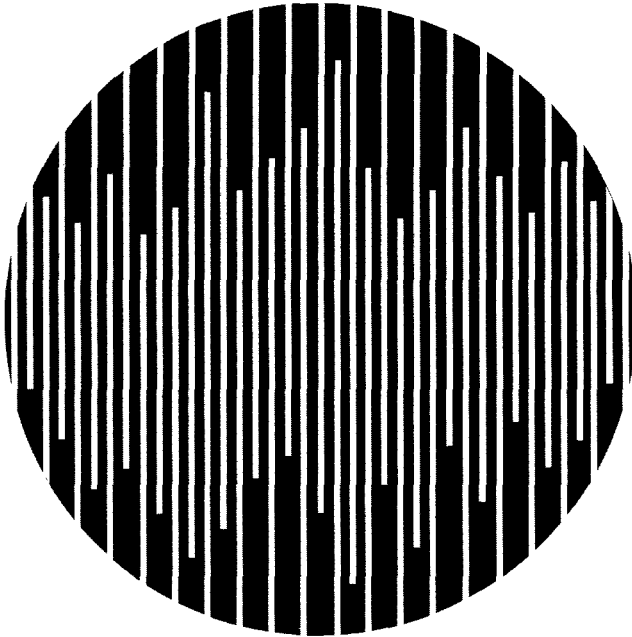# Modicon
PC-L984-785
Extra Register
Programmable
Controller
User Manual

GM-L984-785 Rev. B

AEG

MODICON

Modicon PC–L984–785 Extra Register Programmable Controller User Manual

Preface

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984–130	984–145	984–351	984–455	Modsoft®	Modbus Plus

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Tables

Chapter 1
Introduction

▢ This document describes the functionality of the PC–L984–785 Programmable Controller. When used in an Extra Register Configuration, particular attention is given to deviations from other 984 product family members.

This manual does not apply when using the PC–L984–785 as a PC–0984–785 replacement. Refer to GM–0984–501 for system Planning and installation of the 785.

The PC-L984-785 PLC

Product Overview

The functionality of the new PC-L984-785 when used as an Extra Register Controller is similar to the 984-785, with the size of State RAM increased from the 12.5k to an optional 32k or 64k words. This controller provides more reference numbers than any existing Modicon PLC. The User Logic area is increased to expand the amount of relay logic that can be programmed.

The re-arrangement of the storage memory, in the PLC, makes programming loadable DXs easier. The programming can now be done in alternate languages (such as Manufacturing State language, or C) on a PC. The loadable DX can either be loaded into the user logic area of page 0, or directly into the execution buffer of 160K/320K/480K bytes. The loadable DX files are in MS DOS relocatable format, that are relocated by the controller.

The number of local (Drop 1) Input and Output points are increased from 512 to 1024.

The maximum value of constants is increased from 9999 to 65535, in all functions with the exception of any DX function which specifies a lower limit.

The 785L supports the same User Logic set as defined in the 984 Systems Manual GM-0984-SYS for the other 984 controllers and has, in addition, specific logic functions to handle the enhanced Memory functionality. User Logic programming can be implemented on any Modicon Programming Panel.

☞ **Note**   The functionality of the PC-L984-785, when used as a replacement controller for the 0984-785, remains identical to the 0984-785 (when used with the Extra Register Cartridge AS-E785-904).

785L Differences

One of the distinct features of this controller is the larger State RAM size of either 32 or 64K words. Another is the use of pages 1 through 8 as an execution buffer

2   Introduction

for loading special DX functions. Depending on the size of the main RAM (512 or 768K bytes) and your state RAM configuration election, the memory partitions into four different allocations.

When you configure the memory by selecting either 32 or 64k state RAM, the partitioned result allows Extended Memory for 6X register files. Your selection sets configuration parameters for controller downloading.

Due to the new memory arrangement, the 785L with the Extra Register excecutive cartridge, you can not use the standard loadables designed for other dash–8 series controllers unless they are modified. Special versions for this controller are identified by a "rev" byte in the header (following the name). For use in the 785L this information must be rev 0C0 hex or higher.

Required Software Revisions

When used with the Extra Register excecutive cartridge, the PC–L984–785 Extra Register Controller requires updates to the firmware in some of the options in the 984 family:

Table 1   Unit Upgrades

Unit		Status	Minumum PROM Combination
S908	Remote I/O	Upgraded Exec #131	1005
S985–800	Modbus Plus		1006
C996	Coprocessor	Needs Update Software	1000
S980–800 –810	Map	Needs Update	1001
E785–914	Executive		1000

Table 2   Loadable DX Upgrades

Loadable		Part
ICMP / DRUM	Disk Media	SW–AP98–SDA
	P190 Tape	SW–AP98–STA
MTRM	Disk Media	SW–MRTM–1DA
	P190 Tape	SW–MRTM–1TA
EARS	Disk Media	SW–AP9D–EDA
EUCA		SW–EUCA–D8L
HLTH		SW–HLTH–D8L
MAP3		SW–APPL–MAP
FNXX		SW–AP98–GDA
CALL		SW–AP98–CXA

Hot standby is supported with an AS–S911–801 module with the following limits:

HSBY data transfers are limited to 9999 registers, including up to 1000 input registers (3x references), 8192 discrete outputs (0x references), and 8192 discrete inputs (1x references)

The Hot standby Loadable must be Rev. C or greater

The Remote I/O processor is an S908–1xx with an E908–131 Executive PROM 1006 or higher. Both RIOP's in the hot standby system must have identical PROM revision levels.

❑ The PC–L984–785, when used as a PC–0984–785 replacement, retains identical functionality to the PC–0984–785.

Reference Documents

GM–0984–SYS   Modicon 984 Programmable Controller Systems Manual
GM–0984–501   Modicon 680/685 780/785/785L
   System Planning and Installation Guide
GM–MSFT–001   Modicon Modsoft Programmer User Manual
PI–MBUS–300   Rev. C Modicon Modbus Protocol Reference Guide
GM–MBPL–004   X85 Controller Modbus Plus installation
GM–MBPL–001   Modbus System Planing

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Chapter 2
Installation

❑ This Chapter provides an orientation regarding the installation and Start up the PC–L984–785 when used with the Extra Register Executive cartridge. This manual does not apply when using the PC–L984–785 as a PC–0984–785 replacement. Refer to GM–0984–501 for system Planning and installation for the 785.

Controller Orientation

Extra Register Model

When used in the Extra Register configuration,There are a number of possible configurations of the PC– L984–785 FLC memory (see Table 3). The size of the State RAM is selectable at 32k or 64k words. The user logic, Execution Buffer and Extended Memory (6X reference) is determined by the size of the RAM cartridge you install and the selected state RAM.

Hardware

The PC–L984–785 uses the same 80186 CPU as the 984–785 but has a different UPI and has an extended RAM cartridge of 256K(–032) or 512K bytes(–048) included, giving a total of 512K or 768K bytes of RAM. Figure 1 illustrates the combination of "plug in" executive and memory cartridges you install.

☞   **Note**   When used in the Extra Register configuration, an AS–S908–131 (at minimum revision 1005) Executive MUST be installed in the S908 remote I/O Processor

The following table shows how this RAM partitions in each configuration:

Table 3   Memory Utilization

		64K State 512K RAM	768K RAM	32K State 512K RAM	768K RAM
User Logic	words	16k	32k	32k	48k
Execution Buffer	bytes	160k	320k	320k	480k
Extended Memory	words	72k	0	96k	24k
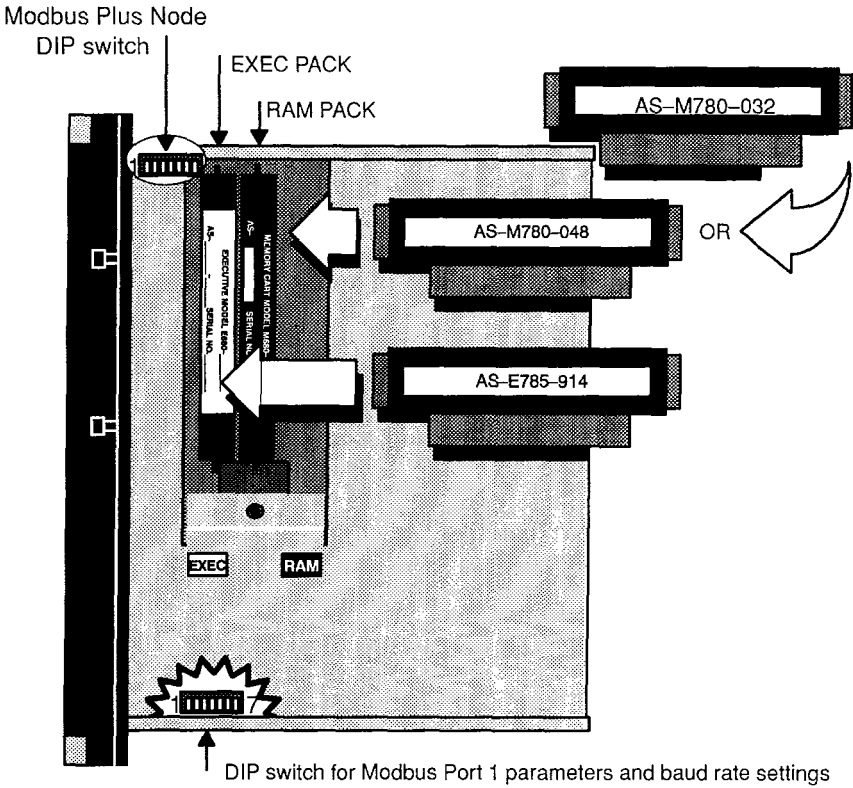
Figure 1 Location of Removable Executive and Memory Cartridges

Exec ID
The Exec ID for the PC–L984–785 Extra Register is in the range 0850 to 085F hex.

☞   **Note**   One of the memory cartridges MUST be installed.

Controls and Indicators

Figure 2 illustrates the front panel of this One and one–half slot wide controller. This figure provides the additional detail related to input power and primary switching that are located under the Modicon standard module handle.

Front Panel Status Indicators

POWER OK Green LED: Generated by the power supply to indicate input power is OK and voltage outputs are OK.

READY Amber LED: Is *on* to indicate the controller has passed power–up diagnostics. The lamp remains on in unconfigured, stopped and run states as long as health status is OK. Indicator is *off* when an error condition is detected by internal diagnostics.

RUN Green LED: Controller was started and is solving logic.

BATTERY LOW Red LED: ON when battery needs to be replaced (14 day holdup from initial indication). User memory is protected for up to one year by the date coded lithium battery which has a five year shelf life.

For special applications a time–of–day clock is provided. The clock is powered by the battery. The module is shipped with the battery installed.

MODBUS PLUS Green LED: Blinking when communication processor has communications access.

MODBUS Green LED: ON when communication processor has unit address and communications are in process.

AC POWER IN

AC POWER SWITCH

(WHITE) NEUT
(BLACK) HOT
(GREEN) GND
115V OP
JUMPER

OFF DC POWER
ON

+ DC
– POWER IN

BATTERY COMPARTMENT
WITH COVER REMOVED

BATTERY

MEM–DIP
TOGGLE

ÆG

984

MODEL 785

AC LOW
OFF AC POWER
AC HI
ON
GND
JUMPER FOR 115V
DC POWER OK
READY
RUN
BATTERY LOW
MODBUS PLUS
MODBUS

MEMORY PROTECT
ON   OFF

Modbus Plus

CPU P/N   REV
PROGRAMMABLE CONTROLLER
MODBUS PORT 1

MODICON

LITHIUM BATTERY AA CELL
DATE INSTALLED

MODBUS PLUS CONNECTOR

MODBUS CONNECTOR

Figure 2 View Showing Controls and Indicators

Front Panel Controls

There are two switches directly located on the front panel:

AC POWER This ON/OFF switch controls the main power

MEMORY PROTECT This key switch can be set to ON and key removed to pro-
tect the content of the memory from change. OFF allows
normal program development.

The Detail of figure 1 illustrates the AC input power connections and the DC option
select switch located under the Controller handle. When you have wired your +24
VDC to the controller you can run the controller on the DC only or run on AC with
a power fail DC backup.

DC POWER Position the toggle switch to ON for DC backup.

Behind the Battery cover and just below the battery there is a toggle switch:

MEM DIP This switch enables the configuration of Modbus Port 1 pa-
rameters as set, in the DIP switches (as illustrated in
Figure 3 are accessible from the bottom of the Controller)
or reads the port parameters from Memory.

The memory byte allocated to this parameter provides an
operating environment of:

9600 Baud, Even Parity, 1 Stop Bit, RTU

The switch configuration upon shipment has the same de-
fault setting as the Memory setting. Because the switch set-
ting is sensed at power up if you are set to DIP and change
the setting you must power cycle the unit to implement the
new setting. The same is true if you switch from DIP to
MEM. The available Baud rate is listed in Table 4.

	DOWN	**UP**
SWITCH FUNCTION SWITCH NO.		
1	BAUD SELECT	BAUD SELECT
2	BAUD SELECT	BAUD SELECT
3	BAUD SELECT	BAUD SELECT
4	NO PARITY	PARITY
5	ODD PARITY	EVEN PARITY
6	2 STOP BITS	1 STOP BIT
7	ASCII (7 BITS)	RTU (8 BITS)

UP   DOWN

1 2 3 4 5 6 7   DIP SWITCH
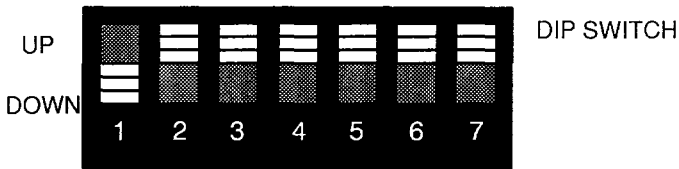
Default settings as shown above:
9600 Baud/Even/Parity/1 Stop/RTU

Figure 3 Modbus Port DIP Switch Orientation and Coding

☞ **Note**   Although certain production units may contain an 8–position DIP switch set, only the first seven are used.

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

Table 4   DIP Switch for Modbus BAUD Rate Settings

Baud	Switch 1	Switch 2	Switch 3
19,200	up	up	up
9600	down	up	up
4800	up	down	up
2400	down	down	up
1200	up	up	down
600	down	up	down
300	up	down	down
150	down	down	down

Modbus Plus DIP Switch
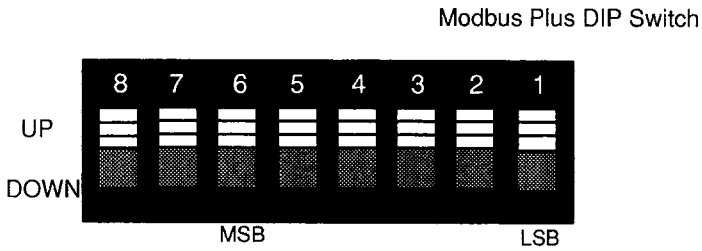
Figure 4 Modbus Plus Node Address DIP

Modbus Plus Address

These switches are accessible from the top of the unit and are factory set to the above pattern. Switch 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 4 is the binary 0 which is node address 1. To change to an address of 2, place the LSB switch "down" (000001) etc,.

Low Battery

From the time the Low Battery LED comes on, if the unit continues to be powered ON, the battery *must* be changed withen 14 days. If the battery is not changed the PLC will *not* restart on a power up and data may be lost.

Chapter 3
PC–L984–785 Specifics

❏ This Chapter, while providing some typical 984 Series Controller operation, concentrates on differences encountered due to it's specific architecture when used in a Extra Register configuration.

984–785 Memory

Physical – Logical Overview

Chapter One described the Physical – Logical relationship between the selection of Memory cartridges and your memory partition using the configurator. In Figure 5 the distribution of memory in hardware elements is provided.
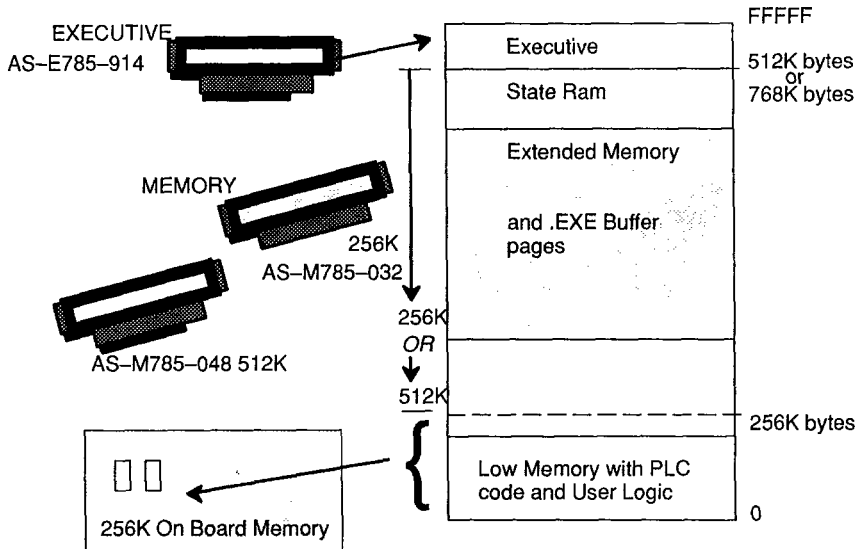
Figure 5 Memory Distribution

Size of RAM

The State RAM size (32 or 64K) is indicated for configuration by the most significant bit of word 174 in the configuration Table. This configuration word is only checked at power up and on an "exit dim" command. At these times the PLCs internal pointers to User Logic, State RAM , Execution Buffer, and Extended Memory are set up before the configuration is validated. This implies that all of the

configuration table must be updated when there is a change to this flag, or the illegal configuration and dim awareness is set in the stop word. The table is set from the panel configuration as in Figure 6 where the "L785" is selected (Modsoft Type selection displays as 785L) and the partition selections are displayed for your choice.

```
                      User Logic\        /State RAM
┌─────────────────────────────────\─────/──────────────────────────────┐
│↓Utility ↓PLC Ops ↓OvrView  Ports \ TCop  /Segmnts  Loadabl  Cfg Ext  Quit│
│┌F1───────F2───────F3───────F4───┐\─F5───/─F6───────F7───────F8-OFF──F9──│
│              CONFIGURATION OVERVIEW                                      │
│                            │\ Size of Full Logic Area   31740           │
│    PLC  :                  │ \   of TCop Words          00015           │
│    PLC Type      984 -  785L │ 32/32│                                   │
│    Exec Pack             914 │ 48/32│   I/O Type        800             │
│    Memory              32/32K│ 16/64│ of Segments       32              │
│    Extended Memory        0K │ 32/64│ops/Channel Pairs  1               │
│    Redundant              N  └──────┴dules              1               │
│    DCP Drop ID                                                          │
│  ──────────────────────────────   ─────────────────────────────        │
│                                    ASCII  :                             │
│                                    Number of Messages      0            │
│    Ranges   :                      Message Area Size       0            │
│    0xxxx    000001 - 001536        Number of ASCII Ports   0            │
│    1xxxx    100001 - 100512        Simple ASCII Output                  │
│    3xxxx    300001 - 300048        Simple ASCII Input                   │
│    4xxxx    400001 - 401872   ─────────────────────────────            │
│    4xxxx for SFC      None         Specials  :                          │
│  ──────────────────────────────   SKIP Functions          Y            │
│                                    Battery Coil           0-----        │
│    0xxxx for SFC      None         Timer Register         4-----        │
└────────────────────────────────────────────────────────────────────────┘
```

Figure 6 Modsoft Configuration Initialization for Extra Register L785

Word 100 of the configuration table gives the state RAM size in the number of 1k segments which can be 64, or 32.

Word 99 of the configuration table gives the size of User Logic in the number of 4k sections. Valid numbers are 4, 8 or 12, for 16k, 32k or 48k of User Logic. User Logic size depends on the selected size of State RAM and the extended RAM cartridge installed in the PLC

⬟STOP   **Warning   Re–partitioning memory clears user logic and .exe DX Loadable buffer**

⚠️ **Caution When you initially configure your State RAM size, a power cycle is required to guarantee all option modules will get proper memory partition information. If you subsequently change to the other size you must repeat the power cycle to implement the change.**

You must select the partition you want and write the configuration to the PLC before loading any .exe buffer loadables. Internal software checks are made against the history of the state selection in config. word 174 and does not allow you to load the .exe loadable unless there is a match. You may see the error message:

```
ERROR: EXEC BUF LOAD NOT ALLOWED, MEM REPARTITIONING IS PENDING.
```

Configuration Partition

Depending of your Memory Cartridge and choice of configurations the memory partitions that result are:

Table 5   Memory Partitions

Function	M780–032 512K		M780–048 768K	Bytes
User Logic Page 0	16K	32K	32K	48K (Bytes – 3 per instruction word)
State RAM Page F	64K	32K	64K	32K (Words)
X Memory 6X Reg	72K	0	96K	24K (Words)
Execution Buffer .EXE	160K	320K	320K	480K (Bytes)

☞ **Note**   1)   The .EXE buffer is always 10 times the user logic size.
2)   Approximately 34 KB of M780–032 or 048 is used for internal controller overhead.

Number of Discretes and Registers

The maximum number of each register type increases over current limits in the existing 984–8 products. The 785 Extra Register limits for each configuration are shown in Table 6.

Table 6   Maximum Number of Discrete I/O Points and Registers *

	Type	64k	32k State RAM
Output	0X		
or		65504	65504
Input	1X		
Input Register	3X	64992	32224
Output Holding Register**	4X	57766	28640

* Assumes minimums assigned to the balance of the other types
** This number is reduced due to allotted history bits.

☞   **Note**   Only the 1st 16383 (16K) of each type may be used for, I/O through the Traffic Cop, and as control in the segment scheduler. The remainder is for internal use only.

The maximum of each *type* expressed in Table 6 fit into the *total* configured memory space according to the following formula:

$A + B + C + D + E + F \ <=$ 65024 for 64 K State RAM or
32256 for 32K State RAM

(and the combined mix of configured #0X + #1X $<=$ 65536)

Where:
   A = Number of (0X / 16) * 3 to include History and Disable bits

   B = Number of (1X / 16) * 3 to include History and Disable bits

   C = 0 if ready to start 3X on a 16 word boundary otherwise add the required difference.

D = Number of 3X

E = 0 if ready to start 4X on a 16 word boundary otherwise add the required
difference.

F = Number of 4X + (2 * ((#4X +15) / 16)) to include Up / Down counter
history.

Changes in the Modsoft and DIBM panel software (Configurator, Traffic Cop, and
Programmer) have been made to display register addresses that can now be up to
6 digits long. Figure 7 illustrates the Modsoft configuration assignment of Type ad-
dress as 6 digit entries (including Specials) based in the 785L selection.
The State RAM soft key option selection and 6 digit references are also illustrated.

```
↓Utility ↓PLC Ops ↓OvrView  Ports    TCop      Segmnts  Loadabl  Cfg Ext  Quit
F1───────F2────────F3────────F4────────F5─────────F6────────F7──────────F8─OFF──F9──
                    CONFIGURATION OVERVIEW
                                        │ Size of Full Logic Area  31740
     PLC  :                               of TCop Words      00015
     PLC Type       984 -    785L   32/32
     Exec Pack                914   48/32     I/O Type        800
     Memory               32/32K    16/64  of Segments       32
     Extended Memory          0K    32/64  ops/Channel Pairs 1
     Redundant                 N           dules             1
     DCP Drop ID
                                        ASCII  :
                                        Number of Messages      0
     Ranges    :                        Message Area Size       0
     0xxxx    000001 - 001536           Number of ASCII Ports   0
     1xxxx    100001 - 100512           Simple ASCII Output
     3xxxx    300001 - 300048           Simple ASCII Input
     4xxxx    400001 - 401872
     4xxxx for SFC      None            Specials  :
                                        SKIP Functions          Y
                                        Battery Coil            0-----
     0xxxx for SFC      None            Timer Register          4-----
                                        Time of Day Clock       4-----
```

Figure 7 Six Place Register Address in 984–785L Extra Register

```
╔═══════════════════════════════════════════════════════════════════╗
║ 984 CONFIG.(24-BIT LOGIC WORD)        PC TYPE : 984-785-XR   EXEC ID = 850 ║
║                                                                           ║
║ TOTAL LOGIC:   29494    TOTAL MESSAGE WORDS:  00200   BATTERY COIL:  000000 ║
║ TOTAL XMEM:    000000   NUMBER OF MESSAGES:   00005   TIMER REG:     000000 ║
║ SEGMENTS:      0032     # OF RS232 PORTS:     04      # OF IO DROPS:    32  ║
║ DX MODULES:    _001     TIME OF DAY CLOCK:    000000  TOTAL T.C. WORDS:01364 ║
║ DCP DROP ID:   000                                                        ║
║ AVAIL PAGE 0:  29494                                                      ║
║                                                                           ║
║             COILS:        00544   DISCRETE INPUTS:  00032                  ║
║             INPUT REGS:   00640   HOLDING REGS:     20001                  ║
║                                                                           ║
║             MODE    PARITY   STOP/DATA  BAUD RATE  DEVICE ADDR  DELAY       ║
║             ----    ------   ---------  ---------  -----------  -----       ║
║    PORT 1:  RTU     EVEN        1         09600      001         01         ║
║    PORT 2:  RTU     EVEN        1         09600      001         01         ║
║    PORT 3:  RTU     EVEN        1         09600      001         01         ║
║                                                                           ║
║ NET:00000 UNIT:001 SEG:00 AVAIL:00000 USED:00000 DATE:090591 AR:000000     ║
║   F1      F2       F3       F4       F5       F6   ╱  F7  ╲    F8           ║
║ NO SKIPS BATTERY  TIMER   TIME OF   DCP            │↑32K SRAM↑│PREVIOU      ║
║ ↓ SKIPS ↓COIL 0XXXXREG 4XXXX DAY CLOCK DROP ID    ╲ 64K SRAM ╱  MENU        ║
╚═══════════════════════════════════════════════════════════════════╝
```

Figure 8 P190 Emulator (DIBM) State Ram Configuration

The P190 Emulator screen is reached using the Configuration menu SPECIALS key.

Chapter 4
The .EXE Loadable

□ This Chapter instructs you in how to implement the .exe Load-
able Function. The .exe Loadable DX is implemented in a stan-
dard DOS file architecture but cannot be executed on a DOS
PC.

DX Loadable

Format

The 785L handles two types of loadable DX, one is standard upgraded loadable used on all 984–8 controllers, the other is .exe loadable which is a new feature. The standard loadable is stored in memory page 0, but as the loadable consumes memory it subtracts from available User Logic restricting user programming. The .exe loadable is designed to eliminate this program limitation, by arranging the PC–L984–785 memory to make pages 1 – 8 available to store the .exe loadable code.

Though standard loadable allows user to create a function written in C and Intel assembly languages, it is not efficient to use due to memory limitation. The approach taken for .exe loadables removes this limitation, and opens up the possible space for loadable DX to a maximum of 480K bytes.

Loading The .exe file

In a Modsoft environment you can load a .exe into the panel using the Loadabl function from the Configuration screen. This selection (Figure 9) results in the display of the loadable request prompt and DX functional menu selectable functions seen in Figure 10.

```
↓Utility ↓PLC Ops ↓OvrView  Ports    TCop     Segmnts  Loadabl  Cfg Ext  Quit
┌F1───────F2───────F3────────F4───────F5───────F6───────F7───────F8-OFF──F9──
                         CONFIGURATION OVERVIEW
                                      Size of Full Logic Area   31740
        PLC  :                        Number of TCop Words       00015
        PLC Type        984 -   785L
        Exec Pack                914  I/O  :    I/O Type         800
        Memory               32/32K   Number of Segments         32
        Extended Memory          0K   I/O Drops/Channel Pairs    1
        Redundant                 N   I/O Modules                1
        DCP Drop ID
                                      ASCII  :
                                      Number of Messages         0
```

Figure 9 Modsoft Configuration Loadabl Select

24   The .EXE Loadable

```
┌─────────────────────────────────────────────────────────────────┐
│ ↓Utility ↓PLC Ops ↓Dir    ↓Edit    Quit                         │
│ ┌F1──────F2──────F3──────F4──────F5──────F6──────F7──────F8-OFF──F9──│
│ │                                                               │
│ │      DX Loadable Configuration      ╔═══════════════════════╗ │
│ │                                     ║ DX Memory Used:    0   ║ │
│ │                                     ║ Total Memory Avail: 31740 ║ │
│ │      Name   Rev    Size   Opcode    ╚═══════════════════════╝ │
│ │      ═══════════════════════════                              │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ │                                                               │
│ └Press 'Enter' or '?' to view current loadable selection list──│
└─────────────────────────────────────────────────────────────────┘
```
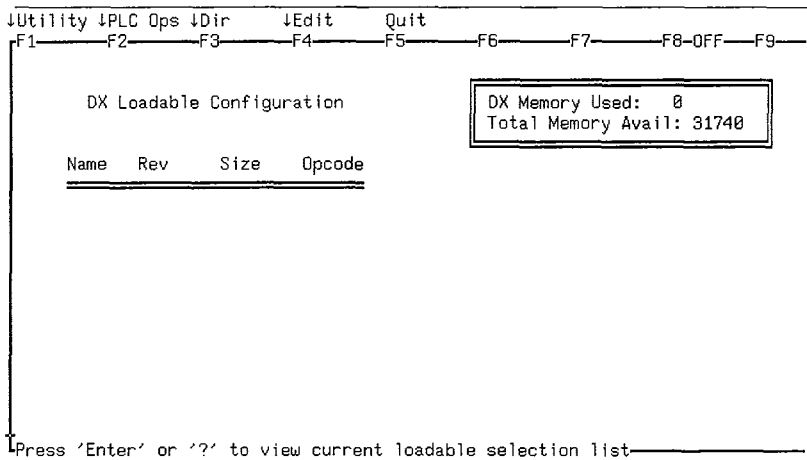
Figure 10 Loadable screen

You can display existing loadables and enter the data you requre on the display prompt line. If you want to add a loadable from an external file use the Dir function which provides a pulldown selection for load or delete operations.

```
┌─────────────────────────────────────────────────
│ ↓Utility ↓PLC Ops ↓Dir    ↓Edit    Quit        /
│ ┌F1──────F2──────┬Directory┐──────F5──────      /
│ │                │Load     │                    │
│ │                │Delete   │                   /
│ │      DX Loadabl└─────────┘ ion              /
│ │                                            │
│ │      Name   Rev    Size   Opcode           /
│ │      ════════════════════════             /
│ ││                             _____/
│ ││                            /
│ │└───────────────────────────/
│ └──────────────────────────/
```
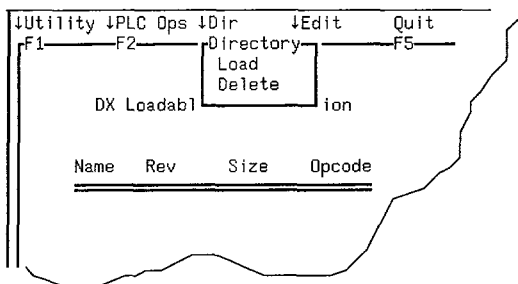
Figure 11 Loadable Dir selection

When you select the Load option a display prompt for *Filename:* is posted to which you respond with the Drive, Path and File name with proper .extension.

```
↓Utility ↓PLC Ops ↓Dir      ↓Edit     Quit
 F1        F2        F3        F4       F5        F6        F7

       DX Loadable Configuration           DX Memory Used:
                                            Total Memory Ava

     Name    Rev     Size     Opcode




      Filename:     drive path\filename.exe

 Press 'Enter' or '?' to view current loadable selection list
```
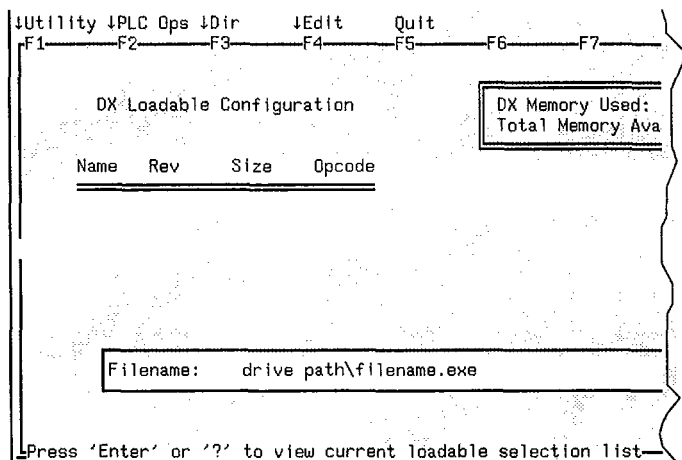
Figure 12 Setting the File Path for DX Load

If your programming panel is the IBM–PC running Modicon P190 Emulator (DIBM) software you start the DX load process from the main configuration menu by pressing the <F5> or MODULES key. The display appears as Figure 13 offering you a choice of loading or deleting modules.

```
NET:00000 UNIT:001 SEG:00 AVAIL:00000 USED:00000 DATE:090591 AR:000000
  F1      F2      F3      F4      F5      F6      F7      F8
  SET     MODBUS  ASCII   SPECIALS  MODULES
  SIZE    PORTS
```

```
      CONTROLLER MUST BE STOPPED TO LOAD/DELETE PROGRAM
NET:00000 UNIT:001 SEG:00 AVAIL:00000 USED:00000 DATE:090591 AR:000000
  F1      F2      F3      F4      F5      F6      F7      F8
  LOAD    DELETE                                        PREVIOUS
  MODULES MODULES                                       MENU
```

Figure 13 DIBM 785L Extra Register Load DX Module Screen

When Load Modules (F1) is selected the display illustrated in Figure 14 appears to prompt you for a disk path and file name entry. This figure provides an example of a "typical" path entry.
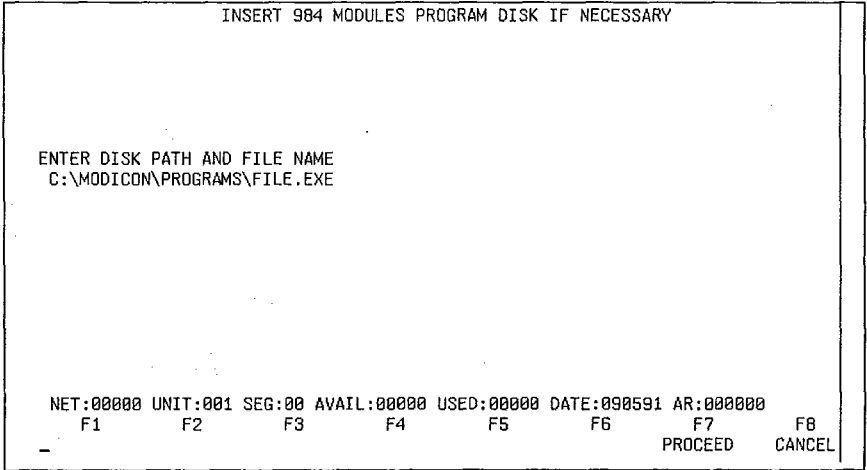
```
┌─────────────────────────────────────────────────────────────────┐
│            INSERT 984 MODULES PROGRAM DISK IF NECESSARY           │
│                                                                   │
│                                                                   │
│                                                                   │
│   ENTER DISK PATH AND FILE NAME                                   │
│    C:\MODICON\PROGRAMS\FILE.EXE                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│   NET:00000 UNIT:001 SEG:00 AVAIL:00000 USED:00000 DATE:090591 AR:000000 │
│     F1        F2        F3       F4       F5       F6      F7       F8    │
│  _                                                       PROCEED   CANCEL │
└─────────────────────────────────────────────────────────────────┘
```

Figure 14 .exe File Path Entry Screen

When you proceed with the load the 785L Loadables Directory Screen is displayed

```
┌─────────────────────────────────────────────────────────────────┐
│            IBM MODULES PROGRAM DISK            DATE: XX?XX?XXXX    │
│            PROGRAM DIRECTORY:    Filename                          │
│                                                                   │
│                                                                   │
│            ENTER PROGRAM NAME: _____                            │
│                                                                   │
│                                                                   │
│                                                                   │
│                                                                   │
│  NET:00000 UNIT:001 SEG:00 AVAIL:00000 USED:00000 DATE:090591 AR:000000 │
│    F1        F2       F3       F4       F5       F6       F7       F8     │
│   LOAD                                                          PREVIOUS  │
│   PROGRAM                                                         MENU_   │
└─────────────────────────────────────────────────────────────────┘
```
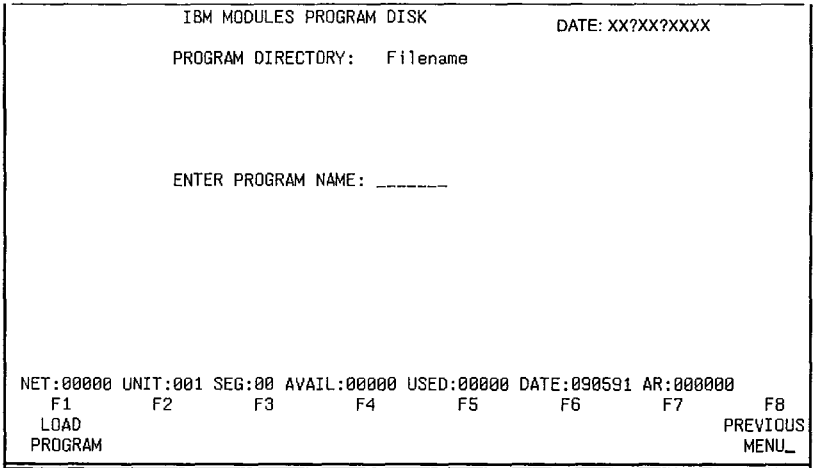
Figure 15 .exe Loadable Directory Screen

28   The .EXE Loadable

There is only one filename in the directory of the .exe disk. The date at the top of the screen comes from the DOS directory date on the file being loaded. The program name is put in for you.

Delete a .exe File

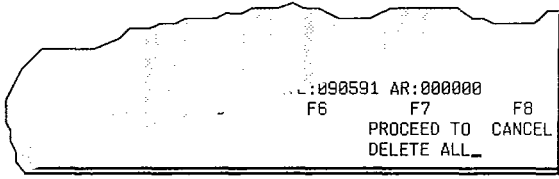If you had chosen the "delete" action from the load/delete screen the softkey menu appears as in:

Figure 16 785L Extra Register Delete DX Module Softkeys

When using the Modsoft Panel you can delete the DX by deleting the assigned Opcode and downloading the resulting configuration.

Chapter 5
Commands

▢ This Chapter describes both Port programming functions that are available in the PC–L984–785 Controller, when used in an Extra register configuration

Peripheral Port Commands

Changes to Current Commands

The following defines the Peripheral Port Command Programming Subfunctions that now have access to the execution buffer, pages 1 – 8. Each page is 64k bytes long and is accessed by these commands as 32k words. These commands also have full access to Page F, including the Header Control Block (HCB). When reading the Version Table (address FF20 – FF3F) from Page F, including the number of built in DX's (address FF21), the data is read from the Executive PROM.

Read Memory Contiguous   03
Write Memory Contiguous   04
Write Memory under Mask   05
Read Memory Scattered   2E

In Read and Write Memory Contiguous (03, 04) commands, the count of words to read or write has been increased from 16 to 123 locations.

In the Read and Write Nodes (06, 07) commands, the count of nodes to read or write has been increased from 11 to 81.

(See PI–MBUS–300 for Modbus programming commands).

New Modcom function

A new major Modbus Function Code (#126) has been developed. The subfunctions are:
     41 Hex =   Read scattered groups in Memory command
     42 Hex =   Write scattered groups in Memory command
     43 Hex =   Move Memory Command
     45 Hex =   Fill Memory

(See PI–MBUS–300 for Modbus programming commands).

Standard Modbus Functions *

Mask Write 4X Register

Function (22) modifies the specified 4X register using an 'AND' mask and an 'OR' mask. The masked write function can be used to set and/or clear individual bits within an 4X register.

The function can alter the contents of any 4X register at any time.

COMMAND:

Device Address
16 hex
data–hi
data–low
AND Mask–hi
AND Mask–low
OR Mask–hi
OR Mask–low
Error Check
LRC

RESPONSE: Echo the command block after modifying the register

Figure 17 Modbus Mask Write 4x Register Command

Read and Write 4X Registers

The Function (23) performs a read and a write operation in a single Modbus transaction. The function can alter the contents of any group of 4X registers, and then return the values of any other group of 4X registers at any time.

* These new functions are documented in PI–MBUS–300

COMMAND:

Device Address
17 hex
Read start hi
Read start low
to Read hi
to Read low
Write start hi
Write start low
to Write hi
to Write low
byte count
data–hi
data–low

data–hi
data–low
Error Check
LRC

RESPONSE:

Device Address
17 hex
byte count
data–hi
data–low

data–hi
data–low
Error Check
LRC

Figure 18 Read and Write 4X Command

Read FIFO Queue

This function (24) is used to read the contents of a FIFO, of up to 31 4X queue registers, plus the queue total, or up to 32 registers in total. The Read Queue function will only return the queue count and the number of entries in the queue, or an error (03 (illegal data value)) if the queue count is greater than 31.

34   Commands

```
┌─────────────────────────┐
│      Device Address     │
├─────────────────────────┤
│         18 hex          │
├─────────────────────────┤
│       FIFO Start hi     │
├─────────────────────────┤
│       FIFO Start low    │
├─────────────────────────┤
│       Error Check       │
├─────────────────────────┤
│          LRC            │
└─────────────────────────┘


┌─────────────────────────┐
│      Device Address     │
├─────────────────────────┤
│         17 hex          │
├─────────────────────────┤
│       byte count        │
├─────────────────────────┤
│        data–hi          │
├─────────────────────────┤
│        data–low         │
└─────────────────────────┘
            ▼
┌─────────────────────────┐
│        data–hi          │
├─────────────────────────┤
│        data–low         │
├─────────────────────────┤
│       Error Check       │
├─────────────────────────┤
│          LRC            │
└─────────────────────────┘
```

Figure 19 Read FIFO Queue Command

Modified DX Functions

XMWT and XMRD Function Blocks

The Extended Memory function blocks XMWT and XMRD function as described in the 984 Programmable Controller systems manual GM–0984–SYS with two exceptions. The functions are available from the panel DX selection when 785L is configured.

1). The bottom input is ignored because the 984–785L can not detect memory errors as it reads or writes to the extended memory.

2). The status word bits 14 and 15 are not used because the memory does not have parity and the extended memory is not separated from the remainder of the Controller memory.

Figure 20 is an example of the panel implementation of a XMWT Block. In the figure the top node refers to the address of the first reference to get for transfer to the 6X area. The middle node and Reference screen illustrates the 6 register control block associated with Extended Memory transfers.
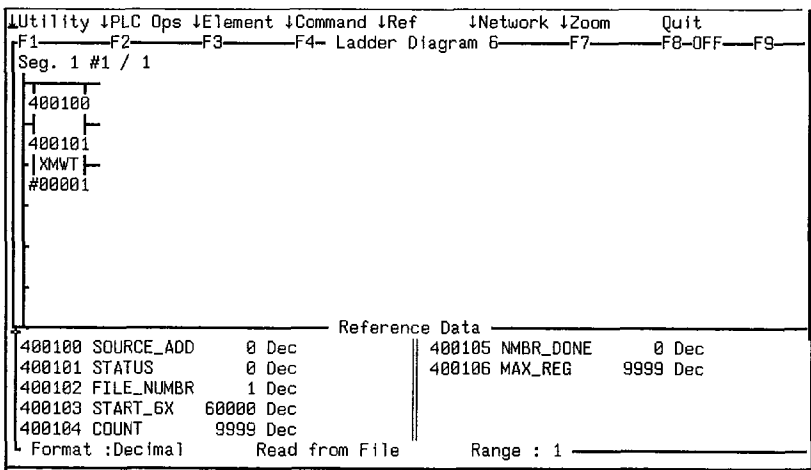
```
↓Utility ↓PLC Ops ↓Element ↓Command ↓Ref    ↓Network ↓Zoom   Quit
┌F1─────F2──────F3──────F4─ Ladder Diagram 6──────F7──────F8–OFF──F9──
Seg. 1 #1 / 1
┌─────┐
│400100│
┤    ├─
│400101│
┤|XMWT|├
│#00001│




────────────── Reference Data ──────────────
400100 SOURCE_ADD    0 Dec    ‖ 400105 NMBR_DONE    0 Dec
400101 STATUS        0 Dec    ‖ 400106 MAX_REG    9999 Dec
400102 FILE_NUMBR    1 Dec    ‖
400103 START_6X  60000 Dec    ‖
400104 COUNT      9999 Dec    ‖
Format :Decimal      Read from File      Range : 1 ──────
```

Figure 20 Extended Memory DX at Panel Level

CKSM Function

The Checksum function block has a new opcode of '2D' in the 785L instead of
'BF'. This change allows the 785L to have both the MSTR and CKSM function
blocks installed at the same time.

Standard DX Loadable

In the DX loadable header the 'software revision' byte (0E hex) must contain a val-
ue of 0C0 hex or greater if the loadable is to run with 64k of state RAM. With 64k
state RAM the addresses of the 4x registers in the top and/or middle nodes may
be in the 2nd 32k of state RAM. Addresses passed to the loadable are normalized.
To insure proper use of all 4x registers, the dx loadable code should always use
the complete address passed to the loadable on the stack in 'C' compatible format.

Extended Memory Read and Write Functions

The extended memory Modbus read and write functions are described in the
"Modbus Protocol Reference Guide" as Read/Write General Reference function
codes 20 and 21. The only difference in the PC–L984–785 Extra Register imple-
mentation is the size of the extended memory, which changes the number of files
and the number of registers.

Table 7   Extended Memory Allocation

TYPE	512k byte RAM			768k byte RAM	
State RAM	64k words	32k words		64k words	32k words
Extended Memory	72k "	0		96k "	24k "
Number of Files	8	0		10	3
Registers in last File	3728	0		8304	4576

Appendix A
Stopped Error Codes

❑ The Stopped error code displayed on you programming panel is defined in this Appendix.

Stopped Error Codes

The following lists stopped error codes for your 984 controller

Hex code	Description
7FFF	Controller unhealthy
8000	Controller stopped
4000	Bad I/O traffic cop
2000	Controller in dim awareness
1000	Bad port intervention
0800	Bad segment scheduler
0400	Son did not start segment
0200	Bad power–down checksum
0080	Watchdog expired
0040	Real time clock failed
0020	Bad coil used table
0010	Remote I.O option failed
0008	Illegal node type user
0004	User logic checksum error
0002	Discretes disable error
0001	Bad configuration

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