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Programmable Control Products

Logicmaster™ 90-70 Programming Software

User's Manual

GFK-0263G *June 1998*

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CIMPLICITY 90-ADS	Helpmate	Series Five	Workmaster
CIMSTAR	Logicmaster	Series 90	

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Preface

This programming software user's manual describes the features that are used to create ladder logic user programs for the Series 90-70 PLC. These features are available with Release 7.02 of the Logicmaster 90-70 programming software.

Revisions to This Manual

Changes made to this manual reflect the features of Release 7 of Logicmaster 90-70 software for the Series 90-70 PLC. The Release 7 and later CPU and Logicmaster software offer new capabilities and expanded functionality which we have documented in this manual and the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265G). CIMPLICITY Control 2.1 or later is required to take full advantage of some of the new capabilities of the the Release 7 and later CPUs. Additionally, corrections and clarifications have been made in this manual where necessary. The following list describes the major revisions of this manual, as compared to the previous version (GFK-0263F):

- New installation instructions for installing under Windows® 95 or Windows NT® beginning on page 2-4.
- If you have a C program but do not have the Toolkit on your PC or if you are putting the standalone program into more than one folder, Logicmaster now has a way of accommodating that need. Instructions on how to use the C Standalone Program Merge feature to bring a C program into your Logicmaster folder. For more information, refer to the instructions beginning on page 3-76.
- CPX 772, CPX782, CPX928, and CPX935 support a flash memory option which allows you to store program logic, configuration data, reference tables, passwords, and the OEM key to the flash memory device located on the Series 90-70 PLC. Previously, only the CPU 781 and 782 models could use this option. To learn more about this, refer to page 9-12.
- The CPX models of CPUs have embedded serial COM ports giving you the ability to monitor your program with one of the two new ports while using the other ports for other communications (usually eliminating the need for an additional communications module). To learn more about this, refer to page 11-55.
- The CGR772 and CGR935 CPUs have enhanced Hot Standby features and allows for configuration of GENIUS dual bus. For more information about these CPUs, refer to the *Series 90™-70 Enhanced Hot Standby CPU Redundancy User's Guide* (GFK-1527).

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The following features are available ***only with*** CIMPLICITY Control:

- Ethernet Global Data: This feature allows a PLC CPU's memory to be shared with the other PLCs and HMI devices on an Ethernet network. It also allows the PLC to collect data from other PLCs on a periodic basis.
- Increased Program Size: Using a Release 7.2 or later 90-70 PLC, you can store larger LD or SFC programs than previously to Series 90-70 PLC CPUs with expansion memory boards larger than 512 kilobytes.
- I/O Scan Sets: The I/O Scan Set feature allows the scanning of I/O points to be more closely scheduled with its use in user logic programs. This feature removes the need to scan all I/O on every sweep, thus reducing sweep time and increasing throughput. FIP, IC660/661, and Release 7.2 or later Series 90-70 I/O points can be assigned to groups called Scan Sets.
- Selective Synchronous FIP Programs: This feature allows the execution of a user program to be synchronized with the scanning of a scan set, where at least one input variable in the set is assigned to a FIP Bus Controller (FBC).
- VME 3rd Party Interrupts: The Release 7.2 or later Series 90-70 PLC currently allows interrupts from discrete and analog modules to trigger LD interrupt blocks and Standalone C programs in the PLC. Release 7.20 of the Series 90-70 PLC extends this capability to include interrupts from 3rd Party VME modules. Please refer to GFK-0448E, the *User's Guide to Integration of 3rd Party VME Modules* for more details on VME 3rd Party interrupts.
- Name Resolution Files: Release 7.20 of the Series 90-70 PLC supports the storing of Name Resolution Files from Windows programming software to Network Adapters capable of Name Resolution. Naming Resolution involves resolving a symbolic name to its necessary address information required for communication. This feature provides users with a means to use a Symbolic Name to reach the remote destination.
- Store/Load/Verify Genius Block Configuration: PLC Release 7.20 supports the storing of Genius Device Configuration. Windows programming software Release 2.00 or later is required to configure the devices. The configuration is stored to the PLC, and is then passed on to the GBC/NBC for eventual storage in the Genius devices. In addition, load/verify of device configuration will be supported.

Using This Manual

The information in this book is arranged as chapters that correspond to the main features of the Logicmaster 90-70 software.

Chapter 1. Introduction: provides an overview of the features available with the Logicmaster 90-70 programming software. After you read chapter 1, refer to the chapters that describe the functions you want to use.

Chapter 2. Operation: explains what you need to know to install and start up the software. It also explains the format of the software screen displays.

Chapter 3. Program Editing: describes program entry and edit features.

Chapter 4. Reference Tables: describes how to display tables of reference values, change formats in reference tables, force references, and override bit-oriented references.

Chapter 5. PLC Control and Status: describes how to control and modify the operation of a connected PLC. These features include how to change the PLC operating state, display and access PLC privilege levels, display and clear PLC and I/O faults, display PLC and program memory usage, display configured reference sizes, and modify sweep parameters.

Chapter 6. Program Librarian: explains how to use the librarian function to reuse program blocks from other programs without having to re-enter the logic.

Chapter 7. Programmer Setup: explains how to set up the programmer for communication with the PLC, and how to select the programmer operating mode.

Chapter 8. Program Folders: describes how to create, select, rename, modify, copy, or delete program folders.

Chapter 9. Program Utilities: describes how to use program utility functions to transfer programs and tables between the programmer and the PLC, to compare programs and data in the programmer with programs and data in the PLC, and to clear PLC memory.

Chapter 10. Print Functions: describes how to use the print functions to enter printer parameters, create files containing information to be printed, and print copies of programs, reference tables, and display screens.

Chapter 11. I/O Configuration: describes how to use the configuration software to configure the I/O modules.

Chapter 12. CPU Configuration: describes how to use the configuration software to set the operating characteristics of the CPU.

There are eleven appendixes in this manual:

Appendix A. Programming Lesson: provides a sample programming lesson with simple instructions for creating a program folder, creating a program, entering a variable declaration, adding ladder logic to the program, printing the program, and exiting the programmer.

Appendix B. Configuration Lesson: provides a sample configuration lesson with simple instructions for creating a program folder and configuring various modules.

Appendix C. Variable Programming Lesson: provides a sample variable programming lesson.

Appendix D. Programmer Environment Setup: describes how to modify the setup parameters.

Appendix E. Instruction Mnemonics: lists mnemonics that can be typed to display program instructions while searching through or editing a program.

Appendix F. Key Functions: lists the special keyboard assignments used for Logicmaster 90-70 software.

Appendix G. User Command Menu: describes how to maintain a file of MS-DOS executable commands outside of the Logicmaster software packages.

Appendix H. Data Import: describes how to use ASCII text-based files to quickly update data zoom blocks in the program editor and data tables in the reference editor.

Appendix I. Files Created with Logicmaster 90-70 Software: describes the files created by Logicmaster 90-70 software that are associated with the program or folder.

Appendix J. Common User Errors: describes common problems which may occur and the corrective action to take.

Appendix K. Variable Declaration Table Import/Export Using Comma Separated Variable (CSV) Format: describes the formatting steps necessary to import a CSV file into the Variable Declaration Table and / or export from the Variable Declaration Table into a CSV file.

Related Publications

Series 90™ -70 Programmable Controller Reference Manual (GFK-0265).

Logicmaster™ 90-70 Important Product Information (GFK-0350).

Series 90™ -70 Programmable Controller Installation Manual (GFK-0262).

Series 90™ Programmable Coprocessor Module and Support Software User's Manual (GFK-0255).

Series 90™ PCM Development Software (PCOP) User's Manual (GFK-0487).

C Programmer's Toolkit for Series 90™ -70 PLCs User's Manual (GFK-0646).

Series 90™ Sequential Function Chart Programming Language User's Manual (GFK-0854).

MegaBasic™ Programming Language Reference Manual (GFK-0256).

CIMPLICITY™ 90-ADS Alphanumeric Display System User's Manual (GFK-0499).

CIMPLICITY™ 90-ADS Alphanumeric Display System Reference Manual (GFK-0641).

Alphanumeric Display Coprocessor Module Data Sheet (GFK-0521).

Series 90™ -70 Genius I/O System User's Manual (GEK-90486-1).

Series 90™ -70 Genius I/O Analog and Discrete Blocks User's Manual (GEK-90486-2).

Workmaster® II PLC Programming Unit Guide to Operation (GFK-0401).

Series 90™ -70 Genius Bus Controller User's Manual (GFK-0398).

Series 90™ -70 FIP Bus Controller User's Manual (GFK-1038).

Series 90™ -70 Remote I/O Scanner User's Manual (GFK-0579).

Guidelines for the Selection of Third-Party VME Modules (GFK-0448).

Series 90™ Ethernet Communications User's Manual (GFK-0868).

Series 90™ MAP 3.0 Communications User's Manual (GFK-0869).

We Welcome Your Comments and Suggestions

At GE Fanuc Automation, we strive to produce quality technical documentation. After you have used this manual, please take a few moments to complete and return the Reader's Comment Card located on the next page.

David Bruton
Sr. Technical Writer

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Chapter 1 Introduction

Section 1: Product Overview

Logicmaster 90-70 programming software is used to configure and program the Series 90-70 programmable controller.

Note

In this manual, the WSI version of Logicmaster 90-70 software refers to using a Work Station Interface (WSI) Board in the programmer to provide serial communication between the programmer and the attached PLC. The standard serial communications version of Logicmaster 90-70 software refers to using ports COM1 and COM2 instead of the Work Station Interface Board.

Configuration is the process of assigning logical addresses, as well as other characteristics, to the hardware modules in the system. It may be done either before or after programming, using the configuration software; however, it is recommended that configuration be done first.

Programming consists of creating an application program for a PLC.

What You Will Need

To run Logicmaster 90-70 software, you will need:

- A computer with a hard disk:
  - A Workmaster® II industrial computer with a 101-key keyboard, or
  - A personal computer with an Intel 80386 or higher processor and a minimum of 2 Megabytes of memory, or
  - A Zenith™ Mastersport™ SL notebook computer or other laptop computers with an Intel 80386 or higher processor and a minimum of 2 Megabytes of memory.
- At least 4 Megabytes of free disk space.
- The Release 5 WSI version of Logicmaster 90-70 software requires a **minimum** of 545K of available conventional RAM memory to run and at least 1024K of Lotus / Intel / Microsoft Expanded Memory (LIM EMS 3.2 or higher).
- The standard serial communications version of Logicmaster 90-70 software requires either a **minimum** of 590K of available conventional RAM, or 545K of available conventional RAM plus an additional 49K of Upper Memory Blocks (UMB), High Memory Area, or Expanded Memory (EMS) for the communications driver. At least 1024K of Lotus / Intel / Microsoft Expanded Memory (LIM EMS 3.2 or higher) is also required. (Refer to chapter 7, section 4, "Standard Serial COM Port.")

Note

Some folders may require additional memory. If additional memory is required, system software error ID: 0000 EX: 0000 will be displayed. Check the AUTOEXEC.BAT and CONFIG.SYS files to remove any device drivers and Terminate and Stay Resident (TSR) programs in order to free more RAM. Logicmaster 90-70 software does not require the ANSI.SYS device driver.

MS-DOS Version

To run Logicmaster 90-70 software, MS-DOS® Version 5.0 (or higher) must be installed on your computer.

Logicmaster 90-70 software provides foreign keyboard support, depending on the configuration of MS-DOS residing on the host computer. Consult your MS-DOS User's Manual for information on configuring for your country.

Note

You can run Logicmaster in a MS-DOS window under Windows 95 or Windows NT, but you cannot install Logicmaster in a MS-DOS window under Windows 95 or Windows NT. Refer to Section 3 or Chapter 2 for details.

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® *MS-DOS is a registered trademark of Microsoft Corporation.*

Help Screens

Logicmaster 90-70 software includes detailed Help screens. These Help screens are loaded onto the hard disk of your programmer during the software installation procedure and are readily accessible. To access the Help screens, press **ALT-H** for help, **ALT-I** for instruction mnemonic help, or **ALT-K** for key help.

Key Functions

Appendix E, *Key Functions*, lists the keyboard functions that are active in the Logicmaster 90-70 software environment. Appendix E also contains a perforated Help card which can be removed from this manual. This information may also be displayed on the programmer screen by pressing **ALT-K** to access key help.

Before You Begin

You will find Logicmaster 90-70 programming software easy to use and to understand. When you are ready to begin, turn to chapter 2. It will tell you:

- How to install the software in your computer.
- How to start up the software.
- How to use your computer's keyboard to perform special programming functions.
- How to enter data, move the cursor, and read the status information on your screen.

After starting up the software, try the short programming lesson in appendix A and the configuration lesson in appendix B.

When you are ready to use the programming software to create a program, monitor a system, or perform any of its other functions, you will find instructions in other chapters of this book.

Section 2: Configuration Software

CPU Configuration

Configuration software is used to display and modify the characteristics of the CPU (such as the time-of-day clock, SNP ID, memory configuration, and fault category). Chapter 12, "CPU Configuration," explains how to complete the CPU configuration for your system. This will set up or change the system features described below.

PLC Time and Date

The PLC maintains the current time and date. These settings can be displayed and changed using the CPU configuration function.

SNP ID

For multidrop configurations, each CPU connected to the system must have a unique identification name. The current SNP ID can be displayed and changed using the CPU configuration function.

PLC Memory Configuration

You can display the current memory allocated to both discrete references and register references. In addition, you can change the amount of program logic memory used for analog I/O and register memory.

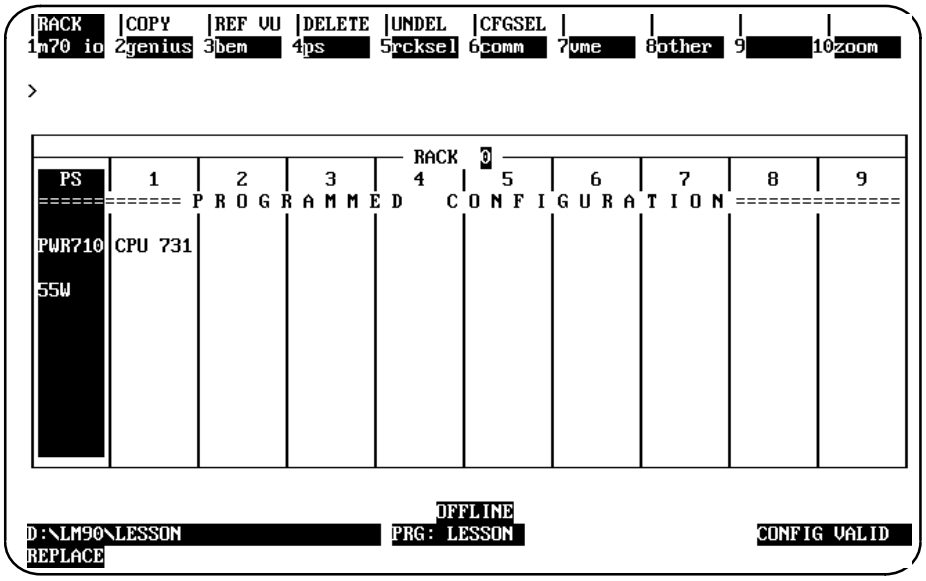
System Response to Faults

To ensure safe operation of the control system, the PLC must be able to respond appropriately to certain types of faults. Fatal faults cause the CPU to set fault references and then go to **STOP** mode. Diagnostic faults cause the CPU to set fault references, but the PLC keeps operating. For many faults, the default action (fatal or diagnostic) can be configured to suit the needs of the application.

I/O Configuration

The I/O configuration function is used to describe the modules that are present in the PLC racks, to assign logical addresses, and select options for individual modules. These logical addresses are independent of physical location or function. Chapter 11, "I/O Configuration," explains how to complete the I/O configuration for your system.

The I/O configuration rack screen represents the appearance of the Series 90-70 I/O rack. Use the Next and Previous page keys, or the Up and Down cursor keys, to display another rack. Then, use the Left and Right cursor keys to move the cursor to the slot to be displayed or configured.



To complete the I/O configuration:

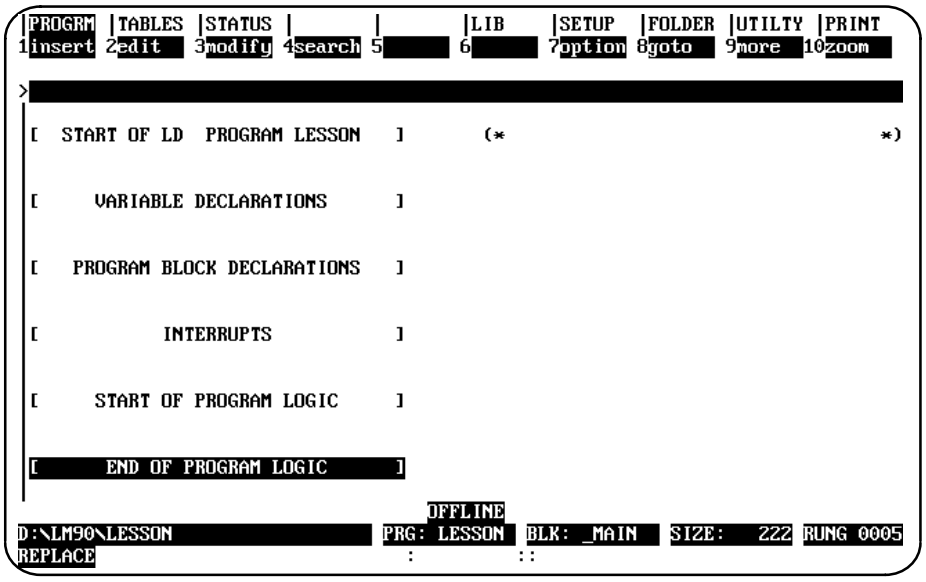
1. Select the module present in each slot.
2. Assign each module a reference address. The configuration software automatically supplies the next highest reference address for each module; however, you can change this address.
3. For some modules, you can also select options, such as the configuration mode for a Programmable Coprocessor Module.

Editing features make it easy to copy, move, replace, delete, or undelete configurations.

Section 3: Programming Software

Creating or Editing a Program

Chapter 3, "Program Editing," describes how to create and edit programs. The basic elements of a program are displayed when the programming screen is first selected.



Marker	Description
Variable Declarations	To access the variable declaration table, move the cursor to this marker, and press **Zoom (F10)**. Nicknames and reference descriptions can then be entered in the table.
Program Block Declarations	A program can include more than one block of logic. Additional blocks can be called from other blocks. When that is done, blocks must be declared before they are called. To declare a block, move the cursor to this marker, and press **Zoom (F10)**. The main block has a block declaration table. This table lists all blocks which are part of the complete program. Blocks do not have block declaration tables. However, blocks can be called from the main block or from any block in the program.
Interrupts	The main program block also has a section for interrupts. This lists any program blocks that will be called as the result of an interrupt from a hardware module. Interrupt declarations themselves do not declare a program block; they must first be specified in the program block declaration section. This marker shows where interrupt logic can be included in the program. If I/O modules capable of generating interrupts are present in the PLC, their inputs can be used to cause the execution of certain program logic. Their use is optional. To enter interrupt logic, move the cursor to this marker, and press **Zoom (F10)**.
Start / End of Program Logic	All logic is placed between these two markers. To enter logic, place the cursor on the **[END OF PROGRAM LOGIC]** marker, and press **Insert (F1)**.

Editing functions include rung insert / edit, select, cut, delete, paste, include, and write. In addition, search and goto functions allow you to position the cursor on a particular rung or element. An optional feature of the search function is the replacement of the search target with a user-specified element and / or reference address.

Chapter 3, section 4, "Program Annotation," describes how annotation can be added to a program to make the program easier to read and understand. Three types of annotation (nicknames, reference descriptions, and rung comments) are supported by Logicmaster 90-70 software.

Displaying Tables of Reference Values

Chapter 4, "Reference Tables," explains how to use the reference tables feature to display the current values of program references. If the programmer is connected to a PLC and in **ONLINE** or **MONITOR** mode, the values shown in the table are from the PLC. In **OFFLINE** mode, they are from the current folder. There are separate tables for each type of program reference; for example, all discrete inputs (%I), all discrete outputs (%Q), and all registers (%R). In addition, there are 99 user-defined tables called mixed reference tables.

The format of individual items or an entire reference table can easily be changed to units that are suitable to your application. You can also return a standard reference table to its default format and fill the table locations with zero.

Starting/Stopping PLC Execution

PLC program execution is started or stopped from the Run / Stop PLC screen, or by pressing **ALT-R** from any screen. For more information, refer to chapter 5, "PLC Control and Status."

Fault Display and Clearing

When the programmer computer is monitoring an operating PLC system, any faults that have occurred are displayed in one of two fault tables. PLC faults are listed in the PLC fault table. Faults from the I / O system are listed in the I / O fault table. All faults are identified by time, date, and location.

Additional information about each fault can be displayed by positioning the cursor on the fault in the fault table and pressing the **Zoom (F10)** softkey.

Faults can be cleared from the fault table displays. For information about the PLC and I / O fault tables, refer to chapter 5, "PLC Control and Status."

PLC Sweep Time Display and Change

Chapter 5, "PLC Control and Status," explains how to use the programming software to:

- Display the current CPU sweep time. This is the amount of time required for one complete cycle of program execution, I / O scan, communications windows, and other functions.
- See whether or not **CONSTANT SWEEP TIME** mode is enabled, and read its setting.
- Display the currently selected time interval for the watchdog timer. This timer is used to shut down the CPU if the sweep time is too long.
- Display or change the times currently allocated for the programmer window and the system communications window.

PLC and Program Memory Information

Chapter 5, "PLC Control and Status," also explains how to display information about:

- PLC memory size.
- PLC memory used and available.
- User program (RLD) memory used for logic, data, declarations, and annotation.
- Memory used for configured program references.
- Standalone C program memory size

Selecting the Programmer Operating Mode

Both the programmer and the configuration software operate in three modes: **OFFLINE**, **MONITOR**, and **ONLINE**. In **OFFLINE** mode, no data transfer takes place between the computer and the PLC. Programs and configuration data may conveniently be developed in **OFFLINE** mode, with or without the computer connected to a PLC. In **MONITOR** mode, if communications have been established between the computer and the PLC, the computer can read data from the PLC but may not transfer data to it. With communications established in **ONLINE** mode, programs and other data can be transferred between the PLC and the computer.

If you are using a Workmaster or CIMSTAR I industrial computer, you may configure the Logicmaster 90-70 software to use the keyswitch to select the operating mode. For those computers without a keyswitch, or if the keyswitch is not enabled, mode selection can be made by:

- Pressing the **ALT** and **M** keys simultaneously; i.e., press the **ALT** key and hold it down, then press the **M** key. Repeatedly pressing **ALT-M** switches the operating mode from **OFFLINE** to **MONITOR** to **ONLINE** and then back to **OFFLINE**.
- Going to the Programmer Setup screen (**Shift-F7**) and selecting an operating mode. For more information on using the Programmer Setup screen to select the operating mode, refer to chapter 7, section 2, "Programmer Operating Mode."

System Security

Security for configuration and program functions consists of:

- A range of four privilege levels for the PLC, which may be protected using passwords.
- A software lock that can be applied to individual program folders.
- A selectable operating mode.
- A software lock that can be applied to individual program blocks.
- An OEM key.

Passwords are a configurable feature of the Series 90-70 PLC. Their purpose is to provide different levels of access privilege for the PLC when the programmer is in **ONLINE** mode. Passwords may not be set, or the password access (privilege) level may not be changed, when the programmer is in **OFFLINE** mode. The use of passwords is optional and may be set up using the status functions in the configurator. Passwords may be used to restrict changing I/O and PLC configuration data, changing programs, and clearing faults.

Chapter 3, section 8, "Program Blocks, External Blocks, and Interrupts," describes how individual program blocks may be locked and unlocked.

Chapter 5, "PLC Control and Status," describes the programmer's privilege levels and explains how to enter passwords. Chapter 5 also describes how passwords are specified.

Program folders can be protected to prevent accidental changes to program and configuration information. Each program folder can be either "locked" or "unlocked". After a folder is locked, its contents cannot be changed or deleted. For more information on locking program folders, see chapter 8, "Program Folders."

Setting up PLC Communications using a WSI Board

For the WSI version of Logicmaster 90-70 software, the serial port on the Work Station Interface (WSI) Board in the programmer provides serial communication between the programmer and the attached PLC. The COMSET serial port setup function is used to configure the WSI serial port, and to save or recall those configurations from disk files. Refer to chapter 7, section 5, "WSI Serial Port," for instructions on WSI serial port setup.

The parallel port on the WSI Board requires no port setup; however, you must select **PARALLEL** as the port connection. Refer also to section 5 of chapter 7 for information on selecting SNP / parallel connection.

Setting up PLC Serial Communications Using Standard COM Serial Ports

For the standard serial communications version of Logicmaster 90-70 software, the COM1 or COM2 serial port may be set up to provide serial communications between the programmer and the attached PLC. The COMSET serial port setup is used to configure the COM1 or COM2 serial port, and to save or recall those configurations from disk files. Refer to chapter 7, section 4, "Standard Serial COM Port," for instructions on PLC communications serial port setup.

Program Folders

Each program and the corresponding configuration is assigned to a subdirectory called a program folder. Both the configuration software and the programming software use a set of program utility functions to create and maintain program folders. Chapter 8, "Program Folders," explains how to use the program folder functions to:

- Select another program folder.
- Create a new program folder.
- Delete an unneeded program folder.
- Rename a program folder.
- Make a backup copy of the current program folder.
- Restore a program folder with its backup copy.
- Clear the contents (entire or selective) of the current program folder.
- Lock / unlock a program folder.
- Copy the contents (entire or selective) of one program folder into the current program folder.

Application programs and related files can be stored on the same hard disk as the software. They can also be copied to floppy disks for portability or for independent storage.

Transferring Programs

The program utility functions, described in chapter 9, "Program Utilities," are used to:

- Transfer programs and configuration between the PLC and the programmer.
- Clear part or all of the program and / or configuration from PLC memory.
- Compare (verify) a program or configuration in the PLC with the current folder to determine if they are the same.

Printing Programs and Configuration

The programming software includes a complete set of print functions. You can select the contents and format of the printout. In addition, you can print cross references for the references used in the program.

You can also print copies of your system configuration by using the print function in the configuration software. Refer to chapter 10, section 5, "Print Configuration," for information about printing configuration screens.

Chapter 2 Operation

This chapter explains what you will need to know to install and start up the Logicmaster 90-70 software. It also explains keyboard use and content of the Logicmaster 90-70 software screens.

Section	Title	Description	Page
1	Hardware Setup (WSI Version)	Describes the two Work Station Interface Boards which are available. Section 1 also provides information on grounding and cabling.	2-2
2	Hardware Setup (Standard Serial Communications Version)	Describes the serial card which must be installed in your computer in order to use the standard serial communications version of Logicmaster 90-70 software.	2-3
3	Software Installation	Explains how to install the Logicmaster 90-70 programming and configuration software on your computer's hard disk.	2-4
4	Startup / Exit	Describes how to start up Logicmaster 90-70 software.	2-14
5	Keyboard Functions	Describes keyboard functions in the Logicmaster 90-70 software environment.	2-22
6	Screen Format	Shows the format of the display screen and describes the information that appears.	2-25

Section 1: Hardware Setup (WSI Version)

Installing the Work Station Interface Board

The Work Station Interface (WSI) Board provides a high-performance serial interface between a Series 90-70 PLC and the programmer for the WSI version of Logicmaster 90-70 software.

There are two Work Station Interface Boards available; one is for an AT-type computer, and the other is for a PS/2-type computer. The WSI Board is included as part of a package with Logicmaster 90-70 programming software. If you have a Workmaster II computer, the WSI board was installed at the factory. For installation instructions on other programming devices, consult the computer manufacturer's instructions for option boards.

Grounding

Be sure the computer has a ground connection in common with the CPU rack. This is usually done by connecting the programmer computer to the same power source (with the same ground reference point) as the rack.

Warning

If the programmer is not connected as described above, damage to the Work Station Interface Board can occur. Erratic control operation may also result. If the programmer is online to an operating system, possible erratic operation may cause conditions which are hazardous to personnel and equipment.

Cabling

The communications cable that connects the computer to the PLC is a shielded twisted pair cable with a 37-pin D connector on each end. The maximum length for this cable is 50 feet. After installing the Work Station Interface Board in your computer, connect the computer to the PLC by first attaching the cable to the Work Station Interface Board and then to either the SNP port on the CPU module or the parallel port on the Bus Transmitter Module (BTM).

Section 2: Hardware Setup (Standard Serial Com Version)

If you have the Logicmaster 90-70 version of software which communicates with the PLC using the standard serial communication ports, a serial board with COM1, COM2, COM3, or COM4 must be installed in the computer in order to communicate with the PLC. Refer to GFK-0262, *Series 90-70 Programmable Controller Installation Manual*, for instructions on establishing a serial connection between the Series 90-70 PLC serial port and the serial port on the programming computer, without having a Work Station Interface Board installed in the computer.

Section 3: Software Installation

To use Logicmaster 90-70 software, it must be installed on the programmer computer's hard disk or network disk. MS-DOS Version 3.1 or later must already exist on the hard disk or network disk.

The Logicmaster 90-70 installation procedure creates three subdirectories on the hard disk:

Software Version	Subdirectories Created
WSI	\LM90 \LM90\P70 \LM90\C70
Standardserialcommunications	\LM90 \LM90\P70S \LM90\C70S

Note

Refer to the IPI accompanying the specific release of Logicmaster for updated instructions on installation of the Logicmaster software. The information presented in this chapter is not intended to reflect differences in specific releases of the Logicmaster software.

Also, please note that you cannot install most versions of Logicmaster in a MS-DOS box under Windows 95 or Windows NT. You have to restart in DOS mode and then install. Refer to the IPI for specific instructions.

There is a new version of Logicmaster (IC641SWP716) that was specifically designed as a DOS application that installs and works under Windows NT and Windows 95. This new version provides SNP or TCP/IP Ethernet communications to Series 90-70 PLCs and uses standard TCP/IP Windows drivers to provide maximum compatibility in a network environment. As a program designed for Windows NT and Windows 95, it consumes less of the system resources, easily handling the multitasking attributes of the Windows NT or Windows 95 operating system. For more information about this new product, call 1-800-GEFanuc.

AUTOEXEC.BAT and CONFIG.SYS Files

Before starting to install Logicmaster 90-70 software, check the content of your hard disk root directory to see whether the CONFIG.SYS and AUTOEXEC.BAT files are present. Operation of Logicmaster 90-70 software requires these files to be present. If they are not, they will be installed automatically during the installation. If your hard disk already has these two files, you may be asked during installation whether the INSTALL process

should modify them. If you prefer, you can edit your existing files for use with Logicmaster 90-70 software.

The CONFIG.SYS (System Configuration) file is a short, readable file that describes the configuration of MS-DOS. Different software packages may use different system configurations. For all Logicmaster 90-70 applications, the file must contain at least these two lines:

```
Buffers = 15
Files   = 20
```

Note

If MS-DOS 5.0 is used and is loaded high, buffers may be set higher (e.g., buffers = 60). This will help Logicmaster 90-70 software performance during program searches, program loads, program stores, and other disk operations.

If you want to check the content of an existing CONFIG.SYS file, you can use the TYPE command.

Caution

If an existing CONFIG.SYS file is modified, you must reboot your machine before running Logicmaster 90-70 software.

The AUTOEXEC.BAT file must have **`(drive ID):\LM90`** added to the existing path. **`(drive ID)`** is the letter which corresponds to the hard disk drive where Logicmaster 90-70 software is installed.

If you need to run Version 5.0 or later of Logicmaster 90-70 software from a disk that does not contain the software, add this to your AUTOEXEC.BAT file:

```
SET $PLCROOT=(drive ID):\LM90
```

Running Other Software with the CONFIG.SYS File For Logicmaster 90-70 Software

Other types of software may require different entries in the CONFIG.SYS file. It is not always possible to combine the requirements for multiple software packages in one CONFIG.SYS file. In that case, you must maintain multiple versions of the CONFIG.SYS file with different file names. Your MS-DOS manual contains more information about the CONFIG.SYS file.

Caution

If the CONFIG.SYS or AUTOEXEC.BAT file loads many RAM resident utilities, Logicmaster 90-70 software may not run. These utilities should be kept at a minimum when running Logicmaster 90-70 software.

If you have loaded device drivers for special devices or a local area network, which terminate and stay resident, these programs may need to be removed before installing and running the Logicmaster 90-70 software. The MS-DOS CHKDSK or MEM command may be used to determine available memory (bytes free).

Logicmaster 90-70 software does not require the ANSI.SYS device driver; it may be removed in order to obtain more memory.

If you want to check the content of an existing CONFIG.SYS file, you can use the TYPE command. (Recommended buffer size is 40; minimum is 15.)

- The WSI version of Logicmaster 90-70 software requires a minimum of 545 KB (558,080 bytes) of available MS-DOS application memory in order to run.

  The Standard Serial COM Port version requires either a ***minimum*** of 590 KB (604,160 bytes) of available DOS application memory, or 520 KB (532,480 bytes) of available DOS application memory *and* 42 KB of available High Memory Area, Upper Memory Block or Expanded Memory for the COM port driver (see page NO TAG and following for details about the Standard Serial COM Port version and memory management).

  Both versions require a minimum 1024 KB of Lotus/Intel/Microsoft Expanded Memory (LIM EMS 3.2 or higher) for optimum performance. If additional DOS application memory (also called "low memory" or "conventional memory") is needed, system software error ID: 0000 EX: 0000 will occur. Remove any unneeded TSR (Terminate and Stay Resident) programs and any unnecessary device drivers from the AUTOEXEC.BAT and CONFIG.SYS files to make more memory available.

  The following configurations will assist you in setting up your computer system to run Logicmaster 90-70 software optimally on 386/486 computers with a minimum of 2 MB RAM.

Logicmaster 90-70 Software (Standard MS-DOS Version 5.0)	**Configuration**
CONFIG.SYS	DEVICE=C:\DOS\HIMEM.SYS DOS=HIGH,UMB DEVICE=C:\DOS\EMM386.EXE 1024 RAM X=CE00–CFFF FILES=20 BUFFERS=40

Note

The above EMM386.EXE switch "X=CE00–CFFF " is used to reserve this area of memory for the Series 90-70 WSI card. If the computer does not have a WSI card, the "X= CE00– CFFF" is not required; however, the "EMM386.EXE 1024 RAM" specification enhances performance and may be necessary if you have over 537 MB of free hard disk space (see next paragraph below). If you have less than 537 MB of free hard disk space, the special precautions discussed below are unnecessary.

If you have over 537 MB of free hard disk space and you have the statement DEVICE=C:\DOS\EMM386.EXE NOEMS in your CONFIG.SYS, you will receive the following error: **`(00032) An unknown error occurred during install initialization`**. To prevent this error. from occurring, you must specify Expanded Memory in your CONFIG.SYS, e.g., DEVICE=C:\DOS\EMM386.EXE 1024 RAM. If you are using a commercial memory manager, such as QEMM™ or 386MAX™, this precaution may not be necessary. (See IPI GFK-0350 which comes with this Logicmaster release for examples of tested configurations using QEMM™ and 386MAX™.)

In addition, some folders may require additional memory. If additional memory is required, system software error ID: 0000 EX: 0000 will be displayed. Check the AUTOEXEC.BAT and CONFIG.SYS files to remove any device drivers and Terminate and Stay Resident (TSR) programs in order to free more RAM. Logicmaster 90-70 software does not require the ANSI.SYS device driver.

The AUTOEXEC.BAT file must have **`(drive ID):\LM90`** added to the existing path. **`(drive ID)`** is the letter which corresponds to the hard disk drive where Logicmaster 90-70 software is installed.

If you need to run Version 4.01 or later of Logicmaster 90-70 software from a disk that does not contain the software, add this to your AUTOEXEC.BAT file:

```
SET $PLCROOT=(drive ID):\LM90
```

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Installing Logicmaster Under Windows® 95

You can run Logicmaster under Windows 95, but you cannot install it without rebooting into DOS mode. Although Windows 95 supports most standard DOS programs, the Logicmaster distribution diskettes contain a copy protection track that cannot be read using normal DOS file services. You must shut down the Windows 95 operating system and restart the computer in DOS mode before running the Logicmaster 90 Install program for both Logicmaster and SFC. Follow these steps for a successful installation.

- Click the Windows 95 Start button and select Shut Down.
- From the Shut Down dialog box, select the "Restart the computer in MS-DOS mode" option and press **Enter**.
- At the DOS prompt, insert the first Logicmaster distribution diskette and type **A**: (or **B**:), press **Enter**, then type **INSTALL**.
- Proceed with the standard installation.
- Configure your CONFIG.SYS and AUTOEXEC.BAT files as discussed previously.
- Restart your computer.

Installing Logicmaster Under Windows NT™

You can run Logicmaster under Windows NT, but you cannot install it without going into DOS mode. To do so, restart your computer and select the option that takes you into standard DOS mode. Then follow the steps shown above for Windows 95 beginning with the third step.

If you do not have MS-DOS on your NT system, you can temporarily reboot from a floppy drive with an MS-DOS system disk if your NT system uses FAT-based file system.

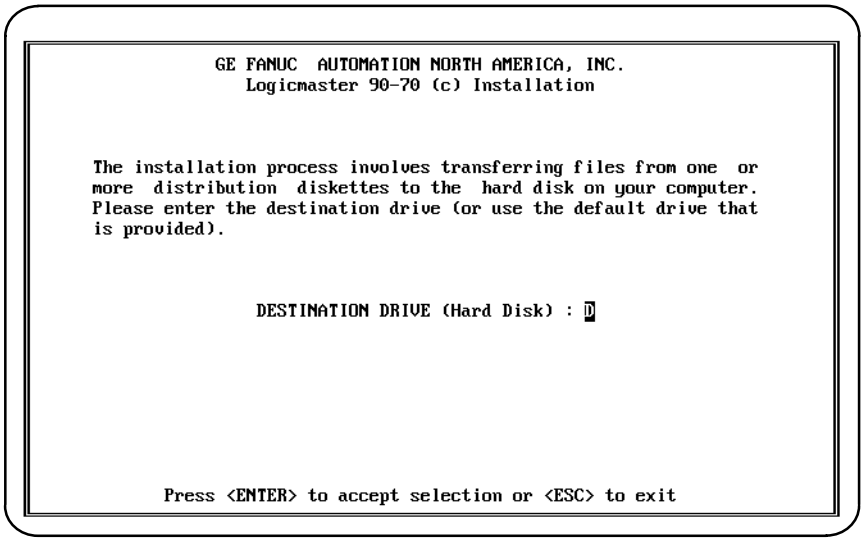
Note

Logicmaster 90-70 TCP/IP Ethernet for DOS cannot be run from a DOS window under Windows®, Windows 95, or Windows NT. For the other versions of Logicmaster, refer also to the IPI accompanying the software disks for additional information about installing Logicmaster.

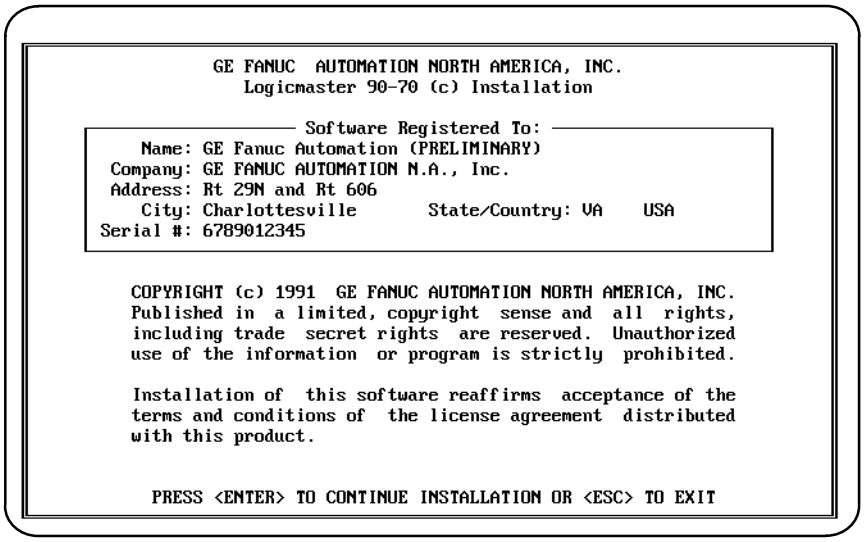
There is a new version of Logicmaster (IC641SWP716) that was specifically designed as a DOS application that installs and works under Windows NT and Windows 95. This new version provides SNP or TCP/IP Ethernet communications to Series 90-70 PLCs and uses standard TCP/IP Windows drivers to provide maximum compatibility in a network environment. As a program designed for Windows NT and Windows 95, it consumes less of the system resources, easily handling the multitasking attributes of the Windows NT or Windows 95 operating system. For more information about this new product, call 1-800-GEFanuc.

Installation Instructions

1. Boot up the computer using MS-DOS.
2. Be sure the CONFIG.SYS file has files set to at least 20, i.e., FILES=20.
3. Remove the write-protect tab from the disk.
4. Insert the Logicmaster 90-70 software disk into the computer's disk drive.
5. At the MS-DOS prompt, enter the designation of the disk drive followed by a colon. For example, if the disk is in drive A, type: **A:** and press the **Enter** key.
6. Begin the installation procedure by typing: **INSTALL** and pressing the **Enter** key. The following screen is displayed.



7. Specify the hard disk drive and press the **Enter** key, or just press the **Enter** key if the default is correct. The following screen is displayed if this is the first installation of this disk.



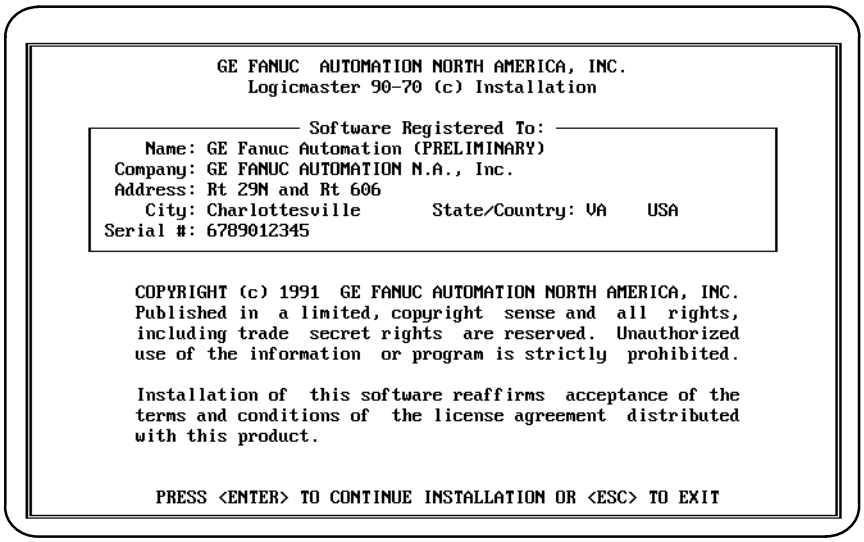
Note

The ***Serial Number*** field must contain the serial number from your registration card or the back of the distribution disks.

8. Use the cursor keys to move between fields. Each field is validated as you move off the field. You must fill in all of the fields and press the **Enter** key in order for the installation process to continue. If any fields are empty or invalid when the **Enter** key is pressed, the first invalid field is highlighted and an error message is displayed. The system will prompt you to confirm that the registration information is correct as displayed.

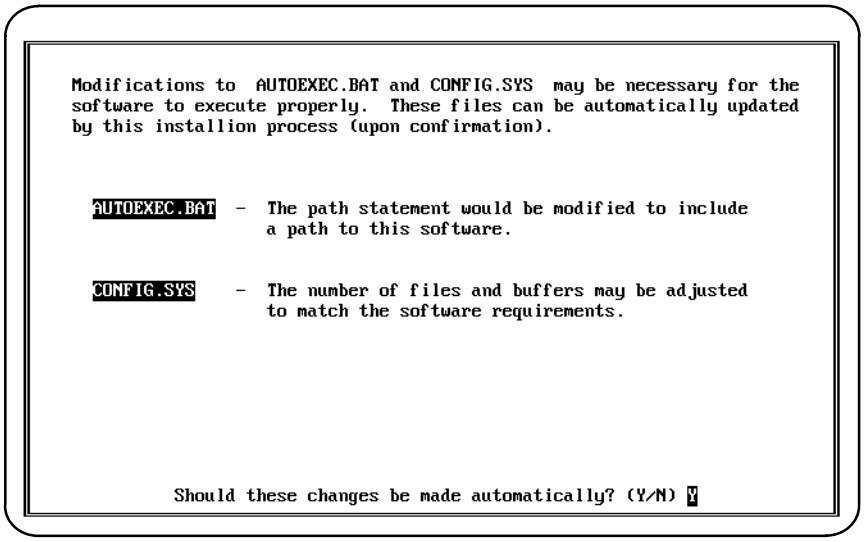
   If the registration data is not correct, press: **N** (No) and correct the registration information. When the registration data is correct, press: **Y** (Yes). The data is then encoded and written onto the master distribution disk. This screen is displayed until the registration data is successfully written to the master disk, or until the installation program is aborted by pressing the **Escape** key. You may print this screen by pressing the **Print Screen** key.

9. When the registration data is successfully written to the master disk, the installation process can begin. The following screen is displayed after the registration data has been entered, or on future Logicmaster installations of the same software package. (Registration is not required once the data is written to the master disk.) Read the licensing agreement.



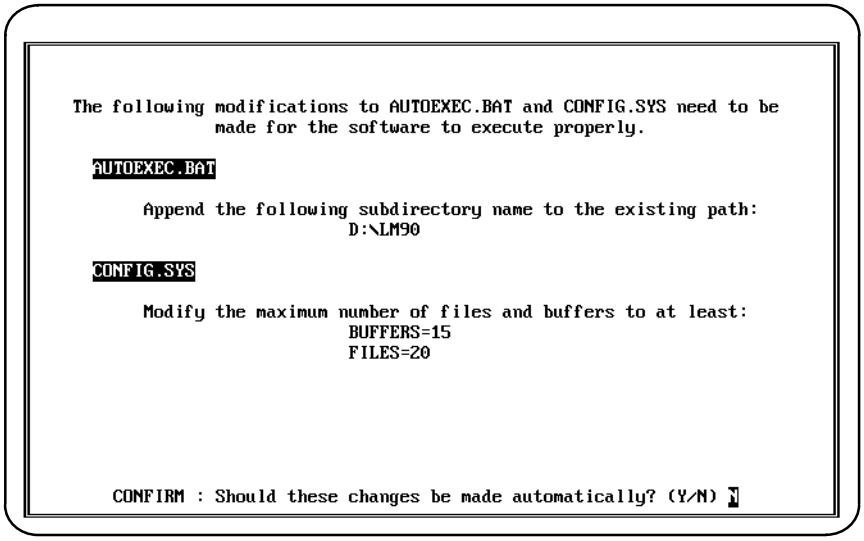
This information is displayed each time an installation is performed. Pressing the **Enter** key after reading this screen means you agree to comply with the stated terms. Press the **Escape (ESC**) key to terminate INSTALL and return to MS-DOS.

10. First, the installation procedure creates the \LM90 directory in the root directory, if it does not already exist. INSTALL checks the AUTOEXEC.BAT and CONFIG.SYS files in the root directory of the hard disk. These files must contain certain commands to ensure that Logicmaster 90-70 software executes properly. If neither file exists, they are both created. If either file already exists, INSTALL will ask if the files should be automatically modified.



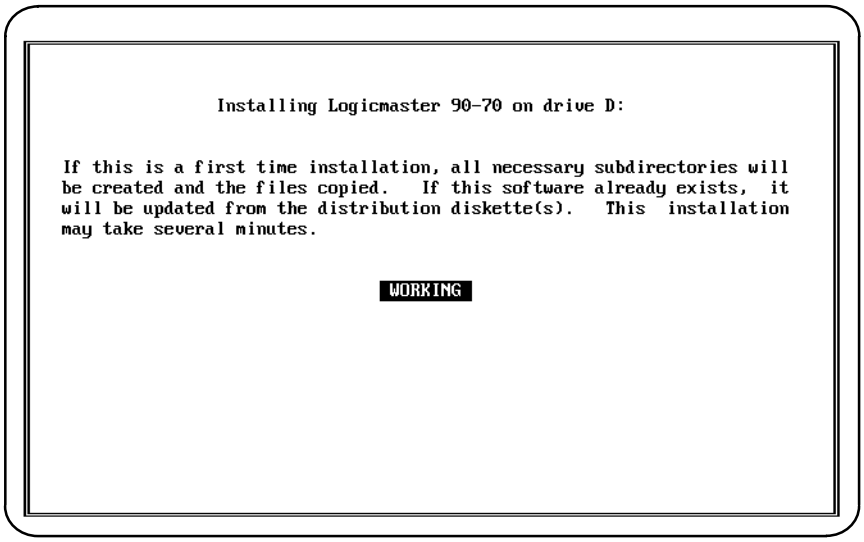
If you want the AUTOEXEC.BAT and CONFIG.SYS files to be automatically modified, enter **Y** (Yes) or press the **Enter** key. If there were already versions of those files in the root directory, they will be renamed to AUTOEXEC.L90 and CONFIG.L90, respectively.

If you already have AUTOEXEC.BAT and / or CONFIG.SYS files and plan to edit them yourself, enter **N** (No). The following screen is displayed:



11. If you are using a Workmaster industrial computer, remove the lines **device=c:\gexmem2.sys** and **device=c:\gexdisk.sys**. The line **device=c:\gexdisk.sys.** The line **device=c:\gexmem.sys** may remain for Expanded Memory.

12. If you change your mind and want INSTALL to automatically update the AUTOEXEC.BAT and CONFIG.SYS files, enter **Y** (Yes). Otherwise, enter **N** (No) or press the **Enter** key.



13. INSTALL attempts to create three subdirectories under the root directory on the hard disk, and transfers the appropriate files to those subdirectories. If the subdirectories already exist, any files in them are deleted and the new files installed. If folders exist, they are not deleted.

14. INSTALL will then prompt you to insert any other disks. After all the files have been transferred, the final installation screen is displayed.

15. The computer must now be rebooted in order to complete the installation process. After removing the last disk used during the installation process, press **CTRL-ALT-Delete** to reboot the computer. When the MS-DOS prompt is displayed, enter **LM90** to start up the software.

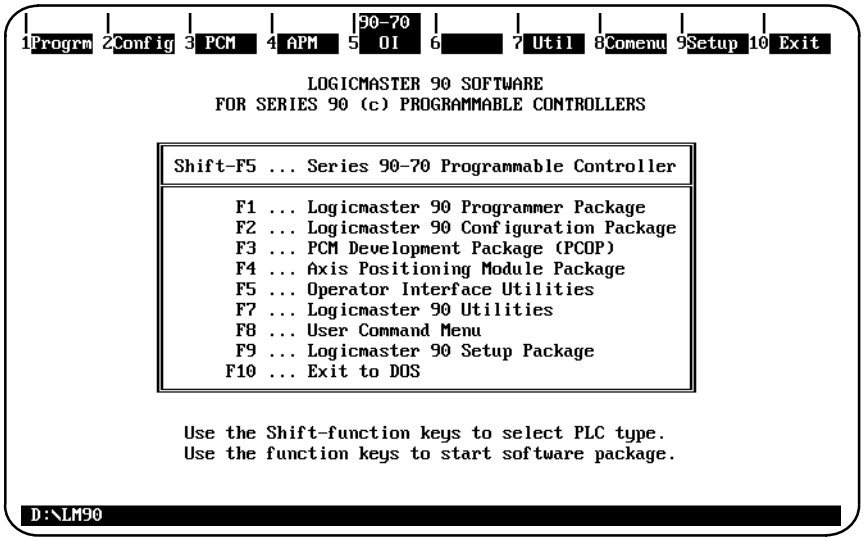
Programmer Setup

A default setup file is created during installation. Only in special circumstances will this file need to be changed. Refer to appendix D, "Programmer Environment Setup," for instructions on modifying the setup parameters.

Section 4: Startup/Exit

To start up Logicmaster 90-70 software:

1. At the MS-DOS prompt, type **LM90** and press the **Enter** key. The menu of Series 90 PLCs and functions is displayed.



Note

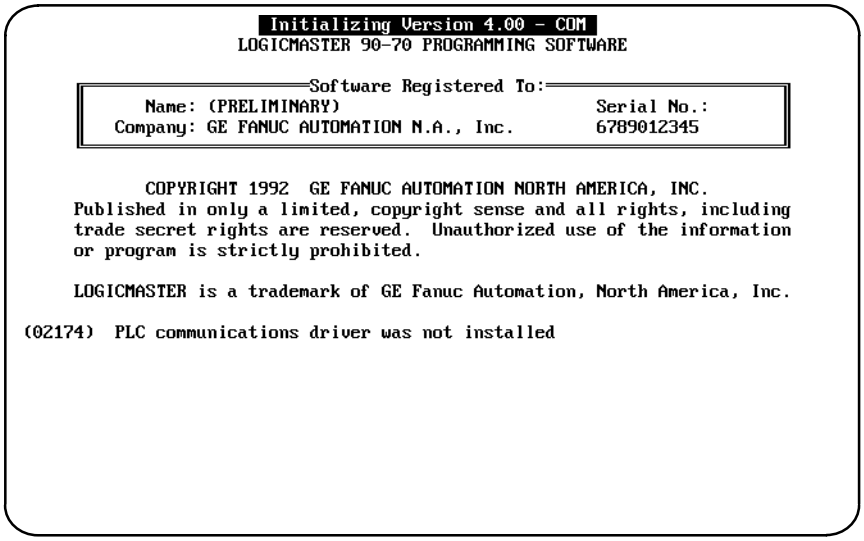
Beginning with Release 4, a teach file can be used to enter the Logicmaster 90-70 software. This entry teach file will contain the keystrokes previously taught while entering the programming or configurator software. Information on using a teach file to enter the Logicmaster 90-70 software can be found in chapter 2, section 5, *Keyboard Functions.*

2. Press the appropriate function key:
   - To select the programming software, press **Program (F1**).
   - To select the configuration software, press **Config (F2**).
   - To select the PCM configuration software, press **PCM (F3)**.
   - To select the Axis Positioning Module package, press **APM (F4)**.
   - To select operator interface utilities, press **OI (F5**).
   - To access the Logicmaster 90 utilities package, press **Utilities (F7**).
   - To access a file of MS-DOS executable commands (COMENU.PRD) outside the Logicmaster 90 software package, press **Comenu (F8**).
   - To access the Logicmaster 90 setup package, press **Setup (F9**).
   - To return to MS-DOS, press **Exit (F10)**.

3. If only one version of Logicmaster 90-70 software (either WSI or standard serial communications) is installed, it will be run automatically. If both versions are installed, the Logicmaster 90 Setup Package (F9) can be used to select the version to run. Refer to appendix D, "Programmer Environment Setup," for instructions on modifying the programmer environment setup.

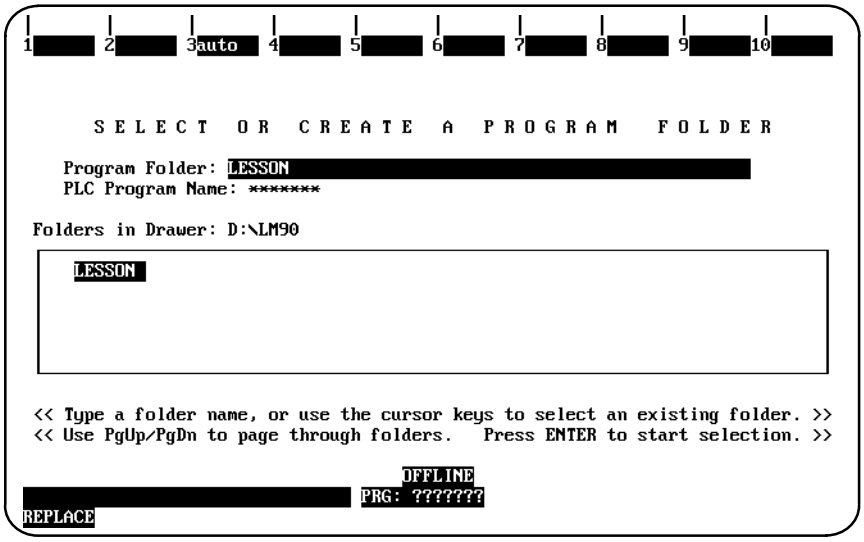
Starting the Programming or Configuration Software

To load the programming software, select Program (F1) from the menu of Series 90 PLCs and functions, shown on the previous page. To load the configuration software, select Config (F2). After selecting Program (F1) or Config (F2), the following screen appears:



When the Logicmaster 90-70 software powers up, it attempts to automatically select a program folder.

- If there is a program folder beneath the drawer last selected, whose name matches the program name in the attached PLC, that folder is selected.
- If the current directory is a program folder and its name matches the program name in the attached PLC, that folder is selected.
- If there is a program folder beneath the current directory, whose name matches the program name in the attached PLC, that folder is selected.
- If the current directory is a program folder, it is selected.
- Other wise, the initial select screen is displayed with the name of the last folder selected in the ***Folder*** field.



Note

At serial baud rates of 1200 or less, the folder cannot be automatically selected during startup. Once in the programming software, however, you may use the auto function to automatically select a folder. (Refer to the information on "Automatic Folder Selection" in chapter 8, "Program Folders.")

Enter a name of up to seven characters for the program folder. (The name is also used for the program.) After entering a name, press the **Enter** key. If you need more information about program folders, refer to chapter 8, "Program Folders".

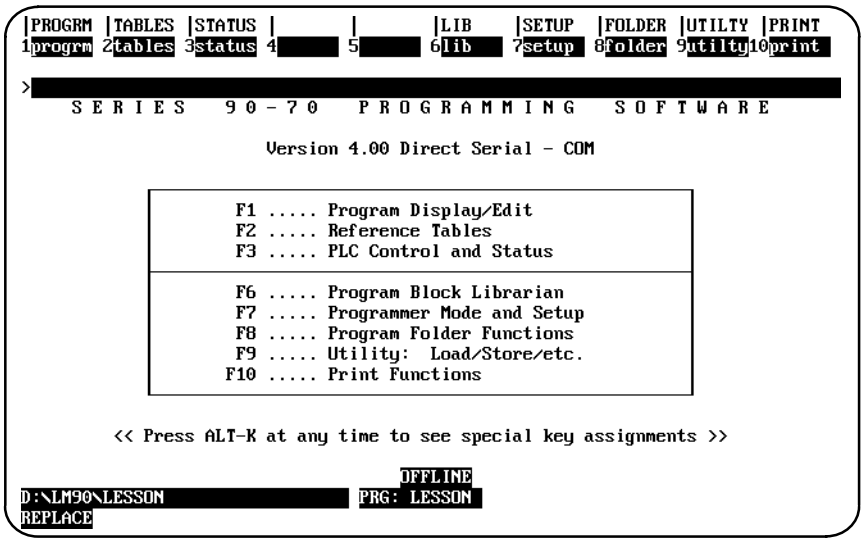
Exiting (Quitting) the Programming or Configuration Software

To exit the software at any time, press **CTRL-Break** and confirm the prompt, or repeatedly press the **Escape** key at each prompt. You should always exit the software before turning the computer off; otherwise, some changes may be lost.

If you respond to the exit prompt ("Exit Logicmaster 90 Package? (Y / N)") by entering a **1** instead of a **Y** (Yes) or **N** (No), a bookmark feature saves the current context. The next time you run the software, you will return to the same general location when you re-enter the software.

Programming Software Main Menu

If you select Program (F1) from the menu of Series 90 PLCs and functions, the Programming Software main menu shown below is displayed. This menu is used to access the primary functions of Logicmaster 90-70 programming software.



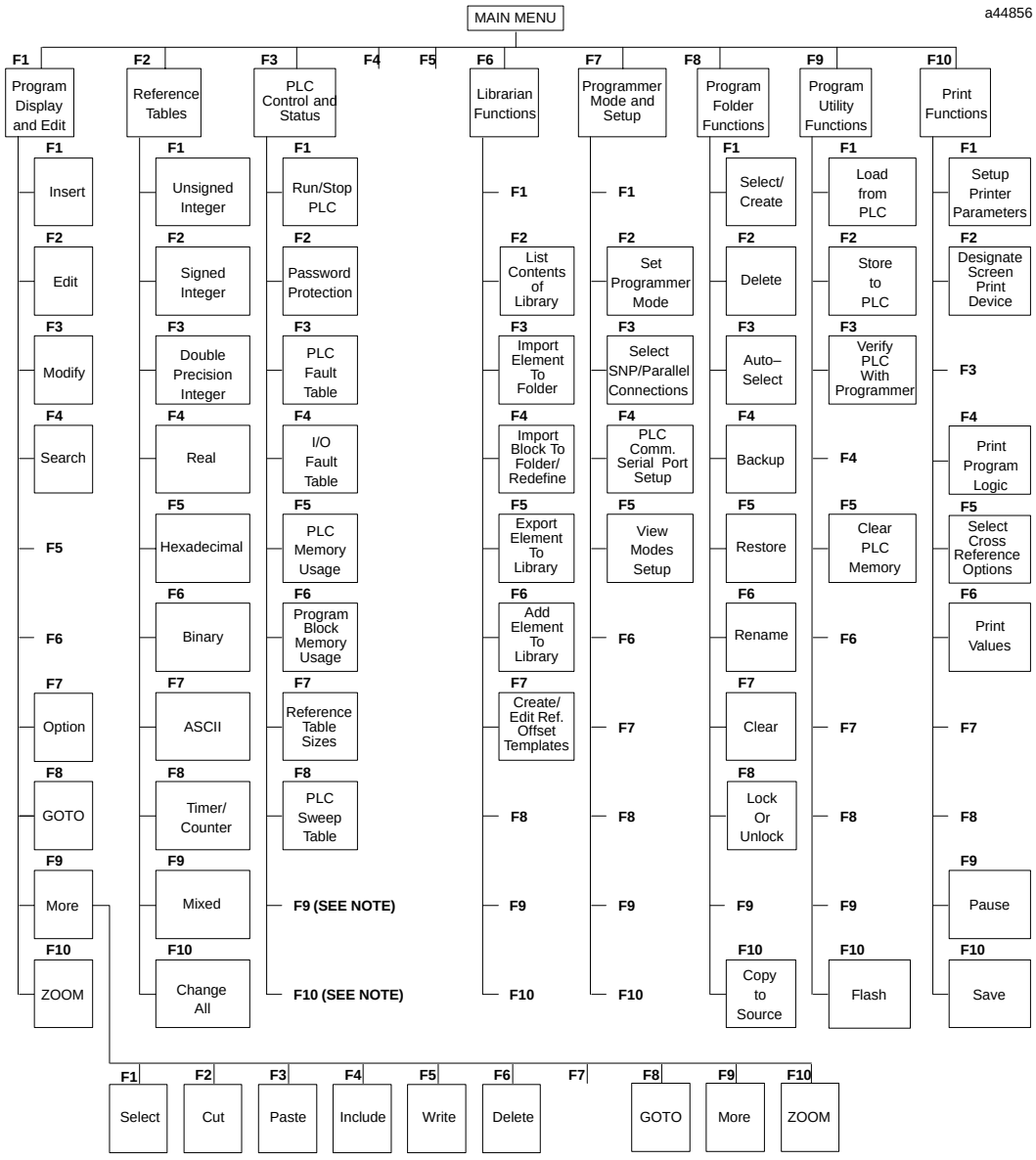
Note

For the WSI version of Logicmaster 90-70 software, **WSI** is displayed after the version number in the screen shown above. For the standard serial communications version of software, **COM** is displayed after the version number.

Function Key	Function	Description
F1	Program	Create or edit a program or monitor program logic. Chapter 3 describes the program display and explains how to create or edit a program.
F2	Tables	Display and change reference data. To select a particular reference table, enter the reference type on the command line before pressing **F2**. Chapter 4 describes monitoring data and explains how to change tables and variable data.
F3	Status	Select the status functions. These functions include displays of I/O faults and PLC faults. The memory configuration and the current PLC access level can also be viewed. Chapter 5 describes these functions.
F6	Librarian	List the contents of the library, import a block from the library, export a block to the library, add an element to the library, or create / edit reference offset templates. Chapter 6 describes these features.
F7	Setup	Display and change serial port setup and other programmer configuration. Chapter 7 explains how to use these functions.
F8	Folder	Create, select, clear, rename, delete, lock, or back up a program folder. Chapter 8 explains how to use the folder functions.
F9	Utility	Load, store, or verify a program, or clear PLC memory. Chapter 9 explains how to use the utility functions.
F10	Print	Print a program folder. Chapter 10 describes the print functions.

The function keys remain active after selecting a programming function. You can go directly from one programming function to another without returning to the main menu by simultaneously pressing the **shift key** and the desired function softkey.

The bottom of the main menu screen displays three lines of status information. Chapter 2, section 6, *Screen Format*, explains the content of the screen's status area.



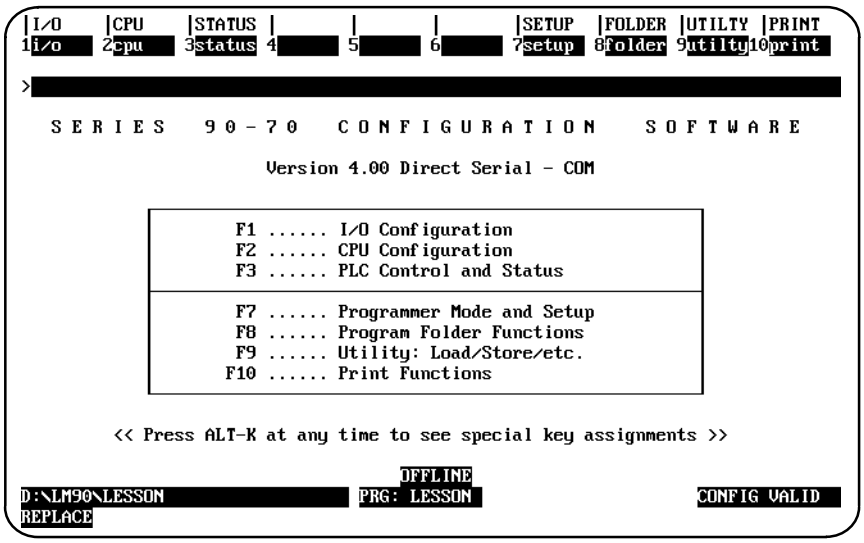
NOTE: **Press Insert (F1) and Edit (F2) to display the programming instruction menus.**
When Password Protection (F2) is pressed (PLC Control and Status functions), F9 will become the OEM softkey.

When PLC Fault Table (F3) or I/O Fault Table (F4) is pressed (PLC Control and Status functions) F9 will become the Clear softkey and F10 will become the ZOOM softkey.

Figure 2-1. Programming Software Menu Tree

Configuration Software Main Menu

If you select Configuration (F2) from the menu of Series 90 PLCs and functions, the Configuration Software main menu shown below is displayed. The menu lists the primary functions of the software. The first three menu entries are used to select PLC configuration functions. The remaining entries are used to select support functions.



Note

For the WSI version of Logicmaster 90-70 software, **WSI** is displayed after the version number in the screen shown above. For the standard serial communications version of software, **COM** is displayed after the version number.

Function Key	Function	Description
F1	I/O	I/O configuration is the process of describing to the software the content of a PLC system's rack(s) and Genius I/O busses. Chapter 11 tells how to complete I/O configuration.
F2	CPU	CPU configuration sets the operating characteristics of the CPU. Chapter 12 describes the CPU configuration.
F3	Status	The status function displays I/O faults and PLC faults. You will also use this function to display PLC information such as memory usage and to assign passwords. Chapter 5 describes these displays.
F7	Setup	The programmer setup function sets up the computer's serial ports, current operating mode, and PLC connection. Refer to chapter 7 for information on the setup function.
F8	Folder	Program folder functions are a group of file-handling utilities which you will use to create, delete, back up, and limit access to configuration and program files. Chapter 8 describes these functions.
F9	Utility	Program utilities are used to transfer information between the computer and the PLC. An additional program utility is used to clear memory in the PLC. Chapter 9 explains how to use the program utilities.
F10	Print	Print functions are used to generate configuration printouts and to set up a destination for screen prints. Chapter 10 describes these print functions.

The functions are selected using the function keys shown on the top line of the screen. You can go directly from one function to another without returning to the main menu by using the shift function keys.

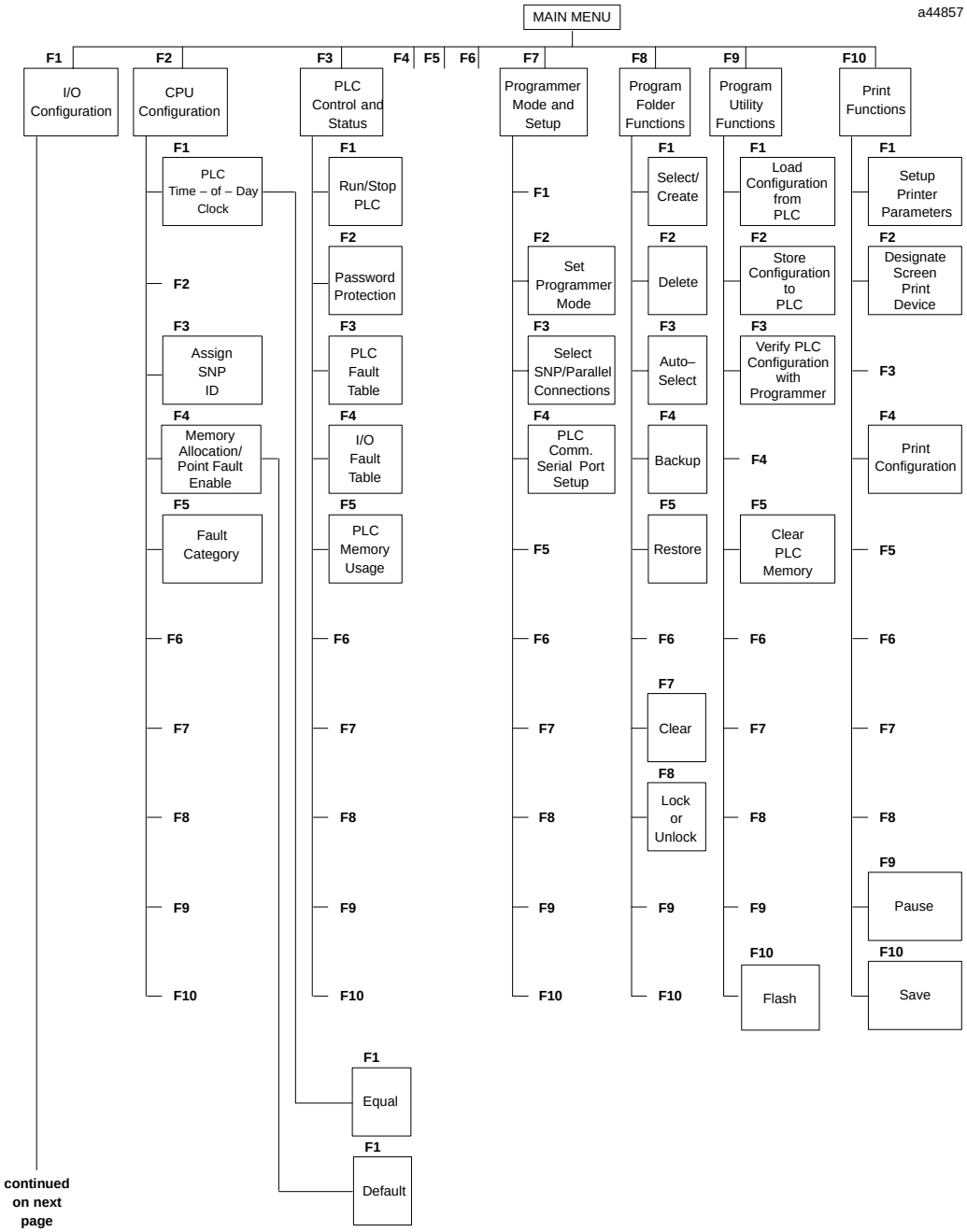


Figure 2-2. Configuration Software Menu Tree

Figure 2-2. Configuration Software Menu Tree (cont'd)

Section 5: Keyboard Functions

This section describes the keyboard functions that are active in the Logicmaster 90-70 software environment. It also describes playback functions, which can be used to assign sequences of frequently-used keystrokes to a file for simple recall later on.

Keyboards Supported

Logicmaster 90-70 programming software can be used with the 83-key or 101-key keyboard for an IBM PC personal computer, or a Workmaster, Workmaster II, or CIMSTAR I industrial computer. Other types of keyboards for the IBM PC / XT, PC / AT, or IBM-compatible computer may work with Logicmaster 90-70 software, but have not been tested. The 91-key keyboard for the Workmaster computer, developed for use with Logicmaster 6 programming software, would be difficult to use since Logicmaster 90-70 software was designed to use with standard keyboards.

Key Functions

Appendix E, *Key Functions*, lists the keyboard functions that are active in the Logicmaster 90-70 software environment. Appendix E also contains a perforated Help card which can be removed from this manual. This information may also be displayed on the programmer screen by pressing **ALT-K** to access key help.

Keystroke Macros (Teach Mode)

Logicmaster 90-70 software can be instructed to record sequences of keystrokes and play them back with a single keystroke. These sequences of keystrokes are referred to as keystroke macros or teach sequences.

A combination of keystrokes might represent a series of frequently-used functions or part of a program that you want to duplicate. An example of a simple keystroke macro would be the sequence of keystrokes needed to create the following line of logic:

The auto-next highest reference address function, described on pages 3-107 and 3-108 at the end of chapter 3, section 10, *Rung Edit*, provides another example of using a keystroke macro.

The keystrokes that make up a keystroke macro are stored in a file named KEYx.DEF, where x is a digit in the set 0 to 9 that you choose when you create the keystroke macro. This file is called a teach file; it is located in the current program folder.

Creating a Teach Sequence

Follow the steps below to create a keystroke macro:

1. Select the starting point in Logicmaster 90-70 software at which you wish your macro to begin. You must remember this starting point when you execute or play back the macro you are about to record. For example, if you are editing ladder diagram logic, you must ensure that a condition such as whether you were in **EDIT** mode when you started recording holds when you are playing back the macro.
2. It is often simplest to begin recording the macro from an easy-to-remember starting point such as the main menu, the Print menu, or the Edit Program commands. When you wish to begin recording keystrokes, press and hold the **ALT** key while pressing the **T** key. Then, select a playback file by pressing one of the key combinations between **ALT-0** and **ALT-9**. If you select a key combination that has been used previously in the current folder, the software will ask you if you want to overwrite it. Logicmaster 90-70 software will now record all the keystrokes that you make.
3. When you have completed your sequence of keystrokes, press **ALT-Q** to exit **TEACH** mode. The software will stop recording keystrokes and create a teach file.

Playing Back a Teach Sequence

Before replaying the keystroke macro, be sure that the Logicmaster 90-70 software is in the state it was in when you started recording the macro. Then, press the **ALT-digit** combination you were prompted for when you started recording. The software will rapidly execute the keystrokes you recorded as though they were entered from the keyboard.

The only keyboard input recognized during playback is ALT-A, which causes the Logicmaster 90-70 software to ask you if you want to stop the playback.

If an error condition is encountered during playback, an error message is displayed, playback is paused, and you will be prompted to continue or stop the key sequence.

Pausing the Playback of a Teach Sequence

A pause may be entered in a keystroke macro. If you are recording a sequence of keystrokes and need to pause playback to examine something on the screen, press **ALT-Z** at the point where you would like playback to pause. This may be done as many times as you like while recording a macro. A message will be displayed telling you that a user prompt key (a pause) has been recorded.

When the Logicmaster 90-70 software encounters the ALT-Z key combination during playback, it displays a prompt and waits until the space bar is pressed to continue.

Using a Teach File to Run Software from an MS-DOS Batch File

Logicmaster 90-70 software may be run using a teach file, which contains keystrokes previously taught while entering the Logicmaster 90-70 programming or configuration software packages. This feature allows **LM90** to be invoked from an MS-DOS batch file, to play back keystrokes to perform desired function(s), and to return to the batch file to execute the next command. This can be helpful when executing multiple print requests.

The keystroke macro is stored as the text file <filename>.tch. The file name must identify either the programming or configuration software package. For example, prg9070.tch could be used as the file name for the programming software, and cfg9070.tch, for the configurator software. The file extension must be **.tch**.

To begin the keystroke macro, enter the executable path, at the MS-DOS prompt, which corresponds to the version of software installed on your computer:

Software Version	Executable Path
WSIprogrammer	c:\lm90\p70\prg9070
WSIconfigurator	c:\lm90\c70\cfg9070
Standardserialcommunicationsprogrammer	c:\lm90\p70s\prg9070
Standardserialcommunicationsconfigurator	c:\lm90\c70s\cfg9070

Enter the name of the text file for this macro (e.g., prg9070.tch) and the letter **t** after the path. The **t** indicates **TEACH** mode. For example, to begin recording keystrokes to a text file named prg9070.tch, enter:

```
c:\lm90\p70\prg9070 prg9070.tch t
```

To end the teach sequence, press **ALT-Q** or **CTRL-Break** to end the teach sequence and exit the software.

To play back the keystroke macro, enter the path and teach file name, followed by the letter **p** for **PLAYBACK** mode. For example, to play back a macro for the programming software, enter:

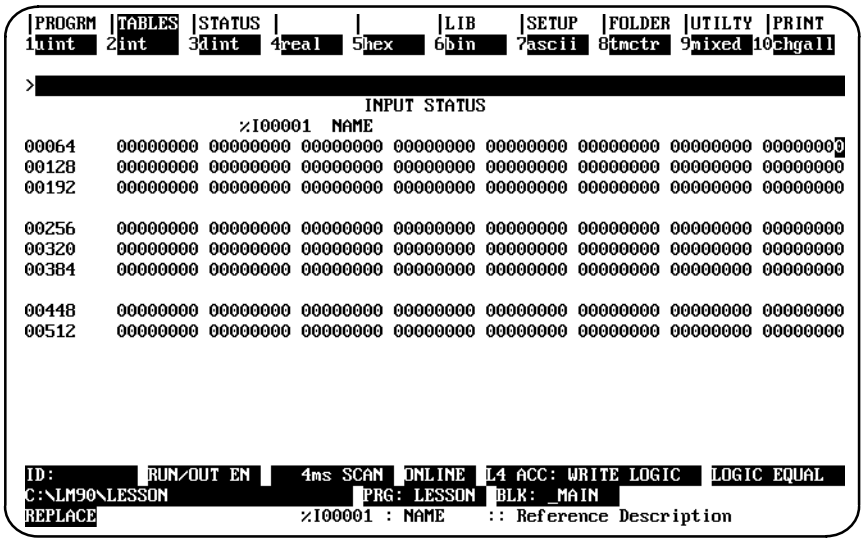
c:\lm90\p70\prg9070 prg9070.tch p or **c:\lm90\p70\prg9070 p**

To initialize the communications driver for the standard COM port version of Logicmaster 90 software, the batch file must contain the line: **c:\lm90wsil70 i** before the command to create or play back the teach file. The line: **c:\lm90\wsil70 r** must be added after the command to create or playback the teach file in order to remove the communications driver. For example:

```
c:\lm90\wsil70 i
c:\lm90\p70s\prg9070 p
c:\lm90\wsil70 r
```

Section 6: Screen Format

This is a typical bit-oriented reference table display for Logicmaster 90-70 software.



The main part of the screen shows menus, data, and other information related to the function you are currently using.

Function Key Assignments

The top two lines of the screen show the functions that are currently available. The main functions displayed in the upper line are selected by pressing the shift key with a function key, **F1** through **F10**.

The active function appears in a reverse-video block. In the following example, the active main function is reference tables.

The lower line displays the secondary functions that can be selected with that main function key active. In the example above, the display formats can be selected while the reference table function is active. These display formats are selected by pressing a function key, **F1** through **F10**, without using the shift key.

Message Line

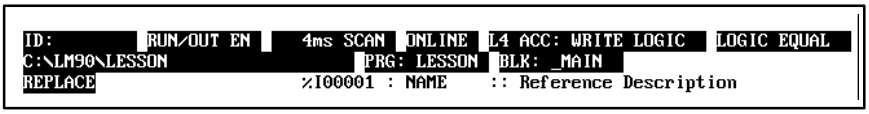
Directly under the function key area is the message line. Errors in command syntax, or those discovered while executing commands or selections, are displayed on the message line. Prompts for additional information required from the user are also displayed on the message line.

Command Line

The command line, identified by the **>** prompt, displays typed entries, such as data to be used for the table being displayed. It is also used to enter instruction mnemonics, reference addresses, values for constants, nicknames, and reference descriptions.

Status Information

The bottom three lines display information about the status of the programmer, the PLC, the program, and the keyboard. The information displayed will change depending on the programmer mode. For example:



Status Area	Description
Top line	Displays information about the attached PLC and the programmer.
Second line	Identifies the drawer, folder, and current program name. In the example above, C:\ACME\CONVEYOR is the drawer, and \CVLINE3 is the folder. The name of the current program is also CVLINE3.
Third line	Shows the status of the keyboard; whether Caps Lock, Scroll Lock or Num Lock is active, and whether the keyboard is in **REPLACE** or **INSERT** mode. For some programming functions, the third status line displays additional information, described in later sections of the manual. Items appear in the status information area only when needed.

The three lines of status information does not have to be displayed at the bottom of the screen if you want to display additional lines of logic. Use ALT-E to toggle the display of status information off and on.

PLC/Programmer Status: Definitions

The top line of the status area displays information about a PLC and about the programmer. Some of the information displayed reflects selections made using the PLC monitoring functions. For information about using these functions, please refer to chapter 5, "PLC Control and Status."

Items that may appear on this line are explained in the following table. (Items will not appear on the status lines if they are not used for the currently active function.)

Field	Description
SNP ID	The Series Ninety Protocol (SNP) identifier assigned to the PLC or Remote I/O Scanner.
PLC State	The current status of the CPU or Remote I/O Scanner: **RUN/OUT EN:** PLC running the logic program, outputs enabled. **RUN/OUT DIS:** PLC running the logic program, outputs disabled. **STOP/IOSCAN:** PLC stopped, not executing the logic program, scanning I/O. **STOP/NO IO:** PLC stopped, not executing the logic program, no I/O scan. **STOP/FAULT:** PLC stopped due to a fault; check fault tables.
Scan Time	The CPU or Remote I/O Scanner sweep time in milliseconds. This is followed by the type of the scan, which may be: **SCAN:** Each scan executed as fast as possible. **FIXED:** Constant sweep timer enabled, scan fixed to set time limit. **OVER:** Constant sweep timer enabled, scan exceeds the set time limit.
Mode	The current mode of the programmer connected to the CPU or Remote I/O Scanner: **OFFLINE:** No communications with PLC, or no PLC attached. **ONLINE:** Actively communicating with the PLC. **MONITOR:** Same as ONLINE, but programmer cannot modify the contents of the PLC.
Access Level	The password access level of the PLC: **LEVEL 4:** Change password, write logic / configuration. **LEVEL 3:** Write logic / configuration, PLC stopped. **LEVEL 2:** Write data, clear fault tables. **LEVEL 1:** Read PLC only.
Equality	This field compares the program in the PLC with the version in the folder: **LOGIC EQUAL:** Both program versions are the same. **LOGIC NOTEQ:** Program versions may be different. **BLOCK EDIT:** The PLC program is the same as that in the current program folder, the current block is being edited online and may be different in the programmer. The block can be stored to the PLC by pressing **ALT-S**.

Selecting the Programmer Operating Mode

Both the programmer and the configuration software operate in three modes: **OFFLINE**, **MONITOR**, and **ONLINE**. In **OFFLINE** mode, no data transfer takes place between the computer and the PLC. Programs and configuration data may conveniently be developed in **OFFLINE** mode, with or without the computer connected to a PLC. In **MONITOR** mode, if communications have been established between the computer and the PLC, the computer can read data from the PLC but may not transfer data to it. With communications established in **ONLINE** mode, programs and other data can be transferred between the PLC and the computer.

If you are using a Workmaster or CIMSTAR I industrial computer, you may configure the Logicmaster 90-70 software to use the keyswitch to select the operating mode. For those computers without a keyswitch, or if the keyswitch is not enabled, mode selection can be made by:

- Pressing the **ALT** and M keys simultaneously. Repeatedly pressing **ALT** and **M** switches the operating mode from **OFFLINE** to **MONITOR** to **ONLINE** and then back to **OFFLINE**.
- Going to the Programmer Setup screen **(Shift-F7)** and selecting an operating mode. For more information on using the Programmer Setup screen to select the operating mode, refer to chapter 7, section 2, "Programmer Operating Mode."

Chapter 3 Program Editing

This chapter describes the program edit features of Logicmaster 90-70 programming software. Program display and editing may be protected by passwords. If your system has been set up to use passwords and is in **ONLINE** mode, you may have to enter a password in order to use the functions described in this chapter. Chapter 3 contains the following sections:

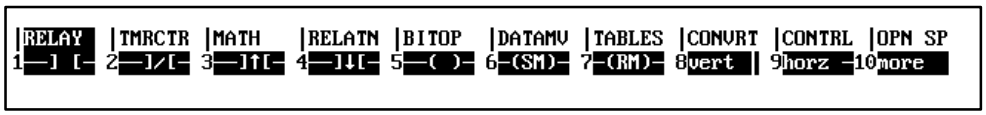
Section	Title	Description	Page
1	Ladder Logic Program Elements	Summarizes the Series 90-70 instruction set. Refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265, for additional information on these instructions.	3-2
2	Program Format	Describes the format of a ladder logic rung.	3-23
3	Program Entry	Describes how to insert logic elements and functions in a program and three ways to exit from a rung.	3-27
4	Program Annotation	Describes program annotation and how to enter nicknames and reference descriptions.	3-34
5	Variable Declaration Table	Describes how to enter annotation using the variable declaration table.	3-37
6	Rung Comments	Describes how to insert rung comments.	3-51
7	Changing the Display Mode	Describes how to show reference description information at each symbol or reference address in the program.	3-55
8	Program Blocks, External Blocks, and Interrupts	Describes how to use program block declarations and interrupt declarations in a main program block.	3-60
9	Multiple Programs: Program Declarations	Describes how to set priorities for execution of standalone C programs and how to specify local data references for standalone C programs.	3-75
10	Parameterized Subroutines	Describes how to use parameterized subroutines in a program.	3-83
11	Rung Edit	Describes how to modify an existing program by adding rungs, deleting rungs, and editing rungs. This section also describes how to select, cut, paste, include, and write rungs or declarations, and how to use the open space functions to open element spaces in the rung.	3-102
12	Editor Options	Describes options in the program editor, including multiple coil use, automatic insertion of references, and how to automatically create unbound references.	3-127
13	Search Function	Describes how to search for a reference or instruction using the search function.	3-142
14	Online Editing / Monitoring	Describes how to make changes to or debug a program while the program is running.	3-148

Note

When the program editor is entered, the Logicmaster 90-70 software checks the amount of space on the disk containing the program folder. If insufficient space exists to support changes to the program, the folder is temporarily locked. Program logic may be viewed, but not changed. If space is freed up on the disk using MS-DOS, the lock state is automatically cleared when you run Logicmaster 90-70 software.

Section 1: Ladder Logic Program Elements

The tables in this section summarize the programming instructions available for the Series 90-70 PLC. You can access all of these instructions from either the **Insert (F1)** or **Edit (F2)** function by selecting one of the main functions displayed in the upper line shown below. Press the **Shift** key and the **function** key for the function you wish to select. For example, to select one of the math functions, first press **Shift-F3** to display the math functions listed in table 3-3 in this section. Then, select the appropriate math function by pressing the **function** key for the particular function.



These function keys provide access to the instructions required to edit ladder diagram rungs:

Function Key	Function	Description	Page
F1	Relay Functions	Select contacts, coils, and links in ladder logic rungs.	3-3
F2	Timer / Counter Functions	Select on-delay stopwatch, off-delay, and on-delay timers; up counters; and down counters.	3-5
F3	Math Functions	Select addition, subtraction, multiplication, division, modulo division, square root, absolute value, trigonometric, logarithmic / exponential, and radian conversion functions.	3-6
F4	Relational Functions	Select functions which can compare two numbers: equal, not equal, greater than, greater than or equal, less than, less than or equal, or compare.	3-8
F5	Bit Operation Functions	Select functions which perform comparison and move operations on bit strings: Logical AND, OR, and exclusive OR; logical invert; shift left or right; rotate left or right; bit test, bit set, bit clear, and bit position; and masked compare.	3-9
F6	Data Move Functions	Select basic data move functions including move, block move, block clear, shift register, bit sequencer, swap, and communications request. VME functions include read, write, read / modify / write, test / set, configuration read, configuration write, data initialization, data initialization of a COMMREQ, and data initialization of ASCII data.	3-10
F7	Table Functions	Select functions to enter values into tables, copy values out of tables, sort arrays, and copy from one array to another. Search for all array values which are equal, not equal, greater than, less than, greater than or equal, or less than or equal to a specified value.	3-12
F8	Conversion Functions	Select functions to convert values from one data type to another.	3-13
F9	Control Functions	Limit program execution, call a program, enter a comment in a program, or change how the CPU executes a program.	3-14

Appendix E lists the complete mnemonics for each programming instruction. Please refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265, for additional information on each instruction.

Table 3-1. Relay Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Relay Functions (Shift-F1) displays these function key assignments:				
F1	–| |–	&NOCON	Normally Open Contact	A normally open contact passes power if the associate reference is ON.
F2	–| / |–	&NCCON	Normally Closed Contact	A normally closed contact passes power if the associated reference is OFF.
F3	–| ↑ |–	&PCON	Positive Transition Contact	A positive transition contact passes power if the associated reference is ON and was OFF for the previous scan.
F4	–| ↓ |–	&NCON	Negative Transition Contact	A negative transition contact passes power if the associated reference is OFF and was ON for the previous scan.
F5	–( )–	&NOCOI	Normally Open Coil	The associated reference is set ON if the coil receives power.
F6	–(SM)–	&SM	Retentive SET Coil	The associated reference is set ON if the coil receives power. The reference remains set until reset by an –(RM)– coil. Its state is retained through power failure and **STOP-TO-RUN** transition.
F7	–(RM)–	&RM	Retentive RESET Coil	The associated discrete reference is reset OFF if the coil receives power. The reference remains reset until set by an –(SM)– coil. Its state is retained through power failure and **STOP-TO-RUN** transition.
F8	vert |	&VE	Vertical Link	A vertical link with no contact function or reference.
F9	horz –	&HO	Horizontal Link	A shunt; also acts as a delete function.
F10	more			Additional relay functions you can select.

Table 3-1. Relay Functions (Continued)

Key	Instruction	Mnemonic	Function	Description
Pressing More (F10) displays these additional relay function key assignments:				
F1	——<+>	&COILC	Continuation Coil	If power to the coil is ON, the continuation coil sets the next continuation contact ON. If power is OFF, the continuation coil sets the next continuation contact OFF.
F2	<+>——	&CONC	Continuation Contact	The continuation contact passes power to the right if the preceding continuation coil is set ON.
F3	–(/ M)–	&NCM	Negated Retentive Coil	The associated discrete reference is set ON if the function does not receive power. The state is retained through power failure and **STOP-TO-RUN** transition.
F4	–(/)–	&NCCOI	Negated Coil	The associated discrete reference is set ON if the coil does not receive power.
F5	–(M)–	&NOM	Retentive Coil	The associated discrete reference is set ON if the coil receives power. The state is retained through power failure and **STOP-TO-RUN** transition.
F6	–(S)–	&SL	SET Coil	The associated discrete reference is set ON if the coil receives power. It remains set until reset by an –(R)– coil.
F7	–(R)–	&RL	RESET Coil	The associated discrete reference is set OFF if the coil receives power. It remains reset until set by an –(S)– coil.
F8	–(↑)–	&PCOI	Positive Transition Coil	If the associated discrete reference is OFF when the coil receives power, the reference will be set ON for one logic scan. This coil can be used as a one-shot.
F9	–(↓)–	&NCOI	Negative Transition Coil	If the associated discrete reference is ON and the coil is not receiving power, the reference will be set ON for one logic scan.
F10	more			Additional relay functions you can select.
Pressing More (F10) displays these additional relay function key assignments:				
F1	–| fault |–	&FA	Fault Contact	The fault contact passes power if the associated discrete point or rack / slot / module has a fault.
F2	–| noflt |–	&NOF	No Fault Contact	The no fault contact passes power if the associated discrete point or rack / slot / module does not have a fault.
F4	–| hialr |–	&HI	High Alarm Contact	The high alarm contact passes power if the associated analog point has a high alarm fault.
F5	–| loalr |–	&LO	Low Alarm Contact	The low alarm contact passes power if the associated analog point has a low alarm fault.
F10	more			Return to the first level of relay functions.

Table 3-2. Timer and Counter Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Timer/Counter Functions (Shift-F2) displays these function key assignments:				
F1	ondtr	&ON	On-Delay Stopwatch Timer	The ONDTR function accumulates time while receiving power. It passes power if the current value exceeds the preset value. The current value is reset to zero when the reset (R) input receives power.
F2	ofdt	&OF	Off-Delay Timer	The OFDT function accumulates time while not receiving power. It passes power until the accumulated value reaches the preset value.
F3	tmr	&TM	On-Delay Timer	The current value of the TMR function is set to zero when there is no power flow. The function accumulates time while receiving power, and passes power if the current value is greater than or equal to a preset value.
F4	upctr	&UP	Up Counter	The UPCTR function increments by 1 each time the function receives transitional power. If the current value stored in the counter is greater than or equal to a preset value, the function passes power. The R input is used to reset the counter to zero.
F5	dnctr	&DN	Down Counter	The DNCTR function counts down from a preset value every time the function receives transitional power. If the current value of the counter is zero, the function passes power. The R input is used to set the current value to equal the preset value.
F10	tmbase			Select the time base of a timer. Time may be counted in seconds, tenths of seconds, hundredths of seconds, or thousandths of seconds.
Pressing Timebase (F10) displays these function key assignments:				
F1	1.0s	_SEC	1.0 second	Time is counted in seconds.
F2	0.1s	_TEN	0.1 second	Time is counted in tenths of seconds.
F3	0.01s	_HUN	0.01 second	Time is counted in hundredths of seconds.
F4	0.001s	_TH	0.001 second	Time is counted in thousandths of seconds.
F10	instrs			Return to the timer and counter functions.

Table 3-3. Math Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Math Functions (Shift-F3) displays these function key assignments:				
F1	add	&AD	Addition	Add two numbers. The ADD function passes power if the operation does not result in an overflow.
F2	sub	&SUB	Subtraction	Subtract one number from another. The SUB function passes power if the operation does not result in an overflow.
F3	mul	&MUL	Multiplication	Multiply two numbers. The MUL function passes power if the operation does not result in an overflow.
F4	div	&DIV	Division	Divide one number by another, yielding a quotient. The DIV function passes power if the operation does not result in an overflow and if there is no attempt to divide by zero.
F5	mod	&MOD	Modulo Division	Divide one number by another, yielding a remainder. The MOD function passes power unless there is an attempt to divide by zero.
F6	sqrt	&SQ	Square Root	Find the square root of an integer value. When the function receives power flow, the value of the output Q is set to the square root of the input IN.
F7	abs	&ABS	Absolute Value	Find the absolute value of an integer, double precision integer, or real value. When the function receives power flow, it places the absolute value of input IN in output Q.
F9	more			Additional math functions you can select.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table on pages 3-15 and following.

Table 3-3. Math Functions (Continued)

Key	Instruction	Mnemonic	Function	Description
Pressing More (F9) displays these additional math function key assignments:				
F1	sin	&SIN	Trigonometric Sine	Find the trigonometric sine of the input. When the function receives power flow, it computes the sine of IN, whose units are radians, and stores the result in output Q.
F2	cos	&COS	Trigonometric Cosine	Find the trigonometric cosine of the input. When the function receives power flow, it computes the cosine of IN, whose units are radians, and stores the result in output Q.
F3	tan	&TAN	Trigonometric Tangent	Find the trigonometric tangent of the input. When the function receives power flow, it computes the tangent of IN, whose units are radians, and stores the result in output Q.
F4	asin	&ASIN	Inverse Sine	Find the inverse sine of the input. When the function receives power flow, it computes the inverse sine of IN and stores the result in output Q, whose units are radians.
F5	acos	&ACOS	Inverse Cosine	Find the inverse cosine of the input. When the function receives power flow, it computes the inverse cosine of IN and stores the result in output Q, whose units are radians.
F6	atan	&ATAN	Inverse Tangent	Find the inverse tangent of the input. When the function receives power flow, it computes the inverse tangent of IN and stores the result in output Q, whose units are radians.
F7	deg	&DEG	Convert to Degrees	When the function receives power flow, a RAD_TO_DEG conversion is performed on the real value in input IN and the result is placed in output Q.
F8	rad	&RAD	Convert to Radians	When the function receives power flow, a DEG_TO_RAD conversion is performed on the real value in input IN and the result is placed in output Q.
F9	more			Additional math functions you can select.

Table 3-3. Math Functions (Continued)

Key	Instruction	Mnemonic	Function	Description
Pressing More (F9) displays these additional math function key assignments:				
F1	log 10	&LOG	Base 10 Logarithm	When the function receives power flow, it finds the base 10 logarithm of the real value in input IN and places the result in output Q.
F2	ln	&LN	Natural Logarithm	When the function receives power flow, it finds the natural logarithm of the real value in input IN and places the result in output Q.
F3	exp	&EXP	Power of e	When the function receives power flow, ***e*** is raised to the power specified by IN and the result is placed in Q.
F4	expt	&EXPT	Power of X	When the function receives power flow, ***X*** is raised to the power specified by IN and the result is placed in Q.
F9	more			Return to the first level of math functions.

Table 3-4. Relational Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Relational Functions (Shift-F4) displays these function key assignments:				
F1	eq	&EQ	Equal	Test for equality between two numbers. The function passes power if the two inputs are equal.
F2	ne	&NE	Not Equal	Test for non-equality between two numbers. The NE function passes power if the inputs are not equal.
F3	gt	&GT	Greater Than	Test for one number greater than another. The GT function passes power if the first parameter is greater than the second parameter.
F4	ge	&GE	Greater Than or Equal To	Test for one number greater than or equal to another. The GE function passes power if the first parameter is greater than or equal to the second parameter.
F5	lt	&LT	Less Than	Test for one number less than another. The LT function passes power if the first parameter is less than the second parameter.
F6	le	&LE	Less Than or Equal To	Test for one number less than or equal to another. The LE function passes power if the first parameter is less than or equal to the second parameter.
F7	cmp	&CM	Compare	Compare two numbers and determine if one is less than, equal to, or greater than the other number.
F8	range	&RANG	Range	Test the input value against a range of two numbers.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.

Table 3-5. Bit Operation Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Bit Operation Functions (Shift-F5) displays these function key assignments:				
F1	and	&AN	Logical AND	Logical AND of two bit strings.
F2	or	&OR	Logical OR	Logical OR of two bit strings.
F3	xor	&XO	Logical Exclusive OR	Logical Exclusive OR of two bit strings.
F4	not	&NOT	Logical Invert	Logical inversion of a bit string.
F5	shl	&SHL	Shift Left	Shift a bit string left.
F6	shr	&SHR	Shift Right	Shift a bit string right.
F7	rol	&ROL	Rotate Left	Rotate a bit string left.
F8	ror	&ROR	Rotate Right	Rotate a bit string right.
F9	more			Additional bit operation functions you can select.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.
Pressing More (F9) displays these additional bit operation function key assignments:				
F1	bittst	&BT	Bit Test	Test a bit within a bit string.
F2	bitset	&BS	Bit Set	Set one bit within a string to true.
F3	bitclr	&BCL	Bit Clear	Set one bit within a string to false.
F4	bitpos	&BP	Bit Position	Locate a bit set to true within a bit string.
F5	mkcomp	&MCM	Masked Compare	Perform a masked compare of two arrays.
F9	more			Return to the first level of bit operation functions.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.

Table 3-6. Data Move Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Data Move Functions (Shift-F6) displays these function key assignments:				
F1	move	&MOV	Move	Move one or more bits of data within PLC memory.
F2	blkmov	&BLKM	Block Move	Move a block of up to 7 constants to a PLC memory.
F3	blkclr	&BLKC	Block Clear	Clear (0) one or more bytes / words of PLC memory.
F4	shfreg	&SHF	Shift Register	Shift one or more words or bits of data through a block of PLC memory.
F5	bitseq	&BI	Bit Sequencer	Sequence a 1 through a group of bits in PLC memory.
F6	swap	&SW	Swap	Swap two types of data within a word, or two words within a double word.
F7	comreq	&COMMR	Communication Request	Send a communications request to a smart module in the PLC.
F9	more			Additional data move functions you can select.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.
Pressing More (F9) displays these additional data move function key assignments:				
F1	vme rd	&VMERD	VME Read	Read data from a third-party VME board at a specified VME address.
F2	vme wr	&VMEW	VME Write	Write data to a third-party VME board at a specified VME address.
F3	vme rmw	&VMERM	VME Read / Modify / Write	Update a data element on a third-party VME board using the read / modify / write cycle on the VME bus.
F4	vme ts	&VMET	VME Test and Set	Handle semaphores located on third-party VME boards.
F5	cfgrd	&CFGRD	VME Configuration Read	Read the configuration for a VME module.
F6	cfgwr	&CFGWRT	VME Configuration Write	Write the configuration to a VME module.
F9	more			Additional data move functions you can select.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.

Table 3-6. Data Move Functions (Continued)

Key	Instruction	Mnemonic	Function	Description
Pressing More (F9) displays these additional data move function key assignments:				
F1	dinit	&DINI	Data Initialization	Copy a block of constant data to a reference range.
F2	dcomm	&DCO	Data Initialization of a COMMREQ	Initialize a COMMREQ function with a block of constant data.
F4	dasc	&DA	Data Initialization of ASCII Data	Copy a block of constant ASCII text to a reference range.
F5	dlan	&DL	Data Initialization of DLAN Interface Module	Copy a block of constant data to a reference range.
F9	more			Additional data move functions you can select.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and 3-16.

Table 3-7. Data Table Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Data Table Functions (Shift-F7) displays these function key assignments:				
F1	tblrd	&TBLR	Table Read	Increment the pointer by 1, and then read the entry currently being pointed to in the table.
F2	tblwr	&TBLW	Table Write	Increment the pointer by 1, and then write into the location currently being pointed to in the table.
F3	liford	&LIFOR	LIFO Read	Remove the entry at the pointer location, and decrement the pointer by 1.
F4	lifowr	&LIFOW	LIFO Write	Increment the pointer by 1, and then add an entry above the pointer location.
F5	fiford	&FIFOR	FIFO Read	Remove the first entry from the table.
F6	fifowr	&FIFOW	FIFO Write	Increment the pointer by 1, and then add an entry above the pointer location.
F7	sort	&SORT	Sort	Sort an array into ascending order.
F8	arrmov	&AR	Array Move	Copy a specified number of data elements from a source array to a destination array.
F9	more			Additional data table functions you can select.
F10	types			Specify the data structure of the entries in the table. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and following.
Pressing More (F9) displays these additional data table function key assignments:				
F1	srh eq	&SRCHE	Search Equal	Search array for values equal to a specified value.
F2	srh ne	&SRCHN	Search Not Equal	Search array for values not equal to a specified value.
F3	srh gt	&SRCHGT	Search Greater Than	Search array for values greater than a specified value.
F4	srh ge	&SRCHGE	Search Greater Than or Equal	Search array for values greater than or equal to a specified value.
F5	srh lt	&SRCHLT	Search Less Than	Search array for values less than a specified value.
F6	srh le	&SRCHLE	Search Less Than or Equal	Search array for values less than or equal to a specified value.
F7	arrrng	&ARRANG	Array Range	Test an input value against two arrays of delimiters.
F9	more			Return to the first level of data table functions.
F10	types			Select a data type for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and following.

Table 3-8. Conversion Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Conversion Functions (Shift-F8) displays these function key assignments:				
F3	[→]bcd-4	&TO_BCD4	Convert to BCD-4	Convert a value to 4-digit BCD format. The [→] BCD-4 function passes power unless the number to be converted is out of range (greater than 9999), and no conversion is performed.
F4	[→]bcd-8	&TO_BCD8	Convert to BCD-8	Convert a value to 8-digit BCD format. The [→] BCD-8 function passes power unless the number to be converted is out of range (greater than 99,999,999), and no conversion is performed.
F5	[→]uint	&UINT &TO UINT	Convert to UINT	Convert a value to unsigned integer format. The [→]UINT function passes power unless the number to be converted is out of range (0 to +65,535), and no conversion is performed.
F6	[→]int	&TO_INT	Convert to INT	Convert a value to signed integer format. The [→] INT function passes power unless the number to be converted is out of range (–32,768 to +32,767), and no conversion is performed.
F7	[→t]dint	&DINT &TO DINT	Convert to DINT	Convert a value to double precision integer format. The [→] DINT function passes power unless the number to be converted is out of range (–2,147,483,648 to +2,147,483,647), and no conversion is performed.
F8	[→]real	&REAL &TOREAL	Convert to Real	Convert a value to real value format. The [→] REAL function passes power unless the number to be converted is out of range (±1.401298E–45 to ±3.402823E+38), and no conversion is performed.
F9	more			Additional conversion functions you can select.
F10	types			Select the type of data for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and following.
Pressing More (F9) displays these additional conversion function key assignments:				
F1	[→][→]int	&TRINT	Truncate to Integer	Truncate to a 16-bit signed number. The range is –32,768 to +32,767.
F2	[→][→]dint	&TRDINT	Truncate to Double Precision Integer	Truncate to a 32-bit signed number. The range is –2,147,483,648 to +2,147,483,647.
F9	more			Return to the first level of conversion functions.
F10	types			Select the type of data for the function. Pressing **Types** (**F10**) displays the function keys described in table 3-10 on pages 3-15 and following.

Table 3-9. Control Functions

Key	Instruction	Mnemonic	Function	Description
Selecting Control Functions (Shift-F9) displays these function key assignments:				
F1	call	&CA	Call	Cause a program execution to go to a specified program block or external block. The CALL function always passes power.
F2	do io	&DO	Do I/O	Service a specified range of inputs or outputs immediately (all inputs or outputs on a module will be serviced if any addresses on that module are included in the function – partial I/O module updates are not performed). Optionally, a copy of the scanned I/O can be placed in internal memory.
F3	sus io	&SUS	Suspend I/O	Suspend all normal I/O updates except those specified by the Do I/O instructions. The SUSIO function passes power whenever power is received.
F4	mcr	&MCR	Master Control Relay	Start a master control relay range. An MCR causes all rungs between the MCR and its subsequent ENDMCR to be executed with no power flow. There can be nothing after an MCR in a rung.
F5	endmcr	&ENDMCR	End Master Control Relay	End a Master Control Relay range. There can be nothing after an ENDMCR in the rung.
F6	jump	&JUMP	Jump	Jump to a specified location indicated by LABEL in the logic.
F7	label	&LABEL	Label	The target location of a JUMP instruction.
F8	commnt	&COMME	Comment	A rung explanation. After programming the instruction, the text can be typed in by zooming into the instruction.
F9	svcreq	&SV	Service Request	A special PLC service function. This function passes power if power is received and the function executes properly.
F10	more			Additional control functions you can select.
Pressing More (F10) displays these additional control function key assignments:				
F1	pidisa	&PIDIS	ISA Algorithm	Select the standard ISA PID algorithm.
F2	pidind	&PIDIN	Independent Algorithm	Select the non-interacting independent PID algorithm.
F3 F4 F5	for endfor exit	&FOR &ENDFOR &EXIT	Start FOR loop. End FOR loop. Exit FOR loop.	The FOR, END_FOR, and EXIT instructions enable you to repeat rung logic a specified number of times while varying the value of the FOR INDEX VAR in the loop.
F7	sfcres	&SFC	SFC Reset	Reset the SFC topology and, if the OVR input is active, clear all overrides.
F10	more			Return to the first level of control functions.

Table 3-10. Data Types

Key	Instruction	Mnemonic	Function	Description
Selecting Data Types (F10) displays these function key assignments:				
F1	bit	_BI	Bit	A Bit data type is used with instructions which operate on bit strings that are not multiples of 16 bits, or whose reference address is not on a byte boundary (e.g., MOV or SHFREG).
F2	byte	_BY	Byte	A Byte has an 8-bit value.
F3	word	_W	Word	A Word data type uses 16 consecutive bits of data memory; but, instead of the bits in the data location representing a number, the bits are independent of each other. Each bit represents its own binary state (1 or 0), and the bits are not looked at together to represent an integer number. The valid range of word values is 0 to +65,535.
F4	dword	_DW	Double Word	A Double Word data type has the same characteristics as a single word data type, except that it uses 32 consecutive bits in data memory instead of only 16 bits.
F5	uint	_UI	Unsigned Integer	Unsigned integers use 16-bit memory data locations. They have a valid range of 0 to +65,535 (FFFF hex).
F6	int	_INT	Signed Integer	Signed integers use 16-bit memory data locations, and are represented in 2's complement notation. The valid range of an INT data type is –32,768 to +32,767.
F7	dint	_DI	Double Precision Integer	Double precision integers are stored in 32-bit data memory locations (actually two consecutive 16-bit memory locations) and are always signed values. (Bit 32 is the sign bit.) The valid range of a DINT data type is –2,147,483,648 to +2,147,483,867.
F8	real	_REAL	Floating-Point	Real numbers use 32 consecutive bits (actually two consecutive 16-bit memory locations). The range of numbers that can be stored in this format is from ±1.401298E–45 to ±3.402823E+38.
F9	more			Additional data types you can select.
F10	instrs			Return to the functions.

Table 3-10. Data Types (Continued)

Key	Instruction	Mnemonic	Function	Description
Pressing More (F9) displays these additional control function key assignments:				
F1	bcd-4	_BCD4	Four-Digit Binary Coded Decimal	Four-digit BCD numbers use 16-bit data memory locations. Each BCD digit uses four bits and can represent numbers between 0 and 9. This BCD coding of the 16 bits has a legal value range of 0 to 9,999.
F2	bcd-8	_BCD8	Eight-Digit Binary Coded Decimal	Eight-digit BCD numbers use 16-bit data memory locations (32 consecutive bits). Each BCD digit uses four bits per digit to represent numbers between 0 and 9. The complete valid range of the 8-digit BCD data type is 0 to 99,999,999.
F3	mixed	_MIXED	Mixed	A Mixed data type is available only with the MUL and DIV functions. The MUL function takes two integer inputs and produces a double integer result. The DIV function takes a double integer dividend and an integer divisor to produce an integer result.
F9	more			Return to the first level of data types.
F10	instrs			Return to the functions displayed.

Data Zoom

The data zoom feature supports the PID_ISA or PID_IND function by providing a display window that expands the parameters of the function block and displays them in real time with labels in a format consistent with their use. For example, a word of data may contain several boolean flags. Each flag is labeled and displayed separately. The boolean inputs and outputs to the function are also displayed.

The data zoom feature is available in either **ONLINE** or **OFFLINE** mode. In **ONLINE** mode when the program folder is identical to the PLC, changes made to values are only stored to the PLC. Real-time updates are maintained within the data zoom window. In **OFFLINE** mode, changes made to values are only stored to disk.

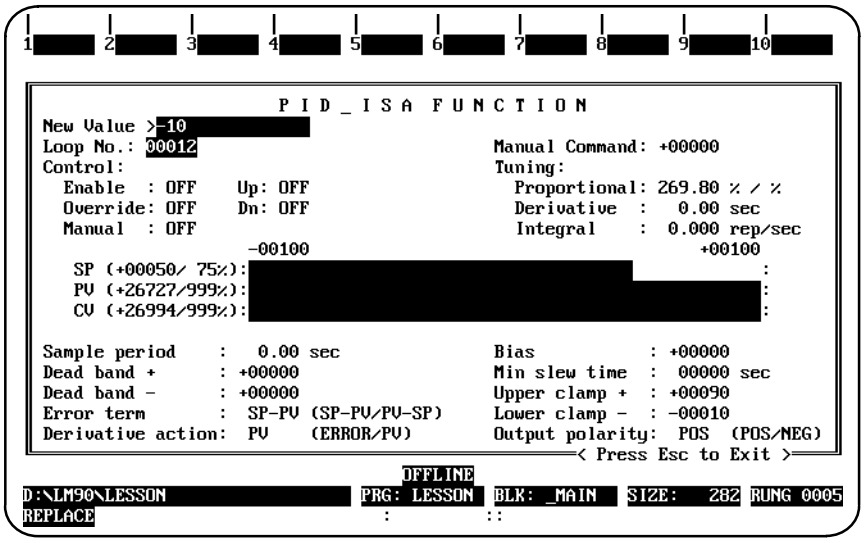
Note

If you try to write-protect a floppy disk while the Data Zoom screen is displayed, any changes made on the Data Zoom screen will be lost when you exit the screen.

Using Data Zoom with the PID Function

The data zoom feature is only available in the program editor. To use this feature:

1. Position the cursor within a PID function block and press **Zoom (F10)**. The following screen shows an example screen for the PID_ISA function.



2. The PID function is displayed as a window, with the cursor positioned on the first field whose value can be changed. Use the arrow keys to cursor to another field.

   Each field in the window is displayed in a format consistent with its usage in the function. In the example above, ***Loop No.*** indicates the number this PID is within a loop structure and is, therefore, displayed as a signed integer. ***Min Slew Time*** is a timing parameter displayed in seconds. Fixed point numbers, like those displayed in the ***Sample Period*** field, are truncated upon entry.

While the data zoom window is displayed, the function softkeys normally displayed at the top of the screen will be blank.

3. The ***New Value*** field functions like a command line. To change the value of any field (provided that field can be changed), use the arrow keys to highlight the field, enter a new value in the ***New Value*** field, and press the **Enter** key. The value of the field will be changed when the **Enter** key is pressed. You can also use the **Tab** key to change the value of a field.

4. Most field values associated with explicit parameters can be changed. The software will not allow you to highlight those fields whose values cannot be changed.

   In the PID function, the ***CV***, ***PV***, and ***Enable*** fields cannot be changed. The following table lists the formulas used to compute the percentages in these fields.

Parameter	Formula
SP	Percentage = (quantity – min value) / (max value – min value), where quantity is the current value of SP. Using this formula with the values displayed on the Data Zoom screen shown on the previous page results in a value of 75% for SP: SP = [50 – (–100)] / [+100 – (–100)] = 150 / 200 = .75 or 75%
PV	Percentage = (quantity – min value) / (max value – min value), where quantity is the current value of PV. Using this formula with the values displayed on the Data Zoom screen shown on the previous page results in a value of 50% for PV: PV = 0 – (–100)] / [+100 – (–100)] = 100 / 200 = .50 or 50%
CV	Percentage = (CV – lower clamp) / (upper clamp – lower clamp). Using this formula with the values displayed on the Data Zoom screen shown on the previous page results in a value of 10% for CV: CV = 0 – (–10)] / [+90 – (–10)] = 10 / 100 = .10 or 10%

   Percentages are calculated to the nearest 1% on the screen. Percentages less than zero are set to 0%. Percentages greater than 999 are set to 999%. The bar will display up to 100%.

   Whenever a bar graph is displayed in data zoom, minimum and maximum scaling values will also need to be displayed. For the PID function, the recommended default minimum and maximum values for the SP and PV bars are –32,000 and +32,000. The minimum and maximum scaling values for the CV bar are the lower and upper clamp values. In the screen shown above, the –100 and +100 displayed immediately above the bar graphs correspond to the minimum and maximum SP and PV scaling values.

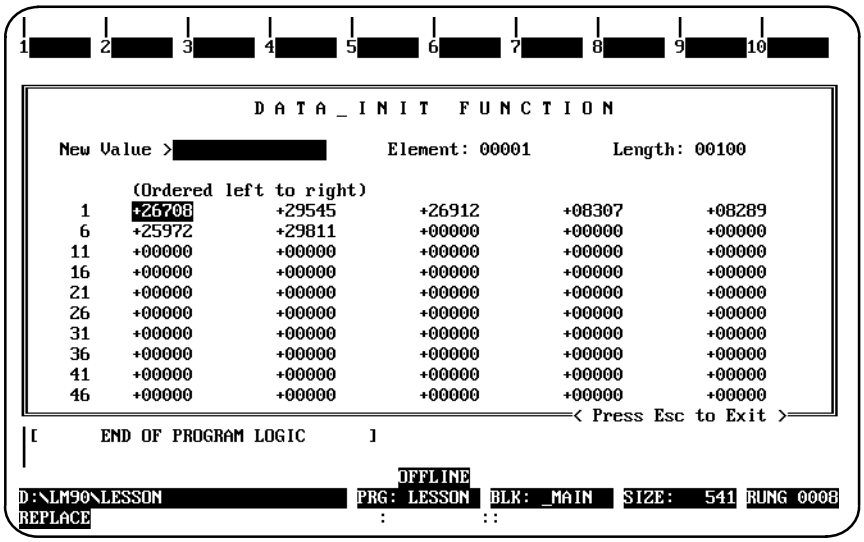
5. Press the **Escape** key to exit the data zoom window and return to your original position within the editor before the data zoom feature was begun.

For more information on the PID function and its parameters, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

Using Data Zoom with the DATA_INIT Function

In addition to the PID function described on the preceding pages, the data zoom feature can also be used with the data initialization functions. For more information on the data initialization functions, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

When you press **Zoom (F10)** to zoom into the DATA_INIT_type function block, a window similar to the one shown below is displayed.



The DATA_INIT_type window contains a ***New Value*** field which functions as a command line, an ***Element*** field which indicates which data element the cursor is currently positioned on, a ***Length*** field which tells how many elements the DATA_INIT_type instruction contains, and the block of constant data. The ***Element*** and ***Length*** fields cannot be edited.

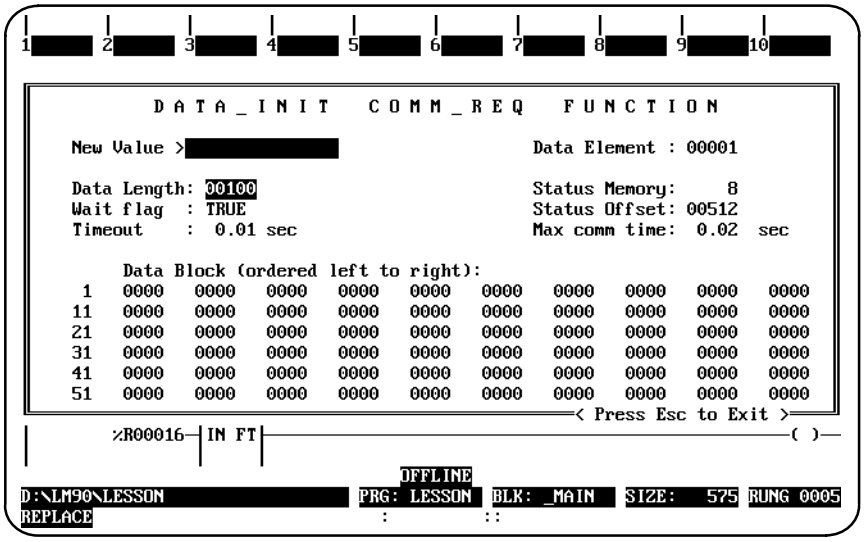
To change a value, position the cursor on the element to be changed, and enter the new value in the ***New Value*** field.

To help you position the cursor, the window contains starting element line labels to the left of the data block. The ***Element*** field will contain the element number the cursor is currently positioned on.

The data block portion of the window will scroll and page.

Zooming into the DATA_INIT_COMM Function Block

When you press **Zoom (F10)** to zoom into the DATA_INIT_COMM function block, a window similar to the one shown below is displayed.



The DATA_INIT_COMM window contains a ***New Value*** field for entering values and a ***DataElement*** field, which indicates which data element in the data block the cursor is currently positioned on. Only the ***Data Element*** field cannot be changed.

The window also contains the first six words of the COMMREQ command block, with labels consistent with each word's use and the COMMREQ data block. The first six words are ***Data Length, Wait Flag, Timeout, Status Memory, Status Offset,*** and ***Max Comm Time***.

The line labels to the left of the data block elements and the ***Data Element*** field will correspond to the data block portion of the COMMREQ block. For example, the data block elements will be labeled beginning with number 1, even though the data block begins at the seventh word of the instruction.

The data block portion of the window will scroll and page.

Note

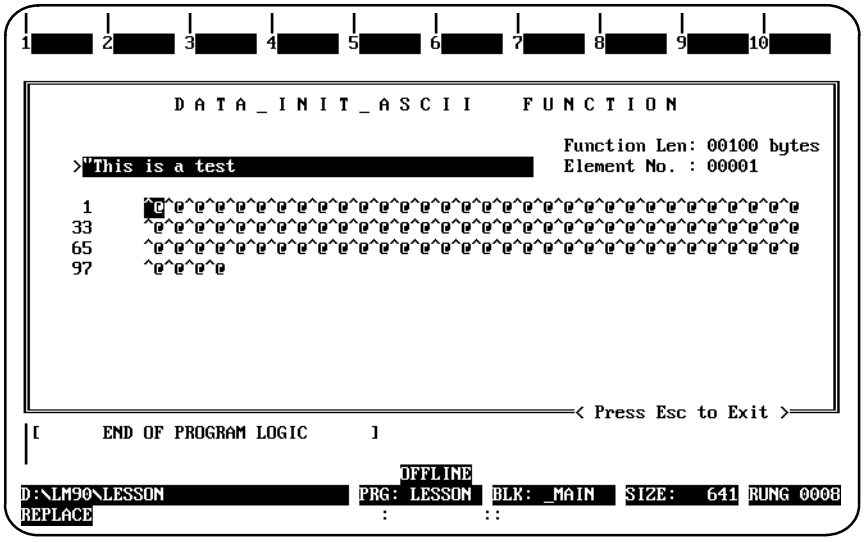
The data block format is hexadecimal.

Zooming into the DATA_INIT_ASCII Function Block

When you press **Zoom (F10)** to zoom into the DATA_INIT_ASCII function block, a window similar to those shown below is displayed.

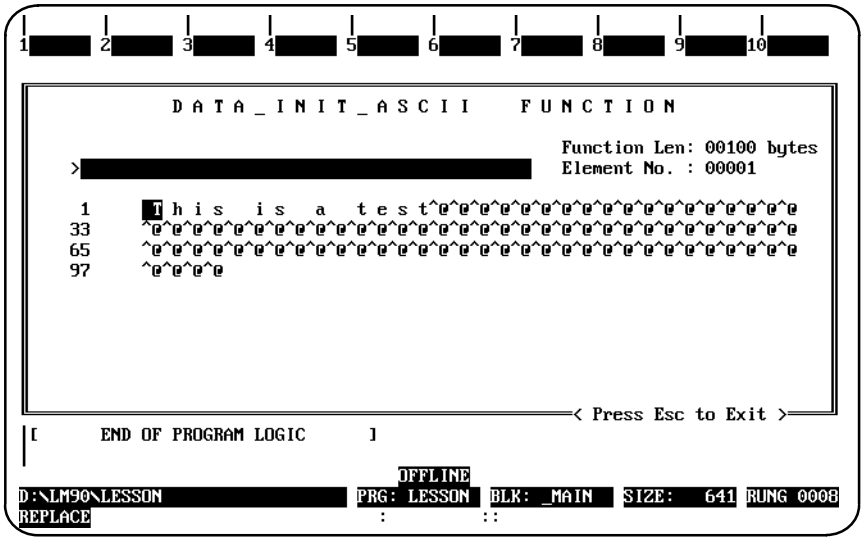
The DATA_INIT_ASCII window contains a mini command line, a ***Function Len*** field which indicates how many character bytes the instruction contains, an ***Element No.*** field which indicates which character byte the cursor is currently positioned on, and the block of ASCII text.

ASCII text is entered by positioning the cursor on the starting byte and typing a quotation mark (“) followed by the desired string on the mini command line (e.g., **This is a test**). (Refer to example on next page.)



You can enter as many characters as will fit on the command line at one time. Enter non-printable characters with a backslash immediately followed by the 3-digit decimal equivalent of the character (e.g., ”\010 for line feed).

After entering the text on the command line, press the **Enter** key.

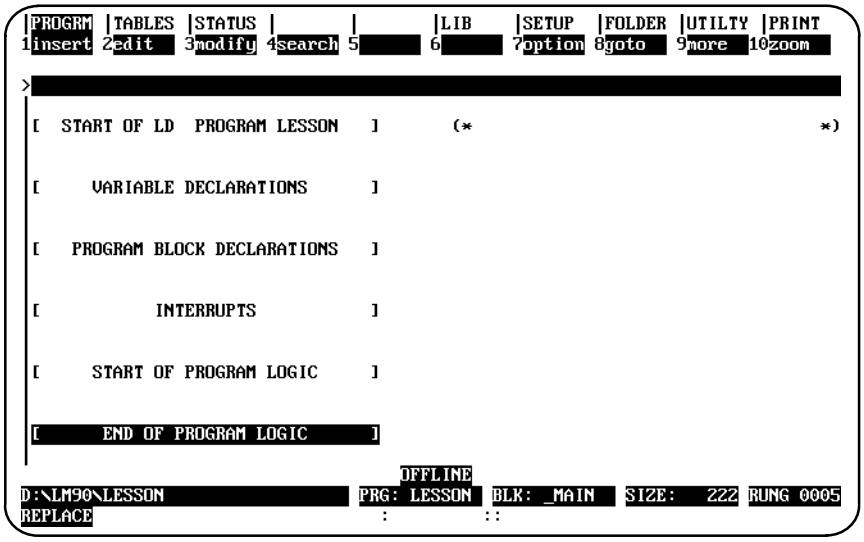


Press the **Escape** key to exit this window and return to the ladder diagram logic display.

Section 2: Program Format

Program elements are combined to form rungs of ladder logic. A ladder diagram has a symbolic power source. Power is considered to flow from the left rail through a contact to the coil or function block connected to the right.

From the main menu, select Program Display / Edit (F1). The screen displays a list of markers which represent parts of a program.



The declaration options for a program block differ, depending on whether it is a main program block or a program block. Program blocks and interrupt assignments may only be created in the main program block.

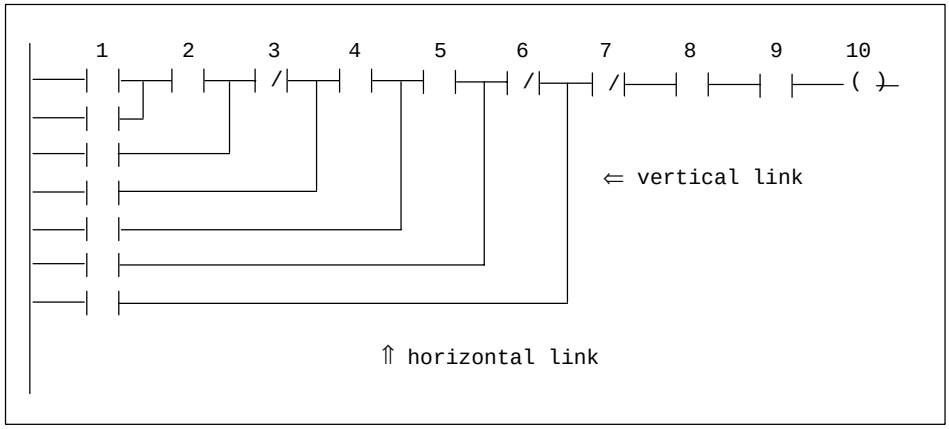
Marker	Description
Variable Declarations	To access the variable declaration table, move the cursor to this marker and press **Zoom (F10)**. Nicknames and reference descriptions can then be entered in the table.
Program Block Declarations	A program can include more than one block of logic. Additional blocks can be called from other blocks. When that is done, blocks must be declared before they are called. To declare a block, move the cursor to this marker and press **Zoom (F10)**. The main block has a block declaration table. This table lists all blocks which are part of the complete program. Blocks do not have block declaration tables. However, blocks can be called from the main block or from any block in the program.
Interrupts	The main program block also has a section for interrupts. This lists any program blocks that will be called as the result of an interrupt from a hardware module. Interrupt declarations themselves do not declare a program block; they must first be specified in the program block declaration section. This marker shows where interrupt logic can be included in the program. If I/O modules capable of generating interrupts are present in the PLC, their inputs can be used to cause the execution of certain program logic. Their use is also optional. To enter interrupt logic, move the cursor to this marker and press **Zoom (F10).**
Start / End of Program Logic	Start and end of _MAIN program blocks. All logic is placed between these two markers. To enter logic, place the cursor on the **[END OF PROGRAM LOGIC]** marker and press **Insert (F1)**.

The cursor keys are used to highlight the area of the program to be displayed or edited.

Structure of a Ladder Logic Rung

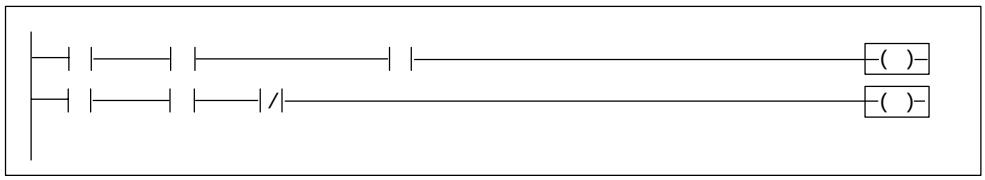
Program logic consists of various elements such as relays, timers, math functions, and other functions, placed together to form rungs of logic. The Logicmaster 90-70 software allows great flexibility in entering program elements; however, it will not allow you to enter a rung with incorrect format or syntax.

Elements can be combined in a rung up to a maximum of eight rows and ten columns. Each rung may contain up to eight parallel horizontal rows; each row may have up to ten vertical columns connected in series. Examples of a single column element include a normally open contact, a normally closed contact, or a coil, as shown below. Examples of multi-column elements include functions, LABELs, and JUMPs. Functions are also examples of multi-row elements.

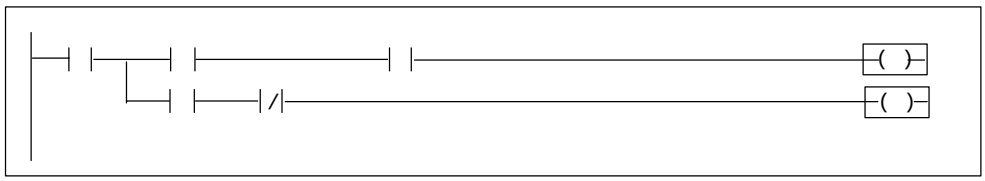


- Contacts should be connected to the topmost available junction.
- The last element of a group of rung elements in series must be a coil, a jump, a function, or a function block.
- Nothing may be to the right of a coil or a jump.
- The tenth position of a rung line is reserved for coils and jumps.
- A CALL instruction may occupy columns 9 and 10.
- A rung may contain up to eight coils.
- A rung line is not required to have elements in each column.
- Horizontal and vertical links are used to carry power around an element or to place elements in parallel or series with one another.
- Horizontal links or rung segments may not carry power flow from right to left.

The following example shows two separate rungs, which must be entered and accepted separately.



In the next example, two rung lines are connected by a vertical link, forming only one rung.



Section 3: Program Entry

Logicmaster 90-70 software was designed to allow for rapid entry of relay ladder diagram programs. By allowing entry of program elements with either function keys or mnemonics, both frequent and occasional users can be satisfied.

Annotation (nicknames, reference descriptions, and rung comments) can be input either prior to logic entry or as each logic element is entered. Rung comments can be entered as logic is created or inserted after the logic has been debugged. For information on annotation, refer to chapter 3, section 4, "Program Annotation."

Note

Program folders on write-protected floppy disks are automatically locked. Remove the write-protect tab and unlock the folder using the lock / unlock current program folder function (see chapter 8).

Using Mnemonics

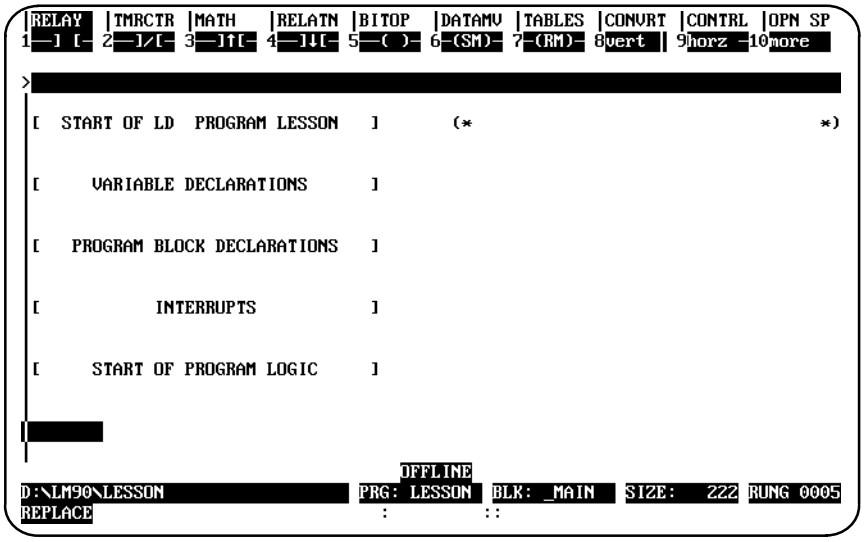
Mnemonic entry enables you to enter an instruction by typing its mnemonic on the command line. For example, to enter the ADD function, you would type **`&ADD`** on the command line and press the **Enter** key.

For some instructions, it is not necessary to type the entire mnemonic, just enough characters for the entry to be unique. For example, instead of typing **`&ADD`** to enter the ADD function, you could simply type **`&AD`** and press the **Enter** key. Appendix E lists the mnemonics of all program instructions. While programming, you can also display a list of mnemonics by pressing **ALT-I**.

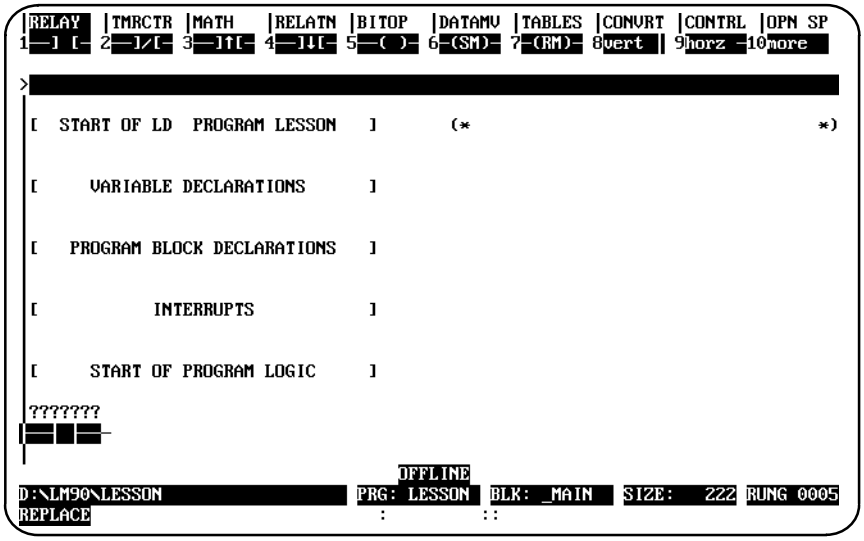
For many functions, you can also specify a data type or reference address. For example, **`&ADD_DINT`** would enter the double precision integer version of the ADD function at the current cursor position in the rung.

Inserting Logic Elements

1. With the cursor on the **[END OF PROGRAM LOGIC]** marker, press **Insert (F1)**. Rungs are always inserted before the rung the cursor is on.



2. To enter a relay element at the cursor location, press the desired function key. For example, to enter a normally open contact, press **F1** with the relay functions displayed for the softkeys at the top of the screen. Or, you may enter the normally open contact by typing the mnemonic **&NOCON** on the command line and pressing the **Enter** key.



3. A reference may now be entered on the command line. For each reference, include both a user reference and location. There are two ways to do this:

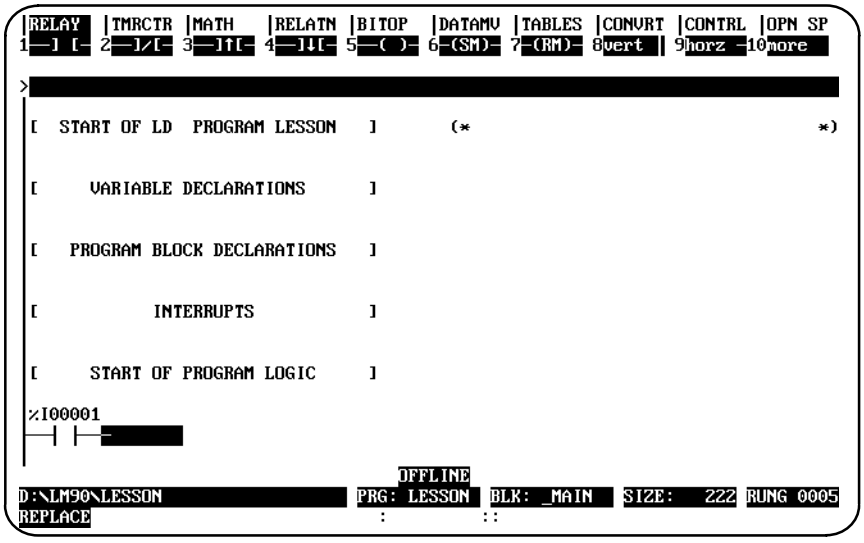
   A. By entering the reference type and then the address (e.g., %I1), or

   B. By entering them in reverse sequence (e.g., 1I). The software automatically places the entry in the correct order and format when you press the **Enter** key. Entering the number before the reference type eliminates having to enter the **%** character.

   Then, press the **Enter** key. The cursor is automatically advanced to the next position, ready for entry of the next element.

   Some program functions require references that begin on a word or byte boundary. The Logicmaster 90-70 software will automatically adjust the entries to be properly aligned.

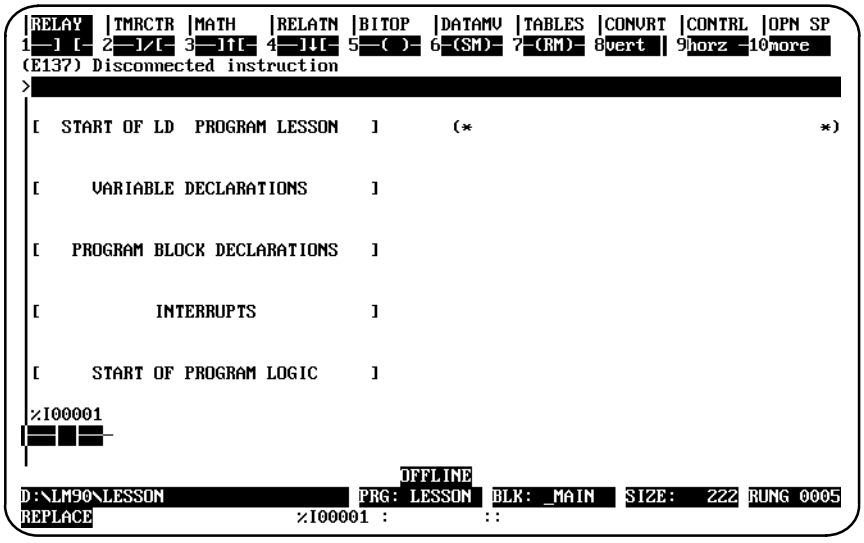
   You may also combine the previous step and this step into one operation by typing the mnemonic **`&NOCON I1`** on the command line and pressing the **Enter** key.



Note

The previous two operations can be combined into one by entering the reference address before pressing the contact function key.

4. This process can be continued until a rung is completed and is ready to be accepted. A rung can be accepted by pressing the **Enter** key with the command line empty, or the Plus (+) key on the numeric keypad. If there is an error in the rung, the rung is not accepted and the cursor is placed on the incorrect element for correction.

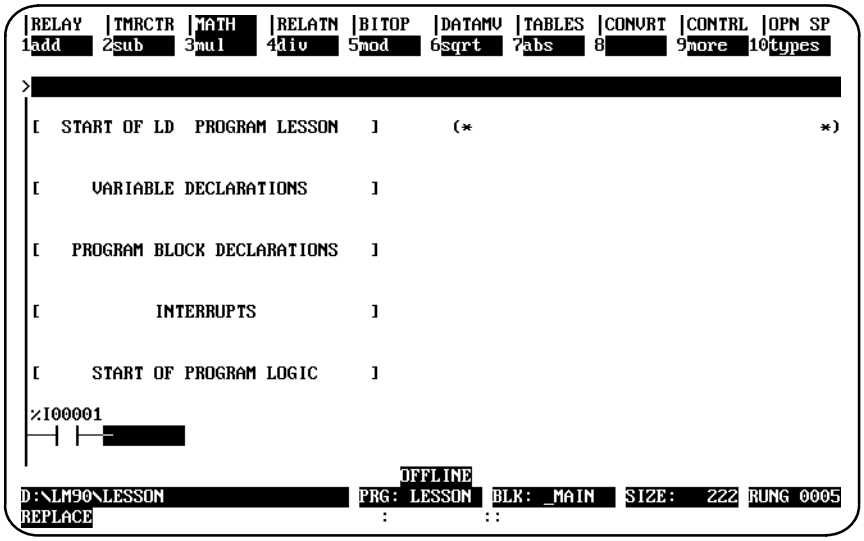


Inserting Functions

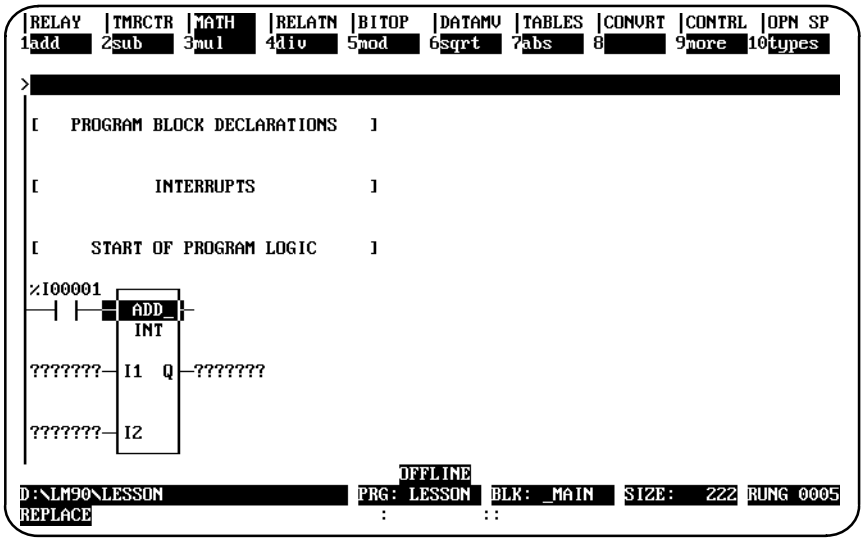
Functions can be entered as easily as relay elements.

1. First, use the relay function keys to enter the enabling logic. In the first example screen shown below, a normally open contact with reference address %I1 is entered as the enabling logic.

2. Select the type of function using the shift-function keys. For example, to select math functions, press **Shift-F3**.

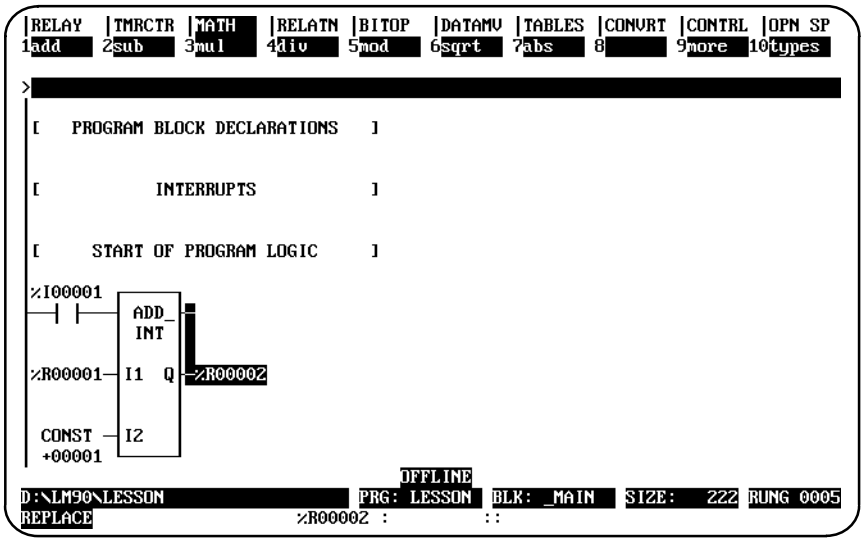


3. Select the function desired using the function keys. For example, to select the ADD function, press **Add (F1)**. Or, you may enter the ADD function by typing the mnemonic **&ADD** on the command line and pressing the **Enter** key.



4. The Tab key can now be used to move the cursor to each parameter position around the function.

5. When the cursor is on the first input, simply type the value to be entered in this position on the command line (for example, %R00001 or 1R), and press the **Tab** key or **Enter** key to place this entry into its position. Pressing the **Tab** key will move the cursor to the next entry position. This process can be continued until the rung is completed and accepted.

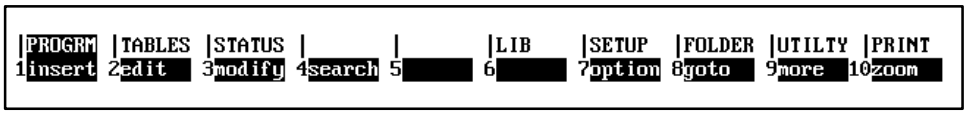


For information on entering comments, refer to chapter 3, section 6, “Rung Comments.” For information on zooming into entries, refer to chapter 3, section 1, “Ladder Logic Program Elements.”

Exiting Rung Entry

There are three ways to exit from a rung.

1. Press the **Escape** key to attempt to accept the current rung. If the rung passes the software validity test, the original function key selections (shown below) are restored and the new logic is added to the program. After accepting a rung, the cursor moves to the next rung, ready for the next rung to be entered. However, in **INSERT** mode a new rung is automatically opened below the newly created rung.



   If the logic fails the check, an error message is displayed and the cursor is positioned on the location where the error occurred.

   Informational messages relating to the executability of the logic may also be displayed. An example of an informational message is "Unbound references used – program is not executable."

2. Press the **Enter** key with the command line empty (or Plus (+) key on the numeric keypad). This causes the same response as pressing the **Escape** key.

3. Press **ALT-A** to exit the insert or edit function without modifying the existing ladder diagram logic. Confirmation is required. Pressing **ALT-A** the first time will restore the rung to its original state. In **INSERT** mode, this would be an empty rung. Pressing **ALT-A** a second time exits the insert function.

Each rung is not saved to disk as it is accepted. To update the disk, press the **Escape** key to exit the program editor and return to the programming software main menu, or press **ALT-U**.

Using the Cursor to Select a Reference Table

You may go directly to the reference table of a reference (e.g., of a function block operand, contact, coil, etc.) under the cursor by pressing **ALT-F2**. Then, press **Shift-F1** from the reference table to return to the same place in the program.

Section 4: Program Annotation

Annotation is optional explanatory text in a program. This text makes the program easier to read and to understand.

Note

Files containing program annotation exist only in the folder, not in the PLC.

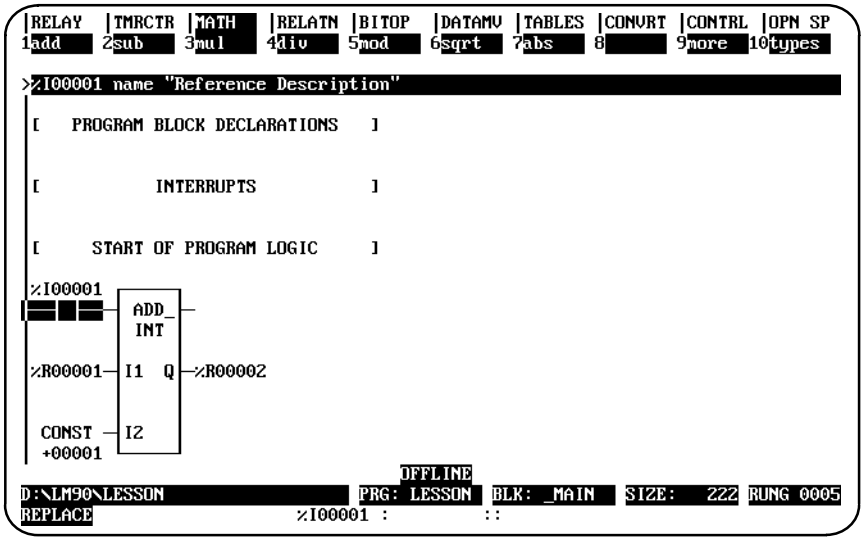
Logicmaster 90-70 software provides the following types of program annotation:

Table 3-11. Program Annotation

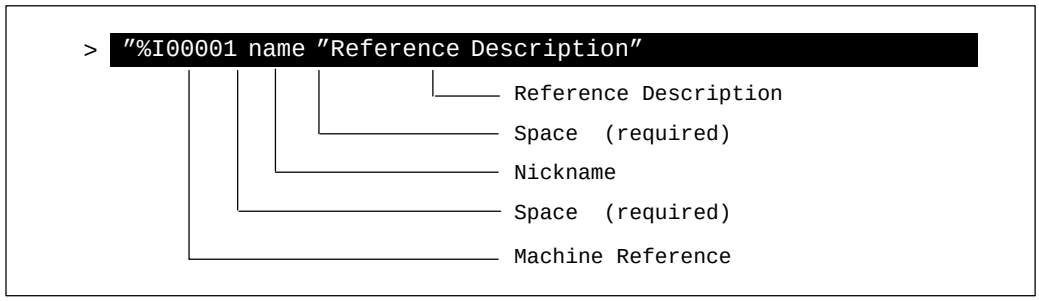
Type	Description
Nickname	An optional 1- to 7-character identifier, which can be used for each program reference. The characters used in a nickname may be a letter from A through Z, a numeral from 0 through 9, an underscore, or the special characters +, –, %, #, @, <, >, =, and &. The first character of the nickname must be a letter. Indirect references do not have nicknames. For example, you cannot assign a nickname to the indirect reference @R00031. For information on indirect references, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265. A nickname is case-insensitive, unless a global nickname has been reassigned in a block. When a global nickname (e.g., SWITCH1) has been reassigned in a block, the local use of that nickname will remain in upper-case letters; however, the global use of that nickname will be displayed in lower-case letters (e.g., switch1).
Reference Description	An optional text description of up to 32 characters which is associated with a machine reference or with implicit identifiers (e.g., program name, program block, or JUMP / LABEL / MCR / ENDMCR). A reference description can be used with or without a nickname.
Comment	Longer blocks of text (rung explanations). A comment consists of up to 2048 characters of text. On the screen, the text of a comment can be read by pressing **Zoom (F10)** with the cursor located at the comment rung. The comment can also be printed as part of the ladder logic.

Entering Nicknames and Reference Descriptions

Nicknames and reference descriptions can be entered in two different ways. The first way is to create a nickname while programming. This is done by entering the nickname and / or reference description on the command line as the reference is used.



The order of entry is not important. For example:



Separate the reference, nickname, and reference description by a space. Use quotation marks before and after the reference description. A double colon (**::**) may also be inserted between the nickname and the reference description. If a double colon is used, quotation marks are not required around the reference description.

If you are in the main block (_MAIN), nicknames, references, and reference descriptions entered on the command line are automatically added to the _MAIN global variable declaration table. If you are in a program block, nicknames, references, and reference descriptions entered on the command line are automatically added to that block's local variable declaration table. To add the entry to the global variable declaration table instead of the local variable declaration table, add **/G** after the entry. For example:

```
%I1 INPUT1 /G
```

When you press the **Enter** key, if there are no conflicts, the nickname is displayed above the program element. It is also temporarily included in the variable declaration table for that program. While inserting or editing a rung, you can press **ALT-V** to view the variable declaration table. Temporary entries are marked with an asterisk. When the rung is accepted, the nickname is permanently added to the table. If the rung is aborted before it is accepted, this information is removed from the table.

If a conflict or error occurs when you press the **Enter** key, the contents of the command line are not applied to the instruction and a message is displayed. Press **CTRL-Home** to display the last entry made on the command line. Then, press the **CTRL** key and the Left or Right cursor key to move within the command line to correct the entry.

Depending on which display mode is active, if you enter a nickname for a reference, it is displayed in the program instead of the reference. For example, if you entered the reference %I00104 for a normally closed contact in the logic, the display would look like this:

If you entered a nickname and (optionally) a reference description for the reference on the command line:

%I00104 XWATMOV ” ’X’ APM waiting move”

The display would look like this instead:

Note

Use **ALT-N** to toggle between reference address display, nickname display, reference description display, and compressed rung display. Refer to chapter 7, “Programmer Setup,” for more information on specifying which modes will be displayed when **ALT-N** is pressed.

The second and simplest way to enter nicknames and reference descriptions, however, is to use the variable declaration table, described in the next section. As each entry is made in the variable declaration table, the reference description for the current entry will appear in a window in the upper right portion of the table. This window consists of 4 lines, each 7 characters in length, and will show the way the description will look above a reference when printed or displayed in expanded mode.

Section 5: Variable Declaration Table

Program annotation can be entered in a program using the variable declaration table, as described in this section.

You may enter nicknames in the _MAIN block or any program block. Nicknames in the program's _MAIN (global) variable declaration table are known to all program blocks. Nicknames in a program block's (local) declaration table are known only to that block.

Each program block may have its own local use of nicknames. The same reference may have different local nicknames in different program blocks, as shown in these examples:

```
BLOCK A     %R1     Light 1
BLOCK B     %R1     Light 2
```

Two program blocks may have the same nickname for different references, as shown in these examples:

```
BLOCK A     %L1     RESET
BLOCK B     %L2     RESET
```

When using a reference address in a program block, Logicmaster 90-70 software retrieves the nickname from the local table. If it does not have a local nickname, the software retrieves the nickname from the _MAIN block's table. If the nickname is not in the _MAIN block's table, the software then looks at the reserved nicknames (e.g., FST_SCN, %S0001).

Note

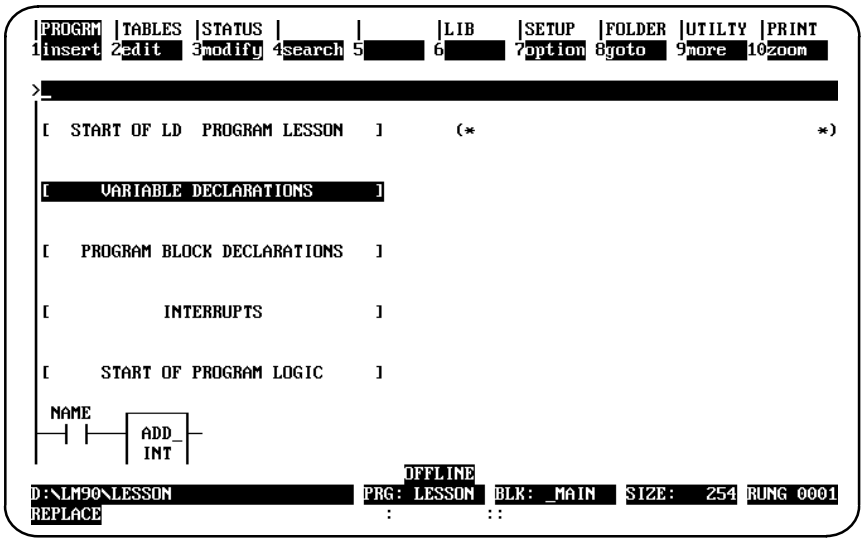
5000 declarations (variables and identifiers) are allowed in the _MAIN variable declaration table, and 1000 declarations (variables and identifiers) are allowed in each program block's variable declaration table. Each table is always arranged in sorted reference address order.

As more nicknames are used, performance in the program editor may be affected. To enhance performance, 1024K of Expanded Memory (LIM / EMSVersion 3.20 or later) and SMARTDRV may be used.

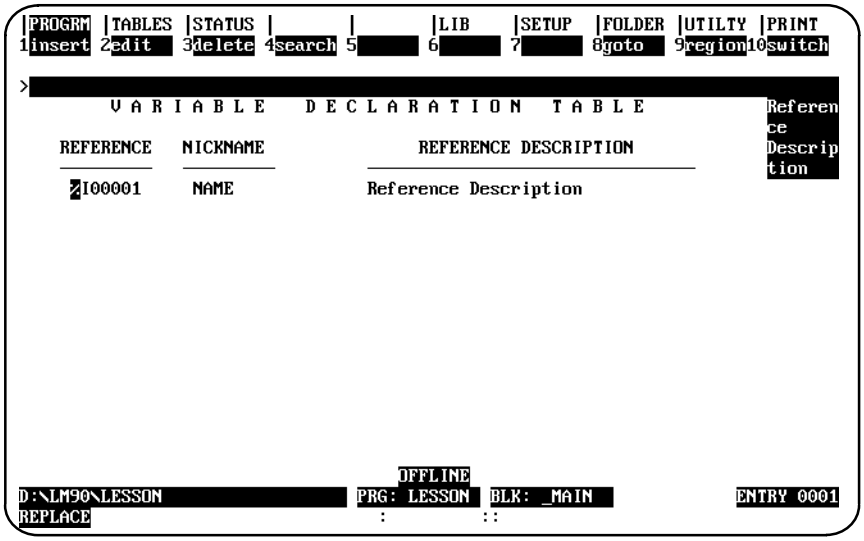
Displaying the Variable Declaration Table

To display the variable declaration table:

1. Move the cursor to highlight the **[VARIABLE DECLARATIONS]** marker.



2. Press **Zoom (F10)**.



3. The identifier table can be displayed from this screen by pressing **Switch (F10)**. (Refer to page 3-45 for a sample identifier table.) This table lists the program name, program block names, external block names, JUMPs, LABELs, MCRs, and ENDMCRs declared in this folder. You cannot insert new entries on this display screen; however, you can edit entries already displayed. For example, you could assign an identifier description to the program name.. The program name cannot have its identifier edited. A block can have its identifier edited if it is not called. All other identifiers and descriptions can be edited.

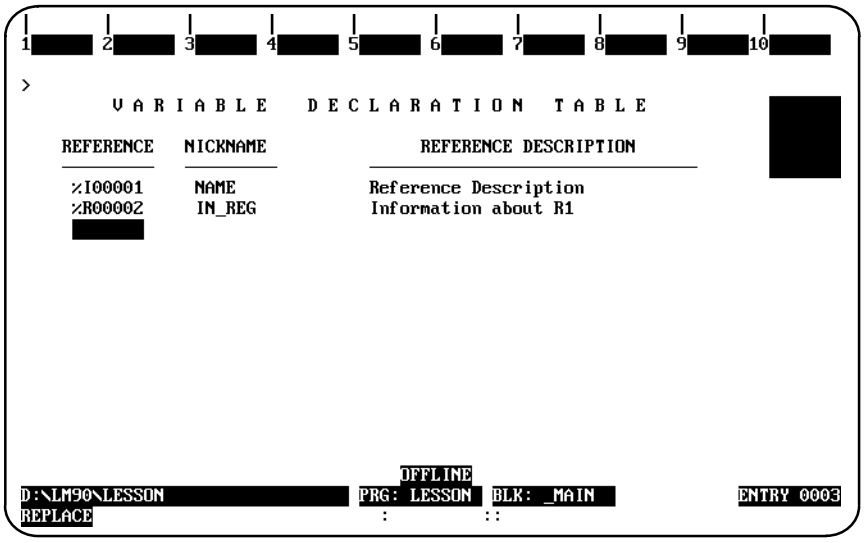
4. Variable declarations may be viewed in a window on the screen, without leaving the insert or edit function, by pressing **ALT-V**. (This can be helpful in checking prior use and reducing errors made while entering references.) The variable declarations displayed in this window, however, cannot be edited. Entries temporarily listed (those created or modified during the current editing session) in the variable declarations table can be easily identified by an asterisk (*). Use the Up / Down cursor keys or Page Up / Down keys to scroll through the entries in this window; then, press the **Escape** key to exit the window.

Entering Variable Declarations

To enter new nicknames and reference descriptions as you go:

1. Press **Insert (F1**). A field will appear in the reference column.
2. Enter the reference in this field (e.g., %R2 or 2R), and then press the **Enter** or **Tab** key to move to the ***Nickname*** field.
3. Enter a nickname (e.g., IN_REG), and then press the **Enter** or **Tab** key to move to the ***Reference Description*** field.
4. Enter a 1- to 32-character description of this reference. The Logicmaster software breaks reference descriptions on boundaries after every seventh character for display in a 4-line x 7-character window. Only 28 characters of the 32-character reference description are displayed in the window. You may want to add extra space in the reference description in order to have the words correctly separated in the window.

   To accept this entry, press the **Enter** key, or the Plus (+) key on the numeric keypad. The variable declaration table is automatically sorted each time you press the **Enter** key to accept a new entry. The cursor then moves to the ***Reference*** field on the next line.



5. To enter a nickname for the next reference, simply press the **Enter** or **Tab** key and the next reference in sequence (in this example, %R0002) will be inserted into the ***Reference*** field. The cursor will move to the ***Nickname*** field. To enter a nickname for a different reference, simply type in this reference and press the **Enter** key.
6. You can continue this process until all references have been defined.
7. To exit **INSERT** mode, press the **Escape** key. To exit the variable declaration table and return to the logic entry screen, press **Escape** again.

Editing Variable Declarations

To change the content of a variable declaration:

1. Place the cursor at the declaration to be changed, and press **Edit (F2)**.
2. Use the **Enter** key, cursor keys, or **Tab** key to move from field to field. Type over the entry as needed.
3. After changing the entry, press the **Enter** key or the **Plus (+)** key on the numeric keypad to accept the changes and move to the next table entry to continue editing. Press the **Escape** key to accept the changes and terminate the editing session.

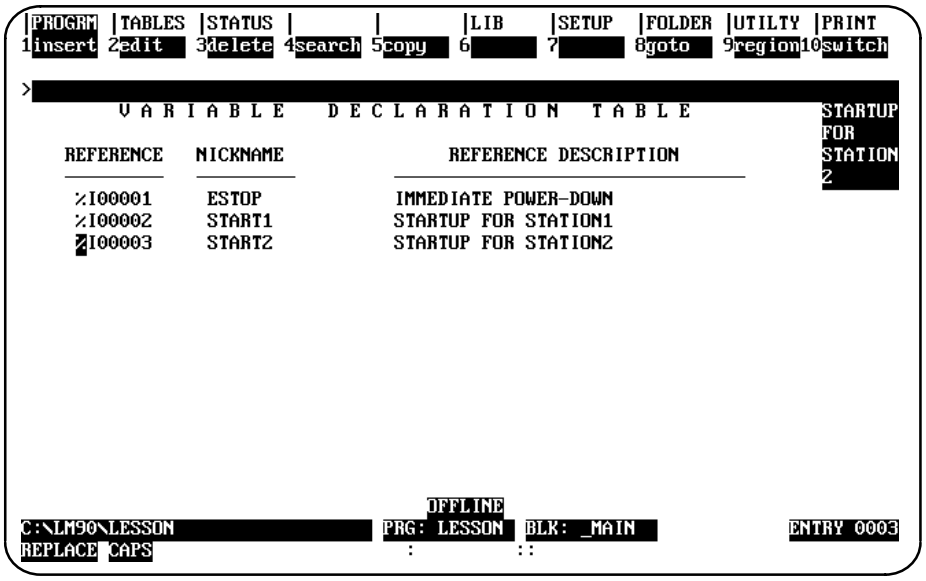
The region functions, described in the rung edit section of this chapter, can also be used to select, cut, paste, include, write, and delete variable declarations. For more information on these functions, refer to chapter 3, section 9, "Rung Edit."

Copying a Variable Declaration

You can copy text from the NICKNAME and REFERENCE DESCRIPTION of another variable. This editing feature is particularly useful when you are creating a program that has several similar variables using similar nicknames and reference descriptions as in the example shown on this page.

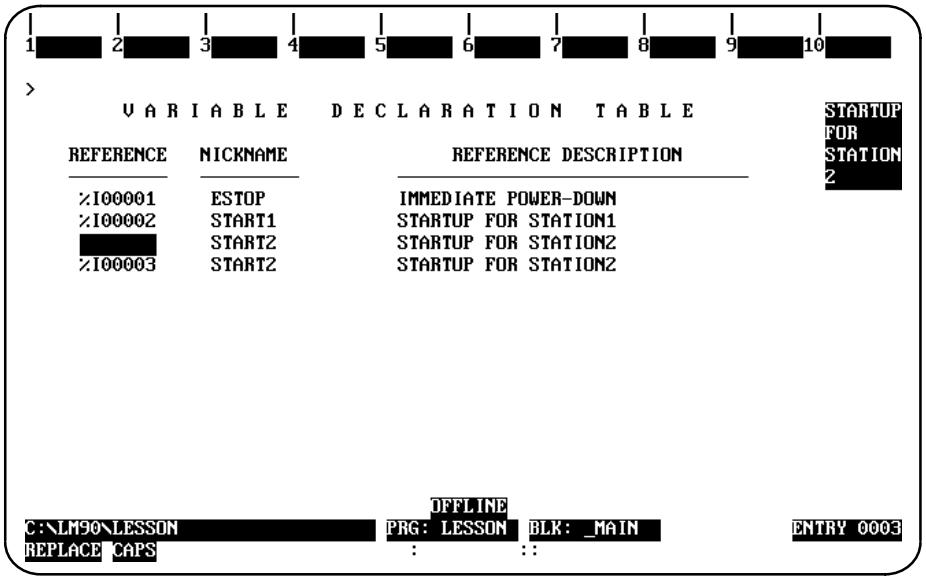
To use this feature, follow these steps:

- Enter the line you wish to copy in the standard way.
- After you press **Enter** at the end of the reference description, press the **Escape** key to accept that variable and change the selections available through the function keys.
- Press the **Up Arrow** key (i.e., the upward cursor mover key) once to move the cursor back to the line you just entered.
- Press the **Copy** function key (**F5** as can be seen in the sample shown below).



The line you copied moves down one, and a copy of it appears where your cursor is located (awaiting your modifications). First enter a new reference number, then edit the nickname and description.

The sample shown on the next page shows the screen that appears immediately after pressing the **Copy** key (**F5**) from the screen shown above.



Notice that the cursor is resting in the REFERENCE (i.e., reference number) field so that you can assign a unique reference number to it. You will also need to assign a unique NICKNAME and REFERENCE DESCRIPTION. Remember, you can use **Ctrl-Right Arrow**, i.e., hold the **Contro**l key down and press the **Right Arrow** key (i.e., the right cursor mover key), to move the cursor across the letters or words you want to keep. Then key over or add to the text you want to change; e.g., in the example shown above, you would only need to key over the last digit on both the nickname and the description.

Note

Make sure you enter a unique reference number. If you just press the **Right Arrow** key to advance to the NICKNAME field, the reference number from the line you copied will drop in by default which will force you to change it to an unused number when you press **Enter** at the end of that line.

Deleting Variable Declarations

To remove one or more entries from the variable declaration table, place the cursor at the first declaration to be deleted and press **Delete (F3)** or **ALT-D**. Another way to delete entries from the table is to use the **Select (F1)** and **Delete (F6)** edit softkeys. Repeat this procedure until all the entries you wish to delete have been removed from the table.

To undo the delete, press **ALT-A** before leaving the table. Once you leave a table, you *cannot* undo a deletion made within that table.

Searching for Variable Declarations

The variable declaration table may be searched for a reference or nickname; it cannot be searched for a reference description. To initiate a search in the variable declaration table:

1. Press **Search (F4)** to display the search function window.
2. Enter either the reference or its associated nickname into the ***Search for*** field. You cannot enter a reference description in this field. Then, press the **Enter** key.

Using Goto

The **Goto (F8)** function key may be used to move the cursor within the variable declaration table. To move to the nth variable declaration, enter **n** on the command line and press **Goto (F8)**. For example, to move the cursor to the first variable declaration, enter **1** on the command line and press **Goto (F8)**.

Cut/Pasting Variable Declarations

The region functions, described in the rung edit section of this chapter, can also be used to select, cut, paste, include, write, and delete variable declarations. For more information on these functions, refer to chapter 3, section 9, "Rung Edit."

Note

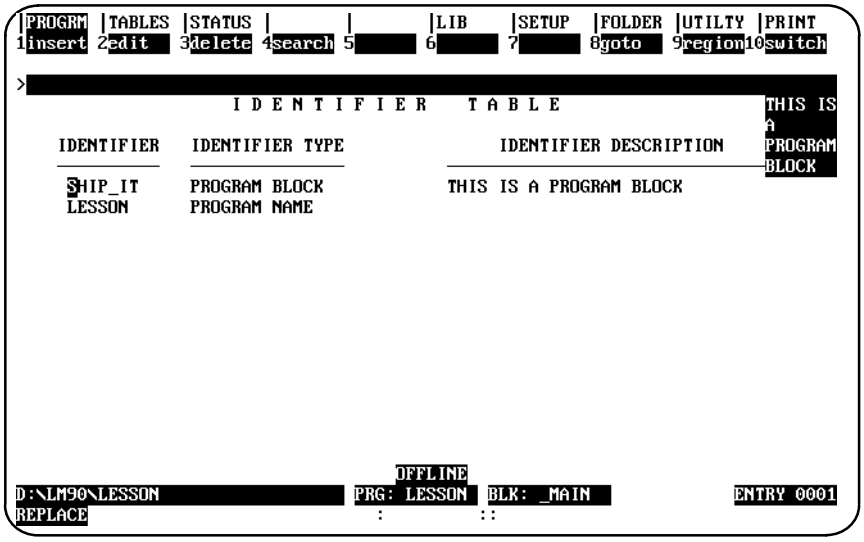
You may not paste or include variable declarations if a reference address in the paste buffer or include file is already in the variable declaration table. However, you may edit the variable declaration table before the paste or include operation to eliminate any reference address conflicts.

Automatically Inserting References

References which do not have nicknames or reference descriptions can be automatically inserted into the variable declaration table as the program is being developed. Then, at a later time, you can go to the variable declaration editor and enter just the annotation. For information on automatically inserting references, refer to chapter 3, section 10, "Editor Options."

Viewing the Identifier Table

The identifier table may be displayed by pressing **Switch (F10)** from the variable declaration table.



The identifier table in the _MAIN program block contains the program name, program block names, Parameterized Subroutine Block names, external block names, JUMPs, LABELs, MCRs, and ENDMCRs. The identifier table in a program block contains JUMPs, LABELs, MCRs, and ENDMCRs.

You cannot insert new entries on this display screen. The program name cannot have its identifier edited. A block can have its identifier edited if it is not called. All other identifiers and descriptions can be edited.

The identifier table may be searched for a reference or nickname; it cannot be searched for a reference description. To initiate a search in the identifier table:

1. Press **Search (F4**) to display the search function window.
2. Enter either the reference or its associated nickname into the ***Search for*** field. You cannot enter a reference description in this field. Then, press the **Enter** key.

Importing to and Exporting from the Variable Declarations Table

Comma Separated Variable (CSV) Format

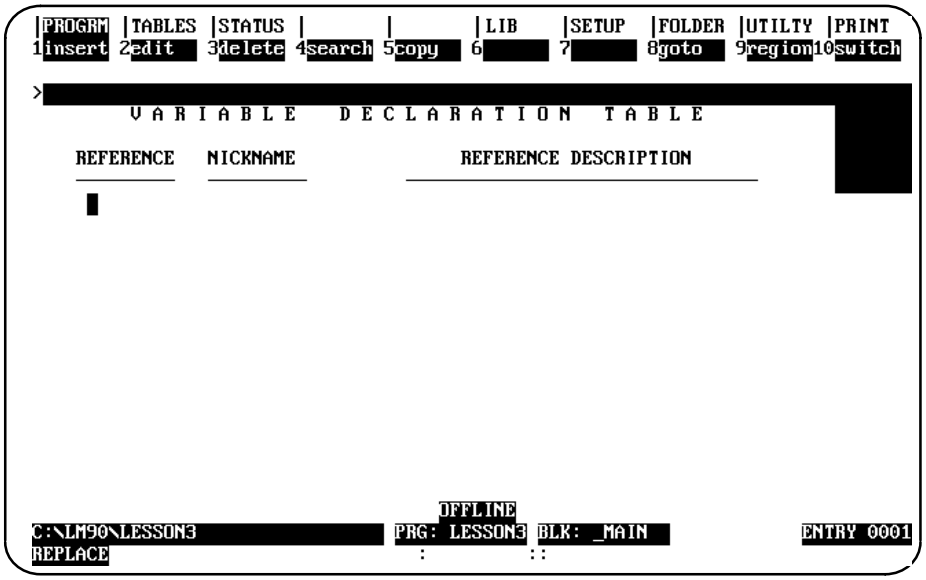
Logicmaster 6.0 and higher uses an extension of the industry-standard Comma Separated Variable (CSV) format called Shared Name File (SNF) format. Importing an SNF into the Variable Declarations Table gives you the ability to define nicknames ahead of time in a spreadsheet program. Exporting an SNF from the Variable Declarations Table gives you the ability to use the exported file with CIMPLICITY® and third party operator interfaces.

The steps for importing and exporting files that use the SNF format are shown here. For information about SNF format, see appendix K.

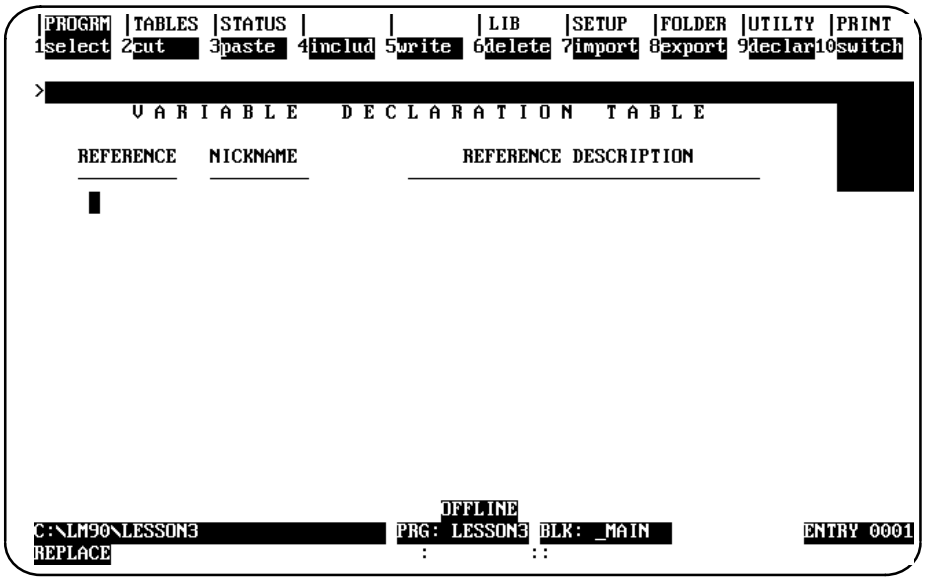
Importing SNF Formatted Files

When importing Shared Name File (SNF) format files, the SNF files must adhere to the standards discussed in Appendix K of this manual. If your file does adhere to those standards, then follow these steps to import:

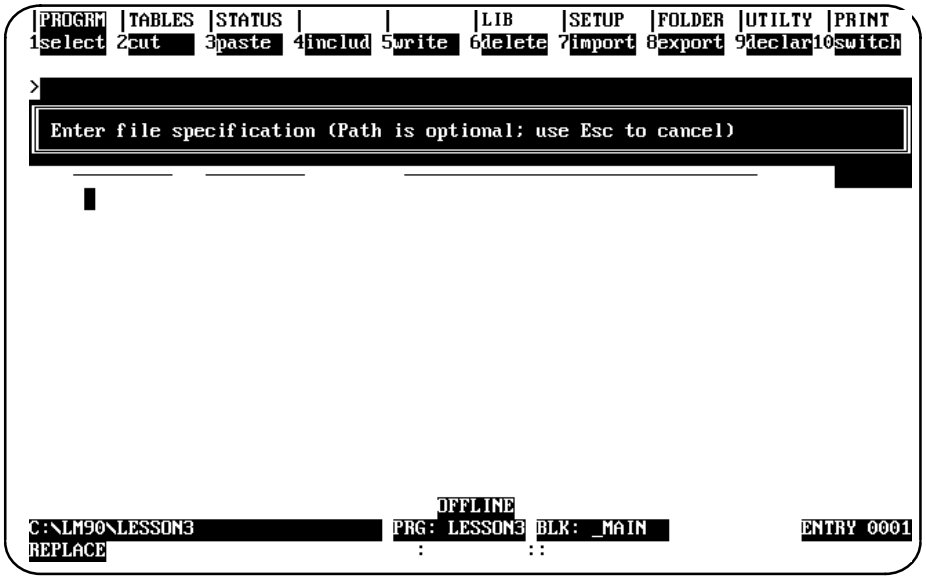
1. Before you begin the next steps (which are all from within the programming software), make sure that your SNF is in the same directory as the program into which you are going to import.
2. Move the cursor to highlight the **[VARIABLE DECLARATIONS]** marker as shown on page 3-38.
3. Press **Zoom** (**F10**).



4. Press **region** (**F9**). Your screen display will change to the one shown on the following page.



5. Press **import** (**F7**). You will see the message shown in the following sample screen.



6. Type the file name. The path is optional because in Step 1 you ensured that the SNF was in the same directory as the folder.

   As long as your SNF follows the guidelines discussed in Appendix K, it will import correctly into the Variable Declarations Table.

Problems and Errors on Import

As mentioned on the previous page, as long as your SNF follows the guidelines discussed in appendix K, it will import correctly into the Variable Declarations Table. If you have any errors, some user errors will halt the process; others will cause other types of responses. Below are the more common user errors and the system's response to them.

1. The specified SNF file name is invalid.

Response: The process aborts, and you will see an error message.

2. The specified nickname contains invalid characters.

Response: The process aborts, and you will see an error message.

3. The specified reference address is invalid.

Response: The process aborts, and you will see an error message.

4. The specified nickname is already used in the system.

Response: Logicmaster will replace (overwrite) its assigned reference address with the one from the CSV file.

5. The specified address has already been assigned a nickname.

Response: Logicmaster will prompt you to skip that address. You can also end the process and edit the CSV file.

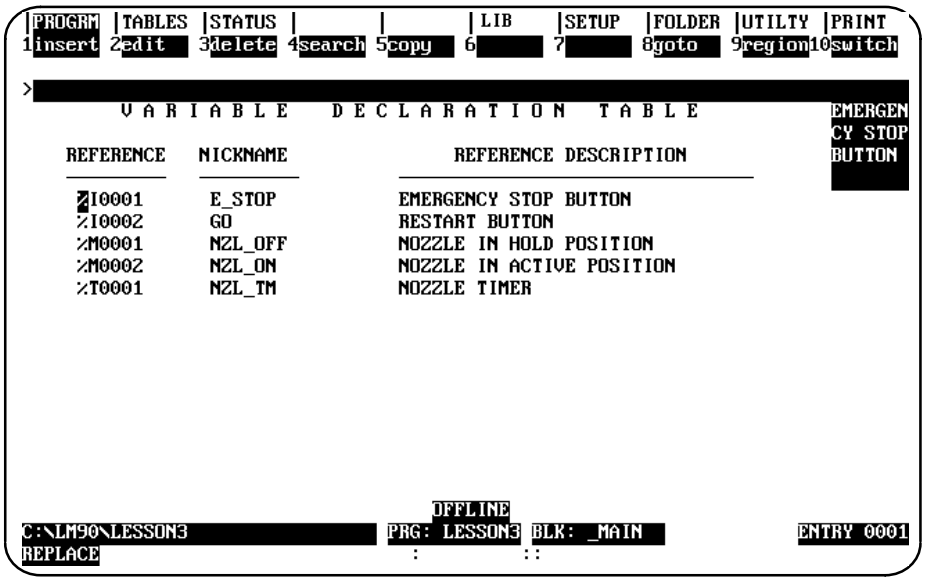
6. The specified reference description contains too many characters.

Response: Logicmaster will truncate the description to the allowed 32 character limit.

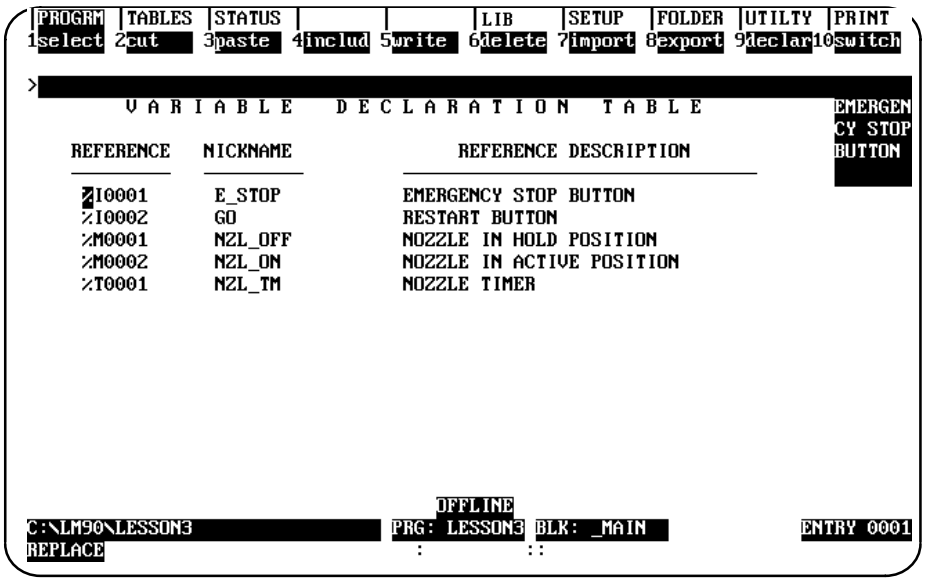
Exporting SNF (CSV) Formatted Files

SNF is an extension of the industry-standard Comma Separated Variable (CSV) format. For more information about CSV and SNF formats, refer to page 3-46. When exporting your Variable Declarations Table to SNF format, Logicmaster will put the Variable Declarations into Shared Name File (SNF) format. For information about SNF format, refer to Appendix K of this manual.

1. Move the cursor to highlight the **[VARIABLE DECLARATIONS]** marker as shown on page 3-38.
2. Press **Zoom** (**F10**).

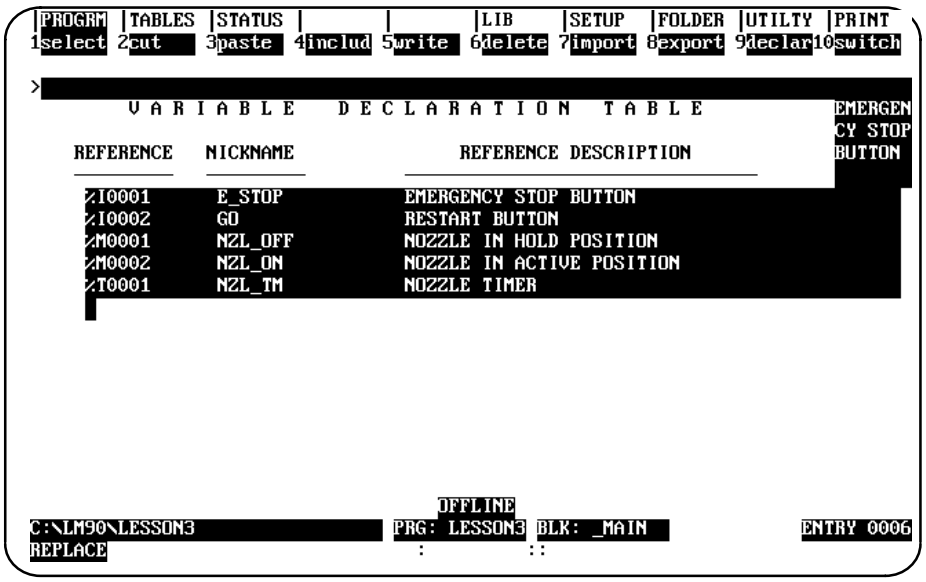


3. Press **region** (**F9**). The selections at the top of the screen will change to the ones shown below.

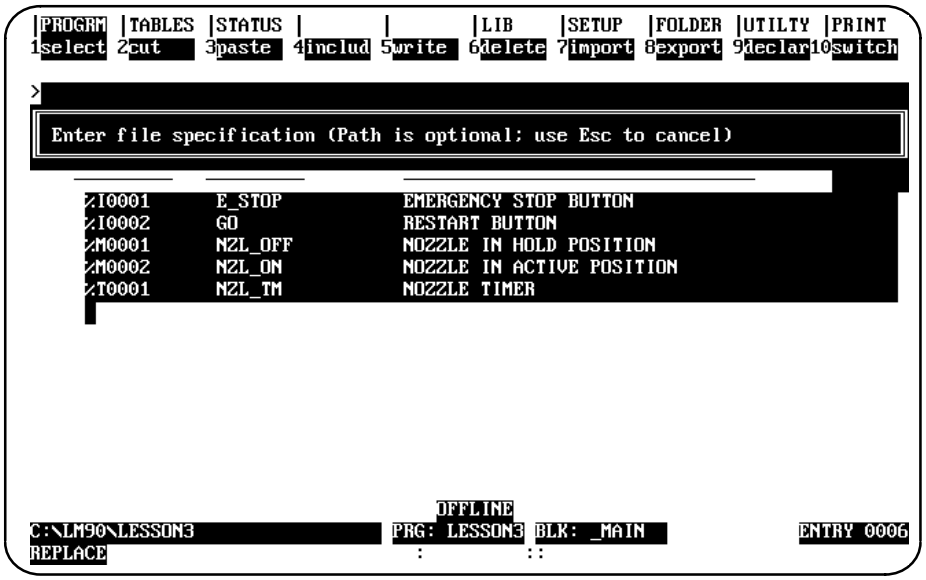


4. Press **select** (**F1**). Then press the **Cursor Down** key (the **Down Arrow** key) until you have highlighted the portion of the Variable Declaration Table you wish to export.

The selected region appears in reverse video as represented in the sample shown below.



5. Press **export (F8)**; then type the name you wish to call the SNF that Logicmaster will create from your Variable Declarations. You do not have to add an extension; Logicmaster will automatically add the extension .SNF. (The recommended method of nomenclature is to use the same name for your SNF as the folder from which it came.) If you do not enter a path, the file will save in the same directory where your program resides. Refer to Appendix K for more information about SNF format.



6. After typing in a name, press **Enter**. The words “Export completed” will appear in the upper left portion of your screen just below the menu.
7. Press the **Escape** key after seeing the “Export completed” to return to the program.

Section 6: Rung Comments

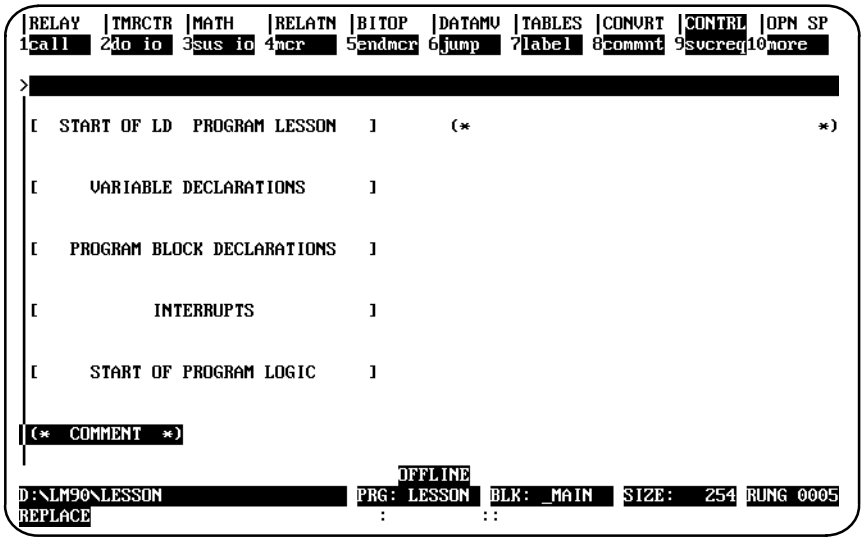
Each COMMENT instruction has a unique text block associated with it. Pasting / including a comment will create a copy of the text block for each COMMENT instruction pasted. The text for any COMMENT instruction is edited independently of any other COMMENT instruction. This allows you to copy a COMMENT instruction by cutting and pasting the text; then, you can edit the pasted text. Refer to chapter 3, section 5, "Variable Declaration Table," for information on cutting and pasting variable declarations.

Releases 1 through 3 of Logicmaster 90-70 software permitted two or more comments to be associated with one block of text. If you have such duplicate comments and want to separate them, write the entire block contents to a side file and delete all the logic. Then, include the side file into the empty block. Now, each of the duplicate comment locations will have its own copy of the text.

Inserting a Rung Comment

To insert rung comments, move the cursor to the rung you wish to insert a comment before.

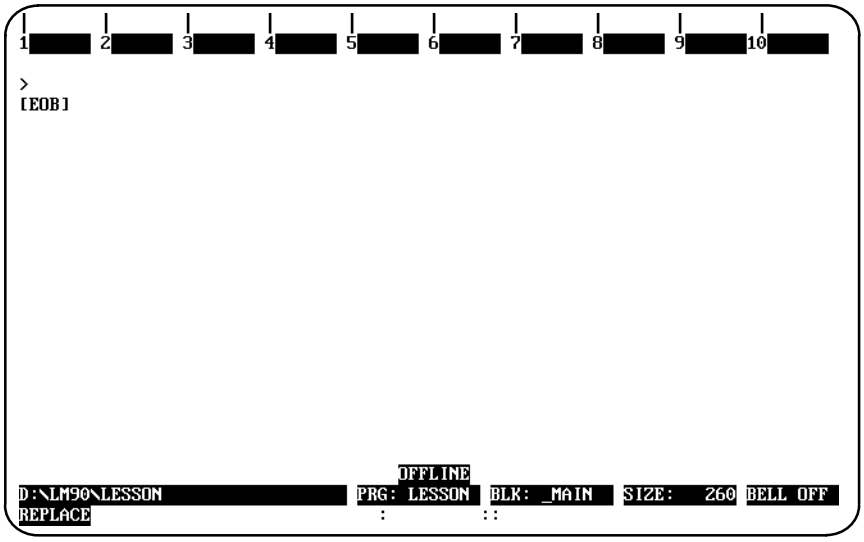
1. Press **Insert (F1)** and then **Control (Shift-F9)** to select the control functions.
2. Press **F8** to select the COMMENT function, or use the mnemonic by typing **&COMMENT** on the command line and pressing the **Enter** key. The screen should appear as shown below:



3. Press the **Escape** key to accept the rung and exit **INSERT** mode.

Adding Text

Text can be entered into the COMMENT instruction by positioning the cursor on the COMMENT instruction and pressing **Zoom (F10)**.



This is a simple full-screen editor, which allows you to input your rung description. Up to 2048 characters of text are permitted.

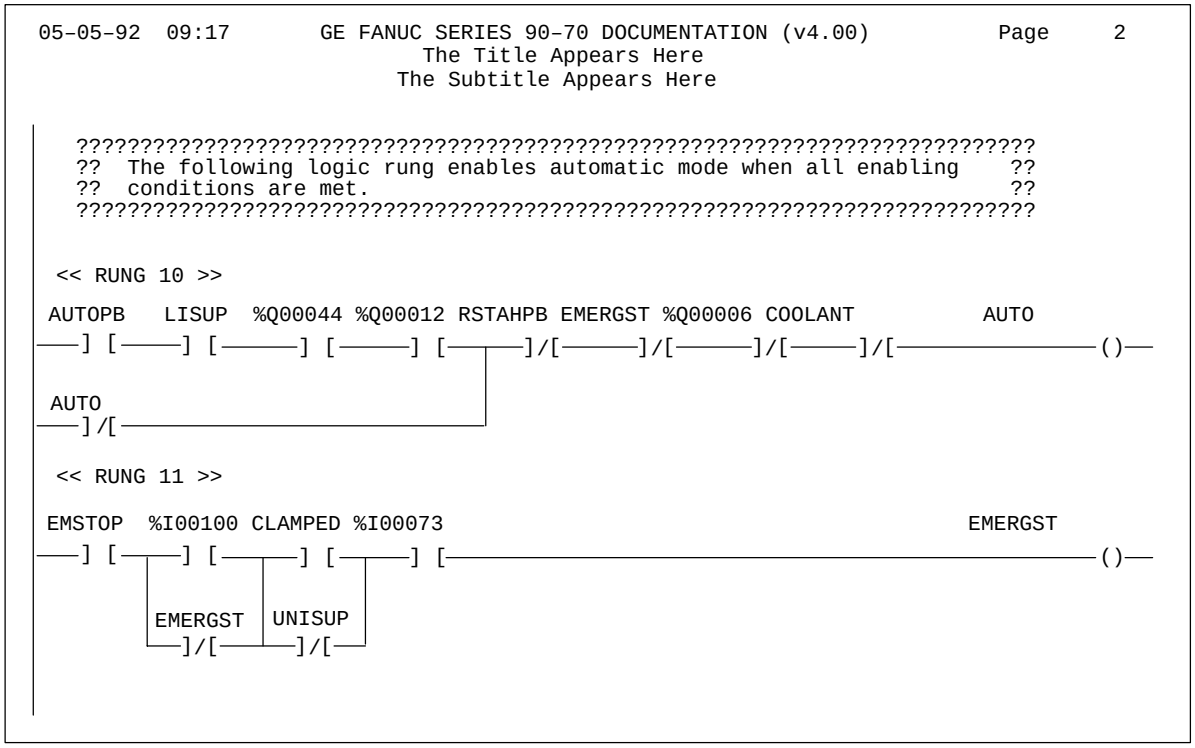
The available keys in the comment editor include:

Key	Description
Cursor keys	Move the cursor within the rung.
Page Up key	Move the cursor up one page.
Page Down key	Move the cursor down one page.
Insert key	Change the text editing mode (**INSERT** or **REPLACE**).
Delete key	Delete the character at the cursor position.
Backspace key	Delete the character to the left of the cursor position.
Home key	Position the cursor on the first character of the first line of the comment text.
End key	Position the cursor at the end of the comment text.

Creating Borders

To make comments stand out in program printouts, borders can be printed around them. The software will automatically create the border using any character you enter, as instructed below:

1. Create the text for the comment.
2. At the beginning of the comment, on a line by itself, enter **\B** (or **\b**, as lower-case alphanumeric characters are also recognized) and an ASCII character to be used as the border. The ASCII character must be the next character after the B. For example, entering **\B?** would create a border of question marks around the outside of the text. If the comment text does not contain **\B** followed by the ASCII character for the border, then Logicmaster 90-70 software prints asterisks by default.



The border of question marks shown in this example will be used for all subsequent rung comments in the program, unless it is changed or the border is deleted.

3. To print out a comment with no border, enter **\B** followed by the space character.

Starting a New Page of Comments

To print a new page of comments:

1. Create the text for the comment.
2. Enter **\P** or **\p**, as lower-case alphanumeric characters are also recognized, on a line by itself.

The text following the **\P** character will then begin on a new page.

The **\P** can be used several times within a comment, with text before and after each one.

Printing a Title and Subtitle

When the printer output is defined as described in chapter 10, a title and subtitle for the printout are created. This title and subtitle will appear on every page, unless changed as described below:

1. At the place in the program where the new title and subtitle should begin, enter a comment in the logic. This will be printed as the beginning of a new page.
2. On the first line of the comment, enter the following:
   A. **\T** or **\t** with the new title (up to 62 characters) on the same line.
   B. **\S** or **\s** with the new subtitle (also up to 62 characters) on the same line.

The new title and / or subtitle will appear on each subsequent page. **\T** or **\S** alone can be specified. **\B**, **\T,** or **\S** must be on separate lines. Those lines must be first in a comment, but they can be in any order.

Creating Longer Comments

The maximum number of characters that can be included in a comment is 2048. Longer text can be included in printouts (but not displayed in program function or mode) using an annotation text file, as instructed below:

1. Create the comment as described on the previous page.
   A. Enter text to the point where the text from the other file should begin.
   B. Move the cursor to the beginning of a new line and enter **\I** or **\i**, the drive followed by a colon, the subdirectory or folder, and the file name, as shown in this example:

      ```
      \I d:\text\commnt1
      ```

      The drive designation is not necessary if the file is located on the same drive as the program folder.
   C. Continue editing the program, or exit to MS-DOS.
2. After exiting the programmer, create a text file using any MS-DOS compatible software package. Give the file the file name in the comment, and place it on the drive specified in the comment.

Section 7: Changing the Display Mode

The view mode setup function, described in chapter 7, section 6, "View Modes Setup," enables you to specify which modes are displayed when you press **ALT-N**. These view modes range from showing only rung references to showing reference names and reference descriptions in an expanded rung form (display all mode). You can also view the maximum amount of program logic on a screen by selecting a compressed rung mode.

Display all mode shows reference description information in four 7-character segments at each occurrence of an identifier or reference address in the program editor. The Variable Declaration Editor displays a 4 x 7 character window with the reference description for the current entry.

Note

The display mode (**ALT-N**) cannot be changed during **`RUNG EDIT`** or **`RUNG INSERT`** mode.

Each time **ALT-N** is pressed, the editor display will move to the next display mode. The five display modes are listed below.

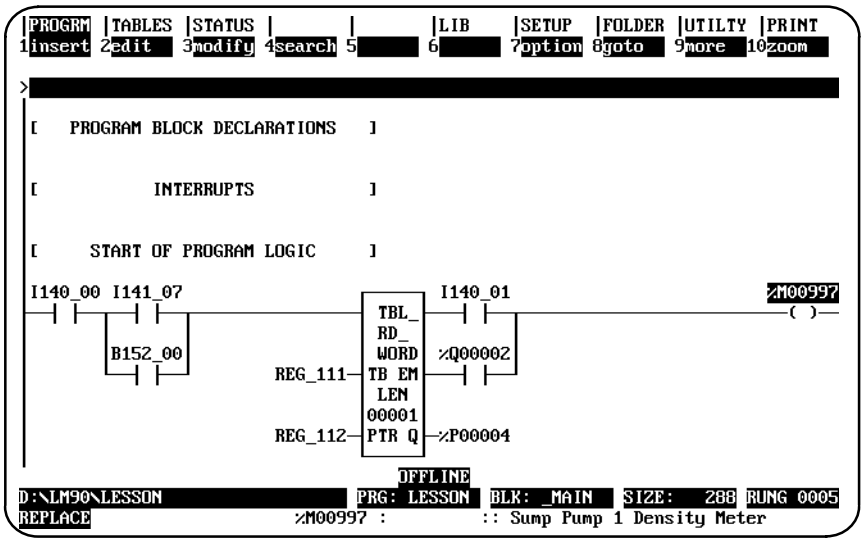
Display All Mode	Description	Lines / Rung
A	Reference descriptions off, nicknames on.	3 screen lines per rung line.
B	Reference descriptions off, nicknames off.	3 screen lines per rung line.
C	Reference descriptions on, nicknames on.	7 screen lines per rung line.
D	Reference descriptions on, nicknames off.	7 screen lines per rung line.
E	Compressed rung mode.	1 screen line per rung line.

Mode A is the default mode. Each time **ALT-N** is pressed, the mode changes to the next mode (e.g., mode A to B). If **ALT-N** is pressed while mode E is displayed, the display cycles back to mode A. Refer to chapter 7, section 6, "View Modes Setup," to select the modes displayed when **ALT-N** is pressed.

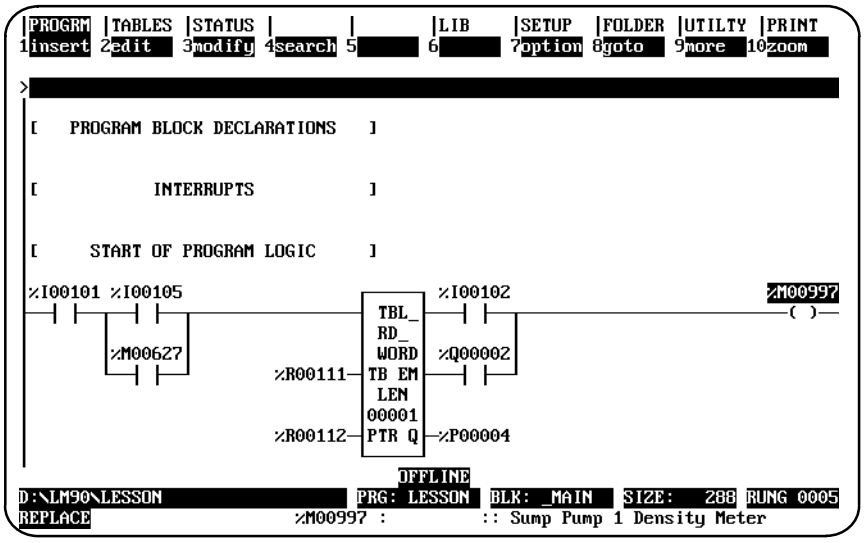
Note

The mode identifier letters A, B, C, D, and E are used for reference in this document only.

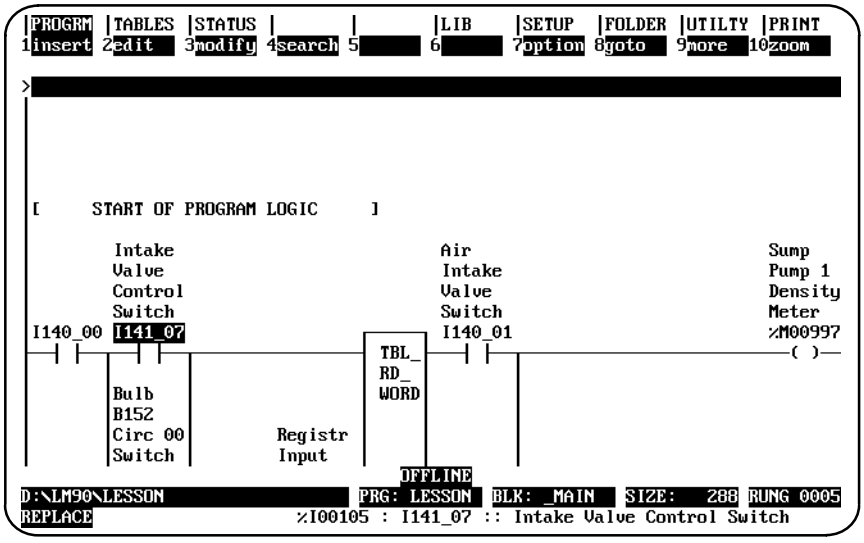
Display Mode A: Reference descriptions off, nicknames on.



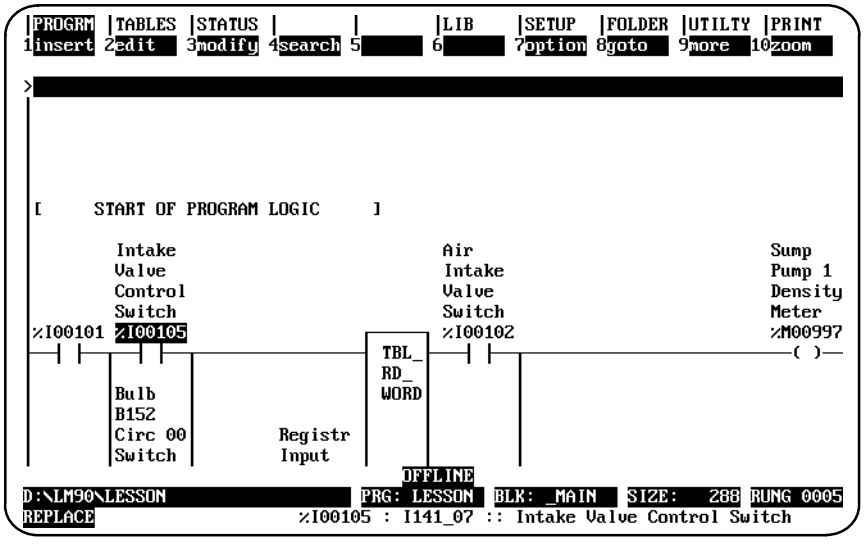
Display Mode B: Reference descriptions off, nicknames off.



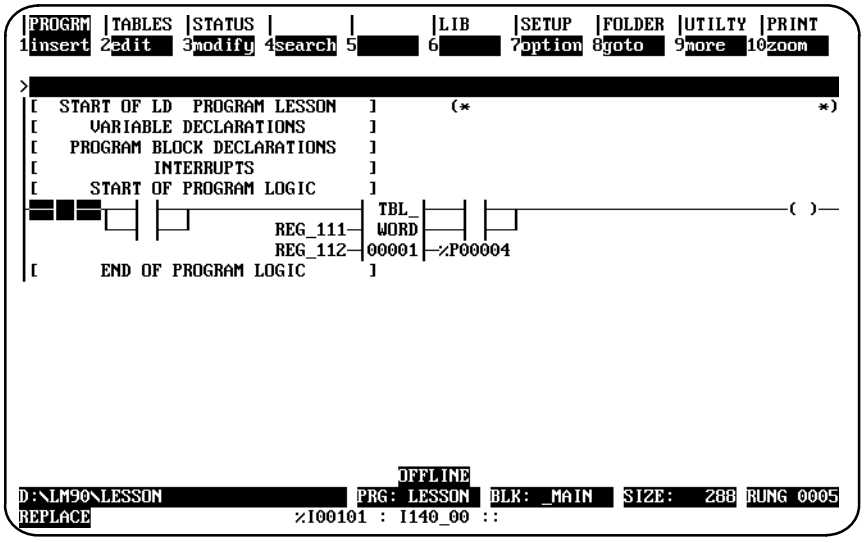
Display Mode C: Reference descriptions on, nicknames on.



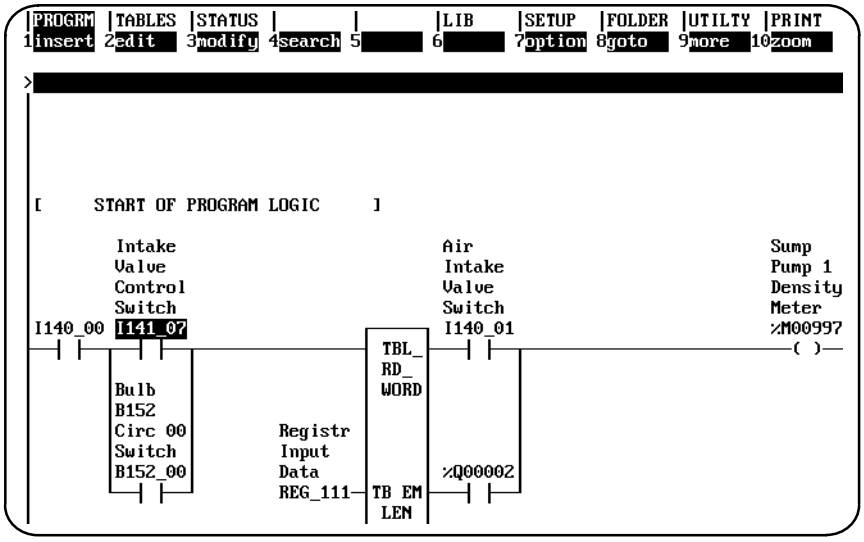
Display Mode D: Reference descriptions on, nicknames off.



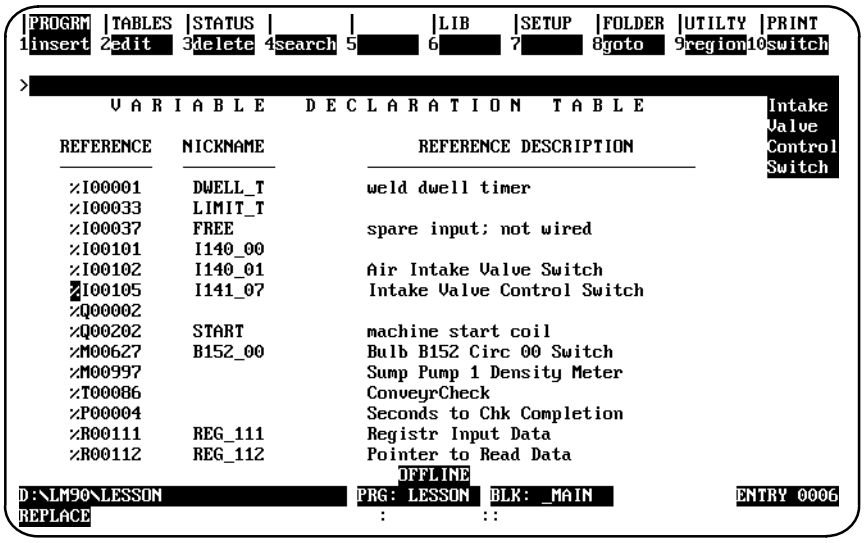
Display Mode E: Compressed rung mode.



Display Mode D without status lines (press **ALT-E** to remove the status lines):



The following screen shows how the reference description breaks within the 4-line x 7-character window when the cursor is on %I00105.



Section 8: Program Blocks, External Blocks, and Interrupts

A program block is a block created and defined by Logicmaster 90-70 software or a third-party vendor. A program block allows you to partition a program. It can also decrease execution time. Program blocks can be displayed and edited using the software.

An external block is a block created outside the Logicmaster 90-70 software environment; it is not written in relay ladder diagram logic. An external block can be transferred into the Logicmaster environment; it can be stored to the PLC from Logicmaster 90-70 software and loaded to the software from the PLC. It cannot be displayed or edited from the software, but it can be called from the main block or from a program block.

Note

The information on external blocks contained in this manual is concerned only with how Logicmaster 90-70 software handles external blocks. This manual does not describe how external blocks are created or debugged. For information on blocks written in C programming language, refer to the *C Programmer's Toolkit for Series 90-70 PLC User's Manual*, GFK-0646.

Eight variations of a CALL EXTERNAL instruction can be used to call external blocks. These eight instructions vary in the number of parameters which convey input and output data blocks. The enable and OK parameters are present for each instruction. For more information on the CALL EXTERNAL instruction, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

The block name specified on the command line determines which CALL or CALL EXTERNAL instruction is programmed. The same Call (F1) softkey provides access to all forms of the CALL instruction; and one &CALL mnemonic can be used to program any form of the instruction. Specifying the &CALL mnemonic will search for the CALL and CALL EXTERNAL instructions.

Specifying another instruction causes the desired instruction to overlay the instruction highlighted by the cursor, if room permits. You can change from the CALL instruction to one of the CALL EXTERNAL instructions or from one of the CALL EXTERNAL instructions to the CALL instruction by specifying the block name and CALL mnemonic on the command line, or by specifying the block name on the command line and pressing the **Call (F1)** softkey.

Displaying/Editing Program Blocks

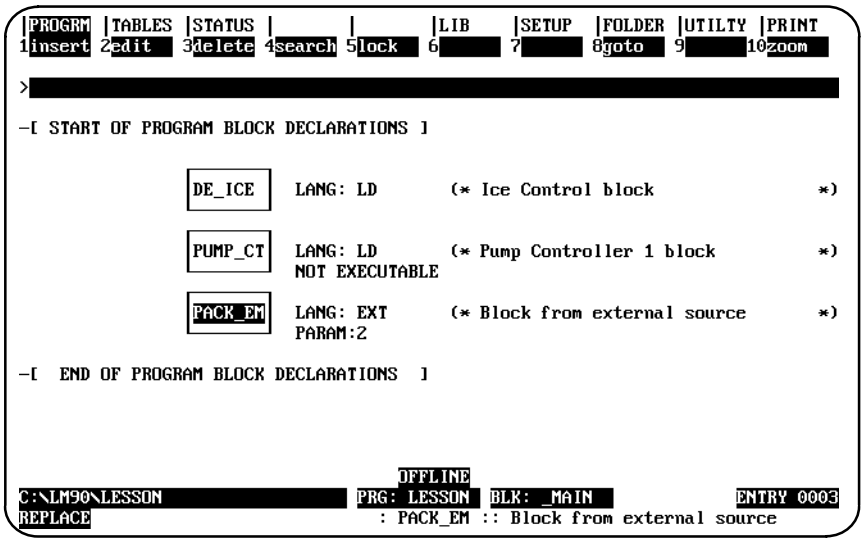
Logic for the _MAIN program block or other program blocks can be displayed from the calling location in the main program block or from the program block declarations.

The program can include logic that executes in response to interrupts received from the hardware. The program block that contains the logic is declared in the program block declaration table. The association between the program block and the interrupt input must be declared in the interrupt logic. After the program block has been declared, logic can be created by zooming into the program block from the program block declaration table, the interrupt declaration logic, or the program logic.

Block Declarations

Up to 255 program blocks and external blocks can be declared in the main program block. (Block declarations cannot be included in a program block.) Each block declaration provides additional logic that may be called from the main program block or from another program block.

Blocks are declared through the program block declaration editor. To add a block declaration in the main program block, place the cursor on the **[PROGRAM BLOCK DECLARATIONS]** marker. Then, press **Zoom (F10)** to display the program block declarations screen.



Program blocks can also be declared through the library import function. External blocks can be declared through the library import function only. For information on the import function, refer to chapter 6, section 2, “Importing an Element from the Library.”

A block declaration consists of:

- A graphic box containing a block name of up to 7 alphanumeric characters.
- The language the block was programmed in. Initially, this field is displayed as **LANG: (blank)**. It will remain empty until you have entered some logic for the block, or until you have zoomed in and then zoomed out of the block without entering any logic. Once you have zoomed into the block to enter logic, the letters **LD** (ladder diagram language) are displayed after **LANG:** beside the block name. **EXT** indicates that the logic was created using an external language such as C.
- A 32-character explanation of the program block; this explanation may be edited.
- An indicator that it has errors. This indicator is only displayed if the block is not executable. The screen shown above includes an example of one block declaration without errors and one with errors.
- For declarations of external blocks, the number of parameter pairs is displayed beneath the language.

Adding Block Declarations

To add a block declaration, place the cursor at the desired location, enter the block name on the command line, and press **Insert (F1)**. A 32-character explanation can also be inserted at this time. If you press **F1** with the command line blank, a box containing seven question marks (???????) will be displayed for the block.

Editing Block Declarations

To edit a block declaration, place the cursor at the declaration to be changed and press **Edit (F2)**. Make the necessary changes by typing over the entry. If there are no references to the block name in the program logic, you can rename the block. After entering your changes, press the **Enter** key (or **Plus (+)** key on the numeric keypad) or press the **Escape** key to accept the modified declaration. The program folder will be updated each time a block name is changed.

Use the Tab, Back Tab, Previous, or Next key, or the cursor keys to move the cursor. Use the Page Up and Page Down keys to scroll the display up and down.

When you exit the block declarations, any changes made are stored automatically to the current program folder. You can also update the program folder while working on the screen by pressing **ALT-U**.

Block declarations can also be edited in the identifier table. For information on the identifier table, refer to chapter 3, section 5, "Variable Declaration Table."

Deleting Block Declarations

A block declaration can be deleted if there are no CALL instructions or interrupt associations to that block in the program logic. Deleting a block declaration also deletes its associated logic. To delete a block declaration, place the cursor on the name of the declaration to be deleted and press **Delete (F3)** or **ALT-D**. The software will prompt you for confirmation to continue.

Searching for Block Declarations

In order to search for a block declaration, you must have the Block Declaration screen displayed on your programmer. Press **Search (F4)**. Enter the name of the block in the ***Search for*** field, set the ***Scope*** to **LOCAL**, and press the **Enter** key.

You can search for a CALL instruction from either the logic or the Block Declaration screen by pressing **Search (F4)**. Enter the name of the block in the ***Search for*** field, or enter **&CALL** to search for all CALL instructions, and press the **Enter** key.

Using Goto

The Goto (F8) function key may be used to move the cursor. To move to a particular block declaration, enter the number of that declaration on the command line and press **Goto (F8)**. For example, to move the cursor to the first block declaration, enter **1** on the command line and press **Goto (F8)**.

You may also go to a block by simply entering the block name with an optional rung number on the command line and pressing **Goto (F8)**.

Zooming into a Declaration

To zoom into a program block declaration, an interrupt declaration, or a CALL instruction, place the cursor on its name and press **Zoom (F10)**. When zooming into a block, note that the ***Block*** field on the status line shows the current block. You can edit the logic on this screen.

You cannot zoom into an external block. If you try to zoom into an external block, an error message will be displayed.

Locking/Unlocking Program Blocks

The block locking feature allows you to lock program blocks. Four types of locks are available:

Type of Lock	Description
View	Once locked, you cannot zoom into that block.
Edit	Once locked, the information in the block cannot be edited.
Perm View	The block is permanently locked and cannot be unlocked.
Perm Edit	The block is permanently locked and cannot be unlocked.

Note

%L memory may still be viewed and / or modified even though the program block is locked.

In addition to the locking capability, locked blocks can also be unlocked, unless they are permanently locked.

A search or search and replace function may be performed on a view locked block. If the target of the search is found in a view locked block, one of the following messages is displayed, instead of logic:

For view locked blocks:

```
Found in locked block <block_name>.  (Continue/Quit)
```

For edit locked blocks:

```
Cannot write to locked block <block_name>.    (Continue/Quit)
```

You may continue or abort the search. If you decide to continue, the locked block is skipped and the search continues from the next block. If you decide to quit, the search is aborted. For more information on search and search / replace, refer to section 11, "Search Function," in this chapter.

Locked blocks may be deleted. Folders that contain locked blocks may be cleared or deleted. If a folder contains locked blocks, these blocks remain locked when the import, export, copy, backup, and restore functions are used. For information on the import and export functions, refer to chapter 6, "Program Librarian." For information on the copy, backup, and restore functions, refer to chapter 8, "Program Folders."

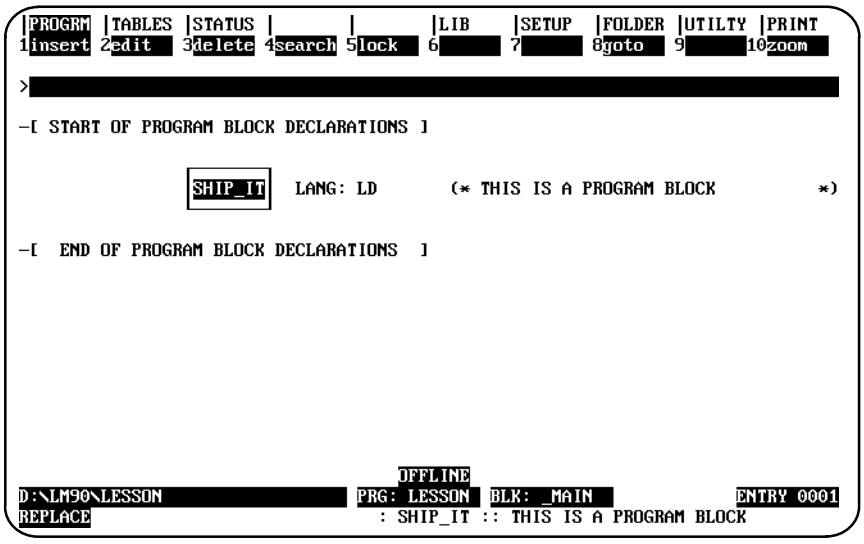
Locking a Program Block

Note

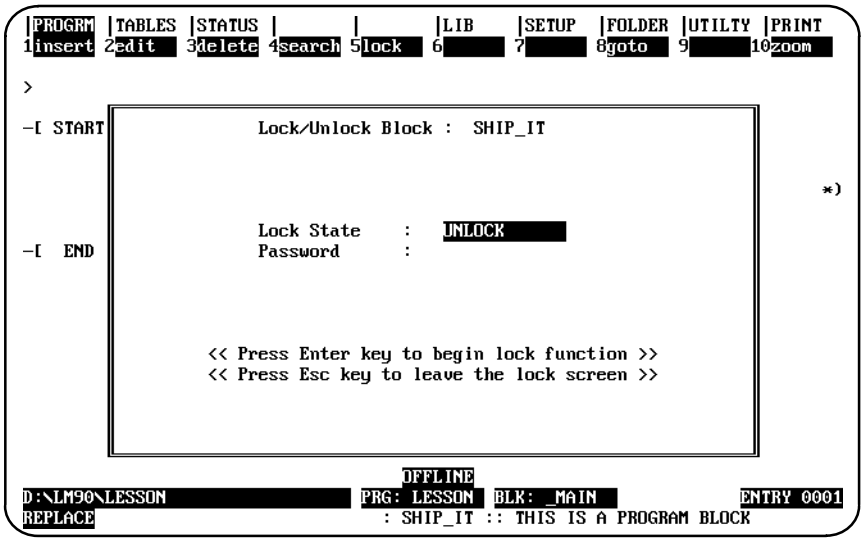
A block cannot be locked if it does not have an established language, or if it is non-zoomable, such as an external block.

To lock a program block:

1. Move the cursor to the **[PROGRAM BLOCK DECLARATIONS]** marker and press **Zoom (F10)**.



2. In the block declaration editor, move the cursor to the desired block and press **Lock (F5)** to display the Lock / Unlock Block screen. The program block name is included as part of the title on this screen.



Note

If **Lock (F5)** is pressed when the cursor is on a block with the ***LANG:*** field empty, the message "Block does not have a language" is displayed. You cannot lock a block without its language defined.

Field	Description
Lock State	Specify the operation to be performed on the current block. Use the Tab key to view the values for this field: **UNLOCK**: The current block is unlocked. **VIEWLOCK**: A view lock is set on the block, and you cannot zoom into the block. If you try to zoom into the block, the error message "Zoom denied because the block is locked" is displayed. **EDITLOCK**: An edit lock is set on the block, and the block cannot be changed. If you try to edit the block, the error message "Edit denied because the block is locked" is displayed. **PERMVIEWLOCK / PERMEDITLOCK**: The block is permanently locked and cannot be unlocked once it is locked. When the desired value is displayed in the ***Lock State*** field, press the **Enter** key. If you try to enter an incorrect value or leave the field empty, a message is displayed in the message area of the screen and the field remains active. If you try to lock a block that is already locked, the message "Block already locked" is displayed in the message area and the screen remains displayed.
Password	Specify a password of up to four (4 maximum) characters to lock a block. Valid characters include A through F and 0 through 9. If a lower-case letter is entered, it is converted to an upper-case letter. Once a password is set, the same password must be entered before the block can be unlocked. The characters of the password are displayed as they are typed into the ***Password*** field. For PERMVIEWLOCK and PERMEDITLOCK, the ***Password*** field is ignored. Passwords are not required and cannot be used with permanently locked blocks.

3. If no lock is set on the current block, the ***LockState*** field is set to **UNLOCK** when the screen is displayed. If a lock is set on the current block, then the ***LockState*** field is set to the type of lock imposed on the block. Initially, the ***Password*** field is empty.

4. To set the lock, enter the value in the ***LockState*** field. Move the cursor to the ***Password*** field, and enter a password. Then, press the **Enter** key. The software will prompt you to confirm the locking process with the message "Is logic block to be locked?(Y / N)."

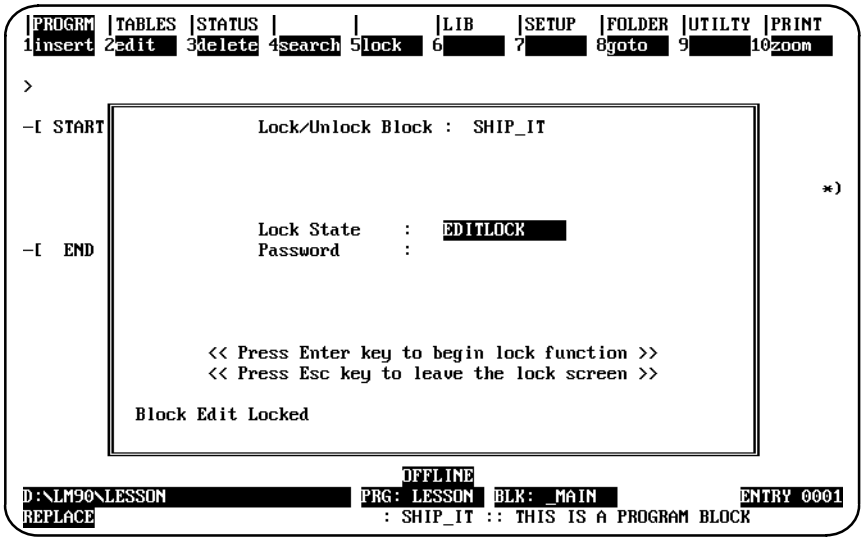
5. If you enter **Y** (Yes) after the confirmation prompt, the locking process begins. Entering **N** (No) aborts the process. Once the block is successfully locked, the message "Block locked" is displayed in the message area of the screen, and the ***Password*** field is cleared.

6. To quit the Lock / Unlock Block screen, press the **Escape** key. To restore the value of the fields to their original values, press **ALT-A**.

Unlocking a Program Block

A previously view locked or edit locked program block may be unlocked in the block declaration editor, unless it is permanently view locked or permanently edit locked.

1. Move the cursor to the desired program block and press **Lock (F5)** to display the Lock / Unlock Block screen.



The current program block name is included as part of the title on this screen. If the current block is locked, the ***LockState*** field indicates the type of lock. If the block is not locked, the field is set to **UNLOCK**. The ***Password*** field is initially empty.

2. To unlock the block, set the value of the ***LockState*** field to **UNLOCK**.

3. Move the cursor to the ***Password*** field, and enter the correct password. As each character of the password is typed, an asterisk is displayed in the field.

4. Then, press the **Enter** key. The password you entered is compared with the password last set. If the two passwords are identical, the block is unlocked and the message "Block unlocked" is displayed in the message area of the screen. Once the block is unlocked, the ***Lock State*** field is set to **UNLOCK** and the ***Password*** field contains the password of the block just unlocked.
5. If the passwords do not match, the block is not unlocked, the error message "Incorrect password given for unlock" is displayed in the message area of the screen, the ***Password*** field is cleared, and the Lock / Unlock Block screen remains displayed.
6. To quit the Lock / Unlock Block screen, press the **Escape** key. To restore the value of the fields to their original values, press **ALT-A**.

Permanently Locking a Program Block

In addition to **VIEWLOCK** and **EDITLOCK**, there are two types of permanent locks. If a **PERMVIEWLOCK** lock is set, all zooms into a block are denied. If a **PERMEDITLOCK** lock is set, all attempts to edit the block are denied. Therefore, passwords are not required and cannot be used with permanently locked blocks.

Caution

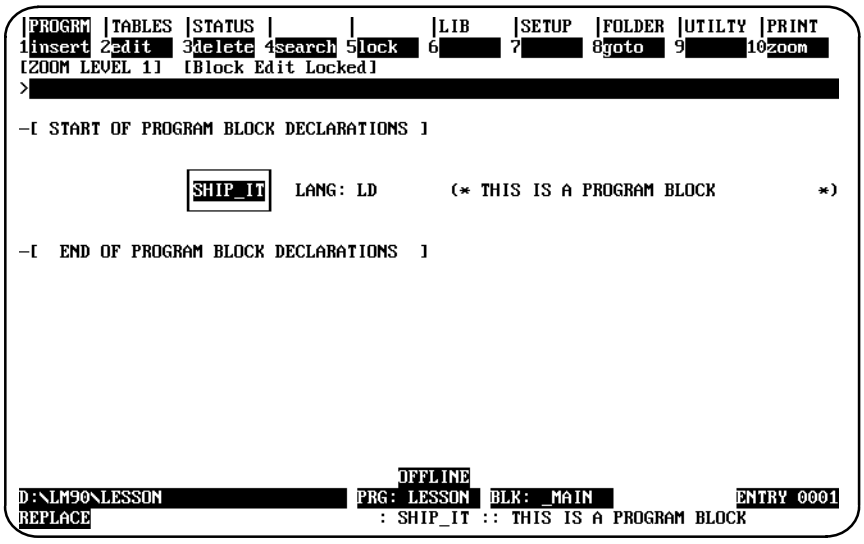
Permanent locks differ from the regular VIEWLOCK and EDITLOCK in that once set, they cannot be removed.

Once a **PERMEDITLOCK** is set, it can only be changed directly to a **PERMVIEWLOCK**; you cannot unlock the block first and then set a **PERMVIEW** lock. A **PERMVIEWLOCK** cannot be changed to any other type of lock.

When you press the **Enter** key to initiate the locking, the software will prompt you to confirm any permanent lock.

Displaying the Lock Status of the Program Block

The display zoom level function (**ALT-X**) can be used to display the lock status of the program block in the block declaration editor. Move the cursor to the desired block, and press **ALT-X**. The following example screen shows a block that is locked for edit.



Interrupts

An interrupt declaration is used to form an association between an interrupt and a block. The block that will execute in response to the interrupt must have its declaration entered in the program block declarations section of the main program block. Up to 64 interrupt declarations can be used.

Note

Timer function blocks do not accumulate time if used in a block that is executed as a result of a timed or I/O interrupt.

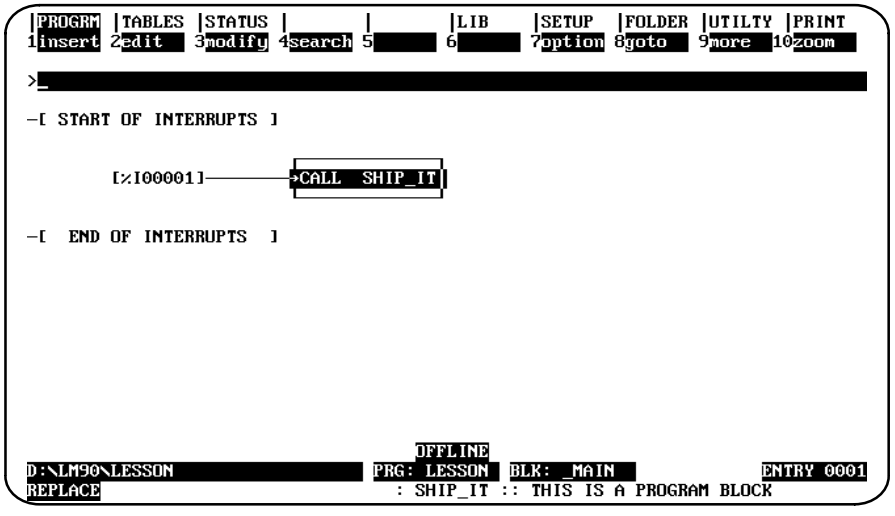
Beginning with Release 6 of the PLC CPU, RLD interrupt blocks may make calls to other blocks. The application stack used during the execution of interrupt blocks is different from the stack used by the RLD program. Therefore, the nested call limit is different from the limit described for calls from the _MAIN block. The PLC will log an "Application Stack Overflow" fault and the PLC will transition to STOP/FAULT mode if a call results in insufficient stack space to complete the call. For additional information, refer to the "Interrupt Handling and Scheduling with Blocks" section of chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265).

Once the association between an interrupt trigger and a block is made, the block will be invoked each time its interrupt is received.

Note

Blocks which may execute as a result of a timed or I/O interrupt should not be called from the _MAIN block or other non-interrupt blocks because portions of the code executed by blocks are not reentrant. In the example below INT1, INT2, BLOCK5, and PSB1 should not be called from _MAIN, BLOCK2, BLOCK3, or BLOCK4.

To add an interrupt declaration in a main program block, place the cursor on the **[INTERRUPTS]** marker and press **Zoom (F10)** to display the interrupts screen.



An interrupt declaration consists of:

- An interrupt trigger which causes execution of the interrupt block logic. It can be used only once to trigger an interrupt. It may be a discrete or analog input. The input module must be configured in order to enable interrupts. Refer to table 11-1, *Discrete Input/Output Configurable Parameters*, in chapter 11, section 5, "Configuring 90-70 I/O Modules," for more information on configuration.
- The name of the block that will execute when the interrupt trigger transitions.

Timed Interrupts

Timed Interrupts enable the interrupt declaration editor to specify timed execution of blocks. The softkey menu for this feature provides selection of timed or simple input trigger driven interrupt declarations. The time base options are 1.0s, 0.10s, 0.01s, and 0.001s.

Note

Timed interrupts are available only in Release 4 or later CPUs.

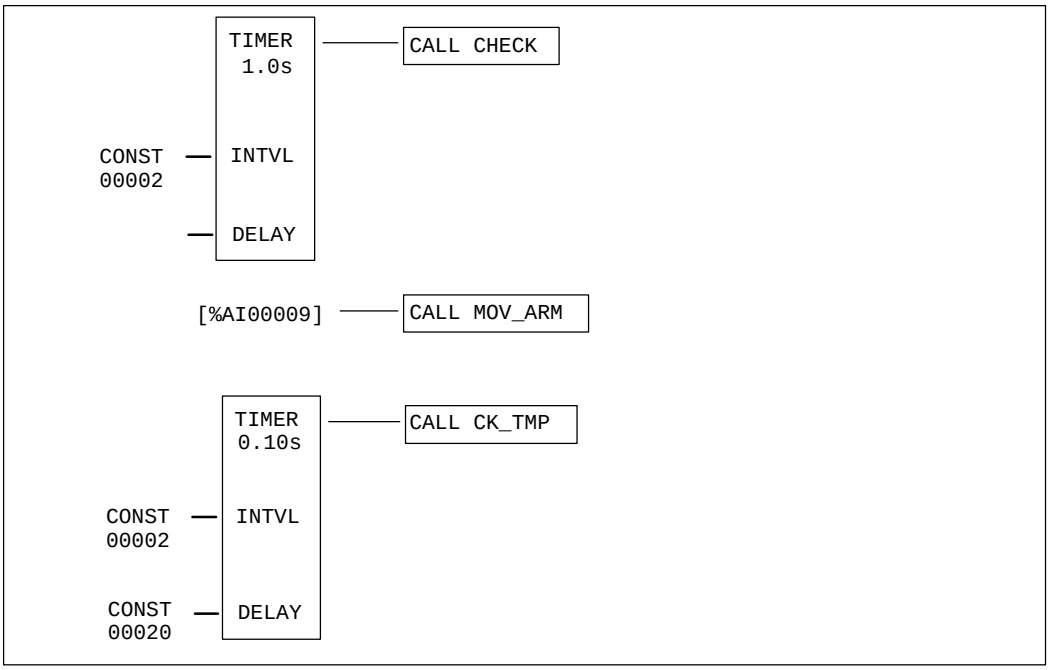
The first execution of a timed interrupt will always occur at ((DELAY * time base) + (INTVL * time base)) after the PLC is placed in **RUN** mode. For example, a timed interrupt with a two-second time interval and a one-second offset would be executed at times of 3 seconds, 5 seconds, 7 seconds, etc., after the PLC is placed in **RUN** mode.

Note

Beginning with Release 4 of the software, there is a limit of 64 input triggered interrupts plus 16 timed interrupts per program.

In the following example, the interrupt block CHECK will be executed at two-second intervals, beginning two seconds after the PLC is placed in **RUN** mode. The absence of a DELAY value indicates that there will not be an initial delay in the first execution of the block.

The input interrupt block MOV_ARM is triggered by %AI00009. The last interrupt block CK_TMP will be executed at 0.2 second intervals (2 * 0.10s) after an initial delay of 2.2 seconds (20 * 0.10s) + (2* 0.10s).



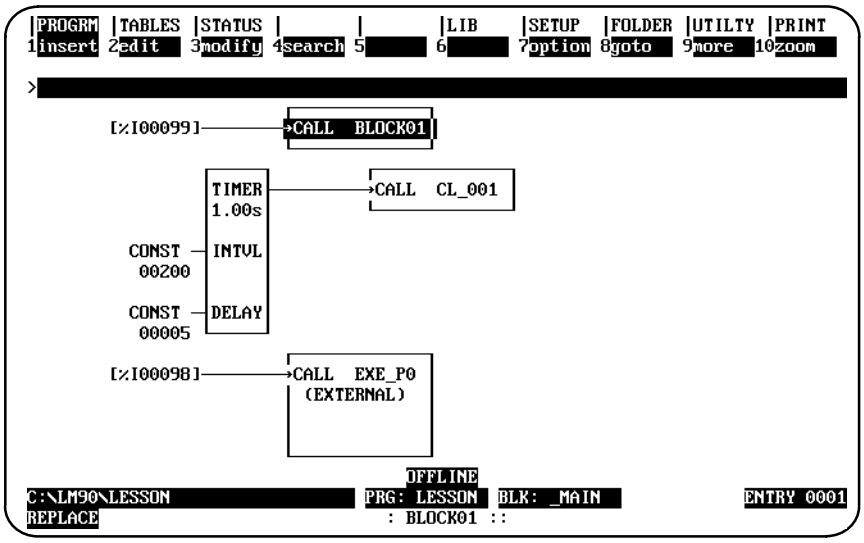
Using Interrupts to Invoke External Blocks

Timed or triggered interrupts may invoke external blocks which have only the enable and OK parameters. An interrupt cannot invoke an external block which has input parameters (X1 through X7) or output parameters (Y1 through Y7) defined.

Input and timed interrupts have two formats, one for ladder diagram program blocks and one for external blocks. To distinguish between the two forms, the parenthesized word **EXTERNAL** is placed in the CALL box when the interrupt is associated with an external block.

The block name specified on the command line determines which form of the interrupt instruction is programmed. When a name is not specified on the command line, the ladder diagram form of the interrupt instruction is programmed by default.

The following example screen shows how the interrupt editor displays various types of interrupts when paging through the interrupt declarations.



Adding an Interrupt Declaration

To add an interrupt declaration, place the cursor at the desired location, enter the name of the block on the command line, and press **Input (F1)** for an interrupt input or **Timed (F2**) for a timed interrupt. If you press either key with the command line blank, seven question marks (???????) will be displayed for the interrupt name.

Interrupt declarations can be completed and accepted like relay ladder diagram rungs.

Note

Timed interrupts are available only in Release 4 or later CPUs.

Editing an Interrupt Declaration

To change an interrupt declaration, place the cursor at the declaration to be changed and press **Edit (F2)**. Type over the entry as needed. After changing the entry, press the **Enter** key (or **Plus (+)** key on the numeric keypad) to move to the next table entry and continue editing; or, press the **Escape** key to exit editing.

Use the Tab, Back Tab, Previous, or Next key, or the cursor keys to move the cursor. Use the Page Up and Page Down keys to scroll the display up and down.

If you are currently in **`INSERT`** or **`EDIT`** mode, pressing **ALT-A** will cancel the changes you have made for that declaration. If you want to quit and restore the interrupt declarations from the program folder, press **ALT-A** while not in **`INSERT`** or **`EDIT`** mode.

When you leave the interrupts section of the block, any changes made are automatically stored to the current program folder. You can also update the program folder while working on the screen by pressing **ALT-U**.

Deleting an Interrupt Declaration

Deleting an interrupt declaration deletes the association between the interrupt trigger and the block. To delete an interrupt declaration, place the cursor at the declaration to be deleted and press **Delete (F3)**.

Searching for an Interrupt Declaration

In order to search for an interrupt declaration, you must have the Block Declaration screen displayed on your programmer. Then, press **Search (F4)**. Enter the name of the block or trigger reference in the ***Search for*** field, set the ***Scope*** to **`LOCAL`**, and press the **Enter** key.

You can search for a block CALL instruction from either the logic or the Interrupt Declaration screen by pressing **Search (F4)**. Then, enter the name of the block in the ***Search for*** field, or enter **`&CALL`** to search for all block CALL instructions, set the ***Scope*** to **`GLOBAL`**, and press the **Enter** key.

Section 9: Multiple Programs: Program Declarations

Beginning with Release 6 of Logicmaster and Release 6 of the Series 90-70 CPU, you can have multiple standalone programs. Refer to chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265) for relevant background information about the multiple standalone programs feature.

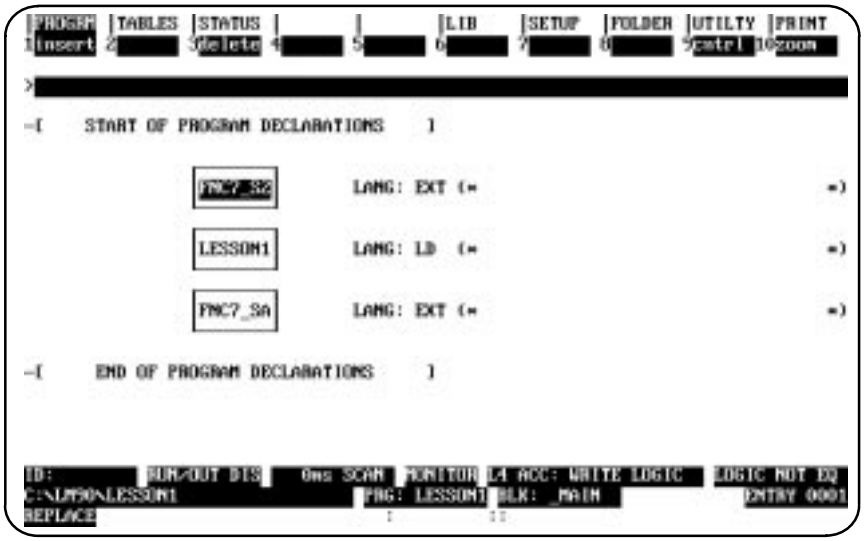
Inserting Multiple Programs and the Program Declarations Screen

To use the Multiple Standalone Programs feature, follow these steps:

1. Create the C program name using the C Programmer's Toolkit, Version 2.0 or later. The Toolkit will prompt the user for a folder when the standalone program is compiled. The C program will then be copied into the specified folder. You will then need to insert the program on this screen as discussed in step 3 below. For information about using the C Programmer's Toolkit, refer to the *C Programmer's Toolkit User's Manual* (GFK-0646).

2. Press the **PROGRM** softkey (**Shift-F1**); then press **F1** again for **Program Display/Edit** functionality.

You will see a screen like the one shown below:



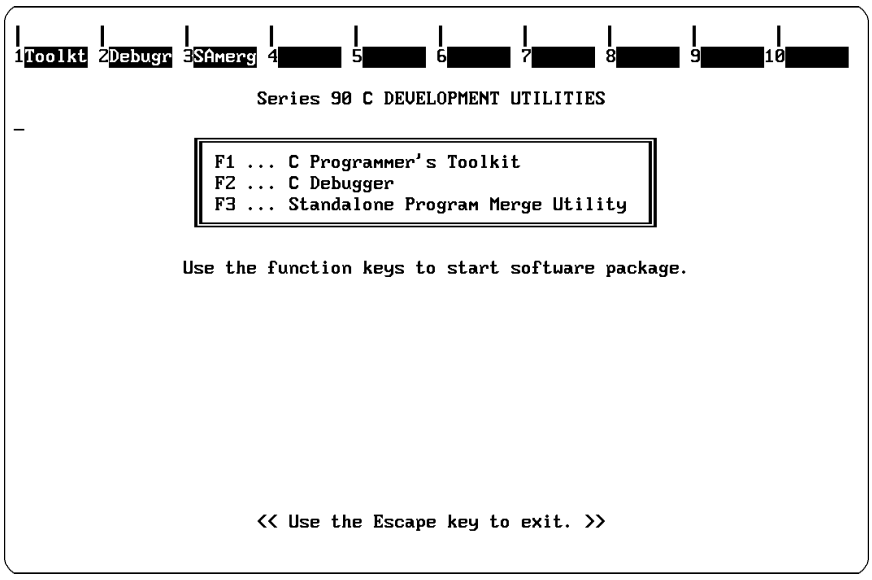
3. To insert C programs, press the **insert** softkey (**F1**); then type the name of the C program you wish to add. If you are in **MONITOR** mode as shown above, you will have to switch (using **Alt-M**) to either **ONLINE** or **OFFLINE** mode before inserting.

From this screen you can set priorities for program scheduling and specify local I/O as discussed on the next two pages. This screen only appears after you have copied programs into a folder through the C Programmer's Toolkit, as discussed above. Folders that do not have C programs will be unaffected and will not have this display.

Standalone C Program Merge Option

An alternate way of bringing a C program into your folder is to use the SA Merge option (especially useful if you have a C program but do not have the Toolkit on your PC or if you are putting the standalone program into more than one folder). To use this option, first press **F6** from the main menu in Logicmaster.

The following screen will be displayed:



Press **F3** to begin the Standalone Program Merge process. The following screen will be displayed:

```
STANDALONE MERGE UTILITY version 1.4

PLEASE ENTER THE NAME OF THE FILE YOU WISH TO COPY
NOTE: ending the string with \ will move to that directory

   Current Subdirectories:
[.]          [..]         [C70S]       [P70S]
[LESSON]     [EM7]        [HSC]        [FIP]
[C70]        [P70]        [FIELD]      [FLDCTRL]
[P70_LIB]    [LESSON1]    [SAINTS]     [MULTI]
[C30S]       [P30S]       [TCPIP]      [MICRO]
[LESSON3]    [TCPIP2]     [LESSON2]    [UPGRADE]
[FIELD1]     [NEW]        [LESSON4]    [NEW1]
[LESSON5]    [FIPNEW]     [CTOOL]      [VME]
[BLKMVR]     [R7CNVT]     [X_PLC]      [E_PLC]
[REAL]       [LESSON6]    [LESSON7]    [REALLY]
[DEC2_96]    [LAB2]       [PROB_1]     [LESSON9]
[COFFEE]     [SNPTEST]    [LESSON8]

   Standalone .STA files in the current directory:
BUBBLE.STA   LIMIT.STA

File to copy: C:\LM90\
```

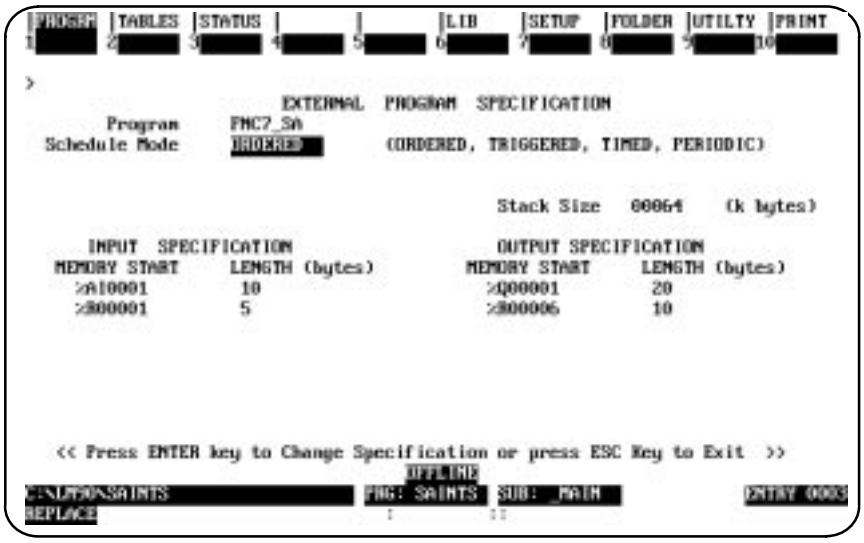
Type the name of the standalone C program you wish to merge into the folder. If the standalone C program is not located in the default directory, type the path and name of the program.

Selecting the Mode and Program Scheduling Options

When using multiple standalone C programs, you can control the settings of priorities for program execution when using Event-Triggered or Timed Schedule Mode. Ordered and Periodic modes provide other methods of controlling program execution. The ability to accommodate multiple programs and to use the Schedule Modes discussed below requires a Release 6 or higher PLC. For detailed technical information on Schedule Modes, refer to the "Program Scheduling Modes" section (and the pages following that section) of chapter 2 in the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265).

To set the priorities, follow these steps:

1. From the Program Declarations screen shown on the previous page, press the **cntrl** softkey (**F9**)
2. A display similar to the following screen will appear.



3. The default scheduling mode is **ORDERED** which will execute all programs in the order in which they appear on the Program Declaration screen (see sample on the previous page), one after another. The choices are **ORDERED**, **TRIGGERED**, **TIMED**, and **PERIODIC**. Press **Tab** with the cursor resting in the "Schedule Mode" field to scroll through the Schedule Mode selections. Press **Enter** to select the mode.

For detailed information about the different Schedule modes, refer to chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265).

Note

Only Release 6 or higher PLCs have the ability to accommodate multiple programs and to use the Schedule Modes.

Triggered and Timed Schedule Modes

If you select **Triggered** or **Timed** modes (step 3 on the previous page), you must specify the **Priority**. The program with the highest priority executes first with 0 being the highest priority. The range 10–99 is reserved for programs that run during any phase of the PLC sweep (i.e., not restricted to the logic window). In Microcycle sweep mode, triggered programs are limited to the logic window phase of the sweep, thus restricting the priority to 100–109. The values 0–9 are reserved. The table presented below shows the allowable priority values.

Table 3-12. Allowable Priority Values

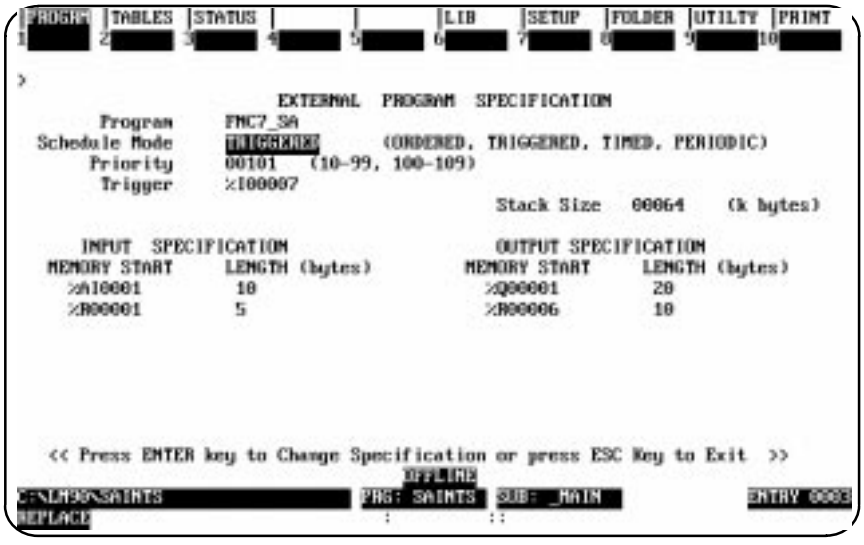
Scheduling Mode	Normal Sweep Constant Sweep Constant Window	Microcycle Sweep
Ordered	N / A	N / A
Periodic	N / A	N / A
Event Triggered	10–99	100–109*
Timed	10–99	N / A

*In Microcycle Sweep mode, Event Triggeredprograms can only run in the logic window portion of the sweep. 100–109 is reserved for the logic window.

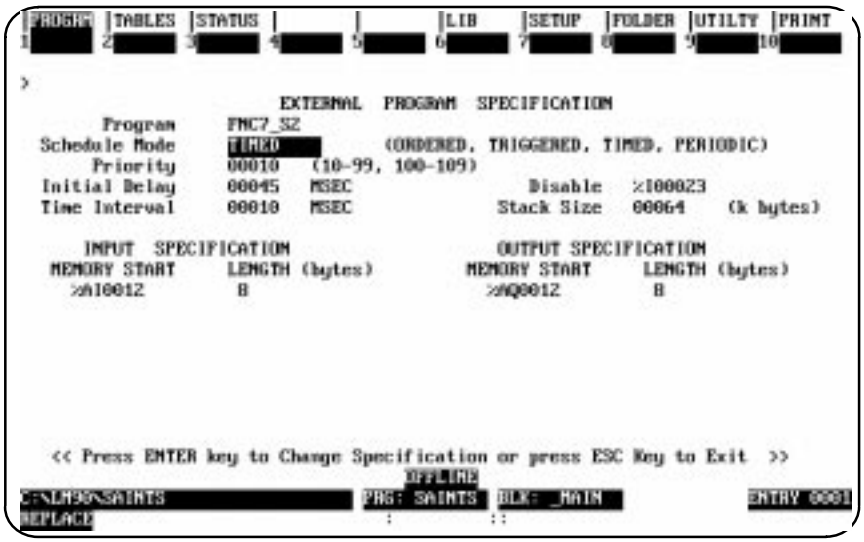
Note

To establish the priorities of execution for Event-Triggered programs, you must choose a number (10–99 in Normal, Constant Sweep, or Constant Window Sweep mode, or 100–109 when the CPU is in Microcycle Sweep mode) *for each program* to determine which program will run first. If two or more programs have the same priority, the order of execution is undefined.

The sample screen shown below shows the settings for an Event-Triggered program with the CPU in Microcycle Sweep mode. Setting the priority at 101 gives it the second highest priority possible for programs in Microcycle mode (see the table shown above).



The sample screen shown below shows the settings for a Timed program with the CPU in Constant Sweep mode. Setting the priority at 10 gives it the highest priority possible for programs in Normal, Constant Sweep, or Constant Window Sweep mode (see the table shown on previous page).

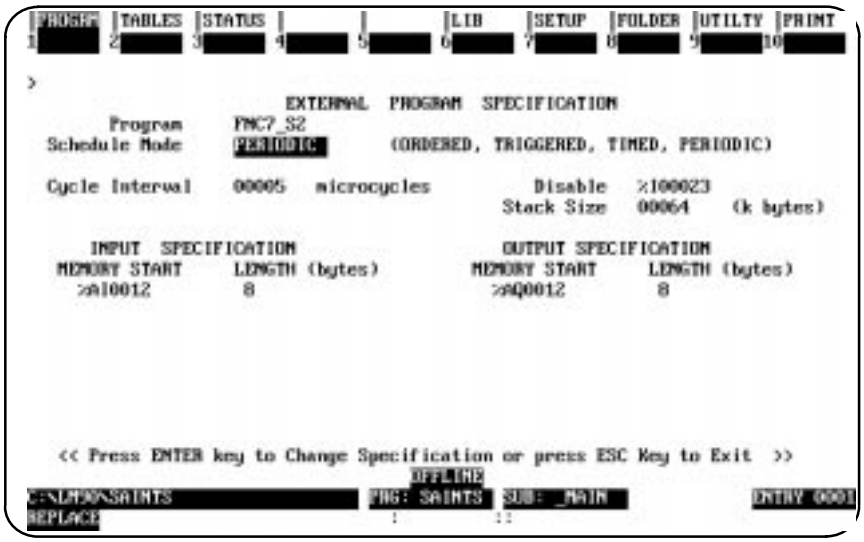


Most of the parameters are self-explanatory with the exception of "Priority" (discussed above) and those that are listed in the table below.

Parameter	Usage
Initial Delay	Enter the number of milliseconds to establish how long the CPU should wait in addition to the Time Interval before the ***first*** execution. If you wish to use seconds rather than milliseconds (the default), move the cursor onto the "**MSEC**" field and press **Tab** to toggle through the choices (MSEC, SEC).
Time Interval	Enter the number of milliseconds for the interval between each activation of the program. If you wish to use seconds rather than milliseconds (the default), move the cursor onto the "**MSEC**" field and press **Tab** to toggle through the choices (MSEC, SEC). In the sample screen shown above, the Initial Delay and the Time Interval parameters will cause program FNC7_S2 to execute every 10 milliseconds after waiting 45 milliseconds once the CPU is put into Run Mode.

Periodic Schedule Mode

In Periodic schedule mode, your entry in the “Cycle Interval” field denotes the cycle during which the program will execute. Periodic schedule mode is supported in Microcycle Sweep mode only. To control the execution of programs in this schedule mode, enter the interval of program execution in the “Cycle Interval” field. An entry of 1 would result in program execution at every Microcycle Sweep. In the example shown below, we have set the program to execute every fifth Microcycle sweep.



Note

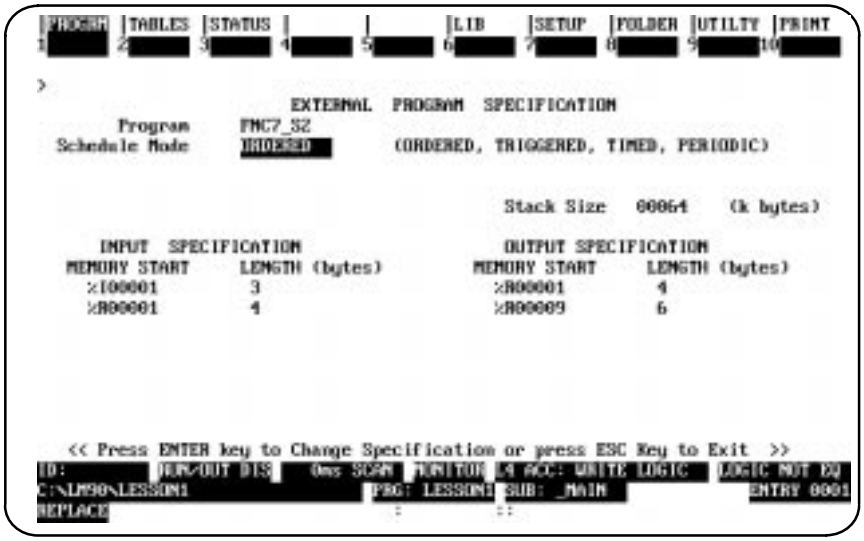
For detailed information on this and the other schedule modes, refer to the “Program Scheduling Modes” section (and the pages following that section) of chapter 2 in the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265).

Specifying Local Data References

As discussed in chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual*, when using multiple standalone C programs, you must specify the local data references so that a list of input reference addresses from the reference tables (%I, %R, etc.) will be copied into the C programs' local static memory.

To specify the local data references, follow these steps:

1. From the Program Declarations screen shown on page 3-75, press the **cntrl** softkey (**F9**)
2. A display similar to the following screen will appear.



The above sample screen shown above has the I/O already specified.

3. Press the **Cursor Down** key once to move the cursor to the **INPUT SPECIFICATION** field.
4. Enter the starting point and length similar to the sample shown above. Use the cursor keys to move from field to field. Press the **Escape** key when you are finished.

Section 10: Parameterized Subroutines

A Parameterized Subroutine Block (PSB) is an optional user-defined function block, configured with between zero and seven input/output parameter pairs. A parameterized subroutine enables you to re-use relay ladder diagram logic within the same program or in multiple programs. Logic which needs to be repeated can be entered in a parameterized subroutine. Calls would then be made to that subroutine to access the logic. In this way, total program size is reduced. Dividing a program into smaller subroutines simplifies programming and reduces the overall amount of logic needed for the program.

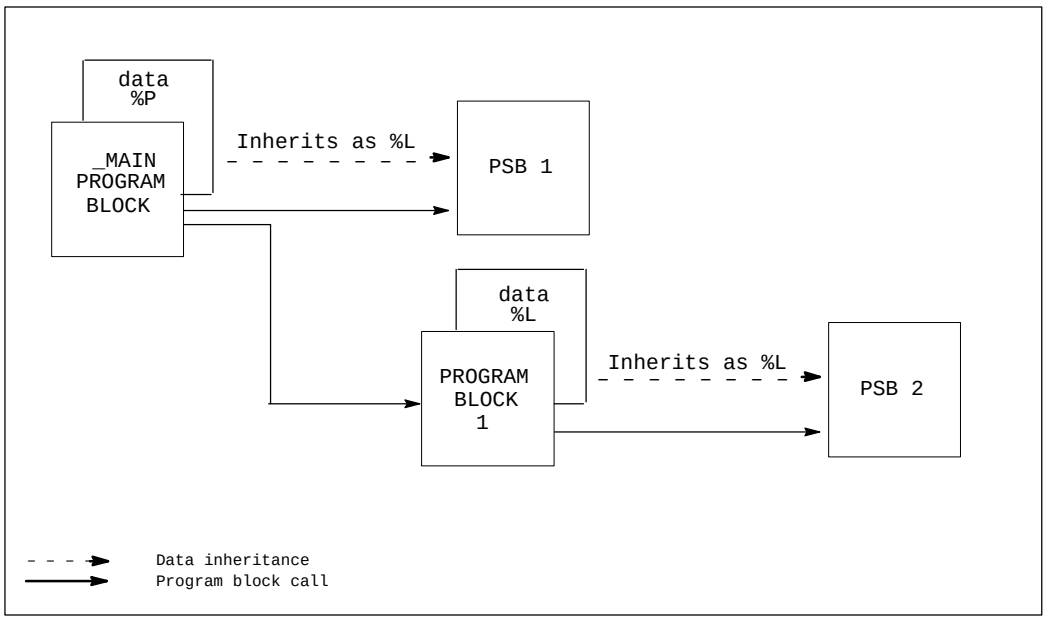
A program can "call" a Parameterized Subroutine Block as it executes; however, the Parameterized Subroutine Block must be declared through the block declaration editor before a CALL instruction can be used for that Parameterized Subroutine Block. For more information on calling a Parameterized Subroutine Block, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

The maximum size of a Parameterized Subroutine Block is 16K bytes of logic. The main program and all blocks must fit within the logic size constraints for that CPU model. Each Parameterized Subroutine Block may have up to 1000 local nicknames and descriptions.

Note

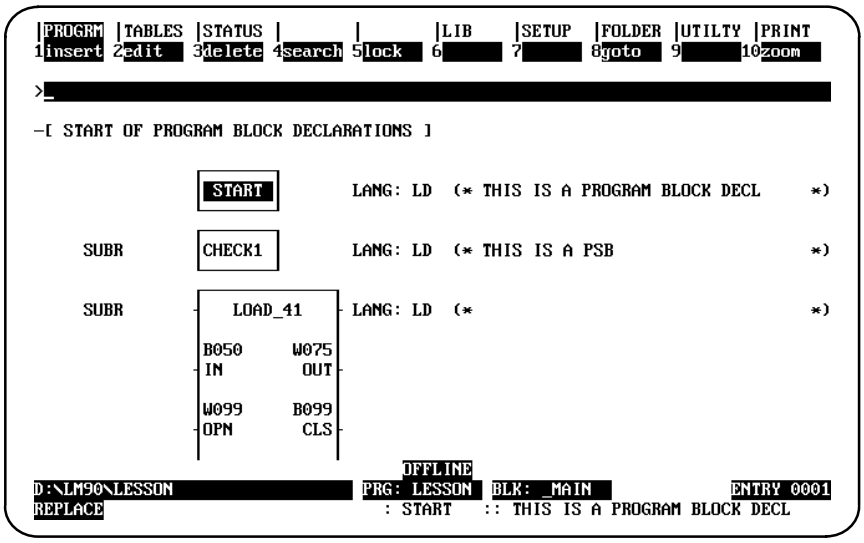
The maximum number of block calls that can occur in any block is 64. The maximum number of declared blocks is 255. No block may be called more than 255 times.

In addition, Parameterized Subroutine Blocks support the use of %P global data. Parameterized subroutine blocks do not have their own local (%L) data, but instead they inherit the local data of the calling block. Parameterized subroutine blocks also inherit %S contacts, such as FST_EXE, from the calling block. If %L references are used within a Parameterized Subroutine Block and the block is called by _MAIN, %L references inherit the %P references (i.e., %L0010 = %P0010) wherever encountered in the Parameterized Subroutine Block.



Block Declarations

Blocks are declared through the block declaration editor. To add a Parameterized Subroutine Block or edit an existing subroutine block from the _MAIN block, position the cursor on the **[PROGRAM BLOCK DECLARATIONS]** marker. Then, press **Zoom (F10)** to display the block declarations screen.



From this screen, you can create, delete, and zoom into parameterized subroutines. In the example displayed above, a program block named START has been declared, along with a subroutine named CHECK1, which has no input / output parameter pairs, and another subroutine named LOAD_41 ,which has four input / output parameter pairs.

The components of a PSB block declaration are:

Parameter	Description
SUBR	This field is automatically generated when a PSB is declared. It identifies the program block as being a Parameterized Subroutine Block. This field cannot be edited.
Block Name	Enter a block name of up to seven characters. The characters used in the block name may be a letter **A** through **Z**, a numeral from **0** through **9**, and an underscore. However, the first character of the name must be a letter. A block name is required and can be edited.
LANG	This field is automatically generated when a PSB is declared. It identifies the language the block was programmed in. For PSB program blocks, the language will always be **LD**. If the block is unexecutable, **NOT EXECUTABLE** will be displayed directly under the language identifier. This field cannot be edited.
Comment	A 32-character explanation of the subroutine block is displayed in this field. The comment is optional and may be edited.
Parameter Name	Subroutine parameter names can be from one to three characters. Valid parameter name characters are **A** through **Z**, a numeral from **0** through **9**, and an underscore. However, the first character of the name must be a letter. **Note:** The number of characters in the parameter name added to the number of digits in the parameter length must not exceed **5**.
Parameter Type	The parameter type describes the data format of each parameter. The available data formats are **BIT**, **WORD**, **NWORD**, and **NONE***.
Parameter Length	The parameter length describes the length of the parameter, in number of units (specified by type). (Default=1) **Note:** The number of characters in the parameter name added to the number of digits in the parameter length must not exceed **5**.

* Default selection.

Adding Block Declarations

Adding a subroutine block declaration may be accomplished several ways. The only difference is what is input on the command line.

Note

Press **ALT-A** at any time to abort this process.

1. Place the cursor at the desired location, and press the **Insert (F1)** softkey.

   A. If you do not have the Sequential Function Chart (SFC) feature, a program block filled with question marks (???????) will be displayed. Skip step 2 and proceed with step 3 below.

   B. If you have the Sequential Function Chart (SFC) feature, a set of softkeys consisting of a Ladder Diagram (LD – F1) softkey and a Sequential Function Chart (SFC – F2) softkey will be displayed. Proceed with step 2.

2. Enter a valid block name on the command line, and press the **Ladder Diagram (F1)** softkey. A standard program block with the block name will be created at the cursor. Also, a set of softkeys consisting of Program Block (F1) and Subroutine (F2) will be displayed.

   A. If no block name or an invalid block name is entered prior to this step, the block will be labeled ???????.

   B. If a block name and number of parameters is entered prior to this step, the block name will be used, but the number of parameters will be ignored.

3. To add a subroutine block with four input/output parameter pairs, enter **4** on the command line, and press the **Subroutine (F2)** softkey. When you press **F2**, the screen displayed will show all of the parameters inactive.

   A. If a valid block name and/or valid number of parameters has not been entered, the following message will be displayed:

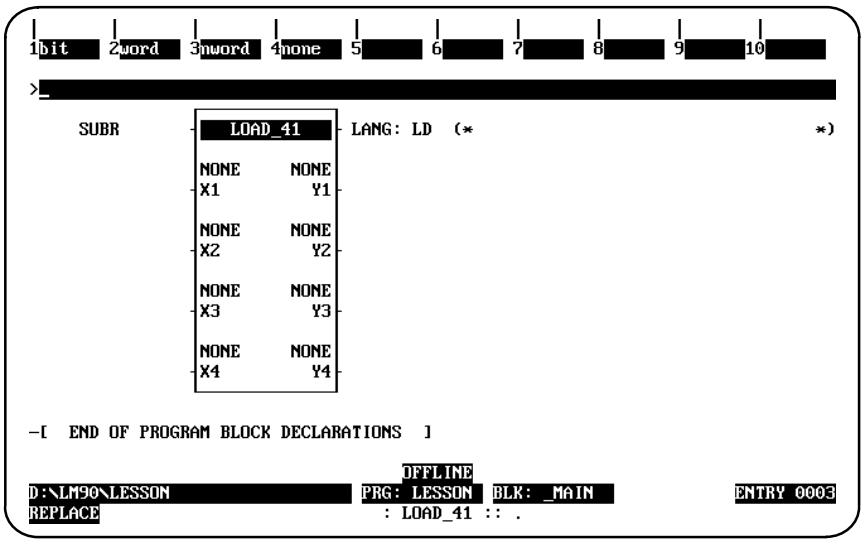
   ```
   Enter number of parameter pairs (0–7) and/or block name
   ```

   B. A block name and number of parameter pairs can be entered on the command line separated by a space. The order of the name and number of parameters may be reversed.

   C. A program block name is required before the block can be accepted.

   D. If the number of parameters is not specified, a default of 0 parameters will be used.

   E. Parameters X1 – X7 are input parameters, and Y1 – Y7 are output parameters.



4. To change X1 from **NONE** to **BIT**, use the Tab key to cursor to the X1 input parameter, and press **F1** to select the parameter type **BIT**.

   A. A valid parameter name and/or parameter length can be entered on the command line prior to pressing one of the softkeys (bit, word, or nword) separated by a space. For example, if you tab to X1, enter **IN 50** on the command line, and press the **Bit (F1)** softkey, a type, length, and name will be entered for the parameter (type = bit, name = IN, length = 50).

   B. If both the name and length are entered, they must be separated by a space. The order in which the name and number of parameters is entered may be reversed.

   C. Arrow keys may be used to move around the subroutine block.

Note

If either the parameter name or the parameter length is invalid, and they are entered together, both will be ignored.

The following table describes the maximum length for each parameter type:

Parameter Type	Maximum Length
Bit	256
Word	512
Nword	512
None	N/A

5. Repeat step 4 above for each parameter.

6. To save the new subroutine block, press the **Escape** key. The information will be written to the folder. If the PSB was created while **ONLINE** and **LOGIC EQUAL**, the status will change from **LOGIC EQUAL** to **BLOCK EDIT**.

Editing Subroutine Blocks

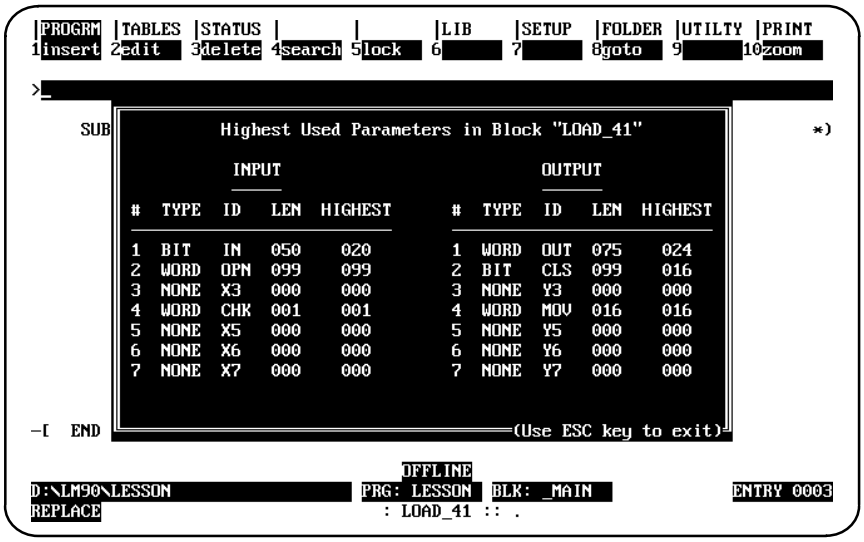
To edit a subroutine block declaration, place the cursor on or adjacent to the subroutine block, and press the **Edit (F2)** softkey. Then, use the Tab key or cursor key to move around the subroutine block.

Note

A subroutine block cannot be edited once a call to that subroutine is made.

Parameter	Description
Block Name	To change the block name, place the cursor anywhere inside the subroutine box, enter a valid name, beginning with an alpha character, on the command line, and press the **Enter** key.
Number of Parameter Pairs	To change the number of parameter pairs, place the cursor anywhere inside the subroutine box, enter a number from `0` to `7` on the command line, and press the **Enter** key. If logic exists in the subroutine, the number of parameter pairs cannot be decreased below the highest used parameter. For example, if X3 is the highest parameter used, the number of parameter pairs cannot be less than 3.
Parameter Length	To change the length of a parameter, place the cursor next to the parameter to be changed, enter the new length on the command line, and press the **Enter** key. If logic exists in the subroutine, the parameter length cannot be decreased below the highest used parameter offset. For example, if you want to change the length of parameter X2 and X2[08] is the highest reference used in the subroutine logic, the parameter length cannot be less than 8.
Parameter Name	To change the name of a parameter, place the cursor next to the parameter to be changed, enter the new name on the command line, and press the **Enter** key. Any logic in the subroutine, referencing the parameter will be updated to the new parameter name.
Parameter Type	To change the parameter type, place the cursor next to the parameter to be changed, and press the appropriate softkey (bit, word, nword, or none) to select the new parameter type. If logic referencing the current parameter exists in the subroutine, the parameter type cannot be changed. A parameter name and / or length may be entered on the command line when changing the type.
Comment	To change the comment, place the cursor anywhere in the comment area, enter a new comment up to 32-characters, and press the **Enter key**.

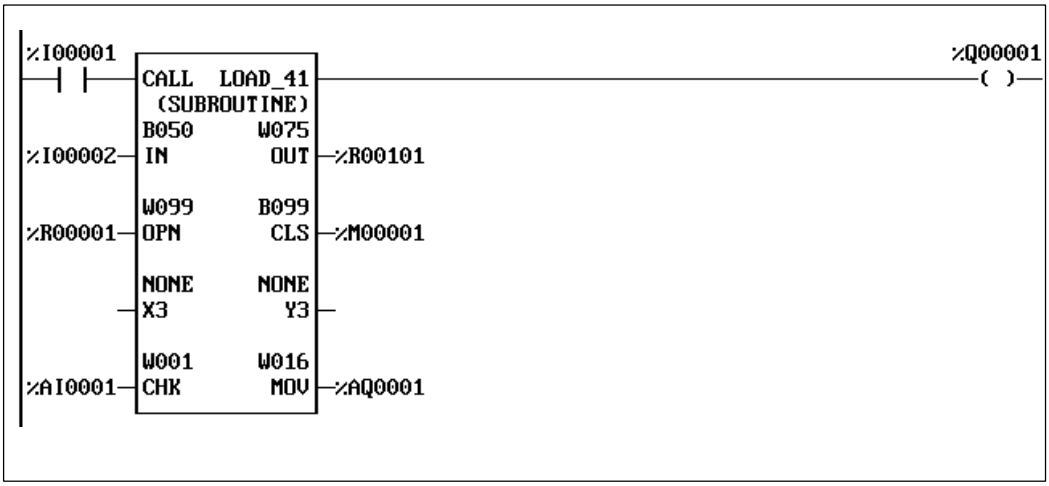
With the cursor on the subroutine block declaration, or while editing the subroutine block declaration, you can press **ALT-W** to display the Highest Used Parameters in Block screen. A sample screen is shown below:



Calling a Parameterized Subroutine in Logic

A parameterized subroutine can be called in relay ladder diagram logic from the _MAIN block, from a program block, or from another parameterized subroutine by using a CALL instruction. Once the name of the subroutine is applied to the CALL instruction, the user-defined parameter set is displayed.

In the following example, if %I00001 is ON, the parameterized subroutine named LOAD_41 is executed. The LOAD_41 subroutine block operates on the input data, located at reference addresses %I00002 – %I00051, %R00001 – %R00099, and %AI0001, and produces values in the block of output data located at reference addresses %R00101 – %R00175, %M00001 – %M00099, and %AQ0001 – %AQ0016. The logic within the subroutine can also control the OK output of the subroutine by referencing Y0[001].



This example shows the subroutine CALL instruction as it will appear in the calling block. By positioning the cursor within the instruction, you can press **F10** to zoom into the parameterized subroutine.

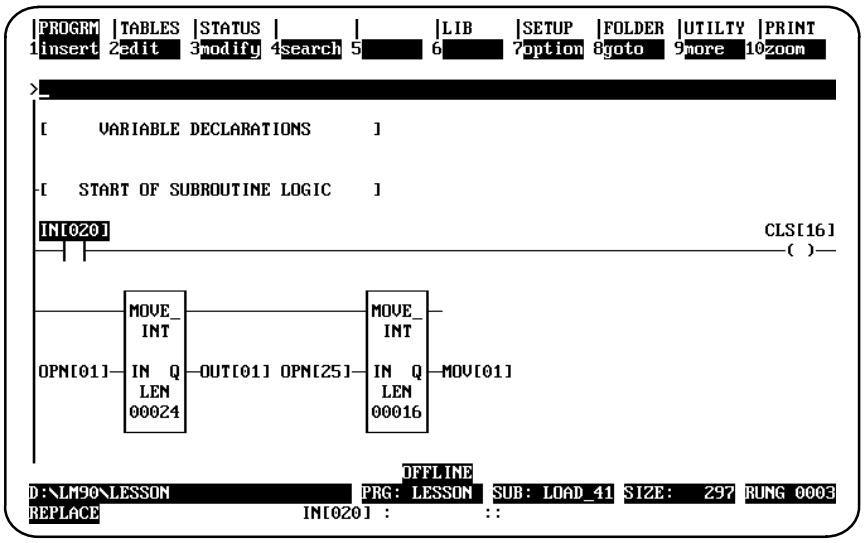
Parameterized subroutine block formal parameters (e.g., X1[001]) may be passed from one Parameterized Subroutine Block to another. Refer to the restrictions listed on page 3-99.

For more information on calling a Parameterized Subroutine Block, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

Inserting/Editing Logic within a Subroutine

Once declared and entered into relay ladder diagram logic, you can position the cursor on the parameterized subroutine call and press the **Zoom (F10**) softkey. You can also zoom into the parameterized subroutine from the block declaration table.

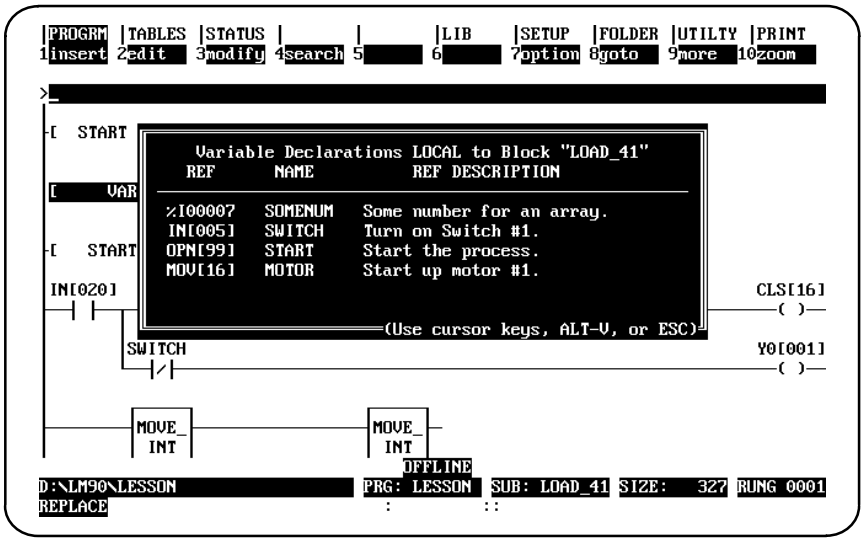
In this example, if you position the cursor on the PSB named LOAD_41, shown in the previous screen, and press the **Zoom (F10)** softkey, the PSB logic will be displayed.



Nicknames may be defined when using a formal parameter. For example, IN[005] may be assigned the name SWITCH by entering **IN[005] SWITCH** on the command line. SWITCH can now be used to reference IN[005] anywhere within the PSB.

Viewing the Variable Declaration Table within a Subroutine

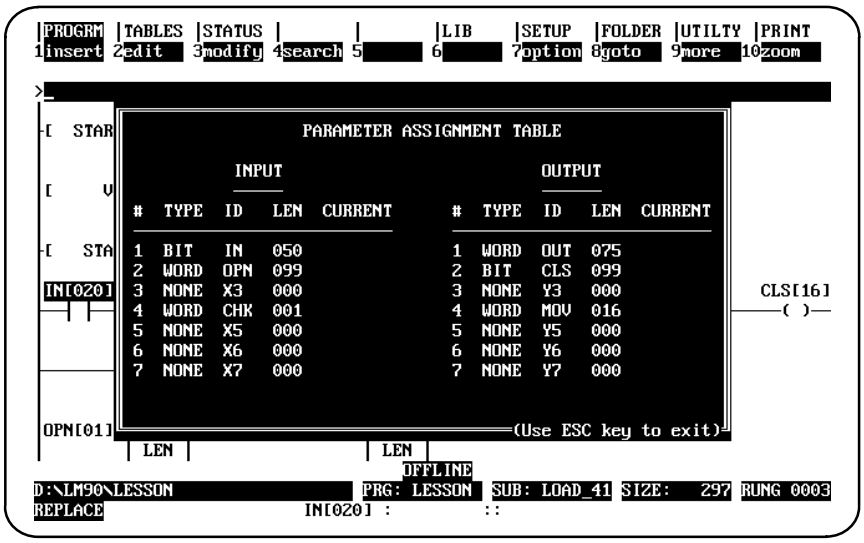
If entries already exist in the variable declaration table, a table similar to the one shown below will be displayed when you zoom into the variable declaration section of a parameterized subroutine. This table can also be viewed by pressing the **ALT-V** keys.



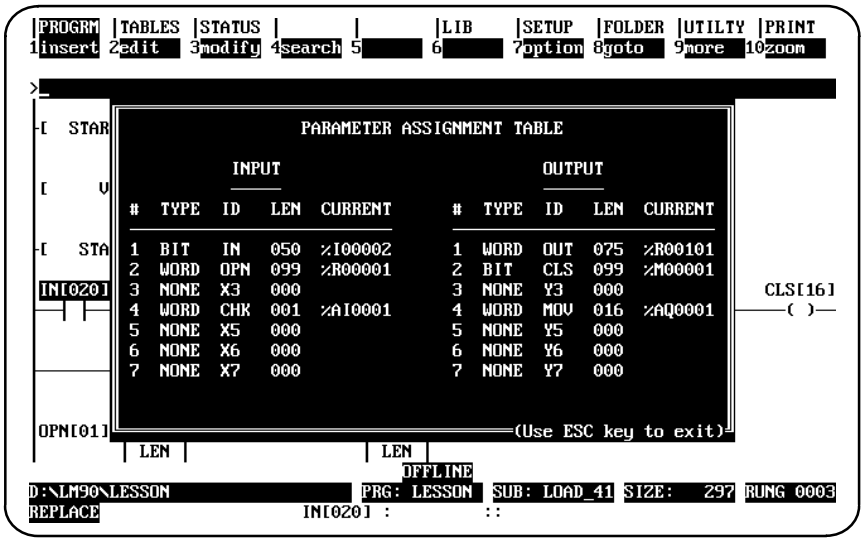
Viewing the Parameter Assignment Table

When zoomed into a Parameterized Subroutine Block, the parameter assignment table may be viewed by pressing **ALT-W**. The table will be slightly different when zooming in from the Program Block Declaration screen or when zooming in from a program block. The difference will be in the ***Current*** column of the table. When zoomed in from the Program Block Declaration screen, the current column will be empty. When zoomed into a call to a PSB, the ***Current*** column will display the current assignment for each parameter.

The following sample parameter assignment table was zoomed in from the Program Block Declaration screen.



The following sample parameter assignment table was zoomed in from a program block.



Referencing Formal Parameters within a Parameterized Subroutine Block

Formal parameters are those parameters used within the Parameterized Subroutine Block that are passed from and to the calling block. They are either BIT, WORD, or NWORD types. Functions that have DINT, DWORD, or REAL parameter types (such as floating point math) require that the Parameterized Subroutine Block formal parameters be declared as NWORD. For a definition and example of NWORDs, as well as an explanation of when to use NWORD parameters rather than WORD parameters, refer to page 3-98.

The formal parameters are identified as **X** or **Y** parameters, followed by the number of the input or output parameter, respectively. For example, X2 indicates the second input parameter used in the parameterized subroutine declaration. The X2 label could be followed by an index value of 1 to the length of the Parameterized Subroutine Block parameter. For example, the maximum index value would be 16 if X2 was defined as having a length of 16.

Up to seven formal parameter pairs may be declared for a Parameterized Subroutine Block. Within the PSB, the formal parameter reference has the form:

ab[ccc]

where:	**a = X**	denotes an input formal parameter.
	a = Y	denotes an output formal parameter.
	b	is a parameter number between 1 and 7.
	c	is a valid BIT, WORD, or NWORD index.

When the formal parameter nicknames are used, the formal parameter reference has the following forms:

d[ccc]
dd[ccc]
ddd[cc]

where: **d**, **dd**, and **ddd** are valid 1, 2, and 3-character nicknames.

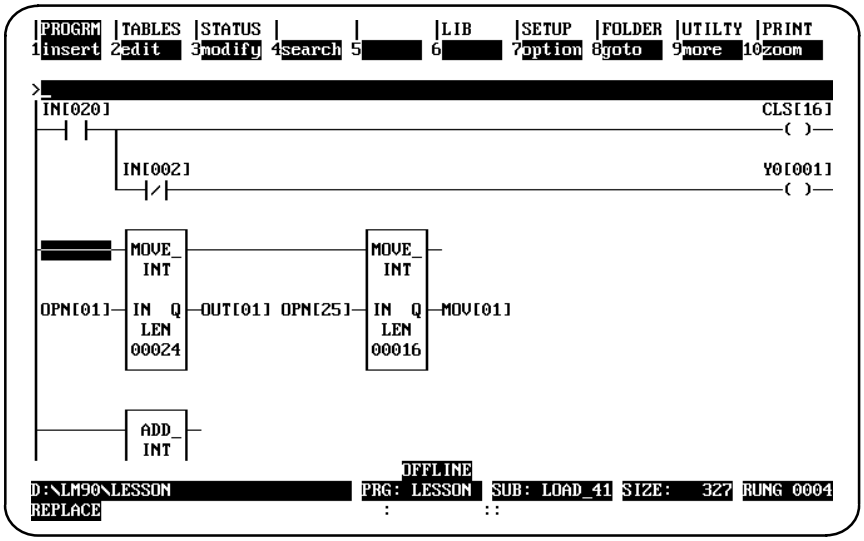
NWORD type parameters may be used on any multi-word type operands, but not on discrete types. If an NWORD parameter type is declared with a length value of 5, N005 will be displayed above the selected parameter location.

Note

For more information about using NWORDs, refer to page 3-98.

Assigned parameters are PLC references or data flow which pass their address or data into or out of a Parameterized Subroutine Block. An assigned parameter may pass either the value of the data in the assigned parameter (BIT type parameters) or the address of the assigned parameter (WORD or NWORD type parameters). Assigned parameters are viewed in the parameter assignment table.

In the following screen, the IN[020] formal parameter value has the state of the assigned parameter of %I00021, and IN[002] has the state of the assigned parameter of %I00003. The OPN[01] – OPN[24] parameters reference the actual values of %R00001 – %R00024. The OPN[25] – OPN[40] parameters reference the actual values of %R00025 – %R00040. The value of the output parameter CLS[16] is assigned to %M00016. OUT[01]–OUT[24] and MOV[01]–MO V[16] reference the word values at parameter locations %R00101 – %R00124 and %AQ00001 – %AQ00016, respectively. The Y0[001] reference on the first rung will control the OK output of parameterized subroutine LOAD_41.



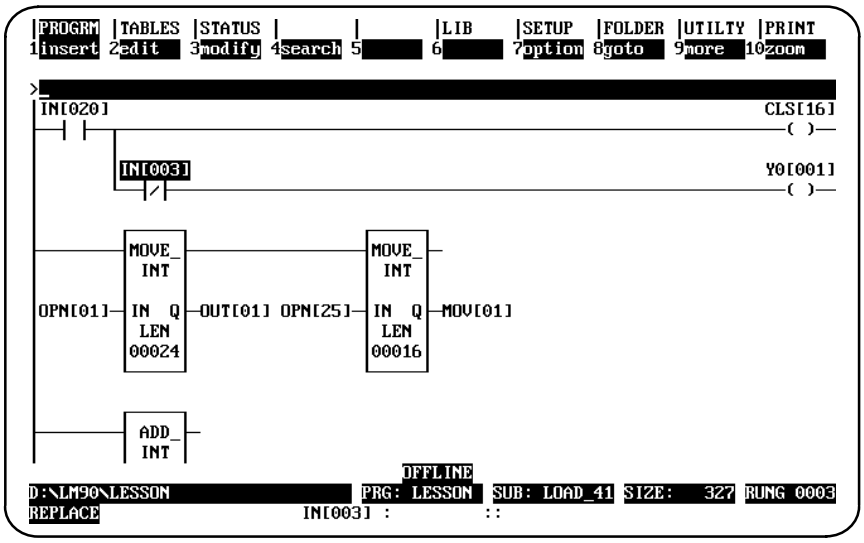
Note

When zoomed into a PSB from the Program Block Declarations, no real-time updates will be displayed for formal parameters (X1 – X7, Y1 – Y7) or local data (%L). You must zoom into the PSB from a call to it to display real-time updates of the formal parameters.

When zoomed into a PSB, power flow input and output parameters, as well as the OK output (Y0[001]) will always be displayed in an OFF state.

Changing Formal Parameters

To change a formal parameter reference, position the cursor at the desired location and enter a new formal parameter reference within the length declared for the parameter. For example, position the cursor on input parameter IN[002]. Enter **IN[003]** on the command line, and press the **Enter** key. This reference of the use of parameter IN[003] will be modified to use the next bit, or %I00004 in this case. The display is updated with the new reference IN[003].



Guidelines to Follow Within a Parameterized Subroutine Block

Follow these guidelines when referencing formal parameters within a parameterized subroutine:

- A formal parameter can be used within a parameterized subroutine at any function parameter location that would normally accept a BIT, WORD, DWORD, or INT type parameter.
- Autonext highest unused function and auto increment / decrement support formal parameters. (To learn more about auto increment, decrement, and next, see page 3-124 and following.)
- Formal parameters are valid references only within 1-parameter to 7-parameter subroutines.
- Online programming within declared formal parameter ranges is supported.
- A **RUN MODE STORE** of an entire program, including parameterized subroutines, is supported.
- Remember that local data (%L) is inherited from the calling block.
- You cannot use auto-next highest with %L references in a PSB.
- Output parameter Y0[001] (single bit output) may be used to set or clear the PSB's OK output. If not used, Y0[001] will default to ON. Parameter Y0[001] is not available in 0-parameter PSBs.

Formal Parameters within a Parameterized Subroutine Block

In general, formal BIT parameters are allowed on all contacts, coils, and function block parameters that allow discrete references (%I, %Q, %M, %T, %S, %G, and %U). Formal WORD and NWORD parameters are allowed on all function block parameters that allow register references (%R, %AI, %AQ, %P, %L, and %UR). However, the list provided on the next page contains several exceptions and restrictions.

Note

NWORDs are used **only** with Parameterized Subroutine Blocks. NWORDs allow an array of words to be referenced. NWORD parameters enforce type checking for DWORD, DINT, and REAL instructions. To avoid confusion, please read the explanation presented below.

NWORDs Defined

An NWORD is a number of words passed into and / or out of a Parameterized Subroutine Block. NWORDs can be treated as WORDs or DWORDs, determined by the way they are accessed. If you are using DWORD / DINT features, such as MATH or MOVE, you must set up the array as shown at the bottom of this page.

NWORD parameters are parameters that make up multiple WORDs; i.e., NWORD parameters comprise an array of WORDs. The size of NWORDs is specified in WORDs, not DWORDs. NWORD parameters may be used on any multi-word operands, but NOT on discrete type parameters.

When to Use NWORD Parameters Rather Than WORD Parameters

If you are using floating point math or if your Parameterized Subroutine Block (PSB) function requires multi-WORD-oriented reference types, use NWORD parameters. WORD parameters allow discrete references (e.g., %I, %Q, etc.); NWORD parameters do not allow discrete references.

Using NWORDs

Within a Parameterized Subroutine Block, the first word of an NWORD parameter would be referenced by X1[1], for example. The second word would be referenced by X1[2], etc.

If you want to pass DWORD parameters into a Parameterized Subroutine Block, you must use the NWORD parameter type. The first DWORD would be referenced by X1[1] (same as for word). However, the second DWORD would be referenced by X1[3]; the third by X1[5], etc.

NWORD Parm X1[1]	First WORD	First DWORD
NWORD Parm X1[2]	Second WORD	
NWORD Parm X1[3]	Third WORD	Second DWORD
NWORD Parm X1[4]	Fourth WORD	
NWORD Parm X1[5]	Fifth WORD	Third DWORD
NWORD Parm X1[6]	Sixth WORD	

Restrictions on Formal Parameters within a Parameterized Subroutine Block

The following list contains several exceptions and restrictions to the general use of formal parameters within a Parameterized Subroutine Block:

1. Transitional contacts, transitional coils, and retentive coils are not allowed with formal parameters. The editor will substitute the non-retentive equivalent of these functions, **+---(M)**, **+---(SM)**, and **+---(/M)**, and display the warning message:

   Coil type was adjusted

2. Retentiveness is not affected by the use of formal parameters or assigned output parameters. Only explicit reference to a non-retentive coil reference can cause clearing on a **STOP-TO-RUN** transition.

3. Formal BIT input parameters cannot be used as output parameters on a function block.

4. Multi-word type function block (i.e., DINT, DWORD, or REAL) parameters are only allowed with formal NWORD parameters.

5. Formal parameters are not allowed on the following function block parameters:

Function	Parameter
Service Request (SVCREQ)	PARMS input parameter.
Communications Request (COMMREQ)	IN input parameter.
DATA_INIT DATA_INIT_COMM DATA_INIT_PID DATA_INIT_ASCII	Q output parameter.
DOIO	ST, END, and ALT parameters.

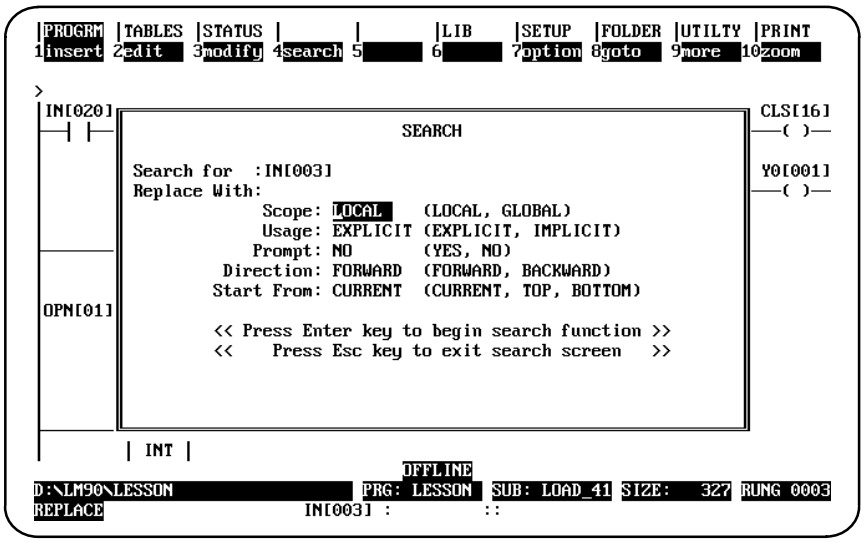
6. A Parameterized Subroutine Block's BIT type formal parameters may not be passed directly to another (nested) Parameterized Subroutine Block. You may, however, create logic that moves the BIT type formal parameter to a temporary storage location such as %I memory and pass this reference to another (nested) Parameterized Subroutine Block.

7. A PSB's WORD type formal parameter may not be passed to another PSB's NWORD type formal parameter.

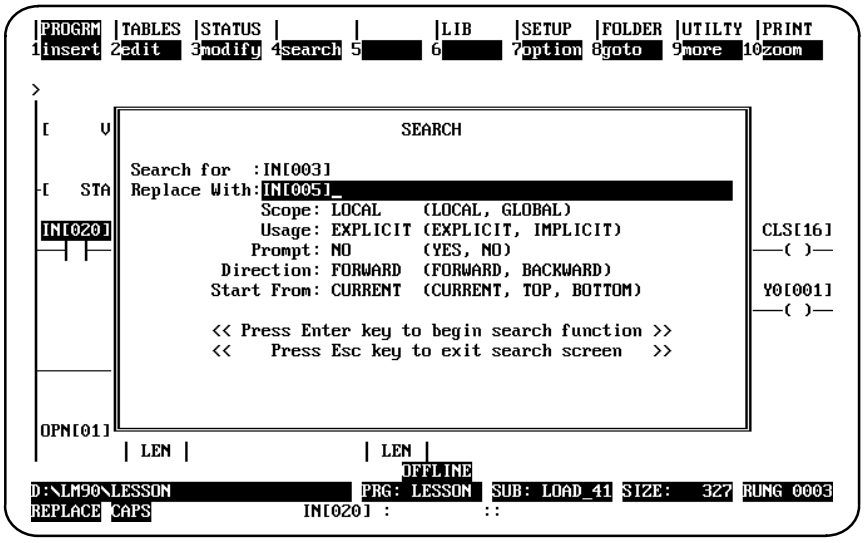
Search and Replace

The search and replace of references with X and Y formal parameters are allowed only locally within a subroutine and only within the valid range and type of declared parameters. Search arguments for formal parameters of the form XN, YN, XN[nnn], and YN[nnn] are supported. The search function may be global or local.

In order to initiate a search for a formal parameter, you must have the subroutine displayed. Press **Search (F4)**. Enter the name of the formal parameter in the ***Search for*** field, set the ***Scope*** to **LOCAL**, and press the **Enter** key. For example, to search for the formal parameter IN[003], enter **IN[003]** in the ***Search for*** field, set the scope to **LOCAL**, and press the **Enter** key.



To replace the formal parameter IN[003] with IN[005], enter **IN[003]** in the ***Search for*** field and **IN[005]** in the ***Replace with*** field. Then, press the **Enter** key to initiate the search and replace.



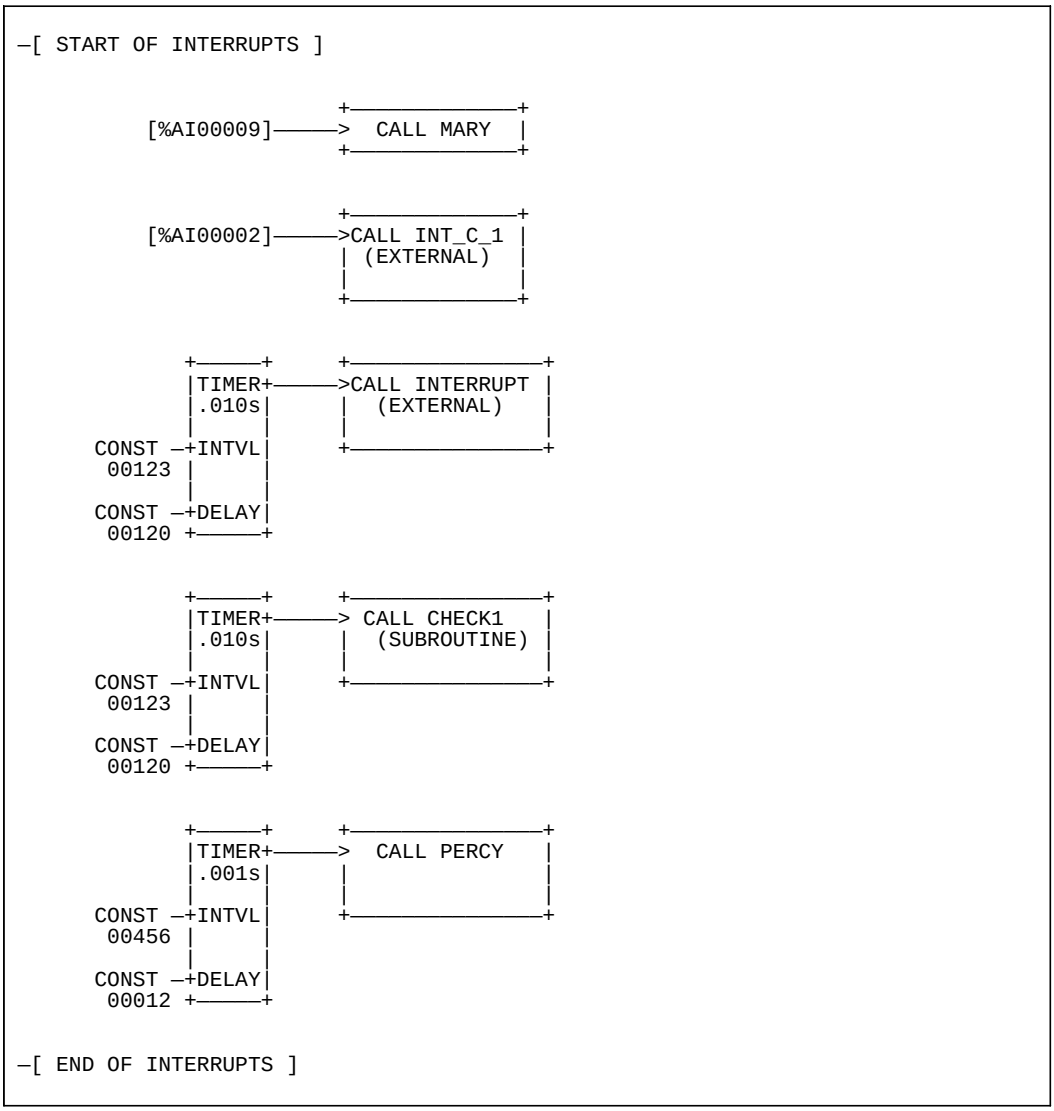
Interrupts

Note

Only 0-parameter PSBs may be invoked by an interrupt.

PSBs invoked by an interrupt are not interruptible, while PSBs invoked from relay ladder diagram logic are interruptible.

The sample below shows how the interrupt editor will display various types of interrupts when paging through the interrupt declarations.

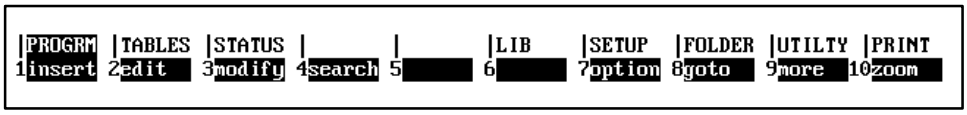


Note

When a PSB is invoked by an interrupt, it will inherit the _MAIN block's local data (%P).

Section 11: Rung Edit

After a logic program has been entered, there is always a need to make modifications, either to correct logic errors or to add new capabilities. Logicmaster 90-70 software has an array of features to make this process easy. The same function keys used to initially enter a rung are available to insert new rungs. In addition, there are function keys to edit or modify existing rungs.



Function Key	Function	Description
F1	Insert	Add one or more rungs to the program. Selecting the insert function opens a new space above the rung where the cursor is positioned and displays the Edit Rung keys, which are used to select program elements. This allows you to create a new rung.
F2	Edit	Edit the rung at the cursor location. The edit function activates the current rung, enabling you to modify that rung. When **F2** is pressed, the Edit Rung keys are displayed at the top of the screen. These keys are used to select program elements.
F3	Modify	Initiate word-for-word instruction changes using the Edit Rung softkeys instead of mnemonics.
F4	Search	Locate a program element.
F7	Option	Access coil checking and other editor options.
F8	Goto	Go to the specified rung.
F9	More	Access additional Edit Rung softkeys.
F10	Zoom	Go to a more detailed level. To return to the original level, press the **Escape** key.

Pressing **More (F9)** displays these additional rung edit softkeys.

Function Key	Function	Description
F1	Select	Select or deselect a rung or group of rungs. Rungs or declarations may also be deselected by pressing **F1** again, by pressing **ALT-A**, or by pressing the **Escape** key. After deselecting the rungs or declarations, the message "Select mode cancelled" is displayed on the message line and the cursor remains on the last rung or declaration that had been selected.
F2	Cut	Delete the selected section of rungs or declarations from a program and put them in the cut buffer. After a cut operation, the cursor will appear on the rung or declaration immediately after the selected region.
F3	Paste	Insert previously cut rungs or declarations from the cut buffer. Cut rungs and declarations may be pasted any number of times, until they are replaced by new information in the cut buffer, or until the program editor is exited.
F4	Include	Insert previously written rungs or declarations back into the original program, or into any other program. Written rungs and declarations may be included any number of times.
F5	Write	Copy the selected section of rungs or declarations from a program into a special file. After a write, the cursor remains on the last rung or declaration selected.
F6	Delete	Delete the rung at the cursor location or a range of selected rungs.
F8	Goto	Enter the rung number on the command line, and then press **F8** to "go to" a specific rung in the ladder diagram logic. You can also specify a block name and rung number in the block to "go to" a specific rung in that block.
F9	More	Return to the first level of Edit Rung softkeys.
F10	Zoom	Zoom into the item the cursor is on.

Note

The function keys listed above can also be applied to the variable declaration table. Using the file write function, a group of reference descriptions can be written to a file to be used by another program.

Editing a Rung

When either the insert, edit, or modify function is activated by pressing **F1**, **F2**, or **F3**, respectively, the following softkey selections are displayed at the top of the screen.

These function keys provide access to the instructions required to edit ladder diagram rungs.

Note

Only one rung is active at a time in either the insert or edit function. Each rung must be completed **and** accepted by the software before the next rung can be edited.

Entering Insert or Edit Mode

Enter either **INSERT** or **EDIT** mode by:

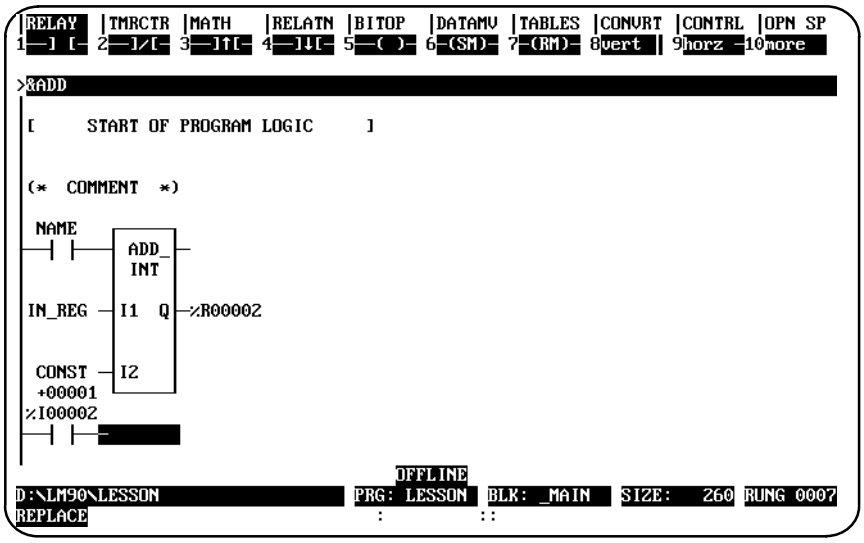
1. Pressing **F1** to enter **INSERT** mode. In this mode, the new rung is inserted before the rung on which the cursor is positioned. Therefore, make sure the cursor is on the rung following the location for the new rung before you press **F1**.
2. Pressing **F2** to enter **EDIT** mode. Then, move the cursor to the rung element you want to change.

Entering Instructions

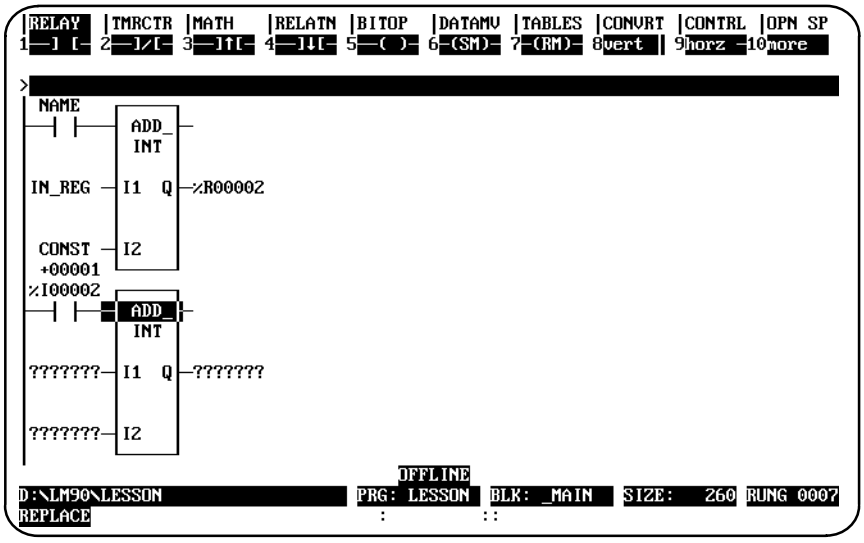
Select instructions by:

1. Typing the mnemonic for the instruction, preceded by an ampersand character (**&**). (Refer to appendix E, "Instruction Mnemonics," for a listing of the mnemonics for Logicmaster 90-70 programming software.) Then, press the **Enter** key.
2. Pressing the Shift key and a function key to display a specific group of instructions. Then, select a specific instruction within that group by pressing its function key.

In this example, the ADD function is selected by typing the mnemonic **&ADD** on the command line.

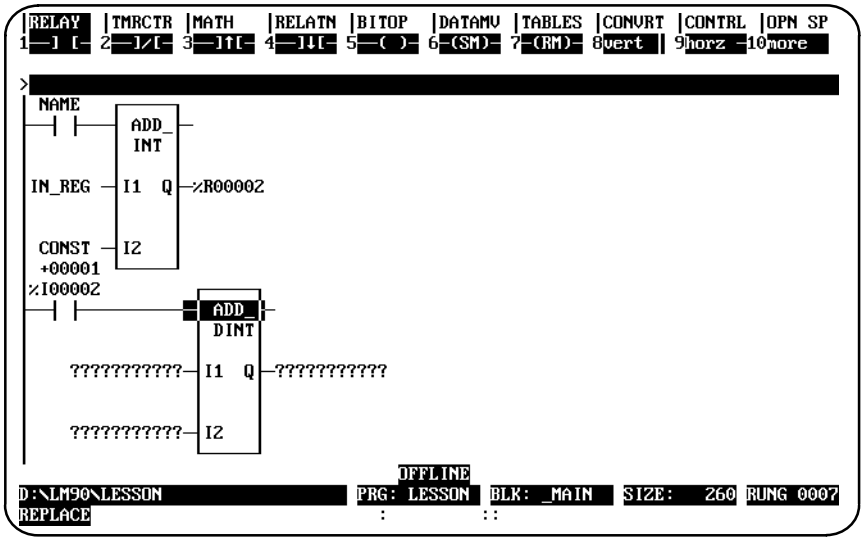


After the **Enter** key is pressed, the screen adjusts to display the complete new instruction and the ADD function is inserted.



Entering/Modifying Data Types

Some instructions support different data types. To change ADD_INT to ADD_DINT, press **Types (F10)** with the math functions still displayed on the screen. Then, press **DINT (F7)** with the cursor on the ADD function block to create the following screen. An alternative way to select ADD_DINT is to type **&ADD_DINT** on the command line, and press the **Enter** key.



Moving the Cursor within a Rung

Use the keys listed in the table below to move within the rung.

Key	Description
Cursor keys Tab and Shift-Tab Home key End key	Move the cursor within the rung. Move among the inputs and outputs of a function. Position the cursor on column 1 in row 1. Position the cursor on the last defined row.
For Command Line Entry	
Insert key Delete key Backspace key CTRL-Left Cursor or CTRL-Right Cursor	Change the text editing mode (**INSERT** or **REPLACE**). Delete the character at the cursor position. Delete the character to the left of the cursor position. Move the cursor within the command line.

Entering a Reference Address

Enter a reference address on the command line. Then, press the **Enter** key to apply the reference to the operand at the current cursor location. Repeat this step for each operand in the instruction.

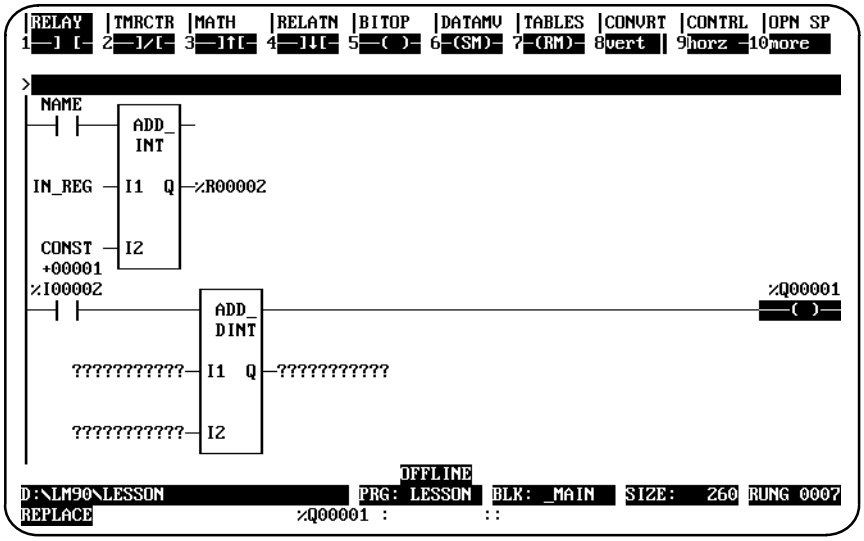
For single operand instructions, the reference address can be entered on the command line before pressing the function key. Then, when the function key is pressed, the reference address is automatically applied to the instruction.

Entering Nicknames

Nicknames can also be created or modified on the command line. To do this, enter the nickname together with its machine reference and any associated reference description. (Refer to chapter 3, section 4, "Program Annotation," for more information on entering nicknames and reference descriptions.)

Using Vertical and Horizontal Links

Use **Vertical Links (F8)** and **Horizontal Links (F9)** to connect the instructions within a rung. These links are available from the relay functions, but may also be entered without returning to the relay function menu by pressing the **Vertical bar (|)** key to enter a vertical link or the **Tilde (~)** key to enter a horizontal link.

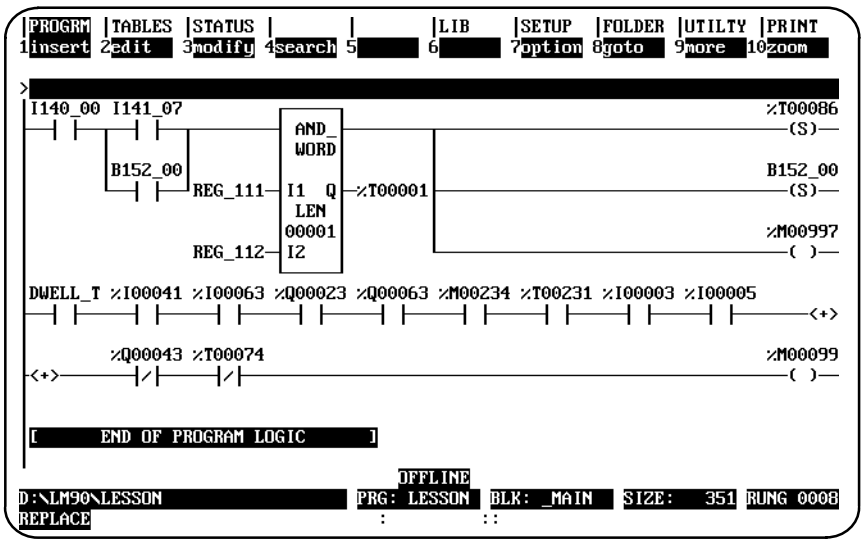


Using Continuation Coils and Contacts

Use a **Continuation Coil (F1)** and the **Continuation Contact (F2)** to continue relay ladder rung logic beyond the limit of ten columns. These keys are available from the relay functions by pressing **More (F10)**; they may also be entered using their mnemonics (&COILCTD and &CONCTD). There can be only one continuation coil and / or one continuation contact per rung.

The **Continuation Coil (F1)** is used to carry the current rung's status to the rung which has a continuation contact. The continuation coil can only be placed in column 10 of the rung. It does not require the use of a continuation contact in following rungs for editing.

The **Continuation Contact (F2)** is used to continue the status of the continuation coil rung's logic on the continuation contact's rung.

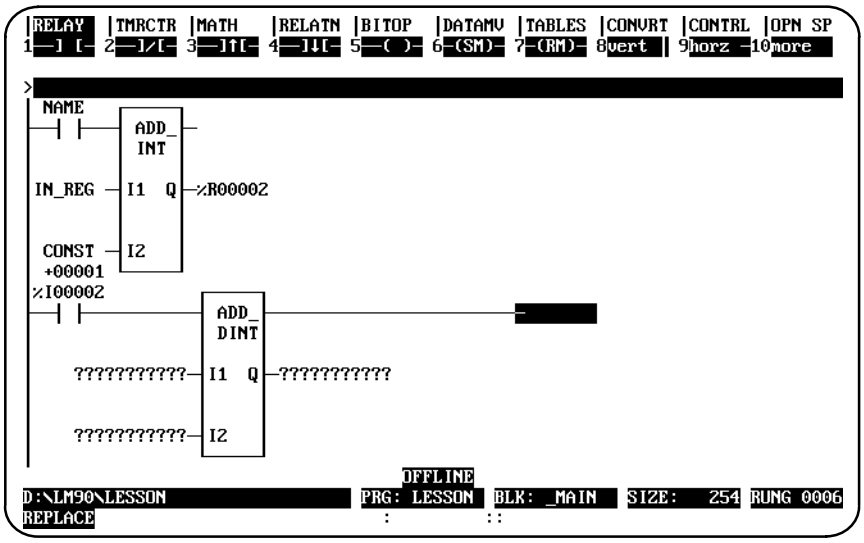


The state of the last executed continuation coil is the flow state that will be used on the next executed continuation contact. The continuation contact does not require a continuation coil in previous rungs for editing. However, if the flow of logic does not execute a continuation coil before it executes a continuation contact, the state of that contact will be no flow.

Deleting an Element

To delete an operand or instruction from a rung while in **INSERT** or **EDIT** mode, press **ALT-D** or **Open Space (Shift-F10)** and then **Delete Instruction (F10)**. Enter another instruction in the space left by the deleted instruction, or enter a horizontal link. An instruction may also be deleted by replacing it with another instruction.

To remove the horizontal links and coil that follow the ADD_DINT instruction, place the cursor on each logic segment and press **ALT-D**. The Tilde (~) key or **Horizontal Link (F9)** softkey can also be used to clear the link.



Using Open Space Functions

To add open space to a rung in **INSERT** or **EDIT** mode, select Open Space (Shift-F10). Then, select the specific function key described below:

Function Key	Function	Description	Page
F1	Move Right	Move the element at the cursor position, and all the elements to the right of the cursor position, one position to the right in all lines. Shunts are automatically inserted into the new column in the rung.	3-118
F3	Move Down	Create room for an additional line of logic above the line the cursor is on.	3-119
F5	Delete Column	Delete an entire column of instructions (including verticals) and operands within a rung. All elements to the right of the deleted column will automatically move left.	3-120
F7	Delete Row	Delete an entire row of instructions (including verticals) and operands within a rung.	3-121
F9	Delete Nickname	Remove nicknames from the variable declarations table. Enter the nickname to be deleted on the command line before pressing **F9**.	–
F10	Delete Instruction	Delete an operand or instruction from a rung. (You may also press **ALT-D** to delete an operand or instruction.)	3-122

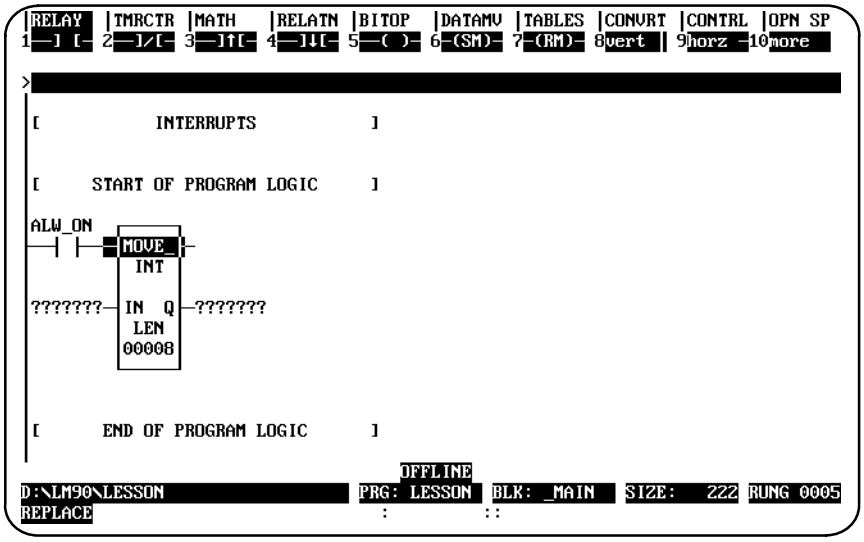
Completing (Accepting) Rung Entry

After changing the rung, press the **Enter** key with the command line empty (or **Plus (+)** key on the numeric keypad) to accept the edited rung and move the cursor to the next rung for editing. In **EDIT** mode, you must press the **Edit (F2)** key after the rung is accepted in order to edit the next rung. In **INSERT** mode, it is not necessary to press **Edit (F2)**. You will still be in **INSERT** mode after the rung is accepted and can enter the next rung. You will remain in **INSERT** mode until the **Escape** key is pressed.

Press **ALT-A** to quit the rung without saving any changes in the program.

Entering an Instruction Length

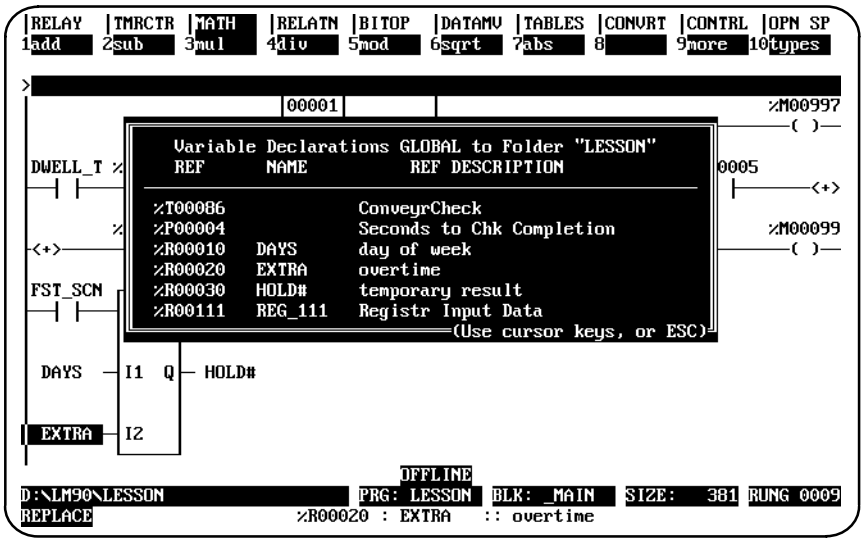
To change the length of the instruction to 8, position the cursor on the function, enter **8** on the command line, and press the **Enter** key.



Viewing Variable Declarations

To view the current set of variable declarations from anywhere in the Program Editor, press **ALT-V** to invoke the variable declaration window. The window allows cursor and page key scrolling. Pressing **ALT-V** again will show the next table if it exists (local or global).

In **RUNG INSERT** or **EDIT** mode, an asterisk (*) is displayed next to the variable declarations that were created or modified during the current editing session. These new or modified declarations will remain declared if the rung is accepted.



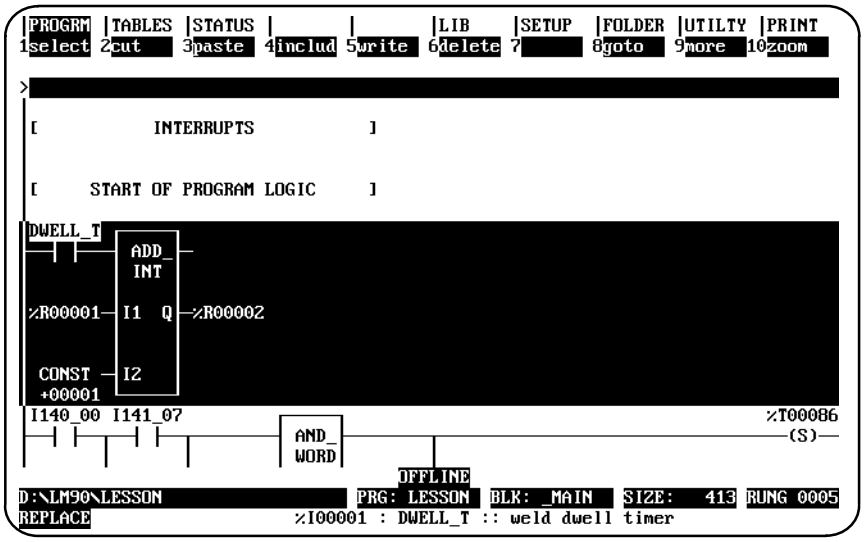
Deleting a Rung

To remove a single rung of logic, place the cursor at the rung, press **More (F9)**, and then press **Delete (F6)**; or simply press **ALT-D** (while not in **INSERT** or **EDIT** mode).

Selecting Rungs

The cutting and file writing of rungs requires that a section of rungs first be selected. To select the rungs:

1. Press **More (F9)** to display the cut / paste function keys.
2. Move the cursor to the rung at the beginning or end of the section to be selected. Then, press **Select (F1)**. The message "Select mode initiated ..." displayed on the message line indicates that the select function has been activated. Once this function is active, the only functions available are cursor, page, cut, write, help, and goto.
3. The current rung is automatically selected. By pressing the **Up/Down** cursor keys, Prev, Next, Page Up / Down, Home, or End keys, you can add subsequent or previous rungs into the selected region. Selected rungs are shown in reverse video on the display.



4. The Select (F1) softkey acts as a toggle between the select and deselect functions. To deselect the selected rungs, press the **Select (F1)** key or **ALT-A**.
   A. Press **Cut (F2)** to cut the selected rungs.
   B. Press **Write (F5)** to write the selected rungs to a file.
   C. Press **Delete (F6)** or **Alt-D** to delete the selected rungs.
5. To deselect the selected rungs, press **Select (F1)**. The F1 key acts as a toggle between the select and deselect function.

Note

The select function can also be used to select variable declarations and interrupt declarations.

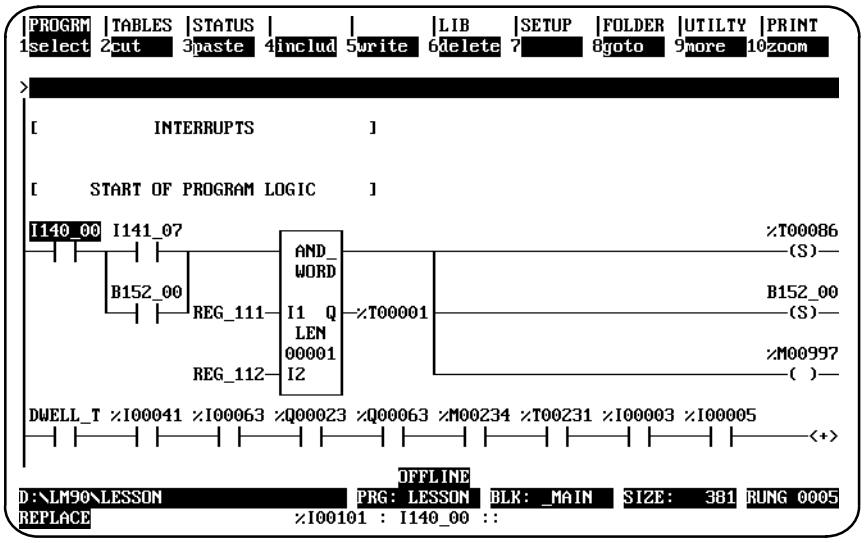
Cutting Selected Rungs

The cut function enables you to remove a section of previously selected rungs from the current program. Any nicknames, reference descriptions, or comment annotation used within the selected rungs are also copied with the cut rungs for later use in a paste operation. However, nicknames and reference descriptions remain in the variable declaration table.

The select function can be used to reorder logic within the program; it is also useful for deleting a section of rungs.

To cut a section of rungs from the current program's logic:

1. Select one or more rungs, as previously described.
2. Press **Cut (F2)** to cut the selected rungs from the program. The select function is automatically exited as part of the cut operation. The cursor will be on the rung after the cut section of rungs.



If the cut buffer becomes full, repeat the operation, selecting a smaller amount of logic.

3. All rungs below the selected section will scroll up to fill the gap of the just-cut section.

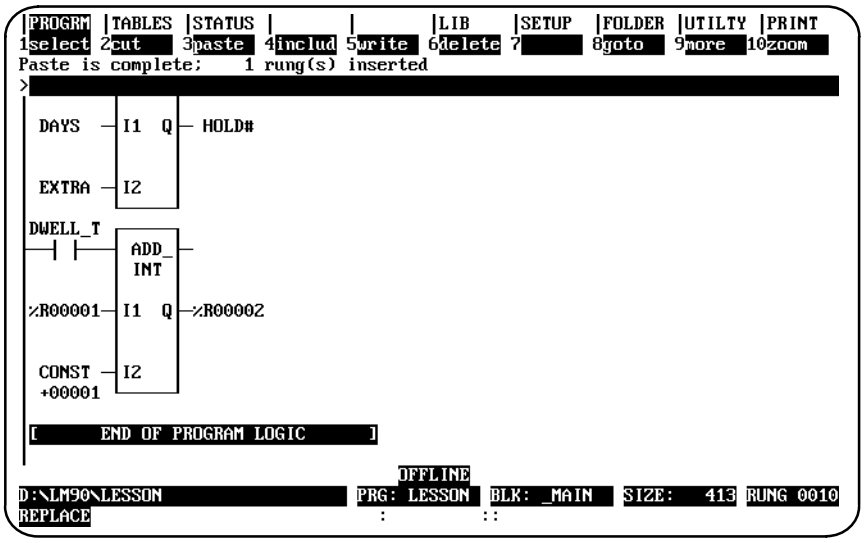
Note

Cut rungs are saved only as long as you remain in the program editor.

Pasting Previously Cut Rungs

The paste function enables you to insert a copy of a section of previously cut rungs before the current rung. Any unique reference address nickname assignments and any identifier name will be added to the current program's variable declaration table.

Once the cut operation is complete and the logic has been placed in the buffer, press **Paste (F3)** to initiate the paste function. The position of the cursor remains the same. All entries below the inserted section will scroll down to make room for the just-pasted rungs.



Conflicts may occur between declarations in the section of rungs to be pasted (buffer) and declarations in the existing (target) program. A nickname in the buffer that is identical to one in the target program is simply passed over and ignored during the paste operation.

When a declaration in the buffer has the same reference address but a different nickname than a declaration in the target program, the declaration from the buffer is not added to the existing program's declaration table.

A name conflict occurs when a declaration in the buffer has the same name as a declaration in the target program, but a different meaning. For a nickname, the different meaning would be a different reference address.

Name conflicts are resolved by automatically generating a unique system name for the conflicting declaration in the buffer, and then adding it to the target program. The presence of system names (any name beginning with the **$** character, e.g., $LA00001) in the pasted logic indicates that name collisions have occurred during the paste operation.

Implicit declarations, such as JUMPs, LABELs, and MCR names, are handled in the same way.

Note

If coil checking is set to SINGLE, rung(s) may not be pasted if a coil-use conflict would occur. %T references should be used on coils to allow rungs to be pasted, or use the WARN MULTIPLE coil check option. (Refer to the information on coil checking later in this section.) %T references may later be replaced with %Q or %M references.

Writing Selected Rungs to a File

The file write function enables you to store a copy of a section of previously selected rungs from the program logic to a disk file called a side file or program segment. This function is useful for creating a file of commonly used rungs which can be used in different programs.

Only variable declarations used in the rungs that are selected are written to the file. To write the entire variable declaration table to a file, you should select the entire table from the variable declaration section of the program.

When a rung containing a CALL instruction is written to a side file, only the call instruction is written. The logic contained in the block being called is not written to the file. You can use the export and import functions to move a block from one program to another.

Note

The file write function differs from the cut function in that selected rungs are not removed from the program.

1. To use the file write function, you must first select the rungs to be written to the side file. Press **F1** to select the current rung; then, select additional rungs required.
2. Enter the name of the side file on the command line, and press **Write (F5)**. The selected section of rungs will be written out to the specified file.

Any valid file name, without an extension, can be used for the side file. If the file specification includes a path, the specified directory must already exist. It is not created as part of a file write operation. If no path is specified, the current folder is assumed.

Including Rungs from a File

The file include function enables you to insert a copy of a file of previously written rungs before the current rung in the program logic. All rungs below the inserted section will be scrolled down to make room for the just-included rungs.

Note

Side files created with Release 4 or later of Logicmaster 90-70 software cannot be inserted into folders using Logicmaster 90-70 software releases prior to Release 4.

Any unique reference address nickname assignments and any identifier names are added to the current program's variable declaration table. If the name in the include file declaration matches a nickname or identifier in the target folder, the duplicate entry is not added. Conflicts are handled as previously described under "Pasting Previously Cut Rungs."

If the name from the include file conflicts with a nickname or identifier in the target folder, a unique system name is automatically generated for the program declaration before it can be added to the target folder. For example, an MCR has the name END_OP in the include file, but END_OP is also the name of the folder (or a nickname). A new name is generated for END_OP ($MC0001).

1. To use the file include function, the program logic to be included must have been previously stored to a particular disk file.
2. Press **Include (F4)** and enter the name of the side file on the command line. Then, press the **Enter** key. The contents of the specified disk file are included before the current rung in the program.

Any valid file name, minus an extension, can be used for the side file. The file specification may include a path; however, if no path is specified, the current folder is assumed.

Open Space Functions

Open space functions are used while editing a rung, to open element spaces in the rung. To display the open space function keys shown below, press **F10**.

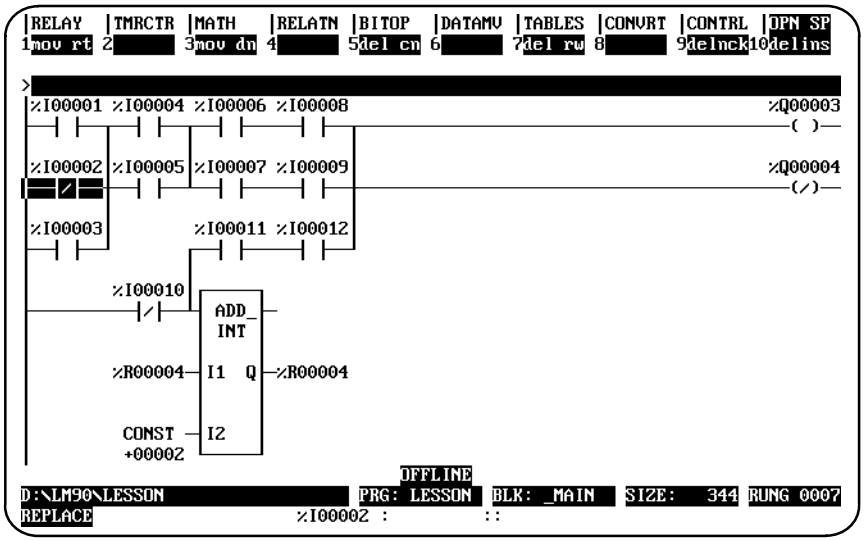
Function Key	Function	Description	Page
F1	Move Right	Move the element at the cursor position, and all the elements to the right of the cursor position, one position to the right in all lines. Shunts are automatically inserted into the new column in the rung.	3-118
F3	Move Down	Create room for an additional line of logic above the line the cursor is on.	3-119
F5	Delete Column	Delete an entire column of instructions (including verticals) and operands within a rung. All elements to the right of the deleted column will automatically move left.	3-120
F7	Delete Row	Delete an entire row of instructions (including verticals) and operands within a rung.	3-121
F9	Delete Nickname	Remove nicknames from the variable declarations table. Enter the nickname to be deleted on the command line before pressing **F9**.	–
F10	Delete Instruction	Delete an operand or instruction from a rung. (You may also press **ALT-D** to delete an operand or instruction.)	3-122

Move Logic Right

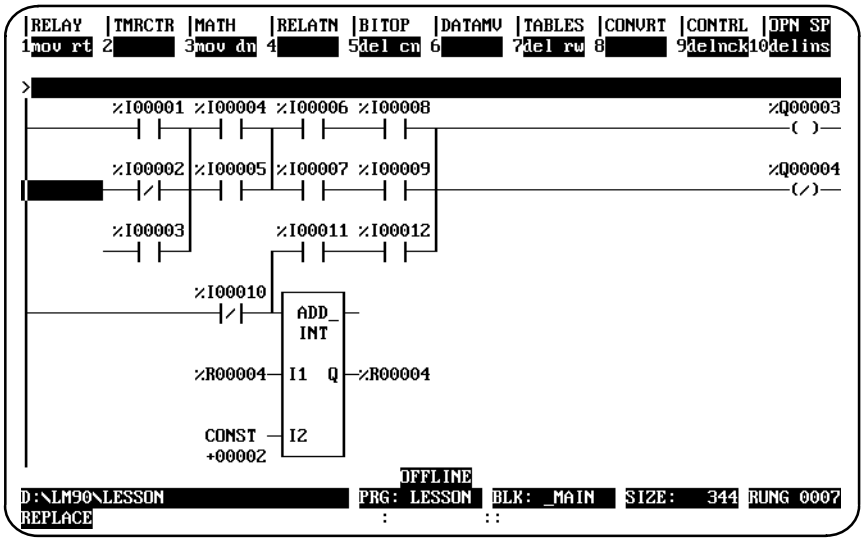
The **Move Right (MOV RT)** function moves the element at the cursor position, and all the elements to the right of the cursor position, one position to the right in all lines. Shunts are automatically inserted into the new column in the rung.

In the following example, the column next to the power rail is moved right one column by positioning the cursor in column 1 and pressing **Move Right (F1)**.

Before:



After:

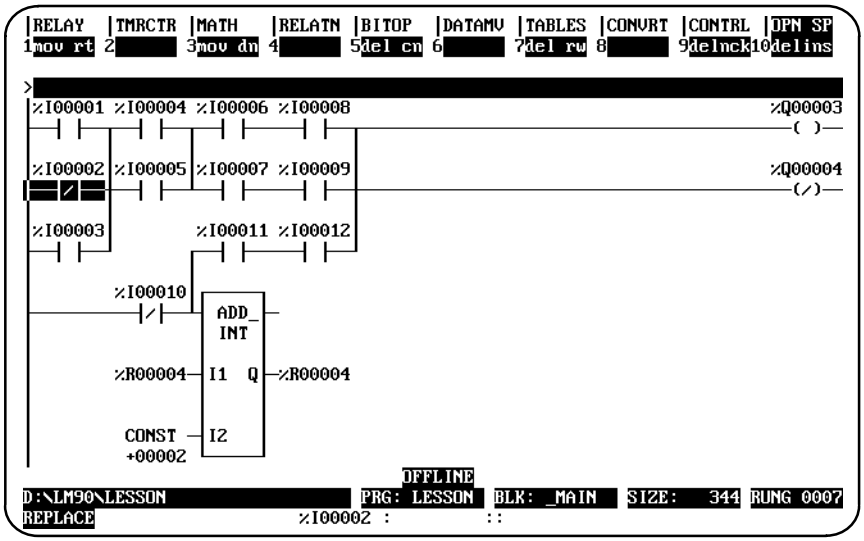


Move Logic Down

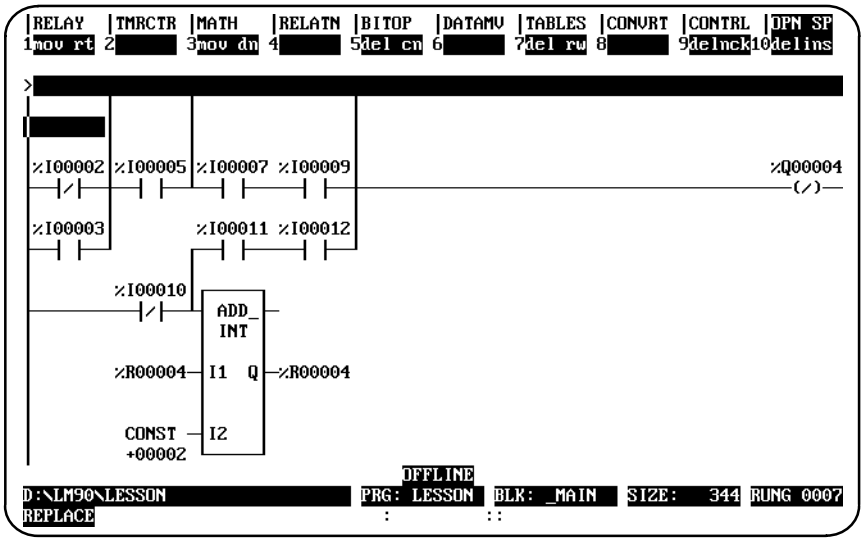
The **Move Down (MOV DN)** function is used to create room for an additional line of logic above the line the cursor is on. All elements in the region to be moved must be located entirely in the same row as the cursor, or in the rows below.

In the following example, the rung of logic beginning with %I00002 is moved down one row by positioning the cursor in row 2 and pressing **Move Down (F3)**.

Before:



After:

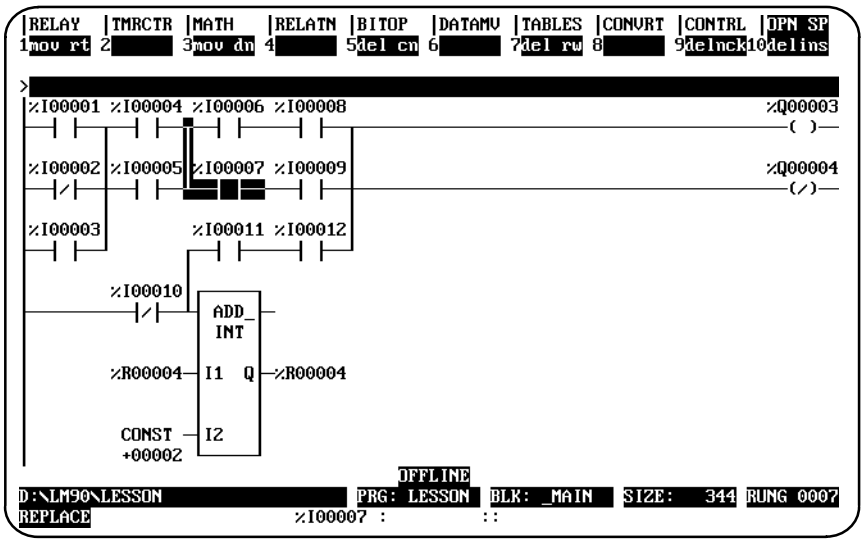


Delete Column

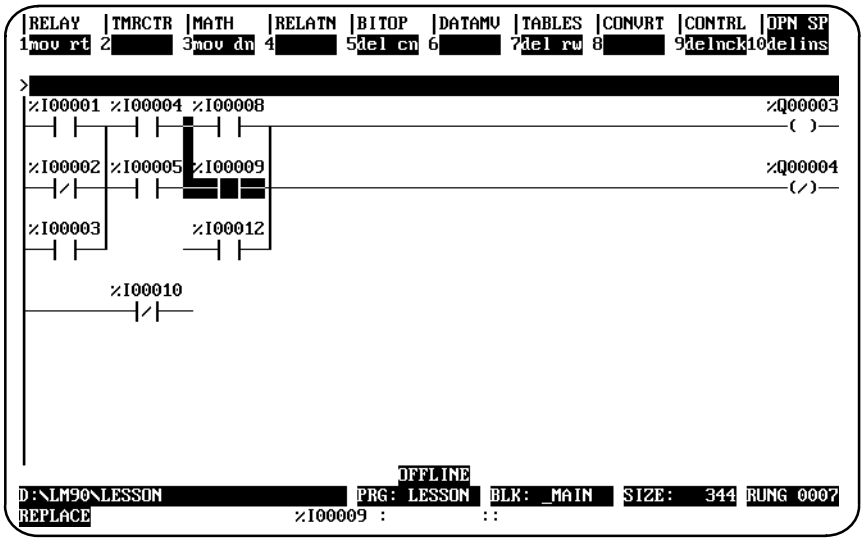
The **Delete Column (DEL CN)** function is used to delete an entire column of instructions (including verticals) and operands within a rung. It can be used to delete a column that contains functions as well as contacts or coils, as long as the function template itself is totally contained within the column.

When the column to be deleted is within a rung that contains no coil or jump instructions, all columns to the right of the deleted column are moved left one column. In the following example, the column which contains %I00007 is deleted by positioning the cursor in column 3 and pressing **Delete Column (F5)**.

Before:



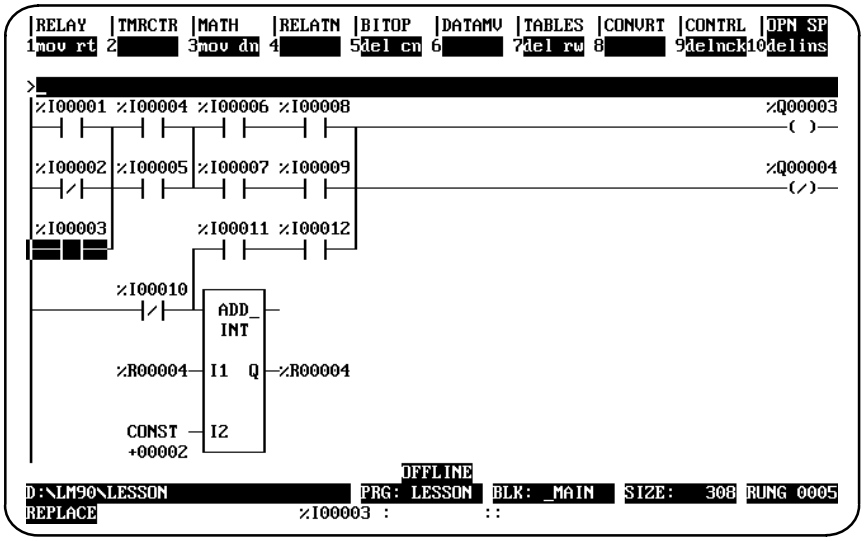
After:



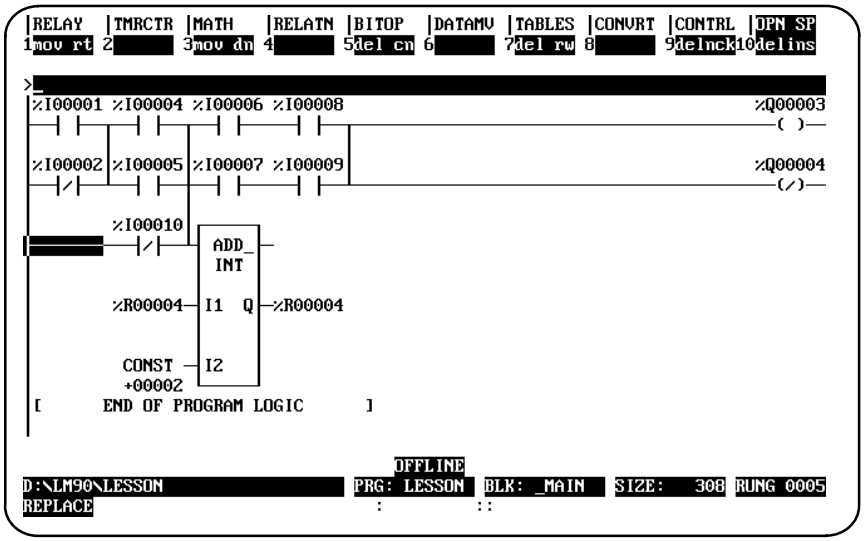
Delete Row

The **Delete Row (DEL RW)** function is used to delete an entire row of instructions (including verticals) and operands within a rung. It can only be used to delete a row whose instructions, together with their operands, are totally contained within the row. For example, the DEL RW function can be used to delete a row with a function such as MCR, but it cannot delete a row containing an ADD_INT function because the ADD_INT function spans several rows. After the deletion, all rows beneath the deleted row move up one row. When a row is moved up to the first row position, its verticals are automatically deleted. In the following example, row 3, which contains %I00003, is deleted by positioning the cursor in row 3 and pressing **Delete Row (F7)**.

Before:



After:

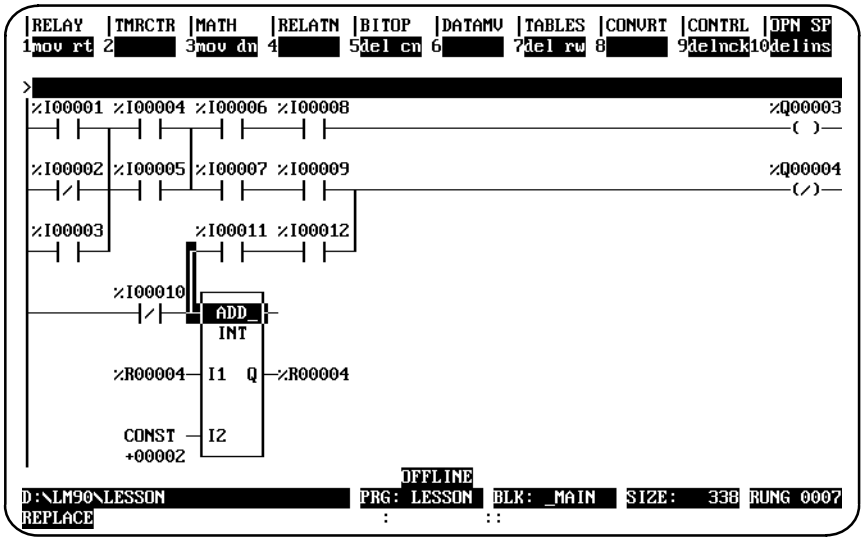


Delete Instruction

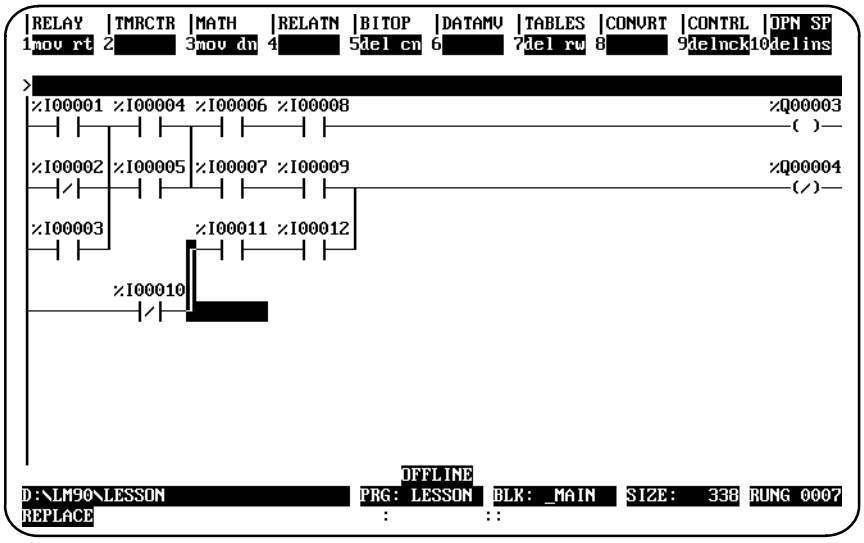
The **Delete Instruction (DELINS)** function is used to delete an operand or instruction from a rung. Another instruction or a horizontal link may then be entered in the space left by the deleted instruction. The **ALT-D** key sequence may also be used to delete instructions; however, the cursor will automatically move to the right after the deletion.

In the following example, the ADD instruction is deleted by positioning the cursor on the ADD function block and pressing **Delete Instruction (F10)**.

Before:



After:



Increment/Decrement Reference Address

The increment / decrement reference address feature is available in either **INSERT** or **EDIT** mode in the program editor and from the variable declaration editor. It allows you to increment or decrement the reference address where the cursor is located by either one or the amount specified on the command line.

Key	Description
CTRL-U	Increment key sequence.
CTRL-D	Decrement key sequence.

Note

For reference operands which must be byte-aligned, the reference address is incremented / decremented by one byte.

For example, a discrete input reference address of a MOVE_INT function block will increment or decrement by one byte (e.g., %I00001 to %I00009). The same reference address on a normally open contact will increment or decrement by one (e.g., %I00001 to %I00002). A register reference address on the input of an ADD function block will also increment or decrement by one (e.g., %R00005 to %R00006).

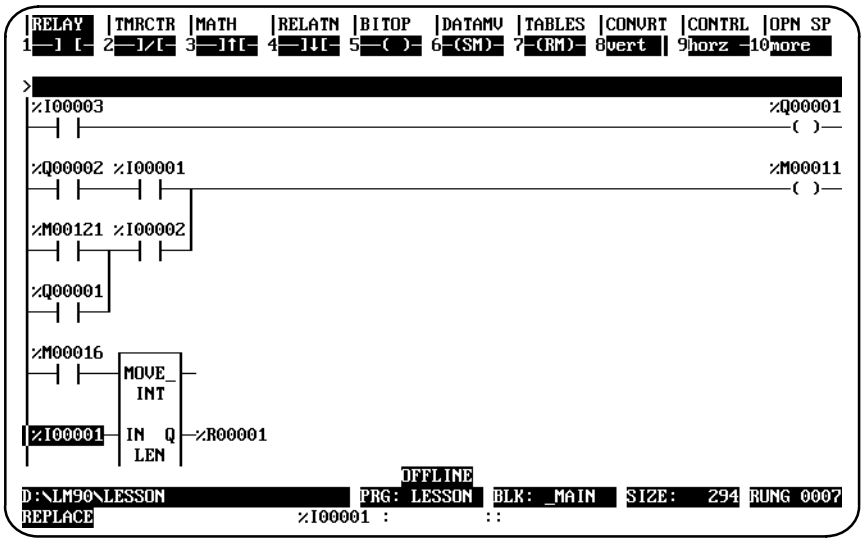
If there is a numeric value on the command line, it is used as the number of bits to add to or subtract from the reference address. For parameters that are byte-aligned, the increment / decrement value is one byte when the value on the command line is between 0 and 8, two bytes when the value is between 9 and 16, etc. The value will remain displayed on the command line after the function is completed so that the reference address can be incremented / decremented by the same value again.

If the reference address reaches the current configuration limit, an error message is displayed and the function is not performed. If the cursor is not on a reference address and you attempt to increment or decrement the address, an error message is also displayed.

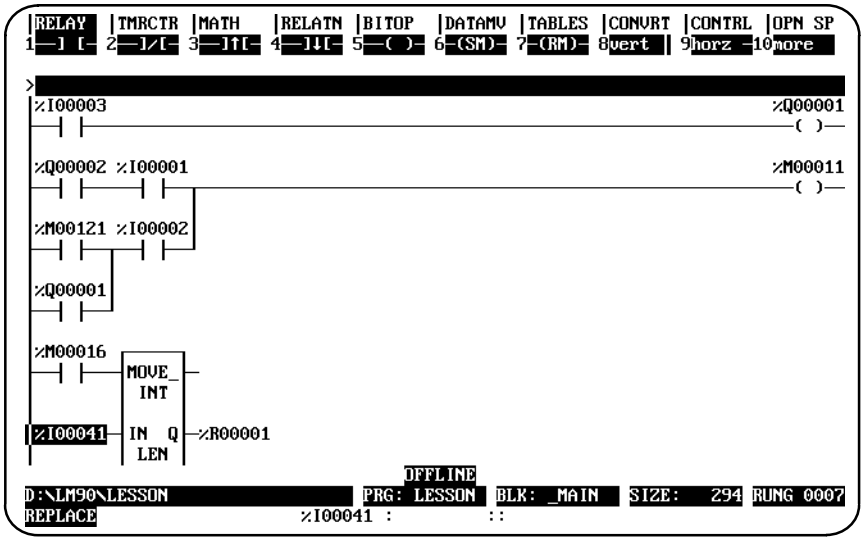
Incrementing/Decrementing within a Rung

This example illustrates how to increment reference address %I00001 in a ladder diagram rung.

1. First, position the cursor on the reference address to be changed. In this example, that would be %I00001.



2. Press **CTRL-U** five times to display the reference address %I00041, as shown in this screen.



3. To decrement the reference address to %I00025, press **CTRL-D** twice. Or, you could enter the decrement amount 16 (2 bytes) on the command line and press **CTRL-D**.

   The value 16 displayed on the command line does not disappear when the decrement is completed. It continues to be displayed on the command line so that you may continue decrementing by that same amount.

Auto-Next Highest Reference

The auto-next highest reference address function automatically uses the next reference offset of the specified type, after the highest currently used in the folder during an editing session. If the parameter requires a byte-aligned reference offset, the next available aligned offset is automatically provided.

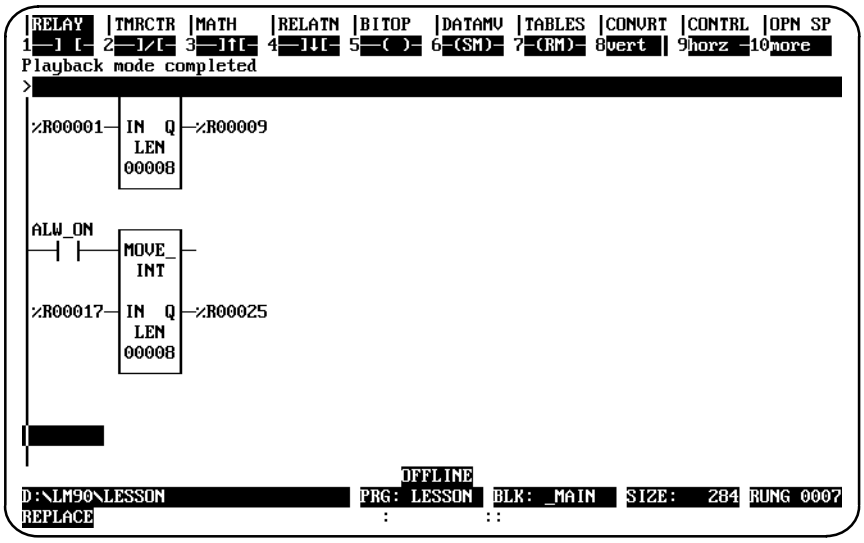
To use this function, enter the **%** character and the user reference (e.g., %I, %Q, %R, etc.) on the command line. The **%** character is used to distinguish a reference type from a nickname character. Then, press the **Enter** key.

For example, if the highest %I reference already used during an editing session is %I00019, and %I is specified as the address for an input operand to an ADD_INT function block, %I00025 (the next available aligned reference) is automatically used.

The following example illustrates how useful the auto-next highest reference address function can be, when used in conjunction with **TEACH** mode. It allows rungs to be entered and reference addresses automatically assigned to the next available reference address. (For more information on **TEACH** mode, refer to chapter 2, section 5, "Keyboard Functions.")

1. Enter **INSERT** mode by pressing **Insert (F1)** from the program editor.
2. Press **ALT-T** to enter **TEACH** mode, and then press **ALT-n**, where **n** is the number to be used for the teach file. For this example, use **ALT-0**.
3. On the command line, type **ALW_ON &NOCON** and press the **Enter** key.
4. Then, type **&MOV** on the command line and press the **Enter** key.
5. Use the Tab key to position the cursor on parameter IN of the MOVE function block.
6. Type **%R** on the command line, and press the **Tab** key.
7. Then, enter **%R** on the command line again (or press **CTRL-Home** to display the previous command line contents), and press the **Enter** key twice.
8. Press **ALT-Q** to exit **TEACH** mode.

9. Press **ALT-0** to play back the teach file. The following screen is displayed. Note that the reference address has automatically been changed to the next available address.



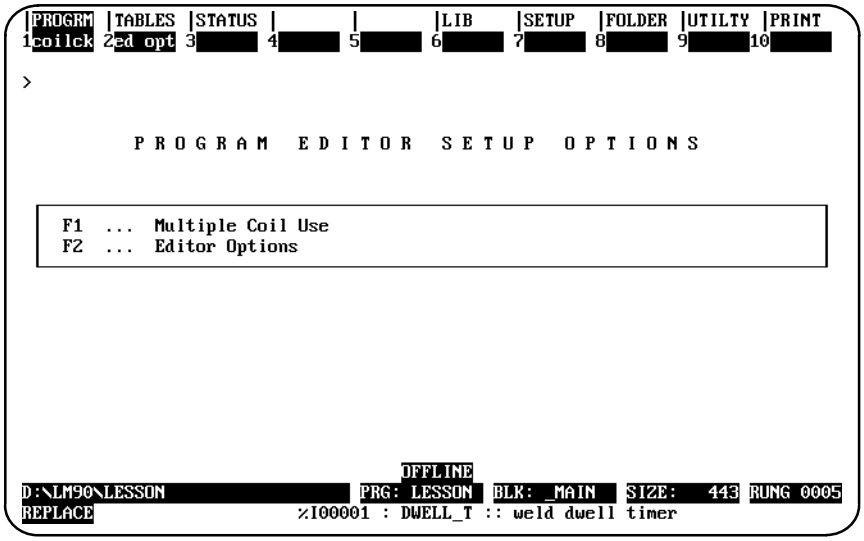
Section 12: Editor Options

The Program Editor Setup Options menu provides access to options in the program editor. These options include multiple coil use, automatically inserting references, automatically creating unbound references, and configuring multiple languages.

Coil Checking

The coil check function of the programming software checks for multiple uses of %M or %Q references with relay coils or outputs on functions. Beginning with Release 4 of Logicmaster 90-70 software, you can select the level of coil checking desired from a screen similar to the one shown below.

To access this screen, press **Program (F1)** from the Programming Software main menu. Then, press **Options (F7)** from the program editor. Instructions for selecting the desired level of coil checking begin on page .



Three levels of coil checking are available:

Level	Name	Description
SINGLE	Coil checking enabled	Single coil use only. When coil use is set to **SINGLE**, Logicmaster 90-70 software does not allow multiple coil use. When the rung is accepted and multiple use is detected, an error message is displayed and the cursor is placed on the first conflict found. You cannot accept the rung until the conflicts are resolved. When this setting is accepted, the coil use map is rebuilt. A "checking coil use" message is displayed while the map is rebuilt. If conflicts are found, only the reference address of the conflict is listed. Only one screen full of conflicts is displayed. If conflicts are found, the ***Current Coil Use*** field is not updated; it is only updated when no conflicts are found.
WARN MULTIPLE*	Coil checking disabled with warning	When coil use is set to **WARN MULTIPLE**, Logicmaster 90-70 software allows multiple coil use with warning messages. The ***Current Coil Use*** field is updated, and the coil use map is rebuilt. A message is displayed while the map is rebuilt and the conflicts are listed. Only one screen of conflicts is displayed.
MULTIPLE	Coil checking disabled	When coil use is set to **MULTIPLE**, Logicmaster 90-70 software allows multiple coil use without any restrictions or messages. The ***Current Coil Use*** field is updated, and the coil use map is not rebuilt. No conflicts are displayed.

* Default selection.

Note

If the program folder is locked, the level of coil checking cannot be changed and the coil map cannot be rebuilt. Refer to the information on unlocking program folders described in chapter 8, "Program Folders."

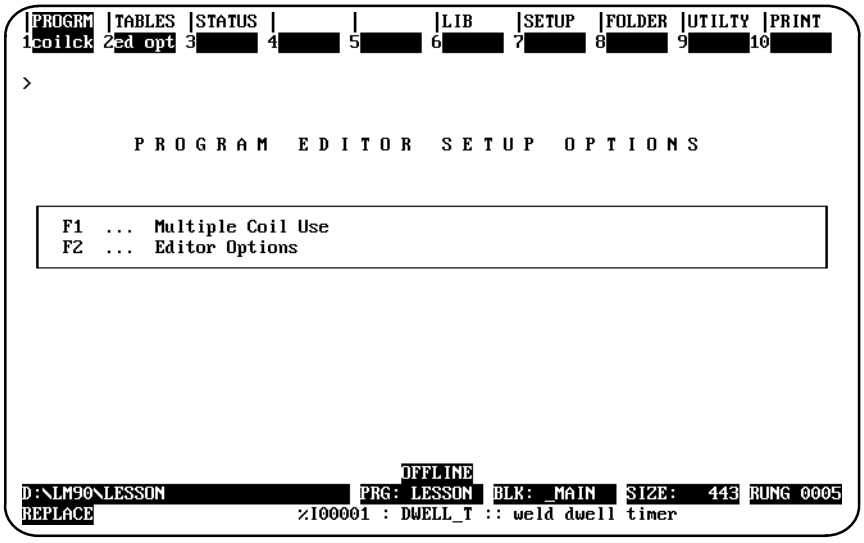
The Coil Check screen shows the current level of coil checking, allows you to change the level, and checks for and displays coil use conflicts on demand. You can change the level selected, regardless of which level was previously selected.

Note

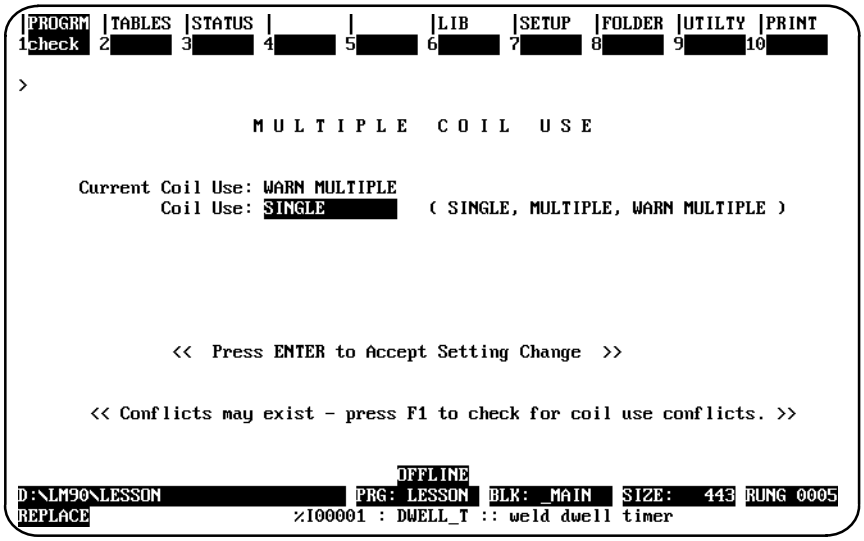
When the program mode is **MONITOR** or **ONLINE** and the program in your computer is identical to the program in the PLC (i.e., **LOGIC EQUAL** status is displayed), only the current level of coil checking is displayed. An error message is displayed if you try to change the coil check level.

To change the level and check for conflicts:

1. Press **Program (F1)** from the Programming Software main menu. Then, press **Option (F7)** from the program editor to display the Program Editor Setup Options menu shown below.



2. Press **Coil Check**–displayed as **Coilck (F1)** to display the Multiple Coil Use screen.



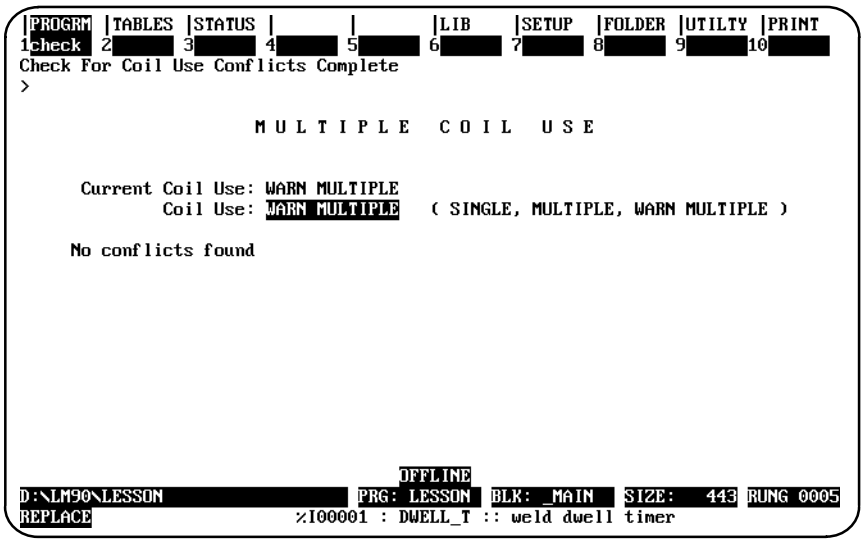
3. The screen shows the current level of coil checking. To select another level, repeatedly press the **Tab** key until the desired setting is displayed. Then, press the **Enter** key to accept the change. Or, you can type the desired setting into the ***Coil Use*** field, and then press the **Enter** key.

4. The coil use map is automatically rebuilt when the **SINGLE** or **WARN MULTIPLE** level is accepted. To rebuild the coil map without changing the current setting, press **Check (F1)**. **F1** may be used regardless of the current coil use setting. The message "Checking Block . . . " is displayed as the map is built, along with the name of the block currently being checked.

   The rebuilding of the map takes approximately 15 seconds per block. For example, a program consisting of 10 to 15 blocks may take up to two minutes to rebuild the map.

5. Press **ALT-A** to abort the rebuild and restore the old coil use map. A message indicating that an abort has occurred is displayed.

6. When the rebuild is complete, any conflicts found are listed. Both explicit and implicit use conflicts are displayed. Only one screen full of conflicts is displayed.



   Conflicts are not saved in memory. When you leave this screen, they will not be redisplayed if you re-enter this display screen. However, the **Check (F1)** softkey may be pressed to check for coil conflicts.

ALT- P may be used to print a screen of conflicts. For information on printing a screen display, refer to chapter 10, section 2, "Selecting a Screen Print Device."

Automatically Creating Unbound References

Unbound references allow you to insert reference addresses in a program which act as place holders for actual reference addresses. These references are not bound to any specific machine reference. They may be specified in the logic or inserted automatically whenever a nickname or reference description is entered without an associated reference address.

Unbound references enable you to program with variables instead of machine references. You can enter an entire ladder diagram program using nicknames only as instruction operands before determining the correct machine addresses. Then, you can use the search and replace function or the librarian reference offsetting feature to replace unbound references with the appropriate machine references.

Although unbound references are non-executable, they allow freer transport of blocks between applications. Blocks using only unbound references are not limited by the I/O configuration constraints of source programs or target application programs. You can export a block from a folder to the library leaving all unbound references intact. You can then import that block to another folder using the variable programming feature or a reference offset template to assign reference addresses to suit the new environment.

The memory types available for unbound references are %U, a discrete memory type, and %UR, a word-oriented memory type. %U references may be used on operands which permit non-aligned, discrete reference addresses. %UR references may be placed on operands which require word-oriented reference addresses or byte-aligned, discrete reference addresses.

The following rules apply to unbound references:

1. A %U reference address cannot be entered as a function operand when a byte-aligned discrete reference address is required.
2. Unbound references are ignored when checks for coil use conflict are performed.
3. If you try to replace a %U reference address with a word-oriented memory type (%R, %P, %L, %AI, or %AQ), the error message "Illegal reference type" appears on the message line and the operation is aborted.
4. If you try to replace a %UR reference with a discrete reference address (%I, %Q, %M, %T, %G, or %S), the memory offset of the discrete reference address must be automatically byte-aligned.

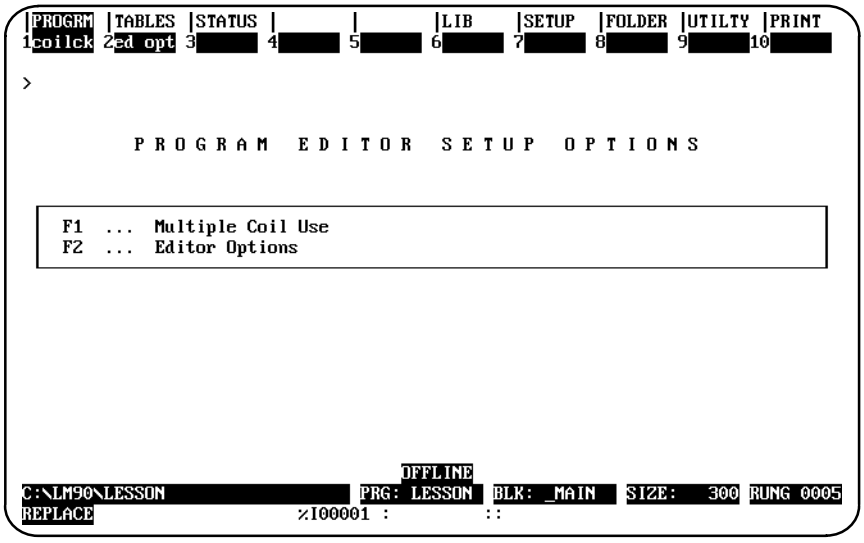
%UR references may be used as indirect references when preceded by the **@** symbol in program logic. The memory offsets of %U (1 – 4096) and %UR are (1 – 9999) are not configurable.

Unbound references can be entered manually in the logic, or they can be inserted automatically whenever you enter a nickname and/or reference description without an associated reference address. The automatic insertion of references can be enabled or disabled from the Editor Options screen as shown on the next page.

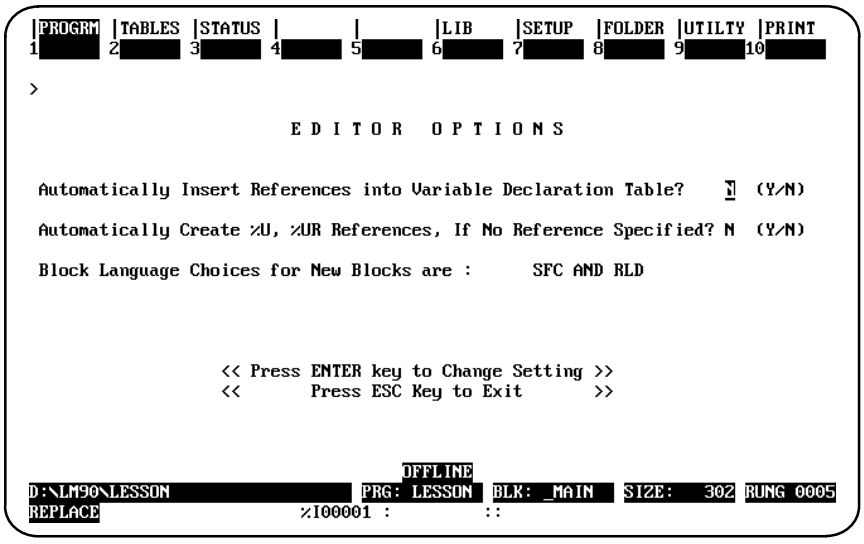
Entering Unbound References

Unbound references can be entered manually in the logic, or they can be inserted automatically whenever you enter a nickname and/or reference description without an associated reference address. The automatic insertion of references can be enabled or disabled from the Editor Options screen.

1. From the Programming Software main menu, press **Program (F1)** and then **Options (F7)** to display the Program Editor Setup Options menu.



2. Press **Editor Options (F2)** to display the Editor Options screen.

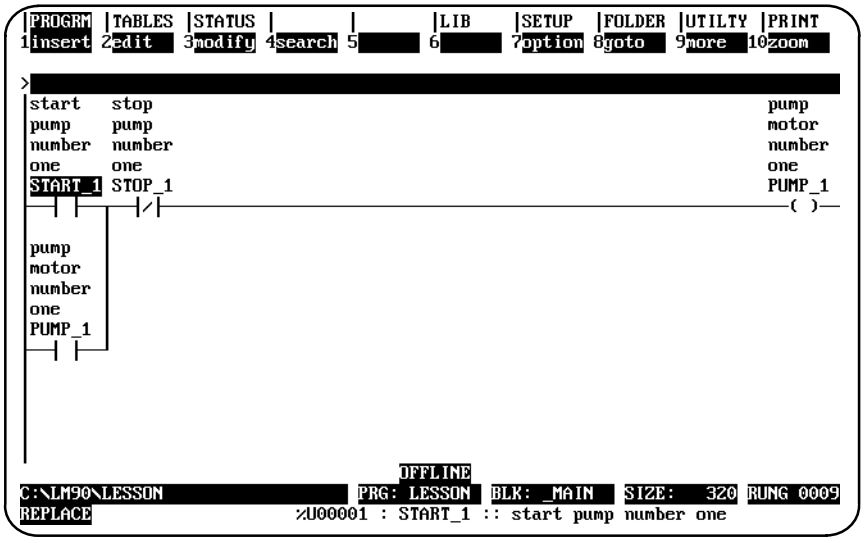


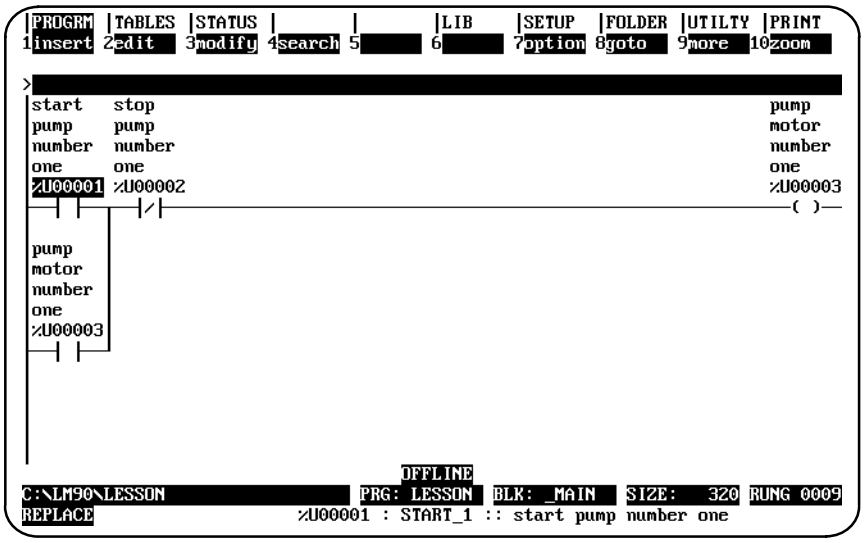
The automatic insertion of unbound references in the logic defaults to the setting which was last entered for the currently selected folder. For a newly created folder, the default value is **N** (No).

When enabled, the automatic insertion of unbound references provides an unbound reference whose memory type is appropriate for the current operand and whose memory offset is the next-highest unused memory offset of its type found in the folder. If you enter an unbound reference address manually, you can also use the automatic insertion function to determine the next-highest unused memory offset.

Whether inserted manually or automatically, unbound references are entered in the appropriate variable declaration table. Unbound references used in the _MAIN logic block are declared in the folder's global variable declaration table; unbound references used in a block are declared in that block's local variable declaration table.

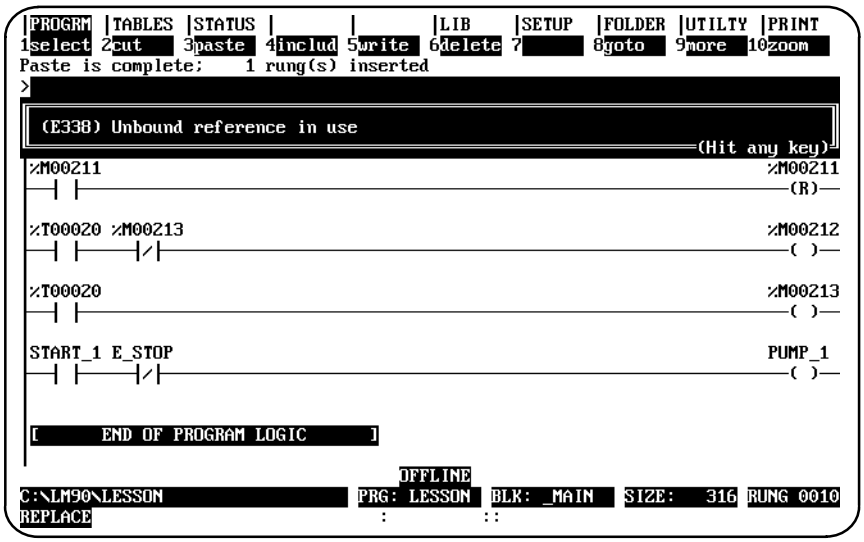
In the following example, the nickname START_1 is entered as the operand on a contact. No %U reference has been used, so %U00001 is automatically assigned to that variable. STOP_1 and PUMP_1 are then entered without associated reference addresses and are automatically assigned %U00002 and %U00003.





In the program editor, unbound references are treated the same as any other reference, with the exception of the paste and include functions. When you try to use either of these functions to insert a rung of logic into a program which contains an unbound reference address already declared in the program, the message “Unbound reference in use” is displayed on the message line as the rung is inserted.

In the following example screen, rung 4 is cut and the nickname associated with %U00002 is changed from STOP_1 to E_STOP. When the original version of rung 4 is pasted, the message ”unbound reference in use” appears in the message box. The rung is included in the logic, but %U00002 is now associated with the nickname E_STOP instead of STOP_1.

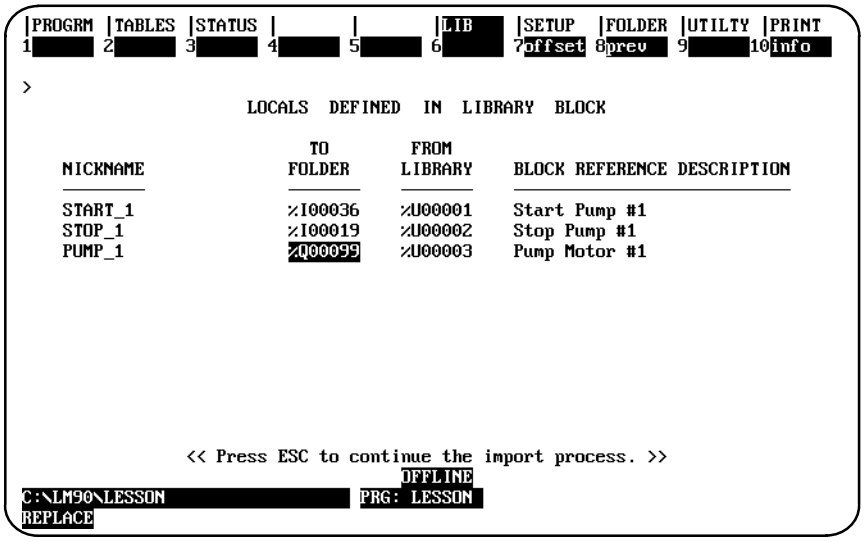


Since unbound references are non-executable, they have no values. Therefore, you cannot access %U or %UR references with reference table or print value functions. You can examine the %U and %UR references used by a program block with the print block cross references function, but the print global cross references function does not support unbound references. You cannot access %U or %UR memory in the configuration software.

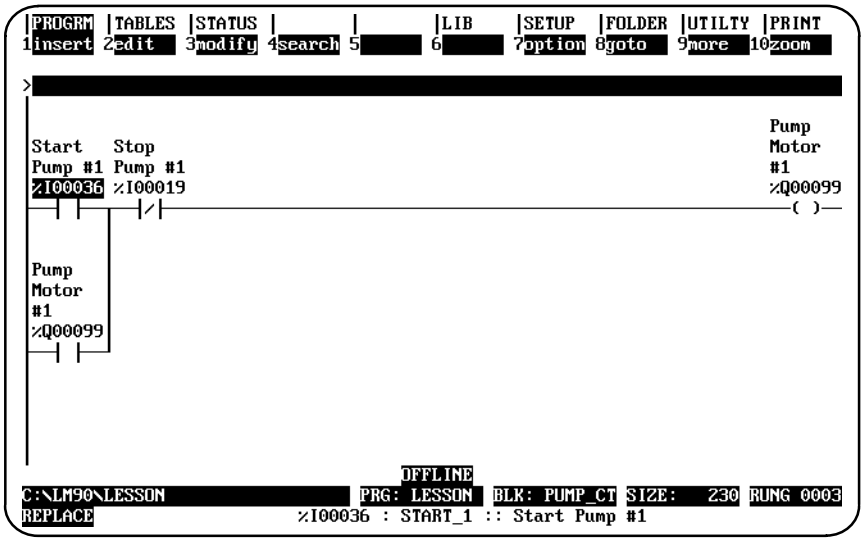
Importing with Unbound References

When a library block using unbound references is imported to a folder, you can replace the unbound references with machine references while the import operation is in process by using variable programming or by using a reference offset template.

Only unbound references with associated nicknames may be replaced using variable programming. In the following example screen, the block PUMP_CT has been exported to the library with unbound references associated with the nicknames START_1, STOP_1, PUMP_1, and VALVE_1.



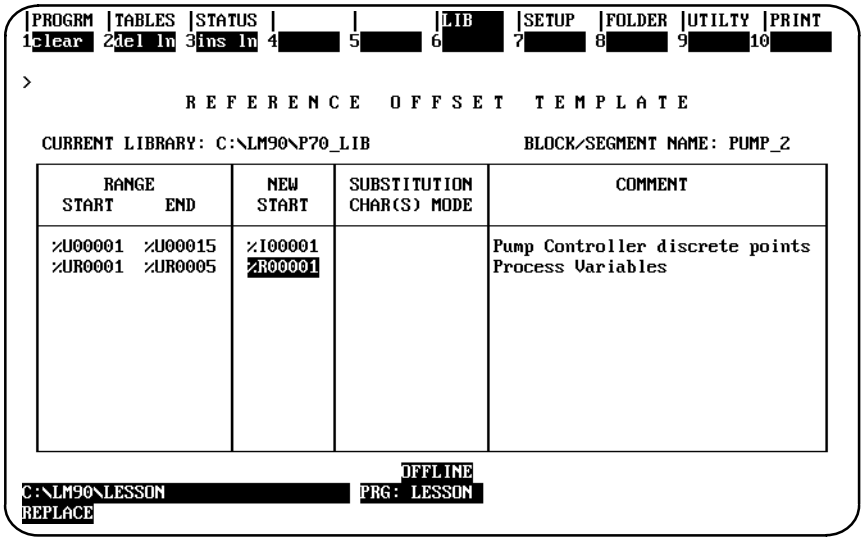
After importing with the variables redefined, the logic for the block appears as shown below.



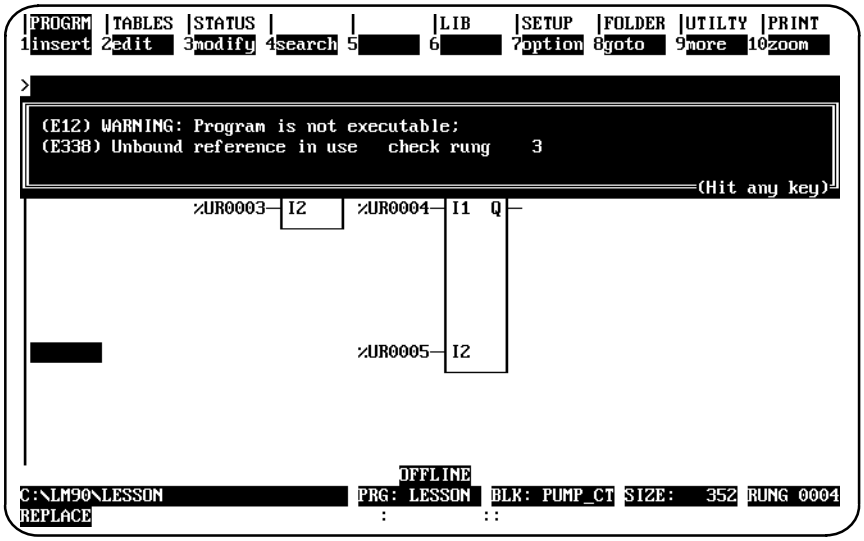
For more information on variable programming, refer to chapter 6, “Program Librarian.”

A second method of replacing unbound references is by using a reference offset template. The reference offset template can be applied during the import operation to replace unbound references (with or without associated nicknames).

In the following example screen, a library block being imported used the unbound references %U00001 through %U00015 and %UR0001 through %UR0005. The following reference offset template was used to transform the block into executable logic as it was imported.



If a library block is imported to a folder with its unbound references intact, you must edit the logic to replace all unbound reference addresses with compatible machine reference addresses before the program can be executed. If you try to enter the program display screen when the currently selected folder contains logic with unbound references, or if you try to zoom into a program block which contains unbound references, the message "Unbound reference in use" is displayed on the message line. If you try to exit the program display screen when the currently selected folder uses unbound references, or if you try to zoom out of a block which uses unbound references, the message box shown in the following screen is displayed.



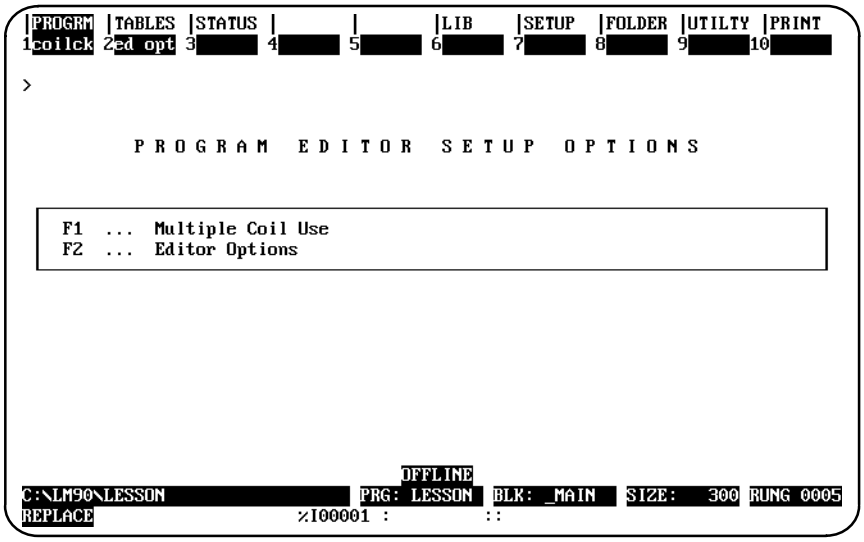
If you try to store to the PLC logic using unbound references, the store operation is aborted and an error message is displayed. You cannot enter unbound references to the logic while online and equal with the PLC.

Automatically Inserting References

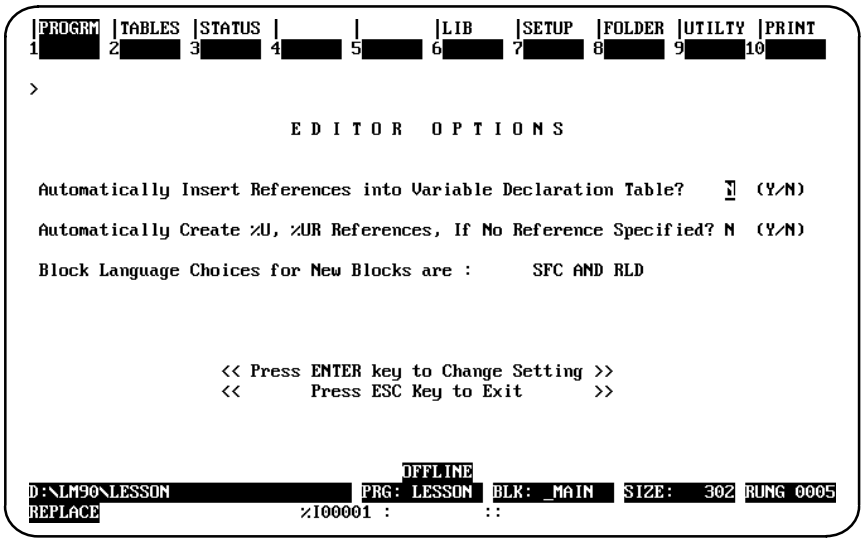
References which do not have nicknames or reference descriptions can be automatically inserted into the variable declaration table as the program is being developed. Then, at a later time, you can go to the variable declaration editor and enter just the annotation.

To enable the automatic insertion of references:

1. From the Programming Software main menu, press **Program (F1)** and then **Options (F7)** to display the Program Editor Setup Options menu.



2. Press **Editor Options (F2)** to display the Editor Options screen.



If the selection for automatically creating %U and %UR references is set to **Y** (Yes), unbound references are automatically entered in the variable declaration tables, regardless of whether the selection for automatically inserting references is set to **Y**.

3. Enter **Y** (Yes) and press the **Enter** key to enable automatic insertion. Explicit references entered on the command line during an edit session are automatically inserted in the variable declaration table; implicit references (those references not entered while programming logic) are not automatically inserted in the table.

   In the following example, the explicit references %M00001, %I00001, %Q00001, and %Q00017 are inserted automatically in the variable declaration table. %I00002 through %I00016 are implicit references and are not inserted automatically in the table.

   In addition, %S and %T references are not added to the table.

   References associated with rungs that are pasted or included are added to the variable declaration table only if this operation were enabled when the rungs were cut or written. Removing rungs using either the cut / paste function or the file include function does not affect the table. Any reference to be removed from the variable declaration table must be deleted using the variable declaration table editor. References entered during a word-for-word operation are not automatically inserted into the variable declaration table.

4. If the variable declaration table becomes full, a message is continuously displayed for each reference entered until some of the references are deleted. Use the variable declaration table editor to delete some references in order to make room for more insertions.

5. To disable the automatic insertion feature, enter **N** (No). When this feature is disabled, references entered on the command line are not placed into the variable declaration table, unless they have a nickname or reference description associated with them.

Note

The default selection for automatically inserting references is **N** (No). Every new folder defaults to **NO**.

Configuring Multiple Languages

If you decide that you want to program all of your blocks in the same language, either relay ladder diagram or sequential function chart, you can set the multiple language option to a single language. Then, you will not have to select a language when you first enter a new block.

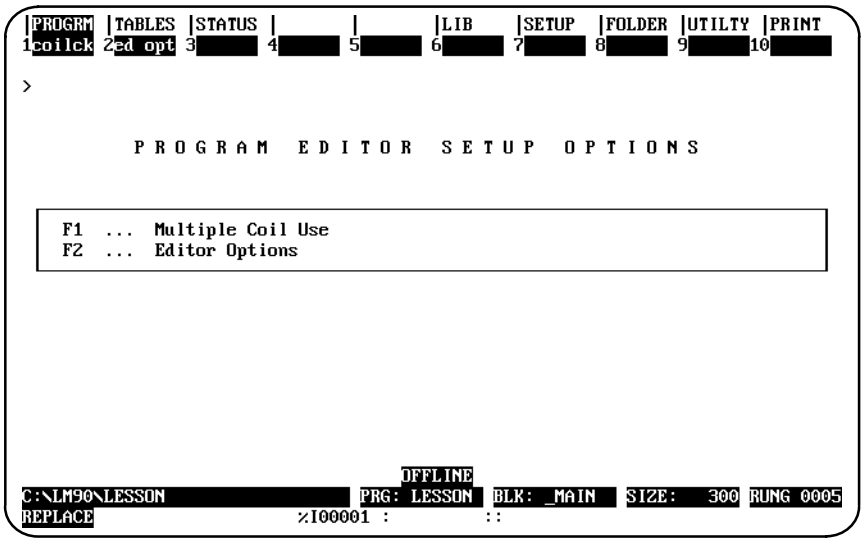
Note

Even if you decide to program all your blocks in sequential function chart language, you can still access relay ladder diagram for those portions of the SFC block where there is no choice of language (e.g., preprocessing actions, postprocessing actions, transition logic, and action logic).

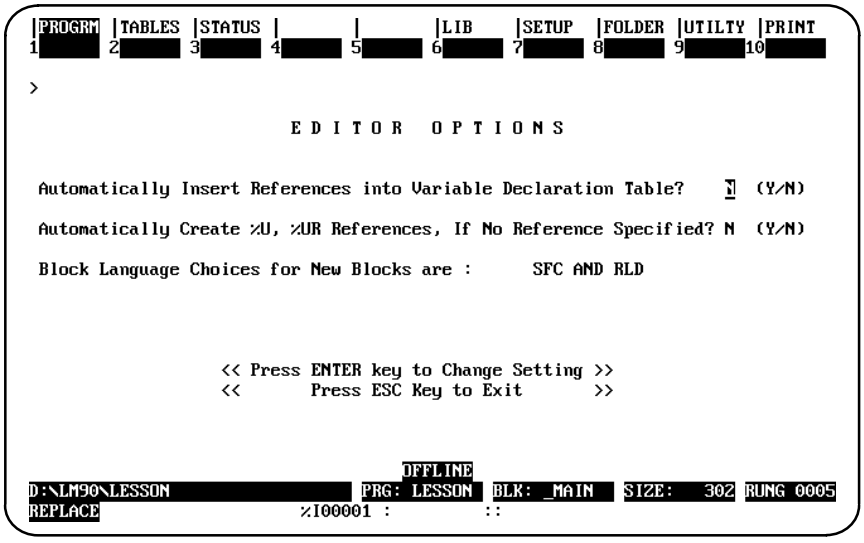
Also note that the SFC option is available only if your organization has purchased the SFC option package. This is an extra option that does not automatically come with the purchase of Logicmaster.

To change the block language configuration:

1. From the Programming Software main menu, press **Program (F1)** and then **Options (F7)** to display the Program Editor Setup Options menu..



2. Press **Editor Options (F2)** to display the Editor Options screen.



3. Cursor to the line:

Block Language Choices for New Blocks are: SFC AND RLD

and press the **Tab** key to select a language. Your choices are **SFC and RLD**, **RLD ONLY**, or **RLD ONLY**.

Note

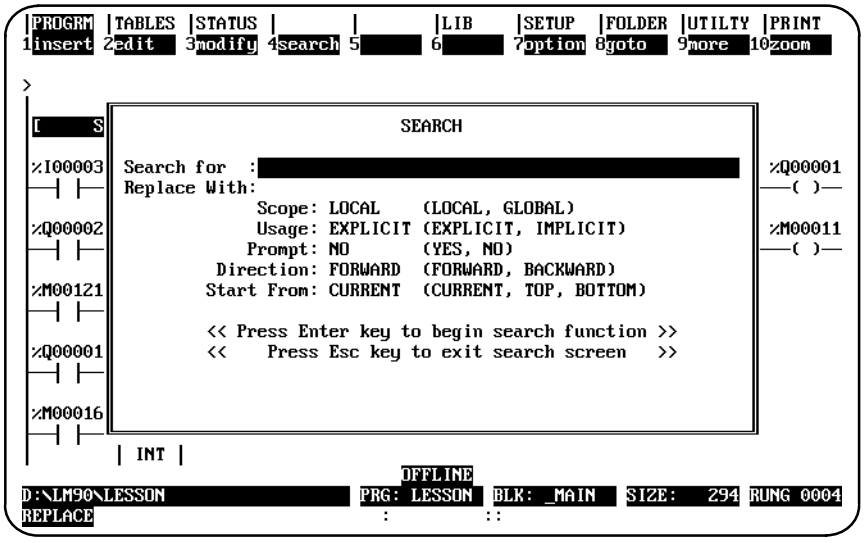
The multiple language option may be changed as often as desired. Your selection takes effect immediately; however, it only impacts the language selection for new blocks. For example, if the **RLD ONLY** option is selected, any old blocks programmed in sequential function chart language will still be in the SFC Editor when you zoom into them.

Remember that the SFC option is available only if your organization has purchased the SFC option package. This is an extra option that does not automatically come with Logicmaster.

Section 13: Search Function

The search function enables you to locate an identifier name, reference address, nickname, instruction, instruction plus reference address, instruction plus nickname, instruction plus identifier name, and reference description anywhere in the program.

1. To begin the search function, select **Search (F4)** from the program edit functions. When **F4** is pressed, a search function window is displayed on the screen.



2. To continue searching for the same target, press **ALT-F4**.

   Pressing only the **Search** key accesses the search function again. Since all fields are already set as desired, simply press the **Enter** key to initiate the search.

3. If the target is not found, a message indicating this is displayed. The search function will remain active.

4. If the target is found in a block that is locked for view, the following message is displayed:

   Found in locked block <block_name>. (Continue/Quit)

   If you continue, all remaining blocks are searched. If you decide to quit, the search is aborted. For more information on viewing locked blocks, refer to chapter 3, section 8, "Program Blocks, External Blocks, and Interrupts."

5. The search can be aborted at any time by pressing **ALT-A (abort)**. A message acknowledging the abort is displayed, and the search function will remain active.

Refer to the definitions in the following table when making entries in the search function window. To change a selection in one of the fields, other than the ***Search for*** and ***Replace with*** fields, use the **Tab** key to toggle through the available choices.

Field	Description
Search for	The target to be searched for. It may be an identifier name, a reference address (e.g., %I00012) or nickname (e.g., WIDGET), an instruction (e.g., &COIL), an instruction plus reference address (e.g., &COIL %Q00001), nickname (e.g., &COIL WIDGET), or identifier name (e.g., &JUMP BLK1), or a reference description entered in quotes. Enter the desired target into this field. Search allows you to locate all uses of a nickname. First, the software searches the local table if you are in a program block. Next, it searches the main variable declaration table and finally the reserved table. The search operation stops when the first occurrence of the search target is found.
Replace with	What will replace the target being searched for.
Scope	Modify the search by specifying whether the target should be searched for in the current program block only or across all program blocks, including the main block (_MAIN) and interrupt declarations. Choices for this field include LOCAL for the current program block only or GLOBAL for all blocks. The search order for all blocks is the program block declaration order, beginning with the current block.
Usage	Modify the search by specifying whether only explicit usage of the reference is checked for (EXPLICIT) or both explicit and implicit usage (IMPLICIT). More information about implicit search can be found at the end of this section.
Prompt	Action to be taken if the search target is found. For the search function, selecting **Y** (Yes) indicates that the system will prompt you for confirmation before searching for the next target. When **Y** (Yes) is selected and the target is found, you may display the search target, disregard this instance of the target and continue searching, or terminate the actual search but remain in the search function. For the search and replace function, selecting **Y** (Yes) indicates that the system will prompt you for confirmation before the found target is replaced. There are four choices available: 1. Replace the current found target and continue. 2. Disregard the found target and continue. 3. Starting from this found target, replace the rest of the found targets without prompting (i.e., change the prompt value to **N** (No). 4. Terminate the replace but remain in the function.
Direction	The direction of the search, either **FORWARD** or **BACKWARD**.
Start From	The starting point of the search, either from the current position (**CURRENT**), from the top of the block (**TOP**), or from the bottom of the block (**BOTTOM**).

The following table shows the legitimate replacement items for the different types of search items.

Search Item	Replacement Item
Reference address or nickname	Reference address or reference nickname.
Identifier	Identifier of the same type.
Instruction	Word-for-word equivalent instruction. Refer to chapter 3, section 12, "Online Editing / Monitoring," for more information on making word-for-word changes.
Instruction and reference	Word-for-word instruction or reference or nickname. Refer to chapter 3, section 12, "Online Editing / Monitoring," for more information on making word-for-word changes.
Instruction and identifier	Identifier of the same type.
Description	No replacement allowed.

Note

If a program contains references that have the same reference description text, searching for the reference description always finds the first occurrence of the reference description.

Using Search and Replace

The search and replace function is used to search and replace the target within the same variable declaration table. It cannot be used to search for the target in one variable table and replace it in another variable table.

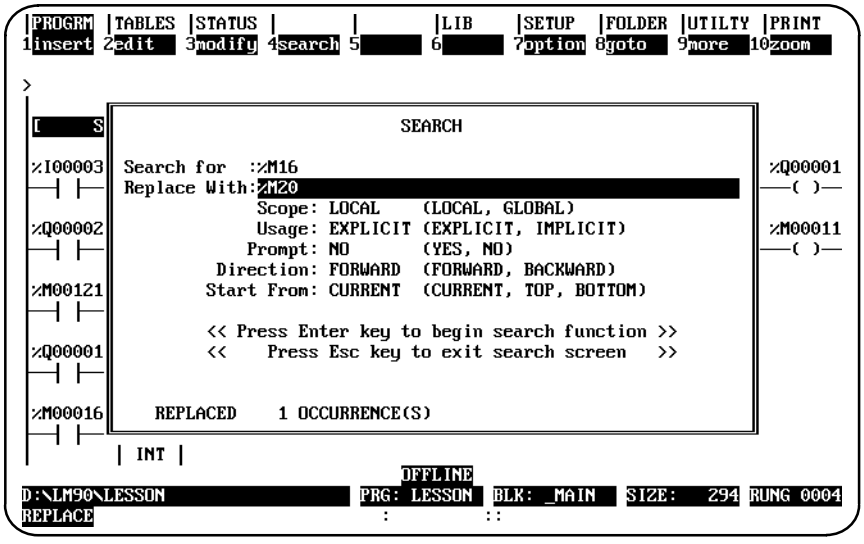
To use the search and replace function:

1. Enter the target to be searched for in the ***Search for*** field and the replacement item in the ***Replace with*** field. Other fields can be changed to further modify the search.
2. Press the **Enter** key to begin the search function, or press the **Escape** key to exit this screen. If the ***Prompt*** field is set to **No**, a "busy" prompt is displayed on the search screen with the current replacement count, indicating that the search and replace function is in progress.
3. If the target is found in a block that is locked for view or edit, the following message is displayed:

```
Cannot write to locked block <block_name>.  (Continue/Quit)
```

You may continue the search and replace operation at the next block or terminate the search and replace. For more information on viewing locked blocks, refer to chapter 3, section 8, "Program Blocks, External Blocks, and Interrupts."

In the following example, %M00016 will be searched for and replaced with %M00020. Since the ***Prompt*** field is set to **No**, no confirmation is required. This screen shows the parameters selected for this search.

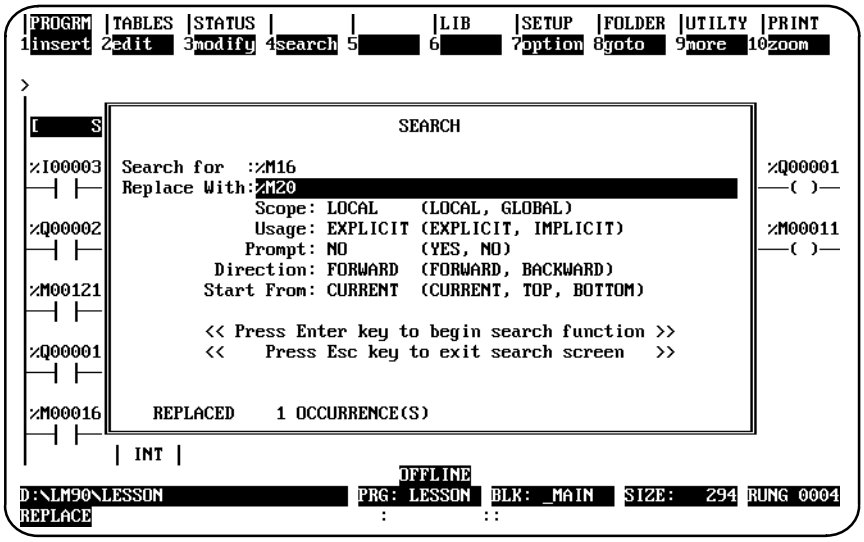


4. If the ***Prompt*** field is set to **Y** (Yes), confirmation is required before each replacement. The following prompt is displayed each time the target (in this example, %M00016) is found:

```
Replace %M00016 with %M00020?      (Yes, No, All, Quit)
```

   Press **Y** (Yes) to replace the current found target with the replacement item and then continue the search. Select **N** (No) to disregard this instance of the target and continue the search. Press **A** (All) to drop the confirmation process, beginning with this found target, and proceed to replace the rest of the found targets with the replacement item. Pressing **Q** (Quit) terminates the current search and replace process, but remains in the function.

5. Assuming that the function replaced one occurrence of %M00016 with %M00020 without error, an appropriate message including the replacement count is displayed and the function remains alive.



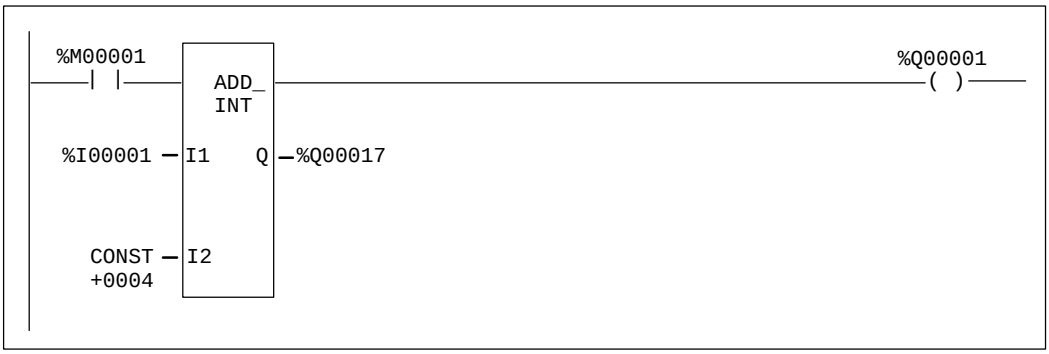
6. If an error occurs while replacing one of the reference addresses, the rung number where the error occurred is displayed at the top of the ladder diagram screen with the cursor on the erroneous item. In addition, a prompt displayed on the message line will ask you to either stop the function or skip the erroneous replacement and continue the function. Press **Y** (Yes) to skip the erroneous replacement and continue with the search and replacement function, or press **N** (No) to stop. A search and replace function, however, cannot be aborted.

Implicit Search

Implicit references are those references which are not directly programmed in the logic. However, due to the length of a function parameter, they are included. An implicit search enables you to locate these implicit references within a program.

Selecting IMPLICIT in the ***Usage*** field of the search function window means that **both** explicit **and** implicit references will be searched for. (Explicit references are those references you entered while programming the logic for your program or program block.)

In the following example, %I00001 is an explicit reference, and %I00002 through %I00016 are implicit references.



Search by Reference Type

The search by reference type function allows you to locate all uses of a specific reference type within the program. To initiate this type of search, enter the **%** character and the user reference (e.g., %R for register references) in the ***Search for*** field. Then, press the **Enter** key. The **%** character is required in order to distinguish a user reference from a nickname character.

Quick Search for a Coil

The quick search feature allows you to search for a coil with a particular reference address by entering the reference address on the command line and then pressing the **Search (F4)** softkey. The search will begin at the current location and continue to search for the reference address until a coil with the specified address is found. The reference address continues to be displayed on the command line so that you can find the next occurrence of a coil with the specified reference address by simply pressing **Search (F4)** again.

Section 14: Online Editing/Monitoring

In addition to offline editing, Logicmaster 90-70 software supports several online functions. To make online changes, the programmer must be in **ONLINE** mode; and logic in the current folder and PLC must be **EQUAL**. Refer to chapter 9, "Program Utilities," for information on verifying the program with the PLC.

The functions available when **ONLINE** and **EQUAL** include:

- Monitoring logic and registers.
- Forcing and overriding discrete references.
- Substituting instructions, constant values, and reference addresses.
- Online changes for data values.
- Inserting and editing rungs in **STOP** or **RUN** mode.

Note

Changes made when **ONLINE** and **EQUAL** are restricted to those of equal size. The PLC is updated as each change is completed.

Inserting or Editing Rungs (Block Edit)

Logic in the program folder and the PLC may be inserted or edited from the program editor while the PLC is in **STOP** or **RUN** mode and the programmer is online and equal. After pressing **Insert (F1)** or **Edit (F2)** to enter **INSERT** or **EDIT** mode and making a change, the status line will change from **LOGIC EQUAL** to **BLOCK EDIT**. One or more rungs may be inserted or modified. After accepting all the changes, the modified logic may be saved to both the program folder and the PLC by pressing **ALT-S**.

ALT-S may also be used to save a single program block while the PLC is in **STOP** mode.

To make changes to multiple program blocks, **RUN MODE STORE** may be used. Refer to chapter 9, "Program Utilities," for information on storing from the programmer to the PLC.

Single Sweep Debug

Single sweep debug allows you to stop the PLC to view or monitor the program after one sweep by pressing **ALT-G**. **ALT-G** may be used while viewing the program, reference tables, PLC fault table, or I/O fault table. To use this feature, the programmer must be in **ONLINE** mode, and the PLC must be in **STOP/IOSCAN** mode. If the PLC is in **RUN** mode, press **ALT-R** to toggle the PLC mode to **STOP**, or select **STOP** mode from the Run/Stop PLC screen using the status functions.

To perform a first scan, type **0** on the command line before pressing **ALT-G**. If the command line is blank or **1** is entered on the command line, a non-first scan single sweep debug is performed.

When the PLC is running sweeps in single-sweep mode, timers do not increment. The user will have to force a value into the timer's CV register to make the timer time out.

Substitutions

If the programmer is in **ONLINE** mode and communicating with an operating PLC and if the program logic in the PLC and in the programmer are equal, an instruction, constant, or reference address may be substituted with another. Every substitution updates the logic in the program folder and in PLC memory.

Instruction substitutions are permitted within the groups listed in the following table. Data types cannot be changed within each group; therefore, it is not necessary to include the data type.

Table 3-13. Substitution Groups

Function	Description	Type This
	Contacts	
–| |–	Normally open contact.	&NOCON
–| / |–	Normally closed contact.	&NCCON
–|[↑]|–	Positive transition contact.	&PCON
–|[↓]|–	Negative transition contact.	&NCON
	Fault Contacts	
–|FAULT|–	Fault contact.	&FAULT
–|NOFLT|–	No fault contact.	&NOFLT
	Alarm Contacts	
–|HIALR|–	High alarm contact.	&HIALR
–|LO ALR|–	High alarm contact.	&LOALR
	Coils	
–( )–	Normally open coil.	&NOCOI
–(/)–	Negated coil.	&NCCOI
–(S)–	SET coil.	&SL
–(R)–	RESET coil.	&RL
–(M)–	Retentive coil.	&NOMCOI
–(/M)–	Negated retentive coil.	&NCM
–(SM)–	Retentive SET coil.	&SM
–(RM)–	Retentive RESET coil.	&RM
–([↑])–	Positive transition coil.	&PCOI
–([↓])–	Negative transition coil.	&NCOI
	Retentive On-Delay Timer Function	
ONDTR_TENTHS	Tenth of a second time base.	&ONDTR_TE
ONDTR_HUNDTHS	Hundredth of a second time base.	&ONDTR_H
ONDTR_SEC	One second time base.	&ONDTR_S
	Off-Delay Timer Function	
OFDT_TENTHS	Tenth of a second time base.	&OFDT_TE
OFDT_HUNDTHS	Hundredth of a second time base.	&OFDT_H
OFDT_SEC	One second time base.	&OFDT_S
	On-Delay Timer Function	
TMR_TENTHS	Tenth of a second time base.	&TMR_TE
TMR_HUNDTHS	Hundredth of a second time base.	&TMR_H
TMR_SEC	One second time base.	&TMR_S
	Counter Functions	
UPCTR	Up counter.	&UP
DNCTR	Down counter.	&DN

Table 3-13. Substitution Groups (Continued)

Function	Description	Type This
Integer Math Functions		
ADD_INT	Signed integer addition.	&AD
SUB_INT	Signed integer subtraction.	&SUB
MUL_INT	Signed integer multiplication.	&MU
DIV_INT	Signed integer division.	&DIV
MOD_INT	Signed integer modulo.	&MOD
Double Integer Math Functions		
ADD_DINT	Double precision integer addition.	&AD
SUB_DINT	Double precision integer subtraction.	&SUB
MUL_DINT	Double precision integer multiplication.	&MU
DIV_DINT	Double precision integer division.	&DIV
MOD_DINT	Double precision integer modulo.	&MOD
Unsigned Integer Math Functions		
ADD_UINT	Unsigned integer addition.	&AD
SUB_UINT	Unsigned integer subtraction.	&SUB
MUL_UINT	Unsigned integer multiplication.	&MU
DIV_UINT	Unsigned integer division.	&DIV
MOD_UINT	Unsigned integer modulo.	&MOD
Real/Floating-Point Math Functions		
ADD_REAL	Real / floating-point addition.	&AD
SUB_REAL	Real / floating-point subtraction.	&SU
MUL_REAL	Real / floating-point multiplication.	&MU
DIV_REAL	Real / floating-point division.	&DIV
EXPT_REAL	Real / floating-point power of X.	&EXPT
Real/Floating-Point Trigonometric Functions		
SIN_REAL	Sin.	&SIN
COS_REAL	Cosine.	&COS
TAN_REAL	Tangent.	&TAN
ASIN_REAL	Inverse sine.	&ASIN
ACOS_REAL	Inverse cosine.	&ACOS
ATAN_REAL	Inverse tangent.	&ATAN
Real/Floating-Point Logarithmic Functions		
SQRT_REAL	Square root.	&SQRT
LOG_REAL	Base 10 logarithm.	&LOG
LN_REAL	Natural logarithm.	&LN
EXP_REAL	Power of e.	&EXP
Degree / Radian Conversion Functions		
RAD_TO_DEG	Convert to degrees.	&DEG
DEG_TO_RAD	Convert to radians.	&RAD
Integer Comparison Functions		
EQ_INT	Test for equality between two integers.	&EQ
NE_INT	Test for no equality between two integers.	&NE
GT_INT	Test for one integer value greater than another.	&GT
GE_INT	Test for one integer value greater than / equal to another.	&GE
LT_INT	Test for one integer value less than another.	&LT
LE_INT	Test for one integer value less than or equal to another.	&LE

Table 3-13. Substitution Groups (Continued)

Function	Description	Type This
DoubleIntegerComparisonFunctions		
EQ_DINT	Test for equality between two double precision integers.	&EQ
NE_DINT	Test for no equality between two double precision integers.	&NE
GT_DINT	Test for one double precision integer value greater than another.	&GT
GE_DINT	Test for one double precision integer value greater than or equal to another.	&GE
LT_DINT	Test for one double precision integer value less than another.	&LT
LE_DINT	Test for one double precision integer value less than or equal to another.	&LE
UnsignedIntegerComparisonFunctions		
EQ_UINT	Test for equality between two unsigned integers.	&EQ
NE_UINT	Test for no equality between two unsigned integers.	&NE
GT_UINT	Test for one unsigned integer value greater than another.	&GT
GE_UINT	Test for one unsigned integer value greater than or equal to another.	&GE
LT_UINT	Test for one unsigned integer value less than another.	&LT
LE_UINT	Test for one unsigned integer value less than or equal to another.	&LE
Real/Floating-PointComparisonFunctions		
EQ_REAL	Test for equality between two real / floating-point values.	&EQ
NE_REAL	Test for no equality between two real / floating-point values.	&NE
GT_REAL	Test for one real / floating-point value greater than another.	&GT
GE_REAL	Test for one real / floating-point value greater than or equal to another.	&GE
LT_REAL	Test for one real / floating-point value less than another.	&LT
LE_REAL	Test for one real / floating-point value less than or equal to another.	&LE
BitOperationFunctions(Word)		
AND_WORD	Logical "and" of two 16-bit word strings.	&AND
OR_WORD	Logical "or" of two 16-bit word strings.	&OR
XOR_WORD	Logical "exclusive or" of two 16-bit word strings.	&XOR
BitOperationFunctions(DoubleWord)		
AND_DWORD	Logical "and" of two 32-bit word strings.	&AND
OR_DWORD	Logical "or" of two 32-bit word strings.	&OR
XOR_DWORD	Logical "exclusive or" of two 32-bit word strings.	&XOR
Shift Bit String Functions(Word)		
SHL_WORD	Shift bit string left.	&SHL
SHR_WORD	Shift bit string right.	&SHR
Shift Bit String Functions(DoubleWord)		
SHL_DWORD	Shift bit string left.	&SHL
SHR_DWORD	Shift bit string right.	&SHR

Table 3-13. Substitution Groups (Continued)

Function	Description	Type This
Rotate Bit String Functions (Word)		
ROL_WORD	Rotate bit string left.	&ROL
ROR_WORD	Rotate bit string right.	&ROR
Rotate Bit String Functions (Double Word)		
ROL_DWORD	Rotate bit string left.	&ROL
ROR_DWORD	Rotate bit string right.	&ROR
Bit Set / Clear Functions (Word)		
BIT_SET_WORD	Set a bit within a bit string to 1.	&BSET
BIT_CLR_WORD	Clear a bit within a bit string.	&BC LR
Bit Set / Clear Functions (Double Word)		
BIT_SET_DWORD	Set a bit within a bit string to 1.	&BSET
BIT_CLR_DWORD	Clear a bit within a bit string.	&BCLR
Integer Search Table Functions		
SRCH_EQ	Search for array values equal to a specified value.	&SRCHE
SRCH_NE	Search for array values not equal to a specified value.	&SRCHN
SRCH_GT	Search for array values greater than a specified value.	&SRCHGT
SRCH_GE	Search for array values greater than or equal to a specified value.	&SRCHGE
SRCH_LT	Search for array values less than a specified value.	&SRCHLT
SRCH_LE	Search for array values less than or equal to a specified value.	&SRCHLE
Double Integer Search Table Functions		
SRCH_EQ	Search for array values equal to a specified value.	&SRCHE
SRCH_NE	Search for array values not equal to a specified value.	&SRCHN
SRCH_GT	Search for array values greater than a specified value.	&SRCHGT
SRCH_GE	Search for array values greater than or equal to a specified value.	&SRCHGE
SRCH_LT	Search for array values less than a specified value.	&SRCHLT
SRCH_LE	Search for array values less than or equal to a specified value.	&SRCHLE
Byte Search Table Functions		
SRCH_EQ	Search for array values equal to a specified value.	&SRCHE
SRCH_NE	Search for array values not equal to a specified value.	&SRCHN
SRCH_GT	Search for array values greater than a specified value.	&SRCHGT
SRCH_GE	Search for array values greater than or equal to a specified value.	&SRCHGE
SRCH_LT	Search for array values less than a specified value.	&SRCHLT
SRCH_LE	Search for array values less than or equal to a specified value.	&SRCHLE
Word Search Table Functions		
SRCH_EQ	Search for array values equal to a specified value.	&SRCHE
SRCH_NE	Search for array values not equal to a specified value.	&SRCHN
SRCH_GT	Search for array values greater than a specified value.	&SRCHGT
SRCH_GE	Search for array values greater than or equal to a specified value.	&SRCHGE
SRCH_LT	Search for array values less than a specified value.	&SRCHLT
SRCH_LE	Search for array values less than or equal to a specified value.	&SRCHLE

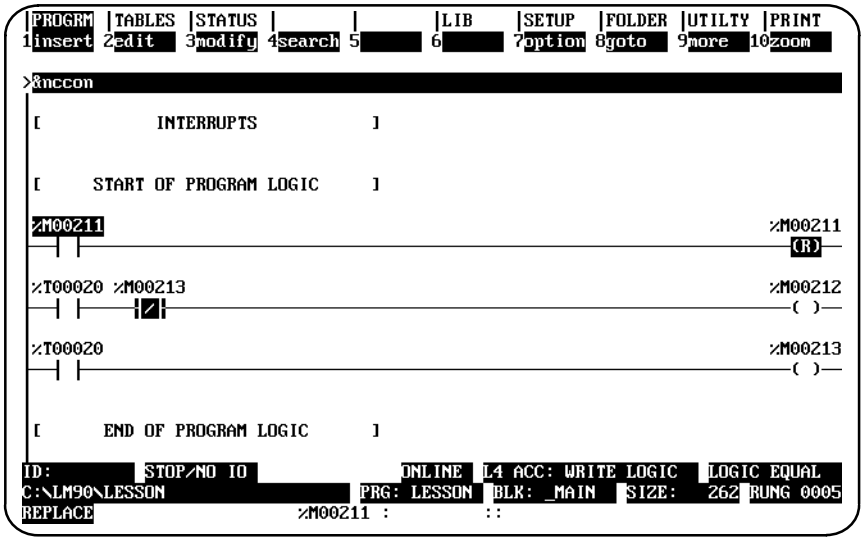
Table 3-13. Substitution Groups (Continued)

Function	Description	Type This
Real/Floating-Point to Integer Conversion Functions		
REAL_TO_INT TRUNC_TO_INT	Convert a real / floating-point value to integer. Round the real number toward zero; the result will be an integer value.	&TO_INT &TRINT
Real/Floating-Point to Double Integer Conversion Functions		
REAL_TO_DINT TRUNC_TO_DINT	Convert a real / floating-point value to double precision integer. Round the real number toward zero; the result will be a double precision integer value.	&TO_DINT &TRDINT

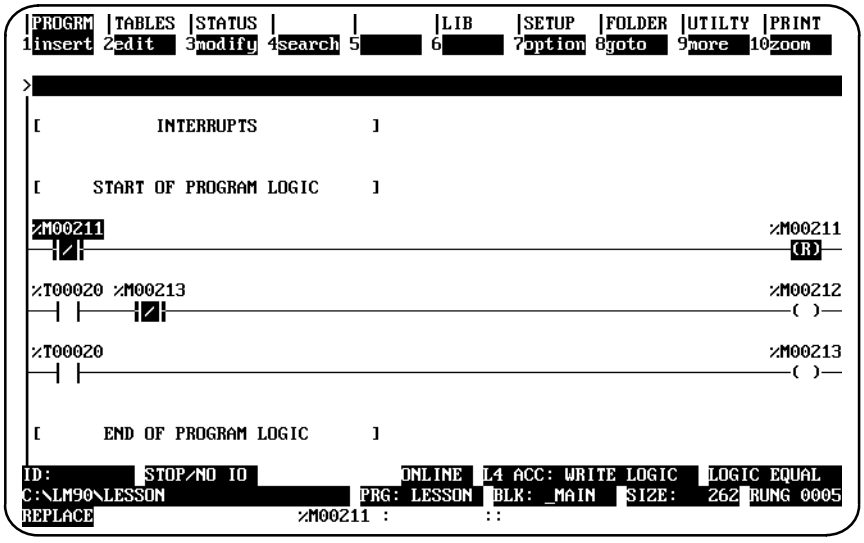
Modifying Instructions

The following steps describe how to change relay ladder diagram elements and update the PLC while online with the PLC running.

1. Place the cursor on the element to be changed.
2. Enter the new instruction mnemonic on the command line. The new instruction must be in the same instruction group as the existing instruction. (Instruction groups are listed in the table at the beginning of this section.)



3. Press the **Enter** key, and enter **Y** (Yes) in response to the confirmation prompt.



The same steps are used to replace functions for other functions in the same instruction group. For example, the NE_INT function can be replaced with the LE_INT function. With the cursor on the NE_INT function, enter the new instruction mnemonic **&LE_INT** on the command line and press the **Enter** key.

Using the Modify Softkey

The **Modify (F3)** softkey enables you to substitute instructions from the rung editor environment by using the rung editor instruction softkeys. Position the cursor on the rung where the substitution is to be made, and press **Modify (F3)**. Then, use the function softkeys to enter the new instruction. You can also use the **Modify (F3)** softkey to change a reference address or constant parameter and to create / modify nicknames.

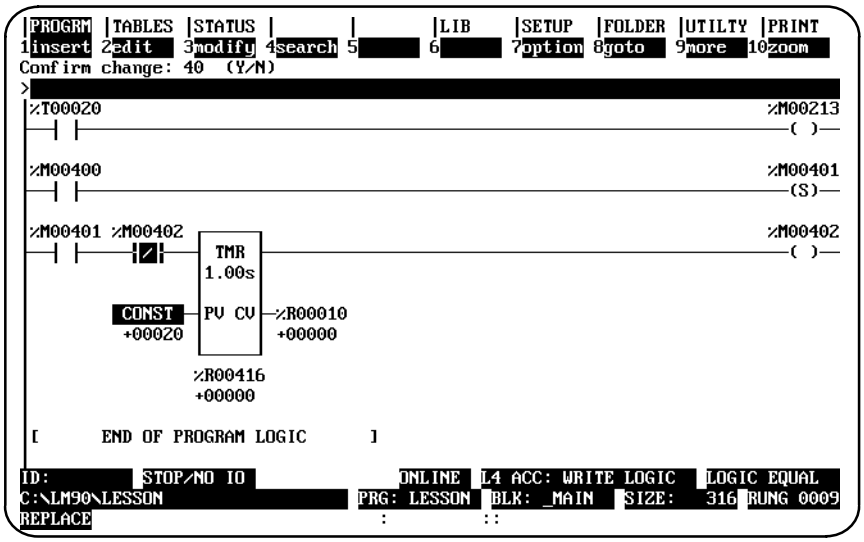
To restore the original values prior to completing the substitution, press **ALT-A**.

When the change is completed, press the **Escape** key.

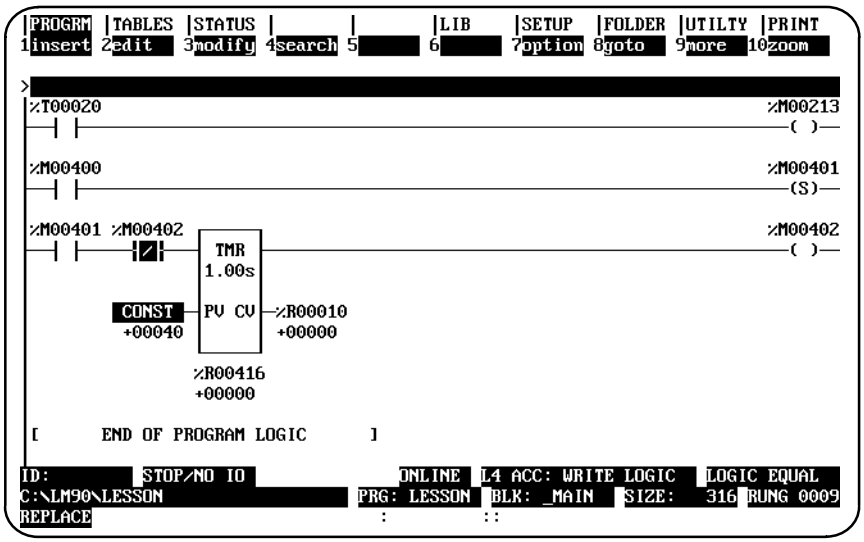
Modifying a Reference Address or Constant

A reference address or other parameter can be changed while online with the PLC running.

1. Place the cursor on the reference to be changed. In this example, the cursor is positioned on the TMR function's PV parameter, which currently contains a value of 20. Enter a new value of 40 on the command line, and press the **Enter** key.



2. Press **Y** (Yes) in response to the confirmation prompt to update the PLC with the new operand value.

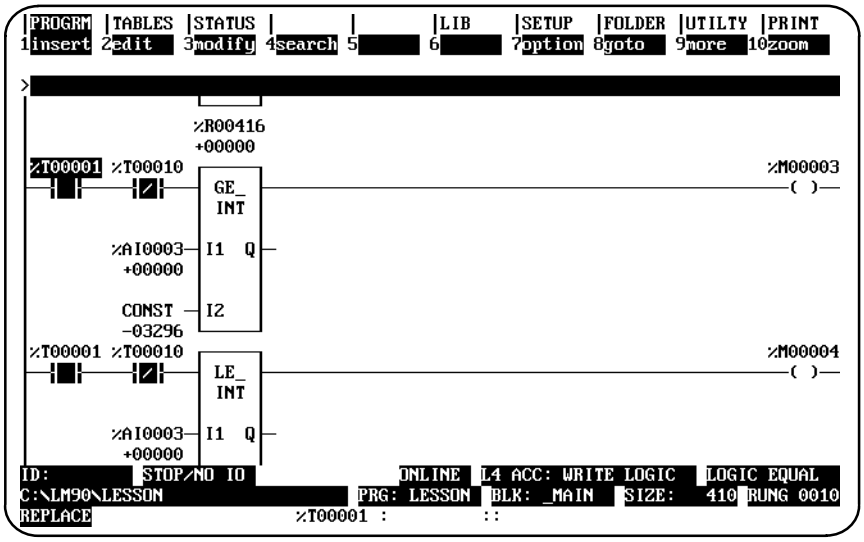


Forcing and Overriding Discrete References

A value that is overridden can be protected from change by the program logic; however, an overridden value can be forced or toggled.

1. Discrete points can be forced or toggled by positioning the cursor on a contact or coil with the reference address to be modified, and pressing **F12** or the **keypad (–)** key.
2. For input points that are being scanned or output points that the logic program changes, you must first override the point by pressing **F11** or the **keypad (*)** key before forcing the reference.
3. Once a point has been overwritten, the first character of the reference address or nickname will flash.
4. To remove an override, position the cursor on the use of the reference address, and press **F11** or the **keypad (*)** key again.

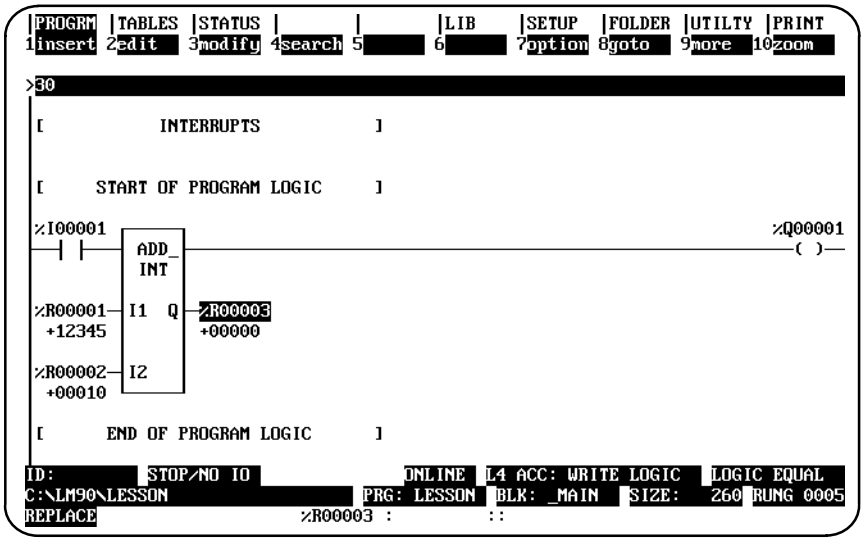
To force the discrete reference %T00001 in the following example, position the cursor on an element which uses that reference. Then, press **F12** to update the PLC.



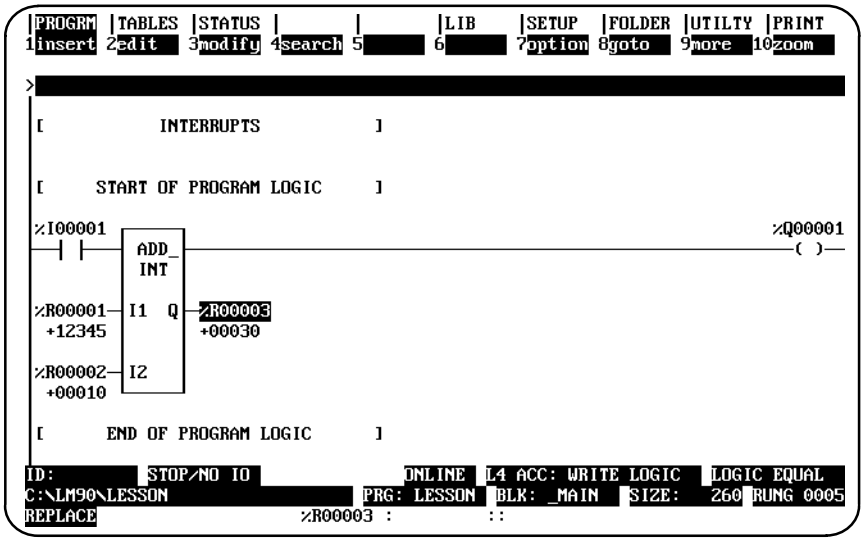
Changing Register Values

The following steps describe how to change the value of a register at the current cursor position.

1. Place the cursor on the register to be changed. (For this example, place the cursor on %R00003.)
2. Enter the new value on the command line. (For this example, enter 30 on the command line.)



3. Press the **Enter** key. The register value for this example will change from 0 to 30, as shown in the screen below.



Chapter 4 Reference Tables

The display reference tables function is used to:

- Display tables of reference values.
- Set all the reference values in the table to zero.
- Change the formats in which reference tables are displayed or printed.
- Change reference values.
- Override discrete references (remove reference control from the PLC).

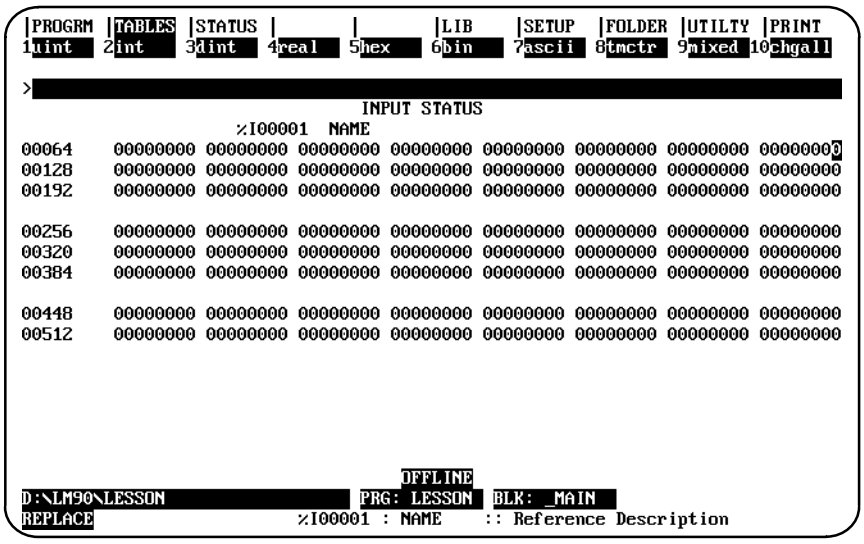
This chapter contains the following sections:

Section	Title	Description	Page
1	Displaying Reference Tables	Explains how to display reference tables.	4-2
2	Changing References Table Values	Explains how to change reference values.	4-6
3	Using Overrides	Explains how to remove control of discrete references from the logic program.	4-10
4	Changing Display Formats	Explains how to make format changes.	4-12
5	Mixed Reference Tables	Describes mixed reference tables.	4-22

Section 1: Displaying Reference Tables

Reference tables can be displayed directly from the main menu in any programming mode, or from any main menu function screen. While a table is displayed, you can change the format of any references in the table for a particular application.

This is a sample reference table used for discrete inputs (%I):



Note

In **OFFLINE** mode, reference values from the current program folder are displayed. In **ONLINE** or **MONITOR** mode, references from the PLC are displayed.

Offline values from a reference table (values from the folder) can also be printed using the print function. These values will have the formats you set up on the display. To print values displayed online, the values must first be loaded from the PLC and then printed.

Displaying a Reference Table

To display a reference table:

1. Enter one of the reference types listed in the following table:

User Reference	Reference Table
%I	Discrete input.
%Q	Discrete output.
%M	Discrete internal.
%T	Discrete temporary.
%G, %GA, %GB, %GC, %GD, %GE	Discrete Genius global data.
%S, %SA, %SB, %SC	Discrete system.
%AI	Analog input.
%AQ	Analog output.
%R	Register.
%P	Program register.
<block name? %L or <block name>↑%L	Local register.

Note

External blocks do not have local data (%L). If you request a table associated with a %L user reference and an external block is specified on the command line, an error message will be displayed.

A. To view the lowest-numbered table of a particular type, enter just the reference type. For example, for the lowest-numbered analog input table, enter **%AI**.

For the lowest-numbered local register table for a particular block, enter just the block name on the command line.

B. To view a table containing a specific reference, enter the reference or its nickname. For example, %AI0123 or 123AI.

2. Then, press Tables **(Shift-F2)**.

3. Once in the reference tables function, you may go to a different reference table by entering the reference on the command line and pressing the **Enter** key.

Using the Cursor to Select a Reference Table

You may go directly to the reference table of a reference (e.g., of a function block operand, contact, coil, etc.) under the cursor by pressing **ALT-F2**. Then, press **Shift-F1** from the reference table to return to the same place in the program.

Moving the Cursor in a Reference Table

Follow these guidelines for moving the cursor in a reference table:

- Use the cursor keys to move one value horizontally or vertically in the table.
- To move the cursor to a specific reference in the same table, enter the reference on the command line and press the **Enter** key. To move to a specific reference in any table, enter the reference on the command line and press the **Enter** key, or use Shift-F2.
- To display the next screen of the same table, use the Page Down key. Use the Page Up key to display the previous screen.
- Use the CTRL-Page Down keys to move the cursor to the first reference of the next line. Use the CTRL-Page Up keys to move the cursor to the first reference of the previous line.
- Use the Home key to go to the first value in the table. Use the End key to go to the last value in the table.

Changing the Reference Table (Default) Display Mode (ALT-N)

The ALT-N key sequence enables you to display reference table data either right to left (lowest reference address on the right) or left to right (lowest reference address on the left). The display mode can be changed in any table (fixed or mixed) and in any program mode (**OFFLINE**, **ONLINE**, or **MONITOR**).

The Home, End, Page Up and Page Down, Previous, Next, and cursor keys function the same, regardless of the view mode selected.

Data displayed in ASCII format differs slightly, in that the quotes are removed and the format is treated as a byte (one character) instead of a word (two characters).

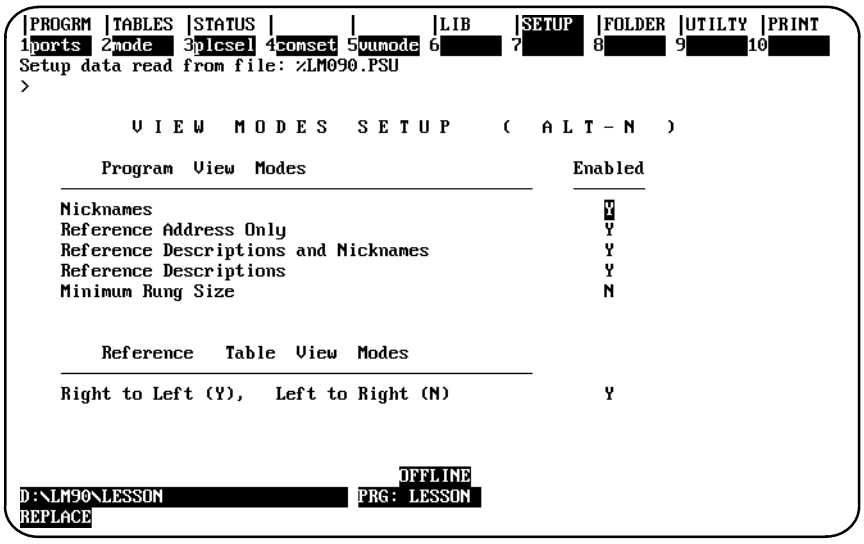
Note

The print function cannot distinguish between these two display modes and prints all tables right to left.

The default display mode (right to left) is the last mode selected with ALT-N. If the display mode has never been changed, the default set in the programmer setup is used. (See chapter 7, section 6, *View Modes Setup (ALT-N)*).

Follow the steps below to change the display mode:

1. The default reference table display mode is displayed on the View Modes Setup screen. To display this screen, press **Setup (F7)** from the Programming Software main menu and then View Modes Setup (F5) from the Programmer Setup menu. The view mode in the following screen is right to left (the default display).



2. To change the default view mode to display left to right, move the cursor to the ***Enabled*** field for the ***Reference Table View Modes*** entry. Then, use the Tab key to toggle the selection to **N** (No) or enter **N**.

3. To validate and save the default view mode selection in the home directory file %LM090.PSU, press **ALT-U**, the Escape key, or the shifted function key.

Section 2: Changing Reference Table Values

You can force (change) both discrete and register reference values with the reference tables function.

Note

If the programmer mode is **OFFLINE**, changes will only be made to the current program folder. Changes made to the program folder may later be stored to the PLC by using the store utility function, described in chapter 9, *Program Utilities*. If the programmer mode is **ONLINE**, any changes will only be made to reference values in the PLC. Reference values in the PLC may then be loaded to the program folder by using the load utility function, also described in chapter 9. No changes to the PLC can be made while the programmer is in **MONITOR** mode.

Warning

Improper use of online program changes can damage equipment or cause personal injury.

Online program changes should always be made with extreme care. Online changes can have serious and unforeseen results on a control system, and on the process to which it applies, if they are improperly used. It is recommended that these functions not be used with people near the equipment. If possible, they should be done with direct visual control over the system and the process. Proper external power disconnects should be made to prevent undesired equipment operation.

In order to make online changes, the status line at the bottom of the screen must show that the programmer is online to the CPU.

Changing a Reference Value

You can enter or change the values of a reference as described below. This method can be used to load a value into a reference. To change a reference value:

1. In the reference table that contains the reference, move the cursor to highlight the reference or enter the reference on the command line.
2. Enter a new value on the screen's command line and press the **Enter** key. The new value will be interpreted in the format (for example, unsigned integer) currently assigned to the reference.

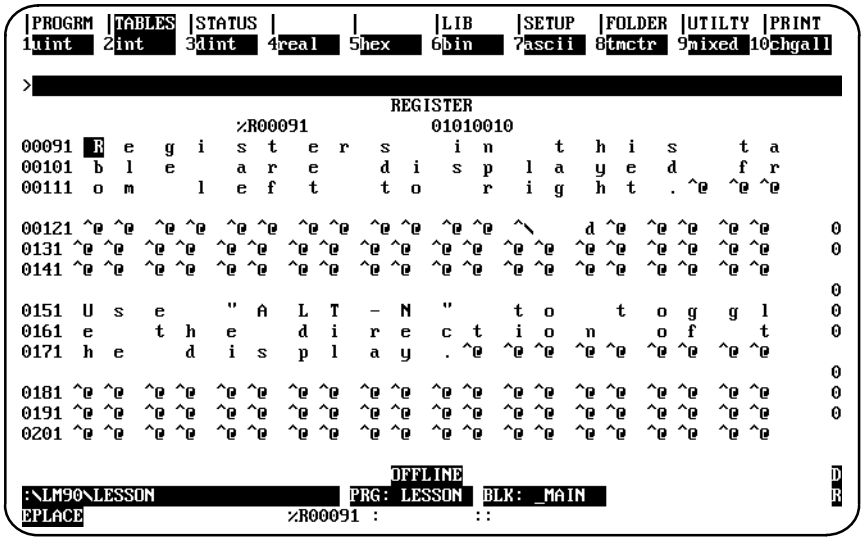
The data import feature can also be used to quickly change values in a reference table. For more information on this feature, refer to appendix H, "Data Import."

ASCII String Entry

An ASCII string up to 79 characters, the size of the command line, can be entered in any table. The string of text is entered the same as a name explanation and is displayed one character at a time, beginning with the reference the cursor is on.

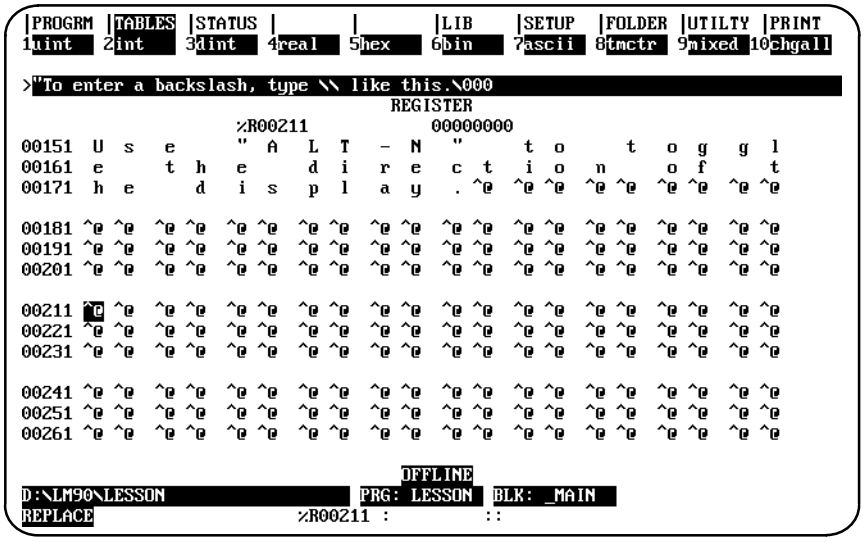
The string is entered by typing the text, enclosed in quotes, on the command line and then pressing the **Enter** key. To include quotes within a string of text, you must begin the string with two colons. For example, to enter the string: **`Use “ALT-N” to toggle`** you must enter **`::Use “ALT-N” to toggle`** on the command line. A string can be accepted without a closing quote, but only to the last non-space character. Trailing spaces are lost without the closing quote.

The following screen shows the reference table display after the string: **`“Registers in this table are displayed from left to right”`** is entered. (The display mode of any reference table can be changed from right to left or left to right, as explained in chapter 4, section 1, *Displaying Reference Tables*.)

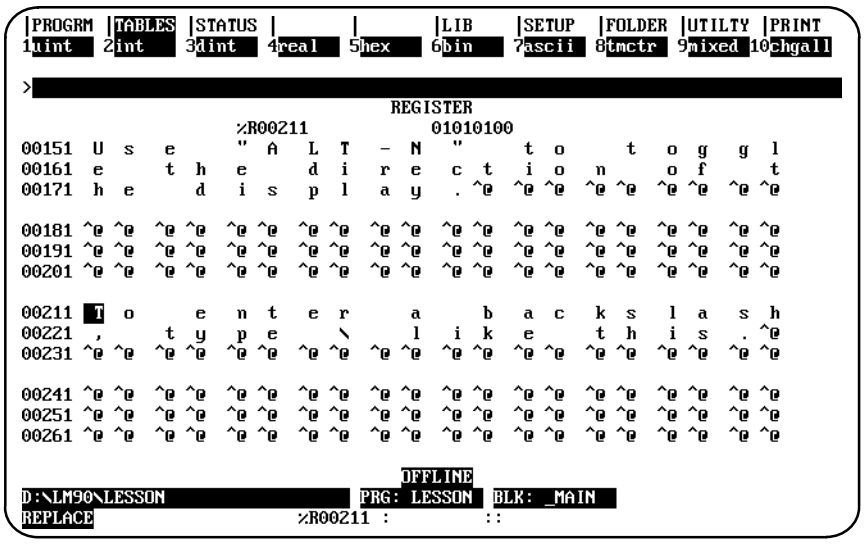


Non-printable characters (e.g., “null” to terminate a string) may be included in the ASCII string by entering a backslash and the three-digit decimal value of the non-printable character (e.g., “\000”). To include a backslash (\) in the text, enter two backslashes. There is no limit, other than the size of the command line, on the number of non-printable characters a string may have. The software performs a check to verify that the value is a valid decimal number.

This example shows a null terminated string.



The next example shows the reference table after the null terminated string is accepted.



Forcing a Discrete Reference

In discrete reference tables, a reference can be forced ON or OFF. If the reference being forced is currently overridden (described below), it retains its new status until forced again. If the reference is not overridden, it retains its new status until changed by some other function, such as rung solution or I/O servicing. This usually occurs within one sweep.

You can enter the desired state (0 or 1) on the command line, or toggle the reference state, as described below. The following method is easier:

You can toggle the reference state as described below.

To toggle a reference:

1. With the table displayed on the screen, place the cursor on the reference to be forced.
2. Press the **keypad minus (–)** key or **F12** key to change that reference to its opposite state. All logic elements in the program that use the reference will reflect the new status.

Changing the Value of a Word of Discrete References

You can change the value of the word where the cursor is. To do that, first you must change the number base of the references. For example, suppose you want to convert discrete references (see below) 0225 through 0240 to ones.

```
                              __ References 0225 through 0240
                          ____|____
                         |         |
0256 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
```

Follow the steps below to change a word of discrete references:

1. The cursor indicates the rightmost (lower-numbered) byte of the word to be changed. (The software automatically adjusts the cursor position if it is incorrectly placed.) Use the function keys to change the number base to one of the following: unsigned integer (by pressing **F1**), signed integer (by pressing **F2**) or hexadecimal (by pressing **F5**).
2. On the command line, type the equivalent of the binary value in the selected format.
3. Press the **Enter** key to change the reference at the cursor position to the new value.
4. Press **Binary (F6)** to convert the format back to binary values.

```
                              __ References 0225 through 0240
                          ____|____
                         |         |
0256 00000000 00000000 11111111 11111111 00000000 00000000 00000000 00000000
```

Section 3: Using Overrides

Discrete references can be overridden from the reference tables display. Discrete references that have been overridden are indicated by flashing digits on the reference table screen. An override removes control of the reference from its normal source. Overridden inputs ignore information from the devices wired to the I/O structure, such as limit switches or pushbuttons. Similarly, overridden outputs ignore programmed logic and internal power flow. Overrides are retained even when power is removed from the system. Non-relay functions such as timers, counters, math functions, and data move functions, still work when a coil is overridden.

Warning

If overrides are applied to a reference associated with a transitional coil or contact, the coil or contact may pulse on for one sweep when the override is removed.

The override is a very powerful tool for program checking and maintenance. You can test a program in a PLC that is not connected to I/O hardware by using overrides to simulate inputs. You can also check a program when I/O is connected by using overrides to prevent coil operation. Overrides can also be used to temporarily bypass a failed input device so that machine operation can continue until the device can be repaired; however, there is the danger of overriding safety devices.

An alternate method of checking a program when I/O is connected is to enter an %S0011 (OVR_PRE) system status/fault reference in the program logic.

After the I/O is wired up, it can be tested by activating each coil with an override to verify I/O communications, module operation, power to a device, wiring to a device, indicator lights, fuses, and other hardware.

After the control system is thoroughly checked and placed in operation, the override is useful in a monitored system. If a sensor or input module should fail while the process is in operation, that input can be overridden. Thus, the process can continue until it can be shut down safely.

References should not be overridden when the programmer is removed from the process, or when making copies of a program. Use the reference tables function to verify all inputs and coils before removing them from the programmer, or copying the program.

Using Overrides

Overrides should be used on an operating system only with extreme care.

Warning

Improper use of the override can damage equipment or cause personal injury.

1. Place the cursor on the reference to be overridden.

Caution

The reference will be overridden throughout the program, not just at the cursor location.

2. Press the **keypad Asterisk (*)** key or **F11**. This toggles the state of the reference between overridden and not overridden. When overridden is selected as the state of the reference, the value displayed in the table will flash.

Removing Overrides

All discrete reference bits on a reference table screen, or starting character in a tag name on a displayed rung, will flash if they have been overridden. To remove an override from one reference, toggle it by placing the cursor on the reference and pressing the **keypad Asterisk (*)** key or **F11**.

To remove all overrides shown on the current screen, including the last three lines which may be hidden beneath the status lines (Press **ALT-E** to remove the status lines.):

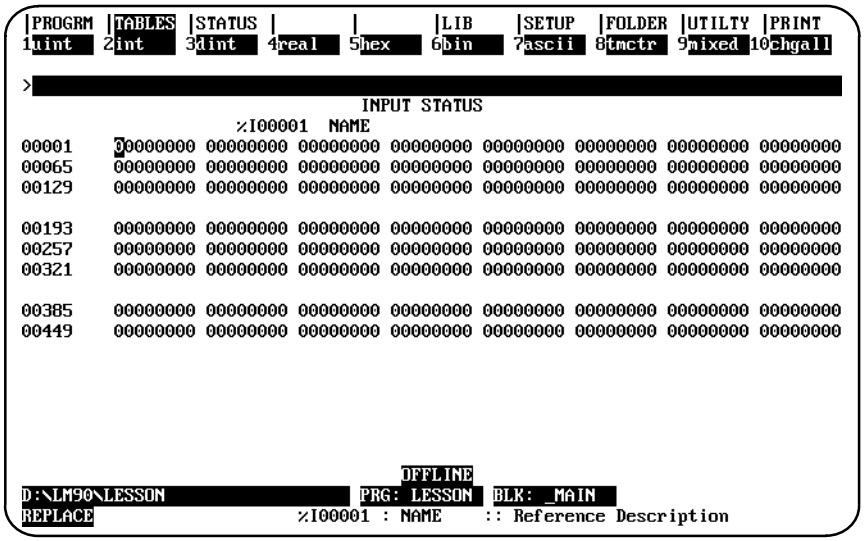
1. Press **Change All (F10)**.
2. Press the **keypad Asterisk (*)** key or **F11**. The screen prompts: “Remove overrides from displayed references? (Y / N)”.
3. Enter **Y** (Yes) to remove the overrides.

Section 4: Changing Display Formats

The format of any reference in a table can be changed for a particular application while the table is displayed on the programmer screen. This section explains how to make format changes.

Discrete Reference Tables

The sample reference table below is used for discrete inputs (%I), discrete outputs (%Q), discrete internal coils (%M), discrete temporary coils (%T), discrete system status references (%S, %SA, %SB, and %SC), and discrete global data (%G).



The default format for discrete reference table displays is to have the values displayed or printed in binary. The format may be changed to unsigned integer, signed integer, or hexadecimal.

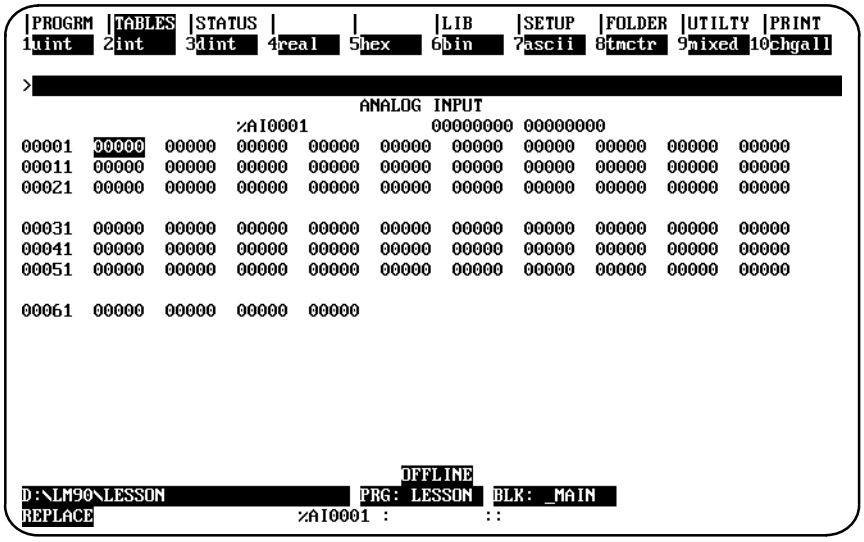
Any of these formats can be used for some of the values in the table, or for the entire table. Thus, each reference table can be uniquely formatted to be most meaningful for the type of information it contains. (Double precision integer, real, and timer / counter are not allowed for discrete references.)

Note

The format for system status references (%S, %SA, %SB, and %SC) cannot be changed. System status references can only be displayed in binary format. The %S reference table values cannot be cleared or changed. %S memory is read only and cannot be written. The bit values in the %SA, %SB, and %SC reference tables can, however, be cleared or toggled.

Register Reference Tables

The sample register reference table below is used for system registers (%R), analog inputs (%AI), analog outputs (%AQ), program registers (%P), and local registers (%L).



The default format for register reference table displays is for the values to be shown or printed as unsigned integers. The format can be changed to signed integer, double precision signed integer, hexadecimal, real, ASCII, or timer / counter. The format can also be changed for some of the values in the table or for the entire table.

In addition, the value of the reference at the cursor is displayed at the top of the table in binary format.

Display Formats

Use the function keys to change display formats. Changes are automatically saved when you leave a reference table display. The table will continue to be displayed in the new format until the format is changed again. If you want to save changes to the program folder **without** leaving the reference table display, press **ALT-U**.

Table 4-1. Display Formats

Format	Function Key	Description
Unsigned Integer	F1	A 16-bit number from 0 to +65,535. In discrete reference tables, 16 consecutive references are used for the display, beginning at a multiple-of-8-plus-one boundary (e.g., 1, 9, 17, 25, 33, etc.). In register reference tables, a single reference is required (e.g.,43,690).
Signed Integer	F2	A 16-bit number from –32,768 to +32,767. In discrete reference tables, 16 consecutive references are used for the display, beginning at a multiple-of-8-plus-one boundary (e.g., 1, 9, 17, 25, 33, etc.). In register reference tables, a single reference is required (e.g., –21,846).
Signed Double Integer	F3	A 32-bit number from –2,147,483,648 to +2,147,483,647. This format can be used for register reference tables only. Two consecutive references are required, beginning at a multiple-of-2-minus-one boundary (e.g., 1, 3, 5, 7, etc.).
Real	F4	32 consecutive bits (actually two consecutive 16-bit memory locations). This format can be used for register reference tables only. The range of numbers that can be stored in this format is from ±1.401298E–45 to ±3.402823E+38.
Hexadecimal	F5	A 16-bit number from 0000 to FFFF. When entering hexadecimal numbers on the command line, a leading A through F must be preceded by a zero. In addition, type an ***h*** at the end of the numeric string to ensure that the entry is read as a hexadecimal number. In discrete reference tables, 16 consecutive references are used, beginning at a multiple-of-8 boundary (e.g., 1, 9, 17, 25, 33, etc.). In register reference tables, a single reference is required (e.g.,0AAAAh).
Binary	F6	A 1-bit number with a value of 0 or 1. This format can be used for discrete reference tables only. A single reference is used. Binary values are displayed in groups of 8 references (e.g., 10101010). Register references cannot be displayed in binary format. However, the 16-bit binary equivalent of the value indicated by the cursor is automatically displayed at the top of the table.
ASCII	F7	8-bit encoded characters. A single reference is required to make up 2 (packed) ASCII characters. The first character of the pair corresponds to the low byte of the reference word. Bit 8 of each pair is a parity bit and is ignored. The remaining 7 bits in each section are converted as shown below. Command codes and non-displayable characters appear on the screen as non-alphanumeric characters (e.g., ^@, ^).
Tmrctr	F8	Three contiguous reference addresses, which support timer / counter functions, display the current value, the preset value, and the EN and Q bits of the control word. Regardless of whether the reference is assigned to a timer or counter, the format can be used as long as the reference type is %R, %P, or %L. More information on this format is provided later in this chapter.
Mixed	F9	Select a user-defined table. Up to 99 user-defined tables may be created.
Change All	F10	Press **F10** to change the format of the entire table.

Table 4-2. ASCII Characters (Decimal and Hexadecimal Equivalents)

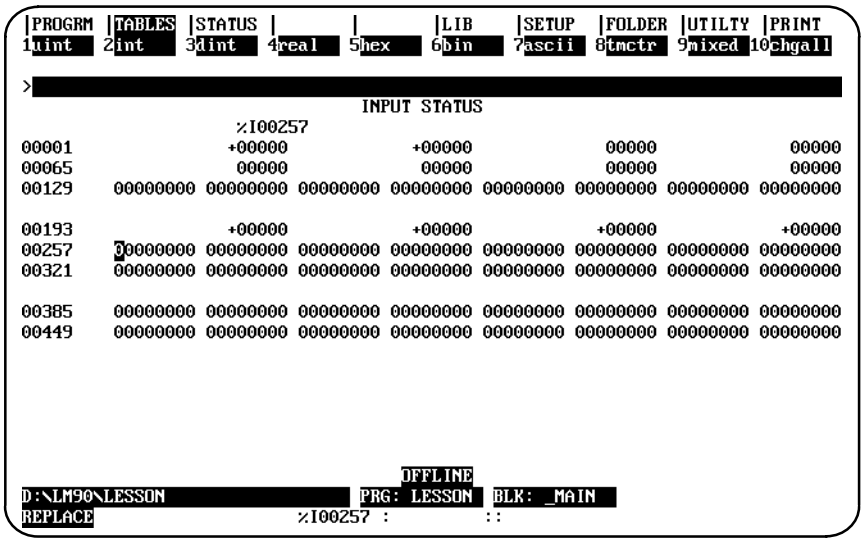
Char.	Dec.	Hex.	Char.	Dec.	Hex.	Char.	Dec.	Hex.
NUL	0	00	0	48	30	[	91	5B
SOH	1	01	1	49	31	\	92	5C
STX	2	02	2	50	32	]	93	5D
ETX	3	03	3	51	33	^	94	5E
EOT	4	04	4	52	34	_	95	5F
ENQ	5	05	5	53	35	’	96	60
ACK	6	06	6	54	36	a	97	61
BEL	7	07	7	55	37	b	98	62
BS	8	08	8	56	38	c	99	63
HT	9	09	9	57	39	d	100	64
LF	10	0A	:	58	3A	e	101	65
VT	11	0B	;	59	3B	f	102	66
FF	12	0C	<	60	3C	g	103	67
CR	13	0D	=	61	3D	h	104	68
SO	14	0E	>	62	3E	i	105	69
SI	15	0F	?	63	3F	j	106	6A
DLE	16	10	@	64	40	k	107	6B
DC1	17	11	A	65	41	l	108	6C
DC2	18	12	B	66	42	m	109	6D
DC3	19	13	C	67	43	n	110	6E
DC4	20	14	D	68	44	o	111	6F
NAK	21	15	E	69	45	p	112	70
SYN	22	16	F	70	46	q	113	71
ETB	23	17	G	71	47	r	114	72
CAN	24	18	H	72	48	s	115	73
EM	25	19	I	73	49	t	116	74
SUB	26	1A	J	74	4A	u	117	75
ESC	27	1B	K	75	4B	v	118	76
FS	28	1C	L	76	4C	w	119	77
GS	29	1D	M	77	4D	x	120	78
RS	30	1E	N	78	4E	y	121	79
US	31	1F	O	79	4F	z	122	7A
SP	32	20	P	80	50	{	123	7B
!	33	21	Q	81	51	|	124	7C
”	34	22	R	82	52	}	125	7D
#	35	23	S	83	53	~	126	7E
$	36	24	T	84	54	“	127	7F
%	37	25	U	85	55			
&	38	26	V	86	56			
’	39	27	W	87	57			
(	40	28	X	88	58			
)	41	29	Y	89	59			
*	42	2A	Z	90	5A			
+	43	2B						
,	44	2C						
–	45	2D						
.	46	2E						
/	47	2F						

Table 4-3. ASCII Characters (Bit Pattern)

Bit Pattern	Character	Bit Pattern	Character	Bit Pattern	Character	Bit Pattern	Character
X0000000	^@	X0100000	(blank)	X1000000	@	X1100000	’
X0000001	^A	X0100001	]	X1000001	A	X1100001	a
X0000010	^B	X0100010	“	X1000010	B	X1100010	b
X0000011	^C	X0100011	#	X1000011	C	X1100011	c
X0000100	^D	X0100100	$	X1000100	D	X1100100	d
X0000101	^E	X0100101	%	X1000101	E	X1100101	e
X0000110	^F	X0100110	&	X1000110	F	X1100110	f
X0000111	^G	X0100111	’	X1000111	G	X1100111	g
X0001000	^H	X0101000	(	X1001000	H	X1101000	h
X0001001	^I	X0101001	)	X1001001	I	X1101001	i
X0001010	^J	X0101010	*	X1001010	J	X1101010	j
X0001011	^K	X0101011	+	X1001011	K	X1101011	k
X0001100	^L	X0101100	,	X1001100	L	X1101100	l
X0001101	^M	X0101101	–	X1001101	M	X1101101	m
X0001110	^N	X0101110	.	X1001110	N	X1101110	n
X0001111	^O	X0101111	/	X1001111	O	X1101111	o
X0010000	^P	X0110000	0	X1010000	P	X1110000	p
X0010001	^Q	X0110001	1	X1010001	Q	X1110001	q
X0010010	^R	X0110010	2	X1010010	R	X1110010	r
X0010011	^S	X0110011	3	X1010011	S	X1110011	s
X0010100	^T	X0110100	4	X1010100	T	X1110100	t
X0010101	^U	X0110101	5	X1010101	U	X1110101	u
X0010110	^V	X0110110	6	X1010110	V	X1110110	v
X0010111	^W	X0110111	7	X1010111	W	X1110111	w
X0011000	^X	X0111000	8	X1011000	X	X1111000	x
X0011001	^Y	X0111001	9	X1011001	Y	X1111001	y
X0011010	^Z	X0111010	:	X1011010	Z	X1111010	z
X0011011	^[	X0111011	;	X1011011	[	X1111011	{
X0011100	^\	X0111100	<	X1011100	\	X1111100	|
X0011101	^]	X0111101	=	X1011101	]	X1111101	}
X0011110	^^	X0111110	>	X1011110	^	X1111110	tilde
X0011111	^_	X0111111	?	X1011111	_	X1111111	delta

Changing the Display Format

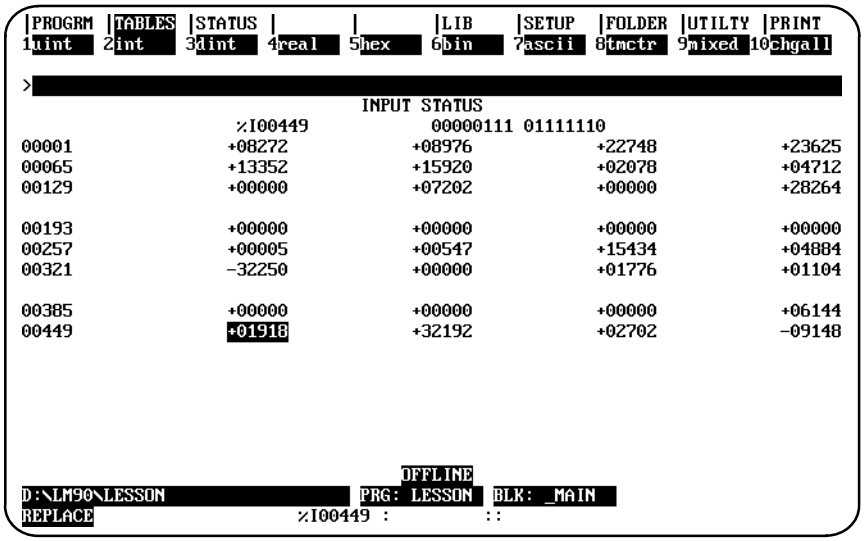
To change the format of one reference, move the cursor to that reference and press the appropriate function key. The new format will appear at the rightmost position of the reference(s). Within any standard reference table, you can change as many reference formats as you want, as shown by the example below.



Changing the Format of a Table

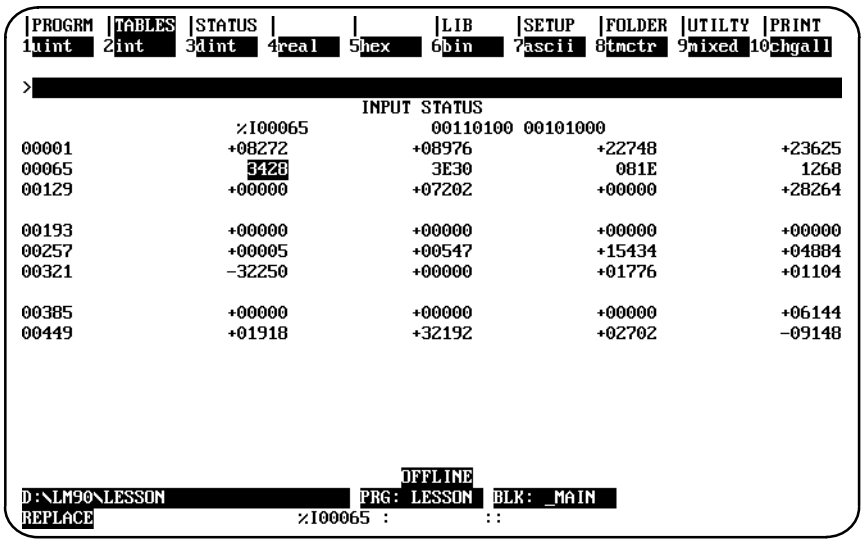
You can also change the format of an entire table, including the values not currently on the screen or portions of the table. To change the format of an entire table:

1. Press **Change All (F10)**.
2. Select the format for the display. For example, press **F2** to select signed integer.



The Change All (F10) key can also be used to change a specified block of range formats.

1. Enter a starting reference (the lower address) and an ending reference (the higher address) from the current table (e.g., 65i 128i).
2. Press **Change All (F10)**.
3. Select the format (e.g., hex).



Entering only a valid starting reference will cause the formats from the starting reference to the end of the table to change. Entering a valid starting reference followed by an invalid entry will also cause the formats from the starting reference to the end of the table to change.

To restore the previous format (and in **OFFLINE** mode, restore the data values stored at the time of the last disk update), press **ALT-A** to abort the change. Pressing **ALT-A** will undo **all** format changes and value changes made since the last disk update.

To save all the changes and remain in the reference table, press **ALT-U**. To save the changes and exit from the reference table, press the **Escape** key.

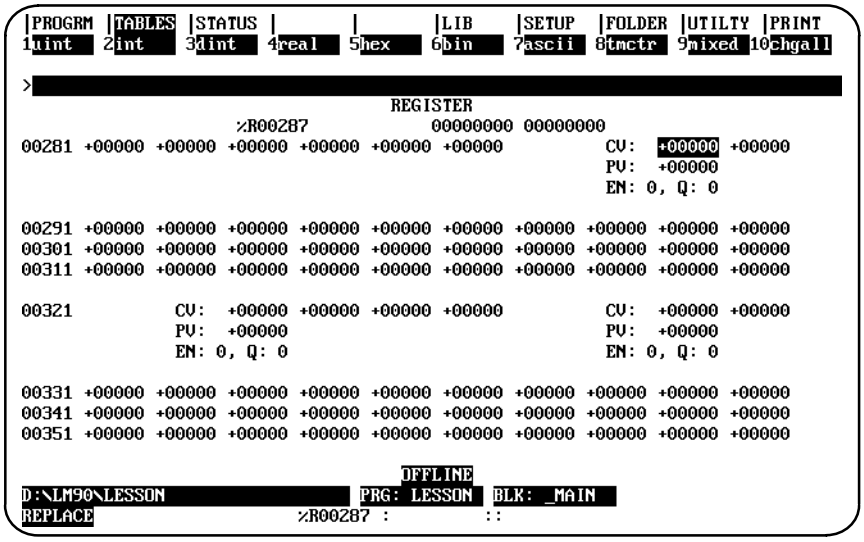
Timer/Counter Format

To support the timer / counter function, a timer / counter format requiring three contiguous reference addresses will display the current value, the preset value, and the control word. In the control word, bit 15 contains the output status (Q), and bit 16 contains the enable status (EN). The rest of the bits in the control word are not used by a counter. For a timer, the rest of the control word bits contain the timer accuracy.

The preset value (PV) can be modified in **ONLINE** or **OFFLINE** mode. If a reference or constant was assigned to the PV parameter of the timer / counter function, the contents of the reference or the constant are written to the PV reference of the timer / counter format when in **RUN** mode.

Regardless of whether the reference is assigned to a timer or counter, the format can be used as long as the reference type is %R, %P, or %L.

The example screen below shows the timer / counter format displayed, using the Timer / Counter (F8) function key.



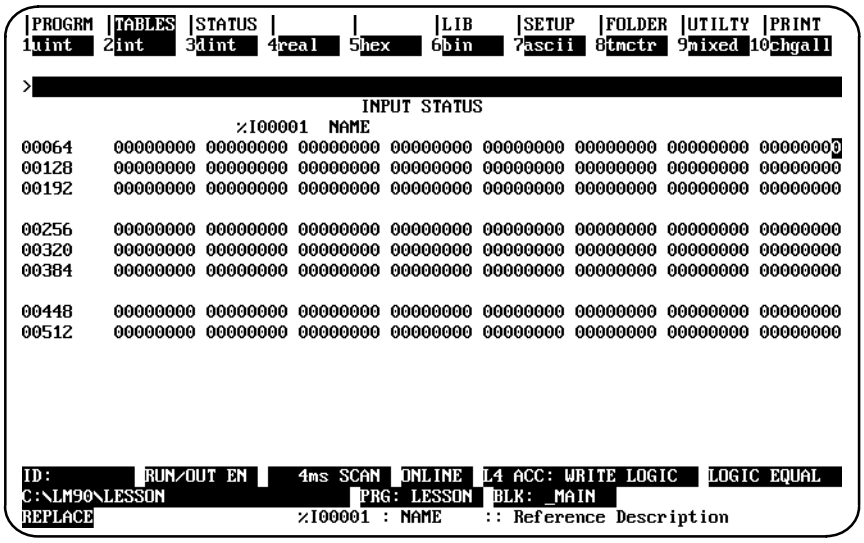
Returning to Default Values

After editing, you can return a standard reference table to its default format and fill the table locations with zeros. This will:

- Set all the reference values in the table to zero.
- Change all references in a discrete reference table back to binary format.
- Change all references in a register reference table back to unsigned integer format.

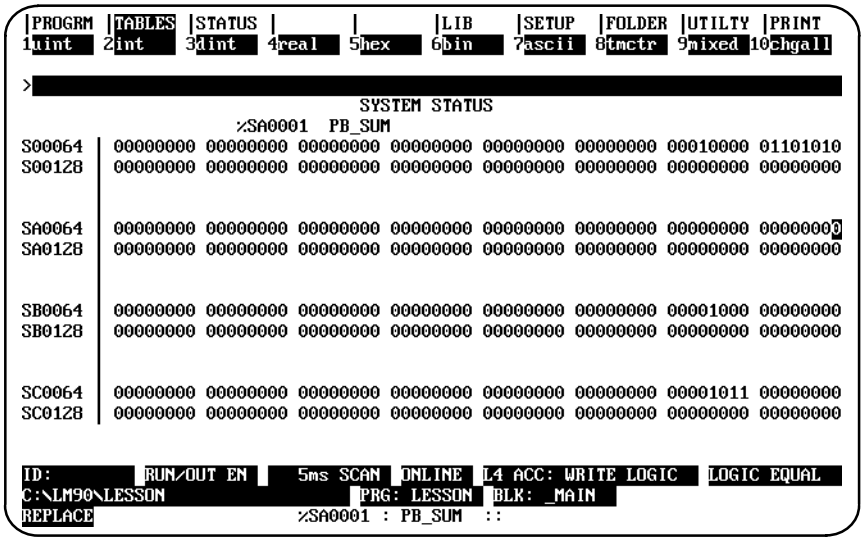
To restore the table to its default content:

1. Select Change All (F10).
2. Enter **0** on the command line, and press the **Enter** key. The screen prompts "Initialize table data and formats to defaults ? (Y / N)".
3. Enter **Y** (Yes) to restore the table's default content. For example:



System Reference Table

The sample system reference table below is used for system references (%S, %SA, %SB, and %SC), in **ONLINE** or **MONITOR** mode. (No data is displayed in **OFFLINE** mode.) The system reference table resembles a mixed reference table; however, format changes are not allowed, the Change All (F10) function key cannot be used, and the cursor cannot be moved to blank lines.



The system reference table is displayed with the cursor on the reference address entered, or the reference address associated with the nickname entered.

In the screen shown above, pressing the **Home** or **Page Up** key will position the cursor on %S00001. Pressing the **End** or **Page Down** key will place the cursor on %SC0128.

Section 5: Mixed Reference Tables

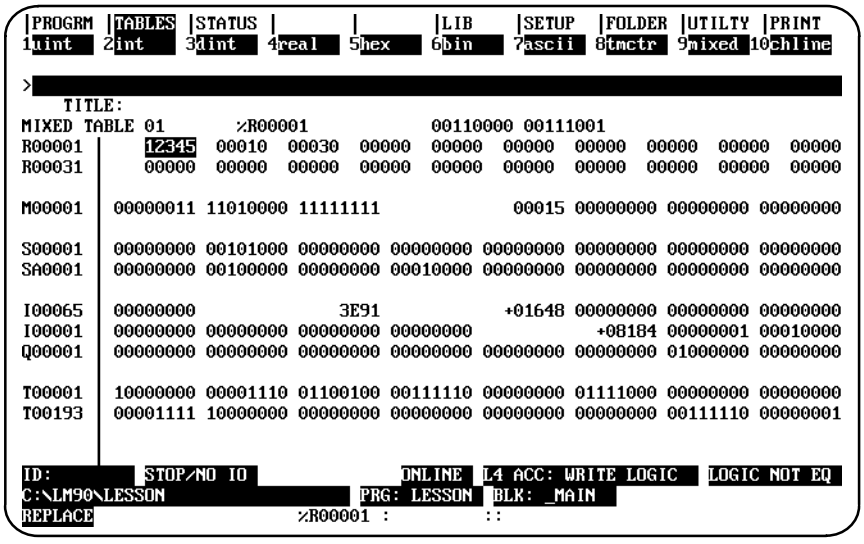
A mixed table represents a collection of data from one or more of the fixed tables. Therefore, the identical information displayed in a mixed table could also be displayed on the related fixed tables.

A total of 99 user-defined mixed reference table displays can be supported. A number from 1 to 99 is associated with each table.

Note

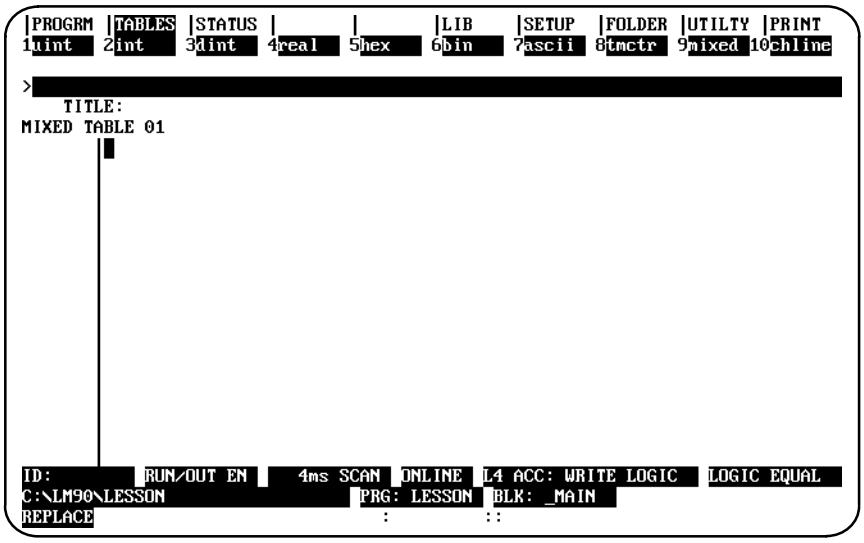
The mixed table function is used only for viewing PLC information; therefore, mixed reference tables are not valid when the programmer mode is **OFFLINE**. When **OFFLINE**, no cursor movement or other mixed table functions are allowed, except for changing tables, exiting reference tables, or changing modes.

To select a mixed table, enter a number from 1 through 99 on the command line, and press **Mixed (F9)**. This is an example of a mixed reference table display.



Field	Description
User-Defined Table Title	A description of the mixed table. A maximum number of 63 characters is allowed. When the cursor is on the 63rd character, it remains fixed, overwriting the last character.
Mixed Table Number	A number from 1 to 99, which indicates the mixed table currently displayed.
Cursor Item Line	Information about the address the cursor is on; namely, the current reference, reference nickname, and current value binary representation.
Table Data	16 display lines. Some may be program block headers or blank lines.

If the mixed table entered is not defined, a blank mixed table (no data, no title, only the mixed table number) is displayed, as shown below.



Editing the Title

To edit the table title, position the cursor on the title of the display by moving the cursor to the topmost data display line and pressing the **Up cursor** key. While editing the title, the Update or Abort key can be used to save or restore a title. A message is displayed when the function is complete.

Note

Since mixed reference tables are defined on a line-by-line basis, the abort function will restore the lines, formats, and title displayed upon entry. Unless an update to disk was done, any lines defined or title edited are lost.

The Mixed (F9) key is used to change from one mixed table to another. The Tables (Shift-F2) key sequence can also be used to get to any table. The Change All (F10) key is not supported for global format changes, as in fixed table displays.

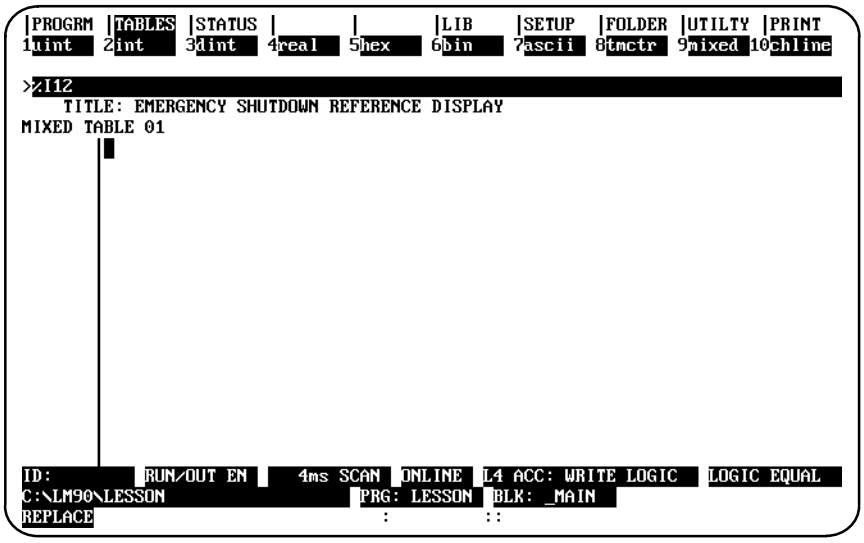
To return to the display area, press the **Enter** key or the **Down cursor** key. The cursor will return to the original position in the topmost data display line.

Defining a Mixed Table

A mixed reference table display is created or changed by pressing **Change Line (F10)**. Each mixed reference table can include data from one program block; it cannot include data from more than one program block.

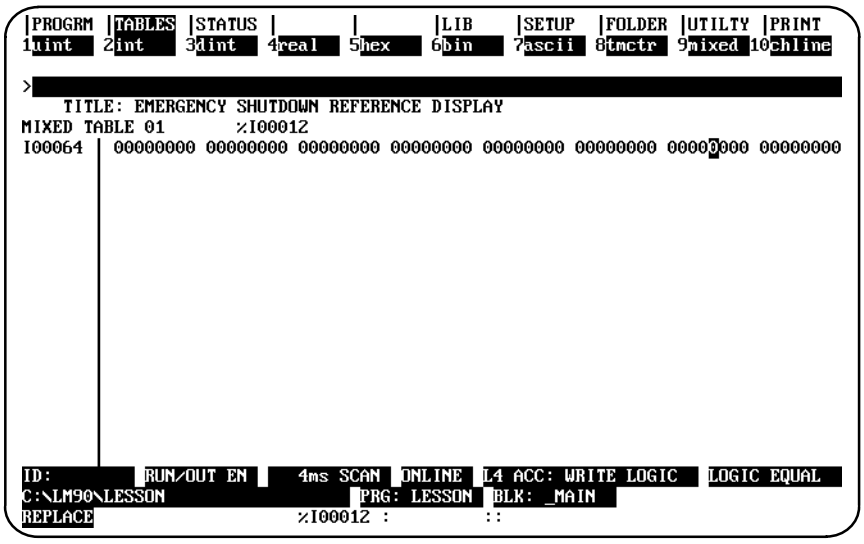
1. First, position the cursor on the display line where a certain data value should be displayed. The line may already be defined, or it may be a blank line.
2. Enter the reference address or nickname of the desired data value on the command line.

   In the following example, a line is defined in mixed reference table 1. With the cursor positioned on the top line of the display, enter **`%I12`** on the command line.



3. Press **Change Line (F10)** to display the desired information. The cursor will be positioned on the requested data value. Any information currently displayed is replaced with the new requested information.

   In this example, when **F10** is pressed, the line of data containing the reference %I00012 data value is entered into the topmost display line.



The default display format for data extracted from a discrete table is binary; for register tables, it is unsigned integer.

The timer / counter format can be used for a %R, %P, or %L line in a mixed table if enough screen space exists for the format. If the two lines below the line are defined or are beyond the table size, an error message is displayed.

Adding %L Data to a Mixed Table

To add local register (%L) data to a mixed reference table, you must enter either the block name followed by a space and then %L (e.g., <blockname> %L) or the block name followed by an up arrow and %L (e.g., <blockname> %L).

Deleting a Line

If the command line is blank when the **Change Line (F10)** key is pressed, the line is cleared, and the cursor is automatically moved to the next line.

If the current line is already blank, moving the cursor to the next line will produce the same result as pressing **F10** with the command line blank.

Moving the Cursor

Cursor movement is the same in mixed tables as in fixed tables. Since blank lines can be defined in a mixed table, the cursor is allowed on blank lines.

Cursoring up is allowed when the cursor is on the topmost line, in order to access the title. You can cursor to lines which contain a message, indicating that the reference is out of range. This allows you to delete or re-define the line.

The same line of references can also be defined twice on the same mixed table display. If the Enter key is used to move the cursor to a duplicate reference address, the search for the reference address begins with the next reference and continues to the end of the table. If the reference address is not found in that section, the search begins with the first non-blank line, lowest reference. If the reference address is still not found, an error message is displayed.

The Enter key cannot be used to change tables.

Exiting from a Mixed Table

To exit from a mixed table, use the Tables (Shift-F2) key sequence to go to another table. Or, enter a reference on the command line (i.e., %R1 to display the register reference table), and press the **Enter** key. You can also press the **Escape** key return to exit from the reference table and return to the programming software main menu.

Timer/Counter Format

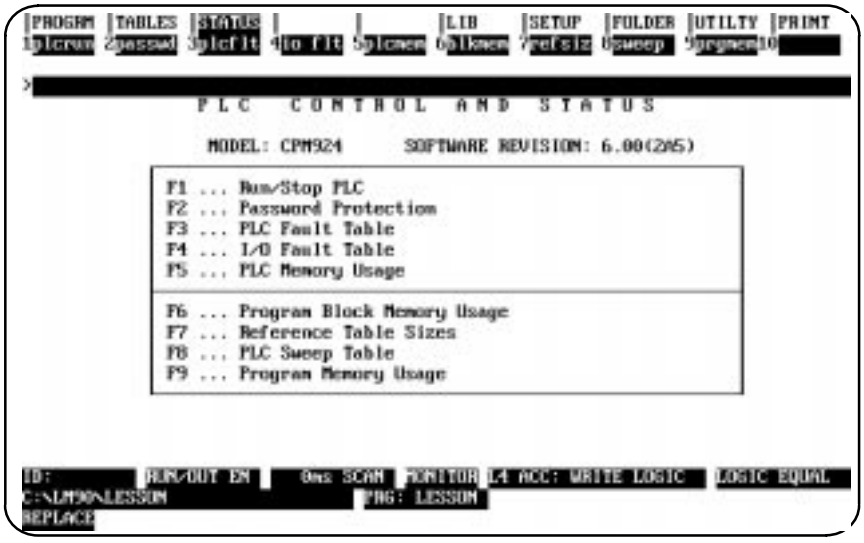
The timer/counter format in a mixed table is the same as in a fixed table, except for the first timer/counter format of the line. In the timer/counter format, the next two lines must be blank so that there is sufficient room for the format. Otherwise, an error message is displayed.

Chapter 5 PLC Control and Status

The programmer can interact with an operating PLC in many ways. Monitoring program execution and reference tables was described in previous chapters. Several additional features involve interaction between the programmer and an operating PLC. To use most of them, the programmer must be connected to the PLC and must be in **ONLINE** or **MONITOR** mode.

If the programmer is not connected or is in **OFFLINE** mode, asterisks may be displayed in place of values in many fields when the function screens are displayed. In addition, some of these features may be protected by passwords.

To use these features, press **Status (F3)** from the main menu, or **Shift-F3** from any other main menu function.



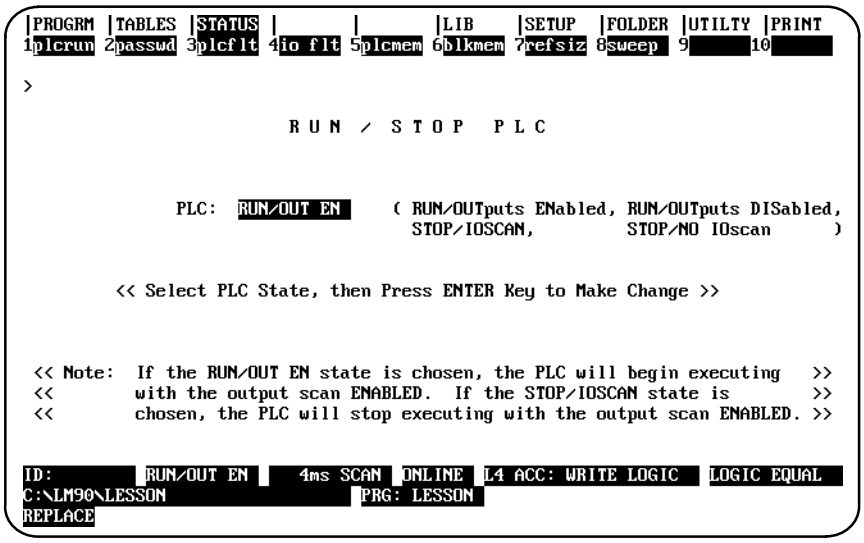
This screen identifies the CPU which is attached, the software revision number, and the PLC Build ID. (The Build ID is included in parentheses after the software revision number.)

The **F9** softkey shows the **prgmem** function selection when the PLC Control and Status menu is displayed. When you press the **passwd (F2)** softkey, the function selection changes, making the **F9** the **oem** protection key. (For information about the password and OEM protection, refer to page 5-3 and following, the **oem** function within the Password Protection functionality is discussed on page 5-7.

F10, which had previously been designated as the **Clear** softkey, is not used unless the active function is either the PLC fault table or the I/O fault table. When either fault table function is active, **F10** will become the **Zoom** softkey.

Run/Stop the PLC

To start or stop program execution in the PLC, and to determine the state of outputs if the PLC is started, press **PLC Run (F1)** from the PLC Control and Status menu or from another PLC functions screen. Communications between the programmer and the PLC must already be established.



If the programmer is in **OFFLINE** mode, default values are displayed on the screen. Press **ALT-M** to change the programmer operating mode to **ONLINE** or **MONITOR** mode. (For the Workmaster and CIMSTAR I computers, use the keyswitch. Refer to appendix D, "Programmer Environment Setup," for instructions on using the keyswitch.) **ALT-R** can also be used to toggle the PLC mode between **RUN** and the configured **STOP** mode from anywhere in the Logicmaster 90-70 programming or configuration software.

Note

If the switch on the CPU module is in the **STOP** position, the programmer cannot command the PLC to go to **RUN** mode. Under those conditions you will receive the following error: "**Invalid PLC Sweep Mode/State**." You will also receive that message if you have the switch set to "**Run with Outputs Disabled**" (i.e., **RUN/DISENABLE** mode).

The switch ***must be*** in the **UP** position, for **RUN/ENABLE** mode, before Logicmaster 90-70 software can place the PLC in **RUN** mode using either **ALT-R** or the screen shown above.

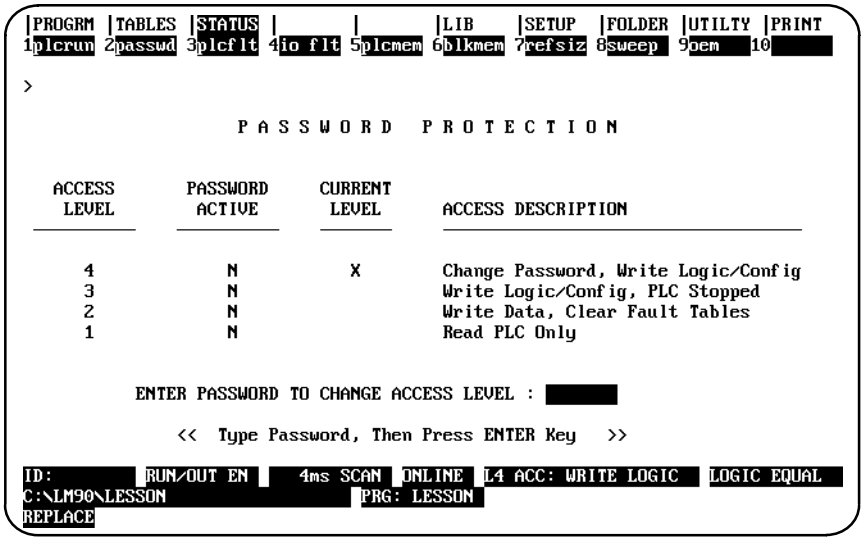
The ***PLC*** field on the screen shown above indicates whether the attached PLC is to be started or stopped. When the programming software is initially executed, this field is initialized to **STOP/IOSCAN**. Use the Tab key to select one of the modes listed below; then, press the **Enter** key.

Mode	Description
Run / Outputs Enabled	The PLC is running the logic program with outputs enabled.
Run / Outputs Disabled	The PLC is running the logic program with outputs disabled.
Stop / IO Scan	The PLC is stopped, not executing the logic program, but scanning I / O.
Stop / No IO Scan	The PLC is stopped, not executing the logic program, no I / O scan.

PLC Password Protection

PLC password protection can be used to restrict access to selected PLC functions. After passwords have been set up, a protected function cannot be used unless the proper password has been entered. Password protection is not intended to restrict access to the programming or configuration software. If PLC communications are suspended, protection level will automatically return to the highest unprotected level.

To display or change the current protection level of the PLC, the programmer must be in **ONLINE** or **MONITOR** mode and communicating with the intended PLC. Select **Password (F2)** from the PLC Control and Status menu or from another PLC functions screen.



If the screen appears without entries, the programmer is in **OFFLINE** mode. Press **ALT-M** to change the programmer operating mode to **ONLINE** or **MONITOR** mode. (For the Workmaster and CIMSTAR I computers, use the keyswitch.)

Field	Description
Access Level	Each access level includes all the privileges of lower levels: **Level 4:** Write to all configuration or logic. Configuration may only be written in **STOP** mode; logic may be written in **STOP** or **RUN** mode. Display, set, or delete passwords for any level. (This is the default if no passwords are assigned.) **Level 3:** Write to any configuration or logic, including word-for-word changes, the addition / deletion of program logic, and the overriding of discrete I / O. **Level 2:** Write to any data memory, except overriding discrete I / O. The PLC can be started or stopped. PLC and I / O fault tables can be cleared. **Level 1:** Read any PLC data except passwords; no PLC memory may be changed.
Password Active	A **Y** (Yes) displayed in this column indicates that a password has been assigned to this access level in the PLC.
Current Level	An **X** displayed in this column indicates the current protection level of the PLC.
Access Description	Access allowed at each level. Privileges accumulate as the level increases; at any given level, all privileges at lower levels are permitted.

Changing the Privilege Level

To access any level, the programmer must be in **ONLINE** or **MONITOR** mode and communicating with the PLC.

1. Move the cursor to the line at the bottom of the screen which prompts you to enter a password to change the access level.
2. Type a password, consisting of up to 7 ASCII characters, and press the **Enter** key. Characters are not displayed as you type them.

A valid password enables you to access the protection level for that password, and also all protection levels below that level.

Creating, Changing, or Removing Passwords

Passwords are created in the configuration software, using the status function as described below. They are then transmitted to the PLC, where they are stored.

Caution

The PLC does not save passwords through a loss of power, unless the CPU battery is attached. After restarting the PLC, passwords must be sent to the PLC again.

The use of passwords is an optional feature; it is not necessary to use any passwords at all. You can also use passwords to restrict access to some PLC features but not to others. Note, however, that the PLC always defaults to the highest unprotected level, so there should not be any "gaps" in protection levels.

To enter or change passwords, the computer must be in **ONLINE** mode and communicating with the PLC. Entering or changing passwords requires access to the highest level. If no passwords have been set up for the system, this level is automatically available. Once passwords have been entered, they can **only** be changed:

- After entering the correct password to access the highest-level privileges.
- In the configuration software, by placing the master diskette No. 1 in the system disk drive of the computer and pressing the **ALT** and **O** keys. Because this allows passwords to be overridden or changed without entering the correct password, it is important to keep the original software master diskettes in a secure location.

To create, change, or remove passwords:

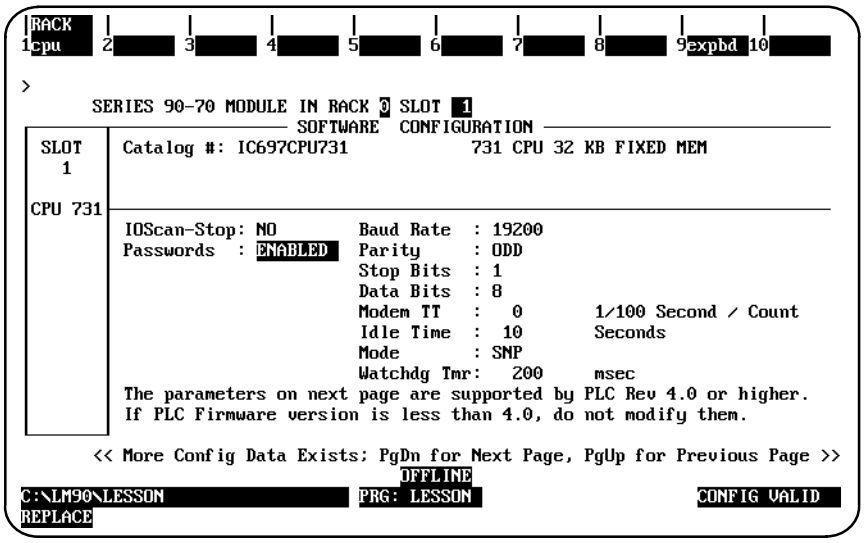
1. Access the Password Protection screen in the configuration software by pressing **Password (F2)** from the PLC Control and Status menu. A column titled "Password" appears on this screen; this column is not displayed in the programming software. Use this column to enter new passwords.
2. If there is not already a password set for the highest level, begin by creating one. This will protect the passwords you enter against unauthorized changes.
3. In the password column, locate the cursor at a level you want to protect or unprotect. Then:
   A. To create or change a password, enter a password consisting of up to 7 ASCII characters.
   B. To remove an existing password previously stored to the PLC, enter seven blank characters or press **ALT-C** to clear the field.
   C. Press the **Enter** key to validate your entry.
4. To save each new password to the PLC, press the **Enter** key again. Respond to the prompt that appears by pressing the **Y** (Yes) key.

   If you want to quit without saving any passwords to the PLC, use the **N** (No) key.
5. To exit, use the **Escape** key or any main menu function key.

Enabling/Disabling Passwords

The ability to use passwords may be enabled or disabled in the configuration software. You may want to disable this feature to prevent someone from setting passwords in the CPU.

A sample CPU module detail screen displaying the ***Passwords*** field that would be used to enable or disable the password feature is shown below. To access this screen, press **Zoom (F10)** with the cursor positioned on the CPU-configured slot on the Rack Configuration screen.



The values for the ***Passwords*** field are **ENABLED** (default selection) or **DISABLED**. Entering **ENABLED** will allow the password feature to be used; entering **DISABLED** will prevent the password feature from being used.

Caution

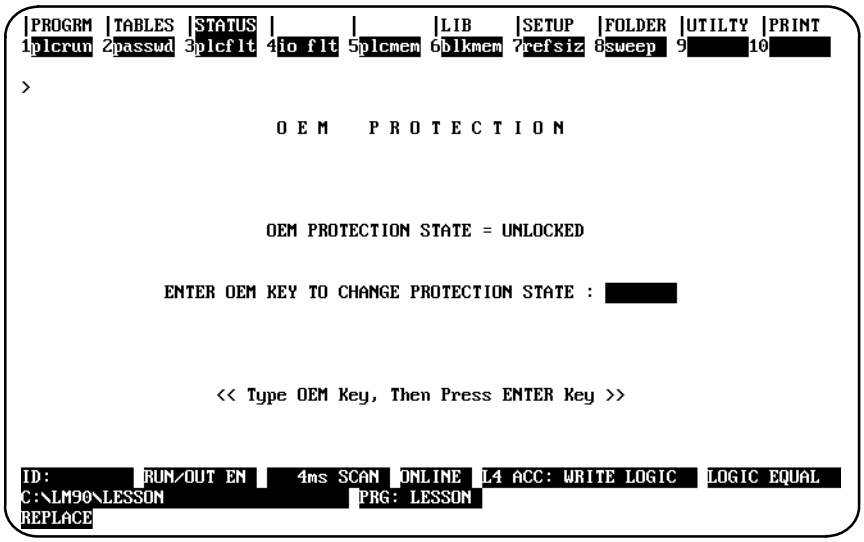
In order to re-enable passwords once they have been disabled, PLC memory must be cleared by a power cycle of the PLC with the CPU battery removed.

Please refer to chapter 11, section 2, "Configuring the CPU Module," for more information on configuring this module.

OEM Protection

The OEM protection feature provides a higher level of security than password protection. It may be used to further restrict access to program logic and configuration parameters.

To display the OEM Protection screen, press **oem (F9)** from the Password Protection screen; i.e., from the STATUS selections press **passwd (F2)**, which causes the **F9** key will display the **oem** selection instead of the **prgmem** selection—then, with the **oem** selection displaying, press **oem (F9)**.



OEM protection is enabled and disabled by entering the OEM key. The OEM key is a 1 to 7 character password. If the OEM key has never been set, it will equal the NULL (blank) string.

Note

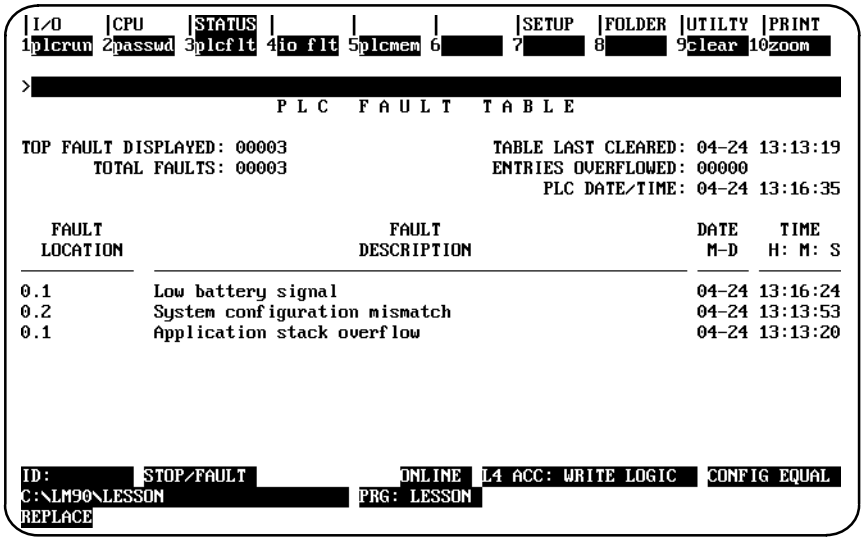
Definition of the OEM key may only be performed in the configuration software; however, OEM protection may be locked or unlocked in the programming software.

The OEM protection state is toggled between unlocked and locked each time the OEM key is correctly entered. The OEM protection state cannot be toggled to locked until the OEM key is set to something other than the NULL (blank) string. Once the OEM protection is locked, it will remain locked until the OEM key is correctly entered to toggle the protection state.

The OEM protection state is retentive across a power cycle. If the OEM protection is locked in the PLC and power is lost, the OEM protection state will remain locked when power is restored to the PLC if the CPU battery is attached.

PLC Fault Table

The PLC Fault Table screen lists PLC faults such as password violations, PLC / configuration mismatches, parity errors, and communications errors. For example:



To display the PLC Fault Table screen, press **PLC Fault (F3)** from the PLC Control and Status menu or from another PLC functions screen. The programmer may be in any operating mode. However, if the programmer is in **OFFLINE** mode, no faults are displayed. In **ONLINE** or **MONITOR** mode, PLC fault data is displayed. In **ONLINE** mode, faults can be cleared (this may be password protected).

Field	Description
Top FaultDisplayed	The index of the PLC fault currently at the top of the fault display is shown on the first line of this screen.
Total Faults	The total number of faults since the table was last cleared.
Table Last Cleared	The date and time faults were last cleared from the fault table. This information is maintained by the PLC.
Entries Overflowed	The number of entries lost because the fault table has overflowed since it was cleared. The PLC fault table can contain up to 16 faults.
PLC Time / Date	The current date and time. This is also maintained by the PLC.

Fault Table Entries

For each fault, the display shows the date and time the fault occurred, and the following information about the fault:

Field	Description
Fault Location	The location of the fault (rack / slot / bus / bus address). For example, 3.2.1.0 refers to rack 3, slot 2, bus 1. For rack-mounted I / O modules, the bus and bus address information does not apply.
Fault Description	The fault that has occurred. Loss of, or missing, rack. Loss of, or missing, IOC. Loss of, or missing, I / O module. Loss of, or missing, option module. Addition of, or extra, rack. Addition of, or extra, IOC. Addition of, or extra, I / O module. Reset of, addition of, or extra option module. IOC fault. I / O module fault. System configuration mismatch. System bus error. PLC CPU hardware failure. [1] Non-fatal module hardware failure. IOC software fault. Option module software failure. Program block checksum failure. Low battery signal. Constant sweep time exceeded. PLC system fault table full. I / O fault table full. User application fault. System bus failure. No user program on power-up. [2] Corrupted user memory – PLC memory cleared. Programmer window not started – No time available. Password access failed. Genius bus address fault. Null system configuration for **RUN** mode. [3] PLC CPU software fault. [4]

1 The PLC CPU OK LED will flash on and off when the programmer is able to retrieve fault table information..

2 The PLC stays in **STOP** mode until a valid program is downloaded and either the programmer commands the PLC to go to **RUN** mode or the PLC Run / Stop toggle switch is switched to **STOP** and then back to **RUN**.

3 Running the system with a null system configuration is the same as having I / O scans suspended.

4 If this fault occurs, the PLC stops all activity except programmer communications. To clear this fault, you must cycle power to the PLC.

Field	Description
FaultDescription (Continued)	Too many IOCs. PLC sequence store failure. PLC watchdog timer timed out. Genius block model number mismatch. Genius block I/O type mismatch. Daughter board mismatch. Unsupported feature in configuration. Unrecognized VME interrupt source. Program block corrupted – program lost. Failed battery signal. Low battery signal. Indirect reference address is out of range. Corrupted user RAM on power-up – PLC memory cleared. Logic execution fault – illegal boolean opcode. Program check failed. Module restart complete. LAN interface restart complete: running a utility. LAN duplicate MAC address: off network till fixed. LAN duplicate MAC address resolved: on network. LAN MAC address mismatch: running soft switch utilities. LAN soft switch / modem mismatch: running soft switch utilities. Remote I/O scanner communications failure: verify bus. Remote I/O scanner serial bus address conflict. Remote I/O scanner hardware fault. Required 12V power supply failed or missing. LAN controller underrun / overun: resuming. LAN interface hardware failure:switched off network. LAN network problem exists: performance degraded. LAN severe network problem: attempting recovery. LAN transceiver fault: off network till fixed. Backplane communications with PLC fault: lost request. Module software corrupted: requesting reload. LAN system–software fault: resuming. LAN system–software fault: aborted assoc and resuming. LAN system–software fault: restarted LAN I/F. LAN system–software fault: reinitializing LLC. Application queue overflow. LAN data memory exhausted – check parameters: resuming. Bad remote application request: discarded request. Bad local application request: discarded request. LAN I/F capacity exceeded: discarded request. LAN PROM / software mismatch: running soft switch utilities. LAN I/F cannot initialize: check parameters, running soft switch utilities. Corrupted Remote I/O Scanner EEPROM: config lost. Remote I/O Scanner communications heartbeat failure.

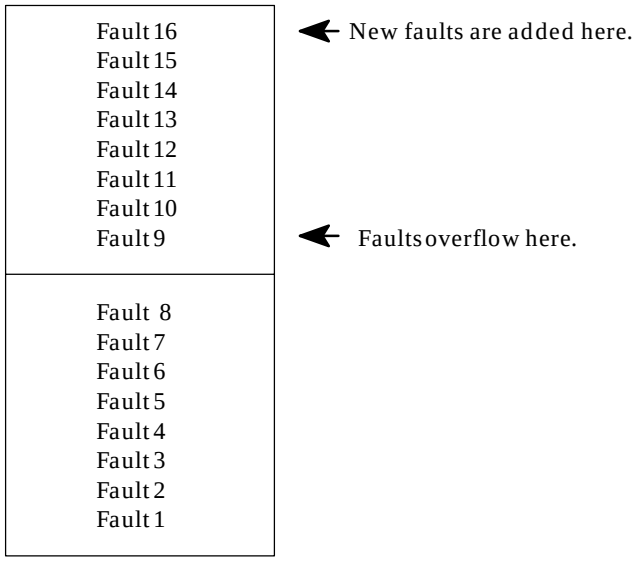
For diagnostic faults, the CPU sets fault references. For fatal faults, the CPU sets fault references and places the CPU in **STOP** mode.

If there are more faults than will fit on one screen, you can display them using the Home, End, Page Up, Page Down, and cursor keys. Refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265, for more fault information.

Number of Faults in the PLC Fault Table

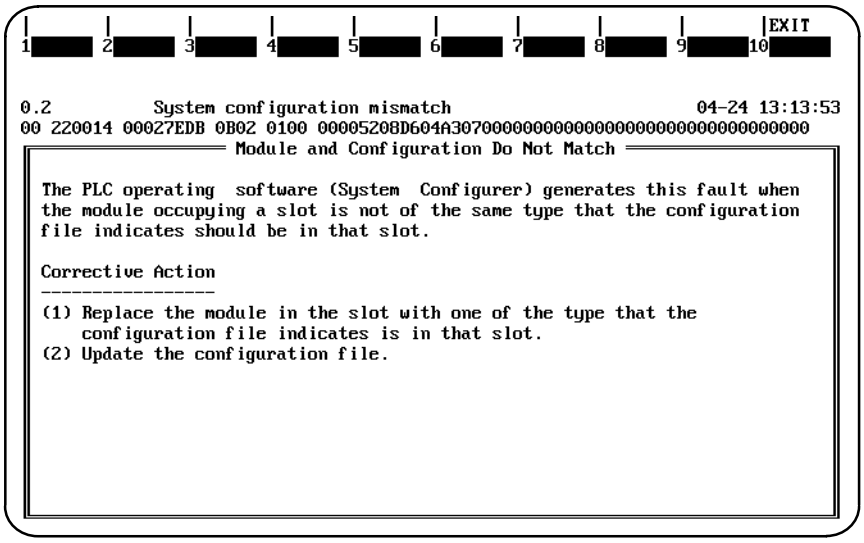
The PLC fault table can contain up to 16 faults. Additional faults cause the table to overflow, and faults are lost. The system reference SY_FULL (%S0009) is set to indicate that the fault table is full.

As faults occur, the first 8 faults are logged into the table and remain there until the table is cleared. None of these eight faults are dropped if the table overflows. For faults 9 through 16, however, the fault table operates as a First-In-First-Out queue. When fault 17 occurs, fault 9 is dropped from the table. Clearing the fault table removes all the fault entries.

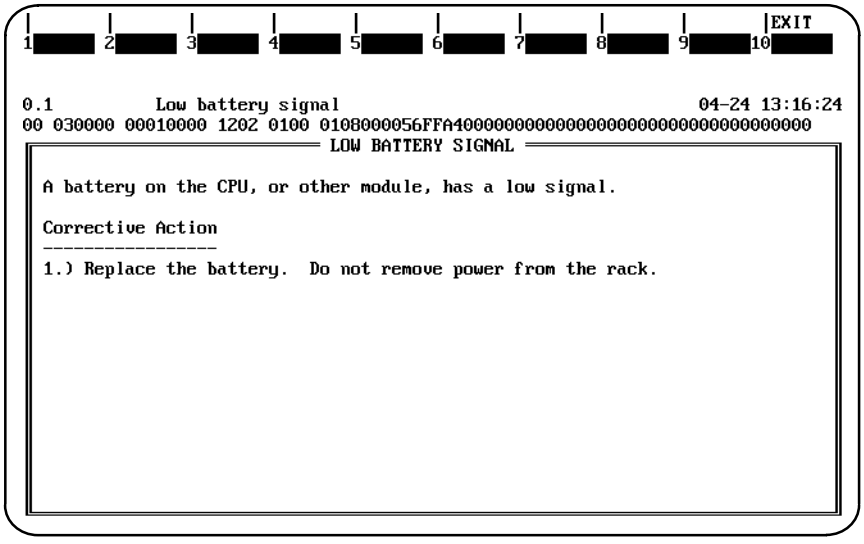


Zooming into the PLC Fault Table

The Zoom (F10) softkey enables you to obtain additional information pertaining to each fault listed in the PLC fault table. By moving the cursor to a particular fault and pressing **Zoom (F10)**, information about the error code, default action, description of the error, and appropriate corrective action is displayed on a screen similar to this one for a system configuration mismatch.



A screen similar to the one shown below would be displayed for a low battery signal.



For more information on fault explanations and correction, refer to chapter 3, "Fault Explanation and Correction," in the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

All softkeys are disabled on this screen, except for Exit (Shift-F10). The Abort key (ALT-A) and the Escape key may also be used to exit from this screen and return to the PLC fault table.

Clearing the Fault Table

Pressing **Clear (F9)** in **ONLINE** mode clears all faults from the fault table. Faults can also be cleared from the program logic using the SVCREQ function, as described in the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265. If passwords have been enabled in the PLC, you must be at level 2 or higher in order to clear the fault table.

If a printer is connected to the programmer, you may want to print a copy of the fault table screen by pressing the **Print Screen** key before clearing the fault table.

Clearing the fault table, of course, does not clear fault conditions in the system. If the condition that caused a fault still exists, the fault may be reported again after storing the configuration, cycling power to the PLC, or during a **STOP-TO-RUN** transition.

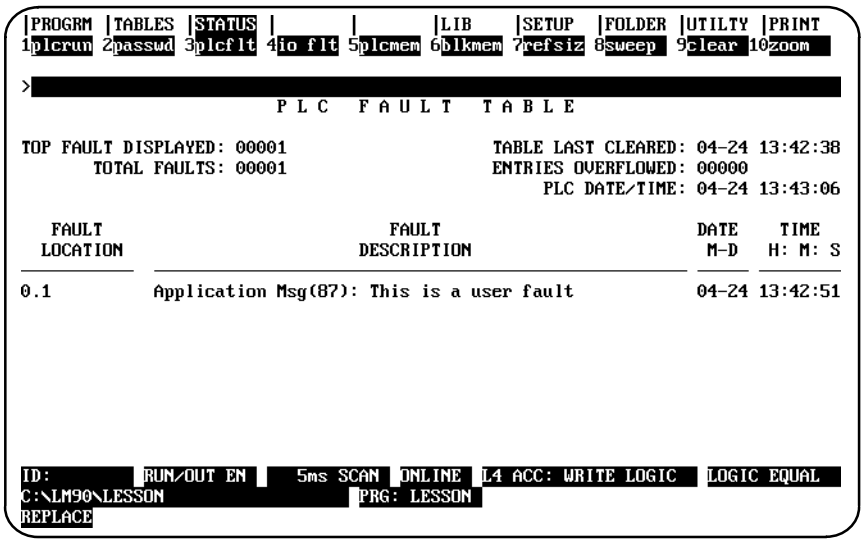
Note

Unlike Genius circuit faults, a PLC fault is not again logged in the PLC fault table if it persists after the fault table is cleared. Thus, after clearing a fault table, it is possible to place the PLC in **RUN** mode with an active fault condition that is configured to be fatal. To avoid this condition, always clear the fault tables **before** rather than after storing the program and configuration.

Displaying User-Defined Faults

User-defined faults can be logged in the PLC fault table using SVCREQ #21. When a user-defined fault occurs, it is logged in the fault table as "Application Msg(error_code):" and may be followed by a descriptive message up to 24 characters. All characters in the descriptive message can be defined by the user. Although the message must end with the null character (e.g., ASCII value 16x00), it does not count as one of the 24 characters. If the message contains more than 24 characters, only the first 24 characters are displayed.

The following example PLC fault table contains a user-defined fault with error code 87.



If you enter a character for the message which is not one of the regular displayable ASCII characters, the code will be ignored and a question mark is displayed.

If you enter a zero or out-of-range error code, the values in the registers used to specify the error message text are converted to their corresponding hexadecimal values and are displayed in place of the fault message. Only the first 24 hexadecimal characters of the registers will be displayed.

Specifying a User-Defined Fault

The values required to initiate a user-defined fault are the fault error code and the message text.

The fault error code is a value in the range of zero to 32,767 which represents the type of fault which occurred. The fault error code is specified in IN1 of the block move command. When the error code is non-zero and is within the range of zero to 32,767, it is displayed on the screen with the message text. If the error code is zero, the values used to specify the message are displayed as hexadecimal characters instead of the error message. If the error code is out of range (e.g., greater than 32,767 or less than zero), the PLC will convert the error code to a zero in order to prevent an out-of-range error code.

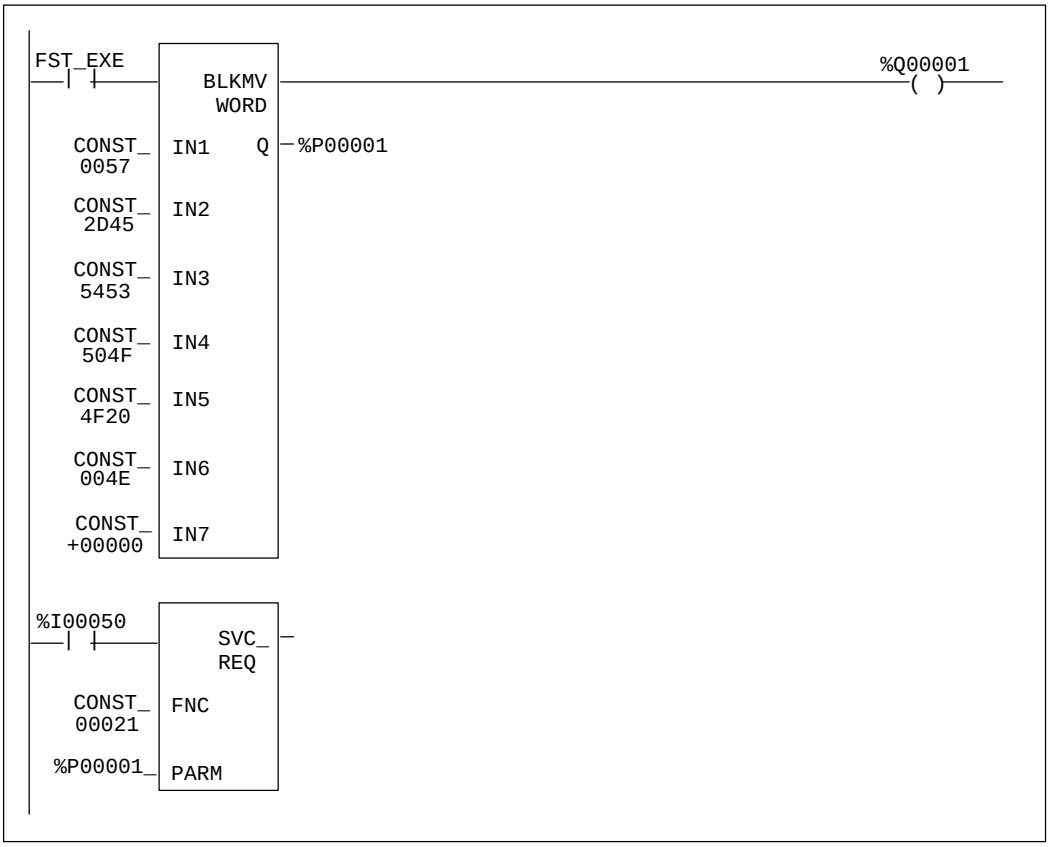
After specifying the fault error code, the message text is entered. Each character of the message is entered in hexadecimal format into the proper word of the input in the block move function. A hexadecimal dump of the fault can be displayed by pressing **CTRL-F** from fault table screen.

In the following example, the value passed to IN1 is the fault error code. The value passed in, 16x0057, represents an error code of 87 and will appear as part of the fault message. The values of the next inputs give the ASCII codes for the text of the error message. For IN2, the input is 2D45. The low byte, 45, decodes to the letter: "**E**" and the high byte, 2D, decodes to "_". Continuing in this manner, the string continues with:

"**S**" "**T**" "**O**" "**P**" " " "**O**" "**N**"

The final character, 00, is the null character which terminates the string. Thus, the decoding yields the string message:

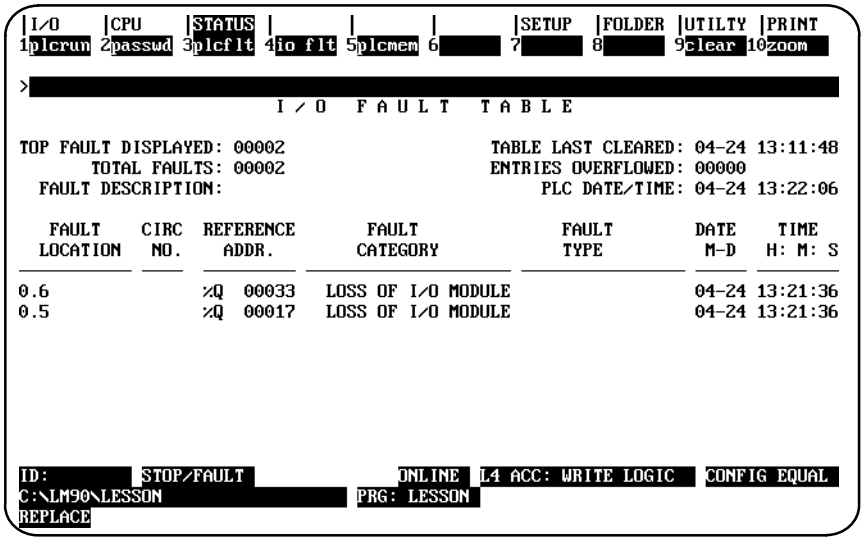
E_STOP ON



After the fault error code and message text are set, SVCREQ function #21 is called to enable the fault. For information about this SVCREQ function, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

I/O Fault Table

The I / O Fault Table screen lists I / O faults such as circuit faults, address conflicts, forced circuits, and I / O bus faults. For example:



Note

Note that the F6, F7, and F8 softkeys are inactive on this screen in the configuration software.

To display the I / O Fault Table screen, press **I/O Fault (F4)** from the PLC Control and Status menu or from another PLC functions screen. The programmer may be in any operating mode. However, if the programmer is in **OFFLINE** mode, no faults are displayed. In **ONLINE** or **MONITOR** mode, PLC fault data is displayed. In **ONLINE** mode, faults can be cleared (this feature may be password protected).

Field	Description
Top FaultDisplayed	The index of the I / O fault currently at the top of the fault display is shown on the first line of this screen.
Total Faults	The total number of faults since the table was last cleared.
FaultDescription	An explanation of the fault that is currently highlighted in the I / O fault table.
Table Last Cleared	The date and time faults were last cleared from the fault table. This information is maintained by the PLC.
Entries Overflowed	The number of entries lost because the fault table has overflowed since it was cleared. The I / O fault table can contain up to 32 faults.
PLC Time / Date	The current date and time. This is also maintained by the PLC.

Fault Description

The fault description provides additional information about the highlighted fault in the I/O fault table.

Fault Type	Fault Description
Discrete Circuit Fault	Loss of user side power wiring. Short in user wiring. Sustained over current. Low or no current flow. Switch over temperature. Switch failure. Point fault. Output fuse blown.
Analog Circuit Fault	Input channel low alarm. Input channel high alarm. Input channel under range. Input channel over range. Input channel open wire. Output channel under range. Output channel over range. Invalid data.
Low Level Analog Fault	Input channel low alarm. Input channel high alarm. Input channel under range. Input channel over range. Input channel open wire. Wiring error. Internal fault. Input channel shorted.
Headend Fault	EEPROM or NVRAM fault. Calibration memory failure. Shared RAM fault. Configuration mismatch. Watchdog timeout. Auxiliary fault. Point fault. Output fuse blown.

Fault Table Entries

For each fault, the display shows the date and time the fault occurred, and the following information about the fault:

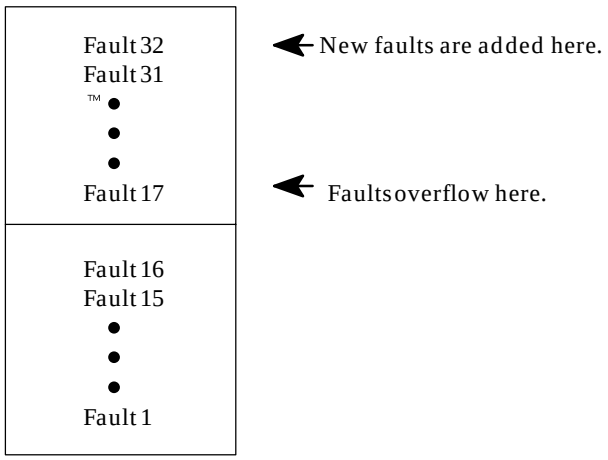
Field	Description
Fault Location	The location of the fault (rack / slot / bus / bus address). For example, 3.2.1.0 refers to rack 3, slot 2, bus 1. For rack-mounted I / O modules, the bus and bus address information does not apply.
Circuit Number	The relative position of a point within its module. The value may be from 0 to 1023.
Reference Address	The I / O reference address where the fault was detected. The address consists of a two or three character identifier (%I, %Q, %AI, or %AQ) specifying the memory type and a five-digit offset within the memory type.
Fault Category	The general type of fault that has occurred. For more information, refer to GFK-0265. For diagnostic faults, the CPU sets fault references. For fatal faults, the CPU sets fault references and places the CPU in **STOP** mode.
Fault Type	This further explains the fault category. For more information, refer to GFK-0265.

If there are more faults than will fit on one screen, you can display them using the Home, End, Page Up, Page Down, and cursor keys.

Number of Faults in the I/O Fault Table

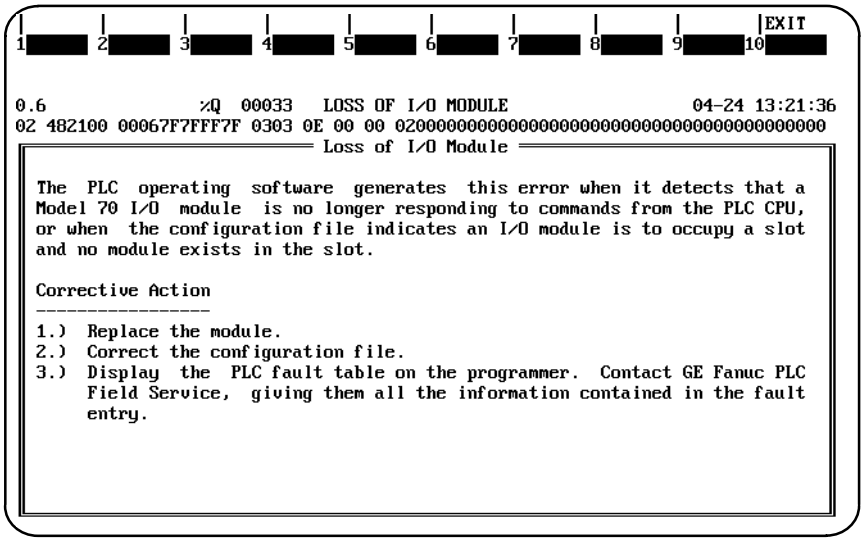
The I / O fault table can contain up to 32 faults. Additional faults cause the table to overflow, and faults are lost. The system reference IO_FULL (%S0010) is set to indicate that the fault table is full.

As faults occur, the first 16 faults are logged into the table and remain there until the table is cleared. None of these 16 faults are dropped if the table overflows. For faults 17 through 32, however, the fault table operates as a First-In-First-Out queue. When fault 33 occurs, fault 17 is dropped from the table. Clearing the fault table removes all the fault entries.



Zooming into the I/O Fault Table

The Zoom (F10) softkey enables you to obtain additional information pertaining to each fault listed in the I/O fault table. By moving the cursor to a particular fault and pressing **Zoom (F10)**, information about the error code, default action, description of the error, and appropriate corrective action is displayed on a screen similar to this one for a Loss of I/O Module error.



For more information on fault explanations and correction, refer to chapter 3, "Fault Explanation and Correction," in the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

All softkeys are disabled on this screen, except for Exit (Shift-F10). The Abort key (ALT-A) and the Escape key may also be used to exit from this screen and return to the PLC fault table.

Clearing the Fault Table

You can clear the fault table in **ONLINE** mode by pressing **Clear (F9)**. (This may be password protected.) This also clears latched fault indications in all connected logged-in Genius blocks. Faults can also be cleared from the program logic.

Caution

Clearing the fault table removes the faults it contains. Clearing the fault table does not clear fault conditions in the system. Clearing the fault table will allow the PLC to be put in RUN mode even though the fault condition may still exist. If the condition that caused a fault still exists, the fault may be reported again after storing the configuration, cycling power to the PLC, or during a STOP-TO-RUN transition.

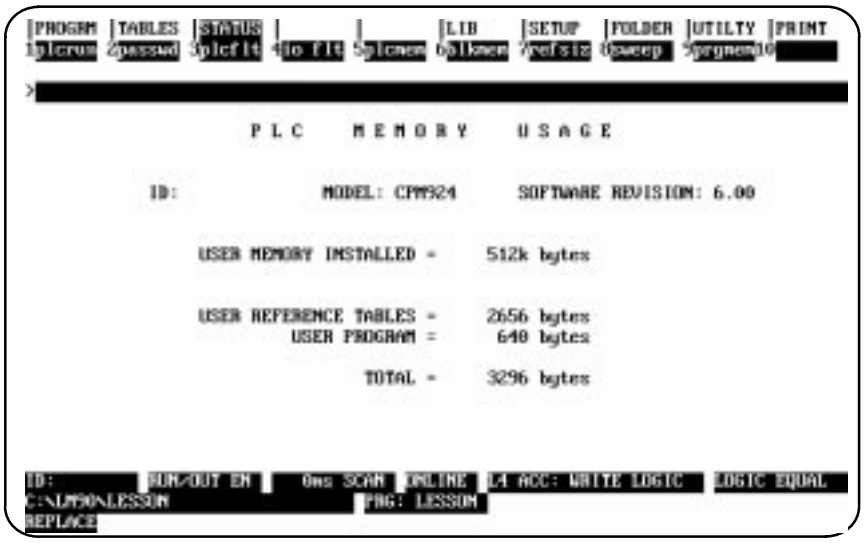
Note

For Genius block faults, clearing the fault table **does** clear fault conditions in the block at the same time the I/O fault table is cleared.

Unlike Genius circuit faults, an I/O fault is not again logged in the I/O fault table if it persists after the fault table is cleared. After clearing a fault table, it is possible to place the PLC in **RUN** mode with an active fault condition that is configured to be fatal. To avoid this condition, always clear the fault tables **before** rather than after storing the program and configuration.

PLC Memory Used

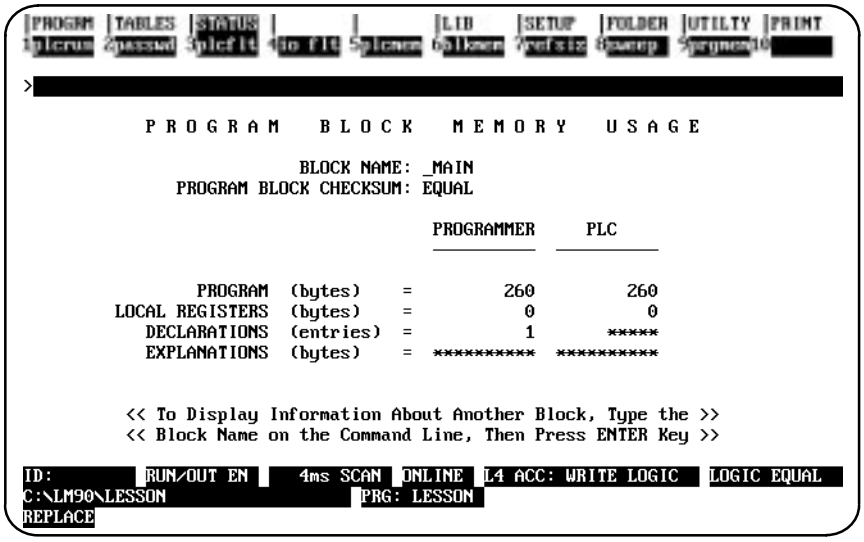
The PLC Memory Usage screen displays the amount of PLC memory available and the amount used for application program information. To display this screen, press **PLC Memory (F5)** from the PLC Control and Status menu or from another PLC functions screen. This is an example of the PLC Memory Usage screen:



Field	Description
PLC ID	In **ONLINE** or **MONITOR** mode, the name of the PLC being communicated with. It will always be the same as that shown in the status area of the screen. The ID name can be set on the Assign PLC ID screen in the configuration software.
Model	The model number of the attached PLC.
SoftwareRevision	The revision of PLC software.
User Memory Installed	The amount of memory in the PLC that is available for application programinformation.
User Reference Tables	The amount of program memory occupied by program data such as register reference tables (%R, %AI, %AQ ...) and program block data tables (%P and %L).
User Program	The amount of program memory occupied by the logic program. This number includes PLC overhead data that is not reflected in the program size reported on the Print Program Header page.
Total	The total of the two previous entries.

Program Block Memory Usage

The Program Block Memory Usage screen shows the amount of memory used for different parts of the application program. For example:



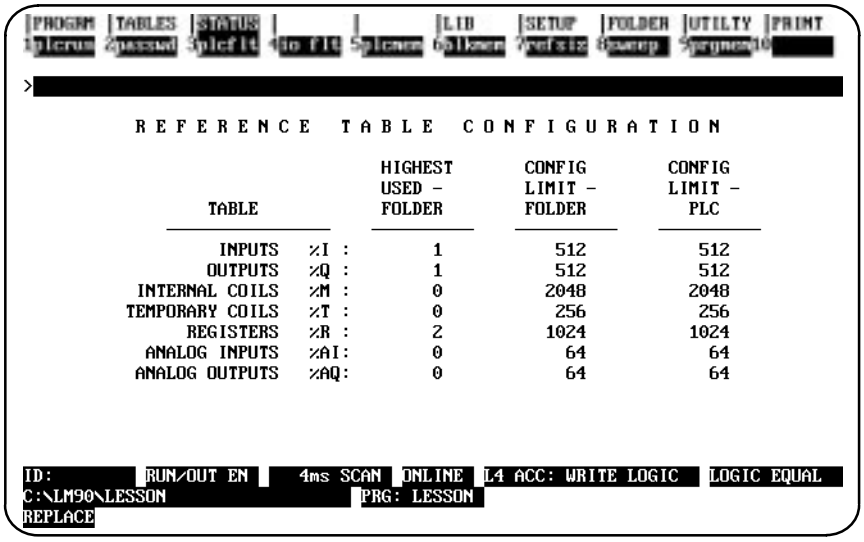
To display the Program Block Memory Usage screen, press **Block Memory (F6)** from the PLC Control and Status menu or from another PLC functions screen. The first program block for which information appears is the _MAIN block. To display information for another program block, enter its name on the command line and press the **Enter** key.

Field	Description
Block Name	The name of the program block for which values are displayed. Values can also be displayed for locked program blocks.
Checksum	The result of a comparison of the code checksums for the block from the programmer and from the PLC. This is either **EQUAL** or **NOT EQUAL**.
Program	The program block's logic data size.
LocalRegisters	The program block's local data size.
Declarations	The number of entries in the program block's variable declaration table.
Explanations	The program block's explanation text size. This field will always display asterisks since no explanations are currently stored in the PLC.

The size of an external block is displayed in the ***Program*** field. All other fields will display asterisks because an external block cannot use local registers, declarations, or explanations.

Configured Reference Sizes

To see how much memory has been used for program references, press **Reference Size (F7)** from the PLC Control and Status menu or from another PLC functions screen.

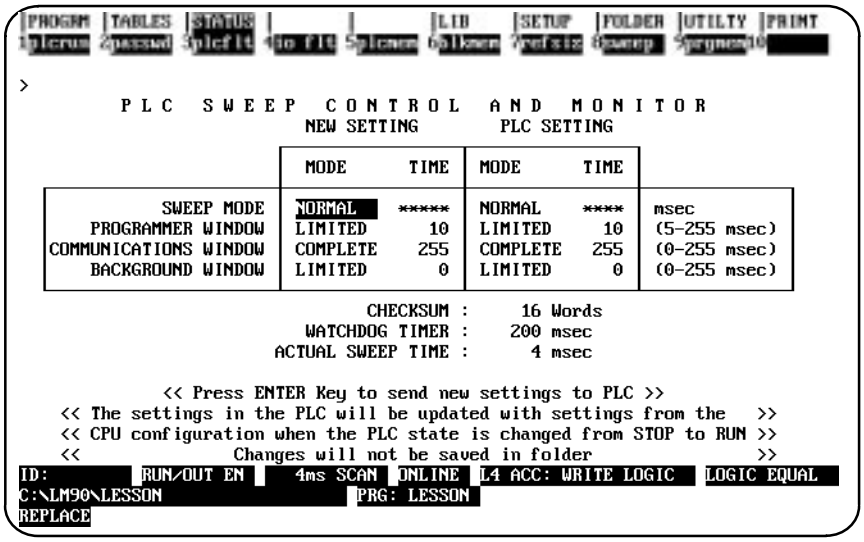


This function is available in all programmer operating modes and also to locked program blocks. If the programmer is in **OFFLINE** mode, no values are displayed for the PLC. If the folder does not have configuration files, the default values for a Model 731 PLC will be displayed in the ***Config Limit – Folder*** column. Values which do not match are highlighted.

Field	Description
Highest Used – Folder	Lists the highest value used. **Note**: The values displayed in this column do not include logic for any external blocks.
Config Limit – Folder	Lists a configuration value for each reference type in the folder.
Config Limit – PLC	Lists a configuration value for each reference type in the PLC.

PLC CPU Sweep Control

To display or change PLC timers, press **sweep (F8)** from the PLC Control and Status menu or from another PLC functions screen. When the screen is entered for the first time, the following screen will be displayed.



In **ONLINE** or **MONITOR** mode, the software shows the current CPU sweep time information. Values displayed in the ***PLC Setting*** column depend on current PLC conditions.

Note

Settings from this screen are only stored in the PLC, not in the folder. These settings may be configured and stored in the folder using the configuration function. For more information, refer to chapter 11, section 2, "Configuring the CPU Module."

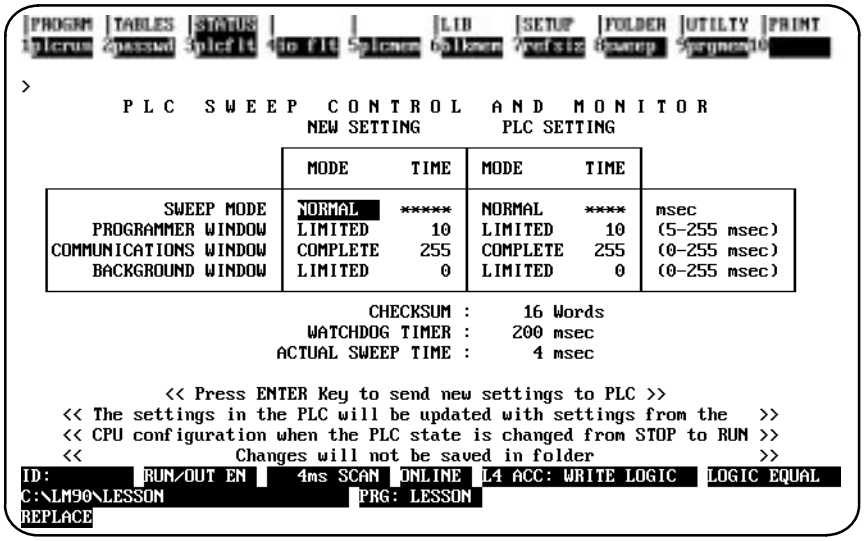
In **ONLINE** mode, you can change these many of the times shown above unless they are password-protected. The WATCHDOG TIMER setting and the CHECKSUM cannot be change from this screen, but can be changed from the configuration software. The ACTUAL SWEEP TIME is an information field and, therefore, cannot be changed by trying to type into the field.

For an explanation of the PLC sweep, refer to chapter 2, "Operation," in the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

Normal Mode

To select **NORMAL** mode for the sweep mode:

1. Move the cursor to the ***Mode*** field in the ***Sweep Mode*** row of the ***New Setting*** column (see Note below).
2. Use the Tab key to toggle through the selections for this mode until **NORMAL** is displayed. Once this mode is selected, the software will not allow you to go to the ***Time*** field in this column.
3. Move the cursor to the ***Mode*** field in the ***Programmer Window*** row in the ***New Setting*** column. Select either **LIMITED** or **COMPLETE** for mode (see Note below). Repeat this step in order to enter a mode for ***Communications Window***. The mode for ***Background Window*** is dependent on the ***Programmer Window*** mode; both selections will be the same.
4. After you have completed all your selections, press the **Enter** key to send the new settings to the PLC. A screen similar to the example one shown below will be displayed.



Note

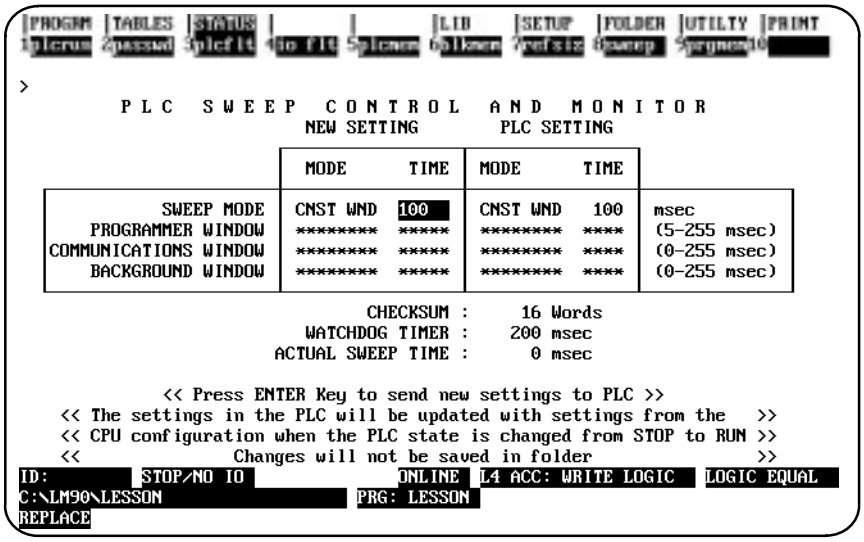
Refer to page 11-9 and following for an explanation of each of the sweep modes. Refer to page 11-10 for an explanation of the Programmer Window modes.

Note

If the communications window is disabled, it can be reenabled manually by putting the PLC into stop mode and resetting the sweep mode, by connecting to a WSI-parallel, or by powercycling the system.

Constant Window Mode

To select **CONSTANT WINDOW** mode, move the cursor to the ***Mode*** field in the ***Sweep Mode*** row of the ***New Setting*** column. Use the **Tab** key to toggle through the selections for this mode until **CNST WND** is displayed. Then, move the cursor to the ***Time*** field in this column, enter the desired constant window time, and press the **Enter** key to send the new setting to the PLC. The following screen will be displayed.



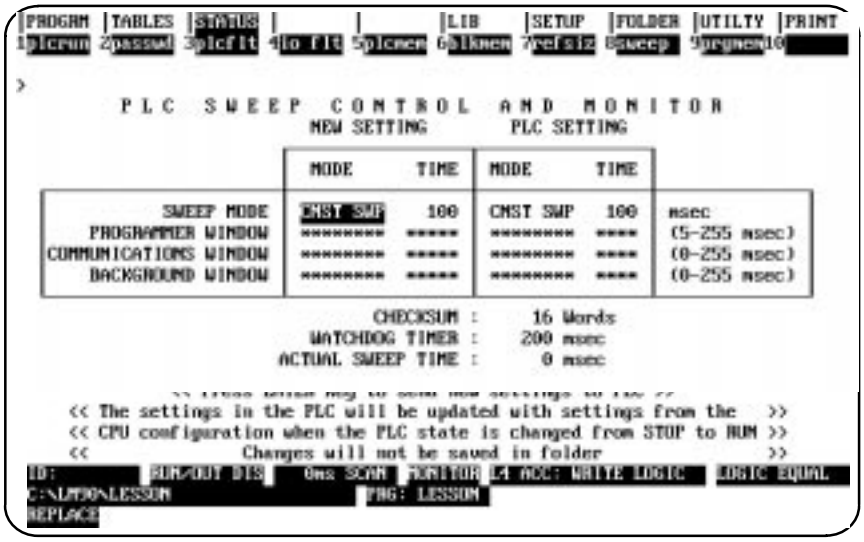
While running in **CONSTANT WINDOW** mode, the modes for programmer window, communication time window, and background window are all set to **CONSTANT** by the PLC. The constant window time is the total time for all windows. The PLC controls the distribution of time among these windows, and so they will not remain the same. Therefore, the mode and time for these windows will not be displayed.

Note

Refer to page 11-9 and following for an explanation of each of the sweep modes.

Constant Sweep Mode

To select **CONSTANT SWEEP** mode, move the cursor to the ***Mode*** field in the ***Sweep Mode*** row of the ***New Setting*** column. Use the **Tab** key to toggle through the selections for this mode until **CNST SWP** is displayed. Then, move the cursor to the ***Time*** field in this column, enter the desired constant sweep time, and press the **Enter** key to send the new setting to the PLC. The following screen will be displayed.



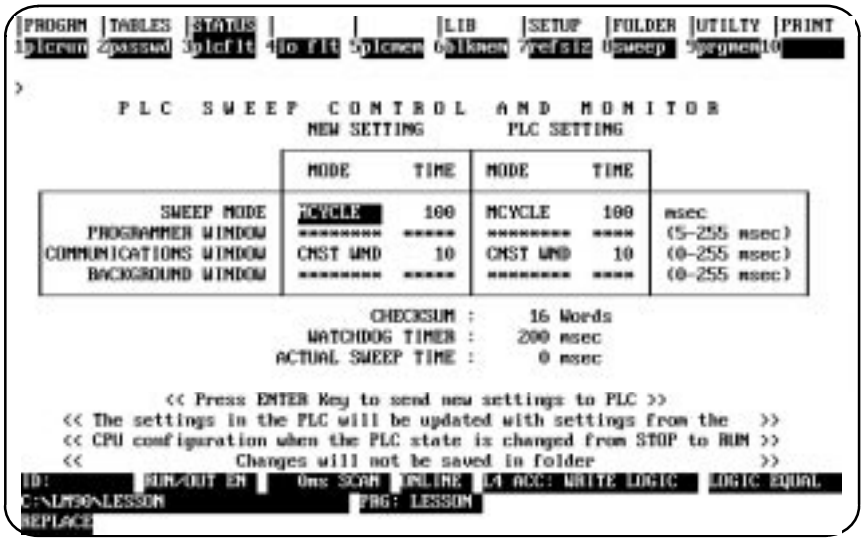
The mode and time for programmer window, communication time window, and background window are controlled by the PLC. These values will not be displayed on the screen.

Note

Refer to page 11-9 and following for an explanation of each of the sweep modes.

Microcycle Sweep Mode

To select **MICROCYCLE SWEEP** mode, move the cursor to the ***Mode*** field in the ***Sweep Mode*** row of the ***New Setting*** column. Use the **Tab** key to toggle through the selections for this mode until **MCYCLE** is displayed. Then, move the cursor to the ***Time*** field in this column, enter the desired constant sweep time, and press the **Enter** key to send the new setting to the PLC. The following screen will be displayed.



Note

Refer to page 11-9 and following for an explanation of each of the sweep modes.

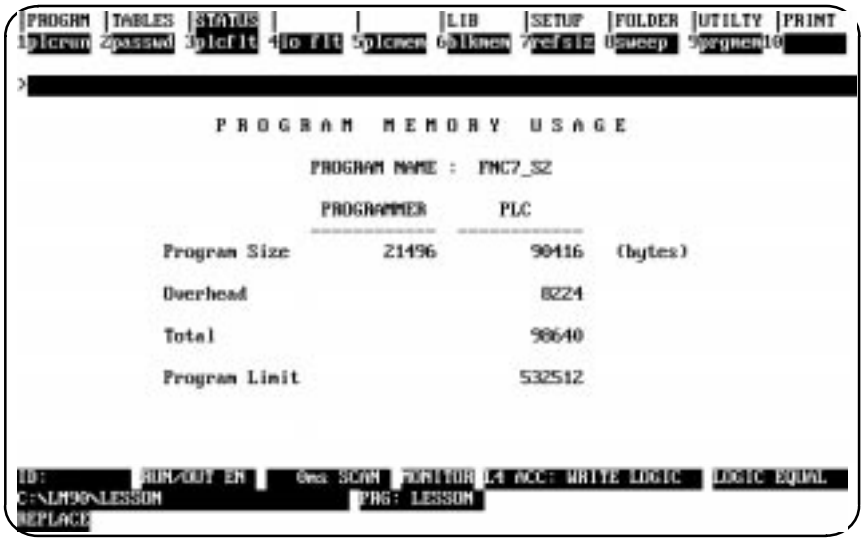
The mode and time for programmer window, communication time window, and background window are controlled by the PLC. These values will not be displayed on the screen.

Note

The PLC will return an error if the sweep mode is changed to or from Microcycle mode from any other mode. The PLC will also return an error if the base cycle time is changed while the PLC is in **RUN** mode. If you need to change the base cycle time, you can do so only in **STOP** mode.

Program Memory Usage

The Program Memory Usage screen shows the amount of memory used by standalone programs. This screen is also available for RLD or SFC programs. It provides a summary of memory usage. For example:



To check the memory usage of an individual standalone program that is part of the folder, type the program name and press **Enter**.

Chapter 6 Program Librarian

The librarian function allows multiple developers to work in parallel on different parts of an application program and merge them later. The program librarian provides these features:

- Program blocks, program segments, external blocks, and parameterized subroutines (collectively called elements) other than the main program block can be copied to the Logicmaster 90-70 library.
- Elements in the library can be copied into an application program.
- Elements can be renamed as they are copied.
- Lists of elements in the library and in the current folder are displayed on the screen.
- Variables (nicknames and their associated reference addresses) used in a program block can be redefined before copying that block to a folder.
- Reference offset templates can be created and/or edited. They are applied to a block or segment during an import operation.
- External blocks can be introduced to the Logicmaster 90 environment.

It is not always possible to put blocks that can be used without change into the library. Logicmaster 90 software provides two methods of modifying the program block as it is brought into the program folder.

The simplest way is called reference offsetting. With reference offsetting, up to ten ranges of addresses can be changed. For example, the change could involve shifting a range of reference addresses from %I00020 through %I00047 to %I00100 through %I00127, or it could include changing the reference type, too. This function is equivalent to a super search and replace function, where each address in the range specified is replaced with its corresponding adjusted address. The one additional unique feature of the function is the ability to keep this list of address ranges to adjust for future import operations.

The second way to change a program block as it is brought into the folder is called variable programming or redefining variables upon import. This method of changing a program block is used when the adjustments need to be performed on a reference-by-reference basis. Variable programming lists the variables (nicknames) used in the program block you are importing and their current assignment. The variables are grouped according to how they were defined in the block and whether this definition corresponds to a definition in the folder you are importing the block to.

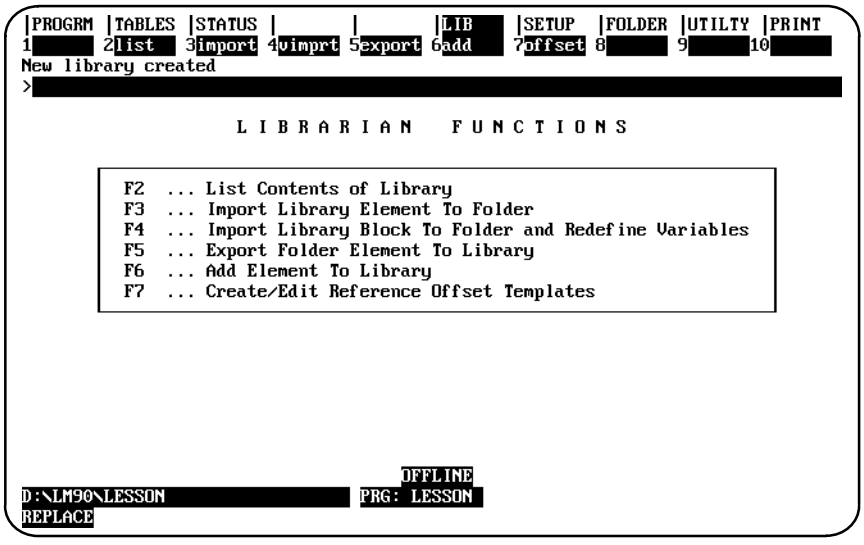
For example, if the folder you are importing to has a global variable ESTOP which is assigned to %I00093 and the block you are importing also has a globally defined variable named ESTOP, variable programming will automatically make the assignment of %I00093 to ESTOP. You can then assign ESTOP to another reference; however, the variable must be made local in order to avoid conflict with the STOP defined in the folder.

Variable programming also provides other features for automatically assigning a range of addresses to a group of variables.

Chapter 6 contains the following sections:

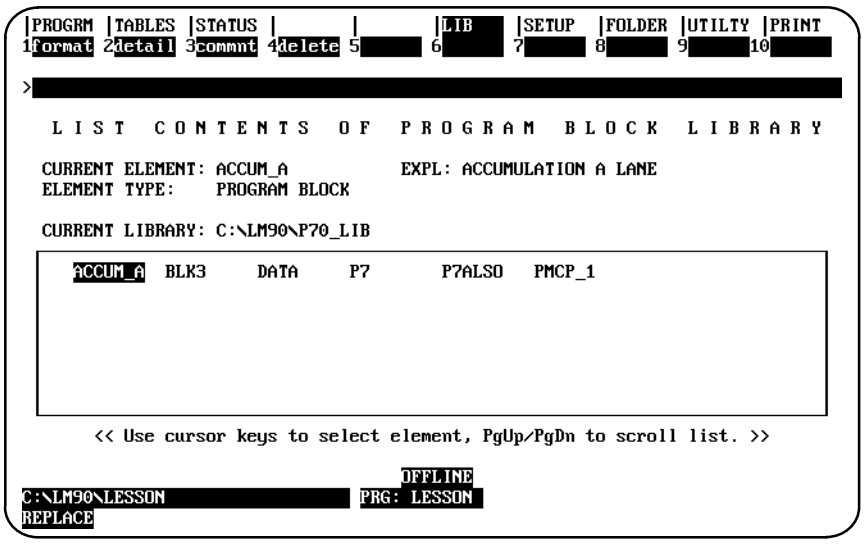
Section	Title	Description	Page
1	Listing the Elements in the Library	Describes how to view the names of all the elements in the library, display information about a table entry, and display annotation for an element.	6-3
2	Importing an Element from the Library	Describes how to copy an element from the library to the current program folder.	6-9
3	Importing a Library Block and Redefining Variables	Describes how to redefine nicknames used in a block before importing the block to a folder. These offsets are applied to the block during the import operation.	6-14
4	Exporting an Element to the Library	Describes how to copy an element from the current program folder to the library.	6-30
5	Adding an Element to the Library	Describes how to copy elements from a specified source directory to the Logicmaster 90 library. You can use this function to copy external blocks written in a language other than ladder logic or program blocks created by third-party vendors.	6-34
6	Creating / Editing a Reference Offset Template	Describes how to create and / or edit a reference offset template for each program block or segment in the Logicmaster 90 library. These offsets are applied to the block or segment during the import operation.	6-38

The first time librarian functions are selected, the Logicmaster 90-70 library directory is created. To use the librarian functions, press **Library (F6)** from the main menu, or Shift-F6 from any other main menu function.



Section 1: Listing the Elements in the Library

The list function enables you to view the names of all the elements in the library. To use this function, press **List (F2)** from the Librarian Functions menu.



The name of each element in the library is displayed within a scrolling window. The name of the current element is shown in reverse video. The entries on this example screen are displayed in a short display format. Refer to the table on the next page for a description of short and long display formats. An example screen in long display format is also shown on the next page.

Elements in the library may include program blocks, program segments, external blocks, and / orsubroutines.

Element	Description
Program Block	A block created and defined by Logicmaster 90-70 software or a third-partyvendor. It can be displayed and edited using the software.
Program Segment	A portion of logic, variable declarations, or interrupts in a file written by Logicmaster 90-70 software from the program editor. A program segment is also called a side file.
External Block	A block created outside of the Logicmaster 90-70 software environment that is not written in ladder diagram (LD) logic. It cannot be displayed or edited from the software, but it can be called from a Logicmaster program.
Subroutine	A parameterized subroutine created and defined by Logicmaster 90-70 software.

If more elements exist in the library than can be displayed at one time in the window, use the Page Up and Page Down keys to scroll through the list of names. Scrolling will occur automatically as you try to cursor beyond the limits of the window. Then, use the cursor keys to select an element from the list; the name of that element will be shown in reverse video.

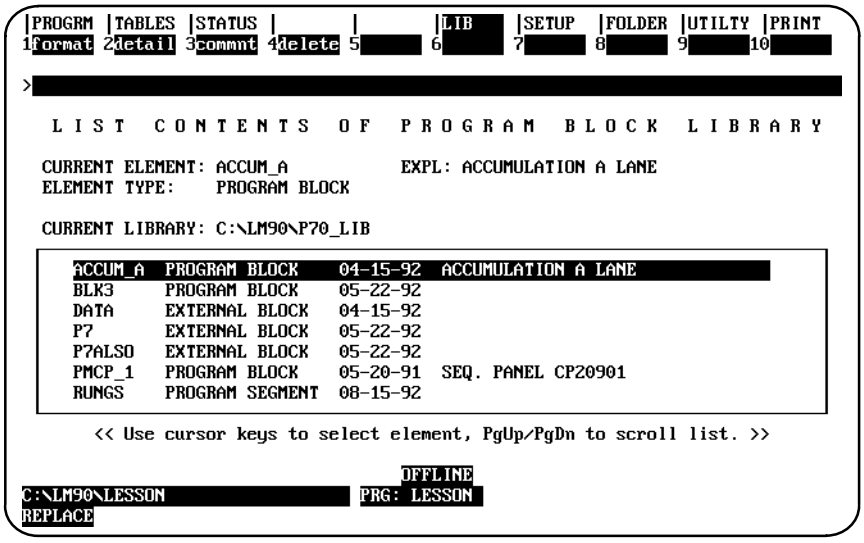
In addition to being displayed in reverse video in the window, the name of the current element, the type of element, and a 32-character explanation are displayed above the scrolling window. Explanation text is entered from the program block declaration editor when the program block is created or edited; therefore, explanations will exist only for Logicmaster 90-70 program blocks. The explanation field will be blank for program segments or external blocks, unless the external blocks have come from the Editor. The fields above the display window are updated as you cursor through the listing in the window.

The following function keys are available on the List Contents of Library screen:

Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the block entries, eight per line, with no explanation. An example screen illustrating the **SHORT** format is shown on the previous page. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation. The date displayed for a program block is the date on the .PRG file in the library. For a program segment, it is the date on the .SDE file. For an external block or subroutine, it is the date from MS-DOS. External blocks will not have explanation text, unless they have come from the Editor. A sample screen in **LONG** format is shown below.
F2	Detail	Display additional information, including memory and reference usage, for elements in the library.
F3	Comment	Display / edit annotation for the selected element. A block of comment text may be associated with any block or segment in the library.
F4	Delete Block	Delete the current element from the library.

* Default selection.

The entries on this example screen are displayed in a long display format. Refer to the table above for an explanation of long and short display formats. An example screen in short display format is shown on the previous page.



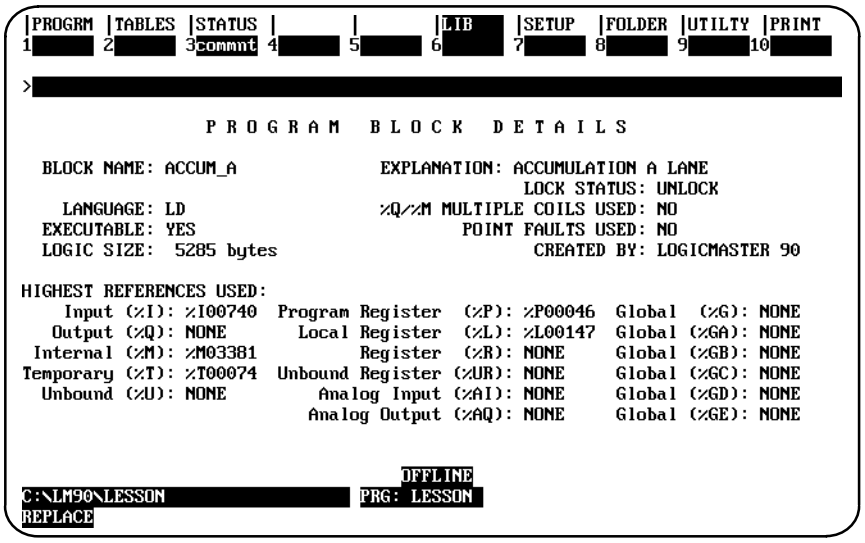
Displaying Information about a Table Entry

Additional information can be displayed for program blocks, program segments, external blocks, and subroutines in the Logicmaster 90-70 library. To use this function, position the cursor on the name of the element in the library window on the List Contents of Library screen, and press **Detail (F2)**.

Note

The Detail (F2) softkey is also available on the Import Library Block and Redefine Variables screen and on the Create / Edit Reference Offset Templates screen.

The following example screen displays additional information for program block ACCUM_A.



The name of the block is displayed, along with its 32-character explanation, at the top of the screen. The second section of the screen displays:

- The language in which the logic for the block was written.
- The executable status of the program block.
- The logic size in bytes.
- The lock status of the block.
- Whether the logic uses multiple %Q or %M references as outputs.
- Whether the logic uses point fault or alarm instructions.
- Whether the logic was written using Logicmaster 90-70 software or a third-party vendor.

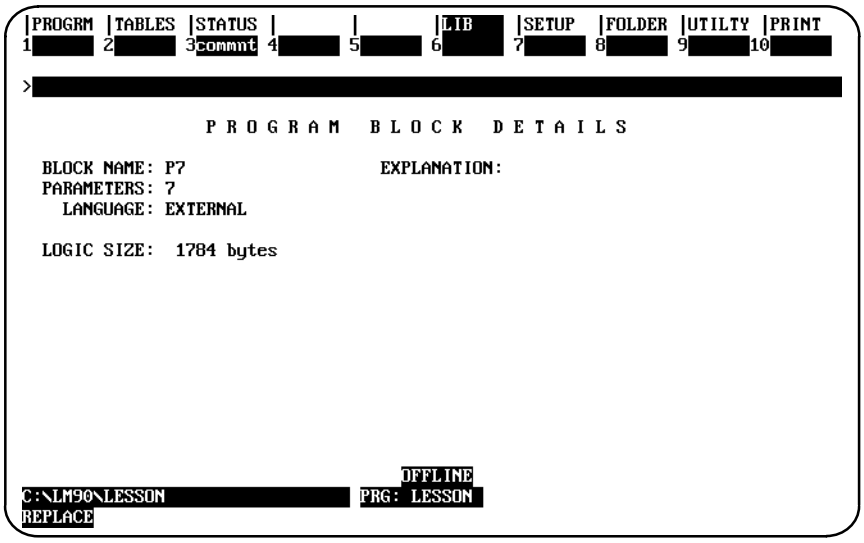
The screen which displays additional information for a subroutine block is similar to the one displayed above; however, parameter information is displayed at the bottom of the screen under the heading of ***Highest ParametersUsed***.

A similar screen can be displayed for program segments, which may contain logic, variable declarations, or interrupt declarations. This screen is identical to the screen displayed for program blocks, except that the second section of the screen displays:

- The type of material in the program segment file.
- For program segments which contain variable or interrupt declarations, the number of declarations in the segment.
- For program segments which contain logic, the number of rungs of logic in the segment.
- The name of the source block.
- For program segments which contain logic, whether the logic uses point fault or alarm instructions.

The bottom portion of the screen lists the highest references used in the logic for each user reference (%I, %Q, %M, %T, %U, %P, %L, %R, %UR, %AI, %AQ, and %G - %GE).

The following example screen displays additional information for an external block. This screen lists the number of parameter pairs and the logic size in bytes.



Press the **Escape** key to return to the List Contents of Library screen.

Displaying Annotation for an Element

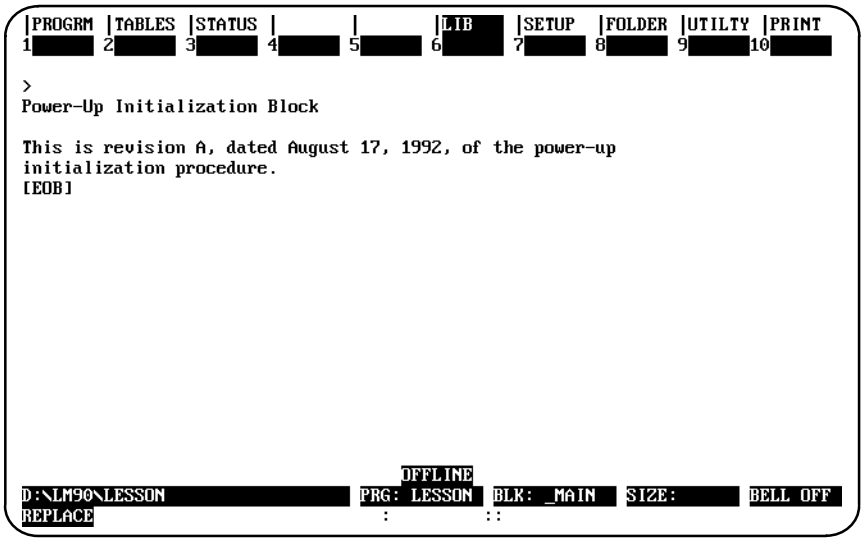
A block of comment text may be created for any block or segment in the library. This annotation is maintained by the librarian in a disk file and will not be imported to the folder with the block it describes.

To use this function, position the cursor on the name of the element in the library window on the List Contents of Library screen, and press **Comment (F3)**.

Note

The Comment (F3) key is also available from the program block or segment information screens, from the Import Library Element to Folder screen, and from the Import and Redefine Variables screen.

The following example screen displays comment text for a program block.

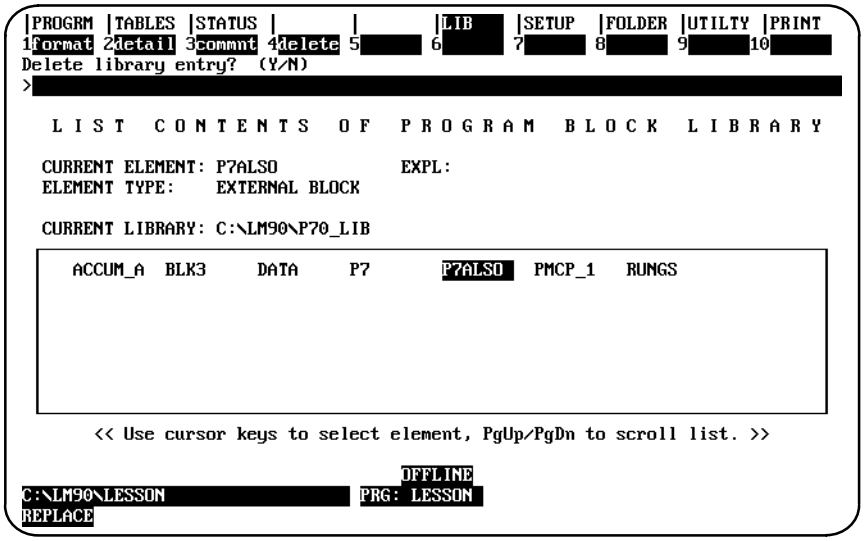


The comment screen may contain up to 18 lines of text, with 80 characters on each line, for a maximum of 1440 characters. Text is entered by typing in the information. The lines of text will wrap. An **[EOB]** (End of Block) marker is displayed at the end of the text.

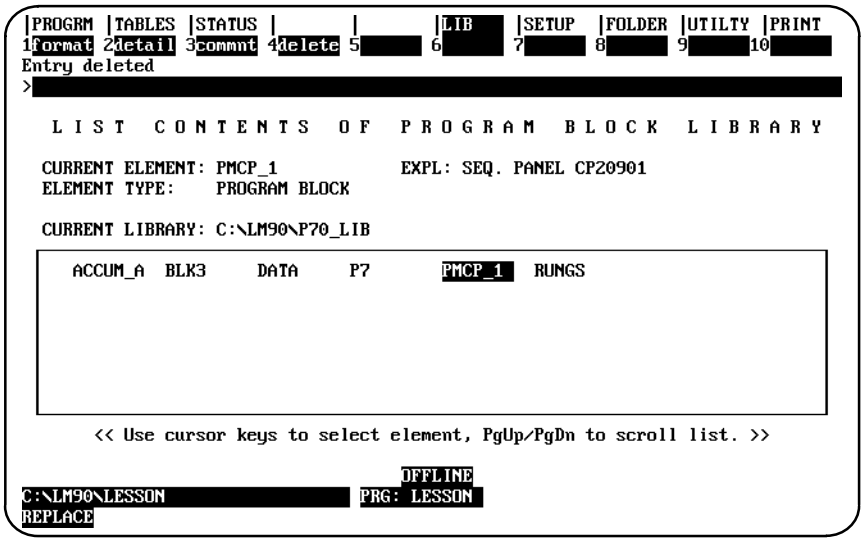
When you have finished entering comment text, press the **Escape** key to save the text, exit this screen, and return to the previous screen. To save the text without exiting the screen, press **ALT-U**. To restore the previous screen contents, press **ALT-A** before saving the new comments to disk.

Deleting an Element

The Delete (F4) softkey may be used to delete the current element from the library. To use this function, position the cursor on the name of the element in the library window on the List Contents of Library screen, and press **Delete (F4)**. The software will prompt you to confirm the deletion. In the following example, P7ALSO will be deleted.

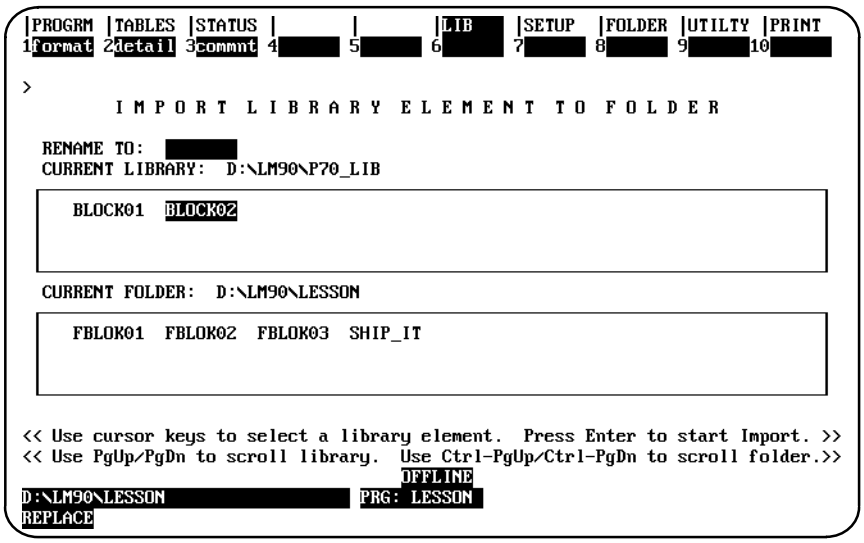


If you enter **Y** (Yes), all files associated with the current element, including the reference offset template and comment text, are deleted. After the deletion is completed, the element is deleted from the list of elements; and the List Contents of Library screen is updated. Once an element has been deleted, it cannot be restored. The following example screen is displayed after P7ALSO has been deleted.



Section 2: Importing an Element from the Library

The import function is used to copy an element from the library to the current program folder. To use this function, press **Import (F3)** from the Librarian Functions menu.



Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the entries, eight per line, with no explanation. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation, if available.
F2	Detail	Display additional information, including memory and reference usage, for elements in the library.
F3	Comment	Display / edit annotation for the selected element. A block of comment text may be associated with any block or segment in the library.

* Default selection.

The import screen contains two scrolling windows. The top window is used to view the list of elements in the library. The library window may be scrolled by using the Page Up and Page Down keys. The bottom window lists the elements in the current program folder. The folder window may be scrolled by using the CTRL-Page Up and CTRL-Page Down keys.

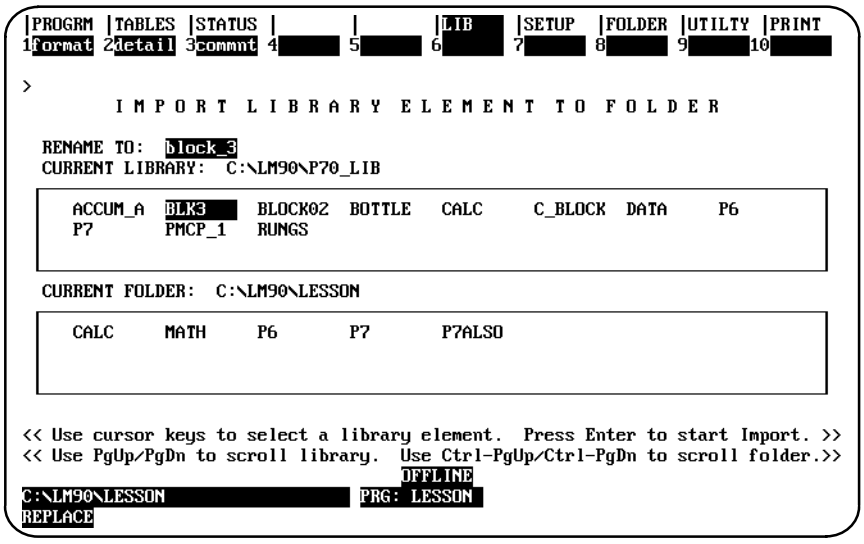
To copy an element from the library to the current program folder:

1. Select the element to be imported by positioning the cursor on its name in the library window (top window).

Note

The current element context is preserved between the list and import screens. If you select an element on the list screen, the same element will be displayed as the current element when you go to the import screen.

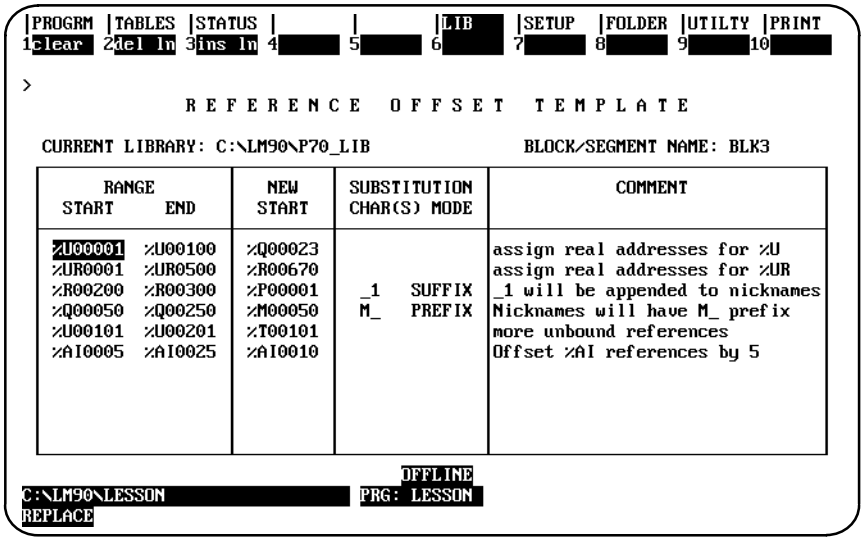
2. If you want to rename the element, enter the new name in the ***Rename to*** field. Any text displayed in this field will be used as the new name when you press the **Enter** key.



3. Press the **Enter** key. The software will prompt you to confirm the name of the element to be imported and the new name, if the element is to be renamed.

   A. When importing an element without reference offsetting and the reference offset template file does not exist, the import operation will begin after you confirm this prompt.

   B. When importing an element with reference offsetting and the reference offset template file does exist, the Reference Offset Template screen will be displayed after pressing the **Enter** key to start the import operation.



Edit the fields on this screen, and press the **Escape** key. Enter **Y** (Yes) after the prompts, "Edit offset template ? (Y / N)" and "Update offset template file ? (Y / N)" to save the reference offsets. Enter **Y** (Yes) after the prompt, "Apply reference offsets ? (Y / N)," to apply the reference offsets. The import operation will begin after you confirm the final prompt, "Import <block_name> ? (Y / N)."

Caution

Applying offsets changes logic.

Reference offsetting can be used to change unbound references (%U and %UR) to real machine references. It is also useful when the block in the library will be imported to several folders, and each program folder will use a different set of addresses. For example, %I00001 – %I00101 could be redefined in folder A to begin with %I00501 and in folder B to begin with %I00601. A third reason for using reference offsetting is to avoid coil use conflicts or exceeding configuration limits. For information on reference offsetting, refer to section 6, "Creating / Editing a Reference Offset Template."

C. When importing an element without reference offsetting and the reference offset template file does exist, the Reference Offset Template screen will be displayed after pressing the **Enter** key to start the import operation. Enter **N** (No) after the prompt, "Edit offset template ? (Y/N)," and press the **Escape** key to exit this screen. Enter **N** (No) after the prompt, "Apply reference offsets ? (Y/N)," to prevent the reference offsets from being applied. The import operation will begin after you confirm the final prompt, "Import <block_name> ?(Y/N)."

4. The librarian will attempt to use the new name to store the imported block in the library.

   A. If the name is already being used for an element of a different type in the library, you must rename the element before the import operation can take place. After an error message is displayed and the import operation is aborted, enter a new name in the ***Rename to*** field, and press the **Enter** key to try again.

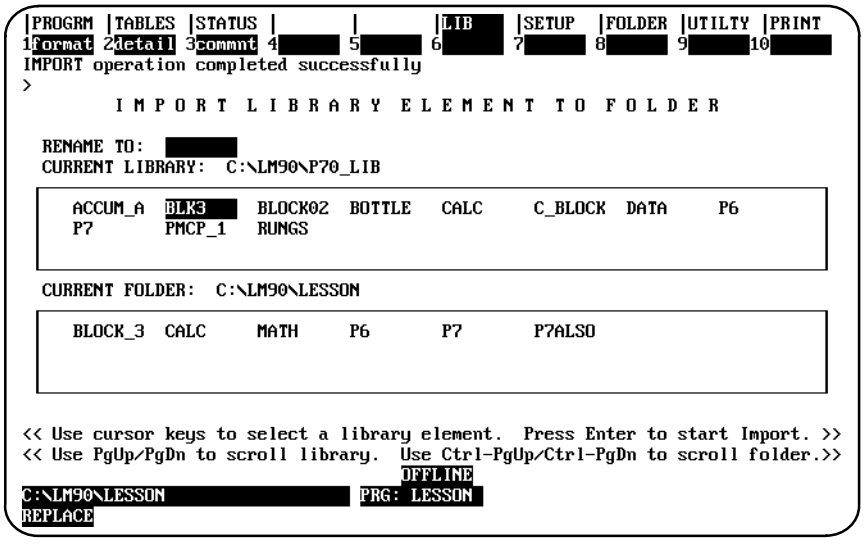
   B. If the name is already being used for an element of the same type, you must either rename or replace the element. The software will prompt you to confirm the replacement. If you enter **N** (No), the import operation is aborted. You can then enter a new name in the ***Rename to*** field, and press the **Enter** key to try again. If you enter **Y** (Yes), the librarian will replace the element in the folder with the imported element.

   C. If the ***Rename to*** field is blank, the original name of the element will be used as the storage name.

Caution

If the import operation is aborted, the librarian will attempt to restore the folder to its original contents; however, complete recovery may not be possible.

5. When an element has been successfully imported, the message, "IMPORT operation completed successfully" will be displayed, as shown on the following screen. The list of names in the folder window is updated to include the new element, plus any program blocks that were created due to implied imports (see explanation on next page).



Name Conflicts

The following name conflicts may occur when applying offset templates:

Name Conflict	Description
Name modified by substitution already exists (different address).	The new name created by substitution characters already exists with a different reference address. The reference address of the original name will be modified as if no substitution had been specified.
Name modified by substitution already exists (implicit name).	The new name created by substitution characters already exists as a LABEL, or MCR. The reference address of the original name will be modified as if no substitution had been specified.
Name modified by substitution already exists (same address).	The new name created by substitution characters already exists with the same reference address. The original name will be deleted, and the existing name will apply.
Different name already exists for modified reference address.	When trying to modify the reference address of an original or modified name, there is a conflict from another existing name defining the same address. The original name will be deleted, and the existing name will apply.

Imports Implied by Program Block Calls

The librarian may have to add program blocks to the folder in addition to the element being imported. This can happen when the imported element contains calls to other program blocks. For example, if the imported block makes a call to XYZ, the librarian will use the following rules to resolve calls to XYZ encountered during the import operation:

1. If the folder already contains a block named XYZ, the librarian will assume that the call refers to that block.
2. If the folder does not contain a block named XYZ, and the main program does not use the name XYZ in some other context, the librarian will add a new, empty block named XYZ to the folder.
3. If the folder uses the name XYZ for something other than a block, the librarian must add to the folder a new, empty block with a system-generated name that is unique within the folder. Calls to XYZ will be changed to calls to the new block.
4. If the folder already contains a parameterized subroutine block named XYZ and its number and type of parameters does not match that of the called block XYZ, a new empty block with a system-generated name will be added to the folder.

In the second and third cases above, the librarian must automatically add entries to the folder's block declarations in addition to the entry for the block selected for import. If the import operation is aborted due to an in-process error, these additional entries are not automatically deleted by the librarian. You must use the block declaration editor to delete them. The empty entries can be identified by the fact that their language assignment field will be blank.

Logicmaster 90-70 software will not create empty external blocks. Therefore, you cannot import a block which calls an external block that does not already exist in the folder.

Section 3: Redefining Variables

Note

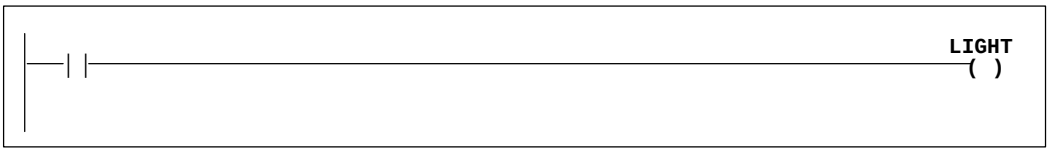
Appendix C provides a tutorial on variable programming. It would be helpful to complete this lesson before using this feature.

A block may use both global and local variables. Global variables are those variables declared in the _MAIN variable declaration table. Local variables are those variables declared in the local variable declaration table for the block. Both global and local variables may be viewed and edited. By redefining variables, you can change the scope and reference address of block variables; however, you cannot change the scope or reference address of any global variable already declared in the current folder.

Variable programming allows you to redefine nicknames used in a program block before the block is imported to a folder. The same nickname may use a different reference address for each application. Multiple developers can create a program, with each programmer using the same global variables to develop separate blocks. These separate blocks can then be incorporated into one program.

For example, the nickname RESET is defined in a program folder as %I00001. When this program folder is exported to the library, a list of global variables used by the block is placed in the library. The nickname RESET is global in both of these folders. It may be used in other blocks, as well. If the scope of this nickname is changed to local, RESET can then be redefined as %I00100 before it is imported to another program folder.

In another example, the nickname LIGHT is a coil in a rung in the library block. LIGHT is global in the source folder. It is not used in the current folder.



When the block is imported to the folder, the nickname LIGHT is entered in the current folder's global table. Because LIGHT is global, it will already be there when additional blocks are imported. However, if there are no other blocks to import to the library, you may want to put LIGHT in the local table. Although it was used globally in the source folder, it will only be used by this block in the current folder.

This function is also useful for changing local reference addresses which were created using %U and %UR references or %M and %T references. When the program is used for a specific application, the references can then be changed to real machine addresses.

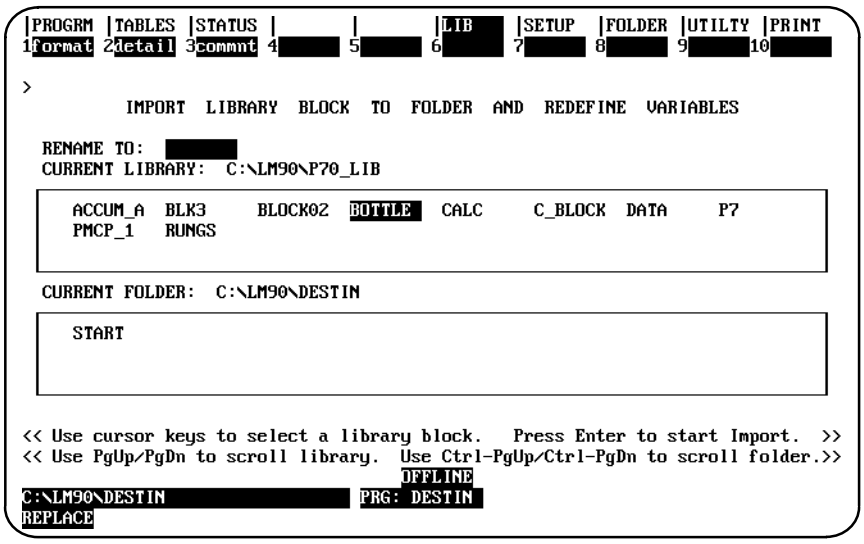
Redefining Variables

Variables can only be redefined in ladder diagram language program blocks or parameterized subroutine blocks. They cannot be redefined in program segments or external blocks.

Note

The variable import function can only be used to move blocks into folders that have a _MAIN block in ladder diagram language. SFC language library blocks or destination folders with a _MAIN block in SFC language cannot use this function.

To use this function, press **Variable Import (F4)** from the Librarian Functions menu.



Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the entries, eight per line, with no explanation. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation, if available.
F2	Detail	Display additional information, including memory and reference usage, for elements in the library.
F3	Comment	Display / edit annotation for the selected element. A block of comment text may be associated with any block or segment in the library.

* Default selection.

When the **Enter** key is pressed, the first of three tables is displayed.

Table	Description
Globals Defined in Folder and Library Block	Lists all global variables found in the program block being imported that have counterparts in the current folder. These variables must either assume the folder's reference address or be inserted into the block's local variable declaration table.
Globals Defined in Library Block Only	Lists all global variables found in the program block being imported which do not have counterparts in the current folder. These variables will cause no nickname conflicts when the block is imported; however, they may cause reference address conflicts with global variables in the current folder. You may want to change their addresses and insert them into the block's local variable declaration table.
Locals Defined in Library Block Only	Lists the remaining variables, all local, found in the program block being imported. Since they are local to the block, they will not cause nickname conflicts when the block is imported. You may want to change their addresses, but their definitions must reside in the block's local variable declaration table after the import is complete.

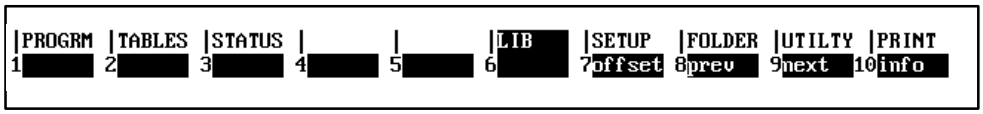
When a table is initially displayed, the global variables in the library block are looked up in the current folder. If the variable is in the current folder, it is either defined as compatible or not. Variables which are not compatible are identified by an asterisk in the table. Additional information about a conflict can be displayed by pressing the **Information (F10)** softkey.

The tables can be edited in any order. Empty tables are displayed. If a table contains more entry lines than can be displayed, use the Home, End, Up / Down, and Page Up / Page Down cursor keys to scroll the screen display.

While editing a table, you may create conflicting local variables or exceed the size limit of the block's local variable declaration table when the three tables are applied together. This error will only become apparent when you press the **Escape** key to complete the import operation.

The number of global variables in the folder and library block combined is determined. This number must not exceed 5000 entries, the size limit of the folder's global variable declaration table. If it does, you must remove some block variables from global use before completing the import operation.

The following function softkeys are available on the table screens.

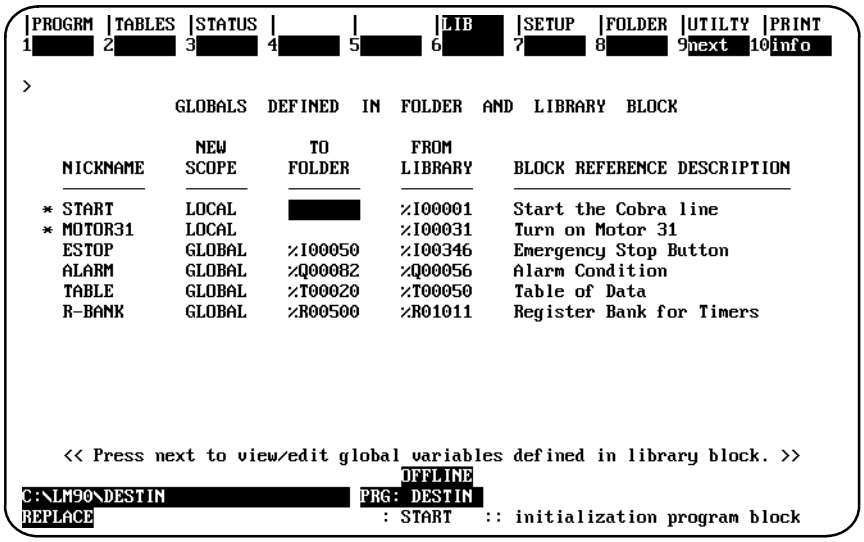


Function Key	Function	Description
F7	Offset	Automatically fill a range of ***To folder*** fields in the Globals Defined in Library Block Only table or in the Locals Defined in Library Block table. (More information on this function follows this table.)
F8	Previous	Move to the previous table. F8 is only available in the Globals Defined in Library Block Only table or in the Locals Defined in Library Block table.
F9	Next	Move to the next table. F9 is only available in the Globals Defined in Folder and Library Block table or in the Globals Defined in Library Block Only table.
F10	Information	Display additional information about any variable on the Globals Defined in Folder and Library Block screen or on the Globals Defined in Library Block Only screen.

When you have finished viewing and editing these tables, press the **Escape** key from any of the tables to begin the import operation.

Globals Defined in Folder and Library Block

The following screen shows a sample table of global variables found in the program block being imported and also in the current folder. These variables must either assume the folder's reference address or be inserted in the local variable declaration table for the block. (If you entered **N** (No) after the prompt "Export globals ? (Y/N)" during the export operation, this table will be blank.) You can view and edit all global variables found in the library block whose nicknames are already used by the current folder as global variables or identifiers.



The default action is to reassign the variable to the reference address in the folder address without changing its scope. In this table, the nickname ESTOP will default to %I00050 because that is how ESTOP is defined in the current folder (DESTIN). If there is a conflict, the scope of the nickname defaults to local, as shown with the nicknames START and MOTOR31.

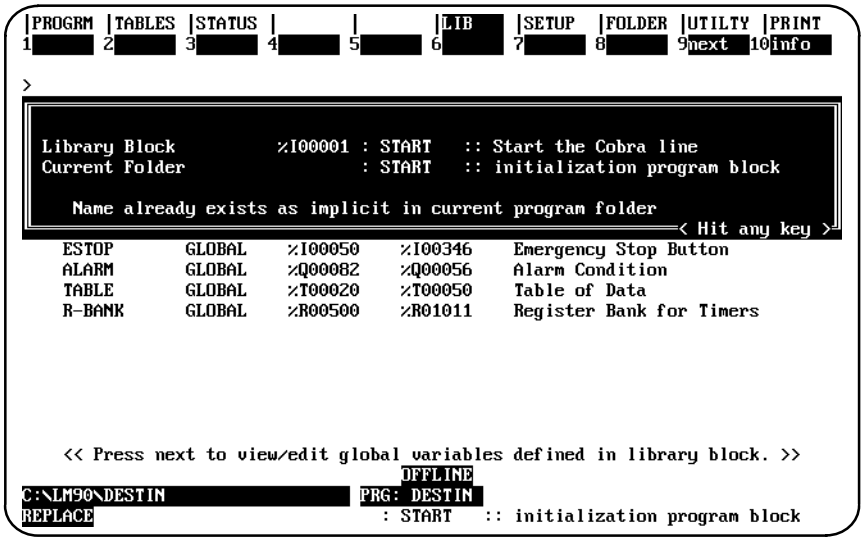
The status line indicates which line the cursor is on in the table. It shows the nickname along with the reference address, if any, and the reference description, if any, in the current folder.

Each entry line contains five fields, described in the following table. Only the ***New Scope*** and ***To Folder*** fields may be edited. You cannot access the other three fields.

Field	Description
Nickname	The nickname associated with the block's variable.
New Scope	The intended scope in the folder after the import is complete. If **GLOBAL** is selected, the variable will reside in the global variable declaration table for the program folder. You may cursor to the ***To Folder*** field, but you cannot edit the field. If **LOCAL** is selected, the variable will be inserted in the local variable declaration table for the newly-imported block. If **NONE** is selected, it cannot be inserted in the block, and the ***To Folder*** field will be blank. If **NONE** is changed to **LOCAL** or **GLOBAL**, the default value in the ***To Folder*** field will be restored.
To Folder	The reference address which the variable will assume when the import is complete. If this field is blank, the reference address will be the same as that shown in the ***FromLibrary*** field.
FromLibrary	The variable's reference address in the block before import. Entry lines in the table are pre-sorted by reference type and offset of the reference address.
Block Reference Description	The block's reference description of the variable.

When the table is first displayed, the ***New Scope*** and ***To Folder*** fields are initialized with default values. The default ***New Scope*** value is **GLOBAL**, and the default ***To Folder*** reference address is the current folder's reference address for that nickname. Press **ALT-A** at any time while editing the table to restore these default values.

The asterisk next to the nickname START indicates that there is a conflict with this nickname. To determine the cause of the conflict, position the cursor on the entry line for the nickname and press **Information (F10)**. For example, if the cursor is moved to the line for START and F10 is pressed, the following screen will be displayed.

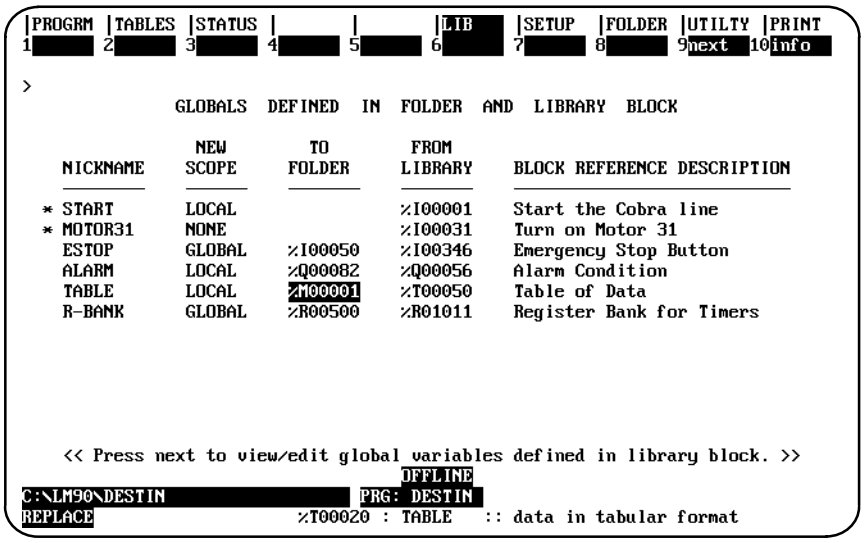


You can see from this screen that START already exists in the current program folder. START is assigned reference address %I00001 in the library block and is used as the name of a program block in the current folder.

Changing the New Scope Field

You can edit the ***New Scope*** field by cursoring to the line for a nickname and using the Tab key to select **LOCAL** or **NONE**. If **NONE** is selected, the nickname will be dropped, and the reference address will be used without a nickname.

In the previous table, there is a conflict with MOTOR31. To resolve this conflict, change the ***New Scope*** field to **NONE**, as shown in the next screen. MOTOR31 will not be inserted in the local variable declaration table for the current folder. The imported block will use %I00031 without a nickname.



Cursor to the line for the nickname ALARM, and change the scope to **LOCAL**. ALARM will be inserted in the local table at the address displayed in the ***To Folder*** field.

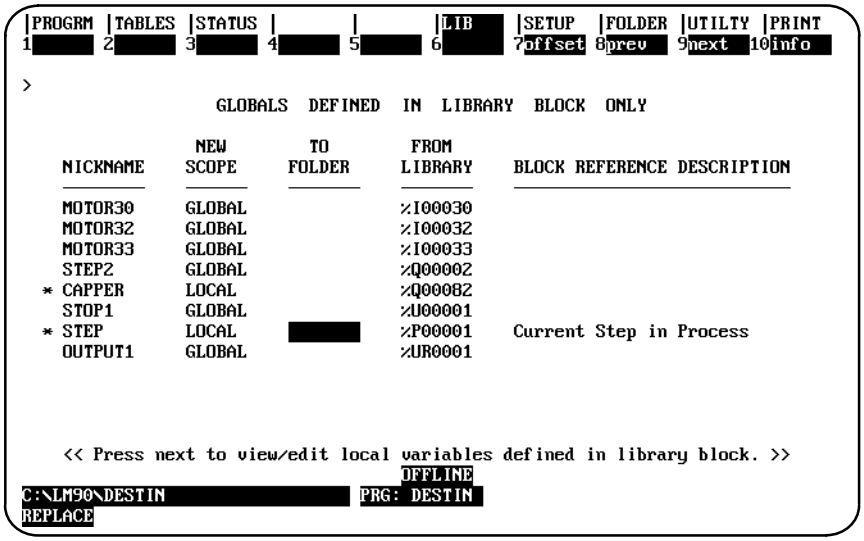
Changing the To Folder Field

You can edit the ***To Folder*** field by positioning the cursor on the line for the nickname and entering a new reference address. In the screen shown above, enter %M00001 for the nickname TABLE. The nickname TABLE will be inserted in the local variable declaration table at %M00001, and the logic will change to reflect this new reference address.

When you are satisfied with the selections for this screen, press the **Next (F9)** softkey to view the global variables defined in the library block.

Globals Defined in Library Block Only

The following screen shows a sample table of global variables found in the program block being imported which are not found in the current folder. (If you entered **N** (No) after the prompt "Export globals ? (Y / N)" during the export operation, this table will be blank.) These variables will not cause a nickname conflict when the block is imported; however, they may cause reference address conflicts with global variables in the current folder. You can view and edit the global variables found in the library block whose nicknames are not used in the current folder as global variables or identifiers.



The default action is to insert the nicknames in the global variable declaration table. For example, MOTOR30 will be inserted at %I00030. If there is a conflict, the scope of the nickname defaults to local, as shown with the nicknames CAPPER and STEP.

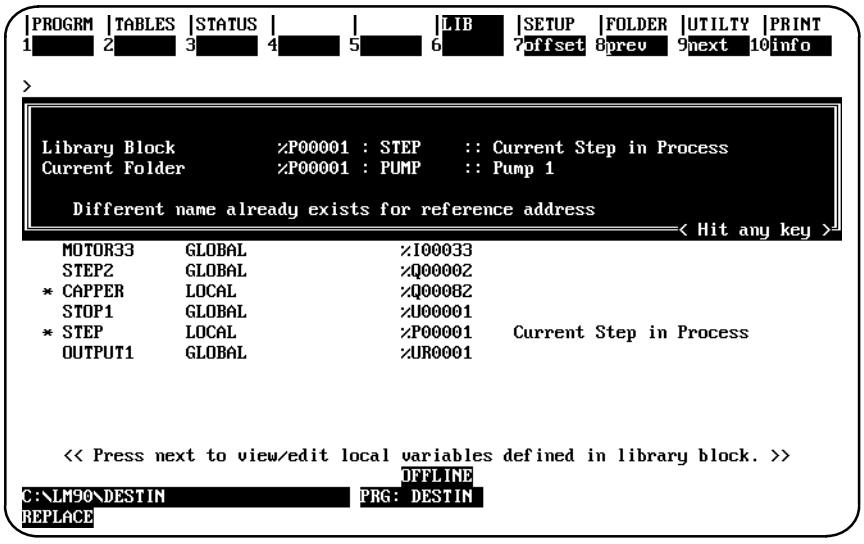
Note that the status line on this screen is blank because the nickname is not used in the folder.

Each entry line contains five fields, described in the following table. Only the ***New Scope*** and ***To Folder*** fields may be edited. You cannot access the other three fields.

Field	Description
Nickname	The nickname associated with the block's variable.
New Scope	The intended scope in the folder after the import is complete. If **GLOBAL** is selected, the variable will be inserted in the global variable declaration table for the program folder. If **LOCAL** is selected, the variable will be inserted in the local variable declaration table for the newly-importedblock. If **NONE** is selected, it will not be inserted in any table and the ***To Folder*** field will be blank.
To Folder	The reference address which the variable will assume when the import is complete. If this field is blank, the variable's reference address will be the same as that shown in the ***FromLibrary*** field.
FromLibrary	The variable's reference address in the block before import. All entry lines in the table are pre-sorted by memory type and offset of the reference address appearing in this field.
Block Reference Description	The block's reference description for the variable.

In the previous screen, the ***New Scope*** field for the nicknames MOTOR30, MOTOR32, MOTOR33, STEP2, STOP1, and OUTPUT1 is set to **GLOBAL**. These variables are defined in the global variable declaration table of the folder where the block was exported to the library from. They are not used in the folder DESTIN. In order to insert these variables in the local variable declaration table for BOTTLE, the ***New Scope*** field must be changed to **LOCAL**.

The asterisk next to the nicknames CAPPER and STEP indicates that there is a conflict with those nicknames. To determine the cause of each conflict, position the cursor on the entry line for the nickname and press **Information (F10)**. For example, if the cursor is moved to the line for STEP and F10 is pressed, the following screen will be displayed.



You can see from this screen that two different nicknames are assigned for the same reference address. %P00001 is identified as STEP in the library block and as PUMP in the current folder. To resolve the conflict, the ***New Scope*** field for CAPPER is changed to **NONE**.

Changing the New Scope Field

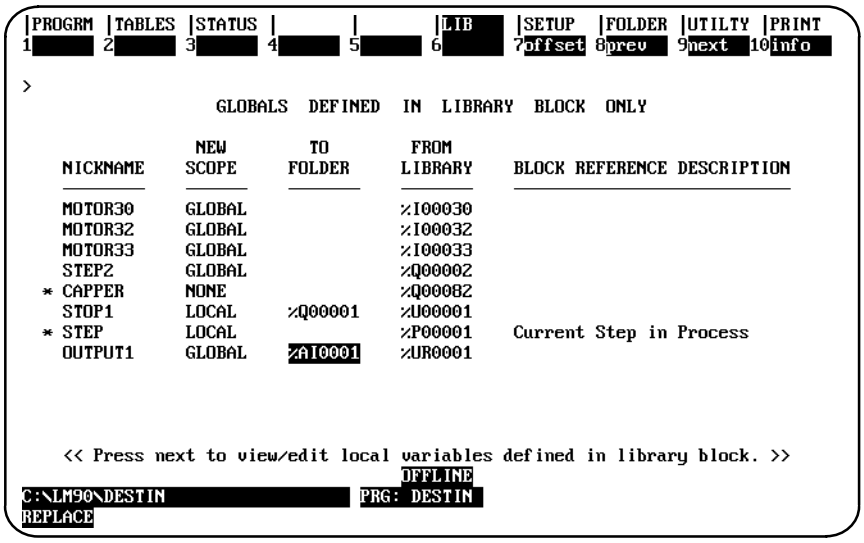
You can edit the ***New Scope*** field by cursoring to the line for a nickname and using the Tab key to select **LOCAL** or **NONE**. If **NONE** is selected, the nickname will be dropped, and the reference address will be used without a nickname.

In the previous table, there is a conflict with CAPPER. To resolve this conflict, change the ***New Scope*** field to **NONE**, as shown in the next screen. CAPPER will not be inserted in the local variable declaration table for the current folder. The block will use reference address %Q00082 without a nickname since CAPPER was dropped.

Cursor to the line for the nickname STOP1, and change the scope to **LOCAL**. Rather than insert STOP1 in the global variable declaration table, which is the default, it will be added to the local variable declaration table.

Changing the To Folder Field

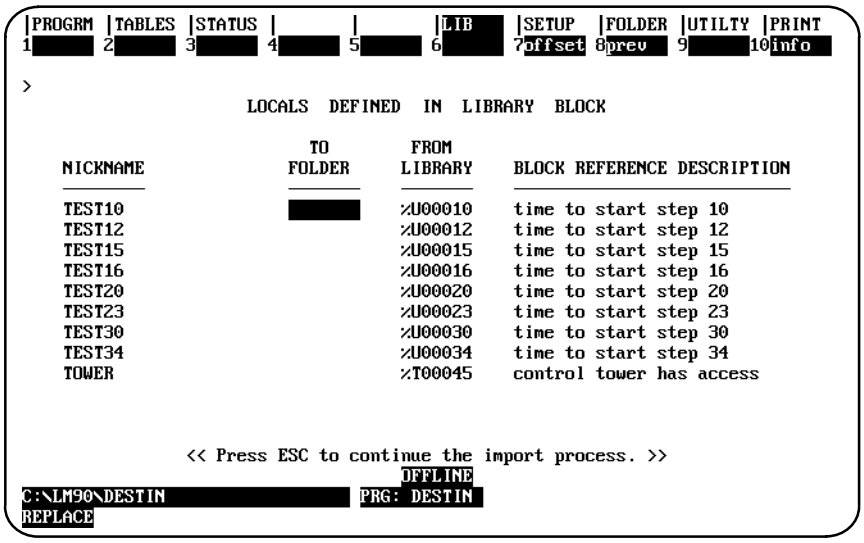
You can edit the ***To Folder*** field by positioning the cursor on the line for the nickname and entering a new reference address. To replace the unbound references shown in the previous screen for STOP1 and OUTPUT1 with real machine references, cursor to the line for STOP1 and enter %Q00021 in the ***To Folder*** field. STOP1 will be inserted in the local variable declaration table at %Q00021. Then, cursor to the line for OUTPUT1 and enter %AQ00011 in the ***To Folder*** field. OUTPUT1 will be inserted in the global variable declaration table at %AI00011.



When you are satisfied with the selections for this screen, press the **Next (F9)** softkey to view the local variables defined in the library block.

Locals Defined in Library Block

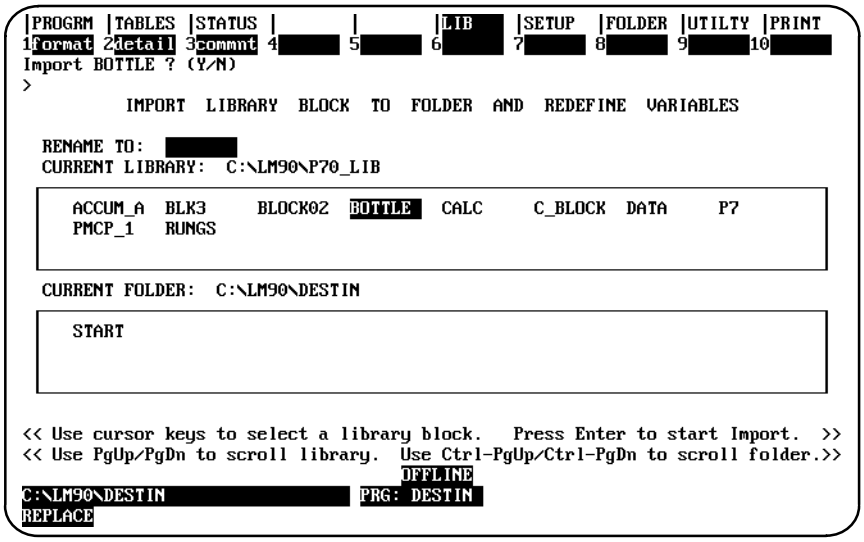
The following screen shows a sample table of the local variables found in the program block being imported. Since they are local to the block, they will not cause conflicts when the block is imported. You may change their addresses, but their definitions must reside in the local variable declaration table after the import is complete.



Each entry line contains four fields, described in the following table. There is no ***New Scope*** field on this screen, as the scope of all variables is **LOCAL** and cannot be changed. Only the ***To Folder*** field may be edited; you cannot access the other three fields.

Field	Description
Nickname	The nickname associated with the block's variable.
To Folder	The reference address which the variable will assume when the import is complete. If this field is blank, the reference address will be the same as that shown in the ***FromLibrary*** field.
FromLibrary	The variable's reference address in the block before import. Entry lines in the table are pre-sorted by reference type and offset of the reference address.
Block Reference Description	The block's reference description of the variable.

When you are satisfied with the selections for this screen, press the **Enter** key to start the import operation.

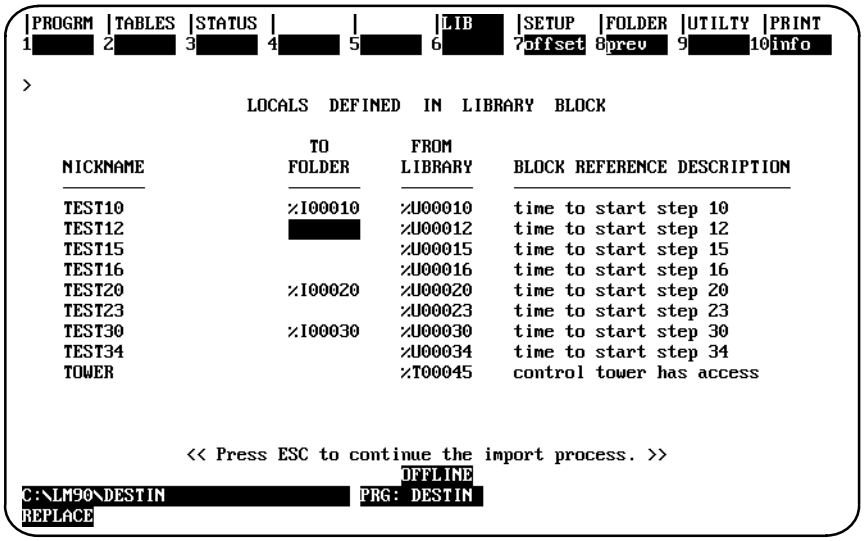


Enter **Y** (Yes) after the prompt "Import <block_name> ? (Y/N)."

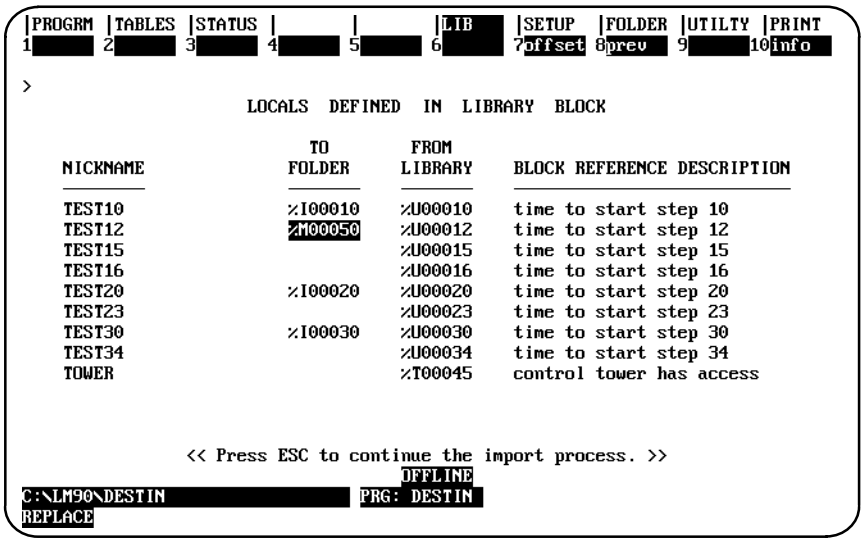
Automatically Filling a Range of To Folder Fields

The offset function can be used to automatically fill a range of ***To Folder*** fields in one of the tables displayed while redefining variables.

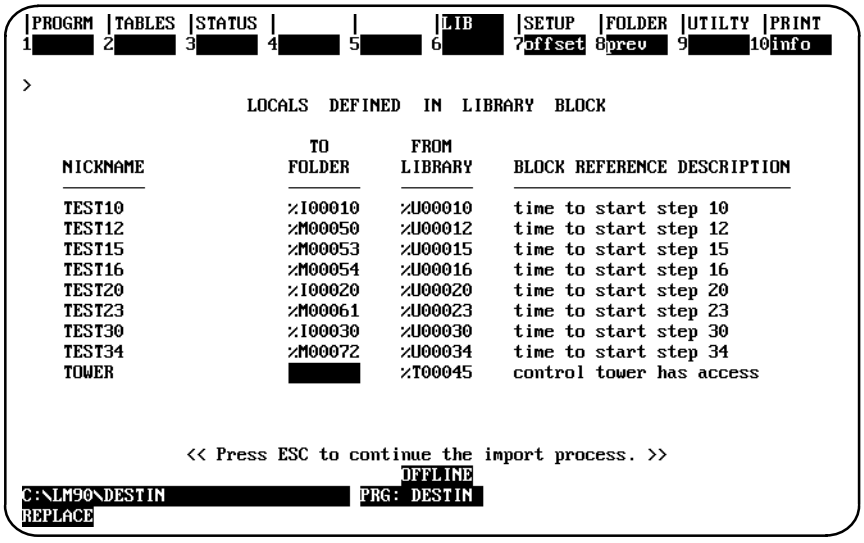
1. Select a starting point in the table, and enter a valid reference address in the ***To Folder*** field. For this example, enter the reference addresses shown below for TEST10, TEST20, and TEST30.



2. Enter %M00050 in the ***To Folder*** field for TEST12.



3. With the cursor positioned on the %M00050, press **Offset (F7)**. All the blank ***To Folder*** fields with the same reference type and a are automatically assigned a new reference address in the ***To Folder*** field. Note how it skips the addresses that were already filled in (%I00010, %I00020, and %I00030). Also, it stops at the next reference type (in this example, %T).



The software will not allow you to enter a word-oriented reference type in the ***To Folder*** field when the ***From Library*** field is a discrete reference type.

The reference address is offset from the ***From Library*** address by a fixed amount. If the ***To Folder*** and ***From Library*** fields are both discrete or both word-oriented reference types, the amount of offset is simply the difference between the addresses displayed in the two fields. If the ***To Folder*** field contains a discrete reference type and the ***From Library*** field contains a word-oriented reference type, the amount of offset is the difference between the addresses plus 8 bits to ensure byte alignment.

Since the reference address in the ***To Folder*** field for TEST12 is %M00050, the amount of offset is 38 bits. Any entry line whose ***From Library*** memory type is %M and whose ***To Folder*** field is empty has its ***New Folder*** field automatically filled. For example, the ***To Folder*** field for TEST25 was originally blank. Now it contains %M00053, which is offset by 38 bits from the reference address in its ***From Library*** field. The offset function filled the ***To Folder*** fields for TEST16, TEST23, and TEST34 before stopping.

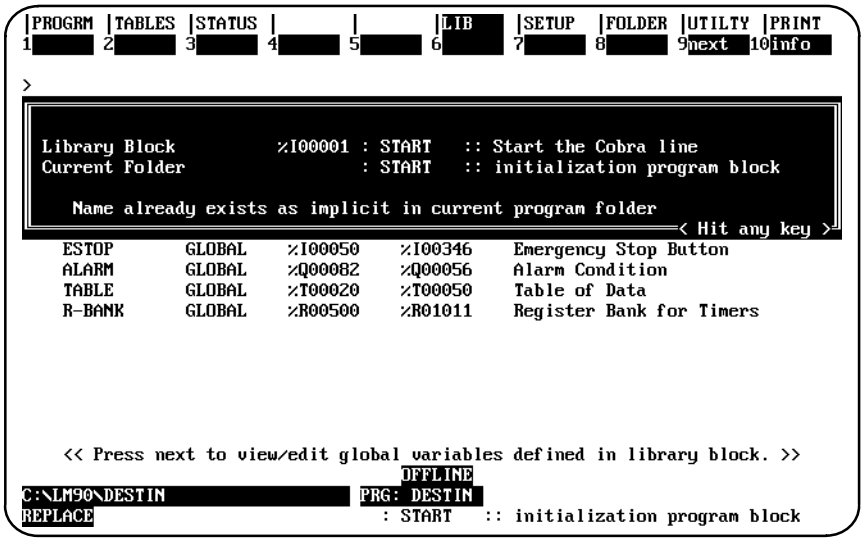
The offset function may be used in conjunction with the auto-next highest feature of Logicmaster 90-70 software. In the example above, you could have specified the next highest %M reference in the ***To Folder*** field for TEST12 using the auto-next highest feature before pressing the **Offset (F7)** key.

Displaying Information about a Table Entry

The Information (F10) softkey is used to display additional information about a nickname or reference address listed in the table. This information can help you determine what caused a conflict.

To display additional information about a nickname or reference address, position the cursor on a specific entry line and press **F10**. The screen display shows the library block's definition of the selected variable and the current folder's use of that variable. If a conflict exists between the library block's definition and the current folder's usage, a descriptive message is displayed.

In the following example screen, there is a conflict with the nickname START. START is used with %I00001 in the library block and also as the name of a program block.



Completing the Operation

Press the **Prev**, **Next**, or **Escape** key to exit a table without losing the changes you have made, as long as you have not entered any errors such as a reference address used by two different nicknames in the same table.

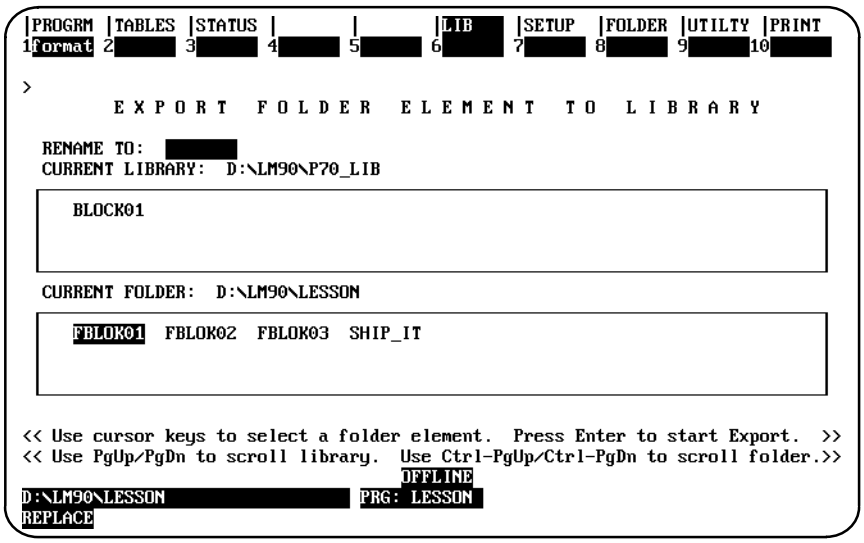
If you press one of the supervisor softkeys (e.g., Program, Tables, Status, etc.), a prompt will warn you that the contents of the tables will be lost if you proceed.

If you press one of the librarian function softkeys, you will abort the import operation and proceed to that function. When you attempt the import operation again with the same program block, all table entries are retained from the previous editing session.

If you press the **Escape** key, the Import Library Block to Folder and Redefine Variables screen is displayed. The software will prompt you to continue to import the block with its variables redefined. You can either exit this screen or restart the import process. If the same block is selected for import, all table entries are retained from the previous editing session. Once you confirm the import prompt, the software will attempt to import the block and update the logic and variable declaration tables with the new variable definitions. If a different block is selected for import, the table entries for the newly selected block are initialized with default values.

Section 4: Exporting an Element to the Library

The export function is used to copy an element from the current program folder to the library. To use this function, press **Export (F5)** from the Librarian Functions menu.



Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the entries, eight per line, with no explanation. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation, if available.

* Default selection.

The export screen contains two scrolling windows. The top window is used to view the list of elements in the library. The library window may be scrolled by using the Page Up and Page Down keys. The bottom window lists the elements in the current program folder. The folder window may be scrolled by using the CTRL-Page Up and CTRL-Page Down keys.

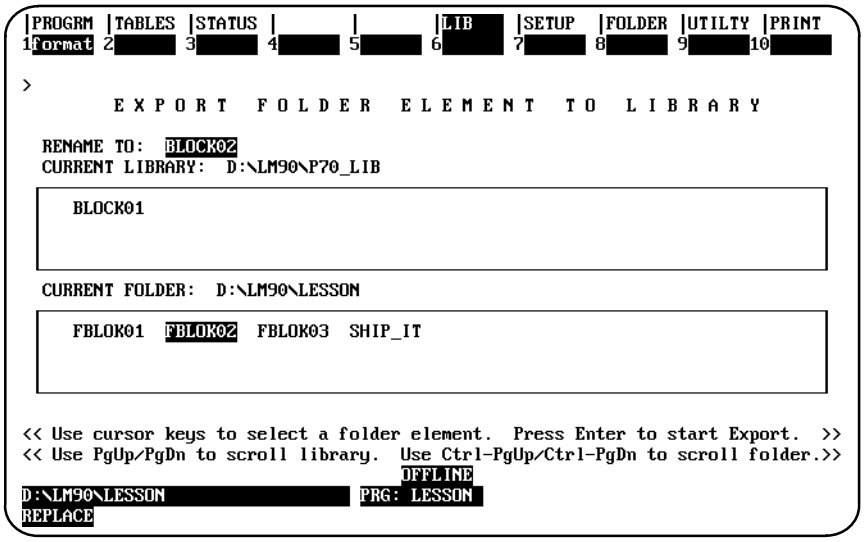
To copy an element from the current program folder to the library:

1. Select the element to be exported by positioning the cursor on its name in the current program folder window (bottom window).

Note

The current element context is preserved between the list and export screens. If you select an element on the list screen, the same element will be displayed as the current element when you go to the export screen.

2. If you want to rename the element, enter the new name in the ***Rename to*** field. Any text displayed in this field will be used as the new name when you press the **Enter** key.



3. Then, press the **Enter** key. The software will prompt you to confirm the name of the element to be exported and the new name, if the element is to be renamed. The librarian will attempt to use the new name to store the exported block in the library.

   A. If the name is already being used for an element of a different type in the library, the message "Element name is already used in Library" will be displayed, and the cursor will not move. You must either rename or replace the element. The software will prompt you to confirm the replacement. If you enter **N** (No), the export operation is aborted. You can then enter a new name in the ***Rename to*** field, and press the **Enter** key to try again. If you enter **Y** (Yes), the librarian will replace the element in the library with the element exported from the folder.

   B. If the name is already being used for an element of the same type, the name specified can be the same as the name of the element in the library, and the replacement will occur.

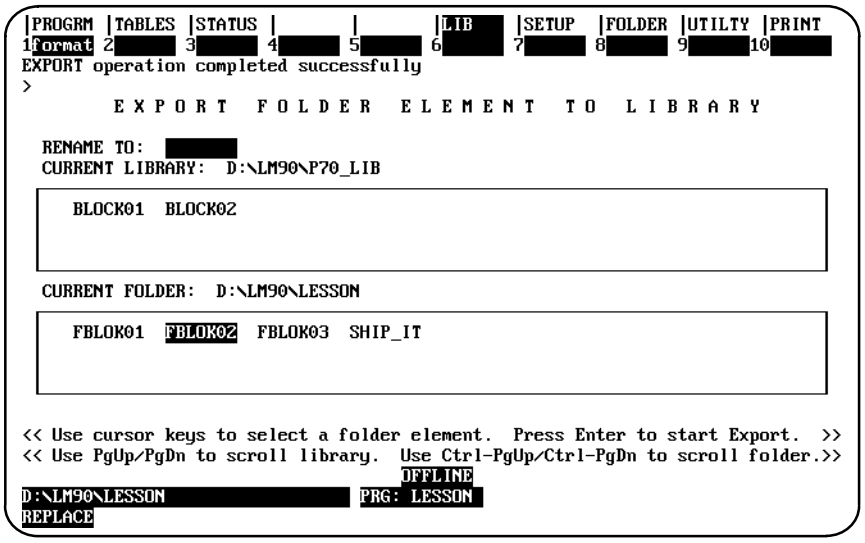
   C. If the ***Rename to*** field is blank, the original name of the program block will be used as the storage name.

4. Next, the software will prompt you to confirm exporting global variables. If you enter **Y** (Yes) to confirm this prompt, information on all global variables used in the block is gathered and stored in the library, along with the block's logic. If you enter **N** (No), the software will skip this step. The export operation will begin after you respond to this second prompt.

Caution

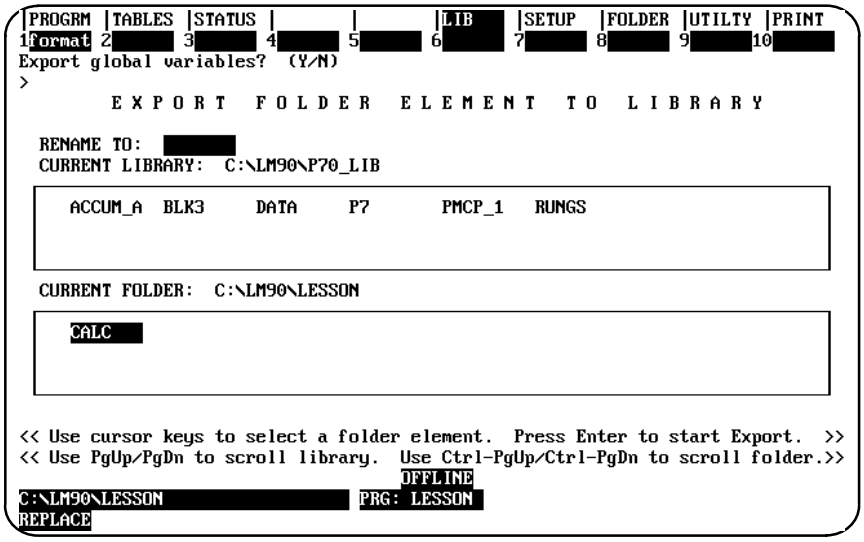
If a read/write disk error occurs, it may not be possible for the librarian to restore the library to its original contents. In this case, the library may be left with an incomplete entry.

5. When an element has been successfully exported, the message, "EXPORT operation completed successfully," will be displayed, as shown on the following screen. The list of names in the library window is updated to include the new element.



Exporting Global Variables

When a program block is exported from a folder to the library, the librarian function will gather information from the source folder about all global variables used in the block. This process takes time and disk space. Therefore, a software prompt will ask you whether you want global variable definitions exported to the library along with the block.



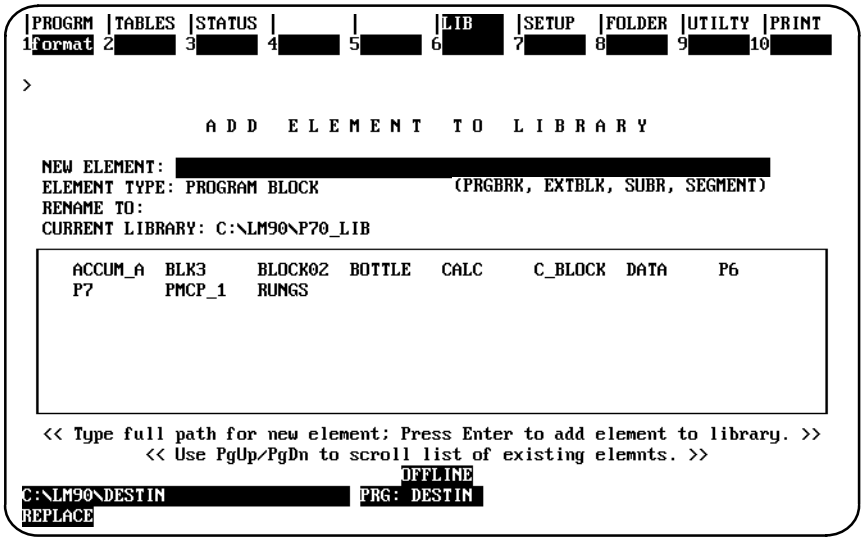
If you confirm this prompt, information on all global variables used in the block is gathered and stored in the library, along with the block's logic. The number of global variables that may be exported with each program block is limited to 1000 variables. If this number is exceeded, an error message is displayed, and the rest of the global variables (1001 – 5000) are not exported. In the logic for the block, their addresses will have no associated nicknames.

You can still use the variable programming feature when the block is imported even if you do not export global variables; however, the first two tables will be empty.

Section 5: Adding an Element to the Library

This function is used to copy elements from a specified source directory to the Logicmaster 90-70 library. You can use this function to copy external blocks written in a language other than ladder logic or program blocks created by third-party vendors. Program segments in a non-folder directory can be copied to the library either by using this function or by using the export function (from a folder only).

To use this function, press **Add (F6)** from the Library Functions menu.



Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the entries, eight per line, with no explanation. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation, if available.

* Default selection.

This screen contains one scrolling window, listing the elements in the library. The library window may be scrolled by using the Page Up and Page Down keys.

There are three fields, which can be edited, above the window.

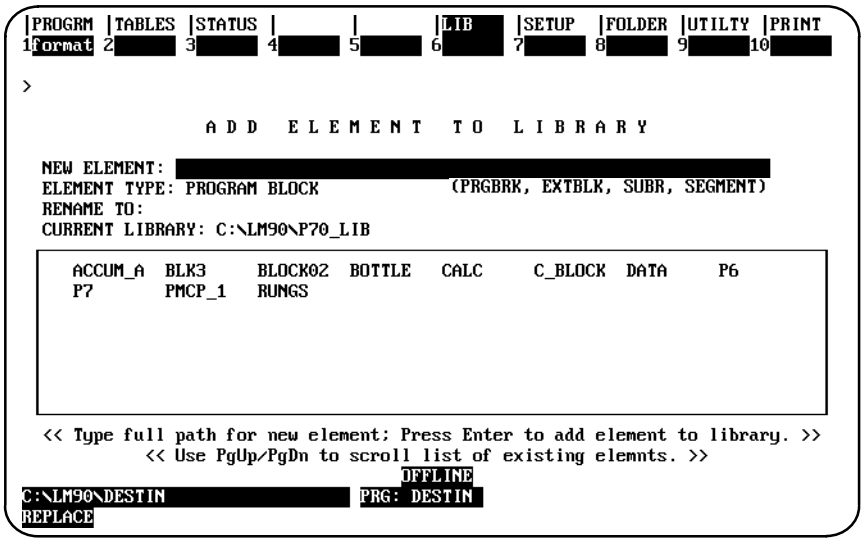
Field	Description
New Element	Enter the full path and name of the element to be added to the library. Since the ***Element Type*** field implicitly states the file extension, it is not necessary to include the extension in the field. If the file extension is included, it must match the type implied by the ***Element Type*** field. In order for the field to be valid, the path must be present. The library is not an acceptable path.
Element Type	Specify the type of element being added, whether it is a program block, an external block, a subroutine, or a program segment. If the field contains invalid text, the message "Invalid field entry" will be displayed.
Rename to	This field is optional. It can be used to enter a name other than the name specified in the ***New Element*** field. If the field contains special characters which are not allowed in names, the message "Invalid character(s) in name" will be displayed.

Use the cursor keys to move among these three fields. The contents of each field must be valid before you can cursor to another field. After you have entered values, where appropriate, press the **Enter** key to start the add element operation.

When adding an external block or subroutine from a working directory to the library, the number of input (X1 – X7) and output (Y1 – Y7) parameter pairs must be specified.

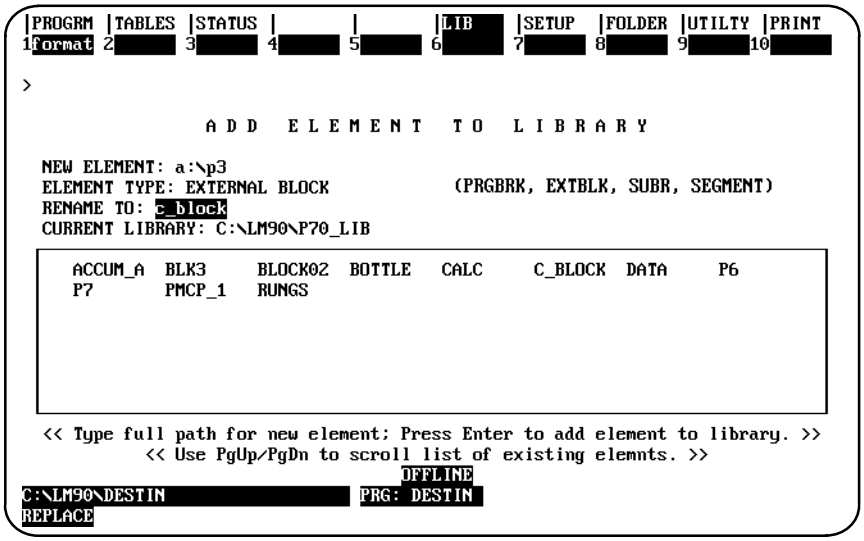
Completing the Operation

After specifying the element's full path, element type, and optional new name, press the **Enter** key to begin the add operation.



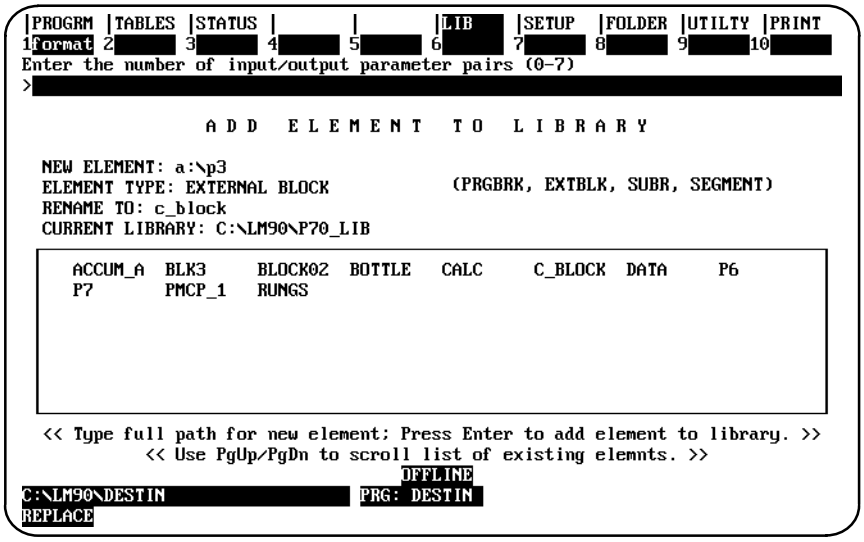
The librarian validates the content of your entry. If you specify a name that is already being used for an element of a different type in the library, the message "Element name is already used in Library" will be displayed, and the cursor will not move. If the elements are the same type, the name specified can be the same as the library element; the new element will replace the element already in the library.

If you try to add an external block or subroutine to the library, the software will prompt you for the number of paired input and output parameters in the block. If you enter a zero, that will mean that the block has no parameters beyond the standard EN and OK parameters. Any invalid response to the prompt will cause the prompt to be repeated.



After the entry is successfully validated, the software will prompt you for confirmation to proceed.

After the element has been successfully added, the message, "Add operation completed successfully" is displayed on the message line. The list of names in the library window is updated to include the new element.



Press the **Escape** key to return to the Librarian Functions menu. The values entered in these fields are not retained when you exit this screen.

Section 6: Creating/Editing a Reference Offset Template

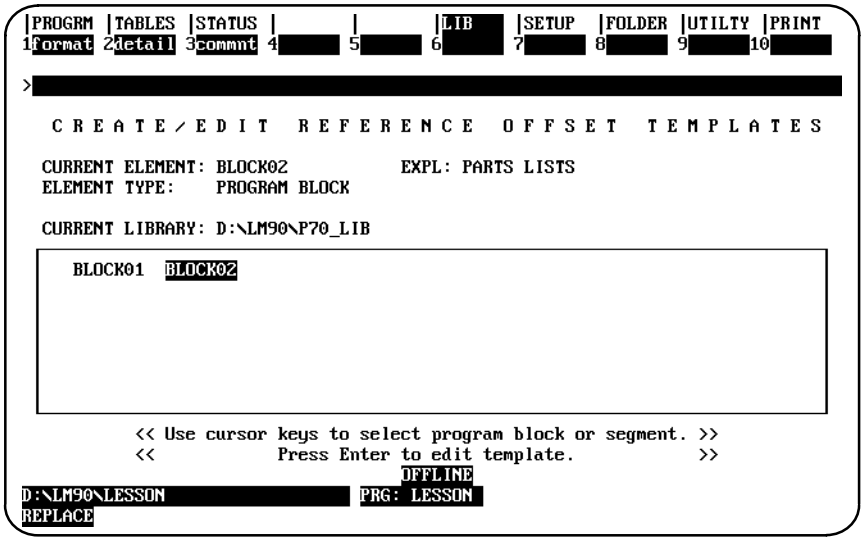
Each program block or segment to be used for an import operation may have a reference offset template in the library. The offset function is used to create or edit this reference offset. The offset function can only be used for ladder diagram language blocks or program segments with no sequential function chart (SFC) variables. It cannot be used for external blocks.

This can be helpful when multiple developers are creating a program, and each programmer is developing a separate block that will later be incorporated into one program. For example, programmers A, B, and C can implement three blocks named _MAIN,MAKE_IT, and PACK_IT, respectively; then, programmer A can integrate the blocks into a program folder named SRC. He can develop a _MAIN block, which calls MAKE_IT and PACK_IT blocks in a folder. Programmer B develops a block MAKE_IT, complete with logic, local data, declarations, and explanations in any folder he wishes. Programmer C does the same for block PACK_IT.

If the folders are on a hard disk, programmers B and C use the copy folder function to copy their work to a floppy disk, which they then turn over to programmer A. Programmer A creates the folder SRC and uses the copy folder function to transfer his folder from the floppy disk to this new folder. Programmers B and C use the export folder function to transfer (export) their program blocks from floppy disk to the LM90 library. Each programmer can create a reference offset template for his block, specifying the start and end reference address ranges. He can also write a block of comment text describing the new blocks.

Programmer A can read the block descriptions in the comment text and view the Program Block Detail screens to learn more about the two blocks. Programmer A then edits the reference offset templates for the MAKE_IT and PACK_IT blocks to specify the new start ranges and nickname substitution characters. This avoids conflicts when the two blocks are integrated into the SRC folder. Programmer A then uses the import function to transfer MAKE_IT and PACK_IT to the SRC folder.

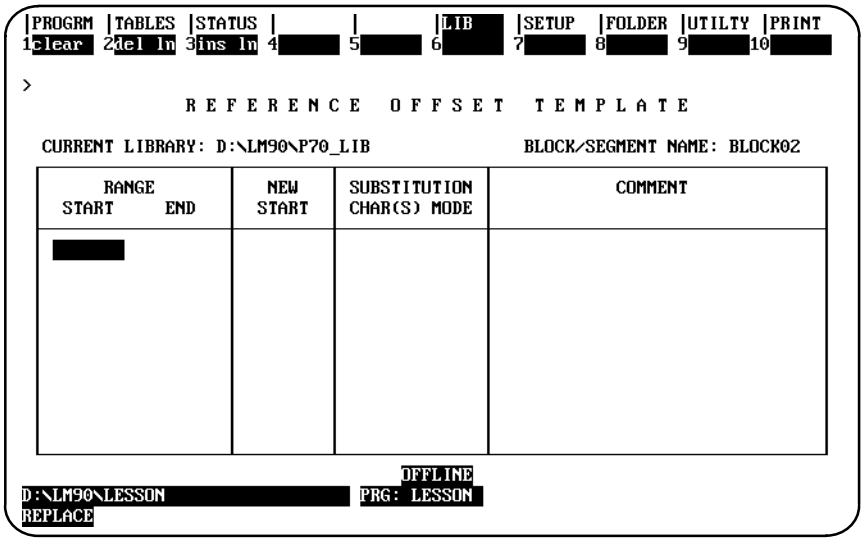
To use the offset function, press **Offset (F7)** from the Librarian Functions menu.



Function Key	Function	Description
F1	Format	Toggle between two display formats. **SHORT*** simply lists the block entries, eight per line, with no explanation. **LONG** places each entry on a separate line, along with its type, date, and 32-character explanation. The date displayed for a program block is the date on the .PRG file in the library. For a program segment, it is the date on the .SDE file. For an external block, it is the date from MS-DOS.
F2	Detail	Display additional information, including memory and reference usage, for elements in the library.
F3	Comment	Display / edit annotation for the selected element. A block of comment text may be associated with any block or segment in the library.

* Default selection.

The Create / Edit Reference Offset Templates screen contains a scrolling window which can be used to view the list of elements currently in the library. The contents of the window may be scrolled using the Page Up and Page Down keys. As with previous librarian screens, the elements may be displayed in either short or long format. Select one of the elements in this window by moving the cursor over the name of the element. Then, press the **Enter** key. The following Reference Offset Template screen will be displayed.



The following function keys are available on the Reference Offset Template screen:

Function Key	Function	Description
F1	Clear	Clear all entry fields on the template. The template will appear as if it had just been entered for the first time. If you try to save an empty template, the template file will be deleted.
F2	Delete Line	Delete the line the cursor is on.
F3	Insert Line	Insert a blank line immediately before the line the cursor is on.

A maximum of ten entries is allowed on this screen. Each entry contains six fields, which may be edited. With the exception of range start and end, these fields are optional.

Field	Description
Range Start / End	Enter the range of reference addresses to be adjusted. For parameterized subroutine blocks, only defined parameters within their declared lengths may be entered in these fields. The entire range of a parameter used by a block or segment may be inserted automatically by entering the range start and range end without specifying an offset. For example, if X1[ ] is entered in both fields, the highest offset for the block or segment is filled in automatically.
New Start	Enter a new beginning reference address for each start and end range. The new reference type must be compatible with reference type listed in the first column for the range. For discrete memory specified in the range fields, only discrete memory may be specified in the ***New Start*** field, and the reference must be byte-aligned. For word-oriented memory specified in the range fields, either word-oriented memory or byte-aligned discrete memory may be specified. Parameterized subroutine block parameters may be entered in the ***New Start*** field. The same rules apply for bit and word PSB parameters as for discrete and word-oriented memory types, described above. For parameterized subroutine blocks, only defined parameters within their declared lengths may be entered in the ***New Start*** field. For segments, any parameter may be entered, as long as it has a valid default name (X1 – X7, Y1 – Y7) and the offset entered and implied by the ***Range*** entry falls within the default limit for the parameter's type. An undefined parameter is assigned a type compatible with the line's Range entry.
Substitution	Add a chosen prefix or suffix to any nicknames associated with offset references. After you have entered the characters in the ***CHAR*** field, select the substitution mode (**PREFIX** or **SUFFIX***) by pressing the **Tab** key. If the ***New Start*** field is blank, no character substitution will be attempted for that entry. If you add a prefix to a long nickname and adding the prefix will result in the nickname exceeding the seven characters allowed, the prefix will write over the same number of characters as are in the prefix. For example, if you add the prefix M_ to the nickname ABCDEFG, which already contains seven characters, the nickname will become M_CDEFG. If you add a suffix to a long nickname and adding the suffix will result in the nickname exceeding the seven characters allowed, the characters in the nickname which exceed the limit will be dropped. For example, if you add the suffix _1 to the nickname ABCD, the nickname will become ABCD_1. If you add the suffix _1 to the nickname ABCDEF, the nickname will become ABCDE_
Comment	Add a description of how the block uses the range.

* Default selection.

Use the cursor keys to move among the entry fields on the template. Use the right arrow key to go to the beginning of an entry line; the cursor will go from the ***Comment*** field to the ***Range Start*** field on the same line. Use the left arrow key to go to the end of the entry line. Use the Up and Down arrow keys to move the cursor between lines.

1. The process of editing a reference offset template may begin in two ways:

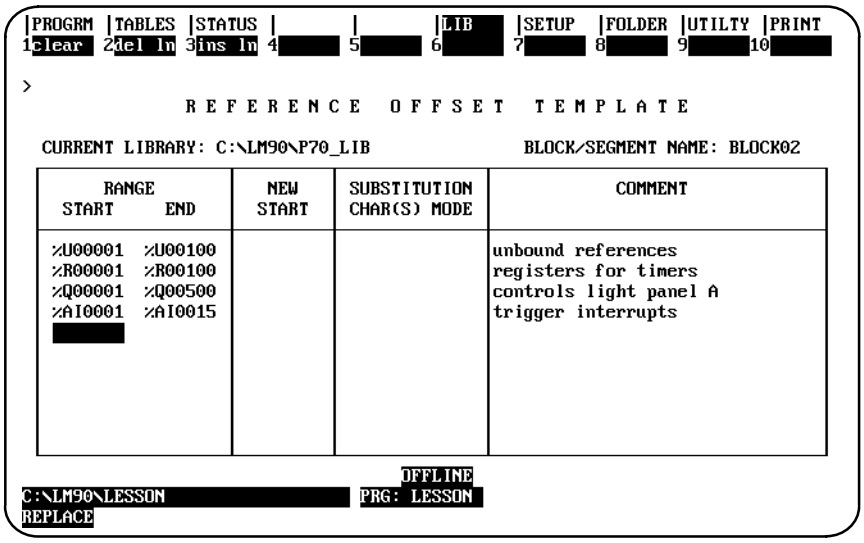
   A. The first way is by pressing the **Enter** key from the Create / Edit Reference Offset Templates screen after selecting a program block or segment. After pressing the **Enter** key, the librarian will begin by checking for disk read errors. If an error is found, you will not be able to enter the Reference Offset Template screen, and an error message will be displayed.

   B. The second way to begin is by pressing the **Enter** key from the import screen when a reference offset template already exists for the selected program block or segment. In this case, you can enter the Reference Offset Template screen and edit an initially clear template if a disk read error is found.

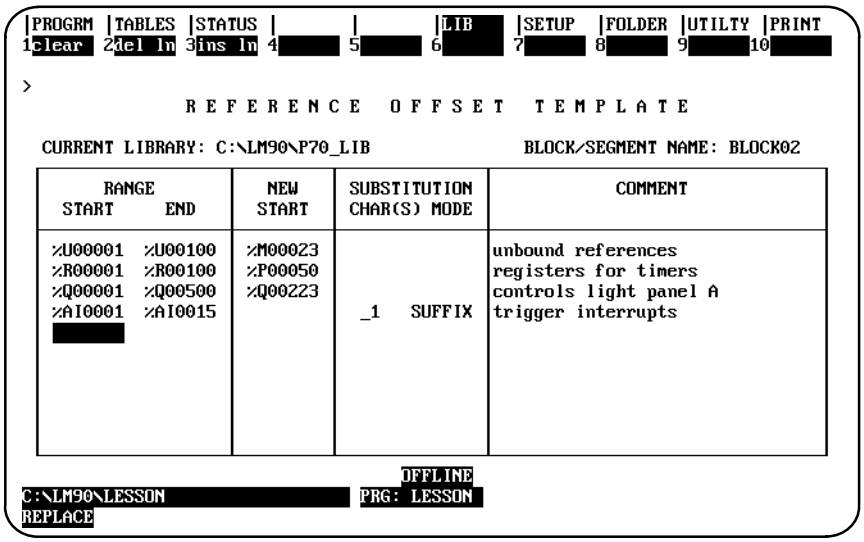
Caution

If a read/write disk error occurs, it may not be possible for the librarian to restore the library to its original contents. In this case, the library may be left with an incomplete entry.

2. On a new reference offset template, the ***Range*** and ***Comment*** columns are completed first. This would typically be done when the block or segment is exported to the library by the author of the block.



3. The template may be edited at a later time to enter new beginning reference addresses in the ***NewStart*** column and substitution characters in the ***Substitution*** column. This is done at or near import to customize the block for the folder it is being brought into.



4. To save the template without exiting the screen, press **ALT-U**. To restore the previous screen contents, press **ALT-A** before saving the template to disk.
5. When you have finished creating / editing the template, press the **Escape** key to save the template, exit this screen, and return to the Librarian Functions menu. If you entered the Reference Offset Template screen through the import process, you will return to the import screen when the Escape key is pressed. When a template has been successfully saved to disk, a completion message is displayed on the message line.

Chapter 7 Programmer Setup

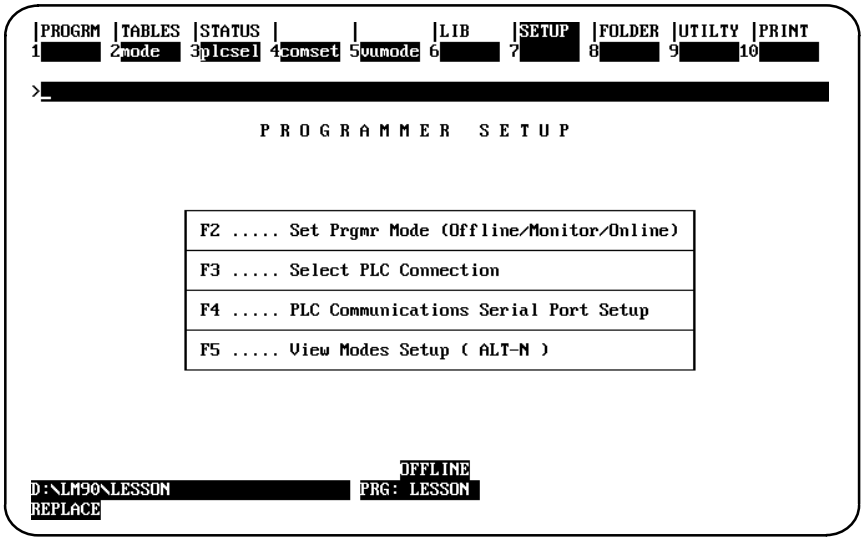
This chapter explains how to set up the programmer for communication with the PLC and how to select the programmer operating mode. It contains the following sections:

Section	Title	Description	Page
1	Printer Serial Port Setup	Explains how to set up ports for printers only.	7-3
2	Programmer Operating Mode	Describes the three operating modes (**OFFLINE**, **ONLINE**, and **MONITOR**) and explains how to select a mode.	7-4
3	SNP / Parallel Connections	Describes how to display a log of SNP IDs defined by the user.	7-6
4	Standard Serial COM Port	Describes the standard serial COM port version of Logicmaster 90-70 software.	7-7
5	WSI Serial Port	Describes the WSI version of Logicmaster 90-70 software.	7-20
6	View Modes Setup (ALT-N)	Explains how to select which modes can be sequenced through when you press **ALT-N**.	7-22

Note

In addition to the Standard Serial COM Port and WSI Serial Port versions, there is a TCP / IP Ethernet version of Logicmaster which is not included in this chapter. For instructions on setting up and using the TCP / IP Ethernet version, refer to the *Logicmaster TCP/IP Ethernet User's Manual* (GFK-1029).

To use the programmer setup features, press **Setup (F7)**.



Note

On computers with a keyswitch, such as the Workmaster or CIMSTAR I industrial computer, the **Mode Selection (F2)** key does not appear on the Programmer Setup screen, unless the keyswitch was disabled during programmer setup.

Section 1: Printer Serial Port Setup

The serial ports, COM1 and COM2, can be used for serial printers. The serial printer port must be configured with the MS-DOS mode command to match the printer settings. The printer settings that must be configured are baud rate, parity, data bits, and stop bits. An example mode command for a serial printer operating on COM2 at 1200 baud, with 8 bits per character, 1 stop bit per character, and no parity bits would be:

```
mode com2:12,n,8,1
```

In the example mode command displayed above, *COM2:* is the port, *12* specifies 1200 baud, *n* specifies no parity, *8* specifies 8 bits per character, and *1* specifies 1 stop bit.

The mode command can be entered as an MS-DOS command or placed in the AUTOEXEC.BAT file. The MS-DOS mode command must be used to configure the serial printer port before entering the Logicmaster 90-70 software package.

If persistent errors occur when printing listings to COM1 or COM2 from within the Logicmaster 90-70 software package, the buffer size on the printer may have to be increased, and the serial baud rate configured for the port may have to be lowered. Read the user manuals provided with your printer and the MS-DOS sections in the manual concerning serial ports, printing, and the mode command.

Note

The standard serial COM port version of Logicmaster 90-70 software requires either the COM1 or COM2 serial port. Do not use the selected Logicmaster 90 serial communications port for serial printing. For more information, refer to section 4, “Standard Serial COM Port,” in this chapter.

Section 2: Programmer Operating Mode

During configuration and programming, the computer will always be in one of three operating modes:

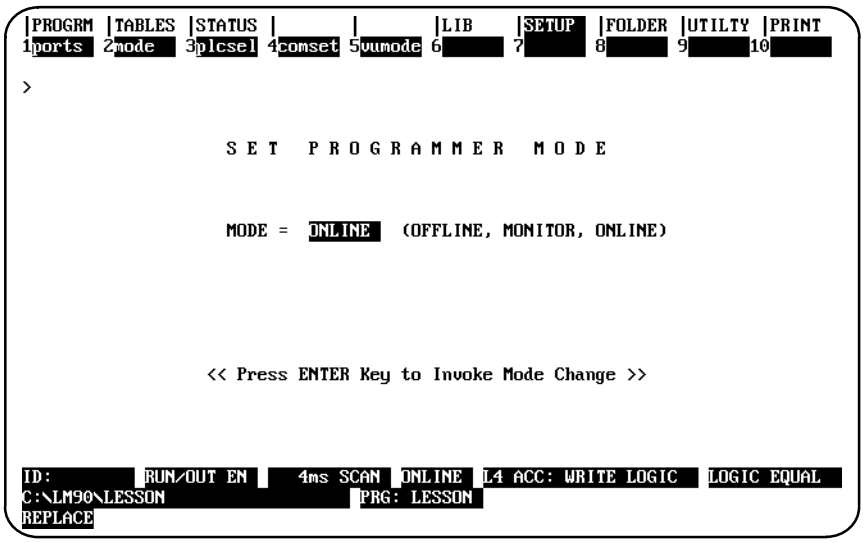
Mode	Description
Offline	**OFFLINE** mode is used for program development. The programmer does not communicate with the PLC in **OFFLINE** mode; power flow display and reference values are not updated.
Online	**ONLINE** mode provides full CPU communications, allowing data to be both read and written.
Monitor	**MONITOR** mode allows programs to be examined and real-time status to be displayed, but no changes of logic, reference values or I / O overrides are allowed. For the Workmaster and CIMSTAR I computers, **MONITOR** mode is the only mode which allows removal of the key from the keyswitch.

Many functions require the computer to be in either **MONITOR** or **ONLINE** mode. To use either of these operating modes, communications must have been established between the computer and the CPU.

Mode Selection

Both the Workmaster and CIMSTAR I computers have a keyswitch which must be used to select the programmer operating mode. The presence of this keyswitch must be indicated in the programmer setup file, as described in appendix D, *Programmer Environment Setup.*

For computers without a keyswitch (e.g., the Workmaster II computer), the programmer mode can be selected by pressing **Mode (F2)** from the Programmer Setup menu or the Serial Port Setup screen. The programmer mode can also be changed by pressing **ALT-M** from another programming function.



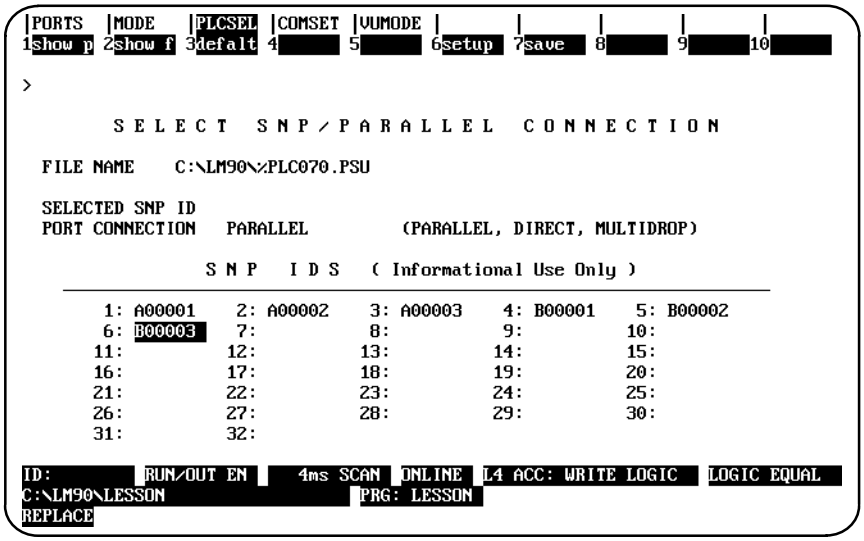
To change the programmer operating mode, use the Tab key to toggle the choices at the cursor position, or type in a new value. Then, press the **Enter** key.

Auto-Verify

Whenever the mode is changed from offline to monitor or online, the Logicmaster 90-70 software will automatically check for logic equality with the attached PLC. This check for logic equality also occurs when selecting a folder or when communications are established with the PLC.

Section 3: SNP/Parallel Connections

The Select SNP / Parallel Connection screen provides a log of SNP IDs defined by the user. Logicmaster 90-70 software does not create or use the information in these fields, but it may be helpful to refer to this listing when selecting a specific SNP ID.



Field	Description
File Name	The name of a disk file containing the PLC selection information. If no file name is entered, the default name %PLC070.PSU is used for the WSI version of Logicmaster 90-70 software. For the standard serial COM port version of Logicmaster 90-70 software, the default name will be %PLC070L.PSU. This field allows you to save the setup parameters to a file other than the default file name. You can then recall the setup from this saved file and perform the setup within that screen.
Selected SNP ID	The name used to identify the PLC to be communicated with. A null string may be specified as the SNP ID by leaving the field blank. This allows communication to any PLC using the currently active serial port setup. The null string SNP ID should be used only for parallel or direct (point-to-point) PLC connections, since all PLCs will respond in a multidrop serial configuration. The SNP ID is limited to seven ASCII characters.
Port Connection	The serial link configuration. The serial port can be set up for parallel, direct (point-to-point) communication with one PLC, or multidrop configuration with several PLCs connected to the WSI Board serial port. Direct connection should not be used with a multidrop configuration. In a multidrop configuration, all PLCs must be set up with the same parity and number of stop bits. They can, however, have a different baud rate.
SNP ID Numbers	These fields allow you to enter the SNP IDs which have already been defined.

Section 4: Standard Serial COM Port

The standard serial COM port version of Logicmaster 90-70 software provides logic programming and configuration for the Series 90-70 PLC, using the COM1 or COM2 serial port instead of a Work Station Interface (WSI) board. This version is available as a separate programming package. It also supports offline programming.

The contents of this programming package include:

- One 5.25-inch High Density diskette, two 3.5-inch Double Density diskettes.
- *Logicmaster 90-70 Programming Software User's Manual*, GFK-0263.
- *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.
- *Important Product Information for the Standard Serial COM Port Version of Logicmaster 90-70 Software*, GFK-0683.
- If the programming package is ordered as IC640HWP706, a Miniconverter Kit, IC690ACC901, is included. The kit consists of an RS-422 (SNP) to RS-232 mini-converter, a 6-foot (2 meter) serial extension cable, and a 9-pin to 25-pin converter plug assembly.

The standard serial COM port version of Logicmaster 90-70 software uses a software communications driver to perform the functions of the WSI board. This communications driver, when added to the Logicmaster 90-70 software, will not fit in the available memory of most computers unless MS-DOS Version 5.0 or a commercially available memory manager is used.

The following steps must be performed in order to establish communications with the Series 90-70 PLC:

1. Configure the computer memory for the communications driver. Logicmaster 90-70 software uses a communications driver that may be loaded into different memory areas. Please refer to "Configuring Memory for the Communications Driver" on page 7-9.
2. If both versions of the software package (WSI or standard serial COM port) are installed on your computer, you must select which version to run from the Start-up Menu's Setup File Editor. Please refer to "Logicmaster 90 Startup Menu" on page 7-11.
3. Connect the cable between the computer's serial port (COM1 or COM2), the RS-422 / RS-485Converter, and the Series 90-70 PLC serial port.

Note

If you have the Miniconverter Kit, IC690ACC901, please refer to GFK-0682 for more information. If you wish to make your own cable, refer to the *Series 90-70 Programmable Controller Installation Manual*, GFK-0262, for more information.

4. Set up the computer's serial port to be used for PLC communications. It should match the characteristics of the Series 90-70 PLC serial port. Please refer to "Setting up the Computer's Serial Port," on page 7-12.

Requirements

To run the standard serial COM port version of Logicmaster 90-70 software, you will need:

Requirement	Description
MS-DOS	MS-DOS Version 5.0 or later.
Memory Manager	MS-DOS Version 5.0 or a memory manager that complies with one of the following specifications: • The LIM / EMS (Lotus Intel Microsoft / Expanded Memory Specification) Version 3.2 or later. • The XMS (eXtended Memory Specification) Version 2.0 or later. • A list of some compliant memory managers is included at the end of this section.
Computer	A Workmaster II, Zenith Mastersport SL Notebook, or other computer with 80386 or higher processors and at least one available COM port.
Hard Disk	At least 4 Megabytes of hard disk space.
RAM	At least 545K (558,080) bytes of available RAM and 49K of High Memory Area, Upper Memory Block, Conventional Memory, or Expanded Memory.
Miniconverter Kit	A Miniconverter Kit, IC690ACC901, may be ordered. This kit contains the necessary cable and converter to connect from your computer to the Series 90-70 PLC.

Port Requirements

The standard serial COM port version requires at least one standard serial COM port in the host computer in order to provide communications with the PLC. This version will support either the COM1 or COM2 port in common use by IBM-compatible machines. These ports must use the INS8250 UART chip, or functional equivalent. The COM1 port has I / O addresses starting at 3F8H, and it uses interrupt line IRQ4 (interrupt 0CH). The COM2 port has I / O addresses starting at 2F8H, and it uses interrupt line IRQ3 (interrupt 0BH). Other serial ports, or ports which do not adhere to these conventions, are not recognized.

While the standard serial COM port version of Logicmaster 90-70 software is active, the serial port assigned to PLC communications will be used exclusively for PLC communications. If a serial printer is being used, a second serial port is required; or you may direct print output to disk files, and then use MS-DOS to print the disk files while outside the Logicmaster environment.

The standard serial COM port version of Logicmaster 90-70 software monitors Clear-to-Send (CTS) to determine a cable disconnect. Therefore, Logicmaster 90-70 software must use a connection with the Series 90-70 PLC that will keep its Request-to-Send (RTS) active in **ONLINE** or **MONITOR** mode. The RTS at the PLC must be connected to CTS at the Logicmaster computer serial port. Half-duplex modems cannot be used with Logicmaster 90-70 software since they rely on RTS / CTS flow control, which is not supported by the software.

The standard serial COM port version of Logicmaster 90-70 software supports multi-drop connections, using RS-422 4-wire hookups or modems. RS-422 multi-drop will work as long as the Series 90 PLC slaves transmit only in response to requests from an attached Logicmaster host.

Configuring Memory for the Communications Driver

The standard serial COM port version of Logicmaster 90-70 software requires a communications driver that may be loaded in different memory areas. The communications driver requires 64K bytes of memory. A memory manager may be required, depending on the computer and the amount of installed memory.

MS-DOS Memory Areas Defined

One of the following memory areas is used to load the communications driver:

- Extended Memory, consisting of the High Memory Area and extended memory blocks.
- MS-DOS System Memory, consisting of Conventional Memory and Upper Memory.
- Expanded Memory.

Type	Description
High Memory Area	65,520 bytes of memory space just above the 1 Megabyte boundary (addresses 0FFFFF to 10FFFF). This area can only be accessed by a computer with 80286 / 80386 / 80486 microprocessors. PCs with 8086 / 8088 / 80188 / 80186 microprocessors cannot address this memory space. Use of the High Memory Area (HMA) requires either HIMEM.SYS or QEMM-386™ memory manager. The memory manager must comply to the Extended Memory Specification XMS 2.0. For more information on using the High Memory Area on an 80386 (Workmaster II) or higher computer, refer to page 7-15.
Upper Memory Block	Memory space between 640K and 1 Megabyte. This memory space is usually used for BIOS or video RAM. On computers with 80386 / 80486 microprocessors and extended memory installed, extended memory can be mapped into this area with the aid of a memory manager or MS-DOS Version 5.0. If you want the communications driver loaded into this area, you can configure the memory manager to make this area available. For more information on using the Upper Memory Block on an 80386 (Workmaster II) or higher computer., refer to page 7-16.
Conventional Memory	The first 640K of memory addresses. It is sometimes referred to as low memory (RAM) or base memory (RAM). For more information on using conventional memory on an 80386 (Workmaster II) or higher computer, refer to page 7-17. For more information on using video RAM on an 80386 (Workmaster II) or higher computer, refer to page 7-18.
Expanded Memory	The user-installed memory option that can be accessed with an expanded memory manager through a page frame area between the MS-DOS 640K and 1024K addresses (e.g., GEXMEM). The communications driver may be loaded to the page frame area. This memory area is suitable for computers with Intel 80xx family processors. Some laptop personal computers with 8086 / 8088 microprocessor and 1 Megabyte of memory come with an expanded memory manager driver (for example, Toshiba 1200). The memory managers must comply to the Lotus / Intel / Microsoft LIM Expanded Memory Specification 3.2 or later. For more information on using Expanded Memory on an 80386 (Workmaster II) or higher computer, refer to page 7-18.

™ QEMM-386 is a trademark of Quarterdeck Office Systems.

Communications Driver Load Order

The communications driver is loaded into the first available memory area found, according to the following sequence (if the option selected from the PLC Communications Options screen is automatic). Refer to appendix D, "Programmer Environment Setup," to specify the area for the communications driver.

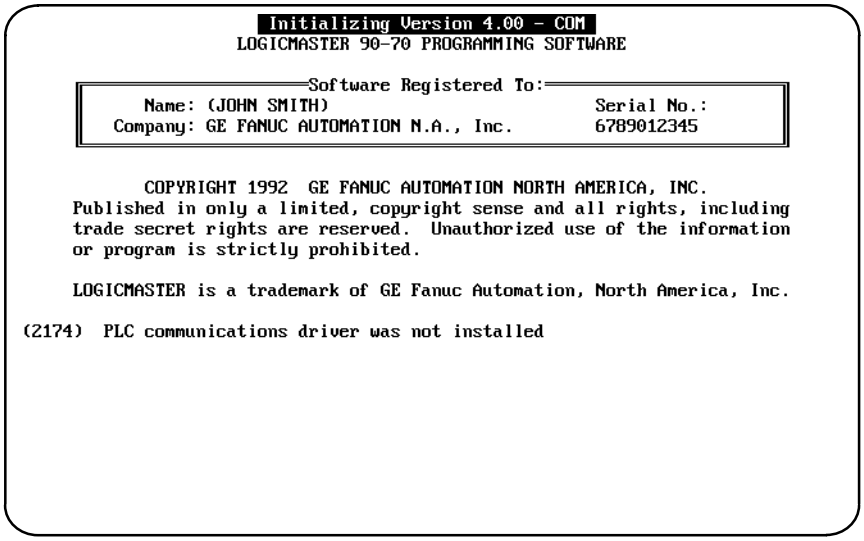
1. If the High Memory Area is free and the computer supports the High Memory Area, the driver is installed in the High Memory Area.
2. If the High Memory Area is not available, Logicmaster 90-70 software will look for the Upper Memory Block area. If there is enough space for the driver, the driver can be installed in the Upper Memory Block space.
3. Then, Logicmaster 90-70 software will examine the MS-DOS conventional memory. If the MS-DOS conventional memory space is large enough for Logicmaster 90-70 software and the communications driver to coexist, the driver will be installed in the MS-DOS memory space as a Terminate-and-Stay-Resident (TSR) program.
4. Next, Logicmaster 90-70 software will examine the Expanded Memory. If the expanded memory manager is installed, the loader will try to allocate an expanded memory page frame area and install the driver in the page frame area.
5. If all these steps fail, the driver is not installed and the following prompt will be displayed: "Do you wish to continue? (Y/N)" If you answer: **Y**, you may program offline without PLC communication capability.
6. If you still wish to communicate, you must ensure that one of the memory areas listed in steps 1 through 4 above is available.

Note

The PLC Communications Serial Port Setup screen in the setup function of Logicmaster 90-70 software will display where the communications driver was loaded. Refer to "Setting Up the Computer's Serial Port" on page 7-12 for more information.

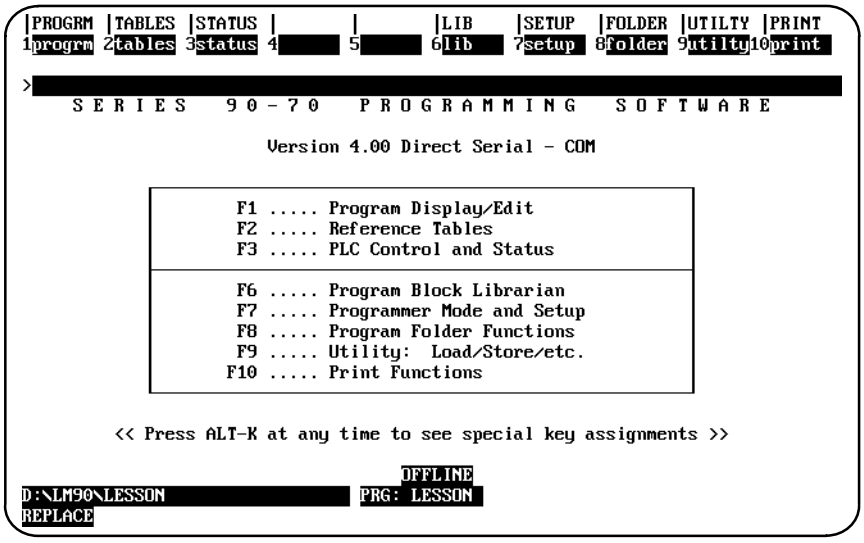
Running Logicmaster 90 Software

When the standard serial COM port version of the software package is entered, the software will attempt to install the correct communications driver in the available memory space. If the driver cannot be installed, the following screen is displayed:



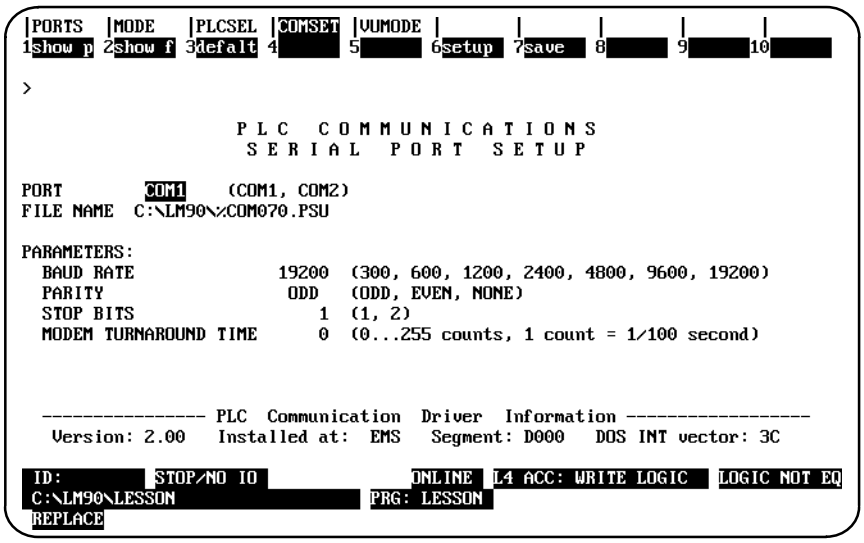
The software will prompt you to continue. If you enter **N** after the prompt, the Logicmaster 90 main menu is displayed. You may then exit back to MS-DOS to correct the memory problem.

If you enter **Y**, the software will proceed without PLC communication capability. (You may program offline.) The main menu screen is then displayed. For example, the programmer software would display this screen:



Setting Up the Computer's Serial Port

The computer's serial port (COM1 or COM2) may be set up from the PLC Communications Serial Port Setup screen in the setup function. Press **Communications Setup (F4)** from the Programmer Setup menu to display the PLC Communications Serial Port Setup screen shown below:



Field	Description
Port Selection	Select the serial COM port (COM1 or COM2) to be used for communicating with the PLC.
Setup File Name	The default file name for saving the setup parameters is changed from %WSI070.PSU to %COM070.PSU, to avoid any confusion with the WSI-based version. The %COM070.PSU will contain additional information, such as the COM port selection, which is not present in the %WSI070.PSU file.
Parameters	Press **Default(F3)** to set the parameters on this screen to their default values. The PLC CPU defaults to these parameters, as displayed on the screen shown above (e.g., 19200 baud, odd parity, 1 stop bit, etc.). These parameters must match the CPU slot configuration that was last stored to the PLC before communications can be established (see chapter 11, section 3, "Configuring the CPU Module"). **Baud Rate**: The transmission rate, in bits per second, of data through the port. **Parity**: Specify whether parity is **odd** or **even**, or, if no parity bit is needed, select **none**. To toggle the selections, place the cursor on the field and press **Tab** to toggle forward, or **Shift-Tab** to toggle backward. **Stop Bits**: All serial communications uses at least one stop bit. Slower devices may use two stop bits. **Modem Turnaround Time**: The time required for the modem to start data transmission after receiving the transmit request. If no modem is used, specify zero. When the PLC is connected through a modem, the value **must** be one or greater.
PLC Communication Driver Information	Information on the communications driver, including: • Version. • Where the driver was installed: High Memory Area (HMA), Expanded Memory (EMS), Conventional MS-DOS Memory (DOS), or Upper Memory Block (UMB). Area. • MS-DOS segment address at which the driver is loaded. • MS-DOS INT vector that it will use.

Setting up the Port

To set up the serial port, enter the appropriate values in the fields on the Serial Port Setup screen. Once all the values have been entered, press **Setup (F6)**.

Displaying Port Settings

The current settings for the Serial Port Setup screen can be displayed by pressing **Show Port (F1)**.

Pressing **F1** while completing the screen will delete all the changes that have been made. The previous settings of the current driver will then be re-displayed on the screen.

Saving the Port Setup

A copy of the current serial port settings may be saved to a disk file by pressing **Save (F7)**. The data is saved to a separate file. If no file name is specified, a default name is assigned.

To create a file of settings which is not automatically invoked, a file name other than the default name can be specified. If no path is given, the current default directory is used. If no file extension is provided, .PSU is used.

When **Save (F7)** is pressed, the settings are stored to a file and also set up on the port.

Displaying File Settings

The settings currently stored in a file can be viewed by first entering the file name and then pressing **Show File (F2)**. If no path is specified, the current default directory is used. If no file extension is provided, .PSU is used. If the ***File Name*** field is blank, the default setup file settings are displayed.

Port Usage Conflicts

The standard serial communications version will reserve one of the COM ports for PLC communications. To avoid any conflicts, you should follow these guidelines:

Conflict	Description
Setup Files	The setup file looked for during system initialization is %COM070.PSU. This file is used to initialize the PLC communications port. If more than one setup file is found for the designated PLC communications port, the PLC communications file %PLC070L.PSU will take precedence.
User Setup	If the Printer Serial Port Setup screen is displayed and you attempt to perform a setup on the designated PLC communications port, a warning is displayed and the setup is not done.
Print Destinations	The Print utility provides several screens for selecting the print output device. Any attempt to select the designated PLC communications port as the output device is denied.

Memory Manager Specifications

Any memory manager used to support the standard serial COM port version of Logicmaster 90-70 software must comply with one of the following specifications:

1. LIM / EMS (Lotus Intel Microsoft / Expanded Memory Specification) Version 3.02 or later.
2. XMS (eXtended Memory Specification) Version 2.0 or later.

Compliant Memory Managers

The following are some drivers which comply with the memory manager specifications listed above:

3. QEMM-386 (Quarterdeck Expanded Memory Manager for 386). This driver can be used on computers with 80386 / 80486 microprocessors. It is available from:

Quarterdeck Office Systems
150 Pico Boulevard
Santa Monica, CA 90405
(213) 392–9701

4. QEMM (Quarterdeck Expanded Memory Manager). This driver can be used on computers with 8086 / 8088 microprocessors. It can be ordered from same address listed above.
5. HIMEM.SYS (MS-DOS Version 5.0) from Microsoft Corporation. This Microsoft memory manager complies with XMS specification. It can be used on computers with 80386 / 80486 microprocessors.
6. EMM386.SYS (MS-DOS Version 5.0) from Microsoft Corporation. This Microsoft memory manager simulates expanded memory while using extended memory. It can be used on computers with 80386 / 80486 microprocessors.
7. BlueMAX™ for PS / 2 computers and 386MAX™ for 80386 AT-based computers. Both are available from:

Qualitas, Inc.
7101 Wisconsin Avenue, Suite 1386
Bethesda, MD 20814
(301) 907–6700

Restrictions

To avoid conflicts of memory usage between the standard serial COM port version of Logicmaster 90-70 software and MS-DOS programs, the following rules must be followed:

1. If the computer is set up to use the High Memory Area memory area, the VDISK program must not be used. Any program using VDISK must remove VDISK before running the Logicmaster 90-70 software.
2. Another application cannot use Expanded Memory if the communications driver is loaded into Expanded Memory.

™ BlueMAX and 386MAX are trademarks of Qualitas, Inc.

Using High Memory Area on 80386 (Workmaster II) Or Higher Computers

Physical Extended Memory for High Memory Area Operation

If not already present, you must add and configure physical memory on your computer to be accessed in memory addresses over 1 Megabyte (FFFFF).

386 Memory Manager

You must install a 386 high memory manager such as Microsoft HIMEM.SYS (MS-DOS Version 5.0), Quarterdeck QEMM-386 or 386MAX. The memory manager should be compliant with the Extended Memory Specification (XMS) Version 2.0 or later.

You can install HIMEM to allow use of the High Memory Area.

1. Verify that your CONFIG.SYS file contains a device command for the HIMEM.SYS extended memory manager (or another memory manager that conforms to the XMS specification). For example:

```
device=c:\dos\himem.sys
```

2. If you have MS-DOS 5.0 (or higher) and wish to use the High Memory Area, do not load MS-DOS into the High Memory Area. (The CONFIG.SYS file should not have a DOS=HIGH command.)
3. Restart your computer by pressing **CTRL-ALT-Delete**.

Using Upper Memory Block on 80386 (Workmaster II) Or Higher Computers

Physical Extended Memory for Upper Memory Block Operation

If not already present, you must add and configure physical memory on your computer to be accessed in memory addresses over 1 Megabyte (FFFFF).

386 Memory Manager

You should install a 386 memory manager such as Microsoft EMM386 (MS-DOS Version 5.0), Quarterdeck QEMM-386 or 386MAX. The memory manager must be compliant with the Extended Memory Specification (XMS) Version 2.0 or later.

With MS-DOS 5.0 (or higher), you can install HIMEM and EMM386 to allow use of the Upper Memory Block.

1. Verify that your CONFIG.SYS file contains a device command for the HIMEM.SYS extended memory manager (or another memory manager that conforms to the XMS specification). For example:

```
device=c:\dos\himem.sys
```

2. Add a device command for EMM386 to your CONFIG.SYS file. The device command for EMM386 must come after the device command for HIMEM and before any commands for device drivers that use expanded memory. For example:

```
device=c:\dos\emm386.exe 1024 ram
```

Note

With MS-DOS 6.0, more upper memory can be obtained from B000 – B7FF that is reserved for monochrome VGA display memory; however, this address space is unused on most computers. To enable extra UMBs, include this address range using the following command line instead of the one above:

```
device=c:\dos\emm386.exe 1024 ram i=b000-b7ff
```

3. Add a DOS=HIGH command to the CONFIG.SYS file. For example:

```
dos=high,umb
```

4. Restart your computer by pressing **CTRL-ALT-Delete**.

Using Conventional Memory on 80386 (Workmaster II) Or Higher Computers

Extended Memory and MS-DOS 5.0

If you have MS-DOS 5.0 (or higher), you can load MS-DOS into high memory. This will free more conventional memory for Logicmaster 90-70 software and the communications driver. You must have at least 590K bytes RAM free.

1. Verify that your CONFIG.SYS file contains a device command for the HIMEM.SYS (MS-DOS Version 5.0 or higher) extended memory manager and the command to load MS-DOS into high memory. For example:

```
device=c:\dos\himem.sys
dos=high
```

2. Restart your computer by pressing **CTRL-ALT-Delete**.

Using Expanded Memory on an 80386 (Workmaster II) Or Higher Computer

Extended Memory

You must install a 386 memory manager such as Microsoft EMM386 (MS-DOS Version 5.0 or higher), Quarterdeck QEMM-386 or 386MAX. These memory managers use extended memory to simulate expanded memory. The memory manager should be compliant with the Extended Memory Specification (XMS) Version 2.0 or later.

386 Memory Manager

To install EMM386 as an expanded-memory emulator:

1. Verify that your CONFIG.SYS file contains a device command for the HIMEM.SYS extended memory manager (or another memory manager that conforms to the XMS specification). For example:

```
device=c:\dos\himem.sys
```

2. Add a device command for EMM386 to your CONFIG.SYS file. The device command for EMM386 must come after the device command for HIMEM and before any commands for device drivers that use expanded memory. For example:

```
device=c:\dos\emm386.exe 1024 ram
```

3. Disable or remove any other device commands for expanded memory managers.
4. Restart your computer by pressing **CTRL-ALT-Delete**.

Using Video RAM on an 80386 (Workmaster II) Or Higher Computer

As described above, the QEMM VIDRAM program from Quarterdeck Office Systems can use the EGA / VGA graphic display memory to gain additional MS-DOS conventional memory for use by the communications driver. The graphic display memory (if your EGA / VGA has 64K to 96K graphic memory) can be turned into 64K to 96K contiguous memory following the 640K conventional memory.

1. Verify that your CONFIG.SYS file contains a device command for the QEMM memory manager. For example:

```
device=c:\qemm\qemm386.sys
```

2. Verify that your AUTOEXEC.BAT file contains a command for the VIDRAM program. For example:

```
c:\qemm\vidram on
```

Tested Configurations

Listed below are configurations which have been tested using the Standard Serial COM Port version of Logicmaster 90-70 software. GE Fanuc offers this list as a guide to selecting compatible hardware for this version of software. These products have demonstrated compatibility with GE Fanuc via in-house testing and / or customer reports; however, hardware manufacturers' modifications to their products may affect compatibility. This list is not exhaustive and is offered as a guide only. No endorsement of any particular product is intended. If you have any questions, please contact the GE Fanuc Hotline, 1-800-GEFANUC.

Computer	MS-DOS / Memory Manager	CONFIG.SYS File *
Zenith Data Systems Z-Note 433 Lnc+ (Driver in MS-DOS)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
Zenith Data Systems Z-Note 433 Lnc+ (Driver in UMB)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high,umb
Zenith Data Systems Z-Note 433 Lnc+ (Driver in EMS)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
Gateway 2000 4DX-33 (Driver in MS-DOS)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
Gateway 2000 4DX-33 (Driver in UMB)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram i=b000-b7ff dos=high,umb
Gateway 2000 4DX-33 (Driver in EMS)	MS-DOS 6.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
Workmaster II (Driver in MS-DOS)	MS-DOS 5.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
Workmaster II (Driver in UMB)	MS-DOS 5.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high,umb
Workmaster II (Driver in EMS)	MS-DOS 5.0 Microsoft HIMEM	device=c:\dos\himem.sys device=c:\dos\emm386.exe 1024 ram dos=high
ZEOS 486 (Driver in MS-DOS)	MS-DOS 6.0 QEMM 6.0	device=c:\dos\qemm386.sys dos=high
ZEOS 486 (Driver in UMB)	MS-DOS 6.0 QEMM 6.0	device=c:\dos\qemm386.sys ram=D000-Dfff dos=high

* Each CONFIG.SYS file contains the lines: files=20 and buffers=48.

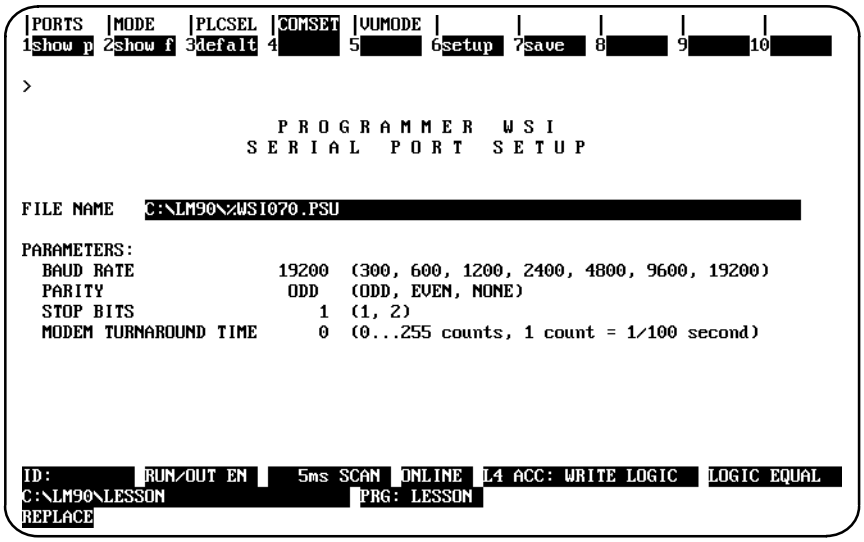
Note

If your computer has a WSI card, the switch **`x=ce00-cfff`** should be added to the **`device=c:\dos\emm386.exe`** lines above to reserve this area of memory for its use. For optimum performance, SMARTDRV should be used.

Section 5: WSI Serial Port

The serial port on the Work Station Interface (WSI) Board in the programmer provides serial communication between the programmer and the attached PLC. The WSI serial port setup functions are used to configure the WSI serial port, and to save or recall those configurations from disk files. If you do not have a WSI Board for serial communications, please turn to the information on PLC communications serial port setup in section 4, "Standard Serial COM Port."

To display the WSI Serial Port Setup screen, press **COMSET (F4)** from the Programmer Setup menu.



Note

The PLC CPU defaults to the parameters displayed on this screen (e.g., 19200 baud, odd parity, etc.) These parameters must match the CPU slot configuration that was last stored to the PLC before communications can be established (see chapter 11, section 3, *Configuring the CPU Module*).

The WSI serial port settings may be viewed, changed, saved to a disk file, or recalled from a disk file in all modes of operation by pressing the appropriate function key.

Field	Description
File Name	The name of a disk file containing the WSI port setup parameters. If no file name is entered, the default name %WSI070.PSU is used. This field allows you to save the setup parameters to a file other than the default file name. You can then recall the setup from this saved file and perform the setup within that screen.
Parameters	Press **Default(F3)** to set the parameters on this screen to their default values. The PLC CPU defaults to these parameters, as displayed on the screen shown above (e.g., 19200 baud, odd parity, 1 stop bit, etc.). These parameters must match the CPU slot configuration that was last stored to the PLC before communications can be established (see chapter 11, section 3, *Configuring the CPU Module).* **Baud Rate:** The transmission rate, in bits per second, of data through the port. **Parity:** An ASCII character may consist of either seven or eight data bits. Specify whether parity is indicated by an odd or even number of bits, or whether no parity bit is added to the word. **Stop Bits:** All communications use one stop bit. Slower devices may use two stop bits. **Modem Turnaround Time:** The time required for the modem to start data transmission after receiving the transmit request. If no modem is used, specify zero. When the PLC is connected through a modem, the value **must** be one or greater.

Setting Up a Port

To set up the serial port, enter the appropriate values in the fields on the WSI Serial Port Setup screen. Once all the values have been entered, press **Setup (F6)**.

Displaying Port Settings

The current settings for the WSI Serial Port Setup screen can be displayed by pressing **Show Port (F1)**.

Pressing **F1** while completing the screen will delete all the changes that have been made. The previous settings of the current driver will then be re-displayed on the screen.

Saving the Port Setup

A copy of the current serial port settings may be saved to a disk file by pressing **Save (F7)**. The data is saved to a separate file. If no file name is specified, a default name is assigned.

To create a file of settings which will not be automatically invoked, a file name other than the default name can be specified. If no path is given, the current default directory is used. If no file extension is provided, .PSU is used.

When **Save (F7)** is pressed, the settings are stored to a file and also set up on the port.

Displaying File Settings

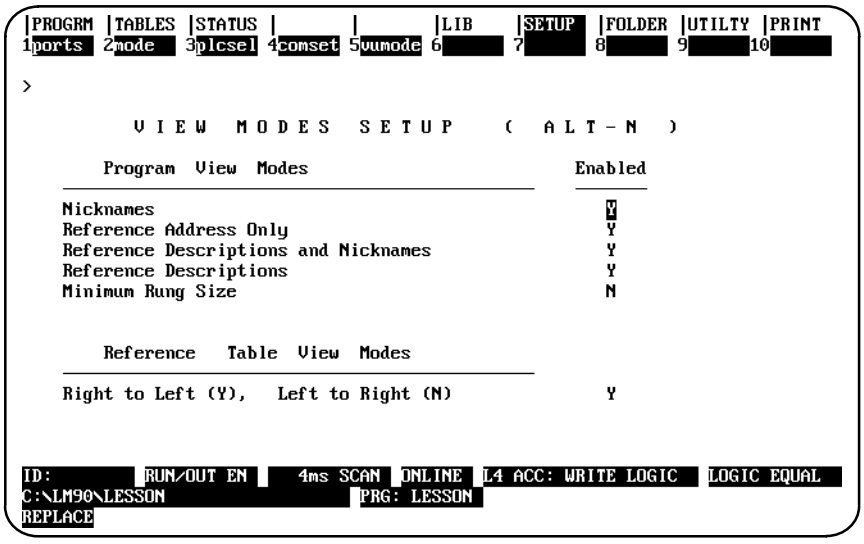
The settings currently stored in a file can be viewed by first entering the file name and then pressing **Show File (F2)**. If no path is specified, the current default directory is used. If no file extension is provided, .PSU is used. If the ***File Name*** field is blank, the default setup file settings are displayed.

Section 6: View Modes Setup (ALT-N)

The view mode setup function enables you to specify which modes are displayed when you press **ALT-N**. These view modes range from showing only rung references to showing reference names and reference descriptions in an expanded rung form (display all mode). You can also view the maximum amount of program logic on a screen by selecting a compressed rung mode.

The Home, End, Page Up, Page Down, Previous, Next, and cursor keys function the same, regardless of the view mode selected.

Display modes are selected from the View Modes Setup screen. To display this screen, press **View Mode (F5)** from the Programmer Setup menu.



When the View Modes Setup screen is displayed, the mode selections which were last saved are shown. The default selections are **Y** (Yes) for all the programmer view modes, except minimum rung size mode whose default selection is **N** (No).

Use the Up and Down cursor keys to move between selection fields. Then, use the Tab key to toggle each selection between **Y** (Yes) and **N** (No), or enter **Y** for the view modes you want to sequence through when you press **ALT-N**. Enter **N** to disable the modes you do not want to sequence through.

To validate and save the view mode selections in the home directory file %LM090.PSU, press **ALT-U** or the **Escape** key. At least one selection must be **Y** (Yes) in order for the selections to be valid. If all view mode selections are **N** (No), an error message is displayed and the selections are not saved.

To abort the selections and use the last saved setup, press **ALT-A**.

Changing the View Mode

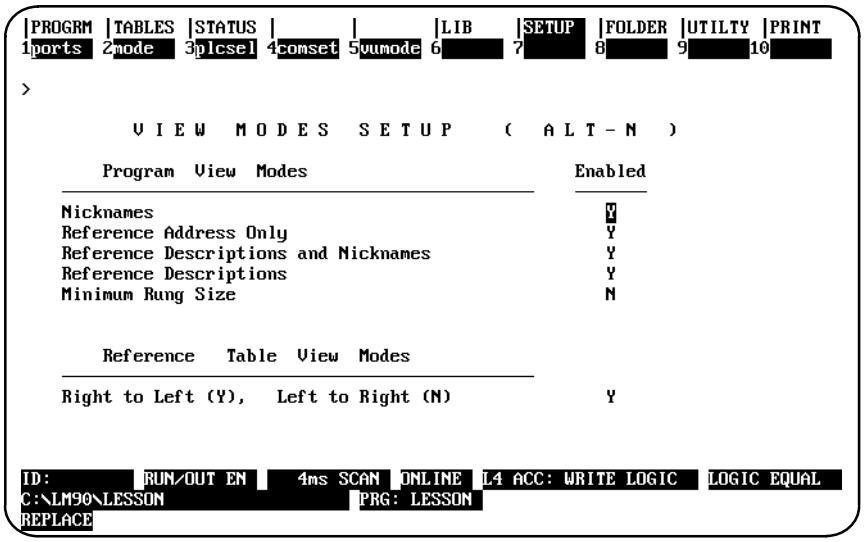
The ALT-N key sequence also enables you to display table data either right to left (lowest reference address on the right) or left to right (lowest reference address on the left). The view mode can be changed in any fixed or mixed table and in any program mode (**OFFLINE**, **ONLINE**, or **MONITOR**).

Note

The print function does not distinguish between these two display modes and prints all tables right to left.

The default view mode is the last view mode selected with ALT-N. If the view mode has never been changed, the default set in the programmer setup is used.

1. The default reference table view mode is displayed on the View Modes Setup screen. To display this screen, press **View Modes Setup (F5)** from the Programmer Setup menu. The view mode in the following screen is right to left (the default display).

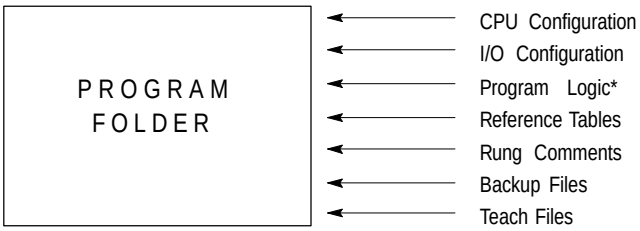


2. To change the default view mode to display left to right, move the cursor to the ***Enabled*** field for the ***Reference Table View Modes*** entry. Then, use the Tab key to toggle the selection to **N** (No) or enter **N**.

3. To validate and save the default view mode selection in the home directory file %LM090.PSU, press **ALT-U** or the **Escape** key.

Chapter 8 Program Folders

Series 90 programs and configuration data are stored in folders. A folder is an MS-DOS subdirectory which contains all the information about one RLD program. A folder can contain standalone C programs or an SFC programs. For more information about options for multiple programs, refer to chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual* (GFK–0265, revision G or later). Folders must be created using Logicmaster 90-70 software. An existing MS-DOS directory cannot be used as a folder.



* The representation shown above is based on an RLD program with no additional standalone C programs.

Drawer

A drawer is an MS-DOS directory path which contains one or more folders.

Note

Drawers must be created using MS-DOS before they can be used by Logicmaster 90-70 programming software.

When Logicmaster 90-70 software is entered, the current MS-DOS directory is the default drawer. The default drawer may be changed from the Select screen by pressing **ALT-C** to clear the ***Program Folder*** field and then entering the MS-DOS directory path (ending in \) of the subdirectory containing the folders you want, for example: **`C:\LM90\FOLDERS\`**.

Refer to appendix I for an explanation of the files created with Logicmaster 90-70 software.

Program Folder Names

Every program will reside in its own program folder. The name of the program in the folder and the program folder will be the same (except for the TEMP folder, described below). The folder name is the program name in the PLC. The software will check these names to be sure they match. Programming functions, such as loading a program from the PLC to a Logicmaster 90-70 folder, are not allowed if the names do not match.

TEMP Program Folder

The special program folder TEMP does not require the folder name and program name to match. The TEMP folder can be used if you need to view a user program and monitor its operation when you do not have the original folder on your machine.

The TEMP folder can also be used to load a copy of a program in the PLC and modify it, without overwriting the previous version.

Note

Annotation files (nicknames, reference descriptions, and comment text) remain in the folder and are not stored to the PLC. Therefore, when loading a program from the PLC to the TEMP folder, the annotation will be missing. Those files are still in the original folder where the program was developed. If another program was developed in the TEMP folder prior to the store operation, the annotation in the recently loaded program will actually belong to the previous program.

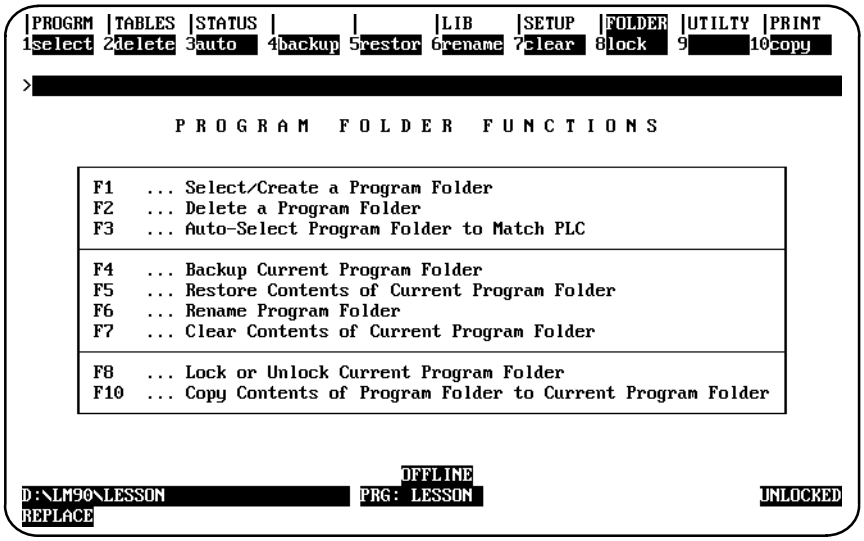
Using Program Folder Functions

Both the configuration software and programming software provide a group of program folder functions. These functions can be used to create, select, delete, back up, restore, rename, clear, lock / unlock, or copy program folders.

Caution

Do not use MS-DOS to copy individual files from one folder to another or to delete files. Doing so may produce unexpected results. MS-DOS may only be safely used to copy an entire program folder to another program folder of the same name. If MS-DOS functions have been used to place program files into a program folder with a different name, you will not be able to select the program folder.

To use a program folder function, press **Folder (F8)** from the main menu. The following screen is displayed in the programming software package. The Rename (F6) and Copy (F10) functions are not available in the configuration software.



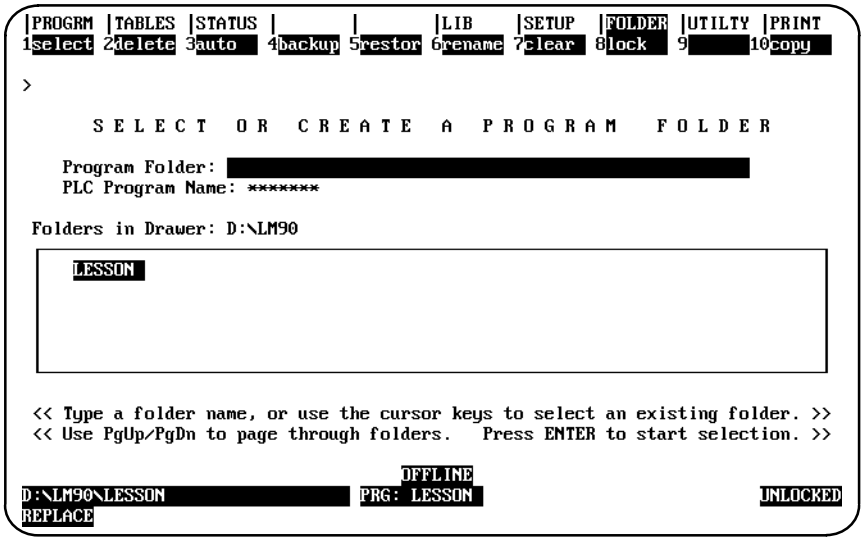
Function Key	Function	Description	Page
F1	Select	Create a new program folder, or select a previously created folder.	8-4
F2	Delete	Remove a program folder that is no longer needed.	8-7
F3	Auto	Automatically select the correct program folder and attempt to verify equality with the PLC program.	8-5
F4	Backup	Make a backup archive of the current program folder.	8-8
F5	Restore	Restore a program folder from its backup archive.	8-10
F6	Rename	Rename a program folder to a new folder name. F6 is not active in the configuration software package.	8-12
F7	Clear	Clear the contents of the current program folder.	8-13
F8	Lock	Lock or unlock a program folder. Locking a program folder prevents its files from being changed or deleted.	8-14
F10	Copy	Copy a program folder into the current program folder. Use this function to make a copy of a program folder that can be modified while retaining the original. F10 is not active in the configuration software package.	8-15

Note

If a folder contains locked program blocks, these blocks remain locked when the Logicmaster 90-70 software copy, backup, and restore folder functions are used. For more information on locking and unlocking program blocks, refer to chapter 3, section 8, “Program Blocks, External Blocks, and Interrupts.”

Selecting/Creating Program Folders

To create a new program folder or use one that already exists, press **Select (F1)** from the Program Folder Functions menu.



Note

Once you edit a program folder using Release 4 of Logicmaster 90-70 software, you cannot use this folder with an earlier release of software.

The name of the last folder selected is shown in reverse video in the ***Program Folder*** field. Other program folders in the current drawer are also listed on the screen. If the attached PLC contains a user program, the name of this program appears in the ***PLC Program Name*** field. If the attached PLC does not contain a user program, this field is blank. If the programmer is offline or not connected to a PLC, this field contains asterisks. This field may not be edited.

To select a folder in the current drawer, move the cursor to the desired folder name or type the name of the program folder in the ***Program Folder*** field, and press the **Enter** key. (This is also the name of the program.) The name can have up to seven characters. If a second diskette is inserted after a folder has already been selected or created on the first diskette, the list of folders is not updated. In order to have the folder list updated, you must reselect the drawer (e.g., enter **A:**.

To select a folder in a different drawer, first select the drawer by entering the drawer MS-DOS path, ending with a "\" and pressing the **Enter** key. For example, enter **C:\LM90\FOLDERS**. When the **Enter** key is pressed, the names of the folders in the newly selected drawer are displayed. Position the cursor on the name of the program folder you wish to select or type the name of the program folder, and press the **Enter** key.

If the program folder already exists, select whether or not to create a backup copy. If the program folder does not already exist, the system will prompt you for confirmation to create a new program folder. This prevents you from accidentally creating a program folder due to a typing mistake. To cancel any changes made to this screen, press **ALT-A (abort)**. To return to the Program Folder menu, use the Escape key.

Auto-Select Function

The Auto (F3) softkey is only active when the select screen is displayed. When **F3** is pressed in **OFFLINE** mode or if the programmer is not communicating with the PLC, a message is displayed indicating that auto-select function is not available in that mode.

When **F3** is pressed in **MONITOR** or **ONLINE** mode, the programming software checks to see if a folder exists in the current directory whose name matches the name of the program in the PLC. If the folder does exist, it is automatically selected. The software then attempts to verify the program or configuration in the folder with that in the PLC, and updates the ***Equality*** field on the status line based on the result. After the select screen is exited, the main menu is displayed

In the programming software, if a matching folder does not exist, the following message is displayed: "Folder matching PLC name not found; load program to TEMP folder? (Y / N)". If **N** (No) is entered, no folder is selected and the select screen remains displayed on the screen.

If **Y** (Yes) is entered, the TEMP folder is selected or created if one does not exist. Program logic and configuration are loaded from the PLC into the TEMP folder. If the TEMP folder already contains logic and / or configuration files, those files are backed up prior to the load. The status lines are updated to show the folder program is equal to the version in the PLC.

In the configuration software, or if the programmer is connected to a Remote I / O Scanner, the message displayed when a matching folder does not exist is "Load configuration to TEMP folder?".

If an error is encountered verifying or loading data from the PLC, an error message is displayed and the select screen continues to be displayed.

Automatic Folder Selection at Power-Up

The automatic folder selection feature allows Logicmaster 90-70 software to automatically select the correct program folder and attempt to verify equality with the PLC program.

During power-up initialization, when the initializing screen is displayed, Logicmaster 90-70 software attempts to establish communications with an attached PLC. If this attempt is not successful, the initial folder selection screen is displayed. The programmer mode will default to **OFFLINE** mode on computers without a programmer mode keyswitch.

If a connection exists, computers without a keyswitch default to **MONITOR** mode. Logicmaster 90-70 software will then check to see if a folder whose name matches the PLC program name exists. If the folder does exist, that folder is automatically selected and an equality check is performed. The main menu screen is displayed after the equality check is completed.

If a matching folder does not exist, the initial folder selection screen is displayed. You can select a folder or press **Auto (F3)** to load to the TEMP folder, or select a new drawer and press **Auto (F3)** to again try to select the matching folder and do an equality check.

Note

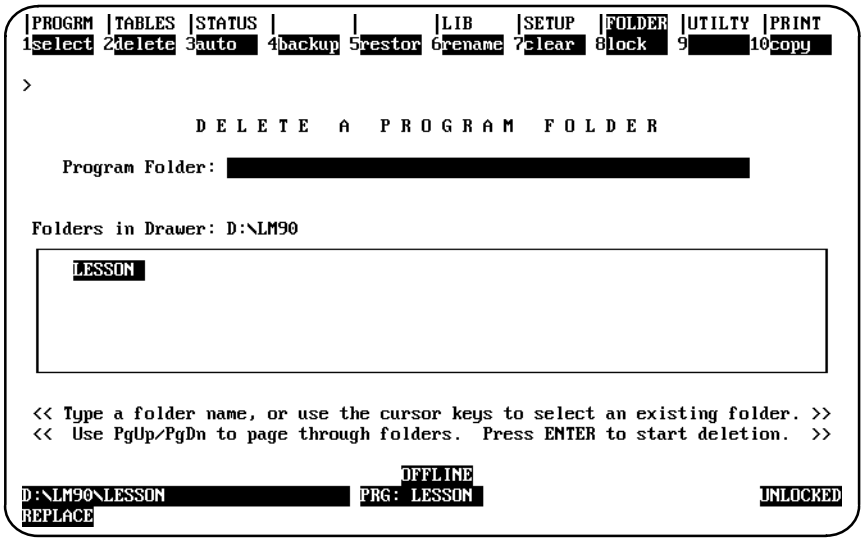
If the baud rate with the serial version of Logicmaster 90-70 software is set to 1200 or less, the programmer does not automatically go to **MONITOR** mode. It goes to **OFFLINE** mode.

Deleting Program Folders

Use this function to remove a program folder that is no longer needed. If the program folder has a backup, that copy is deleted automatically. If you have created any directories using MS-DOS beneath the program folder to be deleted, you must remove them before using the delete function. You may not be able to delete a program folder residing on a virtual drive.

If a program folder is locked (lock status is shown in the lower right corner of your screen), you cannot delete it. Please refer to the information on unlocking program folders provided later in this chapter.

Press **Delete (F2)** from the Program Folder Functions menu.



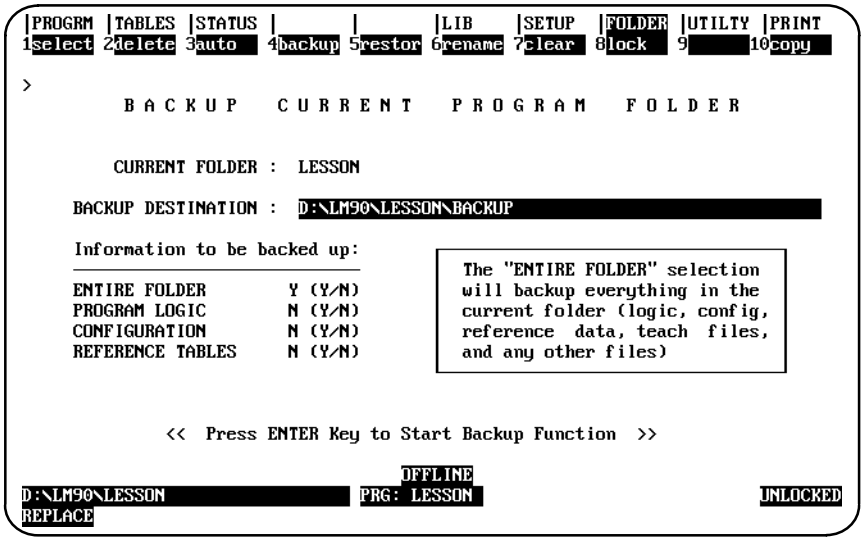
To delete a folder in the current drawer, type the name of the program folder in the ***Program Folder*** field or move the cursor to the desired folder name. Then, press the **Enter** key. The software will not allow the currently selected folder to be deleted.

To delete a folder in a different drawer, enter the full path specification or specify the drawer in the ***Program Folder*** field. The window is changed to display the folders in this drawer.

Respond to the confirmation prompt to continue with the deletion. ***Once started, the delete operation cannot be aborted.*** To return to the Program Folder Functions menu, press the **Escape** key.

Backing Up Program Folders

To create a backup copy of the currently selected program folder, press **Backup (F4)** from the Program Folder Functions menu.



The backup folder is located in a subdirectory under the program folder. If no backup folder exists for the current program folder, one is created automatically.

The ***Backup Destination*** field allows you to specify where you want to put the backup copy. The default destination is the backup directory of the current folder. To change the destination, move the cursor to this field and enter the new destination.

Note

When backing up to a diskette, you must back up to a subdirectory. For example, **A:** cannot be used as the backup destination. If **LESSON** is the folder name, **A:\LESSON** should be used. If only **A:** is specified, you cannot restore from the diskette.

Use the cursor keys to move from one option field to another. To back up the entire contents of the current folder, enter **Y** (Yes) in the ***Entire Folder*** field. To back up only selected options, enter **Y** (Yes) in the corresponding fields:

Field	Description
ProgramLogic	The ladder logic program and %L and %P data.
Configuration	The currentconfiguration.
Reference Tables	The reference tables for the program (except %L and %P data) and reference table formatfiles.

The Tab key may also be used to toggle the selection of each option. The default selection for the ***Entire Folder*** field is **Y** (Yes); all other fields default to **N** (No). Once the ***Entire Folder*** field is set to **Y**, the remaining fields are automatically set to **N**. Once any of the other fields is set to **Y**, the ***Entire Folder*** field is automatically set to **N**.

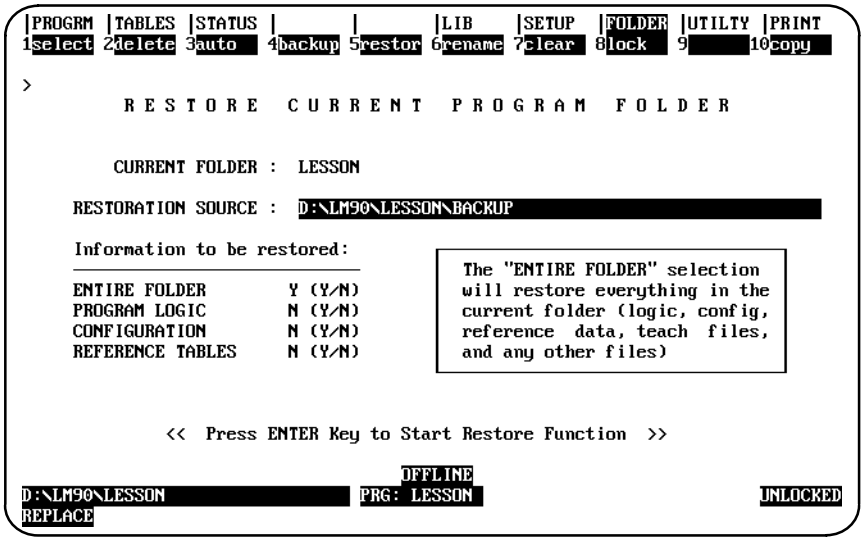
Then, press the **Enter** key. If you back up the entire folder, the software will prompt you for confirmation and then automatically delete the previous backup if one already exists. A new backup copy will be created to reflect the current contents of the program folder. If you back up only program logic or any other options besides the entire folder, the previous backup copy is left intact and the selected options are added to the backup. If the selected options were already contained in the backup, they will first be deleted.

Once started, the backup operation cannot be aborted. To return to the Program Folder Functions menu, press the **Escape** key.

Restoring Program Folders

To restore the contents of the current program folder from the backup copy, press **Restore (F5)** from the Program Folder Functions menu. To restore a program folder, a backup copy must exist.

If the program folder is locked (locked status is shown in the lower right corner of your screen), you must change the status to unlocked before a restore can occur. Please refer to the information on unlocking program folders provided later in this chapter.



The ***RestorationSource*** field allows you to specify where you want to retrieve the backup archive from. The default source is the backup directory of the current folder. To change the source, move the cursor to this field and enter the new source.

Note

The backup archive must be restored to a folder with the same name as the folder from which the backup originally was made. If not, the message "No backup found to restore" is displayed.

When this screen first appears, the selection for the ***Entire Folder*** field is set to **Y** (Yes) as the default selection. All other fields default to **N** (No). Once the ***Entire Folder*** field is set to **Y**, the remaining fields are automatically set to **N**. Once any of the other fields is set to **Y**, the ***Entire Folder*** field is automatically set to **N**.

Use the cursor keys to move from one option field to another. To restore the entire contents of the current folder, enter **Y** (Yes) in the ***Entire Folder*** field. To restore only selected options, enter **Y** (Yes) in the corresponding fields:

Field	Description
Program Logic	The ladder logic program and %L and %P data.
Configuration	The current configuration.
Reference Tables	The reference tables for the program (except %L and %P data) and reference table format files.

Then, press the **Enter** key. If any information exists in the current program folder that would be overwritten by the backup copy, the software will prompt you for confirmation. ***Once started, the restore operation cannot be aborted.***

If the programmer is in **ONLINE** or **MONITOR** mode, an auto-verification is performed to determine whether the restored program or configuration is equal to the PLC.

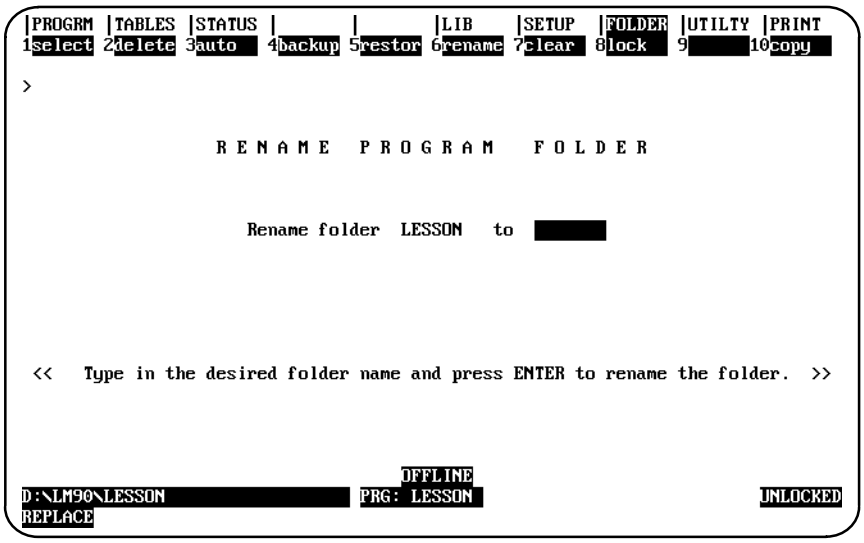
To return to the Program Folder Functions menu, press the **Escape** key.

Renaming Program Folders

This feature of Logicmaster 90-70 software enables you to rename any folder in the current drawer to another folder name that is not being used. The rename function is only available in the programming software; it is not available in the configuration software.

If a program folder is locked (look at the lower right corner of your screen), you cannot rename it. Refer to the information on unlocking program folders provided later in this chapter.

To rename the current folder, press **Rename (F6)** from the Program Folder Functions menu or from another Program Folder screen.



Enter the new folder name in the ***Rename Folder to*** field. If you press an **alphanumeric** key, it is automatically displayed in the ***Rename Folder to*** field. To clear this field, press **ALT-C** or use the **Delete** key to delete the contents of the field.

Press the **Enter** key to start the renaming operation. The software will prompt you for confirmation to continue the operation with the message "Current folder (<file_name>) will be renamed to <file_name>. Continue? (Y/N)." ***Once started, the rename operation cannot be aborted.***

Note

If the folder is renamed after a backup has occurred, the backed up files cannot be restored to the folder without renaming the folder back to its original name.

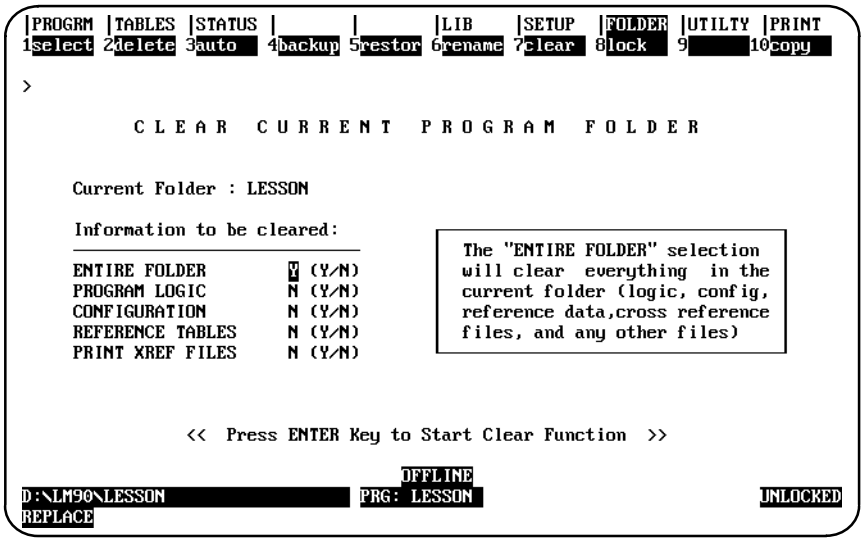
Once the rename operation is completed, the message "Folder renamed successfully" is displayed and the ***Rename Folder to*** field is cleared.

If the rename operation is aborted, the ***Rename Folder to*** field is not automatically cleared since the rename never completed. You must manually clear the field by pressing **ALT-C** or use the **Delete** key to delete the contents of the field.

Clearing Program Folders

To delete the contents of the current program folder while keeping the folder itself for future use, press **Clear (F7)** from the Program Folder Functions menu.

If a program folder is locked (look at the lower right corner of your screen), you cannot clear it. Please refer to the information on unlocking program folders provided later in this chapter.



Use the cursor keys to move from one option field to another. To clear the entire contents of the current folder, enter **Y** (Yes) in the ***Entire Folder*** field. To clear only selected options, enter **Y** (Yes) in the corresponding fields:

Field	Description
ProgramLogic	The ladder logic program and %L and %P data.
Configuration	The currentconfiguration.
Reference Tables	The reference tables for the program (except %L and %P data) and reference table format files.
Print Cross Reference Files	The PRINT.XOV and all .XRF files for the program.

The Tab key may also be used to toggle the selection of each option. The default selection for the ***Entire Folder*** field is set to **Y** (Yes); all other fields default to **N** (No). Once the ***Entire Folder*** field is set to **Y**, the remaining fields are automatically set to **N**. Once any of the other fields is set to **Y**, the ***Entire Folder*** field is automatically set to **N**.

Note

Program annotation files only exist in the folder and not in the PLC. Clearing the folder and then loading the program from the PLC results in lost annotation.

Press the **Enter** key to begin the clear operation. If there is any information in the folder, the software will prompt you for confirmation to continue the clear operation. ***Once started, the clear operation cannot be aborted.***

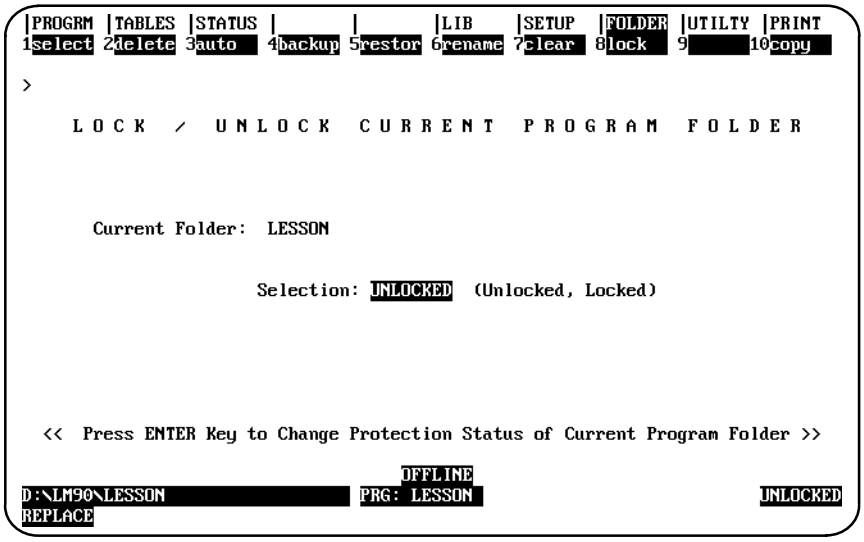
If you answer the continuation prompt by pressing: **Y** (Yes), you will have a chance to back up the current program folder. To create a backup copy, press: **Y** (Yes) at the prompt. Press: **N** (No) if you do not want to back up the information first.

If the programmer is in **ONLINE** or **MONITOR** mode, the status is automatically set to **NOT EQUAL**.

To return to the Program Folder Functions menu, press the **Escape** key.

Locking/Unlocking Program Folders

Locking a program folder protects its files from being accidentally changed. To change the locked status of the current program folder, press **Lock (F8)** from the Program Folder Functions menu.



Use the Tab key to change the access description. Then, press the **Enter** key. The new access description will appear in the lower right corner of the screen.

Note

Program folders on write-protected diskettes are automatically locked. Remove the write-protect tab and unlock the folder using this function.

Note

Copying a locked folder does not copy the lock status to the destination folder.

Copying Program Folders

Use the copy function to copy from one program folder into the current folder. The source program folder is copied into the current program folder. If there are any files in the current folder, they are destroyed by the copy process.

Note

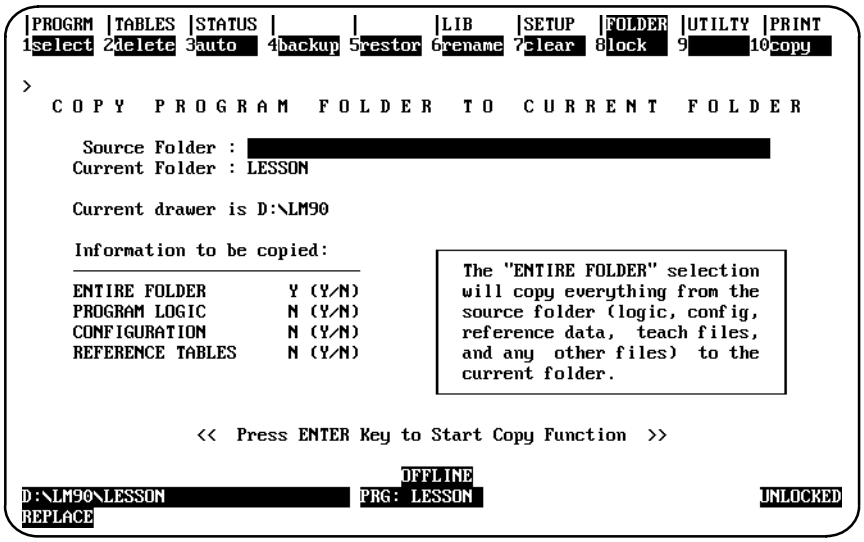
The copy function is only available in the programming software; it is not available in the configuration software.

Note

Copying a locked folder does not copy the lock status to the destination folder.

When repeatedly copying a folder to a series of diskettes, the displayed folder list is not updated after the first floppy disk is removed from the drive. In order to have the folder list updated, you must reselect the drawer (e.g., enter **A:**).

To make a copy of a program folder, press **Copy (F10)** from the Program Folder Functions menu.



Enter the name of the program folder whose contents you want to copy into the currently selected program folder. Then, use the cursor keys to move from one option field to another. To copy the entire contents of the source folder, enter **Y** (Yes) in the ***Entire Folder*** field. To copy only selected options, enter **Y** (Yes) in the corresponding fields:

Field	Description
ProgramLogic	The ladder logic program and %L and %P data.
Configuration	The currentconfiguration.
Reference Tables	The reference tables for the program (except %L and %P data) and reference table formatfiles.

The Tab key may also be used to toggle the selection of each option. The default selection for the ***Entire Folder*** field is set to **Y** (Yes); all other fields default to **N** (No). Once the ***Entire Folder*** field is set to **Y**, the remaining fields are automatically set to **N**. Once any of the other fields is set to **Y**, the ***Entire Folder*** field is automatically set to **N**.

Press the **Enter** key to begin the copy operation. If there is any information in the current folder, the software will prompt you for a confirmation to continue since everything in the current folder will be overwritten. ***Once started, the copy operation cannot be aborted.***

If the programmer is in **ONLINE** or **MONITOR** mode, an auto-verification is performed to determine whether the programmer / configurator is equal to the PLC.

To return to the Program Folder Functions menu, press the **Escape** key.

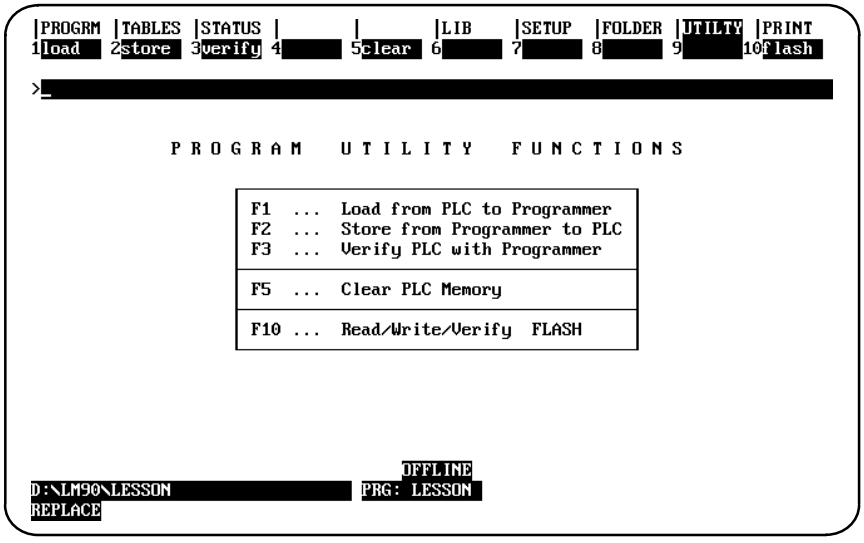
Chapter 9 Program Utilities

The program utility functions are used to transfer programs, configuration data, and reference tables between the programmer and the PLC. They are also used to compare the program, configuration data, and reference tables in the programmer with the program, configuration data, and reference tables in the PLC, and to clear PLC memory.

Note

In the configuration software, only the configuration may be loaded, stored, verified, or cleared. No operations on program logic or tables may be performed.

To access the program utility function, press **Utility (F9)** from the main menu, or **Shift-F9** from any main menu function screen.



Function Key	Function	Description	Page
F1	Load	Copy program logic, configuration data, and / or reference tables from the PLC to the programmer.	9-3
F2	Store	Copy program logic, configuration data, and / or reference tables from the programmer to the PLC.	9-5
F3	Verify	Compare program logic, configuration data, and / or reference data in the programmer with the program logic, configuration data, and / or reference tables in the PLC.	9-9
F5	Clear	Delete program, configuration data, and / or reference tables from PLC memory.	9-11
F10	Flash	Copy program logic, configuration data, register data, passwords, and the OEM key from CPU RAM to the flash memory device.	9-12

Loading from PLC to Programmer

Use the load function to copy program logic, configuration data, and / or reference tables from the PLC to the programmer. The load function copies the program, which remains unchanged in the PLC. If the function is password-protected in the PLC, you must know the password in order to use the function.

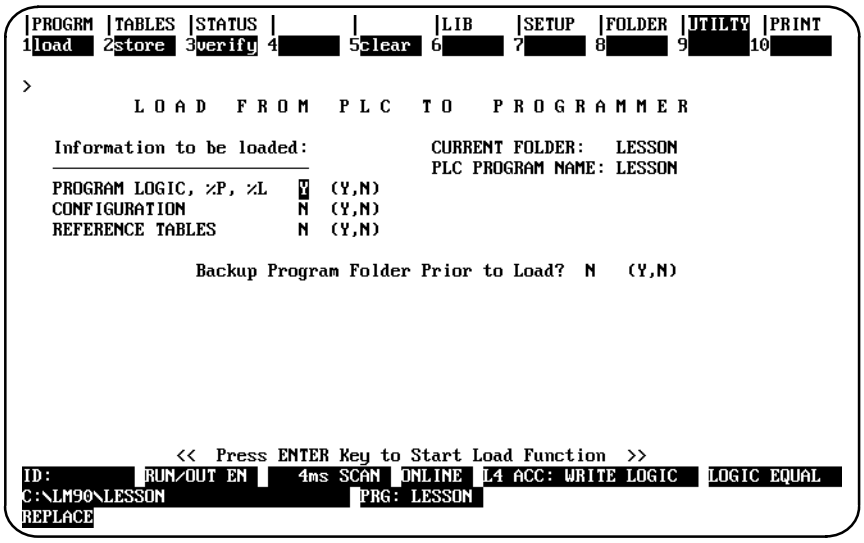
Caution

You cannot load a Release 4 program with an earlier release of Logicmaster 90-70 software.

Note

In the configuration software, only the configuration may be loaded. No operations on program logic or tables may be performed.

To use the load function, the programmer must be in **ONLINE** or **MONITOR** mode. Press **Load (F1)** from the Program Utility Functions menu or from another Program Utilities screen. The Load Program screen appears:



Note

Annotation files (nicknames, reference descriptions, and comment text) remain in the folder and are not stored to the PLC. Therefore, you must load from the PLC to the original folder containing the annotation in order to retain its annotation.

Note

If comment text has been edited since the program was stored to the PLC, do not load the program to the folder to restore equality. The program with the updated text should be stored to the PLC instead. This also applies to identifier descriptions for program blocks which have been edited offline. The program block containing the edited identifier descriptions should be stored to the PLC in order to restore equality.

The Load Program screen shows the currently selected program folder and the program name in the PLC; these cannot be changed on this screen. A program must be loaded to a folder whose name matches the PLC program name or to the TEMP folder (e.g., a folder whose name is TEMP).

Three types of data can be loaded from the PLC to the programmer: program logic, configuration data, and reference tables. When this screen first appears, only the program logic is set to **Y** (Yes), which is the default selection. To load all of the data, change the selection for reference tables and configuration to **Y** (Yes). To load only part of the data, select: **N** (No) for any of the following:

Field	Description
ProgramLogic	The ladder logic program and %L and %P data.
Reference Tables	The reference tables for the program, except %L and %P data.
Configuration	The currentconfiguration.

Also, select whether or not you want to create a backup copy of the current program folder before loading. Use the cursor keys to select items, and type in new selections as appropriate. To restore the original selections while editing this screen, press **ALT-A**.

To begin loading, press the **Enter** key.

The name of the program in the PLC is checked against the name of the current program folder. If the names are the same, the load continues. If the names are not the same, you cannot start the load unless the folder name is TEMP.

After a successful load, the software displays the message “Load Complete”. If a communication error occurs during the load process (indicated by a message on the screen), the selected items are cleared from the current folder. Correct the error and repeat the load function.

To stop a program load, press **ALT-A**.

To return to the Program Utility Functions menu, press the **Escape** key.

Storing to the PLC from the Programmer

Use the store function to copy program logic, configuration data, and / or reference tables from the programmer to the PLC. The store function copies the program, which remains unchanged in the programmer. If the PLC program name is not the same as the folder name, the store function clears the program from the PLC. The selected data is then stored from the new program folder.

If the function is password-protected in the PLC, you must know the password in order to use the function.

Note

In the configuration software, only the configuration may be stored. No operations on program logic or tables may be performed. The screen is slightly different than the one shown on page 9-6. The configuration store screen is shown and discussed on page 9-8.

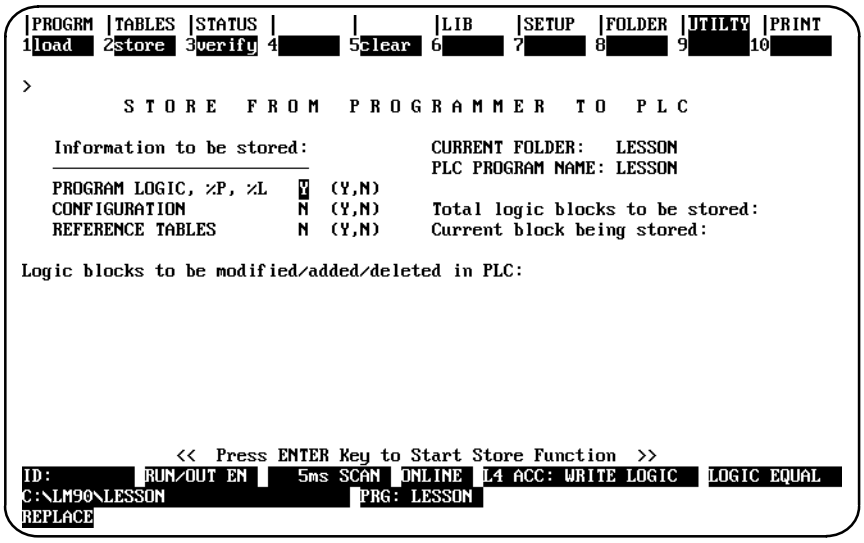
In **RUN MODE STORE**, you can only store program logic under these conditions:

1. Only blocks that have been changed are stored.
2. The old program executes until the new blocks are completely stored; then the new program begins executing in a "bumpless" manner. The PLC CPU must have enough memory to store the old logic and the new until the "bumpless" switchover can occur.
3. The data sizes for %L and %P are based on the highest references used in each block, regardless of whether the block is called. %L and %P data is increased as these references are programmed. If a reference to %L or %P is deleted, the new smaller size is calculated when the folder is selected.
4. Interrupt declaration changes cannot be made.
5. There must be enough PLC memory to store both old and new program blocks.
6. Timed or Event-Triggered programs cannot be added or deleted.
7. Control information (scheduling mode, I / O specification, etc.) for programs cannot be modified.

In **STOP MODE STORE**, the following can be performed:

1. You can store program logic, configuration data, and / or reference tables from the programmer to the PLC.
2. If you choose to store logic only and the PLC program name is different than the program name in the folder, the current logic in the PLC will be cleared and replaced by the new logic in the current folder. The current configuration data and reference tables in the PLC are left intact.
3. If you choose to store logic and configuration data and / or reference tables, the logic, configuration data, and reference tables in the PLC are cleared, and the new data is stored from the programmer to the PLC.

To use the store function, press **Store (F2)** from the Program Utility Functions menu. The Store Program screen appears:



The screen shows the currently selected program folder, which cannot be changed.

Three types of data can be stored from the programmer to the PLC: program logic, configuration data, and reference tables. When this screen first appears, only the program logic is set to **Y** (Yes), which is the default selection. To store all of the data, change the selection for reference tables and configuration to **Y** (Yes). To store only part of the data, select: **N** (No) for any of the following:

Field	Description
ProgramLogic	The ladder logic program and %L and %P data.
Reference Tables	The reference tables for the program, except %L and %P data.
Configuration	The currentconfiguration.

Note

Annotation files (nicknames, reference descriptions, and comment text) remain in the folder and are not stored to the PLC.

Logicmaster 90-70 software identifies external blocks with a unique block type when storing logic to the PLC. If the PLC rejects the external block because it is not in the proper MS-DOS executable file format, the software will display an appropriate error message based on an error code which is unique to external blocks.

Use the cursor keys to select items, and type in new selections as appropriate. To restore the original selections while editing this screen, press **ALT-A**.

The information to be transferred must fit within the configured boundaries of the PLC (for example, its register memory size).

To begin storing, press the **Enter** key. The program must be complete, and must not contain errors in syntax or any instructions which are not supported by the attached PLC. If there are errors, the store operation will be aborted.

After a successful store, the software displays the message "Store Complete". If a communication or disk error occurs during the store process (indicated by a message on the screen), the selected items are cleared from the attached PLC. Correct the error and repeat the store function.

To stop a program store in progress, press **ALT-A** if the PLC is in **STOP** mode. If the PLC is in **RUN** mode when the store begins, you cannot abort the store process.

To return to the Program Utility Functions menu, press the **Escape** key.

Note

If there should be an error in any of the programs being stored, the Store screen will display the applicable error and the name of the program that was being stored when the error occurred. The program name will display whether it is an RLD program or program block, SFC program, or C program.

Loading and Storing %P and %L Memory

%P and %L memory in the 90-70 PLC has to be managed differently than other memory types in the 90-70 PLC because %P and %L memory is part of the logic program. These memory types are transferred to the PLC during a **STOP MODE** store of the Logic. A **RUN MODE** Logic store does ***not*** transfer %P or %L data. Selecting **Y** to Reference Tables when executing a Utility function does ***not*** affect %P or %L data transfer.

Exercise care when entering critical %P or %L values into PLC memory in **ONLINE** mode. Tuning a PID loop would be such an application. At that point this data is saved only in the PLC. If you execute a **STOP MODE** Logic store to the PLC ***before*** executing a Logic load, any %P or %L data would be lost. Keeping this in mind, it is best to execute a PLC Logic load immediately after critical data has been entered into the PLC in Online Mode. A Logic load from PLC to the Programmer will save %P or %L data during both Stop and Run Mode.

Storing a Folder to the PLC from the Configuration Software

As discussed in the Note on page 9-5, when you are in the configuration software and perform a Store, the screen presents only configuration storing options as shown below.

To use the store function, press **Store (F2)** from the Program Utility Functions menu. The Store Configuration screen, like the one shown below, appears.

Field	Description
CURRENT FOLDER	The folder currently loaded in the PC.
PLCPROGRAM NAME	The folder currently stored in the PLC.
CONFIGSELECT	Type **Y** (yes) if you wish to store a different folder than the one currently loaded. Leave it with the default **N** (no) to store the current folder.

To begin storing, press the **Enter** key. The CPU must be in STOP mode for a Configuration Store. If you use the "CONFIG SELECT" option, a list of configuration folders will appear from which to choose. If the PLC already has a configuration folder stored, Logicmaster will prompt you if you wish to overwrite it. Enter Y to continue with the Store.

Verifying a Program with PLC

Use the verify function to compare program logic, configuration data, and / or reference data in the programmer with the program logic, configuration data, and / or reference tables in the PLC. If the function is password protected in the PLC, you must know the password in order to use the function.

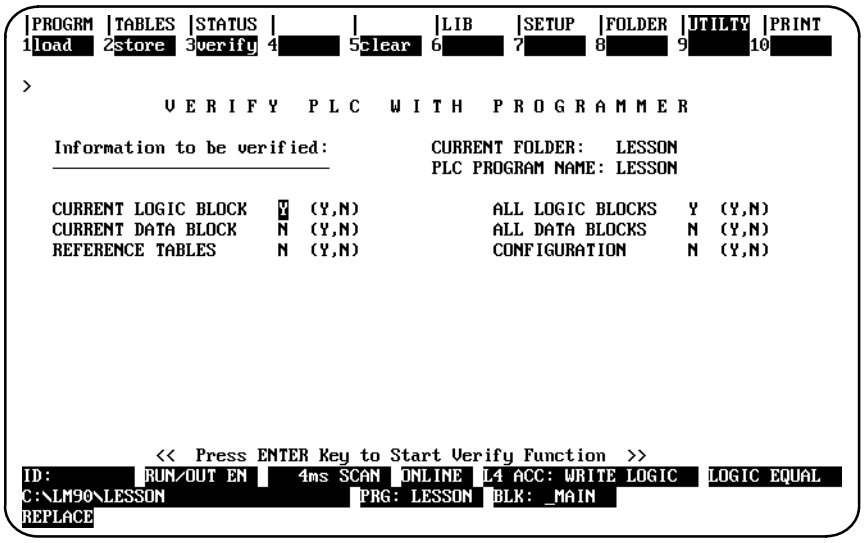
Note

You cannot verify a view locked block with an unlocked block. For more information on viewing locked blocks, refer to chapter 3, section 8, "Program Blocks, External Blocks, and Interrupts."

Note

In the configuration software, only the configuration may be verified. No operations on program logic or tables may be performed.

To use the verify function, the programmer must be in **ONLINE** or **MONITOR** mode. Press **Verify (F3)** from the Program Utility Functions menu or from another Program Utilities screen.



The screen shows the currently selected program folder, which cannot be changed.

Six types of data can be compared: current program logic, configuration data, reference tables, current data block, all data blocks, and all logic blocks. When this screen first appears, the selections for current program logic and all logic blocks are set to **Y** (Yes), which is the default selection.

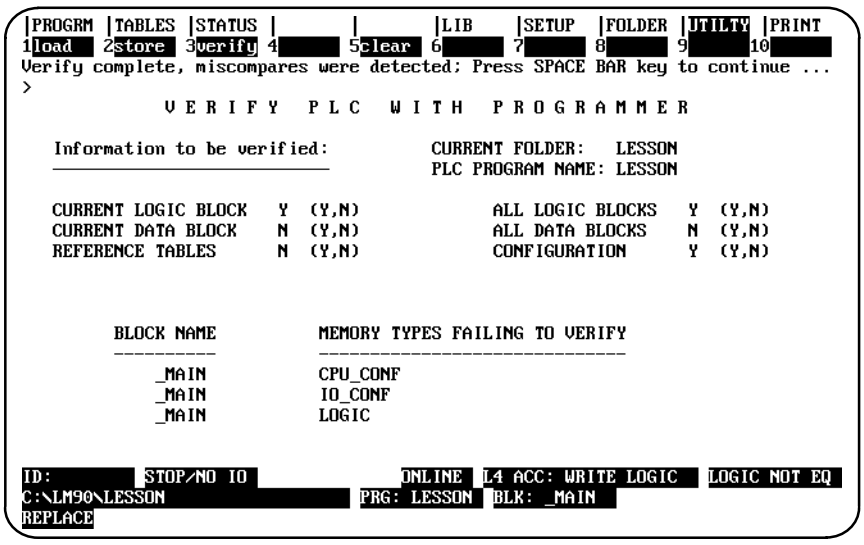
To compare all of the data, you must change the selection for configuration data and reference tables to **Y** (Yes). To compare only part of the data, select: **N** (No) for any of the following:

Field	Description
Current Logic Block	The program block currently zoomed into the program display / edit function and its %L or %P data. (See ***BLK*** field on the status line.)
All Logic Blocks	All program blocks in the program and the %L and %P data blocks. When verifying logic, checksums for logic in an external block in the programmer are compared with their counterparts in the PLC. If one of the checksums mismatches, Logicmaster 90-70 will display the miscomparison on the screen, as it does for other discrepancies.
Current Data Block	The local registers (%P for the main program block, and %L for other program blocks) used by the current logic block.
All Data Blocks	All local registers in the program. External blocks are ignored since they do not have any %L data.
Reference Tables	The reference tables for the program, except %P and %L.
Configuration	The current I / O and CPU configuration.

Press the **Enter** key to begin the verify function. While the verify is occurring, you can press **ALT-A** to abort.

If the information being compared is the same, the screen prompts: "Verify complete; no miscompares detected" and the program logic equality state is set to **EQUAL.** If the program does not successfully verify, the logic equality state is set to **NOT EQUAL**.

When miscompares are found, they are listed on the screen. For example:



Each miscompare displays the name of the program block and the memory type where the miscompare occurs. Pressing the keyboard space bar will restore the screen to its original form or bring up the next page of miscompare information.

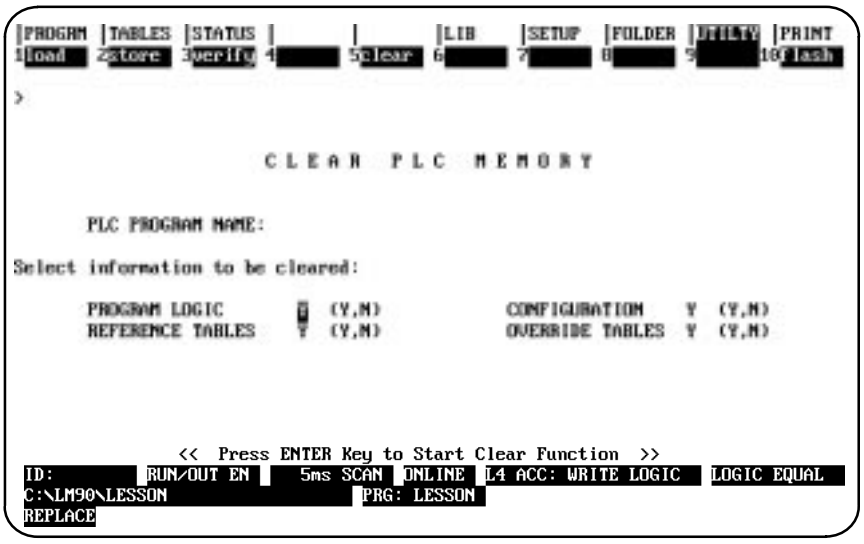
Clearing PLC Memory

Use the clear function to delete a program, configuration data, and / or reference tables from PLC memory.

Note

In the configuration software, only the configuration may be cleared. No operations on program logic or tables may be performed.

If the function is password protected in the PLC, you must know the password in order to use the function. To use the clear function, the programmer must be in **ONLINE** mode. Press **Clear (F5)** from the Program Utility Functions menu or from another Program Utilities screen.



Four types of data can be cleared: program logic, configuration data, reference tables, and reference override tables. When this screen first appears, the selection for each type is set to **Y** (Yes). To clear all of the data, do not change any of these selections. When all options are set to **Y**, the %S fault bits and overrides are cleared. When only the reference tables option is set to **Y**, %S bits and overrides are ***not*** cleared. Select **N** (No) for those you do not want to clear.

Field	Description
ProgramLogic	The ladder logic program, %P or %L data, and block data.
Configuration	The currentconfiguration.
Reference Tables	The reference tables for the program, except %P or %L data.
Override Tables	The reference override tables for the program

Press the **Enter** key to begin the clear function. ***Once the clear operation has begun, it cannot be aborted.*** When the clear operation is complete, the software displays the message “Clear Complete.”

Using Flash Memory

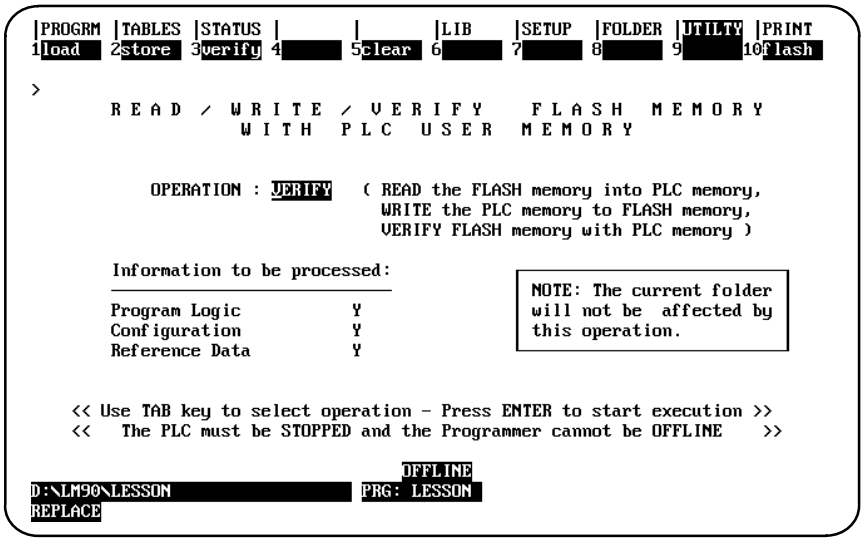
CPU Models 781 and 782 and CPX 772, CPX782, CPX928, and CPX935 support a flash memory option which allows you to store program logic, configuration data, reference tables, passwords, and the OEM key to the flash memory device located on the Series 90-70 PLC's memory daughter board (MEM 732). The read operation allows you to selectively read the contents of flash memory into PLC memory. The write operation writes the entire contents of PLC memory into flash memory. The verify operation allows you to selectively verify the contents of flash memory with PLC memory. If the function is password or OEM protected in the PLC, you must know the password or disable the OEM protection mode in order to use the function.

Note

Only Models 781 and 782 and CPX 772, CPX782, CPX928, and CPX935 let you store user data in flash memory; e.g., Model 914 and higher CPUs have flash memory, but their flash memory cannot be used as described in this section.

The read, write, and verify operations require the programmer to be online and the PLC to be stopped. The verify operation can also be performed while the programmer is in **MONITOR** mode.

To select the flash memory feature, press **Flash (F10)** from the Program Utility Functions menu. The Read / Write / Verify Flash Memory screen appears:



The ***Operation*** field defaults to **VERIFY**. To select an operation, position the cursor on this field and enter the desired operation, or use the Tab key to scroll through the valid operations. Once the desired operation is displayed, select the information to be processed.

Three types of data can be processed : program logic, configuration data, and reference data. When this screen first appears, all three fields are set to **Y** (Yes), which is the default selection. To process only part of the data, select **N** (No) for any of the options, or use the Tab key to toggle the selection of each option. To restore the original selections while editing this screen, press **ALT-A**.

Field	Description
ProgramLogic	All programs and %L and %P data.
Reference Tables	The reference tables for the program, except %L and %P data.
Configuration	The currentconfiguration.

After all the options are selected, press the **Enter** key to start the operation. ***Once the read or write operation has started, it cannot be aborted.***

To return to the Program Utility Functions menu, press the **Escape** key.

Chapter 10 Print Functions

The print function is used to:

- Determine a printing device or file destination for Logicmaster 90-70 screen print text.
- Enter printer parameters.
- Print copies of programs, configurations, and reference tables to files or a printer.
- Print copies of cross reference tables to files or a printer.

Note

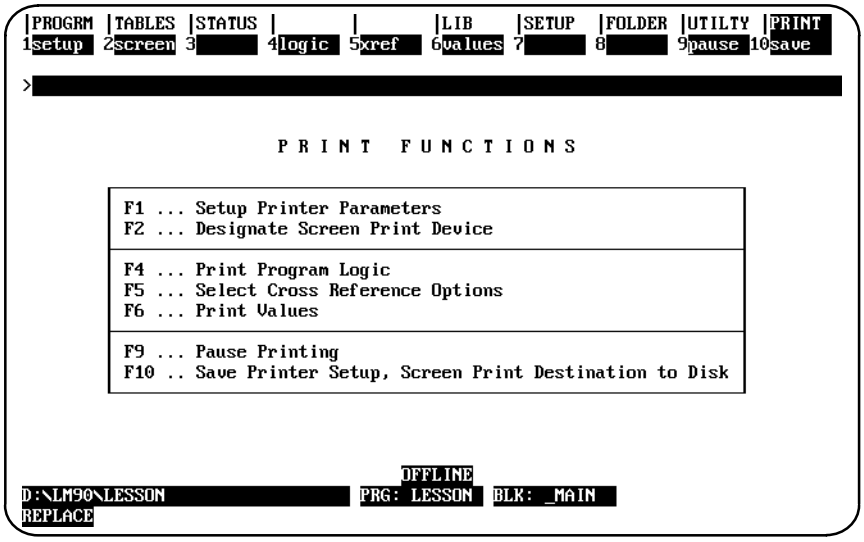
Print may be used to print the reference table values in the program folder only. To print the values from the PLC, the reference values must first be loaded to the folder by using the load utility function (see chapter 9).

Chapter 10 contains the following sections:

Section	Title	Description	Page
1	Printer Parameters	Explains how to check or to change the currently selected printer parameters.	10-3
2	Selecting a Screen Print Device	Explains how to designate a printer or file to receive screen prints.	10-5
3	Print Program	Explains how to print program logic, cross references, variables, and program annotation to a printer or a file.	10-7
4	Print Reference Tables	Explains how to print reference tables to a printer or a file.	10-15
5	PrintConfiguration	Explains how to print configuration data to a printer or a file.	10-18
6	Print FunctionExamples	Illustrates various hard copy listings which can be produced using the print function.	10-22

Print Functions Menu

To display the Print Functions menu in the programming software, press **Print (F10)** from the main menu, or Shift-F10 from any main menu function screen.

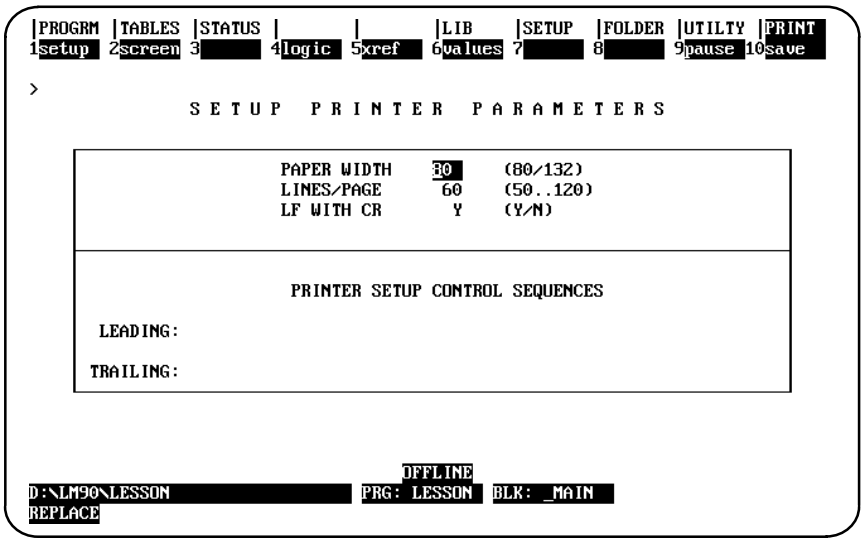


Note

When printing to a file, do not use the same file extensions as are used for the program folder files. Logicmaster 90 software does not prevent the printing of a listing to a file with the same name as one of the program folder files. If this is done, part of the folder may be lost. Refer to appendix I for a list of file extensions used by the software.

Section 1: Printer Parameters

The printer setup parameters must match those of your printer. Default values are supplied. These can be changed and stored in a file for continued use. To change your printer setup or check its contents, press **Setup (F1)** from the Print Functions menu or from another Print Functions screen.



The setup screen shows the value and possible selections for each parameter. This screen can be displayed in both the programming and configuration software packages.

Changing Setup Printer Parameters

To change entries on the Printer Parameters screen:

1. Move the cursor to the item you want to change.
2. Type or use the Tab key to enter new values as needed.
3. When you are finished, decide whether your entries or the default values shown above should be used when the system is started.

   A. To save the printer parameters, press **Save (F10)**. This causes the printer parameters to be written to the PRINT.SET file. This file is written to the home directory. When the programmer is powered up, these entries will replace the standard default values.

   B. To save the printer parameters only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

Printer Parameters

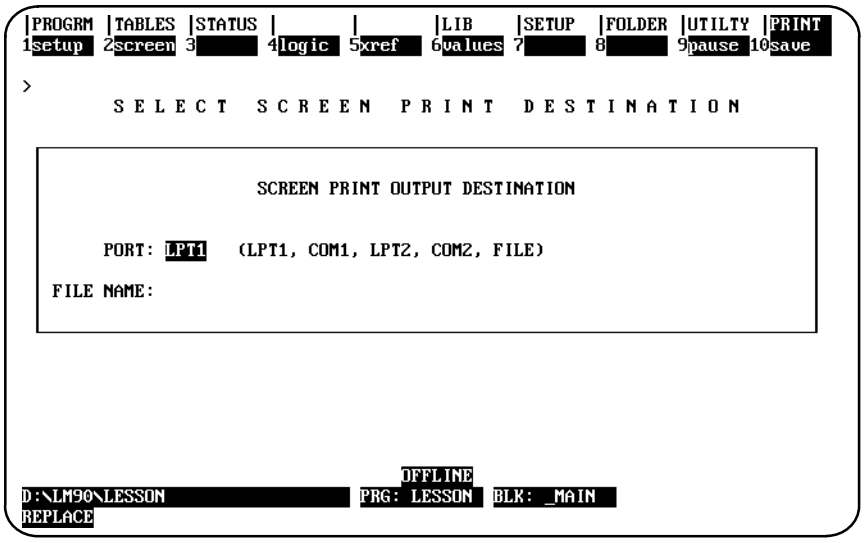
Refer to the following descriptions when changing the entries on the Printer Parameters screen.

Parameter	Description
Paper Width	The number of characters printed on a line. If the printer is set up for standard 8.5-inch wide paper, select 80 characters for the paper width. If the printer uses 11-inch (or wider) paper, you may select either **80** or **132** characters. In 80-character mode, rung numbers and cross references are printed above the rungs. In 132-character mode, the format of the ladder logic is the same. However, rung numbers and cross references are printed to the right of the rungs.
Number of Lines per Page	The number of lines (from **50** to **120**) that can be printed on a page (default = 60). If an associated group of lines will not fit on one page, the system will command the printer to advance to the next page after the number of lines specified by this entry. **Note**: Some printers automatically insert a form feed after printing a certain number of lines (typically, 66). If the printer has this feature, specify a shorter page length to prevent an automatic page eject.
Line Feed with a Carriage Return	The line feed character advances the paper to the next line for printing. This item determines whether the system automatically inserts a line feed (<CR><LF>) each time the printer head should return to the left page margin. **Note**: Some printers can be set up to automatically advance to the next line by entering only <CR>. Refer to the instructions for your printer to determine how it works. If you do not want the programmer to insert a line feed character after each carriage return character, enter **N** (No). To have the programmer insert the <LF> character after each <CR> character, enter **Y** (Yes).
Printer Setup Sequences	If the printer uses leading or trailing control characters, enter the characters here. If you move the cursor to either of these entries, a field will appear where you can enter the appropriate characters. Printer control sequences are issued immediately before and after a listing. This feature can be used to put the printer into a particular mode (for example, compressed output), returning to the original mode after the listing is finished. From 0 to 60 characters can be specified. To enter non-printing characters, use one backslash followed by the three-digit decimal equivalent of the ASCII representative. For example, to identify the Escape character <ESC>, you would enter **\027.** A leading zero is required. If you need to enter the backslash character itself, enter two backslashes: ****.

Section 2: Selecting a Screen Print Device

The print screen function can be used to print a copy of any screen. To execute a screen print, go to the screen you wish to print and press **ALT-P**. The printing of the screen is sent to the selected device or file. To abort the printing before it completes, press any key.

Screen prints can be sent to an output port, or directed to a file. To specify a screen print destination, press **Screen (F2)** from the Print Functions menu or from another Print Functions screen.



This screen can be displayed in both the programming and configuration software packages.

Sending Screen Prints to a Printer

In order to send screen prints to a printer, the selection for the port must match the current printer port. If the port is a serial port (COM1 or COM2), be sure that the port has been configured with the MS-DOS mode command before starting up the Logicmaster 90-70 software. For more information, refer to chapter 7, section 1, "Printer Serial Port Setup." To use COM2, the PC must have two serial ports physically present. (This is an MS-DOS restriction.)

Sending Screens to a File

To send screen prints to a file, the port entry must be ”file”. You can enter any valid file name for the screen print file. This file is used to store all future screen prints, which are added to the end of the file.

When specifying the screen print device destination to disk, use the full path name. If only a file name is specified, the screen print file is written to the folder that was active when the screen print device was specified; this may or may not be the current folder. Refer to appendix I for a listing of reserved file extensions.

If printing is paused while printing to a floppy disk, the disk swapped for a second disk, and then printing is resumed, neither disk will end up with a usable listing file. In addition, the second disk must be formatted before further use.

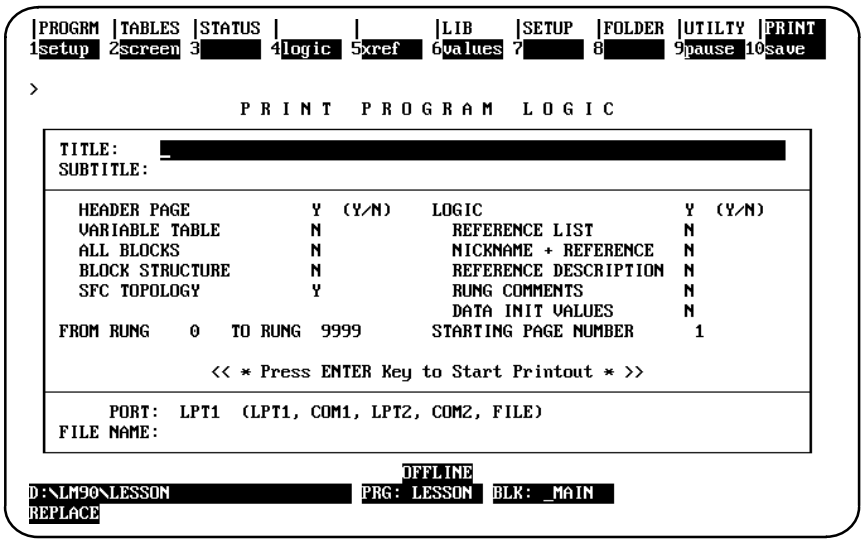
Saving the Port Designation

To save the port designation, press **Save (F10)**. This causes the port designation to be written to the SCRPRINT.SET file. This file is written to the home directory. When the programmer is powered up, the port designation will replace the default values.

To save the port designation only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

Section 3: Print Program

The print program function in the programming software is used to print program logic, cross references, variables, and program annotation. A table of contents is printed at the end of the listing. To use the print program function, press **Logic (F4)** from the Print Functions menu or from another Print Functions screen.



Note

This screen can be displayed in the programming software package only.

Specify the content for the printout on this screen as instructed on the following pages. If you do not change a selection, its default is used. If the printout should also include program cross references (which show other program uses of selected references), press **F5** to select the cross references to be included.

To save the entries on this screen in the PSCREENS.SET file, press **Save (F10)**. This file is written to the home directory. When the programmer is powered up, the new entries will replace the default values. To save the new entries only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

After completing the selections, press the **Enter** key to start printing. Printing will continue unless paused or aborted. When the printing is complete, the software displays the message "Listing complete."

To temporarily suspend printing after it begins, press **Pause (F9)**. To resume printing, press **F9** again.

An attempt to print to a printer that is out of paper results in the message "Printing device is offline; press **pause** to resume," being displayed.

To abort printing while in progress, press **ALT-A** and respond to the prompt. Printing will also abort if you press **CTRL-Break**, which will exit the programming software.

When a listing is being printed to a file and the listing is aborted, the file containing the listing up to that point is closed and is not deleted. It contains valid data up to the point where it was stopped.

Print Program Parameters

Refer to the following definitions when changing the entries on the Print Program screen. Examples are provided in section 6 of this chapter.

Parameter	Description
Title	An optional title of up to **62** characters centered at the top of each page. The title may change if specified in a rung comment. Refer to chapter 3, section 6, "Rung Comments," for information on titles.
Subtitle	An optional line of up to **62** characters printed below the title on each page. The subtitle may change if specified in a rung comment. Refer to chapter 3, section 6, "Rung Comments," for information on subtitles.
Header Page	The header page for a program shows the program name, CPU reference sizes, highest references used in the program, and the size of the program, in bytes. To print header pages, enter **Y** (Yes). A header page for a program block shows the program block name, size of the program block, size in bytes of the program block data (%P for the main program block, %L for all others), the number of entries for that block, and the highest references used by the block. The number of entries for that block includes the number of nicknames plus the number of identifiers, as shown in the variable declaration section of the block.
Variable Table	To print tables of variables and identifiers, enter **Y** (Yes).
AllBlocks	To print all program blocks (except external blocks and those blocks which have been view locked) in the selected program, enter **Y** (Yes). During listing or printing, the name of the program block being printed appears on the status line at the bottom of the screen. Logic for external blocks cannot be printed. When you select the ***All Blocks*** option, the software will print logic for each of the blocks written in ladder diagram language. After printing those blocks, the software will list the external blocks which cannot be printed. Logic for blocks which have been view locked cannot be printed, even if **Y** (Yes) is selected for ***AllBlocks***. A list of the view locked blocks that could not be printed will be included at the end of the printout. For more information on locked blocks, refer to chapter 3, section 8, "Program Blocks, External Blocks, and Interrupts." If ***All Blocks*** is set to **N** (No), only the current program block is printed. This is the last block accessed in **DISPLAY/EDIT** mode. The name of the block is displayed on the status line. Whether one block or all blocks are printed, the printout will include the items specified below.
Block Structure	To print a program block chart, enter **Y** (Yes). Additional information on the structured program block display is provided later in this section.

Parameter	Description
SFC Topology	To print the SFC topology, enter **Y** (Yes). When **Y** (Yes) is selected for both the ***SFC Topology*** option and the ***Logic*** option, both the SFC topology and its underlying action, transition, preprocessing, and postprocessing relay ladder diagram logic will be printed. If the _MAIN block is being printed, the block declaration and interrupt declaration tables will be printed. When **Y** (Yes) is selected for the ***SFC Topology*** option, but **N** (No) is selected for the ***Logic*** option, only the SFC topology will be printed. If the _MAIN block is being printed, the block and interrupt declaration tables will not be printed. When ***N*** (No) is selected for the ***SFC Topology*** option, but **Y** (Yes) is selected for the ***Logic*** option, the underlying relay ladder diagram logic of the SFC topology will be printed. If the _MAIN block is being printed, the block and interrupt declaration tables will be printed. **Note**: The ***SFC Topology*** parameter is only used for the Sequential Function Chart version of Logicmaster 90-70 software. It is not used for the Relay Ladder Diagram version of software.
Logic	To print ladder diagram logic, enter **Y** (Yes). Then, specify the content of the logic printout: **Reference List**: Enter **Y** (Yes) to print a table at the bottom of a page listing all the program references on that page. For each reference, the table lists the machine address, nickname, and reference description. **Nickname and Reference**: Enter **Y** (Yes) to print both machine addresses and their nicknames with the ladder logic. If **N** (No) is entered, only nicknames are printed in the logic. Machine addresses are printed for any references that do not have nicknames assigned. **Reference Description**: Enter **Y** (Yes) to print reference descriptions above the reference addresses at the next print logic request. When the print reference description feature is selected, the first 28 characters of the reference description for each reference address in the logic are printed above the reference address. The reference description is divided into four lines of seven characters each. If the nickname and reference option is also selected, the reference description is printed above the nickname, for a total of six lines above the instruction. If the nickname and reference option is not selected, the reference description is printed directly above the reference address or nickname, for a total of five lines above the instruction. Refer to chapter 3, section 7, "Changing the Display Mode," and chapter 7, "ProgrammerSetup," for information on selecting view modes in the program editor. **Rung Comments**: Enter **N** (No) to print comments in instruction form only. If **Y** (Yes) is entered, rung comment text is printed in place of the comment instruction. Additional text for rung comments may be created as separate files, as described in section 4 of chapter 3. If this has been done, be sure the files are present on the specified drive when printing begins.

Parameter	Description
From / To Rung	To print a range of logic rungs within one program block, enter the first and last rung number of the group to be printed. If the ***All Blocks*** option is set to **Y** (Yes), these fields will be ignored.
Starting Page Number	To begin numbering the printout with a page number other than 1, enter the number here.
Port	Specify the destination of the listing.
File Name	To send the printout to a file instead of to a printer, enter a name for the file here and select **FILE** in the ***Port*** field. If a file already exists with the selected name, the new file will overwrite it. Refer to appendix I for a listing of the file extensions used by the Logicmaster 90-70 software. Do not overwrite one of the Logicmaster 90 files with print text.

Block Structure

A structured program block listing can be included as part of the logic printout. It is printed after the program header page and before all the block information. The display contains each program block name, with an indented list of all the blocks called in that program block.

To include the structured program block display in the next printout, press **Logic (F4)** from the Print Functions menu. On the Print Program Logic screen, select: **Y** (Yes) for ***Block Structure*** (default = No).

The block structure section of the printout lists all the blocks, with their program block calls in a tree structure. The structure starts with the _MAIN block as the first block. The block structure of each interrupt block is also printed.

The total number of times a block is used in a CALL instruction or interrupt declaration is provided. This total number of calls is printed for each block.

Cross References

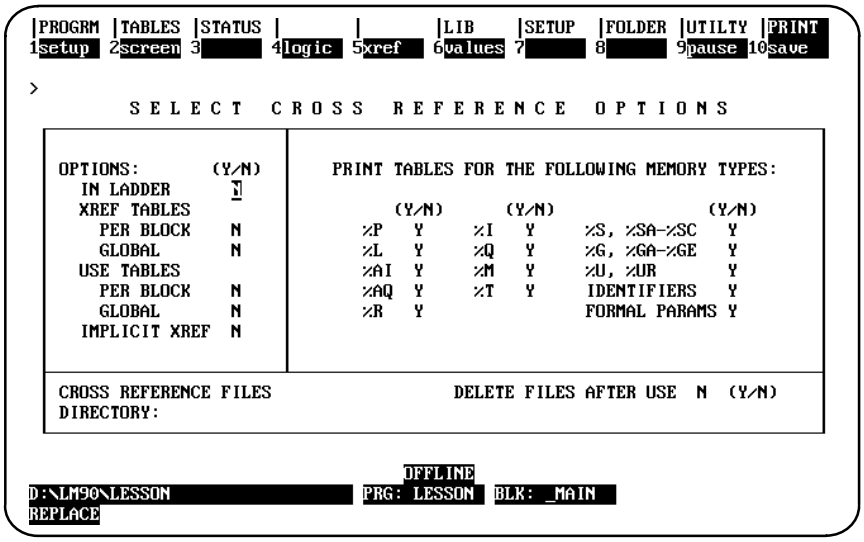
Cross references in a printout show the use of references in the program. Cross references can be included as part of the ladder logic text and / or listed as separate tables.

If the ***AllBlocks*** parameter on the Print Program Logic screen is set to **Y** (Yes), the cross reference tables for each block are printed following the logic for that block.

Note

Cross references for references used within an external block cannot be printed.

To include cross references, press **F5** from the Print Program screen or from another Print Functions screen.



Specify the content and format of the cross reference printing on this screen. If you do not change a selection, its default is used.

To save the entries on this screen in the PSCREENS.SET file, press **Save (F10)**. This file is written to the home directory. When the programmer is powered up, the new entries will replace the default values. To save the new entries only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

After completing the selections, press **Logic (F4)** to return to the Print Program Logic screen to print the listing.

The following table should be used to interpret cross reference instruction symbols:

Symbol	Description
###	Explicit reference.
(###)	Implicitreference.
FBIO	Function block direct reference.
@FBIO	Function block indirect reference.
JMP	Jumpcontrol.
LABEL	Label.
MCR	Mastercontrol relay.
EMCR	End mastercontrol relay.
CALL	Block CALLinstruction.
PARAM	Block CALLinstruction parameter.

Refer to the following definitions when changing the entries on the Cross Reference screen.

Parameter	Description
In Ladder	To include cross references as part of the ladder logic, enter **Y** (Yes). Cross references for each reference address used on the coils in a rung are printed with that rung. In addition, each time the reference address is used on a contact, the most recent rung on which the reference address was used on a coil (referred to as the controlling rung) is listed under the contact.
Cross Reference Tables	Specify whether to print separate tables of cross references for each block and / or a single set of cross reference tables for the program. The printout contains a table for each reference type which has at least one address reference used anywhere in a program. Within each table, cross reference information is printed in ascending order of reference address offset. For each reference address offset, the cross reference data is grouped by block and, then within each block, by the instructions on which the reference is used. For each instruction, rung numbers are printed in ascending order. For references used more than once on a given rung in the same instruction, the rung number is listed only once. **Per Block:** If **Y** (Yes) is selected for ***PerBlock***, sets of unique cross reference tables for each block are printed. A per block cross reference table contains only the cross reference information for references used within the scope of a single block. The default for this option is **N** (No). **Global:** If **Y** (Yes) is selected for , one set of cross reference tables for the program is printed. A global cross reference table for a reference type will contain all the cross reference information for references of that type used anywhere within the scope of the program. The information for a reference address will consist of each block, rung number, and instruction on which the address was used. The information will also include the unique nickname and reference description assigned to the reference address within each block. The default for this option is **N** (No). The nickname and reference description defined for a reference address within the scope of a block is printed when the global cross reference data for that reference address and that block is printed. Implicit cross reference data may be included or excluded from either type of cross reference table listing by entering: **Y** or **N** in the ***ImplicitXref*** field. If included, the implicit usage of a reference address by an instruction is printed with parentheses around the rung number of the rung containing that instruction. An identifier name global cross reference table will be printed when the ***XrefTablesGlobal*** option is selected. Since the only identifier table names known and used globally in a program are the block names, the global identifier name cross reference table will consist only of the usage information for block names. For each block name, the global cross reference identifier table will list the blocks in which it is called, and the rung numbers within each block of the rungs containing the CALL instruction. Global cross reference tables will be printed after all other logic listing text that you selected has been printed and before the global use tables.

Parameter	Description
Use Tables	Specify whether to print separate reference use tables for each block and / or a single set of reference use tables for the program. The symbol **–** means a reference is not used. The symbol ***** means used explicitly on an instruction operand. The symbol **+** means used implicitly by an instruction. When both ***** and **+** apply, the symbol # is used. (Refer to the entry for implicit cross references in this table for more information.) **Per Block**: If **Y** (Yes) is selected for, sets of unique reference use tables for each block are printed. A per block reference use table contains only the reference use information for references used within the scope of a single block. The default for this option is **N** (No). **Global**: If **Y** (Yes) is selected for ***Global***, one set of reference use tables for the program is printed. A global reference use table for a reference type will contain reference use information for the entire program. The default for this option is **N** (No). Implicit reference usage data may be included or excluded from either type of reference use table listing by entering: **Y** or **N** in the ***Implicit Xref*** field.
Implicit Cross Reference	Implicit references are references that are used, but which do not appear directly in the program. For example, if the MOVE_INTinstruction has an input %AI00001, an output %AQ00001, and a length of 5, %AI00001 and %AQ00001 are explicitly used. Due to the length, there are really 5 words of input / output. Therefore, %AI00002 through %AI00005 and %AQ00002 through %AQ00005 are implicitly used. To include both implicit and explicit references in cross reference tables or use tables, enter **Y** (Yes). If **N** (No) is entered, only explicit references are printed.
Memory Types/ Address Ranges	Enter **Y** to select the reference types for which cross reference tables and / or reference use tables will be printed. The tables will begin at reference address offset 1 and end with the highest used reference address offset of each reference address type in the program or block. Enter **N** for those references whose cross reference tables and / or reference use tables will not be printed. To include cross references of block names, and MCR, ENDMCR, JUMP, and LABEL names in a cross reference table printout, enter **Y** (Yes) in the ***Identifiers*** field. To print a local cross reference table for each type Xn and Yn, enter **Y** (Yes) in the ***Formal Params*** field.

Parameter	Description
Directory	Specify a directory to store cross reference data files. The specified location for the .XRF, PRINT.XOV, and GLOBAL.PTX cross reference data files must be either a hard disk, an expanded memory device, or a RAM Disk. The cross reference files cannot be sent to a floppy disk; if they are, an error message will be displayed. If no entry is made here, the files are stored in the current folder. Refer to appendix I for a listing of the file extensions used by Logicmaster 90-70 software. Do not overwrite one of the Logicmaster 90 files. **Note:** Cross reference data files are not automatically deleted when exiting the print function. The .XRF and PRINT.XOV files remain in the designated directory unless you enter **Y** (Yes) in the ***Delete Files After Use*** field. This prevents having to cross reference the same blocks each time a listing is started. When subsequent listings from the same folder are generated, only the cross reference data files for the blocks which have changed since the previous listing are deleted and recreated. The default selection for the ***Delete Files After Use*** field is **N** (No). In addition to the .XRF and PRINT.XOV files, a temporary file named GLOBAL.PTX is created. The file will exist during a listing that includes global cross reference text; it will be deleted when the global cross reference listing terminates successfully, terminates with an error, or aborts.
Delete Files After Use	To delete the cross reference files after the listing completes, enter **Y** (Yes). If you want the cross reference files to remain on disk, enter the default **N** (No). To delete cross reference files from a folder without printing a listing, use the clear folder function.

Note

If both ***Global*** and ***Per Block*** options are selected for cross reference or reference use tables, the listing for %L will consist of a separate table listing for each block in the program since %L is relevant only to the block in which it is used.

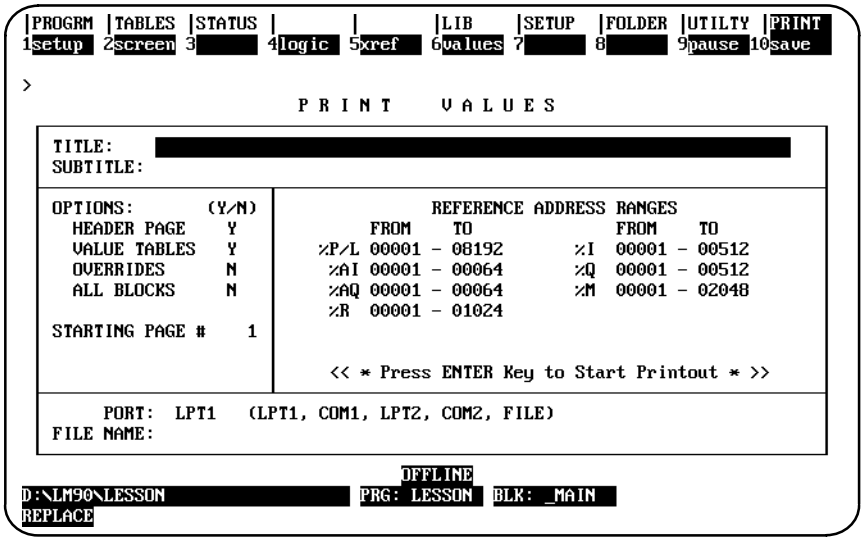
If both options are selected in addition to the ***All Blocks*** option on the Print Program Logic screen, the listings for %L would be redundant under these option selections and are printed only once. %L data is printed as part of the global listing but not part of the block listing.

Section 4: Print Reference Tables

To print reference table values for one or more program blocks, press **Values (F6)** from the Print Functions menu or from another Print Functions screen. A table of contents is printed with each value listing.

Note

Print may be used to print the values in the program folder only. To print the values from the PLC, the reference values must first be loaded to the folder by using the load utility function (see chapter 8).



This screen can be displayed in the programming software package only.

The listing can be directed to a printer or to a file.

These tables correspond to the tables that can be displayed and formatted using the reference tables function. For example:

```
================================================================================
  ==========  INPUT  (%I)  VALUES
================================================================================
  REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
  ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
  %I00064 00000000 00000000 00000000 00000000 00000000 00000000             0008
  %I00128 00000000 00000000 00000000 00000000           +00123 00000000 00000000
  %I00192 00000000 00000000            00345 00000000 00000000 00000000 00000000
        There are no non-zero values in the range from %I00193 to %I00384.
  %I00448 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
  %I00512 00000000 00000000 00001111 01010101 00000000 00000000 00000000 00000000

================================================================================
  ==========  INPUT  (%I)  OVERRIDES
================================================================================
  REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
  ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
        There are no overrides set in the range from %I00001 to %I00064.
  %I00128 -------- -------- -------- -------- -------- -------- 0-0-0-0- 0000----
        There are no overrides set in the range from %I00129 to %I00384.
  %I00448 ----0--- -0---0-- -------- 0------- ------0- -----0-- --0--0-- --------
  %I00512 -------- -------- -0--1111 -------- -0------ --0----- -----0-- 0--0----

  - = not overridden    0 = overridden in OFF state    1 = overridden in ON state
```

Specify the content of the printout on the Print Values screen.

Field	Description
Title	An optional title of up to **62** characters at the top of each page. The title may change if specified in a rung comment. Refer to chapter 3, section 6, "Rung Comments," for information on titles.
Subtitle	An optional line of up to **62** characters printed below the title on each page. The subtitle may change if specified in a rung comment. Refer to chapter 3, section 6, "Rung Comments," for information on subtitles.
Header Page	The header page for a program shows the program name, CPU reference sizes, highest references used in the program (excluding references used within external blocks), and the size of the program, in bytes. To print header pages, enter **Y** (Yes).
Value Tables	To print value tables (input, output, etc.), enter **Y** (Yes). **Note**: There is no local data (%L) to print for an external block.
Overrides	To print the override value tables associated with the selected %I, %Q, and %M references, enter **Y** (Yes).
AllBlocks	To print %L local register tables for all program blocks in the selected program, enter **Y** (Yes). During printing, the name of the program block being printed is displayed on the status line at the bottom of the screen. If ***AllBlocks*** is set to **N** (No), only the current program block local registers will be printed. The name of that block is displayed on the status line.
Starting Page	To begin numbering the printout with a page number other than 1, enter the number here.

Field	Description
Address Range	Specify the range of values to be printed. Enter values only for types of references to be printed. If any references should not be printed, enter zeros in both the ***FROM*** and ***TO*** fields. If the configured limits change (i.e., by changing folders, clearing a folder, or downloading from the PLC), the address ranges will be re-initialized.
Port	Specify the destination of the listing.
File Name	To send the printout to a file instead of to a printer, enter a name for the file here and select **FILE** in the ***Port*** field. If a file already exists with the selected name, the new file will overwrite it. Refer to appendix I for a listing of the file extensions used by the Logicmaster 90 software. Do not overwrite one of the Logicmaster 90 files with print text.

To save the entries on this screen in the PSCREENS.SET file, press **Save (F10)**. This file is written to the home directory. When the programmer is powered up, the new entries will replace the default values. To save the new entries only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

After completing the selections, press the **Enter** key to start printing. Printing will continue unless paused or aborted. When the printing is complete, the software displays the message "Listing complete."

To temporarily suspend printing after it begins, press **Pause (F9)**. To resume printing, press **F9** again.

During printing, press **ALT-A** to abort the printout. Printing will also abort if you press **CTRL-Break** and confirm your action. This will exit the programming software.

Note

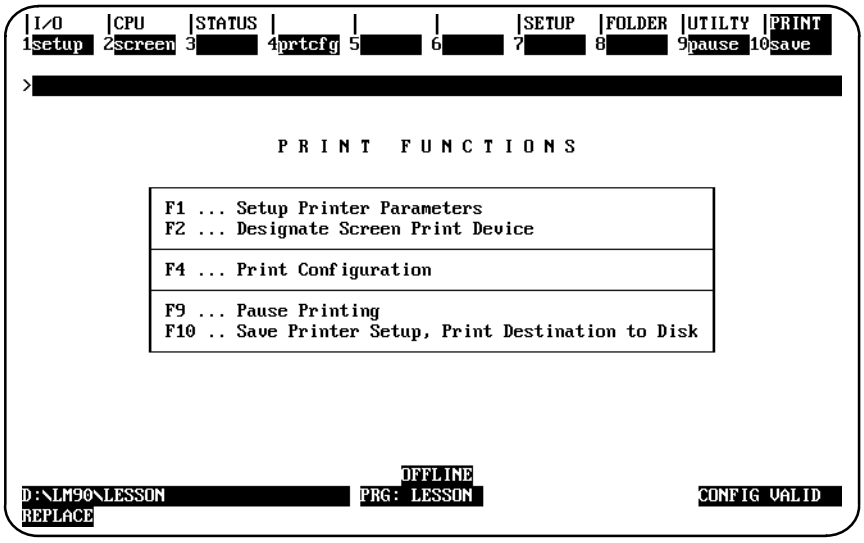
When a listing is being printed to a file and the listing is aborted, the file containing the listing up to that point is closed and is not deleted. It contains valid data up to the point where it was stopped.

Section 5: Print Configuration

In the Logicmaster 90-70 configuration software package, the print function enables you to obtain a listing of all I/O and CPU configuration data. The listing can be directed to a port for immediate printout, or to a file for later printing. The following functions are provided:

- View / change printer parameters.
- Select the screen print destination.
- Generate a rack hardware configuration listing.
- Generate a configured reference address listing (Ref View).
- Generate a CPU configuration listing.

To display the Print Functions menu in the configuration software, press **Print (F10)** from the main menu, or Shift-10 from any main menu function screen.



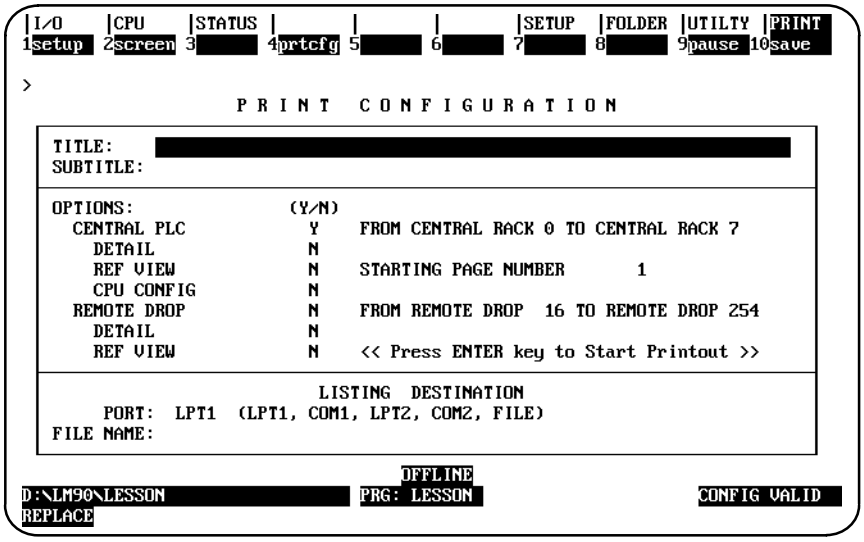
This screen can be displayed in the configuration software package only.

Note

The Setup (F1) and Screen (F2) keys perform the same functions as their corresponding keys in the programming software. Refer to section 1 of this chapter for information on setting up the printer parameters, and to section 2 for information on selecting the screen print output destination.

Accessing the Print Configuration Screen

To use this function, press **Print Configuration (F4)** from the Print Configuration menu. The following screen will be displayed:



The Print Configuration menu defines which parts of the rack configuration should be printed out and the destination of the listing. A header page describing the highest references configured in the I/O configuration is printed automatically with each configuration.

To save the entries on this screen in the PSCREENS.SET file, press **Save (F10)**. This file is written to the home directory. When the programmer is powered up, the new entries will replace the default values. To save the new entries only until the next power-up and then return to the default parameters, do not press **Save (F10)**.

Refer to the following definitions when changing the entries on the Print Configuration screen.

Field	Description
Title	An optional title of up to 62 characters centered at the top of each page.
Subtitle	An optional line of up to 62 characters printed below the title on each page.
Central PLC	To print the configuration that contains the PLC, select: **Y** (Yes). **Detail**: To print the detail screens for each module configured in the Central PLC, enter **Y** (Yes). This field is only available when the selection for the ***Central PLC*** field is **Y** (Yes). If the ***Central PLC*** field is set to **N** (No), the ***Detail*** field is set automatically to **N**. **Reference View**: To print the reference view tables for the Central PLC configuration, enter **Y** (Yes). **CPUConfiguration**: To print CPU configuration data for the Central PLC configuration, enter **Y** (Yes).
Remote Drop	To print the configuration which contains the Remote I/O Scanner with a specified Drop ID (**16** – **254**), select: **Y** (Yes). There can be a total of 239 remote drop configurations, each with a unique Drop ID in the range **16** – **254**. **Detail**: To print the detail screens for each module configured in a remote drop, enter **Y** (Yes). This field is only available when the selection for the ***Remote Drop*** field is **Y** (Yes). If the ***RemoteDrop*** field is set to **N** (No), the ***Detail*** field is set automatically to **N**. **Reference View**: To print the reference view tables for a remote drop configuration, enter **Y** (Yes).
From Central Rack	Enter the number of the first rack of the Central PLC whose configuration data is to be printed. The value of this field may not exceed the value of the ***ToCentral Rack*** field.
To Central Rack	Enter the number of the last rack of the Central PLC whose configuration data is to be printed. The value of this field may not be less than the value of the ***FromCentralRack*** field. In order to print a single rack of information, both the ***FromCentralRack*** and ***toCentralRack*** field must contain the same value.
Starting Page Number	To begin numbering the printout with a page number other than 1, enter the number here. The value may range from **1** to **32,767**.
From Remote Drop	Enter the number of the first remote drop whose configuration data is to be printed. The value may range from **16** to **254**. The value of this field may not exceed the value of the ***To RemoteDrop*** field. All configured racks will be printed of each remote drop selected.
To Remote Drop	Enter the number of the last remote drop whose configuration data is to be printed. The value of this field may be from **16** through **254**. The value may not be less than the value of the ***From RemoteDrop*** field. In order to print a single remote drop configuration, both the ***From RemoteDrop*** and ***To RemoteDrop*** fields must contain the same value.
Port	Specify the destination printer port or file for the listing.
File Name	If "file" is selected for the destination in the ***Port*** field, enter the name of the file to which the printout is to be directed. Any valid file specification may be entered in this field. A new file is always created, overwriting any existing file of the same name. Refer to appendix I for a listing of the file extensions used by the Logicmaster 90-70 software. Do not overwrite one of the Logicmaster 90 files with print text.

Pagination Guidelines

Only one type of screen can be printed on a given page, but multiple detail screens may be printed on a single page, if they fit on that page following these guidelines:

Field	Description
Rack	The printing of a given rack cannot be broken across pages. Only one rack per page is permitted.
Bus	The printing of a given Genius bus screen will not be broken across pages. The printing of a bus requires several screens. They will be printed out starting with the lowest block number and ending with the highest block number.
Detail	The printing of a given detail screen will not be broken across pages. Because the length of a listing page may be changed and there are a variable number of detail screens for a given module, all the screens of a particular module may not be displayed on the same page.

Section 6: Print Function Examples

The following examples illustrate various hard copy listings which can be produced with the print function.

Certain information is presented on every page, regardless of what specific item is currently being printed. The first line of each page of the listing will contain the date, time, software version number, and page number. The user-supplied title and subtitle are centered on the second and third lines of the page, respectively. The program name appears in the bottom left corner of the page. The current program folder specification appears in the bottom center of the page.

Program Logic Header Page:

```
05-05-92  09:17    GE FANUC SERIES 90-70 DOCUMENTATION (v4.00)        Page     1
                          The Title Appears Here
                        The Subtitle Appears Here



                 GGGG EEEEE       FFFFF  AAA  N   N U   U  CCCC
                G     E           F     A   A NN  N U   U C
                G GGG EEEE        FFF   AAAAA N N N U   U C
                G   G E           F     A   A N  NN U   U C
                 GGG  EEEEE       F     A   A N   N  UUU   CCCC



           AAA  U   U TTTTT  OOO  M   M  AAA  TTTTT IIIII  OOO  N   N
          A   A U   U   T   O   O MM MM A   A   T     I   O   O NN  N
          AAAAA U   U   T   O   O M M M AAAAA   T     I   O   O N N N
          A   A U   U   T   O   O M   M A   A   T     I   O   O N  NN
          A   A  UUU    T    OOO  M   M A   A   T   IIIII  OOO  N   N



(*****************************************************************************)
(*                                                                           *)
(*                                Program:  FIRST                            *)
(*                                                                           *)
(*        PLC PROGRAM ENVIRONMENT              HIGHEST REFERENCE USED        *)
(*       -------------------------           -------------------------      *)
(*                INPUT (%I):   512                    INPUT:  %I00100      *)
(*               OUTPUT (%Q):   512                   OUTPUT:  %Q00075      *)
(*             INTERNAL (%M):  2048                 INTERNAL:  %M00006      *)
(*              UNBOUND (%U):  9999                  UNBOUND:     NONE      *)
(*            TEMPORARY (%T):   256                TEMPORARY:     NONE      *)
(*     PROGRAM REGISTER (%P):  NONE           PROGRAM REGISTER:     NONE      *)
(*              REGISTER (%R):  1024                  REGISTER:  %R00003      *)
(*        ANALOG INPUT (%AI):    64              ANALOG INPUT:     NONE      *)
(*       ANALOG OUTPUT (%AQ):    64             ANALOG OUTPUT:     NONE      *)
(*    UNBOUND REGISTER (%UR):  9999           UNBOUND REGISTER:     NONE      *)
(*                                                                           *)
(*                        PROGRAM SIZE (BYTES):      768                     *)
(*                                                                           *)
(*                                                                           *)
(*****************************************************************************)


Program: FIRST              D:\ACME\CONVEYOR\FIRST
```

```
05-05-92  09:17    GE FANUC SERIES 90-70 DOCUMENTATION (v4.00)        Page     2
                              The Title Appears Here
                            The Subtitle Appears Here









(*****************************************************************************)
(*                                                                           *)
(*                                 BLOCK:  _MAIN                             *)
(*                                                                           *)
(*                                                                           *)
(*       PROGRAM REGISTER (%P) MEMORY SIZE (BYTES):     0                    *)
(*                             BLOCK SIZE (BYTES):   440                    *)
(*                           DECLARATIONS (ENTRIES):    11                   *)
(*                                                                           *)
(*                                                                           *)
(*                           HIGHEST REFERENCE USED                          *)
(*                          ------------------------------                   *)
(*                                                                           *)
(*                                    INPUT (%I):  %I00100                   *)
(*                                   OUTPUT (%Q):  %Q00075                   *)
(*                                 INTERNAL (%M):  %M00006                   *)
(*                                   UNBOUND (%U):     NONE                  *)
(*                                TEMPORARY (%T):     NONE                   *)
(*                             LOCAL REGISTER (%L):     NONE                 *)
(*                          PROGRAM REGISTER (%P):     NONE                  *)
(*                                  REGISTER (%R):  %R00003                  *)
(*                             ANALOG INPUT (%AI):     NONE                  *)
(*                            ANALOG OUTPUT (%AQ):     NONE                  *)
(*                         UNBOUND REGISTER (%UR):     NONE                  *)
(*                                                                           *)
(*****************************************************************************)









Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

Program Logic Without Logic Options:

```
05-05-92  09:17    GE FANUC SERIES 90-70 DOCUMENTATION (v4.00)        Page     1
                          The Title Appears Here
                        The Subtitle Appears Here

|[  START OF LD  PROGRAM  FIRST   ]       (*                                 *)
|
|[     VARIABLE DECLARATIONS      ]
|
|[   PROGRAM BLOCK DECLARATIONS   ]

                +-------+
                |PACK_LN|  LANG: LD       (* PACKAGE/MOTION DETECTION         *)
                +-------+

|[           INTERRUPTS           ]
|
|[     START OF PROGRAM LOGIC     ]
|
| << RUNG 5 >>
|
|AUTOPB   LISUP  %Q00038 %Q00012 %I00013 EMERGST %Q00006 %Q00075         %Q00005
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----] [-----] [-------------( )--
|                               |
|%Q00005                        |
+--]/[--------------------------+
|
| << RUNG 6 >>
|
|EMSTOP  %I00100 CLAMPED %I00073                                          EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |      |
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|
| << RUNG 7 >>
|
|%Q00005 %Q00012 %I00021 %I00022                                          %M00001
+--]/[-----]/[--+--] [-----] [-----------------------------------------------( )--
|               |
|%M00005 %M00006|
+--]/[-----] [--+
|
| << RUNG 8 >>
|
|%Q00044 %M00002 +-----+                                                  %Q00006
+--]/[-----] [---+ ADD_+-------------------------------------------------( )--
|               | INT |
|               |     |
|        %R00001-+I1  Q+-%R00003
|               |     |
|        %R00002-+I2   |
|               +-----+
|
|(*  COMMENT  *)
|


Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

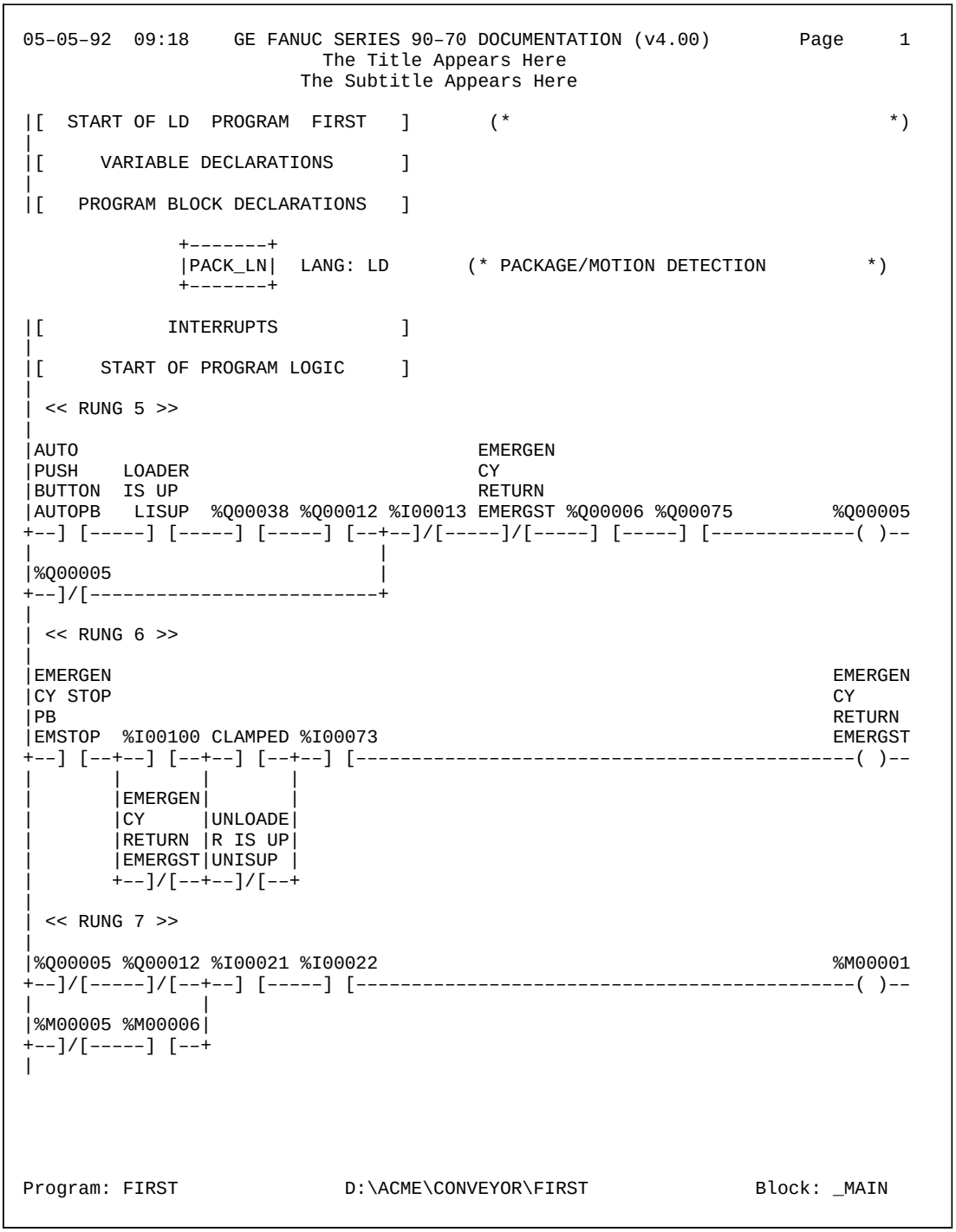
```
05-05-92  09:17    GE FANUC SERIES 90-70 DOCUMENTATION (v4.00)        Page     2
                          The Title Appears Here
                        The Subtitle Appears Here


| << RUNG 10 >>
|
|AUTOPB   LISUP  %Q00044 %Q00012 RSTAHPB EMERGST %Q00006 COOLANT          AUTO
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----]/[-----] [-------------( )--
|                               |
| AUTO                          |
+--]/[--------------------------+
|
| << RUNG 11 >>
|
|EMSTOP  %I00100 CLAMPED %I00073                                          EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |       |
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|
|[      END OF PROGRAM LOGIC      ]
|
```

```
Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

Program Logic with Reference Description Option
No Nickname or Reference Option:

With the ***ReferenceDescription*** option enabled, a four-line reference description, if defined, is printed above each instruction operand. Since the ***Nickname and Reference*** option is not selected, only a single line of either a nickname or a reference address is printed on an instruction operand.



```
05-05-92  09:18    GE FANUC SERIES 90-70 DOCUMENTATION (v4.00)        Page     1
                          The Title Appears Here
                        The Subtitle Appears Here

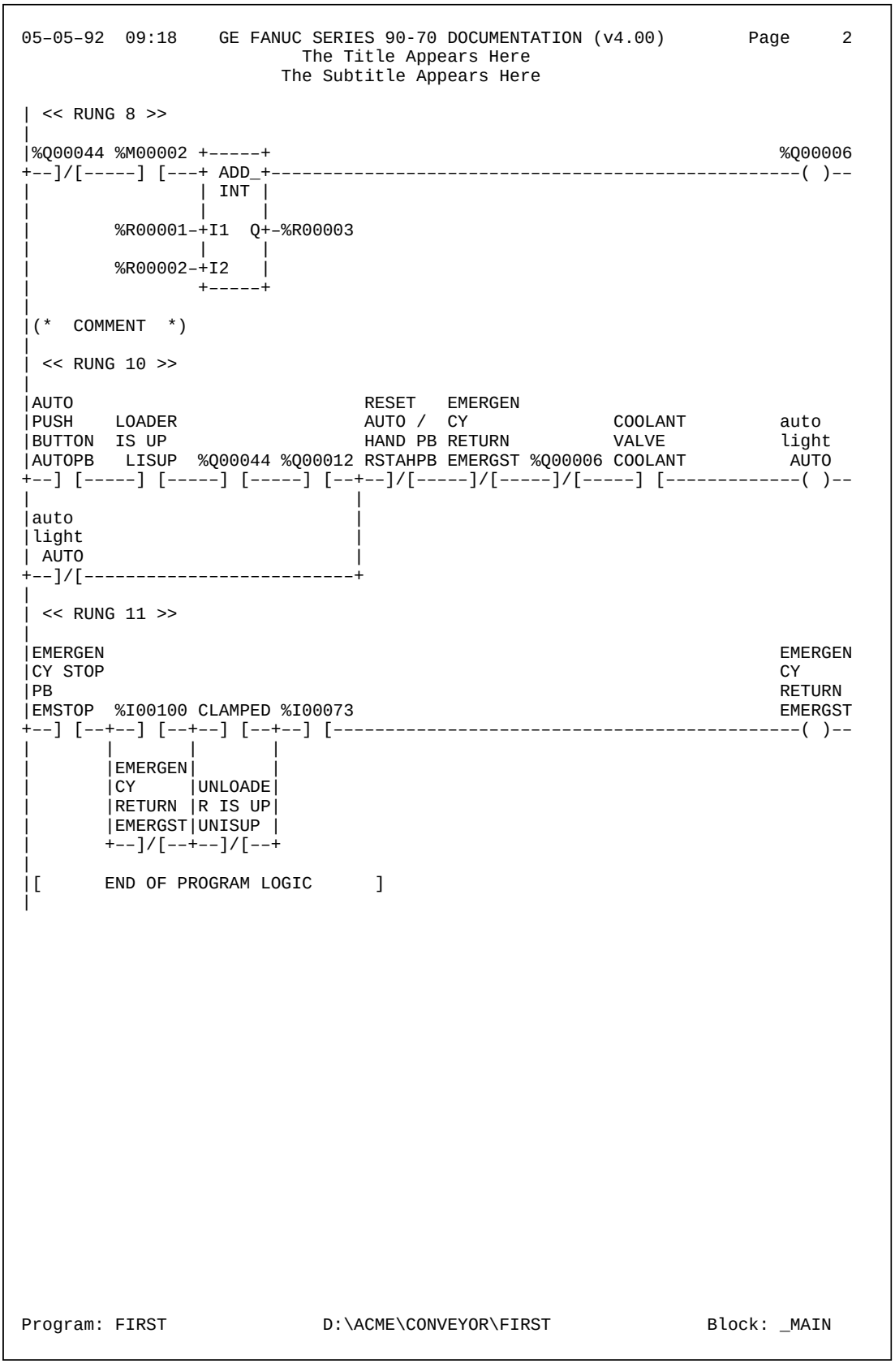
|[  START OF LD  PROGRAM  FIRST   ]       (*                                *)
|
|[     VARIABLE DECLARATIONS      ]
|
|[   PROGRAM BLOCK DECLARATIONS   ]

              +-------+
              |PACK_LN|  LANG: LD       (* PACKAGE/MOTION DETECTION         *)
              +-------+

|[           INTERRUPTS           ]
|
|[     START OF PROGRAM LOGIC     ]
|
| << RUNG 5 >>
|
|AUTO                                    EMERGEN
|PUSH    LOADER                          CY
|BUTTON  IS UP                           RETURN
|AUTOPB   LISUP  %Q00038 %Q00012 %I00013 EMERGST %Q00006 %Q00075         %Q00005
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----] [-----] [-------------( )--
|                               |
|%Q00005                        |
+--]/[--------------------------+
|
| << RUNG 6 >>
|
|EMERGEN                                                                 EMERGEN
|CY STOP                                                                 CY
|PB                                                                      RETURN
|EMSTOP  %I00100 CLAMPED %I00073                                         EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |       |
|       |EMERGEN|       |
|       |CY     |UNLOADE|
|       |RETURN |R IS UP|
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|
| << RUNG 7 >>
|
|%Q00005 %Q00012 %I00021 %I00022                                         %M00001
+--]/[-----]/[--+--] [-----] [-----------------------------------------------( )--
|               |
|%M00005 %M00006|
+--]/[-----] [--+
|




Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```


05-05-92 09:18 GE FANUC SERIES 90-70 DOCUMENTATION (v4.00) Page 2
The Title Appears Here
The Subtitle Appears Here
<< RUNG 8 >>
%Q00044 %M00002 ADD_ INT %R00001 I1 Q %R00003 %R00002 I2 %Q00006
(* COMMENT *)
<< RUNG 10 >>
AUTO PUSH BUTTON AUTOPB LOADER IS UP LISUP %Q00044 %Q00012 RESET AUTO / HAND PB EMERGEN CY RETURN RSTAHPB %Q00006 COOLANT VALVE COOLANT %Q00006 auto light AUTO
auto light AUTO
<< RUNG 11 >>
EMERGEN CY STOP PB EMSTOP %I00100 CLAMPED %I00073 EMERGEN CY RETURN EMERGST
EMERGEN CY RETURN EMERGST UNLOADE R IS UP UNISUP
[END OF PROGRAM LOGIC]
Program: FIRST D:\ACME\CONVEYOR\FIRST Block: _MAIN

80- Column Short Program Logic with In Ladder Cross Reference Options:

```
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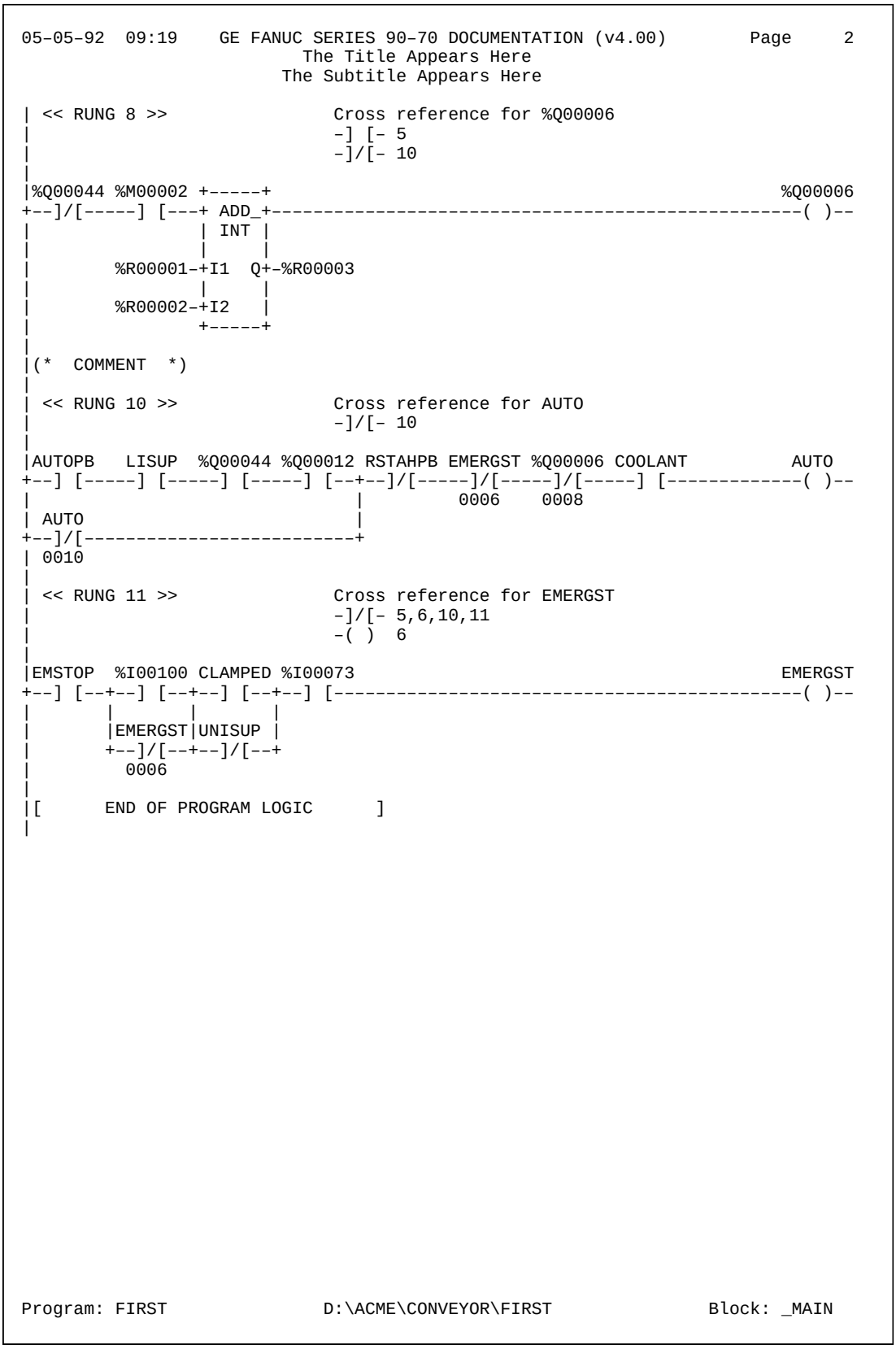
|[  START OF LD  PROGRAM  FIRST   ]       (*                                 *)
|
|[     VARIABLE DECLARATIONS      ]
|
|[   PROGRAM BLOCK DECLARATIONS   ]

                +-------+
                |PACK_LN|  LANG: LD       (* PACKAGE/MOTION DETECTION         *)
                +-------+

|[           INTERRUPTS           ]
|
|[     START OF PROGRAM LOGIC     ]
|
| << RUNG 5 >>                Cross reference for %Q00005
|                             -]/[- 5,7
|
|AUTOPB   LISUP  %Q00038 %Q00012 %I00013 EMERGST %Q00006 %Q00075         %Q00005
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----] [-----] [-------------( )--
|                              |         0011    0008
|%Q00005                       |
+--]/[---------------------------+
| 0005
|
| << RUNG 6 >>                Cross reference for EMERGST
|                             -]/[- 5,6,10,11
|                             -( )  11
|
|EMSTOP  %I00100 CLAMPED %I00073                                          EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |       |
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|         0011
|
| << RUNG 7 >>                Cross reference for %M00001
|                                       NONE
|
|%Q00005 %Q00012 %I00021 %I00022                                          %M00001
+--]/[-----]/[--+--] [-----] [-----------------------------------------------( )--
| 0005          |
|%M00005 %M00006|
+--]/[-----] [--+
|

Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```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<< RUNG 8 >>
Cross reference for %Q00006
-] [- 5
-]/[- 10
%Q00044 %M00002
%Q00006
ADD_
INT
%R00001
I1
Q
%R00003
%R00002
I2
(* COMMENT *)
<< RUNG 10 >>
Cross reference for AUTO
-]/[- 10
AUTOPB LISUP %Q00044 %Q00012 RSTAHPB EMERGST %Q00006 COOLANT AUTO
0006 0008
AUTO
0010
<< RUNG 11 >>
Cross reference for EMERGST
-]/[- 5,6,10,11
-( ) 6
EMSTOP %I00100 CLAMPED %I00073 EMERGST
EMERGST UNISUP
0006
[END OF PROGRAM LOGIC]
Program: FIRST
D:\ACME\CONVEYOR\FIRST
Block: _MAIN

80- Column Logic with Reference List, Rung Comments,Variable Table, and In Ladder Cross Reference Options:

```
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|[  START OF LD  PROGRAM  FIRST   ]      (*                                  *)
|
|[     VARIABLE DECLARATIONS      ]

           V A R I A B L E   D E C L A R A T I O N   T A B L E

          REFERENCE     NICKNAME          REFERENCE DESCRIPTION
          ---------     --------     --------------------------------
          %I00002       EMSTOP       EMERGENCY STOP PB
          %I00003       RSTAHPB      RESET AUTO / HAND PB
          %I00004       AUTOPB       AUTO PUSH BUTTON
          %Q00002       LISUP        LOADER IS UP
          %Q00004       UNISUP       UNLOADER IS UP
          %Q00007       AUTO         auto light
          %Q00020       CLAMPED
          %Q00025       EMERGST      EMERGENCY RETURN
          %Q00061       COOLANT      COOLANT VALVE


                        I D E N T I F I E R   T A B L E

          IDENTIFIER     IDENTIFIER TYPE          IDENTIFIER DESCRIPTION
          ----------     ---------------     ------------------------------
          PACK_LN        PROGRAM BLOCK       PACKAGE/MOTION DETECTION
          FIRST          PROGRAM NAME

|[   PROGRAM BLOCK DECLARATIONS   ]

                +-------+
                |PACK_LN|  LANG: LD       (* PACKAGE/MOTION DETECTION         *)
                +-------+

|[           INTERRUPTS           ]
|
|[     START OF PROGRAM LOGIC     ]
|


Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

```
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| << RUNG 5 >>                Cross reference for %Q00005
|                             -]/[- 5,7
|
|AUTOPB   LISUP  %Q00038 %Q00012 %I00013 EMERGST %Q00006 %Q00075         %Q00005
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----] [-----] [-------------( )--
|                               |         0011    0008
|%Q00005                        |
+--]/[--------------------------+
| 0005
|
| << RUNG 6 >>                Cross reference for EMERGST
|                             -]/[- 5,6,10,11
|                             -( )  11
|
|EMSTOP  %I00100 CLAMPED %I00073                                          EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |       |
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|         0011
|
| << RUNG 7 >>                Cross reference for %M00001
|                                       NONE
|
|%Q00005 %Q00012 %I00021 %I00022                                          %M00001
+--]/[-----]/[--+--] [-----] [-----------------------------------------------( )--
| 0005          |
|%M00005 %M00006|
+--]/[-----] [--+
|



 REFERENCE NICKNAME      REFERENCE DESCRIPTION
  %I00013
  %I00021
  %I00022
  %I00073
  %I00100
  %Q00005
  %Q00006
  %Q00012
  %Q00038
  %Q00075
  %M00001
  %M00005
  %M00006
  %I00004  AUTOPB        AUTO PUSH BUTTON
  %Q00020  CLAMPED
  %Q00025  EMERGST       EMERGENCY RETURN
  %I00002  EMSTOP        EMERGENCY STOP PB
  %Q00002  LISUP         LOADER IS UP
  %Q00004  UNISUP        UNLOADER IS UP



Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

```
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| << RUNG 8 >>               Cross reference for %Q00006
|                            -] [- 5
|                            -]/[- 10
|
|%Q00044 %M00002 +-----+                                                %Q00006
+--]/[-----] [---+ ADD_+-------------------------------------------------( )--
|                | INT |
|                |     |
|        %R00001-+I1  Q+-%R00003
|                |     |
|        %R00002-+I2   |
|                +-----+
|
| (*************************************************************************)
| (* The following logic rung enables automatic mode when all enabling condi- *)
| (* tions are met.  See operator's manual, page 6-12, for more information.  *)
| (*************************************************************************)
|
| << RUNG 10 >>              Cross reference for AUTO
|
|
|
|                            -]/[- 10
|
|AUTOPB   LISUP  %Q00044 %Q00012 RSTAHPB EMERGST %Q00006 COOLANT          AUTO
+--] [-----] [-----] [-----] [--+--]/[-----]/[-----]/[-----] [-------------( )--
|                               |         0006    0008
| AUTO                          |
+--]/[-------------------------+
| 0010
|
```

```
 REFERENCE NICKNAME      REFERENCE DESCRIPTION
  %Q00006
  %Q00012
  %Q00044
  %M00002
  %R00001
  %R00002
  %R00003
  %Q00007  AUTO          auto light
  %I00004  AUTOPB        AUTO PUSH BUTTON
  %Q00061  COOLANT       COOLANT VALVE
  %Q00025  EMERGST       EMERGENCY RETURN
  %Q00002  LISUP         LOADER IS UP
  %I00003  RSTAHPB       RESET AUTO / HAND PB


Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

```
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| << RUNG 11 >>              Cross reference for EMERGST
|                            -]/[- 5,6,10,11
|                            -( )  6
|
|EMSTOP  %I00100 CLAMPED %I00073                                          EMERGST
+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--
|       |       |      |
|       |EMERGST|UNISUP |
|       +--]/[--+--]/[--+
|         0006
|
|[      END OF PROGRAM LOGIC      ]
|
```

```
 REFERENCE NICKNAME      REFERENCE DESCRIPTION
  %I00073
  %I00100
  %Q00020  CLAMPED
  %Q00025  EMERGST       EMERGENCY RETURN
  %I00002  EMSTOP        EMERGENCY STOP PB
  %Q00004  UNISUP        UNLOADER IS UP


Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

132–Column Program Logic with Rung Comments,Nicknames and References, and In Ladder Cross Reference Options:

```
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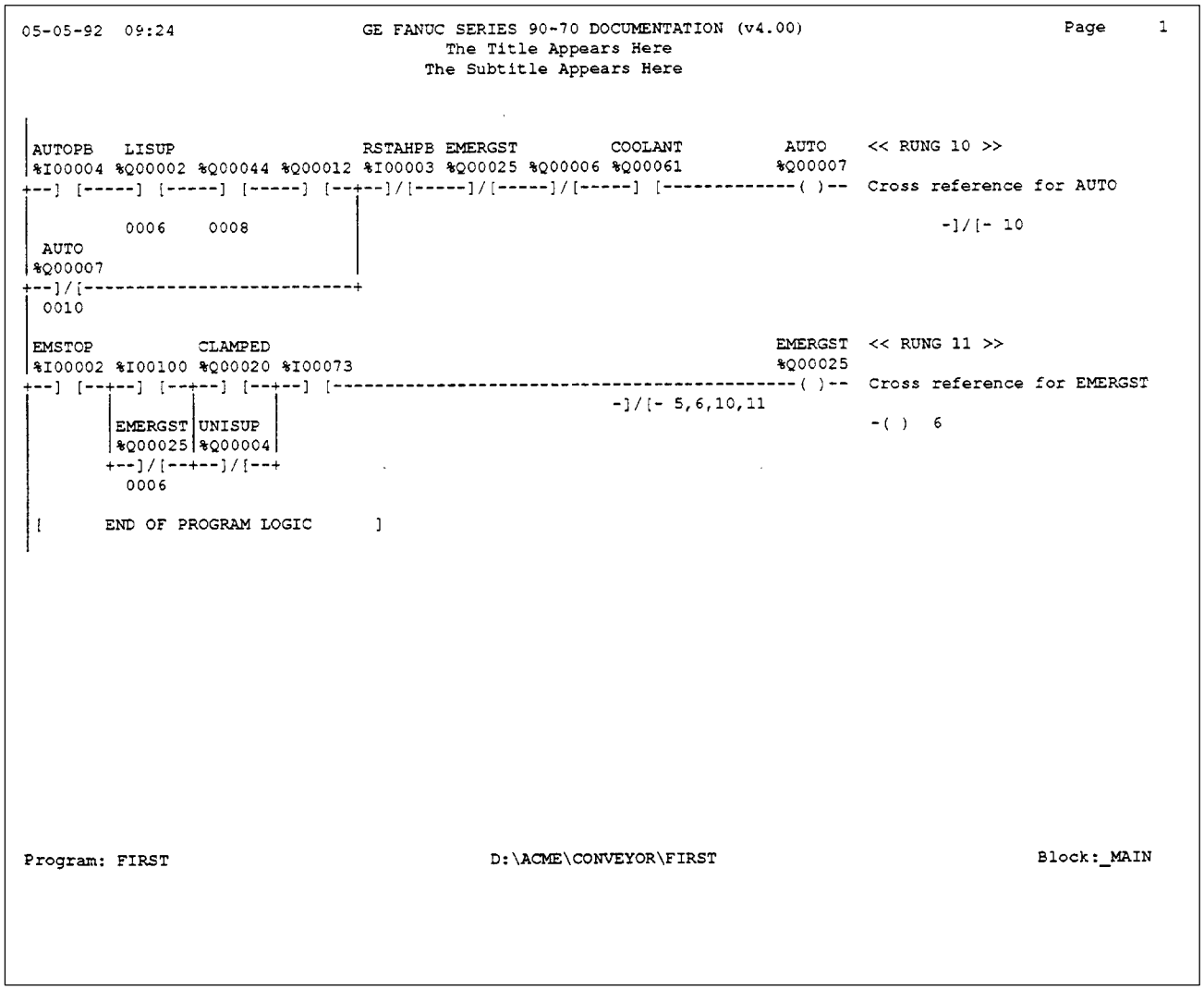
                                      The Subtitle Appears Here


|[   START OF LD  PROGRAM  FIRST   ]       (*                                  *)
|
|[      VARIABLE DECLARATIONS      ]
|
|[    PROGRAM BLOCK DECLARATIONS   ]
          +-------+
          |PACK_LN|  LANG: LD       (* PACKAGE/MOTION DETECTION         *)
          +-------+
|[            INTERRUPTS           ]
|
|[1      START OF PROGRAM LOGIC     ]
|
|  AUTOPB   LISUP                          EMERGST                                  << RUNG 5 >>
|  %I00004 %Q00002 %Q00038 %Q00012 %I00013 %Q00025 %Q00006 %Q00075         %Q00005
|+--] [-----] [-----] [-----] [--+--]/[-----]/[-----] [-----] [-------------( )--  Cross reference for %Q00005
||                              |          0011    0008                           -]/[- 5,7
||                              |
|%Q00005                        |
|+--]/[---------------------------+
|| 0005
||
|  EMSTOP          CLAMPED                                                 EMERGST  << RUNG 6 >>
|  %I00002 %I00100 %Q00020 %I00073                                         %Q00025
|+--] [--+--] [--+--] [--+--] [-----------------------------------------------( )--  Cross reference for EMERGST
|||       |       |       |                                                        -]/[- 5,6,10,11
|||       |EMERGST|UNISUP |                                                        -( )  11
|||       |%Q00025|%Q00004|
|||      +--]/[--+--]/[--+
|||        0011
||
|%Q00005 %Q00012 %I00021 %I00022                                           %M00001  << RUNG 7 >>
|+--]/[-----]/[--+--] [-----] [-----------------------------------------------( )--  Cross reference for %M00001
|| 0005          |                                                                        NONE
|%M00005 %M00006|
|+--]/[-----] [--+
||
||
|%Q00044 %M00002 +------+                                                   %Q00006  << RUNG 8 >>
|+--]/[-----] [---+ ADD_+-------------------------------------------------( )--  Cross reference for %Q00006
||               | INT |                                                        -] [- 5
||               |     |                                                        -]/[- 10
||       %R00001-+I1  Q+-%R00003
||               |     |
||       %R00002-+I2   |
||               |     |
||               +------+
||
|  (*************************************************************************)
|  (* The following logic rung enables automatic mode when all enabling condi- *)
|  (* tions are met.  See operator's manual, page 6-12, for more information.  *)
|  (*************************************************************************)
|

Program: FIRST                          D:\ACME\CONVEYOR\FIRST                          Block: _MAIN
```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AUTOPB %I00004
LISUP %Q00002
%Q00044
%Q00012
RSTAHPB %I00003
EMERGST %Q00025
%Q00006
COOLANT %Q00061
AUTO %Q00007
<< RUNG 10 >>
Cross reference for AUTO
-]/[- 10
0006
0008
AUTO %Q00007
0010
EMSTOP %I00002
%I00100
CLAMPED %Q00020
%I00073
EMERGST %Q00025
<< RUNG 11 >>
Cross reference for EMERGST
-]/[- 5,6,10,11
-( ) 6
EMERGST %Q00025
UNISUP %Q00004
0006
[END OF PROGRAM LOGIC]
Program: FIRST
D:\ACME\CONVEYOR\FIRST
Block:_MAIN

Cross References:

```
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================================================================================
==========  INPUT  (%I)  CROSS REFERENCES
================================================================================
REF.     NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------- -----------------------------------
%I00002  EMSTOP   EMERGENCY STOP PB
                  -] [- 6,11
%I00003  RSTAHPB  RESET AUTO / HAND PB
                  -]/[- 10
%I00004  AUTOPB   AUTO PUSH BUTTON
                  -] [- 5,10
%I00013           -]/[- 5
%I00021           -] [- 7
%I00022           -] [- 7
%I00073           -] [- 6,11
%I00100           -] [- 6,11

================================================================================
==========  OUTPUT  (%Q)  CROSS REFERENCES
================================================================================
REF.     NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------- -----------------------------------
%Q00002  LISUP    LOADER IS UP
                  -] [- 5,10
%Q00004  UNISUP   UNLOADER IS UP
                  -]/[- 6,11
%Q00005           -]/[- 5,7
                  -( )  5
%Q00006           -] [- 5
                  -]/[- 10
                  -( )  8
%Q00007  AUTO     auto light
                  -]/[- 10
                  -( )  10
%Q00012           -] [- 5,10
                  -]/[- 7
%Q00020  CLAMPED  -] [- 6,11
%Q00025  EMERGST  EMERGENCY RETURN
                  -]/[- 5,6,10,11
                  -( )  6,11
%Q00038           -] [- 5
%Q00044           -] [- 10
                  -]/[- 8
%Q00061  COOLANT  COOLANT VALVE
                  -] [- 10
%Q00075           -] [- 5

================================================================================
==========  INTERNAL  (%M)  CROSS REFERENCES
================================================================================
REF.     NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------- -----------------------------------
%M00001           -( )  7
%M00002           -] [- 8

Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

```
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REF.     NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------- ------------------------------------
%M00005           -]/[- 7
%M00006           -] [- 7

================================================================================
==========  REGISTER  (%R)  CROSS REFERENCES
================================================================================
REF.     NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------- ------------------------------------
%R00001           FBIO  8
%R00002           FBIO  8
%R00003           FBIO  8

Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

```
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- no use     * explicit use     + implicit use     # explicit and implicit use

================================================================================
==========  INPUT  (%I)  USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%I00064 -------- -------- -------- -------- -------- --**---- ---*---- ----***-
%I00128                             *--- -------- -------- -------* --------

================================================================================
==========  OUTPUT  (%Q)  USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%Q00064 ---*---- -------- ----*--- --*----- -------* ----*--- ----*--- -****-*-
%Q00128                                                          *-- --------

================================================================================
==========  INTERNAL  (%M)  USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%M00064                                                                  **--**

================================================================================
==========  REGISTER  (%R)  USAGE
================================================================================
REF.    |50        |40        |30        |20        |10      |1
ADDRESS +--------- +--------- +--------- +--------- +--------+
%R00050                                             ***

Program: FIRST              D:\ACME\CONVEYOR\FIRST              Block: _MAIN
```

Global Cross References:

```
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================================================================================
==========  INPUT  (%I)  GLOBAL CROSS REFERENCES
================================================================================
REF.     BLOCK    NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------  -------- -----------------------------------
%I00002  _MAIN    EMSTOP   EMERGENCY STOP PB
                           -] [- 6,11
         PACK_LN           -]/[- 4
%I00003  _MAIN    RSTAHPB  RESET AUTO / HAND PB
                           -]/[- 10
         PACK_LN           -]/[- 3
%I00004  _MAIN    AUTOPB   AUTO PUSH BUTTON
                           -] [- 5,10
         PACK_LN           -] [- 3
%I00013  _MAIN             -]/[- 5
%I00021  _MAIN             -] [- 7
         PACK_LN           -]/[- 5
%I00022  _MAIN             -] [- 7
         PACK_LN           -] [- 5
%I00073  _MAIN             -] [- 6,11
         PACK_LN           -] [- 4
%I00100  _MAIN             -] [- 6,11
         PACK_LN           -]/[- 4

================================================================================
==========  OUTPUT  (%Q)  GLOBAL CROSS REFERENCES
================================================================================
REF.     BLOCK    NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------  -------- -----------------------------------
%Q00002  _MAIN    LISUP    LOADER IS UP
                           -] [- 5,10
         PACK_LN           -] [- 3
%Q00004  _MAIN    UNISUP   UNLOADER IS UP
                           -]/[- 6,11
         PACK_LN           -] [- 4
%Q00005  _MAIN             -]/[- 5,7
                           -( )  5
         PACK_LN           -] [- 5
%Q00006  _MAIN             -] [- 5
                           -]/[- 10
                           -( )  8
         PACK_LN           -]/[- 3
                           -( )  6
%Q00007  _MAIN    AUTO     auto light
                           -]/[- 10
                           -( )  10
         PACK_LN           -]/[- 3
                           -( )  3
%Q00012  _MAIN             -] [- 5,10
                           -]/[- 7
         PACK_LN           -] [- 3,5
%Q00020  _MAIN    CLAMPED  -] [- 6,11
         PACK_LN  CLAMPED  -] [- 4
%Q00025  _MAIN    EMERGST  EMERGENCY RETURN

Program: FIRST              D:\ACME\CONVEYOR\FIRSTGlobal Cross Reference Tables
```

```
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REF.     BLOCK    NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------  -------- -------------------------------------
                           -]/[- 5,6,10,11
                           -( )  6,11
         PACK_LN           -] [- 4
                           -]/[- 3
                           -( )  4
%Q00038  _MAIN             -] [- 5
%Q00044  _MAIN             -] [- 10
                           -]/[- 8
         PACK_LN           -] [- 3
                           -]/[- 6
%Q00061  _MAIN    COOLANT  COOLANT VALVE
                           -] [- 10
         PACK_LN           -] [- 3
%Q00075  _MAIN             -] [- 5

================================================================================
==========  INTERNAL  (%M)  GLOBAL CROSS REFERENCES
================================================================================
REF.     BLOCK    NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------  -------- -------------------------------------
%M00001  _MAIN             -( )  7
         PACK_LN           -( )  5
%M00002  _MAIN             -] [- 8
         PACK_LN           -]^[- 6
%M00005  _MAIN             -]/[- 7
         PACK_LN           -]/[- 5
%M00006  _MAIN             -] [- 7
         PACK_LN           -] [- 5

================================================================================
==========  REGISTER  (%R)  GLOBAL CROSS REFERENCES
================================================================================
REF.     BLOCK    NICKNAME   REF. DESCRIPTION / CROSS REFERENCES
-------  -------  -------- -------------------------------------
%R00001  _MAIN             FBIO  8
         PACK_LN           FBIO  6
%R00002  _MAIN             FBIO  8
         PACK_LN           FBIO  6
%R00003  _MAIN             FBIO  8
         PACK_LN           FBIO  6

Program: FIRST              D:\ACME\CONVEYOR\FIRSTGlobal Cross Reference Tables
```

```
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- no use     * explicit use     + implicit use     # explicit and implicit use

================================================================================
==========  INPUT  (%I)  GLOBAL USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%I00064 -------- -------- -------- -------- -------- --**---- ---*---- ----***-
%I00128                            *--- -------- -------- -------* --------

================================================================================
==========  OUTPUT  (%Q)  GLOBAL USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%Q00064 ---*---- -------- ----*--- --*----- -------* ----*--- ----*--- -****-*-
%Q00128                                                          *-- --------

================================================================================
==========  INTERNAL  (%M)  GLOBAL USAGE
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%M00064                                                                  **--**

================================================================================
==========  REGISTER  (%R)  GLOBAL USAGE
================================================================================
REF.    |50        |40        |30        |20        |10      |1
ADDRESS +--------- +--------- +--------- +--------- +--------+
%R00050                                             ***

Program: FIRST              D:\ACME\CONVEYOR\FIRST           Global Use Tables
```

Value Tables:

```
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================================================================================
==========  INPUT  (%I)  VALUES
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
%I00064 00000000 00000000 00000000 00000000 00000000 00000000              0008
%I00128 00000000 00000000 00000000 00000000            +00123 00000000 00000000
%I00192 00000000 00000000             00345 00000000 00000000 00000000 00000000
       There are no non-zero values in the range from %I00193 to %I00384.
%I00448 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
%I00512 00000000 00000000 00001111 01010101 00000000 00000000 00000000 00000000

================================================================================
==========  INPUT  (%I)  OVERRIDES
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
        There are no overrides set in the range from %I00001 to %I00064.
%I00128 -------- -------- -------- -------- -------- -------- 0-0-0-0- 0000----
        There are no overrides set in the range from %I00129 to %I00384.
%I00448 ----0--- -0---0-- -------- 0------- ------0- -----0-- --0--0-- --------
%I00512 -------- -------- -0--1111 -------- -0------ --0----- -----0-- 0--0----

- = not overridden    0 = overridden in OFF state    1 = overridden in ON state

================================================================================
==========  OUTPUT  (%Q)  VALUES
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
       There are no non-zero values in the range from %Q00001 to %Q00192.
%Q00256 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
%Q00320 00000000 00000000 00000110 00000000              0011             00435
%Q00384            +05432 00000000 00000000 00000000 00000000 00000000 00000000
%Q00448 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
%Q00512 00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000

================================================================================
==========  OUTPUT  (%Q)  OVERRIDES
================================================================================
REF.    |64      |56      |48      |40      |32      |24      |16      |8     |1
ADDRESS +------- +------- +------- +------- +------- +------- +------- +------+
        There are no overrides set in the range from %Q00001 to %Q00256.
%Q00320 -------- -------- ----0110 -------- -------- -------- -------- --------
        There are no overrides set in the range from %Q00321 to %Q00512.

- = not overridden    0 = overridden in OFF state    1 = overridden in ON state









Program: FIRST              D:\ACME\CONVEYOR\FIRST
```

Program Logic Table of Contents:

```
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        *****   L O G I C   T A B L E   O F   C O N T E N T S   *****


                 FIRST                              1

                 Block Structure                    2

                 _MAIN                              3
                    variable table                  4
                    logic                           4
                    cross reference tables          8
                    use tables                     10

                 PACK_LN                           11
                    variable table                 12
                    logic                          12
                    cross reference tables         15
                    use tables                     17

                 Global Cross Reference Tables     18

                 Global Use Tables                 20

Program: FIRST              D:\ACME\CONVEYOR\FIRST           TABLE OF CONTENTS
```

Configuration Header Page:

```
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                                   TITLE
                                SUBTITLE



                 GGGG EEEEE       FFFFF  AAA  N   N U   U  CCCC
                G     E           F     A   A NN  N U   U C
                G GGG EEEE        FFF   AAAAA N N N U   U C
                G   G E           F     A   A N  NN U   U C
                 GGG  EEEEE       F     A   A N   N  UUU   CCCC



           AAA  U   U TTTTT  OOO  M   M  AAA  TTTTT IIIII  OOO  N   N
          A   A U   U   T   O   O MM MM A   A   T     I   O   O NN  N
          AAAAA U   U   T   O   O M M M AAAAA   T     I   O   O N N N
          A   A U   U   T   O   O M   M A   A   T     I   O   O N  NN
          A   A  UUU    T    OOO  M   M A   A   T   IIIII  OOO  N   N



(*****************************************************************************)
(                                                                             )
(      CENTRAL PLC CONFIGURATION                                              )
(                                                                             )
(                                                                             )
(              TOTAL DISCRETE I/O (%I + %Q):    176                           )
(                                                                             )
(              HIGHEST CONFIGURED REFERENCES                                  )
(              ----------------------------                                   )
(              DISCRETE INPUT         (%I) :    128                           )
(              DISCRETE OUTPUT        (%Q) :     64                           )
(                                                                             )
(              ANALOG INPUT          (%AI) :     32                           )
(              ANALOG OUTPUT         (%AQ) :      8                           )
(                                                                             )
(              REGISTER MEMORY        (%R) :      0                           )
(                                                                             )
(*****************************************************************************)









 Folder: C:\R4RC_70\TEST
```

Configuration for Central PLC:

```
08-13-92  13:52    GE-FANUC SERIES 90-70 DOCUMENTATION (v4.01)        Page     2
                                   TITLE
                                SUBTITLE


+-------------------------------------------------------------------------------+
|------+-------+-------+-------+-- RACK  0 ----+-------+-------+-------+-------|
|  PS  |   1   |   2   |   3   |   4   |   5   |   6   |   7   |   8   |   9   |
|============= P R O G R A M M E D    C O N F I G U R A T I O N ===============|
|      |       |       |       |       |       |       |       |       |       |
|PWR710|CPU 771|BEM 731|MDL 240|MDL 240|MDL 240|MDL 340|ALG 230|ALG 320|       |
|      |       |       |       |       |       |       |       |       |       |
|55W   |       |GBC1   |I AC 16|I AC 16|I AC 16|Q AC 16|I ALG 8|Q ALG 4|       |
|      |       |       |       |       |       |       |       |       |       |
|      |512 KB |Devices|Ref Adr|Ref Adr|Ref Adr|Ref Adr|Ref Adr|Ref Adr|       |
|      |       |BUS1: 3|%I00001|%I00017|%I00033|%Q00001|%AI0001|%AQ0001|       |
|      |       |       |       |       |       |       |       |       |       |
|      |       |       |       |       |       |       |       |       |       |
|      |       |       |       |       |       |       |       |       |       |
|      |       |       |       |       |       |       |       |       |       |
+------+-------+-------+-------+-------+-------+-------+-------+-------+-------+









Folder: C:\R4RC_70\TEST                                                  Rack
```

Configuration for Central PLC with Detail of Central PLC Options:

```
08-13-92  13:52    GE-FANUC SERIES 90-70 DOCUMENTATION (v4.01)        Page     3
                                    TITLE
                                  SUBTITLE

       SERIES 90-70 MODULE IN RACK 0 SLOT  0
+-------+----------------- SOFTWARE  CONFIGURATION ----------------------------
| SLOT  | Catalog #: IC697PWR710            POWER SUPPLY 120/240 VAC 55W
|   0   |
|       |
|PWR710 |-------------------------------------------------------------------
|       |
|55W    |
|       |
|       |
|       |
|       |
|       |
|       |
|       |
|       |
+-------+



       SERIES 90-70 MODULE IN RACK 0 SLOT  1
+-------+----------------- SOFTWARE  CONFIGURATION ----------------------------
| SLOT  | Catalog #: IC697CPU771            771 CPU EXPANDABLE MEM
|   1   |
|       |
|CPU 771|-------------------------------------------------------------------
|       | IOScan-Stop: NO        Baud Rate  : 19200
|       | Passwords  : ENABLED   Parity     : ODD
|       |                        Stop Bits  : 1
|       |                        Data Bits  : 8
|       |                        Modem TT   :   0       1/100 Second / Count
|512 KB |                        Idle Time  :  10       Seconds
|       |                        Mode       : SNP
|       |                        Watchdg Tmr:   200     msec
|       | The parameters on next page are supported by PLC Rev 4.0 or higher.
|       | If PLC Firmware version is less than 4.0, do not modify them.
+-------+

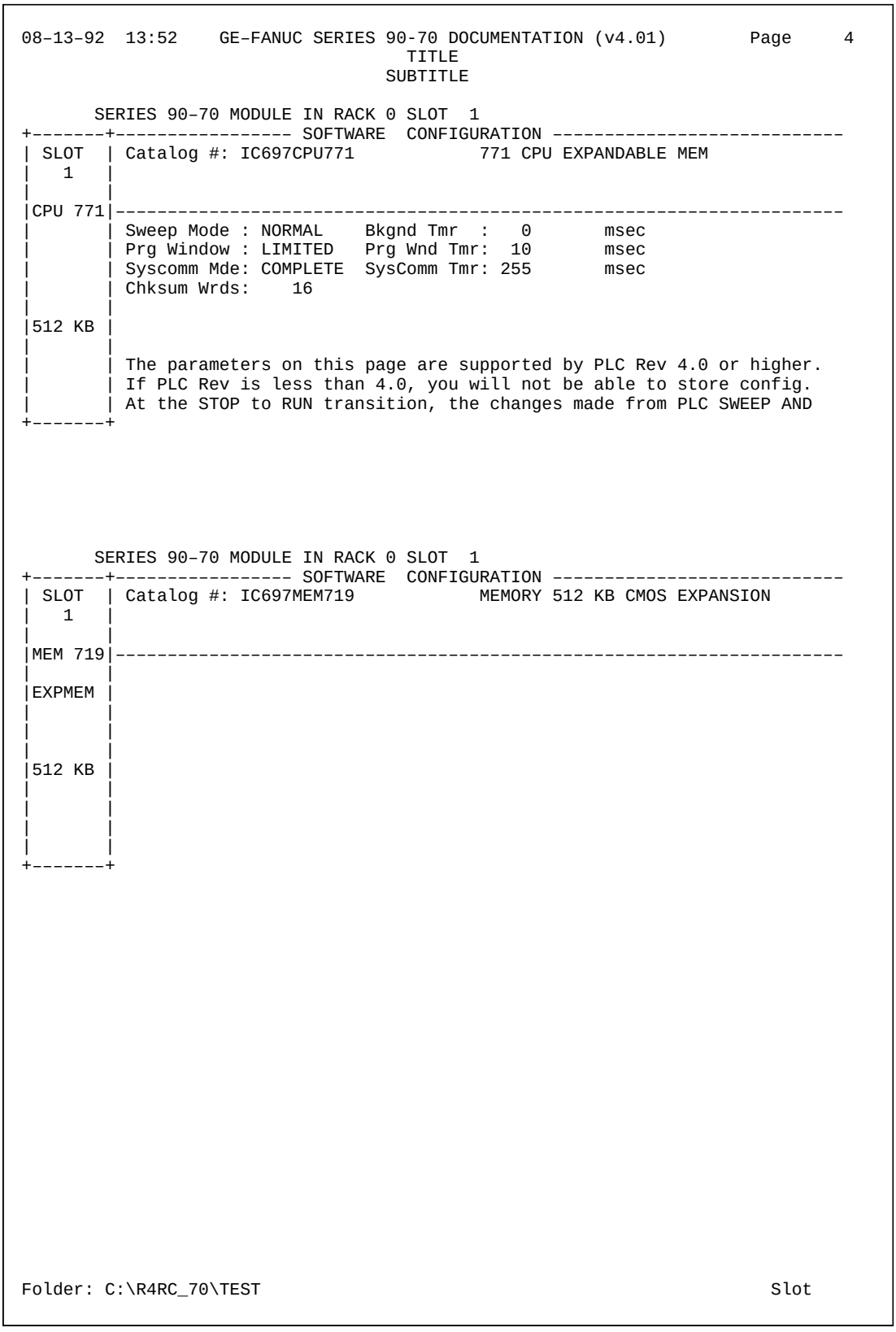








Folder: C:\R4RC_70\TEST                                                 Slot
```



```
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                                    TITLE
                                  SUBTITLE

       SERIES 90-70 MODULE IN RACK 0 SLOT  1
+-------+----------------- SOFTWARE  CONFIGURATION -----------------------------
| SLOT  | Catalog #: IC697CPU771            771 CPU EXPANDABLE MEM
|   1   |
|       |
|CPU 771|-------------------------------------------------------------------------
|       | Sweep Mode : NORMAL    Bkgnd Tmr  :   0       msec
|       | Prg Window : LIMITED   Prg Wnd Tmr:  10       msec
|       | Syscomm Mde: COMPLETE  SysComm Tmr: 255       msec
|       | Chksum Wrds:    16
|       |
|512 KB |
|       |
|       | The parameters on this page are supported by PLC Rev 4.0 or higher.
|       | If PLC Rev is less than 4.0, you will not be able to store config.
|       | At the STOP to RUN transition, the changes made from PLC SWEEP AND
+-------+



       SERIES 90-70 MODULE IN RACK 0 SLOT  1
+-------+----------------- SOFTWARE  CONFIGURATION -----------------------------
| SLOT  | Catalog #: IC697MEM719            MEMORY 512 KB CMOS EXPANSION
|   1   |
|       |
|MEM 719|-------------------------------------------------------------------------
|       |
|EXPMEM |
|       |
|       |
|       |
|512 KB |
|       |
|       |
|       |
|       |
+-------+

Folder: C:\R4RC_70\TEST                                                  Slot
```

Configuration with Reference View Central PLC Option:

```
08-13-92  13:52    GE-FANUC SERIES 90-70 DOCUMENTATION (v4.01)        Page    13
                                    TITLE
                                  SUBTITLE


   --------------------    DISCRETE INPUTS    (%I)  ------------------
  TOTAL  I+Q: 176                                 HIGHEST REF CONFIGURED:  128
  REFERENCE  PHYSICAL          IO    MODULE
  START - END  ADDRESS         TYPE    TYPE         DESCRIPTION
  ----------- --------        ------  -------  ---------------------------------
   00001-00016 0.3             90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00017-00032 0.4             90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00033-00048 0.5             90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00049-00064 0.2.1.30        GENIUS  I AC 16   INPUT BLOCK 115VAC 16CKT
   00065-00128 0.2.1.28        REMOTE  REMSCAN   REMOTE I/O SCANNER - DROP ID 033
   00065-00080 033#0.2         90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00081-00096 033#0.3         90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00097-00112 033#0.4         90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED
   00113-00128 033#0.8         90-70   I AC 16   INPUT 120 VAC 16PT ISOLATED

 Folder: C:\R4RC_70\TEST                                                Ref View
```

Chapter 11 I/O Configuration

The I/O configuration function is used to specify the mapping of logical references used by the user program to the physical I/O modules. It consists of completing setup screens which represent the modules in a rack.

Note

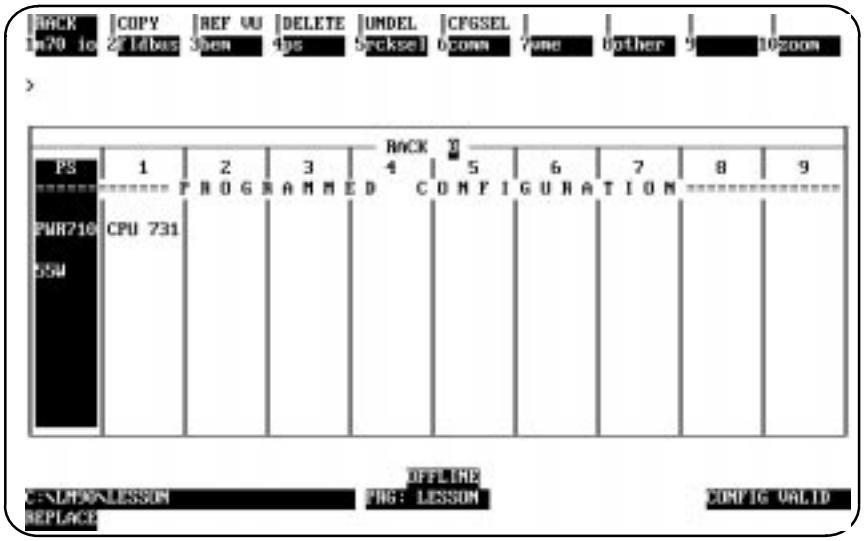
For boards which generate interrupts (e.g., PCM, Genius Bus Controller, Analog Input/Output, GEnet LAN, and Ethernet), you must not have an empty rack slot to the left of the module.

Chapter 11 contains the following sections:

Section	Title	Description	Page
1	Editing I/O Configurations	Explains how to display the rack screen, copy a configuration from one slot to another, change or delete the configuration of a slot, move a configuration to another slot, and save the configuration to disk.	11-3
2	Configuring CPU Modules	Explains how to configure a CPU module.	11-7
3	Configuring Rack Type	Explains how to select a 9-slot, 5-slot, or VME integrator rack.	11-19
4	Configuring a Bus Expansion Module	Explains how to configure Bus Transmitter and Bus Receiver modules.	11-28
5	Configuring 90-70 I/O Modules	Explains how to configure 90-70 I/O modules.	11-29
6	Configuring a Programmable Coprocessor Module	Explains how to configure the PCM as one CCM port, two independent CCM ports, one CCM port and one BASIC application having one port, or one BASIC application using one or both serial ports.	11-40
7	Configuring a Communications Module	Explains how to configure a Communications module in CCM ONLY, RTU ONLY, CCM / RTU, RTU / CCM, SNP ONLY, SNP / CCM, CCM / SNP, SNP / RTU, or RTU / SNP mode.	11-48
8	Configuring an Alphanumeric Display Coprocessor Module	Explains how to configure the ADC module.	11-54
9	Configuring Port 1 or 2 on a CPX model CPU	Explains how to configure the embedded serial COM ports on the CPX series of CPUs	11-55
10	Configuring a Genius Bus Controller	Explains how to configure a Genius Bus Controller, the devices on a bus including configuring a Field Control Module, and Genius I/O blocks.	11-58
11	Configuring a FIP Bus Controller	Explains how to configure a FIP Bus Controller.	11-89
12	Configuring a Remote I/O Scanner Module	Explains how to configure a Remote I/O Scanner Module.	11-91
13	Configuring a GEnet MAP Module	Explains how to configure a GEnet MAP module and the MMS and TCP IP Ethernet modules.	11-95
14	Configuring a High Speed Counter	Explains how to configure the 90-70 High Speed Counter Module for each of the five types of High Speed Counters.	11-101
15	Configuring a Third Party VME Module	Explains how to configure a VME module.	11-107
16	Configuration Reference View	Explains how to use the reference view table to display a listing of configured modules with the same reference (%I, %Q, %AI, %AQ, %R, %G, %GA, %GB, %GC, %GD, or %GE).	11-120

Section 1: Editing I/O Configurations

When editing an I/O configuration, you will always enter the configuration package by doing the following: first from the main LM90 menu, press the **Config** softkey (**F2**); then select the folder you wish to edit (or create a new one to edit) and press **Enter**; then press the **I/O** softkey (**F1**). When **I/O** (**F1**) is selected from the Configuration Software main menu, the I/O Configuration Rack screen, similar to the one shown below, is displayed. The following example represents a sample Series 90-70 PLC configuration as you would see it before configuring additional modules.



The rack shown above is divided into 10 slots. The first slot on the left is labeled "**PS**" at the top and always contains the power supply. The remaining slots are numbered 1 through 9. The CPU module always occupies slot 1 of rack 0. The remaining slots may contain various modules, such as 90-70 I/O modules, a Genius Bus Controller, Bus Expansion Modules, or Programmable Coprocessor Modules.

The cursor position on the I/O Configuration Rack screen is indicated by the slot being displayed in reverse video. Upon entering the Rack screen, the Power Supply slot is shown in reverse video. Use the **Left** or **Right** cursor keys to move the cursor from one slot to the next. To display another rack, use the **Page Up** and **Page Down** keys or the **Cursor Up** and **Cursor Down** keys.

The Rack screen presents an overview perspective of the Series 90-70 PLC system.

Function Key	Function	Description
F1	M70I/O	Add Model 70 I/O modules.
F2	Genius	Add a Genius Bus Controller.
F3	BEM	Add a Bus Transmitter or Bus Receiver module.
F4	Power Supply	Add a power supply. If the power supply already exists, press **Zoom (F10)** to configure it.
F5	Rack Selection	Change the rack type.
F6	Communication	Add a Communications module.
F7	VME	Add a third-party VME module or placeholder.
F8	Other	Add other modules (e.g., PCM, ADC, or GDC).
F10	Zoom	Display the current configuration of a configured slot.

Configuration Validation

CONFIG VALID is displayed in the lower right corner of each display screen after the configuration is successfully validated. When **CONFIG INVALID** is indicated, the file may not be stored to the PLC.

The most common cause of the **CONFIG INVALID** status is fatal overlaps among %I or %AI references, or Genius Global modules which receive global data. It may also occur when a slot in the rack before a board which generates interrupts is left vacant, or when Bus Transmitter and/or Receiver modules are missing.

A warning occurs when non-fatal overlaps occur; however, the configuration is still valid. Non-fatal overlaps occur between references other than those described for fatal overlaps.

Copying Configuration from Slot to Slot

To copy configuration from slot to slot:

1. Position the cursor on the first module and press **Zoom (F10)** to display the slot configuration screen.
2. Configure the module.
3. Press **Rack (Shift-F1)** or the Escape key to return to the rack screen shown above.
4. With the cursor on that slot, press **Copy (Shift-F2)**.
5. Move the cursor to another slot and press the **Enter** key. You can repeat this as many times as needed. As each module is entered, its reference address is set to the next available address.

   If the limit for the reference address has been reached, the copy function will adjust the module's reference address to the maximum allowed. Each copy after the maximum reference address has been reached will result in an address overlap. If a fatal overlap will result from copying a configuration, the copy operation will not be allowed.
6. When finished copying, exit copy mode by pressing the **Escape** key. The software displays the message "Copy Mode Ended."
7. For each copy, press **Zoom (F10**) to display the detail screen. Edit the reference address (if required) and other characteristics as needed.

Changing the Configuration of a Slot

To change the configuration of a slot by replacing the module with another of the **same** type.

1. Place the cursor at the slot to be changed.
2. Press **Zoom (F10)** to display the module's detail screen.
3. Use one of the function keys to select a new module type for the slot. When the list of available modules is displayed, move the cursor to the correct module and press the **Enter** key. Then, enter **Y** (Yes) after the prompt "REPLACE displayed module ? (Y / N)."
4. Complete the configuration; then press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

To change the configuration of a slot by replacing the module with one of a **different** type.

1. Place the cursor at the slot to be changed.
2. Press the function key that represents the type of module you want to place in the slot.
3. After confirming the deletion of the existing module, the module selection screen is displayed.
4. Complete the configuration; then, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Deleting the Configuration of a Module

To delete the configuration of a module:

1. Place the cursor on the module, and press **Delete (Shift-F4)**. Enter **Y** (Yes) after the prompt: "DELETE displayed module from slot ? (Y / N)."

   In the case of a Genius Bus Controller, the prompt will be "DELETE GBC and all attached blocks ? (Y / N)." In the case of a Remote I / O Scanner, the prompt will be "DELETE Remote I / O Scanner from bus and corresponding configuration file ? (Y / N)."

   The configuration of the slot will be deleted.

2. To return the configuration to the slot, press **Undelete (Shift-F5)**.

Moving a Module to Another Slot

To move the configuration of a module to another slot:

1. With the cursor at the configuration to be moved, **press Delete (Shift-F4)**. Enter **Y** (Yes) after the prompt: "DELETE displayed module from slot ? (Y / N)." The configuration of the slot will be deleted.
2. Move the cursor to the new location; it may be in another rack.
3. Press **Undelete (Shift-F5)**. The deleted configuration will appear in the new location. The reference address will not be affected.

Saving the Configuration to Disk

The configuration is automatically saved to a file on disk during the configuration process.

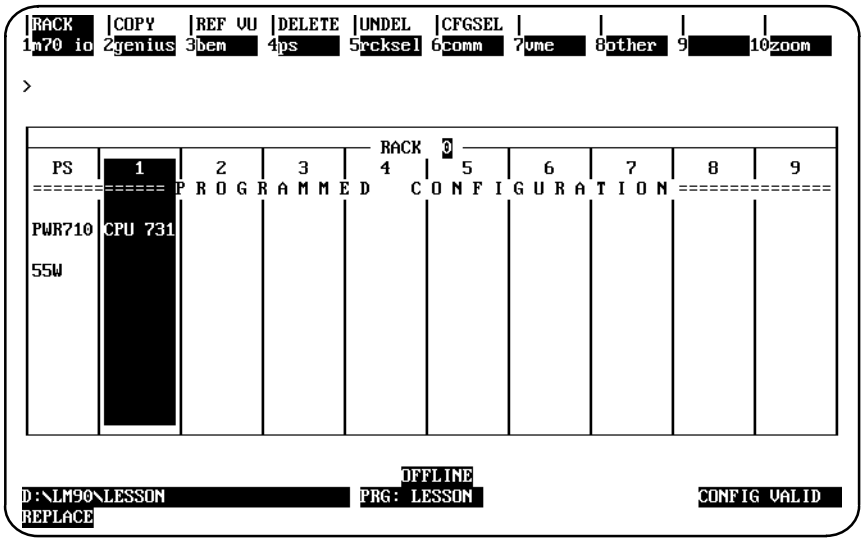
- When module data has been changed within a rack, and that new data is moved or copied from that rack to another rack or when you cursor to a new rack.
- When module data has been changed within a rack, and then the Escape key is pressed to return to the Configuration main menu.
- When module data has been changed and Reference View (Shift-F3) or Configuration Select (Shift-F6) is pressed.
- When configuration data has been changed and Configuration Select (Shift-F6) is pressed.

The configuration may also be written to disk at any time by pressing **ALT-U** to update the disk.

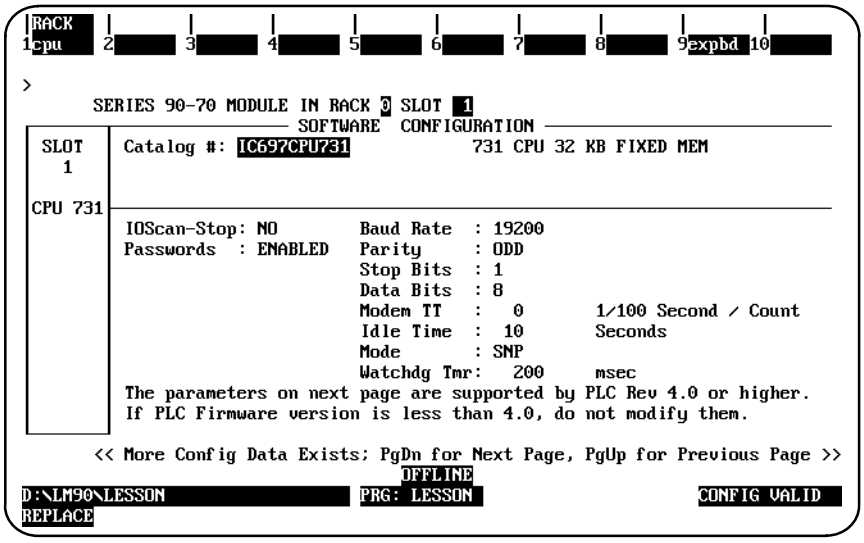
Section 2: Configuring CPU Modules

To configure a CPU module:

1. The CPU module must be located in slot 1 of rack 0. Move the cursor to this slot by pressing the **cursor** keys.



2. Press **Zoom (F10)** to display the CPU detail screen. If you are configuring any CPU other than the 731, turn to page 11-14 for instructions on selecting a different CPU. Then return to this page for instructions on completing the configuration.



Parameter	Description
IOScan-Stop	Indicates whether I/O is to be scanned while the PLC is in **STOP** mode. Choices are **YES** or **NO***.
Passwords	Indicates whether passwords are **ENABLED*** or **DISABLED**.
Timer Faults	Timer faults are used for the Sequential Function Chart version of Logicmaster 90-70 software. If **ENABLED** and the step timer limits are exceeded, a fault will be logged in the PLC fault table.
Baud Rate	Transmission rate in bits per second of data through the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Parity	Specifies whether parity is indicated by an **ODD*** or **EVEN** number of bits, or whether no parity bit (**NONE**) is added to the word.
Stop Bits	Most serial communication uses at least one stop bit. Slower devices use two stop bits. Choices are **1*** or **2**.
Data Bits	Specifies whether the CPU recognizes **7-bit** or **8-bit*** words.
Modem Turnaround Time	Time required for the modem to start data transmission after receiving the transmit request. 1 count = 1/100 second. Choices are **0*** to **255**.
Idle Time	The maximum time the CPU should wait to receive the next message from the programmer before assuming that the programmer has failed and proceeding to its base state. The range of communication idle time is **1** to **60** seconds. Default = 10 seconds.
Mode	**SNP*** indicates that the serial port will be used for SNP communications. **MSG** indicates that the serial port will be used to send print commands from a C program block to the connected device.
Watchdog Timer	Enter a value from **10** to **2550** ms, in 10 ms increments. The watchdog timer value entered here will be used to update the CPU config file. Default = 200 ms.

* Default selection.

Caution

Once passwords are disabled, in order to re-enable the use of passwords, you must clear the PLC memory by cycling power to the PLC with the battery removed.

3. Use the **Tab** key and **Back Tab** key (**Shift-Tab**) to cycle through the selections for each parameter displayed on this screen.
4. Press the **Page Down** key to display the second page of the CPU detail screen. The parameters displayed on this page will depend on which sweep mode is selected.

Caution

If the parameters are changed and the CPU version is less than 4.0, you cannot store the configuration.

Selecting the Sweep Mode

The sweep mode indicates the kinds of tasks the CPU should perform during the sweep and how much time to allocate to each task. The sweep mode is selected on the CPU detail screen. The four possible values are **NORMAL**, **CONSTANT WINDOW**, **CONSTANT SWEEP**, and **MICROCYCLE**. When a new CPU is selected, the default sweep mode is **NORMAL**.

To select a different sweep mode, move the cursor to the ***Sweep Mode*** field and repeatedly press the **Tab** key until the desired selection is displayed on the screen. Press the **Enter** key to accept the value.

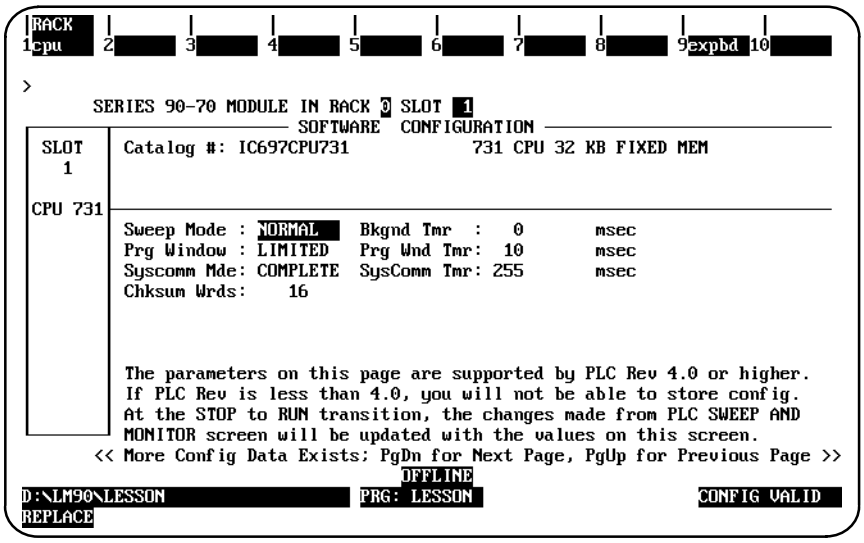
Mode	Description
Normal	The PLC sweep executes as fast as possible. The overall PLC sweep time depends on the logic program and the requests being processed in the windows. In **NORMAL** mode, the overall PLC sweep time is equal to the time required to execute the logic in the program plus the respective window timer values. The window will terminate when it has no more tasks to complete.
Constant Window	Each window will operate in a **RUN-TO-COMPLETION** mode. The PLC will alternate among three windows for a time equal to the value set for the window timer parameter. The overall PLC sweep time is equal to the time required to execute the logic program plus the value of the window timer. This time may vary due to sweep-to-sweep differences in the execution of the program logic.
Constant Sweep	The overall PLC sweep time is fixed. Some or all of the windows at the end of the sweep may not be executed. The windows will terminate when the overall PLC sweep time has reached the value specified for the ***Sweep Timer*** field.
Microcycle	In **MICROCYCLE** mode, the timebase is usually the same as the interval between the invocations of the program with the shortest interval. In that setup, all other programs must execute in whole number multiples of the shortest program's execution interval. You can, however, establish a shorter timebase than the intervals between the beginning of the shortest program, especially advantageous if your inputs are occurring in extremely short intervals.

Note

For a much more detailed discussion of each mode, especially of Microcycle mode, refer to chapter 2 of the *Series 90™-70 Programmable Controller Reference Manual* (GFK-0265).

Normal Mode

When the sweep mode is **NORMAL**, the PLC sweep executes as fast as possible. The overall PLC sweep time depends on the logic program and the requests being processed in the windows. In **NORMAL** mode, the overall PLC sweep time is equal to the time required to execute the logic in the program plus the respective window timer values. The window will terminate when it has no more tasks to complete. The following parameters are displayed when **NORMAL** is selected for sweep mode on the CPU detail screen.



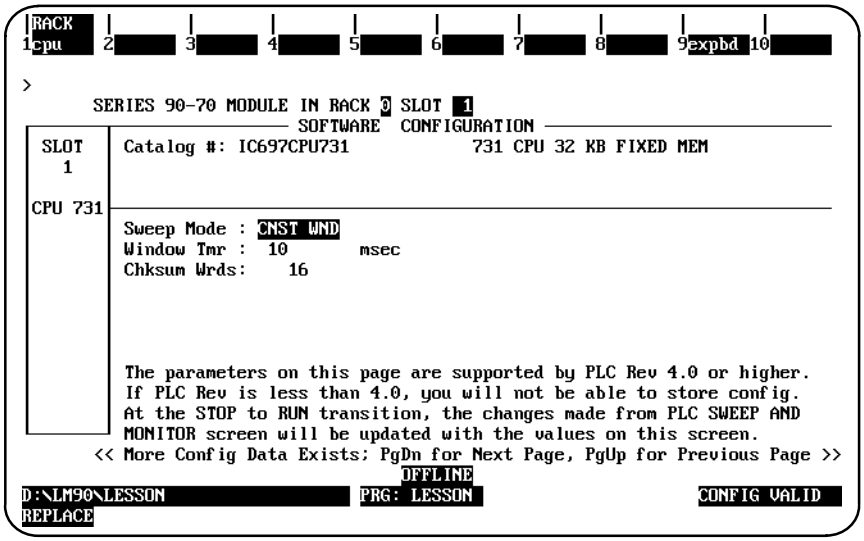
Parameter	Description
Sweep Mode	Sweep mode is set to **NORMAL**.
Programmer Window Mode	Select **LIMITED***, or **COMPLETE**. When **LIMITED** (time-sliced), a value may be entered into the ***ProgrammerWindow Timer*** field.
System Communications Window Mode	Select **LIMITED** or **COMPLETE***. When **LIMITED** (time-sliced) is selected, a value may be entered into the ***SystemCommunications Window Timer*** field. When **COMPLETE** is selected, the window is in a **RUN-TO-COMPLETION** mode, and the ***SystemCommunicationsWindow Timer*** field cannot be edited.
Checksum Words	Number of words of the user program to be used as input to the checksum algorithm each sweep. Enter a value from **0** to **32,760**, in multiples of 8. If the value entered is not a multiple of 8, the value will be automatically adjusted. Default = 16.
Background Task Window Timer	Enter a value from **0*** to **255** ms.
Programmer Window Timer	If the ***ProgrammerWindow Mode*** is set to **LIMITED**, you may enter a value for the timer from **0** to **255** ms. Default = 10.
System Communications Window Timer	If the ***SystemCommunicationsWindow Mode*** is set to **LIMITED**, you may enter a value for the timer from **0** to **255*** ms, in 1 ms increments.

* Default selection.

Constant Window Mode

When the sweep mode is **CONSTANT WINDOW**, each window will operate in a **RUN-TO-COMPLETION** mode. The PLC will alternate among three windows for a time equal to the value set for the window timer parameter. The overall PLC sweep time is equal to the time required to execute the logic program plus the value of the window timer. This time may vary due to sweep-to-sweep differences in the execution of the program logic.

The following parameters are displayed when **CONSTANT WINDOW** is selected for sweep mode on the CPU detail screen.



Parameter	Description
Sweep Mode	Sweep mode is set to **CONSTANT WINDOW**
Window Timer	Enter a value from **5** to **255** ms, in 1 ms increments. Default = 10 ms. This value cannot be greater than the value for the watchdog timer.
Checksum Words	The number of words of user program to be checksummed per sweep. Enter a value from **0** to **32760**, in multiples of 8. If the value entered is not a multiple of 8, the value will be automatically adjusted. Default = 16.

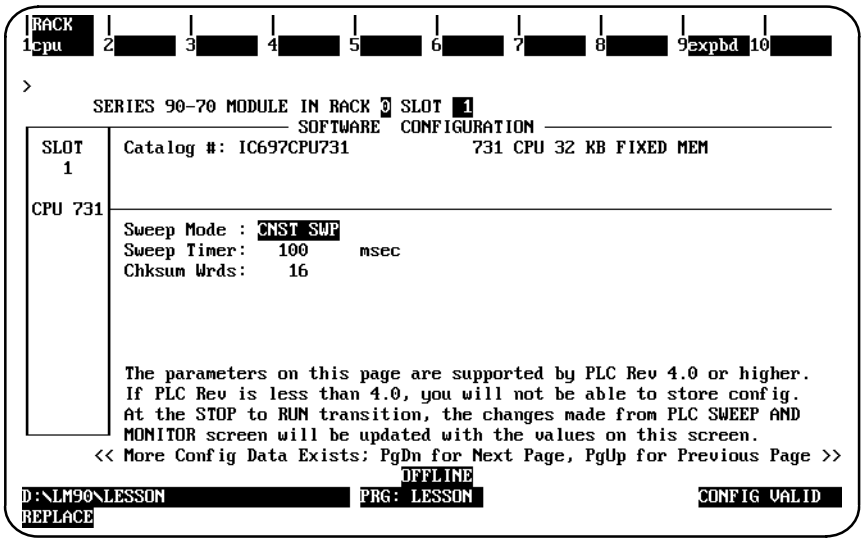
Note

If the communications window is disabled, it can be reenabled manually by putting the PLC into stop mode and resetting the sweep mode, by connecting to a WSI-parallel, or by powercycling the system.

Constant Sweep Mode

When the sweep mode is **CONSTANT SWEEP**, the overall PLC sweep time is fixed. Some or all of the windows at the end of the sweep may not be executed. The windows will terminate when the overall PLC sweep time has reached the value specified in the ***Sweep Timer*** field.

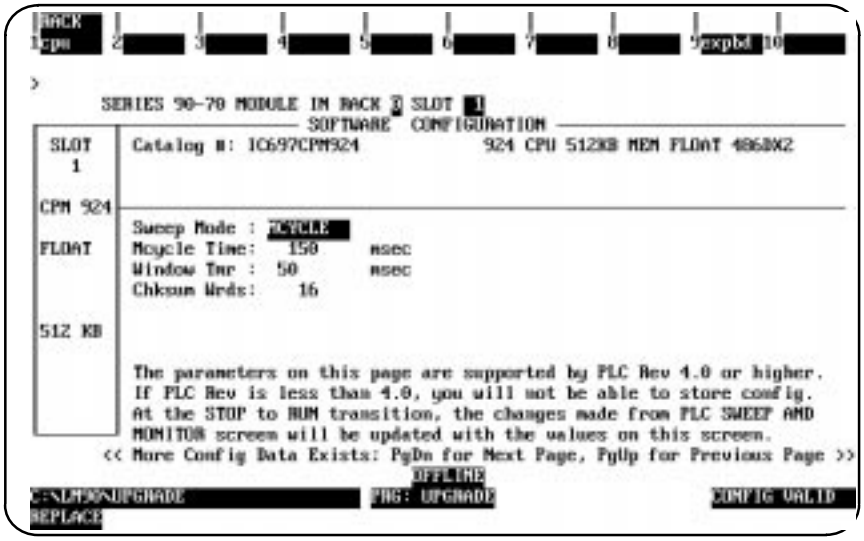
The following parameters are displayed when **CONSTANT SWEEP** is selected for sweep mode on the CPU detail screen.



Parameter	Description
Sweep Mode	Sweep mode is set to **CONSTANT SWEEP**.
Sweep Timer	Enter a value from **10** to **2550** ms, in 10 ms increments. Default = 100 ms. If the value entered is not in this range, it will be rounded to the next highest legal value by the system. This value cannot be greater than the value for the watchdog timer.
Checksum Words	The number of words of user program to be checksummed per sweep. Enter a value from **0** to **32,760**, in multiples of 8. If the value entered is not a multiple of 8, the value will be automatically adjusted. Default = 16.

Microcycle Sweep Mode

The following parameters are displayed when **MICROCYCLE** is selected for sweep mode on the CPU detail screen.



Note

As discussed in chapter 5 of this book, you can change the active sweep through the Status function; however, changing from Microcycle mode to any other mode will cause the PLC to return an error. For the Microcycle mode, the Active Sweep adjustment should only be used to modify the base cycle time.

Remember that Microcycle Sweep mode is a Release 6 feature and requires Release 6 firmware.

Establishing Times and Checksum Words

To modify the defaults for "Mcycle Time," "Window Tmr," and "Chksum Wrds," move the cursor to the field you wish to modify and key in your selection, or press **Tab** and **Shift-Tab** to increment and decrement the available settings.

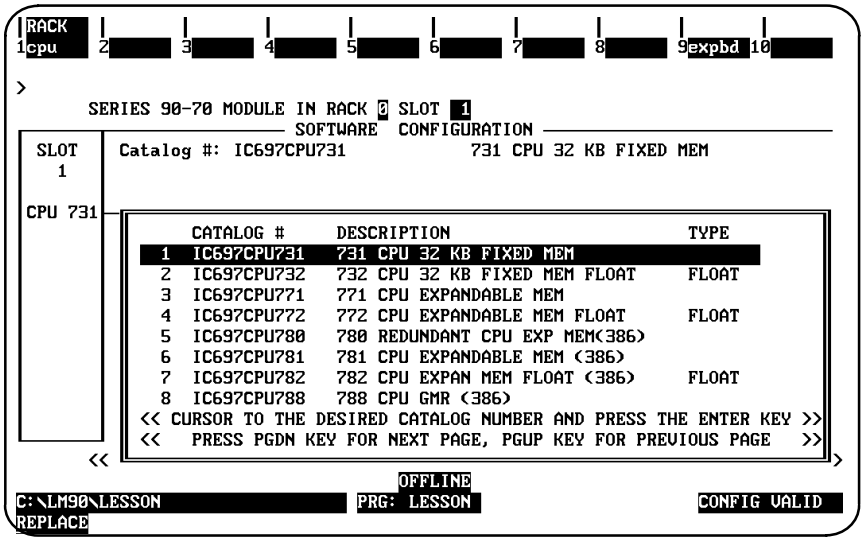
Scheduling Programs to Execute

To control program execution, you need to use the Control (**ctrl**) function from the Program Declarations screen. Refer to the "Multiple Programs: Program Declarations" section of chapter 3 beginning on page 3-75, with the "Selecting the Mode and Program Scheduling Options" part beginning on the second page of that section.

Available CPU Modules

To display a list of available CPU modules:

1. Press **CPU (F1)** to display a list of available CPU modules and their catalog numbers.



2. Position the cursor on the correct CPU module, and press the **Enter** key. Then, enter **Y** (Yes) after the prompt: "REPLACE displayed module? (Y / N)."
3. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Selecting a Different CPU Module

1. To select a different CPU module, move the cursor to the required CPU module and press the **Enter** key. Then, enter **Y** (Yes) after the prompt: "REPLACE displayed module?(Y / N)."

   For example, to configure a 12 mHz 771 CPU, move the cursor to the entry for that module (IC697CPU771) and press the **Enter** key.

2. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Configuring Memory Expansion Boards

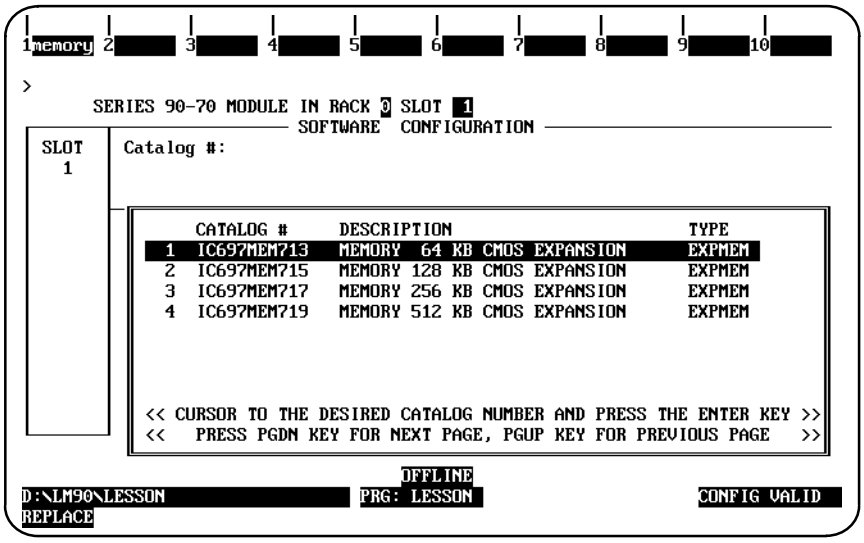
A memory expansion board is required for those CPUs with expandable memory (e.g., 771, 781, 772, and 782). It is not used or supported by CPUs with fixed memory (e.g., 731 and 732).

Note

CPU Models 914, 915, 924, and 925 have expanded memory but do not have an expansion board. The expanded memory is built in and not configurable.

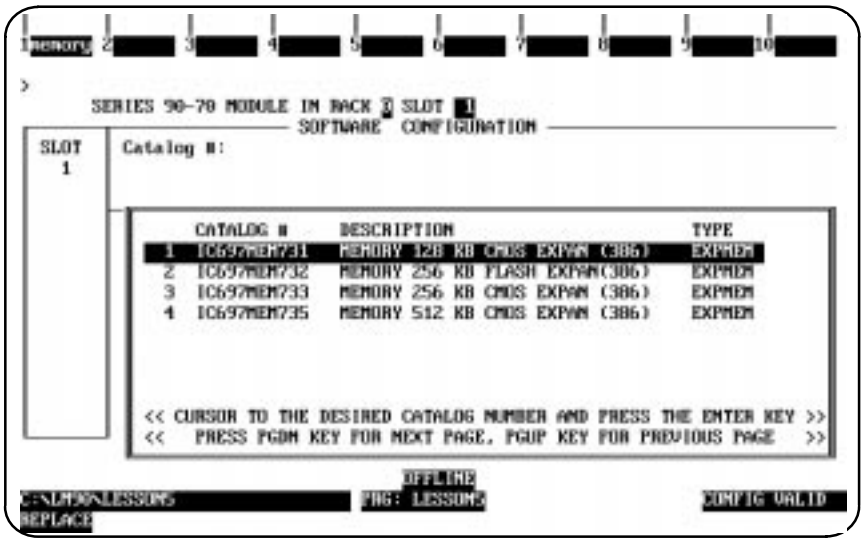
To configure a memory expansion board:

1. With the listing of catalog numbers for the CPU module displayed on the screen, move the cursor to IC697CPU771 to select the Model 771 CPU.
2. Press the **Enter** key to enter the catalog number shown in reverse video and display the CPU detail screen after answering **Y** to the prompt.
3. To enter a Memory Expansion board, press **Expansion Board (F9)**. The expansion board detail screen will be displayed.
4. When Memory (F1) is pressed, the following list of available expansion boards and their catalog numbers is displayed.



Note

The daughter boards displayed in the screen above are for a Model 771 and 772 CPU. A different set of daughter boards is displayed for the Model 781 and 782 CPU. The sample screen on the next page shows the daughter boards available for 781 and 782 CPUs.



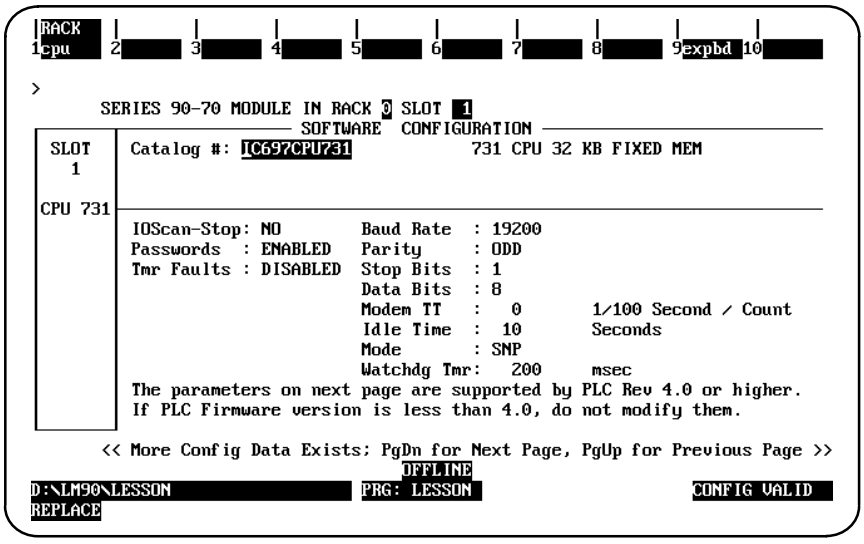
5. Press the **Up** or **Down** cursor moving keys to position the cursor on the required expansion board, and press the **Enter** key. Then, press the **Escape** key to return to the CPU detail screen.

6. Press **Rack (Shift-F1)** or the **Escape** key a second time to return to the rack display.

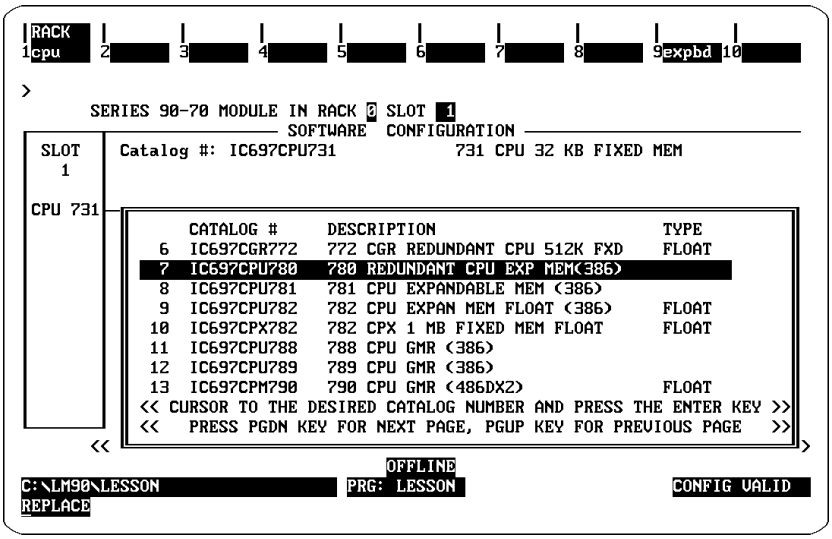
Configuring CPU Redundancy

To configure a Redundant CPU module:

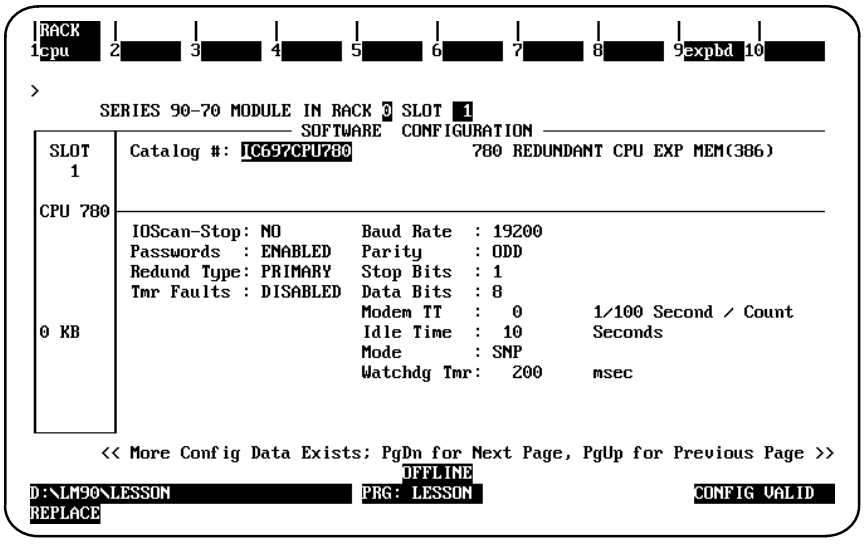
1. Position the cursor on rack 0, slot 1, and press the **Zoom (F10)** softkey to display the detail screen of the configured CPU module..



2. Press the **CPU (F1)** softkey to display the catalog list of CPU modules.



3. Move the cursor to the entry for the Redundant CPU module (IC697CPU780 used in this example—see Note below for other Redundant CPUs), and press the **Enter** key. If the existing configuration does not require any modification to suit the redundant CPU configuration, the prompt: "REPLACE displayed module ? (Y / N)" will be displayed. Enter **Y** (Yes) after the prompt to display the detail screen for the Redundant CPU module.



4. Use the Tab key and Back Tab key (Shift-Tab) to cycle through the selections for each parameter displayed on this screen.

   The parameters are the same as those for the CPU module, as listed on page 11-8. For a description of these parameters, refer to page 11-8. One additional parameter, ***Redund Type***, is included on the detail screen shown above. The ***Redund Type*** parameter specifies whether the CPU is configured as the primary controller or the secondary (standby) controller. The possible values for this parameter are **PRIMARY** (the default), **SECNDARY**, or **SIMPLEX**.

Parameter	Description
Redundancy Type	Select **PRIMARY***, **SECNDARY**, or **SIMPLEX**. If **PRIMARY** is selected, all configured redundant GBC Serial Bus Addresses (SBAs) **must** be 31. If **SECNDARY** is selected, all configured redundant GBC Serial Bus Addresses **must** be 30. If **SIMPLEX** is selected, the CPU acts as a non-redundant CPU. The Serial Bus Addresses of can be any value from 0 to 31

* Default selection.

5. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Note

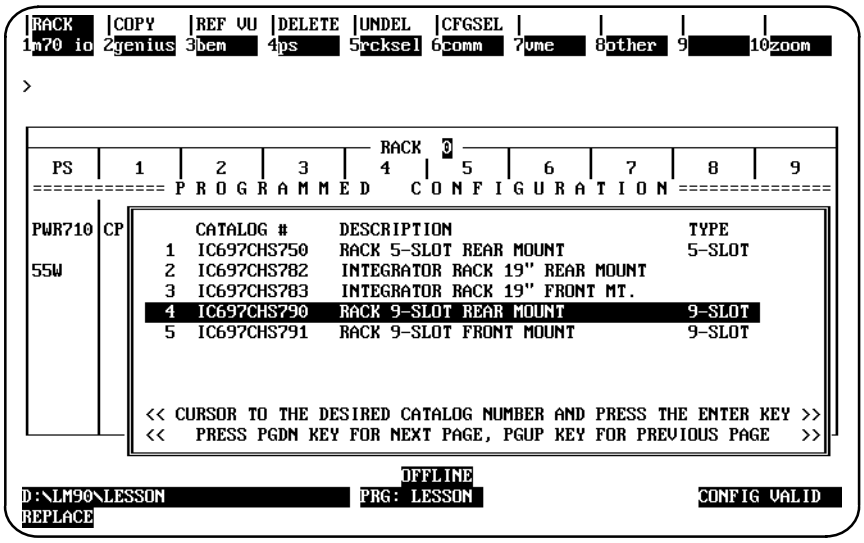
The CGR772 and CGR935 CPUs have enhanced Hot Standby features and allows for configuration of GENIUS dual bus. For more information about these CPUs, refer to the *Series 90™-70 Enhanced Hot Standby CPU Redundancy User's Guide* (GFK-1527). For more information on CPU redundancy for the CPU780, refer to the *Series 90-70 Hot Standby CPU Redundancy User's Guide*, GFK-0827.

Section 3: Configuring Rack Type

Configuring a 9-Slot or 5-Slot Rack

To configure either a 9-slot rack or a 5-slot rack, follow the steps listed below. Initially, a 9-slot rear mount rack (the default) is displayed.

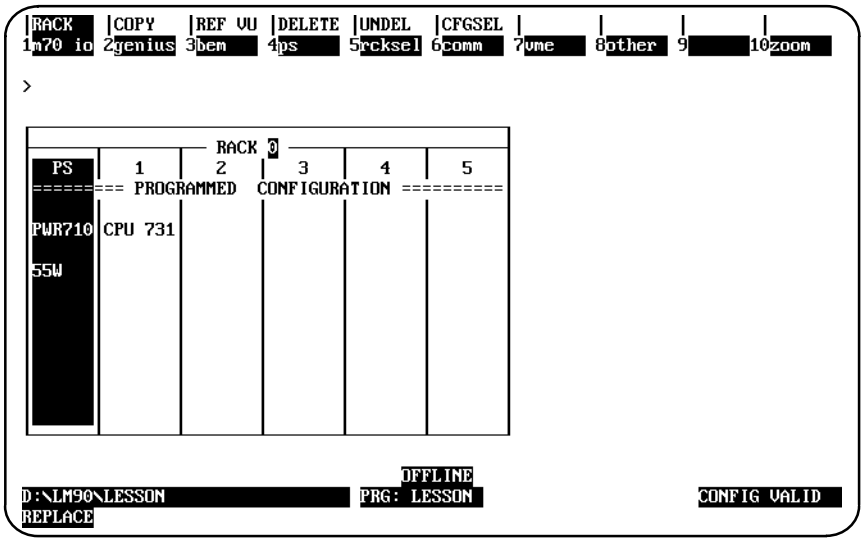
1. When **Rack Selection (F5)** is pressed from the Rack Configuration screen, the following list of available racks and their catalog numbers is displayed.



2. Position the cursor on the required rack, and press the **Enter** key.

3. When switching from a 9-slot rack to a 5-slot rack, a validation check will be performed to see if there are any configured modules in slots 6 through 9. If there are, the following message will be displayed: "Slots greater than 5 will be lost, continue REPLACE? (Y / N)"

   If **N** (No) is pressed, the current rack will remain displayed. If **Y** (Yes) is pressed, the system will automatically delete the modules in slots 6 through 10 before changing the rack size. The 5-slot rack appears as shown below:



The following rules apply when changing the rack type:

- The rack cursor will always be displayed on the Power Supply module after a successful rack change.
- Selecting the catalog number of the same size rack currently configured does not change the display.
- Rack 0, as well as any expansion rack, can be configured to be a 5-slot rack.
- When switching from a 5-slot rack to a 9-slot rack, no validation check is performed.

Configuring a VME Integrator Rack

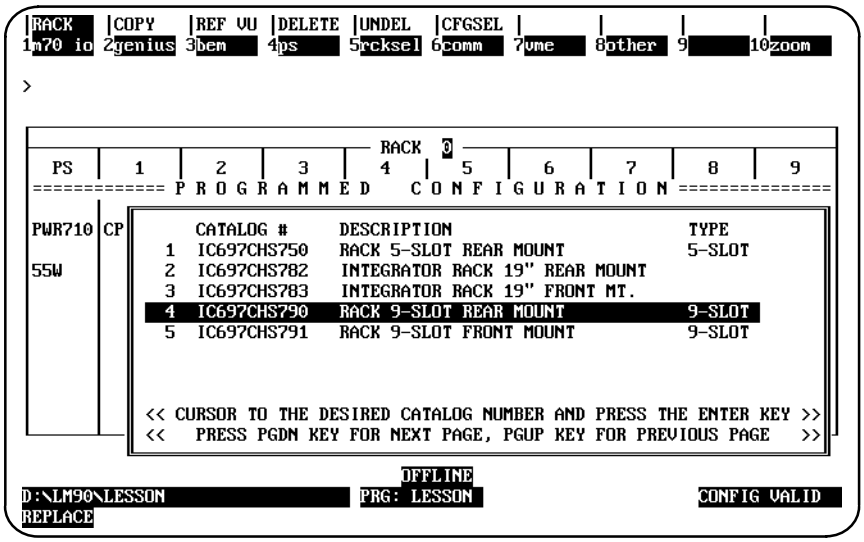
There are two types of VME Integrator Racks, one a front mount and the other a rear mount. Both can function as either a main rack or an expansion rack. All Series 90-70 racks (0 through 7) can be configured as Integrator Racks. Integrator Racks can be intermixed with existing Series 90-70 racks in an I/O configuration; not all racks of an I/O configuration have to be configured with the same rack type and size. For example, a valid I/O configuration could consist of rack 0 and rack 1 configured as Integrator Racks, racks 2 through 6 as Series 90-70 9-slot racks, and rack 7 as a Series 90-70 5-slot rack.

Within a VME Integrator Rack, slots 2 through 8 are each configured as two half-slots if you choose to configure these slots with VME modules; otherwise, the slots are configured the same as if they were slots in an existing Series 90-70 rack. For Release 4 of Logicmaster 90-70 software, the only modules that can be configured in a half-slot of the Integrator Rack are third-party VME modules and Interrupt Jumper modules.

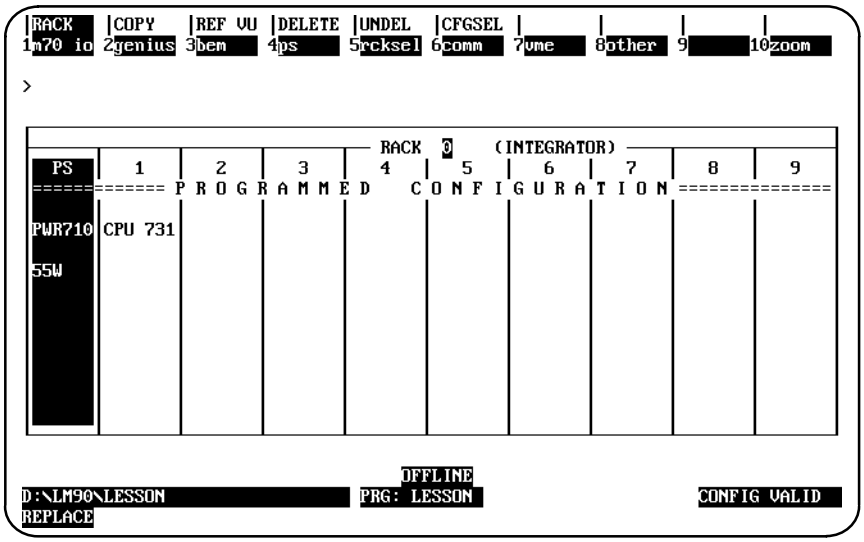
The power supply slot (PS slot, slot 0), slot 1, and slot 9 of any Integrator Rack are full slots and cannot be configured as two half-slots.

To configure a VME Integrator Rack from an existing Series 90-70 rack:

1. Press **Rack Selection (F5)** from the Rack Configuration screen to display a list of available racks and their catalog numbers.



2. Select either the rear or front mount Integrator Rack by positioning the cursor on the catalog number of the desired rack and pressing the **Enter** key.



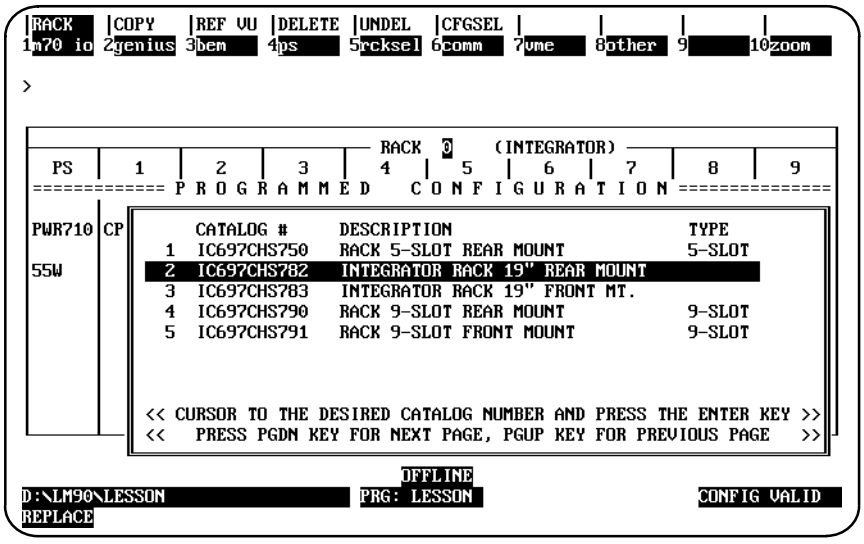
For this screen, the 19-inch rear mount Integrator Rack (IC697CHS782) was selected. This screen appears identical to the Series 90-70 rack, except that the word **(INTEGRATOR)** is displayed after **RACK 0**.

If the rack contains previously configured third-party VME modules, the software will ask you if you want to convert the existing VME modules to half-slot VME modules. If you enter **N** (No), rack selection is aborted. If you enter **Y** (Yes), the current Series 90-70 rack will be converted to an Integrator Rack. Each third-party VME module will be converted to a half-slot type with the left half-slot initially configured and the right half-slot unconfigured.

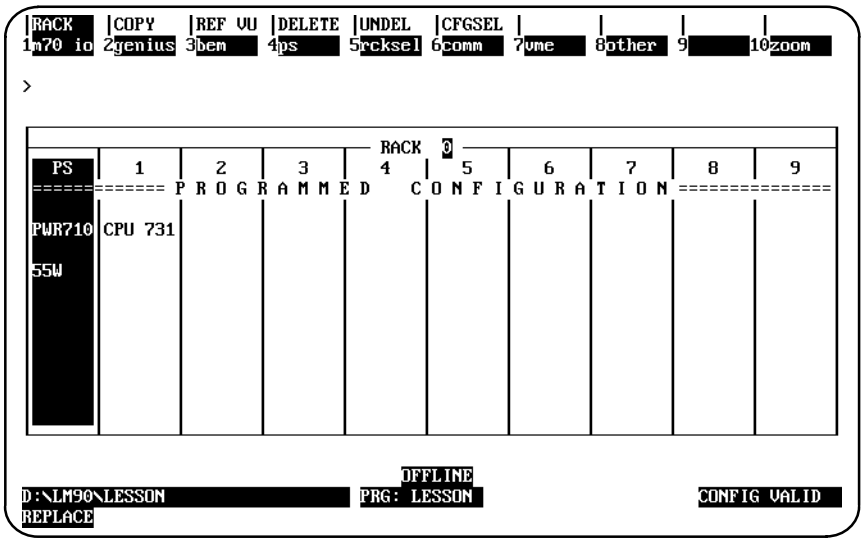
Configuring a Series 90-70 Rack from an Integrator Rack

To configure a Series 90-70 rack from an existing Integrator Rack:

1. Press **Rack Selection (F5)** from the Rack Configuration screen to display a list of available racks and their catalog numbers.



2. Position the cursor on the catalog number of the desired rack and press the **Enter** key.



For this screen, the default rear mount 9-slot rack (IC697CHS790) was selected. Note that the word **(INTEGRATOR)** is no longer displayed after **RACK 0**.

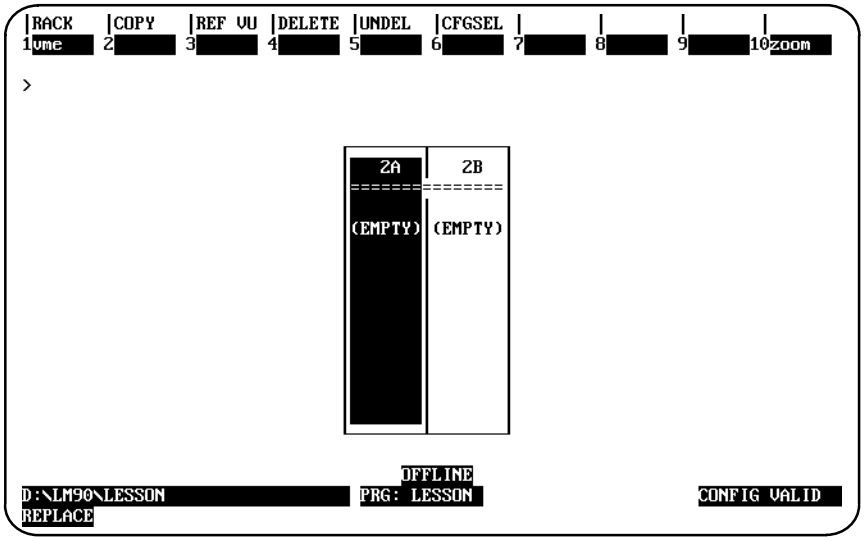
If the rack contains previously configured half-slot VME modules, the software will ask you if you want to convert the existing VME modules to full-slot third-party VME modules. If you enter **N** (No), rack selection is aborted. If you enter **Y** (Yes), the current Integrator Rack will be converted to a Series 90-70 rack and each half-slot VME module will be converted to a full-slot third-party VME module.

If both the left and right half-slots are configured for a given slot in an Integrator Rack and the Integrator Rack is converted to a Series 90-70 rack, the left half-slot module will become the full-slot module for the slot in the new rack, and the right half-slot module will be lost. If only one half-slot in a given slot is configured in the Integrator Rack and the other half-slot is empty or unconfigured, the configured half-slot module will become the full-slot module for the slot in the new rack.

Configuring a Half-Slot in the Integrator Rack

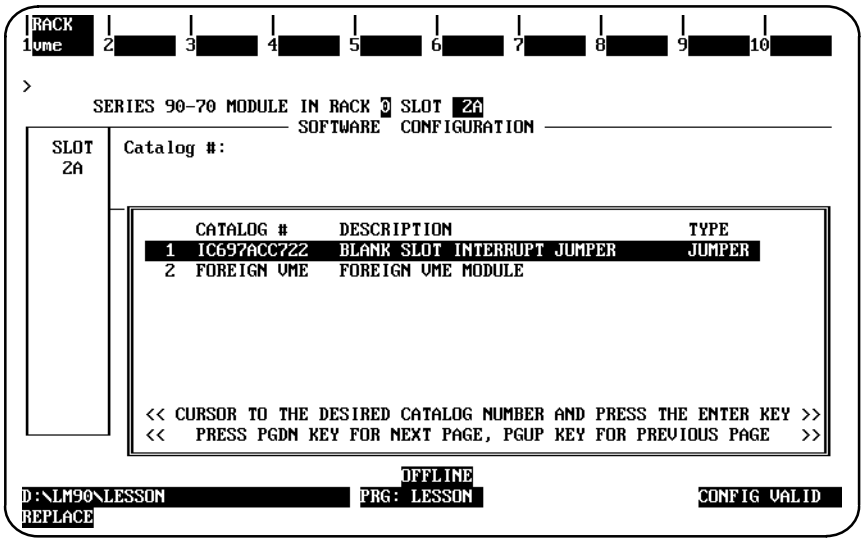
The following procedure describes how to configure the left half-slot of an Integrator Rack slot. This same procedure also applies to configuring the right half-slot of an Integrator Rack slot.

1. With the Integrator Rack displayed on the screen, move the cursor to the slot to be configured as a half-slot and press **VME (F7)**. A half-slot screen similar to the one shown below will be displayed.



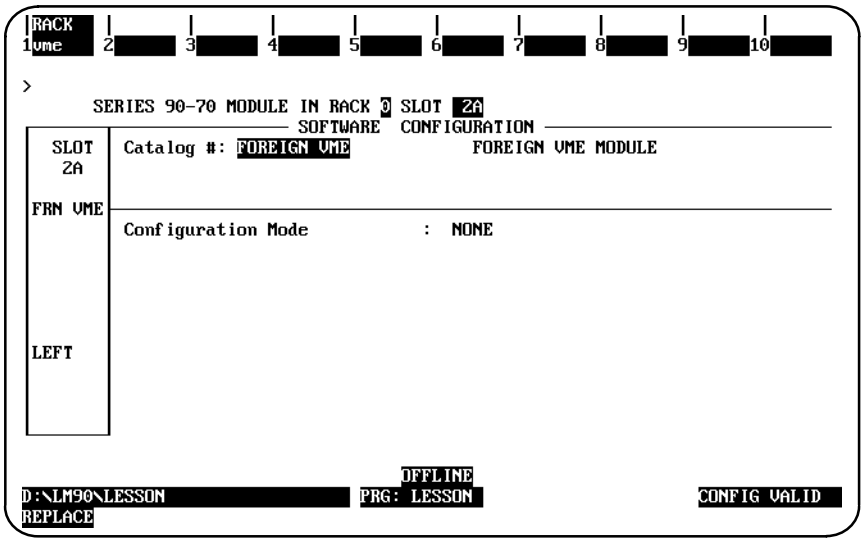
These are the half-slots of slot 2 (2A and 2B). Both half-slots were not previously configured, as indicated by the word **(EMPTY)** displayed on each half-slot. When the half-slot screen shown above is initially displayed, the cursor will always be on the left half-slot. Use the Left and Right cursor keys to cursor to either half-slot.

2. To configure the left half-slot (slot 2A), press **VME (F1)** to display a list of available modules.

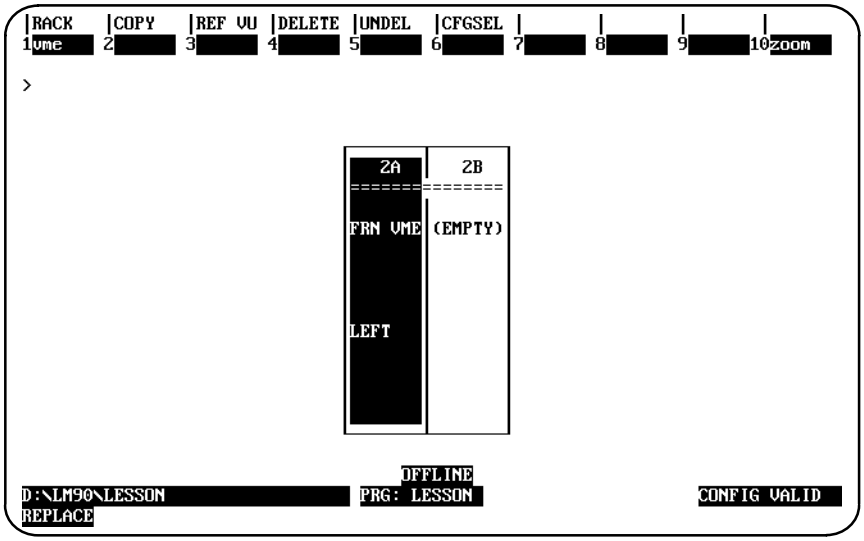


There is only one third-party VME Module listed as **FOREIGN VME MODULE** on the screen shown above. For Release 4, the existing Foreign VME (No Interrupt) Module and the Foreign INT (Interrupt) Module are combined into one module.

3. Position the cursor on **FOREIGN VME MODULE**, and press the **Enter** key.

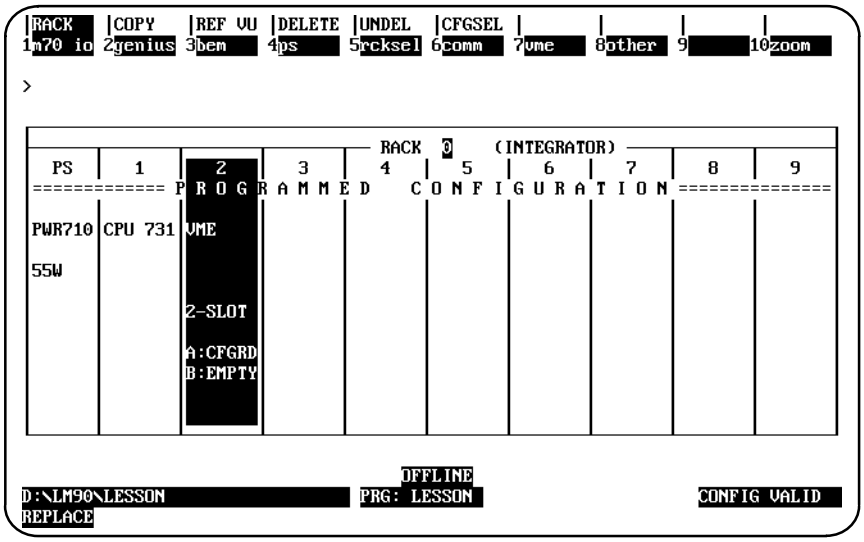


4. Press the **Escape** key to exit the detail screen and return to the half-slot screen.



Slot 2A is now configured.

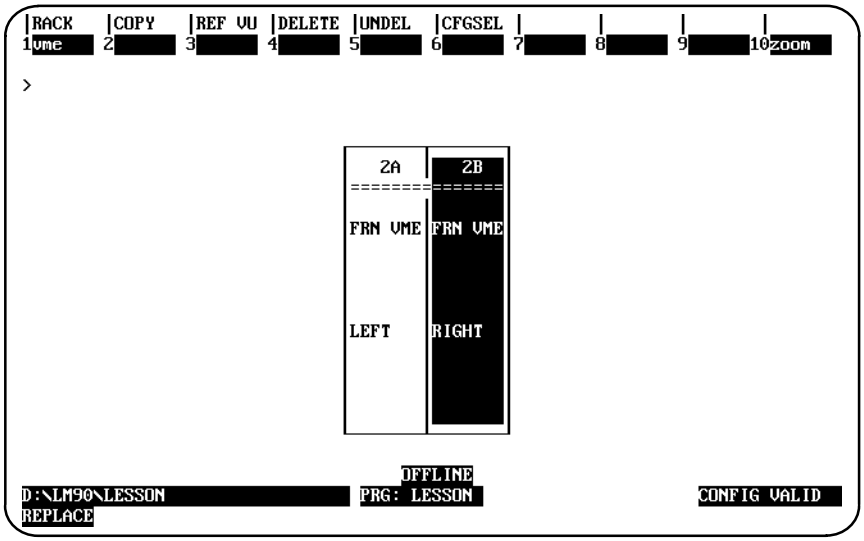
5. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.



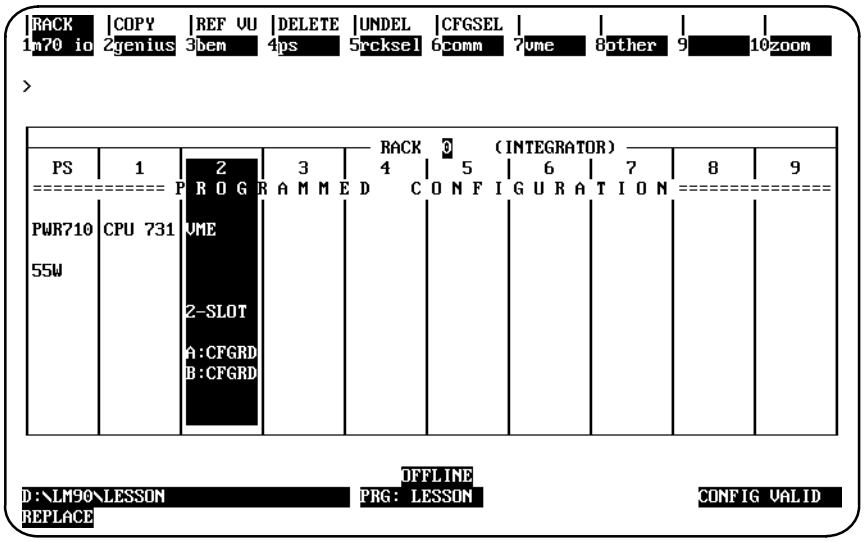
The slot description on slot 2 shows that the left half-slot is configured (**A:CFGRD**) and the right half-slot is empty or unconfigured (**B:EMPTY**).

6. To redisplay the configured left half-slot of slot 2 (2A) from the rack display screen, press **Zoom (F10)**.

   If both half-slots are configured as Foreign VME Modules, the half-slot screen will be displayed as shown below:



7. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display. The slot description for each half of the slot will indicate **CFGRD**.



Section 4: Configuring a Bus Expansion Module

The term Bus Expansion Module includes both Bus Transmitter Modules and Bus Receiver Modules. To configure either type, follow the instructions below.

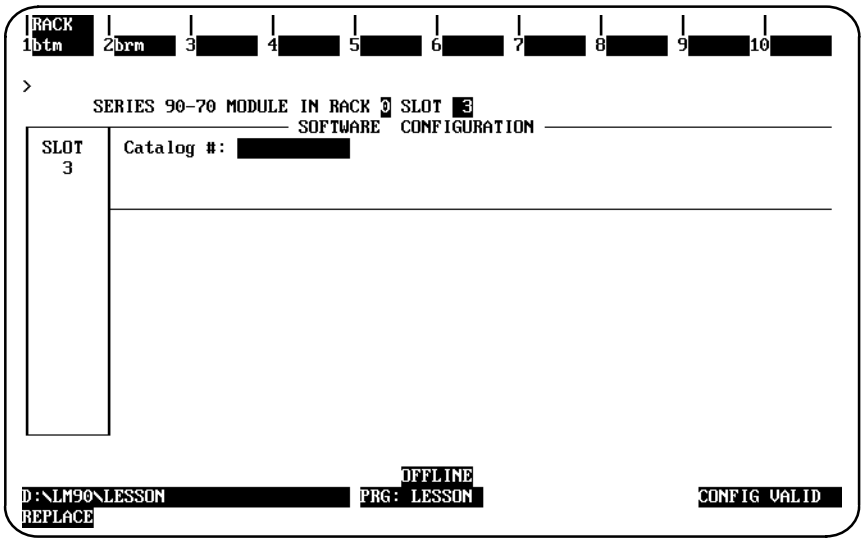
The system must include a Bus Transmitter Module, which is typically located in slot 2 of rack 0. If the PLC system will have more than one rack, a Bus Receiver Module must be located in slot 1 of each expansion rack.

Note

Revision A of the Bus Transmitter Module should be the last module entered in the rack since it must be the right-most module. Revision B of the BTM module does not have to be the right-most module.

To configure a Bus Transmitter or Bus Receiver Module:

1. Move the cursor to the slot where the module will be located.
2. Press **BEM (F3)**. The software zooms into the detail screen.

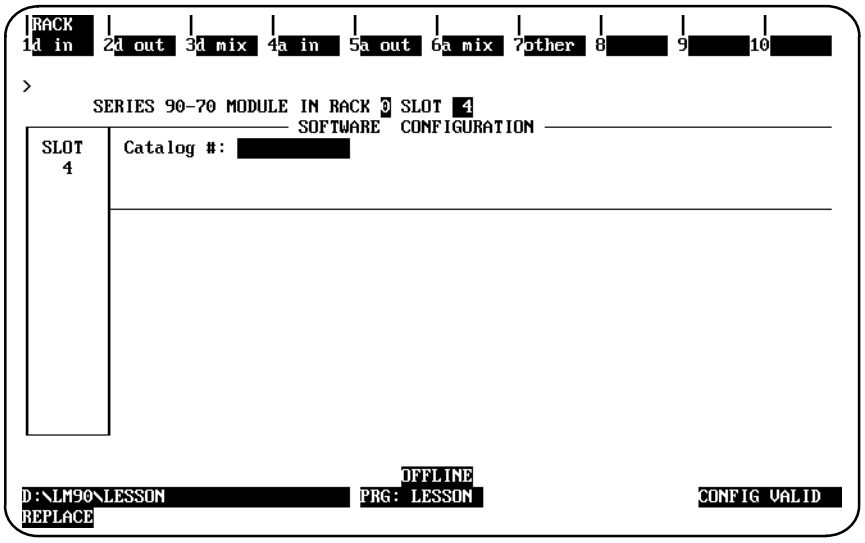


3. To configure the Bus Transmitter Module in rack 0, press **BTM (F1)**. To configure a Bus Receiver Module, press **BRM (F2)**. A list of Bus Transmitter or Bus Receiver Modules and their catalog numbers is displayed.
4. If your screen shows multiple entries, select one by moving the cursor to that line. Press the **Enter** key. The catalog number is displayed in the proper field.
5. No additional configuration is required; press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Section 5: Configuring 90-70 I/O Modules

To configure a 90-70 I/O module:

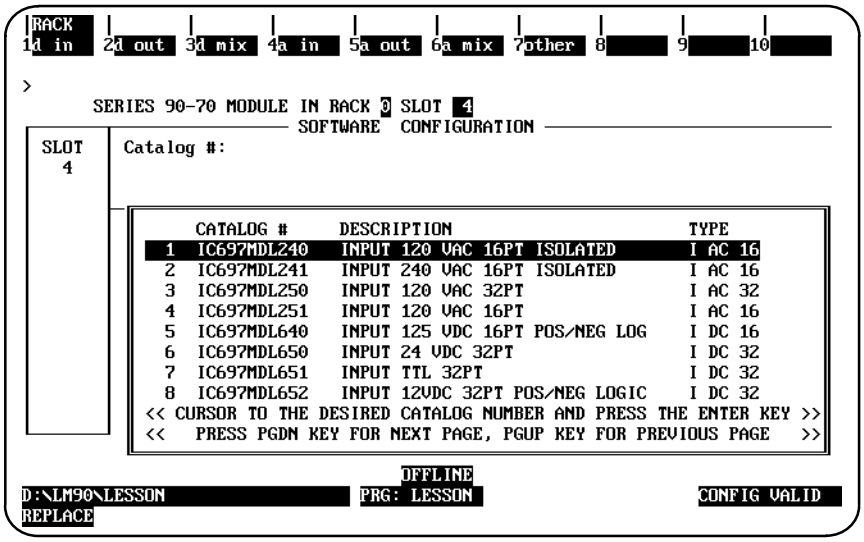
1. Move the cursor to the slot where the module will be located and press **Module 70 I/O (F1)**.



2. Select the module type by pressing the corresponding function key listed below.

Function Key	Module Type	Description
F1	d in	Select a discrete input module.
F2	d out	Select a discrete output module.
F4	a in	Select an analog input module.
F5	a out	Select an analog output module.
F7	other	Add an I/O module not included in one of the other categories.

3. A list of available modules of the type you selected and their catalog numbers will be displayed. For example, when Discrete Input (F1) is pressed, the following list of modules is displayed.



4. Select a module by positioning the cursor on that entry and pressing the **Enter** key.

5. Move the cursor to the module's reference address. The next highest available reference address is automatically configured.

   If you want to use a different reference address, enter it here. For a discrete module, the reference address must begin on a byte boundary. (A byte boundary is a reference address which is a multiple of 8 + 1; e.g., 1, 9, 17, or 25). The software will automatically adjust an incorrect entry to begin on a byte boundary. A message is displayed when the highest available address has been assigned.

6. Depending on the module type, different configurable characteristics may be shown. A default selection for each is given (refer to the following tables). To change any of the default selections, move the cursor to that item, and use the Tab key to display alternatives.

7. After selecting the correct configuration for the module, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Table 11-1. Discrete Input/Output Configurable Parameters

Field	Description
Interrupt	Indicates whether input 1 on the module is used as an interrupt. Choices are **ENABLED** or **DISABLED***. If **ENABLED**, this input can be used to trigger interrupt logic in the CPU. There can be no empty slots to the left of a module configured to generate an interrupt.
Transition	If the interrupt parameter is enabled, this selection determines whether the interrupt will occur on the rising (**POSITIVE***) or falling (**NEGATIVE**) edge of the input signal transition.
Input Filter	Select either **1 millisecond** or **10 milliseconds*** as the filter speed for all inputs on a board.
Output Default	Select whether all outputs on a board will be turned **OFF*** or will **HOLD** their last state or value when the CPU goes to **RUN/DISABLED** or **STOP** mode, or if the CPU watchdog timer expires.

* Default selection.

Table 11-2. Analog Input Configurable Parameters

Field	Description
Range	Allows the Analog Input Base Converter module input type (voltage or current) to be individually programmed for each input channel. The range selected should match the input signal. The Expander Input channels are all the same on a module, either voltage or current, determined by the module type.
Fault Reporting	Fault reporting for each Analog Input Base Converter module channel can be **ENABLED*** or **DISABLED**. If **ENABLED**, overrange and underrange faults are reported to the PLC when they occur. If the associated channel is operating in the current loop mode, an open circuit fault is also reported.
MV / UA High / Low ENG High / Low	Scaling points that allow definition of a linear relationship between the sensed voltage or current and the value in engineering units that is returned to the PLC. Scaling can be configured on a per channel basis for the Base Converter module and on a per module basis for Expander modules. Enter the desired voltage or current input value and the corresponding engineering units for each of two points.
Alarm Interrupt	Alarm reporting for each Analog Input Base Converter channel can be **ENABLED** or **DISABLED***. If **ENABLED**, high and low alarms are reported to the PLC when they occur. (Alarm reporting is not available for Analog Input Expander modules.)
Alarm High or Low	Each Base Converter Input circuit can have two unique alarms, one for a low value and one for a high value. The high value should be greater than the low value. If enabled, a low or high alarm message is sent to the PLC when an input reaches one of these limits. Alarms do not affect the operation of the module or change the overload value of the input.

* Default selection.

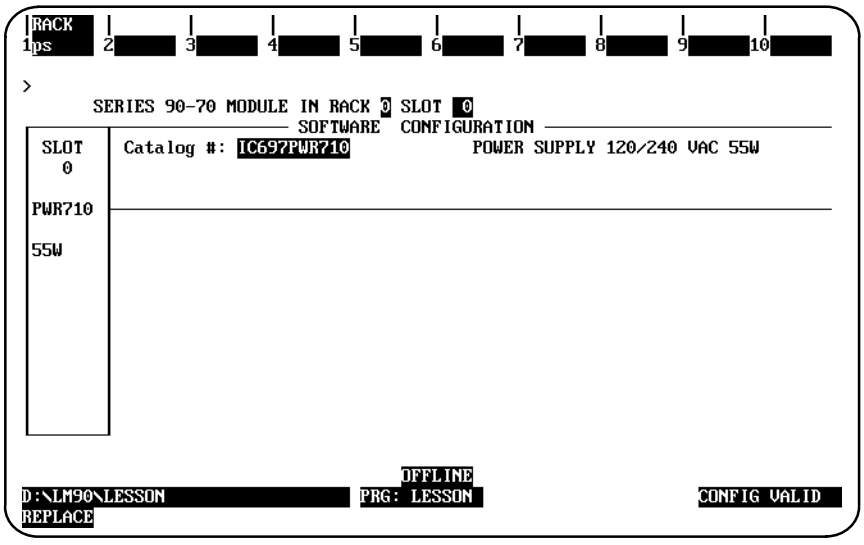
Table 11-3. Analog Output Configurable Parameters

Field	Description
Range	Allowsthe Analog Output module output type (voltage or current) to be individually programmed for each output circuit. The range selected should match the output signal. The 4 to 20 milliamp range can be used for current output devices.
FaultReporting	Fault reporting for each Output Module channel can be **ENABLED** or **DISABLED**. If **ENABLED**, overrange and underrange faults are reported to the PLC when they occur. If the associated channel is operating in the current loop mode, an open circuit fault is also reported.
Output Default	The Analog Output module uses the output default value for each channel as its output value until the CPU writes user data to the module. Select either **HOLD** last state or a predetermined output value when an Analog Output Module detects a SYSFAIL (System Fail signal) or when the PLC commands the module to reset the outputs.
Default Value	Enter the predetermined default value to be used, as described above for output default.
MV / UA High / Low ENG High/Low	Scaling points that allow conversion of the values in engineering units into millivolts or milliamps, as required by the output device being controlled. Enter the desired voltage or current value and the corresponding engineering units for each of two points.

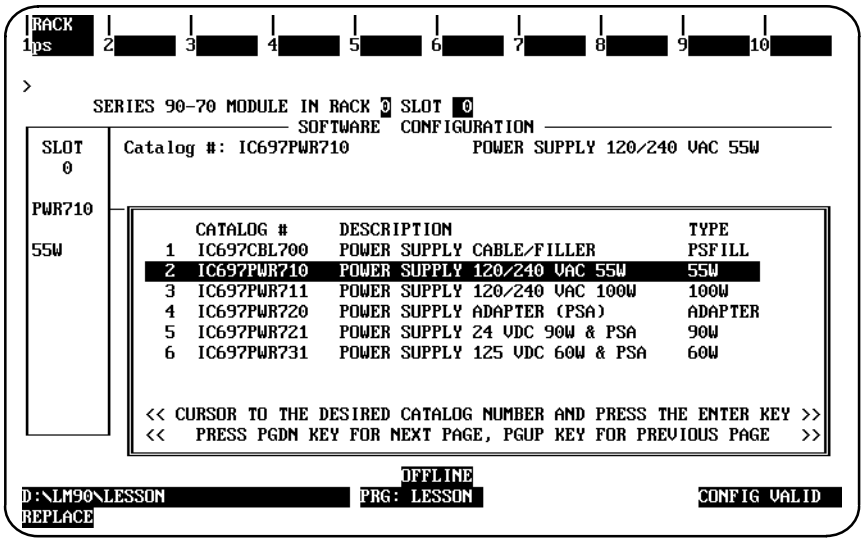
Configuring a Power Supply Module

To configure a power supply module:

1. Move the cursor to the power slot, and press **Zoom (F10)** to zoom into the detail screen for the power supply.

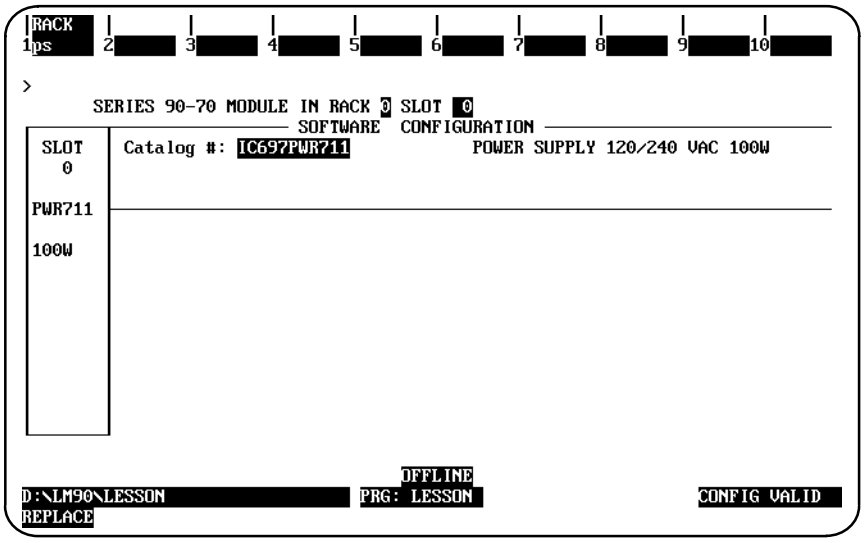


2. Press **Power Supply (F1)** to display a list of available power supplies and their catalog numbers.



3. Select a new power supply by moving the cursor down to any entry. Then, press the **Enter** key. The detail screen for the new power supply will be displayed after you press **Y** (Yes) to respond to the prompt to replace the displayed module.

   For the screen shown below, the 120 / 240 VAC 100W Power Supply (IC697PWR711) was selected.



4. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

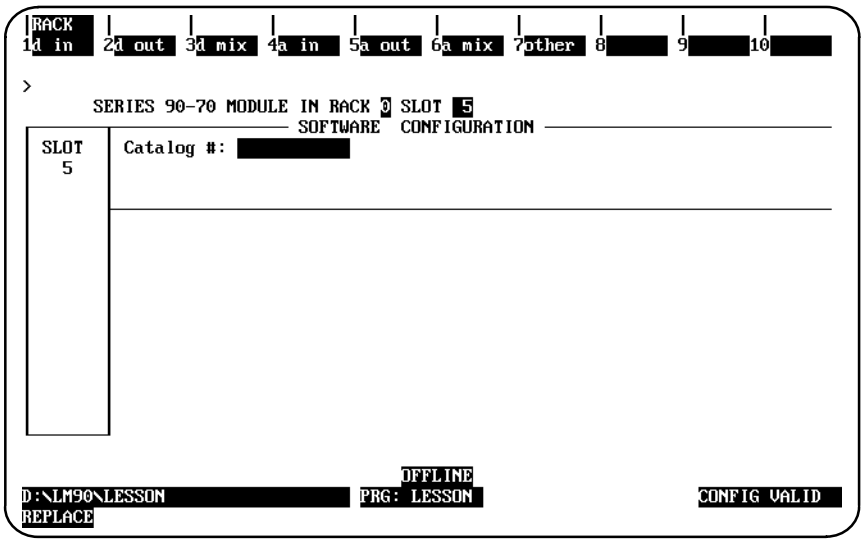
Configuring Generic I/O Modules

A generic I/O module can be used in place of a module not currently in the configurator module data base. You must specify the GE Fanuc catalog number and reference address information for a generic I/O module. The GE Fanuc catalog number must begin with IC697, followed by the remaining six characters of the catalog number.

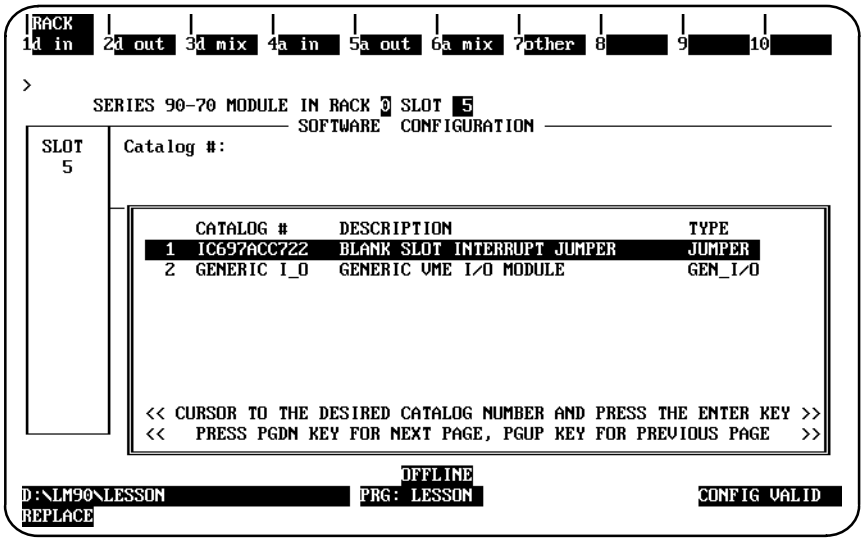
Configuring a Rack-Type Generic I/O Module

To configure a rack-type generic I/O module:

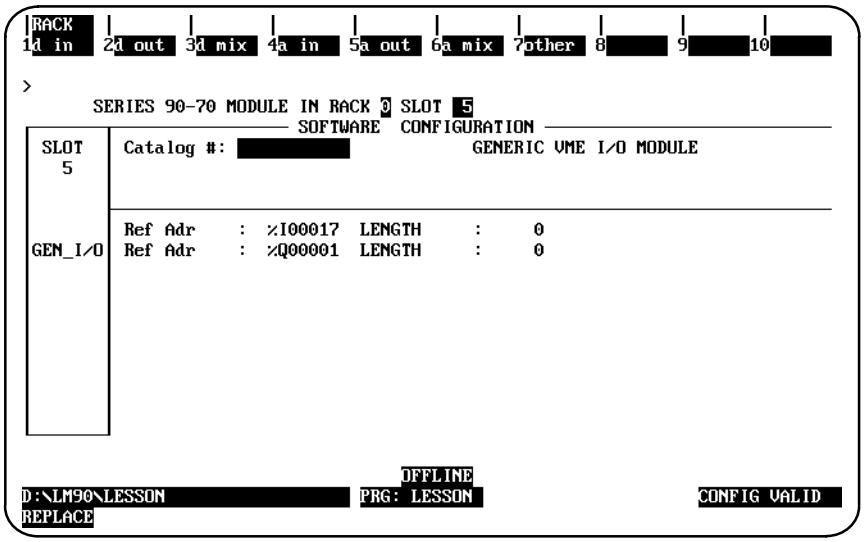
1. Move the cursor to the slot where the module will be located and press **Module 70 I/O (F1)**.



2. Then, press **Other (F7)** to display the list of available other-type modules.



3. Select a generic I/O module by moving the cursor down to that entry. Then, press the **Enter** key to display the detail screen.



4. Specify the GE Fanuc catalog number (IC697xxxxxx) for the module being configured. Initially, this field is blank so that you can enter a catalog number.

5. Once you enter the catalog number, it is converted by the software to a VME ID which is written to disk when the configuration is saved. When reading from disk, Logicmaster 90-70 software will convert the VME ID to a catalog number to display in this field. The catalog number is validated to assure that it spans 11 alphanumeric characters and has a prefix of IC697. If either of these conditions is not met, the entry is marked as incorrect.

6. Enter a starting reference address and length for each of the %I, %Q, %AI, and %AQ references.

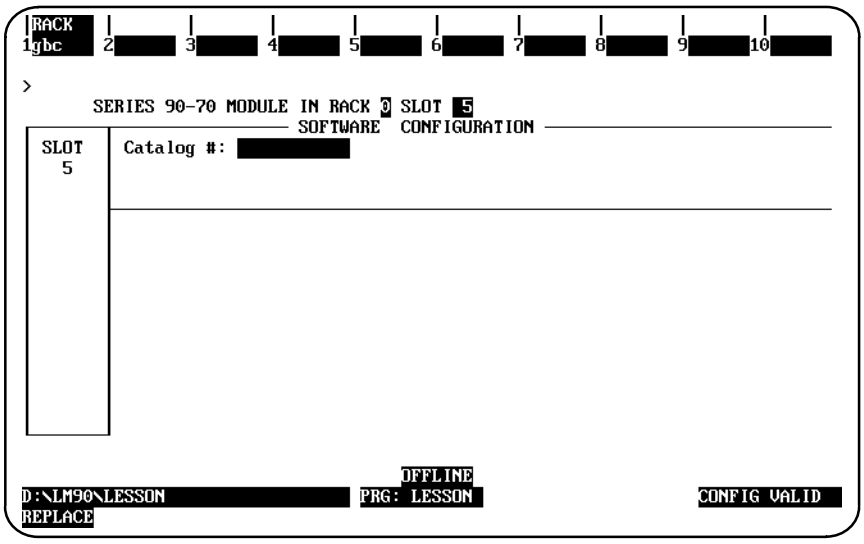
Parameter	Description
Reference Address	Defaults to the next highest reference address. Validated to assure that only the type specified is permitted (e.g., only %I is permitted in the %I reference addressparameter).
Length	Defaults to zero. Validated to be within the configuration memory limits and the configured CPU for the respective reference type.

7. After completing the detail screen, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display. If the reference addresses are at their original default values and the lengths for all of the reference types have been set to at least one, the starting reference address will be displayed on the rack display. If the length of any address is zero, that address will not be included on the rack display.

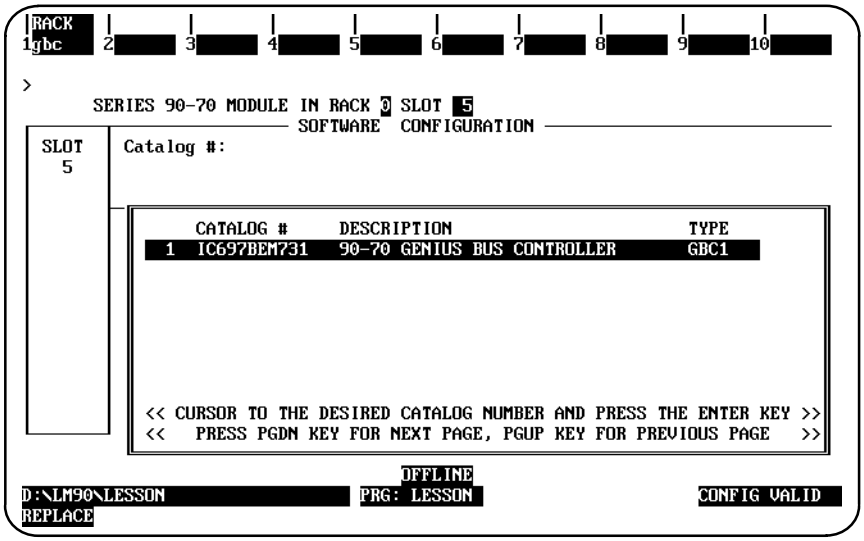
Configuring a Bus Generic I/O Module

To configure a generic I/O for the bus:

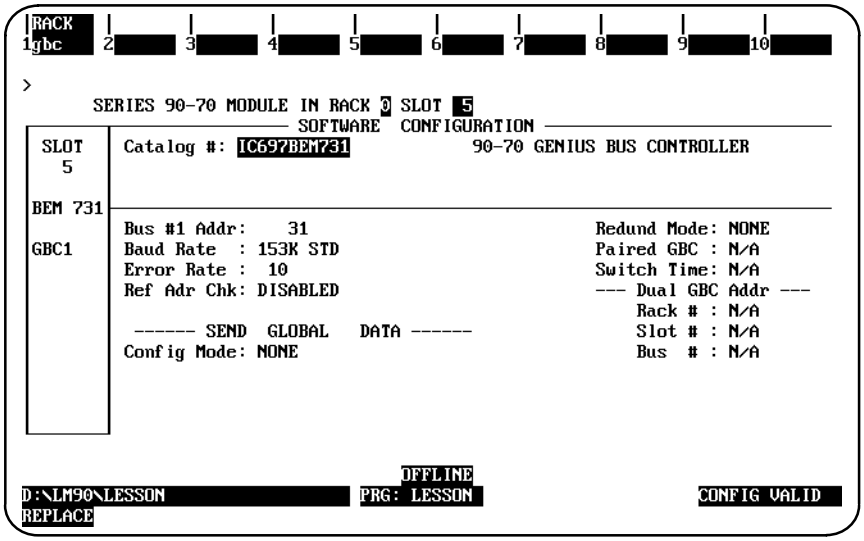
1. Move the cursor to the slot where the module will be located. Then, press **Genius (F2)** to zoom into the slot.



2. Press **GBC (F1)** to display the entry for the Genius Bus Controller (IC697BEM731).

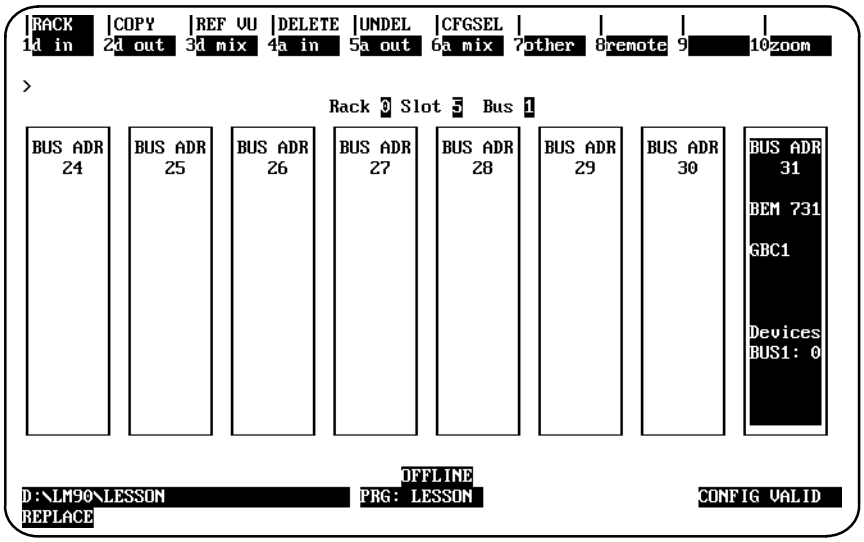


3. Then, press the **Enter** key.

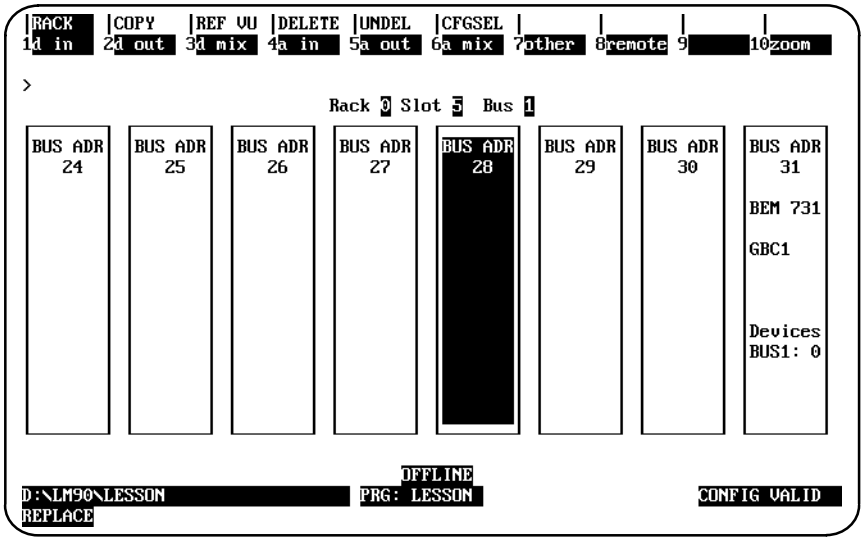


4. Configure the slot for a genius bus controller (GBC). For more information on configuring a GBC, refer to section 9, "Configuring a Genius Bus Controller." Then, press the **Escape** key to zoom out of the detail screen.

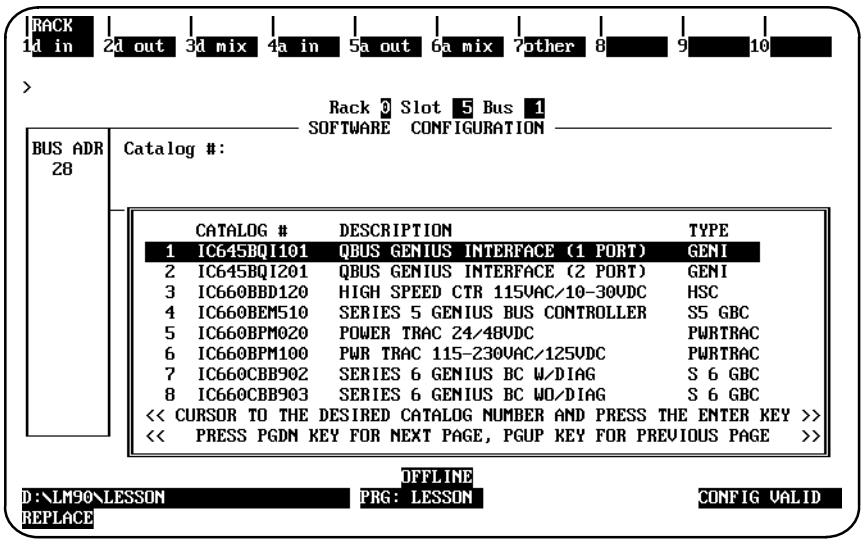
5. To configure an /I/O module on the bus, press **Zoom (F10)** to zoom into the genius bus controller.



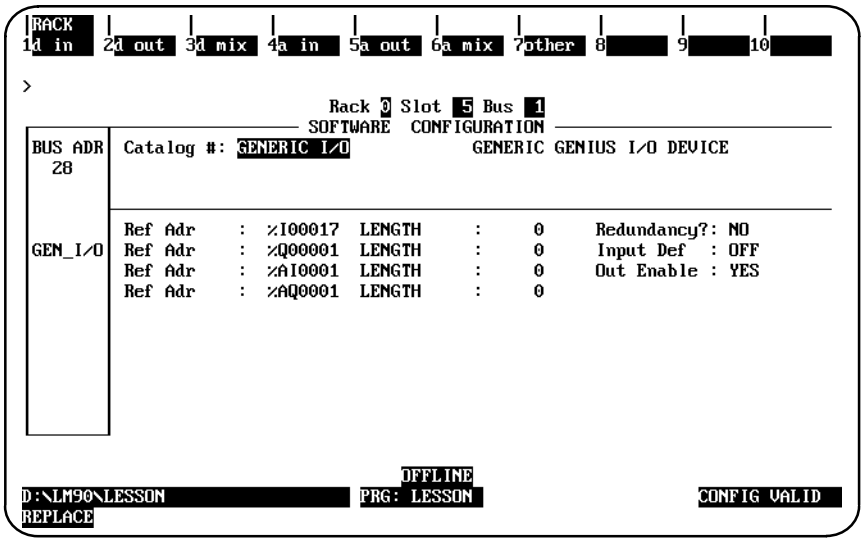
6. Then, cursor to the bus slot to be configured.



7. Press **Other (F7)** to display a list of the other available Genius devices.



8. Cursor down to the entry for the Generic Genius I/O device, and press the **Enter** key to display the detail screen.



9. Enter a starting reference address and length for each of the %I, %Q, %AI, and %AQ references.

Parameter	Description
Reference Address	Defaults to the next highest reference address. Validated to assure that only the type specified is permitted (e.g., only %I is permitted in the %I reference addressparameter).
Length	Defaults to zero. Validated to be within the configuration memory limits and the configured CPU for the respective reference type.

10. Select whether the block will be used in a redundant configuration. If **YES** is selected for the ***Redundancy?*** parameter (default = **NO**), the Genius Bus Controller will supply dual images of the input data from that device, plus any diagnostic data, to the CPU. The CPU will compare the two sets of information before using it. A diagnostic fault will be generated whenever the two sets of data are different.

11. Select whether the Genius input block will hold the last state or turn the inputs off (the default condition).

12. Select whether all outputs will be enabled or disabled when the bus controller is started up. Choices are **YES** (the default) or **NO**.

13. After completing the detail screen, press **Rack (Shift-F1)** or the **Escape** key to save the configuration and return to the rack display. If the reference addresses are at their original default values and the lengths for all of the reference types have been set to at least one, the starting reference address will be displayed on the rack display. If the length of any address is zero, that address will be not be included on the rack display.

Section 6: Configuring a Programmable Coprocessor Module

The Programmable Coprocessor Module (PCM) combines the function of a Communications Module and the ASCII / BASIC Module into a single module. It may be configured to behave as one CCM port, two independent CCM ports, one CCM port and one BASIC application having one port, or one BASIC application using one or both serial ports.

Eight different modes of configuration are supported in the IC697PCM711 PCM Module:

Mode	Description
CCM ONLY *	Select both ports **1** and **2** for CCM.
BASIC *	Select both ports **1** and **2** for BASIC.
BAS / CCM*	Select port **1** for BASIC and port **2** for CCM.
PCM CFG	All configuration data for the PCM is located in the User Configuration Data File (UCDF), created and loaded to the PCM using the PCM development software (PCOP).
PROG PRT	Select Programmer Port mode.
PROG / CCM	Select port **1** for programmer connection and port **2** for CCM.
CCM / PROG	Select port **1** for CCM and port **2** for the programmer.
NONE	No soft switch data enabled.

* These are the most commonly used modes; they enable you to use the PCM without further configuration.

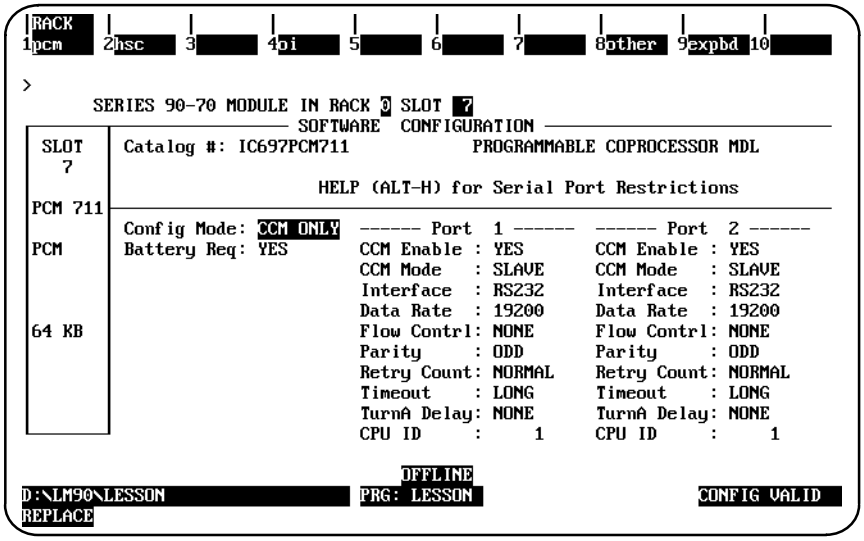
The PCM can accept Logicmaster 90 configuration data for specific configuration parameters related to the operation of the serial ports. This is called Logicmaster Soft Switch Data (SSD) configuration. A user configuration on the PCM (UCDF) will always override SSD in user (soft reset) mode.

For more information on the PCM, please refer to the *Series 90 Programmable Coprocessor Module and Support Software User's Manual*, GFK-0255.

Configuring a PCM

To configure a PCM on the I/O Configuration Rack screen:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.
2. Press **Other (F8)** and then **PCM (F1)** from the I/O Configuration Rack screen to display the entry for the PCM (IC697PCM711).



3. With the cursor positioned on that module, press the **Enter** key to display the detail screen.

Selecting the Configuration Mode

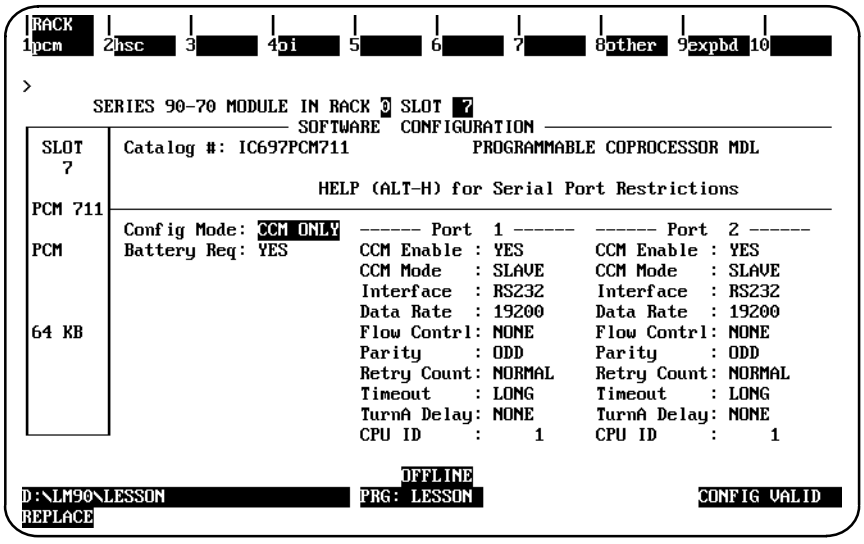
The configuration mode is selected in the ***Configuration Mode*** field on the module detail screen.

1. To select a different configuration mode, move the cursor to the ***Configuration Mode*** field and repeatedly press the **Tab** key until the desired mode is displayed on the screen. Then, press the **Enter** key.
2. Configure the module. Then, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

CCM ONLY Mode

CCM ONLY mode permits complete configuration of the PCM for CCM execution on one or both PCM ports. Soft Switch Data is active on a soft reset or power cycle.

When **CCM ONLY** mode is selected, the following PCM detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **CCM ONLY**.
Battery Required	Specify whether low battery detection is required for applications which requirebattery support of memory. Choices are **YES*** or **NO**.
CCM Enable	Specify whether the port is to be configured for use as a CCM port. Choices are **YES*** or **NO**.
CCM Mode	This parameter displays the availability of ports for CCM access. Choices are **SLAVE***, **PEER**, or **MASTER**.
Interface	The interface parameter can be **RS-232*** or **RS-485**.
Data Rate	Data rate (bits per second or bps) for the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Flow Control	Type of flow control to be used on the port. Choices are **NONE*** or **HARDWARE**.
Parity	Type of parity to be used on the port. Choices are **ODD*** or **NONE**.
Retry Count	Retry counts for CCM mode. Choices are **NORMAL*** or **SHORT**.
Timeout	Length of timeouts used for CCM on the port. Choices are **LONG***, **MEDIUM**, **SHORT**, or **NONE**.
Turnaround Delay	Turnaround delay time to be used for CCM on the port. Choices are **NONE***, **10 ms**, **100 ms**, or **500 ms**.
CPU ID	Address of the port on a multi-drop network. This value is used to calculate the backoff delay upon an inquiry collision in peer mode. The range of values allowed in this field is **1*** to **254**.

* Default selection.

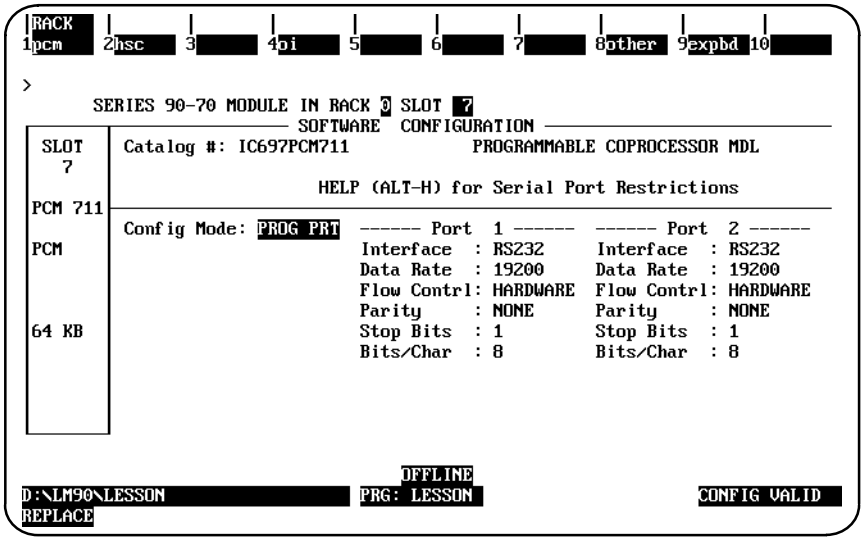
PROG PRT Mode

PROG PRT mode may be used to modify the factory default port settings when developing and executing an application in the PCM such as MegaBasic. This mode is useful when the programmer uses settings different from the factory default, such as when programming from a remote location. The default settings are sufficient for most programmers.

Note

PROG PRT mode will not configure the PCM for MegaBasic execution.

When **PROG PRT** (Programmer Port) mode is selected, the following PCM detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **PROG PRT**.
Interface	The interface parameter can be **RS-232*** or **RS-485**.
Data Rate	Data rate (bits per second or bps) for the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Flow Control	Type of flow control to be used on the port. Choices are **HARDWARE***, **SOFTWARE**, or **NONE**.
Parity	Type of parity to be used on the port. Choices are **NONE***, **EVEN**, or **ODD**.
Stop Bits	Most serial communication uses at least one stop bit. Slower devices use two stop bits. Choices are **1*** or **2**.
Bits per Character	Number of bits per character for data transfer on the port. Choices are **7** or **8***.

* Default selection.

BASIC Mode

BASIC mode provides a typical configuration for MegaBasic programming and operation. MegaBasic can be programmed with a dumb terminal attached to PCM port 1. The MegaBasic program must be named BASIC.PGM. Most MegaBasic applications will use this mode.

Caution

The serial port setting for port 1 must remain at 8 bits, no parity, hardware flow control if the programmer or data file backup (using the PCM development software, PCOP) will be used.

Soft Switch Data is active on a soft reset or power cycle as well as a hard reset. A soft reset or power cycle will run the program BASIC.PGM. A hard reset will place you in MegaBasic at the ready prompt for program development or modification.

BASIC mode selects BASIC configuration for both ports 1 and 2. The parameters for ports 1 and 2 are the same as for PROG PRT mode.

BAS/CCM Mode

BAS/CCM mode selects **BASIC** configuration for port 1 and CCM for port 2. The parameters for port 1 are the same as for **PROG PRT** mode; and for port 2, the parameters are the same as for **CCM ONLY** mode.

PROG/CCM Mode

PROG/CCM mode selects port 1 as the programmer port and port 2 for CCM. The parameters for port 1 are the same as for **PROG PRT** mode; and for port 2, the parameters are the same as for **CCM ONLY** mode.

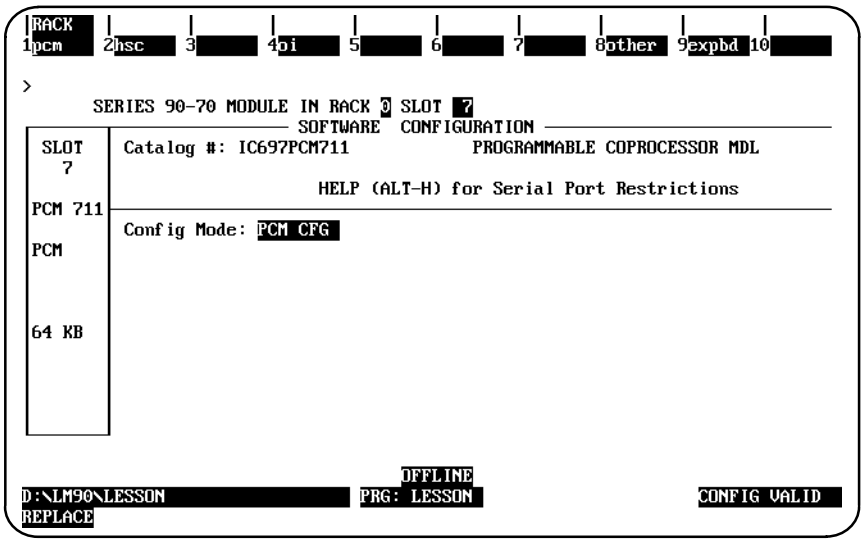
CCM/PROG Mode

CCM/PROG mode selects port 1 for CCM and port 2 as the programmer port. The parameters for port 1 are the same as for **CCM ONLY** mode; and for port 2, the parameters are the same as for **PROG PRT** mode.

PCM CFG Mode

PCM CFG indicates that all configuration data for the PCM is located in the User Configuration (UCDF) on the PCM. The UCDF must be created using the PCM development software (PCOP). Some MegaBasic applications will use this mode.

When **PCM CFG** mode is selected, the following PCM detail screen is displayed.

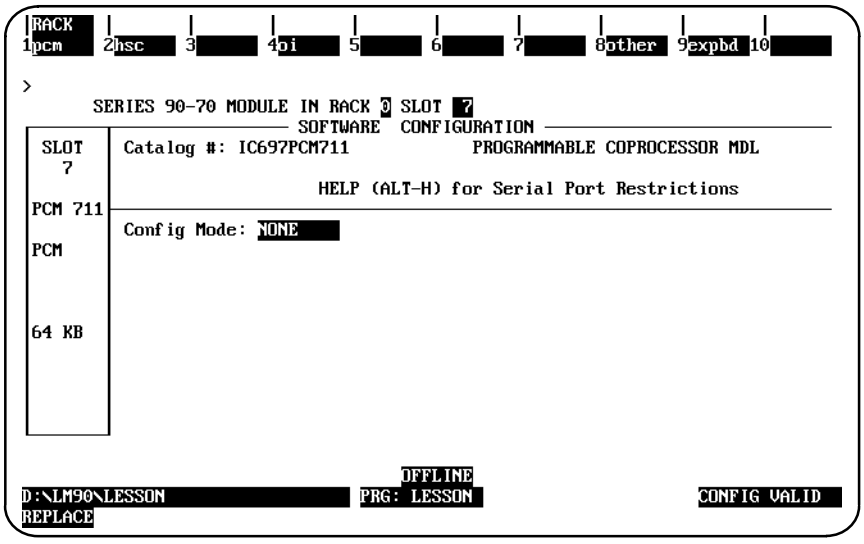


In this screen, the configuration mode is set to **PCM CFG** for the PCM Configuration Data File mode. This mode uses the User Configuration Data (UCDF) that was loaded into a user module named UCDF in the PCM's battery-backed RAM memory. The UCDF is created using the PCM development software (PCOP.) The configuration data is used for building the configuration of the PCM during the power-up sequence, initializing available hardware on the PCM, and specifying the user or system tasks to be started. For more information, refer to the *Series 90 PCM Development Software (PCOP) User's Manual,* GFK-0487.

NONE Mode

NONE mode is used when there is no soft switch data. It is required for compatibility with Release 1 PCM software.

When **NONE** mode is selected, the following PCM detail screen is displayed.

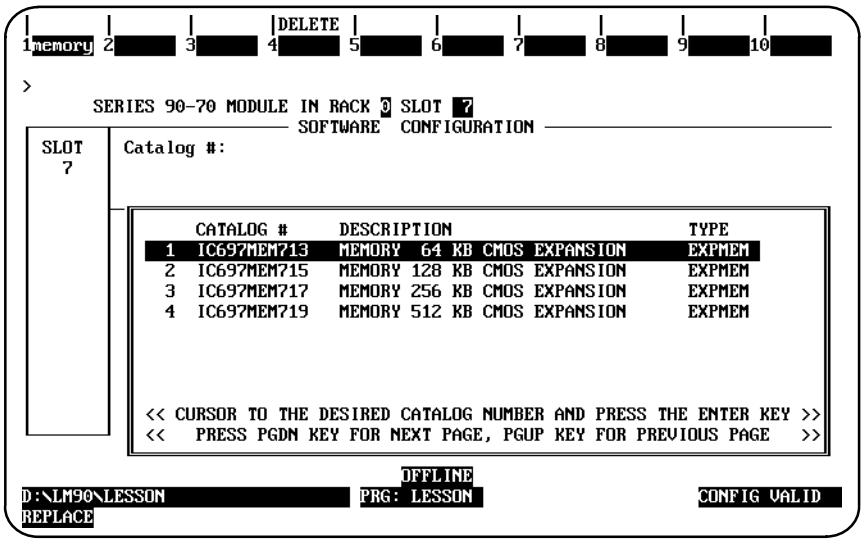


In this screen, the configuration mode is set to **NONE** for the PCM Configuration Data File mode. This mode is used to configure the PCM board with no soft switch data.

Configuring Memory Expansion Boards

A PCM must first be entered before its memory expansion board may be selected. Then, to configure a memory expansion board:

1. Press **Expansion Board (F9)** from the PCM detail screen to enter a Memory Expansion board. Then, press **Memory (F1)** to display a list of available expansion boards and their catalog numbers.



2. Position the cursor on the required expansion board, and press the **Enter** key.
3. Then, press the **Escape** key to return to the PCM detail screen.
4. If you need to delete PCM memory, press **Delete (Shift-F4)**.
5. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Section 7: Configuring a Communications Module

Logicmaster 90-70 programming software provides configuration support of the CMM Communications Module, IC697CMM711. The following modes of configuration are available:

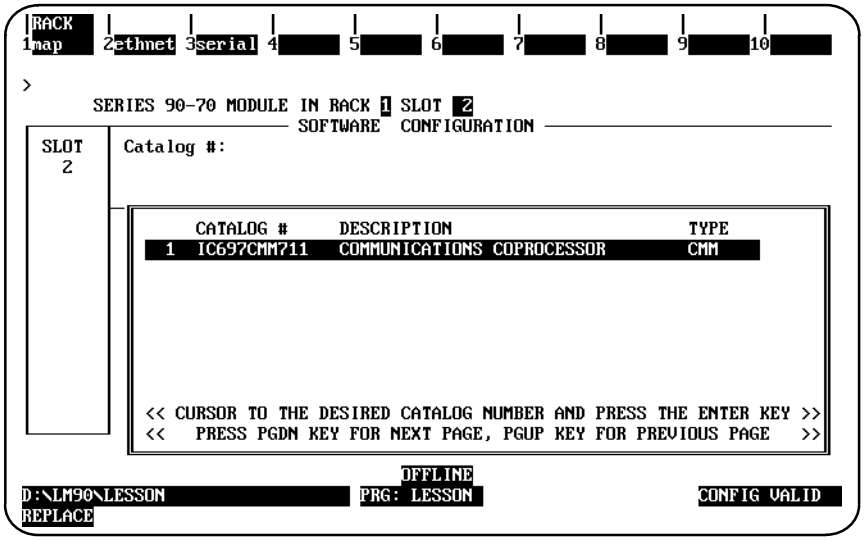
Mode	Description
CCM ONLY	Select both ports **1** and **2** for CCM.
CCM / RTU	Select port **1** for CCM and port **2** for RTU.
RTU / CCM	Select port **1** for RTU and port **2** for CCM.
RTU ONLY	Select both ports **1** and **2** for RTU.
SNP ONLY	Select both ports **1** and **2** for SNP.
SNP / CCM	Select port **1** for SNP and port **2** for CCM.
CCM / SNP	Select port **1** for CCM and port **2** for SNP.
SNP / RTU	Select port **1** for SNP and port **2** for RTU.
RTU / SNP	Select port **1** for RTU and port **2** for SNP.

For more information on the CMM, refer to the *Series 90 Programmable Coprocessor Module and Support Software User's Manual*, GFK-0255.

Configuring a CMM

To configure a CMM on the I/O Configuration Rack screen:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.
2. Press **Communications (F6)** and then **Serial (F3)** from the I/O Configuration Rack screen to display the entry for the CMM (IC697CMM711).



3. With the cursor positioned on that module, press the **Enter** key to display the detail screen.

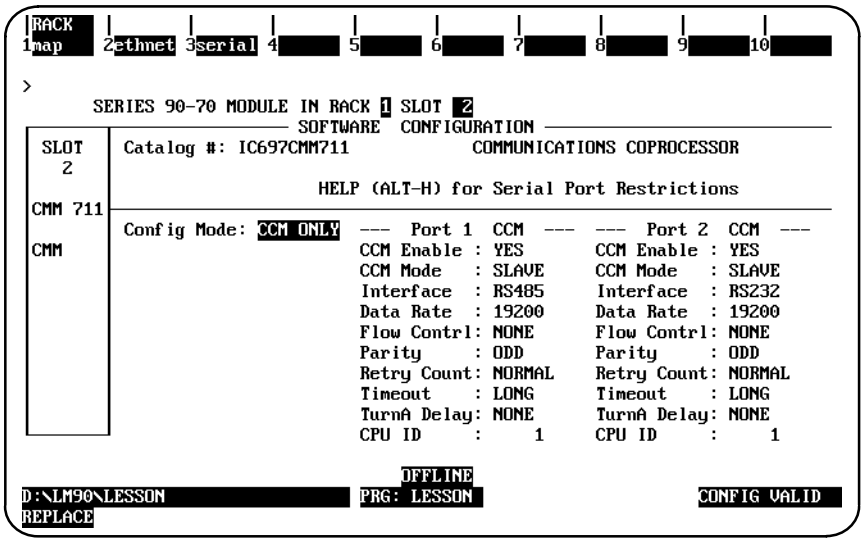
Selecting the Configuration Mode

The configuration mode is selected in the ***Configuration Mode*** field on the module detail screen.

1. To select a different configuration mode, move the cursor to the ***Configuration Mode*** field and repeatedly press the **Tab** key until the desired mode is displayed on the screen. Then, press the **Enter** key.
2. Configure the module. Then, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

CCM ONLY Mode

When **CCM ONLY** mode is selected, the following detail screen is displayed.



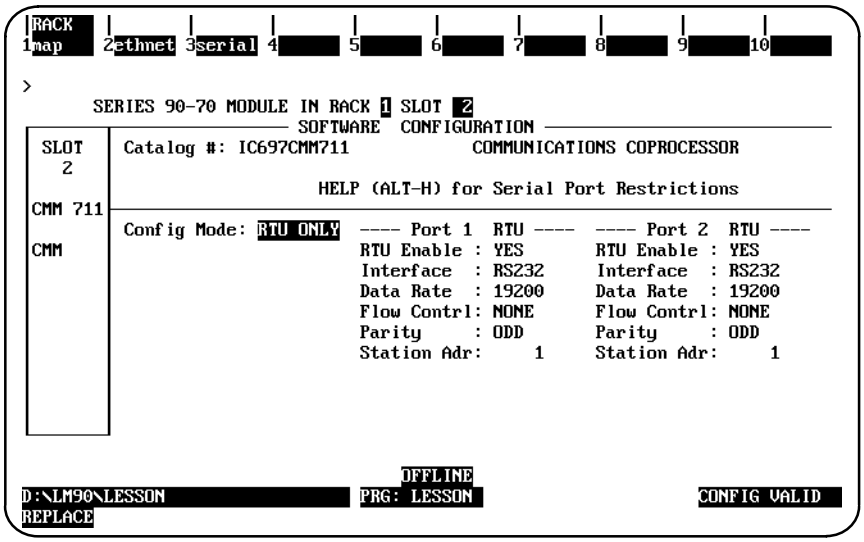
Parameter	Description
Configuration Mode	The configuration mode is set to **CCM ONLY**.
CCM Enable	Specify whether the port is to be configured for use as a CCM port. Choices are **YES*** or **NO**.
CCM Mode	This parameter displays the availability of ports for CCM access. Choices are **SLAVE***, **PEER**, or **MASTER**.
Interface	The interface parameter can be **RS-232*** or **RS-485**.
Data Rate	Data rate (bits per second or bps) for the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Flow Control	Type of flow control to be used on the port. Choices are **NONE*** or **HARDWARE**.
Parity	Type of parity to be used on the port. Choices are **ODD*** or **NONE**.
Retry Count	Retry counts for CCM mode. Choices are **NORMAL*** or **SHORT**.
Timeout	Length of timeouts used for CCM on the port. Choices are **LONG***, **MEDIUM**, **SHORT**, or **NONE**.
Turnaround Delay	Turnaround delay time to be used for CCM on the port. Choices are **NONE***, **10 ms**, **100 ms**, or **500 ms**.
CPU ID	Address of the port on a multi-drop network. This value is used to calculate the backoff delay upon an inquiry collision in peer mode. The range of values allowed in this field is **1*** to **254**.

* Default selection.

RTU ONLY Mode

RTU ONLY mode allows complete configuration of the CCM / RTU for RTU execution on one or both PCM ports.

When **RTU ONLY** mode is selected, the following detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **RTU ONLY**.
RTU Enable	Specify whether the port is to be configured for use as an RTU port. Choices are **YES*** or **NO**.
Interface	The interface parameter can be **RS-232*** or **RS-485**.
Data Rate	Data rate (bits per second or bps) for the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Flow Control	Type of flow control to be used on the port. Choices are **NONE*** or **HARDWARE**.
Parity	Type of parity to be used on the port. Choices are **ODD***, **NONE**, or **EVEN**.
Station Address	Enter a value from **1*** to **247**.

* Default selection.

CCM/RTU Mode

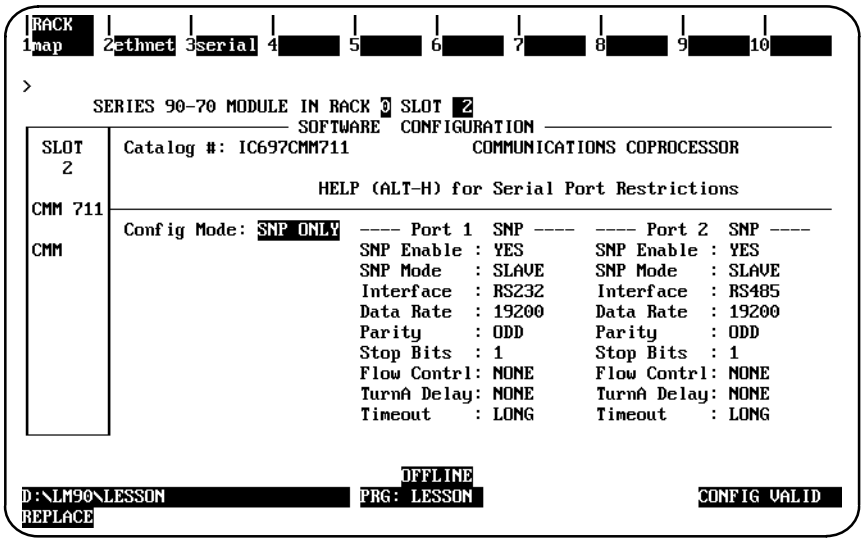
CCM/RTU mode selects port 1 for CCM and port 2 for RTU. The parameters for port 1 are the same as for **CCM ONLY** mode; and for port 2, the parameters are the same as for **RTU ONLY** mode.

RTU/CCM Mode

RTU/CCM mode selects port 1 for RTU and port 2 for CCM. The parameters for port 1 are the same as for **RTU ONLY** mode; and for port 2, the parameters are the same as for **CCM ONLY** mode.

SNP ONLY Mode

When **SNP ONLY** mode is selected, the following detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **SNP ONLY**.
SNP Enable	Specify whether the port is to be configured for use as an SNP port. Choices are **YES*** or **NO**.
SNP Mode	This parameter displays the availability of ports for SNP access. Choices are **SLAVE*** or **MASTER**.
Interface	The interface parameter can be **RS-232*** or **RS-485**.
Data Rate	Data rate (bits per second or bps) for the port. Choices are **300**, **600**, **1200**, **2400**, **4800**, **9600**, or **19200***.
Parity	Type of parity to be used on the port. Choices are **ODD***, **NONE**, or **EVEN**.
Stop Bits	Most serial communication uses at least one stop bit. Slower devices use two stop bits. Choices are **1*** or **2**.
Flow Control	Type of flow control to be used on the port. Choices are **NONE*** or **HARDWARE**.
Turnaround Delay	Turnaround delay time to be used for CCM on the port. Choices are **NONE***, **10 ms**, **100 ms**, or **500 ms**.
Timeout	Length of timeouts used for SNP on the port. Choices are **LONG***, **MEDIUM**, **SHORT**, or **NONE**.

* Default selection.

SNP/CCM Mode

SNP/CCM mode selects port 1 for SNP and port 2 for CCM. The parameters for port 1 are the same as for **SNP ONLY** mode; and for port 2, the parameters are the same as for **CCM ONLY** mode.

CCM/SNP Mode

CCM/SNP mode selects port 1 for CCM and port 2 for SNP. The parameters for port 1 are the same as for **CCM ONLY** mode; and for port 2, the parameters are the same as for **SNP ONLY** mode.

SNP/RTU Mode

SNP/RTU mode selects port 1 for SNP and port 2 for RTU. The parameters for port 1 are the same as for **SNP ONLY** mode; and for port 2, the parameters are the same as for **RTU ONLY** mode.

RTU/SNP Mode

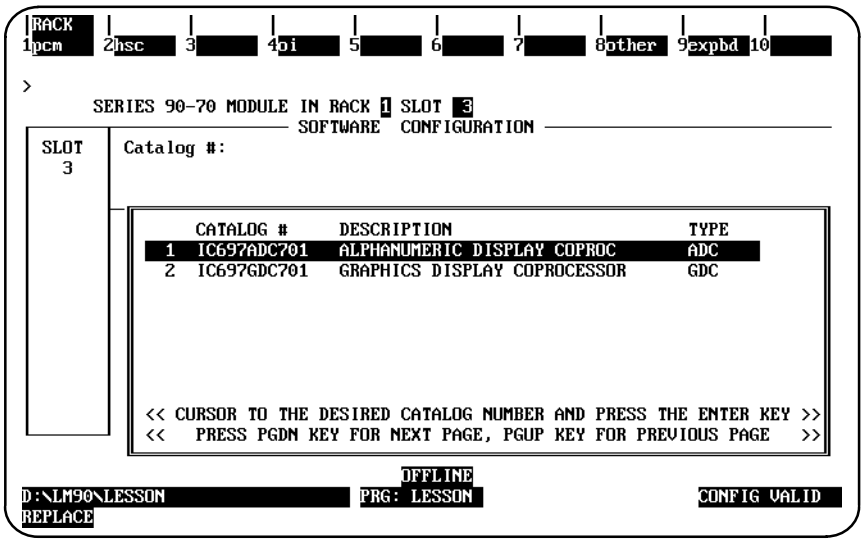
RTU/SNP mode selects port 1 for RTU and port 2 for SNP. The parameters for port 1 are the same as for **RTU ONLY** mode; and for port 2, the parameters are the same as for **SNP ONLY** mode.

Section 8: Configuring an ADC Module

The Alphanumeric Display Coprocessor (ADC) Module is used with the CIMPLICITY 90-ADS software for developing user screens and graphic displays. The CIMPLICITY 90-ADS system is a character-based operator interface generator system for use with the Series 90-70 PLC. For more information on this module, please refer to the *CIMPLICITY 90-ADS Alphanumeric Display System User's Manual*, GFK-0499.

To configure this module on the I/O Configuration Rack screen:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.
2. Press **Other (F8)** and then **Operator Interface (F4)** from the I/O Configuration Rack screen to display a list of available operator interface modules and their catalog numbers.



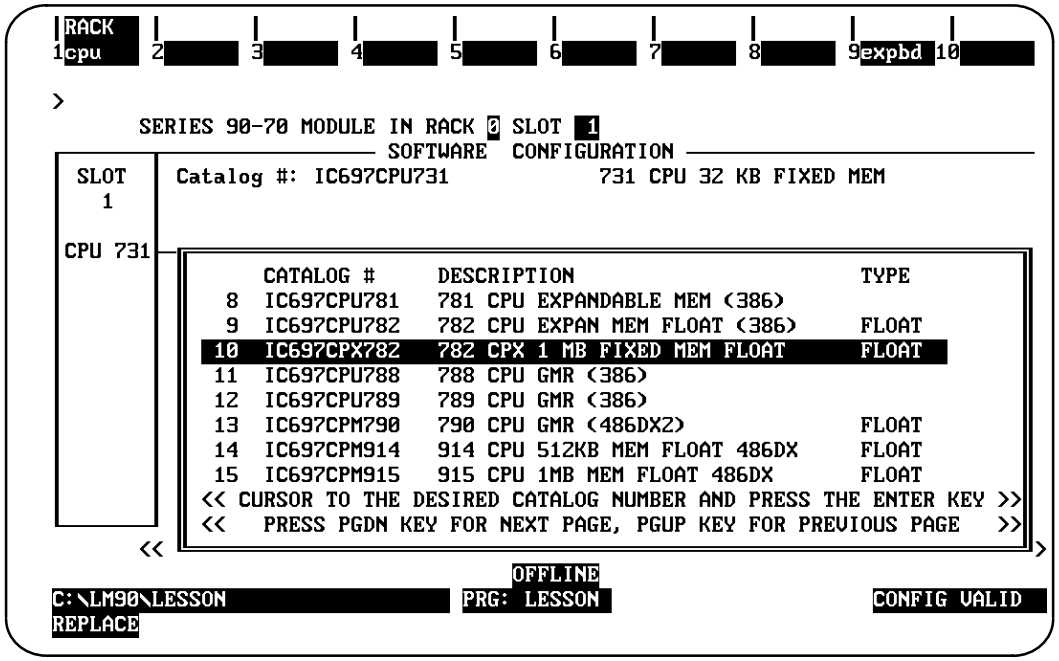
3. Position the cursor on the Alphanumeric Display Coprocessor Module (IC697ADC701), and press the **Enter** key.
4. Then, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Section 9: Configuring Ports 1 and 2 on a CPX Model CPU

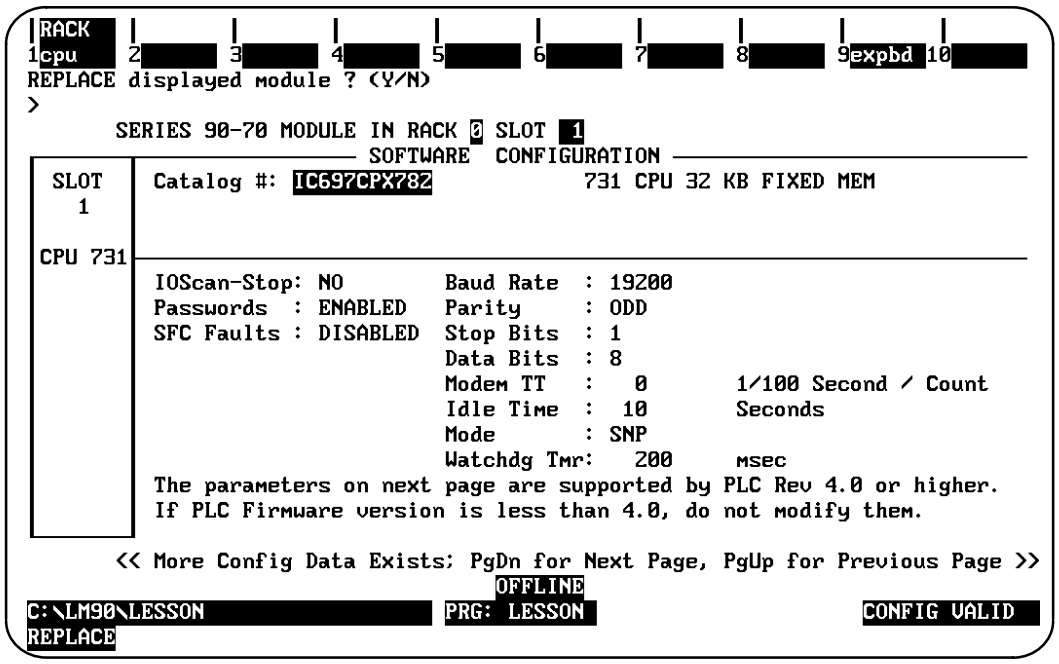
The CPX models of CPUs have embedded serial COM ports. You can configure these ports with Logicmaster 7.02 and later; however, with Release 7.8 CPUs, the ports can only be used for monitoring your program. **You cannot load, store, or verify though Ports 1 and 2 using a Release 7.8 CPX model** (the current model at the time of the release of this manual).

Configuring Ports 1 and 2

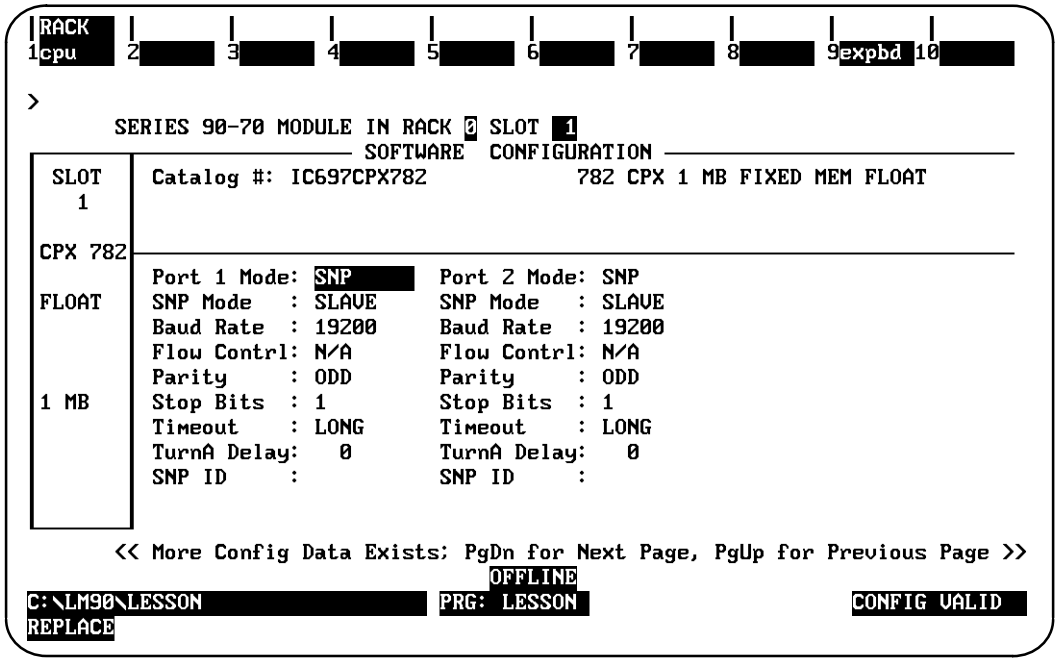
1. Enter the configuration package within Logicmaster and select the CPU from the list as described on page 11-7. For this example, we are using the CPX782 model. Your screen should look similar to this:



2. Press the Page Down key for general configuration. Press Page Down again for Sweep configuration. Press Page Down a third time to configure Ports 1 and 2. Your screen should look similar to the one shown on the top of the following page:



3. Press the Down Arrow key to configure the fields for Ports 1 and 2. A sample configuration is shown below:



The following table shows the parameter definitions for the port configuration screen on CPX models.

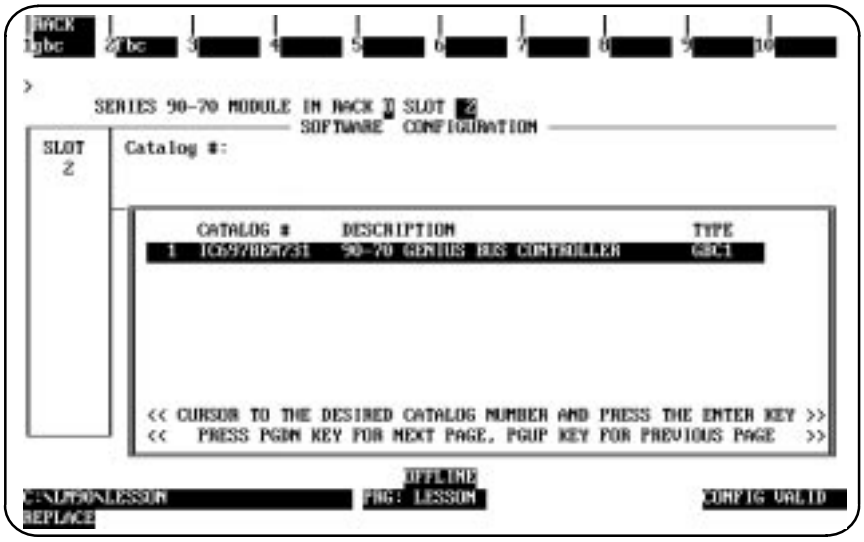
Parameter	Description
Port (1 or 2) Mode	The valid choices are **SNP*** or **DISABLED**.
SNP Mode	This parameter displays the availability of ports for SNP access. Choices are **SLAVE*** or **MASTER**.
Baud Rate	Baud (or data) rate (bits per second or bps) for the port. Choices are **1200**, **2400**, **4800**, **9600**, **19200***, **38400**, **57600**, or **115200**.
Flow Control	You cannot edit this field. It is set to N / A.
Parity	Type of parity to be used on the port. Choices are **ODD***, **NONE**, or **EVEN**.
Stop Bits	Most serial communication uses at least one stop bit. Slower devices use two stop bits. Choices are **1*** or **2**.
Timeout	Length of timeouts used for SNP on the port. Choices are **LONG***, **MEDIUM**, **SHORT**, or **NONE**.
TurnA Delay	Turnaround delay time to be used for this port. Choices are **0 milliseconds** through **999 milliseconds**.
SNP ID	Enter the SNP ID here. You can use up to seven (7) characters.

* Default selection.

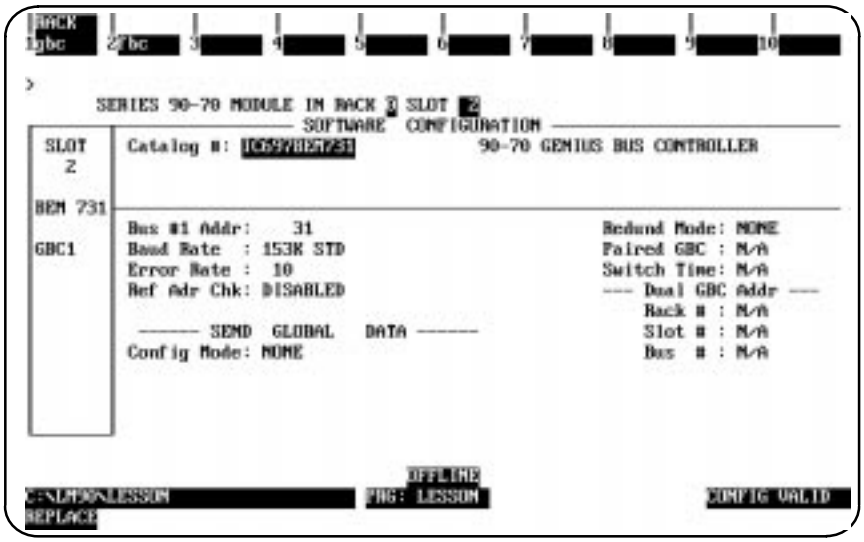
Section 10: Configuring a Genius Bus Controller

The Genius Bus Controller (IC697BEM731) is used to interface a Series 90-70 PLC system to a Genius I/O bus with up to 31 I/O blocks. The bus controller may be located in any rack. A maximum of 31 bus controllers can be used in a system. To configure a bus controller in the rack:

1. Move the cursor to the correct slot.
2. Press **fldbus (F2)** from the rack view to locate a bus controller in the slot.
3. Press **gbc (F1)** to display the entry for the Genius Bus Controller (IC697BEM731).



4. With the catalog number displayed in reverse video, press the **Enter** key. Your screen display will look like the one shown below.



5. Select the correct configuration for the Bus Controller, according to the information provided in the following table. For additional information, refer to the *Series 90™-70 PLC Genius™ Bus Controller User's Manual*, GFK-0398.

6. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

Note

This section provides you with instructions on the steps involved in configuring a Genius Bus Controller. The parameter definitions and other configuration considerations for Genius Bus Controllers are also discussed briefly in this section. For detailed discussions of the parameters and various effects of different configuration options, refer to the *Series 90™-70 PLC Genius™ Bus Controller User's Manual*, GFK-0398.

For each bus, you can select the following:

Parameter	Description
Bus Address	Device number (serial bus address) occupied by the Bus Controller on an individual bus. This address is not related to the assignment of I/O references for the Bus Controller, which are discussed below. Ordinarily, the device number assigned to the Bus Controller is 31*.
Baud Rate	Baud rate to be used by all devices on the serial bus. All devices on a bus must use the same baud rate: **153.6 Kbaud standard, 153.6 Kbaud extended**, **76.8 Kbaud**, or **38.4 Kbaud**. Selection of a baud rate depends on the application, as explained in GEK-90486.
Error Rate	Number of errors which may occur on the Genius Bus in a 10-second sliding window. For all values above zero, the Bus Controller monitors the bus for errors. When the number of errors exceeds the error rate, the Bus Controller turns the Communications LED off and drops off the bus. It remains off the bus until the number of detected errors is fewer than the error rate value. If the bus includes a Bus Switching Module, the error rate must be set to 0. Otherwise, the bus controller may drop off the bus when the BSM is switching a block to the bus. When the error rate value is 0, the Bus Controller uses a rate of 10 errors in 10 seconds. When the detected error rate exceeds 10, the Bus Controller remains on the bus and flashes the Communications LED. It continues to flash until the number of detected errors is less than 10 per 10 seconds.
Reference Address Check	Genius devices may be configured with a status table reference. To have the system verify that references of the Genius devices installed have been configured to match the Logicmaster 90 configuration, set this parameter to **ENABLED**. If **DISABLED*** is selected, no cross-checking is performed.
Global Data	The entries for global data are optional. They are used to set up automatic (Global Data) data transfer between the Bus Controller and another bus interface module on the same bus. In addition to completing the entries below for the Bus Controller sending the data, the bus interface module that receives the data must be configured for Global Data. (This is explained on a later page.)
Configuration Mode	The modes include **NONE**, **MANUAL**, and **AUTO**. **NONE*** mode is used to disable global data for the device. **MANUAL** mode allows any of the valid reference types and lengths to be configured. **AUTO** mode assigns a global (%G) reference address and length based on the Serial Bus Address and Address Scheme. Serial Bus Addresses 16 through 23 use Address Scheme 1, for which 16 bytes of global data is transferred. Serial Bus Addresses 24 through 31 use Address Scheme 2 for which 4 bytes of global data is transferred.
From Address	Beginning PLC address from which data will be transmitted on the bus. It can be %I, %Q, %AI, %AQ, %G, or %R memory.
Data Length	For bit-oriented memory (%I, %Q, or %G), this is the number of bits of data to be transferred. The range is **0** to **1024**. It must be a multiple of 8. If you enter a number that is not a multiple of 8, the software will automatically adjust it upward. For word-oriented memory (%AI, %AQ, or %R), this is the number of words of data to be transferred. The range is 0 to 64. The total amount of memory specified must not exceed the configured memory size for that memory type. Refer to chapter 12, "CPU Configuration," for information on changing the configured memory size.
To (Optional)	This is an optional parameter. If the data is being transmitted to another Series 90-70 Bus Controller, do not complete this entry. If the data is being transmitted to a Bus Controller in either a Series Six PLC or a Series Five PLC, specify the beginning register address where the data will be stored in the other PLC.

* Default selection.

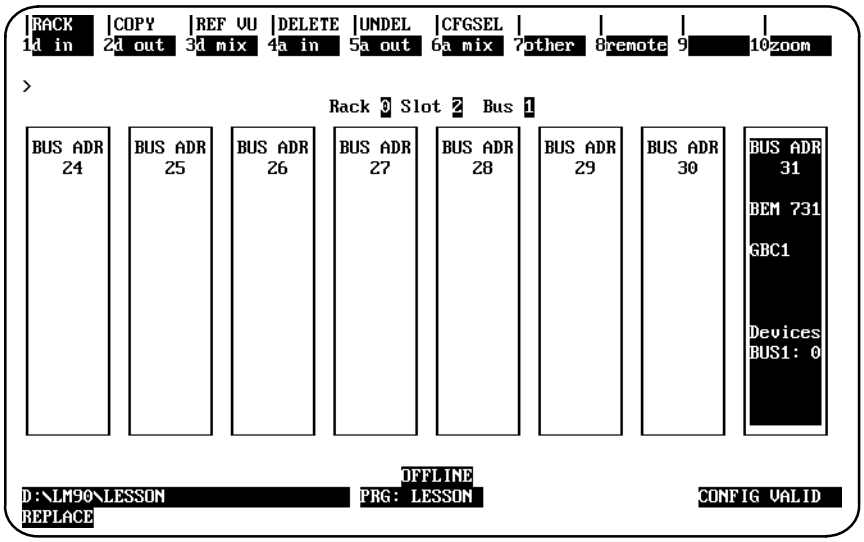
Table 11-4. Configuration Mode Address Scheme

Address Scheme	Serial Bus Address	Start Address	End Address
2	16	%G0001	%G0032
	17	%G0033	%G0064
	18	%G0065	%G0096
	19	%G0097	%G0128
	20	%G0129	%G0160
	21	%G0161	%G0192
	22	%G0193	%G0224
	23	%G0225	%G0256
1	24	%G0257	%G0384
	25	%G0385	%G0512
	26	%G0513	%G0640
	27	%G0641	%G0768
	28	%G0769	%G0896
	29	%G0897	%G1024
	30	%G1025	%G1152
	31	%G1153	%G1280

Configuring the Devices on a Genius I/O Bus

After configuring the Bus Controller, configure the I/O blocks and other devices on the bus. These may be Genius I/O blocks, bus interface devices, or GENA blocks.

1. Position the cursor on the slot in the rack display that was previously configured for the Genius Bus Controller, and press **Zoom (F10)**. A screen representing the locations of devices on the bus is displayed.



The screen displays blocks to represent device numbers 24 through 31. Each block represents a potential device on the bus. Use the Left and Right cursor keys to display additional device number blocks.

2. Move the cursor to the device number that has been selected for the block and press the desired function key (F1 through F8).

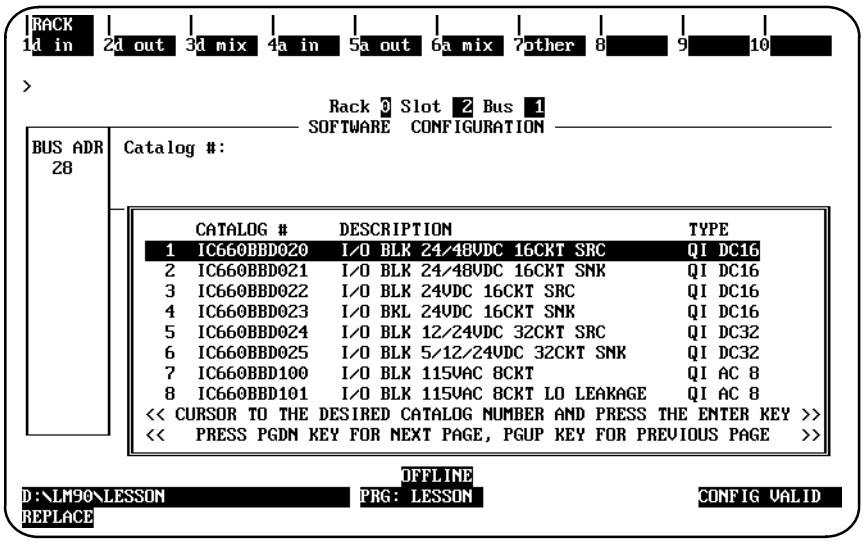
Function Key	Function	Description
F1	d in	Select a discrete input block.
F2	d out	Select a discrete output block.
F3	d mix	Select a discrete block with both inputs and outputs.
F4	a in	Select an analog input block.
F5	a out	Select an analog output block.
F6	a mix	Select an analog block with both inputs and outputs.
F7	other	Select another bus interface device. The device may be a Bus Controller in a different PLC rack, or an I/O Interface Block (IC660ELB904). Also, press **Other (F7)** to select a High Speed Counter or PowerTRAC Module.
F8	remote	Select a Remote I/O Scanner Module.

Note

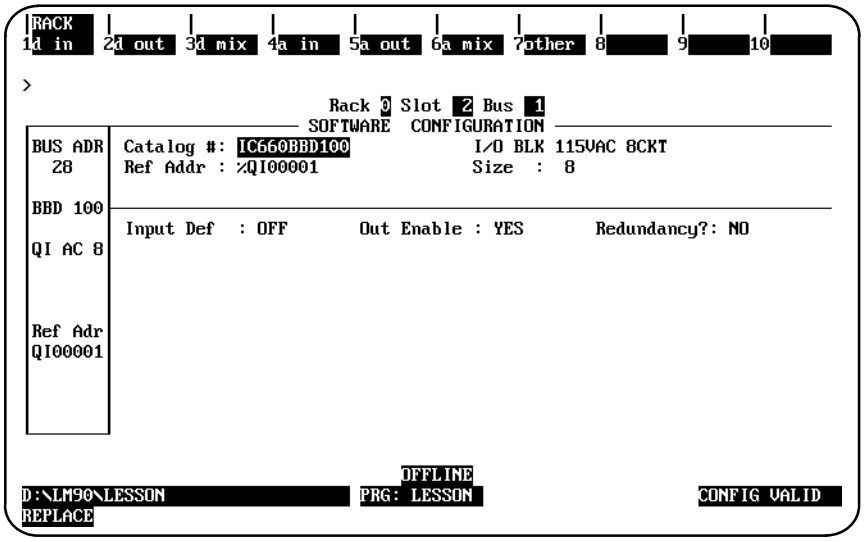
This procedure does not configure I/O blocks, which must be done separately using a Genius Hand Held Monitor. That includes entering the block's device number.

Configuring Genius I/O Blocks

To configure a Genius I/O block on the bus, use the function key for the type of block you wish to select. The screen will list the blocks of that type. For example, if you press **F3 (d mix)**, Genius blocks having both inputs and outputs are listed.



1. Select a block type by moving the cursor, if necessary, and pressing the **Enter** key. The block's catalog number will appear in the proper field. For example, position the cursor on IC660BBD100 and press the **Enter** key.



Parameter	Description
Input Default	Selects whether the Genius Input block will hold the last state or turn the inputs off. Choices are **OFF*** or **HOLD**.
Output Enable	Selects whether all block outputs will be enabled or disabled when the Series 90-70 Bus Controller is started up. Choices are **YES*** or **NO**.
Redundancy?	Selects whether the block will be used in a redundant configuration. Choices are **NO*** or **YES**. When **YES** is selected, the Genius Bus Controller (GBC) will supply dual images of the input data from that device, plus any diagnostic data, to the CPU. The CPU will compare the two sets of information before using it. A diagnostic fault will be generated whenever the two sets of data are different.

* Default selection.

2. The following entry shows the I/O reference address for the block:

Ref Addr : %QI00001

The configuration software automatically displays the first available reference address for the first module of each type. For example, for the first input module, the screen automatically displays the reference address %I00001. For additional modules of the same type, the software automatically increments the reference address. You can use these reference addresses without change.

If you want to use a different reference address, enter it here. For a discrete module, the reference address must begin on a byte boundary (a byte boundary is a number which is one greater than a multiple of 8; for example, 1, 9, 17, or 25). If you assign a reference address out of sequence, the software will continue to increment the reference addresses for additional modules. For example, if you assigned the reference %I00393 to the first input module and it had 16 circuits, the software would automatically increment the reference address for the next input module to %I00409. You could change this to a different address.

A message appears when the highest available address has been assigned, although you may have skipped lower addresses.

References for Inputs-only or Outputs-only Blocks

Inputs-only Genius blocks will occupy one reference in %I or %AI memory for each circuit on the block. Therefore, a discrete block with 16 inputs will occupy 16 reference addresses in %I memory. Similarly, a block with outputs only will occupy one reference in %Q or %AQ memory for each circuit on the block.

References for Blocks with both Inputs and Outputs

References for the block will start at the same input and output address. An analog block will use one analog reference for each input or output (for example, 4 analog inputs and 2 analog outputs).

A discrete block that has both inputs and outputs will require one input and one output reference for each circuit on the block, regardless of whether the circuits are used as inputs or outputs. For example a 32-circuit discrete Genius I/O block (which has 32 circuits that can be used as either inputs or outputs) will use 32 references in %I memory and 32 references in %Q memory beginning at the same address.

For a discrete block with both inputs and outputs, this address is shown in the configuration screen as:

```
Ref Addr :  %QInnnnn
```

For an analog block with both inputs and outputs, this address is shown in the configuration screen as:

```
Ref Addr :  %AQInnnnn
```

Note

Many of the %QI and %AQI blocks may be configured to use %Q or %I, or %AQ or %AI address types rather than the default %QI or %AQI type. If a 32-point %QI block is configured as a %I block, then 32 points of %I space are used and *no* %Q space is used. Each %QI bit counts only once against the %I + %Q total.

Even though the CPU Memory Configuration screen may show 512 for both %I and %Q references, the maximum %I + %Q is 512. If %I uses 512, there is nothing left for %Q.

3. Configurable characteristics for the module are shown on the screen (see previous page). A default selection for each is shown. To change any of the default selections, move the cursor to that item and use the Tab key to display alternatives.
4. After selecting the correct configuration for the module, press the **Escape** key to return to the bus display.

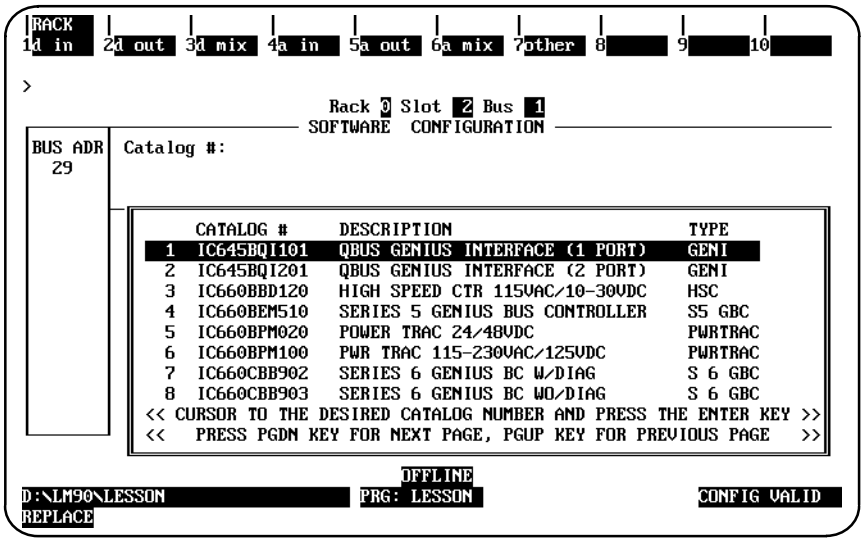
Configuring Additional Devices (on the Same Bus)

More than one additional bus interface device (Bus Controller or similar device) can be located on the bus. The purpose of additional bus interface devices can be to provide communications between PLCs, CPUs, CPU redundancy, or distributed control of I/O blocks.

To add another bus interface module to the bus:

1. In the Bus Address display, locate the cursor at the intended device number for the module. This number should be selected in accordance with instructions in the *Series 90-70 Genius Bus Controller User's Manual*, GFK-0398.

2. Press **Other (F7)** to display a list of modules.



3. Select a module type by moving the cursor and pressing the **Enter** key. The module's catalog number will appear in the proper field.

4. If global data transmission has been set up for the Series 90-70 Bus Controller (the one interfacing this bus to the rack you are configuring), complete the following fields for this bus interface module:

```
---- RECEIVE  GLOBAL  DATA ----
Config Mode: MANUAL
To         :  %R00001
Input Len  :     1
```

Specify the following information if global data will be received by the module:

Parameter	Description
Configuration Mode	There are three modes: **NONE**, **MANUAL**, and **AUTO**. **NONE** mode is used to disable global data for the device. **MANUAL** mode allows any of the valid reference types and lengths to be configured. **AUTO** mode assigns a global (%G) reference address and length based on the bus address. For Address Scheme 1, 16 bytes of global data is transferred. For Address Scheme 2, 4 bytes of global data is transferred. %G is channel 1, %GA is channel 2, %GB is channel 3, %GC is channel 4, %GD is channel 5, and %GE is channel 6.
To	This parameter specifies where the global data broadcast (received) from this module will be stored by the Series 90-70 Bus Controller (the one interfacing this bus to the rack you are configuring). For a Series 90-70 PLC, enter a beginning address in %I, %AI, %Q, %AQ, or %R memory.
Input Length	The amount of global data being received. Enter the same amount selected for the transmitting Bus Controller. For bit-oriented data, this is a number of bits. For word-oriented data, it is the number of words.

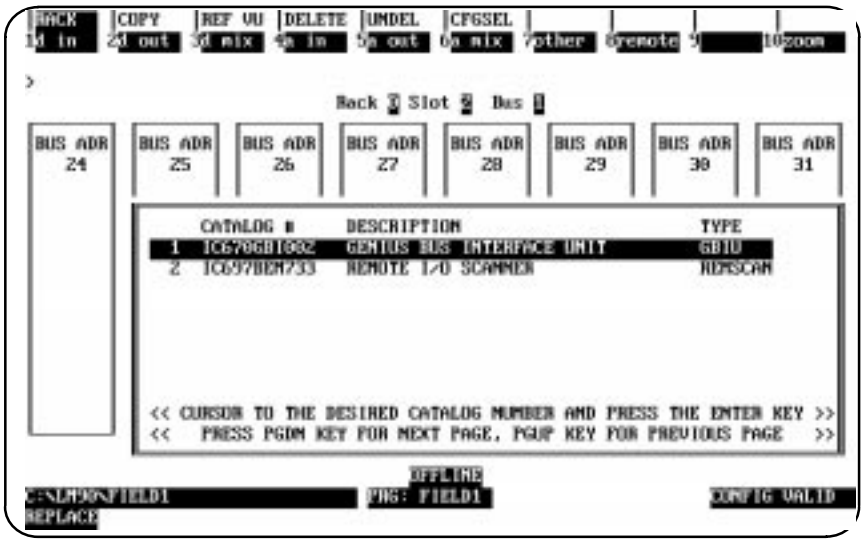
5. After configuring the module, press the **Escape** key to return to the bus display.

Configuring a Genius Bus Interface Unit for Field Control

The directions presented below briefly describe the steps for configuring a Genius Bus Interface Unit for Field Control. For details on the configuration options, refer to the *Field Control™ Distributed I/O and Control System Genius™ Bus Interface Unit User's Manual* (GFK-0825).

To add another bus interface module to the bus:

1. From the the Rack display screen within the configuration software, move the cursor to the slot having the Genius Bus controller. and press **zoom (F10)**.
2. Your cursor will be on BUS ADR 31. Move the cursor to BUS ADR 30, then press **remote (F8)**.
3. The Genius Bus Interface Unit for Field Control is one of the choices available as shown in the sample screen presented below. Select the IC670GBI002, GENIUS BUS INTERFACE UNIT (i.e., place the cursor on the selection and press **Enter**.)



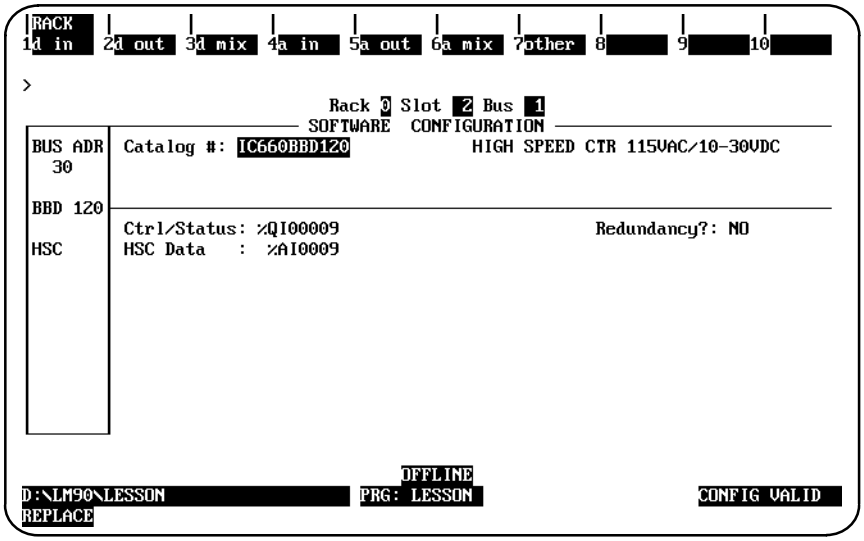
4. After pressing **Enter**, your Bus Address display will include a GBIU in BUS ADR 30. Press **Escape** to save the configuration To complete the configuration, please refer to the *Field Control™ Distributed I/O and Control System Genius™ Bus Interface Unit User's Manual* (GFK-0825) for information about additional configuration options..

Configuring a Genius High Speed Counter

Note

The Series 90-70 configurator supports only the configuration of the control / status reference and the High Speed Counter data reference. All other configuration must be performed using the Genius Hand Held Monitor.

The Genius High Speed Counter detail screen shown below is displayed after pressing **Other (F7)** from the Genius bus and selecting the Genius High Speed Counter from the catalog list displayed.



Parameter	Description
Control / Status	Select the %QI reference location for discrete input data that the Genius High Speed Counter sends to the Series 90-70 PLC and discrete output data that the PLC sends to the High Speed Counter. The length of the discrete data is fixed at 16 bits (2 bytes). Discrete input data (status) consists of the Strobe status, Preload status, Disable status, Output status, Module Ready status, Home input status, and error status (type C only). Discrete output data (status) consists of the following control data: Reset Strobe flag, Reset Preload flag, Outputs Enable, Home command, and Clear Error (type C block only).
HSC Data	Select the %AI reference location for data sent to the PLC by the Genius High Speed Counter. The length of the data is fixed at 15 words. It consists of the latest Count per Timebase value, the contents of the Accumulator(s), and the contents of the Strobe registers. You cannot position the cursor on the ***HSC Data*** field. Its reference offset must be the same as that selected for the Ctrl / Status reference offset. Therefore, selection of the offset for Ctrl / Status determines the reference offset for HSC data. For example, if %QI00017 is selected for Ctrl / Status, then HSC Data automatically becomes %AI00017.
Redundancy?	Selects whether the block will be used in a redundant configuration. Choices are **NO*** or **YES**. When **YES** is selected, the Genius Bus Controller (GBC) will supply dual images of the input data from that device, plus any diagnostic data, to the CPU. The CPU will compare the two sets of information before using it. A diagnostic fault will be generated whenever the two sets of data are different.

The format of these fields depends on whether the block is type A, B, or C.

Genius Bus Redundancy

With Genius bus redundancy, individual redundant blocks have the ability to switch from one GBC bus to another GBC bus with no regard to other devices on a particular bus. The switch is controlled by the Bus Switching Module (BSM). With Dual GBC Redundancy, individual redundant blocks on the same bus all switch to another bus simultaneously.

Note

Genius bus redundancy requires backward and forward compatibility between the PLC and the GBC.

The following table describes the parameters which must be selected:

Parameter	Description
Paired GBC	Indicates where the matching bus controller of the pair is located. **INTERNAL** indicates that the matching GBC is located in the same PLC configuration. **EXTERNAL** indicates that the matching GBC is located in another PLC configuration. **INT/EXT** can only be used when DB/RC has been selected for the ***Redund Mode*** parameter, and there are four GBCs present. Two of the GBCs must be located in the same PLC configuration, and they must have the same Serial Bus Address (either 30 or 31). The other two must be located in an external PLC configuration, and they must have the same Serial Bus Address. If Serial Bus Address 30 is used for the internal GBCs, then Serial Bus Address 31 must be used for the external GBCs, and vice versa.
Redund Mode	Selections for this parameter indicate the type of redundant configuration in which the particular Genius Bus Controller (GBC) will be used. **NONE*** indicates that the GBC will not be used in a redundant configuration. **DUAL BUS** indicates that the Genius devices connected to the GBC being configured will be set up to switch between two physical Local Area Networks (LANs). Each Genius device will be communicating on only one of these LANs at any given moment. Redundant Controller (**RED CTRL**) indicates that the Genius devices will be set up to expect to communicate with two bus controllers. The Genius devices must also be configured for one of the CPU Redundancy modes (Hot Standby or Duplex mode). When configured in one of these modes, they will send input data and diagnostic messages to both bus controllers and will correctly handle the two sets of output data they will be receiving from the two bus controllers. **DB/RC** represents a configuration in which dual busses and redundant controllers are both used.
Switch Time	When dual busses are configured, Genius devices can select a timeout for defaulting outputs. This parameter provides an equivalent selection for defaulting inputs, following either bus switching activities or the apparent loss of a device.
Dual GBC Address	The PLC address of the current GBC's internal paired GBC in the redundant scheme. The GBC bus number must be identified as **1**. If the Paired GBC is **EXTERNAL**, the Dual GBC Address is not applicable.

* Default selection.

Changing a Parameter of a Block

If the redundant block pair resides in the same PLC configuration and you change the value of a parameter for one of the blocks of the pair, the corresponding parameter of the other block will also be changed. If the redundant block pair resides in two different PLC configurations, changing the value of a parameter for one of the blocks of the pair will not change the corresponding parameter of the other block.

Changing a Parameter of a GBC

If the redundant GBC pair resides in the same PLC configuration and you change the Dual GBC Address for one of the GBCs and then try to leave the detail screen, the software will verify that the selected PLC address is unconfigured. If it is not configured, the redundant GBC of the pair is automatically moved from the old address and configured at the new address.

If the new address is configured, the software will prompt you to delete the module at this address. If you enter **Y** (Yes), the module is deleted and the redundant GBC is automatically moved from the old address and configured at the new address. If you enter **N** (No), you must either enter an unconfigured Dual GBC Address or change the value of the ***Paired GBC*** parameter to **EXTERNAL** or the ***Redund Mode*** parameter to **NONE**.

Copying a Block or GBC

If you try to copy one of the blocks of a redundant pair, the block is copied as is, except that the value of its ***Redundancy?*** parameter will be set to **NO**. You can make this copied block redundant by changing the value of the parameter to **YES**.

If you try to copy one of the GBCs of a redundant pair, the GBC is copied as is, except that the value of its ***Redund Mode*** parameter will be set to **NONE**. You can make this copied GBC redundant by changing the value of the parameter to **DUAL BUS**, **RED CTRL**, or **DB/RC**.

Deleting a Block

If the redundant pair resides in the same PLC configuration and you try to delete one of the blocks of the pair, both blocks will be deleted.

If the redundant pair resides in two different PLC configurations, deleting one of the blocks of the pair will not automatically delete the other block. You must ensure that the other block is also deleted in the external configuration.

If the redundant pair resides in either the same PLC configuration or in two different PLC configurations and you try to undelete one of the blocks, only the block that was deleted can be undeleted. The block will be undeleted as is, except that the value of its ***Redundancy?*** parameter will be set to **NO**. You can make this undeleted block redundant by changing the value of the parameter to **YES**; however, you must ensure that both the current and external configurations are updated correctly.

Deleting a GBC

If the redundant GBC pair resides in the same PLC configuration and you try to delete one of the GBCs of the pair, both GBCs will be deleted.

If the redundant pair resides in two different PLC configurations, deleting one of the GBCs of the pair will not automatically delete the other GBC. You must ensure that the other GBC is also deleted in the external configuration.

If the redundant GBC pair resides in either the same PLC configuration or in two different PLC configurations and you try to undelete one of the GBCs, only the GBC that was deleted can be undeleted. The block will be undeleted as is, except that the value of its ***Redund Mode*** parameter will be set to **NONE**. You can make this undeleted GBC redundant by changing the value of the parameter to **DUAL BUS**, **RED CTRL**, or **DB/RC**; however, you must ensure that both the current and external configurations are updated correctly.

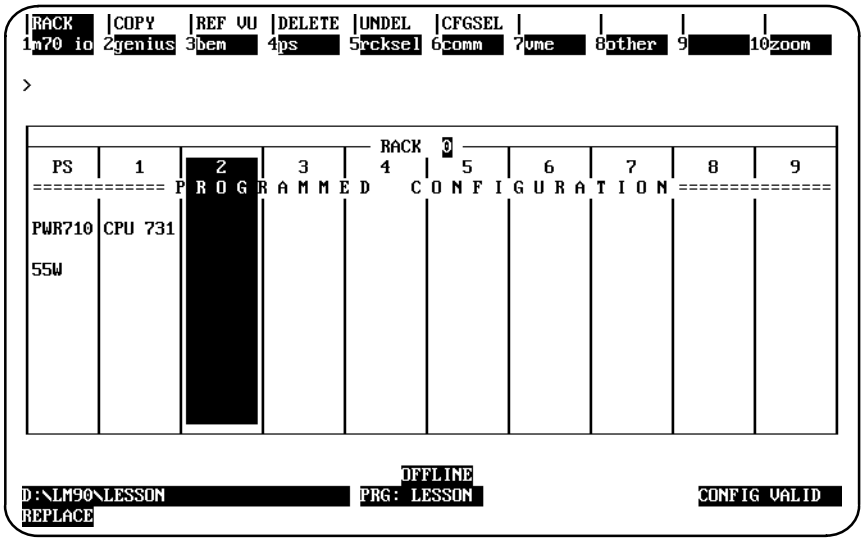
Configuring Genius Bus Redundancy

The choices for the ***Redundancy?*** parameter of a block are **YES** and **NO** (the default). If **YES** is selected for at least one block on a bus, then the ***Redund Mode*** parameter for the Genius Bus Controller must be set to a value other than **NONE** (**DUAL BUS**, **RED CTRL**, or **DB/RC**). If it is set to **NONE** when the ***Redundancy?*** parameter for one of the blocks is changed to **YES**, the GBC's ***Redund Mode*** and ***Paired GBC*** parameters will automatically be set to **DUAL BUS** and **EXTERNAL**, respectively.

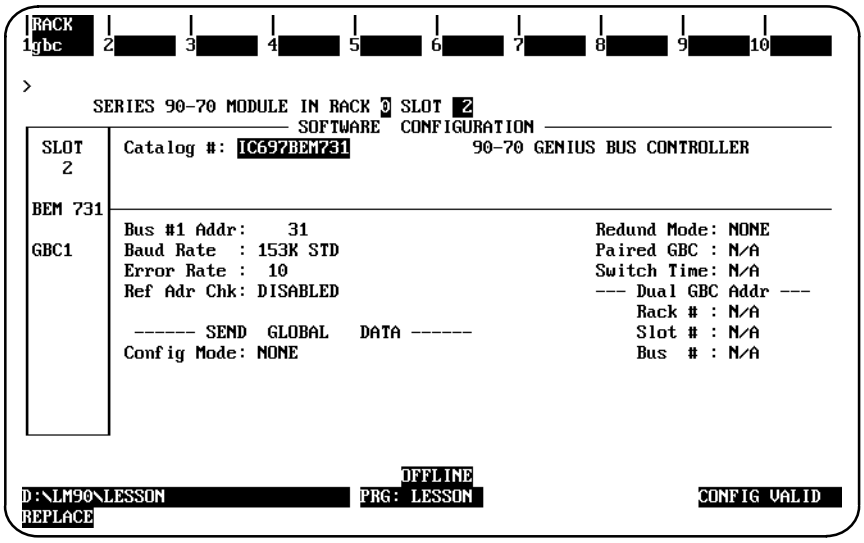
If redundancy is selected for one of the blocks, the ***Redund Mode*** parameter of the GBC is set to **DUAL BUS** or **RED CTRL**, and the ***Paired GBC*** parameter of the GBC is set to **INTERNAL**, the corresponding redundant block will be automatically configured as is at the same block address on the redundant bus.

To configure Genius bus redundancy:

1. Move the cursor to the correct slot in the rack display. For this example, that will be slot 2.

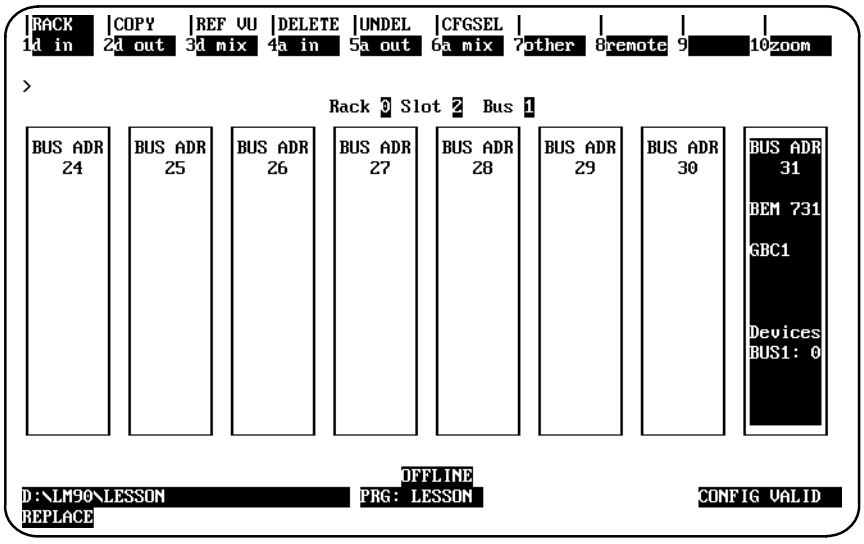


2. Press **Genius (F2)**, **GBC (F1)**, and then the **Enter** key to locate a Genius Bus Controller in the slot.

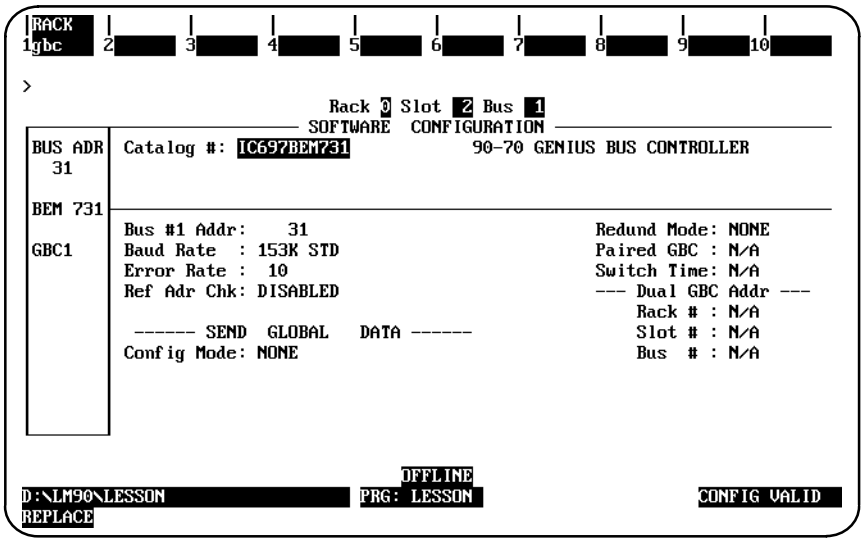


3. Press the **Escape** key to return to the main rack display.

4. Position the cursor on the slot in the rack display that was previously configured for the Genius Bus Controller (for this example, slot 2), and press **Zoom (F10)**. A screen representing the locations of devices on the bus is displayed.



5. Press **Zoom (F10)** again to display the detail screen for the Rack GBC. The parameters displayed are assigned default values.



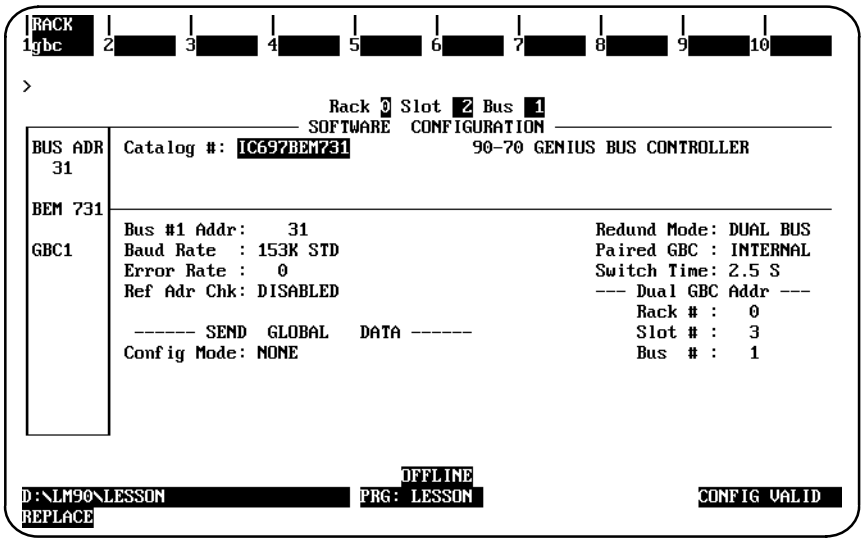
6. Change the default values of the following parameters:

   A. Cursor to ***Redundancy Mode***, and use the Tab key to select **DUAL BUS**.

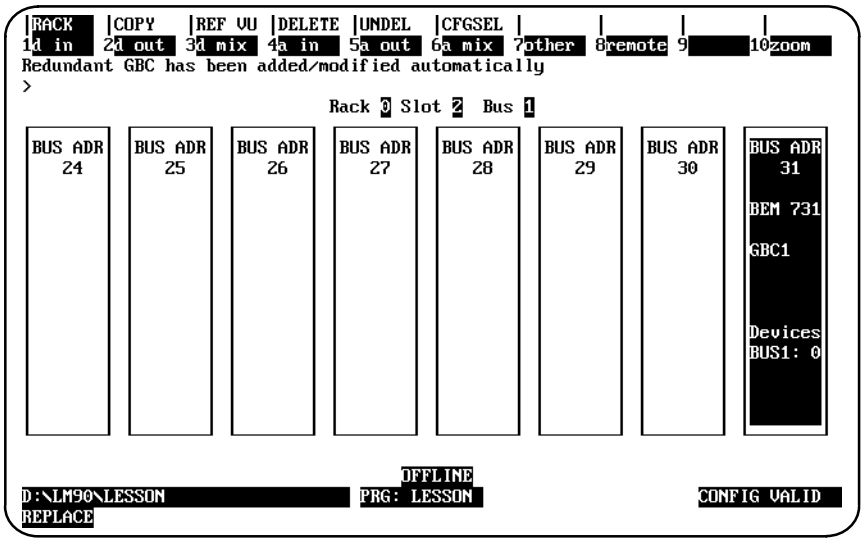
   B. Cursor to ***Paired GBC***, and select **INTERNAL**. Note that the ***Switch Time*** parameter is automatically set to **2.5** seconds by default.

   C. Cursor to ***Rack #***, and enter **0**.

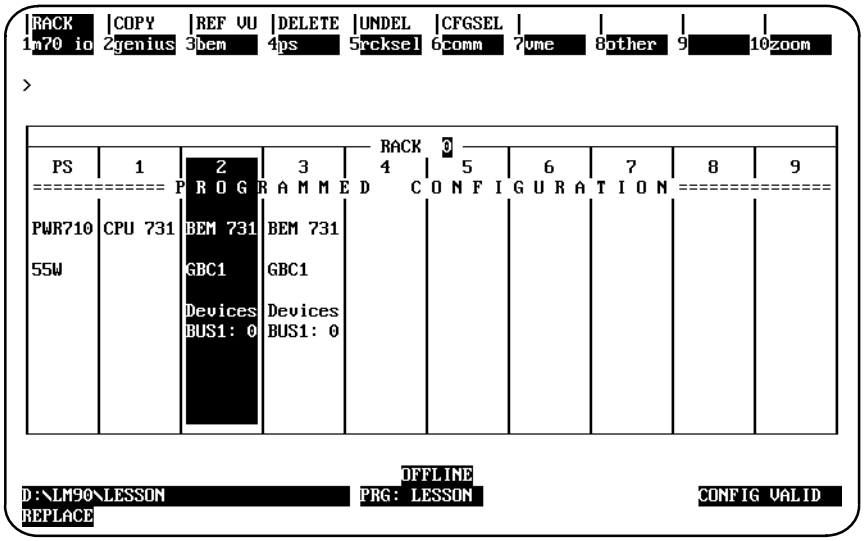
   D. Cursor to ***Slot #***, and enter **3**. Note that the bus number is always **1**.



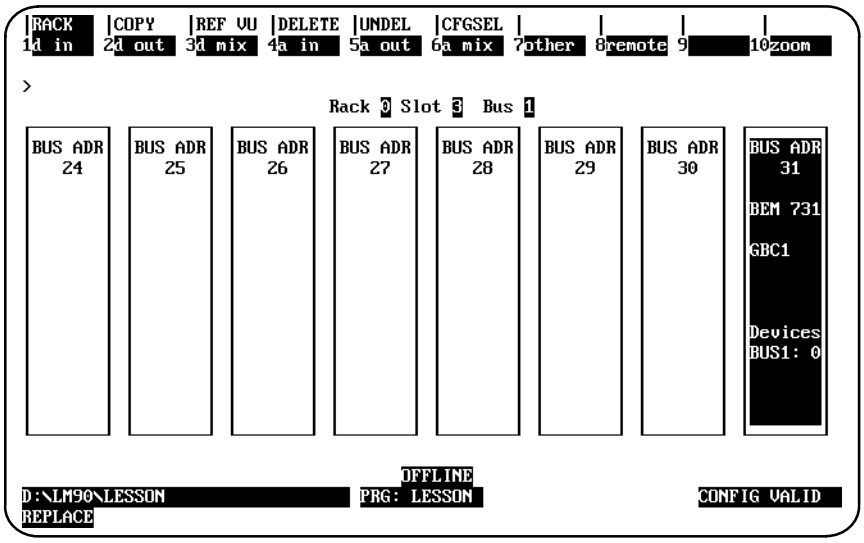
7. Press the **Escape** key. The Redundant GBC is automatically configured, and the following bus screen will be displayed.



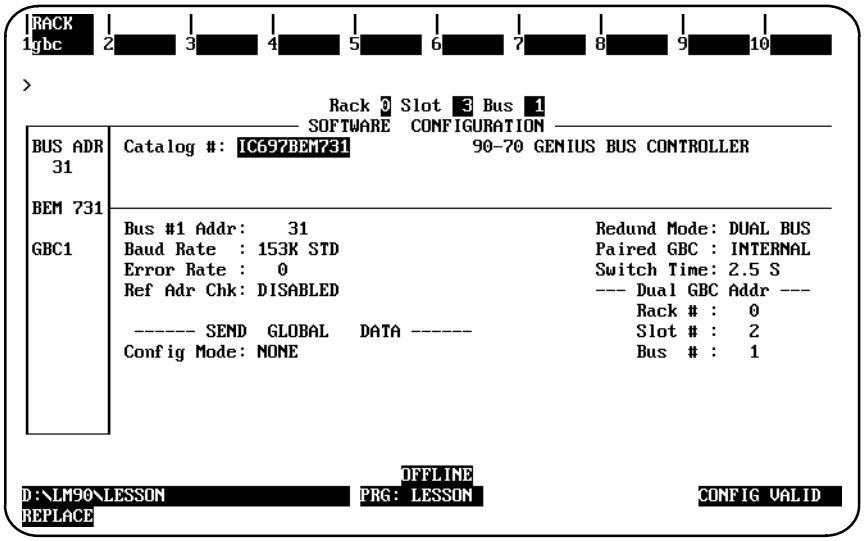
8. Press the **Escape** key to return to the main rack display. The Redundant Rack GBC has been automatically configured at PLC address 0.3.1.



9. Cursor to slot 3, and press Zoom (F10) to display the bus screen for the Redundant GBC.



10. Press **Zoom (F10)** to display the detail screen for the Redundant GBC. The Dual GBC Address has been automatically set to rack 0, slot 2, bus 1.

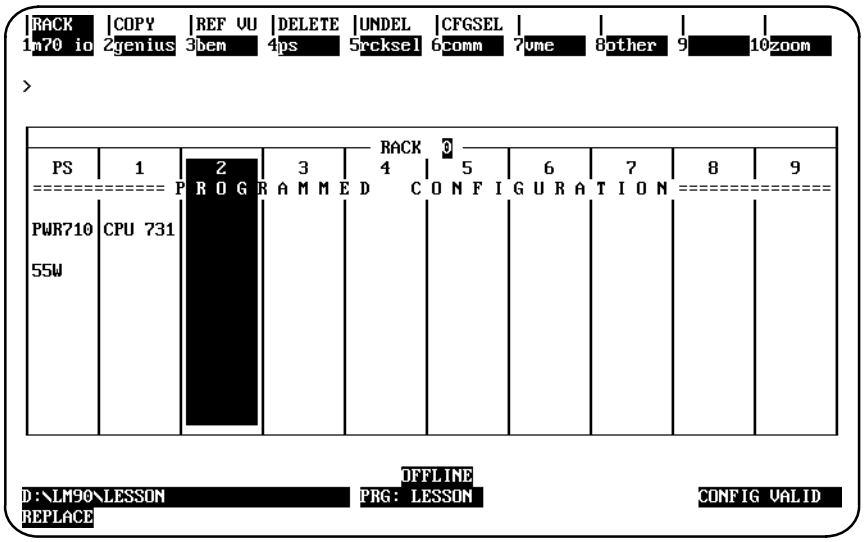


11. Press the **Escape** key twice to return to the main rack display.

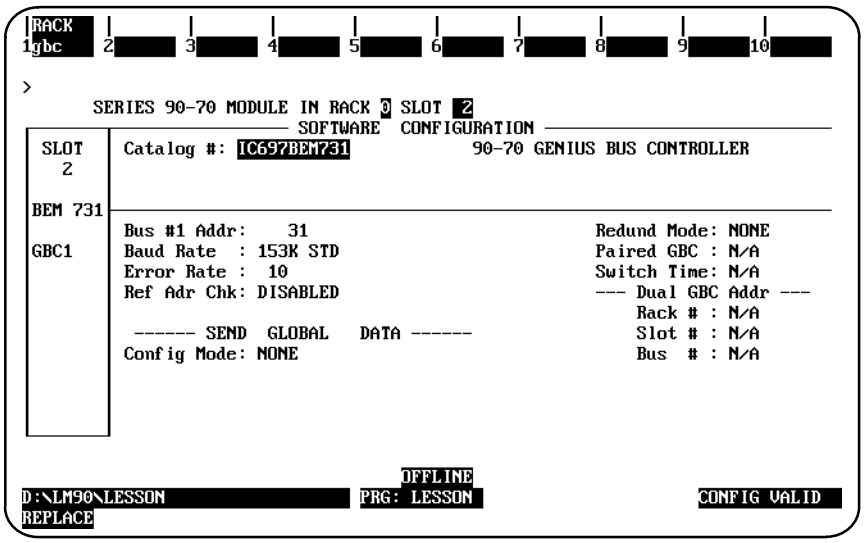
Configuring Dual GBC Redundancy

The following example shows how to configure Dual GBC Redundancy with the ***Redund Mode*** parameter set to **RED CTRL** and an internal Paired GBC:

1. Move the cursor to the correct slot in the rack display. For this example, that will be slot 2.

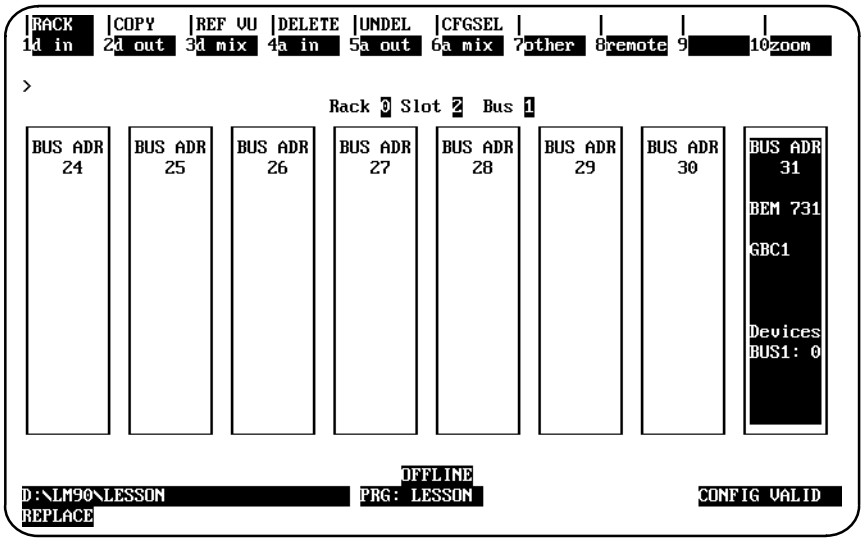


2. Press **Genius (F2)**, **GBC (F1)**, and then the **Enter** key to locate a Genius Bus Controller in the slot.

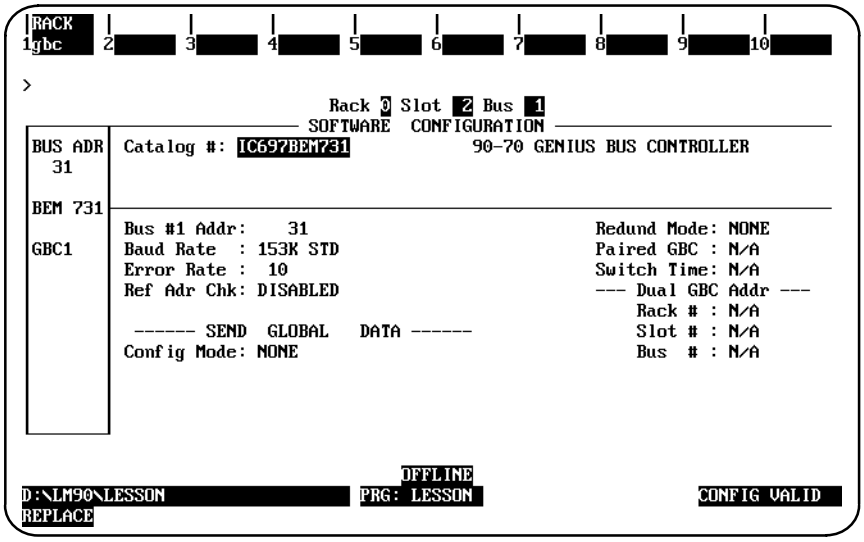


3. Press the **Escape** key to return to the main rack display.

4. Position the cursor on the slot in the rack display that was previously configured for the Genius Bus Controller (for this example, slot 2), and press **Zoom (F10)**. A screen representing the locations of devices on the bus is displayed.



5. Press **Zoom (F10)** again to display the detail screen for the Rack GBC. The parameters displayed are assigned default values.



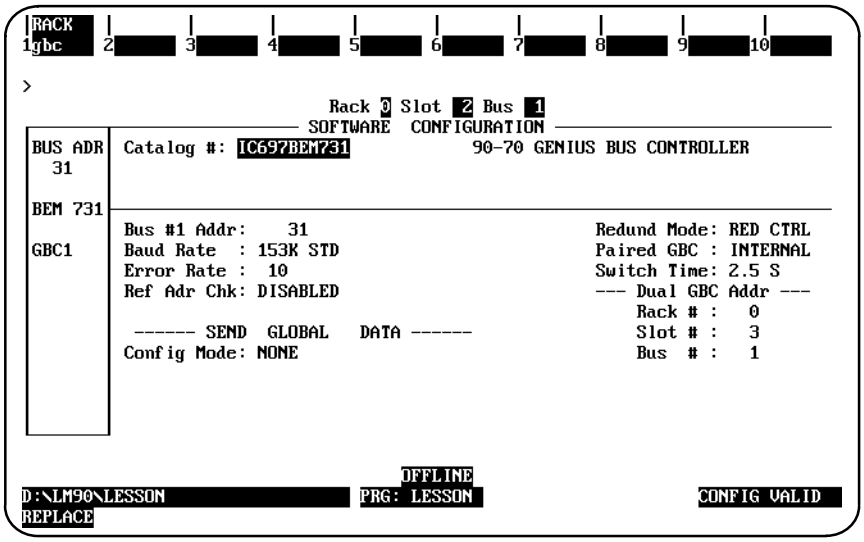
6. Change the default values of the following parameters:

   A. Cursor to ***Redundancy Mode***, and use the Tab key to select **RED CTRL**.

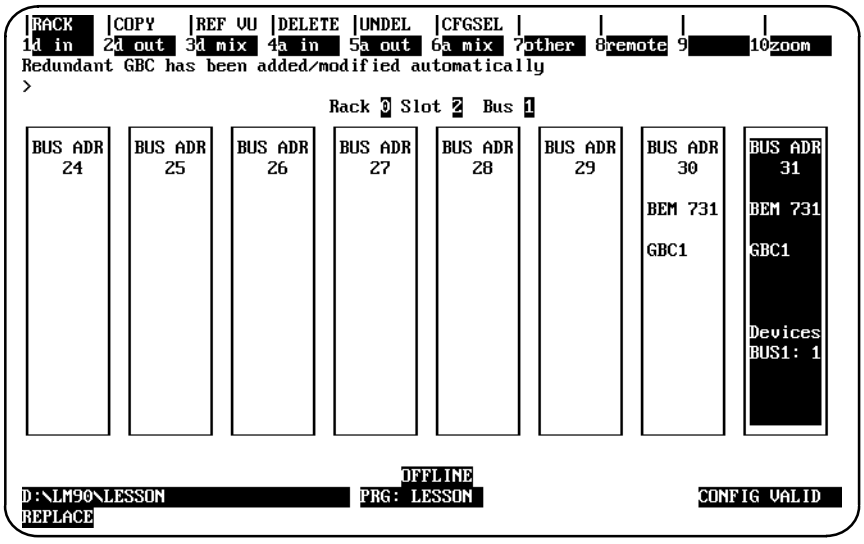
   B. Cursor to ***Paired GBC***, and select **INTERNAL**. Note that the ***Switch Time*** parameter is automatically set to **2.5** seconds by default.

   C. Cursor to ***Rack #***, and enter **0**.

   D. Cursor to ***Slot #***, and enter **3**. Note that the bus number is always **1**.

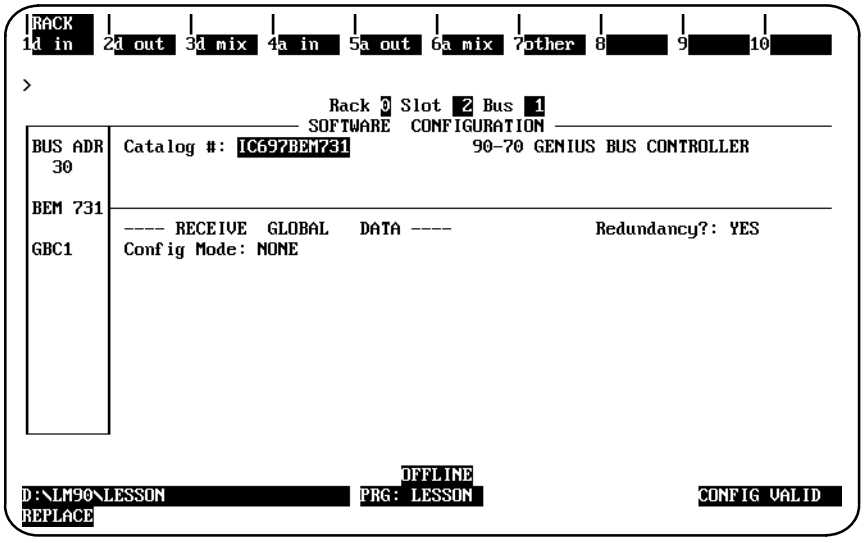


7. Press the **Escape** key. The Redundant GBC is automatically configured, and the following bus screen will be displayed.



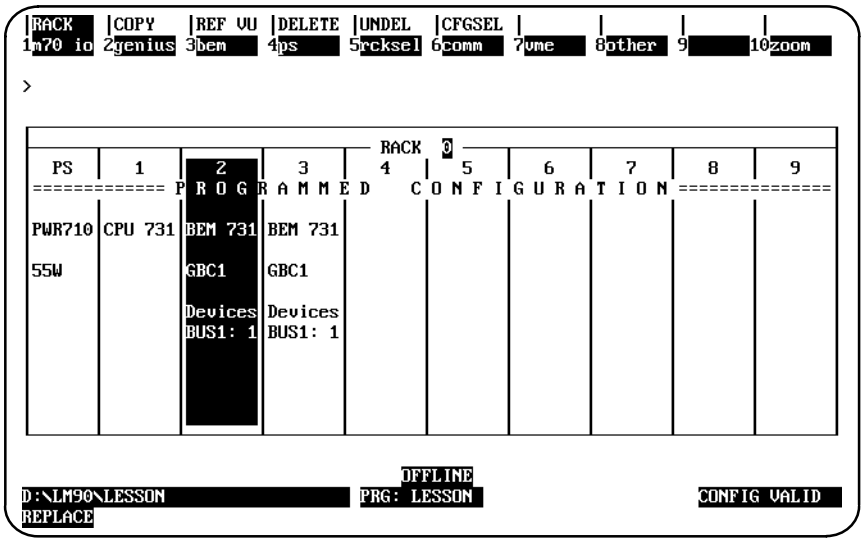
Note that the Bus GBC has been automatically configured in block 30. When this module is used for **RED CTRL** mode, it cannot be deleted from this level; the complete GBC can only be deleted at the rack level.

8. Use the Left cursor key to move the cursor to block 30, and press **Zoom (F10)**. The detail screen for the Bus GBC will be displayed.

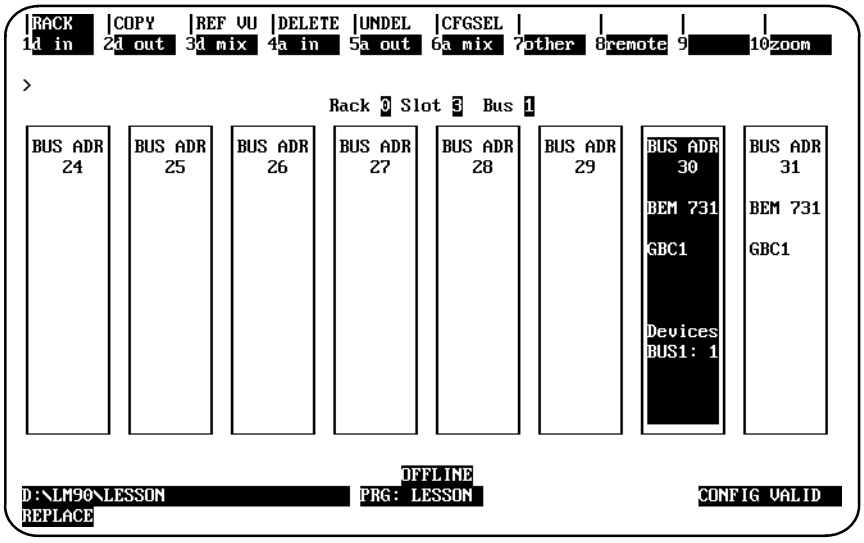


Note that the ***Redundancy?*** parameter is set to **YES**; if you cursor to this parameter, you will not be allowed to select **NO**.

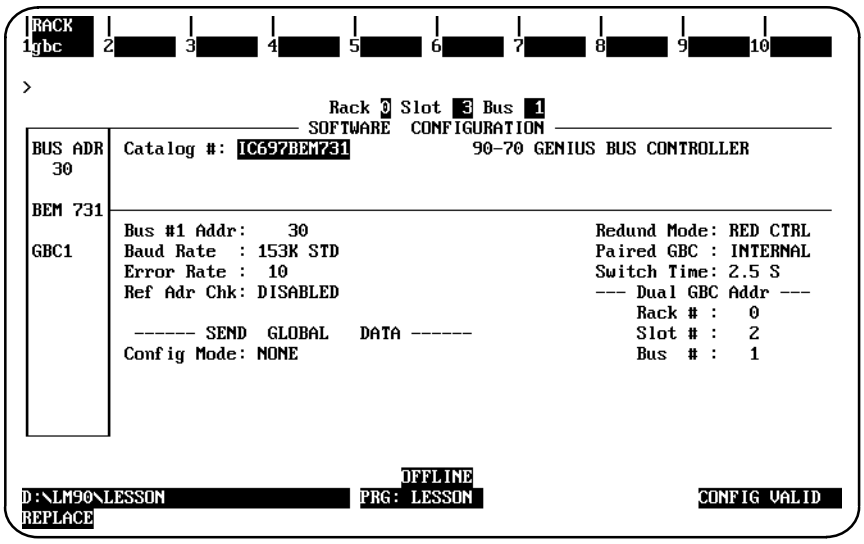
9. Press the **Escape** key twice to return to the main rack display. The Redundant Rack GBC has been automatically configured at PLC address 0.3.1.



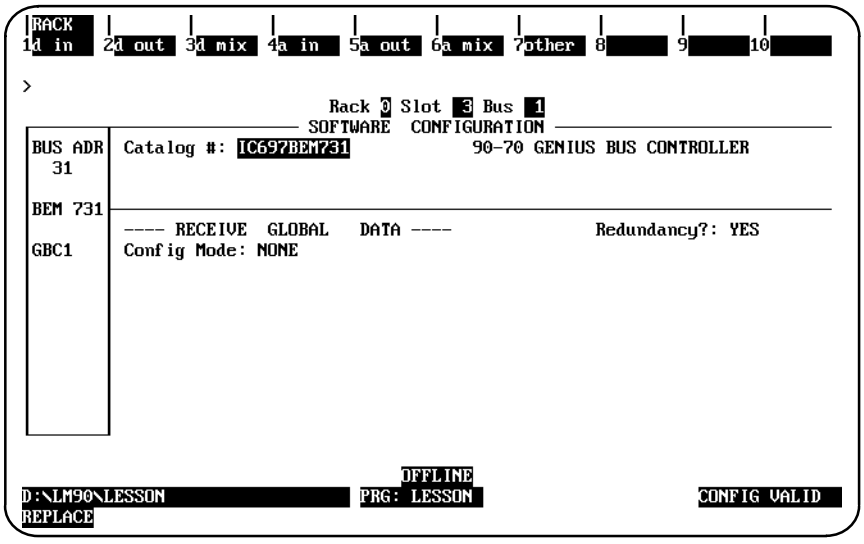
10. Cursor to slot 3, and press **Zoom (F10)** to display the bus screen for the Redundant GBC. Note that the Bus GBC has also been automatically configured in block 31.



11. Press **Zoom (F10)** to display the detail screen for the Redundant GBC. The Dual GBC Address has been automatically set to the address of its Redundant Rack GBC Pair.



12. Press the **Escape** key to return to the bus screen, cursor to block 31, and press **Zoom (F10)** to display the detail screen for the Bus GBC.



Note that the ***Redundancy?*** parameter is set to **YES**; if you cursor to this parameter, you will not be allowed to select **NO**.

13. Press the **Escape** key twice to return to the main rack display.

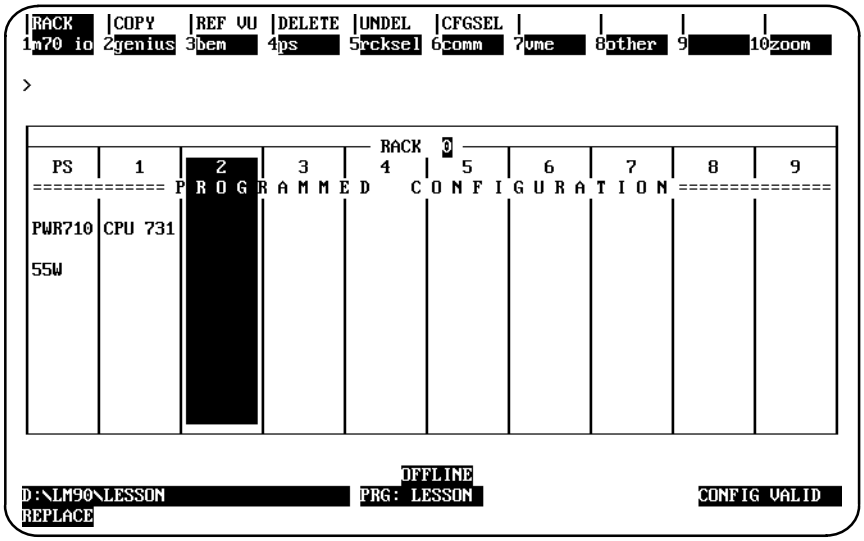
Configuring Genius Bus Redundancy/Dual GBC Redundancy Together

To configure Genius Bus Redundancy and Dual GBC Redundancy together, the Rack GBC's ***Redund Mode*** parameter must be set to **DB/RC**, its ***Paired GBC*** parameter must be set to **INT/EXT**, and the ***Dual GBC Address*** must be provided. The ***Switch Time*** parameter will be automatically set to 2.5 seconds by default.

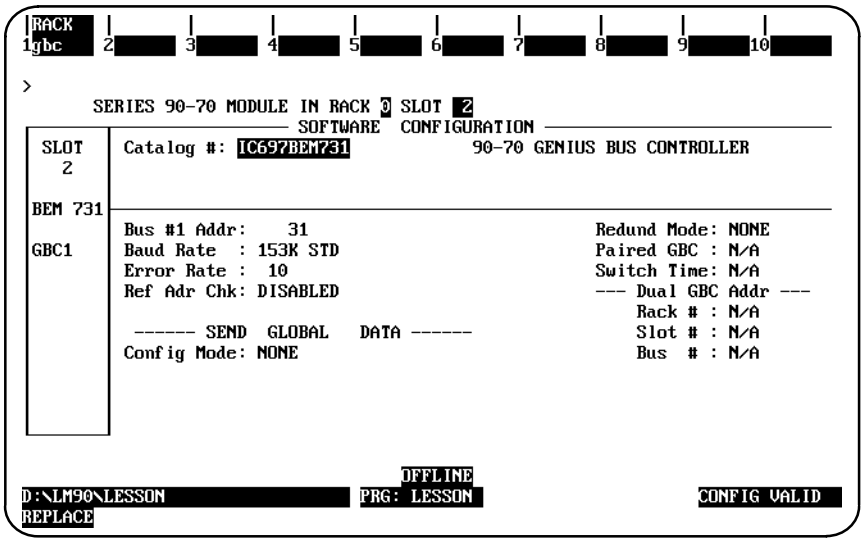
The ***Dual GBC Address*** refers to the **INTERNAL** Paired GBC, the Paired GBC that is configured for Dual Bus Redundancy. You must ensure that the **EXTERNAL** Paired GBC, the Paired GBC that is configured for Hot-Standby and / or Duplex Redundancy, is configured properly.

To configure Genius Bus Redundancy and Dual GBC Redundancy together:

1. Move the cursor to the correct slot in the rack display. For this example, that will be slot 2.

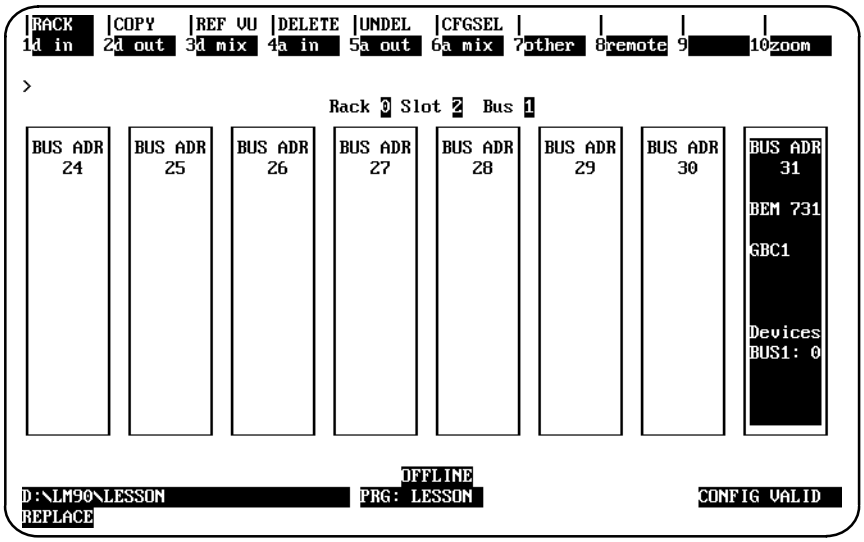


2. Press **Genius (F2)**, **GBC (F1)**, and then the **Enter** key to locate a Genius Bus Controller in the slot.

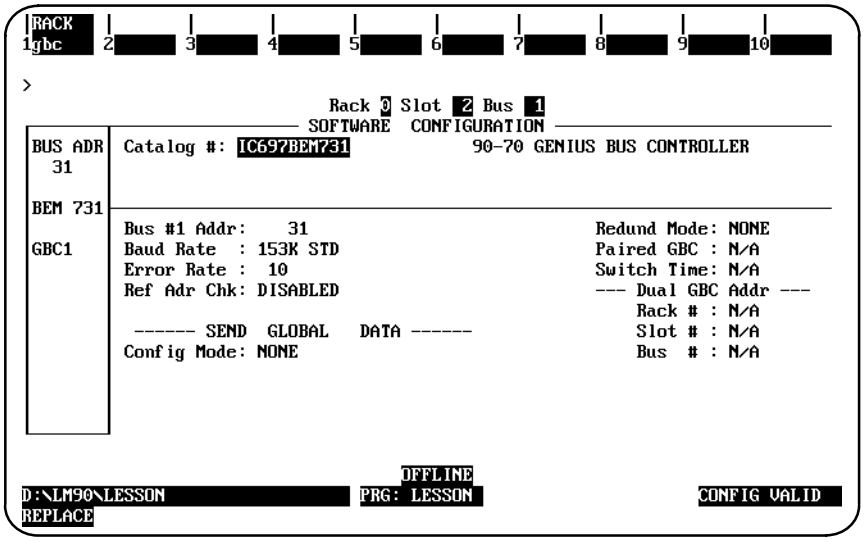


3. Press the **Escape** key to return to the main rack display.

4. Position the cursor on the slot in the rack display that was previously configured for the Genius Bus Controller (for this example, slot 2), and press **Zoom (F10)**. A screen representing the locations of devices on the bus is displayed.



5. Press **Zoom (F10)** to display the detail screen for the Rack GBC. The parameters displayed are assigned default values.

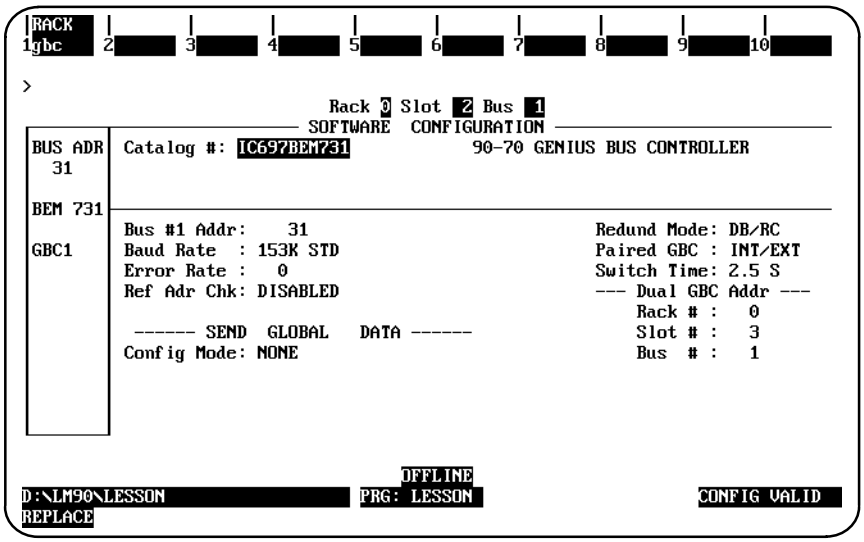


6. Change the default values of the following parameters:

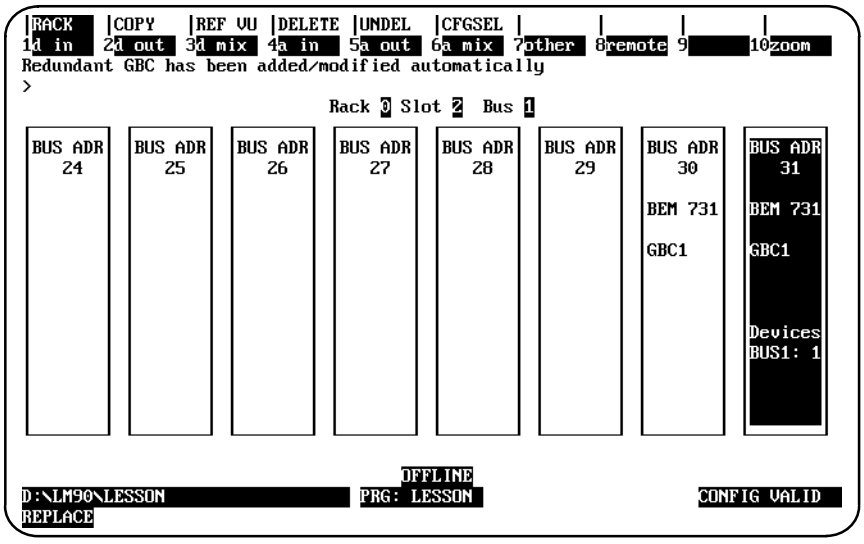
   A. Cursor to ***Redund Mode***, and use the Tab key to select **DB/RC**. Note that the ***Paired GBC*** parameter is automatically set to **INT/EXT** and the ***Switch Time*** parameter is automatically set to **2.5** seconds.

   B. Cursor to ***Rack #***, and enter **0**.

   C. Cursor to ***Slot #***, and enter **3**. Note that the bus number is always **1**.

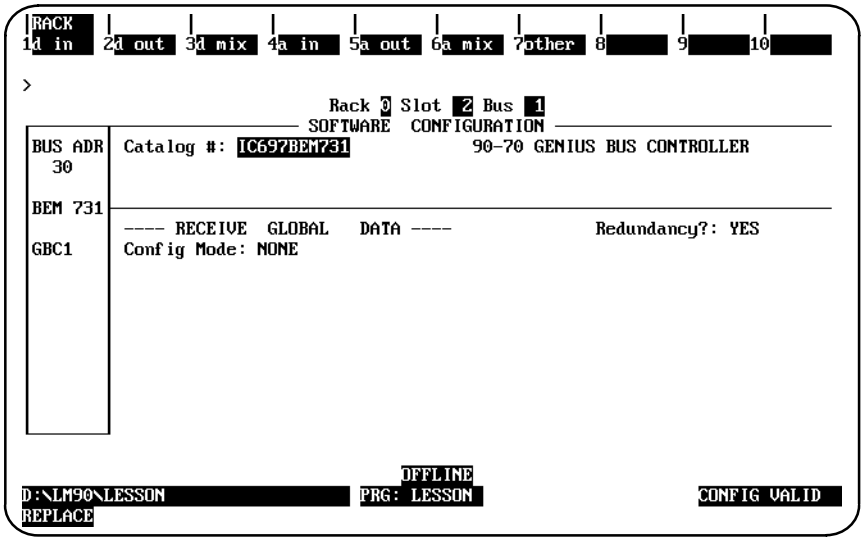


7. Press the **Escape** key. The Redundant GBC is automatically configured, and the following bus screen will be displayed.



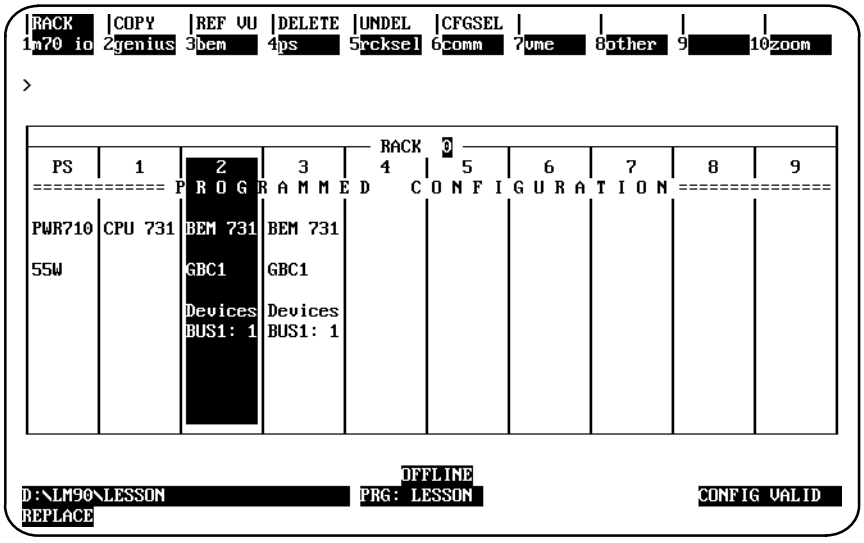
Note that the Bus GBC has been automatically configured in block 30. When this module is used for **DB/RC** mode, it cannot be deleted from this level; the complete GBC can only be deleted at the rack level.

8. Use the Left cursor key to move the cursor to block 30, and press **Zoom (F10)**. The detail screen for the Bus GBC will be displayed.

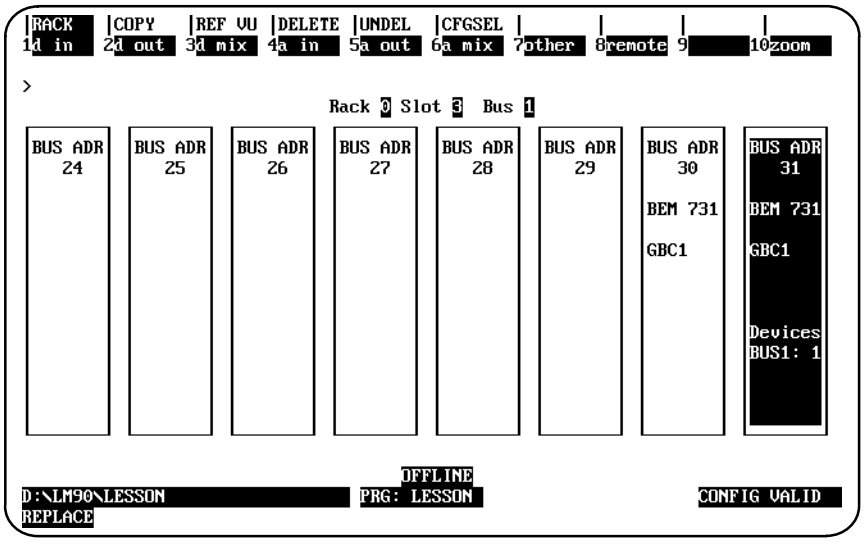


Note that the ***Redundancy?*** parameter is set to **YES**; if you cursor to this parameter, you will not be allowed to select **NO**.

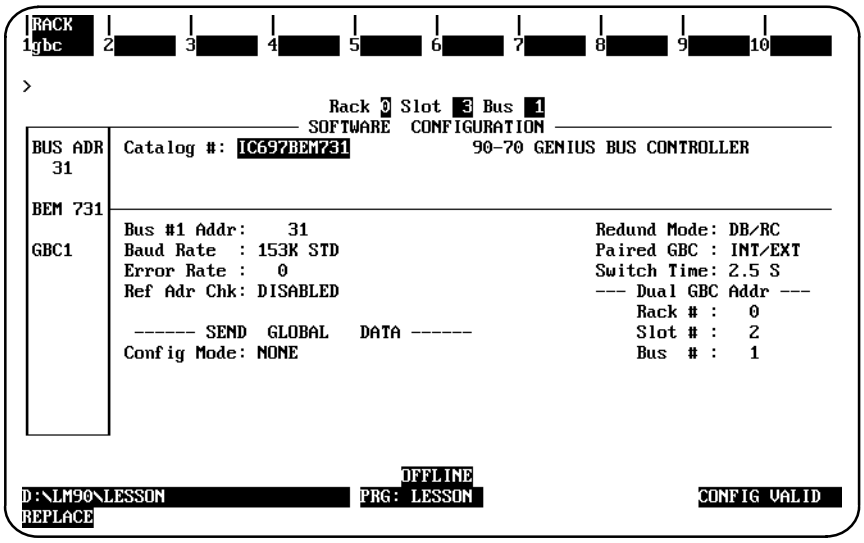
9. Press the **Escape** key twice to return to the main rack display. The Redundant Rack GBC has been automatically configured at PLC address 0.3.1. When you configure the Dual GBC Address, the internal Paired GBC is automatically configured by the software, as shown in the screen below.



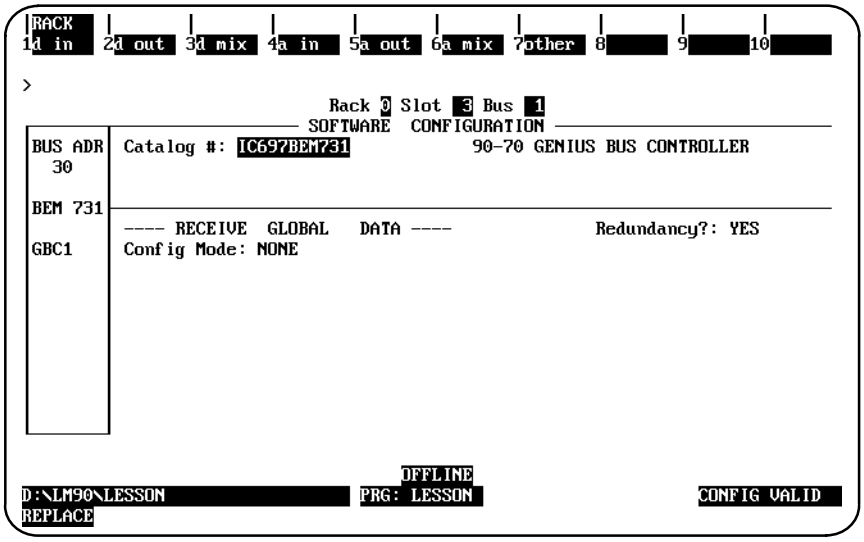
10. Cursor to slot 3, and press **Zoom (F10)** to display the bus screen for the Redundant GBC. Note that the Redundant Bus GBC has been automatically configured in block 30.



11. Press **Zoom (F10)** to display the detail screen for the Redundant GBC. The Dual GBC Address has been automatically set to the address of its internal Redundant Rack GBC Pair.



12. Press the **Escape** key to return to the bus screen, cursor to block 30, and press **Zoom (F10)** to display the detail screen for the Bus GBC.



Note that the ***Redundancy?*** parameter is set to **YES**; if you cursor to this parameter, you will not be allowed to select **NO**.

Note

You must ensure that the externally Paired GBC at block 30 is configured correctly in the external system.

13. Press the **Escape** key twice to return to the main rack display.

Section 11: Configuring a FIP Bus Controller

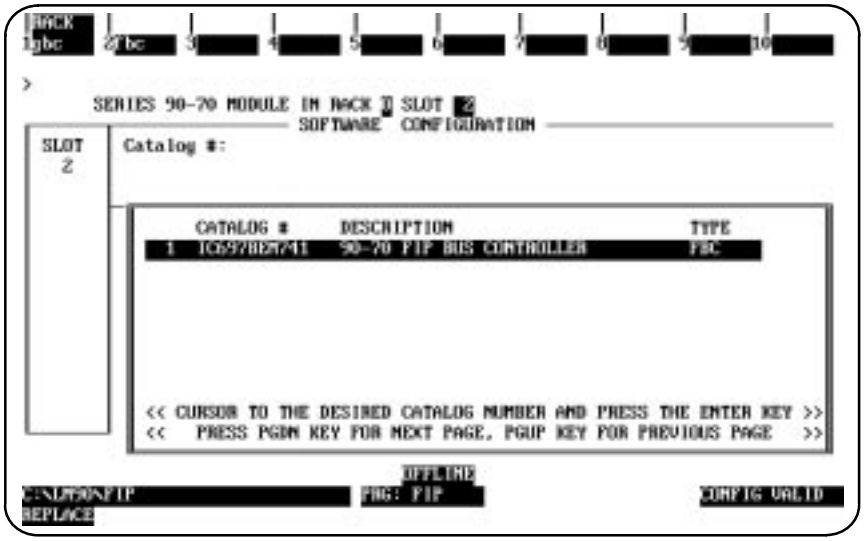
The FIP Bus Controller (IC697BEM741) is used to interface a Series 90-70 PLC system to a FIP I/O bus. The bus controller may be located in any rack. A maximum of 31 bus controllers can be used in a system; of which there can be a maximum of 4 FIP bus controllers. There is a maximum of one FIP Bus Controller per bus and a maximum of 255 I/O stations per bus.

Note

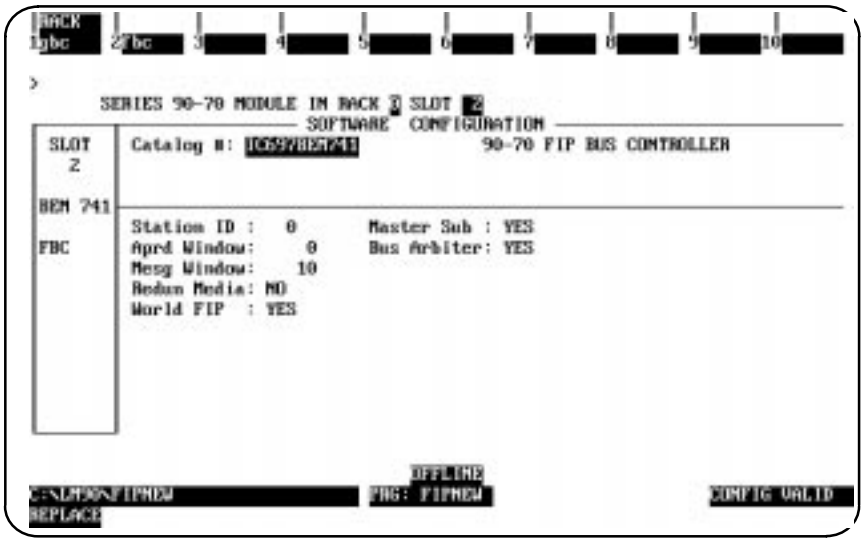
This manual presents the initial steps and brief parameter descriptions for configuration of the FIP Bus Controller. For details concerning the configuration of remote racks, configuration of FIP Field Control, configuration of generic I/O, etc., refer to the *Series 90™-70 FIP Bus Controller User's Manual* (GFK-1038).

To configure a bus controller in the rack, perform the following steps:

1. Move the cursor to the correct slot.
2. Press **fldbus (F2)** to locate a bus controller in the slot.
3. Press **fbc (F2)** to display the entry for the FIP Bus Controller (IC697BEM741).



4. Press **Enter** to select the FIP Bus Controller. Your screen display will change to one like the one shown below.



Parameter	Description
Station ID	The station ID of the FIP Bus Controller. The valid range is 0* to 255.
Aprd Window	The length of the aperiodic variable update window of the FIP macro-cycle in milliseconds. The valid range is 0* to 65,535.
Message Window	The length of the aperiodic message window of the FIP macro-cycle in milliseconds. The valid range is 0 to 65,535 with a default value of 5*.
Redun Media	This indicates whether or not a redundant FIP media configuration is in operation. Press **Tab** to toggle the two selections (**YES** and **NO***).
World FIP	This field specifies whether the frame delimiters used: World FIP (YES*) or FIP (NO). Press **Tab** to toggle the two selections (**YES*** and **NO**).
Data Rate	The data rate for the FIP Bus Controller. Press **Tab** to toggle the selections (300, 600, 1200, 2400, 4800, 9600, 19.2k*, 38.4k 76.8k bps).
Master Sub(subscriber)	This is a display only field that should display "Yes." All devices on a FIP network are known as subscribers. One of the subscribers becomes the Master Subscriber which is responsible for storing configuration files to the subscribers, controlling the subscribers, and reporting faults discovered on the network.
Bus Arbiter	This is a display only field that should display "Yes." One or more FIP devices must perform the role of the Bus Arbiter which controls the access to the FIP network.

* Default selection.

Note

For complete directions on configuring the FIP Bus Controller and its devices (including the FIP Remote I/O Scanner), refer to the *Series 90™-70 FIP Bus Controller User's Manual* (GFK-1038).

Section 12: Configuring a Remote I/O Scanner

The Series 90-70 Remote I/O Scanner (IC697BEM733) is an intelligent module, which mounts in a remote Series 90-70 rack and interfaces 90-70 I/O modules to a Genius bus. The Remote I/O Scanner reference addresses must be configured for a remote drop using Logicmaster 90-70 software. The remote drop can include any mix of discrete and analog input and output modules, up to a total of 128 bytes input and 128 bytes output.

The Remote I/O Scanner provides an interface between the central CPU I/O subsystem and I/O modules in a remote rack subsystem. The Remote I/O Scanner module resides in the remote I/O rack and communicates with the central CPU through the Genius Bus Controller.

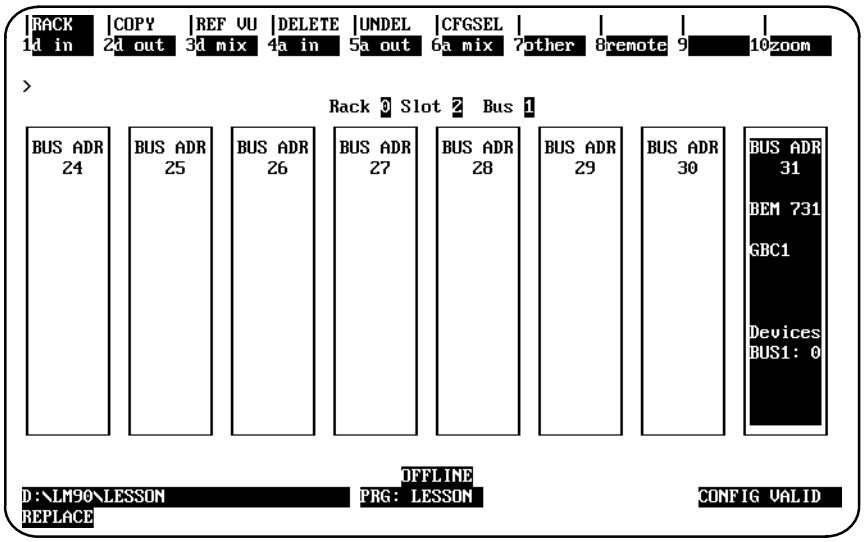
Note

Tbis Remote I/O Scanner is different from the FIP Remote I/O Scanner. For complete directions on configuring the FIP Bus Controller and its devices (including the FIP Remote I/O Scanner), refer to the *Series 90™-70 FIP Bus Controller User's Manual* (GFK-1038). Also, refer to the previous section of this manual for initial configuration steps for the FIP Bus Controller.

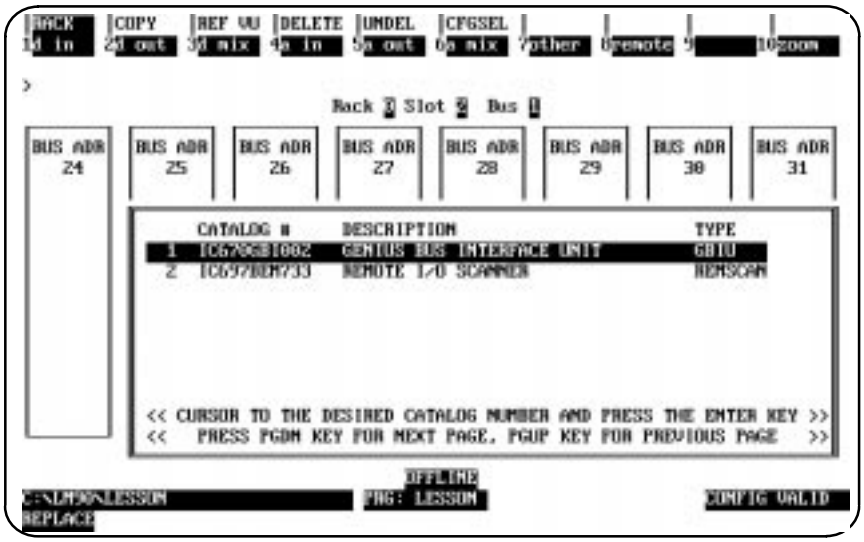
Configuring a Series 90-70 PLC for Use with Remote Drops

To configure a remote drop as part of a Series 90-70 PLC system, add the Remote I/O Scanner as a device on the Genius bus.

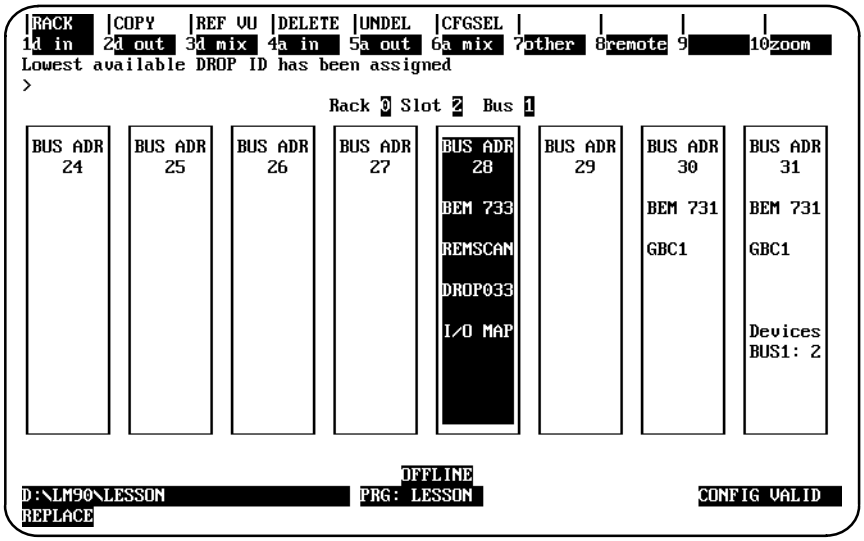
1. Select or create the folder of the PLC configuration.
2. As part of the PLC configuration, configure the Genius bus controller and add the Remote I/O Scanner as a device on the bus. Place the cursor on the GBC's slot representation and press **Zoom (F10)**. The software zooms into the screen which represents the locations of devices on the bus.



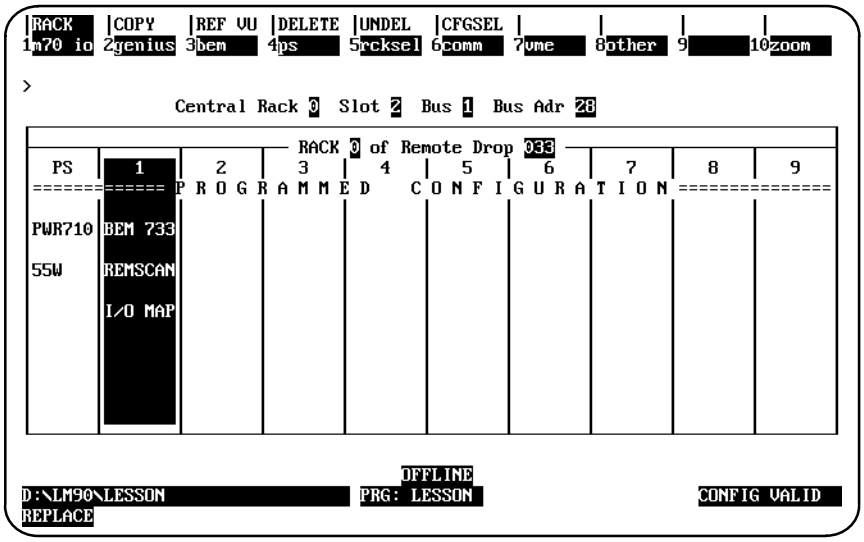
3. Cursor to a device number other than the GBC, and press **Remote (F8)** to display the following screen.



4. Move the cursor down to the “REMOTE I/O SCANNER” (Catalog # IC697BEM733) selection; then press the **Enter** key.



5. Press **Zoom (F10)** to configure the Remote I/O Scanner and Remote Drop modules. For more information on the Remote I/O Scanner, refer to the *Series 90-70 Remote I/O Scanner User's Manual*, GFK-0579.



6. Connect the programmer to the PLC. Store the configuration to the PLC using the utility functions.

Steps 1 through 5 above should always be done first, even in cases where the remote drops are set up, installed, and checked out before the PLC is set up. These steps can all be done offline. Step 6 must be performed after the PLC is online.

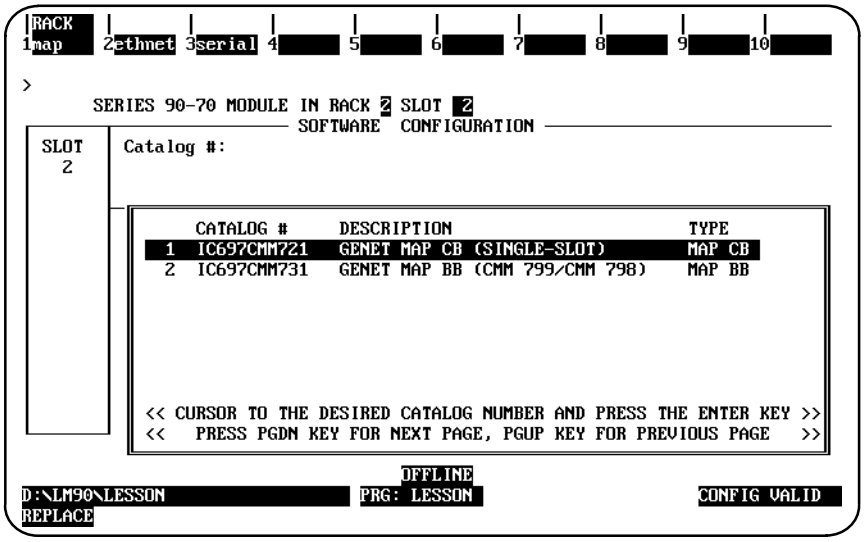
Section 13: Configuring a GEnet MAP Module

Note

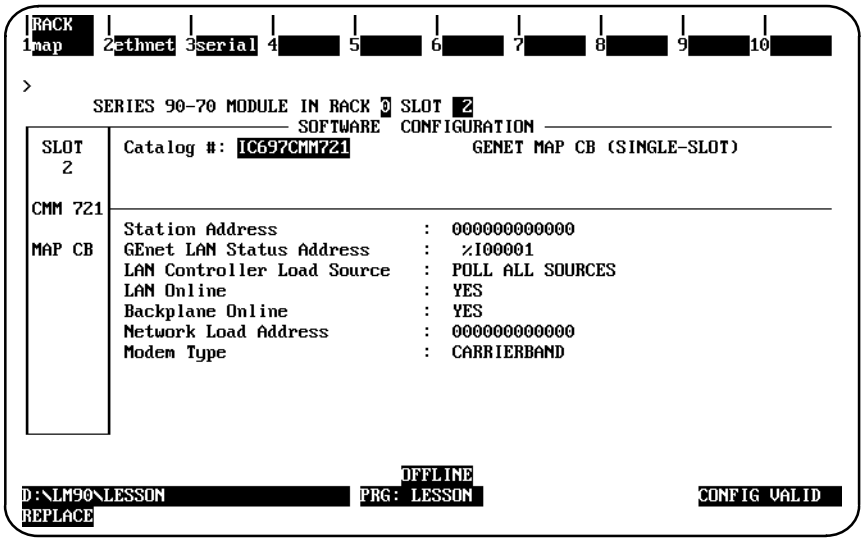
The GEnet MAP Module requires the use of an optional power supply that supplies +12V/–12V. Such power supplies include the IC697PWR711, IC697PWR721, and IC697PWR731.

To configure this module:

1. Move the cursor to the rack slot where the controller module will be located. For MAP broadband applications, it must be the rightmost of two adjacent empty slots.
2. Press **Communications (F6)** and then **MAP (F1)** to display the catalog list of available modules and their catalog numbers.



3. Position the cursor on the required catalog number, and press the **Enter** key to display the detail screen. For the screen shown below, the single-slot GEnet MAP carrierband module (IC697CMM721) was selected.



The following parameters are important to the proper operation of the LAN controller. Except for the ***LAN Interface Status Word Address***, these parameters are passed to the LAN controller upon power-up of the PLC. These parameters can also be viewed at the LAN controller using the Station Manager Access. The Station Manager refers to this set of parameters as Soft Switches. For more information about Station Manager Access, refer to the *Series 90 MAP 3.0 Communications User's Manual*, GFK-0869.

Parameter	Description
Station Address	The Medium Access Control (MAC) address of the station being configured. The default value of 0 instructs the LAN controller to use the globally unique Default Station Address set in its EEPROM at the factory. This default should be used unless you are using locally-administeredMAC addresses. If you use local address administration, contact your company's administrator to find out what address to assign to this station. The MAC address is a 12-digit hexadecimal number organized as 6 bytes. Each byte is represented as a pair of hexadecimal digits. The least significant bit of the first byte must be 0. For example, in a station address of 090019010001, 09 is the first byte. In binary, 09 is 0000 1001, which means the least significant (rightmost) bit is a 1, which is an invalid station address.
LAN Interface Status Word Address	The location of the LAN Interface Status Word (LISW) in PLC memory. The LISW provides a diagnostic interface to the ladder program. The address defaults to the next available 16 bits of %I memory. Allowable user references include %I, %Q, %AI, %AQ, and %R; however, if a DOIO instruction is used, only %I or %AI should be used for the status address in order for the instruction to function properly.

Parameter	Description
LAN Controller Load Source	The load source for the LAN Interface. Choices are to **POLL ALL SOURCES***, **SERIAL PORT**, or **NETWORK**. **POLL ALL SOURCES** instructs the GEnet LAN Interface to first attempt a local serial download and then a network download. If both fail, the sequence is repeated.
LAN Online	Specifies whether the LAN Interface is to logically connect to the LAN after initializing. Choices for this field are **YES*** or **NO**.
Backplane Online	Specifies whether the LAN Interface is to allow application backplane communications. Choices for this field are **YES*** or **NO**. **YES** means all backplane communications are allowed. **NO** means only diagnostics mail traffic is allowed; this precludes application data transfer with the PLC CPU.
Network Load Address	The group address the remote network loader must use to broadcast network configuration information before a network load can be initiated. The address is a 12-digit hexadecimal number organized as 6 bytes. Each byte is represented as a pair of hexadecimal digits. The default value zero instructs the LAN Controller to use the address 090060000000, which is the default used by the downloader of the GEnet System Manager (GSM) software. The least significant bit of the first byte must be 1 to be a group address. For example, in a station address of 090019010001, 09 is the first byte. In binary, 09 is 0000 1001, which means the least significant bit is a 1, which is a valid network load address.
Modem Type	The type of modem to be used. The only selection for carrierband interface is **CARRIERBAND**. Choices for broadband interface include **CH A**, **CH B**, or **CH C***. **Description** — **Frequency(mHz)** Broadband – Channel A (3'4' / PQ) — 59.75 – 71.75 / 252 – 264 Broadband – Channel B (4A'5' / RS) — 71.75 – 83.75 / 264 – 276 Broadband – Channel C (6'FM1' / TU) — 83.75 – 95.75 / 276 – 288

* Default selection.

The broadband interface requires two slots for configuration. When a broadband interface is selected, the adjacent slot to the left of the LAN controller is automatically configured for a broadband modem. If that slot is occupied by another module, selection of the broadband interface is not allowed.

The carrierband interface requires only one slot for configuration. If carrierband is selected, no additional slots need to be configured.

For additional information, please refer to the *Series 90 MAP 3.0 Communications User's Manual*, GFK-0869.

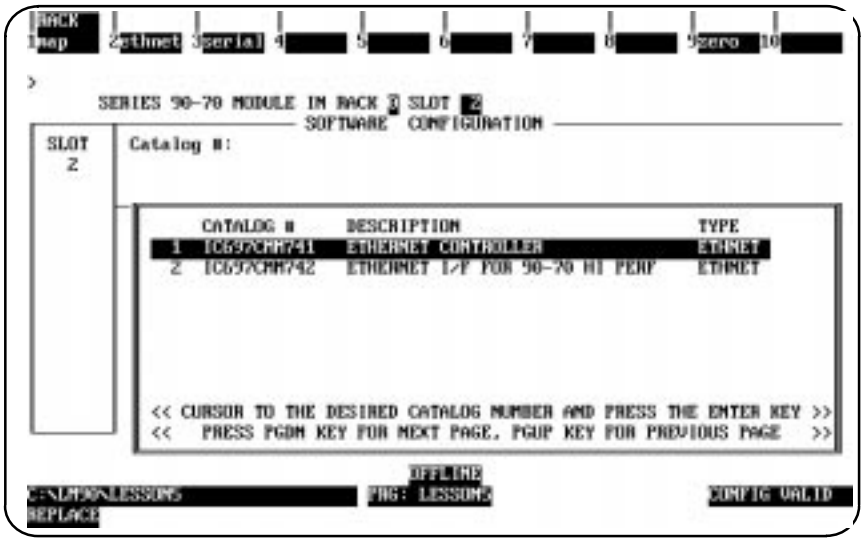
Configuring an MMS or TCP/IP Ethernet Module

Note

The Ethernet Module requires the use of an optional power supply that supplies +12V. Such power supplies include the IC697PWR711, IC697PWR721, and IC697PWR731.

To configure the Ethernet LAN Module:

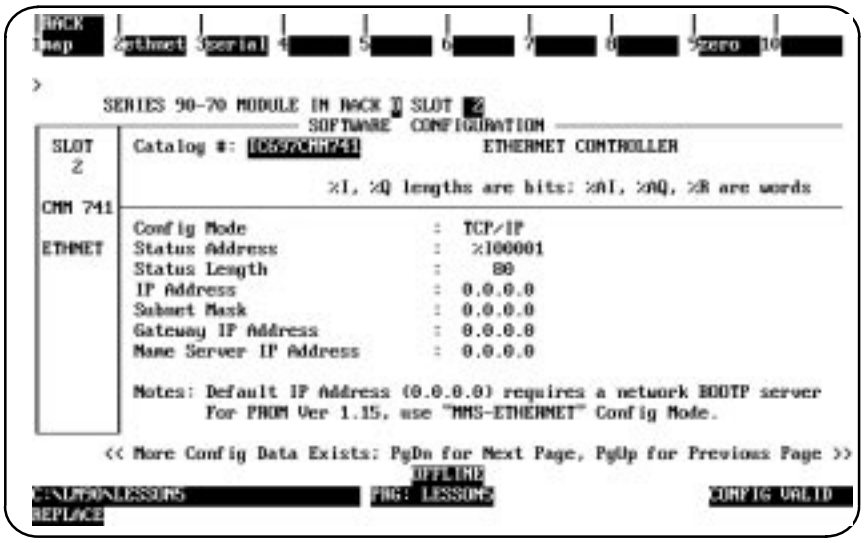
1. Move the cursor to the rack slot where the module will be located.
2. Press **comm (F6)** and then **ethernet (F2)** to display the entry for the Ethernet Controller (IC697CMM741).



Note

At the release date of this manual, the Ethernet Controller (IC697CMM741) is the only one available. IC697CMM742 is forthcoming, and for that reason the configuration setup within Logicmaster has been established.

3. With the cursor positioned on that module, press the **Enter** key to display the detail screen.



4. If you are configuring a TCP / IP ethernet module, then the default "Config Mode" field is correct, and you can proceed to Step 5. If you are configuring an MMS-Ethernet module, then you will need press the **Down Arrow** (cursor down) key once so that your cursor is in the "Config Mode" field; then press **Tab** to toggle the field to the "GENET MMS-ETHERNET CONTROLLER" selection. Then use the guidelines and parameter definitions on page 11-100 to complete your setup.

5. (TCP / IP only)Press the **Down Arrow** (cursor down) key until your cursor is resting in the "IP Address" field. For IP Address, Subnet Mask, Gateway IP Address, and Name Server IP Address, pressing **zero (F9)** sets the default value to zero. To continue the configuration of this module, refer to the *TCP/IP Ethernet Communications for the Series 90™-70 PLC User's Manual* (GFK-1004) for all configuration details.

The following parameters are important to the proper operation of the LAN controller. Except for the ***LAN Interface Status Word Address***, these parameters are passed to the LAN controller upon power-up of the PLC. These parameters can also be viewed at the LAN controller using the Station Manager Access. The Station Manager refers to this set of parameters as Soft Switches. For more information about Station Manager Access, refer to the *Series 90 Ethernet Communications User's Manual*, GFK-0868.

Parameter	Description
Station Address	The Medium Access Control (MAC) address of the station being configured. The default value of 0 instructs the LAN controller to use the globally unique Default Station Address set in its EEPROM at the factory. This default should be used unless you are using locally-administered MAC addresses. If you use local address administration, contact your company's administrator to find out what address to assign to this station. The MAC address is a 12-digit hexadecimal number organized as 6 bytes. Each byte is represented as a pair of hexadecimal digits. The least significant bit of the first byte must be 0. For example, in a station address of 090019010001, 09 is the first byte. In binary, 09 is 0000 1001, which means the least significant (rightmost) bit is a 1, which is an invalid station address.
LAN Interface Status Word Address	The location of the LAN Interface Status Word (LISW) in PLC memory. The LISW provides a diagnostic interface to the ladder program. The address defaults to the next available 16 bits of %I memory. Allowable user references include %I, %Q, %AI, %AQ, and %R.
LAN Controller Load Source	The load source for the LAN Interface. Choices are: **POLL ALL SOURCES***, **SERIAL PORT**, or **NETWORK**. **POLL ALL SOURCES** instructs the Ethernet LAN module to first attempt a local serial download and then a network download. If both fail, the sequence is repeated.
LAN Online	Specifies whether the Ethernet LAN Interface module is to logically connect to the LAN after initializing. Choices for this field are **YES*** or **NO**.
Backplane Online	Specifies whether the Ethernet LAN Interface module is to allow application backplane communications. Choices for this field are **YES*** or **NO**. **YES** means all backplane communications are allowed. **NO** means only diagnostics mail traffic is allowed; this precludes application data transfer with the PLC CPU.
Network Load Address	The group address the remote network loader must use to broadcast network configuration information before a network load can be initiated. The address is a 12-digit hexadecimal number organized as 6 bytes. Each byte is represented as a pair of hexadecimal digits. The least significant bit of the first byte must be 1 to be a group address. For example, in a station address of 090019010001, 09 is the first byte. In binary, 09 is 0000 1001, which means the least significant bit is a 1, which is a valid network load address.

* Default selection.

For additional information, please refer to the *Series 90 Ethernet Communications User's Manual*, GFK-0868.

Section 14: Configuring a High Speed Counter

High Speed Counter Types

The Series 90-70 High Speed Counter module may be configured to count either up or down, to count both up and down, or to count the difference between two changing values. There are five types of counters, A, B, C, D, and E. All counter types have four outputs which can be assigned to any available counter. Each output has programmable On / OffPresets with optional PLC ladder interrupt capability. You can configure the High Speed Counter module module to work as one of following five different types of counters:

- In **Type A** configuration, the HSC70 has four identical and independently programmable unidirectional 16-bit counters which can be configured for up or down operation. Each counter has three inputs: Preload, Count Pulse, and Strobe.
- In **Type B** configuration, the HSC70 has two identical and programmable bi-directional 32-bit counters. Each counter can be independently configured to operate in **Up/Down**, **Pulse/Direction**, or **A Quad B** mode. Both counters have two independent Strobe inputs and Strobe registers. Each counter has a single Preload input to set the accumulator and a Disable input to suspend counting.
- In **Type C** configuration, the HSC70 has one differential bi-directional 32-bit counter with a Disable input to suspend counting. The counter has a **Home Position** register for preloading the accumulator to Home Position value. Home Position is set by a Home Switch input and a Marker input. Two sets of bi-directional counter inputs can be connected differentially. Each pair of inputs can be configured for **Up/Down**, **Pulse/Direction**, or **A Quad B** mode. The Type C configuration has three Strobe registers with Strobe inputs and two Preload values with Preload inputs.
- In **Type D** configuration, the HSC70 has four bi-directional 32-bit counters that can be configured to count in **Up/Down**, **Pulse/Direction**, or **A Quad B** mode. Each counter has a marker input which can be used to set its accumulator value to the counter's Home Position value.
- In **Type E** configuration, the HSC70 has two identical 16-bit counters with Strobe and Preload inputs capable of counting **Up/Down** or **A Quad B** signals. Each has a Count Disable and a Strob Disable input. This counter type is designed primarily as a Down counter, but it can handle up counts to account for A Quad B jitter. When a counter counts down to zero, it turns on a dedicated preset output with a 15 microsecond response time.

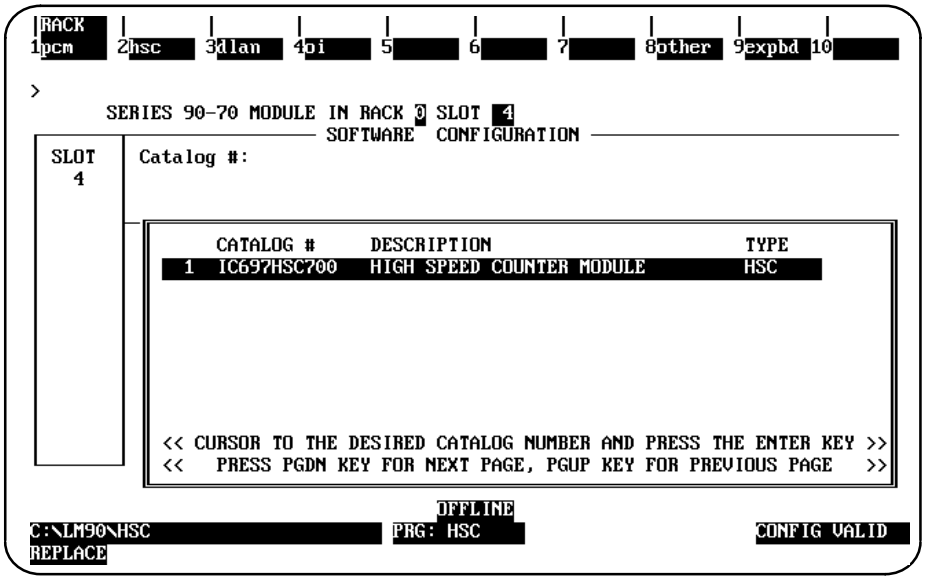
For more information on the High Speed Counter module, refer to GFK-1057 and GFK-1062.

Configuring the High Speed Counter Module

The High Speed Counter module accepts 12 configurable input signals, and provides 4 output signals for counter operations. Many additional features can be changed in the configuration software for the application program.

To configure the High Speed Counter module:

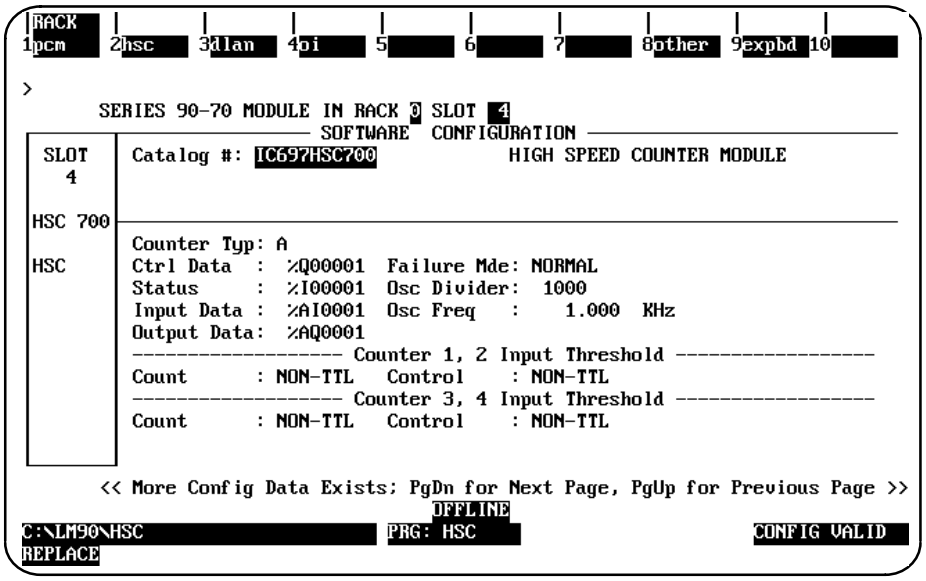
1. Move the cursor to the slot where the module will be located.
2. Press **Other (F8)** and then **High Speed Counter–HSC (F2)** to locate a High Speed Counter Module in the slot.



Note

This manual presents the configuration screens and *brief* parameter descriptions for the High Speed Counter, using a Type A configuration. It's purpose is to step you through a standard configuration. For *detailed* parameter descriptions for all Types (A–E) , read the *90-70 High Speed Counter User's Manual* (GFK-1062).

3. Press the **Enter** key to enter the catalog number shown in reverse video. The following screen will be displayed showing the configuration parameters for Type A counters—see Note below concerning other types.



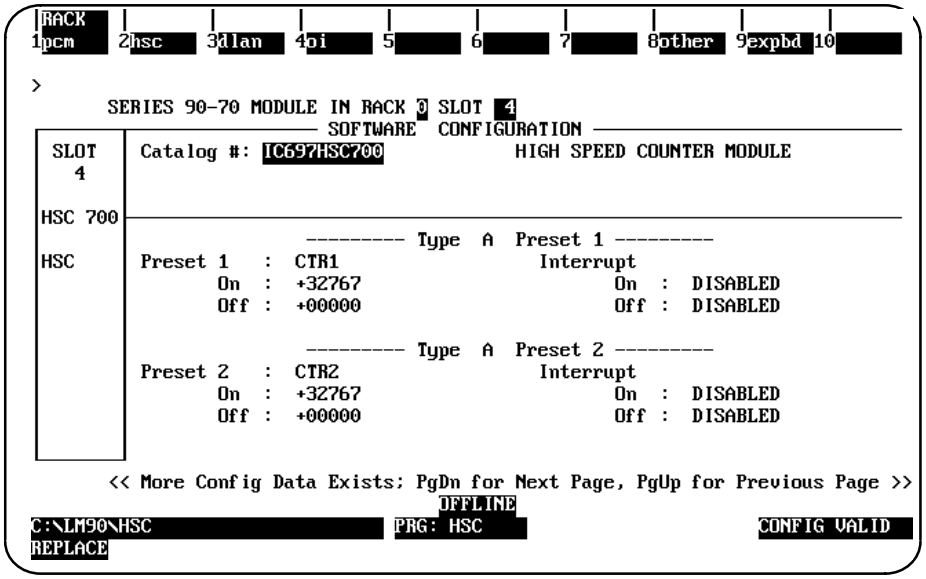
Parameter	Description
Counter Type	Select the desired counter type by entering **A***, **B**, **C**; **D**, or **E**, or press the **Tab** key to toggle the selections. See Note below concerning other counter types.
Ctrl Data	Select the starting %Q reference address for the 32 bits of control data from the PLC.
Status	Select the starting %I reference address of the 32 bits of counter status from the PLC. Discrete input data consists of status information, such as output status, strobe input status, preload input status, home input status (for type C), and module ready status.
Input Data	Select the starting %AI reference address for data sent to the PLC by the HSC module. The length of the data is fixed at 16 words. HSC Data consists of accumulated counts, strobe register contents, and the counter per timebase value.
Output Data	Select the starting %AI reference address of the two words of input data. Discrete output data consists of control information, such as output enable / disable, strobe enable / disable, counter enable / disable, preload enable / disable, clear error, and home command (for type C).
Failure Mode	Enter a value to select an output failure mode: **NORMAL***, **OFF**, and **HOLD**.
Osc(oscillator) Divider	This is used to determine the frequency output. Select the 16-bit value that is divided into 660 Khz in order to achieve the final reference frequency displayed in the **Osc Freq** field directly below this field.
Osc Freq	This is a display only field showing the reference frequency.
Counter Input Threshold–Count	This field identifies the type of counter input. The choices are **NON-TTL***, **TTL**, or **Mag-Pkup**(magnetic pickup). For more information, see the *90-70 High Speed Counter User's Manual* (GFK-1062).
Counter Input Threshold–Control	This field identifies the type of control input. The choices are **NON-TTL***, **TTL**, or **Mag-Pkup**(magnetic pickup). For more information, see the *90-70 High Speed Counter User's Manual* (GFK-1062).

* Default selection.

Note

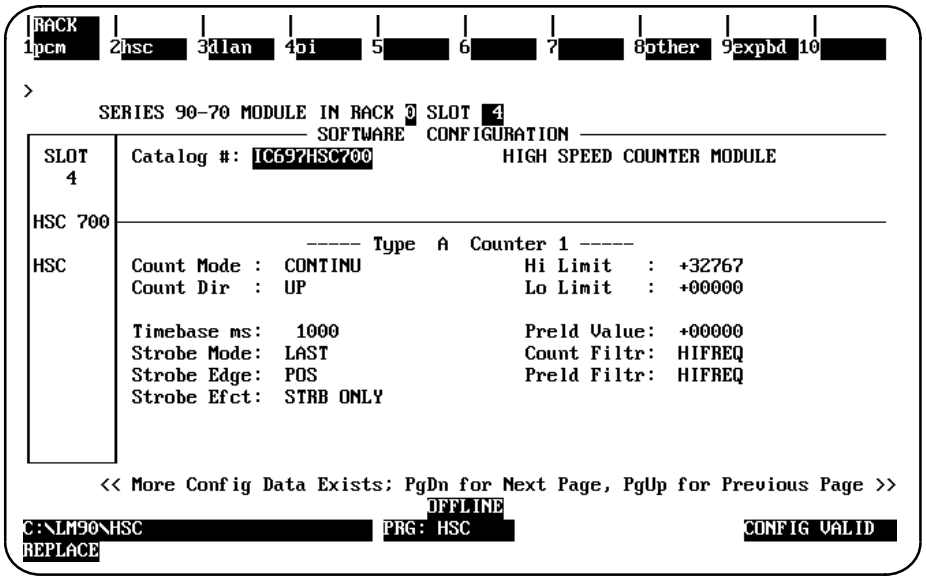
To change to from Counter Type A to Type B, C, D, or E, see page 11-106.

4. Press the **Page Down** key to display the following screen.



Parameter	Parameter Description
Preset 1	This is the preset counter number (**CTR1***, **CTR2**, **CTR3**, or **CTR4**).
On	This is the Output On user counts preset. The valid parameter values are –32768 to +32767.
Off	This is the Output Off user counts preset. The valid parameter values are –32768 to +32767.
On	This is the on preset 1 interrupt. The choices are **ENABLED** or **DISABLED**.
Off	This is the off preset 1 interrupt. The choices are **ENABLED** or **DISABLED**.
Presets 2, 3, 4	The same descriptions shown above for Preset 1 apply to Preset 2, 3, and 4.

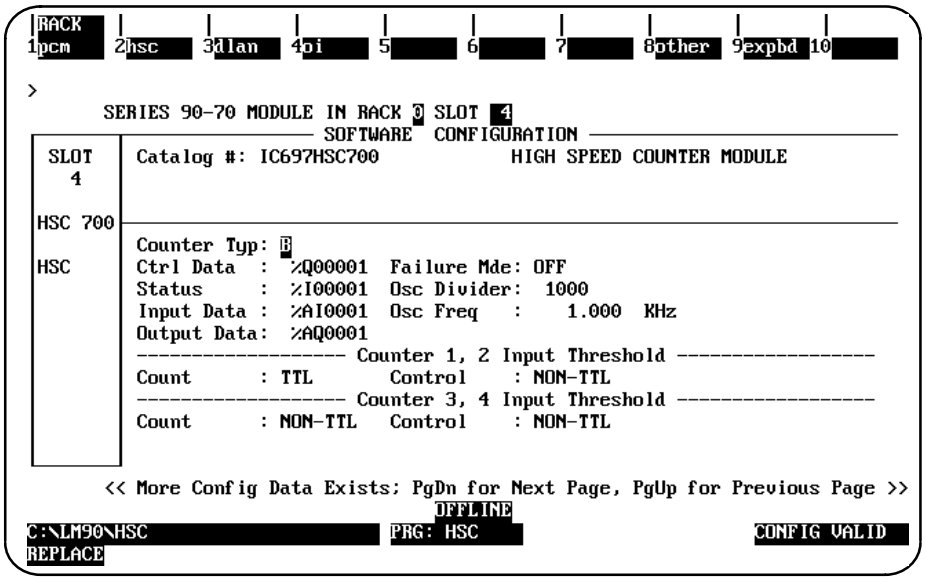
5. Press the **Page Down** key to display the screen shown below.



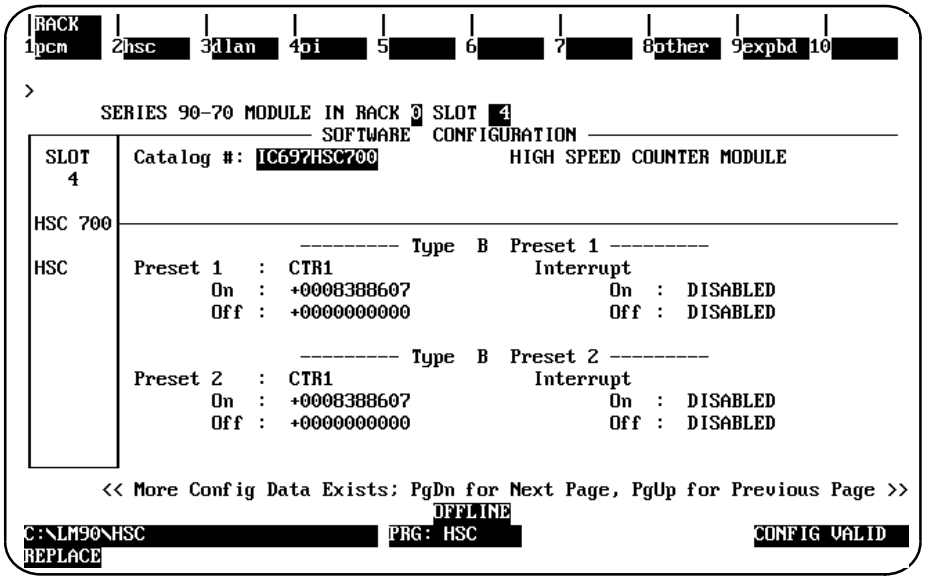
Parameter	Parameter Description
Count Mode	Select one of the two choices for this field: single shot (abbreviated on screen as **SINGSHOT**) means count and stop at limit; continuous (abbreviated on screen as **CONTINU**) means count and wrap at limit. Press **Tab** to toggle the selections.
Count Dir	This field defines the count direction, **UP** or **Down**. Press **Tab** to toggle the selections.
Timebase mS	This field determines the number of counts per time base in milliseconds. Press **Tab** to increment the default number (1000) or **Shift-Tab** to decrement the number, or key in the desired number.
Strobe Mode	Select which Strobe input pulse the Strobe register will report. The choices are **FIRST** and **LAST**. The effects of this selection are discussed in detail in the *Series90-70™ High Speed Counter User's Manual* (GFK-1062).
Strobe Edge	Select which counter trigger edge you want to have active, the **POS** (positive) or **NEG** (negative) edge. Press **Tab** to toggle the selections.
Strobe Efct	Select one of the two Strobe effect options: **STRB ONLY** where the strobe pulse only causes the Accumulator value to be copied into the Strobe register and the Strobe flag to be set, or **STRB/PRELOAD** where a Strobe pulse will copy the Accumulator value into the Strobe register simultaneouslyperform a preload and set the Accumulator to the Preload value. As with the other fields, you can press **Tab** to toggle the selections.
HighLimit	Select the highest value for count Accumulator
Low Limit	Select the lowest value for count Accumulator
Preload Val	Select the Accumulator preload user counts.
Count Filtr	Select the Count Input Filter, **HIFREQ** or **LOWFREQ**. Press **Tab** to toggle the selections.
Preld Filtr	Select the Preload Filter, **HIFREQ** or **LOWFREQ**. Press **Tab** to toggle the selections.

6. To change from Type A to Type B or one of the other Types, move the cursor to the ***CounterType*** field on the main detail screen for the Type A counter; then press the **Tab** key to toggle the selections. When B is displayed in this field, press the **Enter** key.

   This example screen lists the module configuration parameters for a Type B counter.



7. Press the **Page Down** key to display the detail screen for Type B Counter 1. Repeatedly press the **Page Down** or **Page Up** key to scroll through the detail screen for each counter and then return to the main detail screen for the Type B counter.



Note

Follow the same steps for configuring Types B through E counters as shown in on the preceding pages for Type A counters. To understand the different effects the parameter settings have for all Types (A–E) , read the *90-70 High Speed Counter User's Manual* (GFK-1062).

Section 15: Configuring a Third Party VME Module

Third party VME modules may be configured to be recognized by the PLC. Six modes of configuration are available:

Mode	Description
None	The module is used only as a placeholder.
Interrupt Only	The module may produce interrupts.
Bus Interface	The module may use the read and write config functions.
Full Mail	The module may use the complete logical layer or mailbox system of the Series 90-70 PLC identically to the features currently supported for smart modules.
Reduced Mail	The module may perform a limited set of service requests with the PLC through the simpler mailbox system used for Series 90-70 analog I/O modules.
I/O Scan	The module may have defined I/O that will be scanned by the PLC.

Note

For more information about configuring third party VME modules, refer to the Series 90-70 Programmable Controller's User's Guide to Integration of Third Party VME Modules (GFK-0448).

Configuring a VME Module

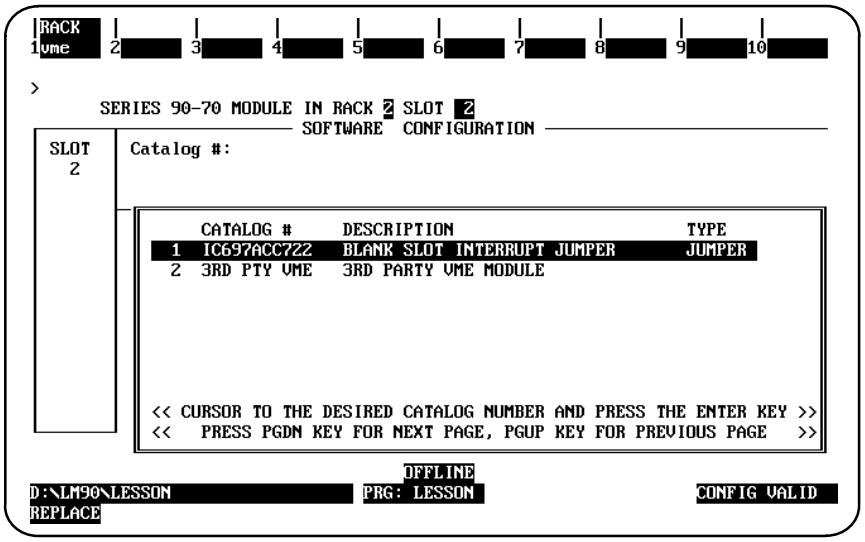
To configure a VME module on the I/O Configuration Rack screen:

1. Move the cursor to the desired rack and slot location. The slot may be either unconfigured or previously configured.

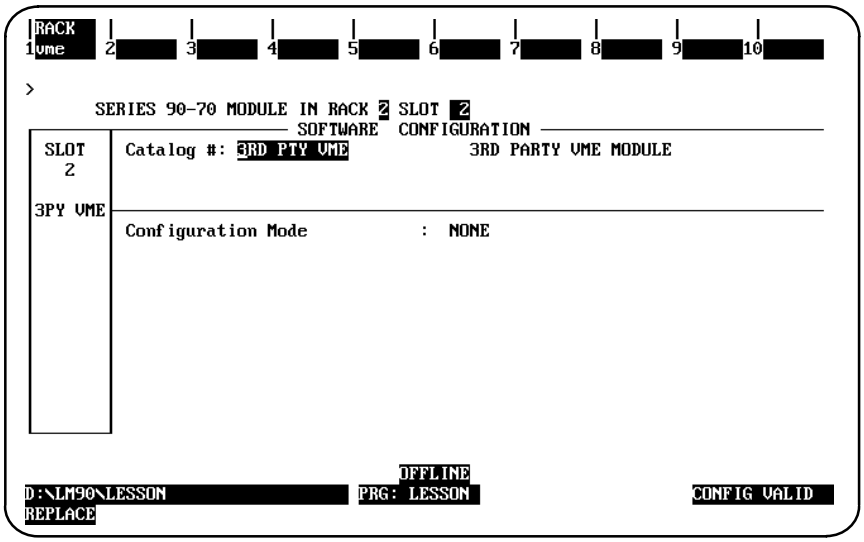
Note

When configuring the VME module in a VME Integrator Rack, the half-slot screen for a particular slot is displayed. This allows you to configure the half slots of that slot. The remainder of the configuration process is the same for the VME Integrator Rack as it is for a standard I/O rack.

2. Press **VME (F7)** and then **VME (F1)** from the I/O Configuration Rack screen to display a list of available modules.



3. Position the cursor on the 3RD PTY VME module, and press the **Enter** key to display the detail screen for that module.



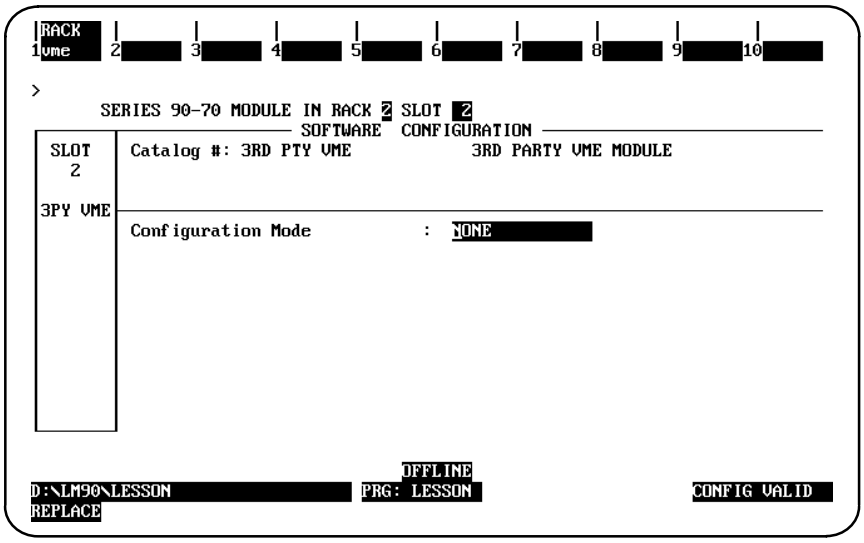
Selecting the Configuration Mode

The configuration mode specifies how the module will be accessed. The configuration mode is selected in the ***Configuration Mode*** field on the module detail screen.

1. To select a different configuration mode, move the cursor to the ***ConfigurationMode*** field and repeatedly press the **Tab** key until the desired mode is displayed on the screen. Then, press the **Enter** key.
2. Configure the module. Then, press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.

None Mode

When **NONE** mode is selected, the following VME detail screen is displayed.



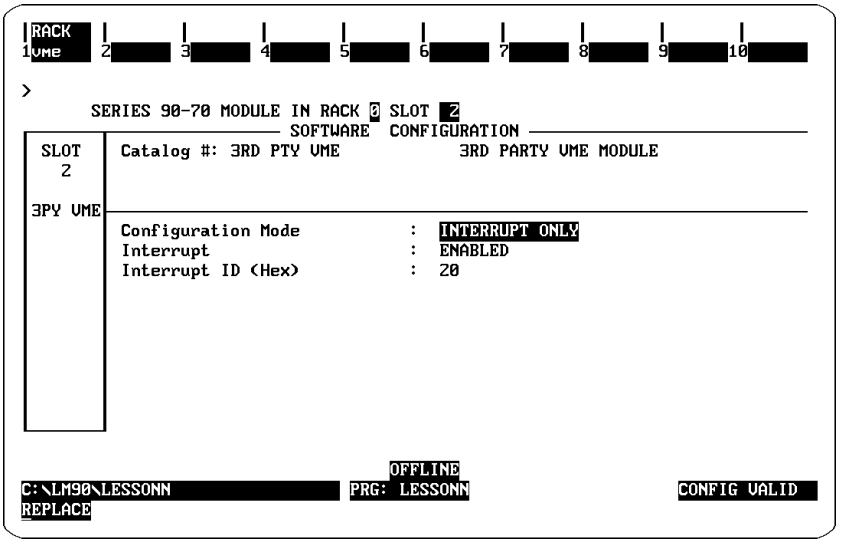
The configuration mode on this screen is set to **NONE**. There are no other parameters to be selected.

Interrupt Only Mode

Note

INTERRUPT ONLY mode is not supported by a Release 6 or earlier CPU. This functionality is reserved for possible use by future CPUs.

When **INTERRUPT ONLY** mode is selected, the following VME detail screen is displayed.



Parameter	Description
ConfigurationMode	The configuration mode is set to **INTERRUPT ONLY**.
Interrupt	Select whether to **ENABLE*** or **DISABLE** interrupts. If **ENABLED**, the module will generate interrupts.
Interrupt ID	A byte hexadecimal value which identifies the module driving the interrupt line. The value in this field must either be in the form "slot:rack", based on the rack and slot the module is in, or a value in the range F0 to FE hex. For example, if a VME module is configured in slot 3 of rack 0, a value of 30 (30H; slot 3 rack 0) is displayed. Each VME module configured within the system must have a different interrupt ID. The default value must be a value based on the rack and slot the module is in. The first half-slot configured for a slot (either A or B) will be assigned the slot:rack ID; the second half-slot configured for the slot (either A or B) will be in the range **F0** – **FE**.

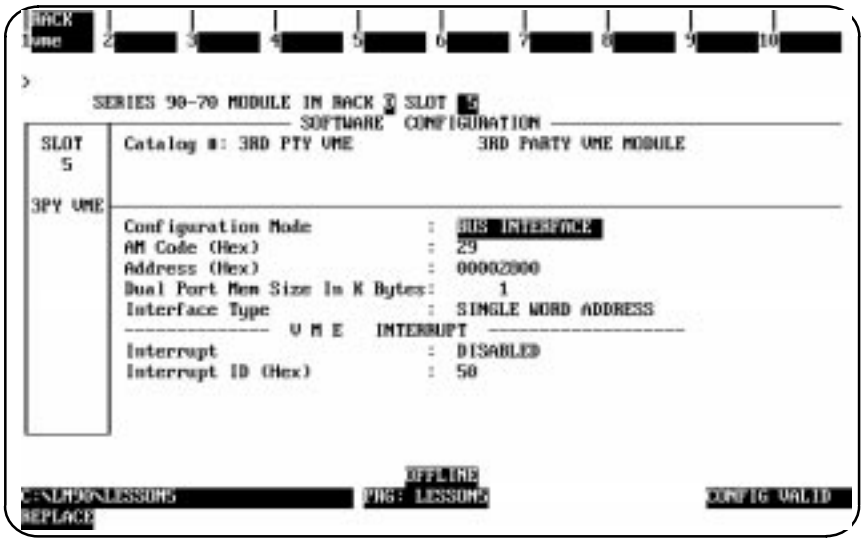
* Default selection.

Bus Interface Mode

Note

BUS INTERFACE mode is supported by a Release 4 or later CPU.

When **BUS INTERFACE** mode is selected, the following VME detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **BUS INTERFACE**.
AddressModifier Code	The memory space (in hexadecimal) on the VME bus that the module responds to. Choices are: **09H** = extended non-privilege data access. **0AH** = extended non-privilege program access. **0DH** = extended supervisory data access. **0EH** = extended supervisory program access. **29H*** = short non-privilege access. **2DH** = short supervisory access. **39H** = standard non-privilege data access. **3AH** = standard non-privilege program access. **3DH** = standard supervisory data access. **3EH** = standard supervisory program access.
Address	A 16-bit, 24-bit, or 32-bit hexadecimal value, depending on the AM mode selected. If the AM code is **29H** or **2DH**, the address range must be a 16-bit value, 0000 to 0000FFFF. If the AM code is **39H**, **3AH**, **3DH**, or **3EH**, the address range must be a 24-bit value, 0000 to 00FFFFFF. If the AM code is **09H**, **0AH**, **0DH**, or **0EH**, the address range must be a 32-bit value, 0000 to FFFFFFFF. (Although the Series 90-70 I / O rack does not contain the P2 backplane, the upper eight address lines of the 32-bit address can be jumpered to a fixed value on the module.) Default = 0000FFFF.
Dual Port Memory Size in K Bytes	The size of the dual port memory (in 1K increments) for the VME module. Values are **1*** to **16,384**.
Interface Type	Specify how data is to be read / written to the VME module. Choices are: **WORD ACCESS:** Data is to be read / written a word at a time to consecutive addresses. **BYTE ADDRESS:** Data is to be read / written a byte at a time to consecutive addresses. **ODD BYTE ONLY:** Data is to be read / written only to odd bytes because the hardware cannot support even addresses. **SINGLE WORD ADDRESS:** also called same address. Data is to be read a word at a time from the same address on the VME bus into PLC memory and written a word at a time from consecutive words in PLC memory to the same address. **SINGLE BYTE ADDRESS:** Data is to be read a byte at a time from the same address on the VME bus into PLC memory and written a byte at a time from consecutive words in PLC memory to the same address.
Interrupt	Select whether to **ENABLE** or **DISABLE*** interrupts. If **ENABLED**, the module will generate interrupts.
Interrupt ID	A byte hexadecimal value which identifies the module driving the interrupt line. The value in this field must either be in the form "slot:rack", based on the rack and slot the module is in, or a value in the range F0 to FE hex. For example, if a VME module is configured in slot 3 of rack 0, a value of 30 (30H; slot 3 rack 0) is displayed. Each VME module configured within the system must have a different interrupt ID. The default value must be a value based on the rack and slot the module is in. The first half-slot configured for a slot (either A or B) will be assigned the slot:rack ID; the second half-slot configured for the slot (either A or B) will be in the range **F0** – **FE**.

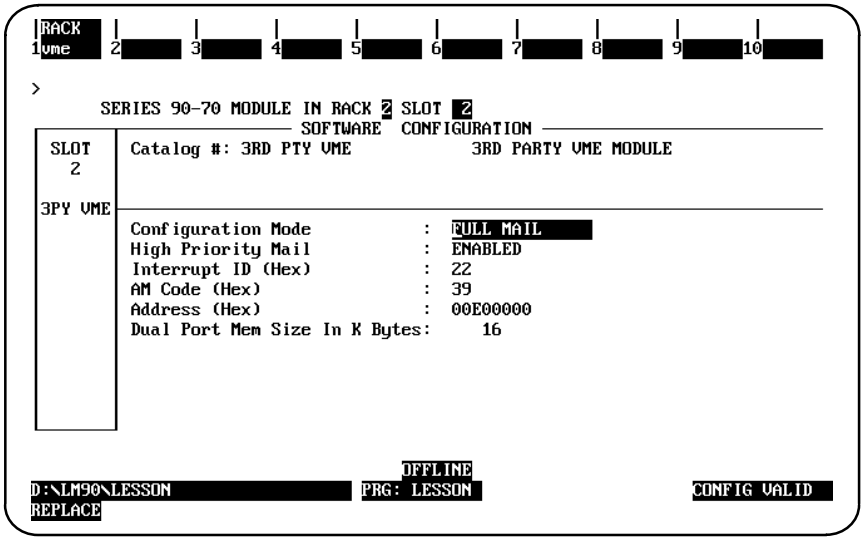
* Default selection.

Full Mail Mode

Note

FULL MAIL mode is supported by Release 5.5 or later CPUs.

When **FULL MAIL** mode is selected, the following VME detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **FULL MAIL**.
High Priority Mail	Select whether to **ENABLE*** or **DISABLE** high priority mail.
Interrupt ID	A byte hexadecimal value which identifies the module driving the interrupt line. The value in this field must either be in the form "slot:rack", based on the rack and slot the module is in, or a value in the range F0 to FE hex. For example, if a VME module is configured in slot 3 of rack 0, a value of 30 (30H; slot 3 rack 0) is displayed. Each VME module configured within the system must have a different interrupt ID. The default value must be a value based on the rack and slot the module is in. The first half-slot configured for a slot (either A or B) will be assigned the slot:rack ID; the second half-slot configured for the slot (either A or B) will be in the range **F0** – **FE**.
Address Modifier Code	The memory space (in hexadecimal) on the VME bus that the module responds to. In rack zero, the choices are: **09H** = extended non-privilege data access. **0AH** = extended non-privilege program access. **0DH** = extended supervisory data access. **0EH** = extended supervisory program access. **39H*** = standard non-privilege data access. **3AH** = standard non-privilege program access. **3DH** = standard supervisory data access. **3EH** = standard supervisory program access. In racks 1 – 7, the AM code must be **39H**.
Address	A 24-bit or 32-bit hexadecimal value, depending on the AM code selected. In rack zero, for 24-bit addressing modes where the AM code is **09H**, **0AH**, **0DH**, or **0EH**, the address must be xxxx0000H. For 32-bit addressing modes where the AM code is **39H**, **3AH**, **3DH**, or **3EH**, the address must be 00xx0000H. (Default = 00100000H) In racks 1 – 7, the address must be 00xx0000H. Default = 10000H * (((10H – rack) * 10H) + (2 * (slot – 2))) The hexadecimal digits represented by "x" may have any value from 0 through F, inclusive. Although the Series 90-70 I / O rack does not contain the P2 backplane, the upper eight address lines of the 32-bit address can be jumpered to a fixed value on the module.
Dual Port Memory Size in K Bytes	The size of the dual port memory (in 1K increments) for the VME module. Values are **16*** to **16,384**.

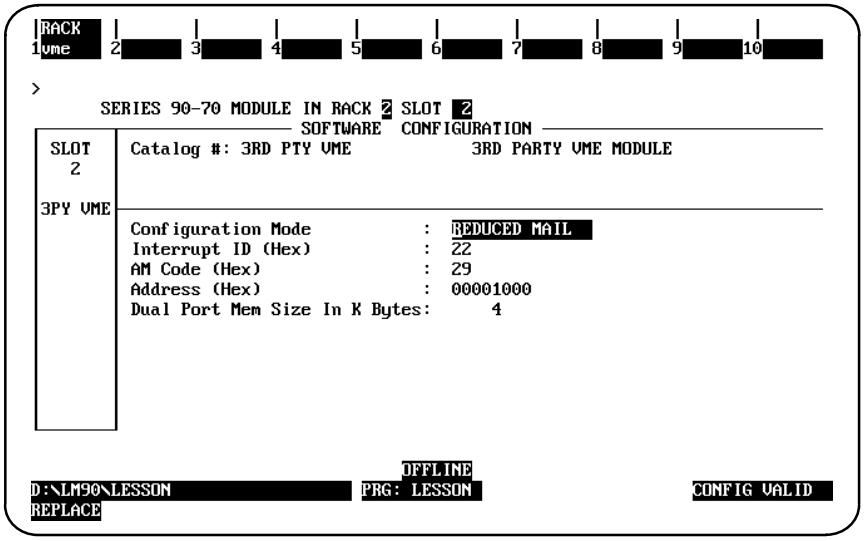
* Default selection.

Reduced Mail Mode

Note

REDUCED MAIL mode is not supported by a Release 6 or earlier CPU. This functionality is reserved for possible use by future CPUs.

When **REDUCED MAIL** mode is selected, the following VME detail screen is displayed.



Parameter	Description
Configuration Mode	The configuration mode is set to **REDUCED MAIL**.
Interrupt ID	A byte hexadecimal value which identifies the module driving the interrupt line. The value in this field must either be in the form "slot:rack", based on the rack and slot the module is in, or a value in the range F0 to FE hex. For example, if a VME module is configured in slot 3 of rack 0, a value of 30 (30H; slot 3 rack 0) is displayed. Each VME module configured within the system must have a different interrupt ID. The default value must be a value based on the rack and slot the module is in. The first half-slot configured for a slot (either A or B) will be assigned the slot:rack ID; the second half-slot configured for the slot (either A or B) will be in the range **F0** – **FE**.
AddressModifier Code	The memory space (in hexadecimal) on the VME bus that the module responds to. Choices are: **09** = extended non-privilege data access. **0A** = extended non-privilege program access. **0D** = extended supervisory data access. **0E** = extended supervisory program access. **29*** = short non-privilege access. **2D** = short supervisory access. **39** = standard non-privilege data access. **3A** = standard non-privilege program access. **3D** = standard supervisory data access. **3E** = standard supervisory program access.
Address	A 16-bit, 24-bit, or 32-bit hexadecimal value, depending on the AM mode selected. If the AM code is **29** or **2D**, the address range must be a 16-bit value, 0000 to 0000FFFF. If the AM code is **39**, **3A**, **3D**, or **3E**, the address range must be a 24-bit value, 0000 to 00FFFFFF. If the AM code is **09**, **0A**, **0D**, or **0E**, the address range must be a 32-bit value, 0000 to FFFFFFFF. (Although the Series 90-70 I / O rack does not contain the P2 backplane, the upper eight address lines of the 32-bit address can be jumpered to a fixed value on the module.) Default = 0000FFFF.
Dual Port Memory Size in K Bytes	The size of the dual port memory (in 1K increments) for the VME module. Values are **4*** to **16,384**.

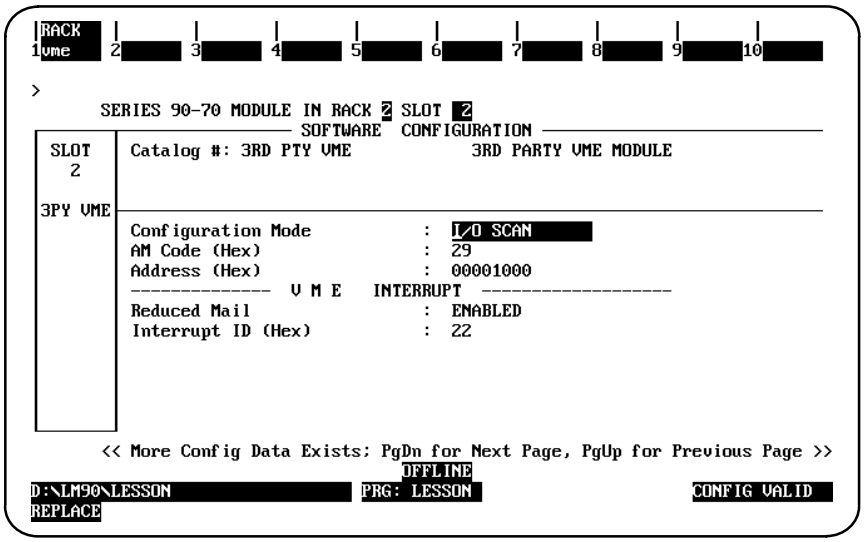
* Default selection.

I/O Scan Mode

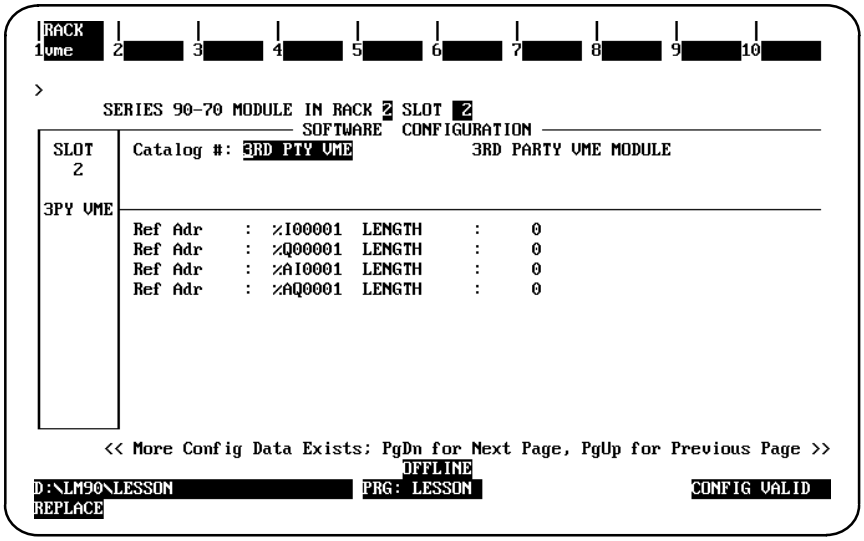
Note

I/O SCAN mode is supported by Release 5.5 and later CPUs.

When **I/O SCAN** mode is selected, the following VME detail screen is displayed.



Press the **Page Down** key to display the reference address parameters.



Parameter	Description
Configuration Mode	The configuration mode is set to **I/O SCAN**.
AddressModifier Code	The memory space (in hexadecimal) on the VME bus that the module responds to. Choices are: **09H** = extended non-privilege data access. **0AH** = extended non-privilege program access. **0DH** = extended supervisory data access. **0EH** = extended supervisory program access. **29H*** = short non-privilege access. **2DH** = short supervisory access. **39H** = standard non-privilege data access. **3AH** = standard non-privilege program access. **3DH** = standard supervisory data access. **3EH** = standard supervisory program access.
Address	A 16-bit, 24-bit, or 32-bit hexadecimal value, depending on the AM mode selected. If the AM code is **29H** or **2DH**, the address range must be a 16-bit value, 0000 to 0000FFFF. If the AM code is **39H**, **3AH**, **3DH**, or **3EH**, the address range must be a 24-bit value, 0000 to 00FFFFFF. If the AM code is **09H**, **0AH**, **0DH**, or **0EH**, the address range must be a 32-bit value, 0000 to FFFFFFFF. Default = (slot * 2K).
Reduced Mail	Select whether to **ENABLE*** or **DISABLE** interrupts. If **ENABLED**, the module will generate interrupts.
Interrupt ID	A byte hexadecimal value which identifies the module driving the interrupt line. The value in this field must either be in the form "slot:rack", based on the rack and slot the module is in, or a value in the range F0 to FE hex. For example, if a VME module is configured in slot 3 of rack 0, a value of 30 (30H; slot 3 rack 0) is displayed. Each VME module configured within the system must have a different interrupt ID. The default value must be a value based on the rack and slot the module is in. The first half-slot configured for a slot (either A or B) will be assigned the slot:rack ID; the second half-slot configured for the slot (either A or B) will be in the range **F0** – **FE**.
Reference Address / Length	The %I, %Q, %AI, and %AQ offsets and lengths that will be scanned by the PLC. For %I and %Q, the valid range is from **0** to **16** bytes. For %AI and %AQ, the valid range is from **0** to **64** words.

* Default selection.

Section 16: Configuration Reference View

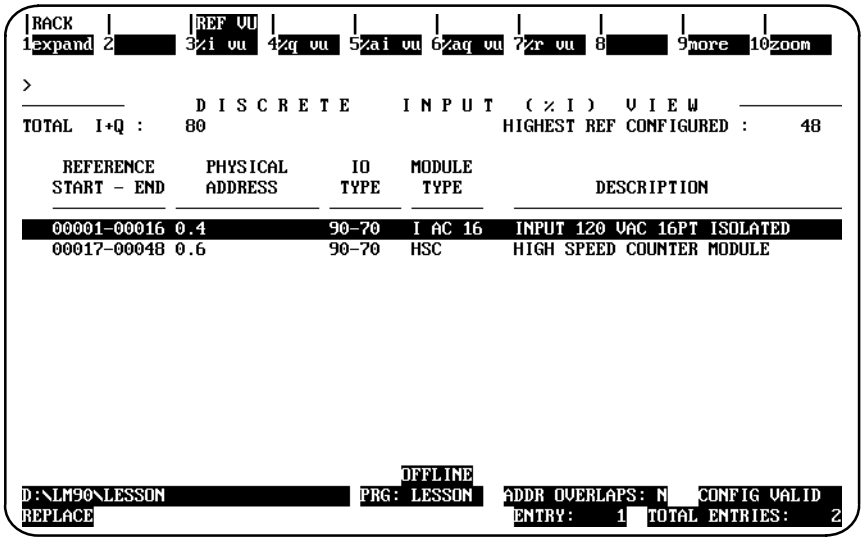
The configuration reference view feature enables you to view tabular displays of configured modules with the same reference (%I, %Q, %AI, %AQ, %G, or %R). This feature can be helpful when assigning new reference addresses or resolving address conflicts, such as overlapping.

The reference view table is sorted in ascending order by user reference, with the lowest address listed first. Mixed discrete inputs and outputs (%QI) are shown in both the %Q and %I tables. Mixed analog inputs and outputs (%AQI) are shown in both the %AQ and %AI tables.

Data contained in the reference view table may only be viewed; it cannot be edited. Modules configured from the rack screens have a reference address assigned to them. When the reference address of a module is changed, the reference view table is updated automatically. When a module is configured, it is automatically entered into the reference view table for its reference type. When a module is deleted, it is automatically removed from the table.

Displaying the Reference View Table

The Reference View screen for the current module reference type may be displayed by pressing **Reference View (Shift-F3)** from any rack or bus in the I/O configuration rack function. For example, to display the %I Discrete Input Reference screen shown below, press **Reference View (Shift-F3)** from a rack or bus screen.



If the Expand (F1) function key is pressed on a remote drop configuration, the reference view of the corresponding remote drop configuration is displayed.

To display a different Reference View screen, press the appropriate function key (F3 through F7) for the view screen you wish to display. Additional user references (%G, %GA, %GB, %GC, %GD, and %GE) can be displayed by first pressing **More (F9)** and then the appropriate function key.

The first line of the display area clearly identifies the reference type of this view. On the second line, ***TotalUsed*** on an analog reference view screen displays the total number of references configured. On a discrete reference view screen, ***Total I+Q*** displays the combined total. The highest reference number configured is also displayed on the second line.

Each entry in the reference view table contains the following information:

Field	Description
Reference Start – End	The starting and ending reference addresses for the module.
PhysicalAddress	The PLC hardware physical address for the module. Each entry in this column will contain the following information, each separated by a period (for example, rack . slot . bus . block address).
IO Type	The input / output type which controls this module.
Module Type	The type and size of the module.
Description	The description field.

If overlaps exist in the table, a **Y** (Yes) is displayed on the second status line at the bottom of the screen. If there are no overlaps, an **N** (No) is displayed.

The position of the selected entry is displayed in the ***Entry*** field, and the number of reference table entries is displayed in the ***TotalEntries*** field. For example, in the previous screen, the first entry is the selected entry, and the total number of entries is two.

Moving the Cursor

Use the Up and Down cursor keys to scroll between rows of the reference view table. The cursor field will always include an entire module (e.g., a single row).

Press the **Home** key to position the cursor at the beginning of the table, or the End key to go to the end of the table.

If all the configured modules in the PLC cannot be displayed on a single screen, press the **Page Down** key to view additional entries, or the Page Up key to view previous entries.

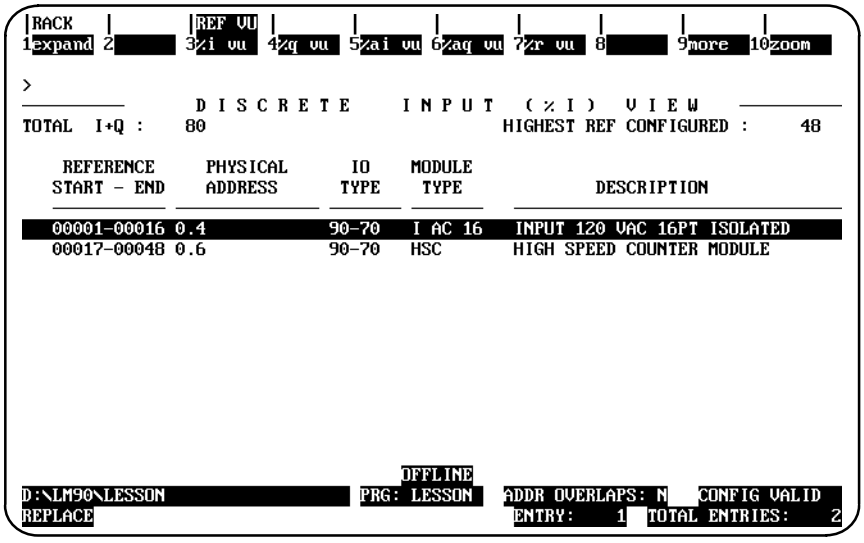
Displaying the Rack Screen

All of the Reference View screens have a Rack (Shift-F1) function key displayed at the top of the screen. This key may be used to go directly to the Rack screen from the reference view function.

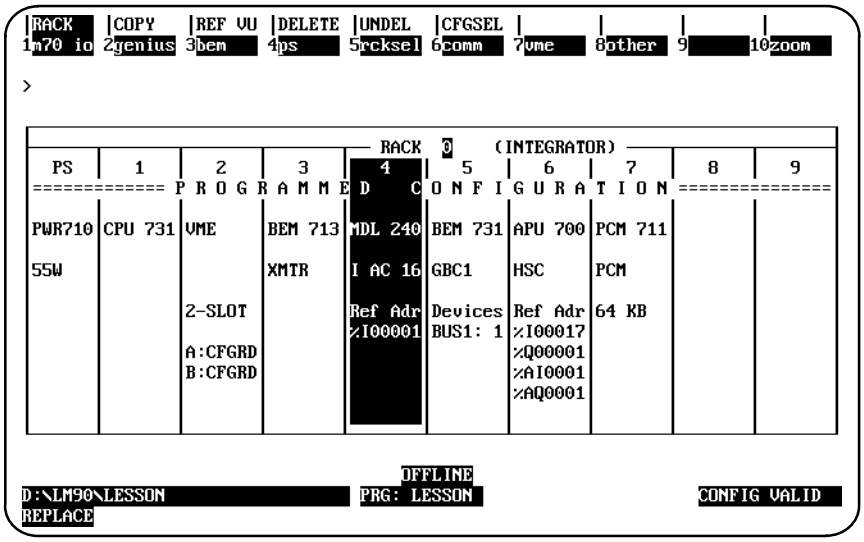
Note

The Rack (Shift-F1) function key will access the Bus screen if a block entry was highlighted when the function key was pressed.

In the following example, a 16-point isolated 120 VAC input module is shown in reverse video. This module is physically located in slot 4 of the main rack.



When Rack (Shift-F1) is pressed from the Reference View screen, the screen will display the main rack and highlight the slot of the module selected on the Reference View screen (for this example, slot 4).



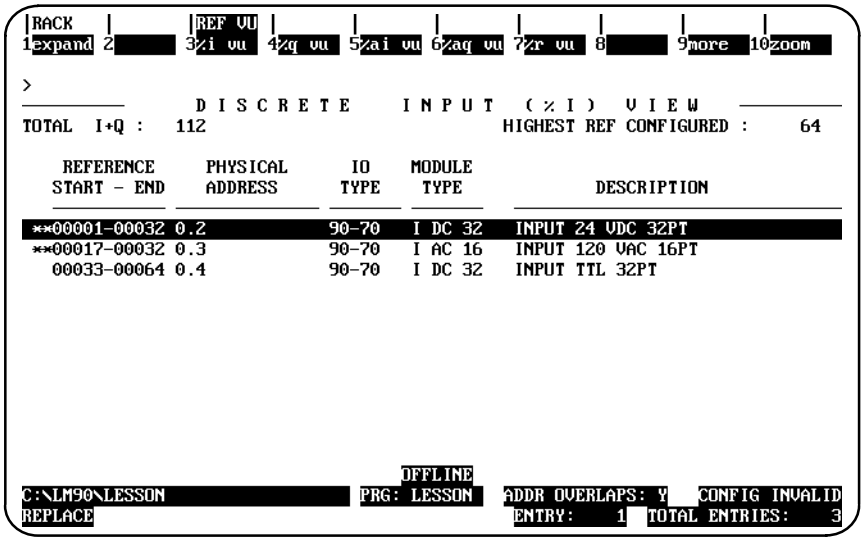
To return to the Reference View screen, press **Reference View (Shift-F3)**.

Displaying the Bus Screen

The Rack **(Shift-F1)** function key may also be used to go directly to the bus level screen of the module currently highlighted by the cursor, if it is a bus level module. When Rack **(Shift-F1)** is pressed, the screen will display the module bus level function screen. To return to the Reference View screen, press **Reference View (Shift-F3)**.

Overlapping References

Overlapping references will result in an invalid configuration. When the reference address assigned to a module overlaps with another module's reference address of the same reference type, an asterisk (*****) is displayed at the beginning of the row for both modules. If the overlap is fatal, resulting in **CONFIG INVALID**, double asterisks (******) are displayed.



Modules with reference addresses that lie outside the I/O Map of a remote drop configuration will be marked with an exclamation mark (*!*).

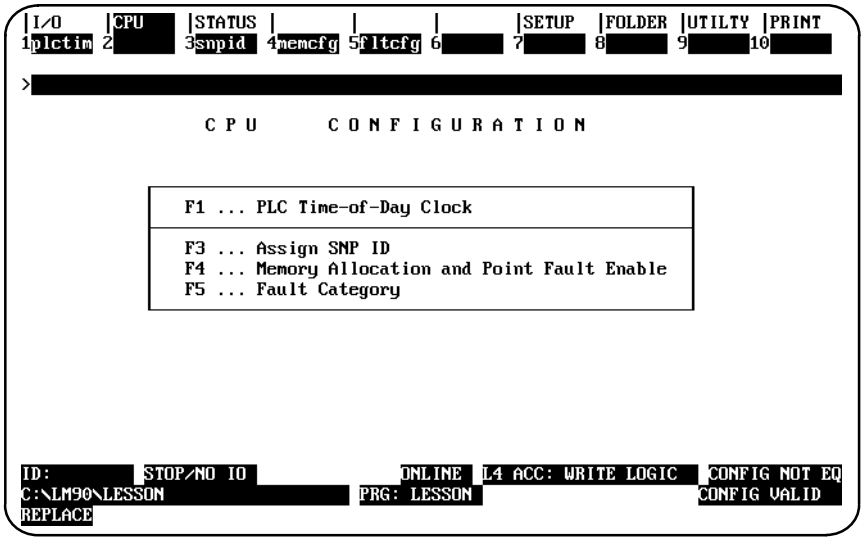
To resolve the conflicting overlap, position the cursor on the reference address which must be changed and press **Detail (F10)**. The detail module screen will be displayed, allowing the address to be adjusted.

Caution

When adjusting reference addresses, be careful not to cause another overlap.

Chapter 12 CPU Configuration

Use the CPU configuration function to set the operating characteristics of the CPU. To access the CPU configuration functions, press **CPU (F2)** from the main menu. Then continue below.



Function Key	Function	Description	Page
F1	PLC Time-of-Day Clock	View the computer's time-of-day clock, or view and change the PLC time-of-day clock.	12-2
F3	SNP ID	Assign a new value to the Series Ninety Protocol (SNP) ID.	12-4
F4	Memory Configuration	View and change the CPU memory allocation and the use of point fault references.	12-5
F5	Fault Category	View and change how the CPU responds to faults.	12-7

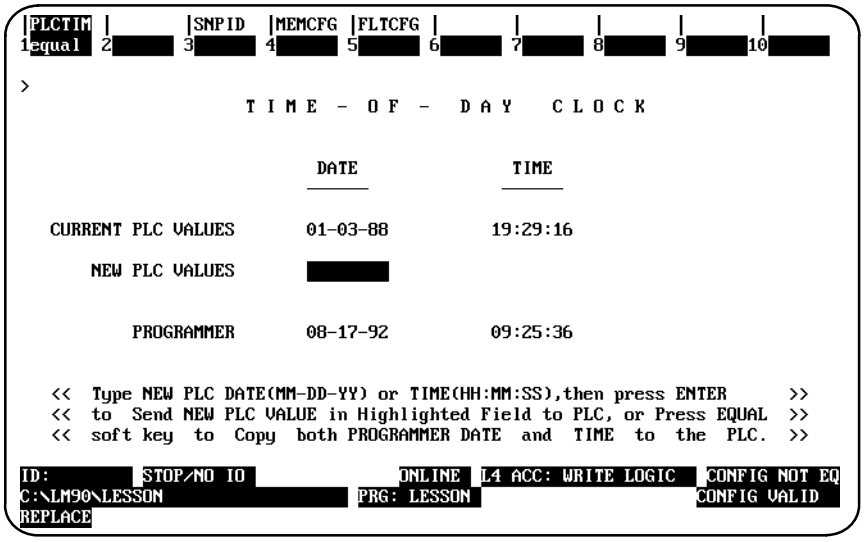
These functions are described on the pages that follow.

Storing the CPU Configuration to the PLC

Use the program utility functions (in **ONLINE** mode) to store configuration data to the PLC. For instructions, please refer to chapter 9, "Program Utilities."

PLC Date and Time

To display the current date and time, press **PLC Time (F1)** from the CPU Configuration menu.



Note

When this screen is first displayed, the time-of-day clock is read from the PLC. Elapsed time is tracked by the Logicmaster 90-70 software. Other devices, such as CIMPLICITY 90-ADS, may change the time-of-day clock, but the change will not be reflected on this screen until you exit and return to this screen.

The current date and time for the programmer are displayed in all operating modes. To also display the PLC date and time, place the computer in **ONLINE** or **MONITOR** mode. If the programmer is in **OFFLINE** mode or is not communicating with the CPU, asterisks are displayed in the ***Current PLC Values*** fields.

Changing the PLC Date and Time

To change the date and / or time shown for the PLC, the computer must be in **ONLINE** mode and communicating with the PLC.

To make the PLC date and time the same as the values shown for the computer, press **Equal (F1)**. To use a different date and / or time:

1. Enter the new date, using dash (minus) characters between fields (MM-DD-YY).

Abbreviation	Description
MM	Month from 01 to 12.
DD	Day from 01 to 31.
YY	Year from 00 to 99.

2. Enter the new time, using colons between fields (HH:MM:SS). If hours are specified, entering minutes and seconds is optional. Partial times must, however, end with a colon (e.g., HH: or HH:MM:).

Abbreviation	Description
HH	Hours from 00 to 23.
MM	Minutes from 00 to 59.
SS	Seconds from 00 to 59.

Note

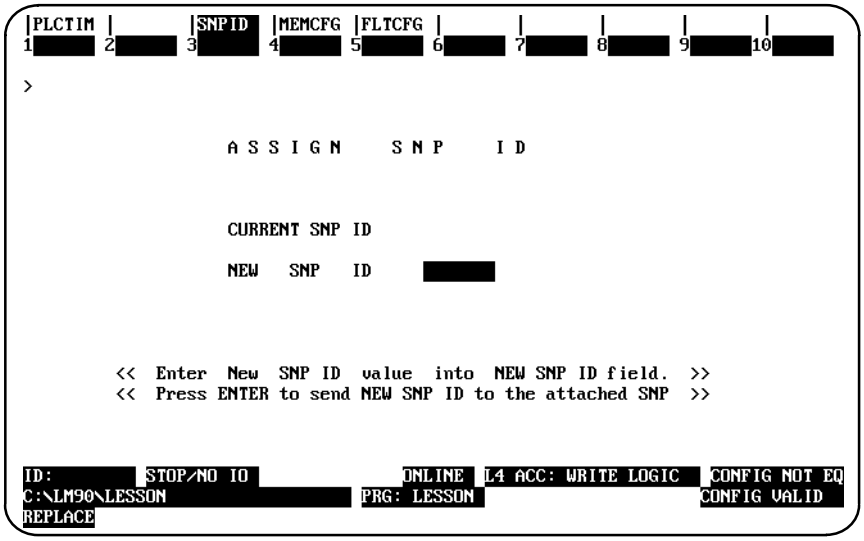
If hours are specified, entering minutes and seconds is optional. Partial times must, however, end with a colon. For example, HH: or HH:MM:.

3. Press the **Enter** or **Escape** key. The change in the currently highlighted field is sent to the PLC and will appear in the ***Current PLC Values*** field on the screen.
4. Press the **Escape** key to exit this screen and return to the CPU configuration menu.

SNP ID

For multidrop configurations, each CPU connected to the system must have a unique identification name consisting of 1 to 7 characters. The SNP ID is not required for peer-to-peer communications.

The current SNP ID value is displayed in **ONLINE** or **MONITOR** mode. To display the current SNP ID or assign a new name, press **SNP ID (F3)**. The entry for the ***New SNP ID*** field can only be changed in **ONLINE** mode with communications. If the programmer is in **OFFLINE** mode or is not communicating with the CPU, asterisks are displayed in the ***Current SNP ID*** field.



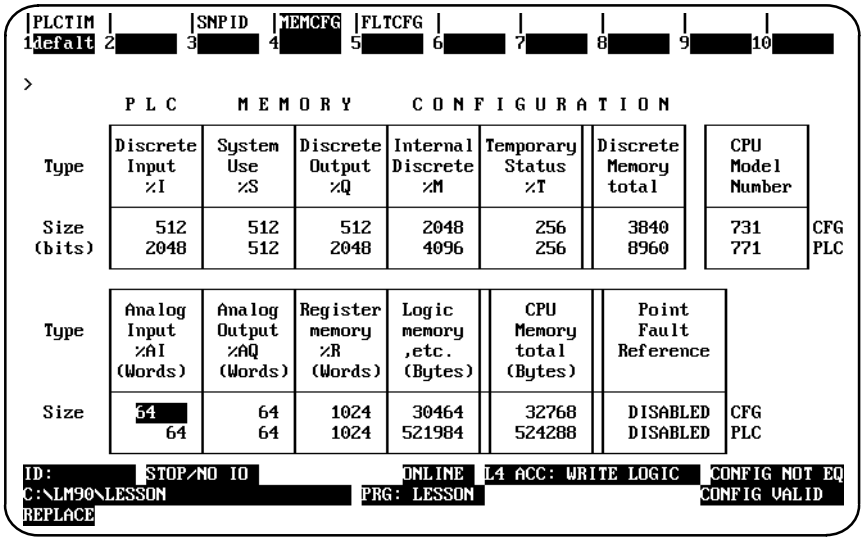
Changing the SNP ID Name

To change the identification of the PLC:

1. Enter a new name in the ***New SNP ID*** field, using the alphanumeric characters (A – Z, 0 – 9) or special characters (–, @, _, #, $, %, <, >, =, +, &). The first character must be alphabetic.
2. To clear the SNP ID, enter all blank characters.
3. Press the **Enter** key to send this new name to the attached SNP device.
4. Press the **Escape** key to exit this screen and return to the CPU configuration menu.

PLC Memory Configuration

To display the current memory configuration, press **Memory Configuration (F4)** from the CPU Configuration menu.



The current memory allocations stored in the program folder are displayed in all operating modes. To display the PLC values, place the computer in **ONLINE** or **MONITOR** mode.

The upper portion of this screen shows the maximum values for discrete references (%I, %Q, %M, %T, %S, and %G). These values are set by the system and will change only when the CPU model number is changed.

The lower portion of this screen shows values for register references (%AI, %AQ, and %R). You can change the amount of memory allocated to analog I/O and register use in one-word increments (2 bytes).

The sum of CPU memory, according to the particular CPU model, and any expansion memory is displayed in the ***CPU Memory Total*** field.

Note

Using all the Logic memory will result in an error condition, which will prevent you from leaving this function.

Changing Memory Allocation

The memory allocation for analog I/O (%AI and %AQ) and registers (%R) in the current program folder can be changed with the computer in any operating mode:

1. To use the default values shown below, press **Default (F1)**. To enter different values instead, move the cursor to the value you want to change and use the Tab / Shift-Tab keys to increment / decrement the value.
2. For system registers, enter a value which is a multiple of 1024. If the number is not a multiple of 1024, the software will automatically round it upward. For example, if you enter 1500, it will automatically be changed to 2048. Zero is a valid entry for system registers and is, therefore, not rounded upward.

Memory Type	Default Amount	Configurable Range
Analog Inputs	64 words	0 to 8,192 words
Analog Outputs	64 words	0 to 8,192 words
System Registers	1,024 words	0 to 16,384 words

3. When you press the **Enter** or **Escape** key, any changes you have made are stored to the current program folder.

Enabling/Disabling I/O Point Faults

Assigning point fault references causes the CPU to reserve additional memory to store point faults. The additional memory will correspond to the amounts of %I, %Q, %AI, and %AQ memories. One byte is used for each %AI and %AQ word, one bit for each %I and %Q (in byte increments).

This feature must be set to **ENABLED** to use the Fault and No Fault program instructions or the High and Low Alarm instructions with ***Point Fault*** references. An example of a Fault instruction used with a point fault reference is shown below:

```
%AI00001
[FAULT]
```

When the Fault and No Fault instructions are used with rack / slot / bus / block or Genius bus fault references, this feature does **not** have to be enabled; it may be disabled. An example of a Fault instruction used with a rack / slot reference is shown below:

```
RACK_00
[FAULT]
```

To enable or disable this feature, move the cursor to the ***Point Fault Reference*** box, and use the Tab key to toggle the current selection. The selection cannot be changed to **DISABLED** if the logic program uses a fault contact as a ***Point Fault*** references. The Default (F1) key can also be used to disable I/O point fault references if the logic program does not use Fault and No Fault instructions as fault point references or High and Low Alarm instructions.

Storing PLC Memory Configuration

The new values for the PLC memory configuration are sent to the PLC through the store configuration function. Refer to chapter 9, "Program Utilities," for more information on this function.

Fault Categories

In order to assure safe operation, the PLC must be able to respond appropriately to certain types of faults. For some faults, this means that the PLC must stop executing. The appropriate response to a fault may depend on the nature of the application.

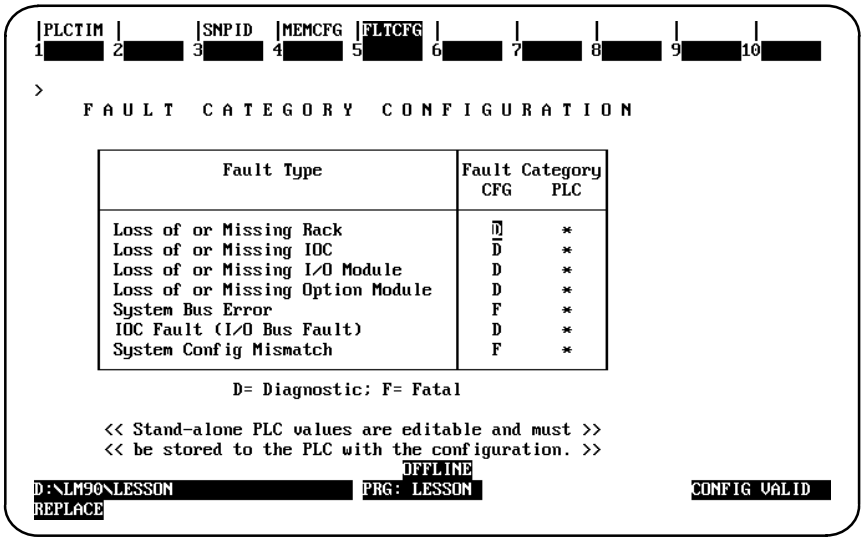
Faults are automatically considered to be either fatal, diagnostic, or informational. All system faults are initially assigned to one of three actions:

Fault Action	Description
Fatal	These faults stop the PLC from executing, set diagnostic variables, and are logged in a fault table.
Diagnostic	These faults do not stop the PLC from executing. However, they do set diagnostic variables and are logged in a fault table.
Informational	These faults are logged in a fault table, but cause no other action.

For more information on faults, refer to chapter 3, "Fault Explanation and Correction," in the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

Displaying the Current Fault Categories

The categories of certain faults can be changed during CPU configuration by pressing **Fault Category (F5)** to display the Fault Category Configuration screen.



The fault categories from the current program folder are displayed in all operating modes. If your programmer is attached to a PLC and is in **ONLINE** or **MONITOR** mode, the PLC fault categories will also be displayed.

Changing Fault Categories

Fault categories can be changed if the assigned categories and associated responses are not appropriate for an application.

Caution

Change fault categories with care. Be sure to consider all conditions that may occur before changing any fault category.

To change a fault category, cursor to the category to be changed in the CFG (left) column. Use the Tab key to toggle the entry (D / F). After completing the changes, press the **Enter** key to save your changes.

The changed configuration must be stored to the PLC, as described in chapter 9, *Program Utilities*.

Appendix A Programming Lesson

This appendix contains a tutorial for the programming software package. The lesson includes:

- Creating a program folder.
- Creating a program block.
- Entering a variable declaration.
- Adding ladder logic to the program block.
- Printing the program.
- Exiting the programmer.

Help Screens

Logicmaster 90-70 software includes detailed Help screens. These Help screens are loaded onto the hard disk of your programmer during the software installation procedure and are readily accessible. To access the Help screens, press **ALT-H** for help, **ALT-I** for instruction mnemonic help, or **ALT-K** for key help.

Starting the Lesson

Before you can start, the programming software must be installed and started. If that has not been done yet, please turn back to chapter 2, “Operation,” for instructions.

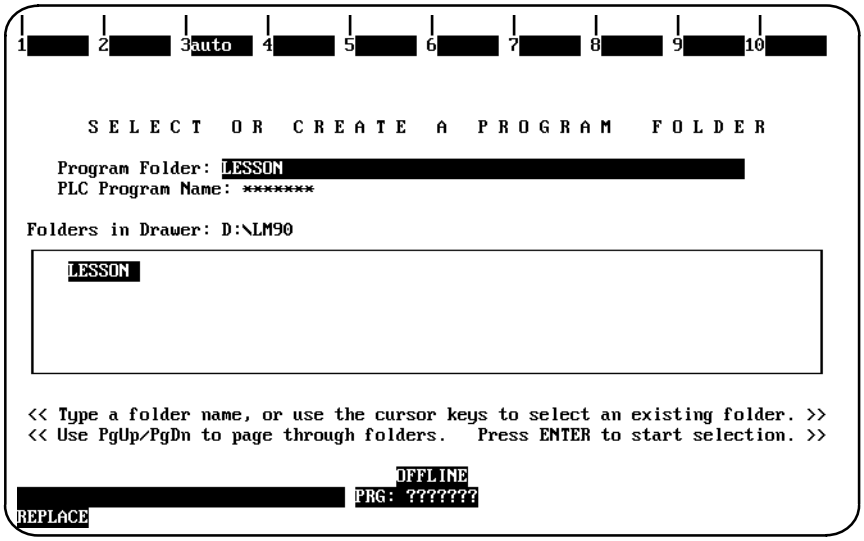
Exiting the Programmer

You can exit the programmer at any time by pressing the **CTRL-Break** keys.

Creating a Program Folder

For this lesson, you will create and use a program folder named **LESSON**.

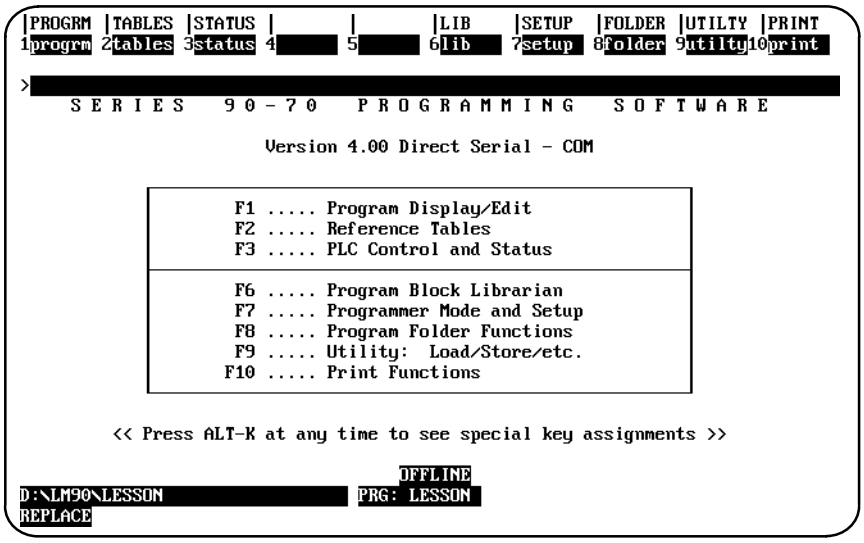
When Logicmaster 90-70 software is started (if the current default directory is an existing program folder), a screen similar to the one shown below appears. If the software is already running, you can display a similar screen from the Program Folder menu by pressing **Folder (F8 or Shift-F8)** from the programming software main menu and then **Select (F1)**.



1. If the current default directory is not an existing program folder, type in a name of seven characters or less for the folder. For this lesson, type **LESSON**.
2. Press the **Enter** key. The following prompt will appear at the top of the screen:

```
Program folder does not exist; create new folder?  (Y/N)
```

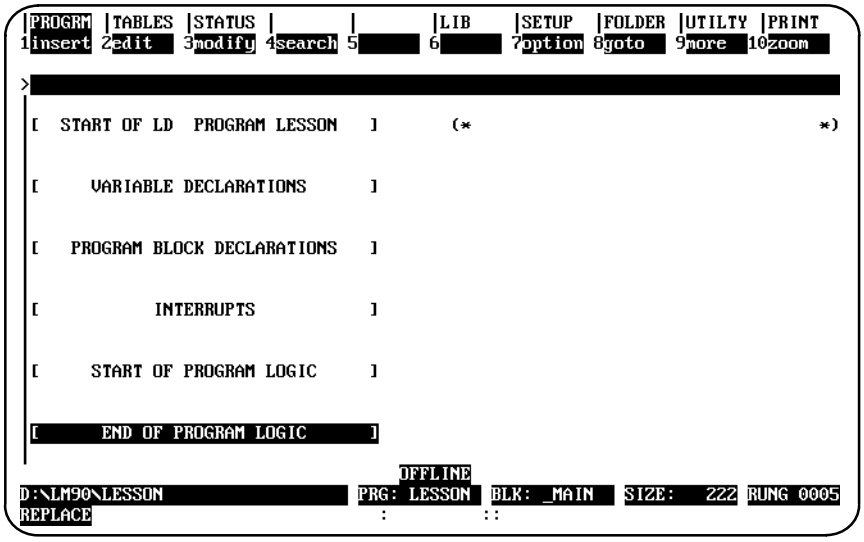
3. To create the program folder, enter **Y** (Yes). The software will accept the name and display the programming software main menu.



The name of your new program folder (**LESSON**) should be displayed at the bottom of the screen.

Creating a _MAIN Block

Press **Program (F1)** to create a program in this program folder Unless you have the SFC version of Logicmaster, the following screen will be displayed:



Note

If you have the SFC version of Logicmaster 90-70, the next screen you will see will be the "SERIES 90-70 PROGRAMMING LANGUAGE SELECTION" screen which will offer you two choices for the program you are about to create, "F1 . . . . RELAY LADDER DIAGRAM (LD)" or "F2 . . . . SEQUENTIAL FUNCTION CHART (SFC)." For this exercise, press F1 to activate Relay Ladder Diagram programming.

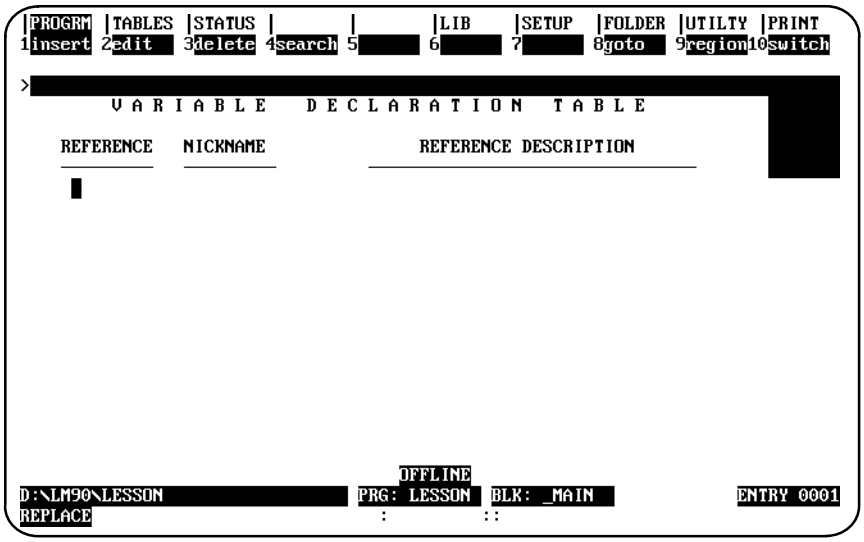
The screen presented above shows a **[VARIABLE DECLARATIONS]** marker where variable declarations can be inserted. Variable declarations are used to list nicknames and reference descriptions for the block. At the _MAIN block, the nicknames listed in the variable declaration table are known throughout all blocks; in a program block, however, the nicknames are local and known only to that particular block.

Some program blocks will contain no declarations. This lesson shows how to enter a variable declaration.

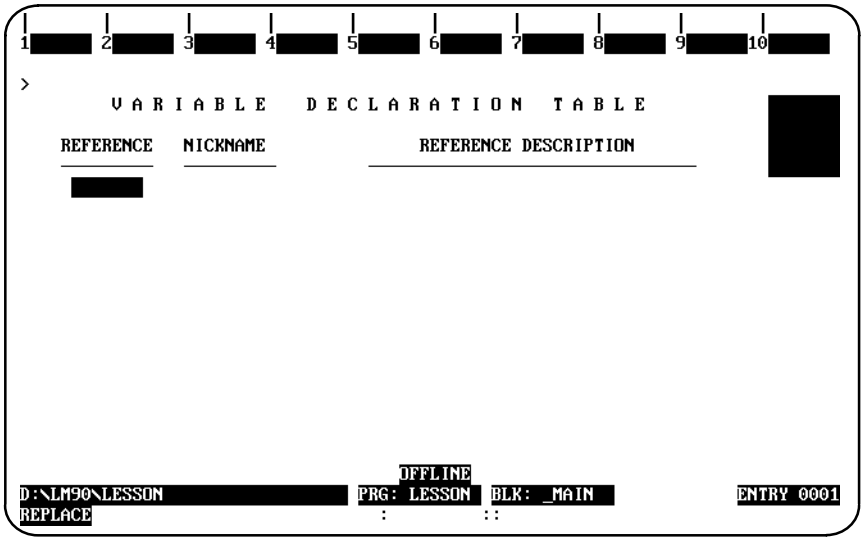
Entering a Variable Declaration

To enter a variable declaration:

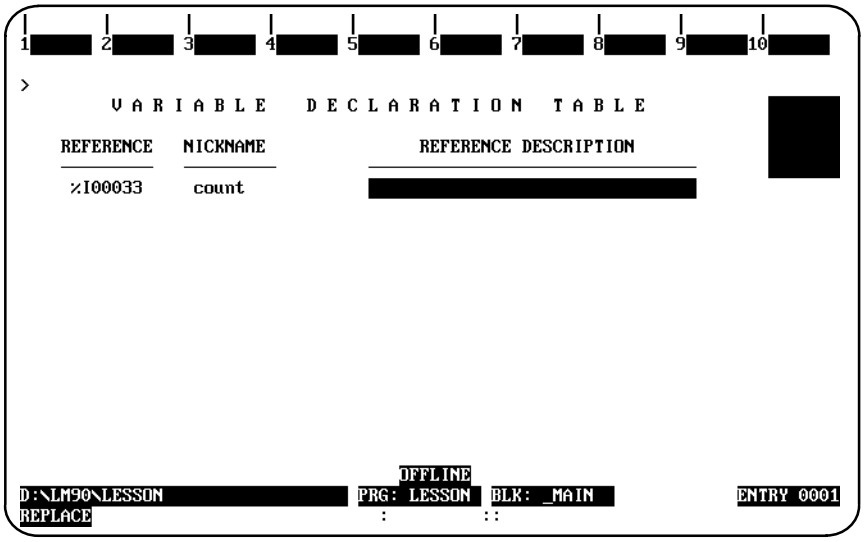
1. Use the cursor keys to move the cursor block to the **[VARIABLE DECLARATIONS]** marker; i.e., press the Up Arrow key till the cursor is resting on the **[VARIABLE DECLARATIONS]** marker.
2. Press **Zoom (F10)** to display a table where variables for the **_MAIN** block can be entered.



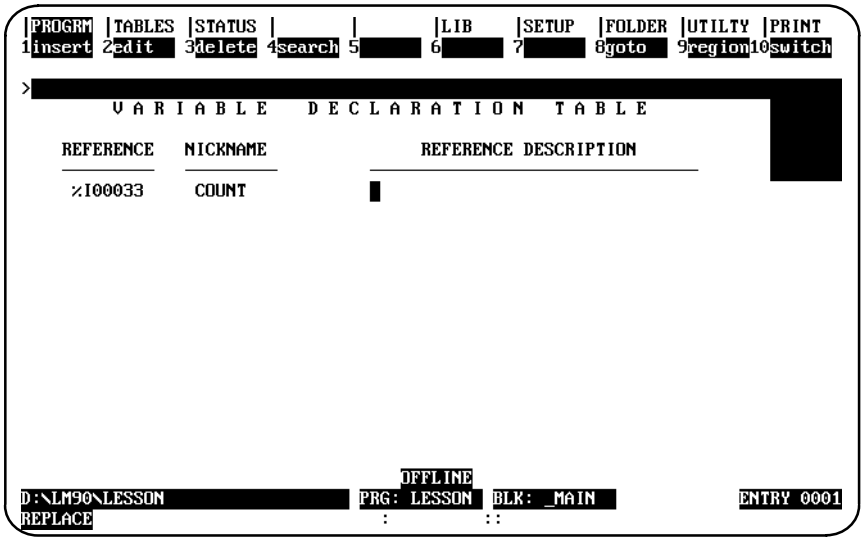
3. Press **Insert (F1)** to begin entering information in the ***Reference*** field. Your screen will look like the one shown below.



4. Enter the machine reference the nickname will represent. For this lesson, type **%I33** or **33I**.
5. Press the **Enter** key. The cursor block moves to the ***Nickname*** field.
6. Type the nickname **count**, and press the **Enter** key. The cursor block moves to the ***Reference Description*** field.



7. For this lesson, we will not use the ***Reference Description*** field. Press the **Escape** key to save your entries and leave **INSERT** mode. Note that when you press the Escape key, the software automatically changes your entry in the ***Nickname*** field to uppercase letters.

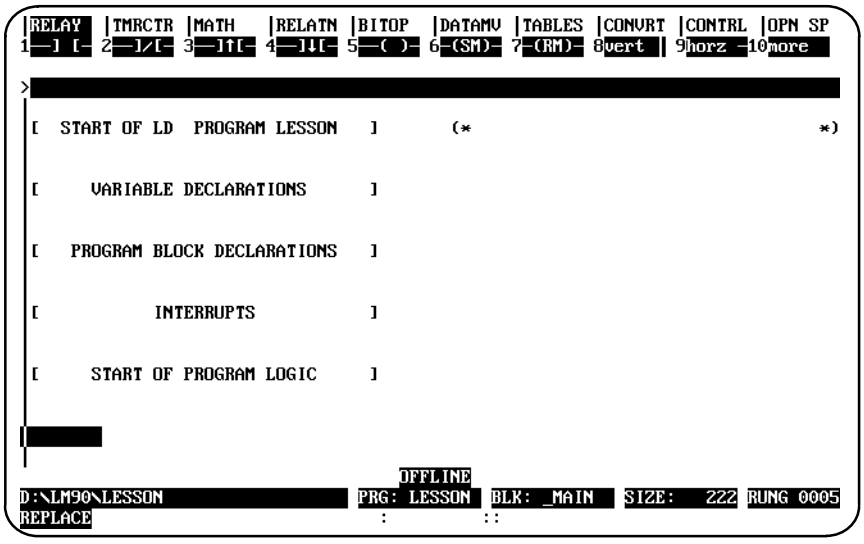


8. Press the **Escape** key again to return to the ladder logic display for the MAIN block.

Adding Ladder Logic to the _MAIN Block

To create logic for the example _MAIN block:

1. On the _MAIN block screen, use the **Down cursor** key to move the cursor to the **[END OF PROGRAM LOGIC]** marker.
2. Press **Insert (F1)**. You can now insert ladder logic at the cursor location.



The top line of the display shows these ladder logic functions:

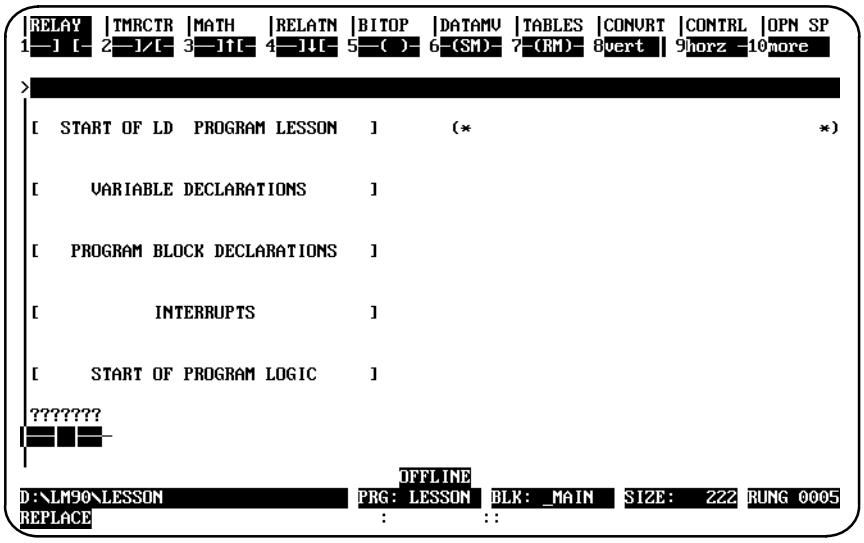
- Relay contacts and coils.
- Timers and counters.
- Math functions.
- Relational (comparison) functions.
- Logical bit operation functions.
- Data move functions.
- Table functions.
- Conversion functions.
- Control functions.
- Open space operations.

All of these functions are listed in chapter 3. For additional information, refer to the *Series 90-70 Programmable Controller Reference Manual*, GFK-0265.

Note

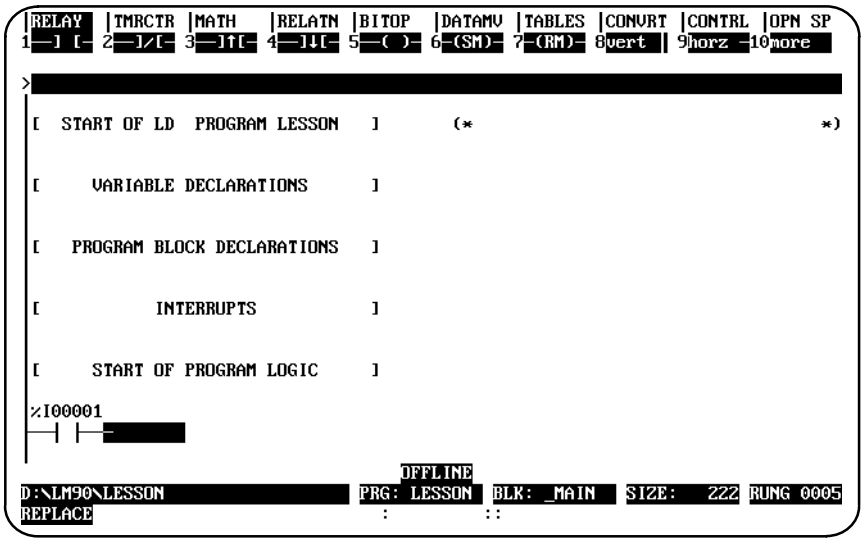
ALT-E can be used to toggle the display of the status area at the bottom of the screen. Press **ALT-E** to remove the status information; then, press **ALT-E** again to display it again. For more information on the status area, refer to chapter 2, section 6, “Screen Format.”

3. The reverse-video block on the top line shows that the currently selected type of function is RELAY. Press **F1** to start the rung with a normally open contact.

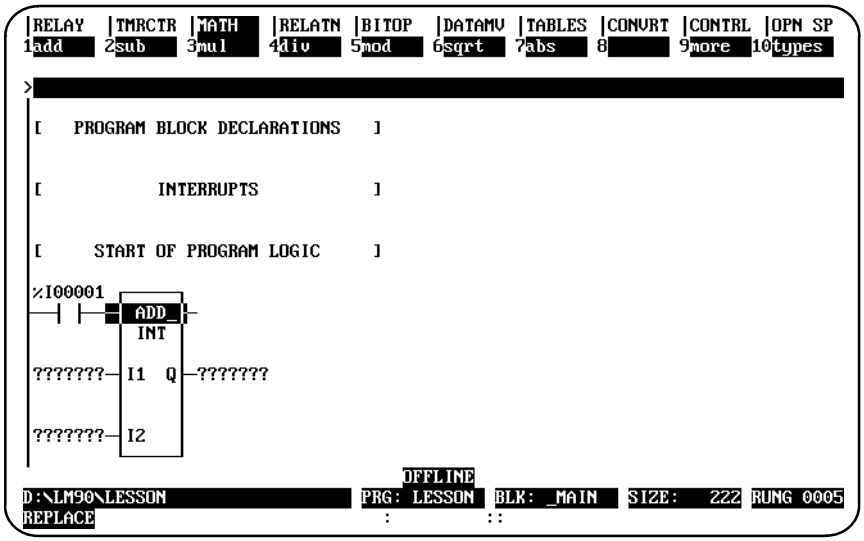


4. Type in **%I** as a reference for the contact. Note that typing **1I** has the same result. The reference appears in the command line at the top of the screen.

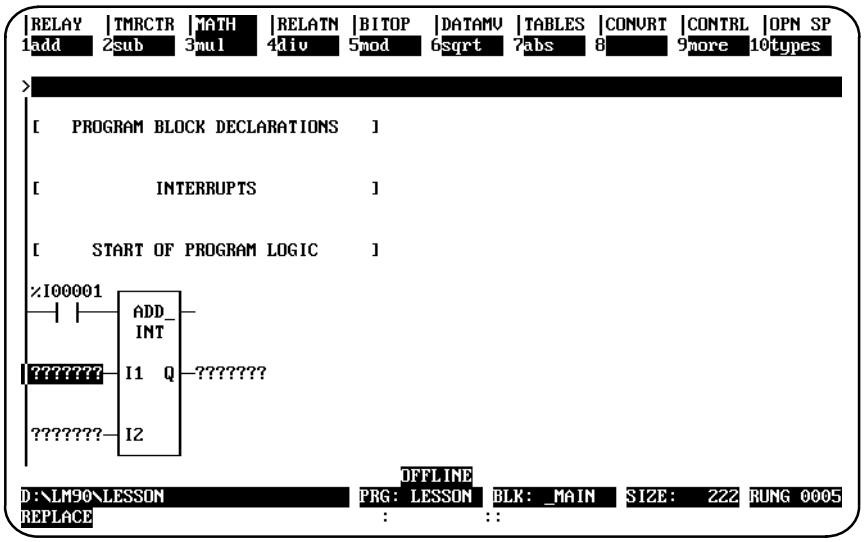
5. Press the **Enter** key. The software automatically changes your entry to the correct format and moves the cursor to the next location in the rung.



6. Add a math function to the rung. Press **Math (Shift-F3)** to select the math functions. At the top of the screen, the reverse video block moves to MATH. The second line shows the types of math functions that are currently available. Press **Add (F1)** to place an addition function in the rung.

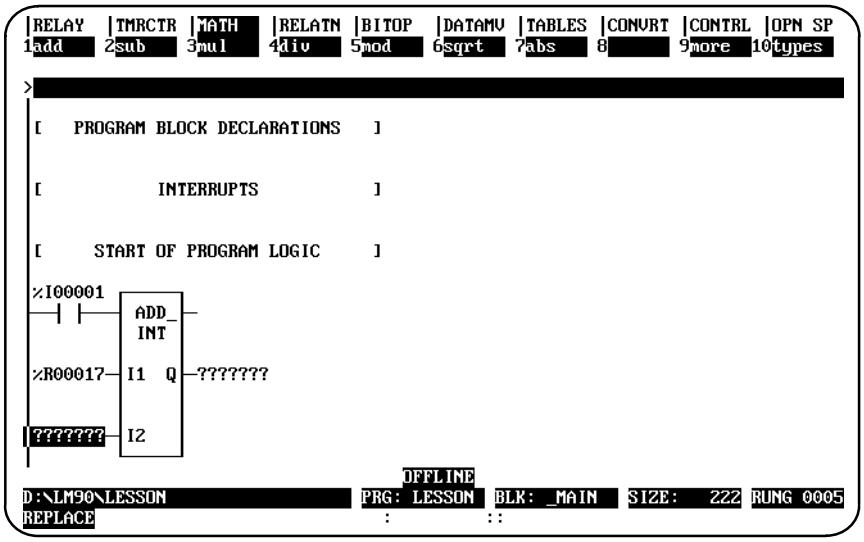


7. Press the **Tab** key twice to move the cursor to the first input parameter (where the question marks are and next to "I1" which is within the box). This field will represent the first of the two numbers to be added.

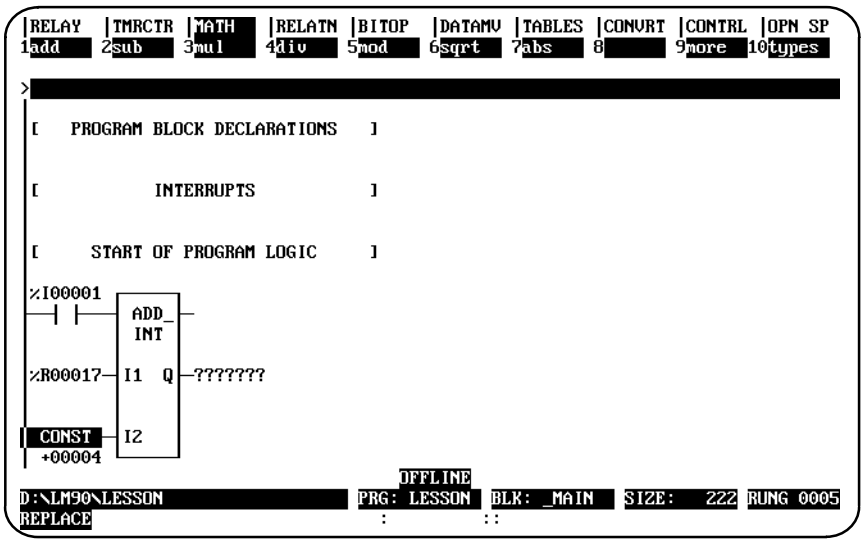


8. Specify the first number to be added. For this lesson, enter **%R17** or **17R**. This represents register reference %R00017. Then, press the **Enter** key.

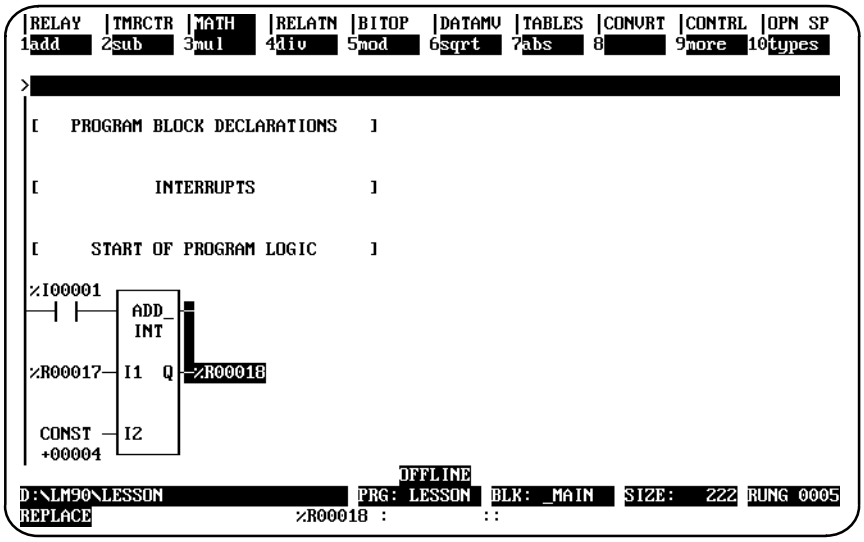
9. Use the **Tab** key to move the cursor to the second input parameter (I2). This field will represent the number to be added to the current value of the reference %R00017.



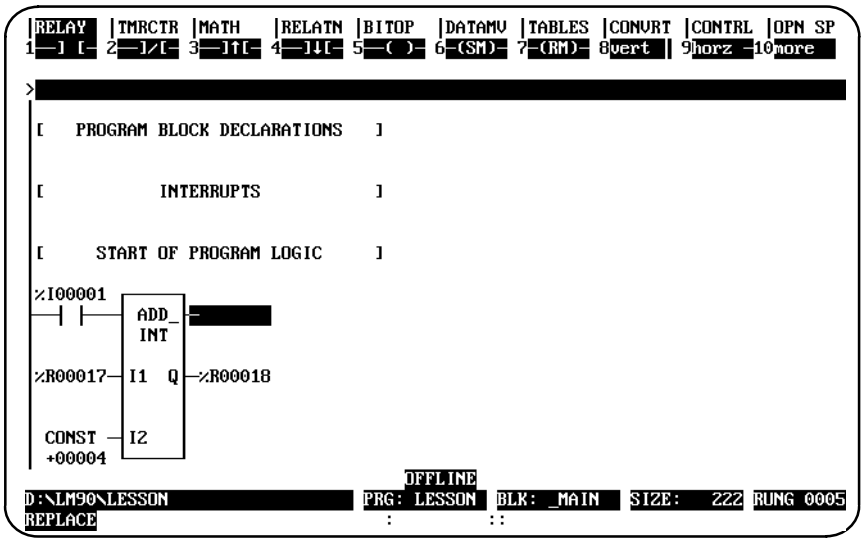
10. Type the number **4** as the value to be added. Press the **Enter** key. Because you did not type a **%** symbol before the number, the software knows it is a constant.



11. Use the **Tab** key to move the cursor to the next parameter (Q). Q is an output reference which represents the location for the sum (output) of the addition. Type the reference **%R18**, and press the **Enter** key.

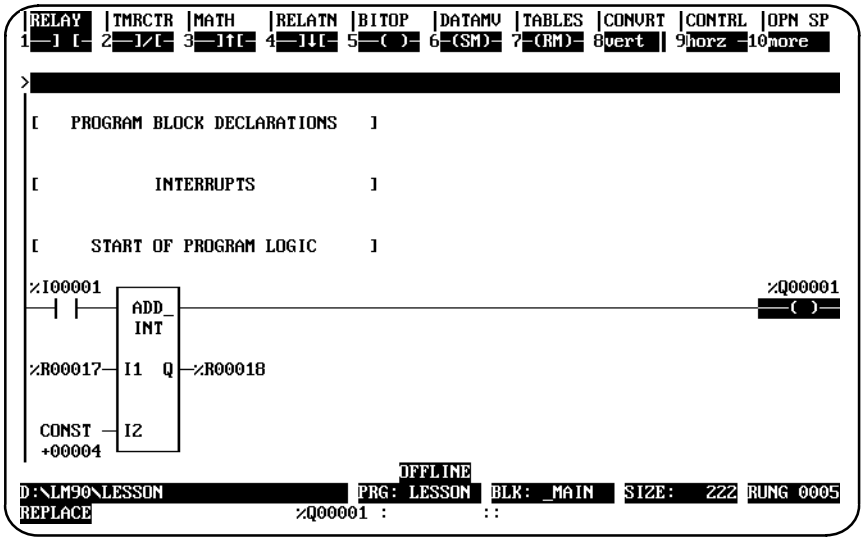


12. Press the **Tab** key to move the cursor block up to the top rung line. To complete the rung by programming a coil, press **Shift-F1** to select the relay functions.



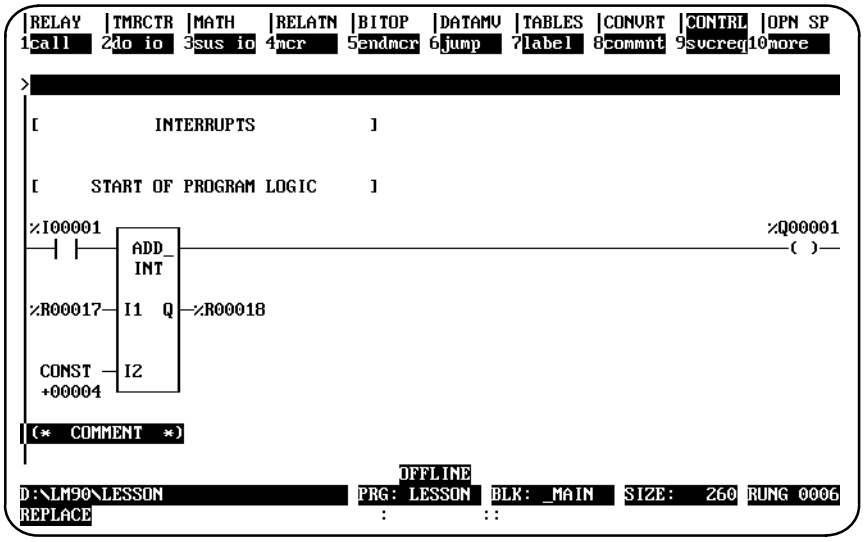
13. Enter **%Q1** on the command line. Do ***not*** press the **Enter** key. This will be the reference for the coil.

14. Press **F5** to enter a coil at the end of the rung. Notice that the reference can be entered either before selecting the function as shown here, or after selecting the function as shown earlier.

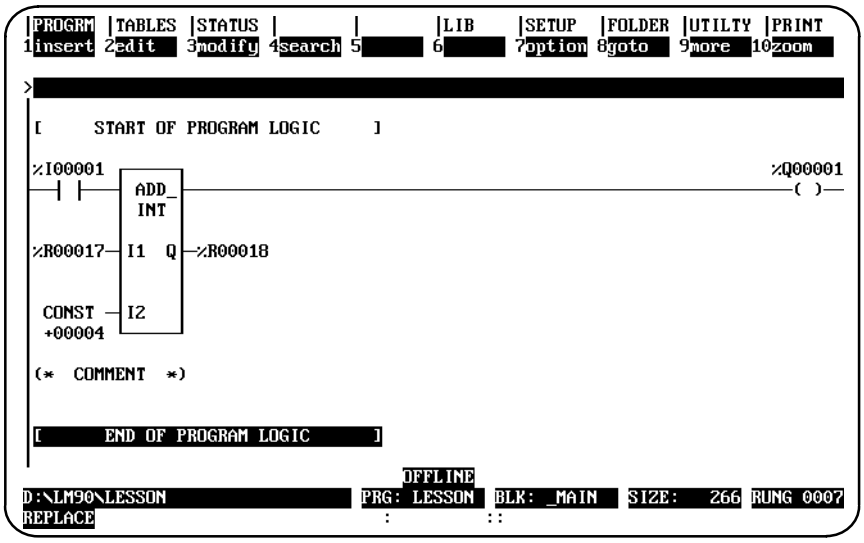


15. To accept the rung, press the **Enter** key (or the **Plus (+)** key on the numeric keypad). This accepts the completed rung, and the cursor moves downward so you can insert another line of logic.

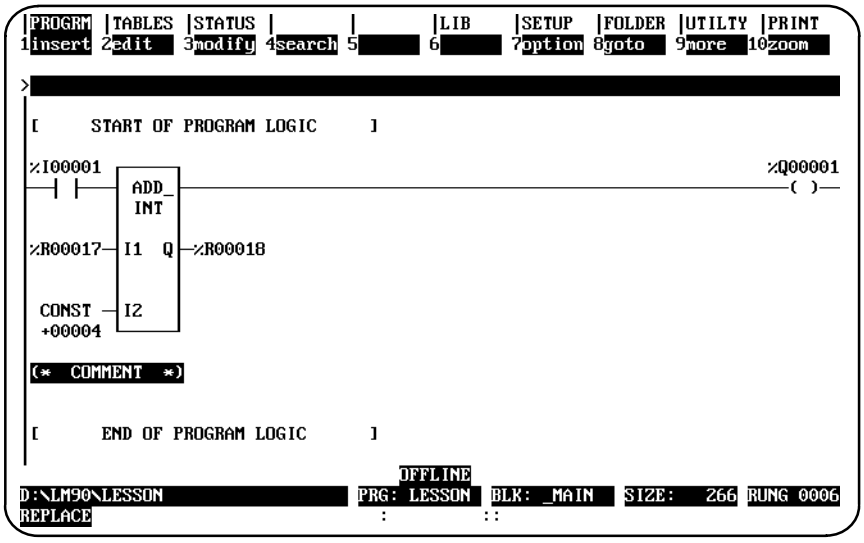
16. Select the control functions by pressing **Shift-F9**. Press **Comment (F8)** to add a comment to the program.



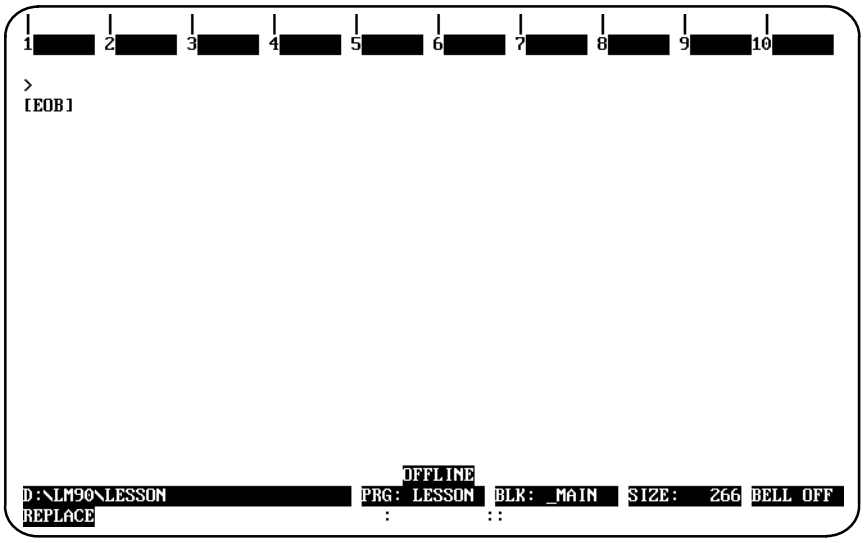
17. Press the **Enter** key and then the **Escape** key to return these key functions to the top of the screen:



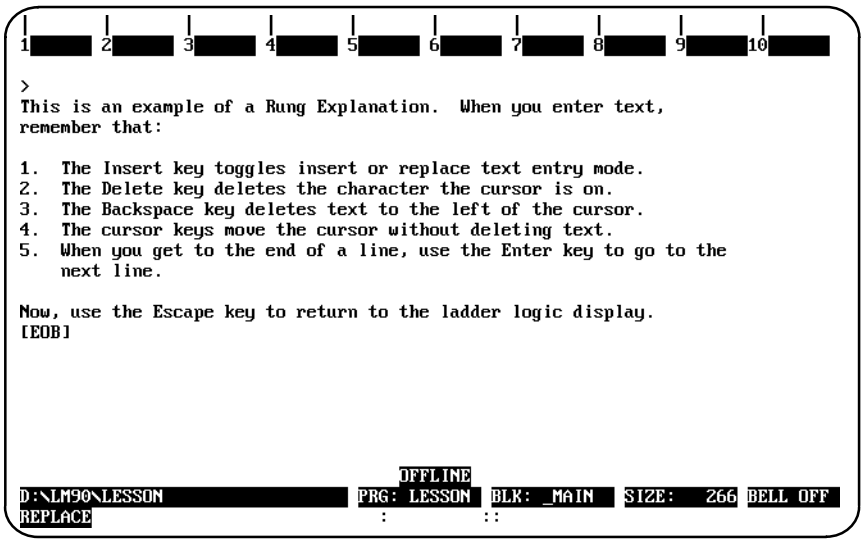
18. Move the cursor up to highlight the COMMENT instruction:



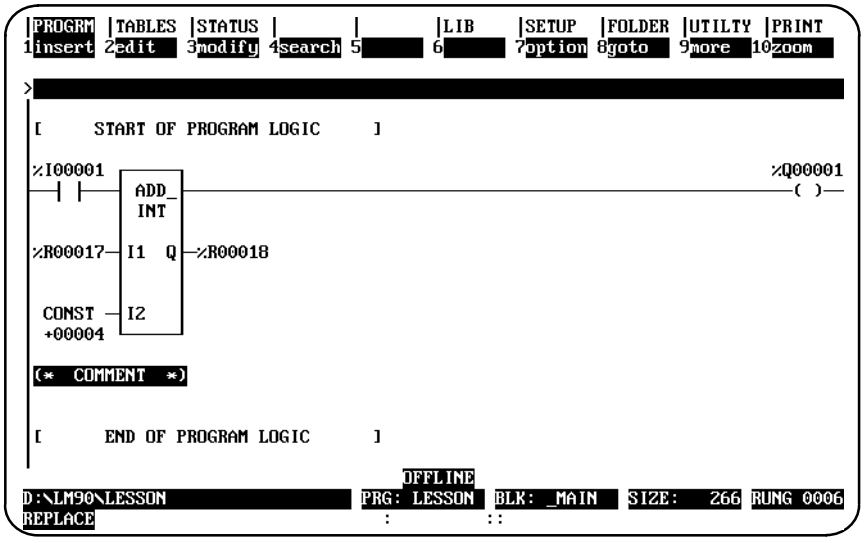
19. Press **Zoom (F10)**. The program logic is replaced with a blank screen where you can enter text.



20. Beginning at the **[EOB"]** (End of Buffer) symbol, enter the text shown below:



21. Pressing the **Escape** key returns the ladder logic display to the screen.



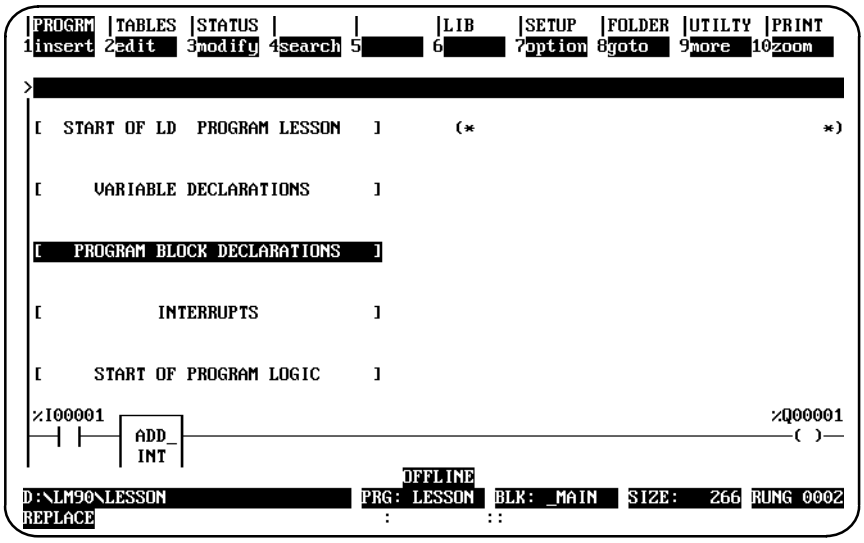
22. You could display the comment again by pressing **Zoom (F10)** with the cursor located at the comment rung.

23. That completes this lesson. Press the **Escape** key to return to the main menu. The following information pertains to program blocks. If you want to practice creating a program block, continue below. If you want to print this program now, continue on page A-23.

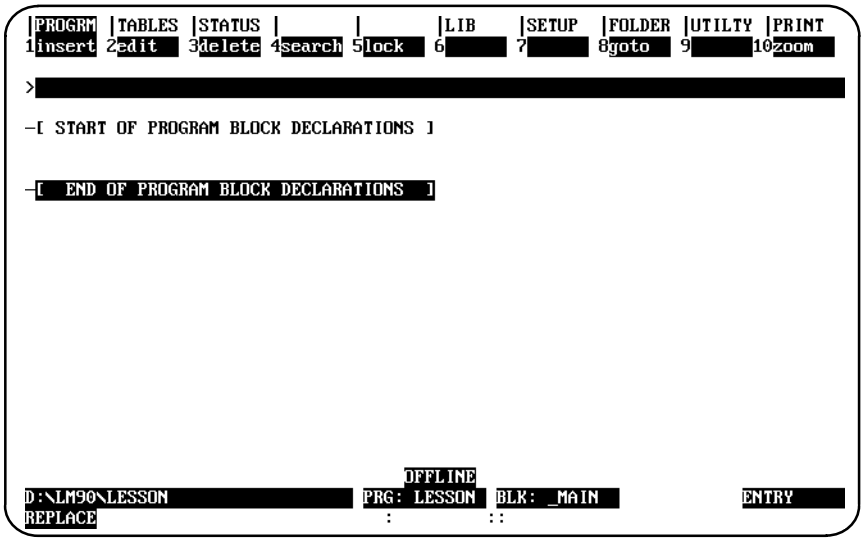
Creating a Program Block

Program blocks are declared through the block declaration editor.

1. To create a program block declaration, position the cursor on the **[BLOCK DECLARATIONS]** marker.

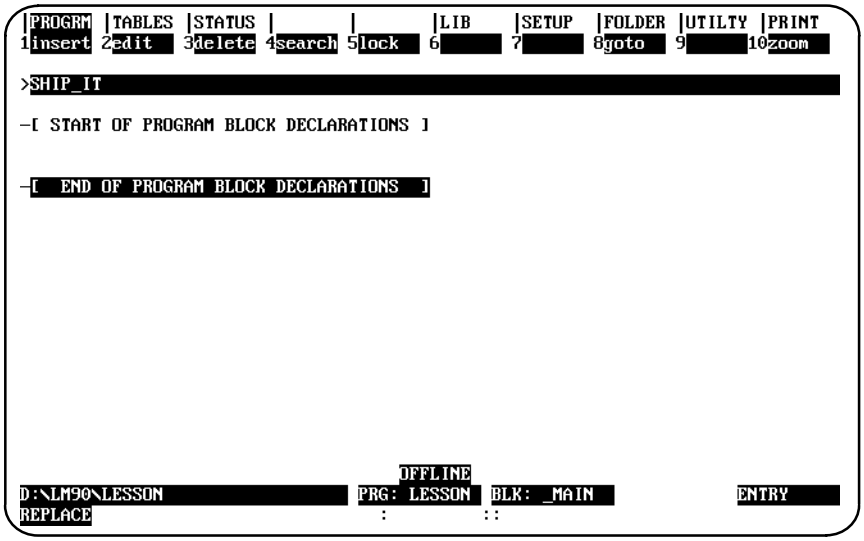


2. Then, press the **Zoom (F10)** key.

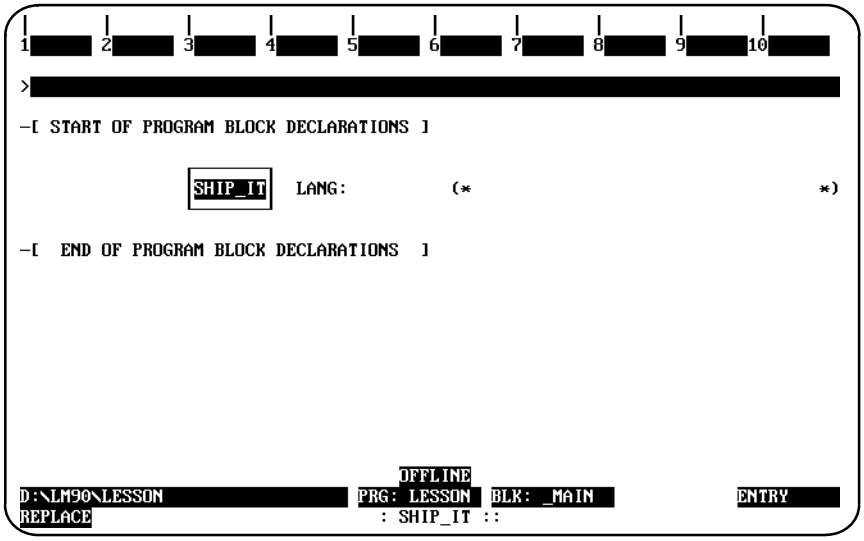


If you have the SFC option installed, you will an extra, self-explanatory, step here.

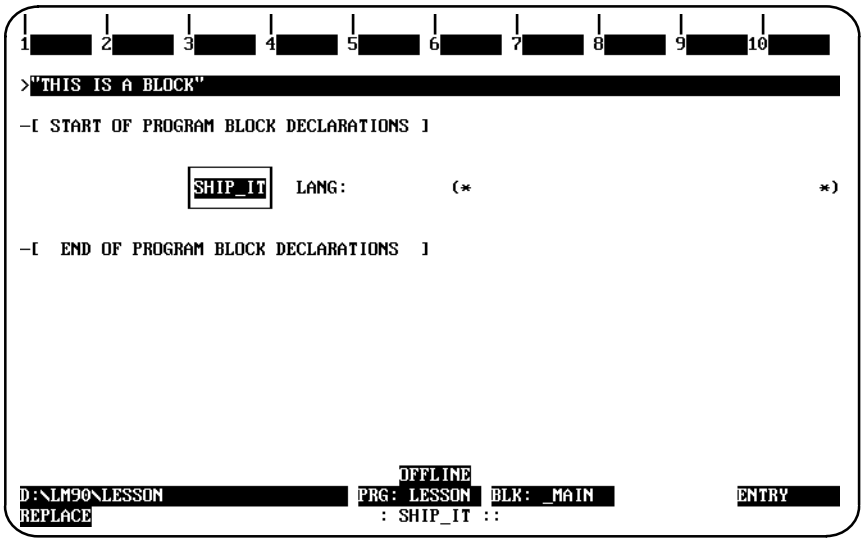
3. Enter the name of the program block on the command line. For this lesson, type in the name **SHIP_IT**. (make sure you include the underscore because only single name entries are allowed). Do ***not*** press the **Enter** key.



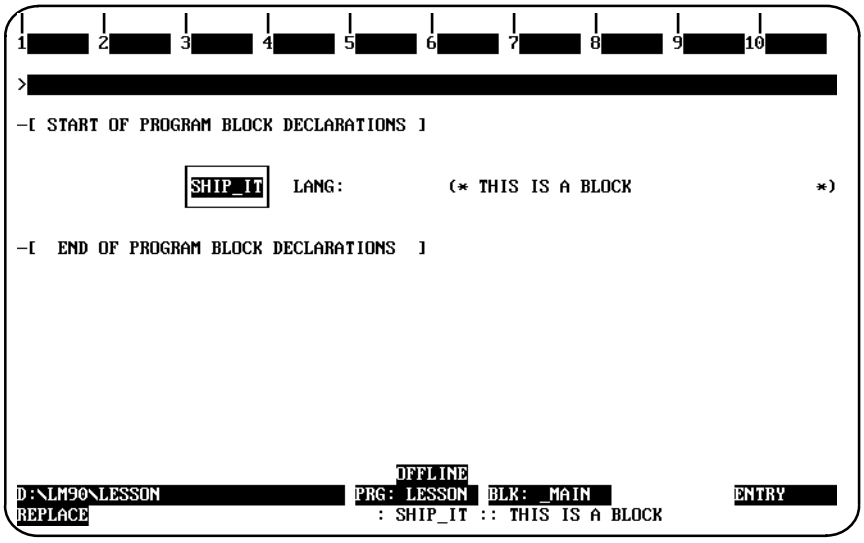
4. Then, press the **Insert (F1)** key.



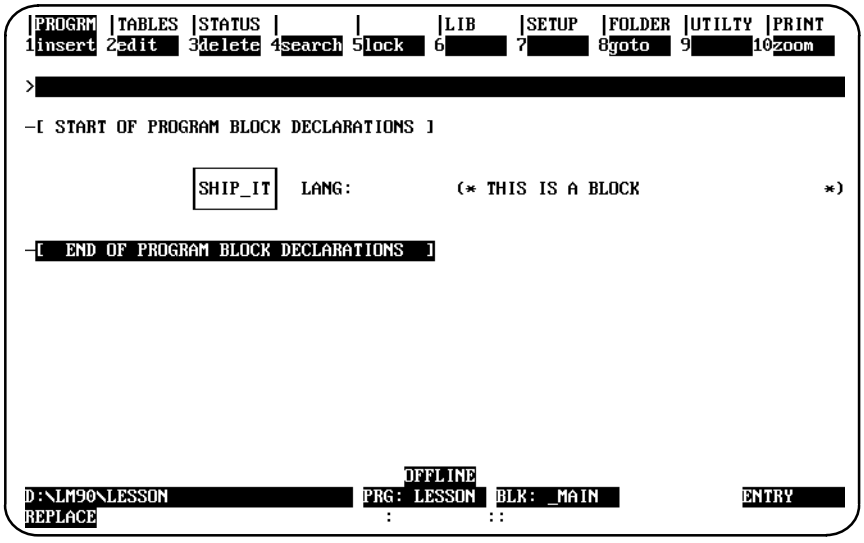
5. An explanation of up to 32 characters can also be entered at this time. Type the description **"THIS IS A BLOCK"** on the command line.



6. Press the **Enter** key.

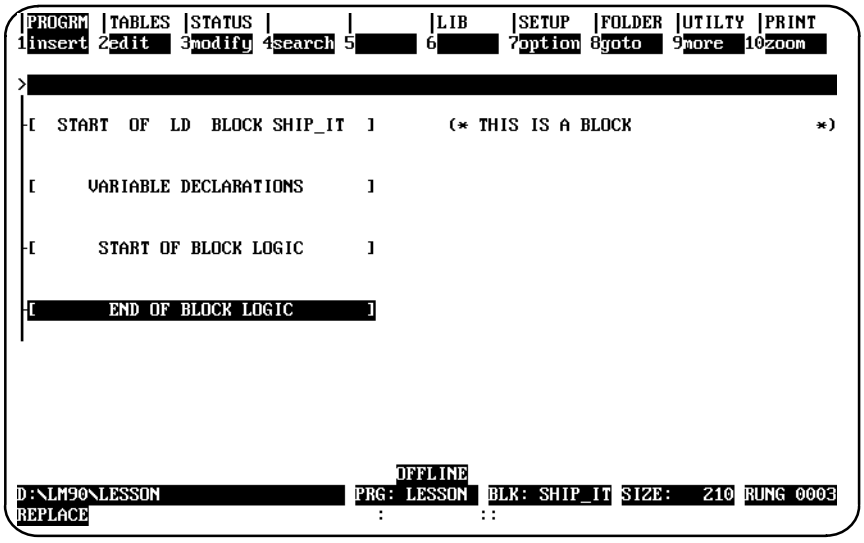


7. Then, press the **Escape** key.

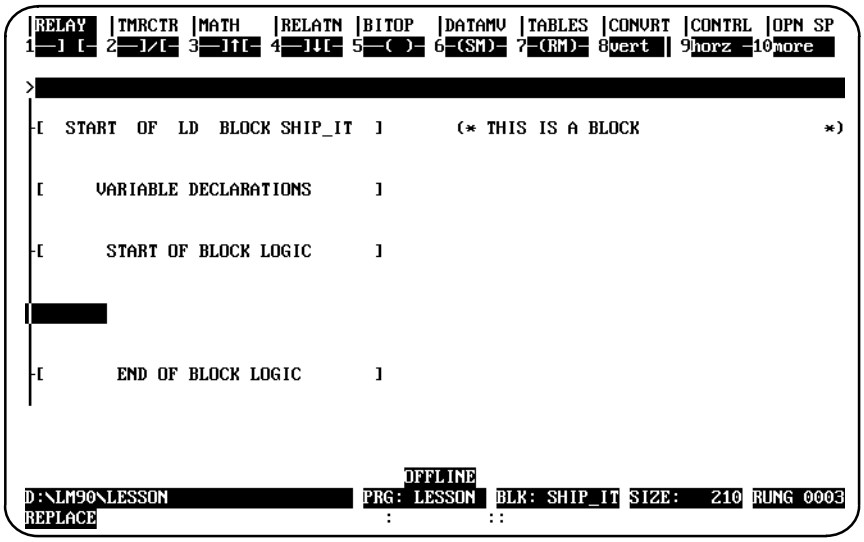


There are two alternate methods of entering this information. Both methods combine the previous step and this step into one operation. The first method is to type the name **SHIP_IT** and the description **"THIS IS A BLOCK"** together on the command line (separated by a space). Press the **Insert (F1)** key and then press the **Escape** key. The second method is to first press the **Insert (F1)** key, type the name and description together on the command line. Then, press the **Enter** key, followed by the Escape key.

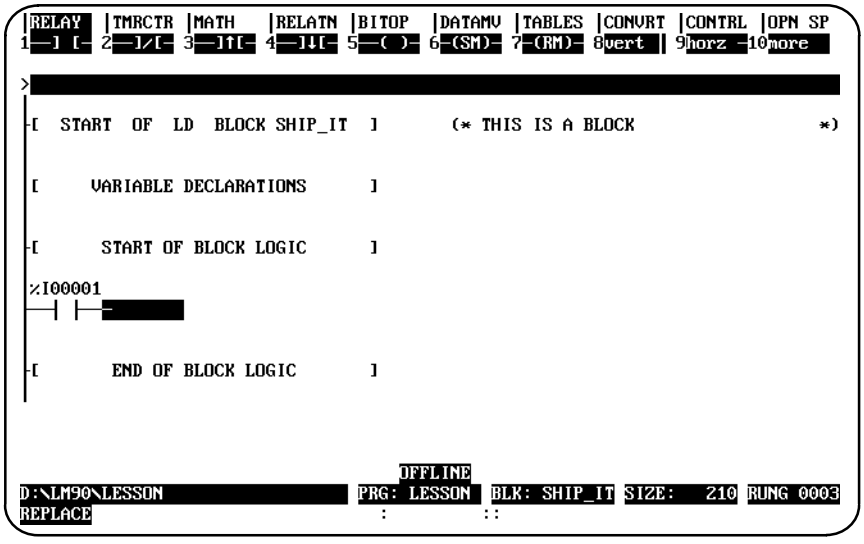
8. Use the cursor keys to position the cursor on the program block declaration named **SHIP_IT**. Then, press **Zoom (F10)**. Note that the name of the block (**BLK: _MAIN**) in the status area of the previous screen has now been changed to the name of the program block (**BLK: SHIP_IT**).



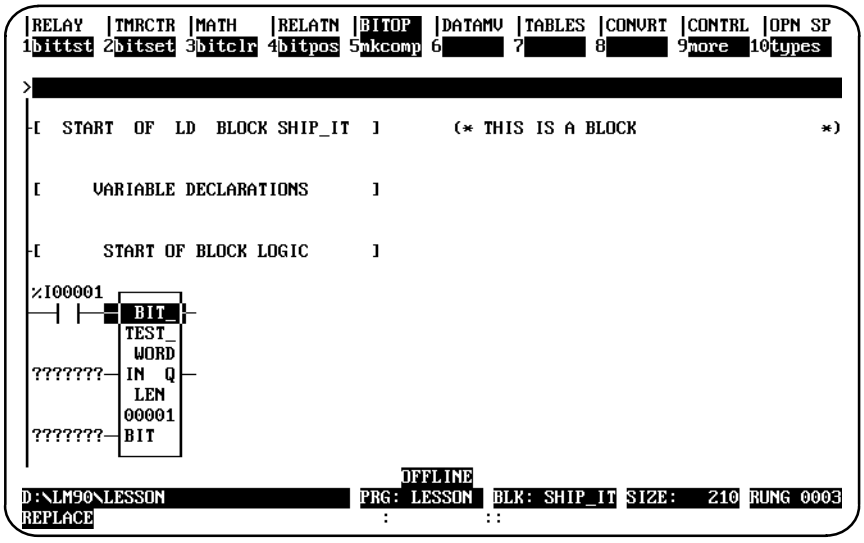
9. You can create logic for the program block on this screen. Position the cursor on the **[END OF PROGRAM LOGIC]** marker and press **Insert (F1)**. You can now insert ladder logic at the cursor location.



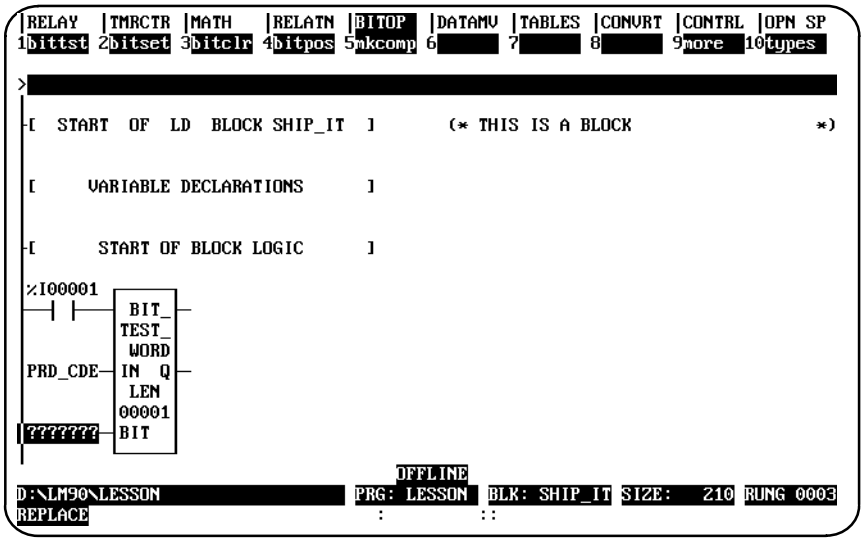
10. Press **F1** to start the rung with a normally open contact. Type in the reference **%I1**, and press the **Enter** key. The software automatically changes your entry to the correct format and moves the cursor to the next location in the rung.



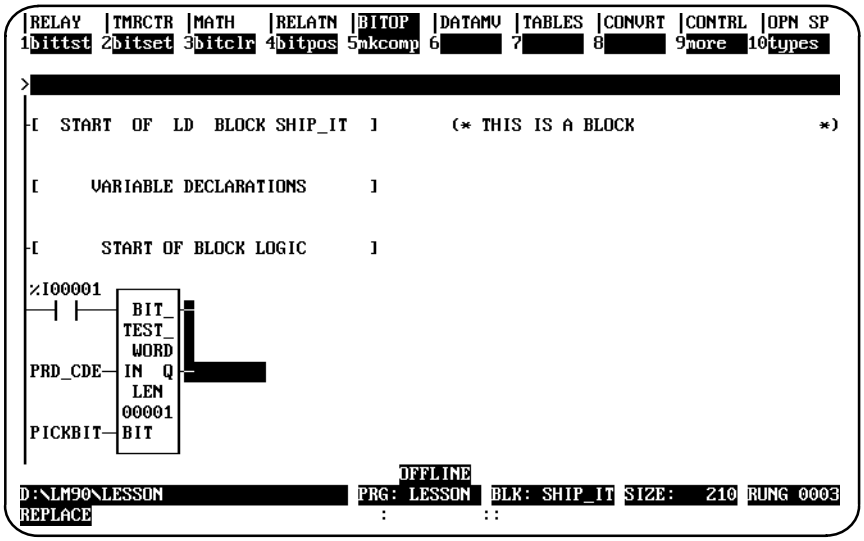
11. Add a bit operation function to the rung. To do so, press **Bit Operation (Shift-F5)** to select the functions. At the top of the screen, the reverse video block moves to BITOP. The second line shows the types of bit operation functions that are currently available. Press **More (F9)** to display additional bit operation functions you can select. Then, press **Bit Test (F1)** to insert a function in the rung that will test a bit within a bit string.



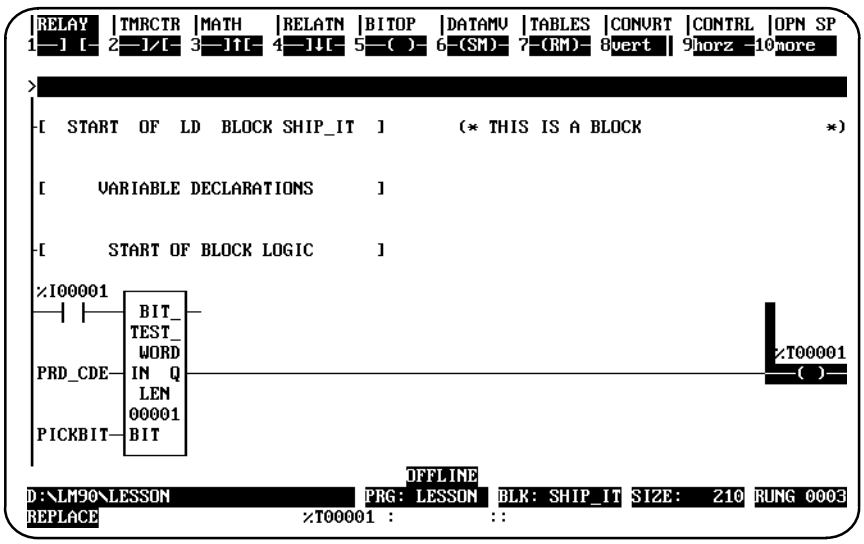
12. Use the **Tab** key to move the cursor to the parameter IN. IN contains the first word of the data to be operated on. For this lesson, type **PRD_CDE** on the command line. Because you have not previously entered the nickname PRD_CDE in the variable declaration table, you will also need to enter a reference address for the nickname now; therefore, after typing **PRD_CDE** on the command line, press the Space bar (to add a space to separate the two entries) and then type **%R1** for the reference address. Then, press the **Tab** key. The software will enter the reference address in the logic and automatically move the cursor to the next parameter (BIT).



13. BIT contains the bit number of IN that should be tested. For this lesson, enter **PICKBIT** and the reference address **%R2** on the command line—don't forget to separate the two entries with a space. (If the nickname PICKBIT had previously been entered in the variable declaration table, you would not need to enter it here on the command line.) Then, press the **Tab** key. Again, the software will enter the reference address in the logic and automatically move the cursor to the next parameter (Q).



14. Output Q is energized if the bit tested is a 1. Press **Relay (Shift-F1)** to display the relay functions. Then, type the reference **%T1** on the command line, and press **F5** to enter a coil at the end of the rung.



15. The LEN parameter represents the number of words in the string to be tested. This is set at 1 and does not need to be changed for this lesson. However, if you wanted to change the number of words to 5, for example, you would position the cursor on the function, enter **5** on the command line, and press the **Enter** key.

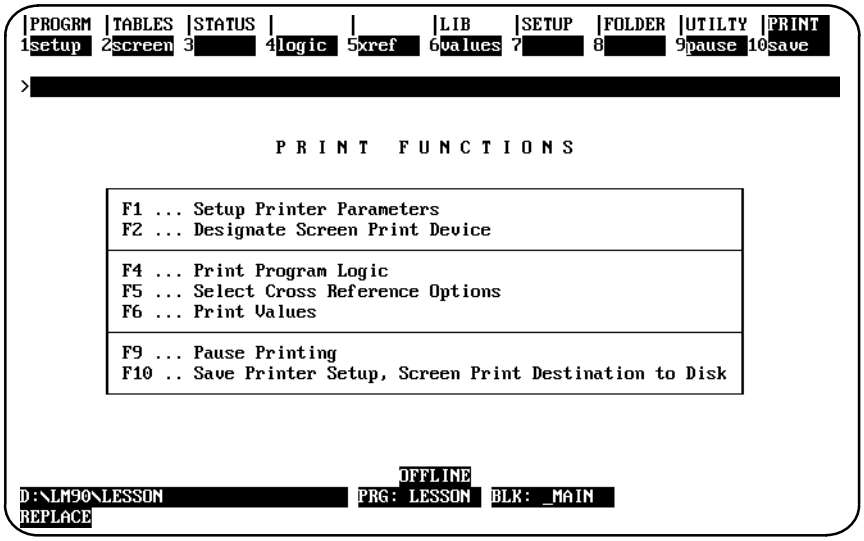
16. That completes the example program block. In this block, whenever input %I00001 is set, the bit at the location contained in reference PICKBIT is tested. The bit is part of string PRD_CDE. If it is 1, output Q passes power flow and coil %T00001 is turned on.

17. Press the **Escape** key a total of four times to return to the main menu. If you want to print this program now, continue the steps shown below.

Printing the Program

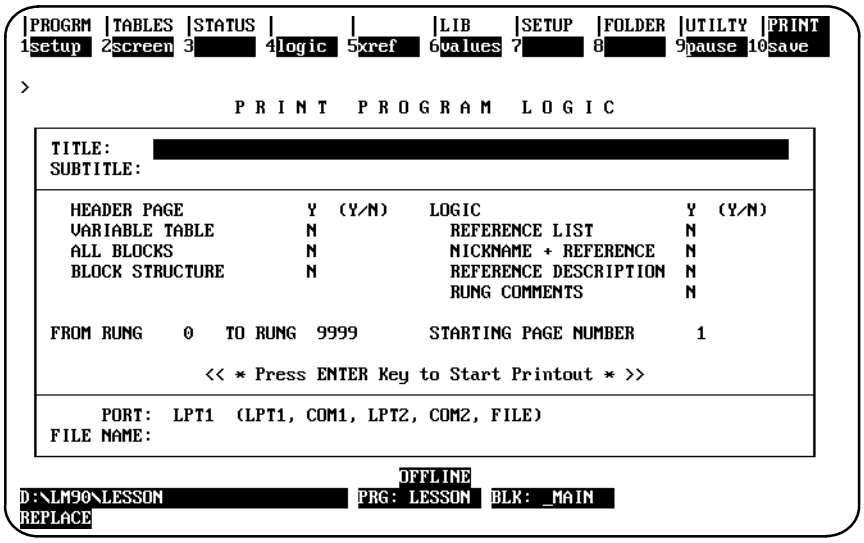
If you have a printer connected to the computer, and the Logicmaster 90-70 software has been set up to communicate with it, you can print the lesson program now. The software assumes a default printer setup. If that is not correct for your printer, you can enter changes on the Printer Parameters screen, as explained in chapter 10. If the printer has not already been used to print Logicmaster 90-70 programs, you should check chapter 10, "Print Functions," before continuing.

1. To display the Print Function menu, press **Print (F10)**.



This menu is used to set printer parameters (F1 and F2), request printing (F4, F5, and F6), pause printing (F9), and save the printer setup (F10). Default printer setup values are supplied with the software, but are easily changed if needed. Chapter 10 explains printer setup in detail.

2. Press **Logic (F4)** to print program logic. Define the printout content on the screen that appears.



3. Enter a title for the printout, such as: **PRACTICE PROGRAM**.
4. Both the title and subtitle entries are optional. Skip the subtitle entry.
5. The illustration above shows the default selections for the printout options. To include the example rung explanation in the printout, move the cursor to: "RUNG COMMENTS N." Use the **Tab** key to toggle the section from **N** (No) to **Y** (Yes).
6. The other entries shown are suitable for this lesson, so they can be skipped.
7. The listing destination (lower part of the screen) allows you to direct the printout to a serial or parallel port, or to a file. If the destination shown is not correct, use the **Down cursor** key to move the cursor to ***PORT***. Enter the correct port designation.
8. When you are ready to print the program, press the **Enter** key. When you see the prompt, "Start printout? (Y / N)," type **Y** to begin. While the program is being printed, the software displays the message:

Listing in progress ... (Listing CAN be paused or aborted).

Ending the Lesson

The program you created was saved when you exited the display / edit program function.

Appendix B Configuration Lesson

This appendix contains a tutorial for the configuration software package. The lesson includes:

- Creating a program folder.
- Configuring a CPU module.
- Configuring a Bus Expansion Module.
- Configuring a 90-70 I/O module.
- Configuring a Genius Bus Controller.
- Configuring a Genius I/O Block.

You can exit and save the lesson at any time, as explained below. It is not necessary to complete all of the steps.

- To exit and save the lesson, press the **Escape** key.
- To exit without saving the lesson, press **CTRL-Break**.

Help Screens

Logicmaster 90-70 software includes detailed Help screens. These Help screens are loaded onto the hard disk of your programmer during the software installation procedure and are readily accessible. To access the Help screens, press **ALT-H** for help, **ALT-I** for instruction mnemonic help, or **ALT-K** for key help.

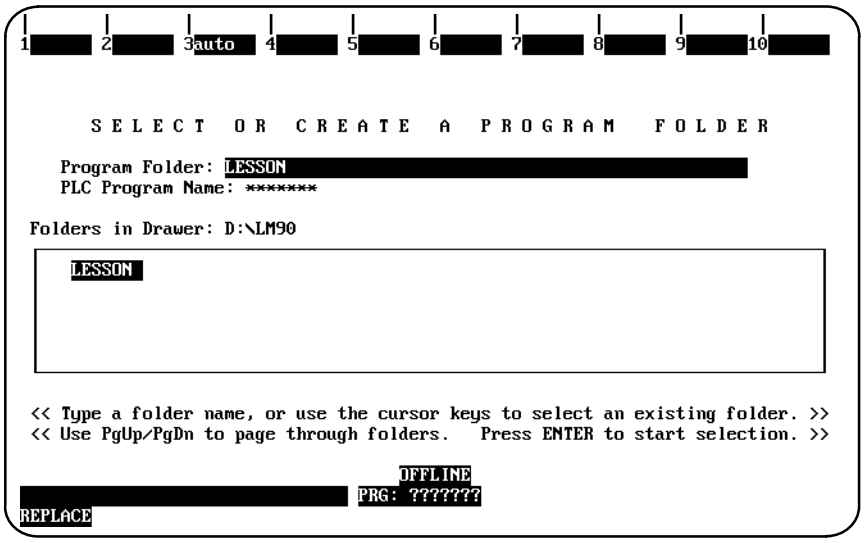
Starting the Lesson

Before you can start, the configuration software must be installed and started up. If that has not been done yet, please turn back to chapter 2, "Operation," for instructions.

Creating a Program Folder

Each program and its associated configuration are stored as many files. These files are stored in a subdirectory called a program folder. For this lesson, you will use a program folder named **LESSON**.

When Logicmaster 90-70 software is started (if the current default directory is an existing program folder), a screen similar to the one shown below appears. If the software is already running, you can display a similar screen from the Program Folder menu by pressing **Folder (F8 or Shift-F8)** from the configuration main menu and then Select (F1).

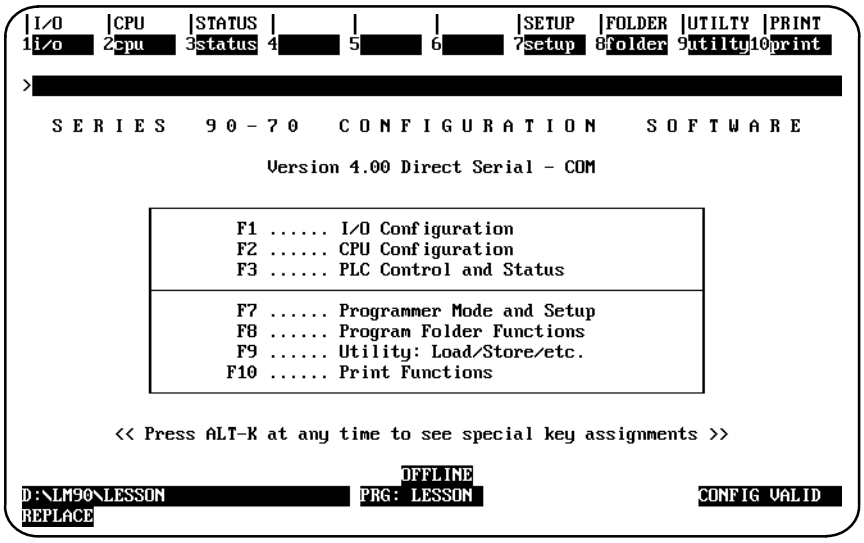


1. If the current default directory is not an existing program folder, type in a name of seven characters or less for the folder. For this lesson, type **LESSON**.

2. Press the **Enter** key. The following prompt will appear at the top of the screen:

```
Program folder does not exist; create new folder?  (Y/N)
```

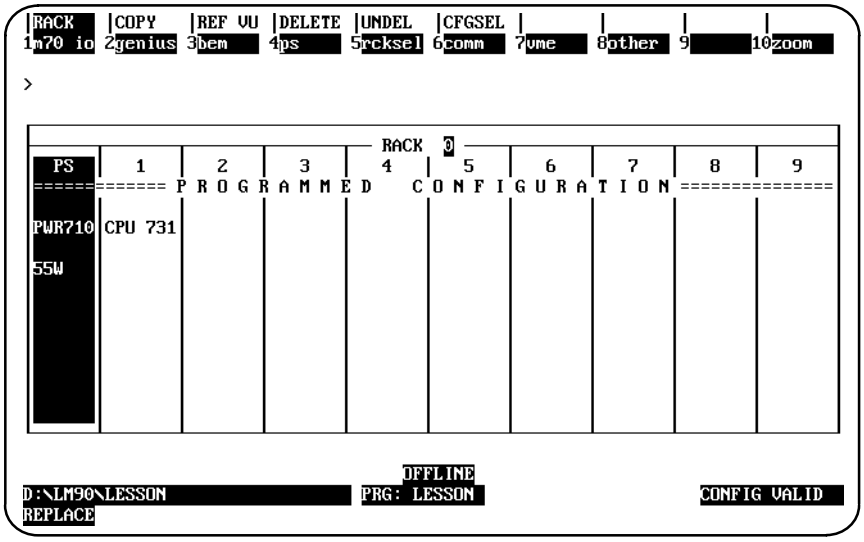
3. To create the program folder, enter **Y** (Yes). The software will accept the name and display the configuration software main menu.



The name of your new program folder (**LESSON**) should be displayed at the bottom of the screen.

Displaying the Rack Configuration

From the main menu, press **I/O (F1** or **Shift-F1** from the Folder screen) to display the beginning screen.

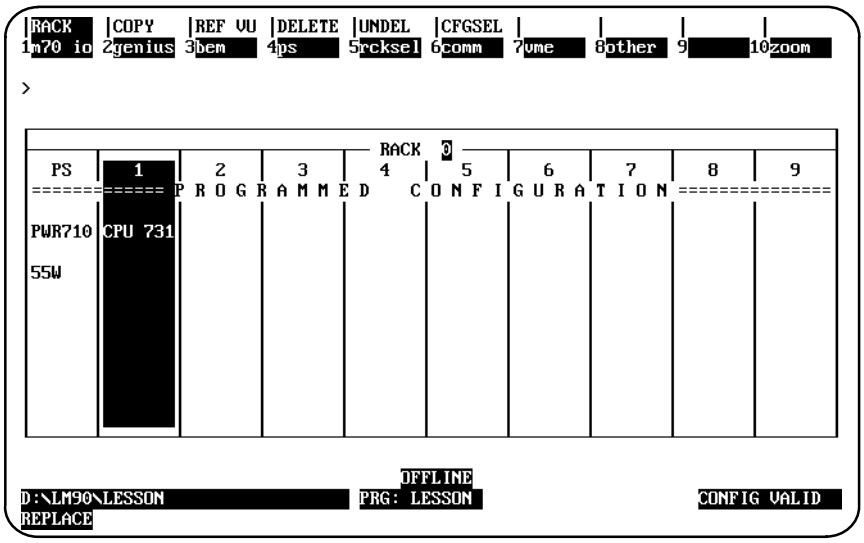


The screen shows the slots available in rack 0, which is the first rack in the system. Use the Next Page or Prev page key, or the Up or Down cursor key, to display the configuration of another rack.

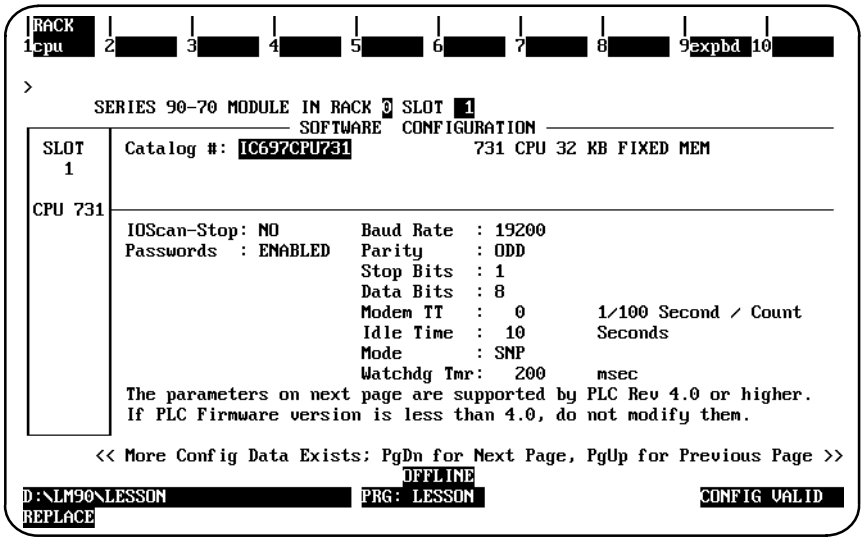
Configuring a CPU Module

The left slot contains the power supply. Although it requires no additional configuration, its configuration may be changed. Slot 1 contains the CPU module, for which you will enter an example configuration.

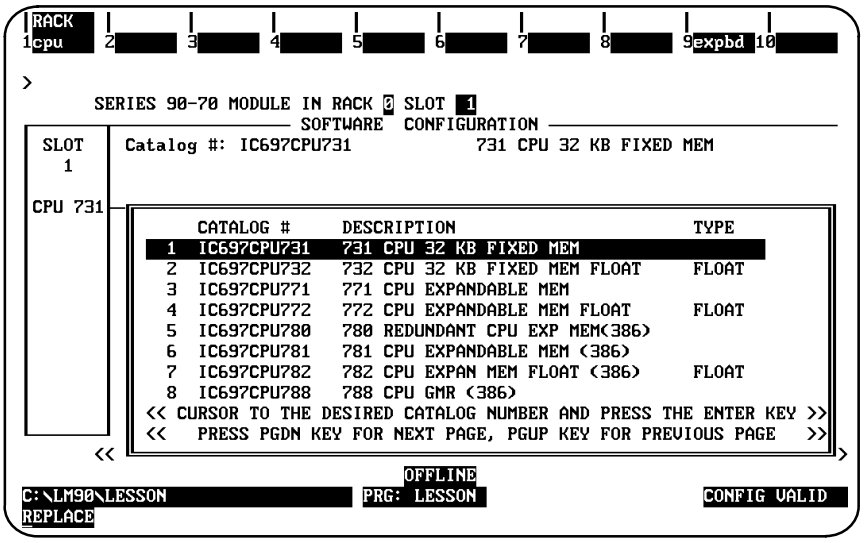
1. Press the **Right** cursor key once to highlight slot 1.



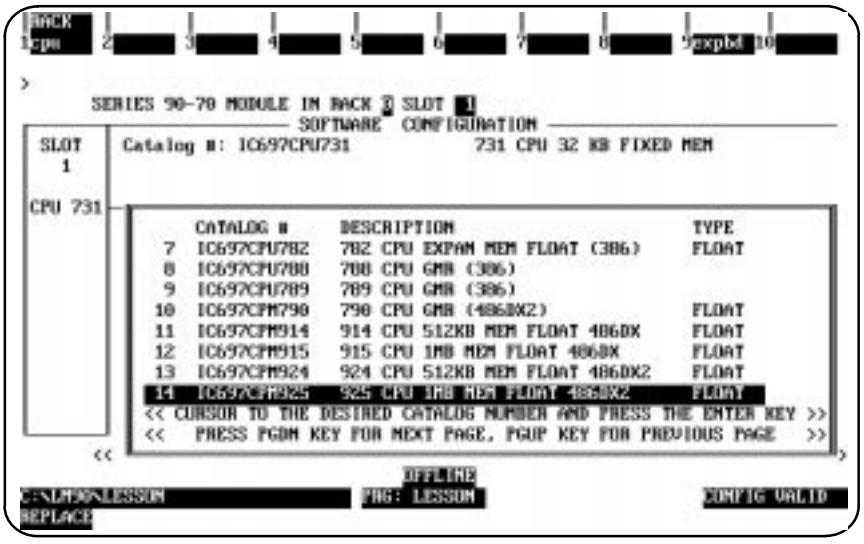
2. Press **Zoom (F10)** to display this detail screen.



3. When each of the parameters on the screen has been entered, press **CPU (F1)** to display the list of available CPU modules and their catalog numbers.



4. If you are configuring another type of CPU module, move the cursor to the desired module and press the **Enter** key. If your CPU is not listed on the first "page" (as shown above), then press the **Page Down** key to view the additional CPUs. The second page looks like the one shown below.

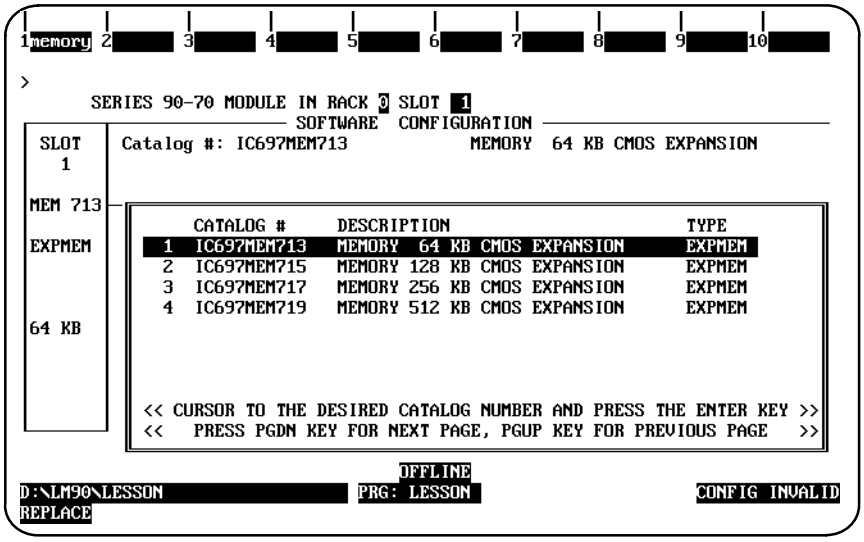


5. Then, enter **Y** (Yes) after the prompt:

```
REPLACE displayed module?  (Y/N)
```

6. Press **Rack (Shift-F1)** or the **Escape** key to exit from the detail screen and return to the rack display.

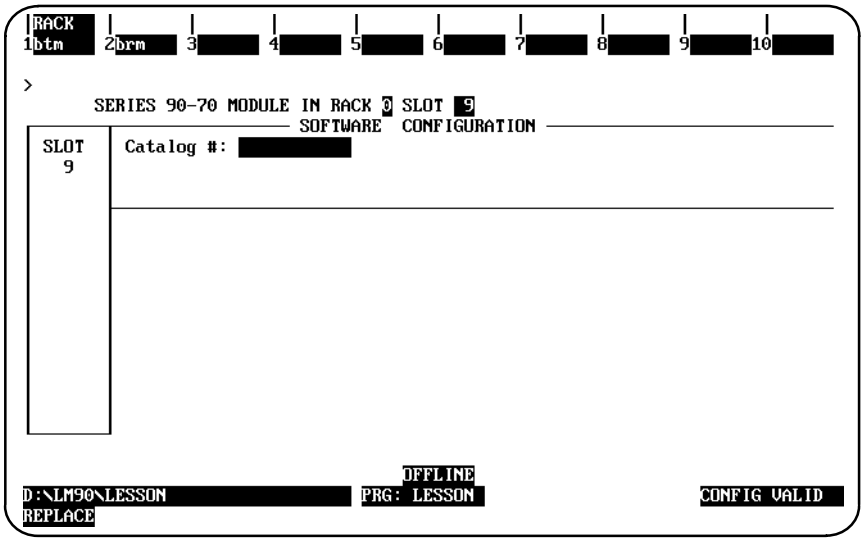
7. If the CPU requires expansion memory, a message indicating that will be displayed. To configure the CPU expansion memory, press **Expansion Board (F9)** and then **Memory (F1)** to display the list of catalog numbers.



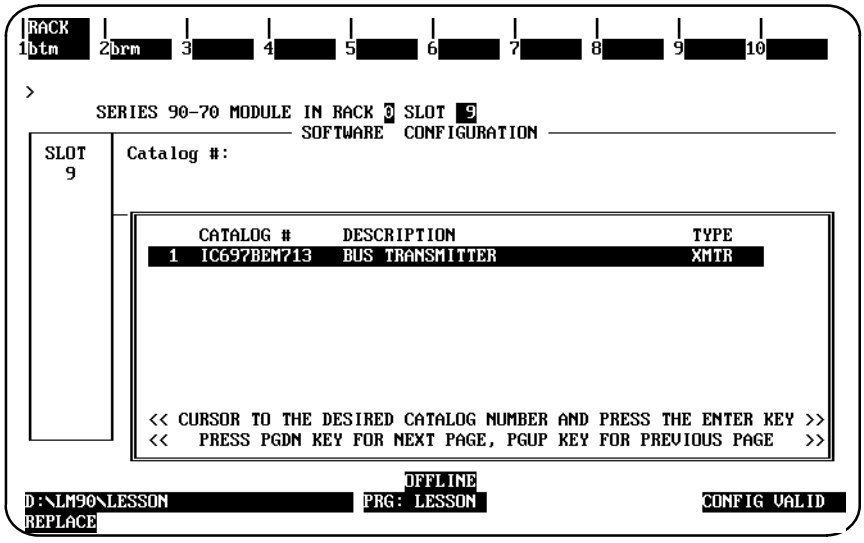
Select an expansion memory board by moving the cursor to any entry and pressing the **Enter** key.

8. Press the **Escape** key to exit the CPU detail screen. Press **Rack (Shift-F1)** or the **Escape** key again to return to the rack screen.

9. Press the **Right cursor** key repeatedly until the last slot on the screen is highlighted. Then, press **BEM (F3)** to locate a Bus Expansion Module in slot 9. The software zooms into this detail screen.



10. Because this is the first rack, the module in this slot must be a Bus Transmitter Module (to communicate with a Bus Receiver Module in the expansion racks). Press **F1** to display a list of Bus Transmitter Modules.



Note

Revision A of the Bus Transmitter Module should be the last module entered in the rack since it must be the right-most module. Revision B of the BTM module does not have to be the right-most module.

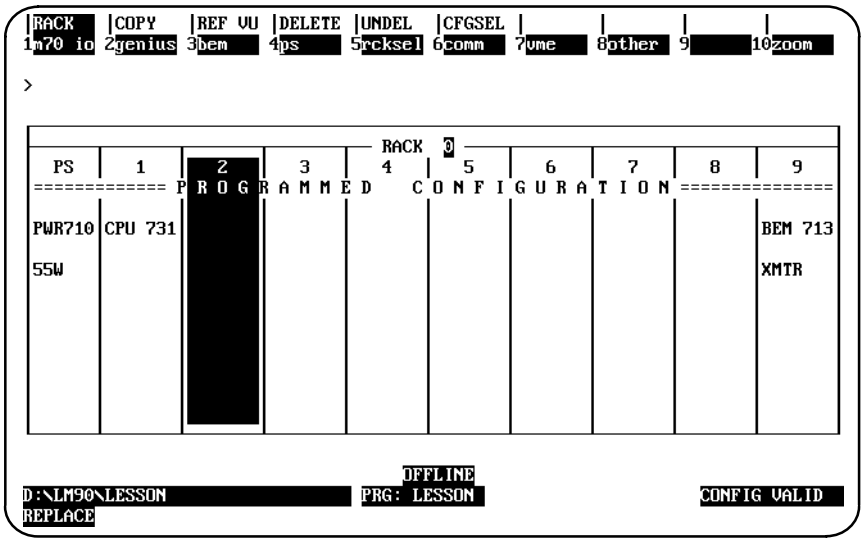
11. If more than one Bus Transmitter Module is listed, select one by moving the cursor to that entry and pressing the **Enter** key. The catalog number will be displayed in the ***Catalog #*** field.

12. Press the **Escape** key to save this change and return to the rack display.

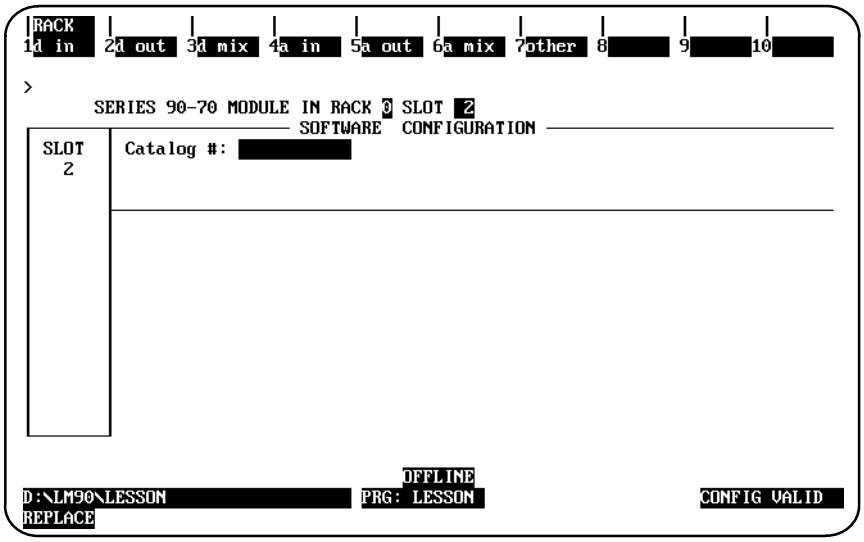
Configuring a 90-70 I/O Module

Next, you will configure slot 2 of the main rack for a 90-70 I/O module.

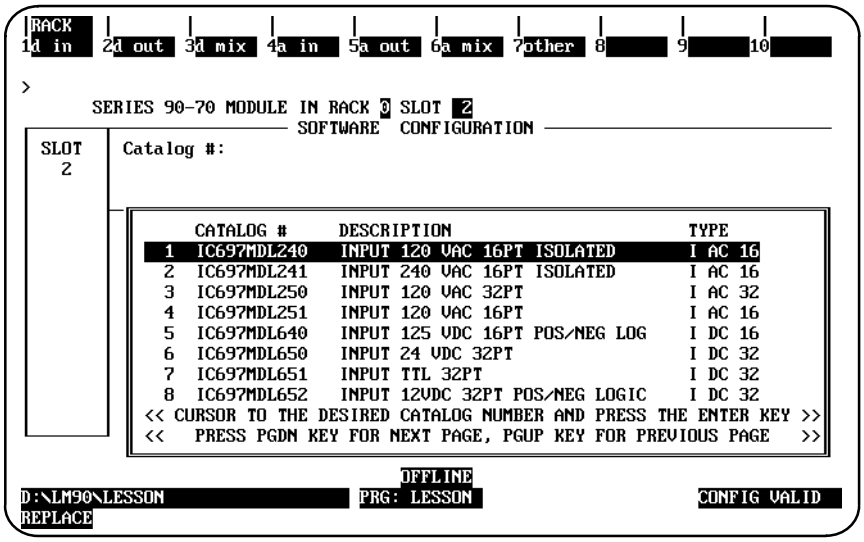
1. Use the Left cursor key to highlight slot 2.



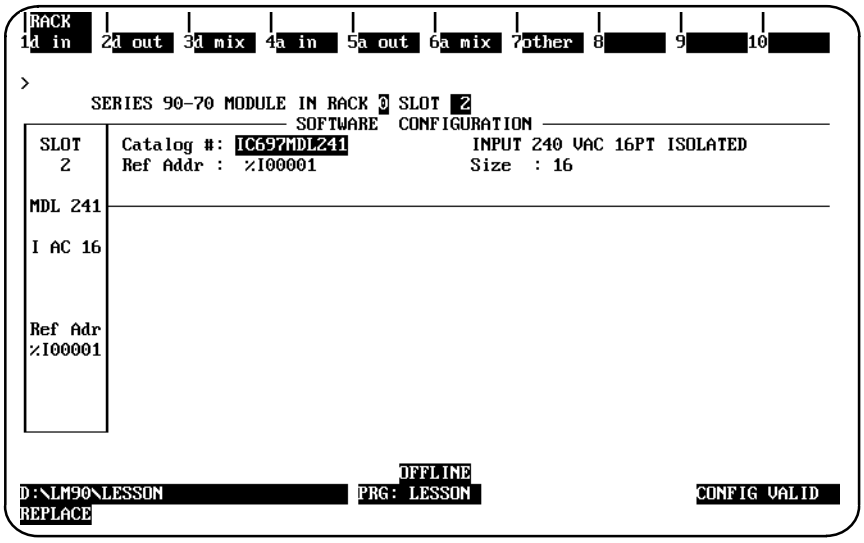
2. Press **Module 70 I/O (F1)** to locate a 90-70 I/O Module in slot 2. The software zooms into the detail screen.



3. The types of modules that might be placed in this slot are shown by the key functions at the top of the screen. For this example, select a Discrete Input module by pressing **F1**. A list of modules is displayed.



4. Select a module by moving the cursor to any entry and pressing the **Enter** key. Its catalog number will appear in reverse video in the proper field. For this example, move the cursor to **IC697MDL241** and press the **Enter** key. The following screen is displayed:



5. Assign a beginning I/O reference address to this module. Move the cursor down to:

```
Ref Addr :  %I00001
```

   For this example, you will purposely enter an incorrect I/O reference. First, move the small cursor to the right in the ***Reference Address*** field by pressing the **CTRL** and **Right cursor** keys. Enter **1** and then **6** as the last two digits. Now the reference address should look like this:

```
Ref Addr :  %I00016
```

   This reference address is incorrect because it does not begin on a byte boundary. (A byte boundary is a number which is one greater than an integer multiple of 8; for example, 1, 9, 17, or 25.)

6. Watch the reference address. Notice that when you press the **Down cursor** key once, the software automatically changes the reference address to the next lowest byte boundary:

```
Ref Addr :  %I00009
```

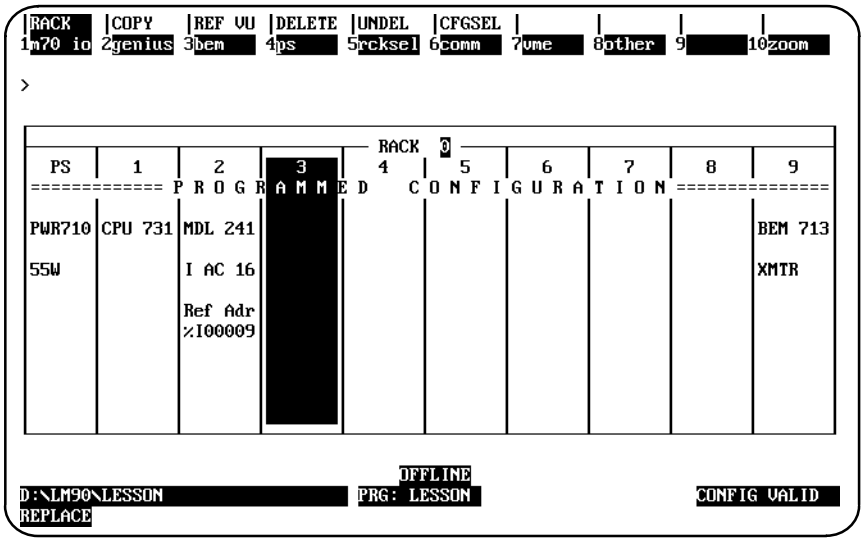
   and the message "The Reference Address has been adjusted to be byte aligned" will be displayed.

7. For this lesson, the rest of the entries on this screen need not be changed. Press the **Escape** key to return to the rack display.

Configuring a Genius I/O Bus Controller

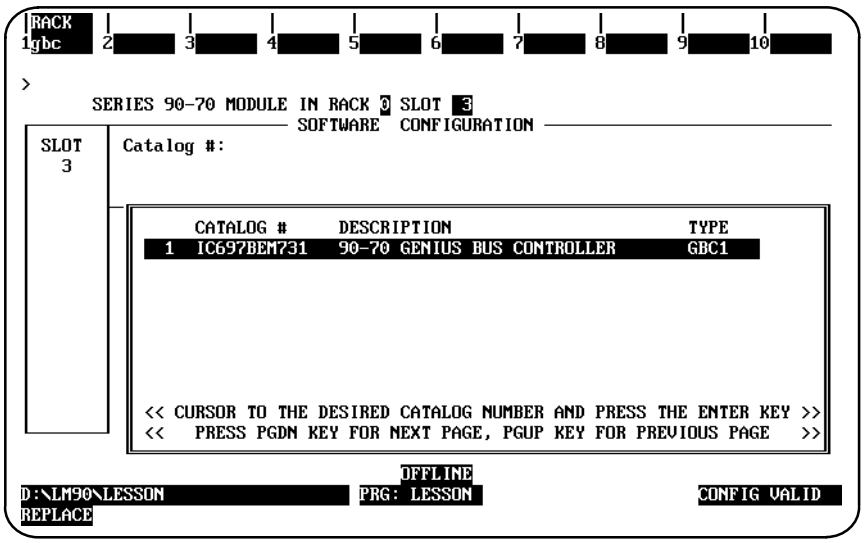
Next, you will configure slot 3 of the main rack for a Genius Bus Controller.

1. Use the Right cursor key to highlight slot 3.

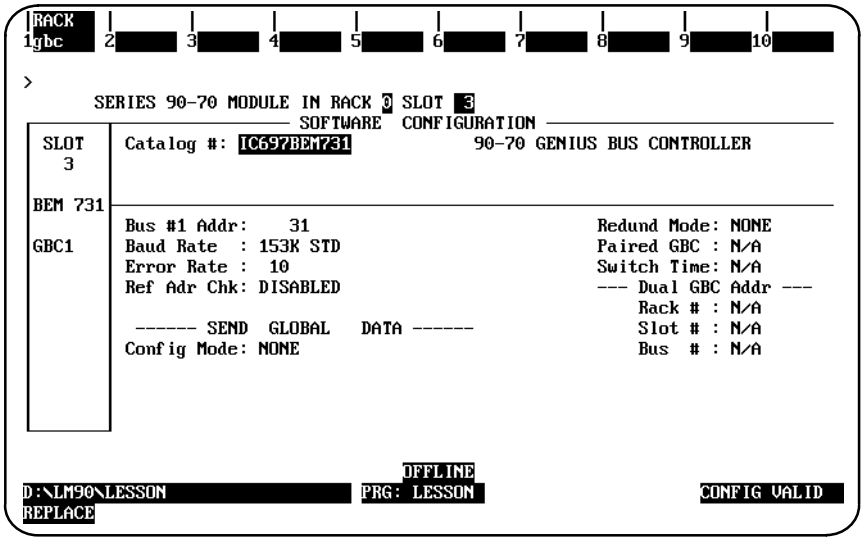


2. Press **Genius (F2)** to locate a Bus Controller in slot 3. The software zooms into a detail screen.

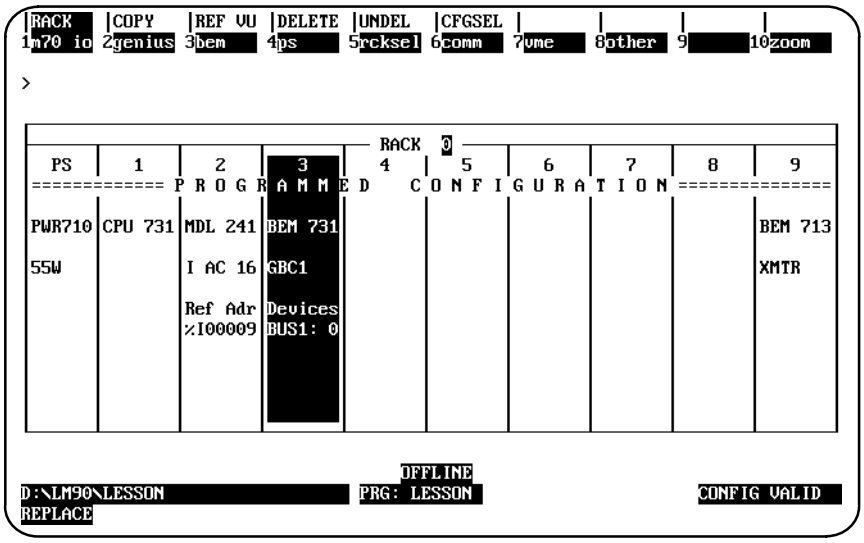
3. Press **GBC (F1)** to display the entry for the Genius Bus Controller (**IC697BEM731**).



4. Then, press the **Enter** key.



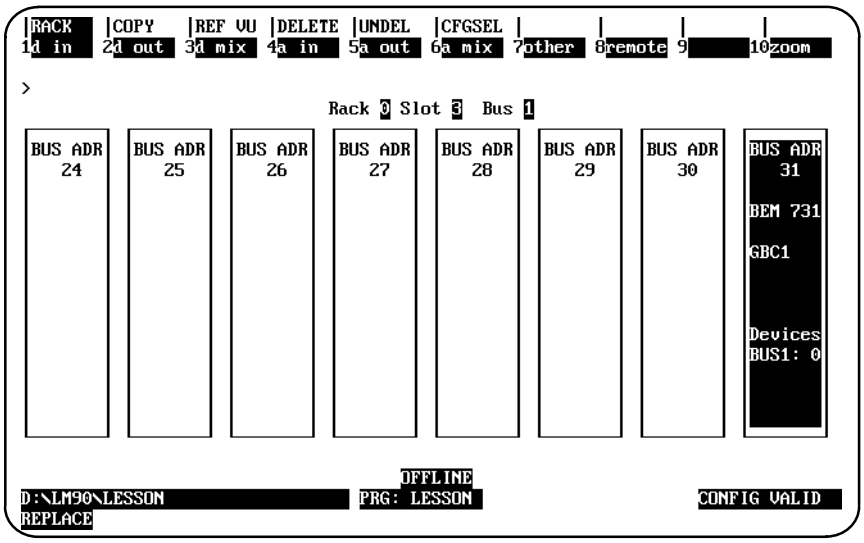
5. To change the bus controller parameters shown in the center area of the screen, you must be familiar with information in GEK-90486. For this example, we will assume the default entries are correct. Press **Rack (Shift-F1)** or the **Escape** key to return to the rack display.



Configuring a Genius I/O Block

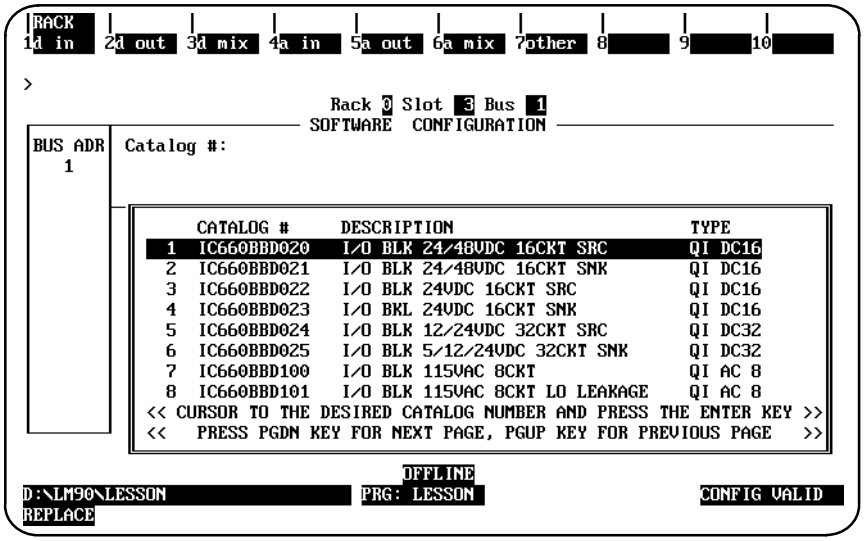
In order to configure a Genius I/O block, the cursor should still be on slot 3 of the rack display, as shown in the previous screen above.

1. Press **Zoom (F10)**. The software zooms into the Bus screen which represents the locations of devices on the bus.

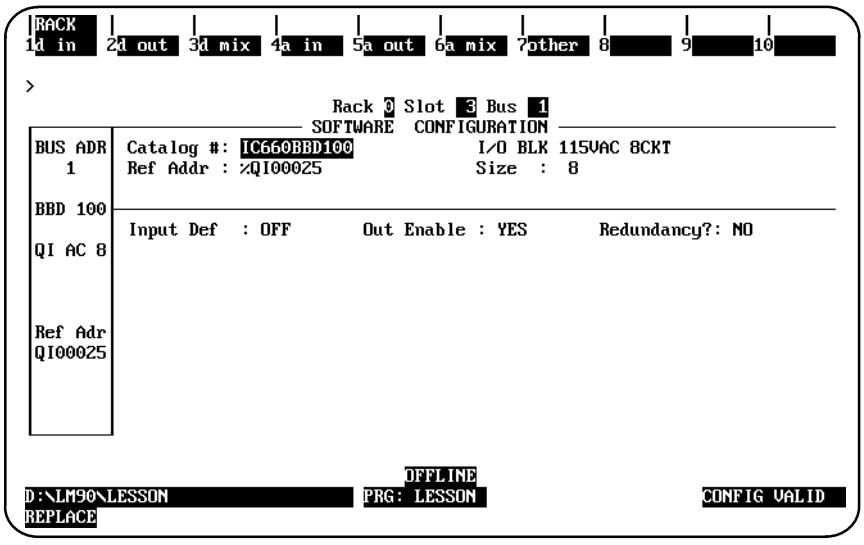


2. The cursor highlights the bus controller, which was assigned device number (bus address) 31 automatically during the previous part of the lesson.

3. For the lesson, assign a Genius I/O block to device number (bus address) 1 by pressing the **Right cursor** key twice. The screen displays blocks which represent device numbers 0 through 7. With the cursor on BUS ADR 1, press **F3** to select the type of block.



4. Select a catalog number by moving the cursor, if necessary, and pressing the **Enter** key. The screen will display additional entries if you press the **cursor** keys. For this lesson, select the Genius Phase B 115VAC 8 circuit I/O block (**IC660BBD100**) by moving the cursor to that entry and pressing the **Enter** key.



5. Move the cursor down to:

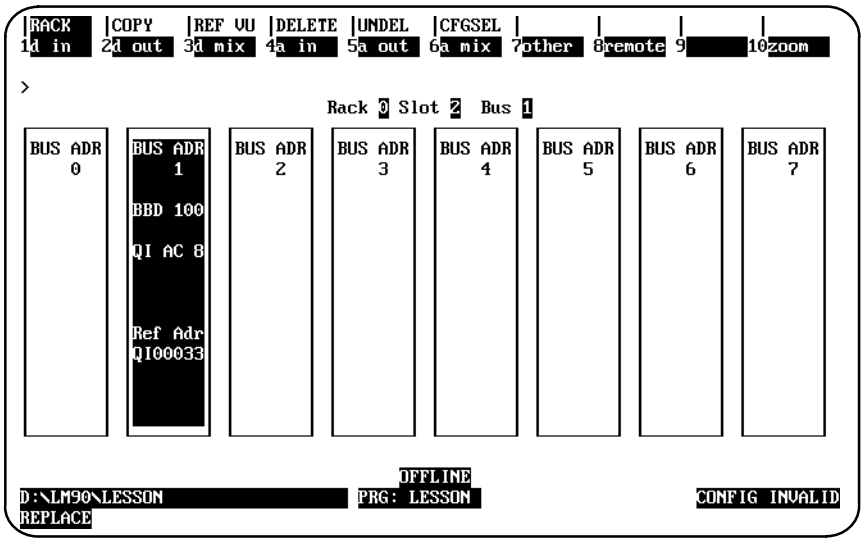
```
Ref Addr :  %QI00025
```

   Notice that the software has automatically assigned the next available I/O references. It is not necessary to change this reference address. However, for the lesson you can move the cursor using the CTRL and Right cursor keys, then enter:

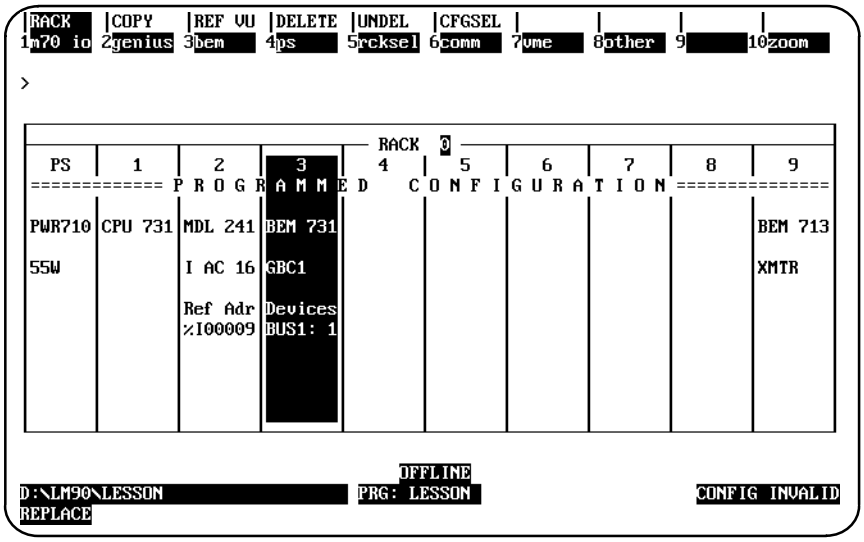
```
Ref Addr :  %QI00033
```

   and press the **Enter** key. This reference address is correct because it begins on a byte boundary.

6. For this lesson, the rest of the entries on this screen do not need to be changed. Press **Rack (Shift-F1)** or the **Escape** key to return to the bus display.



7. Press **Rack (Shift-F1)** or the **Escape** key again to return to the rack display. The entries you have made will automatically be saved in program folder named **LESSON**.



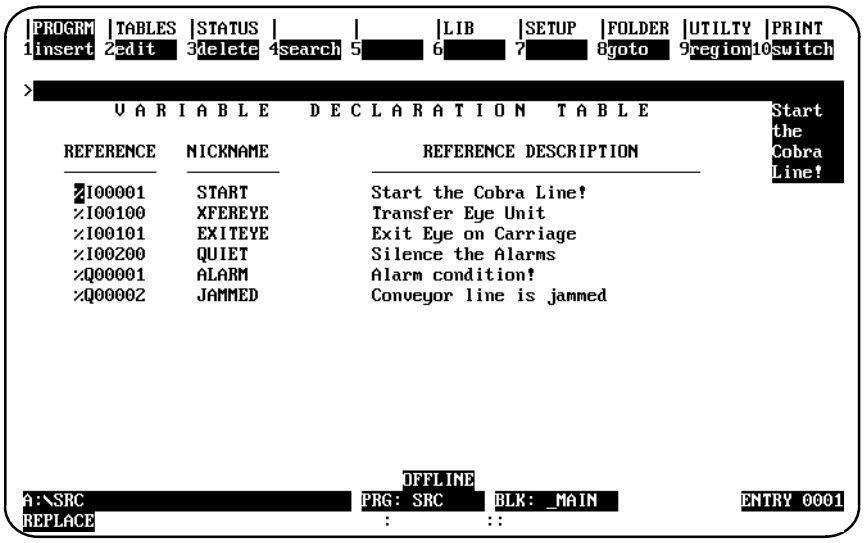
Ending the Lesson

The configuration created was saved when you pressed **Rack (Shift-F1)** or the **Escape** key to return to the rack display. This is the end of the lesson.

Appendix C Variable Programming Lesson

This appendix contains a tutorial which illustrates how to redefine variables while importing a program folder to the library:

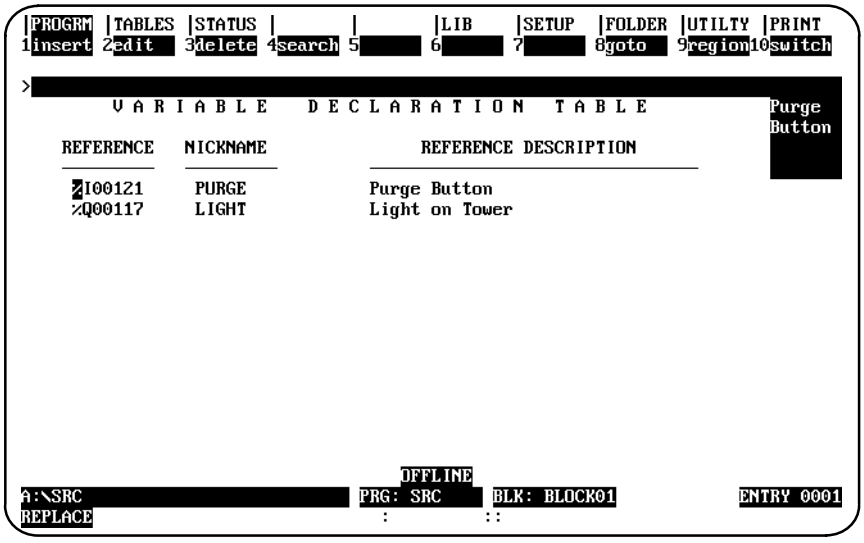
1. Create a source program folder named **SRC**. Position the cursor on the **[VARIABLE DECLARATIONS]** marker in the programming software, and press **Zoom (F10)** to display the global variable declaration table. Enter the variables shown on this screen in the _MAIN variable declaration table.



2. Press the **Escape** key to return to the list of markers. Then, move the cursor to the **[PROGRAM BLOCK DECLARATIONS]** marker, and press **Zoom (F10)**.

3. Create a program block named **BLOCK01** in program folder **SRC**. Then, press **Zoom (F10)** to zoom into that block.

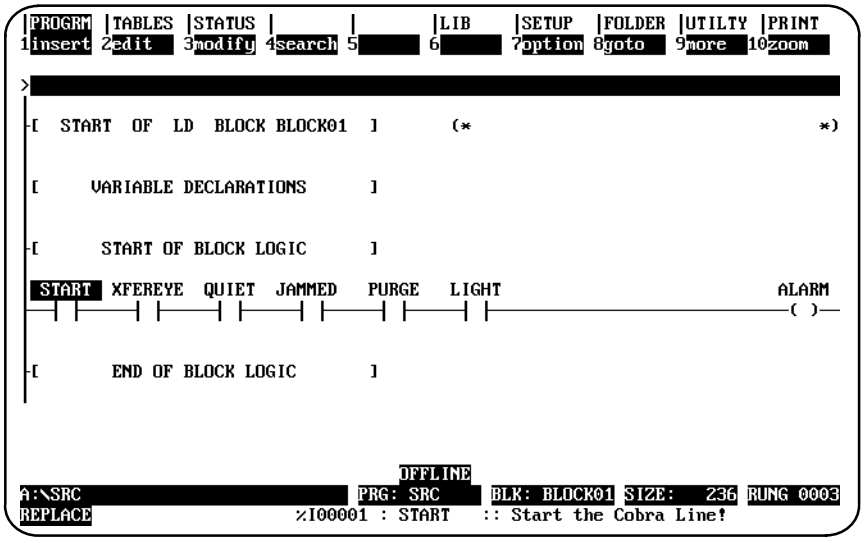
4. Move the cursor to the **[VARIABLE DECLARATIONS]** marker for **BLOCK01**, and press **Zoom (F10)**. Enter the variables shown on this screen in the local variable declaration table for **BLOCK01**.



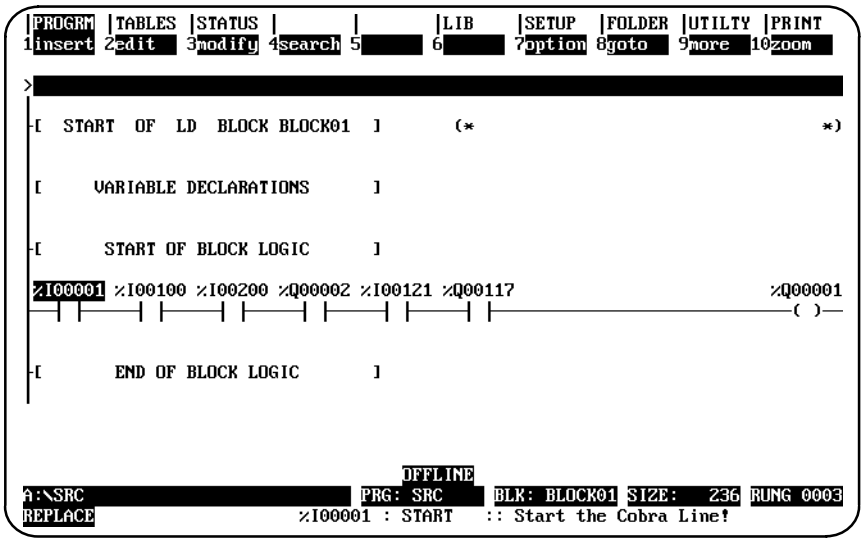
Note that **BLK: BLOCK01** is now displayed on the status line. **BLK: _MAIN** was displayed on the status line for the global variable declaration table in program folder **SRC**.

5. Press the **Escape** key to return to the list of markers. Then, move the cursor to the **[END OF BLOCK LOGIC]** marker, and press **Insert (F1)**.

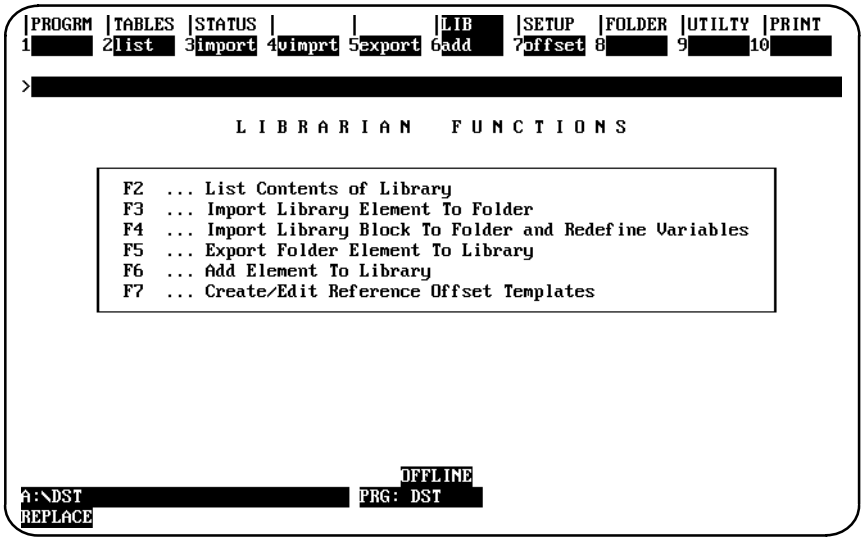
6. Enter the logic for **BLOCK01** using variables from both the global and local variable declaration tables. The variables **START**, **XFEREYE**, **QUIET**, **JAMMED**, and **ALARM** are from the global variable declaration table; **PURGE** and **LIGHT** are from the local variable declaration table.



7. Press **ALT-N** to view the logic with reference addresses.

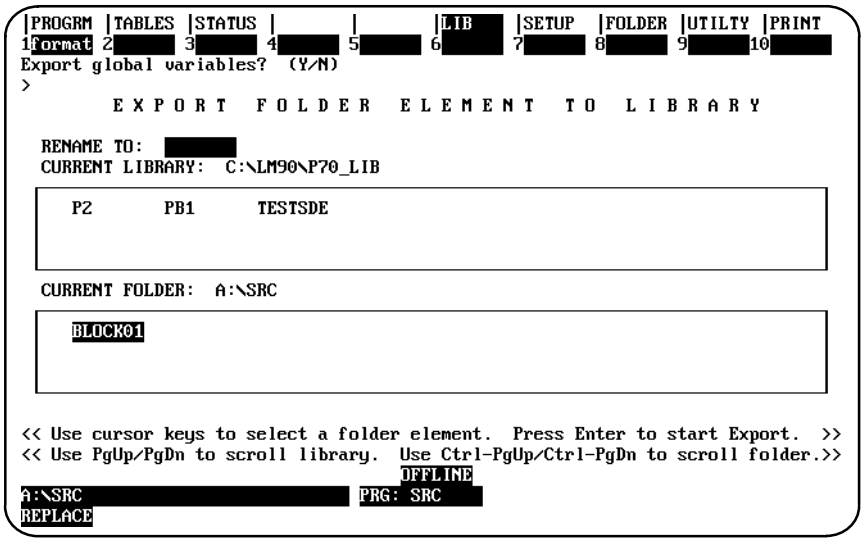


8. Press the **Escape** key repeatedly to exit **BLOCK01** and exit the program editor. Select Program Block Librarian (F6) from the programming software main menu.



9. Use the Export function (F5) to place **BLOCK01** in the library with global variables. You must enter **Y** after the prompt:

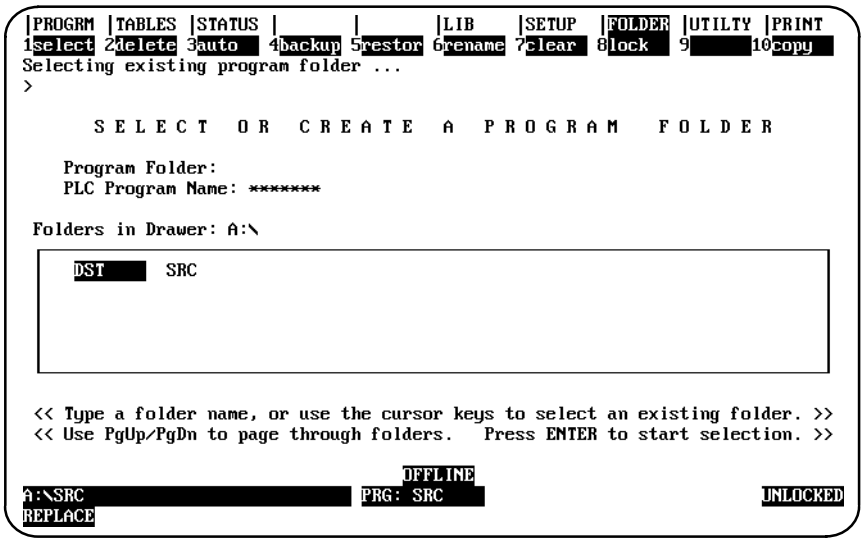
```
Export global variables?  (Y/N)
```



The export operation only takes those global variables that **BLOCK01** uses in its logic.

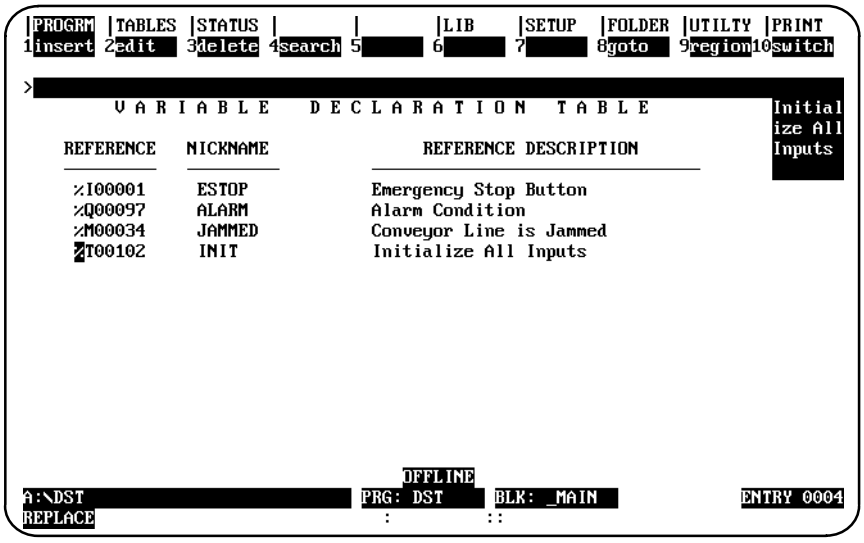
10. When the export operation is completed, press the **Escape** key to return to the programming software main menu. That completes the source program folder.

11. Select or create a destination program folder. For the sample screen shown below, an existing program folder named **DST** was selected.

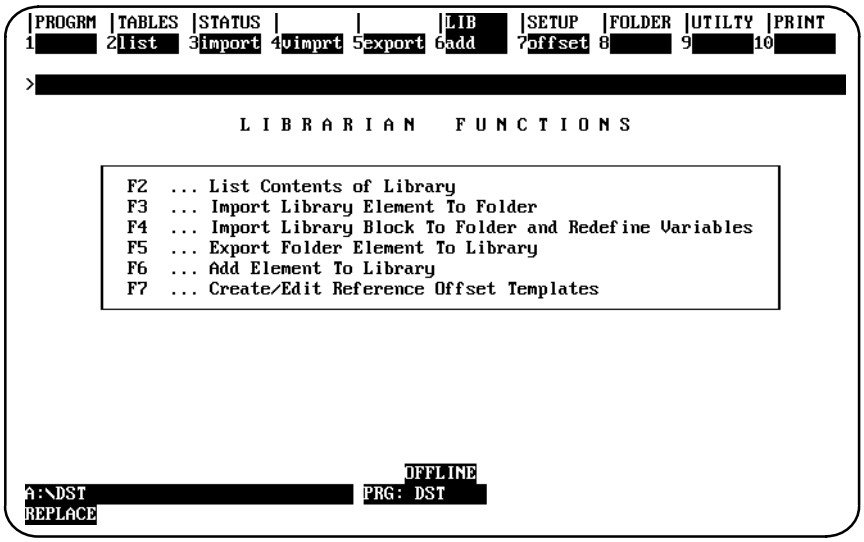


If you do not already have a folder named **DST**, you can create one.

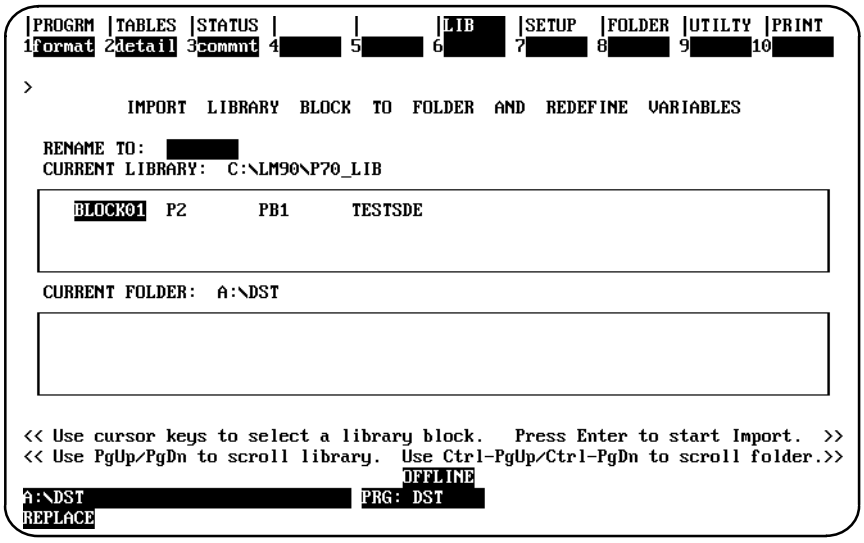
12. Position the cursor on the **[VARIABLE DECLARATIONS]** marker in the programming software, and press **Zoom (F10)** to display the global variable declaration table. Enter the variables shown on this screen in the _MAIN variable declaration table. Note that the nicknames **JAMMED** and **ALARM** were also used in the global variable declaration table for folder **SRC**.



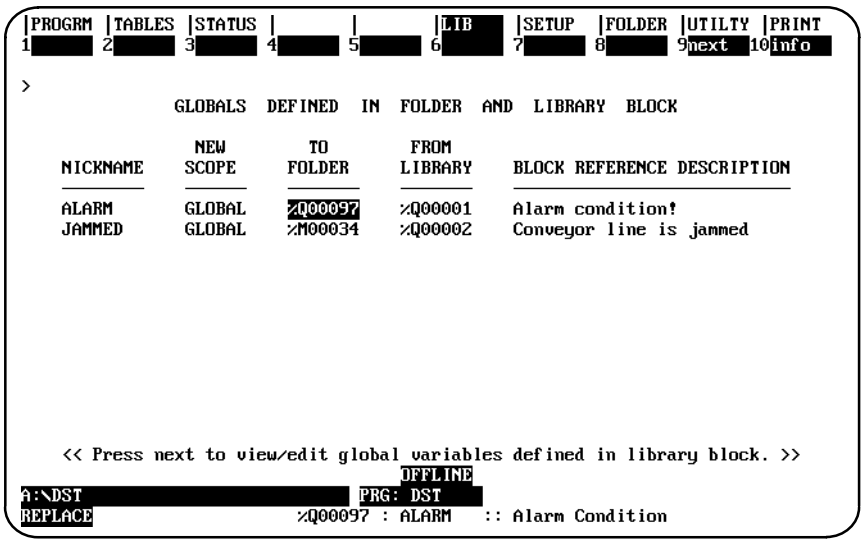
13. Press the **Escape** key twice to return to the programming software main menu.
14. Select the Program Block Librarian (F6).



15. Press **Variable Import (F4)** to import **BLOCK01** to the folder **DST** as **BLOCK01**.



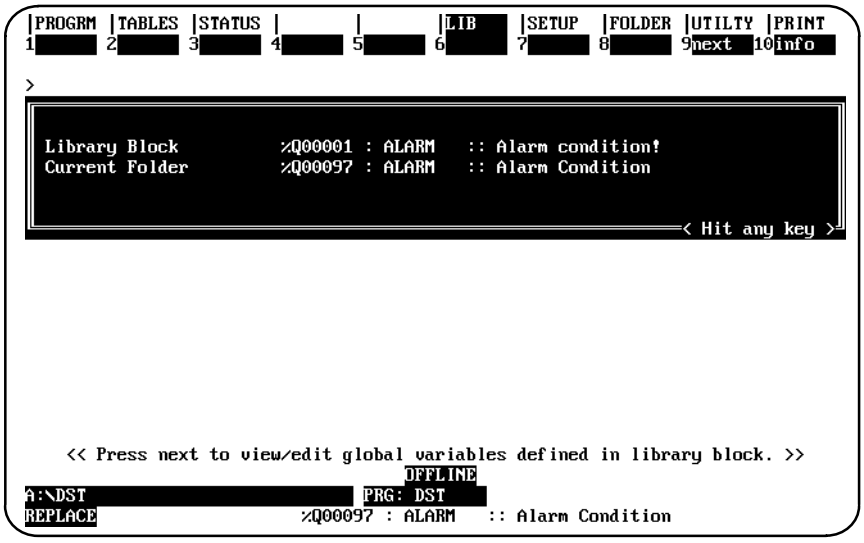
16. Press the **Enter** key. The first screen displayed contains the nicknames used in **BLOCK01** in both the **SRC** and **DST** global variable declaration tables. The reference addresses in the ***From Library*** column are from **BLOCK01**; the reference addresses in the ***To Folder*** column show how the nickname is assigned in folder **DST**.



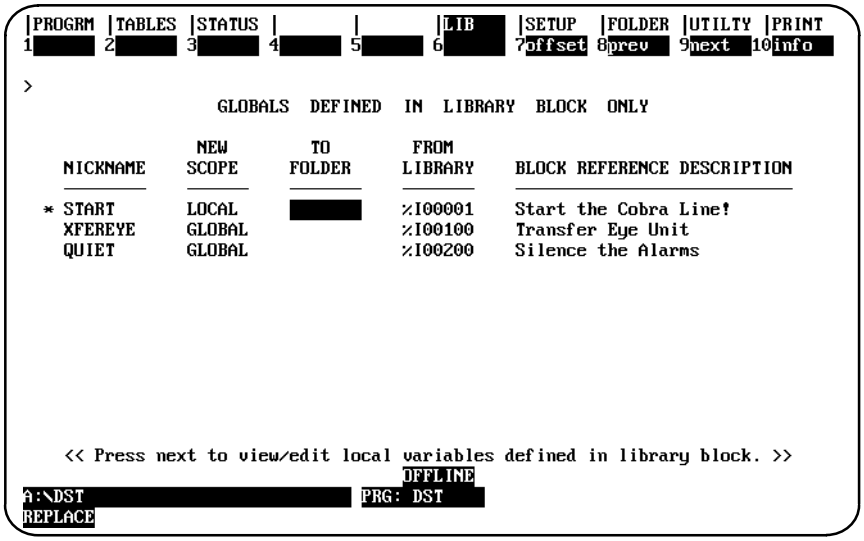
You can change the ***Scope*** for either nickname to local.

By default, %Q00001 is reassigned to %Q00097 in the logic for **BLOCK01**, but it still has the same nickname **ALARM**. Also, %Q00002 is reassigned to %M00034 with the same nickname **JAMMED**.

To display additional information about the use of a nickname in the table, position the cursor on that line and press **Information (F10)**. To display a screen similar to the one shown below, position the cursor on the line for **ALARM** and press **F10**.

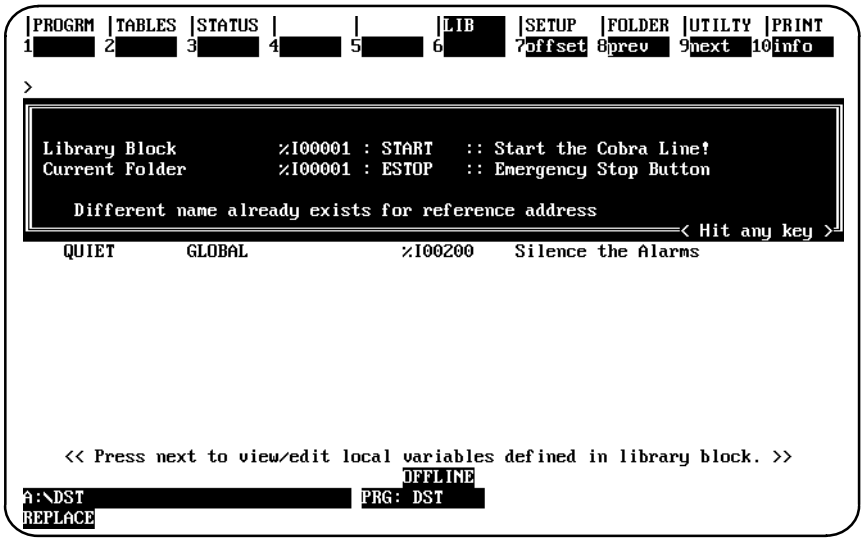


17. Press **Next (F9)** to display the second table shown during the variable import. This table lists the global variables used in **BLOCK01** in folder **SRC**, but not in the global variable declaration table for folder **DST**.



You can edit the ***New Scope*** and ***To Folder*** columns, as illustrated in the following steps:

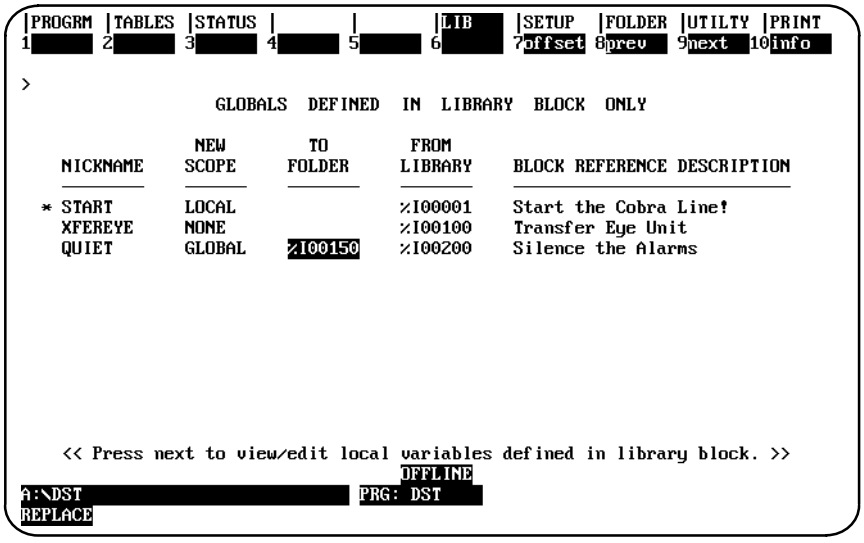
A. An asterisk indicates that there is a conflict between the nickname or reference address in the destination folder and its use in the source folder. In this example, the asterisk by the nickname **START** indicates that %I00001 is already assigned to the nickname **ESTOP**. To display that information about %I00001, position the cursor on the line for %I00001 and press **Information (F10)**.



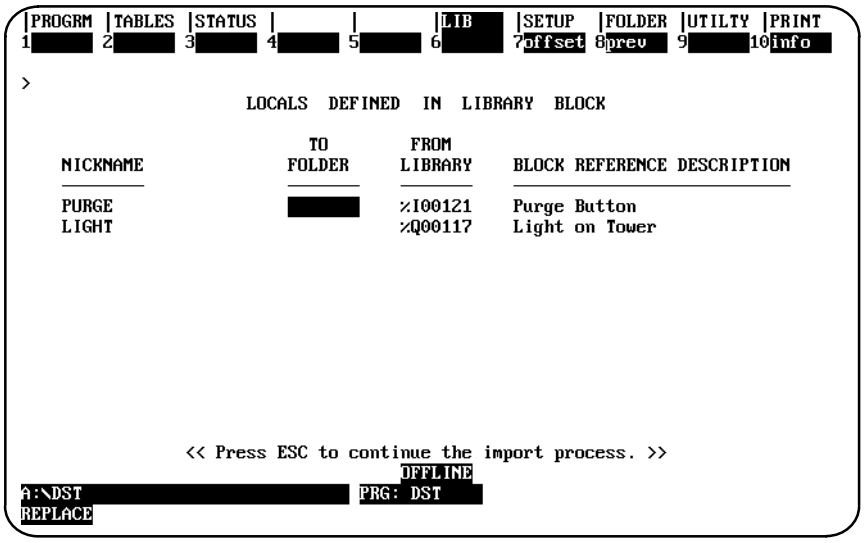
B. The scope for the nickname **START** is set to local; that means the reference address %I00001 will only be inserted in the local variable declaration table. Because the reference address for **START** conflicts with the reference address for the nickname **ESTOP**, **START** cannot be inserted in the global variable declaration table for **DST**.

C. Cursor to the line displaying the nickname **XFEREYE**, and change the selection in the ***New Scope*** column to **NONE**. The nickname **XFEREYE** will not be inserted in the global variable declaration table for **DST** or in the local variable declaration table for **BLOCK01**. The logic in **BLOCK01** will use the address reference %I00100 without a nickname.

D. Cursor to the line displaying the nickname **QUIET**, and enter the reference address %I00150 in the ***To Folder*** column. **QUIET** will be inserted in the global variable declaration table for **DST** with reference address %I00150. In addition, the reference address assigned to **QUIET** in the logic for **BLOCK01** will be changed to %I00150.

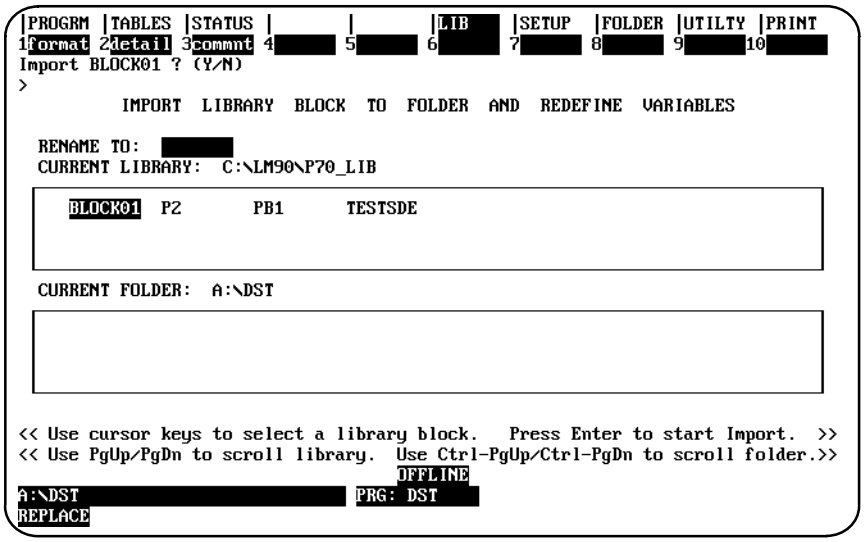


18. Press **Next (F9)** to display the third table shown during the variable import. This table lists the variables defined only in the local variable declaration table.

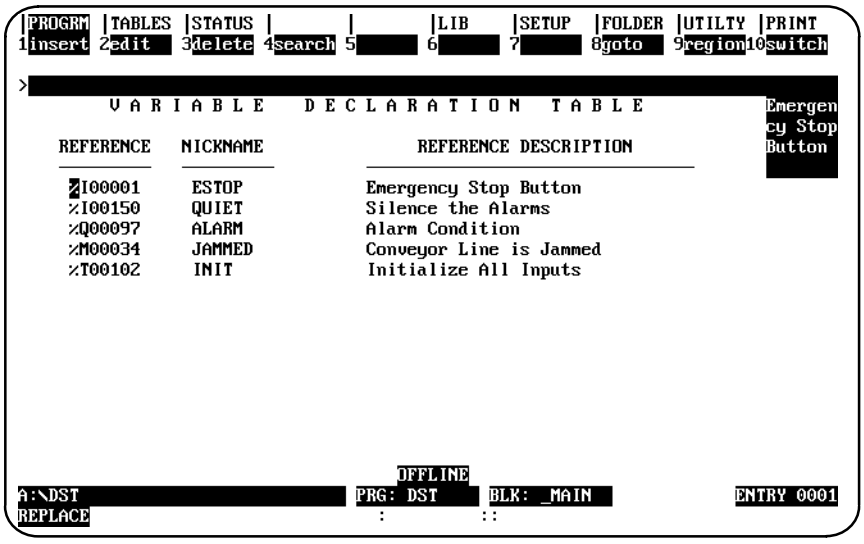


19. Press the **Escape** key to start the import and redefine variables operation. Enter **Y** (YES) after the prompt:

```
Import BLOCK01?  (Y/N)
```

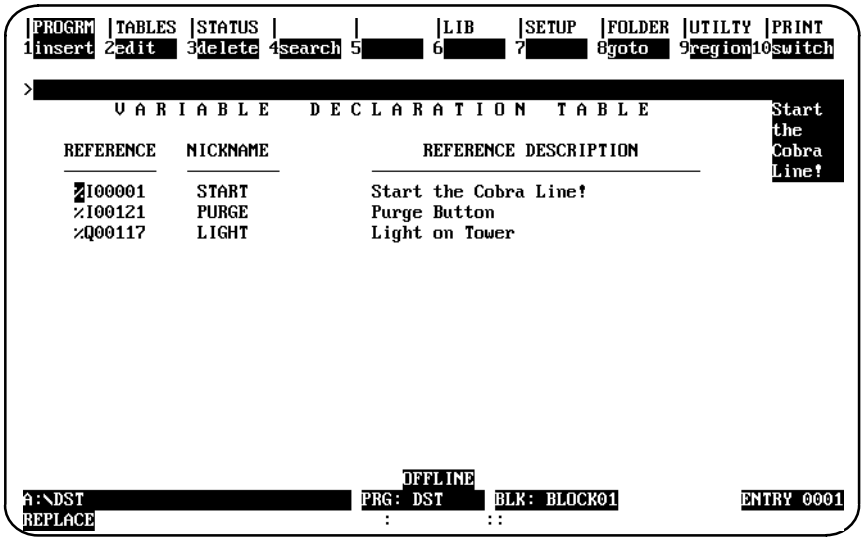


20. After the import operation has successfully completed, press the **Escape** key to exit the program block librarian. Then, press **Program (F1)** to view the variable declarations and logic for the folder **DST**. Position the cursor on the **[VARIABLE DECLARATIONS]** marker, and press **Zoom (F10)** to display the global variable declaration table for that folder. **QUIET** has now been added to the variable declaration table.

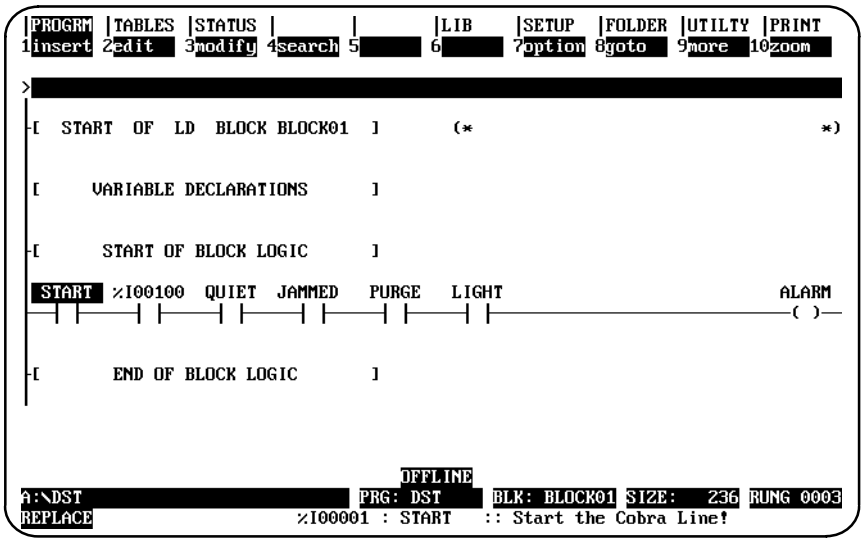


21. Press the **Escape** key to exit the variable declaration table. Then, position the cursor on the **[PROGRAM BLOCK DECLARATIONS]** marker, and press **Zoom (F10)**. Zoom into **BLOCK01** to view its logic and global variables.

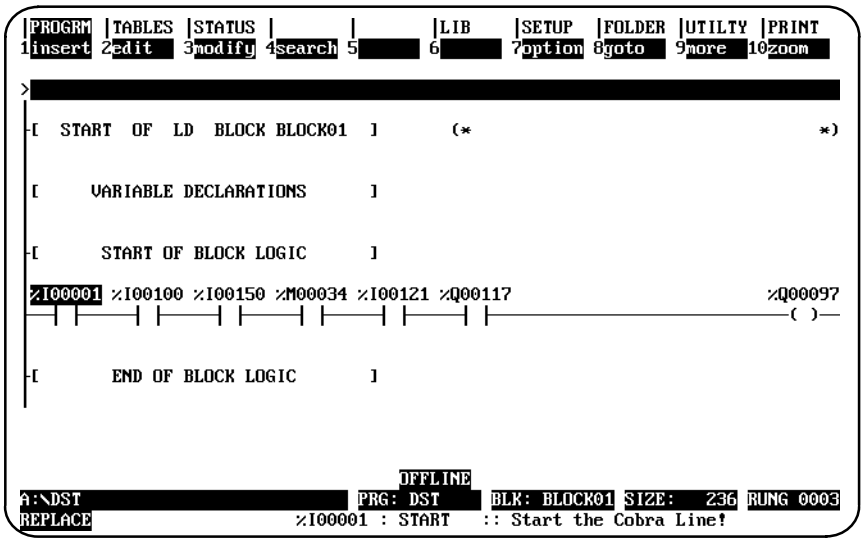
22. Move the cursor to the **[VARIABLE DECLARATIONS]** marker, and press **Zoom (F10)** to display the local variable declaration table for **BLOCK01** in **DST**. Note that **START** has been added to the table.



23. Press the **Escape** key to exit the variable declaration table. Then, cursor down to the ladder logic display. Note that the logic displayed with nicknames for **BLOCK01** in folder **DST** is the same as the logic displayed with nicknames for **BLOCK01** in folder **SRC** (see step 6), except for the nickname **XFEREYE**. Because the scope of the nickname **XFEREYE** was changed to **NONE** on the Globals Defined in Library Block Only screen, the nickname has been dropped.



24. Press **Alt-N** to view the logic with reference addresses. Note that the reference addresses for the nicknames **START** (%I00001), **PURGE** (%I00121), and **LIGHT** (%Q00117) in **BLOCK01** in folder **DST** are the same as those used for **BLOCK01** in folder **SRC** (see step 7). However, the reference addresses for **QUIET**, **JAMMED**, and **ALARM** have changed.



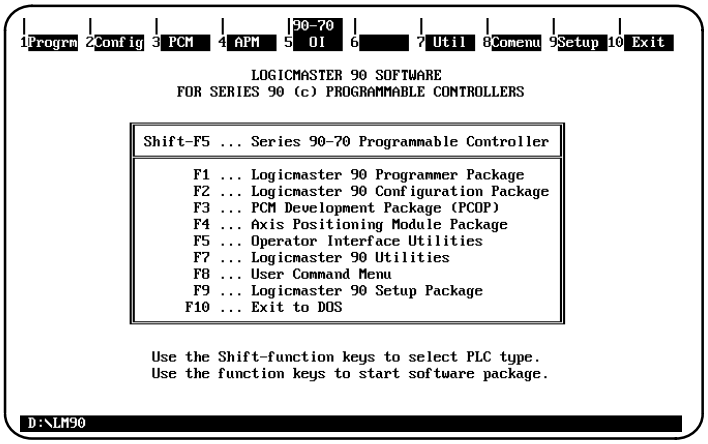
25. This is the end of the lesson. Press the **Escape** key repeatedly to return to the programming software main menu.

Appendix D Programmer Environment Setup

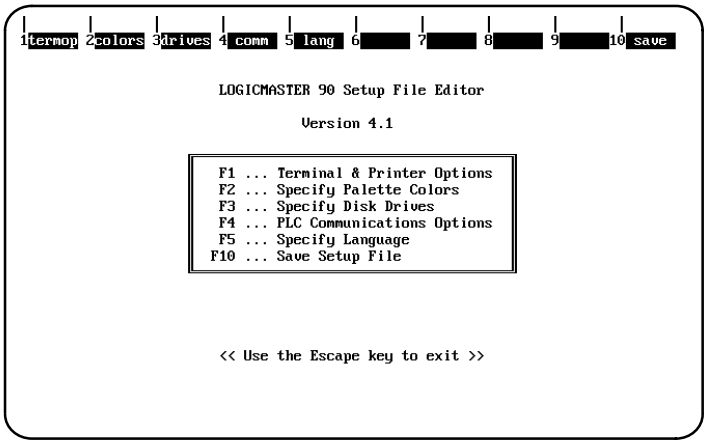
A default setup file is created during installation. Only in special circumstances will this file need to be changed. Follow the steps below in order to edit the setup file.

Displaying the Setup Screen

1. After completing the installation and restarting the computer as described, at the MS-DOS prompt, type **`LM90`** and press the **Enter** key. A menu of Series 90 PLCs and functions is displayed.

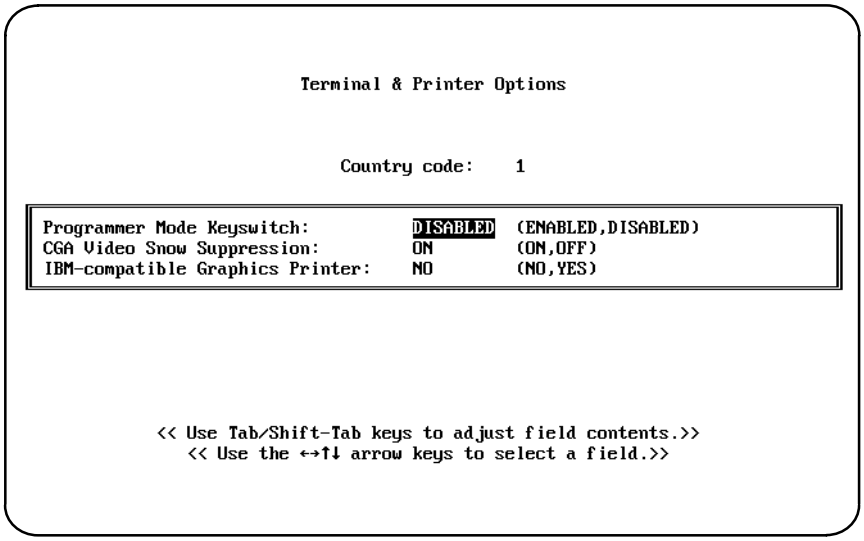


2. Press **Setup (F9)** to select the setup function. The following menu is displayed:



Selecting Terminal and Printer Options

To select terminal and printer options, press **Terminal Options (F1)** from the Setup File Editor menu.



Use the cursor keys to move from one option field to another. Selected fields are shown in reverse video on the display screen. Then, use the Tab and Back Tab (Shift-Tab) keys to toggle each selection.

Field	Description
Programmer Mode Keyswitch	Logicmaster 90-70 software may be run on machines with or without a keyswitch to specify the operational mode (**ONLINE**, **MONITOR**, or **OFFLINE**). Choices for this field are **ENABLED** or **DISABLED***. For a Workmaster or CIMSTAR I industrial computer with a keyswitch, the keyswitch should be enabled. For computers without a keyswitch, it should be disabled. **Note**: Enabling the keyswitch disables the use of ALT-M to change modes. You must disable the keyswitch in order to use ALT-M to change operational modes on a computer with a keyswitch.
CGA Video Snow Suppression	This field is important only if your personal computer uses a CGA (Color Graphics Adapter)-compatible videoadapter. If you have a CGA-compatible adapter that does not need delays to avoid video flicker (referred to as snow), you may increase the performance of Logicmaster 90-70 software by using this entry to disable snow control. Choices for this field are **ON*** or **OFF**. For a system using an IBM-compatible Color Graphics Adapter, snow control should be enabled by selecting **ON**. For systems which have eliminated this problem, the selection should be **OFF**.
IBM-Compatible Graphics Printer	If your printer is capable of producing IBM-compatible graphics characters, you may improve the appearance of your ladder logic printouts by enabling this option. Choices for this field are **YES** or **NO***.

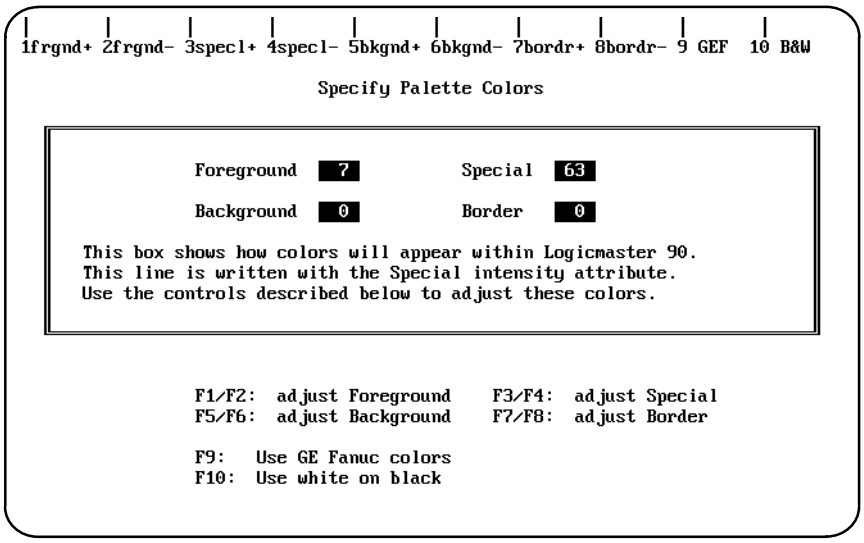
* Default selection.

When the selections are complete, press the **Escape** key to return to the Setup File Editor menu.

Specifying Palette Colors

If your personal computer has a color monitor and the video adapter is an EGA (Enhanced Graphics Adapter) or VGA (Video Graphics Array), you may select the colors that will be used in the Logicmaster 90-70 displays.

To specify palette colors, press **Colors (F2)** from the Setup File Editor menu.



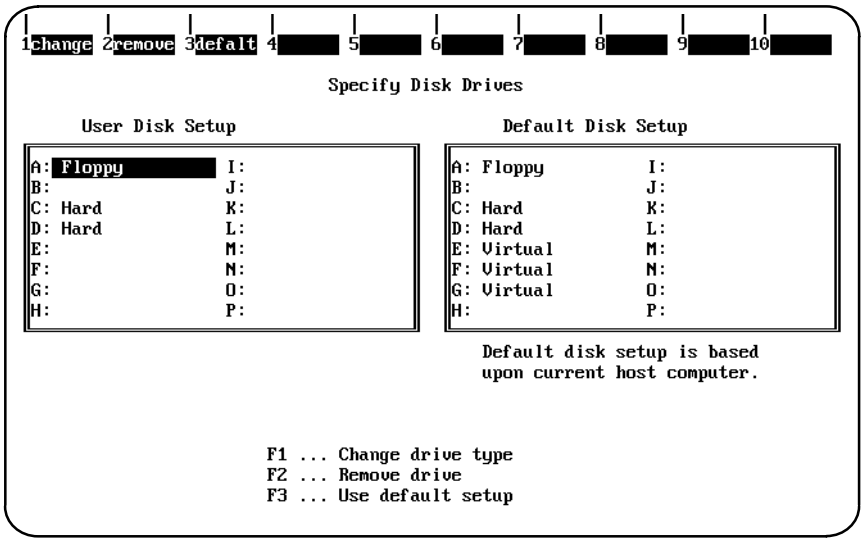
The middle portion of the screen, enclosed in a box, provides a sample display using the currently selected colors. The numeric values stored in the palette registers control the foreground, background, special, and screen border colors.

The color values in the palette registers may be changed by pressing the function keys **(F1 through F10)**, as described in the lower portion of the screen. The function keys are paired; one key increases the value while the other decreases it. The values may be adjusted within the range **0** to **63**. As the values are changed, the colors in the sample display box are updated accordingly.

You may wish to experiment with different color combinations. When you are satisfied with your selections, press the **Escape** key to return to the Setup menu. The color values will be saved along with the other setup information; these color values will be used each time you start up the Logicmaster 90-70 software.

Completing the Disk Drive Setup

To complete the disk drive setup, press **Drives (F3)** from the Setup File Editor menu.

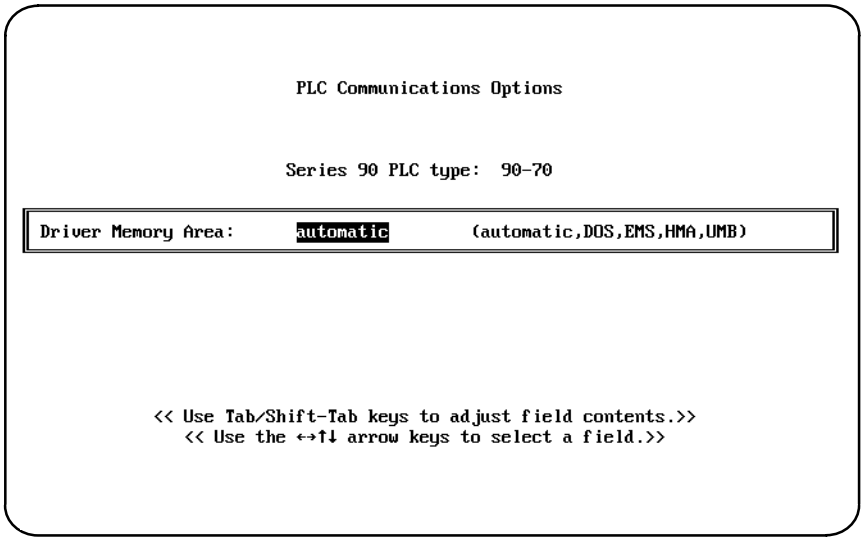


1. If the drives shown on the left of your screen are correct, press **Default (F3)**. If the current selections are not correct, change them as instructed.
2. Press the **Escape** key to return to the Setup File Editor menu.

PLC Communications Options

The PLC Communications Options screen enables you to select whether to communicate with the PLC through a WSI Board or serial COM port and to select one of four different interrupt lines on the PC backplane. To display this screen, press **Communications (F4)** from the Setup File Editor menu.

In the following example screen, only the standard serial communications version of software is installed.

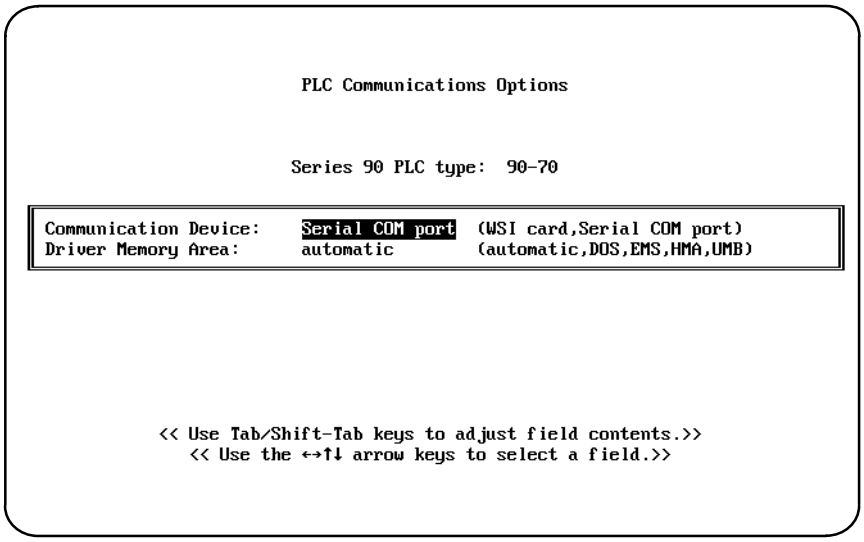


Field	Description
Communication Device	When both the WSI and standard serial communications versions of Logicmaster 90-70 software are installed, you must choose whether to communicate with the PLC through a **WSI Board*** or **serial COM port**.
WSIB Interrupt Line	In a PC or PC-AT computer, the WSI Board can be configured to use four different interrupt lines on the PC backplane. Choices are **IRQ3**, **IRQ4**, **IRQ5**, or **IRQ7***. This option is available only if you are using the WSIB2 Board for communications. If you have the older WSIB1 Board, the interrupt line is displayed as IRQ3 and is not changeable. If you have selected a serial COM port for communications, this option is not displayed.
Driver Memory Area	Select the area of memory you wish the communication drivers to load into, or allow the software to automatically choose the area of memory.

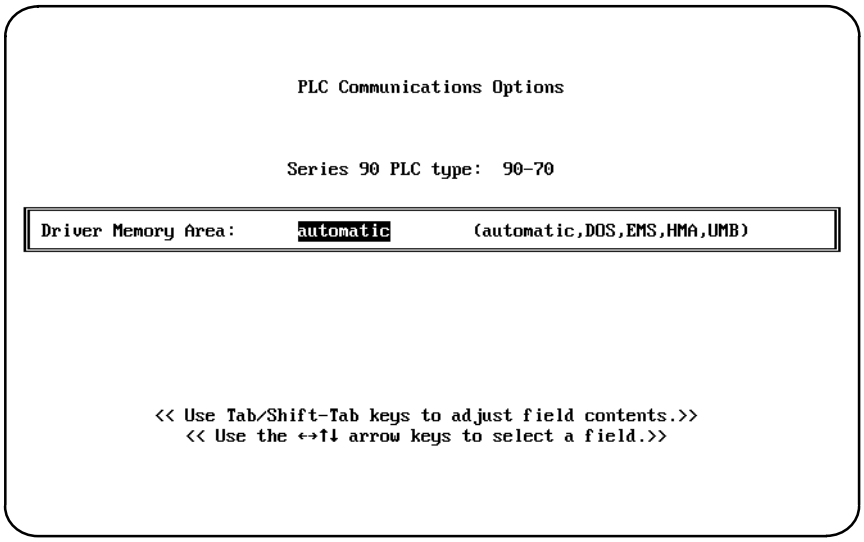
* Default selection.

Use the cursor keys to move from one option field to another. Selected fields are shown in reverse video on the display screen. Then, use the Tab and Back Tab (Shift-Tab) keys to toggle each selection.

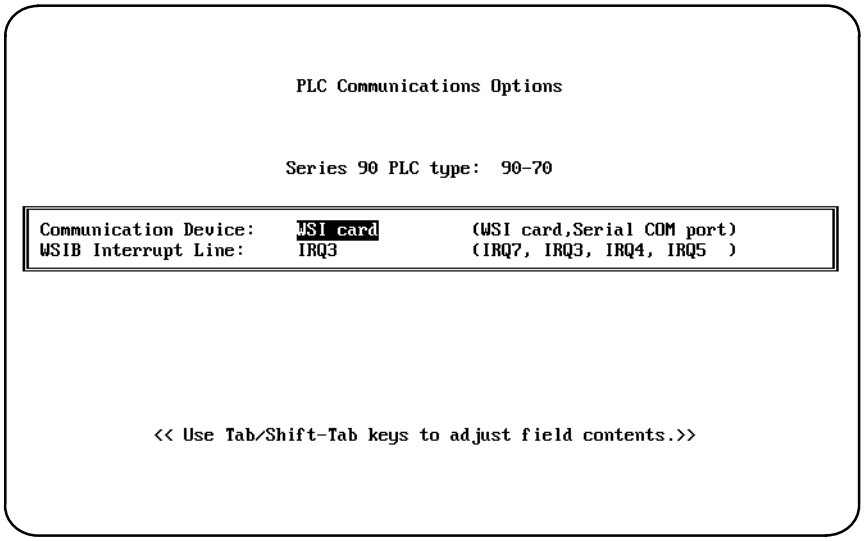
In the following example, both the WSI and standard serial communications versions of Logicmaster 90-70 software are installed, and the serial COM port was chosen as the communication device.



In the next example, only the standard serial communications version of software is installed. Options allow the area of memory to be automatically selected, or you may choose the area of memory you wish the communication drivers to load into.



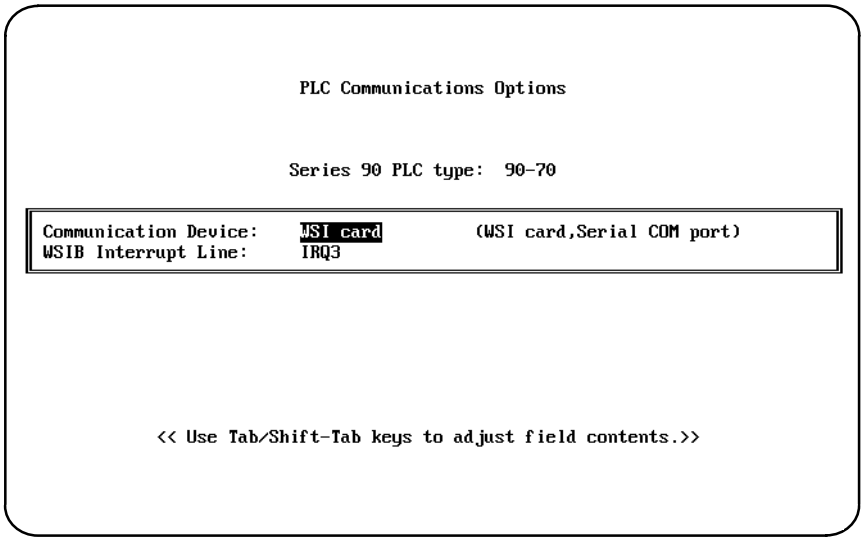
In the next example, only the WSI version of software is installed, and a WSIB2 Board was used. Note that the default value IRQ7 appears in the ***WSIB Interrupt Line*** field. This value can be changed by using the Tab and Back Tab (Shift-Tab) keys to toggle each selection.



Note

When the WSI Version of Release 4 or later of Logicmaster 90-70 software is used on a Workmaster II industrial computer or other microchannel personal computer with a WS9A2 board, the selection of an interrupt line on the PLC Communications Options screen must be set to IRQ3. Failure to select IRQ3 will result in improper setup of the board, possible lockup of the Logicmaster software during startup, and failure to communicate with the PLC.

In this example, again only the WSI version of software is installed, but a non-configurable WSIB1 Board was used. The interrupt line IRQ3 is displayed in the ***WSIB Interrupt Line*** field and cannot be changed. Again, there are no options to select; the screen is presented only to provide information.



Saving the Programmer Environment Setup

To save the setup information in a file for future use, press **Save (F10)** from the Setup File Editor menu. After the file is saved, the software displays the message:

```
Setup File saved successfully as c:\lm90\lm90.prd.
```

Press any key to return to the Setup File Editor menu. Then, press the **Escape** key to return to the menu of Series 90 PLCs and functions.

Appendix E Instruction Mnemonics

In program display / edit mode, you can quickly enter or search for a program instruction by typing the ampersand (&) character followed by the instruction's mnemonic. For some instructions, you can also specify a reference address or nickname, a label, or a location reference address.

This appendix lists the mnemonics of the programming instructions for Logicmaster 90-70 programming software. At any time during programming, you can display a help screen with these mnemonics by pressing the **ALT** and **I** keys.

Table E-1. Contacts, Coils, Links, Timers, and Counters

Instruction	Mnemonic									
	All	INT	UINT	DINT	BIT	BYTE	WORD	DWORD	REAL	MIXED
Contacts										
Any Contact	&CON	&CON								
–| |–	&NOCON	&NOCON								
–| / |–	&NCCON	&NCCON								
–| ↑|–	&PCON	&PCON								
–| ↓|–	&NCON	&NCON								
–[F AULT]–	&FA	&FA								
–| NOFL T]–	&NOF	&NOF								
–[HIALR]–	&HI	&HI								
–[LO ALR]–	&LOA	&LOA								
<+>——	&CONC	&CONC								
Coils										
Any Coil	&COI	&COI								
–( )–	&NOCOI	&NOCOI								
–(/)–	&NCCOI	&NCCOI								
–(↑)–	&PCOI	&PCOI								
–(↓)–	&NCOI	&NCOI								
–(S)–	&SL	&SL								
–(r)–	&RL	&RL								
–(SM)–	&SM	&SM								
–(RM)–	&RM	&RM								
–(M)–	&NOM	&NOM								
–(/M)–	&NCM	&NCM								
——<+>	&COILC	&COILC								
Links										
Horizontal	&HO	&HO								
Vertical	&VE	&VE								
Timers										
ONDTR	&ON	&ON								
OFDT	&OF	&OF								
TMR	&TM	&TM								
Counters										
UPCTR	&UP	&UP								
DNCTR	&DN	&DN								

Table E-2. Math, Relational, and Bit Operations

Instruction	Mnemonic									
	All	INT	UINT	DINT	BIT	BYTE	WORD	DWORD	REAL	MIXED
Math										
ADD	&AD	&AD_I	&AD_UI	&AD_DI					&AD_R	
SUB	&SUB	&SUB_I	&SUB_UI	&SUB_DI					&AD_R	
MUL	&MUL	&MUL_I	&MUL_UI	&MUL_DI					&MUL_R	&MUL_M
DIV	&DIV	&DIV_I	&DIV_UI	&DIV_DI					&DIV_R	&DIV_M
MOD	&MOD	&MOD_I	&MOD_UI	&MOD_DI						
SQRT	&SQ	&SQ_I		&SQ_DI					&SQ_R	
ABS	&ABS	&ABS_I		&ABS_DI					&ABS_R	
SIN	&SIN	&SIN								
COS	&COS	&COS								
TAN	&TAN	&TAN								
IASIN	&ASIN	&ASIN								
ACOS	&ACOS	&ACOS								
ATAN	&ATAN	&ATAN								
LOG	&LOG	&LOG								
LN	&LN	&LN								
EXP	&EXP	&EXP								
EXPT	&EXPT	&EXPT								
DEG	&DEG	&DEG								
RAD	&RAD	&RAD								
Relational										
EQ	&EQ	&EQ_I	&EQ_UI	&EQ_DI					&EQ_R	
NE	&NE	&NE_I	&NE_UI	&NE_DI					&NE_R	
GT	&GT	&GT_I	&GT_UI	&GT_DI					&GT_R	
GE	&GE	&GE_I	&GE_UI	&GE_DI					&GE_R	
LT	&LT	&LT_I	&LT_UI	&LT_DI					&LT_R	
LE	&LE	&LE_I	&LE_UI	&LE_DI					&LE_R	
CMP	&CM	&CM_I	&CM_UI	&CM_DI					&CM_R	
RANGE	&RANG	&RANG_I		&RANG_DI			&RANG_W	&RANG_DW		
BitOperation										
AND	&AN						&AN_W	&AN_DW		
OR	&OR						&OR_W	&OR_DW		
XOR	&XO						&XO_W	&XO_DW		
NOT	&NOT						&NOT_W	&NOT_DW		
SHL	&SHL						&SHL_W	&SHL_DW		
SHR	&SHR						&SHR_W	&SHR_DW		
ROL	&ROL						&ROL_W	&ROL_DW		
ROR	&ROR						&ROR_W	&ROR_DW		
BTST	&BT						&BT_W	&BT_DW		
BSET	&BS						&BS_W	&BS_DW		
BLCR	&BCL						&BCL_W	&BCL_DW		
BPOS	&BP						&BP_W	&BP_DW		
MCMP	&MCM						&MCM_W	&MCM_DW		

Table E-3. Data Move and Data Table Operations

Instruction	Mnemonic									
	All	INT	UINT	DINT	BIT	BYTE	WORD	DWORD	REAL	MIXED
DataMove										
MOVE	&MOV	&MOV_I	&MOV_UI	&MOV_DI	&MOV_BI		&MOV_W	&MOV_DW	&MOV_R	
BLKMOV	&BLKM	&BLKM_I	&BLKM_UI	&BLKM_DI			&BLKM_W	&BLKM_DW	&BLKM_R	
BLKCLR	&BLKC									
SHFR	&SHF				&SHF_BI		&SHF_W	&SHF_DW		
BITSEQ	&BI									
SWAP	&SW						&SW_W	&SW_DW		
COMMREQ	&COMMR									
VMERD	&VMERD					&VMERD_BY	&VMERD_W			
VMEWRT	&VMEW					&VMEWR_BY	&VMERD_W			
VMERMW	&VMERM					&VMERM_BY	&VMERM_W			
VMETST	&VMET					&VMET_BY	&VMET_W			
VME_CFG_RD	&CFGRD									
VME_CFG_WRT	&CFGWRT									
DATA_INIT	&DINI									
DATA_INIT_COMM	&DCO									
DATA_INIT_ASCII	&DA									
Data Table										
TBLRD	&TBLR	&TBLR_I	&TBLR_UI	&TBLR_DI			&TBLR_W	&TBLR_DW		
TBLWR	&TBLW	&TBLW_I	&TBLW_UI	&TBLW_DI			&TBLW_W	&TBLW_DW		
LIFORD	&LIFOR	&LIFOR_I	&LIFOR_UI	&LIFOR_DI			&LIFOR_W	&LIFOR_DW		
LIFOWRT	&LIFOW	&LIFOW_I	&LIFOW_UI	&LIFOW_DI			&LIFOW_W	&LIFOW_DW		
FIFORD	&FIFOR	&FIFOR_I	&FIFOR_UI	&FIFOR_DI			&FIFOR_W	&FIFOR_DW		
FIFOWRT	&FIFOW	&FIFOW_I	&FIFOW_UI	&FIFOW_DI			&FIFOW_W	&FIFOW_DW		
SORT	&SORT	&SORT_I	&SORT_UI				&SORT_W			
ARRAY_MOVE	&AR	&AR_I	&AR_UI	&AR_DI	&AR_BI	&AR_BY	&AR_W	&AR_DW		
SRCH_EQ	&SRCHE	&SRCHE_I	&SRCHE_UI	&SRCHE_DI		&SRCHE_BY	&SRCH_W	&SRCH_DW		
SRCH_NE	&SRCHN	&SRCHN_I	&SRCHN_UI	&SRCHN_DI		&SRCHN_BY	&SRCHN_W	&SRCHN_DW		
SRCH_GT	&SRCHGT	&SRCHGT_I	&SRCHGT_UI	&SRCHGT_DI		&SRCHGT_BY	&SRCHGT_W	&SRCHGT_DW		
SRCH_GE	&SRCHGE	&SRCHGE_I	&SRCHGE_UI	&SRCHGE_DI		&SRCHGE_BY	&SRCHGE_W	&SRCHGE_DW		
SRCH_LT	&SRCHLT	&SRCHLT_I	&SRCHLT_UI	&SRCHLT_DI		&SRCHLT_BY	&SRCHLT_W	&SRCHLT_DW		
SRCH_LE	&SRCHLE	&SRCHLE_I	&SRCHLE_UI	&SRCHLE_DI		&SRCHLE_BY	&SRCHLE_W	&SRCHLE_DW		
ARRAY_RANGE	&ARRANG	&ARRANG_I		&ARRANG_DI			&ARRANG_W	&ARRANG_DW		

Table E-4. Conversion and Control Operations

Instruction	Mnemonic									
	All	INT	UINT	DINT	BIT	BYTE	WORD	DWORD	REAL	MIXED
Conversion										
to BCD–4	&BCD4	&BCD4	&BCD4_UI							
to BCD–8				&BCD8						
to UINT	&UI	&UI		&UI_DI					&UI_R	
to INT	&I	&I		&I_DI					&I_R	
to DINT	&DIN	&DIN	&DIN_UI						&DIN_R	
to REAL	&R	&R	&R_UI	&R_DI						
BCD–4 to UINT	&UI_BCD4									
BCD–4 to INT	&I_BCD4									
BCD–8 to DINT	&DI_BCD8									
BCD–4 to REAL	&R_BCD4									
BCD–8 to REAL	&R_BCD8									
TRUN	&TRINT	&TRINT		&TRDINT						
Control										
CALL	&CA									
DOIO	&DO									
SUSIO	&SUS									
MCR	&MCR									
ENDMCR	&ENDMCR									
JUMP	&JUMP									
LABEL	&LABEL									
COMMENT	&COMME									
SVCREQ	&SV									
PIDISA	&PIDIS									
PIDIND	&PIDIN									
FOR	&FOR									
END_FOR	&ENDFOR									
EXIT	&EXIT									

Appendix F Key Functions

The following table lists the keyboard functions that are active in the Logicmaster 90-70 software environment. This information may also be displayed on the programmer screen by pressing **ALT-K** to access key help.

Key Sequence	Description	Key Sequence	Description
Keys Available throughout the Software Package			
ALT-A	Abort.	CTRL-Break	Exit package.
ALT-C	Clear field.	Esc	Zoom out.
ALT-M	Change programmer mode.	CTRL-Home	Previous command line contents.
ALT-R	Change PLC **RUN/STOP** state.	CTRL-End	Next command line contents.
ALT-E	Toggle status area.	CTRL-←	Cursor left within the field.
ALT-L	List directory files.	CTRL-→	Cursor right within the field.
ALT-P	Print screen.	CTRL-D	Decrement reference address.
ALT-H	Help.	CTRL-U	Increment reference address.
ALT-K	Key help.	Tab	Change / increment field contents.
ALT-I	Instruction mnemonic help.	Shift-Tab	Change / decrement field contents.
ALT-T	Start **TEACH** mode.	Enter	Accept field contents.
ALT-Q	Stop **TEACH** mode.	CTRL-E	Display last system error.
ALT-Z	Pause **TEACH** playback.	F12 (or Keypad–)	Toggle discrete reference.
ALT-n	Playback file n (n = 0 thru 9).	F11 (or Keypad *)	Override discrete reference.
Keys Available in the Program Editor Only			
ALT-B	Toggle text editor bell.	Keypad +	Accept rung.
ALT-D	Delete rung element. / Delete rung.	Enter	Accept rung.
ALT-S	Store block to PLC and disk.	CTRL-PgUp	Previous rung.
ALT-X	Display zoom level & block state.	CTRL-PgDn	Next rung.
ALT-V	Variable table window.	~	Horizontal link.
ALT-W	Display PSB parameter table.	|	Vertical link.
ALT-F2	Go to operand reference table.	Tab	Go to next operand field.
Special Keys			
ALT-G	Single sweep debug. Available only in program editor, reference table editor, and status fault tables.		
ALT-N	Toggle display options. Available only in program editor and reference table editor.		
ALT-O	Password override. Available only on Password screen in configuration software.		
ALT-U	Update disk.		

The Help card on the next page contains a listing of the key help and also the instruction mnemonics help text for Logicmaster 90 software. This card is printed in triplicate and is perforated for easier removal from the manual.

This page contains side 1 of GFJ-056B.

This page contains side 2 of GFJ-056B.

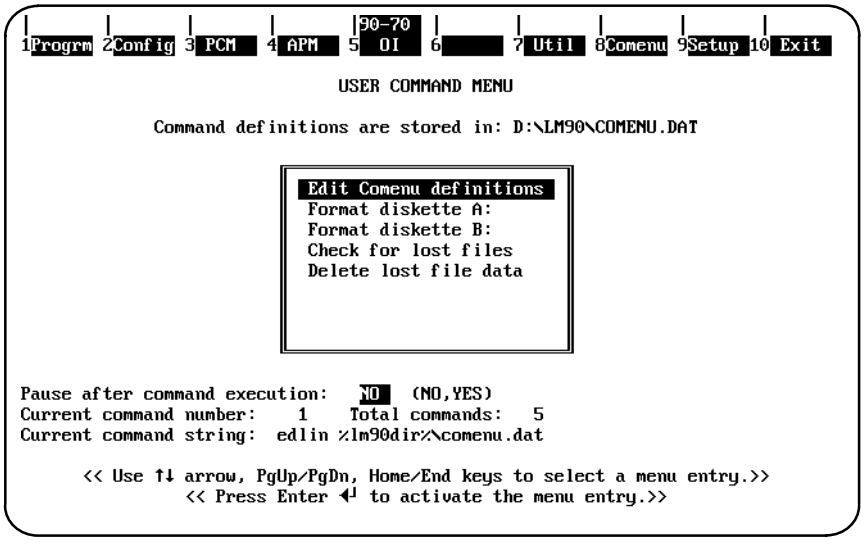
Appendix G User Command Menu

You can maintain a file of MS-DOS executable commands outside of the Logicmaster software packages. This command definition file named COMENU.PRD contains a list of task entries, each with a unique display label and associated MS-DOS command. The file is stored in the Logicmaster home directory (normally LM90) and can be edited using an MS-DOS compatible text editor such as EDLIN. The MS-DOS commands in this file can be used to run other software packages and perform routine MS-DOS functions, such as disk maintenance.

Accessing the User Command Menu

The MS-DOS executable commands maintained in the COMENU.PRD file are accessed from the User Command menu called ***Comenu***.

1. To display this menu, press **Comenu (F8)** from the menu of Series 90 PLCs and functions. A sample Comenu is shown below.



2. When **F8** is pressed, the Logicmaster startup program reads the Comenu definition file and creates a display similar to the one shown above.
3. Use the cursor keys, the Page Up and Down keys, or the Home and End keys to select a command. The label for the currently selected entry is shown in reverse video. If more command definitions are available than can be displayed on the screen, use the cursor keys to scroll through the entries. The number of the currently selected command and the total number of commands are displayed beneath the labels window. The MS-DOS command string for the current entry is shown beneath the labels window for verification of the command text associated with the entry.
4. Move the cursor to the desired command label and press the **Enter** key. The menu program will clear the screen and submit the selected command to MS-DOS for execution. Subsequent screens are controlled by MS-DOS and the selected command.
5. When the command is completed, control will normally return immediately to the Comenu display. However, you may wish to pause after the execution of the command in order to study the display generated by the command. If a pause is desired, enter **Y** (Yes) in the ***Pause after command execution*** field, or use the Tab, Shift-Tab, Space, or Backspace key to toggle the value of the field from **No** to **Yes**.
6. After the pause, MS-DOS will prompt you to press any key in order to continue. When a key is pressed, the User Command menu is displayed again.
7. Press **Exit (F10)** or the **Escape** key to return to the menu of Series 90 PLCs and functions.

Creating a COMENU.PRD File

A default command definition file is provided with the Logicmaster 90-70 software. The default file provides example definitions and includes entries for performing disk formatting.

Definitions may be entered in the COMENU.PRD file in either of two forms:

```
<display label> = <DOS command string>
```

or

```
<display label> =
<DOS command string>
```

according to these guidelines:

1. Blank lines and lines beginning with a semicolon are ignored.
2. Lead and trailing space and tab characters around the label and command are ignored.

3. The label may be any text up to 50 characters long. Labels which exceed this length are truncated.

4. The equal sign (=) must appear on the same line as the label. A carriage return and linefeed may follow the equal sign if you want the command text to start on a separate line.

5. Each command string is terminated by a carriage return and linefeed, or by the end-of-file. The command string itself should not contain any carriage returns, even if the string is longer than can be displayed on a single line.

6. The command string is limited by MS-DOS to a maximum length of 127 characters. Commands which exceed this length are ignored, and the associated label is not displayed.

7. A maximum of 100 definitions can be processed; any additional definitions beyond the limit are ignored.

8. You may include in the definition file a command for editing the definition file itself. This will allow you to modify the file even while remaining within the Logicmaster environment.

Example Comenu Definition File

The following is an example Comenu definition file used to create the Comenu shown above.

```
 ; This is the Comenu definition file.
 ;    Blank lines and lines starting with a semicolon are ignored.

 ; The following entry may be used to start the editor on this file,
 ; so that additional revisions may be made without leaving the LM90 shell.

 Edit Comemu definitions =
      edlin  \LM90\COMENU.PRD

; Disk utilities:

 Format diskette A:    = format a: /v
 Format diskette B:    = format b: /v
 Check for lost files  = chkdsk /f
 Delete lost file data= del \file0*.chk
 Duplicate floppy A:   = diskcopy a: a:

 ; Third–party packages:

 Cadepa grafcet package = \SWN\CADEPA

 ; User applications:

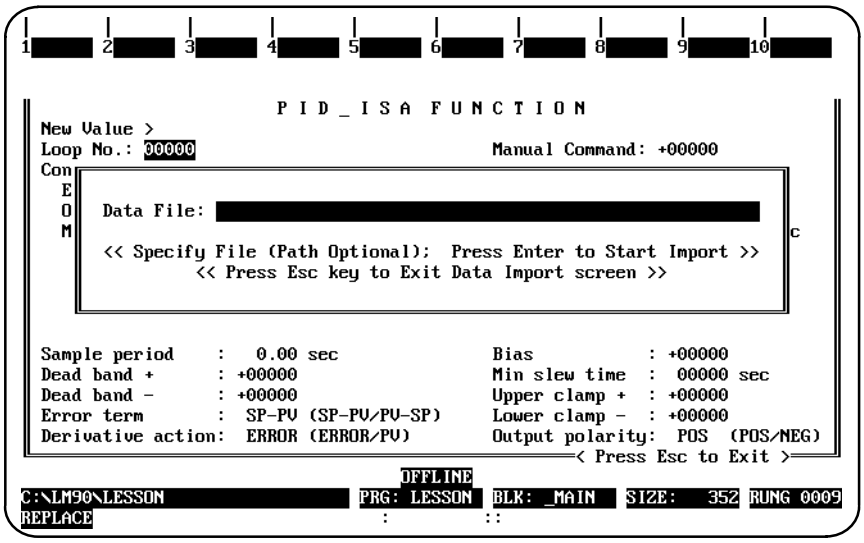
 Application 1 = \appl\appl.bat
 Application 2 = \appl\app2.bat
```

Appendix H Data Import

The data import feature allows you to use ASCII text-based files to quickly update data zoom blocks in the program editor and data tables in the reference editor. In addition to text representation of values to be entered, the file may contain command representations, which are interpreted by data import as individual keystrokes. Thus, many of the same actions done directly from the keyboard (e.g., cursor movement, data entry, format changes, etc.) can be done through data import.

In order to use the data import feature, you must be familiar with the reference table editor (see chapter 4, “Reference Table,” and chapter 3, “Program Editing.”

Data import can be initiated from a data zoom block in the program editor or from any of the reference editor screens by pressing **CTRL-I**. A file specification window similar to the one shown below will be displayed:



Enter the name of the external file in the ***Data File*** field. Your response may be a full path name, not to exceed the size of the prompt field.

A. If the file is not in the current disk directory, you must enter the complete file path.

B. If the file specified does not have an extension, the external file name will default to a .DI extension.

C. If an invalid file specification is entered or the file cannot be opened for input, an error message will be displayed, the file specification window will remain on the screen, and the invalid file specification will remain in the ***Data File*** field.

Note

When the programmer is in **`ONLINE`** mode, real-time updates are suspended while the file specification window remains on the screen.

Press the **Enter** key. ***Once started, the data import cannot be aborted.*** The process will continue until either a valid file name is entered, or until you press **CTRL-A**, **CTRL-Break**, or the **Escape** key to abort the data import operation. In addition, pressing **CTRL-Break** will exit the Logicmaster 90 software package.

Data being imported will be input into Logicmaster 90-70 software starting at the current cursor position. The current cursor will advance after each data value. The direction the current cursor advances will depend on the currently active Logicmaster environment. For example, in the reference table editor with default display mode, the cursor advances to the left; in a data initialize instruction, the cursor advances to the right.

Data from an external file will be input into the Logicmaster 90-70 software data item by data item. When a data item in the external file is found to be invalid, the import will stop and control will return to the keyboard. All data input before the invalid item will be retained by the Logicmaster 90-70 software. Data will continue to be imported until the end of the external file, the end of the data initialization data buffer or reference table is reached, or an error occurs.

Format and Content of the External File

The data import data file is an ASCII text-based file which may be created with any text editor or similar program. All white space (spaces, tabs, form feeds, carriage returns, and line feeds) are ignored except as field separators. A field may consist of a value to be entered into the current table at the cursor position or a series of characters representing a key command.

1. Uppercase letters are required for commands (e.g., INT must be uppercase; int is not allowed.)
2. The content of the data file is restricted to data values, data format commands, Logicmaster 90 valid reference addresses, and limited cursor movement commands.
3. Data values are strings which would be considered legal at the input position in Logicmaster 90-70 software. For example, "\027 (the Escape character) would be a valid data value for an ASCII input field.
4. Format commands **[INT]**, **[DINT]**, **[UINT]**, **[REAL]**, **[HEX]**, **[BIN]**, **[ASCII]**, **[CHGALL]**, **[OVERRIDE]**, **[TOGGLE]**, **[TMCTR]**, and **[MIXED]** are allowed.
5. Cursor movement commands **[UP]**, **[DOWN]**, **[LEFT]**, **[RIGHT]**, **[PAGEUP]**, **[PAGEDN]**, and **[HOME]** are allowed.
6. A semicolon (**;**) represents the Enter key. A comma (**,**) represents the Enter key with automatic field advancement. The new_line at the end of a non-comment line will serve as an implied comma.
7. Data in the external file must be separated by a comma or a carriage return. Commas and carriage returns imply automatic advancement to the next input position in the Logicmaster environment when they occur after a data value.
8. Format commands must immediately precede the data value they are defining (e.g., a valid external file sequence:

   [HEX], 0ab; an invalid sequence: [HEX], [DOWN], 0ab)

   Format commands define the following data value and change the Logicmaster 90 format at the input position.
9. Reference addresses must precede the data value they are positioning. For example:

   %R1, 0ab or **%R1, [HEX], 0ab**

10. The **#** character as the first character in an import file line will cause all remaining characters on that line to be ignored. These lines can be used for comments, as desired.

The following examples incorporate these guidelines for format and content.

Example	Explanation
1i:, 1,1,1; 8i; 1,1,1;	Sets I1, 2, 3, 8, 9, and 10 to 1.
1r;[CHGALL][HEX]55,0AA55,55AA	Changes the entire real table format to hex and enters 0055, AA55, and 55AA into R1, 2, 3, leaving the cursor on R4.
[CHGALL][ASCII]8r;“abcdefgh”	Changes the entire input table to ASCII format, positions the cursor to R8, and enters the characters into R8 ... R11, leaving the cursor on R8.
[CHGALL]0;	Clear a reference table and initialize to the default format.

The following two examples illustrate valid external data files for import into Logicmaster 90 software. Although the two files differ in format and content, they would make the same changes to the %R reference table. The examples assume that the reference table is in right to left display mode.

External File #1:

```
[CHGALL] 0;
%R31, 1223, 101, 5, [HEX] 0ab, +100, 34, 345, 73, 700, 9, [INT] –56,
[DOWN] [LEFT] 5555, 1, +33, [INT] –4667, [LEFT] [REAL] –2.8301E+06,
6789, 99, [HEX] 0c00, [INT] 777, [INT] 3221, [INT] –54, 0, 88,
[ASCII] “li”,, [ASCII] “ne”,, [ASCII] “ f”,, [ASCII] “au”,, [ASCII] “lt”;
```

External File #2:

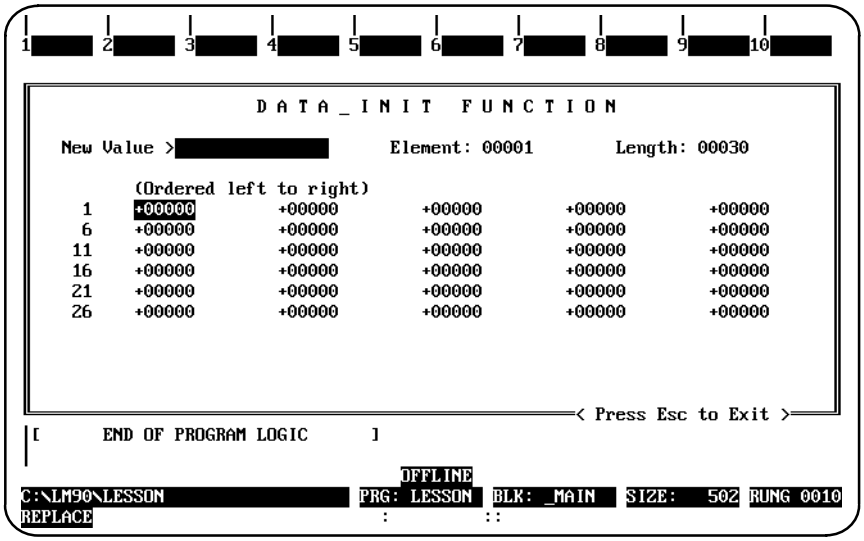
```
[CHGALL] 0;
%R31;           1223,                    %R32;           101,
%R33; [INT]        5,                    %R34; [HEX]     0AB,
%R35; [INT]      100,                    %R36;            34,
%R37;            345,                    %R38;            73,
%R39;            700,                    %R40;             9,
%R41; [INT]      –56,                    %R53; [INT]    5555,
%R54;              1,                    %R55; [INT]     +33,
%R56; [INT]    –4667,
%R57; [REAL]   –2.38301E+06,
%R60;            6789,                   %R61;            99,
%R62; [HEX]      0C00,                   %R63; [INT]     777,
%R64; [INT]      3221,                   %R65; [INT]     –54,
%R66;               0,                   %R67;            88,
%R68; [ASCII]  “li”,                     %R69; [ASCII]    “ne”,
%R70; [ASCII]  “ f”,                     %R71; [ASCII]    “au”,
%R72; [ASCII]  “lt”;
```

Importing Data in the Program Editor

Data import is available for these data initialize instructions:

- DATA_INIT_type.
- DATA_INIT_COM.
- DATA_INIT_ASCII.

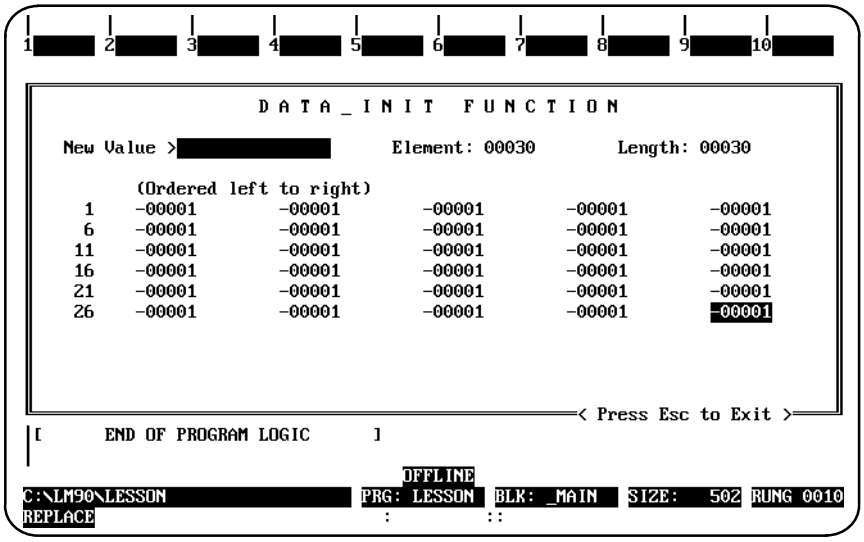
A screen similar to the one shown below for the DATA_INIT function is displayed when you press the **Zoom (F10)** key with the cursor positioned on the DATA_INIT function block in the logic.



You could set all the bits in 30 words of data to 1 by importing the following data file:

```
-1, -1, -1, -1, -1, -1, -1, -1, -1, -1,
-1, -1, -1, -1, -1, -1, -1, -1, -1, -1,
-1, -1, -1, -1, -1, -1, -1, -1, -1, -1;
```

After the data import is complete, a screen similar to this one for the DATA_INIT function is displayed.

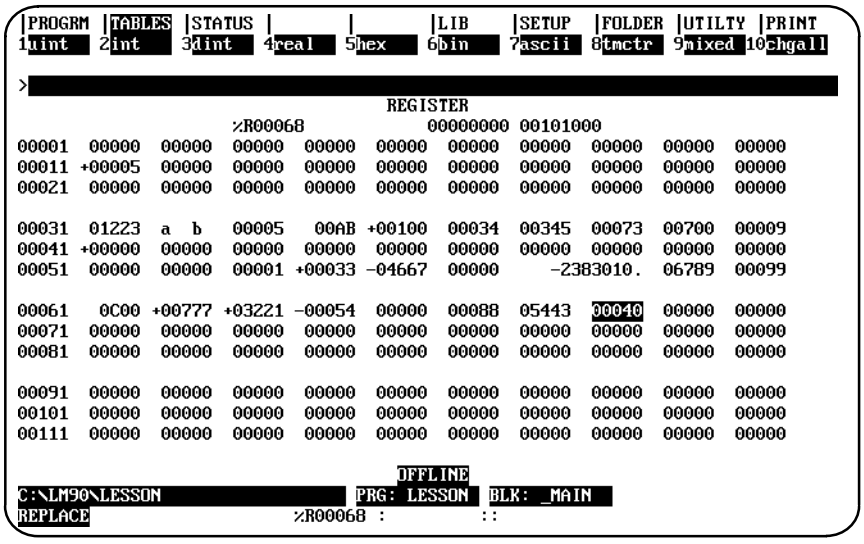


Reference addresses have no meaning within the data initialize instructions. In addition, the data formats in the instruction cannot be changed. As a result, format commands and reference addresses in an external data file being imported into these instructions are considered invalid data items and will cause the import to be aborted.

Importing Data in the Reference Tables Editor

Data import is available in all reference tables, including mixed tables.

The following screen shows an example %R reference table before beginning a data import.

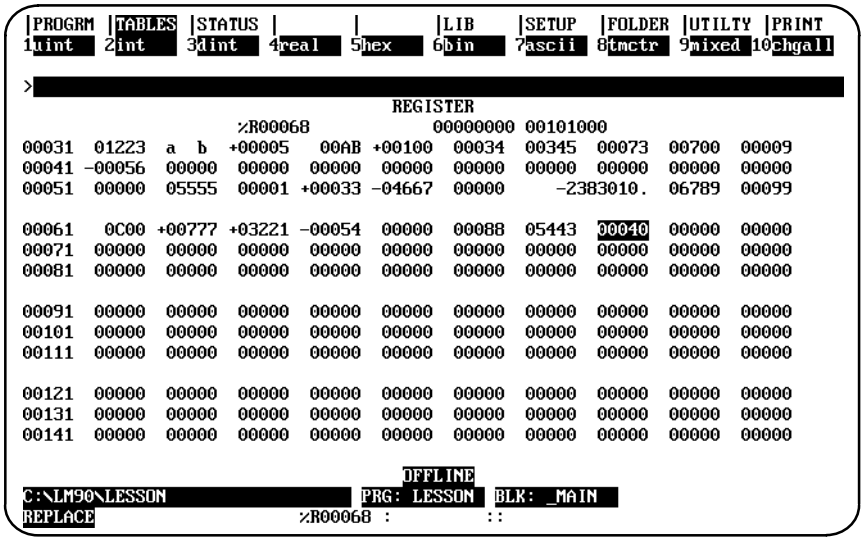


This is a sample external text file which could be imported into the %R reference table:

```
%R31;           1223,       %R32; [ASCII]            “ab”,
%R33;  [INT]       5,       %R34; [HEX]              0AB,
%R35;  [INT]     100,        %R36;                     34,
%R37;            345,       %R38;                     73,
%R39;            700,       %R40;                      9,
%R41;  [INT]     -56,       %R52; [INT]             5555,
%R53;              1,       %R54; [INT]              +33,
%R55; [INT]    -4667,
%R57; [REAL]   -2.38301E+06,
%R59;           6789,       %R60;                     99,
%R61; [HEX]     0C00,       %R62; [INT]              777,
%R63; [INT]     3221,       %R64; [INT]              -54,
%R65;              0,       %R66;                     88,
%R67;           5443,       %R68;                     40,
```

Note that the reference address %R31 at the beginning of the external file starts the data import at a different position than that of the current cursor position before the data import.

After the data import is complete, the example %R reference table would appear as:



Appendix I

Files Created with Logicmaster 90-70 Software

This appendix lists the files created with Logicmaster 90-70 software. The files are identified here by their extensions. The content of each file is briefly discussed, along with an explanation of when the file is created. None of these files is created during the INSTALL process.

Caution

Do not use MS-DOS to copy individual files from one folder to another or to delete files. Doing so may produce unexpected results. MS-DOS may only be safely used to copy an entire program folder to another program folder of the same name.

Files in the Program Folder

The following files are associated with program logic. They are created as a result of editing the program.

Note

.EXT and .STA are new file extensions available with Release 6 of Logicmaster. .PDT and .SYE are new file extensions available with Release 4 of Logicmaster 90-70 software. .PDT combines .PRG and .DAT files from earlier releases into one file. .STE combines .SYM and .NXP files from earlier releases into one file.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.PDT	This file contains the program block logic, including initial data for %P data and %L data (for a program block).	The _MAIN.PDT file is created during the first edit session in the program. When a program block is declared, its .PDT file is created.
.DEC	This file contains program block and interrupt declarations, as well as other data including information about the coil usage and retentive sense of the %Q and %M references.	The _MAIN.DEC file is created during the first edit session in the program. There is one .DEC file for the entire program.
.STE	This file contains the nicknames, identifiers, and reference descriptions associated with a particular block.	The _MAIN.STE file is created during the first edit session. The .STE file for a program block is created when a nickname,identifier, or reference description is first defined within that block.
.EXP	This file contains the text for comment rungs.	The .EXP file is created when the first comment rung for a block is programmed. Each block may have its own .EXP file.
.LH1	This file contains the header from each .PDT file.	The .LH1 file is created during the first edit session. There is one .LH1 file per folder.
.SDE	This file contains material that was selected and written to a program segment.	The .SDE file is created when you press **Write (F5)**. Unlike the other files listed above, .SDE files may be written to any MS-DOS directory. The default destination is the current folder.
.EXT	For each folder using standalone C programs, there will be two types of files with the .EXT extension. The file named LMFOLDER.EXT includes the folder name and the name of each program in the folder. The other type has the same name as each C program that has been added to the folder followed by the extension, .EXT. These files are binary and contain scheduling information about the program. (Refer to page 3-75 and following for instructions on inserting C programs, setting priorities, etc.)	The .EXT files are created when you insert C program(s) and are updated when you add / delete programs, set priorities, modes, etc. (Refer to page 3-75 and following for instructions on inserting C programs, setting priorities, etc.)
.STA	These files are standalone C programs.	These files are created by the C Programmer's Toolkit, not by Logicmaster.

When specifying values using the reference table function, Logicmaster 90-70 software creates files to contain this information. The folder may contain these two files for each reference type. Only reference types which permit overrides may have override files. (The %I reference is used here only as an example.)

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.I	The _MAIN.I file contains initial values for %I references.	The _MAIN.I file is created when data is first entered for any %I reference. There is only one .I file per folder.
.IO	The _MAIN.IO file contains initial override data for %I references.	The _MAIN.IO file is created when data is first entered for any %I reference. There is only one .IO file per folder.

When specifying formats using the reference table function, Logicmaster 90-70 software creates files to contain this information.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.RDF	The .RDF files contain information specifying the formats for reference data.	The FIXED.RDF and MIXED.RDF files are created when a reference format is specified for any of the fixed or mixed tables,respectively. A folder may contain up to two of these files.

The configurator packages creates files to contain the configuration data.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.CFG	The IOCFG.CFG file contains information about the I/O configuration for the program. The CPUCFG.CFG file contains information about the CPU configuration for the program. The DROPxxx.CFG file contains information about remote dropconfigurations.	The IOCFG.CFG and CPUCFG.CFG files are created when any configuration data is first edited. The DROPxxx.CFG file is created when configuring a Remote I/O Drop.

Teach files are used to store a sequence of keystrokes that may be repeated.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.DEF	This file contains keys that were pressed while in Teach mode.	The .DEF file is created when Teach mode is entered and a file name is specified.

Files in the Library

The following files are associated with the program block library.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.TOC	This file serves as the table of contents for blocks in the library.	The .TOC file is created when the library is created. There is only one .TOC file per library.
.ENV	This file contains information about the coil usage and retentive sense of the %Q and %M references used in a block.	An .ENV file is created for each program block as it is exported to the library.
.OFF	This file contains reference offset data.	The .OFF file is created when data is saved from the reference offset template. Only one .OFF file is created per block / segment.
.CMT	This file contains comment text.	The .CMT file is created when comment text is saved. Only one .CMT file is created per block / segment.
.STL	This file contains global nicknames.	The .STL file is created during the export operation when you answer **Y** (Yes) to the prompt "exportglobals?". Only one .STL file is created per block.

Files in the Logicmaster 90-70 Home Directory

For your convenience, Logicmaster 90-70 software creates files that store information to be used as defaults the next time the software is booted.

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.DAT	The modem auto-dial feature writes information in the MODEM.DAT file. This file is only used with Logicmaster 90-30 software.	The .DAT file is created using Logicmaster 90-30 software when modem information is saved.
.PSU	These files contain setup information that is specified using the Programmer Setup functions. A file name may be specified for these setup files. Default file names are %COM1.PSU or %COM2.PSU, %PLC070.PSU, and %WSI070.PSU. These files contain information that can be used as defaults on the Printer Serial Port Setup, Select SNP Connections, and Programmer WSI Serial Port Setup screens, respectively.	The .PSU files are created when **Save (F7)** is pressed.
.SET	This file contains information that is specified using the Print functions.	A PRINT.SET file is created when information on the Setup Printer Parameters screen is saved. The SCRPRINT.SET file is associated with information on the Select Screen Print Destination screen.
.FLD	The LAST70.FLD file contains the name of the selected folder.	The .FLD file is created when the first folder is created when booting the software. It is used as the default the next time the software executes.
.PTC	The _MAIN.PTC file is a temporary file which contains data for printing the table of contents.	The _MAIN.PTC file is created when a logic or values listing is started. It is deleted when the listing terminates successfully terminates with an error, or aborts.

Cross Reference Data Files

Print function cross reference data files are not automatically deleted when you exit the print function. You can, however, specify that the files be deleted at the end of a cross reference listing by setting the ***Delete Files After Use*** field on the Cross Reference screen to **Y** (Yes). (Refer to chapter 10, section 3, "Print Program," for more information on this option.)

Extension	File Description	When Logicmaster 90-70 Software Creates the File
.XRF	The .XRF file contains cross reference data for a single logic block.	A .XRF file is created for each logic block when printing a listing containing cross reference tables, reference use tables, or in-ladder cross references.
.XOV	The PRINT.XOV file contains data for managing the .XRF files.	A PRINT.XOV file is created when the all blocks option is selected while printing a listing containing cross reference tables, reference use tables, or in-ladder cross references.
.PTX	A temporary file.	The GLOBAL.PTX file exists during a listing that includes global cross reference text. It is deleted when the global cross reference listing terminates successfully, terminates with an error, or aborts.

Appendix J Commom User Errors

Error Message: "Error Detected in WSI Board"

Some users of IBM-clone computers have experienced difficulty using Logicmaster 90-70 software. The computer backplane clock rate for the WSI Board slot should not be greater than 8 mHz.

In addition, certain device drivers installed by CONFIG.SYS when MS-DOS is booted can prevent the expansion bus from performing 8-bit data transfers with the Work Station Interface (WSI) Board. When this situation occurs, the Logicmaster 90-70 software displays the error message "Error detected in WSI Board" during initialization.

To correct the problem for a COMPAQ computer:

1. Copy CONFIG.SYS to CONFIG.SAV to preserve the original version of the CONFIG.SYS file.
2. Examine the CONFIG.SYS file (type CONFIG.SYS) for a DEVICE statement similar to one of these statements:

```
device=xxxxxx.sys bus 16
device=c:xxx/sys bus 16
device=c:xxx.sys <other parameters> bus 16
```

   where ***<other parameters>*** represents any number of words or numbers separated by spaces.

3. Using a text editor such as EDLIN, remove "bus 16" from the statement.
4. Save the modified version.
5. Power the computer off and on. A warm boot (i.e., pressing **CTRL-ALT-Delete**) will not reset the hardware for correct 8-bit operation.

If some other application program requires the unmodified form of the device driver, different versions of the CONFIG.SYS file can be used for it and for Logicmaster 90-70 software. A good method for managing this technique is to use a separate batch file to copy each version when it is needed from its permanent, distinctive file name (e.g., CONFIG.LM) to CONFIG.SYS.

Trouble Communicating with the Series 90-70 PLC
Error Message: "Error Detected in WSI Board Port"
Error Message: "Error Loading Code into WSI Board"

Certain boards installed in the computer can conflict with the interrupt used by the Work Station Interface Board. The WSI Board uses the expansion bus IRQ3 interrupt request line. IRQ3 is assigned to the COM2 serial port and is also used by other communication adapters. If the WSI Board is installed in a computer where COM2 is used by an application which requires the use of interrupts (e.g., serial mouse), then neither the WSI Board nor the COM2 application will operate properly. The WSIB2 Board has a software-configurable interrupt request line. Refer to the information on PLC communications options in appendix D, *Programmer Environment Setup*, for information on moving the interrupt request line to one that does not conflict.

The WSI Board uses the MS-DOS memory addresses ranging from CE00:0 to CE00:1FFF. Other applications must avoid this address range. It may be possible to configure the application to use a different address range than that of the WSI Board. Consult the documentation for the conflicting application for more information.

The WSI Board uses the I/O port addresses 310 hex to 313 hex. Other applications must avoid these port addresses in order to prevent conflicts.

Error Message: "File System Error"

If the message "File System Error" occurs, the FILES allocated in the CONFIG.SYS file is probably too low. Change or add this line to the CONFIG.SYS file:

```
FILES=20
```

You must then reboot your computer in order to activate the new value for FILES in the modified CONFIG.SYS file. To reboot your computer, press **CTRL-ALT-Delete**.

If this line already exists, try changing the number to 30 (i.e., FILES=30) and rebooting your computer.

Error Message: "Read/Write PLC Initialization Aborted"

If the message "Read/Write PLC Initialization Failure" occurs while attempting to run Logicmaster 90-70 software, the WSI Board may not be seated properly. Re-install the WSI Board in the computer slot or try another slot. If this does not correct the problem, the board may be bad.

Error Message: "Constant Out of Range"

If the message "Constant Out of Range" occurs while trying to enter hexadecimal constants, you may be trying to enter hex constants into integer type functions. Use the Types (F10) function softkey to change the function type.

Cannot Install the Software

You must have at least 1.4 Megabytes of hard disk space and an additional 600K bytes of temporary hard disk space if Lotus / Intel / Microsoft expanded memory (LIM 3.0 or higher) is not available for Logicmaster 90-70 software. Also, be sure the CONFIG.SYS file has files set to at least 20, i.e., FILES=20.

If the message "The unarchive program failed (PK11)" occurs, check the CONFIG.SYS file. It should have the line FILES=20. If it does, try changing that to FILES=30, reboot the computer, and try the INSTALL procedure again.

If the message "The unarchive program failed (PK1)" occurs, try installing the software again. If the INSTALL procedure still fails, the INSTALL diskette is probably bad.

Error Message: "Comm Driver Not Loaded"

If the message "Comm Driver Not Loaded" occurs, you may be trying to run the standard serial communications version of Logicmaster 90-70 software without the correct version of MS-DOS and / or without a memory manager. Refer to chapter 1, "Introduction," for a list of what you will need in order to run the Logicmaster 90-70 software.

Printer Output Is Garbled

If the ***Specify Graphics Printer*** option was enabled in the Logicmaster 90 setup package, make sure that the attached printer supports the IBM graphics character set.

If you have a serial printer, make sure the appropriate serial port has been configured with the MS-DOS mode command to match the printer settings. The MS-DOS mode command should be used to configure the serial printer port before starting up the Logicmaster 90 software package. See chapter 7, section 1, "Printer Serial Port Setup."

Error Message: "Port/File Access Denied"

Attempting to print logic to a virtual drive which is full results in the error "Port / File access denied." To correct the problem, delete some files from your virtual disk.

System Software Error ID: 0000 EX: 0000

Logicmaster 90-70 software does not have enough available RAM to perform the operation. Check the AUTOEXEC.BAT and CONFIG.SYS files to remove any device drivers or Terminate and Stay Resident (TSR) programs in order to free more RAM.

Busy Message Displayed After Load

The message "Loading ....." will continue to be displayed after a load operation fails because of incompatible files. To clear the busy message, press any key.

Appendix K

Variable Declaration Table Import/Export Using Comma Separated Variable (CSV) Format

Comma Separated Variable (CSV) Format and SNF Format

To import to and export from the Variable Declaration Table, Logicmaster 6.0 and higher uses an extension of the industry-standard Comma Separated Variable (CSV) format called Shared Name File (SNF) format. Importing an SNF into the Variable Declarations Table gives you the ability to define nicknames ahead of time in a spreadsheet program. Exporting an SNF from the Variable Declarations Table gives you the ability to use the exported file with CIMPLICITY® and third party operator interfaces.

The Shared Name File (or SNF) format is an extension of the industry-standard Comma Separated Variable (CSV) format. If you are planning on importing a file into the Variable Declarations Table as discussed on page 3-46, you must ensure that your file is in SNF format. When exporting Variable Declarations as discussed on page 3-49, Logicmaster places the files into SNF format (see page 3-46 for more information on SNF format).

SNF files contain two types of information, Comments and Records. Comment lines begin with the Comment Line Sequence ## (i.e., two consecutive pound characters as the first non-blank characters in the line). Records, except for Header Section records (see below), do not begin with the Comment Line sequence.

Note

The ability to import and export CSV files is a Release 6 or later feature.

General SNF Format Rules

- Shared Name Files shall have a default extension of ".SNF". The recommended naming convention is that the filename be the same as the source file (folder) from which the SNF is generated.
- Comment lines begin with the double pound sign ("##") character sequence as the first non-blank character.
- Comment lines may appear anywhere within the SNF, but may not occur inside a record.
- Records continued over several lines may not have intervening comment lines.
- The SNF will consist of three sections which must occur in order:

  (1) an optional Header section

  (2) a required Field Names section

  (3) a required Data section.

- All sections are made up of comma separated variable (CSV) records. Each CSV record is composed of a list of fields separated by commas. Individual fields may be enclosed within double quotation marks, and fields that contain commas must be enclosed within quotes.
- All records in a section must include the same fields, and the fields must be in the same order in each record. Fields in records may be left empty, but empty fields must be delimited with commas like all other fields.
- Spaces surrounding the comma delimiters in a record are ignored. To include leading or trailing spaces in a field, surround the field with quotation marks.
- Records may span one or more lines of text in an SNF file. A line of text in an SNF file ends with the new line character (or character sequence) appropriate for the operating system. The last line of text in the file must include a new line character.
- Any line beginning with a double colon sequence (::) is considered a continuation of the record started on the previous line. Fields must be contained within a single line, and their trailing comma delimiter must follow the field on the same line as the field (i.e., lines of text followed by continuation lines must end in a non-quoted comma).
- Blank lines are not allowed.
- The maximum line size is 2000 characters.
- The maximum record size is 2000 characters not counting continuation characters and new line characters.
- The maximum number of fields in a record is 100.

Header Section Rules

- Header section records may not span multiple lines.
- The Header section contains structured comments which provide some context for the file.
- All header section entries must be accepted by any package using the SNF format, but they need only interpret and use the ones they recognize.

Field Names Section Rules

- The Field Names Section contains one and only one record.
- The Field Names Section begins with the first non-comment line in the file.
- Field Names are case insensitive.
- PT_ID must be the first field in the Field Names section.
- No empty field are permitted in the Field Names section.

Data Section Rules

- The Data Section follows the Field Names Section.
- The Data Section begins on the first non-comment line after the Field Name section and continues to the end of the file.
- Predefined Keywords in the Data section are case insensitive.
- PT_IDs in the Data Section are case insensitive.

- Empty fields are permitted in the Data section, but they must be delimited by commas.
- If the PT_ID field is empty, the ADDR field must be present and not empty.
- The format of numbers shall be whatever Excel 5.0 uses as a default when creating a CSV files.

The Header Section

This section of the SNF contains fields which define the context of the SNF. The Header section has four keywords currently defined. It is expected that additional keywords will be defined by GE Fanuc and in addition customers will wish to add their own keywords.

##&&Cr eator	This identifies the program which specified the content of this SNF file. Three possible values generated by GE Fanuc programs are as follows: "CIMPLICITY" or "LOGICMASTER". Other values for this field will not cause an error.
##&&Cr eateDate	This specifies the date when this SNF file was created. The date format shall be in the format "(d)d-mmm-yyyy", for example, 31-MAY-1994, 4-NOV-1986, or 11-Sep-1994
##&&ProgDate	The date of the creation of the program with which this SNF file is associated. If Logicmaster is creating the SNF file, this field contains the date the program was last updated.
##&&F ileType	This identifies what type of data is contained within this SNF. The possible values for this field are as follows: "I/O" and "I/O_WITH_FAULTS." ("I/O" is the only value currently implemented; "I/O WITH FAULTS" is reserved for future reference.)
##&&DelV arDecl	This identifies the blocks for which the Variable Declaration Table should be deleted before the import occurs. The possible values are "ALLBLOCKS" to delete the Variable Declaration of all blocks, "_MAIN" to delete the program's global Variable Declaration, or the name of the desired blocks can be listed (as in the second example shown below).

EXAMPLES

#&&DelV arDecl, _MAIN
or
#&&DelV arDecl, _MAIN, Block1, SLIDE
or
#&&DelV arDecl, ALLBLOCKS

The Field Names Section

This section of the SNF is used to specify the names of the fields in the Data section, and the order of these named fields. The order of the fields in the field names section is the order to be used in all records of the Data section. The field names recognized by Logicmaster are shown below.

Note: Cimplicity® recognizes these field names plus field names specified in the *Cimplicity® Systems Import/Export Utility Operation Manual* (GFK-0923).

Field Name	Meaning of This Field	Logicmaster Equivalent
PT_ID	Tag Name of this point *	Nickname
ADDR	A mnemonic reference to a PLC memory location.	Reference
DESC	An ASCII string describing what data this point represents.	Reference Description
PT_TYPE	What type of data is being described by this point	No Logicmaster equivalent (I / O is the only valid entry at this time.)

*There are additional field names used by Cimplicity. For those field names refer to the Cimplicity documentation. Additional fields which are not supported by the importing program will be ignored without error.

The field name order as shown in the above table is the preferred order.

Specifying a Block Other Than _MAIN

To specify a block in which to place the variable declaration during import, use the following syntax, **"reference_address,block_name"** (the quotation marks are required). If the block name exceeds the seven (7) character maximum, the import will abort. In addition, if the specified block name does not exist, the import will be aborted.

The following example demonstrates the syntax needed:

PT_ID, ADDR, DESC
Input1, %I1, "First input"
Input2, "%I2, BLOCK1", "Second input"
Output1, %Q1, "First output"
Output2, "%Q2, BLOCK1","Second output"

If the import of this file is initiated in _Main, Input1 and Output1 will be defined in the variable declarations for _MAIN while Input2 and Output2 will be defined in the variable declarations for BLOCK1.

Example of Variable Declaration Table

VARIABLE DECLARATION TABLE

REFERENCE	NICKNAME	REFERENCE DESCRIPTION
%I00001	SNERT	Starting point
%I00002	I2	Begin
%Q00001	BLIVET	Allowable over
%R00001	TIC101	Temperature Setpoint 101
%AI0001	REBLIV	Analog input
%AQ0001	DIVOT	Output

Example of an SNF File with All of Variable Declaration Table Selected for Export

##&&Creator, LOGICMASTER
##&&CeateDate,2-June-95
##&&FileType,I/O
PT_ID,ADDR,DESC,PT_TYPE
SNERT,%I00001,Starting point,
I2,%I00002,Begin,
BLIVET,%Q00001,Allowable over,
TIC101,%R00001,Temperature Setpoint 101,
REBLIV,%AI0001,analog input,
DIVOT,%AQ0001,Output,

Example of an Excel Spreadsheet Which Can Be Saved as a CSV for Import into Logicmaster

# # Example of Excel spreadsheet which can be saved as a CSV file to be imported				
##&&Creator	Excel			
##&&CreateDate	2-June-95			
##&&F ileType	I/O			
PT_ID	ADDR	DESC	PT_TYPE	
SNERT	%I00001	Starting point		
I2	%I00001	Begin		
TIC101	%R00001	Temperature Setpoint 101		
REBLIV	%AI0001	Analog input		
DIVOT	%AQ0001	Output		
##PT_ID is the equivalent of Nickname				
## ADDR is the equivalent of Reference				

After saving this spreadsheet as a CSV file and then importing it into the Variable Declaration Table, the fields will be the same as the first example shown above.

Longer Example CSV (SNF) File

The following is an example of the CSV format (i.e., SNF format) created by Logicmaster. This example was exported from Logicmaster as noted in the first four lines. The double pound sign and double ampersand denotes commented lines. If you had created this in a spreadsheet program, it would look the same without the commented lines.

```
##&&Creator,LOGICMASTER
##&&CreateDate,17-MAR-1995
##&&ProgDate,21-FEB-1995
##&&FileType,I/O
PT_ID,ADDR,DESC,PT_TYPE
D_HATCH,%I00001,Dry Hatch Status,BOOL
W_HATCH,%I00002,Wet Hatch Status,BOOL
A_RESET,%I00008,Alarm  Reset,BOOL
ALM_ACK,%Q01000,Alarm Acknowledge from BCS,BOOL
BCS_INT,%Q01001,BCSinitialization,BOOL
NEXT_BT,%Q01002,Next Batch,BOOL
AGIT_ON,%M01001,Agitator Status,
BULK_ON,%M01002,Bulk Ingred Valve Status,
STEAM_O,%M01003,Steam Valve Status,
AGIT_SP,%R00011,Agitate Speed Setpnt,INT
TEMP_SP,%R00012,Reactor Temp   Setpnt,INT
AGIT_T,%R00013,Agitate Time  (seconds),INT
BULK_AD,%R00014,Bulk   Add    Measure (lbs),INT
PHCTL1A,%R00021,BulkAddPhase  Control Reg #1,INT
PHCTL1B,%R00022,BulkAddPhase  Control Reg #2,INT
PH_CB1A,%R00023,BulkAddPhase  Ctl But Reg #1,INT
PH_CB1B,%R00024,BulkAddPhase  Ctl But Reg #2,INT
INTL_R1,%R00025,BulkAddPhase  Intlock Reg,INT
PHSTS_1,%R00026,BulkAddPhase  Status  Reg,INT
BK_WGT,%R00027,Bulk   Added  Weight,INT
R_TEMP,%AI0001,Reactor Temp,INT
LIQ_LEV,%AI0002,ReactorLiquidLevel,INT
AGIT_S,%AI0003,Agitate Speed,INT
ST_F_RT,%AI0004,Steam  Flow   Rate,INT
AGIT_SC,%AQ0001,Agitate Speed Command,INT
ST_V_PO,%AQ0002,Steam  Valve  Position,INT
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