ALLEN-BRADLEY

I/O Scanner-Message Handling Module

User's Manual

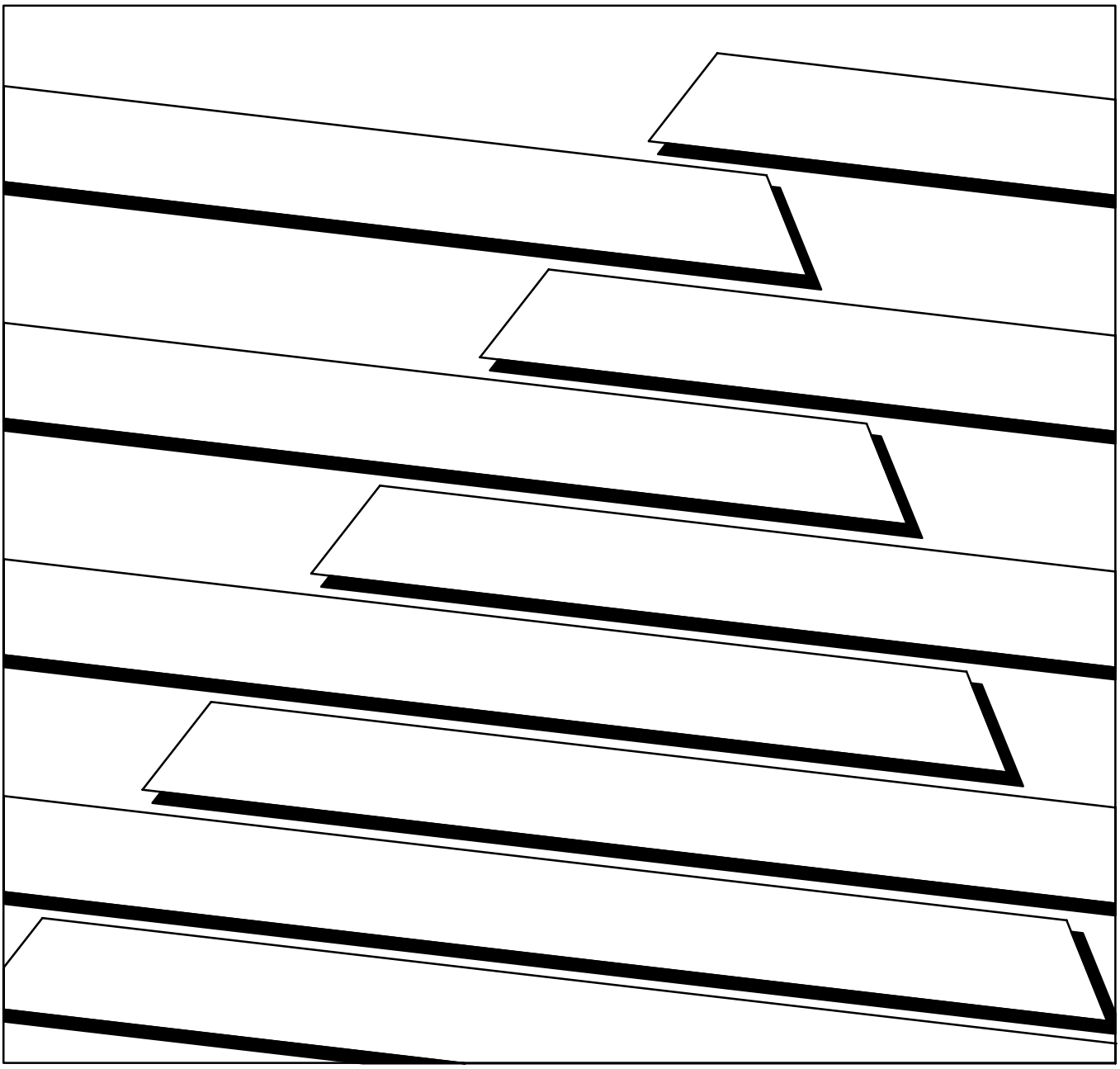


Table of Contents

Chapter 1

Using This Manual

1.0 Important Information for the Reader

Read this chapter before you use the I/O Scanner-Message Handling Module (cat. no. 1775-S4B). It tells you how to use the Reader this manual properly and efficiently for the tasks you will have to perform.

1.1 Manual's Purpose

This manual shows you how to install and operate your I/O scanner-message handling module. The operation of this module is divided into two topics:

- Using the I/O scanner-message handling module to communicate with bulletin 1771 I/O chassis
- Using the I/O scanner-message handling module's report generation capability

1.2 Audience

Before you read this manual or attempt to use the I/O scanner-message handling module, you should be familiar with the basic operation of the PLC-3 controller. If you are not familiar with the PLC-3 controller, refer to the following publications:

- PLC-3 Programmable Controller Installation and Operations Manual (publication 1775-6.7.1, formerly 1775-800)
- PLC-3 Controller Programming Manual (publication 1775-6.4.1, formerly 1775-801)

You can also use our Publication Index (publication SD499) as a guide to further information about products related to our I/O scanner-message handling module. Consult your local Allen-Bradley distributor or sales engineer for information regarding this publication or any needed information.

1.3 Terminology

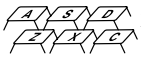
We refer to certain types of equipment throughout this manual. To make the manual easier for you to read and understand, we avoid repeating full product names where possible.

We refer to:

- I/O Scanner-Message Handling Module (cat. no. 1775-S4B) as the **1775-S4B scanner**
- I/O Scanner-Programmer Interface Module (cat. no. 1775-S4A) as the **1775-S4A scanner**
- Industrial Terminal System (cat. no. 1770-T4) as the **industrial terminal**
- RS-232-C compatible devices which communicate to the PLC-3 controller through the 1775-S4B scanner, such as the data terminals, computers, or printers as **RS-232-C devices**

1.4 Conventions

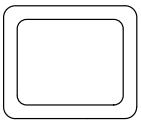
In this manual, we use certain notational conventions to indicate keystrokes and items displayed on a CRT or printer:

-  is used to show keystrokes that you enter from the data terminal keyboard. The keystrokes appear in blue and may be enclosed in brackets to indicate a specific key on the keyboard such as:

  [ENTER]

  In some cases, rather than specific keystrokes, you may be instructed to enter a variable. In that case, the variable is printed in blue lower case letters and enclosed in angle brackets (< >) such as:

  <address>

-  is used to show the 1775-S4B scanner's response to your keystrokes such as:

  S4B>

We describe any exceptions to these conventions where they occur.

1.5 Manual Design

This manual is designed with as many as three divisions per page. These divisions include:

- Headings in the left margin describe the contents of the text
- Text provides explanations, information, and examples
- Figures show displays, hardware, and diagrams

1.6 Important Information

In this manual, there are three different types of important information:

WARNING: Informs you where you could injure yourself if you do not follow the written procedure.

CAUTION: Informs you where you could damage your equipment if you do not follow the written procedure.

NOTES inform you of exceptions to the general rules or important information.

Chapter 2

Introducing the I/O Scanner-Message Handling Module

2.0 Chapter Objectives

This chapter discusses the functions and features of the 1775-S4B scanner. When you finish reading this chapter, you should:

- Be able to identify the hardware components of the 1775-S4B scanner
- Know the basic features and functions of the 1775-S4B scanner

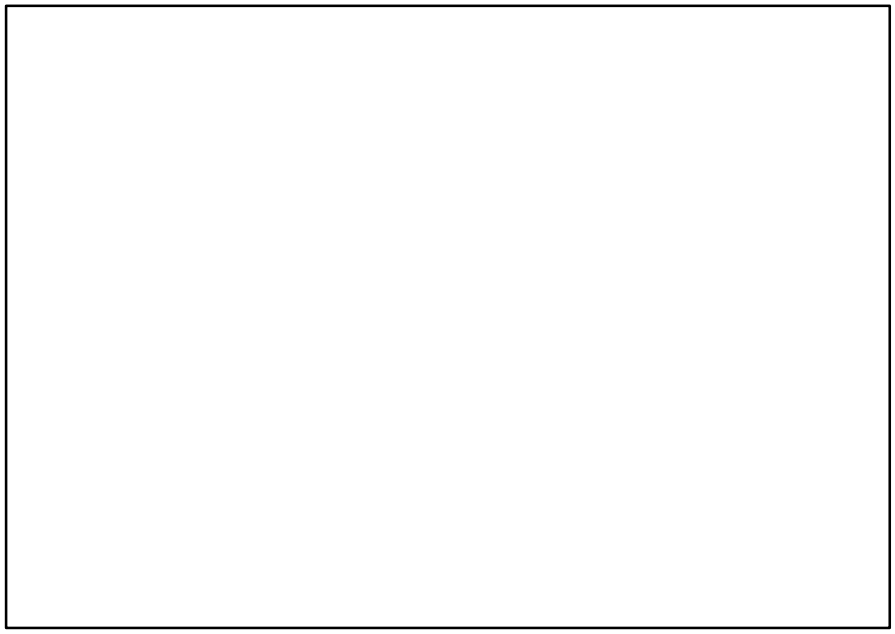
2.1 Looking at the 1775-S4B Scanner's Front Edge

Your 1775-S4B scanner fits into the PLC-3 processor chassis. Looking at the front edge, you will see the following (figure 2.1):

- Pass and Fail indicators
- Thumbwheel switch
- I/O channel status indicators
- Backup connector
- Channel 5 connector
- Terminal swing arm

These components are described in the following sections.

Figure 2.1
I/O Scanner-Message Handling Module



2.1.1 Pass and Fail Indicators

At the top of the 1775-S4B scanner's front edge, LED indicators labeled PASS and FAIL keep you informed on the general condition of the 1775-S4B scanner. These indicators have the following meanings:

Pass (green)	Fail (red)	Meaning
On	Off	Normal Operation
Off	On	Module Fault
On	On	Power-up or system reset
Off	Off	PLC-3 processor is not on

2.1.2 Thumbwheel Switch

The thumbwheel switch is below the PASS and FAIL indicators. Setting it at a unique number (1 to 15) enables the PLC-3 processor to differentiate it from another 1775-S4B scanner.

CAUTION: Do not change the thumbwheel setting on the 1775-S4B scanner while processor power is on. Equipment damage could result.

2.1.3 I/O Channel Status Indicators

Below the thumbwheel switch are four green LEDs labeled:

- CH1
- CH2
- CH3
- CH4

Each LED corresponds to one of the four I/O communication channels. Each I/O channel can connect to a bulletin 1771 I/O chassis or a group of chassis providing direct communication with the 1775-S4B scanner. Each indicator has the following meanings:

If the LED is:	Then:
On	Proper communication exists between 1775-S4B scanner and the I/O chassis on the corresponding I/O channel.
Flashing	A fault exists on one or more of the I/O chassis on the corresponding I/O channel.
Off	No I/O chassis are connected to the corresponding I/O channel.

2.1.4 Backup Connector

Below the I/O channel indicators is a connector labeled BACKUP. This connector is not used.

2.1.5 Channel 5 Connector

Below the backup connector is a 25-pin D-shell connector labeled CH5. This connector provides communication with an RS-232-C device such as a data terminal, a computer, or a printer. Refer to chapter 3 for installation information.

2.1.6 Terminal Swing Arm

Near the bottom of the 1775-S4B scanner is a Terminal Swing Arm (cat. no. 1775-WA). This swing arm contains the connection terminals for channels 1 to 4 which scan I/O chassis. We discuss cable connections for the I/O communication channels in chapter 3.

2.2 1775-S4B Scanner Features and Functions

Now that you are aware of the 1775-S4B scanner's hardware components, this section summarizes the basic features and functions of the I/O scanner-message handling module:

Features	Functions
Four I/O communication channels	To communicate with I/O Adapter Modules (cat. no. 1771-AS) in I/O chassis. You can connect up to 16 I/O chassis to one 1775-S4B scanner I/O channel. The 1775-S4B scanner can communicate with 2,048 inputs and 2,048 outputs per scanner total.
Report generation channel	To communicate with an RS-232-C compatible data terminal for report generation. You can execute messages from your data terminal or from a MSG instruction in the ladder diagram program.
Status indicators	To keep you informed on the 1775-S4B scanner's status. These LEDs indicate the general module status and the active state of each I/O communication channel.
Thumbwheel switch	To distinguish one 1775-S4B scanner from another. You can insert up to 15 1775-S4B scanners in one PLC-3 system.
Terminal swing arm	To easily connect bulletin 1771 I/O chassis to the 1775-S4B scanner. The terminal swing arm disconnects so you can easily attach Twinaxial Cable (cat. no. 1770-CD). An I/O chassis can connect to a 1775-S4B scanner up to 10,000 cable feet away.

2.3 Specifications

Location

- Single slot in a PLC-3 processor chassis

Functions

- I/O interface
- Report generation

I/O Capacity

- 2,048 inputs and 2,048 outputs

Channels Per Module

- 4 I/O communication
- 1 RS-232-C communication

Communication Rate

- 57.6 baud or 115.2 kbaud (I/O channel)
- 110 to 19.2 kbaud (RS-232-C channel)

I/O Channel Cable Length

- 10,000 cable feet (max)

Nominal I/O Scan Times

- 5.5 to 6.5ms for one I/O channel
- 6ms for two I/O channels
- 6ms for three I/O channels
- 6 to 6.5ms for four I/O channels

Backplane Current

- 2.7A from 5V DC circuit
- 2mA from +15V DC circuit
- 2mA from -15V DC circuit

Environmental Conditions

- Operational Temperature: 0 to 60° C (32 to 140° F)
- Storage Temperature: -40 to 85° C (-40 to 185° F)
- Relative Humidity: 5 to 95% (without condensation)

2.4 Chapter Summary

In this chapter, you were introduced to the:

- Hardware components on the 1775-S4B scanner
- Basic features and functions of the 1775-S4B scanner
- Specifications of the 1775-S4B scanner

The next chapters describe installation procedures and PLC-3 LIST selections for the 1775-S4B scanner.

Chapter 3

Installing Your 1775-S4B Scanner

3.0 Chapter Objectives

The 1775-S4B scanner provides the PLC-3 processor with an RS-232-C compatible channel for report generation and a terminal swing arm for I/O scanning. After reading this chapter, you should be able to:

- Insert a 1775-S4B scanner into a PLC-3 system
- Connect an RS-232-C device to the channel 5 connector on the 1775-S4B scanner
- Connect I/O chassis to the terminal swing arm on the 1775-S4B scanner

3.1 Inserting Your 1775-S4B Scanner

The first step is inserting your 1775-S4B scanner. You can slide the 1775-S4B scanner into any slot of a PLC-3 Processor Chassis (cat. no. 1775-Al, 1775-A2). The chassis electromechanically interlocks helping to guard against inserting or removing modules while power is on.

3.2 Using the 1775-S4B Scanner's RS-232-C Channel

The channel 5, 25-pin connector provides RS-232-C communication to a modem, computer, or data terminal for report generation capability. We discuss report generation in chapter 5. The following two sections discuss connecting RS-232-C devices to the 1775-S4B scanner.

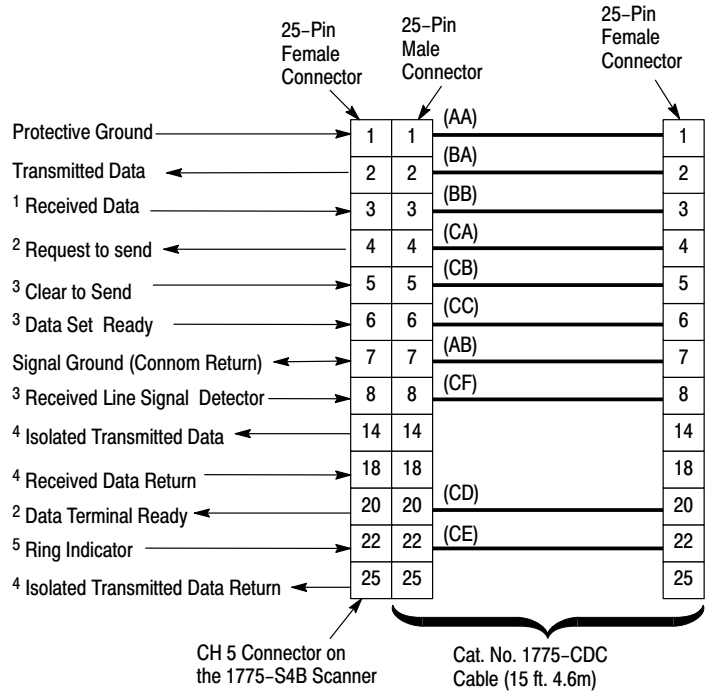
3.2.1 Connecting RS-232-C Devices

Figure 3.1 shows the pin assignments for the channel 5 connector. You can use Peripheral Cable (cat. no. 1775-CDC) to connect RS-232-C data terminals or computers to the 1775-S4B scanner. This peripheral cable is 15 feet or 4.6 meters long (figure 3.2). If you need more distance, you can connect an RS-232-C device up to 50 feet or 15.2 meters from the 1775-S4B scanner by using Remote I/O Interconnect Cable (cat. no. 1778-CR), or equivalent, and two 25-Pin Connector Kits (cat. no. 1770-XXP). Figure 3.3 shows the appropriate wiring.

If an RS-232-C device must be more than 50 cable feet or 15.2 cable meters from the 1775-S4B module, use a line driver/receiver or a modem.

You could also use the cable that comes with the RS-232-C device. However, the connector must have a right angle hood; otherwise, the PLC-3 processor door will not close.

Figure 3.1
Wiring Diagram of Peripheral Cable for Connecting RS-232-C Device to 1775-S4B Scanner



1 This pin is for both long line and RS–232–C campatible transmission

2 Signals from the data terminal to these input pins have no effect on the operation of the module.

3 The module always holds these output pins high (ON).

4 These pins are for long line transmission; they are not RS–232–C compatible.

5 The module always holds this output pin low (OFF).

Figure 3.2
Connecting an RS-232-C Device to the 1775-S4B Scanner Using Peripheral Cable

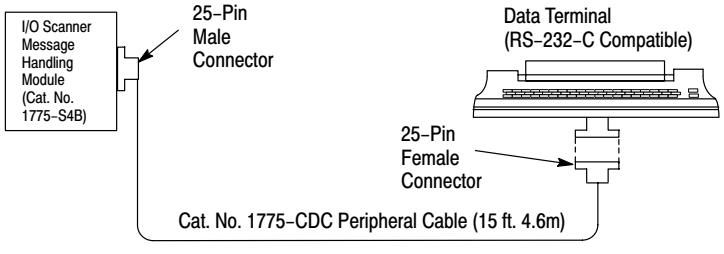
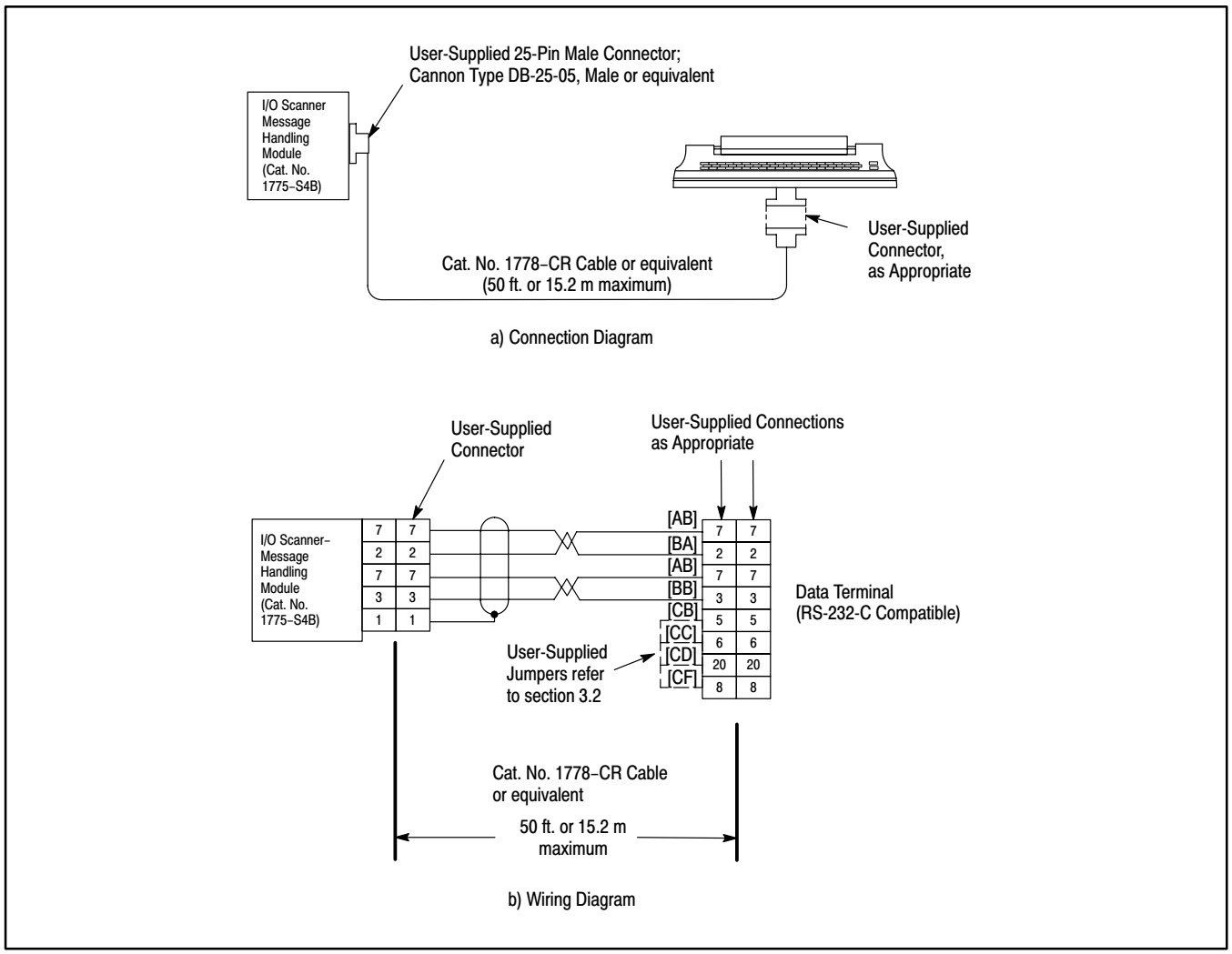


Figure 3.3
Connecting an RS-232-C Device to the 1775-S4B Scanner Using Remote I/O Interconnect Cable



Some RS-232-C devices may require a high signal for a clear to send (CB) signal at pin 5, a data set ready (CC) signal at pin 6, or a data carrier detect (CF) signal at pin 8 for proper operation. Depending on your connections, note the following:

- If you are using the 1775-CDC cable to connect directly between the 1775-S4B scanner and the RS-232-C device or its cable, the 1775-S4B scanner provides these signals.
- If you are constructing a cable for the RS-232-C device, you can jumper pin 20 to pin 5, 6, or 8 as required by the RS-232-C device.

The RS-232-C device should pull pin 20 high to provide its own signal. This jumpering is shown by dashed lines in the wiring diagram of figure 3.3.

3.2.2 Connecting an Industrial Terminal

You can use the PLC-3 Industrial Terminal Cable (cat. no. 1775-CAT) for connecting an industrial terminal to the 1775-S4B scanner. Refer to the steps below for proper connection:

Step 1—Connect the end labeled INDUSTRIAL TERMINAL END to channel B of the industrial terminal.

Step 2—Connect the end labeled PLC-3 END to the channel 5 connector on the 1775-S4B scanner.

The 1775-CAT cable is 10 feet or 3 meters long (figure 3.4). If you want to connect the industrial terminal up to 5,000 cable feet (1,524 cable meters) away from the 1775-S4B scanner, refer to figure 3.5. Use 1778-CR cable or equivalent cable and two 25-pin male connector kits (cat. no. 1770-XXP).

Figure 3.4
Connecting an Industrial Terminal to the 1775-S4B Scanner Using Industrial Terminal Cable

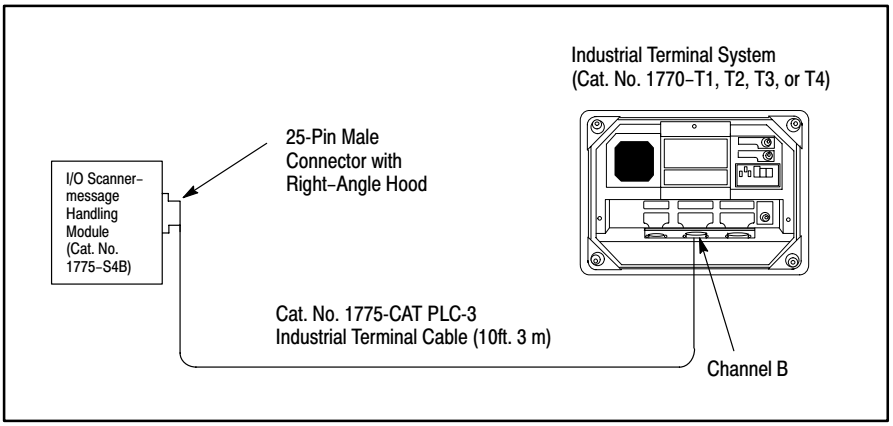
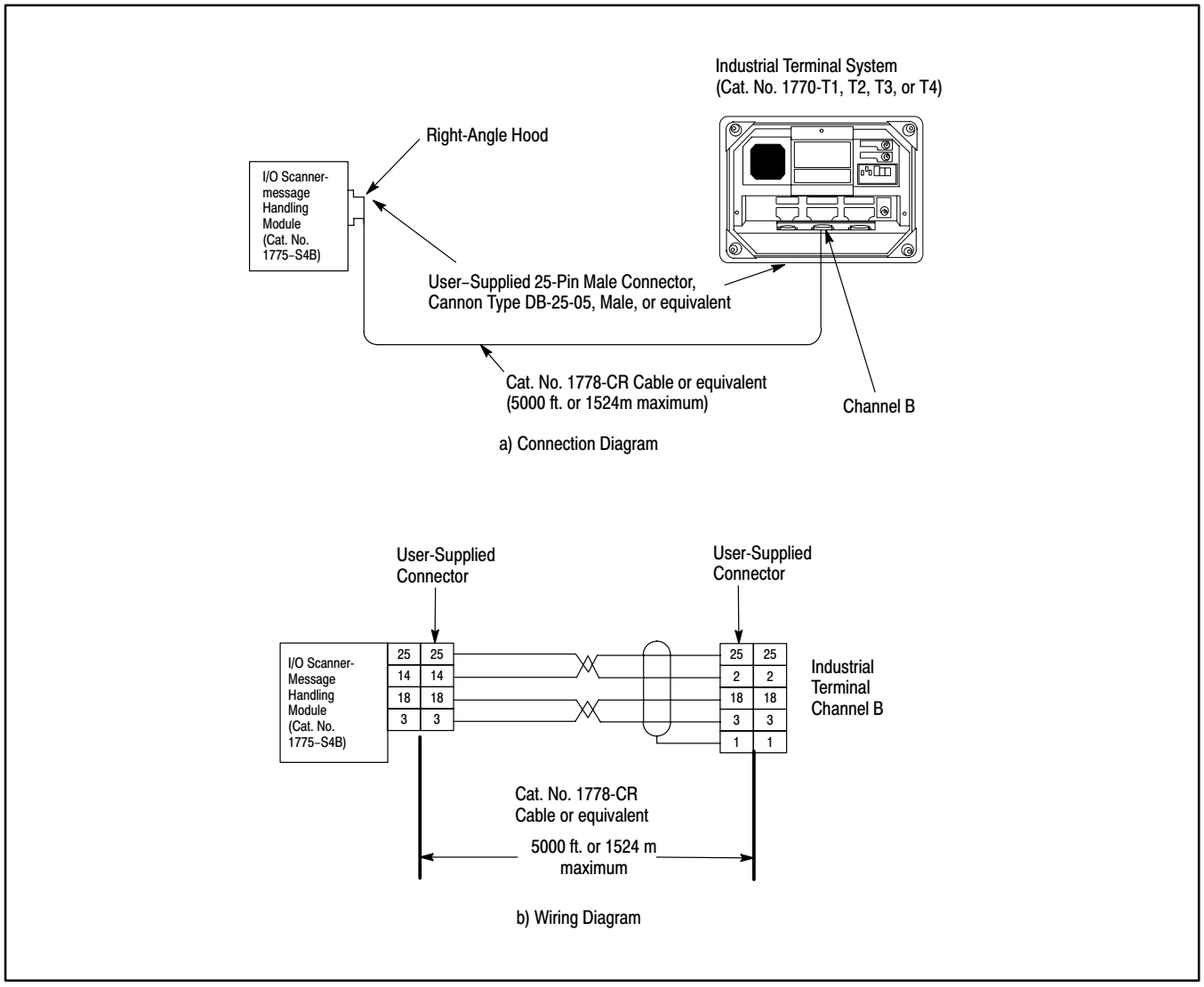


Figure 3.5
Connecting an Industrial Terminal to the 1775-S4B Scanner Using Remote I/O Interconnect Cable



3.3 Using the 1775-S4B Scanner's I/O Terminal Swing Arm

The I/O terminal swing arm provides cable connection for Twinaxial Cable (cat. no. 1770-CD) which connects to 1771 I/O chassis. This swing arm contains terminals for I/O channels 1 thru 4. Figure 3.6 shows how to wire the 1770-CD cable to the terminals on the terminal swing arm.

Figure 3.6
I/O Scanner Module I/O Channel Connections

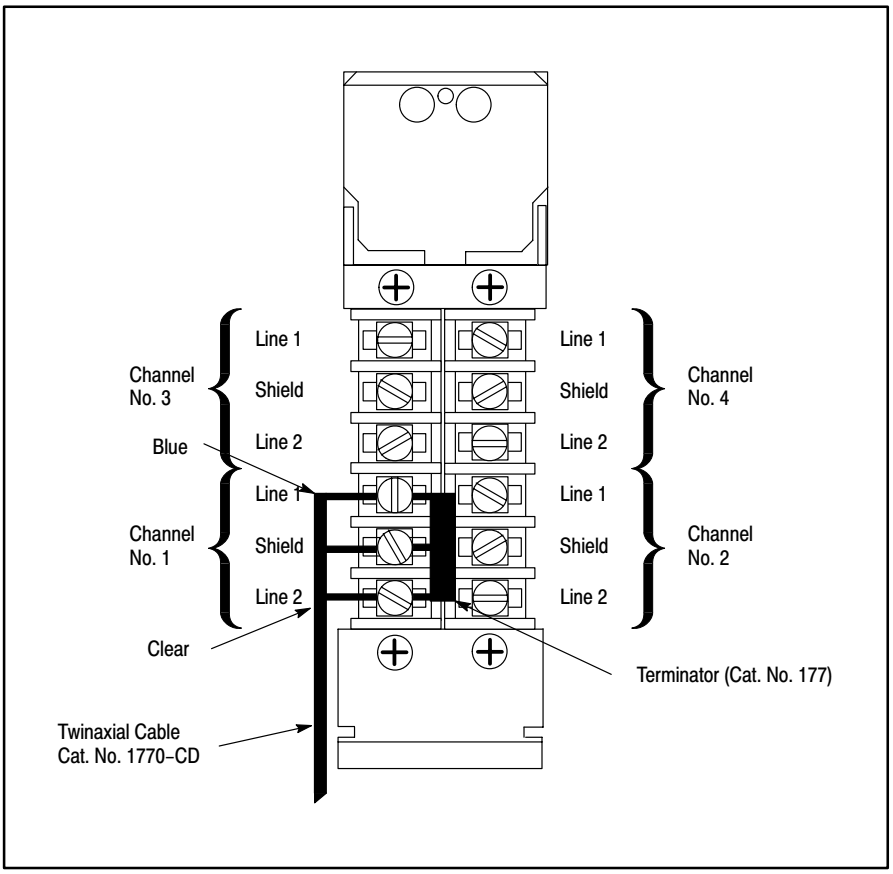
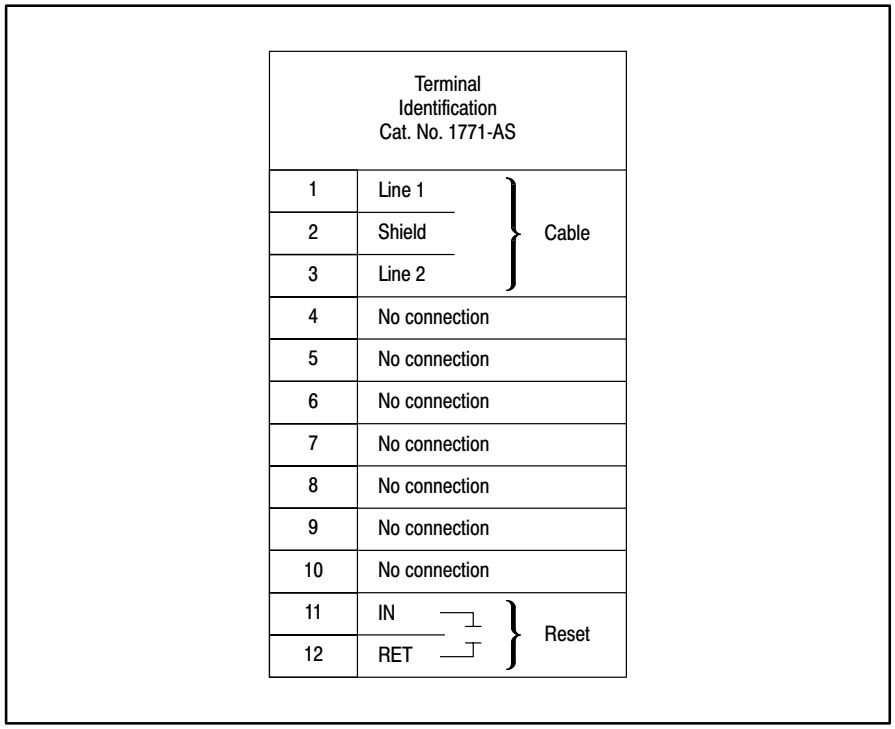


Figure 3.7 shows the terminal identification label which indicates the proper connections for each I/O adapter module to an I/O channel. This label is on the side of the module. The connections are made at screw terminals on a wiring arm in front of each I/O adapter module.

Figure 3.7
I/O Adapter Module (cat. no. 1771-AS) Terminal Identification Label



Perform the following steps to make proper I/O channel connections:

Step 1—Connect the twinaxial cable in a serial (daisy chain) fashion from the 1775-S4B scanner to each I/O chassis within the I/O channel (figure 3.8).

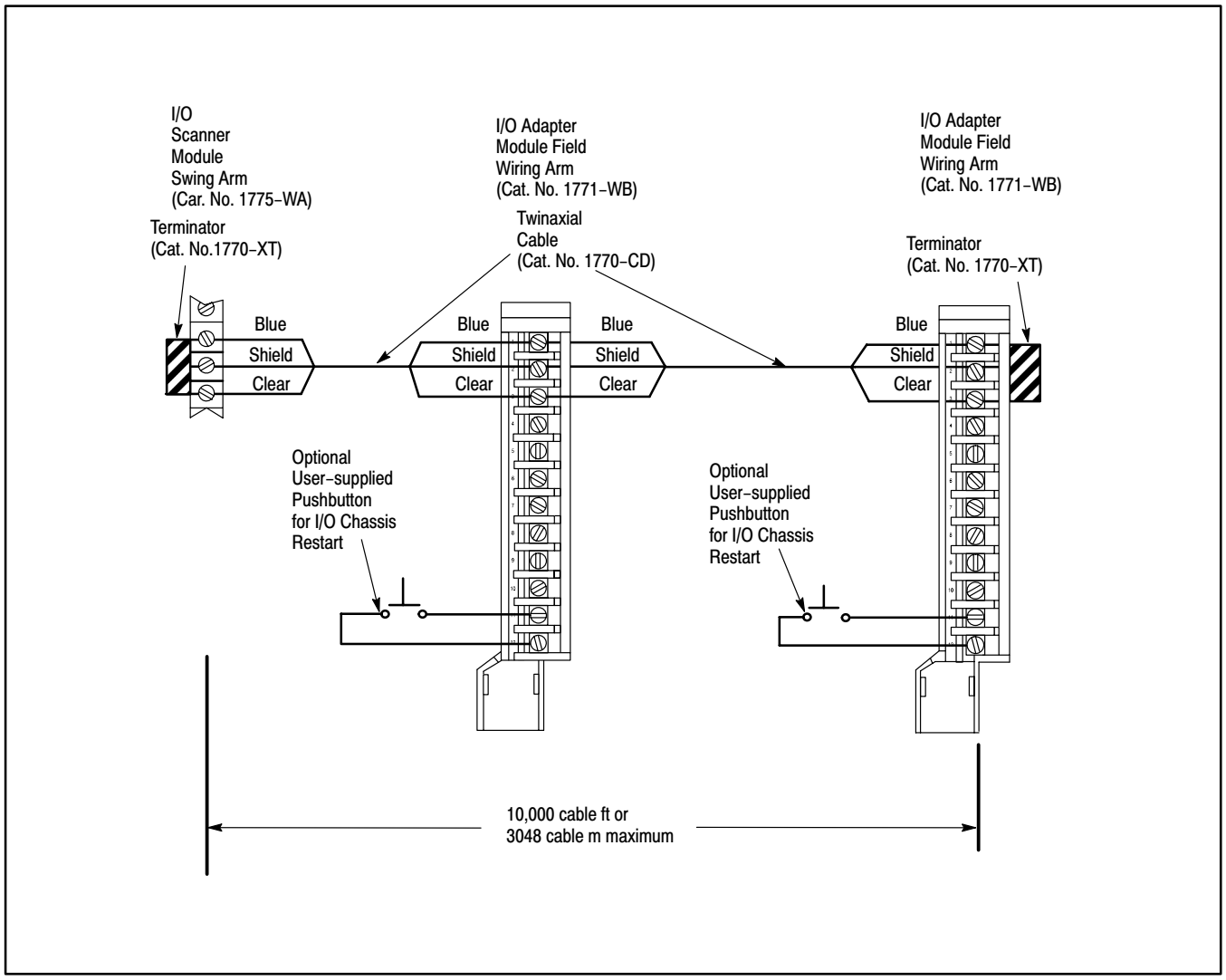
Step 2—Connect the signal conductor with blue insulation to the LINE 1 terminal at the 1775-S4B scanner and at each I/O adapter module in the I/O channel.

Step 3—Connect the signal conductor with clear insulation to the LINE 2 terminal. Connect the shield drain wire to the SHIELD terminal.

Step 4—Connect a Terminator (cat. no. 1770-XT) between the terminals at each end of each I/O channel.

You can optionally connect a normally open, momentary contact switch between terminals 11 and 12 at each I/O adapter module. You could then use such a reset switch to reset the I/O adapter module if the PLC-3 processor detects a fault at the I/O chassis. Refer to the PLC-3 Programmable Controller Installation and Operation Manual (publication 1775-6.7.1, formerly 1775-800) for detailed information.

Figure 3.8
I/O Channel Connections



3.4 Chapter Summary

In this chapter, you read installation procedures for:

- Connecting an RS-232-C device to channel 5 for report generation
- Connecting I/O chassis to the terminal swing arm for I/O scanning

Before you begin operating the 1775-S4B scanner, we suggest that you double check all connections.

The next chapter describes LIST selections for the 1775-S4B scanner.

Chapter 4

Operating the LIST Function

4.0 Chapter Objectives

The LIST function allows you to select parameters to operate the PLC-3 controller. After reading this chapter, you should be able to:

- Select operating parameters for the RS-232-C communication channel on the 1775-S4B scanner
- Select operating parameters for the I/O communication channels on the 1775-S4B scanner

4.1 Entering LIST

You can operate the LIST function for the 1775-S4B scanner through a 1770-T4 terminal or the data access panel on the PLC-3 Main Chassis (cat. no. 1775-Al). Refer to the PLC-3 Programmable Controller Installation and Operation Manual (publication 1775-6.7.1, formerly 1775-800) for detailed information on operating the LIST function.

Figure 4.1 shows you the parameters that you can select for each channel. We explain these parameters in the following sections.

4.2 Configuring the RS-232-C Communication Channel

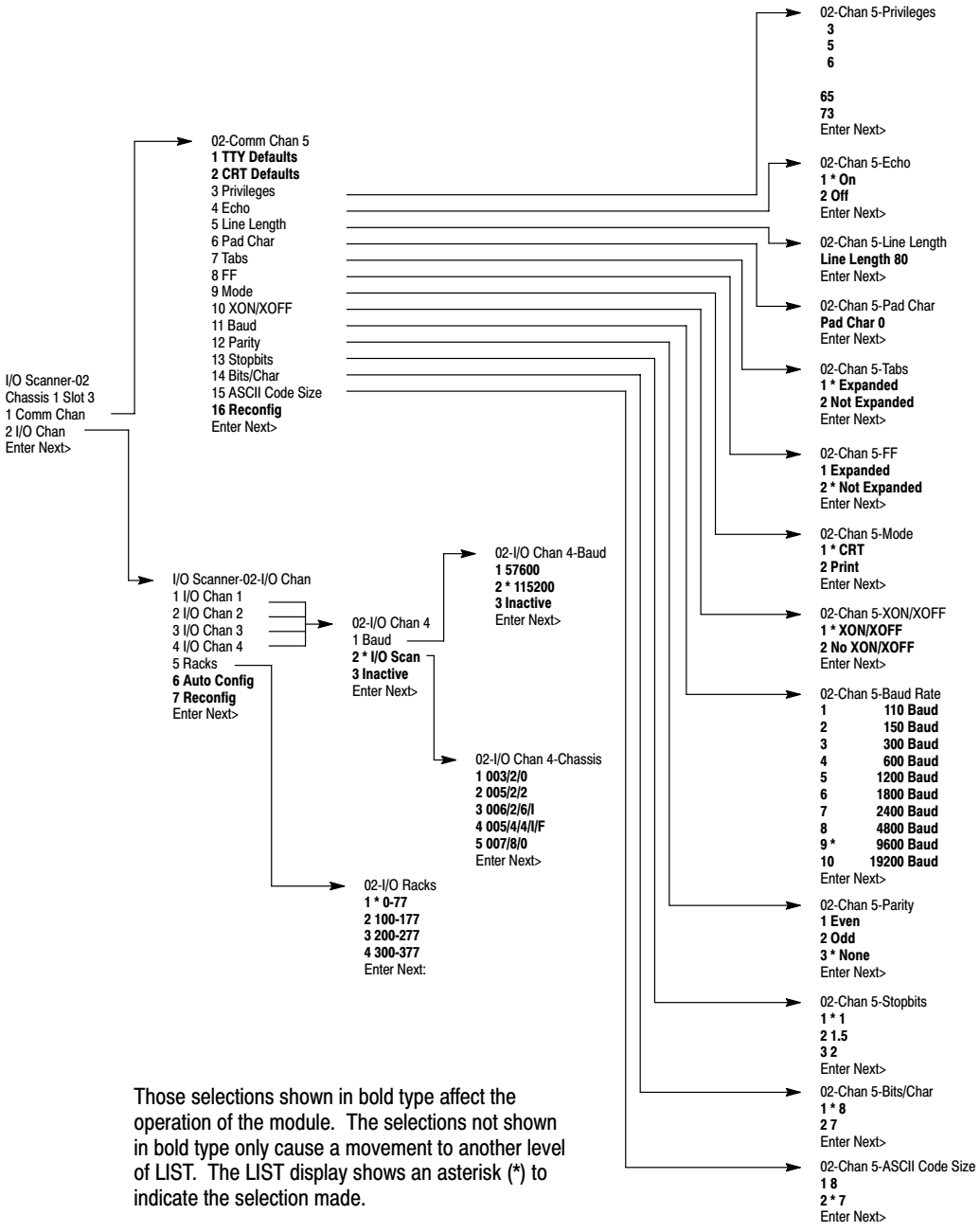
If you select COMM CHAN to configure the RS-232-C communication channel, you can make the following selections:

- TTY (Printer) defaults
- CRT defaults
- Privileges
- Echo
- Line length
- Pad characters
- Tabs
- Form feed
- Mode
- XON/XOFF
- Communication rate (baud)
- Parity
- Stop bits
- Data bits/character
- ASCII code size

- Reconfig

We explain these selections in the following sections.

Figure 4.1
LIST Selections for the 1775-S48 Scanner



Those selections shown in bold type affect the operation of the module. The selections not shown in bold type only cause a movement to another level of LIST. The LIST display shows an asterisk (*) to indicate the selection made.

4.2.1 TTY (Printer) Defaults

The TTY defaults selection configures the RS-232-C communication channel for report generation communication with a printer terminal. Table 4.A lists the parameter selections for TTY defaults. You can use the printer terminal for report generation functions that we discuss in chapters 5 through 11.

Table 4.A
Channel 5 Default Selections

Parameter	TTY Defaults	CRT Defaults
Privileges	3, 5, 6, 65, 73	3, 5, 6, 65, 73
Echo	On	On
Line length	80	80
Pad Char	4	0
Tabs	Expanded	Not Expanded
Form feed	Expanded	Expanded
Mode	Print	CRT
XON/XOFF	XON/XOFF	XON/XOFF
Baud	300 Baud	9600 Baud
Parity	None	None
Stop bits	1	1
Bits/Character	8	8
ASCII Code Size	7	7

4.2.2 CRT Defaults

The CRT defaults selection configures the RS-232-C communication channel for report generation communication with a CRT terminal. Table 4.A lists the parameter selections for CRT defaults. You can use the CRT terminal for report generation functions that we discuss in chapters 5 through 11.

You must configure the RS-232-C communication channel for TTY or CRT defaults. If you make no selection, the channel configures for CRT defaults.

4.2.3 Privileges

The LIST function allows you to select operating parameters for the RS-232-C communication channel on the 1775-S4B scanner. These operating parameters are called privileges and are primarily a list of PLC-3 memory areas into which channel 5 has access. For example, if a report generation message is to write into the message area of PLC-3 memory, you must select privilege 5 which corresponds to the message area after you select the privileges selection in LIST.

Some privileges, however, do not deal with PLC-3 memory areas. For example, privilege 65 allows you to edit or delete report generation messages. Table 4.B lists the available privileges. We describe all the privileges below:

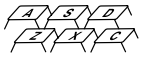
- **Privilege 0**—System status area. Allows device on channel 5 to write to the system status area of PLC-3 memory.
- **Privilege 1**—System pointers area. Allows device on channel 5 to write to the system pointer area of PLC-3 memory.
- **Privilege 2**—Module status area. Allows device on channel 5 to write to the module status area of PLC-3 memory.
- **Privilege 3**—Data table area. Allows device on channel 5 to write to the data table area of PLC-3 memory.
- **Privilege 4**—Program area. Allows device on channel 5 to write to the program area of PLC-3 memory.
- **Privilege 5**—Message area. Allows device on channel 5 to write to the message area of PLC-3 memory.
- **Privilege 6**—System symbol area. Allows device on channel 5 to write to system symbol area of PLC-3 memory.
- **Privilege 7**—User symbol area. Allows device on channel 5 to write to user symbol area of PLC-3 memory.
- **Privilege 10**—Force table area. Allows device on channel 5 to write to force table area of PLC-3 memory.
- **Privilege 65**—Edit report generation messages. Allows device on channel 5 to edit or delete report generation messages.
- **Privilege 73**—Accept keyboard input. Allows device on channel 5 to input data for report generation.

Table 4.B
Privileges

Privilege Number	Description
0	Write access to system status area
1	Write access to system pointers area
2	Write access to module status area
3	Write access to data table area[1]
4	Write access to program area
5	Write access to messages area[1]
6	Write access to systems symbols area[1]
7	Write access to user symbols area
10	Write access to force tables area
65	Edit or delete report generation messages[1]
73	Accept keyboard input for report generation[1]

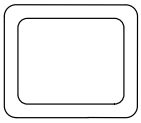
[1] indicates the default privileges.

To add a privilege to channel 5, type the number of the privilege. For example:



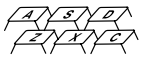
At the privileges menu if you enter:

ENTER NEXT > 10



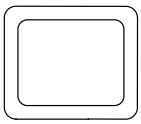
The PLC-3 processor adds privilege 10 (write access to force table area) and redisplays the privileges list.

You can make a privilege independent of the memory protect keyswitch position by typing /I after the privilege number. For example:



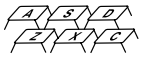
If you enter:

ENTER NEXT >3/I



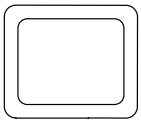
The PLC-3 processor places /1 after privilege 3 (write access to data table area) and redisplays the privileges list. Then the PLC-3 processor updates the data table regardless of the memory protect keyswitch position.

To delete a privilege from a local channel, type /D after the privilege number. For example:



If you enter:

ENTER NEXT > 4/D



The PLC-3 processor deletes privilege 4 (write access to the user program area) and redisplays the privileges list.

If you do not specify privileges, the default privileges are 3, 5, 6, 65, and 73.

4.2.4 Echo

The echo selection determines whether channel 5 immediately transmits back to the data terminal a copy of each character received from the data terminal. To enable the echo selection, your RS-232-C device must be set for full-duplex. Note the following:

If you:	Then:
Select echo	Each keystroke from the data terminal prints out or displays after being echoed by the channel.
Do not select echo	The keystrokes do not display, unless you can configure the data terminal to do so directly.

The echo selection defaults to on.

4.2.5 Line Length

You can select a line length value of 0 to 255 characters. If you select a value of 1 to 255, a new line starts automatically whenever the line length of a message exceeds the line length value selected.

As an example, consider message text stored with the intention of printing on a 132-column printer. If an 80-column printer is used, selecting a line length value of 80 automatically causes a new line to start after 80 characters. This prevents the end of each line from being lost. The default line length is 80 characters.

If you select value 0, a new line does not automatically start. You can use the value 0 for many applications involving graphic displays.

4.2.6 Pad Characters

After CR and LF characters are sent to an unbuffered printer to start a new line, the printer needs some time to position the print head at the start of the new line. NUL characters follow CR and LF characters to give the printer this time. Pad characters (1 to 255) provide the number of needed NUL characters. If no NUL characters are needed, enter a pad characters value of 0. If you do not specify a pad character, this selection defaults to 0.

4.2.7 Tabs

The tabs selection determines what the channel transmits for a tab function:

If you select:	Then:
Not expanded	The channel sends an HT (tab) character in the message transmission for each HT character in the stored message text. Sending tab characters is only appropriate when transmitting to a data terminal which supports a hardware tab function.
Expanded	The channel considers a tab position to exist every 8 columns. Each time a HT character is reached in the stored message, the channel sends the number of SP characters to move the cursor to the next tab position.

The default selection is not expanded.

4.2.8 Form Feed

The form feed selection determines what character or characters the channel transmits to accomplish the form feed function:

If you select:	Then:
Not expanded	The channel sends a FF character in the transmission for each FF character in the message text. Sending FF characters is only appropriate when transmitting to a data which supports a hardware form feed function.
Expanded	The channel sends seven LF characters in the message transmission for each FF character in the stored message text. This selection does not provide a true form feed function, but it can provide a separation between messages.

The default selection is expanded.

4.2.9 Mode

The mode selection determines what the 1775-S4B scanner does when you enter a DEL (delete character) from your keyboard. You can make the following selections:

If you select:	Then:
CRT	A DEL character causes the 1775-S4B scanner to send back the characters BS, SP, BS to erase the character from the screen.
Print	A DEL character causes the 1775-S4B scanner to send back the character being deleted so that it prints again with a slash (/) character on each side. For example, if you type an E, you would see it printed as: E If you then delete it, you would see: E/E/

With either selection, a DEL character deletes the previous character entered. The default selection is CRT.

4.2.10 XON/XOFF

The XON/XOFF selection determines whether the 1775-S4B scanner responds to XON and XOFF characters received from the data terminal.

Some data terminals can receive data transmissions at a faster rate than they can print. They hold the received data in a buffer until the printing can catch up during the time between transmissions from the module. However, when a long message is transmitting, this buffer can become full. Therefore, the 1775- S4B scanner provides an XON/XOFF hand-shaking function which temporarily inhibits data transmissions until the buffer has room. To use this hand-shaking function, you can generate the following characters:

- DC3 (XOFF) character generates automatically when the buffer is full or if you enter [CTRL] S from the keyboard.
- DC l (XON) character generates automatically when the buffer is full or if you enter [CTRL] Q from the keyboard.
- CAN (cancel) character generates if you enter [CTRL] X or [BREAK] from the keyboard.

This selection operates as follows:

If you select:	Then:
XON/XOFF	When the data terminal sends the ASCII character DC3 (XOFF), the 1775-S4B scanner is inhibited from transmitting until it receives the ASCII character DC1 (XON). You can use the ASCII character CAN (cancel) to abort the suspended transmission. The 1775-S4B scanner ignores any other character.
NO XON/XOFF	The 1775-S4B scanner does not respond to any DC3 (XOFF) character received from the data terminal.

The default selection is XON/XOFF.

4.2.11 Communication Rate

The rate at which the 1775-S4B scanner communicates with RS-232-C devices connected on its channel 5 connector is the communication or baud rate. You can select one of the following communication rates:

- 110 Baud
- 150 Baud
- 300 Baud
- 600 Baud
- 1200 Baud
- 1800 Baud
- 2400 Baud
- 4800 Baud
- 9600 Baud
- 19200 Baud

Select the communication rate by typing the number corresponding to the desired rate. The 1775-S4B scanner displays an asterisk next to the current communication rate. The default selection is 9600 Baud.

4.2.12 Parity

The 1775-S4B scanner can communicate through channel 5 using the following parity selections:

If you select:	Then:
Even	The channel transmits an even parity bit with each character and checks for an even parity bit in each character received.
Odd	The channel transmits an odd parity bit with each character and checks for an odd parity bit in each character received.
None	The channel does not transmit a parity bit and does not check for a parity bit in each character received.

The 1775-S4B scanner displays an asterisk next to the current parity state. The default parity selection is none.

4.2.13 Stop Bits

You can specify the number of stop bits that the 1775-S4B uses to communicate with its RS-232-C communication channel. The stop bit selections are 1, 1.5, or 2. The 1775-S4B scanner displays an asterisk next to the current stop bit selection. To change the number of stop bits, type the number corresponding to the desired selection. The default stop bits selection is 1.

4.2.14 Data Bits Per Character

The bits/char selections are 7 or 8. The channel transmits the selected number of data bits per character. The channel only accepts characters received with the selected number of data bits per character. The default selection is 8 data bits per character.

4.2.15 ASCII Code Size

The ASCII code size selections are 7 or 8. You use this selection when 8 data bits per character is selected. Then select one of the following:

If you select:	Then:
7	The RS-232-C communication channel uses the first 7 bits only in decoding the character transmitted.
8	The RS-232-C communication channel uses all 8 bits in decoding the character transmitted.

The default ASCII code size is 7.

4.2.16 Reconfigure

The reconfigure selection implements the channel 5 selections. For example, if you select CRT defaults, the 1775-S4B scanner does not implement the change until you select reconfigure. In response to selecting reconfig:

If channel 5:	Then:
Is not currently executing	The 1775-S4B scanner reconfigures the channel immediately.
Is currently executing	The 1775-S4B scanner waits until the task completes executing before it reconfigures the channel.

When the 1775-S4B scanner reconfigures the channel, the asterisk beside the reconfiguration selection disappears.

4.3 Configuring the I/O Communication Channels

If you select I/O CHAN to configure an I/O communication channel, you can select the following parameters:

- I/O Chan 1
- I/O Chan 2
- I/O Chan 3
- I/O Chan 4
- Racks
- Auto Config
- Reconfig

We explain these parameters in the following sections.

4.3.1 I/O Channel Configuration

If you select an I/O channel, you can make the following selections for the corresponding I/O communication channel:

- Communication rate (baud)
- I/O scan

We explain these selections in the following sections.

4.3.1.1 Communication Rate

You can select one of the following communication rates for the corresponding I/O communication channel:

If you select:	Then:
57.6 kbaud	The maximum I/O channel cable length can be 10,000 feet.
115.2 kbaud	The maximum I/O channel cable length can be 5,000 feet.

4.3.1.2 I/O Chassis Scanning Sequence

You can change the order of execution for an I/O scan of the corresponding I/O communication channel by selecting the I/O scan selection in LIST. When you configure an I/O channel for I/O scan, list the I/O chassis in the order that you want the 1775-S4B scanner to communicate with them. This allows you to assign a higher priority to some I/O chassis than to others by listing the higher priority chassis more than once.

As an example, if there are six entries in the I/O chassis list, and entries 1 and 4 are the same, then the chassis listed under entries 1 and 4 will be updated twice as often as the other chassis. You can list a chassis as often as you desire, provided that the list contains no more than 32 entries.

Each I/O chassis is listed once in the default configuration at initial powerup or after an autoconfigure.

When forming the I/O chassis list, remember the following considerations:

- Rack numbers which are not assigned consecutively cause greater memory requirements by allocating memory for unused racks.
- No more than 16 I/O adapters can connect to one I/O communication channel on the 1775-S4B scanner.
- No more than 16 different rack numbers can be assigned to one 1775-S4B scanner.
- When using complementary or duplicate I/O, two chassis with the same rack and starting module group numbers must be on different channels

of the same 1775-S4B scanner. Refer to the PLC-3 Programmable Controller Installation and Operations Manual (publication 1775-6.7.1, formerly 1775-800) for detailed information on complimentary and duplicate I/O.

- Rack number 77_8, is used for internal PLC-3 communication. Do not assign this number to an I/O rack (although you can use the associated addresses for internal storage).

Use the following format to enter chassis in the chassis list:

<entry number>/<rack number>/<chassis size>/
<starting module group number>/<attributes >

Entry number defines the position of the entry in the chassis list. For example, to insert an entry between the third and fourth entries, use entry number 4. The new entry becomes the fourth entry, and all entries numbered 4 or greater have their numbers incremented by one.

Rack number is the I/O chassis' I/O rack number, in octal. The rack number must be within the range of the rack group selected for the 1775-S4B scanner (refer to section 3.2). The last two digits of the rack number must correspond to the switch settings on the I/O adapter module in the I/O chassis.

Chassis size is the number of module groups in the chassis. You can enter:

- 2 for a 32 I/O chassis
- 4 for a 64 I/O chassis
- 8 for a 128 I/O chassis

Starting module group is the lowest numbered module group in the chassis. It can be 0, 2, 4, or 6.

Attributes can be:

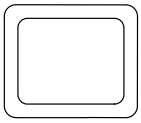
- I if the chassis is for inputs only
- F if a fault in the chassis is to be considered a major fault

You can have 0, 1, or 2 attributes associated with the chassis.

You can delete entries from the rack list by typing the entry number and pressing [ENTER]. For example:

To delete the third entry in the rack list, type:

3 [ENTER]



The 1775-S4B scanner removes the third entry in the rack list and redisplays the rack list.

An asterisk (*) appearing before an entry in the rack list indicates that the corresponding I/O chassis or I/O adapter module is faulted.

4.3.2 I/O Rack Group Selection

The I/O rack group selection in LIST selects the range of I/O rack numbers that the I/O scanner module can address. Presently, the PLC-3 controller uses only rack number 0 to 76_8, and the first rack group is selected by default, so you do not have to make a selection here.

The subscript ($_8$) indicates that the value is expressed in an octal format.

If you plan to use rack numbers greater than 37_8, consider the following:

- Racks numbered greater than 37_8 increase the I/O scan time.
- The amount of memory required for the input and output sections depends on the highest rack number containing inputs or outputs, respectively. Therefore, skipping rack numbers is an inefficient use of memory.

4.3.3 Reconfig and Auto Config

The I/O channel portion of LIST includes selections for reconfig and auto config. A reconfig implements other changes which you made in LIST. For example, if you list an I/O chassis three times in the rack list, and you change the rack list to include that chassis 6 times, the 1775-S4B scanner does not change its polling sequence until you select reconfig. Reconfig works for the all the I/O communication channels. Therefore, you can reconfigure the I/O communication channels once, after making all I/O channel selections, instead of making separate reconfigure selections for each I/O channel.

If an asterisk is displayed next to the reconfig selection, change(s) have been requested but not implemented. Upon selecting reconfig, the 1775-S4B scanner implements the changes and removes the asterisk.

CAUTION: If the PLC-3 processor is in the run mode and executing block transfers, selecting reconfig could cause a bad address fault to occur.

If this situation occurs you should:

- Clear the bad fault address in a fault routine
- Clear the block transfer bit
- Restart the block transfer in the ladder diagram program

Auto config first creates a new I/O chassis list in which each I/O chassis has equal priority with no attributes assigned. Then a reconfiguration executes.

The 1775-S4B scanner performs an auto configure at powerup under the following conditions:

- No I/O channel configured for I/O scan has entries in the rack list.
- Neither auto configure nor reconfigure has been selected during a previous powerup (at least since the last time you cleared memory).

When forming the I/O chassis list during an auto configuration, the 1775-S4B scanner polls all valid addresses (rack 0 to 768). If the 1775-S4B scanner receives response to an address, it adds that I/O rack address to the list. To assign attributes or priorities to the I/O chassis, add them manually through LIST and reconfigure the I/O channel.

You can only perform an auto configuration when:

- PLC-3 processor is in program load mode.
- Power is applied to the I/O chassis.
- Switch 2 of each I/O chassis is set to “on” to allow the I/O chassis to be restarted from the PLC-3 processor.

If power is not applied to the I/O chassis, the PLC-3 processor attempts to perform an auto configuration, and since the I/O chassis does not respond, the 1775-S4B scanner does not enter it in the I/O chassis list. For an entry to get into the I/O chassis list in auto config, a valid communication path must exist between the 1775-S4B scanner and the I/O adapter module for the I/O chassis.

4.4 Chapter Summary

In this chapter, you read about PLC-3 LIST selections for the 1775-S4B scanner. You can access LIST from the PLC-3 front panel or the RS-232-C channel (channel 5) on the 1775-S4A scanner. Upon selecting the 1775-S4B scanner:

- Select COMM CHAN to configure channel 5
- Select I/O CHAN to configure an I/O channel

The remainder of this publication describes the 1775-S4B scanner's report generation capability. If you do not use this capability, you do not need to read the remaining chapters.

Chapter 5

Getting Started in Report Generation

5.0 Chapter Objectives

The 1775-S4B scanner uses a programming language for report generation to print or display formatted text and data. After reading this chapter, you should be able to:

- Understand the command line structure
- Write and execute a simple procedure
- Execute a procedure using the message instruction in a ladder diagram program

5.1 Introduction

Before you start generating reports with your 1775-S4B scanner, you need to understand certain key concepts:

- **Report generation**—A programming language that the 1775-S4B scanner uses to print or display formatted text and data.
- **Procedure**—A collection of report generation command lines that the 1775-S4B scanner uses to generate formatted text and data.
- **Report**—The output generated when a procedure is executed. For example, shift report, machine status report, or downtime report.

We refer to these terms throughout the discussion of report generation for the 1775-S4B scanner.

5.2 Command Line Format

The general format for a command line that you will use to generate reports is:

<command> </modifier> <parameters> <;comment>

The command tells the 1775-S4B scanner what to do. The 1775- S4B scanner only recognizes one command per command line.

The optional modifier tells the 1775-S4B scanner which way to execute the command.

The parameters tell the 1775-S4B scanner what data to change.

The optional comment tells someone reading the procedure what the command line does. The 1775-S4B scanner accepts the semicolon (;) delimiter as an instruction to ignore the rest of the line. So, you can use the semicolon to document command lines in a procedure.

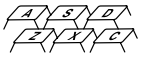
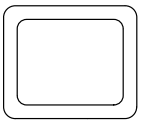
As an example, suppose you enter the line:

```
P 'FIRST SHIFT PRODUCTION';TITLE OF REPORT
```

P is the abbreviation for the print command which tells the 1775-S4B scanner to print out the data FIRST SHIFT PRODUCTION. TITLE OF REPORT is the comment which tells what the command line prints out.

5.3 Getting Started

Now that you have been introduced to report generation, let's do some programming. In describing report generation programming, we use the following icons to indicate your action and the 1775-GA module's response:

-  shows your input. The actual input characters are shown in blue.
-  shows the 1775-GA module's response to your input.

Before you program your 1775-S4B, you need to perform the following steps:

Step 1—Configure the RS-232-C channel through LIST (chapter 4).

Step 2—Connect the data terminal to the channel 5 connector on the 1775-S4B scanner. These connections are described in chapter 3.

Step 3—If you are using an industrial terminal, select alphanumeric mode. This selection makes the industrial terminal function as a data terminal. Then make sure you select the same communication options for the industrial terminal that you selected in LIST for channel 5 on the 1775-S4B scanner**.**

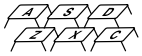
Step 4—Press [ENTER] or [RETURN]. The terminal displays the prompt:

```
S4B>
```

You are now ready to use your 1775-S4B scanner for report generation.

5.4 Executing a Simple Procedure

If you have the S4B> prompt on your CRT, you can create and execute report generation procedures. The first step is to create the procedure by entering the edit mode.

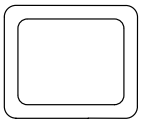


Simply type:

```
Ed @TEST1 [ENTER]
```

ED is the abbreviation for the edit command. The edit command is a report generation command that enables you to create and store a new procedure or edit an existing procedure. Also, you may notice that an (@) sign precedes the first character in the procedure name. The 1775-S4B scanner interprets an @ sign as a system symbol delimiter and accepts the characters that follow as the procedure name. Following the @ sign, you can use up to eight characters to name your procedure. Report generation accepts any alphanumeric character(s) and the underscore character(s) (_) for procedure names. Procedures names must start with a letter following the @ sign.

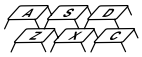
NOTE: If you are using an industrial terminal to execute report generation procedures, you cannot use lower case letters to name a procedure as the industrial terminal does not recognize lower case letters. However, the 1775-S4B scanner does recognize lower case letters.



After you enter the command line above, the 1775-S4B scanner enters the edit mode by displaying the following lines on the CRT:

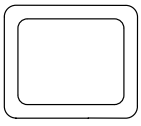
```
<EOB>
*
```

<EOB> means end of block and signifies that the file, or the memory area for the procedure is currently empty.

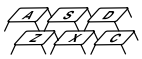


Next, you have to tell the 1775-S4B scanner that you want to insert some text. So type:

```
I [ENTER]
```

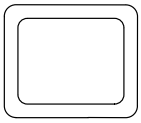


When the cursor moves to the line after the asterisk, the 1775-S4B scanner is ready for you to enter a line.

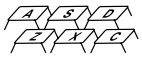


Type:

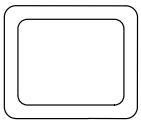
```
P ‘PRINTING ON THE’[ENTER]
P ‘SCREEN’[ENTER]
```



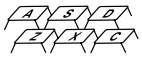
The 1775-S4B scanner's line pointer or cursor moves to the next line.



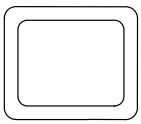
Now exit the insert mode by pressing [ENTER].



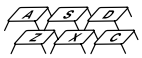
The 1775-S4B scanner returns the * signifying the edit mode.



Then press E followed by [ENTER] to exit the edit mode.

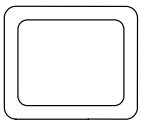


The 1775-S4B scanner returns the S4B> prompt. You can now execute your procedure.



Just type:

```
S4B> @TEST1
```



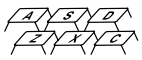
If you followed the instructions, the CRT displays the lines:

```
PRINTING ON THE
SCREEN
S4B>
```

Figure 5.1 summarizes the instructions presented in this section.

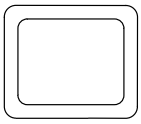
Figure 5.1
Creating and Executing a Simple Procedure

```
S4B> ED @ TEST1
<EOB>
*I
P 'PRINTING ON THE'
P 'SCREEN'

S4B> @ TEST1
PRINTING ON THE
SCREEN

S4B>
```



Now type:

S4B> DI [ENTER]



DI is the abbreviation for the directory command. The directory command returns:

- All stored procedure names
- Extended address of all procedures
- Number of words used by each procedure

If you made a mistake while entering the procedure, you can edit your procedure. Editing instructions are discussed in chapter 7 of this manual.

5.5 Executing Procedures from the Message Instruction in the User Program

In addition to commanding the execution of a procedure from the terminal, you can use the message send instruction to execute a report generation procedure from a ladder diagram program. You simply specify an extended address of the 1775-S4B scanner which enables it to execute the procedure.

When the logic of the rung in the ladder diagram program is true, the Main Processor Module (cat. no. 1775-LI, L2), or the (CPU), alerts the 1775-S4B scanner to execute the specified procedure. The CPU continues to scan the rest of the program after alerting the 1775-S4B scanner. The 1775-S4B scanner then executes the procedures and turns on the done bit if the procedure executes properly. If a problem occurs during procedure execution, the 1775-S4B scanner turns on the error bit, and an error code displays in the MSG instruction block.

The message instruction requires the following parameters:

- Control file address
- Channel address
- Message type
- Procedure name

The control file address is the data table file address that the PLC-3 processor uses to store the message status bits, error code, channel address, and procedure name. The control file should be a binary file and can have a starting word address other than zero. The CPU uses this file to locate the 1775-S4B scanner to execute the procedure. This file must be at least ten words long.

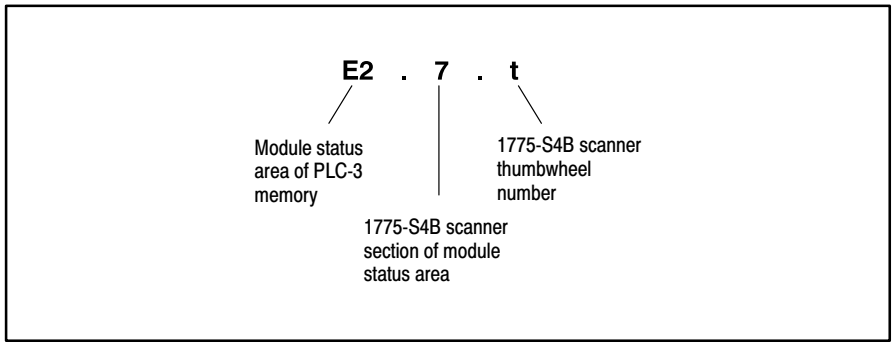
The channel address is the extended address of the 1775-S4B scanner that executes the procedure. This address has the following format (figure 5.2):

E2.7.t

where:

- E2 = the module status area of PLC-3 memory
- 7 = the 1775-S4B scanner section of the module status area
- t = the thumbwheel number on the 1775-S4B scanner

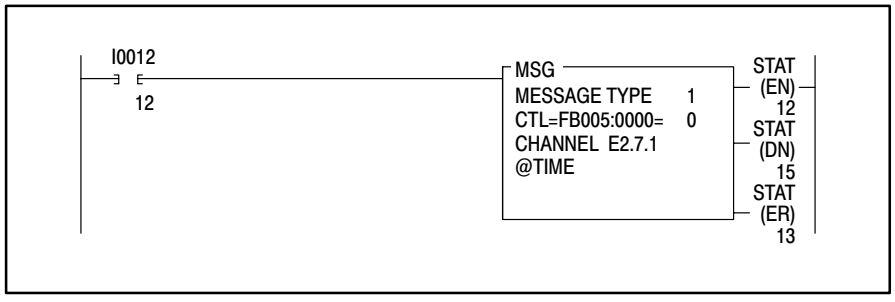
Figure 5.2
MSG Instruction Extended Addressing Format



The message type must always be one, and the message itself should be a report generation procedure name.

An example program using the message send instruction to execute a report generation procedure appears in figure 5.3.

Figure 5.3
Example Rung Which Executes a Report Generation Procedure



5.6 Control Modes

As we have described in this chapter, you can:

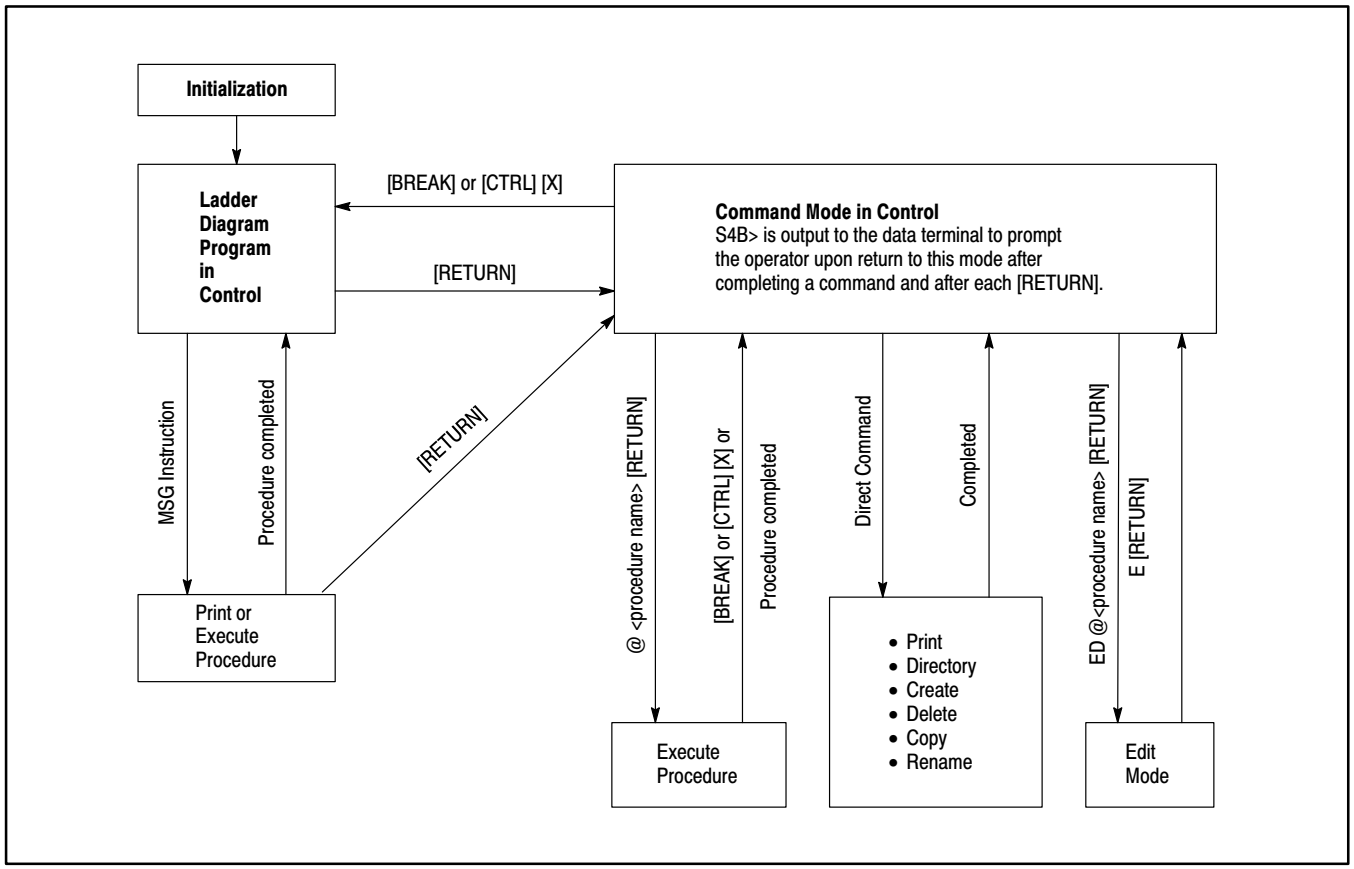
- Create and execute report generation procedures from the S4B> prompt
- Call for procedures to execute from MSG instructions in your ladder diagram program

The communication that occurs between the RS-232-C device on channel 5 of the 1775-S4B scanner can be in one of two control modes:

- **Command mode**—The data terminal keyboard has direct control over the operation of the 1775-S4B scanner. When you execute a procedure at the S4B> prompt, you are in the command mode.
- **Ladder diagram mode**—The ladder diagram program has direct control over the operation of the 1775-S4B scanner. When a procedure executes from the MSG instruction to an RS-232-C device connected to channel 5 on the 1775-S4B scanner, you are in the ladder diagram mode.

Figure 5.4 shows you the report generation control modes and how to move from one to another.

Figure 5.4
Report Generation Control Modes



When you turn on your PLC-3 processor it initializes with ladder diagram mode in control. So if you connect an RS-232-C device to the channel 5 connector on the 1775-S4B scanner, report generation procedures sent from MSG instructions in your ladder diagram program will execute at the RS-232-C device. When a procedure completes executing, ladder diagram mode remains in control. Thus, you can execute consecutive procedures from the ladder diagram program.

Now if you press [ENTER] or [RETURN] after initialization or after a message procedure has been executed, the S4B> prompt displays at the RS-232-C device. This prompt indicates that the command mode is in control. In command mode, you can execute or edit report generation procedures or enter report generation commands from your keyboard to operate report generation. We describe report generation operation in the following chapters. The report generation commands listed in figure 5.4 are described in chapter 10.

Now if you press [BREAK] or [CTRL] X while you are in the command mode, the following message displays:

REPORT GENERATION ABORTED

At this point, ladder diagram mode is in control.

If the ladder diagram program calls for the 1775-S4B scanner to execute report generation commands or procedures while the command mode controls the 1775-S4B scanner, the 1775-S4B scanner does not respond to the ladder diagram program immediately. In this case, the 1775-S4B scanner stores as many as 4 report generation instructions in a ladder diagram program until the 1775-S4B scanner switches to ladder diagram control. If the ladder diagram program contains more than 4 report generation instructions and you switch the 1775-S4B scanner to ladder diagram mode:

- The 1775-S4B scanner executes the first 4 instructions in the order that they were stored.
- The 1775-S4B scanner executes any remaining instruction(s) in random order.

5.7 Chapter Summary

In this chapter, you were introduced to report generation on the 1775-S4B scanner. The remainder of the publication describes the various parameters, commands, and functions used to generate reports on the 1775-S4B scanner.

Chapter 6

Logical Addressing for Report Generation

6.0 Chapter Objectives

In addition to creating text in procedures, you can use report generation to manipulate data within a specific area of PLC–3 memory. After reading this chapter, you should be able to:

- Use data table addressing to specify a memory area
- Use extended addressing to specify a memory area

6.1 Introduction

Logical addressing for 1775–S4B scanner report generation is similar to logical addressing for the PLC–3 front panel or the industrial terminal. The dollar sign ($) delimiter tells the 1775–S4B scanner that the following data denotes a PLC–3 memory address. You can specify PLC–3 addresses in two ways:

- Data table addresses
- Extended addresses

We discuss the formats for each of these logical addressing methods in the following sections.

6.2 Data Table Addressing

You can specify data table sections of memory by using data table addressing. In data table addressing, you follow the $ sign with the data table section specifier. Then you can specify a file, word, and/or bit. Table 6.A shows the data table section specifiers. You must use a colon before the word number.

You can specify an octal address format for data table addresses by entering a leading zero in the bit position of the address. Using this format can make your report generation procedure compatible with ladder diagram program addressing and I/O terminal numbering. Figure 6.1 shows how the bit numbering formats in report generation correspond to the bit numbering format within a PLC–3 memory word.

Some examples appear below:

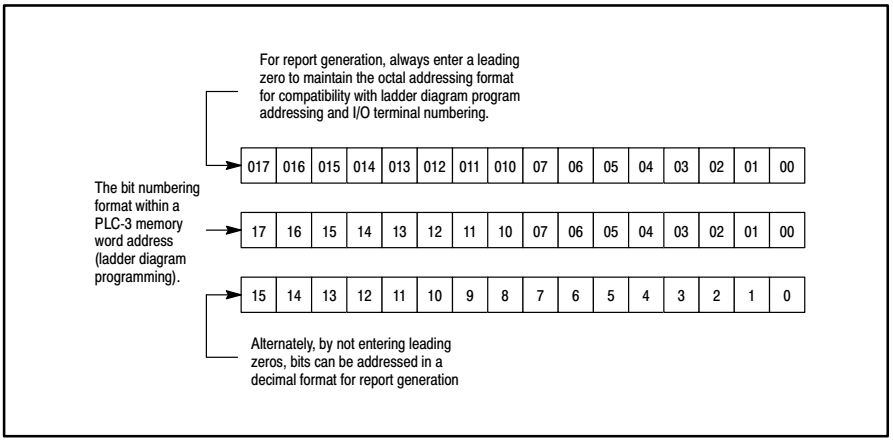
Data Table Address	Description
$B1:5	This address specifies binary file, 1, word 5.
$D0:1 or $D:1	These addresses specify the same address, decimal file 0 word 1. If you are specifying file 0, you need not enter a zero after the section specifier.
$TPRE:57	This address specifies the preset of timer 57.
$B1:5/12	This address specifies binary file 1, word 5, bit 12 decimal.
$B1:5/12 or $B1:5/014	Both addresses specify binary file 1, word 5, bit 12 decimal. In the second example, 014 represents the octal value for 12. To enter a value in octal, enter a zero before the value.

Table 6.A
Data Table Section Specifiers

Section Specifier	Extended Address	Data Table Section
O	3.1.1	Output
I	3.1.2	Input
T	3.1.3	Timers
C	3.1.4	Counters
N	3.1.5	Integers
F	3.1.6	Floating Point[1]
D	3.1.7	Decimal
B	3.1.8	Binary
A	3.1.9	ASCII
H	3.1.10	High Order Integers
P	3.1.12	Pointers[1]
S	3.1.13	Status

[1] You can only access these sections through extended addressing

Figure 6.1
Bit Numbering Formats



6.3
Extended Addressing

Extended addressing can access any area of PLC–3 memory. In extended addressing, you enter E followed by the memory area. Then you enter parameters, or levels that the memory area requires, seperated by periods to specify a memory address to the bit level if necessary. For example, if you are specifying a data table address, you follow the $ sign with E3 to specify the data table. Then you must enter a context number, data table section, file number, structure, word and/or bit. Table 6.B outlines the memory areas along with required parameters.

Table 6.B
PLC–3 Extended Addressing

SYSTEM STATUS E0	**Context** 0	**Section**			**Word** 0-22
SYSTEM POINTERS E1	**Context** 0	**Section** 0			**Word** 0-32767
MODULE STATUS E2	**Module Type** 1 – memory 2 – main processor 3 – I/O scanner-programmer interface 4 – reserved 5 – communication adapter 6 – expansion 7 – I/O scanner-message handling 8 – peripheral communication 9 – communication interface 14 – memory communication	**Thumbwheel Switch** 1-15			**Module Data** Defines system attributes
DATA TABLE E3	**Context** 1-15	**Section** 1 – output 2 – input image 3 – timers* 4 – counters* 5 – integers 6 – floating point 7 – decimal 8 – binary 9 – ASCII 10 – high order integer 12 – pointers* 13 – status * these sections must have a file number of zero	**File** 0 for timers, counters, and pointers. 0-999 for all other sections.	**Structure** 0-9999 for timers, counters, and pointers 0 for all other sections.	**Word** 0-7777_8 for input and output image tables. For timers and counters: 0 – control (CTL) 1 – preset (PRE) 2 – accumulator (ACC) For pointers: 0 – section (SEC) 1 – file (FIL) 2 – word (WRD) 0-9999 for all other sections

USER PROGRAM E4	**Context** 1-15	**Section** 0 – program status 1 – main 2 – subroutine 3 – faults	**Rung** 0-32767	**Instruction** 0-32767	**Word** 0-32767
MESSAGES E5	**Context** 1-15	**Section** 1 – report generation 2 – comments 3 – terminal (MACROS) 4 – data highway 5 – assistance (HELP)	**Message** 0-65535		**Word** 0-32767
SYSTEM SYMBOLS E6	**Symbol Context** 1-15	**Symbol Type** 1	**Number** 0-32767		**Word** 0-32767
SYSTEM SCRATCHPAD E7					
CONVERTED PROCEDURES E8					
FORCE TABLE E10	**Context** 1-15	**Force Type** 0 – status (no rack number word must be 0) 1 – forced output 2 – forced input	**Rack Number** 0-37	**Word** 0-15	**Bit (force type 0 only)** 0 – input enable/disable 1 – output enable/disable

You can specify an octal address format for extended addresses by entering a leading zero in the bit position of the address. Using this format can make your report generation procedure compatible with ladder diagram program addressing and I/O terminal numbering. Figure 6.1 shows how the bit numbering formats in report generation correspond to the bit numbering format within a PLC–3 memory word.

Some examples appear below:

Extended Address	Description
$E3.1.2.3.0.0	This address translates to the data table (3), context (1), input image table (2), file (3), structure (0), and word (0).
$E3.1.8.1.0.5 or $B1:5	These addresses specify binary file 1 word 5.
$E0.0.0.17	This address specifies system status area hour storage word. To access the system status area, you must select privilege 0 in LIST. Refer to chapter 4 for detailed information on selecting privileges.
$E3.1.8.0.0.1/10 or $E3.1.8.0.0.I/O12	These addresses specify to bit 10 of the data table area, binary file 0, word 1, bit 10. The octal value 12 is 10 decimal.

6.4 Chapter Summary

In this chapter, you read about addressing PLC–3 memory areas:

- You can use the extended addressing format to specify any location in PLC–3 memory.
- You can use the data table addressing format to specify any section of the data table.

The next chapter describes editing procedures.

Chapter 7

Editing a Procedure

7.0 Chapter Objectives

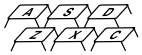
In chapter 5, you learned how to enter the edit mode to insert a procedure and execute the procedure at the S4B> prompt. After you read this chapter, you should be able to use all editing commands available with the 1775-S4B scanner.

7.1 Editing a Simple Procedure

In chapter 5, we created a procedure called @TEST1 and executed it. Now suppose you want to change the procedure. This section discusses editing a simple procedure. If you are comfortable with the procedure concept, you can move on to the next section (section 7.2) of this chapter.

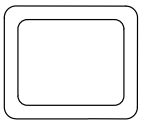
Our procedure called @TEST1 from chapter 5 contains the following lines:

```
P 'PRINTING ON THE'
P 'SCREEN'
```



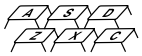
Let's change the procedure. Type:

```
S4B> ED @TESTI [ENTER]
```



This time, the CRT displays the lines:

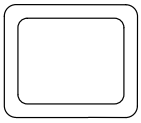
```
P 'PRINTING ON THE'
*
```



Type the line:

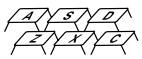
```
C/PRINTING/PRINT OUT/ [ENTER]
```

This instruction tells the 1775-S4B scanner to change PRINTING from the procedure text to PRINT OUT.

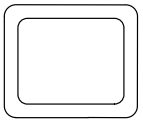


So, the 1775-S4B scanner responds with the line:

```
P 'PRINT OUT ON THE'
*
```

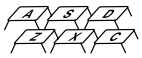


Now press [ENTER].

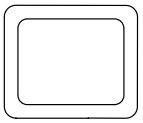


The 1775-S4B scanner displays the next line of the procedure @TEST1:

```
P 'SCREEN'
*
```

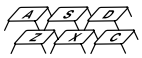


Now press [ENTER].



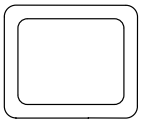
The 1775-S4B scanner displays the lines:

```
<EOB>
*
```

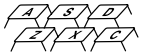


Type:

```
I[ENTER]
```

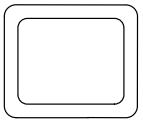


The cursor moves to the line above the asterisk.

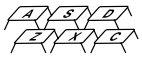


Now type:

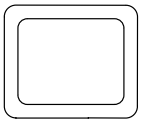
```
P 'CONTAINS THREE LINES'[ENTER]
```



The 1775-S4B scanner's line pointer moves to the next line.



Exit the insert mode by pressing the [ENTER] twice.



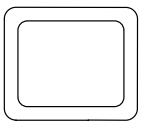
The 1775-S4B exits the insert mode and displays:

```
<EOB>
*
```

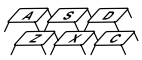
At this point, you are still in the edit mode for the procedure

To exit the edit mode type:

```
E[ENTER]
```

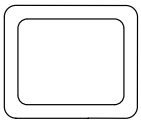


The 1775-S4B scanner exits the edit mode and displays the S4B> prompt.



At the S4B> prompt, enter:

@TEST1 [ENTER]



The 1775-S4B scanner prints the lines:

PRINT OUT ON THE
SCREEN
CONTAINS THREE LINES

7.2 Entering the Edit Mode

Now that you have a basic understanding of editing in report generation, this section discusses the editing commands in more detail.

To enter the editing mode, you use the edit command:

Definition: To create a new procedure or change an existing procedure.

Abbreviation: ED

Format: ED/<scope modifier>/<section modifier>@<procedure name>

Description: The edit command allows you to create a new procedure or change an already existing procedure. Along with edit command and procedure name, you can enter two types of modifiers:

- Scope modifier that defines the scope of the system symbol.
- Section modifier that defines a specific section of the message area.

The scope modifiers include:

Modifier	Format with Abbreviation	Description
Local	/L	Defines that the procedure name is only recognized in the current operating context. If you do not specify a modifer on the edit command, the 1775-S4B scanner configures the procedure name as local.
Global	/G	Defines that the procedure name is recognized from any context.

The section modifiers include:

Modifier	Format with Abbreviation	Description
Report	/R	Selects the report generation section
Comment	/C	Selects the rung comment message section
Terminal	/T	Selects the industrial terminal macros message section
Highway	/H	Selects the data highway message section
Assist	/A	Selects the assistance (HELP) message section

The edit command causes the 1775-S4B scanner to search the symbol table for the procedure name. If the procedure does not exist, the 1775-S4B scanner creates the symbol and assigns it to a message in the specified section. If you do not use a modifier, the 1775-S4B scanner creates a local procedure in the report generation section by default. The 1775-S4B scanner then displays an asterisk (*) on the CRT, followed by the first line in the procedure. In a new procedure, the only line is an end of block, <EOB>, symbol.

7.3 Editing Commands

When you see the asterisk (*), you have access to the report generation editing commands. The editing commands include (table 7.A):

Table 7.A
Editing Commands

Command	Keyboard Entry
Insert lines	I [ENTER][1]
Set line pointer	<line number> [ENTER]
Advance line pointer	<number of lines>A [ENTER]
Backup line pointer	<number of lines>B [ENTER]
Display line number	L [ENTER]
Type out lines	<number of lines>T [ENTER]
Search for text	<number of occurrences>S/text/ [ENTER]
Changing text characters	<number of occurrences>C/ <old text>/ <new text>/ [ENTER]
Delete lines	<number of lines>D [ENTER]
Exit edit mode	E [ENTER]

[1] Any number of lines can then be added to exit the insert mode, enter an extra [ENTER] after any line.

The following sections describe these editing commands.

While in the editing mode, if you enter a command other than those listed in table 7.A, the 1775-S4B scanner displays the message:

<ERROR>

If any line in a procedure exceeds 134 characters or more than one character follows the last carriage return of the procedure, the 1775-S4B scanner displays the message:

<BAD FILE>

7.3.1 Insert Lines

Definition: To insert lines into a procedure.

Abbreviation: I

Format: I [ENTER]

Description: The insert lines command places the 1775-S4B scanner into the insert mode. The 1775-S4B scanner inserts all command lines that you enter before the current line. To exit the insert mode, press [ENTER].

You must exit the insert mode before you use any other editing command. Exit the insert mode by pressing [ENTER].

Example using the insert lines command:

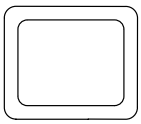
Suppose procedure @EXAMPLE contains the following lines:

```
P ‘LINE l’
P ‘LINE 2’
P ‘LINE 3’
```

Suppose you decide that you need to insert the line, P ‘LINE 1A’, between the first two lines of the procedure:

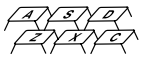
First, you need to enter the edit mode by typing:

S4B> ED @EXAMPLE[ENTER]

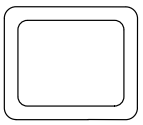


The 1775-S4B scanner returns:

```
P ‘LINE l’
*
```

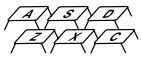


Now press [ENTER]



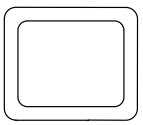
The second line of the procedure prints out:

```
P 'LINE 2'
*
```



When using the insert command, you insert text above the procedure line displayed on the CRT. So now, we can insert the new line by typing:

```
* I [ENTER]
P 'LINE 1A'[ENTER]
[ENTER]
```



The 1775-S4B scanner displays an asterisk on the next line. Now P 'LINE 1A' becomes the second line in the procedure, and the 1775-S4B scanner automatically adjusts the rest of the procedure.

7.3.2 Set Line Pointer

Definition: To set the line pointer or cursor at a specific line in the procedure.

Format: <Line number> [ENTER]

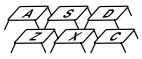
Description: The set line pointer command sets the line pointer to the line number that you specify.

The first line of the procedure is number 1. If you enter 0 or a number which exceeds the number of lines in the procedure, you will move to a point just beyond the last line of the procedure (indicated by <EOB>).

Example using the set line pointer command:

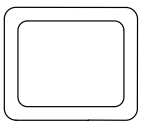
In our @EXAMPLE procedure which contains the following lines:

```
P 'LINE l'
P 'LINE 1A'
P 'LINE 2'
P 'LINE 3'
```



We can immediately look at line four by entering:

```
*4[ENTER]
```



The following line prints out:

```
P 'LINE 3'
*
```

Remember, you just inserted a line into this procedure.

7.3.3 Advance Line Pointer

Definition: To advance the line pointer or cursor in the procedure.

Abbreviation: A

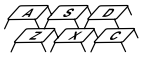
Format: <number of lines>A [ENTER]

Description: The advance line pointer command advances the line pointer the specified number of line(s) in the procedure. If you use a value greater than the number of lines remaining in the procedure, or enter a 0 for the number, the line pointer moves to the end of the procedure. To advance one line, type A [ENTER] or just [ENTER].

Example using the advance line pointer command:

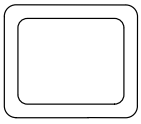
For the procedure @EXAMPLE which contains the following lines:

```
P 'LINE l'
P 'LINE 1A'
P 'LINE 2'
P 'LINE 3'
```



If you are editing the first line and want to advance to the third line, simply enter 2A at the asterisk:

```
P 'LINE l'
*2A[ENTER]
```



The 1775-S4B scanner moves two lines in the procedure and displays:

```
P 'LINE 2'
*
```

7.3.4 Backup Line Pointer

Definition: To backup the line pointer or cursor in the procedure.

Abbreviation: B

Format: <number of lines>B [ENTER]

Description: The backup line pointer command backs the line pointer up line(s) in the procedure. If you use a value greater than the current line number, or enter a 0, the line pointer moves to the first line.

Example using the backup line pointer command:

In the @EXAMPLE procedure which contains the following lines:

```
P ’LINE l’
P ‘LINE 1A’
P ‘LINE 2’
P ‘LINE 3’
```

We can move from the third procedure line to the first procedure line by entering 2B at the asterisk:

```
P ‘LINE 2’
*2B[ENTER]
```

The 1775-S4B scanner displays:

```
P ‘LINE l’
*
```

7.3.5 Display Line Number

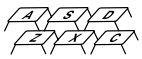
Definition: To display the current line number.

Abbreviation: L

Format: L [ENTER]

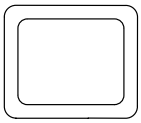
Description: The display line number command displays the number of the current line. When you are editing your procedure, often you lose track of the line number. Just enter L after the asterisk to display the line number.

Example using the display line number command:



In the edit mode, simply enter L at the asterisk:

```
P ‘LINE 1’
* L [ENTER]
```



The 1775-S4B scanner returns the line number:

```
1
*
```

7.3.6 Type Out Lines

Definition: To print out lines of the procedure.

Abbreviation: T

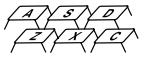
Format: <number of lines>T [ENTER]

Description: The type out lines command prints out line(s) of the procedure, starting with the current line. If you enter 0 or a number greater than the number of lines in the procedure, the 1775-S4B scanner types the rest of the procedure starting with the current line.

Example using the type out lines command:

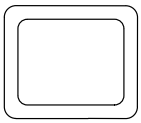
For the procedure @EXAMPLE which contains the following lines:

```
P 'LINE l'
P 'LINE 1A'
P 'LINE 2'
P 'LINE 3'
```



If we are at the first line of the procedure, we could enter:

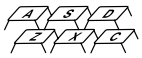
```
P 'LINE l'
* 2T
```



The 1775-S4B scanner displays the next two lines in the procedure:

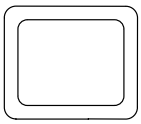
```
P 'LINE l'
P 'LINE 1A'
P 'LINE 2'
*
```

Notice that the current line prints out followed by the next two lines in the procedure.



If you enter 0T at the asterisk:

```
P 'LINE 2'
*0T
```



The 1775-S4B scanner displays the rest of the procedure from the current line:

```
P 'LINE 2'
P 'LINE 3'
```

7.3.7 Searching for Text

Definition: To locate specific text in a procedure.

Abbreviation: S

Format: <number of occurrences>S/<text>/ [ENTER]

Description: The search command searches for the occurrence of the specified text after the current line. The slashes (/) are delimiters, which

can be any non-blank characters that do not appear in the text. If you do not specify a number of occurrences, the 1775-S4B scanner locates the first occurrence. If the specified value of n is 0 or is greater than the number of occurrences of the text, the 1775-S4B scanner locates the last occurrence. If the 1775-S4B scanner cannot find the text that you specify, the following message displays:

<NOT_FOUND>

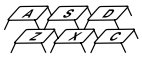
If you do not enter the search command correctly (such as not using the same character for both delimiters), the 1775-S4B scanner displays the following message:

<ERROR>

Example using the search command:

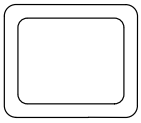
In the procedure @EXAMPLE which contains the following lines:

```
P ‘LINE l’
P ‘LINE 1A’
P ‘LINE 2’
P ‘LINE 3’
```



If we wanted to locate the third occurrence of the word line, simply enter 3S/LINE/ after the asterisk:

```
P ‘LINE l’
*3S/LINE/[ENTER]
```



The 1775-S4B scanner displays the procedure line that contains the third occurrence of the word line starting after the current line of the procedure:

```
P ‘LINE 3’
*
```

7.3.8 Change Text Characters

Definition: To change text in a procedure.

Abbreviation: C

Format: <number of occurrences>C/<old text>/<newtext>/ [ENTER]

Description: The change text characters command changes occurrence(s) of the old text with the new text, starting with the first occurrence on the current line. The slashes (/) represent delimiters, which can be any non-blank characters that do not appear in the text. If you do not specify a number before C, the 1775-S4B scanner changes the first occurrence of the

text on the line. If the 1775-S4B scanner cannot find the text that you specify, the following message displays:

<NOT_FOUND>

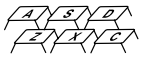
If you do not enter the change command correctly (such as not using the same character for both delimiters), the 1775-S4B scanner displays the following message:

<ERROR>

Example using the change text characters command:

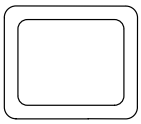
Suppose you want to change the word LINE to INDEX in the first line of the procedure @EXAMPLE. If the first line of the procedure @EXAMPLE contains the following text:

P ’LINE 1’



Simply enter C/LINE/INDEX/ after the asterisk:

P ‘LINE l’
* C/LINE/INDEX/ [ENTER]



The 1775-S4B scanner returns:

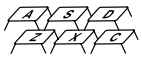
P ‘INDEX l’
*

As a second example, suppose you were editing a line which contains:

P ‘THIS IS A TEST’

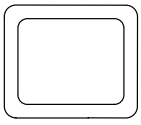
If you want to change this line to read:

P ‘THIS WAS A TEST’



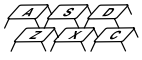
You could enter the following at the asterisk:

*C/IS/WAS/[ENTER]



The 1775-S4B scanner returns:

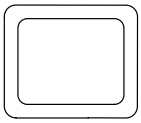
P ‘THWAS IS A TEST’



You must enter text that is unique in the line.

To correct our mistake enter:

*C/WAS IS/IS WAS/ [ENTER]

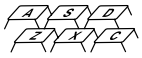


The 1775-S4B scanner now returns:

P ‘THIS WAS A TEST’

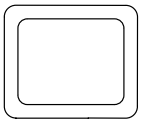
As a third example, if you are changing multiple occurrences in a line, you must specify this in the change command. Otherwise, the 1775-S4B scanner only changes one occurrence per line. Suppose you are editing a line that contains:

P $N9:1 $N9:2 $N9:3 $N9:4



If you want to change all the nines in this line to sevens, make the following change command:

*4C/9/7/ [ENTER]



The 1775-S4B scanner changes the four occurrences of nines to sevens and returns:

P $N7:1 $N7:2 $N7:3 $N7:4

7.3.9 Delete Lines

Definition: To remove lines from the procedure.

Abbreviation: D

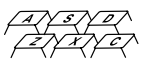
Format: <number of lines>D [ENTER]

Description: The delete lines command deletes line(s) of the procedure, starting with the current line.

Example using the delete lines command:

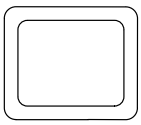
For the procedure @EXAMPLE which contains the lines:

P ‘INDEX l’
P ‘LINE 1A’
P ‘LINE 2’
P ‘LINE 3’



We can delete the first two lines of @EXAMPLE by entering 2D at the initial asterisk:

P ‘INDEX l’
* 2D [ENTER]



The 1775-S4B scanner deletes the first two lines of @EXAMPLE, revises the procedure line numbers, and returns:

```
P 'LINE 2'
*
```

7.3.10 Exit Edit Mode

Definition: To exit the edit mode and return to the command mode.

Abbreviation: E

Format: E [ENTER]

Description: The exit command takes the 1775-S4B scanner out of the edit mode, and returns the S4B> prompt.

Example using the exit edit mode command:

To exit the edit mode, just enter E:

```
* E [ENTER]
```

The 1775-S4B scanner returns the S4B> prompt:

7.4 Editing Messages with a 1775-S4A Scanner

You can use the 1775-S4A scanner to edit any type of message in the message area of memory. If you connect an industrial terminal to the 1775-S4A scanner, you could edit one report generation procedure while the 1775-S4B scanner executes another procedure.

CAUTION: Do not attempt to execute or edit a report generation procedure that is being executed or edited by another scanner. Unpredictable results may occur.

To enter the message edit mode on the 1775-S4A scanner, connect the industrial terminal to the 1775-S4A scanner, and enter the following at the $ sign:

```
ME, MR, <message number> [ENTER]
```

ME is the message edit command. MR stands for a message in the report generation section of the message area. You could also enter:

- MA for assist
- MT for terminal

- MC for comment
- MH for highway

The message number is part of the extended address of the message procedure. Consider the following extended address:

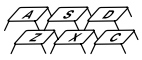
E5.1.1.24.0

where:

- 5 designates the message area
- 1 designates context 1
- 1 designates the report generation section in the area
- 24 designates the message number within the section
- 0 designates the starting word within the message

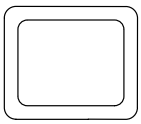
The starting word must always be 0.

Upon entering the message edit mode, the text of the message procedure displays, if any exists. Table 7.B shows editing commands for positioning the cursor and for deleting text. You can type in text to be added to the message procedure. Characters enter the procedure to the left of the cursor.

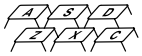


To exit the edit mode, press:

[CANCEL COMMAND]

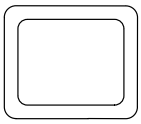


The PLC-3 processor returns the ladder diagram programming display.



You can generate a new procedure in this edit mode. However, you must place the new procedure name in the symbol table before the 1775-S4B can edit and/or execute it. Refer to chapter 9 for a discussion on the symbol table. Simply enter:

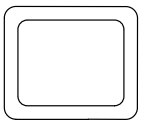
IS,<procedure name>,MR<message number>.0 [ENTER] [ENTER]



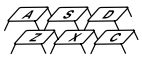
The 1775-S4B scanner inserts the procedure name into the symbol table.

You can also remove a procedure in this edit mode. However, before the 1775-S4B removes it the from the symbol table, you must enter the following:

RS,<procedure name>[ENTER]

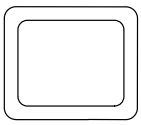


The 1775-S4B scanner removes the procedure name from the symbol table.



You can generate a listing of all symbols and their memory addresses by entering:

LS [ENTER]



The 1775-S4B scanner displays a list of all symbols. For more information on editing messages through the 1775-S4A scanner, refer to the PLC-3 Programmable Controller Programming Manual (publication 1775-6.4.1, formerly 1775-801).

Table 7.B
1775-S4A Scanner Editing Commands

Command	Keyboard Entry
Move 1 character to the right	[→]
Move 1 character to the left	[←]
Move 1 line up	[↑]
Move 1 line down	[↓]
Move 10 lines up	[RUNG ↑]
Move 10 lines down	[RUNG ↓]
Delete the character at the cursor	[DELETE]
Delete the message procedure from the message area	[CTRL] D
Delete the characters from the cursor through the end of the line	[TRUNC]
Insert the next character into the message procedure[1]	[INSERT]
Exit 1775-S4A message editor	[CNCL CMD]

[1] You can use this command to store the control commands listed in this table in your procedure. Otherwise, the command executes when you enter the keystroke.

7.5 Chapter Summary

In this chapter you read about editing report generation procedures. You can edit procedures:

- In the command mode by using the report generation editing commands
- In the ladder diagram mode by using the 1775-S4A editing commands through channel 5 on the 1775-S4A scanner

The next chapter describes the use of symbols and expressions in report generation.

Chapter 8

Using Symbols and Expressions in Report Generation

8.0 Chapter Objectives

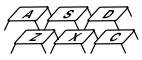
After reading this chapter, you should be able to:

- Use symbols within procedures
- Use symbols within PLC-3 memory
- Use expressions within procedures

8.1 Creating and Executing a Simple Procedure with a Symbol

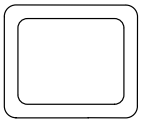
Before we define symbols, let's work through another procedure which uses symbols. The definition of a symbol entails many topics, but for right now, a symbol is a variable within a procedure that can represent a number, character, group of numbers, group of characters, procedure name, or an address.

Our procedure is @EASY. In @EASY, we will let symbol A represent the number 10.



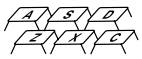
Enter the edit mode and insert the following lines:

```
S4B> ED @EASY [ENTER]
```



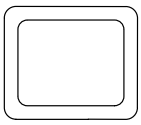
The 1775-S4B scanner enters the edit mode for the procedure @EASY and displays:

```
<EOB>
*
```

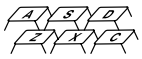


Now enter:

```
* I [ENTER]
```

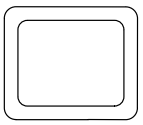


The 1775-S4B scanner enters the insert mode.

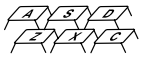


Now enter the following line:

```
A = 10 [ENTER]
```

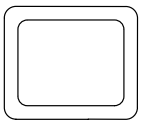


This is the first line of the procedure.

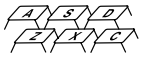


Now enter the following line:

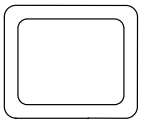
P A [ENTER]



This is the second line of the procedure.



Now press the [ENTER] key to exit the edit mode.

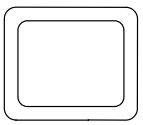


The 1775-S4B scanner displays:

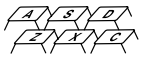
<EOB>
*

Now to exit the edit mode, enter:

* E [ENTER]

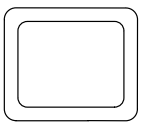


The 1775-S4B scanner exits the edit mode and returns the S4B> prompt.



To execute the procedure, enter:

S4B> @EASY [ENTER]



The 1775-S4B scanner executes the procedure @EASY. The following line prints out:

10

As you will see in the next sections, not only is A in @EASY a symbol, but the procedure name @EASY is also a symbol. In the following sections, we will define the different types of symbols.

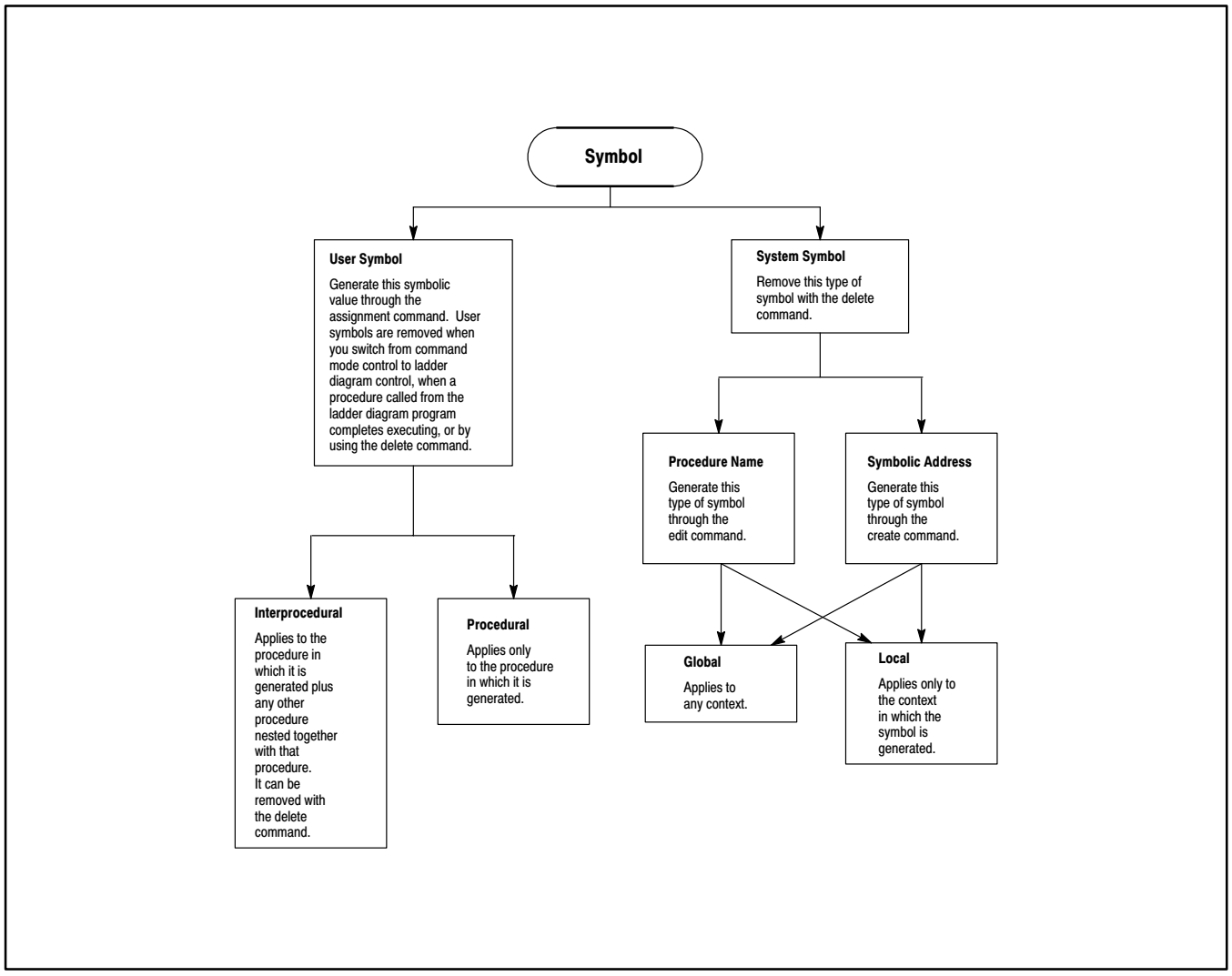
8.2 Symbols

In the procedure @EASY, from chapter 8, the variable A serves as a user symbol within the procedure, however, symbols have many purposes which we discuss in this chapter. The PLC-3 controller supports two types of symbols (figure 8.1):

- User symbols
- System symbols

The following sections explain these types of symbols.

Figure 8.1
Report Generation Symbols



8.3 User Symbols

A user symbol is a name which represents data within a procedure. Such data can be individual or groups of characters or numbers. The user symbol must begin with a letter and can contain up to eight unique upper or lower case letters, numbers, or the underscore character. For example:

```
USER_SYN
```

Report generation supports three types of user symbols:

- **Numeric**—Variables that represent a number. The 1775- S4B scanner stores numeric user symbols as 32-bit integers. You can use = or == to assign numbers to numeric user symbols. Section 8.3.1 discusses these assignment statements.

  Example: A=10

- **String**—Variables or characters that represent a group of numbers or characters. The 1775-S4B scanner stores string user symbols as ASCII characters. You can use =? or ==? to assign strings of data to a string user symbol. Section 8.3.1 discusses these assignment statements.

  Example: QFR =? ‘ABCDEF’

- **Label**—Markers within procedures that tell the 1775-S4B scanner to move to another section of the procedure. Labels must end with a colon (:).

  Example: BOTTOM:

You can classify a user symbol in one of two ways:

- Procedural
- Interprocedural

If you declare a procedural user symbol in a procedure, the 1775-S4B scanner recognizes the symbol only in that procedure. For example, if you declare A = 10 in a procedure, the 1775-S4B scanner recognizes A as being 10 anywhere in that procedure.

If you declare an interprocedural user symbol in a procedure, the 1775-S4B scanner recognizes the symbol in that procedure and any other procedure that the top procedure calls. For example, suppose you are executing a procedure named @MASTER and you declare B == 10. Then, @MASTER calls the procedure @SLAVE by executing the line:

```
@SLAVE
```

The procedure @SLAVE can use and alter B and any other interprocedural user symbol declared in @MASTER, but @SLAVE does not recognize procedural user symbols declared in @MASTER.

Refer to the next section for a discussion on the assignment statements.

CAUTION: In using user symbols, note the following:

- Do not use the same variable(s) to declare a procedural and an interprocedural user symbol within the same procedure, unpredictable results could occur.
- Do not use the same variable(s) to delare numeric or string user symbols and labels within the same procedure, unpredictable results could occur.
- Do not cycle power on the PLC-3 processor chassis or enter [CTRL] X on your keyboard while a procedure is executing, you will erase all user symbols from PLC-3 memory.

8.3.1 Assignment Statements

An assignment statement assigns a value to an address or a variable. Report generation uses the following symbols in assignment statements:

Symbol	Function
=	Assigns the numeric value on the right to the variable or address on the left. If a user symbol is on the left, it is defined to be a procedural symbol. **Example:** A = 10
==	Assigns the numeric value on the right to the variable or address on the left. If a user symbol is on the left, it is defined as a interprocedural symbol. **Example: B** == I00
=?	Assigns the string value on the right to the variable or address on the left. Only a user symbol can appear on the left side of a string assignment. **Example:** CHAR =? 'ENTER A CHARACTER'
==?	Assigns the string value on the right to the variable on the left. If a user symbol is on the left, it is defined as a interprocedural symbol. **Example:** CHAR ==? 'ENTER TEMPERATURE READING'

An assignment statement can look very much like an algebraic equation, but there is one important difference. In algebraic equations, there is no difference between the statements:

A=B

and

B=A

But in an assignment statement, the two statements are very different. Suppose, for example, that before the 1775-S4B scanner executes the statement, A contains the value 5 and B contains the value 10. If you now execute the first statement (A = B), both A and B would contain the value 10. However, if you execute the second statement (B = A) instead, A and B would contain the value 5. Therefore, instead of thinking about an assignment statement as A equals B, it may be useful to think of it as the value in A is replaced by the value in B.

8.3.2 Memory Storage for User Symbols

Area 7 of PLC-3 memory is the system scratchpad area. This area stores a user symbol(s) and the value or string assigned to that symbol. When the 1775-S4B scanner executes a procedure which contains user symbols, the 1775-S4B scanner stores the numeric or string value that is generated by the assignment command. The 1775-S4B scanner makes this area large enough to contain all the user symbols generated in a procedure:

- If the user symbol is procedural, the section(s) of the scratchpad area that store the symbol are deleted after the procedure executes.
- If the user symbol is interprocedural, the section(s) of the scratchpad area that store the symbol remain, since other procedures can recognize interprocedural user symbols.

When you are calculating maximum memory usage for your report generation procedures, remember that user symbols take up memory while the procedure is executing.

If you nest procedure execution, the scratchpad area is not deleted until the calling procedure and all nested procedures have executed. Refer to chapter 10 for detailed information on nesting procedures.

8.3.3 User Symbol for Detecting Errors

When the 1775-S4B scanner detects an error in executing a procedure or a direct command, it assigns a numeric value to the interprocedural user symbol:

ERROR

This user symbol must be reserved exclusively for this purpose.

8.4 System Symbols

A system symbol represents an entire procedure or a PLC-3 memory address. You must precede the system symbol with the @ delimiter. The system symbol can contain up to eight unique upper and lower case letters, numbers, or the underscore character. The first character in the procedure name must be a letter or an underscore character. For example:

@TIME

If you are using an industrial terminal to execute report generation procedures, you cannot use lower case letters to name a system symbol as the industrial terminal does not recognize lower case letters.

Report generation supports two types of system symbols:

- **Procedure name**—The name that identifies a procedure. You use the edit command to create and store the procedure and its name.

  Example: ED @TEST

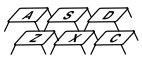
- **Symbolic address**—A specific PLC-3 memory address. You use the create command to assign and store a symbolic address.

  Example: CR @HR $E0.0.0.17

You can classify system symbols in one of two ways:

- Local
- Global

If you create a local system symbol, the 1775-S4B scanner only recognizes this symbol in the context in which you created it. For example:

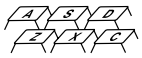


If you enter:

ED @TEST

The 1775-S4B scanner only recognizes @TEST in the current context.

If you create a global symbol by using the global modifier (/G), the 1775-S4B scanner recognizes the symbol in any context. For example:



If you enter:

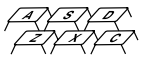
CR/G@HR$E0.0.0.17

The global modifier (/G) makes the system symbol @HR a global system symbol. The 1775-S4B scanner recognizes this symbolic address in any context.

Refer to the PLC-3 Programmable Controller Programming Manual (publication 1775-6.4.1, formerly 1775-801) for a complete discussion on context in the PLC-3 system. Refer to chapters 7 and 10 of this manual for detailed information on the edit and create commands.

8.4.1 Symbol Table

The PLC-3 processor stores system symbols in the system symbol table.



You can look at this table by typing:

DI [ENTER]

The PLC-3 processor returns a list of the system symbols recognized in the current context. An example directory is given below:

Directory - System Symbols

NAME	ADDRESS	SIZE
MP_1	$E5.1.1.0.0	127
SA_1	$E0.0.0.7	
MP_3	$E5.1.1.1.0	12457
MP_2	$E5.1.1.2.0	765
COUNT	$N1:23	

In the example above, @MP_1, @SA_1, and @MP_3 are global system symbols. The other symbols @MP_2 and @COUNT are local system symbols. The size column shows the number of words used to store each message. Thus, @MP_1, @MP_3, and @MP_2 are procedures, and @SA_1 and @COUNT are symbolic addresses.

The 1775-S4B scanner stores the system symbols in the symbol table in the order that you create them.

8.4.2 Memory Storage for System Symbols

The 1775-S4B scanner uses areas 5 and 6 of PLC-3 memory to store information about system symbols.

Area 5 of PLC-3 memory is the message area which stores the contents of all messages. As we discussed in chapter 7, the PLC-3 processor can store data under different sections of this area. These different sections include:

- Report generation procedures
- Rung comments
- Terminal or macro commands
- Data highway procedures
- Assistance messages

When you use the edit command to create a procedure, the PLC-3 processor stores the contents of the procedure under one of these sections. You can address these sections by using the following extended addressing format:

E5.<context>.< message section number>. <message number>.<word>

The character E5 denotes the message area. The context value can be 1 thru 15. The following values correspond to each of the message sections:

- 1 for report generation
- 2 for rung comment
- 3 for terminal or macro commands
- 4 for data highway
- 5 for assistance

As an example, the following address corresponds to report generation procedure number 57:

$E5.1.1.57 or $E5.1.1.57.0

You will notice that the symbol table lists the extended address for each procedure.

Area 6 of PLC-3 memory stores the names and corresponding memory address for all system symbols. When you use the edit or create commands to create a procedure or symbolic address, the 1775-S4B scanner stores the name and the memory address for the system symbol in this area. When the 1775-S4B scanner executes a procedure or uses a symbolic address, it looks up the name in this area to find the extended address of the system symbol. It then can execute the procedure or find the memory location for the symbolic address.

You can access the system symbols area by using the following extended addressing format:

E6.<context>.1.<symbol number>.<word number>

The character E6 denotes the system symbol area. You can enter values from 0 thru 15 for the context with 0 being the context for global system symbols. The next level is always 1. The symbol number and the word number can be values from 0 thru 32,767.

8.5 Expressions

When you want the 1775-S4B scanner to perform mathematical, comparison, or bitwise operations within a procedure, you can use an expression. An expression is a mathematical statement which enables the 1775-S4B scanner to manipulate data in PLC-3 memory. You can use operators in expressions to combine:

- Direct integer values
- Direct string values
- String or integer user symbols
- Values at logical addresses
- Values at symbolic addresses
- Values of functions

To format an expression, simply enclose the statement in parentheses. For example:

(6 + 3)

Table 8.A lists the operators that you can use in an expression. Along with each operator, table 8.A gives an order of execution number for each operator. This number tells you which operator executes first if you have more than one operator in a statement. Order of execution moves from 1 thru 10 with 1 executing first. For example:

(6 + 3 * 2)

The *, or multiply operator, has a higher precedence than the + or addition operator. In evaluating this expression, the 1775-S4B scanner multiplies 3 by 2 and adds 6. The result is 12.

If you want the addition operation to occur before the multiplication, you would enter the expression as follows:

((6 + 3) * 2)

Table 8.A
Expression Operators

Operator	Order of Execution[1]	Description
~ or .BNOT.	1	Bitwise 32-bit complement
.NOT.	1	Logical complement
/	1	Bit test
*	2	Multiply
%	2	Divide
+	3	Add
-	3	Subtract
>>	4	Bit Shift right
<<	4	Bit Shift left
& or .BAND.	5	Bitwise 32-bit AND
^ or .BXOR.	6	Bitwise 32-bit EXCLUSIVE OR
| or .BOR.	7	Bitwise 32-bit OR
.EQ.	8	Compare equal
.GE.	8	Compare grater or equal
.GT.	8	Compare greater
.LE.	8	Compare less or equal
.LT.	8	Compare less
.NE.	8	Compare not equal
.SNE.	8	String compare not equal
.SEQ.	8	String compare equal
.AND.	9	Logical AND
.OR.	10	Logical OR

[1] Order of execution moves from 1 to 10 with 1 executing first. When operators have the same order of execution number, the order for their execution within an expression is from left to right.

The parentheses around the 6 + 3 tells the 1775-S4B scanner to execute the contents of the inside parentheses first. Thus, the expression returns 18 as the answer.

If two or more operators with the same level appear in an expression, the 1775-S4B scanner executes them in the order that they appear on the statement line. For example:

(6 + 3 - 2)

The 1775-S4B scanner adds 6 and 3, then subtracts 2, and returns 7 as the answer.

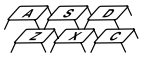
The following sections explain the functions of these operators.

8.5.1 Octal/Decimal Values

You can enter numbers into an expression as decimal values or octal values by using the following formats:

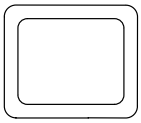
If you enter:	Then:
A value with a leading zero	The 1775-S4B scanner recognizes the value as octal.
A value without a leading zero	The 1775-S4B scanner recognizes the value as decimal.

For example:



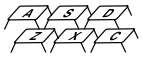
If you enter:

P (5+10 + 017)



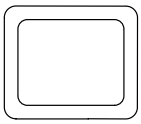
The 1775-S4B scanner would return 30 as the answer. The numbers 5 and 10 are decimal and the leading 0 makes 17 an octal value (or 15 decimal).

As a second example, consider the following:



If you enter:

P 72
P (58)
P (072)



The first line corresponds to the input of rack 7, module group 2. The second line corresponds to the same address, since 58 decimal is 72 octal. The third line is an expression which specifies 72 as octal.

8.5.2 Comparison Operations

Report generation supports the following comparison operators:

.EQ.—compare equal

.GE.—compare greater than or equal to

.GT.—compare greater than

.LE.—compare less than or equal to

.NE.—compare not equal

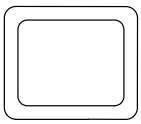
.SNE.—compare string not equal

.SEQ.—compare string equal to

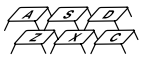
The result of a comparison operation is either 1 for true or 0 for false. For example, consider the following procedure:

If you enter:

```
$CACC:1 = 50
$CACC:2 = 37
A = ($CACC:l.GT. $CACC:2)
```

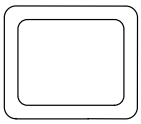


The value of user symbol A would be 1 since 50 is greater than 37. If the statement is false, the value of the user symbol would be 0 for false.



If you enter:

```
STRD =? 'ABCD'
STRE =? 'ABCE'
A = (STRD.SEQ.STRE)
P A
```



The value of user symbol A would be 0 since the two strings do not match.

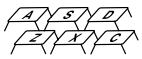
8.5.3 Complement Operation

Report generation supports the following complement operators:

.NOT.—logical complement

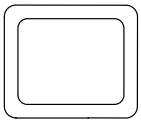
~ or .BNOT.—bitwise 32-bit complement

The result of a logical complement is either 1 for true or 0 for false. For example:



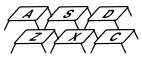
If you enter:

```
A = 0
P (.NOT.A)
```



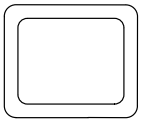
The 1775-S4B scanner would print a 1, because A is equal to zero. If A equals any value other than zero, the 1775-S4B scanner would return a 0 for false.

When executing the .BNOT. operator for a bitwise 32-bit complement of a 32-bit value, the 1775-S4B scanner returns the opposite state of each bit in the value. For example:



If you enter:

```
P (.BNOT.B)
```



If user symbol B's bit pattern contains:

1001001100000000

The 1775-S4B scanner would return the following for the expression:

0110110011111111

8.5.4 Bitwise Operations

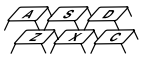
Report generation supports the following bitwise operators:

& or .BAND.—bitwise 32-bit AND

^ or .BXOR.—bitwise 32-bit EXCLUSIVE OR

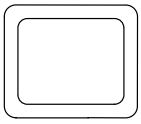
| or .BOR.—bitwise 32-bit OR

Bitwise operators enable you to manipulate 32-bit values. For example:



If you enter:

G=(Q.BAND.T)



G stores a 32-bit result of the binary AND operation between user symbols Q and T. You can also use.BXOR. and.BOR. operators to perform binary EXCLUSIVE OR and binary OR operations.

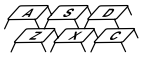
8.5.5 Logical Operations

Report generation supports the following logical operators:

.AND.—logical AND

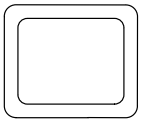
.OR.—logical OR

Logical operations return 1 if the expression is true and 0 if the expression is false. For example:



If you enter:

A=10
B=9
C=3
D=4
P (A.GT.B .AND. C.NE.D)



The 1775-S4B scanner prints out a 1 in this case because 10 is greater than 9 and 3 is not equal to 4.

8.5.6 Shift Operations

Report generation supports the following shift operators:

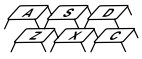
<<—Bit shift left

>>—Bit shift right

The shift operators shift binary values a specified number of bit positions to the left or right.

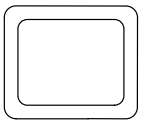
When executing a bit shift left, a 0 shifts into the right most bit. When executing a bit shift right, the left most bit does not change state. If the left most bit is a 0, a 0 shifts in. Thus, the sign on the value will not change due to a shift operation.

Some examples using bit shift operations are given below:



The following command lines show the execution of the bit shift left operator:

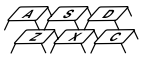
```
A=5
B=(A<<1)
P A
P B
```



The 1775-S4B scanner prints out 5 for user symbol A and 2 for user symbol B which is a bit shift left operation on user symbol A.

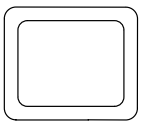
The bit patterns for the two values are given below:

User Symbol	Value Stored	Bit Pattern (32-bits)
A	5	00...00000101
B	2	00...00000010



The following command lines show the execution of the bit shift right operator:

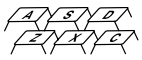
```
A=5
B=(A>>1)
P A
P B
```



The 1775-S4B scanner prints out 5 for user symbol A and 10 for user symbol B which is a bit shift right operation on user symbol A.

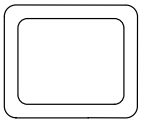
The bit patterns for the two values are given below:

User Symbol	Value Stored	Bit Pattern (32-bits)
A	5	00...00000101
B	10	00...00001010



The following command lines show a bit shift execution on a negative value:

```
A=-1
B=(A>>1)
P A
P B
```



The 1775-S4B scanner prints out the value -1 for user symbol A and -1 for user symbol B which is a bit shift operation on user symbol A.

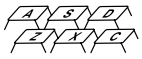
The bit patterns for the two values are given below:

User Symbol	Value Stored	Bit Pattern (32-bits)
A	-1	11...11111111
B	-1	11...11111111

8.5.7 Bit Operation

Report generation supports the slash (/) for a bit test:

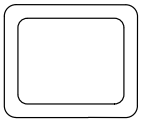
If the bit is:	Then the 1775-S4B scanner returns:
On	1
Off	0



For example:

If you enter:

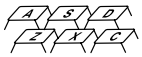
```
P ($I:12/010)
```



The 1775-S4B scanner returns the value 0 or 1:

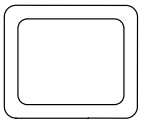
If Input word 12, bit 10 is:	Then the 1775-S4B scanner returns:
On	1
Off	0

If you do not enclose the entire expression in parentheses, the 1775-S4B scanner displays an error code.

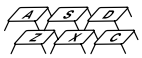


If you enter:

```
P (A/31)
```

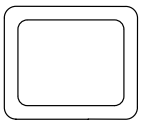


The 1775-S4B scanner prints the status of decimal bit 31 of user symbol A.



If you enter:

```
P (@HR/015)
```



The 1775-S4B scanner prints the status of octal bit 15 of symbolic address @HR.

8.5.8 Arithmetic Operations

Report generation supports the following arithmetic operators:

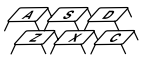
*—multiplication

%—division

+—addition

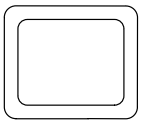
-—subtraction

Arithmetic operators allow you to perform arithmetic functions. For example:

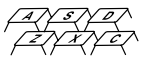


If you enter:

```
A=10
B=2
P (A*B)
```



The 1775-S4B scanner returns the value 20.



If you enter:

```
A=10
B=2
P (A%B)
```

The 1775-S4B scanner returns the value 5.

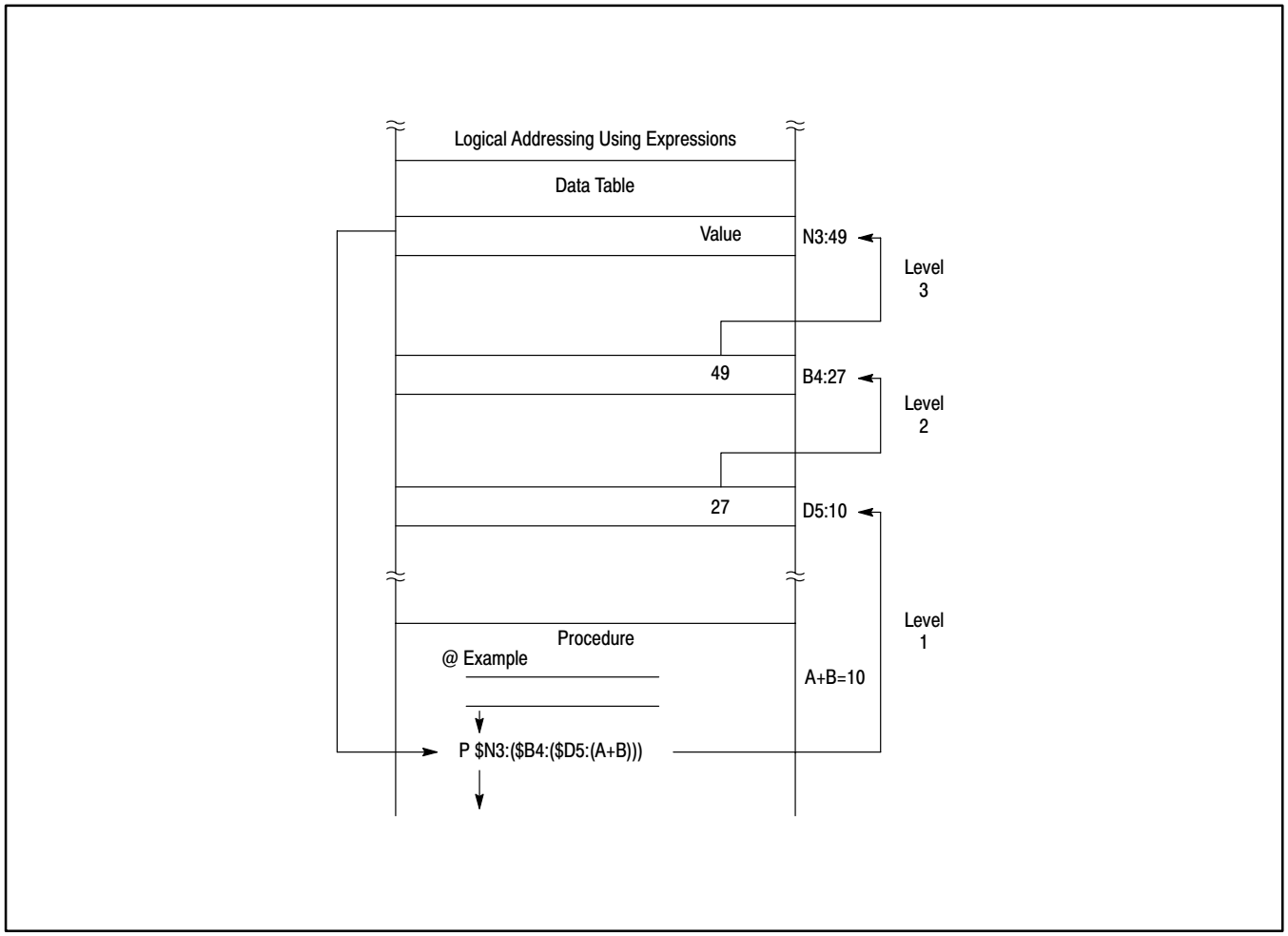
NOTE: If you attempt to divide a value by zero, the 1775-S4B scanner returns error code 20.

8.5.9 Expressions and Logical Addressing

You can also use expressions inside a logical address. This use of expressions enables you to create indirect logical addresses which can function similar to data table pointers. Some examples appear below:

Expression	Description
$N3:($CACC:1)	In this expression, CACC:1 supplies the word number for the integer file 3.
$N(A+B):45	In this expression, A+B supplies the file number for integer word 45.
$N($D2:5):(QFR * @HR-12)	In this expression, word D2:5 supplies the file number, and QFR * @HR-12 supplies the word number
$N3:($B4:($D5:(A+B)))	In this expression, we set up three levels of indirect addressing (figure 8.2): → Word number of decimal file 5 → Word number of binary file 4 → Word number of integer file 3

Figure 8.2
Three Levels of Indirect Addressing



8.6 Chapter Summary

In this chapter, you read about the use of symbols and expressions in generating reports on your 1775-S4B scanner. Symbols are characters that represent data. Report generation supports two types of symbols:

- User symbols are variables used to represent data such as values, PLC-3 memory addresses, strings, or labels. You can declare by using assignment statements to be procedural or interprocedural in scope. The 1775-S4B scanner stores user symbols in the system scratchpad area of PLC-3 memory.

- A system symbol is a name which represents an entire procedure or a PLC-3 memory address. You must precede the system symbol with the @ sign. You can declare system symbols to be local or global in scope. The 1775-S4B scanner stores system symbols in the symbol table area of PLC-3 memory. You can display a list of system symbols by using the directory command.

Expressions enable you to perform mathematical, comparison, or bitwise operations. Expressions are always enclosed in parenthesis.

The next chapter describes formatting data in report generation.

Chapter 9

Formatting Data in Report Generation

9.0 Chapter Objectives

In the last three chapters, we discussed writing, editing, and using symbols and expressions in procedures. After reading this chapter, you should be able to:

- Format input and output data
- Use standard control characters
- Use carriage and cursor control characters
- Use special industrial terminal control characters
- Use conversion table

These are the topics that we will discuss in this chapter.

9.1 Formatting Input and Output Data

Report generation for the 1775–S4B scanner uses a format specification system which enables you to input and output data in many forms. This formatting capability extends over all input and output commands (print and inquire).

The formatting system allows you to alter aspects of the data. These aspects include:

- Justification—The margin style for each line of data.
- Field width—The number of characters that make up the data display.
- Base—The number base which expresses the data.

9.1.1 Specifying a Format

To specify a format, an exclamation point (!) should follow the input or output data. Formatting is not essential; however, it gives you control over the appearance of the data. The maximum format specification package includes:

```
!JFWWWB
```

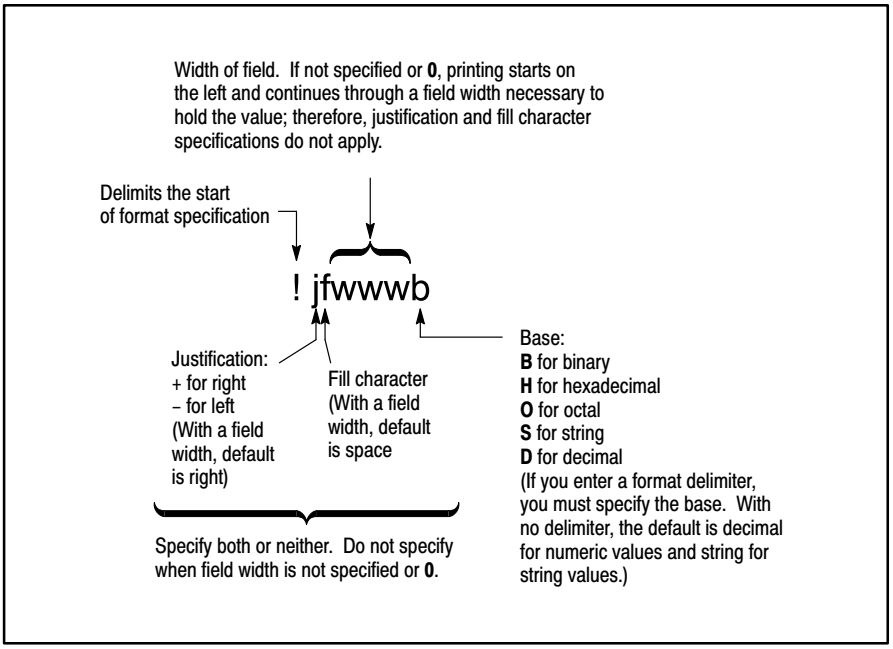
where:

- ! = formatting delimiter
- J = justification instructions

- F = fill character instructions
- W = field width instructions
- B = base system instructions

Figure 9.1 summarizes these format specifiers. The following four sections discuss the J, F, W, and B specifiers.

Figure 9.1
Specifying a Data Format



9.1.2 Justifying Margins

The J and F characters in the format specification above allow you to justify output margins. The J character can be:

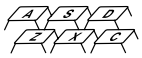
- + for flush right margin justification
- – for flush left margin justification

If you do not enter a margin justification character, the default format is flush right.

The F character allows you to pad unused areas of a line, if the display width is greater than the data length. Refer to the next section on determining the display width. Any character can pad output data, but a + or – sign must preceed the character. If you do not enter a justification

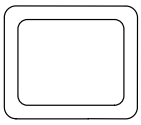
character, the output displays a flush right margin with spaces filling any unused areas.

Examples of formatting margins and pads are given below:



If you enter:

```
A=456
B=678
P B!+010D
P B!+.10D
P B!–*10D
```



The 1775–S4B scanner displays:

```
0000000456
.......678
678*******
```

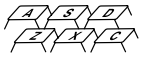
Looking at the printout, variables A and B contain each input value. Variable A prints out flush right preceded by zeros, and variable B prints out flush right preceded by periods. Finally, variable B prints out flush left followed by asterisks.

9.1.3 Displaying Data

In the example above, you will notice that the number 10 follows the fill character. This number, denoted by W in the format specification, indicates the width of the output display, or the number of characters that can appear for the output display. In the example, ten character spaces were allotted. Thus, the integer value 678 takes up three spaces and seven asterisks fill the remainder of the line. The field width character, W, enables you to specify an output display's width on a line. Remember, more than one output display can appear on a line.

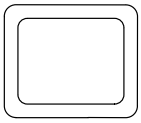
To specify a field width, simply enter the desired number after the fill character, or after the! if margin justification is not specified. If you enter a zero, or do not enter a value for the field width, then space will automatically be allotted for the output display.

An example is given below:



If you enter:

```
A=2
PA!+*8D
PA!+0D
PA!+*8D
PA!D
```

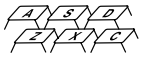


The 1775–S4B scanner displays:

```
*******2
2
*******2
2
```

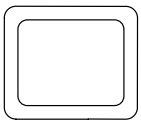
If you specify a field width that is too small for the data, the 1775–S4B scanner makes room to display the entire expression. No data truncation occurs.

Specifying a field width is particularly useful for formatting columns of data. Consider the following example:



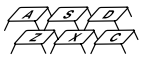
If you enter:

```
P ’LINE1 ’$CACC:0’ ’$CACC:1
P ’LINE2 ’$CACC:3’ ’$CACC:4
P ’LINE3 ’$CACC:5’ ’$CACC:6
```



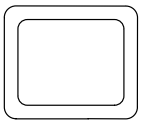
In these command lines, $CACC is a logical address which represents a word location in PLC–3 memory. Suppose the following values print out:

```
LINE 1 128 4752
LINE 2 5 2839
LINE 3 628 67
```



As you can see, the columns are not uniform. To straighten the columns, you can specify a field width.

```
P ‘LINE1 ’$CACC:0!+05D’ ’$CACC:1
P ‘LINE2 ’$CACC:3!+05D’ ’$CACC:4
P ‘LINE3 ’$CACC:5!+05D’ ’$CACC:6
```



Now the following would print out:

```
LINE 1 00128 04572
LINE 2 00005 02839
LINE 3 00628 00067
```

By specifying a field width of 5, the 1775–S4B scanner makes the printout for all the values the same size. In the format statements, we specified 0 as the fill character. So the 1775–S4B scanner fills any extra space with zeros. Also, you may notice that we specified the format once per line. The last format specified on a command line becomes the default format for the rest of the line. The D which ends the format specification defines the base for the format. We discuss formatting bases in the next section.

9.1.4 Specifying a Base Format

You can specify a base format specifier to format data in a specific numbering system. The base format specifiers are given below:

Format Specifiers	Format
H	Hexidecimal
O	Octal
D	Decimal
B	Binary
S	String

If you do not specify a format, the following base conversions occur:

- Integers default to decimal.
- Strings default to strings.

On a command line, once you specify a format, the rest of the line in the procedure defaults to that format until you specify a new format.

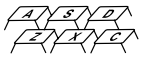
The following sections explain these base format specifiers.

9.1.4.1 Base Formatting Examples

By using the following specifiers, you can display data in different numbering systems:

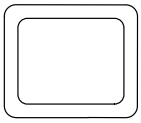
- B—Binary
- H—Hexadecimal
- D—Decimal
- O—Octal

As an example, suppose you have the following procedure:



If you enter:

```
A=1234
P A!016B
P A!16H
P A!16D
P A!16O
```

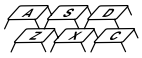


The 1775–S4B scanner returns the following:

1775-S4B Printout	Description of Value
0000010011010010	Binary value for 1234
4D2	Hexadecimal value for 1234
1234	Decimal value for 1234
2322	Octal value for 1234

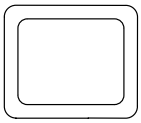
9.1.4.2 String Values

The S base specifier serves when you are displaying strings of data. Suppose you have the following procedure:



If you enter:

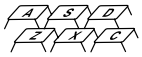
```
A=1234
P ‘THE VALUE IS’A!S
```



The 1775–S4B scanner displays:

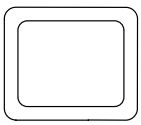
```
THE VALUE IS R
```

You may wonder why an R appears after the three spaces. R represents the ASCII character for the lower seven bits of the value 1234. The 1775–S4B scanner displays the ASCII value(s) in hex for these bits any time you assign a string or address to a symbol using an equal sign.



To print out the actual data, you would need to use the special assignment statement =? which tells the 1775–S4B scanner that the symbol represents a string of information:

```
A=?’1234’
P’THE VALUE IS’A!S
```



The 1775–S4B scanner displays:

```
THE VALUE IS 1234
```

9.2 Using Standard Control Characters

Report generation specifies that the following three characters serve special functions:

- ^ (uparrow)
- \ (backslash)
- ’ (single quote)

The uparrow and the backslash serve as modifiers. When a string is followed by one of the characters outlined in table 9.A, report generation executes a specific task. For example:

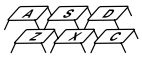
\R designates a carriage return
\H designates a backspace

Table 9.A
Three Ways of Control Character Generation in a String

Control Character Generated		String Characters		
NUL	Null		^@	\0
SOH	Start of Heading (CC)		^A	\1
STX	Start of Text (CC)		^B	\2
ETX	End of Text (CC)		^C	\3
EOT	End of Transmission		^D	\4
ENQ	Enquiry (CC)		^E	\5
ACK	Acknowledge (CC)		^F	\6
BEL	Bell (audible or attention signal)		^G	\7
BS	Backspace (FE)		^H	\10
HT	Horizontal Tabulation (FE)	\T	^I	\11
LF	Line Feed (FE)	\L	^J	\12
VT	Vertical Tabulation (FE)		^K	\13
FF	Form Feed (FE)	\F	^L	\14
CR	Carriage Return (FE)	\R	^M	\15
SO	Shift Out		^N	\16
SI	Shift In		^O	\17
DLE	Data Link Escape (CC)		^P	\20
DC1	Device Control 1		^Q	\21
DC2	Device Control 2		^R	\22
DC3	Device Control 3		^S	\23
DC4	Device Control 4 (Stop)		^T	\24
NAK	Negative Acknowledgement (CC)		^U	\25
SYN	Synchronous Idle (CC)		^V	\26
ETB	End of Transmisison Block (CC)		^W	\27
CAN	Cancel		^X	\30
EM	End of Medium		^Y	\31
SUB	Substitute		^Z	\32
ESC	Escape		^[	\33
FS	File Separator (IS)		^\	\34
GS	Group Separator (IS)		^]	\35
RS	Record Separator (IS)		^^	\36
US	Unit Separator (IS)		^_	\37
DEL	Delete			\177
	New Line – CR and LF	\N		
	Suppress the CR and LF that are otherwise implied at the end of the line	\X		

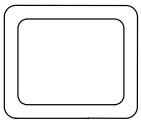
Note: (CC) Communication Control
(FE) Formal Effector
(IS) Information Separator

The single quote accompanies the print or inquire command. Enclosing a character or string of characters with single quotes tells the 1775–S4B scanner to print the specified characters as a string value having no numerical significance. For example:



If you enter:

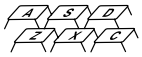
P ‘TEST THE PROCEDURE’



The 1775–S4B scanner prints out:

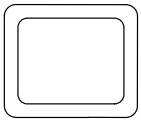
TEST THE PROCEDURE

If you would like to display one of these special characters, simply precede it with a backslash.



If you enter:

P ‘THE SPECIAL CHARACTERS ARE \^, \\,AND \’.’



The 1775–S4B scanner prints out:

THE SPECIAL CHARACTERS ARE ^, \, AND ‘.

9.3 Using Carriage and Cursor Control Characters

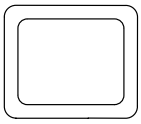
Carriage and cursor control characters enable you to imply carriage control. The commands available to you include:

- \T represents a horizontal tab
- \L represents a line feed
- \F represents a form feed
- \R represents a carriage return
- \X represents a line suppression
- \N represents a new line

Work through the following example to see how these control characters function. Enter the following procedure and call it @LINES. Then exit the edit mode and execute @LINES. The procedure is given below:

If you enter:

```
P ‘START’
P ‘LINE1\L LINE2\N’
P ‘LINE3\X’
P ‘LINE4\N’
P ‘LINE5\R LINE6’
P ‘END’
```



The 1775–S4B scanner prints out:

```
START
LINE1
        LINE2

LINE3LINE4

LINE6
END
```

We describe the execution of this procedure in the following paragraphs.

First, START prints on the first line.

```
START
```

The cursor moves to the next line automatically and prints LINE 1.

```
START
LINE1
```

The \L instruction attached to LINE l moves the cursor down one line, and it remains at the same line position. Thus LINE2 prints out beyond LINE l on the next line.

```
START
LINE1
        LINE2
```

The \N instruction attached to LINE2 moves the cursor down two lines and returns the cursor to the beginning of the second line. LINE3 prints on the CRT.

```
START
LINE1
        LINE2

LINE3
```

The \X instruction attached to LINE3 keeps the cursor on the same line and LINE4 from the next print command prints next to LINE3.

```
START
LINE1
        LINE2

LINE3LINE4
```

The \N instruction attached to LINE4 moves the cursor down two lines. The \R instruction attached to LINE5 moves the cursor to the beginning of that line. In effect, this erases LINE5, and thus, it does not print. LINE6, the next print instruction, prints on the line.

```
START
LINE1
        LINE2

LINE3LINE4

LINE6
```

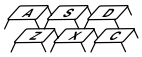
The cursor automatically returns to the next line and END prints out to complete the procedure.

```
START
LINE1
        LINE2

LINE3LINE4

LINE6
END
```

9.4 Using Industrial Terminal Control Characters

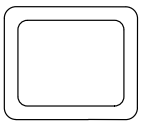
There are several control codes unique to the industrial terminal that use [CTRL] or [^] P as part of the key sequence. These control codes control cursor positioning and other operating characteristics. Table 9.B lists these codes and their functions.

For example:



If you enter:

[CTRL] P 5 G OR [^] P 5 G



The industrial terminal is placed in the graphics capability mode.

NOTE: When you are displaying data or graphic elements on the industrial terminal, note that the industrial terminal accepts the following values for column and line numbers:

- 0 to 79 are valid column numbers.
- 0 to 23 are valid line numbers.

Table 9.B
Industrial Terminal Control Codes

Control Code Key Sequence	Function
[CTRL] P <Column #>; <Line #> A	Positions the cursor at the specified column and line number. [CTRL] P A will position the cursor at the top left corner of the screen.
[CTRL] P F	Moves the cursor one space to the right.
[CTRL] P U	Moves the cursor one line up in the same column.
[CTRL] P 5 C	Turns cursor ON.
[CTRL] P 4 C	Turns cursor OFF.
[CTRL] P 5 G	Turns ON graphics capability.
[CTRL] P 5 P	Turn Channel C ON.
[CTRL] P 4 P	Turn Channel C OFF.
Key Sequence	**Attribute[1]**
[CTRL] P 0 T	Attribute 0 = Normal Intensity
[CTRL] P 1 T	Attribute 1 = Underline
[CTRL] P 2 T	Attribute 2 = Intensity
[CTRL] P 3 T	Attribute 3 = Blinking
[CTRL] P 4 T	Attribute 4 = Reverse Video

[1] Any three attributes can be used at one time using the following key sequence:
[CTRL] P <Attribute #>; <Attribute #> T.

9.5 Using the Conversion Table

Table 9.C is the decimal – octal – hexidecimal – ASCII conversion table. This table converts an ASCII character to its decimal, hexidecimal, and octal equivalents. The table is divided into four columns:

- Column 1 contains all the control characters.
- Column 2 contains numbers and symbols.
- Column 3 contains the capital letters. If you press the control key [CTRL] and a capital letter, the control code matches the control character in the first column. For example: [CTRL] G is the control character BEL.
- Column 4 contains lower case letters and symbols.

In addition table 9.D gives you the binary bit patterns for hexadecimal values.

Table 9.C
Decimal/Hexadecimal/Octal/ASCII Conversion Table

Column 1				Column 2				Column 3				Column 4			
DEC	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**
00	00	000	NUL	32	20	040	SP	64	40	100	@	96	60	140	\
01	01	001	SOH	33	21	041	!	65	41	101	A	97	61	141	a
02	02	002	STX	34	22	042	“	66	42	102	B	98	62	142	b
03	03	003	ETX	35	23	043	#	67	43	103	C	99	63	143	c
04	04	004	EOT	36	24	044	$	68	44	104	D	100	64	144	d
05	05	005	ENQ	37	25	045	%	69	45	105	E	101	65	145	e
06	06	006	ACK	38	26	046	&	70	46	106	F	102	66	146	f
07	07	007	BEL	39	27	047	‘	71	47	107	G	103	67	147	g
08	08	010	BS	40	28	050	(	72	48	110	H	104	68	150	h
09	09	011	HT	41	29	051	)	73	49	111	I	105	69	151	i
10	0A	012	LF	42	2A	052	*	74	4A	112	J	106	6A	152	j
11	0B	013	VT	43	2B	053	+	75	4B	113	K	107	6B	153	k
12	0C	014	FF	44	2C	054	,	76	4C	114	L	108	6C	154	l
13	0D	015	CR	45	2D	055	–	77	4D	115	M	109	6D	155	m
14	0E	016	S0	46	2E	056	.	78	4E	116	N	110	6E	156	n
15	0F	017	SI	47	2F	057	/	79	4F	117	O	111	6F	157	o
16	10	020	DLE	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM	57	39	071	9	89	59	131	Y	121	79	171	y
26	1A	032	SUB	58	3A	072	:	90	5A	132	Z	122	7A	172	z
27	1B	033	ESC	59	3B	073	;	91	5B	133	[	123	7B	173	{
28	1C	034	FS	60	3C	074	<	92	5C	134	\	124	7C	174	|
29	1D	035	GS	61	3D	075	=	93	5D	135	]	125	7D	175	}
30	1E	036	RS	62	3E	076	>	94	5E	136	^	126	7E	176	~
31	1F	037	US	63	3F	077	?	95	5F	137	–	127	7F	177	DEL

Table 9.D
Binary Patterns For Hexadecimal Digits

Hexadecimal Digits	Binary Equivalent	Decimal
0	0000	0
1	0001	1
2	0010	2
3	0011	3
4	0100	4
5	0101	5
6	0110	6
7	0111	7
8	1000	8
9	1001	9
A	1010	10
B	1011	11
C	1100	12
D	1101	13
E	1110	14
F	1111	15

9.6 Chapter Summary

In this chapter, you read about formatting data on your 1775–S4B scanner. The formatting system allows you to:

- Specify margin justification
- Specify the number of characters that make up the data display for each user symbol, string, or value
- Specify the numbering system or base that the user symbol, string, or value displays in.

The 1775–S4B scanner also recognizes cursor and carriage control characters that you can use to format data.

In the next chapter, we describe the commands that you can use to generate reports on the 1775–S4B scanner.

Chapter 10

Using Commands in Report Generation

10.0 Chapter Objectives

This chapter describes the commands which make up the report generation programming language. After reading this chapter, you should be able to:

- Use report generation commands directly in the command mode
- Use report generation commands within procedures to manipulate data

10.1 Commands

As we described in chapter 5, the report generation programming language uses commands to tell the 1775-S4B scanner what to do. Report generation supports two types of commands:

- Direct commands which you enter individually in the command mode for immediate execution
- Indirect commands which you enter into a procedure in sequence with the other commands for later execution

We describe 1775-S4B scanner commands for report generation in the following sections.

Report generation does not limit you to using commands directly from the command mode or indirectly within a procedure. We present the commands under the topic in which they are normally used. Some commands have applications for both topics so we discuss them under both topics. However, you can use any command from the command mode or within a procedure to meet your needs.

10.2 Direct Commands

A direct command tells the 1775-S4B scanner to perform the command immediately after you enter it. You enter a direct command from the data terminal keyboard whenever the 1775-S4B scanner is in the command mode, indicated by the S4B> prompt. Direct commands include:

- Print
- Directory
- Create
- Delete
- Copy

- Rename
- Execute

We describe these commands in the following sections.

10.2.1 Print

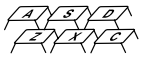
Definition: To display the contents of a procedure.

Abbreviation: P

Format: P @<procedure name>

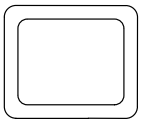
Description: If you enter a print command followed by a procedure name at the S4B> prompt, the 1775-S4B scanner displays the procedure exactly as stored in PLC-3 memory. You can also use the Print command within procedures to print out data. Refer to section 10.3.8 for detailed information.

Example using the print command to print out a procedure:



If you enter:

S4B> P @TEST



The 1775-S4B scanner displays the lines which make up the procedure @TEST.

10.2.2 Directory

Definition: To display a list of all system symbols.

Abbreviation: DI

Format: DI

Description: The directory command tells the 1775-S4B scanner to display a list which includes:

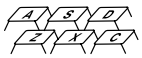
- Names of all system symbols
- Addresses of all system symbols
- Sizes of procedure text associated with each system symbol

If the system symbol table contains both global and local system symbols, the global system symbols are listed first followed by the local system symbols separated by a blank line. For each group, the 1775-S4B scanner lists the system symbols in the order that you created them.

For a procedure, the 1775-S4B scanner lists the extended address for the message area location. This address starts with E5. The size is the number of words that make up the procedure.

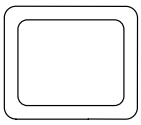
For a symbolic address, the 1775-S4B scanner lists the corresponding logical address. This address could be displayed in extended address or data table address format. The 1775-S4B scanner does not display the size for symbolic addresses.

Example using the directory command:



If you enter:

S4B> DI [ENTER]



The 1775-S4B scanner returns:

Directory - System Symbols

NAME	ADDRESS	SIZE
MP_1	$E5.1.1.0.0	127
A1B	$E0.0.0.7	
REPORT	$E5.1.1.1.0	12457
MP_2	$E5.1.1.2.0	765
COUNT	$N1:23	

In the example directory above, @MP_1, @A1B, and @REPORT are global system symbols. The other symbols @MP_2 and @COUNT are local system symbols. The size column shows the number of words used to store each message. Thus, @MP_1, @REPORT, and @MP_2 are procedures, and @A1B and @COUNT are symbolic addresses.

10.2.3 Create

Definition: To define a symbolic address.

Abbreviation: CR

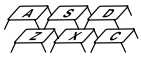
Format: CR/<scope modifier> @<system symbol name> $<logical address>

Description: You can use the create command to generate a symbolic address. The symbolic address is a system symbol which represents a logical address. The 1775-S4B scanner stores the symbolic address and its corresponding logical address in the system symbol table. You can use the global modifier (/G) to create a symbolic address which the 1775-S4B scanner will recognize in any context. Refer to chapter 8 for detailed information on system symbols. The local modifier is the default scope modifier.

If you assign a logical address to a symbolic address that already exists, the 1775-S4B scanner replaces the original logical address with the new logical address.

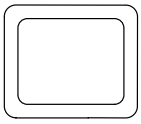
On the other hand, if you assign a logical address to a procedure name that already exists, the 1775-S4B scanner displays error code 30.

Examples using the create command:

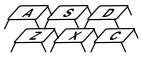


If you enter:

```
S4B> CR @COUNT $N1:23
```

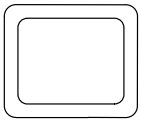


The 1775-S4B scanner creates a local symbolic address for an integer word.



If you enter:

```
S4B> CR/G @SA_1 $E0.0.0.7
```



The 1775-S4B scanner creates a global symbolic address @SA_1 for logical address E0.0.0.7.

10.2.4 Delete

Definition: To remove a system symbol.

Abbreviation: DEL

Format: DEL/<scope modifier>/<section modifier> @<system symbol>

Description: You can use the delete command at the S4B> prompt to delete a system symbol from the symbol table. You can enter the global modifier (/G) if you are deleting a global system symbol. Table 10.A lists the message area section modifiers. The section modifier specifies the message area that stores the system symbol.

Table 10.A
Command Section Modifiers

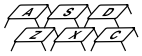
Section Modifier	Abbreviation	Type of Message File to Generate
Report	/R	Report Generation Message Procedure
Comment	/C	Rung Comment
Terminal	/T	Macro Commands
Highway	/H	Data Highway Message Procedure
Assist	/A	Help Message

The default modifiers are local for the scope modifier and report for the section modifier.

You can also use the delete command within a procedure to delete a user symbol. Refer to section 10.3.11 for detailed information.

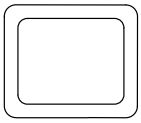
If you delete a procedure name from the system symbol table, you remove the procedure name and contents from PLC-3 memory.

Examples using the delete command:

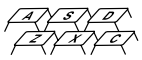


If you enter:

S4B> DEL @AB



The 1775-S4B scanner deletes the local report generation system symbol @AB.



If you enter:

S4B> DEL/G/H @DH2

The 1775-S4B scanner deletes the global highway procedure @DH2.

10.2.5 Copy

Definition: To duplicate a procedure.

Abbreviation: CO

Format: CO/<scope modifier>/<section modifier> @<original name> @<copy name>

Description: You can use the copy command to duplicate a procedure. The original name is the procedure that you want to copy . The copy name is the procedure name for the copy. When the 1775-S4B scanner executes the copy command, it does not delete the original procedure.

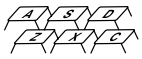
When you execute the copy command, the 1775-S4B scanner generates an error code:

- If the copy name already exists in the symbol table
- If sufficient memory is not available for the copy.

A scope modifier specifies whether the original procedure is local (CO/L) or global (CO/G). If the original procedure is local, the copy procedure becomes local. If the original procedure is global, the copy procedure becomes global.

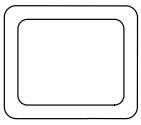
Table 10.A lists the message area section modifiers. The section modifier specifies the section of the message area in which the copy procedure is to be stored. The section where the original procedure is located does not matter. If you do not enter modifiers, the copy command defaults to local for the scope modifier and report for the section modifier.

Examples for the copy command:

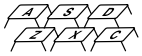


If you enter:

S4B> CO @MP_4 @MP_8

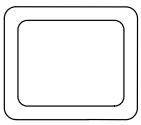


The 1775-S4B scanner copies the local procedure @MP_4 into the report section of the message area as a local procedure and names the copy @MP_8.



If you enter:

S4B> CO/G/H @HP_5 @HP_6



The 1775-S4B scanner copies the global highway procedure @HP_5 into the highway section of the message area as a global procedure and names the copy @HP_6.

10.2.6 Rename

Definition: To assign a new name to an existing procedure.

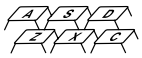
Abbreviation: RE

Format: RE/<scope modifier> @<old name> @<new name>

Description: You can use the rename command to change the name of a system symbol. The old name is the system symbol which you are renaming. The destination is the new name. The new name for the system symbol must not be a name already on the symbol table, or an error code will display. If the old name is a global system symbol, you must enter the

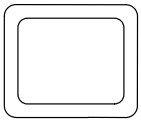
global scope modifier (/G). The local modifier is the default scope modifier.

Examples using the rename command:

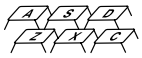


If you enter:

S4B>RE @MP_6 @MP_7

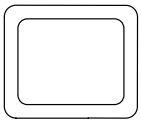


The 1775-S4B scanner changes the name of the local system symbol @MP_6 to @MP_7.



If you enter:

S4B> RE/G @SA_12 @PARTS



The 1775-S4B scanner changes the name of the global procedure @SA_12 to @PARTS.

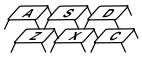
10.2.7 Execute

Definition: To execute the command lines that make up a procedure.

Format: @<procedure name>

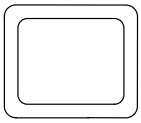
Description: If you enter a procedure name preceded by the at sign (@), the 1775-S4B scanner executes the procedure. This command functions at the S4B> prompt and in the MSG block of a ladder diagram program.

Example using the execute command:



If you enter:

S4B> @TIME



The 1775-S4B scanner executes all the command lines that make up the procedure @TIME.

10.3 Indirect Commands

You enter indirect commands into a procedure through the edit mode. The commands in the procedure are then executed by the 1775-S4B scanner whenever you tell it to execute that procedure. Indirect commands include:

- Print
- Execute
- Case
- Exit
- Stop
- If
- Goto
- On_error
- Assignment
- Inquire
- Delete

We describe these commands in the following sections.

10.3.1 Print

Definition: To display information.

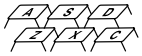
Abbreviation: P

Format: P <data specifier>

Description: In addition to displaying a procedure, the print command tells the 1775-S4B scanner to display the value of other data which you can specify. You can use this command at the command mode or within a procedure. A data specifier could be:

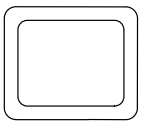
- Procedure name
- String
- User symbol
- Logical address
- Symbolic address
- Expression

Examples using the print command:

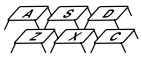


If you enter:

```
P @TEST
```

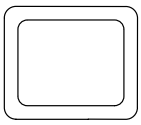


The 1775-S4B scanner displays the lines which make up the procedure @TEST.



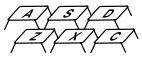
If you enter:

P ‘THIS IS A STRING’



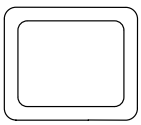
The 1775-S4B scanner displays:

THIS IS A STRING



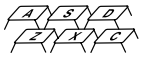
If you enter:

P ‘THE TEMP. IN BUILDING ’A ‘ IS ‘B’ DEGREES F’



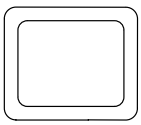
If the user symbol A contains the value 2, and B contains the value 78, then 1775-S4B scanner displays the line:

THE TEMP. IN BUILDING 2 IS 78 DEGREES F

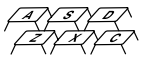


If you enter:

P $D2:0

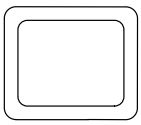


The 1775-S4B scanner returns the contents of D2:0.



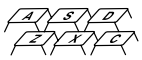
If you enter:

P @SA



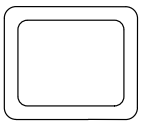
If @SA is a symbolic address which corresponds to I:147, the 1775-S4B scanner displays:

1:147



If you enter:

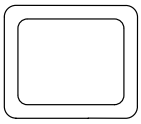
P (@SA)



If @SA is a symbolic address which corresponds to I:147, the 1775-S4B scanner prints out the current value of I:147.

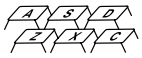
If you enter:

P (5+3)



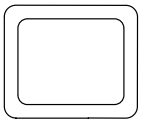
The 1775-S4B scanner returns the value:

8



If you enter:

P $N:($CACC:19)



In this example, an expression is used as part of a logical address. The accumulated value of counter 19 in the expression selects a word in the integer section of the data table. The 1775-S4B scanner prints out the current value of the selected word.

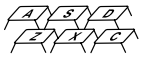
10.3.2 Execute

Definition: To execute a procedure or nest procedure execution.

Format: @<procedure name>

Description: You can use the execute command line within a procedure to nest procedure execution. By placing @<procedure name> within a procedure, you can call for a procedure to execute within a procedure. This type of procedure execution is called nesting. Nesting procedures is similar to executing subroutines in a ladder diagram program. You can nest procedures 3 levels in report generation. If you attempt to nest beyond 3 levels, the 1775-S4B displays an error code.

Example using the execute command:

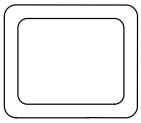


Suppose you enter a procedure called @MAKEUP which contains the following lines:

```
P 'REPORT ITEMS'
@ITEMA
@ITEMB
```

You could call this procedure to execute from another procedure @REPORT:

```
P 'REPORT'
@MAKEUP
```



The 1775-S4B scanner displays the introductory line followed by the execution of @MAKEUP.

10.3.3 Case

Definition: To call for a procedure to execute based on the value of an expression.

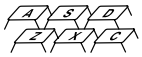
Abbreviation: CA

Format: CA (<expression>) @<procedure 1>... @<procedure n>

Description: The case command allows you to call one of several procedures depending on the value of an expression. The expression must generate values from zero to one less than the number of procedure names on the case command line. For example, if the number of procedure names is 5, then the allowed values from the expression are 0 to 4. Negative numbers and values greater than 4 generate errors. When the expression returns a value, the corresponding procedure executes. For example, if the expression returns a 1, the second procedure on the case command line executes. Remember, if the expression returns a 0, the first procedure after the case command expression executes.

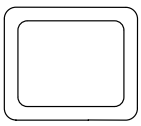
NOTE: Your list of procedures must be on the case command line.

Examples using the case command:



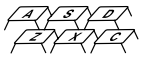
If you enter:

```
<command line 1>
<command line 2>
CA (A+@HR-57) @I @J @K
```



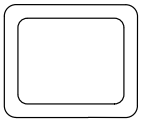
In the procedure above, the case command line returns a value between 0 and 2 for the expression A+@HR-57.

If the expression returns:	Then the 1775-S4B scanner executes:
0	@I
1	@J
2	@K



If you enter:

```
CA ($I:12/010) @OFF @ON
```



The 1775-S4B scanner tests bit I:12/010, and returns 0 or 1.

If the expression returns:	Then the 1775-S4B scanner executes:
0	@OFF
1	@ON

10.3.4 Exit

Definition: To halt procedure execution.

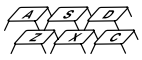
Abbreviation: EX

Format: EX

Description: You can use the exit command in a procedure to halt procedure execution. If you enter this command into a procedure which is called by a higher nested level procedure, the 1775-S4B scanner continues executing the next highest procedure. The exit command is similar to the RETURN instruction which ends a subroutine in a ladder diagram program.

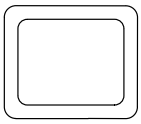
At the end of each procedure is an implied exit command.

Examples using the exit command:

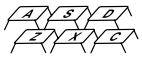


From our last example, suppose @MAKEUP is a monthly report procedure and you have three other procedures for monthly reports (@MAKEUP2, @MAKEUP3, and @MAKEUP4). You could have all four of these reports execute under one procedure which we call @REPORT. by entering the following lines:

```
P ‘Report Items For 4 reports’
@MAKEUP
@MAKEUP2
@MAKEUP3
@MAKEUP4
```

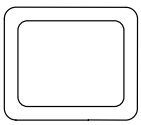


The 1775-S4B scanner displays the introductory line followed by the execution of @MAKEUP, @MAKEUP2, @MAKEUP3, @MAKEUP4.



If you enter the following lines for the procedure @MAKEUP:

```
P ‘Report Items‘
I($I:2/03) EX
@ITEMA
@ITEMB
```



In executing @MAKEUP, If bit I:2/03 is:

- Off, the 1775-S4B scanner executes procedures @ITEMA and @ITEMB
- On, the 1775-S4B scanner exits procedure execution before executing @ITEMA and @ITEMB. The 1775-S4B scanner returns to @REPORT and executes @MAKEUP2, @MAKEUP3, and @MAKEUP4.

10.3.5 Stop

Definition: To stop procedure execution and perform a specific instruction.

Abbreviation: S

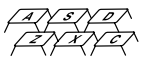
Format: S <data specifier>

Description: When the 1775-S4B scanner comes across a stop command in a procedure, it stops executing that procedure and all calling procedures. You can optionally specify any of the following data specifiers:

- Procedure name
- String of data
- User symbol
- Logical address
- Symbolic address
- Expression

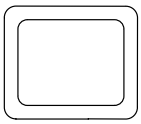
When the 1775-S4B scanner executes the stop command line, the data which you specify after the stop command prints out, and execution of the procedure stops. If the procedure had been called up by another procedure, the calling procedure is also stopped.

Example using the stop command:



If you enter:

S ERROR



The 1775-S4B scanner prints out the value or data assigned to the user symbol ERROR, stops executing the procedure, and stops executing any calling procedure.

10.3.6 If

Definition: To execute a command based on the value from an expression.

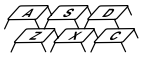
Abbreviation: IF

Format: IF (<expression>) <action command statement>

Description: The if command allows you to test an expression. When the 1775-S4B scanner reads the if command, it tests the expression for a true state (value other than 0) or a false state (0).

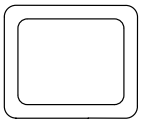
If the expression returns:	Then the 1775-S4B scanner:
True	Executes the action command on the if command line.
False	Does not execute the action command on the if command line.

Examples using the if command:



If you enter:

```
IF (ABC.EQ.12)P ’YOU SELECTED ENTRY #12’
<command line>
```



The 1775-S4B scanner tests user symbol ABC. If ABC equals 12, the statement YOU SELECTED ENTRY #12 displays. If ABC does not equal 12, the next command line executes.

10.3.7 Goto

Definition: To jump to a specific place in the procedure.

Abbreviation: G

Format: G <label>

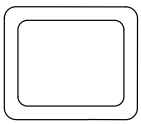
Description: The goto command tells the 1775-S4B scanner to jump to a specific label in the procedure. When a goto command appears in a procedure, the 1775-S4B scanner finds the label and begins executing the next command line.

The label can consist of numeric digits, alphabetic characters, and the underscore character. The first character must be an alphabetic character or the underscore character. You can make the label any length, but its first eight characters must be unique. A label can only appear once in a procedure. Labels cannot have the same name as a command or command abbreviation. You can use the goto command with the if command to program loops in a procedure. Using loops in your procedure allows you to execute command lines repeatedly based on a condition.

Examples using the goto command:

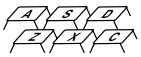
If you enter:

```
P ‘LINE1’
IF ($I:12/010) G SW 10_ON
P ‘LINE2’
SW10_0N:
P ‘LINE3’
```



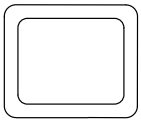
In the procedure above, the if command tests bit I:12/010 for an on or off state:

If bit I:12/010 is:	Then the 1775-S4B scanner:
On	Executes the G SW10_ON command following the if command and displays: LINE 1 LINE 3
Off	Does not execute the G SW10_ON command following the if command and displays: LINE 1 LINE 2 LINE 3



If you enter:

```
<command line 1>
<command line 2>
SKIP_OVR:
<command line 3>
<command line 4>
IF($CACC:1.GE.10)G SKIP_OVR
<command line 5>
<command line 6>
```



In the procedure above, the 1775-S4B scanner executes command lines 1, 2, 3, and 4 then if the current accumulated value of counter l is greater than or equal to 10, the 1775-S4B scanner goes back to the label SKIP_OVR and executes command lines 3 and 4. If the accumulated value of counter 1 is less than 10, the 1775-S4B scanner executes command lines 5 and 6.

10.3.8 On_error

Definition: To execute a command if a runtime error occurs during procedure execution.

Abbreviation: O

Format: O <action command statement>

Description: You can use the on_error command to tell the 1775-S4B scanner what to do if a runtime error occurs during procedure execution. A runtime error is an error that occurs while the 1775-S4B executes a procedure.

In normal operation, the 1775-S4B scanner executes the procedure line by line. If a runtime error occurs, the 1775-S4B scanner displays an error code which describes the problem. These error codes are listed in appendix C.

The 1775-S4B scanner does not execute an on_error command line in sequence with the other command lines in the procedure. If the 1775-S4B scanner detects a runtime error on a command line in the procedure, its response to that error is determined by the last on_error command line. By entering an action command statement following the on_error, you can instruct the 1775-S4B scanner to display specific information if it detects a runtime error.

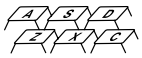
If the last preceding on_error command line contains an action command statement, the 1775-S4B scanner executes the action command statement when it detects a runtime error.

If you do not insert any on_error command lines in your procedure, the 1775-S4B scanner displays the erroneous line along with the error code and procedure execution stops. The 1775-S4B scanner assigns the error code message to the interprocedural user symbol ERROR. You can display the latest error code by executing a print command with ERROR as the data specifier.

If you enter the on_error command on a command line without an action command statement, the 1775-S4B scanner does not display the erroneous line or error code, and procedure execution continues.

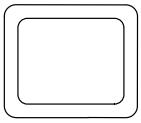
If a syntax error occurs in any of the command lines below an on_error command line, the 1775-S4B scanner does not display an error code. Therefore, we suggest that you insert on_error command lines into your procedure after you correct all syntax errors.

Example using the on_error command:



If you enter:

```
<command line 1>
<command line 2>
<command line 3>
<command line 4>
O G DIV_ERR
A=(B%C)
<command line 7>
<command line 8>
<command line 9>
O @NO_PROC
CA (A - B) @S @T @U @V
<command line 12>
<command line 13>
```



The procedure above contains three on_error command lines which execute if the 1775-S4B scanner detects a runtime error in the following command lines:

- When a runtime error occurs in command lines 1 thru 4, the 1775-S4B scanner displays the error code at the data terminal, and procedure execution stops.
- When a runtime error occurs in command lines 6 (A = (B % C)) thru command line 9, the 1775-S4B scanner executes the on_error goto DIV_ERR command line.
- When a runtime error occurs in command lines 11 (CA (A – B) @S @T @U @V thru command line 13, the 1775-S4B scanner executes the on_error @NO_PROC command line.

10.3.9 Assignment

Definition: To assign a value from a specific source to a specific destination.

Format: <destination> <assignment statement> <source>

Description: You can use the assignment command to write a numeric or string value from a specific source to a specific destination. Looking at the command format, the destination for the value can be:

- Logical address
- Symbolic address
- User symbol

The assignment command assigns the source to the destination. Different from the other report generation commands, you do not enter assignment to implement this command. The 1775-S4B scanner recognizes the assignment command by the assignment statement. The 1775-S4B scanner recognizes four assignment statements:

Statement	Function
=	Assigns the numeric value on the right to the variable or address on the left. If a user symbol is on the left, it is defined to be a procedural symbol. **Example:** A = 10
==	Assigns the numeric value on the right to the variable or address on the left. If a user symbol is on the left, it is defined as an interprocedural symbol. **Example:** B == 100
=?	Assigns the string value on the right to the variable or address on the left. Only a user symbol can appear on the left side of a string assignment. **Example:** CHAR =? 'ENTER A CHARACTER'
==?	Assigns the string value on the right to the variable on the left. If a user symbol is on the left, it is defined as an interprocedural symbol. **Example:** CHAR ==? 'ENTER TEMPERATURE READING'

Refer to chapter 8 for a discussion on these assignment statements.

The source for a value depends upon what the value is. If the value is a string, the source can be:

- Direct string value
- User symbol

If the value is a number, the source can be:

- Direct numeric value
- Value at a logical address
- Value at a symbolic address
- Value of an expression
- Value of a user symbol

When the 1775-S4B scanner reads an assignment statement, it reads the data from the right side of the assignment statement to the left side. Thus, the source data moves to the destination data.

You can use the assignment statement for two purposes:

- Instruct the 1775-S4B scanner to execute a data table read
- Instruct the 1775-S4B scanner to execute a data table write

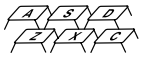
A data table read copies information from the data table to the destination. A data table write copies information from a source into the data table.

When assigning a numeric value to an address, do not attempt to assign a value which is too large for that address. This causes the 1775-S4B scanner to generate error code 89. The ranges include:

- -32,768 to +32,767 for signed integer values.
- 0 to 65,535 for unsigned integer values.

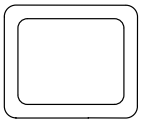
When assigning a user symbol to an address, make sure that the user symbol contains a numeric value, not a string. You cannot assign a numeric value larger than 32-bits (-2,147,483,648 to +2,147,483,647).

Examples using the assignment command:

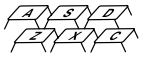


If you enter:

A = $N:3

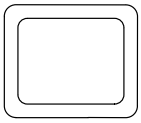


The 1775-S4B scanner copies the contents of integer file 0, word 3 into user symbol A.

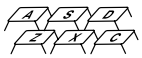


If we reverse the command line:

$N:3 = A

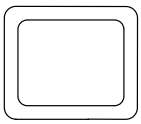


The 1775-S4B scanner copies the data in user symbol A into integer file 0, word 3.

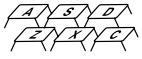


If you enter:

US_2 = 1738

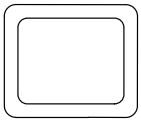


The 1775-S4B scanner copies the integer 1,738 into the user symbol US_2.

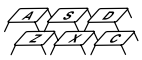


If you enter:

US_3==?'YES'

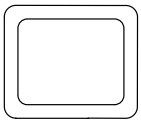


The 1775-S4B scanner copies the string YES into the interprocedural user symbol US_3.



If you enter:

US_4==(US_4+$N4:25)



The 1775-S4B scanner adds the current value at logical address N4:25 to the current value in user symbol US_4 and places the result in interprocedural user symbol

10.3.10 Inquire

Definition: To make the 1775-S4B scanner wait for data and a carriage return to be entered before executing the rest of the procedure.

Abbreviation: IN

Format: IN <user symbol> <!format> <data specifier>

Description: The inquire command causes the 1775-S4B scanner to wait for you to enter a value followed by a carriage return from the data terminal before executing the rest of the procedure. The incoming value from the data terminal is assigned to the user symbol. The !format specifies the format that the 1775-S4B scanner stores incoming data (table 1O.B). If you do not specify a format, the 1775-S4B scanner stores the incoming data in decimal format. The data specifier allows you to display a message which prompts the operator to input data. You can use the same data specifiers as with the print command. You can enter \X with the string to have the input data display on the same line.

Table 10.B
Inquire Format Specification

Format Characters	Format Description
IN <symbol>	Decimal
IN <symbol>!D	Decimal
IN <symbol>!B	Binary
IN <symbol>!H	Hexadecimal
IN <symbol>!O	Octal
IN <symbol>!S	String

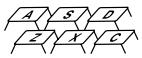
When you are using the inquire commands for reading and/or writing data, the 1775-S4B scanner waits until all the data is typed in and [ENTER] is pressed before continuing execution. You may want to condition the inquire command with an if command so that the 1775-S4B scanner only executes the inquire command when someone is available to respond.

You could also use the following input access functions which you can use to time out the terminal keyboard:

- Getchar()—which searches the input buffer for a character
- Testchar()—which tests the input buffer for a character
- Testline()—which tests the input buffer for an available complete line

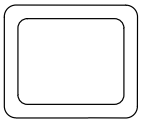
Refer to chapter 11 for detailed information on these functions.

Example using the inquire command:



If you enter:

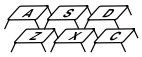
```
IN US_8'SET POINT:\X'
P US_8
```



When the command line above executes, the following line displays on the CRT:

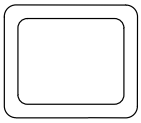
```
SET POINT:
```

This line prompts you to enter a number followed by an [ENTER]. Suppose you enter 2 3 8 [ENTER], the 1775-S4B scanner would store 238 in user symbol US_8. The \X places the user input on the same line as the message.



So the entry would appear:

```
SET POINT: 238
```



Then the 1775-S4B scanner prints user symbol US_8:

```
238
```

10.3.11 Delete

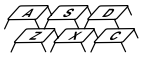
Definition: To remove a user symbol.

Abbreviation: DEL

Format: DEL <user symbol>

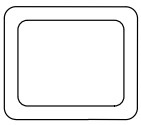
Description: In addition to deleting system symbols from the S4B> prompt, you can use the delete command to delete user symbols.

Example using the delete command:



If you enter:

DEL A



The 1775-S4B scanner deletes user symbol A from the procedure.

10.4 Chapter Summary

In this chapter, you read about the commands that you can use to tell the 1775-S4B what to do:

- You can execute these commands directly from the S4B> prompt.
- You can execute these commands indirectly by placing them in procedures.

The next chapter describes functions that you can use along with commands to generate reports on the 1775-S4B scanner.

Chapter 11

Using Report Generation Functions

11.0 Chapter Objectives

Like report generation commands, you can use functions within a procedure to tell the 1775-S4B scanner what to do. This chapter describes the report generation functions. After reading this chapter, you should be able to:

- Distinguish a report generation function from a report generation command
- Use functions within report generation procedures

11.1 Report Generation Functions

You can think of a report generation function as being auxiliary to a report generation command. As we described in chapter 10, you can execute commands from the command mode or within procedures. You can also execute functions from the command mode or within procedures. However, to execute a function, you must accompany it with a command on a command line. That is, you cannot have a function on a command line without a command.

The general format for a function is:

Function (<parameter>)

The angle brackets around parameter indicate that some functions do not require any parameters. However, the parentheses are required for all functions. For example, the function:

G()

requires no parameters. However, the parentheses are required to successfully execute the function.

The 1775-S4B scanner supports two types of functions:

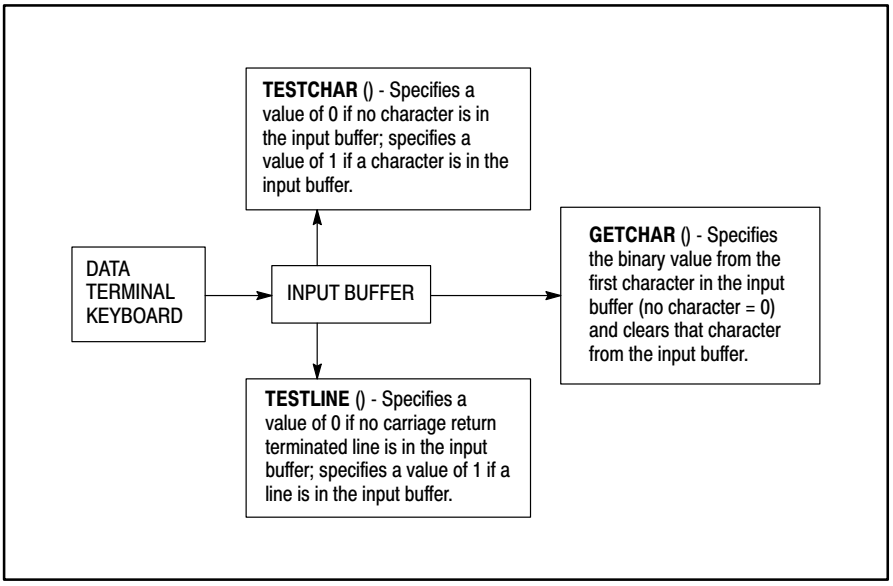
- Input access functions
- Format conversion functions

We describe the report generation functions in the following sections.

11.2
Input Access Functions

Input access functions give you the capability of entering characters into a procedure during procedure execution. Figure 11.1 shows you the relationship of the three input access functions to the data terminal keyboard.

Figure 11.1
Input Access Functions



These functions work with the inquire command to provide interaction between the procedure and your input from the keyboard. When you use these functions or the inquire command, the 1775-S4B scanner stores characters that are input from the data terminal in the input buffer. The inquire command waits until all data is entered and [ENTER] is pressed before continuing procedure execution. The input access functions allow you to timeout the keyboard while the rest of the procedure continues to execute. The input access functions include:

- Getchar
- Testchar
- Testline

We describe these functions in the following three sections.

11.2.1 Getchar

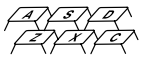
Definition: To search the data terminal input buffer for a character.

Abbreviation: G

Format: G()

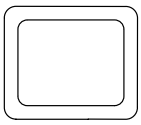
Description: The getchar function returns the binary bit pattern of the first character in the input buffer. The 1775-S4B scanner reads the decimal value of the character and clears the character from the input buffer. Commands and operators can use this value specified by the getchar function. Refer to table 9.D for the binary conversion information. If no character is in the input buffer or if you enter a NUL character, the getchar value is zero.

Example using the getchar function:



If you enter:

```
IF (G().EQ. 65) @MP_A
```



The 1775-S4B scanner executes procedure @MP_A if the first character entered is decimal 65 or the ASCII character A.

11.2.2 Testchar

Definition: To test the data terminal input buffer for a character.

Abbreviation: TESTC

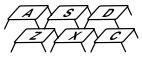
Format: TESTC()

Description: The testchar function tests the input buffer for a character and returns one of the following values:

If the value is:	Then the input buffer:
1	Contains a character
0	Is empty

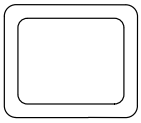
The testchar function does not clear a character from the input buffer. Commands and operators can use this value specified by the testchar function.

Example using the testchar function:



If you enter:

```
IF (TESTC()) G LABEL_2
```



In the command line above, if a character is in the input buffer, the 1775-S4B scanner executes the goto command.

11.2.3 Testline

Definition: To test the data terminal input buffer for a complete line.

Abbreviation: TESTL

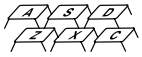
Format: TESTL()

Description: The testline function tests the input buffer for a line. The 1775-S4B scanner defines a line to be one or more characters followed by a carriage return. The testline function returns one of the following values:

If the value is:	Then the input buffer:
1	Contains a line of data terminated by a carriage return.
0	Does not contain a line terminated by a carriage return.

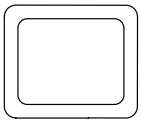
The testline function does not clear a line from the input buffer. Commands and operators can use this value specified by the testline function.

Example using the testline function:



If you enter:

```
IF (TESTL()) IN US_6
```



In the command line above, if a line is in the input buffer, the 1775-S4B scanner executes the inquire command.

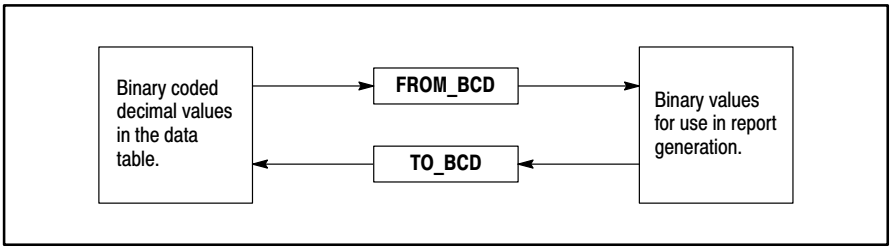
11.3 Format Conversion Functions

Format conversion functions give you the capability to express values in binary or binary coded decimal format. Figure 11.2 shows you the relationship between the two format conversion functions. The format conversion functions include:

- To_bcd
- From_bcd

We describe these functions in the following sections.

Figure 11.2
Format Conversion Functions



11.3.1 To_bcd

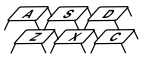
Definition: To convert an expression from 32-bit integer to its BCD equivalent.

Abbreviation: TO

Format: TO (<expression>)

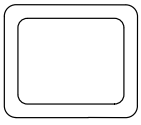
Description: The to_bcd function accepts an arithmetic value, expression, which converts to a 32-bit integer. The binary coded decimal equivalent returns.

Example using the to_bcd function:



If you enter:

```
$D:0=10
```



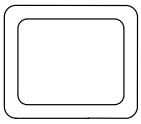
This assignment command line writes a decimal 10 into word zero of the binary section. Without the to_bcd function, the binary value assigned to word address D:5 would be:

```
0000 0000 0000 1010
```

When interpreted as a BCD value, a non-recognizable value is produced.

If you use the to_bcd function:

$D:0 = TO(10)



The value 10 converts to:

0000 0000 0001 0000

11.3.2 From_bcd

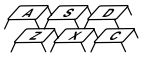
Definition: To convert an expression from BCD to its binary.

Abbreviation: F

Format: F (<expression>)

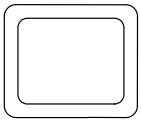
Description: The from_bcd function performs the opposite operation to the to_bcd function. It converts expression to a 32 bit BCD number and returns the binary representation.

Example using the from_bcd function:



If you enter:

F($D:0)



If decimal file 0 contains the BCD value (0000 0000 0001 0000). The from_bcd function converts $D:0 to the binary bit pattern.

0000 0000 0000 1010

11.4 Chapter Summary

In this chapter, you read about the functions that you can use to tell the 1775-S4B what to do. Functions must be accompanied by a command for proper execution. Report generation supports two types of functions:

- Input access functions give you the capability of entering characters into a procedure during procedure execution.
- Format conversion functions give you the capability of expressing values in binary or binary coded decimal format.

The next chapter describes factors that affect 1775-S4B scanner execution time.

Chapter 12

Execution Time Considerations

12.0 Chapter Objectives

After reading this chapter, you will be aware of the factors that affect 1775-S4B scanner execution time.

12.1 Introduction

The 1775-S4B scanner can execute procedures of many commands, operators, and functions. However, each command, operator, and function takes a certain amount of time to execute. In some cases, a procedure executes faster than the data transmits for printing. In other cases, the execution time may be long enough to cause a delay between print items in a procedure.

Obviously, one factor in execution time is the length of a procedure; the longer the procedure, the longer the execution time. However, you should also consider the following less obvious factors:

- Active I/O channels
- Address complexity
- Symbol order
- Assignment values
- Command line comments

We describe these factors in the following five sections.

12.2 Active I/O Channels

The 1775-S4B scanner gives top priority to its four I/O channels. If any I/O channels are active, the 1775-S4B scanner gives top priority to scanning and processing I/O data.

You should also be aware that it takes several times longer to execute a procedure while four I/O channels are active than while no I/O channels are active.

If procedure execution speed is critical in your application, you can make the unused I/O channels inactive in LIST to increase speed. Refer to chapter 4 for detailed information on the LIST function.

You also might consider adding another 1775-S4A scanner to perform I/O scans. This additional scanner could enable the 1775-S4B scanner to execute procedures with all its I/O channels inactive.

You also might consider purchasing a Peripheral Communication Module (cat. no. 1775-GA). This module features a faster executing enhanced version of report generation. Contact your Allen-Bradley representative for more information on this product.

12.3 Address Complexity

Procedure execution times are slower if you use complex formats for addresses. For example, the 1775-S4B scanner takes longer to find the word at extended address E3.1.8.5.0.2 than at data table address B5:2 even though these addresses reference the same word in memory. If you use a symbol to define part of an address, the 1775-S4B scanner takes more time to find the word. The 1775-S4B scanner can find a symbolic address in less time than a complex extended address, but in more time than a simple logical address.

12.4 Symbol Order

The 1775-S4B scanner lists procedural user symbols, interprocedural user symbols, local system symbols, and global system symbols in their own symbol table.The 1775-S4B scanner fills each table with the corresponding symbols in the order that you create them. The 1775-S4B scanner can find a symbol at the beginning of the table in less time than one at the end of the table. Therefore, to save time, you should define the most used symbols first so that they are at the beginning of their corresponding symbol table. Renaming a symbol does not change its placement in the corresponding symbol table.

12.5 Assignment Values

In a procedure, you can assign a value to a user symbol for later use in the procedure. You can also assign a value to a data table address for later use in the procedure. The 1775-S4B scanner takes more time to assign values to user symbols than to data table addresses.

12.6 Command Line Comments

As we described in chapter 5, you can enter a semicolon (;) followed by a comment to document each line of your procedure. If you enter comments in your procedure, it takes the 1775-S4B scanner longer to execute the procedure. If execution speed is critical in your application, you should consider:

- Limiting the number of comments in the procedure, or
- Copying the procedure, removing the comments from the copy, and executing the copy.

12.7 Chapter Summary

In this chapter, you read about factors that affect 1775-S4B scanner execution time. If execution is critical in your application, you should carefully analyze your procedures to make sure that you take into account these factors.

Appendix **A**

Using a Peripheral Communication Module

A.0 Appendix Objectives

This appendix briefly describes the peripheral communication module for enhanced report generation capability and describes how you can enter report generation procedures so that they can execute from a 1775-S4B scanner or a peripheral communication module.

A.1 Introduction

If you want to expand your PLC-3 report generation capability, you can use a peripheral communication module. This PLC-3 module features multi-RS-232-C communication and disk storage interface capability. The module also features an enhanced version of report generation called GA Basic. Contact your Allen-Bradley distributor or sales engineer for detailed information on the peripheral communication module.

A.2 Modifying Your Report Generation Procedures

You easily modify your 1775-S4B report generation procedures to execute on the 1775-S4B scanner or the peripheral communication module. Note the following guidelines:

- Abbreviate your commands for peripheral communication module compatibiltiy.
- Abbreviate your modifiers for peripheral communication module compatibility.
- Abbreviate your functions for peripheral communication module compatibility.
- Enter leading zeros for file, word, and bit to specify octal addresses.
- Enter leading and trailing spaces when using the.EQ. expression.
- Enter a base format specifier anytime you specify a format.
- Do not enter the line suppression control character (\X) on an assignment command line.

We discuss these guidelines in the following sections.

A.2.1 Abbreviating Commands

If you use the command abbreviations for report generation on your 1775-S4B scanner, note that GA Basic uses the following command abbreviations:

S4B Command Name	GA Basic Abbreviation
Case	CA
Copy	COP
Create	CR
Delete	DELE
Directory	DIR
Exit	EX
Goto	GO
If	IF
Inquire	IN
On_error	ON
Print	P
Rename	REN
Stop	ST

A.2.2 Abbreviating Modifiers

If you use the modifier abbreviations for report generation on your 1775-S4B scanner, note that GA Basic uses the following modifier abbreviations:

Modifier Name	GA Basic Abbreviation
/Assist	/A
/Comment	/COM
/Global	/G
/Highway	/H
/Local	/LO
/Report	/REP
/Terminal	/TERMINAL

A.2.3 Abbreviating Functions

If you use the function abbreviations for report generation on your 1775-S4B scanner, note that GA Basic uses the following function abbreviations:

Function Name	GA Basic Abbreviation
From_bcd	FR
Getchar	G
Testchar	TESTC
Testline	TESTL
To_bcd	TO

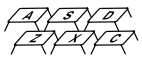
A.2.4 Specifying Octal Addresses

When you are specifying an octal address for a word or bit, you must enter leading zeros for the file, word, and bit for the operation to function properly in GA Basic. For example:

Address	Description
$B01:05/012	The address would correspond to binary file 1, word 5, bit 10 (decimal). Octal addressing for 1775-S4B report generation is discussed in chapter 6.

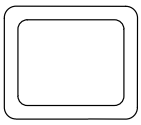
A.2.5 Using the .EQ. Expression Operator

When you are using the.EQ. expression operator, enter spaces before and after the operator. For example:



If you enter:

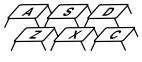
```
IF (A .EQ. 10) GO LOOP
```



The peripheral communication module jumps to the label LOOP if user A is equal to 10. Without the leading and trailing spaces around the .EQ. operation, the module generates an error code.

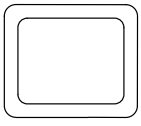
A.2.6 Formatting Data

When you are formatting data, the minimum format that the peripheral communication module accepts is a base modifier. Otherwise, your procedure generates an error. For example:



If you enter:

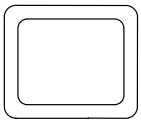
```
P A!016B
```



The formatted statement above would be valid for GA Basic. The peripheral communication module prints user symbol A in 16-bit binary.

The following formatted statement would not be accepted:

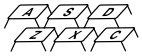
```
P A!7
```



The formatted statement above would cause the peripheral communication module to generate an error.

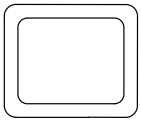
A.2.7 Suppressing the Line Feed

Report generation for the 1775-S4B scanner and GA Basic programming for the peripheral communication module support the \X control character for line suppression. You can use this control character to display the execution of command lines on one line of the print out or CRT screen. For example:



If you enter:

```
P ‘ABC\X’
P ‘TEST VARIABLES’
```



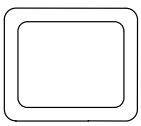
The strings ABC and TEST VARIABLES display on the same line:

```
ABC TEST VARIABLES
```

Report generation allows you to execute the \X character on an assignment command line. However, if you execute this command line on the peripheral communication module, an error generates. Thus, if you want to execute report generation procedures on the peripheral communication module, do not place the \X character on an assignment command line. You can place the \X character on the command line that outputs the data such as the print or inquire command lines. For example:

If you enter:

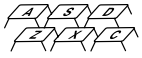
```
A =? ‘ABC/X’
B =? ‘TEST VARIABLES’
P A
P B
```



The 1775-S4B scanner displays:

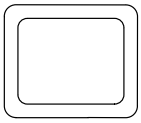
```
ABC TEST VARIABLES
```

The peripheral communication module displays an error code.



To execute these command lines on the peripheral communication, you could enter:

```
A =?‘ABC’
B =?‘TEST VARIABILES’
P A‘\X’
P B
```



The 1775-GA module displays:

```
ABC TEST VARIABLES
```

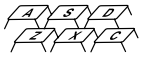
A.3 Bit Shift Operation

Report generation for the 1775-S4B scanner and GA Basic programming for the peripheral communication module support the bit shift left and bit shift right expression operators. These shift operators shift binary values a specified number of bit positions to the left or right.

In report generation on the 1775-S4B scanner:

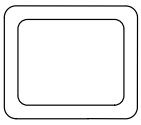
- Bit shift left shifts a 0 into the right most bit.
- Bit shift right does not change the state of the left most bit. If the left most bit is a 0, a 0 shifts in.

Thus, the sign on the value cannot change due to a shift operation. Refer to chapter 8 for detailed information on bit shift operation. An example is given below:



The following command lines show a bit shift execution on a negative value:

```
A = -1
B = (A>>1)
P A
P B
```



The 1775-S4B scanner prints out the value -1 for user symbol A and -1 for user symbol B which is a bit shift operation on user symbol A.

The bit patterns for the two values are given below:

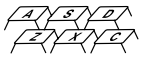
User Symbol	Value Stored	Bit Pattern (32-bits)
A	-1	11... 11111111
B	-1	11... 11111111

In GA Basic programming on the peripheral communication module:

Bit shift left shifts a 0 into the right most bit.

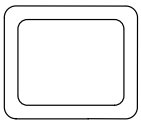
Bit shift right shifts a 0 into the left most bit.

Thus, the sign on the value could change due to a shift operation. An example is given below:



The following command lines show a bit shift execution that changes the sign on a value:

```
A = -1
B = (A>>1)
P A
P B
```



The peripheral communication module prints out the value -1 for user symbol A and 2147483647 for user symbol B which is a bit shift operation on user symbol A.

The bit patterns for the two values are given below:

User Symbol	Value Stored	Bit Pattern (32-bits)
A	-1	11... 11111111
B	2147483647	01... 11111111

A.4
Form Feed Selection in LIST

In configuring your PLC-3 system, both the 1775-S4B scanner and the peripheral communication module use the CRT defaults selection for RS-232-C communication. This selection configures:

- Channel 5 on the 1775-S4B scanner for report generation protocol.
- RS-232-C channels on the peripheral communication module for GA Basic protocol.

One parameter that the CRT defaults selection sets is the form feed. The form feed parameter determines what character or characters are transmitted by the channel to accomplish the form feed function. Your selections are:

- Not Expanded—The channel sends a FF (form feed) character.
- Expanded—The channel sends seven LF (line feed) characters.

When you select CRT defaults for:

- Channel 5 on the 1775-S4B scanner, the form feed parameter is set for **expanded**.
- RS-232-C channels on the peripheral communication module, the form feed parameter is set for **not expanded**.

Appendix **B**

Floating Point Values on the 1775-S4B Scanner

B.0 Appendix Objectives

This appendix gives you a ladder diagram program which you can use to access floating point numbers on the 1775-S4B scanner.

B.1 Introduction

Since the 1775-S4B scanner does not directly allow access to floating point numbers, a technique is desirable to allow access to these numbers for use in report generation. The following program which is described in detail in section B.2 allows you to input a floating point into the floating point file 0, word 0 (F0:0) in the data table. The program breaks the number apart and places the result into high order integer (H) file 0 words 0, 1, and 2 (H0:0, H0:l, H0:2). The converted format is:

(+ or - A). (BBBBBB) $E^{(+or-C)}$

where:

- H0:0 = (+ or - A)
- H0:l = (BBBBBB)
- H0:2 = (+ or - C)

These three words can then be reformatted into usable print statements. An example print statement could be:

P 0 '.' 1!-06D 'E' 2!+2D

The ladder diagram program is given in figure B.l.

B.2 Program Explanation

The program shown in figure B.1 performs the floating point conversion routine. The following words contain constants and **must be entered as shown**:

N0:l = 1
N0:2 = 0

F0:6 = 1 E-38
F0:7 = 9.99999 E-1
F0:8 = 1 E I
F0:9 = 9.99999 E0
F0:10 = 1 E 0
F0:11 = 1 E 6

CAUTION: Failure to enter these constants as shown above prior to going to **run** mode may cause a **watchdog timeout** which will shut down the PLC-3 processor.

Additional data table usage is as follows:

F0:0 new floating point value
F0:l old floating point value
F0:2 storage word
F0:3 storage word
F0:4 storage word
F0:5 storage word

C0 less than range counter (preset must be < 40)
Cl greater than range counter (preset must be > 40)
C2 watchdog counter (preset must equal 40)

N0:0 storage word
H0:0 result word
H0:l result word
H0:2 result word

B0:0/0 One-shot bit
B0:0/l Conversion complete (in range) flag bit
B0:0/2 Multiply flag bit
B0:0/3 Divide flag bit
B0:0/4 Negate result flag bit
B0:0/5 Conversion fault flag bit

Figure B.1
Floating Point Conversion User Program

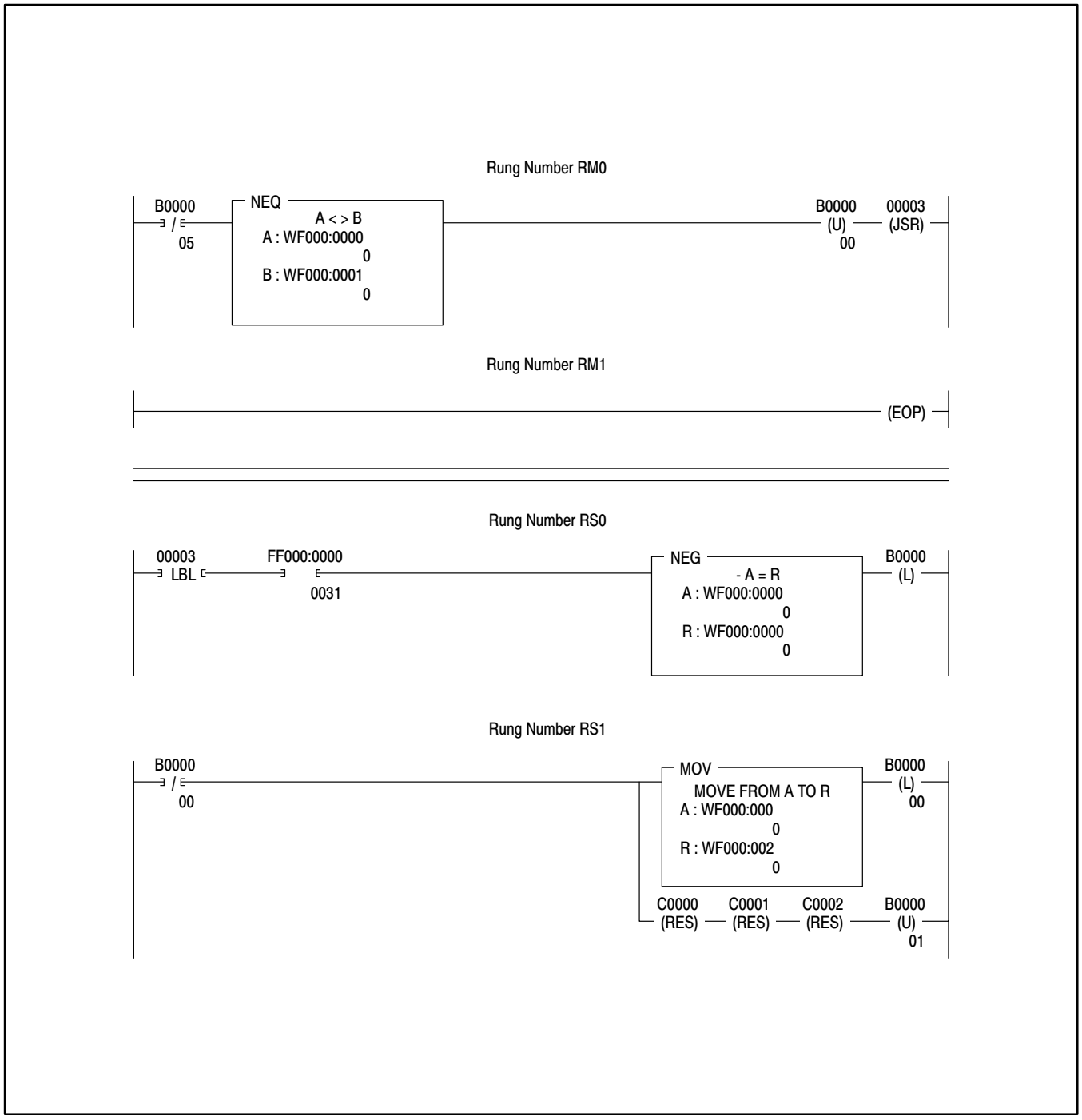


Figure B.1
Floating Point Conversion User Program (continued)

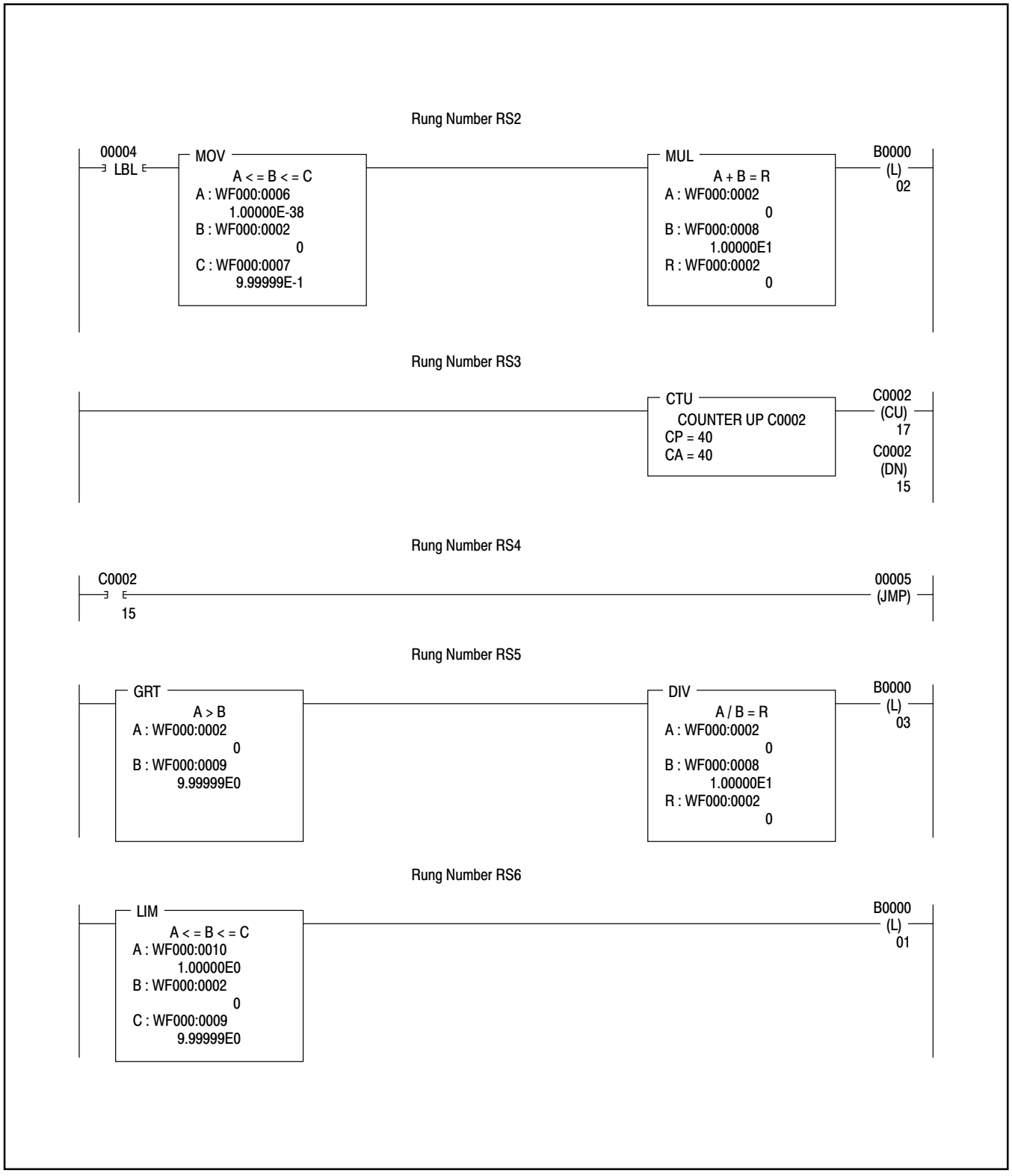


Figure B.1
Floating Point Conversion User Program (continued)

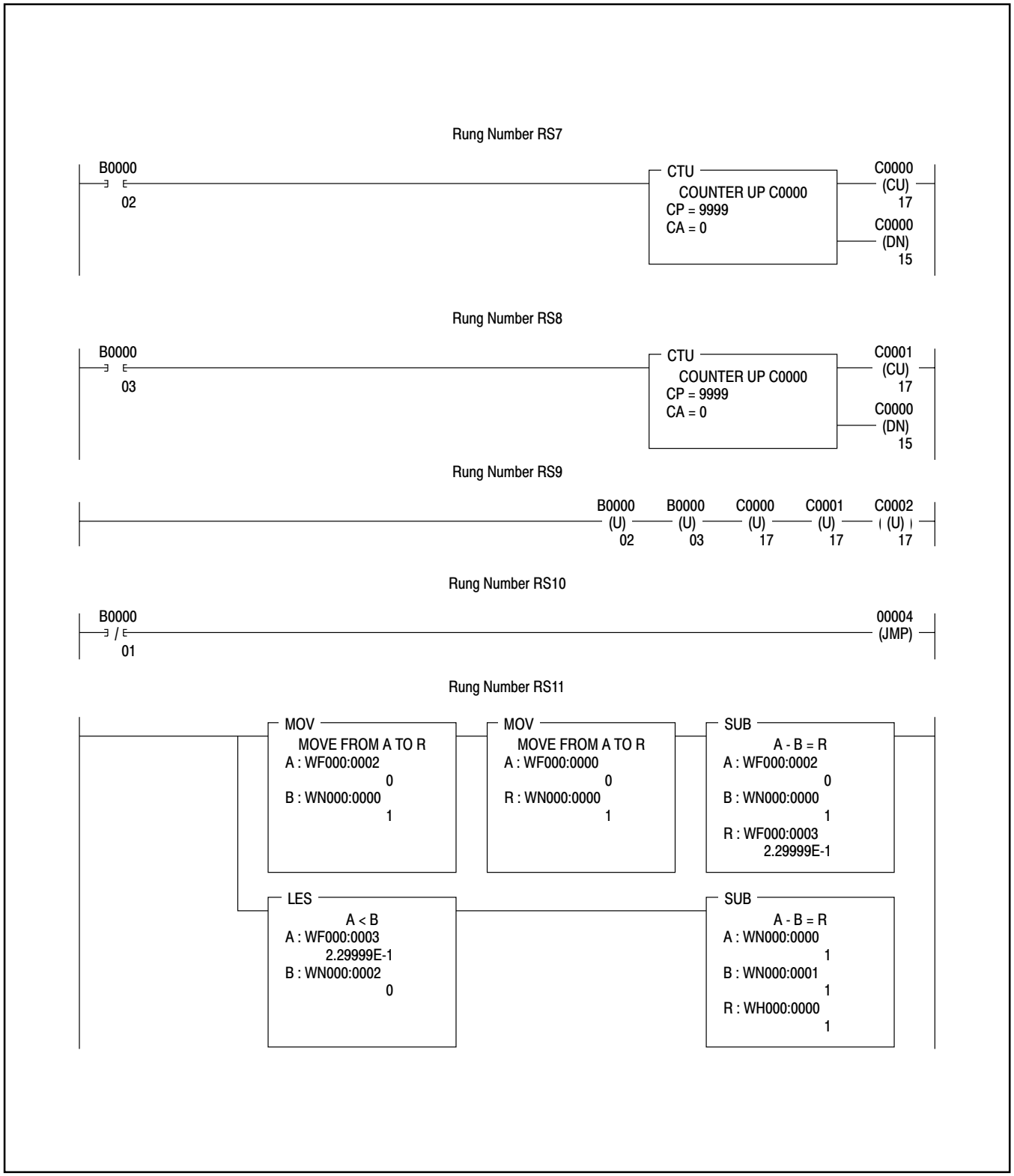


Figure B.1
Floating Point Conversion User Program (continued)

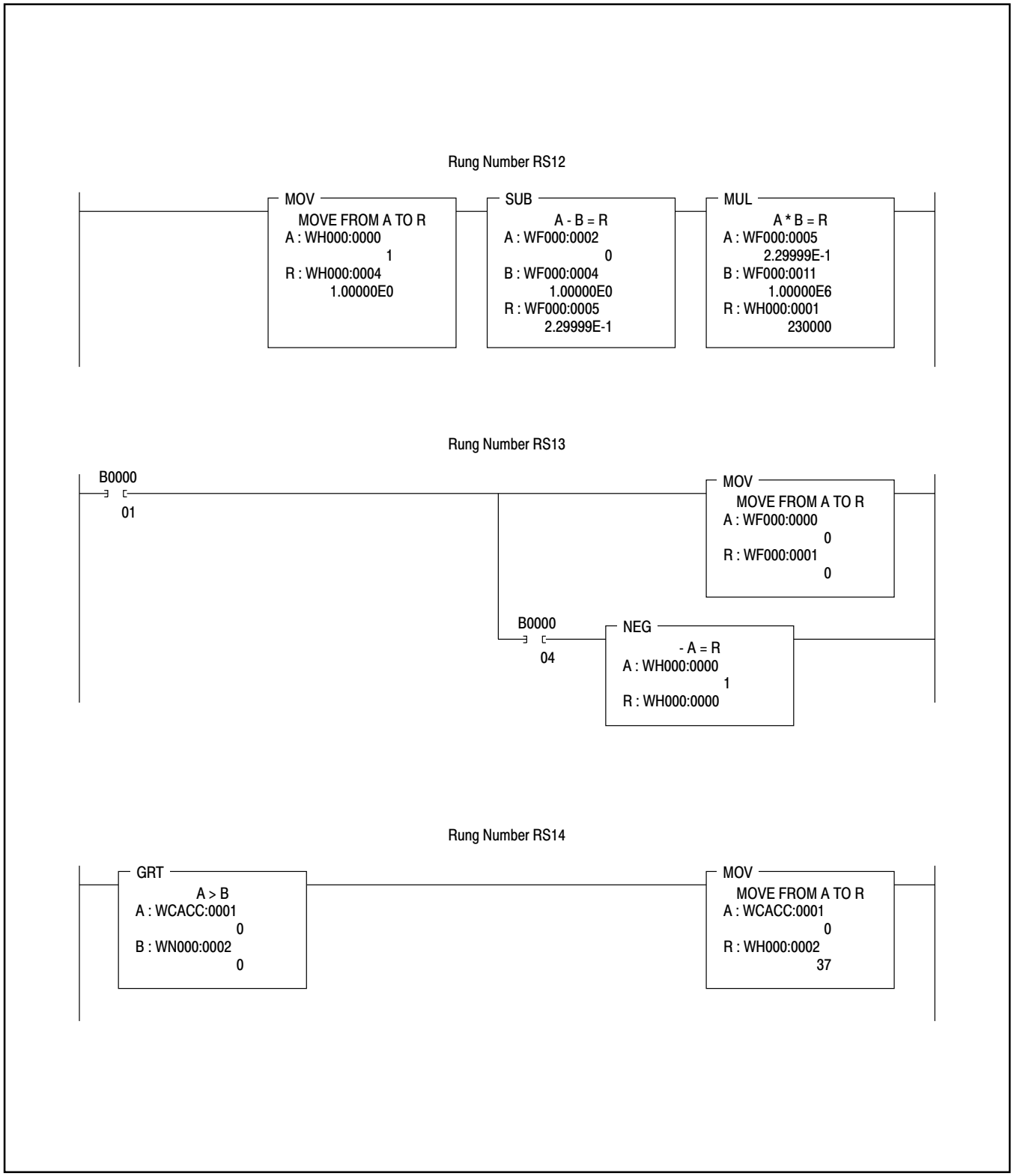
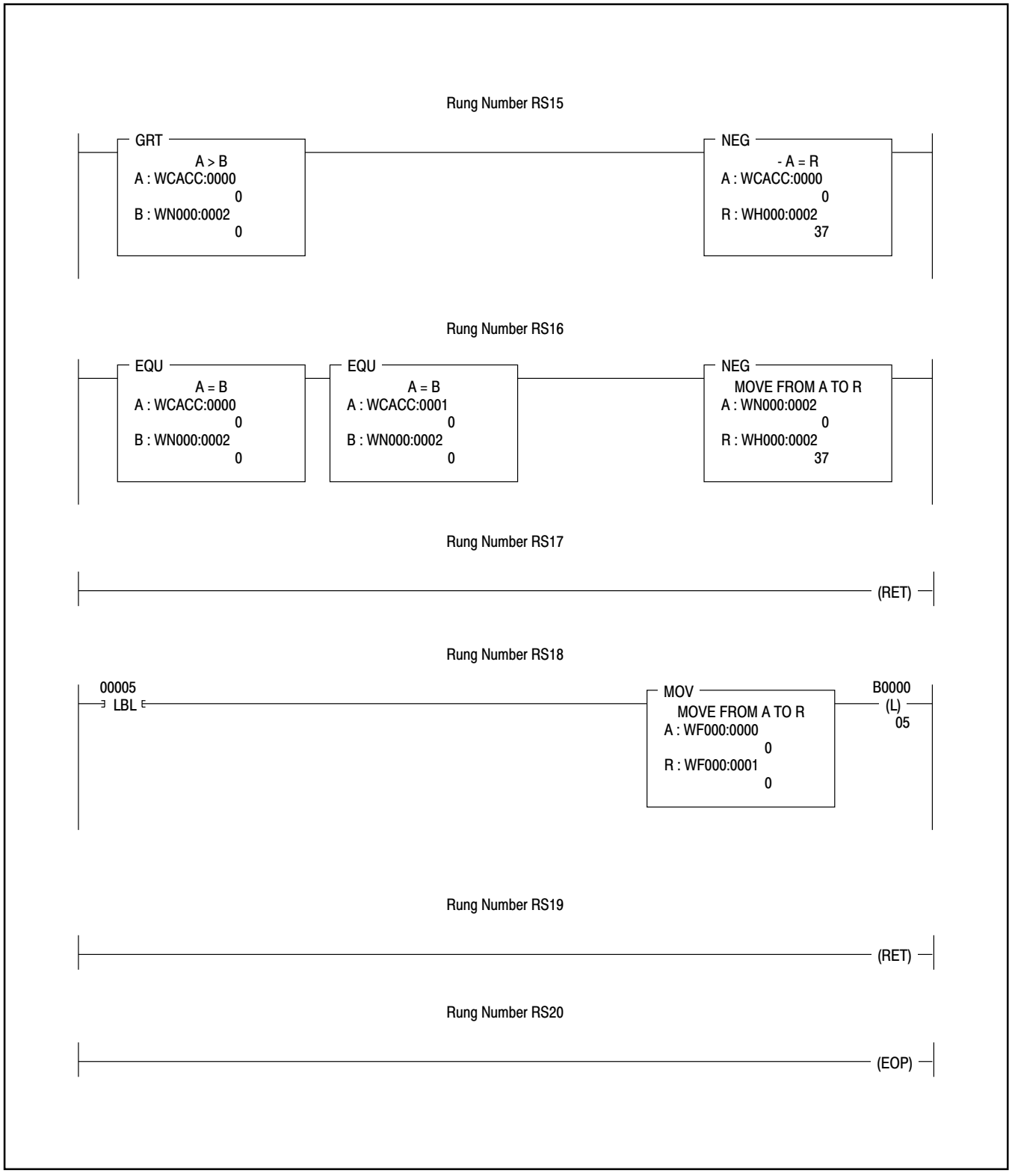


Figure B.1
Floating Point Conversion User Program (continued)



Rung Number	Description
RM0:	Whenever there is not a conversion fault and whenever F0:0 does not equal 0 (i.e., F0:0 changes value) reset the one-shot bit and jump-to-subroutine.
RM1:	End of program for main program section.
RS0:	If F0:0 is less than 0 (negative), negate F0:0 and latch on the negate result flag bit. This rung allows us to work on only positive floating point numbers.
RS1:	If the one-shot bit is not on (reset by RM0) move F0:0 to F0:2, turn on the one-shot bit, reset counters C0-2 and unlatch the conversion complete bit.
RS2:	If 1E-38 <= F0:2 <= E-1 (essentially -infinity and 1), multiply F0:2 by 10 and latch the multiply flag bit. Store result in F0:2. In range is defined in rung RS6 (essentially 1 to 10 or X EO). If FO:2 is multiplied by 10, it becomes closer to being in range.
RS3:	Unconditional watchdog counter C2 **must have** a preset of 40.
RS4:	If watchdog counter C2 counts out (ACC = PRE), jump to label 5 (rung RS18).
RS5:	If F0:2 > 9.99999 E0, (essentially 10 to +infinity), divide F0:2 by 10 and latch the devide flag bit. Store the result in F0:2. In range is defined in rung RS6 (essentially 1 to 10 or X E0). If F0:2 is divided by 10, it becomes closer to being in range. Rungs RS2 and RS5 are mutually exclusive.
RS6:	If 1 E0 <= F0:2 <= 9.99999 E0, F0:2 is in range and B0:0/L is latched on to indicate that the conversion is complete.
RS7:	If a multiplication was performed in rung RS2, count that occurrence. This keeps track of how many times we multiply F0:2 by 10 before it comes into range. The less than range counter C0 is incremented.
RS8:	If a division was performed in rung RS5, count that occurrence. This keeps track of how many times we divide F0:2 by 10 before it comes into range. The greater than range counter Cl is incremented.
RS9:	Unlatches the multiply and divide flag bits and also unlatches the enable bits of counters C0, Cl, and C2. This is necessary so that when we jump back to label 4, the counters will be able to increment properly (they must see a false-to-true transition to increment).
RS10:	If the conversion is not complete, jump back to label 4 and repeat process until value falls into range.
RS11:	This rung is only executed when the value is in range. The value is moved into N0:0. This strips off the fractional part. N0:0 is subtracted from F0:2. F0:3 now contains only the fractional part. Due to rounding, if F0:3 > 0, N0:0 is decremented by 1.
RS12:	Calculates the fractional part of the number and places it into H0:1.
RS13:	When the conversion is complete, move F0:0 into F0:1 making the two values equal. This will prevent any further jumps to subroutine (rung RM0) unless the value of F0:0 changes. Also, if the negate result flag bit is set, negate the integer result stored in H0:0 and reset the negate result flag bit.

Rung Number	Description
RS14:	The greater than range counter kept track of how many times we divided by 10. When the conversion is complete, this corresponds exactly to the positive exponent. If it has accumulated, move its count into the result word H0:2 as a positive exponent.
RS15:	The less than range counter kept track of how many times we multiplied by 10. When the conversion is complete, this corresponds exactly to the negative exponent. If it has accumulated, move its count into the result word H0:2 as a negative exponent. Either C0 or C1 will be > 0, but not both.
RS16:	For the case where the exponent is zero (X E 0), neither C0 nor C1 will have incremented. Therefore, a value of zero is moved into the result word H0:2 as an exponent of 0.
RS17:	Return to main program section.
RS18:	If the watchdog counter has counted out, we make F0:0=F0:1 and latch the conversion fault flag bit.
RS19:	Return to main program section.
RS20:	End of program for subroutine section.

NOTE: Certain floating point values will never come into range. If this happens, we continue to loop in the subroutine. If we loop too long, the PLC-3 system watchdog timer will time out shutting down the system. Rung RS3 provides an automatic safeguard for the condition. If watchdog counter C2 ever counts 40 loops (a condition indicating a non-convertible value), we jump to label 5 (rung RS18). Rung RS19 latches on the conversion fault flag bit, sets F0:0 = F0:l, and the subroutine is exited. It is the responsibility of the user to increment (bump) the value of F0:0 and to reset the conversion fault flag bit. Failure to reset the conversion fault flag bit will cause further conversions to cease and the result words to remain at the last previously converted value.

Appendix **C**

Report Generation Quick Reference Guide

C.0 Quick Reference

This appendix contains tables and figures which will remind you how to do report generation on the 1775-S4B scanner:

Figure or Table **Page**

Figure C.1
Specifying a Data Format

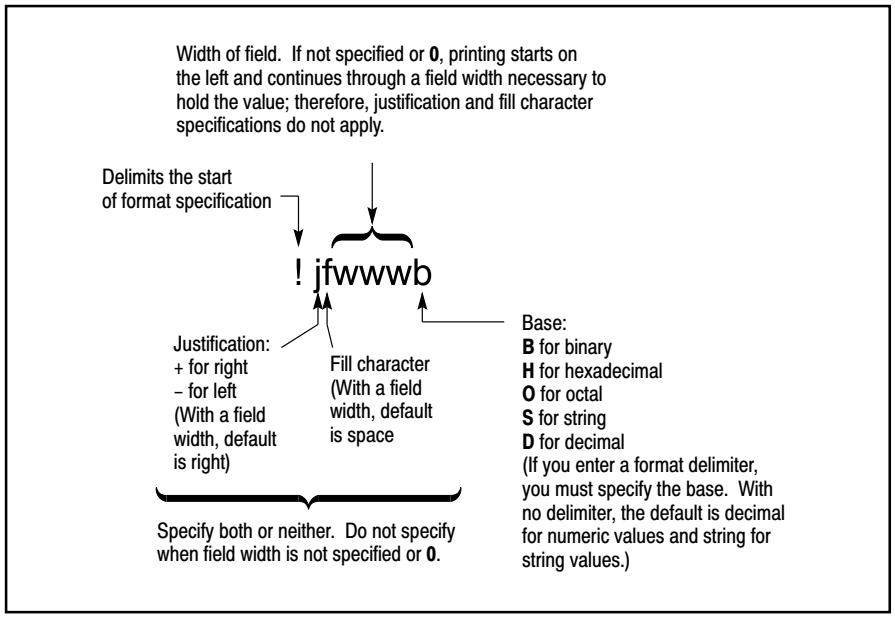


Table C.A
Decimal/Hexadecimal/Octal/ASCII Conversion Table

Column 1				Column 2				Column 3				Column 4			
DEC	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**	**DEC**	**HEX**	**OCT**	**ASC**
00	00	000	NUL	32	20	040	SP	64	40	100	@	96	60	140	\
01	01	001	SOH	33	21	041	!	65	41	101	A	97	61	141	a
02	02	002	STX	34	22	042	“	66	42	102	B	98	62	142	b
03	03	003	ETX	35	23	043	#	67	43	103	C	99	63	143	c
04	04	004	EOT	36	24	044	$	68	44	104	D	100	64	144	d
05	05	005	ENQ	37	25	045	%	69	45	105	E	101	65	145	e
06	06	006	ACK	38	26	046	&	70	46	106	F	102	66	146	f
07	07	007	BEL	39	27	047	‘	71	47	107	G	103	67	147	g
08	08	010	BS	40	28	050	(	72	48	110	H	104	68	150	h
09	09	011	HT	41	29	051	)	73	49	111	I	105	69	151	i
10	0A	012	LF	42	2A	052	*	74	4A	112	J	106	6A	152	j
11	0B	013	VT	43	2B	053	+	75	4B	113	K	107	6B	153	k
12	0C	014	FF	44	2C	054	,	76	4C	114	L	108	6C	154	l
13	0D	015	CR	45	2D	055	–	77	4D	115	M	109	6D	155	m
14	0E	016	S0	46	2E	056	.	78	4E	116	N	110	6E	156	n
15	0F	017	SI	47	2F	057	/	79	4F	117	O	111	6F	157	o
16	10	020	DLE	48	30	060	0	80	50	120	P	112	70	160	p
17	11	021	DC1	49	31	061	1	81	51	121	Q	113	71	161	q
18	12	022	DC2	50	32	062	2	82	52	122	R	114	72	162	r
19	13	023	DC3	51	33	063	3	83	53	123	S	115	73	163	s
20	14	024	DC4	52	34	064	4	84	54	124	T	116	74	164	t
21	15	025	NAK	53	35	065	5	85	55	125	U	117	75	165	u
22	16	026	SYN	54	36	066	6	86	56	126	V	118	76	166	v
23	17	027	ETB	55	37	067	7	87	57	127	W	119	77	167	w
24	18	030	CAN	56	38	070	8	88	58	130	X	120	78	170	x
25	19	031	EM	57	39	071	9	89	59	131	Y	121	79	171	y
26	1A	032	SUB	58	3A	072	:	90	5A	132	Z	122	7A	172	z
27	1B	033	ESC	59	3B	073	;	91	5B	133	[	123	7B	173	{
28	1C	034	FS	60	3C	074	<	92	5C	134	\	124	7C	174	|
29	1D	035	GS	61	3D	075	=	93	5D	135	]	125	7D	175	}
30	1E	036	RS	62	3E	076	>	94	5E	136	^	126	7E	176	~
31	1F	037	US	63	3F	077	?	95	5F	137	–	127	7F	177	DEL

Table C.B
Expression Operators

Operator	Order of Execution[1]	Description
~ or .BNOT.	1	Bitwise 32-bit complement
.NOT.	1	Logical complement
/	1	Bit test
*	2	Multiply
%	2	Divide
+	3	Add
–	3	Subtract
>>	4	Bit Shift right
<<	4	Bit Shift left
& or .BAND.	5	Bitwise 32-bit AND
^ or .BXOR.	6	Bitwise 32-bit EXCLUSIVE OR
| or .BOR.	7	Bitwise 32-bit OR
.EQ.	8	Compare equal
.GE.	8	Compare grater or equal
.GT.	8	Compare greater
.LE.	8	Compare less or equal
.LT.	8	Compare less
.NE.	8	Compare not equal
.SNE.	8	String compare not equal
.SEQ.	8	String compare equal
.AND.	9	Logical AND
.OR.	10	Logical OR

[1] Order of execution moves from 1 to 10 with 1 executing first. When operators have the same order of execution number, the order for their execution within an expression is from left to right.

Table C.C
Assigning User Symbols

If you want to:	Then do this:
Assign a numeric value to a procedural user symbol	<user symbol> = <numeric value>
Assign a numeric value to an interprocedural user symbol	<user symbol> == <numeric value>
Assign a string of data to a procedural user symbol	<user symbol> =? '<string of data>'
Assign a string of data to an interprocedural user symbol	<user symbol> ==? '<string of data>'

Table C.D
Section Modifiers

Section Modifier	Abbreviation	Type of Message File to Generate
Report	/R	Report Generation Message Procedure
Comment	/C	Rung Comment
Terminal	/T	Macro Commands
Highway	/H	Data Highway Message Procedure
Assist	/A	Help Message

Table C.E
Editing Procedures

If you want to:	Then do this:
Insert lines	I [ENTER][1]
Set the line pointer	<line number> [ENTER]
Advance the line pointer	<number of lines>A [ENTER]
Backup the line pointer	<number of lines>B [ENTER]
Display the line number	L [ENTER]
Type out lines	<number of lines>T [ENTER]
Search for text	<number of occurrences>S/<text>/ [ENTER][2]
Change text characters	<number of occurrences>C/<old text>/ <new text>/[ENTER][2]
Delete lines	<number of lines>D [ENTER]
Exit edit mode and return to S4B> prompt level	E [ENTER]

[1] Any number of lines can then be added. To exit the insert mode, enter an extra [ENTER] after any line.

[2] You can use any ASCII character as the delimiter as long as it does not occur in the text that you are searching for or changing. We use the slash (/) in this table.

Table C.F
Using Commands From the S4B> Prompt

If you want to:	Then do this:
Execute the command lines that make up a procedure	@<procedure name>
Duplicate a procedure	CO/<scope number>/<section modifier> @<original name> @<copy name>
Define a symbolic address	CR/<scope modifier> @<symbol name> $<logical address>
Remove a system symbol	DEL/<scope modifier>/<section modifier> @<system symbol>
Display a list of all the system symbols	DI
Create a procedure or edit an existing procedure	ED @<procedure name>[1]
Display the contents of a procedure	P @<procedure name>
Assign a new name to an existing procedure	RE/<scope modifier>/<section modifier> @<old name> @<new name>

[1] Refer to table C.E for editing commands

Table C.G
Using Commands Within Procedures

If you want to:	Then do this:
Next procedure execution	@<procedure name>
Assign a value from a specific source to a specific destination	<destination> <assignment statement><source>
Call for a procedure to execute based on the value of an expression	CA(<expression>) @<procedure 1> @<procedure 2> ... @<procedure n>
Remove a user symbol	DEL <user symbol>
Halt procedure execution	EX
Jump to a specific place in the procedure	G <label>
Execute a command based on the value from an expression	I(<expression>) <action command statement>
Make the 1775-S4B scanner wait for data and a carriage return to be entered before executing the rest of the procedure	IN<user symbol> !<format><data specifier>
Execute a command if a runtime occurs during procedure execution	O<action command statement>
Displays a string of test, user symbol, logical address, symbolic address, or expression	P<data specifier>
Stop procedure execution and perform a specific instruction	S<data specifier>

Table C.H
Using Functions

If you want to:	Then do this:
Convert an expression from BCD to its binary equivalent	F(expression)
Search the data terminal input buffer for a character	G()
Test the data terminal input buffer for a character	TESTC()
Test the data terminal input buffer for a complete line	TESTL()
Convert an expression from 32-bit integer to its BCD equivalent	TO(expression)

Table C.I
Error Codes

Codes	Description
10	Illegal operands for string compare.
11	Illegal operands for arithmetic operation.
12	Illegal arithmetic operation.
13	Missing parenthesis in expression.
14	Illegal expression syntax.
15	Illegal unary operator.
16	Illegal right side of arithmetic assignment.
17	Bad data following address.
18	Illegal string assignment.
19	Invalid data being assigned to address.
20	Division by zero.
21	Symbol already defined.
22	Illegal assignment operation with system symbol.
23	System symbol must be symbolic address.
24	Illegal left side of assignment operation.
26	Must specify system symbol for copy, create, edit, or rename statement.
27	Illegal data for system symbol.
29	Symbol to delete not found.
30	Procedure symbol already defined.
31	Unrecognized command modifier.
33	Must use system symbol.
34	Bad symbol on right side of string assignment.
36	Illegal right side of string operator.
37	Bad expression in case command.
38	Procedure not found for case command.
39	Unbalanced delimiters on command line.
40	Unrecognized or ambiguous command.
42	Illegal data following Goto command.
43	Illegal use of label (e.g. not in procedure).
44	Label not found.
45	Duplicate label.
46	Too many nested procedures.
47	Insufficient privilege.
48	Unbalanced parentheses in expression.
56	Illegal symbol in expression.

Table C.I
Error Codes (continued)

Codes	Description
57	Symbol undefined.
59	Bad level specified in logical address.
60	Unrecognized section specifier.
61	Bad format for timer/counter address.
62	Bad word specifier in timer/counter address.
63	Missing colon between file and word.
64	Illegal word specifier.
65	Illegal context specifier.
66	Attempt to execute a symbol that is not defined as a procedure.
67	Insufficient memory for operation.
68	Arithmetic overflow.
69	Illegal bit specified in bit write.
70	Cannot write a bit in local symbols.
71	Bad data for bit write (must be a 1 or 0).
72	Illegal assignment statement.
73	Undefined assignment operator.
74	Illegal fill character (e.g. carriage return).
75	Illegal symbol in inquire command.
76	Illegal string format specified.
77	Illegal use of exit command.
78	Illegal use of stop command.
79	Stop encountered in procedure.
80	Exit encountered in procedure.
81	Attempt to edit invalid symbol (1) not type procedure (2) modifier doesn't match procedure type.
87	Invalid base specifier for command.
88	Attempt to read or write at bad address.
89	Illegal value specified or being written into memory.
90	Illegal data for print command.
91	Data entered does not follow format.
92	Function not defined.
93	Illegal string.
94	Expression too complex for evaluation.
95	No keyboard privilege.

Appendix **D**

Glossary

Address: An expression preceded by a dollar sign that represents where data is stored.

ASCII: American Standards Code for Information Interchange. It is an 8-bit (7 bits plus a parity bit) code for representing alphanumerics, punctuation marks, and control code characters.

Baud: A rate of communication equal to the number of code elements (bits) per second.

BCD: Abbreviation for Binary Coded Decimal. A method used to express individual decimal digits (0 thru 9) in 4-bit binary notation.

Binary	BCD
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9

Binary: A numbering system using only the digits 0 and 1. Also called ”base 2”.

Bit:
1) Binary digit. The smallest unit of information in the binary numbering system. Represented by the digits 0 and 1.
2) The smallest division of a PLC-3 memory word.

Byte: Equals 8 bits.

Channel: A designated path for a signal.

Character: One symbol of a set of elementary symbols such as a letter of the alphabet or a decimal numeral.

Command: A task initiated by a user that tells the 1775-S4B module what to do.

Command line: The command and any other input needed to execute the command properly.

Command mode: Direct operation of the 1775-S4B scanner through data terminal keyboard input. The prompt S4B> cues the user for input.

CRT terminal: A terminal containing a cathode ray tube used to display programs, reports, or user input.

Cursor: A means for indicating on a CRT screen where data entry or editing occurs.

Data: A general term for any type of information.

Data table: The part of the PLC-3 memory that contains current I/O values, files, etc., where data is monitored, manipulated, operated upon, and changed for control purposes.

Data terminal: A device used only to send or receive data.

Decimal: Pertains to the base-10 numbering system.

Display: The image which appears on a CRT screen.

Duplex: A means of two-way data communication. See full-duplex and half-duplex.

Echo: A portion of the transmitted signal returned from the start point to the source with sufficient magnitude and delay to cause interference.

Edit: To deliberately modify a procedure.

Execution: The performance of a specific operation that is accomplished through processing one instruction, a series of instructions, or a complete program or procedure.

Full duplex: A bi-directional mode of communication where data may be transmitted and received simultaneously.

Floating point value: A fractional (fixed point) or exponential value. These values can be stored in the floating point section of the data table.

Function: An auxiliary command that works with a report generation command to specify how a command line should execute.

Half duplex: A mode of data transmission capable of communicating in two directions, but only in one direction at a time.

Hardware: The mechanical, electrical, and electronic devices which compose a programmable controller and its application.

Hexadecimal numbering system: A numbering system that uses the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and the letters A, B, C, D, E, F to represent numbers and codes. Base 16.

Information: Data that has been processed into a meaningful form. It adds to a representation and tells the recipient something that was not known before. Information Should be timely, accurate, and complete; it reduces uncertainty. Contrast with data.

Integer: Any positive or negative counting number or zero.

Intelligent terminal: A computer-oriented terminal that has built-in, data-checking capabilities and a small memory. Special functions may also be built into the terminal to perform certain checks on the data or to handle certain kinds of transactions.

Interfacing: A method of interconnecting the 1775-S4B scanner with various devices through the use of cables.

I/O: Input/Output

I/O chassis: An assembly used to house I/O modules.

Jumper: A short length of conductor used to make a connection between terminals.

Ladder diagram mode: Direct operation of the 1775-S4B scanner through the ladder diagram program. The MSG instruction can be used to print out or execute a procedure at an RS-232-C device connected to the 1775-S4B scanner's channel 5 connector.

Ladder diagram programming: A method of writing a PLC-3 application program in a format similar to a relay ladder diagram.

LED: Light-Emitting Diode.

LIST: A menu-driven program that is used to set the operating parameters for the PLC-3 programmable controller.

Modem: Modulator/Demodulator. A data transceiver.

Modem handshaking: A signaling protocol used for transferring information between devices in a synchronized manner at a rate acceptable to both devices.

Modifier: A parameter preceded by a slash (/) that follows a command. It tells the 1775-S4B scanner how to execute the command.

MSG instruction: A PLC-3 ladder diagram instruction that sends a message or procedure to a specified RS-232-C port in the PLC-3 system.

Octal Numbering System: A numbering system that uses a base eight; for example, the decimal number 324 would be written in octal notation as 504_8. Only the digits 0 thru 7 are used.

Parity: A method of testing the accuracy of inary numbers used in recorded, transmitted, or received data.There are two types of parity:

- Even parity is a condition that occurs when the sum of the number of (1s) in a binary word is always even.
- Odd parity is a condition that occurs when the sum of the number of (1s) in a binary word is always odd.

Procedure: A collection of report generation command lines that the 1775-S4B scanner uses to generate formatted text and data.

Procedure name: A group of eight alphabetic and/or numeric characters used to identify a procedure.

Privilege: A resource of the PLC-3 programmable controller. The user can restrict these resources from external ports such as the PLC-3 front panel or an RS-232-C port. These resources include:

- Ability to write to major sections of PLC-3 memory
- Ability to create, delete, and move sections of PLC-3 memory
- Ability to configure the watchdog timer, system clock, and operating context
- Ability to configure the I/O channels and RS-232-C channels

- Ability to configure the mode (RUN, TEST, PROGRAM LOAD)

Rack: A quantity of I/O modules that accesses 128 discrete I/O points.

Report: The output generated when a procedure is executed by the 1775-S4B scanner.

Report generation: A programming language that the 1775-S4B scanner uses to print or display formatted text and data.

RS-232-C: An electrical connection standard.

RS-232-C device: An electronic device that provides data at various rates, eight data bits per second.

Runtime error: An error detected by the 1775-S4B scanner when it is executing the command lines of a procedure.

String: A group of characters.

Twinaxial cable: A single-shielded, twisted-pair cable which has low-loss signal transmission and high noise immunity.

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