A·B QUALITY

Allen-Bradley

Distributed Diagnostics and Machine Control

(Cat. No. 6404-DDMC)

User Manual

Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in this guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Allen-Bradley does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Allen-Bradley publication SGI-1.1, *Safety Guidelines for the Application, Installation, and Maintenance of Solid State Control* (available from your local Allen-Bradley office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

Allen-Bradley publication ICCG-9.11, *Software Licensing Agreement*, provides the licensing terms for the use of this software as both a developer's tool and a Runtime package. All software that is part of this package is covered by the license including:

- FIX, Factory Link, and RSView code/screens
- PLC (ladder) functions
- PanelView screens

Throughout this manual we use these notes to make you aware of safety considerations:

 ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attention statements help you to:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is critical for successful application and understanding of the product.

Using this Manual

Manual Objectives

This manual shows you how to implement and use a Distributed Diagnostics and Machine Control (DDMC32) system. This system provides diagnostic machine fault detection and automatic messaging capabilities. Diagnostic messages provided by DDMC32 help reduce the downtime associated with troubleshooting your equipment.

In this manual we provide procedures for:

- installing DDMC32 system components

- configuring DDMC32 software

- monitoring a system, using DDMC32

Audience

We assume that if you are using this manual, you know or are familiar with:

- PLC-5™ hardware

- 6200 Series software

- 1771 I/O

- Allen-Bradley operator interface and programming terminals

- the line or machine for which you are developing the program

What this Manual Contains   Table P.A lists the chapters of this manual and the contents of each chapter.

Table P.A
Sections of this Manual

If you want to read about:	Refer to chapter:
Overview of DDMC32 components and how they fit into the system	1 — Understanding How a DDMC32 System Works
Procedures for installing DDMC32 hardware components	2 — Installing DDMC32 Hardware Components
Procedures for setting up your operator interface terminal; procedures for installing 6200 Series and DDMC32 software	3 — Installing DDMC32 Software
Overview of the Smart Directed Sequencer instruction in the PLC-5 and the PLC-5/250 and procedures for entering data into the instruction screens; naming steps; editing step descriptions	4 — Configuring SDS Instructions
Overview of the Diagnostic Fault Annunciator instruction in the PLC-5 and the PLC-5/250 and procedures for entering data into the instruction screens; configuring instruction messages; documenting the instruction	5 — Configuring DFA Instructions
Procedures for importing the SDS instruction's documentation into the operator interface data base; message database options	6 — Creating and Updating the Message Database
Overview of the parts of the diagnostic message and procedures for configuring the format of diagnostic messages for display	7 — Configuring Diagnostic Messages
Software tools and techniques for debugging your system; error list, I/O monitor, step history, input history, extended status, and I/O history screen displays	8 — Debugging Your DDMC32 System
Procedures for configuring output devices, Clock/Creep Option, Start/Stop and other related options	9 — Configuration and Operation of the DDMC32 System
Overview of the Report Generator; configuring and scheduling fault logs	10 — Using the Report Generator Software
Smart Directed Sequencer execution times, control file requirements, step description file requirements, maximum steps, and step description file layout; Diagnostic Fault Annunciator execution times, control file requirements; Data Highway Plus message block layout and communication delay	Appendix A — Reference Information

ATTENTION and Important Notes

Information that is especially important is identified with an ATTENTION or Important note:

> ⚠ **ATTENTION:** identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

> **Important:** provides you with information that is critical for the successful application and understanding of this product.

Terms and Conventions

In this manual, we use the following terms:

- **DDMC32 (Distributed Diagnostics and Machine Control 32–bit)** — Industrial automation system containing hardware and software components that help you configure a control and diagnostics system for your equipment

- **SDS (Smart Directed Sequencer)** — An instruction that resides in ladder logic, providing state machine control and up-to-date diagnostics for your machine

- **DFA (Diagnostic Fault Annunciator)** — A monitoring-only instruction which resides in ladder logic, used to generate messages when a fault occurs

- **programmable controller** — A solid-state control device that is programmed to control process or machine operation

- **I/O** — Input/Output

- **State** — The current value of an input or output at a particular point in time

In this manual, we use the following conventions to describe how you enter information.

- The Enter key and Function keys look like this:

  `[ENTER]   [ESC]   [F2]`

- Words or commands that you enter appear in bold. For example:

  SDS

- Variables that you must enter appear in italics. For example:

  Nxx:00

- Messages on the screen look like this:

  ```
  While DRILL STATION 32R was AT FULL DEPTH the RETURNED LIMIT
  SWITCH turned ON
  ```

- "Type" means type in the information using your keyboard

- "Enter" means type in the information and then press your keyboard's `[ENTER]` key

Related Publications

For more information about DDMC32 components, see the following publications:

Publication Title	Publication Number
DDMC32 User Manual	6401–6.5.1
PLC-5 Processors	
1785 PLC-5 Family Programmable Controllers Installation Manual	1785-6.6.1
1785 PLC-5 Programmable Controller Design Manual	1785-6.2.1
Pyramid Integrator™ Design Manual	5000-6.2.1
PLC-5 Programming Software Documentation Set	9399-PLC5MAN
PLC-5/250™ Programming Software Documentation Set	9313–5250
Communications	
Data Highway/Data Highway Plus™ Protocol and Command Set User's Manual	1770-6.5.16
Peer Communication Link Interface Module (cat. no. 1784-KT) Product Data	1784-2.3

Notes:

Understanding How a DDMC32 System Works

What this Chapter Contains

This chapter provides an overview of Distributed Diagnostics and Machine Control (DDMC32). It contains the following sections:

How the DDMC32 System Works

Distributed Diagnostics and Machine Control (DDMC32) for WindowsNT™ is an industrial automation system built around programmable controllers, operator interfaces, communications, and software. The system architecture lets you configure DDMC32 to your manufacturing needs. Ideal in transfer line and other machine applications, DDMC32 can be configured for other industrial applications such as material handling, packaging, and assembling.

DDMC32 is a flexible system based on the PLC-5 family of programmable controllers. You can use single or multiple PLC-5 processors to create either a centralized or distributed configuration. Processors communicate with each other over the Data Highway Plus.

Special instructions in the PLC-5 processor — a Smart Directed Sequencer (SDS) and a Diagnostic Fault Annunciator (DFA) provide diagnostic machine-fault detection and automatic messaging capabilities in the DDMC32 Monitoring system. You enter SDS and DFA instructions into ladder logic in 6200 Series software.

When a fault is detected, the SDS instruction sends a message over the Data Highway Plus to the operator interface terminal where the Monitoring software automatically assembles the appropriate diagnostic message. This diagnostic message helps reduce downtime associated with troubleshooting your equipment, because it specifies the device that caused the fault condition and the step in the sequence when the fault occurred.

The DDMC32 System illustration (seen below) shows how DDMC32 uses the SDS instruction to detect a fault condition and send the diagnostic message to the operator interface.

DDMC32 System

1. SDS instruction detects a fault condition.

SDS

PLC-5/20   IMC 123

EMSG

Input to PLC-5

2. PLC sends encoded message to operator interface on Data Highway Plus.

Symbol Data Base

3. Background task extracts information from data base and constructs message.

PLC-5/20

While SLIDE was ADVANCING, the returned LS turned ON.

Operator Interface

IMC 120

4. Concatenated message is displayed on CRT and passed out COM 1 port.

Understanding the SDS Instruction

An integral part of the DDMC32 system is the Smart Directed Sequencer (SDS) instruction (see the figure below). The SDS instruction provides state-based control and resides in ladder logic. The SDS instruction lets you develop control and diagnostic programs using state logic. The SDS instruction is provided as a custom application routine (CAR) which is downloadable into the PLC-5 processor through 6200 Series software prior to instruction entry. The CAR occupies one program file and is declared when entering an SDS instruction; it is referenced by the SDS instruction at runtime.

Smart Directed Sequencer Instruction Terminal Display (PLC-5 processor)

```
                                          DRILL
                                          MACHINE
                                          HEAD 1
                         ┌ SDS ─────────────────────────────┐
                         │ SMART DIRECTED SEQUENCER          ├─(EN)
───────────────────────┤ Control File          N10:0       │
                         │ Step Desc. File       N11:0       ├─(ST)
                         │ Length                  144       │
                         │ No. of Steps             12       ├─(ER)
                         │ Position/Step:            0       │
                         │ No. of I/O                8       ├─(ES)
                         │ Prog file number          3       │
                         └───────────────────────────────────┘
```

Each SDS instruction contains a sequence of user-defined steps which guide the logical flow of the instruction, for example, Ready, Advancing, Advanced, etc. Each step represents a unique collection of I/O (input/output) and subsequent step conditions (or destination steps you define according to your application). Information for each step is easily configured through a fill-in-the-blanks configuration template (see next page). This template contains fields for the following:

- inputs and outputs (you enter actual names for control items rather than obscure addresses)

- transitions of the inputs or equations for combined inputs

- destination steps

- output states

- step timer (how long until a timeout occurs)

- message on or off

Sample Step Configuration Template With SDS Instruction

```
  STEP 1    READY                   TIMER=0.0s – DISABLED            MSG:OFF

 No   Input ID          Equation    Destination    No   Output ID          State
  0 RET'D LS            OFF-->ON       STEP 0        0 FORWARD MOTOR 1       OFF
  1 ADV'D LS            OFF-->ON       STEP 10       1 REVERSE MOTOR 1       OFF
  2 FULL DEPTH LS       OFF-->ON       STEP 0        2 DRILL MOTOR          OFF
  3 ADVANCE COMMAND     OFF-->ON     **STEP 2
  4 RETURN COMMAND




 Press a function key.

 Program        edit mode                            PLC-5/25 Addr 1
         Display  Step    Step    Edit    Step    Msg    Input  Output  Marked
         Symbol   Name    Type    Step    Timer   On    Transit State   Exit
          F2      F3      F4      F5      F6      F7      F8      F9      F10
```

How the Transitional SDS Instruction Handles Inputs

Transitional equations provide state-based control. Each transitional equation defines the destination step based on the *transition* of a particular input (ON —> OFF or OFF —> ON). When input state transition conditions are used, the expected input states appear on the left side of the equation column and the transition states on the right. The destination column is on the right of the equation column (see the figure above).

At power up, the SDS instruction starts out in an "initialized" step. The instruction searches through each defined step to find a match based on the *expected* states of inputs. If it cannot find a match, the SDS instruction looks for a set of conditions defined by a *combinatorial equation* (see the figure on page 1-5). If a transition is specified, you must validate the entry state or you will not see a transition and will be locked into a step.

Because all input states in each step may be important, you must consider the logical progression of I/O sequencing when developing a step configuration. These considerations differ from those you make with traditional ladder logic, as the sequence of I/O changes are not relevant.

For example, in the figure below, the expected input conditions for step 1 are (in order): off, off, off, off, don't care. The instruction will enter this step only when inputs 0, 1, 2, and 3 are off. This figure shows another example of the SDS instruction looking for a step to enter.

SDS Instruction Looking for a Step to Enter

When transition conditions are used the instruction looks for a match of actual and expected inputs. If inputs do not match, the instruction continues its search.

ACTUAL INPUTS

OFF
ON
OFF
ON

When the instruction finds a match, it enters the step.

STEP 1 EXPECTED INPUTS

OFF --> ON
OFF --> ON
OFF --> ON
ON   --> OFF

STEP 2 EXPECTED INPUTS

OFF --> ON
ON   --> OFF
OFF --> ON
ON   --> OFF
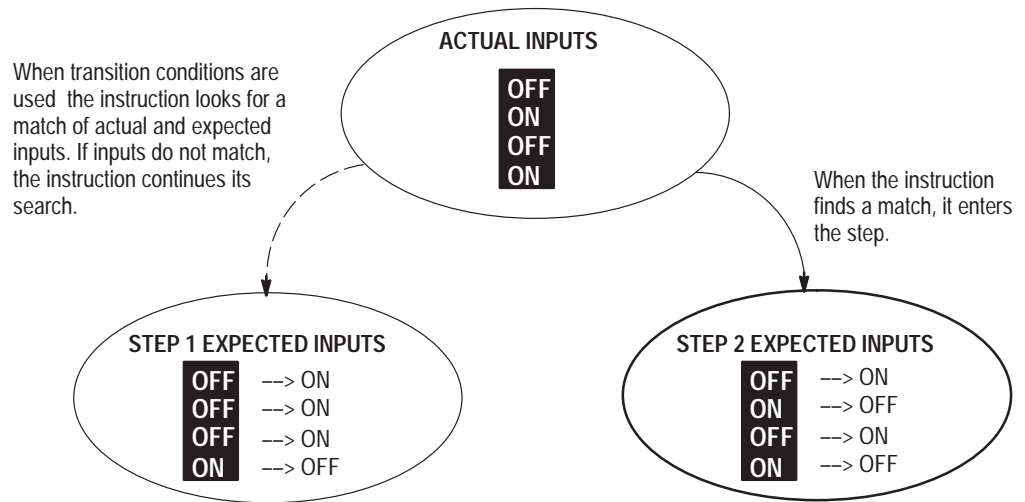
During runtime, an input change or a step timer timeout directs the SDS to another step. If the instruction detects a mismatch (the actual inputs do not match the expected inputs), it generates a mismatch fault. To aid you with programming, the software looks for obvious programmed mismatches before you accept an instruction.

How the Combinatorial SDS Instruction Handles Inputs

Combinatorial equations define destination steps based on input state values and the relationship between a *collection* of inputs. The combinatorial equation lets you accommodate complex combinations in the instruction while keeping the number of steps within a configuration to a minimum. (You can define up to 4 logical AND combinations in an 8-input SDS instruction; You can define up to 8 ANDed conditions in a 16- or 32-input instruction.)

The instruction scans the inputs from the top of the input list to the bottom, looking for a transition. When the actual inputs do not match the expected inputs, the instruction begins scanning the combinatorial equations for a match and remains in the step until all conditions for the equation(s) are met. The combinatorial SDS instruction ignores the "expected" entry states so that, even if possible, no mismatch error is generated.

When a valid transition, a set of conditions as specified by an equation, or a timeout occurs, the instruction moves to the destination step to verify the inputs before entering the step (this occurs for transition equations only, not ANDed conditions). See the following section for information on how the SDS handles outputs.

How the SDS Instruction Handles Outputs

The SDS instruction sets or resets outputs as it enters each step (based on how you define outputs in the configuration template). The table below shows what happens to outputs when the SDS enters an error step, step 0, or the initialization step.

States of Outputs Based on Destination Steps

If the SDS instruction enters:	Then outputs:
an error step	are set as defined in that step
step 0	reset to off
initialization step	stay in the last state

Message Generation

The SDS instruction generates an error message or status message when it enters a new step which has its message bit enabled. This message is displayed on the operator interface terminal and/or an annunciator panel if you so specify. (The figure on page 1–4 shows where you can turn messages on and off using the [F7] key.) Error messages are cleared from the display device (operator interface terminal or annunciator panel) only when the instruction goes to step 0. All other types of messages are cleared when the instruction moves to the next step.

Understanding the DFA Instruction

The Diagnostic Fault Annunciator (DFA) instruction is a monitoring–only instruction; that is, it monitors inputs you define, but it cannot control outputs. Valid inputs can be:

- storage points, such as binary bits

- counter/timer done bits

- outputs (real or logical)

- lube level sensors

- alarms

- fault bits set by another device or by ladder logic

- any valid bit address

The following figure shows a DFA instruction in a ladder program.

A DFA Instruction (PLC 5/250)

```
                                          ASSEMBLY
                                          MACHINE

                              ┌─ DFA ──────────────────────────┐
                              │ DIAGNOSTIC FAULT ANNUNCIATOR    │──(EN)──
──────────────────────────────│ Control File          N27:0    │
                              │ No. of I/O               16    │──(ER)──
                              │ Program file number       3    │
                              │ Msg Control Block     0MSG0:0  │
                              └────────────────────────────────┘
```
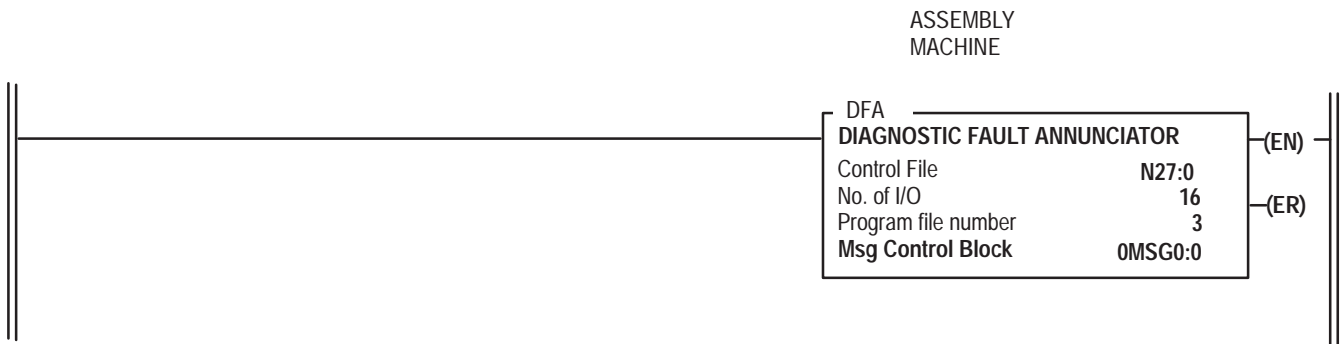
If you currently have diagnostics programmed in ladder logic, you can use the DFA instruction to generate messages when a fault occurs. In addition, you can create other types of operational and diagnostic messages with the DFA instruction, such as tool change messages and operating instructions.

Implementing DDMC32 Instruction in Levels

You can implement DDMC32 instructions at three different operational levels, depending on the amount of diagnostics and control that you need for your application. Each level provides incremental increases in terms of diagnostic coupling with the control. The figure and table below show the levels of implementation.

Levels of DDMC32 Implementation

Level 3

The DFA instruction can be used on all levels since it is used for global type errors. Unlike the SDS instruction, which is constructed around a given mechanism and its associated I/O, the DFA instruction is constructed around constantly monitored conditions that do not fit into a state structure.

- SDS Instruction for Control and Diagnostics
- DFA Instruction for Messages

Level 2

- Ladder Logic for Control
- SDS Instruction for Messages and Diagnostics
- DFA Instruction for Messages

Level 1

- Ladder Logic for Control and Diagnostics
- DFA Instructions for Messages

Important: A Level 3 Implementation does not limit you to only using the SDS instruction for control and diagnostics. You may also include Level 1 and Level 2 Implementations for diagnostics outside of the Level 3 SDS instruction, for example, lube faults or overloads.

Description of DDMC32 Levels

This level	Uses this DDMC32 instruction	Control is handled by:	Diagnostics are handled by:	Message Generation is handled by:
1	DFA	ladder logic	ladder logic	DFA
2	SDS and DFA	ladder logic	SDS	SDS and DFA
3	SDS and DFA	SDS and ladder logic	SDS	SDS and DFA

DDMC32 System Components

A typical DDMC32 system applies the following system components:

- 6400 Series Software

  Monitoring software (6404-DDMC)

- 6200 Series Software

- PLC-5 family of programmable controllers

- 1771 I/O

- 6180 Industrial Computer with the following minimum configuration:

Cat. # 6180 – AB   C   B   D   B   A   C   A   C   Z   A

100 MHZ Pentium Processor

10.4″ TFT

PCI 2Mg DRAM Video Board

16Mg RAM

1.3G Hard Drive

3.5″ Floppy Drive

Series

No Software

Windows NT™ 4.0

120V Power Card

1784-KTX
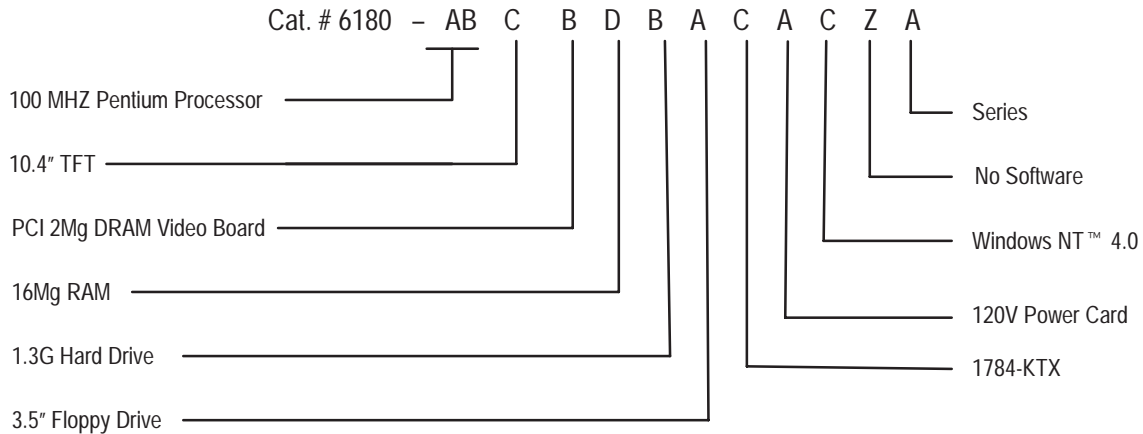
- Data Highway Plus

- Dataliner™ message displays

DDMC32 Software

DDMC32 software contains several tools to help you monitor, generate, annunciate, and store information about faults.

When a fault is detected by a PLC diagnostic instruction, a message packet with the appropriate coded data is sent to the operator interface terminal. The DDMC32 software assembles the data used during programming to form the text of the fault message. If configured by the user, the terminal automatically displays the message in a window reserved for alarm messages. Because the software automatically assembles the message, you do not have to create and store separate and unique diagnostic messages.

You have to configure the message templates using the Template Editor in the DDMC32 software. The Template Editor permits you to design templates to reflect individual types of DFA and SDS faults (per each Processor/Control File combination for these instructions. When a DFA or SDS instruction generates a fault, the corresponding template is used by the DDMC32 software to build the appropriate message that will be displayed.

For more information on the DDMC32 Message Template Editor see the section on Accessing the Message Template Editor in Chapter 7 – Configuring Diagnostic Messages.

The DDMC32 software also provides:

- a fault log that shows all fault messages generated by the software

- an interface for marquees to optionally display diagnostic messages

- a fault report which lets you see where and when each fault occurs by frequency and duration

These selections are configured by the user who may direct the faults to some or all of the above devices.

6200 Series Software

This software provides the capability to program and monitor your PLC-5 family programmable controller using your operator interface terminal.

6200 Series Software uses menu-driven screens and configuration utilities that simplify entry. You can use 6200 Series Software to develop ladder programs and configure DDMC32 instructions.

To learn more about 6200 Series Software, refer to the PLC-5 Programming Software Documentation Set (publication 9399-PLC5MAN) or the PLC-5/250 Programming Software Documentation Set (publication 9313–5250).

PLC-5 Family of Programmable Controllers

The PLC-5 family of programmable controllers is the heart of the DDMC32 system, providing a flexible framework for processing. You can create:

- a centralized configuration to control a large number of I/O from one location

- a distributed configuration to control I/O from several remote locations. (All PLC-5 processors can be linked using the Data Highway Plus to a common operator interface terminal where programming, monitoring, and troubleshooting are performed.)

All PLC-5 processors can still be programmed with familiar ladder logic in addition to using the diagnostic instructions. In DDMC32, PLC-5 processors utilize the instructions that can automatically detect machine faults and abnormal conditions. Using 6200 Series software, you can program PLC-5 processors with industrial computers, the plant floor terminals, or any IBM AT–compatible computer.

If you want to know more about the PLC-5 processor, refer to PLC-5 Family Programmable Controllers Installation Manual (publication 1785-10.4) or the Pyramid Integrator Design Manual (publication 5000-6.2.1).

1771 I/O

With DDMC32 you can select from more than 80 types of I/O modules to create a configuration perfect for your manufacturing needs. I/O modules can be discrete, analog, or intelligent. Refer to the Automation Systems Product Catalog.

6180 Industrial Computer

The 6180 Industrial Computer provides an industrially hardened, expandable hardware platform. This computer is versatile and modular, and lets you design a configuration suitable for your individual application. The 6180 computer is the common operator interface for your DDMC32 system.

You can use the 6180 computer to:

- develop ladder logic rungs and SDS instructions using 6200 Series Software and the SDS Configuration Utility

- display diagnostic messages using Monitoring Software

- define graphic displays of your equipment that can be used to monitor the operation

For more information about the 6180 Industrial Computer, refer to the 6180 Industrial computer brochure (publication 6180-1.0).

Data Highway Plus

Data Highway Plus (DH+) is the network that links the PLC-5 programmable controllers and the operator interface terminal so that they can communicate with one another.

The Data Highway Plus lets you:

- download ladder logic with SDS instructions into multiple PLC-5s

- receive diagnostic messages from multiple PLC-5s

- implement a centralized common operator interface for all control elements of the DDMC32 system

If you want to know more about Data Highway Plus, refer to Data Highway/Data Highway Plus Protocol and Command Set Manual (publication 1770-6.5.16).

Dataliner Message Displays

Dataliner message displays (bul. no. 2706, series DL10) are highly visible message display devices used for diagnostics, operator prompts, and status messages. These displays can be used with your system as annunciator panels for the messages sent by the DDMC32 software.

What to Do Next

This chapter gave you an overview of how the DDMC32 system works to diagnose faults and generate messages, and how the SDS and DFA instructions work within the DDMC32 system. In addition, this chapter described the components that make up a DDMC32 system.

Chapter 2 contains information for installing the DDMC32 hardware components described in this chapter.

Installing DDMC32 Hardware Components

What this Chapter Contains

Read this chapter to learn how to install your DDMC32 hardware components when using a 6180 Industrial Computer.

In this chapter we overview DDMC32 hardware configurations and provide procedures for installing the hardware components. In addition, we reference specific hardware publications so that you can find more information, if needed.

This chapter contains the following sections:

Section:	Page:
Hardware Configurations	2-1
Installing DDMC32 Components	2-3
What to do Next	2–4

Hardware Configurations

You can have one or several PLC-5 processors in your DDMC32 hardware configuration, in addition to a 6180 Series Industrial Computer. The different DDMC32 hardware configurations are referenced in the following table and on the subsequent pages.

DDMC32 Hardware Configurations

If your configuration uses:	Refer to figure:
One PLC-5 and the 6180 Industrial Computer	DDMC32 Component Configuration with one PLC-5 Processor and a 6180 Industrial Computer
Multiple PLC-5 (multi-drop peer communications link) and the 6180 Industrial Computer	DDMC32 Component Configuration with multiple PLC-5 Processors and a 6180 Industrial Computer

DDMC32 Component Configuration with one PLC-5 Processor and a 6180 Industrial Computer
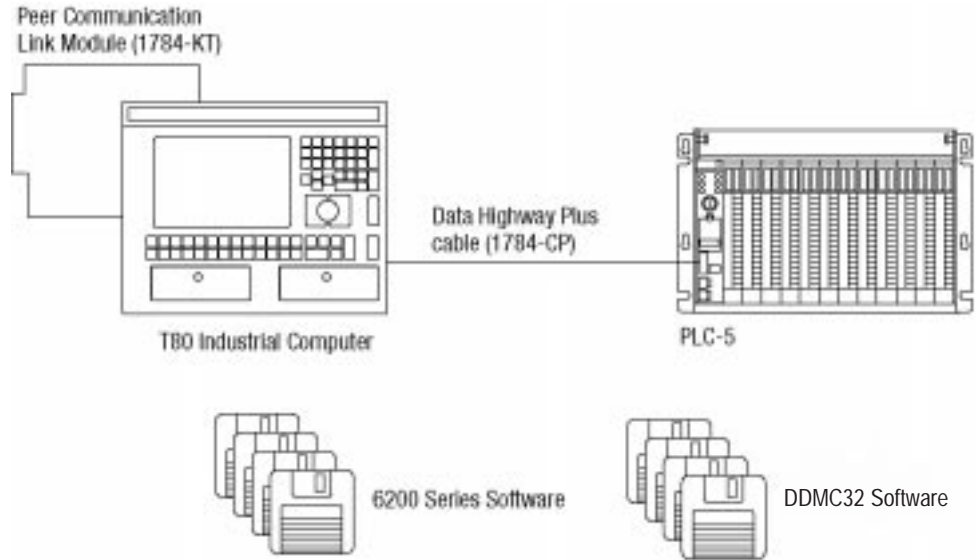
DDMC32 Component Configuration with Multiple PLC-5 Processors and 6180 Industrial Computer
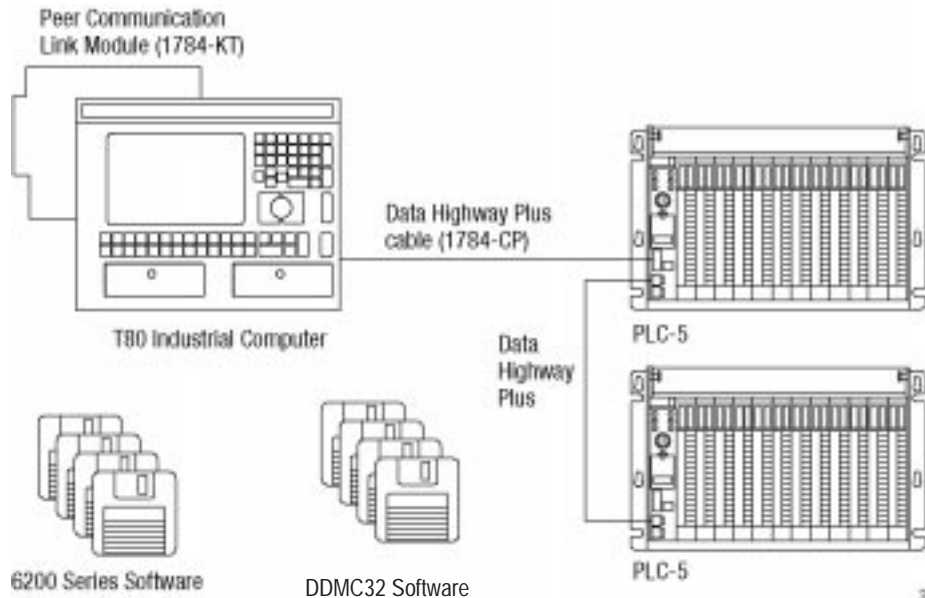
⚠ **ATTENTION:** If you are using your DDMC32 software (cat. no. 6404-DDMC) with a PLC-5/250 processor, you must make certain that the Remote Scanner Module (cat. no. 5150-RS) has a daughterboard (cat. no. 5150-MRS) with a part number of 960456-05 or later (For example, -05, - 06, -07, etc.). You can locate this part number along the bottom edge of the removable 5150-MRS daughterboard. Failure to observe this caution could result in erroneous data appearing in the input image table or internal storage table.

Contact your local Allen-Bradley support office or call Technical Support at (216) 646-6800 to arrange for shipment of updated modules.

Installing DDMC32 Components

The procedure for installing DDMC32 components varies depending on the operator interface terminal you use. We describe procedures for 6180 Industrial Computer on the following pages.

Using a 6180 Industrial Computer

The table below lists the general procedure for installing your DDMC32 hardware components when using a 6180 Industrial Computer. Refer to the manuals listed for more detail.

Installing DDMC32 Hardware Components when using a 6180 Industrial Computer

To perform this task:	Refer to this manual:	Publication or Cat. Number:
1. Install PLC-5 or PLC-5/250 and 1771 I/O	PLC-5 Family Processor Installation Instructions	1785-10.4
	Pyramid Integrator Design/Installation/Startup and Integration Manual	5110-ISET
2. Install communications link**:** a. Set the 6-switch assembly switches as follows: 1 2 3 4 5 6 OPEN X X X CLOSED X X X (Based on the factory's setting, only switches 2 and 3 must be modified.) **Important:** When installing and configuring your 6200 series software, the switch setting for "on" will correspond to a 1 and the switch setting for "off" will correspond to a 0.	Communication Interface Module Installation Data	1784-2.31
b. Install Data Highway Plus Interface Module (cat. no. 1784-KT) into an ISA slot .	6180 Industrial Computer User's Manual	6160-6.5.1
c. Connect the 1784-CP cable from the 6180 to the PLC-5 or 5/250.	PLC-5 Family Programmable Controllers Hardware User Manual	1786-6.5.12
If using a multiple PLC-5 configuration: Connect PLC-5 processors with cables and 3-pin connectors	Pyramid Integrator Design/Installation/ Startup and Integration Manual	5110-ISET

What to Do Next

Now that you have installed your hardware components, you can install your software. Chapter 3 describes procedures for installing software for a DDMC32 system.

Installing DDMC32 Software

What this Chapter Contains

Read this chapter to learn how to install your DDMC32 software. To install your software, you perform the following tasks:

- set up your operator interface terminal

- install 6200 Series software

- install DDMC32 Monitoring Software

This chapter contains the following sections:

Section:	Page:
Setting Up Your Operator Interface Terminal	3-1
Installing and Configuring the Software	3-1
Installing DDMC32 Software	3-2
Completing the DDMC32 Software Installation	3-8
What to do Next	3-8

Setting Up Your Operator Interface Terminal

Before you install your DDMC32 software, you must power up the 6180 Industrial Computer or your PC with 6200 Series software (v. 4.5 or later), Microsoft Windows NT™ 4.0, and RS Linx (v. 1.70.62 or later).

Using a 6180 Industrial Computer

To power up the 6180 computer, turn the system power switch on the rear of the computer to the ON position. The system performs a series of self-tests to determine if its components are properly installed and operating. You do not have to change the 6180 setup information to run the DDMC32 software.

Installing and Configuring the Software

Install and configure Windows NT™ on your PC according to your product information.

Next, install and configure RSLinx on your operator interface terminal (refer to the Rockwell Software Installation Guide for Windows-based products for further information).

Finally, install your 6200 Series software on your PC (reference the PLC-5 Programming Software documentation, publication 6200-N8.001).

Once you have the software installed, you must configure the 1784-KT address to correspond with the switch assembly setting.

For the **6180 Industrial Computer**, set the 1784-KT address to **001011**.

- This address is a recommended station address only. If you have conflicting hardware installed, you must find your own settings.

Installing DDMC32 Software

There are several DDMC32 disks in the installation disk set. To install your DDMC32 software, follow the procedure below. At this point, we assume that you have formatted your hard disk and installed Windows NT ™.

1.   Insert the first DDMC32 disk into the appropriate drive.

2.   From the **Start** menu on the Windows NT Taskbar, choose **Run...** to begin the DDMC32 setup program.

3.   In the Run dialog box, enter the drive letter and name of the DDMC32 setup program (e.g., A:\setup.exe).

4.   Ensure the drive letter is correct and click on **OK**.

   Setup will begin. Follow the instructions as they appear on the screen.
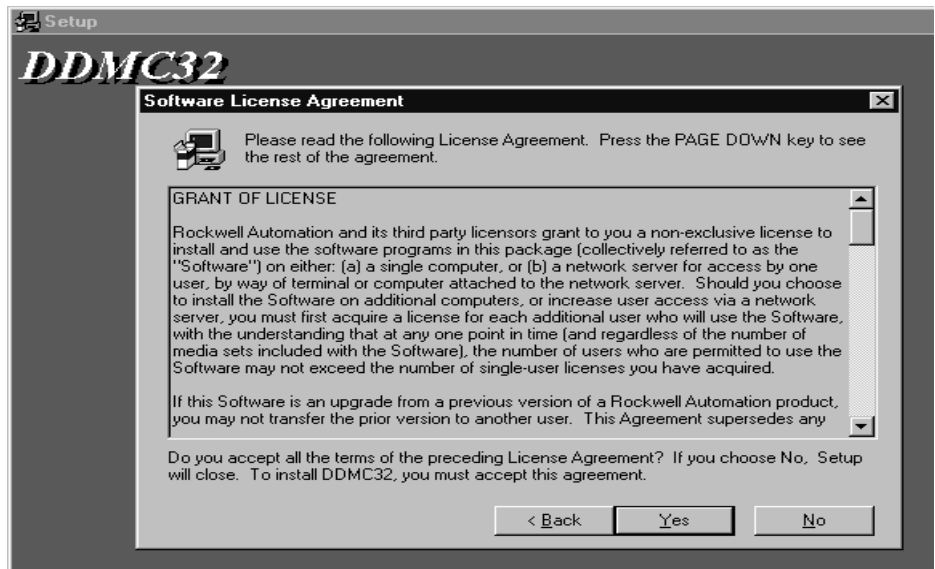
The DDMC32 Welcome Setup screen appears.

DDMC32 Welcome screen

5.   Click on the **Next** button to continue (or **Cancel** to quit the setup program).

The Software License Agreement screen appears.

Software License Agreement

6. Click on **Yes** to accept or **Back** to return to the Welcome screen. Click on **No** to terminate the program installation.

Once you have accepted the Software License Agreement, the Choose Destination Location screen appears.
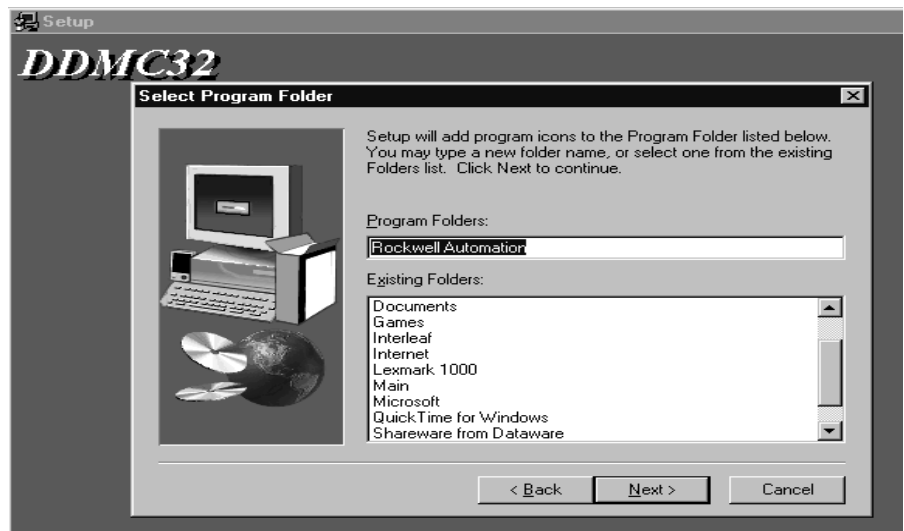
Choose Destination Location screen

7. Click on the **Browse** button to select an alternate destination for the program installation, or click on Next to accept the default destination and continue with the setup.

Once you have verified your destination location, the Select Program Folder screen appears.

Select Program Folder Screen

The Select Program Folder screen allows you to select a Program Folder into which the DDMC32 program icon will be placed. The default folder is named Rockwell Automation. You may use this folder, select one from the Existing Folders window, or create a new folder by typing in your folder name.

8.   Click on the Next button.

The Select DDMC32 Option(s) screen appears.

Select DDMC32 Option(s) Screen

9.   Select one or both of the options you want to use with the DDMC32 software.

Important: At this point, if any changes need to be made to previous entries, click on the **Back** button until the appropriate screen has been reached. Make any corrections and continue with the setup as described.

---

10. Click on the **Next** button.

The Add DDMC32 to Startup Folder screen appears.

Add DDMC32 to Startup Folder screen

11. Select **Yes** to add DDMC32 to your Startup folder.

The default is **No**, in which case DDMC32 will not be added to your Startup folder.

12. Click on the **Next** button.

The Start Copying Files screen appears.
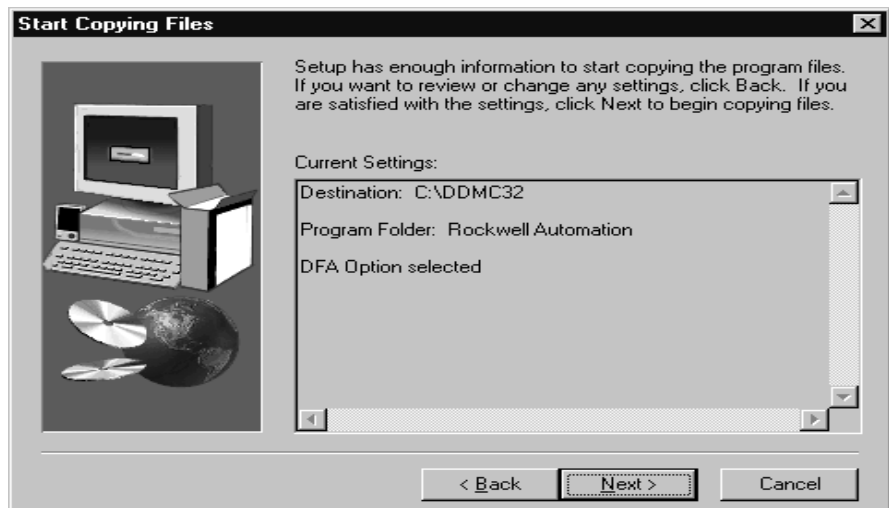
Your selections up to this point are listed. You can either go back and change them, or click on the Next button to accept your selections and begin copying files to your hard drive.

While files are being copied, the Progress screen is displayed.

Setup DDMC32 Progress screen
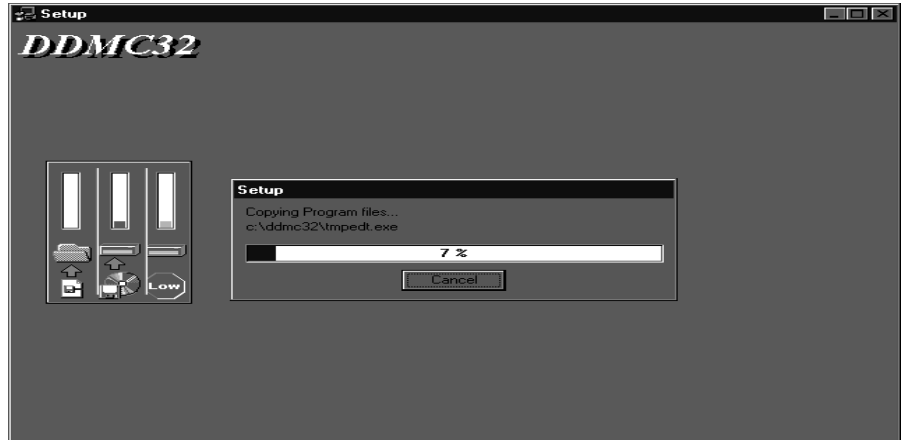
This screen shows the progress the installation disk is making. Follow the instructions on the screen to complete the setup.

The following window will appear each time a new disk is required for the setup. Follow the instructions and click on the **OK** button to continue.

Setup Needs the Next Disk screen

**Completing the DDMC32
Software Installation**

Once the installation of the software is complete, the Setup Complete
screen appears:

Setup Complete screen

From this screen you may choose to read the latest release notes
concerning the DDMC32 software, and/or to launch the program by
clicking on the required box.

Important: It is recommended that you read the release notes before
proceeding.

---

13. Click on the **Finish** button to complete the setup and activate your
selections.

What to Do Next

Now that you've installed the software on your computer, you can begin to
set up the software for your particular application.

Configuring SDS Instructions

What this Chapter Contains

Read this chapter to learn about the SDS instruction and procedures that describe programming and configuring the SDS instruction:

Important: You can use an SDS instruction in either the PLC-5 processor or the PLC-5/250 processor. There are some minor differences in the procedures for programming and configuring the instruction, depending on which processor you are using. We note these differences where applicable. Examples in this chapter are for the PLC-5 processor.

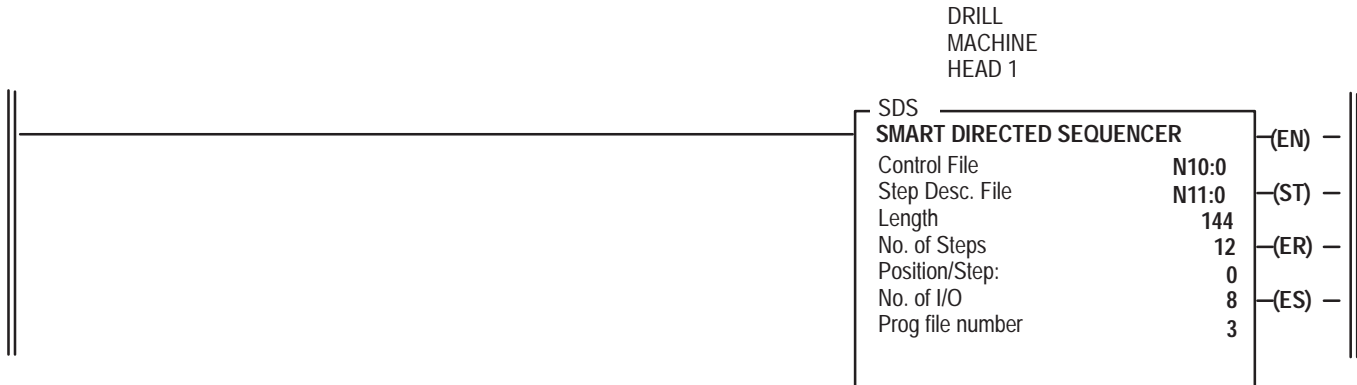This chapter contains the following sections:

Smart Directed Sequencer Overview

The SmartDirected Sequencer (SDS) instruction resides in ladder logic and provides state control that can be used to characterize normal and abnormal conditions.

The figure below shows an SDS instruction in a ladder program.

An SDS Instruction Ladder Program

```
                                                DRILL
                                                MACHINE
                                                HEAD 1
   ┌─ SDS ──────────────────────────────┐
   │  SMART DIRECTED SEQUENCER           ├─(EN)─
   │  Control File              N10:0    │
   │  Step Desc. File           N11:0    ├─(ST)─
   │  Length                      144    │
   │  No. of Steps                 12    ├─(ER)─
   │  Position/Step:                0    │
   │  No. of I/O                    8    ├─(ES)─
   │  Prog file number              3    │
   └─────────────────────────────────────┘
```

The SDS instruction permits the user to classify groups of input values into equation form. When an equation is physically satisfied by input conditions, the SDS transitions to the destination step appropriate to that equation and applies the output control related to that step.

The SDS instruction allows two basic types of logic equations:

- transitional

- combinatorial

Transitional Equations

The SDS instruction which uses transition equations provides traditional state-based control. Essentially, this type of SDS instruction is built around the state transition concept, where each input transition directs the instruction to a unique next step using a logical OR structure. In other words, one input change directs the instruction to step A, another to step B, etc. See the next page for an example of what is meant by transitional equations.

Graphic Example of Transitional Equations
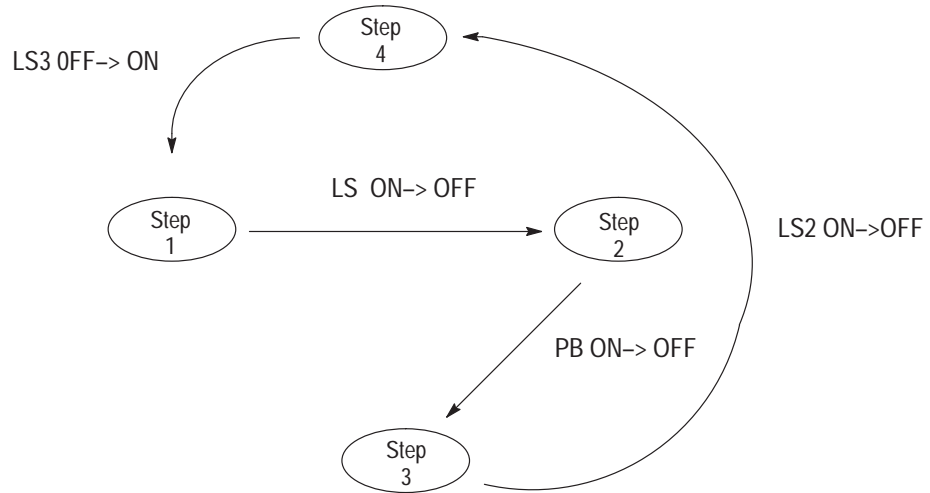
This type of SDS instruction operates from a series of step tables that define output states for each step, and input transitions as either normal or abnormal. Normal transitions direct the SDS instruction to another step; abnormal transitions can cause the instruction to send a message to the operator interface terminal, where DDMC32 software automatically assembles and displays the appropriate diagnostic message.

The SDS instruction also allows you to implement "shadow mode" diagnostics. In "shadow mode" control is placed in the ladder logic; the SDS simply monitors the I/O performing the control and performs diagnostics on that I/O.

Combinatorial Equations

In addition to the transitional equation, the SDS instruction can also use combinatorial conditions or equations which allow for the ANDing of inputs in addition to the OR function (as seen in transitional equations).

You can also use the NOT function, although it is not as true an operand as the AND function is. The NOT function is concerned with input state only. This allows complex combinations or mechanisms that are not easily defined by individual state transitions to be accommodated more easily within the SDS framework with a minimum number of steps. See the next page for an example of what is meant by combinatorial equations.

Graphic Example of Combinatorial Equations
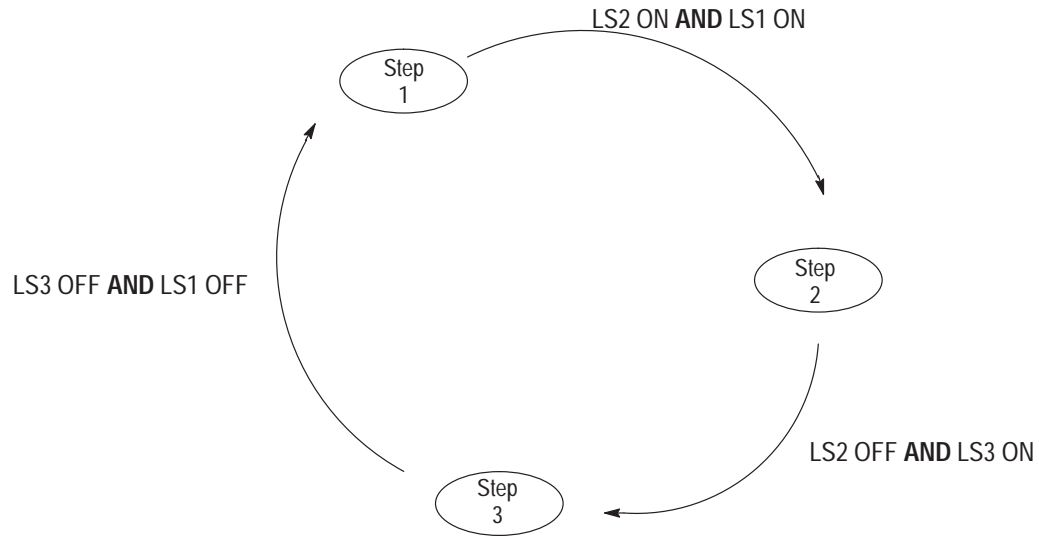
With traditional state-based programming, you need to take into account all of the probable states for the implementation. (The number of possible states is 2 to the nth power, where n is the number of inputs.)

The SDS instruction that uses combinatorial equations eliminates this need to account for all possible input states, and provides a means to enter Boolean expressions similar to ladder logic. In this case, the SDS instruction will not advance to another step until all conditions defined in an equation are fulfilled, regardless of their order or timing relationship with each other.

Using the SDS instruction in combinatorial mode also allows you to replace external ladder logic. By using combinatorial equations in the SDS instruction, you can get diagnostic information on the logical conditions not yet fulfilled. This feature can be useful in generating operator guidance messages, as well as diagnostic messages.

Programming the SDS Instruction

Once you have determined where you want to apply the SDS instruction, you can enter it into your ladder program and configure the instruction. Perform the following tasks to program the SDS instruction:

- download the SDS CAR

- enter the SDS instruction

- enter the configuration information

- enter I/O information

To program the SDS instruction into your ladder program:

1. Access the PLC-5 or PLC-5/250 Programming Software main menu, shown below, from the Allen-Bradley main menu interface.

Programming Software Main Menu (PLC-5)

```
+======================= PLC-5 PROGRAMMING SOFTWARE =======================+
|                                                                          |
|                      A 6200 Series Software Product                      |
|                                                                          |
|   Copyright 1986, 1987, 1988, 1989, 1990, 1991, Allen-Bradley Company, Inc. |
|                          All Rights Reserved                             |
|                                                                          |
|                             Release 4.3                                  |
|                                                                          |
|     This software is licensed to:  Company    Allen-Bradley Co.          |
|                                    Location    747 Alpha Drive           |
|                                                PSP Engineering           |
|                 Serial Number:  ZZ0AA0PP                                  |
+==========================================================================+
| Fri June 14, 1991                                          9:39:09 am    |
+--------------------------------------------------------------------------+
| Terminal Address: 77     Current Device: 1784-KT (DH+)     PLC Address: 1 |
+==========================================================================+

Press a function key


Online  Online  Offline Offline   Who   Sftware  File   Reports Compare  Exit
Program Configr Program Configr          Configr  Utils                   System
 F1       F2      F3      F4       F5      F6       F7      F8     F9       F10
```

2. Press **[F1] - Online Program** .

The system displays the online program directory (see the figure below).

Online Program Directory (PLC-5)

```
+= PROGRAM DIRECTORY FOR PROCESSOR: SDSDEMO  ====================[ ONLINE  ]===+
| File          Name        Type              Size(words)                    |
|----------------------------------------------------------------------------|
|   0                       system            4                              |
|   1                       undefined         0                              |
|   2                       ladder            259                            |
|   3          SDS5         custom routine    1350                           |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
|                                                                            |
+============================================================================+

Press a function key or enter a program descriptor.
>
Program                                              PLC-5/25 Addr 5
 Proc     Save    Return  Change    Who   Memory    Monitor Monitor
Functns Restore to Menu Station             Map       File    SFC
  F1      F2      F3      F4      F5      F6           F8      F9
```

The cursor is placed on the first user-accessible file.

If the program directory does not list the SDS CAR file, you will need to download it to the PLC-5; otherwise your can go to the "Entering or Modifying an SDS Instruction" on page 4–9.

Downloading the SDS CAR File

Important: To download the SDS CAR file you must be in online programming mode.

Do the following to download the SDS CAR file into your program:

1. Press **[F2]- Save Restore.**

The system displays the Save Restore function keys.

2. Press **[F4]- Restore Program.**

The system displays a window containing a file directory of a specific type (see the figure below).

File Directory Window (PLC-5)

```
+= PROGRAM DIRECTORY FOR PROCESSOR: += C:\IPDS\ARCH\PLC5\*.CAR    ===========+=+
| File          Name        Type  |   Name        Size    Date     Time  | |
|---------------------------------|--------------------------------------|-|
|   0                             | SDS5         5672   5-04-90  12:50p   | |
|   1                             |                                      | |
|   2                             |                                      | |
|   3                             |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
|                                 |                                      | |
+=================================+======================================+=+

Press a function key , or move cursor to select file.

>
Program                                              PLC-5/25  Addr 5
 Begin                                       Define  Select
 Oper                                        Dirctry Type
  F1                                           F7      F8
```

3. Press **[F8] - Select Type** until the CAR files appear in the file directory window.

4. Cursor to the desired CAR file.

Important: Program file numbers for the SDS and DFA instruction must be unique. You need to specify only one SDS and one DFA CAR program file number per processor, regardless of the number of SDS or DFA instructions you use.

---

5. Download the CAR file:

If you are using a PLC-5:

a. Press **[F1] - Begin Restore.**

The system prompts you to enter a file number.

b. Type the file number and press **[ENTER].**

The system returns to the Program Directory.

If you are using a PLC-5/250:

a. Press **[F1] - Begin Oper.**

The system prompts you to enter a program descriptor.

b. Type the program descriptor, for example, *1CAR0*, and press
[ENTER].

In the program descriptor, the first number refers to the number in
the thumbwheel window on the logic processor (in this case, 1). A
logic processor runs control logic which controls steps, transitions,
processor input interrupts, selectable timed interrupts, and
independent background programs.

CAR refers to the type of file; *0* refers to the program file number into
which the *CAR* will be downloaded.

The system returns to the Program Directory.

Entering or Modifying an SDS Instruction

To enter or modify an SDS instruction in your ladder program:

1. Cursor to the program you want to edit in the Program Directory and press **[F8] - Monitor File.**

The system displays your ladder program and the Ladder Editor main menu.

2. Cursor to the rung where you want to position the SDS instruction.

If you are modifying an existing rung, cursor to the SDS rung.

Important: When cursored on the R rung of an IR (Insert/Replace) rung pair, the SDS configuration utility uses the configuration information from the I rung.

---

3. Press **[F10] - Edit.**

The system displays the Ladder Editing screen.

4. If you are editing an existing rung, press **[F5] - Modify Rung**.

If you are entering a new rung, press **[F4] - Insert Rung.**

The system displays the Edit Rung screen.

5. If you want to change an existing instruction, press **[F5] - Modify Instruction**.

If you are entering a new instruction, press **[F4] - Insert Instruction.**

The system prompts you for the instruction you want to add.

6. Type **SDS,** if it does not already appear at the prompt, and press **[ENTER]**. (If you are modifying an existing instruction, **SDS** already appears at the prompt.)

   As an alternate method of entering the instruction, you may:

   ▪ Press **[F10] – Others**

   ▪ Press **[F9] – Seqncer** from the Instruction Classes function keys

   ▪ Press **[F6] – SDS** from the Shift Sequencer function keys

   The system displays the SDS instruction, seen below.

SDS Instruction (PLC-5)

```
|                                              +SDS------------------------+      |
+---------------------------------------------+SMART DIRECTED SEQUENCER    +-(EN)-+
|                                             |Control File              |      |
|                                             |Step Desc. File           +-(ST) |
|                                             |Length                    |      |
|                                             |No. of Steps              +-(ER) |
|                                             |Position/Step:            |      |
|                                             |No. of I/O                +-(ES) |
|                                             |Program File No.          |      |
|                                             +--------------------------+      |
|                                                                               |
+-----------------------------[END OF FILE]-------------------------------------+
|                                                                               |



Enter the operand.
Enter the Control File address>
Program Forces:Disabled  Edits:None                    PLC-5/25 Addr 5
```

Entering or Modifying SDS Instruction Information

Once the SDS instruction is displayed, the system prompts you to enter the Control File starting address. To enter or modify parameters into the SDS instruction:

1. Type the Control File address and press **[ENTER]**.

The control file must be expressed in the following manner:

For the:	Use this format:	Where:
PLC-5	*Nfff:eee*	*fff* = an integer file between 10 - 999 and *eee* = an element number between 0 - 999.
PLC-5/250	*Nffff:eeee*	*ffff* = an integer file between 10 - 9999 and *eeee* = an element number between 0 - 9999.

In the PLC-5/250, when you enter the control file address, the system displays a number (1, 2, 3, or 4) in front of the address. This number represents the logic processor in the PLC-5/250.

Important: The control file and the step descriptor file addresses must be local to the logic processor that is executing the associated SDS instruction. Do not place either of these files in system memory. Do not reference this step descriptor file in other logic processors.

The PLC-5/250 chassis supports up to four logic processor modules. For more information on logic processors, refer to the PLC-5/250 Programming Software Documentation Set (publication 9313-5250).

When the Control File address is entered, the system prompts you to enter the Step Description File address.

2. Determine the Step Description File address.

The Step Description File address must be expressed in the manner shown in the following table:

For the:	Use this format:	Where:
PLC-5	*Nfff:eee*	*fff* = an integer file between 10 - 999 and *eee* = an element number between 0 - 999.
PLC-5/250	*Nffff:eeee*	*ffff* = an integer file between 10 - 9999 and *eeee* = an element number between 0 - 9999.

If you want to start your step description file at the end of the control file, you need to leave enough memory for the control file. The amount of memory used by the control file depends on the number of I/O that you control in the SDS.

We recommend that you use a separate integer file for the step description file.

Use the following table to determine the starting address of the Step Description File if you want the file to start at the address immediately following the control file.

Step Description File Address

If you have this number of I/O:	Then you must allow this number of words for your Control File in the PLC-5:	Then you must allow for this number of words for your Control File in the PLC-5/250:
8	68	58
16	68	58
32	68	58

For example, in the PLC-5, if your control file address is N10:0 and you are putting your step description file for an SDS with 8 I/O at the end of the control file, your step description file must start at N10:69.

Similarly, in the PLC-5/250, if your control file address is 1N10:0 and you are putting your step description file for an SDS with 8 I/O at the end of the control file, your step description file must start at 1N10:59.

3. Type your Step Description File address and press **[ENTER]**.

The system prompts you for the number of steps. The table below lists the number of steps you can enter per SDS instruction, depending on the number of I/O you have.

Number of Steps Per SDS Instruction

If you have this number of I/O:	Then you can enter this number of steps per SDS instruction in the PLC-5:	Then you can enter this number of steps per SDS instruction in the PLC-5/250:
8	76	250
16	45	250
32	23	232

4. Type the number of steps to be directed by the SDS instruction and press **[ENTER]**.

The system prompts you for the number of I/O you are using. Valid number of I/O are **8**, **16**, or **32**.

5. Type the number of I/O you are using and press **[ENTER]**.

The system prompts you for the Program File number. The program file number refers to the program file number of the SDS file in the online or offline program directory.

6. Type the Program File number and press **[ENTER]**.

The I/O Definition screen is displayed. If you have a PLC-5 processor, continue with "Entering or Modifying I/O Information" on page 4-14.

In the PLC-5/250 processor, the system prompts you for the Message Control Block address.

7. If you have a PLC-5/250 processor, type the Message Control Block address and press **[ENTER].**

The Message Control Block address must be entered in the following manner:

*0***MSG***X:X*

where:

- *0* is the Resource Manager global memory (must be set to zero)

- *X:X*

  message control block number (0-9999)

  file number (0-9999)

For example, 0MSG0:0 is a valid message control block address.

The I/O Definition screen is displayed (see below).

Entering or Modifying I/O Information

The inputs and outputs you enter into the I/O Defines on the I/O Definition screen are used by each step in the SDS instruction. You can enter logical addresses and symbols into the I/O Definition screen.

The following figure shows the screen you see if you are modifying I/O information. (If you are entering new information, you have additional function key options.)

Modify I/O Definition Screen (PLC-5/250)

```
       Smart Directed Sequencer I/O          Input Defines       Output Defines
       Definition for Control Block      0: I:001/16         0: O:000/04
                  N10:0                   1: I:001/15         1: O:000/01
                                          2: I:001/14         2: O:000/02
                                          3: IS:003/02        3:
       +=Ins Cmt==+      +=Adr Cmt==+     4: IS:003/03        4:
       |DRILL     |      |RETURNED L|     5:                  5:
       |MACHINE   |      |S         |     6:                  6:
       |HEAD 1    |      |          |     7:                  7:
       |          |      |          |
       |          |      |          |
       +==========+      +==========+

Operator Interface Station Addr : 77
Timebase for Step Timer         : 0.01
Port Number for Message         : 2




Press a key to change a parameter or <ENTER> to accept parameters.
>
Program    Forces:Disabled  Data:Decimal    Addr:Decimal  PLC-5/250 Addr 5
Station Timebas  Port            Documnt       Modify
Address                                        IO Addr
 F1      F2      F3           F5               F7
```

The **Ins Cmt** (Instruction Comment) window on the I/O Definition screen displays the instruction comment associated with the instruction in the ladder program. The **Adr Cmt** (Address Comment) window displays the address comment for the cursored address in the I/O Defines field.

The maximum number of possible inputs and outputs in the I/O Defines field correlates with the number of I/O you entered in the Number of I/O field when programming the SDS instruction.

Important: Consider carefully the order in which you assign I/O points in the I/O Defines field. The order of I/O assignments can make a significant difference in the performance of the DDMC32 system.

The order in which an SDS instruction checks I/O information is based on the equations assigned in a given step (the "current" step). The order of evaluation is as follows:

- single bit transitions — This includes all inputs that have an equation assigned to them as ON–> OFF or OFF–> ON

- combinatorial equations — This includes any operations that contain multiple inputs with either an AND or NOT operand

- timers — This includes any transitions that are generated by a timer (no inputs are used for this transition)

You can perform the following tasks from the I/O Definition screen:

If you want to:	Press this key:
Enter an operator interface station address.	[F1] - Station Address
Enter a new timebase for the step timer.	[F2] - Timebas
Enter the port number for the message. **(PLC-5/250 only)**	[F3] - Port
Display the Documentation screen for the SDS instruction.	[F5] - Documnt
Modify an I/O address at the cursored location.	[F7] - Modify IO Addr
Insert an I/O address at the cursored location.[1]	[F8] – Insert IO Addr
Delete an I/O address at the cursored location.[1]	[F9] – Delete IO Addr
Remove an I/O address at the cursored location.[1]	[F10] – Remove IO Addr

[1] These function keys do not appear on the screen if you have accepted edits once (for example, if you are modifying the instruction).

To insert or modify information in the I/O Definition screen, follow the procedure below.

1. If you want to change the Operator Interface Station Address:

    a. Press **[F1] - Station Address.**

    b. Type the number of the Data Highway Plus node (0-77) where you want the diagnostic messages sent, for example **77**, and press **[ENTER].**

    Important: If you want to send diagnostic messages to other operator interface stations, use the Message Instruction in 6200 Series software. For procedures on sending messages with the Message Instruction, refer to PLC-5 Programming Software Documentation Set (publication 6200-N8.001) or the PLC-5/250 Programming Software Documentation Set (publication 6200-N8.002).

    ---

2. If you want to change the step timer timebase from 10 milliseconds to 1 second, or vice versa, do the following:

    a. Press **[F2] - Timebas.**

    b. Enter the new timebase.

3. If you have a PLC-5/250 and you want to change the port number:

    a. Press **[F3] - Port.**

    b. Enter the port number. The following table shows the port number to enter for the specific link type.

    Important: The port number is not selectable on these PLC-5 processors:

    - PLC-5/20
    - PLC-5/30
    - PLC-5/40
    - PLC-5/11
    - PLC-5/40L
    - PLC-5/60
    - PLC-5/60L
    - PLC–5/80

Port Number Entries

For this link:	Enter this port number:
ASCII, DF1, Master, and Slave	1
port 2A, 2B for DH and DH+	2
port 3 for DH and DH+	3

4. If you want to alter an existing address or enter a new address in a list of I/O points:

    a. Press **[F7] - Modify IO Addr.** The system prompts you for an address.

    b. Type in your I/O address and press **[ENTER].** Valid entries include any logical address specified to the bit level, with the exception of indirect addresses.

    c. After entering or modifying an I/O address, cursor to the next field and repeat this step until you have completed all entries or changes.

5. After entering all your I/O addresses, press **[ESC]** to display the I/O Definition screen function keys, and then press **[ENTER]**.

    The system returns to the SDS instruction.

6. Press **[ENTER].**

    The system displays the Edit Rung screen.

Edit Rung Screen (PLC-5)

```
I                                                     DRILL                  I
I                                                     MACHINE                I
I                                                     HEAD 1                 I
I                                         +SDS------------------------+      I
I----------------------------------------+SMART DIRECTED SEQUENCER   +-(EN)-I
I                                         |Control File        N10:0|      I
I                                         |Step Desc. File     N11:0+-(ST) I
I                                         |Length                156|      I
I                                         |No. of Steps         12+-(ER) I
I                                         |Position/Step:          0|      I
I                                         |No. of I/O             8+-(ES) I
I                                         |Prog file number        3|      I
I                                         +--------------------------+      I



   Press a function key for desired editing function, or type a mnemonic.
   (file 2, rung 8)
   Program    Forces:None      Edits:None      Rung:Modify  PLC-5/25 Addr 1
   Branch          Append  Insert  Modify  Delete  Undel                Accept
     *              Instr   Instr   Instr   Instr   Instr                 Rung
    F1              F3      F4      F5      F6      F7                    F10
```

7. Press **[F10] - Accept Rung**.

Important: You **must** accept the rung to save the information you entered into the SDS instruction.

Documenting the SDS Instruction

The SDS instruction provides a documentation function that lets you describe the instruction and its associated addresses. The documentation function also lets you assign symbols to addresses.

To document your SDS, Press **[F5] - Documnt** from the I/O Definition screen.

The system displays the SDS Instruction Documentation screen.

SDS Instruction Documentation Screen (PLC-5)

```
       Smart Directed Sequencer I/O        Input Defines      Output Defines
       Definition for Control Block     0: I:001/16        0: O:000/04
                  N10:0                 1: I:001/15        1: O:000/01
                                        2: I:001/14        2: O:000/02
                                        3: B3/2            3:
    +=Ins Cmt==+     +=Adr Cmt==+       4: B3/3            4:
    |DRILL     |     |RETURNED L|       5:                 5:
    |MACHINE   |     |S         |       6:                 6:
    |HEAD 1    |     |          |       7:                 7:
    |          |     |          |
    |          |     |          |
    +==========+     +==========+

Operator Interface Station Addr : 77

Timebase for Step Timer        : 0.01



Press a function key.

Program    Forces:None     Data:Decimal   Addr:Decimal PLC-5/25 Addr 1
         Instr  Address               Modify Remove          Display Save &
         Comment Comment              Symbol Symbol          Symbol Contnue
           F2      F3                   F6     F7               F9    F10
```

From SDS Instruction Definition screen you can perform the following documentation tasks:

If you want to:	Press this key:
Activate the cursor in the instruction comment window and display the Instruction Comment Editor.	[F2] - Instr Comment
Activate the cursor in the address comment window and display the Address Comment Editor.	[F3] - Address Comment
Assign a symbol to an address or change an existing symbol.	[F6] - Modify Symbol
Remove the symbol from the current address.	[F7] - Remove Symbol
Save your work in the data base. If you are editing off line, the archive file is updated and the comment and symbol files are saved. If you are editing on line, only the comment and symbol files are saved.	[F10] - Save & Contnue

Editing Instruction and Address Comments

To activate the cursor in the instruction comment window:

1.   From the SDS instruction screen:

- Press **[F2] - Instr Comment** to edit instruction comments. The system displays the Instruction Comment Editor screen, below.

- Press **[F3] - Address Comment** to edit address comments. The system displays the Address Comment Editor screen, next page.

Instruction Comment Editor Screen (PLC-5)

```
       Smart Directed Sequencer I/O        Input Defines      Output Defines
       Definition for Control Block     0: I:001/16        0: O:000/04
              N10:0                     1: I:001/15        1: O:000/01
                                        2: I:001/14        2: O:000/02
                                        3: B3/2            3:
      +=Ins Cmt==+     +=Adr Cmt==+     4: B3/3            4:
      |DRILL     |     |FULL      |     5:                 5:
      |MACHINE   |     |DEPTH LS  |     6:                 6:
      |HEAD 1    |     |          |     7:                 7:
      |          |     |          |
      |          |     |          |
      +==========+     +==========+

Operator Interface Station Addr : 77
Timebase for Step Timer         : 0.01




Enter instruction comment for :  SDS,N10:0

Program     Edit mode:Insert          Col:1   Line:1       PLC-5/25 Addr 1
Delete    Undel  Delete   Undel  Delete   Undel          Accept/
Comment Comment  Line     Line   Word     Word            Exit
  F1      F2      F3        F4     F5       F6              F8
```

Address Comment Editor Screen (PLC-5)

```
        Smart Directed Sequencer I/O           Input Defines        Output Defines
        Definition for Control Block        0: I:001/16          0: O:000/04
                N10:0                        1: I:001/15          1: O:000/01
                                             2: I:001/14          2: O:000/02
                                             3: B3/2              3:
        +=Ins Cmt==+      +=Adr Cmt==+       4: B3/3              4:
        |DRILL     |      |FULL      |       5:                   5:
        |MACHINE   |      |DEPTH LS  |       6:                   6:
        |HEAD 1    |      |          |       7:                   7:
        |          |      |          |
        |          |      |          |
        +==========+      +==========+

Operator Interface Station Addr : 77
Timebase for Step Timer         : 0.01




Enter address comment for :  I:001/14

Program    Edit mode:Insert           Col:1   Line:1      PLC-5/25 Addr 1
Delete    Undel  Delete   Undel  Delete   Undel             Accept/   Next    Prev
Comment  Comment  Line     Line   Word     Word               Exit   Address Address
  F1       F2       F3       F4     F5       F6                 F8       F9      F10
```

2. Edit the instruction or address comment. The function keys for both Editor screens are the same, except that the Address Comment Editor screen has function keys for moving the cursor to the next or previous address:

If you want to:	Press this key:
Delete the current comment.	[F1] - Delete Comment
Re-insert the last deleted comment where the cursor is.	[F2] - Undel Comment
Delete the line the cursor is on from the current comment.	[F3] - Delete Line
Re-insert the last deleted line from a comment.	[F4] - Undel Line
Delete the word the cursor is on from the current comment.	[F5] - Delete Word
Re-insert the last deleted word from a comment.	[F6] - Undel Word
Save the current comment and return to the I/O Definition screen.	[F8] - Accept/Exit
For Address Comments Only: Save the current comment and/or move the cursor to the next address.	[F9] - Next Address
Save the current comment and/or move the cursor to the previous address.	[F10] - Prev Address

3. When you are finished, press **[F8] - Accept/Exit**.

Configuring the SDS Instruction

Once you have entered your I/O information into the I/O Definition screen and accepted the rung, you are ready to configure steps in the SDS instruction. To do this, you must first access the Step Directory.

Using the Step Directory

The Step Directory is a list of all the steps in an SDS instruction and is accessed from the Ladder Editing screen. The number of available steps in the directory correlates to the number of steps you entered in the Number of Steps field when programming the SDS instruction.

If you are configuring your SDS instruction, the Step Directory contains Step 0 (the Initialization step) and an entry for each step. Each time you configure a new step, the Step Directory adds that step to its list by displaying a step's title.

To access the Step Directory:

1. Cursor to the SDS instruction using the arrow keys.

2. Press **[F10] – Edit**.

3. Press **[F2] - I/O Edit.**

    The system displays the Step Directory.

Step Directory (PLC-5)

```
+================= Step Directory for DRILL MACHINE HEAD 1 ==================+
|                                                                           |
|    Control File: N10:0              Step Description File: N10:102         |
|                                                                           |
|    Step #      Step Name                Step #      Step Name             |
|      0          INITIALIZATION                                            |
|      1          LOADING                                                   |
|      2                                                                    |
|      3                                                                    |
|      4                                                                    |
|      5                                                                    |
|      6                                                                    |
|      7                                                                    |
|      8                                                                    |
|      9                                                                    |
|     10                                                                    |
+===========================================================================+


 Press a function key or enter step number.
 STEP 10
 Program          edit mode            Current Step 0   PLC-5/25 Addr 1 Proc Name
 Change  Update   Exit         Edit    Extnded             I/O           Accept
  Mode   Msg DB                Step     Edit              Monitor        Edits
  F1      F2       F3           F5       F6                 F8            F10
```

You can perform the following functions from the Step Directory:

If you want to:	Press this key:
Change between remote/run program mode and test mode.	[F1] - Change Mode
Update the internal SDS data base documentation for diagnostic messages.	[F2] - Update Msg DB
Exit the configuration utility. (This key is active only when the Step Directory is your point of entry into the SDS instruction.)	[F3] - Exit
Configure or edit your combinatorial or transitional equations	[F5] - Edit Step
Display the Extended Edit screen.	[F6] – Extnded Edit
Display the I/O Monitor screen. (Refer to Chapter 8 - "Debugging Your DDMC32 System" for information on the I/O Monitor screen.)	[F8] - I/O Monitor
Accept all entries/edits. The system prompts you to confirm your decision.	[F10] - Accept Edits
Display error list. [1]	[F9] -Display Err Lst

[1] [F9] is displayed **only** as a result of pressing [F10] - Accept Edits when errors exist in the configuration.

Configuring or Editing Steps

From the Step Directory, cursor to the appropriate step and press
[F5] - Edit Step (you cannot edit Step 0). You see the Edit Step screen as shown below.

Edit Step screen (PLC-5)

```
   STEP 1     LOADING          TIMER=5.00s         STEP  11    MSG:ON

 No   Input ID          Equation    Destination    No   Output ID        State
  0 PART IN POSITION    ON -> OFF      **STEP 2     1   VALVE 4          OFF
  1 CLAMP LS1                                       2    CLAMPS OPEN     ON
  2 CLAMP LS2                                       3   CLAMPS CLOSED    OFF
  3 CLAMP LS3                                       4    SOLENOID        LAST
  4 CLAMP LS4                                       5   LIGHT            LAST
  5 HAND                                            6   MOTOR 2          ON
  6 AUTO
  7 JOG PB
  8 PERMISSIVE






 Press a function key.
 Enter destination step number or 'INIT' >
 Prog       edit mode                           5/25 Addr 5   SDSTEST
  Equatn Display  Step     Step    Edit    Step    Msg    Equatn Output  Marked
   List   Symbol  Name     Type    Step    Timer   Off    Editor State   Exit
    F1      F2      F3       F4      F5      F6      F7      F8     F9      F10
```

You can perform all of the tasks necessary to configure steps from the Edit Step screen:

If you want to:	Press this key:
Display all equations related to a particular step and enter your equations.	[F1] - Equatn List
Toggle between address comment, symbolic name, or logical address of I/O. The function key always displays the next format; for example, if address comments are being displayed, then [F2] reads Display Symbol.	[F2] - Display Comment/Symbol/LogAdr
Enter or modify step name. Step name may be up to 20 characters long.	[F3] - Step Name
Select between normal step label or error step label. Normal is displayed as STEP; error is displayed as ERSTEP. See chapter 7, "Configuring Diagnostic Messages" for details regarding selection of this field as it relates to diagnostics.	[F4] - Step Type
Switch to another step without leaving the Edit Step screen. System prompts you for step you want to edit.	[F5] - Edit Step
Enter or change the timer preset value and destination step of step timer. The step timer can be used as a watchdog timer to ensure an input transition occurs within a specified time (by entering WARN as a destination step), or as a dwell timer. You can enter up to 10 characters in the step timer field. Valid ranges for step timers are: – time base 1.0 (32767 seconds) – time base 0.01 (327.67 seconds)	[F6] - Step Timer
Select between message ON and message OFF on the operator interface display. Function key displays the opposite function. The function is normally off for a normal step and on for an error step to generate a message.	[F7] - Msg On/Off
Switch between the input transitions of ON->OFF, OFF->ON, AND, or NOT. Function key is active only when cursor is in input transition field.	[F8] - Equatn Editor
Switch between output state of ON, OFF, and LAST. LAST maintains the last state of the output. This key is active only when the cursor is in the output state field.	[F9] - Output State
Select the one valid exit out of the step; that is, select the "normal" path for the operation.	[F10] – Marked Exit

See the following sections for information on configuring or editing transitional and combinatorial equations:

If you want to:	See page:
Configure or edit transitional equations	4-25
Configure or edit combinatorial equations	4-27

Configuring or Editing Transitional Equations
To edit or configure steps based solely on transitional equations, start at the Edit Step screen on page 4–23:

1. Press **[F3] - Step Name** from the I/O Edit screen.

    The system prompts you to type in the name for your step. (When you enter the step name, the Step Directory is automatically updated to contain that step name.)

    Important: When assigning names to your steps, use names that will fit into your expected diagnostic message layout. The step name is used for the message generation and should be as descriptive as possible of the operation being performed in that step. Think about how you intend to present diagnostic messages in DDMC32 and assign messages accordingly. For example:

Step Name:	Possible Message:
WAITING FOR PART	LIMIT SWITCH 1 is ON while **WAITING FOR PART**
MOVING PART ON CONVEYOR	LIMIT SWITCH 1 turned ON while **MOVING PART ON CONVEYOR**

    ---

2. Type your step name and press **[ENTER]** to accept it.

    The system returns you to the Edit Step screen.

3. Press **[F4] - Step Type**.

    This key toggles the step between a normal step and an error step (see the upper left corner of your screen). Select the appropriate option.

4. Enter the equation:

    a. Cursor to the equation field and press **[F8] - Equatn Editor**. (You see the transitional equation in the lower left corner of your screen if you are editing. If you are configuring the step for the first time, the lower left corner is empty.)

    b. Press **[F8]-ON->OFF** or **[F9]-OFF->ON** to set the equation.

5. Cursor to the destination field. You are prompted:

    ```
    Enter destination step or 'INIT' >
    ```

    Type the destination step and press **[ENTER].**

6. Cursor to the output field and press **[F9] - Output State**.

   This key toggles the cursored output state which will be applied for control between ON, OFF, and LAST (no changes).

7. Press **[F6] - Step Timer**.

   The system prompts you to enter your step timer preset value and your destination step number. The destination step number can be:

   ▪ a step

   ▪ an error step

   ▪ a warning (The instruction displays a Warning message without stopping the program execution. For example, a warning message can be displayed to notify the operator that a transition is taking too long.)

   ▪ INIT (Initialize). *Do not* confuse INIT with Step 0 (Initialization) on the step directory. These steps react differently, as noted below:

INIT vs. Step 0

If you specify this destination:	This happens:
INIT	Outputs remain in their current state. The step timer is disabled. For two program scans and beginning at Step 1, the system searches all normal steps with defined input transitions, looking to match current input states with expected input states. When current inputs match expected inputs, that state is entered. If no match is found in two program scans, the program enters Step 0. **Important:** INIT can not enter an error step or step with no defined input transitions.
Step 0	All outputs are turned off. Starting at Step 1, the system searches all steps with defined input transitions, looking to match current input states with expected input states. When current inputs match expected inputs, the program enters that step; otherwise it stays in Step 0. You cannot configure Step 0. **Important:** Step 0 can enter a status step or error step, unless the step has no defined input transitions.

> ⚠ **ATTENTION:** Because the instruction does not recognize transitions when in INIT, outputs may stay on for up to 2 program scans.

8. Press **[F7] - Msg On/Off.**

This key is a toggle key which allows you to choose whether or not you want the message related to this step to appear on the operator interface display.

Important: If you do not specify information for a field, it is assigned a default setting. Defaults settings for fields are:

This setting:	Has this default:
outputs	off
type of step	normal step
destination step	timer destination step
timer	0.00 (disabled)
messaging	off

Configuring or Editing Combinatorial Equations

With the addition of the combinatorial function, the step configuration utility lets you use AND and NOT functions, in addition to the traditional ON>OFF and OFF>ON transitions. This lets you:

- enter an equation that will solve steady state conditions and expressions

- select the traditional transition conditions

Important: The order in which you configure your steps is important. Step assignment should reflect as closely as possible the order that operations occur on the particular machine (e.g. step 1 — machine startup, step 2 — first machine operation, step 3 — second machine operation, etc.) This will help you organize your SDS instruction in a format that can be understood at a later date if troubleshooting is necessary.

More important than organizational considerations is the functional impact that order has on the SDS instruction. By logically presenting your steps in order of machine operation, you will avoid going to improper destinations when step destinations are zero or initialize.

To configure or edit combinatorial equations, you must enter some additional information not needed in transitional equations:

1. Access the Edit Step screen, seen below. If you are editing, cursor to EQ*x* (*x* is equal to the number of the equation within the step); if you are adding the equation, the equation field is blank. Press **[F1]-Equatn List.**

    The system displays the Equation List screen seen below:

Equation List Screen (PLC-5)

```
STEP 4     CLAMPING

Eq#                                        |Equation
 1     0    ON->OFF
 2     1    OFF->ON
 3     2    EQ1
 4     3









Press a function key.

Rem RUN                                          5/25 Addr 1 DB_TEST
 Equatn                    Cancel               Toggle    Edit
  Zoom                     Equatn               Equatn   Equatn
   F1                        F5                   F9       F10
```
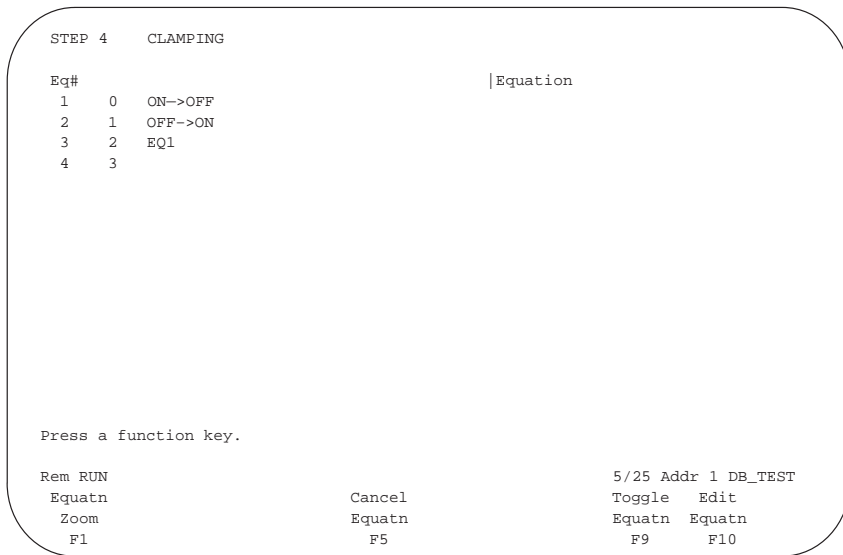
From the Equation List screen, you can perform the following tasks:

If you want to:	Press this key:
View a large equation which will not fit in the equation list..	[F1] - Equatn Zoom
Remove an equation from the equation list.	[F5] - Cancel Equatn
View the equation in an alternate form (abbreviated or expanded).	[F9] - Toggle Equatn
Edit an existing or enter a new equation.	[F10] - Edit Equatn

2.   Press **[F10] - Edit Equatn.**

The system displays the Equation Editor screen, below. If you are editing
an existing equation, that equation appears in the lower left corner of your
screen. If you are configuring the equation for the first time, the lower
left corner is empty.

Equation Editor Screen (PLC-5)

```
 STEP 4    CLAMPING
                                         +=======================+
 Eq#                        |Equation    | 1 I:000/01            |
  1    0&4                               | 2 I:000/02            |
  2                                      |                       |
  3                                      |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         |                       |
                                         +=======================+



 Press a function key.
 0&4
 Program                                          5/25 Addr 1  DB_TEST
 Select  Display        &            !        ON>OFF  OFF>ON  Accept
  Input  Symbol        AND          NOT                        Equatn
   F1      F2          F4           F6          F8      F9      F10
```
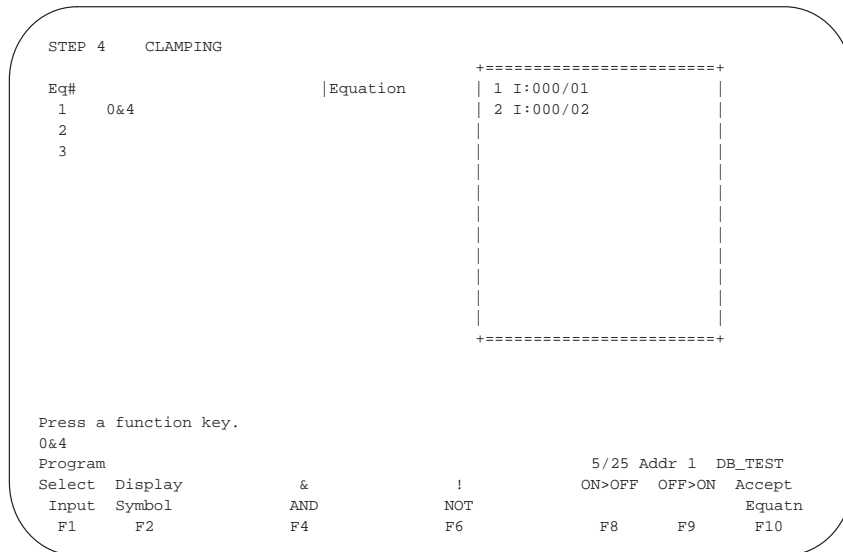
3.   Cursor to an input in the selection window that you want to place in your
      equation and press **[F1] - Select Input.**

All available input operands appear in the selection window. As you
select an input, it disappears from this window.

The system displays the input you select in the lower left corner of the
screen.

4.   Select the operator you want to use in your equation:

If you want to:	Do this:
combine 2 or more inputs	1. Select an input and press **[F1]-Select Input** 2. Press **[F4]-AND**. 3. Select the next input and press **[F1]-Select Input** (See the Important note on page 4-30.)
negate an input	1. Combine the inputs as shown above. 2. Place the cursor on the input you wish to negate and press **[F6] - NOT**.

Important: Since it is concerned with state only, the NOT function is used to negate the state associated with that particular input. For example: **!1&4** means that if the state in equation 1 is NOT true AND the state in equation 4 is true, then proceed to the destination step.

The system displays the operator in the window on the lower left corner of the screen, next to the input, forming your equation as you continue.

Important: The following procedure is another method by which you can AND your inputs. From the Equation Edit screen:

- Press **[F1] - Select Input** to select the first input of your equation.

- Press **[F1] - Select Input** again to select your second input.

Using this method, the AND is automatically placed between your inputs.

5. Continue selecting inputs and operands until your equation is complete.

The following conditions apply to every equation you enter:

- If you want to use a single input in more than one equation within a single step, you need to duplicate it in the I/O Defines on the I/O Definition screen.

- Inputs do not have to be contiguous. The order in which each input occurs or goes true is not significant as long as the Boolean expression is fulfilled.

- More than one expression can be entered and mixed with transitions to create logical OR functions.

- Up to four logical AND combinations can be defined in an 8 input SDS, which would be the equivalent Boolean of A+B or C+D or E+F or X+Y. Up to eight AND conditions can be defined for a 16 or 32 I/O SDS.

6. When you have finished entering your equation, press **[F10] - Accept Equation.**

Important: After you have accepted an equation, the label `EQx` (where *x* is equal to the number of the equation within the step) appears on the Step Edit screen.

---

7. Press `[ESC]` to return to the Equation List screen.

    On the Equation List screen, it is possible to view your equation in two different forms:

    - Abbreviated form — shows the input numbers and operands. For example: `0&1&2`

    - Expanded form — uses input address comments. For example: `Start/Stop = 1 AND All Sta.s Returned = 1 AND Start Auto = 1`

    You can use the `[F9] - Toggle Equatn` key from the Equation List or Equation Zoom screens to view the different forms of your equation.

8. Press `[ESC]` again and the system returns you to the Edit Step screen.

Exiting the SDS Instruction

Once you have configured all of your steps, you can save and exit the SDS instruction.

To save the SDS instruction:

1. Press `[ESC]`.

    The system displays the Step Directory.

2. Press `[F10] - Accept Edits`.

    The system prompts you to confirm your decision.

3. Press `[F8] - Yes`.

    If your configuration is correct, the system returns to the Step Directory. Continue with Step 4.

If your configuration contains errors, the system displays an error list that describes each error in the configuration. To correct errors:

a.   Press **[ESC]**.

The system displays the Step Directory, which now contains **[F9] - Display Err Lst**. To view the list at any time, press **[F9]**.

b.   Reconfigure steps from the Edit Step screen as needed to correct the errors, and repeat Steps 1, 2, and 3. Refer to the chapter entitled, "Debugging Your DDMC32 System" for correcting step configuration errors.

Important: If this is a new SDS instruction, or if you updated an existing instruction (changed an address, comment, or step name), press **[F2] – Update Msg DB**   (update message database).

The system flashes a   Working...   prompt, indicating that a 6200 database export file is being created. (Later, you will need to import this file.) The processor name is used as the name of the export file with an extension of **.SDS**. For example, if your processor name is DRILL, the system creates an export file DRILL.SDS. Export files are stored in the directory:

C:\IPDS\ARCH\PLC5 or **C:\IPDS\ARCH\PLC5250**

4.   Press **[F3] - Exit** to exit the SDS instruction configuration utility.

If your edits produced errors in your configuration, the system prompts you to save your work.

5.   Press **[F8] - Yes**.

The system displays the Ladder Editor main menu. If you have other SDS instructions to configure or edit, you can do so as described in the "Enter or Modify SDS Instructions" section in this chapter. If not, you may exit the program as described in the next chapter.

Copying the SDS Instruction Database

After you update the message database, you may want to copy it to disk to be used at another workstation. To do this:

1. Insert a disk into the disk drive.

2. Exit to DOS.

3. From any directory on the hard drive, type:

ATTRIB +A \IPDS\ARCH\PLC5**_processor name_.SDS /S** and press **[ENTER].**

This command turns on the archive bit of all files so the next command knows which ones to copy.

4. Type:

XCOPY \IPDS\ARCH\PLC5**_processor name_.SDS** _disk drive_**:\IPDS\ARCH\PLC5**_processor name_**.SDS /S/M**

and press **[ENTER].**

For example:

XCOPY \IPDS\ARCH\PLC5\PROC1.SDS A:\IPDS\ARCH\PLC5\PROC1.SDS /S/M

and press **[ENTER].**

The system displays all the files being transferred.

The **/M** in the **xcopy** command (see above) turns off the archive bit after a file is copied. If you fill up one disk during the copying process, re-execute step 3 and the copying process on the next disk will pick up where you left off.

5. Insert the disk in the system to which you are transferring the database.

6. Type:

XCOPY _disk drive:_**\IPDS\ARCH\PLC5**_processor name_**.SDS** _hard drive:_ **/S**

and press **[ENTER].**

For example:

XCOPY A:\IPDS\ARCH\PLC5\PROC1.SDS C: /S and press **[ENTER].**

The system now copies the database to your disk.

Editing and Copying SDS Instructions

To save time when configuring instructions, you may want to copy information from one instruction to another. To do this, you can edit and copy information from steps that you have already configured. You do this from the Extended Edit screen.

Editing Steps

To access the Extended Edit screen (next page) press **[F6] – Extnded Edit** from the Step Directory.

Extended Edit Screen (PLC-5)

```
+================= Step Directory for DRILL MACHINE HEAD 1 ==================+
|                                                                           |
|    Control File: N10:0                    Step Description File: N10:102   |
|                                                                           |
|    Step #      Step Name                    Step #      Step Name         |
|     0    INITIALIZATION                      11    STOPPED                 |
|     1    READY                               12                           |
|     2    READY TO ADVANCE                                                 |
|     3    ADVANCING                                                        |
|     4    ADVANCED                                                         |
|     5    AT FULL DEPTH                                                    |
|     6    FULL DEPTH DWELL                                                 |
|     7    FWD & RETURNING                                                  |
|     8    ADV'D & RETURNING                                                |
|     9    RETURNING                                                        |
|    10    ERROR                                                            |
+===========================================================================+


 Press a function key or enter step number.
 STEP 1
 Program        edit mode                Current Step 0   PLC-5/25 Addr 1
  Clear    Copy    Copy    Change
  Step     Step   Config  Config
   F1       F2      F3      F4
```

You can perform the following tasks from the Extended Edit screen.

If you want to:	Press this key:
Remove the configuration of the cursored step.	[F1] - Clear Step
Copy an existing step to the cursored location. The system prompts you to enter the step number of the existing step from which you want to copy.	[F2] - Copy Step
Copy the configuration of an SDS instruction to a file. You may want to do this if you are using an SDS instruction as a template for other SDS instructions.	[F3] - Copy Config
Retrieve an existing SDS configuration from a file into this instruction.	[F4] - Change Config

Copying an SDS Configuration to a File

To copy an SDS configuration to a file:

1. Press **[F3] – Copy Config** from the Extended Edit screen.

The system prompts you for a file name. The file name can be up to 8 characters.

2. Type in the file name.

The system adds a .SLS extension to the file name. For example, if the file name is DRILL, the system changes it to DRILL.SLS.

Comments for I/O are not copied as part of this file.

Copying an SDS Configuration File to a Disk

You can copy SDS configurations to a disk to transfer to other workstations. To copy an SDS configuration to a disk:

1. Insert a disk into the disk drive.

2. Exit to DOS.

3. From any directory, type:

copy *hard drive***:\IPDS\ARCH\PLC5***name of file***.SLS** *disk drive***:\IPDS\ARCH\PLC5***name of file***.SLS**

and press **[ENTER].**

For example,

copy C:\IPDS\ARCH\PLC5\DRILL.SLS A:\IPDS\ARCH\PLC5\DRILL.SLS

and press **[ENTER].**

If you want to copy all of the files, you can replace *name of file* with an asterisk (*).

4. Insert the disk into the system to which you are transferring the configuration.

5. Type:

```
copy disk drive:\IPDS\ARCH\PLC5\name of file.SLS hard drive:\IPDS\ARCH\PLC5\name of file.SLS
```

and press [ENTER].

For example,

```
copy A:\IPDS\ARCH\PLC5\DRILL.SLS C:\IPDS\ARCH\PLC5\DRILL.SLS
```

and press **[ENTER].**

The system now copies the SDS configuration file to your disk.

Copying an Existing SDS Configuration from a File

Important: To copy an existing SDS configuration from a file into another instruction, the number and order of inputs in the saved configuration must match exactly the number and order of inputs in the new SDS into which it is being copied.

If they do not match, an error is reported when you accept the edits. You see a message telling you to clear the step (you cannot edit invalid steps).

The PLC-5/250 allows 32 bits for the timer preset value; the PLC-5 allows only 16. If you are copying a PLC-5/250 configuration into a PLC-5 configuration, timer preset accuracy is limited to 16 bits. The other 16 bits are not lost by the PLC-5, they are just not used.

To retrieve an SDS instruction from a file:

1. Press **[F4] – Change Config** from the Extended Edit screen.

The system displays the Change Configuration screen (below).

Change Configuration Screen (PLC-5)

```
  DRILLSDS.SLS  06-08-90       09:35:26




                                        +--------------------------------+
                                        |DRILL MACHINE HEAD 1            |
                                        |NUMBER OF STEPS: 12             |
                                        |NUMBER OF IO: 8                 |
                                        +--------------------------------+



  Use up or down arrow to choose a configuration and RETURN to select.

  Program                                              PLC-5/25 Addr 1
```
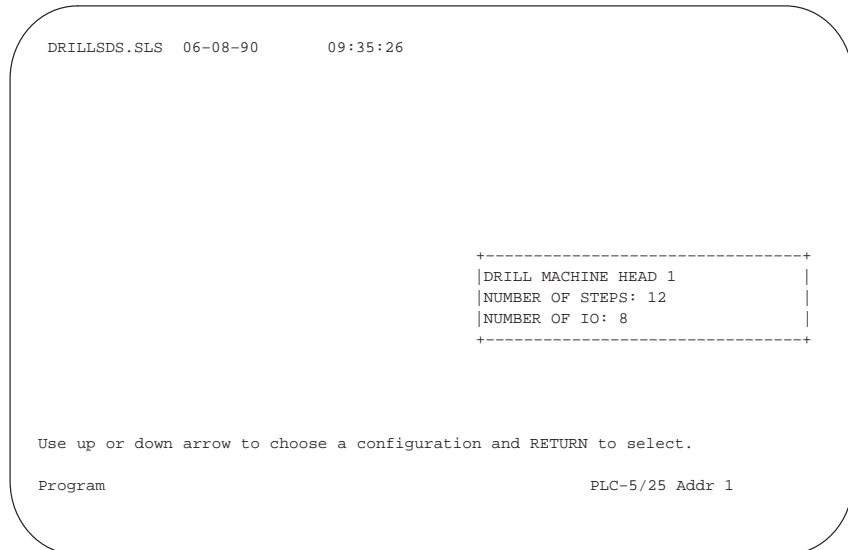
2. Cursor to the file you want to copy and press **[ENTER]**.

If the file contains too many steps or I/O, the system displays a message telling you that you cannot copy the configuration. Otherwise, the configuration is copied.

The system returns to the Step Directory screen.

What to Do Next

Once you have configured all of your steps, save the SDS instruction. Chapter 5 describes how to configure a DFA instruction. Chapter 6 describes how to create and/or update a message database with the documentation you import.

Notes:

Configuring DFA Instructions

What this Chapter Contains

Read this chapter to learn about the DFA instruction and procedures that describe:

- programming the DFA instruction

- configuring the DFA instruction

Important: You can use the DFA instruction in either the PLC-5 processor or the PLC-5/250 processor. There are some minor differences in the procedures for programming and configuring the instruction, depending on which processor you are using. We note these differences where applicable.

This chapter contains the following sections:

Section:	Page:
Diagnostic Fault Annunciator Overview	5-2
Programming the DFA Instruction	5-2
Documenting the DFA Instruction	5-12
Configuring Messages for the DFA Instruction	5-16
Exiting the DFA Instruction	5-18
What to do Next	5-18

Diagnostic Fault Annunciator Overview

The Diagnostic Fault Annunciator (DFA) instruction is a monitoring only instruction; that is, it monitors inputs you define, but it cannot control outputs. Valid inputs can be:

- storage points, such as binary bits

- counter / timer done bits

- discrete outputs (real or logical)

- any valid bit address

- fault bits set by another device (like an IMC motion controller) or by ladder logic

The following figure shows a DFA instruction in a ladder program.

A DFA Instruction (PLC-5/250)

```
                                              ASSEMBLY
                                              MACHINE

                                  ┌─ DFA ─────────────────────────┐
                                  │ DIAGNOSTIC FAULT ANNUNCIATOR   │──(EN)─
                                  │ Control File          1N10:0   │
                                  │ No. of I/O                16   │──(ER)─
                                  │ Program file number        1   │
                                  │ Msg Control Block   0MSG0:0    │
                                  └────────────────────────────────┘
```
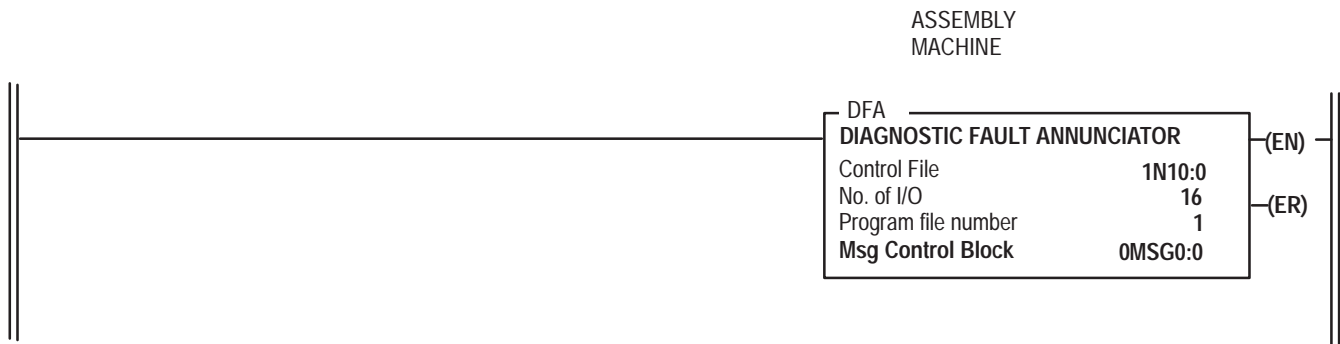
If you currently have diagnostics programmed in ladder logic, you can use the DFA instruction to generate messages when a fault occurs. In addition, you can create other types of operational and diagnostic messages with the DFA instruction, such as tool change messages and operating instructions.

Programming the DFA Instruction

Once you have determined where you want to apply the DFA instruction, you can enter it into your ladder program and configure the instruction. You perform the following tasks to program the DFA instruction:

- download the DFA CAR

- enter the DFA instruction

- enter the configuration information

- enter I/O information

To enter the DFA instruction into your ladder program:

1. Access the PLC-5 or PLC-5/250 Programming Software main menu (below) from the Allen-Bradley Main Menu interface.

Programming Software Main Menu (PLC-5)

```
+======================== PLC-5 PROGRAMMING SOFTWARE ========================+
|                                                                            |
|                      A 6200 Series Software Product                        |
|                                                                            |
|Copyright 1986, 1987, 1988, 1989, 1990, 1991, 1992 Allen-Bradley Company, Inc |
|                          All Rights Reserved                               |
|                                                                            |
|                             Release 4.3                                    |
|                                                                            |
|   This software is licensed to:  Company    Allen-Bradley Co.              |
|                                  Location   747 Alpha Drive                |
|                                             PSP Engineering                |
|                    Serial Number:  ZZ0AA0PP                                |
+============================================================================+
| Fri June 14, 1992                                              9:39:09 am  |
+----------------------------------------------------------------------------+
| Terminal Address: 77    Current Device: 1784-KT (DH+)      PLC Address:  1 |
+============================================================================+

Press a function key


Online  Online  Offline Offline   Who   Sftware  File     Reports Compare  Exit
Program Configr Program Configr           Configr Utils                    System
  F1      F2      F3      F4      F5      F6      F7        F8      F9      F10
```

2. Press **[F1] - Online Program.**

The system displays the online program directory:

Program Directory (online PLC-5)

```
+= PROGRAM DIRECTORY FOR PROCESSOR: SDSC5 =======================[ ONLINE  ]===+
|    File            Name            Type              Size(words) |
|-----------------------------------------------------------------------------|
|     0                             system                 10      |
|     1                             undefined               0      |
|     2                             ladder                 67      |
|     3         DFA5                custom routine        223      |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
|                                                                  |
+=============================================================================+

Press a function key or enter file number or name.
>
Program                PLC-5/25 Series A  Revision H    5/25 Addr 1  SDSC5
  Proc    Save   Return  Change    Who   Memory                Monitor
Functns Restore to Menu Station Active    Map                   File
  F1      F2      F3      F4      F5      F6                     F8
```

If you are configuring a new program, you need to download the DFA CAR file. If not, go to "Entering or Modifying a DFA Instruction" on page 5-5.

Download the DFA CAR file

Important: To download the DFA CAR file you must be in online Program mode.

To download the DFA CAR file into your program, do the following steps:

1.   Press **[F2] - Save Restore**.

The system displays the Save Restore function keys.

2.   Press **[F4] - Restore Program.**

The system displays a window containing a file directory of a specific type (see the figure below).

File Directory Window (PLC-5)

```
+= PROGRAM DIRECTORY FOR PROCESSOR: += D:\IPDS\ARCH\PLC5\*.CAR =============+=+
|       File            Name        |    Name     Size     Date     Time   | |
|-----------------------------------|--------------------------------------|-|
|        0                          |  DFA5        936   9-06-91  10:11a  | |
|        1                          |  SDS5       5672   9-06-91  10:10a  | |
|        2                          |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
|                                   |                                      | |
+===================================+======================================+=+

Press a function key or enter file name or move cursor to select file.
>
Program                PLC-5/25 Series A  Revision H     5/25 Addr 1  SDSC5
 Begin                                    Define  Select   Save   Fl Conv
Restore                                   Dirctry  Type   Config  Utility
  Fl                                        F7      F8      F9      F10
```

3.   Press **[F8] - Select Type** until the CAR directory appears in the file directory window.

    4.   Cursor to the desired CAR file.

Important: The program file number for the DFA file must be different than that of the SDS file.

---

    5.   Enter the CAR file:

      If you are using a PLC-5:

    a.   Press `[F1] - Begin Restore.`

        The system prompts you to enter a file number.

    b.   Type the file number and press `[ENTER]`.

        The system returns to the Program Directory.

      If you are using a PLC-5/250:

    a.   Press `[F1] - Begin Oper.`

        The system prompts you to enter a program descriptor.

    b.   Type the program descriptor, for example, *1CAR0*, and press `[ENTER].`

        In the program descriptor, the first number refers to the number in the thumbwheel window on the logic processor (in this case, 1). A logic processor runs control logic, which controls steps, transitions, processor input interrupts, selectable timed interrupts, and independent background programs.

        CAR refers to the type of file; *0* refers to the program file to download the CAR into.

        The system returns to the Program Directory.

Enter or Modify a DFA Instruction

To enter or modify DFA instruction in your ladder program:

1.   Cursor to the file you want to edit in the Program Directory and press `[F8] - Monitor File.`

The system displays your ladder program and the Ladder Editor main menu.

2.   Cursor to the rung where you want to position the DFA instruction.

If you are modifying an existing rung, cursor to the DFA rung.

3.   Press **[F10] - Edit.**

The system displays the Ladder Editing screen.

4.   If you are:

- editing an existing rung, press **[F5] - Modify Rung**.

- entering a new rung, press **[F4] - Insert Rung**.

The system displays the Edit Rung screen.

5.   If you are:

- changing an existing instruction, press **[F5] - Modify Instruction**.

- entering a new instruction, press **[F4] - Insert Instruction**.

The system prompts you for the instruction you want to add.

6.   Type **DFA**, and press **[ENTER]**. (If you are modifying an existing instruction, DFA already appears at the prompt.)

Important: As an alternate method of entering the instruction, you may:

- Press **[F10] - Others**.

- Press **[F9] - Seqncer** from the Instruction Classes function keys.

- Press **[F5] - DFA** from the Sequencer function keys.

The system displays the DFA instruction (see the figure below).

DFA Instruction

```
|                                         +DFA------------------------+    |
+----------------------------------------+DIAGNOSTIC FAULT ANNUNCIATOR+-(EN)-+
|                                        |Control File                |    |
|                                        |No. of I/O             +-(ER)-|
|                                        |Program File No.            |    |
|                                        +--------------------------+    |
|                                                                         |
+----------------------------[END OF FILE]--------------------------------+
|                                                                         |




Enter the operand.
Enter the Control File address>
Program    Forces:Disabled  Edits:None                    PLC-5/25 Addr 5
```
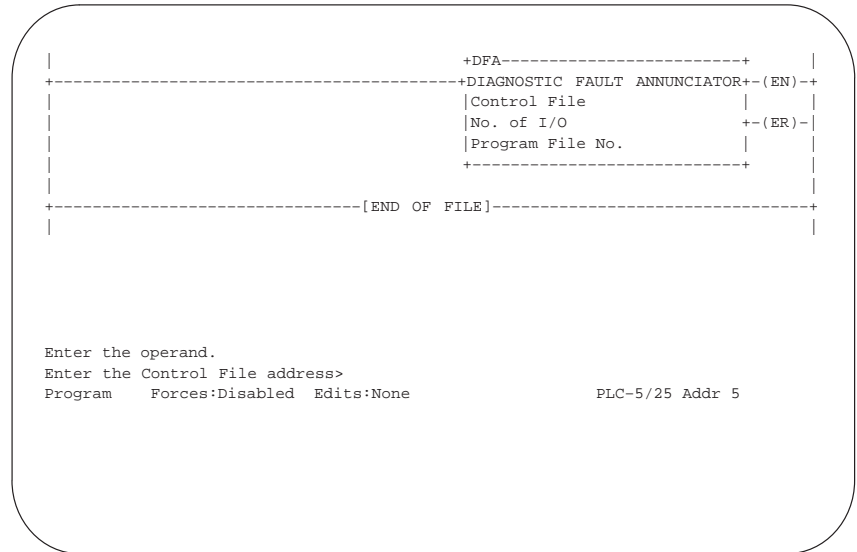
Enter or Modify DFA Instruction Information

Once the DFA instruction is displayed, the system prompts you to enter the
Control File Starting Address. To enter parameters into the DFA
instruction:

1. Type the Control File address and press **[ENTER].**

The control file must be expressed in the following manner:

For the:	Use this format:	Where:
PLC-5	*Nfff:eee*	*fff* = an integer file between 10 - 999 and *eee* = an element number between 0 - 999.
PLC-5/250	*Nffff:eeee*	*ffff* = an integer file between 10 - 9999 and *eeee* = an element number between 0 - 9999.

In the PLC-5/250, when you enter the control file address, the system
displays a number (1, 2, 3, or 4) in front of the address. This number
represents the logic processor in the PLC-5/250.

The PLC-5/250 chassis supports up to four logic processor modules.
For more information on logic processors, refer to the PLC-5/250
Programming Software Documentation Set (publication 9313-5250).

When the control file address is entered, the system prompts you to enter the number of I/O. Valid entries of I/O are 8, 16, or 32.

Important: The control file address must be local to the logic processor executing the associated DFA instruction. Do not place this file in system memory.

---

2. Type the number of I/O you are using and press **[ENTER]**.

The system prompts you for the program file number. The program file number refers to the number of the DFA CAR file in the online or offline program directory.

3. Type the DFA CAR program file number and press **[ENTER].**

In the PLC-5 processor, the system displays the I/O Definition screen. If you have a PLC-5 processor, continue with "Enter or Modify Input Information" on page 5-9.

In the PLC-5/250 processor, the system prompts you for the Message Control Block address.

4. If you have a PLC-5/250 processor, type the Message Control Block address and press **[ENTER].**

The Message Control Block address must be entered in the following manner:

*0***MSG***X:X*

where:

- *0* is the Resource Manager global memory (must be set to zero)

- *X:X*

message control block number (0-9999)

file number (0-9999)

For example, 0MSG0:0 is a valid control block address.

The system displays the Input Definition screen (see the figure on the next page).

Enter or Modify Input Information

The inputs you enter into the Input Defines on the Input Definition screen are monitored by the DFA instruction. You can enter logical addresses and symbols into the Input Definition screen. The screen on the next page shows the Input Definition Screen for *entering* inputs.

Important: If you are *modifying* information, you see fewer function key options (see the table on pages 5-9 and 5-10).

Input Definition Screen (for entering inputs)

```
        Diagnostic Fault Annunciator           Input Defines
        Definition for Control Block       0:
                    N27:0                  1: I:001/10
                                           2: SWITCH1
                                           3: B3/30
        +=Ins Cmt==+     +=Adr Cmt==+      4: 0:002/02
        |ASSEMBLY  |     |new input |      5: 0:002:01
        |MACHINE   |     |          |      6: I:001/11
        |          |     |          |      7:
        |          |     |          |      8:
        |          |     |          |      9:
        +==========+     +==========+     10:
                                          11:
Operator Interface Station Addr : 77      12:
                                          13:
                                          14:
                                          15:
Press a key to change a parameter or <ENTER> to accept parameters,
>
Program    Forces: None     Edits: None                 PLC-5/25 Addr 5
Station                Documnt        Modify   Insert   Delete   Remove
Address                               Inputs   Inputs   Inputs   Inputs
  F1                      F5            F7       F8       F9       F10
```

The **Ins Cmt** (Instruction Comment) window on the Input Definition screen displays the name of the instruction from the ladder program. The **Adr Cmt** (Address Comment) window displays the address comment for the cursored address in the Input Defines field.

The number of inputs in the Input Defines field correlates with the number of inputs you entered when programming the DFA instruction.

You can perform the following tasks from the Input Definition screen:

If you want to:	Press this key:
Enter an operator interface station address.	[F1] - Station Address
Enter the port number for the message. **PLC-5/250 only)**	[F3] - Port

Display the Documentation screen for the DFA instruction.	[F5] - Documnt
Modify an input address at the cursored location.	[F7] - Modify Inputs
Insert an input address at the cursored location[1]	[F8] – Insert Inputs
Delete an input address at the cursored location[1]	[F9] – Delete Inputs
Remove an input address at the cursored location[1]	[F10] – Remove Inputs

[1] These function keys do not appear on the screen if you are modifying the instruction.

To insert or modify information in the Input Definition screen, follow the procedure below.

1. If you want to change the Operator Interface Station Address:

    a. Press **[F1] - Station Address**

    b. Type the number of the Data Highway Plus node ($0-77_8$) where you want the diagnostic message sent, for example **77**, and press **[ENTER].**

Important: If you want to send diagnostic messages to other operator interface stations, use the Message Instruction in 6200 Series software. For procedures on sending messages with the Message Instruction, refer to PLC-5 Programming Software Documentation Set (publication 9399-PL5MAN) or the PLC-5/250 Programming Software Documentation Set (publication 9313-5250).

---

2. If you have a PLC-5/250 and you want to change the port number, your screen has an additional option:

    a. Press **[F3] - Port.**

    b. Enter the port number. The following table shows the port number to enter for the specific link type.

Port Number Entries

For this link:	Enter this port number:
ASCII, DF1, Master, and Slave	1
port 2A, 2B for DH and DH+	2
port 3 for DH and DH+	3

3.   If you want to alter an existing address or enter a new address in a list of inputs:

    a.   Press **[F7] - Modify Inputs.** The system prompts you for an address.

    b.   Type in your input address and press **[ENTER].**

        Valid entries include any logical address specified to the bit level, with the exception of indirect addresses.

4.   After entering or modifying an input address, cursor to the next field and repeat this step until you have completed all entries or changes.

5.   After entering all your addresses, press **[ESC]** to display the Input Definition screen function keys, and then press **[ENTER].**

    The system returns to the DFA instruction.

6.   Press **[ENTER].**

    The system displays the Edit Rung screenseen below.

Edit Rung Screen

```
 I                                             +DFA------------------------+      I
 I---------------------------------------------+DIAGNOSTIC FAULT ANNUNCIATOR+-(EN)-I
 I                                             |Control File          N10:0|      I
 I                                             |No. of I/O                8+-(ER) I
 I                                             |Program File No.      1CAR0|      I
 I                                             +---------------------------+      I
 |                                                                                |
 +------------------------------[END OF FILE]-------------------------------------+
 |                                                                                |




 Press a function key for desired editing function, or type a mnemonic.
 1STEP0:0>
 Program    Forces:Disabled  Edits:None      Rung:Insert  PLC-5/25 Addr 5
 Branch          Append   Insert  Modify  Delete   Undel                  Accept
    *            Instr    Instr   Instr   Instr    Instr                    Rung
  F1             F3       F4      F5      F6       F7                       F10
```

7.   Press **[F10] - Accept Rung.**

Important: You **must** accept the rung to save the information you entered into the DFA instruction.

Documenting the DFA Instruction

The DFA instruction provides a documentation function that lets you describe the instruction and its associated addresses. The documentation function also lets you assign symbols to addresses.

To document your DFA instruction, press **[F5] - Documnt** from the Input Definition screen.

The system displays the DFA Instruction Documentation screen (next page).

DFA Instruction Documentation Screen

```
     Diagnostic Fault Annunciator        Input Defines
     Definition for Control Block     0: I:001/16
             N10:0                    1: I:001/15
                                      2: I:001/14
                                      3: IS:003/02
   +=Ins Cmt==+     +=Adr Cmt==+      4: IS:003/03
   |DRILL     |     |RETURNED L|      5:
   |MACHINE   |     |S         |      6:
   |HEAD 1    |     |          |      7:
   |          |     |          |
   |          |     |          |
   +==========+     +==========+

Operator Interface Station Addr : 77



Press a function key.
>
Program    Forces:Disabled  Edits:None     Addr:Decimal PLC-5/25 Addr 5
       Instr  Address                  Modify  Remove       Display Save &
       Comment Comment                 Symbol  Symbol       Symbol  Contnue
        F2     F3                        F6      F7           F9      F10
```

From this screen you can perform the following documentation tasks:

If you want to:	Press this key:
Activate the cursor in the instruction comment window and display the Instruction Comment Editor.	[F2] - Instr Comment
Activate the cursor in the address comment window and display the Address Comment Editor.	[F3] - Address Comment
Assign a symbol to an address or change and existing symbol.	[F6] - Modify Symbol
Remove the symbol from the current address.	[F7] - Remove Symbol
Switch between address comment, symbolic name, or logical address of input. The function key always displays the next format; for example, if address comments are being displayed, then [F2] reads Display Symbol.	[F9] - Display Comment/Symbol/Log Adr
Save your work in the database. If you are editing off line, the archive file is updated and the comment and symbol files are saved. If you are editing on line, only the comment and symbol files are saved.	[F10] - Save & Contnue

Editing Instruction and Address Comments

To activate the cursor in the instruction comment window, press
[F2] - Instr Comment from the DFA Instruction Documentation screen.

The system displays the Instruction Comment Editor screen:

Instruction Comment Editor Screen

```
      Diagnostic Fault Annunciator        Input Defines
      Definition for Control Block     0: I:001/16
               N10:0                    1: I:001/15
                                        2: I:001/14
                                        3: IS:003/02
      +=Ins Cmt==+     +=Adr Cmt==+     4: IS:003/03
      |DRILL     |     |RETURNED L|     5:
      |MACHINE   |     |S         |     6:
      |HEAD 1    |     |          |     7:
      |          |     |          |
      |          |     |          |
      +==========+     +==========+

Operator Interface Station Addr : 77



Enter instruction comment for :  SDS,1N10:0
>
Program    Edit mode:Insert          Col:7   Line:3       PLC-5/25 Addr 5
Delete   Undel  Delete   Undel  Delete   Undel          Accept/
Comment  Comment Line     Line   Word     Word            Exit
  F1      F2      F3       F4     F5       F6              F8
```

To activate the cursor in the address comment window, press
[F3] - Address Comment from the DFA Instruction Documentation
screen.

The system displays the Address Comment Editor screen:

Address Comment Editor Screen

```
      Diagnostic Fault Annunciator         Input Defines
      Definition for Control Block      0: I:001/16
               N10:0                     1: I:001/15
                                         2: I:001/14
                                         3: IS:003/02
      +=Ins Cmt==+     +=Adr Cmt==+      4: IS:003/03
      |DRILL     |     |RETURNED L|      5:
      |MACHINE   |     |S         |      6:
      |HEAD 1    |     |          |      7:
      |          |     |          |
      |          |     |          |
      +==========+     +==========+

Operator Interface Station Addr : 77



Enter address comment for :  I:001/16
>
Program    Edit mode:Insert          Col:2   Line:2       PLC-5/25 Addr 5
Delete   Undel  Delete   Undel  Delete   Undel          Accept/  Next    Prev
Comment  Comment Line     Line   Word     Word            Exit   Address Address
  F1      F2      F3       F4     F5       F6              F8      F9      F10
```

The function keys for both Editor screens are the same, except that the Address Comment Editor screen has soft function keys for moving the cursor to the next or previous address:

If you want to:	Press this key:
Delete the current comment.	[F1] - Delete Comment
Re-insert the last deleted comment where the cursor is.	[F2] - Undel Comment
Delete the line the cursor is on from the current comment.	[F3] - Delete Line
Re-insert the last deleted line from a comment.	[F4] - Undel Line
Delete the word the cursor is on from the current comment.	[F5] - Delete Word
Re-insert the last deleted word from a comment.	[F6] - Undel Word
Save the current comment and return to the Input Definition screen.	[F8] - Accept Edits
For Address Comments Only: Save the current comment and/or move the cursor to the next address.	[F9] - Next Address
Save the current comment and/or move the cursor to the previous address.	[F10] - Prev Address

Configuring Messages for the DFA Instruction

The DFA instruction provides a feature which lets you enter the equivalent of pre-stored text messages to relate to your inputs. When an input or inputs change to the defined state (ON or OFF), the DDMC32 software automatically generates the message on the operator interface terminal.

To enter your messages, follow the procedure below:

1. Start on the Ladder Editing screen.

2. Cursor to the DFA instruction and press **[F10] - Edit.**

3. Press **[F2] - I/O Edit.**

   The system displays the DFA Message screen:

DFA Message Screen

```
                         DFA for DFA 1 AT N9:0
 No     Input ID              Input Message                         State
  0 C4:01/ON            TOOL CHANGE REQUIRED
  1 I:000/02            LUBE FAULT
  2 I:000/01            LUBE LEVEL LOW
  3 I:000/06            NO PARTS PRESENT
  4 I:B3/03             LOAD PARTS IN STA.5
  5 I:000/04            PLACE MACHINE IN AUTO MODE
  6 O:000/05            TIME TO CALL MAINTENANCE
  7 T5:1/ON             MACHINE OVER CYCLE




 Press a function key or enter input number.
 >
 Rem Prog                                        5/25 Addr 5   DB_TEST
 Change  Display  Exit         Input         Edit    Input         Accept
  Mode   Symbol               Monitor       Message  State          Edits
  F1       F2     F3            F5             F7      F8            F10
```

You can perform the following tasks from the DFA Message screen:

If you want to:	Press this key:
Switch between program mode, test mode, and run mode.	[F1] - Change Mode
Switch between address comment, symbolic name, or logical address of input. The function key always displays the next format; for example, if address comments are being displayed, then [F2] reads Display Symbol.	[F2] - Display Comment/Symbol/Log Adr
Exit the configuration utility.	[F3] - Exit
Display the Input Monitor screen. (Refer to the chapter entitled "Debugging Your DDMC32 System" for information on the Input Monitor screen.)	[F5] - Input Monitor
Display the Edit Message screen for the cursored message so that the message can be edited.	[F7] - Edit Message
Define/change the input state for the selected input.	[F8] - Input State
Accept all entries/edits. The system prompts you to confirm your decision.	[F10] - Accept Edits

4. To enter your messages, press **[F7] - Edit Message.**

The system displays the Edit Message screen:

Edit Message Screen

```
                        DFA for DFA 1 AT N9:0
 No     Input ID                 Input Message                         State
  0 C4:01/ON            TOOL CHANGE REQUIRED
  1 I:000/02            LUBE FAULT
  2 I:000/01            LUBE LEVEL LOW
  3 I:000/06            NO PARTS PRESENT
  4 I:B3/03             LOAD PARTS IN STA.5
  5 I:000/04            PLACE MACHINE IN AUTO MODE
  6 O:000/05            TIME TO CALL MAINTENANCE
  7 T5:1/ON             MACHINE OVER CYCLE





  Enter the desired comment.  Press <CR> to accept the comment, <ESC> to return
  TOOL CHANGE REQUIRED
  Rem Prog                                          5/25 Addr 5   DB_TEST
```

5. Cursor to the message you wish to edit or to the number of the input where you wish to enter a new message and type the new message.

Any message you enter may have a total length of up to 50 characters.

6. Once you have completed your changes, press `[ENTER]` to accept the comment.

7. Press `[ESC]` to return to the DFA Message screen.

8. Cursor to the state column of the desired input and press `[F8] - Input State.`

   `[F8]` is a toggle key which allows you to choose from OFF, ON, or NONE (if you select NONE, a message is never sent) for the state in which you want your message to be sent. Continue to press this key until you reach the state in which you want your message to be sent.

Exiting the DFA Instruction

Once you have configured your diagnostic messages, you can exit the DFA instruction.

To exit the DFA instruction:

1. Press `[ESC]`.

   The system displays the DFA Message screen.

2. Press `[F10] - Accept Edits`.

   The system prompts you to confirm your decision.

3. Press `[F8] - Yes`.

4. Press `[F3] - Exit`. Once you've entered and documented all of your input information, the system asks if you want to save your work.

5. Press `[F8] - Yes`.

   The system displays the Ladder Editor main menu. If you have other DFA instructions to configure or edit, you can do so as described in the "Enter or Modify DFA Instructions" section in this chapter. If not, you may exit the program as described in the next chapter.

What to Do Next

Chapter 6 describes how to create a message database with the documentation imported from the DFA instruction.

Creating and Updating the Message Database

What this Chapter Contains

Read this chapter to learn how to import the documentation from the SDS instruction(s) and the DFA instruction(s) into the message database so it can be used by the DDMC32 software.

This chapter contains the following sections:

Section:	Page:
Importing the SDS and DFA Documentation	6-1
Message Database Options	6–3
What to do Next	6-5

Importing the SDS and DFA Documentation

When you are done configuring your ladder program or making changes in the Ladder Editor, you are ready to exit the program. If you want the DDMC32 software to reflect any of the documentation changes or additions made to the program, you must import the information into the DDMC32 message database. (At this point, all SDS and/or DFA documentation has been written to an ASCII file.)

To import SDS and/or DFA instruction information to the DDMC32 message database, follow the procedure on the following pages.

1. From the Database menu, choose the appropriate command for the type of instruction information you want to import into the database.

   For DFA Instruction Information:

   Select Import 6200.DFA File. The Import 6200.DFA File screen appears.

   For SDS Instruction Information:

   Select Import 6200.SDS File. The Import 6200.SDS File screen appears.
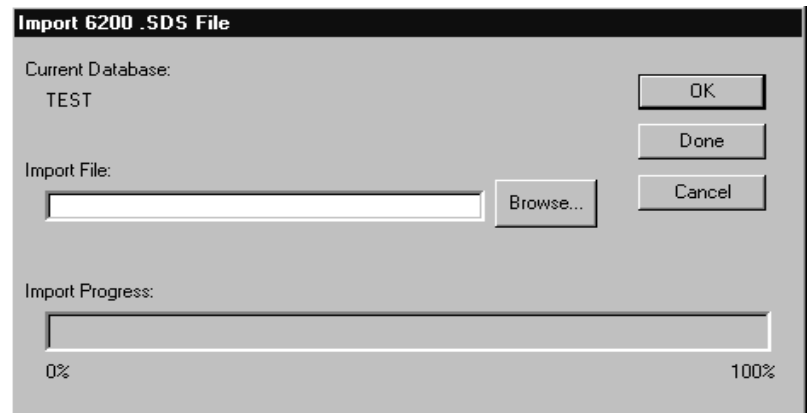
2. Enter the import path file, or click on **Browse...** to locate the file to import.

3. Click on **OK**.
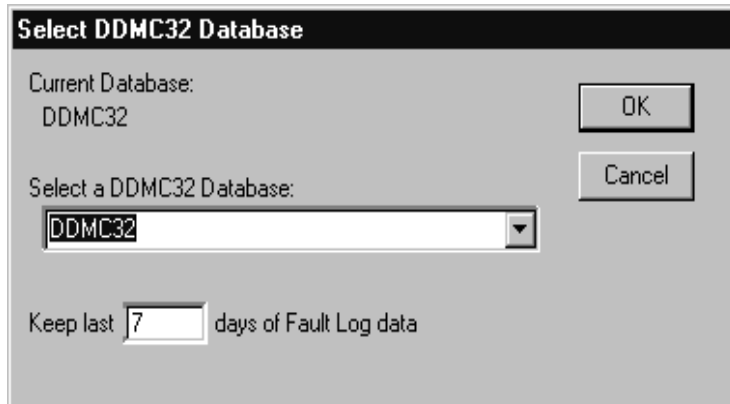
   The Import Progress bar will show you the progress of the file import process. Repeat this process for each .SDS and/or .DFA file you want to import.

4. Click on **Done** when complete.

Message Database Options

You may select, create, or Copy a DDMC32 database by clicking on the desired option from the menu. The following screens are displayed according to the option you have chosen.
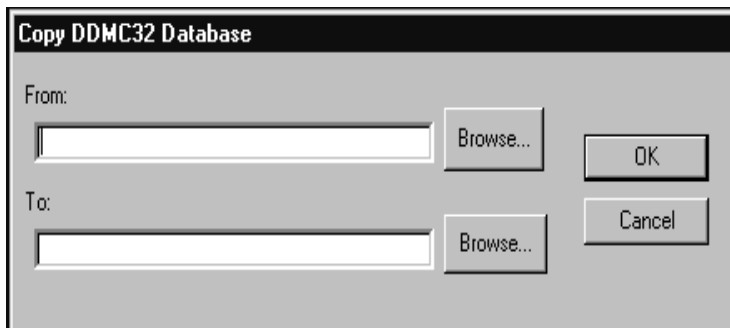
Select Database

```
Select DDMC32 Database

Current Database:
  DDMC32                                      [  OK  ]

                                             [ Cancel ]
Select a DDMC32 Database:
[DDMC32                              ▼]

Keep last [ 7 ]    days of Fault Log data
```

Create Database

```
Create DDMC32 Database

Current Database:
  DDMC32                                      [  OK  ]

                                             [ Done ]
Create Database:
[                        ] [ Browse... ]     [ Cancel ]
```

Copy Database

```
Copy DDMC32 Database

From:
[                        ] [ Browse... ]
                                             [  OK  ]
To:
[                        ] [ Browse... ]     [ Cancel ]
```

When you select a database, you can also choose how many days of fault log data to keep. If you have Auto-Purging enabled, fault log data will automatically be purged, based on the value entered.

For all of the above screens, you can type in the database name or click on **Browse...** to find the required database.

Click on **OK** when complete and continue with your next function.

Deleting a Message Database

1.   To delete a message database, select **Delete Message Database** from the Database menu.

      The Delete Database Selection screen appears.

Delete Database Selection Screen
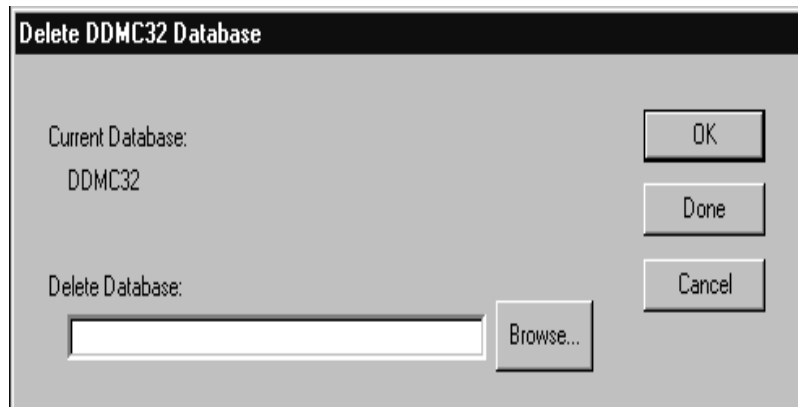
2.   Type in the database path or click on **Browse...** to find the file and click on **OK**.

      The Verify Delete screen appears, prompting you to confirm that you want to delete the database.

Verify File Delete

3. Click on **Yes** to verify, or **No** to abort the delete.

Important: Once you click on Yes to verify the delete there is no way to abort the process. **Ensure that the selected database is the correct file.**

If you click on **Yes** to verify that you want to delete the database, the file is deleted and the **File Delete Complete** screen appears.

File Delete Complete
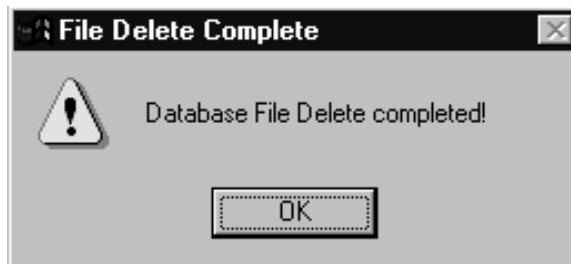
4. Click on **OK** to close this window.

What to Do Next

Now that you have completed creating and/or updating your message database, you can configure the Diagnostic Message Utility. Chapter 7 describes the procedures for Configuring Diagnostic Messages.

Notes:

Configuring Diagnostic Messages

What this Chapter Contains

Read this chapter to learn about diagnostic messages provided in the DDMC32 system and procedures to configure the format for diagnostic messages. To configure diagnostic messages, you:

- build the message out of fragments and link the text with your own words

- select options for message display

This chapter contains the following sections:

Understanding the Parts of a Diagnostic Message

The DDMC32 software contains a routine that generates messages as faults occur. When a fault is detected by the SDS or DFA instruction the operator interface terminal automatically displays a message in a window reserved for messages (if configured by the user). That same message can also be broadcast to annunciator panels in the plant such as a Dataliner Message Display (bulletin number 2706, series DL10).

Diagnostic Message Fragments

To create a diagnostic message, you can select from several different fragments and string them together, with connector words you define, to form a sentence. In other words, you tell the software how to configure the message by selecting message fragments and linking them with your own words.

Because you enter the fragments to form the diagnostic sentence when you configure the SDS and DFA instructions, it is very important that you assign clear names to steps, inputs, and outputs (for example, RETURNING, ADVANCING) so that your message makes sense.

An example of a clear statement constructed from fragments (shown in italics) and linking text might be:

Proc1 was *Advancing* when *Sta3 ADVANCE Request* turned *off*

Important: Fragment options for the SDS and DFA instruction messages are different. The options for each type of instruction are listed below. Items accompanied by (src) refer to source steps; items accompanied by (dest) refer to destination steps.

SDS Message Fragment Options

This Message Fragment :	Is the:
processor	eight character name of the processor where the SDS instruction resides, for example, *Proc1* or *xferline*
instruction comment	name of the SDS instruction, for example, *Drill Station #1, Station 32R,* or *ProbeSta*
step comment (src)	step where the error occurred, for example, *Advancing, Returning,* or *Loading*
logical address (src)	data type, file number, offset, and bit number of the bit which changed to cause the message, for example, *N10:000/2, I:020/05,* or *O:001/12*
symbolic address (src)	10 character symbolic string, entered in the PLC programming software, which represents the bit which changed to cause the message, for example, *SW103*
short address comment (src)	20 character or less portion of the address comment that was delimited by asterisks (*) when the comment was entered in the PLC programming software, for example, *Switch 1,*or *AdvancedL.S.*
long address comment (src)	description of up to 50 characters of the bit address which changed to cause the message, for example, *"Tool change required"*

This Message Fragment :	Is the:
ON/OFF state (src)	For error messages: the state of the source bit with a 1 represented by the word ON and a 0 represented by the word OFF. For Warning and 1 valid exit messages: the state of the source bit with a 1 represented by the word OFF and a 0 represented by the word ON.
OFF/ON state (src)	For error messages: the state of the source bit with a 1 represented by the word OFF and a 0 represented by the word ON. For Warning and 1 valid exit messages: the state of the source bit with a 1 represented by the word OFF and a 0 represented by the word ON.
step comment (dest)	step the SDS instruction was moving to when the message was generated
logical address (dest)	data type, file number, offset, and bit number of the bit which did not match the expected inputs, for example, *I:007/3*.
symbolic address (dest)	10 character symbolic string, entered in the PLC-5 programming software, which represents the bit which did not match the expected inputs, for example, *LED002*.
short address comment (dest)	portion of the destination address comment that was delimited by asterisks (*) when the comment was entered in the PLC-5 programming software.
address comment (dest)	full description of the bit address which did not match the expected inputs.

DFA Message Fragment Options

All definitions of fragment options for the DFA message are the same as for the SDS message unless otherwise specified.

- processor name
- instruction comment
- DFA bit message[1]
- logical address
- symbolic address
- short address comment
- address comment
- ON/OFF state
- OFF/ON state

[1]the DFA message which is associated with a change in this bit's value

Diagnostic Message Types

The Message Template Editor contains screens for you to assign your own connector words and to determine the length of each fragment, letting you customize your own diagnostic messages. You can configure nine different types of messages for display. The following table contains examples of the default messages that will be displayed if you choose not to configure your own message fragments:

Message:	Description:
step from 0	A step 0 message is displayed when an SDS instruction moves from a step 0 to any other step. (The destination step must have MSG'S ON.)
one valid exit timeout	A one-valid exit timeout message is displayed when the step timer causes an exit condition and the destination step has MSG's ON. This message is displayed when the step has only one valid exit. (A valid exit is a destination step that is not an error step or Step 0.) Example configuration: *instruction comment, timeout* **while** *step, bit (or input device)* **didn't turn** *bit state* For example: *ASSEMBLY MACHINE, TIMEOUT* **WHILE** *LOADING PARTPRESENT* **DIDN'T GO** *ON*
error	An error message is displayed when an error step (ERSTEP) is entered with the message function turned ON. The message remains on the display until the SDS instruction passes through Step 0. Example configuration: *instruction comment* **was** *step* **when** *bit (or input device)* **turned** *bit state* For example: *DRILLSTA.2* **WAS** *ADVANCING* **WHEN** *RETURNEDLS* **TURNED** *ON*
init error	An INIT error message occurs when an instruction can not leave the initialization step after two program scans because the inputs do not match any steps in the instruction.
input mismatch	A mismatched step message occurs when a transition condition (either input transition or step timer) occurs, but the inputs taken from the PLC data table do not match the expected inputs for the destination step. This message remains on the display for as long as the input mismatch lasts. Example configuration: *instruction comment,* **can't enter** *step (D),* **because** *bit (or input device)(D), bit state (D)* For example: *PALLITZER* **CAN'T ENTER** *LOADING* **BECAUSE** *GATE4SENSOR* **DIDN'T TURN** *OFF*
status	A status message is displayed when a normal step is entered with the message function turned ON. The message remains on the display until the current step is exited. Example configuration: **the** *processor name, instruction comment* **is** *step.* For example: **THE** *AREA2, BATCHING OPERATION* **IS** *MIXING*
step timeout	A step timeout message is displayed when the step timer causes an exit condition and the destination step has the message function turned ON. Example configuration: *processor name, instruction comment* **timed out while** *step* For example: *OP150, STATION 25L* **TIMED OUT WHILE** *RETURNING*
warning timeout	A warning timeout messages occurs when a transition is taking too long to occur. The SDS remains in the same step while the message is displayed.

Message:	Description:
	Example configuration: **Warning,** *instruction comment,* **is** *step,* **too long** For example: **WARNING** *WELDING FIXTURE 17* **IS** *CLAMPING* **TOO LONG**
DFA	The DFA message occurs when a message is sent from the DFA instruction. Example configuration: *DFA bit message* For example: *OP123* **TOOL CHANGE REQUIRED**

Accessing the Message Template Editor Functions

This section tells you how to configure and edit diagnostic messages. To access the Message Template Editor:

1. Start on the WindowsNT™ desktop.

2. Click on the DDMC32 icon.

3. On the DDMC32 menu bar click on the DDMC32 tag to activate the drop down menu:

DDMC32 Drop Down Menu Option
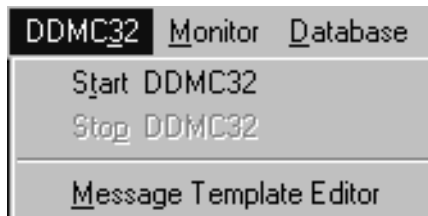
4. Select the Message Template Editor option.

The DDMC32 Template Editor screen appears.

DDMC32 Template Editor
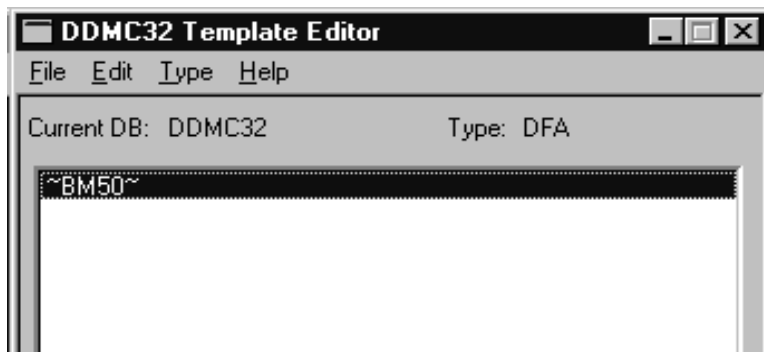
Message Template Editor Function

The DDMC32 Template Editor allows you to create or modify templates to fit your needs. There are four menu items that provide access to the editing functions:

- File

- Edit

- Type

- Help

These four items contain the following:

File: At this time, only the exit option is available.

Exit – Exits the DDMC32 Template Editor and returns you to the main menu.

Edit: From this selection you can create new templates, edit existing templates, or delete an existing template.

Edit Selections
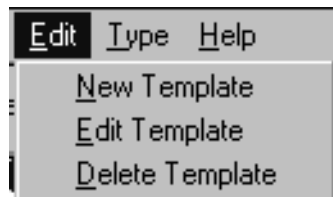
New Template – Enables you to create a new template using the New Template editor screen.

Edit Template – Takes you to the Edit Template editor for the highlighted selection.

Delete Template – Click here to select an existing template to delete from the database. You will be prompted to verify the delete before it occurs.

Type: Click on Type to select a message type (see below). When you
select one of the listed message types, it becomes the default and displays
templates with only that message type.

Type Selection
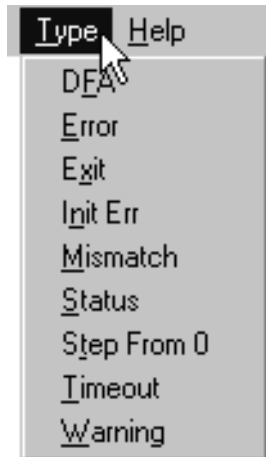
Help: The Help function displays the following information:
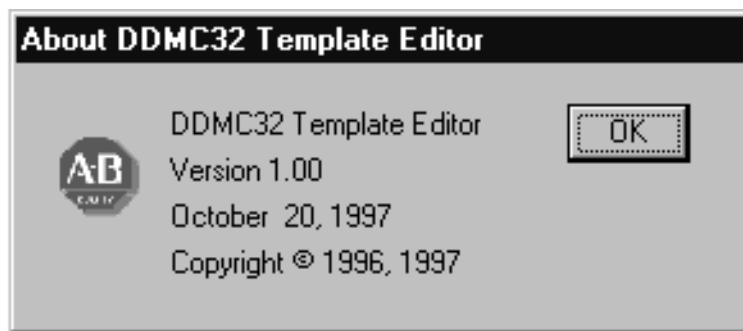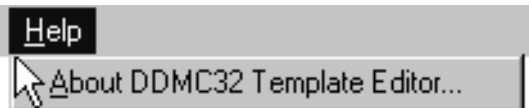
Configuring Diagnostic Messages

To configure diagnostic messages, follow the procedure below. Fragment options for the message vary depending on the type of message you are creating. We use the Error Message as an example through all steps.

1. From the DDMC32 Template Editor menu, select the Type option.

    The drop down list displays all available message types.

2. Click on the type of message you want to configure (in this case, the Error message).

    The selected Template Editor screen appears.

DDMC32 Template Editor Screen for an Error Message
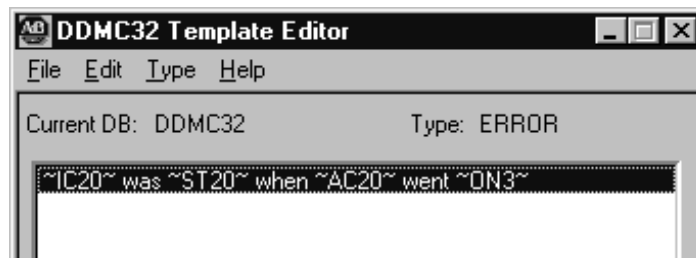
3. Select one of the templates from the Template Editor screen and click on Edit on the Template Editor menu bar.

Edit Select List
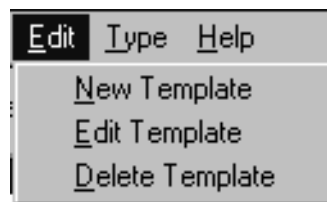
4. Select Edit Template from the drop down list, or double-click the selection in the Template Editor window.

The Edit Template screen appears.

Edit Template Screen
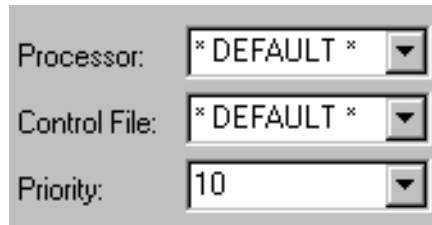
5. Click on the required template selection buttons that you want to use to configure your error message. See the figures below for examples.

Select the corresponding Processor and Control File for the SDS instruction whose messages you want to display.

Use "Default" for the Processor and/or Control File if you want a particular message to be displayed for any Processor/Control File combination. Otherwise select only the Processor/Control File combination you want to use with the template you are editing.

Important: It is assumed that you have imported the .SDS file into the database prior to editing these messages.

Priority will assign a priority to the message (with 1 being the highest and 10 being the lowest). A message of higher priority will replace a message of lower priority on the Window Banner or Marquee.

Processor:	* DEFAULT * ▼
Control File:	* DEFAULT * ▼
Priority:	10 ▼

You can choose to Show or Suppress extra blanks in your message depending on how you want to format your message.

Extra Blanks:

○ Show ⦿ Suppress

Multiple messages may be enabled or disabled for SDS instructions only (for example, multiple messages may be generated for a single SDS fault).

Multiple Messages:

○ Enable ⦿ Disable

Message Fragments (i.e., Processor Name, Instruction Comment, etc.) are selected from buttons on the right side of the screen. When a fragment is selected, you are prompted to type in the maximum length of the fragment. This value will be inserted as part of the Message.

Fragment Length window
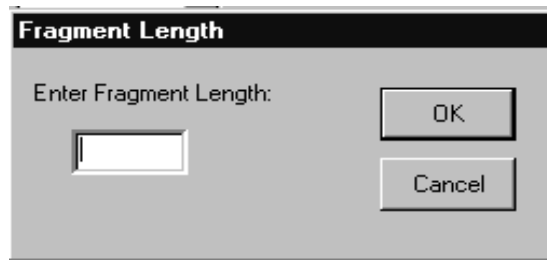
Finally, each individual message can be configured as to where it will display the message. Using selections from the "Send To:" portion of the dialog box to select Banner (Display), Marquee, Printer and Logger:
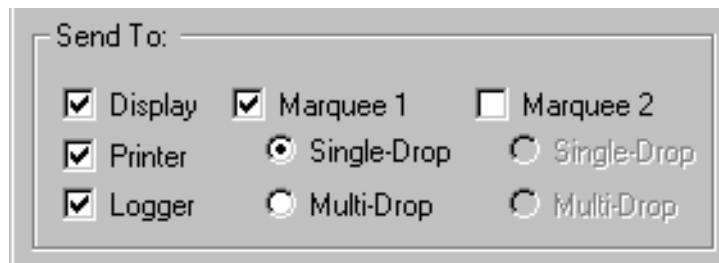
6. Click on **OK** when you have completed and are satisfied with your selections.

7. Repeat this procedure for each message template you create.

What to Do Next

Now that you have configured your diagnostic messages, you can debug any problems you may have encountered. Chapter 8 describes the procedures for debugging your DDMC32 setup and how to configure your system and prepare to run DDMC32.

Notes:

Debugging Your DDMC32 System

What this Chapter Contains

Read this chapter to become familiar with the types of errors that can occur in your DDMC32 system and troubleshooting tips for correcting those errors. Tools within the DDMC32 system that help you detect problems include:

- error list

- I/O monitor display

- step history

- input history

- extended status display

Important: As you debug your system, we recommend that you use two operator interface terminals. Use one terminal for running 6200 Series software so that you can debug any errors within the SDS configuration utility; use the other for running the DDMC32 software.

This chapter contains the following sections:

Section:	Page:
Correcting Step Configuration Errors	8-1
Locating Sequencing and Timing Errors	8-5
Troubleshooting Problems in your Operator Interface	8-12
What to do Next	8-13

Correcting Step Configuration Errors

If you have errors in your step configuration when completing SDS instruction entry, the system displays an error list (see next page). This error list may be accessed by pressing **[F9] – Display Err Lst** from the Step Directory until errors are corrected.

Sample Error List Screen

```
                    ERRORS IN STATION 7R  CONFIGURATION

 ERROR   1 : Step 1, Input 0;transition condition results in an input state
             mismatch for specified destination step
 ERROR   2 : Step 15, timer; specified destination step is not configured












 Press a key for desired function, or <ESC> to return to directory.

 Program         monitor mode              Current Step 0       PLC-5/12 Addr 4
```

The error list displays configuration errors in different formats depending on the type of error that occurs. The errors that could occur are:

- input state mismatch

- timer destination step not configured

- timer destination step out of range

- destination step not configured

- destination step out of range

- invalid configuration

- marked exit

- warning timeout

These errors are described in the following sections.

Input State Mismatch

Important: This type of error is not used for ANDed conditions.

The format for the input state mismatch error in the error list looks like this:

```
Step xxx, Input xx; transition condition results in an input state
mismatch for specified destination step.
```

This condition occurs when a user-specified transition along with the other specified condition of the inputs for the current step do not match the expected input conditions for the destination step. See the following step configurations for an example.

	Step 1			**Step 2**	
Input 0	ON–->OFF	STEP 2	Input 0	ON–->OFF	ERSTEP 15
Input 1	OFF–->ON	STEP 10	Input 1	OFF–->ON	STEP 10
Input 2	OFF–->ON	ERSTEP 15	Input 2	ON–->OFF	STEP 3
Input 3	OFF–->ON	ERSTEP 15	Input 3	OFF–->ON	ERSTEP 15

If input 0 goes off, the system would display the following error:

```
Step 1,Input 0; transition condition results in an input state
mismatch for specified destination step
```

To correct the error, you must change the input transition so that the exit conditions from one step match the entry conditions of the destination step. In our example, the inputs from Step 1 to Step 2 show that inputs 1 through 3 in Step 1 must be OFF; however, the entry conditions for Step 2 require inputs 1 and 3 to be OFF and input 0 to be ON.

Timer Destination Step Not Configured

The format for the timer destination step not configured error in the error list looks like this:

```
Step xxx, timer; specified destination step is not configured
```

This condition occurs when the step timer destination step is not a valid step.

To correct the error, you must either configure the specified step or change the step to an already configured step.

Timer Destination Step Out of Range

The format for the timer destination step out of range error in the error list looks like this:

```
Step xxx, timer; specified destination step is out of range
```

This condition only occurs if changes were made outside of the configuration utility, resulting in an invalid configuration.

To correct the error, you must select a valid destination step.

Destination Step Not Configured

The format for the destination step not configured error in the error list looks like this:

```
Step xxx, Input xx; specified destination step is not configured
```

This condition occurs when an input transition destination is not a configured step.

To correct the error, you must either configure the specified step or change the step to an already configured step.

Destination Step Out of Range

The format for the destination step out of range error in the error list looks like this:

```
Step xxx, Input xx; specified destination step is out of range
```

This condition only occurs if changes were made outside the configuration utility, resulting in an invalid configuration.

To correct the error, select a valid destination step.

Invalid Configuration

The format for the invalid configuration error in the error list looks like this:

```
 Invalid configuration, no valid steps
```

This condition occurs when you attempt to accept edits without configuring any steps, or when the data table is somehow altered outside of the configuration utility. To correct the error, configure steps you need for your application.

Marked Exit

The marked exit error looks like this in the error list:

```
Marked exit, destination cannot be 0, init, or error step
```

This error occurs when you designate a marked exit for a step with a destination of 0, init, or an error step.

To correct the error, you must change the destination step of the marked exit to a non-error step.

Warning Timeouts

The warning timeouts error looks like this in the error list:

```
Warning timeouts require at least one non-error input
transition destination
```

This error occurs, if you designate the destination of a step timeout as WARNING, and all of the transitions in that step go to error steps, step 0, or INIT.

To correct the error, you must provide a non-error destination for at least one of the inputs in the step configuration.

Locating Sequencing and Timing Errors

DDMC32 offers various utilities for showing sequence and timing of inputs and outputs. These are:

- I/O Monitor

- Step History

- Input History

- Extended Status

Using I/O Monitor

The I/O Monitor screen shows all inputs and outputs in the SDS instruction and inputs in the DFA instruction, and the current status of each. With the I/O Monitor screen, you can determine if inputs and outputs are actuating properly.

For example, if the I/O monitor screen says the forward motor is on, but on the machine the motor is not activated, check for a problem with your motor. Likewise, if the motor is supposed to go on and the output shows that the motor is off, check your software for a problem.

To access the I/O Monitor screen, press [**F8] - I/O Monitor** on the Step Directory of an SDS instruction or [**F5] - Input Monitor** on the Input Message screen of a DFA instruction.

The figure below shows the I/O Monitor screen for the drill machine station.

I/O Monitor screen for Drill Machine Station (SDS Instruction)

```
                  I/O MONITOR FOR DRILL MACHINE HEAD 1

  No    Input ID            State      No    Output ID           State
   0  I:001/16               OFF        0  O:000/04               OFF
   1  I:001/15               OFF        1  O:000/01               OFF
   2  I:001/14               OFF        2  O:000/02               OFF
   3  B3/2                   OFF
   4  B3/3                   OFF












  Press a function key.

  Program        edit mode                  Current Step 0      PLC-5/12 Addr 4
  Change  Display            Step    Input  Extnded           Step
   Mode   Comment           History History Status            Dirctry
   F1       F2                F4      F5      F6                 F8
```
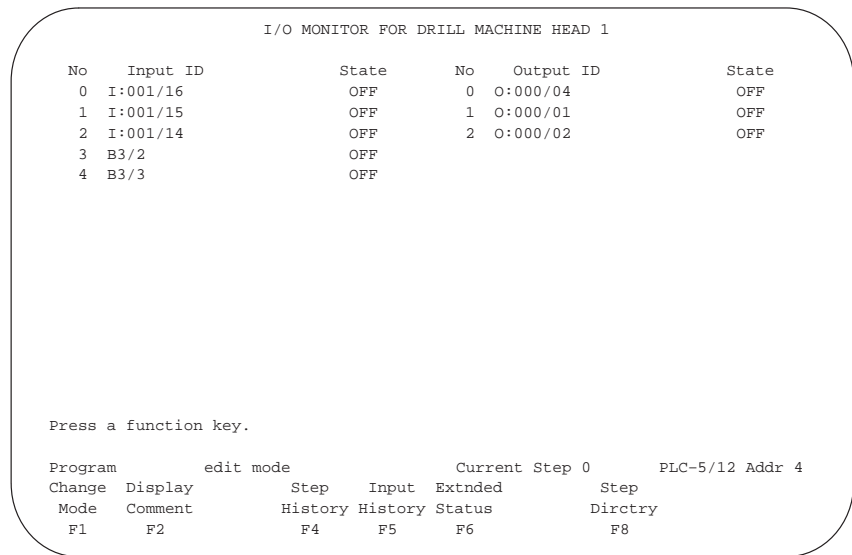
You can perform the following tasks from the I/O Monitor screen:

If you want to:	Press this key:
Change between remote run/program mode and test mode.	[F1] - Change Mode
Select between address comment, symbolic name, or logical address of I/O. The function key always displays the **next** optional format; for example, if address comments are being displayed, then [F2] reads Display Symbol.	[F2] - Display Comment/Symbol/ Log Adr
Exit the configuration utility.	[F3] - Exit
For SDS Instructions only Display the step history screen.	[F4] - Step History
Display the input history screen.	[F5] - Input History
Display the extended status screen.	[F6] - Extnded Status
Display the Step Directory.	[F8] - Step Dirctry

Using the Step History

The step history shows the steps in your SDS instruction as they occur and the time it takes each step to occur. You can use the step history to determine if steps are taking too long or occurring at the wrong time.

To access the step history, press **[F4] – Step History** on the I/O Monitor screen.

The following screen shows a step history for a transfer line station.

Step History for a Transfer Line Station

```
                   Step History for STATION 7R
    accumulated time       duration      step #     stepname
    00:00:00.36           00:00:00.36       1       READY TO START
    00:00:02.36           00:00:02.00       2       PART IN PLACE
    00:00:04.35           00:00:01.99       3       CLAMPING
    00:00:07.36           00:00:03.01       4       STARTING SPINDLES
    00:00:07.86           00:00:00.50       5       CYCLING IMC AXIS
    00:00:36.86           00:00:29.00       6       ADVANCING SLIDE
    00:00:39.87           00:00:03.01       7       SLIDE FULL DEPTH
    00:01:06.83           00:00:26.96       8       SLIDE RETURNING
    00:01:07.83           00:00:01.00       9       SLIDE RETURNED
    00:01:10.28           00:00:02.45       1       READY TO START




 Press a key for desired histogram function.

 RUN           Hist:Started  Mode:Paged   Disk Recording Off  Current Step:1
  Start    Stop   Contin   Paged   Step                       Write
 History History  Mode     Mode    Trigger                    To Disk
   F1       F2      F3       F4       F5                         F8
```

You can perform the following tasks from the Step History screen:

If you want to:	Press this key:
Begin monitoring the current instruction.	[F1] - Start History
Stop monitoring the current instruction.	[F2] - Stop History
Display data continuously on the screen as new data is collected. If new data is generated faster that the display can be updated, eventually the data buffers overflow and "Data Overrun" is displayed.	[F3] - Contin Mode
Display data one page at a time. Press Next Page or Previous Page to scroll through the data.	[F4] - Paged Mode
Specify a starting point at which to activate the timer and display. When the SDS instruction is in the specified step, the timer is waiting for a transition from the step. When this occurs, the timer is set to zero and the display screen is activated, logging all steps from that point on.	[F5] - Step Trigger
Store the step history on disk.	[F8] - Write to Disk

Using the Input History

The input history shows inputs in your SDS and DFA instructions as they transition, and the time it takes each input to transition. The input history is similar to the step history.

Use the input history to determine if inputs are transitioning at the right time or taking too long to transition.

Input History for a Transfer Line Station (SDS Instruction)

```
                    Input History for STATION 7R
      accumulated time      duration     input     state   address
        00:00:00.53        00:00:00.53     2         1      I:006/01
        00:00:01.81        00:00:01.28     2         0      I:006/01
        00:00:02.04        00:00:00.23     3         1      I:006/02
        00:00:03.03        00:00:00.99     3         0      I:006/02
        00:00:03.05        00:00:00.02     9         1      I:001/04
        00:00:03.75        00:00:00.70     9         0      I:001/04
        00:00:03.99        00:00:00.24     1         1      I:006/00
        00:00:07.03        00:00:03.04     1         0      I:006/00




  Press a key for desired histogram function.

  RUN           Hist:Started  Mode:Paged   Disk Recording Off  Current Step:13
   Start    Stop    Contin   Paged   Input                         Write
  History History  Mode     Mode    Trigger                       To Disk
   F1       F2       F3       F4       F5                            F8
```

You can perform the following tasks from the Input History screen:

If you want to:	Press this key:
Begin monitoring the current instruction.	[F1] - Start History
Stop monitoring the current instruction.	[F2] - Stop History
Display data continuously on the screen as new data is collected. If new data is generated faster that the display can be updated, eventually the data buffers overflow and "Data Overrun" is displayed.	[F3] - Contin Mode
Display data one page at a time. Press Next Page or Previous Page to scroll through the data.	[F4] - Paged Mode
Specify a starting point at which to activate the timer and display. When the SDS instruction is looking at a specified input, the timer is waiting for a transition. When this occurs, the timer is set to zero and the display screen is activated, logging all inputs from that point on.	[F5] - Input Trigger
Store the input history on disk.	[F8] - Write to Disk

Using Extended Status

The Extended Status screen gives you information from the SDS data base in user-friendly terms. The fields on the Extended Status screen show the status of specific bits in the control file. A message type field on the screen shows the type of error that occurs, the last step, the input ID, and the state of the input. These message types correspond to the messages you configured in the Diagnostic Message Configurator. The messages are:

- status

- error

- step timeout

- warning timeout

- one valid exit timeout

- input mismatch

- zero step

- init error

- DFA

Refer to Chapter 7, "Configuring Diagnostic Messages" for information about messages in the Diagnostic Message Configurator.

To access the Extended Status screen, press **[F6] - Extnded Status** on the I/O Monitor screen.

The figure on page 8–11 shows a sample Extended Status screen when an input mismatch occurs. Fields on the screen are described. When this type of error occurs, the screen displays information about the last step executed and the step to be performed.

Sample Extended Status Screen for an SDS Instruction

SDS Instruction
output bits

Message Instruction (MSG)
Status Information
(For information about
this instruction, Refer to
PLC-5 Family Programmable
Controllers Processor
Manual (publication
1785-6.8.2)

```
         Timed out: 0 TO (bit 8)        SDS is enabled: 1 EN
      To be retried: 0 NR (bit 9)          Runtime error: 0 ER
  Awaiting execution: 0 EW (bit 10)     Program error step: 0 ES
         Continuous: 0 CO (bit 11)   Input mismatch active: 0
             Error: 1 ER (bit 12)      Step timer enabled: 0 TE
       Message done: 0 DN (bit 13)       Step timer (accum): 0.0
 Message transmitting: 0 ST (bit 14)   Enabled inputs (15-0): 1000 0111 1111 1111
     Message enabled: 0 EN (bit 15)

                       Message type: Error message

                        Last step: 6 - ADVANCING SLIDE
             Input ID:   2  I:006/01               Input state: ON




  Press a function key.

  RUN            monitor mode              Current Step 13     PLC-5/12 Addr 4
         Display
         Comment
           F2
```

The extended status screen for the DFA instruction is somewhat different
from that of the SDS instruction. The following figure shows an example
of an Extended Status screen for a DFA instruction.

Extended Status Screen for a DFA Instruction

```
        Message Type: 0                    PLC Type: 0
      Processor Name:                      Control File Number: 0
                                           Control File Element Number: 0

    Message Active Bits: 0000 0000 0000 0000   15-0
                         0000 0000 0000 0000   31-16
          Mapped Inputs: 0000 0000 0000 0000   15-0
                         0000 0000 0000 0000   31-16
      Message Clear Bits: 0000 0000 0000 0000   15-0
                         0000 0000 0000 0000   31-16




  Press a function key.

  >
   Prog                                    5/250 Addr 5  DB_TEST
```

The Extended Status screen for the DFA instruction gives you information about your inputs at the bit level. The information is less complex than that of the Extended Status screen for the SDS instructions because DFA is a monitoring only function.

While in the Extended Status screen, you can use
[F2] - Display Comment/Symbol/Adr to select between address comment, symbolic name, or logical address of I/O. The function key always displays the **next** format; for example, if address comments are being displayed, then **[F2]** reads "Display Symbol."

Troubleshooting Problems in Your Operator Interface

Certain problems could occur while you are configuring your operator interface. The following table lists some problems that could occur.

Troubleshooting Operator Interface Problems

If this is happening:	Then you should:
Ladder program is not sending messages to operator interface terminal or annunciator panel	Check each SDS instruction to make sure the operator interface station address specified is the correct address.
System is displaying messages from the SDS but they are printing with the database tag instead of the address comments you entered in the SDS instruction	Import or update the message database (refer to chapter 6).

What to Do Next

Once the system is fully configured and free of bugs, the operator can monitor and operate the system. Chapter 9, 'Configuration and Operation of the DDMC32 System' tells you how to configure, start and run the DDMC32 system.

Notes:

Configuration and Operation of the DDMC32 System

What this Chapter Contains

Read this chapter to become familiar with configuring, starting and running the DDMC32 system.

This chapter contains the following sections:

Configuring Output Devices

From the Configure menu, you can set the output for your marquee and/or banner, select the type of instructions to be displayed, and enable auto-start for several options.

Configuring Marquees

1. From the Configure menu, choose Output Devices.

The Configure Output Devices screen appears.

Configure Output Devices screen

2. For each marquee, enter the following information:
- Type
- Port
- Baud
- Parity
- Data Length
- Stop Bits

3. Click on **OK**.

A message box appears, notifying you that your changes will take effect the next time the DDMC32 software is restarted.

Activating the Banner, Logger, Printer, and Audible Message Options

From the Configure Output Devices screen, you can activate the Banner, Logger, Printer, and Audible Message options by clicking on their corresponding checkboxes. Once you have chosen the appropriate options, click on OK to close the Configure Output Devices screen.

Configuring the Clock/Creep Option

The DDMC32 system enables you to configure the timing on your marquee output. You can enable Clock or Creep output.

Enable the Clock/Creep Functions

1.   From the Configure menu, choose Clock/Creep.

The Configure Clock/Creep screen appears.

Configure Clock/Creep screen

2.   To use the Clock or Creep functions, check the Enable Clock/Creep checkbox, and then click on either Clock or Creep.

If you check Clock, the Clock section of the screen is enabled; if you check Creep, the Creep section of the screen is enabled.

Configure the Clock Function

If you enable the Clock function, you must configure the following parameters:

- Define the output device(s) on which you want the clock to appear. Specify Banner, Marquee1, and/or Marquee2.

- Enter the column in which you want to start the clock time (enter 1 through 80).

- Enter the rate (in seconds) at which you want the clock to refresh.

Configure the Creep Function

If you enable the Creep function, you must configure the following parameters:

- Define the output device(s) on which you want the clock to appear. Specify Banner, Marquee1, and/or Marquee2.

- Enter the column from which you want the creep to start (enter 1 through 80).

- Enter a background character. This character will be used to separate your message from its next occurrence (e.g., use an * to precede the start of your message each time it creeps across the display).

- Enter how quickly you want the message to move across the screen.

- Enter the display width. Use this value to determine the width of your message.

- Enter the actual text of the message you want to be displayed.

- Enter the direction of the creep. Choose from Left to Right or Right to Left.

Selecting Instruction Types

Select this option to configure the DDMC32 software to look for DFA and/or SDS messages.

1. From the Configure menu, choose <u>S</u>elect Instruction Type(s).

The Select Instruction Type(s) screen appears.

Select Instruction Type(s)
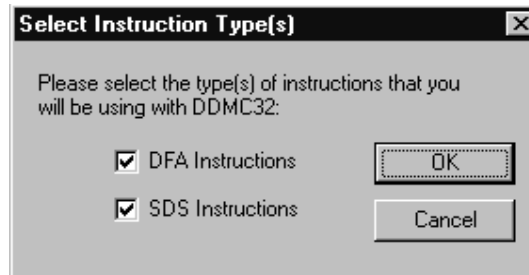
2. Check the DFA and/or SDS Instruction checkboxes as appropriate for your needs.

3. Click on **OK** to finish.

Auto-Starting DDMC32

You can elect to Auto-Start DDMC32 software whenever you log in to your Windows NT ™ system. To enable this option, from the Configure menu, choose <u>A</u>uto-Start DDMC32. The software will then automatically be launched every time you log in.

To disable this option, simply choose it from the Configure menu again.

Auto-Hiding the Banner

The DDMC32 system enables you to enable or disable the screen banner each time you start DDMC32. To enable this option, from the Configure menu, choose Auto-<u>H</u>ide Banner. Checking this option automatically minimizes the message banner if there are no messages.

If you select this option, you must restart the DDMC32 application before the new changes will take place.

To disable this option, simply choose it from the Configure menu again.

Auto-Purging the Database

The DDMC32 system enables you to automatically purge the Fault table of the current DDMC32 database. To enable this option, from the Configure menu, choose Auto-<u>P</u>urge Database. The frequency with which the database is purged depends upon the number of days you entered when selecting your database.

If you select this option, you must restart the DDMC32 application before the new changes will take place.

To disable this option, simply choose it from the Configure menu again.

Starting and Stopping DDMC32

The DDMC32 system is started from your Windows NT™ main menu or desktop. Once the DDMC32 main screen appears, click on DDMC<u>3</u>2 to get the following drop down menu:

DDMC32 system menu options

DDMC<u>32</u>	<u>M</u>onitor	<u>D</u>atabase

S<u>t</u>art DDMC32
Sto<u>p</u> DDMC32

<u>M</u>essage Template Editor
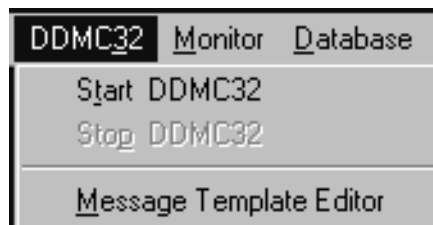
Starting the DDMC32 system

From the DDMC32 menu, choose S<u>t</u>art DDMC32 to begin. The DDMC32 main screen will be minimized and the Message Banner, if enabled, appears. Once the system is started, it begins displaying messages from the PLC processor and outputting formatted messages to the selected output devices.

Stopping the DDMC32 system

From the DDMC32 menu, choose Sto<u>p</u> DDMC32 to remove the Message Banner, if enabled, and stop the output of formatted messages to the selected output devices.

Note: If the Message Banner is displayed, you will have to minimize it in order to be able to access the menu options.

Monitoring the Fault Log

If you have enabled the logging function, you can monitor the fault log to see which faults have occurred. To monitor the fault log, from the Monitor menu, choose Monitor Fault Log.

Clearing the Fault Log

To clear the fault log of all faults, from the Monitor menu, choose Clear Fault Log. You must stop the DDMC software first. Once you select this option, you will be prompted to confirm that you wish to finish the clear process. Once you confirm, you will see a message indicating that all faults have been cleared.

What to Do Next

Once the system is fully configured, the operator can monitor the system. Chapter 10, 'Using the Report Generator Software', tells you how to monitor the system reports and faults.

Notes:

Using the Report Generator Software

What this Chapter Contains

Read this chapter to learn how to access screens within the DDMC32 Report Generator software to analyze your DDMC32 databases.

DDMC32 Report Generator software offers several options to help you maintain and troubleshoot your system. Some of the ones you may use include:

- predefined and custom reports

- scheduled automatic reports

- multiple report display

This chapter contains the following sections:

Becoming Familiar with the Report Generation Options

Your point of access to the Report Generation software is the Menu bar of DDMC32:

Reports Help

   Report Generation

Click on Report Generation. The New Report screen appears.

New Report screen
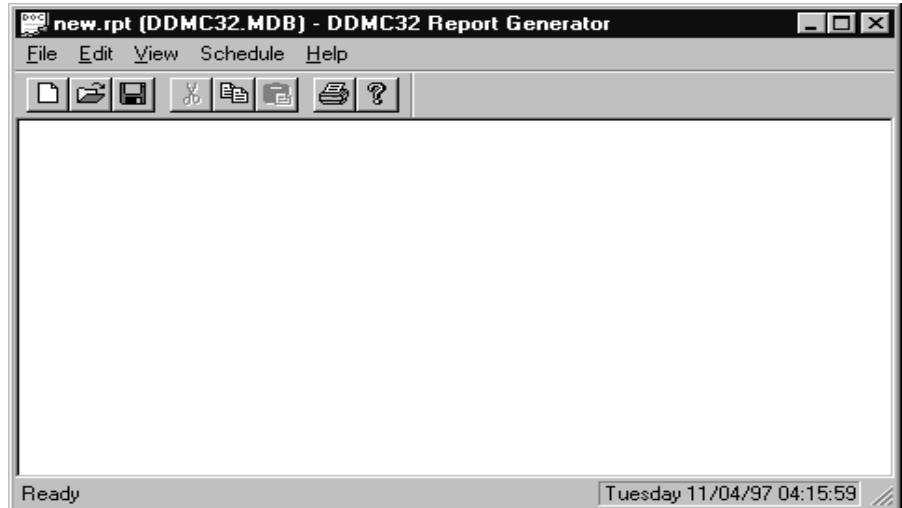
From this screen you may select from File, Edit, View, Schedule, and Help:

File Selection Menu
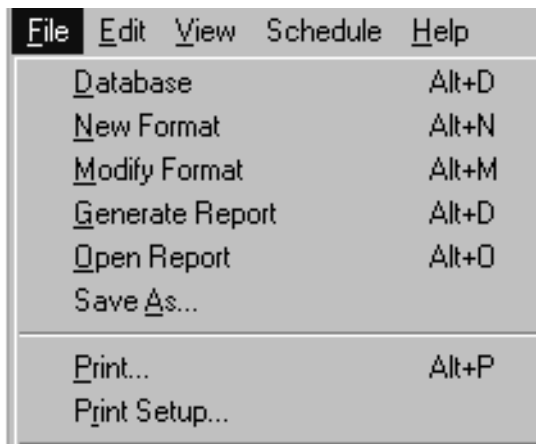
See the next section for a description of these options.

Menu Selections

Reference the following tables for the tasks associated with each selection.

File Menu Option

If you want to:	Choose File and...:
Select an existing database	Database
Create a new report format	New Format
Modify the report format	Modify Format
Generate a report	Generate Report
Open a report for viewing	Open Report
Save a specific report	Save Report
Print a report	Print...
Set printer options	Print Setup
Exit the Report Generator and return to the DDMC32 main screen	Exit

Edit Menu Option

If you want to:	Choose Edit and...:
Copy selected text from the report to the Windows clipboard	Copy

View Menu Option

If you want to:	Choose View and...:
Show or hide the toolbar (Note: the Toolbar contains the same options as the menu. Icons are used for recognition purposes.)	Toolbar
See detailed information on the current report line of the Weekly Default or Monday, Tuesday, ...Sunday reports	Extended Info

Schedule Menu Option

If you want to:	Choose Schedule and...:
Add a scheduled report time, such as a daily, weekly or hourly	Add
Modify a scheduled report generation time	Modify
Supply the Report Generator with a user name and password for an existing account with administrative privileges.	Login

Help Menu Option

If you want to:	Choose Schedule and...:
See the Report Generator version information	About

Toolbar

The Toolbar is a shortcut to options that are used on a regular basis. Use the mouse pointer to view a brief description of each function.

Configuring Reports

Select Reports from the DDMC32 menu bar to run the Report Generation program. The DDMC32 Report Generator screen appears

Report Generator screen
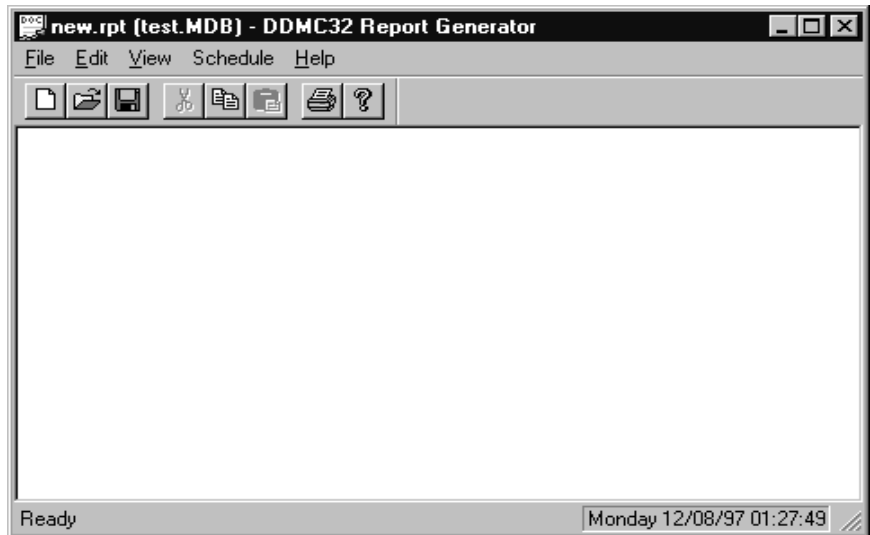
Selecting a New Database

You can select a new database for the report function by clicking on Database. The Database Selection screen appears.

Database Selection Screen
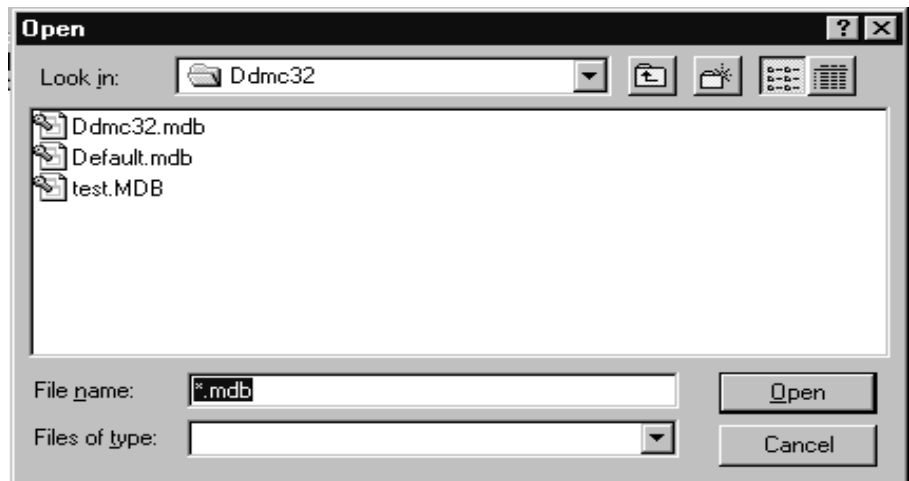
Highlight the database file you need and click on **Open** or (double-click on the database) to open. Your selection will be saved as the default database, and will be used in the future until changed.

Selecting a New Format

Selecting a New Format means that you can customize a report format to fit your specific needs. The Edit Report Format screen (seen below) is used to prepare new report formats.

New Format screen

Title

This screen field gives your report a unique descriptive title which will appear on the report.

Directory

This will default to the DDMC32 default that was set up when you installed your system. If you want the report to be saved into a different directory type the *complete* directory name in this field.

File Name

Type in the file name, normally this would be the similar to your title with the .rpt extension added (for example, you have titled your report Test, your file name would then be Test.rpt).

Print

The Print field defaults to No. This means that that the report will not be automatically printed to the default printer whenever the report is generated. To have the report printed every time it is run, click on the Yes radio button.

This selection is useful for printing scheduled reports at the time the report is generated.

Add Date to Name

This option makes each report unique by appending the database name and date to the report name. This report is always saved to disk, named according to the following format: Report Name, Database Name, Day of Year, Hour of Day, and Minute.

Processor

Select the processor name to limit the report to only the selected processor, or leave the default of All, which will include all processors in your report.

Message

Choose the messages you want to be displayed. Selecting All will display the report messages for both .SDS and .DFA messages. To display only the .sds or .dfa messages, click on the arrow and select from the drop down list.

Width

This is the number of characters per report line. The Width defaults to 80 characters.

Old Report

Selecting Append will append the current report to an existing report of the same name.

Report Type

Determines whether each line of the report will wrap to the next line or be truncated if it is longer than the width field.

Top 10

Determines the major style of the report. The "Don't Care" selection simply displays the contents of the Message Log. This is the format of the weekly default and Monday, Tuesday, ..., Sunday reports.

Days

Selects the time span of the report. Choose Sorted to display the entire contents of the database.

Modify a Format

To Modify a Format, select Modify from the drop down File menu and open the file you want to modify. From this point, see Selecting a New Format. The steps used to modify a format are the same as those previously described.

The Report Generator contains formats for several standard reports:

- Daily

- Duration

- Frequency

- Weekly Default

- Monday, Tuesday, ..., Sunday

Generating Reports

To generate a report, select Generate Report from the File menu on the Report Generation menu bar. A list of all available report names appears.

Open screen

```
Open                                                    ? X
Look in:    Ddmc32              ▼  ⬆  📁  ▦  ▦

daily.fmt            sunday.fmt
duration.fmt         thursday.fmt
frequency.fmt        tuesday.fmt
friday.fmt           wednesday.fmt
monday.fmt           wklydflt.fmt
saturday.fmt


File name:     *.fmt                           Open

Files of type:                        ▼        Cancel
```
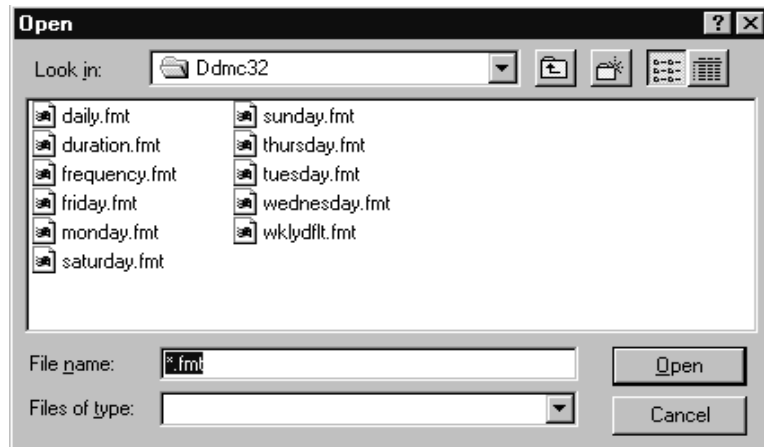
Highlight the report you need, and click on Open. The selected report will be displayed on the screen and written to the disk in the default DDMC32 directory.

Opening a Report

To view an existing report, select Open Report from the File menu. Highlight the report and click on Open.

Save As...

If you have generated a report or opened an existing report and want to save it under a specific name, choose Save As... from the File menu. Choose the directory you want the file to be saved in and type in a new file name in File name field.

Important: Do not add .rpt to the end of the file name. DDMC32 will automatically add the .rpt extension.

Printing a Report

You can print reports at any time. To print a report:

1.	Generate or open a report.

2.	From the File menu, choose <u>P</u>rint.

3.	Set the parameters for your print scheme and click on OK.

The report, or a portion of the report, if chosen, is printed to the default printer.

Modifying a Printer Options

You can modify the way reports are printed. To change printer options:

1.	From the File menu, choose <u>P</u>rint Setup.

2.	Change the parameters as desired, and click on **OK**.

Scheduling a Report

You can schedule a report by selecting Schedule from the Report Generation main menu. Using the Scheduler you can set dates and times for the generation of a specific report type. You can also view the scheduled reports you have previously set up through the Command Scheduler interface. Selecting the login will allow you to specify the account the report will be associated with.

When you choose Add from the Schedule menu, the Open screen appears, with all the available report types listed for you to choose from.

Open screen
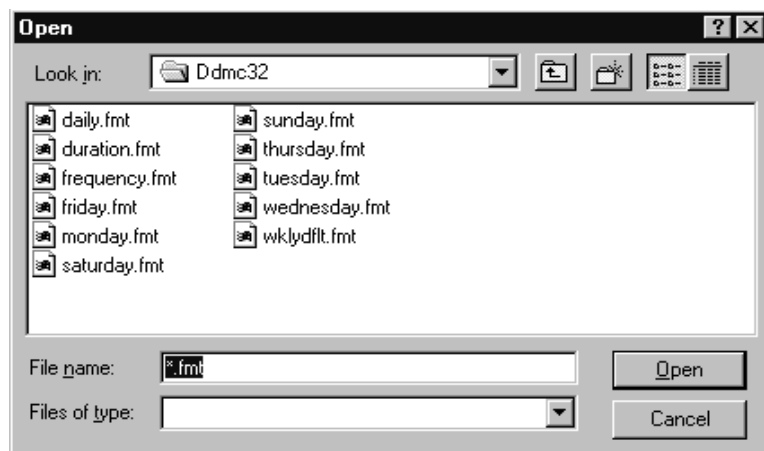
Once you select a report type, the DDMC32 Command Scheduler appears, with its associated Add Command screen displayed.

DDMC Command Scheduler

10-10
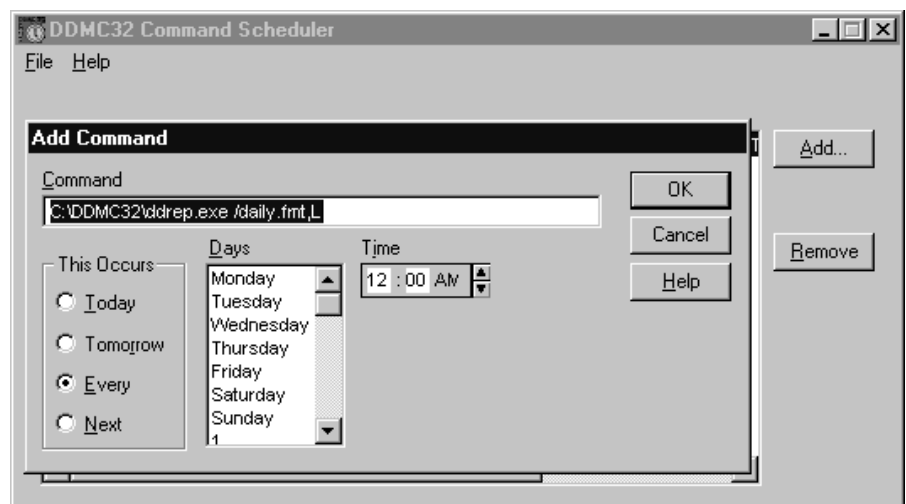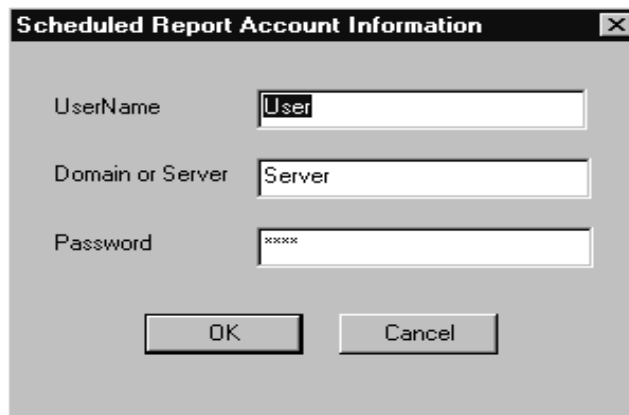
The Command field of the Add Command screen contains the command required to run the chosen report. You must specify the time and days for the report to run, and then click on **OK**. The DDMC Command Scheduler will display the scheduling information for the task. You can then close the Scheduler by choosing Exit from the File menu.

When you choose Modify from the Schedule menu of the Report Generator, the DDMC32 Command Scheduler is executed, displaying a list of all the currently scheduled tasks. You can modify these task schedules using by clicking on the Change button on the DDMC32 Command Scheduler (see figure on previous page).

If you choose Login from the Schedule menu of the Report Generator, the Scheduled Report Account Information screen appears.

Scheduled Report Account Information screen

You must supply the User Name and Password of a Login account with Administrative privileges, on the computer where the Report Generator will run. The Domain or Server field is optional, and may be left blank. This information is necessary for the Report Generator to acquire the resources to create and print a report without any user intervention.

Miscellaneous Operations

This section describes two additional procedures that can assist you in working with reports.

Copying Report Text

From the Edit menu, choose <u>C</u>opy to copy selected text from the Report Generator to the Windows clipboard. This function is useful for including all or portions of a report into a word processor.

Viewing Report Information

From the View menu, choose <u>E</u>xtended Info to display additional information about the selected line of a weekly default or Monday, Tuesday, ..., Sunday report. Click on a line of the report, and then choose Extended Info to get detailed information about that line.

What to Do Next

Once you have finished configuring and printing the log you can reference Appendix A, 'Reference Information', or Appendix B, 'DDMC32 Directory Structure', for further information.

Reference Information

Appendix Overview

This appendix provides reference information about the SDS and DFA instructions. This appendix shows:

- SDS Information

    - execution times
    - control file size requirements
    - step description file requirements
    - how to determine the amount of data table memory for SDS instructions
    - how to determine the amount of program file memory for SDS instructions
    - maximum steps allowable without going over a file boundary
    - control file layout

- DFA Information

    - execution times
    - control file size requirements
    - amount of program file memory needed for DFA instruction
    - control status bits

Reference Information for the SDS Instruction

Read this section for reference information for the SDS instruction.

Execution Times

Tables A.A and A.B show the execution times per program scan for an SDS instruction in the PLC-5 or the PLC-5/250 with 8, 16, and 32 I/O. Combinatorial SDS "OR" and "AND" transitions have been averaged in; these are typical times.

Table A.A
Execution Times for an SDS Instruction in the PLC-5

Number of I/O	(Step 0) Initialization 0.350 ms base +	Typical	Step Transition (No MSG)	Step Transition (with MSG)
8	0.050 ms/step	0.433 ms	0.633 ms	0.720 ms
16	0.050 ms/step	0.433 ms	0.633 ms	0.720 ms
t32	0.050 ms/step	0.433 ms	0.633 ms	0.720 ms

Table A.B
Execution Times for an SDS Instruction in the PLC-5/250

Number of I/O	(Step 0) Initialization 0.200 ms base +	Typical	Step Transition (No MSG)	Step Transition (with MSG)
8	0.013 ms/step	0.200 ms	0.245 ms	0.270 ms
16	0.013 ms/step	0.200 ms	0.245 ms	0.270 ms
32	0.013 ms/step	0.200 ms	0.245 ms	0.270 ms

Control File Size Requirements

Tables A.C and A.D list the control file size requirements in the PLC-5 processor and the PLC-5/250 for an SDS instruction with 8, 16, and 32 I/O.

Table A.C
Control File Size Requirements for an SDS Instruction in the PLC-5

Number of I/O	Number of Words Needed for Control File
8	68
16	68
32	68

Table A.D
Control File Size Requirements for an SDS Instruction in the PLC-5/250

Number of I/O	Number of Words Needed for Control File
8	58
16	58
32	58

Step Description File Size Requirements

Table A.E lists the number of words needed for each step in the step description file for an SDS instruction with 8, 16, and 32 I/O.

Table A.E
Step Description File Size Requirements (for both PLC-5 and PLC-5/250)

Number of I/O	Number of Words Needed for Each Step in Step Description File
8	13
16	22
32	43

Determining Amount of Data Table Memory Needed for SDS Instructions

When used for control and diagnostics (as opposed to monitoring-only), the SDS instruction requires at least twice as much memory as the original ladder logic. You must take this into account when planning your program.

To calculate the amount of memory required for an SDS instruction, use the following formula:

size of control file + ((number of steps defined) x words needed per step)

For example, consider that we have 4 SDS instructions in the PLC-5 with 10 steps each. Each instruction has 8 inputs and 8 outputs:

68 words needed for control file + (10 steps x 13 words needed per step) =

198 words per SDS x 4 SDS instructions =

792 words of data table memory

Determining Amount of Program File Memory Needed for SDS CAR File

An SDS instruction uses program memory for the contents of the CAR file. (The SDS CAR uses 1267 words of program memory in the PLC-5 processor and 1280 words of program memory in the PLC-5/250 processor.) The total amount of program memory used is different depending on if you are using a PLC–5 processor or a PLC-5/250 processor.

PLC-5 Processor

To determine the amount of program memory used per SDS instruction in the PLC-5 processor, use the following formula:

22 words + 3 words per I/O programmed

For example, consider that we have 2 SDS instructions with 4 inputs and 2 outputs each:

2 SDS instructions (22 words + 4 inputs (3) + 2 outputs (3)) =

2 (22 + 12 + 6) =

2 (40) =

80 words of program file memory

PLC-5/250 Processor

To determine the amount of program memory used per SDS instruction in the PLC-5/250 processor, use the formula from Table A.F depending on your number of I/O.

Table A.F
Formulas for Determining Amount of Program File Memory for SDS Instructions in the PLC-5/250

Number of I/O:	Formula:
8	226 words + (number of I/O points defined x 20) + x
16	258 words + (number of I/O points defined x 20) + x
32	322 words + (number of I/O points defined x 20) + x

For example, consider that we have 2 SDS instructions with 8 I/O (4 inputs defined and 2 outputs defined):

2 SDS instructions (226 words + 4 inputs (20) + 2 outputs (20)) =

2 (226 + 80 + 40) =

2 (346) =

692 words of program file memory

Maximum Number of Steps per SDS Instruction

Tables A.G and A.H list the number of steps you can enter per SDS instruction in the PLC-5 and PLC-5/250 depending on the number of I/O you have.

Table A.G
Number of Steps Per SDS Instruction in the PLC-5

If you have this number of I/O:	Then you can enter this number of steps per SDS instruction:
8	76
16	45
32	23

Table A.H
Number of Steps Per SDS Instruction in the PLC-5/250

If you have this number of I/O:	Then you can enter this number of steps per SDS instruction:
8	250
16	250
32	232

Loading Considerations for Multiple PLC-5 Configuration

The DDMC32 system does not limit the number of PLC-5s you can link to the operator interface. However, to maximize performance of the Data Highway Plus, we recommend that you have no more than 20 PLC-5s linked to one Data Highway Plus.

Your messages do not get lost when using multiple PLC-5s; they are, however, read on a first-in basis.

Control File Layout

The following table shows the SDS instruction control file layout.

	0	Control/Status bits	1 WORD
	1	Length	1 WORD
	2	Number of Steps	1 WORD
	3	Current Step (N)	1 WORD
	4	Last Step (N - 1)	1 WORD
Inputs 16-31	5	Mapped Inputs	
Inputs 0-15	6	Mapped Inputs	2 WORDS
Inputs 16-31	7	Mapped Outputs	
Inputs 0-15	8	Mapped Outputs	2 WORDS
For Internal Use			

The control status bits are:

15	14	13	12	11	10	09	08	07	06	05	04	03	02	01	00
EN			ES	ER	ST	ME	TE	RS	DV	PC	MR				TB

The following table defines the control/status bits

Bit:	Definition:
EN	Rung Enable
ES	Error Step indicator; if true, sequencer is in an error step
ER	Error; true if runtime error detected
ST	Step Transition; true for one PLC scan if step transition occurred
ME	Message Enable; true if message is to be sent
TE	Timer Enable; true if timer is used in current step
RS	Reset Sequencer; a status bit; if true, sequencer is in normal run mode; if false, sequencer is in step zero mode.
DV	Future use
PC	Precheck; if 0, precheck is enabled and the SDS, at state transition, will check if the destination step expected inputs match the mapped inputs; if 1, precheck is disabled and the SDS instruction, at state transition, will not check the destination step expected inputs
MR	Mismatch Reset; a control bit; if the SDS instruction is in a mismatch condition, setting this bit to 1 will release the mismatch check and the SDS instruction will start from step 0 to find a step to enter
TB	Time base; the instruction entry allows the programmer to select either .01 or 1.0 second time base for the timer

You can obtain information about the control file from the Extended Status screen in the SDS instruction. The Extended Status screen provides the status of specific bits in the control file in user-friendly terms.

Reference Information for the DFA Instruction

Read this section to learn about reference information for the DFA instruction.

Execution Times

Tables A.I and A.J show the execution times per program scan for a DFA instruction in the PLC-5 or the PLC-5/250 with 8, 16, and 32 I/O.

Table A.I
Execution Times for a DFA Instruction in the PLC-5

Number of I/O:	Typical:	Send a Message:
8	0.224 ms	0.320 ms
16	0.224 ms	0.320 ms
32	0.224 ms	0.320 ms

Table A.J
Execution Times for a DFA Instruction in the PLC-5/250

Number of I/O:	Typical:	Send a Message:
8	0.166 ms	0.207 ms
16	0.166 ms	0.207 ms
32	0.166 ms	0.207 ms

Control File Size Requirements

Table A.K lists the control file size requirements in the PLC-5 and PLC-5/250 for a DFA instruction.

Table A.K
Control File Size Requirements for a DFA Instruction in the PLC-5 and PLC-5/250

Controller:	Number of I/O:	Number of Words Needed for Control File:
PLC-5	8, 16, or 32	69
PLC-5/250	8, 16, or 32	58

Amount of Program File Memory Needed for DFA CAR File

A DFA instruction uses program memory for the contents of the CAR file. (The DFA CAR uses 223 words of program memory in the PLC-5 processor and 210 words of program memory in the PLC-5/250 processor.) Therefore, the total amount of program memory used is different depending on if you are using a PLC–5 processor or a PLC-5/250 processor.

PLC-5 Processor

To determine the amount of program memory used per DFA instruction in the PLC-5 processor, use the following formula:

17 words + 4 words per I/O programmed

–or–

17 words + (4 (# of inputs defined))

For example, consider that we have 2 DFA instructions with 4 inputs each:

2 DFA instructions (17 words + (4 (4)) =

2 (17 + 16) =

2 (33) =

66 words of program file memory

PLC-5/250 Processor

To determine the amount of program memory used per DFA instruction in the PLC-5/250 processor, use the formula from Table A.L depending on your number of I/O.

Table A.L
Formulas for Determining Amount of Program File Memory for DFA Instructions in the PLC-5/250

Number of I/O:	Formula:
8	194 words + (number of I/O points defined x 20)
16	224 words + (number of I/O points defined x 20)
32	288 words + (number of I/O points defined x 20)

For example, consider that we have 2 DFA instructions with 8 I/O (4 inputs defined):

2 DFA instructions (194 words + 4 inputs (20)) =

2 (194 + 80) =

2 (274) =

548 words of program file memory

The control status bits are:

Bit:	Definition:
EN	Rung Enable
ER	Error; true if runtime error detected
ME	Message Enable; true is message is to be sent

You can obtain information about the control file from the Extended Status screen in the DFA instruction. The Extended Status screen provides the status of specific bits in the control file in user-friendly terms.

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