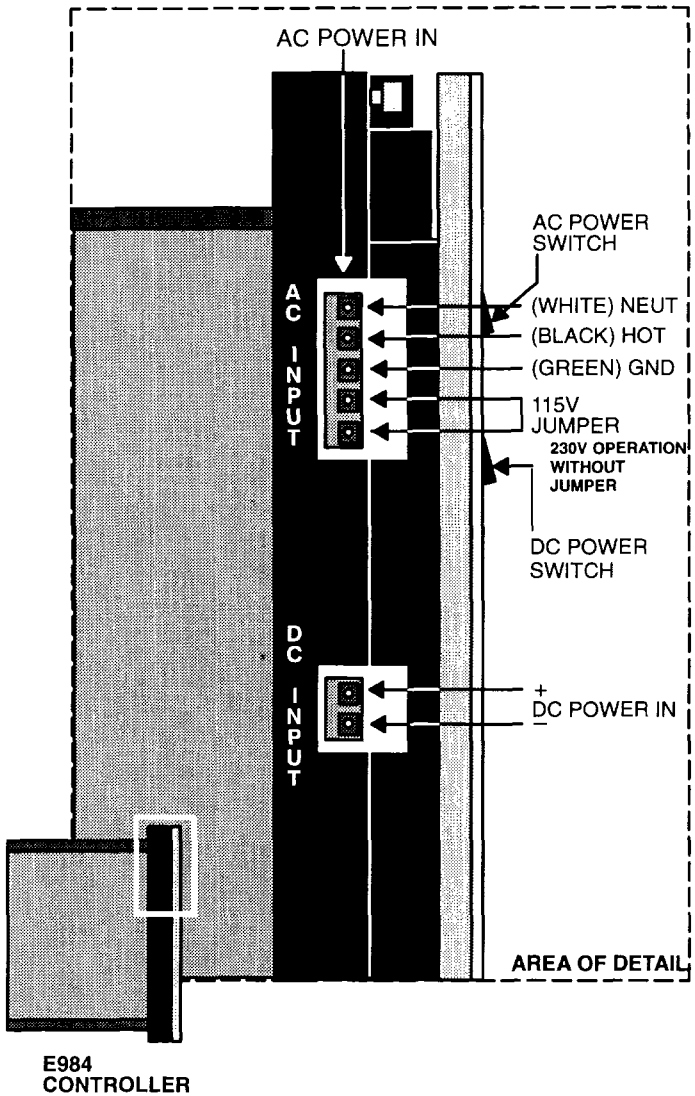


Figure 10 685E/785E/785K Primary Power Input Connections

The 385D/785D input can range from 105 to 150 VDC with the nominal at 125 VDC controlled by a front panel rocker switch. The 24 VDC option is also available. The 385D I/O capacity is 18.75W maximum using 3.5Amps, while the 785D I/O capacity is 60W maximum using 7 Amps.

☞ **Note** The primary power AC/DC input feature was not designed, nor is it suitable as an automatic battery backup provision in the event of an AC/DC outage. This is because the controller's externally sourced input joins with the, internally produced DC. At any given time, the Controller is taking from the higher of the two voltage sources if there is as little as a 1V differential. The consequence of this would be to draw down the DC battery if there were an extended period(s) of reduced AC/DC voltage supply.

If you want a backup alternative, one could be configured from a user–supplied DC power supply with its own backup battery and charger combination along with appropriate monitoring provisions.

Primary Power Cable (AC/DC)

Ideally, the input AC/DC power lines should be dedicated to the PLC installation to minimize problems that arise when sharing AC power with electrically "noisy" equipment.

Provide for strain relief by installing a service loop and cable restraint on the primary power cable as its connector is not locked in place.

AC Power Cable
The recommended AC power cable should consist of three insulated leads of Number 14 AWG stranded copper. The cable leads insert in the plug–in power cable connector shipped installed in the AC input connector jack from the factory.

The color code (standard) for the AC cable is white for AC neutral, black for AC hot, and green for factory or earth ground. The European color code is light blue instead of white for neutral, brown instead of black for the hot wire, and green/yellow instead of green for ground.

Your AC source cable must be suitable for supplying 115/230 Vac at 5A peak for the turn–on surge and 0.4 continuous at worst–case, low voltage conditions at 60° C.

☞ **Note** Factory and earth grounds often have different potentials; e.g., building steel versus grounding rods.

DC Power Cable
The recommended DC power cable should consist of three insulated leads of Number 18 AWG stranded copper. The cable leads insert in the plug–in power cable connector shipped installed in the DC input connector jack from the factory.

If you are planning DC backup, note the discussion under *"Power Supply Function,"* section 1. Note also, that your external DC input should go directly to the controller from the power source and not involve your I/O.

Communications Processing Function

Communications options vary from model to model. Modbus, Modbus and Bridge mode, or Modbus Plus and Bridge mode, are available using a combination of hardware DIP switches and software as discussed below.

Table 3 Communication Options per PLC

PLC	Comm Ports
381E	2 Modbus
385E	1 Modbus & 1 Modbus Plus
385D	1 Modbus & 1 Modbus Plus
480E	2 Modbus & RI/O
485E	1 Modbus & 1 Modbus Plus & RI/O
485K	1 Modbus & 1 Modbus Plus & RI/O
685E	2 Modbus & 1 Modbus Plus
785E	2 Modbus & 1 Modbus Plus
785D	2 Modbus & 1 Modbus Plus
785K	2 Modbus & 1 Modbus Plus

Comm Switch Configuration for MODBUS, Ports

MODBUS Port 1 is software configurable or will default to preset parameters depending on the position of the three position toggle switch, located on the lower left side panel behind the module handle. For software configuration, put the MEM–DEFAULT–MODEM switch in the MEM position and use your panel to select the communications parameters required.

In the "Default" or "Modem" positions you will power up with the following parameters:

Table 4 Port 1 Configuration

	381E/385E/385D/480E/485E/485K	385/485 ONLY
MEM	Port 1 Communication Parameters Taken from Configuration Table	Bridge Mode capable only if Panel programmed this option (Default is NO Bridge Mode)
DEFAULT	Port 1 Communication Parameters are: RTU, 9600 BAUD, Even Parity, 1 Stop Bit Address is set on Dip Switch underneath if 385/485 or is 1 if 381/480.	Bridge Mode capable without panel intervention (i.e. automatic)
MODEM	Port 1 Communication Parameters are: ASCII, 2400 BAUD, Even Parity, 1 Stop Bit Address is set on Dip switch underneath if 385/485 or is 1 if 381/480	Bridge Mode capable without panel intervention (i.e. automatic)

The second Modbus Port on the 381/480 is configurable only by using your programming panel.

Modbus Port Software Configuration

You can use Modicon Modsoft programming panel software to set an internal memory variable for either Modbus port 1 or port 2 (when the MEM/DEFAULT/MODEM slide switch is in MEM). Refer to Figure 11.

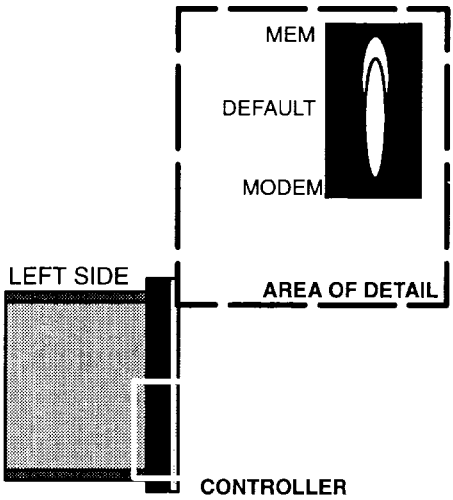


Figure 11 MEM/DEFAULT/MODEM DIP Switch

For convenience, a summary of Modsoft screens showing the communications parameters available is presented here. From the Main menu you select the "Offline" "Select Program or New Program" entry and then select Config from the Status screen, the results are illustrated in Figure 12. With the cursor on the Ports selection press the ↵ key to display the port parameter screen.

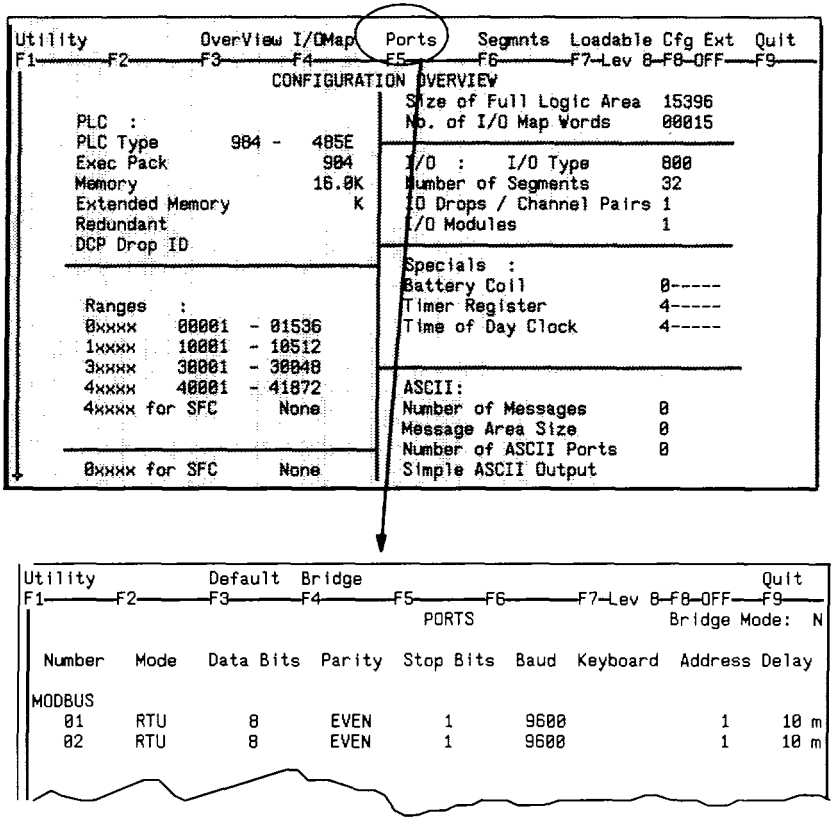


Figure 12 Communication Port Selection Screen

You can fill in the data fields as you require. Pressing the ? key while on a field displays a parameter list for that field.

Caution Port 2 does not support the following parameters: 2 stop bits with RTU and parity; 1 stop bit with ASCII and no parity.

Modbus Plus Node Address Setting (385/485 ONLY)

These node address switches are the first 6 Dip's shown in Figure 13, and viewed from the bottom of the unit. Switches One through six can be set to the binary bit pattern 000000 through 111111 which are the equivalent of decimal 0 through 63

respectively. To derive the node address add "1" to the binary. The default shown in Figure 13 is the binary 0 which is node address 1. To change to an address of 2, place the LSB switch "Toward the number" (000001) etc,. The 8 position DIP switch for setting the Modbus Plus port address is located at the bottom of the unit casing. Refer to Figure 13.

☞ **Note** The 381/480 models do not have an 8 position DIP Switch.

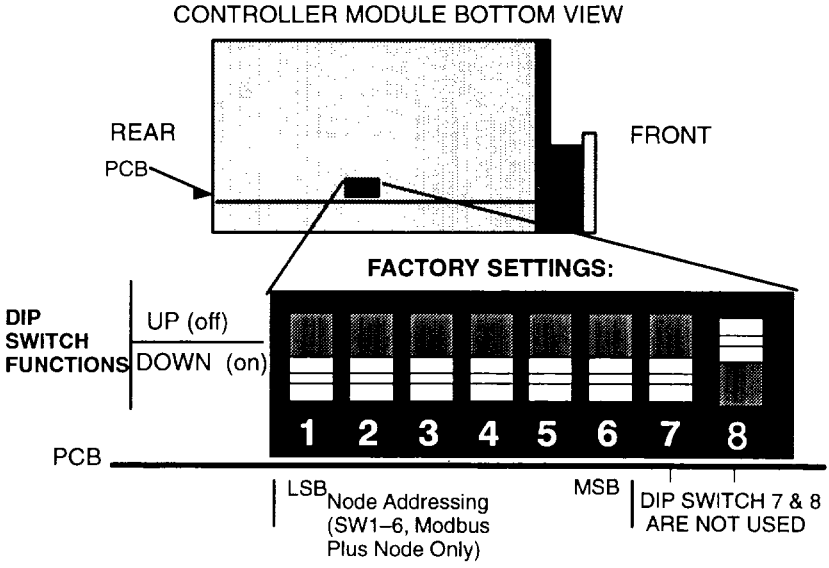


Figure 13 DIP Switch for Modbus Plus Node (385/485 ONLY)

Modbus Plus Bridge Mode (385/485 ONLY)

A communications Bridge mode is a standard feature which allows access to the Peer network in DIP mode. Using this mode you can program or monitor any individual node on the Modbus Plus Network using a program panel connected to modbus port 1.

When the Mem/Default/Modem DIP switch is in the MEM position the bridge mode can also be enabled or disabled by using the panel software "Offline" "Configuration" "PORTS" *Bridge* subfunction.

Using MSTR Block To Change Modbus Plus Address

You setup the MSTR block by transitioning the enable input ON *for one scan.* The MSTR function Done output passes power in the same scan (assuming no errors). There will be a delay of up to 10 seconds in the availability of the newly addressed Controller due to the time required fully implement the change including re–initializing the link.

If you hold the MSTR block enabled for more than one scan, the Change Address Command is issued for each scan so enabled. This results in a race condition locking the controller out of effective operation.

Part of the process of implementing the Change Address Command allows testing for:

If the specified address equals 0
If the specified address is greater than 64
If the specified address is equal to the current address.

In each true case the PEER Processor ignores the Change Address Request but remains available to the host processor.

Modbus Plus Node Address Software Change (385/485 ONLY)

The on board dip switches as shown in Figure 13 are read by the PEER PLC at power–up to determine what the Node address is. This setting stays in effect until a power–cycle with new settings or a software controlled "Change Address Command" is issued to the PEER PLC. The Ladder Logic implemented MSTR Block is the mechanism by which you issue the proper command.

☞ **Note** The Controller in which you want to change the Node address must be running.

MSTR Format

You can issue the "Change Address Command" using the ladder logic MSTR DX block. Figure 14 is an example of a Modsoft screen with MSTR block.

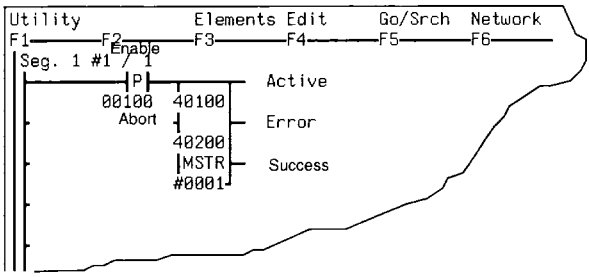


Figure 14 MSTR Block on Modsoft screen With Input/Output Labels

- The top node (40100 in the example) defines the first of a nine register block that contains:

4TTTT	Operation Type	FFFF Hex *Change Address Command*
4TTTT+1	Error Status	See Appendix C for Error Codes
4TTTT+2	Pattern 1	1234 Hex
4TTTT+3	Pattern 2	5678 Hex
4TTTT+4	Pattern 3	XXAA Hex where xx = 00 for builtin 01 for S985 #1 02 for S985 #2
4TTTT+5	Pattern 4	XXBB Hex
4TTTT+6	Pattern 5	XXCC Hex
4TTTT+7	Pattern 6	XXDD Hex
4TTTT+8	Pattern 7	XXEE Hex

When the Error output passes power, the content of the Error Status register contains an error code to help you determine the cause of the error.

These registers provide a margin of safety against inadvertent change of address. The values in these seven registers MUST contain exactly the above data or an error will result.

- The middle node (40200 in the example Figure 14) contains the new address. The new address can be a value between 1 and 64.

- The bottom node (a value of 1 in the example) may be set to any value from 1 to 100 but only one address is involved from the middle node.

Port Delay Timer
Each Modbus port (one or two) can be assigned a time delay value from 10 milliseconds to 200 milliseconds in duration. You use the Modsoft configurator PORTS menu to do this.

685E/785E/785D/785K

Comm Switch Configuration for MODBUS, Ports
MODBUS Ports 1 and 2 are software configurable, but through–the–chassis, user accessible DIP switch has been provided to manually configure Modbus Port 1 on the 984 CPU. The second port is software configurable only. The MEM (software) DIP switch (default) is enabled (even while operational) using a toggle switch located on the controller side panel.

☞ **Note** The switch used for Modbus Port 1 fixed defaults is selected by opening (off) or closing (on) **DIP switch 8.**

In the "Default" or "Mem" positions you will power up with the following parameters in Table 5:

Table 5 Port 1 Configuration

	685E/785E/785D/785K	685/785 ONLY
MEM	Port 1 Communication Parameters Taken from Configuration Table	Bridge Mode capable only if Panel programmed this option (Default is NO Bridge Mode)
DIP	Port 1 Communication Parameters are: RTU, 9600 BAUD, Even Parity, 1 Stop Bit Address is set on Dip Switch underneath if 685/785.	Bridge Mode capable without panel intervention (i.e. automatic)
DIP/ DIPSW8	Port 1 Communication Parameters are: RTU, 2400 BAUD, Even Parity, 1 Stop Bit Address is set on Dip Switch underneath if 685/785.	Bridge Mode capable without panel intervention (i.e. automatic)

The second Modbus Port on the 685/785 is configurable only by using your programming panel.

Modbus Port Software Configuration

You can use Modicon Modsoft programming panel software to set an internal memory variable for either Modbus port 1 or port 2 (when the MEM/DIP slide switch is in MEM). Refer to Figure 11. The two settings available are:

RTU, 9600 baud, Even Parity, 1 Stop bit, (switch 8 in the position shown in Figure 17) or, ASCII, 2400 baud, Even Parity, 1 Stop bit, (switch 8 position "down").

☞ **Note** When the MEM/DIP enable slide is returned to MEM position, Port 1 comm parameters and link address return to original memory configured values after a power cycle.

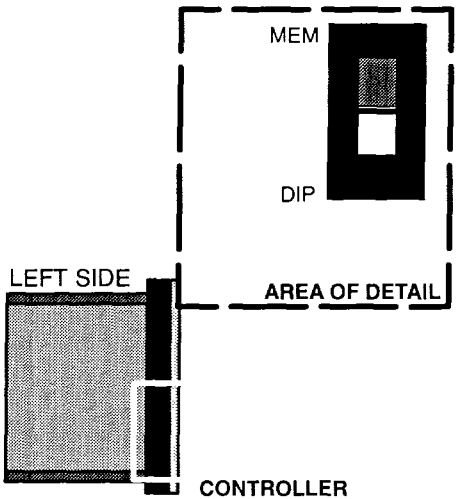


Figure 15 MEM/DIP DIP Switch

For convenience, a summary of Modsoft screens showing the communications parameters available is presented here. From the Main menu you select the "Offline" "Select Program or New Program" entry and then select Config from the Status screen, the results are illustrated in Figure 12. With the cursor on the Ports selection press the ↵ key to display the port parameter screen.

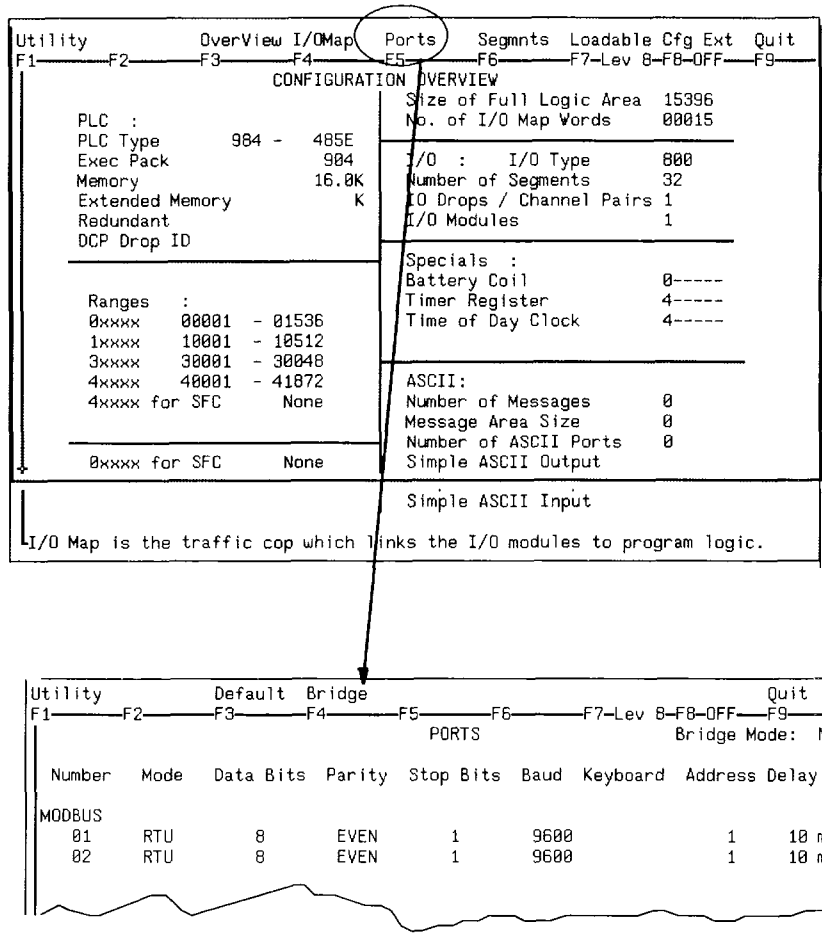


Figure 16 Comm. Port Selection Screen (485E Example)

You can fill in the data fields as you require. Pressing the ? key while on a field displays a parameter list for that field.

Caution Unsupported Parameters are: 2 stop bits with RTU and parity; 1 stop bit with ASCII and no parity.

Modbus Plus Node Address Setting (685/785 ONLY)
These node address switches are the first 6 Dip's seen below, and viewed from the bottom of the unit. Switch 7 is not used, switch 8 is the Modbus default select switch. Switches one through six can be set to the binary bit pattern 000000 through 111111 which are the equivalent of decimal 0 through 63 respectively. To derive the node address add "1" to the binary. The default shown in Figure 13 is the binary 0 which is node address 1. To change to an address of 2, place the LSB switch "Toward the number" (000001) etc,. The 8 position DIP switch for setting the Modbus Plus port address is located at the bottom of the unit casing. Refer to Figure 13.

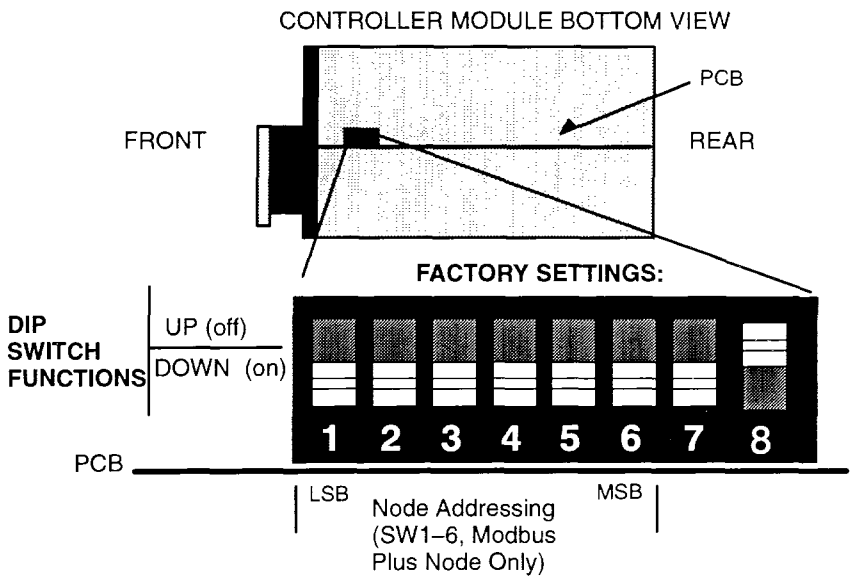


Figure 17 DIP Switch for Modbus Plus Node (685/785 ONLY)

To familiarize you with the switch settings, Table 6 provides you with the first 16 addresses. Only the UP is shown all others are down.

Table 6 Partial Modbus Plus Address Examples

1	2	3	4	5	6	Address
–	–	–	–	–	–	1
UP	–	–	–			2
–	UP	–	–			3
UP	UP	–	–			4
–	–	UP	–			5
UP	UP	–				6
–	UP	UP	–			7
UP	UP	UP	–			8
–	–	–	UP			9
UP	–	–	UP			10
–	UP	–	UP			11
UP	UP	–	UP			12
–	–	UP	UP			13
UP	–	UP	UP			14
–	UP	UP	UP			15
UP	UP	UP	UP			16

Chapter 3
System Installation

- Panel/Bulkhead Mounting
- Rack Mounting
- Field Wiring
- I/O Module
- Power Supply
- RI/O Head/Receiver

Panel/Bulkhead Mounting

As shown in Figure 18 and Figure 19 below, the housing has keyholes at the top and bottom of the housing for bulkhead mounting purposes. The keyholes are sized for 5/16–inch bolts. The recommended ground point is also shown.

Procedure Panel/Bulkhead Mounting Installation

Step 1 Install and ground your bulkhead mounting surface for Drop 2.

Step 2 Layout your drop based on your RI/O configuration diagram and installation plan.

Step 3 Install 1/4 inch inserts into the panel or metal mounting surface for your primary housing as shown in Figure 18 and Figure 19.

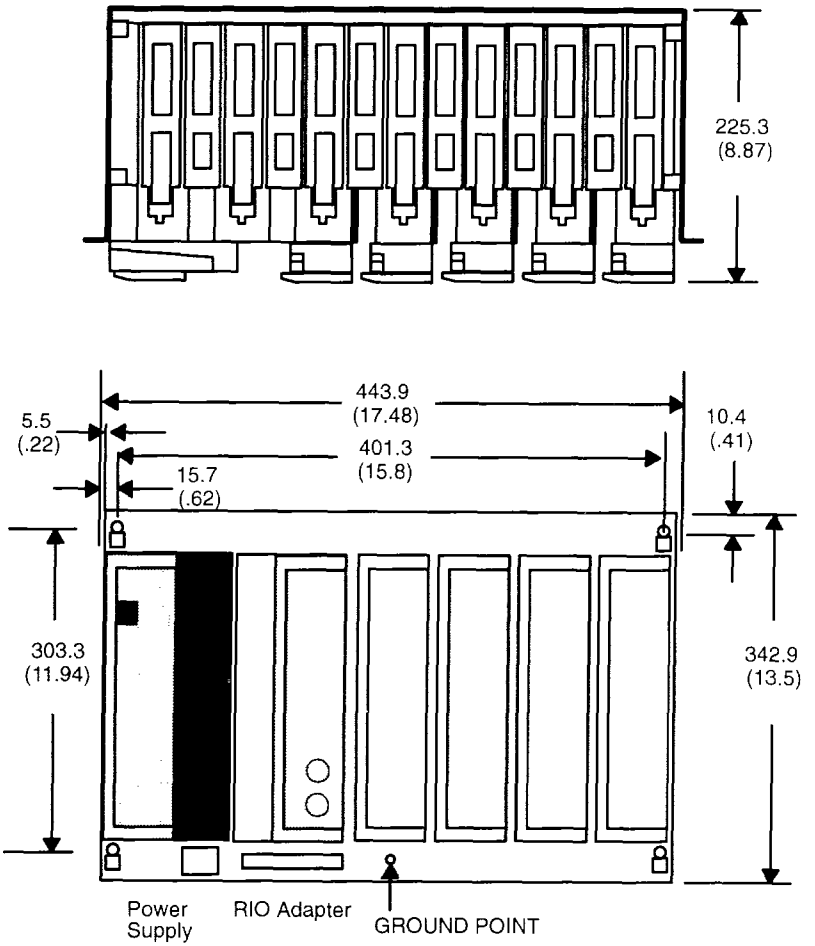


Figure 18 Remote I/O H819 Panel/Bulkhead Mounting Dimensions

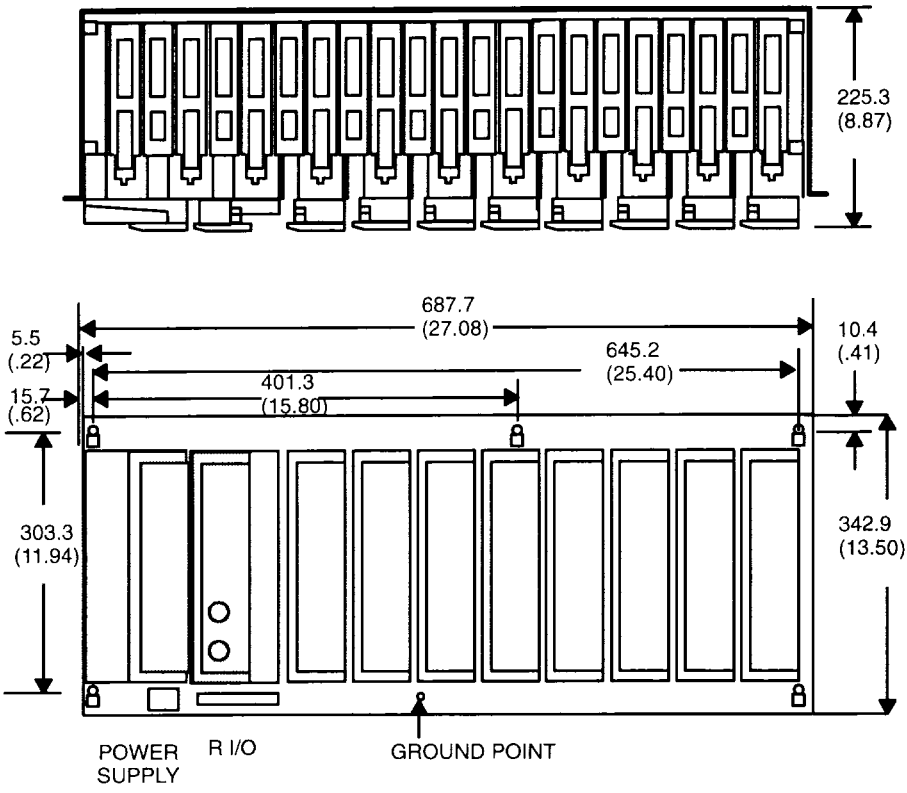


Figure 19 H827 RI/O Housing Panel/Bulkhead Mounting Dimensions

Step 4 As shown in Figure 20 below, attach the primary housing to its mounting surface by inserting the required number of 1/4–inch bolts. (H819 requires four bolts in the housing's mounting flange.) Also install cable troughs for your RI/O module slots.

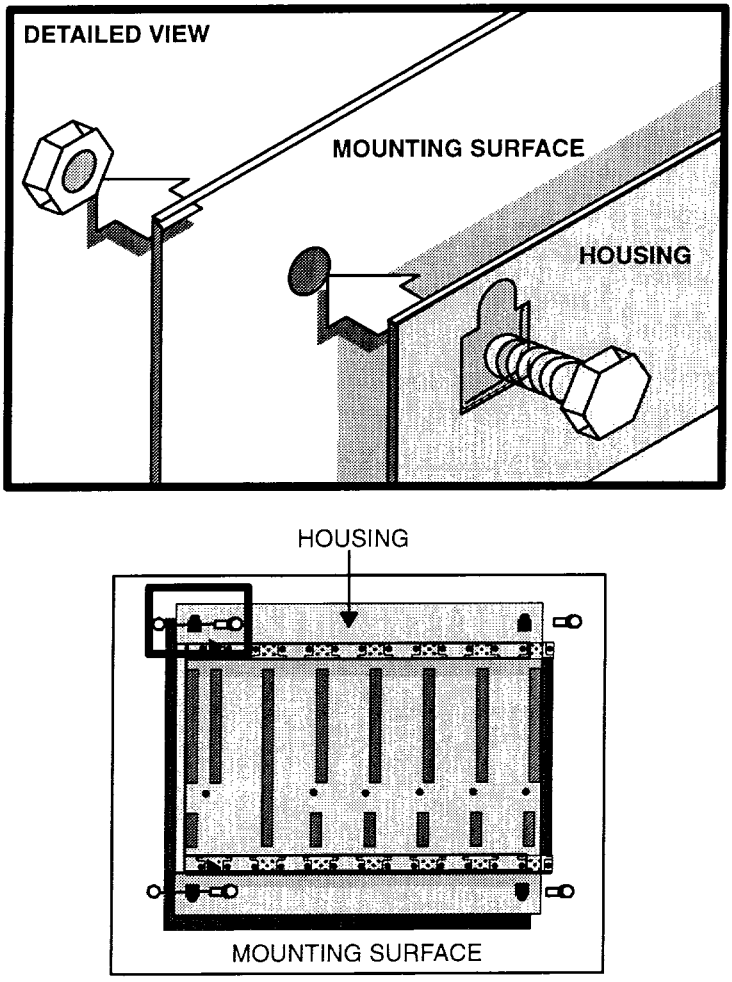


Figure 20 Attach Housing to Mounting Surface

Step 5 Repeat Steps (3) and (4) above for each housing in Drop 2.

Step 6 Using appropriate lengths, connect your W801 signal cable and W802 power cable (use W804 auxiliary power cable when required) between the signal and power connector ports at the top and bottom of each housing as shown in Figure 21. Make sure the cable ground lug is attached to Housing Ground Point.

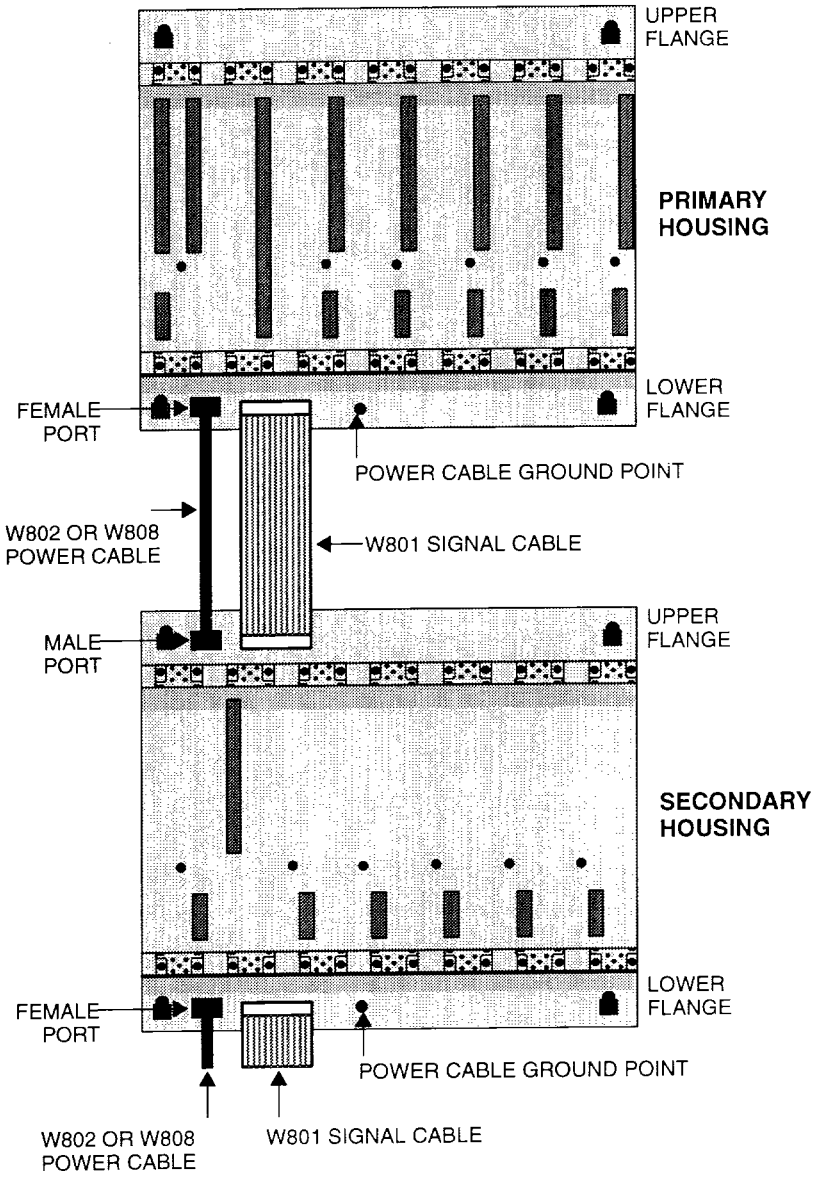


Figure 21 Connecting Cables within Each Drop

Step 7 Ground all W802 power cables to each housing's ground point in the drop as shown in Figure 5–1 preceding. The grounding lug requires a #10 machine screw.

Step 8 Repeat Steps (1) thru (7) above for all remaining RI/O drops.

Rack Mounting

The H819 Module Housings can be mounted in a 19–inch standard (EIA) rack. This requires installing a rack adaptor mounting flange kit. Figure 22 shows the housing's rack mounting dimensions.

The following hardware is required for rack mounting each housing:

- (1) Rack mounting adaptor kit which includes: a pair of rack mounting flanges; (8) #8–32 Pan Head Machine Screws (supplied) to attach rack mount flanges to ends of housing; (8) 1/4 bolts (supplied) to attach flange kit to back of housing.

- (8) #10–32, Pan Head Machine Screws to mount the housing with flange adaptor to NEMA rack.

- (8) #10–32 Flat Lock Nuts if mounting holes in rack's side rails rails are not threaded.

  Other special mounting hardware may be required depending upon the installation site.

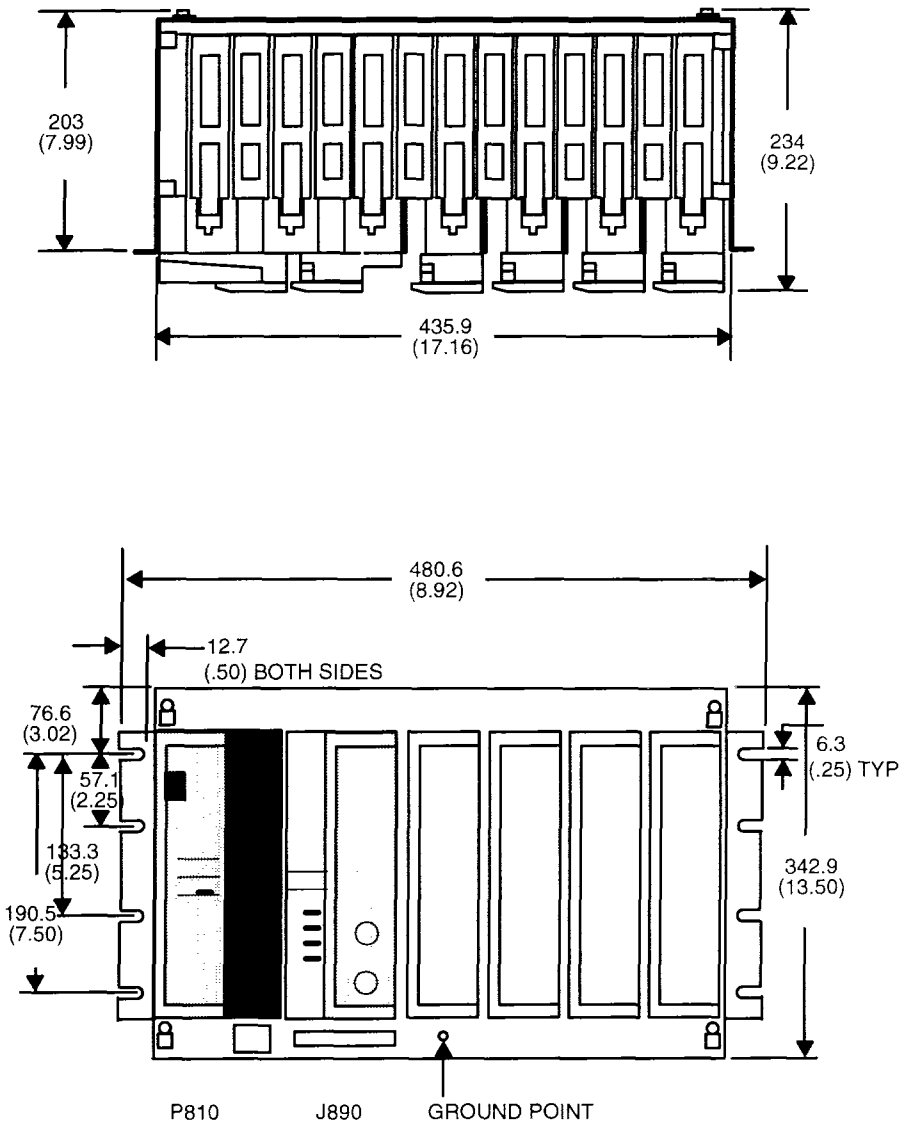


Figure 22 H819 Housing Rack Mount Dimensions

Procedure Rack Mounting Installation

Step 1 At Drop 2, using #8–32 mounting hardware shown in Figure 23, replace the primary housing's two end plates with rack mounting flanges.

Step 2 Use 1/4–inch bolts (supplied) attach each flange to the housing's back panel.

Step 3 When the rack mount flange is installed, ensure that contact with the back plate of the housing makes a good ground.

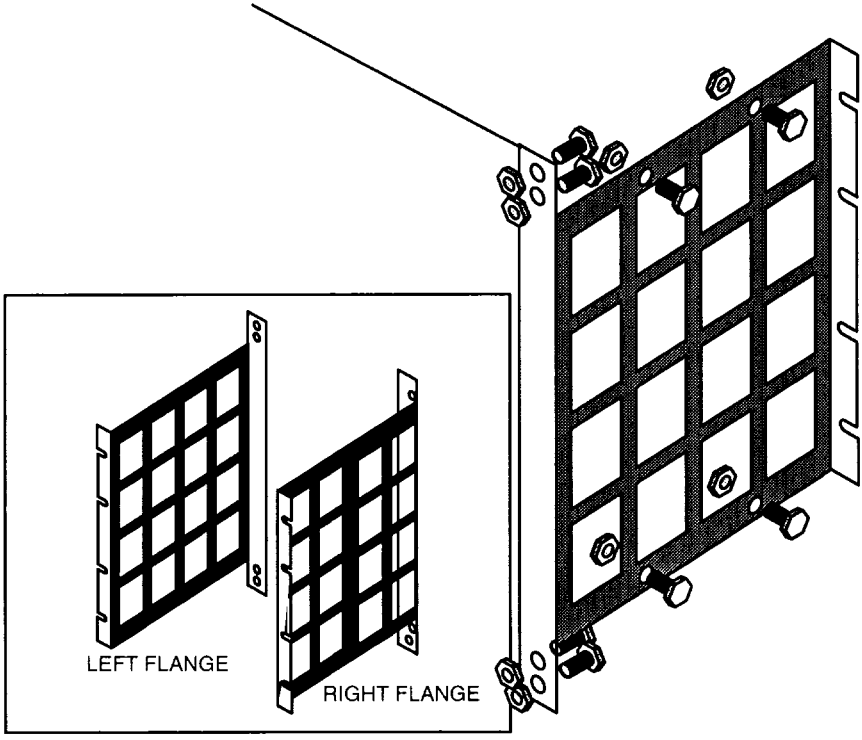


Figure 23 Attaching Rack Mounting Flange to Housing

Step 4 To attach the module housing to the rack as shown in Figure 24, lift the empty module housing to its mount position in the rack and insert the mounting screws. Use #10–32 pan head screws to attach the module housing to the rack. Install cable troughs for all Remote I/O modules.

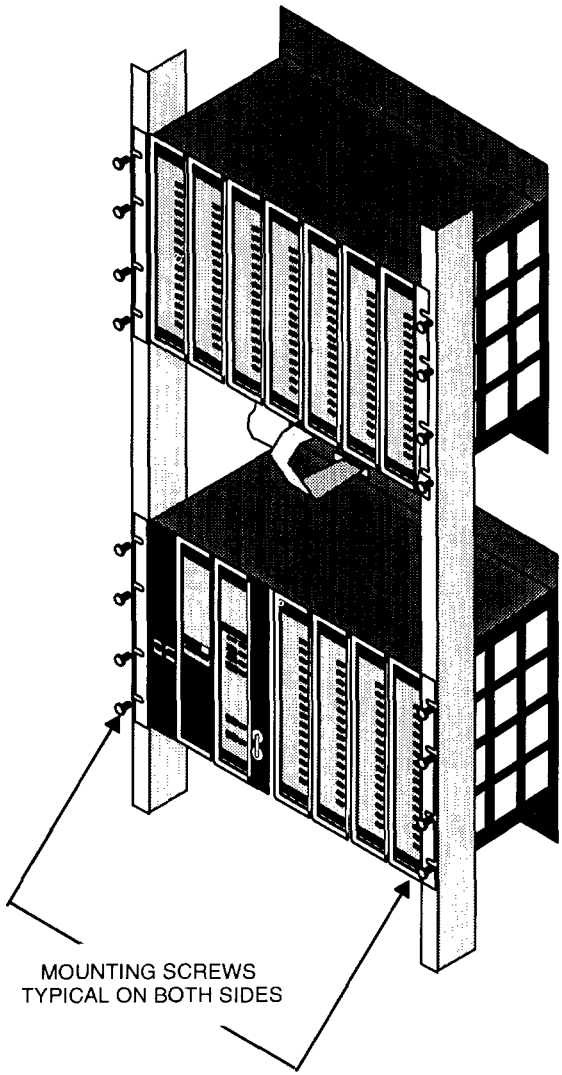


Figure 24 Rack Mounting Your Housing

Step 5 Repeat Steps (1) thru (4) above for all remaining housings within Drop 2.

Step 6 Using appropriate lengths, connect your W801 signal cable and W802 power cable (use W808 auxiliary power cable when required) between the signal and power connector ports at the top and bottom of each housing within the drop as shown in Figure 21.

Step 7 Ground each W802 power cable to the housing's ground point shown earlier in Figure 18. The grounding lug requires a #10 machine screw.

Step 8 Ground your rack for Drop 2 to the best possible ground following good practices.

Step 9 Repeat Steps (1) thru (8) above for all remaining drops according to plan.

Procedure Connecting Your Field Wiring

Field wiring should be in place before the I/O modules are inserted into the racks. During installation, the slot to the left of the slot being wired must be empty.

As shown in Figure 25, field wiring is routed through the wire trough to the terminal block. There are field wiring terminal screws on each terminal block. User field wiring crosses from the left side into the wire connectors. Each terminal can accept as many as four #22 AWG wires, as many as two #14 AWG wires, or a single #12 AWG wire. The wires can be solid or stranded.

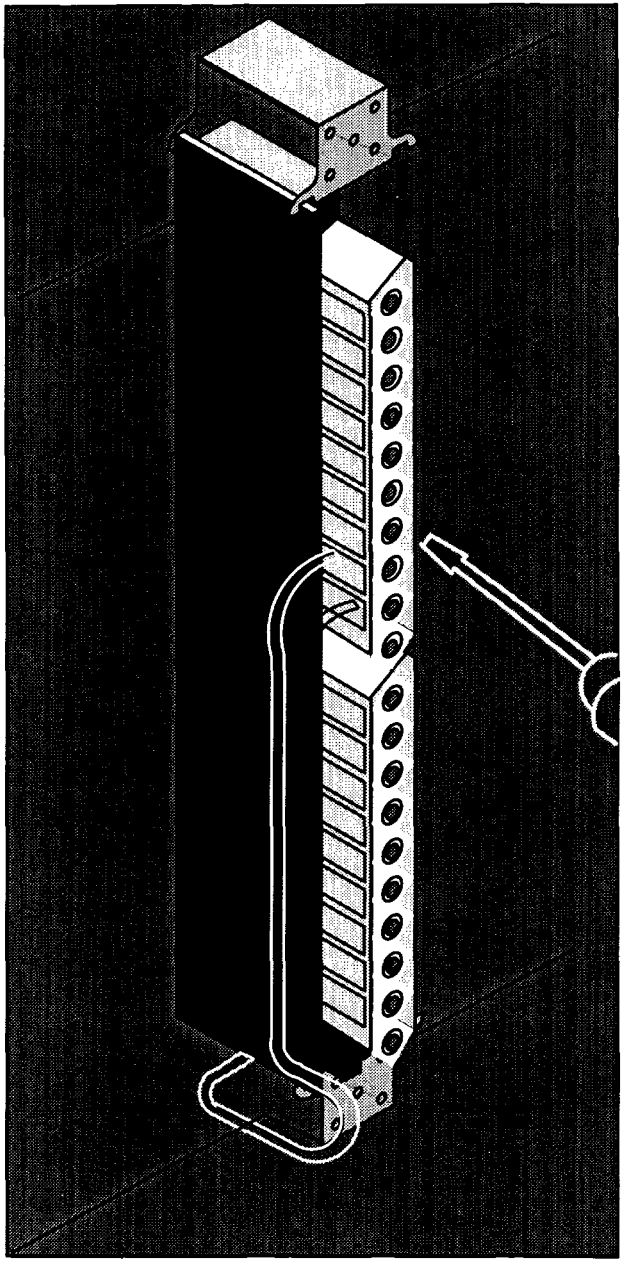


Figure 25 Field Wiring to Terminal Strip (20 Pin Shown)

Step 1 If you already have a Power Supply installed, ensure it's OFF and will remain OFF.

Step 2 Bring field wiring to last housing in the Drop.

Step 3 Fan–out your cable breakout and lay it in the cable trough for rightmost I/O module slot on housing.

Step 4 Open the wire connectors by turning the recessed terminal screws CCW.

Step 5 Insert the field wires into the wire connectors and tighten the terminal screws.

Step 6 Repeat Steps (3) thru (5) for each slot in last housing.

Step 7 Repeat Steps (1) thru (6) above for each housing in the Drop.

Step 8 Repeat Steps (1) thru (7) above for each remaining Drop.

I/O Module Insertion

The I/O modules insert into designated slots. They connect to each other within the housing by way of the backplane connectors. The I/O connectors mounted on the I/O modules mate with the terminal block connectors mounted on the housing. Each module has two captive screws which secure it to the housing. Figure 26 shows the I/O module insertion.

Procedure I/O Module Installation

Step 1 At Drop, insert key pins in last housing according to plan.

Step 2 Insert last I/O Module jn rightmost slot of last housing in Drop.

Step 3 Secure I/O module with captive screws.

Step 4 Working right to left, repeat Steps (2) and (3) above for all remaining I/O slots in last housing.

Step 5 Repeat Steps (1) thru (4) above for all housings in Drop.

Step 6 Repeat Steps (1) thru (5) above for all remaining drops.

☞ **Note** Initial module, auxiliary Power Supply or Remote I/O adapter installation, may be difficult, as the bullpin ground spring has to be expanded over the housing bullpin. If difficulty in seen, carefully rock the module in the housing, until seated over the bullpin.

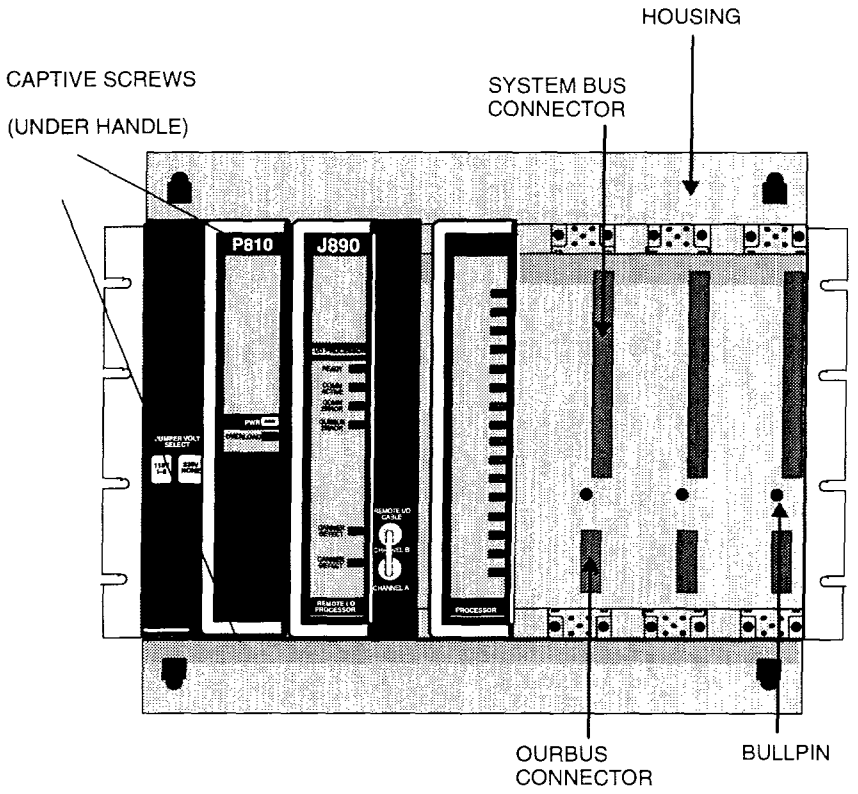


Figure 26 800 Series RI/O Module Installation

Warning 800 SERIES I/O MODULES MUST NOT BE REMOVED AND REPLACED (HOT–SWAPPED) WHILE THE POWER SUPPLY MODULE IS ENERGIZED (ON).

Power Supply

Your PLC and 800 remote I/O power supply (P810) module goes in the first slot of the primary housing in each drop. The power supply passes power to the I/O modules within its housing via backplane connectors and from housing to housing within the drop via a W802 power cable(s) The W804 Auxiliary power cable is used to send switching signals (IOPCH) into a housing that has its own auxiliary power supply.

The power supply module shown in Figure 27 is secured to the housing by two captive screws located behind the handle.

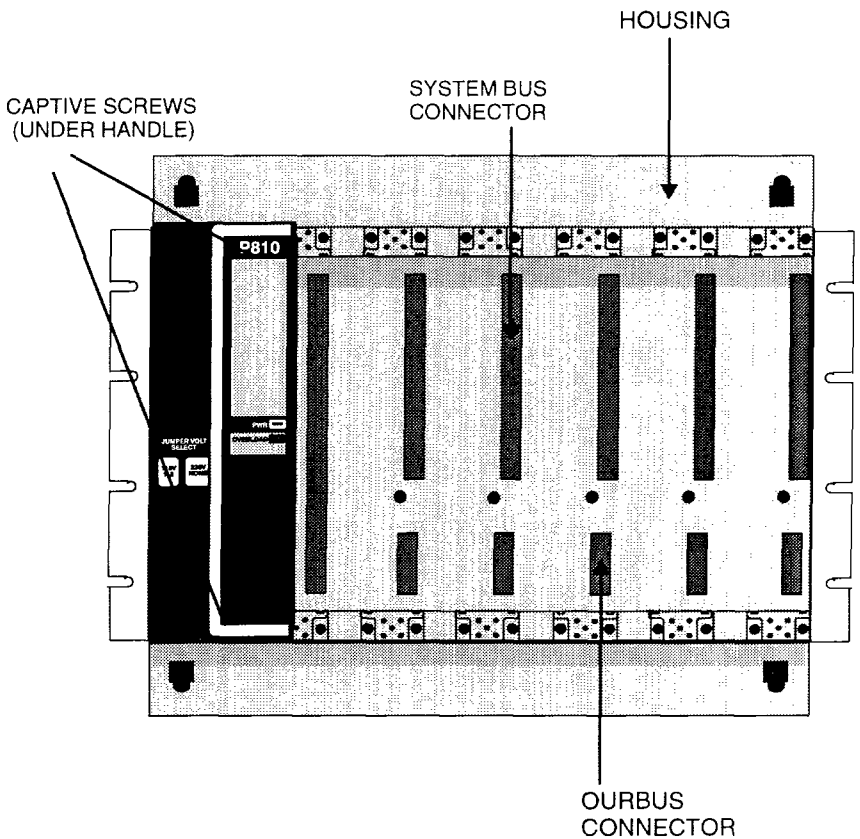


Figure 27 P810 Power Supply Insertion

Power Supply Installation and Wiring

STOP

Warning **ENSURE THE MAIN POWER TO THE INSTALLATION IS OFF AND WILL REMAIN OFF BEFORE WIRING POWER SUPPLY.**

Step 1 Install your P810 in a Drop.

Step 2 Remove protective cover plate over power supply's input power terminal strip.

Step 3 Wire AC input connector as shown in Figure 28.

Step 4 The P810 is shipped from the factory wired for 115 Vac operation; i.e., 1 & 2 jumpered. Ensure this is the case.

To wire for 230 Vac operation, remove the jumper.

☞ **Note** To wire a P800, see Figure 29. To wire a P884, see Figure 30.

Step 5 Reinstall protective cover.

Step 6 Repeat Steps (1) thru (5) above for each remaining drop.

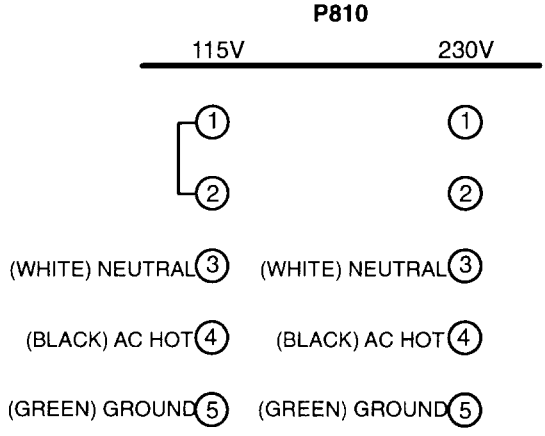


Figure 28 P810 Power Supply Terminal Strip

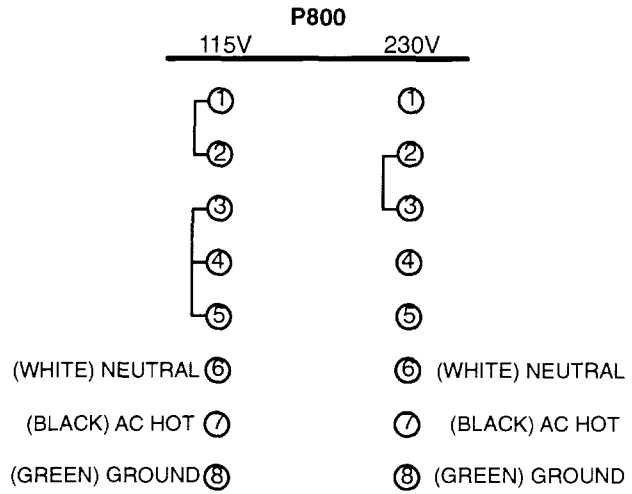


Figure 29 P800 Power Supply Terminal Strip

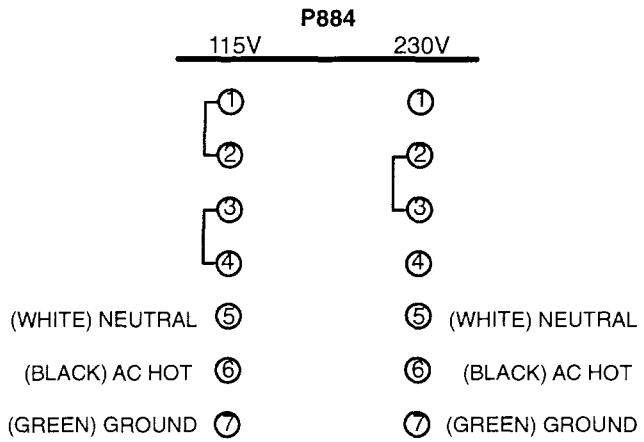


Figure 30 P884 Power Supply Terminal Strip

Verify Your Local I/O

Finish your installation verification by configuring and I/O mapping your PLC and then communicating with local I/O.

Note Record Executive ID and version number from the panel software status screen.

Step 1 Set your controller's input power to OFF. Shut off auxiliary power.

Step 2 Install a simple I/O module in Slot 2 of primary housing (a B805 for example) and secure with captive screws.

Step 3 Re–power

Controller to IBM PC Programming Panel Software

Step 4 Connect PLC to panel via either Modbus Port 1 or Modbus Plus.

Step 5 At your DOS prompt type CD\Modsoft then at the Modsoft directory prompt (typically C:\MODSOFT>)type MODSOFT to execute the panel software.

Expert Step 5 assumes your panel software is available in your computer. If it is not refer to the Modsoft Programmer User Manual GM–MSFT–001 for the load procedure.

Getting PLC into RUN Mode

A new controller can not be RUN without providing some data about the configuration in which it is to operate. Steps 6 through 11 provide a quick method to assure that your new controller will RUN.

Step 6 Press the panel "Enter" key (↵) to display the main menu.

Step 7 You can either download pre–existing configuration data using the "Transfer" function or initialize a configuration by selecting an Offline program function from the ↓Menu, then overview PLC type and other ↓parameters.

Step 8 You will see the configuration "Overview" screen illustrated for example in Figure 31. Select the information that defines your PLC configuration.

Step 9 Return to the main menu and select "File to PLC" from the "Transfer" Menu.

Step 10 When the Transfer is complete, you are prompted to "Start Controller", follow that up with a "Y". The controller will start and the Green RUN LED is lighted.

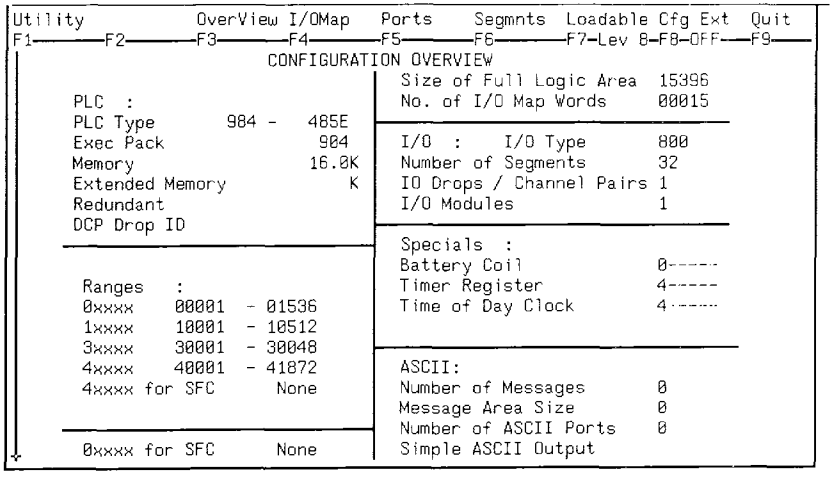


Figure 31 A Configuration Overview Screen Initial Screen

I/O Quick Check

To check the I/O side of your configuration, assuming you have a B805 and B804 in slot 3 and 4 respectively. Stop the controller if running and go back to offline.

Re–select the program and go to configuration screen. Proceed to add the I/O Mapping information for these two modules to the configuration data you already established by:

Step 11 Enter the number of I/O modules as the value 2, from the "Overview" menu.

Step 12 Go to the "IO/Map" menu function and define the presence of the two modules. Figure 32 is an example of what the data looks like.

```
Utility          DelDrop  HoldTme  ASCPort  GetDrop                    Quit
F1———F2———F3———F4———F5———F6———F7–Lev 8–F8–OFF—F9—

                              I/O MAP
                          800 SERIES I/O
Drop              :  1  of 1        Rack            :            1
Drop Hold Up Time :  3     (x100ms) ASCII Port      :            0
Number Inputs     :  16             Number Outputs  :            16

        Module      Reference Numbers          Data     Module
 Slot    Type     Input          Output         type   Description

 101     984                                           PLC-485E
 102     B805   10001 -10016                           16-IN          B805
 103     B804                  00001 -00016            16-OUT         B804
 104     B8
 105     B8
 106     B8
 107     B8
 108     B8
 109     B8
 110     B8
```

Figure 32 I/O Map Data

Step 13 Return to the main menu and select the Transfer "File to PLC" menu and at the "Start" prompt, respond with "Y" and watch the RUN LED go on.

Step 14 You have now repeated the earlier steps (step 10) to download the configuration but this time the I/O map data is downloaded with it.

Step 15 Visually inspect installation and verify operation. In summary, your Green POWER OK indicator and Amber READY indicator status should remain ON. The RUN indicator should be Green. Your I/O module ACTIVE indicators should be Green.

Your PC installation is now complete and verified. If you have an obvious problem, take the appropriate corrective action. If your LED status is incorrect, refer to the Installation Troubleshooting Chart in Appendix B.

RI/O Head/Receiver

The 381E/385E/385D PLC's only support local I/O not RI/O. Therefore the following sections do not apply to these PLC's. The RI/O head installation section applies to 685E/785E/785D/785K PLC's because these systems require an additional hardware module that functions as the RI/O head (S908) and because 480E/485E/485K PLC's have their RI/O head built–in. The RI/O receiver installation section applies to 480E/485E/485K and 685E/785E/785D/785K PLC's.

RI/O Head Installation (685E/785E/785D/785K ONLY)

The RI/O Interface has an exec cartridge for the remote I/O interface. Depending on which cartridge has been installed, the RI/O drop limit is either 16 or 31. Your RI/O exec cartridge installation is accomplished through an access panel in the left side of the RI/O head (S908) module's chassis.

☞ **Note** Please refer to GM–0984–RIO *The Remote I/O Planning Guide* for more detail information.

⚠ **Caution MODICON cannot endorse Splitter networks as good practice and recommends that they not be used!**

☞ **Note** If you installed your S908 RI/O head in the local installation procedure, skip the installation procedure below.

Procedure Setup & Installation of S908 RI/O Processor in Primary Housing

Step 1 Open access port in S908 and ensure correct Executive Cartridge is securely installed (–131 or –016).

Step 2 Secure access port.

Step 3 Install S908 in a primary slot of the controller H819/H827 primary rack.

Step 4 Secure module with captive screws.

RI/O Receiver Install (480E/485E/485K & 685E/785E/785D/785K)

The J890/J892 RI/O receiver is used with 800 Series I/O in a 480E/485E/485K system. In this section, you will be setting J890/892 RIO adapter, DIP switch settings for Drop Address and Port Configuration and mounting.

Figure 33 shows DIP switch locations on J890/892 modules. Note the J890 RI/O module has only one DIP switch which is used for the Drop Address. The J892 RI/O (ASCII) has both a Drop Address DIP switch and a Port Parameters DIP switch. Because the switches are on the rear of the units, you must set them before installation in a rack.

☞ **Note** The P890/P892 RI/O receiver (with built–in power supply) may be used instead of the J890/J892 RI/O receiver. Please refer to *P890/P892 RI/O Processor Installation Instructions* (Modicon Part Number GI–P890–001) for detail information regarding DIP–Switch settings.

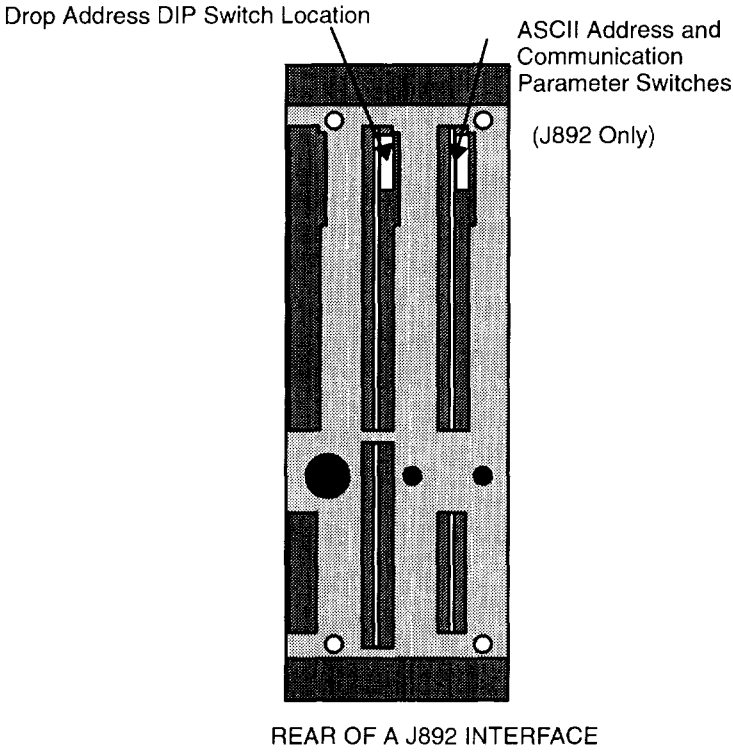


Figure 33 J890/J892 Dip Switch Locations (Rear of Modules)

Procedure Set Drop Address/ASCII Ports for J89X & Install

Step 1 Using drop address switch shown in Figure 34, set Drop address as shown in Table 5–1 below. The address is equal to the binary value plus 1. The White portion of the switch in the illustration represents the switch rocker in the set position. In the example below the address is set to 2.

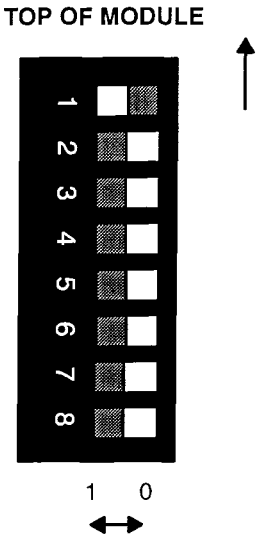


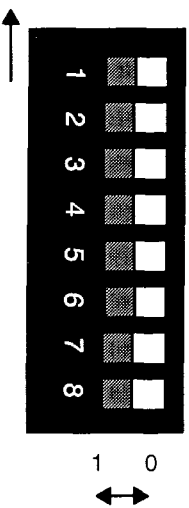
Figure 34 Drop Address Switch Characteristics

Table 7 J890/J892 Drop Address Switch Settings

ADDRESS	LSB SW1 1	2	3	4	MSB 5
	1	2	4	8	16 = binary weighted value
1	0	0	0	0	0
2	1	0	0	0	0
3	0	1	0	0	0
4	1	1	0	0	0
5	0	0	1	0	0
6	1	0	1	0	0
7	0	1	1	0	0
8	1	1	1	0	0
9	0	0	0	1	0
10	1	0	0	1	0
11	0	1	0	1	0
12	1	1	0	1	0
13	0	0	1	1	0
14	1	0	1	1	0
15	0	1	1	1	0
16	1	1	1	1	0
17	0	0	0	0	1
18	1	0	0	0	1
19	0	1	0	0	1
20	1	1	0	0	1
21	0	0	1	0	1
22	1	0	1	0	1
23	0	1	1	0	1
24	1	1	1	0	1
25	0	0	0	1	1
26	1	0	0	1	1
27	0	1	0	1	1
28	1	1	0	1	1
29	0	0	1	1	1
30	1	0	1	1	1
31	0	1	1	1	1
32	1	1	1	1	1

Note For J890 RIO Adaptor, skip Step 2 below.

Step 2 Using ASCII port switch shown in Figure 33 and Figure 35, set J892's RS232 Port address as shown in Table 5–2.



Switch 1 sets the RS232 handshaking for the bottom port
1 = Data Terminal Ready
0 = XON/XOFF

Switch 2 sets the RS232 handshaking for the top port
1 = Data Terminal Ready
0 = XON/XOFF

Switches 3 – 6 set device/port address per Table 8

Switch 7 is for Continuous Confidence Test Mode
1 = Local Diagnostic (takes unit Off–line)
0 = On–Line (Normal setting)

Switch 8 is not used, always set in the 0 position

Figure 35 ASCII Drop Port Assignment Switches

Table 8 J892 ASCII Port Address Settings

ADDRESS	LSB SW3 1	4 2	5 4	MSB 6 8 = binary weighted value
1,2	0	0	0	0
3,4	1	0	0	0
5,6	0	1	0	0
7,8	1	1	0	0
9,10	0	0	1	0
11,12	1	0	1	0
13,14	0	1	1	0
15,16	1	1	1	0
17,18	0	0	0	1
19,20	1	0	0	1
21,22	0	1	0	1
23,24	1	1	0	1
25,26	0	0	1	1
27,28	1	0	1	1
29,30	0	1	1	1
31,32	1	1	1	1

Step 3 Install J89X module next to the power supply module and secure with captive screws.

Step 4 Repeat Steps (1) thru (3) above for all remaining drops.

Verify Your RIO Installation

Note Your RIO system is ready for initial power up and check–out after Remote I/O Cabling is complete (Refer to GM–0984–RIO The Remote I/O Planning Guide).

Step 1 Visually inspect installation including grounds at the Drop.

Step 2 Energize your RIO power supply and J89X RIOP adaptor at a selected Drop.

Step 3 Visually inspect installation and verify operation. Your Power Supply POWER ON Indicator and your J89X READY Indicator should both come up Green.

Step 4 Connect Programming Panel to controller, stop, configure and I/O map it. Put up a small test program and communicate with the selected Drop to verify cable system installation to this point.

If necessary, see Appendix B for Cable Checkout information and/or for Error Codes and other related troubleshooting information.

Step 5 Repeat Steps 1 thru 4 above for all remaining drops.

Appendix A
Specifications

- Built–In Power Supply
- Output I/O Service
- External Power Requirements
- Physical Characteristics
- Electrical Characteristics
- Circuit Characteristics
- Environmental Characteristics
- End User Part Numbers

Controller Specifications

Built–in Power Supply

Input Power*	115 Vac ± 15%	Frequency 47–63Hz
	230 Vac ± 15 %	Frequency 47–63Hz
	24 Vdc ± 15%	Isolated Source
	125 Vdc ± 20%	Isolated Source

*See current requirements under "External Power Requirements" (below).

Input Watts	44.0W @ 115/230VAC (381E/385E/480E/480K) 37.5W@ 125VDC (385D/485D) 64W@ 115/230VAC (685E/785E/785K) 62.5W @ 125VDC (785D) 35.0W @ 24VDC (381E/385E/480E/480K) 60.7W @ 24VDC (685K/685D/785K/785D)
Output Watts	25.0W @ 115/230VAC (381E/385E/480E/480K) 25.0W@ 125VDC (385D/485D) 60.0W@ 115/230VAC (685E/785E/785K) 60.0W @ 125VDC (785D) 25.0W @ 24VDC (381E/385E/480E/480K) 60.0W @ 24VDC(685K/685D/785K/785D)
Fuses	0.750A, 3A SB Buss, Not customer replaceable (38x/48x) 1.5A, 3A SB Buss, Not customer replaceable (68x/78x)
Holdup	32ms for CPU from POWER OK going inactive
Inrush	6.4A AC, (thyristor regulator) (38x/48x) 10A AC, (68x/78x) 6.44A AC, (785D)

Output to I/O Service

38x Current*
- V1 5Vdc I/O 3.5A max
- V2 4.3Vdc I/O 3.5A max

48x Current*
- V1 5Vdc I/O 3.5A max
- V2 4.3Vdc I/O 3.5A max
- V3–5Vdc I/O 0.250A max

* When added, any combination of V1 and V2 must not exceed 3.5 Amperes.

68x/78x Current*
- V1 5Vdc CPU 1.0A max
- V2 5Vdc System Options & I/O 7.0A max
- V3 4.3Vdc I/O 6.0A max
- V4–5Vdc I/O 0.5A max

* The combination of 2,3 and 4 cannot exceed 7.0 Amperes.

External Power Requirements

AC Isolation Transformer	100W (38x/48x) 0.5kVA (68x/78x)
Ext 24Vdc P.S.	31W nom, @ 24Vdc (38x/48x) (24A peak); or 70W nominal (68x/78x) (24A peak)
RI/OHead Load	1.6A max @ 5VDC
I/O Module Loads	See the *Modicon Programmable Controller Systems Manual* (GM–0984–SYS) or the data sheet shipped with your module.

Physical Characteristics

Dimensions

WxHxD inch	2.54 x 10.5 x 8 (38x/48x)
WxHxD (mm)	(39.4 x 266 x 203) (38x/48x)
WxHxD inch	3.10 x 10.5 x 8 (68x/78x)
WxHxD (mm)	(79.0 x 266 x 203) (68x/78x)

Weight

4 lbs, 5 oz (38x/48x)
5 lbs, 5 oz (68x/78x)

Slots Required

1 (38x/48x)
1.5 (68x/78x)

Electrical Characteristics

Static Discharge 15kV to all surfaces

Magnetic 20 Gauss field inside Helmholtz Coil, 0.25 to 8 pps

Agency Approval Designed to meet UL, CSA, VDE agency safety requirements

Surge Withstand Per IEEE 472–1974, ANSI C37.90a

Circuit Characteristics

Scan Rate 1.0 – 2.5 ms/K words of user logic

Throughput Varies according to controller type and logic mix. Refer to the section regarding Optomize Mode (685E/785E ONLY) located in Chapter One

Memory Flash RAM Memory technology and Static Volatile RAM

Time–of–Day Clock ± 1 sec/day @ constant 25C
± 3 sec/day with varying temperature 0–40C
± 8 sec/day with varying temperature 0–60C

Real-time Clock 10 msecs ± 0.1%

Local I/O Pts.

(38x/48x)	512
(68x/78x)	1024

Remote I/O

(48x)	Up to 6 drops, each drop 512 bits in/ 512 bits out
(68x/78x)	16, or 31 drops, each drop 512 bits in/ 512 bits out
	16 drops @ 1K/1K, or 31 drops @ 512/512 (local still has 1K/1K)

Total I/O Cap

(48x)	6 Remote Drops plus 1 Local
	512 Other Drops up to Defined Max. I/O Pts.
(68x/78x)	31 Remote Drops plus 1 Local
	512 or 1024* Other Drops up to Defined Max. I/O Pts.
	*Defined by S908 Executive in use.

Environmental Characteristics

Temperature	Operating: 0 –> 60C
Storage:	–40 –> +80C
Humidity	0–95% Non–condensing
Max Wet Bulb	Non–operating: Non–condensing Operating: 85 deg. F
Altitude	10,000 feet max
Shock	+ 10g's, 11ms, 3 pulses per axis

Vibration (Operating)	5Hz to 50Hz @ .005 in D.A., 30 min/axis 50Hz to 500Hz @ 0.625 g's, 30 min/axis
Vibration (Passive)	10Hz to 50Hz @ .029 g's/Hz 50Hz to 300Hz @ .029 g's/Hz, –8dB/octave

End User Part Numbers

Table 9 End User Part Numbers

PART NUMBER	DESCRIPTION
Controllers	
PC–E984–381	CPU/PS 115/220VAC 24VDC
PC–E984–385	CPU/PS 115/220VAC 24VDC
PC–D984–385	CPU/PS 125/24VDC 24VDC
PC–E984–480	CPU/PS 115/220VAC 24VDC
PC–E984–485	CPU/PS 115/220VAC 24VDC
PC–K984–485	CPU/PS 115/220VAC 24VDC, memory protect key
PC–E984–685	CPU/PS 115/220VAC 24VDC
PC–E984–785	CPU/PS 115/220VAC 24VDC
PC–D984–785	CPU/PS 125/24VDC
PC–K984–785	CPU/PS 115/220VAC 24VDC, memory protect key
RI/O	
AS–S908–110	S908 RI/O Module (single cable)
AS–S908–120	S908 RI/O Module (dual cable)
AS–E908–016	Executive Cartridge for S908 (16 drops)
AS–E908–131	Executive Cartridge for S908 (31 drops)
AS–S911–801	Executive Cartridge for S911
AS–J890–xxx	RI/O Receiver
AS–J892–xxx	RI/O Receiver w/ ASCII Ports
AS–P890–xxx	RI/O Receiver w/ built–in power supply
AS–P892–xxx	RI/O Receiver w/ built–in power supply and w/ ASCII Ports

Power Supplies

AS–P810–xxx	RI/O Power Supply
AS–P884–xxx	Main Power Supply

Housings

AS–H819–209	Primary 19" Housing w/ systems bus
AS–H827–209	Primary 27" Housing w/ systems bus
AS–H819–xxx	Secondary 19" Housing w/ Ourbus only
AS–H827–xxx	Secondary 27" Housing w/ Ourbus only
AS–H810–209	Primary 10" Housing w/ systems bus
AS–H810–100	Secondary 10" Housing w/ Ourbus bus

Cables

AS–W952–012	IBM PC/AT to 984–X80
AS–W954–006	Modem to 984–X80
AS–W955–012	IBM PC/XT to 984–X80
AS–W955–025	IBM PC/XT to 984–X80
AS–W956–012	IBM PC/AT to 984–X80
AS–W956–025	IBM PC/AT to 984–X80
AS–W957–003	J878 to 984–X80
AS–W958–001	25–pin Adaptor to 984–X80
AS–W801–0xx	Housing interconnect signal cable
AS–W802–012	Housing interconnect power cable
AS–W804–0xx	Housing interconnect aux power cable
AS–W808–0xx	Housing interconnect power cable
AS–W960–012	Panelmate to 984–X80

Appendix B
Troubleshooting

- Stopped Error Codes
- MODBUS Cable Pinouts
- Installation Verification Troubleshooting Guide
- Master Function Error Codes
- Customer Service and Technical Assistance

Stopped Error Codes

Table 10 lists stopped error codes for your controllers. These codes may be read using the Modsoft "PC & I/O status" screen.

Table 10 Stopped Error Codes

Machine Stop Bits	Description
0x7FFF	Controller unhealthy
0x8000	Controller stopped
0x4000	Bad I/O traffic cop. Mismatch
0x2000	PC in dim awareness
0x1000	Bad port intervention
0x0800	Bad segment scheduler
0x0400	Son did not start segment
0x0200	Bad power–down checksum (RAM Error)
0x0100	No EOL detected; Bad Network
0x0080	Watchdog expired
0x0040	Real time clock failed
0x0020	Bad coil used table
0x0010	Remote IO option failed
0x0008	Illegal node type user
0x0004	User logic checksum error
0x0002	Discretes disable error
0x0001	Bad configuration

Note: These errors can be seen in combination. Use the Modsoft PC & I/O Status screens to determine bit structure.

Figure 36 gives Modbus cable pinouts for use in troubleshooting or should you need to fabricate your own.

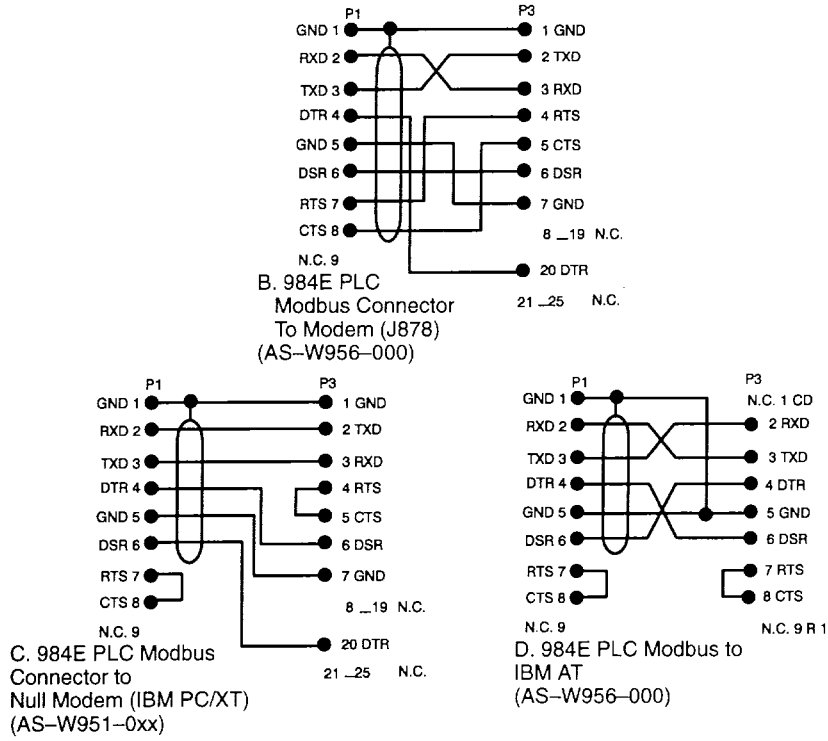
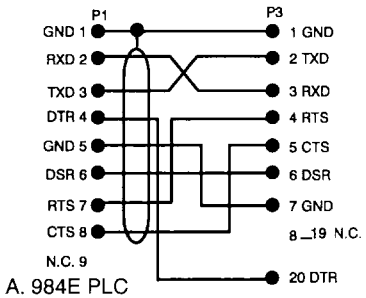
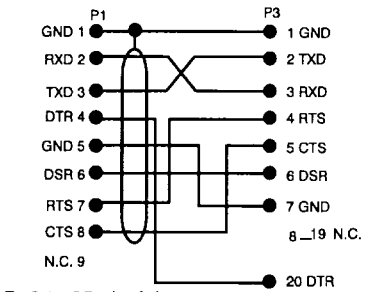


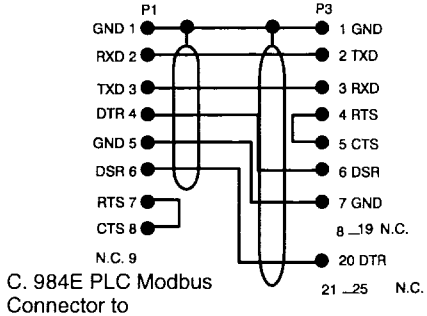
Figure 36 Modbus Cable Pinouts



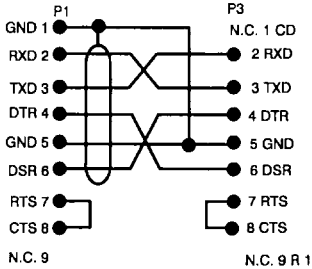
A. 984E PLC Modbus Connector To Modem (J878) (AS–W954–006)



B. 8 to 25 pin Adapter (AS–W958–001)

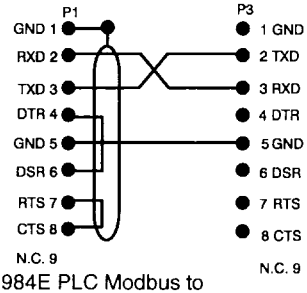


C. 984E PLC Modbus Connector to Null Modem (IBM PC/XT) (AS–W955–0xx)



D. 984E PLC Modbus to IBM AT (AS–W952–012)

Figure 37 Modbus Cable Pinouts Cont.



A. 984E PLC Modbus to Panelmate (AS–W960–012)

Figure 38 Modbus Cable Pinouts Cont.

Installation Verification Troubleshooting

Figure 39 (Sheets 1 & 2) offer you a modular approach to troubleshooting your PC System.

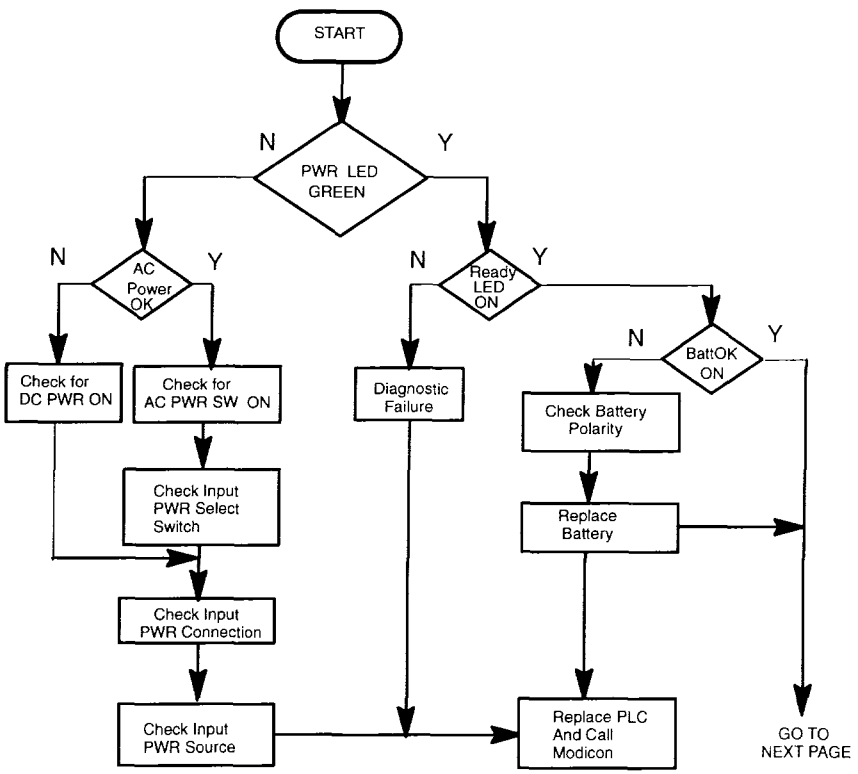


Figure 39 Controller Installation Troubleshooting Chart

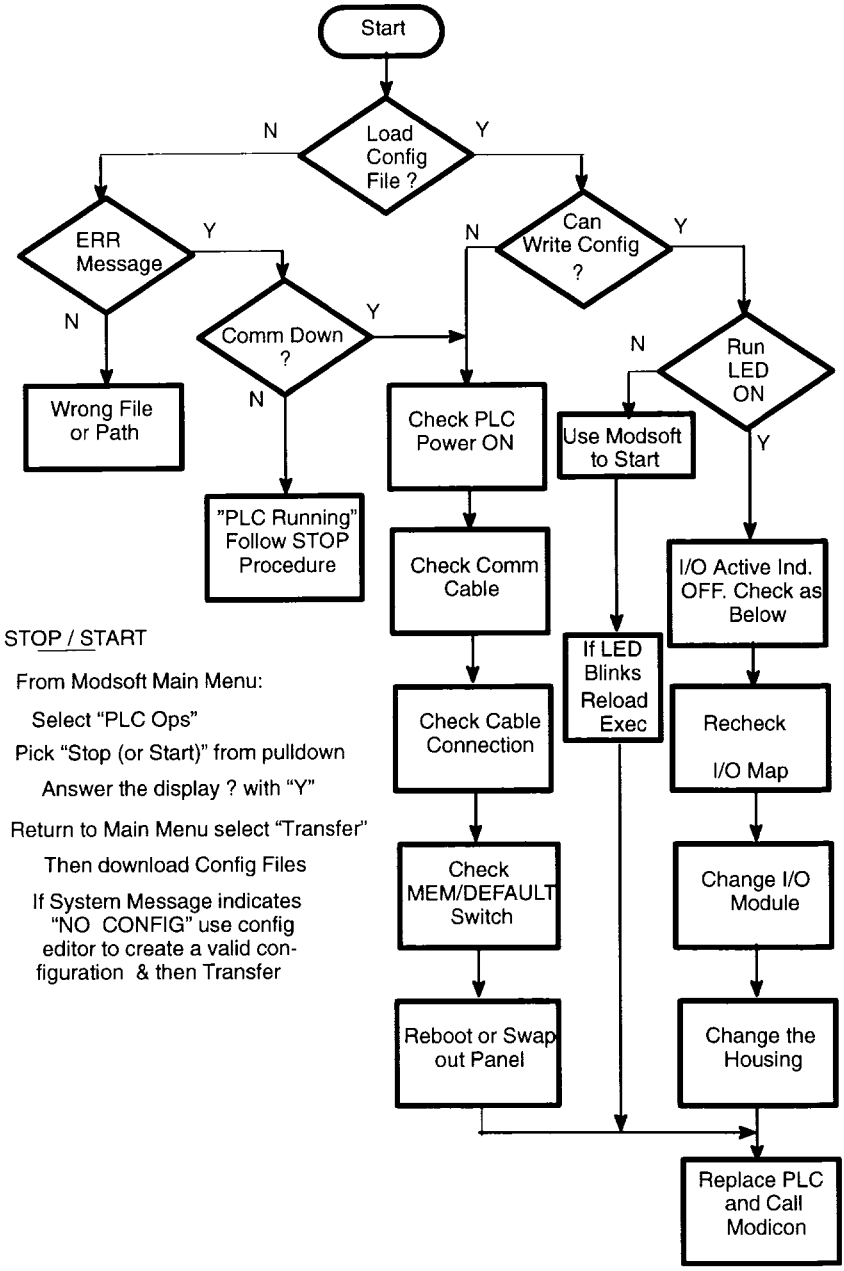


Figure 40 Controller Installation Troubleshooting Chart (Sheet 2)

Master Function Error Codes

The MSTR block reports error conditions by putting a code in the Error Status register. The code is a hexadecimal value in the form: "Mmss" where M is the Major code, m is the minor code and ss is the sub–code. Table 11 lists the code with the associated meaning.

Table 11 MSTR Error Code Definitions

Code	Meaning
1001	User initiated abort
2001	Invalid operation type
2002	User Parameter changed
2003	Invalid Length
2004	Invalid offset
2005	Invalid length and offset
2006	Invalid SDDA
2007	Invalid SDNA
2008	Invalid SDNR
2009	Invalid route (equal to own address)
200A	Global read request length more than available
200B	PEER Cop conflict on write/read global data
200C	Bad pattern for change address request
200D	Bad address for change address request
30ss	Modbus slave exception response
4001	Inconsistent Modbus slave response
5001	Inconsistent network response
6mss	Routing failure
F001	Selected S985 option is not present

The sub–code (ss) can convey the following:

01 Illegal Modbus function requested. The slave device does not support the requested operation.

02 Illegal data address requested. The register(s) being read/written do not exist in the slave device (e.g., not configured).

03 Illegal data value requested. "The data being read/written is invalid."

04 Not assigned

05 Slave has accepted long duration program command (does not apply).

06 Function requested cannot be performed at this time because a long duration program command is in process.

07 Slave has rejected long duration program command

The m field indicator provides an index into the routing information and indicates at which device the failure was detected. A value of 0 indicates the local device. a 1 is routing 1, 2 is routing 2 etc.

Customer Service & Technical Assistance

MODICON telephone numbers are as follows:

- To call us from anywhere in North America except from within the state of Massachusetts: 1–(800)–468–5342

- To call us from within Massachusetts or from outside North America: 1–(508)–975–5001

Customer Service – When calling the MODICON telephone number, ask for service from the list below.

When calling the 800 number, you will get a recording asking you to enter a one digit code for the type of service you want (listed below). However, this only works with a "touch tone" phone. If using a dial phone, hang on and the operator will intercept after a short pause.

The service categories – and *extra digit* code responses for push–button phones – are:

1 – Hardware or software technical support

2 – Order entry, buying hardware or software

3 – Modfax

4 – Training/course registration inquiries

5 – General information other than above.

☞ **Note** MODFAX: For hardware data sheets, application notes, software information available. Recommended catalogue 1098 which is the master of all available catalogues (only twelve pages) lists all catalogues available on the MODFAX system.

☞ **Note** BBS (Modicon's Customer Service Bulletin Board): For Modsoft updates, conversion utilities, hardware and software help, field service bulletins, Modbus and Modbus Plus help, software revision levels, FLASH EXEC updates for 984E controllers, and more. Parameters are: up to 14.4k baud, no parity, 8 data, 1 stop, phone 1–(508)–975–9779.

Index

P

R

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