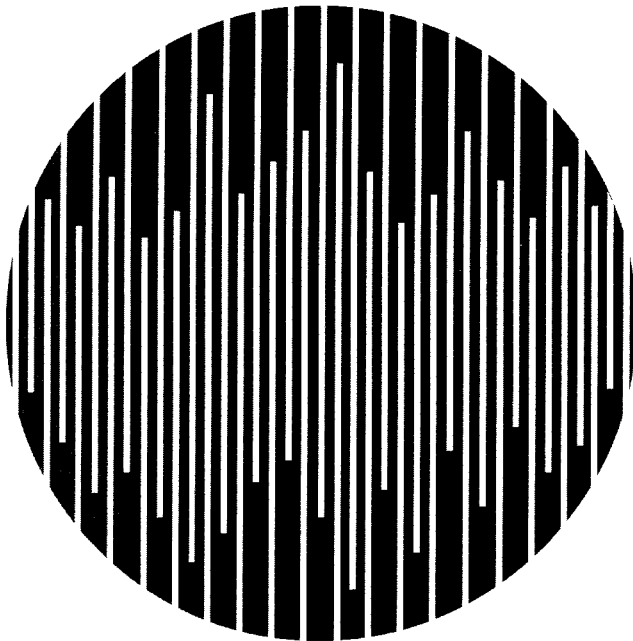


# **System Planning and Installation Guide for Model PC-E984-381/385 & PC-E984-385D**

GM-E984-202 Rev. A

**AEG**



**MODICON**



# **System Planning and Installation Guide for Model PC-E984-381/385 & PC-E984-385D**

GM-E984-202 Rev. A

November, 1992

**MODICON, Inc.  
One High Street  
North Andover, Massachusetts 01845**



# Preface

---

This guide describes the PC–E984–381 and PC–E984–385/385D Programmable Logic Controller systems together with system planning information and installation procedures.

For brevity and your convenience, the PC–E984–381/385 controller is referred to in context as the Model 381E or 385E. Both Model 381E and 385E are enhanced with an extra Modbus Port.. The 385D is a 125 VDC version which is otherwise just like a 385E.

In the context of this manual, the terms “Programmable Controller” and “Programmable Logic Controller” have been abbreviated to “PLC” for brevity. References to IBM's personal computer are written out or in context with IBM's initials.

It is necessary to say that the information in this document is subject to change without notice and should not be construed as a commitment by MODICON, Inc., Industrial Automation Systems. MODICON, Inc. assumes no responsibility for any errors that may appear in this document. Further, no part of this document may be reproduced in any form or by any means, electronic or mechanical, without the express written permission of MODICON, Inc., Industrial Automation Systems. All rights reserved.

The following are MODICON, Inc. trademarks:

Modicon®	P190	984A	984–380	984–381	E984–381
984–385	E984–385	D984–385	Micro 984	984	984B
984–480	E984–480	984–485	E984–485	984–680	Modbus®
984X	984–685	E984–685	984–780	984–785	E984–785
984–785L	984–120	984–130	984–145	984–351	984–455
Modsoft®	Modbus Plus				

IBM® is a registered trademark of International Business Machines, Inc.; IBM PC is a trademark of International Business Machines, Inc.

© Copyright 1992 Modicon, Inc.

# Objectives

---

This manual has been written to help you plan, configure, mount, wire, connect, check out and, if necessary, troubleshoot your PC–E984–381/385/385D PC system. After reading this publication:

- ❑ 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 E984–38x model PC system's functions.

Chapter 2 offers information for planning your installation with Local I/O.

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

Appendix A gives system specifications including a summary table of I/O module specifications.

Appendix B gives Stopped Error Codes, MODBUS cable connector pinouts, a table of MODICON 381E/385E/385D system end–user part numbers, Customer Service/Technical Support telephone numbers, and Installation Verification troubleshooting charts.

## Related Documents

---

GM-MSFT-001	Modsoft Programmer User Guide
GM-0984-SYS	984 Programmable Controller Systems Manual

### Incoming Inspection Guidelines

Procedure	Guidelines for Inspection
Step 1	Before you do anything, verify your shipment is complete and undamaged. If the shipment is incomplete or damaged, notify the carrier and your distributor.
Step 2	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?

- To the extent 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.

# Table of Contents

---

<b>Chapter 1 Controller Introduction</b> .....	<b>1</b>
E984–381/385/385D Programmable Controller System Description .....	2
Overview .....	2
System Features .....	3
System Capacity .....	3
Executive NV RAM .....	4
Executive Functionality .....	4
Module Housings .....	5
Construction .....	6
Power Supply Function (AC and DC) .....	7
Communications Processing Function .....	9
Central Processing Unit (CPU) Function .....	9
Mainframe Controls .....	10
Mainframe Status Indicators .....	10
<b>Chapter 2 Planning Controller and IO Installation</b> ...	<b>13</b>
Planning .....	14
Overview .....	14
Space Requirements .....	14
Primary Power Lines .....	14
Environmental Requirements .....	15
Mounting Hardware Requirements .....	15
Housing Installation Options .....	16
Panel or Bulkhead Mounting .....	16
Rack Mounting .....	18
Grounding Your Installation .....	22
Primary Power Cable (AC/DC) .....	22
DIP Switch Configuration for MODBUS, Port 1 .....	24
Modbus Port Software Configuration .....	24
Modbus Plus Node Address Setting .....	27
Manual Node Address Change .....	27
Modbus Plus Bridge Mode .....	27
Modbus Plus Node Address Software Change .....	28
MSTR Format .....	28
Implementation of Mbus+ Node Address Change via MSTR Block. ....	29



Port Delay Timer .....	30
<b>Chapter 3 Installing Controller and Local I/O .....</b>	<b>31</b>
Model 381E, 385E and 385D Installation Procedure with Local I/O ...	32
Procedure for Installation Checkout – Unconfigured PC .....	35
Procedure for Installation Checkout – Configured PC w/ Local I/O ..	36
Controller to IBM PC Programming Panel Software .....	37
Getting PC into RUN Mode .....	37
I/O Quick Check .....	39
<b>Appendix A 381E/385E/385D System Specifications ..</b>	<b>41</b>
Mainframe Specifications .....	42
Indicators .....	43
Circuit Characteristics .....	43
Environmental Characteristics .....	44
Built-in Power Supply .....	45
External Power Issue Specifications .....	45
<b>Appendix B Troubleshooting .....</b>	<b>47</b>
Stopped Error Codes .....	48
Customer Service & Technical Assistance .....	50
Installation Verification Troubleshooting .....	52
Master Function Error Codes .....	54

## Figures

Figure 1 Model 381E, 385E and 385D Physical Perspective . . . . .	3
Figure 2 Model ‘E’ Controller in Primary Housing AS–H819–209 . . . . .	6
Figure 3 Wiring Connectors, Communications and Memory Switches . . .	8
Figure 4 H819 Housing Panel or Bulkhead Mounting Dimensions . . . . .	17
Figure 5 H827 Housing Panel or Bulkhead Mounting Dimensions . . . . .	18
Figure 6 H819 Rack Mount Dimensions . . . . .	20
Figure 7 Communication Port Selection Screen . . . . .	25
Figure 8 View of MEM/DEFAULT communication parameter switch . . . . .	26
Figure 9 Modbus Plus Node Address DIPs 1–6 . . . . .	27
Figure 10 MSTR Block on Modsoft screen With Input/Output Labels . . .	28
Figure 11 Typical Local Drop Configuration . . . . .	33
Figure 12 Configuration Overview Screen . . . . .	38
Figure 13 Traffic Cop Data . . . . .	39
Figure 14 Modbus Cable Pinouts . . . . .	51
Figure 15 PLC Installation Troubleshooting Chart . . . . .	52
Figure 16 PLC Installation Troubleshooting Chart (Sheet 2) . . . . .	53

## Tables

Table 1 Memory Per Configuration . . . . .	4
Table 2 Port 1 Configuration . . . . .	24
Table 3 Stopped Error Codes . . . . .	48
Table 4 Model 381E/385E and D Controller Part Numbers . . . . .	49
Table 5 MSTR Error Code Definitions . . . . .	54

# **Chapter 1**

# **Controller Introduction**

---

- This chapter describes your 984, “E” Model 381/385/385D Programmable Controller system.

# **E984–381/385/385D Programmable Controller System Description**

---

## **Overview**

The Modicon 984 Model 381E, 385E and 385D Controller is a mid-range Programmable Logic Controller in a modular, expandable, architecture. It employs Modicon 800 series housings, interfaces and I/O modules. The Model "E" is supported by the same instruction set as the other 984 Controller models and is programmed by the Modicon Modsoft Programming Panel.



**Note** The 385D Model is the same as the 385E except it is the 125VDC version.

Figure 1 is a perspective view of the 381E/385E and 385D system's controller module with built-in power supply. Certain physical features are noted.

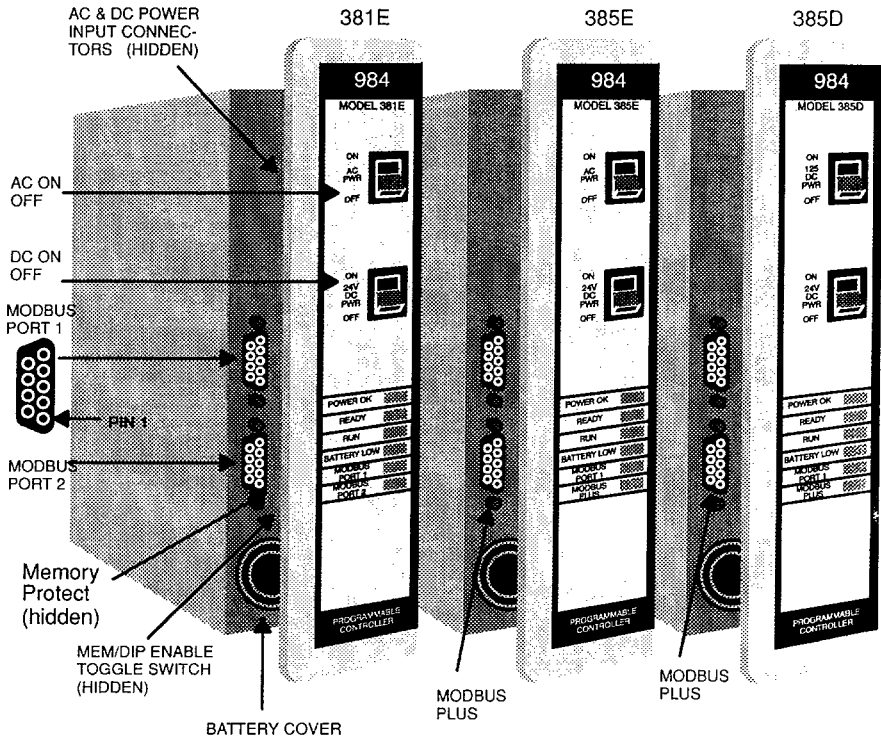


Figure 1 Model 381E, 385E and 385D Physical Perspective

## System Features

The Model 381E/385E/385D system's features are described below followed by somewhat more detailed functional descriptions.

### System Capacity

The Model 381E/385E memory provisions are summarized in Table 1:

**Table 1 Memory Per Configuration**

Controller	Memory		RI/O	Comm Ports	Local I/O (max) in/out	Discrete I/O any mix in/out	TOTAL Registers
	User	State					
381E	16k	2k	0	2 Modbus	512/512	512	2048
385E	16k	2k	0	1 Modbus and 1 Modbus +	512/512	512	2048
385D <i>Same as 385E</i>							

The user logic and state RAM support one local drop. This local drop has a maximum I/O module capacity of 21 I/O Modules (19 modules if an auxiliary power supply is required) and up to 512 discrete points of local I/O (any mix).

### Executive NV RAM

The Model "E" controller has its bootable memory and executive software downloaded to Non Volatile RAM during the manufacturing process and is not accessible to the user.

### Executive Functionality

#### □ 381E

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, Peer Cop, Local I/O only.

#### □ 385E

Executive ID of 81C (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.

## **Module Housings**

The Model 381E/385E system uses Modicon 800 series housings for its controller and I/O modules; specifically, a 19" primary housing with a seven module capacity or a 27" primary housing with an eleven module capacity.

**Primary Enclosure** – With the single width Model "E" controller in your primary enclosure, the 19' and 27" primary enclosures will accommodate up to 6 or 10 I/O modules, respectively.

**Secondary Enclosure** – The secondary housing will accommodate a one and one-half wide P810, P800 or P884 auxiliary power supply if a power supply expander is required and as many I/O modules as there is room remaining.

Specifically, 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 2. For simplicity's sake, the 27" housing is not shown in this manual except as required in the illustration on panel mounting dimensions.

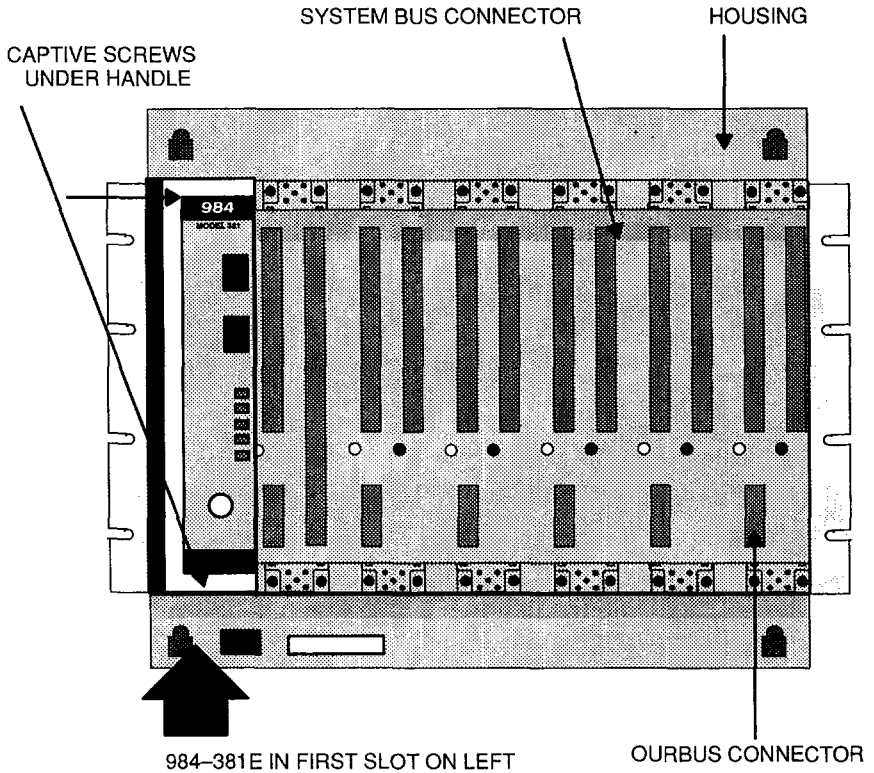


Figure 2 Model "E" Controller in Primary Housing AS-H819-209

### Construction

The Model "E" controller is housed in a rugged metal chassis designed to withstand specified temperature and humidity extremes as well as vibration, shock, and ambient atmospheric conditions consistent with the "factory floor."

The primary housing employs a shielded backplane which provides for internal communications within the housing. The backplane protects the internal system communications from both electromagnetic (EMI) and radio frequency interference (RFI).



Captive screws secure all modules in the housings and they should be used to insure good electrical contact between the connector at the rear of the module and backplane in the housing. Key pin protection is also available.

User memory is backed up by a lithium battery which has a one year service life. It will hold-up for 14 days after the BAT LOW indicator comes on. The battery's installed but unused service life is rated at one year, with a five year shelf life.

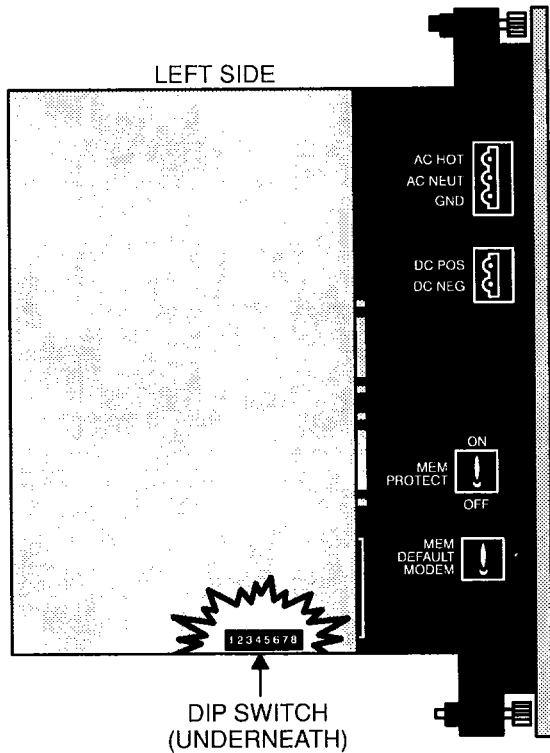
A manually operated memory-protect toggle switch prevents accidental access to the user's program. This switch is located on the left side of the unit, above the 3 position communications toggle switch (see Figure 3).

## **Power Supply Function (AC and DC)**

The Model 381E/385E and 385D system's controller module comes with a built-in I/O power supply.

The Model "E" Controllers run on 97 through 276 VAC (47 to 63 Hertz) and 24Vdc. As shown on Figure 3, 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 3 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 3 Wiring Connectors, Communications and Memory Switches**

The 385D 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.



**Note** The primary power DC input feature was not designed, nor is it suitable as an automatic battery backup provision in the event of an AC outage. This is because the controller's externally sourced DC input joins with the AC sourced, internally produced DC. At any given time, the Controller is taking from the higher of the two DC 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 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.

## Communications Processing Function

The Models 381E/385E/385D have Modbus capability for data transfer and remote programming. Through this port, communication processing on the CPU board can be linked from the controller to supervisory and programming devices such as a host computer or Modicon programmer. The Modbus port allows you to schedule one Modbus service per scan. The Model 381 has a second Modbus port which allows you to incorporate your controller into the Modbus network and still have a free port for connecting your local programming panel. The second port on the 385E and D is for the Modbus Plus network Connection..

Figure 3 illustrated the controller from the left side. The MEM/DEFAULT/MODEM toggle switch enables your preset communications configuration for Modbus port 1. (For software configuration, refer to software configurator in Panel software documentation.)

The DIP switch for setting Modbus Plus port parameters is shown at the bottom of the illustration but access to the DIP switch is actually through the bottom of the module's case.

## Central Processing Unit (CPU) Function

The Model "E" uses 24 bit memory architecture and a 16 bit CPU which is fully compatible with the Modicon 984 PC instruction set, solves user logic at a nominal rate of 2.5 ms per thousand nodes of user logic. For special applications, a time-of-day clock is provided on all "E" Models.

# Mainframe Controls

---

## Mainframe Status Indicators

Status indicators on the CPU module are:

POWER OK	Green LED: When ON, indicates input power OK and voltage outputs OK. Your I/O power OK is indicated by the READY LED.
READY	Amber LED: When ON, 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 is in Kernal mode and needs the executive reloaded.
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.

(The port 2 indicator is labeled MODBUS PLUS on the 385E and 385D and indicates status as:)

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.



# **Chapter 2**

# **Planning Controller and IO Installation**

---

- This chapter describes planning considerations for installing your PC-E984-381/385 and 385D Controller with local I/O.

# Planning

---

## Overview

The 381E/385E and 385D Controller is designed to work with your Modicon Modsoft programming panel; Modicon 800 series housings, interfaces and I/O modules.

The site planner must also consider the peripheral equipment (such as a Programming panel, 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 module 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 depending only on the on the cable length employed.

## 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 PC 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 as the connector is not locked in place.

## **Environmental Requirements**

In planning for controller 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 984–381E/385E and 385D system housing can be panel/bulkhead mounted or rack mounted as described in the following text.

## **Panel or Bulkhead Mounting**

As shown in Figure 4 below, the H819 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.

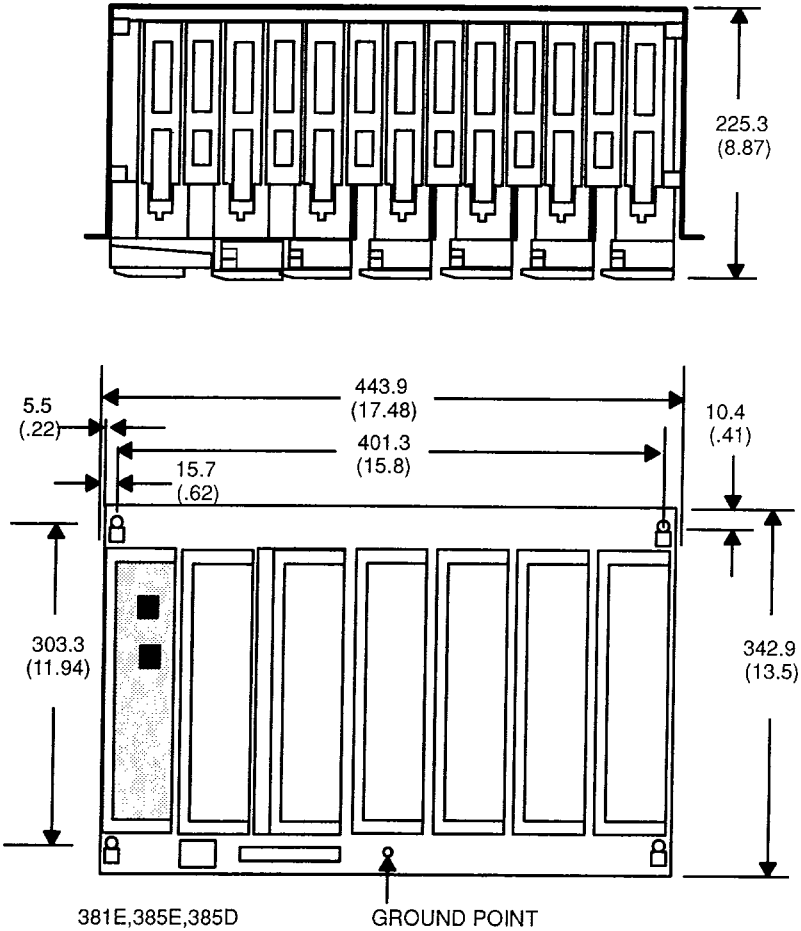
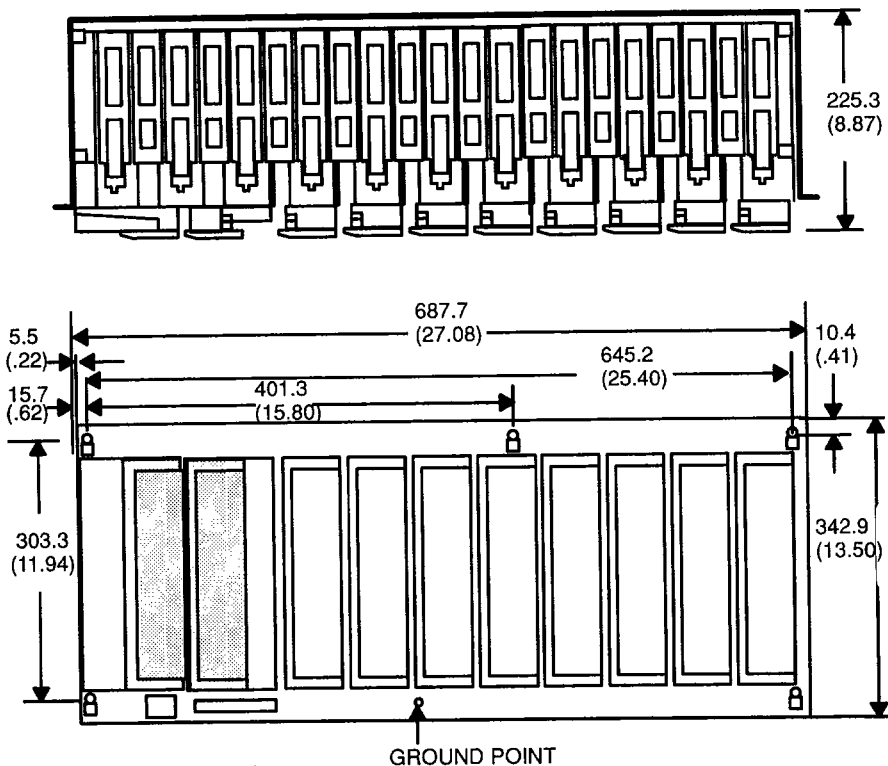


Figure 4 H819 Housing Panel or Bulkhead Mounting Dimensions



**Figure 2 H827 Housing Panel or Bulkhead Mounting Dimensions**

## Rack Mounting

The H819 Module Housings can be mounted in a 19-inch standard (EIA) rack. Hardware is supplied for installing the “rack adaptor – mounting flange kit” on the housing but not for installing the adapted housing in the rack.

Figure 3 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 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

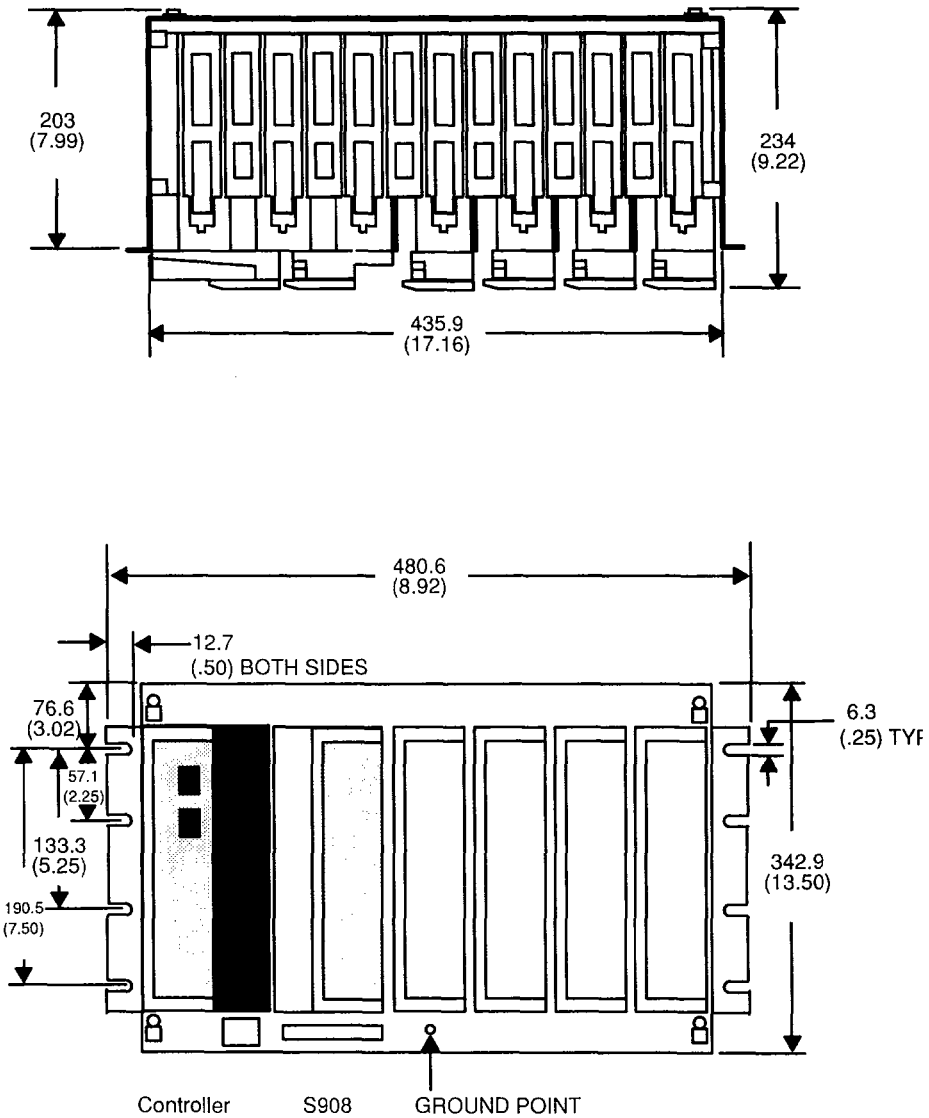


Figure 6 H819 Rack Mount Dimensions

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).

Since the only cooling available to the 984 PC is derived from natural convection air flow. If the PC is placed within a NEMA enclosure, some provision for added cooling may be required.

# Grounding Your Installation

---

For grounding purposes, Modicon recommends that your 381E/385E and 385D PC housing(s) 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 meet the requirement. This type of installation provides both a low frequency (AC) safety ground path and a low impedance shield path for EMI/RFI.

If a metal mounting plate (preferred ) is not feasible, Modicon recommends that all PC housings within a drop be interconnected by a flat braided copper ground strap with a minimum width of one inch. The ground strap should be kept 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, Modicon recommends the entire installation be grounded by a one inch wide (min) flat, braided copper strap installed between the the primary housing ground connection point and a suitable factory ground. The bulkhead and rack mounting illustrations show the housing's recommended ground connection point.

## Primary Power Cable (AC/DC)

Ideally, the power lines should be dedicated to the PC 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 0.4A continuous at worst-case, low voltage conditions.



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

**DC Power Cable** For DC power input, use at least AWG 18.

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.

Your DC source cable must be suitable for supplying 24Vdc at 24A peak (turn-on surge) and 1.7A continuous at worst-case, low voltage.

# DIP Switch Configuration for MODBUS, Port 1

---

MODBUS Port 1 is both manually and software configurable. For configuration, The 3 position MEM/DEFAULT/MODEM switch on the Left side panel of the controller (behind the handle Figure 8) is used. For software configuration (the MEM position), use the Modicon programming panel port configuraton software. The “Default”, “Modem” parameters are:

**Table 2 Port 1 Configuration**

	<b>381E and 385E</b>	<b>385E Only</b>
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: <b>RTU, 9600 BAUD, Even Parity, 1 Stop Bit</b> Address is set on Dip switch underneath if 385E or is 1 if 381E.	Bridge Mode capable without panel intervention (i.e. automatic)
MODEM	Port 1 Communication Parameters are: <b>ASCII, 2400 BAUD, Even Parity, 1 Stop Bit</b> Address is set on Dip switch underneath if 385E or is 1 if 381E	Bridge Mode capable without panel intervention (i.e. automatic)

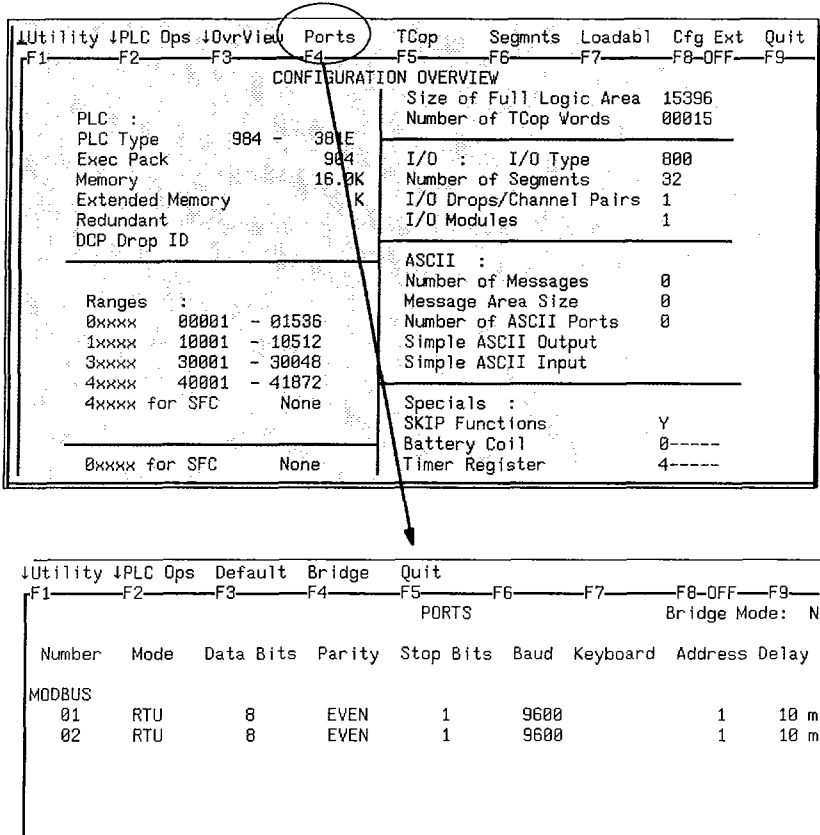
The second modbus port on the 381E is only set using the programming panel.

## 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). For convenience, a summary of Modsoft screens showing the communications parameters available is presented here.

From the Main menu you select the “↓Offline” entry and then select Config from

the pulldown selection the results are illustrated in Figure 7. With the cursor on the Ports selection press the  $\downarrow$  key to display the port parameter screen.



**Figure 7 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.

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

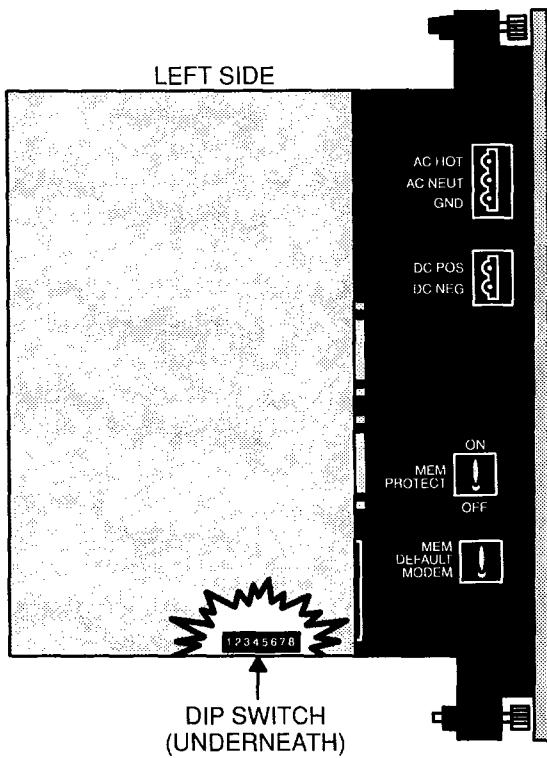


Figure 8 View of MEM/DEFAULT communication parameter switch

# Modbus Plus Node Address Setting

## Manual Node Address Change

These node address switches are the first 6 Dip's seen above, and viewed from the bottom of the unit. Switches 7 and 8 are not used. 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 9 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.,.

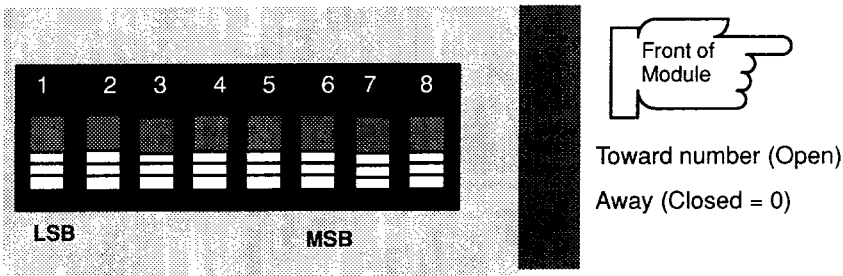


Figure 9 Modbus Plus Node Address DIPs 1-6


## Modbus Plus Bridge Mode

A communications Bridge mode is a standard feature which allows access to the Peer network. 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 / Dip select slide switch is in the MEM position the bridge mode can be enabled or disabled by using the panel software "Offline" "Configuration" "PORTS" *Bridge* subfunction.

## Modbus Plus Node Address Software Change

The on board dip switches (illustrated above) 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 10 is an example of a Modsoft screen with MSTR block.

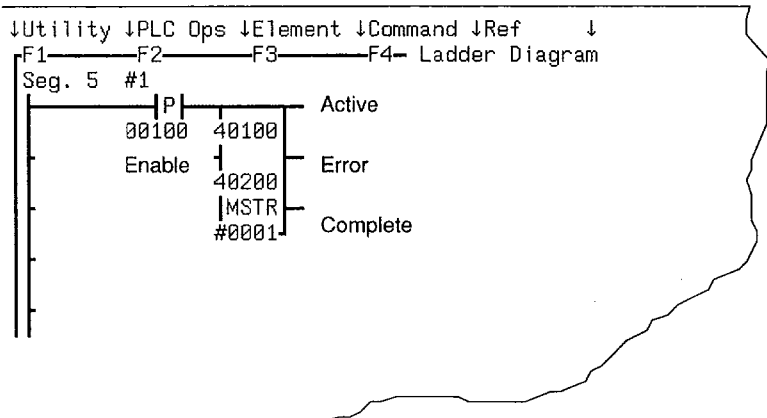


Figure 10 MSTR Block on Modsoft screen With Input/Output Labels

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

4TTTT	Operation Type	FFFF Hex	<i>Change Address Command</i>
4TTTT+1	Error Status		See Appendix B 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) 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.

### **Implementation of Mbus+ Node Address Change via MSTR Block.**

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 reinitialize 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.

## **Port Delay Timer**

Each Modbus port (one, or two ) can be assigned a time delay value from 10 Miliseconds to 1 second in duration. You use the Modsoft configurator PORTS menu to do this.



# **Chapter 3**

## **Installing Controller and Local I/O**

---

- This chapter is an installation procedure for your PC-E984-381 385E or 383D with local I/O.

# Model 381E, 385E and 385D Installation Procedure with Local I/O

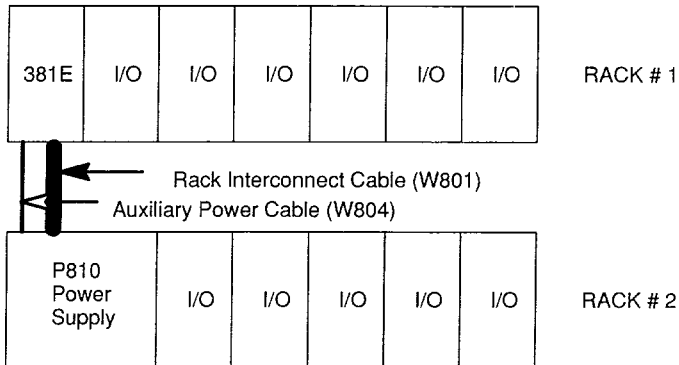
---



**Warning** ENSURE THAT YOUR ELECTRICAL SERVICE IS PROPERLY GROUNDED AND IN ACCORDANCE WITH THE ELECTRICAL CODE FOR YOUR AREA. INSTALLATION AND MAINTENANCE SHOULD BE PERFORMED BY A QUALIFIED PERSON IN CONFORMANCE WITH LOCAL CODE AND THE NATIONAL ELECTRICAL CODE, ANSI/NFPA PUBLICATION NO. 70.

## Procedure    Installation

- Step 1    Install cable troughs in your primary and secondary housings in accordance with the local drop, I/O module assignments planned.
  
- Step 2    Mount housings for local drop on desired surface taking care to observe system ground requirements.
  
- Step 3    Connect power and signal cable between primary and secondary housings as required by your configuration. See example shown in Figure 11.



**Figure 11 Typical Local Drop Configuration**

- Step 4 Ground power cable's ground strap to system ground on housing (shown in Chapter 2).
- Step 5 Set MEM – DEFAULT – MODEM communication select switch for MODBUS Port 1 as desired. (Default position assumed during installation checkout).
- Step 6 Verify presence of memory backup battery.

If lithium battery has been supplied separately, install in battery compartment observing polarity marked inside battery compartment cover.



**Note** When removing battery, push to compress loading spring which will partially eject battery as you let go.

- Step 7 Install 381E or 385E/D controller module in Slot 1 of primary housing, securing with captive screws.
- Step 8 Set memory protect switch to OFF.
- Step 9 If using an auxiliary power supply, partially insert it in Slot 1 of expansion housing.



**Warning** IN STEPS 10 THRU 19 BELOW, THE AC AND DC PRIMARY SOURCES SHOULD NOT BE CONNECTED (ENERGIZED) ON THE SOURCE SIDE.

- Step 10 Wire auxiliary power supply input power, and then secure module in housing.
- Step 11 Wire AC primary power cable to controller's AC input power connector shown in Chapter 1 Figure 3 .
- Step 12 Form service loop in AC input power cable and install mechanical restraint on housing.
- Step 13 Plug AC input power cable connector into controller's AC input power jack at left side of module. **DO NOT CONNECT TO PRIMARY POWER SOURCE AT THIS TIME!**
- Step 14 If using DC input, wire to controller's DC input connector.
- Step 15 Form service loop in DC input power cord and install mechanical restraint on housing.
- Step 16 Plug DC input power cable connector into controller's DC input power jack on left side of controller. **DO NOT CONNECT TO PRIMARY POWER SOURCE AT THIS TIME!**
- Step 17 Do field wiring for local drop and attach to I/O connectors.
- Step 18 Install key pins in I/O housing slots (as required in your installation plan).

- Step 19 Verify ground and cable connections are secure and according to plan.



**Note** Other than local I/O, the physical installation of your Model “E” Controller is now complete. You are ready for initial power-up and installation check-out.

## Procedure for Installation Checkout – Unconfigured PC

- Step 1 If using DC input power, energize DC power source and switch controller’s DC power switch to ON.

If not using DC input, go to Step 4 below.

- Step 2 Visually inspect installation and verify operation. After a few seconds of delay for internal diagnostics, your Model 381E/385E (or D) POWER OK indicator should come up Green and the READY indicator, Amber. The BATTERY LOW indicator should be OFF.



**Note** If you have an obvious mechanical or electrical problem, take the appropriate corrective action.

If your LED status seems incorrect, try to eliminate the possibility of a false indication resulting from parallax error (one LED lighting more than one indicator window). If your LED status is incorrect, refer to the Installation Troubleshooting Chart, Figure B-2.

If all else fails, call us at the number listed under technical assistance, Appendix B.

- Step 3 Switch controller’s DC input power switch to OFF.

Step 4 Connect primary power input to AC source and set controller's AC power switch to ON.

Step 5 Visually inspect installation and verify operation. After a few seconds of delay for internal diagnostics, your Model "E" Controller POWER OK indicator should come up Green and the READY indicator, Amber. The BATTERY LOW indicator should be OFF.



**Note** If you see the RUN light blink 3 times followed by a slightly longer off period, the checksum diagnostic failed and the Kernel mode is entered. Notify your systems programmer. You have to download the executive to continue.

If your LED status seems incorrect, try to eliminate the possibility of a false indication resulting from parallax error (one LED lighting more than one indicator window). If your LED status is incorrect, refer to the Installation Troubleshooting Chart in Appendix B.



**Note** If you have an obvious mechanical or electrical problem of any nature, take the appropriate corrective action.

If your LED status seems incorrect, try to eliminate the possibility of a false indication resulting from parallax error (one LED lighting more than one indicator window). If your LED status is incorrect, refer to the Installation Troubleshooting Chart, Figure B-2.

If all else fails, call us at the number listed under technical assistance, Appendix B.

## Procedure for Installation Checkout – Configured PC w/ Local I/O



**Note** Record Executive ID and the version number from The panel software Status Screen.

Finish your installation verification by configuring and Traffic Copping your PC and then communicating with local I/O.

- 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 Repower

### Controller to IBM PC Programming Panel Software

- Step 4 Connect Controller MODBUS, Port 1 to panel Serial Port using W955 cable with 25 to 9 pin converter or W956 9 to 9 pin cable and power-up the panel.
- Step 5 At your DOS prompt type CD\Modsoft then at the MOD-SOFT directory prompt 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 PC 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 Filer or initialize a configuration by selecting "Config" from the the ↓Offline menu entry.

- Step 8 You will see the configuration overview screen as illustrated in Figure 12. The Menu selections allow you to select the information that defines your PLC configuration.
- Step 9 Return to the main menu and select "Login" From the ↓PLC Ops Menu. If the cable and PLC are ok You will see the modbus LED Flash.
- Step 10 Return to the main menu select the LRV entry and Select ↓LRV Options of "Configuration" and No State. You will see the screen display the configuration word length and the Modbus Port flashes during the transfer.
- Step 11 If you now return to the Main menu ↓PLC Ops and select the "Start" function and then follow that up with a "Y" to the screen prompt, the controller will start and the Green RUN LED is lighted.

Utility	PLC Ops	Overview	Ports	TCop	Segmnts	Loadabl	Cfg Ext	Quit
F1	F2	F3	F4	F5	F6	F7	F8-OFF	F9
CONFIGURATION OVERVIEW								
PLC : PLC Type           984 - 381E Exec Pack           904 Memory            16.0K Extended Memory    K Redundant DCP Drop ID				Size of Full Logic Area 15396 Number of TCop Words 00015				
Ranges : 0xxxx 00001 - 01536 1xxxx 10001 - 10512 3xxxx 30001 - 30048 4xxxx 40001 - 41872 4xxxx for SFC       None 0xxxx for SFC       None				I/O : I/O Type 800 Number of Segments 32 I/O Drops/Channel Pairs 1 I/O Modules 1				
				ASCII : Number of Messages 0 Message Area Size 0 Number of ASCII Ports 0 Simple ASCII Output Simple ASCII Input				
				Specials : SKIP Functions Y Battery Coil 0----- Timer Register 4-----				

Figure 12 Configuration Overview 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. Proceed to add the Traffic Cop information for these two modules to the configuration data you already established by:

- Step 12 Return to the panel Configuration screen and enter the number of I/O modules as the value 2.
- Step 13 Go to the Config screen TCOp function and define the presence of the two modules. Figure 13 is an example of what the data looks like.

Slot	Module Type	Reference Input	Reference Output	Data type	Module Description
101	984				PLC-381E
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				
111	B8				

Figure 13 Traffic Cop Data

- Step 14 Return to the main menu and select the ↓PLC Ops menu "Stop" function. Respond to the screen prompt with "Y" and watch the RUN LED go off.
- Step 15 You now repeat the earlier steps (step 10) to download the configuration but this time the traffic cop data is downloaded with it.

- Step 16 Use the ↓PLC Ops menu to Restart the controller.
- Step 17 Visually inspect installation and verify operation. The 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.



**Note** 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

# Appendix A

## 381E/385E/385D System Specifications

---

□ This appendix covers the following specifications:

□ PHYSICAL CHARACTERISTICS

Dimensions  
Weight

□ ELECTRICAL CHARACTERISTICS

Static Discharge    Agency Approval  
Magnetic            Indicators

□ CIRCUIT CHARACTERISTICS

Scan Rate            Memory  
Throughput         Holdup  
I/O                    Power Consumption  
Surge Withstand    Time-of-Day Clock

## □ ENVIRONMENTAL CHARACTERISTICS

Temperature	Humidity
Max Wet Bulb	Altitude
Shock	Vibration

## □ BUILT-IN POWER SUPPLY

Input Power	Fusing
Holdup	Indicators
Output Power	Output Voltage

## □ EXTERNAL POWER ISSUES

AC Isolation Transformer  
External 24Vdc Power Supply  
800 Series I/O Module Loading

## Mainframe Specifications

### ***Physical Characteristics***

#### Dimensions

WxHxD inch	2.54 x 10.5 x 8
WxHxD (mm)	(39.4 x 266 x 203)

Weight ≈ 5 lbs, 1 oz

### ***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 applicable agency safety requirements

## Indicators

- ❑ **POWER OK** Green LED: When ON, indicates input power OK and voltage outputs OK. (Your I/O power OK is indicated by READY LED.)
- ❑ **READY** Amber LED: When ON, indicates Controller passed power-up diagnostics. Remains ON in Stopped and Run mode 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 is in Kernal mode and needs the executive reloaded.
- ❑ **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.



**Note** There are two Modbus ports on the 381E only. The 385E and 385D have one Modbus and One **Modbus Plus** Port.

## Circuit Characteristics

- ❑ **Scan Rate** 2.5 ms per thousand nodes of user logic
- ❑ **Throughput** <15ms for 64 I/O points
- I/O** 512 discrete points any mix maximum configuration  
1024 register points 512 in/512 out  
Max I/O Modules in drop = 21

### Memory Capacity *User Logic Registers Option*

16 K Words User Logic    1920 State RAM

Holdup                            32ms for CPU from "POWER OK" going inactive

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

### Model 381E

Time-of-Day Clock     $\pm 1$  sec/day @ 25C

$\pm 3$  sec/day, 0-40C

$\pm 8$  sec/day, 0-60C

## Environmental Characteristics

Temperature                      Operating: 0 → 60C  
Storage: -40 → +80C

Humidity                          0-95% Non-condensing

Max Wet Bulb                    Non-operating: Non-condensing  
Operating: 85F

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 (Non-operating)    10Hz to 50Hz @ .029 g's/Hz  
50Hz to 300Hz @ .029 g's/Hz,  
-8dB/octave

## Built-in Power Supply

Input Power 115 Vac  $\pm$  15% 47–63 Hz

230 Vac  $\pm$  15 % 47–63 Hz

24 Vdc  $\pm$  15% Isolated source (24v @ 3A)

125 VDC  $\pm$  15% Isolated source (105v @ .295A, 125v @ .248A)

Maximum inrush current surge 6.44A.

Fuses 0.750A, 3A SB Buss, Not customer replaceable

Holdup 32ms for CPU from Power OK going inactive

### Steady State

Power Consumption 5 W

Current .42 A @ 120 Vac

Indicators Green LED: POWER OK

Output to I/O 18.75 Watts to I/O service

### Output\*

V1 5Vdc I/O 3.5A max

V2 4.3Vdc I/O 3.5A max

## External Power Issue Specifications

Isolation 100W (recommended) based on

Transformer 40.8W (meas) and assuming 0.4A continuous (w/97Vac  
115V  $\pm$  15%), 5A peak

Ext 24Vdc P.S. 31W nom, 1.3A dc continuous @ 24Vdc (24A peak); or  
1.7A dc cont @ 20.4Vdc (24V  $-15\%$ )





# Appendix B

## Troubleshooting

---

- This appendix contains troubleshooting help and Modicon telephone numbers for Customer Service and Technical Support. Modbus cable pinouts are illustrated for troubleshooting purposes. An installation verification troubleshooting chart is illustrated on two sheets.

## Stopped Error Codes

---

Table 3 lists all stopped error codes applicable to 984 family controllers.

**Table 3** Stopped Error Codes

Machine Stop Bits		Description
PCSICK	0x7FFF	Controller unhealthy
PCSTOPPED	0x8000	Controller stopped
BADTCOP	0x4000	Bad I/O traffic cop
DIMAWAR	0x2000	PC in dim awareness
PORTIVENT	0x1000	Bad port intervention
BADSEGSCH	0x0800	Bad segment scheduler
SONNOTIST	0x0400	Son did not start segment
PDCHEKSUM	0x0200	Bad power-down checksum
NOEOLDOIO	0x0080	Watchdog expired
RTCFAILED	0x0040	Real time clock failed
BADOXUSED	0x0020	Bad coil used table
RIOFAILED	0x0010	Remote IO option failed
NODETYPE	0x0008	Illegal node type user
ULCSUMERR	0x0004	User logic checksum error
DSCRDISAB	0x0002	Discretes disable error
BADCONFIG	0x0001	Bad configuration

Table 4 shows MODICON 984–381/[385] system end-user part numbers.

**Table 4** Model 381E/385E and D Controller – End–User Part Numbers

<b>Part Number</b>	<b>Description</b>
<i>Housings</i>	
AS–H819–209	Primary 19" Housing
AS–H827–209	Primary 27" Housing
AS–H819–100	Secondary 19" Housing
AS–H827–100	Secondary 27" Housing
<i>Cables</i>	
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–W953–006	P190 to 984–x80
AS–W953–012	P190 to 984–x80
AS–W953–025	P190 to 984–x80
AS–W801–0xx	Housing interconnect signal cable
AS–W802–0xx	Housing interconnect power cable
AS–W804–0xx	Housing interconnect aux power cable
AS–W808–0xx	Housing interconnect power cable
<i>Software</i>	
Modsoft	SW–MS1D–9SA Revision 1.2 is required

# **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 5001 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” – Return/exchange status inquiries

“4” – Training/course registration inquiries

“5” – General information other than above.

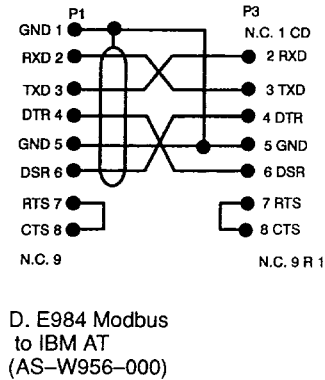
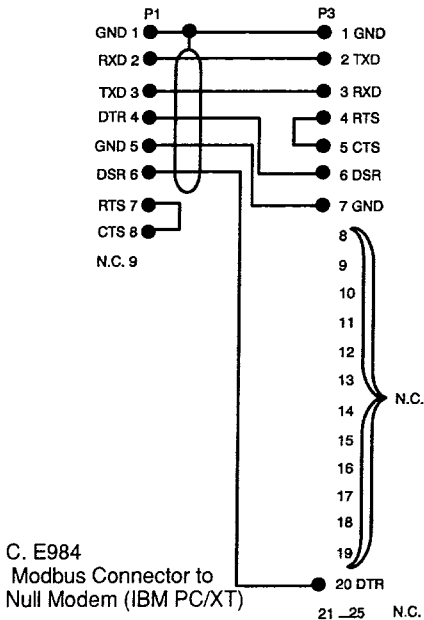
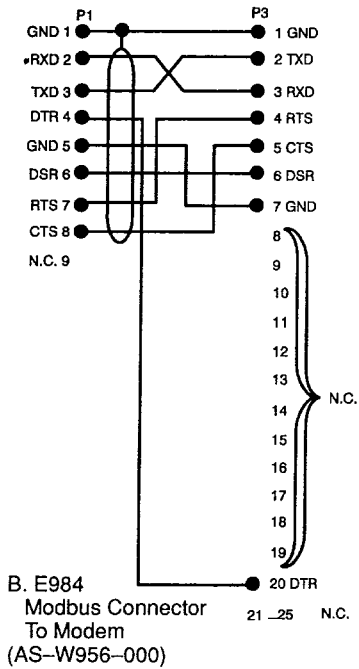
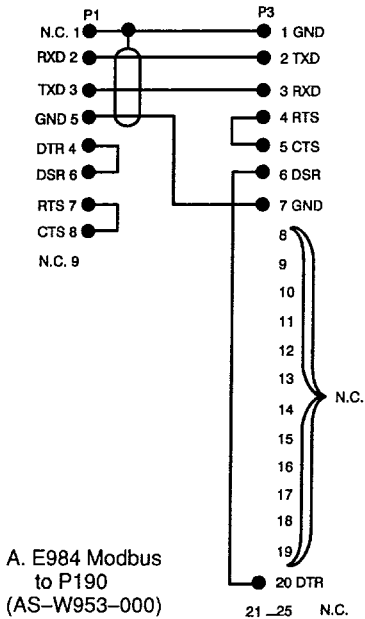


Figure 14 Modbus Cable Pinouts

# Installation Verification Troubleshooting

Figure 15 (Sheets 1 & 2) offer you a modular approach to troubleshooting your PC System.

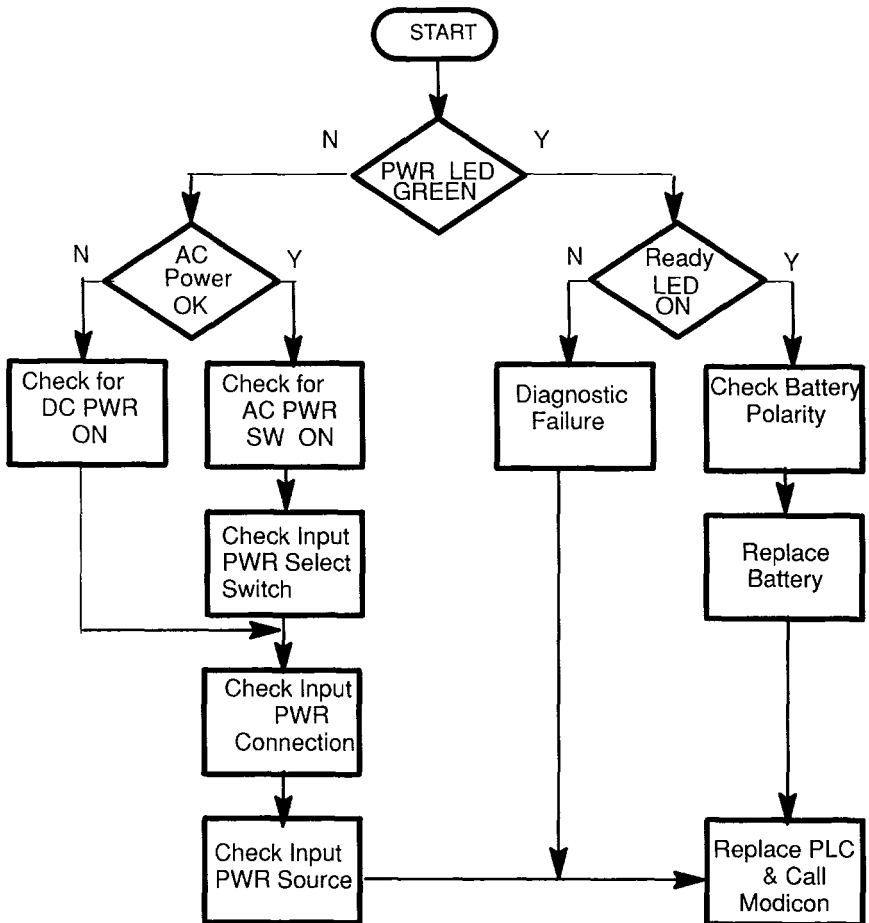
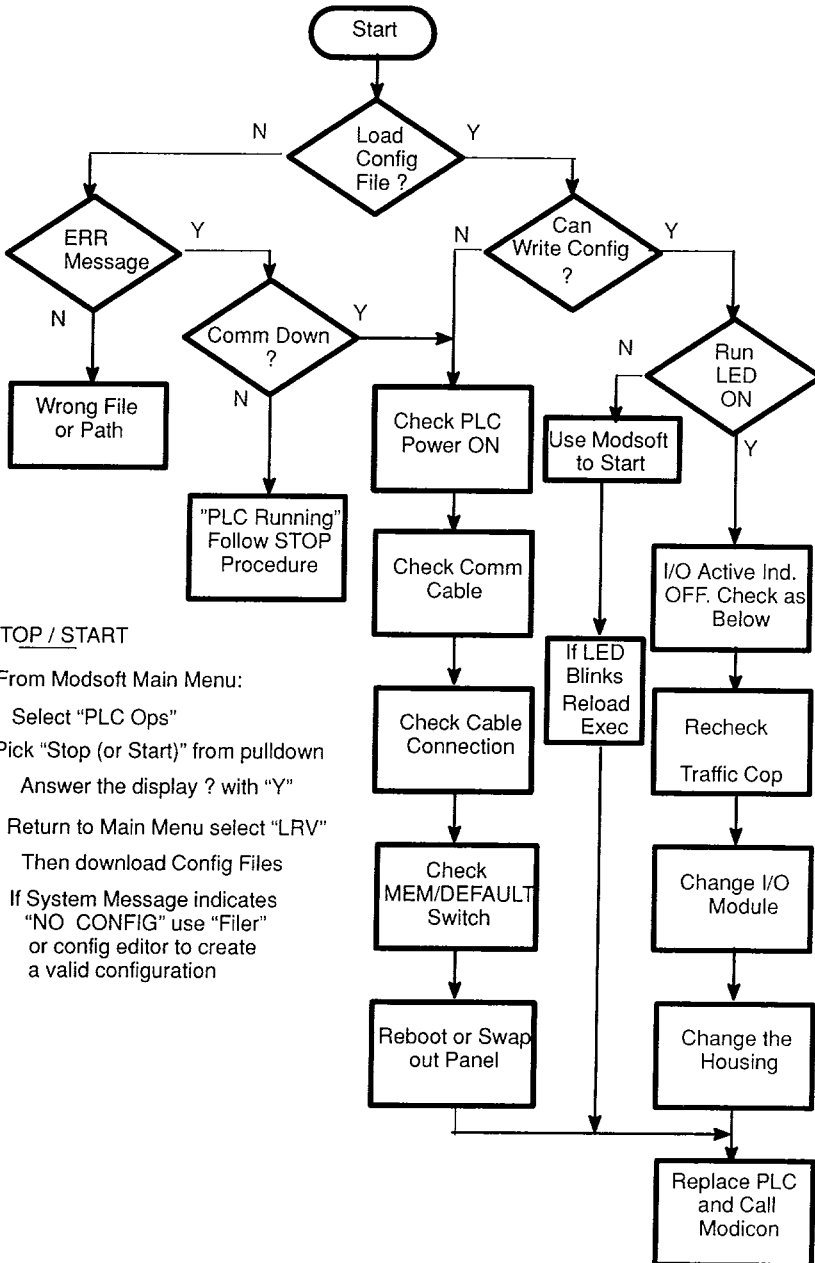


Figure 15 PLC Installation Troubleshooting Chart



**STOP / START**

From Modsoft Main Menu:

Select "PLC Ops"

Pick "Stop (or Start)" from pulldown

Answer the display ? with "Y"

Return to Main Menu select "LRV"

Then download Config Files

If System Message indicates "NO CONFIG" use "Filer" or config editor to create a valid configuration

Figure 16 PLC 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 5 lists the code with the associated meaning.

**Table 5 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.



# Index

---

## B

Battery, 7  
Bridge Mode, 27

## C

Comm Port Timing, 30  
Communication Ports, 43  
Communications Cable, 37  
Configuration Select Switch, 24  
Cooling, 21  
CPU Stopped Error Codes, 48

## D

DC Power, 23  
Diagnostics, 36

## E

Equipment Housing, 5

## G

Grounding, 16, 22, 23, 32

## H

Housing Clearance, 14

## I

Indicators, 43

## K

Kernal Mode, 10  
Key Pins, 34

## L

Local I/O, 32

## M

Memory Protect Switch, 34  
Modbus, 9  
Modbus Plus, 9, 10  
Modbus Plus Address, 28  
Modbus Plus Address DIP, 27  
Model E Controller, 2  
Modicon Assistance, 50  
Modsoft, 2, 37  
Mounting bolts, 15  
MSTR Block, 28  
MSTR Block Errors, 54

## P

Power OK, 35  
Primary Housing, 6  
Primary Power, 14, 22

## R

R I/O Housing, 18  
Run Mode, 37

## S

Software ID, 36

## T

Traffic Cop, 39  
Troubleshooting, 35, 52





Modicon, Inc., Industrial Automation Systems  
One High Street, North Andover, MA 01845  
(508) 794-0800  
24 Hour Support Center 1-800-468-5342